



Building Direct, High-Performance Connections to Google Cloud Platform

Welcome

Thank you for your interest in our whitepaper, “Building Direct, High-Performance Connections to Google Cloud Platform”.

At Zayo, we have seen companies embrace and adopt the cloud over the last decade. As they have shifted, savvy enterprises started to notice gaps in their cloud connectivity strategy. Using the public internet to connect to the cloud was costing them money, causing performance issues, and compromising the security of their data and workloads.

Personally, I love examples. We recently supported a cloud migration and the ongoing management for a global e-commerce marketplace that provides unique and creative goods, enabling a community of sellers to turn their ideas into successful businesses. This company takes over 40 million active buyers and sellers and processes over one billion events per day.

Historically this company was perfectly content running its e-commerce platform on-premises, but as the company scaled, the time came to consider a change—both to better functionality and sustainability. The company decided to make a commitment to reduce energy utilization from its data centers by 25% over the next few years, a task made significantly easier by utilizing the cloud. In addition to reducing energy consumption with the cloud, being able to support rapid compute deployment, machine learning, and complex analytics brought them into the Google Cloud Platform.

By utilizing a direct connection in combination with the new cloud services, this e-commerce company improved landing page experiences, search algorithms to promote items, and was better equipped to analyze competitive shipping rates. As a fiber-based provider, Zayo was able to ensure the necessary speed, data capacity, and security to support their migration and future within Google Cloud.

The success of this e-commerce platform showcases how Zayo and Google Cloud Platform combined provide cost-effective, performant, and secure connectivity options. We hope this whitepaper provides insight into the strategy behind private, dedicated connectivity and how it can be an integral component of any cloud solution.

Cheers,
Tyler



TYLER COATES
SENIOR VICE PRESIDENT,
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Introduction



Zayo Group Holdings, Inc. (NYSE: ZAYO) provides mission-critical bandwidth to the world's most impactful companies, fueling the innovations that are transforming our society. Zayo's 130,000-mile network in North America and Europe includes extensive metro connectivity to thousands of buildings and data centers. Zayo's communications infrastructure solutions include dark fiber, private data networks, wavelengths, Ethernet, dedicated internet access and data center colocation services. Zayo owns and operates a Tier 1 IP backbone and 51 carrier-neutral data centers. Through its CloudLink service, Zayo provides low-latency private connectivity that attaches enterprises to their public cloud environments. Zayo serves wireless and wireline carriers, media, tech, content, finance, healthcare and other large enterprises.

For more information, visit zayo.com.



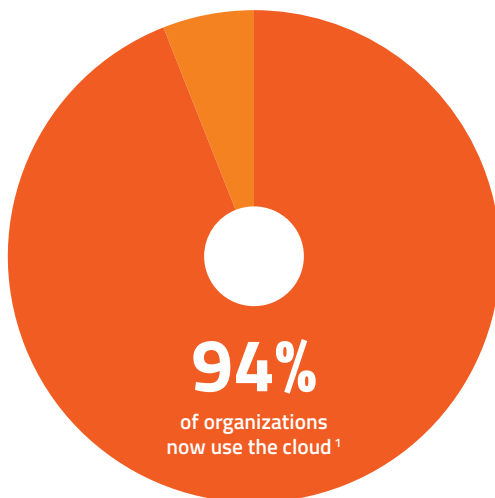
Google Cloud is widely recognized as a global leader in delivering a secure, open, intelligent and transformative enterprise cloud platform. Built on Google's private network, it is the product of nearly 20 years of innovation in security, network architecture, collaboration, artificial intelligence and open source software. Google offers a simply engineered set of tools and unparalleled technology across Google Cloud Platform and G Suite that help bring people, insights and ideas together. Customers across more than 150 countries trust Google Cloud to modernize their computing environment for today's digital world.

