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Network Considerations for Building a Hybrid Cloud Environment

Using Hitachi Cloud Connect for Equinix

Hitachi Vantara
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Table of
Contents

Notices and Disclaimer

About This Guide

Introduction

This white paper examines the networking requirements to consider when building a hybrid cloud environment with Hitachi Cloud Connect for Equinix. This information was accumulated while setting up our own environment, which was needed to validate use cases for the Hitachi Cloud Connect for Equinix solution.

Our hybrid cloud environment consisted of three domains:

- An on-premises data center located in Englewood, Colorado.
- A near-cloud Equinix colocation data center (named SV10) located in San Jose, California.
- A cloud hosted by AWS in Northern California.

The relationship between the three domains is illustrated in *Figure 1*. These network requirements of these three domains are described in detail in the Key Components section.
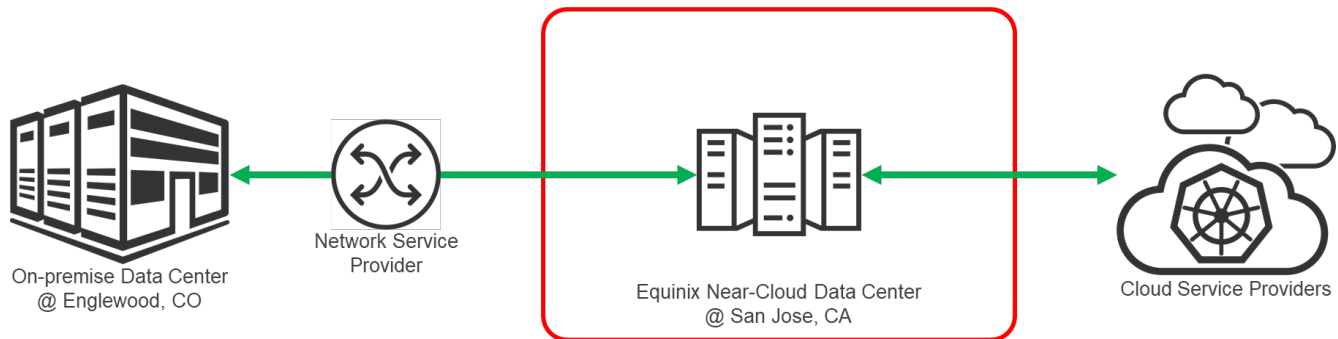
Figure 1: *High Level Diagram*

Note: The information shared here is specific to our requirements. It can be used as a guideline or a starting point, but we recommend conducting a proof-of-concept in a non-production, isolated test environment matching your production environment before implementing this solution.

Intended Audience

This document is intended for Hitachi Vantara staff and IT professionals of Hitachi Vantara customers and partners who are responsible for planning and deploying such as solution.

Document Revisions

Revision Number	Date	Author	Details
1.0	April 2022	Hitachi Vantara LLC	Initial Release

References

- Equinix Cross Connect Ports: https://docs.equinix.com/en-us/Content/Interconnection/Cross_Connects/xc-cross-connects.htm
- Equinix Fabric Ports: https://docs.equinix.com/en-us/Content/Interconnection/Fabric/Fabric-landing-main.htm
- AWS Direct Connect: https://docs.aws.amazon.com/directconnect/latest/UserGuide/Welcome.html

Comments

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Thank You!

Solution Overview

Hitachi Cloud Connect for Equinix enables clients to place Hitachi Virtual Storage Platform (VSP) data storage systems in their preferred co-location center to support the superior performance and added security benefits of third-party, highly connected data centers for data protection and disaster recovery efforts. By provisioning data in a co-location and using applications running in the cloud, customers can keep data under their control while leveraging a public and private cloud for performance.

This offering allows clients to locate Hitachi VSP enterprise-class storage at Equinix International Business Exchange™ (IBX) data centers worldwide and includes the option for customers to procure this solution through one agreement and invoice, greatly simplifying and accelerating their time to market. By using Equinix IBX data centers and Equinix Fabric™ to interconnect sources of data to applications, VSP storage systems enable organizations to locate their data next to clouds while still maintaining control by enabling applications such as data protection and back-up for hybrid- and multi-cloud data availability.

