POWERSHELL CRASH COURSE

PRESENTED BY: JAMES HONEYCUTT

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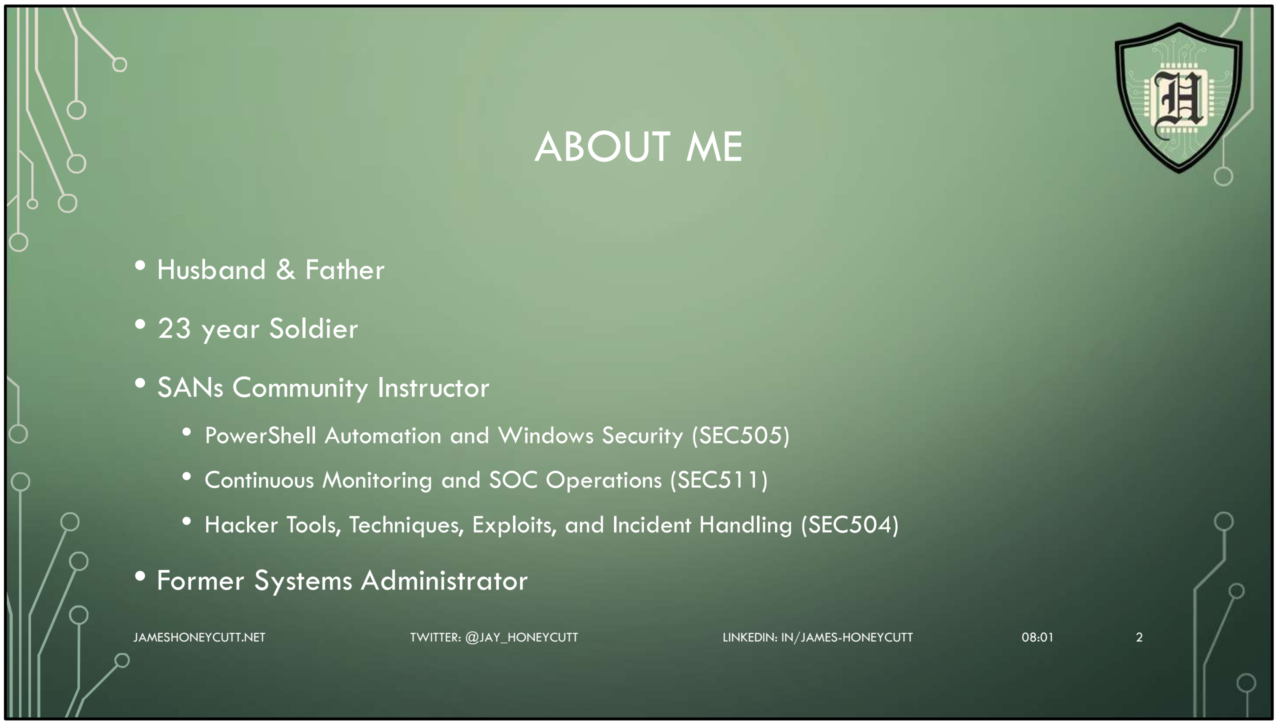

ABOUT ME

- Husband & Father
- 23 year Soldier
- SANs Community Instructor
  - PowerShell Automation and Windows Security (SEC505)
  - Continuous Monitoring and SOC Operations (SEC511)
  - Hacker Tools, Techniques, Exploits, and Incident Handling (SEC504)
- Former Systems Administrator

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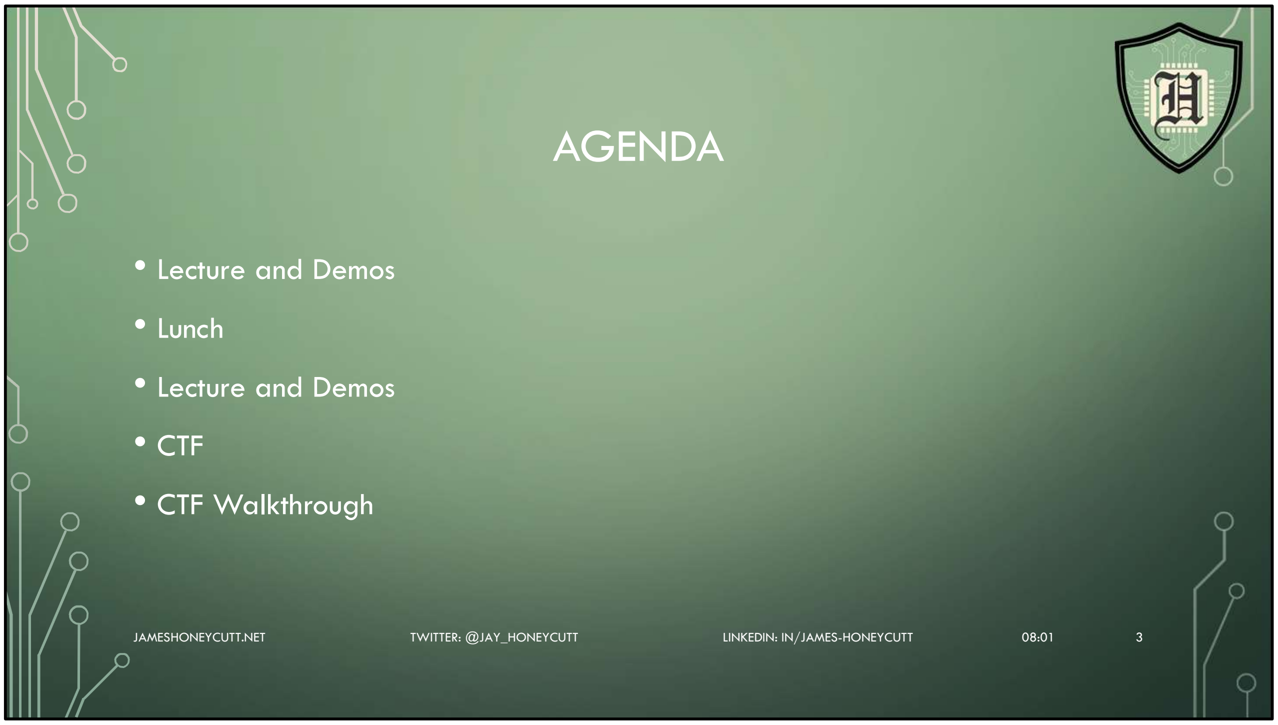
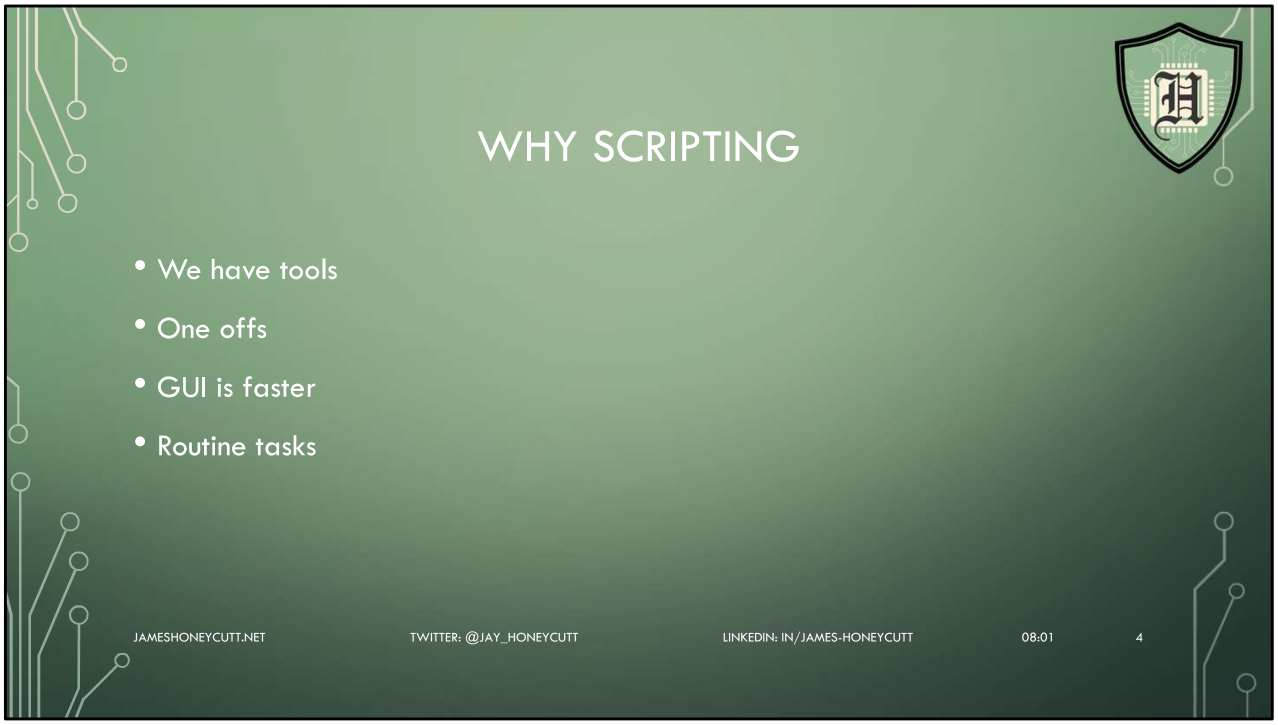


AGENDA

- Lecture and Demos
- Lunch
- Lecture and Demos
- CTF
- CTF Walkthrough

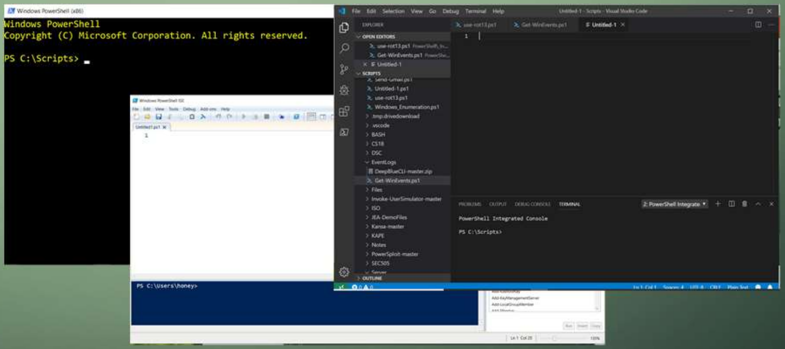


WHY SCRIPTING

- We have tools
- One offs
- GUI is faster
- Routine tasks

ENVIRONMENTS

- PowerShell Console
- PowerShell ISE
- VSCode



```
Windows PowerShell
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PS C:\Scripts>
```
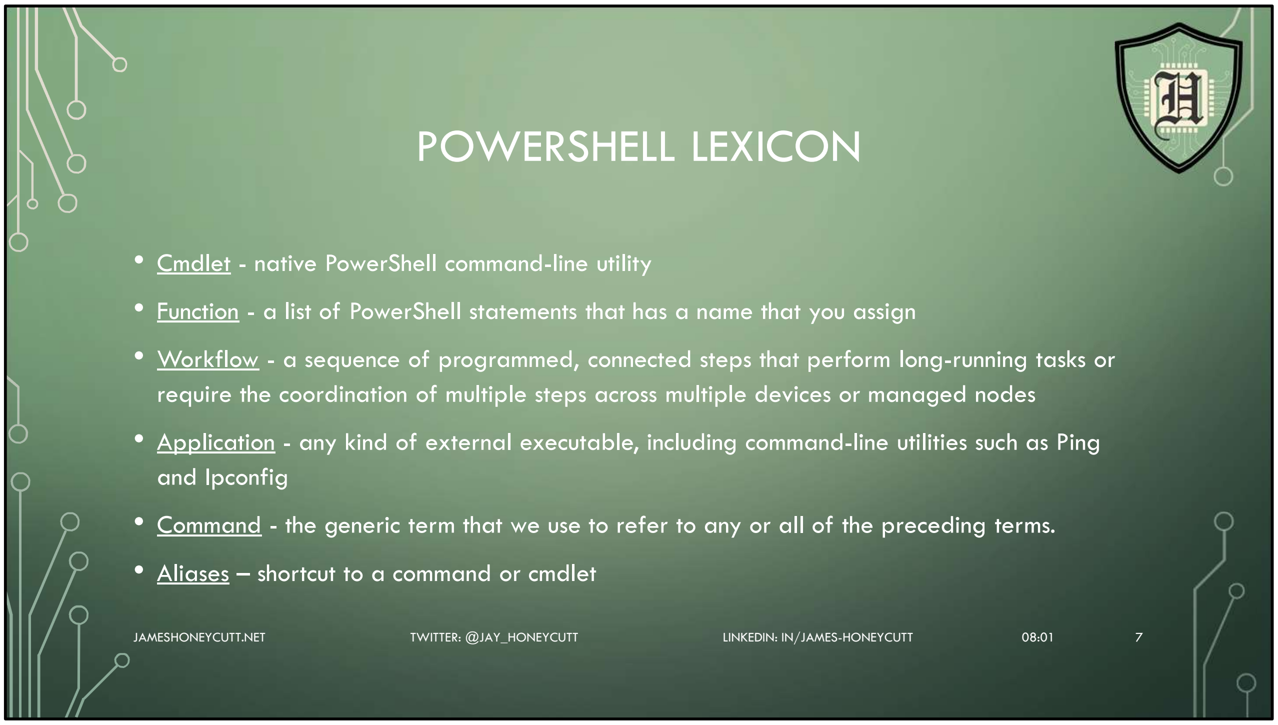

```
PS C:\Users\honey>
```

```
PowerShell Integrated Console

PS C:\Scripts>
```

LIVE DEMO


POWERSHELL LEXICON

- Cmdlet - native PowerShell command-line utility
- Function - a list of PowerShell statements that has a name that you assign
- Workflow - a sequence of programmed, connected steps that perform long-running tasks or require the coordination of multiple steps across multiple devices or managed nodes
- Application - any kind of external executable, including command-line utilities such as Ping and Ipconfig
- Command - the generic term that we use to refer to any or all of the preceding terms.
- Aliases – shortcut to a command or cmdlet

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A *cmdlet* is a native PowerShell command-line utility. These exist only inside PowerShell and are written in a .NET Framework language such as C#. The word *cmdlet* is unique to PowerShell, so if you add it to your search keywords on Google or Bing, the results you get back will be mainly PowerShell-related. The word is pronounced *command-let*.

A *function* can be similar to a cmdlet, but rather than being written in a .NET language, functions are written in PowerShell's own scripting language.

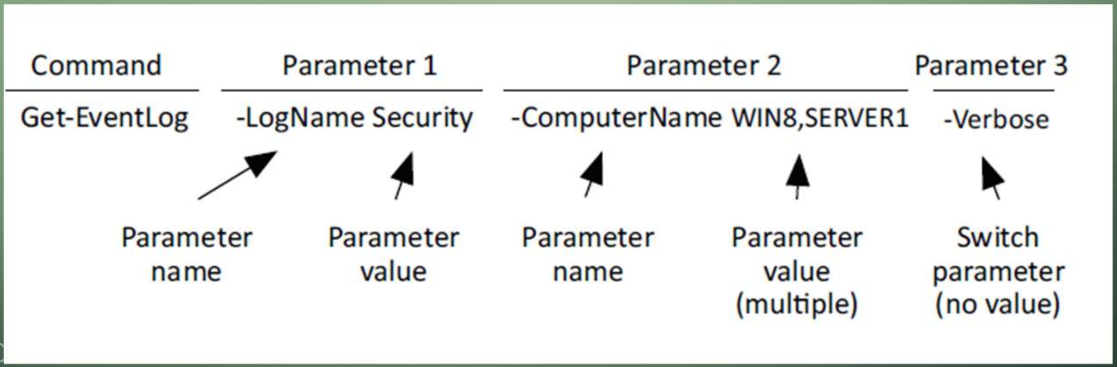
A *workflow* is a special kind of function that ties into PowerShell's workflow execution system.

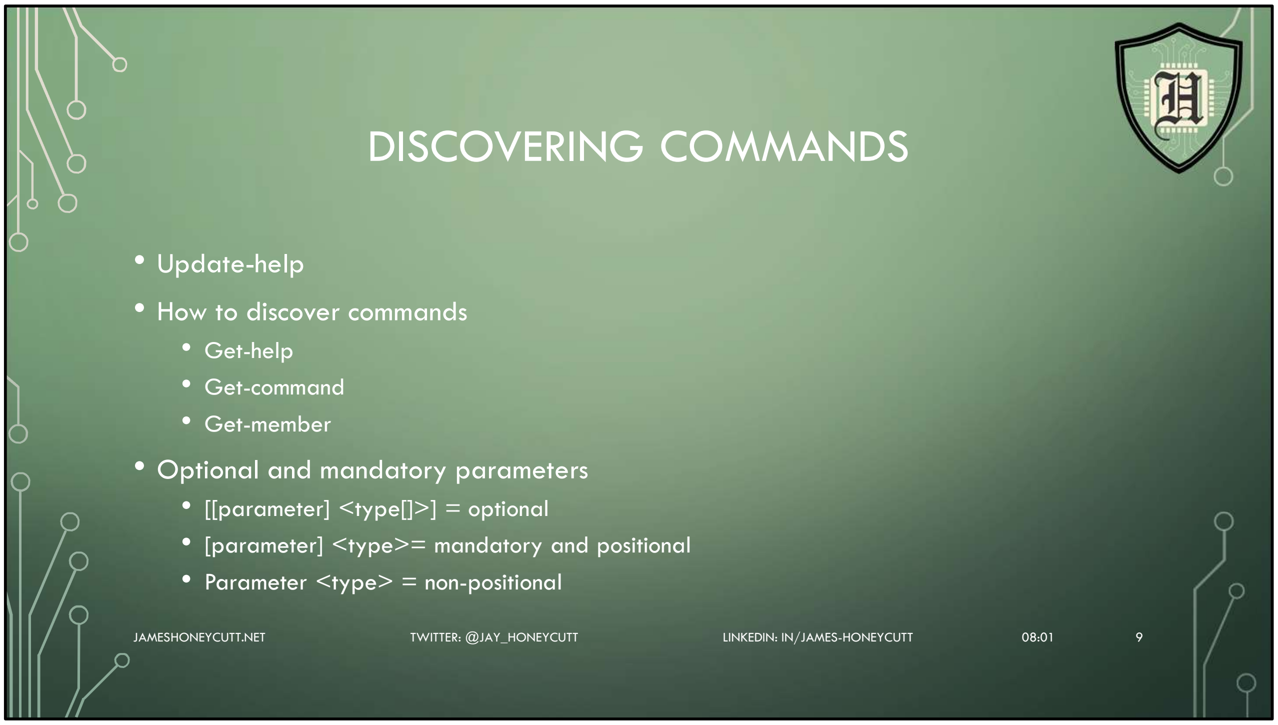
An *application* is any kind of external executable, including command-line utilities such as Ping and Ipconfig.

Command is the generic term that we use to refer to any or all of the preceding terms.

An alias is a shortcut to a command

COMMAND STRUCTURE




DISCOVERING COMMANDS

- Update-help
- How to discover commands
  - Get-help
  - Get-command
  - Get-member
- Optional and mandatory parameters
  - [[parameter] <type[]>] = optional
  - [parameter] <type>= mandatory and positional
  - Parameter <type> = non-positional

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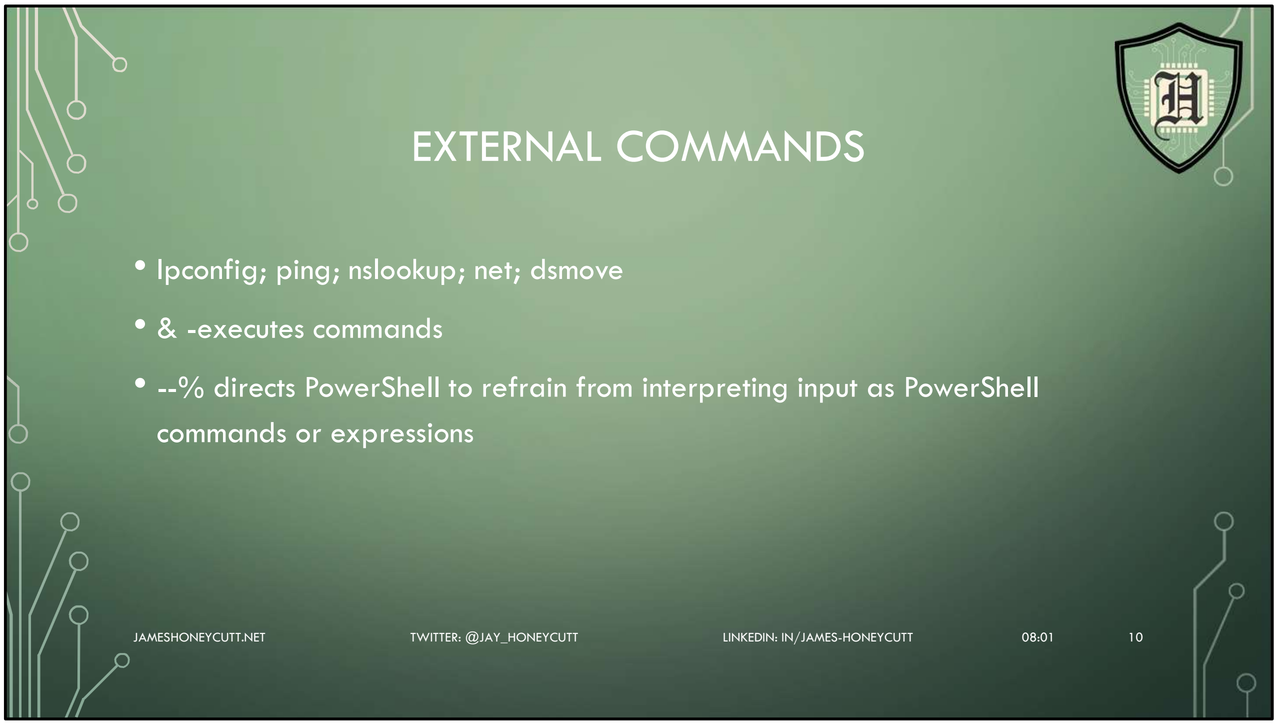
Demo/Try It Now
Get-Help (get-even)
Get-Command
Get-Member
Show-Command
Get-alias

Note
Multiple Parameter sets has unique parameters

Update-Help

get-help *even*
get-help Get-WinEvent
-asstring only works works with computername and list attribute

[[parameter] <type[]>] = optional
[parameter] <type>= mandatory and positional
Parameter <type> = non-positional



EXTERNAL COMMANDS

- Ipconfig; ping; nslookup; net; dsmove
- & -executes commands
- --% directs PowerShell to refrain from interpreting input as PowerShell commands or expressions

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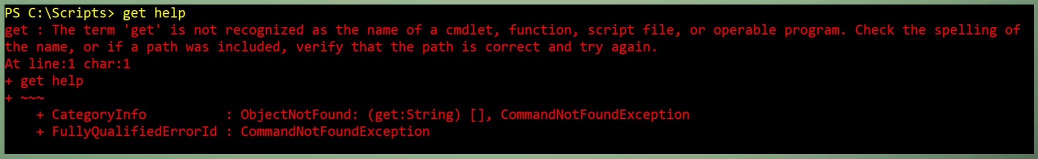
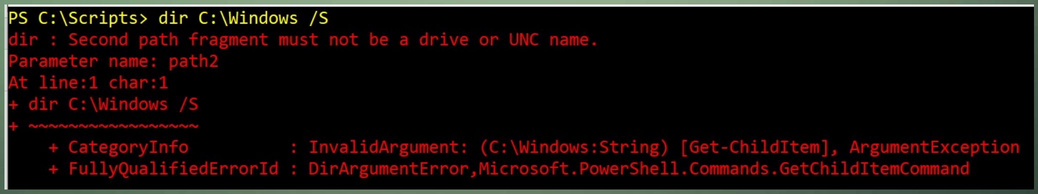
```
&("C:\Program Files (x86)\Windows Media Player\wmplayer.exe“) “C:\Users\honey\Google Drive\Presentations\PowerShell\JumpStart\GetStartedPowerShell3M02_mid.mp4” /fullscreen

C:\windows\system32\sc.exe --% qc "bits"
```

DEALING WITH ERRORS



```
PS C:\Scripts> get help
get : The term 'get' 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 help
+ ~~~
    + CategoryInfo          : ObjectNotFound: (get:String) [], CommandNotFoundException
    + FullyQualifiedErrorId : CommandNotFoundException
```



```
PS C:\Scripts> dir C:\Windows /S
dir : Second path fragment must not be a drive or UNC name.
Parameter name: path2
At line:1 char:1
+ dir C:\Windows /S
+ ~~~~~~~~~~~~~~~~~
    + CategoryInfo          : InvalidArgument: (C:\Windows:String) [Get-ChildItem], ArgumentException
    + FullyQualifiedErrorId : DirArgumentError,Microsoft.PowerShell.Commands.GetChildItemCommand
```

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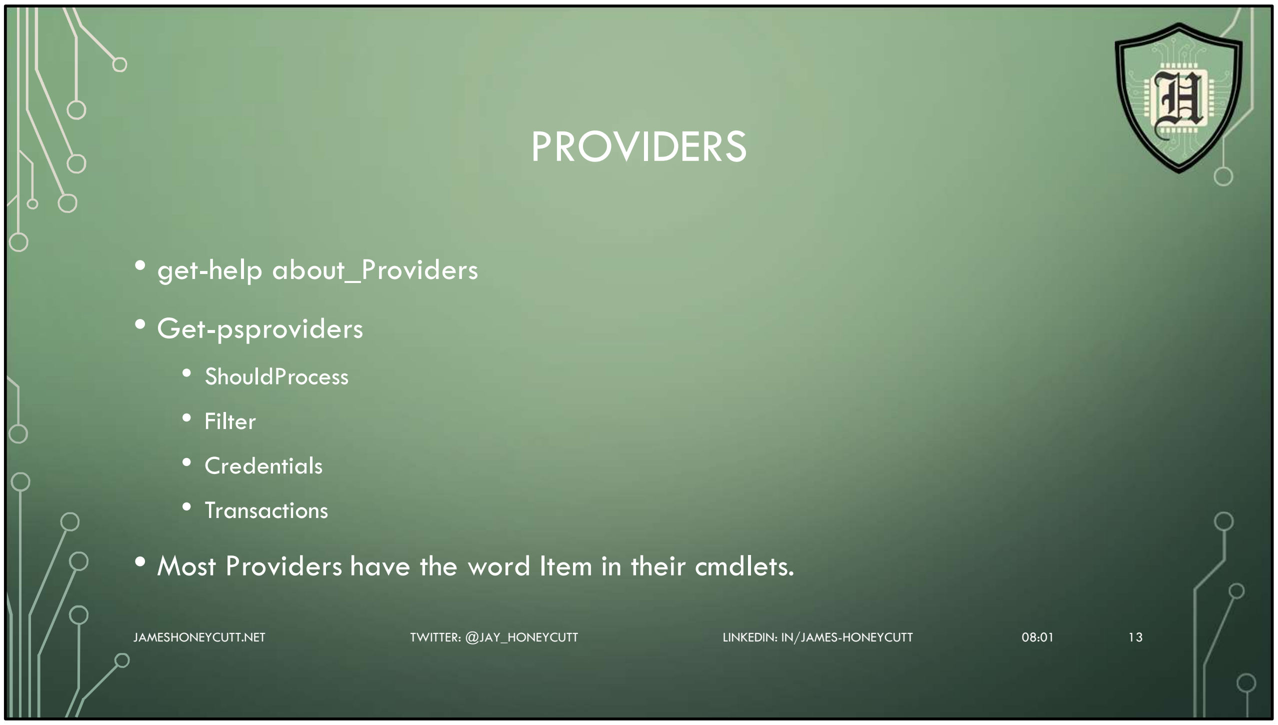
$error


PROVIDERS

- get-help about_Providers
- Get-psproviders
  - ShouldProcess
  - Filter
  - Credentials
  - Transactions
- Most Providers have the word Item in their cmdlets.