Executive Summary

The adoption of public cloud soars as 94% of organizations are now using it for critical business operations.¹ Companies have grown more and more comfortable moving mission-critical data and workloads from on-premises locations to the cloud. The transition to the cloud comes with uncertainty around security risks, performance trade-offs and potential cost burdens.

CloudLink by Zayo and Google have partnered to minimize the uncertainty for companies looking to optimize their cloud investment and specifically their connection to GCP.

CloudLink by Zayo addresses concerns around security, performance and costs by partnering with Google Cloud to provide CIOs a secure, performant, cost-optimized solution to direct cloud connectivity. Through first and last mile, private connectivity leveraging Zayo's global network, CloudLink delivers Google Cloud Platform to customer's enterprise locations or data centers.



1. Source: RightScale 2019 State of the Cloud Report from Flexera

"Partner Interconnect gives Google Cloud customers even more connectivity choices for hybrid environments. Together with Zayo's CloudLink, we are making it easier for customers to extend their on-prem infrastructure to the Google Cloud Platform."

JOHN VEIZADES

PRODUCT MANAGER
GOOGLE CLOUD

Terminology

Google Cloud Platform

Google Cloud Platform (GCP) consists of a set of physical assets, such as computers and hard disk drives, and virtual resources, such as virtual machines (VMs), that are contained in Google's data centers around the globe. Each data center location is in a global region. Regions include Central US, Western Europe and East Asia. Each region is a collection of zones, which are isolated from each other within the region. Each zone is identified by a name that combines a letter identifier with the name of the region.

CloudLink

CloudLink by Zayo is a direct, private connection from enterprise locations and data centers to the cloud at over 300 global cloud on-ramps.

On-Ramp

An on-ramp is a location where a company connects to a cloud service provider. It is a physical location and has a specific address.

NNI

NNI stands for Network to Network Interface and generally connects two networks together.

Diversity

Diversity is a network architecture with alternative paths available for network traffic in case of a failure.

Redundancy

A system design in which a component is duplicated, so if it fails, there will be a backup.

Latency

This is a measure of delay of traffic from one location to another and is measured in milliseconds.

Traditional Connectivity Models

There are two main types of traditional cloud connectivity.

Public Internet: The simplest, most widely available option to connect to Google Cloud is through the public internet. Data and workloads travel between GCP and a company's on-premises locations through multiple hops and often multiple carriers.

Private Connectivity: Conversely, companies can connect to the Google Cloud Platform through a private connection. This method relies on direct physical connections between a company's on-premises locations and Google Cloud.

Risks in Traditional Cloud Connectivity Models

While traditional connectivity models may suffice for some use cases, there are some major risks.



Security

Without a direct connection, there is more surface area for a potential attack to take place from a malicious actor. While the public internet is a simple connection, it is not secured by a single entity and therefore, less secure than a private connection.



Performance

There are no guaranteed speeds with public internet. Data and workloads may travel quickly between a company's premises and GCP; however, they may be slowed down significantly if there is a lot of other traffic also traveling back and forth. This can cause significant performance issues and slower speeds.



Reliability

The public internet cannot offer a company reliable speeds, especially in the case of large-scale cloud migration. A dedicated and private connection will allow companies to access their data and workloads in GCP at reliable, consistent speeds.



Costs

Data egress charges are significantly more expensive for companies relying on the public internet for access to GCP. Through a public internet connection, data egress fees are \$0.09 per gig. Through a private connection, egress fees drop to \$0.02 per gig.

Optimized Cloud Connectivity

Interconnect Overview

GCP's Interconnect extends a company's on-premises network to Google's network through highly available, low-latency connections. Google Interconnect is a private connection into Google Cloud.

Dedicated Interconnect

Dedicated Interconnect requires a minimum private connection speed of 10Gbps, making it ideal for companies in need of a high-bandwidth connection for large data transfers. Multiple connections can be lagged together for a maximum of 10 circuits, or 100Gbps. Dedicated Interconnect enables companies to transfer large amounts of data between networks, which can be more cost effective, secure and reliable than purchasing additional bandwidth over the public internet.