Highlights

- Get direct multi-cloud connectivity to the public cloud providers, improving your cloud workflow agility and eliminating latency.

- Improve hybrid cloud operations, visibility, management, and real-time insights and analytics with Hitachi Ops Center suite.

- Use the Hitachi cloud migration tools you know to move your applications between hyperscalers without penalties.

- Extend cybersecurity beyond your data center. Create impregnable data copies by combining VSP and Ops Center capabilities.

- Take advantage of Hitachi experience that spans years of service and support for VSPs — more than 150PB of storage — in Equinix locations worldwide.

If you want to discuss options for hosting at Equinix, contact your Hitachi Vantara sales team. You can also visit the Hitachi Cloud Connect for Equinix webpage for more information: https://hitachivantara.com/en-us/products/storage/flash-storage/cloud-connect-for-equinix.html.

Key Components

The major components of the solution are described in the following sections.

On-premises Data Center

The starting point for our hybrid cloud environment was our on-premises data center in Englewood, Colorado. This site hosted the majority of our test equipment. In business continuity lingo, this data center was the primary site.

This site hosted thousands of devices, including storage systems, SAN switches, network switches, and servers. For the purpose of our testing, we used the following equipment:

- A VSP E790 as the primary storage system
- Four Quanta D51B-2U servers as the primary vSphere cluster
- A Brocade G720 FC switch for the SAN fabric between the storage system and servers
- A Cisco Nexus 93180YC-EX switch for IP traffic

To connect our primary site with the Equinix near-cloud data center, we purchased a 10G Wavelength link from Lumen configured with Multiprotocol Label Switching (MPLS). The link was patched into the Cisco Nexus 93180YC-EX at the primary site.

The following are key components relating to the deployment of the MPLS connection on this end:

- **Letter Of Authorization (LOA)**: A letter that authorizes someone to perform an action on someone else's behalf. In this context, our data center service provider in Englewood needed an LOA from Lumen to complete the connection from Lumen's network patch panel to our equipment.
- **Single Mode Fiber Cables**: This cable type was required to complete the connection from Lumen to the Cisco Nexus switch. The sheath on this cable type is yellow. Multimode cables, which have an aqua sheath, will not work. See this link for more details on the differences between Single Mode and Multimode: https://community.fs.com/blog/single-mode-cabling-cost-vs-multimode-cabling-cost.html.
- **Long Range Transceivers**: Long Range transceivers are necessary to complete long distance connections. The specific model that we used was 10/25Gbase-LR-S. The standard Short Range transceivers will not work. These usually have a black handle while the Long Range transceivers have a blue handle. See this link for more details on the differences between Long Range and Short Range: https://info.hummingbirdnetworks.com/blog/answering-your-frequently-asked-questions-about-different-types-of-10-gigabit-cisco-sfp-units.

It is important for you to be aware of these components and purchase them, meaning cables and transceivers, ahead of time (if necessary) so they do not delay your hybrid cloud implementation.

Equinix Near-Cloud Data Center

The other end of the MPLS connection was in San Jose, California. It terminated at a colocation data center operated by Equinix. This location served as the Disaster Recovery (DR) site for our validation projects. It included the following equipment:

- A VSP 5200 and a VSP E1090 as secondary storage systems (for block replication and backup use cases)
- Four Hitachi Advanced Server DS220 servers as the secondary vSphere cluster
- A Brocade 6510 FC switch for the SAN fabric between the storage systems and servers
- A Cisco Nexus 93180YC-FX switch for IP traffic

The following are key components relating to the deployment of the MPLS connection on this end and uplink to the AWS cloud:

- **Letter of Authorization**: A letter that authorizes someone to perform an action on someone else's behalf. In this context, Equinix required an LOA from Lumen to complete the connection from Lumen's network patch panel to our Cross Connect port (described in a following section).
- **Equinix Ports**: Equinix offers many different types of ports that service various connection requirements. A complete list is available at https://docs.equinix.com/en-us/Content/home.htm.

