Microsoft
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ASSOCIATE

Network Security Groups

Network Security Groups (**NSGs**) are built-in tools for network control that allow us to control incoming and outgoing traffic on a network interface or at the subnet level. They contain sets of rules that allow or deny specific traffic to specific resources or subnets in Azure. An NSG can be associated with either a subnet (by applying security rules to all resources associated with the subnet) or a **Network Interface Card** (**NIC**), which is done by applying security rules to the **Virtual Machine** (**VM**) associated with the NIC.

We will cover the following recipes in this chapter:

- Creating a new NSG in the Azure portal
- Creating a new NSG with PowerShell
- Creating a new allow rule in an NSG
- Creating a new deny rule in an NSG
- Creating a new NSG rule with PowerShell
- Assigning an NSG to a subnet
- Assigning an NSG to a network interface
- Assigning an NSG to a subnet with PowerShell
- Creating an **Application Security Group** (**ASG**)
- Associating an ASG with a VM
- Creating rules with an NSG and an ASG

Technical requirements

For this chapter, the following is required:

- An Azure subscription
- Azure PowerShell

The code samples can be found at https://github.com/PacktPublishing/Azure-Networking-Cookbook-Second-Edition/tree/master/Chapter03.

Creating a new NSG in the Azure portal

As a first step to more effectively control network traffic, we are going to create a new NSG.

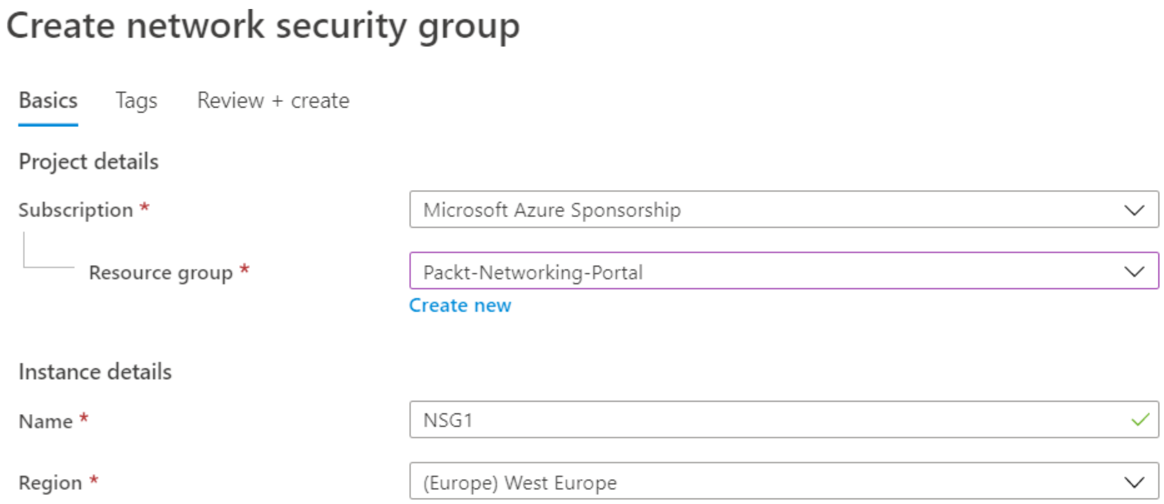
Getting ready

Before you start, open your browser and go to the Azure portal, at https://portal.azure.com.

How to do it...

To create a new NSG using the Azure portal, we must follow these steps:

1. In the Azure portal, select **Create a resource** and choose **Network security group** under **Networking** (or search for `network security group` in the search bar).
2. The parameters we need to define for the deployment are **Subscription**, **Resource group**, **Name**, and **Region**. An example of the required parameters is shown in *Figure 3.1*:



Create network security group

Project details

Subscription * Microsoft Azure Sponsorship

Resource group * Packt-Networking-Portal

Instance details

Name * NSG1

Region * (Europe) West Europe

Figure 3.1: Creating a new NSG using the Azure portal

After the deployment has been validated and started (it takes a few moments to complete), the NSG is ready for use.

How it works...

The NSG deployment can be initiated during a VM deployment. This will associate the NSG to the NIC associated with the deployed VM. In this case, the NSG is already associated with the resource, and rules defined in the NSG will apply only to the associated VM.

If the NSG is deployed separately, as seen in this recipe, it is not associated and the rules that are created within it are not applied until an association has been created with the NIC or the subnet. When it is associated with a subnet, the NSG rules will apply to all resources on the subnet.

Let's move on to the next recipe to understand how to create a new NSG using PowerShell.

Creating a new NSG with PowerShell

Alternatively, we can create an NSG using PowerShell. The advantage of this approach is that we can add NSG rules in a single script, creating custom rules right after the NSG is created. This allows us to automate the deployment process and create our own *default* rules right after the NSG has been created.

Getting ready

Open the PowerShell console and make sure you are connected to your Azure subscription. Refer to *Chapter 1*, *Azure Virtual Network*, for a refresher on how to do this.

How to do it...

To deploy a new NSG, execute the following command:

```
New-AzNetworkSecurityGroup -Name "nsg1" -ResourceGroupName "Packt-Networking-
Script" -Location "westeurope"
```

How it works...

The script is using the **Resource Group** (**RG**) that was deployed in *Chapter 1*, *Azure Virtual Network* (we will use the same RG for all deployments). Otherwise, a new RG needs to be deployed prior to executing the script. The final outcome will be the same as creating a new NSG using the Azure portal: a new NSG will be created with default rules. An advantage of using PowerShell is that we can add additional rules during deployment that will help automate the process. You will see an example of this in the *Creating a new NSG rule with PowerShell* recipe later in this chapter.

In this recipe, you learned to create a new NSG using PowerShell. Let's move on to the next recipe to learn how to allow rules in NSG using the Azure portal.

Creating a new allow rule in an NSG

When a new NSG is created, only the default rules are present, which allow all outbound traffic and block all inbound traffic. To change these, additional rules need to be created. First, we are going to show you how to create a new rule to allow inbound traffic.

