PowerShell Scripting Patterns and Practices

https://github.com/jdhitsolutions/SpiceWorld2021

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Automating with PowerShell

- PowerShell is about automation
  - Increase efficiency
  - Maintain consistency
  - DevOps
- Automation target is irrelevant
  - Microsoft 365
  - Active Directory
  - Azure
- You will use the same scripting techniques and concepts

You can’t learn PowerShell scripting in 30 minutes…

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…but I can teach you some guiding principles and best practices

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Terms

- Cmdlet
  - PowerShell core unit of execution
  - Compiled .NET command
- Script
  - PowerShell “batch” file
  - An automated session or control script
  - .ps1 file extension
  - Can also be used to define functions
- Function
  - Self-contained, repeatable blocks of code
  - Your version of a compiled cmdlet
  - Written in PowerShell’s scripting language

Terms

- Module
  - PowerShell's packaging mechanism
  - Collection of functions and supporting files
  - Deploy modules via PowerShell Gallery
    - Or your own
  - Module commands
    - `Get-Command –noun module`

Start with a command

- Run core command or commands in an interactive console session
- Learning something new?
  - Learn from the GUI
  - Then learn the PowerShell commands
- Identify possible parameters
  - Test with variables
- Think about "scripting at scale"

Use the right tools

- Use a PowerShell-aware scripting tool
  - Notepad is not PowerShell-aware
- The PowerShell ISE is deprecated
  - Doesn't support PowerShell 7
- VS Code is the community standard
  - Free
  - Ecosystem of extensions
  - Cross-platform

Avoid Problems

- Make sure your script file will properly run before starting
- These are your prerequisites at the beginning of your file
- `#requires –version 5.1`
- `#requires –RunAsAdministrator`
- `#requires –Modules Hyper-V`
- `Help about_requires`
- In modules you can define many of these in the manifest

Naming Conventions

- Scripts can have any name
  - Avoid spaces
- Module name should reflect the toolset
  - Use a prefix
- Function names should be **Verb-Noun**
  - `Get-Verb`
  - Singular noun
  - Consider a prefix
  - You can alias the function name
- Variable and Parameter names should be meaningful
  - No Hungarian notation
  - Use PowerShell standard names
- Use full cmdlet and parameter names – ***no aliases***

```
Function MakeHomeFolders {
    Param($p,$n,$server)
    Try {
        [void](Test-WSMan $server -ErrorAction Stop)
        icm {
            $strFold = "Data", "Reports", "Public", "Documents"
            $h = ni $using:p -N $using:n -i Directory
            $strFold | % { ni $h.FullName -N $_ -i Directory }
        } -cn $server
    }
    Catch {
        ww "Unable to create home folders on $server. $($_.exception.message)"
    }
}
```

ww is a privately-defined alias for Write-Warning

```
Function MakeHomeFolders {
    Param($p,$n,$server)
    Try {
        [void](Test-WSMan $server -ErrorAction Stop)
        icm {
            $strFold = "Data", "Reports", "Public", "Documents"
            $h = ni $using:p -N $using:n -i Directory
            $strFold | % { ni $h.FullName -N $_ -i Directory }
        } -cn $server
    }
    Catch {
        ww "Unable to create home folders on $server. $($_.exception.message)"
    }
}
```

Avoid this

ww is a privately-defined alias for Write-Warning

```
Function New-HomeFolder {
   [cmdletbinding()]
   [alias("Make-HomeFolder")]
    Param($Path, $Name, $Computername)
    Try {
      [void](Test-WSMan -ComputerName $Computername -ErrorAction Stop)
      Invoke-Command -ScriptBlock {
        $Folders = "Data", "Reports", "Public", "Documents"
        #$Home is a built-in variable so don't use that
        $homeFolder = New-Item -Path $using:Path -Name $using:Name -ItemType Directory
        $Folders | ForEach-Object {
            New-Item -Name $_ -Path $homeFolder.FullName -ItemType Directory
        }
      } -ComputerName $Computername
    }
    Catch {
       Write-Warning "Unable to create home folders on $Computername.$($_.exception.message)"
    }
}
```

Parameters

- You can use parameters in scripts and functions
- Use common and standard parameter names
- Parameter names become variables in your code
- Simple names
  - No spaces, numbers, or special characters
- Define parameter aliases to satisfy corporate culture

