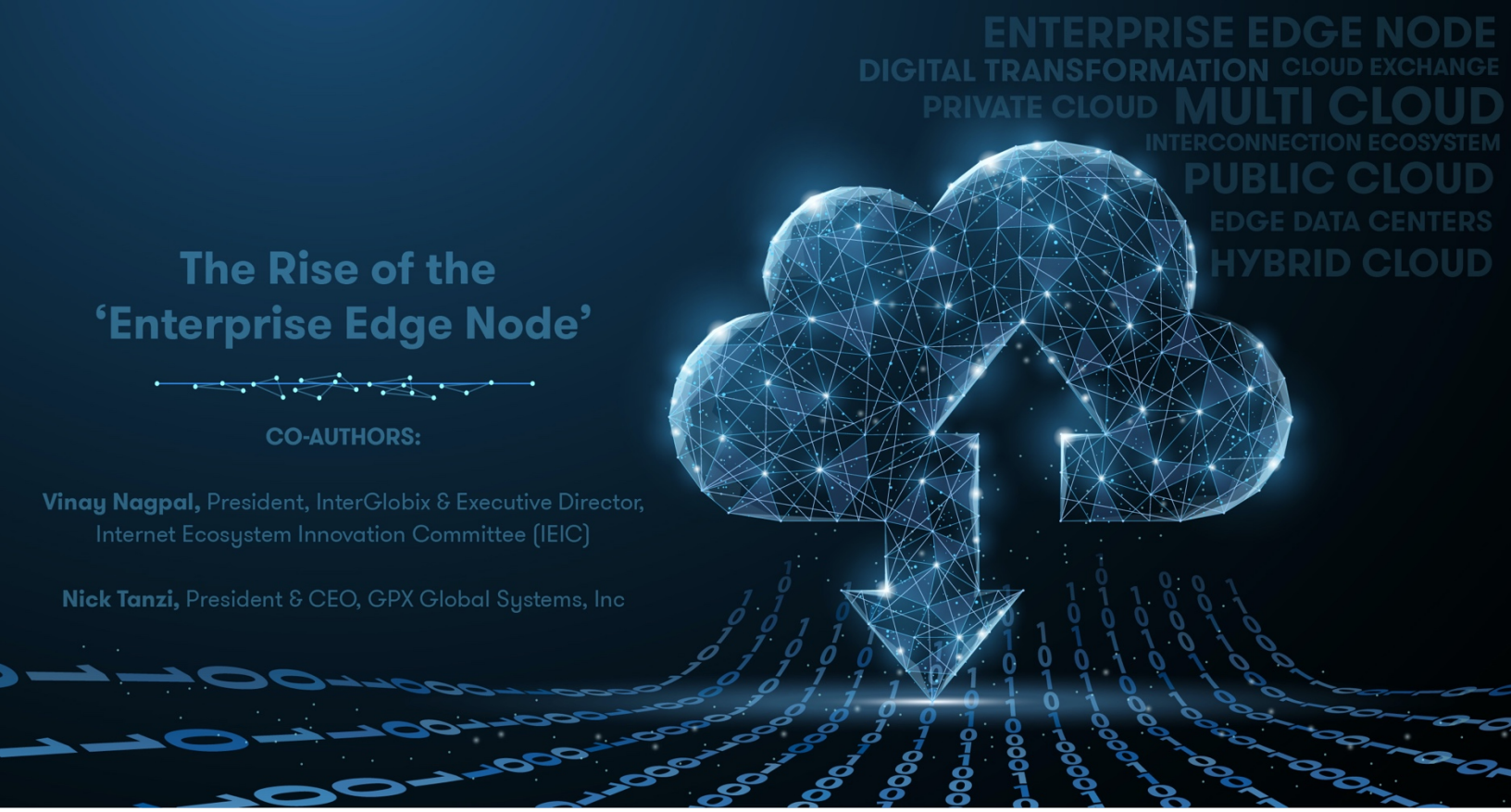

WHITE PAPER

The Rise of the 'Enterprise Edge Node'

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THE ENTERPRISE IT SPECTRUM

The move to a shared services architecture in the information technology (IT) realm is not new for the enterprises. "Cloud" services which represent the delivery of IT services through web-based tools and applications, as opposed to a direct connection to a server, have become mainstream over the last decade or so. The explosive digitalization of corporate enterprises and the strong appeal of cloud-based services–which includes ease-of-use, scalability, and economies of scale–enables the corporate enterprises to focus on their core business functions, as opposed to the hardware and software aspects of IT.

