1

Getting Started with PowerShell

This introductory chapter will take a look at the fundamentals of working with PowerShell. It is meant as a basic primer on PowerShell for cybersecurity and acts as an introduction to **object-oriented programming** (**OOP**) and how to get started when working with PowerShell.

This chapter complements ***Chapter 2***, *PowerShell Scripting Fundamentals*, in which we will dive deeper into the scripting part. Both chapters should help you to get started and act as a reference when working with later chapters.

You will learn the basics of what PowerShell is, its history, and why it has gained more importance in the last few years when it comes to cybersecurity.

You will get an overview of the editors and how to help yourself using existing functionalities. In this chapter, you will gain a deeper understanding of the following topics:

- What is PowerShell?
- The history of PowerShell
- Why is PowerShell useful for cybersecurity?
- Introduction to OOP
- Windows PowerShell and PowerShell Core
- Execution policy

- Help system
- PowerShell versions
- PowerShell editors

Technical requirements

To get the most out of this chapter, ensure that you have the following:

- PowerShell 7.3 and above
- Visual Studio Code installed
- Access to the GitHub repository for **`Chapter01`**:

https://github.com/PacktPublishing/PowerShell-Automation-and-Scripting-for-Cybersecurity/tree/master/Chapter01

What is PowerShell?

PowerShell is a scripting framework and command shell, built on .NET. It is implemented, by default, on Windows **Operating Systems** (**OSs**). It is object-based, which means that everything you work with (such as variables, input, and more) has properties and methods. That opens up a lot of possibilities when working with PowerShell.

Additionally, PowerShell has a pipeline and allows you to pipe input into other commands to reuse it. This combines the advantages of a command line-based script language with an object-oriented language. And on top of this, it has a built-in help system that allows you to help yourself while working on the console.

PowerShell does not exclusively run on Windows OSs. Since PowerShell Core was released in 2016, it can run on any OS, including Linux and macOS devices.

It helps security professionals to get a lot of work done in a very short space of time. Not only do blue teamers find it useful, but also red teamers. As with every feature that provides a lot of capabilities and enables you to do your daily work in a more efficient way, it can be used for good and bad purposes. It can be a mighty tool for professionals, but as usual, security professionals need to do their part to secure their environments so that existing tools and machines will not be abused by adversaries.

But first, let's take a look at how PowerShell was born and how it developed over the years.

The history of PowerShell

Before PowerShell was created, there were already **Command Line Interfaces** (**CLIs**) available, shipped with each OS to manage the system via command line: `COMMAND.COM` was the default in MS DOS and Windows 9.x, while `cmd.exe` was the default in the Windows NT family. The latter, `cmd.exe`, is still integrated within modern Windows OSs such as Windows 10.

Those CLIs could be used to not only execute commands from the command line but also to write scripts to automate tasks, using the batch file syntax.

Because not all functions of the **Graphical User Interface** (**GUI**) were available, it was not possible to automate all tasks via the command line. Additionally, the language had inconsistencies, so scripting was not as easy as it should have been in the first place.

In 1998, Microsoft released **Windows Script Host** (`cscript.exe`) in Windows 98 to overcome the limits of the former CLIs and to improve the scripting experience. With `cscript.exe`, it now became possible to work with the APIs of the **Component Object Model** (**COM**), which made this interface very mighty; so mighty that not only did system administrators leverage this new feature but also the malware authors. This quickly lent **`cscript.exe`** the reputation of being a vulnerable vector of the OS.

Additionally, the documentation of Windows Script Host was not easily accessible, and there were even more CLIs developed for different use cases besides **`cscript.exe`**, such as **`netsh`** and **`wmic`**.

In 1999, *Jeffrey Snover*, who had a UNIX background, started to work for Microsoft. *Snover* was a big fan of command lines and automation, so his initial goal was to use UNIX tools on Microsoft systems, supporting the Microsoft Windows **Services for UNIX** (**SFU**).

However, as there is a big architectural difference between Windows and UNIX-based systems, he quickly noticed that making UNIX tools work on Windows didn't bring any value to Windows-based systems.

While UNIX systems relied on ASCII files that could be easily leveraged and manipulated with tools such as **`awk`**, **`sed`**, **`grep`**, and more, Windows systems were API-based, leveraging structured data.

So, he decided that he could do better and, in 2002, started to work on a new command-line interface called **Monad** (also known as **Microsoft Shell**/**MSH**).

Now, Monad not only had the option to pass structured data (objects) into the pipe, instead of simple text, but also run scripts remotely on multiple devices. Additionally, it was easier for administrators to use Monad for administration as many default tasks were simplified within this framework.

On April 25, 2006, Microsoft announced that Monad was renamed PowerShell. In the same year, the first version of PowerShell was released, and not much later (in January 2007), PowerShell was released for Windows Vista.

In 2009, PowerShell 2.0 was released as a component of Windows 7 and Windows Server 2008 R2 that was integrated, by default, into the OS.

Over the years, PowerShell was developed even further, and many new versions were released in the meantime, containing new features and improvements.

Then, in 2016, Microsoft announced that PowerShell would be made open source (MIT license) and would also be supported cross-platform.

PowerShell 5.1, which was also released in 2016, was the last Windows-only PowerShell version. It is still shipped on Windows systems but is no longer developed.

The PowerShell team was in the process of supporting Nano Server. So, there was a full version of PowerShell supporting Windows servers and clients. Nano Server had a severely trimmed version of .NET (called .NET Core), so the team had to reduce functions and chop it down to make PowerShell work with .NET Core. So, technically PowerShell 5.1 for Nano Server was the first version of PowerShell Core.

The first real and official version of PowerShell Core was 6.0, which also offered support for cross-platform such as macOS and Linux.

Why is PowerShell useful for cybersecurity?

PowerShell runs on most modern Windows systems as a default. It helps administrators to automate their daily workflows. Since PowerShell is available on all systems, it also makes it easier for attackers to use the scripting language for their own purposes – if attackers get access to a system, for example, through a **credential theft** attack.

For attackers, that sounds amazing: a preinstalled scripting framework that provides direct access to cmdlets and the underlying .NET Framework. Automation allows you to get a lot done – not just for a good purpose.

Is PowerShell dangerous, and should it be disabled?

No! I have often heard this question when talking to CISOs. As PowerShell is seen more and more in the hands of the red team, some people fear the capabilities of this mighty scripting framework.

But as usual, it's not black and white, and organizations should rather think about how to harden their systems and protect their identities, how to implement better detection, and how to leverage PowerShell in a way that benefits their workloads and processes – instead of worrying about PowerShell.

In the end, when you set up a server, you don't just install it and connect it to the internet. The same goes for PowerShell: you don't just enable PowerShell remote usage in your organization allowing everybody to connect remotely to your servers, regardless of their role.

PowerShell is just a scripting language, similar to the preinstalled **cscript** or **batch**. Technically, it provides the same potential impact as **Java** or **.NET**.

And if we compare it to Linux or macOS, saying that PowerShell is dangerous is like saying that **Bash or zsh** is dangerous.

A friend who worked in incident response for many years once told me about adversaries dropping **C#** code files on the target boxes and calling **csc.exe** (which is part of the .NET Framework) to compile the dropped files directly on the box. Which is a very effective way to abuse a preinstalled software to install the adversary's code on the system without even leveraging PowerShell.

So, in other words, it is not the language that is dangerous or malicious; adversaries still require identities or authorization for the execution, which can be constrained by the security expert or administrator who is responsible for the environment's security.

And to be honest, all red teamers that I know or have talked to are starting to move more and more to other languages such as C# or C++ instead of PowerShell, if they want to stay undetected during their attacks.

If the right security measures and detections are implemented, it is almost impossible to go unnoticed when using PowerShell for an attack in a well-configured and protected environment. Once you have followed the security best practices, PowerShell will support you to keep your environment safe and help you track any attackers in your environment.

Additionally, a lot of your environmental security depends on your global credentials and access hygiene: before attackers can leverage PowerShell, first, they need access to a system. We'll take a closer look at how to secure your environment credential-wise in ***Chapter 6***, *Active Directory – Attacks and Mitigation*.

How can PowerShell support my blue team?

PowerShell not only enables your IT professionals to work more efficiently and to get things done quicker, but it also provides your security team with great options.

PowerShell offers a lot of built-in safety guards that you will learn more about in this book:

- **Automation and compliance**: One of the main benefits is that you can automate repeatable, tedious tasks. Not only will your administrators benefit from automating tasks, but your **Security**

Operations Center (**SOC**) can automate response actions taken, triggered by certain events.

One of the main reasons organizations are getting breached is missing security updates. It is not easy to keep all systems up to date – even with updated management systems such as **Windows Server Update Services** (**WSUS**) in place. PowerShell can help to build a mechanism to regularly check whether updates are missing to keep your environment secure.

Auditing and enforcing compliance can easily be achieved using **Desired State Configuration** (**DSC**).

Automate security checks to audit Active Directory or server security and enforce your security baselines. DSC allows you to control the configuration of your servers at any time. You can configure your machines to reset their configuration up to every 15 minutes to the configuration you specified.

Additionally, if you integrate DSC as part of your incident response plan, it is very easy to rebuild potentially compromised servers from the scratch.

- **Control who is allowed to do what and where**: By configuring **PowerShell remoting/WinRM**, you can specify *who* is allowed to log on to *which device or server*. Of course, it does not help against **credential theft** (as this is not a PowerShell topic), but it helps to granularly define which identity is allowed to do what. Additionally, it provides great auditing capabilities for remote connections.

Constrained Language mode lets you restrict which PowerShell elements are allowed in a session. This can already help to prevent certain attacks.

And using **Just Enough Administration** (**JEA**), you can even restrict which roles/identities are allowed to run which commands on which machine. You can even restrict the parameters of a command.

- **Find out what is going on in your environment**: PowerShell provides an extensive logging framework with many additional logging options such as creating transcripts and script block logging.

Every action in PowerShell can be tracked if the right infrastructure is put behind it. You can even automate your response actions using a **Security Orchestration, Automation, and Response** (**SOAR**) approach.

Using PowerShell, you can quickly pull and search event logs of multiple servers, connecting remotely to analyze them.

In a case of a security breach, PowerShell can also help you to collect and investigate the forensic artifacts and to automate the investigation. There are great modules such as *PowerForensics* that you can reuse for your forensics operations and post-breach remediation.

- **Restrict which scripts are allowed to run**: By default, PowerShell brings a feature called **Execution Policy**. Although it is *not* a security control, it prevents users from unintentionally running scripts.

Signing your code helps you to verify whether a script that is run is considered legit: if you allow only signed scripts to run, this is a great way to prevent your users to run scripts directly downloaded from the internet.

AppLocker, in combination with **Code Signing**, can help you to control which scripts are allowed to run in your organization.

The mentioned solutions do not restrict interactive code restriction though.

- **Detect and stop malicious code from execution**: The **Antimalware Scan Interface** (**AMSI**) provides a possibility to have your code checked by the antimalware solution that is currently present on the machine. This can help to detect malicious code and is also a great safeguard against file-less malware attacks (**living off the land**) – attacks that don't require files to be stored on the machine, but rather directly run the code in memory.

It is integrated directly into PowerShell and can assess scripts, interactive use, and dynamic code evaluation.

These are only some examples of how PowerShell can support the blue team, but it should already give you an overview of how blue teamers can benefit from using and auditing PowerShell.

It is also worth reading the great blog article *PowerShell ♥ the Blue Team that* the Microsoft PowerShell team has published to provide advice on how PowerShell supports blue teamers: **https://devblogs.microsoft.com/powershell/powershell-the-blue-team/**.