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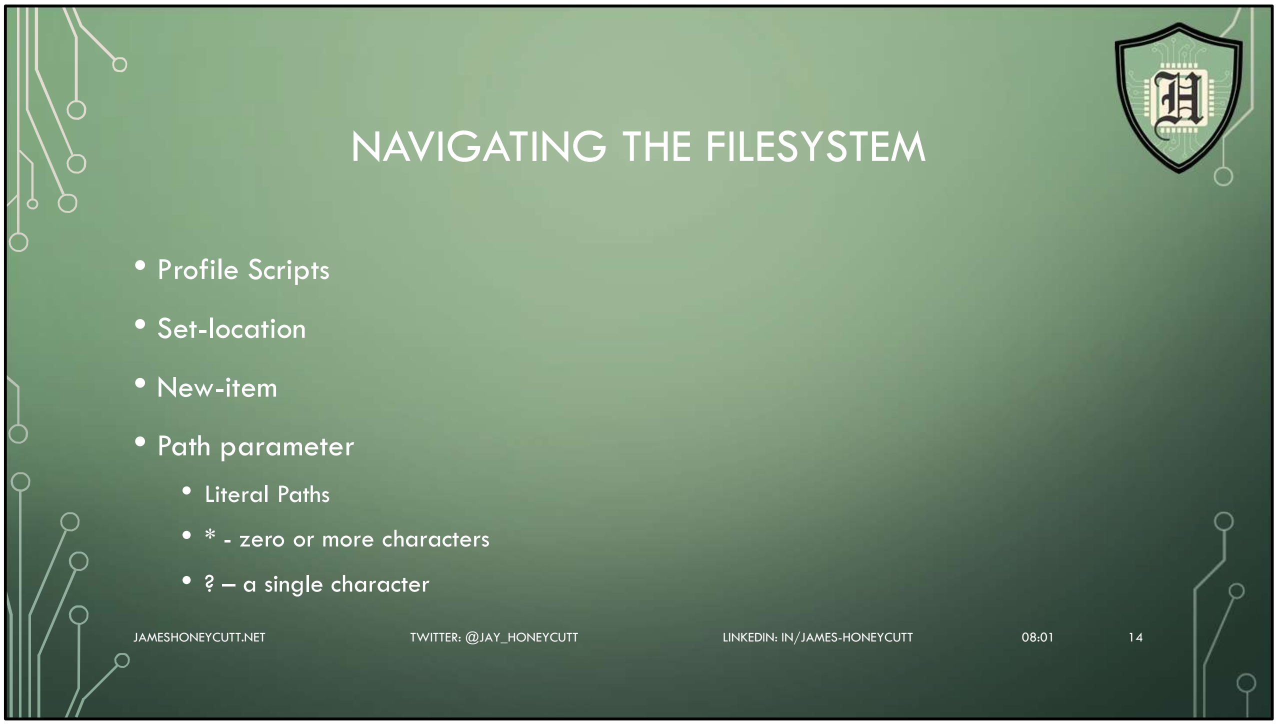
ShouldProcess—The provider supports the use of the -WhatIf and -Confirm parameters, enabling you to “test” certain actions before committing to them.

Filter—The provider supports the -Filter parameter on the cmdlets that manipulate providers’ content.

Credentials—The provider permits you to specify alternate credentials when connecting to data stores. There’s a -credential parameter for this.

Transactions—The provider supports the use of transactions, which allows you to use the provider to make several changes, and then either roll back or commit those changes as a single unit.



NAVIGATING THE FILESYSTEM

- Profile Scripts
- Set-location
- New-item
- Path parameter
  - Literal Paths
  - * - zero or more characters
  - ? – a single character

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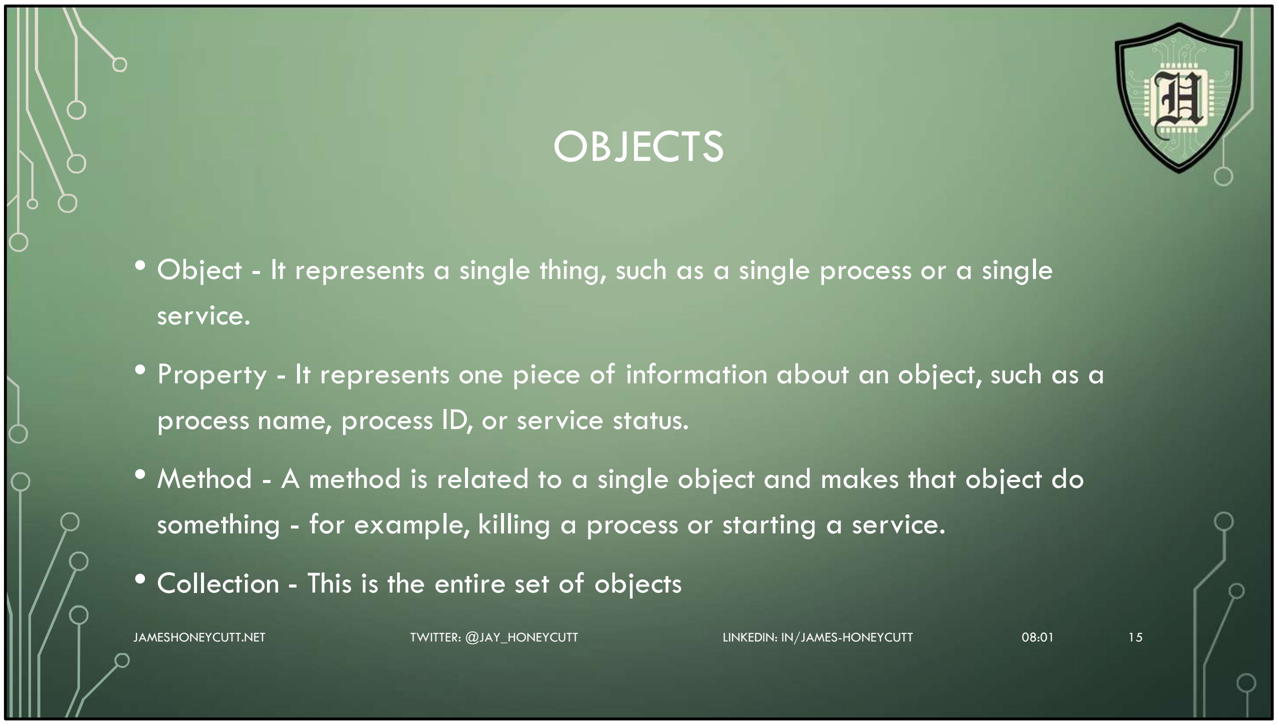
```
Get-childitem C:\Scripts\*\?????????.ps1
Get-childitem C:\Scripts\*\????.ps1
Get-childitem C:\Scripts\*\*.ps1
Get-childitem C:\*\*.ps1
Get-childitem C:\*\*\*.ps1

Get-childitem HKLM:\Software\Microsoft\Windows\CurrentVersion\Run
Get-childitem HKCU:\Software\Microsoft\Windows\CurrentVersion\Run
Get-childitem HKLM:\Software\Microsoft\Windows\CurrentVersion\RunOnce
Get-childitem HKCU:\Software\Microsoft\Windows\CurrentVersion\RunOnce

Measure-Command -Expression {Get-childitem HKCU:\Software\*\*\*\}
Measure-Command -Expression {Get-childitem
HKCU:\Software\Microsoft\Windows\CurrentVersion}
```



OBJECTS

- Object - It represents a single thing, such as a single process or a single service.
- Property - It represents one piece of information about an object, such as a process name, process ID, or service status.
- Method - A method is related to a single object and makes that object do something - for example, killing a process or starting a service.
- Collection - This is the entire set of objects

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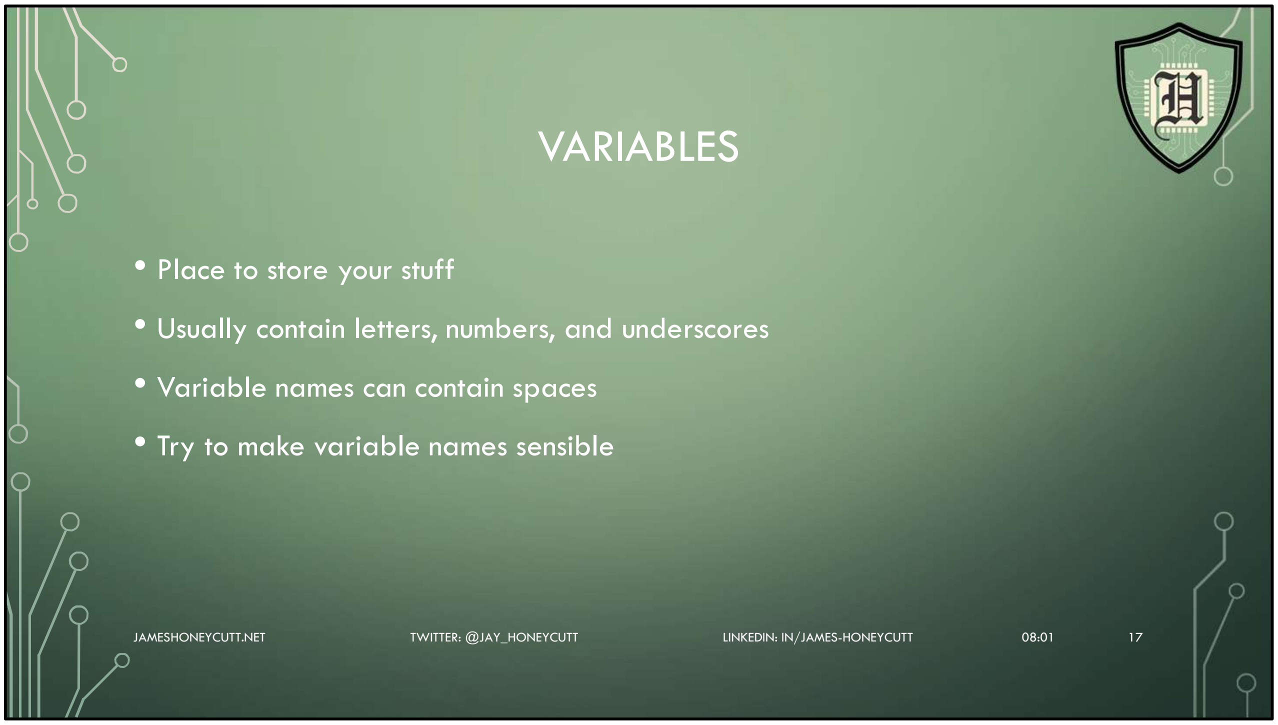
Tasklist pull information, but cannot perform any actions

```
Get-Process | ConvertTo-HTML | Out-File processes.html

get-process | get-member | where {$_.membertype -eq 'Property'} | group MemberType |
sort count –Descending

(Get-service –name bits).start()
(Get-service –name bits).stop()

Get-Service * | where {($_.starttype -like "man*") -and ($_.status -eq "Stopped")} | Select-
Object -Property Name, Status, StartType
get-service * | where {$_.starttype -like "man*"} | select Name, Status, StartType | group
status | sort count –Descending

Get-Process | Sort VM -descending | gm
Get-Process | Sort VM -descending | Select Name,ID,VM | gm
```

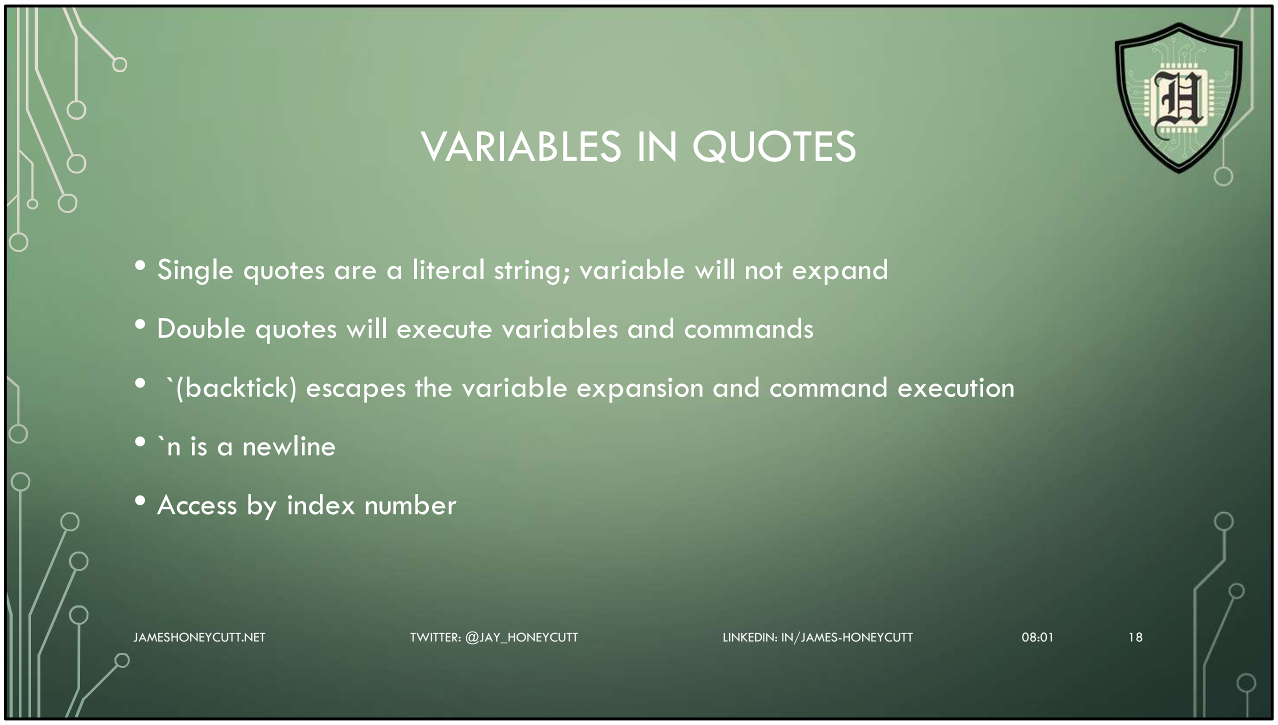
OBJECTS (CONT)

- ScriptProperty -
- Property -
- NoteProperty -
- AliasProperty -



VARIABLES

- Place to store your stuff
- Usually contain letters, numbers, and underscores
- Variable names can contain spaces
- Try to make variable names sensible



VARIABLES IN QUOTES

- Single quotes are a literal string; variable will not expand
- Double quotes will execute variables and commands
- `(backtick) escapes the variable expansion and command execution
- `n is a newline
- Access by index number

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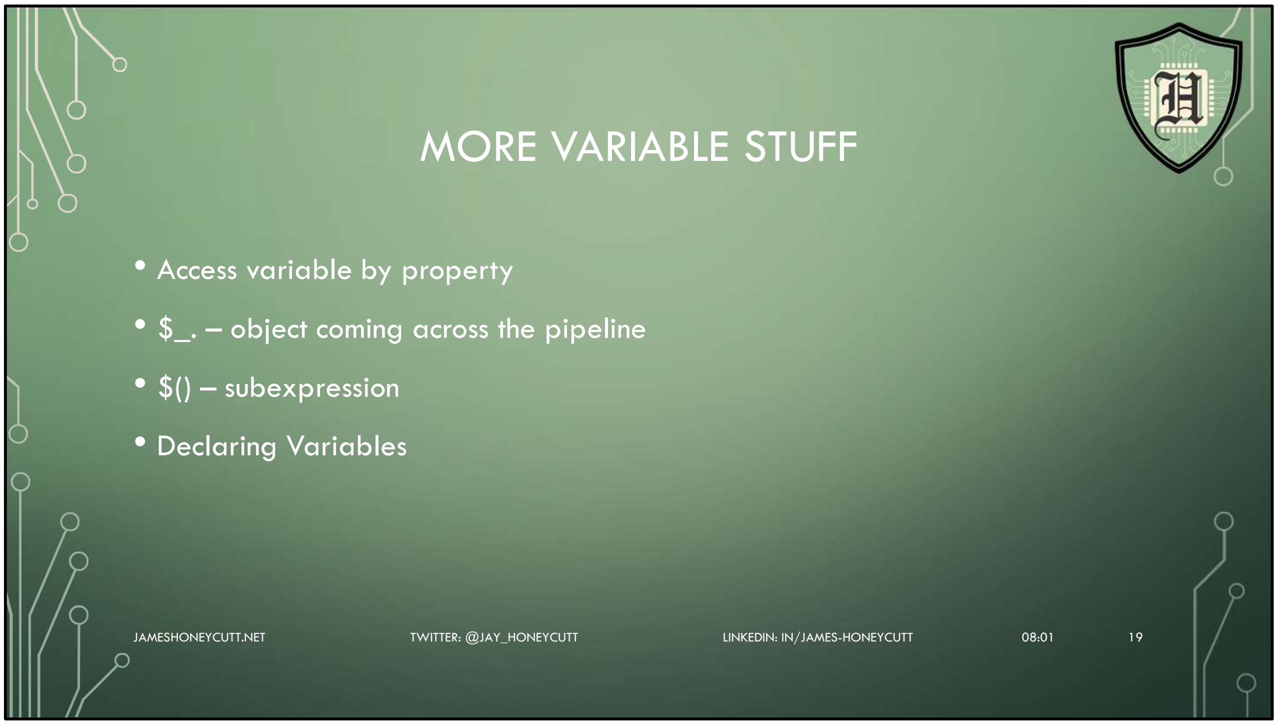
```
$var = 5
$String = ‘What does $var contain?’
$String2 = “What does $var contain?”
$var = 89; $string2

$string3 = "`$var contains $var“
"`$(get-date) is how you execute a command within quotes“

$object1 = 'Object01 Object02 Object03’
$object2 = 'Object01','Object02','Object03'
$objectList = "Object01 `nObject02 `nObject03“

$ListVariables = 'Object1', 'Object2', 'Object3', 'Object4’
$var[0]
$var[-1] last object
$var[-2] 2nd to last objects
$var.length
$var.touppper()
$var.tolower()                    $var.replace()
```


MORE VARIABLE STUFF

- Access variable by property
- $_. – object coming across the pipeline
- $() – subexpression
- Declaring Variables

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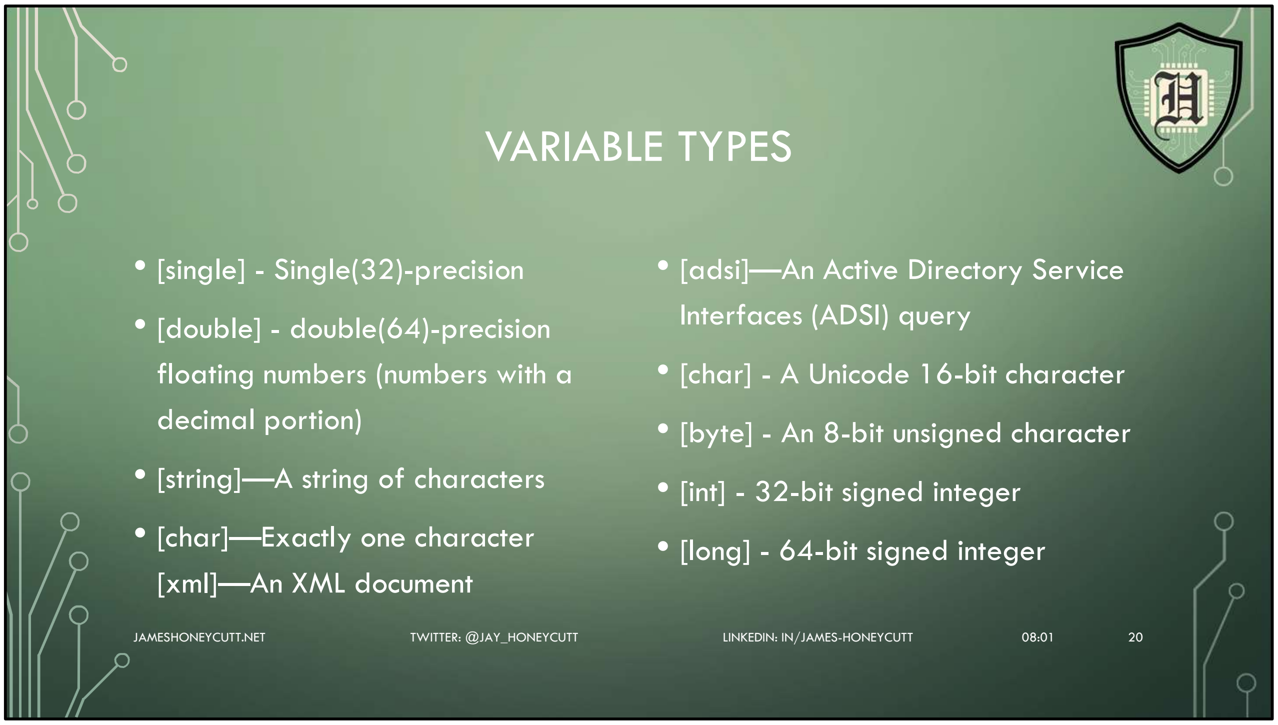
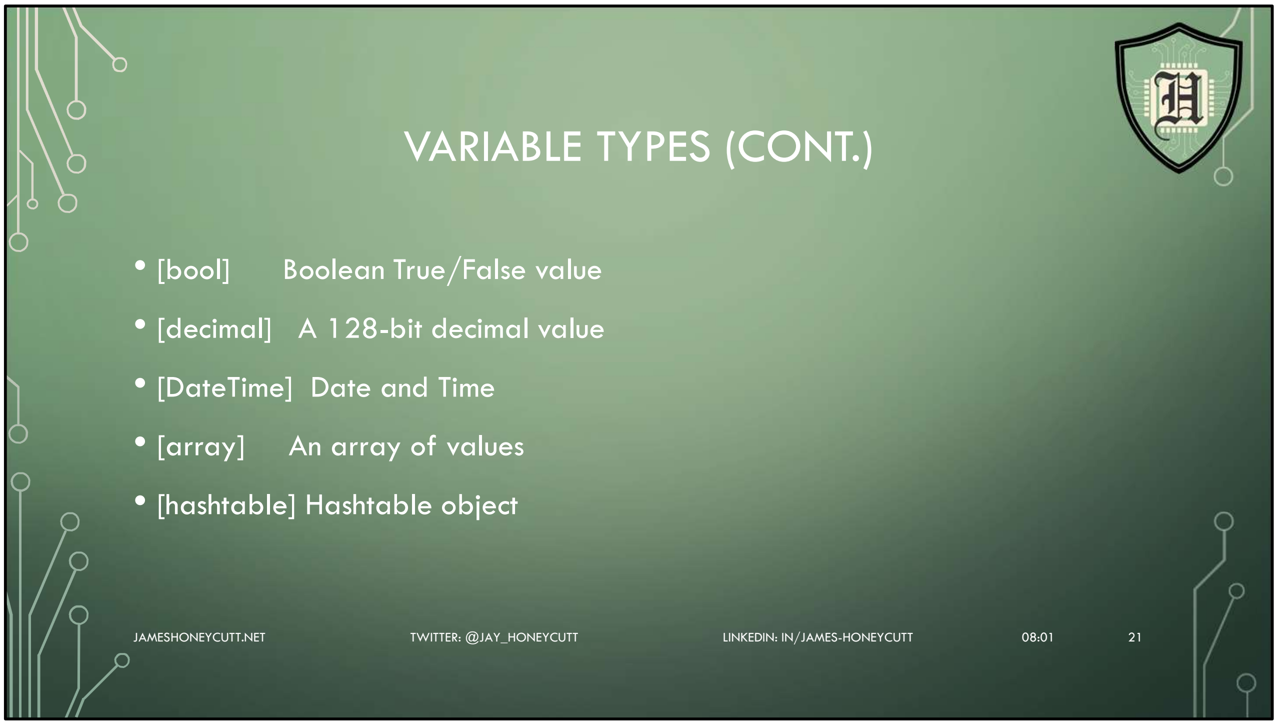
```
$services = Get-service
$services.name

Get-Service | ForEach-Object { Write-Output $_.Name }

$today = “Today is get-date”

$number = Read-host “Enter a number: “
[int]$number = Read-host "Enter a number"
```



