7 Managing Networking in the Enterprise

In this chapter, we cover the following recipes:

- Configuring IP addressing
- Testing network connectivity
- Installing DHCP
- Configuring DHCP scopes and options
- Using DHCP
- Implementing DHCP failover and load balancing
- Deploying DNS in the Enterprise
- Configuring DNS forwarding
- Managing DNS zones and resource records

Introduction

Every organization's heart is its network – the infrastructure that enables your client and server systems to interoperate. Windows has included networking features since the early days of Windows for Workgroups 3.1 (and earlier with Microsoft LAN Manager).

One thing worth noting is that even in the cloud age, "the network" isn't going anywhere; its role of enabling a client to connect to a server is just changing, with some servers (and clients) now in the cloud. The cloud is really just resources in someone else's network, and you still need the network to communicate.

Every server or workstation in your environment needs to have a correct IP configuration. While IPv6 is gaining in popularity, most organizations rely on IPV4. In the *Configuring IP addressing* recipe, we look at setting a network interface's IPv4 configuration, including DNS settings.

Many organizations assign a static IPv4 address to most server systems. The servers used throughout this book, for example, make use of static IP addresses. For client hosts and some servers, an alternative to assigning a static IP address is to use the **Dynamic Host Control Protocol** (**DHCP**). DHCP is a network management protocol that enables a workstation to lease an IP address (and release it when the lease expires). You set up a DHCP server to issue IP address configuration to clients using the *Installing DHCP* recipe.

Once you have installed your DHCP server, you can use the *Configuring DHCP scopes and options* recipe to set up the details that your DHCP server is to hand out to clients. In the *Configuring DHCP failover and load balancing* recipe, we deploy a second DHCP server and configure it to act as a failover/load balancing DHCP service.

In this chapter's final recipe, *Configuring DNS zones and resource records*, you configure the DNS server on `DC1` with zones and additional resource records. Before you can administer your Windows Server 2022 infrastructure, you need to create an environment to use PowerShell to carry out the administration.

Configuring IP addressing

By default, Windows uses DHCP to configure all NICs that the Windows installation process discovers when installing Windows. Once you complete the Windows installation, you can use the control panel applet (`ncpa.cpl`), the network shell console application (`netsh.exe`), or, of course, PowerShell to set IP configuration manually. In this recipe, you set the IP address details for `SRV2` and ensure the host registers DNS names in the Reskit.Org DNS domain (on the DNS service running on `DC1`).

Setting up any host requires setting an IP address, a subnet mask, and a default gateway, which you do in the first part of this recipe. Then, you configure `SRV2` (a workgroup host) to register with the DNS server on `DC1.Reskit.Org`. This approach raises some challenges. By default, when you create `DC1.Reskit.Org` as a DC, the domain promotion process sets the domain's DNS zone to require secure updates. That means a workgroup host cannot register. You can overcome this by setting the zone to allow all updates. But this could be dangerous as it allows ANY host to, potentially, register their address. A second challenge is that since `SRV2` is not a domain member, remoting to `DC1` fails. A solution to that issue is to set the WinRM service to trust all hosts. Configuring WinRM to disregard server authentication has security implications you should consider before using this approach in production.

Getting ready

This recipe uses `SRV2`, a recently added workgroup host. As with all hosts used in this book, you install `SRV2` using the Reskit installation scripts you can find on GitHub at `https://github.com/doctordns/ReskitBuildScripts`. You should also have loaded PowerShell 7 and VS Code, as you did in *Chapter 1*, *Installing and Configuring PowerShell 7.1*. To simplify this setup, you can run the two setup scripts in `https://github.com/doctordns/PACKT-PS7/tree/master/scripts/goodies`. Run the first script in the Windows PowerShell ISE and the second in an elevated VS Code instance.

Note that using Azure for these VMs is not supported.

By default, this host is a DHCP client.

How to do it...

1. Discovering the network adapter, adapter interface, and adapter interface index

```
$IPType    = 'IPv4'
$Adapter   = Get-NetAdapter |  Where-Object Status -eq 'Up'
$Interface = $Adapter | Get-NetIPInterface -AddressFamily $IPType
$Index     = $Interface.IfIndex
Get-NetIPAddress -InterfaceIndex $Index -AddressFamily $IPType |
  Format-Table -Property Interface*, IPAddress, PrefixLength
```

2. Setting a new IP address for the NIC

```
$IPHT = @{
  InterfaceIndex = $Index
  PrefixLength   = 24
  IPAddress      = '10.10.10.51'
  DefaultGateway = '10.10.10.254'
  AddressFamily  = $IPType
}
New-NetIPAddress @IPHT
```

3. Verifying the new IP address

```
Get-NetIPAddress -InterfaceIndex $Index -AddressFamily $IPType |
  Format-Table IPAddress, InterfaceIndex, PrefixLength
```

4. Setting DNS server IP address

```
$CAHT = @{
  InterfaceIndex  = $Index
  ServerAddresses = '10.10.10.10'
}
Set-DnsClientServerAddress @CAHT
```

5. Verifying the new IP configuration

```
Get-NetIPAddress -InterfaceIndex $Index -AddressFamily $IPType |
  Format-Table
```

6. Testing that SRV2 can see the domain controller

```
Test-NetConnection -ComputerName DC1.Reskit.Org |
  Format-Table
```

7. Creating a credential for DC1

```
$U    = 'Reskit\Administrator'
$PPT  = 'Pa$$w0rd'
$PSC  = ConvertTo-SecureString -String $ppt -AsPlainText -Force
$Cred = [pscredential]::new($U,$PSC)
```

8. Setting WinRM on SRV2 to trust DC1

```
$TPPATH = 'WSMan:\localhost\Client\TrustedHosts'
Set-Item -Path $TPPATH -Value 'DC1' -Force
Restart-Service -Name WinRM -Force
```

9. Enabling non-secure updates to Reskit.Org DNS domain

```
$DNSSSB = {
  $SBHT = @{
    Name          = 'Reskit.Org'
    DynamicUpdate = 'NonsecureAndSecure'
  }
  Set-DnsServerPrimaryZone @SBHT
}
Invoke-Command -ComputerName DC1 -ScriptBlock $DNSSSB -Credential $Cred
```

10. Ensuring SRV2 registers within the Reskit.Org DNS zone

```
$DNSCHT = @{
  InterfaceIndex                 = $Index
  ConnectionSpecificSuffix       = 'Reskit.Org'
  RegisterThisConnectionsAddress = $true
  UseSuffixWhenRegistering       = $true
}
Set-DnsClient  @DNSCHT
```

11. Registering host IP address at DC1

```
Register-DnsClient
```

12. Pre-staging SRV2 in AD

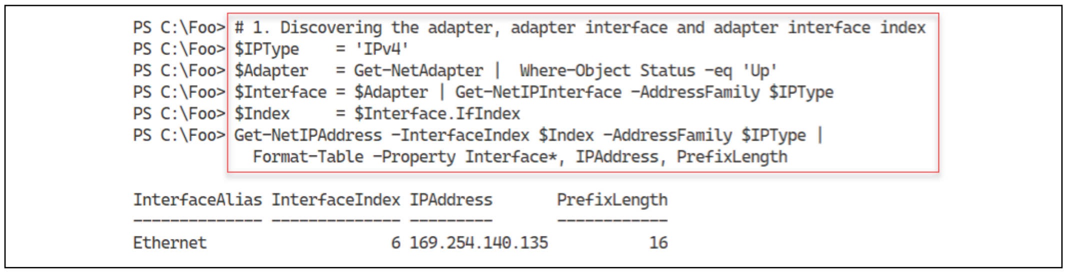
```
$SB = {New-ADComputer -Name SRV2}
Invoke-Command -ComputerName DC1 -ScriptBlock $SB
```

13. Testing the DNS server on `DC1.Reskit.Org` resolves `SRV2`

```
Resolve-DnsName -Name SRV2.Reskit.Org -Type 'A' -Server DC1.Reskit.Org
```

How it works...

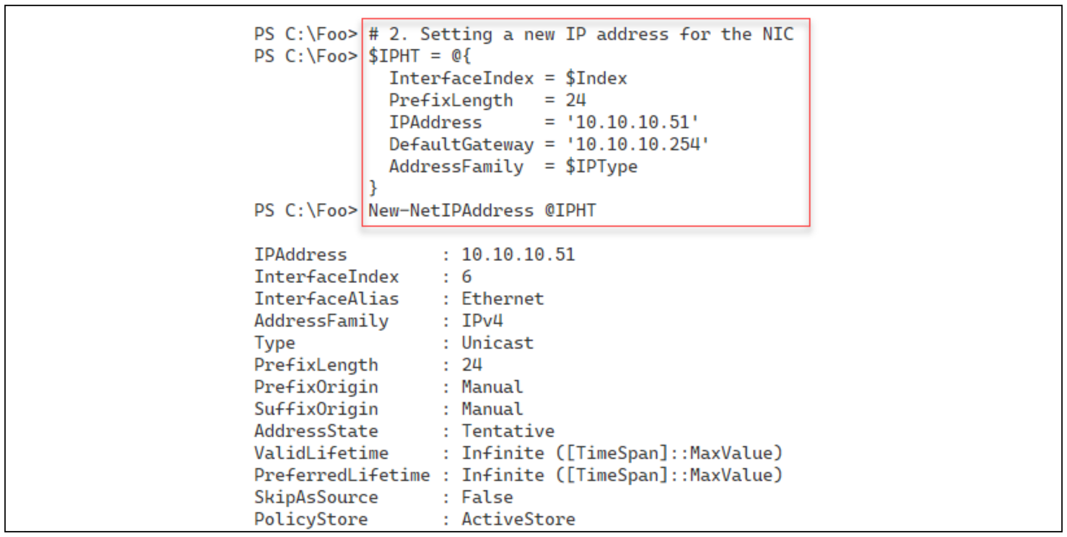
In *step 1*, you use `Get-NetAdapter` and `Get-NetIPAddress` to determine the IP address of this server. Then, you display the resultant address, which looks like this:



```
PS C:\Foo> # 1. Discovering the adapter, adapter interface and adapter interface index
PS C:\Foo> $IPType    = 'IPv4'
PS C:\Foo> $Adapter   = Get-NetAdapter |  Where-Object Status -eq 'Up'
PS C:\Foo> $Interface = $Adapter | Get-NetIPInterface -AddressFamily $IPType
PS C:\Foo> $Index     = $Interface.IfIndex
PS C:\Foo> Get-NetIPAddress -InterfaceIndex $Index -AddressFamily $IPType |
             Format-Table -Property Interface*, IPAddress, PrefixLength

InterfaceAlias InterfaceIndex IPAddress       PrefixLength
-------------- -------------- ---------       ------------
Ethernet                    6 169.254.140.135           16
```

Figure 7.1: Discovering the adapter, adapter interface, and adapter interface index

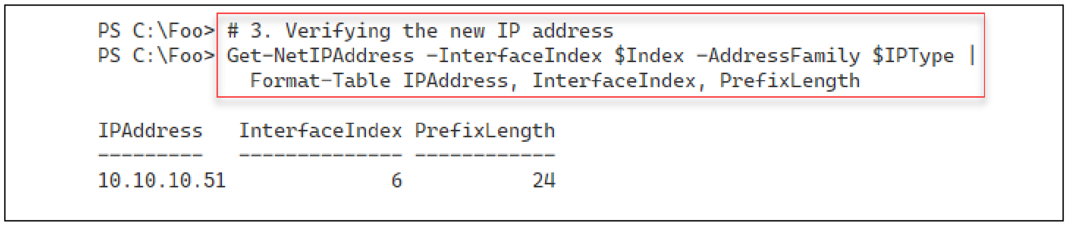
In *step 2*, you use the `New-NetIPAddress` cmdlet to set a static IP address on `SRV2`. The output looks like this:



```
PS C:\Foo> # 2. Setting a new IP address for the NIC
PS C:\Foo> $IPHT = @{
             InterfaceIndex = $Index
             PrefixLength   = 24
             IPAddress      = '10.10.10.51'
             DefaultGateway = '10.10.10.254'
             AddressFamily  = $IPType
           }
PS C:\Foo> New-NetIPAddress @IPHT

IPAddress         : 10.10.10.51
InterfaceIndex    : 6
InterfaceAlias    : Ethernet
AddressFamily     : IPv4
Type              : Unicast
PrefixLength      : 24
PrefixOrigin      : Manual
SuffixOrigin      : Manual
AddressState      : Tentative
ValidLifetime     : Infinite ([TimeSpan]::MaxValue)
PreferredLifetime : Infinite ([TimeSpan]::MaxValue)
SkipAsSource      : False
PolicyStore       : ActiveStore
```

Figure 7.2: Setting a new IP address for the NIC

To double check that you have configured `SRV2` with the correct IP address configuration, you can use the `Get-NetIPaddress` cmdlet. The output looks like this:

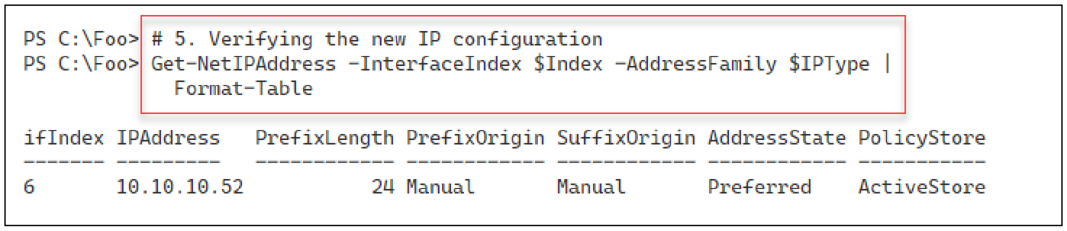


```
PS C:\Foo> # 3. Verifying the new IP address
PS C:\Foo> Get-NetIPAddress -InterfaceIndex $Index -AddressFamily $IPType |
             Format-Table IPAddress, InterfaceIndex, PrefixLength

IPAddress    InterfaceIndex PrefixLength
---------    -------------- ------------
10.10.10.51               6           24
```

Figure 7.3: Verifying the new IP address

Besides setting an IP address, subnet mask, and default gateway, you also need to configure `SRV2` with a DNS server address. In *step 4*, you use the `Set-DnsClientServerAddress` cmdlet, which creates no output.

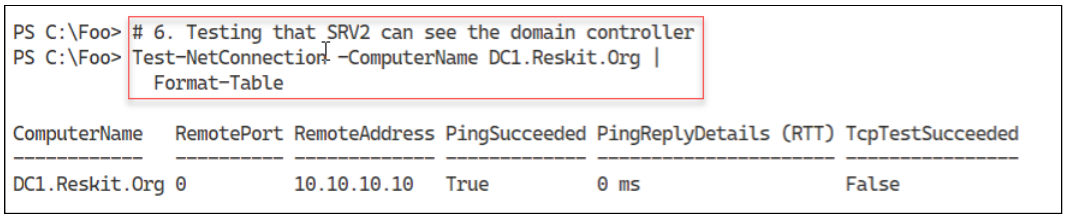
To check the updated IP configuration on `SRV2`, in *step 5*, you verify the configuration by (re) using the `Get-Get-NetIPAddress` cmdlet, with output like this:



```
PS C:\Foo> # 5. Verifying the new IP configuration
PS C:\Foo> Get-NetIPAddress -InterfaceIndex $Index -AddressFamily $IPType |
             Format-Table

ifIndex IPAddress     PrefixLength PrefixOrigin SuffixOrigin AddressState PolicyStore
------- ---------     ------------ ------------ ------------ ------------ -----------
6       10.10.10.52             24 Manual       Manual       Preferred    ActiveStore
```

Figure 7.4: Verifying the new IP configuration

In *step 6*, you use `Test-interconnection` to ensure `SRV2` can connect to `DC1`, the domain controller in the Reskit.Org domain, with this as the output:



```
PS C:\Foo> # 6. Testing that SRV2 can see the domain controller
PS C:\Foo> Test-NetConnection -ComputerName DC1.Reskit.Org |
             Format-Table

ComputerName   RemotePort RemoteAddress PingSucceeded PingReplyDetails (RTT) TcpTestSucceeded
------------   ---------- ------------- ------------- ---------------------- ----------------
DC1.Reskit.Org 0          10.10.10.10   True          0 ms                   False
```

Figure 7.5: Testing that SRV2 can see the domain controller

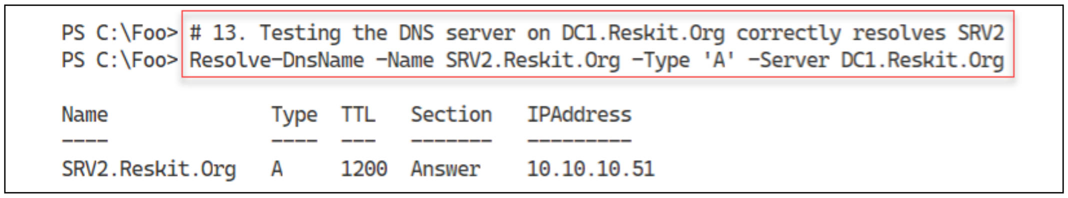
To enable `SRV2`, a workgroup computer to run commands on `DC1`, you need the correct Windows credentials. In *step 7*, which creates no output, you create credentials for the Administrator user in `Reskit.Org`.

