

Lumen® Cloud Connect: EVPL to Microsoft Azure

Direct, secure, private connection to Microsoft Azure using Azure portal and Azure Resource Manager (ARM)

LUMEN®

Purpose

- The purpose of this document is to provide an end-to-end walkthrough to set up ExpressRoute for the first time using Lumen Cloud Connect.
- Information contained is provided to serve as a supplement to Microsoft documentation linked throughout this document. Be sure to check the provided links to obtain the most up-to-date information and for more details pertaining to Microsoft processes.

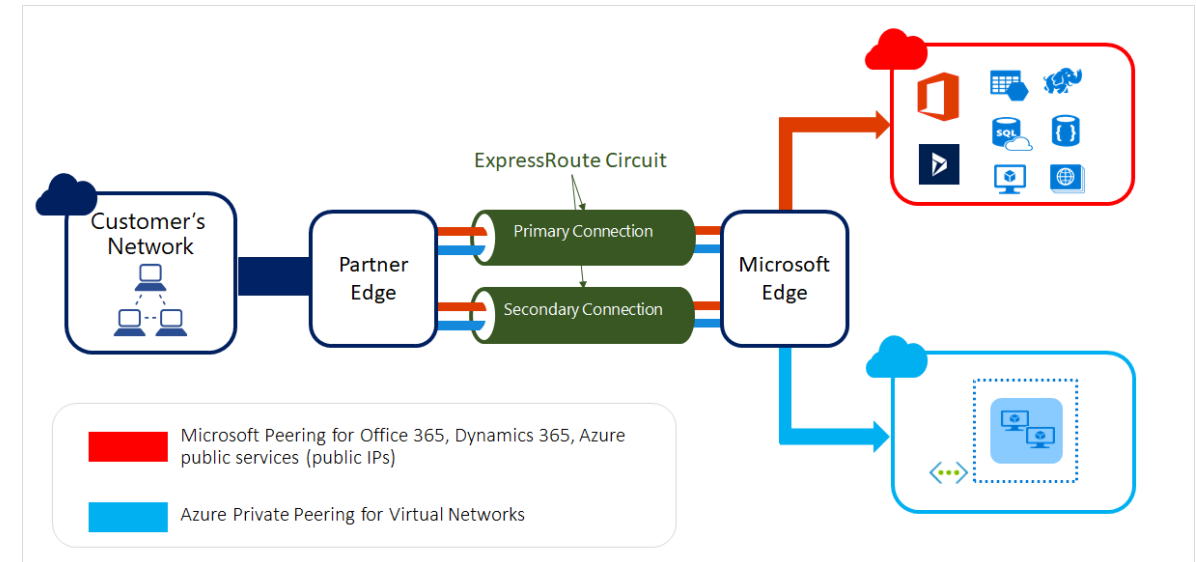
Disclaimer: The material in this guide is for informational purposes only and is taken from Microsoft Azure's website material. All Microsoft related configuration information is based off of the Azure Resource Manager (ARM) portal environment.

Roles and responsibilities

Steps required to set up Azure ExpressRoute connectivity	End customer	Lumen	Microsoft Azure (Automated via portal)
Set up physical connectivity to Azure ExpressRoute location			
Decide on the type of BGP peering required (Azure private peering—IaaS or Microsoft peering—PaaS/SaaS)	X		
Order layer-2 EVPL Cloud Connect service to Azure ExpressRoute location from Lumen representative	X		
Order Microsoft Azure ExpressRoute connection using Azure portal. Select Level 3 Communications – EXCHANGE as the service provider name with the appropriate bandwidth and location. (For more details, contact your Cloud Connect solutions architect.)	X		
Provision layer-2 EVPL service device with VLAN tag, connecting to Microsoft Azure ExpressRoute		X	
Provision ExpressRoute circuit and provide the ExpressRoute service key to Lumen	X		X
Set up BGP peering between your edge router and Azure edge device			
Configure BGP peering on your routers	X		
Configure BGP peering on Azure side	X		
*** Configure BGP route filtering (required for Microsoft peering PaaS/SaaS)	X		
Link services on Azure to the dedicated circuit			
Link virtual network(s) to the dedicated circuit*	X		
*Connectivity to services hosted on public IPs is enabled as soon as the dedicated circuit has been enabled			

