3 Exploring Compatibility with Windows PowerShell

In this chapter, we cover the following recipes:

- Exploring compatibility with Windows PowerShell
- Using the Windows PowerShell compatibility solution
- Exploring compatibility solution limitations
- Exploring the module deny list
- Importing format XML
- Leveraging compatibility

Introduction

Microsoft built Windows PowerShell to work with Microsoft's .NET Framework. You can think of PowerShell as a layer on top of .NET. When you use `Get-ChildItem` to return file or folder details, the cmdlet invokes a .NET class to do much of the heavy lifting involved. In *Chapter 5, Exploring .NET*, you learn more about .NET.

As Windows PowerShell evolved, each new version took advantage of improvements in newer versions of .NET to provide additional features.

In 2014, Microsoft announced that they would release the .NET Framework as open source, to be known as .NET Core. Microsoft also decided to freeze development of Windows PowerShell, in favor of open sourcing Windows PowerShell. The first two initial versions were known as PowerShell Core. With the release of PowerShell 7.0, the team dropped the name "Core" and announced that future versions are to be known as just PowerShell. This book refers to the latest version as simply PowerShell 7.

As an IT professional, the critical question you should be asking is whether PowerShell 7 can run your specific workload. The answer, as ever, is "it depends." It depends on the specific Windows PowerShell features and modules/commands on which you rely. Since there are many product teams involved, a fully coordinated solution is not straightforward. As this book shows, there is very little you were able to do in Windows PowerShell that you cannot do in PowerShell 7.

Module compatibility

In terms of compatibility with Windows PowerShell, there are three sets of modules containing different commands to look at:

- Modules/commands shipped with Windows PowerShell and on which your scripts depend.
- Modules/commands included as part of a Windows feature – these contain commands to manage aspects of Windows services, usually as part of the **Remote Server Administration Tools** (**RSAT**), which you can load independently of the services themselves.
- Other third-party modules, such as the `NTFSSecurity` module. This book makes use of several external modules whose authors may, or may not, have updated their modules to run on .NET Core.

Windows PowerShell included modules that provide basic PowerShell functionality. For example, the `Microsoft.PowerShell.Management` module contains the `Get-Process` cmdlet. With PowerShell 7, the development team re-implemented the fundamental Windows PowerShell commands to provide good fidelity with Windows PowerShell. A few Windows PowerShell commands made use of proprietary APIs, so they could not be included, but the number is relatively small.

These core modules (`Microsoft.PowerShell.*`) now reside in the PowerShell installation folder, which simplifies side-by-side use of multiple versions of PowerShell. Through the use of the environment variable `PSModulePath`, when you call a cmdlet in PowerShell 7, you get the "right" cmdlet and supported underpinnings. It is important to note that these core modules were developed by the Windows PowerShell team initially and are not part of the open source PowerShell.

The Windows client and Windows Server also provide modules that enable you to manage your systems. Modules like the Active Directory module give you the tools to manage AD in your environment. These Windows modules live in the `C:\Windows\System32\WindowsPowerShell\v1.0\modules` folder.

The ownership of these operating system-related modules lies with the individual product teams, some of whom have not been motivated to update their modules to run with .NET Core. Like so many things, this is a work in progress. Some modules, such as the `ActiveDirectory` module, have been updated and are available natively in PowerShell 7. For a quick look at compatibility, view this document: `https://docs.microsoft.com/en-us/powershell/scripting/whats-new/module-compatibility?view=powershell-7.1`. It is worth noting that updating these OS modules can only be done by upgrading to a newer version of the OS, which is unfortunate.

The final set of commands to think about are third-party modules, possibly obtained from the PowerShell Gallery, Spiceworks, or a host of other online sources. As the recipes in this book demonstrate, some third-party modules work fine natively in the latest versions of PowerShell 7, while others do not and may never work.

In the *Exploring compatibility with Windows PowerShell* recipe, you look specifically at the new commands you have available in PowerShell 7, as well as where PowerShell and Windows PowerShell find core commands.

Since many of the Windows product teams and other module providers might not update their modules to work natively, the PowerShell team devised a compatibility solution that enables you to import and use Windows PowerShell modules more or less seamlessly in PowerShell 7. In the *Using the Windows PowerShell compatibility solution* recipe, you investigate the workings of the Windows PowerShell compatibility solution.

Incompatible modules

With the compatibility solution, the modules developed for Windows PowerShell work well, as demonstrated by many recipes in this book. However, there are some small and some more fundamental issues in a few cases. Some things do not and may never work inside PowerShell 7 and beyond. For instance, despite the compatibility solution, the `BestPractices`, `PSScheduledJob`, and `WindowsUpdate` modules will not work in PowerShell 7.

With Windows PowerShell you use `WindowsUpdate` to manage **Windows Server Update Services** (**WSUS**). WSUS, the `UpdateServices` module, makes use of object methods. With the compatibility mechanism, these methods are not available in a PowerShell 7 session. Additionally, the module makes use of the **Simple Object Access Protocol** (**SOAP**) protocol for which .NET Core provides no support (and is not likely to anytime soon). The other two modules make use of .NET types that are not provided with .NET Core and are not likely to be updated.

Other Windows PowerShell features that are not going to work in PowerShell 7 include:

- Windows PowerShell workflows: Workflows require the Windows Workflow Foundation component of .NET, which the .NET team has not ported to .NET Core.
- Windows PowerShell snap-ins: Snap-ins provided a way to add new cmdlets in PowerShell V2. Modules replaced snap-ins as an add-in mechanism in PowerShell V2, and are the sole method you use to add commands to PowerShell. You can convert some older snap-ins into modules by creating a module manifest, but most require the authors to re-engineer their modules.
- The WMI cmdlets: The `CIMCmdlets` module replaces the older WMI Cmdlets.
- **Desired State Configuration** (**DSC**): The core functions of DSC are not available to you from within PowerShell 7.
- The `WebAdministration` module's IIS provider: This means many IIS configuration scripts do not work in PowerShell 7, even with the compatibility solution.
- The `Add-Computer`, `Checkpoint-Computer`, `Remove-Computer`, and `Restore-Computer` commands from the `Microsoft.PowerShell.Management` module.

While there are a few Windows PowerShell features and commands you cannot use in PowerShell 7, even with the help of the Windows PowerShell compatibility solution, you can always use Windows PowerShell.

As noted above, there are just three Microsoft-authored modules that do not work in PowerShell 7, natively or via the compatibility mechanism. If you try to use these, you will receive unhelpful error messages. To avoid an awful user experience (and no doubt tons of support calls), the PowerShell team devised a list of modules that PowerShell does not load. If you try to use these modules, you get an error message, as you see in the *Exploring the module deny list* recipe.

One downside to the compatibility mechanism is that any format XML included with the module does not get loaded into the PowerShell 7 session. The result is that PowerShell 7 does not format objects as nicely. Fortunately, there is a way around this, as you see in the *Importing format XML* recipe.

The Windows PowerShell compatibility solution makes use of a specially created PowerShell remoting session. In *Leveraging compatibility*, you look at that session and learn how you can take advantage of it.

Despite compatibility issues, it is more than worthwhile to move forward to PowerShell 7 and away from Windows PowerShell. One key reason is improved performance. You can use the `ForEach-Object -Parallel` construct to run script blocks in parallel without having to resort to workflows. If your script has to perform actions on a large number of computers, or you are processing a large array, the performance improvements in PowerShell 7 justify moving forward. On top of this, there are all the newly added features, which make life so much easier.

Exploring compatibility with Windows PowerShell

When you invoke a cmdlet, PowerShell has to load the module containing the cmdlet and can then run that cmdlet. By default, PowerShell uses the paths on the environment variable `$env:PSModulePath` to discover the modules and the cmdlets contained in those modules.

As this recipe shows, the set of paths held by `$env:PSModulePath` has changed between Windows PowerShell 5.1 and PowerShell 7.

In this recipe, you examine the paths that PowerShell uses by default to load modules. You also look at the new commands now provided in PowerShell 7.

Getting ready

You use `SRV1` for this recipe after you have loaded PowerShell 7.1 and VS Code.

How to do it...

1. Ensuring PowerShell remoting is fully enabled

```
Enable-PSRemoting -Force -WarningAction SilentlyContinue |
  Out-Null
```

2. Getting session using endpoint for Windows PowerShell 5.1

```
$SHT1 = @{
  ComputerName      = 'localhost'
  ConfigurationName = 'microsoft.powershell'
}
$SWP51 = New-PSSession @SHT1
```

3. Getting session using PowerShell 7.1 endpoint

```
$CNFName = Get-PSSessionConfiguration |
             Where-Object PSVersion -eq '7.1' |
               Select-Object -Last 1
$SHT2 = @{
  ComputerName      = 'localhost'
  ConfigurationName = $CNFName.Name
}
$SP71    = New-PSSession @SHT2
```

4. Defining a script block to view default module paths

```
$SBMP = {
  $PSVersionTable
  $env:PSModulePath -split ';'
}
```

5. Reviewing paths in Windows PowerShell 5.1

```
Invoke-Command -ScriptBlock $SBMP -Session $SWP51
```

6. Reviewing paths in PowerShell 7.1

```
Invoke-Command -ScriptBlock $SBMP -Session $SP71
```

7. Creating a script block to get commands in PowerShell

```
$SBC = {
  $ModPaths = $ENv:PSModulePath -split ';'
  $CMDS = @()
  Foreach ($ModPath in $ModPaths) {
    if (!(Test-Path $Modpath)) {Continue}
    # Process modules found in an existing module path
    $Mods = Get-ChildItem -Path $ModPath -Directory
    foreach ($Mod in $Mods){
      $Name  = $Mod.Name
      $Cmds  += Get-Command -Module $Name
    }
  }
  $Cmds  # return all commands discovered
}
```

8. Discovering all 7.1 cmdlets

```
$CMDS71 = Invoke-Command -ScriptBlock $SBC -Session $SP71 |
            Where-Object CommandType -eq 'Cmdlet'
"Total commands available in PowerShell  7.1 [{0}]" -f $Cmds71.count
```

9. Discovering all 5.1 cmdlets

```
$CMDS51 = Invoke-Command -ScriptBlock $SBC -Session $SWP51 |
            Where-Object CommandType -eq 'Cmdlet'
"Total commands available in PowerShell  5.1 [{0}]" -f $Cmds51.count
```

10. Creating arrays of just cmdlet names

```
$Commands51 = $CMDS51 |
  Select-Object -ExpandProperty Name |
    Sort-Object -Unique
$Commands71 = $CMDS71 |
  Select-Object -ExpandProperty Name |
    Sort-Object -Unique
```

11. Discovering new commands in PowerShell 7.1

```
Compare-Object $Commands51 $Commands71  |
  Where-Object sideindicator -match '^=>'
```

12. Creating a script block to check core PowerShell modules

```
$CMSB = {
  $M = Get-Module -Name 'Microsoft.PowerShell*' -ListAvailable
  $M
  "$($M.count) modules found in $($PSVersionTable.PSVersion)"
}
```

13. Viewing core modules in Windows PowerShell 5.1

```
Invoke-Command -Session $SWP51 -ScriptBlock $CMSB
```

14. Viewing core modules in PowerShell 7.1

```
Invoke-Command -Session $SP71 -ScriptBlock $CMSB
```

How it works...

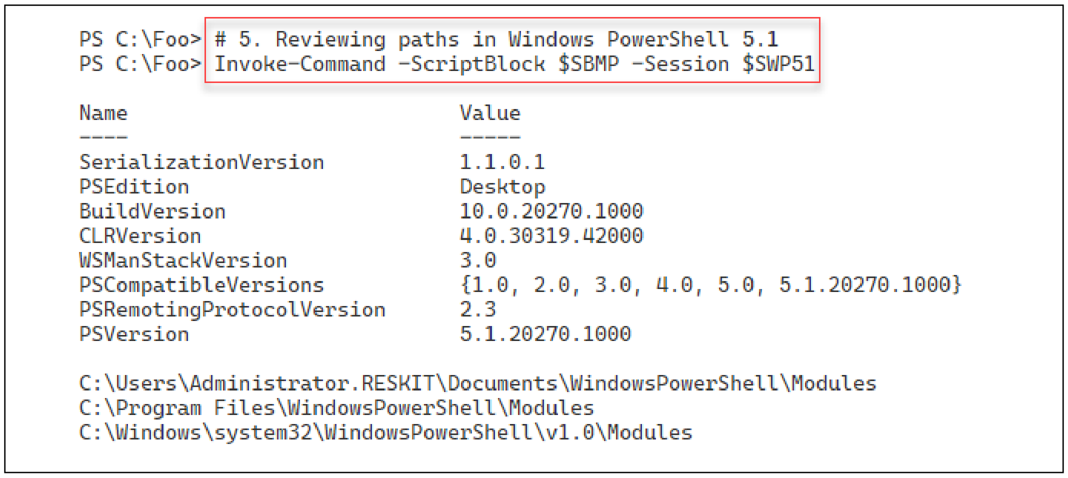
In *step 1*, you ensure that PowerShell remoting is enabled fully within PowerShell 7. This should not be necessary, but this step, which produces no output, ensures that the endpoints you use later in this recipe exist.