You will learn more about possible attacks, mitigations, and bypasses during your journey throughout this book.

But first, let's start refreshing your knowledge of PowerShell fundamentals. Enjoy!

Getting started with PowerShell

Before we can jump directly into scripting for cybersecurity and crazy red or blue team tasks, it is important to know some of the basics of PowerShell. Here are some refreshers that will help you to get started.

Introduction to OOP

PowerShell is an object-oriented language. OOP allows developers to think of software development as if they were working with real-life objects or entities. Some of the main advantages of OOP are that it's scalable, flexible, and overall, it lets you efficiently reuse your code.

Some of the base terminologies in OOP are **classes**, **objects**, **properties**, and **methods**. And if we look at the four main principles of OOP – **encapsulation**, **abstraction**, **inheritance**, and **polymorphism** – you quickly feel overwhelmed if you have no experience with OOP yet.

But don't worry, it is not as hard as it sounds, and OOP will make your life easier!

To better understand those concepts and principles, let's look at Alice and Bob as an example. They are both human beings; therefore, they share the same *class*: `human`. Both are our working entities in our example and, therefore, are our *objects*.

A *class* is a collection of properties and methods, similar to a blueprint for objects. Alice and Bob are both humans and share many *properties* and *methods*. Both have a certain amount of energy they can spend per day, can feel more or less relaxed, and need to work to gain money.

Both need to work and like to drink coffee. During the night, both need to sleep to restore their energy:

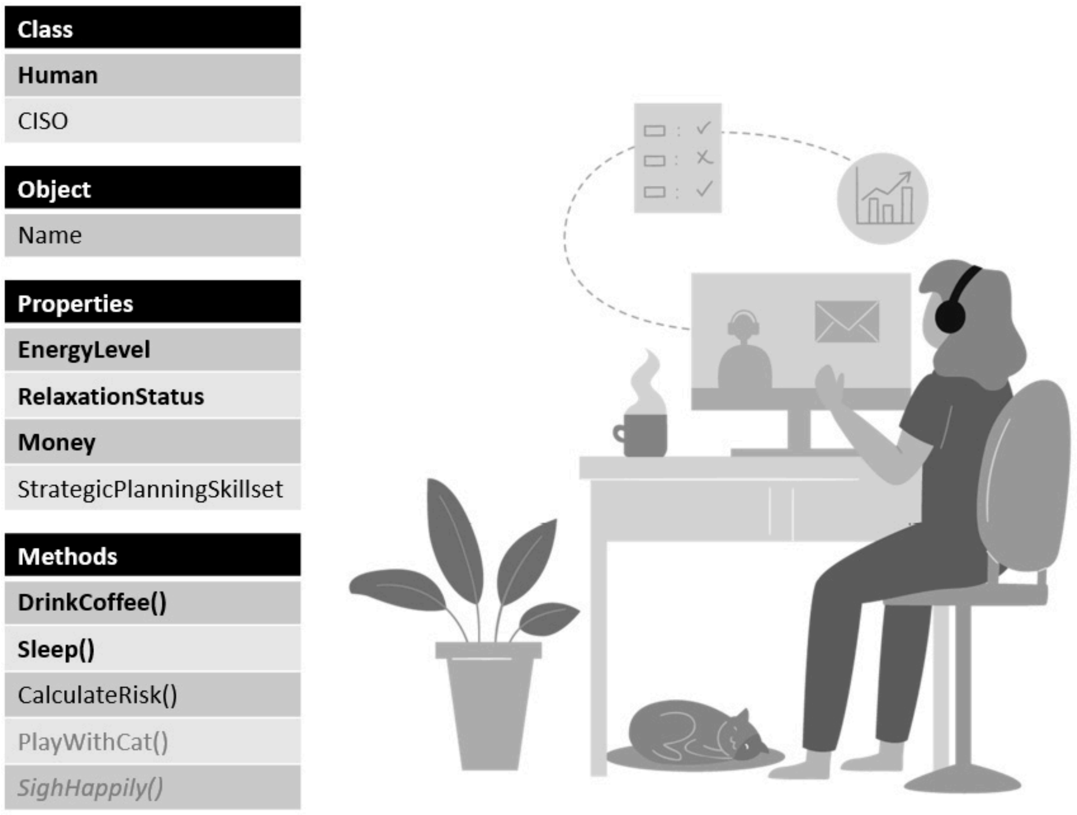


Figure 1.1 – Alice, the CISO

Alice works as a **Chief Information Security Officer** (**CISO**) and, often, plays between meetings and in the evening with her cat Mr. Meow, which helps her to relax.

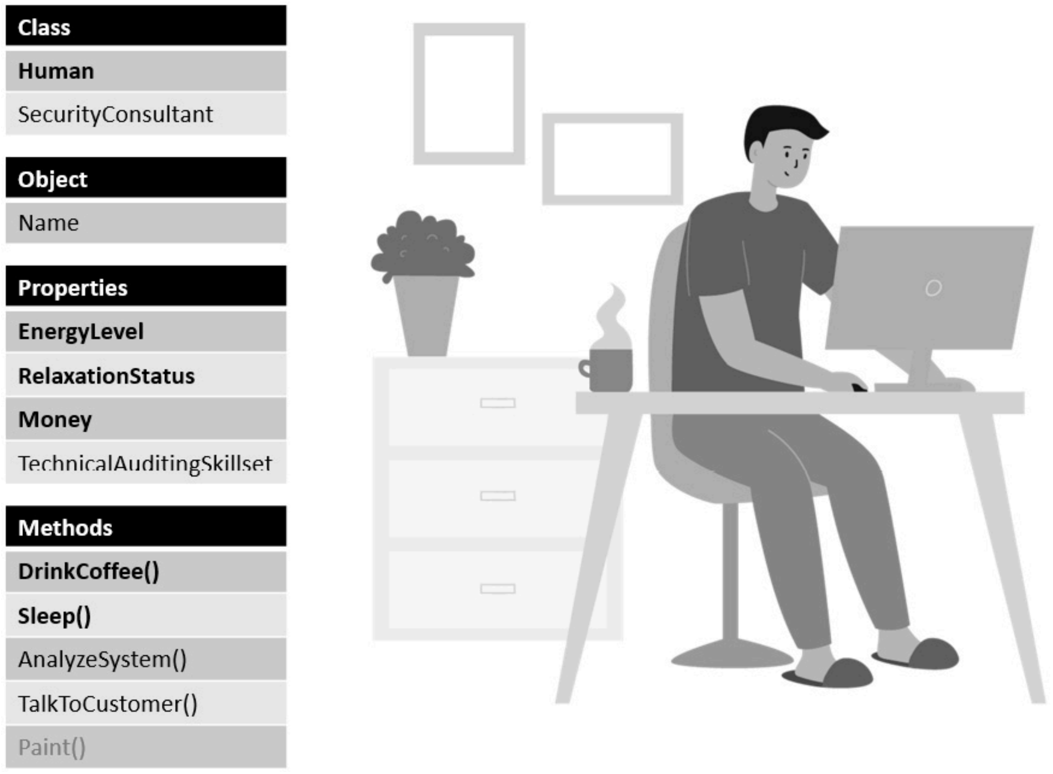


Figure 1.2 – Bob, the security consultant

In comparison, Bob works as a security consultant. Although he is also a human, he has different *methods* than Alice: Bob does not have a cat, but he enjoys painting in his spare time, which makes him feel relaxed and restores his batteries.

Let's explore the four main principles of OOP, looking at Alice and Bob.

Encapsulation

Encapsulation is achieved if each object keeps its state **private** inside a class. Other objects cannot access it directly, they need to call a method to change its state.

For example, Alice's state includes the private `EnergyLevel`, `RelaxationStatus`, and `Money` properties. She also has a private `SighHappily()` method. She can call this method whenever she wants; the other classes can't influence whenever Alice sighs happily. When Alice plays with her cat Mr. Meow, the `SighHappily()` method is called by default – Alice really enjoys this activity.

What other classes can do is call the public `Work()`, `DrinkCoffee()`, `Sleep()`, and `PlayWithCat()` functions. Those functions can change the internal state and even call the private `SighHappily()` method when Alice plays with her cat Mr. Meow:

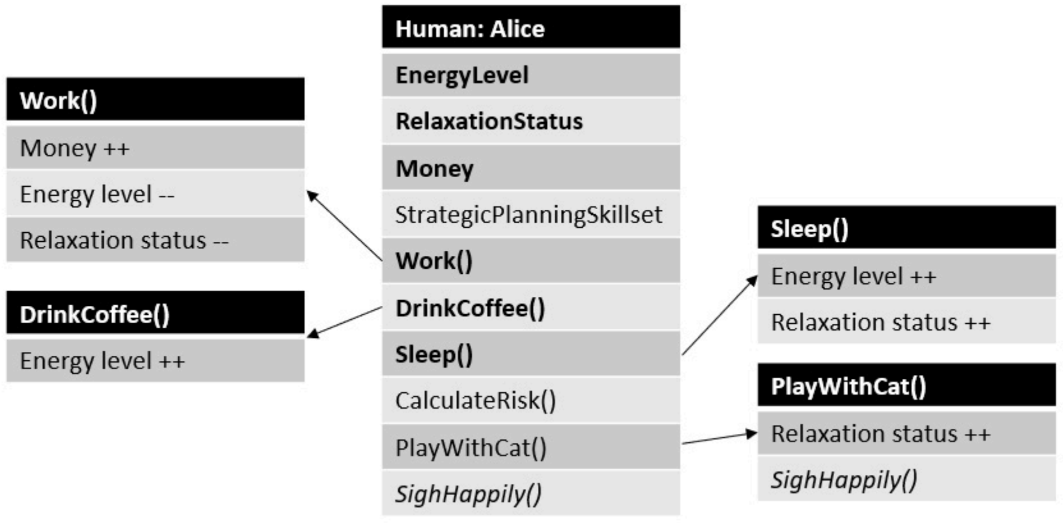


Figure 1.3 – A closer look at public and private methods

To summarize, if you want to change a private property's value, you always need to call a public method that is linked to the private state. Like in real life, there is no magic cure – besides coffee – to immediately remove your tiredness. And even with coffee, you still need to perform an action to drink it. The binding that exists between the private state and the public methods is called **encapsulation**.

Abstraction

Abstraction can be thought of as a natural extension of encapsulation. Often, a code base becomes super extensive, and you can lose the overview. Applying abstraction means that each object should expose its methods at only a high level and should hide details that are not necessary to other objects.

So, for example, we have the `Work()` method defined in the `human` class.

Depending on how technical your parents are, they might understand what you do in your daily job. Mine, however, do not understand a word that I say. They just know that I work with computers. So, if I talk with my parents on the phone, instead of telling them every detail and boring them to death, I just tell them that I have finished work.

A similar principle should also apply when writing object-oriented code. Although there are many different operations behind the **`Work()`**method, it is abstracted and only the relevant data is shown.

Another example could be an elevator in the office. When you push a button to get to a different floor, something happens below the surface. But only the buttons and the display, indicating the floor level, are shown to the user of the elevator. This principle is called abstraction and helps to keep an overview of the task that should be achieved.

Inheritance

If you require very similar classes or objects, you won't want to duplicate existing code. This would make things more complicated, work-intensive, and there would be a higher chance of implementing bugs – for example, if you have to change the code for all different instances and forget one.

So, our Alice and Bob objects are quite similar and share a *common logic*, but they are *not entirely the same*. They are both humans, but they have different professions that require different skillsets and tasks performed.