With *step 8*, you configure the WinRM service to trust `DC1` explicitly. This step creates no output.

In *step 9*, you reconfigure the DNS service on `DC1` to enable non-secure updates to the Reskit.Org domain. In *step 10*, you configure `SRV2` to register itself within the `Reskit.Org` zone on `DC1`. And then, in *step 11*, you register SRV2's IP address within the DNS service on `DC1`. These three steps also produce no output.

In the next step, *step 12*, you pre-stage the `SRV2` computer into the Reskit.Org AD. This step, which creates no output at the console, creates the `SRV2` computer account within the AD. This means a low privilege user can now add `SRV2` to the domain. Also, note that you run this command remotely on `DC1` – this is because you have not yet added the AD tools to `SRV2`.

In the final step, *step 13*, you query the DNS service to resolve the domain name, `SRV2.Reskit.Org`. This step produces the following output:



```
PS C:\Foo> # 13. Testing the DNS server on DC1.Reskit.Org correctly resolves SRV2
PS C:\Foo> Resolve-DnsName -Name SRV2.Reskit.Org -Type 'A' -Server DC1.Reskit.Org

Name             Type TTL   Section   IPAddress
----             ---- ---   -------   ---------
SRV2.Reskit.Org  A    1200  Answer    10.10.10.51
```

Figure 7.6: Testing the DNS server on DC1.Reskit.Org resolves SRV2

In this recipe, you configured a workgroup server to have a static IP address. You also configured the DNS service to enable SRV2 to register a DNS record within the `Reskit.Org` domain. In most production scenarios, you would join `SRV2` to the domain, in which case DNS registration just works without needing *step 7* through *step 11*.

There's more...

In *step 5*, you verify SRV2's IP address. This test does not check SRV2's DNS configuration. To check the DNS address as well, you could use `Get-NetIPConfiguration`.

In *step 7*, you create a credential to enable you to run commands on `DC1`. In this step, you use the Enterprise/Domain Administrator account. In production, a better approach would be to create another user with a subset of the Enterprise Admin's group's permissions, then use that user to perform *step 9*.

In *step 8*, you configure WinRM to trust the DNS server, `DC1`. This configuration is necessary for a workgroup environment because, by default, workgroup computers do not trust other servers when using PowerShell remoting. PowerShell remoting, by default, performs mutual authentication. Kerberos provides mutual authentication in a domain environment, while in a workgroup environment, you could use SSL to connect to `DC1`. By configuring `SRV2` to trust `DC1`, you are disabling the authentication of `DC1` by `SRV2`. In a protected environment, like where you have your set of Reskit.Org servers, this is acceptable. In production and especially in larger environments, a better approach is to enable SSL for remoting to hosts in separate security realms.

Testing network connectivity

In today's connected world, network connectivity is vital. When you add a new server to your infrastructure, it is useful to ensure that the server can connect to and use the network.

In this recipe, you perform necessary network connectivity tests on the newly installed `SRV2` host. You should ensure that full connectivity exists before adding a server to the domain.

Getting ready

This recipe uses `SRV2`, a workgroup host. You gave this host a static IP address in the *Configuring IP addressing* recipe.

How to do it...

1. Verifying `SRV2` itself is up and that Loopback is working

   ```
   Test-Connection -ComputerName SRV2 -Count 1 -IPv4
   ```

2. Testing connection to local host's WinRM port

   ```
   Test-NetConnection -ComputerName SRV2 -CommonTCPPort WinRM
   ```

3. Testing basic connectivity to `DC1`

   ```
   Test-Connection -ComputerName DC1.Reskit.Org -Count 1
   ```

4. Checking connectivity to SMB port on `DC1`

   ```
   Test-NetConnection -ComputerName DC1.Reskit.Org -CommonTCPPort SMB
   ```

5. Checking connectivity to the LDAP port on `DC1`

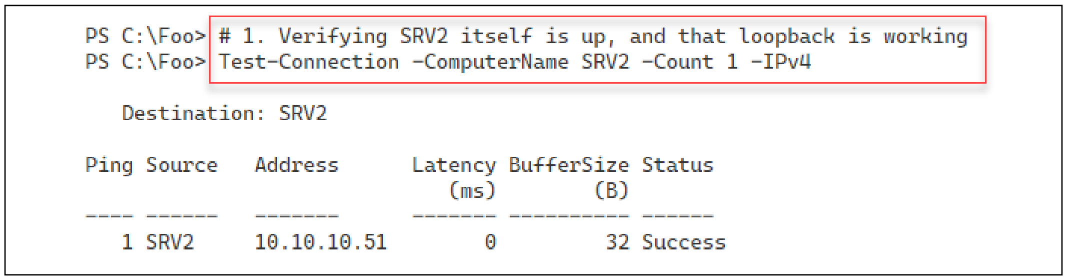
   ```
   Test-NetConnection -ComputerName DC1.Reskit.Org -Port 389
   ```

6. Examining the path to a remote server on the Internet

   ```
   $NCHT = @{
     ComputerName     = 'WWW.Packt.Com'
     TraceRoute       = $true
     InformationLevel = 'Detailed'
   }
   Test-NetConnection @NCHT    # Check our wonderful publisher
   ```

How it works...

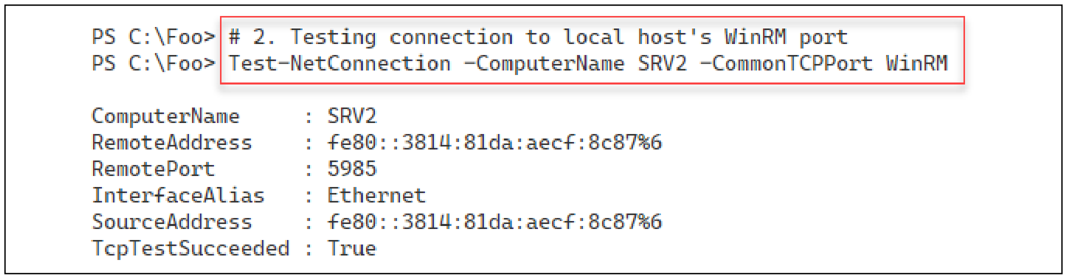
In *step 1*, you verify that SRV2's Loopback adapter works and that the basic TCP/IP stack is up and working. The output looks like this:



```
PS C:\Foo> # 1. Verifying SRV2 itself is up, and that loopback is working
PS C:\Foo> Test-Connection -ComputerName SRV2 -Count 1 -IPv4

   Destination: SRV2

Ping Source    Address      Latency BufferSize Status
                               (ms)        (B)
---- ------    --------     ------- ---------- ------
   1 SRV2      10.10.10.51        0         32 Success
```

Figure 7.7: Verifying SRV2 itself is up and that Loopback is working

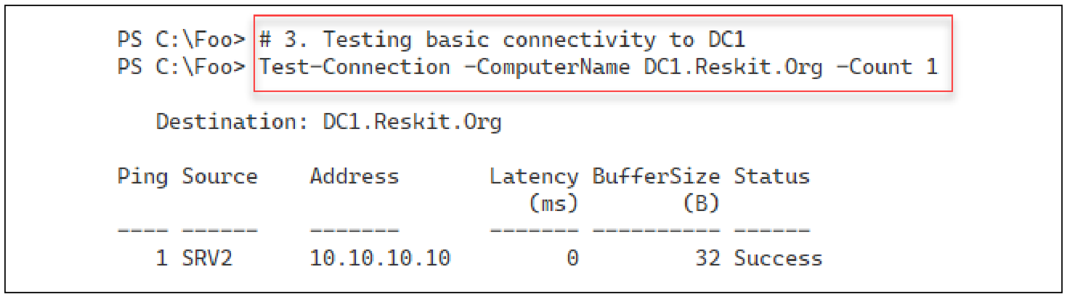
In *step 2*, you check that the WinRM port is open and working, with output like this:



```
PS C:\Foo> # 2. Testing connection to local host's WinRM port
PS C:\Foo> Test-NetConnection -ComputerName SRV2 -CommonTCPPort WinRM

ComputerName     : SRV2
RemoteAddress    : fe80::3814:81da:aecf:8c87%6
RemotePort       : 5985
InterfaceAlias   : Ethernet
SourceAddress    : fe80::3814:81da:aecf:8c87%6
TcpTestSucceeded : True
```

Figure 7.8: Testing the connection to the local host's WinRM port

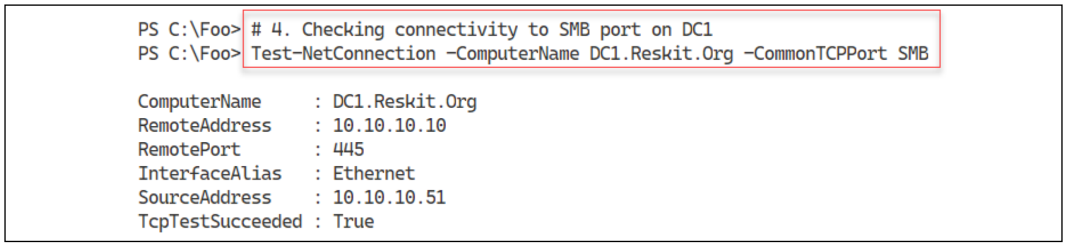
In the `Reskit.Org` network, `DC1` is a domain controller and a DNS server. In *step 3*, you test the connectivity to this critical enterprise server, with output like this:



```
PS C:\Foo> # 3. Testing basic connectivity to DC1
PS C:\Foo> Test-Connection -ComputerName DC1.Reskit.Org -Count 1

   Destination: DC1.Reskit.Org

Ping Source    Address      Latency BufferSize Status
                               (ms)        (B)
---- ------    --------     ------- ---------- ------
   1 SRV2      10.10.10.10        0         32 Success
```

Figure 7.9: Testing basic connectivity to DC1

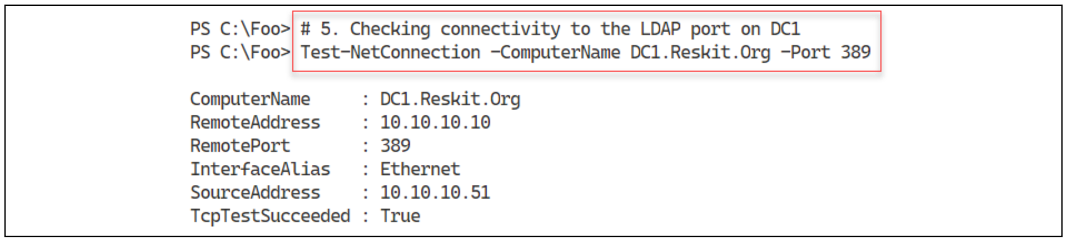
In any domain environment, hosts need to access the SYSVOL share on a DC to download group policy `.POL` files. In *step 4*, you test that `SRV2` can access the SMB port, port `445`, on the DC, with output like this:



```
PS C:\Foo> # 4. Checking connectivity to SMB port on DC1
PS C:\Foo> Test-NetConnection -ComputerName DC1.Reskit.Org -CommonTCPPort SMB

ComputerName     : DC1.Reskit.Org
RemoteAddress    : 10.10.10.10
RemotePort       : 445
InterfaceAlias   : Ethernet
SourceAddress    : 10.10.10.51
TcpTestSucceeded : True
```

Figure 7.10: Checking connectivity to the SMB port on DC1

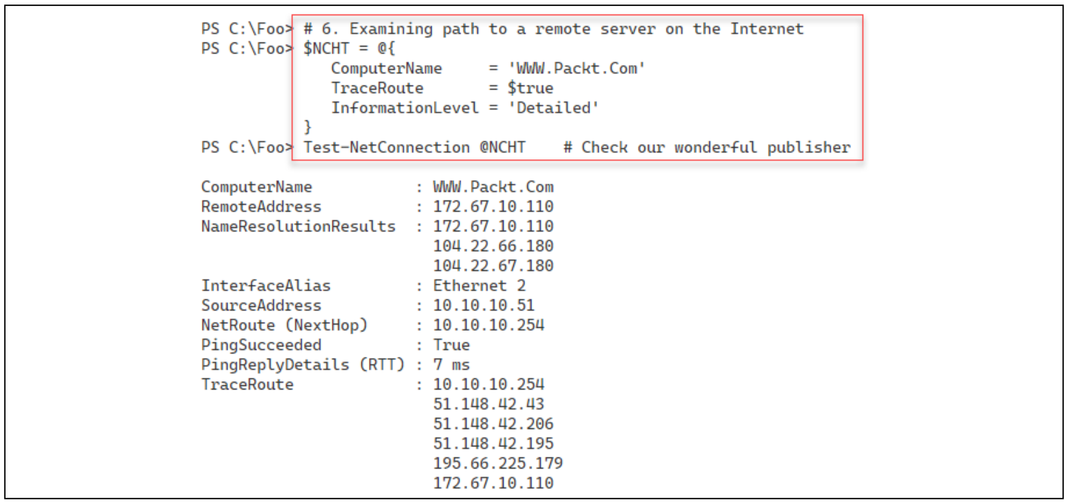
In *step 5*, you test that `SRV2` can access `DC1` on the LDAP port, port `389`, with the following output:



```
PS C:\Foo> # 5. Checking connectivity to the LDAP port on DC1
PS C:\Foo> Test-NetConnection -ComputerName DC1.Reskit.Org -Port 389

ComputerName     : DC1.Reskit.Org
RemoteAddress    : 10.10.10.10
RemotePort       : 389
InterfaceAlias   : Ethernet
SourceAddress    : 10.10.10.51
TcpTestSucceeded : True
```

Figure 7.11: Checking connectivity to the LDAP port on DC1

In *step 6*, you check connectivity to the Internet and test the network path to the publisher's website at `www.packt.com`. The output is:



```
PS C:\Foo> # 6. Examining path to a remote server on the Internet
PS C:\Foo> $NCHT = @{
   ComputerName     = 'WWW.Packt.Com'
   TraceRoute       = $true
   InformationLevel = 'Detailed'
}
PS C:\Foo> Test-NetConnection @NCHT    # Check our wonderful publisher

ComputerName           : WWW.Packt.Com
RemoteAddress          : 172.67.10.110
NameResolutionResults  : 172.67.10.110
                         104.22.66.180
                         104.22.67.180
InterfaceAlias         : Ethernet 2
SourceAddress          : 10.10.10.51
NetRoute (NextHop)     : 10.10.10.254
PingSucceeded          : True
PingReplyDetails (RTT) : 7 ms
TraceRoute             : 10.10.10.254
                         51.148.42.43
                         51.148.42.206
                         51.148.42.195
                         195.66.225.179
                         172.67.10.110
```

Figure 7.12: Examining the path to a remote server on the Internet

There's more...

This recipe's steps confirm that the host can accept connections over WinRM and can contact the DC for core activities. You could add several additional tests, such as testing you can access the DNS server and resolve DNS queries.

In *step 6*, you test the Internet connectivity to our publisher's website (`www.packt.com`). Since we are just testing the connectivity to this site, you only need to specify the actual computer name and do not need the HTTP or HTTPS prefix.

Installing DHCP

In previous recipes, you configured `SRV2` with a static IP address and tested its connectivity. Each server needs a unique IP address and other configuration options to configure on a server-by-server basis. You can also configure client computers running Windows 10 or other OSes manually, although this can be a huge and challenging task in large organizations.

Dynamic Host Configuration Protocol (**DHCP**) enables a DHCP client to get its IP configuration and other networking details automagically from a DHCP server. DHCP automates IP configuration and avoids the work and the inevitable issues involved with manual IP configuration.

Windows and most other client operating systems, including Linux and Apple Macs, have a built-in DHCP client. Windows Server also includes a DHCP server service you can install to provide DHCP services to the clients. You can install DHCP using Server Manager and configure the service using the DHCP GUI application. Alternatively, you can automate the installation of DHCP, as you can see in this recipe. In the next recipe, *Configuring DHCP scopes and options*, you configure the DHCP service to issue IP addresses in a specific range. You also configure DHCP to provide DHCP clients with other IP address configuration options, such as the subnet mask, default gateway, and the DNS server IP address or addresses.

