MULTI-ACCESS SD-WAN ANYWHERE

Deploying resilient multi-access network services with software-defined wide-area networking (SD-WAN)

Insight Paper





EXECUTIVE SUMMARY

Steady adoption of intelligent cloud and edge services is driving a new era of innovation in networking technology. The need for more dynamic scalability, operational agility, and high availability has given rise to new approaches to designing and optimising networks. The emergence of software-defined wide area networking (SD-WAN) is a result of this trend, and it is now playing a key role in underserved areas where satellite access is essential.

SD-WAN is a breakthrough innovation that separates key networking functions from purpose-built network hardware, yielding more flexible, software-based network control that is ideally suited to today's world of cloud applications. By integrating SD-WAN with multiorbit satellite communications and terrestrial networks, each application can be delivered over the optimal WAN connection. In addition, SD-WAN technology will optimise satelliteenabled networks for cloud applications as well as improve the security and management of network services. There are many SD-WAN uses cases in telecom and mobile network operator (MNO) networks that can take advantage of a multi-orbit capability. For example, SD-WAN can be used to build resiliency into networks with Medium Earth Orbit (MEO) IP trunks as a primary transport link or as an automatic back-up path for fibre-based trunks. Another important use case for SD-WAN is to provide flow-based restoration for business continuity and disaster recovery. For example, when an enterprise site is affected by an outage, operator-defined policies determine how specific applications are prioritised and routed over a satellite-based back-up connection.

SD-WAN features prominently in the SES Signature Solutions portfolio as an enabler of hybrid, multi-access managed network services. With the industry's only commercially proven multi-orbit satellite fleet, our customers can use SD-WAN to meet a diverse range of networking challenges, combining GEO, MEO and other access technologies to improve application visibility and control, improve network resiliency, and reduce costs by optimising capacity use. SD-WAN is also a key enabler of future SES services based on O3b mPOWER, our second generation MEO constellation. As customers use O3b mPOWER for multi-gigabit per second services, SD-WAN will be paramount to any cloud-scale hybrid networking solution.

SD-WAN DEFINED

SD-WAN is a subset of software-defined networking (SDN) technology, which separates the control plane and data plane of network connections and enables programmability of network functions and applications via software. SD-WAN uses SDN principles to manage and automate the provisioning of access connections such as terrestrial and mobile broadband and satellite. It can also be used to prioritise and steer applications over expressly routed connections to public and private cloud data centres, to the public internet, or to a corporate headquarters or branch site. Use of SD-WAN to combine multi-orbit satellite connections, as well as combinations of satellite and other access technologies into a secure managed service, is a recent innovation led by SES.

For telcos and MNO's, SD-WAN software instances can be deployed as virtual network functions (VNFs) that run on general-purpose "universal" customer premises equipment (CPE), which lowers capital and operating costs, especially compared to configuring and managing single-purpose network appliances. This flexible software architecture means SD-WAN functionality can be deployed quickly to the customer site or at an edge gateway close to the customer. Moreover, SD-WAN solutions are provisioned, managed, and controlled by software in the cloud.

SD-WAN: MEETING CRITICAL NETWORKING CHALLENGES

The emergence and growth of SD-WAN is a result of the fundamental ways in which the cloud has changed the world of networking. Steady migration of business applications to the cloud means telco networks must be far more intelligent and agile in how bandwidth is provisioned, controlled, and billed for; and it requires a step-function improvement in service availability and security, considering that enterprise and public sector customers' most critical applications are now more frequently operating in the cloud.

Improving Network Resiliency and Service Availability

In today's dynamic IT and communications environment, network service availability is a critical challenge for customers of telcos and MNO's. The proliferation of cloud applications, which are often used to process data and provide analytics in real-time, has increased the need for pervasive and resilient network access. Whether it's an oil rig sending analytics data to the cloud or an unmanned aerial vehicle (UAV) sending sensor data in real-time to a government data centre, enterprises and public sector agencies are seeing unprecedented demand for highly available network services.