  For our testing, we required an Equinix Fabric Port and a Cross Connect port. Note that these have a one-time installation charge and a monthly flat fee. *Figure 2* is a sample quote for two Equinix Fabric Ports and one Cross Connect port. The two columns under Proposed Unit Pricing are Non-reoccurring Charge and Monthly Reoccurring Charge.

Service Description	Qty	Proposed Unit Pricing	
		NRC	MRC
1 10g ECX Connection	2	███	███
1 Cross Connect	1	███	███

Figure 2: *Sample Quote for Equinix Ports*

- **Cross Connect Port**: Provided an uplink back to the MPLS connection in Lumen's patch panel in San Jose. The official description of this product is "With Cross Connects, network providers can efficiently distribute content or exchange data, and deploy applications in the cloud. Also, Cross Connects minimize latency by connecting to multiple infrastructures within a data center." Here is an illustrated example from Equinix's website (https://docs.equinix.com/en-us/Content/Interconnection/Cross_Connects/xc-cross-connects.htm):
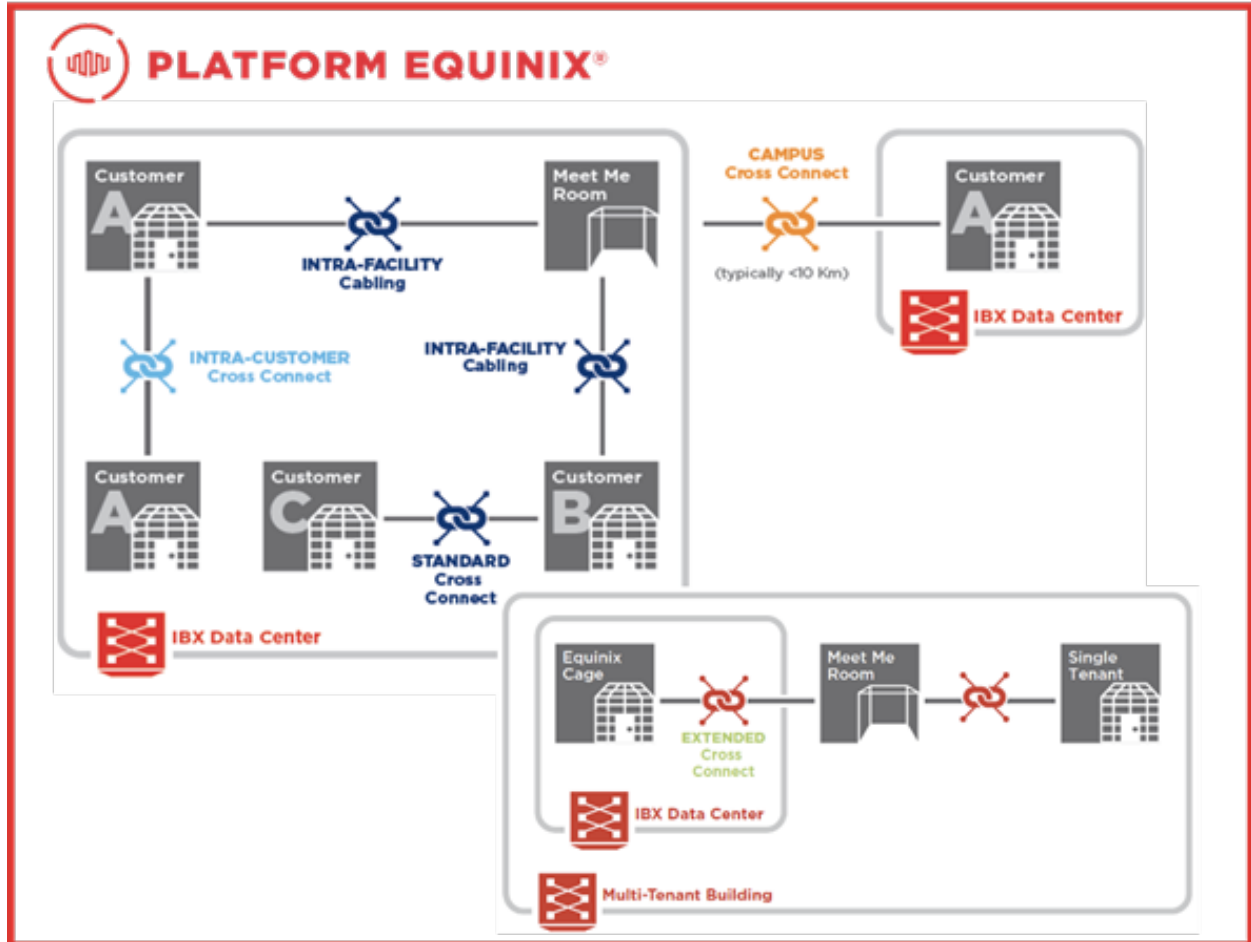
- **Equinix Fabric Port**: Provided a connection to the Equinix Fabric, which ultimately allowed us to connect to the AWS cloud. According to Equinix, the Fabric allows you to connect to cloud, network and other providers, another Equinix Fabric customer, other Equinix customers, vendors and partners, and more. Here is an illustrated example from Equinix's website (https://docs.equinix.com/en-us/Content/Interconnection/Fabric/Fabric-landing-main.htm):
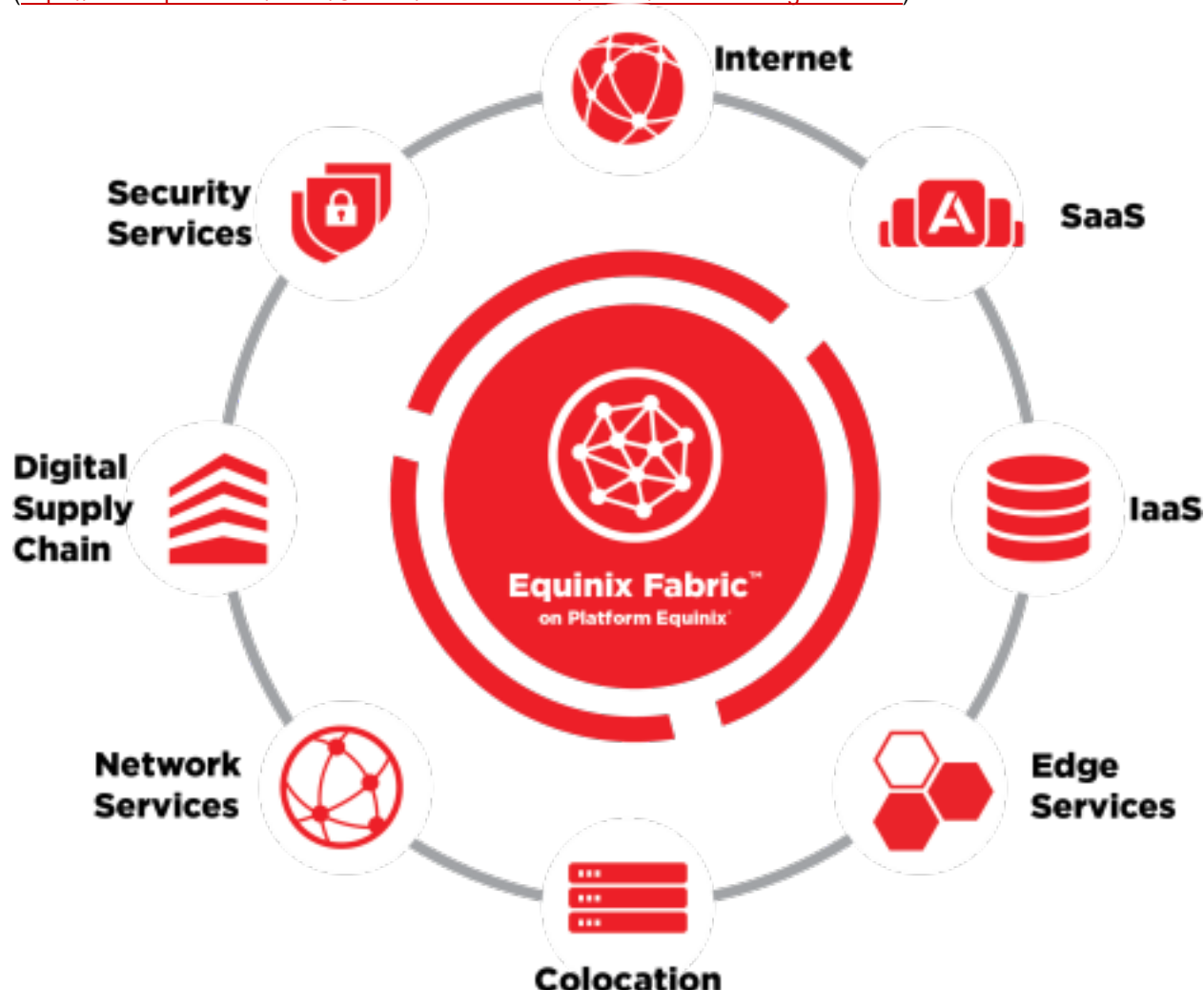
- **Single Mode Fiber Cables**: This cable type was required to complete the Cross Connect link from Lumen to the Cisco Nexus switch and also between the Equinix Fabric Port and the Cisco Nexus switch. The sheath on this cable type is yellow. Multimode cables, which have an aqua sheath, will not work. See this link for more details the differences between Single Mode and Multimode: https://community.fs.com/blog/single-mode-cabling-cost-vs-multimode-cabling-cost.html.

