



SD-WAN: Addressing Network Challenges for Unified Communications as a Service (UCaaS)

How the Silver Peak Unity EdgeConnect SD-WAN edge platform enhances the quality and performance of UCaaS applications

TYPICAL APPLICATIONS IN A UCaaS SERVICE

- Phone services (VoIP)
- Voicemail
- Team messaging
- Business messaging
- Audio conferencing
- Video conferencing
- File and desktop sharing
- Call center functions
- Email and call monitoring and analysis

TYPICAL INTEGRATIONS WITH THIRD PARTY CLOUD APPS

- Storage services
- Office productivity suites
- Collaboration apps
- Sales and CRM apps

UCaaS has a Great Value Proposition

Unified Communications as a Service (UCaaS) offerings are equally appealing to small and midsize businesses and large global enterprises alike. Through a UCaaS service provider, organizations can take advantage of a wide range of fully integrated communication and collaboration applications, without the headaches involved in managing, integrating, and upgrading such applications themselves.

UCaaS services help organizations increase the productivity of their employees and improve collaboration with suppliers and business partners. They also give call centers, help desks, and sales and marketing groups within the organizations better tools to interact with customers. New users can be added on demand, with no capital expenditures. A complete communications infrastructure for new offices can be spun up in minutes, instead of days or weeks.

Not surprisingly, UCaaS service providers have enjoyed great success to date. As of mid-2019, three publicly-held UCaaS companies alone (Ring Central, 8x8, and Vonage) had combined annual revenue of over \$2 billion USD and a combined stock market capitalization of about \$15 billion.

What Could Go Wrong?

Low-quality internet connections can result in:

- Dropped voice and video calls with customers
- Garbled phone calls to colleagues in remote locations
- Pixelated video in video conferences
- Intolerably slow screen sharing in sales demos and marketing presentations

UCaaS Applications Are Vulnerable to Unreliable Networks

Broadband services are generally far less expensive than the private lines and MPLS networks typically required by legacy enterprise voice services. A key part of the UCaaS value proposition is the opportunity to deploy them to dramatically lower network costs. However, neither UCaaS service providers nor their customers can control the performance or quality of communication over broadband links.

This lack of control is important, because most communication and collaboration applications are by their nature sensitive to network latency, jitter and packet loss. They require high bandwidth and excellent network quality to deliver the highest quality of experience to users. Contention, jitter, packet loss, and service interruptions can severely impact the performance of UCaaS applications, and, in turn, employee productivity and customer satisfaction.

Of course, companies can still use private lines and MPLS networks to connect to UCaaS data centers, but these are costly, suffer from some latency and jitter (albeit not as much as internet connections), and are difficult to add or change.

SD-WAN Solutions for Performance, Availability, and the Best End User Experience

A Software-Defined Wide Area Network (SD-WAN) is a virtual WAN architecture that provides enterprises

with the flexibility to leverage any combination of WAN transport services, including broadband internet, to securely and directly connect users to applications.

The Silver Peak [Unity EdgeConnect™](#) SD-WAN edge platform can significantly enhance the ability of UCaaS services to deliver on their promise of high-quality communications and collaboration, through capabilities such as:

Tunnel bonding, which pools multiple network links into a single logical connection.

Application visibility and control, which identify and classify network traffic and intelligently enforce quality of service (QoS) and security policies based on business intent (for example, prioritizing latency-sensitive applications like voice over IP and video conferencing).

Path conditioning, which reconstitutes lost packets and re-sequences packets that arrive out of order, reducing the number of packets that need to be retransmitted.

Load balancing, which spreads traffic from a single session across multiple links on a packet-by-packet basis to maintain the connection even if a link experiences a brownout or outage.

Dynamic path control, which monitors the health and performance of links and assigns the best paths to UCaaS traffic.

Sub-second failover, which dramatically reduces the potential that a link failure will have a perceptible impact on the experience of UCaaS users.

Centralized reporting and orchestration, which helps administrators troubleshoot network problems and manage QoS and security policies at remote locations.

