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Improve the App and Desktop Experience for Branch and Mobile Workers With SD-WAN

IMPROVE THE APP AND DESKTOP EXPERIENCE FOR BRANCH AND MOBILE WORKERS WITH SD-WAN

" Optimizing the User Experience While Ensuring Reliability Is Essential for a Successful Desktop or Application Virtualization Deployment . "

Ensuring a positive experience for workers co-located with the enterprise datacenter is not a problem. However, for the remote workforce,which includes branch and mobile workers, achieving this goal is more challenging. Poor WAN performance can degrade the virtual desktop experience and lead to employee complaints and lowered productivity. Using our Bonded Internet and SD-WAN with a virtualized environment ensures high WAN reliability and optimizes application performance, responsiveness and reliability.

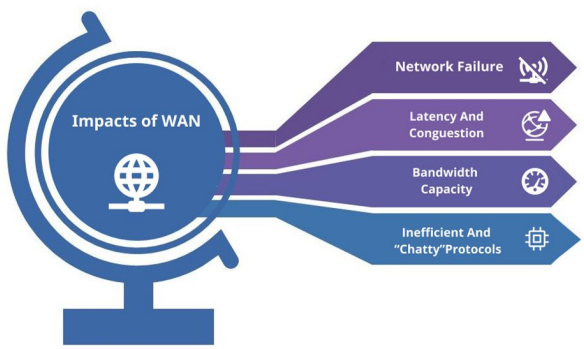
" When Implementing an App or Desktop Virtualization Solution, IT Must Ensure That the User Experience Is the Same or Better Than What Employees Receive Through Traditional, Localized PC Sessions. Otherwise, When the Shift to the New Desktop Delivery Method Occurs, Any Degradation in Performance Will Generate Complaints and Potentially Cause the Virtualization Initiative to Fail. "

The Bonded Internet and SD-WAN solution provides optimized application performance across the enterprise WAN. By combining software-defined WAN intelligence with WAN Optimization, enhanced support for Desktop and App, and deep visibility into application delivery performance, our SD-WAN delivers the reliability, security, and experience that branch and mobile users expect from enterprise and SaaS-based applications as well as unified communications. This white paper focuses on how our SD-WAN improves the quality and reliability of virtualized applications and desktops, and explores the tight integration between SD-WAN and Bonded Internet.

How the WAN Impacts Desktop and Application Virtualization.

WAN problems are more than just the occasional disconnects caused by a failed firmware upgrade or a poorly conceived configuration change. The most bothersome problems are subtler and often add up over the duration of a virtualized desktop or application session. For example, a document that took five seconds to load an hour ago now takes five minutes, even though the person remains in the same location on the same network. When this occurs, the person typically remembers how wonderful life was under the "old way" of doing things, with all applications and desktop sessions running locally.

Desktop virtualization may lead to daily user dissatisfaction, which is not something the IT team wants to tell management. Upon digging deeper into the problem, IT quickly discovers that virtualization software is not the issue the root cause is the WAN.



• Network Failure

With virtualization, the connection between a branch office and the data center becomes an essential lifeline. If that connection is lost, productivity will immediately suffer. Enterprises generally minimize this risk by using expensive private circuits with SLAs such as MPLS and sometimes by paying for backup connections. But MPLS

connections do fail or degrade in spite of SLAs, and waiting for traffic to be routed to the backup connection can disrupt the virtual session and force users to reconnect.

WAN Latency and Congestion

When users are performing highly interactive tasks, fast application response time is essential to a superior experience and high productivity. Many people accept slow response times whenaccessing public websites but find them unacceptable when performing work-related tasks and remotely accessing the corporate network. These delays are often due to latency and congestion in the WAN. In corporate LAN networks, round-trip time (RTT) is often within tenths of a millisecond. Over the WAN, however, RTT canrange from tens to hundreds of milliseconds depending on distance, network design and traffic congestion. As latency and congestion conditions worsen, higher RTTs turn virtual desktop sessions into a waiting game for branch and mobile users.

Bandwidth Capacity

Network bandwidth is simply the amount of data the network can transfer at any given time. The remote user feels the impact of limited bandwidth most acutely when downloading or uploading files, watching streaming multimedia or conducting other activities that require large session input/output (I/O).

