Using Dell Technologies APEX Data Storage Services at Equinix

A Detailed Review

December 2021

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White Paper

Abstract

This white paper discusses APEX Data Storage Services at an Equinix International Business Exchange including the use of Equinix Metal, Equinix Fabric, and cloud compute.

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Overview

As-a-Service models are growing more attractive as a way to achieve simplicity, reduce expenses, and align with organizational objectives. Choice, agility, and the ability to treat storage capacity as an operating expense (OpEx) are all reasons why the adoption of as-a-Service is predicted to grow significantly in the coming years. Storage as-a-Service should be a consideration for any IT organization with the need to optimize its data storage environment, meet changing demands, and focus on delivering outcomes that align with business goals.

The Dell Technologies APEX Data Storage Services offering enables customers to optimize for simplicity by eliminating over- and under-purchasing as well as complex procurement and migration cycles. Customers can easily manage their as-a-Service experience through a single interface called the APEX Console. Increase agility by scaling up and down to respond dynamically to customer and workload requirements, and only pay for what is used at a single rate with no overage fees. APEX Services are designed to be deployed in a customer data center, an edge location, or a colocation facility such as an Equinix data center.

Dell Technologies has partnered with Equinix, allowing APEX Data Storage Services to be deployed in Equinix International Business Exchange™ (IBX®) data centers. This gives customers the opportunity to build and interconnect foundational digital infrastructure that leverages the best of APEX Data Storage Services and the vibrant multi-cloud ecosystem on Platform Equinix®. The combined effect provides choice, mobility, cost, and performance advantages for customers.

Audience

This document is intended for IT administrators, storage architects, partners, and Dell Technologies™ or Equinix employees. This audience also includes any individuals who may evaluate, acquire, manage, operate, or design a storage environment using APEX Data Storage Services systems in an Equinix IBX data center.

Revisions

Date	Description
December 2021	Initial release

We value your feedback

Dell Technologies and the authors of this document welcome your feedback on this document. Contact the Dell Technologies team by email.

Author: Bryan McFeeters

Contributors: Wei Chen, Ryan Poulin

Overview

Dell Technologies APEX Data Storage Services is an as-a-Service portfolio of scalable and elastic storage resources. The underlying infrastructure is selected to match storage needs, which include the data service type (block or file), performance requirements, and capacity. When deployed within an Equinix location, multiple compute and networking options are available for the APEX Data Storage Services solution. These are outlined below and discussed in detail later in this paper.

Compute

The type of compute resource utilized can be selected depending on and driven by customer requirements. The compute resource can either be customer owned hardware deployed within an Equinix location, Equinix Metal, or compute located within a cloud provider. Customers can also leverage a combination of these, which provides flexibility within the solution. For whichever option is selected, the customer is responsible for the configuration and connectivity of the compute resource chosen to work with the APEX Data Storage Services system.

Utilizing customer owned compute resources such as Dell PowerEdge or other x86 based servers is not a problem when APEX Data Storage Services is located within an Equinix facility. Multiple colocation solutions are provided for customers who want to utilize their own IT infrastructure within an Equinix data center. Customer owned hardware can be installed within an Equinix provided server cabinet, cage, or suite based on equipment size and other requirements such as power and cooling. Physical security requirements are also considered. With each option the hardware is interconnection-ready providing private, local, and virtual interconnections to other services such as Dell Technologies APEX Data Storage Services. For this type of configuration, the compute must be physically located within the same metro area as the APEX Data Storage Services system.

Customers who want to utilize physical compute resources can also leverage Equinix Metal. Equinix Metal allows customers to reserve and deploy high-performance bare metal servers from Equinix within minutes. This hardware, which includes Dell PowerEdge servers, is deployed and operated by Equinix for customer use and can be reserved for a committed period of time. A wide variety of servers are available, along with different CPU, RAM, network, and storage configurations. Once the hardware is reserved and configured, the Equinix Metal portal and Equinix Fabric portal can used to connect to the server to the APEX Data Storage Services system.

Dell Technologies APEX Data Storage Services also supports compute located within a public cloud. When APEX Data Storage Services is installed within an Equinix facility, Equinix Fabric can be leveraged to allow cloud compute to connect to the APEX Data Storage Services system. Dell Technologies APEX Data Storage Services supports compute located within Amazon Web Services via AWS Direct Connect and Microsoft Azure with ExpressRoute.

Networking

Once the APEX Data Storage Services system is installed, connectivity to the compute resource must be ordered and configured by the customer. Equinix Fabric is utilized to establish connectivity between the physical or cloud-based compute resources and the APEX Data Storage Services system. Equinix Fabric provides low-latency private connections running over a purpose-built Layer 2 network within Equinix. Once connectivity is established, storage can be provisioned from the APEX Data Storage Services system to the compute resource.

Storage

For some storage features and functionality, additional network services such as DNS, NTP, etc. may be required to be installed and available. For more information on the post deployment configuration and prerequisites for APEX Data Storage services in a Equinix colocation facility and how to leverage more advanced capabilities it is important to review our onboarding guide, "Dell Technologies APEX Data Storage Services Onboarding Guide for Dell-managed Colocation Offers" as well as more detailed information on our storage subsystems:

- https://www.delltechnologies.com/asset/en-us/products/storage/industry-market/h16463-isilon-advanced-networking-fundamentals.pdf

- https://dl.dell.com/topicspdf/pwrstrt-ntwkg_en-us.pdf

Connectivity and Compute Billing

The subscription invoice for APEX Data Storage Service within Equinix accounts is for the storage infrastructure and its connection to the Equinix Fabric for management and data access. The cost for utilizing Equinix Metal or another cloud service provider for compute as well as the necessary connection to Equinix Fabric to complete the connection is the responsibility of the user. If using Azure or AWS for cloud compute, the egress pricing is lower than a direct internet connection when leveraging Equinix's connectivity with Azure ExpressRoute and AWS Direct Connect respectively. Additional details on compute and connectivity pricing can be found on the following sites:

- https://metal.equinix.com/product/servers/

- https://azure.microsoft.com/en-us/pricing/details/expressroute/#pricing

- https://aws.amazon.com/directconnect/pricing/

Terminology

The following table provides definitions for some of the terms that are used in this document.

Table 1.   Terminology

Term	Definition
Equinix Fabric	A software-defined interconnection service that allows any business to connect its own distributed infrastructure to any other company's infrastructure on Platform Equinix across a globally connected network.
Azure ExpressRoute	A network solution that provides a private connection to Azure cloud services which does not traverse through the Internet.
Equinix International Business Exchange (IBX)	An Equinix data center that is offered in 230 locations in more than 60 metros with availability exceeding 99.999%
AWS Direct Connect	A network solution that provides a private connection to AWS cloud services which does not traverse through the Internet.
Equinix Metal	An automated, interconnected, low-latency bare metal-as-a-service that is available in global locations across Platform Equinix.

Equinix Metal

Overview

APEX Data Storage Services integration within Platform Equinix allows you to leverage Equinix Metal and tap into it for interconnected, automated, scalable, secure, powerful compute-as-a-service resources.

Getting started is easy through the ordering process and subscription models from both companies providing flexibility, reduced management, and various combinations of infrastructure to meet the needs and deliver the desired outcomes for a myriad of projects. The combination of the services offered can help reduce costs associated with datacenter space, resources, and staffing while providing cloud connectivity access to data sources closer to the edge.

APEX Data Storage Services currently supports a dedicated port connection via Equinix Fabric to Equinix Metal server instances.

More information on the options and the benefits of dedicated connections is available through the Equinix Metal documentation website.