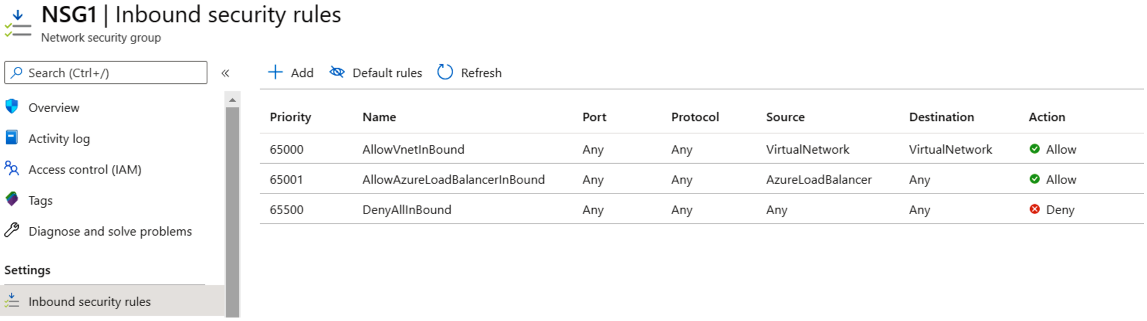
Getting ready

Before you start, open your browser and go to the Azure portal at https://portal.azure.com. Locate the previously created NSG.

How to do it...

To create a new NSG allow rule using the Azure portal, we must follow these steps:

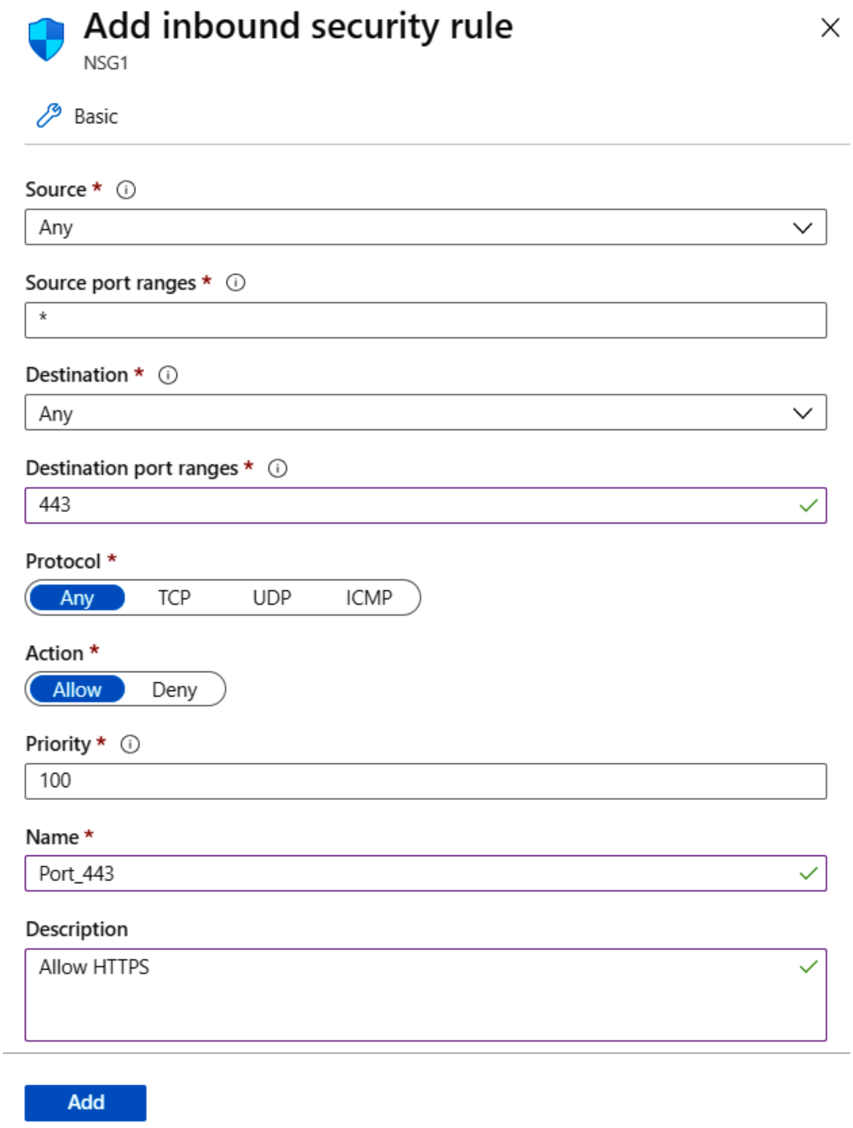
1. In the **NSG** pane, locate the **Inbound security rules** option under **Settings**.
2. Click on the **Add** button at the top of the page and wait for the new pane, to open:



Priority	Name	Port	Protocol	Source	Destination	Action
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	✓ Allow
65001	AllowAzureLoadBalancerInBound	Any	Any	AzureLoadBalancer	Any	✓ Allow
65500	DenyAllInBound	Any	Any	Any	Any	✕ Deny

Figure 3.2: Creating a new NSG allow rule using the Azure portal

3. In the new pane, we need to provide information for the **Source** (location and port range), **Destination** (location and port range), **Protocol**, **Action**, **Priority**, **Name**, and **Description** fields. If you want to allow traffic, make sure you select **Allow** for **Action**. An example of how to create a rule to allow traffic over port **443** (thus allowing traffic to the web server) is shown in *Figure* 3.3:



Add inbound security rule

NSG1

Basic

Source * : Any

Source port ranges * : *

Destination * : Any

Destination port ranges * : 443

Protocol * : [✓ Any] TCP UDP ICMP

Action * : [✓ Allow] Deny

Priority * : 100

Name * : Port_443

Description : Allow HTTPS

Figure 3.3: Creating a rule to allow traffic over port 443

How it works...