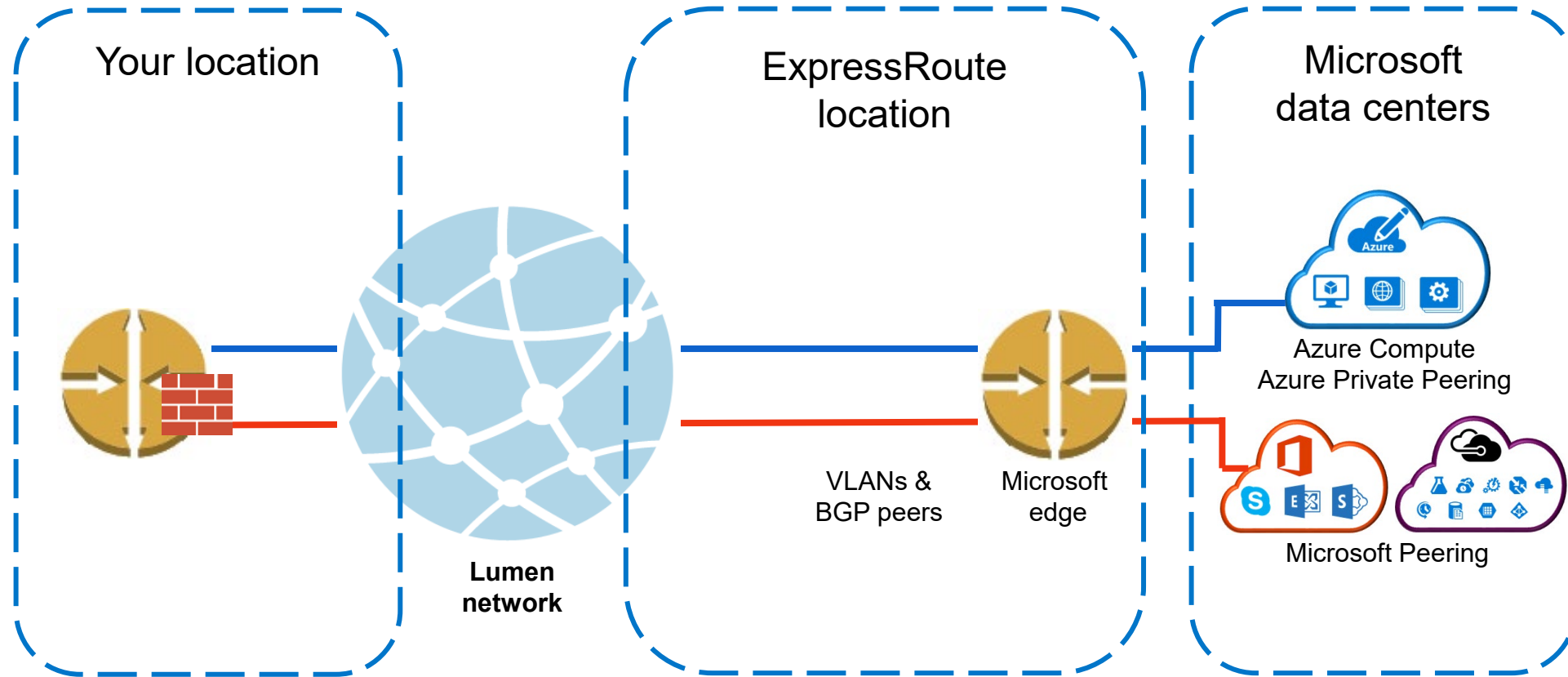
Background information

- Microsoft Azure ExpressRoute lets you create private connections between Microsoft datacenters and the infrastructure that's in a co-location environment or at a customer premise. ExpressRoute connections offer higher security, more reliability, faster speeds and predictable latencies than typical connections over the Internet. In some cases, using ExpressRoute connections to transfer data between your on-premises network and Azure can also yield significant cost benefits.
- Azure offers circuit bandwidths from 50Mbps to 10Gbps (50Mbps, 100Mbps, 200Mbps, 500Mbps, 1Gbps, 2Gbps, 5Gbps, and 10Gbps).
- Azure compute services, namely virtual machines (IaaS) and virtual networks (VNETs) deployed within a virtual network can be connected through the Azure private peering domain.
- PaaS services such as Azure Storage, SQL databases, and web apps are offered on public IP addresses. You can privately connect to services hosted on public IP addresses, including VIPs of your cloud services, through the Microsoft peering routing domain. You can connect the Microsoft peering domain to your extranet and connect to all Azure services on their public IP addresses from your location without having to connect through the internet
- [Learn more about Microsoft ExpressRoute](#)