The Base Case: Local Internet Breakout from a Branch Office

To begin with a simple example, an EdgeConnect SD-WAN appliance can be deployed in a branch office to enable intelligent, policy-based local internet breakout of UCaaS network traffic.

The left side of Figure 1 shows a remote branch office with a typical internet breakout configuration, where network traffic from the office travels across a low-cost broadband link. When an employee uses a

UCaaS service, some traffic will go to the UCaaS data center, and some may go to cloud-based applications integrated with the UCaaS service (say Microsoft Office 365, Google G Suite, Box, or Salesforce.com). Of course, other traffic from non-UCaaS applications will share same broadband connection to connect to other branch offices, the corporate data center, and other SaaS services in the cloud.

In this scenario, the branch office connects to the broadband link through a WAN router. But most traditional WAN edge routers can't distinguish what packets belong to what applications, and those that can require time-consuming, error-prone manual configuration of QoS settings. As a result, application traffic and QoS-sensitive UCaaS packets are often forwarded through the same queue and given the same priority. UCaaS voice and video packets wait their turn amidst packets from less time-sensitive business applications (say, accounting applications and expense reports) and bandwidth-hungry non-business applications (say, employees playing games and watching YouTube). Additional problems can result if the router receives more traffic from the LAN than the broadband link can accommodate, which creates congestion at the WAN interface of the router and causes random packets to be dropped.

Prioritization of latency-sensitive applications

The situation is very different on the right side of Figure 1, where outgoing traffic from the branch office runs through an EdgeConnect SD-WAN appliance.

With EdgeConnect, real-time applications such as UCaaS can be mapped to a high-priority “business intent overlay.” This is a virtual WAN overlay that specifies QoS and security policies to manage an application’s traffic across the WAN. It enables policy-based, QoS aware local breakout of UCaaS services. Business intent overlay parameters can include:

- Application priority and bonding policies
- Primary and secondary transport services
- Failover policies
- Brownout thresholds for packet loss, latency, and jitter
- Security policies

As illustrated on the right side of Figure 1, the business intent overlay for real-time applications like UCaaS specifies high priority. The EdgeConnect SD-WAN appliance in the branch will perform local Internet breakout of UCaaS traffic through a high-priority queue, ahead of packets for less time-sensitive business and non-business applications.

EdgeConnect appliances not only distinguish traffic from different applications, they do so with maximum efficiency. Silver Peak [First-packet iQ™](#) uniquely identifies and classifies applications on the first packet of the flow. Application traffic is then automatically directed to the applicable business intent overlay which enforces the correct QoS and security policies. Other SD-WAN and network solutions with

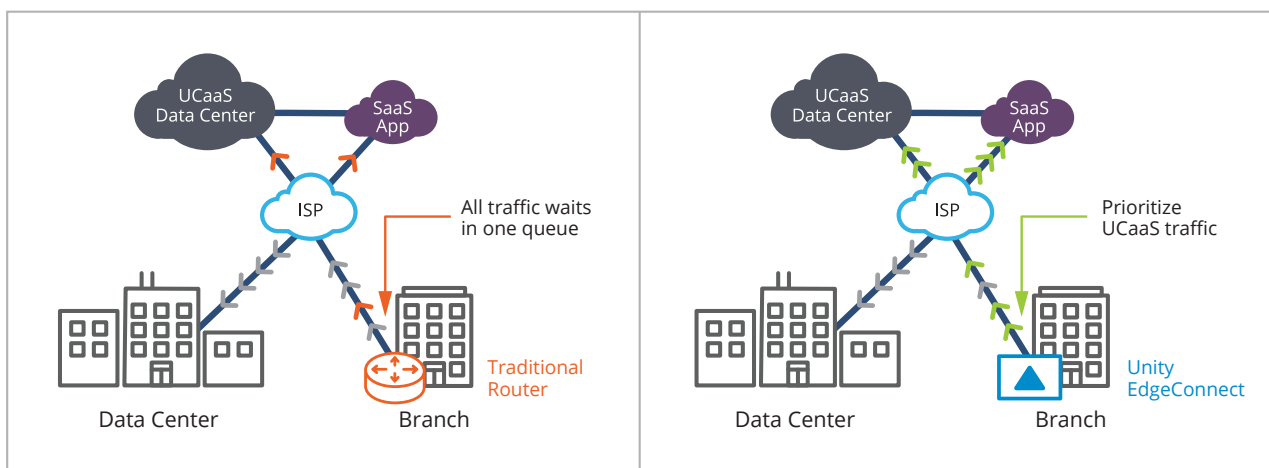


Figure 1: A Unity EdgeConnect SD-WAN appliance at the remote office can identify UCaaS traffic on the first packet and prioritize it over other applications