The recent trend of frequent network outages has highlighted the economic risk of losing network access. According to Gartner, 98% of organisations say a single hour of downtime costs over \$100,000, while 81% of respondents indicated that an hour of downtime costs their business over \$300,000. One-third of those enterprises reported that an hour of downtime costs their firms \$1-5 million. For telcos and MNO's, these risks represent the possibility of service level agreement (SLA) credits, which must be minimised to ensure profitable services. According to a recent study by Deloitte on Internet connectivity, improving the resiliency and performance of network access can boost overall Gross Domestic Product (GDP) and economic growth. For instance, reliable access to dynamic information on weather conditions allows farmers to maximise crop yields and outputs, leading to 33% higher profits. Deloitte also estimates that in low and middle-income economies, firms in the manufacturing sector with reliable broadband Internet access generate 6% more foreign sales than those without.

SD-WAN can improve service availability, network resiliency, and the overall customer experience. With SD-WAN, network operators can create a resilient, multi-access network that rebalances traffic among active links in case of a failure. For example, SD-WAN can be easily configured to rebalance traffic to a satellite link in the event of a fibre cut. An SD-WAN approach for multi-access failover is an improvement over legacy router-based networks because it is driven by application-level policy control and analytics, which can monitor performance in real time and automate changes to optimise performance.



FIGURE 1: Average GDP impact of temporary internet outages

SOURCE: "The economic impact of disruptions to Internet connectivity." Deloitte, October 2016.

Optimising Application Performance

A positive customer experience depends on managing application performance. The rise of cloud applications and IoT is putting a premium on the need for more flexible, software-controlled network access that can identify and properly prioritise business applications. Designed for this need, SD-WAN is used to monitor application performance and deliver configuration changes in real-time. Based on policies determined and controlled by the user, SD-WAN steers any type of traffic to its destination over the most suitable access technology and with the appropriate quality-of-service (QoS).

Mitigating Network Complexity

Adding links to a communications network lays the groundwork for better resiliency. However, as multiple links and redundant systems are added to a communications platform, managing a larger number of connections increases network complexity. In mainstay networks, the complexity derived from multiple, diversely routed paths is exacerbated by the inherent high-touch configuration and element management model required by legacy routers, switches, and other purpose-built systems. SD-WAN is designed to remove this complexity by making the network more programmable, automating service provisioning and equipment configuration over any access medium, and centralising network management with simpler, smarter monitoring and analytics tools.



KEY ELEMENTS OF HYBRID, MULTI-ACCESS NETWORKS POWERED BY SD-WAN

Applied to multi-access networks using satellite links, SD-WAN provides several key capabilities that result in more intelligent, resilient, and efficient network services, whether for telcos, mobile network operators, satellite service providers, enterprises or government agencies. The most critical of these capabilities include:

- Application-aware Routing: Identifying traffic types and assigning applications to the most suitable access link is the foundational capability for SD-WAN based multi-access networking. For example, applications requiring low latency and high bandwidth can be routed to a MEO satellite and applications that can tolerate higher latency can be steered to a GEO satellite.
- Analytics and Detailed Reporting: Network operators seeking more holistic application-level visibility, control and trends analysis need access to detailed reporting and predictive analytics tools.
- **Programmability:** Building software-based programmability into the network increases service velocity. As SD-WAN can be delivered as a software-based VNF and provisioned from the cloud, new services, software updates, and management functions can be rolled out very quickly without costly hardware upgrades and manual configuration.
- Link Bonding: SD-WAN enables simple aggregation of multiple links into a single logical connection. SD-WAN is transport-agnostic, which helps end-users build networks more flexibly and cost effectively, reducing dependency on expensive MPLS VPN tunnels as a mainstay transport mechanism.
- Enhanced Security: SD-WAN adds multiple layers of security to the network. Rather than requiring a number of specialised appliances, SD-WAN leverages universal CPE and virtualised software instances to simplify and reduce the cost of security operations, deploying integrated stateful and next-generation firewall, malware protection, URL and content filtering, intrusion-protection services (IPS) and anti-virus, DDoS (Distributed Denial of Service) protection, and next-generation VPN.



What are the strongest drivers for SD-WAN deployment by end customers?

FIGURE 2: Leading drivers of SD-WAN deployment

SOURCE: "What are the strongest drivers for SD-WAN deployment by end customers?." Futuriom, March 2019.

SES Combines SD-WAN with the Power of a Multi-Orbit Fleet

With more than 70 satellites in operation, and the industry's only portfolio of managed network services incorporating MEO high-throughput satellites (HTS) and GEO wideband and HTS assets, SES affords network operators more flexibility, with unmatched global coverage, to meet your most pressing networking challenges. We are using SD-WAN across our entire portfolio as the enabler of multi-orbit, multi-access networking solutions, applicable in telco and MNO networks, government applications, or networks on-the-move like commercial aviation, cruise, and commercial maritime.