	Private Peering	Microsoft Peering
Max. # prefixes supported per peering	4000 by default, 10,000 with ExpressRoute Premium	200
IP address ranges supported	Any valid IP address within your WAN.	Public IP addresses owned by you or your connectivity provider.
AS Number requirements	Private and public AS numbers. You must own the public AS number if you choose to use one.	Private and public AS numbers. However, you must prove ownership of public IP addresses.
IP protocols supported	IPv4 and IPv6	IPv4 and IPv6
Routing Interface IP addresses	RFC1918 and public IP addresses	Public IP addresses registered to you in routing registries.
MDS Hash support	Yes	Yes

Cloud Connect for Microsoft ExpressRoute



- For connections to Microsoft Azure, your equipment must support Q-in-Q (see page 14).
- You are responsible for express route costs and configuration.
- When accessing Microsoft peering for PaaS/SaaS services, you must provide firewall / NAT services.

Private peering ————
Microsoft peering ————

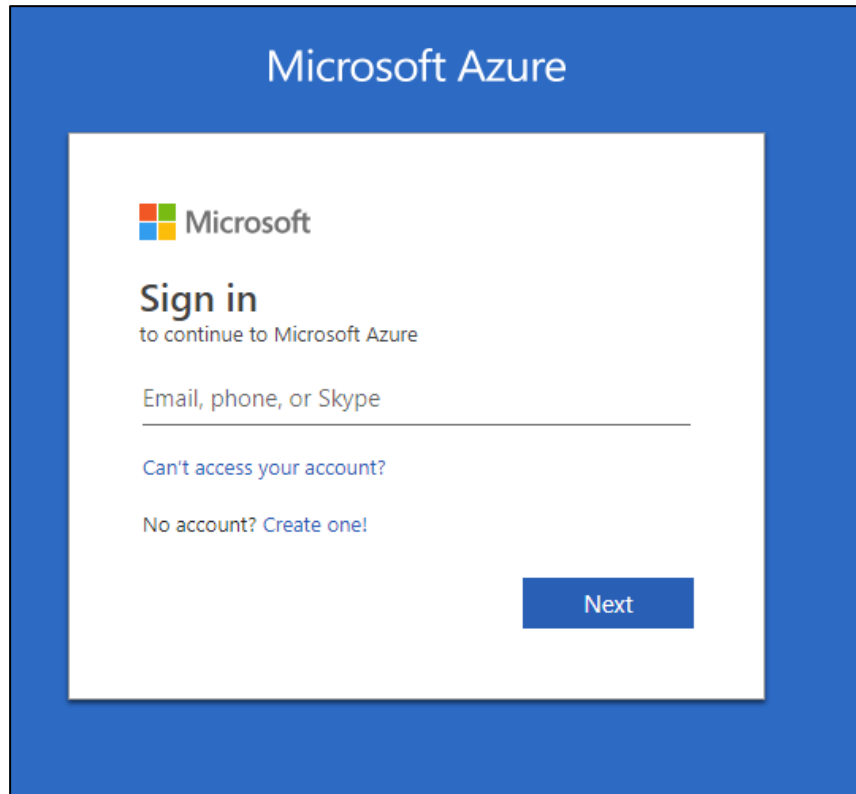
High-level step review

1. Sign in to Azure portal
2. Create a new ExpressRoute circuit
3. View the circuits and properties
4. Request Lumen Cloud Connect service
5. Upon request, send the service key to Lumen technical design engineer for Cloud Connect provisioning
6. Lumen provisions layer-2 from customer to Microsoft ExpressRoute
7. Customer completes layer-3 configuration, attaching any VNETs and/or accessing any Public/Office365 resources

Source: <https://azure.microsoft.com/en-us/documentation/articles/expressroute-howto-circuit-portal-resource-manager/>

Sign in to Azure portal

- <http://portal.azure.com/>



The image shows a screenshot of the Microsoft Azure sign-in page. The page has a blue header with the text "Microsoft Azure". Below the header is a white box containing the Microsoft logo and the text "Sign in to continue to Microsoft Azure". There is a text input field labeled "Email, phone, or Skype". Below the input field are two links: "Can't access your account?" and "No account? Create one!". At the bottom right of the white box is a blue button labeled "Next".