By default, all traffic coming from Azure Load Balancer or Azure Virtual Network is allowed. All traffic coming over the internet is denied. To change this, we need to create additional rules. Make sure you set the right priority when creating rules. Rules with the highest priority (that is, those with the lower number) are processed first, so if you have two rules, one of which is denying traffic and one of which is allowing it, the rule with higher priority will take precedence, while the one with lower priority will be ignored.

In this recipe, you learned how to create a new rule to allow inbound traffic. In the next recipe, you will learn how to create a new rule in NSG to deny traffic.

Creating a new deny rule in an NSG

When a new NSG is created, only the default rules are present. The default rules allow all outbound traffic and block all inbound traffic. To change this, additional rules need to be created. Now, we are going to show you how to create a new outbound rule to deny traffic.

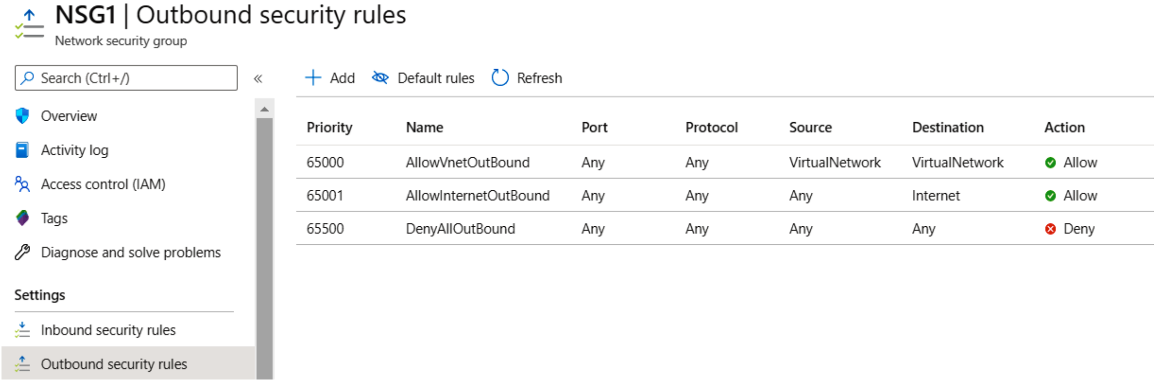
Getting ready

Before you start, open your browser and go to the Azure portal at https://portal.azure.com. Locate the previously created NSG.

How to do it...

To create a new NSG deny rule using the Azure portal, we must follow these steps:

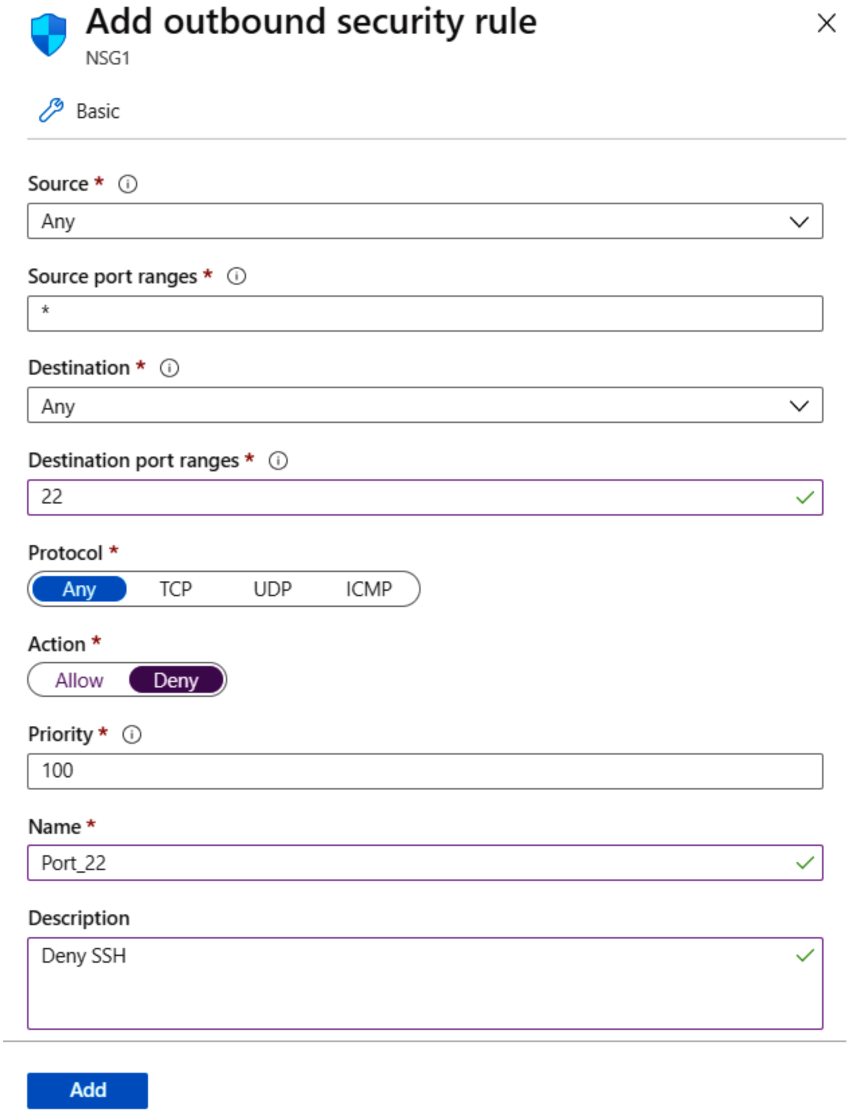
1. In the **NSG** pane, locate the **Outbound security rules** option under **Settings**.
2. Click on the **Add** button at the top of the page and wait for the new pane to open:



Priority	Name	Port	Protocol	Source	Destination	Action
65000	AllowVnetOutBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowInternetOutBound	Any	Any	Any	Internet	Allow
65500	DenyAllOutBound	Any	Any	Any	Any	Deny

