White Paper

SD-WAN: Enabler of Innovative Edge Services

Sponsored by: Lumen and VMware

Ghassan Abdo
April 2021

SITUATION OVERVIEW

The Case for Edge Services

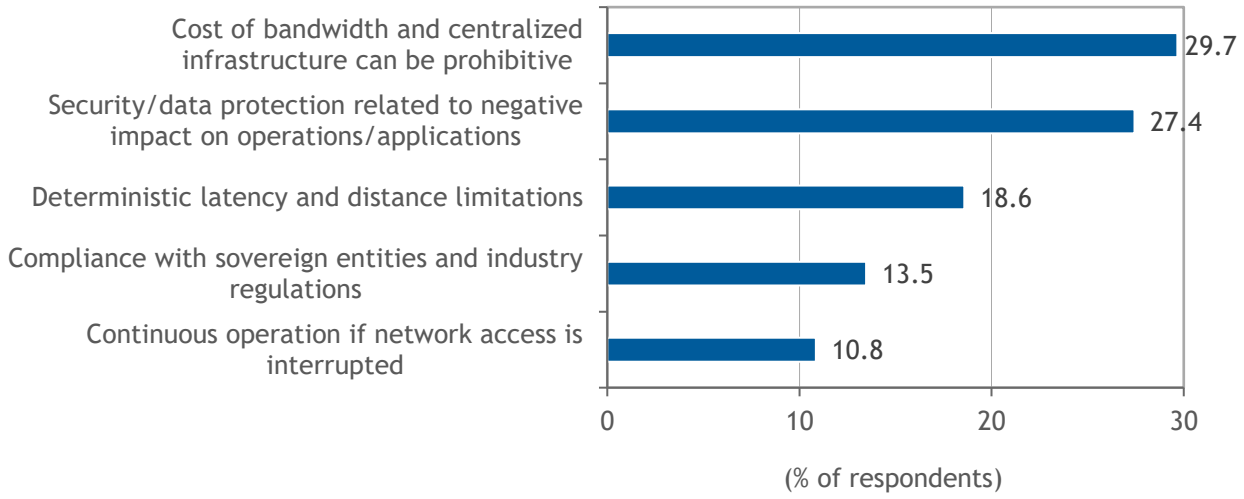
Market demand and technology enablers are converging to put edge compute at the forefront of industry discussions. These drivers have been further accelerated with COVID-19. IDC predicts that by 2024, over 50% of new enterprise IT infrastructure deployed will be at the edge rather than in corporate datacenters, up from less than 10% today. By 2024, there will be an 800% increase in the number of applications at the edge. IDC predicts that in terms of edge locations, the potential deployment of over 7 million edge locations in the same time frame will support an exponentially increasing number of IoT devices, which are expected to reach around 38 billion.

Recent surveys conducted by IDC indicate that edge computing has become a top priority for C-suite executives and is critical to the success of strategic business objectives. Edge compute will spur the development of innovative low-latency edge services characterized by deployment of compute, storage, and networking close to where events take place. These surveys confirm wide interest in edge services as 73% of respondents view edge as a strategic investment and 17% of respondents state it is required by business operations. Enterprises have instituted KPIs for measuring the effectiveness of edge solutions, including cost, security, compliance, performance, and uptime (see Figure 1).

FIGURE 1

Primary Motivations for Deploying Edge Solutions

Q. What is your organization's primary motivation for deploying edge solutions?



Source: IDC's *Edge Services Thought Leadership Survey,* September 2020

Enterprise uptake of edge services is motivated by deployment of low-latency services. Edge compute can address latency issues inherent in centralized computing paradigms by distributing resources closer to where data is generated and consumed. This is critical for many industries that rely on real-time analysis of data to drive process automation and rich customer experiences. In addition to addressing low-latency requirements, edge services need to provide deterministic and predictable performance.

Edge services rely on the network, particularly the wide area network (WAN), to meet its expected quality-of-service (QoS) parameters including latency, predictability, and traffic performance. An agile network based on SD-WAN is the right complement to deliver on the promise of innovative low-latency edge services.