In *step 2*, you create a new PowerShell remoting session to a Windows PowerShell 5.1 endpoint on the local computer. The endpoint's configuration name, `microsoft.powershell`, is a well-known configuration name that runs Windows PowerShell 5.1.

With *step 3*, you then repeat the operation and create a new PowerShell remoting session to a PowerShell 7.1 endpoint. This step produces no output.

In *step 4*, you create a simple script block that displays the PowerShell version table and shows the endpoint's module paths.

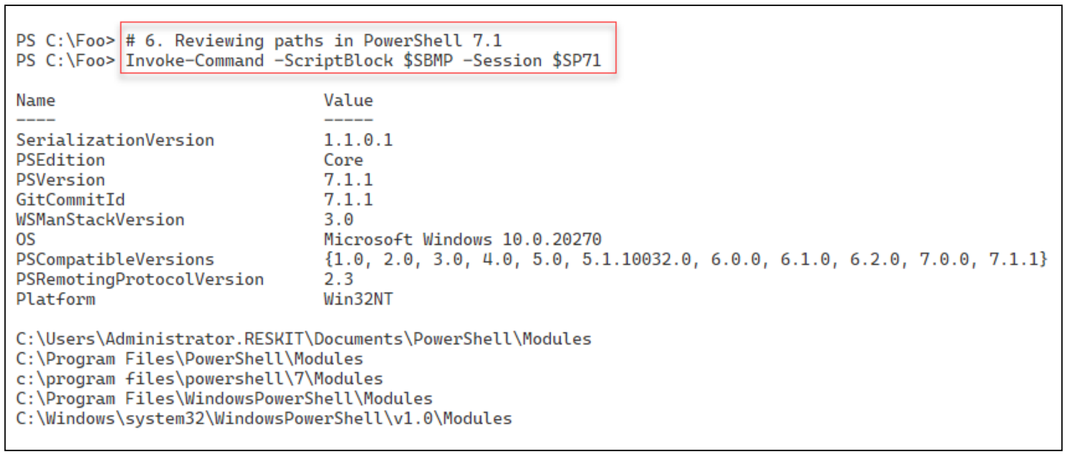
In *step 5*, you view the version of PowerShell running (inside the remoting session) and that version's module paths. The output of this step looks like this:



```
PS C:\Foo> # 5. Reviewing paths in Windows PowerShell 5.1
PS C:\Foo> Invoke-Command -ScriptBlock $SBMP -Session $SWP51

Name                           Value
----                           -----
SerializationVersion           1.1.0.1
PSEdition                      Desktop
BuildVersion                   10.0.20270.1000
CLRVersion                     4.0.30319.42000
WSManStackVersion              3.0
PSCompatibleVersions           {1.0, 2.0, 3.0, 4.0, 5.0, 5.1.20270.1000}
PSRemotingProtocolVersion      2.3
PSVersion                      5.1.20270.1000

C:\Users\Administrator.RESKIT\Documents\WindowsPowerShell\Modules
C:\Program Files\WindowsPowerShell\Modules
C:\Windows\system32\WindowsPowerShell\v1.0\Modules
```

Figure 3.1: Inspecting the PowerShell 5.1 version and module paths

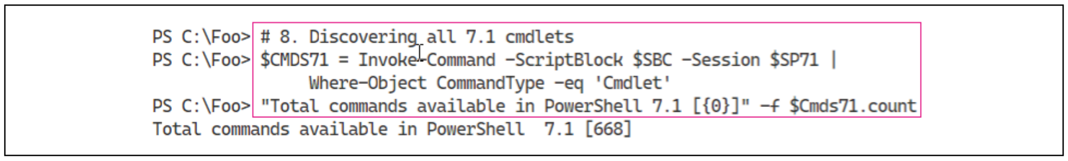
In *step 6*, you view the paths inside a PowerShell 7.1 endpoint, which looks like this:



```
PS C:\Foo> # 6. Reviewing paths in PowerShell 7.1
PS C:\Foo> Invoke-Command -ScriptBlock $SBMP -Session $SP71

Name                           Value
----                           -----
SerializationVersion           1.1.0.1
PSEdition                      Core
PSVersion                      7.1.1
GitCommitId                    7.1.1
WSManStackVersion              3.0
OS                             Microsoft Windows 10.0.20270
PSCompatibleVersions           {1.0, 2.0, 3.0, 4.0, 5.0, 5.1.10032.0, 6.0.0, 6.1.0, 6.2.0, 7.0.0, 7.1.1}
PSRemotingProtocolVersion      2.3
Platform                       Win32NT

C:\Users\Administrator.RESKIT\Documents\PowerShell\Modules
C:\Program Files\PowerShell\Modules
c:\program files\powershell\7\Modules
C:\Program Files\WindowsPowerShell\Modules
C:\Windows\system32\WindowsPowerShell\v1.0\Modules
```

Figure 3.2: Inspecting the PowerShell 7.1 version and module paths

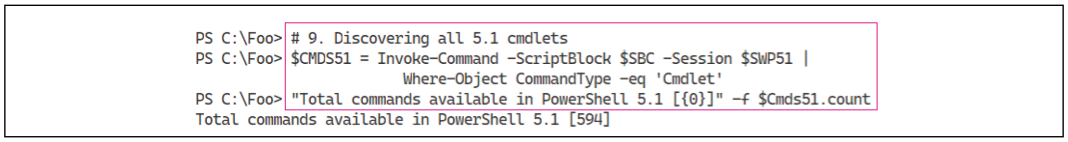
In *step 7*, you create a script block gets the details of each module available in a given remoting endpoint. This step produces no output. In *step 8*, you run the script block in a PowerShell 7.1 remoting endpoint to discover the commands available, which looks like this:



```
PS C:\Foo> # 8. Discovering all 7.1 cmdlets
PS C:\Foo> $CMDS71 = Invoke-Command -ScriptBlock $SBC -Session $SP71 |
               Where-Object CommandType -eq 'Cmdlet'
PS C:\Foo> "Total commands available in PowerShell 7.1 [{0}]" -f $Cmds71.count
Total commands available in PowerShell  7.1 [668]
```

Figure 3.3: Discovering all cmdlets in PowerShell 7.1

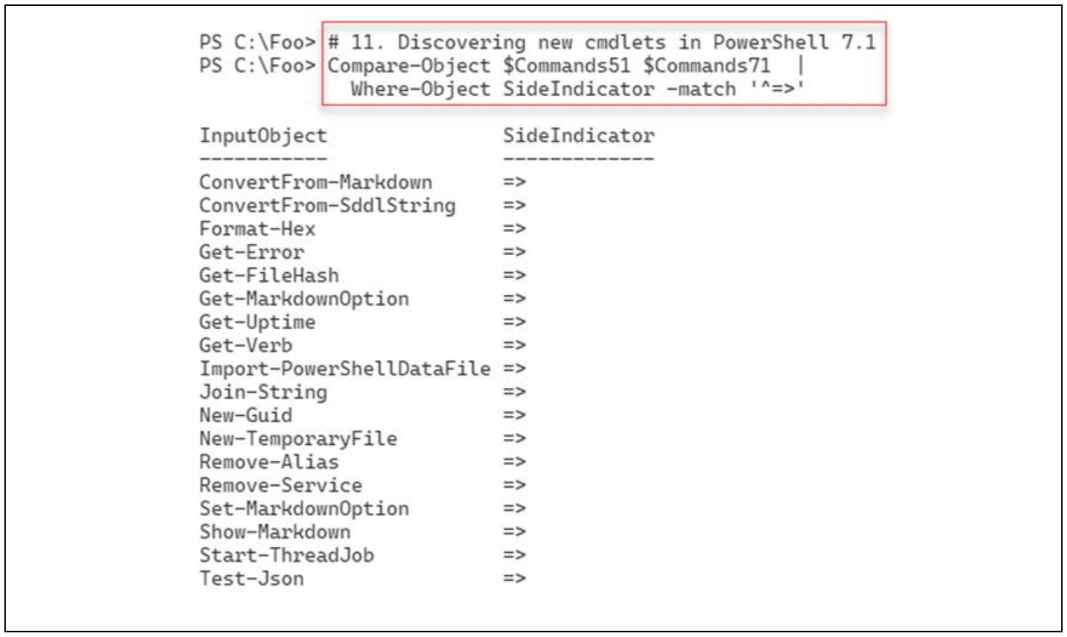
In *step 9*, you run this script block inside the Windows PowerShell endpoint to produce output like the following:



```
PS C:\Foo> # 9. Discovering all 5.1 cmdlets
PS C:\Foo> $CMDS51 = Invoke-Command -ScriptBlock $SBC -Session $SWP51 |
                      Where-Object CommandType -eq 'Cmdlet'
PS C:\Foo> "Total commands available in PowerShell 5.1 [{0}]" -f $Cmds51.count
Total commands available in PowerShell 5.1 [594]
```

Figure 3.4: Discovering all cmdlets in PowerShell 5.1

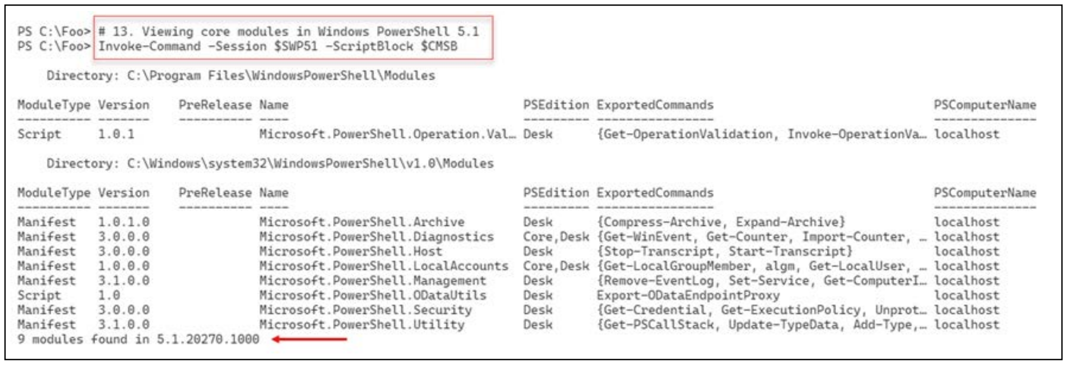
In *step 10*, you create arrays to contain the names of the commands available. You compare these in *step 11*, to discover the commands in PowerShell 7.1 that are not in Windows PowerShell 5.1, which looks like this:



```
PS C:\Foo> # 11. Discovering new cmdlets in PowerShell 7.1
PS C:\Foo> Compare-Object $Commands51 $Commands71  |
             Where-Object SideIndicator -match '^=>'

InputObject               SideIndicator
-----------               -------------
ConvertFrom-Markdown      =>
ConvertFrom-SddlString    =>
Format-Hex                =>
Get-Error                 =>
Get-FileHash              =>
Get-MarkdownOption        =>
Get-Uptime                =>
Get-Verb                  =>
Import-PowerShellDataFile =>
Join-String               =>
New-Guid                  =>
New-TemporaryFile         =>
Remove-Alias              =>
Remove-Service            =>
Set-MarkdownOption        =>
Show-Markdown             =>
Start-ThreadJob           =>
Test-Json                 =>
```