All CISOs and all security consultants are humans, so both roles **inherit** all properties and methods from the **`human`** class.

Similar to the **`SecurityConsultant`** class, the **`CISO`** class inherits all properties and methods of the **`human`** class. However, while the **`CISO`** class also introduces the **`StrategicPlanningSkillset`** property and the **`CalculateRisk()`** method, they are not necessary for the **`SecurityConsultant`** class.

The **`SecurityConsultant`** class defines their own **`TechnicalAuditingSkillset`** property and **`AnalyzeSystem()`** and **`TalkToCustomer()`** methods.

Alice inherits all the skills that were defined in the **`human`** class, and in the **`CISO`** class, which builds a *hierarchy*: **`human`** is now the parent class of the **`CISO`** class, while the **`CISO`** class is Alice's **parent** class – in this case, Alice is the **child** object.

Additionally, Bob inherits all the properties and methods defined in the **`human`** class, but in comparison to Alice, he inherits everything from the **`SecurityConsultant`** class:

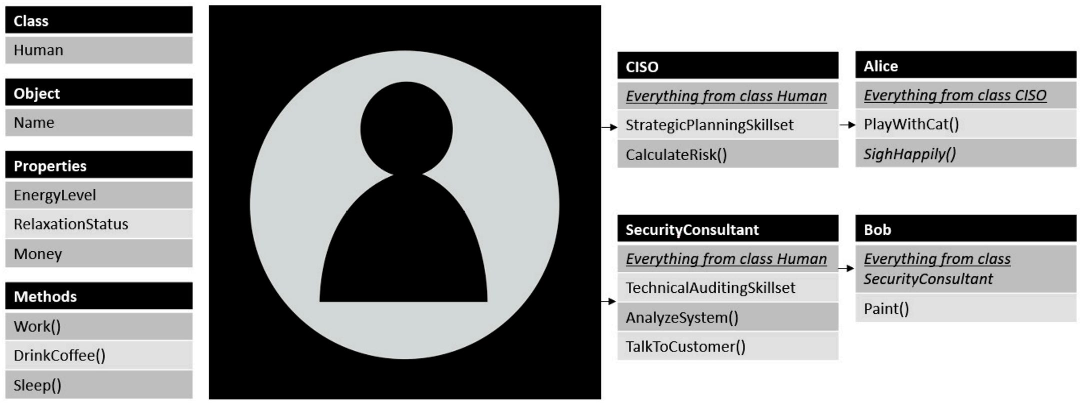


Figure 1.4 – Inheritance: parent and child classes and objects

And yes, dear security consultants and CISOs, I know that your profession requires far more skills and that your role is far more challenging than is shown in this example. I tried to make it abstract to keep it simple.

Looking at Alice and Bob, Alice enjoys spending time with her cat, Mr. Meow, so she brings her unique **`PlayWithCat()`** and **`SighHappily()`** methods. Bob does not have a cat, but he enjoys painting and, therefore, has the unique **`Paint()`** method.

Using **inheritance**, we only need to add what is necessary to implement the required changes while using the existing logic with the parent classes.

Polymorphism

Now that we have looked into the concept of inheritance, **polymorphism** is not far off. Polymorphism means that although you can create different objects out of different classes, all classes and objects can be used just like their parents.

If we look at Alice and Bob, both are humans. That means we can rely on the fact that both support the **`EnergyLevel`**, **`RelaxationStatus`**, and **`Money`** properties along with the **`Work()`**, **`DrinkCoffee()`**, and **`Sleep()`** methods.

Additionally, they can support other unique properties and methods, but they always support the same ones as their parents to avoid confusion.

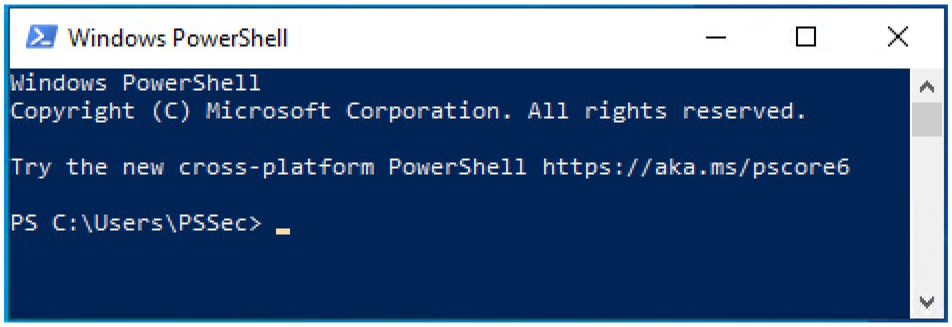
Please note that this overview should only serve as a high-level overview; if you want to dive deeper into the concepts of OOP, you might want to look into other literature solely on OOP, such as *Learning Object-Oriented Programming*, which is written by Gaston C. Hillar and also published by Packt.

Now that you understand the base concepts of OOP, let's get back to working with PowerShell.

Windows PowerShell

By default, Windows PowerShell 5.1 is installed on all newer systems, starting with Windows 10. You can either open it by searching in your Start menu for **`PowerShell`**, or you can also start it via *Windows key* + *R* and typing in **`powershell`** or **`powershell.exe`**.

In this console, you can run commands, scripts, or cmdlets:



```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\PSSec> _
```

Figure 1.5 – The Windows PowerShell version 5.1 CLI

On Windows 10 devices, the default location of Windows PowerShell v5.1 is under the following:

- Windows PowerShell: **`%SystemRoot%\system32\WindowsPowerShell\v1.0\powershell.exe`**
- Windows PowerShell (x86): **`%SystemRoot%\syswow64\WindowsPowerShell\v1.0\powershell.exe`**

WHY IS THERE A V1.0 IN THE PATH? DOES THAT MEAN I'M RUNNING AN OLD VERSION?

As we will also take a more detailed look at PowerShell versions in this book, you might think Omg, I heard that old versions do not provide all necessary security features, such as logging and many more! Am I at risk?

No, you aren't. Although the path contains **`v1`**, *newer versions are being installed in this exact path. Originally it was planned to create a new folder with the correct version name, but later Microsoft decided against it so that no breaking changes are caused.*

You might have also noticed the **`.ps1`** *script extension. We have the same reason here: originally it was also planned that each version will be differentiated by the script extension. But out of backward compatibility reasons, this idea was not implemented for PowerShell v2 logic.*

But since Windows PowerShell will not be developed further, it makes sense to install and use the latest PowerShell Core binaries.

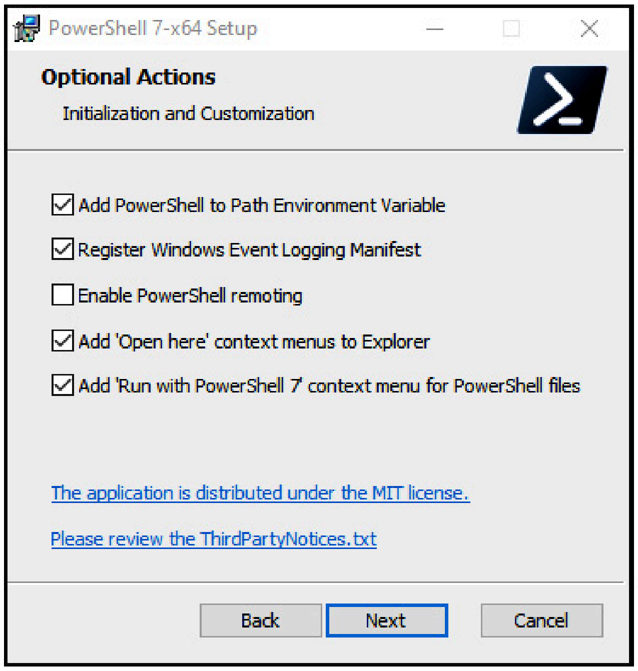
PowerShell Core

On newer systems, Windows PowerShell version 5.1 is still installed by default. To use the latest PowerShell Core version, you need to manually download and install it. While this book was written, the latest stable PowerShell Core version was PowerShell 7.3.6.

To learn more about how to download and install the latest PowerShell Core version, you can leverage the official documentation: https://docs.microsoft.com/en-us/powershell/scripting/install/installing-powershell-core-on-windows.

You will find the latest stable PowerShell Core version here: https://aka.ms/powershell-release?tag=stable.

Download it and start the installation. The installation wizard opens and guides you through the installation. Depending on your requirements, you can specify what should be configured by default:



- [✓] Add PowerShell to Path Environment Variable
- [✓] Register Windows Event Logging Manifest
- [ ] Enable PowerShell remoting
- [✓] Add 'Open here' context menus to Explorer
- [✓] Add 'Run with PowerShell 7' context menu for PowerShell files

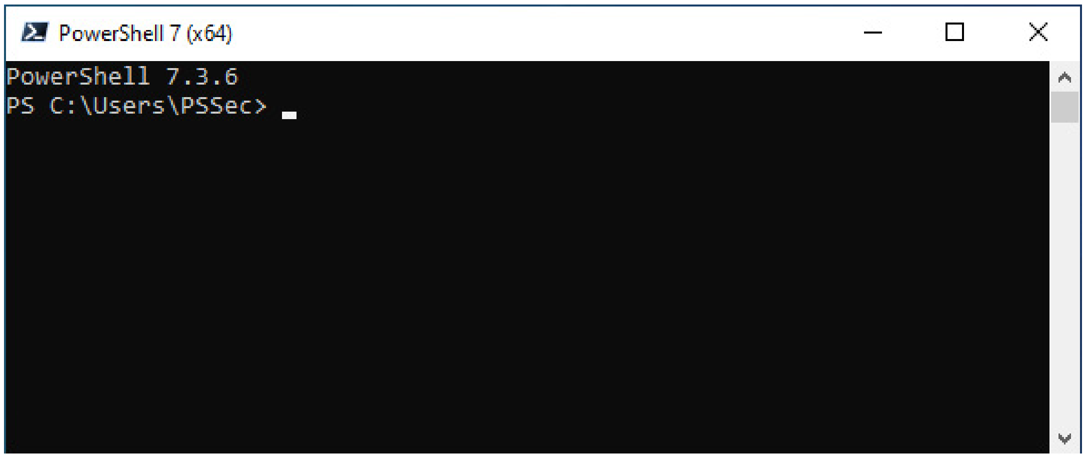
The application is distributed under the MIT license.

Please review the ThirdPartyNotices.txt

Figure 1.6 – Installing PowerShell 7

Don't worry if you haven't enabled **PowerShell remoting** yet. You can configure this option later. The wizard runs through and installs PowerShell Core in the separate **`$env:ProgramFiles\PowerShell\7`** location. PowerShell 7 is designed to run parallel to PowerShell 5.1.

After the setup is complete, you can launch the new PowerShell console and pin it to your taskbar or the Start menu:



```
PowerShell 7.3.6
PS C:\Users\PSSec>
```

Figure 1.7 – The PowerShell version 7 CLI

Now you can use the latest PowerShell Core version instead of the old Windows PowerShell version 5.1.