Create a new ExpressRoute circuit

- After clicking ExpressRoute, portal will display 'Create ExpressRoute circuit' blade. When filling in the values on this blade, here are some helpful tips:
- Select the provider as Level 3 Communications – EXCHANGE
- Select the appropriate ExpressRoute location.
 - Note: Silicon Valley = San Jose; Washington DC = Ashburn
- Specify the correct SKU for Tier and Data Metering:
 - SKU / Tier determines whether an ExpressRoute standard or an ExpressRoute premium add-on is enabled.
 - Billing Model / Data Metering determines the billing type that Microsoft will use to bill the customer directly for ExpressRoute.
 - Note that the billing type can be changed from Metered to Unlimited, but may not be changed from Unlimited to Metered
- Select the appropriate Subscription and Resource Group
 - User must have a subscription type set, such as Pay-As-You-Go
 - A Resource group is a collection of resources that share the same lifecycle, permissions, and policies.
 - Additional information can be found here: <https://azure.microsoft.com/en-us/documentation/articles/resource-group-portal/>

Important: The **Peering location** indicates the physical location where you are peering with Microsoft. This is not linked to **Location** property, which refers to the geography where the Azure network resource provider is located.

The screenshot shows the 'Create ExpressRoute circuit' blade in the Microsoft Azure portal. The 'Provider' dropdown menu is highlighted with an orange box, showing 'Level 3 Communications - EXCHANGE'. Other fields include Circuit name (Test_Circuit), Peering location (Silicon Valley), Bandwidth (50Mbps), SKU (Standard), Billing model (Metered), Subscription (Pay-As-You-Go), Resource group (PSBTEST), and Location (West US). The 'Create' button is visible at the bottom.

Create a new ExpressRoute circuit, cont.

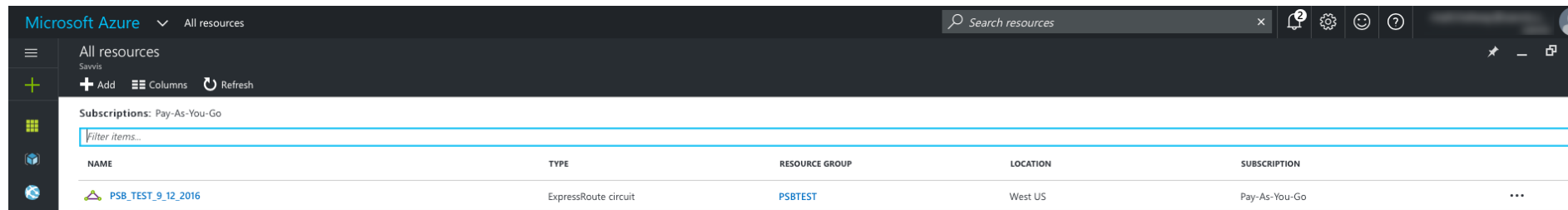
- Create an ExpressRoute circuit by selecting the option to create a new resource.

The screenshot shows the Microsoft Azure Marketplace interface. The left sidebar lists various service categories. The top navigation bar shows the breadcrumb path: New > Marketplace > Everything > ExpressRoute. A search bar in the center contains the text 'expressroute'. Below the search bar, a table displays search results. The first result, 'ExpressRoute' by Microsoft, is highlighted. A 'Create' button is visible at the bottom right of the results section.

