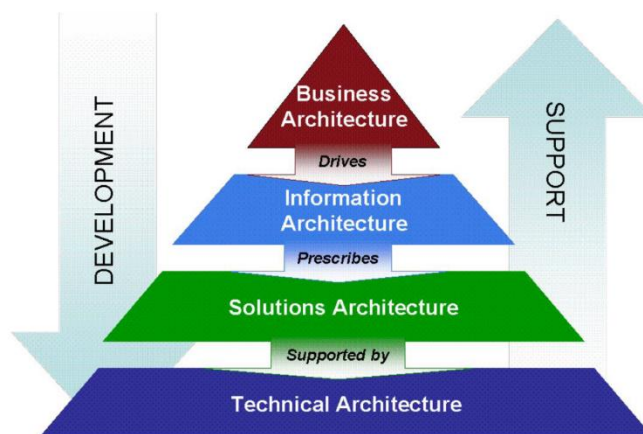




Enterprise Architecture Technical Brief

Cloud Exchanges

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Cloud Exchange Recommendation

Because cloud exchanges facilitate faster Cloud Service Provider (CSP) connections, we recommend their use as a business enabler that satisfies an agency’s multiple cloud connectivity needs. The cloud exchange approach generally appeals to those that want to use the cloud more, but don't wish to trust the public internet as their communications link. Leveraging cloud exchange access through VITA is considered the simplest method for engaging cloud exchange functionality for an agency, and one that complies with stringent Commonwealth of Virginia security guidelines.



For any comments, questions, and/or concerns with this technical brief, please contact VITA EA: ea@vita.virginia.gov

¹ Picture courtesy of Linked-In and retrieved from <https://media.licdn.com/mpr/mpr/AEEAAQAAAAAAAAAM9AAAAJDExMTk1NmMxLTVmNDU0NDczZC1lNTM4LThlYmY0NTJlNTBhYg.jpg> on May 18, 2017.



Enterprise Architecture Cloud Exchange

Cloud Exchange Overview

In general, cloud computing is Internet-based computing, whereby shared resources, software, and information are provided to computers and other devices on-demand. Cloud computing customers do not own the physical infrastructure, choosing instead to avoid capital expenditure by renting usage from a third-party provider. They consume resources as a service and pay only for resources that they use.²

Cloud exchanges are part of what is considered Interconnection Oriented Architecture™ (IOA). IOA enables a transformative approach to IT that supports digital engagement and leverages the power of digital ecosystems. Cloud exchanges are part of the cloud enabling ecosystem technology. IOA is used by more than 8,500 companies to accelerate digital transformation as the foundation for a global digital platform.

Cloud exchanges are an important interconnection capability for cloud service providers (CSP's) and cloud customers that enables private virtual connections for direct cloud access. For instance, the Equinix Cloud Exchange enables CSP's and user's to establish affordable, private, high-performance connections within their Platform Equinix offering. This interconnection service enables private virtual connections for direct cloud access with automated provisioning.³

Tony Bishop, chief strategy officer at the 451 Group, parent of 451 Research and Uptime Institute, said as enterprises increasingly move to the cloud, they need a **new level of interconnectivity** to access multiple clouds, across multiple sites, from a broad range of networks.⁴



A recent survey from leading IT professionals indicates **82% of Enterprises are adopting a multi-cloud strategy**, citing security, managing multiple clouds, and lack of resources as the top 3 challenges in leveraging the cloud effectively. In spite of those challenges, many enterprises are actively moving more of their workloads to the cloud. Today, 39% of enterprise workloads run in the cloud; in two years, that number will climb to 57%.⁵

² Center for Innovative Technology. The Commonwealth Innovation Index – Phase 1 Update (PDF document), page 21 of 51. Retrieved from http://www.cit.org/assets/1/7/Innovation_Index_Report_Update_final.pdf on May 15, 2017.

³ Equinix. Products and Services: Equinix Cloud Exchange (PDF document), page 1 of 2. Retrieved from <http://www.equinix.com/resources/data-sheets/equinix-cloud-exchange/> on May 15, 2017.

⁴ The Equinix Blog. *Equinix Cloud Exchange Brings New Level of Interconnection and Potential to the Cloud* by Jay Lindsay. Retrieved from <https://blog.equinix.com/blog/2014/04/30/equinix-cloud-exchange-brings-new-level-of-interconnection-and-potential-to-the-cloud/> on April 30, 2014.

⁵ RightScale 2016 State of the Cloud Report –and– 451 Research, Cloud Computing, 2016. Retrieved from <https://www.digitalrealty.com/services/interconnection/service-exchange/> on May 15, 2017.