Figure 3.4: Creating a new NSG deny rule using the Azure portal

3. In the new pane, we need to provide information for **Source** (location and port range), **Destination** (location and port range), **Protocol**, **Action**, **Priority**, **Name**, and **Description**. If you want to deny traffic, make sure you select **Deny** for **Action**. An example of how to create a rule to deny traffic over port **22** is shown in *Figure 3.5*:



Add outbound security rule

NSG1

Basic

Source * ⓘ

Any

Source port ranges * ⓘ

*

Destination * ⓘ

Any

Destination port ranges * ⓘ

22 ✓

Protocol *

[✓ Any] TCP UDP ICMP

Action *

Allow [✓ Deny]

Priority * ⓘ

100

Name *

Port_22 ✓

Description

Deny SSH ✓

Figure 3.5: Adding an outbound security rule

How it works...

All outbound traffic is allowed by default, regardless of where it is going. If we want to explicitly deny traffic on a specific port, we need to create a rule to do so. Make sure you set the priority right when creating rules. Rules with the highest priority (those with the lowest numbers) are processed first, so if you have two rules where one is denying traffic and one is allowing it, the rule with higher priority will apply.

Let's move on to the next recipe, where you will learn how to create an NSG rule using PowerShell.

Creating a new NSG rule with PowerShell

Alternatively, we can create an NSG rule using PowerShell. This command can be executed right after the NSG has been created, allowing us to create and configure an NSG in a single script. This way, we can standardize deployment and have rules applied each time an NSG is created.

Getting ready

Open the PowerShell console and make sure you are connected to your Azure subscription.

How to do it...

To create a new NSG rule, execute the following command:

```
$nsg = Get-AzNetworkSecurityGroup -Name 'nsg1' -ResourceGroupName 'Packt-
Networking-Script'

$nsg | Add-AzNetworkSecurityRuleConfig -Name 'Allow_HTTPS' -Description
'Allow_HTTPS' -Access Allow -Protocol Tcp -Direction Inbound -Priority 100
-SourceAddressPrefix Internet -SourcePortRange * -DestinationAddressPrefix *
-DestinationPortRange 443 | Set-AzNetworkSecurityGroup
```

How it works...

Using a script, creating an NSG rule is just a matter of parameters. The **`Access`** parameter, which can be either **`Allow`** or **`Deny`**, will determine whether we want to allow traffic or deny it. The **`Direction`** parameter, which can be **`Inbound`** or **`Outbound`**, determines whether the rule is for inbound or outbound traffic. All other parameters are the same, no matter what kind of rule we want to create. Again, priority plays a very important role, so we must make sure it's chosen correctly.

There's more...

As mentioned in the *Creating a new* NSG *with PowerShell* recipe, we can create the NSG and the rules that are needed in a single script. The following script is an example of this:

```
$nsg = New-AzNetworkSecurityGroup -Name 'nsg1' -ResourceGroupName 'Packt-
Networking-Script' -Location "westeurope"

$nsg | Add-AzNetworkSecurityRuleConfig -Name 'Allow_HTTPS' -Description
'Allow_HTTPS' -Access Allow -Protocol Tcp -Direction Inbound -Priority 100
-SourceAddressPrefix Internet -SourcePortRange * -DestinationAddressPrefix *
-DestinationPortRange 443 | Set-AzNetworkSecurityGroup
```

This recipe explained how to create a new NSG rule using PowerShell. In the next recipe, you will learn how to assign an NSG to a subnet.

Assigning an NSG to a subnet

The NSG and its rules must be assigned to a resource to have any impact. Here, you are going to see how to associate an NSG with a subnet.

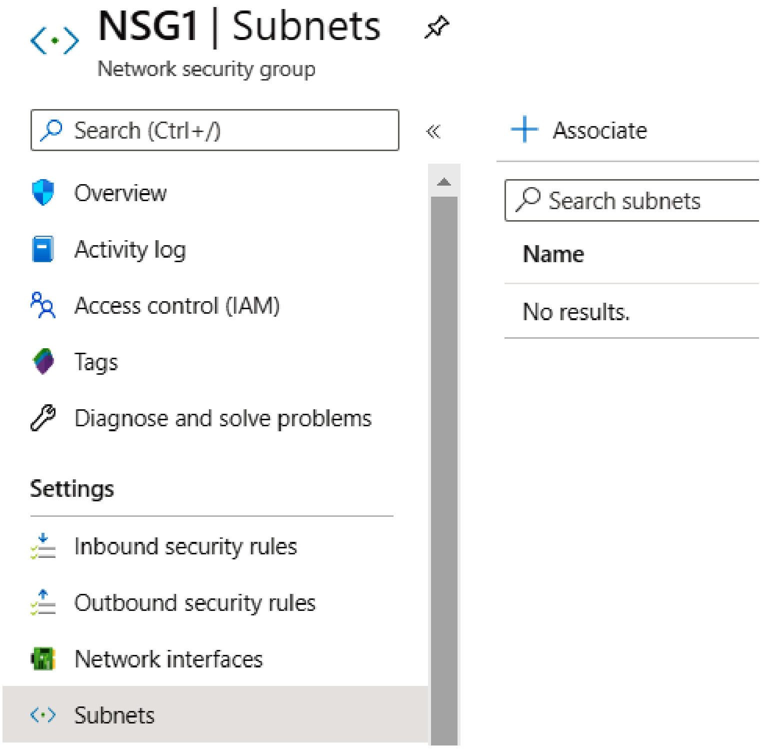
Getting ready

Before you start, open your browser and go to the Azure portal at https://portal.azure.com. Locate the previously created NSG.

How to do it...