Partner Interconnect

Partner Interconnect is for companies requiring a private connection with lower bandwidth needs. The minimum bandwidth for partner interconnect is 50Mbps and ranges up to 10Gbps. Partner Interconnect offers companies a secure and reliable way to access their data and workloads in GCP through private connectivity.

CloudLink Overview

CloudLink by Zayo is a direct, private and secure connection from an enterprise or data center to 50+ Cloud Service Providers. CloudLink, paired with Google Interconnect, provides a low-latency and secure connection to Google Cloud Platform. The solution includes both dedicated and partner models and multiple transport protocol options including waves, Ethernet and IP-VPN with speeds between 50Mbps and 100Gbps.

Multiple Connectivity Options

For **Dedicated Interconnect**, CloudLink by Zayo provides a direct physical connection between a company's premises or data center and their Google Virtual Private Cloud (VPC). CloudLink by Zayo offers multiple transport protocol options including waves, Ethernet or IP-VPN/MPLS. A single dedicated interconnect is permitted; however, Google does not provide an availability SLA. For redundancy, and to obtain a 99.9% availability SLA from Google, the company must build duplicate interconnects in the same metro but in two different metropolitan availability zones. For a 99.99% Google availability Google SLA, there must be two more interconnects (Zone 1 and Zone 2) within a metro market, plus two more interconnects (Zone 1 and Zone 2) within a different, geographically diverse market for a total of four connections.

For **Partner Interconnect**, CloudLink by Zayo provides a direct, physical connection between a company's premises or data center and its Virtual Private Cloud (VPC). Zayo provides multiple transport protocol options including Ethernet or IP-VPN/MPLS. Zayo provisions two zones (Zone 1 and Zone 2) within a metro location. This provides the company with a 99.9% availability SLA. For a 99.99% Google availability Google SLA, there must be two more interconnects (Zone 1 and Zone 2) within a metro market, plus two more interconnects (Zone 1 and Zone 2) within a different, geographically diverse market for a total of four connections.

Network Scale

Zayo's Google Interconnect Private On-Ramp Locations



Locale	Google Regions	Dedicated Interconnect
NORTH AMERICA GEOPOLITICAL REGION		
Atlanta		Zone1 Equinix AT2: 56 Marietta St NW Atlanta, GA Zone2 Equinix AT2: 56 Marietta St NW Atlanta, GA
Aurora	northamerica-northeast1 (Montréal)	Zone1 CyrusOne CHI1: 2905 Diehl Rd Aurora, IL Zone2 CyrusOne CHI1: 2905 Diehl Rd Aurora, IL
Chicago	us-central1 (Iowa) us-east1 (South Carolina)	Zone1 Equinix CH1: 350 E Cermak Rd Chicago, IL Zone2 Equinix CH1: 350 E Cermak Rd Chicago, IL
Dallas	us-east4 (Virginia) us-west1 (Oregon)	Zone1 Equinix DA1: 1950 N Stemmons Fwy Dallas, TX Zone2 Equinix DA1: 1950 N Stemmons Fwy Dallas, TX
Denver	us-west2 (Los Angeles)	Zone1 CoreSite DE1: 910 15th St Denver, CO Zone2 CoreSite DE1: 910 15th St Denver, CO
Los Angeles		Zone1 Equinix LA1: 600 W 7th St Los Angeles, CA Zone2 CoreSite LA1: 624 S Grand Ave Los Angeles, CA