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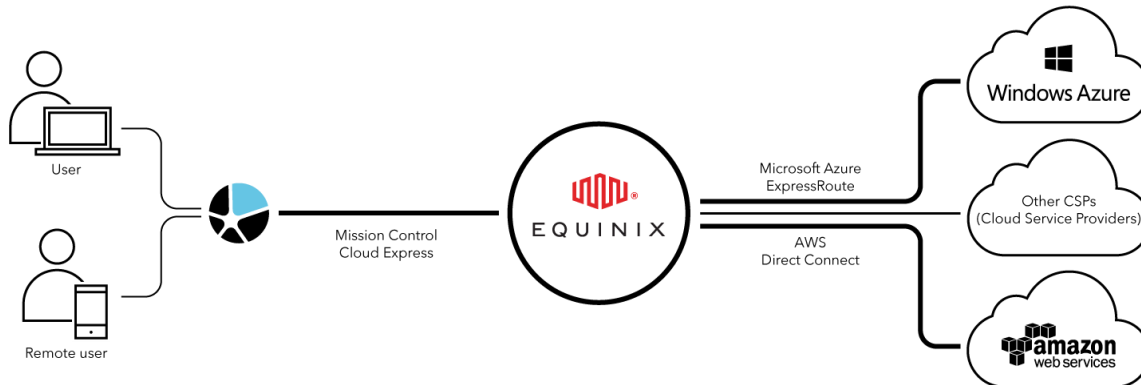