By definition, delivering virtual desktops to remote endpoints requires more WAN bandwidth than executing local applications. In hosted desktop sessions, all elements related to desktop and application delivery reside in the datacenter and all activities, from screen updates to keystrokes, execute across the WAN. Therefore, bandwidth requirements increase in direct proportion to the number of virtualized desktop sessions.

A new factor that is increasing demands on bandwidth is video content usage within the enterprise. While videoprovides a richer training, marketing and collaboration experience, its transmission to branch and mobile workers consumes large amounts of costly WAN bandwidth and may congest the WAN pipe. The situation is even worse in the case of mandatory training and compliance videos where the same content is watched over and over by multiple branch employees, leading to repeated downloads. Or if a popular video goes viral within the enterprise,the same files will traverse the WAN link from server to branch multiple times. These scenarios result not only ina poor viewing experience but also in slower response time for any other business-critical applications that operate over the same links.

Inefficient and "Chatty" Protocols

For users that run traditional client server applications alongside their virtual desktops, another issue that can arise is the significant communication overhead required due to "chatty" protocols. As it turns out, many common email,file sharing and productivity applications use protocols – such as CIFS and MAPI – that rely on considerable back-and-forth handshaking between the endpoint system and the corresponding datacenter-based server. The problem in this case is that, with the relatively high RTT over a WAN link, the accumulated delay from all ofthese handshakes quickly adds up – with the end result being a significantly degraded user experience.

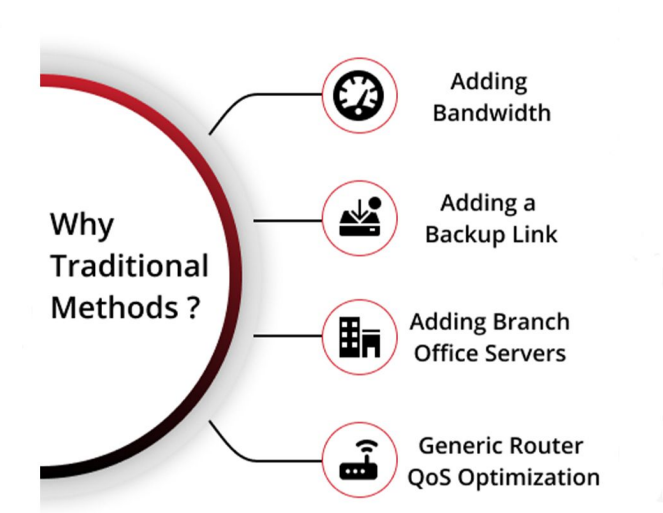
Why Traditional Methods for Ensuring the User Experience Fall Short

Adding a Backup Link

The most common solution to prevent a network outage from impacting users in remote branches is to pay for a second, backup link. Usually this is a broadband circuit that can be used for general Internet access and acts as a fall back for the primary MPLS link. But without a software-defined networks to manage the two links, this is not an ideal solution. Switching to the backup link when the primary fails either requires manual intervention or a reliance on routing protocols. In either case, the failover will not preserve the users' sessions and they will be impacted by the outage. When the primary link is restored, it will often flap and this can cause traffic to be routed on an off it multiple times until it stabilizes – each time further impacting the user experience. And during normal operation, that excess bandwidth in thebackup link isn't available for the virtual sessions, even if the primary link is congested.

Adding Bandwidth

When trying to solve a branch or mobile user experience challenge, the most common approach taken is simplyto add more bandwidth.However, mobile users working from wireless hotspots or home often have no choice but to endure bandwidth and latency issues because they are beyond the control of the organization. Clearly, thelocal coffee shop is unlikely to invest in higher-capacity trunking for the roaming road warrior.Branch offices can also present a dilemma for IT. In many cases, the branch office resides on a leased network trunk shared with other businesses, and connects to the corporate datacenter across the WAN. Multiple users and applications compete for the same bandwidth. In this scenario, IT must make a trade-off between user experience and cost of the shared network trunk.Adding more bandwidth means higher cost of ownership,delaying some of the ROI benefits associated with desktop and application centralization. From a technical perspective, it is also important to recognize that although adding more bandwidth has the potential to alleviate congestion related performance issues, it actually does nothing to reduce the underlying latency of a WAN link (which is primarily a function of distance), or to resolve the problems caused by chatty applications and protocols.And adding bandwidth can be expensive if the company relies on private circuits such as MPLS to achieve the reliability they require. Using public broadband connections such as DSL and Cable would allow them to add bandwidth at a much lower cost, but the inherent unpredictability of these best-effort networks isn't ideal for supporting virtualization.