Getting ready

This recipe uses `DC1`, a domain controller in the Reskit.Org domain. You should have installed AD on this host and configured it as per earlier recipes in *Chapter 5*, *Exploring .NET* and *Chapter 6*, *Managing Active Directory*.

How to do it...

1. Installing the DHCP feature on `DC1` and adding the management tools

```
Import-Module -Name ServerManager -WarningAction SilentlyContinue
Install-WindowsFeature -Name DHCP -IncludeManagementTools
```

2. Adding DC1 to trusted DHCP servers and adding the DHCP security group

```
Import-Module -Name DHCPServer -WarningAction SilentlyContinue
Add-DhcpServerInDC
Add-DHCPServerSecurityGroup
```

3. Letting DHCP know it's all configured

```
$DHCPHT = @{
  Path  = 'HKLM:\SOFTWARE\Microsoft\ServerManager\Roles\12'
  Name  = 'ConfigurationState'
  Value = 2
}
Set-ItemProperty @DHCPHT
```

4. Restarting the DHCP server

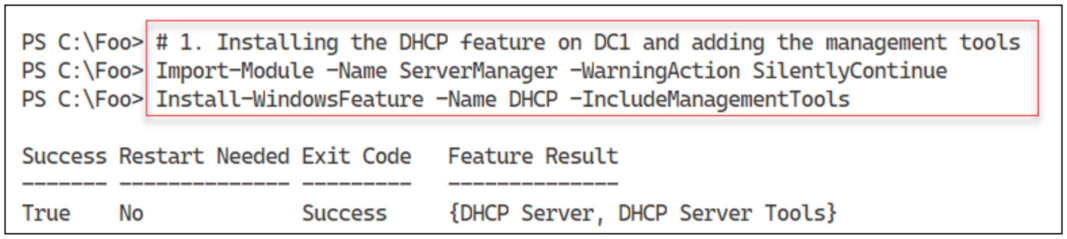
```
Restart-Service -Name DHCPServer -Force
```

5. Testing service availability

```
Get-Service -Name DHCPServer |
  Format-List -Property *
```

How it works...

In *step 1*, you import the `ServerManager` module and use `Install-WindowsFeature` to add the DHCP server service to `DC1`. The output from this step looks like this:



```
PS C:\Foo> # 1. Installing the DHCP feature on DC1 and adding the management tools
PS C:\Foo> Import-Module -Name ServerManager -WarningAction SilentlyContinue
PS C:\Foo> Install-WindowsFeature -Name DHCP -IncludeManagementTools

Success Restart Needed Exit Code   Feature Result
------- -------------- ---------   --------------
True    No             Success     {DHCP Server, DHCP Server Tools}
```

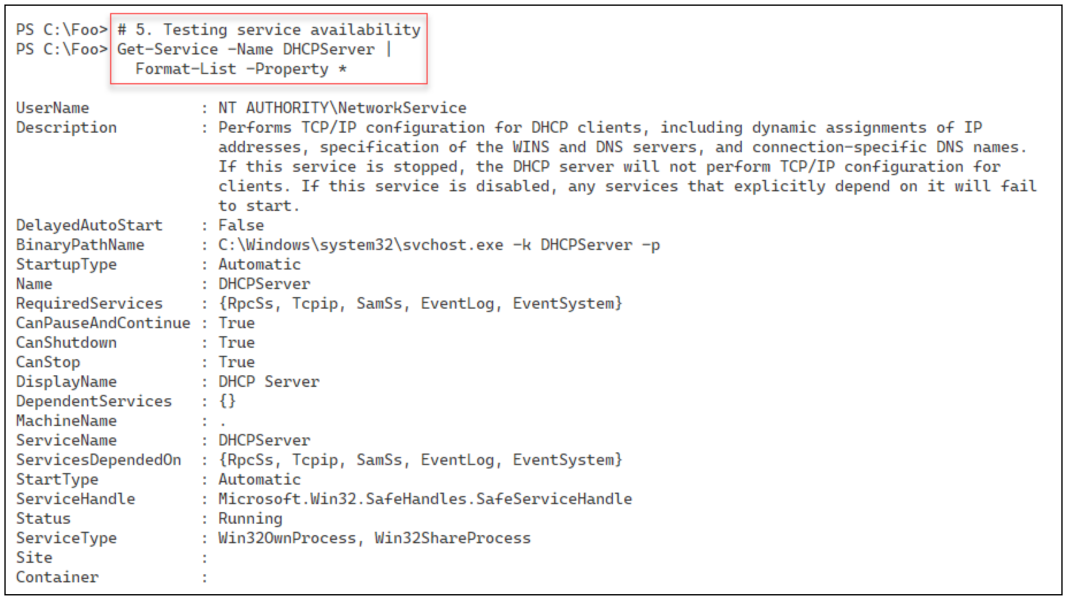
Figure 7.13: Installing the DHCP feature on DC1 and adding the management tools

In *step 2*, you add `DC1` to the set of authorized DHCP servers in the domain and add the DHCP security groups to the DHCP server, which produces no output to the console. The groups that this command adds are the `DHCP Users` and `DHCP Administrators` security groups. For more details on these groups, see `https://secureidentity.se/delegate-dhcp-admins-in-the-domain/`.

In *step 3*, you set a registry entry to tell Windows that all post-deployment DHCP configuration activities are complete. The GUI installation process takes you through this automatically. When installing via PowerShell, you need to set the registry entry to complete the configuration.

When you have completed the configuration activities, you restart the DHCP service. Once restarted, the DHCP service can issue IP configuration to DHCP clients. For this to happen, you must also have specified the configuration information you specify in the *Configuring DHCP scopes and options* recipe. *Step 2*, *step 3*, and *step 4* produce no output.

In *step 5*, you complete this recipe by ensuring that the DHCP service has started. The output of this step looks like this:



```
PS C:\Foo> # 5. Testing service availability
PS C:\Foo> Get-Service -Name DHCPServer |
             Format-List -Property *

UserName            : NT AUTHORITY\NetworkService
Description         : Performs TCP/IP configuration for DHCP clients, including dynamic assignments of IP
                      addresses, specification of the WINS and DNS servers, and connection-specific DNS names.
                      If this service is stopped, the DHCP server will not perform TCP/IP configuration for
                      clients. If this service is disabled, any services that explicitly depend on it will fail
                      to start.
DelayedAutoStart    : False
BinaryPathName      : C:\Windows\system32\svchost.exe -k DHCPServer -p
StartupType         : Automatic
Name                : DHCPServer
RequiredServices    : {RpcSs, Tcpip, SamSs, EventLog, EventSystem}
CanPauseAndContinue : True
CanShutdown         : True
CanStop             : True
DisplayName         : DHCP Server
DependentServices   : {}
MachineName         : .
ServiceName         : DHCPServer
ServicesDependedOn  : {RpcSs, Tcpip, SamSs, EventLog, EventSystem}
StartType           : Automatic
ServiceHandle       : Microsoft.Win32.SafeHandles.SafeServiceHandle
Status              : Running
ServiceType         : Win32OwnProcess, Win32ShareProcess
Site                :
Container           :
```

Figure 7.14: Testing service availability

There's more...

When the Windows DHCP service starts, it checks to ensure the server is on the DHCP server list authorized in the domain. The DHCP service does not start on any non-authorized DHCP server. Adding `DC1` to the list of authorized servers can help to guard against rogue DHCP servers.

In *step 5*, you check the DHCP service. The output from `Get-Service` includes a description of the service and the path name to the service executable. The DHCP service does not run in its own process. Instead, it runs inside `svchost.exe`. It is for this reason that you do not see the service explicitly when you use `Get-Process`.

Configuring DHCP scopes and options

Installing DHCP is simple, as you see in the *Installing DHCP* recipe. You add the Windows feature and then carry out two small configuration steps. In most cases, you probably do not need to take these extra steps. The extra steps enable you to use the relevant security groups and avoid the Server Manager GUI message stating that there are configuration steps that have not been performed yet.

Before your DHCP server can provide IP address configuration information to DHCP clients, you need to create a DHCP scope and DHCP options. A DHCP scope is a range of DHCP addresses that your DHCP server can give out for a given IP subnet. DHCP options are specific configuration options your DHCP server provides, such as the DNS server's IP address and the IPv4 default gateway.

You can set DHCP options at a scope level or a server level, depending on your organization's needs. For example, you would most likely specify a default gateway in the scope options, with DNS server address(es) set at the server level.

In this recipe, you create a new scope for the `10.10.10.0/24` subnet and specify both scope- and server-level options.

Getting ready

You run this recipe on `DC1`, a domain controller in the Reskit.Org domain, after installing the DHCP server service. You must have installed PowerShell 7 and VS Code on this host.

How to do it...

1. Importing the DHCP server module

```
Import-Module DHCPServer -WarningAction SilentlyContinue
```

2. Creating an IPv4 scope

```
$SCOPEHT = @{
  Name         = 'ReskitOrg'
  StartRange   = '10.10.10.150'
  EndRange     = '10.10.10.199'
  SubnetMask   = '255.255.255.0'
  ComputerName = 'DC1.Reskit.Org'
}
Add-DhcpServerV4Scope @SCOPEHT
```

3. Getting IPV4 scopes from the server

```
Get-DhcpServerv4Scope -ComputerName DC1.Reskit.Org
```

4. Setting server-wide option values

```
$OPTION1HT = @{
  ComputerName = 'DC1.Reskit.Org' # DHCP Server to Configure
  DnsDomain    = 'Reskit.Org'     # Client DNS Domain
  DnsServer    = '10.10.10.10'    # Client DNS Server
}
Set-DhcpServerV4OptionValue @OPTION1HT
```

5. Setting a scope-specific option

```
$OPTION2HT = @{
  ComputerName = 'DC1.Reskit.Org' # DHCP Server to Configure
  Router       = '10.10.10.254'
  ScopeID      = '10.10.10.0'
}
Set-DhcpServerV4OptionValue @OPTION2HT
```

6. Viewing DHCP server options

```
Get-DhcpServerv4OptionValue | Format-Table -AutoSize
```

7. Viewing scope-specific options

```
Get-DhcpServerv4OptionValue -ScopeId '10.10.10.10' |
  Format-Table -AutoSize
```

8. Viewing DHCPv4 option definitions

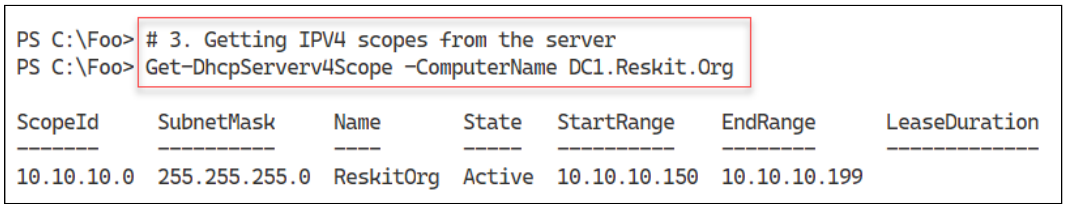
```
Get-DhcpServerv4OptionDefinition | Format-Table -AutoSize
```

How it works...

In *step 1*, you import the `DHCPServer` module. When you installed DHCP (in the *Installing DHCP* recipe), you added the management tools, including this module. However, the DHCP team has not yet made this module compatible with PowerShell 7. This step, which produces no output, loads the module using the Windows PowerShell Compatibility solution. You read about the Windows PowerShell Compatibility solution in *Chapter 3*, *Exploring Compatibility with Windows PowerShell*.

In *step 2*, you create a new DHCP scope for IPV4 addresses. The scope enables the DHCP server to issue IP addresses in the `10.10.10.150` - `10.10.10.199` range. This step produces no output.

In *step 3*, you use `Get-DHCPServerIPV4Scope` to retrieve details of all the DHCP scopes you have defined on `DC1`. The output of this step looks like this:

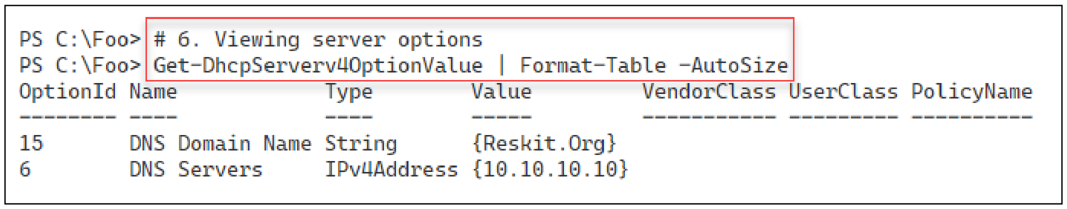


```
PS C:\Foo> # 3. Getting IPV4 scopes from the server
PS C:\Foo> Get-DhcpServerv4Scope -ComputerName DC1.Reskit.Org

ScopeId     SubnetMask     Name       State   StartRange    EndRange      LeaseDuration
-------     ----------     ----       -----   ----------    --------      -------------
10.10.10.0  255.255.255.0  ReskitOrg  Active  10.10.10.150  10.10.10.199
```

Figure 7.15: Getting IPV4 scopes from the server

In *step 4*, you set two server-wide DHCP options, creating no output. These are options and values offered to all clients of any DHCP scope defined on this server. In *step 5*, you specify a scope option. These two steps produce no output.

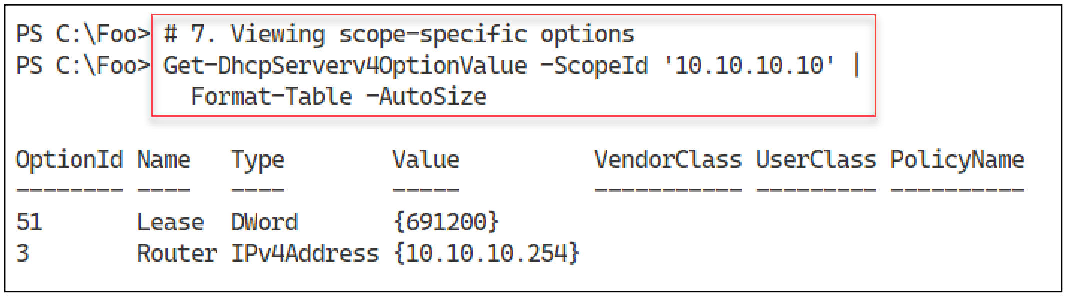
In *step 6*, you view the DHCP server-wide options, with output that looks like this:



```
PS C:\Foo> # 6. Viewing server options
PS C:\Foo> Get-DhcpServerv4OptionValue | Format-Table -AutoSize
OptionId Name            Type        Value          VendorClass UserClass PolicyName
-------- ----            ----        -----          ----------- --------- ----------
15       DNS Domain Name String      {Reskit.Org}
6        DNS Servers     IPv4Address {10.10.10.10}
```