Parameters

- Take advantage of parameter validation
- Carefully consider positional vs named parameters
- *Tip*: define a help message
- `help about_functions_advanced_parameters`

```
Param(
        [Parameter(Position = 0, HelpMessage = "Specify the username")]
        [ValidatePattern("^\w{2,15}$")]
        [string]$Name,

        [Parameter(HelpMessage = "Specify the top-level path")]
        [ValidateNotNullorEmpty()]
        [string]$Path = "D:\Users",

        [Parameter(HelpMessage = "Enter the server name")]
        [alias("server", "cn")]
        [ValidateSet("SRV1", "SRV2", "SRV3")]
        [string]$Computername = "SRV1",

        [Parameter(Mandatory, HelpMessage = "Enter an alternate credential")]
        [alias("RunAs")]
        [PSCredential]$Credential
    )
```

Objects in the pipeline

- Functions write one type of object to the pipeline
- `Write-Host` is for messaging not output
  - Learn to use `Write-Progress`
  - `Use foreground and/or background colors`
- `Write-Output` is redundant
- Do not format your output
- Learn to create your own formatting files (.ps1xml)

```
Function Get-Server {

  #This is a poor scripting example

  Param($Computername = $env:COMPUTERNAME)

    $os =Get-CimInstance win32_Operatingsystem -CimSession $Computername
    Write-Host ($Computername + " [" + $os.Caption+ "]")
    $t = Get-Process -ComputerName $Computername |
    sort workingset -Descending | select -first 5
    write-host "Top processes"
    $t
    $c = Get-Volume -DriveLetter C -CimSession $Computername
    Write-host ("Free space on C: " + $c.SizeRemaining)
    Write-Host ("Free memory: " + $os.FreePhysicalMemory)
}
```

```
Function Get-Server {
    [cmdletbinding()]
    [outputtype("companyServerInfo")]
    Param($Computername = $env:COMPUTERNAME)

    Write-Host "Getting server info for $Computername" -ForegroundColor Green
    $os = Get-CimInstance win32_Operatingsystem -CimSession $Computername
    $t = Get-Process -ComputerName $Computername |
    Sort-Object workingset -Descending | Select-Object -First 5
    $c = Get-Volume -DriveLetter C -CimSession $Computername
    [pscustomobject]@{
        PSTypename      = "companyServerInfo"
        Computername    = $Computername.ToUpper()
        OperatingSystem = $os.caption
        TopProcesses    = $t
        FreeDiskGB      = $c.SizeRemaining / 1GB
        FreeMemoryGB    = $os.FreePhysicalMemory / 1mb
        ReportDate      = Get-Date
    }
}
```

```
PS C:\> Get-Server
Getting server info for THINKP1


Computername    : THINKP1
OperatingSystem : Microsoft Windows 11 Pro
TopProcesses    : {System.Diagnostics.Process (Memory Compression), System.Diagnostics.Process (SamsungMagician),
                  System.Diagnostics.Process (firefox), System.Diagnostics.Process (dwm)...}
FreeDiskGB      : 104.209136962891
FreeMemoryGB    : 9.69895172119141
ReportDate      : 8/3/2021 10:59:51 AM
```

```xml
<?xml version="1.0" encoding="UTF-8"?>
<Configuration>
  <ViewDefinitions>
    <View>
     <Name>default</Name>
      <ViewSelectedBy>
        <TypeName>CompanyServerinfo</TypeName>
      </ViewSelectedBy>
      <GroupBy>
          <PropertyName>Computername</PropertyName>
      </GroupBy>
      <TableControl>
       <TableHeaders>
         <TableColumnHeader>
            <Label>OperatingSystem</Label>
            <Width>25</Width>
            <Alignment>left</Alignment>
          </TableColumnHeader>
          <TableColumnHeader>
            <Label>TopProcesses</Label>
            <Width>51</Width>
            <Alignment>left</Alignment>
           ...
```

```
PS C:\> Get-Server
Getting server info for THINKP1


   Computername: THINKP1

OperatingSystem           TopProcesses                                          FreeDiskGB FreeMemGB
---------------           ------------                                          ---------- ---------
Microsoft Windows 11 Pro  Memory Compression,powershell,SamsungMagician,fi...    104.3874         8
```

```
PS C:\> $s | select *


Computername     : THINKP1
OperatingSystem  : Microsoft Windows 11 Pro
TopProcesses     : {System.Diagnostics.Process (Memory Co
                   System.Diagnostics.Process (powershell
FreeDiskGB       : 104.222946166992
FreeMemoryGB     : 8.9820442199707
ReportDate       : 8/3/2021 11:07:29 AM
```

```
PS C:\> $s.TopProcesses

Handles  NPM(K)    PM(K)      WS(K)     CPU(s)     Id  SI ProcessName
-------  ------    -----      -----     ------     --  -- -----------
      0       0     3916    1603392     162.42   3852   0 Memory Compression
    781     578   130564    1246260      53.48  15752   1 SamsungMagician
   1186     104  5039184    4865980   2,839.17  12384   1 powershell
    618     100   447488     423136      52.52  21832   1 firefox
   1738     397  5230604     406964   4,792.97   1808   1 dwm
```

```
Function Get-FolderReport {
    Param($Folder)

    dir $folder -file | Group extension | Select Count,Name,
    @{N="Size";E={$_.group | measure length -sum | select -expand sum}} |
    Sort Size -Descending | Ft -auto
}
```

```
Function Get-FolderReport {
    [cmdletbinding()]
    [alias("gfr")]
    [outputtype("companyFolderReport")]
    Param(
        [Parameter(Position = 0, HelpMessage = "Enter the folder path")]
        [ValidateScript( { Test-Path $_ })]
        [string]$Path = "."
    )

    $groups = Get-ChildItem -Path $Path -File | Where-Object {$_.Extension} |
    Group-Object -Property extension
    foreach ($item in $Groups) {
        $size = $item.Group | Measure-Object -Property length -Sum
        [pscustomobject]@{
            PSTypename = "companyFolderReport"
            Path       = (Convert-Path $Path)
            Extension  = $item.Name.substring(1)
            Count      = $item.Count
            Size       = $size.sum
            AuditDate  = Get-Date
        }
    }
}
```

```
Path      : C:\work
Extension : iso
Count     : 1
Size      : 1694584141
AuditDate : 8/3/2021 4:45:28 PM
```

```
PS C:\> Get-FolderReport c:\work | Sort size -Descending | Select -first 10


   Directory: C:\work

Count Extension       SizeKB
----- ---------       ------
1     iso       1654867.3252
10    xml         66328.6562
1     zip         13177.1904
8     html          566.5801
8     json           357.584
24    txt           312.5029
7     csv           183.6768
1     pdf            78.8125
4     png            46.4824
2     jpg            23.2686


PS C:\>
```