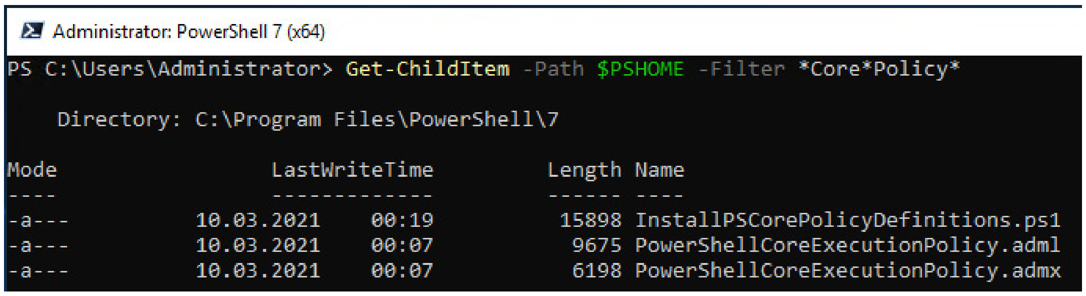
Installing PowerShell Core Group Policy definitions

To define consistent options for your servers in your environment, Group Policy helps with the configuration.

When installing PowerShell 7, Group Policy templates, along with an installation script, will be populated under **`$PSHOME`**.

Group Policy requires two kinds of templates (**`.admx`**, **`.adml`**) to allow the configuration of registry-based settings.

You can find the templates as well as the installation script using the **`Get-ChildItem -Path $PSHOME -Filter *Core*Policy*`** command:



Administrator: PowerShell 7 (x64)

```
PS C:\Users\Administrator> Get-ChildItem -Path $PSHOME -Filter *Core*Policy*

    Directory: C:\Program Files\PowerShell\7

Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
-a---          10.03.2021    00:19          15898 InstallPSCorePolicyDefinitions.ps1
-a---          10.03.2021    00:07           9675 PowerShellCoreExecutionPolicy.adml
-a---          10.03.2021    00:07           6198 PowerShellCoreExecutionPolicy.admx
```

Figure 1.8 – Locating the PowerShell Core Group Policy templates and installation script

Type **`$PSHOME\InstallPSCorePolicyDefinitions.ps1`** into your domain controller, press *Tab*, and confirm with *Enter*.

The Group Policy templates for PowerShell Core will be installed, and you can access them by navigating to the following:

- **Computer Configuration** | **Administrative Templates** | **PowerShell Core**
- **User Configuration** |**Administrative Templates** | **PowerShell Core**

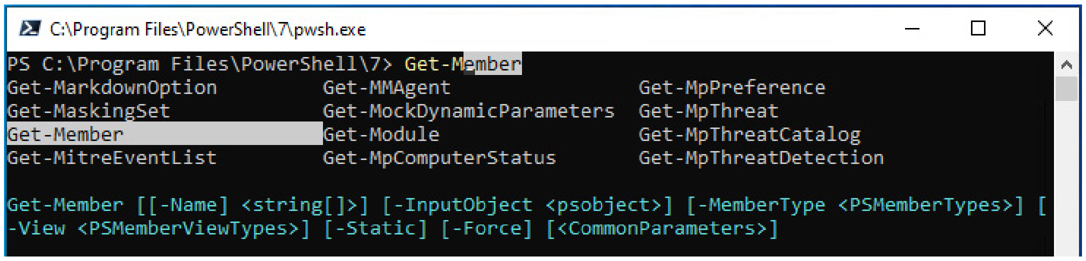
You can now use them to configure PowerShell Core in your environment, in parallel to Windows PowerShell.

You can configure both policies differently, but to avoid confusion and misconfiguration, I recommend configuring the setting in Windows PowerShell and checking the **Use Windows PowerShell Policy setting** box, which is available in all PowerShell Core Group Policy settings.

Autocompletion

Autocompleting commands can be very useful and can save a lot of time. You can either use *Tab* or *Ctrl* + spacebar for autocompletion:

- With *Tab*, the command that comes nearest to the command that you already typed in is shown. With every other *Tab* you can switch through the commands and have the next one – sorted alphabetically – entered.
- If there are multiple commands that fit the string you entered, you can type *Ctrl* + spacebar to see all possible commands. You can use the arrow keys to select a command. Confirm with *Enter*:

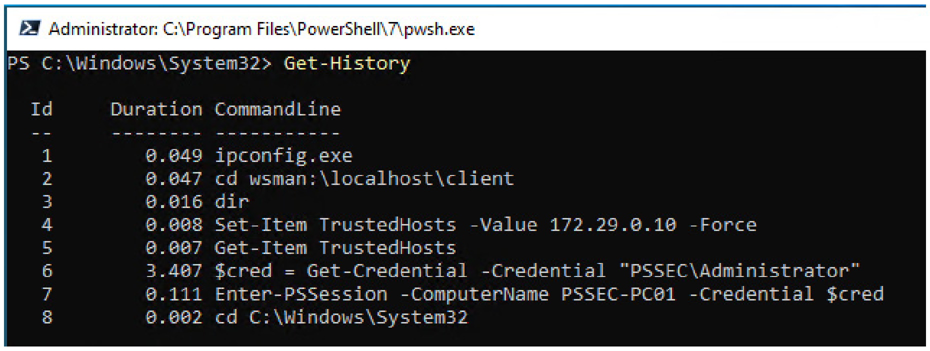


```
C:\Program Files\PowerShell\7\pwsh.exe
PS C:\Program Files\PowerShell\7> Get-Member
Get-MarkdownOption          Get-MMAgent                 Get-MpPreference
Get-MaskingSet              Get-MockDynamicParameters   Get-MpThreat
Get-Member                  Get-Module                  Get-MpThreatCatalog
Get-MitreEventList          Get-MpComputerStatus        Get-MpThreatDetection

Get-Member [[-Name] <string[]>] [-InputObject <psobject>] [-MemberType <PSMemberTypes>] [
-View <PSMemberViewTypes>] [-Static] [-Force] [<CommonParameters>]
```

Figure 1.9 – Using Ctrl + spacebar to choose the right command

Working with the PowerShell history

Sometimes, it can be useful to find out which commands you have used recently in your PowerShell session:



```
Administrator: C:\Program Files\PowerShell\7\pwsh.exe
PS C:\Windows\System32> Get-History

  Id     Duration CommandLine
  --     -------- -----------
   1        0.049 ipconfig.exe
   2        0.047 cd wsman:\localhost\client
   3        0.016 dir
   4        0.008 Set-Item TrustedHosts -Value 172.29.0.10 -Force
   5        0.007 Get-Item TrustedHosts
   6        3.407 $cred = Get-Credential -Credential "PSSEC\Administrator"
   7        0.111 Enter-PSSession -ComputerName PSSEC-PC01 -Credential $cred
   8        0.002 cd C:\Windows\System32
```

Figure 1.10 – Using Get-History

All recently used commands are shown. Use the arrow keys to browse the last-used commands, change them, and run them again.

In this example, one of the last commands that was run was the **`Enter-PSSession`** command, which initiates a PowerShell remoting session to the specified host – in this case, to **`PSSEC-PC01`**.

If you want to initiate another PowerShell remoting session to **PSSEC-PC02** instead of **PSSEC-PC01**, you don't have to type in the whole command again: just use the *arrow up key* once, then change **-ComputerName** to **PSSEC-PC02** and hit *Enter* to execute it.

If your configuration allows you to connect to **PSSEC-PC02** from this PC using the same credentials, the connection is established, and you can work remotely on **PSSEC-PC02**.

We will have a closer look at PowerShell remoting in ***Chapter 3***, *Exploring PowerShell Remote Management Technologies and PowerShell Remoting*.

Searching the PowerShell history

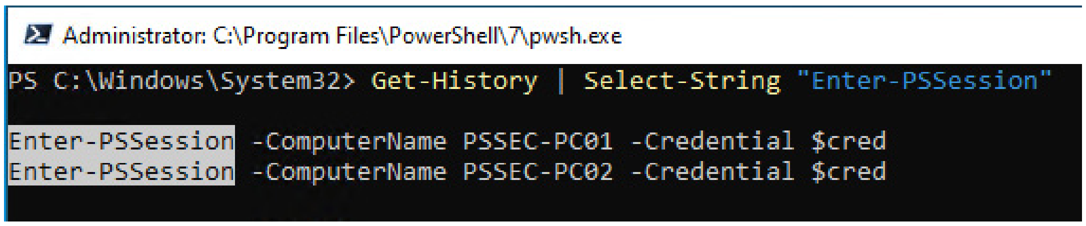
To search the history, pipe the **Get-History** command to **Select-String** and define the string that you are searching for:

```
Get-History | Select-String <string to search>
```

If you are a person who likes to keep your commands terse, **aliases** might speak to you. We will take a look at them later, but for now, here's an example of how you'd search the history, using the same commands but abbreviated as an alias:

```
h | sts <string to search>
```

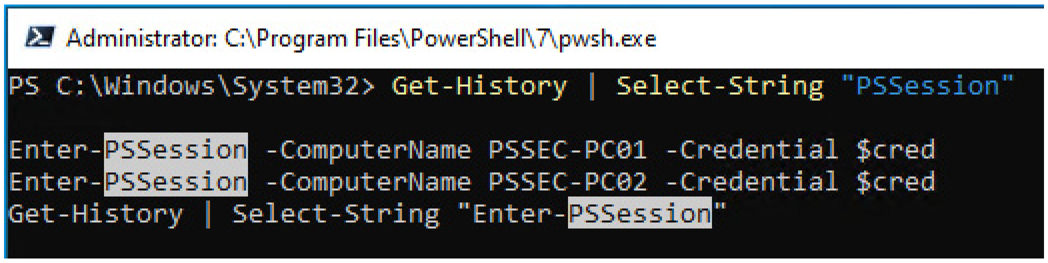
If you want to see all the PowerShell remoting sessions that were established in this session, you can search for the **Enter-PSSession** string:



```
PS C:\Windows\System32> Get-History | Select-String "Enter-PSSession"

Enter-PSSession -ComputerName PSSEC-PC01 -Credential $cred
Enter-PSSession -ComputerName PSSEC-PC02 -Credential $cred
```

Figure 1.11 – Searching the session history

However, if you only search for a substring such as **PSSession**, you can find **all** occurrences of the **PSSession** string, including the last execution of **Get-History**:



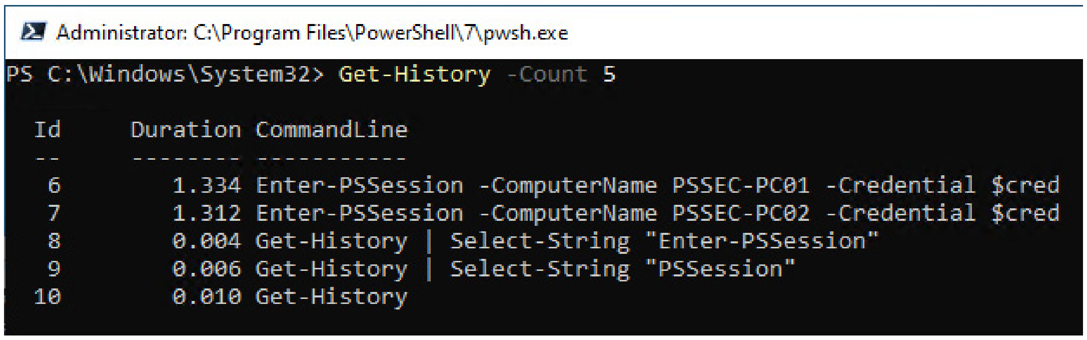
Administrator: C:\Program Files\PowerShell\7\pwsh.exe

```
PS C:\Windows\System32> Get-History | Select-String "PSSession"

Enter-PSSession -ComputerName PSSEC-PC01 -Credential $cred
Enter-PSSession -ComputerName PSSEC-PC02 -Credential $cred
Get-History | Select-String "Enter-PSSession"
```

Figure 1.12 – Searching the session history

When you are looking for a command that was run recently, you don't have to query the entire history. To only get the last *X* history entries, you can specify the **-Count** parameter.

