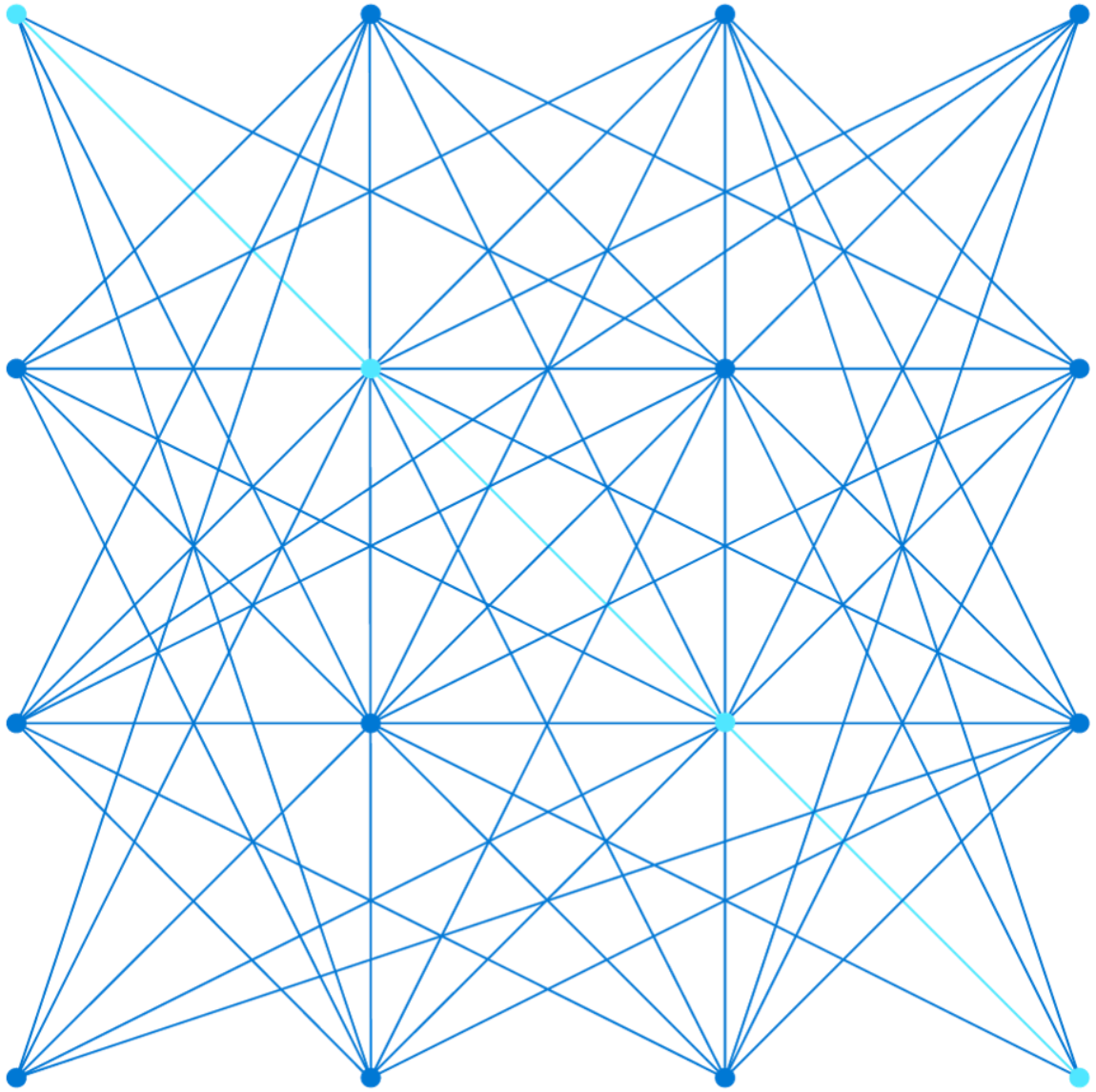
Microsoft Azure

Guten Morgen!

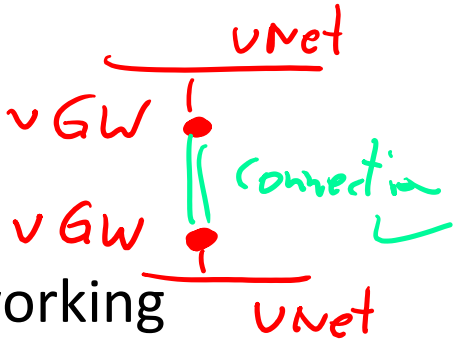
AZ-700

Design and implement Azure ExpressRoute



RBAC

Course Agenda



Module 01: Introduction to Azure Virtual Networks

Module 02: Designing and Implementing Hybrid Networking

Module 03: Designing and Implementing Azure ExpressRoute

Module 04: Load balance non-HTTP(S) traffic in Azure ← Lab

Module 05: Load balance HTTP(S) traffic in Azure

Module 06: Design and Implement Network Security

Module 07: Design and Implement private access to Azure Services

Module 08: Design and Implement Network Monitoring

Module Overview

Explore Azure ExpressRoute

Design an ExpressRoute deployment

Exercise - Configure an ExpressRoute Gateway

Exercice - Provision an ExpressRoute circuit

Configure peering for an ExpressRoute deployment

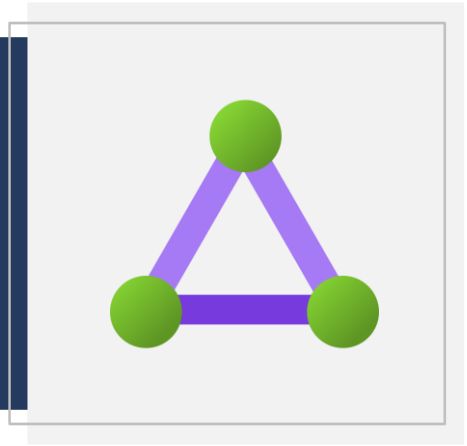
Connect an ExpressRoute circuit to a VNet

Connect geographically dispersed networks with ExpressRoute Global Reach

Improve data path performance between networks with ExpressRoute FastPath

Troubleshoot ExpressRoute connection issues

Explore Azure ExpressRoute



Explore Azure ExpressRoute Overview

- ExpressRoute Capabilities
- Understand use cases for Azure ExpressRoute
- ExpressRoute connectivity models
- Design considerations for ExpressRoute deployments
- Bidirectional Forwarding Detection (BFD)
- Configure encryption over ExpressRoute
- Review

ExpressRoute Capabilities

Layer 3 connectivity with redundancy

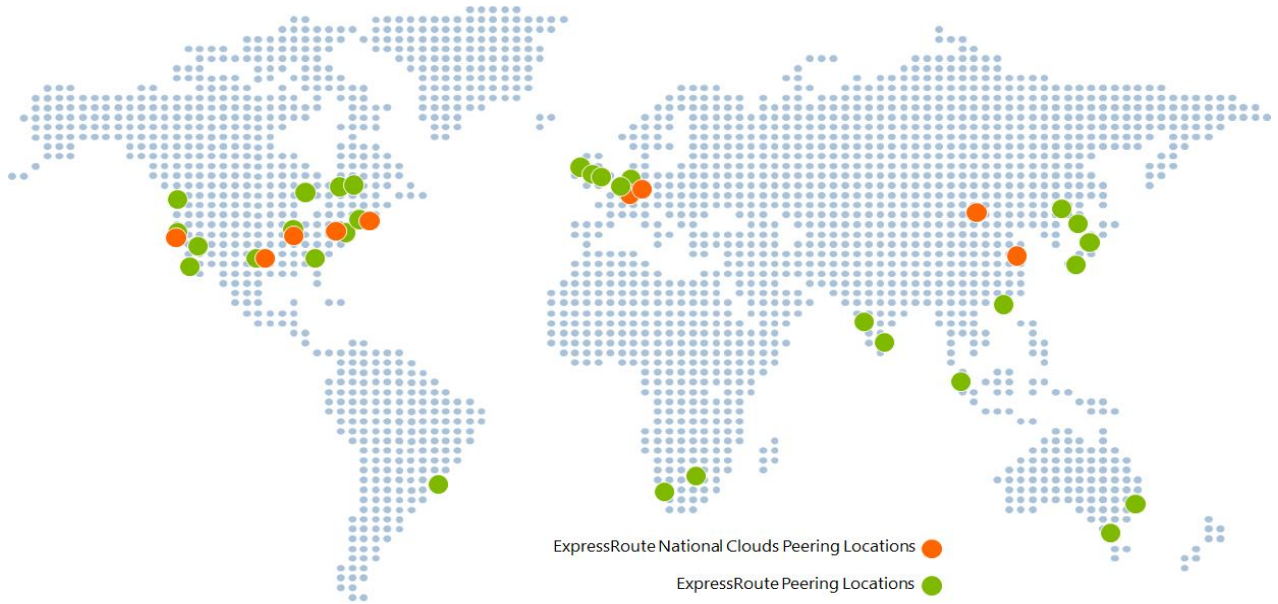
Connectivity to all regions within a geography

Global connectivity with ExpressRoute premium add-on

Across on-premises connectivity with ExpressRoute Global Reach

Bandwidth options – 50 Mbps to 100 Gbps

Billing models – Unlimited, metered



Understand use cases for Azure ExpressRoute

Faster and Reliable connection to Azure services

Built in redundant circuits

Storage, backup, and Recovery

Border Gateway Protocol (BGP)

Extends Data center capabilities

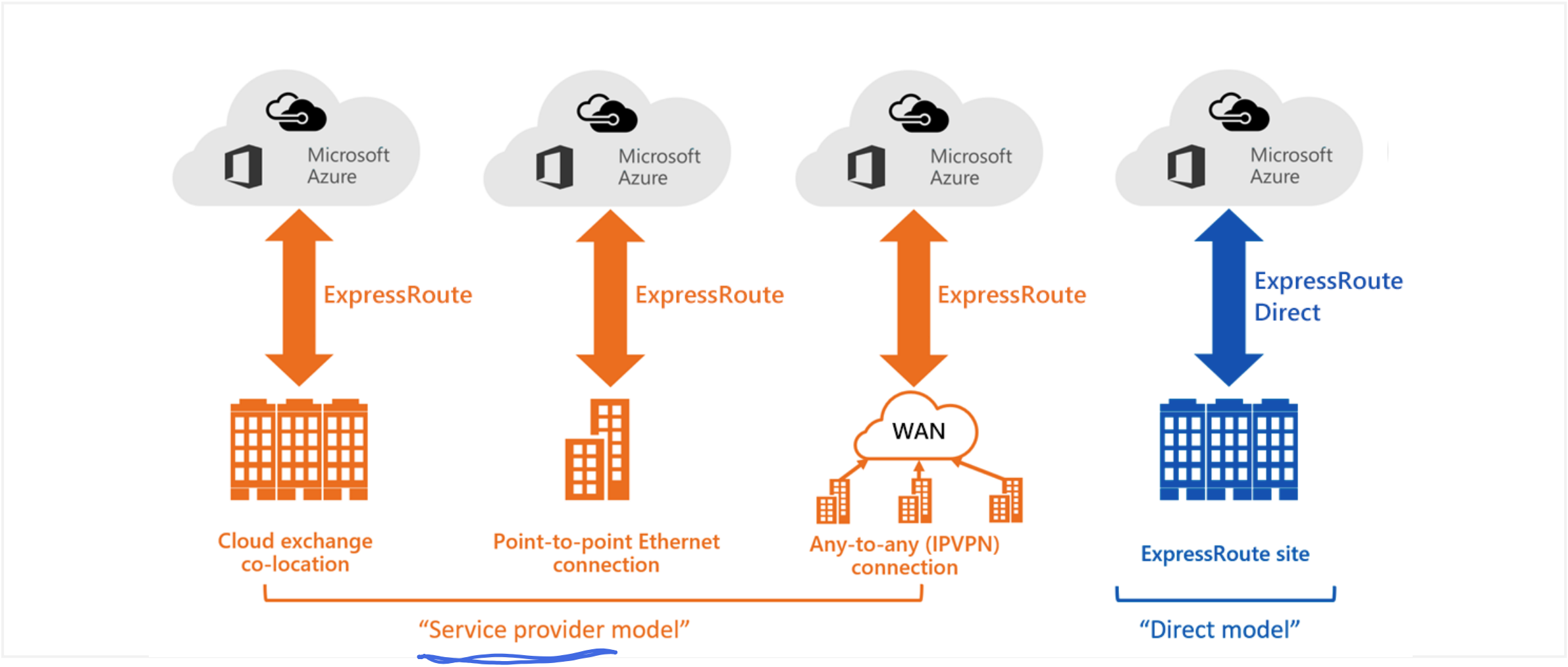
Integrates with existing Multiprotocol Label Switching (MPLS)