Figure 3.5: Discovering cmdlets that are in PowerShell 7.1 but not 5.1

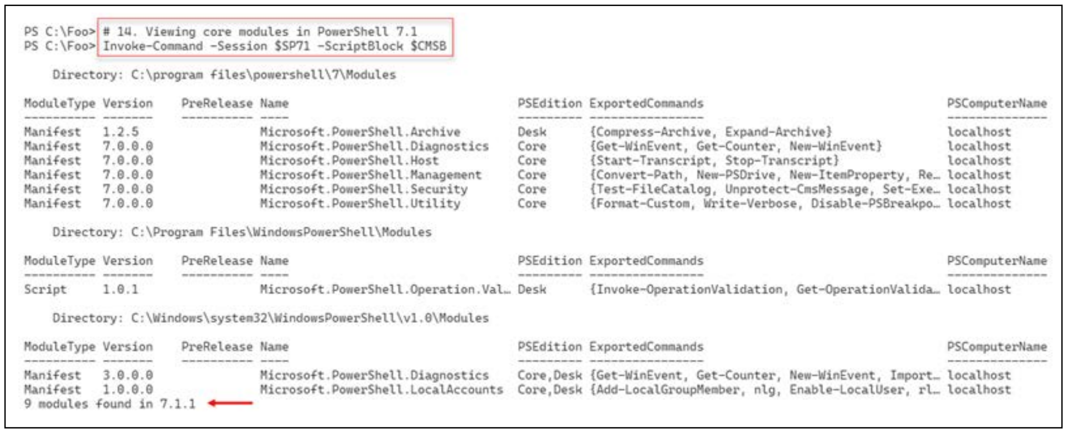
In *step 12*, you create a script block that you can use to discover the core PowerShell modules and their file storage locations. This step creates no output. In *step 13*, you run this script block inside the Windows PowerShell remoting session you created earlier, which looks like this:



```
PS C:\Foo> # 13. Viewing core modules in Windows PowerShell 5.1
PS C:\Foo> Invoke-Command -Session $SWP51 -ScriptBlock $CMSB

    Directory: C:\Program Files\WindowsPowerShell\Modules

ModuleType Version    PreRelease Name                               PSEdition ExportedCommands                           PSComputerName
---------- -------    ---------- ----                               --------- ----------------                           --------------
Script     1.0.1                 Microsoft.PowerShell.Operation.Val… Desk      {Get-OperationValidation, Invoke-OperationVa… localhost

    Directory: C:\Windows\system32\WindowsPowerShell\v1.0\Modules

ModuleType Version    PreRelease Name                               PSEdition ExportedCommands                           PSComputerName
---------- -------    ---------- ----                               --------- ----------------                           --------------
Manifest   1.0.1.0               Microsoft.PowerShell.Archive       Desk      {Compress-Archive, Expand-Archive}         localhost
Manifest   3.0.0.0               Microsoft.PowerShell.Diagnostics   Core,Desk {Get-WinEvent, Get-Counter, Import-Counter, … localhost
Manifest   3.0.0.0               Microsoft.PowerShell.Host          Desk      {Stop-Transcript, Start-Transcript}        localhost
Manifest   1.0.0.0               Microsoft.PowerShell.LocalAccounts Core,Desk {Get-LocalGroupMember, algm, Get-LocalUser, … localhost
Manifest   3.1.0.0               Microsoft.PowerShell.Management    Desk      {Remove-EventLog, Set-Service, Get-ComputerI… localhost
Script     1.0                   Microsoft.PowerShell.ODataUtils    Desk      Export-ODataEndpointProxy                  localhost
Manifest   3.0.0.0               Microsoft.PowerShell.Security      Desk      {Get-Credential, Get-ExecutionPolicy, Unprot… localhost
Manifest   3.1.0.0               Microsoft.PowerShell.Utility       Desk      {Get-PSCallStack, Update-TypeData, Add-Type,… localhost
9 modules found in 5.1.20270.1000
```

Figure 3.6: Viewing core modules in PowerShell 5.1

You then rerun this script block in a PowerShell 7.1 endpoint, in *step 14*. The output from this step looks like this:



```
PS C:\Foo> # 14. Viewing core modules in PowerShell 7.1
PS C:\Foo> Invoke-Command -Session $SP71 -ScriptBlock $CMSB

    Directory: C:\program files\powershell\7\Modules

ModuleType Version    PreRelease Name                               PSEdition ExportedCommands                           PSComputerName
---------- -------    ---------- ----                               --------- ----------------                           --------------
Manifest   1.2.5                 Microsoft.PowerShell.Archive       Desk      {Compress-Archive, Expand-Archive}         localhost
Manifest   7.0.0.0               Microsoft.PowerShell.Diagnostics   Core      {Get-WinEvent, Get-Counter, New-WinEvent}  localhost
Manifest   7.0.0.0               Microsoft.PowerShell.Host          Core      {Start-Transcript, Stop-Transcript}        localhost
Manifest   7.0.0.0               Microsoft.PowerShell.Management    Core      {Convert-Path, New-PSDrive, New-ItemProperty, Re… localhost
Manifest   7.0.0.0               Microsoft.PowerShell.Security      Core      {Test-FileCatalog, Unprotect-CmsMessage, Set-Exe… localhost
Manifest   7.0.0.0               Microsoft.PowerShell.Utility       Core      {Format-Custom, Write-Verbose, Disable-PSBreakpo… localhost

    Directory: C:\Program Files\WindowsPowerShell\Modules

ModuleType Version    PreRelease Name                               PSEdition ExportedCommands                           PSComputerName
---------- -------    ---------- ----                               --------- ----------------                           --------------
Script     1.0.1                 Microsoft.PowerShell.Operation.Val… Desk      {Invoke-OperationValidation, Get-OperationValida… localhost

    Directory: C:\Windows\system32\WindowsPowerShell\v1.0\Modules

ModuleType Version    PreRelease Name                               PSEdition ExportedCommands                           PSComputerName
---------- -------    ---------- ----                               --------- ----------------                           --------------
Manifest   3.0.0.0               Microsoft.PowerShell.Diagnostics   Core,Desk {Get-WinEvent, Get-Counter, New-WinEvent, Import… localhost
Manifest   1.0.0.0               Microsoft.PowerShell.LocalAccounts Core,Desk {Add-LocalGroupMember, nlg, Enable-LocalUser, rl… localhost
9 modules found in 7.1.1
```

Figure 3.7: Viewing core modules in PowerShell 7.1

There's more...

The code in *step 2* creates a PowerShell remoting endpoint to a well-known endpoint for Windows PowerShell 5. You cannot view Windows PowerShell remoting endpoint configurations from within PowerShell 7.1.

In *step 3*, you get a session that provides PowerShell 7.1 using a slightly different technique than you used in *step 2*. PowerShell 7.1 has multiple endpoints, especially if you have both a release version and a preview version loaded side by side. You can use `Get-PSSessionConfiguration` to view the available remoting endpoint configurations in your specific PowerShell 7 host. Thus, you do not see the Windows PowerShell remoting endpoints inside PowerShell 7. Although the `Get-PSSessionConfiguration` cmdlet does not return any Windows PowerShell configuration details, the remoting endpoints do exist, and you can use them, as you see in *step 2*.

In *steps 5* and *6*, you discover the default module paths in Windows PowerShell and PowerShell 7.1. As you can see, in PowerShell 7, there are five default module paths, versus just three in Windows PowerShell 5.1. The first three module folders with PowerShell 7 enable PowerShell 7 to pick up commands from PowerShell 7.1-specific folders (if they exist), and the last two modules enable you to access older Windows PowerShell commands that you do not have with PowerShell 7.

In *steps 13* and *14*, you discover the core modules inside Windows PowerShell. These core modules contain the basic internal PowerShell commands, such as `Get-ChildItem`, found in the `Microsoft.PowerShell.Management` module.

Using the Windows PowerShell compatibility solution

The PowerShell 7 Windows compatibility solution allows you to use older Windows PowerShell commands whose developers have not (yet) ported the commands to work natively in PowerShell 7. PowerShell 7 creates a special remoting session into a Windows PowerShell 5.1 endpoint, loads the modules into the remote session, then uses implicit remoting to expose proxy functions inside the PowerShell 7 session. This remoting session has a unique session name, `WinPSCompatSession`. Should you use multiple Windows PowerShell modules, PowerShell 7 loads them all into a single remoting session. Also, this session uses the "process" transport mechanism versus **Windows Remote Management** (**WinRM**). WinRM is the core transport protocol used with PowerShell remoting. The process transport is the transport used to run background jobs; it has less overhead than using WinRM, so is more efficient.

An example of the compatibility mechanism is using `Get-WindowsFeature`, a cmdlet inside the `ServerManager` module. You use the command to get details of features that are installed, or not, inside Windows Server. You use other commands in the `ServerManager` module to install and remove features.

Unfortunately, the Windows Server team has not yet updated this module to work within PowerShell Core. Via the compatibility solution, the commands in the `ServerManager` module enable you to add, remove, and view features. The Windows PowerShell compatibility mechanism allows you to use existing Windows PowerShell scripts in PowerShell 7, although with some very minor caveats.

When you invoke commands in PowerShell 7, PowerShell uses its command discovery mechanism to determine which module contains your desired command. In this case, that module is the `ServerManager` Windows PowerShell module. PowerShell 7 then creates the remoting session and, using implicit remoting, imports the commands in the module as proxy functions. You then invoke the proxy functions to accomplish your goal. For the most part, this is totally transparent. You use the module's commands, and they return the object(s) you request. A minor caveat is that the compatibility mechanism does not import format XML for the Windows PowerShell module. The result is that the default output of some objects is not the same. There is a workaround for this, described in the *Importing format XML* recipe.

With implicit remoting, PowerShell creates a function inside a PowerShell 7 session with the same name and parameters as the actual command (in the remote session). You can view the function definition in the `Function` drive (`Get-Item Function:Get-WindowsFeature | Format-List -Property *`). The output shows the proxy function definition that PowerShell 7 creates when it imports the remote module.

When you invoke the command by name, for example, `Get-WindowsFeature`, PowerShell runs the function. The function then invokes the remote cmdlet using the steppable pipeline. Implicit remoting is a complex feature that is virtually transparent in operation. You can read more about implicit remoting at `https://www.techtutsonline.com/implicit-remoting-windows-powershell/`.

Getting ready

You run this recipe on `SRV1`, after installing PowerShell 7 and VS Code.

How to do it...

1. Discovering the `ServerManager` module

```
Get-Module -Name ServerManager -ListAvailable
```

2. Discovering a command in the `ServerManager` module

```
Get-Command -Name Get-WindowsFeature
```

3. Importing the module explicitly

```
Import-Module -Name ServerManager
```

4. Discovering the commands inside the module

```
Get-Module -Name ServerManager | Format-List
```

5. Using a command in the `ServerManager` module

```
Get-WindowsFeature -Name TFTP-Client
```

6. Running the command in a remoting session

```
$Session = Get-PSSession -Name WinPSCompatSession
Invoke-Command -Session $Session -ScriptBlock {
  Get-WindowsFeature -Name DHCP |
    Format-Table
}
```

7. Removing the `ServerManager` module from the current session

```
Get-Module -Name ServerManager |
  Remove-Module
```

8. Installing a Windows feature using module autoload

```
Install-WindowsFeature -Name TFTP-Client
```

9. Discovering the feature

```
Get-WindowsFeature -Name TFTP-Client
```

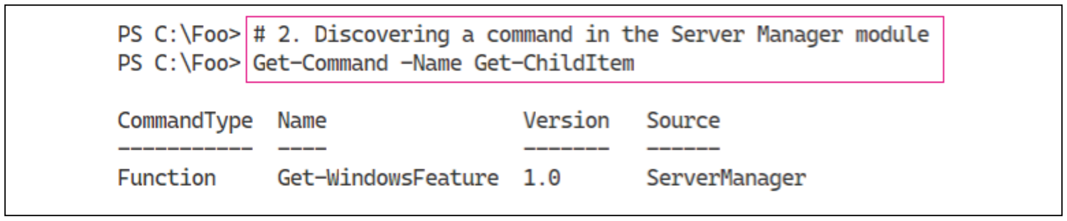
10. Viewing output inside Windows PowerShell session

```
Invoke-Command -Session $Session -ScriptBlock {
    Get-WindowsFeature -Name 'TFTP-Client' |
      Format-Table
}
```

How it works...

In *step 1*, you use the `Get-Module` command to discover the commands in the `ServerManager` module. Despite using the `-ListAvailable` switch, since this module does not work natively in PowerShell 7, this command returns no output.