Adding Branch Office Server

Alternatively, IT may decide not centralize everything at the headquarters' datacenter. Instead, servers runningcertain mission-critical applications can be installed in each branch office to reduce the amount of network traffic. While this approach solves the WAN related performance issues, IT must now manage the remote servers and ensure data replication, which adds costs and detracts from the benefits of centralization, consolidation and desktop virtualization initiatives.

Still another option is to create a local virtual desktop delivery infrastructure for certain branch offices. Thisalternative maintains alignment with the overall corporate virtualization initiative, but still increases infrastructure expenses. Additionally, this approach clearly does not solve the challenge facing employees who need to work from their homes or other remote locations—the WAN is still their only connection point.

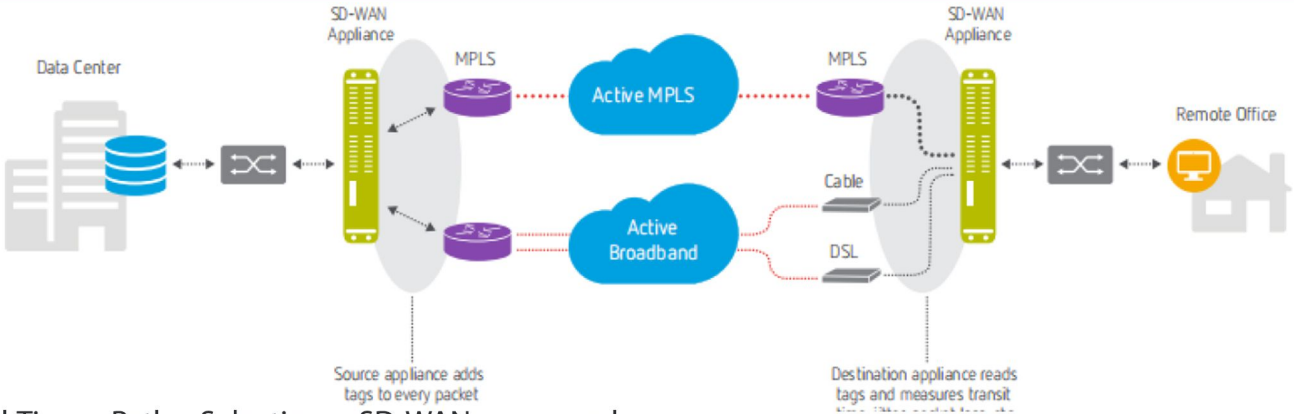
Generic Router QoS Optimization

The latest-generation network routers and trunked switches support features that prioritize network traffic and improve overall quality of service (QoS). Most of these solutions are designed to prioritize some packets ahead of others, as opposed to being truly application aware. To obtain a deeply granular view of application traffic and differentiate an interactive desktop virtualization session from a background printing activity, a different solution is needed.

Our SD-WAN Powered Bonded Internet Enhances the User Experience for App and Desktop Virtualization

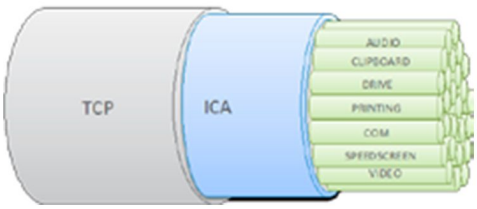
We specifically engineered our SD-WAN solution to deliver a reliable and secure high-definition user experience with virtual desktops and apps hosted and delivered by Bonded Internet. The key to the success of our SD-WAN with Desktop and App is two-fold: first, it proactively manages how these applications are transported across the WAN while at the same time, optimizes the application traffic that ultimately gets transported across the WAN.

Figure 1 Shows a Headquarters-to-Branch Office Scenario With the Bonded SD-WAN Appliances Included at Each Location.



Real-Time Path Selection. SD-WAN powered Bonded Internet proactively manages how Desktop and App traffic is transported across the WAN by identifying the best WAN path for each individual workflow within a Desktop session or each individual App session. In the figure below, the source (sending) appliance adds tags to each packet with information about the time sent and its order in the packet flow. The destination (receiving) appliance reads these tags and uses the data to measure transit time, congestion, jitter, packet loss and other information about the performance and health of the path. The appliances share this information with the controller, which uses queuing theory and predictive behavioral statistical modeling to create a "map" of all of the paths in the WAN. This information is continuously updated with information from recent packets.