- https://metal.equinix.com/developers/docs/equinix-interconnect/introduction/
- https://metal.equinix.com/developers/docs/equinix-interconnect/interconnection-model/

Note: When requesting a new connection in the Equinix Metal portal be sure that you first select the project that contains the servers and VLANs you intend to use when the connection is completed.
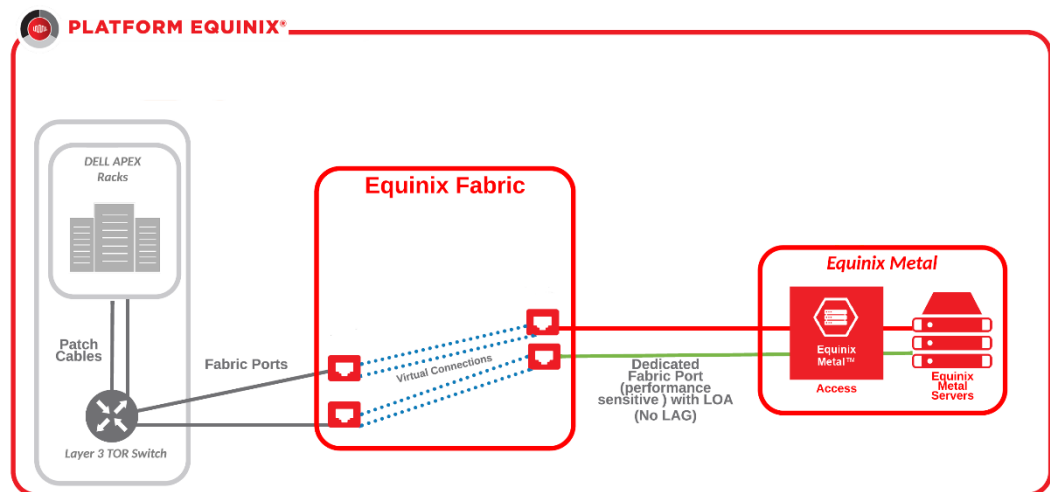

Figure 1.   **Metal connection types**

Dedicated Connections

Whether you are starting with existing Equinix Metal servers or planning to deploy both Equinix Metal and APEX Data Storage Services at the same time, the process for connecting the resources together is the same. Although the setup requires a Equinix Fabric account to complete, the overall process is simple and dedicated connections allow for better latency and traffic isolation.

Once you have Equinix Metal servers available that you want to connect to APEX Data Storage Services, you will need to decide on the network connection speed, single or redundant links, and the location of the storage that you want to use. The process for this is initiated through the Equinix Metal portal by navigating to the "IPs & Networks" area and selecting "Connections". Simply enter in the desired parameters, being sure to check the "Dedicated Port" checkbox and press the "Submit Connection Request" button.

Figure 2.   Creating a new Metal connection

After submitting the request, Equinix Metal support will contact you via email and their integrated web chat to walk you through the additional information, such as Equinix Fabric billing account, needed for them to create a Letter of Authority (LOA). Once that LOA is provided back, it can be used in the Fabric portal as part of requesting a new fabric port. The process and information required for ordering the dedicated port is documented by Equinix here:

- https://metal.equinix.com/developers/docs/equinix-interconnect/dedicated-ports-fabric/

Once the new port is configured by the Equinix Fabric team, the completion email is forwarded to Equinix Metal support to finalize the connection.

While the fabric port is being configured, a request can be made to APEX support services to configure the connection on the storage switch side and to generate a Z-side fabric token. Use this token along with the finalized fabric port to create a virtual connection by logging back in the Equinix Fabric portal and following the steps outlined below or in the Equinix documentation here:

- https://docs.equinix.com/en-us/Content/Interconnection/Fabric/service%20tokens/Fabric-create-connection-with-Zside.htm

In the Equinix Fabric portal after choosing to create a new connection you have many options available. Simply select the option to "Connect using a service token".
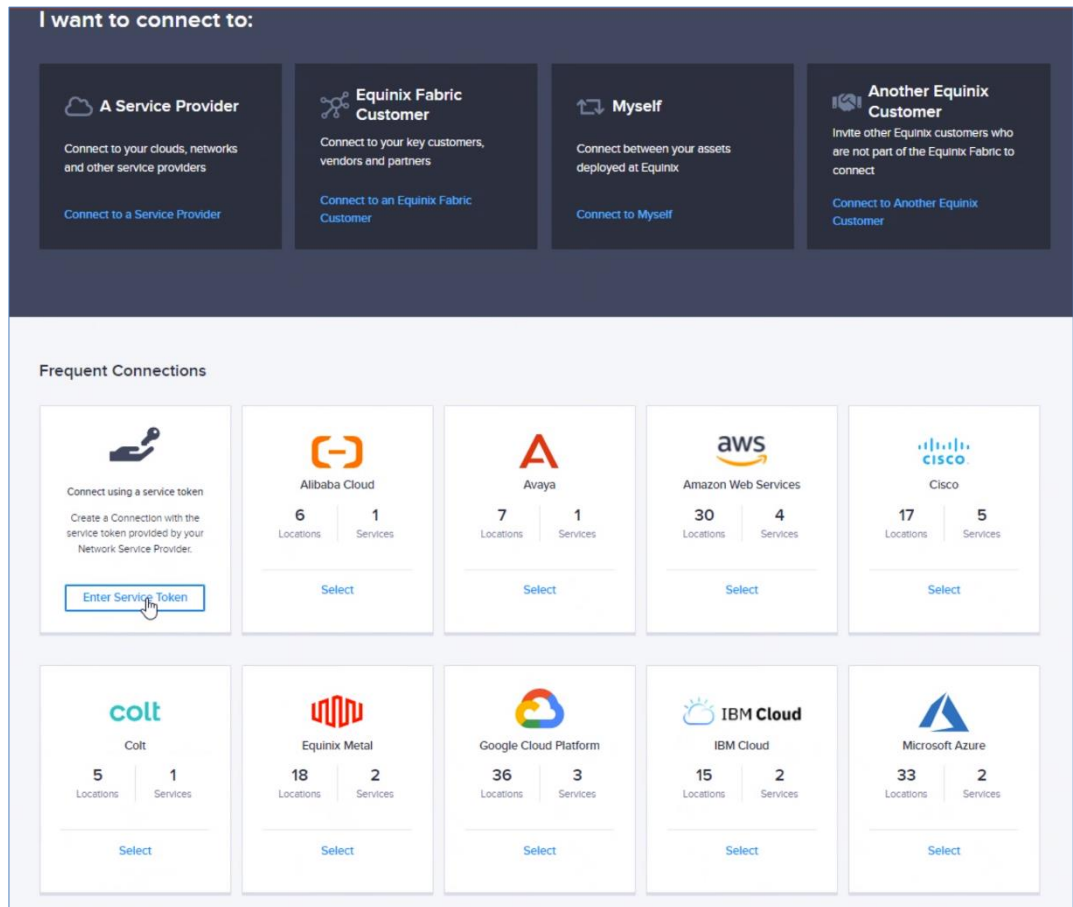

Figure 3. **Virtual connection with service token**

Validation, verification, and redemption of the service token is accomplished next by entering the token and viewing the resulting information.
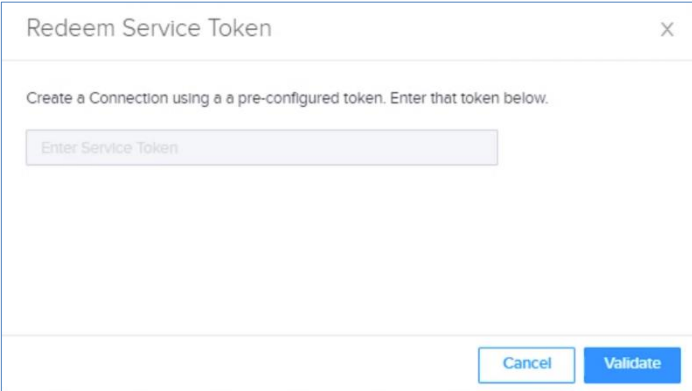
Figure 4.   **Enter the Z-side token**
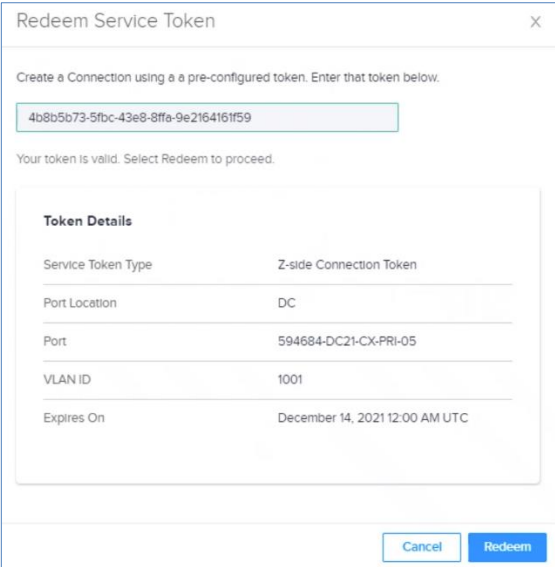
Figure 5.   **Verification of token information**