Functions as cmdlets

- Use `[cmdletbinding()]`
  - Common parameters
  - Pipeline input
  - WhatIf
  - ParameterSets
- Insert `Write-Verbose` during development
- Begin/Process/End scriptblocks
- `help about_functions_advanced*`

Advanced Function Demo

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Tips for better PowerShell code

- Document your code
- Use cmdlets over .NET code
- Learn to use `Write-Progress`
- Leverage splatting

Tips for better PowerShell code

- Handle Errors
- Properly format your code
- Who is your code for?
- Don't let Google write your code

Resources

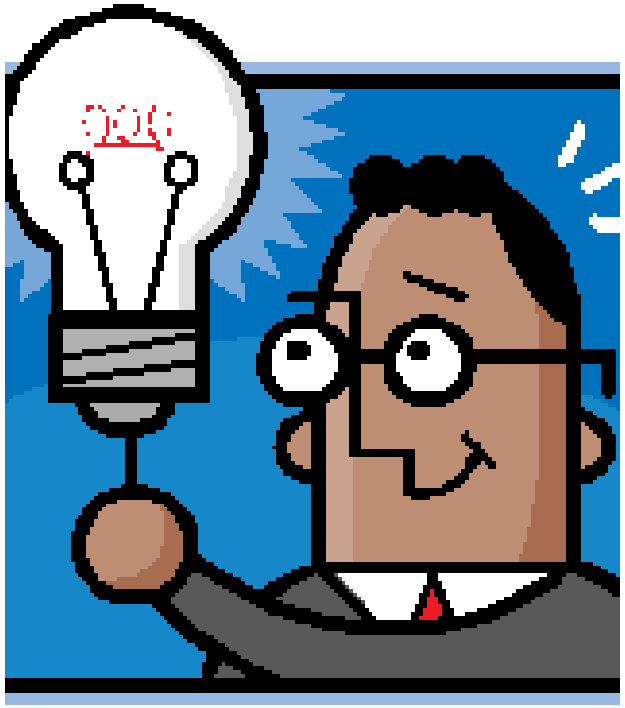
https://docs.microsoft.com/powershell/

https://jdhitsolutions.com/blog

PowerShell.org

#PowerShell

Pluralsight.com



Resources

- You can start with Learn PowerShell Scripting in a Month of Lunches (Manning)
- https://leanpub.com/powershell-scripting-toolmaking
- Check out other PowerShell resources on Leanpub

Questions and answers coming up

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Thank you.

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