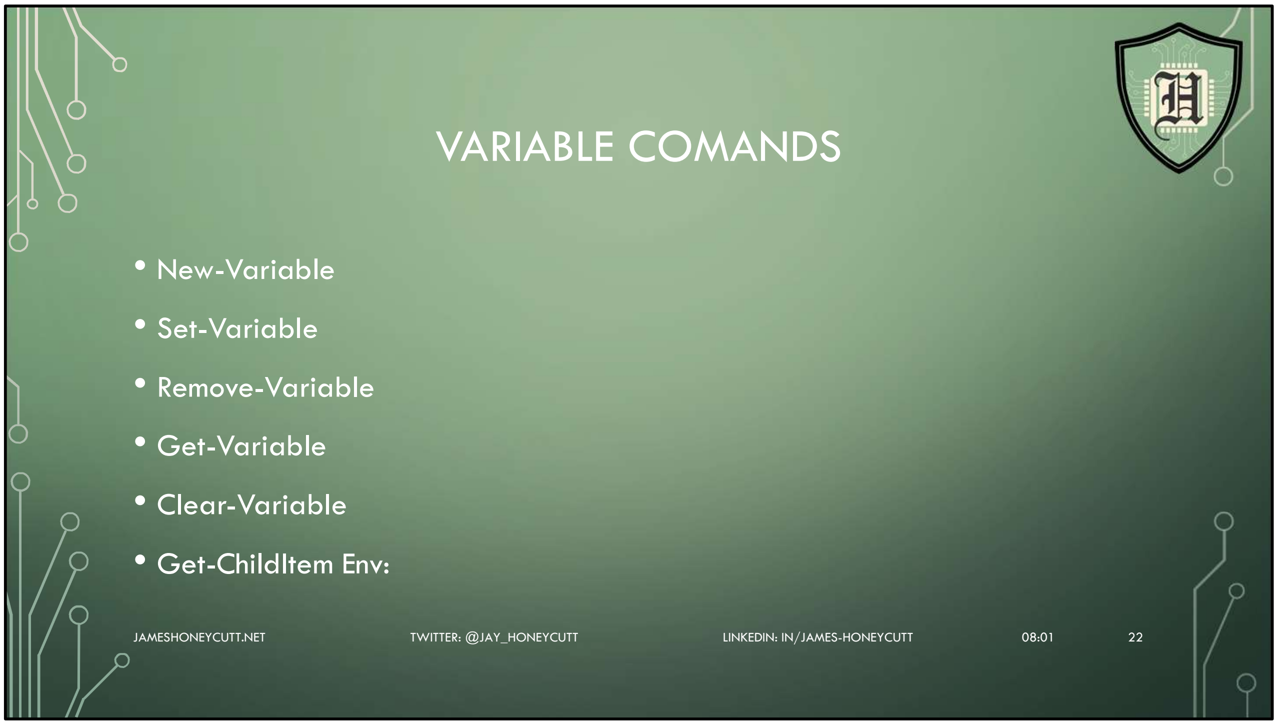
VARIABLE TYPES

- [single] - Single(32)-precision
- [double] - double(64)-precision floating numbers (numbers with a decimal portion)
- [string]—A string of characters
- [char]—Exactly one character [xml]—An XML document
- [adsi]—An Active Directory Service Interfaces (ADSI) query
- [char] - A Unicode 16-bit character
- [byte] - An 8-bit unsigned character
- [int] - 32-bit signed integer
- [long] - 64-bit signed integer



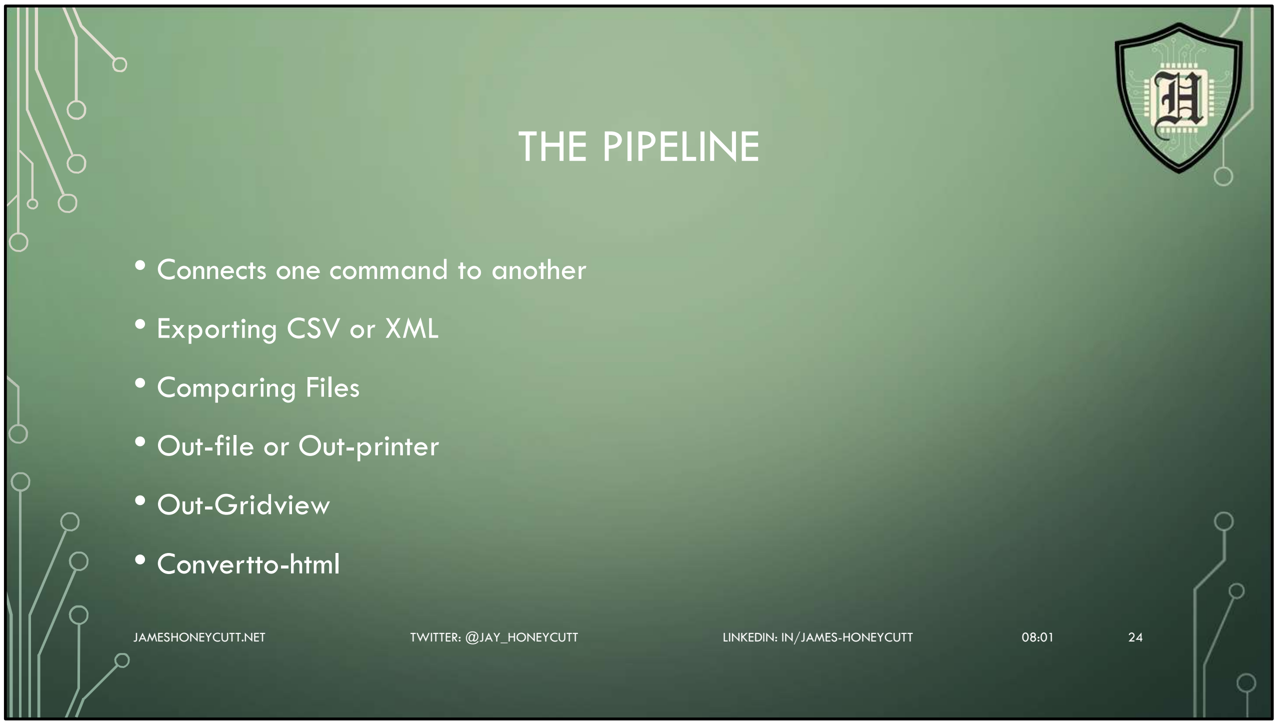
VARIABLE TYPES (CONT.)

[bool]	Boolean True/False value
[decimal]	A 128-bit decimal value
[DateTime]	Date and Time
[array]	An array of values
[hashtable]	Hashtable object



VARIABLE COMANDS

- New-Variable
- Set-Variable
- Remove-Variable
- Get-Variable
- Clear-Variable
- Get-ChildItem Env:



THE PIPELINE

- Connects one command to another
- Exporting CSV or XML
- Comparing Files
- Out-file or Out-printer
- Out-Gridview
- Convertto-html

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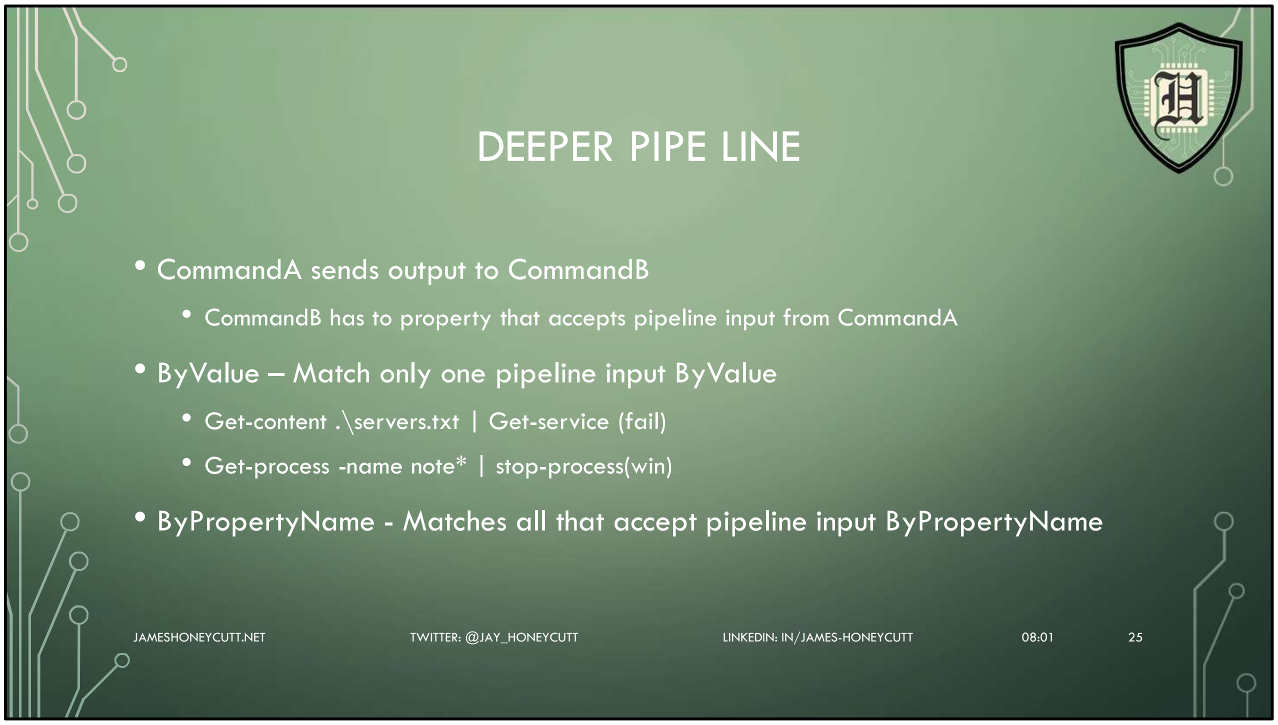
```
Get-Service | ConvertTo-HTML | Out-File services.html

Get-Process -name Notepad | Stop-Process

 get-process | export-csv c:\temp\processes.csv -NoTypeInformation
```



DEEPER PIPE LINE

- CommandA sends output to CommandB
  - CommandB has to property that accepts pipeline input from CommandA
- ByValue – Match only one pipeline input ByValue
  - Get-content .\servers.txt | Get-service (fail)
  - Get-process -name note* | stop-process(win)
- ByPropertyName - Matches all that accept pipeline input ByPropertyName

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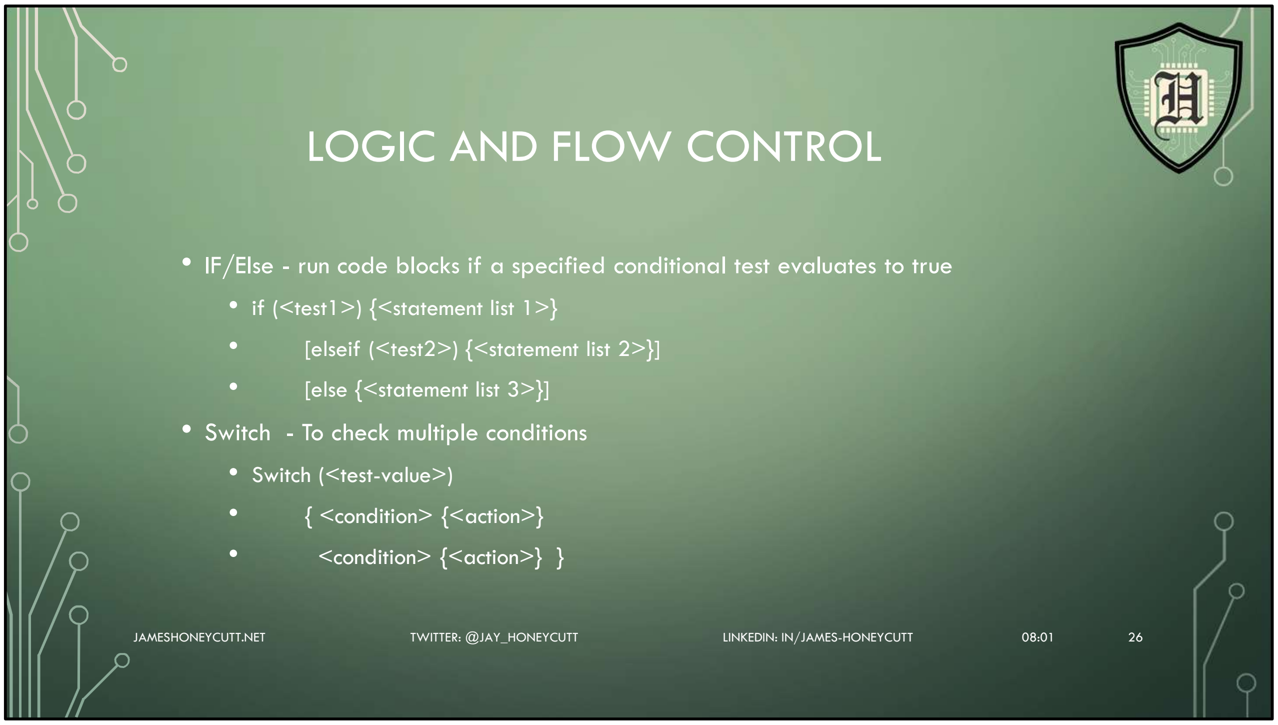
Get-help get-service –full

Get-content .\servers.txt | Get-service (fail)
Get-process -name note* | stop-process(win)



LOGIC AND FLOW CONTROL

- IF/Else - run code blocks if a specified conditional test evaluates to true
  - if (<test1>) {<statement list 1>}
  -         [elseif (<test2>) {<statement list 2>}]
  -         [else {<statement list 3>}]
- Switch - To check multiple conditions
  - Switch (<test-value>)
  -         { <condition> {<action>}
  -           <condition> {<action>} }

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If/Elses

```
 $a = 1
if (($a -gt 2) -and ($a -le 10))
   {Write-Host "The Value $a is greater than 2 less than 10."}
elseif  ($a -le 2)
   {Write-Host "The value $a is less than 2."}
else {Write-Host "The value $a is greater than 10."}
```

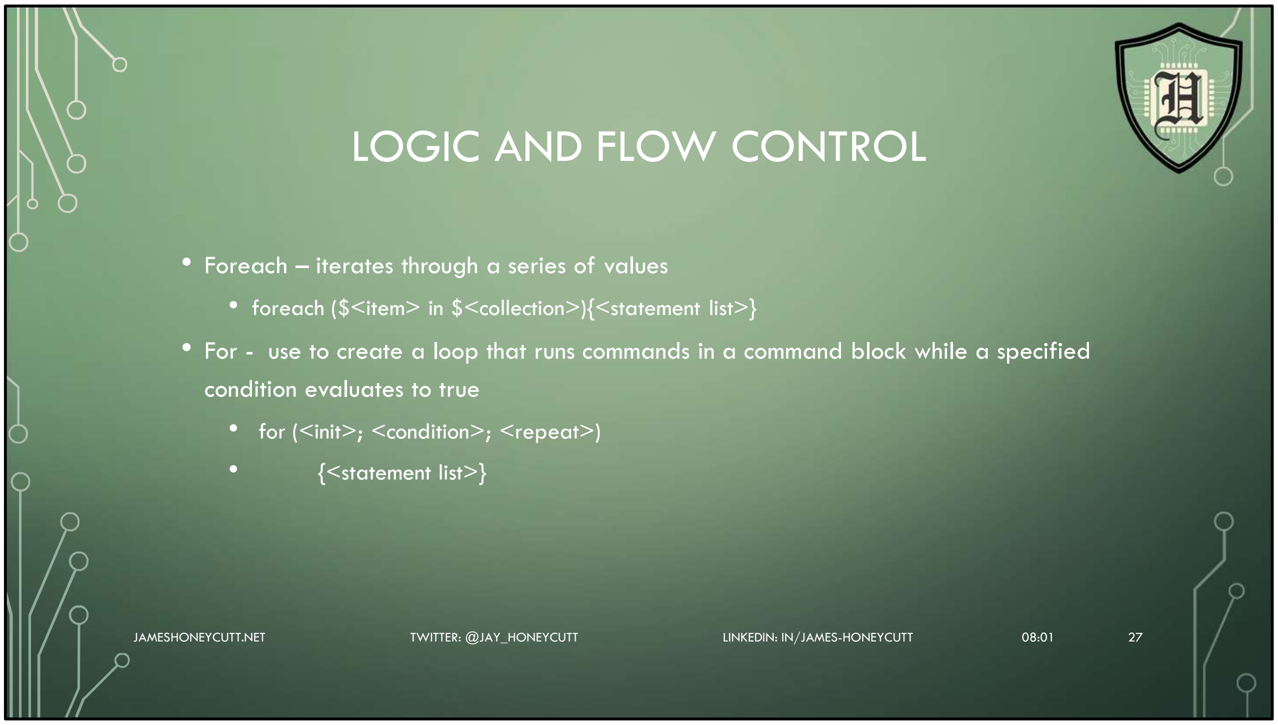
code “C:\Scripts\PowerShell\UserAccounts\Uploaded to GitHub\New-ADUser_Prompted.ps1”

Switch

```
$a = 3
switch ($a)
       {
          1 {"It is one."}
          2 {"It is two."}
          3 {"It is three."; Break}
```

```
        4 {"It is four."}
        3 {"Three again."}
    }
```

```
code C:\Scripts\PowerShell\Vmware\ViewVM-SetState.ps1
```



LOGIC AND FLOW CONTROL

- Foreach – iterates through a series of values
  - foreach ($<item> in $<collection>){<statement list>}
- For - use to create a loop that runs commands in a command block while a specified condition evaluates to true
  - for (<init>; <condition>; <repeat>)
  - {<statement list>}

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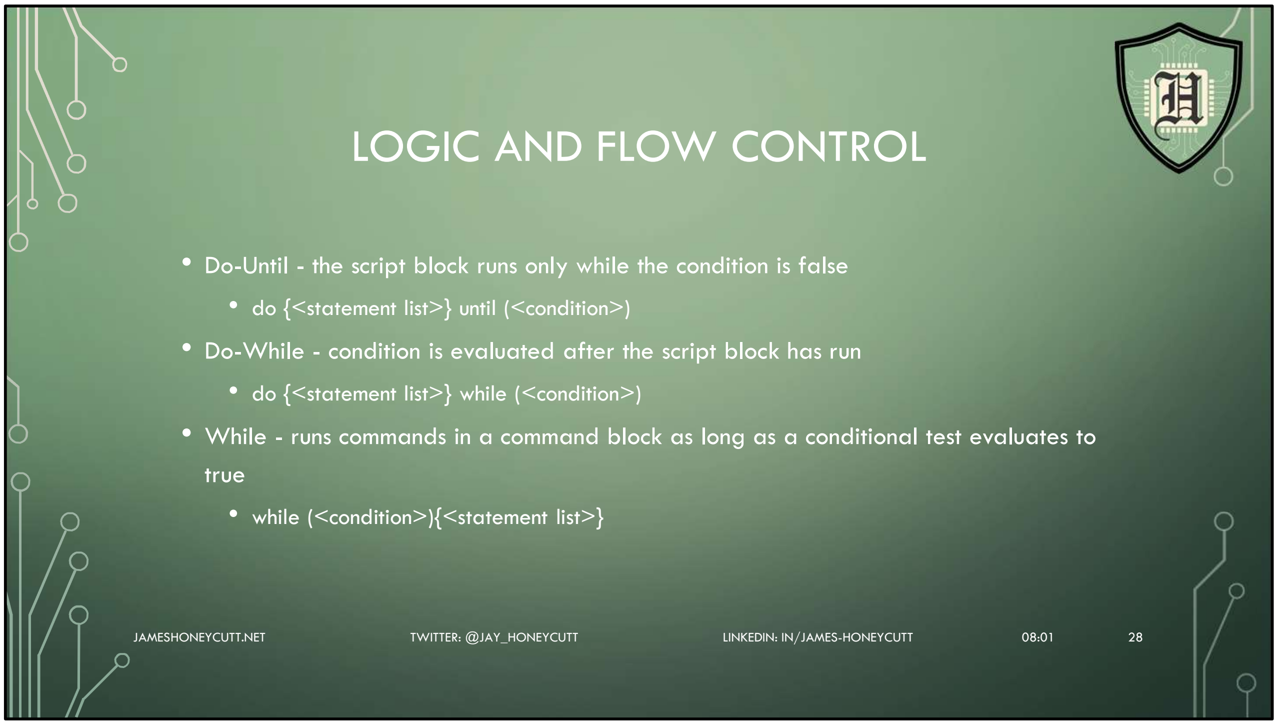
ForEach
```
$letterArray = "a","b","c","d“
foreach ($letter in $letterArray) {Write-Host $letter}

 code “C:\Scripts\PowerShell\UserAccounts\Uploaded to GitHub\Get-InactiveUsers.ps1”
```

For
```
for($i=1; $i -le 100; $i++){Write-Host $i}
```



LOGIC AND FLOW CONTROL

- Do-Until - the script block runs only while the condition is false
  - do {<statement list>} until (<condition>)
- Do-While - condition is evaluated after the script block has run
  - do {<statement list>} while (<condition>)
- While - runs commands in a command block as long as a conditional test evaluates to true
  - while (<condition>){<statement list>}

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Do-Until

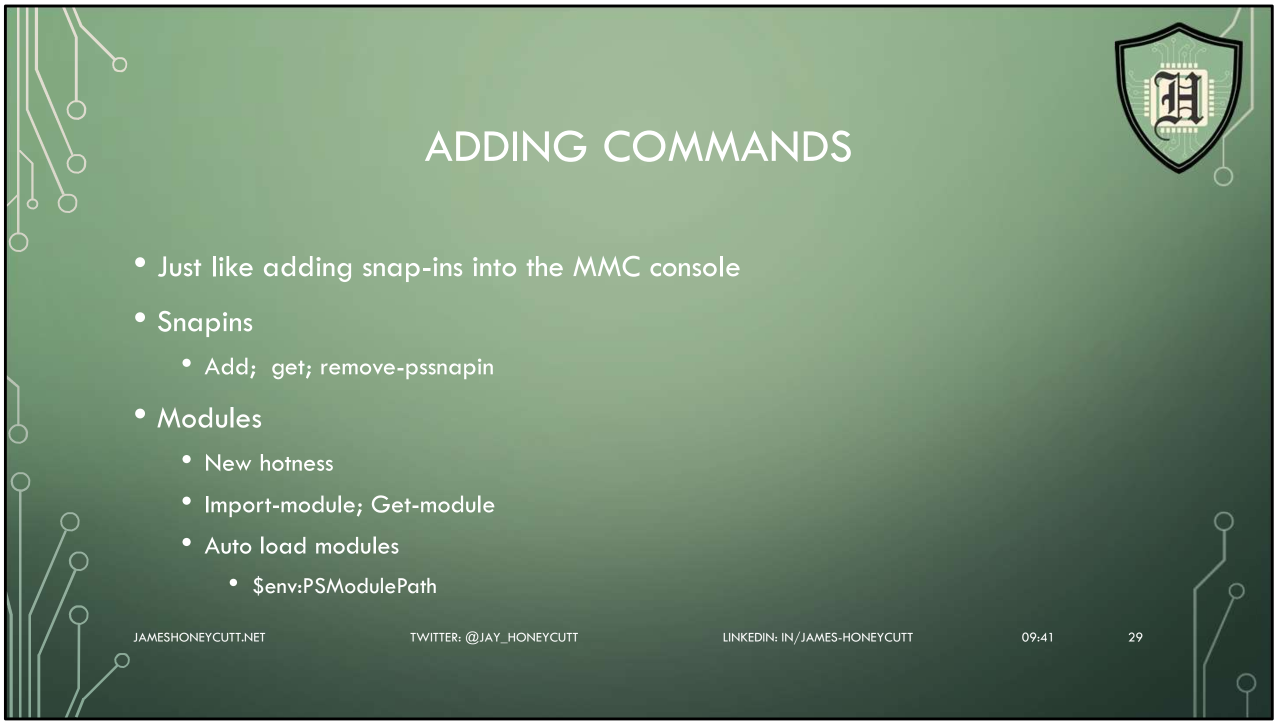
code C:\Scripts\PowerShell\UserAccounts\lockaccounts.ps1

Do-While

code C:\Scripts\PowerShell_InProgress\Generate-Files.ps1

While

code C:\Scripts\PowerShell\UserAccounts\Invoke-RandomUser.ps1


ADDING COMMANDS

- Just like adding snap-ins into the MMC console
- Snapins
  - Add; get; remove-pssnapin
- Modules
  - New hotness
  - Import-module; Get-module
  - Auto load modules
    - $env:PSModulePath