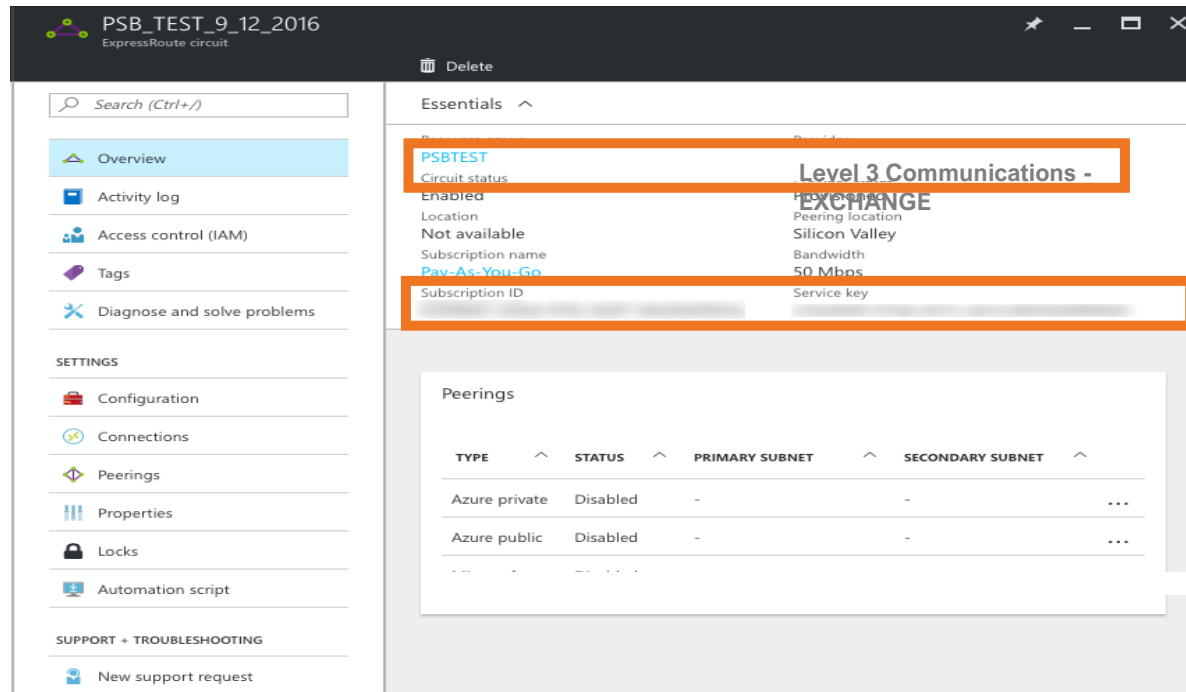
NAME	PUBLISHER	CATEGORY
ExpressRoute	Microsoft	Networking
Virtual network gateway	Microsoft	Networking
App Service Environment	Microsoft	Web + mobile
Connection	Microsoft	Networking
BizTalk360	Kovai Limited	Compute

View the circuits and properties

- View all created ExpressRoute circuits by selecting All resources on the left menu.



NAME	TYPE	RESOURCE GROUP	LOCATION	SUBSCRIPTION
PSB_TEST_9_12_2016	ExpressRoute circuit	PSBTEST	West US	Pay-As-You-Go



PSB_TEST_9_12_2016
ExpressRoute circuit

Delete

Search (Ctrl+/)

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

SETTINGS

Configuration

Connections

Peerings

Properties

Locks

Automation script

SUPPORT + TROUBLESHOOTING

New support request

Essentials

PSBTEST

Circuit status: Enabled

Location: Not available

Subscription name: Pay-As-You-Go

Subscription ID: [REDACTED]

Level 3 Communications - EXCHANGE

Peering location: Silicon Valley

Bandwidth: 50 Mbps

Service key: [REDACTED]

Peerings

TYPE	STATUS	PRIMARY SUBNET	SECONDARY SUBNET
Azure private	Disabled	-	-
Azure public	Disabled	-	-

Request Lumen Cloud Connect service

- To order a Lumen Cloud Connect, contact your Lumen representative. Information needed by Lumen to complete connection:
 - Microsoft Azure ExpressRoute service key completed during Lumen provisioning steps
 - Request Cloud Connect to the appropriate Azure ExpressRoute location
 - Bandwidth of EVPL connection requested (typically matches ExpressRoute speed)
 - What Azure service(s) are you connecting to:
 - Azure private peering (Compute/IaaS)
 - Microsoft peering (Azure PaaS, Office 365, Dynamics 365, etc.)
 - Cloud Connect contractual term length: 1 year, 3 years, etc.