Figure 7.16: Viewing server options

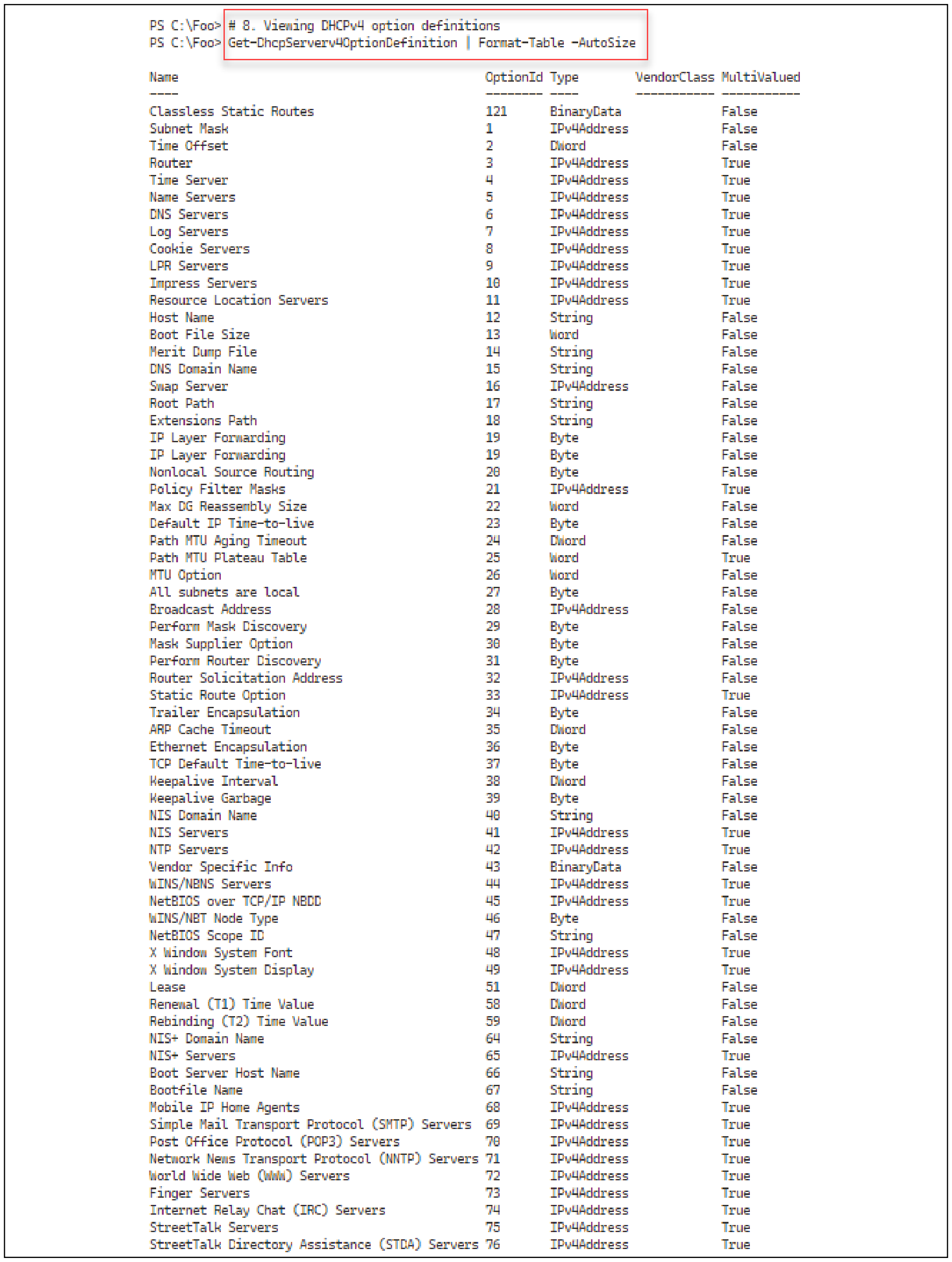
With *step 7*, you view the options you have set on the `10.10.10.10` scope, which looks like this:



```
PS C:\Foo> # 7. Viewing scope-specific options
PS C:\Foo> Get-DhcpServerv4OptionValue -ScopeId '10.10.10.10' |
             Format-Table -AutoSize

OptionId Name   Type        Value          VendorClass UserClass PolicyName
-------- ----   ----        -----          ----------- --------- ----------
51       Lease  DWord       {691200}
3        Router IPv4Address {10.10.10.254}
```

Figure 7.17: Viewing scope-specific options

There are 66 DHCP options you can use to provide option values to DHCP clients. Most of these options are of little use in most cases but provide support for niche and uncommon scenarios. You view the set of options defined by default in *step 8*, which looks like this:



```
PS C:\Foo> # 8. Viewing DHCPv4 option definitions
PS C:\Foo> Get-DhcpServerv4OptionDefinition | Format-Table -AutoSize

Name                                           OptionId Type        VendorClass MultiValued
----                                           -------- ----        ----------- -----------
Classless Static Routes                        121      BinaryData              False
Subnet Mask                                    1        IPv4Address             False
Time Offset                                    2        DWord                   False
Router                                         3        IPv4Address             True
Time Server                                    4        IPv4Address             True
Name Servers                                   5        IPv4Address             True
DNS Servers                                    6        IPv4Address             True
Log Servers                                    7        IPv4Address             True
Cookie Servers                                 8        IPv4Address             True
LPR Servers                                    9        IPv4Address             True
Impress Servers                                10       IPv4Address             True
Resource Location Servers                      11       IPv4Address             True
Host Name                                      12       String                  False
Boot File Size                                 13       Word                    False
Merit Dump File                                14       String                  False
DNS Domain Name                                15       String                  False
Swap Server                                    16       IPv4Address             False
Root Path                                      17       String                  False
Extensions Path                                18       String                  False
IP Layer Forwarding                            19       Byte                    False
IP Layer Forwarding                            19       Byte                    False
Nonlocal Source Routing                        20       Byte                    False
Policy Filter Masks                            21       IPv4Address             True
Max DG Reassembly Size                         22       Word                    False
Default IP Time-to-live                        23       Byte                    False
Path MTU Aging Timeout                         24       DWord                   False
Path MTU Plateau Table                         25       Word                    True
MTU Option                                     26       Word                    False
All subnets are local                          27       Byte                    False
Broadcast Address                              28       IPv4Address             False
Perform Mask Discovery                         29       Byte                    False
Mask Supplier Option                           30       Byte                    False
Perform Router Discovery                       31       Byte                    False
Router Solicitation Address                    32       IPv4Address             False
Static Route Option                            33       IPv4Address             True
Trailer Encapsulation                          34       Byte                    False
ARP Cache Timeout                              35       DWord                   False
Ethernet Encapsulation                         36       Byte                    False
TCP Default Time-to-live                       37       Byte                    False
Keepalive Interval                             38       DWord                   False
Keepalive Garbage                              39       Byte                    False
NIS Domain Name                                40       String                  False
NIS Servers                                    41       IPv4Address             True
NTP Servers                                    42       IPv4Address             True
Vendor Specific Info                           43       BinaryData              False
WINS/NBNS Servers                              44       IPv4Address             True
NetBIOS over TCP/IP NBDD                       45       IPv4Address             True
WINS/NBT Node Type                             46       Byte                    False
NetBIOS Scope ID                               47       String                  False
X Window System Font                           48       IPv4Address             True
X Window System Display                        49       IPv4Address             True
Lease                                          51       DWord                   False
Renewal (T1) Time Value                        58       DWord                   False
Rebinding (T2) Time Value                      59       DWord                   False
NIS+ Domain Name                               64       String                  False
NIS+ Servers                                   65       IPv4Address             True
Boot Server Host Name                          66       String                  False
Bootfile Name                                  67       String                  False
Mobile IP Home Agents                          68       IPv4Address             True
Simple Mail Transport Protocol (SMTP) Servers  69       IPv4Address             True
Post Office Protocol (POP3) Servers            70       IPv4Address             True
Network News Transport Protocol (NNTP) Servers 71       IPv4Address             True
World Wide Web (WWW) Servers                   72       IPv4Address             True
Finger Servers                                 73       IPv4Address             True
Internet Relay Chat (IRC) Servers              74       IPv4Address             True
StreetTalk Servers                             75       IPv4Address             True
StreetTalk Directory Assistance (STDA) Servers 76       IPv4Address             True
```

Figure 7.18: Viewing DHCPv4 option definitions

There's more...

In *step 2*, you create a new scope and give it a scope name. However, as you can see in *step 5* and elsewhere, the DHCP cmdlets do not provide a `-DHCPScopeName` parameter. Instead, you specify a `ScopeID`. In general, this is the subnet for the IP addresses in the scope, `10.10.10.0/24`. But even then, as you can see in *step 7*, the cmdlet accepts any IP address in the `10.10.10.0/24` subnet as the subnet ID, including `10.10.10.10` as shown.

Using DHCP

After installing the DHCP service and configuring the scope(s) and option values, your DHCP services can issue IP configuration data to any client. Since the DHCP protocol acts at the IP level, the protocol performs no authentication when any DHCP client uses the protocol to request IP configuration details. That means that any client you attach to the physical subnet can ask for and receive IP confirmation details.

In the *Configuring IP addressing* recipe, you set a static IP address for `SRV2`. In this recipe, you reconfigure this server to obtain a DHCP-based IP address (and the options you set in the *Configuring DHCP scopes and options* recipe).

Getting ready

You run this recipe on `SRV2`, which you've reconfigured to get its address via DHCP. You also need `DC1`, a domain controller for the Reskit.Org domain, and the DHCP server that you set up and configured in earlier recipes in this chapter.

How to do it...

1. Adding DHCP RSAT tools

```
Import-Module -Name ServerManager -WarningAction SilentlyContinue
Install-WindowsFeature -Name RSAT-DHCP
```

2. Importing the DHCP module

```
Import-Module -Name DHCPServer -WarningAction SilentlyContinue
```

3. Viewing the scopes on `DC1`

```
Get-DhcpServerv4Scope -ComputerName DC1
```

4. Getting V4 scope statistics from `DC1`

```
Get-DhcpServerv4ScopeStatistics -ComputerName DC1
```

5. Discovering a free IP address

```
Get-DhcpServerv4FreeIPAddress -ComputerName DC1 -ScopeId 10.10.10.42
```

6. Getting SRV2 NIC configuration

```
$NIC = Get-NetIPConfiguration -InterfaceIndex 6
```

7. Getting IP interface details

```
$NIC |
  Get-NetIPInterface  |
    Where-Object AddressFamily -eq 'IPv4'
```

8. Enabling DHCP on the NIC

```
$NIC |
  Get-NetIPInterface  |
    Where-Object AddressFamily -eq 'IPv4' |
      Set-NetIPInterface -Dhcp Enabled
```

9. Checking IP address assigned

```
Get-NetIPAddress -InterfaceAlias "Ethernet"   |
  Where-Object AddressFamily -eq 'IPv4'
```

10. Getting updated V4 scope statistics from DC1

```
Get-DhcpServerv4ScopeStatistics -ComputerName DC1
```

11. Discovering the next free IP address

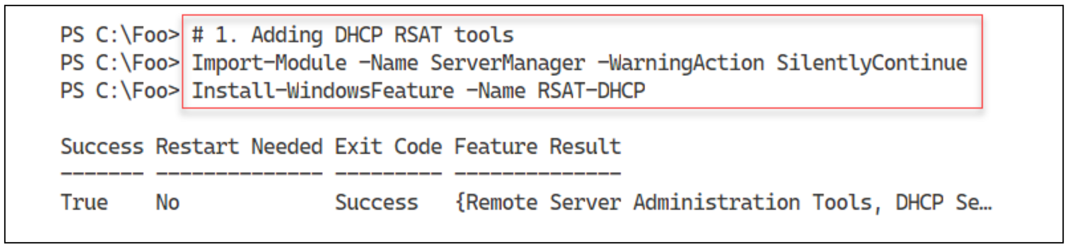
```
Get-DhcpServerv4FreeIPAddress -ComputerName DC1 -ScopeId 10.10.10.42
```

12. Checking IPv4 DNS name resolution

```
Resolve-DnsName -Name SRV2.Reskit.Org -Type A
```

How it works...

In *step 1*, you install the RSAT-DHCP feature to add the DHCP server's PowerShell module on SRV1, with output like this:

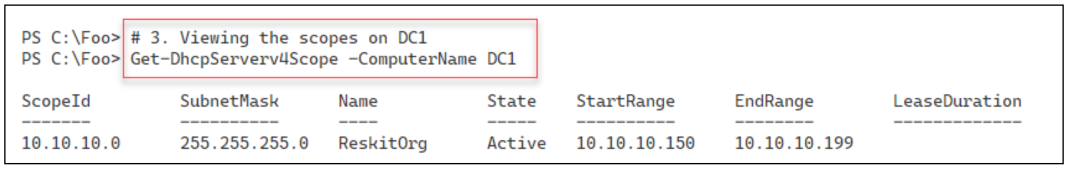


```
PS C:\Foo> # 1. Adding DHCP RSAT tools
PS C:\Foo> Import-Module -Name ServerManager -WarningAction SilentlyContinue
PS C:\Foo> Install-WindowsFeature -Name RSAT-DHCP

Success Restart Needed Exit Code Feature Result
------- -------------- --------- --------------
True    No             Success   {Remote Server Administration Tools, DHCP Se…
```

Figure 7.19: Adding DHCP RSAT tools

The DHCP server module is not .NET Core compatible. In *step 2*, you explicitly load this module using `Import-Module`, which creates no output.

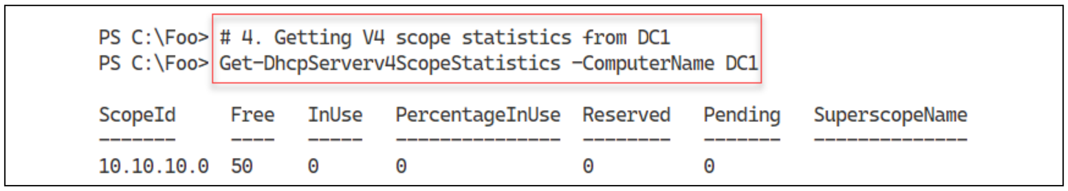
In *step 3*, you look at the scopes available on `DC1` (the DHCP server you installed in the *Installing DHCP* recipe). The output looks like this:



```
PS C:\Foo> # 3. Viewing the scopes on DC1
PS C:\Foo> Get-DhcpServerv4Scope -ComputerName DC1

ScopeId         SubnetMask      Name           State    StartRange      EndRange        LeaseDuration
-------         ----------      ----           -----    ----------      --------        -------------
10.10.10.0      255.255.255.0   ReskitOrg      Active   10.10.10.150    10.10.10.199
```

Figure 7.20: Viewing the scopes on DC1

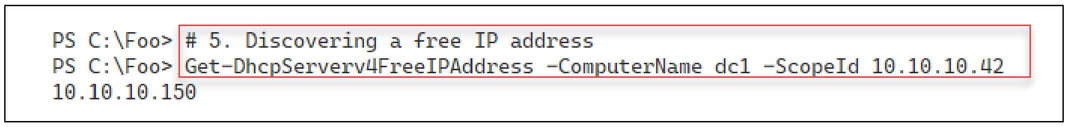
In *step 4*, you examine the scope statistics for the DHCP scope you created in the *Configuring DHCP scopes and options* recipe, which produces output like this:



```
PS C:\Foo> # 4. Getting V4 scope statistics from DC1
PS C:\Foo> Get-DhcpServerv4ScopeStatistics -ComputerName DC1

ScopeId    Free  InUse  PercentageInUse  Reserved  Pending  SuperscopeName
-------    ----  -----  ---------------  --------  -------  --------------
10.10.10.0 50    0      0                0         0
```

Figure 7.21: Getting V2 scope statistics from DC1

In *step 5*, you use the `Get-DhcpServerv4FreeIPAddress` cmdlet to find the first available free IP address in the scope. The output resembles this:

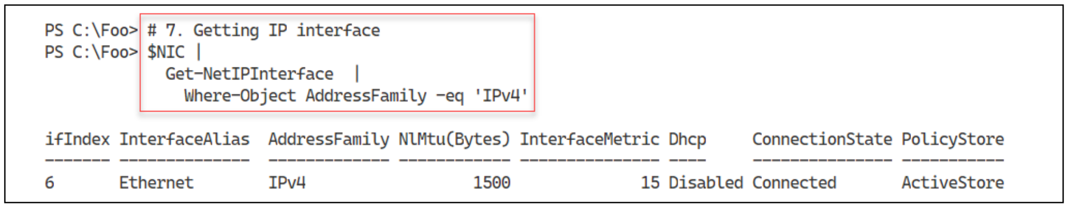


```
PS C:\Foo> # 5. Discovering a free IP address
PS C:\Foo> Get-DhcpServerv4FreeIPAddress -ComputerName dc1 -ScopeId 10.10.10.42
10.10.10.150
```

Figure 7.22: Discovering a free IP address in the scope

In *step 6*, you get the NIC details and store them in the `$NIC` variable, producing no output. Note that you specify an `InterfaceIndex` of 6, which should be your VM's NIC.