Locale	Google Regions	Dedicated Interconnect	
NORTH AMERICA GEOPOLITICAL REGION (CONTINUED)			
Miami	northamerica-northeast1 (Montréal) us-central1 (Iowa) us-east1 (South Carolina) us-east4 (Virginia) us-west1 (Oregon) us-west2 (Los Angeles)	Zone1	Equinix MI1: 50 NE 9th St Miami, FL
		Zone2	Equinix MI1: 50 NE 9th St Miami, FL
Montreal		Zone1	Cologix MTL3: 1250 Boul Rene-Levesque O Montreal, QC
		Zone2	Cologix MTL3: 1250 Boul Rene-Levesque O Montreal, QC
Newark		Zone1	Equinix NY1: 165 Halsey St Newark, NJ
		Zone2	Equinix NY1: 165 Halsey St Newark, NJ
New York		Zone1	Digital Realty: 111 8th Ave New York, NY
		Zone2	Zayo: 60 Hudson St New York, NY
San Jose	us-east4 (Virginia) us-west1 (Oregon) us-west2 (Los Angeles)	Zone1	Equinix SV1: 11 Great Oaks Blvd San Jose, CA
		Zone2	Equinix SV1: 11 Great Oaks Blvd San Jose, CA
Seattle		Zone1	Equinix SE2: 2001 6th Ave Seattle, WA
		Zone2	Equinix SE2: 2001 6th Ave Seattle, WA
Toronto		Zone1	Northam Realty: 151 Front Street West Toronto
		Zone2	Equinix TR2: 45 Parliament St Toronto
Washington DC		Zone1	Equinix DC2: 21715 Filigree Ct Ashburn, VA
		Zone2	Equinix DC2: 21715 Filigree Ct Ashburn, VA
EUROPE GEOPOLITICAL REGION			
Amsterdam	europe-north1 (Finland) europe-west1 (Belgium) europe-west2 (UK) europe-west3 (Germany) europe-west4 (Netherlands)	Zone1	Equinix AM5: Schepenbergweg 42 Amsterdam, NL
		Zone2	Equinix AM3: Science Park 610 Amsterdam, NL
Frankfurt		Zone1	Equinix FR4: Lärchenstrasse 110 Frankfurt, Germany
		Zone2	Equinix FR4: Lärchenstrasse 110 Frankfurt, Germany
London		Zone1	Equinix LD5: 8 Buckingham Ave Slough, UK
		Zone2	Global Switch 2: 3 Nutmeg Lane London, UK
Paris		Zone1	Interxion PAR7: 1-3 Rue Râteau La Courneuve, France
		Zone2	Global Switch: 7-9 Rue Petit Clichy, France
Milan		Zone1	Infracom Italia: Via Caldera 21 Milan, Italy
		Zone2	Infracom Italia: Via Caldera 21 Milan, Italy
ASIA GEOPOLITICAL REGION			
Hong Kong	asia-east1 (Taiwan) asia-northeast1 (Japan) asia-southeast1 (Singapore)	Zone1	MEGA-i: 399 Chai Wan Rd Hong Kong
		Zone2	Equinix HK2: 3 Shing Yiu St Kwai Chung, Hong Kong
Singapore		Zone1	Global Switch: 2 Tai Seng Ave Singapore
		Zone2	Equinix SG3: 26A Ayer Rajah Crescent Singapore
Tokyo		Zone1	ComSpace I: Horidomecho Nihonbashi 1-5-3 Chuo-ku Tokyo
		Zone2	Equinix TY2: 3-8-21 Higashi Shinagawa-ku Tokyo
AUSTRALIA GEOPOLITICAL REGION			
Sydney	australia-southeast1 (Sydney)	Zone1	47 Bourke Rd Sydney, AU
		Zone2	4 Eden Park Drive Sydney, AU

Google Global Technology Partner

CloudLink by Zayo is one of Google's Global Technology Partners for Google Interconnect in the Infrastructure category.

Benefits



Performance

CloudLink is a high-performance, low-latency solution for direct cloud connectivity. With a direct connection, instead of a public internet connection, companies get higher performance and lower latency because their traffic and workloads are not competing with significant amounts of other traffic. CloudLink provides a dedicated path at consistent speeds. Through Zayo's expansive global network, CloudLink is able to build diversity and redundancy into CloudLink connections.



