Microsoft

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10325A

Lab Instructions and Lab Answer Key: Automating Administration with Windows PowerShell® 2.0

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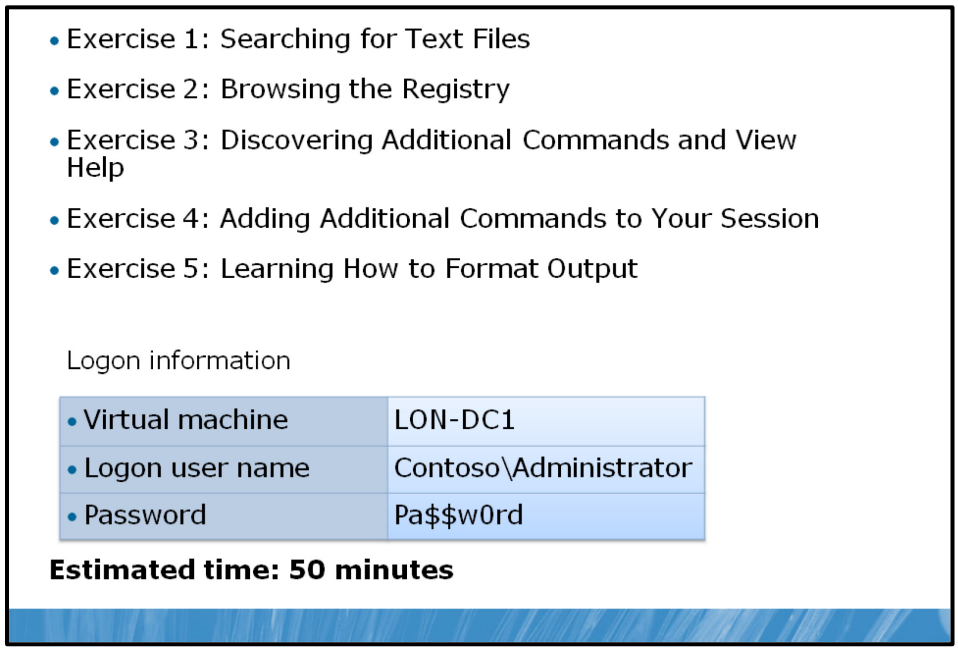
Module 1

Lab Instructions: Fundamentals for Using Microsoft® Windows PowerShell® v2

Contents:

Lab A: Using Windows PowerShell As an Interactive Command-Line Shell



Estimated time: 50 minutes

You work as a systems administrator. You have installed Windows Server 2008 R2 and need to learn how to automate some tasks. You heard that PowerShell was great for this sort of thing and need to start learning how to use it. You have used command-line utilities in the past and want to get started working with PowerShell as quickly as possible. You're also looking for tips on how you can discover things in PowerShell on your own.

Lab Setup

For this lab, you will be browsing the file system and Registry and learning how to use PowerShell on a domain controller using a domain administrator credential. Before you begin the lab you must:

1. Start the **LON-DC1** virtual machine, and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
2. Open a Windows PowerShell session as **Administrator**.
3. Open Windows PowerShell and execute the following command:

   "These are my notes" | Out-File C:\users\Administrator\Documents\notes.txt

Exercise 1: Searching for Text Files

Scenario

You are working with another administrator on a Windows Server 2008 R2 domain controller. The other administrator had been documenting his work in a text file in a user profile, but you're not sure which profile has the file. You are taking a colleague's advice and starting to use PowerShell to perform tasks you would previously have done with cmd.exe to find the file.

The main tasks for this exercise are as follows:

1. Browse the local file system using familiar command prompt and/or UNIX commands.
2. View the entire contents of one user's profile folder.
3. View a list of all text files in all users' document folders.

▶ Task 1: Browse the local file system using familiar command prompt and/or UNIX commands

- Open **Windows PowerShell** and set the current location to **C:**.
- Show the contents of the **C:\users** folder from your current location.

> **Hint:** What command would you use to see a *directory* listing? Read the help for that command and see if it has a parameter that lets you specify the *path* of the folder that you want to see a directory listing for.

- Show the contents of the **C:\users** folder from within that folder.

> **Hint:** What command would you use to *change directories?* Use that command to change to the C:\Users folder.

- Create a folder called **Test** at the root of the **C** drive.

> **Hint:** What command would you use to *make* a *directory*? Use that command to create the new folder.

- Remove the **C:\Test** folder.

▶ Task 2: View the entire contents of a folder

- Get the entire list of all files in all folders and subfolders of the user profile folder for the **Administrator** account.

> **Hint:** What command would you use to see a *directory* listing? Does that command have a parameter that would enable to you specify the *path* of the directory you want to see a listing for? Is there a parameter that would *recurse* subdirectories?

- Repeat the last activity using the shortest parameter names possible.

Hint: You only need to type enough of a parameter name so that Windows PowerShell can uniquely identify the parameter you are referring to. "-comp" is often easier to type than "-computername," for example.

▶ Task 3: View a list of all text files in all users' document folders

- Get the list of all text files in all subfolders of all user profile folders.

Hint: You know the command that will list files and folders. Does that command support a parameter that would enable you to *include* only certain types of files, such as *.txt?

- Open the notes.txt file in the **Administrator** account's documents folder in Notepad.

Results: After this exercise, you should have successfully navigated the file system, discovered the notes.txt file in the Administrator's user profile folder, and viewed the contents of that file in notepad.

Exercise 2: Browsing the Registry

Scenario

You are working on a shared computer and want to identify differences in startup programs between different accounts. You must show the different startup programs for the current user profile and built-in accounts on screen, but you don't have to actually do the comparison.

The main tasks for this exercise are as follows:

1. View cmdlet help.
2. Navigate the Registry.
3. Create a new PSDrive.

▶ Task 1: View cmdlet help

- View basic help information for the **Get-PSDrive** cmdlet using Get-Help.
- View full help information for the **Get-PSDrive** cmdlet using Get-Help with the **-Full** parameter.

▶ Task 2: Navigate the registry

- Show a list of all available PSDrives using the **Get-PSDrive** cmdlet.
- Change the current location to **HKLM:\Software\Microsoft**.
- Show a list of all available PSDrives for the **Registry** provider.
- Change the current location to the **HKEY_CURRENT_USER** registry hive and list the contents at the root of that drive.

▶ Task 3: Create a new PSDrive

- Create a new PSDrive using the **New-PSDrive** cmdlet. This drive should be named **"HKU"** and it should have the **HKEY_USERS Registry** hive as the root.

> **Hint:** Read the help to discover the three pieces of information that the New-PSDrive cmdlet needs in order to create a new drive. The PSProvider for the Registry is called "Registry."

- View a list of all Registry PSDrives including the HKU drive you just added using the **Get-PSDrive** cmdlet.

Exercise 3: Discovering Additional Commands and Viewing Help

Scenario

To properly use PowerShell, you need to know how to identify commands, discover new commands, and get help information to learn how to use commands.

The main tasks for this exercise are as follows:

1. Discover commands using aliases and aliases using commands.
2. Learn how to use the help system using Get-Help.
3. Discover new commands with Get-Command.
4. Get current, online help for a command.

▶ Task 1: Discover commands using aliases and aliases using commands

- Find the command associated with the alias "dir" using **Get-Alias**.
- Find other aliases for the same command using **Get-Alias** with the **Definition** parameter.

▶ Task 2: Learn how to use the help system using Get-Help

- View basic help information for the **Get-Help** cmdlet using that cmdlet itself.
- View the examples for **Get-Help** using the help proxy command.
- Show the full help for **Get-Help** using the help proxy command.

▶ Task 3: Discover new commands with Get-Command

- Find all commands with **"Service"** in their name using **Get-Command** and wildcards.
- View basic help information for **Get-Command** using the help command.
- Find all commands of type cmdlet with **"Service"** in their name using **Get-Command**, wildcards and the **CommandType** parameter.
- Find all commands with the **"Service"** noun using **Get-Command** with the **Noun** parameter.

▶ Task 4: Get current, online help for a command

- Get the current, online help for the **Get-Service** cmdlet using the **Get-Help** cmdlet.

Results: After this exercise, you should know how to discover commands using aliases or wildcards, how to look up different parts of help information for a command, how to use help information to learn how to use a command, and how to get current help online.

Exercise 4: Adding Additional Commands to Your Session

Scenario

When working with some Windows components and server products, you must load modules or snap-ins to be able to access the commands they provide.

The main tasks for this exercise are as follows:

1. Find all "Module" commands.
2. List all modules that are available.
3. Load the ServerManager module into the current session.
4. View all commands included in the ServerManager module.

▶ Task 1: Find all "Module" commands

- Show all **"Module"** commands using **Get-Command** so you know what is used to manage modules.

▶ Task 2: List all modules that are available

- List all modules that are available on the current system using **Get-Module**.

Hint: You can also get a directory listing of the $pshome/modules folder.

▶ Task 3: Load the ServerManager module into the current session

- View basic help documentation and examples for **Import-Module** so that you know what modules are and how to load them.
- Load the **ServerManager** module into the current session.

▶ Task 4: View all commands included in the ServerManager module

- Show a list of all commands that are part of the **ServerManager** module using **Get-Command**.
- Get a list of the Windows roles and features that are installed or available on the current system using **Get-WindowsFeature**.

Results: After this exercise, you should be able to view and load modules into PowerShell and show what commands they contain.

Exercise 5: Learning How to Format Output

Scenario

When viewing data in PowerShell, you can format the output to get the results you need.

The main tasks for this exercise are as follows:

1. View the default table format for a command.
2. View the default list and wide formats for a command.

▶ Task 1: View the default table format for a command

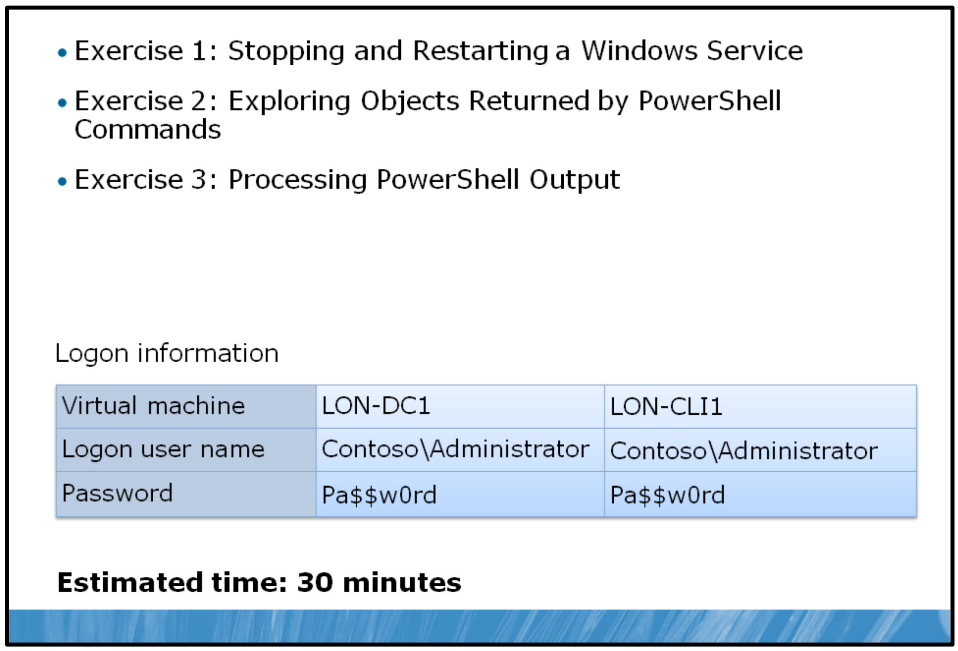
- View a list of all processes whose names start with **"w"** using the **Get-Process** command.
- Show the default table view for process objects using the same command but passing the results to **Format-Table**.

▶ Task 2: View the default list and wide formats for a command

- Using the same **Get-Process** command, show the default list view for process objects by passing the results to **Format-List**.
- Using the same **Get-Process** command, show the default wide view for process objects by passing the results to **Format-Wide**.

Results: After this exercise, you should be able to show PowerShell output in table, list and wide formats using default views.

Lab B: Using the Windows PowerShell Pipeline



Estimated time: 30 minutes

You are the server administrator in an enterprise. You have a computer on which you want to make administrative changes, such as working with Services. Working with those services using the GUI adds administrative overhead, so you wish to use Windows PowerShell to accomplish the necessary tasks. To better understand how Windows PowerShell interacts with those services, you also need to explore the members, properties, and output options for the necessary commands.

Lab Setup

For this lab, you will be browsing the stopping and restarting services and viewing event log entries on a domain controller using a domain administrator credential. Before you begin the lab, you must:

1. Start the **LON-DC1** virtual machine. You do not need to log on, but wait until the boot process is complete.
2. Start the **LON-CLI1** virtual machine, and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
3. Open a Windows PowerShell session as **Administrator**.

Exercise 1: Stopping and Restarting a Windows Service

Scenario

You have used PowerShell to view processes and services on various computers and now you want to perform some tasks to change the configuration on a computer.

The main tasks for this exercise are as follows:

1. View the Windows Update service details.
2. Determine what would happen if you stopped the Windows Update service.
3. Stop the Windows Update service with confirmation.
4. Restart the Windows Update service.

▶ Task 1: View the Windows Update service

- Open Windows PowerShell.
- Use the **Get-Service** cmdlet to view the Windows Update service.

Hint: Do not run Get-Service by itself. Rather, include a parameter so that only the Windows Update service is returned.

▶ Task 2: Determine what would happen if you stopped the service

- Use a pipeline to pass the results of your last **Get-Service** call to the **Stop-Service** cmdlet with the **WhatIf** parameter to see what would happen.

▶ Task 3: Stop the Windows Update service with confirmation

- Use a pipeline to pass the results of your last **Get-Service** call to the **Stop-Service** cmdlet with the **Confirm** parameter. When you are prompted press **Y** to stop the service.

▶ Task 4: Restart the Windows Update service

- Use a pipeline to pass the results of your last **Get-Service** call to the **Start-Service** cmdlet to restart the service.

Results: After this exercise, you should have successfully stopped and restarted the Windows Update service and learned about how the WhatIf and Confirm common parameters can prevent accidental changes.

Exercise 2: Exploring Objects Returned by PowerShell Commands

Scenario

You are using PowerShell to manage files and services and you know that everything returned by the commands you use are objects. You want to learn more about the properties and methods on those objects so that you can use them directly in your work to generate the reports you need.

The main tasks for this exercise are as follows:

1. View cmdlet help.
2. Get visible members for Service objects.
3. Get properties for Service objects.
4. Get all members for Service objects.
5. Get base and adapted or extended members for Service objects.
6. Find properties by wildcard search and show them in a table.

▶ Task 1: View cmdlet help

- View full help information for the **Get-Member** cmdlet.

▶ Task 2: Get visible members for Service objects

- Use **Get-Member** in a pipeline to show all visible members for **Service** objects.

▶ Task 3: Get properties for Service objects

- Use **Get-Member** in a pipeline to show all properties that are available for **Service** objects.

▶ Task 4: Get all members for Service objects

- Use **Get-Member** in a pipeline to show all members that are available for **Service** objects.

▶ Task 5: Get base and extended or adapted members for Service objects

- Use **Get-Member** in a pipeline to show a view containing all of the original (without extension or adaptation) members that are available in **Service** objects.
- Use **Get-Member** in a pipeline to show a view containing all of the extended and adapted members that are available in **Service** objects.

▶ Task 6: Find properties by wildcard search and show them in a table

- Get a list of all files and folders (hidden and visible) at the root of the C: drive.
- Show all properties on files and folders that contain the string **"Time"**.
- Generate a table showing all files and folders at the root of the **C:** drive with their name, creation time, last access time and last write time.

Hint: The Get-Member cmdlet supports several parameters that let you customize the information it provides.

Results: After this exercise, you should be able to use Get-Member to discover properties and methods on data returned from PowerShell cmdlets and use that information to format tables with specific columns.

Exercise 3: Processing PowerShell Output

Scenario

You have used PowerShell to generate output in the PowerShell console, and now you would like to save the output to a file or work with the output in a Windows dialog so that you can sort and filter the output to get the results you need.

The main tasks for this exercise are as follows:

1. List all commands that are designed to process output.
2. Show the default output for a command.
3. Send command output to a file.
4. Send command output to a grid and sort and filter the results.

▶ Task 1: List all commands that are designed to process output

- Show all commands with the verb **"Out"** in their name.

Hint: The Get-Command cmdlet supports parameters that let you customize its behavior. For example, one parameter enables you to only retrieve the cmdlets that have a particular verb.

▶ Task 2: Show the default output for a command

- Review the help information for the **Get-EventLog** cmdlet including the parameters and the examples so that you understand how it works.
- Show the 100 most recent events from the **System** event log of type warning or error in the default output.

Note: The Get-EventLog cmdlet includes several parameters that can help filter the type of information that the cmdlet returns.

▶ Task 3: Send command output to a file

- Pipe the results of the same command you used to get the 100 most recent events from the **System** event log of type warning or error to a file using the appropriate **"Out"** command.

▶ Task 4: Send command output to a grid and sort and filter the results

- Pipe the results of the same command you just used to get event log data to the **"Out"** command that displays a grid view.
- Sort the results in the grid by **InstanceId** in descending order.
- Filter the results in the grid to show only one **InstanceId**.

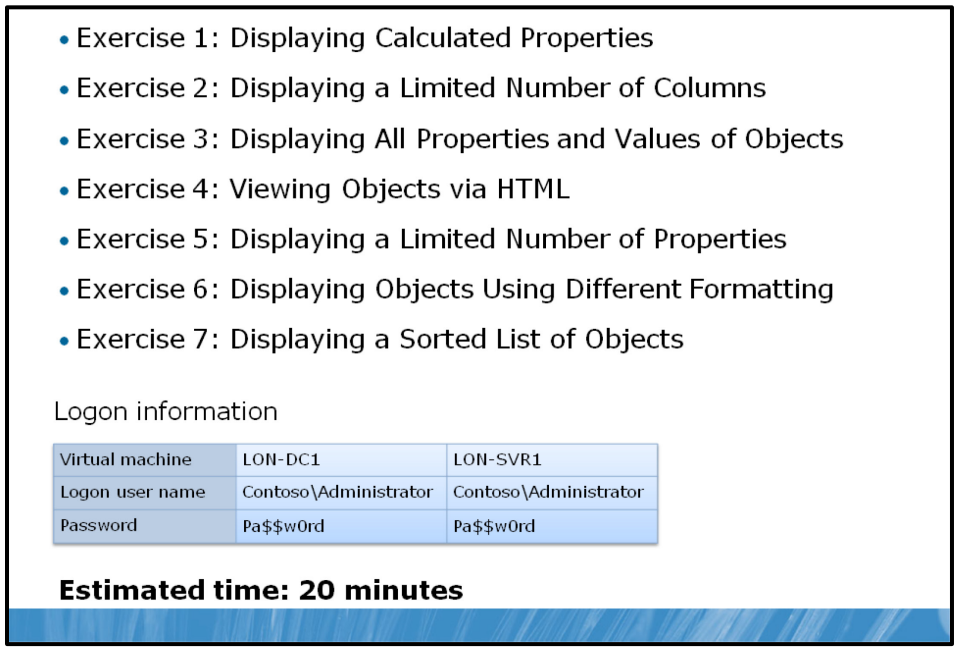
Results: After this exercise, you should know how to use PowerShell commands to redirect output to files or a grid view, and how to sort and filter data in the grid view.

Module 2

Lab Instructions: Understanding and Using the Formatting System

Contents:

Lab: Using the Formatting Subsystem



Estimated time: 20 minutes

You are a system administrator for a company and work with a team of developers. Recently, some users have complained about an in-house developed application. The developers have asked you to monitor the processes associated with the troubled application and let them have easy access to the data. You have decided to provide them with that information via an HTML-based page so they can easily view the information in a Web browser. You also want to customize your view of this information as you view it in the PowerShell console.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1. Start the **LON-DC1** virtual machine. You don't need to log on but wait until the boot process is complete.
2. Start the **LON-SVR1** virtual machine, and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
3. Open a Windows PowerShell session as **Administrator**.

Exercise 1: Displaying Calculated Properties

Scenario

You need to check the status of processes on your server, and you want to display their status and also show custom properties in a table format.The main tasks for this exercise are as follows:

1. Retrieve a list of processes.
2. Display a table of objects.
3. Select the properties to display.
4. Use calculated properties to show a custom property.

▶ Task 1: Retrieve a list of processes

- Open Windows PowerShell and retrieve a list of running processes.

▶ Task 2: Display a table of objects

- Show the list of running processes formatted as a table.

▶ Task 3: Select the properties to display

- Show the list of running processes formatted as a table showing only the **CPU**, **Id**, and **ProcessName** values.

▶ Task 4: Use calculated properties to show a custom property

- Show the list of running processes formatted as a table showing the **CPU**, **Id**, **ProcessName** values, and a custom property named **TotalMemory**, which is the sum of the physical and virtual memory used for each process.

Hint: Just add the values together—don't be concerned if one is displayed in KB and the other in MB.

Results: After this exercise, you will have displayed the CPU, ID and ProcessName values of all the running processes. You also will have created a custom property adding the physical and virtual memory using calculated properties.

Exercise 2: Displaying a Limited Number of Columns

Scenario

You need to display a list of services on your systems. You need to filter out some of the columns that you don't need when reviewing the status of the services.The main tasks for this exercise are as follows:

1. Retrieve a list of services.
2. Display a specific number of columns from a collection of objects.

▶ Task 1: Retrieve a list of services

- Retrieve a list of services.

▶ Task 2: Display a specific number of columns from a collection of objects

- Retrieve a list of services and display only the **Status** and **Name** properties.

Results: After this exercise, you will have displayed a specific number of columns from all the installed services instead of displaying all their default properties.

Exercise 3: Displaying All Properties and Values of Objects

Scenario

You often retrieve a list of processes from your systems and need to display all the properties and values of the services and not just the default values normally display.The main tasks for this exercise are as follows:

1. Retrieve a list of processes.
2. Display every property and value for all the objects.

▶ Task 1: Retrieve a list of processes

- Retrieve a list of processes.

▶ Task 2: Display every property and value for all the objects

- Retrieve a list of processes and display all their properties and values.

Results: After this exercise, you will have displayed all of the properties of all of the running processes instead of displaying only their default properties.

Exercise 4: Viewing Objects via HTML

Scenario

You have been asked by the development team to post a log of entries from one server's application event log. You have decided to automate the gathering of the information and are posting it on an internal Web site for the developers to review.The main tasks for this exercise are as follows:

1. Retrieve a list of event log entries.
2. Convert a list of event log entries to HTML.
3. Use a custom title for an HTML page.
4. View an HTML page in the default Web browser.

▶ Task 1: Retrieve a list of event log entries

- Retrieve the newest 25 events from the **Windows Application** event log.

▶ Task 2: Convert a list of event log entries to HTML

- Retrieve the newest 25 events from the **Windows Application** event log and convert the events as HTML and save the results to a file.

▶ Task 3: Use a custom title for an HTML page

- Retrieve the newest 25 events from the **Windows Application** event log and convert the events as HTML file while changing its title to **Last 25 events** and save the results to a file.

▶ Task 4: View an HTML page in the default Web browser

- View the resulting file from the previous task in the default Web browser (Hint: use **Invoke-Item**).

Results: After this exercise, you will have displayed a customized HTML page that contains a listing of the 25 newest events from the Windows Application event log.

Exercise 5: Displaying a Limited Number of Properties

Scenario

You need to review the length of certain files in a particular directory and want to use PowerShell to accomplish this task.The main tasks for this exercise are as follows:

1. Display a list of files from a selected folder.
2. Display a table with several different file properties.

▶ Task 1: Display a list of files from a selected folder

- Retrieve a list of all the files that start with *au* and end with *.dll* from the C:\Windows\System32 directory.

▶ Task 2: Display a table with several different file properties

- Retrieve a list of all the files of that start with *au* and end with *.dll* from the C:\Windows\System32 directory and display the **Name**, **Length** and **Extension** properties using a table.

Results: After this exercise, you will have displayed a table containing the Name, Length and Extension properties of all the files in C:\Windows\System32 that start with *au* and have the extension *.dll*.

Exercise 6: Displaying Objects Using Different Formatting

Scenario

You often use PowerShell to verify the status of processes and services and want to know how to change the way that the information is displayed in the console.The main tasks for this exercise are as follows:

1. Retrieve a list of services.
2. Display a table showing only a few specific properties.
3. Display a table by eliminating any empty spaces between columns.

▶ Task 1: Retrieve a list of services

- Retrieve a list of services.

▶ Task 2: Display a table showing only a few specific properties

- Retrieve a list of services and display only the **DisplayName**, **Status** and **DependentServices** properties using a table.

▶ Task 3: Display a table by eliminating any empty spaces between columns

- Retrieve a list of services and display only the **DisplayName**, **Status** and **DependentServices** properties using a table and eliminating any empty spaces between columns.

Results: After this exercise, you will have displayed a table of all the installed services by displaying only the DisplayName, Status, and DependentServices properties. You have also removed any empty spaces between each column.

Exercise 7: Displaying a Sorted List of Objects

Scenario

You use PowerShell to view the status of processes and services and want to modify how some of the columns display data and even possibly create new customized columns.The main tasks for this exercise are as follows:

1. Retrieve a list of services.
2. Display a table while sorting a specific property.

▶ Task 1: Retrieve a list of services

- Retrieve a list of services.

▶ Task 2: Display a table while sorting a specific property

- Retrieve a list of services and display a table showing the services by sorting on the **Status** property.

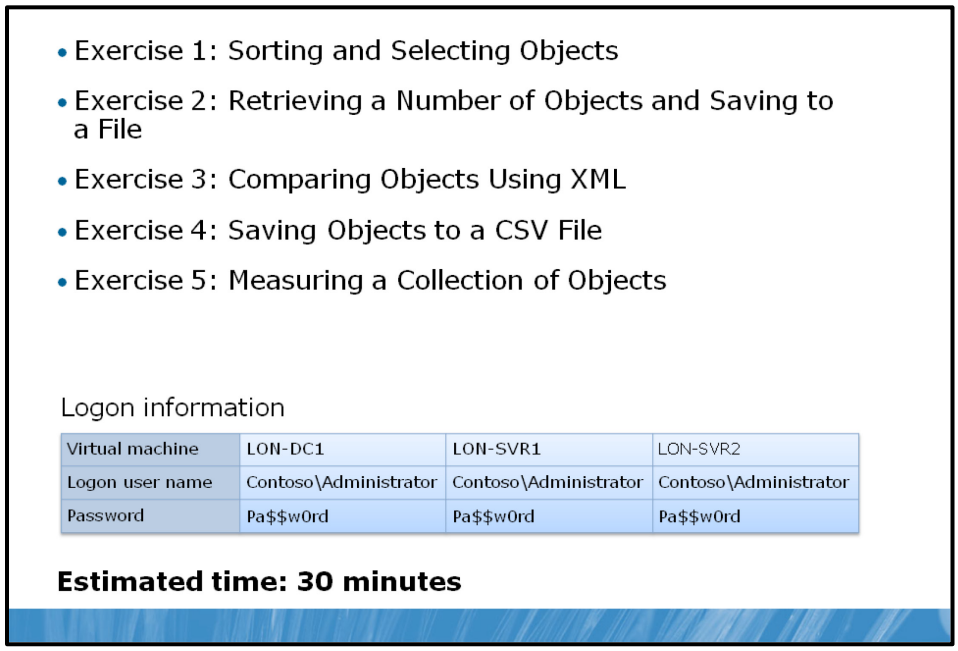
Results: After this exercise, you will have displayed a table of the installed services sorted by their Status property.

Module 3

Lab Instructions: Core Windows PowerShell® Cmdlets

Contents:

Lab A: Using the Core Cmdlets



Estimated time: 30 minutes

You work as a system administrator in a small company. The company you work with has not invested in an enterprise-class monitoring solution. As a result, you have to do a lot of performance monitoring and capacity management/trending. One of your duties is to log in to servers and gather some basic statistics, which you do on an almost daily basis. You would like to keep a record of their current status by saving a file locally on the server as a future reference.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1. Start the **LON-DC1**, **LON-SVR1**, and **LON-SVR2** virtual machines, and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
2. Disable the Windows Firewall on **LON-DC1**, **LON-SVR1**, and **LON-SVR2**. You can do this from **Start | Control Panel | Windows Firewall**. There, click the link to **Turn Windows Firewall on or off**, and **Turn off the Windows Firewall for all network locations**.

Note: This is not security best practice and under no circumstances should this be done in a production environment. Using Windows PowerShell doesn't necessarily require the Windows Firewall to be completely disabled. However, purely for the learning purposes of this class, we will disable the firewall on all machines for all labs in order to focus our attentions on PowerShell as opposed to firewall configurations to get a better understanding of the powershell concepts involved.

Exercise 1: Sorting and Selecting Objects

Scenario

You often check the status of processes on your server and would like to sort the processes so you can easily view their status.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows

1. Retrieve a list of processes.
2. Sort a list of processes.
3. Select a certain number of processes.

▶ Task 1: Retrieve a list of processes

- Open **Windows PowerShell** and retrieve a list of running processes.

▶ Task 2: Sort a list of processes

- Retrieve a list of running processes and sort them.

▶ Task 3: Select a certain number of processes

- Retrieve a list of running processes, sort them, and select only the first five.

Results: After this exercise, you will have retrieved a list of first 5 services sorted alphabetically by their service name.

Exercise 2: Retrieving a Number of Objects and Saving to a File

Scenario

You are currently having problems with an application, and want to check for the last five events in the Windows Application event log.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows

1. Retrieve a list of event logs.
2. Retrieve a certain number of events.
3. Export a certain number of events to a file.

▶ Task 1: Retrieve a list of event logs

- Retrieve a list of the Windows event logs.

▶ Task 2: Retrieve a certain number of events

- Retrieve a list of the five newest/most recent events in the **Windows Application** event log.

▶ Task 3: Export a certain number of events to a file

- Retrieve a list of the five newest/most recent events in the **Windows Application** event log and export the events to a CSV formatted file.

Results: After this exercise, you will have exported the five most recent events from the Windows Application event log to a CSV file.

Exercise 3: Comparing Objects Using XML

Scenario

You suspect that the status of a service is changing, and want to monitor that status of the service so you can determine if its status has changed.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows:

1. Retrieve a list of services.
2. Save a list of services to a XML formatted file.
3. Stop a service.
4. Compare services with different statuses.
5. Restart a service.

▶ Task 1: Retrieve a list of services

- Retrieve a list of services.

▶ Task 2: Save a list of services to an XML formatted file

- Retrieve a list of services and save the listing to an XML formatted file.

▶ Task 3: Stop a service

- Stop and thus change the status of the **Windows Time** service ("w32time").

▶ Task 4: Compare services with different statuses

- Retrieve a new list of services and save the listing to an XML formatted file. (Use a different file name than what was used in Task 2.)
- Using the data from the XML formatted files, compare the old and new list of services by comparing the **Status** property.

Hint: When you specify a comparison property for the Compare-Object cmdlet, you can include more than one property. To do so, provide list of properties for the cmdlet's -property parameter, inserting a comma between each property. For example, if you tell it only to compare the Status property, you will not be able to see the name of the service. If you include both the State and Name properties, then you will see the name of the service.

▶ Task 5: Restart a service

- Change the status of the **Windows Time** service back to its original state.

Results: After this exercise, you will have determined that the Status property of two service objects has changed after the Windows time service was modified.

Exercise 4: Saving Objects to a CSV File

Scenario

You want to get a list of processes in a format that could be readable by Microsoft Excel to produce management reports and metrics.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows

1. Retrieve a list of processes.
2. Export a list of processes to a file.
3. Use a non-default separator.

▶ Task 1: Retrieve a list of processes

- Retrieve a list of running processes.

▶ Task 2: Export a list of processes to a file

- Retrieve a list of running processes and export them to a CSV formatted file.

▶ Task 3: Use a non-default separator

- Retrieve a list of running processes and export them to a CSV formatted file, but use a semi-colon ";" as the delimiter.

Results: After this exercise, you will have exported a list of processes to a CSV file using the default separator ",", and the non-default separator ";".

Exercise 5: Measuring a Collection of Objects

Scenario

You are getting reports that there seem to be problems with one of the servers you are monitoring, and want to get a quick report of the CPU time used by processes on the server.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows

1. Retrieve a list of processes.
2. Measure the average, maximum, minimum, and average of a collection.

▶ Task 1: Retrieve a list of processes

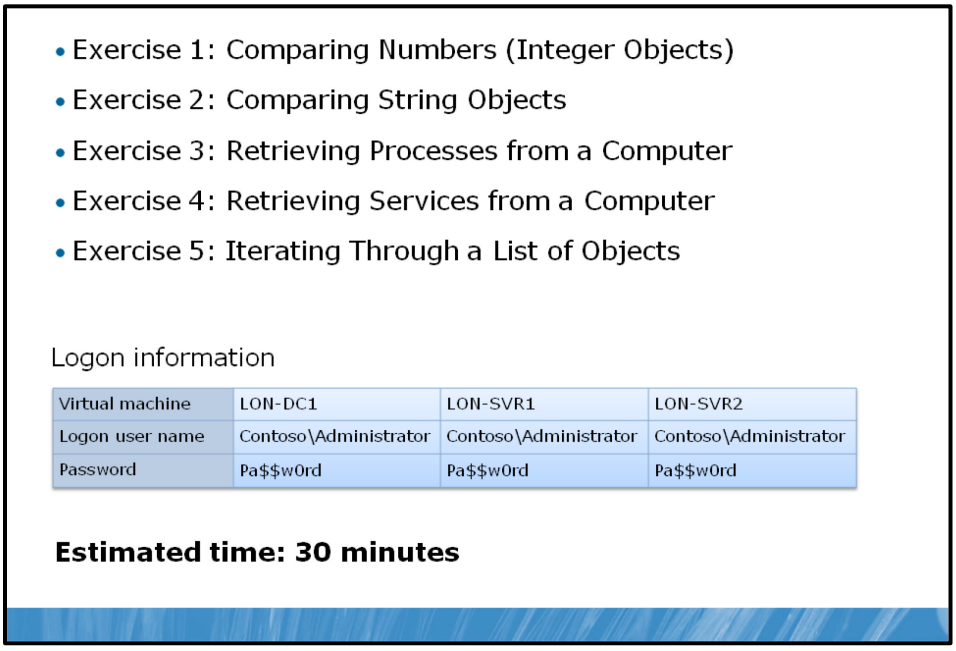
- Retrieve a list of the running processes.

▶ Task 2: Measure the average, maximum and minimum of a collection

- Retrieve a list of the running processes and measure the average, maximum, and minimum of the CPU property of the entire collection.

Results: After this exercise, you will have measured the average, minimum and maximum values of the CPU property of all the running processes.

Lab B: Filtering and Enumerating Objects in the Pipeline



Estimated time: 30 minutes

You are a system administrator. One of your tasks in the morning as your shift is starting is to check the status of the processes and services for the servers you are responsible for. Lately, you have a particular service installed on several computers that have been having issues. Your corporate monitoring solution has not always been alerting that the service has stopped running.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1. Start the **LON-DC1** virtual machine. You do not need to log on, but wait until the boot process is complete.
2. Start the **LON-SVR1** virtual machine, and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
3. Start the **LON-SVR2** virtual machine. You do not need to log on at this time.
4. Open a Windows PowerShell session as **Administrator**.

Exercise 1: Comparing Numbers (Integer Objects)

Scenario

You need to check the status of processes and services on your server; however, before you begin, verify that PowerShell's comparison capabilities can indeed compare simple and complex expressions.

Note: An *integer object* is any whole number, such as 4 or 5. Numbers that have a fraction, such as 2.3, are not integers. Windows PowerShell can sometimes interpret a string as a number, when the number is enclosed in quotation marks, such as "7." However, integers are not normally enclosed in quotation marks.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows:

1. Compare using a simple expression.
2. Compare more complex expressions.

▶ Task 1: Compare using a simple expression

- Open **Windows PowerShell** and create an expression that determines whether 3 is greater than 5.

▶ Task 2: Compare using a more complex expression

- Create a complex expression that determines whether 3 is smaller than 4 and 5 is equal to 5.

Results: After this exercise, you will have determined that 3 is smaller than 5 by having True returned, and also that the complex expression that compares whether 3 is smaller than 4 and 5 is equal to 5 resolves to True because both sides of the complex expression alone resolve to True.

Exercise 2: Comparing String Objects

Scenario

Continuing with the previous exercise, you want to expand the comparison to see how string objects compare in PowerShell. In this exercise, look at both simple as well as complex expressions.

Note: A *string object* is any sequence of characters that is enclosed within single or double quotation marks, such as "powershell" or 'windows.'

The main tasks for this exercise are carried out on LON-SVR1 and are as follows:

1. Compare using a simple expression.
2. Compare using a more complex expression.

▶ Task 1: Compare using a simple expression

- Create an expression that determines whether the string *PowerShell* is equal to *powershell*.

▶ Task 2: Compare using a more complex expression

- Create a complex expression that determines whether the string *logfile* is equal to *logfiles* and *host* is equal to *HOST*. In the latter string, use a case-sensitive expression.

Results: After this exercise, you will have determined that *PowerShell* is considered equal to *powershell* using the default comparison operators, and that the complex expression comparing *logfile* to *logfiles* and *host* to *HOST* resolves to False because one side of the complex expression alone resolves to False.

Exercise 3: Retrieving Processes from a Computer

Scenario

With the previous exercises complete, you're ready to try out PowerShell with a few administrative activities. You manage a large number of servers and would like to use PowerShell to easily query other servers to retrieve a list of the running processes.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows:

1. Retrieve a list of processes.
2. Retrieve objects from a remote computer.

▶ Task 1: Retrieve a list of processes

- Retrieve a list of running processes.

▶ Task 2: Retrieve objects from a remote computer

- From LON-SVR1, retrieve a list of running processes on LON-DC1.

Results: After this exercise, you will have retrieved the list of processes running remotely on LON-DC1 from LON-SVR1.

Exercise 4: Retrieving Services from a Computer

Scenario

You would like to use PowerShell to easily query other servers to retrieve a list of the services installed.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows:

1. Retrieve a list of services.
2. Retrieve objects from a remote computer.
3. Filter a collection of objects.

▶ Task 1: Retrieve a list of services

- Retrieve a list of services.

▶ Task 2: Retrieve objects from a remote computer

- From LON-SVR1, retrieve a list of services from LON-DC1.

▶ Task 3: Filter a collection of objects

- From LON-SVR1, retrieve a list of services from LON-DC1 that have a name that starts with the letter "*w*."

Results: After this exercise, you will have retrieved a list of all the installed services that start with the letter *w* on LON-DC1 from LON-SVR1.