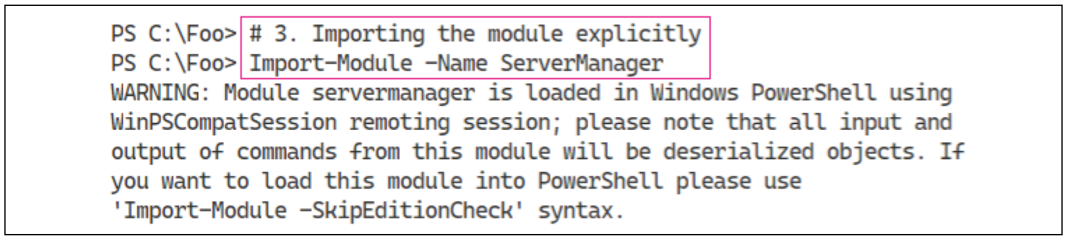
In *step 2*, you use `Get-Command` to discover the `Get-WindowsFeature` command. The output looks like this:



```
PS C:\Foo> # 2. Discovering a command in the Server Manager module
PS C:\Foo> Get-Command -Name Get-ChildItem

CommandType  Name                Version   Source
-----------  ----                -------   ------
Function     Get-WindowsFeature  1.0       ServerManager
```

Figure 3.8: Discovering the Get-WindowsFeature command

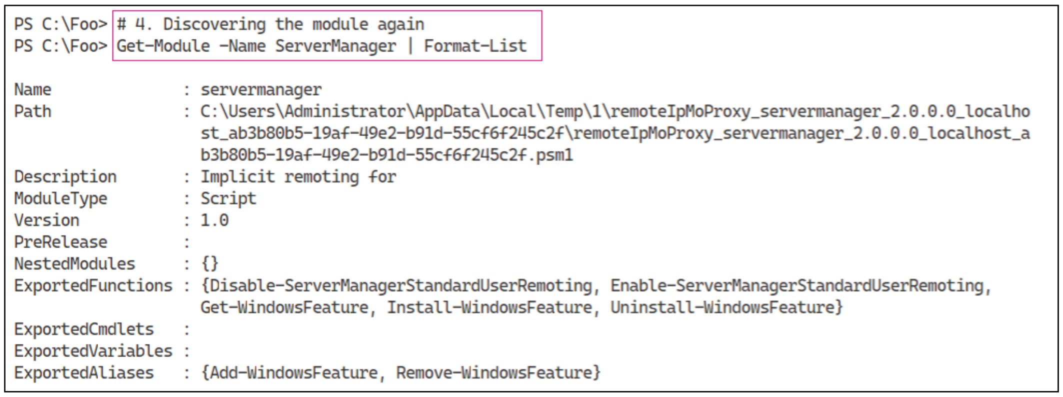
In *step 3*, you import the `ServerManager` module explicitly, which looks like this:



```
PS C:\Foo> # 3. Importing the module explicitly
PS C:\Foo> Import-Module -Name ServerManager
WARNING: Module servermanager is loaded in Windows PowerShell using
WinPSCompatSession remoting session; please note that all input and
output of commands from this module will be deserialized objects. If
you want to load this module into PowerShell please use
'Import-Module -SkipEditionCheck' syntax.
```

Figure 3.9: Importing the ServerManager module explicitly

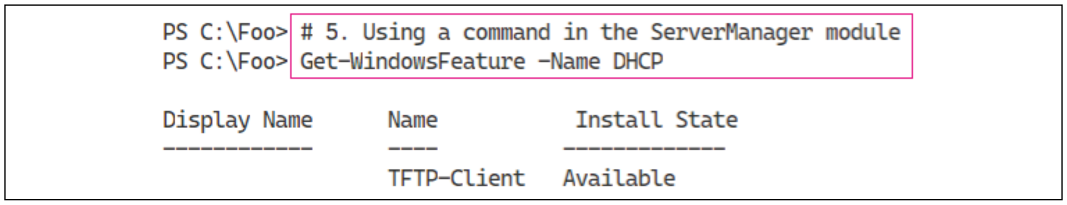
Now that PowerShell 7 has imported the module, you can see the output from `Get-Module.` The output from *step 4* looks like this:



```
PS C:\Foo> # 4. Discovering the module again
PS C:\Foo> Get-Module -Name ServerManager | Format-List

Name              : servermanager
Path              : C:\Users\Administrator\AppData\Local\Temp\1\remoteIpMoProxy_servermanager_2.0.0.0_localho
                    st_ab3b80b5-19af-49e2-b91d-55cf6f245c2f\remoteIpMoProxy_servermanager_2.0.0.0_localhost_a
                    b3b80b5-19af-49e2-b91d-55cf6f245c2f.psm1
Description       : Implicit remoting for
ModuleType        : Script
Version           : 1.0
PreRelease        :
NestedModules     : {}
ExportedFunctions : {Disable-ServerManagerStandardUserRemoting, Enable-ServerManagerStandardUserRemoting,
                    Get-WindowsFeature, Install-WindowsFeature, Uninstall-WindowsFeature}
ExportedCmdlets   :
ExportedVariables :
ExportedAliases   : {Add-WindowsFeature, Remove-WindowsFeature}
```

Figure 3.10: Discovering the ServerManager module

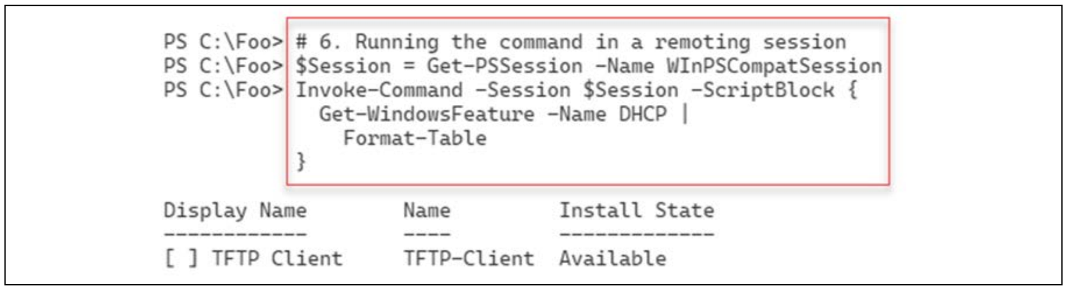
To illustrate that an older Windows PowerShell command works with PowerShell 7, in *step 5*, you invoke `Get-WindowsFeature`. This command discovers whether the TFTP Client feature is installed, which looks like this:



```
PS C:\Foo> # 5. Using a command in the ServerManager module
PS C:\Foo> Get-WindowsFeature -Name DHCP

Display Name      Name          Install State
------------      ----         -------------
                  TFTP-Client  Available
```

Figure 3.11: Invoking the Get-WindowsFeature command

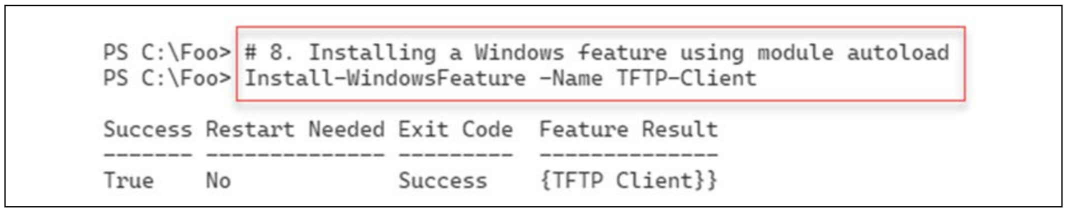
In *step 6*, you rerun the `Get-WindowsFeature` command inside the Windows PowerShell remoting session, with output like this:



```
PS C:\Foo> # 6. Running the command in a remoting session
PS C:\Foo> $Session = Get-PSSession -Name WInPSCompatSession
PS C:\Foo> Invoke-Command -Session $Session -ScriptBlock {
             Get-WindowsFeature -Name DHCP |
               Format-Table
           }

Display Name        Name         Install State
------------        ----         -------------
[ ] TFTP Client     TFTP-Client  Available
```

Figure 3.12: Invoking Get-WindowsFeature in a remoting session

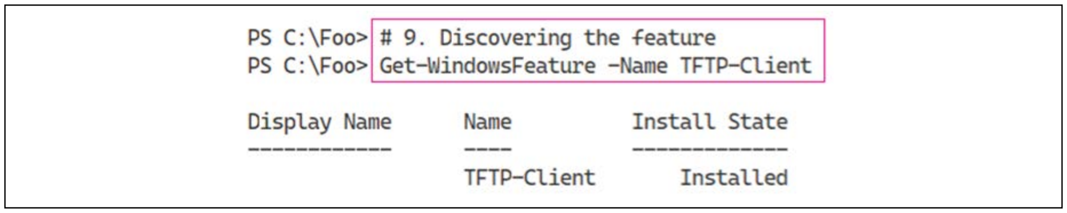
In *step 7*, you remove the `ServerManager` module from the current PowerShell session, producing no output. In *step 8*, you install the `TFTP-Client` feature, which looks like this:



```
PS C:\Foo> # 8. Installing a Windows feature using module autoload
PS C:\Foo> Install-WindowsFeature -Name TFTP-Client

Success Restart Needed Exit Code  Feature Result
------- -------------- ---------  --------------
True    No             Success    {TFTP Client}}
```

Figure 3.13: Installing TFTP-Client

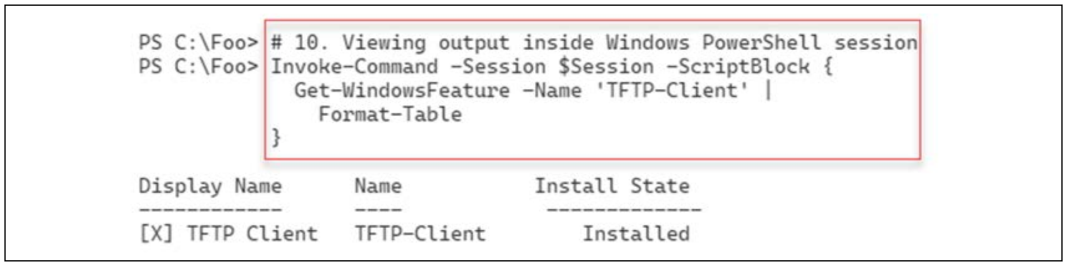
In *step 9*, you rerun the `Get-WindowsFeature` command to check the state of the `TFTP-Client` feature, which looks like this:



```
PS C:\Foo> # 9. Discovering the feature
PS C:\Foo> Get-WindowsFeature -Name TFTP-Client

Display Name      Name          Install State
------------      ----          -------------
                  TFTP-Client       Installed
```

Figure 3.14: Checking the state of TFTP-Client

In *step 10*, you re-view the `TFTP-Client` feature inside the Windows PowerShell remoting session, which looks like this:



```
PS C:\Foo> # 10. Viewing output inside Windows PowerShell session
PS C:\Foo> Invoke-Command -Session $Session -ScriptBlock {
             Get-WindowsFeature -Name 'TFTP-Client' |
               Format-Table
           }

Display Name      Name           Install State
------------      ----           -------------
[X] TFTP Client   TFTP-Client        Installed
```

Figure 3.15: Viewing TFTP-Client inside the remoting session

There's more...

In *step 1*, you attempted to find the `ServerManager` module using the `-ListAvailable` switch. This module is not available natively in PowerShell 7, hence the lack of output. Even though the compatibility mechanism can find the module, by default, `Get-Module` does not display the module.

In *step 2*, you discover that the `Get-WindowsFeature` command comes from the `ServerManager` module, and you then load it explicitly in *step 3*. Loading the module using `Import-Module` generates the warning message you can see in the output. Note that in PowerShell 7, the `Get-WindowsFeature` command is a function, rather than a cmdlet. The implicit remoting process creates a proxy function (in the PowerShell 7 session), which then invokes the underlying command in the remote session. You can examine the function's definition to see how the proxy function invokes the remote function.

In *steps 9* and *10*, you view the output from `Get-WindowsFeature` inside PowerShell 7 and then inside the remoting session to Windows PowerShell. In *step 9*, you see a different output from *step 10*, which is the result of PowerShell 7 not importing the format XML for this module. You can see how to get around this minor issue in *Importing format XML* later in this chapter.

The Windows PowerShell compatibility mechanism in PowerShell 7 does an excellent job of supporting otherwise incompatible Windows PowerShell modules. But even with this, there are some commands and modules that are just not going to work.

Exploring compatibility solution limitations

In the previous recipe, you saw how you could use the Windows PowerShell compatibility mechanism built into PowerShell 7. This solution provides you with access to modules that their owners have not yet converted to run natively in PowerShell 7. This solution provides improved compatibility but does have some minor limitations.

The first limitation is discovery. You can't easily discover unsupported commands. You cannot, for example, use PowerShell 7's `Get-Module` to list the `ServerManager` module, even though you can use `Get-Command` to discover commands inside the module.