Predictable, reliable, and high-throughput connections

SLA

Private connection to Microsoft cloud

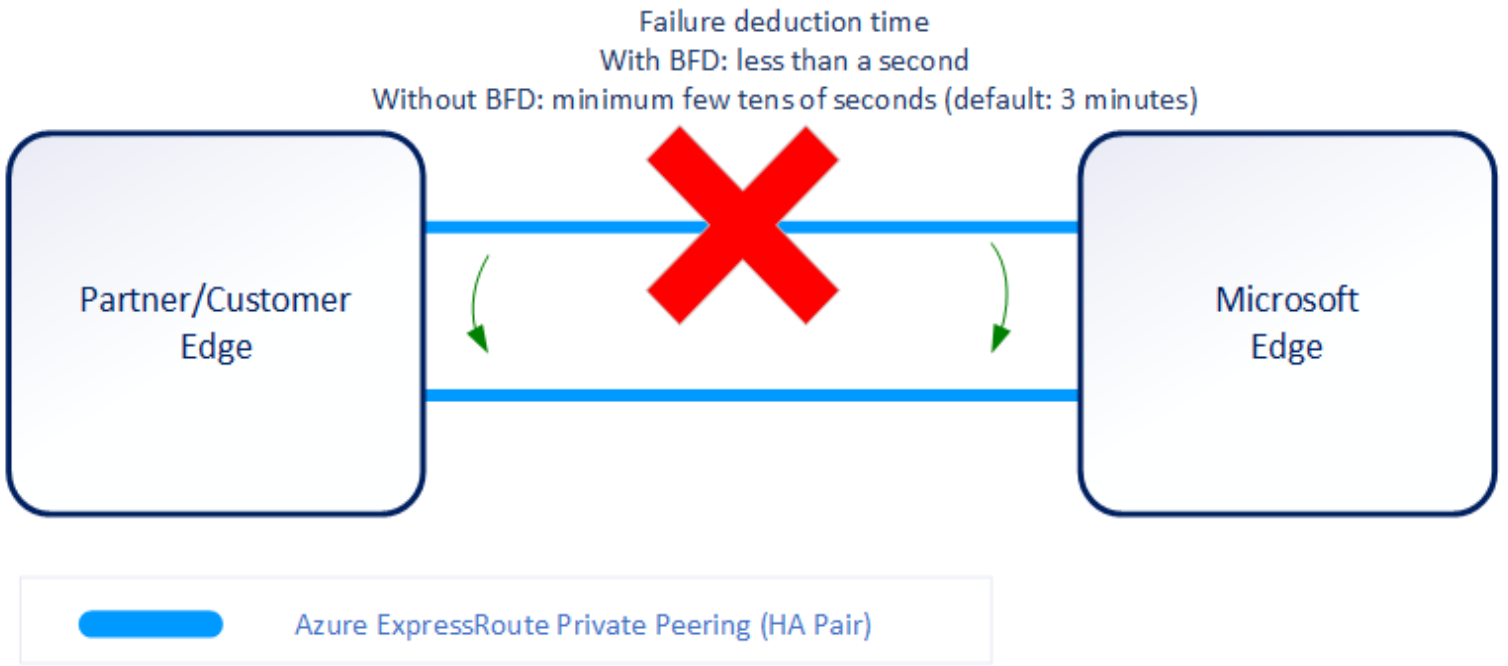
ExpressRoute connectivity models



Design considerations for ExpressRoute deployments

ExpressRoute using a Service Provider	ExpressRoute Direct
Uses service providers to enable fast onboarding and connectivity into existing infrastructure	Requires 100 Gbps/10 Gbps infrastructure and full management of all layers
Integrates with hundreds of providers including Ethernet and MPLS	Direct/Dedicated capacity for regulated industries and massive data ingestion
Circuits SKUs from 50 Mbps to 10 Gbps	Customer may select a combination of the following circuit SKUs on 100-Gbps ExpressRoute Direct: (5 Gbps, 10 Gbps, 40 Gbps, 100 Gbps) Customer may select a combination of the following circuit SKUs on 10-Gbps ExpressRoute Direct: (1 Gbps, 2 Gbps, 5 Gbps, 10 Gbps)
Optimized for single tenant	Optimized for single tenant with multiple business units and multiple work environments

Bidirectional Forwarding Detection (BFD) with ExpressRoute Private Peering

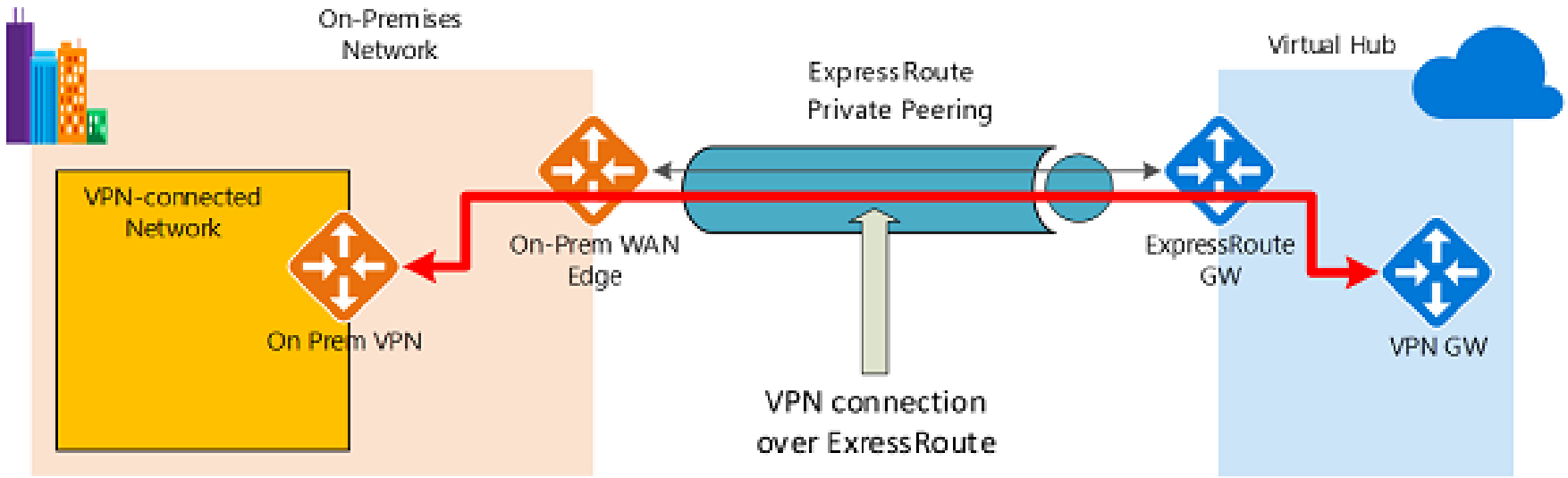


BFD is configured by default

You only need to configure BFD on both your primary and secondary devices

You configure the BFD on the interface and then link it to the BGP session.

Configure encryption over ExpressRoute

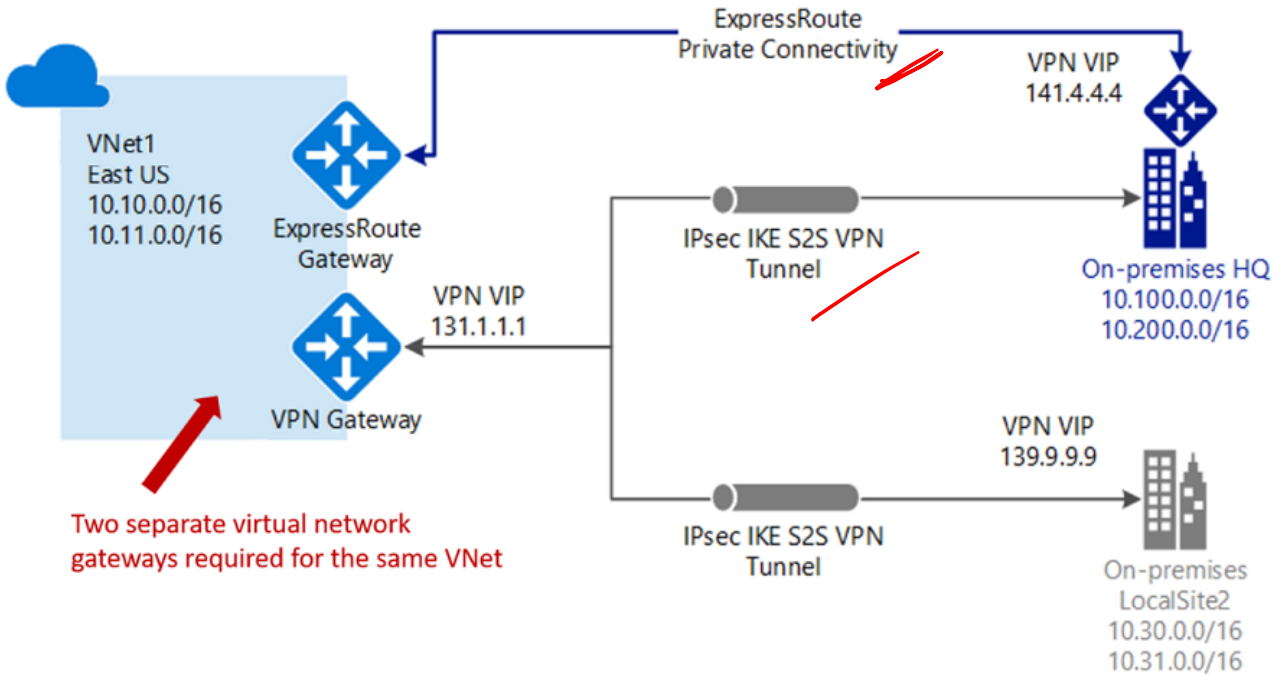


Establish ExpressRoute connectivity with an ExpressRoute circuit and private peering

Establish the VPN connectivity over ExpressRoute

Routing between the on-premises networks and Azure over both the ExpressRoute and VPN paths

Coexisting Site-to-Site and ExpressRoute



Use S2S VPN as a secure failover path for ExpressRoute

Use S2S VPNs to connect to sites that are not connected with ExpressRoute

Notice two VNet gateways for the same virtual network

Design an ExpressRoute deployment Review

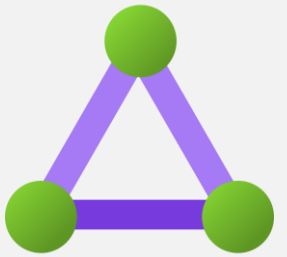
Knowledge Check Questions

Microsoft Learn Modules (docs.microsoft.com/Learn)

Connect your on-premises network to the Microsoft global network by using ExpressRoute

Configure the network for your virtual machines

Design an ExpressRoute deployment



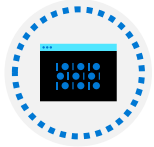
Design an ExpressRoute deployment Overview