The destination (z-side) port information will be displayed in the next page and allow you to select the location and the associated dedicated metal port (a-side) for the virtual connection.
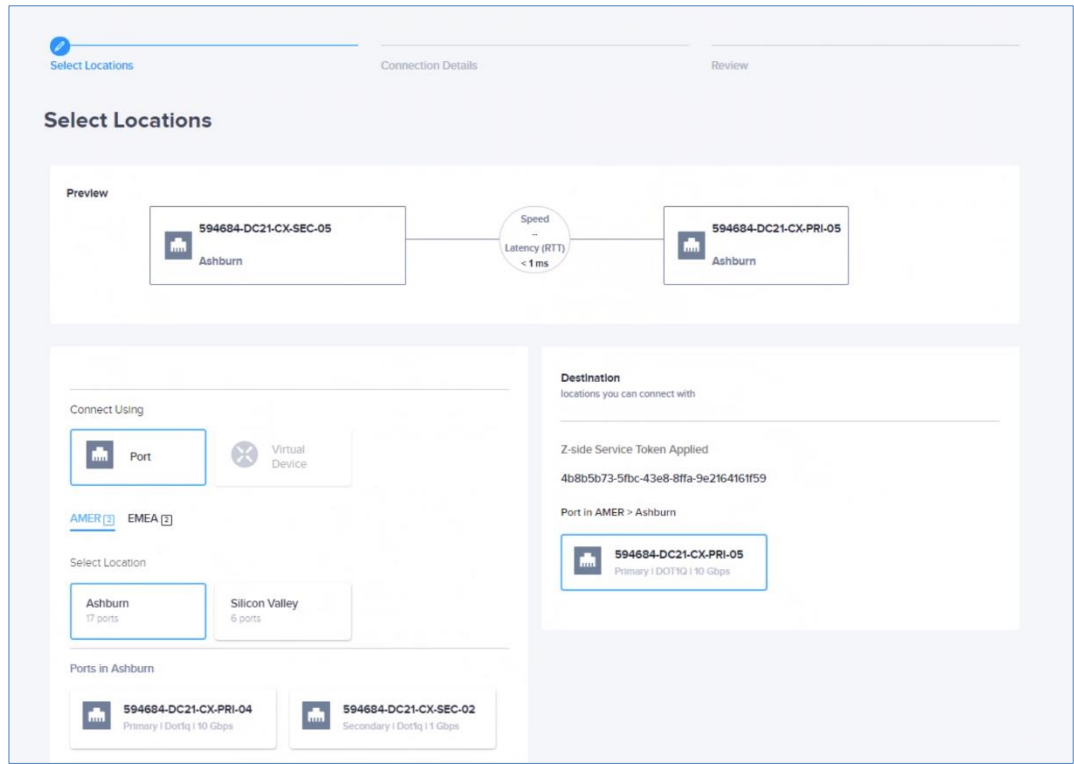
Figure 6.   A-side port selection

The next steps are to fill in the connection name, VLAN ID and on the next screen the desired connection speed.

Note: The VLAN ID entered for the virtual connection in the fabric portal can be any number between 2 and 4092 and will be used as the NNI VLAN in the Equinix Metal portal.
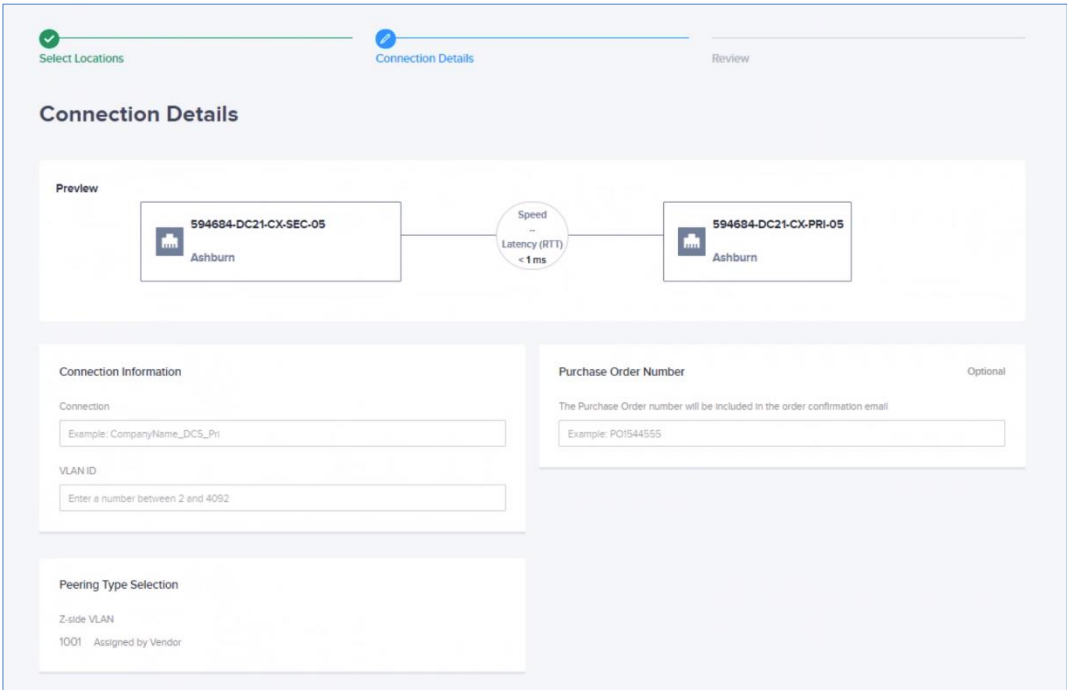
Figure 7. Connection details
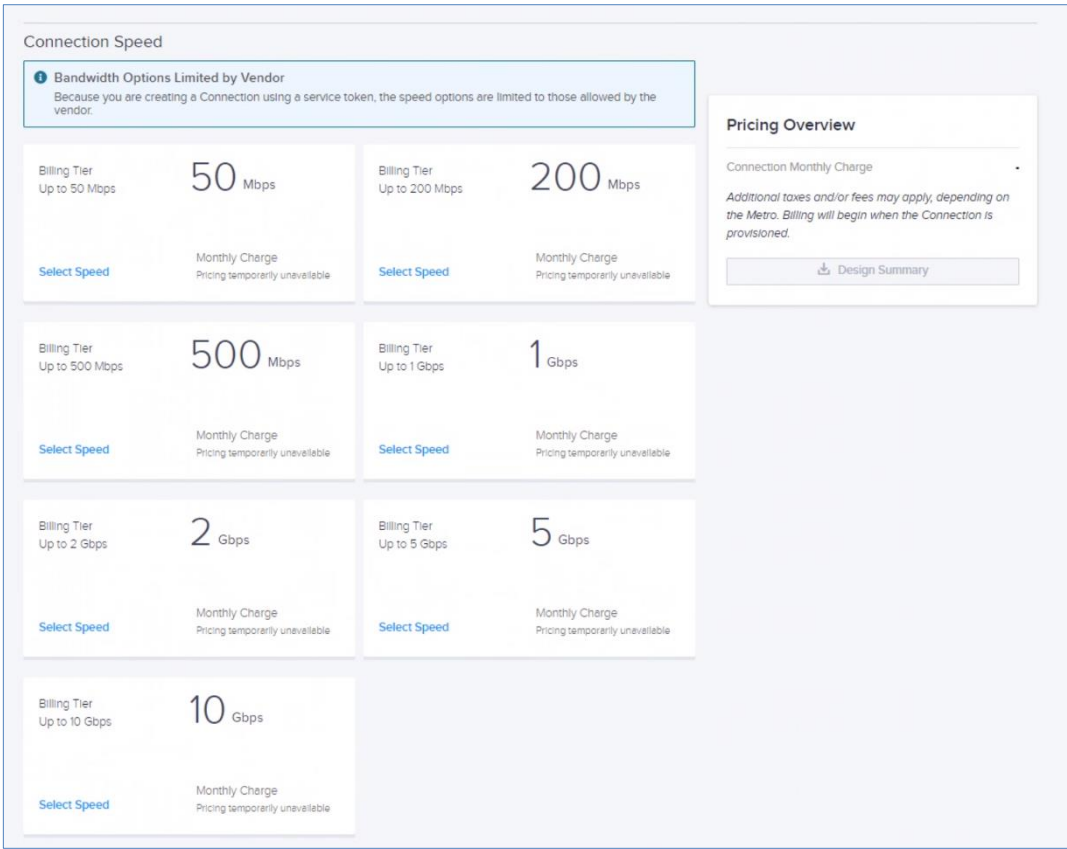
Figure 8. Connection speed