Exercise 5: Iterating Through a List of Objects

Scenario

You have a long list of systems that you administer that includes desktops, application servers, and Active Directory servers. Often, you have to perform actions only on the application servers so you need a method to be able to filter those out from the system list.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows:

1. Create a file.
2. Import the contents of a file.
3. Iterate through a list of objects.
4. Filter a list of objects.

▶ Task 1: Create a file

- Create a txt file **C:\Systems.txt** with the below entries. You can do this from the powershell command line if you are able or you can open Notepad and just enter the below data, each on a single line if you need.
  - **LON-SVR1.contoso.com**
  - **LON-SVR2.contoso.com**
  - **LON-DC1.contoso.com**
  - **LON-CLI1.contoso.com**

▶ Task 2: Import the contents of a file

- Retrieve the contents of the file created.

▶ Task 3: Iterate through a list of objects

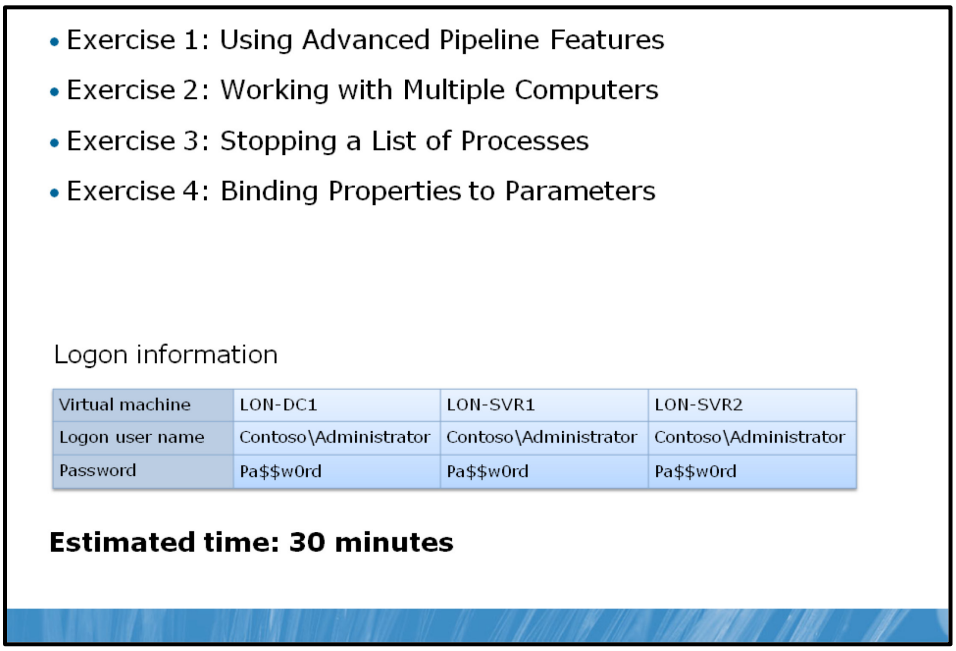
- Retrieve the contents of the created file and display all the entries in lowercase.
- Start by running the command **Get-Content –Path "C:\Systems.txt" | Get-Member**. Notice that the **String** objects each have several methods. To execute one of those methods, you will reference the **String** object (in a **ForEach-Object** script block—do so by using the **$_** placeholder), type a period, then type the method name, followed by parentheses. For example, $_.ToUpper().

▶ Task 4: Filter a list of objects

- Retrieve the contents of the file created and display only the entries where the name includes *SVR*.

Results: After this exercise, you will have retrieved a list of entries from a file, have changed all the characters to lowercase, and have also filtered the list of entries to return only the ones with the string *SVR* in the entry name.

Lab C: Using Pipeline Parameter Binding



Estimated time: 30 minutes

You are a system administrator for a company with about 100 users and desktop computers. You want to perform a set of tasks against those users and computers using Windows PowerShell. You want to accomplish those tasks using data from external files. You need to add a set of users to Active Directory, using properly-formatted and improperly-formatted CSV files. You also need to regularly reboot a set of computers based on the contents of a CSV file. Finally, you also need to stop a list of processes on computers, based on the contents of a CSV file.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1. Start the **LON-DC1** virtual machine, and then logon by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
2. Start the **LON-SVR1** virtual machine. You do not need to log on.
3. Start the **LON-SVR2** virtual machine. You do not need to log on.
4. On LON-DC1, open a Windows PowerShell session as **Administrator**.

Exercise 1: Using Advanced Pipeline Features

Scenario

You have created a properly-formatted CSV formatted file of new users that need to be added to your Active Directory installation. You want to use PowerShell to automate the process.

The main tasks for this exercise are as follows:

1. Import the Active Directory module.
2. Import a CSV file.
3. Create users in Active Directory using advanced pipeline features.

▶ Task 1: Import the Active Directory module

- On LON-DC1, import the **Active Directory** module.

▶ Task 2: Import a CSV file

- Import the CSV file **E:\Mod03\Labfiles\Module3_LabC_Exercise1.csv**.

▶ Task 3: Create users in Active Directory

- Using advanced pipeline features, import the CSV file **E:\Mod03\Labfiles\Module3_LabC_Exercise1.csv**, and create new Active Directory users.

Results: After this exercise, you will have automated the creation of users in the contoso.com domain.

Exercise 2: Working with Multiple Computers

This is an *optional exercise* to complete if you have extra time, or if you want to explore on your own.

Scenario

You manage several types of systems from clients, to servers, and domain controllers. You are allowed to update and reboot servers before 8AM. You have a list in a CSV file of all the systems in your company and only want to reboot the ones that are servers.

The main tasks for this exercise are carried out on LON-DC1 and are as follows:

1. Create a CSV file.
2. Import a CSV file and filter the results.
3. Restart a group of computers.

▶ Task 1: Create a CSV file

- On LON-DC1, create a CSV file **C:\Inventory.csv** with the below contents. Again, you can do this from the powershell command line if you are able or you can open Notepad and just enter the below data, each on a single line if you need.
  - **Type,Name**
  - **AD,LON-DC1**
  - **Server,LON-SVR1**
  - **Server,LON-SVR2**
  - **Client,LON-CLI1**

▶ Task 2: Import a CSV file and filter the results

- Import the CSV file created, and list only the systems where the Type is *Server*.

▶ Task 3: Restart a group of computers

- Import the CSV file created, and restart the systems where the Type is *Server*.

Note: If someone is logged in to LON-SVR1 and LON-SVR2 you may receive an error message. To overcome the error message and achieve a successful re-start the virtual machines, log off from them and then re-run the script.

Results: After this exercise, you will have restarted a filtered group of servers.

Exercise 3: Stopping a List of Processes

Scenario

There are a set of inappropriate processes that are currently running on systems within your network. You have been given a CSV file that contains the list of computers and associated processes that must be stopped on each computer.

The main tasks for this exercise are as follows:

1. Start 2 applications.
2. Create a CSV file.
3. Import a CSV file and iterate through a collection of objects.
4. Stop a list of processes.

▶ Task 1: Start two applications

- On LON-DC1, open one session of Notepad and Wordpad.

▶ Task 2: Create a CSV file

- Open Windows PowerShell and create a CSV file named **C:\Process.csv** with the following entries.
  - **Computer,ProcName**
  - **LON-DC1,Notepad**
  - **LON-DC1,Wordpad**

▶ Task 3: Import a CSV file and iterate through a collection of objects

- Import the CSV file created in the previous task, **C:\Process.csv**, and select the **ProcName** property to display.

▶ Task 4: Stop a list of processes

- Import the CSV file created in Task 2, **C:\Process.csv**, and stop each of the processes listed.

Results: After this exercise, you will have stopped a list of processes based on values imported from a CSV file.

Exercise 4: Binding Properties to Parameters

Note: Complete this exercise only if you have finished the previous exercises and still have time remaining. If you do not have time, you can complete this exercise on your own.

Scenario

You were provided a CSV formatted file with improper formatting. That file includes a second set of new users that need to be added to your Active Directory installation. You want to use PowerShell to automate the process.

The main tasks for this exercise are as follows:

1. Import a CSV file.
2. Create users in Active Directory.

▶ Task 1: Import a CSV file

- On LON-DC1, import the CSV file **E:\Mod03\Labfiles\Module3_LabC_Exercise4.csv**.

▶ Task 2: Create users in Active Directory

- Import the CSV file **E:\Mod03\Labfiles\Module3_LabC_Exercise4.csv** and create new Active Directory users by specifically binding properties to parameters. From the CSV file, map the properties according to the following table:

CSV file property	New-ADUser parameter
EmployeeName	Name and SamAccountName
Town	City
Unit	Department
Id	EmployeeNumber

- Also, hard code the value for the **Company** parameter as **Contoso**.

Hint: You have already seen the syntax used to rename a property. You will have to repeat this syntax once for each property than you want to rename. To save typing, you may wish to complete this task in the Windows PowerShell ISE. That will allow you to type the syntax once, and then copy and paste it (and modify the values of each pasted copy) to help reduce the amount of typing.

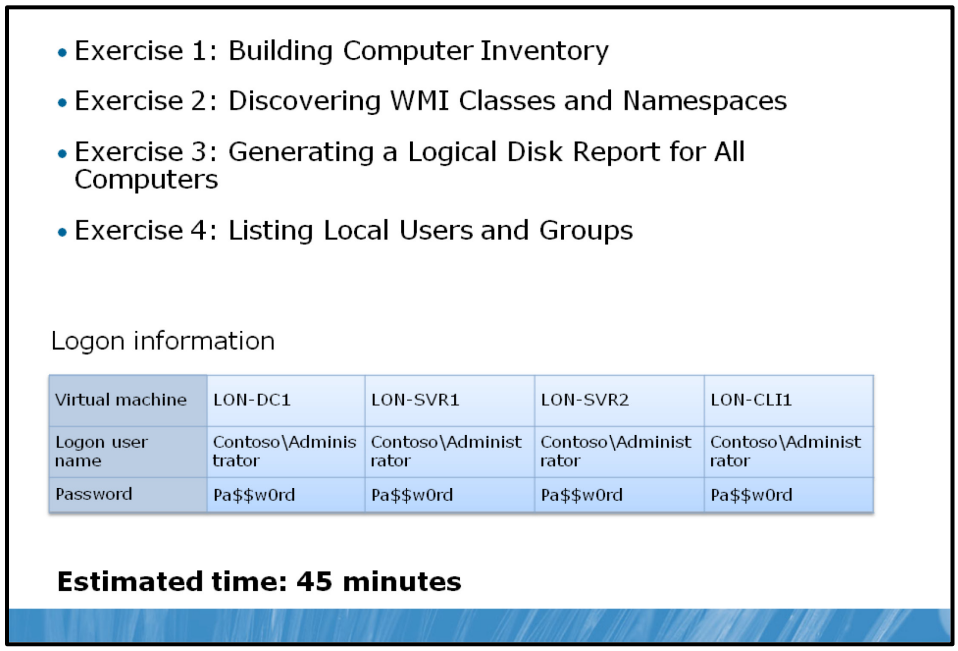
Results: After this exercise, you will have automated the creation of 20 users in the contoso.com domain.

Module 4

Lab Instructions: Windows® Management Instrumentation

Contents:

Lab: Using Windows Management Instrumentation in Windows PowerShell



Estimated time: 45 minutes

You work as a systems administrator, and you need to perform certain tasks against the computers, users, and groups that you manage. You need to check inventory of your computers, including the operating system versions, service pack versions, and asset tags. Your organization uses the BIOS serial number as an asset tag tracking system. You need to monitor logical drive space on multiple remote computers. You also need to generate reports showing local users and groups on those machines for audit purposes.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1. Start the **LON-DC1**, **LON-SVR1**, **LON-SVR2**, and **LON-CLI1** virtual machines, and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
2. Disable the **Windows Firewall** on LON-DC1, LON-SVR1, and LON-SVR2 and remain logged on to the virtual machines.
3. Disable the **Windows Firewall** on LON-CLI1 and also remain logged onto this virtual machine.
4. On LON-CLI1, open the Windows PowerShell console. All PowerShell commands will be run within the Windows PowerShell console.
5. On virtual machine LON-CLI1, create a text file containing the names of all computers in the domain, one on each line, and save it as **C:\users\administrator\documents\computers.txt**. You can either do this in the PowerShell command line if you are able or manually. Its contents should look as follows:

- LON-DC1.contoso.com
- LON-SVR1.contoso.com
- LON-SVR2.contoso.com
- LON-CLI1.contoso.com

Exercise 1: Building Computer Inventory

Scenario

You work as a system administrator. Periodically you need to inventory your domain computers. The inventory information you require includes the operating system version, the service pack version, and the asset tag. Your organization uses the BIOS serial number as the asset tag for all computer systems.

The main tasks for this exercise are carried out on LON-CLI1 and are as follows:

1. Retrieve the operating system information for the local computer.
2. Extract specific version information from the operating system object.
3. Retrieve operating system version numbers from the local computer "remotely".
4. Retrieve operating system version numbers from multiple computers in one command.
5. Export operating system version numbers (both the operating system version and the service pack version) for multiple computers to a .csv file.
6. Retrieve BIOS serial numbers from multiple computers.
7. Create a custom object for each computer containing all inventory information.
8. Export the results of the last command to a file.

▶ Task 1: Retrieve the operating system information

1. Get the operating system information from the local computer using **Get-WmiObject** with the **Win32_OperatingSystem** class.
2. Show all properties of the Win32_OperatingSystem object you just retrieved.

▶ Task 2: Extract version information from the operating system object

1. Show all properties of the Win32_OperatingSystem object with *version* in their name.
2. Generate a table showing the **__SERVER**, **Version**, **ServicePackMajorVersion**, and **ServicePackMinorVersion** properties of the **Win32_OperatingSystem** object.

> **Hint:** The __SERVER property starts with two underscore characters.

▶ Task 3: Retrieve the local operating system information "remotely"

1. Repeat the last command, passing the **LON-CLI1** computer name to the **ComputerName** parameter of the **Get-WmiObject** cmdlet.
2. Show the help information for the **ComputerName** parameter of the **Get-WmiObject** cmdlet. Note that **ComputerName** accepts an array of strings.

▶ Task 4: Retrieve the operating system information for all computers

1. Read the list of domain computer names from the **computers.txt** file in your documents folder.
2. Modify the last command you ran to retrieve operating system information so that it shows the information for all computers in the domain.

▶ Task 5: Export the operating system information for all computers

1. Read the help information for the **Select-Object** cmdlet.

2. Replace the call to **Format-Table** in the last **Get-WmiObject** command pipeline with **Select-Object**, maintaining the list of properties that are required.
3. Export the operating system information to a .csv file called **Inventory.csv**.

▶ Task 6: Retrieve the BIOS information for all computers

- Retrieve the BIOS information for all computers using the **Win32_BIOS** class.

▶ Task 7: Create a custom object for each computer containing all inventory information

1. Read the help information and examples for the **Select-Object** cmdlet so that you understand what it is used for and how it works.
2. Combine the operating system version information and BIOS serial numbers into one set of results using **Select-Object**.

Hint: This is a complex command. You need to execute Get-WmiObject and use Select-Object to create a custom column. The expression for that custom column is another call to Get-WmiObject. Refer to the course material for an example of this complex technique.

▶ Task 8: Export the inventory report

- Export the results of the last command to a .csv file called **Inventory.csv**.

Results: After this exercise, you should have successfully retrieved operating system and BIOS information from all computers in your domain, built custom objects using Select-Object, and generated an inventory report in a .csv file.

Exercise 2: Discovering WMI Classes and Namespaces

Scenario

You are retrieving computer information remotely using WMI. You need to be able to discover classes and namespaces on a remote computer so that you can get the data you need.

The main tasks for this exercise are carried out on LON-DC1 and are as follows:

1. View WMI classes in the default namespace on LON-DC1.
2. Find WMI classes using wildcards on LON-DC1.
3. Enumerate the list of top-level WMI namespaces on the LON-DC1 computer.

▶ Task 1: View WMI classes in the default namespace

1. On LON-DC1, read help information for the **List** parameter in the **Get-WmiObject** cmdlet.
2. Get a list of all **WMI** classes in the default namespace on the LON-DC1 computer.

▶ Task 2: Find WMI classes using wildcards

1. Find all **WMI** classes in the default namespace on LON-DC1 that contain *Printer* in their class name.
2. Find all **WMI** classes in all namespaces on LON-DC1 that contain *Printer* in their class name.

▶ Task 3: Enumerate top-level WMI namespaces

1. Enumerate the top-level **WMI** namespaces by retrieving **WMI** objects of class **__NAMESPACE** in the root namespace on LON-DC1.

Hint: The __NAMESPACE class name begins with two underscore characters.

2. Generate a list of only the top-level WMI namespace names by using **Get-WmiObject** with **Select-Object**.

Hint: Sometimes, a property is a collection of other objects. Select-Object can expand that property into a list of those objects by using the -ExpandProperty parameter. For example, -ExpandProperty Name expands the Name property.

Results: After this exercise, you should be able to find WMI classes in a specific namespace, find WMI classes using a wildcard search, and find WMI namespaces on local or remote computers.

Exercise 3: Generating a Logical Disk Report for All Computers

Scenario

To monitor disk-space usage for computers in your organization, you want to use PowerShell to retrieve and process WMI information.

The main tasks for this exercise are carried out on LON-CLI1 and are as follows:

1. Learn how to discover the WMI class used to retrieve logical disk information.
2. Retrieve logical disk information from the local machine.
3. Apply a server-side filter to filter the logical disks to include only hard disks and gather disk information for all computers in your domain.
4. Add a calculated value to your report showing percent-free information for hard disks for all computers in your domain.
5. Learn how to discover information related to WMI classes.

▶ Task 1: Discover the WMI class used to retrieve logical disk information

- Find all **WMI** classes in the default namespace on the local machine that contain *LogicalDisk* in the class name.

Hint: If you examine the help for Get-WmiObject, you see that the -class parameter is positional and is in position 2. That means you do not have to type the -class parameter name; you can simply provide a value, if you place it in the correct position.

▶ Task 2: Retrieve logical disk information from the local machine

- Get all logical disk drives for the local machine using the **Get-WmiObject** cmdlet.

▶ Task 3: Retrieve logical disk information for hard disks in all computers in your domain

1. Read help information for the **Filter** parameter of the **Get-WmiObject** cmdlet.
2. Read the list of computer names in your domain from the **computers.txt** file in your documents folder.
3. Get all hard disks for all computers in your domain using the **Get-WmiObject** cmdlet. The **DriveType** property value for hard disks is **3**. Show the results in a table with the **computer name**, **device id**, and **free-space** information.

▶ Task 4: Add a calculated PercentFree value to your report

- Add a calculated parameter to your hard disk table that has the following properties:
  - Label: 'PercentFree'
  - Expression: {$_.FreeSpace / $_.Size}
  - FormatString: '{0:#0.00%}'

Hint: You have already seen examples of the structure necessary to create a custom or calculated column. In this task, you are doing the same thing. However, in addition to the Label and Expression elements that you have seen before, you are adding a FormatString element.

▶ Task 5: Discover WMI information related to the logical drives

1. Show only the first hard drive found in your report.
2. Invoke the **GetRelated()** method on the first drive, and show the results in a table containing **__CLASS** and **__RELPATH**.

> **Hint:** __CLASS and __RELPATH both begin with two underscore characters. These are properties of the WMI objects, just like any other properties. The underscore characters indicate that they are system properties, added by WMI and contain information that helps WMI locate and manage the objects.

Hint: Remember that Get-WmiObject returns objects and that some objects have *methods* that perform actions. GetRelated() is one such method. For example, you could enclose an entire WMI command in parentheses to execute the GetRelated() method of the object(s) returned by that command:

```
(Get-WmiObject your parameters go here | Select -First 1).GetRelated()
```

That Select-Object command ensures that only the first returned object is used.

Results: After this exercise, you should know how to check logical disk free-space information using WMI, how to add calculated properties to a report, and how to find related WMI information from your WMI data.

Exercise 4: Listing Local Users and Groups

Scenario

Corporate regulations require that you maintain an inventory of local users and groups on computers in your domain for audit purposes.

The main tasks for this exercise are carried out on LON-CLI1 and are as follows:

1. Find the WMI classes used to retrieve local users and groups.
2. Generate a report showing all local user accounts and groups from all computers in your domain. This report should contain the WMI object class to identify the object type as well as the computer name, user or group name, and SID.

▶ Task 1: Find the WMI classes used to retrieve local users and groups

1. Search for **WMI** classes representing local users in the default namespace using **Get-WmiObject**.
2. Search for **WMI** classes representing local groups in the default namespace using **Get-WmiObject**.

▶ Task 2: Generate a local users and groups report

1. Retrieve a list of all local user accounts on the local computer and identify the properties containing the WMI object class name, the computer name, the user name, and the SID.
2. Retrieve a list of all local groups on the local computer and identify the properties containing the WMI object class name, the computer name, the user name, and the SID.
3. Read the basic help information for the **ForEach-Object** cmdlet. Note that **ForEach-Object** allows you to process a collection of objects one at a time.
4. Generate a single table showing all local users and groups from all computers in the computers.txt file that is in your documents folder. Format the table output so that it contains only the object type, the computer name, the user or group name, and the SID.

Hint: If you want to include two (or more) independent shell commands into a single {script block}, separate the commands by using a semicolon.

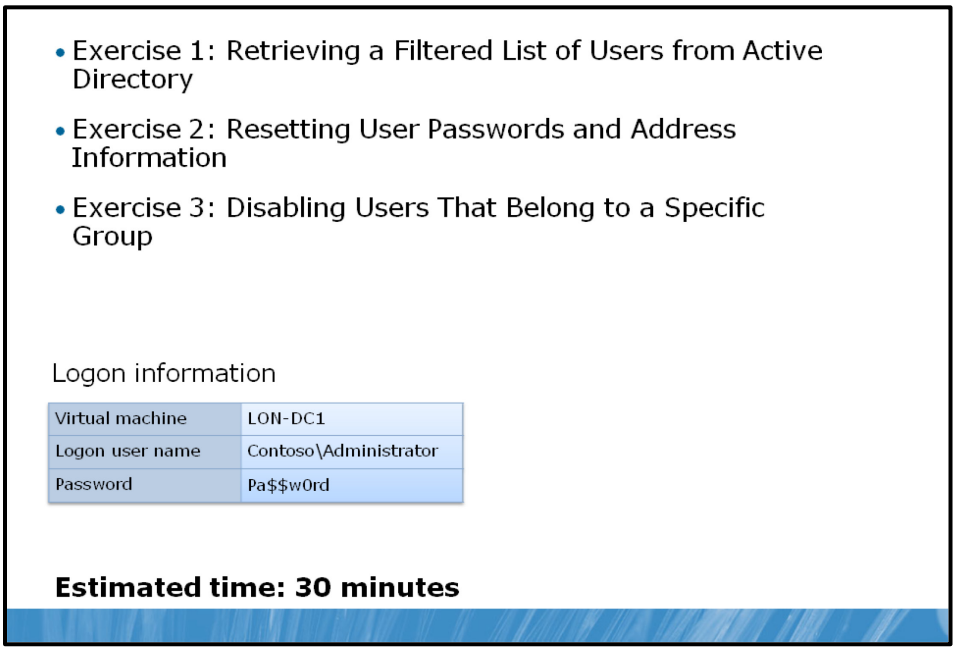
Results: After this exercise, you should be able to retrieve local user and group account information from local and remote computers and generate a report combining this information into a single table.

Module 5

Lab Instructions: Automating Active Directory® Administration

Contents:

Lab A: Managing Users and Groups



Estimated time: 30 minutes

You are an Active Directory administrator and want to manage your users and groups via PowerShell. You recently upgraded your domain controller to Windows Server 2008 R2 and want to try the new PowerShell Active Directory cmdlets that came with it. In order to handle internal tasks more quickly and be prepared to automate them, you want to learn how to find information in Active Directory as well as how to accomplish basic tasks such as resetting users' passwords, disabling users, and moving objects in Active Directory.

Lab Setup

Before you begin the lab you must:

1. Start the **LON-DC1** virtual machine and log on with the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
2. Open the Windows PowerShell console. All commands will be run within the Windows PowerShell console.
3. In the Windows PowerShell console, execute the following command:
   - **Set-ExecutionPolicy RemoteSigned**

Exercise 1: Retrieving a Filtered List of Users from Active Directory

Scenario

You want to manage your users and groups via PowerShell. To begin, you want to use Windows PowerShell to retrieve a filtered list of users from Active Directory.

The main tasks for this exercise are as follows:

1. List all modules installed on the local system.
2. Import the Active Directory module and populate the Active Directory Environment.
3. List all commands in the Active Directory module.
4. Retrieve all users matching a specific city and title by using server-side filtering.

▶ Task 1: List all modules installed on the local system

1. Read the help documentation and examples for the **Get-Module** command to familiarize yourself with how it works.
2. Show a list of all modules installed on the LON-DC1 computer by using **Get-Module** with the **ListAvailable** parameter.

▶ Task 2: Import the Active Directory module and populate the Active Directory environment

1. Read the help documentation and examples for the **Import-Module** command so that you understand how it works.
2. Use the **Import-Module** command to import the **Active Directory** module into your current PowerShell session.
3. In the Windows PowerShell console execute the following command: **E:\Mod05\Labfiles\Lab_05_setup.ps1**.

▶ Task 3: List all commands in the Active Directory module

- Use **Get-Command** to retrieve a list of all commands that were loaded when you imported the Active Directory module.

▶ Task 4: Retrieve all users matching a specific city and title by using server-side filtering

1. Read the help documentation and examples for the **Get-ADUser** command to learn how you can use it to retrieve Active Directory users. Pay extra attention to the -filter parameter.
2. Invoke **Get-ADUser** with no parameters to see which parameters are required and learn how to use them.
3. Retrieve a list of all Active Directory users whose office attribute has a value of "Bellevue."
4. Retrieve a list of all Active Directory users whose office attribute has a value of "Bellevue" and whose title attribute has a value of "PowerShell Scripter."

Results: After this exercise you should have successfully imported the Active Directory module into PowerShell and used it to retrieve a filtered list of users from Active Directory.

Exercise 2: Resetting User Passwords and Address Information

Scenario

You are working in Bellevue, Washington, and you are automating some Active Directory tasks using PowerShell. You need to reset user passwords and change address information for some remote users.

The main tasks for this exercise are as follows:

1. Retrieve a list of remote users.
2. Reset remote user passwords to a specific password.
3. Change remote user address information to your local Bellevue, Washington office.

▶ Task 1: Retrieve a list of remote users

- Use **Get-ADUser** with the -filter parameter to retrieve a list of users whose office attribute is not set to "Bellevue."

▶ Task 2: Reset remote user passwords to a specific password

1. Review the documentation and examples for the **Read-Host** and **Set-ADAccountPassword** commands. Pay close attention to the **AsSecureString** parameter for **Read-Host** and the **Reset** and **NewPassword** parameters for **Set-ADAccountPassword**.
2. Pass the list of users whose office is not "Bellevue" to the **Set-ADAccountPassword** command and use it with **Read-Host** to set their passwords to a password of **Pa$$w0rd** that you are prompted to enter in PowerShell.

▶ Task 3: Change remote user address information to your local Bellevue, Washington office

1. Look up the help documentation for the **Properties** parameter of **Get-ADUser**.
2. Retrieve a list of users whose office is not "Bellevue." When retrieving the users, use the **Properties** parameter to retrieve the **Office**, **StreetAddress**, **City**, **State**, **Country/Region**, and **PostalCode** attributes. Show the results in a table containing **SamAccountName** along with the other attributes you specified in the **Properties** parameter.
3. Read the help documentation and examples for the **Set-ADUser** cmdlet.
4. Pass the results of the **Get-ADUser** command you just used to the **Set-ADUser** command, and set the following values:

   Office: **Bellevue**
   StreetAddress: **2345 Main St.**
   City: **Bellevue**
   State: **WA**
   Country: **US**
   PostalCode: **95102**

Results: After this exercise, you should be able to reset passwords and modify attributes for a filtered list of Active Directory users.

Exercise 3: Disabling Users That Belong to a Specific Group

Scenario

Your organization has recently terminated a project at work called "CleanUp" and you need to disable all users that belong to the Active Directory group corresponding to the project.

The main tasks for this exercise are as follows:

1. Retrieve a list of all Active Directory groups.
2. Retrieve a specific Active Directory group named "CleanUp."
3. Retrieve a list of members in the Active Directory group named "CleanUp."
4. Disable the members of the Active Directory group named "CleanUp."

▶ Task 1: Retrieve a list of all Active Directory groups

1. Read the documentation and examples for the **Get-ADGroup** cmdlet.
2. Retrieve a list of all Active Directory groups by using the **Get-ADGroup** cmdlet.

▶ Task 2: Retrieve a specific Active Directory group named "CleanUp"

- Retrieve the Active Directory group named "CleanUp" by using the **Get-ADGroup** cmdlet.

▶ Task 3: Retrieve a list of members in the Active Directory group named "CleanUp"

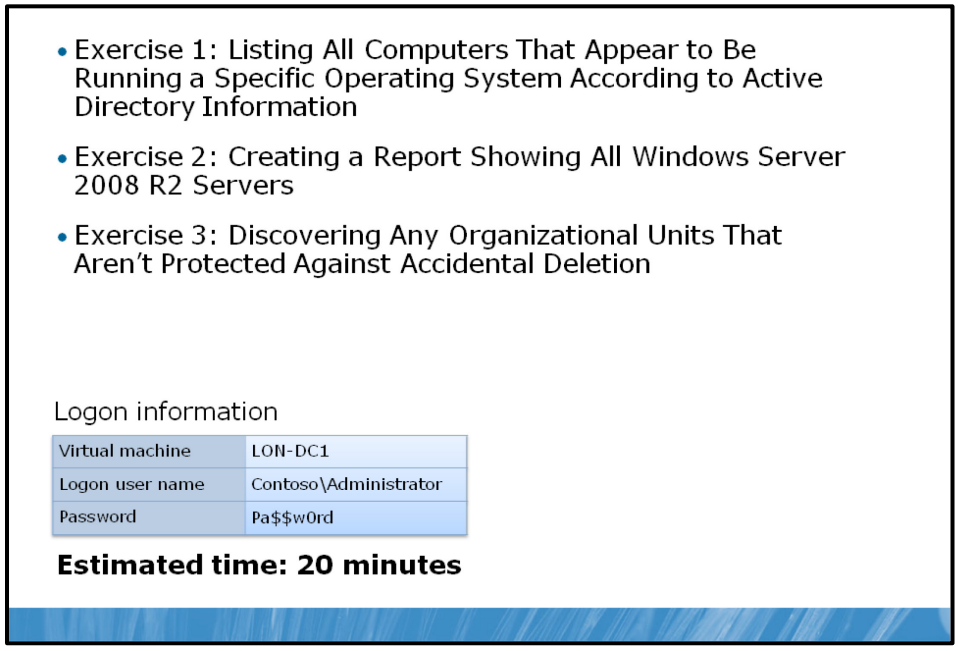
1. Read the help documentation and examples for the **Get-ADGroupMember** cmdlet.
2. Use the **Get-ADGroup** and **Get-ADGroupMember** cmdlets to retrieve a list of the members in the Active Directory group named "CleanUp."

▶ Task 4: Disable the members of the Active Directory group named "CleanUp"

1. Read the help documentation and examples for the **Disable-ADAccount** cmdlet.
2. Use the **Disable-ADAccount** cmdlet with the **WhatIf** parameter and the list of members of the Active Directory group named "CleanUp" to see what would happen if you were to disable the members in that group.
3. Repeat the last command without the **WhatIf** parameter to actually disable the group members.

Results: After this exercise, you should know how to retrieve groups from Active Directory, view their membership, and disable user accounts.

Lab B: Managing Computers and Other Directory Objects



Estimated time: 20 minutes

As an Active Directory administrator, in addition to managing users and groups, you need to monitor the servers in your organization. Active Directory contains details identifying servers, and you want to use those details to discover servers and generate reports. To meet new security policies, your company has decided to put more stringent password policies in place. You need to create fine-grained password policies for your organization and heard that PowerShell was the only way to do so. Also, as a senior IT administrator responsible for a team, you want to make sure that your team members don't accidentally delete important information in Active Directory. You want to use a new feature for organizational units OUs that prevents them from accidental deletion.

Lab Setup

Before you begin the lab you must:

1. Start the **LON-DC1** virtual machine and log on with the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
2. Open **Windows PowerShell**. All PowerShell commands will be run within the Windows PowerShell console.

Exercise 1: Listing All Computers That Appear to Be Running a Specific Operating System According to Active Directory Information

Scenario

As an Active Directory administrator, in addition to managing users and groups you also need to monitor the servers in your organization. Active Directory contains details identifying servers, and you want to use those details to discover servers.

The main tasks for this exercise are as follows:

1. Import the Active Directory module.
2. List all of the properties for one AD computer object.
3. Find any properties containing operating system information on an AD computer.
4. Retrieve all computers running a specific operating system.

▶ Task 1: Import the Active Directory module

- Import the Active Directory module into your current PowerShell session.

▶ Task 2: List all of the properties for one AD computer object

1. Read the help documentation and examples for the **Get-ADComputer** cmdlet.
2. Show all properties for one computer from Active Directory using the Get-**ADComputer** cmdlet with the **-filter**, **Properties**, and **ResultSetSize** parameters.

▶ Task 3: Find any properties containing operating system information on an AD computer

- Get one computer from Active Directory and show all properties containing operating system information.

▶ Task 4: Retrieve all computers running a specific operating system

1. Get a list of all computers running "Windows Server 2008 R2" using **Get-ADComputer** with the -filter parameter.
2. Repeat the last command but include the **OperatingSystem** property in the objects that are returned.

Results: After this exercise you should be able to retrieve AD computers that match specific criteria and indicate which properties you want to retrieve for those computers.

Exercise 2: Creating a Report Showing All Windows Server 2008 R2 Servers

Scenario

Now that you can discover servers in your organization using Active Directory, your manager would like you to generate a report showing all Windows Server 2008 R2 servers in your organization.

The main tasks for this exercise are as follows:

1. Retrieve all computers running Windows Server 2008 R2.
2. Generate an HTML report showing only the computer name, SID, and operating system details.
3. Generate a CSV file showing only the computer name, SID, and operating system details.

▶ Task 1: Retrieve all computers running Windows Server 2008 R2

- Retrieve all AD computers running the Windows Server 2008 R2 operating system. Include the **OperatingSystem**, **OperatingSystemHotfix**, **OperatingSystemServicePack**, and **OperatingSystemVersion** properties in the computer objects that you retrieve.

▶ Task 2: Generate an HTML report showing only the computer name, SID, and operating system details

1. Read the help documentation and examples for the **ConvertTo-Html** and **Out-File** cmdlets so that you understand how they work.
2. Rerun the command from Task 1 to retrieve Windows Server 2008 R2 servers. Generate an HTML table fragment by passing the results to the **ConvertTo-Html** cmdlet. Don't forget to use the **Fragment** parameter.
3. Rerun the command from Task 1 to retrieve Windows Server 2008 R2 servers. Generate an HTML file by passing the results to the **ConvertTo-Html** and **Out-File** cmdlets. Name the resulting file **C:\OSList.htm**.
4. Use PowerShell to open the **C:\OSList.htm** file in Internet Explorer.

▶ Task 3: Generate a CSV file showing only the computer name, SID, and operating system details

1. Read the help documentation and examples for the **Export-Csv** cmdlet so that you understand how it works.
2. Rerun the command from Task 1 to retrieve Windows Server 2008 R2 servers. **Use Select-Object** to select only the **Name**, **SID**, and **OperatingSystem*** attributes.
3. Pass the results of the last command to **Export-Csv** to create a CSV file containing the results. Name the resulting file **C:\OSList.csv**.
4. Use PowerShell to open the **C:\OSList.csv** file in Notepad.

Results: After this exercise, you should be able to generate HTML and CSV documents containing information you retrieved using PowerShell commands.

Exercise 3: Discovering Any Organizational Units That Aren't Protected Against Accidental Deletion

Scenario

As a senior IT administrator responsible for a team, you want to make sure that your team members don't accidentally delete important information in Active Directory. You know about the new feature for OUs that prevents them from accidental deletion and you want to monitor the OUs in your environment to ensure that they are appropriately protected.

The main tasks for this exercise are as follows:

1. Retrieve all organizational units.
2. Retrieve organizational units that are not protected against accidental deletion.

▶ Task 1: Retrieve all organizational units

1. Read the help documentation and examples for the **Get-ADOrganizationalUnit** cmdlet to learn how it works.
2. Get a list of all organizational units in AD. Include the **ProtectedFromAccidentalDeletion** property in the results.

▶ Task 2: Retrieve organizational units that are not protected against accidental deletion

- Use the **Get-ADOrganizationalUnit** cmdlet to get a list of all organizational units whose **ProtectedFromAccidentalDeletion** property is set to **false**.

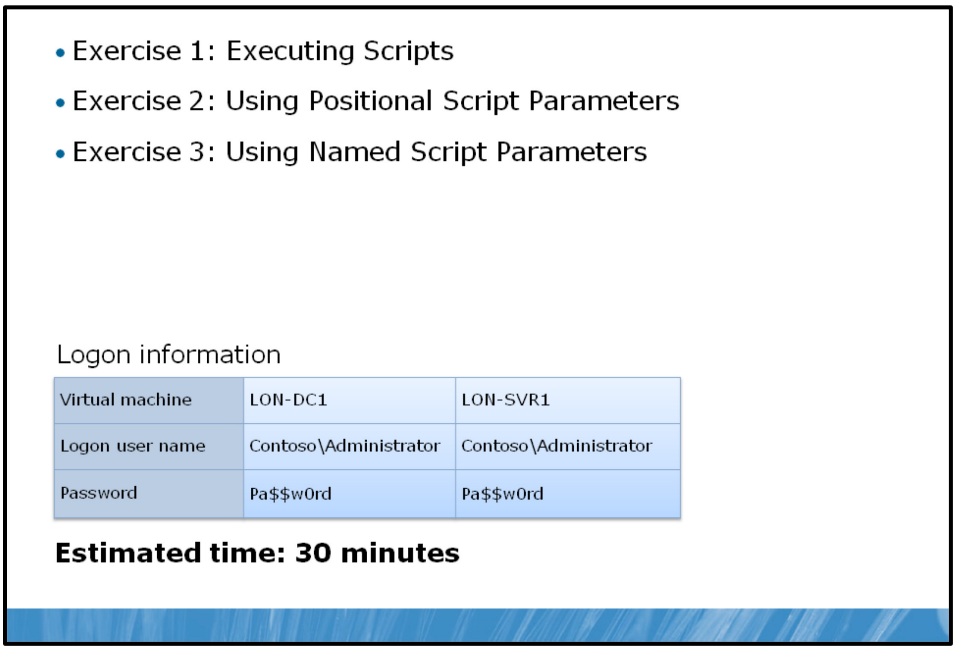
Results: After this exercise, you should be able to use the Active Directory cmdlets to retrieve organizational units from Active Directory.