ExpressRoute SKUs and Tiers

Choose a peering location

Choose the right ExpressRoute Circuit and billing model

Demonstration



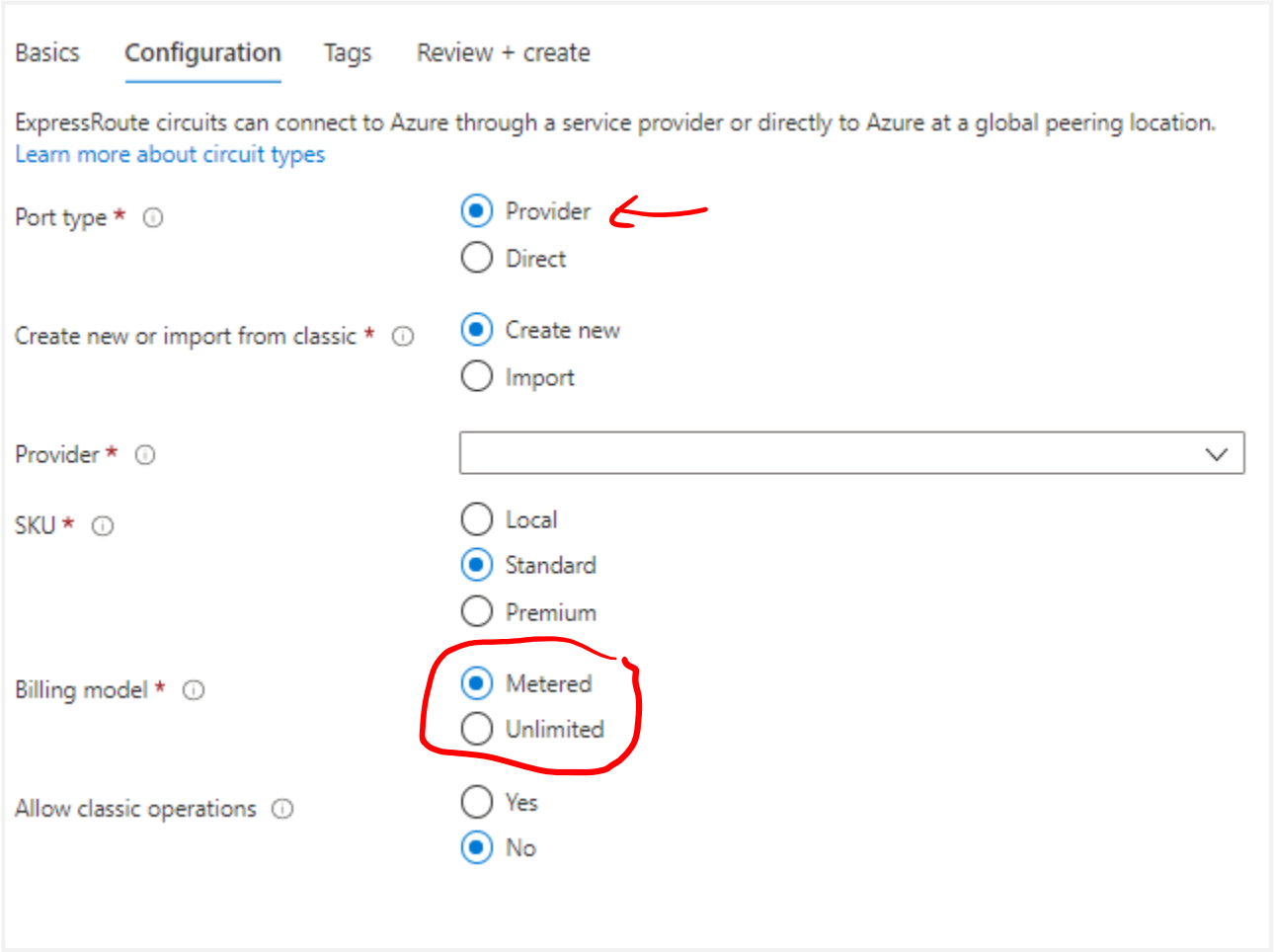
Review

ExpressRoute SKUs

Local (if available) - provides free egress data transfer and gives you access to only 1-2 Azure regions in the same area as your circuit

Standard SKU - gives you access to all Azure regions in a geopolitical area

Premium SKU - provides support for more than 4K routes, ability to connect to more than 10 virtual networks, and global connectivity



Choose a peering location

Choose the right ExpressRoute Circuit and billing model

Choose Metered or unlimited data plan

Choose Bandwidth

You can increase gateway size but not decrease without service outage

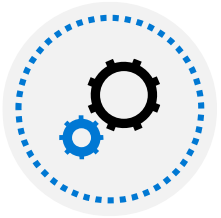
Pricing varies by region and zone

Unlimited data. Billing is based on a monthly fee; all inbound and outbound data transfer is included free of charge.

Metered data. Billing is based on a monthly fee; all inbound data transfer is free of charge. Outbound data transfer is charged per GB of data transfer. Data transfer rates vary by region.

ExpressRoute premium add-on. ExpressRoute premium is an add-on to the ExpressRoute circuit.

Demonstration



Review and deploy ExpressRoute circuit

Review and deploy ExpressRoute gateway

Design for an ExpressRoute deployment - Review

Knowledge Check

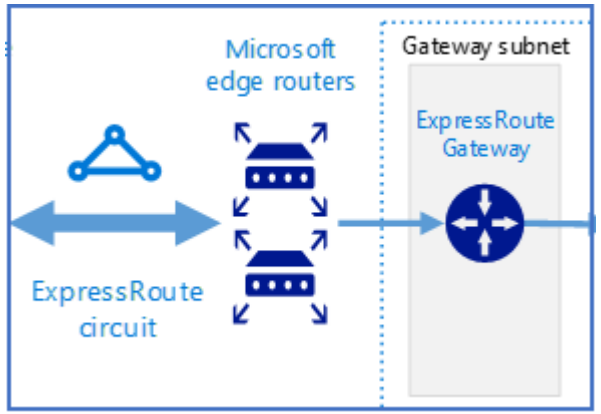
Microsoft Learn Modules (docs.microsoft.com/Learn)

Azure ExpressRoute: Designing for high availability | Microsoft Docs

Extend an on-premises network using ExpressRoute - Azure Architecture Center | Microsoft Docs

Exercise - Configure an ExpressRoute Gateway

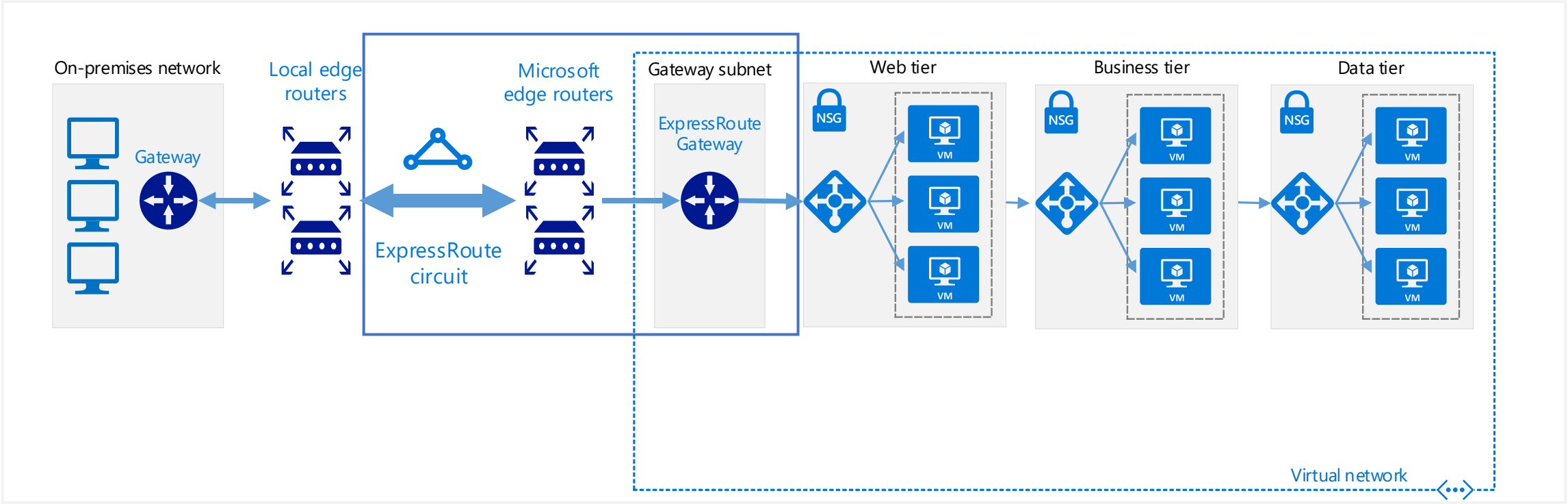
Exercise - Configure an ExpressRoute Gateway



In this exercise, you learn how to:

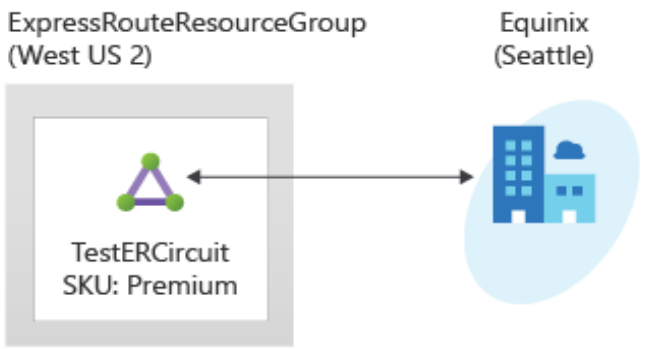
Task 1: Create the VNet and gateway subnet

Task 2: Create the virtual network gateway



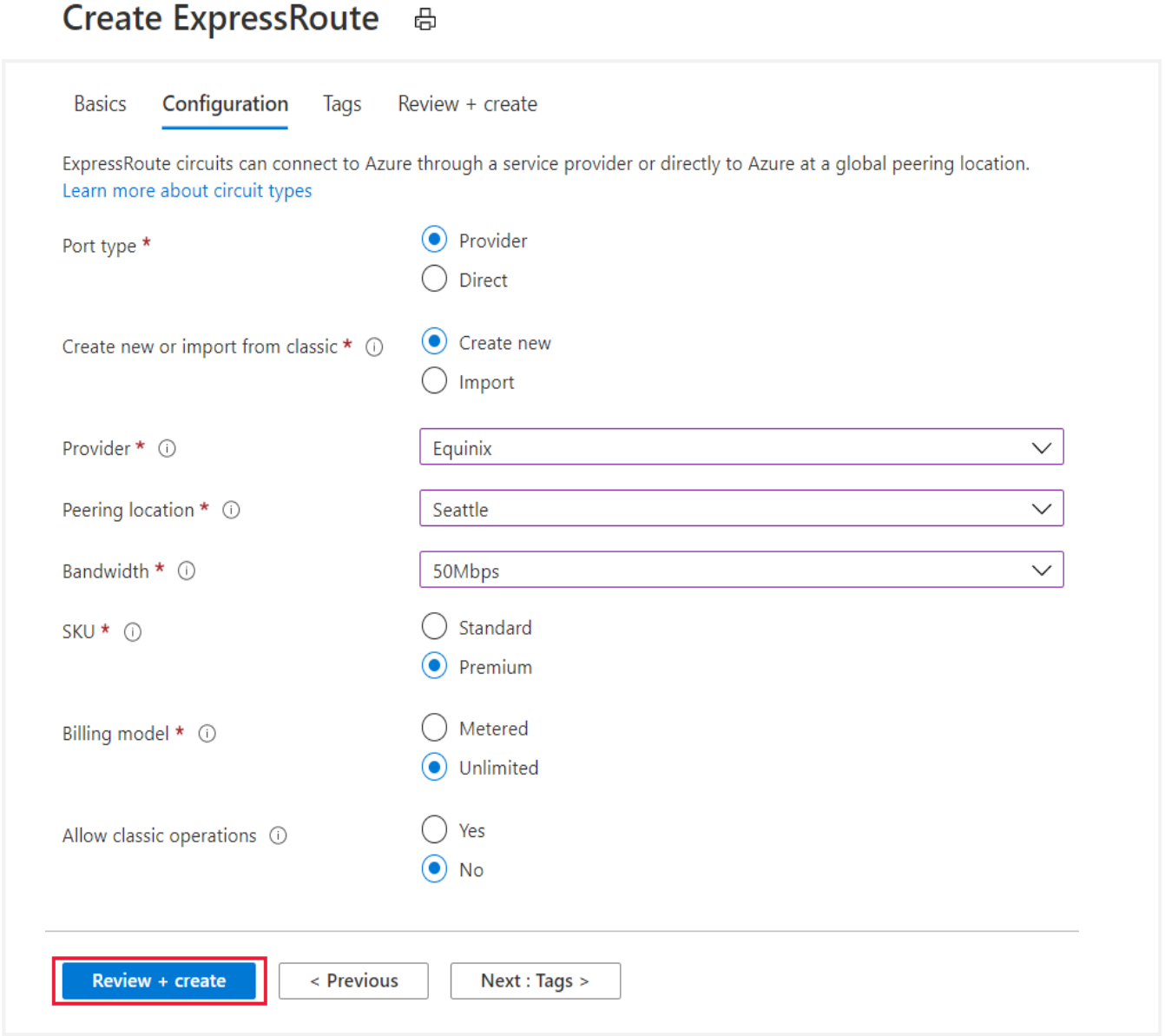
Exercice - Provision an ExpressRoute circuit

Exercise

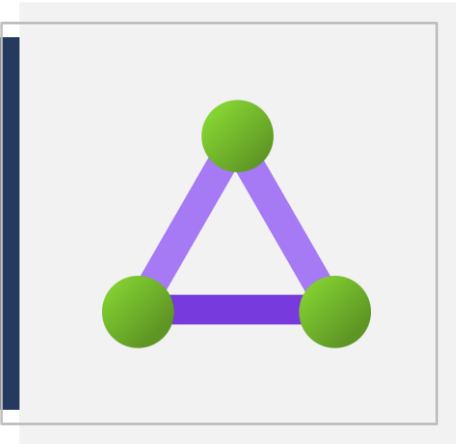


In this exercise, you learn how to:

Task 1: Create and provision an ExpressRoute circuit
Task 2: Retrieve your Service key
Task 3: Deprovisioning an ExpressRoute circuit



