EDGE COMPUTING:

Get Closer to the Cloud

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EXECUTIVE SUMMARY

We've come full circle. From storing data locally to moving it to a centralized data center, then to the cloud, and then to a multi-cloud system, data processing is now coming back down to earth. Edge computing is placing information and resources closer to users for an improved experience. The catalyst is the growing volume of data and the evolving complexity of applications. Whereas the internet (as originally conceived) is fine for remote information sharing, research, ecommerce and other applications where latency is not an issue, it is woefully inadequate to handle the interactivity demanded by artificial intelligence, virtual reality, augmented reality, telemedicine and other coming applications that require a nanosecond response.

For example, by 2025, 175 zettabytes (175 trillion gigabytes) of data will be generated around the globe[1]. A single autonomous vehicle equipped with multiple sensors to ensure safe driving will produce 10 GB of data every second[2]. Every piece of online media will be HD, sucking up more bandwidth. And this is to say nothing about the millions of consumers who expect near instant response to perform their jobs, purchase goods and services, or simply access entertainment from anywhere at any time.

To provide the experience consumers expect, information needs to be closer to the user. Edge computing allows for faster responsiveness, as opposed to waiting for the centralized data center to receive and process requests. Digital enterprises, Internet Service Providers and Cloud Service Providers need to invest in edge computing technology to deliver the experience that will engage users and retain them as long-term customers to maximize advertising and subscription revenues. Companies that fail to invest in edge computing today could find themselves in the unenviable position of scrambling to catch up to their competitors tomorrow[3].

This White Paper is intended to educate IT professionals about the advantages edge computing offers over traditional forms of network architecture to deliver a better user experience through faster response.

EDGE COMPUTING:

Reshaping the Network Horizon

Network and web access is the lifeblood of all digital enterprises today, and is one of the prime offerings of every Internet and Cloud Service Provider. It is the conduit through which all data is exchanged, services are provided and revenues are derived. Edge computing is transforming how those services and information are delivered to end users and customers.

For residential consumers, ISPs provide the direct links between users and their personal information, news and entertainment. They are the retail customers who pay monthly subscriptions and view the advertisements that fuel provider revenues. ISPs are their always-on connections to email, ecommerce and ESPN. In an increasingly mobile world, these users could be accessing their data or shopping from anywhere, anytime. Placing information closer to users and even anticipating their next request reduces latency and makes for more satisfied customers.

Small businesses without a modern, secure network infrastructure are leasing necessary services from ISPs/CSPs, who in turn are building networks of smaller micro data centers to bring data processing and storage closer to customers requiring more speed and reliability.

Even large commercial enterprises with their own private networks are migrating to the edge to improve the experience of their internal customers, aka employees. Whether that is the attendant in the airport car rental lot checking in returning vehicles via tablet, a broker executing trades through the New York Stock Exchange, business executives discussing strategy on a video conference call, or a consulting physician viewing telemedicine images from three time zones away during surgery – nanosecond response is critical to maximizing productivity, profitability and perhaps even saving lives.

The bottom line is that improving the customer experience is key to attracting and retaining consumers (both external and internal), and edge computing enhances that experience greatly. Edge computing is truly reshaping the network horizon.

THE EVOLUTION OF EDGE COMPUTING

Once upon a time (circa 2010), the IT world was dominated by centralized data processing technology; all information and transactions flowed into and out of an organization's single data center. That model provided stability, security and control, but began to experience latency issues as file sizes grew and applications became more complex and interactive. Service providers and large enterprises started migrating some functions and data storage to the cloud to improve performance, and eventually to a multi-cloud or hybrid system. The goal was to lighten the processing load, spread the risk, enable backup and provide redundancy – all while placing content closer to users in different geographies for a better experience. Today the multi-cloud strategy has fragmented further to place smaller servers with some processing power close enough to front-line users to deliver real-time interactivity. That's the Edge.