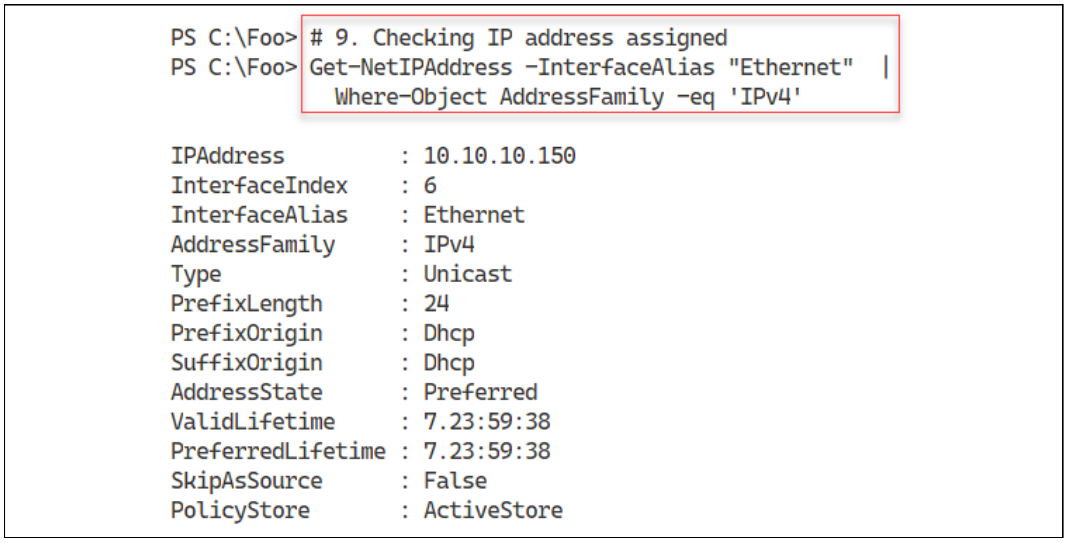
In *step 7*, you use that variable to get the details of the NIC, with output like this:



```
PS C:\Foo> # 7. Getting IP interface
PS C:\Foo> $NIC |
             Get-NetIPInterface  |
               Where-Object AddressFamily -eq 'IPv4'

ifIndex InterfaceAlias  AddressFamily NlMtu(Bytes) InterfaceMetric Dhcp     ConnectionState PolicyStore
------- --------------  ------------- ------------ --------------- ----     --------------- -----------
6       Ethernet        IPv4                  1500              15 Disabled Connected       ActiveStore
```

Figure 7.23: Getting the IP interface details

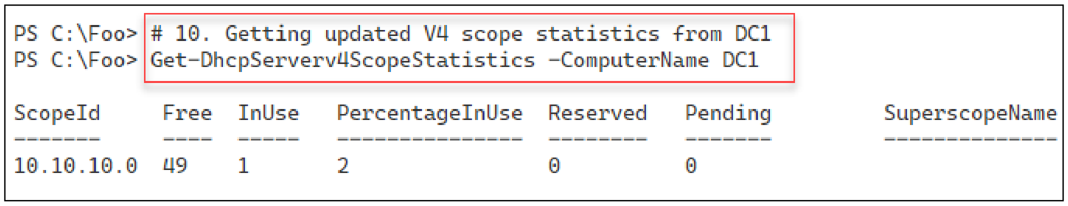
In *step 8*, you change the NIC to get configuration details from the DHCP server. This step creates no output. In *step 9*, you view the NIC's IPV4 address; this time, one assigned by DHCP. The output looks like this:



```
PS C:\Foo> # 9. Checking IP address assigned
PS C:\Foo> Get-NetIPAddress -InterfaceAlias "Ethernet"  |
             Where-Object AddressFamily -eq 'IPv4'

IPAddress         : 10.10.10.150
InterfaceIndex    : 6
InterfaceAlias    : Ethernet
AddressFamily     : IPv4
Type              : Unicast
PrefixLength      : 24
PrefixOrigin      : Dhcp
SuffixOrigin      : Dhcp
AddressState      : Preferred
ValidLifetime     : 7.23:59:38
PreferredLifetime : 7.23:59:38
SkipAsSource      : False
PolicyStore       : ActiveStore
```

Figure 7.24: Checking IP address assigned

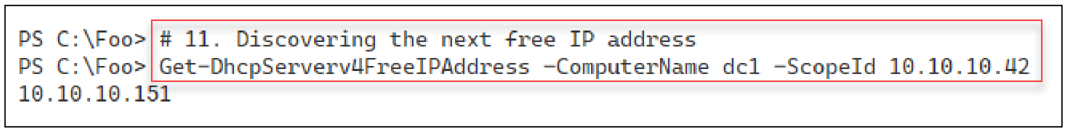
In *step 10*, you re-examine the scope statistics, with output like this:



```
PS C:\Foo> # 10. Getting updated V4 scope statistics from DC1
PS C:\Foo> Get-DhcpServerv4ScopeStatistics -ComputerName DC1

ScopeId     Free  InUse   PercentageInUse  Reserved  Pending          SuperscopeName
-------     ----  -----   ---------------  --------  -------          --------------
10.10.10.0  49    1       2                0         0
```

Figure 7.25: Getting updated V4 scope statistics from DC1

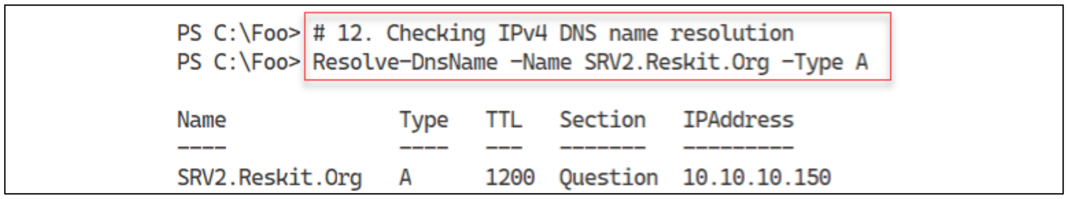
With *step 11*, you recheck and discover the next free IP address in the DHCP scope, with output like this:



```
PS C:\Foo> # 11. Discovering the next free IP address
PS C:\Foo> Get-DhcpServerv4FreeIPAddress -ComputerName dc1 -ScopeId 10.10.10.42
10.10.10.151
```

Figure 7.26: Discovering the next free IP address

In the final step, you check that `SRV2` has registered its new IP address in the DNS server on `DC1`. The output looks like:



```
PS C:\Foo> # 12. Checking IPv4 DNS name resolution
PS C:\Foo> Resolve-DnsName -Name SRV2.Reskit.Org -Type A

Name              Type   TTL   Section    IPAddress
----              ----   ---   -------    ---------
SRV2.Reskit.Org   A      1200  Question   10.10.10.150
```

Figure 7.27: Checking IPv4 DNS name resolution

There's more...

In this recipe, you use the DHCP server cmdlets to get information from the DHCP server on `DC1`. These cmdlets show how you can obtain information from the DHCP server, including the next free IP address and statistics on the scope (free/used addresses and more).

In *step 6*, you get the network configuration for the NIC with an `InterfaceIndex` of 6. In some cases, you may find that Windows has assigned a different interface index for the NIC. As an alternative, you could use the `-InterfaceAlias` parameter to specify the name of the interface.

In *step 7*, you get the IP interface details to allow you, in *step 8*, to convert the NIC from a static IP address into a dynamic one, based on DHCP.

In *step 9*, you view the DHCP supplied IP address information for `SRV2`. If you perform *step 8* and immediately run *step 9*, you may find that the NIC shows an **Automatic Private IP Addressing** (**APIPA**) IP address in the `169.254.0.0/24` subnet. This address is transient. When you change to DHCP (as you did in *step 8*), Windows removes the static address and creates an APIPA address. Once `SRV2` contacts the DHCP server and negotiates an address, you see the output shown for *step 9*, as in *Figure 7.24*. Obtaining a lease can take a few seconds, so be patient.

Implementing DHCP failover and load balancing

As shown in the two previous recipes, the installation and configuration of a single on-premises DHCP server is straightforward. However, a single DHCP server represents a single point of failure, which is never a good thing. The solution is always to have a second DHCP server. In earlier versions of Windows, you could do this with two DHCP servers, each with a scope. Typically, you used to split the full set of IP addresses and allow each server to have part of that set. The traditional "wisdom" was to do an 80/20 split – have 80% of the scope supplied by your primary DHCP server and 20% on the backup server.

Independent DHCP servers are an error-prone approach and were never ideal since these independent servers did not coordinate scope details. That 80/20 "rule" was a recommendation for one specific customer scenario (a large firm in the Pacific Northwest) and possibly was not meant to become a best practice.

In Windows Server 2012, Microsoft added a DHCP failover and load balancing mechanism that simplified deploying DHCP in an organization. You can now set up two DHCP servers, define a DHCP scope, and allow both servers to work in tandem.

In this recipe, you install DHCP on a second server, `DC2`, and then configure and use the failover and load balancing capabilities of Windows Server.

Getting ready

This recipe uses the two DCs you have installed, `DC1` and `DC2`. You should also have installed DHCP on DNS (*Installing DHCP*) and configured a DNS zone (*Configuring DHCP scopes and options*). You run this recipe on `DC2`.

How to do it...

1. Installing the DHCP server feature on `DC2`

```
Import-Module -Name ServerManager -WarningAction SilentlyContinue
$FEATUREHT = @{
  Name                   = 'DHCP'
  IncludeManagementTools = $True
}
Install-WindowsFeature @FEATUREHT
```

2. Letting DHCP know it is fully configured

```
$IPHT = @{
  Path  = 'HKLM:\SOFTWARE\Microsoft\ServerManager\Roles\12'
  Name  = 'ConfigurationState'
  Value = 2
}
Set-ItemProperty @IPHT
```

3. Authorizing the DHCP server in AD

```
Import-Module -Name DHCPServer -WarningAction 'SilentlyContinue'
Add-DhcpServerInDC -DnsName DC2.Reskit.Org
```

4. Viewing authorized DHCP servers in the Reskit domain

```
Get-DhcpServerInDC
```

5. Configuring failover and load balancing

```
$FAILOVERHT = @{
  ComputerName       = 'DC1.Reskit.Org'
  PartnerServer      = 'DC2.Reskit.Org'
  Name               = 'DC1-DC2'
  ScopeID            = '10.10.10.0'
  LoadBalancePercent = 60
  SharedSecret       = 'j3RryIsTheB3est!'
  Force              = $true
  Verbose            = $True
}
Invoke-Command -ComputerName DC1.Reskit.org -ScriptBlock {
  Add-DhcpServerv4Failover @Using:FAILOVERHT
}
```

6. Getting active leases in the scope (from both servers!)

```
$DHCPServers = 'DC1.Reskit.Org', 'DC2.Reskit.Org'
$DHCPServers |
  ForEach-Object {
    "Server $_" | Format-Table
    Get-DhcpServerv4Scope -ComputerName $_ | Format-Table
  }
```

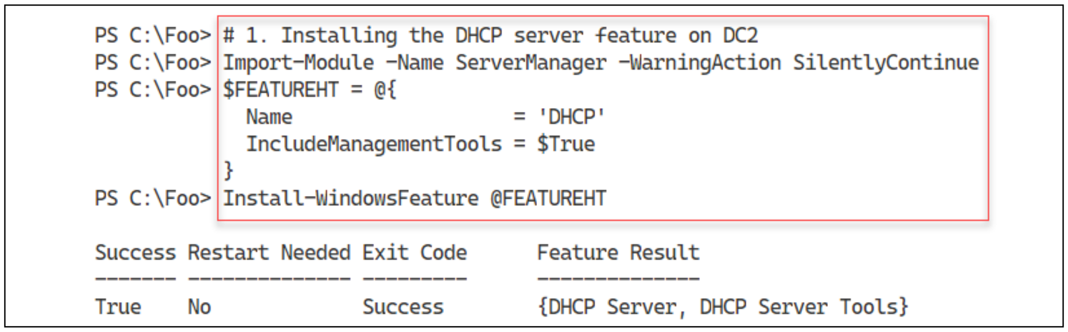
7. Viewing DHCP server statistics from both DHCP servers

```
$DHCPServers |
  ForEach-Object {
    "Server $_" | Format-Table
    Get-DhcpServerv4ScopeStatistics -ComputerName $_  | Format-Table
  }
```

How it works...

Using the first three steps in this recipe, you install the DHCP server feature on `DC2`. These steps duplicate the approach you used in the *Installing DHCP* recipe to install DHCP on `DC1`.

In *step 1*, you import the Server Manager module and then install the DHCP feature, with output like this:



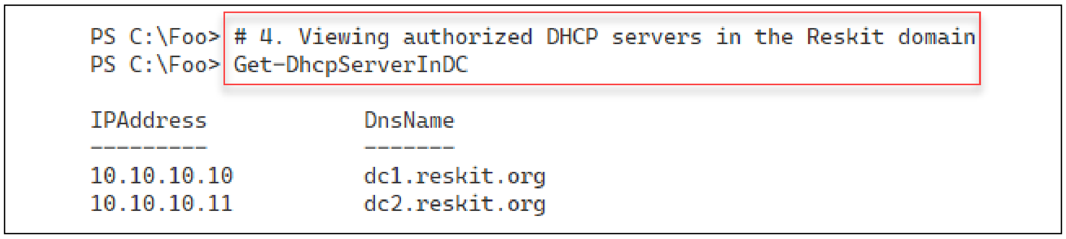
```
PS C:\Foo> # 1. Installing the DHCP server feature on DC2
PS C:\Foo> Import-Module -Name ServerManager -WarningAction SilentlyContinue
PS C:\Foo> $FEATUREHT = @{
             Name                   = 'DHCP'
             IncludeManagementTools = $True
           }
PS C:\Foo> Install-WindowsFeature @FEATUREHT

Success Restart Needed Exit Code      Feature Result
------- -------------- ---------      --------------
True    No             Success        {DHCP Server, DHCP Server Tools}
```

Figure 7.28: Installing the DHCP server feature on DC2

In *step 2*, you set a registry key to tell Windows that you have completed the DHCP feature installation. Without this step, any time you use the Server Manager GUI on `DC2`, you will see a message indicating that additional configuration is required. This step produces no output.

In *step 3*, you import the DHCP server PowerShell module and add `DC2` to the list of authorized DHCP servers in the Reskit domain. This step produces no output.

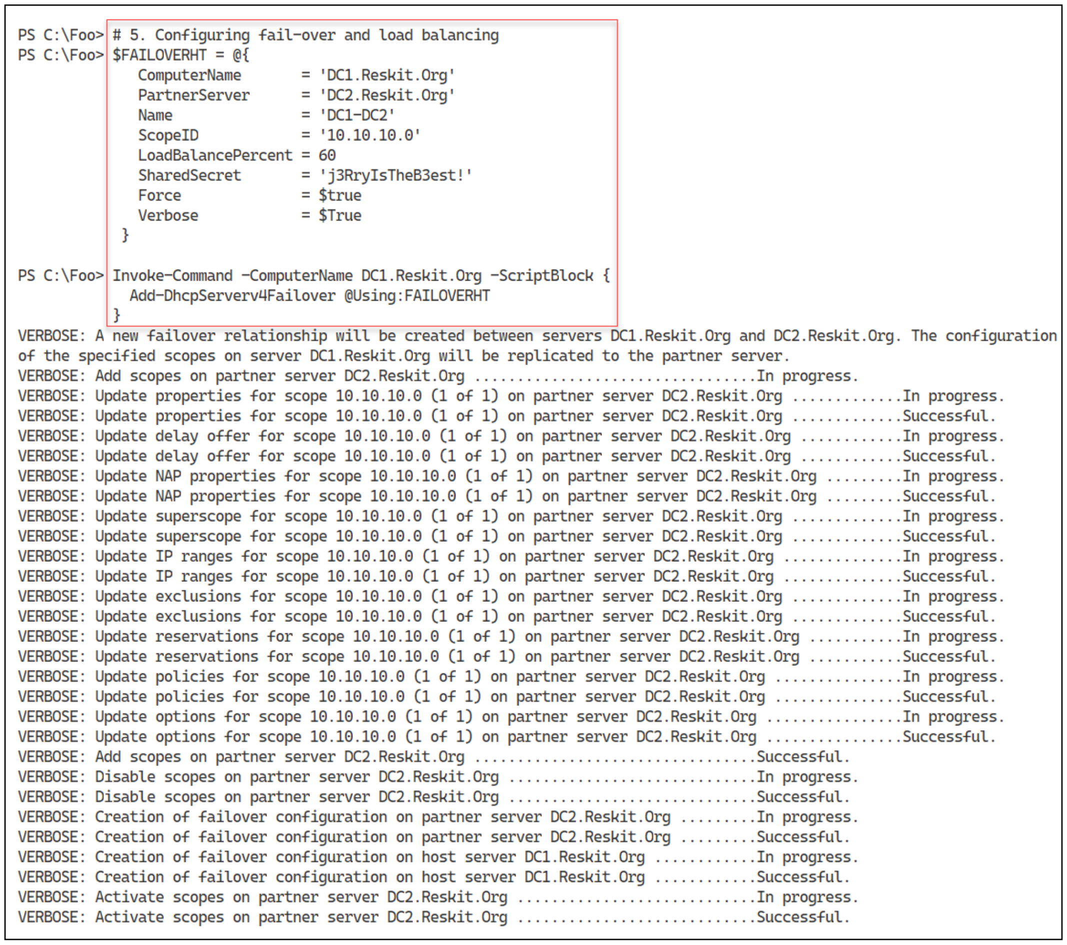
In *step 4*, you examine the set of authorized DHCP servers, which produces the following output:



```
PS C:\Foo> # 4. Viewing authorized DHCP servers in the Reskit domain
PS C:\Foo> Get-DhcpServerInDC

IPAddress            DnsName
---------            -------
10.10.10.10          dc1.reskit.org
10.10.10.11          dc2.reskit.org
```