Configure peering for an ExpressRoute deployment



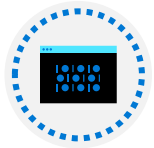
Configure peering for an ExpressRoute deployment Overview

Configure Private peering

Configure Microsoft peering

Choose between private peering only, Microsoft peering only, or both

Route filters



Review

Configure Private peering

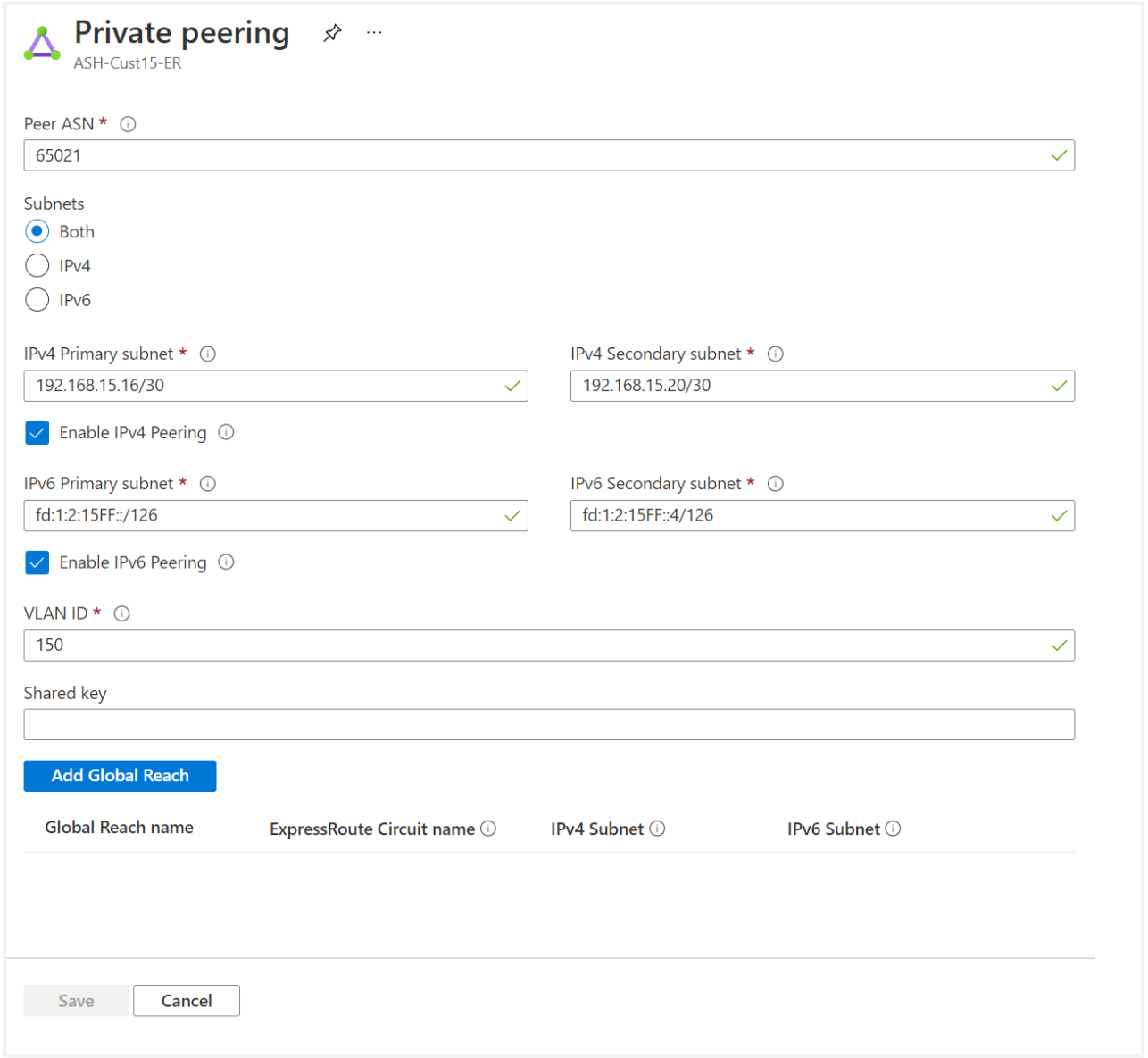
A pair of subnets that are not part of any address space reserved for virtual networks. One subnet will be used for the primary link, while the other will be used for the secondary link

A valid on-prem VLAN ID to establish this peering on

AS number for peering

Advertise the routes from your on-premises Edge router to Azure via BGP

Optional - An MD5 hash if you choose to use one



Configure Microsoft peering

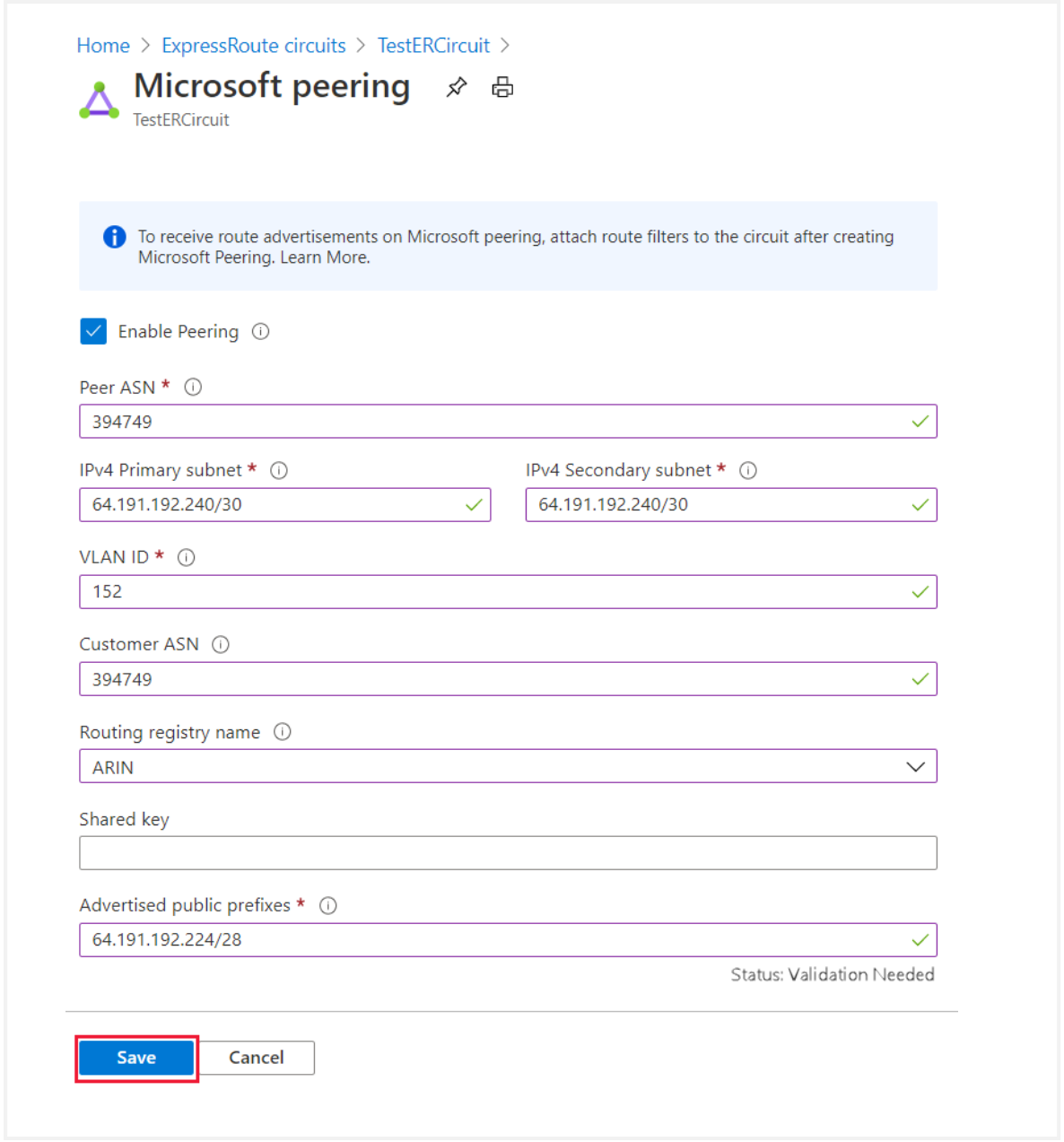
A pair of subnets owned by you and registered in an RIR/IRR. One subnet will be used for the primary link, while the other will be used for the secondary link.

A valid on-prem VLAN ID to establish this peering on

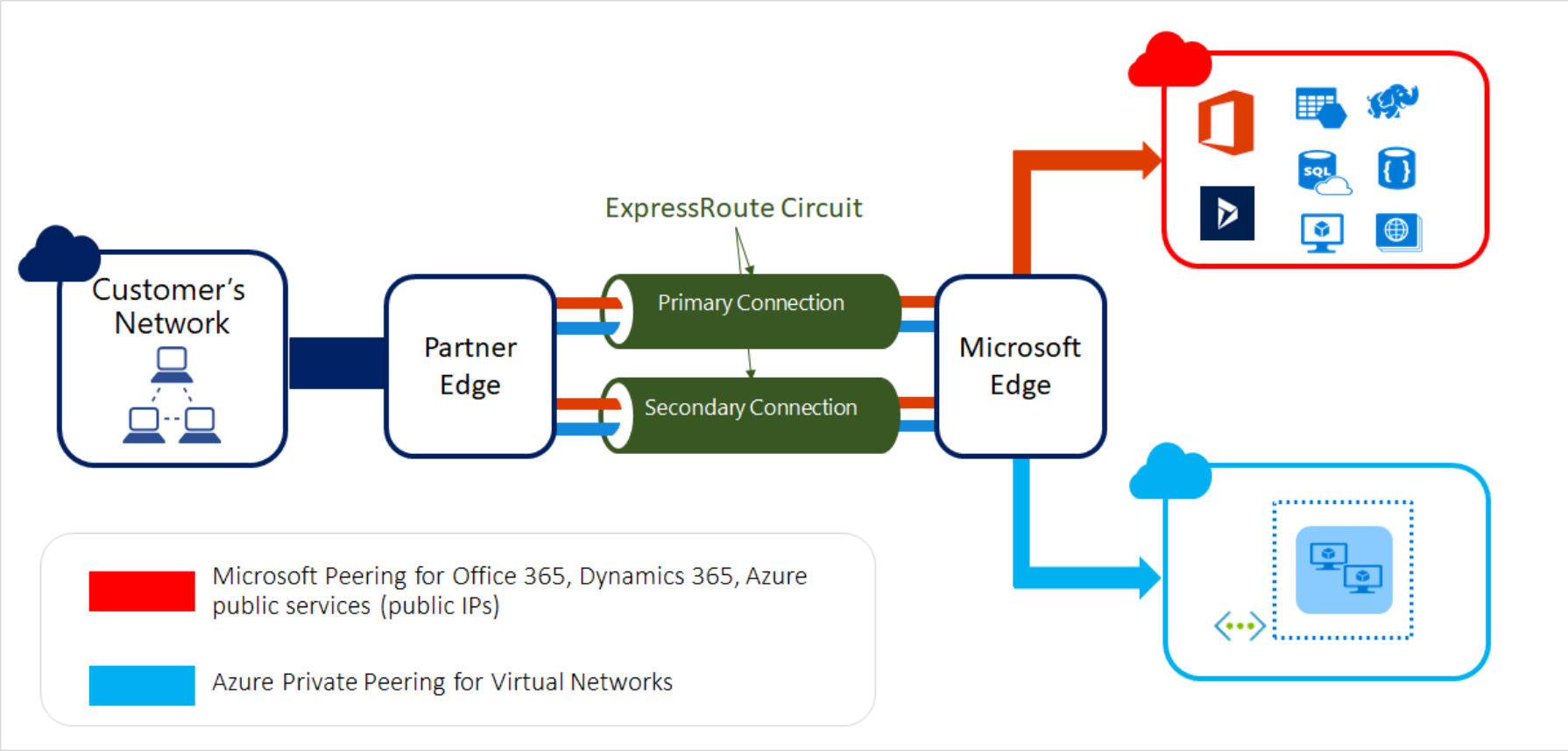
AS number for peering

Advertised prefixes: You provide a list of all prefixes you plan to advertise over the BGP session