Figure 2: Example of cloud exchange to CSP interconnection capabilities.⁶

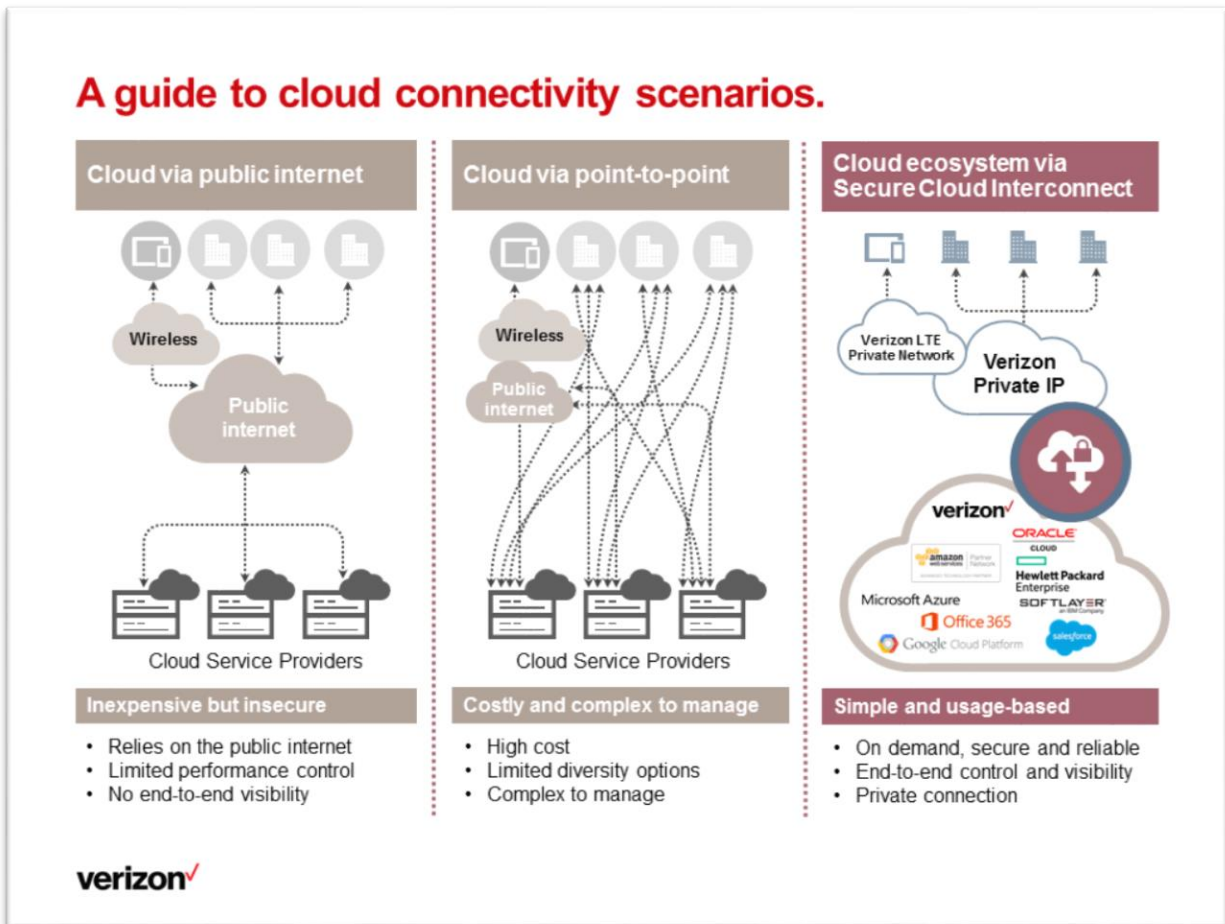


Figure 3: Verizon Guide to Cloud Connectivity Scenarios.⁷

⁶ Verizon Secure Cloud Interconnect (SCI) Diagrams. Retrieved from <http://www.verizonenterprise.com/> on February 6, 2017.

⁷ Ibid.



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Other names associated with the concept of a cloud exchange including popular connections to/from a cloud exchange include:

- Cloud Broker
- Verizon Secure Cloud Interconnect (SCI)
- MS Azure ExpressRoute
- Zayo's CloudLink
- Digital Realty Cloud Service Exchange
- Equinix Cloud Exchange
- NTT Multi-Cloud Connect Services
- AWS Direct Connect
- AlohaNAP Cloud Connect service
- AT&T NetBond Cloud Connectivity Service
- RCS Interconnect Hub
- Google Cloud Interconnect
- Kinx Cloud Hub
- Multi-cloud Access, etc.

As Digital Realty Solutions Architect, Okey Keke mentions, "For organizations today, the cloud question is no longer one of "public or private," it's a matter of choosing the right cloud at the right time."⁸

⁸ Service Exchange and the Benefits of a Multi-Cloud Environment by Okey Keke, Sr., Solutions Architect (article) on December 7, 2016. Retrieved from <https://www.digitalrealty.com/blog/service-exchange-and-the-benefits-of-a-multi-cloud-environment/> on May 18, 2017.



Cloud Exchange Benefits

Following are some examples of cloud exchange benefits:

1. Equinix⁹
 - a. Enables automated interconnection of CSP's.
For instance, the Equinix Cloud Exchange provides exchange members with technology that enables them to manage connections to multiple cloud services in near-real time. The whole process is automated from end-to-end.
 - b. One port, many circuits.
A cloud exchange has what Equinix calls a "one port, many virtual circuits" feature. As the number of participants in the Cloud Exchange grows, service providers and consumers connect to them over a single, physical port.
2. Digital Reality Service Exchange¹⁰
 - a. A secure private cloud connection that avoids the public internet.
 - i. Secure, high-performance private connections by removing the public internet from the connectivity equation to your IaaS, PaaS and SaaS providers.
 - b. Simple multi-cloud access – one connection to access many clouds.
 - i. Multi-cloud connectivity to major CSP's by simplifying provisioning and management across multiple cloud platforms leveraging one port with many virtual connections.
 - c. Highly available cloud access with redundant connectivity options.
3. Equinix¹¹
 - a. Faster Access
 - i. Accessing new technology services or switching CSP's takes minutes and meters of cable, not months and miles of fiber.
Moreover, reducing the number of CSP's is also easier – scaling up and scaling down to match demand and changes in service requirements.
4. InformationWeek¹²
 - a. Reduce WAN Costs
 - i. Ihab Tarazi, Equinix CTO, claimed companies may "reduce their WAN costs by 40%" by connecting to an Equinix hub and choosing their cloud or other partner destinations from there.

⁹ The Equinix Blog. Equinix Cloud Exchange Brings New Level of Interconnection and Potential to the Cloud by Jay Lindsay. Retrieved from <https://blog.equinix.com/blog/2014/04/30/equinix-cloud-exchange-brings-new-level-of-interconnection-and-potential-to-the-cloud/> on April 30, 2014.

¹⁰ Service Exchange – Future Proof Your IT Architecture (PDF document), page 1 of 2. Retrieved from <https://www.digitalrealty.com> on April 4, 2017.

¹¹ Private Cloud Connectivity by Equinix. Retrieved from <http://www.equinix.com/solutions/cloud-infrastructure/private-cloud/connectivity/> on May 18, 2017.

¹² Equinix Cloud Exchange: Private Access To Public Clouds by InformationWeek (article) on February 15, 2015. Retrieved from <http://www.informationweek.com/cloud/infrastructure-as-a-service/equinix-cloud-exchange-private-access-to-public-clouds/d/d-id/1318972> on May 18, 2017.