- **Long Range Transceivers**: Long Range transceivers are necessary to complete long distance connections. The specific model that we used was 10/25Gbase-LR-S. The standard Short Range transceivers will not work. These usually have a black handle while the Long Range transceivers have a blue handle. See this link for more details on the differences between Long Range and Short Range: https://info.hummingbirdnetworks.com/blog/answering-your-frequently-asked-questions-about-different-types-of-10-gigabit-cisco-sfp-units.

- **Border Gateway Protocol (BGP) Support on Switch**: BGP is required to support AWS Direct Connect (as listed in this link: https://aws.amazon.com/directconnect/faqs/). On our Cisco Nexus switch, this meant enabling the Enterprise Services feature, which required purchasing a license key. Check with your switch vendor to determine what, if any, licensing is required to enable BGP.

AWS Cloud

Our hybrid cloud validation projects started with AWS as the primary cloud provider. The closest AWS region to our Equinix near-cloud data center in San Jose was us-west-1, which is physically in Northern California. The response time was very quick at around 1 millisecond.

The following are key components relating to the AWS cloud portion of our hybrid cloud environment:

- **AWS Direct Connect (DX)**: Logical, private link that connected our equipment at Equinix to the AWS cloud without going through the internet. Our DX speed was 10 Gbps, but lower and higher speeds are available.

  In terms of billing, DX has two separate charges: port hours and data transfer.

  - **Port Hours**: According to AWS (https://aws.amazon.com/directconnect/faqs/, Billing section): "Pricing is per port-hour consumed for each port type. Partial port hours consumed are billed as full hours."

  - **Data Transfer**: Fee for outgoing data, calculated by per gigabyte, that varies based on the AWS region. More details are available at https://aws.amazon.com/directconnect/pricing/. Note that incoming traffic is not charged.

- **Virtual Interface**: A virtual interface is required to complete the Direct Connect link on the AWS side. There are three types: private, public, and transit. We deployed a private virtual interface because it was the most appropriate type for a hybrid cloud deployment. More information on the use cases for the three types is available at https://aws.amazon.com/premiumsupport/knowledge-center/public-private-interface-dx/.