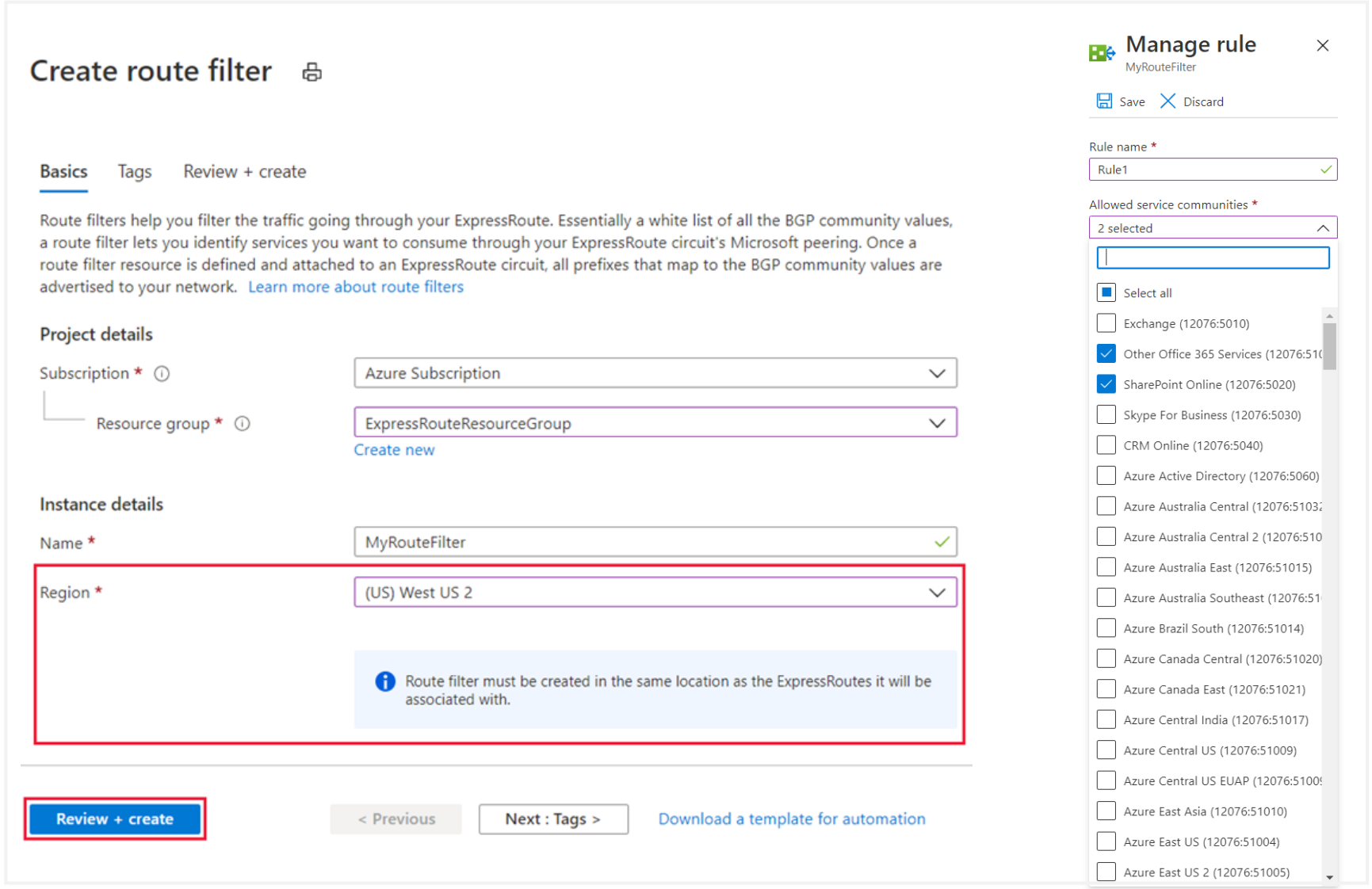
Routing Registry Name



Choose between private peering only, Microsoft peering only, or both



Route filters



Create route filter and create route filter rules

Attach the route filter to an ExpressRoute circuit

Configure peering for an ExpressRoute deployment- Review

Knowledge Check	Microsoft Learn Modules (docs.microsoft.com/Learn)

[Azure ExpressRoute: circuits and peering | Microsoft Docs]

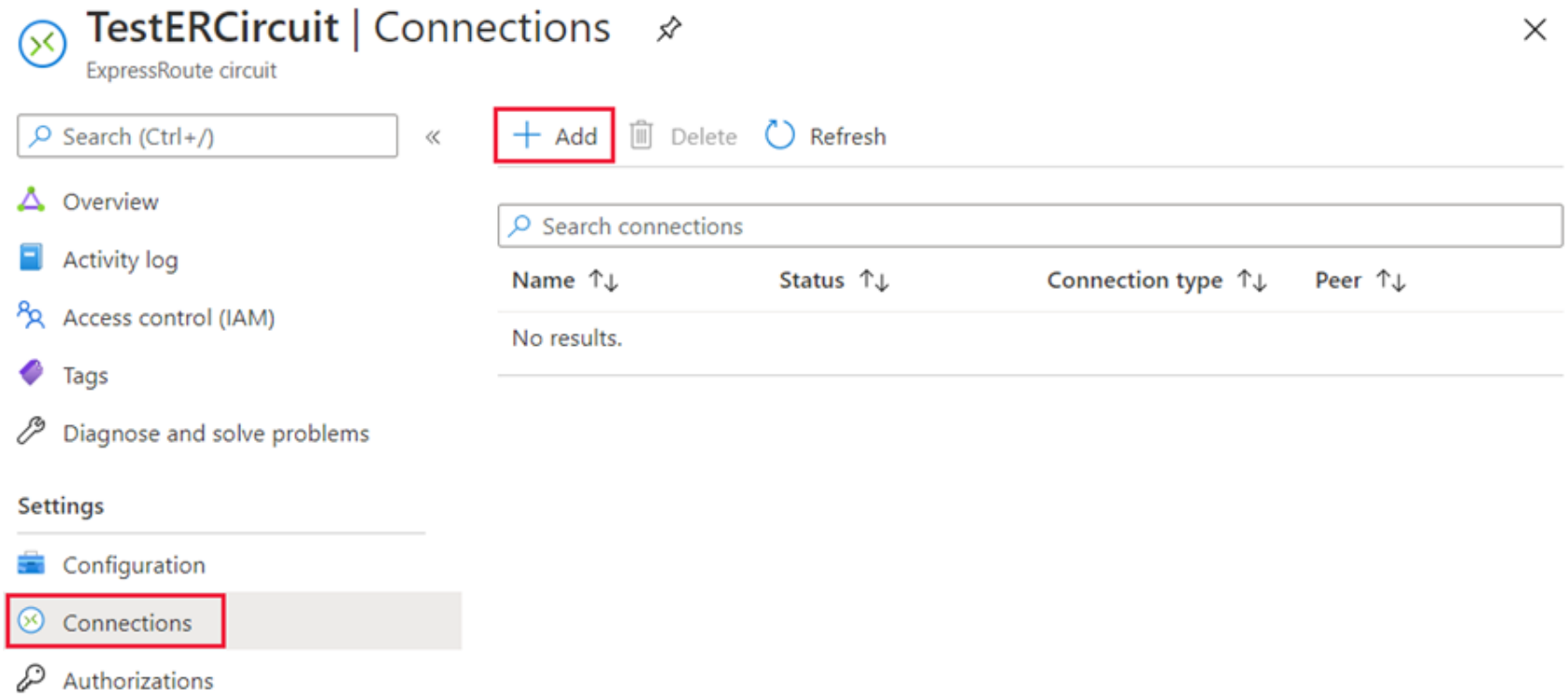
Connect an ExpressRoute circuit to a VNet

Connect an ExpressRoute circuit to a VNet Overview

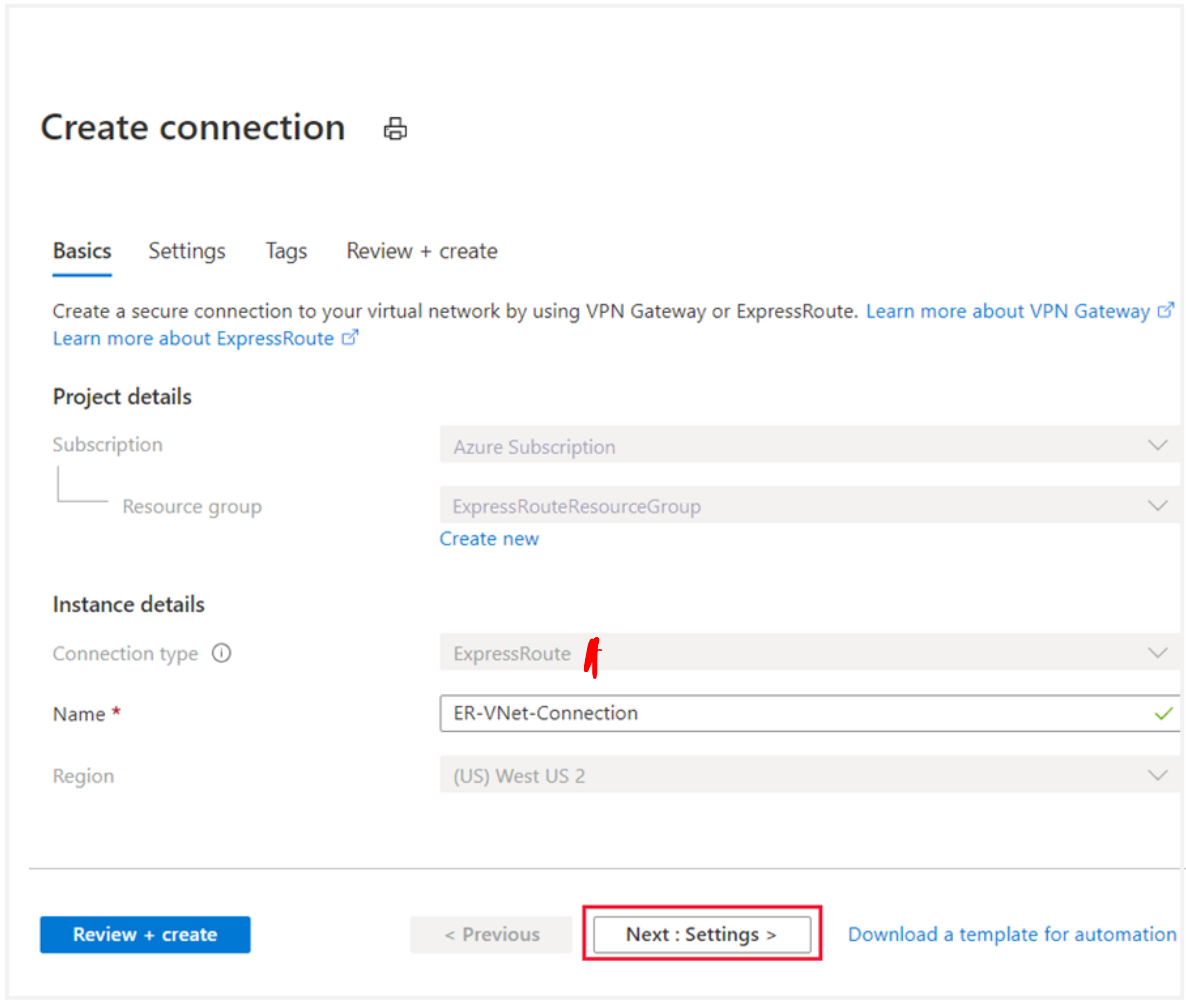
Connect virtual network to an ExpressRoute circuit