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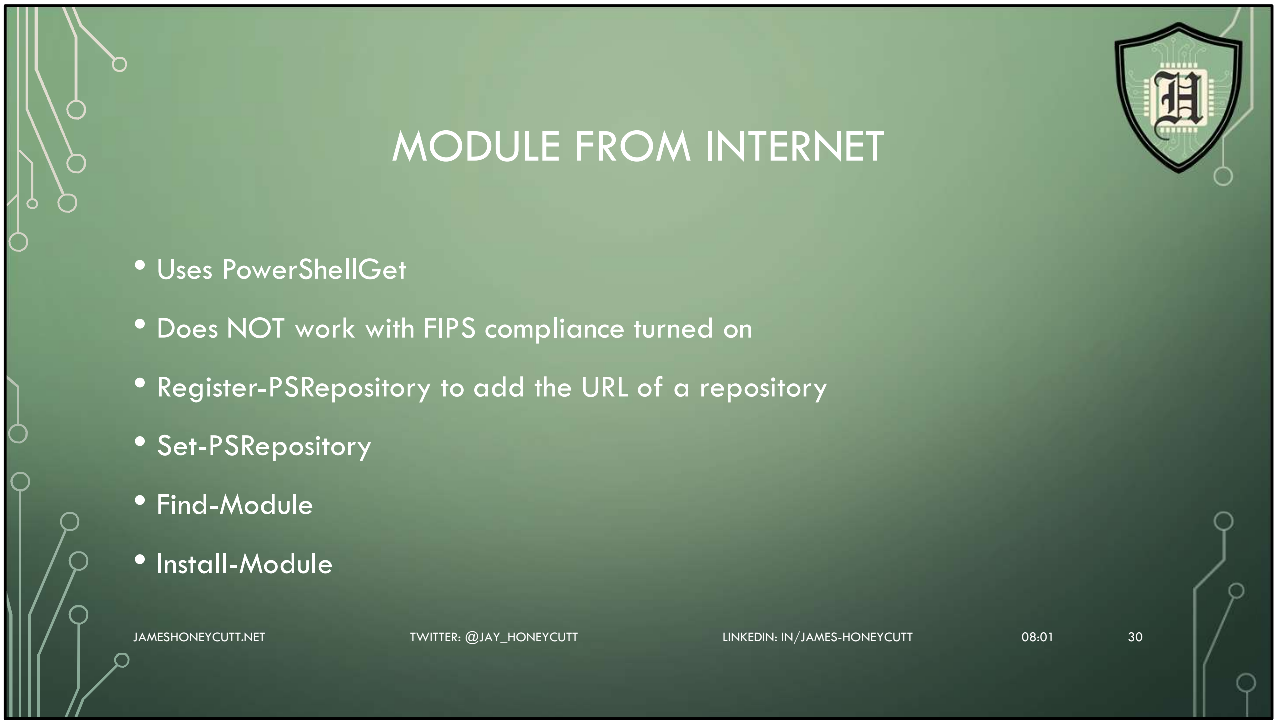
Snapins
Code “C:\Scripts\PowerShell\VMware\Uploaded to GitHub\Refresh-availableVMs.ps1”

Modules
Code “C:\Scripts\PowerShell\VMware\Uploaded to GitHub\New-ADUser_Prompted.ps1”
Code “C:\Scripts\PowerShell\VMware\Uploaded to GitHub\Export-OVA.ps1”

```
Get-module –listavailable
 get-command *host*
Get-help get-host
Get-help get-vmhost

$env:psmodulepath


get-module -ListAvailable VM* | foreach ($Module -in $_.name) { Uninstall-Module -Name
$Module}
```



MODULE FROM INTERNET

- Uses PowerShellGet
- Does NOT work with FIPS compliance turned on
- Register-PSRepository to add the URL of a repository
- Set-PSRepository
- Find-Module
- Install-Module

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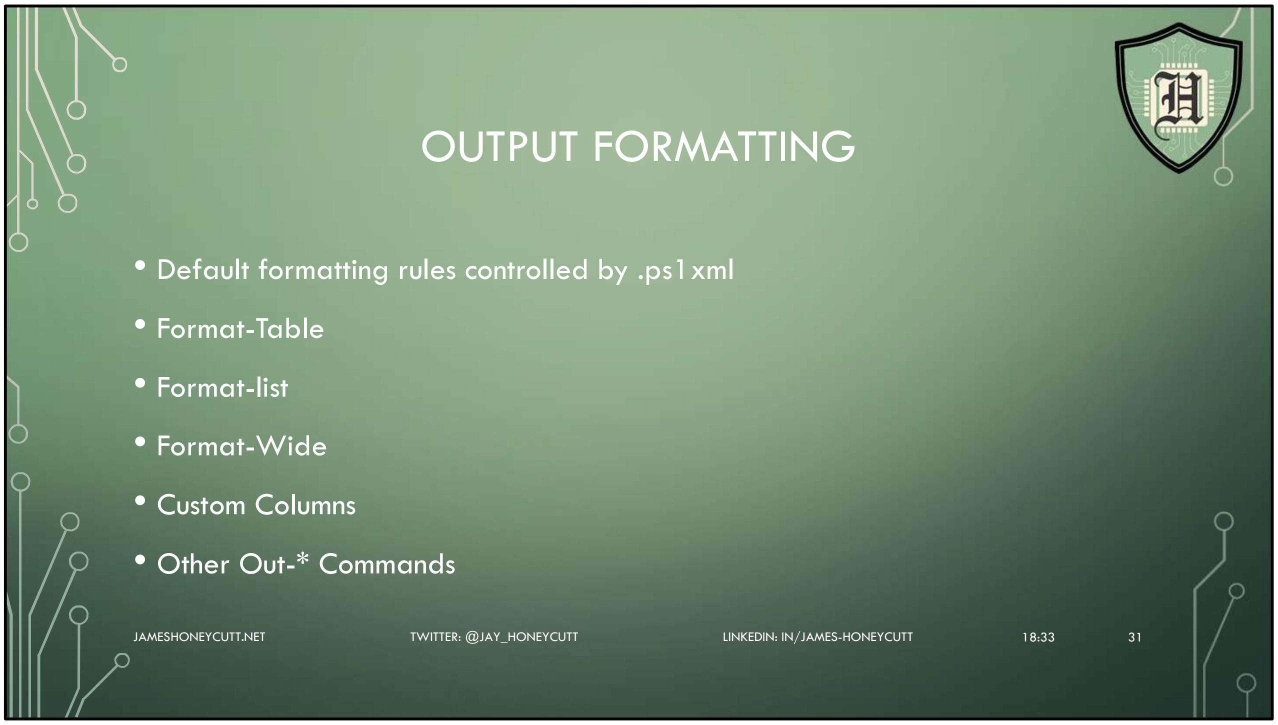
get-command *sql*
Find-module *sql*
Install-module SqlServer

get-command *sql*
get-command -module SqlServer

Set-PSRepository –name “MyLocalStore”

Profile Scripts


OUTPUT FORMATTING

- Default formatting rules controlled by .ps1xml
- Format-Table
- Format-list
- Format-Wide
- Custom Columns
- Other Out-* Commands

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Third formatting rule
i) Four or less properties; format as table
ii) Five or more properties; format as list

Format-Table
-autosize (adjusts to column width)
(1) Get-Process | select -last 15 | Format-Table
ii) -property (instead of piping to select)
(1) Get-Process | select -last 15 | Format-Table -Property MachineName, ID, ProcessName, responding
iii) –groupBy
(1) Get-Service | Sort-Object Status | Format-Table -groupBy Status
iv) –wrap
(1) Get-Service | Format-Table Name,Status,DisplayName -autoSize –wrap

Format-Wide (wide list)
i) Grabs “name” property and creates a 2 column list
ii) -column to change the # of columns
iii) -property select other property instead of name property

Format-list
   -property
      Get-Process | Format-list -Property Name,ID
   -groupBy
      Get-Process | Format-list -Property Name,ID -GroupBy name
   -others

get-command out-*
Get-Service | Group-Object -Property Status | Sort-Object -Property Count -Descending | ConvertTo-Json | Out-File .\Services.json

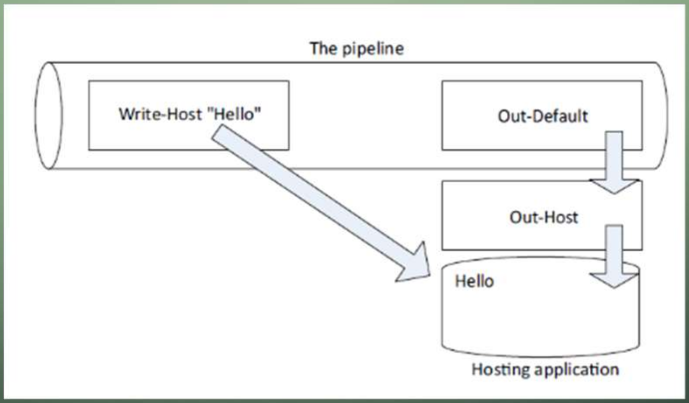
Custom Columns
   Get-Process | select -first 5 | Format-Table -Property name,vm
   Get-Process | select -first 5 | Format-Table Name, @{name='VM(MB)';expression={$_.VM / 1MB -as [int]}} –autosize

Code “C:\Scripts\PowerShell\Server\Uploaded to GitHub\Get-ServerRebootStatus.ps1”

$userData = Import-Csv 'C:\Users\honey\Google Drive\Presentations\PowerShell\PowerShell Crash Course\UserData.csv'
$userData | select -First 5 | Format-Table -property ID, @{name='FName';expression={$_.first_name}}, @{name='LName';expression={$_.last_name}}, email, gender
$userData | select ID, @{name='FName';expression={$_.first_name}}, @{name='LName';expression={$_.last_name}}, email, gender | export-csv 'C:\Users\honey\Google Drive\Presentations\PowerShell\PowerShell Crash Course\temp.csv' -NoTypeInformation

get-command out-*

WRITE-HOST

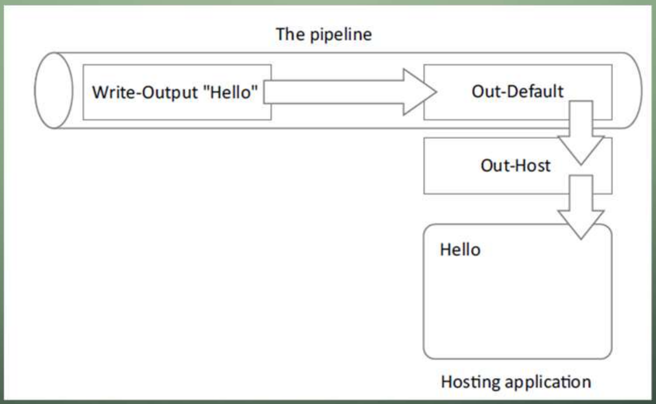


write-host "COLORFUL!" -fore yellow -back magenta

Anything written to the screen (-host) cannot be captured.
i.e unattended script or remote commands (invoke)

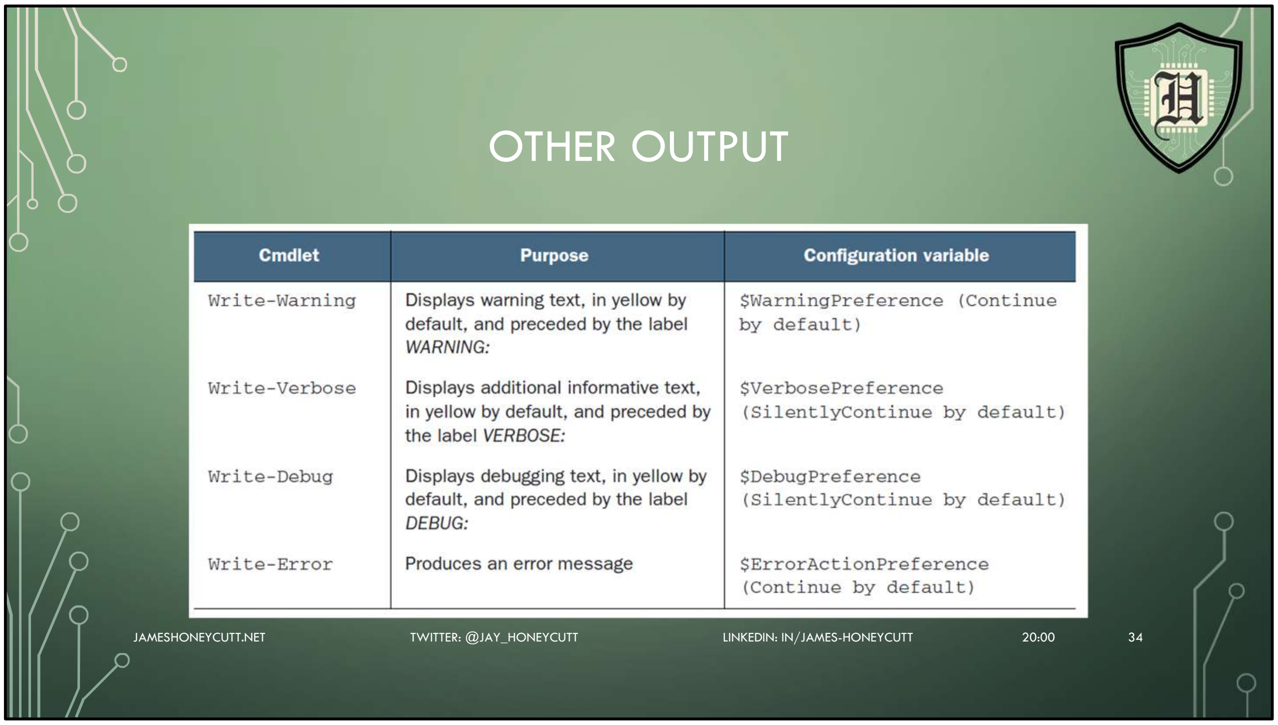
Best practice is to use Write-Verbose
Used for “warm and fuzzy messages”
Connecting to xyz server
Testing connecton

WRITE-OUTPUT



Can send objects into the pipeline
Write-output Hello

```
write-output "Hello" | where-object { $_.length -gt 3 } | out-default | write-host
```



OTHER OUTPUT

Cmdlet	Purpose	Configuration variable
`Write-Warning`	Displays warning text, in yellow by default, and preceded by the label *WARNING:*	`$WarningPreference (Continue by default)`
`Write-Verbose`	Displays additional informative text, in yellow by default, and preceded by the label *VERBOSE:*	`$VerbosePreference (SilentlyContinue by default)`
`Write-Debug`	Displays debugging text, in yellow by default, and preceded by the label *DEBUG:*	`$DebugPreference (SilentlyContinue by default)`
`Write-Error`	Produces an error message	`$ErrorActionPreference (Continue by default)`

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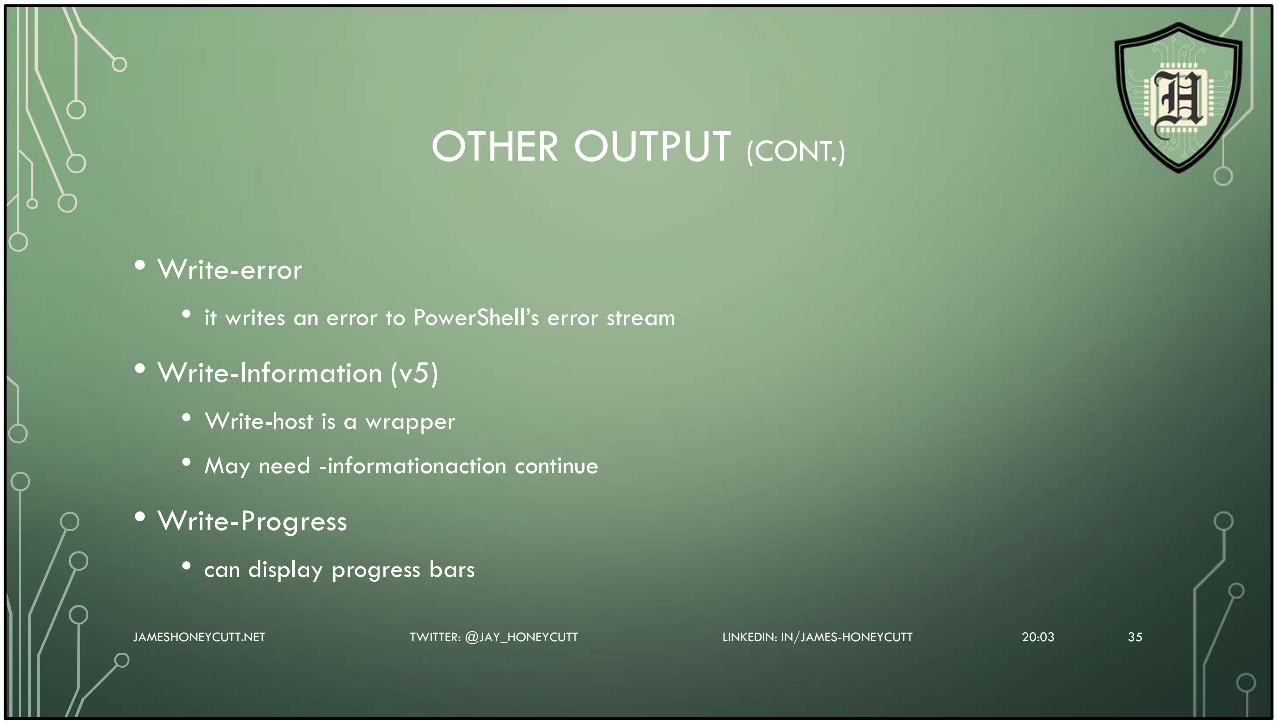
Write-Information (v5)
 Write-host is a wrapper
 May need -informationaction continue

Write-Progress
 can display progress bars

Write-verbose
 Write-Verbose "Test Message" –Verbose

Write-Information
Get-ChildItem C:\Users\honey\Documents\*.pdf; Write-Information -MessageData "Here are your PDFs!" -InformationAction Continue



OTHER OUTPUT (CONT.)

- Write-error
  - it writes an error to PowerShell's error stream
- Write-Information (v5)
  - Write-host is a wrapper
  - May need -informationaction continue
- Write-Progress
  - can display progress bars

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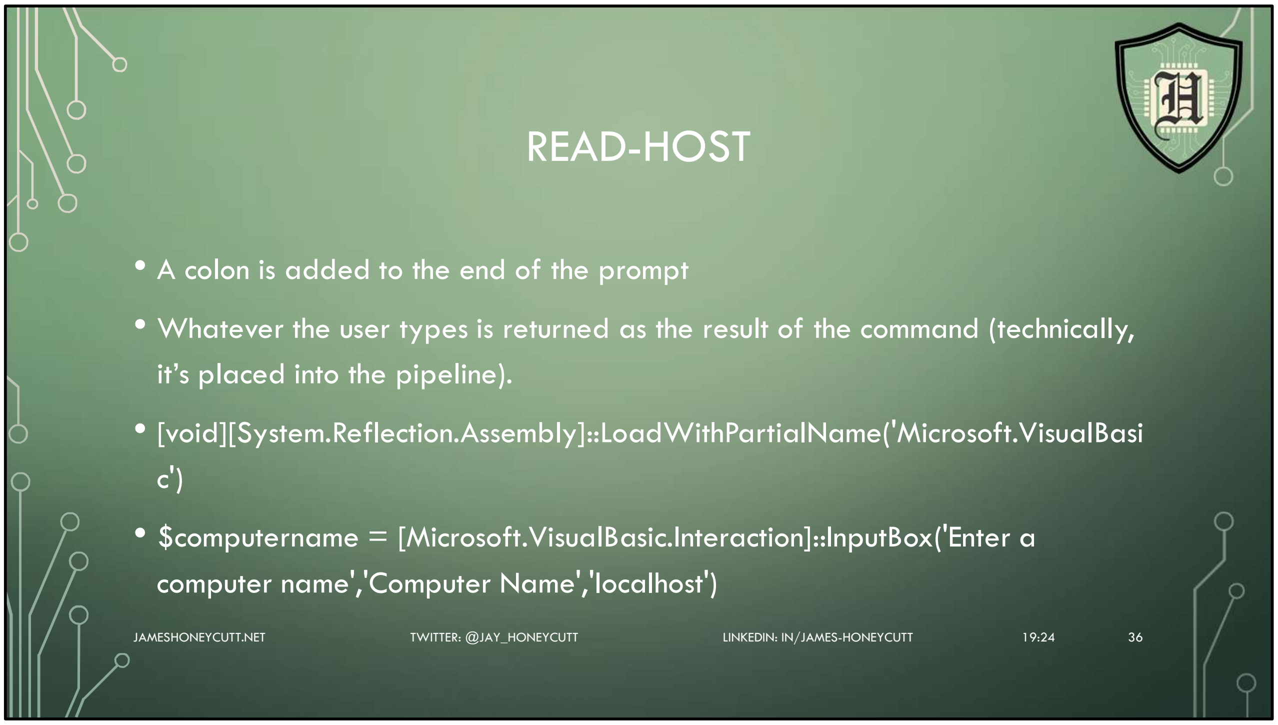
$error

Write-error
it writes an error to PowerShell's error stream

Write-Information (v5)
Write-host is a wrapper
May need -informationaction continue
Get-ChildItem C:\Users\honey\Documents\*.pdf; Write-Information -MessageData "Here are your PDFs!" -InformationAction Continue

Write-Progress
can display progress bars



READ-HOST

- A colon is added to the end of the prompt
- Whatever the user types is returned as the result of the command (technically, it's placed into the pipeline).
- [void][System.Reflection.Assembly]::LoadWithPartialName('Microsoft.VisualBasic')
- $computername = [Microsoft.VisualBasic.Interaction]::InputBox('Enter a computer name','Computer Name','localhost')

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read-host "What is your name?"
Code "C:\Scripts\PowerShell\UserAccounts\Uploaded to GitHub\New-ADUser_Prompted.ps1"

[void][System.Reflection.Assembly]::LoadWithPartialName('Microsoft.VisualBasic')

[void] - part is converting the result of the command into the void data type.
an object that does not have a value of any **type** data type is a special type that means "throw the result away."
Another way to do the same thing would be to pipe the result to Out-Null.

[System.Reflection.Assembly] – represents our application
enclosed the type name in square brackets, as if we were declaring a variable to be of that type
we're using two colons to access a static method of the type
Static methods exist without us having to create an instance of the type.

LoadWithPartialName ()
static method we're using
accepts the name of the framework component we want to load.

```
$computername = [Microsoft.VisualBasic.Interaction]::InputBox('Enter a computer
name','Computer Name','localhost')
```

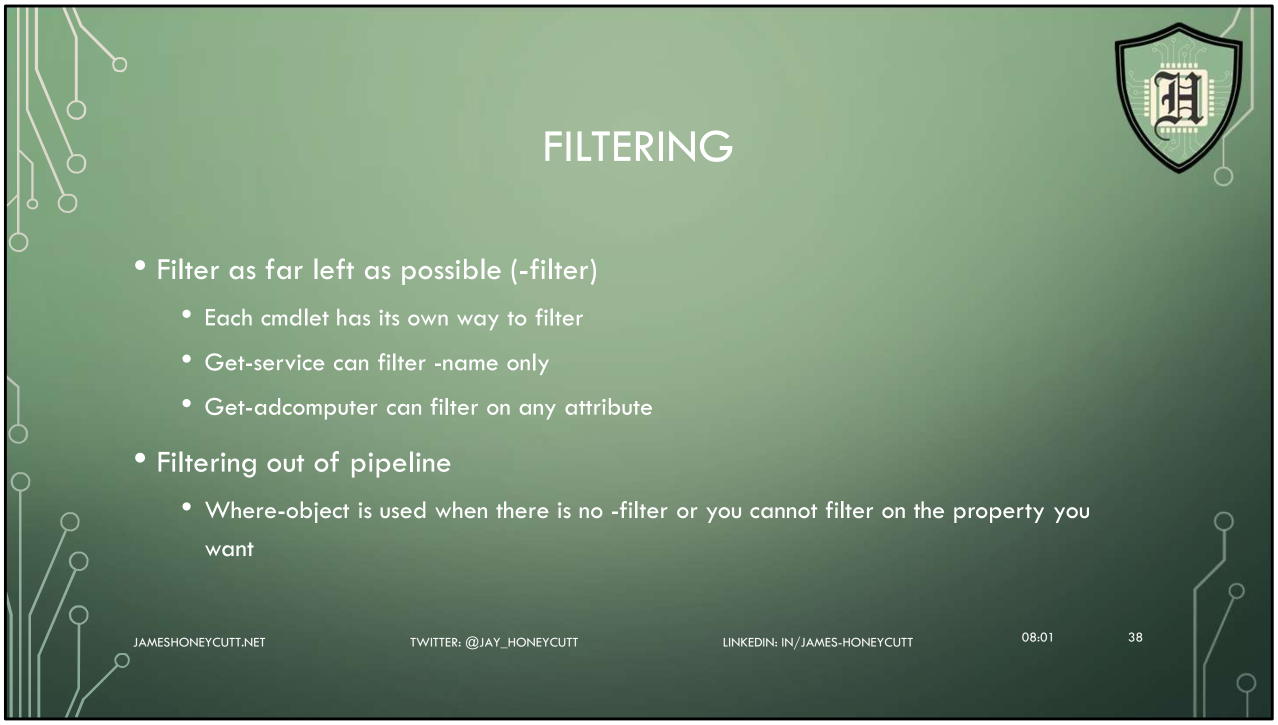
[Microsoft.VisualBasic.Interaction]
: Loaded into memory with the previous command

'Enter a computer name'
: The first parameter is the text for your prompt.

'Computer Name'
: The second parameter is the title for the prompt's dialog box.

'localhost'
: The default value that you want prefilled in the input box.