Enterprises have choices on how to purchase and deploy edge services, spanning do-it-yourself (DIY) or managed services. DIY presents challenges related to integration of newer technologies, the need for cloud-native software expertise, and potential to create multiple silos that do not interoperate. We believe working with a managed service provider (SP), in particular a communication service provider, is a good choice to minimize risk with the edge services deployment journey and introduce SD-WAN as an upgrade from legacy networking.

Edge services have garnered the interest of services providers including communication SPs, public cloud providers, and content delivery networks (CDNs). These players are accelerating their effort to gain a foothold in this emerging opportunity. For communication SPs, edge services represent a new monetization opportunity for multi-access edge compute. They can offer edge services as a managed service with monthly recurring revenue. For public cloud providers (i.e., hyperscalers), it is an opportunity to deploy their cloud-native stack at the network edge to provide seamless integration of services from edge to cloud. For CDNs, it is an extension of their edge presence to enrich media

streaming with personalized, interactive, and high-definition customer experience and expand into adjacent markets.

Alliances are forming among communication SP groups in collaboration with standards bodies and public cloud providers to define edge architecture, edge platform, and edge use cases. These alliances foresee the important role interoperability will play in facilitating and accelerating the development of global edge computing applications. These efforts will drive further innovation in software-defined WAN and cement its role as a key enabler of edge services.

Why Agile Networking Architecture

The networking industry is undergoing a major transformation as evidenced by:

- Accelerating growth of global IP traffic estimated at 40% CAGR, which is impacting the economics of network expansion
- Proliferation of IoT and growth of global ecommerce, which is moving intelligence and data gathering to the edge
- Continued adoption of the cloud, which is transforming wide area networks
- Enterprises that are demanding a rich media experience to address the needs of their customers
- The rise of low-latency edge use cases

The network architecture must adapt to these emerging trends. This requires the buildout of an advanced network based on software-defined networking principles — a network that is agile and flexible enough to allow an enterprise to host its apps and data across multiple clouds at the lowest cost and with superior performance. Building a self-configuring, automated network that can react to applications with varying performance and traffic demands and reconfigure itself for optimal business outcomes will be a foundational cornerstone of the digital business.

The agile network should be architected with the following principles:

- Cloud consumption model
- Integration of full-scale security capabilities
- Uniform service-level agreement (SLA)
- Access to pretested multivendor virtual functions
- Integrated self-service portal and global reach and visibility across IT assets
- Support for low-latency use cases
- Bandwidth on demand
- High availability
- Reliability and disaster recovery
- Security built into the network

SD-WAN as Platform for Service Innovation

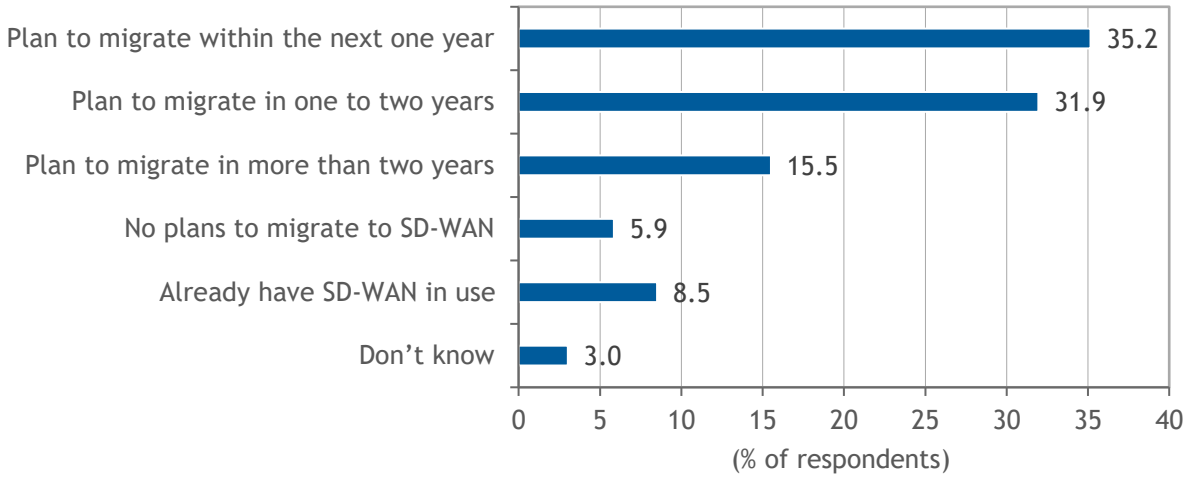
Over the past decade, enterprises have gradually embraced the cloud as a destination for their applications. The traditional enterprise WAN architecture has had to evolve to address the new requirements of the multicloud era. Security in a cloud context and the rising complexity of multitransport and multicloud connectivity are the top challenges faced by network administrators in