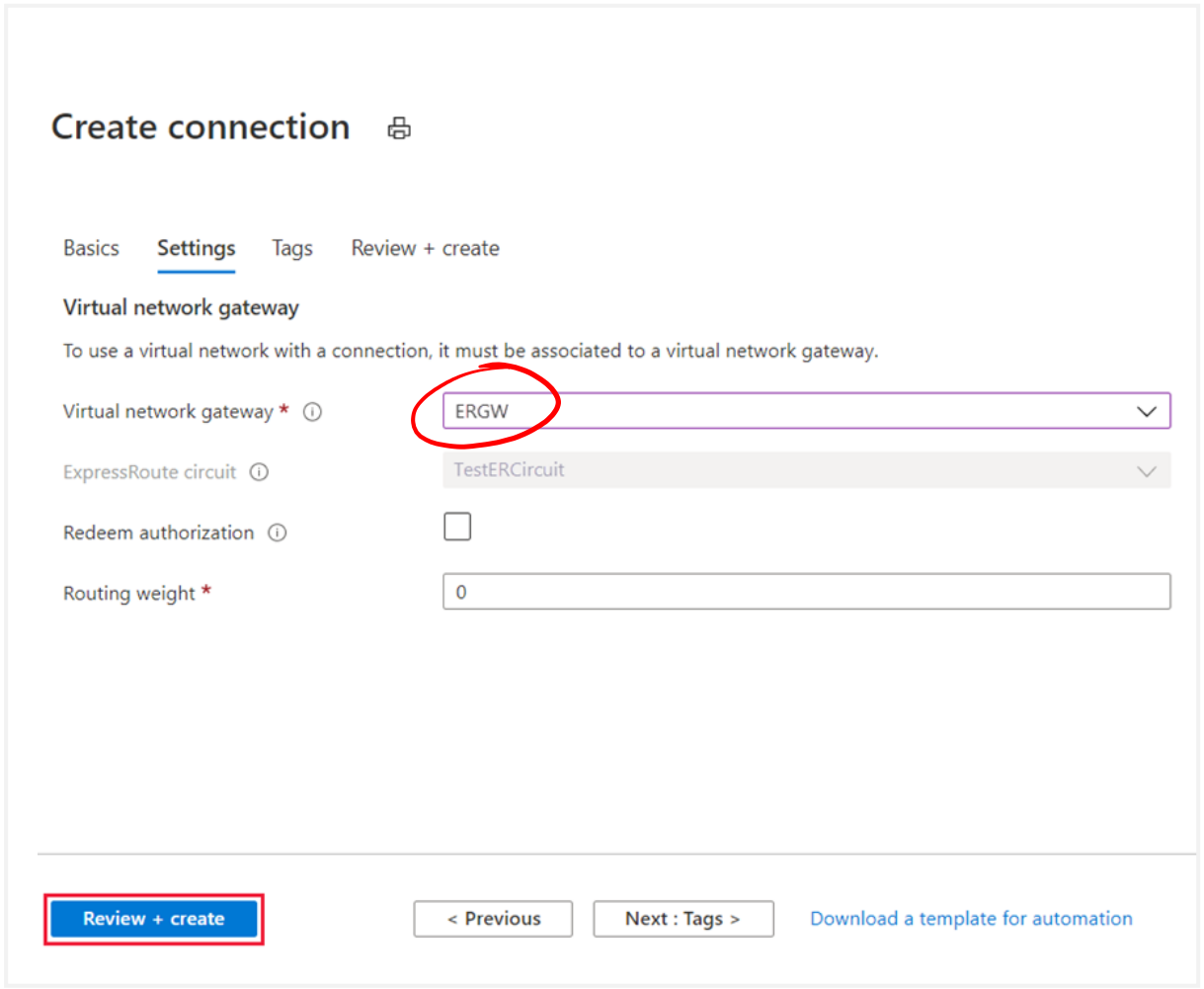
Review

Connect virtual network to an ExpressRoute circuit

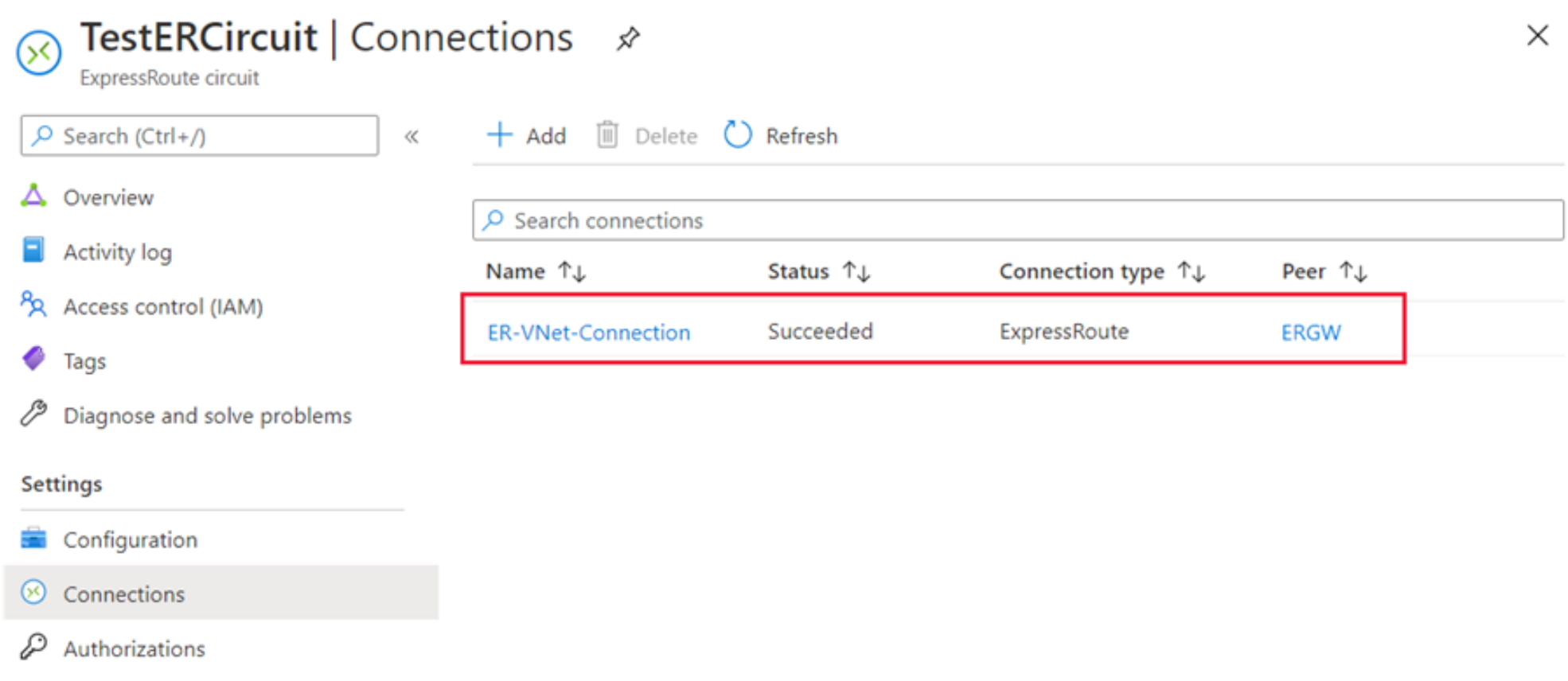


Connect virtual network to an ExpressRoute circuit – continued





Verify connection



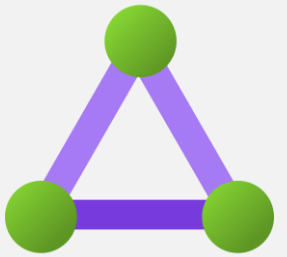
Connect an ExpressRoute circuit to a VNet - Review

Knowledge Check

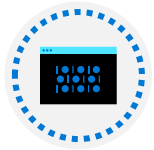
Microsoft Learn Modules (docs.microsoft.com/Learn)

Azure ExpressRoute: Circuit configuration workflow | Microsoft Docs

Connect geographically dispersed networks with ExpressRoute Global Reach



Connect geographically dispersed networks with ExpressRoute Global Reach Overview



Use Cross-region connectivity to link multiple ExpressRoutes

Choose when to use ExpressRoute Global Reach

Configure ExpressRoute Global Reach

Review

Use Cross-region connectivity to link multiple ExpressRoutes

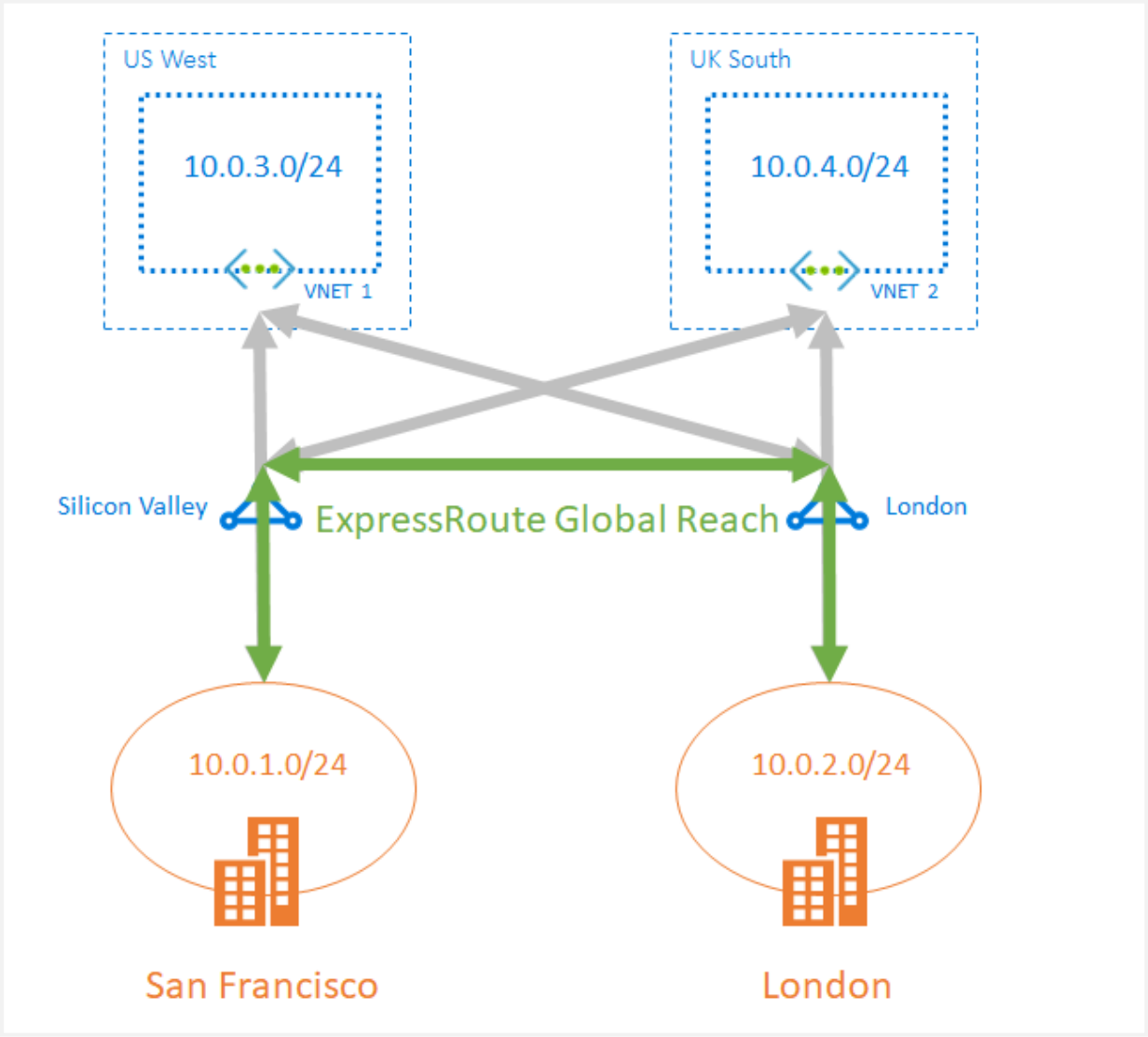
Connectivity to all regions within a geopolitical region

Global connectivity with ExpressRoute Premium

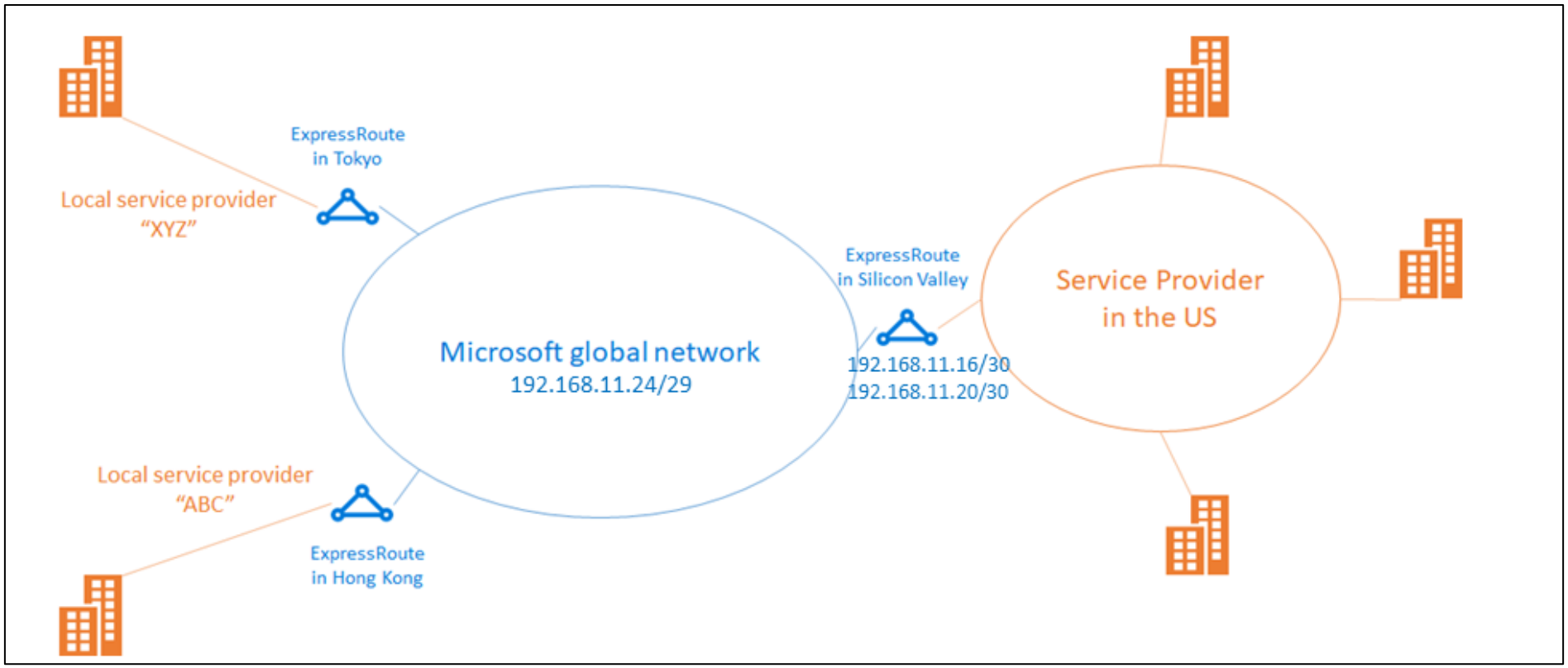
Local connectivity with ExpressRoute Local