Fine-Grained Quality of Service (QoS): Our SD-WAN deviceuniquely supports classification and prioritization of session. As a result, interactive discrete workflows within each Desktop traffic such as screen refreshes and mouse movements can be given preference over other elements of Desktop/Applications as well as other applications such as file downloads and web browsing. Minimum bandwidth utilization is also assured as the priority queuing engine that reserves a configured percentage of bandwidth for each class of traffic, or queue, automatically makes any unused capaci-



Specialized rules and policies for each type of workflow are available out of the box, and can be customized by the enterprise to tailor the behavior of HD traffic over the WAN. Examples of specialized behaviors that can be applied are:

- Best path selection, taking into account the individual network characteristics required by each type of workflow.
- Packet duplication of low bandwidth, loss sensitive workflows to ensure no packets are lost and retransmits are never required.
- Dynamic link bonding, which creates more bandwidth than is available on any single link, to speed the performance of bulk data transfers.
- Configurable queue depths and retransmit times and optional packet reordering to mitigate the effects of network issues.

These capabilities allow Bonded Internet SD-WAN appliances to continuously measure and monitor the performance, quality and health of every MPLS and broadband connection in the WAN, then apply that knowledge to providing quality of service, path selection, traffic shaping, sub-second failover and other services.Our SD-WAN powered Bonded Internet solution also contains a comprehensive set of highly complementary optimization technologies, including specific optimizations for HD technology, the Desktop/App delivery protocol. This combination of HD technology and WAN optimization designed for the HD technology is something that competing virtual desktop solutions can't offer either, and this is one reason for the success of our SD wan powered Bonded Internet for virtual desktop deployments.

Adaptive TCP Flow Control: Designed to overcome networks characterized by high packet loss rates and high latency,the SD-WAN flow control technology employs a collection of standards-based techniques to bypass conservative, default TCP flow control settings to more thoroughly utilize available bandwidth.

Adaptive Compression: Depending on the type of traffic being sent and prevailing network conditions, our SD-WAN dynamically selects among multiple compression, caching, and data de-duplication algorithms to dramatically reduce bandwidth consumption. Intimate knowledge of HD and direct communication with Desktop server processes ensure optimal treatment down to the level of individual virtual channels. A specially developed nano-pattern matcher further ensures maximum gains are achieved by delivering optimal compression for the mouse movements, keyboard entries, and screen update traffic typical of virtual desktop sessions.

Adaptive Protocol Acceleration: This technology orchestrates with App or Desktop to provide intelligent acceleration of HD by sensing and responding to the network and traffic conditions. Latency mitigation is provided by eliminating unnecessary round trips for HD and several other application protocols.

These include HTTP/HTTPs, CIFS, MAPI, FTP, NFS and more some of which are utilized during negotiation of virtual desktop sessions, and to deliver desktops and applications that are streamed instead of hosted.See Figure 2.

SD-WAN Powered Bonded Internet Accelerates Common Enterprise Applications

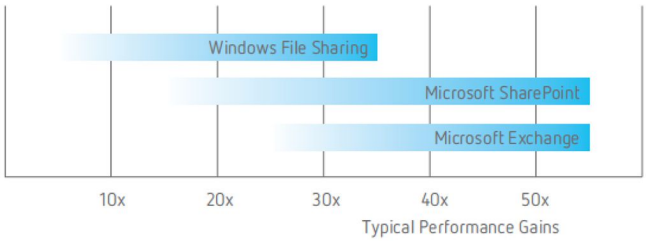


Figure 2: Our SD-WAN Benefits Many Common Applications

Per-Application Performance Monitoring

In-depth, application-level performance monitoring is provided. An open, standards- based technology, supplements the network-level data readily available via IP/ NetFlow with per-flow usage and performance data for individual applications, including Desktop and App. A high-speed collector, includes embedded correlation capabilities that automatically organize collected records by resource (e.g., by user, application, and SD-WAN appliance).

Administrators can then view reports of both real-time and historical statistics from a variety of corresponding entry points, while also leveraging multi-level drill-down capabilities to examine underlying data and reveal the actual source of any ongoing, imminent, or potential future application performance issues.

Video Optimization: Our SD-WAN also improves the performance of video delivered within a Desktop and App environment. By identifying, classifying and caching video content, Our SD-WANBonded Internet significantly reduces associated WAN bandwidth demands while ensuring that business-related content is given a higher priority than other content employees may view.