Module 6

Lab Instructions: Windows PowerShell® Scripts

Contents:

Lab: Writing Windows PowerShell Scripts



Estimated time: 30 minutes

You are a system administrator, and have commands that you run regularly at work. To save time and also to be able to more easily pass around your commonly used commands to others, you have decided to copy your commands into a script. To make it easier for more junior administrators or even desktop users to use your script, you've added simple command-line arguments that can be passed dynamically to your script when run.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1 Start the **LON-DC1** virtual machine. You do not need to log on but wait until the boot process is complete.

2 Start the **LON-SVR1** virtual machine, and then log on by using the following credentials:

- Username: **CONTOSO\administrator**
- Password: **Pa$$w0rd**

3 Open a Windows PowerShell session as **Administrator**.

Exercise 1: Executing Scripts

Scenario

To administer your systems, you like to copy commonly used commands into a script so you can easily invoke them later.The main tasks for this exercise are carried out on LON-SVR1 and are as follows:

1. Check the execution policy setting.
2. Create a script.
3. Execute a script from the shell.

▶ Task 1: Check the execution policy setting

- Check the execution policy to make sure scripts can be executed without needing to be signed.

▶ Task 2: Create a script

- Create a PowerShell script **C:\Script.ps1** that contains a command will get all the running *powershell* processes. You can use Notepad to do this then replace the file extension from **.txt** to **.ps1** once you are finished.

▶ Task 3: Execute a script from the shell

- Run the script from the PowerShell console calling the script name **C:\Script.ps1**.

Results: After this exercise, you will have created and run a simple script that lists all the "powershell" processes.

Exercise 2: Using Positional Script Parameters

Scenario

With basic scripting firmly understood, you now want to expand a few scripts to make them easier to use. You want to be able to easily pass parameters to your script so that they can be more generalized.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows:

1. Copy commands into a script.
2. Use commands with hard-coded values as parameter values.
3. Identify variable portions of a command.
4. Create positional script parameters.
5. Execute a script from the shell.

▶ Task 1: Copy commands into a script

- Create a script named **C:\Script2.ps1** containing the following command:

```
Get-EventLog –LogName Application –Newest 100|Group-Object -Property InstanceId|Sort-
Object –Descending -Property Count|Select-Object –Property Name,Count -First
5|Format-Table –AutoSize
```

▶ Task 2: Use commands with hard-coded values as parameter values

- Run the script just created.

▶ Task 3: Identify variable portions of a command

- Review the script and determine what parts of the command could be considered variable values.

▶ Task 4: Create positional script parameters

- Create a new script **C:\Script3.ps1** that accepts positional script parameters for the four values underlined below.

Hint: Create a script that accepts four parameters, such as $log, $new, $group, and $first. In addition to defining those parameters in a Param() block, use those parameters in place of the hard-coded values in the command.

```
Get-EventLog –LogName Application –Newest 100|Group-Object -Property InstanceId|Sort-
Object –Descending -Property Count|Select-Object –Property Name,Count -First
5|Format-Table –AutoSize
```

▶ Task 5: Execute a script from the shell

- Run the script just created by passing back the same values that were replaced by the parameters (in the same order).

Hint: To run the script, provide the four parameterized values, - such as "Application," 100, "InstanceId," and 5, in the order in which they are defined in the Param() block.

Results: After this exercise, you will have created and run a script that uses positional parameters instead of hard-coded values.

Exercise 3: Using Named Script Parameters

Scenario

You want to be able to easily pass parameters to your script so that they can be more generalized. This time, however, you wish to use named parameters as opposed to positional parameters in your script.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows:

1. Copy commands into a script.
2. Use commands with hard-coded values as parameter values.
3. Identify variable portions of a command.
4. Create named script parameters.
5. Execute a script from the shell.

▶ Task 1: Copy commands into a script

- Create a script **C:\Script4.ps1** that contains the following command:

```
Get-Counter -Counter "\Processor(_Total)\% Processor Time" -SampleInterval 2 -
MaxSamples 3
```

▶ Task 2: Use commands with hard-coded values as parameter values

- Run the script just created.

▶ Task 3: Identify variable portions of a command

- Review the script and determine what parts of the command could be considered variable values.

▶ Task 4: Create named script parameters

- Create a new script **C:\Script5.ps1** that accepts named script parameters for the three values underlined below.

Hint: Create a Param() block with three variables, such as $cpu, $interval, and $max. Then, use those variables in place of the hard-coded values _Total, 2, and 3.

```
Get-Counter -Counter "\Processor(_Total)\% Processor Time" -SampleInterval 2 -
MaxSamples 3
```

Do not run this script now. You will run it in the next task.

▶ Task 5: Execute a script from the shell

- Run the script that you just created. When you do so, pass in the same values that were just replaced by parameters by specifying the parameter names and the corresponding values.

Hint: You need to provide values for the parameters you just added to the script.
If your parameters were $cpu, $interval, and $max, you run the script by using the -cpu, -interval, and -max parameters, passing appropriate values to each.

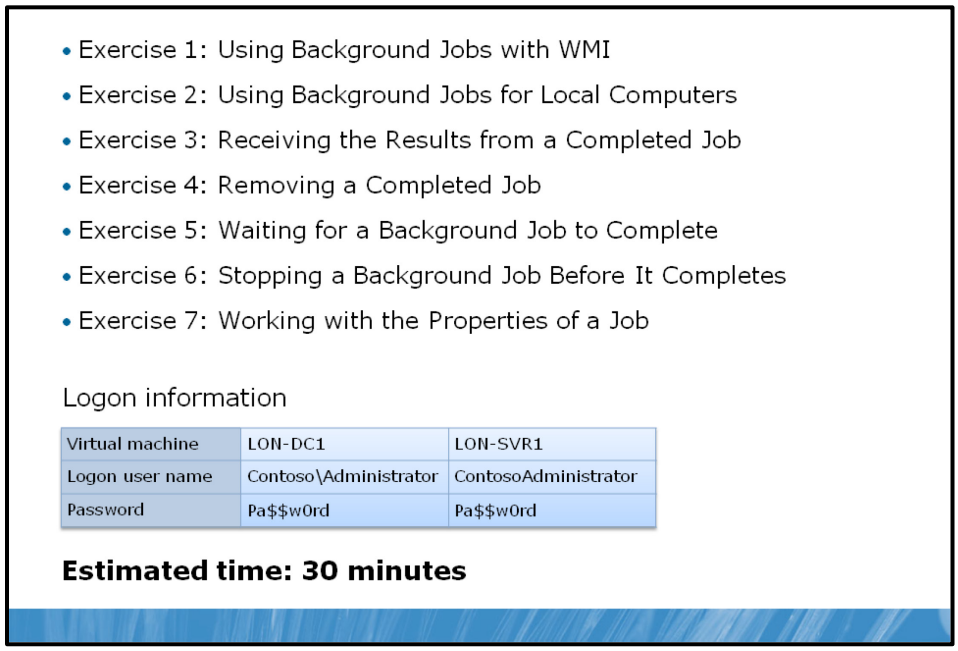
Results: After this exercise, you will have created and run a script that uses named parameters instead of using hardcoded values.

Module 7

Lab Instructions: Background Jobs and Remote Administration

Contents:

Lab A: Working with Background Jobs



Estimated time: 30 minutes

You are a system administrator who has several scripts already developed. Some of the scripts can take anywhere from a few seconds to several minutes to complete. You would waste a lot of productive time if you ran the scripts one-by-one and waited for each to finish. To save time, you are going to use background jobs to run all the scripts synchronously, and be able to control everything from one PowerShell console.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1 Start the **LON-DC1** virtual machine. You do not need to log on, but wait until the boot process is complete.

2 Start the **LON-SVR1** virtual machine and then log on by using the following credentials:

- Username: **CONTOSO\administrator**
- Password: **Pa$$w0rd**

3 Open a Windows PowerShell session as **Administrator**.

Exercise 1: Using Background Jobs with WMI

Scenario

You use WMI to gather a lot of information from servers and would like to use background jobs so you can continue using the console while they are running. The main tasks for this exercise are as follows:

1. Start a background job.
2. Check the status of a background job.
3. Use Windows Management Instrumentation.
4. Retrieve information from remote computers.

Perform these tasks on the LON-SVR1 virtual machine.

▶ Task 1: Start a background job

- Open **Windows PowerShell** and run a background job that simply runs **Get-Process –Name PowerShell**.

▶ Task 2: Check the status of a background job

- Check the status of the background job just started.

▶ Task 3: Use Windows Management Instrumentation

- Use WMI to retrieve the local computer name (use the **Win32_ComputerSystem** class).

▶ Task 4: Retrieve information from remote computers

- Using a background job, run the previous WMI command against LON-DC1 and view the results.

Results: After this exercise, you will have used a background job that uses WMI to retrieve the Win32_ComputerSystem class from LON-DC1 remotely.

Exercise 2: Using Background Jobs for Local Computers

Scenario

You often run commands that take a long time and would like to use background jobs so you can continue using the console while they are running.

The main tasks for this exercise are as follows:

1. Start a background job.
2. Check the status of a background job.
3. Retrieve information from local commands.

▶ Task 1: Start a background job

- Start a background job that retrieves all of the services on the local machine.

▶ Task 2: Check the status of a background job

- Check the status of the background job.

▶ Task 3: Retrieve information from local commands

- Retrieve the results from the background job.

Results: After this exercise, you will have used a background job to retrieve a listing of all the installed services on LON-SVR1.

Exercise 3: Receiving the Results from a Completed Job

Scenario

You often use background jobs to run commands and now would like to view the results of the jobs you have started and are completed.The main tasks for this exercise are as follows:

1. Run a background job.
2. Check the status of a background job.
3. Receive results from a background job and keep the results in memory.
4. Remove the results of a background job from memory.

Perform these tasks on the LON-SVR1 virtual machine.

▶ Task 1: Run a background job

- Start a background job that will retrieve the most recent 100 events from the **Windows Application** event log.

▶ Task 2: Check the status of a background job

- Check the status of the background job just started.

▶ Task 3: Receive the results of a background job and keep the results in memory

- Receive the results of the background job just started and keep the results in memory.

▶ Task 4: Remove the results of a background job from memory

- Receive the results of the background job just started and remove the results from memory.

Results: After this exercise, you will have used a background job to retrieve a listing of the most recent 100 events in the Windows Application event log. You also will have seen how to save and remove the results from memory.

Exercise 4: Removing a Completed Job

Scenario

You often use background jobs to run commands and now would like to remove some of the jobs from memory so the listing of any previously completed jobs is cleared up.The main tasks for this exercise are as follows:

1. Run a background job.
2. Check the status of a background job.
3. Remove a completed job.

Perform these tasks on the LON-SVR1 virtual machine.

▶ Task 1: Run a background job

- Start a background job that will run the **Get-HotFix** cmdlet.

▶ Task 2: Check the status of a background job

- Check the status of the background job just started.

▶ Task 3: Remove a completed job

- Once completed, remove the completed job from memory.

Results: After this exercise, you will have run Get-HotFix as a background job, checked its status, and once completed, will have removed the entire job from memory.

Exercise 5: Waiting for a Background Job to Complete

Scenario

You often use background jobs to run commands and now would like to save some of the results to a text file for future reference. The main tasks for this exercise are as follows:

1. Start a background job.
2. Check the status of a background job.
3. Wait for background job to complete.
4. Copy the results of a background job to a file.

Perform these tasks on the LON-SVR1 virtual machine.

▶ Task 1: Start a background job

- Start a background job that simply runs the **Start-Sleep** cmdlet with a parameter value of **15 seconds**.

▶ Task 2: Check the status of a background job

- Check the status of the background job just started.

▶ Task 3: Wait for a background job to complete

- Run a command that will wait until the background job is completed.

▶ Task 4: Copy the results of a background job to a file

- Copy the results of the background job to a local text file.

Results: After this exercise, you will have run Start-Sleep for 15 seconds, checked its status, and will have run the Wait-Job cmdlet to ensure the job was completed. You will also have copied the results of the background job to a local file.

Exercise 6: Waiting for a Background Job to Complete

Scenario

You often use background jobs to run commands and have noticed that one of your jobs appears to be hung. You would like to stop it to make sure it isn't using any server resources.

The main tasks for this exercise are as follows:

1. Start a background job.
2. Check the status of the background job.
3. Stop a background job that has not yet completed.

Perform these tasks on the LON-SVR1 virtual machine.

▶ Task 1: Start a background job

- Start a background job that runs as an infinite loop.

Hint: The script block for this job will be something like this:
{ while ($true) { Start-Sleep -seconds 1 } }

▶ Task 2: Check the status of the background job

- Check the status of the background job just created.

▶ Task 3: Stop a background job that has not yet completed

- Stop the background job even though it is still running.

Results: After this exercise, you will have run a simple endless command as a background job, checked its status, and will have stopped the background job before it returned a completed status.

Exercise 7: Working with the Properties of a Job

Scenario

You often use background jobs to run commands and would like to display some of the properties of those jobs.

The main tasks for this exercise are as follows:

1. Start a background job.
2. Display a list of background jobs.
3. Use Get-Member to look at the properties of a job.

Perform these tasks on the LON-SVR1 virtual machine.

▶ Task 1: Start a background job

- Start a background job that gets a listing of all the directories and files in **C:\Windows\System32**.

▶ Task 2: Display a list of background jobs

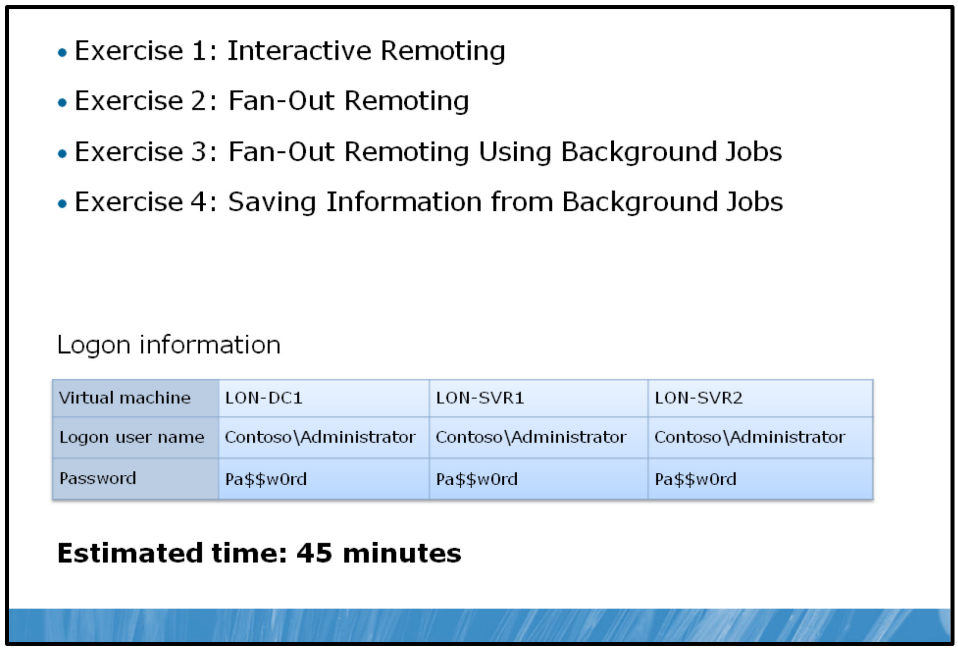
- Display a list of all the background jobs on the system.

▶ Task 3: Use Get-Member to look at the properties of a job

- Use **Get-Member** to look at the properties of the background job just created.

Results: After this exercise, you will have started a background job that retrieves a listing of all the contents of C:\Windows\System32, used Get-Member to view the methods and properties of a background job, and you will have displayed the ChildJobs property of the background job.

Lab B: Using Windows PowerShell Remoting



Estimated time: 45 minutes

You are a system administrator and often need to run commands on remote computers. You could ask each user to run the commands themselves, but you prefer to have control to run the commands yourself. You have heard about being able to run remote commands using WMI, and know that your company also has a desktop management system that may be able to run these commands, but you would rather be in complete control of the commands yourself. Furthermore, your company uses host firewalls and you know that they can cause issues with using WMI. So you've decided to implement PowerShell remoting throughout your organization.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1 Start the **LON-DC1**, **LON-SVR1**, and **LON-SVR2** virtual machines, and then log on by using the following credentials:

- Username: **CONTOSO\administrator**
- Password: **Pa$$w0rd**

2 Open a Windows PowerShell session as **Administrator** on all three virtual machines.

3 Run the following command on all three virtual machines:

- **Enable-PSRemoting –Force**

Exercise 1: Interactive Remoting

Scenario

You often have to work with remote computers and want to open up an interactive remoting session to run commands interactively on other computers.The main tasks for this exercise are carried out on LON-SVR1 and are as follows:

1. Initiate a 1:1 remoting session to a remote computer.
2. Run remote commands interactively.

▶ Task 1: Initiate a 1:1 remoting session to a remote computer

- On LON-SVR1, initiate an interactive remoting session to LON-DC1.

▶ Task 2: Run remote commands interactively

- On LON-SVR1, using the interactive remoting session to LON-DC1, issue the command **Get-HotFix**.

Results: After this exercise, you will have initiated a 1:1 remoting session with LON-DC1 from LON-SVR1 and will have issued Get-HotFix remotely.

Exercise 2: Fan-Out Remoting

Scenario

You often have to check the event logs of remote servers to check for certain events and would like to use PowerShell remoting to ease the process of connecting to remote computers.The main tasks for this exercise are as follows:

1. Invoke a command on multiple computers.
2. Sort and filter objects in the pipeline.

▶ Task 1: Invoke a command on multiple computers

- From LON-SVR1, invoke the command **Get-EventLog –LogName Application –Newest 100** on LON-SVR2 and LON-DC1.

▶ Task 2: Sort and filter objects in the pipeline

- Run the same command again and group the results by the **EventId** property, sort them in descending order by the resulting **Count** property, then select only the first five to display.

Results: After this exercise, you will have invoked a command on LON-DC1 and LON-SVR2 from LON-SVR1 to retrieve a listing of the 100 newest events from the Windows Application event log, and will have grouped and sorted the results to display the top five EventId values that have occurred the most.

Exercise 3: Fan-Out Remoting Using Background Jobs

Scenario

You have an upcoming corporate audit and have to check the system drive of remote servers to check for certain permissions. You would like to use PowerShell remoting to ease the process of connecting to these remote computers. By experience, the auditing process can take a long time per server, so you will also want to start this as a background job so you can continue using your PowerShell console while the job is running. The main tasks for this exercise are as follows:

1. Invoke a command on multiple computers as a background job.
2. Wait for the parent job to complete.
3. Get the ID of all child jobs.
4. Sort and filter objects in the pipeline.

▶ Task 1: Invoke a command on multiple computers as a background job

- From LON-SVR1, invoke the command **"Get-Acl –Path C:\Windows\System32* –Filter *.dll"** on LON-SVR2 and LON-DC1 as a background job.

▶ Task 2: Wait for the parent job to complete

- From LON-SVR1, invoke the cmdlet to wait until the previous background job completes.

▶ Task 3: Get the ID of all child jobs

- From LON-SVR1, get a listing of all the IDs of the child jobs from the previous background job.

▶ Task 4: Sort and filter objects in the pipeline

- Once the job is completed, retrieve the results and filter the output to only display files where the owner name contains *Administrator*.

Hint: Remember, you can use the -like operator and a comparison value such as **Administrator** to search for owner names that contain *Administrator*.

Results: After this exercise, you will have invoked a command on LON-DC1 and LON-SVR2 as a background job from LON-SVR1 to retrieve the ACLs on all the files in C:\Windows\System32 with the extension **.dll*, and will have filtered to display only the files with the owner being the *BUILTIN\Administrators*.

Exercise 4: Saving Information from Background Jobs

Scenario

For that same corporate audit, you need to verify information about % Processor Time PerfMon counters for multiple machines. You need to save information about one computer to a text file. The main tasks for this exercise are as follows:

1 Invoke a command on multiple computers as a background job.

2 Wait for the parent job to complete.

3 Receive the results only from a single child job.

4 Export the results to a file.

▶ Task 1: Invoke a command on multiple computers as a background job

- From LON-SVR1, invoke the command **Get-Counter -Counter "\Processor(_Total)\% Processor Time" -SampleInterval 2 -MaxSamples 3** on LON-SVR2 and LON-DC1 as a background job.

▶ Task 2: Wait for the parent job to complete

- From LON-SVR1, invoke the cmdlet to wait until the previous background job completes.

▶ Task 3: Receive the results only from a single child job

- From LON-SVR1, get the results of the child job that retrieved the results from LON-DC1.

▶ Task 4: Export the results to a file

- From LON-SVR1, use the previous results of the child job that retrieved the results from LON-DC1 and save them to a file.

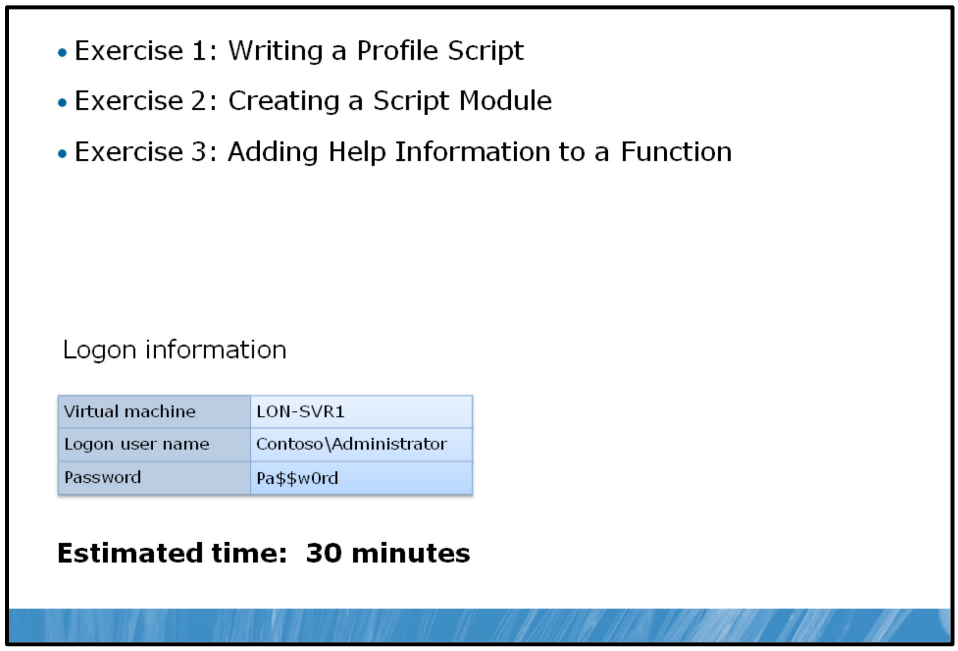
Results: After this exercise, you will have invoked a command on LON-DC1 and LON-SVR2 as a background job from LON-SVR1 to retrieve the total %Processor Time value, waited for the parent job to complete, and will have retrieved the results of the child job that was used for LON-DC1 only by saving the results to a file.

Module 8

Lab Instructions: Advanced Windows PowerShell® Tips and Tricks

Contents:

Lab: Advanced PowerShell Tips and Tricks



Estimated time: 30 minutes

You are a system administrator and have been developing lots of scripts and functions for several months. You want to pass this knowledge easily to your coworkers and also to provide them with good documentation on how to use what you have developed. You have also developed a few custom commands that you want to ensure are always available in your interactive shell. To accomplish this, you will add those commands to a profile script.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1. Start the **LON-SVR1** virtual machine, and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
2. Open a Windows PowerShell session as **Administrator**.

Exercise 1: Writing a Profile Script

Scenario

You have a series of commands you want to run every time you start a new PowerShell console to save time.

The main tasks for this exercise are as follows:

1. Write a profile script.
2. Test a profile script.

▶ Task 1: Write a profile script

- Write a profile script that does the following things:
  a. Sets the current directory to C:.
  b. Loads the Server Manager PowerShell module.
  c. Prompts the user to enter alternate credentials and saves them to a variable.

▶ Task 2: Test a profile script

- Load the previously written profile script into the current session.

Results: After this exercise, you will have written and tested a profile script that sets the current directory, loads the Server Manager module, and creates a variable containing a credential object.

Exercise 2: Creating a Script Module

Scenario

You have some long, one-line commands you often type to get status information on your servers and services. You want to add these often-typed commands into a module so that you can easily transfer them to other computers and easily share them with others. The main tasks for this exercise are as follows:

1. Package a function as a script module.
2. Load a script module.
3. Test the script module.

▶ Task 1: Package a function as a script module

- Create the function **Get-AppEvents** and save it as a module script file name **MyAppEvents.psm1**. The function **Get-AppEvents** has the following code.

```
Funnction Get-AppEvents {
  Get-EventLog –LogName Application –Newest 100 |
    Group-Object -Property InstanceId |
    Sort-Object –Descending -Property Count |
    Select-Object –Property Name,Count -First 5 |
    Format-Table –AutoSize
}
```

Hint: Simply type the preceding code into a new script in the Windows PowerShell ISE. Then save the file as MyAppEvents.psm1. Be sure to save the file in the correct location for modules, in a module folder named MyAppEvents. For example: \Documents\WindowsPowerShell\Modules\MyAppEvents\MyAppEvents.psm1.

▶ Task 2: Load a script module

- Load the script module just created named **MyAppEvents**.

▶ Task 3: Test the script module

- Invoke the function **Get-AppEvents**.

Results: After this exercise, you will have written and tested a script module that runs a long command line that retrieves the five EventId values that have occurred the most often in the latest 100 events in the Windows Application event log.

Exercise 3: Adding Help Information to a Function

Scenario

You have some long, one-line commands that you have added to functions. You want to be able to use the Get-Help cmdlet to get help information from the functions you created to serve as a reminder on how to use them and what information they provide. The main tasks for this exercise are as follows:

1. Add comment-based help to a function.
2. Test comment-based help.
3. Reload a module.

▶ Task 1: Add comment-based help to a function

- Edit the function Get-AppEvents in the MyAppEvents module created in Exercise 1 Task1 to add the following to the function, which will add a DESCRIPTION and EXAMPLE to the help information. For example, add the following:

```
<#
.SYNOPSIS
Get-AppEvents retrieves the newest 100 events from the Application
event log, groups and sorts them by InstanceID and then displays only
top 5 events that have occurred the most.
.DESCRIPTION
See the synopsis section.
.EXAMPLE
To run the function, simply invoke it:
PS> Get-AppEvents
#>
```

▶ Task 2: Test comment-based help

- Test the comment-based help for the Get-AppEvents function with no parameters passed and also with the –Examples switch passed.

Hint: If no help is displayed, or if an error message is displayed, proceed to the next Task.

▶ Task 3: Reload a module

- If the comment-based help is not working, remove and reimport the **MyAppEvents** module. Then test the comment-based help for the **Get-AppEvents** function again.

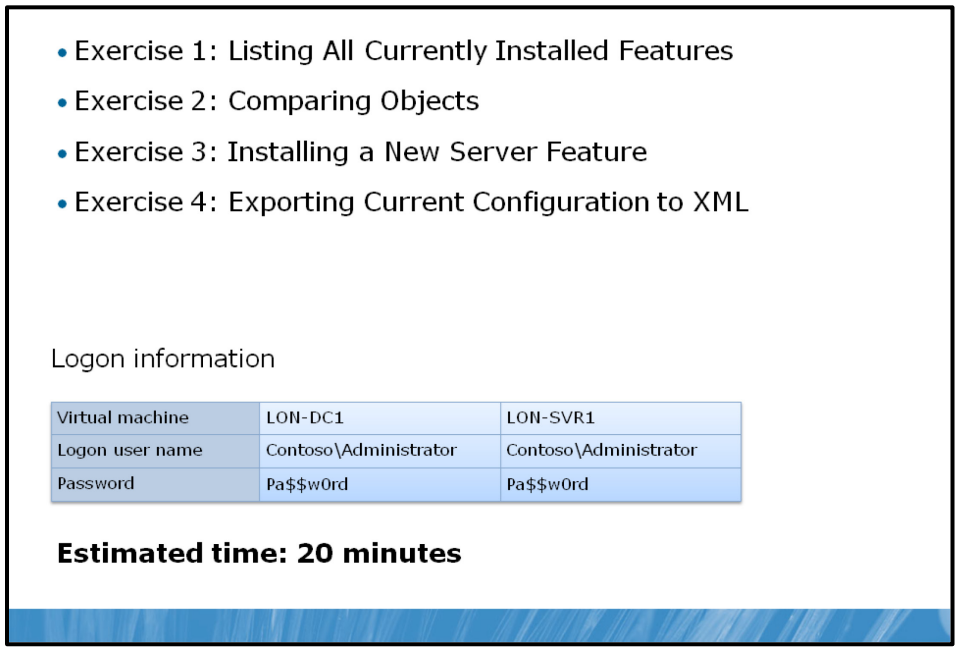
Results: After this exercise, you will have added and tested comment-based help in the function that retrieves the five EventId values that have occurred the most in the latest 100 events in the Windows Application event log.

Module 9

Lab Instructions: Automating Windows Server® 2008 Administration

Contents:

Lab A: Using the Server Manager Cmdlets



Estimate time: 20 minutes

You work as a systems administrator, focusing on servers. You are configuring a new Windows Server 2008 R2 file server. The server must meet a standard configuration, and you must provide an audit trail of the final configuration in the form of an XML file.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1. Start the **LON-DC1** virtual machine and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
2. On LON-DC1, open a Windows PowerShell session as **Administrator**.
3. On LON-DC1, open the **Start** menu. Under the **Administrative Tools** folder, open the **Group Policy Management Console**.
4. In the left pane of the Group Policy Management Console, expand the forest and domain until you see the **Starter GPO** folder. Select the **Starter GPO** folder by clicking on it.
5. In the right pane, click the **Create Starter GPOs** button to create the Starter GPOs.
6. Ensure that Windows PowerShell remoting is enabled on **LON-SVR1** and **LON-SVR2**. If you completed the previous labs in this course and have not shut down and discarded the changes in the virtual machines, remoting will be enabled. If not, open a Windows PowerShell session on those two virtual machines and run **Enable-PSRemoting** on each.
7. In Windows PowerShell, execute the following two commands:
   - **Set-ExecutionPolicy RemoteSigned**

- **E:\Mod09\Labfiles\Lab_09_Setup.ps1**

Note: Some of the Group Policy Objects and DNS entries that this script will modify may already exist in the virtual machine and you may receive and error saying so if you have used the virtual machine during earlier modules and have not discarded those changes.

8. Ensure that the Windows Firewall is disabled on **LON-SVR1**, **LON-DC1**, and **LON-SVR2**.
9. Start the **LON-SVR1** virtual machine, and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
10. Open a Windows PowerShell session as **Administrator**.

Exercise 1: Listing All Currently Installed Features

Scenario

You are configuring a new Windows Server 2008 R2 file server. Other administrators have been using it for testing, so you don't know what state it is in. You want to use the Server Manager cmdlets in Windows PowerShell to discover how the server is currently configured.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows:

1. Import the Windows Server Manager PowerShell module.
2. View the module contents.
3. View all installed server features using Windows PowerShell.

▶ Task 1: Import the Windows Server Manager PowerShell module

1. On LON-SVR1, in Windows PowerShell, view the list of all available modules.
2. Import the **Server Manager** module into your PowerShell session.

▶ Task 2: View the module contents

- View the contents of the ServerManager module.

▶ Task 3: View all installed server features

1 Display the available and installed server features using Windows PowerShell and the Server Manager cmdlets.

2 Display only the server features that have been installed using Windows PowerShell and the Server Manager cmdlets.

Note: The Windows Feature object has a Boolean property called Installed that indicates whether it is installed or not.

Results: After this exercise, you should have successfully loaded the ServerManager PowerShell module, displayed the module contents, and viewed installed and available server features.

Exercise 2: Comparing Objects

Scenario

You need to compare the current configuration against your corporate standard. The standard configuration has been documented using the Export-Clixml cmdlet. You must compare the feature configuration information in this file against the current configuration.

The main tasks for this exercise are carried out on LON-SVR1 and as follows:

1. Import an XML file with standard configuration information.
2. Compare the standard configuration to the current configuration using the Compare-Object cmdlet.

▶ Task 1: Import the XML file

1. Import the **TargetFeatures.xml** file from the **E:\Mod09\Labfiles** folder, which was created with **Export-Clixml** cmdlet, as the variable **$target**.
2. Create a variable that contains the current server feature configuration.

▶ Task 2: Compare the imported features with the current features

- Compare the installed property of the **$target** and **$current** objects using the **Compare-Object** cmdlet. The **$target** variable is the reference object and **$current** is the difference object.

Note: The installed property should be the only thing that is different, but you can include other property names to make the result more meaningful.

Results: After this exercise, you should be able to identify which server features need to be installed and which need to be removed to bring the configuration into compliance.

Exercise 3: Installing a New Server Feature

Scenario

To bring the server configuration into compliance, you need to install the missing server features.

The main task for this exercise is carried out on LON-SVR1 and is as follows:

1 Install the missing Windows Server features.

▶ Task 1: View cmdlet help

- View help and examples for the **Add-WindowsFeature** cmdlet.

▶ Task 2: Install missing features

- To install the missing features based on the comparison you did in Exercise 2, you could simply make a written note of features installed in **$target**, but not installed in **$current**, and manually use **Add-WindowsFeature** to install each one. You can also accomplish this task using Windows PowerShell. Write a pipelined expression to install features that should be installed but are not.

Note: Remember, you can use the –WhatIf common parameter with Add-WindowsFeature so you can preview what the cmdlet would do without actually making any changes.

Results: After this exercise, you should have installed the server features that were installed in the imported configuration but not in the current configuration.

Exercise 4: Exporting Current Configuration to XML

Scenario

To provide an audit trail, you must export the current configuration to an XML file.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows:

1. Verify the current configuration of installed features.
2. Create an XML file with information about the current feature configuration.

▶ Task 1: Verify the current configuration

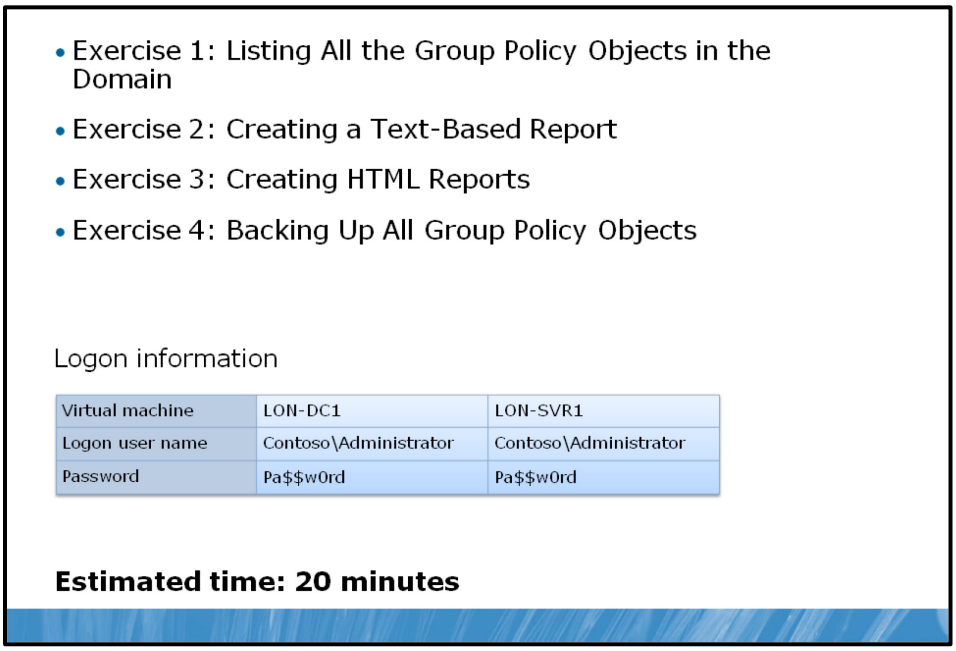
- Using Windows PowerShell, display only the currently installed features, and make sure only the following features are installed: **File-Services**, **FS-FileServer**, **Windows-Internal-DB**, **Backup-Features**, **Backup**, **Backup-Tools**, and **WSRM**.

▶ Task 2: Export configuration to XML

- Get all server features and export to a PowerShell XML file called **LON-SVR1-Features.xml**. Store the file in your documents folder.

Results: After this exercise, you should have created an XML file that contains the current and now standardized, feature configuration.

Lab B: Using the Group Policy Cmdlets



Estimated time: 20 minutes

You are a Windows administrator responsible for managing Group Policy objects in your domain. Your manager has asked for a report of all your Group Policy Objects. You manager also wants to make sure that all Group Policy Objects are being backed up.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1. Start the **LON-SVR1** virtual machine. You do not need to log on, but wait until the boot process is complete.
2. Start the **LON-DC1** virtual machine, and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
3. Open a Windows PowerShell session.

Exercise 1: Listing All Group Policy Objects in the Domain

Scenario

Your manager has asked for a report of all your Group Policy Objects. You will start this process by gathering a list of all the Group Policy Objects in the domain.

The main tasks for this exercise are carried out on LON-DC1 and are as follows:

1. Import the Group Policy PowerShell module.
2. View the module contents.
3. View all Group Policy objects using Windows PowerShell.

▶ Task 1: Import the Group Policy PowerShell module

1. Open Windows PowerShell and view the list of available modules.
2. Import the **Group Policy** module into your PowerShell session.

▶ Task 2: View the module contents

- View the contents of the Group Policy module.

▶ Task 3: View Group Policy objects

- Display all Group Policy objects in the domain using Windows PowerShell.

Results: After this exercise, you should have successfully loaded the GroupPolicy PowerShell module, displayed the module contents, and viewed all Group Policy objects in the domain.

Exercise 2: Creating a Text-Based Report

Scenario

Your manager has asked for some brief, summary reports of the Group Policy objects in your domain in a text file format.

The main tasks for this exercise are as follows:

1. Get selected information from all Group Policy objects in the domain.
2. Create a text file with this information.

▶ Task 1: Get selected Group Policy object properties

- Using Windows PowerShell, get all Group Policy objects for the domain displaying the *GPO* name, when it was created, and when it was last modified. The output should be sorted by the time the GPO was last modified.

Note: Group Policy objects in PowerShell are like any other object in that they have properties. Use Get-Member to discover property names.

▶ Task 2: Create a text file report

- Collect the same information specified in the previous task and save the results to a text file called **GPOSummary.txt** in **\\LON-SVR1\E$\Mod09\Labfiles**.

Results: After this exercise, you should have a text file that displays selected properties about all Group Policy objects in your domain.