An example of how edge computing changed the fortunes of one company highlights what the edge can do for you:

Teetering on the edge of survival, a present-day well-known video streaming company had recently switched from mailing CDs to a downloadable service. Initially hailed for its innovative approach, the quality of service was disappointing. The company assumed it could digitally deliver its product using the Internet as it was originally built. Wrong. With millions of simultaneous high bandwidth requests for titles that had to traverse long distances from a centralized data center, the waiting and buffering caused customers to leave in droves.

Staring at failure, management altered their delivery strategy. They would build an open-connect platform and deploy thousands of small yet powerful servers across the globe, partnering with local data centers, telcos and ISPs to put their content closer to users. The Edge was born, and the rest is history. Within five years the video streaming service grew larger than many cable companies that had been in business for decades and remains an industry giant today.

Edge computing is a game changer. With capabilities like popularity algorithms and artificial intelligence to anticipate a user's next request – whether that's a movie title or a new pair of sneakers – the edge is only going to get smarter, faster and closer as other providers roll out their own services.

LIVING ON THE EDGE

So **what** is edge computing? Edge computing is defined as a distributed computing model in which some of the data collection/processing elements of a network are placed closer to the physical location of end users for faster response and better agility[1]. An early adaptation of the edge compute concept is the familiar internet cookie. In the days when computers didn't have much memory, websites would deposit commonly used images on a user's PC so the graphic would not need to be downloaded each time the page was viewed. Today, PC memory isn't really an issue. But rather than store links to frequently used files on the desktop, a much more advanced version of the cookie concept uses micro data centers with limited processing capabilities as a mid-point between the user and the central cloud to reduce latency.

Edge servers not only perform real-time data processing, popularity algorithms allow them to analyze a user's current content or latest search request to queue up related information. Embedded AI capabilities identify trending topics and even steer users towards advertisements for desired products and services by evaluating behaviors and predicting their next move. Edge computing enhances the user experience by interacting with the primary cloud and intelligently caching content even before the user requests it for what seems like a better-than-real-time response. For example, you've been swiping left searching for Star Wars movies. Meanwhile the network is also teeing up Star Trek and other space-related titles on a local server to offer you alternatives in the same genre that you may not have considered... yet.

And **where** exactly is the edge? That's the beauty of it; like the Force, it's all around you. You can almost feel it, and it's getting closer than ever before. The edge moves with you as the network detects your location and routes your queries and data through the nearest cloud for reduced latency. It's the closest cell phone tower or wireless access point.

It's the server cabinet on a street corner you didn't even realize you just walked past. In Dallas today and Chicago tomorrow? Not a problem. As long as you're within the network domain, you're at the edge. The edge is not replacing the network infrastructure; it's adding another layer to perform some processing, basic analytics, caching and data visualization even closer to the user for improved performance.

The value of edge computing is not limited to high profile or ultra-time-sensitive applications like financial transactions, autonomous vehicle driving and healthcare. The edge can impact the most mundane tasks, like allowing a retail associate to check another store for inventory, or tracking the sales activity of a new sandwich at every fast food franchise. In some applications, the data is handled locally; in others, information collected at the edge is sent to the central cloud in batches during low traffic periods for big data processing. And then there is the Internet of Things (IoT) and edge sensors embedded in devices like smart traffic lights, vehicles, robots and appliances feeding data to the cloud to better manage system performance. All of these are viable edge applications, but our focus here is on impacting the user experience. Because who wants to wait three seconds for a channel to change? Or 20 minutes to download a movie? Today's users are conditioned to near-instant response, and if they can't get a fast answer, they click off to another site or service that will deliver.