For example, when a user at a branch office with a properly configured SD-WAN appliance plays a video from the video server hosted in the data center or on the public Internet, the request for video content will result in caching of that video on the local SD-WAN device. Once cached, the video will be served form the local SD-WAN appliance in response to all subsequent requests until the content is flushed or marked as stale.Local video caching has two main advantages. First, performance is faster and video download times improve by a factor of 45 or more because the video is delivered at LAN speeds (Figure 3). Second, WAN link usage for redundant transfers is minimized. SD-WAN video caching supports all video content transmitted over HTTP including videos played directly within the browser or played in a App/Desktop environment with Flash redirection enabled.

Out-of-the-Box Support for Desktop: Another major strength of our SD-WAN powered Bonded Internet is the ability for seamless deployment. No configuration changes are required as it automatically orchestrates with Desktop and other service delivery components to maximize

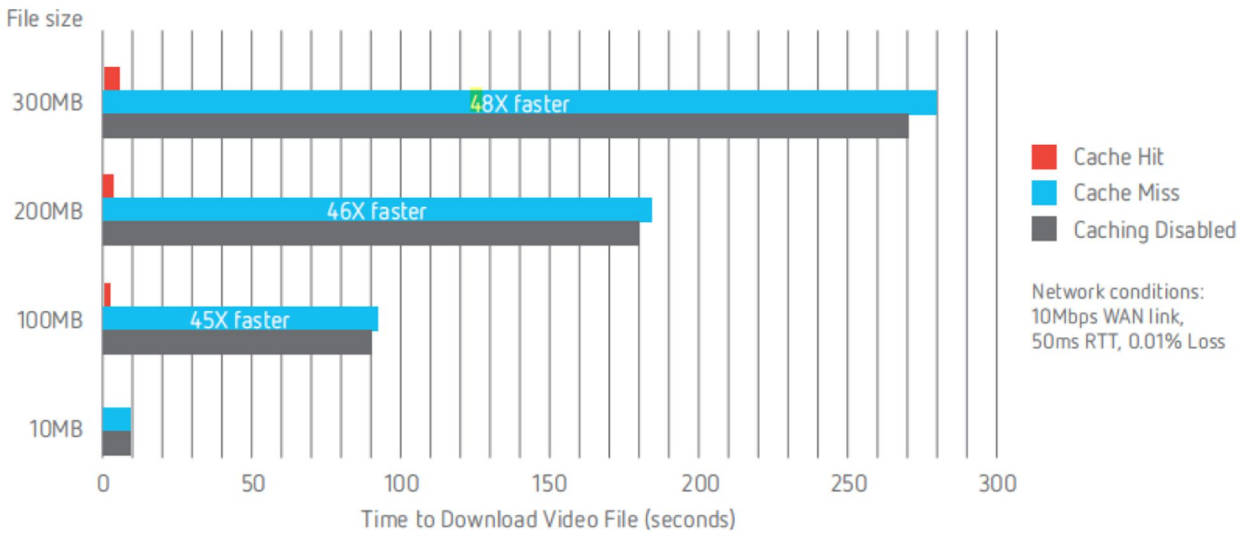


Figure 3: Download Times With Our SD-WAN Video Caching

Example Include:

- Decrypting, optimizing, and then re-encrypting traffic natively encrypted by Desktop.
- Suppressing Desktop TCP optimization and compression functionality to avoid redundant and potentially conflicting processing, while also enabling data de-duplication to operate across multiple users' sessions (rather than on each session individually);
- Applying specialized policies for each type of workflow to individually optimize each function.
- Interoperating with Gateway to optimize all TCP traffic within the secure tunnel for remote and mobile users;

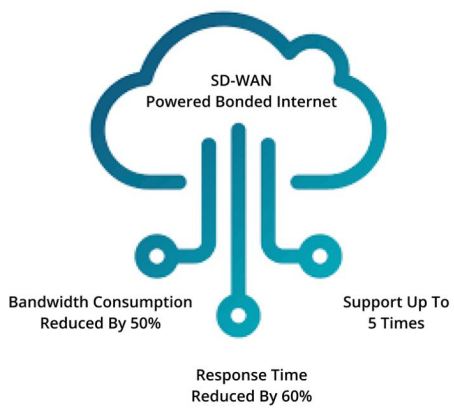
Video Caching Acceleration With NetScaler SD-WAN

The overall impact of these technologies and capabilities is typically quite significant.