Finally, you can confirm all the parameters and submit the order for the virtual connection.
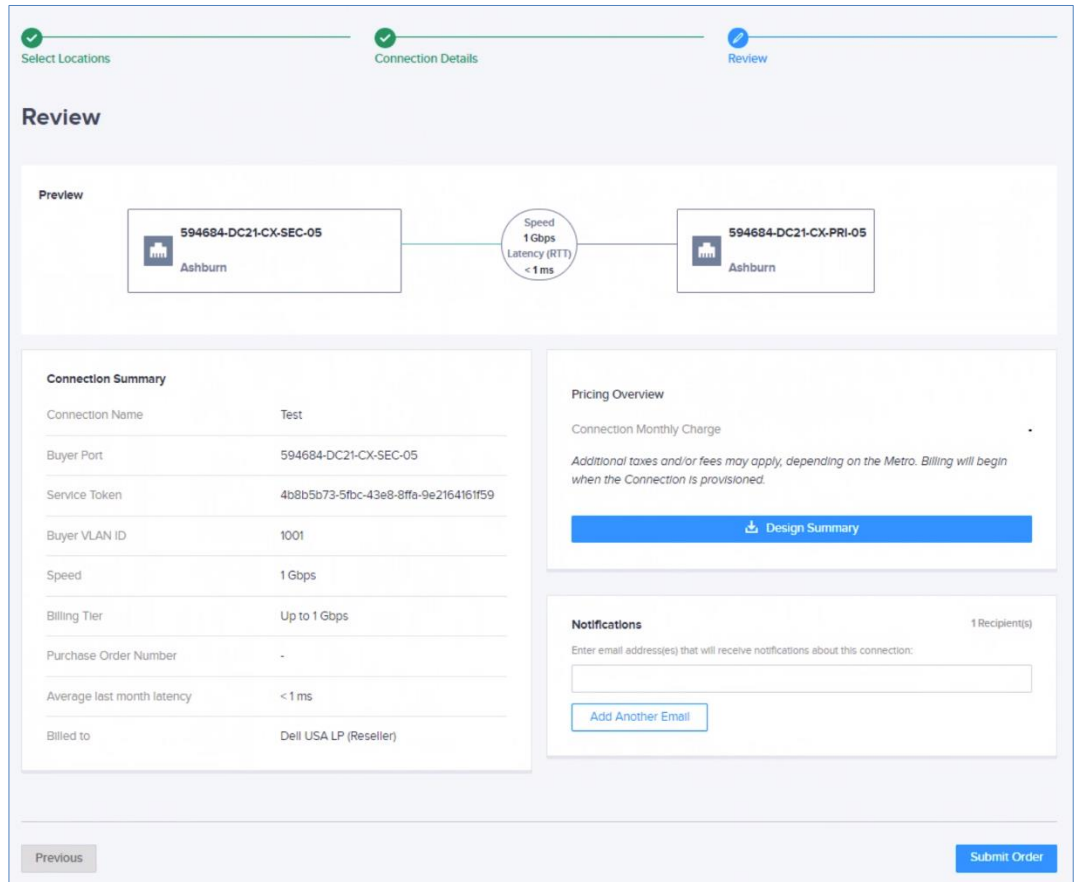
Figure 9.   Final order review

When notified from Equinix the end-to-end connection in is in place across Equinix Fabric, the Equinix Metal connection can be mapped from the NNI VLAN, used in the fabric connection, to the VLAN used on the storage and Equinix Metal server endpoint. That will allow any hosts within Equinix Metal using that VLAN to connect to the storage provided.

Back in the Equinix Metal portal, the desired host side VLANs can be added to the Equinix Metal Portal for use by Equinix Metal server instances in the appropriate location. Navigate to the "IPs & Networks" area again, chose "Layer 2" then click on "Add New VLAN" and enter a few simple parameters.
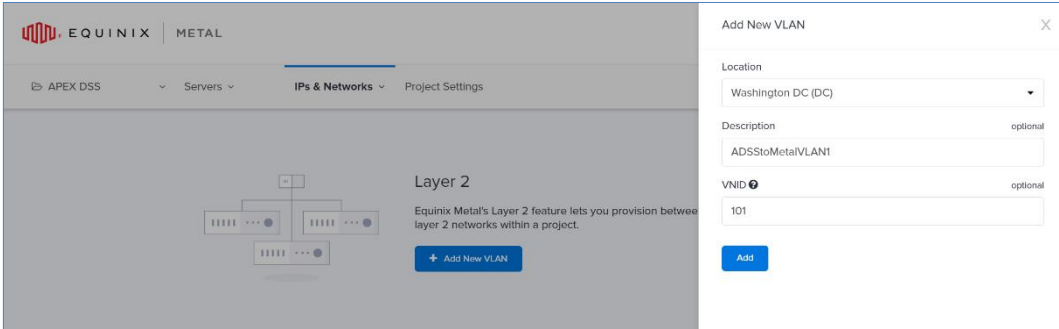
Figure 10.   Adding a new VLAN

For each port in a Metal connection, it is necessary add and map the NNI VLAN to the Metal VLAN that is going to be used by servers. This is done simply by clicking on the "Manage" button from withing a port details view in a Metal connection as shown in figure 11. The Metal VLAN ID can be any number from 2 to 3999, it does not have to match the VLAN used on the storage side.
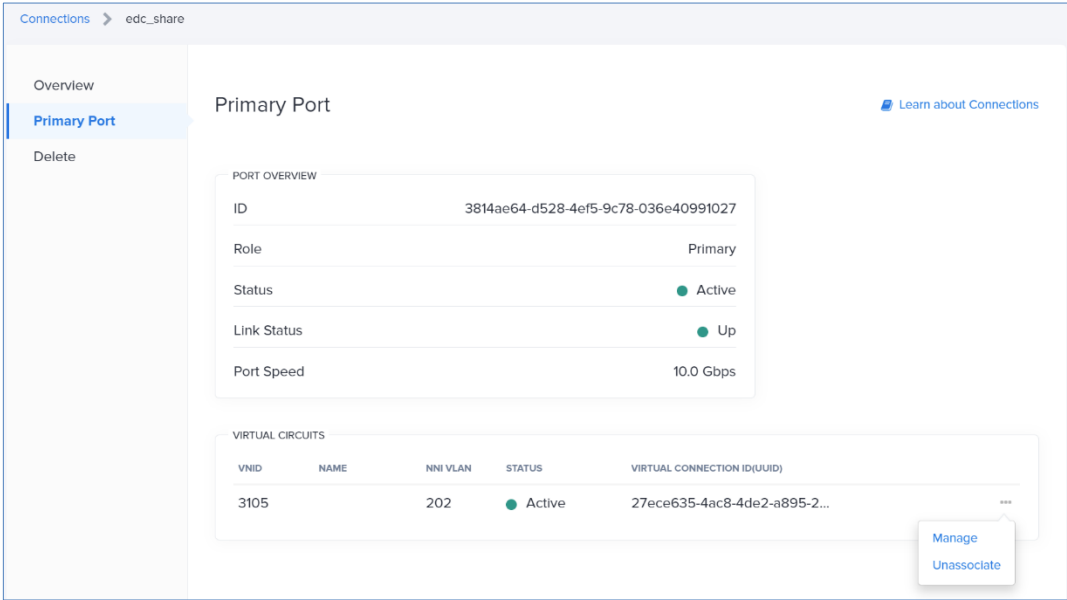
Figure 11.   Connection Port VLAN Mapping