Figure 7.29: Viewing authorized DHCP servers in the Reskit domain

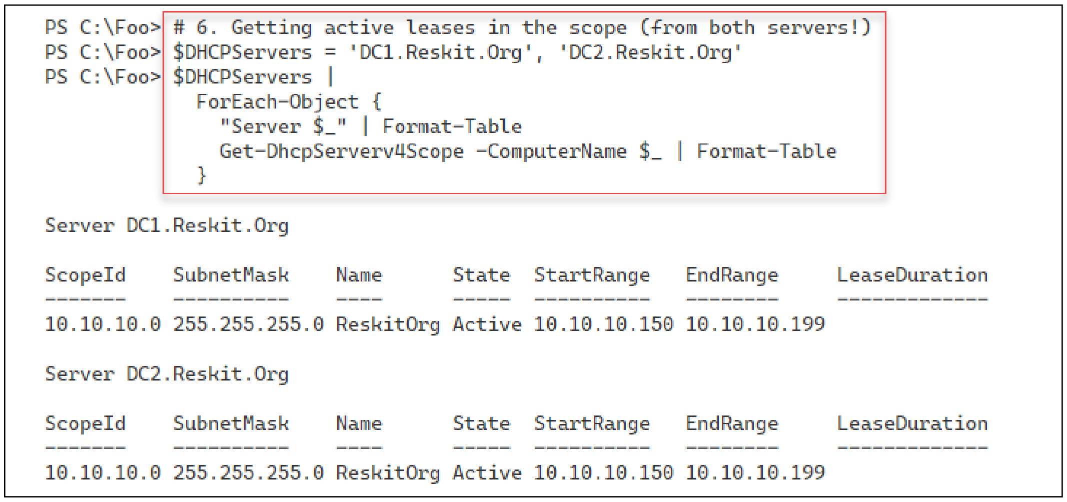
In *step 5*, you configure DHCP load balancing and failover, with output like this:



```
PS C:\Foo> # 5. Configuring fail-over and load balancing
PS C:\Foo> $FAILOVERHT = @{
              ComputerName       = 'DC1.Reskit.Org'
              PartnerServer      = 'DC2.Reskit.Org'
              Name               = 'DC1-DC2'
              ScopeID            = '10.10.10.0'
              LoadBalancePercent = 60
              SharedSecret       = 'j3RryIsTheB3est!'
              Force              = $true
              Verbose            = $True
            }

PS C:\Foo> Invoke-Command -ComputerName DC1.Reskit.Org -ScriptBlock {
             Add-DhcpServerv4Failover @Using:FAILOVERHT
           }
VERBOSE: A new failover relationship will be created between servers DC1.Reskit.Org and DC2.Reskit.Org. The configuration
of the specified scopes on server DC1.Reskit.Org will be replicated to the partner server.
VERBOSE: Add scopes on partner server DC2.Reskit.Org ..................................In progress.
VERBOSE: Update properties for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ............In progress.
VERBOSE: Update properties for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ............Successful.
VERBOSE: Update delay offer for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ...........In progress.
VERBOSE: Update delay offer for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ...........Successful.
VERBOSE: Update NAP properties for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ........In progress.
VERBOSE: Update NAP properties for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ........Successful.
VERBOSE: Update superscope for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ............In progress.
VERBOSE: Update superscope for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ............Successful.
VERBOSE: Update IP ranges for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org .............In progress.
VERBOSE: Update IP ranges for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org .............Successful.
VERBOSE: Update exclusions for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ............In progress.
VERBOSE: Update exclusions for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ............Successful.
VERBOSE: Update reservations for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ..........In progress.
VERBOSE: Update reservations for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ..........Successful.
VERBOSE: Update policies for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ..............In progress.
VERBOSE: Update policies for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ..............Successful.
VERBOSE: Update options for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ...............In progress.
VERBOSE: Update options for scope 10.10.10.0 (1 of 1) on partner server DC2.Reskit.Org ...............Successful.
VERBOSE: Add scopes on partner server DC2.Reskit.Org ..................................Successful.
VERBOSE: Disable scopes on partner server DC2.Reskit.Org ..............................In progress.
VERBOSE: Disable scopes on partner server DC2.Reskit.Org ..............................Successful.
VERBOSE: Creation of failover configuration on partner server DC2.Reskit.Org .........In progress.
VERBOSE: Creation of failover configuration on partner server DC2.Reskit.Org .........Successful.
VERBOSE: Creation of failover configuration on host server DC1.Reskit.Org ............In progress.
VERBOSE: Creation of failover configuration on host server DC1.Reskit.Org ............Successful.
VERBOSE: Activate scopes on partner server DC2.Reskit.Org .............................In progress.
VERBOSE: Activate scopes on partner server DC2.Reskit.Org .............................Successful.
```

Figure 7.30: Configuring failover and load balancing

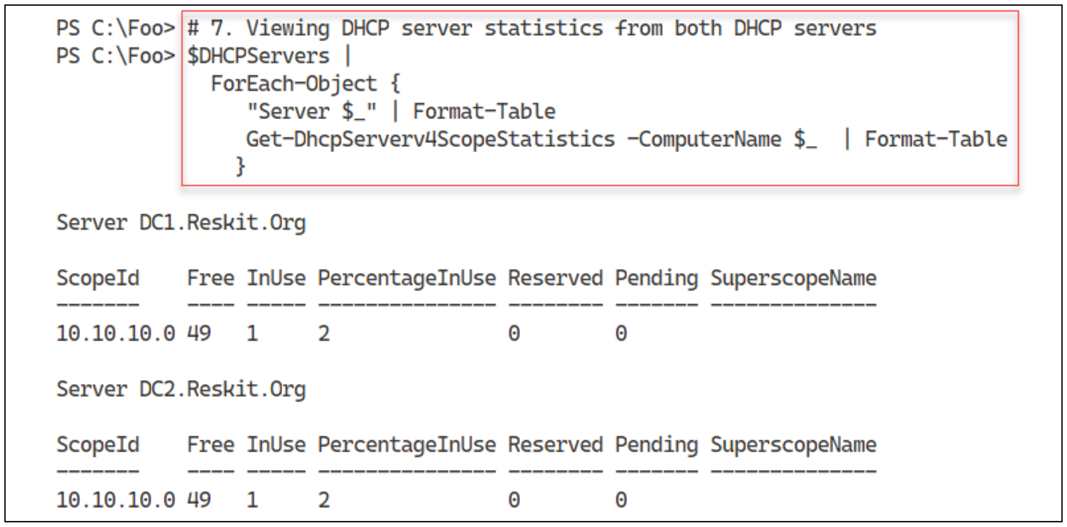
With *step 6*, you examine the scopes on both DHCP servers, with the following output:



```
PS C:\Foo> # 6. Getting active leases in the scope (from both servers!)
PS C:\Foo> $DHCPServers = 'DC1.Reskit.Org', 'DC2.Reskit.Org'
PS C:\Foo> $DHCPServers |
             ForEach-Object {
               "Server $_" | Format-Table
               Get-DhcpServerv4Scope -ComputerName $_ | Format-Table
             }

Server DC1.Reskit.Org

ScopeId    SubnetMask    Name      State  StartRange   EndRange     LeaseDuration
-------    ----------    ----      -----  ----------   --------     -------------
10.10.10.0 255.255.255.0 ReskitOrg Active 10.10.10.150 10.10.10.199

Server DC2.Reskit.Org

ScopeId    SubnetMask    Name      State  StartRange   EndRange     LeaseDuration
-------    ----------    ----      -----  ----------   --------     -------------
10.10.10.0 255.255.255.0 ReskitOrg Active 10.10.10.150 10.10.10.199
```

Figure 7.31: Getting active leases in the scope from both servers

In *step 7*, you view the DHCP server statistics from your two DHCP servers, with output like this:



```
PS C:\Foo> # 7. Viewing DHCP server statistics from both DHCP servers
PS C:\Foo> $DHCPServers |
             ForEach-Object {
                "Server $_" | Format-Table
                Get-DhcpServerv4ScopeStatistics -ComputerName $_  | Format-Table
              }

Server DC1.Reskit.Org

ScopeId    Free InUse PercentageInUse Reserved Pending SuperscopeName
-------    ---- ----- --------------- -------- ------- --------------
10.10.10.0 49   1     2               0        0

Server DC2.Reskit.Org

ScopeId    Free InUse PercentageInUse Reserved Pending SuperscopeName
-------    ---- ----- --------------- -------- ------- --------------
10.10.10.0 49   1     2               0        0
```

Figure 7.32: Viewing DHCP statistics from both servers

There's more...

Unlike in the *Installing DHCP* recipe, in this recipe, you do not add the DHCP-related local security groups on `DC2`. If you plan to delegate administrative privileges, you may wish to add those groups, as you did in the earlier recipe.

In *step 5*, you establish a load balancing and failover relationship between the two DHCP servers. By using the `-Verbose` switch for the `Add-DhcpServerV4Failover` cmdlet, you can see precisely what the command is doing, step by step. As you can see in the output in *Figure 7.30*, this command copies full details of all the scopes on `DC1` to `DC2`. You should note that the relationship is on a scope-by-scope basis.

Depending on your needs, you can configure different sorts of relationships between DHCP servers using the `-ServerRole` parameter. For more details on this parameter and others that you can use to fine-tune the relationship between the two partners, see `https://docs.microsoft.com/powershell/module/dhcpserver/add-dhcpserverv4failover`.

The DHCP failover feature provides several additional settings to control precisely when to failover and for how long (and when to failback). These settings allow you to control, for example, what might happen during a planned reboot of your DHCP server.

Deploying DNS in the Enterprise

When you installed Active Directory in *Chapter 6*, *Managing Active Directory*, you added a single DNS server on `DC1`. When you added a replica DC, `DC2`, and when you added the child domain with `UKDC1`, you did not set up any additional DNS servers in your forest. In an enterprise organization, this is not best practice. You always want to configure your clients and servers so that they use at least two DNS servers. For servers with a static DNS setting, you should also update the DHCP DNS server option settings to ensure that your DHCP servers also provide two DNS server entries to DHCP clients.

In most organizations, there are several DNS service configuration options you may wish to set. These include whether to allow DNS server recursion on the server, the maximum size of the DNS cache, and whether to use **Extended DNS** (**EDNS**).

EDNS (also referred to as EDNS0 or, more recently, EDNS(0)) is an extension mechanism that enables more recent DNS servers to interact with older servers that may not be capable of specific actions. For more details on EDNS(0), see `https://en.wikipedia.org/wiki/Extension_Mechanisms_for_DNS`.

This recipe is a starting point. There are other DNS server options you may wish to consider updating, such as DNS security. Additionally, you may need to reconfigure other servers and update the static IP address settings (to point to both DNS servers). And finally, in the `Reskit.Org` forest, you should also be updating the child domain `UK.Reskit.Org`.

In this recipe, you update the domain-wide DNS settings in the Reskit.Org domain. These settings include ensuring that you configure DC2's DNS service in the same way as `DC1`, updating DNS server configuration settings, configuring both `DC1` and `DC2` to point to the correct DNS servers, and updating DHCP to issue both DNS server addresses. You then examine the DNS settings.

In the *Configuring IP addressing* recipe, you configured `SRV2`, a workgroup host, to update DNS. You configured the Reskit.Org zone on `DC1` to allow non-domain members to update their DNS registrations using dynamic DNS. This configuration is not a best practice configuration. In the final steps of this recipe, you update the DNS zones for Reskit.Org to allow only secure updates and join `SRV2` to the Reskit.Org domain with a static IP address.

Getting ready

You run this recipe on `DC2`, with `DC1` and `SRV2` also operational. You run this recipe after setting up DNS on both `DC1` and `DC2` and implementing DHCP.

How to do it...

1. Installing the DNS feature on `DC2`

```
Import-Module -Name ServerManager -WarningAction SilentlyContinue
Install-WindowsFeature -Name DNS -IncludeManagementTools
```

2. Creating a script block to set DNS server options

```
$SB1 = {
  # Enable recursion on this server
  Set-DnsServerRecursion -Enable $true
  # Configure DNS Server cache maximum size
  Set-DnsServerCache  -MaxKBSize 20480  # 28 MB
  # Enable EDNS
  $EDNSHT = @{
    EnableProbes    = $true
    EnableReception = $true
  }
  Set-DnsServerEDns @EDNSHT
  # Enable Global Name Zone
  Set-DnsServerGlobalNameZone -Enable $true
}
```

3. Reconfiguring DNS on `DC2` and `DC1`

```
Invoke-Command -ScriptBlock $SB1
Invoke-Command -ScriptBlock $SB1 -ComputerName DC1
```

4. Creating a script block to configure `DC2` to have two DNS servers

```
$SB2 = {
  $NIC =
     Get-NetIPInterface -InterfaceAlias "Ethernet" -AddressFamily IPv4
  $DNSSERVERS = ('127.0.0.1','10.10.10.10')
  $DNSHT = @{
    InterfaceIndex  = $NIC.InterfaceIndex
    ServerAddresses = $DNSSERVERS
  }
  Set-DnsClientServerAddress @DNSHT
  Start-Service -Name DNS
}
```

5. Configuring `DC2` to have two DNS servers

```
Invoke-Command -ScriptBlock $SB2
```

6. Creating a script block to configure `DC1` to have two DNS servers

```
$SB3 = {
  $NIC =
    Get-NetIPInterface -InterfaceAlias "Ethernet" -AddressFamily IPv4
  $DNSSERVERS = ('127.0.0.1','10.10.10.11')
  $DNSHT = @{
    InterfaceIndex  = $NIC.InterfaceIndex
    ServerAddresses = $DNSSERVERS
  }
  Set-DnsClientServerAddress @DNSHT
  Start-Service -Name DNS
}
```

7. Configuring `DC1` to have two DNS servers

```
Invoke-Command -ScriptBlock $SB3 -ComputerName DC1
```

8. Updating DHCP scope to add two DNS entries

```
$DNSOPTIONHT = @{
  DnsServer    = '10.10.10.11',
                 '10.10.10.10'    # Client DNS Servers
  DnsDomain    = 'Reskit.Org'
  Force        = $true
}
Set-DhcpServerV4OptionValue @DNSOPTIONHT -ComputerName DC1
Set-DhcpServerV4OptionValue @DNSOPTIONHT -ComputerName DC2
```

9. Getting DNS service details

```
$DNSRV = Get-DNSServer -ComputerName DC2.Reskit.Org
```

10. Viewing recursion settings

```
$DNSRV |
  Select-Object -ExpandProperty ServerRecursion
```

11. Viewing server cache settings

```
$DNSRV |
  Select-Object -ExpandProperty ServerCache
```

12. Viewing EDNS settings

```
$DNSRV |
  Select-Object -ExpandProperty ServerEdns
```

13. Setting Reskit.Org zone to be secure only

```
$DNSSSB = {
  $SBHT = @{
    Name          = 'Reskit.Org'
    DynamicUpdate = 'Secure'
  }
  Set-DnsServerPrimaryZone @SBHT
}
Invoke-Command -ComputerName DC1 -ScriptBlock $DNSSSB
Invoke-Command -ComputerName DC2 -ScriptBlock $DNSSSB
```

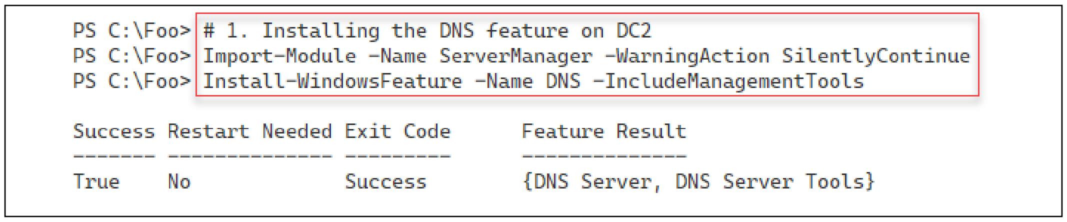
Run the next step on SRV2.

14. Adding SRV2 to domain

```
$User  = 'Reskit\Administrator'
$Pass  = 'Pa$$w0rd'
$PSS   = $Pass | ConvertTo-SecureString -Force -AsPlainText
$CRED  = [PSCredential]::new($User,$PSS)
$Sess  = New-PSSession -UseWindowsPowerShell
Invoke-Command -Session $Sess -Scriptblock {
  $ACHT = @{
    Credential = $using:Cred
    Domain     = 'Reskit.org'
    Force      = $True
  }
  Add-Computer @ACHT
  Restart-Computer
} | Out-Null
```

How it works...