TIME FOR
LUNCH
TIME FOR



FILTERING

- Filter as far left as possible (-filter)
  - Each cmdlet has its own way to filter
  - Get-service can filter -name only
  - Get-adcomputer can filter on any attribute
- Filtering out of pipeline
  - Where-object is used when there is no -filter or you cannot filter on the property you want

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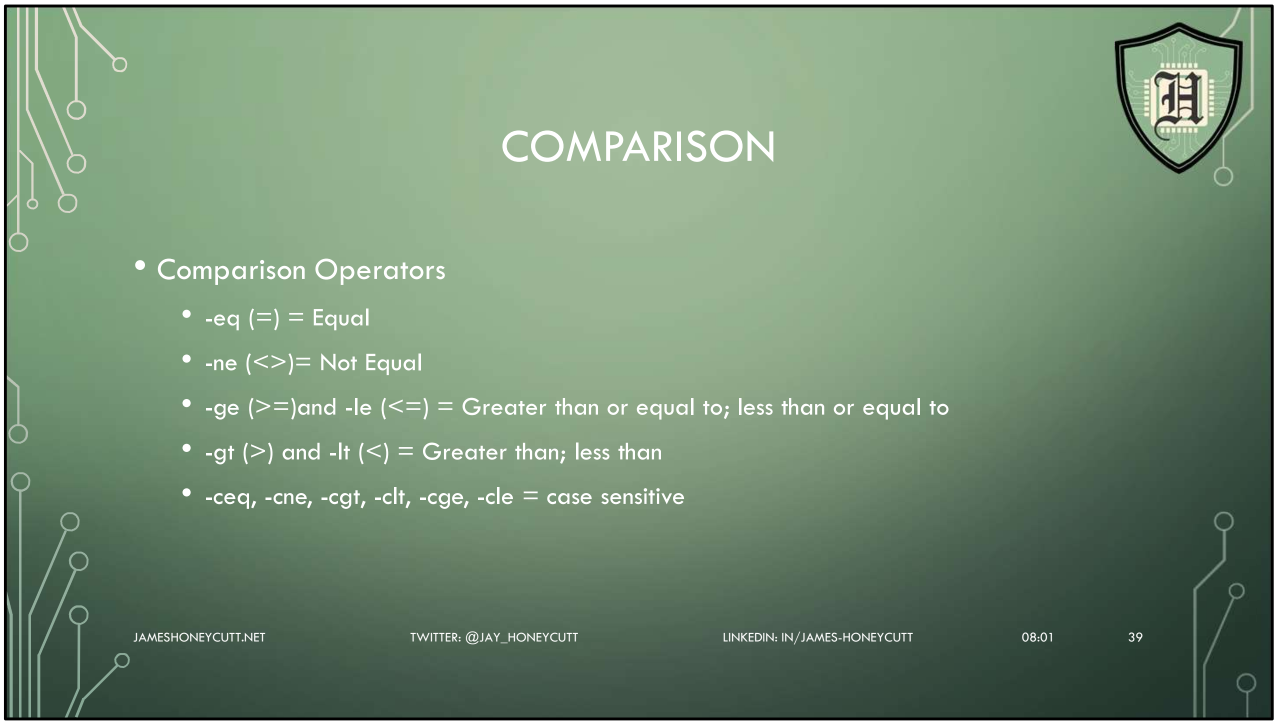
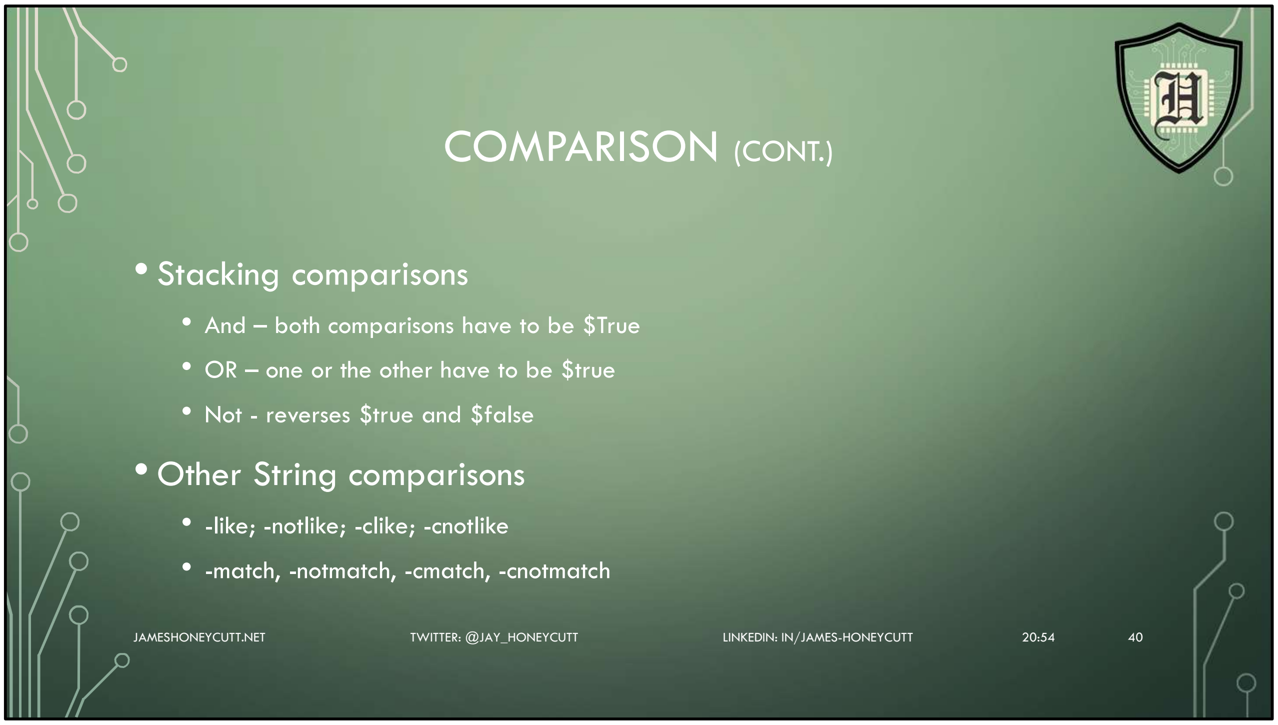


COMPARISON

- Comparison Operators
  - -eq (=) = Equal
  - -ne (<>)= Not Equal
  - -ge (>=)and -le (<=) = Greater than or equal to; less than or equal to
  - -gt (>) and -lt (<) = Greater than; less than
  - -ceq, -cne, -cgt, -clt, -cge, -cle = case sensitive


COMPARISON (CONT.)

- Stacking comparisons
  - And – both comparisons have to be $True
  - OR – one or the other have to be $true
  - Not - reverses $true and $false
- Other String comparisons
  - -like; -notlike; -clike; -cnotlike
  - -match, -notmatch, -cmatch, -cnotmatch

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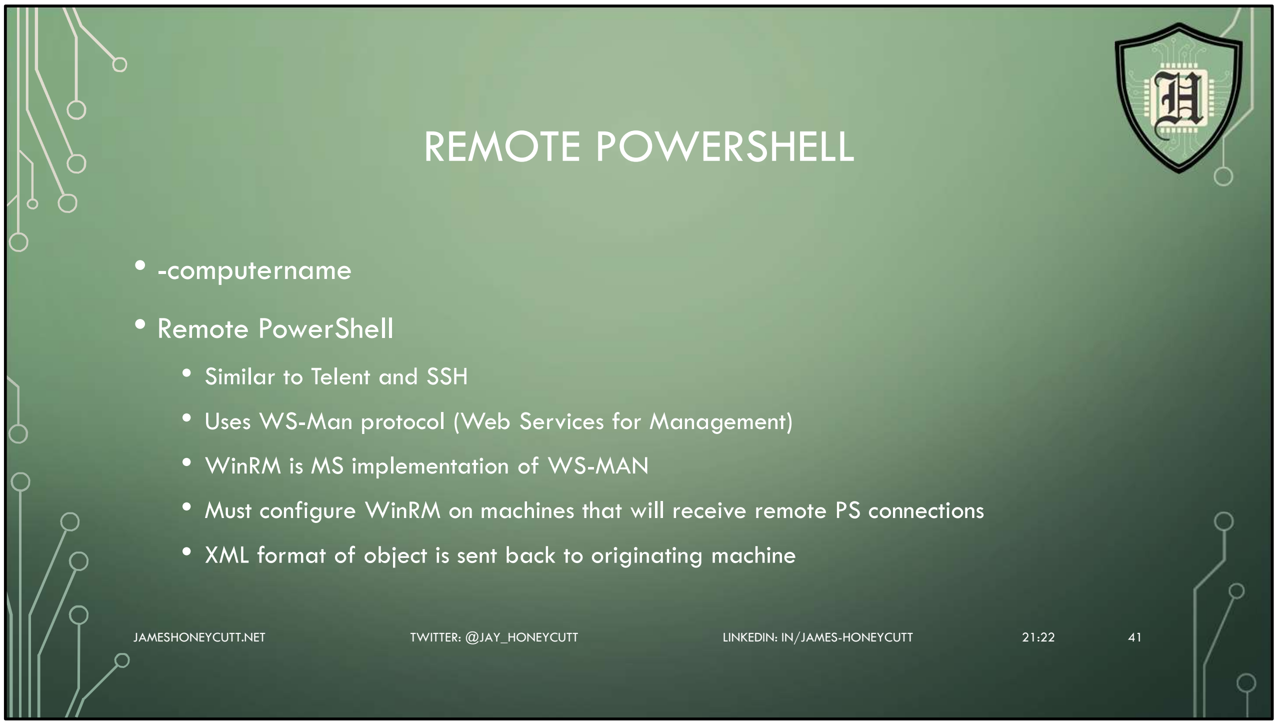
get-service | where-object {$_.status -eq 'running’ }

Get-Service | Where Status -eq 'Running’
   Simple; new in v3; good when only comparing 1 object

get-service | where-object {$_.status -eq 'running' -AND $_.StartType -eq 'Manual’}
Original syntax; used for multi compare

Get-Process | Where-Object -filter { $_.Name -notlike 'powershell*' } | Sort VM -descending | Select -first 10 | Measure-Object -property VM –sum

Code “C:\Scripts\PowerShell\UserAccounts\Uploaded to GitHub\New-ADUser_Prompted.ps1”



REMOTE POWERSHELL

- -computername
- Remote PowerShell
  - Similar to Telent and SSH
  - Uses WS-Man protocol (Web Services for Management)
  - WinRM is MS implementation of WS-MAN
  - Must configure WinRM on machines that will receive remote PS connections
  - XML format of object is sent back to originating machine

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Remote PowerShell

Similar to Telent and SSH

Uses WS-Man protocol (Web Services for Management)

Over http (5985) and https (5986)

WSMan: drive manages remote sessions

Get-ChildItem WSMan:\localhost\Shell

IdleTimeout - specifies the amount of time a session can be idle before it's shut down automatically

MaxConcurrentUsers - specifies the number of users who can have a session open at once

MaxShellRunTime - determines the maximum amount of time a session can be open.

MaxShellsPerUser - sets a limit on the number of sessions a single user can have open at once

Get-ChildItem WSMan:\localhost\Service\

MaxConnections - sets the upper limit on incoming connections to the entire remoting infrastructure.

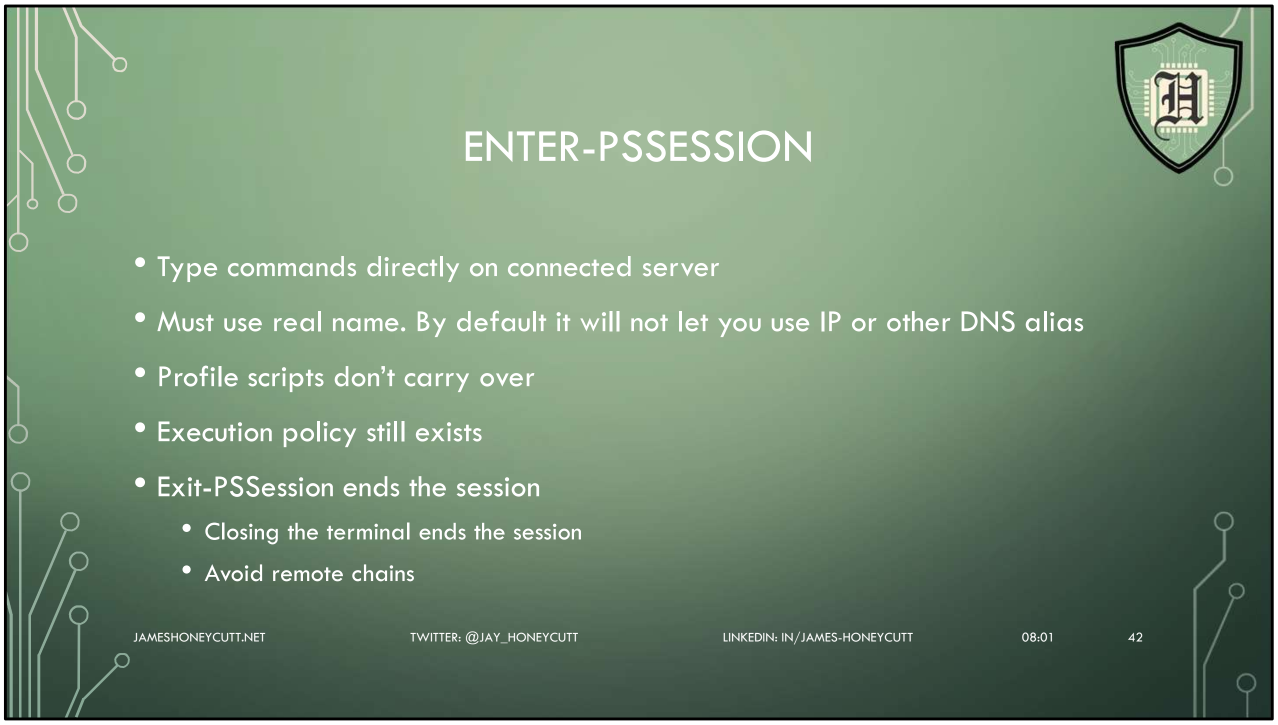
WinRM is MS implementation of WS-MAN

Installed and enabled by default on Servers 2012r2 and up

        - Installed and disabled by default on Win7 and up
    - XML format of object is sent back to originating machine
        - Serialization – to XML format
        - Deserialization – from XML format
        - Only a snapshot
    - Must configure WinRM on machines that will receive remote PS connections
        - Enable-PSRemoting (call Set-WSManQuickConfig; starts and sets WinRM service to autostart, Registers PowerShell as an endpoint; creates needed firewall rules.

Any adapter set to Public can’t have Windows Firewall exceptions

Test-WSMan
Get-PSSessionConfiguration
Enable-PSRemoting -SkipNetworkProfileCheck -Verbose



ENTER-PSSESSION

- Type commands directly on connected server
- Must use real name. By default it will not let you use IP or other DNS alias
- Profile scripts don't carry over
- Execution policy still exists
- Exit-PSSession ends the session
  - Closing the terminal ends the session
  - Avoid remote chains

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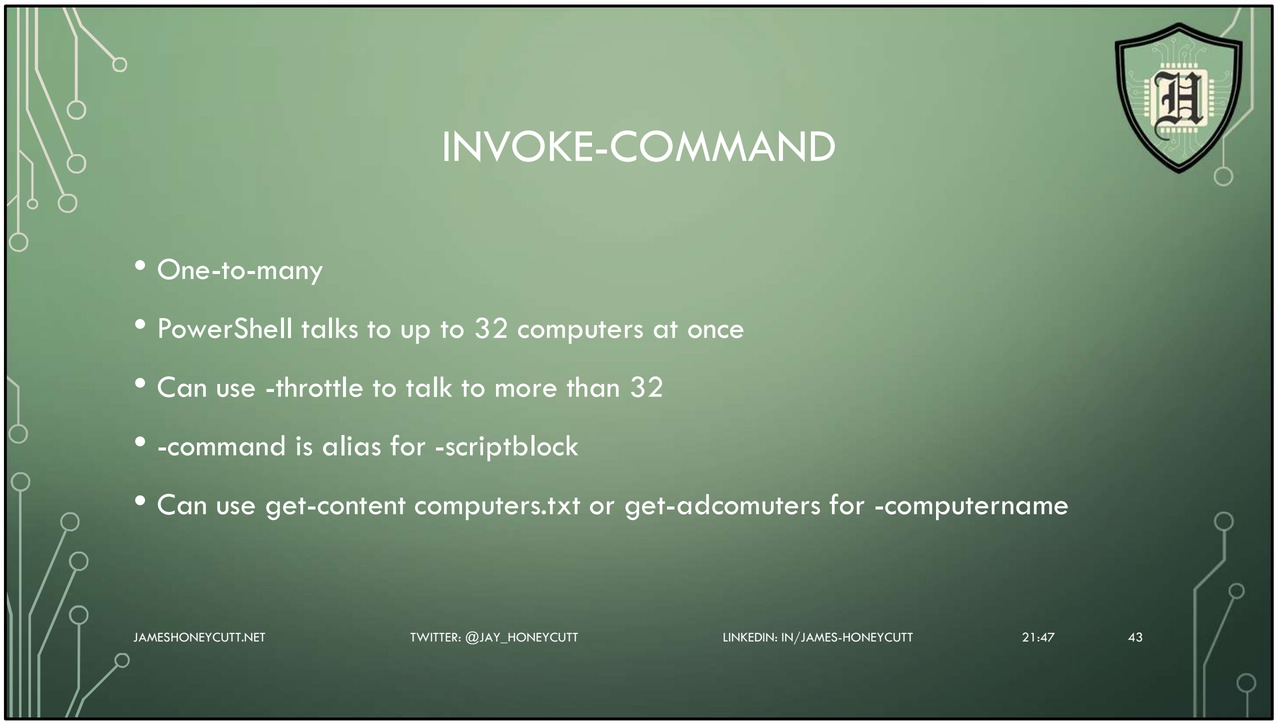
```
enter-pssession localhost
enter-pssession DESKTOP-52INA1A -Credential desktop-52ina1a\honey
```



INVOKE-COMMAND

- One-to-many
- PowerShell talks to up to 32 computers at once
- Can use -throttle to talk to more than 32
- -command is alias for -scriptblock
- Can use get-content computers.txt or get-adcomuters for -computername

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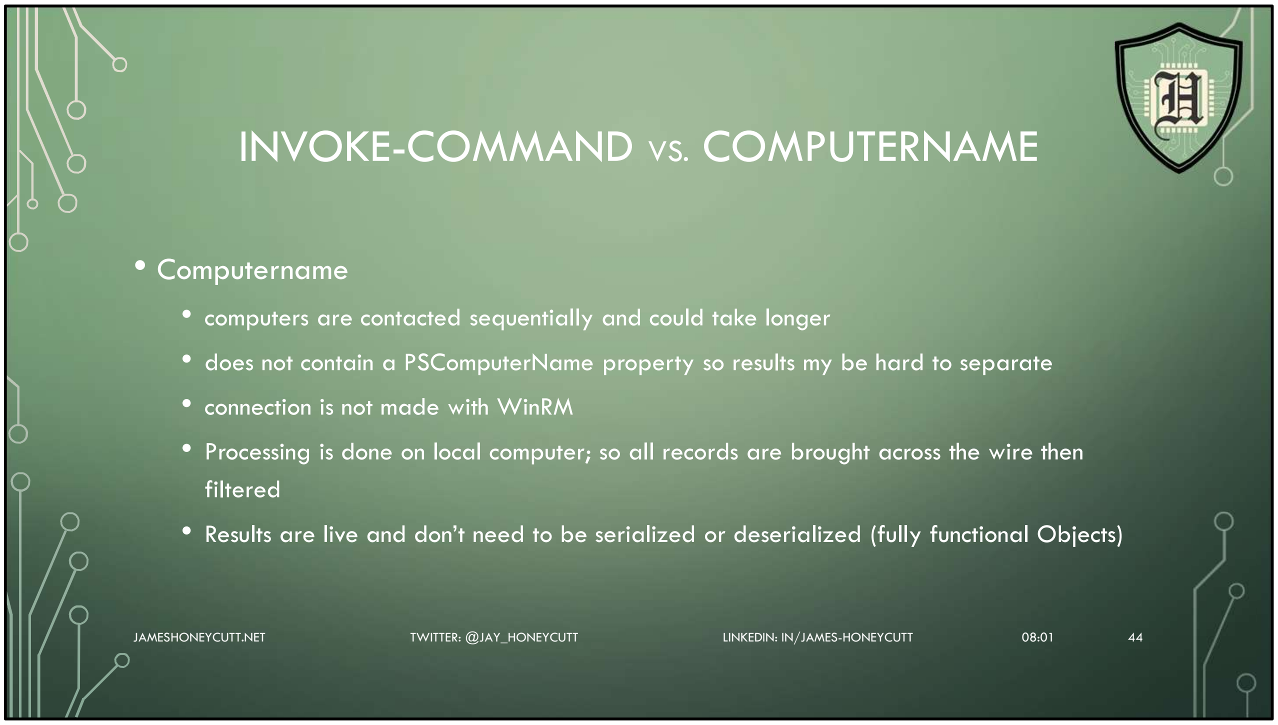
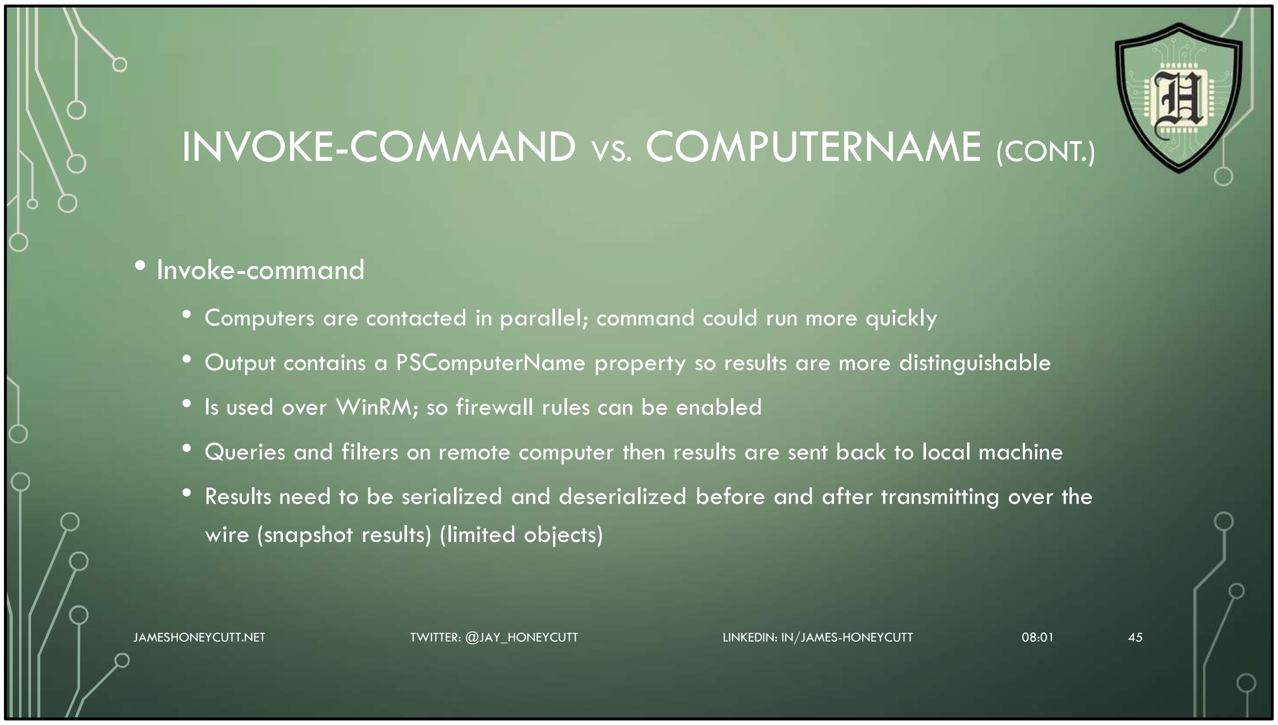
Invoke-Command -computerName localhost, DESKTOP-52INA1A -Credential $creds -command { Get-EventLog Security | where {$_.eventID -eq 4826}}

Code “C:\Scripts\PowerShell\Server\Uploaded to GitHub\Get-ServerRebootStatus.ps1”



INVOKE-COMMAND vs. COMPUTERNAME

- Computername
  - computers are contacted sequentially and could take longer
  - does not contain a PSComputerName property so results my be hard to separate
  - connection is not made with WinRM
  - Processing is done on local computer; so all records are brought across the wire then filtered
  - Results are live and don't need to be serialized or deserialized (fully functional Objects)



INVOKE-COMMAND VS. COMPUTERNAME (CONT.)