Exercise 3: Creating HTML Reports

Scenario

You need to document Group Policy objects for historical and audit purposes. Your manager has also asked for a HTML-formatted report on the default domain policy.

The main tasks for this exercise are as follows:

1. Create an HTML report for the Default Domain policy.
2. Create an individual HTML report for each group policy object.

▶ Task 1: Create a default Domain Policy report

- Using Windows PowerShell, create an HTML report for the default domain policy called **DefaultDomainPolicy.htm** and save it in your documents folder.

▶ Task 2: Create individual GPO reports

- Using a PowerShell expression, create individual HTML reports for each Group Policy object and save them to **\\LON-SVR1\E$\Mod09\Labfiles**. The filename should be in the format GPO *display name*.htm.

Hint: You need to retrieve the GPOs, and then enumerate them by using ForEach-Object. Within the ForEach-Object script block, use a GPO cmdlet that generates a GPO report. That cmdlet identifies the GPOs by using an -id parameter; using $_.id for that parameter value will identify each GPO that you enumerate.

Results: After this exercise, you should have html reports for every Group Policy object in the domain.

Exercise 4: Backing Up All Group Policy Objects

Scenario

For business continuity purposes it is critical that Group Policy objects are properly backed up on a weekly basis. Your manager has asked you to develop a PowerShell solution you can run on a weekly basis to back up all Group Policy objects.

The main task for this exercise is:

1 Back up a Group Policy Object individually and collectively.

▶ Task 1: Back up the Default Domain policy

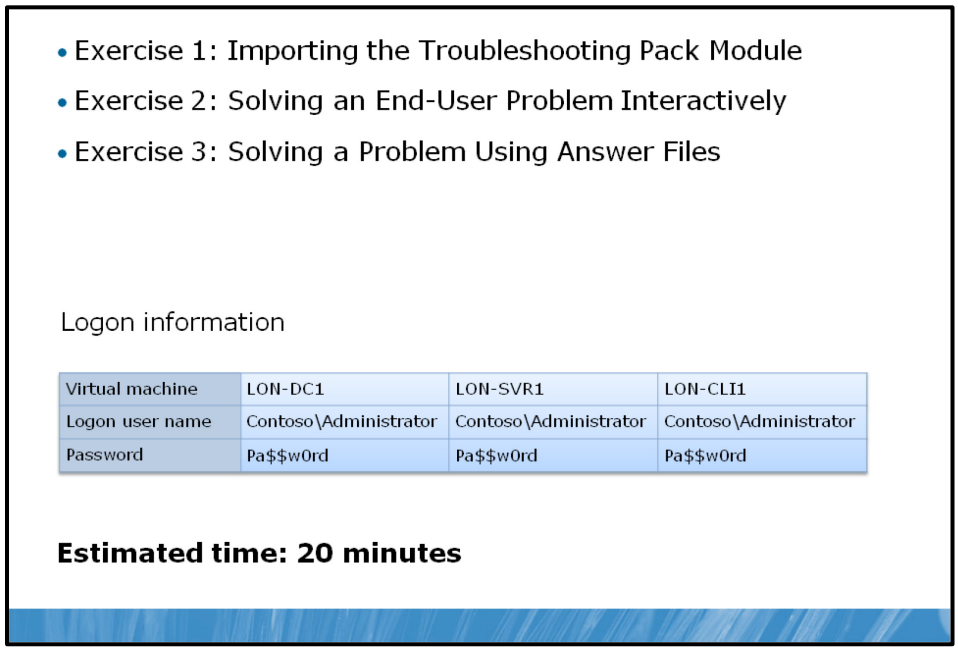
- Using Windows PowerShell, create a local backup of the Default Domain policy to your documents folder.

▶ Task 2: Back up all Group Policy objects

- Using Windows PowerShell, back up all group policy objects in the domain to **\\LON-SVR1\E$\Mod09\Labfiles**. Add the comment *Weekly Backup* to each backup.

Results: After this exercise, you should have backups of every Group Policy object in the domain.

Lab C: Using the Troubleshooting Pack Cmdlets



Estimated time: 20 minutes

You work as a systems technician, troubleshooting problems with individual desktops. The help desk manager has asked for your assistance in troubleshooting a desktop problem. She has heard you can solve problems with Windows PowerShell and has asked for your assistance in learning more.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1 Start the **LON-DC1** and **LON-SVR1** virtual machines. You do not need to log on, but wait until the boot process is complete.

2 Start the **LON-CLI1** virtual machine, and then logon by using the following credentials:

- Username: **CONTOSO\administrator**
- Password: **Pa$$w0rd**

3 Open a Windows PowerShell session on LON-CLI1.

Exercise 1: Importing the Troubleshooting Pack Module

Scenario

Your company has standardized on Windows 7 as the client operating system which includes PowerShell. You need to become familiar with PowerShell-based tools that you can use to troubleshoot and resolve problems.

The main tasks for this exercise are carried out on LON-CLI1 and are as follows:

1. Import the Troubleshooting Pack PowerShell module.
2. View the module contents.

▶ Task 1: Import the Troubleshooting Pack PowerShell module

- On LON-CLI1, import the **Troubleshooting Pack** module into your PowerShell session.

▶ Task 2: View the module contents

- View the contents of the Troubleshooting Pack module.

Results: After this exercise, you will have successfully loaded the Troubleshooting Pack module and know what cmdlets it offers.

Exercise 2: Solving an End-User Problem Interactively

Scenario

Since you have to support Windows 7 clients, you plan to use Windows PowerShell to resolve problems faster and more efficiently. There is an ongoing problem with the Windows Search service. Using the Troubleshooting Pack cmdlets, your job is to find a way to identify this problem and resolve it.

The main tasks for this exercise are:

1. Stop Windows search.
2. Run an interactive troubleshooting session.
3. View the report.

▶ Task 1: Stop Windows search

- To simulate the problem, use Windows PowerShell to stop the Windows Search service if it is running.

▶ Task 2: Run an interactive troubleshooting session

1. Using the Search troubleshooting pack, run a troubleshooting session and save the results to the current directory. When prompted, indicate that *Files don't appear in search results*.
2. When prompted, allow the troubleshooter to fix the problem.

▶ Task 3: View the report

- Using Internet Explorer, view the contents of ResultReport.xml.

Results: After this exercise, you should have successfully run an interactive troubleshooting session in Windows PowerShell and generated a report file.

Exercise 3: Solving a Problem Using Answer Files

Scenario

You have a recurring problem that is relatively easy to resolve once it has been identified. You want to develop an answer file for this problem so that if the suspected problem exists, you can run the file so, the problem can be resolved quickly with minimal intervention on your part.

The main tasks for this exercise are as follows:

1. Create a troubleshooting pack answer file.
2. Use the answer file to resolve a problem.
3. Run a troubleshooting session unattended.

▶ Task 1: Create an answer file

- Create an answer file called **SearchAnswer.xml** in your documents folder for the Search troubleshooting pack. When prompted, answer that *Files Don't Appear in Search Results*. Leave any other questions blank.

▶ Task 2: Invoke troubleshooting using the answer file

1. Using Windows PowerShell, stop the Windows Search service if it is running. This will simulate the problem.
2. Use the answer file you created in Task 1 and invoke the Search troubleshooting pack. Do not fix any problems when prompted.

▶ Task 3: Invoke troubleshooting unattended

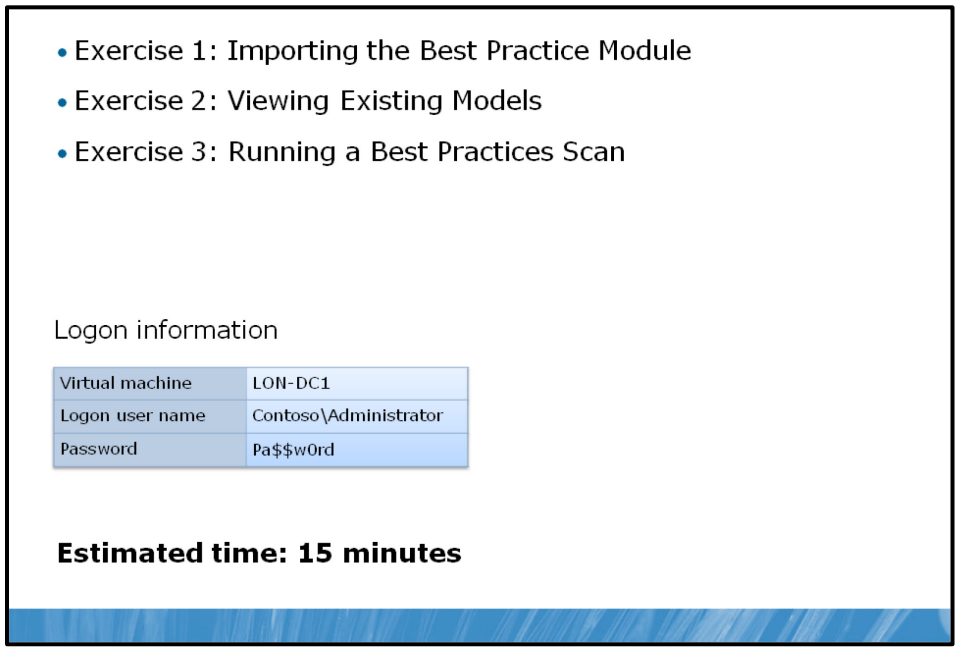
- Using the answer file you created in Task 1, invoke the Search troubleshooting pack in unattended mode.

▶ Task 4: Verify the solution

- Using Windows PowerShell, check the status of the Windows Search service and verify that it is now running.

Results: After this exercise, you should have a troubleshooting answer file which you have used interactively and unattended to troubleshoot and solve a problem.

Lab D: Using the Best Practices Analyzer Cmdlets



Estimated time: 15 minutes

You work as a systems administrator, and you are responsible for a group of servers running Windows Server 2008 R2. As part of your automated audit process, you want to prepare a series of best practice reports depending on what server roles are installed.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1 Start the **LON-DC1** virtual machine, and then log on by using the following credentials:

- Username: **CONTOSO\administrator**
- Password: **Pa$$w0rd**

2 Open a Windows PowerShell session.

Exercise 1: Importing the Best Practices Module

Scenario

As a Windows administrator, it is very important that your systems operate at peak efficiency while remaining secure. As a company policy you closely follow Microsoft recommended best practices. Windows PowerShell has a solution for analyzing your computers and network to see if they meet their recommended best practices. You want to learn more about this.

The main tasks for this exercise are as follows:

1. Import the Best Practices PowerShell module.
2. View the module contents.

▶ Task 1: Import the Best Practices PowerShell module

1. Open Windows PowerShell and view the list of available modules.
2. Import the **Best Practices** module into your PowerShell session.

▶ Task 2: View the module contents

- View the contents of the Best Practices module.

Results: After this exercise, you should have successfully loaded the Best Practices PowerShell module and displayed the module contents.

Exercise 2: Viewing Existing Models

Scenario

In continuing your investigation of how PowerShell can help with analyzing best practices, you need to discover what areas it can scan.

The main task for this exercise is:

1 Display all available best practice models.

▶ Task 1: Display all available best practice models

- In Windows PowerShell, display all the best practice models you can use.

Results: After this exercise, you should be able to identify which areas can be scanned for best practices.

Exercise 3: Running a Best Practices Scan

Scenario

Now that you know what areas you can scan, you decide to discover how well your systems match up to the best practice model.

The main tasks for this exercise are as follows:

1. Run a best practices scan.
2. View the results.
3. Create a best practices scan report.

▶ Task 1: Run a best practices scan

- Using Windows PowerShell, run a best practices scan for Active Directory.

▶ Task 2: View the scan results

- Save the results of the Active Directory scan to a variable called **$results** and view the results.

▶ Task 3: View selected results

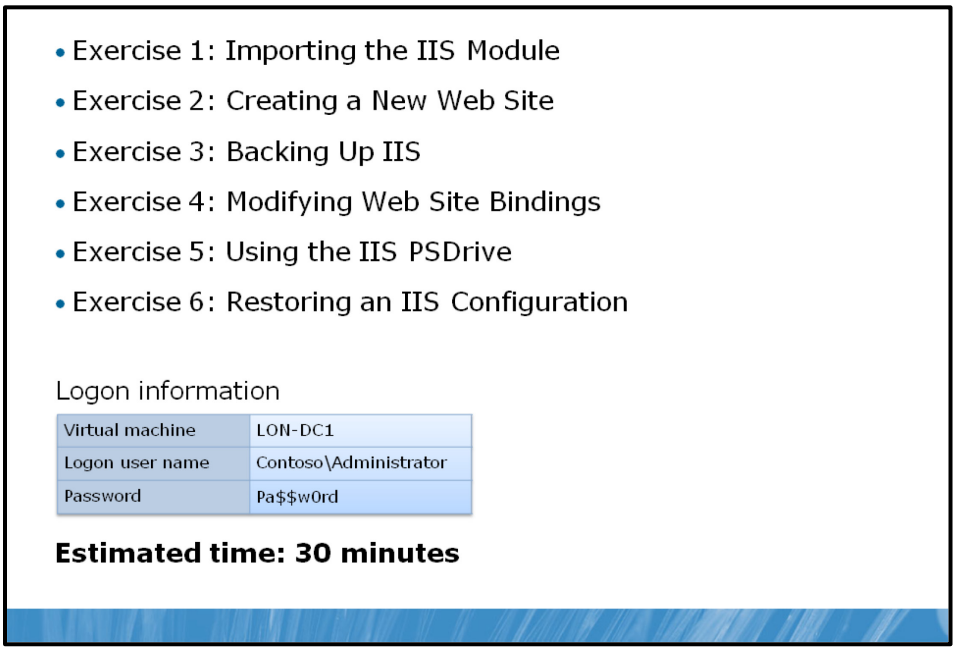
- Each item in a scan result has a **Severity** property. Using Windows PowerShell, display only scan results from your last Active Directory scan that are of the Error type.

▶ Task 4: Create a best practices report

1. Using Windows PowerShell, run a best practices scan for Active Directory and generate an HTML report capturing these properties: **ResultID**, **Severity**, **Category**, **Title**, **Problem**, **Impact**, **Resolution**, and **Compliance**. The report should be sorted by **Severity**. Save the file to your documents folder. Use the CSS file found in your lab folder to provide formatting.
2. Open Windows Internet Explorer® to view the file.

Results: After this exercise, you should have an HTML report that compares your current Active Directory configuration to the Best Practices model.

Lab E: Using the IIS Cmdlets



Estimated time: 30 minutes

You are a Windows Administrator tasked with managing a small Web server used for internal purposes. Your job includes creating and managing Web sites. Because your company charges for internal IT services, you need to automate Web site management so that it can be done in the most efficient manner possible.

Lab Setup

For this lab, you will use the available virtual machine environment. Before you begin the lab, you must:

1 Start the **LON-DC1** virtual machine, and then log on by using the following credentials:

- Username: **CONTOSO\administrator**
- Password: **Pa$$w0rd**

2 Open a Windows PowerShell session.

Exercise 1: Importing the IIS Module

Scenario

Your job includes creating and managing Web sites. Because your company charges back for IT services, you need to automate Web site management so that it can be done in the most efficient manner possible. You have heard that you can manage IIS from Windows PowerShell and want to learn more.

The main tasks for this exercise are as follows:

1. Import the IIS PowerShell module.
2. View the module contents.

▶ Task 1: Import the IIS PowerShell module

1. Open Windows PowerShell and view the list of available modules.
2. Import the IIS management module into your PowerShell session.

▶ Task 2: View the module contents

- View the contents of the IIS module.

Results: After this exercise, you should have successfully loaded the IIS PowerShell module and displayed the module contents.

Exercise 2: Creating a New Web Site

Scenario

You want to test the IIS cmdlets by creating a simple Web site.

The main tasks for this exercise are as follows:

1. Create a simple Web site using the IIS cmdlets.
2. View all web sites.
3. Verify the Web site.

▶ Task 1: Create a new Web site

1. Using the IIS cmdlets, create a new Web site using these settings:
   a. Name: **PowerShellDemo**
   b. Port: **80**
   c. Physical Path: **%SystemDrive%\Inetpub\PowerShellDemo**
2. Copy underconstruction.htm from the lab folder to the root of the new site as **default.htm**.

▶ Task 2: View all Web sites

- Using Windows PowerShell and the IIS cmdlets, view all Web sites running on LON-DC1.

▶ Task 3: Verify the Web site

1. Using Windows PowerShell, stop the Default Web site if it is running.
2. Using Windows PowerShell, start the new PowerShellDemo site.
3. Open the LON-DC1 Web server in Internet Explorer and verify you have reached the new site.

Results: After this exercise, you should be able to open the new Web site in Internet explorer and view the default document.

Exercise 3: Backing Up IIS

Scenario

Before making changes to IIS or Web site configurations, you need to have a backup. You want to use the IIS cmdlets to back up your IIS configuration.

The main tasks for this exercise are as follows:

1. Back up your IIS configuration.
2. Verify the backup.

▶ Task 1: Back up IIS

- Using the IIS cmdlets, back up your IIS configuration with a name of **Backup1**.

▶ Task 2: Verify the backup

- Using the IIS cmdlets, verify the Backup1 backup you just created.

Results: After this exercise, you should have a verified backup of IIS.

Exercise 4: Modifying Web Site Bindings

Scenario

To provide additional security for your internal Web server, you want to change the binding from the default port to a new port.

The main tasks for this exercise are as follows:

1. Display the current binding information for all Web sites.
2. Change the binding information for all sites to a new port.
3. Verify the site bindings have been changed.

▶ Task 1: Display current binding information for all Web sites

- Using the IIS cmdlets, display current binding settings for all Web sites on LON-DC1.

▶ Task 2: Change port binding

- Using Windows PowerShell, change the port binding for all Web sites on LON-DC1 from port **80** to port **8001**. This includes the site using a host header.

▶ Task 3: Verify the new bindings

1. Using Windows PowerShell and the IIS cmdlets, view the new binding information.
2. Using Internet Explorer, connect to the PowerShell Demo site on LON-DC1 using the new binding information.

Results: After this exercise, you should have changed the default binding on all sites to 8001 and verified the change.

Exercise 5: Using the IIS PSDrive

Scenario

Because your Web server includes several sites, you do not want the default site to start automatically. Using the IIS PSDrive, you need to reconfigure the site so that it does not start automatically.

The main tasks for this exercise are as follows:

1. Use the IIS PSDrive to navigate through the site folder.
2. Display current properties for the default site.
3. Modify the default site so that it is not automatically started by the server.

▶ Task 1: Connect to the IIS PSDrive

1. Display all available PSDrives in your PowerShell session.
2. Change your PowerShell location to the root of your IIS PSDrive.

▶ Task 2: Navigate to the default site

- Within the IIS PS Drive, navigate to the folder that represents the Default Site.

▶ Task 3: Display all properties for the default site

- Using Windows PowerShell and the IIS PSDrive, display a list of all properties for the default site.

Tip: Not all properties may be displayed by default.

▶ Task 4: Modify the default site

1. Using Windows PowerShell and the IIS PSDrive, modify the default site so that the site does not start automatically.
2. Change your PowerShell location back to **C:**.

Results: After this exercise, you should have navigated through the IIS PSDrive and modified the Default Web site so that it does not start automatically.

Exercise 6: Restoring an IIS Configuration

Scenario

You realize you don't want to keep the changes you've made so you wish to restore IIS to its previous configuration.

The main tasks for this exercise are:

1. View all available IIS configuration backups.
2. Restore the most current IIS backup.

▶ Task 1: View existing backups

- Using Windows PowerShell and the IIS cmdlets, display all available IIS configuration backups.

▶ Task 2: Restore the most recent configuration

- Using Windows PowerShell and the IIS cmdlets, restore the most recent IIS configuration.

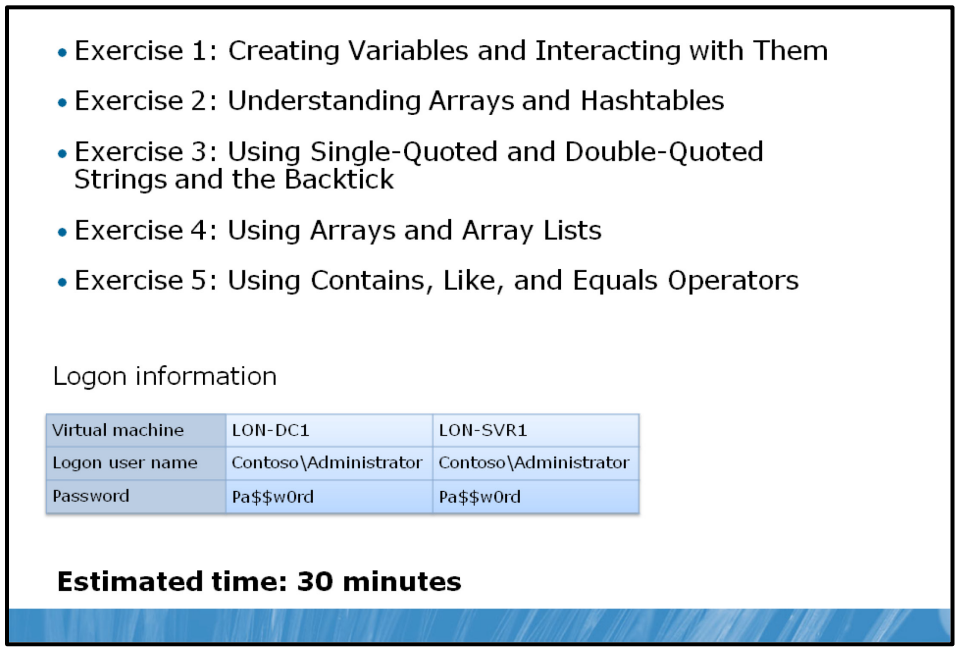
Results: After this exercise, you should have restored IIS back to an earlier configuration with all sites back on port 80. You can ignore any errors about denied access to c:\windows\system32\inetserv\config\scheman\wsmanconfig_schema.xml.

Module 11

Lab Instructions: Writing Your Own Windows PowerShell® Scripts

Contents:

Lab A: Using Variables and Arrays



Estimated time: 30 minutes

You've been using PowerShell interactively for long enough that you're comfortable with the cmdlets you use. Now you want to start automating your environment and you need to create scripts that work on a larger scale. Your developer friend told you about variables, arrays, and hashtables. He also suggested that you need to learn the key looping constructs like for, while, do, etc., so that you can take advantage of them in your automation scripts.

Lab Setup

Before you begin the lab you must:

1. Start the **LON-DC1** and **LON-SVR1** virtual machines and log on with the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
2. On LON-SVR1, open the Windows PowerShell ISE. All PowerShell commands are run within the Windows PowerShell ISE program.

Exercise 1: Creating Variables and Interacting with Them

Scenario

You've been using PowerShell interactively for long enough that you're comfortable with the cmdlets you use. You have noticed that you often repeat the same command when working interactively and would like to learn how to avoid unnecessary repetition. A colleague told you that you can store results in variables so you need to experiment with variables and learn how they work.

The main tasks for this exercise are carried out on LON-SVR1 and are as follows:

1. Create strongly- and weakly-typed variables.
2. View all variables and their values.
3. Assign values to variables from a child scope and learn how scopes affect variables.
4. Remove a variable.

▶ Task 1: Create and work with variables and variable types

1. Create a variable called **myValue** and assign the value of **1** to it.
2. Assign "Hello" to the value of **myValue**. Notice that the variable changed from an integer to a string.
3. Read help documentation and examples for the **Get-Variable** cmdlet.
4. Show all properties for the **myValue** variable using **Get-Variable**.
5. Show the contents of the **myValue** variable using **Get-Variable** with the **ValueOnly** parameter.
6. Redefine the variable **myValue** assigning it as an **[int]** (integer). Assign the value of **1** to it.
7. Try to assign the value of "Hello" to the **myValue** variable. Notice that an error was raised in PowerShell because the variable **myValue** has been typed as an [int].

▶ Task 2: View all variables and their values

- Get a list of all variables and their current values in the current scope by using the **Get-Variable** cmdlet.

▶ Task 3: Remove a variable

1. Read the help documentation and examples for the **Remove-Variable** cmdlet to learn how you can use it to remove variables.
2. Remove the **myValue** variable you created earlier using the **Remove-Variable** cmdlet.

Results: After this exercise, you should be able to create new variables, view variable values and remove variables.

Exercise 2: Understanding Arrays and Hashtables

Scenario

When you are automating tasks in your environment, there are times when you would like to store a collection of objects in a variable and work with that collection. You want to explore how to do this using arrays and hashtables.

The main tasks for this exercise are as follows:

1. Create an array of services.
2. Access individual items and groups of items in an array.
3. Retrieve the count of objects in an array.
4. Create a hashtable of services.
5. Access individual items in a hashtable.
6. Enumerate key and value collections of a hashtable.
7. Remove a value from a hashtable.

▶ Task 1: Create an array of services

1. Read the documentation in **about_Arrays** to understand how arrays work in PowerShell.
2. Create a variable called **services** and assign it to a list of all Windows services.
3. Show the contents of the **services** variable.
4. Show the type of the **services** variable.

▶ Task 2: Access individual items and groups of items in an array

1. Show the first item in the services array.
2. Show the second item in the services array.
3. Show the last item in the services array.
4. Show the first ten items in the services array.

▶ Task 3: Retrieve the count of objects in an array

- Determine how many items are in an array by using the **Count** property.

▶ Task 4: Create a hashtable of services

1. Read the documentation in **about_Hash_Tables** to understand how hashtables work in PowerShell.
2. Create a new, empty hashtable called **serviceTable**.
3. Use the services array to populate the **serviceTable** hashtable using the service name as the key and the service as the value.

Hint: One way to do this is to use the ForEach scripting construct, which you will learn about next. This is different from the ForEach-Object cmdlet. For example, if $services contains your services, and $serviceTable is your empty hashtable:

```
ForEach ($service in $services) {
  $serviceTable[$service.Name] = $service
}
```

This creates a hashtable $serviceTable, where the keys are service names, and the values are the actual service objects. You can access a service by its name.

4. Show the **serviceTable** hashtable contents.

▶ Task 5: Access individual items in a hashtable

1. Show the **BITS** entry in the **serviceTable** hashtable.

Hint: If $serviceTable is your hashtable, $serviceTable['service_name'] accesses the service namedservice_name.

2. Show the **wuauserv** entry in the **serviceTable** hashtable.
3. Use **Get-Member** to show all properties and methods on the **serviceTable** hashtable.
4. Determine how many items are in the **serviceTable** hashtable.

Hint: Hashtables are objects, and one of their properties is Count. If you start with the variable that contains your hashtable, follow it with a period, and follow that with the Count property, you can retrieve the contents of the Count property.

▶ Task 6: Enumerate key and value collections of a hashtable

Hint: Hashtables are objects, and expose properties such as Keys and Values. These properties are *collections,* meaning they contain other objects - such as all the keys in the hastable, or all the values in the hashtable, respectively. Use the Keys and Values properties in the same way you used the Count property earlier.

1. Show all keys in the **serviceTable** hashtable.
2. Show all values in the **serviceTable** hashtable.

▶ Task 7: Remove a value from a hashtable

1. Remove the **BITS** entry from the **serviceTable** hashtable using the appropriate method.

Hint: Hashtables have a Remove() method that can remove items identified by their key. For example, $hash.Remove('Hello') would remove the element having the key "Hllo"from the hashtable in $hash.

2. Show the **BITS** entry in the **serviceTable** hashtable to verify that it was properly removed.

Results: After this exercise, you should be able to create arrays and hashtables, access individual items in arrays and hashtables, and remove items from hashtables.

Exercise 3: Using Single-Quoted and Double-Quoted Strings and the Backtick

Scenario

While automating tasks, you would like to format some of the output using strings. You need to understand how different strings work in PowerShell so that you can create compound strings that contain variable values. Also, while using PowerShell interactively you noticed that there are times when you would like to split a command across multiple lines.

The main tasks for this exercise are as follows:

1. Learn the differences between single-quoted and double-quoted strings.
2. Use a backtick (`) to escape characters in a string.
3. Use a backtick (`) as a line continuance character in a command.

▶ Task 1: Learn the differences between single-quoted and double-quoted strings

1. Create a variable called **myValue** and assign it a value of 'Hello'.
2. Show the value of the following string by entering it into PowerShell: "The value is $myValue". Note how the string variable was expanded in the double-quoted string.
3. Show the value of the following string by entering it into PowerShell: 'The value is not $myValue'. Note how the string variable was not expanded in the single-quoted string.

▶ Task 2: Use a backtick (') to escape characters in a string

1. Show the value of the following string by entering it into PowerShell: "The value is not `$myValue". Make sure you enter the backtick before **$myValue** and note how the string variable was not expanded in the double-quoted string when the $ was escaped with a backtick.
2. List the contents of the C:\Program Files directory.
3. Repeat the last command without using quotation marks by using a backtick to escape the space between *Program* and *Files*.

▶ Task 3: Use a backtick (`) as a line continuance character in a command

- Retrieve the Windows Update service object using **Get-Service**. Place the **Name** parameter on the second line of the command and use a backtick at the end of the first line to indicate that the command spans two lines.

Results: After this exercise, you should be able to create simple and compound strings and use a backtick to split a single command across multiple lines.

Exercise 4: Using Arrays and Array Lists

Scenario

While working with arrays, you noticed that you were not able to easily find items in the array or remove items from the array. You need to learn about Array Lists so that you can manipulate the contents of the collection more easily.

The main tasks for this exercise are as follows:

1. Learn how to extract items from an array.
2. Discover the properties and methods for an array.

▶ Task 1: Learn how to extract items from an array

1. Create a variable called **days** and assign an array of the seven days of the week to that variable, starting with **Sunday**.
2. Show the third item in the **days** array.

▶ Task 2: Discover the properties and methods for an array

1. Pass the **days** array to **Get-Member** to see the properties and methods. Note that the properties and methods that appear are for the items in the **days** array and not for the **days** array itself.
2. Use **Get-Member** with the **InputObject** parameter to show the properties and methods for the **days** array. This technique also shows the properties and methods for the **days** array itself.

Results: After this exercise, you should be able to extract specific items from arrays by index or from array lists by name. You should also be able to discover the properties and methods for an array or array list.

Exercise 5: Using Contains, Like and Equals Operators

Scenario

Sometimes when you are working with your scripts, you find yourself working with collections of items. You need to explore how to find items in those collections that match or partially match a string.

The main tasks for this exercise are as follows:

1. Use contains, like and equals operators to find elements in arrays.
2. Understand the difference when using those operators with strings.

▶ Task 1: Use contains, like and equals operators to find elements in arrays

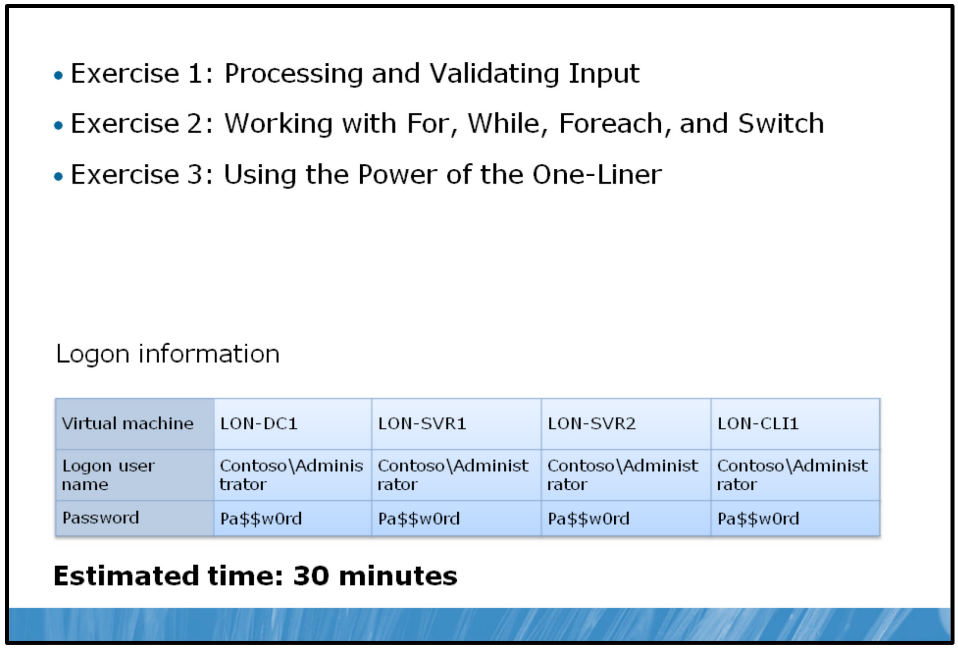
1. Read the **about_Comparison_Operators** documentation that describes the **contains**, **like**, and **equals** operators to understand how they are used in PowerShell.
2. Create a new variable called **colors** and assign an array to it containing the following values: **Red**, **Orange**, **Yellow**, **Green**, **Black**, **Blue**, **Gray**, **Purple**, **Brown**, and **Blue**.
3. Use the **like** operator to show all colors in the colors array that end with **e**.
4. Use the **like** operator to show all colors in the colors array that start with **b**.
5. Use the **like** operator to show all colors in the colors array that contain **a**.
6. Use the **contains** operator to determine if the colors array contains the value **White**.
7. Use the **contains** operator to determine if the colors array contains the value **Green**.
8. Use the **equals** operator to find all values in the colors array that are equal to the value **Blue**.

▶ Task 2: Understand the difference when using those operators with strings

1. Create a new variable called **favoriteColor** and assign the value of **Green** to it.
2. Use the like operator to determine whether the value in **favoriteColor** contains **e**.
3. Use the **contains** operator to determine whether the value in **favoriteColor** contains **e**. Note that this returns false because it treats the **favoriteColor** variable like an array of strings.

Results: After this exercise, you should be able use the contains, like, and equal operators to show partial contents of a collection. You should also understand how these operators function differently, depending on the type of object they are being used with.

Lab B: Using Scripting Constructs



Estimated time: 30 minutes

Some of your junior IT staff could benefit from PowerShell scripts but they don't have the skills yet to write them themselves. You want to create some command-line utilities that allow those staff members to do specific tasks based on their input. As an Active Directory administrator, you need to be able to provision new accounts and make large scale changes very easily. PowerShell looping constructs have become required knowledge for you to get this work done in an efficient manner. You want to be careful with your scripts so that they don't take too long to run in your enterprise and so that they don't use too many system resources.

Before you begin the lab you must:

1. Start the **LON-DC1**, **LON-SVR1**, **LON-SVR2**, and **LON-CLI1** virtual machines. Wait until the boot process is complete.
2. Log on to LON-DC1 with the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
3. Open the Windows PowerShell ISE on LON-DC1. All PowerShell commands are run within the Windows PowerShell ISE program.
4. Disable the firewall on the LON-DC1, LON-SVR1, LON-SVR2, and LON-CLI1 virtual machines.

This is not a security best practice and under no circumstances should this be done in a production environment. This is done in this instance purely to allow us to focus on the learning task at hand and concentrate on PowerShell concepts.

Note: You may choose to complete these exercises in the Windows PowerShell ISE or in the Windows PowerShell console. In the console, you can open a construct using a left brace {, and the shell allows you to press Enter to continue a new line. When you do so, the shell prompt changes to >>, indicating that you are still inside a construct. Continue typing, and when you are done, close the construct with a right brace } and press Enter. You must press Enter one last time on a >> line to tell the shell that you are finished.

Alternately, complete the exercises in the Windows PowerShell ISE, which is better-designed for multiline commands and scripts.

Exercise 1: Processing and Validating Input

Scenario

Some of your junior IT staff could benefit from PowerShell scripts but they don't have the skills yet to write them themselves. You want to create some command-line utilities that allow those staff members to do specific tasks based on their input.

The main tasks for this exercise are as follows:

1. Read input from the end user.
2. Validate input received from the end user.
3. Create a script that prompts for specific input and exits only when the right input is found or when no input is provided.

▶ Task 1: Read input from the end user

1. Read the help documentation and examples for the **Read-Host** cmdlet so that you understand how it is used.
2. Use **Read-Host** to prompt for input, setting the prompt text to *Enter anything you like and press <ENTER> when done*.
3. Create a new variable called **serverName** and assign a value entered at the prompt through **Read-Host**. Use *Server Name* for the prompt text.

▶ Task 2: Validate input received from the end user

1. Read the documentation in **about_if** to understand how **if** statements work.
2. Create an **if** statement that outputs *Server name '$serverName' is REJECTED* if the value of the **serverName** variable does not start with *SERVER* or *Server name '$serverName' is OK!* if the value of the **serverName** variable does start with *SERVER*.

▶ Task 3: Create a script that prompts for specific input and exits only when the right input is found or when no input is provided

1. Read the documentation in **about_do** to understand how the **do...while** statement works.
2. Create a **do...while** statement that clears the screen and then prompts the user for a server name. The prompt text should be '*Server Name (this must start with "SERVER")*'. The loop should terminate when the user either provides a server name that starts with *SERVER* or doesn't provide any input at all and just presses <ENTER>.
3. Output the value of the **serverName** variable in the console.
4. Combine the results of steps 2 and 3 into a script and run it.

Results: After this exercise, you should be able to read and process user input in a PowerShell script.

Exercise 2: Working with For, While, Foreach, and Switch

Scenario

As an Active Directory administrator, you need to be able to provision new accounts and make large-scale changes very easily. PowerShell looping constructs have become required knowledge for you to get this work done in an efficient manner. You'll start with some basic for a while loops, and then move on to using what you've learned for your Active Directory tasks.

The main tasks for this exercise are as follows:

1. Create a basic for loop.
2. Create a basic while loop.
3. Use the for statement to create users in Active Directory.
4. Use foreach to iterate through a collection of objects.
5. Use switch to test a value and translate it to a human-readable string.

▶ Task 1: Create a basic for loop

1. Create a new variable called **i** and assign a value of **100** to that variable.
2. Read the documentation in **about_For** so that you understand how **for** loops work.
3. Create a **for** loop with the following values:

   init: **$i**
   condition: **$i -lt 100**
   repeat: **$i++**
   Inside the **for** loop write the value of **$i** out to the current host using **Write-Host**. Note that the loop does not run and no output is produced.
4. Repeat the last task using an init value of **$i = 0**. Note that the numbers 0 through 99 are output to the host.

▶ Task 2: Create a basic while loop

1. Assign a value of 0 to the **i** variable.
2. Read the documentation in **about_While** so that you understand how **while** loops work.
3. Create a **while** loop with the following condition: **$i -lt 100**. Inside the **while** loop write the value of **$i** out to the current host using **Write**-**Host** and increment the value of **$i**. Note that this loop produces the exact same output as the **for** loop you just ran.