At this point the VLAN mapped to the connection is available to add to any new server instances or existing server instances. If not set already change the network type on the server to "Layer 2" or "Hybrid" within the server instance network settings.
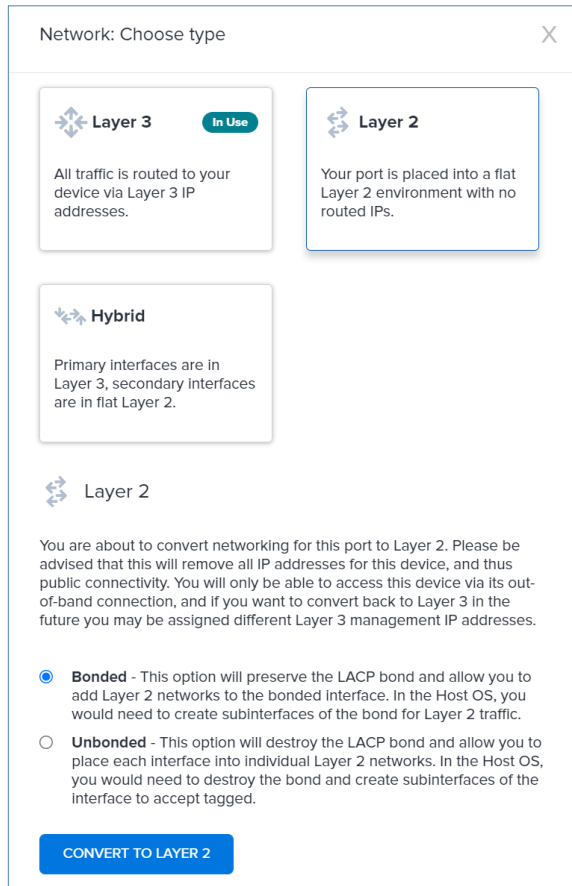
Figure 12.   Changing network configuration on a server

Once layer 2 networking is available on the Equinix Metal server instance, the previously used VLAN for data and storage management can be added using the "Add New VLAN" button.
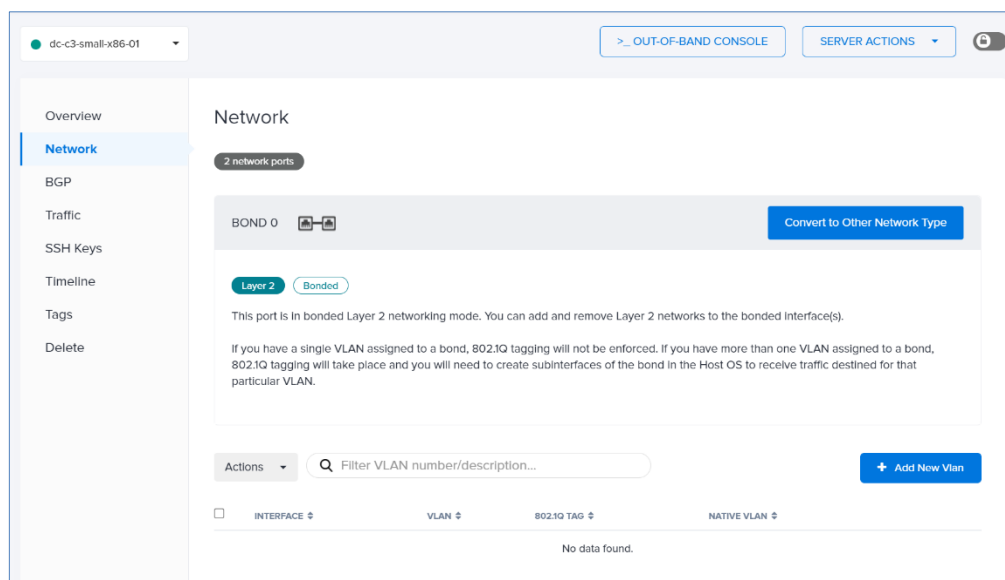
Figure 13.   Adding a VLAN to a server instance

After the connectivity is established to a server instance in the Equinix Metal portal, the next step is to finish the configuration of networking parameters inside the host's operating system to align with the Metal VLANs and data storage IP address/network scheme. Information for various operating systems is available through Equinix layer 2 networking documentation and developer guides.

- https://metal.equinix.com/developers/docs/layer2-networking/overview/

- https://metal.equinix.com/developers/guides/vmware-esxi/

Provisioning Block and File Storage

For control and management of the file and block storage from APEX Data Storage Services within Equinix, a host running a supported web browser with connectivity to the storage network is required. This management host could be a Equinix Metal instance running Microsoft Windows or Linux or even a virtual machine running those operating systems. The only requirement is to have network connectivity to the storage subnet.

An alternative to having a host with a web browser within Equinix would be to piggyback on a host that has a SSH server and tunnel web browser traffic through it. That way a laptop or workstation outside of Equinix can be used as the control point for storage management operations such as provisioning.

For APEX Data Storage File Services, the element manager interface can be reached directly via the IP addresses used on the network by the data storage system.

Further information on file storage configuration and administration can be found here:

- https://dl.dell.com/content/docu100461-onefs-9-1-0-0-web-administration-guide.pdf?language=en-us

For Block Services, there is an additional route necessary to add to hosts on the storage network to reach the element manager interface. The routing depends on the initial configuration of the system and agreed upon IP addressing scheme. For example, the following commands are used in ESXi, Linux, and Windows. Here the block storage management network is on the 100.64.63.x subnet and the data storage switch gateway is 172.16.1.1

- esxcli network ip route ipv4 add --gateway 172.16.1.1 --network 100.64.63.0/24

- ip route add 100.64.63.0/24 via 172.16.1.1 dev bond0.1001

- route ADD 100.64.63.0/24 172.16.1.1 IF 12

Further information on block storage configuration and administration can be found here:

- https://www.dell.com/support/kbdoc/en-us/000130110/powerstore-info-hub-product-documentation-videos