- **Direct Connect Gateway** and **Virtual Private Gateway**: These were needed to pass traffic between the private virtual interface and our Amazon Virtual Private Cloud (VPC) in us-west-1 region. See the following illustration from an AWS document (https://docs.aws.amazon.com/directconnect/latest/UserGuide/direct-connect-gateways-intro.html) for an example. Even though our deployment in AWS was in only one region, the use of a Direct Connect Gateway would have allowed us to expand to additional regions.
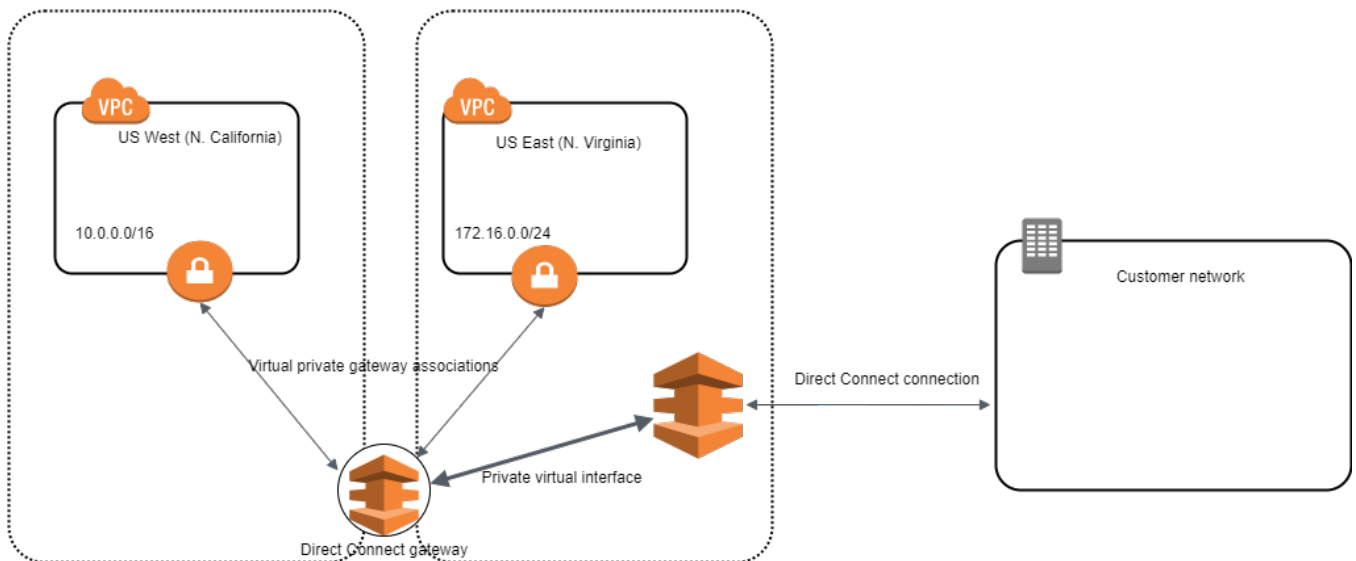
Deployment Example

This section describes the test environment and hardware specifications used in our validation projects for Hitachi Cloud Connect for Equinix.