Using our SD-WAN powered Bonded Internet in conjunction, enterprises can expect to reduce the average bandwidth consumed per session by up to 50 percent (depending on the types of work flow being processed), reduce response times for workflow such as printing by up to 60 percent, and support up to five times as many users on a given connection before having to invest in increased bandwidth.

The net result is that our SD-WAN accelerates the ROI and time to value associated with desktop and application centralization and virtualization, while eliminating the costs and administrative burden of adding extra branch servers.

By pro-actively avoiding underlying network issues, quickly moving traffic off of failed links, and ensuring the best path for each individual workflow, IT can build a single desktop virtualization infrastructure that provides an excellent experience for all users regardless of location or network conditions.



WAN Bandwidth

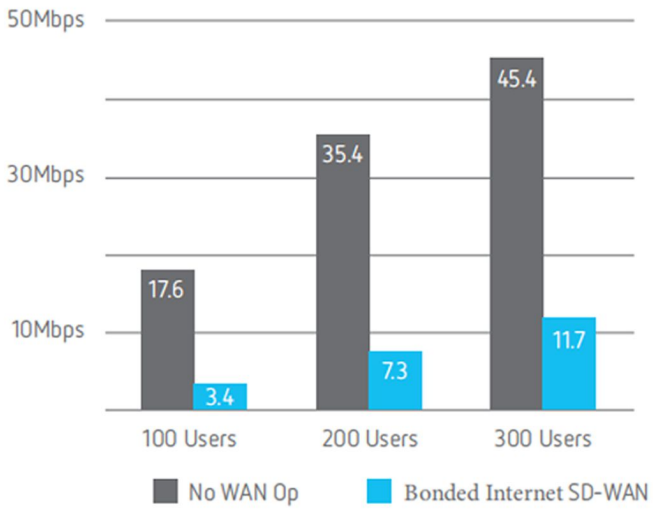


Figure 4: SD-WAN optimization

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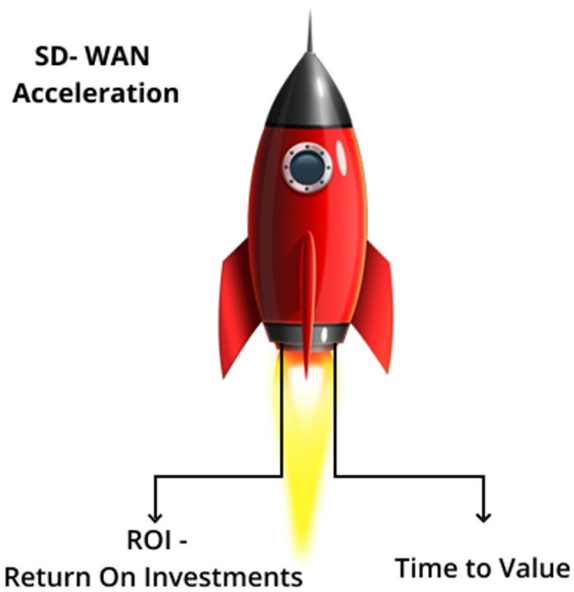

Conclusion

App and desktop virtualization provide a smart, highly effective way to enhance user productivity and reduceremote infrastructure requirements while securely extending corporate data to employees on the go. However,once workers move outside the corporate headquarters boundary, they are at the mercy of their WANconnectivity. Innovative WAN technologies are needed to build a more reliable network that adapts to application demand and provides granular visibility into WAN traffic, while optimizing performance where it counts the most.

We engineered our SD-WAN solution to deliver a high-definition user experience not only for typical enterprise applications, but also for Desktop and App. Our SD-WAN:

- Allows broadband connections to be used as the WAN, cost-effectively providing the bandwidth needed for optimal application performance.
- Automatically reroutes traffic off of poor quality links or failed links.
- Applies QoS to individual data flows, allowing for specialized handling for each type of data.
- Accelerates time-consuming tasks such as printing, file downloads and page scrolling by up to five times,with a corresponding decrease in WAN bandwidth.
- Reduces video traffic bandwidth requirements by a factor of 5 through new video delivery optimization enhancements.
- Simplifies branch office infrastructure by selecting our SD-WAN branch office appliance.
- Shortens configuration time with out-of-the box integration.