There is an increasing number of practical use cases of SD-WAN driven multi-access network solutions combining GEO and MEO assets. For instance, GEO can be used as a cost-effective way to scale an existing MEO based service, applying SD-WAN link bonding, load balancing (on a per-application basis), and application-aware traffic steering to maximise bandwidth efficiency. MEO or GEO can be used as an intelligent, automatic resiliency measure, whether for a primary satellite connection or one based on fibre or another access technology. A few of the many practical SD-WAN multi-access use cases are highlighted in the next section.

A growing number of SD-WAN deployments require dedicated, private connectivity to public cloud platforms, such as Microsoft Azure and IBM Global Cloud. Our partnerships with top-tier cloud service providers ensure "one-hop" connectivity from any business site to one of these platforms or to a private cloud data centre, connecting your remote sites directly to cloud workloads anywhere in the world. In a multi-access networking environment enabled by SD-WAN, you can determine policies that steer traffic over "express" routes to any data centre, branch office, headquarters or the public internet.

SD-WAN is offered as part of our portfolio of managed network services, which offload the financial and operational risk of deploying and managing networks end-to-end. Our experience in delivering managed network services, including those that add application-level value to managed connectivity, ensures you have a trusted partner with which to deploy SD-WAN quickly and easily.



FIGURE 3: SES SD-WAN solution topology

Automating SD-WAN Service Delivery with ONAP

SES is the first satellite-enabled communications provider to adopt Open Network Automation Platform (ONAP), an open source software platform for real-time, policy-driven orchestration and automation of network services, including SD-WAN. Running on the Microsoft Azure cloud platform, our ONAP solution allows you to create and deliver services rapidly—to any global end-point—across both physical and virtual network domains.

By leveraging ONAP-based automation, we help you accelerate time-to-market for SD-WAN and other applications by simplifying network extension over our satellite fleet and automating network configuration and service provisioning processes. And with SD-WAN made available as a VNF instance via ONAP, you can use a self-service portal to easily deploy SD-WAN to any universal CPE, avoiding the high-touch configuration model of traditional, router-based WAN services. This helps simplify SD-WAN service activation, minimise configuration error, and lower overall operating costs.

Integrating SD-WAN with O3b mPOWER

Our next-generation MEO constellation, O3b mPOWER, will strengthen our SD-WAN enabled multi-access solutions even further. Building on the commercial and operational success of the first-generation O3b MEO fleet, O3b mPOWER supports transit links of up to 10 gigabits per second, low-latency performance, and highly flexible, dynamic bandwidth allocation ideal for cloud workloads. In addition, O3b mPOWER can route traffic more flexibly to the nearest cloud service provider data centre, helping reduce latency further and improve cloud application performance.

Deployed with SD-WAN, O3b mPOWER delivers cloud-scale performance and application-level intelligence to multi-access environments. O3b mPOWER enabled point-to-point transit links are MEF certified, adhering to the same performance thresholds of the metro and core fibre networks operated by telcos and other service providers worldwide. With O3b mPOWER, network operators can deploy SD-WAN to provide incremental scale and high-throughput resiliency in any under-served area, including urban environments where fibre and mobile infrastructure lack physical redundancy.

KEY TELCO AND MNO USE CASES FOR SD-WAN POWERED MULTI-ACCESS SERVICES

Building resilient, application-aware multi-access network solution leveraging GEO and MEO satellite fleets provides tangible business value to telcos and MNO's, illustrated by several use cases.

USE CASE 1 – TRUNK RESILIENCY: SD-WAN INTEGRATED INTO HYBRID, MEO-TERRESTRIAL IP TRANSIT

Available today, our Managed IP Transit service is delivered over the O3b MEO fleet, which provides high-throughput and low latency network extension for telcos, MNO's and other network operators. In a multi-access environment, Managed IP Transit can serve as a scalable, reliable primary trunk or back-up connection alongside another MEO connection, fibre or other access media.

Deployed with SD-WAN, our Managed IP Transit service provides traffic rebalancing, automatic failover and intelligent traffic steering in the event of service degradation or an outage. In addition, SD-WAN allows a telco or MNO to intelligently scale overall trunk capacity when the protection link is available. As O3b MEO trunks deliver industry-leading, fibre-equivalent scale today, overall capacity will scale even further in the near future, to multiple gigabits per second per trunk, with O3b mPOWER.