In this example, to get the last five entries, specify **-Count 5**:



Administrator: C:\Program Files\PowerShell\7\pwsh.exe

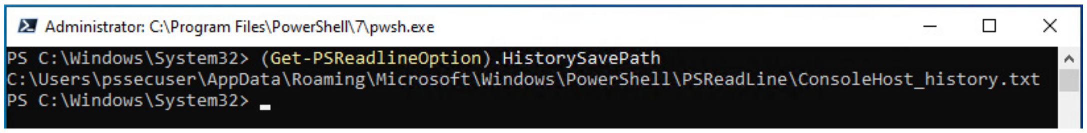
```
PS C:\Windows\System32> Get-History -Count 5

  Id     Duration CommandLine
  --     -------- -----------
   6        1.334 Enter-PSSession -ComputerName PSSEC-PC01 -Credential $cred
   7        1.312 Enter-PSSession -ComputerName PSSEC-PC02 -Credential $cred
   8        0.004 Get-History | Select-String "Enter-PSSession"
   9        0.006 Get-History | Select-String "PSSession"
  10        0.010 Get-History
```

Figure 1.13 – Getting the last five history entries

When you close a PowerShell session, the *session history* is deleted. That means you will get no results if you use the session-bound **Get-History** command upon starting a new session.

But there's also a *persistent history* that you can query, as provided by the **PSReadline** module.

The history is stored in a file, which is stored under the path configured in **(Get-PSReadlineOption).HistorySavePath**:



```
Administrator: C:\Program Files\PowerShell\7\pwsh.exe
PS C:\Windows\System32> (Get-PSReadlineOption).HistorySavePath
C:\Users\pssecuser\AppData\Roaming\Microsoft\Windows\PowerShell\PSReadLine\ConsoleHost_history.txt
PS C:\Windows\System32>
```

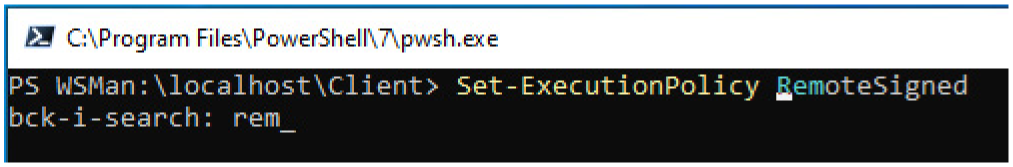
Figure 1.14 – Displaying the location of the persistent history

You can either open the file or inspect the content using **`Get-Content`**:

```
> Get-Content (Get-PSReadlineOption).HistorySavePath
```

If you just want to search for a command to execute it once more, the **interactive search** might be helpful. Press *Ctrl* + *R* to search backward, and type in characters or words that were part of the command that you executed earlier.

As you are searching backward, the most recent command that you executed will appear in your command line. To find the next match, press *Ctrl* + *R* again:



```
C:\Program Files\PowerShell\7\pwsh.exe
PS WSMan:\localhost\Client> Set-ExecutionPolicy RemoteSigned
bck-i-search: rem_
```

Figure 1.15 – Using the interactive search to search backward

Ctrl + *S* works just like *Ctrl* + *R* but searches forward. You can use both shortcuts to move back and forth in the search results.

Ctrl + *R* and *Ctrl* + *S* allow you to search the permanent history, so you are not restricted to search for the commands run during this session.

Clearing the screen

Sometimes, after running multiple commands, you might want to start with an empty shell without reopening it – to keep your current session, history, and variables:

```
> Clear
```

After typing in the **`Clear`** command and confirming with *Enter*, your current PowerShell console will be cleared, and you can start with a fresh and clean console. All variables set in this session are still accessible, and your history is still available.

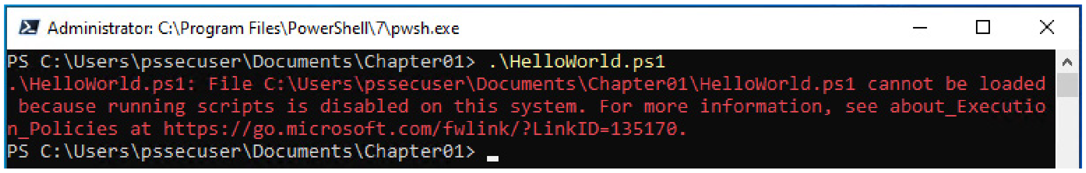
Instead of **`Clear`**, you can also use the **`cls`** alias or the *Ctrl* + *L* shortcut.

Canceling a command

If you are running a command, sometimes, you might want to cancel it out for different reasons. It could be that you executed the command by accident, perhaps a command takes too long, or you want to try a different approach – it doesn't matter, *Ctrl* + *C* is your friend. Press *Ctrl* + *C* to cancel a running command.

Execution Policy

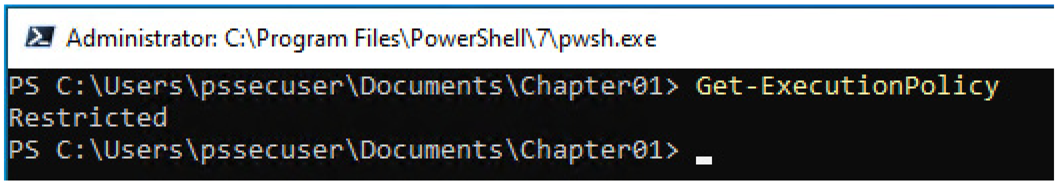
Before we get started writing PowerShell scripts, let's take a closer look at a mechanism called Execution Policy. If you have tried to run a script on a system that was not configured to run scripts, you might have already stumbled upon this feature:



```
Administrator: C:\Program Files\PowerShell\7\pwsh.exe
PS C:\Users\pssecuser\Documents\Chapter01> .\HelloWorld.ps1
.\HelloWorld.ps1: File C:\Users\pssecuser\Documents\Chapter01\HelloWorld.ps1 cannot be loaded
 because running scripts is disabled on this system. For more information, see about_Executio
n_Policies at https://go.microsoft.com/fwlink/?LinkID=135170.
PS C:\Users\pssecuser\Documents\Chapter01> _
```

Figure 1.16 – Trying to execute a script on a system with Execution Policy configured as Restricted

Execution Policy is a feature that restricts the execution of PowerShell scripts on the system. Use **`Get-ExecutionPolicy`** to find out how the Execution Policy setting is configured:



```
Administrator: C:\Program Files\PowerShell\7\pwsh.exe
PS C:\Users\pssecuser\Documents\Chapter01> Get-ExecutionPolicy
Restricted
PS C:\Users\pssecuser\Documents\Chapter01> _
```

Figure 1.17 – Finding out the current Execution Policy setting

While the default setting on all Windows clients is *Restricted*, the default setting on Windows servers is *RemoteSigned*. Having the *Restricted* setting configured, the system does not run scripts at all, while *RemoteSigned* allows the execution of local scripts and remote scripts that were signed.

Configuring Execution Policy

To start working with PowerShell and create your own scripts, first, you need to configure the Execution Policy setting.

Execution Policy is a feature that allows you to avoid running PowerShell code by accident. It does not protect against attackers who are trying to run code on your system on purpose.

Rather, it is a feature that protects you from your own mistakes – for example, if you have downloaded a script from the internet that you want to inspect before running, and you double-click on it by mistake, Execution Policy helps you to prevent this.

Execution Policy options

The following are the Execution Policy options that determine whether it is allowed to run scripts on the current system or whether they need to be signed to run:

- **`AllSigned`**: Only scripts that are signed by a trusted publisher can be executed, including local scripts.

In *1, AppLocker, Application Control, and Code Signing*, you can find out more about **script signing**, or you can refer to the online documentation at **https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.core/about/about_signing**.

- **`Bypass`**: Nothing is blocked, and scripts run without generating a warning or a prompt.
- **`RemoteSigned`**: Only locally created scripts can run if they are unsigned. All scripts that were downloaded from the internet, or are stored on a remote network location, need to be signed by a trusted publisher.
- **`Restricted`**: This is the default configuration. It is not possible to run PowerShell scripts or load configuration files. It is still possible to run interactive code.
- **`Unrestricted`**: All scripts can be run, regardless of whether they were downloaded from the internet or were created locally. If scripts were downloaded from the internet, you will still get prompted if you want to run the file.

The Execution Policy scope

To specify who or what will be affected by the Execution Policy feature, you can define **scopes**. The **`-scope`** parameter allows you to set the scope that is affected by the Execution Policy feature:

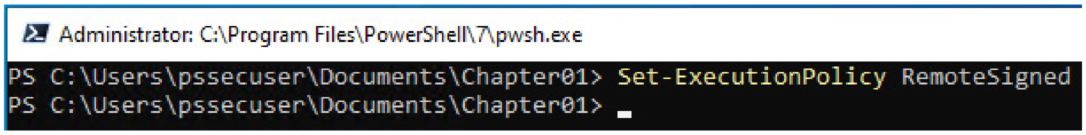
- **`CurrentUser`**: This means that the current user on this computer is affected.
- **`LocalMachine`**: This is the default scope. All users on this computer are affected.
- **`MachinePolicy`**: This affects all users on this computer.
- **`Process`**: This only affects the current PowerShell session.

One good way is to sign all scripts that are being run in your organization. Through this, you can not only identify which scripts are allowed, but it also allows you to use further mitigations such as AppLocker in a better way (you can read more about AppLocker in ***"11" on page 435***, *AppLocker, Application Control, and Code Signing*) – and you can configure Execution Policy to **`AllSigned`**.

Of course, if you develop your own PowerShell scripts, they are not signed while you are still working on them.

To maintain protection from running scripts unintentionally, but to have the ability to run locally developed scripts nevertheless, the **`RemoteSigned`** setting is a good approach. In this case, only local scripts (that is, scripts that weren't downloaded from the internet and signed) can be run; unsigned scripts from the internet will be blocked from running.