Subscription management, monitoring, and health reporting is available through the APEX Console and CloudIQ. Those systems provide easy access to understand what you have subscribed to, what is deployed and available, and the capacity and utilization of the file or block storage. If you are viewing the APEX Console from a system that has additional network access to the storage element manager then it is also a simple click of the "Manage Storage Resources" button the console to bring up that interface and configure/provision storage.
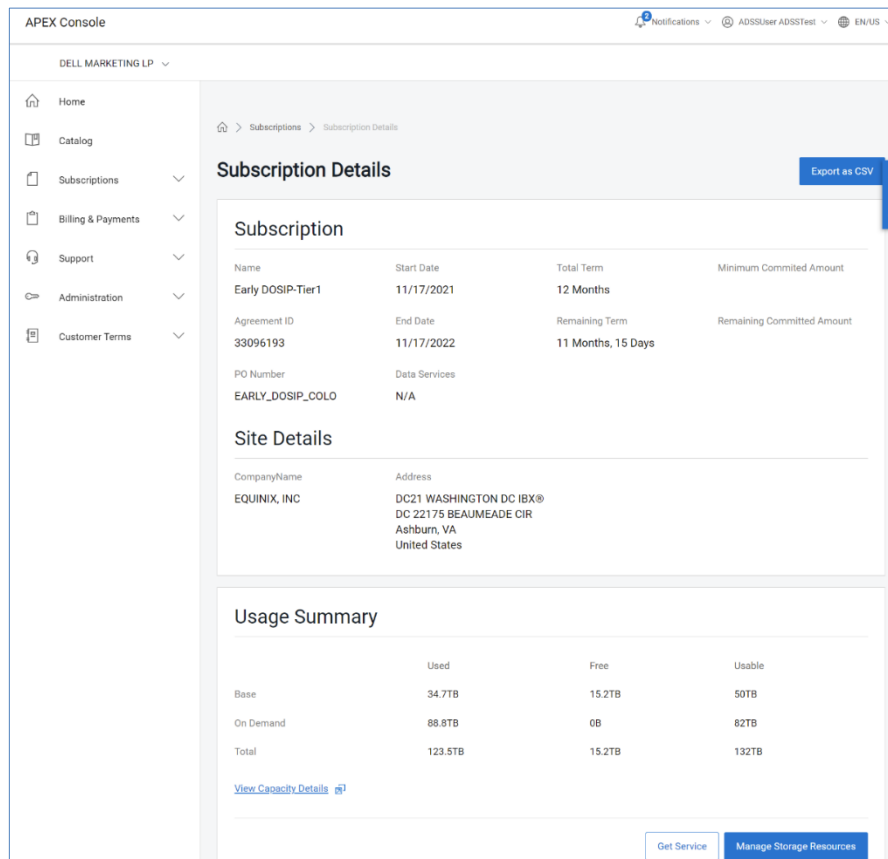
Figure 14.   APEX Console Subscription Details

The multitude of summary and detailed reports in CloudIQ provides easy to understand information on the APEX Data Storage Services and traditional customer owned systems you have registered in your data center or the ones in an Equinix colocation facility. You can login to CloudIQ directly or use the "View Capacity Details" link in the APEX Console for quick launch in context access.
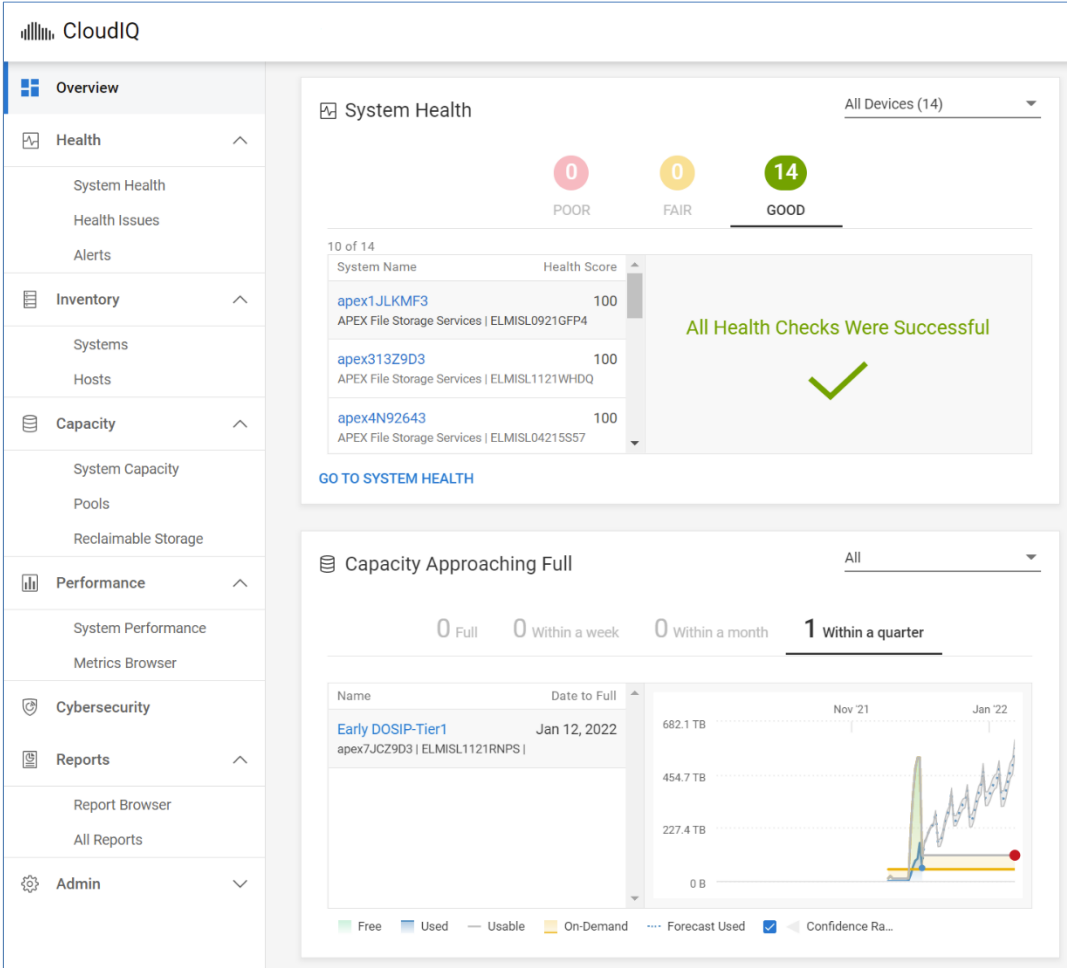
Figure 15.   CloudIQ System Health

Cloud compute

Cloud computing services can be connected to APEX Data Storage Services solutions through the Equinix Fabric. The following cloud providers are supported:

- Amazon Web Services (AWS)

Figure 16 shows an overview of the components used to communicate between the APEX Data Storage Services system and the cloud providers through the Equinix Fabric.
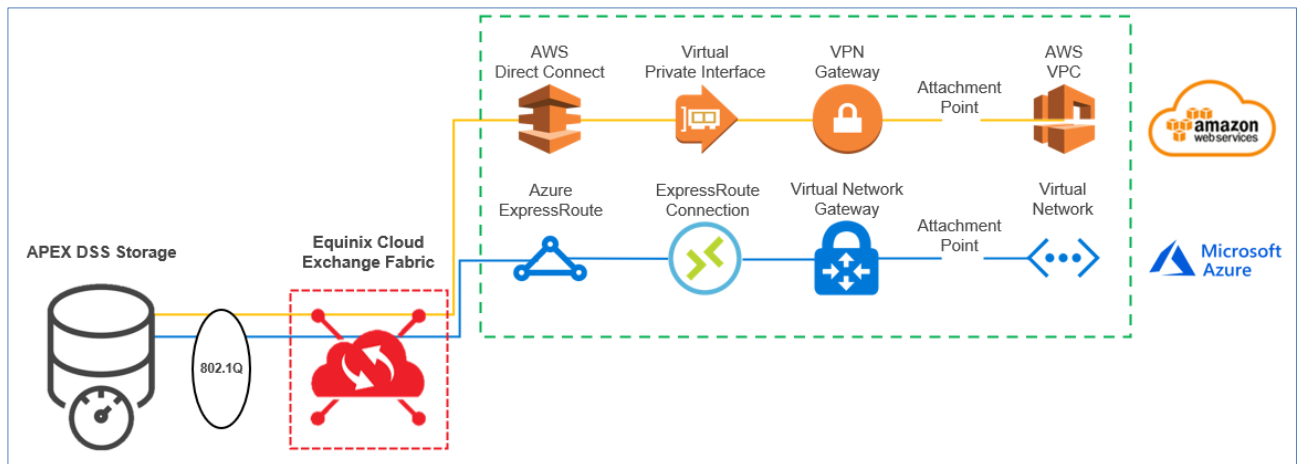
Figure 16.   Cloud compute connectivity

The sections below describe the overall steps and show a reference architecture for connecting cloud compute to APEX Data Storage Services in Equinix.