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With the customer able to build more of his own network connections through hub, he has to pay less to a WAN service provider, he said.

5. Google Interconnect¹³

a. Typical Cloud Interconnect Use Cases

- i. Data intensive applications – Services that require a network connection which has consistent high demands for data, can have significant benefits from using a Cloud Interconnect connection. For example, one use case is a data center which constantly pulls/pushes data from/to Google Cloud Storage to perform heavy computation task on machines within the data center.
- ii. Latency sensitive applications – Services that demand a predictable and fast request-response cycle from or to your cloud resources. For example, an on-demand service sending small images to be manipulated on Compute Engine instances and then displaying them on some website a user has just opened.

6. Equinix¹⁴

a. Connect to the cloud securely for better piece of mind.

Challenge – A government agency required secure connectivity to the cloud for sensitive workloads and wanted dependable performance and a global networking alternative to the public Internet

Solution – The agency leveraged its existing investment to:

- ✦ Secure global connectivity from the WAN to the cloud.
- ✦ Improve reliability with MPLS VPN bandwidth.
- ✦ Experience a quick implementation.

The agency was able to quickly and securely connect to the cloud while avoiding performance-impacting events related to use of the public Internet.

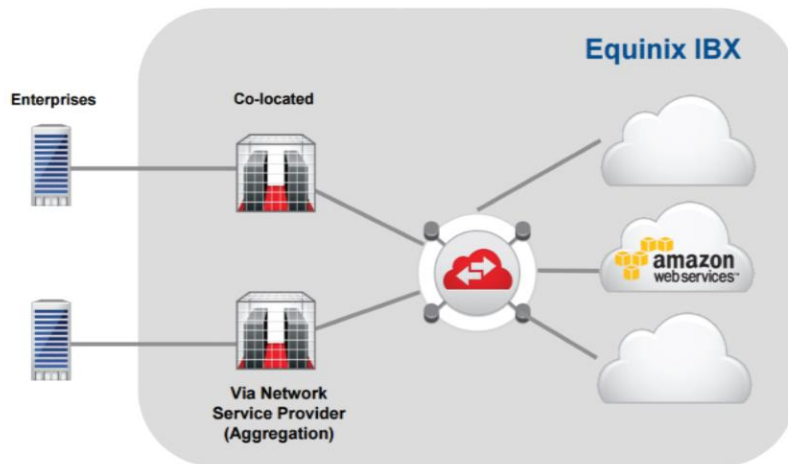
- b. Connect directly to leading CSP's.
- c. On-demand provisioning and simplified management.
- d. True bandwidth on-demand.

¹³ Google Cloud Platform – Google Cloud Interconnect. Retrieved from <https://cloud.google.com/interconnect/docs> on April 4, 2017.

¹⁴ Verizon Secure Cloud Interconnect (SCI) Customer Use Cases (PDF document). Retrieved from <http://www.verizonenterprise.com/> on January 23, 2017.

Equinix Cloud Exchange

Provides agile, secure, instant interconnection to cloud services



Benefits

- Increase your addressable market
- Offer direct, secure private connection through multiple major carriers
- Automated, near real-time provisioning
- Consistent throughput and low latency
- Cost-effective

Features

- Layer 2 Ethernet service
- Layer 3 Ethernet service on roadmap
- Up to 10G virtual connections
- 1GB or 10GB physical ports
- 99.9999% high availability platform
- 20+ global markets supported
- Integrated APIs and Web portal
- **AWS speeds via ECX is < 500Mbps**

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Figure 4: Equinix Cloud Exchange Benefits and Features.¹⁵



¹⁵ Equinix: Exploring Interconnection Oriented Architectures (IOA) with AWS by Eric M. Hui (PDF document), p19 of 23. Retrieved from https://www.slideshare.net/AmazonWebServices/exploring-interconnection-oriented-architectures-with-aws?from_action=save on May 15, 2017.



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Cloud Exchange Symbols

Following are the symbols often seen referencing cloud exchange interconnections:

 <p>Cloud Exchange</p>	 <p>RCS Interconnect Hub</p>	
 <p>Interconnect</p>	 <p>Secure Cloud Interconnect</p>	
<p>Equinix Cloud Exchange</p> 	 <p>Cloud Hub</p>	 <p>RCS Interconnect Hub</p>
	 <p>SERVICE EXCHANGE</p>	 <p>Cloud Exchange</p>