Another limitation of the compatibility solution is that PowerShell 7 does not import any display or type XML contained in the module. The result is that some commands may display output slightly differently. There are ways around this, including just running the entire command inside a remoting session.

Despite the compatibility solution, some Windows Server modules simply do not work at all in PowerShell 7. If you load one of these modules manually, the module may load, but some or all of the commands in the module do not work and often return error messages that are not actionable.

Getting ready

Run this in a new PowerShell session on `SRV1` after you have installed PowerShell 7 and VS Code.

How to do it...

1. Attempting to view a Windows PowerShell module

   ```
   Get-Module -Name ServerManager -ListAvailable
   ```

2. Trying to load a module without edition check

   ```
   Import-Module -Name ServerManager -SkipEditionCheck
   ```

3. Discovering the `Get-WindowsFeature` Windows PowerShell command

   ```
   Get-Command -Name Get-WindowsFeature
   ```

4. Examining the Windows PowerShell compatibility remote session

   ```
   $Session = Get-PSSession
   $Session | Format-Table -AutoSize
   ```

5. Examining `Get-WindowsFeature` in the remote session

   ```
   $SBRC = {Get-Command -Name Get-WindowsFeature}
   Invoke-Command -Session $Session -ScriptBlock $SBRC
   ```

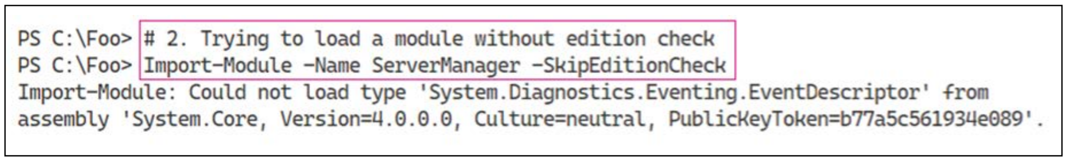
6. Invoking `Get-WindowsFeature` locally

   ```
   Invoke-Command $SBRC
   ```

How it works...

In *step 1*, you use the `Get-Module` cmdlet to get details of the `ServerManager` module. However, since this module is not supported natively, `Get-Module` returns no output when you invoke it within a PowerShell 7 session, even though you use the `-ListAvailable` switch.

In *step 2*, you use the `-SkipEditionCheck` switch to instruct `Import-Module` to try to load the `ServerManager` module into the PowerShell 7 session, which looks like this:

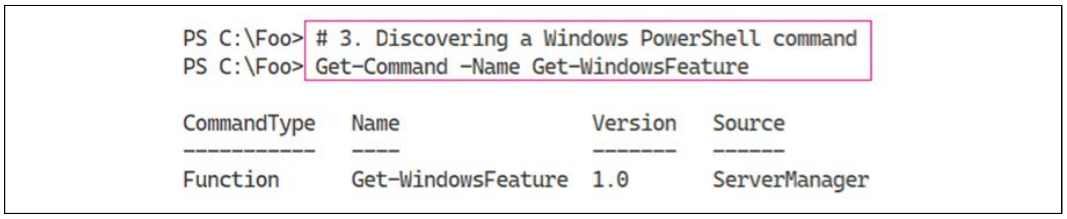


```
PS C:\Foo> # 2. Trying to load a module without edition check
PS C:\Foo> Import-Module -Name ServerManager -SkipEditionCheck
Import-Module: Could not load type 'System.Diagnostics.Eventing.EventDescriptor' from
assembly 'System.Core, Version=4.0.0.0, Culture=neutral, PublicKeyToken=b77a5c561934e089'.
```

Figure 3.16: Loading ServerManager without edition check

As you can see in the output, `Import-Module` errors out when it attempts to load the module in PowerShell 7, with an error message stating that `Import-Module` was not able to load the .NET type `System.Diagnostics.Eventing.EventDescriptor`. Since the `EventDescriptor` type is not available in .NET Core, you cannot use the `ServerManager` module natively. The only alternatives are for the Server Manager team to update their code, or for you to run the cmdlet in Windows PowerShell (either explicitly or via the compatibility mechanism).

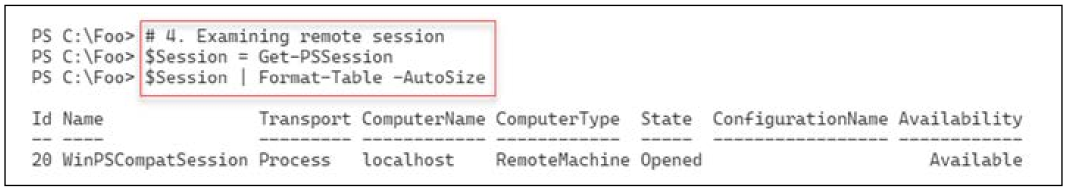
In *step 3*, you use `Get-Command` to discover the `Get-WindowsFeature` command, which succeeds, as you can see in the output from this step:



```
PS C:\Foo> # 3. Discovering a Windows PowerShell command
PS C:\Foo> Get-Command -Name Get-WindowsFeature

CommandType     Name                  Version    Source
-----------     ----                  -------    ------
Function        Get-WindowsFeature    1.0        ServerManager
```

Figure 3.17: Discovering the Get-WindowsFeature command

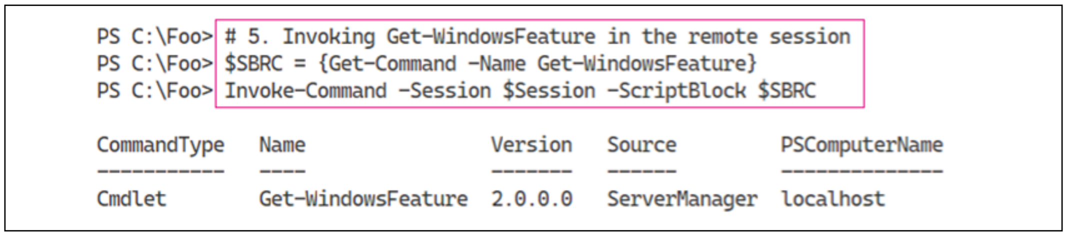
In *step 4*, you use `Get-PSSession` to discover the Windows PowerShell compatibility remote session. The output of this step is as follows:



```
PS C:\Foo> # 4. Examining remote session
PS C:\Foo> $Session = Get-PSSession
PS C:\Foo> $Session | Format-Table -AutoSize

Id Name                Transport ComputerName ComputerType  State  ConfigurationName Availability
-- ----                --------- ------------ ------------  -----  ----------------- ------------
20 WinPSCompatSession  Process   localhost    RemoteMachine Opened                      Available
```

Figure 3.18: Discovering the compatibility remote session

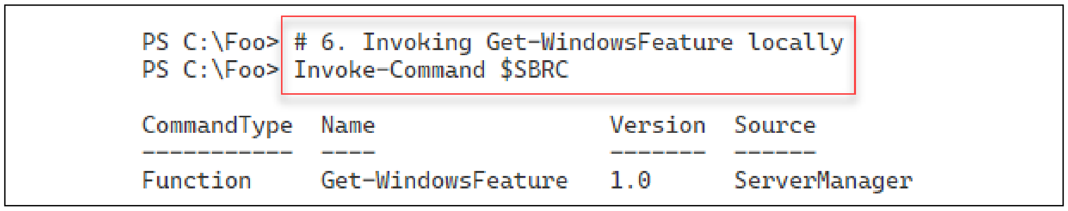
In *step 5*, you invoke the `Get-WindowsFeature` command inside the remoting session to view the command details inside Windows PowerShell 5.1, like this:



```
PS C:\Foo> # 5. Invoking Get-WindowsFeature in the remote session
PS C:\Foo> $SBRC = {Get-Command -Name Get-WindowsFeature}
PS C:\Foo> Invoke-Command -Session $Session -ScriptBlock $SBRC

CommandType     Name                  Version    Source           PSComputerName
-----------     ----                  -------    ------           --------------
Cmdlet          Get-WindowsFeature    2.0.0.0    ServerManager    localhost
```

Figure 3.19: Invoking Get-WindowsFeature in the remote session

With *step 6*, you run `Invoke-Command` to discover the details about this command inside your PowerShell 7 console. The output of this step is as follows:



```
PS C:\Foo> # 6. Invoking Get-WindowsFeature locally
PS C:\Foo> Invoke-Command $SBRC

CommandType  Name                 Version  Source
-----------  ----                 -------  ------
Function     Get-WindowsFeature   1.0      ServerManager
```

Figure 3.20: Invoking Get-WindowsFeature locally

There's more...

As you can see from the steps in this recipe, the Windows PowerShell compatibility solution imposes some minor restrictions on features Windows PowerShell users have grown accustomed to having. These limitations are relatively minor, and there are some workarounds.

As you can see in *step 1*, some modules are not directly discoverable in PowerShell 7. Attempting to force load a module into a PowerShell 7 session, as you attempt in *step 2*, fails (with a rather unhelpful message for the user).

In this case, when PowerShell 7 begins to load the module, PowerShell attempts to utilize a type (a .NET object) that does exist in the full .NET CLR, but not in .NET Core. This .NET type is not only not implemented in .NET Core, but the .NET team have effectively deprecated it. To read through the discussions on this, see `https://github.com/dotnet/core/issues/2933`. The discussion in this post is an outstanding example of the transparency of open source software where you can see the problem and trace its resolution.

The `ServerManager` module is one of many Windows team modules that require updating before it can be used natively in PowerShell 7. Hopefully, future releases of Windows Server might address these modules. But in the meantime, the Windows PowerShell compatibility mechanism provides an excellent solution to most of the non-compatible modules.

In *steps 5* and *6*, you examine the details of the `Get-WindowsFeature` command. Inside Windows PowerShell 5.1, this command is a cmdlet. When, in *step 6*, you view the command inside the PowerShell 7.1 console, you can see the command is a (proxy) function. If you view the function definition (`ls function:get-WindowsFeature.definition`), you can see how PowerShell uses the steppable pipeline to run the command in the remote session. For more background on the steppable pipeline, which has been a feature of Windows PowerShell since version 2, see `https://livebook.manning.com/book/windows-powershell-in-action-third-edition/chapter-10/327`.

Exploring the module deny list

During the development of PowerShell 7, it became clear that a few Windows PowerShell modules did not work with PowerShell 7 despite the compatibility solution. Worse, if you attempted to use them, the error messages that resulted were cryptic and non-actionable. One suggested solution was to create a list of modules that were known to not be usable within PowerShell 7. When `Import-Module` attempts to load any module on this list, the failure is more graceful with a cleaner message.

One possible issue that such a deny list might cause would be if the module owners were to release an updated module previously on the deny list that now works. To simplify this situation, PowerShell 7 stores the deny list in a configuration file in the `$PSHOME` folder.

In PowerShell 7.1, there are three modules that are in the deny list:

- `PSScheduledJob`: Windows PowerShell commands to manage the Windows Task Manager service. This module is installed in Windows Server by default.
- `BestPractices`: Windows Server commands to view, run, and view the results of best practice scans of core Windows Server services. This module is installed in Windows Server by default.
- `UpdateServices`: You use this module to manage the **Windows Server Update Services** (**WSUS**) You can install it along with WSUS, or as part of the RSAT tools. This module makes use of object methods to manage the WSUS service, and these methods are not available via the compatibility mechanism. This module also makes use of the **Simple Object Access Protocol** (**SOAP**), which is also not implemented in .NET Core. For this reason, enabling you to manage WSUS natively in PowerShell 7 requires a significant development effort. Microsoft has not committed to undertake this work at this time.

It might be tempting to edit the deny list and to remove modules from it. However, such actions have no practical value. You can import the `BestPractices` module explicitly into a PowerShell 7 session, but the cmdlets in the module fail with more cryptic and non-actionable error messages.

In this recipe, you look at PowerShell's module load deny list and discover how it works in practice.

Getting ready

You run this recipe on `SRV1`, a Windows Server Datacenter Edition server with PowerShell 7 and VS Code installed.

How to do it...