Security

CloudLink is a secure way to connect data and workloads to the GCP. CloudLink is a private, dedicated connection to cloud service providers. CloudLink avoids the public internet and its inherent risks including malicious actors, DDoS attacks and hacking. For companies with HIPAA compliant data, GDPR standards or PCI standards, a direct connection is more secure simply because it is private. CloudLink also provides 24x7 threat monitoring by Zayo's NOC.



Cost Savings

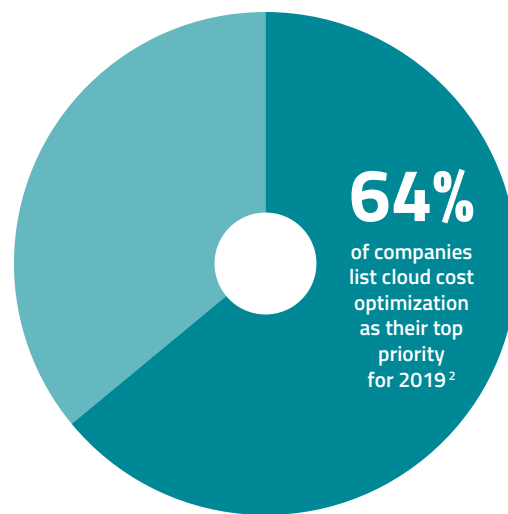
Finally, CloudLink helps companies save significant money in the form of lower data egress fees. Google charges companies between \$0.09/G - \$0.14/G in data egress fees for pulling information out of the cloud. By leveraging private connectivity with CloudLink, data egress fees drop to about \$0.02/G.

Cloud Migration

Scenario

Though there are many reasons for implementing a direct connection to Google Cloud Platform, a large-scale cloud migration is a likely scenario for many customers across all industries.

According to the RightScale “2019 State of the Cloud Report,” companies plan to spend 24% more on public cloud in 2019 than they did in 2018. Additionally, 58% of enterprises name “moving more workloads to the cloud” as a top priority for 2019. Though migration is a priority, cloud cost optimization is an even higher priority as 64% of survey respondents named it their top priority for 2019.



Challenges

As companies prepare for a large-scale cloud migration many challenges arise. First, large-scale migrations can take anywhere from days to months depending on the amount of data and workloads the company needs to migrate. Relying on the public internet for a migration means that companies are unable to accurately estimate when the migration will be complete because this type of connection is not reliable. Interruptions from competing traffic may slow the migration down significantly. Next, companies need to understand the security risks that come with moving data and workloads to the cloud. Once data and workloads are in the cloud, they are secure; however, a connection to the public internet leaves companies open to potential risks and attacks. Finally, while the migration of data and workloads to the cloud is typically inexpensive, companies will begin to incur data egress fees as they pull data down from the cloud. Without a direct connection, data egress charges can be costly and burdensome for companies relying on the cloud for mission-critical data and workloads.

2. Source: RightScale 2019 State of the Cloud Report from Flexera

Solution

By combining CloudLink by Zayo and Google Interconnect, companies are able to achieve high-performance, secure, cost-optimized, private connections to Google Cloud Platform. Depending on locations, bandwidth needs and desired GCP zones, CloudLink can design a direct connectivity solution for any company.

Benefits

Companies relying on CloudLink to migrate data and workloads to Google Cloud Platform can expect to see three important benefits, including:

PREDICTABLE MIGRATION COMPLETION	FIRST AND LAST MILE PRIVATE CONNECTIVITY	COST SAVINGS
CloudLink is a direct, physical connection from a company's premises or data center to GCP, providing a predictable and consistent migration route for data and workloads. A completion date will be set for the migration depending on the amount of data and workloads to be transferred. If a company needs migration to take place as quickly as possible, CloudLink along with Google Dedicated Interconnect offers a 10Gbps connection to GCP.	For companies with sensitive information including government documents, financial transaction records, patient or customer data, a private connection is important. Migration to GCP is possible over the public internet; however, CloudLink and Interconnect provide a private, closed connection all the way to the cloud. This connection is more secure as it reduces the surface area for a potential attack from a malicious actor.	After a successful migration, companies with dedicated or partner interconnect will realize significant cost savings through lower data egress fees. With CloudLink and Interconnect, egress fees will drop to \$0.02/Gbps from \$0.09/Gbps.