Amazon Web Services (AWS)

Amazon Web Services (AWS) leverages AWS Direct Connect to establish a dedicated connection between AWS and the Equinix IBX. AWS Direct Connect transports data through the private network connection instead of the public internet. Benefits of AWS Direct Connect include increased bandwidth, security, and consistency while lowering latency and cost.

When using AWS Direct Connect through the Equinix Fabric, a hosted connection is created to support a single Virtual Interface (VIF). The connection enables attaching to Amazon Virtual Private Clouds (VPCs) through a Virtual Private Gateway. The VIF provides an 802.1Q VLAN ID, a /30 network for the customer and AWS router interfaces, and a Border Gateway Protocol (BGP) session in between to advertise routes. A private VIF is created to connect to VPCs using private IP addresses in a region.

The sections below show the steps required to configure AWS compute for APEX Data Storage Services in Equinix.

Pre-requisites:

- AWS account ID

- AWS account credentials

Equinix connection

The first step in the process starts on the Equinix side, a connection between Equinix Fabric and AWS Direct Connect needs to be established. The connection request is configured by a Dell Technologies APEX lifecycle services representative. If you want to set up AWS cloud compute as part of a new APEX Data Storage Services deployment, if possible, please provide the information below in the initial deployment meeting. To initiate this request on an existing APEX Data Storage Services system, please open a service request in the APEX Console and provide the information below.

- Connection Type – AWS Direct Connect

- AWS Account ID – Your 12-digit AWS account ID

- Primary/Secondary Circuit – Origin and destination

- Speed – Choose one: 50 Mbps, 100 Mbps, 200 Mbps, 500 Mbps, 1 Gbps, 2 Gbps, 5 Gbps, or 10 Gbps

To learn more about the benefits and features of using AWS with Equinix, there is more information on the partnership as well as AWS Direct Connect on these websites:

- https://www.equinix.com/partners/aws

- https://docs.aws.amazon.com/directconnect/latest/UserGuide/Welcome.html

After you have submitted the service request, your Customer Success Manager (CSM) will be engaged to work with you through the configuration process. Please note that once the connection is created, these settings cannot be changed. Wait until you receive an email notification stating that the connection is ready before proceeding to the next step. That notification will contain additional details to setup resources on the AWS side.

Amazon Virtual Private Cloud (VPC)

For providing the compute resources an existing Amazon VPC can be used. If a new VPC is needed, while the Equinix connection is being established, configure the AWS Virtual Private Cloud (VPC) by following the steps below (and Amazon documentation).

In either case, any VPCs that are used should not have an overlapping subnet with the default APEX Data Storage Services network, 172.18.x.x. If any overlap is expected, please work with your CSM and support services team to determine new subnet and configure storage resources appropriately for storage connectivity.

1. Login to the AWS Management Console
2. For better performance due to geographical proximity, be sure to select and create AWS resources in a region that is close to the Equinix datacenter where the storage system is deployed.
3. Configure an AWS Virtual Private Cloud (VPC) along with a subnet, route table, and Virtual Private Gateway (VGW)

   a. Create the VPC

      i. Name
      ii. IPv4 CIDR block – this should be a private address block per RFC1918
      iii. IPv6 CIDR block (disabled)
      iv. Tenancy

   b. Create a subnet

                i.   VPC

                ii.   Name

                iii. Availability Zone – this value should be in close geographical proximity to the deployed storage system for best performance

                iv. IPv4 CIDR block - subset of VPC CIDR block

    c.   Create a route table

                i.   Name

                ii.   VPC

    d.   Create a VGW - only done after Equinix connection

                i.   Name

                ii.   ASN – Provided by CSM and support team

AWS Direct Connect

Your CSM will notify you once the Equinix connection is ready. When the connection is ready, you can accept the pending connections from Equinix in AWS and establish the virtual interfaces. For the peering connection parameters please work with your CSM to obtain the appropriate values based on setting applied to the APEX Data Storage Services system.

1. Navigate to the Direct Connect page
2. Accept both pending connections from Equinix

Note: The VLAN ID that is displayed may be different than what is set above since Equinix Fabric dynamically maps the VLAN ID provided by AWS to the desired VLAN ID

Accepting the connection requests transition the state of the connection to be available, as shown in Figure 10.

Direct Connect > Connections > DXCON-FGBD4SHX

DXCON-FGBD4SHX

[Edit] [Delete]

General configuration

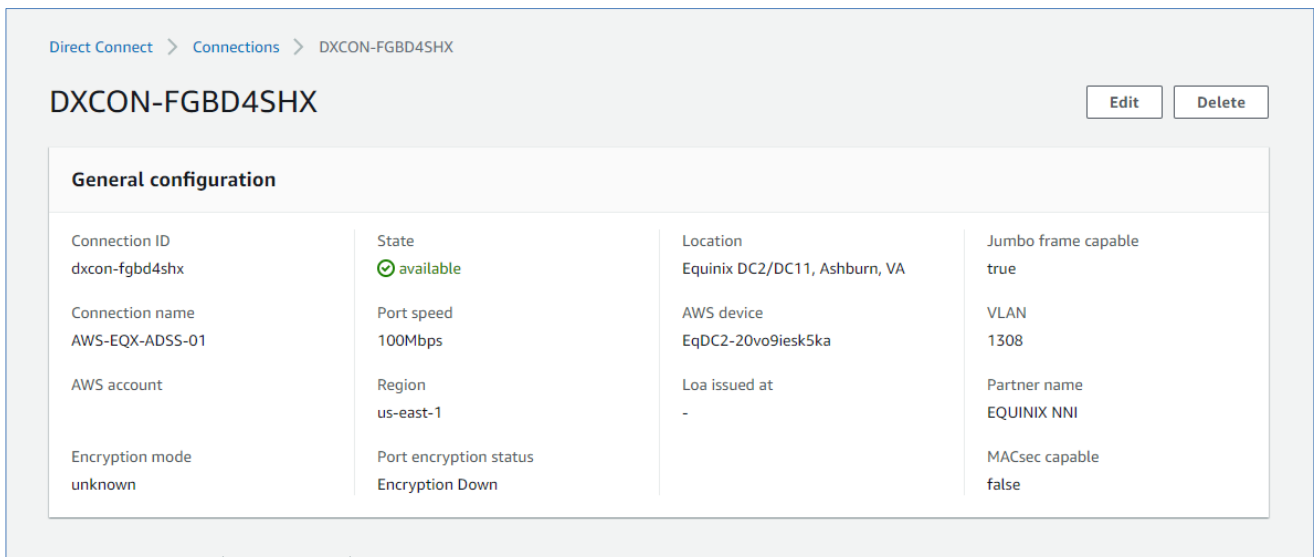| Connection ID	State	Location	Jumbo frame capable
dxcon-fgbd4shx	⊘ available	Equinix DC2/DC11, Ashburn, VA	true
Connection name	Port speed	AWS device	VLAN
AWS-EQX-ADSS-01	100Mbps	EqDC2-20vo9iesk5ka	1308
AWS account	Region	Loa issued at	Partner name
	us-east-1	-	EQUINIX NNI
Encryption mode	Port encryption status		MACsec capable
unknown	Encryption Down		false

Figure 17.   **AWS Direct Connect connection**

3. Establish a virtual interface for the router interfaces and BGP sessions. A configured Private VIF and peering is shown in **Error! Reference source not f ound.**11.

    a. Type = Private
    b. Provide a virtual interface name
    c. Connection = Direct Connect connection from Equinix
    d. Virtual interface owner = My AWS account or another AWS account
    e. Gateway type = Virtual Private Gateway
    f. Virtual private gateway – Choose the VPG that is attached to a VPC that you wish to connect to
    g. VLAN – Provided by CSM and support team
    h. BGP ASN – Provided by CSM and support team
    i. Additional settings - Your CSM and support team will work with you to established agreed upon values for these parameters

        i. Address family
        ii. Your router peer IP
        iii. Amazon router peer IP
        iv. BGP authentication key
        v. Jumbo MTU
        vi. Tags

    j. Create the virtual interface

Figure 18.   **Private VIF and peering**

AWS VM Connections

Once the AWS Direct Connect, private virtual interface, virtual private gateway are configured and attached to a VPC instance you can then start deploying EC2 instances and connect them to the storage over the network. When launching an instance, you will be able to choose the VPC and subnet that were previously configured with the network settings to communicate back to the storage system.