Connectivity Diagram

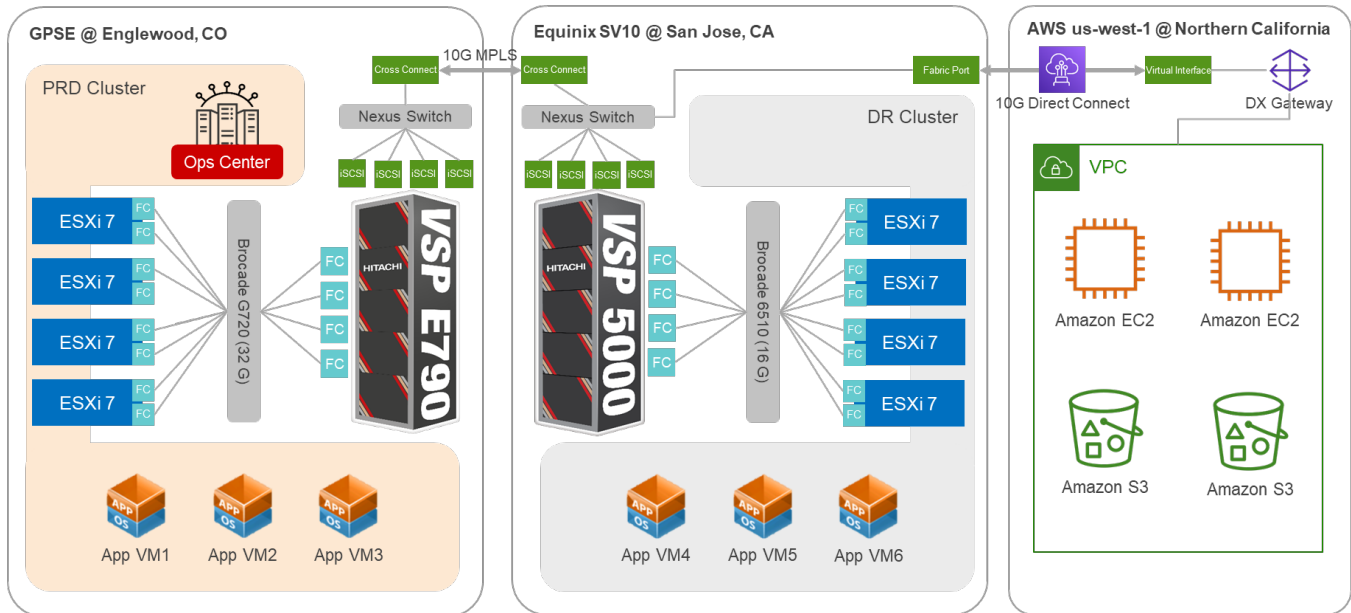*Figure 3* shows the hybrid cloud environment with connection details.

Figure 3: *Connectivity Diagram*

Hardware Specifications

Table 1 provides the hardware specifications for the equipment at the on-premises data center.

Item	Description	Version	Function
Hitachi VSP E790	768 GB cache (2) MPUs; 32 cores/MPU (3) RAID6 6D+2P parity groups (2) 32 Gbps FC ports	SVOS RF 9.6 93-06-01-80/00-M035	Primary storage system

Quanta D51B-2U	(2) 12-core Intel Xeon E5-2680 v3
	    @ 2.5 GHz
	192 GB cache
	(1) Emulex LPe32002 HBA
	(1) Intel 82599 10 Gigabit
	    Ethernet Controller
		BMC 3.83.00
		BIOS S2B_3B22
			4-node primary vSphere cluster (PRD)

Brocade G720	Gen 7 Fiber Channel switch	FOS 9.0.1a	Provided FC connectivity between the VSP E790 and primary vSphere cluster.
Cisco Nexus 93180YC-EX	(48) 1/10/25-Gbps fiber ports (6) 40/100-Gbps QSFP28 ports	NXOS 9.2(3)	Network switch. Provided WAN link to DR site.

Table 1: *Hardware Components at Primary Site*

Table 2 provides the hardware specifications for the equipment at the Equinix near-cloud data center.

Item	Description	Version	Function
Hitachi VSP 5200	1 TB cache (2) MPUs; 20 cores/MPU (4) RAID6 6D+2P parity groups (2) 32 Gbps FC ports	SVOS RF 9.8 90-08-02-00/01-M079	Secondary storage system
Hitachi VSP E1090	1,024 GB cache (2) 32-core MPUs (3) RAID6 6D-2P parity groups (2) 32 Gbps FC ports	SVOS RF 9.8 93-06-21-80/00	Secondary storage system
Hitachi Advanced Server DS220	(2) 18-core Intel Xeon Gold 6140 @ 2.3 GHz 128 GB cache (1) Emulex LPe32002 HBA (1) Intel Ethernet Network Adapter XXV710	BMC 4.70.06 BIOS S5BH3B22.H00	4-node secondary vSphere cluster (DR)
Brocade 6510	16 Gbps capable Fiber Channel switch	Gen 7 Fiber Channel switch	Provided FC connectivity between the VSP 5200 and VSP E1090 and secondary vSphere cluster.
Cisco Nexus 93180YC-FX	(48) 1/10/25-Gbps fiber ports (6) 40/100-Gbps QSFP28 ports	NXOS 9.3(4)	Network switch. Provided WAN link to primary site.