- Invoke-command
  - Computers are contacted in parallel; command could run more quickly
  - Output contains a PSComputerName property so results are more distinguishable
  - Is used over WinRM; so firewall rules can be enabled
  - Queries and filters on remote computer then results are sent back to local machine
  - Results need to be serialized and deserialized before and after transmitting over the wire (snapshot results) (limited objects)

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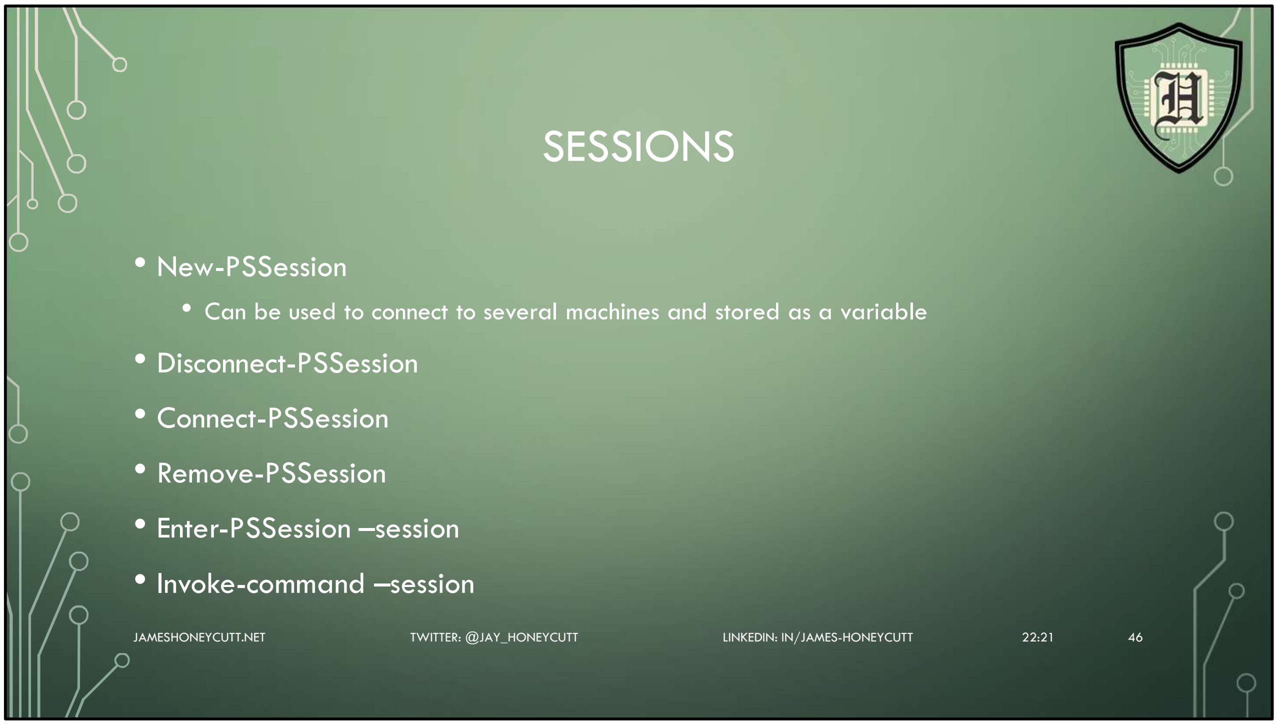
get-service XblGameSave | start-service

Invoke-Command -computerName localhost, DESKTOP-52INA1A -Credential desktop-52ina1a\honey -command {get-process –name notpad | stop-process}

Get-process -ComputerName desktop-52ina1a -Name notepad

Decentralized objects (demo
    Get-service | get-member
    Invoke-command -computername DESKTOP-52INA1A -Credential desktop-52ina1a\honey -scriptblock {get-service} | get-member


SESSIONS

- New-PSSession
  - Can be used to connect to several machines and stored as a variable
- Disconnect-PSSession
- Connect-PSSession
- Remove-PSSession
- Enter-PSSession –session
- Invoke-command –session

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$sessions = New-PSSession -ComputerName localhost, DESKTOP-52INA1A -Credential desktop-52ina1a\honey

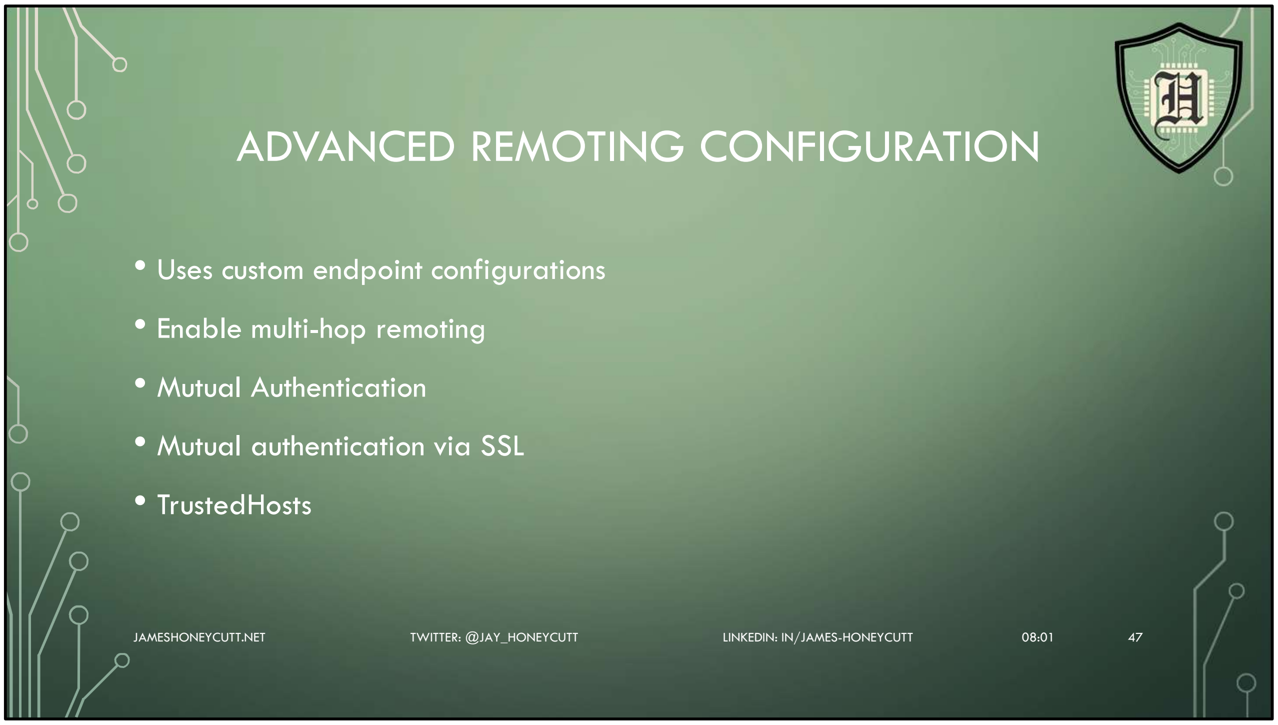
Disconnect-PSSession
Disconnects from the session, but leaves the connection
Same domain admin can see the connection of a different computer
Admin creates session on Comp1 to Comp2, then disconnects session, logs into Comp3 and checks sessions on Comp2, sees his disconnected session
Connect-PSSession
Remove-PSSession

```
Enter-PSSession -Session $sessions [0]
Enter-PSSession -Session ($sessions |where { $_.computername -eq ‘localhost’ })
Enter-PSSession -Session (Get-PSSession | where {$_.computername -eq 'localhost’})
```

```
$s_server1,$s_server2 = new-pssession -computer localhost, DESKTOP-52INA1A -
Credential desktop-52ina1a\honey
```

```
Invoke-Command -Command { Get-WmiObject -Class win32_process } -Session $sessions |
Format-Table -Property PSComputerName, processname, ProcessID, ParentProcessID
```

```
invoke-command -command { get-wmiobject -class win32_process } -session $sessions |
Select-Object ProcessName, PSComputerName, Path | Group-Object ProcessName | Sort-
Object Count -Descending | Format-Table -AutoSize
```



ADVANCED REMOTING CONFIGURATION

- Uses custom endpoint configurations
- Enable multi-hop remoting
- Mutual Authentication
- Mutual authentication via SSL
- TrustedHosts

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Advanced remoting configuration
  Uses custom endpoint configurations (reference my JEA Talk)

  Enabling multihop remoting
    Second Hop Problem
    Enable-WSManCredSSP -Role Client -DelegateComputer $computer (2nd Hop Computer)
    Enable-WSManCredSSP -Role Server (ran on middle man computer

Digging deeper into remoting authentication
  PowerShell remoting employs mutual authentication
  Mostly take care of in a domain environment
  The name must resolve to an IP address.
  The name must match the computer's name in the directory.

Mutual authentication via SSL
  you need to obtain an SSL digital certificate for the destination machine
  you need to create an HTTPS listener
  https://leanpub.com/secretsofpowershellremoting

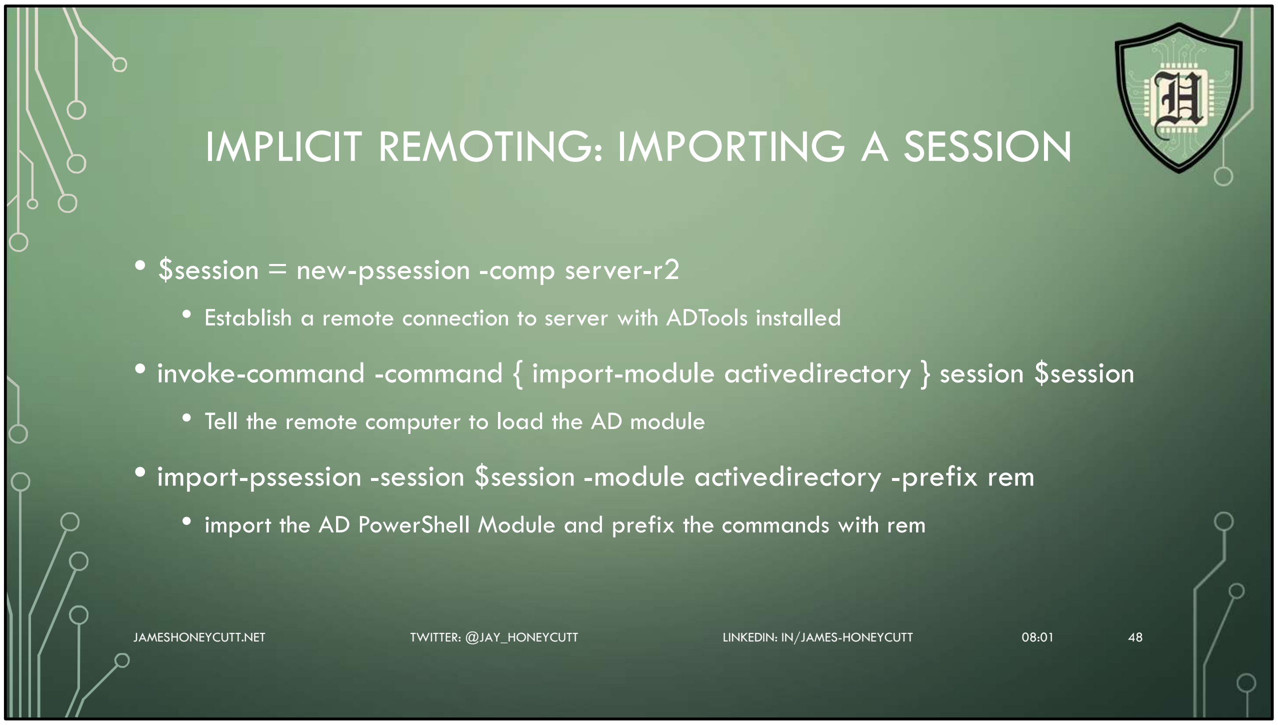
TrustedHosts

Shuts off Mutual Authentication

The TrustedHosts item can contain a comma-separated list of computer names, IP addresses, and fully-qualified domain names.

Wildcards are permitted.

```
Get-Item wsman:\localhost\Client\TrustedHosts
Set-Item wsman:localhost\client\trustedhosts -Value *
```



IMPLICIT REMOTING: IMPORTING A SESSION

- $session = new-pssession -comp server-r2
  - Establish a remote connection to server with ADTools installed
- invoke-command -command { import-module activedirectory } session $session
  - Tell the remote computer to load the AD module
- import-pssession -session $session -module activedirectory -prefix rem
  - import the AD PowerShell Module and prefix the commands with rem

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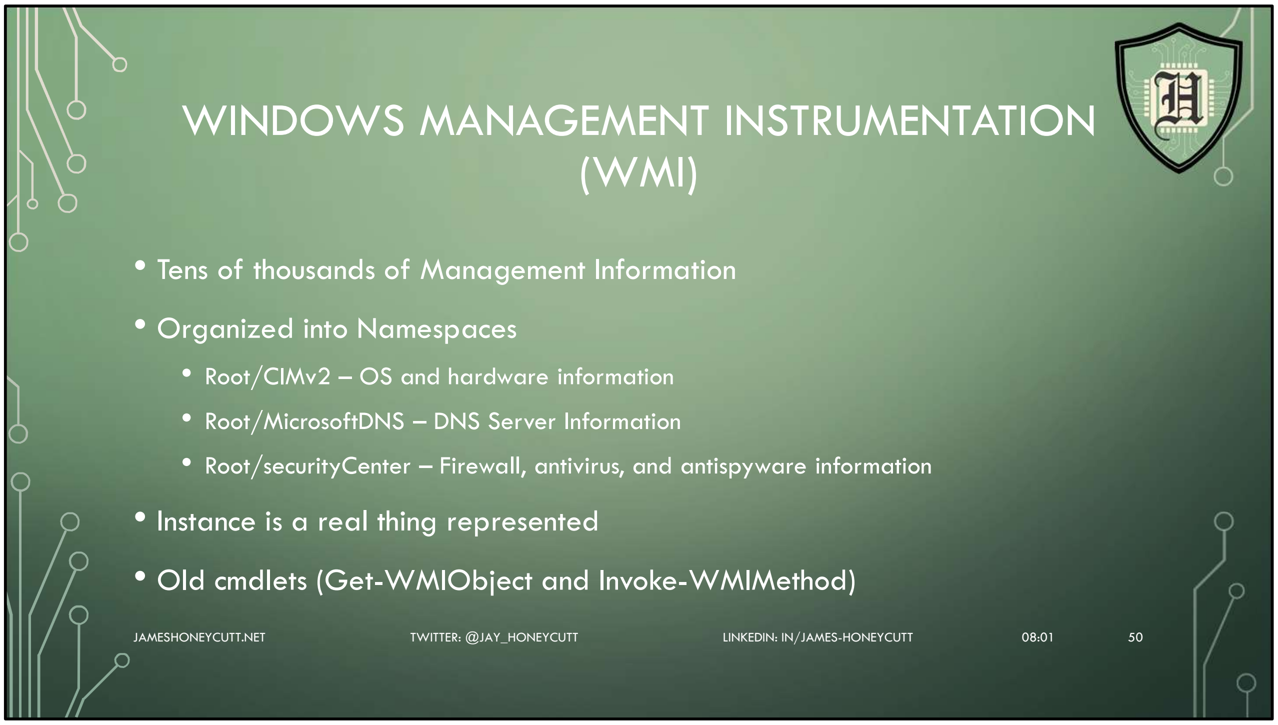
Code “C:\Scripts\PowerShell\UserAccounts\RemoveUser_Prompted.ps1”

PowerShell creates a temporary local module with shortcuts to the commands on the remote server
Results brought back through the session are decentralized and do not have methods



WINDOWS MANAGEMENT INSTRUMENTATION (WMI)

- Tens of thousands of Management Information
- Organized into Namespaces
  - Root/CIMv2 – OS and hardware information
  - Root/MicrosoftDNS – DNS Server Information
  - Root/securityCenter – Firewall, antivirus, and antispyware information
- Instance is a real thing represented
- Old cmdlets (Get-WMIObject and Invoke-WMIMethod)

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ROOT\CIMV2\Win32_LogicalDisk

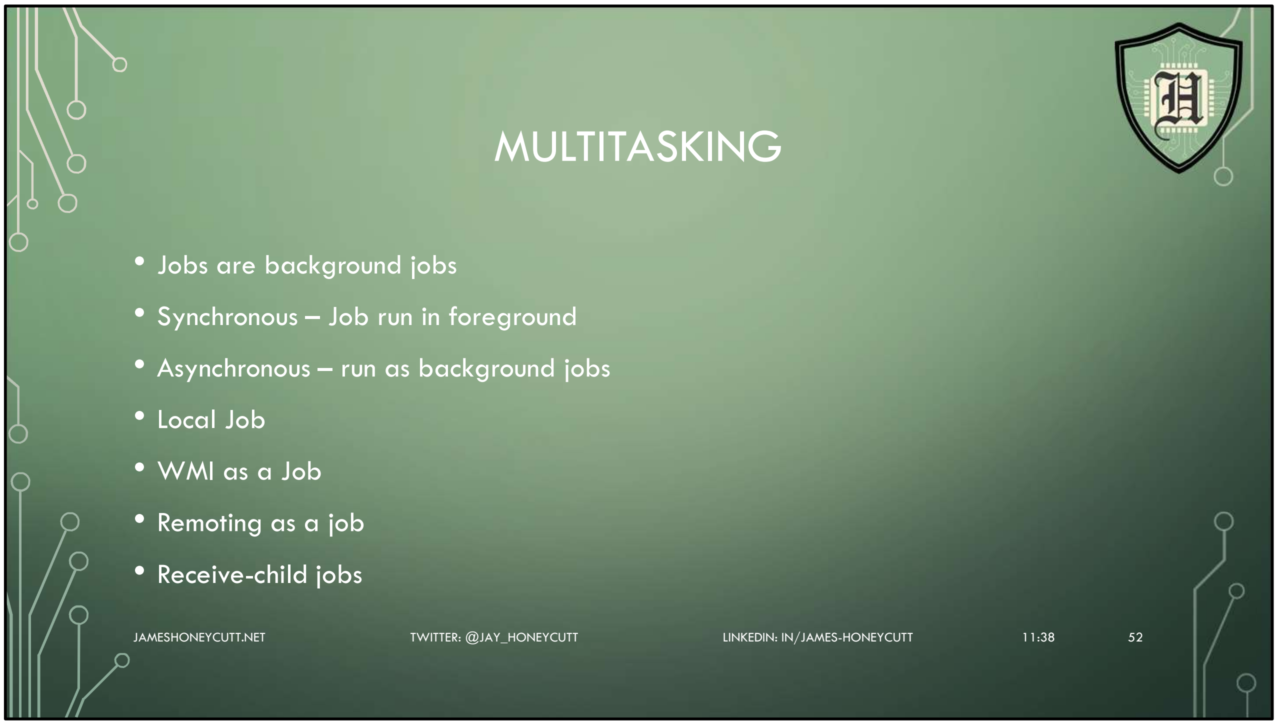
```
Get-WmiObject -Namespace root\CIMv2 -list | where {$_.name -like '*dis*'}
Get-WmiObject -class win32_desktop -filter "name='DESKTOP-52INA1A\\honey'"
```

CIM_ Class are often base classes and access directly
 Communicates over RPC – If firewall supports stateful inspection

Win32_ are Windows specific
 Communicates over WS-MAN (WinRM)

COMMON INFORMATION MODEL (CIM)

- Similar to get-wmiobject
- CIM cmdlets are wrappers for WMI commands
- -classname instead of -class
- -list not available; must user -namespace instead
- -credential not available; must use invoke-command



MULTITASKING

- Jobs are background jobs
- Synchronous – Job run in foreground
- Asynchronous – run as background jobs
- Local Job
- WMI as a Job
- Remoting as a job
- Receive-child jobs

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Start-job –scriptblock
  Local job has support -computername
  Requires remote powershell scripting

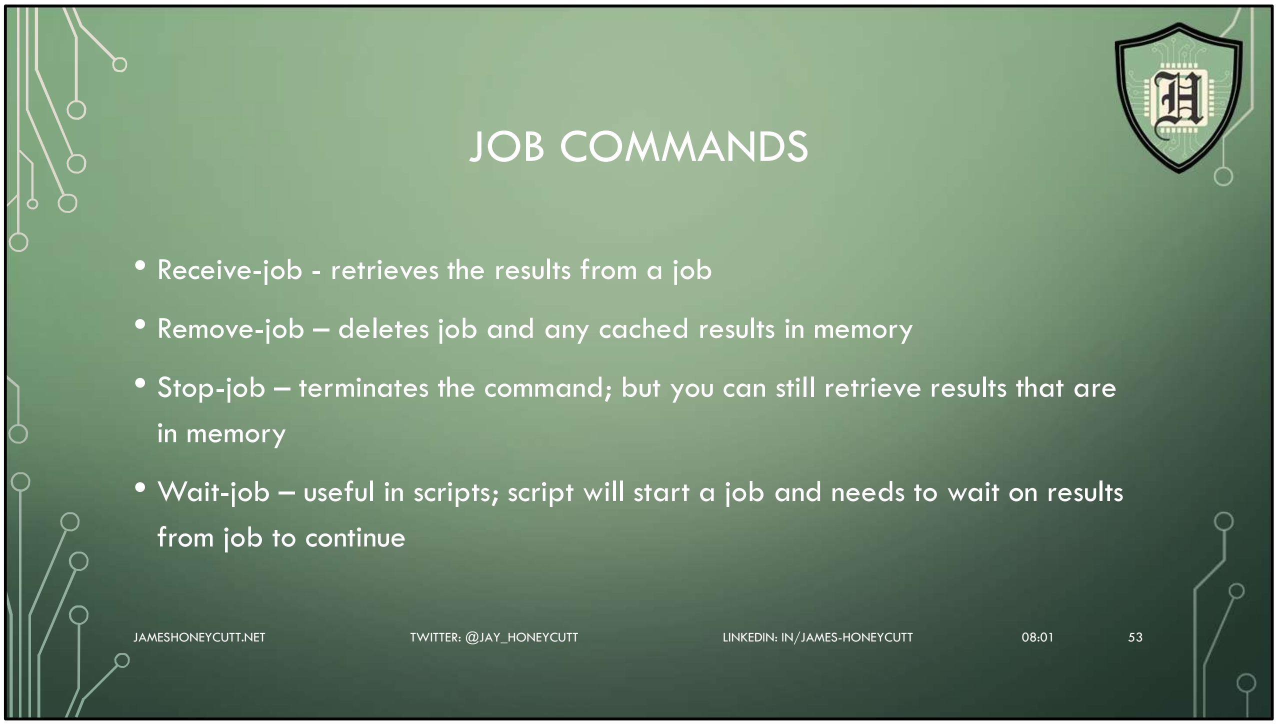
```
start-job -ScriptBlock {Get-Service}
start-job -scriptblock {get-eventlog security -computer localhost, DESKTOP-52INA1A}
```

WMI as a Job
  Used -asjob parameter
  Creates a child job for every computer in the list
  Uses normal WMI communications
  Get-ciminstance requires start-job or invoke-command with get-ciminstance in scriptblock

```
start-job -scriptblock {get-eventlog security -computer localhost, DESKTOP-52INA1A } -Credential $creds
```

Remoting as a job
Used invoke-command –asjob
Requires PSv2 or higher with remoting enabled

Has -jobname parameter



JOB COMMANDS

- Receive-job - retrieves the results from a job
- Remove-job – deletes job and any cached results in memory
- Stop-job – terminates the command; but you can still retrieve results that are in memory
- Wait-job – useful in scripts; script will start a job and needs to wait on results from job to continue

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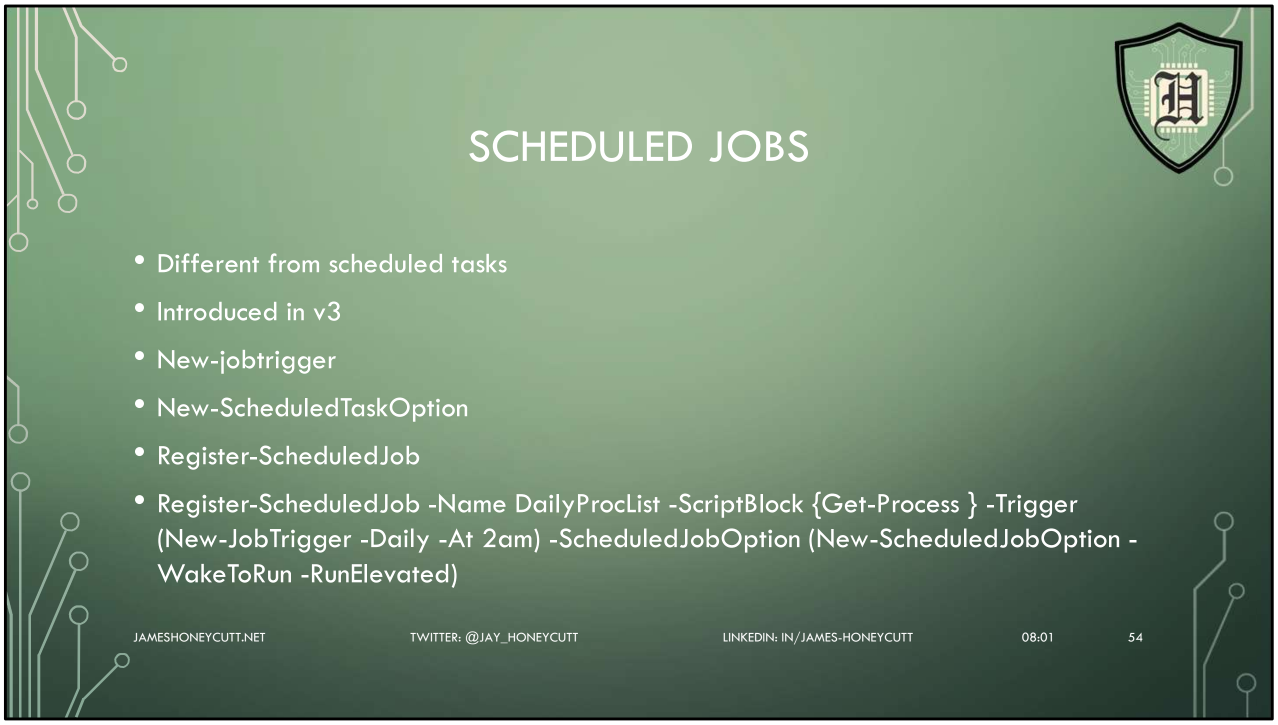
Receive-job
   By name or job ID
   Receive-jobs clears them out of cache and cannot be retrieved a second time; must use -keep or out-cliXML
   Results are decentralized; can be piped into export-xml, sort-object, format-list, convertto-html; out-file
Has more data property
   Will be false if there is no data in memory (if you viewed and did not use the -keep parameter)
   Will be true if there is data in memory

Get-jobs | receive-jobs



SCHEDULED JOBS

- Different from scheduled tasks
- Introduced in v3
- New-jobtrigger
- New-ScheduledTaskOption
- Register-ScheduledJob
- Register-ScheduledJob -Name DailyProcList -ScriptBlock {Get-Process } -Trigger (New-JobTrigger -Daily -At 2am) -ScheduledJobOption (New-ScheduledJobOption -WakeToRun -RunElevated)