To assign an NSG to a subnet, follow these steps:

1. In the NSG pane, locate the **Subnets** option under **Settings**.
2. Click on the **Associate** button at the top of the page and wait for the new pane to open:



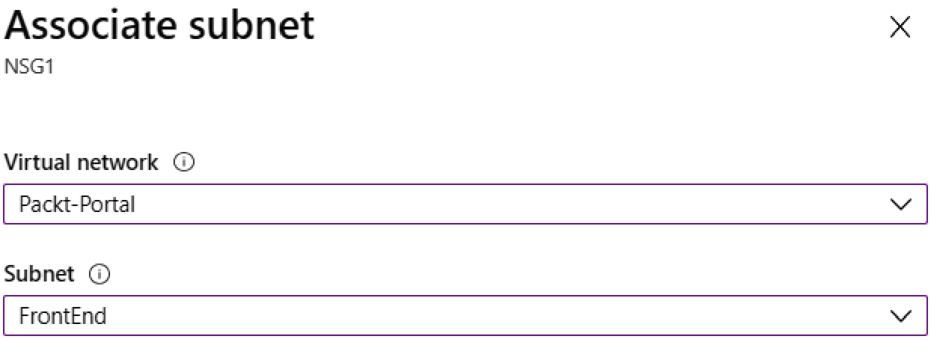
NSG1 | Subnets

Network security group

Name
No results.

Figure 3.6: Assigning an NSG to a subnet

3. In the new pane, first select the virtual network that contains the subnet you want to associate the NSG with, and then select the subnet, as seen in *Figure 3.7*:



Associate subnet

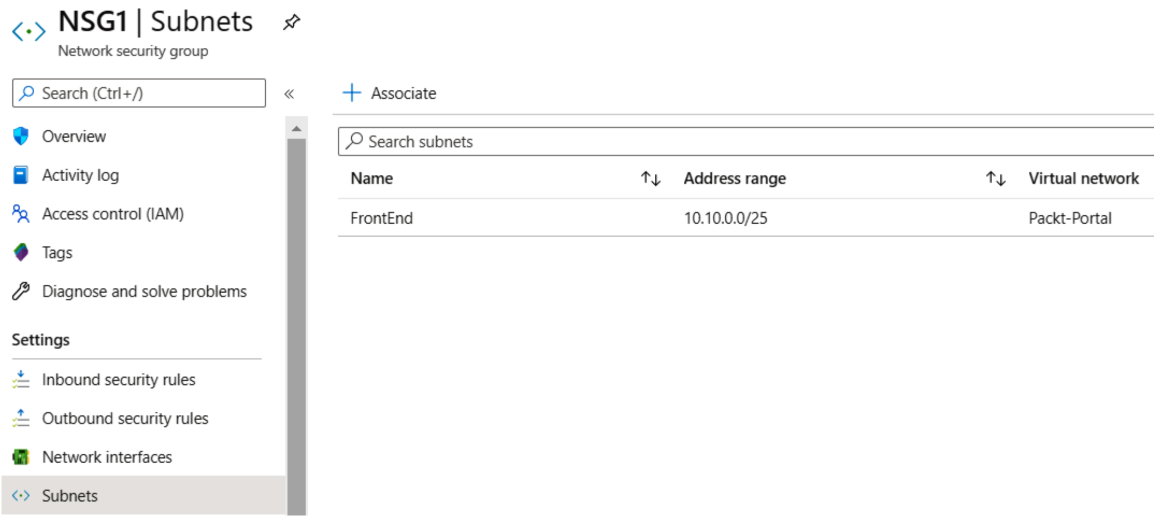
NSG1

Virtual network: Packt-Portal

Subnet: FrontEnd

Figure 3.7: Associating the subset with the NSG

4. After submitting the change, the subnet will appear in a list of associated subnets:



Name ↑↓	Address range ↑↓	Virtual network
FrontEnd	10.10.0.0/25	Packt-Portal

Figure 3.8: A list of associated subnets

How it works...

When an NSG is associated with a subnet, the rules in the NSG will apply to all of the resources in the subnet. Note that the subnet can be associated with more than one NSG, and the rules from all the NSGs will apply in that case. Priority is the most important factor when looking at a single NSG, but when the rules from more NSGs are observed, the **`Deny`** rule will prevail. So, if we have two NSGs on a subnet, one with **`Allow`** on port **`443`** and another one with the **`Deny`** rule on the same port, traffic on this port will be denied.

Let's move on to the next recipe and learn how to assign an NSG to a network interface.

Assigning an NSG to a network interface

Now, we are going to widen our scope and show you how to associate an NSG with a network interface.

Getting ready

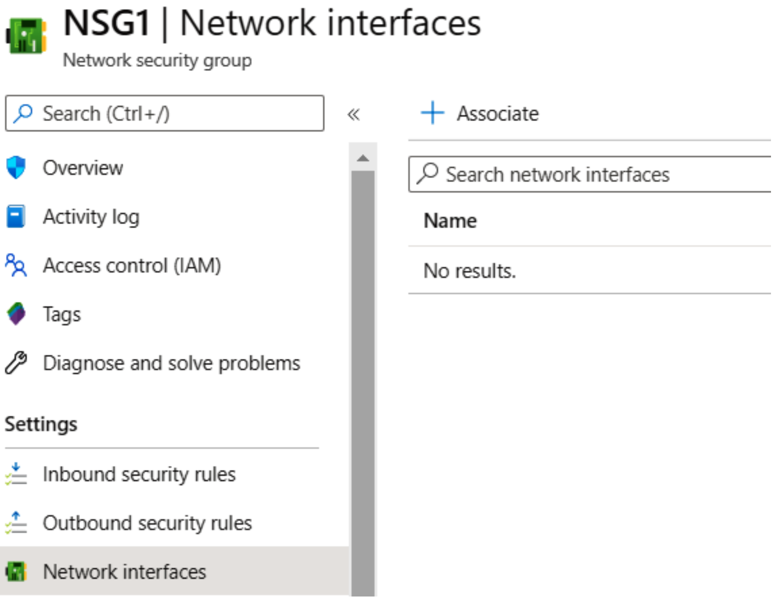
Before you start, open your browser and go to the Azure portal at https://portal.azure.com. Locate the previously created NSG.