Getting Started with Direct Cloud Connectivity

Implementation & Deployment

Dedicated Interconnect

To get started with **Dedicated Interconnect**, a company needs to purchase a 10Gbps Dedicated Interconnect port from Google and dedicated CloudLink circuits from Zayo. Zayo installs the circuits between the company locations or data centers and the Google port. From there, the company provides Zayo with its LOA/CFA for its Google Port and Zayo installs a cross connect. If the connection is over a layer-3 service, Zayo will manage BGP routing between the company's network and Google.

Partner Interconnect

To get started with **Partner Interconnect**, a company needs to purchase two virtual Partner Interconnect ports from Google and dedicated CloudLink circuits from Zayo. Zayo installs the circuits between the company locations or data centers and the Google ports. The company is not responsible for cross connects to Google but is responsible for establishing BGP routing directly with Google if they have chosen a layer-2 service. For a layer-3 service, Zayo manages BGP routing between the company's network and Google. The company is responsible for configuring and managing their Google Cloud router.

Best Practices

For mission-critical applications that have a low tolerance for downtime, Google recommends that you use a 99.99% available configuration. To be covered under the production-level applications SLA (99.99% monthly uptime percentage), you must build your network according to this topology.



The 99.99% availability configuration requires **four connections across two GCP regions**.

Additionally, CloudLink recommends reassessing bandwidth usage and bandwidth requirements periodically to confirm cost are optimized.

Costs

For **Dedicated Interconnect**, there is a \$1,700 monthly recurring cost to Google for the 10Gbps port and \$0.02/Gbps for data egress on average. Zayo costs will vary based on bandwidth size, type of connection and locations.

For **Partner Interconnect**, a company pays Google a virtual port charge for 50Mbps - 10Gbps of \$78 - \$1,800 monthly recurring cost and \$0.02 for data egress on average. Zayo costs will vary based on bandwidth size, type of connection and locations.

The 99.99% availability configuration requires four connections across two GCP regions.

CloudLink recommends reassessing bandwidth usage and bandwidth requirements periodically to confirm cost are optimized.

Summary & Conclusion

Thank you for taking the time to review this “Building Direct, High-Performance Connections to Google Cloud Platform” whitepaper from Zayo and Google.

As you invest further in Google Cloud Platform, direct connectivity becomes more important. CloudLink by Zayo combined with Google Interconnect offers customers a scalable, secure solution to direct connectivity into GCP.

Many CIOs and CTOs who have endorsed a cloud migration or “cloud first” strategy face a number of concerns from across the business. Very often those concerns include:

- The governance of the consumption of cloud resources
- Managing cloud spend in partnership with the Finance and Cloud Center of Excellence
- The inherent security risk of moving previous on-prem data and workloads to the public cloud

When designing your network-to-cloud architecture, remember:

- Public internet is the easiest way to reach your cloud but can present major and minor issues including security, performance, reliability and costs
- Google Interconnect is private connectivity into the Google Cloud
- CloudLink relies on Zayo’s 12.5M+ mile all-fiber backbone to connect companies from their locations or data centers to the Google Cloud

We hope this whitepaper was helpful to you as you strategize your next moves along your digital transformation journey. The teams at Zayo and Google are here to help you reach your cloud connectivity goals by partnering with you to build a custom-designed strategy for your company.

Reach out today for assistance in building a direct, high-performance connection into the Google Cloud Platform.

As you invest further in Google Cloud Platform, direct connectivity becomes more important.

The teams at Zayo and Google are here to help you reach your cloud connectivity goals by partnering with you to build a custom-designed strategy for your company.

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