When the operating system is up and running for the instance you can configure iSCSI for block storage or NFS/SMB for file storage as described in the Equinix Metal Provisioning block and file storage section above.

Microsoft Azure

Microsoft Azure leverages ExpressRoute to establish a private connection between Azure and the Equinix IBX. ExpressRoute transports data through a private network connection instead of over the public Internet. Azure ExpressRoute circuits enable increased security, reliability, and speed while providing lower and latency and cost.

The sections below show the steps required to configure Azure compute for APEX Data Storage Services in Equinix. Additional information on the features and benefits of ExpressRoute with Equinix can be found here:

- https://www.equinix.com/partners/microsoft-azure
- https://docs.microsoft.com/en-us/azure/expressroute/

Pre-requisites:

- Azure account information

Azure ExpressRoute Circuit

The first step in the process is to request an ExpressRoute circuit which is completed from within the Azure portal. A tutorial of the process is available from Microsoft. The high-level steps and parameters are below.

1. Login to the Azure Portal
2. Navigate to the ExpressRoute page
3. Create an ExpressRoute circuit and provide:

   a. Subscription – Choose your subscription
   b. Resource group – Choose or create a new resource group
   c. Region – Choose your Azure region
   d. Name – Provide a circuit name
   e. Port type = Provider
   f. Create new or import from classic = Create new
   g. Provider = Equinix
   h. Peering location – The location where the connection will be provisioned
   i. Bandwidth = 50/100/200/500 Mbps, 1/2/5/10 Gbps
   j. SKU type = Standard
   k. Billing type = Unlimited or Metered
   l. Allow classic operations = No

4. View the circuit and ensure that is created and in a "not provisioned" state
5. Save the Service Key for the circuit

Equinix connection

Once the Azure ExpressRoute Circuit request is created, an Equinix Fabric connection needs to be established. The next step in the process would be to work with your CSM and submit a service ticket to start the configuration on the storage side within Equinix by a Dell Technologies APEX lifecycle services representative. Wait until you receive an email notification stating that the connection is ready before proceeding to the next step. The following information will be required:

- Type: Azure ExpressRoute
- Azure ExpressRoute Service Key (from above)

Configure Azure private peering

Once the Equinix connection is created, we can confirm that the circuit is now in a "provisioned" state. Then, we can configure peering in the Azure Portal. An ExpressRoute circuit with private peering is shown in Figure 12.

1. Login to the Azure Portal
2. Navigate to the ExpressRoute page
3. View the circuit details and ensure that is now in a "provisioned" state
4. Confirm the peering status shows "not provisioned"
5. Configure Azure private peering – set primary and secondary subnets, bgp password/key, vlan, peer ASN, etc., screenshot of config page
6. Confirm the Azure private peering status changes to "provisioned"

Essentials						JSON View
Resource group (change) : scus-apex-expressroutecircuits-rg			Provider	: Equinix		
Circuit status	: Enabled		Provider status	: Provisioned		
Location	: East US 2		Peering location	: Washington DC		
Subscription (change)	: AzD1N-APEX-DSS-Sx01		Bandwidth	: 100 Mbps		
Subscription ID	: ▓▓▓ ▓▓▓▓-▓▓▓ 1-4▓▓▓-▓▓▓▓-▓▓▓-▓▓▓▓▓▓▓		Service key	: ▓▓▓▓▓▓▓-▓▓▓▓-▓▓▓▓-▓▓▓▓-▓▓▓▓▓▓▓1 1		
Tags (change)	: Click here to add tags					

Peerings					
Type	Status	Primary subnet	Secondary subnet	Last modified by	
∨ Azure private	Provisioned	One subnet configured	One subnet configured	Customer	...
	Enabled	▓▓▓.▓▓.▓▓/▓▓	▓▓▓.▓▓.▓▓.▓▓/▓▓		
Azure public	Not provisioned	-	-	-	
Microsoft	Not provisioned	-	-	-	

Figure 19.   Azure ExpressRoute circuit and peering

Create VNet, subnets and virtual network gateway

To allow VMs to access provisioned storage they must have an interface on a VNet with the correct network parameters and routing. Either an existing VNet can be used or a new one created. However, the IP address space must not overlap with the private addresses used on the storage system. Creation of the VNet and an associate subnet is accomplished using the Azure portal and requires a few simple parameters as seen on this quickstart page

The next step is to create a gateway subnet in the VNet for use by the virtual private gateway resource. Navigate to the desired VNet and select the button to add "Gateway subnet" and simply enter the agreed upon parameters as in this tutorial.

Finally, in the portal you can create the virtual private gateway with type ExpressRoute which can take up to 45 minutes to complete.

Connect virtual network gateway to ExpressRoute circuit

With the VNet, subnets, and VPG created and available the last step is to link the VPG and ExpressRoute circuit together. In the Azure portal, start provisioning a connection to link your virtual network gateway to your ExpressRoute circuit by navigating to your circuit and selecting Connection > Add to open the Add connection page. The quick wizard walks you through the creation of the connection where the name and the desired VNet are supplied along with other parameters.

By selecting an ExpressRoute circuit and clicking on "Peerings" in the settings you can then see the routing that is advertised by clicking on "View route table".

Figure 20.   Azure Route Table

Azure VM Connections

With the Azure to Equinix network connectivity fully complete, VMs can now be deployed with interfaces on the VMnet connecting back to the storage system in Equinix.

When the operating system is up and running for the instance, you can configure iSCSI for block storage or NFS/SMB for file storage as described in the Equinix Metal Provisioning block and file storage section above.

Conclusion

Increasing expectations for greater IT simplicity and agility can place significant burden on IT infrastructure and those who manage it. However, it is possible to reduce demand on your IT resources and enable your digital acceleration with Dell Technologies and Equinix.

APEX Data Storage Services together with Equinix can provide:

- **Secure multi-cloud capabilities:** Leverage unmatched multi-cloud connectivity via Equinix Fabric, with no vendor lock-in or excessive egress fees.

- **The ability to grow your business and quickly expand into new regions:** Easily deploy storage resources where you need them, enabling new opportunities for efficient growth and geographic expansion.

- **Consistent, predictable high-speed deployments:** Get up and running quickly with full APEX Data Storage Services deployments at Equinix Data Centers in as few as 14 days.[1]

- **Simplified experience:** Predictable pricing, designed for OpEx treatment[2], with no overage fees for on-demand usage and a single invoice from a single vendor.

- **A dependable partnership:** Global scale, leading technologies, IT expertise and risk avoidance in infrastructure lifecycle management.

- **Data center operations best practices:** 20+ years of proven expertise at Equinix to support mission critical business resiliency.

The ability to connect the underlying APEX Data Storage Services infrastructure, deployed in a Dell-managed colocation facility hosted by Equinix, to compute resources with Equinix Metal or cloud service providers like AWS and Microsoft Azure gives you the flexibility to leverage dynamic, scalable, and secure infrastructure resources.

A hybrid cloud operating model is the future of IT, and more than ever, colocation is central to a hybrid cloud strategy. Dell Technologies and Equinix make this vision of IT a reality.

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[1] Applies in US, UK, France and Germany. TTV measured between order acceptance and activation. Subject to customer credit approval and site qualification, which must be completed before order placement, and customer participation in pre-deployment planning. Product availability, holidays and other factors may impact deployment time.

[2] OpEx treatment is subject to customer internal accounting review and policies