Use the **`Set-ExecutionPolicy`** cmdlet as an administrator to configure the Execution Policy setting:



```
Administrator: C:\Program Files\PowerShell\7\pwsh.exe
PS C:\Users\pssecuser\Documents\Chapter01> Set-ExecutionPolicy RemoteSigned
PS C:\Users\pssecuser\Documents\Chapter01> _
```

Figure 1.18 – Configuring the Execution Policy setting

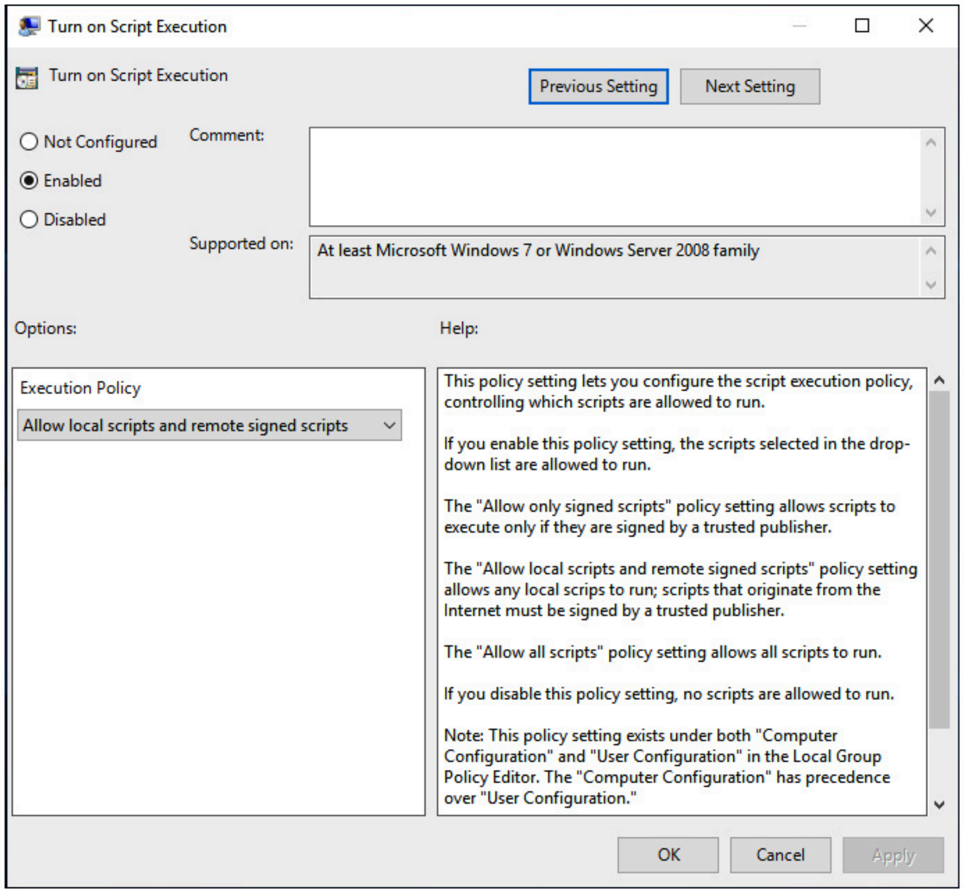
The Execution Policy setting is being configured. Now you can run your own scripts and imported modules on your system.

Windows PowerShell – configuring Execution Policy via Group Policy

If you don't want to set the Execution Policy setting for every machine in your organization manually, you can also configure it globally via Group Policy.

To configure Group Policy for *Windows PowerShell*, create a new **Group Policy Object** (**GPO**) that is linked to the root folder in which all your devices are located and that you want to configure Execution Policy for.

Then, navigate to **Computer Configuration** | **Policies** | **Administrative Templates** | **Windows Components** | **Windows PowerShell**:



Turn on Script Execution

Not Configured [✓ Enabled] Disabled

Supported on: At least Microsoft Windows 7 or Windows Server 2008 family

Execution Policy: Allow local scripts and remote signed scripts

Help:

This policy setting lets you configure the script execution policy, controlling which scripts are allowed to run.

If you enable this policy setting, the scripts selected in the drop-down list are allowed to run.

The "Allow only signed scripts" policy setting allows scripts to execute only if they are signed by a trusted publisher.

The "Allow local scripts and remote signed scripts" policy setting allows any local scrips to run; scripts that originate from the Internet must be signed by a trusted publisher.

The "Allow all scripts" policy setting allows all scripts to run.

If you disable this policy setting, no scripts are allowed to run.

Note: This policy setting exists under both "Computer Configuration" and "User Configuration" in the Local Group Policy Editor. The "Computer Configuration" has precedence over "User Configuration."

Figure 1.19 – Configuring the Execution Policy feature using GPO for Windows PowerShell

Configure the **Turn on Script Execution** setting, and choose the **Allow local scripts and remote signed scripts** option, which configures Execution Policy to **RemoteSigned**.

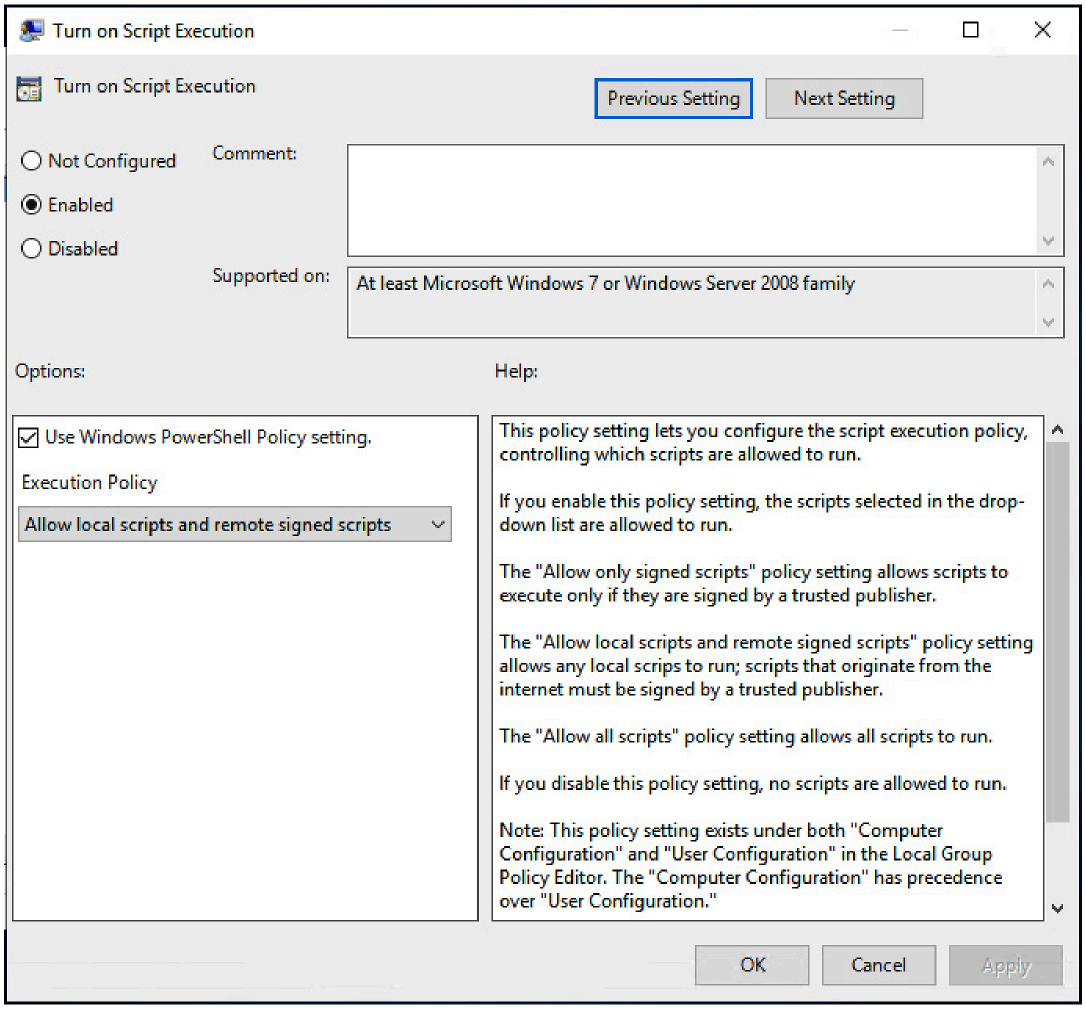
PowerShell Core – configuring Execution Policy via Group Policy

Since Windows PowerShell and PowerShell Core are designed to run in parallel, you also need to configure the Execution Policy settings for PowerShell Core.

The Group Policy settings for PowerShell Core are located in the following paths:

- **Computer Configuration** | **Administrative Templates** | **PowerShell Core**

- **User Configuration** | **Administrative Templates** | **PowerShell Core**:



Turn on Script Execution

Not Configured [✓ Enabled] Disabled

Comment:

Supported on: At least Microsoft Windows 7 or Windows Server 2008 family

[✓] Use Windows PowerShell Policy setting.

Execution Policy: Allow local scripts and remote signed scripts

This policy setting lets you configure the script execution policy, controlling which scripts are allowed to run.

If you enable this policy setting, the scripts selected in the drop-down list are allowed to run.

The "Allow only signed scripts" policy setting allows scripts to execute only if they are signed by a trusted publisher.

The "Allow local scripts and remote signed scripts" policy setting allows any local scrips to run; scripts that originate from the internet must be signed by a trusted publisher.

The "Allow all scripts" policy setting allows all scripts to run.

If you disable this policy setting, no scripts are allowed to run.

Note: This policy setting exists under both "Computer Configuration" and "User Configuration" in the Local Group Policy Editor. The "Computer Configuration" has precedence over "User Configuration."

Figure 1.20 – Configuring the Execution Policy setting using GPO for PowerShell Core

Configure the settings of your choice, and apply the changes. In this case, the settings configured in the Windows PowerShell Group Policy will be applied.

Execution Policy is not a security control – avoiding Execution Policy

As mentioned earlier, Execution Policy is a feature that keeps you from running scripts unintentionally. It is not a feature designed to protect you from malicious users or from code run directly on the machine.

Even if Execution Policy is configured as strictly as possible, you can still type in any code into a PowerShell prompt.

Essentially, when we speak of *bypassing Execution Policy*, we are simply **avoiding** Execution Policy, as you will see in this section. Although it's not a *real hack*, some people in the security community still like to call avoiding Execution Policy a *bypass*.

Avoiding Execution Policy is quite easy – the easiest way is by using its own **`-Bypass`** parameter.

This parameter was introduced when people started to think of Execution Policy as a security control. The PowerShell team wanted to avoid this misconception so that organizations were not lulled into a false sense of security.

I created a simple script that just writes **Hello World!** into the console, which you can find on GitHub at https://github.com/PacktPublishing/PowerShell-Automation-and-Scripting-for-Cybersecurity/blob/master/Chapter01/HelloWorld.ps1.

With Execution Policy set to restricted, I get an error message when I try to run the script without any additional parameters.

However, if I run the script using **`powershell.exe`** as an administrator with the **`-ExecutionPolicy`** parameter set to **`Bypass`**, the script runs without any issues:

```
> powershell.exe -ExecutionPolicy Bypass -File .\HelloWorld.ps1
Hello World!
```

If Execution Policy is configured via *Group Policy*, it **can't be avoided** just by using the **`-Bypass`** parameter.

As Execution Policy only restricts the execution of scripts, another way is to simply pass the content of the script to **`Invoke-Expression`**. Again, the content of the script is run without any issues – even if Execution Policy was configured using Group Policy:

```
Get-Content .\HelloWorld.ps1 | Invoke-Expression
Hello World!
```

Piping the content of the script into **`Invoke-Expression`** causes the content of the script to be handled as if the commands were executed locally using the command line; this bypasses Execution Policy and Execution Policy only applies to executing scripts and not local commands.

Those are only some examples out of many ways to avoid **`ExecutionPolicy`**, there are some examples of avoiding **`ExecutionPolicy`** in *"8" on page 337*, *Red Team Tasks and Cookbook*. Therefore, don't be under the false impression that **`ExecutionPolicy`** protects you from attackers.

If you are interested in what mitigations can help you to improve the security of your environment, you can read more about it in *Section 3, Securing PowerShell – Effective Mitigations in Detail*.

Help system

To be successful in PowerShell, understanding and using the help system is key. To get started, you will find some useful advice in this book. As I will cover only the basics and mostly concentrate on scripting for cybersecurity, I advise you to also review the documentation on the PowerShell help system. This can be found at https://docs.microsoft.com/en-us/powershell/scripting/learn/ps101/02-help-system.

There are three functions that make your life easier when you are working with PowerShell:

- **`Get-Help`**

- **`Get-Command`**
- **`Get-Member`**

Let's take a deeper look at how to use them and how they can help you.