deep packet inspection (DPI) techniques typically require 2-6 packets to identify an application in HTTP traffic, and 10-12 packets for applications in HTTPS traffic.

EdgeConnect can also perform traffic shaping, which guarantees bandwidth to high-priority applications and ensures that traffic sent does not exceed the capacity of the broadband link and cause packet loss.

The Next Step: Extending the WAN Fabric to an IaaS Platform with SD-WAN

Many organizations have deployed SD-WAN solutions to connect distributed offices to one another and to data centers and headquarters locations with improved performance and reliability and lower costs.

But as “cloud-first” enterprises rapidly migrate applications to IaaS platforms, a major new use case for SD-WAN technology has emerged: improving the performance and reliability of applications hosted in public cloud instances. Configurations like the one shown in Figure 2 extend the SD-WAN fabric to cloud-based applications. This Figure shows a remote branch office with connections through two ISPs to an “Infrastructure as a Service” (IaaS) platform such as

Amazon Web Services (AWS), Google Computing Platform (GCP), or Microsoft Azure. Network traffic across this “first mile” (first from the office employee’s perspective) can be sent long distances, making several hops between several tiers of ISPs, with unpredictable levels of contention, packet loss, and jitter. In this architecture, two EdgeConnect appliances “bookend” the links between the branch office and an instance of an IaaS platform close to the UCaaS data center. By using two EdgeConnect SD-WAN appliances, one at the branch office and the other on the IaaS platform can “ruggedize” this first mile, providing much better performance, reliability, and network quality.

This figure shows the branch sending network traffic through two broadband connections, although in practice the branch could be served by multiple broadband, 4G/LTE, or MPLS connections. The performance, quality and reliability of UCaaS and other SaaS application traffic between the branch office and the IaaS or SaaS platform benefit from the following advanced EdgeConnect SD-WAN features.

Path conditioning

Silver Peak advanced path conditioning overcomes the effects of packet loss, latency, and jitter. Path conditioning methods include adaptive forward error correction (FEC), which identifies missing packets

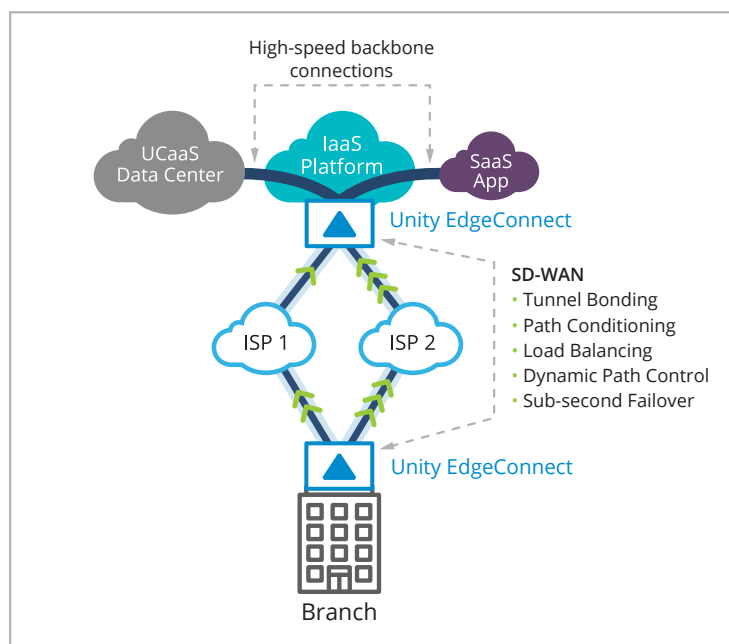


Figure 2: Two SD-WAN appliances work together to improve the performance and reliability of traffic in the “first mile” between the branch and the IaaS platform. High-speed backbone connections in the cloud improve network quality and performance over the “last mile” between the IaaS platform and the UCaaS data center.