▶ Task 3: Use the for statement to create users in Active Directory

1. Import the Active Directory module into the current session.
2. Read the help documentation and examples for the **New-ADUser** cmdlet so that you understand how it works.
3. Create a new user named **Module11BTest1** in the **CN=Users,DC=contoso,DC=com** container with a SAM account name of **Module11BTest1**. Use the **PassThru** parameter to show the user once they are created.
4. Create a new variable called **numUsers** and assign the value of **10** to that variable.
5. Create a **for** loop to generate 9 more users. The **for** loop counter (**$i**) should be initialized to **2** and the **for** loop should terminate when the counter is equal to the value of the **numUsers** variable. All users should have a name and SAM account name of **Module11BTest$i** and they should be created

in the **CN=Users,DC=contoso,DC=com** container. Use the **PassThru** parameter to show the users once they are created.

6. Remove the test users by retrieving all users whose name starts with **Module11BTest** using **Get-ADUser** and piping them to **Remove-ADUser**.

▶ Task 4: Use foreach to iterate through a collection of objects

1. Read the documentation in **about_foreach** so that you understand how the **foreach** statement works.
2. Retrieve a list of logical disks using **Get-WmiObject** with the **Win32_LogicalDisk** class. Store the results in a new variable called **disks**.
3. Use the **foreach** operator to iterate through the **disks** array. The current item should be stored in a variable called **disk**. Inside the loop use **Select-Object** to output the **DeviceId** and **DriveType** properties for each disk.

▶ Task 5: Use switch to test a value and translate it to a human-readable string

1. Read the documentation in **about_switch** so that you understand how the **switch** statement works.
2. Using the same **foreach** loop you just created, add a **switch** statement to lookup a display name for the **DriveType** property integer value. Store the display name in a variable called **driveTypeValue**. Update the **Select-Object** statement to output the **driveTypeValue** value as a calculated value called **DriveType** instead of the **DriveType** property. The **DriveType** values and their corresponding display names are:

   0: Unknown
   1: No Root Directory
   2: Removable Disk
   3: Local Disk
   4: Network Drive
   5: Compact Disk
   6: RAM Disk

Results: After this exercise, you should be able to use the for, foreach, and switch statements in your PowerShell scripts.

Exercise 3: Using the Power of the One-Liner

Scenario

Now that you can perform large scale optimizations against Active Directory, you want to be careful with your scripts so that they don't take too long to run in your enterprise and so that they don't use too many system resources. At the same time, you also want to prove to yourself how scripting and one-liner commands can be interchangeable.

The main tasks for this exercise are as follows:

1. Create scripts to retrieve and process data.
2. Create one-liners for those scripts that are much more efficient.

▶ Task 1: Create scripts to retrieve and process data

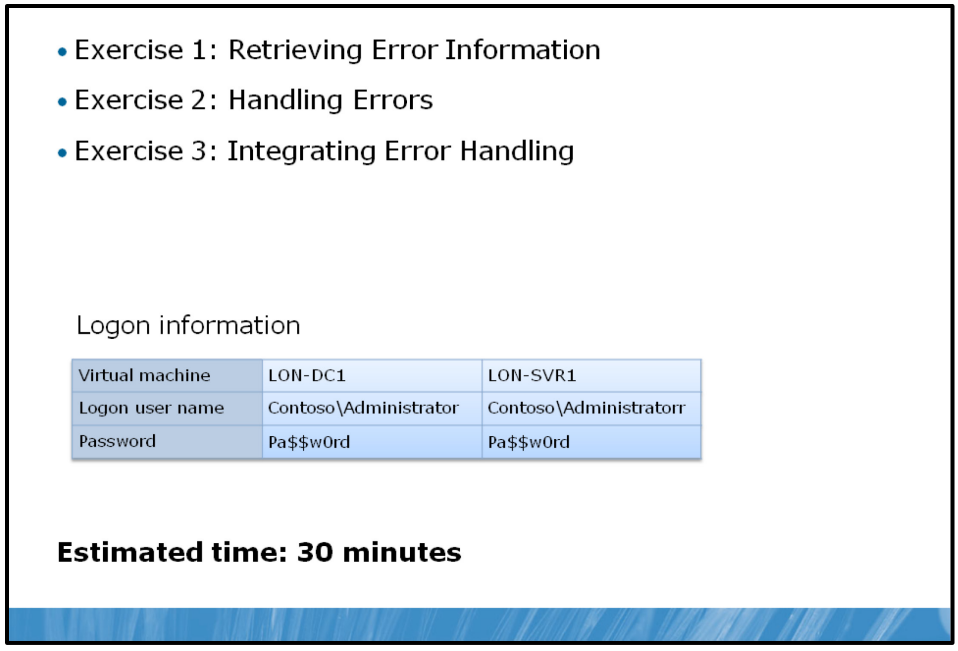
1. Use the **foreach** statement to iterate through a list of the names of all computers in your domain (**LON-DC1**, **LON-SVR1**, **LON-SVR2** and **LON-CLI1**). For each computer, get the **Windows Update** service using **Get-Service**.
2. Use the **foreach** statement to iterate through all Active Directory users. For each user, include the **Office** attribute in the results and show only users that have an Office attribute value of *Bellevue*.

▶ Task 2: Create one-liners for those scripts that are much more efficient

1. Use **Get-Service** to retrieve the Windows Update service from all computers in the domain. Pass an array of computer names directly into the **ComputerNames** parameter.
2. Use **Get-ADUser** to retrieve all Active Directory users whose **Office** attribute has a value of *Bellevue*.

Results: After this exercise, you should understand that many short scripts can be converted into simple one-liner commands that are efficient and require less memory.

Lab C: Error Trapping and Handling



Estimated time: 30 minutes

You are assigned to update a Windows PowerShell script that gathers audit information from machines on your network. All errors must be logged to the Windows Event Log under the Windows PowerShell event log according to company policy. This script is designed to run from the task scheduler, so the event log is the only way that you are notified if the script is not completing its audit as necessary.

Lab Setup

Before you begin the lab you must:

1. Start the **LON-DC1** virtual machines Wait until the boot process is complete.
2. Start the **LON-SVR1** virtual machine and log on with the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
3. On LON-SVR1, open the Windows PowerShell ISE. All PowerShell commands are run within the Windows PowerShell ISE program.
4. In the PowerShell window, type the following command and press ENTER:

```
Set-ExecutionPolicy RemoteSigned –Scope CurrentUser.
```

5. In the PowerShell window, type the following command and press ENTER:

```
Set-Location E:\Mod11\Labfiles
```

Exercise 1: Retrieving Error Information

Scenario

Since your audit scripts need to run unattended, you would like to understand how Windows PowerShell commands respond when they encounter a problem. After seeing how Windows PowerShell acts on encountering an error, you need to find out how to control those errors and identify what problems were encountered. Finally, you want to be able to create your own errors, so you can provide meaningful messages for your environment.

1. Identify the Error Action Preference settings.
2. Control error action in scope.
3. Control error action per command.
4. Review errors globally.
5. Review errors by command.

▶ Task 1: Identify the Error Action Preference settings

1. Examine the **$ErrorActionPreference** variable.
2. Review the help for the preference variables and common parameters.

▶ Task 2: Control nonterminating error action in scope

1. Confirm that **$ErrorActionPreference** is set to **Continue**.
2. Run **ErrorActionPreference.ps1** and set the **FilePath** parameter to **Servers.txt** (the script and the text file are in the E:\Mod11\Labfiles folder).
3. Rerun the **ErrorActionPreference.ps1** script and set the **FilePath** parameter to **DoesNotExist.txt**.
4. Set **$ErrorActionPreference** to its other values and run the script with a **FilePath** of **DoesNotExist.txt** for each value. Note the difference in how the error condition is handled.
5. Close Windows PowerShell.

▶ Task 3: Control error action per command

1. Open **ErrorActionPreference.ps1** (from the E:\Mod11\Labfiles folder) in the Windows PowerShell ISE.
2. Confirm that **$ErrorActionPreference** is set to **Continue**.
3. Use the **-ErrorAction** parameter for **Get-Content** (line 6) to control the error action at the cmdlet. Run the script once with a **FilePath** of **DoesNotExist.txt** for each error action setting.
4. Remove the **-ErrorAction** parameter from line 6 and save the file.

▶ Task 4: Review errors globally

1. Open Windows PowerShell.
2. Confirm that **$ErrorActionPreference** is set to **Continue**.
3. Run **ErrorActionPreference.ps1** and set the **FilePath** parameter to '**ServersWithErrors.txt**' (the text file is in the E:\Mod11\Labfiles folder).
4. Examine the **$error automatic** variable.

Task 5: Review errors by command

1. In the script pane of Windows PowerShell ISE, edit line **12** of the **ErrorActionPreference.ps1** script to include the **-ErrorVariable global:ComputerSystemError**.
2. Run **ErrorActionPreference.ps1** and set the **FilePath** parameter to **ServersWithErrors.txt**.
3. Examine the **ComputerSystemError** variable.
4. Remove the **ComputerSystemError** variable from the global scope.
5. In the script pane of Windows PowerShell ISE, edit line **12** of the **ErrorActionPreference.ps1** script to include the **-ErrorVariable +global:ComputerSystemError**.
6. Run **ErrorActionPreference.ps1** and set the **FilePath** parameter to **ServersWithErrors.txt**.
7. Examine the **ComputerSystemError** variable.
8. Remove the **-ErrorVariable +global:ComputerSystemError** from line **12** and save the script.

Results: After this exercise, you should have identified terminating and nonterminating errors, controlled the Windows PowerShell runtime's Error Action Preference both in scope and by command, examined where error information is available.

Exercise 2: Handling Errors

Now that you have a feel for how errors occur and how to control their output, you need to identify the trouble spots and add some error handling to your scripts. In your experimentation, you notice that there are specific types of errors thrown and you need to identify how to deal with different types of errors.

The main tasks for this exercise are as follows:

1. Handle scoped errors.
2. Handle error prone sections of code.
3. Clean up errors in code.
4. Catch specific types of errors.

▶ Task 1: Handle scoped errors

1. Open the Windows PowerShell ISE and open **UsingTrap.ps1** (from the E:\Mod11\Labfiles folder).
2. Run **UsingTrap.ps1**and set the **FilePath** parameter to **ServersWithErrors.txt** (from the E:\Mod11\Labfiles folder).
3. Modify the **trap** statement to display other information from the various errors.
4. Move the **trap** statement to different spots in the scope of the script (into the function **InventoryServer**, just under the first **if** statement) and see how that impacts the continuation after the error.
5. Remove the **-ErrorAction** parameters from the **Get-WmiObject** commands and run the script. Notice the change in behavior when the errors change from terminating errors to nonterminating errors.

▶ Task 2: Handle error prone sections of code

1. Open **AddingTryCatch.ps1** (from the E:\Mod11\Labfiles folder) in the Windows PowerShell ISE.
2. Change the **if** statement on lines 42 to 45 to be:

```
try {
  if ( $ping.Send("$server").Status -eq 'Success' )
  {
   InventoryServer($server)
  }
}
catch
{
  Write-Error "Unable to ping $server"
  Write-Host "The error is located on line number:
($_.InvocationInfo.ScriptLineNumber)"
  Write-Host "$($_.InvocationInfo.Line.Trim())"
}
```

3. Run the **AddingTryCatch.ps1** and set the **FilePath** parameter to **ServersWithErrors.txt** (from the E:\Mod11\Labfiles folder).

▶ Task 3: Clean up after error prone code

- In the Windows PowerShell ISE, in the **AddingTry.ps1** file, after the closing brace in the **catch** add:

```
finally {
    Write-Host "Finished with $server"
}
```

Question: What type of scenarios would a **finally** block be useful for?

▶ Task 4: Catch specific types of errors

1. In the Windows PowerShell ISE, in the **AddingTry.ps1** file change the **catch** statement from:

```
catch {
```

   to:

```
catch [System.InvalidOperationException] {
```

2. Run **AddingTry.ps1** and set the **FilePath** parameter to **ServersWithErrors.txt**.
3. Open **UsingTrap.ps1** (from the E:\Mod11\Labfiles folder) in the Windows PowerShell ISE.
4. Change the **trap** statement from:

```
trap {
```

   to:

```
trap [System.InvalidOperationException]  {
```

5. Run **UsingTrap.ps1** and set the **FilePath** parameter to **ServersWithErrors.txt**.
6. Save both files and close the Windows PowerShell ISE.

Results: After this exercise, you should have an understanding of how trap and try/catch/finally can catch errors while a script is running. You should also have started to identify potential trouble spots in scripts as areas to focus your error handling efforts.

Exercise 3: Integrating Error Handling

Having gotten comfortable with the error handling mechanisms in PowerShell, you need to incorporate that into your existing scripts. Because company policy dictates that errors are to be logged to the event log, you also need to determine how to write error log entries.

The main tasks for this exercise are as follows:

1. Set up the shell environment.
2. Create new Event Source for the Windows PowerShell Event Log.
3. Write error messages to the Windows PowerShell Event Log.
4. Add a top level Trap function to catch unexpected errors and log them to the event log.
5. Add localized Try/Catch/Finally error handling to potential trouble spots, and log the errors to the event log.

▶ Task 1: Set up the shell environment

1. On the **Start** menu click **All Programs**, click **Accessories**, click **Windows PowerShell**, right-click **Windows PowerShell** and choose **Run As Administrator**.
2. In the PowerShell window, type the following command and press ENTER:

```
Set-ExecutionPolicy 'RemoteSigned' -Scope CurrentUser
```

3. In the PowerShell window, type the following command and press ENTER:

```
Set-Location E:\Mod11\Labfiles
```

▶ Task 2: Create new Event Source for the Windows PowerShell Event Log

1. Start Windows PowerShell as an administrator.
2. Use **New-EventLog** to create an event source called **AuditScript** in the Windows PowerShell event log.

▶ Task 3: Write error messages to the Windows PowerShell Event Log

1. Use **Write-EventLog** to write a new event to the Windows PowerShell event log.
2. Open the event viewer and verify that the event was written to the event log.
3. Close Windows PowerShell.

▶ Task 4: Add a top level Trap function to catch unexpected errors and log them to the event log

1. Open the Windows PowerShell ISE and open **AuditScript.ps1**.
2. Create a **trap** function in the primary scope of the application to catch any unhandled errors and log them to the event log. The script name, type of error, the command generating the error, and the line number where the error occurred should all be logged to the event log.

▶ Task 5: Add localized Try...Catch error handling to potential trouble spots and log the errors to the event log

1. Review the **AuditScript.ps1** file and look for potential trouble spots. Wrap those spots in a **try/catch** or **try/catch/finally** block. Add other PowerShell statements as necessary to make the script hardened to dealing with errors.
2. Run **AuditScript.ps1** with the **FilePath** parameter to **AuditTest0.txt**, then **AuditTest1.txt**, and finally **AuditTest2.txt**.

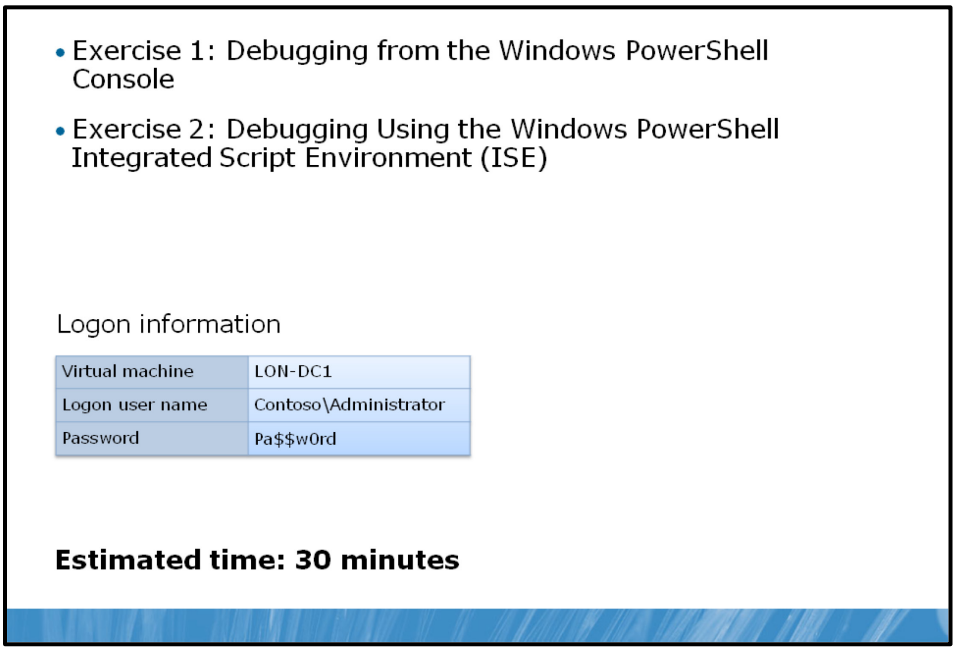
3. Check the event log for and verify that any errors were logged. Also, compare the output files to verify that the outputs are all the same by using the commands that follow:

```
Compare-Object –ReferenceObject (Import-CliXML AuditLog-AuditTest0.txt.xml) –
DifferenceObject (Import-CliXML AuditLog-AuditTest1.txt.xml)

Compare-Object –ReferenceObject (Import-CliXML AuditLog-AuditTest1.txt.xml) –
DifferenceObject (Import-CliXML AuditLog-AuditTest2.txt.xml)

Compare-Object –ReferenceObject (Import-CliXML AuditLog-AuditTest0.txt.xml) –
DifferenceObject (Import-CliXML AuditLog-AuditTest2.txt.xml)
```

4. Close the Windows PowerShell ISE.

Results: After this exercise, you should have created an event source in the Windows PowerShell event log, created a top-level trap to catch unexpected errors and log them, and wrapped potentially error-prone sections of script in a try/catch block.

Lab D: Debugging a Script



Estimated time: 30 minutes

Your manager has provided you with several Windows PowerShell scripts that are not functioning as expected. The first script is EvaluatePingTimes, which loads a log of ping tests run against various machines on your WAN. It categorizes the results based on the expected network latency. However, there is a problem with the totals not matching the number of ping tests performed. The second script is CalculatePerfMonStats, which imports some PerfMon data relating to memory usage on a server and calculates some statistics. For some of the counters, there seems to be a problem with how the numbers are read in, as some math errors are generated.

Lab Setup

For this lab, you use the available virtual machine environment. Before you being the lab, you must:

1. Start the **LON-DC1** virtual machine and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
2. Open a Windows PowerShell session.

Exercise 1: Debugging from the Windows PowerShell Console

Scenario

Since you are responsible for fixing several error prone scripts, you need to experiment with some of the debugging facilities in PowerShell. First, you explore how debugging statements can be written to the console. After that, you can explore how PowerShell allows you to step through the script and interactively explore the current state of variables. Finally, after finding some of your problem areas, you can use the breakpoint features to stop a script at the trouble spots for further investigation.

The main tasks for this exercise are as follows:

1. Use $DebugPreference to enable debugging statements.
2. Use Write-Debug to provide information as the script progresses.
3. Use Set-PSDebug to trace the progress through the script.
4. Use Set-PSBreakpoint to break into a script's progress at specified points.
5. Use Get-PSBreakpoint and Remove-PSBreakpoint to manage breakpoints.
6. Use Set-PSBreakpoint to break into a script if certain conditions are met.

▶ Task 1: Use $DebugPreference to enable debugging statements

1. Run the **EvaluatePingTimes.ps1** script and pass the **PingTestResults.xml** file as the **–Path** parameter and use the **–FirstRun** switch (the script and the xml file are in the E:\Mod11\Labfiles folder).
2. Set the **$DebugPreference** variable to **Continue**.
3. Re-run the **EvaluatePingTimes.ps1** script with the same parameters.

▶ Task 2: Use Write-Debug to provide information as the script progresses

1. Open **CalculatePerfMonStats.ps1** (the script is in the E:\Mod11\Labfiles folder) in Notepad.
2. Add **Write-Debug** statements inside functions, inside loops, and in other areas where variables change or are assigned.
3. In the Windows PowerShell prompt, verify that **$DebugPreference** is set to **Continue**.
4. Run the **CalculatePerfMonStats.ps1** with a **–Path** parameter of **PerfmonData.csv** (which can be found in the E:\Mod11\Labfiles folder.

▶ Task 3: Use Set-PSDebug to trace the progress through the script

1. Set **$DebugPreference** to **SilentlyContinue**.
2. Use **Set-PSDebug** to set the trace level to **1**.
3. Run the **EvaluatePingTimes.ps1** script and pass the **PingTestResults.xml** file as the **–Path** parameter and use the **–FirstRun** switch.
4. Use **Set-PSDebug** to set the trace level to **2** and rerun the **EvaluatePingTimes.ps1** script with the same parameters as before.
5. Use **Set-PSDebug** to step through the script.
6. Turn off script debugging.

▶ Task 4: Use Set-PSBreakpoint to break into a script's progress at specified points

1. Use **Set-PSBreakpoint** to set breakpoints at lines **36**, **40**, **44**, and **48** of **EvaluatePingTimes.ps1**.
2. Run the script and pass the **PingTestResults.xml** file as the **–Path** parameter and use the **–FirstRun** switch.
3. Explore the values in the script at the point in time. (Remember - $_ is the current object in the pipeline or the current object being evaluated in a switch statement!)

Task 5: Use Get-PSBreakpoint and Remove-PSBreakpoint to manage breakpoints

- Remove the breakpoints from lines **36**, **40**, and **48**.

Task 6: Use Set-PSBreakpoint to break into a script if certain conditions are met

1. Remove all the existing breakpoints.
2. Create a breakpoint on line **44** of **EvaluatePingTimes.ps1** and use the **–Action** parameter to check if the **RoundtripTime** property is equal to **35**. If it is, have the script break into a nested prompt. If not, let the script continue.
3. Run the script and pass the **PingTestResults.xml** file as the **–Path** parameter and use the **–FirstRun** switch.
4. Close the Windows PowerShell prompt.

Results: After this exercise, you should have an understanding of how the DebugPreference automatic variable controls debugging messages, know how to step through troublesome scripts and track how things are changing, and set breakpoints in a script to further troubleshoot script performance.

Exercise 2: Debugging Using the Windows PowerShell Integrated Scripting Environment (ISE)

Scenario

Having just finished using the debugging tools from the console, you want to take advantage of the graphical script editor the Windows PowerShell ISE provides. You will use the debugging skills developed in the previous exercise to step through and work with another problem script.

The main tasks for this exercise are as follows:

1. Set breakpoints directly in the script editor.
2. Step through a script using the menu shortcuts or the keyboard.

▶ Task 1: Set a breakpoint

1. In the script editor, set your cursor on line **33**. Use the **Toggle Breakpoint** function from the **Debug** menu to set a breakpoint.
2. Right click on line **25** and choose **Toggle Breakpoint**.
3. Set your cursor on line **44** and use F9 to set a breakpoint.
4. In the command window, use **Get-PSBreakpoint** to examine breakpoints you have set.
5. Remove those breakpoints.

▶ Task 2: Step through the script

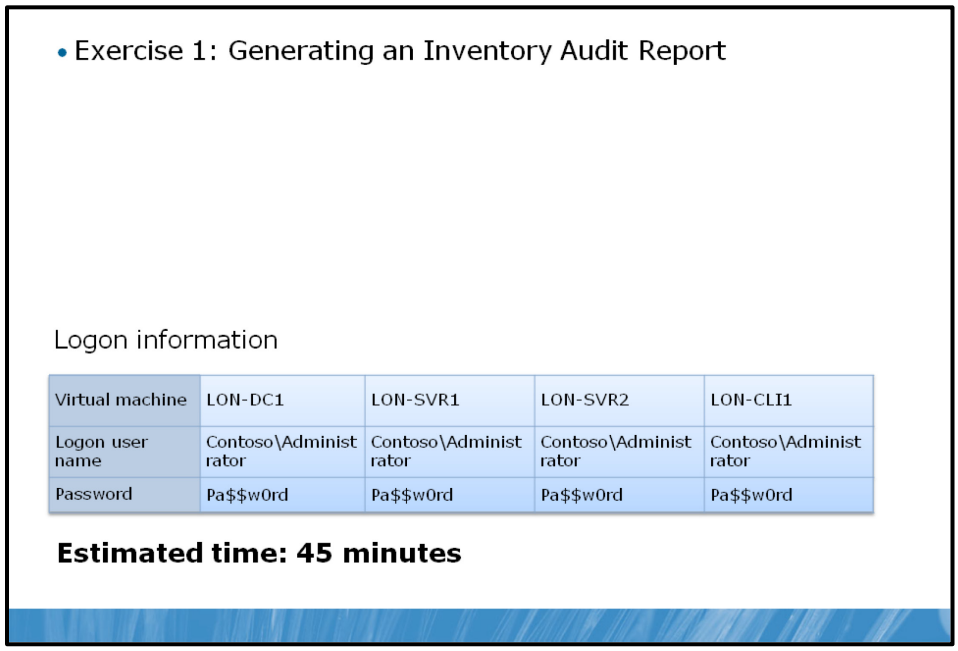
1. Set a breakpoint on the first statement of the **foreach** loop where **CreateStatistics** is called and which breaks in only if **$CounterValue** is **Memory\Pages/sec**.

Hint: Check the help on Set-PSBreakpoint for how to set a breakpoint on a command.

2. From the command window, run the script with the **–Path** parameter set to the **PerfmonData.csv** file (in the E:\Mod11\Labfiles folder).
3. When the script breaks, use F11 or the **Step Into** option off of the **Debug** menu to step into the **CreateStatistics** function. Step into the function one more time.
4. Step over (using the keyboard or the Debug menu) the first line in the **CalculateMedian** function.
5. Step out of the **CalculateMedian** function.
6. Move into the command window and examine the **$Stats** variable.
7. Continue running the script.
8. Close the Windows PowerShell ISE.

Results: After this exercise, you should have used the tooling built in to the Windows PowerShell ISE to debug a script.

Lab E: Modularization



Estimated time: 45 minutes

You now have the knowledge and experience you need to begin crafting some very capable scripts to automate administrative activities. You will use those skills to create two scripts, one for generating an inventory report and anther for testing network performance.

Lab Setup

Before you begin the lab you must:

1. Start the **LON-DC1**, **LON-SVR1**, **LON-SVR2**, and **LON-CLI1** virtual machines. Wait until the boot process is complete.
2. Log on to the **LON-CLI1** virtual machine with the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
3. Open the Windows PowerShell ISE. All PowerShell commands run within the Windows PowerShell ISE program.
4. Create a text file containing the names of all computers in the domain, one on each line, and save it as **C:\users\Administrator\documents\computers.txt**.

Exercise 1: Generating an Inventory Audit Report

Scenario

Your business is conducting an inventory audit and needs to generate a list of configuration information for several servers. This list must include the server's name, BIOS serial number, operating system version, service pack version, and total number of processor cores. This list must be in table format for management, in a CSV file for importation into a configuration database, and in an XML file for archival purposes.

The main tasks for this exercise are as follows:

1. Create a function called Get-Inventory that accepts computer names as pipeline input. This function must loop through each of the computers and use WMI to retrieve the BIOS serial number, operating system version, service pack version, and total number of processor cores. It returns a single object for each computer containing the server name and the properties retrieved from WMI.
2. Pass a list of all server names in your domain to the function and export the results of the function in three formats: .txt, .csv and .xml.

▶ Task 1: Create an inventory gathering function

1. Read the help documentation and examples for the **New-Object** cmdlet so that you understand how it can be used to generate new custom objects.
2. Read the help documentation in **about_function** and the help options listed in here to learn more about functions and how they work.
3. Create a function called **Get-Inventory**. The **Get-Inventory** function should accept computer names from the pipeline. You do not need to declare a parameter for this.
4. In the body of the function create a **PROCESS** script block that iterates through the values piped into the function. Within that script block, retrieve BIOS, operating system and processor information using **Get-WmiObject**. It must then return a new object that contains the computer name, BIOS serial number, operating system version, service pack version and the number of processor cores.
5. Run this command to call your function:

```
'LON-DC1','LON-SVR1','LON-SVR2' | Get-Inventory
```

Hint: You can enter that command as the last line in your script, underneath your function, and then run the script.

▶ Task 2: Export the results of the function in three formats: txt, csv and xml

1. Create a text file called **C:\inventory.txt** by piping the output of your **Get-Inventory** function to the **Out-File** cmdlet.
2. Create a csv file called **C:\inventory.csv** by piping the output of your **Get-Inventory** function to the **Export-Csv** cmdlet.
3. Create an xml file called **C:\inventory.xml** by piping the output of your **Get-Inventory** function to the **Export-Clixml** cmdlet.

Results: After this exercise, you should be able to create a pipeline function that processes information passed in from the pipeline and uses it to retrieve other information. You should also be able to combine multiple objects into one object and export data from a function in multiple formats.

Module 1

Lab Answer Key: Fundamentals for Using Microsoft® Windows PowerShell® v2

Contents:

Lab A: Using Windows PowerShell As an Interactive Command-Line Shell

Before You Begin

1. Start the **LON-DC1** virtual machine.
2. Log on to **LON-DC1** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
3. Open a Windows PowerShell session as **Administrator**. by doing the following:
   a. **Go to Start > All Programs > Accessories > Windows PowerShell**.
   b. Right click **Windows PowerShell** and click **Run as administrator**.
4. In the Windows PowerShell windows execute the following command:

   "These are my notes" | Out-File C:\users\Administrator \Documents\notes.txt

Exercise 1: Searching for Text Files

▶ Task 1: Browse the local file system using familiar command prompt and/or UNIX commands

1. In the PowerShell window, type the following command and press ENTER:

```
cd C:\
```

2. In the PowerShell window, type the following command and press ENTER:

```
dir C:\users
```

3. In the PowerShell window, type the following command and press ENTER:

```
cd users
dir
```

4. In the PowerShell window, type the following command and press ENTER:

```
cd C:\
```

5. In the PowerShell window, type the following command and press ENTER:

```
chdir users
ls
```

6. In the PowerShell window, type the following command and press ENTER:

```
cd \
md test
```

7. In the PowerShell window type the following command and press ENTER:

```
rm test
```

▶ Task 2: View the entire contents of a folder

1. In the PowerShell window, type the following command and press ENTER:

```
dir C:\users\administrator -recurse
```

2. In the PowerShell window, type the following command and press ENTER:

```
dir C:\users\administrator -r
```

▶ Task 3: View a list of all text files in all users' document folders

1. In the PowerShell window, type the following command and press ENTER:

```
dir C:\users\*\documents -recurse -include *.txt
```

2. In the PowerShell window, type the following command and press ENTER:

```
notepad C:\users\administrator\documents\notes.txt
```

Results: After this exercise, you should have successfully navigated the file system, discovered the notes.txt file in the Administrator's user profile folder, and viewed the contents of that file in notepad.

Exercise 2: Browsing the Registry

▶ Task 1: View cmdlet help

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-PSDrive
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-PSDrive -Full | more
```

▶ Task 2: Navigate the registry

1. In the PowerShell window, type the following command and press ENTER:

```
Get-PSDrive
```

2. In the PowerShell window ,type the following command and press ENTER:

```
cd HKLM:
cd Software
cd Microsoft
```

3. In the PowerShell window, type the following command and press ENTER:

```
Get-PSDrive -PSProvider Registry
```

4. In the PowerShell window, type the following command and press ENTER:

```
cd HKCU:
dir
```

▶ Task 3: Create a new PSDrive

1. In the PowerShell window, type the following command and press ENTER:

```
New-PSDrive –Name HKU –PSProvider Registry –Root Registry::HKEY_USERS
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-PSDrive –PSProvider Registry
```

Exercise 3: Discovering Additional Commands and Viewing Help

Task 1: Discover commands using aliases and aliases using commands

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Alias dir
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-Alias –Definition Get-ChildItem
```

Task 2: Learn how to use the help system using Get-Help

1. In the PowerShell window, type the following command and press ENTER:

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

2. In the PowerShell window, type the following command and press ENTER:

```
help Get-Help -Examples
```

3. In the PowerShell window, type the following command and press ENTER:

```
help Get-Help –Full
```

Task 3: Discover new commands with Get-Command

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Command *Service*
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-Command
```

3. In the PowerShell window, type the following command and press ENTER:

```
Get-Command *Service* -CommandType cmdlet
```

4. In the PowerShell window, type the following command and press ENTER:

```
Get-Command –Noun Service
```

Task 4: Get current, online help for a command

- In the PowerShell window, type the following command and press ENTER:

Note: If you receive a blocking message saying this site has been blocked by Internet Explorer Enhanced Security Configuration, you should add the site to your trusted sites in the Secuity tab of Internet Options or just click Add on the blocking dialogue that you receieved.

```
Get-Help Get-Service -Online
```

Results: After this exercise, you should know how to discover commands using aliases or wildcards, how to look up different parts of help information for a command, how to use help information to learn how to use a command, and how to get current help online.

Exercise 4: Adding Additional Commands to Your Session

▶ Task 1: Find all "Module" commands

- In the PowerShell window, type the following command and press ENTER:

```
Get-Command -Noun Module
```

▶ Task 2: List all modules that are available

- In the PowerShell window, type the following command and press ENTER:

```
Get-Module -ListAvailable
```

▶ Task 3: Load the ServerManager module into the current session

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Import-Module
```

2. In the PowerShell window, type the following command and press ENTER:

```
Import-Module ServerManager
```

▶ Task 4: View all commands included in the ServerManager module

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Command -Module ServerManager
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-WindowsFeature
```

Results: After this exercise, you should be able to view and load modules into PowerShell and show what commands they contain.

Exercise 5: Learning How to Format Output

▶ Task 1: View the default table format for a command

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Process w*
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-Process w* | Format-Table
```

▶ Task 2: View the default list and wide formats for a command

1. In the PowerShell window, type the following command and press ENTER:

```
gps w* | Format-List
```

2. In the PowerShell window, type the following command and press ENTER:

```
gps w* | Format-Wide
```

Results: After this exercise, you should be able to show PowerShell output in table, list and wide formats using default views.

Lab Review

1. What is the name of the cmdlet with the alias dir?

   Answer: Get-ChildItem.

2. How many Registry PSDrives are available in PowerShell by default?

   Answer: two; HKLM and HKCU.

3. How many commands are there with the noun Service?

   Answer: eight; Get-Service, New-Service, Restart-Service, Resume-Service, Set-Service, Start-Service, Stop-Service, Suspend-Service.

4. What command do you use to load modules into your current session?

   Answer: Import-Module (or ipmo if you use the alias).

5. How do you format PowerShell output in a list format?

   Answer: You pipe the output to Format-List.

Lab B: Using the Windows PowerShell Pipeline

Before You Begin

1. Start the **LON-DC1** virtual machine. You do not need to log on, but wait until the boot process is complete.
2. Start the **LON-CLI1** virtual machine, and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
3. Open a Windows PowerShell session as **Administrator**. by doing the following:
   a. Go to **Start > All Programs > Accessories > Windows PowerShell**.
   b. Right click **Windows PowerShell** and click on **Run as administrator**.

Exercise 1: Stopping and Restarting a Windows Service

▶ Task 1: View the Windows Update service

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service "Windows Update"
```

▶ Task 2: Determine what would happen if you stopped the service

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service wuauserv | Stop-Service -whatif
```

▶ Task 3: Stop the Windows Update service with confirmation

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service wuauserv | Stop-Service -confirm
```

▶ Task 4: Restart the Windows Update service

- In the PowerShell window, type the following command and press ENTER:

```
gsv wuauserv | Start-Service
```

Results: After this exercise, you should have successfully stopped and restarted the Windows Update service and learned about how the WhatIf and Confirm common parameters can prevent accidental changes.

Exercise 2: Exploring Objects Returned by PowerShell Commands

▶ Task 1: View cmdlet help

- In the PowerShell window, type the following command and press ENTER:

```
help Get-Member -Full
```

▶ Task 2: Get visible members for Service objects

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service | Get-Member
```

Task 3: Get properties for Service objects

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service | Get-Member –MemberType Property
```

Task 4: Get all members for Service objects

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service | Get-Member –Force
```

Task 5: Get base and extended or adapted members for Service objects

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Service | Get-Member –View Base
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-Service | Get-Member –View Adapted,Extended
```

Task 6: Find properties by wildcard search and show them in a table

1. In the PowerShell window, type the following command and press ENTER:

```
dir C:\ -Force
```

2. In the PowerShell window ,type the following command and press ENTER:

```
dir C:\ -Force | Get-Member *Time* -MemberType Property
```

3. In the PowerShell window, type the following command and press ENTER:

```
dir C:\ -Force | Format-Table Name,*Time
```

Results: After this exercise, you should be able to use Get-Member to discover properties and methods on data returned from PowerShell cmdlets and use that information to format tables with specific columns.

Exercise 3: Processing PowerShell Output

Task 1: List all commands that are designed to process output

- In the PowerShell window, type the following command and press ENTER:

```
Get-Command –verb Out
```

Task 2: Show the default output for a command

1. In the PowerShell window, type the following command and press ENTER:

```
help Get-EventLog -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-EventLog System –Newest 100 –EntryType Warning,Error | Out-Default
```

▶ Task 3: Send command output to a file

- In the PowerShell window, type the following command and press ENTER:

```
Get-EventLog System -Newest 100 -EntryType Warning,Error | Out-File
C:\users\Administrator\Documents\RecentIssues.txt
```

▶ Task 4: Send command output to a grid and sort and filter the results

1. In the PowerShell window, type the following command and press ENTER:

```
Get-EventLog System -Newest 100 -EntryType Warning,Error | Out-GridView
```

2. Click on the **InstanceID** column header twice; once to sort in ascending order, then a second time to sort in descending order.
3. Filter the results in the grid to show only one InstanceId.
   a. Click on the **Add criteria** button.
   b. Select the check box beside **InstanceID**.
   c. Click on the **Add** button.
   d. Click on the hyperlink **is less than or equal to operator** and change **operator** to **equals**.
   e. Enter any event ID that you have in your result set in the <Empty> text box.
   f. Click on the **X** in the top right corner of the grid view window to close it.

Results: After this exercise, you should know how to use PowerShell commands to redirect output to files or a grid view, and how to sort and filter data in the grid view.

Lab Review

1. How can you use PowerShell to see what a command will do before you actually do it?

   Answer: Use the -WhatIf common parameter.

2. What are the two most common categories of members on objects and what are they used for?

   Answer: Properties and methods. Properties are used to store information about the object. Methods are used to perform an action using the object.

3. What command is used to show PowerShell data in a grid?

   Answer: Out-GridView.

Module 2

Lab Answer Key: Understanding and Using the Formatting System

Contents:

Lab: Using the Formatting Subsystem

Before You Begin

1. Start the **LON-DC1** virtual machine.
2. Start the **LON-SVR1** virtual machine.
3. Log on to **LON-SVR1 as Contoso\Administrator** with a password of **Pa$$w0rd**.
4. On the **Start** menu of LON-SVR1, click **All Programs** , click **Accessories**, click **Windows PowerShell**, and then click **Windows PowerShell**.

Exercise 1: Displaying Calculated Properties

▶ Task 1: Retrieve a list of processes

- In the Windows PowerShell® window, type the following command and press ENTER:

```
Get-Process
```

▶ Task 2: Display a table of objects

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process|Format-Table
```

▶ Task 3: Select the properties to display

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process|Format-Table –Property CPU,Id,ProcessName
```

▶ Task 4: Use calculated properties to show a custom property

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process|Format-Table –Property CPU,
ID,ProcessName,@{Label="TotalMemory";Expression={$_.WS+$_.VM}}
```

Results: After this exercise, you will have displayed the CPU, ID and ProcessName values of all the running processes and have created a custom property adding the physical and virtual memory using calculated properties.