1. Getting the PowerShell configuration file

   ```
   $CFFile = "$PSHOME/powershell.config.json"
   Get-Item -Path $CFFile
   ```

2. Viewing contents

   ```
   Get-Content -Path $CFFile
   ```

3. Attempting to load a module on the deny list

   ```
   Import-Module -Name BestPractices
   ```

4. Loading the module, overriding edition check

   ```
   Import-Module -Name BestPractices -SkipEditionCheck
   ```

5. Viewing the module definition

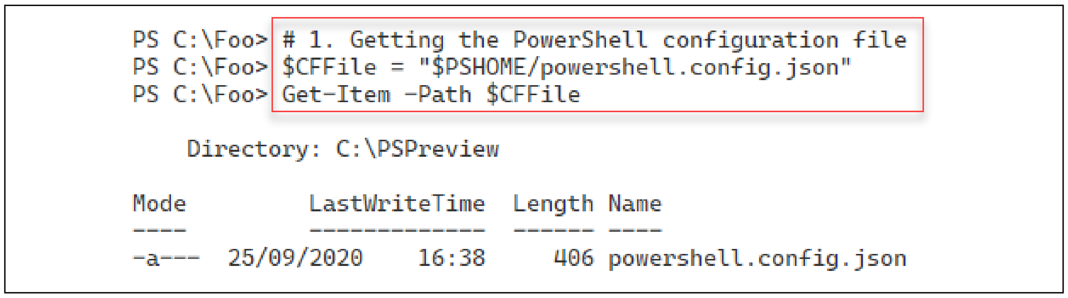
   ```
   Get-Module -Name BestPractices
   ```

6. Attempting to use `Get-BpaModel`

   ```
   Get-BpaModel
   ```

How it works...

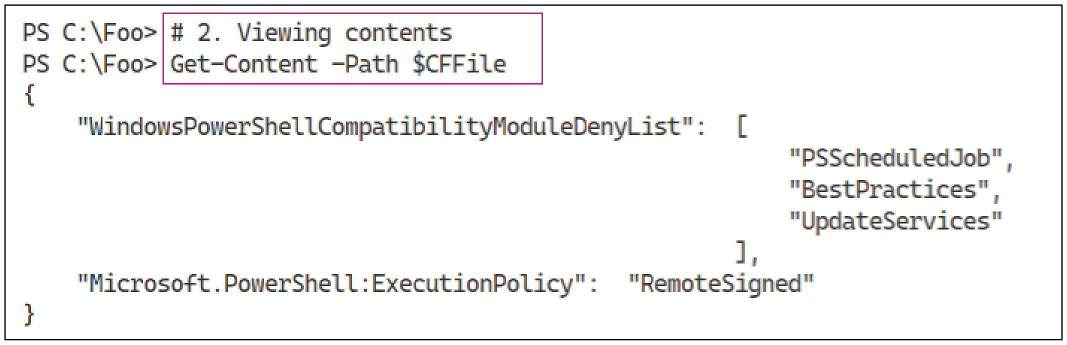
In *step 1*, you locate and view file details of PowerShell's configuration file, `powershell.config.json`. This file is in the PowerShell installation folder. You can see the output in the following screenshot:



```
PS C:\Foo> # 1. Getting the PowerShell configuration file
PS C:\Foo> $CFFile = "$PSHOME/powershell.config.json"
PS C:\Foo> Get-Item -Path $CFFile

    Directory: C:\PSPreview

Mode         LastWriteTime  Length Name
----         -------------  ------ ----
-a---   25/09/2020    16:38    406 powershell.config.json
```

Figure 3.21: Getting the PowerShell configuration file

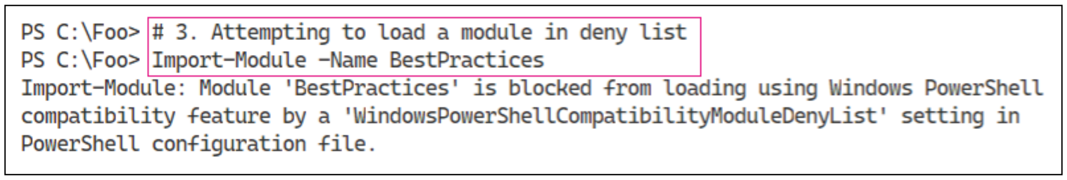
In *step 2*, you view the contents of this file, which looks like this:



```
PS C:\Foo> # 2. Viewing contents
PS C:\Foo> Get-Content -Path $CFFile
{
    "WindowsPowerShellCompatibilityModuleDenyList":  [
                                                         "PSScheduledJob",
                                                         "BestPractices",
                                                         "UpdateServices"
                                                     ],
    "Microsoft.PowerShell:ExecutionPolicy":  "RemoteSigned"
}
```

Figure 3.22: Viewing the contents of the configuration file

In *step 3*, you attempt to use `Import-Module` to import a module you can see (in the output from *step 2*) is on the module deny list. The output of this step looks like this:

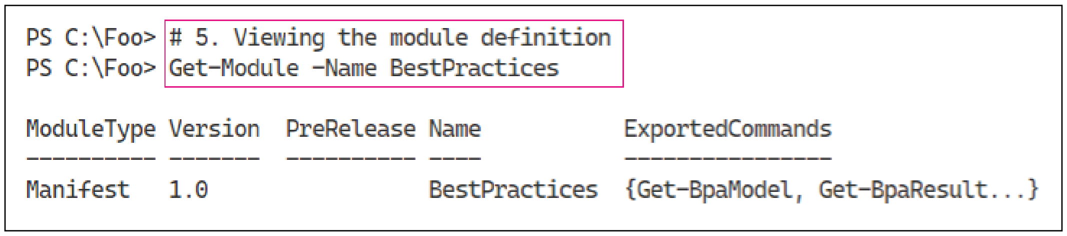


```
PS C:\Foo> # 3. Attempting to load a module in deny list
PS C:\Foo> Import-Module -Name BestPractices
Import-Module: Module 'BestPractices' is blocked from loading using Windows PowerShell
compatibility feature by a 'WindowsPowerShellCompatibilityModuleDenyList' setting in
PowerShell configuration file.
```

Figure 3.23: Attempting to load BestPractices, which is on the deny list

With PowerShell 7, you can force `Import-Module` to ignore the deny list and attempt to load the module in a PowerShell 7 session, as you can see in *step 4*. To do this, you specify the switch `-SkipEditionCheck`. This switch tells PowerShell to import the module without checking compatibility or attempting to load the module in the compatibility session.

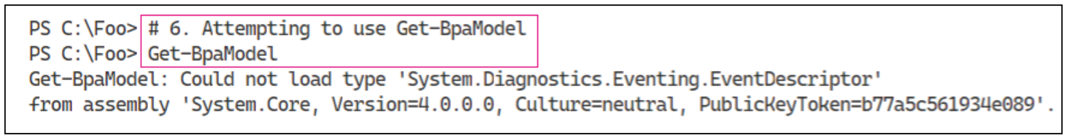
With *step 5*, the import appears to work in that `Import-Module` does import the module, as you can see in the output from this step:



```
PS C:\Foo> # 5. Viewing the module definition
PS C:\Foo> Get-Module -Name BestPractices

ModuleType Version   PreRelease Name          ExportedCommands
---------- -------   ---------- ----          ----------------
Manifest   1.0                  BestPractices {Get-BpaModel, Get-BpaResult...}
```

Figure 3.24: Viewing the BestPractices module definition

As you can see in *step 6*, running commands in modules on the deny list is likely to fail. In this case, the cmdlet `Get-BpaModel` makes use of a .NET type that does not exist in .NET Core, rendering the cmdlet unable to function:



```
PS C:\Foo> # 6. Attempting to use Get-BpaModel
PS C:\Foo> Get-BpaModel
Get-BpaModel: Could not load type 'System.Diagnostics.Eventing.EventDescriptor'
from assembly 'System.Core, Version=4.0.0.0, Culture=neutral, PublicKeyToken=b77a5c561934e089'.
```

Figure 3.25: Attempting to use Get-BpaModel

The compatibility mechanism means many older Windows PowerShell modules are going to be usable by your older scripts. However, some modules (just three, as it turns out) are not usable directly in PowerShell 7 or via the Windows PowerShell compatibility mechanism.

There's more...

In *step 2*, you view the configuration file. This file contains two sets of settings. The first creates the module deny list, and the other sets the starting execution policy. You can use the `Set-ExecutionPolicy` cmdlet to change the execution policy, in which case PowerShell writes an updated version of this file reflecting the updated execution policy. The module deny list in this configuration file contains the three module names whose contents are known not to work in PowerShell 7, as you saw in earlier recipes in this chapter.

As you can see in *steps 4* and *5*, you can import modules that are not compatible with .NET Core. The result is that, although you can import a non-compatible module, the commands in that module are not likely to work as expected. And when they fail, the error message is cryptic and not directly actionable.

In summary, the Windows PowerShell compatibility mechanism enables you to use a large number of additional commands in PowerShell 7. The mechanism is not perfect as it does impose a few limitations, but it is a functional approach in almost all cases. Furthermore, although you can, explicitly bypassing the compatibility mechanism is probably not very useful.

Importing format XML

PowerShell, ever since the very beginning, has displayed objects automatically and with nice-looking output. By default, PowerShell displays objects and properties for any object. It creates a table if the object to be displayed contains fewer than five properties, or it creates a list. PowerShell formats each property by calling the `.ToString()` method for each property.

You or the cmdlet developer can improve the output by using format XML. Format XML is custom-written XML that you store in a `format.ps1XML` file. The format XML file tells PowerShell precisely how to display a particular object type (as a table or a list), which properties to display, what headings to use (for tables), and how to display individual properties.

In Windows PowerShell, Microsoft included several format XML files that you can see in the Windows PowerShell home folder. You can view these by typing `ls $PSHOME/*.format.ps1xml`.

In PowerShell 7, the default format XML is inside the code implementing each cmdlet, instead of being a separate file as in Windows PowerShell. The result is that there are, by default, no `format.ps1XML` files in PowerShell 7's `$PSHOME` folder. As with Windows PowerShell, you can always write your own custom format XML files to customize how PowerShell displays objects by default.

The use of customized format XML is a great solution when you are displaying particular objects, typically from the command line, and the default display is not adequate for your purposes. You can implement format XML that tells PowerShell 7 to display objects as you want them displayed and import the format XML in your profile file.

An alternative to creating format XML is to pipe the objects to `Format-Table` or `Format-List`, specifying the properties that you wish to display. You can even use hash tables with `Format-Table` to define how properties are formatted. Depending on how often you display any given object, format XML can be useful to alter the information you see, especially at the console.

For more information about format XML, see `https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.core/about/about_format.ps1xml`.

Module developers often create format XML to help display objects generated by commands inside the module. The `ServerManager` module, for example, has format XML that enables the pretty output created with `Get-WindowsFeature`. This module is not directly supported by PowerShell 7. You can access the commands in the module thanks to the Windows PowerShell compatibility mechanism described earlier in this chapter. One restriction, by default, of the compatibility mechanism is that it does not import format XML (if it exists). The net result is that output can look different when you run scripts or issue console commands in PowerShell 7 versus Windows PowerShell.

The simple way around this is to import the format XML manually, as you see in this recipe.

Getting ready

You run this recipe on `SRV1`, a workgroup server running Windows Server Datacenter Edition and on which you have installed PowerShell 7 and VS Code.

How to do it...

1. Importing the `ServerManager` module

   ```
   Import-Module -Name ServerManager
   ```

2. Checking a Windows feature

   ```
   Get-WindowsFeature -Name Simple-TCPIP
   ```

3. Running this command in the compatibility session

   ```
   $S = Get-PSSession -Name 'WinPSCompatSession'
   Invoke-Command -Session $S -ScriptBlock {
       Get-WindowsFeature -Name Simple-TCPIP }
   ```

4. Running this command with formatting in the remote session

   ```
   Invoke-Command -Session $S -ScriptBlock {
                       Get-WindowsFeature -Name Simple-TCPIP |
                         Format-Table}
   ```

5. Getting path to Windows PowerShell modules

   ```
   $Paths = $env:PSModulePath -split ';'
   foreach ($Path in $Paths) {
     if ($Path -match 'system32') {$S32Path = $Path; break}
   }
   "System32 path: [$S32Path]"
   ```

6. Displaying path to the format XML for the `ServerManager` module

   ```
   $FXML = "$S32path/ServerManager"
   $FF = Get-ChildItem -Path $FXML\*.format.ps1xml
   "Format XML file: [$FF]"
   ```

7. Updating the format XML

   ```
   Foreach ($F in $FF) {
     Update-FormatData -PrependPath $F.FullName}
   ```

8. Viewing the Windows `Simple-TCPIP` feature

   ```
   Get-WindowsFeature -Name Simple-TCPIP
   ```

9. Adding `Simple-TCPIP` Services

```
Add-WindowsFeature -Name Simple-TCPIP
```

10. Examining the `Simple-TCPIP` feature

```
Get-WindowsFeature -Name Simple-TCPIP
```

11. Using the `Simple-TCPIP` Windows feature

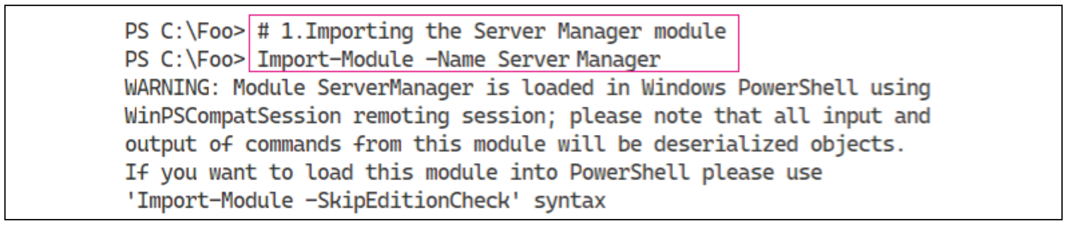
```
Install-WindowsFeature Telnet-Client |
  Out-Null
Start-Service -Name simptcp
```

12. Using the Quote of the Day service

```
Telnet SRV1 qotd
```

How it works...