How to do it...

To assign an NSG to a network interface, follow these steps:

1. In the NSG pane, locate the **Network interfaces** option under **Settings**.

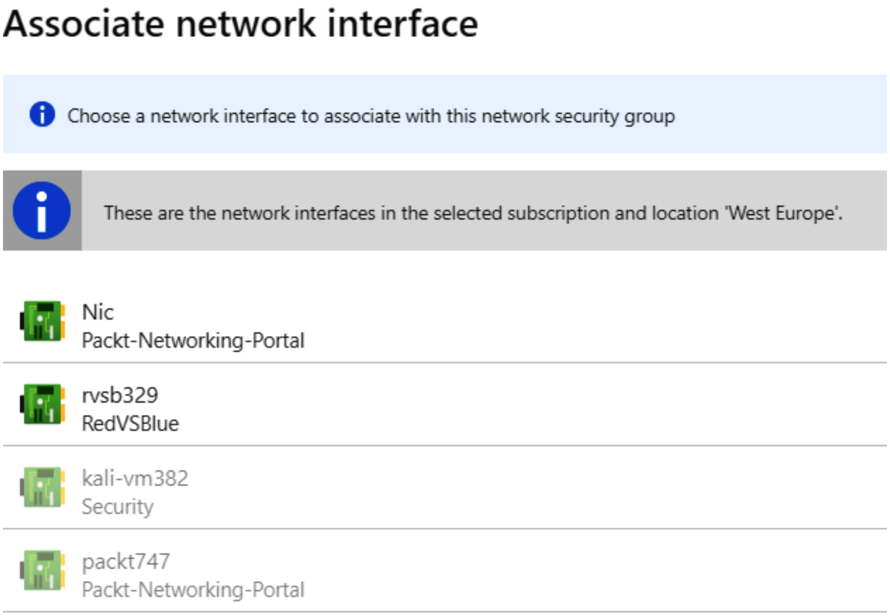
2. Click on the **Associate** button at the top of the page and wait for the new pane to open:



Name
No results.

Figure 3.9: Assigning the NSG to a network interface

3. Select the NIC you want to associate the NSG with from the list of those available:


Associate network interface

Choose a network interface to associate with this network security group

These are the network interfaces in the selected subscription and location 'West Europe'.

Nic
Packt-Networking-Portal

rvsb329
RedVSBlue

kali-vm382
Security

packt747
Packt-Networking-Portal

Figure 3.10: Associating with the network interface

How it works...

When an NSG is associated with an NIC, the NSG rules will apply only to a single NIC (or a VM associated with the NIC). The NIC can be associated with only one NSG directly, but a subnet associated with an NIC can have an association with another NSG (or even multiple NSGs). This is similar to when we have multiple NSGs assigned to a single subnet, and the **Deny** rule will take higher priority. If one of the NSGs allows traffic on a port, but another NSG is blocking it, traffic will be denied.

In this recipe, you learned how to assign an NSG to a network interface. Let's move on to the next recipe, where you will learn how to assign an NSG using PowerShell.

Assigning an NSG to a subnet with PowerShell

Alternatively, we can associate an NSG using Azure PowerShell. In this recipe, we are going to show you how to associate an NSG with a subnet.

Getting ready

Open the PowerShell console and make sure you are connected to your Azure subscription.

How to do it...

To associate an NSG with a subnet, execute the following command:

```
$vnet = Get-AzVirtualNetwork -Name 'Packt-Script' -ResourceGroupName 'Packt-
Networking-Script'

$subnet = Get-AzVirtualNetworkSubnetConfig -VirtualNetwork $vnet -Name
BackEnd

$nsg = Get-AzNetworkSecurityGroup -ResourceGroupName 'Packt-Networking-
Script' -Name 'nsg1'

$subnet.NetworkSecurityGroup = $nsg

Set-AzVirtualNetwork -VirtualNetwork $vnet
```

How it works...

To assign an NSG using PowerShell, we need to collect information on the virtual network, subnet, and NSG. When all of the information is gathered, we can perform the association using the **Set-AzVirtualNetwork** command and apply the changes.

Let's move on to the next recipe and create an ASG using the Azure portal.

Creating an Application Security Group (ASG)

ASGs are an extension of NSGs, allowing us to create additional rules and take better control of traffic. Using only NSGs allows us to create rules that will allow or deny traffic only for a specific source, IP address, or subnet. ASGs allow us to create better filtering and create additional checks on what traffic is allowed based on ASGs. For example, with NSGs, we can create a rule that subnet A can communicate with subnet B. If we have the application structure for it and an associated ASG, we can add resources in application groups. By adding this element, we can create a rule that will allow communication between subnet A and subnet B, but only if the resources belong to the same application.