Table 2: *Hardware Components at DR Site*

Configuration Screenshots

This section contains configuration screenshots from our hybrid cloud environment.

Figure 4 shows the configuration of the WAN uplink on the primary site Cisco Nexus switch.

```
interface Ethernet1/46
  description WAN to SV10
  switchport mode trunk
  switchport trunk allowed vlan 31
  flowcontrol receive on
  flowcontrol send on
  mtu 9216
  speed 10000
```

Figure 4: *WAN Uplink from Primary Site*

Figure 5 shows several important configuration sections from the Cisco Nexus switch servicing the DR site. The first one, referring to switchport 1/46, is the uplink to AWS. VLAN 1312 is chosen when initiating the AWS Direct Connect link from the Equinix Customer Portal. The second, referring to switchport 1/48, is the WAN uplink for the DR site. The final section contains the BGP configuration needed for the AWS Direct Connect link.

```
interface Ethernet1/46
  description ECX1 Primary to AWS via patch port
  switchport mode trunk
  switchport trunk allowed vlan 1312
  speed 10000
  duplex full

interface Ethernet1/48
  description Cross Connect to Lumen
  switchport mode trunk
  switchport trunk allowed vlan 31
  speed 10000

router bgp 65001
  address-family ipv4 unicast
    network 172.23.0.0/17
  neighbor 169.254.253.13
    remote-as 65510
    password 3 xxxxxx
    address-family ipv4 unicast
```

Figure 5: *Details from DR Cisco Nexus Switch*

Figure 6 shows the Fabric & Network Edge section of the Equinix Cloud Portal. It displays the Equinix Fabric Port used to connect to AWS Direct Connect.
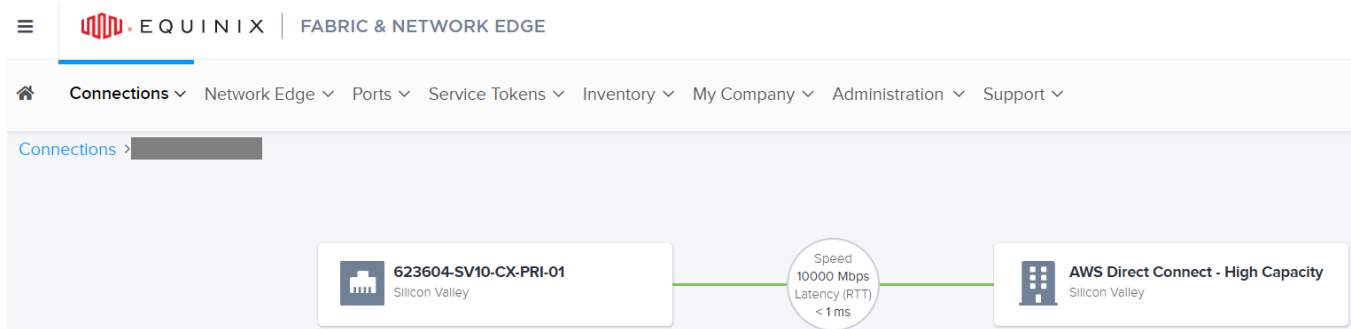

Figure 6: *Equinix Fabric Connection to AWS*

The square boxes in *Figure 6* represent the source and destination of the connection. We can click either one to get more information. For example, *Figure 7* shows details for the AWS destination.

Figure 7: *Destination Details*

Figure 8 shows the established Direct Connect link within the AWS Console. Notice the location is the Equinix SV5 data center. In the previous figures from the Equinix Cloud Portal, we saw that our Equinix Fabric Port terminated at the Equinix SV10 data center. This means there is at least one jump from our patch panel in SV10 before the connection is physically established to the AWS networking equipment in SV5.

Figure 8: *Established Direct Connect*