Get-Help

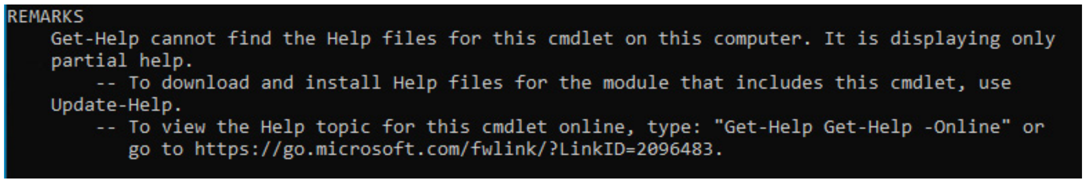
If you are familiar with working on Linux systems, **`Get-Help`** is similar to what the **`man`** pages in Linux are, that is, a collection of how-to pages and tutorials on how to use certain commands in the best way possible.

If you don't know how to use a command, just use **`Get-Help <command>`** and you will know which options it provides and how to use it.

When you are running **`Get-Help`** for the first time on your computer, you might only see a very restricted version of the help pages, along with a remark that states that the help files are missing for this cmdlet on this computer:

```
Get-Help -Name Get-Help
```

As mentioned, the output only displays partial help:



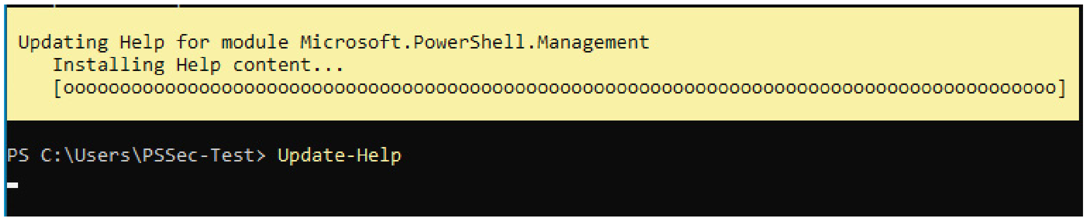
```
REMARKS
    Get-Help cannot find the Help files for this cmdlet on this computer. It is displaying only
    partial help.
        -- To download and install Help files for the module that includes this cmdlet, use
    Update-Help.
        -- To view the Help topic for this cmdlet online, type: "Get-Help Get-Help -Online" or
           go to https://go.microsoft.com/fwlink/?LinkID=2096483.
```

Figure 1.21 – Output of Get-Help when the help files are missing for a cmdlet

Therefore, first, you need to update your help files. An internet connection is required. Open PowerShell as an administrator and run the following command:

```
Update-Help
```

You should see an overlay that shows you the status of the update:



```
Updating Help for module Microsoft.PowerShell.Management
   Installing Help content...
   [ooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooo]

PS C:\Users\PSSec-Test> Update-Help
```

Figure 1.22 – Updating help

As soon as the update is finished, you can use all the help files as intended. As help files get quickly outdated, it makes sense to update them regularly or even create a scheduled task to update the help files on your system.

DID YOU KNOW?

PowerShell help files are not deployed by default because the files get outdated so quickly. As it makes no sense to ship outdated help files, they are not installed by default.

You can use the following **`Get-Help`** parameters:

- **`Detailed`**: This displays the basic help page and adds parameter descriptions along with examples.
- **`Examples`**: This only displays the example section.
- **`Full`**: This displays the complete help page.
- **`Online`**: This displays the online version of the specified help page. It does not work in a remote session.
- **`Parameter`**: This parameter only displays help for the specified parameter.
- **`ShowWindow`**: This displays the help page in a separate window. It not only provides better reading comfort but also allows you to search and configure the settings.

The easiest way to get all the information that the help file provides is by using the **`-Full`** parameter:

```
Get-Help -Name Get-Content -Full
```

Running this command gets you the full help pages for the **`Get-Content`** function:

Figure 1.23 – The full Help pages for the Get-Content function

Please also review the official PowerShell documentation for more advanced ways of **`Get-Help`**: https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.core/get-help.

Get-Command

`Get-Command` gets you all commands that are currently installed on the computer, including aliases, applications, cmdlets, filters, functions, and scripts:

```
Get-Command
```

Additionally, it can show you which commands are available for a certain module. In this case, we investigate the **EventList** module that we have installed from the **PowerShell Gallery**, which is a central repository for the modules, scripts, and other PowerShell-related resources:

```
> Get-Command -Module EventList
CommandType Name                                 Version    Source
----------- ----                                 -------    ------
Function    Add-EventListConfiguration           2.0.0      EventList
Function    Get-AgentConfigString                2.0.0      EventList
Function    Get-BaselineEventList                2.0.0      EventList
Function    Get-BaselineNameFromDB               2.0.0      EventList
Function    Get-GroupPolicyFromMitreTechniques  2.0.0      EventList
Function    Get-MitreEventList                   2.0.0      EventList
Function    Get-SigmaPath                        2.0.0      EventList
Function    Get-SigmaQueries                     2.0.0      EventList
Function    Get-SigmaSupportedSiemFromDb         2.0.0      EventList
Function    Import-BaselineFromFolder            2.0.0      EventList
Function    Import-YamlCofigurationFromFolder   2.0.0      EventList
Function    Open-EventListGUI                    2.0.0      EventList
Function    Remove-AllBaselines                  2.0.0      EventList
Function    Remove-AllYamlConfigurations         2.0.0      EventList
Function    Remove-EventListConfiguration        2.0.0      EventList
Function    Remove-OneBaseline                   2.0.0      EventList
```

Get-Command can be also very helpful if you are looking for a specific cmdlet, but you can't remember its name. For example, if you want to find out all the cmdlets that are available on your computer that have **Alias** in their name, **Get-Command** can be very helpful:

```
> Get-Command -Name "*Alias*" -CommandType Cmdlet
CommandType  Name          Version    Source
-----------  ----          -------    ------
Cmdlet       Export-Alias  3.1.0.0    Microsoft.PowerShell.Utility
Cmdlet        Get-Alias      3.1.0.0    Microsoft.PowerShell.Utility
Cmdlet        Import-Alias   3.1.0.0    Microsoft.PowerShell.Utility
Cmdlet        New-Alias      3.1.0.0    Microsoft.PowerShell.Utility
Cmdlet        Set-Alias      3.1.0.0    Microsoft.PowerShell.Utility
```

If you don't remember a certain command exactly, use the **-UseFuzzyMatching** parameter. This shows you all of the related commands:

```
Get-Command get-commnd -UseFuzzyMatching
CommandType   Name          Version   Source
-----------   ----          -------   ------
Cmdlet        Get-Command   7.1.3.0   Microsoft.PowerShell.Core
Application   getconf       0.0.0.0   /usr/bin/getconf
Application   command       0.0.0.0   /usr/bin/command
```

Additionally, please review the documentation to get more advanced examples on how **Get-Command** can help you: https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.core/get-command.

Get-Member

Get-Member helps you to display the members within an object.

In PowerShell, everything is an object, even a simple string. **Get-Member** is very useful for seeing which operations are possible.

So, if you want to see what operations are possible when using your **"Hello World!"** string, just type in the following:

```
"Hello World!" | Get-Member
```

All available methods and properties will be displayed, and you can choose from the list the one that best fits your use case:

Figure 1.24 – Displaying all the available members of a string

In the preceding example, I also inserted the **`| Sort-Object Name`** string. It sorts the output alphabetically and helps you to quickly find a method or property by name.

If **`Sort-Object`** was not specified, **`Get-Member`** would have sorted the output alphabetically by **`MemberType`** (that is, **`Method`**, **`ParameterizedProperty`**, and **`Property`**).

After you have chosen the operation that you want to run, you can use it by adding **`.`**(a *dot*), followed by the *operation*. So, if you want to find out the length of your string, add the **`Length`** operation:

```
> ("Hello World!").Length
12
```

Of course, you can also work with variables, numbers, and all other objects.

To display the data type of a variable, you can use **`GetType()`**. In this example, we use **`GetType()`** to find out that the data type of the **`$x`** variable is integer:

```
> $x = 4
> $x.GetType()
IsPublic IsSerial Name  BaseType
-------- -------- ----  --------
True     True     Int32 System.ValueType
```

To get more advanced examples regarding how to use **`Get-Member`**, please also make sure that you review the official documentation at https://docs.microsoft.com/en-us/powershell/module/microsoft.powershell.utility/get-member.

PowerShell versions

As PowerShell functionalities are often tied to a certain version, it might be useful to check the PowerShell version that is installed on your system.

You can use the **`$PSVersionTable.PSVersion`** environment variable:

```
> $PSVersionTable.PSVersion
Major  Minor  Build  Revision
-----  -----  -----  --------
5      1      19041  610
```

In this example, PowerShell 5.1 has been installed.

Exploring security features added with each version

PowerShell is backward compatible with earlier versions. Therefore, it makes sense to always upgrade to the latest version.

But let's have a look at which security-related features were made available with which version. This overview should serve only as a reference, so I won't dive into every feature in detail.

PowerShell v1

The first PowerShell version, PowerShell v1, was released in 2006 as a standalone version. It introduced the following list of security-related features:

- Signed scripts and PowerShell **Subject Interface Package** (**SIP**).
- **`Get-AuthenticodeSignature`**, **`*-Acl`**, and **`Get-PfxCertificate cmdlets.`**
- Execution Policy.
- Requiring *intent* to run scripts from the current directory (**`./foo.ps1`**).
- Scripts are not run if they are double-clicked.
- PowerShell Engine logging: Some commands could be logged via **`LogPipelineExecutionDetails`**, although this is difficult to configure.
- Built-in protection from scripts that are sent directly via email: This intentionally adds PowerShell extensions to Windows' *Unsafe to email* list.
- **Software Restriction Policies** (**SRPs**) and AppLocker support.

PowerShell v2

In 2009, the second version of PowerShell (PowerShell v2) was released. This version was included in the Windows 7 OS by default. It offered the following list of features:

- Eventing
- Transactions
- Changes within Execution Policy
    - *Scopes* to Execution Policy (the process, user, and machine)

    - The *ExecutionPolicy Bypass* implementation to make people stop treating it like a security control
- PowerShell remoting security
- Modules and module security
- IIS-hosted remoting endpoints
    - This was very difficult to configure and required DIY constrained endpoints.
- **`Add-Type`**
- Data language

PowerShell v3

PowerShell v3, released in 2012, was included by default in the Windows 8 OS. It offered the following list of features:

- Unblock-File and alternate data stream management in core cmdlets.
- The initial implementation of constrained language (for Windows RT).
- Registry settings for module logging (via **`LogPipelineExecutionDetails`**).
- Constrained endpoints: These were still hard to configure, but a *more* admin-friendly version of IIS-hosted remoting endpoints.

PowerShell v4

Following PowerShell version v3, PowerShell v4 was just released in 2013 – 1 year after the former version – and was included, by default, in the Windows 8.1 OS. Its features are listed as follows:

- Workflows.
- DSC security, especially for signed policy documents.
- PowerShell web services security.
- With KB3000850, many significant security features could be ported into PowerShell version 4, such as module logging, script

block logging, transcription, and more. However, those features were included, by default, in PowerShell version 5.