Across on-premises connectivity with ExpressRoute Global Reach

ExpressRoute Direct



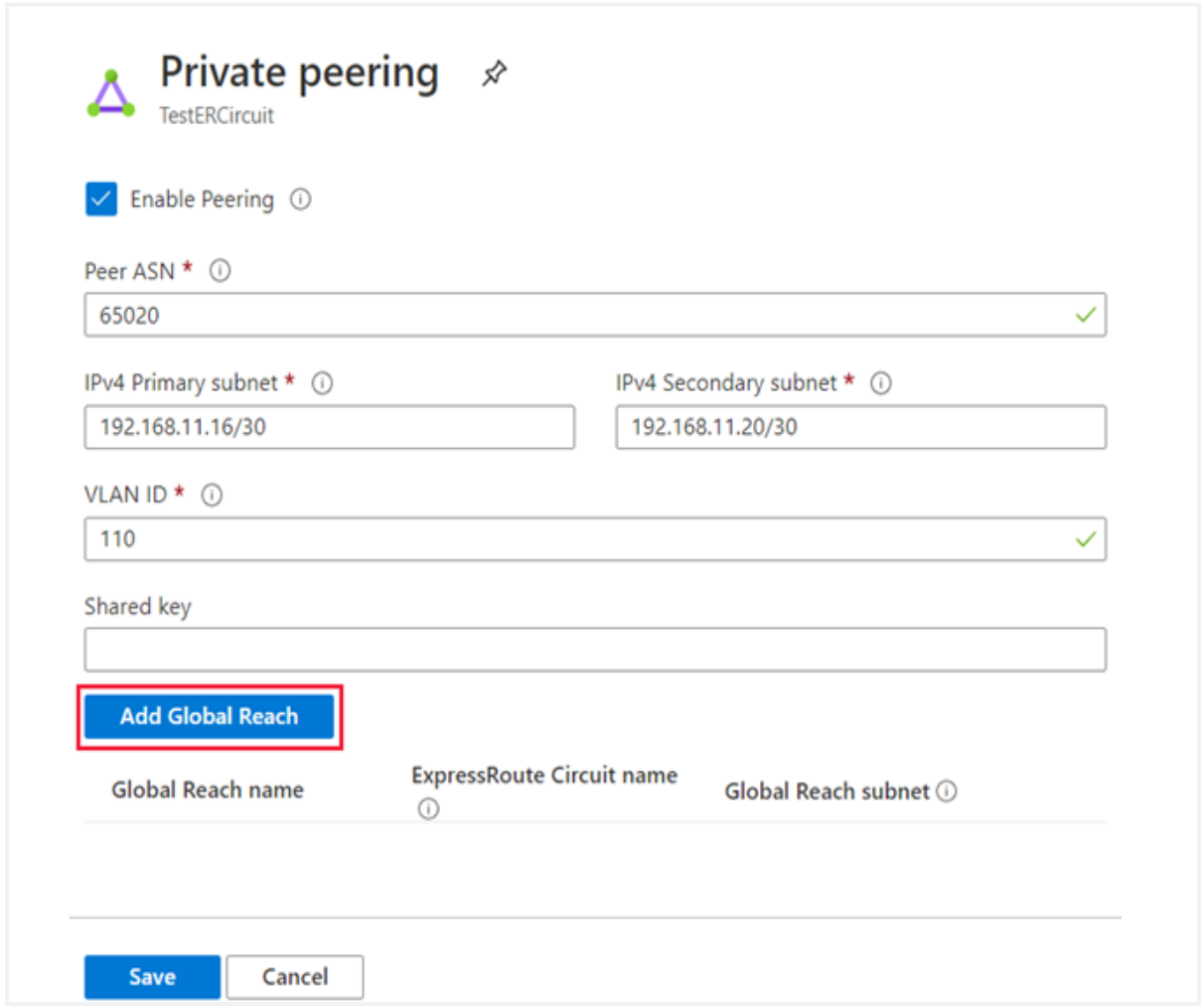
ExpressRoute Global Reach

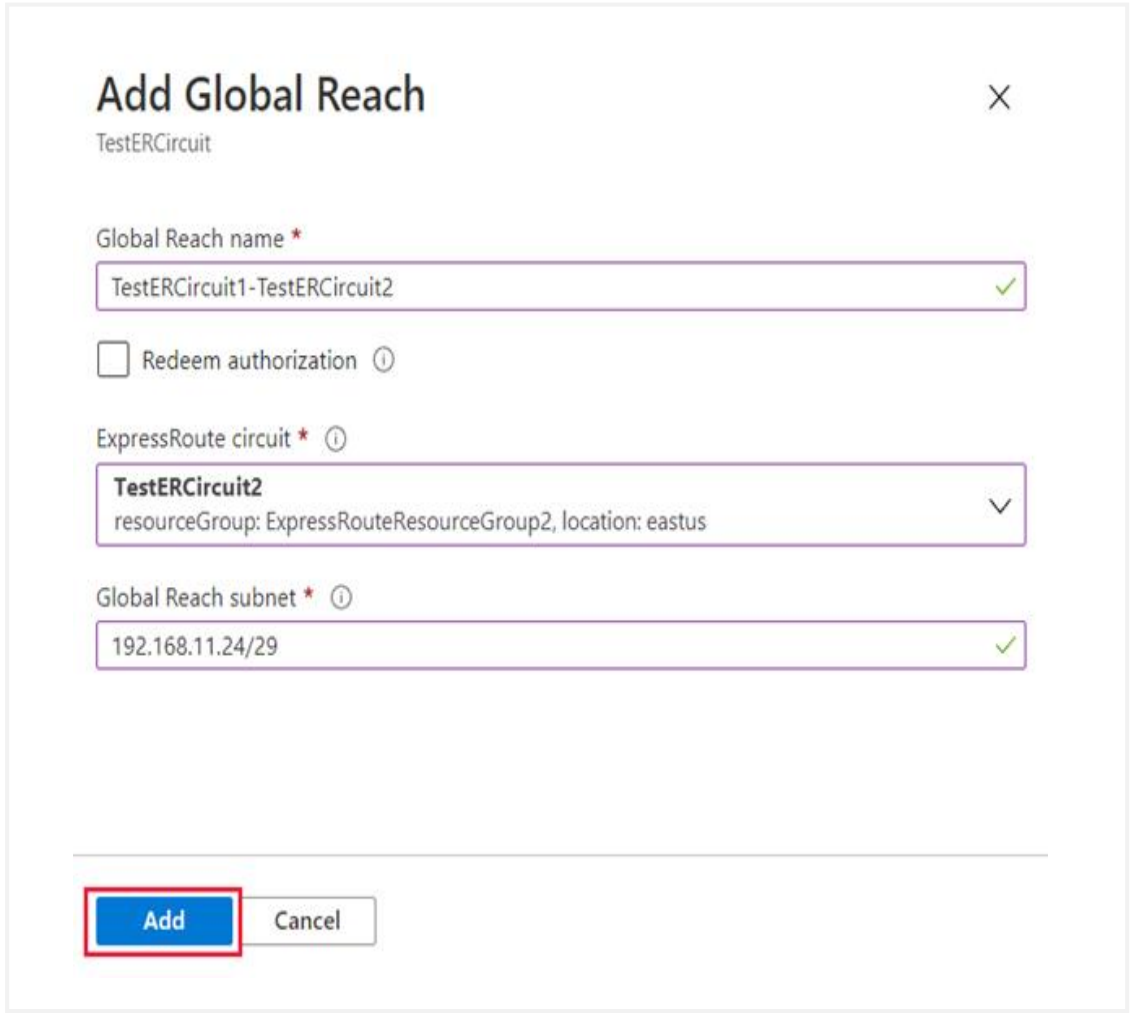


Designed to complement your service provider's WAN implementation and connect your branch offices across the world

You can link ExpressRoute circuits together to make a private network between your on-premises networks

Configure ExpressRoute Global Reach





Connect geographically dispersed networks with ExpressRoute Global Reach - Review

Knowledge Check

Microsoft Learn Modules (docs.microsoft.com/Learn)

[Azure ExpressRoute: Connect to Microsoft Cloud using Global Reach | Microsoft Docs]

Improve data path performance between networks with ExpressRoute FastPath

Improve data path performance between networks with ExpressRoute FastPath Overview

ExpressRoute FastPath

Configure ExpressRoute FastPath

Review

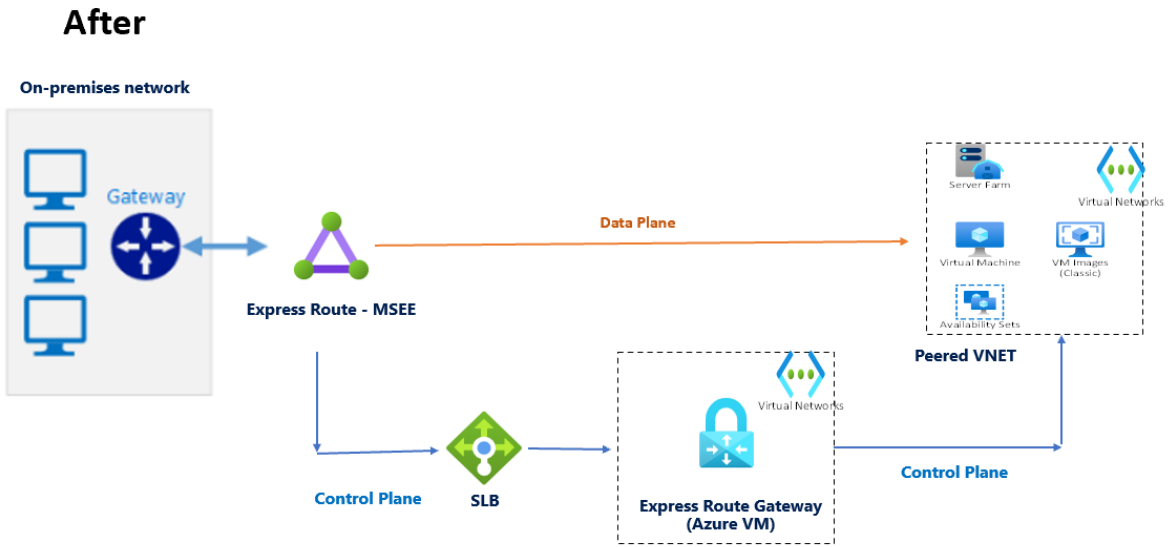
ExpressRoute FastPath

FastPath is designed to improve the data path performance between your on-premises network and your virtual network

When enabled, FastPath sends network traffic directly to virtual machines in the virtual network, bypassing the gateway.

FastPath improves data path performance such as packets per second and connections per second between your on-premises network and your virtual network.