Exercise 2: Displaying a Limited Number of Columns

▶ Task 1: Retrieve a list of services

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service
```

▶ Task 2: Display a specific number of columns from a collection of objects

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service|Format-Table –Property Status,Name
```

Results: After this exercise, you will have displayed a specific number of columns from all the installed services instead of displaying all their default properties.

Exercise 3: Displaying All Properties and Values of Objects

▶ Task 1: Retrieve a list of processes

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process
```

▶ Task 2: Display every property and value for all the objects

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process|Format-List –Property *
```

Results: After this exercise, you will have displayed all of the properties of all of the running processes instead of displaying only their default properties.

Exercise 4: Viewing Objects via HTML

▶ Task 1: Retrieve a list of event log entries

- In the PowerShell window, type the following command and press ENTER:

```
Get-EventLog –LogName Application –Newest 25
```

▶ Task 2: Convert a list of event log entries to HTML

- In the PowerShell window, type the following command and press ENTER:

```
Get-EventLog –LogName Application –Newest 25|ConvertTo-Html|Out-File –FilePath
"C:\events.html"
```

▶ Task 3: Use a custom title for an HTML page

- In the PowerShell window, type the following command and press ENTER:

```
Get-EventLog –LogName Application –Newest 25|ConvertTo-Html –Title “Last 25
events”|Out-File –FilePath “C:\events.html”
```

▶ Task 4: View an HTML page in the default Web browser

- In the PowerShell window, type the following command and press ENTER:

```
Invoke-Item –Path “C:\events.html”
```

Results: After this exercise, you will have displayed a customized HTML page that contains a listing of the 25 newest events from the Windows Application event log.

Exercise 5: Displaying a Limited Number of Properties

Task 1: Display a list of files from a selected folder

- In the PowerShell window, type the following command and press ENTER:

```
Get-ChildItem –Path “C:\Windows\System32” –Filter “au*.dll”
```

Task 2: Display a table with several different file properties

- In the PowerShell window, type the following command and press ENTER:

```
Get-ChildItem –Path “C:\Windows\System32” –Filter “au*.dll”|Format-Table –Property
Name,Length,Extension
```

Results: After this exercise, you will have displayed a table containing the Name, Length and Extension properties of all the files in C:\Windows\System32 that start with “au” and have the extension “.dll”.

Exercise 6: Displaying Objects Using Different Formatting

Task 1: Retrieve a list of services

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service
```

Task 2: Display a table showing only a few specific properties

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service|Format-Table –Property DisplayName,Status,DependantServices
```

Task 3: Display a table by eliminating any empty spaces between columns

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service|Format-Table –AutoSize –Property DisplayName,Status,DependantServices
```

Results: After this exercise, you will have displayed a table of all the installed services by displaying only the DisplayName, Status, and DependentServices properties, and you will have also removed any empty spaces between each column.

Exercise 7: Displaying a Sorted List of Objects

Task 1: Retrieve a list of services

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service
```

Task 2: Display a table while sorting a specific property

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service|Sort-Object –Property Status|Format-Table
```

Results: After this exercise, you will have displayed a table of the installed services sorted by their Status property.

Lab Review

1. It would be nice to be able to format the color of each row in some cases. Does Format-Table appear to provide the ability to change the color of rows?

   Answer: No, Format-Table doesn't provide the ability to color rows within a table. Write-Host does provide coloring functionality though, but it can't be directly integrated with Format-Table.

2. What might happen if I used Select-Object in the pipeline, after I've used Format-Table (…|format-table <something>|select-object <something>)? Would that work?

   Answer: No, Format-Table is meant to be used at the end of a pipeline. It actually modified the objects before displaying them, so using Select-Object on these modified objects won't work as expected.

Module 3

Lab Answer Key: Core Windows PowerShell® Cmdlets

Contents:

Lab A: Using the Core Cmdlets

Before You Begin

1. Start the **LON-DC1**, **LON-SVR1**, and **LON-SVR2** virtual machines.
2. Log on to **LON-DC1**, **LON-SVR1**, and **LON-SVR2** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
3. Disable the Windows® Firewall for LON-DC1 by carrying out the following steps
   a. Go to **Start** > **Control Panel** > **System and Security** > **Windows Firewall**.
   b. Click **Turn Windows Firewall on or off**.
   c. In the **Domain network location settings** section, click the radio button **Turn off Windows Firewall (not recommended)**.
   d. In the **Home or work (private) network location** settings, click the radio button **Turn off Windows Firewall (not recommended)**.
   e. In the **Public network location** settings, click the radio button **Turn off Windows Firewall (not recommended)**.
   f. Click **OK**.
   g. Repeat steps **a** to **e** for virtual mahcines LON-SVR1 and LON-SVR2.

Note: This is not security best practice and under no circumstances should this be done in a production environment. This is done in this instance purely to allow us to focus on the learning task at hand and concentrate on powershell concepts.

4. On the **Start** menu of LON-SVR1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, click **Windows PowerShell**.

Exercise 1: Sorting and Selecting Objects

▶ Task 1: Retrieve a list of processes

- On LON-SVR1, in the Windows PowerShell® window, type the following command and press ENTER:

```
Get-Process
```

▶ Task 2: Sort a list of processes

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process | Sort-Object
```

▶ Task 3: Select a certain number of processes

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process | Sort-Object | Select-Object –First 5
```

Results: After this exercise, you will have retrieved a list of first five services sorted alphabetically by their service name.

Exercise 2: Retrieving a Number of Objects and Saving to a File

▶ Task 1: Retrieve a list of event logs

- In the PowerShell window, type the following command and press ENTER:

```
Get-EventLog –List
```

▶ Task 2: Retrieve a certain number of events

- In the PowerShell window, type the following command and press ENTER:

```
Get-EventLog –LogName Application –Newest 5
```

▶ Task 3: Export a certain number of events to a file

- In the PowerShell window, type the following command and press ENTER:

```
Get-EventLog –LogName Application –Newest 5 | Export-Csv –Path "C:\Export.csv"
```

Results: After this exercise, you will have exported the five most recent events from the Windows Application event log to a CSV file.

Exercise 3: Comparing Objects Using XML

▶ Task 1: Retrieve a list of services

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service
```

▶ Task 2: Save a list of services to an XML formatted file

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service | Export-Clixml –Path "C:\Export.xml"
```

▶ Task 3: Stop a service

- In the PowerShell window, type the following command and press ENTER:

```
Stop-Service –Name "w32time"
```

▶ Task 4: Compare services with different statuses

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Service | Export-Clixml –Path "C:\Export2.xml"
```

2. In the PowerShell window, type the following command and press ENTER:

```
Compare-Object –ReferenceObject (Import-Clixml –Path "C:\Export.xml") –
DifferenceObject (Import-Clixml –Path "C:\Export2.xml") –Property Name,Status
```

▶ Task 5: Restart a service

- In the PowerShell window, type the following command and press ENTER:

```
Start-Service –Name "w32time"
```

Results: After this exercise, you will have determined that the Status property of two service comparison objects had changed after the Windows time service was modified.The difference between the files is the status of the W32Time service changing from running to stopped.

Exercise 4: Saving Objects to a CSV file

▶ Task 1: Retrieve a list of processes

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process
```

▶ Task 2: Export a list of processes to a file

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process | Export-Csv –Path "C:\Export2.csv"
```

▶ Task 3: Use a non-default separator

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process | Export-Csv –Path "C:\Export3.csv" –Delimiter ";"
```

Results: After this exercise, you will have exported a list of processes to a CSV file using the default separator ",", and the non-default separator ";".

Exercise 5: Measuring a Collection of Objects

▶ Task 1: Retrieve a list of processes

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process
```

▶ Task 2: Measure the average, maximum and minimum of a collection

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process | Measure-Object –Property CPU –Average –Maximum –Minimum
```

Results: After this exercise, you will have measured the average, minimum and maximum values of the CPU property of all the running processes.

Lab Review

1. Can you think of other delimiters you may want to use with Export-Csv?

   Answer: Other examples could be "|" and ":".

2. Is there a difference between saving objects to a variable versus saving them to XML formatted file?

   Answer: One thing XML formatted files are useful for, is being able to actually save the information of objects to disk, and even possibly transferring the information to another system.

3. In terms of objects having properties and methods, if an object is saved to a file, is anything lost?

   Answer: One of the disadvantages of files versus variables is that even when the file is imported, the methods of the original object are basically lost.

Lab B: Filtering and Enumerating Objects in the Pipeline

Before You Begin

1. Start the **LON-DC1** virtual machine.
2. Start the **LON-SVR1** virtual machine.
3. Start the **LON-SVR2** virtual machine.
4. Log on to **LON-SVR1** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
5. On the **Start** menu of LON-SVR1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, click **Windows PowerShell**.

Exercise 1: Comparing Numbers (Integer Objects)

▶ Task 1: Compare using a simple expression

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
3 -gt 5
```

▶ Task 2: Compare using a more complex expression

- In the PowerShell window, type the following command and press ENTER:

```
(3 -lt 4) -and (5 -eq 5)
```

Results: After this exercise, you will have determined that 3 is smaller than 5 by having True returned, and also that the complex expression that compares whether 3 is smaller than 4 and 5 is equal to 5 resolves to True because both sides of the complex expression alone resolve to True.

Exercise 2: Comparing String Objects

▶ Task 1: Compare using a simple expression

- In the PowerShell window, type the following command and press ENTER:

```
"PowerShell" -eq "powershell"
```

▶ Task 2: Compare using a more complex expression

- In the PowerShell window, type the following command and press ENTER:

```
("logfile" -eq "logfiles") -and ("host" -ceq "HOST")
```

Results: After this exercise, you will have determined that *PowerShell* is considered equal to *powershell* using the default comparison operators, and that the complex expression comparing *logfile* to *logfiles* and *host* to *HOST* resolves to False because one side of the complex expression alone resolves to False.

Exercise 3: Retrieving Processes from a Computer

▶ Task 1: Retrieve a list of processes

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process
```

▶ Task 2: Retrieve objects from a remote computer

- In the PowerShell window, type the following command and press ENTER:

```
Get-Process –ComputerName "LON-DC1"
```

Results: After this exercise, you will have retrieved the list of processes running remotely on LON-DC1 from LON-SVR1.

Exercise 4: Retrieving Services from a Computer

▶ Task 1: Retrieve a list of services

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service
```

▶ Task 2: Retrieve objects from a remote computer

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service –ComputerName "LON-DC1"
```

▶ Task 3: Filter a collection of objects

- In the PowerShell window, type the following command and press ENTER:

```
Get-Service –ComputerName "LON-DC1" –Name "w*"
```

Results: After this exercise, you will have retrieved a list of all the installed services that start with the letter "w" on LON-DC1 from LON-SVR1.

Exercise 5: Iterating Through a List of Objects

▶ Task 1: Create a file

- Create a txt file named **C:\Systems.txt** that contains the following text: You can do this from the powershell command line if you are able or you can open Notepad and just enter the below data, each on a single line if you need.
  - **LON-SVR1.contoso.com**
  - **LON-SVR2.contoso.com**
  - **LON-DC1.contoso.com**
  - **LON-CLI1.contoso.com**

▶ Task 2: Import the contents of a file

- In the PowerShell window, type the following command and press ENTER:

```
Get-Content –Path "C:\Systems.txt"
```

▶ Task 3: Iterate through a list of objects

- In the PowerShell window, type the following command and press ENTER:

```
Get-Content –Path "C:\Systems.txt" | ForEach-Object –Process {$_.ToLower()}
```

▶ Task 4: Filter a list of objects

- In the PowerShell window, type the following command and press ENTER:

```
Get-Content –Path "C:\Systems.txt" | Where-Object –FilterScript {$_ -like "*SVR*"}
```

Results: After this exercise, you will have retrieved a list of entries from a file, have changed all the characters to lowercase, and also have filtered the list of entries to return only the ones with the string SVR in the entry name.

Lab Review

1. What if you wanted to filter a list of processes that started with s* and with e*? Would you use Where-Object or –Name?

   Answer: You would use Where-Object like this Get-Process|Where-Object{$_.Name –like "s*" –or $_.Name –like "e*"}. –Name doesn't support regular expressions for a value.

2. When working with remote services, are there any advantages in using the –Name parameter versus using Where-Object?

   Answer: Yes, the advantage of using –Name is that it has an effect similar to filtering. With something like Get-Service –Comp LON-DC1 –Name "a*", only the services that start with *a* are retrieved. If this was done instead Get-Service –Comp LON-DC1|Where-Object{$_.Name –like "a*"}, in this case, all of the services from the remote machine are retrieved and are processed locally as they are passed to Where-Object.

3. What might interfere with doing any kind of query of a remote computer?

   Answer: Network firewalls, and even client side firewalls can interfere with remote queries like Get-Service and Get-Process.

Lab C: Using Pipeline Parameter Bindingsvr

Before You Begin

1. Start the **LON-DC1** virtual machine.
2. Start the **LON-SVR1** virtual machine. You do not need to logon.
3. Start the **LON-SVR2** virtual machine. You do not need to logon.
4. Log on to **LON-DC1** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
5. On the **Start** menu of LON-DC1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, click **Windows PowerShell**.

Exercise 1: Using Advanced Pipeline Features

▶ Task 1: Import the Active Directory module

- On LON-DC1, in the PowerShell window, type the following command and press ENTER:

```
Import-Module –Name ActiveDirectory
```

▶ Task 2: Import a CSV file

- In the PowerShell window, type the following command and press ENTER:

```
Import-Csv –Path "E:\Mod03\Labfiles\Module3_LabC_Exercise1.csv"
```

▶ Task 3: Create users in Active Directory

- In the PowerShell window, type the following command and press ENTER:

```
Import-Csv –Path "E:\Mod03\Labfiles\Module3_LabC_Exercise1.csv" | New-ADUser
```

Results: After this exercise, you will have automated the creation of 50 users in the contoso.com domain.

Exercise 2: Working with Multiple Computers

▶ Task 1: Create a CSV file

- On LON-DC1, at the command prompt of the Windows PowerShell window, create a CSV file named **"C:\Inventory.csv"** that contains the following text:
  - **Type,Name**
  - **AD,LON-DC1**
  - **Server,LON-SVR1**
  - **Server,LON-SVR2**
  - **Client,LON-CLI1**

▶ Task 2: Import a CSV file and filter the results

- In the PowerShell window, type the following command and press ENTER:

```
Import-Csv –Path "C:\Inventory.csv" | Where-Object –FilterScript {$_.Type –eq
"Server"}
```

▶ Task 3: Restart a group of computers

- In the PowerShell window, type the following command and press ENTER:

```
Import-Csv –Path "C:\Inventory.csv "|Where-Object –FilterScript {$_.Type –eq
"Server"} | ForEach-Object –Process {Restart-Computer –ComputerName $_.Name}
```

Note: If someone is logged in to LON-SVR1 and LON-SVR2 you may receive an error message. To overcome the error message successful re-start the virtual machines, log off from them and then re-run the script.

Results: After this exercise, you will have restarted a filtered group of servers.

Exercise 3: Stopping a List of Processes

▶ Task 1: Start two applications

- On LON-DC1, start the **Notepad.exe** and **Wordpad.exe** applications.

▶ Task 2: Create a CSV file

- At the command prompt of the Windows PowerShell window, create a CSV file named **C:\Process.csv** that contains the following text:
  - **Computer,ProcName**
  - **LON-DC1,Notepad**
  - **LON-DC1,Wordpad**

▶ Task 3: Import a CSV file and iterate through a collection of objects

- In the PowerShell window, type the following command and press ENTER:

```
Import-Csv –Path "C:\Process.csv" | Select-Object –Property "ProcName"
```

▶ Task 4: Stop a list of processes

- In the PowerShell window, type the following command and press ENTER:

```
Import-Csv –Path "C:\Process.csv" | Select-Object –Property "ProcName" | ForEach-
Object –Process {Stop-Process –Name $_.ProcName}
```

Results: After this exercise, you will have stopped a list of processes based on values imported from a CSV file.

Exercise 4: Binding Properties to Parameters

▶ Task 1: Import a CSV file

- In the PowerShell window, type the following command and press ENTER:

```
Import-Csv –Path "E:\Mod03\Labfiles\Module3_LabC_Exercise4.csv"
```

▶ Task 2: Create users in Active Directory

- In the PowerShell window, type the following command and press ENTER:

```
Import-Csv –Path "E:\Mod03\Labfiles\Module3_LabC_Exercise4.csv"|Select-Object –
Property @{Name="Name";Expression={$_.EmployeeName}},@{
Name="SamAccountName";Expression={$_.EmployeeName}},@{Name="
City";Expression={$_.Town}},@{ Name="Department";Expression={$_.Unit}},@{Name="
EmployeeNumber";Expression={$_.Id }}|New-ADUser –Company "Contoso"
```

Results: After this exercise, you will have automated the creation of 20 users in the contoso.com domain.

Lab Review

1. Do all cmdlets accept pipeline input like New-ADUser?

   Answer: No, not all cmdlet parameters have been programmed this way. To check whether a parameter accepts pipeline input can be determined by checking Get-Help with the –Full switch.

2. What is an advantage when a cmdlet parameter accepts pipeline input?

   Answer: A definite advantage is the shorter amount of typing required when the input can be read from any kind of input.

3. Before stopping a process, could a check be made to only stop the process if it was using more than a certain amount of physical or virtual memory?

   Answer: Yes, simple using the filter cmdlet Where-Object in the pipeline could easily verify the current memory status. That would be useful in a script that is running regularly to check whether a process is having memory problems, and terminate it once it goes over a certain value.

Module 4

Lab Answer Key: Windows® Management Instrumentation

Contents:

Lab: Using Windows Management Instrumentation in Windows PowerShell

Before You Begin

1. Start the **LON-DC1**, **LON-SVR1**, **LON-SVR2**, and **LON-CLI1** virtual machines.
2. Ensure that the Windows® Firewall on LON-DC1, LON-SVR1, LON-SVR2, and LON-CLI1 machines has been disabled by completing the following steps:
   a. On LON –DC1 go to **Start > Control Panel > System and Security > Windows Firewall**.
   b. Click on **Turn Windows Firewall on or off**.
   c. In the **Domain network location settings** section, click the radio button **Turn off Windows Firewall (not recommended)**.
   d. In the **Home or work (private) network location** settings, click the radio button **Turn off Windows Firewall (not recommended)**.
   e. In the **Public network location** settings, click the radio button **Turn off Windows Firewall(not recommended)**.
   f. Remain logged on to the virtual machine.
   g. Repeat steps **a** to **e** for virtual mahcines LON-SVR1, LON-SVR2 and LON-CLI1.

Note: This is not security best practice and under no circumstances should this be done in a production environment. This is done in this instance purely to allow us to focus on the learning task at hand and concentrate on powershell concepts.

3. Log on to both **LON-CLI1** and **LON-DC1** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
4. On the **Start** menu of LON-CLI1 and LON-DC1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, click **Windows PowerShell** again.
5. On virtual machine LON-CLI1, create a text file containing the names of all computers in the domain, one on each line, and save it as **C:\users\administrator\documents\computers.txt**. You can either do this in the PowerShell command line if you are able or manually. Its contents should look as follows:

   LON-DC1.contoso.com
   LON-SVR1.contoso.com
   LON-SVR2.contoso.com
   LON-CLI1.contoso.com

Exercise 1: Building Computer Inventory

► Task 1: Retrieve the operating system information

1. On LON-CLI1, in the Windows PowerShell® window, type the following command and press ENTER:

```
Get-WmiObject –Class Win32_OperatingSystem
```

2. In the PowerShell window, type the following command and press ENTER:

```
gwmi Win32_OperatingSystem | Format-List *
```

Task 2: Extract version information from the operating system object

1. In the PowerShell window, type the following command and press ENTER:

```
gwmi Win32_OperatingSystem | fl *version*
```

2. In the PowerShell window, type the following command and press ENTER:

```
gwmi Win32_OperatingSystem | Format-Table
__SERVER,Version,ServicePackMajorVersion,ServicePackMinorVersion
```

Note: There are two underscores as a prefix to class SERVER.

Task 3: Retrieve the local operating system information "remotely"

1. In the PowerShell window, type the following command and press ENTER:

```
gwmi Win32_OperatingSystem -ComputerName LON-CLI1 | Format-Table
__SERVER,Version,ServicePackMajorVersion,ServicePackMinorVersion
```

2. In the PowerShell window, type the following command and press ENTER:

```
get-help gwmi -parameter ComputerName
```

Task 4: Retrieve the operating system information for all computers

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Content C:\users\administrator\documents\computers.txt
```

2. In the PowerShell window, type the following command and press ENTER:

```
gwmi Win32_OperatingSystem -ComputerName (gc
C:\users\Administrator\documents\computers.txt) | Format-Table
__SERVER,Version,ServicePackMajorVersion,ServicePackMinorVersion
```

Task 5: Export the operating system information for all computers

1. In the PowerShell window, type the following command and press ENTER:

```
get-help select-object -full
```

2. In the PowerShell window, type the following command and press ENTER:

```
gwmi Win32_OperatingSystem -ComputerName (gc
C:\users\Administrator\documents\computers.txt) | Select-Object
__SERVER,Version,ServicePackMajorVersion,ServicePackMinorVersion
```

3. In the PowerShell window, type the following command and press ENTER:

```
gwmi Win32_OperatingSystem -ComputerName (gc
C:\users\Administrator\documents\computers.txt) | Select-Object
__SERVER,Version,ServicePackMajorVersion,ServicePackMinorVersion | Export-Csv
C:\Inventory.csv
```

▶ Task 6: Retrieve the BIOS information for all computers

- In the PowerShell window, type the following command and press ENTER:

```
gwmi Win32_BIOS -ComputerName (gc C:\users\Administrator\documents\computers.txt)
```

▶ Task 7: Create a custom object for each computer containing all inventory information

1. In the PowerShell window, type the following command and press ENTER:

```
get-help select-object -full
```

2. In the PowerShell window, type the following command and press ENTER:

```
gwmi Win32_OperatingSystem -ComputerName (gc
C:\users\Administrator\documents\computers.txt) | Select-Object
__SERVER,Version,ServicePackMajorVersion,ServicePackMinorVersion,@{name='AssetTag';ex
pression={(gwmi Win32_BIOS -ComputerName $_.__SERVER).SerialNumber}}
```

▶ Task 8: Export the inventory report

- In the PowerShell window, type the following command and press ENTER:

```
gwmi Win32_OperatingSystem -ComputerName (gc
C:\users\Administrator\documents\computers.txt) | Select-Object
__SERVER,Version,ServicePackMajorVersion,ServicePackMinorVersion,@{name='AssetTag';ex
pression={(gwmi Win32_BIOS -ComputerName $_.__SERVER).SerialNumber}} | Export-Csv
C:\Inventory.csv
```

Results: After this exercise, you should have successfully retrieved operating system and BIOS information from all computers in your domain, built custom objects using Select-Object, and generated an inventory report in a .csv file.

Exercise 2: Discovering WMI Classes and Namespaces

▶ Task 1: View WMI classes in the default namespace

1. ON LON-DC1, in the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-WmiObject -Parameter List
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject –List –ComputerName LON-DC1
```

▶ Task 2: Find WMI classes using wildcards

1. In the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject –Class *Printer* -List –ComputerName LON-DC1
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject -Namespace Root -Class *Printer* -List -Recurse -ComputerName LON-DC1
```

▶ Task 3: Enumerate top-level WMI namespaces

1. In the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject –Namespace Root –Class __NAMESPACE –ComputerName LON-DC1
```

Note: There are two underscores as a prefix to class NAMESPACE.

2. In the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject -Namespace Root -Class __NAMESPACE -ComputerName LON-DC1 | Select-
Object -ExpandProperty Name
```

Results: After this exercise, you should be able to find WMI classes in a specific namespace, find WMI classes using a wildcard search, and find WMI namespaces on local or remote computers.

Exercise 3: Generating a Logical Disk Report for all Computers

▶ Task 1: Discover the WMI class used to retrieve logical disk information

- On LON-CLI1, in the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject –class *disk* -list
```

▶ Task 2: Retrieve logical disk information from the local machine

- In the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject Win32_LogicalDisk
```

▶ Task 3: Retrieve logical disk information for hard disks in all computers in your domain

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-WmiObject –Parameter Filter
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject Win32_LogicalDisk -Filter 'DriveType=3' -ComputerName (gc
C:\Users\Administrator\documents\computers.txt)
```

3. In the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject Win32_LogicalDisk -Filter 'DriveType=3' -ComputerName (gc
C:\Users\Administrator\documents\computers.txt) | Format-Table
__SERVER,DeviceID,FreeSpace
```

Note: You may need to change the path and filename of the computers.txt file to correspond with the path and filename used on your computer.

▶ Task 4: Add a calculated PercentFree value to your report

- In the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject Win32_LogicalDisk -Filter 'DriveType=3' -ComputerName (gc
C:\Users\Administrator\documents\computers.txt) | Format-Table
__SERVER,DeviceID,FreeSpace,@{Label='PercentFree';Expression={$_.FreeSpace /
$_.Size};FormatString='{0:#0.00%}'}
```

Note: For more information on the FormatString element and the formatting commands it accepts, see http://go.microsoft.com/fwlink/?LinkId=193576.

▶ Task 5: Discover WMI information related to the logical drives

1. In the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject Win32_LogicalDisk -Filter 'DriveType=3' -ComputerName (gc
C:\Users\Administrator\documents\computers.txt) | Select-Object -First 1
```

2. In the PowerShell window, type the following command and press ENTER:

```
(Get-WmiObject Win32_LogicalDisk -Filter 'DriveType=3' -ComputerName (gc
C:\Users\Administrator\documents\computers.txt) | Select-Object -First
1).GetRelated() | Format-Table __CLASS,__RELPATH
```

Results: After this exercise, you should know how to check logical disk free-space information using WMI, how to add calculated properties to a report, and how to find related WMI information from your WMI data.

Exercise 4: Listing Local Users and Groups

▶ Task 1: Find the WMI classes used to retrieve local users and groups

1. On LON-CLI1, in the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject -List *user*
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject -List *group*
```

▶ Task 2: Generate a local users and groups report

1. In the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject -Class Win32_UserAccount
Get-WmiObject -Class Win32_UserAccount | fl *
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject -Class Win32_Group
Get-WmiObject -Class Win32_Group | fl *
```

3. In the PowerShell window, type the following command and press ENTER:

```
Get-Help ForEach-object -full
```

4. In the PowerShell window, type the following command and press ENTER:

```
gc C:\users\administrator\documents\computers.txt | ForEach-Object {
Get-WmiObject –Class Win32_UserAccount –Computer  $_;
Get-WmiObject –Class Win32_Group –Computer $_
} | Format-Table –Property __CLASS,Domain,Name,SID
```

Results: After this exercise, you should be able to retrieve local user and group account information from local and remote computers and generate a report combining this information into a single table.

Lab Review

1. How do you list WMI classes in a specific namespace?

   Answer: Call Get-WmiObject passing the namespace into the Namespace parameter and using the List switch parameter—for example, Get-WmiObject –Namespace root\default -List.

2. What is the WMI class to retrieve operating system information called?

   Answer: Win32_OperatingSystem.

3. How do you use a server-side filter when using Get-WmiObject?

   Answer: Pass a WMI expression to filter the data to the remote computer you are working with by using the Filter parameter.

Module 5

Lab Answer Key: Automating Active Directory® Administration

Contents:

Lab A: Managing Users and Groups

Before You Begin

1. Start the **LON-DC1** virtual machine.
2. Log on to **LON-DC1** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
3. Disable the Windows® Firewall for LON-DC1 by carrying out the following steps
   a. Go to **Start** > **Control Panel** > **System and Security** > **Windows Firewall**.
   b. Click on **Turn Windows Firewall on or off**.
   c. In the **Domain network location settings** section, click the radio button **Turn off Windows Firewall (not recommended)**.
   d. In the **Home or work (private) network location** settings, click the radio button **Turn off Windows Firewall (not recommended)**.
   e. In the Public network location settings, click the radio button **Turn off Windows Firewall (not recommended)**.

Note: This is not security best practice and under no circumstances should this be done in a production environment. This is done in this instance purely to allow us to focus on the learning task at hand and concentrate on powershell concepts. You can close the Windows Firewall dialogue when finished.

4. On the **Start** menu of LON-DC1, click **All Programs**, click **Accessories**, click **Windows PowerShell**, and then click **Windows PowerShell**. All commands will be run within the Windows PowerShell console.
5. In Windows PowerShell®, execute the following command:

```
Set-ExecutionPolicy RemoteSigned
```

Exercise 1: Retrieving a Filtered List of Users from Active Directory

The main tasks for this exercise are:

1. List all modules installed on the local system.
2. Import the Active Directory module.
3. List all commands in the Active Directory module.
4. Retrieve all users matching a specific city and title by using server-side filtering.

▶ Task 1: List all modules installed on the local system

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-Module -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-Module –ListAvailable
```

▶ Task 2: Import the Active Directory module and populate the Active Directory environment

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Import-Module -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Import-Module ActiveDirectory
```

3. In the PowerShell window, type the following command and press ENTER:

```
E:\Mod05\Labfiles\Lab_05_Setup.ps1
```

▶ Task 3: List all commands in the Active Directory module

- In the PowerShell window, type the following command and press ENTER:

```
Get-Command -Module ActiveDirectory
```

▶ Task 4: Retrieve all users matching a specific city and title by using server-side filtering

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-ADUser -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-ADUser
```

3. When you are prompted to enter a value for the **Filter** parameter, type the following and click **OK**:

```
!?
```

4. After reviewing the help documentation for the **Filter** parameter, type the following and press ENTER:

```
office -eq "Bellevue"
```

5. In the PowerShell window, type the following command and press ENTER:

```
Get-ADUser -Filter 'office -eq "Bellevue"'
```

6. In the PowerShell window, type the following command and press ENTER:

```
Get-ADUser -Filter '(office -eq "Bellevue") -and (title -eq "PowerShell Scripter")'
```

Results: After this exercise you should have successfully imported the Active Directory module into PowerShell and used it to retrieve a filtered list of users from Active Directory.

Exercise 2: Resetting User Passwords and Address Information

▶ Task 1: Retrieve a list of remote users

- In the PowerShell window, type the following command and press ENTER:

```
Get-ADUser -Filter 'office -ne "Bellevue"'
```

▶ Task 2: Reset remote user passwords to a specific password

1. In the PowerShell window, type the following command and press ENTER after each line:

```
Get-Help Read-Host -Full
Get-Help Set-ADAccountPassword -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-ADUser -Filter 'office -ne "Bellevue"' | Set-ADAccountPassword -Reset -
NewPassword (Read-Host -AsSecureString 'New password')
```

3. When prompted enter the password **Pa$$w0rd** and press ENTER:

```
Pa$$w0rd
```

▶ Task 3: Change remote user address information to your local Bellevue, Washington office

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-ADUser -Parameter Properties
```

2. In the PowerShell window type the following command and press ENTER:

```
Get-ADUser -Filter 'office -ne "Bellevue"' -Properties
Office,StreetAddress,City,State,Country,PostalCode | Format-Table
SamAccountName,Office,StreetAddress,City,State,Country,PostalCode
```

3. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Set-ADUser -Full
```

4. In the PowerShell window, type the following command and press ENTER:

```
Get-ADUser -Filter 'office -ne "Bellevue"' -Properties
Office,StreetAddress,City,State,Country,PostalCode | Set-ADUser -Office Bellevue -
StreetAddress '2345 Main St.' -City Bellevue -State WA -Country US -PostalCode
'95102'
```

Results: After this exercise, you should be able to reset passwords and modify attributes for a filtered list of Active Directory users.

Exercise 3: Disabling Users That Belong to a Specific Group

▶ Task 1: Retrieve a list of all Active Directory groups

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-ADGroup -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-ADGroup -Filter *
```

▶ Task 2: Retrieve a specific Active Directory group named "CleanUp"

- In the PowerShell window, type the following command and press ENTER:

```
Get-ADGroup -Identity CleanUp
```

Task 3: Retrieve a list of members in the Active Directory group named "CleanUp"

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-ADGroupMember -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-ADGroup -Identity CleanUp | Get-ADGroupMember
```

Task 4: Disable the members of the Active Directory group named "CleanUp"

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Disable-ADAccount -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-ADGroup -Identity CleanUp | Get-ADGroupMember | Disable-ADAccount -WhatIf
```

3. In the PowerShell window, type the following command and press ENTER:

```
Get-ADGroup -Identity CleanUp | Get-ADGroupMember | Disable-ADAccount
```

Results: After this exercise, you should know how to retrieve groups from Active Directory, view their membership, and disable user accounts.

Lab Review

1. Which common Active Directory cmdlet parameter is used to limit search results to matches based on attributes?

   Answer: -filter.

2. Which common Active Directory cmdlet parameter is used to specify the attributes that you want in your query results?

   Answer: Properties.

3. How do you add the Active Directory functionality to your PowerShell session?

   Answer: ipmo ActiveDirectory

Lab B: Managing Computers and Other Directory Objects

Before You Begin

1. Start the **LON-DC1** virtual machine.
2. Ensure that the Windows Firewall on LON-DC1 has been disabled.
3. Log on to **LON-DC1** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
4. On the **Start** menu of LON-DC1, click **All Programs**, click **Accessories**, click **Windows PowerShell**, and then click **Windows PowerShell**. All commands will be run within the Windows PowerShell console.

Exercise 1: Listing All Computers That Appear to Be Running a Specific Operating System According to Active Directory Information

▶ Task 1: Import the Active Directory module

- In the PowerShell window, type the following command and press ENTER:

```
import-Module ActiveDirectory
```

▶ Task 2: List all of the properties for one AD computer object

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-ADComputer -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-ADComputer -Filter * -Properties * -ResultSetSize 1 | fl *
```

▶ Task 3: Find any properties containing operating system information on an AD computer

- In the PowerShell window, type the following command and press ENTER:

```
Get-ADComputer -Filter * -Properties * -ResultSetSize 1 | fl *operatingsystem*
```

▶ Task 4: Retrieve all computers running a specific operating system

1. In the PowerShell window, type the following command and press ENTER:

```
Get-ADComputer -Filter 'OperatingSystem -like "Windows Server 2008 R2*"'
```

Note: In some installations, the previous solution might not work, and might result in an error message regarding extended attributes. If that occurs, use the alternate solution provided next.

2. In the PowerShell window, type the following command and press ENTER:

```
Get-ADComputer -Filter 'OperatingSystem -like "Windows Server 2008 R2*"' -Properties
OperatingSystem
```

Results: After this exercise you should be able to retrieve AD computers that match specific criteria and indicate which properties you want to retrieve for those computers.

Exercise 2: Creating a Report Showing All Windows Server 2008 R2 Servers

▶ Task 1: Retrieve all computers running Windows Server 2008 R2

- In the PowerShell window, type the following command and press ENTER:

```
Get-ADComputer -Filter 'OperatingSystem -like "Windows Server 2008 R2*"' -Properties
OperatingSystem,OperatingSystemHotfix,OperatingSystemServicePack,OperatingSystemVersi
on
```

▶ Task 2: Generate an HTML report showing only the computer name, SID, and operating system details

1. In the PowerShell window, type the following commands and press ENTER at the end of each line:

```
Get-Help ConvertTo-Html –Full
Get-Help Out-File -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-ADComputer -Filter 'OperatingSystem -like "Windows Server 2008 R2*"' -Properties
OperatingSystem,OperatingSystemHotfix,OperatingSystemServicePack,OperatingSystemVersi
on | ConvertTo-Html -Property Name,SID,OperatingSystem* -Fragment
```

3. In the PowerShell window, type the following command and press ENTER:

```
Get-ADComputer -Filter 'OperatingSystem -like "Windows Server 2008 R2*"' -Properties
OperatingSystem,OperatingSystemHotfix,OperatingSystemServicePack,OperatingSystemVersi
on | ConvertTo-Html -Property Name,SID,OperatingSystem* | Out-File C:\OSList.htm
```

4. In the PowerShell window, type the following command and press ENTER:

```
C:\OSlist.htm
```

▶ Task 3: Generate a CSV file showing only the computer name, SID, and operating system details

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Export-Csv -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-ADComputer -Filter 'OperatingSystem -like "Windows Server 2008 R2*"' -Properties
OperatingSystem,OperatingSystemHotfix,OperatingSystemServicePack,OperatingSystemVersi
on | Select-Object Name,SID,OperatingSystem*
```

3. In the PowerShell window, type the following command and press ENTER:

```
Get-ADComputer -Filter 'OperatingSystem -like "Windows Server 2008 R2*"' -Properties
OperatingSystem,OperatingSystemHotfix,OperatingSystemServicePack,OperatingSystemVersi
on | Select-Object Name,SID,OperatingSystem* | Export-Csv C:\OSList.csv
```

4. In the PowerShell window, type the following command and press ENTER:

```
notepad C:\OSList.csv
```

Results: After this exercise, you should be able to generate HTML and CSV documents containing information that you retrieved by using PowerShell commands.

Exercise 3: Discovering Any Organizational Units That Aren't Protected Against Accidental Deletion

▶ Task 1: Retrieve all organizational units

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-ADOrganizationalUnit -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-ADOrganizationalUnit -Filter * -Properties ProtectedFromAccidentalDeletion
```

▶ Task 2: Retrieve organizational units that are not protected against accidental deletion

- In the PowerShell window, type the following command and press ENTER:

```
Get-ADOrganizationalUnit -Filter * -Properties ProtectedFromAccidentalDeletion |
Where-Object {-not $_.ProtectedFromAccidentalDeletion}
```

Results: After this exercise, you should be able to use the Active Directory cmdlets to retrieve organizational units from Active Directory.

Lab Review

1. How can you see a list of all attributes that are available for an Active Directory object?

   Answer: Get-ADUser -Filter * -Properties * -ResultSetSize 1 | fl *

2. Which parameter can be used to limit the total number of objects returned in an Active Directory query?

   Answer: ResultSetSize

Module 6

Lab Answer Key: Windows PowerShell® Scripts

Contents:

Lab: Writing Windows PowerShell Scripts

Before You Begin

1. Start the **LON-DC1** virtual machine.
2. Start the **LON-SVR1** virtual machine.
3. Log on to **LON-SVR1** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
4. On the **Start** menu of LON-SVR1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, click **Windows PowerShell**.

Exercise 1: Executing Scripts

▶ Task 1: Check the execution policy setting

1. In the Windows PowerShell® window, type the following command and press ENTER:

```
Get-ExecutionPolicy
```

2. If the results from the previous command is "Restricted", in the PowerShell window, type the following command and press ENTER:

```
Set-ExecutionPolicy -ExecutionPolicy "RemoteSigned"
```

3. In the Execution Policy Change prompt type **Y** to indicate confirmation of your decision to change the policy:

▶ Task 2: Create a script

- Start the Notepad application. Create a new file named **C:\Script.ps1** and enter the following text into the file. Save the file.