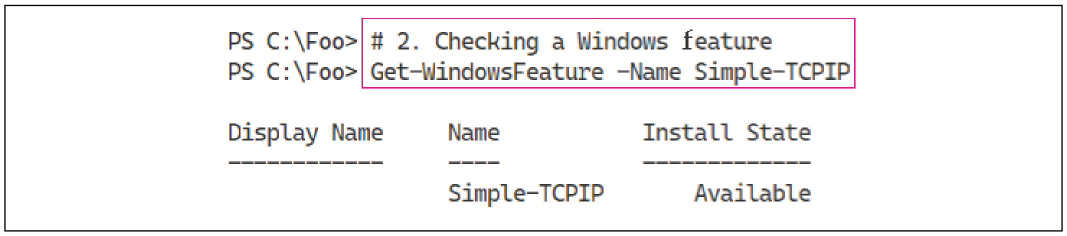
In *step 1*, inside a PowerShell 7.1 session, you import the `ServerManager` module, with output that looks like this:



```
PS C:\Foo> # 1.Importing the Server Manager module
PS C:\Foo> Import-Module -Name Server Manager
WARNING: Module ServerManager is loaded in Windows PowerShell using
WinPSCompatSession remoting session; please note that all input and
output of commands from this module will be deserialized objects.
If you want to load this module into PowerShell please use
'Import-Module -SkipEditionCheck' syntax
```

Figure 3.26: Importing the ServerManager module

Next, in *step 2*, you examine a Windows feature, the `Simple-TCPIP` services feature, using the `Get-WindowsFeature` command, which produces output that looks like this:

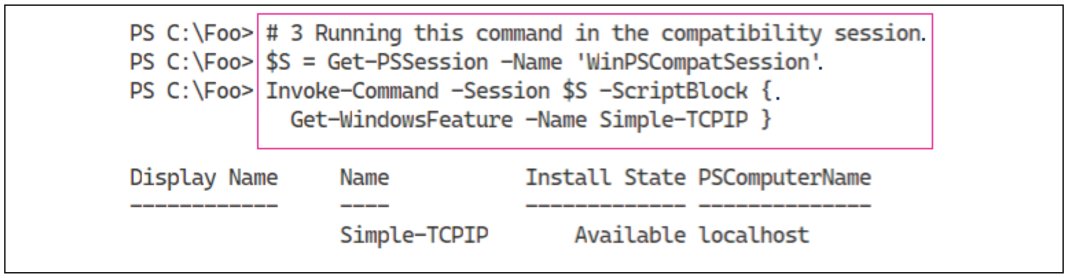


```
PS C:\Foo> # 2. Checking a Windows feature
PS C:\Foo> Get-WindowsFeature -Name Simple-TCPIP

Display Name     Name           Install State
------------     ----           -------------
                 Simple-TCPIP       Available
```

Figure 3.27: Examining the Simple-TCPIP feature

Note that, in the output, the **Display Name** column contains no information. PowerShell uses the format XML to populate the contents of this **Display Name** column. Since the compatibility mechanism does not import the format XML into the PowerShell session, you see a sub-optimal output.

In *step 3*, you use the Windows PowerShell compatibility remoting session to run the `Get-WindowsFeature` cmdlet in the remoting session. The output of this step looks like this:

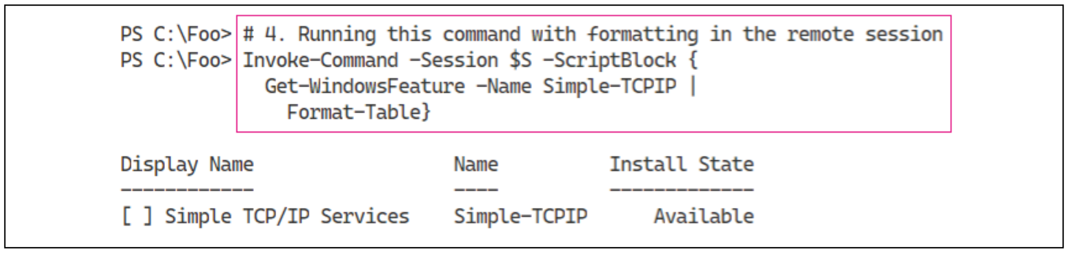


```
PS C:\Foo> # 3 Running this command in the compatibility session.
PS C:\Foo> $S = Get-PSSession -Name 'WinPSCompatSession'.
PS C:\Foo> Invoke-Command -Session $S -ScriptBlock {.
             Get-WindowsFeature -Name Simple-TCPIP }

Display Name     Name          Install State PSComputerName
------------     ----          ------------- --------------
                 Simple-TCPIP      Available localhost
```

Figure 3.28: Running Get-WindowsFeature in the compatibility session

In both *steps 2* and *3*, the `Get-WindowsFeature` cmdlet produces an object that the PowerShell 7 session formats without the benefit of format XML.

In *step 4*, you run the `Get-WindowsFeature` command to retrieve the feature details then perform formatting in the remote session, with output like this:

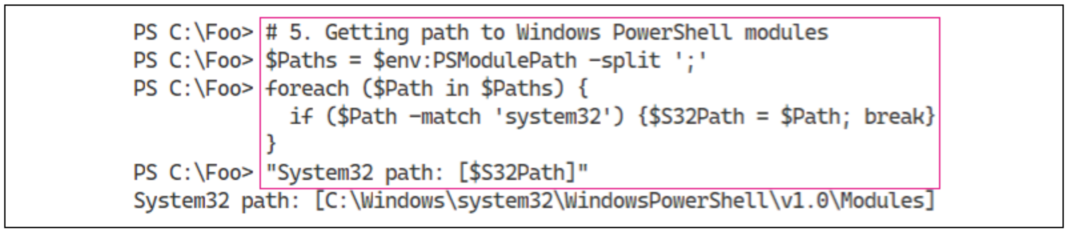


```
PS C:\Foo> # 4. Running this command with formatting in the remote session
PS C:\Foo> Invoke-Command -Session $S -ScriptBlock {
             Get-WindowsFeature -Name Simple-TCPIP |
               Format-Table}

Display Name                Name          Install State
------------                ----          -------------
[ ] Simple TCP/IP Services  Simple-TCPIP      Available
```

Figure 3.29: Running Get-WindowsFeature in the remote session

You see the nicely formatted **Display Name** filled, since Windows PowerShell performs the formatting of the output from the `Get-WindowsFeature` cmdlet fully within the compatibility session, where the format XML exists.

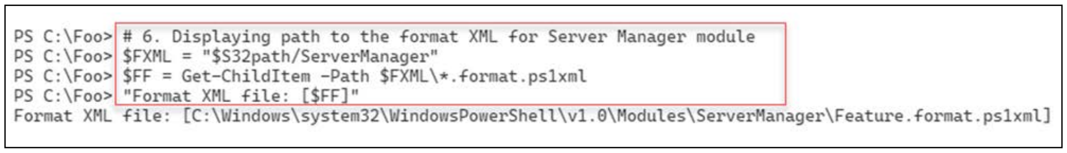
In *step 5*, you parse the `PSModulePath` Windows environment variable to discover the default path to the Windows PowerShell modules. This path holds the modules added by core Windows services and includes the `ServerManager` module. The output of these commands looks like this:



```
PS C:\Foo> # 5. Getting path to Windows PowerShell modules
PS C:\Foo> $Paths = $env:PSModulePath -split ';'
PS C:\Foo> foreach ($Path in $Paths) {
             if ($Path -match 'system32') {$S32Path = $Path; break}
           }
PS C:\Foo> "System32 path: [$S32Path]"
System32 path: [C:\Windows\system32\WindowsPowerShell\v1.0\Modules]
```

Figure 3.30: Getting the path to Windows PowerShell modules

In *step 6*, you discover the filename for the format XML for the `ServerManager` module, which produces output like this:



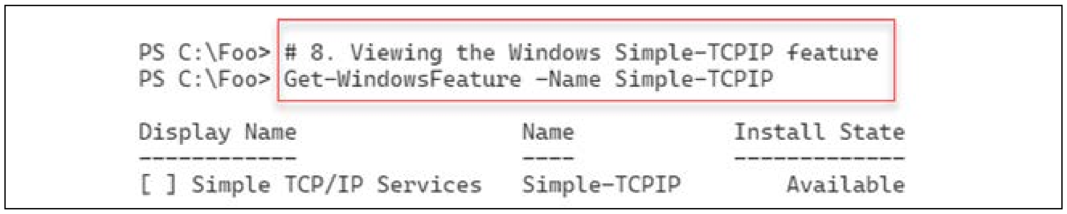
```
PS C:\Foo> # 6. Displaying path to the format XML for Server Manager module
PS C:\Foo> $FXML = "$S32path/ServerManager"
PS C:\Foo> $FF = Get-ChildItem -Path $FXML\*.format.ps1xml
PS C:\Foo> "Format XML file: [$FF]"
Format XML file: [C:\Windows\system32\WindowsPowerShell\v1.0\Modules\ServerManager\Feature.format.ps1xml]
```

Figure 3.31: Retrieving the path to the format XML for ServerManager

Most, but not all, Windows modules have a single format XML file.

In *step 7*, which produces no output, you update the format data for the current Windows PowerShell session. If a module has multiple format XML files, this approach ensures they are all imported.

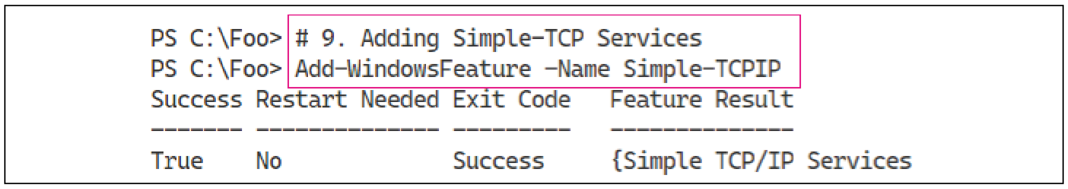
In *step 8*, you view a Windows feature, the Simple TCP/IP service, which has the feature name `Simple-TCPIP`. The output from this command looks like this:



```
PS C:\Foo> # 8. Viewing the Windows Simple-TCPIP feature
PS C:\Foo> Get-WindowsFeature -Name Simple-TCPIP

Display Name                Name             Install State
------------                ----             -------------
[ ] Simple TCP/IP Services  Simple-TCPIP         Available
```

Figure 3.32: Viewing Simple-TCPIP

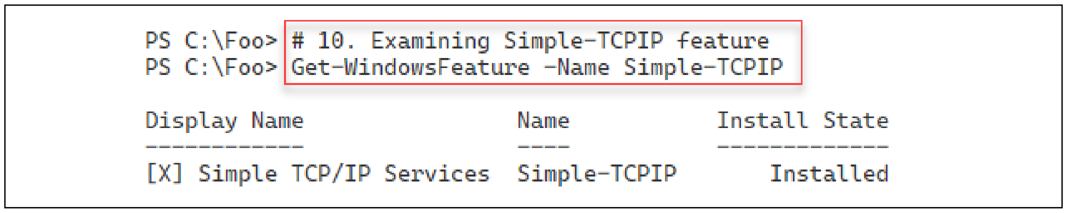
In *step 9*, you add the `Simple-TCPIP` Windows feature to `SRV1`, which produces output like this:



```
PS C:\Foo> # 9. Adding Simple-TCP Services
PS C:\Foo> Add-WindowsFeature -Name Simple-TCPIP
Success Restart Needed Exit Code   Feature Result
------- -------------- ---------   --------------
True    No             Success     {Simple TCP/IP Services
```

Figure 3.33: Adding Simple-TCPIP to SRV1

In the next step, *step 10*, you view the `Simple-TCPIP` Windows feature, which now looks like this:



```
PS C:\Foo> # 10. Examining Simple-TCPIP feature
PS C:\Foo> Get-WindowsFeature -Name Simple-TCPIP

Display Name                 Name          Install State
------------                 ----          -------------
[X] Simple TCP/IP Services   Simple-TCPIP      Installed
```

Figure 3.34: Viewing Simple-TCPIP

To test the `Simple-TCPIP` feature, you must install the Telnet client. Then you start the service. You perform both actions in *step 11*, which produces no output.