That's why edge computing is so critical to the future of networking and the sustainability of digital enterprises. It provides enhanced responsiveness and intelligence, anticipating behaviors to improve network performance and customer satisfaction. And just in time, too. There is a surge of data coming and all kinds of "things" are going to be talking to each other. The network is going to have to do some "thinking" to search and find the right results to a query for device status, news or media. To provide the experience a user expects, that information needs to be close at hand – on the edge. Edge computing, while transparent to the user, allows for faster reactions rather than waiting for the centralized data center to receive and process requests. So, the next time you're downloading a movie, checking your bank balance, on a conference call or surfing the web for that perfect gift, chances are you're closer to the edge than you thought.

EDGE COMPUTING: RISKS & REWARDS [2,3,4,5,6,7]

There's a risk to any change in business strategy, especially one that alters the very core of how your network operates. But in this case there is a greater risk to doing nothing. The internet, as originally built, is great for exchanging information and enabling remote point-to-point communications but was not designed to securely handle millions of simultaneous transactions and queries from large populations of geographically disbursed users. In today's online world there is limited customer loyalty; users will click off to a site that can provide the fastest response. With the coming deluge in data, digital traffic jams are guaranteed. Spinning hourglasses equate to lost advertising revenues, lost opportunities for a sale, and eventually a lost customer. Dangerous precedents for any business. Here are some of the primary upsides and downsides of migrating to edge computing:

Speed. The most important benefit of edge computing is the ability to reduce latency. Instead of communicating with a server farm located 3,000 miles away, the central cloud can spin up a copy of the accessed file or application and move it to a micro data center located only 100 miles away from the user to vastly improve responsiveness. (However, that speed may still be affected by the processing power of the destination device, and/or any issues of routing data through local network connections over the "last mile" that may be beyond the purview of the edge server.)

Cost. It will take time and a significant investment to deploy a network of edge servers, but in doing so businesses will deliver the real-time user experience that will retain customers, maximize advertising revenues and improve return on investment. Further, the monthly cost of electricity used to cool a massive data center complex can easily exceed the cost of electricity used for data processing. It can, therefore, theoretically cost less to cool multiple micro data centers than one large one.

Security. Whereas centralized cloud computing and data centers allow for tighter control, they are more vulnerable to malware and DDoS cyberattacks. Edge computing is a more resilient model. It distributes processing loads, data storage, and applications across a range of devices and data centers, which makes it difficult for any single disruption to take down the network. But at the same time, the attack surface is wider as there are many more devices, servers and gateways to monitor and protect. Should an attack occur, edge computing allows administrators to seal off the compromised portion of the network without shutting down the entire system.

Application performance. Responsiveness will be improved as the network can make better use of its resources. Unused bandwidth can be shifted to another task or queue up the next piece of content. With edge servers installed in peering exchanges, embedded in ISPs and placed throughout metro areas, users are much closer to their data. But these smaller micro data centers can be overwhelmed more easily when an event such as a celebrity death, political scandal or new product announcement goes viral and leads to an unexpected spike in demand. Organizations and service providers using edge computing must constantly monitor activity to see if larger edge compute nodes are required or if more processing power needs to be directed at a particular location.

Reliable, versatile and scalable. Migrating to the edge reduces dependence on a single system. It provides redundancy, failover capabilities and built-in data backup. Should an outage occur at one location, other network segments can continue to operate normally while data is rerouted around the affected edge server. Is the business expanding? A centralized data center is expensive to operate and maintain. It has finite processing limits as defined by its square footage and the number of servers it holds. Edge computing offers a less expensive route to expansion and scalability. Moving into a new market or country? Has growth exceeded expectations? Powerful edge servers that fit in the bed of an average pickup truck can be deployed at the point of need (and moved when economic conditions change) without adding more bandwidth demands on the centralized cloud/data center.

EMBRACE THE EDGE

The age of Edge Computing is here. We get it. We embrace it. We partner with companies developing and using edge technologies all in the name of delivering a better overall experience to you, our customer, and in turn, your customers. Want to learn more about what migrating to the edge can do for your business? Ask us; the edge is just around the corner.

SOURCES & ACKNOWLEGEMENTS

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