```
Get-Process -Name powershell
```

▶ Task 3: Execute a script from the shell

- In the PowerShell window, type the following command and press ENTER after each line:

```
Set-Location -Path "C:\"
./Script.ps1
```

Results: After this exercise, you will have created and run a simple script that lists all the *powershell* processes.

Exercise 2: Using Positional Script Parameters

▶ Task 1: Copy commands into a script

- Start the Notepad application. Create a new file named **C:\Script2.ps1** and enter the following text into the file. Save the file.

```
Get-EventLog -LogName Application -Newest 100|Group-Object -Property InstanceId|Sort-
Object -Descending -Property Count|Select-Object -Property Name,Count -First
5|Format-Table -AutoSize
```

Task 2: Use commands with hardcoded values as parameter values

- In the PowerShell window, type the following command and press ENTER:

```
Set-Location -Path "C:\"
./Script2.ps1
```

Task 3: Identify variable portions of a command

- The following underlined values are considered as variable names:

```
Get-EventLog -LogName Application -Newest 100|Group-Object -Property InstanceId|Sort-
Object -Descending -Property Count|Select-Object -Property Name,Count -First
5|Format-Table -AutoSize
```

Task 4: Create positional script parameters

- Start the Notepad application. Create a new file named **C:\Script3.ps1** and enter the following text into the file. Save the file.

```
Param($log,$new,$group,$first)
Get-EventLog -LogName $log -Newest $new|Group-Object -Property $group|Sort-Object -
Descending -Property Count|Select-Object -Property Name,Count -First $first|Format-
Table -AutoSize
```

Task 5: Execute a script from the shell

- At the command prompt of the Windows PowerShell window, run the script just created and pass it four arguments.

```
Set-Location -Path "C:\"
./Script3.ps1 "Application" 100 "InstanceId" 5
```

Results: After this exercise, you will have created and run a script that uses positional parameters instead of using hardcoded values.

Exercise 3: Using Named Script Parameters

Task 1: Copy commands into a script

- Start the Notepad application. Create a new file named **C:\Script4.ps1** and enter the following text into the file. Save the file.

```
Get-Counter -Counter "\Processor(_Total)\% Processor Time" -SampleInterval 2 -
MaxSamples 3
```

Task 2: Use commands with hardcoded values as parameter values

- In the PowerShell window, type the following command and press ENTER:

```
Set-Location -Path "C:\"
./Script4.ps1
```

Task 3: Identify variable portions of a command

- The following underlined values are considered variable names:

```
Get-Counter -Counter "\Processor(_Total)\% Processor Time" -SampleInterval 2 -
MaxSamples 3
```

Task 4: Create named script parameters

- Start the Notepad application. Create a new file named **C:\Script5.ps1** and enter the following text into the file. Save the file.

```
Param($cpu,$interval,$max)
Get-Counter -Counter "\Processor($cpu)\% Processor Time" -SampleInterval $interval -
MaxSamples $max
```

Task 5: Execute a script from the shell

- At the command prompt of the Windows PowerShell window, run the script just created by specifying all the parameter names and changing their order.

```
Set-Location –Path "C:\"
./Script5.ps1 –interval 2 –max 3 –cpu "_Total"
```

Results: After this exercise, you will have created and run a script that uses named parameters instead of using hard-coded values.

Lab Review

1. If you send a script to another user with Windows 7 or Windows Server 2008 R2, will they be able to run the script? Is PowerShell included with these versions? Is it included with older Windows operating system versions?

   Answer: Yes, both Windows 7 and Windows Server 2008 R2 come with PowerShell v2 by default. By default, their execution policy is set to Restricted, however, so a user won't be able to immediately run any scripts without changing the execution policy.

2. If you send a script to another user, how can the user incorporate the script so that it automatically runs every time PowerShell is opened?

   Answer: By adding if to the profile, the user can make PowerShell load the script every time it is opened.

3. Is there a way to specify a default value for parameters in the param statement?

   Answer: Yes, for example, by using the syntax param([string]$my="value"). In that case, unless a different value is provided when you invoke the script, $my will be assigned the string "value".

Module 7

Lab Answer Key: Background Jobs and Remote Administration

Contents:

Lab A: Working with Background Jobs

Before You Begin

1. Start the **LON-DC1** and **LON-SVR1** virtual machines.
2. Log on to **LON-SVR1** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
3. On the **Start** menu of LON-SVR1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, click **Windows PowerShell**.

Exercise 1: Using Background Jobs with WMI

▶ Task 1: Start a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Start-Job -ScriptBlock {Get-Process -Name PowerShell}
```

▶ Task 2: Check the status of a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Get-Job -Id 1
```

Note: The job ID 1 might be different on your computer. Run Get-Job with no parameters to see a list of jobs and their ID numbers.

▶ Task 3: Use Windows Management Instrumentation

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Get-WmiObject -Class Win32_ComputerSystem
```

▶ Task 4: Retrieve information from remote computers

1. On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Start-Job -ScriptBlock {Get-WmiObject -ComputerName LON-DC1 -Class
Win32_ComputerSystem}
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-Job -Id 3
```

Note: The job ID number might be different on your computer. Run Get-Job with no parameters to see a list of jobs and their ID numbers.

3. In the PowerShell window, type the following command and press ENTER:

```
Get-Job -Id 3|Receive-Job
```

Results: After this exercise, you will have used a background job to use WMI to retrieve the Win32_ComputerSystem class from LON-DC1 remotely.

Exercise 2: Using Background Jobs for Local Computers

Task 1: Start a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Start-Job -ScriptBlock {Get-Service}
```

Task 2: Check the status of a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Get-Job -Id 5
```

Note: The job ID number might be different on your computer. Run Get-Job with no parameters to see a list of jobs and their ID numbers.

Task 3: Retrieve information from local commands

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Get-Job -Id 5|Receive-Job
```

Results: After this exercise, you will have used a background job to retrieve a listing of all the installed services on LON-SVR1.

Exercise 3: Receiving the Results from a Completed Job

Task 1: Run a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Start-Job -ScriptBlock {Get-EventLog -LogName Application –Newest 100}
```

Task 2: Check the status of a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Get-Job -Id 7
```

Note: The job ID number might be different on your computer. Run Get-Job with no parameters to see a list of jobs and their ID numbers.

Task 3: Receive the results of a background job and keep the results in memory

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Get-Job -Id 7|Receive-Job -Keep
```

▶ Task 4: Remove the results of a background job from memory

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Get-Job -Id 7|Receive-Job
```

Results: After this exercise, you will have used a background job to retrieve a listing of the latest 100 events in the Windows Application event log. You also will have seen how to save and remove the results from memory.

Exercise 4: Removing a Completed Job

▶ Task 1: Run a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Start-Job -ScriptBlock {Get-HotFix}
```

▶ Task 2: Check the status of a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Get-Job -Id 9
```

Note: The job ID number might be different on your computer. Run Get-Job with no parameters to see a list of jobs and their ID numbers.

▶ Task 3: Remove a completed job

1. On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Wait-Job -Id 9
```

2. On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Remove-Job -Id 9
```

Results: After this exercise, you will have run Get-HotFix as a background job, checked its status, and once completed, you will have removed the entire job from memory.

Exercise 5: Waiting for a Background Job to Complete

▶ Task 1: Start a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Start-Job -ScriptBlock {Start-Sleep -Seconds 15}
```

▶ Task 2: Check the status of a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Get-Job -Id 11
```

Note: The job ID number might be different on your computer. Run Get-Job with no parameters to see a list of jobs and their ID numbers.

▶ Task 3: Wait for a background job to complete

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Wait-Job -Id 11
```

▶ Task 4: Copy the results of a background job to a file

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Receive-Job -Id 11|Out-File -FilePath "C:\jobs.txt"
```

Results: After this exercise, you will have run Start-Sleep for 15 seconds, checked its status, and will have run the Wait-Job cmdlet to ensure the job was completed. You also will have copied the results of the background job to a local file.

Exercise 6: Stopping a Background Job Before It Completes

▶ Task 1: Start a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Start-Job -ScriptBlock {while($true){Start-Sleep -Seconds 1}}
```

▶ Task 2: Check the status of the background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Get-Job -Id 13
```

Note: The job ID number might be different on your computer. Run Get-Job with no parameters to see a list of jobs and their ID numbers.

▶ Task 3: Stop a background job that has not completed yet

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Stop-Job -Id 13
```

Results: After this exercise, you will have run a simple endless command as a background job, checked its status, and will have stopped the background job before it returned a completed status.

Exercise 7: Working with the Properties of a Job

▶ Task 1: Start a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Start-Job -ScriptBlock {Get-Childitem -Path "C:\Windows\System32"}
```

Task 2: Display a list of background jobs

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Get-Job
```

Task 3: Use Get-Member to look at the properties of a job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Get-Job -Id 15|Get-Member
```

Note: The job ID number might be different on your computer. Run Get-Job with no parameters to see a list of jobs and their ID numbers.

Results: After this exercise, you will have started a background job that retrieves a listing of all the contents of C:\Windows\System32, used Get-Member to view the methods and properties of a background job, and will have displayed the ChildJobs property of the background job.

Lab Review

1. You have started a PowerShell console and have started a couple of background jobs. What happens to the background jobs if they are still running and the main console is closed?

   Answer: The background jobs will basically stop running completed and all the information they may contain will be lost.

2. If you have two or more PowerShell consoles open, and start a background job in one console, can you access the job from the other console?

   Answer: No, jobs are tied directly to the console that started them and cannot be accessed by any other consoles.

Lab B: Using Windows PowerShell Remoting

Before You Begin

1. Start the **LON-DC1**, **LON-SVR1**, and **LON-SVR2** virtual machines.
2. Log on to **LON-DC1**, **LON-SVR1**, and **LON-SVR2** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
3. On the **Start** menu of LON-DC1, LON-SVR1, and LON-SVR2 click **All Programs**, click **Accessories**, click **Windows PowerShell**, and then click **Windows PowerShell**.
4. In the Windows PowerShell window of LON-DC1, LON-SVR1, and LON-SVR2, run the command **Enable-PSRemoting –Force**.

Exercise 1: Interactive Remoting

▶ Task 1: Initiate a 1:1 remoting session to a remote computer

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Enter-PSSession –ComputerName LON-DC1
```

▶ Task 2: Run remote commands interactively

- In the PowerShell window, type the following command and press ENTER:

```
Get-HotFix
```

Results: After this exercise, you will have initiated a 1:1 remoting session with LON-DC1 from LON-SVR1 and will have issued Get-HotFix remotely.

Exercise 2: Fan-Out Remoting

▶ Task 1: Invoke a command on multiple computers

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

Note: If you are still in the remote session with LON-DC1 you can exit now by typing "Exit-pssession".

```
Invoke-Command –ScriptBlock {Get-EventLog –LogName Application –Newest 100} –
ComputerName LON-DC1,LON-SVR2
```

▶ Task 2: Sort and filter objects in the pipeline

- In the PowerShell window, type the following command and press ENTER:

```
Invoke-Command –ScriptBlock {Get-EventLog –LogName Application –Newest 100} –
ComputerName LON-DC1,LON-SVR2|Group-Object –Property EventId|Sort-Object –Descending
–Property Count|Select-Object –First 5
```

Results: After this exercise, you will have invoked a command on LON-DC1 and LON-SVR2 from LON-SVR1 to retrieve a listing of the 100 newest events from the Windows Application event log, and will have grouped and sorted the results to display the top five EventId values that have occurred the most.

Exercise 3: Fan-Out Remoting Using Background Jobs

▶ Task 1: Invoke a command on multiple computers as a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Invoke-Command –AsJob –ScriptBlock {Get-Acl –Path "C:\Windows\System32\*" –Filter
"*.dll"} –ComputerName LON-DC1,LON-SVR2
```

▶ Task 2: Wait for the parent job to complete

- In the PowerShell window, type the following command and press ENTER:

```
Wait-Job –Id 1
```

Note: The job ID 1 might be different on your computer. Run Get-Job with no parameters to see a list of jobs and their ID numbers.

▶ Task 3: Get the ID of all child jobs

- In the PowerShell window, type the following command and press ENTER:

```
Get-Job –Id 1 | Select-Object –Property ChildJobs
```

▶ Task 4: Sort and filter objects in the pipeline

- In the PowerShell window, type the following command and press ENTER:

```
Receive-Job –Id 2,3 –Keep|Where-Object –FilterScript {$_.Owner –like
"*Administrator*"}
```

Results: After this exercise, you will have invoked a command on LON-DC1 and LON-SVR2 as a background job from LON-SVR1 to retrieve the ACLs on all the files in C:\Windows\System32 with the extension "*.dll", and will have filtered to display only the files with the owner being the Administrators.

Exercise 4: Saving Information from Background Jobs

▶ Task 1: Invoke a command on multiple computers as a background job

- On LON-SVR1, in the PowerShell window, type the following command and press ENTER:

```
Invoke-Command –AsJob –ScriptBlock {Get-Counter –Counter  "\Processor(_Total)\%
Processor Time" -SampleInterval 2 -MaxSamples 3} –ComputerName LON-DC1,LON-SVR2
```

Task 2: Wait for the parent job to complete

- In the PowerShell window, type the following command and press ENTER:

```
Wait-Job –Id 4
```

Note: The job ID number might be different on your computer. Run Get-Job with no parameters to see a list of jobs and their ID numbers.

Task 3: Receive the results only from a single child job

- In the PowerShell window, type the following command and press ENTER:

```
Receive-Job –Id 5,6 –Keep|Where-Object –FilterScript {$_.PSComputerName –eq "LON-DC1"}
```

Note: The ID numbers of the items you want to use in the above command are the next two sequential numbers from the original job in task 1. If you wish to see these listed you can type o determine the ID numbers by typing *get-job –ID X*| *select-object –property childjobs* where X is the ID number from Task 1 above.

Task 4: Export the results to a file

- In the PowerShell window, type the following command and press ENTER:

```
Receive-Job –Id 5,6 –Keep|Where-Object –FilterScript {$_.PSComputerName –eq "LON-DC1"}|Out-File –FilePath "C:\counter.txt"
```

Results: After this exercise, you will have invoked a command on LON-DC1 and LON-SVR2 as a background job from LON-SVR1 to retrieve the total *%Processor Time* value, waited for the parent job to complete, and will have retrieved the results of the child job that was used for LON-DC1 only by saving the results to a file.

Lab Review

1. Is there any limit to the number of remote sessions that can be run?

   Answer: Basically, the only limit is availability of resources on all the systems involved in PowerShell remoting. There is, however, a ThrottleLimit property available for Invoke-Command which limits the number of simultaneous child jobs that can run at any one time.

2. If I use Invoke-Command from one console and start it as a background job, can other consoles on the same server also see the background jobs and access their information directly?

   Answer: No, all the background jobs are basically attached to the console that they were initiated from. You can, however, share information between consoles, but it requires using some intermediary, like saving the output from a job to a text or XML file, and importing that file into the other console.

Module 8

Lab Answer Key: Advanced Windows PowerShell® Tips and Tricks

Contents:

Lab: Advanced PowerShell Tips and Tricks

Before You Begin

1. Start the **LON-SVR1** virtual machine, and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
2. On the **Start** menu of LON-SVR1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, then right-click **Windows PowerShell** and click **Run As Administrator**.

Exercise 1: Writing a Profile Script

▶ Task 1: Write a profile script

1. In the Windows PowerShell® window, type the following command and press ENTER:

```
New-Item –Type File –Path $profile -Force
```

Note: You may need to run *Set-executionpolicy remotesigned* if that setting is not already defined.

2. In the PowerShell window, type the following command and press ENTER:

```
Notepad $profile
```

   If you get prompted to provide credentials you can use username **Contoso\Administrator** and password **Pa$$w0rd**.
3. In the Notepad window, type the following, and then click **Save** and **Exit**.

```
Set-Location –Path "C:\"
Import-Module –Name ServerManager
$cred=Get-Credential
```

▶ Task 2: Test a profile script

- In the PowerShell window, type the following command and press ENTER:

```
. $profile
```

Note: As outlined earlier in Task 1 you may need to run *Set-executionpolicy remotesigned* if that setting is not already defined. Also, again If you get prompted to provide credentials you can use username Contoso\Administrator and password Pa$$w0rd.

Hint: That command is a period (or dot), a space, and then $profile.

Results: After this exercise, you should have a better understanding on how to write and use a profile script.

Exercise 2: Creating a Script Module

▶ Task 1: Package a function as a script module

1. Use Windows® Explorer to open your **Documents** (or **My Documents**) folder.
2. Double-click the **Windows PowerShell** folder. (If the folder does not exist, create it.)
3. Create a new subfolder named **Modules**. Double-click the new folder.
4. Create a new subfolder named **MyAppEvents**. Double-click the new folder.
5. Click **All Programs**, click **Accessories**, click **Windows PowerShell**, right-click **Windows PowerShell ISE** and click **Run As Administrator**
6. In the Windows PowerShell ISE open a new script file by pressing CTRL+N.
7. In the new script, type the following. Then save the file in the MyAppEvents folder that you created previously. Name the file **MyAppEvents.psm1**.

```
Function Get-AppEvents {
  Get-EventLog –LogName Application –Newest 100 |
    Group-Object -Property InstanceId |
    Sort-Object –Descending -Property Count |
    Select-Object –Property Name,Count -First 5 |
    Format-Table –AutoSize
}
```

▶ Task 2: Load a script module

- In the PowerShell window, type the following command and press ENTER:

Note: You may need to enter the full path to the file if you receive an error. You may also want to use the SPSHome directory location.

```
Import-Module –Name MyAppEvents
```

▶ Task 3: Test the script module

- In the PowerShell window, type the following command and press ENTER:

```
Get-AppEvents
```

Results: After this exercise, you should have a better understanding of how to create and import script modules.

Exercise 3: Adding Help Information to a Function

▶ Task 1: Add comment based help to a function

1. In the Windows PowerShell ISE window, open the **MyAppEvent.psm1** file that you created in the previous exercise.
2. In the script, type the following, and then click **Save** and **Exit.** You may need to add only the boldfaced portion.

```
function Get-AppEvents {
<#
.SYNOPSIS
Get-AppEvents retrieves the newest 100 events from the Application
event log, groups and sorts them by InstanceID and then displays only
top 5 events that have occured the most.
.DESCRIPTION
See the synopsis section.
.EXAMPLE
To run the function, simply invoke it:
PS> Get-AppEvents
#>
Get-EventLog –LogName Application –Newest 100|Group-Object -Property InstanceId|Sort-
Object –Descending -Property Count|Select-Object –Property Name,Count -First
5|Format-Table –AutoSize
}
```

▶ Task 2: Test comment-based help

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-AppEvents
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-AppEvents –Examples
```

▶ Task 3: Reload a module

1. In the PowerShell window, type the following command and press ENTER:

```
Remove-Module –Name MyAppEvents
```

2. In the PowerShell window, type the following command and press ENTER:

```
Import-Module –Name MyAppEvents
```

3. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-AppEvents
```

Results: After this exercise, you should have a better understanding of how to add comment-based help to a function.

Lab Review

1. What's the difference between adding comment-based help to a function versus adding lots of regular comments in the script itself?

   Answer: Using comment-based help allows the Get-Help cmdlet to be used directly from the command line to get help information for functions that are included within modules. Otherwise, the user has to open the script file and read through nonstandardized help information, and that's only if the script author actually added comments.

2. Why is it important to refrain from using customized aliases in a module that is shared with others?

   Answer: Because these customized aliases may not exist on other computers and, as a result, modules used by others may produce unexpected results.

Module 9

Lab Answer Key: Automating Windows Server® 2008 Administration

Contents:

Lab A: Using the Server Manager Cmdlets

Before You Begin

1. Start the **LON-DC1**, **LON-SVR1** and **LON-SVR2** virtual machines.
2. Log on to **LON-DC1** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
3. On the **Start** menu of LON-DC1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, right-click **Windows PowerShell** and click **Run As Administrator**.
4. On LON-DC1, open a Windows PowerShell® session as **Administrator**.
5. On LON-DC1, open the **Start** menu. Under the **Administrative Tools** folder, open the **Group Policy Management Console**.
6. In the left pane of the **Group Policy Management** console, expand the forest and domain until you see the **Starter GPOs** folder. Select the **Starter GPOs** folder by clicking on it.
7. In the right pane, click the **Create Starter GPOs Folder** button to create the Starter GPOs.
8. Ensure that Windows PowerShell remoting is enabled on LON-SVR1 and LON-SVR2. If you completed the previous labs in this course and have not shut down and discarded the changes in the virtual machines, remoting will be enabled. If not, open a Windows PowerShell session on those two virtual machines and run Enable-PSRemoting on each.
9. In Windows PowerShell, execute the following two commands:
    a. **Set-ExecutionPolicy RemoteSigned**
    b. **E:\Mod09\Labfiles\Lab_09_Setup.ps1**

Note: Some of the Group Policy Objects and DNS entries that this script will modify may already exist in the virtual machine and you may receive and error saying so if you have used the virtual machine during earlier modules and have not discarded those changes.

10. Log on to **LON-SVR1** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
11. On the **Start** menu of LON-SVR1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, right-click **Windows PowerShell** and click **Run As Administrator**.
12. Disable the Windows® Firewall for LON-SVR1 by carrying out the following steps
    a. Go to **Start > Control Panel > System and Security > Windows Firewall**.
    b. Click on **Turn Windows Firewall on or off**.
    c. In the **Domain network location settings** section, click the radio button Turn off Windows Firewall (not recommended).
    d. In the **Home or work (private) network** location settings, click the radio button **Turn off Windows Firewall (not recommended)**.
    e. In the **Public network location** settings, click the radio button **Turn off Windows Firewall (not recommended)**.
    f. Repeat steps a to e for virtual machines LON-DC1 and LON-SVR2.

Note: This is not security best practice and under no circumstances should this be done in a production environment. This is done in this instance purely to allow us to focus on the learning task at hand and concentrate on powershell concepts.

Exercise 1: Listing All Currently Installed Features

▶ Task 1: Import the Windows Server Manager PowerShell module

1. On LON-SVR1, in the Windows PowerShell window, type the following command and press ENTER:

```
Get-Module -ListAvailable
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
Import-Module ServerManager
```

▶ Task 2: View the module contents

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-Command –module ServerManager
```

▶ Task 3: View all installed server features

1. In the Windows PowerShell window, type the following command and press ENTER:

```
Get-WindowsFeature
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
Get-WindowsFeature | Where {$_.installed}
```

Exercise 2: Comparing Objects

▶ Task 1: Import the XML file

1. On LON-SVR1, in the Windows PowerShell window, type the following command and press ENTER:

```
$target=Import-Clixml –path E:\Mod09\Labfiles\TargetFeatures.xml
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
$current=Get-WindowsFeature
```

▶ Task 2: Compare the imported features with the current features

- In the Windows PowerShell window, type the following command and press ENTER:

```
Compare-Object $target $current –property installed,Name
```

Exercise 3: Installing a New Server Feature

▶ Task 1: View cmdlet help

- On LON-SVR1, in the Windows PowerShell window, type the following command and press ENTER:

```
help Add-WindowsFeature –full
```

▶ Task 2: Install missing features

- In the Windows PowerShell window, type the following command and press ENTER:

```
Compare-Object $target $current –property installed,name | where {$_.sideIndicator –
eq "=>" –and –not $_.installed} | foreach {Add-WindowsFeature $_.name}
```

Note: There are usually several ways to accomplish a task in Windows PowerShell. The solution here is but one possible choice. You may have a different solution that also works.

Exercise 4: Exporting Current Configuration to XML

▶ Task 1: Verify the current configuration

- On LON-SVR1, in the Windows PowerShell window, type the following command and press ENTER:

```
Get-WindowsFeature | where {$_.installed}
```

▶ Task 2: Export configuration to XML

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-WindowsFeature | Export-Clixml $env:userprofile\documents\LON-SVR1-Features.xml.
```

Lab Review

1. What module do you need to import to manage server features?

   Answer: ServerManager

2. What cmdlets are used to manage server features?

   Answer: Get-WindowsFeature, Add-WindowsFeature and Remove-WindowsFeature

3. What type of object does Get-WindowsFeature write to the pipeline?

   Answer: Microsoft.Windows.ServerManager.Commands.Feature

4. What are some of its properties?

   Answer: Path,DisplayName, Name, Installed,Parent, and SubFeatures

5. Does the cmdlet support configuring a remote server?

   Answer: No. Although you could use a PSSession to remotely manage features on another server.

Lab B: Using the Group Policy Cmdlets

Before You Begin

1. Start the **LON-DC1** virtual machine.
2. Log on to **LON-DC1** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
3. Start the **LON-SVR1** virtual machine. You do not need to log on.
4. On the **Start** menu of LON-DC1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, click **Windows PowerShell**.

Exercise 1: Listing All Group Policy Objects in the Domain

▶ Task 1: Import the Group Policy PowerShell module

1. On LON-DC1, in the Windows PowerShell window, type the following command and press ENTER:

```
Get-Module -ListAvailable
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
Import-Module GroupPolicy
```

▶ Task 2: View the module contents

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-Command –module GroupPolicy
```

▶ Task 3: View Group Policy objects

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-GPO –all
```

Exercise 2: Creating a Text-Based Report

▶ Task 1: Get selected Group Policy object properties

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-Gpo -all | Sort ModificationTime | Select Displayname,*time
```

▶ Task 2: Create a text file report

- In the Windows PowerShell window, type the following command and press ENTER:

```
get-gpo -all | Sort ModificationTime | Select Displayname,*time | out-file \\LON-
SVR1\E$\Mod09\Labfiles\Reports_GPOSummary.txt
```

Exercise 3: Creating HTML Reports

▶ Task 1: Create a default Domain Policy report

- In the Windows PowerShell window, type the following one line command and press ENTER:

```
Get-GPOReport -Name "Default Domain Policy" -ReportType HTML -Path
$env:userprofile\documents\DefaultDomainPolicy.htm
```

▶ Task 2: Create individual GPO reports

- In the Windows PowerShell window, type the following one line command and press ENTER:

```
Get-Gpo -all | foreach {Get-GPOReport –id $_.id -ReportType HTML -Path \\LON-
SVR1\E$\Mod09\Labfiles\$($_.Displayname).htm}
```

Exercise 4: Backing Up All Group Policy Objects

▶ Task 1: Back up the Default Domain policy

- In the Windows PowerShell window, type the following command and press ENTER:

```
Backup-Gpo -Name "Default Domain Policy" -Path $env:userprofile\documents
```

▶ Task 2: Back up all Group Policy objects

- In the Windows PowerShell window, type the following command and press ENTER:

```
Backup-GPO -All -Path \\LON-SVR1\E$\Mod09\Labfiles -Comment "Weekly Backup"
```

Lab Review

1. What module do you need to import to manage Group Policy?

   Answer: GroupPolicy

2. What cmdlet is used to get Group Policy information?

   Answer: Get-GPO

3. What type of Group Policy reports can you create?

   Answer: XML and HTML

4. Can you back,up individual Group Policy objects?

   Answer: Yes. Or you can back all Group Policy objects at the same time.

Lab C: Using the Troubleshooting Pack Cmdlets

Before You Begin

1. Start the **LON-DC1** and **LON-SVR1** virtual machines. You do not need to log on.
2. Start the **LON-CLI1** virtual machine and log on as **Contoso\Administrator** with a password of **Pa$$w0rd**.
3. On the **Start** menu of LON-CLI1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, click **Windows PowerShell**.

Exercise 1: Importing the Troubleshooting Pack Module

▶ Task 1: Import the Troubleshooting Pack PowerShell module

- On LON-CLI1, in the Windows PowerShell window, type the following command and press ENTER:

```
Import-Module TroubleShootingPack
```

▶ Task 2: View the module contents

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-Command –module TroubleShootingPack
```

Exercise 2: Solving an End-User Problem Interactively

▶ Task 1: Stop Windows search

- On LON-CLI1, in the Windows PowerShell window, type the following command and press ENTER:

```
Stop-Service WSearch
```

▶ Task 2: Run an interactive troubleshooting session

1. In the Windows PowerShell window, type the following command and press ENTER:

```
$pack=Get-Troubleshootingpack $env:windir\diagnostics\system\search
```

2. In the PowerShell window, type the following command and press ENTER:

```
Invoke-TroubleshootingPack $pack -Result "c:\result.xml"
```

3. Type **1** and Press ENTER.
4. Type **1** and press ENTER.
5. Type **x** and press ENTER. (it should be lowercase **x** that is used)

▶ Task 3: View the report

1. Click the **Internet Explorer** icon on the Taskbar.
2. In the Internet Explorer navigation field type **C:\result.xml** and press ENTER.

   If prompted, answer yes to run scripts and allow blocked content.
3. Double-click files to review them. There will be several file sin the C:\Result.xml folder.
4. After reviewing the file, close Internet Explorer.

Exercise 3: Solving a Problem Using Answer Files

▶ Task 1: Create an answer file

1. In the Windows PowerShell window, type the following one line command and press ENTER:

```
Get-Troubleshootingpack C:\Windows\diagnostics\system\search -AnswerFile
SearchAnswer.xml
```

2. Press ENTER.
3. Type **1** and press ENTER.
4. Press ENTER.

▶ Task 2: Invoke troubleshooting using the answer file

1. In the Windows PowerShell window, type the following command and press ENTER:

```
Stop-Service WSearch
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
Invoke-TroubleshootingPack $pack -AnswerFile SearchAnswer.xml
```

3. Type **x** and press ENTER. (It should be lowercase **x** that is used.)

▶ Task 3: Invoke troubleshooting unattended

- In the Windows PowerShell window, type the following command and press ENTER:

```
Invoke-TroubleshootingPack $pack -AnswerFile SearchAnswer.xml –Unattended
```

▶ Task 4: Verify the solution

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-Service WSearch
```

Lab Review

1. What cmdlet do you use to load the Troubleshooting Pack?

   Answer: Import-Module

2. What are the cmdlets in the Troubleshooting Pack?

   Answer: Get-Troubleshootingpack, Invoke-Troubleshootingpack

3. Can you resolve a problem without using an answer file?

   Answer: Yes.

Lab D: Using the Best Practices Analyzer Cmdlets

Before You Begin

1. Start the **LON-DC1** virtual machine and log on as **Contoso\Administrator** with a password of **Pa$$w0rd**.
2. On the **Start** menu of LON-DC1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, and then click **Windows PowerShell**.

Exercise 1: Importing the Best Practices Module

▶ Task 1: Import the Best Practices PowerShell module

1. On LON-DC1, in the Windows PowerShell window, type the following command and press ENTER:

```
Get-Module –ListAvailable
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
Import-Module BestPractices
```

▶ Task 2: View the module contents

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-Command -module BestPractices
```

Exercise 2: Viewing Existing Models

▶ Task 1: Display all available best practice models

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-BpaModel
```

Exercise 3: Running a Best Practices Scan

▶ Task 1: Run a best practices scan

- In the Windows PowerShell window, type the following command and press ENTER:

```
Invoke-BpaModel microsoft/windows/directoryservices
```

▶ Task 2: View the scan results

1. In the Windows PowerShell window, type the following command and press ENTER:

```
$results=Get-BpaResult microsoft/windows/directoryservices
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
$results| more
```

3. Press the SPACEBAR to advance to the next page or type **Q** to quit.

Task 3: View selected results

- In the Windows PowerShell window, type the following command and press ENTER:

```
$results | where {$_.severity –eq “Error"}
```

Depending on the current configuration, there may not be any errors to display.

Task 4: Create a best practices report

1. In the Windows PowerShell window, type the following command and press ENTER:

```
$results | sort Severity | Select
ResultID,Severity,Category,Title,Problem,Impact,Resolution,Compliance | ConvertTo-
Html -Title "Active Directory Best Practice Scan" -CssUri
E:\Mod09\LabFiles\bpareport.css | Out-File $env:userprofile\documents\adbpa.htm
```

2. Click **Start**, click **All Programs** and then click **Internet Explorer**.
3. In the URL navigation field type **C:\Users\Administrator.NYC-DC1 \Documents\adbpa.htm**.
4. Close Internet Explorer after viewing the file.

Lab Review

1. What module do you need to import to run Best Practices scans?

   Answer: BestPractices

2. What are some of the items that you can view in a scan result?

   Answer: Severity, Category, Problem, Impact, Compliance and Help.

3. What are some of the Best Practice models available?

   Answer:
   Microsoft/Windows/DirectoryServices
   Microsoft/Windows/DNSServer
   Microsoft/Windows/WebServer

Lab E: Using the IIS Cmdlets

Before You Begin

1. Start the **LON-DC1** virtual machine and log on as **Contoso\Administrator** with a password of **Pa$$w0rd**.
2. On the **Start** menu of LON-DC1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, and then click **Windows PowerShell**.

Exercise 1: Importing the IIS Module

▶ Task 1: Import the IIS PowerShell module

1. In the Windows PowerShell window, type the following command and press ENTER:

```
Get-Module -ListAvailable
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
Import-Module WebAdministration
```

▶ Task 2: View the module contents

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-Command –module WebAdministration
```

Exercise 2: Creating a New Web Site

▶ Task 1: Create a new Web site

1. In the Windows PowerShell window, type the following command and press ENTER:

```
mkdir $env:systemdrive\inetpub\PowerShellDemo
```

2. In the Windows PowerShell window, type the following one-line command and press ENTER:

```
Copy [path to lab folder]\UnderConstruction.html –destination
$env:systemdrive\inetpub\PowerShellDemo\default.htm
```

3. In the Windows PowerShell window, type the following one-line command and press ENTER:

```
New-WebSite -Name PowerShellDemo -port 80 -PhysicalPath
$env:systemdrive\inetpub\PowerShellDemo
```

▶ Task 2: View all Web sites

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-Website
```

▶ Task 3: Verify the Web site

1. In the Windows PowerShell window, type the following command and press ENTER:

```
Stop-Website "Default Web Site"
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
Start-Website "PowerShellDemo"
```

3. On LON-DC1, click **Start**, click **All Programs** and then click **Internet Explorer**.
4. In the URL navigation field type:

```
http://lon-dc1
```

and press ENTER.

5. Close Internet Explorer after viewing the welcome page.

Exercise 3: Backing Up IIS

▶ Task 1: Back up IIS

- In the Windows PowerShell window, type the following command and press ENTER:

```
Backup-WebConfiguration Backup1
```

▶ Task 2: Verify the backup

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-WebConfigurationBackup Backup1
```

Exercise 4: Modifying Web Site Bindings

▶ Task 1: Display current binding information for all Web sites

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-WebSite
```

Note: Because the Get-WebBinding cmdlet doesn't include the Web site name, you might use a command like this:

```
Get-WebSite | Foreach { $_ | add-member Noteproperty -name BindingInformation -value ((Get-WebBinding $_.name).bindinginformation) -passthru} | Select Name,BindingInformation
```

▶ Task 2: Change port binding

- In the Windows PowerShell window, type the following one line command and press ENTER:

```
Get-WebSite | Foreach { $name=$_.name ; Get-WebBinding $name | Set-WebBinding -name $name -PropertyName Port -Value 8001}
```

▶ Task 3: Verify the new bindings

1. In the Windows PowerShell window, type the following command and press ENTER:

```
Get-WebSite
```

2. On LON-DC1, click **Start**, click **All Programs** and then click **Internet Explorer**.
3. In the URL navigation field type:

```
http://lon-dc1:8001
```

4. Close Internet Explorer.

Exercise 5: Using the IIS PSDrive

▶ Task 1: Connect to the IIS PSDrive

1. In the Windows PowerShell window, type the following command and press ENTER:

```
Get-PSDrive
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
cd IIS:
```

▶ Task 2: Navigate to the default site

- In the Windows PowerShell window, type the following command and press ENTER:

```
cd "Sites\Default Web Site"
```

▶ Task 3: Display all properties for the default site

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-Item . | select *
```

▶ Task 4: Modify the default site

1. In the Windows PowerShell window, type the following command and press ENTER:

```
Set-ItemProperty . -Name serverAutoStart -Value $False
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
cd C:
```

Exercise 6: Restoring an IIS Configuration

▶ Task 1: View existing backups

- In the Windows PowerShell window, type the following command and press ENTER:

```
Get-WebConfigurationBackup
```

▶ Task 2: Restore the most recent configuration

1. In the Windows PowerShell window, type the following command and press ENTER:

```
Restore-WebConfiguration –name Backup1
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
Get-WebSite
```

Note: You can ignore any errors about denied access to c:\windows\system32\inetserv\config\scheman\wsmanconfig_schema.xml.or c:\windows\system32\inetserv\mbschema.xml.

Lab Review

1. What module do you need to import to manage IIS?

   Answer: WebAdministration

2. What cmdlet do you use to create a new Web site?

   Answer: New-WebSite

3. What cmdlet do you use to stop a Web site?

   Answer: Stop-WebSite

4. What cmdlets do you use to modify Web site bindings?

   Answer: Set-WebBinding

5. What do you see in the Sites folder of the IIS PSDrive?

   Answer: A listing of all Web sites on the server such as Default Web Site

Module 11

Lab Answer Key: Writing Your Own Windows PowerShell® Scripts

Contents:

Lab A: Using Variables and Arrays

Before You Begin

1. Start the **LON-DC1** and **LON-SVR1** virtual machines.
2. Log on to **LON-SVR1** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
3. On the **Start** menu of LON-SVR1, click **All Programs**, click **Accessories**, click **Windows PowerShell**, and then click **Windows PowerShell ISE**.

Exercise 1: Creating Variables and Interacting with Them

▶ Task 1: Create and work with variables and variable types

1. In the Windows PowerShell® ISE window, type the following command and press ENTER:

```
$myValue = 1
```

2. In the PowerShell window, type the following command and press ENTER:

```
$myValue = 'Hello'
```

3. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Get-Variable -Full
```

4. In the PowerShell window, type the following command and press ENTER:

```
Get-Variable myValue | fl *
```

5. In the PowerShell window, type the following command and press ENTER:

```
Get-Variable myValue -ValueOnly
```

6. In the PowerShell window, type the following command and press ENTER:

```
[int]$myValue = 1
```

7. In the PowerShell window, type the following command and press ENTER:

```
$myValue = 'Hello'
```

▶ Task 2: View all variables and their values

- In the PowerShell window, type the following command and press ENTER:

```
Get-Variable
```

▶ Task 3: Remove a variable

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Help Remove-Variable -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Remove-Variable myValue
```

Results: After this exercise, you should be able to create new variables, view variable values, and remove variables.