and regenerates them in real time at the receiving end, and real-time Packet Order Correction (POC), which re-sequences packets that arrive out of order. Both techniques reduce the number of packets that need to be retransmitted between the branch and the IaaS platform, and greatly improve the perceived quality of voice over IP (VoIP), video, and other UCaaS applications. (Figure 3a and 3b)

Tunnel bonding, load balancing, and dynamic path control

With most traditional WAN routers, the network traffic for each application session must be assigned to a single WAN link. If the link is congested, or suffers from packet loss and jitter, the application becomes unstable.

EdgeConnect overcomes these problems with tunnel bonding and packet-by-packet load balancing.

Tunnel bonding combines multiple WAN links to create a single logical link. **Load balancing** spreads data packets from a single session across whichever paths have the highest amount of available bandwidth. **Dynamic path control** routes latency-sensitive UCaaS applications through whatever links

currently offer the best performance and the least jitter and packet loss. By continuously monitoring the quality of all available paths between two locations and adapting to impairments in real-time, EdgeConnect creates a single, robust, high-availability connection.

Sub-second failover

Dynamic path control helps EdgeConnect deliver one additional key benefit: automatic, seamless, sub-second failover from a failed or impaired WAN connection to the secondary link. EdgeConnect continuously monitors the throughput, packet loss, latency and jitter across all transport services and adapts if performance falls below pre-defined thresholds. If a brownout or blackout occurs, the remaining link(s) in the tunnel continue to carry traffic. In the vast majority of cases of a failed link UCaaS users won't notice any disruption at all to voice calls, audio and video conferences, or any other application. Without the Silver Peak SD-WAN platform, the consequences from a failed connection would range from a break of several seconds to requiring participants to reinitiate voice calls and video conferences.

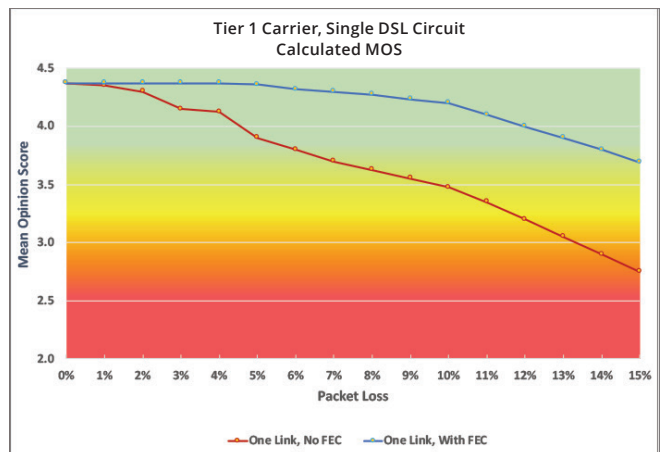
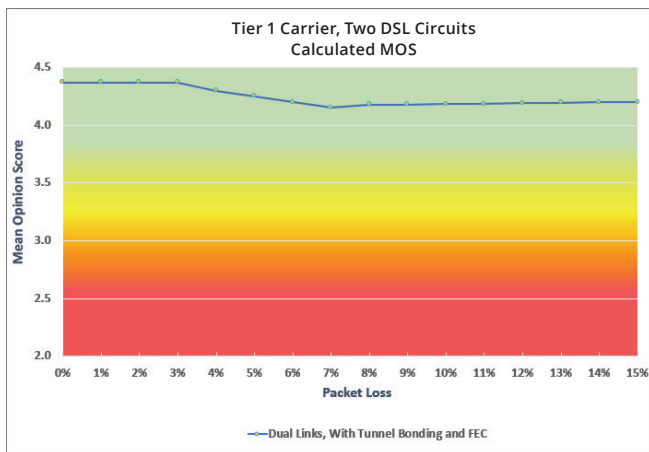


Figure 3a and 3b: UCaaS vendor lab tests. Figure 3a demonstrates how EdgeConnect path conditioning enables very good voice call quality (Mean Opinion Score or MOS > 4.0) across a single link connection experiencing 15% packet loss. Test case results for two links shown in Figure 3b, validates the ability to deliver better than toll quality (MOS > 4.0) voice during periods of high packet loss, when using error correction techniques.