You can enable ExpressRoute FastPath if your virtual network gateway is Ultra Performance or ErGw3AZ



Configure ExpressRoute FastPath

Configure FastPath on a new connection using PowerShell:

```
$circuit = Get-AzExpressRouteCircuit -Name "MyCircuit" `
-ResourceGroupName "MyRG"

$gw = Get-AzVirtualNetworkGateway -Name "MyGateway" `
-ResourceGroupName "MyRG"

$connection = New-AzVirtualNetworkGatewayConnection `
-Name "MyConnection" -ResourceGroupName "MyRG" `
-ExpressRouteGatewayBypass -VirtualNetworkGateway1 $gw
-PeerId $circuit.Id -ConnectionType ExpressRoute `
-Location "MyLocation"

```

Improve data path performance between networks with ExpressRoute FastPath - Review

Knowledge Check

Microsoft Learn Modules (docs.microsoft.com/Learn)

[About Azure ExpressRoute FastPath | Microsoft Docs]

Troubleshoot ExpressRoute connection issues

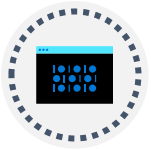
Troubleshoot ExpressRoute connection issues Overview

Verify circuit provisioning and state through the Azure portal

Validate Peering Configuration

Validate Address Resolution Protocol (ARP)

Troubleshooting network performance

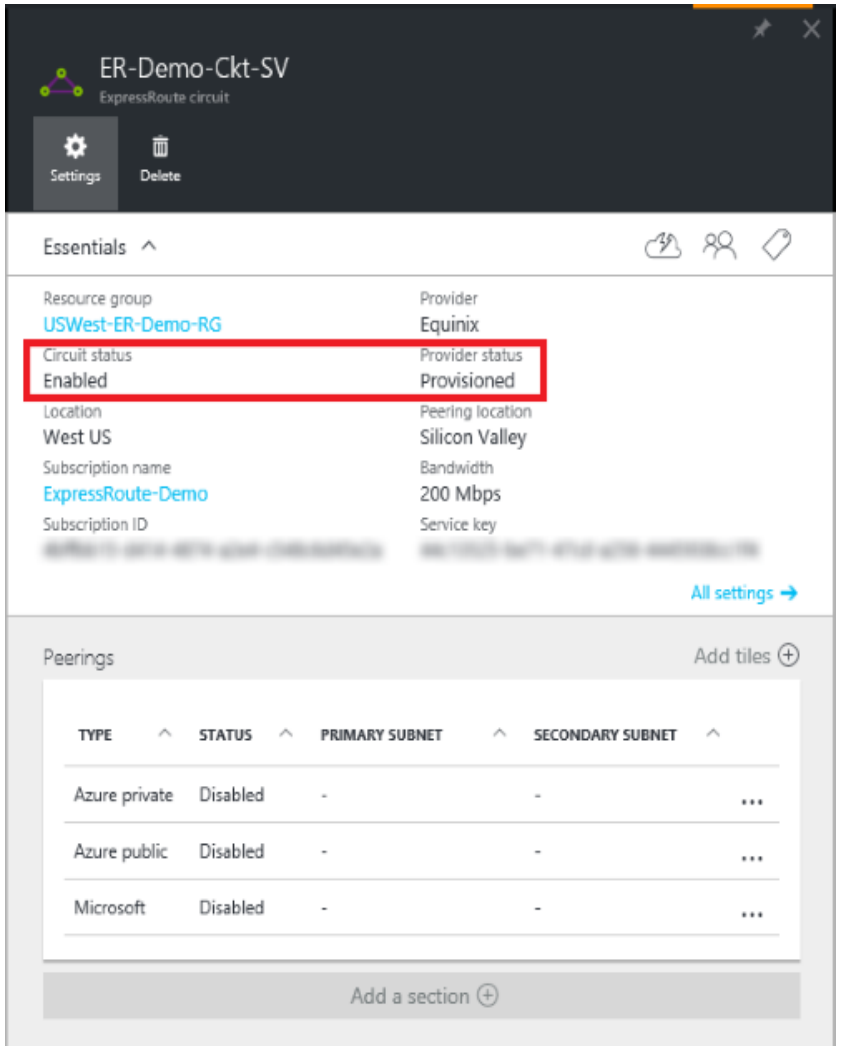


Review

Verify circuit provisioning and state

Get-AzExpressRouteCircuit -ResourceGroupName “USWest-ER-Demo-RG” –Name “ER-Demo-Ckt-SV”

```
Name                  : ER-Demo-Ckt-SV
ResourceGroupName     : USWest-ER-Demo-RG
Location              : westus
Id                    : /subscriptions/**********/resourceGroups/ USWest-
ER-Demo-RG /providers/**********/expressRouteCircuits/ ER-Demo-Ckt-SV
Etag                  : W/"#################################"
ProvisioningState     : Succeeded
Sku                   : {
                        "Name": "Standard_UnlimitedData",
                        "Tier": "Standard",
                        "Family": "UnlimitedData"
                                }
CircuitProvisioningState       : Enabled
ServiceProviderProvisioningState : Provisioned
ServiceProviderNotes           :
ServiceProviderProperties      : {
                        "ServiceProviderName": "****",
                        "PeeringLocation": "******",
                        "BandwidthInMbps": 200
                                }
ServiceKey            : ************************************
Peerings              : []
Authorizations        : []
```



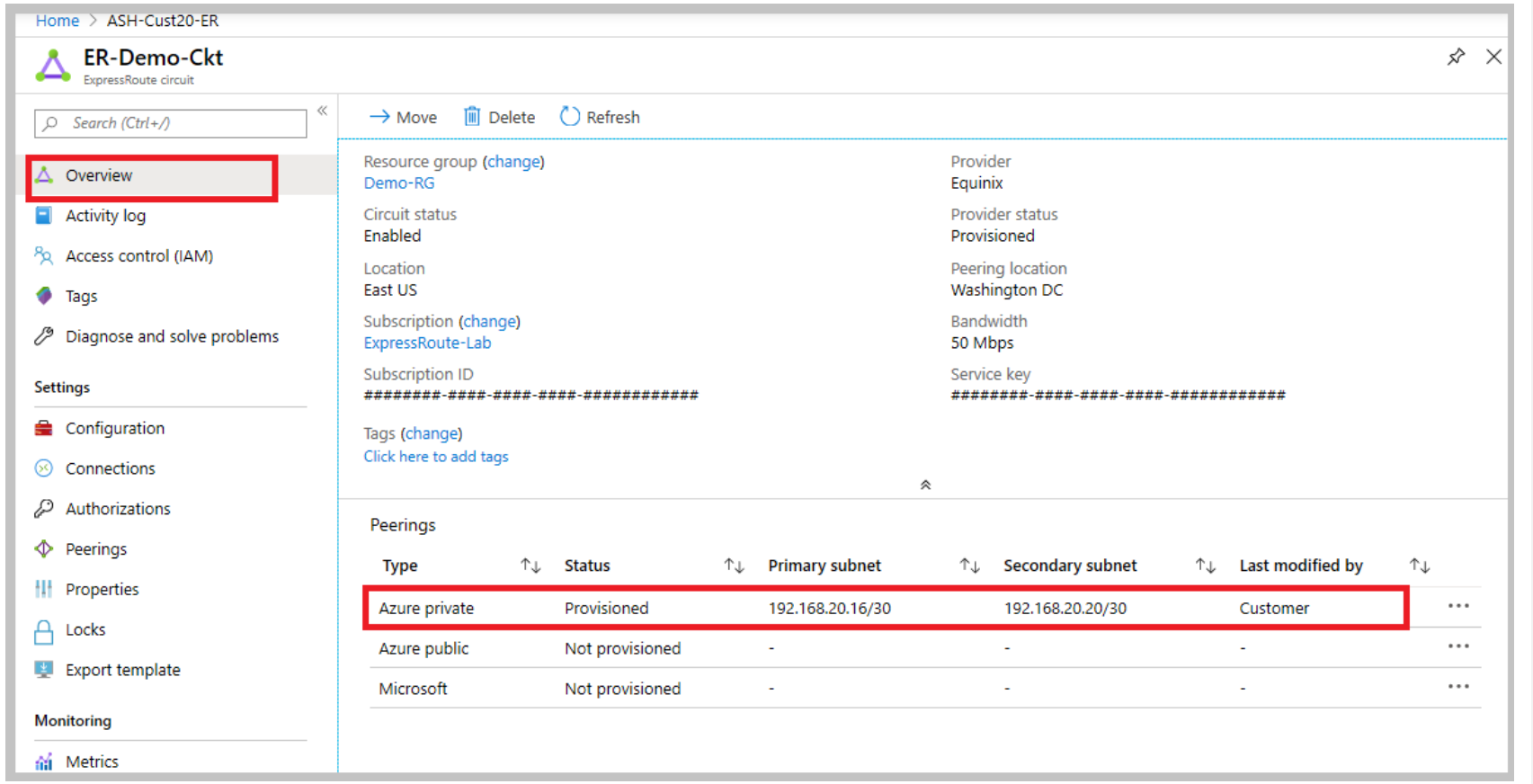
Reset a failed circuit

```
Connect-AzAccount
Get-AzSubscription
Select-AzSubscription -SubscriptionName "Replace_with_your_subscription_name“
$ckt = Get-AzExpressRouteCircuit -Name "ExpressRouteARMCircuit" -ResourceGroupName "ExpressRouteResourceGroup"

Set-AzExpressRouteCircuit -ExpressRouteCircuit $ckt
```

The circuit should now be healthy. Open a support ticket with Microsoft support if the circuit is still in a failed state.

Validate Peering Configuration



Validate ARP

Address Resolution Protocol (ARP):

- layer 2 protocol defined in RFC 826.
- Used to map the Ethernet address (MAC address) with an ip address.

Title of ARP table error messages:

- On-premises MAC address show incomplete
- Microsoft entry in the ARP table

The ARP table provides a mapping of the IP address and MAC address for a particular peering. The ARP table for an ExpressRoute circuit peering provides the following information for each interface (primary and secondary):

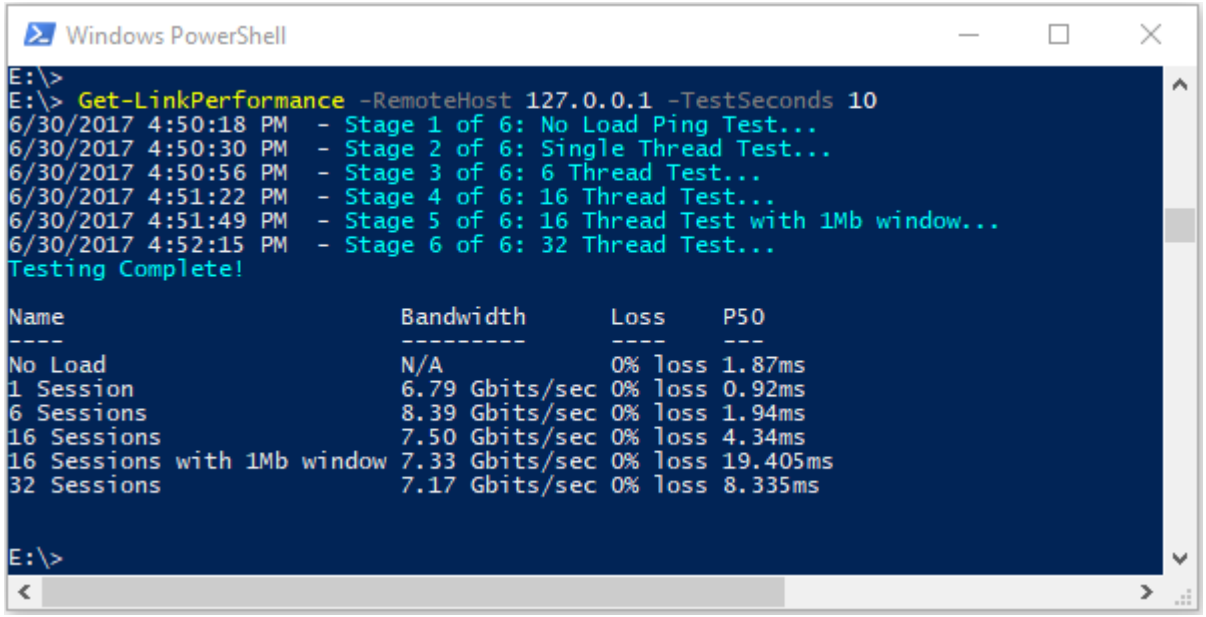
- Mapping of on-premises router interface ip address to the MAC address
- Mapping of ExpressRoute router interface ip address to the MAC address
- Age of the mapping ARP tables can help validate layer 2 configuration and troubleshooting basic layer 2 connectivity issues.

Troubleshooting network performance

Most network issues can be analyzed and isolated with Azure Network Watcher or PowerShell and CLI

To help with troubleshooting, the Azure Connectivity Toolkit (AzureCT) was developed to put some of these tools in an easy package.

These tools and methods are wrapped into a PowerShell module (AzureCT) that you can install and use



Troubleshoot ExpressRoute connection issues - Review

Knowledge Check

Microsoft Learn Modules (docs.microsoft.com/Learn)

Azure ExpressRoute: Verify Connectivity - Troubleshooting Guide | Microsoft Docs

Troubleshoot network link performance: Azure | Microsoft Docs

Reset a failed circuit - ExpressRoute: PowerShell: Azure | Microsoft Docs

End of presentation