JOURNEY TO THE CLOUD

As the adoption of cloud-based services continues to be on the rise, different models such as multi cloud and hybrid cloud have been developed. While formulating and executing their outsourcing strategies, enterprises have considerations for two aspects (at a high level)–the compute and the network. Usually enterprises adopt a multi-pronged approach when designing their outsourced architecture. In this outsourcing proposition, the network component is extremely critical as it "glues" together the various aspects of their architecture. These innovative and evolving business models form the genesis of the rise of the "Enterprise Edge Node," which signifies an enterprise's network components that they outsource and colocate at a connectivity-rich, low-latency "edge" data center.

The primary goal of moving the enterprise network components to an edge data center is to interconnect to a multitude of partners in an interconnection ecosystem. These partners comprise–Cloud Service Providers, Telco's, Internet Service Providers (ISPs), Software-defined Networking (SDNs), Internet Exchange Providers (IXPs), and Content Distribution Networks (CDNs).

This paper provides an in-depth look at the various facets of interconnection for enterprises as part of their outsourcing strategy. The paper touches on the critical importance for the enterprises to establish a highly connected Enterprise Edge Node in a connectivity-rich and carrier-neutral third-party edge data center.

PUBLIC & PRIVATE CLOUD

As an enterprise continues its journey to the cloud, it is clear that there is no magic formula and certainly no one-strategy-fits-all approach. Enterprises are actively evaluating the cloud-based services and the cloud providers so they can offload the workloads from their in-house

IT systems to a cloud-based environment. This allows them to adopt cloud-based services and taking advantage of economies of scale and price.

In a "public cloud" environment, the cloud resources like servers and storage are owned and operated by a third-party cloud service provider and delivered over the Internet. Amazon Web Services, Google Cloud, and Microsoft Azure are examples of a public cloud. With a public cloud, all hardware, software, and other supporting infrastructure are owned and managed by the cloud provider and typically delivered over the public Internet. In a "private cloud" environment, the cloud resources are owned and operated by the enterprise and delivered over private network. In a public cloud architecture, multiple organizations can take advantage of the shared cloud infrastructure, whereas in a private cloud, the computing resources are used exclusively by one organization. Furthermore, in the case of a private cloud the infrastructure can be hosted at the organizations on-premises data center or at a third-party data center, but always accessible via a private network. Whereas in the case of public cloud, the infrastructure is either hosted in the cloud provider's data center or in a third-party colocation data center.

MULTI CLOUD & HYBRID CLOUD

With the growing choices of cloud providers, enterprises are typically adopting a multi cloud strategy that encompasses offloading different IT workloads to different cloud providers. The enterprises could do this for a variety of reasons including–to reduce their dependency on any one single cloud provider, for the availability of feature-sets, and for architectural similarities. Furthermore, enterprises do not usually offload all of their IT workloads all at once. They do it in a phased approach, which can be for various reasons. A hybrid cloud strategy enables an enterprise to keep part of their IT infrastructure in-house and/or outsource part of their infrastructure in a colocation environment. At times, enterprises choose to go with a model that comprises–private cloud, multiple public clouds, and colocation.

Regardless of whether a multi cloud or hybrid cloud architecture is part of an enterprise's plan, there are two crucial components involved. One is secure, high-speed, low-latency network connectivity, and the second is a highly reliable data center. Typically, the network connectivity component is key not just in terms of public-facing Internet, but also connectivity from the enterprise to the outsourced cloud environment–be it the cloud provider-owned data center or a third-party data center where the cloud provider has their cloud infrastructure hosted.