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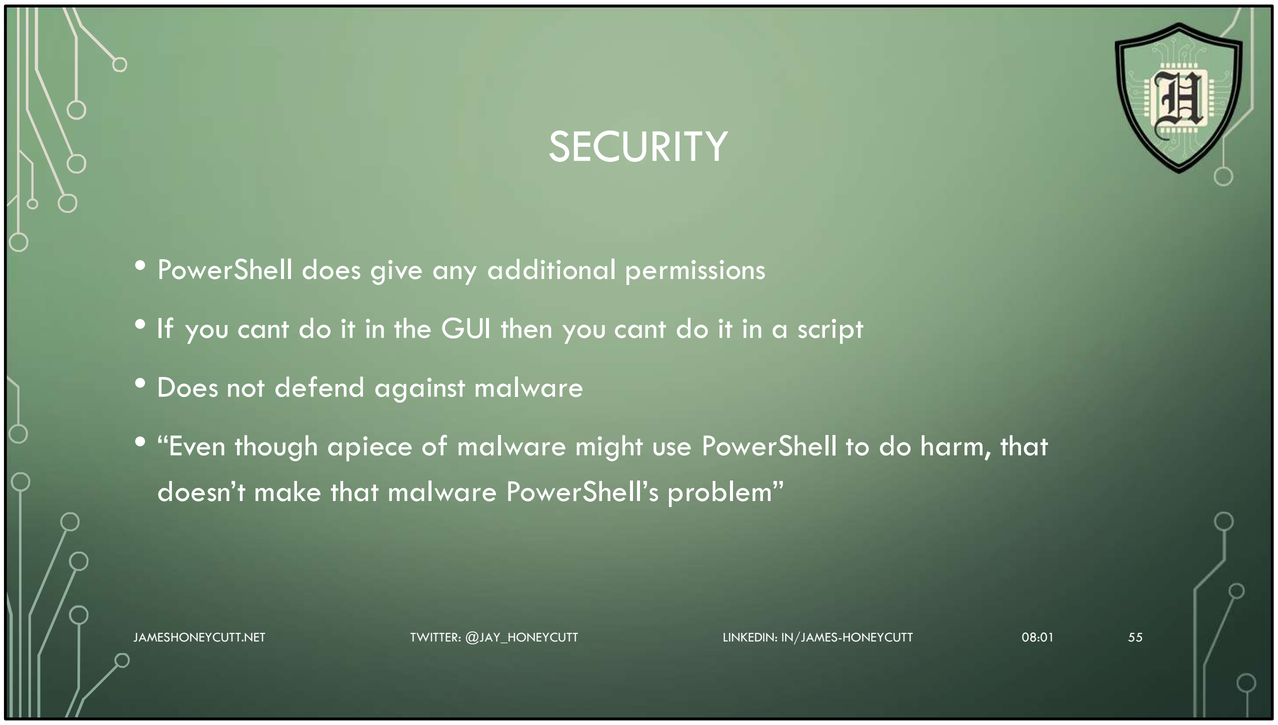
Code C:\Scripts\PowerShell_InProgress\Create-EvilTask.ps1

Scheduled task cannot produce output

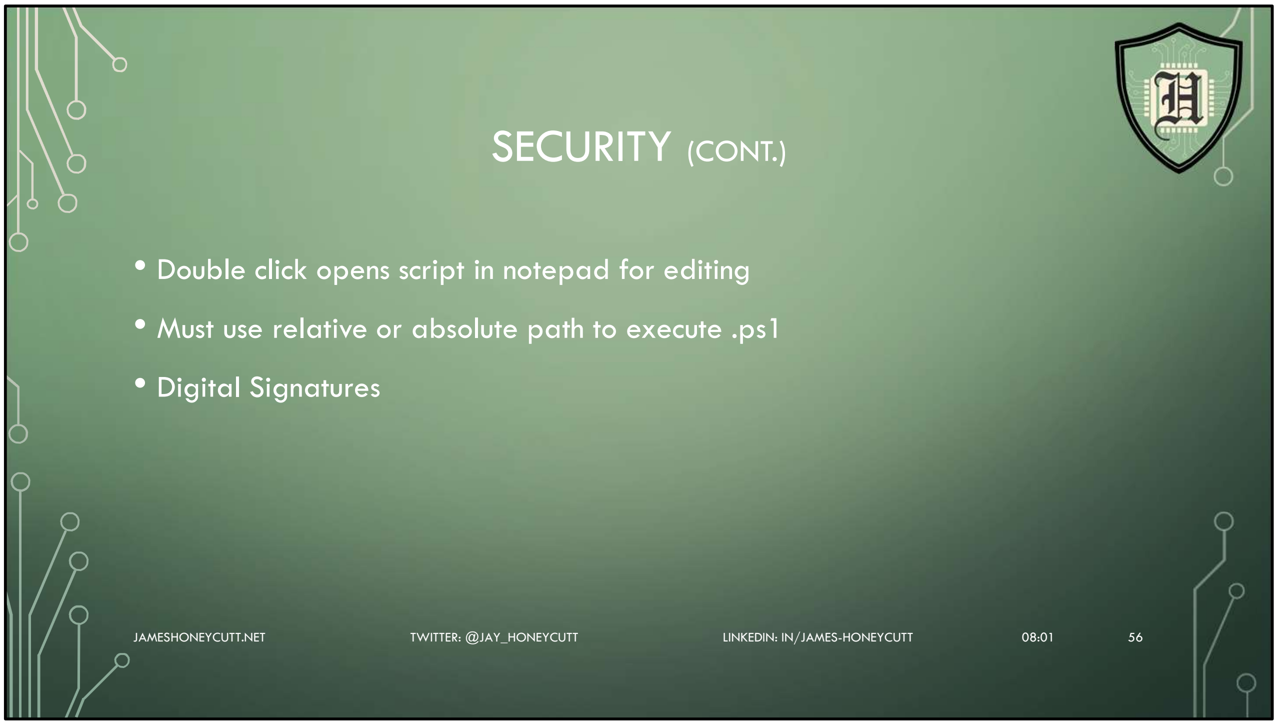
Scheduled Jobs are a hybrid of background jobs and scheduled tasks

job and scheduled job cmdlets, you can use the Task Scheduler UI and scheduled task cmdlets to manage scheduled jobs, but you can't use the job or scheduled job cmdlets to manage scheduled tasks.



SECURITY

- PowerShell does give any additional permissions
- If you cant do it in the GUI then you cant do it in a script
- Does not defend against malware
- “Even though apiece of malware might use PowerShell to do harm, that doesn’t make that malware PowerShell’s problem”



SECURITY (CONT.)

- Double click opens script in notepad for editing
- Must use relative or absolute path to execute .ps1
- Digital Signatures

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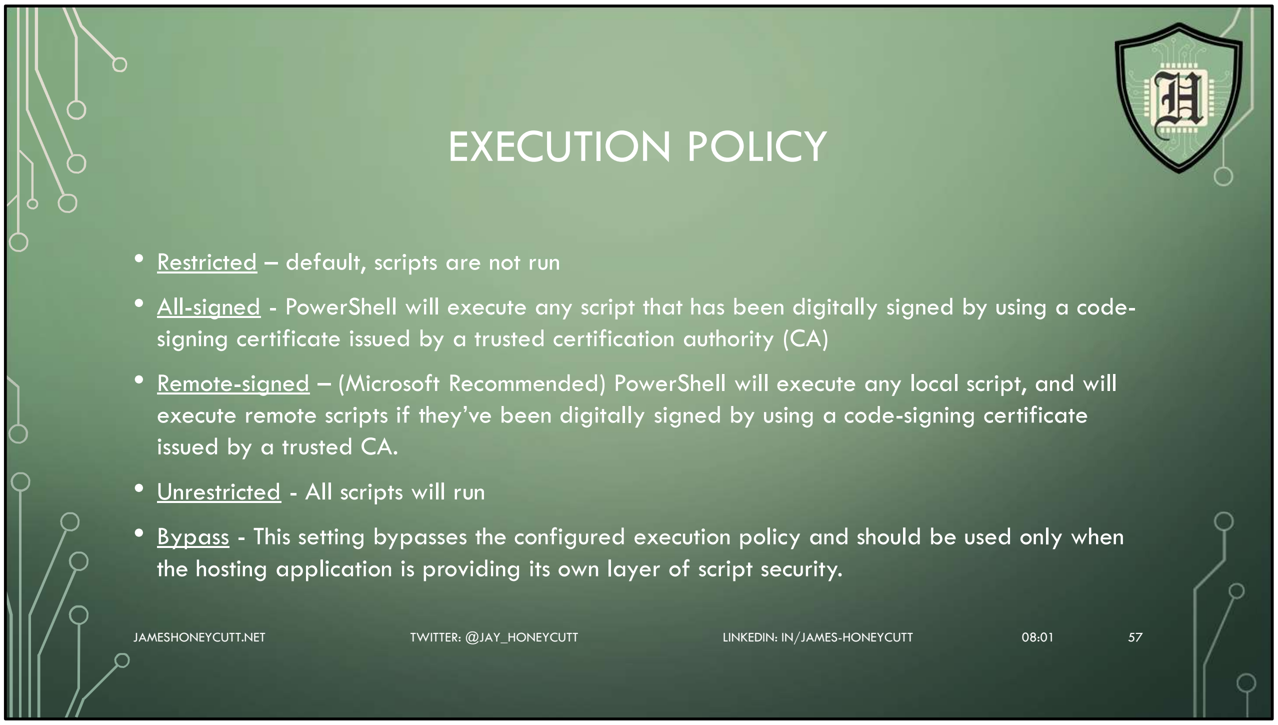
Must use relative or absolute path to execute .ps1
Protects from command hijacking

Digital Signatures
Set-AuthenticodeSignature "C:\Scripts\Publish\PowerShell\Files\Backup-Files.ps1" (get-childitem Cert:\CurrentUser\My -CodeSigningcert)



EXECUTION POLICY

- Restricted – default, scripts are not run
- All-signed - PowerShell will execute any script that has been digitally signed by using a code-signing certificate issued by a trusted certification authority (CA)
- Remote-signed – (Microsoft Recommended) PowerShell will execute any local script, and will execute remote scripts if they've been digitally signed by using a code-signing certificate issued by a trusted CA.
- Unrestricted - All scripts will run
- Bypass - This setting bypasses the configured execution policy and should be used only when the hosting application is providing its own layer of script security.

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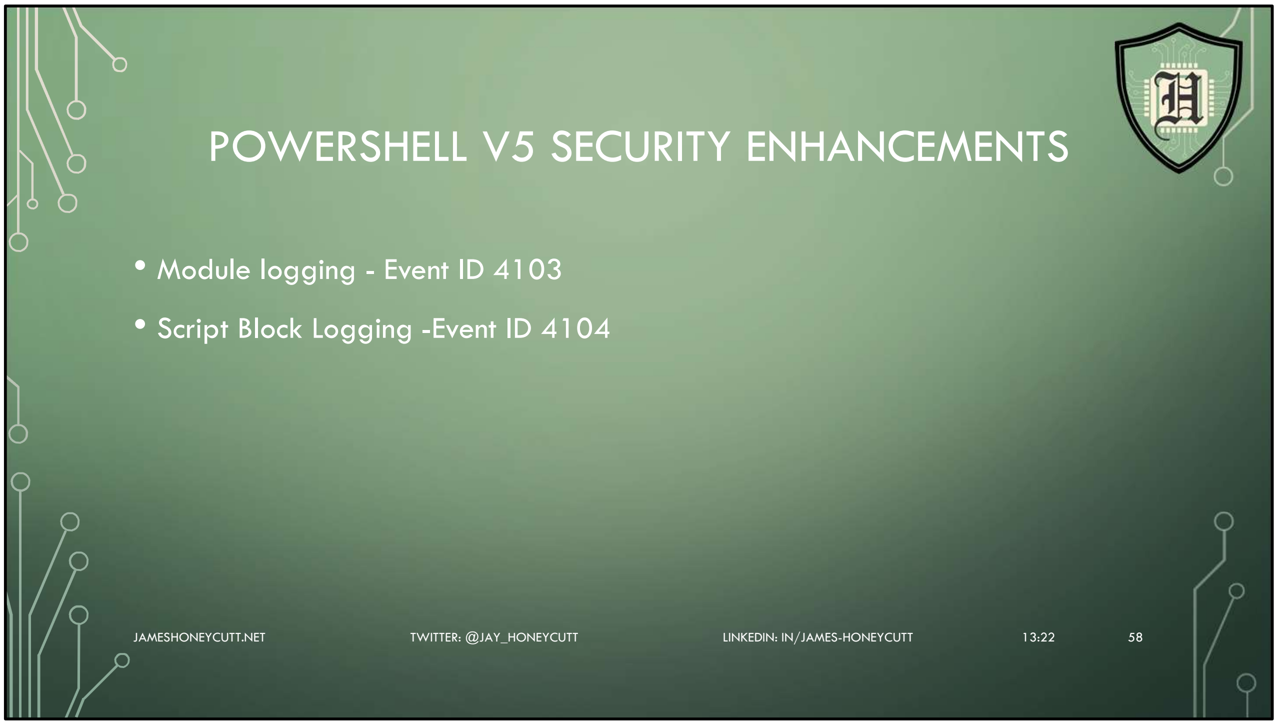
Changed by:
Set-executionpolicy
Must have rights to change HKEY_LOCAL_MACHINE of the registry

GPO
Configuration > Policies > Administrative Templates > Windows Components >Windows PowerShell

Powershell.exe – executionpolicy (overwrites any local or group policy)

Digital Signatures
Set-AuthenticodeSignature "C:\Scripts\Publish\PowerShell\Files\Backup-Files.ps1" (get-childitem Cert:\CurrentUser\My -CodeSigningcert)



POWERSHELL V5 SECURITY ENHANCEMENTS

- Module logging - Event ID 4103
- Script Block Logging -Event ID 4104

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Module logging - Event ID 4103
Logs PowerShell pipeline execution details during execution including variable initialization, and command invocation
Able to record some de-obfuscated scripts, and also some output data
Available in v3

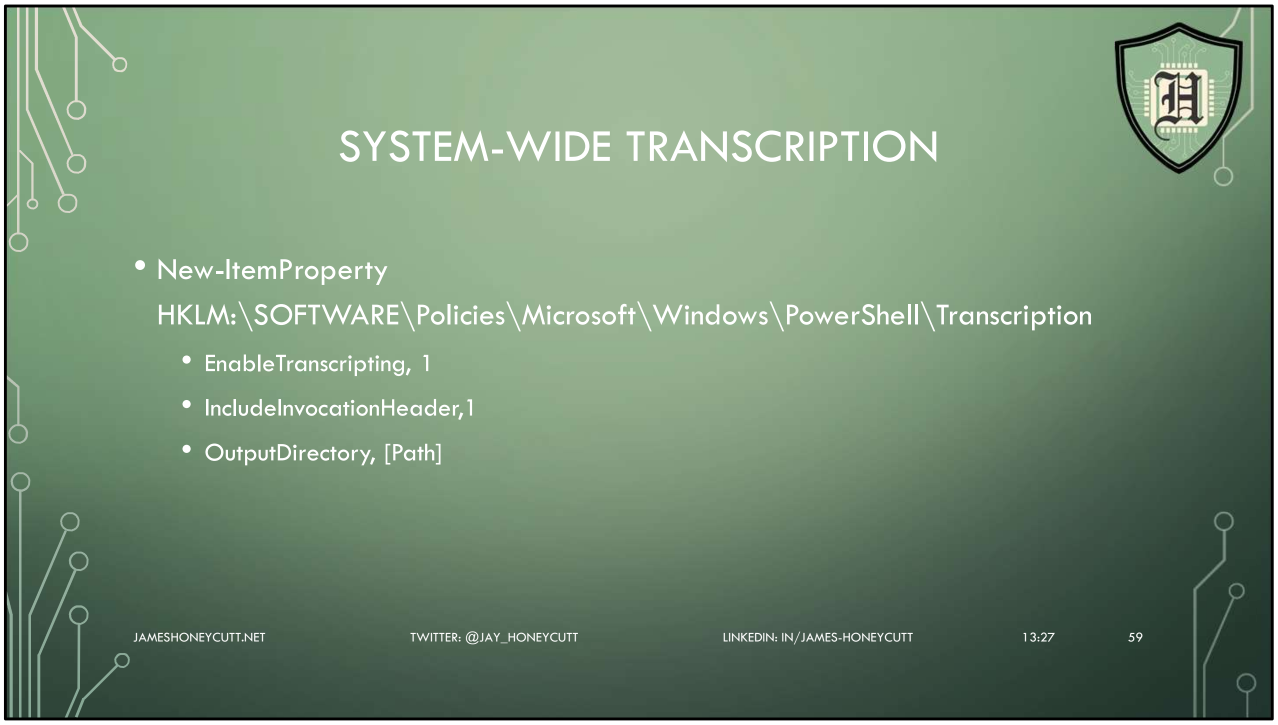
```
Get-WinEvent -LogName application | where {$_.ID -eq 4104}
```

Script Block Logging -Event ID 4104
Logs and records all blocks of PowerShell code as they are executing
Captures all de-obfuscated code
Available in v5

HKLM:\Software\Policies\Microsoft\Windows\PowerShell\ScriptBlockLogging
Create Registry key

```
New-Item
HKLM:\SOFTWARE\Policies\Microsoft\Windows\PowerShell\ScriptBlockLogging –Force
New-ItemProperty
HKLM:\SOFTWARE\Policies\Microsoft\Windows\PowerShell\ScriptBlockLogging -Name
"EnableScriptBlockLogging" -PropertyType "DWORD" -Value 1
```

```
Get-WinEvent -LogName Microsoft-Windows-PowerShell/Operational | where {$_.Id -eq
"4103"} | select -first 5 | format-list
```



SYSTEM-WIDE TRANSCRIPTION

- New-ItemProperty HKLM:\SOFTWARE\Policies\Microsoft\Windows\PowerShell\Transcription
  - EnableTranscripting, 1
  - IncludeInvocationHeader,1
  - OutputDirectory, [Path]

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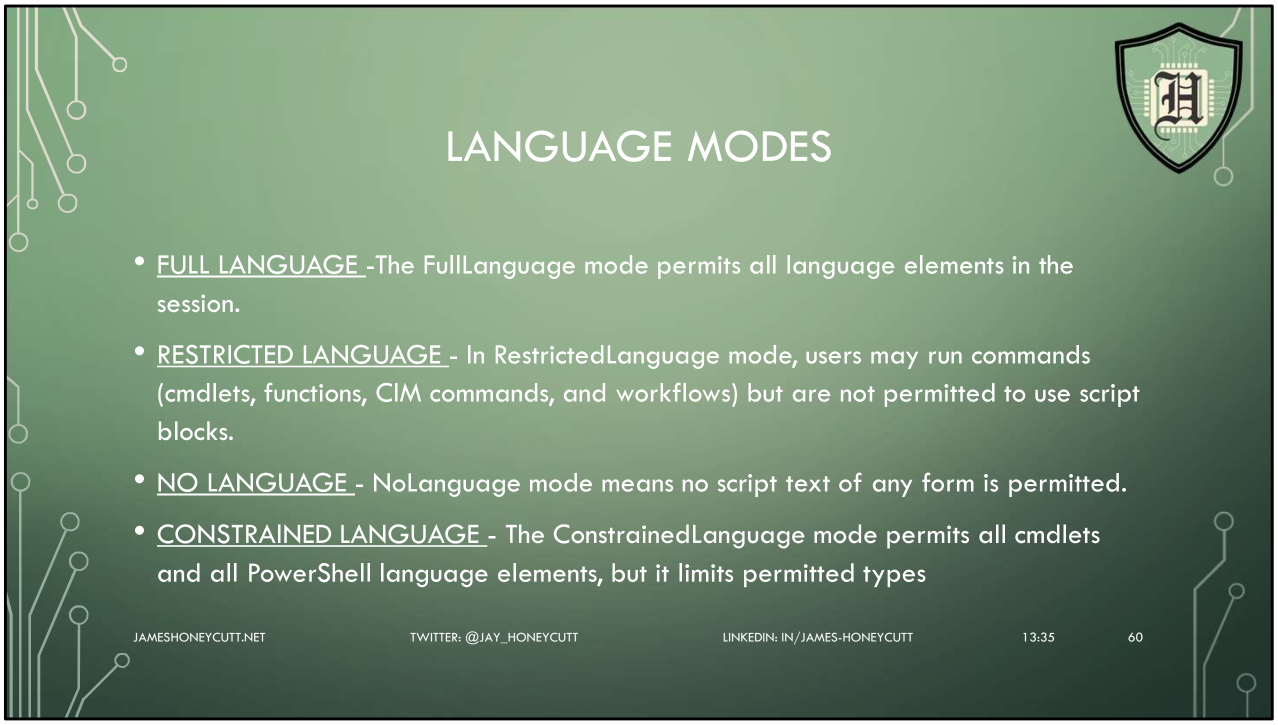
```
New-ItemProperty
HKLM:\SOFTWARE\Policies\Microsoft\Windows\PowerShell\Transcription -Name
"EnableTranscripting" -PropertyType "DWORD" -Value 1
New-ItemProperty
HKLM:\SOFTWARE\Policies\Microsoft\Windows\PowerShell\Transcription -Name
"IncludeInvocationHeader" -PropertyType "DWORD" -Value 1
New-ItemProperty
HKLM:\SOFTWARE\Policies\Microsoft\Windows\PowerShell\Transcription -Name
"OutputDirectory" -PropertyType "DWORD" -Value 1
```



LANGUAGE MODES

- FULL LANGUAGE -The FullLanguage mode permits all language elements in the session.
- RESTRICTED LANGUAGE - In RestrictedLanguage mode, users may run commands (cmdlets, functions, CIM commands, and workflows) but are not permitted to use script blocks.
- NO LANGUAGE - NoLanguage mode means no script text of any form is permitted.
- CONSTRAINED LANGUAGE - The ConstrainedLanguage mode permits all cmdlets and all PowerShell language elements, but it limits permitted types

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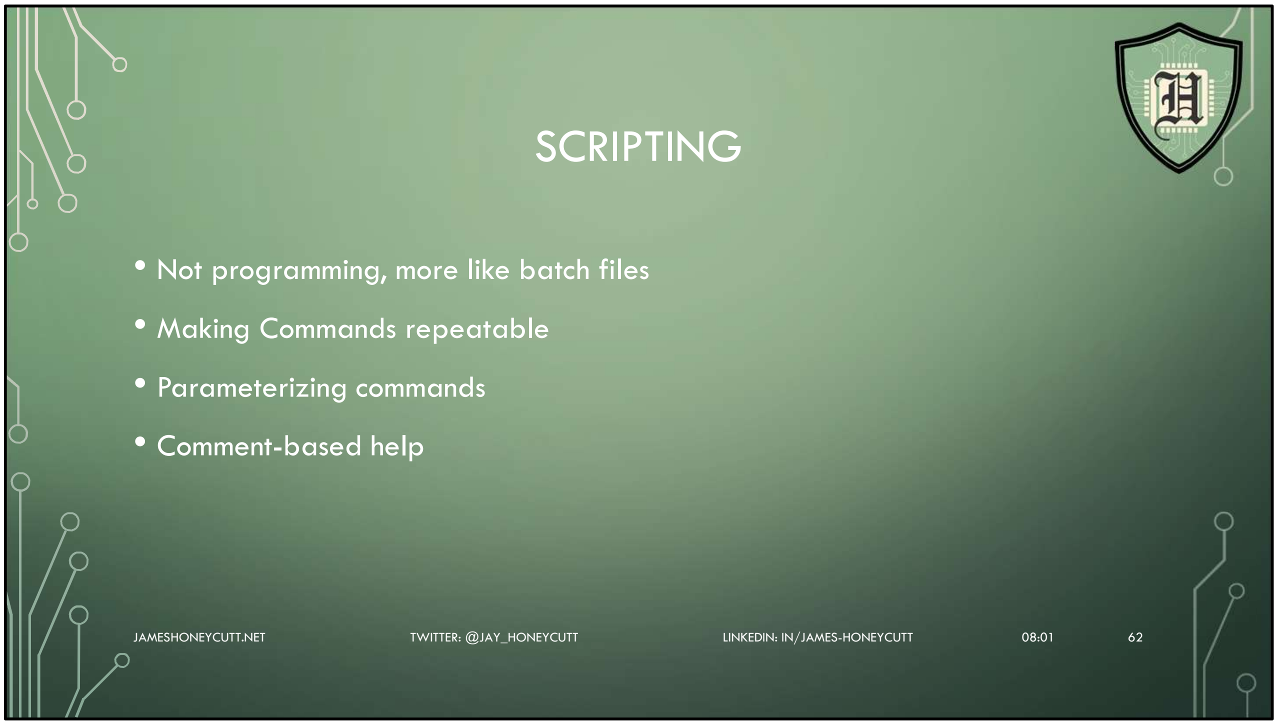
```
Disable-WindowsOptionalFeature -Online -FeatureName MicrosoftWindowsPowerShellV2
$ExecutionContext.SessionState.LanguageMode
```



SCRIPTING

- Not programming, more like batch files
- Making Commands repeatable
- Parameterizing commands
- Comment-based help

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Code C:\Scripts\Publish\PowerShell\Files\Backup-Files.ps1

SCRIPTING (CONT.)

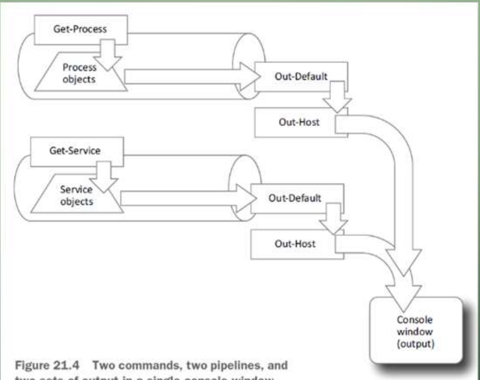


Figure 21.4 Two commands, two pipelines, and two sets of output in a single console window

Get-Process
Get-Service

SCRIPTING (CONT.)