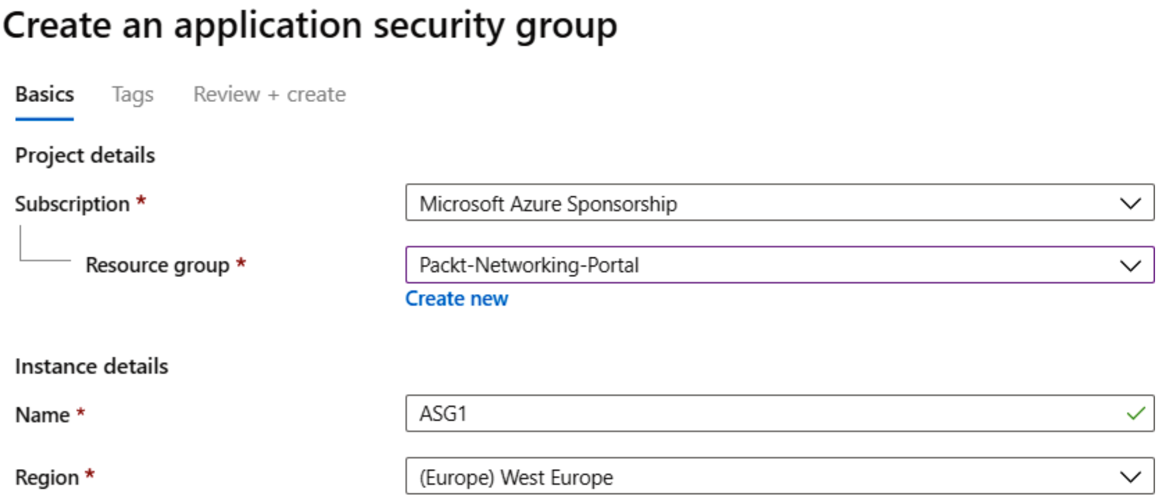
Getting ready

Before you start, open your browser and go to the Azure portal at https://portal.azure.com.

How to do it...

To create an ASG using the Azure portal, we must follow these steps:

1. In the Azure portal, select **Create a resource** and choose **Application security group** under **Networking** (or search for `application security group` in the search bar).
2. The parameters we need to define for deployment are **Subscription**, **Resource group**, **Name**, and **Region**. An example of the required parameters is shown in *Figure 3.11*:


Create an application security group

Project details

Subscription * Microsoft Azure Sponsorship

Resource group * Packt-Networking-Portal

Instance details

Name * ASG1

Region * (Europe) West Europe

Figure 3.11: Creating an ASG using the Azure portal

How it works...

ASGs don't make much difference on their own and must be combined with NSGs to create NSG rules that will allow better control of traffic, applying additional checks before traffic flow is allowed.

Now that we have created an ASG, let's move on to a new recipe where we will associate the ASG with a VM.

Associating an ASG with a VM

After creating an ASG, we must associate it with a VM. After this is done, we can create rules with the NSG and ASG for traffic control.

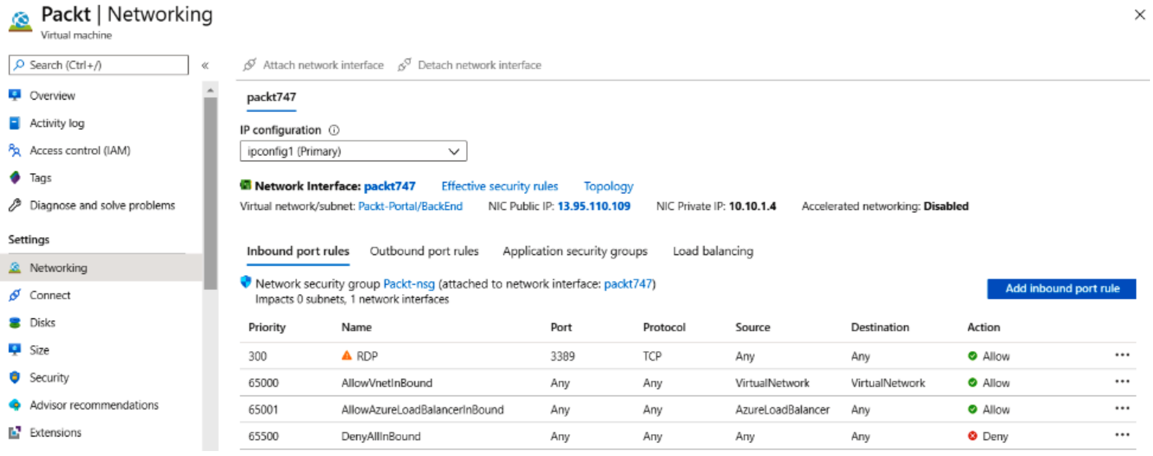
Getting ready

Before you start, open your browser and go to the Azure portal at https://portal.azure.com. Locate the previously created VM.

How to do it...

To associate an ASG with a VM, we must follow these steps:

1. In the VM pane, locate the **Networking** settings.
2. In the **Networking** settings, select the **Application security groups** tab, as shown in *Figure* 3.12:



IP configuration: ipconfig1 (Primary)

Network Interface: packt747 Effective security rules Topology

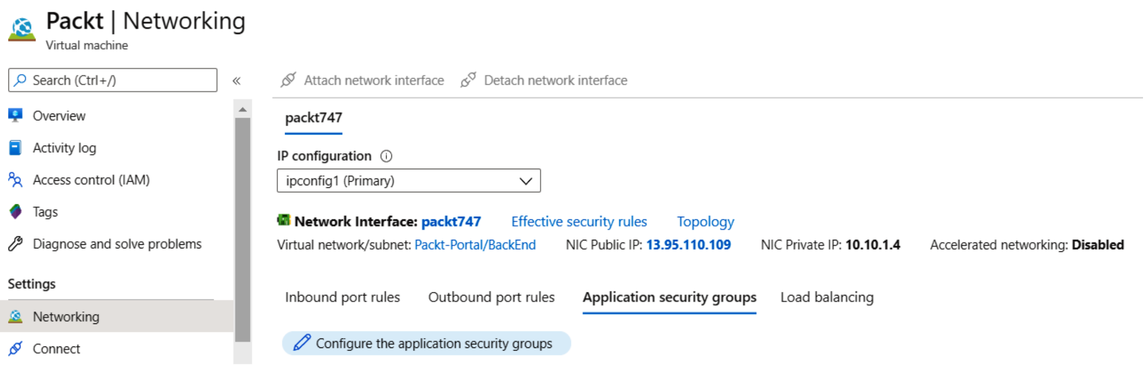
Virtual network/subnet: Packt-Portal/BackEnd NIC Public IP: **13.95.110.109** NIC Private IP: **10.10.1.4** Accelerated networking: **Disabled**

Network security group Packt-nsg (attached to network interface: packt747)
Impacts 0 subnets, 1 network interfaces