Upon request, send the service key to Lumen for Cloud Connect provisioning

- The Lumen technical design engineer will request the ExpressRoute service key from you before provisioning but after order entry.
- On this blade, Provider status provides information on the current state of provisioning on the service-provider (Lumen) side. Circuit status provides the state on the Microsoft side.
- When creating a new ExpressRoute circuit, the circuit will be in the following state:
 - Provider status: Not provisioned
 - Circuit status: Enabled
- The circuit will change to the following state when the connectivity provider (Lumen) is in the process of enabling it:
 - Provider status: Provisioning
 - Circuit status: Enabled
- To be able to use an ExpressRoute circuit, the circuit must be in the following state:
 - Provider status: Provisioned
 - Circuit status: Enabled

Essentials ^

Resource group	Provider
PSBTEST	Level 3 Communications - EXCHANGE
Circuit status	Provider status
Enabled	Provisioned
Location	Peering location
Not available	Silicon Valley
Subscription name	Bandwidth
Pay-As-You-Go	50 Mbps
Subscription ID	Service key

Peerings

TYPE ^	STATUS ^	PRIMARY SUBNET ^	SECONDARY SUBNET ^	
Azure public	Disabled	-	-	...
Microsoft	Disabled	-	-	...

Lumen provisions Cloud Connect to ExpressRoute

- Upon network order submission, Lumen provisions a layer-2 EVPL connection from your location to the requested ExpressRoute Location
- Turn up of Layer 2 EVPL service to local ExpressRoute interconnect point: Lumen configures layer-2 VLAN(s) between Lumen and Microsoft and between Lumen and your location.
- Lumen completes configuration and provides you with layer-2 VLAN information for equipment and Azure configurations you need to complete.
- You configure appropriate layer-2 VLAN tagging on equipment using Q-in-Q tagging configuration. (Note that the Lumen EtherType specification of double-tagged frames is for both inner and outer tags to be 0x8100.)
- Turn up of layer-3 BGP/routing between your location and Azure: You configure layer-3/BGP on your router and on Azure side via the customers Azure portal account.

Microsoft peering now supports Azure public (PaaS) services

- Microsoft has announced they are combining both their PaaS/SaaS services over a single pair of BGP Peers (Microsoft Peering)
- Before April 1, 2018, ExpressRoute had three peering connections:
 - Azure Private (IaaS) peering for connecting to Azure VNets
 - Azure Public (PaaS) peering to reach Azure PaaS services
 - Microsoft Peering (SaaS) for Office 365 and Dynamics 365
- To simplify ExpressRoute management and configuration, Microsoft has merged Azure public routes into the Microsoft Peering connection:
 - You can now access Azure PaaS and Microsoft SaaS services via the Microsoft peering connection
 - You now only need two peering types (Private / MSFT Peering)
 - Refer to the following to move public peering to Microsoft peering: <https://docs.microsoft.com/en-us/azure/expressroute/how-to-move-peering>
- Note: While you can receive all PaaS/SaaS services over MSFT Peering, the Office365 service still requires you to apply for approval directly with Microsoft to enable the Office365 service via ExpressRoute. All other services can be accessed via the MSFT Peering VLAN without a prior approval.
- Additional guidance and direction from Microsoft:
 - [Azure ExpressRoute for Office 365](#)
 - [Network connectivity to Office 365](#)

Workflow for Microsoft peering

- To be able to successfully connect to services through Microsoft peering, you must complete the following configuration steps:
 - You must have an active ExpressRoute circuit that has Microsoft peering provisioned. You can use the following instructions to accomplish these tasks:
 - Create an ExpressRoute circuit and have the circuit enabled by your connectivity provider before you proceed. The ExpressRoute circuit must be in a provisioned and enabled state.
 - You can then provision Microsoft peering for the circuit.
 - You must create and configure a route filter
 - Identify the services you want to consume through Microsoft peering
 - Identify the list of BGP community values associated with the services
 - Create a rule to allow the prefix list matching the BGP community values
 - You must attach the route filter to the ExpressRoute circuit

Source: <https://azure.microsoft.com/en-us/documentation/articles/expressroute-howto-circuit-portal-resource-manager/>