PowerShell v5

PowerShell v5 was released in 2015 and was included, by default, in the Windows 10 OS. A lot of security features that are available nowadays in PowerShell were provided with this release. They are listed as follows:

- Security transparency
- **AMSI**
- Transcription
- Script block logging
- Module logging
- Protected event logging
- JEA
- Local JEA (for interactive constrained/kiosk modes)
- Secure code generation APIs
- Constrained language
- **Cryptographic Message Syntax** (**CMS**) cmdlets, `*-FileCatalog` cmdlets, `ConvertFrom-SddlString`, `Format-Hex`, and `Get-FileHash`
- PowerShell Gallery security
- `Revoke-Obfuscation`
- The Injection Hunter module
- PowerShell classes security

PowerShell v6

With PowerShell v6, which was released as a standalone in 2018, the PowerShell team was mostly focused on the effort to make PowerShell available cross-platform as open source software. PowerShell v6 introduced the first macOS and Unix shell to offer full security transparency. Its features include the following:

- OpenSSH on Windows

- Cross-platform parity: full security transparency via Syslog

PowerShell editors

Before we get started, you might want to choose an editor. Before you start typing your scripts into `notepad.exe` or want to use PowerShell ISE for PowerShell 7, let's take a look at what PowerShell editors you can use for free and what the potential downsides are.

Windows PowerShell ISE

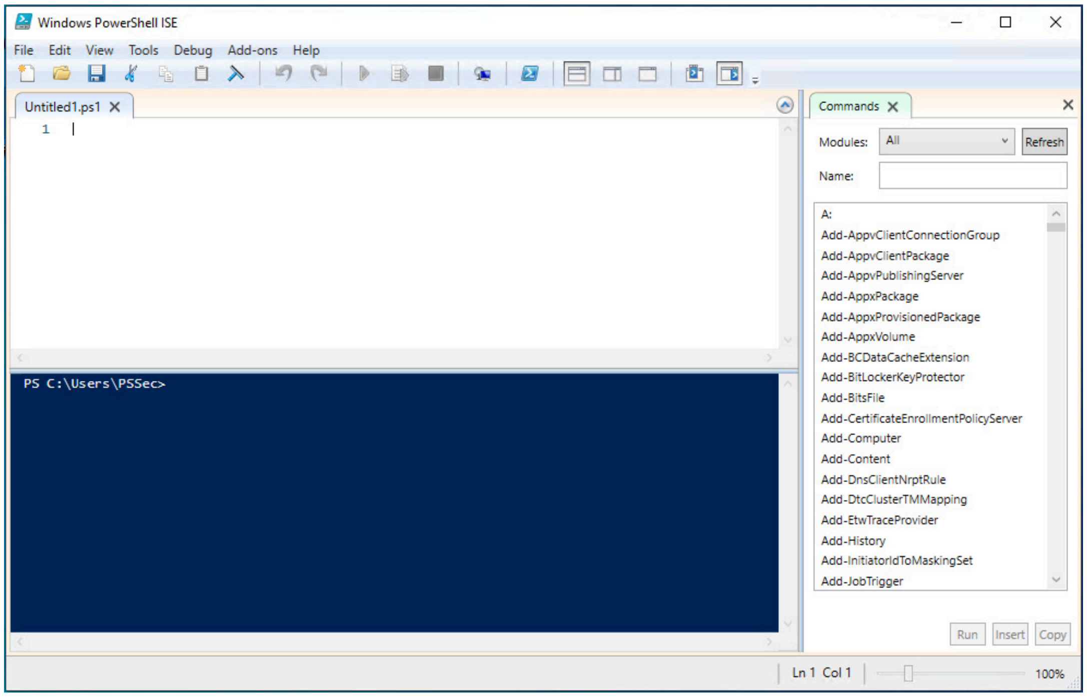
The **Windows PowerShell Integrated Scripting Environment** (**ISE**) is a host application that is integrated within Microsoft Windows systems. As this application is pre-installed, this makes it very easy for beginners to simply open the Windows PowerShell ISE and type in their very first script.

The downside of the Windows PowerShell ISE is that, currently, it **does not support PowerShell Core** – and currently, there's no intention by the PowerShell team to add support.

To open it, you can either open the Windows Start menu and search for `PowerShell ISE`, or you can run it by opening the command line, using the *Windows key* + *R* shortcut, and typing in `powershell_ise` or `powershell_ise.exe`.

When you start the Windows PowerShell ISE, you will only see a PowerShell command line, the menu, and the available commands. Before you can use the editor, you either need to open a file or create a new blank file.

You can also click on the little drop-down arrow on the right-hand side to expand the scripting pane or enable the scripting pane from the **View** menu:



```
PS C:\Users\PSSec>
```

A:
Add-AppvClientConnectionGroup
Add-AppvClientPackage
Add-AppvPublishingServer
Add-AppxPackage
Add-AppxProvisionedPackage
Add-AppxVolume
Add-BCDataCacheExtension
Add-BitLockerKeyProtector
Add-BitsFile
Add-CertificateEnrollmentPolicyServer
Add-Computer
Add-Content
Add-DnsClientNrptRule
Add-DtcClusterTMMapping
Add-EtwTraceProvider
Add-History
Add-InitiatorIdToMaskingSet
Add-JobTrigger

Figure 1.25 – Windows PowerShell ISE after opening a new file

On Windows 10 devices, the default location of the PowerShell ISE is under the following:

- Windows PowerShell ISE:

```
%windir%\system32\WindowsPowerShell\v1.0\PowerShell_ISE.exe
```

- Windows PowerShell ISE (x86):

```
%windir%\syswow64\WindowsPowerShell\v1.0\PowerShell_ISE.exe
```

WHERE DO THOSE NASTY ERRORS COME FROM?

When working with PowerShell or the PowerShell ISE, sometimes, errors can appear that are caused by the fact that you had insufficient permissions. To overcome that issue, start PowerShell (ISE) as an administrator if your use case requires it.

Windows PowerShell ISE commands

On the right-hand pane, you can browse through all commands and modules that are available in this session. Especially if you are not that familiar with existing cmdlets, this can help you a lot.

Visual Studio Code

Yes, you could just use Windows PowerShell or Windows PowerShell ISE to work with PowerShell 5.1. But honestly, you should use PowerShell Core 7 instead.

You want to write complex scripts, functions, and modules, and, therefore, you want to use a good editor that supports you while scripting.

Visual Studio Code is not the only recommended editor to use to edit PowerShell, but it comes for free as an open source and cross-platform version.

It was developed by Microsoft and can be downloaded from the official Visual Studio Code web page at https://code.visualstudio.com/.

Visual Studio versus Visual Studio Code

When you search for Visual Studio Code, it often happens that you stumble onto Visual Studio, which is – despite the name – a completely different product.

Visual Studio is a full-featured **integrated development environment (IDE)**, which consists of multiple tools that help a developer to develop, debug, compile, and deploy their code. Visual Studio even contains a tool to easily design **GUI** components.

Visual Studio Code is an editor that provides a lot of features, but in the end, it is very useful for code developers. Additionally, it provides Git integration, which makes it very easy to connect with your versioning system to track changes and eventually revert them.

To summarize, Visual Studio is a big suite that was designed to develop apps for Android, iOS, Mac, Windows, the web, and the cloud, as Microsoft states. In comparison, Visual Studio Code is a code editor that supports thousands of extensions and provides many features. Visual Studio does not run on Linux systems, while Visual Studio Code works on cross-platform systems.

As Visual Studio is a full-featured IDE with many features, it might take longer to load when starting the program. So, for working with PowerShell, I recommend using Visual Studio Code, which is not only my preferred editor but also the recommended editor for PowerShell.

Working with Visual Studio Code

Visual Studio Code offers some great benefits when working with PowerShell. The PowerShell team has even released a guide on how to leverage Visual Studio Code for your PowerShell development. You can find it at **https://docs.microsoft.com/en-us/powershell/scripting/dev-cross-plat/vscode/using-vscode**.

Once you have installed Visual Studio Code onto your OS, this is what the UI should look like when you open it:

Figure 1.26 – The Visual Studio Code editor

If you want to get the most out of Visual Studio Code, make sure that you follow the documentation. Nevertheless, here are my must-haves when working on my PowerShell projects in Virtual Studio Code.

Installing the PowerShell extension

To properly work with PowerShell using Visual Studio Code, the PowerShell extension should be installed and activated.

If you start a new project or file and use PowerShell code before installing the PowerShell extension, Visual Studio Code suggests installing the PowerShell extension. Confirm with **Yes** to the prompt on the installation of the PowerShell extension.

If you want to download the extension manually, you can download the Visual Studio PowerShell extension via the following link: **https://marketplace.visualstudio.com/items?itemName=ms-vscode.PowerShell**.

Launch the quick opening option by pressing *Ctrl* + *P* and type in **`ext install powershell`**. Then, press *Enter*.

The extensions pane opens. Search for **`PowerShell`** and click on the **Install** button. Follow the instructions.

After the installation, the PowerShell extension is automatically displayed. If you want to access it later again, you can either open the **Extensions** pane directly from the menu or by using the *Ctrl* + *Shift* + *X* shortcut:

Figure 1.27 – Visual Studio Code: Installing the PowerShell extension

AUTOMATED FORMATTING IN VISUAL STUDIO CODE

By pressing Alt + Shift + F, Visual Studio Code automatically formats your current code. You can specify your formatting preferences by adjusting your workspace configuration.

Summary

In this chapter, you learned how to get started when working with PowerShell for cybersecurity. You obtained a high-level understanding of OOP and its four main principles. You learned what properties and methods are and how they apply to an object.

You now understand how to install the latest version of PowerShell Core and understand how to perform some basic tasks such as working with the history, clearing the screen, and canceling commands.

You have learned that Execution Policy is only a feature that keeps you from running scripts unintentionally, and it's important to understand that it is not a security control to prevent you from attackers.

You learned how to help yourself and obtain more information about cmdlets, functions, methods, and properties, using the help system.

Now that you have also found and installed your preferred PowerShell editor, you are ready to get started, learn about the PowerShell scripting fundamentals, and write your first scripts in the next chapter.

Further reading

If you want to explore some of the topics that were mentioned in this chapter, use these resources:

- Getting Started with PowerShell: **https://docs.microsoft.com/en-us/powershell/scripting/learn/ps101/01-getting-started**
- Installing and upgrading to PowerShell version 5.1: **https://docs.microsoft.com/en-us/powershell/scripting/windows-powershell/install/installing-windows-powershell**
- Migrating from Windows PowerShell 5.1 to PowerShell 7: **https://docs.microsoft.com/en-us/powershell/scripting/install/migrating-from-windows-powershell-51-to-powershell-7**.

- Installing the latest PowerShell release on Windows: **https://docs.microsoft.com/en-us/powershell/scripting/install/installing-powershell-core-on-windows**
- Installing PowerShell on Linux: **https://docs.microsoft.com/en-us/powershell/scripting/install/installing-powershell-core-on-linux**
- Installing PowerShell on macOS: **https://docs.microsoft.com/en-us/powershell/scripting/install/installing-powershell-core-on-macos**
- Installing PowerShell on ARM: **https://docs.microsoft.com/en-us/powershell/scripting/install/powershell-core-on-arm**
- Using PowerShell in Docker: **https://docs.microsoft.com/en-us/powershell/scripting/install/powershell-in-docker**
- PowerShell ♥ the Blue Team: **https://devblogs.microsoft.com/powershell/powershell-the-blue-team/**
- Using Visual Studio Code for PowerShell Development: **https://docs.microsoft.com/en-us/powershell/scripting/dev-cross-plat/vscode/using-vscode**

You can also find all the links mentioned in this chapter in the GitHub repository for ***Chapter 1***. There is no need to manually type in every link: **https://github.com/PacktPublishing/PowerShell-Automation-and-Scripting-for-Cybersecurity/blob/master/Chapter01/Links.md**.