Simple set-up with a business intent overlay

One of the distinguishing features of the EdgeConnect SD-WAN edge platform is that the features mentioned above can be configured and managed simply by creating a business intent overlay and assigning real-time application traffic to it. For example, EdgeConnect can automatically identify common UCaaS applications and assign them to a business intent overlay called “RealTime” or “UCaaS” that specifies the use of multiple paths simultaneously, the fastest failover, the use of strong encryption, and other QoS and security policies for high-priority applications. EdgeConnect automates the rest, continuously monitoring the quality of available paths and automatically using path conditioning, load balancing, dynamic path control, and other capabilities to maximize the performance and reliability of the UCaaS applications.

Application visibility and control

Silver Peak [Unity Orchestrator™](#), a part of the EdgeConnect SD-WAN platform, helps administrators troubleshoot network problems affecting UCaaS applications. For each WAN link between the branch office and the IaaS platform, a dashboard with detailed charts show real-time and historical data for latency, packet loss, jitter, Mean Opinion Score (MOS, a common measure of the quality of audio and video traffic), and other factors related to application quality and performance. Administrators can also view the bandwidth consumed by UCaaS (and other) applications to help plan for future WAN needs.

Changes to QoS or security policies and new policies for additional applications are programmed centrally and “pushed” to all sites in the EdgeConnect SD-WAN. Orchestrator ensures that policies are programmed consistently across the network.

Benefiting from a high-performance last mile

Most UCaaS service providers have deployed high-speed backbone connections with massive bandwidth between their data centers and leading IaaS platforms such as AWS, Azure, and GCP.

In Figure 2, the SD-WAN appliance on the IaaS platform can provide access to these backbone connections. As a result, UCaaS traffic can travel between the IaaS platform and the UCaaS data center at very high speed with almost no packet loss or jitter.

In other words, the SD-WAN appliances in Figure 2 not only improve the performance and reliability of traffic across the “first mile” from the branch office to the IaaS platform, they also provide an opportunity to leverage a very high-performance connection over the “last mile” to the UCaaS service provider.

This contrasts with the situation shown in Figure 1, where traffic from the branch office to the UCaaS data center would follow unpredictable, uncontrolled paths, probably with multiple hops between multiple internet service providers across long distances.

A similar situation applies to many of the SaaS applications that interface with UCaaS services, including file storage services such as Box and DropBox, office productivity products such as Microsoft Office 365 and Google G Suite, collaboration apps such as Slack and Skype for Business, and sales and customer relationship management applications such as Salesforce and Oracle Sales Cloud. Most of these SaaS applications also have high-speed backbone connections to the major IaaS platforms. As a result, configurations like that shown in Figure 2 can address the “last mile” problem for most leading SaaS applications as well as for UCaaS services.

The Business Benefits of Using an SD-WAN Architecture with UCaaS Services

The technical advantages of using the EdgeConnect SD-WAN edge platform with UCaaS services add up to three very important business benefits: improved user experience, lower costs, and increased business agility.

Better employee and customer experiences with UCaaS applications

Voice calls are clear, video conferences are sharp, file and screen sharing work better, and call center transactions go more smoothly. Employee productivity and customer satisfaction are increased.

Lower costs

Organizations can take full advantage of low-cost internet connections without sacrificing voice and video application performance, quality and availability. Network administrators gain visibility and control that allow them to manage and plan networks more efficiently.

Increased agility

Organizations can open new remote offices faster and increase network capacity flexibly by adding internet connections, confident that the SD-WAN platform will always utilize the best available paths between UCaaS users and their applications.



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SP-SB-UCaaS-092319