enterprises today. SD-WAN expands the possibilities for enterprises to migrate to cloud applications in a secure manner and provides a flexible deployment model. As such, SD-WAN became the enterprise WAN's architectural response to support enterprises' move to the cloud. SD-WAN brings a plethora of advantages that translate into service agility, optimized access to cloud applications, improved performance, and easier management of the enterprise network. A recent survey by IDC confirms the strong interest in SD-WAN by surveyed enterprises (see Figure 2).

FIGURE 2

SD-WAN Migration Trends

Q. Does your company plan to migrate any of your existing WAN/network connections to a SD-WAN alternative?



n = 600

Source: IDC's *U.S. Enterprise Communications Survey,* 2020

As workloads shift to the edge, the question arises on the role of SD-WAN in addressing the demands of low-latency edge services. SD-WAN's underlying agile architecture coupled with deployments of SD-WAN logic at either the customer premises equipment (CPE) or provider POPs cements its important role in addressing connectivity and resource demands at the edge. White-box CPEs (or uCPE) are x-86-based devices that can run virtualized instances of routing, security, and policy management. These devices, a mini-DC in their own right, can be used to run an analytics application to support manufacturing or a pricing application to support a retail environment. The CPE is an edge device deployed on premises with compute, storage, and networking capacity with ability to run multiple applications in addition to networking. SD-WAN functionality that is deployed at the service provider edge locations or POPs can also host edge services to the extent that the distance is suitable from a latency perspective.

The same benefits that SD-WAN brought to the multicloud era can be realized in edge applications as follows:

- Cost-effective and dynamic bandwidth management underpinned by multiple connectivity options
- Faster deployment enabled by zero-touch provisioning
- Higher availability with active-active connectivity
- Cloud-based security supporting the full stack including applications
- Integration and interoperability of multivendor VNSs that will result in a wider set of services
- Flexibility of hosting edge applications at the CPE or provider edge POPs (Latency requirements will determine the optimal hosting location.)
- Potential for richer analytics with implementation of ML
- An orchestration layer that can facilitate integration of multicloud services
- Support of virtualized network services such as VNFs and containers
- Leverage of edge locations to host control plane of SD-WAN and optimize use of compute and network resources

Nonetheless, realizing the full potential of SD-WAN to support the deployment of global edge services will require ecosystem participants (i.e., vendors and service providers) to deal with the following challenges:

- Expand the developer ecosystem and provide tools and open APIs. The developer community is key to the introduction of new and innovative services.
- Integrate key enterprise customers and media providers as partners in this new development ecosystem.
- Create opportunities for interoperability across service provider networks, hyperscalers, and vendor solutions.
- Employ open systems platform technologies and minimize proprietary applications. Portability of applications will create differentiation among the managed edge providers.
- Embrace the emergence of a marketplace for edge services. A marketplace in this context is an independent entity that will host a range of edge services.
- Accelerate the use of automation tools to provide near-real-time reporting and analytics.
- Integrate AI/ML technologies across the total value chain of managed edge services.