In *step 1*, you install the DNS feature on `DC1`, with output like this:

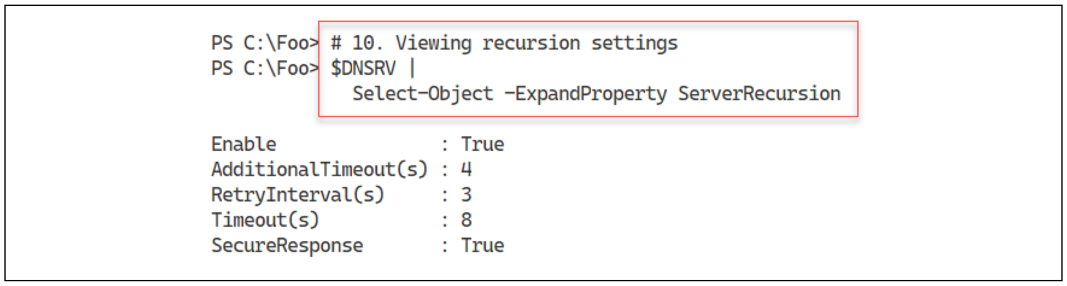


```
PS C:\Foo> # 1. Installing the DNS feature on DC2
PS C:\Foo> Import-Module -Name ServerManager -WarningAction SilentlyContinue
PS C:\Foo> Install-WindowsFeature -Name DNS -IncludeManagementTools

Success Restart Needed Exit Code      Feature Result
------- -------------- ---------      --------------
True    No             Success        {DNS Server, DNS Server Tools}
```

Figure 7.33: Installing the DNS feature on DC2

In *step 2*, you create a script block that contains the DNS server options. In *step 3*, you run this script block on both `DC1` and `DC2`. In *step 4*, you create a script block to use to set the IP configuration on `DC2`. In *step 5*, you run this script block to reconfigure `DC2`. In *step 6* and *step 7*, you reconfigure the static IP setting on `DC1`. In *step 8*, you update the DHCP server's DHCP options to ensure the DHCP server on both hosts supplies two DNS server IP addresses to clients of either DHCP server. These seven steps produce no output.

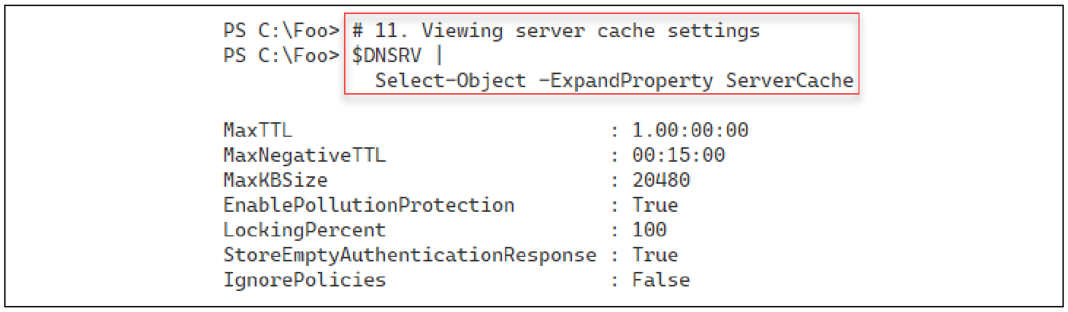
In *step 9*, you get the DNS server details from `DC2`, producing no output. In *step 10*, you examine the DNS server recursion settings, with output like this:



```
PS C:\Foo> # 10. Viewing recursion settings
PS C:\Foo> $DNSRV |
             Select-Object -ExpandProperty ServerRecursion

Enable               : True
AdditionalTimeout(s) : 4
RetryInterval(s)     : 3
Timeout(s)           : 8
SecureResponse       : True
```

Figure 7.34: Viewing DNS server recursion settings

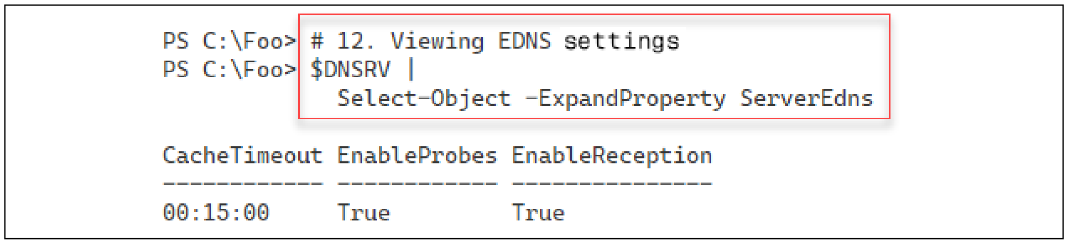
In *step 11*, you examine the DNS server cache settings on `DC2`, with output like this:



```
PS C:\Foo> # 11. Viewing server cache settings
PS C:\Foo> $DNSRV |
             Select-Object -ExpandProperty ServerCache

MaxTTL                             : 1.00:00:00
MaxNegativeTTL                     : 00:15:00
MaxKBSize                          : 20480
EnablePollutionProtection          : True
LockingPercent                     : 100
StoreEmptyAuthenticationResponse   : True
IgnorePolicies                     : False
```

Figure 7.35: Viewing server cache settings

In *step 12*, you view the EDNS settings on `DC2`, with output like this:



```
PS C:\Foo> # 12. Viewing EDNS settings
PS C:\Foo> $DNSRV |
             Select-Object -ExpandProperty ServerEdns

CacheTimeout EnableProbes EnableReception
------------ ------------ ---------------
00:15:00     True         True
```

Figure 7.36: Viewing EDNS settings on DC2

In *step 13*, you change the DNS domain for `Reskit.Org` so that it only accepts secure dynamic updates on both DNS servers in the domain.

In the final step of this recipe, *step 14*, you add `SRV2` to the `Reskit.Org` domain. This step produces no output.

There's more...

In this recipe, you install and configure DNS on `DC2`. You also set DNS server options on both DNS servers (`DC1` and `DC2`). In *step 5* and *step 7*, you configure your domain controllers so that they point to themselves first and to the other DNS servers second. Configuring DNS in this manner is a best practice.

In an earlier recipe, you configured your DHCP servers so that they provided a single DNS server IP address to DHCP clients. In *step 8*, you update DHCP to provide two DNS server IP addresses.

You then obtain and view the DNS server recursion, server cache, and EDNS settings on `DC2`. You could extend these steps by examining the settings on `DC2` and comparing them to ensure consistent configuration.

In the *Configuring IP addressing* recipe, you used a workgroup computer, `SRV2`, and enabled it to register with DNS by setting the domain to accept non-secure updates. Using non-secure DNS updates is not a best practice as it could allow a rogue computer to "steal" a real DNS name. In *step 13*, you ensure that the `Reskit.Org` DNS domain only allows secure updates. Then, in *step 14* and *step 15*, you add `SRV2` to the domain. For the remainder of this book, `SRV2` is a domain-joined computer and not a workgroup system. These last three steps produce no output.

In this recipe, you set up DNS for use in the Reskit.Org domain. You made no changes to DNS with respect to the UK.Reskit.Org sub-domain. In production, you would want at least a second DC and would need to update your DNS server address settings for servers in the UK domain.

Another production aspect regards replication of domains. In this chapter, you created a DNS zone for `Reskit.Org`. The recipes you use set that domain to be AD integrated and to be replicated to every DC in the `Reskit.Org` forest. This means that all DNS server changes to the `Reskit.Org` domain are replicated automatically to `UKDC1`. Depending on your usage scenario, you may wish to adjust the zone replication scope for AD-integrated zones.

Configuring DNS forwarding

When a DNS server gets a query for a **resource record** (**RR**) not held by the server, it can use recursion to discover a DNS server that can resolve the RR. If, for example, you use `Resolve-DNSName` to resolve `www.packt.com`, the configured DNS server may not hold a zone that would help. Your DNS service then looks to the DNS root servers to discover a DNS server that can via the recursion process. Eventually, the process finds a DNS server that can resolve the RR. Your DNS server then caches these details locally in the DNS server cache.

If you are resolving publicly available names, this process works great. But you might have internally supplied DNS names that the DNS can't resolve via the mechanism. An example might be when two companies merge. There may be internal hostnames (for example, `intranet.kapoho.com` and `intranet.reskit.org`) that your organization's internal DNS servers can resolve but are not available from publicly facing DNS servers. In that scenario, you can set up **conditional forwarding**. Conditional forwarding enables one DNS server to forward a query to another DNS server or set of servers and not use recursion. You can learn a bit more about conditional forwarding here: `https://medium.com/tech-jobs-academy/dns-forwarding-and-conditional-forwarding-f3118bc93984`.

An alternative to using conditional forwarding is to use stub zones. You can learn more about the differences between conditional forwarding and stub zones here: `https://blogs.msmvps.com/acefekay/2018/03/20/what-should-i-use-a-stub-conditional-forwader-forwarder-or-secondary-zone/`.

Getting ready

In this recipe, you use `DC1`, a domain controller and DNS server for Reskit.Org. You have previously promoted `DC1` to be a DC and installed/configured DNS by following the recipes earlier in this chapter and book.

How to do it...

1. Obtaining the IP addresses of DNS servers for `packt.com`

```
$NS = Resolve-DnsName -Name packt.com -Type NS |
  Where-Object Name -eq 'packt.com'
$NS
```

2. Obtaining the IPV4 addresses for these hosts

   ```
   $NSIPS = foreach ($Server in $NS) {
     (Resolve-DnsName -Name $Server.NameHost -Type A).IPAddress
   }
   $NSIPS
   ```

3. Adding conditional forwarder on `DC1`

   ```
   $CFHT = @{
     Name          = 'Packt.Com'
     MasterServers = $NSIPS
   }
   Add-DnsServerConditionalForwarderZone @CFHT
   ```

4. Checking zone on `DC1`

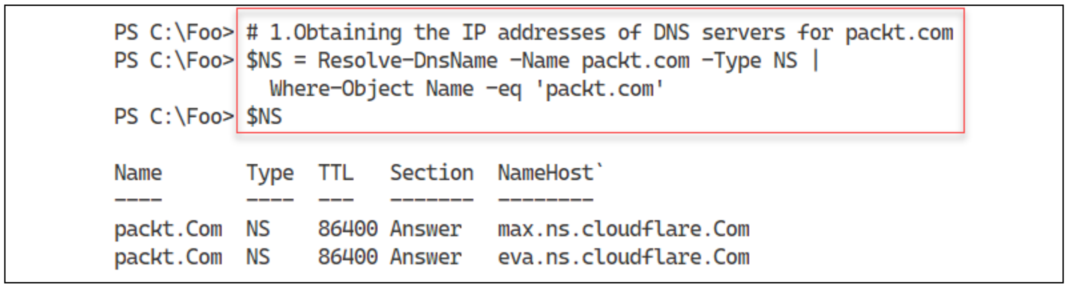
   ```
   Get-DnsServerZone -Name Packt.Com
   ```

5. Testing conditional forwarding

   ```
   Resolve-DNSName -Name WWW.Packt.Com -Server DC1 |
    Format-Table
   ```

How it works...

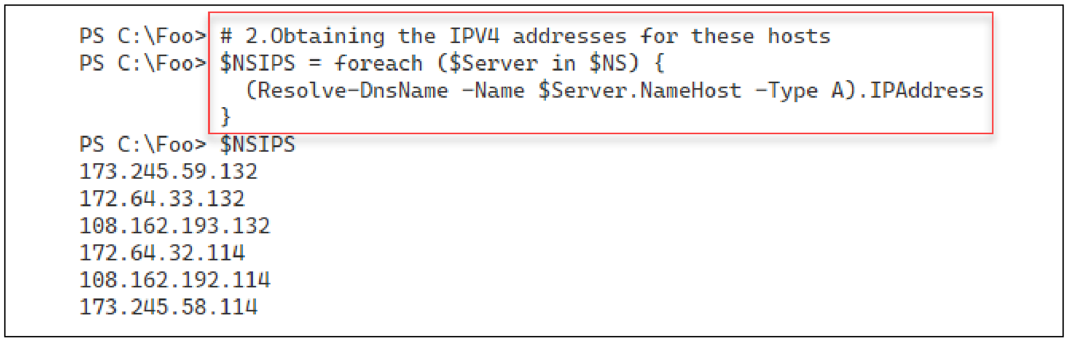
In *step 1*, you resolve the name servers serving the `packt.com` domain on the Internet, and then you display the results, like this:



```
PS C:\Foo> # 1.Obtaining the IP addresses of DNS servers for packt.com
PS C:\Foo> $NS = Resolve-DnsName -Name packt.com -Type NS |
             Where-Object Name -eq 'packt.com'
PS C:\Foo> $NS

Name       Type  TTL   Section  NameHost`
----       ----  ---   -------  --------
packt.Com  NS    86400 Answer   max.ns.cloudflare.Com
packt.Com  NS    86400 Answer   eva.ns.cloudflare.Com
```

Figure 7.37: Obtaining the IP addresses of the DNS servers for packt.com

In *step 2*, you use the DNS servers you just retrieved and resolve their IPv4 addresses from the hostnames (which you got in *step 1*). This step produces the following output:

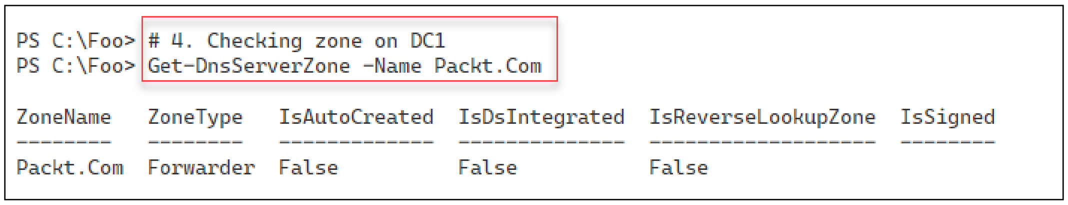


```
PS C:\Foo> # 2.Obtaining the IPV4 addresses for these hosts
PS C:\Foo> $NSIPS = foreach ($Server in $NS) {
             (Resolve-DnsName -Name $Server.NameHost -Type A).IPAddress
           }
PS C:\Foo> $NSIPS
173.245.59.132
172.64.33.132
108.162.193.132
172.64.32.114
108.162.192.114
173.245.58.114
```

Figure 7.38: Obtaining the IPv4 addresses for hosts

In *step 3*, which generates no output, you create a DNS forwarding zone for `packt.com`, which you populate with the IP addresses returned in *step 2*.

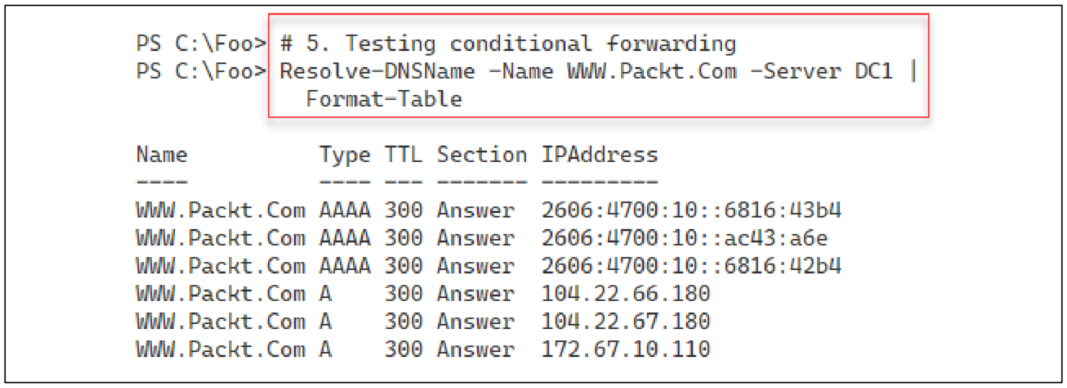
In *step 4*, you view the conditional forwarder domain defined on `DC1`, with output like this:



```
PS C:\Foo> # 4. Checking zone on DC1
PS C:\Foo> Get-DnsServerZone -Name Packt.Com

ZoneName  ZoneType  IsAutoCreated IsDsIntegrated IsReverseLookupZone IsSigned
--------  --------  ------------- -------------- ------------------- --------
Packt.Com Forwarder False         False          False
```

Figure 7.39: Checking the zone on DC1

With the final step, *step 5*, you resolve `www.packt.com`, which returns both IPv4 and IPv6 addresses, like this:



```
PS C:\Foo> # 5. Testing conditional forwarding
PS C:\Foo> Resolve-DNSName -Name WWW.Packt.Com -Server DC1 |
             Format-Table

Name          Type TTL Section IPAddress
----          ---- --- ------- ---------
WWW.Packt.Com AAAA 300 Answer  2606:4700:10::6816:43b4
WWW.Packt.Com AAAA 300 Answer  2606:4700:10::ac43:a6e
WWW.Packt.Com AAAA 300 Answer  2606:4700:10::6816:42b4
WWW.Packt.Com A    300 Answer  104.22.66.180
WWW.Packt.Com A    300 Answer  104.22.67.180
WWW.Packt.Com A    300 Answer  172.67.10.110
```

Figure 7.40: Testing conditional forwarding

There's more...