Priority	Name	Port	Protocol	Source	Destination	Action
300	⚠ RDP	3389	TCP	Any	Any	✓ Allow
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	✓ Allow
65001	AllowAzureLoadBalancerInBound	Any	Any	AzureLoadBalancer	Any	✓ Allow
65500	DenyAllInBound	Any	Any	Any	Any	✗ Deny

Figure 3.12: Associating an ASG with a VM

3. In the **Application security groups** settings, select **Configure the application security groups**, as shown in *Figure* 3.13:



Packt | Networking
Virtual machine

Search (Ctrl+/) «

Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems

Settings
Networking
Connect

Attach network interface   Detach network interface

packt747

IP configuration ⓘ
ipconfig1 (Primary)

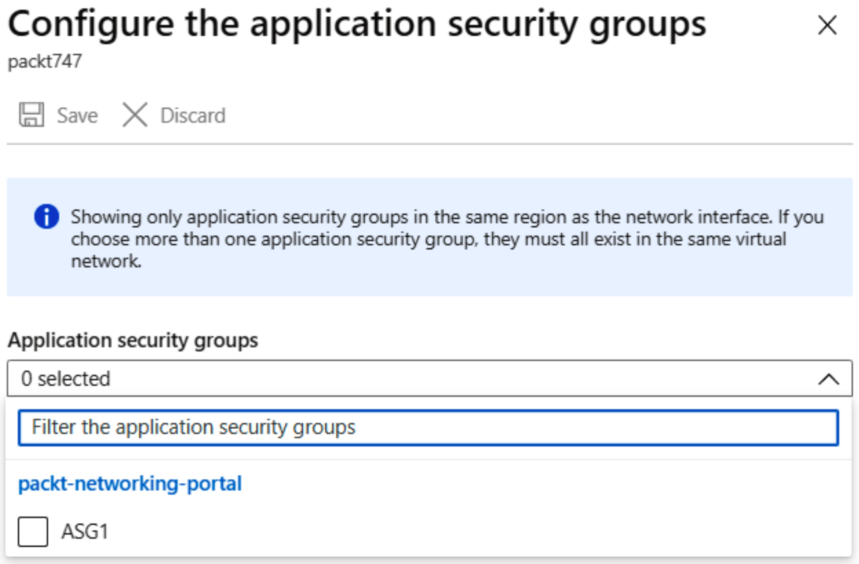
Network Interface: packt747   Effective security rules   Topology
Virtual network/subnet: Packt-Portal/BackEnd   NIC Public IP: 13.95.110.109   NIC Private IP: 10.10.1.4   Accelerated networking: Disabled

Inbound port rules   Outbound port rules   Application security groups   Load balancing

Configure the application security groups

Figure 3.13: Configuring ASGs

4. In the new pane from the list of available ASGs, select the ASG that you want to associate the VM with:



Configure the application security groups ×
packt747

Save   Discard

Showing only application security groups in the same region as the network interface. If you choose more than one application security group, they must all exist in the same virtual network.

Application security groups
0 selected
Filter the application security groups
packt-networking-portal
□ ASG1

Figure 3.14: Associating an ASG with a VM

5. After clicking **Save**, it takes a few seconds to apply the changes, after which the VM will be associated with the ASG.

How it works...

The VM must be associated with the ASG. We can associate more than one VM with each ASG. The ASG is then used in combination with the NSG to create new NSG rules.

In the next recipe, we will create new rules using an NSG and an ASG.

Creating rules with an NSG and an ASG

As a final step, we can use NSGs and ASGs to create new rules with better control. This approach allows us to have better control of traffic, limiting incoming traffic not only to a specific subnet but also only based on whether or not the resource is part of the ASG.

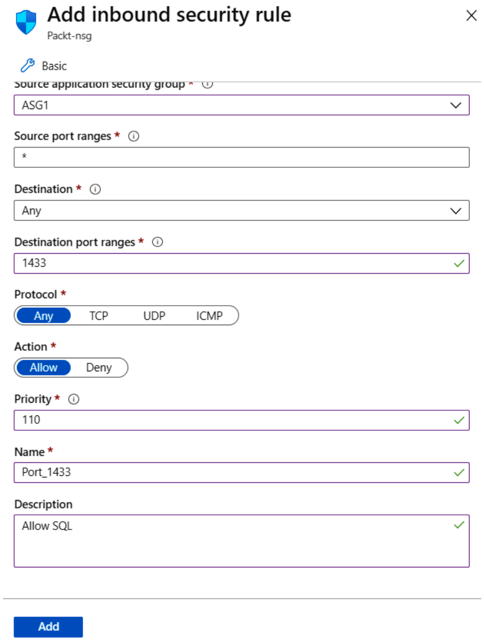
Getting ready

Before you start, open your browser and go to the Azure portal at https://portal.azure.com. Locate the previously created NSG.

How to do it...

To create a rule using both an ASG and an NSG, we must follow these steps:

1. In the NSG pane, find **Inbound security rules**. Select **Add** to add a new rule.
2. For the source, select **Application Security Group**, and then select the ASG you want to use as the source. We also need to provide parameters for **Source**, **Source port ranges**, **Destination**, **Destination port ranges**, **Protocol**, **Action**, **Priority**, **Name**, and **Description**. An example is shown in *Figure* 3.15:



Add inbound security rule

Packt-nsg

Basic

Source application security group *

ASG1

Source port ranges *

*

Destination *

Any

Destination port ranges *

1433

Protocol *

[✓ Any] TCP UDP ICMP

Action *

[✓ Allow] Deny

Priority *

110

Name *

Port_1433

Description

Allow SQL

Figure 3.15: Adding an inbound security rule

How it works…

Using only NSGs to create rules, we can allow or deny traffic only for a specific IP address or range. With an ASG, we can widen or narrow this as needed. For example, we can create a rule to allow VMs from a frontend subnet, but only if these VMs are in a specific ASG. Alternatively, we can allow access to a number of VMs from different virtual networks and subnets, but only if they belong to a specific ASG.