In *step 12*, you use the **Quote Of The Day** (**QOTD**) protocol. You can use QOTD for debugging connectivity issues, as well as measuring network performance. RFC 8965 defines the QOTD protocol; you can view the protocol definition at `https://tools.ietf.org/html/rfc865` and read more about using QOTD at `https://searchcio.techtarget.com/tip/Quote-of-the-Day-A-troubleshooting-networking-protocol`.

There's more...

In *step 1*, you import the `ServerManager` module. This ensures that the Windows compatibility remoting session is set up. If you have just run some of the earlier recipes in this chapter in the same PowerShell session, this step is redundant as the compatibility remoting session has already been set up and the `ServerManager` module is already loaded.

In *step 2*, you see that the output from `Get-WindowsFeature` does not populate the **Display Name** column. Likewise, in *step 3*. In both of these steps, PowerShell performs basic default formatting. In *step 4*, you get the details of the Windows feature and perform the formatting all in the remote session. As you can see, in the remote session, formatting makes use of format XML to produce superior output. In this case, the format XML populated the **Display Name** field and added an indication of whether the feature is installed (or not).

In *steps 5* and *6*, you discover the Windows PowerShell default modules folder and find the name of the format XML for this module. Having discovered the filename for the format XML, in *step 7*, you import this format information. With the format XML imported, in *step 8*, you run the `Get-WindowsFeature` cmdlet to view a Windows feature. Since you have imported the format XML, the result is the output that is the same as you saw in *step 4*.

This recipe uses the `Simple-TCPIP` feature to demonstrate how you can use a command in PowerShell 7.1 and get the same output you are used to from using Windows PowerShell. The simple TCIP/IP services provided by this function are very old-school protocols, such as QOTD. In production, these services are of potentially no value, and not adding them is a best practice.

Leveraging compatibility

In this chapter so far, you have looked at the issue of compatibility between Windows PowerShell and PowerShell 7. You have examined the new features in PowerShell 7 and looked at the Windows PowerShell compatibility mechanism.

The compatibility mechanism allows you to use incompatible Windows PowerShell cmdlets inside a PowerShell session. Incompatible Windows PowerShell cmdlets/modules rely on features that, while present in the full .NET CLR, are not available in .NET Core 5.0 (and are unlikely ever to be added to .NET Core). For example, the `Get-WindowsFeature` cmdlet uses a .NET type `System.Diagnostics.Eventing.EventDescriptor`, as you saw earlier. Although the cmdlet cannot run natively in PowerShell 7, the compatibility mechanism allows you to make use of the cmdlet's functionality.

When `Import-Module` begins loading an incompatible module, it checks to see if a remoting session with the name `WinPSCompatSession` exists. If that remoting session exists, PowerShell makes use of it. If the session does not exist, `Import-Module` creates a new remoting session with that name. PowerShell 7 then imports the module in the remote session and creates proxy functions in the PowerShell 7 session.

Once `Import-Module` has created the remoting session, PowerShell uses that single session for all future use, so loading multiple modules utilizes a single remoting session.

Getting ready

You run this recipe on `SRV1`, on which you have installed PowerShell 7 and VS Code. `SRV1` is a workgroup server running Windows Server Datacenter Edition.

How to do it...

1. Creating a session using the reserved name

   ```
   $S1 = New-PSSession -Name WinPSCompatSession -ComputerName SRV1
   ```

2. Getting loaded modules in the remote session

   ```
   Invoke-Command -Session $S1 -ScriptBlock {Get-Module}
   ```

3. Loading the `ServerManager` module in the remote session

   ```
   Import-Module -Name ServerManager -WarningAction SilentlyContinue |
     Out-Null
   ```

4. Getting loaded modules in the remote session

   ```
   Invoke-Command -Session $S1 -ScriptBlock {Get-Module}
   ```

5. Using `Get-WindowsFeature`

   ```
   Get-WindowsFeature -Name PowerShell
   ```

6. Closing remoting sessions and removing module from current PS7 session

   ```
   Get-PSSession | Remove-PSSession
   Get-Module -Name ServerManager | Remove-Module
   ```

7. Creating a default compatibility remoting session

   ```
   Import-Module -Name ServerManager -WarningAction SilentlyContinue
   ```

8. Getting the new remoting session

   ```
   $S2 = Get-PSSession -Name 'WinPSCompatSession'
   $S2
   ```

9. Examining modules in `WinPSCompatSession`

   ```
   Invoke-Command -Session $S2 -ScriptBlock {Get-Module}
   ```

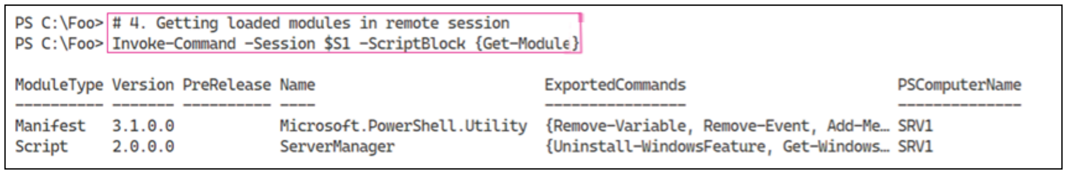
How it works...

In *step 1*, you create a new remoting session using the session name `WinPSCompatSession`. This step produces no output, but it does create a remoting session to a Windows PowerShell endpoint. PowerShell 7 holds the name of the endpoint that `New-PSSession` uses, unless you use the parameter `-ConfigurationName` to specify an alternate configuration name when you create the new remoting session.

In *step 2*, you run the `Get-Module` cmdlet to return the modules currently loaded in the remoting session you established in *step 1*. PowerShell generates no output for this step, indicating that there are no modules so far imported into the remoting session.

With *step 3*, you import the `ServerManager` module. Since this module is not compatible with PowerShell 7, PowerShell uses the Window PowerShell compatibility session you created earlier. `Import-Module` only checks to see if there is an existing remoting session with the name `WinPSCompatSession`. This step generates no output.

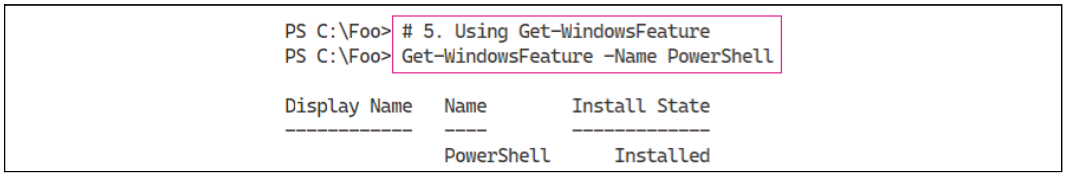
In *step 4*, you recheck the modules loaded into the remote session. As you can see in the output, this command discovers two modules loaded in the remoting session, one of which is the Windows PowerShell `ServerManager` module. The output from this step looks like this:



```
PS C:\Foo> # 4. Getting loaded modules in remote session
PS C:\Foo> Invoke-Command -Session $S1 -ScriptBlock {Get-Module}

ModuleType Version PreRelease Name                          ExportedCommands                          PSComputerName
---------- ------- ---------- ----                          ----------------                          --------------
Manifest   3.1.0.0            Microsoft.PowerShell.Utility  {Remove-Variable, Remove-Event, Add-Me… SRV1
Script     2.0.0.0            ServerManager                 {Uninstall-WindowsFeature, Get-Windows… SRV1
```

Figure 3.35: Getting loaded modules in the remote session

In *step 5*, you invoke `Get-WindowsFeature` to discover the PowerShell feature. As you can see in the output, this feature is both available and installed in `SRV1`:

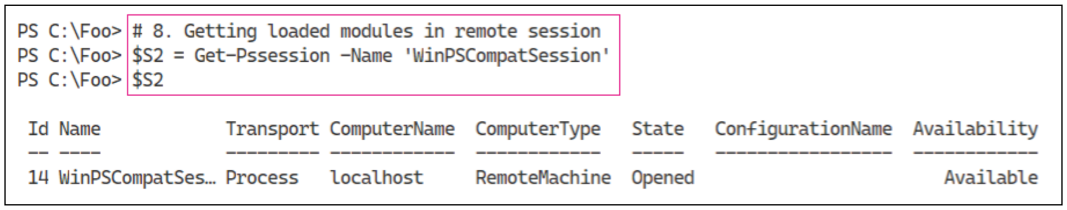


```
PS C:\Foo> # 5. Using Get-WindowsFeature
PS C:\Foo> Get-WindowsFeature -Name PowerShell

Display Name    Name        Install State
------------    ----        -------------
                PowerShell      Installed
```

Figure 3.36: Invoking Get-WindowsFeature

In *step 6*, you close the remoting session that you created earlier in this recipe and remove all loaded modules. This step generates no output. In *step 7*, you import the (non-PowerShell 7-compatible) `ServerManager` module. As you have seen previously, this command creates a compatibility session, although there is no output from this step.

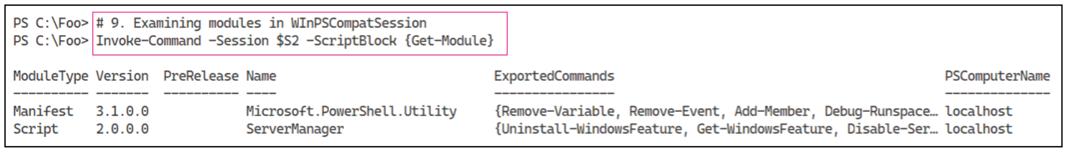
In *step 8*, you get and then display the remoting session, which produces output like this:



```
PS C:\Foo> # 8. Getting loaded modules in remote session
PS C:\Foo> $S2 = Get-Pssession -Name 'WinPSCompatSession'
PS C:\Foo> $S2

 Id Name            Transport ComputerName ComputerType  State  ConfigurationName Availability
 -- ----            --------- ------------ ------------  -----  ----------------- ------------
 14 WinPSCompatSes… Process   localhost    RemoteMachine Opened                      Available
```

Figure 3.37: Getting loaded modules in the remote session

In *step 9*, you check to see the modules loaded in the Windows compatibility session (which you create in *step 7* by importing a module). The output from this step looks like this:



```
PS C:\Foo> # 9. Examining modules in WInPSCompatSession
PS C:\Foo> Invoke-Command -Session $S2 -ScriptBlock {Get-Module}

ModuleType Version  PreRelease Name                             ExportedCommands                                         PSComputerName
---------- -------  ---------- ----                             ----------------                                         --------------
Manifest   3.1.0.0             Microsoft.PowerShell.Utility     {Remove-Variable, Remove-Event, Add-Member, Debug-Runspace… localhost
Script     2.0.0.0             ServerManager                    {Uninstall-WindowsFeature, Get-WindowsFeature, Disable-Ser… localhost
```

Figure 3.38: Checking modules loaded in the Windows compatibility session

There's more...

In this recipe, you create two PowerShell remoting sessions. In *step 1*, you create it explicitly by using `New-PSSession`. Later, in *step 7*, you call `Import-Module` to import an incompatible module. `Import-Module` then creates a remoting session, since one does not exist.

As you can see in this recipe, so long as there is a remoting session with the name `WinPSCompatSession` in PowerShell 7, `Import-Module` uses that to attempt to load, in this case, the `ServerManager` module.

One potential use for the approach shown in this recipe might be when you wish to create a constrained endpoint for use with delegated administration that relies on older Windows PowerShell cmdlets. You could create the endpoint configuration details and then, in the scripts, create a remoting session using the customized endpoint and name the session `WinPSCompatSession`.