In *step 1*, you discover the name server names for the DNS servers that serve `packt.com`. In this case, these servers are part of Cloudflare's distributed DNS service. For more information on how this service works, see `https://www.cloudflare.com/dns/`.

In *step 2*, you resolve those DNS server names into IP addresses. In *step 3*, you create a conditional forwarding domain that forwards queries for `packt.com` (such as `www.packt.com`) to one of the six IP addresses you saw in *step 2*.

In *step 4*, you view the conditional forwarding zone on `DC1`. Since the zone is not DS integrated, DNS does not replicate it to `DC2`. In production, you should repeat *step 3* on `DC2`.

In *step 5*, you resolve `www.packt.com` via conditional forwarding. Since the name servers you discovered support IPv6 AAAA address records, this step returns both IPv4 and IPv6 addresses. If you are in an environment that supports IPv6, you should consider modifying *step 2* so that it returns the IPv4 and IPv6 addresses and then use them in *step 3*.

Managing DNS zones and resource records

The DNS service enables you to resolve names to other information. Most DNS usage resolves a hostname to its IP (IPv4 or IPv6) addresses. But there are other resolutions, such as determining email servers or for anti-spam, that also rely on DNS.

DNS servers hold **zones**. A DNS zone is a container for a set of RRs related to a specific DNS domain. When you enter `www.packt.com`, your browser uses DNS to resolve that website name into an IP address and contacts the server at that IP address. If you use an email client to send mail, for example, to `DoctorDNS@Gmail.Com`, the email client uses DNS to discover an email server to which to send the mail.

Before you can use DNS to hold a RR, you must first create a DNS forward lookup zone. A zone is one part of the global (or internal) DNS namespace. You can configure different zones to hold different parts of your namespace. In *Chapter 6*, *Managing Active Directory*, you added a child domain to the `Reskit.Org` forest, `UK.Reskit.Org`. You could, for example, have one zone holding RRs for `Reskit.Org` on `DC1` and `DC2`, while delegating to a new zone, `UK.Reskit.Org`, on `UKDC1`.

A reverse lookup zone is one that does the reverse – you use it to obtain a hostname from its IP address. You may find reverse lookup zones useful, but you do not need them for most domain usage. The old `nslookup.exe` command is one tool that uses the reverse lookup zone, for example. For more details on DNS in Windows, see `https://docs.microsoft.com/windows-server/networking/dns/dns-top`.

Traditionally, DNS stores and obtains zone details from files on the DNS server. When the DNS service starts up, it reads these zone files and updates the files as needed when it receives updates. If you have multiple DNS servers, you need to configure your service to perform replication to ensure all DNS servers are in sync.

With Windows 2000, Microsoft added AD-integrated zones. DNS stores the DNS data for these zone types within AD. These zones replicate their zone data via AD replication, which simplifies the setup. This also means that when you created the AD service on `DC1`, DNS created a zone in the DNS server on `DC1` and replicated the zone data to all DCs in the forest. For more information on AD-integrated zones, see `https://docs.microsoft.com/windows-server/identity/ad-ds/plan/active-directory-integrated-dns-zones`.

In this recipe, you create a DNS forward and reverse look up zone and then create RRs in those zones. Once added, you test DNS resolution.

Getting ready

You run this recipe on `DC1`, but you need both `DC1` and `DC2` online. You have installed AD and DNS on both servers, and by doing so, you created a single forward lookup zone for the `Reskit.Org` forest.

How to do it...

1. Creating a new primary forward DNS zone for `Cookham.Net`

```
$ZHT1 = @{
  Name              = 'Cookham.Net'
  ResponsiblePerson = 'dnsadmin.cookham.net.'
  ReplicationScope  = 'Forest'
  ComputerName      = 'DC1.Reskit.Org'
}
Add-DnsServerPrimaryZone @ZHT1
```

2. Creating a reverse lookup zone

```
$ZHT2 = @{
  NetworkID         = '10.10.10.0/24'
  ResponsiblePerson = 'dnsadmin.reskit.org.'
  ReplicationScope  = 'Forest'
  ComputerName      = 'DC1.Reskit.Org'
}
Add-DnsServerPrimaryZone @ZHT2
```

3. Registering DNS for `DC1`, `DC2`

```
Register-DnsClient
Invoke-Command -ComputerName DC2 -ScriptBlock {Register-DnsClient}
```

4. Checking the DNS zones on DC1

   ```
   Get-DNSServerZone -ComputerName DC1
   ```

5. Adding resource records to Cookham.Net zone

   ```
   # Adding an A record
   $RRHT1 = @{
     ZoneName      =  'Cookham.Net'
     A              =  $true
     Name           = 'Home'
     AllowUpdateAny =  $true
     IPv4Address    = '10.42.42.42'
   }
   Add-DnsServerResourceRecord @RRHT1

   # Adding a Cname record
   $RRHT2 = @{
     ZoneName      = 'Cookham.Net'
     Name          = 'MAIL'
     HostNameAlias = 'Home.Cookham.Net'
   }
   Add-DnsServerResourceRecordCName @RRHT2

   # Adding an MX record
   $MXHT = @{
     Preference     = 10
     Name           = '.'
     TimeToLive     = '4:00:00'
     MailExchange   = 'Mail.Cookham.Net'
     ZoneName       = 'Cookham.Net'
   }
   Add-DnsServerResourceRecordMX @MXHT
   ```

6. Restarting DNS service to ensure replication

   ```
   Restart-Service -Name DNS
   $SB = {Restart-Service -Name DNS}
   Invoke-Command -ComputerName DC2 -ScriptBlock $SB
   ```

7. Checking results of RRs in Cookham.Net zone

   ```
   Get-DnsServerResourceRecord -ZoneName 'Cookham.Net'
   ```

8. Testing DNS resolution on DC2, DC1

   ```
   # Testing The CNAME from DC1
   Resolve-DnsName -Server DC1.Reskit.Org -Name 'Mail.Cookham.Net'
   # Testing the MX on DC2
   Resolve-DnsName -Server DC2.Reskit.Org -Name 'Cookham.Net'
   ```

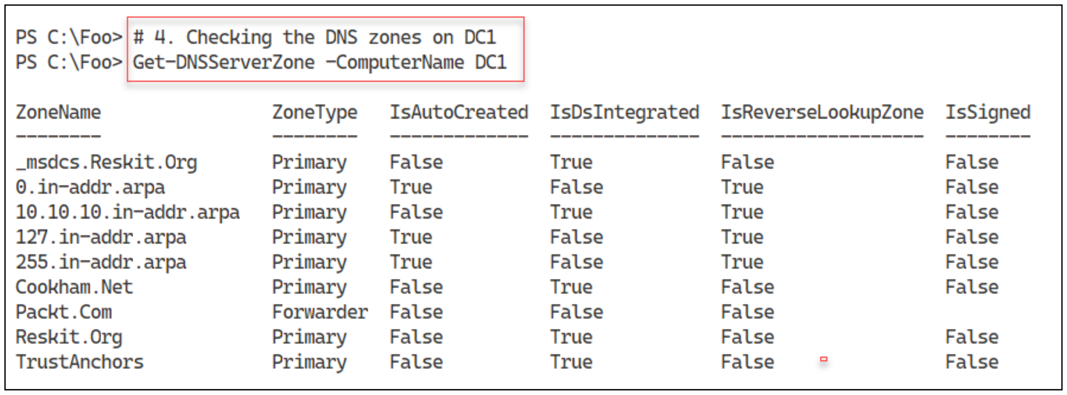
9. Testing the reverse lookup zone

   ```
   Resolve-DnsName -Name '10.10.10.10'
   ```

How it works...

In *step 1*, which you run on `DC1`, you create a new primary forward DNS zone for the DNS domain `Cookham.Net`. In *step 2*, you create a primary reverse lookup zone for `10.10.10.0/24`. In *step 3*, you run `Register-DNSClient` on both `DC1` and `DC2`. This ensures that both DCs have updated their DNS details. These three steps produce no console output.

In *step 4*, you check the DNS zones held by the DNS service on `DC1`. The output looks like this:

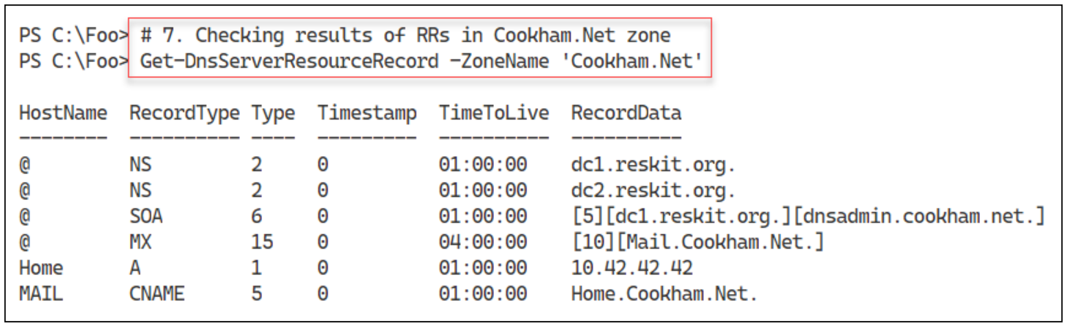


```
PS C:\Foo> # 4. Checking the DNS zones on DC1
PS C:\Foo> Get-DNSServerZone -ComputerName DC1

ZoneName                 ZoneType  IsAutoCreated IsDsIntegrated IsReverseLookupZone IsSigned
--------                 --------  ------------- -------------- ------------------- --------
_msdcs.Reskit.Org        Primary   False         True           False               False
0.in-addr.arpa           Primary   True          False          True                False
10.10.10.in-addr.arpa    Primary   False         True           True                False
127.in-addr.arpa         Primary   True          False          True                False
255.in-addr.arpa         Primary   True          False          True                False
Cookham.Net              Primary   False         True           False               False
Packt.Com                Forwarder False         False          False
Reskit.Org               Primary   False         True           False               False
TrustAnchors             Primary   False         True           False               False
```

Figure 7.41: Checking the DNS zones on DC1

In *step 5*, you add three RRs to `Cookham.Net`: an A record, a CNAME record, and an MX record. In *step 6*, you restart the DNS service on both `DC1` and `DC2` to ensure replication has ensured both DNS servers are up to date. These two steps generate no console output.

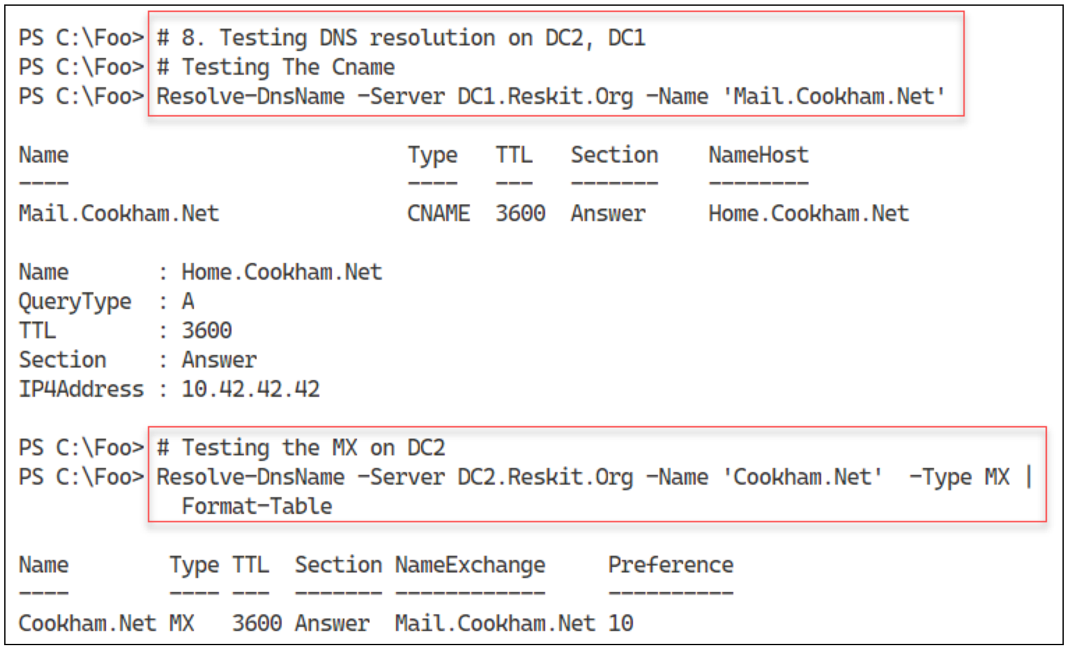
In *step 7*, you get all the DNS resource records for `Cookham.Net`, which looks like this:



```
PS C:\Foo> # 7. Checking results of RRs in Cookham.Net zone
PS C:\Foo> Get-DnsServerResourceRecord -ZoneName 'Cookham.Net'

HostName RecordType Type Timestamp TimeToLive RecordData
-------- ---------- ---- --------- ---------- ----------
@        NS         2    0         01:00:00   dc1.reskit.org.
@        NS         2    0         01:00:00   dc2.reskit.org.
@        SOA        6    0         01:00:00   [5][dc1.reskit.org.][dnsadmin.cookham.net.]
@        MX         15   0         04:00:00   [10][Mail.Cookham.Net.]
Home     A          1    0         01:00:00   10.42.42.42
MAIL     CNAME      5    0         01:00:00   Home.Cookham.Net.
```

Figure 7.42: Checking the DNS RRs for Cookham.Net

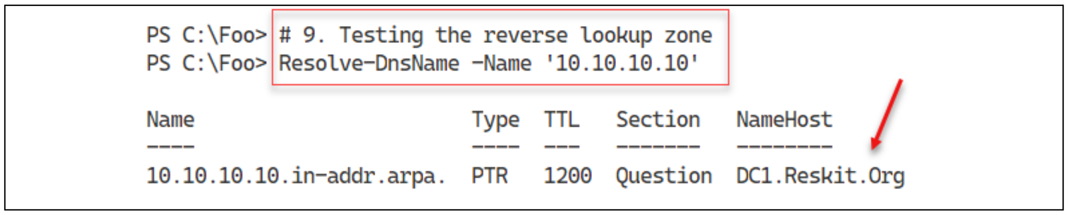
In *step 8*, you test the DNS name resolution from `DC1` and `DC2`. You first resolve the `Mail.Cookham.Net` CNAME RR from `DC1`, then check the MX record from `DC2`. The output from these two commands is as follows:



```
PS C:\Foo> # 8. Testing DNS resolution on DC2, DC1
PS C:\Foo> # Testing The Cname
PS C:\Foo> Resolve-DnsName -Server DC1.Reskit.Org -Name 'Mail.Cookham.Net'

Name                           Type   TTL   Section    NameHost
----                           ----   ---   -------    --------
Mail.Cookham.Net               CNAME  3600  Answer     Home.Cookham.Net

Name       : Home.Cookham.Net
QueryType  : A
TTL        : 3600
Section    : Answer
IP4Address : 10.42.42.42

PS C:\Foo> # Testing the MX on DC2
PS C:\Foo> Resolve-DnsName -Server DC2.Reskit.Org -Name 'Cookham.Net'  -Type MX |
             Format-Table

Name        Type TTL  Section NameExchange     Preference
----        ---- ---  ------- ------------     ----------
Cookham.Net MX   3600 Answer  Mail.Cookham.Net 10
```

Figure 7.43: Checking the DNS name resolution from DC1 and DC2

In *step 9*, you test the reverse lookup zone and resolve `10.10.10.10` to a domain name, like this:



```
PS C:\Foo> # 9. Testing the reverse lookup zone
PS C:\Foo> Resolve-DnsName -Name '10.10.10.10'

Name                          Type  TTL   Section   NameHost
----                          ----  ---   -------   --------
10.10.10.10.in-addr.arpa.     PTR   1200  Question  DC1.Reskit.Org
```

Figure 7.44: Testing the reverse lookup zone

There's more...

In *step 5*, you create some new RRs for the `Cookham.Net` zone, which you test in later steps. To ensure that AD and DNS replicate the new RRs from, in this case, `DC1` to `DC2`, in *step 6*, you restart the DNS service on both DCs. Restarting the DNS service ensures replication between the DNS services.