Another important component of a hybrid cloud architecture that is applicable especially in terms of a third-party data center is colocation. The colocation service provider offers an enterprise the option to retain the ownership of their equipment and gain space/power/ interconnectivity in a data center environment wherein they can get 24/7 access and have their equipment hosted in a highly secure and reliable environment.

EDGE DATA CENTER

The key purpose of an "edge" data center is to provide connectivity-rich, neutral and open interconnection ecosystem. As compared to hyperscale or enterprise data centers, edge data centers are typically smaller facilities located close to the populations they serve. The edge data centers deliver cloud computing resources and cached content to end-users offering a colocation environment with a multitude of connectivity options to its customers. Content Distribution Networks (CDNs) also tend to gravitate towards such edge data centers, as they become prime locations to off-load content from the CDNs to the access providers or eyeball networks. In most scenarios, the edge data centers connect to a larger central data center or multiple data centers, where the servers or the "compute" capability resides.

The key value proposition of an edge data center is to offer customers interconnection services with a multitude of network partners to choose from including CSPs, Telco's, SDNs, IXPs, and CDNs. Each provider plays a role in forming a highly connected and robust interconnection ecosystem. Edge data centers represent two use cases that are both very critical in their own way:

1) Edge data centers are the foundation and key enablers for the acceleration of multi cloud deployment.

2) Edge data centers are integral to the efficient high-quality distribution of content across multiple platforms (ISPs, Telco's, Mobile, and WiFi etc.)

ENTERPRISE EDGE NODE

The value proposition of such a third-party data center is directly proportionate to the density of networks and cloud service providers present in a data center that can offer a multitude of connectivity and service options to the enterprise customer. It is extremely valuable for an enterprise to colocate in a connectivity-rich, carrier-neutral data center that offers a robust interconnection ecosystem. The enterprises have their network nodes or "Enterprise Edge Node" deployed at such a data center to be able to take advantage of the various connectivity options available to them via a direct, private, and low latency interconnection systems that are owned and operated within the walls of the datacenter.

An Enterprise Edge Node that is hosted in a connectivity-rich and carrier-neutral edge data center comprises networking equipment owned and operated by the enterprise customer in a colocation environment. The enterprises have 24/7 access to their infrastructure deployed in a third-party data center, in this case an edge data center, where their Enterprise Edge Node is colocated.

The Enterprise Edge Node forms the basis of vital connectivity platform for enterprises to develop secure, reliable, and scalable private, public, and hybrid cloud architectures.

*"The ability to host an enterprise network node or an 'Enterprise Edge Node' in a highly reliable data center that is not only carrier-neutral, but also hosts multiple Cloud Service Providers (CSPs) and offers seamless connectivity to those CSPs, should be of utmost value to any enterprise to execute their multi cloud and/or hybrid cloud strategies," said **Dr. Jason Black, Head of Global Network Infrastructure at Uber**. "Such a connectivity-rich interconnection ecosystem, especially with a highly reliable and highly scalable and predictable interconnection model, becomes a vital building block of any enterprise's IT and business strategy."*

Dr. Jason Black
***Head of Global Network Infrastructure,* Uber**

Key attributes of carrier-neutral Edge Data Centers are:

1. Connectivity to multiple cloud providers.
2. Dedicated private connectivity to cloud providers who offer direct connectivity services bypassing the public Internet (e.g. AWS DirectConnect, Oracle FastConnect, and Google Dedicated Interconnect).
3. The ability to connect one or more carriers and implement a highly reliable, scalable, and secure network interconnecting an enterprise on-premise infrastructure to their infrastructure collocated in the enterprise's edge data center.
4. The ability to connect to an interconnection ecosystem including multiple cloud service providers, telco's, ISPs, SDN's, IXP's, and CDN's inside an edge data center.