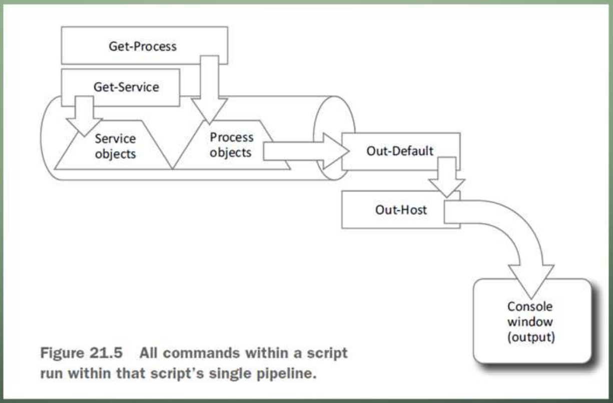
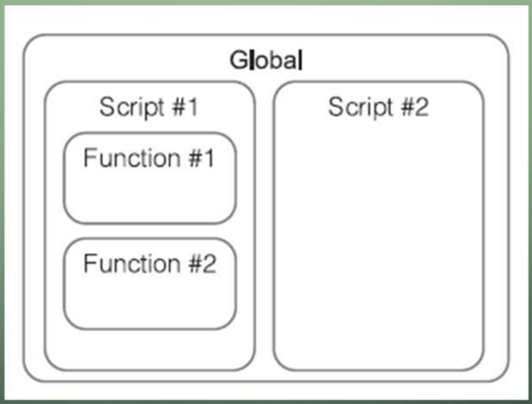


Figure 21.5 All commands within a script run within that script's single pipeline.

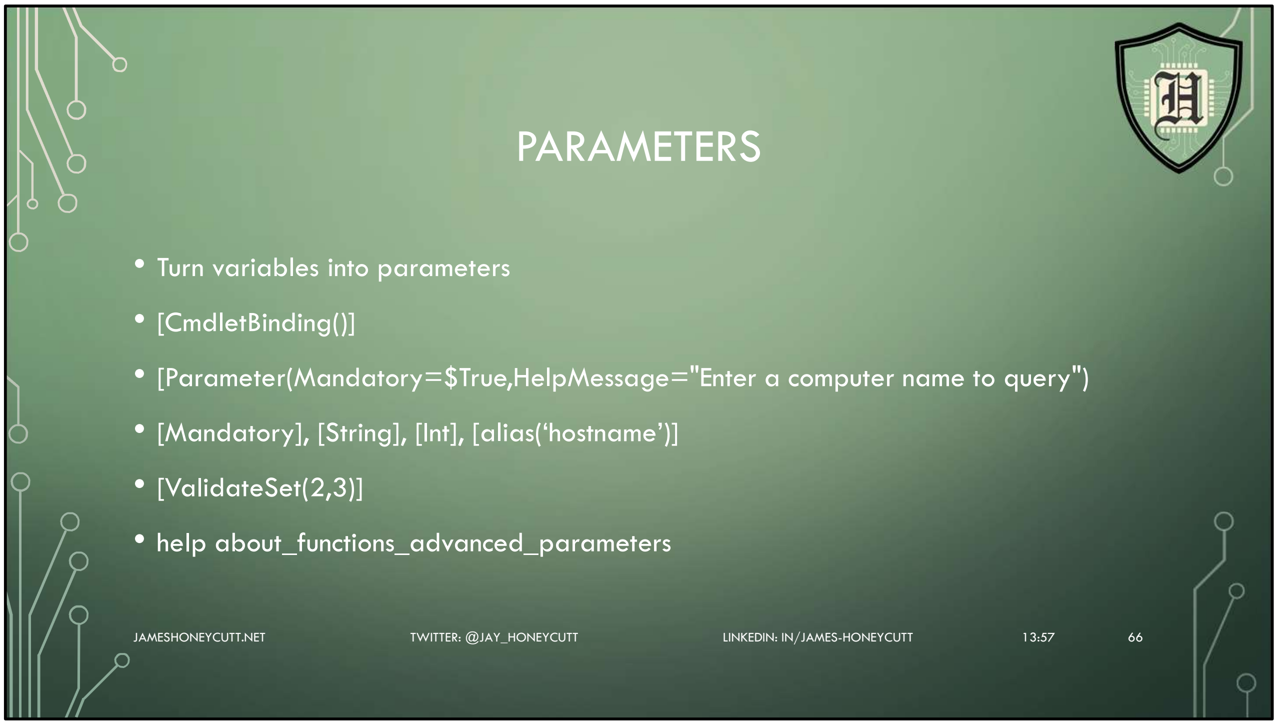
Ise "C:\Users\honey\Google Drive\Presentations\PowerShell\PowerShell Crash Course\Scripting-Demo.ps1"
Ise "C:\Users\honey\Google Drive\Presentations\PowerShell\PowerShell Crash Course\Scope.ps1"

VARIABLE SCOPE



Ise “C:\Users\honey\Google Drive\Presentations\PowerShell\PowerShell Crash Course\Scope.ps1”

function x {$x + (.\scope.ps1)}



PARAMETERS

- Turn variables into parameters
- [CmdletBinding()]
- [Parameter(Mandatory=$True,HelpMessage="Enter a computer name to query")
- [Mandatory], [String], [Int], [alias('hostname')]
- [ValidateSet(2,3)]
- help about_functions_advanced_parameters

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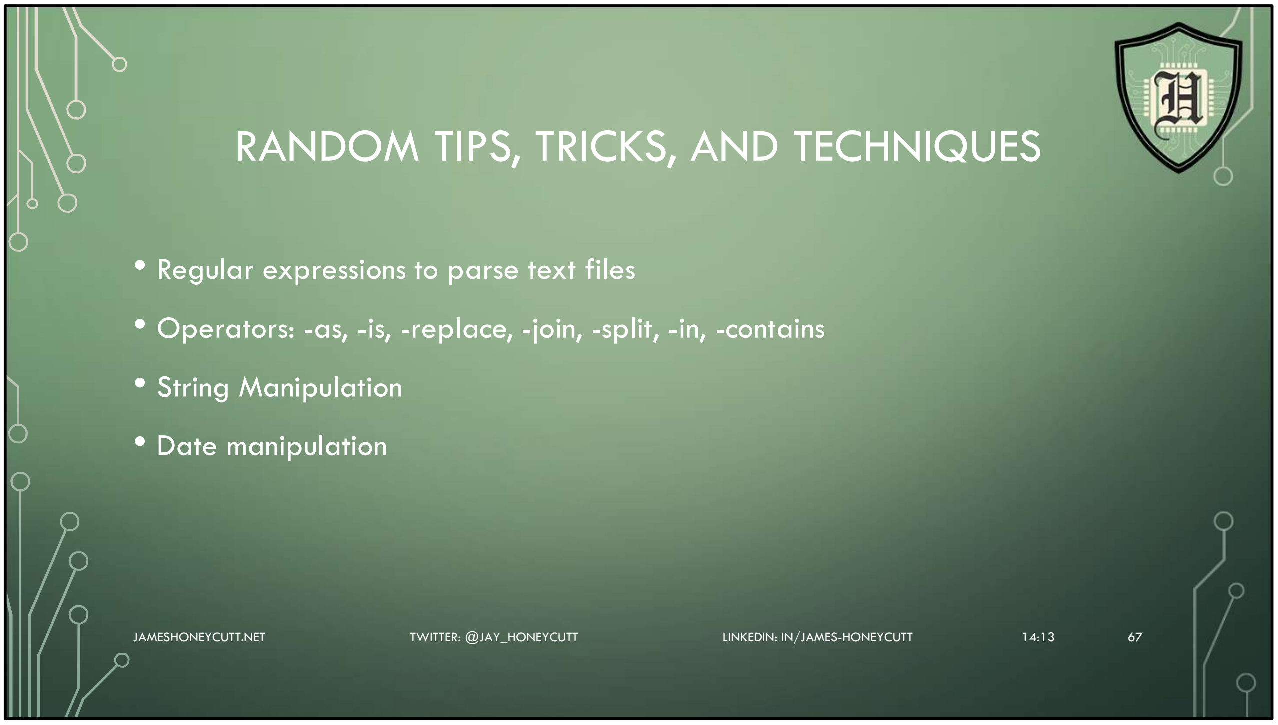
Ise "C:\Users\honey\Google Drive\Presentations\PowerShell\PowerShell Crash Course\Get-DiskInventory.ps1"

Code "C:\Scripts\Publish\PowerShell\Files\Backup-Files.ps1"



RANDOM TIPS, TRICKS, AND TECHNIQUES

- Regular expressions to parse text files
- Operators: -as, -is, -replace, -join, -split, -in, -contains
- String Manipulation
- Date manipulation

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Regex
Used with -match and -cmatch (case sensitive)

```
Get-WinEvent -Path "C:\Users\honey\Documents\PowerShellCTF\Win7-security.evtx" | where { $_.id -eq 4624 } | select -ExpandProperty message | Select-String -Pattern "Logon\D+:\s+3" | measure
```

Operators: -as, -is, -replace, -join, -split, -in, -contains

as - operator produces a new object in an attempt to convert an existing object into a different type

```
1000 / 3 -as [int]
```

Is - It's designed to return True or False if an object is of a particular type or not

```
123.45 -is [int]
"SERVER-R2" -is [string]
$True -is [bool]
(Get-Date) -is [datetime]
```

Replace - operator is designed to locate all occurrences of one string within another and replace those occurrences with a third string (linux sed command)

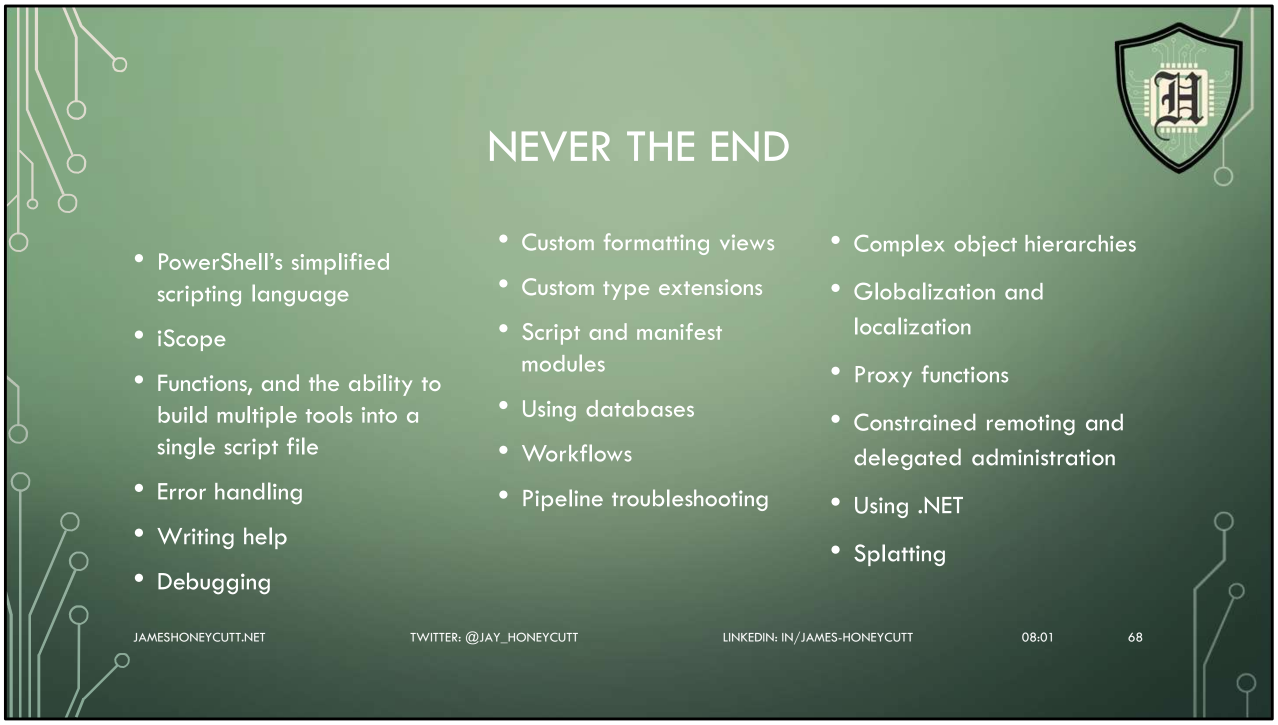
```
"192.168.34.12" -replace "34","15"
```

- join and -split operators are designed to convert arrays to delimited lists, and vice versa (linux Cut, and Awk commands)
  - $array = "one","two","three","four","five"
  - $array -join "|"
  - $string = $array -join "|"
- split - It takes a delimited string and makes an array from it
  - $array = (gc computers.tdf) -split "`t"
- Contains – operator is used to test whether a given object exists within a collection
  - $collection = 'abc','def','ghi','jkl'
  - $collection -contains 'abc'
- Like - operator is designed for wildcard string comparisons
  - 'this' -contains '*his*'

String Manipulation
- "Hello" | gm
- IndexOf() tells you the location of a given character within the string:
  - "SERVER-R2".IndexOf("-")
- ToLower() and ToUpper() convert the case of a string
  - $computername = "SERVER17"
  - $computername.tolower()
- Trim() removes whitespace from both ends of a string;
  - $username = " Don "
  - $username.Trim()
- TrimStart() and TrimEnd() remove whitespace from the beginning or end of a string, respectively

Date manipulation
- get-date | gm

$90daysago = $today.adddays(-90)



NEVER THE END

- PowerShell's simplified scripting language
- iScope
- Functions, and the ability to build multiple tools into a single script file
- Error handling
- Writing help
- Debugging
- Custom formatting views
- Custom type extensions
- Script and manifest modules
- Using databases
- Workflows
- Pipeline troubleshooting
- Complex object hierarchies
- Globalization and localization
- Proxy functions
- Constrained remoting and delegated administration
- Using .NET
- Splatting

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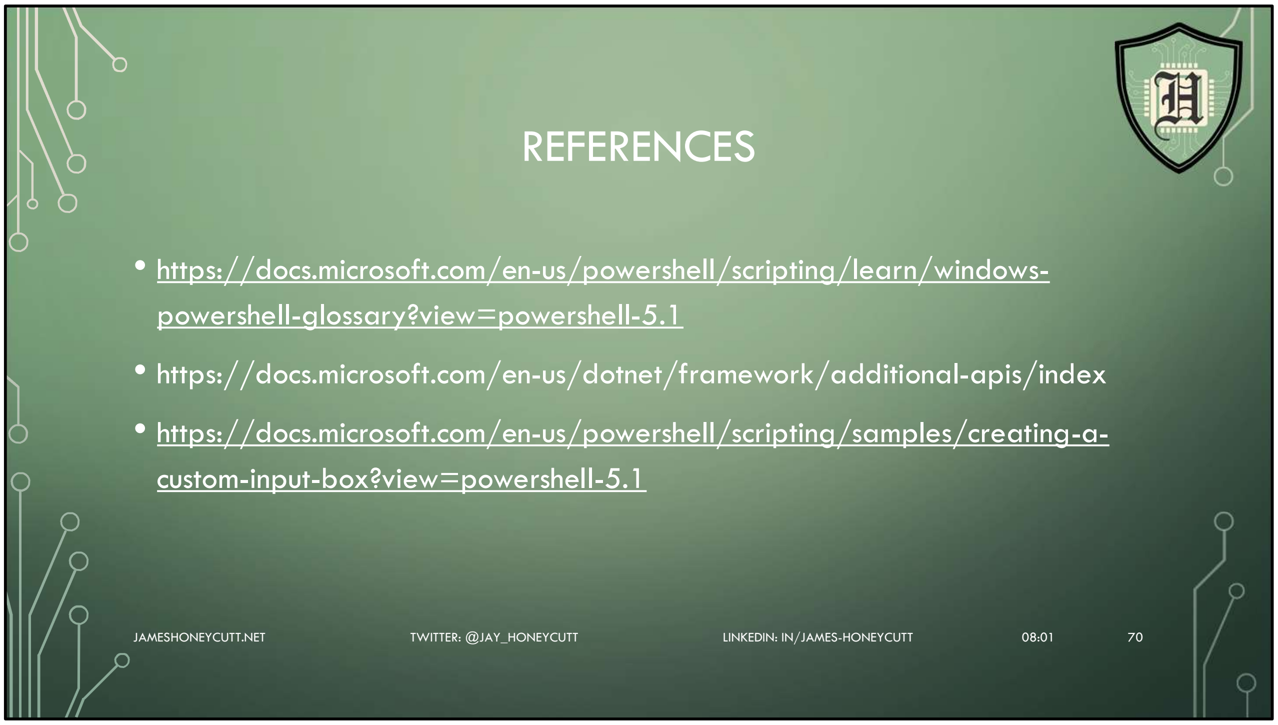

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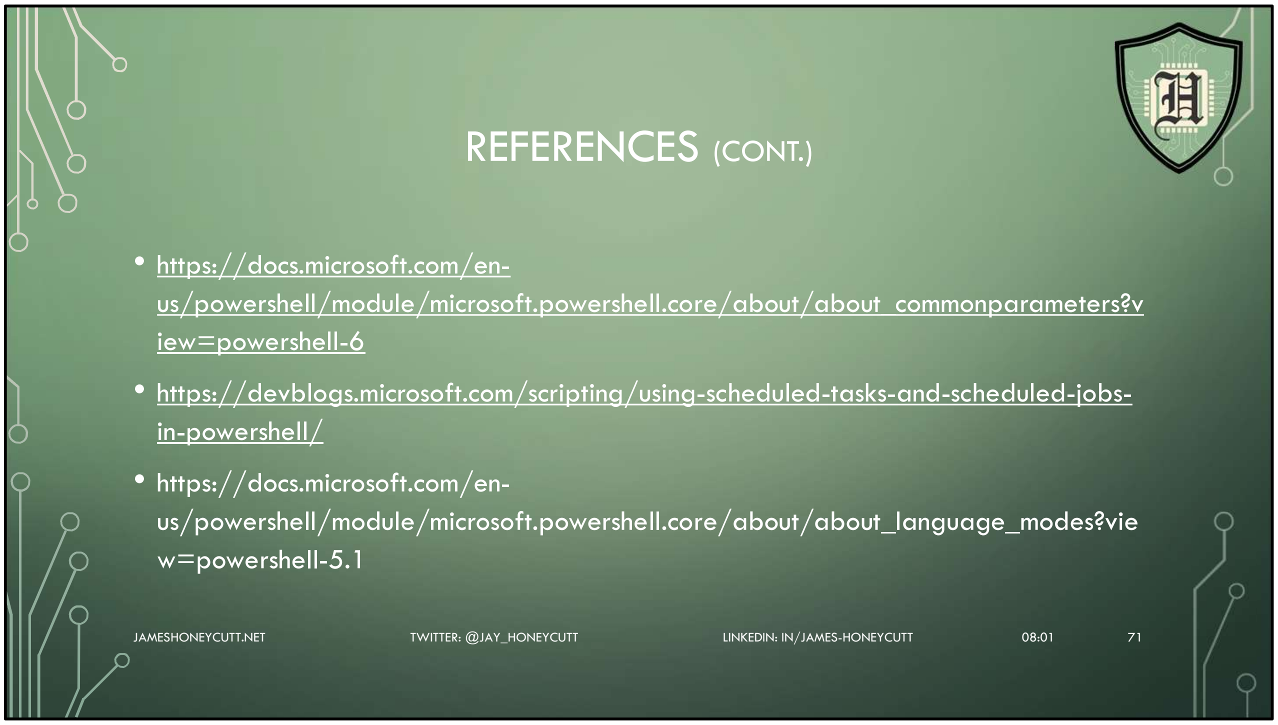

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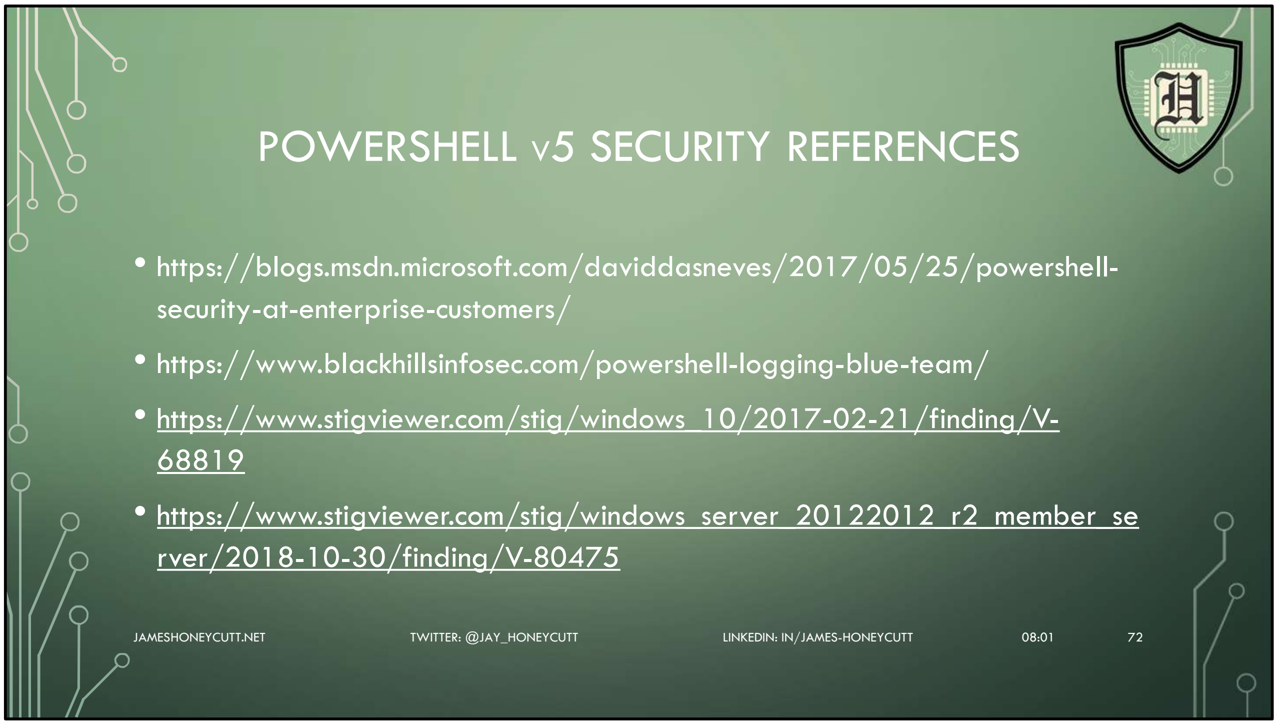

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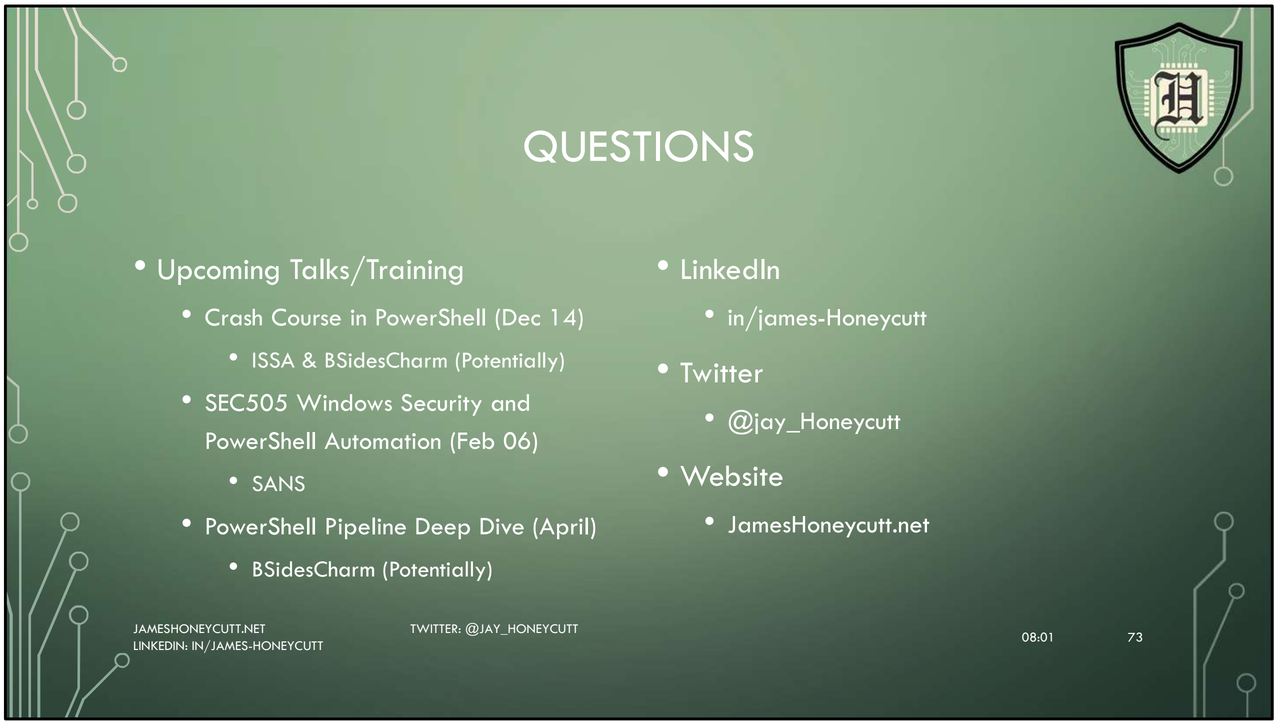

QUESTIONS

- Upcoming Talks/Training
  - Crash Course in PowerShell (Dec 14)
    - ISSA & BSidesCharm (Potentially)
  - SEC505 Windows Security and PowerShell Automation (Feb 06)
    - SANS
  - PowerShell Pipeline Deep Dive (April)
    - BSidesCharm (Potentially)
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