Microsoft ExpressRoute resources

Introduction	https://azure.microsoft.com/en-us/documentation/articles/expressroute-introduction/
FAQ	https://azure.microsoft.com/en-us/documentation/articles/expressroute-faqs/
Pricing	http://azure.microsoft.com/pricing/details/expressroute/ <ul style="list-style-type: none">• Use exchange provider pricing• There is a Premium if you need >4k routes or ability to reach other global regions
Prerequisites	https://azure.microsoft.com/en-us/documentation/articles/expressroute-prerequisites/
Circuits & routing domains	https://azure.microsoft.com/en-us/documentation/articles/expressroute-circuit-peerings/
Partners & peering locations	https://azure.microsoft.com/en-us/documentation/articles/expressroute-locations/
Azure Regions	http://azure.microsoft.com/en-us/regions/
Designing Materials	<ul style="list-style-type: none">• https://azure.microsoft.com/en-us/documentation/articles/expressroute-routing/• https://azure.microsoft.com/en-us/documentation/articles/expressroute-nat/
Configuration Materials	<ul style="list-style-type: none">• https://azure.microsoft.com/en-us/documentation/articles/expressroute-howto-circuit-arm/• https://azure.microsoft.com/en-us/documentation/articles/expressroute-howto-routing-arm/• https://azure.microsoft.com/en-us/documentation/articles/expressroute-howto-linkvnet-arm/• https://azure.microsoft.com/en-us/documentation/articles/expressroute-howto-vnet-portal-arm/
Diversity	<ul style="list-style-type: none">• Single port includes diversity from IQ+ edge to Microsoft• PE/Path diversity available by ordering 2 IQ ports which would require only a single ExpressRoute subscription• Full diversity achieved by ordering at 2 separate locations which would require multiple ExpressRoute subscriptions
Notes	<ul style="list-style-type: none">• Azure data center public IP blocks: http://www.microsoft.com/en-us/download/details.aspx?id=41653• Dynamic routing via BGP• Azure Compute supports bring your own private IP

Microsoft Office365 resources

Microsoft Office365 via ExpressRoute approval form	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbRyOZxByRF1dLgv7k6ye5z8pUQkdLRTQ5QkcyOTU3VkNEOfdOWk9IRDZTUy4u
Overview	https://support.office.com/en-us/article/Azure-ExpressRoute-for-Office-365-6d2534a2-c19c-4a99-be5e-33a0cee5d3bd?ui=en-US&rs=en-US&ad=US
O365 traffic management	https://support.office.com/en-us/article/Office-365-network-traffic-management-e1da26c6-2d39-4379-af6f-4da213218408?ui=en-US&rs=en-US&ad=US
Client Connectivity	https://support.office.com/en-us/article/Client-connectivity-4232abcf-4ae5-43aa-bfa1-9a078a99c78b
QoS	https://azure.microsoft.com/en-us/documentation/articles/expressroute-qos/
Office 365 locations	https://www.microsoft.com/online/legal/v2/?docid=25 <ul style="list-style-type: none">• O365 has a primary & DR site for each tenant.• Internet access will be proxied through the closest O365 location and backhauled on Microsoft backbone
Address blocks	https://support.office.com/en-us/article/Office-365-URLs-and-IP-address-ranges-8548a211-3fe7-47cb-abb1-355ea5aa88a2
CDN usage	https://support.office.com/en-us/article/Content-delivery-networks-0140f704-6614-49bb-aa6c-89b75dcd7f1f
Network planning	https://support.office.com/en-us/article/Network-planning-and-performance-tuning-for-Office-365-e5f1228c-da3c-4654-bf16-d163daee8848
Implementing ExpressRoute for Office 365	https://support.office.com/en-us/article/Implementing-ExpressRoute-for-Office-365-77735c9d-8b80-4d2f-890e-a8598547dea6
O365 step-by-step installation	https://support.office.com/en-us/article/Download-and-install-or-reinstall-Office-365-Office-2016-or-Office-2013-on-your-PC-or-Mac-4414eaaf-0478-48be-9c42-23adc4716658?ui=en-US&rs=en-US&ad=US
Route filters	https://docs.microsoft.com/en-us/azure/expressroute/how-to-routefilter-portal