In one commercial deployment today with a regional telco, an SES MEO connection serves as the primary connection to a fibre-based link, as the provider's terrestrial infrastructure is prone to outages. SES deployed SD-WAN CPE on both links to perform load balancing, application-level traffic steering, and automatic failover in the case of link degradation or failure. SES is also providing the operator with access to traffic analytics reports on a regular basis, offering insights into improving bandwidth efficiency and service quality.



FIGURE 4: Trunk Resiliency: SD-WAN Integrated into Hybrid, MEO-Terrestrial IP Transit

USE CASE 2: ENABLING SEAMLESS BUSINESS CONTINUITY AND DISASTER RECOVERY (BC/DR)

As telco enterprise customers strive to connect every business site to a cloud-based IT environment, assurance of business continuity and disaster recovery is an increasingly important goal. In many remote and underserved areas, business sites are prone to environmental conditions that wreak havoc on terrestrial connections that are limited in terms of path diversity, driving the need for satellite-based business continuity solutions.

SD-WAN is an ideal fit for business continuity because of its intent-based approach to network behaviour. Telcos and MNO's can use SD-WAN's policy engine to determine which applications receive priority, defining QoS parameters for each application, in the event of a failure. A satellite-based SD-WAN business continuity solution provides a diverse access medium for terrestrial links or even another satellite connection.

SES is the only satellite-enabled network operator that can enable telcos and MNO's to match the right orbital technology, GEO or MEO, to business continuity solutions based on application need. In addition, our partnerships with Microsoft, IBM and other cloud providers enable telcos to offer SD-WAN based BC/DR solutions that connect business sites to Azure, IBM Cloud and other cloud environments over dedicated, expressly routed connections.



FIGURE 5: Enabling Seamless Business Continuity and Disaster Recovery (BC/DR)

USE CASE 3: MULTI-ORBIT SD-WAN ENABLED ENTERPRISE VPN

One of the most appealing capabilities of SD-WAN among telcos, service providers and enterprise customers is the capability to embed security functions directly into the network, without the need to configure additional security appliances or applications. Market research from Futuriom indicates that security is one of the most cited features of SD-WAN technology. When 120 service providers were asked what they thought were the strongest drivers for SD-WAN technology from customers, 31.7 % cited better security, the top response.

In the use case of multi-orbit SD-WAN enabled enterprise VPN, the telco or satellite service provider can create secure links by activating IPSec tunneling on SD-WAN CPE, which steers encrypted traffic over MEO and GEO links. This enables the telco to configure secure tunnels back to the enterprise's headquarters or to another location of their choice, such as a public cloud data centre.

The SD-WAN CPE can be programmed to activate additional security capabilities in the form of VNFs provisioned from a cloud-based orchestration platform. Next-generation firewall (NGFW), intrusion detection services (IDS) and anti-virus protection (AV) are among the VNFs that can be quickly and easily instantiated from the orchestration layer. As a result, the addition of SD-WAN functionality to our solution portfolio creates new revenue opportunities for our telco and service provider customers.



FIGURE 6: Multi-Orbit SD-WAN Enabled Enterprise VPN

CONCLUSION: DEPLOYING INTELLIGENT, CLOUD-SCALE NETWORKS OF THE FUTURE

SD-WAN is a key element of our network modernisation strategy, which aims to help you meet the challenges of bringing new, differentiated services to market faster and lowering total cost of ownership per unit of throughput. Managed and controlled with cloud-based software, SD-WAN is part of our broader architectural vision rooted in the principles of software-defined networking, network functions virtualisation, and open, standards-based service orchestration.

SD-WAN is an enabler of intelligent, resilient, and secure multi-access network solutions, which are increasingly important as telcos, MNO's, enterprises, and government agencies rely on the cloud for their most critical business applications. Using application-aware traffic steering and network insights from real-time monitoring and control, SD-WAN mitigates the complexity of managing multiple access connections to form a single, logical network service, and it optimises application performance based on policies you define and manage.

SES is the only satellite-enabled network services provider with a commercially proven, multi-orbit satellite fleet. This affords our telco and MNO customers the ability to use MEO and GEO satellite links to create intelligent multi-access solutions, addressing use cases in load balancing and bandwidth optimisation, IP trunking, business continuity and disaster recovery, and secure enterprise VPN services.

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