Exercise 2: Understanding Arrays and Hashtables

▶ Task 1: Create an array of services

1. In the PowerShell window, type the following command and press ENTER:

```
get-help about_arrays
```

2. In the PowerShell window, type the following command and press ENTER:

```
$services = Get-Service
```

3. In the PowerShell window, type the following command and press ENTER:

```
$services
```

4. In the PowerShell window, type the following command and press ENTER:

```
$services.GetType().FullName
```

▶ Task 2: Access individual items and groups of items in an array

1. In the PowerShell window, type the following command and press ENTER:

```
$services[0]
```

2. In the PowerShell window, type the following command and press ENTER:

```
$services[1]
```

3. In the PowerShell window, type the following command and press ENTER:

```
$services[-1]
```

4. In the PowerShell window, type the following command and press ENTER:

```
$services[0..9]
```

▶ Task 3: Retrieve the count of objects in an array

- In the PowerShell window, type the following command and press ENTER:

```
$services.Count
```

▶ Task 4: Create a hashtable of services

1. In the PowerShell window, type the following command and press ENTER:

```
get-help about_hash_tables
```

2. In the PowerShell window, type the following command and press ENTER:

```
$serviceTable = @{}
```

3. In the PowerShell window, type the following command and press ENTER:

```
   foreach ($service in $services) {
$serviceTable[$service.Name] = $service
}
```

4. In the PowerShell window, type the following command and press ENTER:

```
$serviceTable
```

Task 5: Access individual items in a hashtable

1. In the PowerShell window, type the following command and press ENTER:

```
$serviceTable['BITS']
```

2. In the PowerShell window, type the following command and press ENTER:

```
$serviceTable['wuauserv']
```

3. In the PowerShell window, type the following command and press ENTER:

```
$serviceTable | gm
```

4. In the PowerShell window, type the following command and press ENTER:

```
$serviceTable.Count
```

Task 6: Enumerate key and value collections of a hashtable

1. In the PowerShell window, type the following command and press ENTER:

```
$serviceTable.Keys
```

2. In the PowerShell window, type the following command and press ENTER:

```
$serviceTable.Values
```

Task 7: Remove a value from a hashtable

1. In the PowerShell window, type the following command and press ENTER:

```
$serviceTable.Remove('BITS')
```

2. In the PowerShell window, type the following command and press ENTER:

```
$serviceTable['BITS']
```

Results: After this exercise, you should be able to create arrays and hashtables, access individual items in arrays and hashtables, and remove items from hashtables.

Exercise 3: Using Single-Quoted and Double-Quoted Strings and the Backtick

Task 1: Learn the differences between single-quoted and double-quoted strings

1. In the PowerShell window, type the following command and press ENTER:

```
$myValue = 'Hello'
```

2. In the PowerShell window, type the following command and press ENTER:

```
"The value is $myValue"
```

3. In the PowerShell window, type the following command and press ENTER:

```
'The value is not $myValue'
```

Task 2: Use a backtick (`) to escape characters in a string

1. In the PowerShell window, type the following command and press ENTER:

```
"Nor is the value `$myValue"
```

2. In the PowerShell window, type the following command and press ENTER:

```
dir 'C:\Program Files'
```

3. In the PowerShell window, type the following command and press ENTER:

```
dir C:\Program` Files
```

Task 3: Use a backtick (`) as a line continuance character in a command

- In the PowerShell window, type the following command and press ENTER:

```
   Get-Service `
-name "Windows Update"
```

Results: After this exercise, you should be able to create simple and compound strings and use a backtick to split a single command across multiple lines.

Exercise 4: Using Arrays and Array Lists

Task 1: Learn how to extract items from an array

1. In the PowerShell window, type the following command and press ENTER:

```
$days = @('Sunday','Monday','Tuesday','Wednesday','Thursday','Friday','Saturday')
```

2. In the PowerShell window, type the following command and press ENTER:

```
$days[2]
```

Task 2: Discover the properties and methods for an array

1. In the PowerShell window, type the following command and press ENTER:

```
$days | Get-Member
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-Member -InputObject $days
```

Results: After this exercise, you should be able to extract specific items from arrays by index or from array lists by name. You should also be able to discover the properties and methods for an array or array list.

Exercise 5: Using Contains, Like and Equals Operators

▶ Task 1: Use contains, like and equals operators to find elements in arrays

1. In the PowerShell window, type the following command and press ENTER:

```
get-help about_comparison_operators
```

2. In the PowerShell window, type the following command and press ENTER:

```
$colors =
@('Red','Orange','Yellow','Green','Black','Blue','Gray','Purple','Brown','Blue')
```

3. In the PowerShell window, type the following command and press ENTER:

```
$colors -like '*e'
```

4. In the PowerShell window, type the following command and press ENTER:

```
$colors -like 'b*'
```

5. In the PowerShell window, type the following command and press ENTER:

```
$colors -like '*a*'
```

6. In the PowerShell window, type the following command and press ENTER:

```
$colors -contains 'White'
```

7. In the PowerShell window, type the following command and press ENTER:

```
$colors -contains 'Green'
```

8. In the PowerShell window, type the following command and press ENTER:

```
$colors -eq 'Blue'
```

▶ Task 2: Understand the difference when using those operators with strings

1. In the PowerShell window, type the following command and press ENTER:

```
$favoriteColor = 'Green'
```

2. In the PowerShell window, type the following command and press ENTER:

```
$favoriteColor -like '*e*'
```

3. In the PowerShell window, type the following command and press ENTER:

```
$favoriteColor -contains 'e'
```

Results: After this exercise, you should be able use the contains, like, and equal operators to show partial contents of a collection. You should also understand how these operators function differently, depending on the type of object they are being used with.

Lab Review

1. How do you retrieve the members (properties and methods) for a collection?

   Answer: Use Get-Member with the InputObject parameter and pass the collection to InputObject.

2. When should you use a double-quoted string instead of a single-quoted string?

   Answer: When you want the variables and/or subexpressions inside the string expanded and the resulting values placed in the string.

Lab B: Using Scripting Constructs

Before You Begin

1. Start the **LON-DC1**, **LON-SVR1**, **LON-SVR2**, and **LON-CLI1** virtual machines.
2. Log on to **LON-DC1** as **Contoso\Administrator** with a password of **Pa$$w0rd**.
3. On the **Start** menu of LON-DC1 click **All Programs**, click **Accessories**, click **Windows PowerShell**, and click **Windows PowerShell ISE**.
4. On LON-CLI1, disable Windows Firewall by carrying out the following steps:
   a. Go to **Start> Control Panel>System and Security> Windows Firewall**.
   b. Click **Turn Windows Firewall on or off**.
   c. In the **Domain network location settings** section, click **Turn off Windows Firewall (not recommended)**.
   d. In the **Home or work (private) network location** settings, click **Turn off Windows Firewall (not recommended)**.
   e. In the **Public network location** settings, click **Turn off Windows Firewall (not recommended)**.
   f. Repeat steps a through e for virtual machines LON-DC1, LON-SVR1, and LON-SVR2.

Note: Disabling the firewall is not a security best practice and under no circumstances should this be done in a production environment. This is done in this instance purely to allow us to focus on the learning task at hand and concentrate on PowerShell concepts.

Exercise 1: Processing and Validating Input

▶ Task 1: Read input from the end user

1. In the PowerShell ISE window, type the following command and press ENTER:

```
Get-Help Read-Host -Full
```

2. In the PowerShell window, type the following command and press ENTER:

```
Read-Host -Prompt 'Enter anything you like and press <ENTER> when done'
```

You will receive the Windows PowerShell ISE – Input dialogue bearing the text you outlined above in Step 2. Enter any text you like and click **OK**.

3. In the PowerShell window, type the following command and press ENTER:

```
$serverName = Read-Host -Prompt 'Server Name'
```

Again you will receive the Windows PowerShell ISE – Input dialogue bearing the text you outlined above in Step 3. Enter any text you like and click **OK**.

▶ Task 2: Validate input received from the end user

1. In the PowerShell window, type the following command and press ENTER:

```
get-help about_if
```

2. In the PowerShell window, type the following command and press ENTER

```
   if ($serverName -notlike 'SERVER*') {
"Server name '$serverName' is REJECTED"
} else {"Server name '$serverName' is OK!"
}
```

3. Run the command if it has not already run by pressing Enter in the last step. You can run the commands by highlighting the code you wish to run, right clicking and going to "Run Selection" or by pressing F5. In the resultant diaogue type any text and click **OK**.

▶ Task 3: Create a script that prompts for specific input and exits only when the right input is found or when no input is provided

1. In the PowerShell window, type the following command and press ENTER:

```
get-help about_do
```

2. In the PowerShell window, type the following command and press ENTER:

```
   do {
cls
$serverName = Read-Host -Prompt 'Server Name (this must start with "SERVER")'
} until ((-not $serverName) -or ($serverName -like 'SERVER*'))
```

3. In the PowerShell window, type the following command and press ENTER:

```
$serverName
```

4. In the PowerShell window, type the following command and press ENTER:

```
   do {
cls
$serverName = Read-Host -Prompt 'Server Name (this must start with "SERVER")'
} until ((-not $serverName) -or ($serverName -like 'SERVER*'))
$serverName
```

5. Again run the command if it has not already run by pressing Enter in the last step. You can run the commands by highlighting the code you wish to run, right clicking and going to "Run Selection" or by pressing F5. In the resultant diaogue type any text and click **OK**.

Results: After this exercise, you should be able to read and process user input in a PowerShell script.

Exercise 2: Working with For, While, Foreach, and Switch

▶ Task 1: Create a basic for loop

1. In the PowerShell window, type the following command and press ENTER:

```
$i = 100
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-Help about_For
```

3. In the PowerShell window, type the following command and press ENTER:

```
   for ($i; $i -lt 100; $i++) {
Write-Host $i
}
```

4. In the PowerShell window, type the following command and press ENTER:

```
   for ($i = 0; $i -lt 100; $i++) {
Write-Host $i
}
```

Task 2: Create a basic while loop

1. In the PowerShell window, type the following command and press ENTER:

```
$i = 0
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-Help about_While
```

3. In the PowerShell window, type the following command and press ENTER:

```
   while ($i -lt 100) {
write $i; $i++ }
```

Task 3: Use the for statement to create users in Active Directory

1. In the PowerShell window, type the following command and press ENTER:

```
Import-Module ActiveDirectory
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-Help New-ADUser
```

3. In the PowerShell window, type the following command and press ENTER:

```
New-ADUser -Name "Module11BTest1" -Path 'CN=Users,DC=contoso,DC=com' -SamAccountName
"Module11BTest1" -PassThru
```

4. In the PowerShell window, type the following command and press ENTER:

```
$numUsers = 10
```

5. In the PowerShell window, type the following command and press ENTER:

```
   for ($i = 2; $i -le $numUsers; $i++) {
New-ADUser -Name "Module11BTest$i" -Path 'CN=Users,DC=contoso,DC=com' -SamAccountName
"Module11BTest$i" -PassThru
}
```

6. In the PowerShell window, type the following command and press ENTER:

```
Get-ADUser -filter 'name -like "Module11BTest*"' | Remove-ADUser
```

When you are prompted to confirm whether or not you want to remove the users, press **A** to remove all test users.

▶ Task 4: Use foreach to iterate through a collection of objects

1. In the PowerShell window, type the following command and press ENTER:

```
get-help about_foreach
```

2. In the PowerShell window, type the following command and press ENTER:

```
$disks = Get-WmiObject Win32_LogicalDisk
```

3. In the PowerShell window, type the following command and press ENTER:

```
foreach ($disk in $disks) {
$disk | Select-Object DeviceID,DriveType
}
```

▶ Task 5: Use switch to test a value and translate it to a human-readable string

1. In the PowerShell window, type the following command and press ENTER:

```
get-help about_switch
```

2. In the PowerShell window, type the following command and press ENTER:

```
foreach ($disk in $disks) {
  $driveTypeValue = switch ($disk.DriveType) {
    0 {
      'Unknown'
      break
    }
    1 {
      'No Root Directory'
      break
    }
    2 {
      'Removable Disk'
      break
    }
    3 {
      'Local Disk'
      break
    }
    4 {
      'Network Drive'
      break
    }
    5 {
      'Compact Disk'
      break
    }
    6 {
      'RAM Disk'
      break
    }
  }
  $disk |
  Select-Object -Property  DeviceID,
    @{name='DriveType';expression={$driveTypeValue}}
}
```

Note: Be aware of the formatting if you receive errors. This will execute if typed exactly as above. You should enter this into the PowerShell ISE or you can type it all on one line and use semi-colon ; before the break command.

i.e .....6 {'RAM Disk'; break }.....

3. Run the commands if it has not already run by pressing Enter in the last step. You can run the commands by highlighting the code you wish to run, right clicking and going to "Run Selection" or by pressing F5. In the resultant diaogue type any text and click **OK**.

Results: After this exercise, you should be able to use the for, foreach, and switch statements in your PowerShell scripts.

Exercise 3: Using the Power of the One-Liner

▶ Task 1: Create scripts to retrieve and process data

1. In the PowerShell window, type the following command and press ENTER:

```
   foreach ($computer in @('LON-DC1','LON-SVR1','LON-SVR2','LON-CLI1')) {
Get-Service -Name wuauserv -ComputerName $computer
}
```

2. In the PowerShell window, type the following command and press ENTER:

```
   foreach ($user in Get-ADUser -Filter * -Properties Office) {
if ($user.Office -eq 'Bellevue') {
$user
}
}
```

▶ Task 2: Create one-liners for those scripts that are much more efficient

1. In the PowerShell window, type the following command and press ENTER:

```
Get-Service -Name w* -ComputerName @('LON-DC1','LON-SVR1','LON-SVR2','LON-CLI1')
```

Note: Remember that the @ and parentheses are optional; the shell treats this comma-separated list as an array with or without them.

2. In the PowerShell window, type the following command and press ENTER:

```
Get-ADUser -Filter 'Office -eq "Bellevue"' -Properties Office
```

Results: After this exercise, you should understand that many short scripts can be converted into simple one-liner commands that are efficient and require less memory.

Lab Review

1. Name three different keywords that allow you to do something in a loop.

   Answer: for, foreach, and while

2. What keyword should you use when you need to compare one value against many other individual values?

   Answer: switch

3. What makes a PowerShell one-liner so powerful?

   Answer: The fact that it can process a limitless amount of data and make changes to that data without many commands and without a large memory footprint.

4. What is the name of the top-most scope?

   Answer: Global

Lab C: Error Trapping and Handling

Before You Begin

1. Start the **LON-DC1** virtual machines Wait until the boot process is complete.
2. Start the **LON-SVR1** virtual machine and log on with the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
3. On LON-SVR1, open the **Windows PowerShell ISE**. All PowerShell commands will be run within the Windows PowerShell ISE program.
4. In the PowerShell window, type the following command and press ENTER:

```
Set-ExecutionPolicy RemoteSigned –Scope CurrentUser
```

   If you receive a prompt to confirm execution policy change, click **Yes**.

5. In the PowerShell window, type the following command and press ENTER:

```
Set-Location E:\Mod11\Labfiles
```

Exercise 1: Retrieving Error Information

▶ Task 1: Identify the Error Action Preference settings

1. In the PowerShell window, type the following command and press ENTER:

```
$ErrorActionPreference
```

2. In the PowerShell window, type the following command and press ENTER:

```
Get-Help  about_preference_variables
```

3. In the PowerShell window, type the following command and press ENTER:

```
Get-Help  about_CommonParameters
```

▶ Task 2: Control nonterminating error action in scope

1. In the PowerShell window, type the following command and press ENTER:

```
Set-Location E:\Mod11\Labfiles
```

2. In the PowerShell window, type the following command and press ENTER:

```
$ErrorActionPreference = 'Continue'
```

3. In the PowerShell window, type the following command and press ENTER:

```
./ErrorActionPreference.ps1 –FilePath Servers.txt
```

4. In the PowerShell window, type the following command and press ENTER:

```
./ErrorActionPreference.ps1 –FilePath DoesNotExist.txt
```

5. In the PowerShell window, type the following command and press ENTER:

```
$ErrorActionPreference = 'SilentlyContinue'
```

6. In the PowerShell window, type the following command and press ENTER:

```
./ErrorActionPreference.ps1 –FilePath DoesNotExist.txt
```

7. In the PowerShell window, type the following command and press ENTER:

```
$ErrorActionPreference = 'Inquire'
```

8. In the PowerShell window, type the following command and press ENTER:

```
./ErrorActionPreference.ps1 –FilePath DoesNotExist.txt
```

9. In the PowerShell window, type the following command and press ENTER:

```
$ErrorActionPreference = 'Stop'
```

10. In the PowerShell window, type the following command and press ENTER:

```
./ErrorActionPreference.ps1 –FilePath DoesNotExist.txt
```

11. Close the Windows PowerShell window.

▶ Task 3: Control error action per command

1. Open the Windows PowerShell ISE again and click the **File** menu, click on the **Open** menu item, and navigate to and select **E:\Mod11\Labfiles\ErrorActionPreference.ps1**.
2. In the PowerShell window, type the following command and press ENTER:

```
$ErrorActionPreference = 'Continue'
```

3. Edit line 6 of **ErrorActionPreference.ps1** to be the following and save the file:

```
[string[]]$servers = Get-Content $FilePath –ErrorAction 'SilentlyContinue'
```

4. In the PowerShell window, type the following command and press ENTER:

```
.\ErrorActionPreference.ps1 –FilePath DoesNotExist.txt
```

5. Edit line 6 of **ErrorActionPreference.ps1** to be the following and save the file:

```
[string[]]$servers = Get-Content $FilePath –ErrorAction 'Inquire'
```

6. In the PowerShell window, type the following command and press ENTER:

```
.\ErrorActionPreference.ps1 –FilePath DoesNotExist.txt
```

7. Edit line 6 of **ErrorActionPreference.ps1** to be the following and save the file:

```
[string[]]$servers = Get-Content $FilePath -ErrorAction 'Stop'
```

8. In the PowerShell window, type the following command and press ENTER

```
.\ErrorActionPreference.ps1 -FilePath DoesNotExist.txt
```

9. Edit line 6 of **ErrorActionPreference.ps1** to be the following and save the file:

```
[string[]]$servers = Get-Content $FilePath$err
```

10. Do not close the file in the script editor.

Task 4: Review errors globally

1. In the PowerShell window, type the following command and press ENTER:

```
Set-Location E:\Mod11\Labfiles
```

2. In the PowerShell window, type the following command and press ENTER:

```
$ErrorActionPreference = 'Continue'
```

3. In the PowerShell window, type the following command and press ENTER:

```
./ErrorActionPreference.ps1 -FilePath ServersWithErrors.txt
```

4. In the PowerShell window, type the following command and press ENTER:

```
$Error
```

5. In the PowerShell window, type the following command and press ENTER:

```
$Error[0] | get-member
```

6. Close the Windows PowerShell window.

Task 5: Review errors by command

1. Open the Windows PowerShell ISE and in the script pane edit line 12 of **ErrorActionPreference.ps1** to be the following and save the file:

```
$ComputerSystem = Get-WmiObject -Class Win32_ComputerSystem -Computername $server -
ErrorVariable global:ComputerSystemError
```

2. In the PowerShell window, type the following command and press ENTER:

```
.\ErrorActionPreference.ps1 -FilePath ServersWithErrors.txt
```

3. In the PowerShell window, type the following command and press ENTER:

```
$ComputerSystemError | Format-List *
```

4. In the PowerShell window, type the following command and press ENTER:

```
$ComputerSystemError | Get-Member
```

5. In the PowerShell window, type the following command and press ENTER:

```
Remove-Variable ComputerSystemError
```

6. In the script pane, edit line 12 of **ErrorActionPreference.ps1** to be the following and save the file:

```
$ComputerSystem = Get-WmiObject -Class Win32_ComputerSystem -Computername $server -
ErrorVariable +global:ComputerSystemError
```

7. In the PowerShell window, type the following command and press ENTER:

```
.\ErrorActionPreference.ps1 -FilePath ServersWithErrors.txt.
```

8. In the PowerShell window, type the following command and press ENTER:

```
$ComputerSystemError | Format-List *
```

9. In the PowerShell window, type the following command and press ENTER:

```
$ComputerSystemError | Get-Member
```

10. In the script pane, edit line 12 of **ErrorActionPreference.ps1** to be the following and save the file:

```
$ComputerSystem = Get-WmiObject -Class Win32_ComputerSystem -Computername $server.
```

Results: After this exercise, you should have identified terminating and nonterminating errors, controlled the Windows PowerShell runtime's Error Action Preference both in scope and by command, and examined where error information is available.

Exercise 2: Handling Errors

▶ Task 1: Handle scoped errors

1. In the Windows PowerShell ISE, click the **File** menu, click on the **Open** menu item, and navigate to and select **E:\Mod11\Labfiles\UsingTrap.ps1**.
2. In the PowerShell window, type the following command and press ENTER:

```
./UsingTrap.ps1 -FilePath ServersWithErrors.txt
```

3. In the script pane, edit the trap statement to include **$_ | get-member** to find additional information that can be used to enhance an error message.
4. Moving the trap statement above the foreach statement on line 38 stops the foreach loop at the first error. Moving the trap statement under the if statement at line 49 does not catch any ping errors but catches errors from within the **InventoryServer** function.

▶ Task 2: Handle error prone sections of code

1. In the Windows PowerShell ISE, click the **File** menu, click on the **Open** menu item, and navigate to and select **E:\Mod11\Labfiles\AddingTryCatch.ps1**.
2. In the script pane, edit the if statement on lines 42 to 45 to be the following and save the file:

```
   try{
          if ( $ping.Send("$server").Status -eq 'Success')
          {
```

```
                InventoryServer($server)
        }
  }
  Catch {
        Write-Error "Unable to ping $server"
        Write-Error "The error is located on line number: $
($_.InvocationInfo.ScriptLineNumber)"
        Write-Error "$($_.InvocationInfo.Line.Trim())"
  }
```

3. From the command pane, enter the following and press ENTER:

```
./AddingTryCatch.ps1 –FilePath ServersWithErrors.txt
```

▶ Task 3: Clean up after error prone code

1. In the script pane, after the closing brace in the catch statement, add the following and save the file:

```
  finally {
        Write-Host "Finished with $server"
  }
```

Question: What type of scenarios would a **finally** block be useful for?

Answer: The finally block is useful for closing out database connections, disposing of COM objects, unregistering events tied to unmanaged code (via the Win32 API), and cleaning up after any long-running process with potential errors.

▶ Task 4: Catch specific types of errors

1. In the script pane, change the first line of the catch statement from:

```
  catch {
```

to:

```
  catch [System.InvalidOperationException] {
```

and save the script.

2. In the command pane, enter the following command and press ENTER:

```
./AddingTryCatch.ps1 –FilePath ServersWithErrors.txt.
```

3. Click the **File** menu, click on the open item, and navigate to and select **E:\Mod11\Labfiles\UsingTrap.ps1**.
4. In the script pane, edit the trap statement from:

```
        trap {
```

to:

```
        trap [System.InvalidOperationException] {
```

and save the file.

5. In the command pane, enter the following command and press ENTER:

```
./UsingTrap.ps1 –FilePath ServersWithErrors.txt.
```

6. Save both files and close the Windows PowerShell ISE.

Results: After this exercise, you should have an understanding of how the Trap and Try…Catch…Finally constructs can catch errors while a script is running. You should also have started to identify potential trouble spots in scripts as areas to focus your error handling efforts.

Exercise 3: Integrating Error Handling

▶ Task 1: Set up the shell environment

1. On the **Start** menu click **All Programs**, click **Accessories**, click **Windows PowerShell**, right-click **Windows PowerShell,** and choose **Run as Administrator**.
2. In the PowerShell window, type the following command and press ENTER:

```
Set-ExecutionPolicy 'RemoteSigned' –Scope CurrentUser
```

   Click **Yes** in the Execution Policy Change dialogue when prompted to confirm the change.
3. In the PowerShell window, type the following command and press ENTER:

```
Set-Location E:\Mod11\Labfiles
```

▶ Task 2: Create new Event Source for the Windows PowerShell Event Log

- In the PowerShell window, type the following command and press ENTER:

```
New-EventLog –Source AuditScript –LogName 'Windows PowerShell'
```

▶ Task 3: Write error messages to the Windows PowerShell Event Log

1. In the PowerShell window, type the following command and press ENTER:

```
Write-EventLog -LogName 'Windows PowerShell' -Source 'AuditScript' -Message 'This is
a test' –EventID 3030
```

2. In the PowerShell window, type the following command and press ENTER:

```
Show-EventLog
```

3. In the event viewer, verify that your log entry was written to the Windows PowerShell event log under **Event Viewer > Applications and Service Logs > Microsoft > Windows PowerShell**.
4. Close Windows PowerShell.

▶ Task 4: Add a top level Trap function to catch unexpected errors and log them to the event log

1. On the **Start** menu click **All Programs**, click **Accessories**, click **Windows PowerShell**, and click **Windows PowerShell ISE**.
2. In the Windows PowerShell ISE, click the **File** menu, click on the **Open** menu item, and navigate to and select **E:\Mod11\Labfiles\AuditScript.ps1**.

3. In the script pane, between the param block and the first function, enter the following and save the script:

```
trap {
               $message = @"
Unhandled error in the script.
       from $($_.InvocationInfo.ScriptName)
        at line :$($_.InvocationInfo.ScriptLineNumber)
        by: $($_.InvocationInfo.InvocationName)
       Message: $($_.exception.message)
"@
      Write-EventLog -LogName "Windows PowerShell" -Source "AuditScript" -EventID
3030 -EntryType Error -Message $message }
```

Task 5: Add localized Try…Catch error handling to potential trouble spots, and log the errors to the event log

1. In the script pane, edit the script to match **AuditScriptFinal.ps1**.
2. In the command pane, type the following and press ENTER:

```
./AuditScript.ps1 –FilePath AuditTest0.txt
```

3. In the command pane, type the following and press ENTER:

```
./AuditScript.ps1 –FilePath AuditTest1.txt
```

4. In the command pane, type the following and press ENTER:

```
./AuditScript.ps1 –FilePath AuditTest2.txt
```

5. In the command pane, type the following and press ENTER:

```
Show-EventLog
```

6. Verify that errors were written to the event log from the script.
7. In the command pane, type the following and press ENTER:

```
Compare-Object –ReferenceObject (Import-CliXML AuditLog-AuditTest0.txt.xml) –
DifferenceObject (Import-CliXML AuditLog-AuditTest1.txt.xml)
```

8. In the command pane, type the following and press ENTER:

```
Compare-Object –ReferenceObject (Import-CliXML AuditLog-AuditTest1.txt.xml) –
DifferenceObject (Import-CliXML AuditLog-AuditTest2.txt.xml)
```

9. In the command pane, type the following and press ENTER:

```
Compare-Object –ReferenceObject (Import-CliXML AuditLog-AuditTest0.txt.xml) –
DifferenceObject (Import-CliXML AuditLog-AuditTest2.txt.xml)
```

10. Close the Windows PowerShell ISE.

Results: After this exercise, you should have created an event source in the Windows PowerShell event log, created a top-level trap to catch unexpected errors and log them, and wrapped potentially error prone sections of script in a Try…Catch construct.

Lab Review

1. How can you find out what members the error records have?

   Answer: $host.EnterNestedPrompt() to your trap or catch statement (or set a breakpoint) and work interactively with the error record.

2. What type of information are the error records providing you?

   Answer: What the error was, where the error was, and what the script state was at the time of the error.

3. What type of tasks might you need to do regardless of whether a task succeeds or fails?

   Answer: Close database connections, remove references to COM objects, and log success or failures to databases.

4. How would you find any cmdlets that work with the event log?

   Answer: Get-Command *EventLog*

Lab D: Debugging a Script

Before You Begin

1. Start the **LON-DC1** virtual machine, and then log on by using the following credentials:
   - Username: **CONTOSO\administrator**
   - Password: **Pa$$w0rd**
2. Open a Windows PowerShell session.

Exercise 1: Debugging from the Windows PowerShell Console

Task 1: Use $DebugPreference to enable debugging statements

1. In the Windows PowerShell window, type the following command and press ENTER:

```
Set-Location E:\Mod11\Labfiles
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
.\EvaluatePingTimes.ps1 –Path .\PingTestResults.xml -FirstRun
```

3. In the Windows PowerShell window, type the following command and press ENTER:

```
$DebugPreference = 'Continue'
```

4. In the Windows PowerShell window, type the following command and press ENTER:

```
.\EvaluatePingTimes.ps1 –Path .\PingTestResults.xml -FirstRun
```

Task 2: Use Write-Debug to provide information as the script progresses

1. In the Windows PowerShell window, type the following command and press ENTER:

```
Notepad ./CalculatePerfMonStats.ps1
```

2. Add **Write-Debug** statements inside functions, inside loops, and in other areas where variables change or are assigned, such as on line 20:

```
Write-Debug $SortedValues[$MiddleOfResults]
```

3. Save **CalculatePerfMonStats.ps1**.
4. In the Windows PowerShell window, type the following command and press ENTER:

```
.\CalculatePerfMonStats.ps1 –Path .\PerfmonData.csv
```

Task 3: Use Set-PSDebug to trace the progress through the script

1. In the Windows PowerShell window, type the following command and press ENTER:

```
$DebugPreference = 'SilentlyContinue'
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
Set-PSDebug –Trace 1
```

3. In the Windows PowerShell window, type the following command and press ENTER:

```
./EvaluatePingTimes.ps1 –Path PingTestResults.xml –FirstRun
```

4. In the Windows PowerShell window, type the following command and press ENTER:

```
Set-PSDebug –Trace 2
```

5. In the Windows PowerShell window, type the following command and press ENTER:

```
.\EvaluatePingTimes.ps1 –Path .\PingTestResults.xml –FirstRun
```

6. In the Windows PowerShell window, type the following command and press ENTER:

```
Set-PSDebug –Off
```

▶ Task 4: Use Set-PSBreakpoint to break into a script's progress at specified points

1. In the Windows PowerShell window, type the following command and press ENTER:

```
Set-PSBreakpoint –Line 36, 40, 44, 48 –Script EvaluatePingTimes.ps1
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
.\EvaluatePingTimes.ps1 –Path .\PingTestResults.xml –FirstRun
```

3. In the Windows PowerShell window, type the following command at the nested prompt and press ENTER:

```
$_ | Format-List
```

▶ Task 5: Use Get-PSBreakpoint and Remove-PSBreakpoint to manage breakpoints

1. In the Windows PowerShell window, type the following command and press ENTER:

```
Get-PSBreakpoint
```

2. Note the ID of one of the breakpoints for the next command
3. In the Windows PowerShell window, type the following command and press ENTER:

```
Remove-PSBreakpoint  -ID <ID  of one of the existing breakpoints>
```

4. In the Windows PowerShell window, type the following command and press ENTER:

```
Get-PSBreakpoint
```

5. In the Windows PowerShell window, type the following command and press ENTER:

```
Get-PSBreakpoint | Remove-PSBreakpoint
```

▶ Task 6: Use Set-PSBreakpoint to break into a script if certain conditions are met

1. In the Windows PowerShell window, type the following command and press ENTER:

```
Set-PSBreakpoint –Line 44 –Script .\EvaluatePingTimes.ps1 –Action { if
($_.RoundtripTime –eq 35) {break} else {continue}}
```

2. In the Windows PowerShell window, type the following command and press ENTER:

```
.\EvaluatePingTimes.ps1 –Path .\PingTestResults.xml –FirstRun
```

3. In the Windows PowerShell window, type the following command at the nested prompt and press ENTER:

```
$_.RoundtripTime
```

4. In the Windows PowerShell window, type the following command at the nested prompt and press ENTER:

```
exit
```

5. Close the Windows PowerShell Prompt.

Results: After this exercise, you should have an understanding of how the $DebugPreference automatic variable controls debugging messages, know how to step through troublesome scripts and track how things are changing, and set breakpoints in a script to further troubleshoot script performance.

Exercise 2: Debugging Using the Windows PowerShell Integrated Scripting Environment (ISE)

▶ Task 1: Set a breakpoint

1. In the Windows PowerShell ISE script pane with the file **E:\Mod11\Labfiles \CalculatePerfMonStats.ps1** open and loaded into the ISE, set the cursor on line 33. Select **Toggle Breakpoint** from the **Debug** menu.
2. Right-click on line 25 in the script pane. Choose **Toggle Breakpoint**.
3. Set the cursor on line 44 in the script pane. Press F9.
4. In the Windows PowerShell command window, type the following command and press ENTER: (Ensure the set-location value is still E:\Mod11\Labfiles.)

```
Get-PSBreakpoint
```

5. In the command window, type the following command and press ENTER:

```
Get-PSBreakpoint | Remove-PSBreakpoint
```

▶ Task 2: Step through the script

1. In the Windows PowerShell command window, type the following command and press ENTER:

```
Set-PSBreakpoint –Command CreateStatistics –Script CalculatePerfMonStats.ps1 –Action
{if ($CounterValue –like 'Memory\Pages/sec') {break;} else {continue}}
```

2. In the command window, type the following command and press ENTER:

```
./CalculatePerfMonStats.ps1 –Path PerfmonData.csv
```

3. When the script breaks, press F11. Press F11 again to step into the **CalculateMedian** function.
4. Press F10 to step over the first line of the **CalculateMedian** function.
5. Press SHIFT+F11 to step out of the **CalculateMedian** function.
6. When the script breaks, in the command pane, type the following command and press ENTER:

```
$Stats | Format-List
```

7. When the script breaks, in the command pane, type the following command and press ENTER:

```
exit
```

8. Close the Windows PowerShell ISE.

Results: After this exercise, you should have used the integrated debugging features in the Windows PowerShell ISE to debug a script by setting breakpoints and stepping through the script.

Lab Review

1. What are the key variables in your script, and when are they used?

   Answer: Identifying the key variables provides a starting place for setting breakpoints on variables or as places to surround with Write-Debug statements.

2. Are your commands getting the correct inputs?

   Answer: Using the debugging techniques, we can set breakpoints, use tracing, and step through our scripts to verify that what is coming into a script, function, or cmdlet is what we expect.

3. Are there hard coded paths, filenames, IP addresses, or other resources that may vary depending on where the script is run?

   Answer: Having hard-coded values in a script make it more brittle, requiring that you change the script to run in a different environment. If during debugging, you see hard-coded values, consider moving them to a parameter.

4. Are the variable names spelled correctly?

   Answer: Use Set-PSDebug –Strict to verify that you are not accessing variables that have not been initialized.

5. Are the variable names easy to distinguish from each other?

   Answer: If there are similarly spelled variables that are hard to distinguish, spelling mistakes and transposition are common errors.

Lab E: Modularization

Before You Begin

1. Start the **LON-DC1**, **LON-SVR1**, **LON-SVR2**, and **LON-CLI1** virtual machines. Wait until the boot process is complete.
2. Log on to the **LON-CLI1** virtual machine with the following credentials:
   a. Username: **CONTOSO\administrator**
   b. Password: **Pa$$w0rd**
3. Open the **Windows PowerShell ISE**. All PowerShell commands are run within the Windows PowerShell ISE program.
4. Create a text file containing the names of all computers in the domain, one on each line, and save it as **C:\users\Administrator\documents\computers.txt**.

Exercise 1: Generating an Inventory Audit Report

▶ Task 1: Create an inventory gathering function

1. In the PowerShell ISE window, type the following command into the command pane and press ENTER:

```
Get-Help New-Object -Full
```

2. In the PowerShell ISE window, type the following command into the command pane and press ENTER:

```
Get-Help about_functions
```

3. In the PowerShell ISE window, type the following into the script pane, pressing ENTER at the end of every line:

```
Function Get-Inventory {
  PROCESS {
   $bios = Get-WmiObject -Class Win32_BIOS -ComputerName $_
   $os = Get-WmiObject -Class Win32_OperatingSystem
    -ComputerName $_
   $processor = Get-WmiObject -Class Win32_Processor
    -ComputerName $_
   $obj = New-Object -TypeName PSObject
   $obj | Add-Member NoteProperty ComputerName $_
   $obj | Add-Member NoteProperty BiosSerialNumber
    ($bios.serialnumber)
   $obj | Add-Member NoteProperty OSVersion
    ($os.caption)
   $obj | Add-Member NoteProperty SPVersion
    ($os.servicepackmajorversion)
   $obj | Add-Member NoteProperty NumProcessorCores
    ($processor.numberofcores)
   write-output $obj
  }
}
'LON-DC1','LON-SVR1','LON-SVR2' | Get-Inventory
```

4. Run the commands if it has not already run by pressing Enter in the last step. You can run the commands by highlighting the code you wish to run, right clicking and going to "Run Selection" or by pressing F5. In the resultant diaogue type any text and click **OK**.

Note: If you are receiving error messages when running it double check that your formatting is correct as well as the syntax. You could also save this as a script and then run that script by calling it from the Windows PowerShell command line.

▶ Task 2: Export the results of the function in three formats: .txt, .csv, and .xml

1. In the PowerShell ISE window, modify this line:

```
'LON-DC1','LON-SVR1','LON-SVR2' | Get-Inventory
```

to read:

```
'LON-DC1','LON-SVR1','LON-SVR2' | Get-Inventory |
Out-File inventory.txt
```

2. In the PowerShell ISE window, modify this line:

```
'LON-DC1','LON-SVR1','LON-SVR2' | Get-Inventory |
Out-File inventory.txt
```

to read:

```
'LON-DC1','LON-SVR1','LON-SVR2' | Get-Inventory |
Export-CSV inventory.csv
```

3. In the PowerShell ISE window, modify this line:

```
'LON-DC1','LON-SVR1','LON-SVR2' | Get-Inventory |
Export-CSV inventory.csv
```

to read:

```
'LON-DC1','LON-SVR1','LON-SVR2' | Get-Inventory |
Export-CliXML inventory.xml
```

Results: After this exercise, you should be able to create a pipeline function (also known as a filter) that processes information passed in from the pipeline and uses it to retrieve other information. You should also be able to combine multiple objects into one object and export data from a function in multiple formats.

Lab Review

1. What parameter attributes are used to indicate that a parameter accepts pipeline input?
   Answer: ValueFromPipeline and ValueFromPipelineByPropertyName
2. What is the advantage of using an advanced function instead of a regular function?
   Answer: There are many advantages. Advanced functions support help documentation, parameter and cmdlet attributes so that PowerShell can handle many things automatically like parameter validation and WhatIf, it's easier to accept pipeline input in advanced functions, advanced functions support parameter sets are a few examples of how advanced functions offer advantages over regular functions.