DEDICATED PRIVATE CONNECTION TO CLOUD SERVICE PROVIDERS

As cloud nodes are built in edge data centers, major cloud operators provide the ability for enterprises to connect to the cloud platform via a dedicated private connection inside a data center bypassing the public Internet. These are private connections to the cloud "on-ramps." Examples of cloud providers offering the capability to establish private dedicated connections are Alibaba Express Connect, AWS DirectConnect, Google Dedicated Interconnect, IBM Cloud Direct Link, Microsoft ExpressRoute, Oracle FastConnect, and Salesforce Express Connect.

OPEN CLOUD EXCHANGE

As enterprises connect to multiple cloud providers, the cloud exchange architecture continues to gain popularity. An "open cloud exchange" enables enterprises to connect to multiple cloud providers with one simple port. The cloud exchange model is categorized into two types. First, where an SDN provider or an interconnection provider takes space/power in multiple data centers (where the CSPs are present) and establishes a cloud exchange (e.g. Megaport, PacketFabric, DE-CIX); and second where a data center operator establishes a cloud exchange in its facility and offers it as a service to customers (e.g. CoreSite Open Cloud Exchange, GPX Open Cloud Exchange, Equinix Cloud Exchange).

THE PANDEMIC EFFECT

The current global pandemic has made us realize that a reliable and resilient Internet is extremely important to human civilization. In the past few months, the uses of the Internet have manifested into various forms including remote working, virtual classroom, telemedicine as well as virtual meetings among family and friends. As corporate enterprises have come to terms that things may never go back to the way they were, they have to gear up to support their remote workers for the foreseeable future. This involves, among other things, ensuring that remote workers can access company data in a secure and reliable way, and the cloud-based model due to its inherent characteristics offers those traits. Therefore, enterprise organizations are speeding up their cloud adoption plans, and implementing a multi cloud and hybrid cloud architecture for their IT applications faster than they anticipated.

ANALYSTS' VIEW

- As per a recent RBC Capital Markets report published in April 2020, in their first annual Foundations Global Interconnection Survey, more than 70 percent of their respondents said they are connecting or have plans to connect to cloud service providers, and more than 60 percent are using or have plans to use network-as-a-service platforms within

the next 12 months.

- According to Flexera's 2020 State of the Cloud Report, 59 percent of the enterprises interviewed either had "slightly higher" or "significantly higher" accelerated plans to move to the cloud due to the current pandemic.

- According to a recent survey cited in a Cowen Research report, the companies surveyed expect their spend with public cloud providers to grown 38 percent year-over-year in 2020, accelerating vs. 36 percent year-over-year growth in the 2019 survey. COVID-19 is accelerating the migration for more than 50 percent of respondents. The reasons for acceleration being flexibility, resiliency, and remote working. Business continuity and collaboration tools are part of long-term IT strategy now.

- On-premise infrastructure, usage continues to be on the decline with the shift towards private cloud, public cloud, and SaaS. 36 percent of enterprise workloads/applications are still hosted on-premise (in comparison to 42 percent in last year's survey), and over the next five years this number is expected to be 30 percent. This represents opportunity for third-party colocation data center providers.

SUMMARY

As the "new normal" gets defined in the months to come, one thing is for certain, there is no going back to the way things were. Among other changes, the accelerated move to the cloud is going to be an after-effect of the current pandemic, in-fact it is a trend already starting to emerge. As an increased number of enterprises realize the speed and ease of deployment, the ability to scale, and the cost-efficiencies associated with a cloud-based model, the adoption of cloud-based services will see a continued increase in the years to come. Along with it, the role of an edge data center will become more and more vital in the industry as enterprises outsource and establish their network node or their Enterprise Edge Node inside an edge data center provider's facility. With this move, not only will they gain access to multiple CSPs via an open cloud exchange but also have access to multiple network connectivity providers including Telco's, ISP's, SDN's and CDN's. Each of these providers represent key building blocks of a connectivity-rich interconnection ecosystem which is the backbone of digital transformation.