The Programmable Edge: Embracing the Developer Community

IDC predicts that over 520 million new apps/services will be developed and deployed in support of the digital economy by 2024. By 2023, 60% of the G2000 enterprises will have created their own software ecosystem. The implication here is clear. We need to enable a wider ecosystem of developers to contribute to creating and innovating these new services and additionally employ the latest software development tools to expand to such a scale.

The key development technologies that will be employed to accelerate service creation at the edge include:

- Agile/DevOps methods
- Democratized development

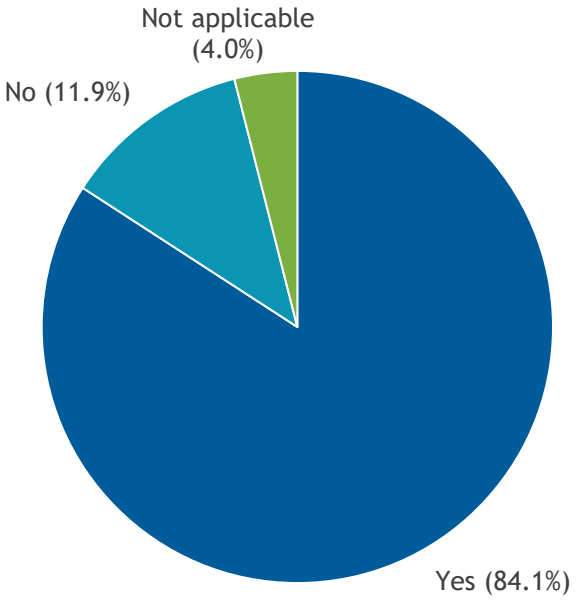
- Microservices architecture
- Streamline and simplify development of AI/ML apps and training models

It is expected that 80% of edge workloads will be created with container/microservices to reduce app infrastructure needs and improve digital service resilience. Integration of AI/ML will be needed to enrich the service capabilities and deliver a customer-rich dashboard. As indicated in Figure 3, 84% of enterprises recently surveyed by IDC consider programmability at the edge to be a critical capability.

FIGURE 3

Programmability at the Edge

Q. Is edge programmability (e.g., containers and JavaScripting) an important consideration when choosing an edge platform?



n = 600

Source: IDC's *U.S. Enterprise Communications Survey,* 2020

Edge Services Use Cases Supported by SD-WAN

Edge computing, leveraging SD-WAN, will spur the development of a new set of low-latency edge use cases. Edge services are relevant to many industries. With SD-WAN, these industries will benefit from the low-latency, high-performance, security, and storage capabilities of these edge services. Edge locations are valuable assets that can integrate edge use cases with the agile architecture of SD-WAN. This integration of edge compute and SD-WAN has the potential to enhance customer experience, drive operational efficiencies, and improve performance.

The industry is debating which use cases will provide better return on investments in edge compute. While it is too early to tell which use cases will emerge to prominence, we believe service providers will play a critical role in the commercial success of these use cases as they can be better positioned to integrate edge compute with SD-WAN. Examples of low-latency edge use cases that will leverage SD-WAN include:

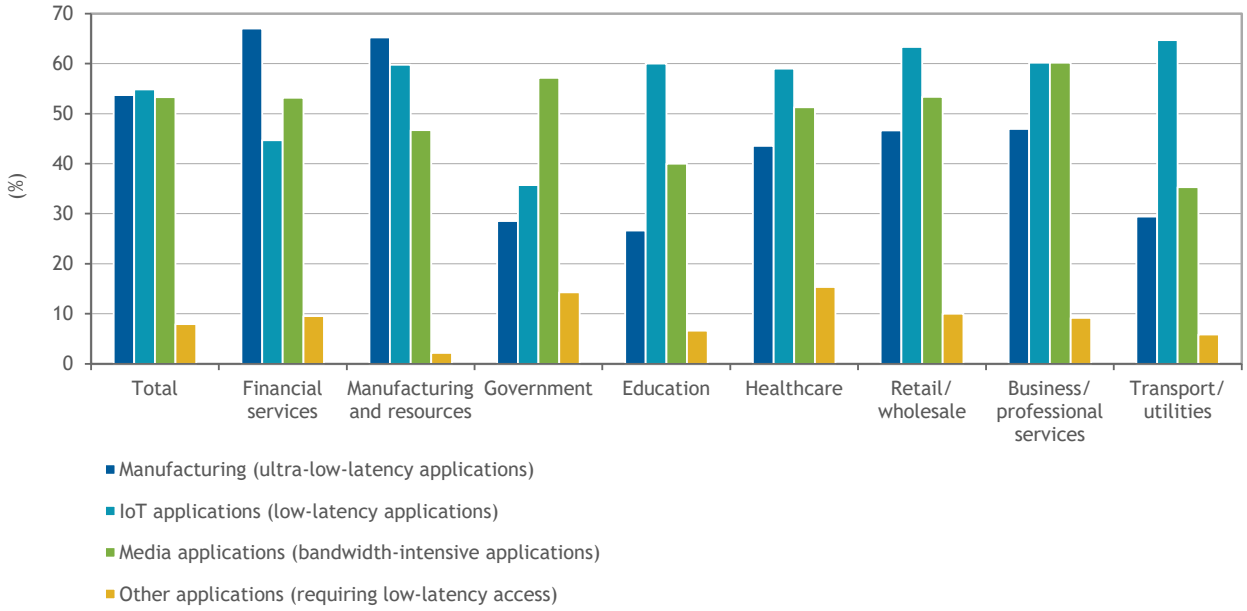
- **Industrial:** Provide productivity enhancements to manufacturing facilities such as optimized use of robotics and connected factory.
- **Media:** Extend the media experience toward interactive, personal, content-rich, and high-quality video experience, enhanced with video analytics.
- **Retail:** Improve the point-of-sale experience with mobile devices, supported with real-time pricing management.
- **Healthcare:** Enhance the delivery of patient care.
- **Gaming:** Expand the online multiplayer experience with new categories of streaming games combined with complex augmented and virtual reality (AR/VR).
- **Energy:** Optimize energy consumption with analysis of extreme-scale data sets.
- **Logistics:** Augment existing equipment with IoT to improve maintenance and operation.
- **Retail banking/financial:** Enhance use cases and applications that have a high need for robust web app caching and application distribution.

A recent IDC edge survey (see Figure 4) indicated that across all verticals, ultra-low-latency manufacturing, low-latency IoT, and bandwidth-intensive media applications are top use cases. Variations for individual industries are also indicated in Figure 4.

FIGURE 4

Main Use Cases for Edge Services

Q. What are your company's main use cases for edge services?



n = 600

Source: IDC's *U.S. Enterprise Communications Survey,* 2020

CONCLUSION

SD-WAN has been embraced by enterprises to help accelerate their digital transformation journey underpinned by the adoption of cloud services and enablement of rich media online customer experience. With the emergence of low-latency edge services as the new paradigm for transforming legacy enterprise applications toward a modern software-based architecture, SD-WAN is proving to be a strategic asset. The demand of traffic at the edge coupled with the need to address latency and performance requirements elevates the role of SD-WAN as a critical architecture to enable edge services.

At IDC, we predict that both SD-WAN and edge services will grow at a fast pace for the foreseeable future. This growth will bring about challenges related to interoperability of multivendor solutions and global standards to facilitate seamless integration between edge and cloud. This is in addition to potential emergence of a fragmented market with distinct implementations of cloud-native stacks. Resolving these challenges will define the next chapter of edge services.

MESSAGE FROM THE SPONSOR

Lumen is guided by our belief that humanity is at its best when technology advances the way we live and work. With approximately 450,000 route fiber miles and serving customers in more than 60 countries, we deliver the fastest, most secure platform for applications and data to help businesses, government and communities deliver amazing experiences.

For more information about Lumen SD-WAN offerings, visit https://www.lumen.com/en-us/networking/sd-wan.html.

About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.

Global Headquarters

140 Kendrick Street
Building B
Needham, MA 02494
USA
508.872.8200
Twitter: @IDC
blogs.idc.com
www.idc.com