Using Silver Peak to Optimize Virtual Applications and Desktops Across the WAN

Improve the performance and reliability of virtualization

Application virtualization (for example, Citrix XenApp) and Virtual Desktop Infrastructures (for example, Citrix XenDesktop, Microsoft Desktop Virtualization, and VMware VDI) deliver enormous management and costs savings throughout an enterprise. However, the benefits of virtualization can easily be lost if application performance hampers end user productivity, as often happens when virtual applications and desktops are delivered across a Wide Area Network (WAN).

Silver Peak's WAN acceleration solution helps enterprises reap the rewards of virtualization by overcoming network challenges that impact the performance of these applications across the WAN. More specifically, Silver Peak addresses latency, packet loss, and bandwidth challenges that cause virtual applications and VDI to be unresponsive and/or unreliable across the WAN.

This paper discusses these WAN challenges in detail, and describes how they can be overcome using WAN acceleration. In addition, it provides best practice recommendations for deploying WAN acceleration in virtual application and desktop environments.

UNDERSTANDING THE ISSUES

Why do virtualized applications and virtual desktops perform poorly across the WAN? It is typically not due to the application or VDI architecture, it is due to the network.

Virtualized applications are very interactive, requiring screen updates and mouse movements to be sent over the WAN using thin-client protocols (for example, Citrix ICA and Microsoft RDP). While these work fine in a Local Area Network (LAN), there are unique challenges when communicating across a WAN that can have an adverse effect on the performance of these protocols, resulting in slow screen refresh rates and occasional session disconnects.

There are many similarities between traditional virtualized applications and the still evolving VDI landscape, most notably the need to deliver real-time performance

over the WAN. This is especially true in "server-side" VDI implementations such as VMware VDI and Citrix XenDesktop, where all components—applications and/or operating systems—are installed, maintained, and secured in the data center. In this environment, all screen displays, keyboard entries, and mouse movements traverse the network, requiring the same real-time WAN performance as traditional virtualized applications.

"Client-side" VDI solutions such as Microsoft's Application Virtualization are slightly different as they require data to be streamed to the client—full or partial applications and/or operating systems—at the beginning of a session. This places an additional demand on the WAN, which first needs to handle a large transfer of data to the client, and then needs to support real-time interaction between the client and host for mouse, keyboard, and screen updates.

Packet loss can expand a 200-millisecond roundtrip into one second, making virtual applications and VDI unusable.

All of the above virtualization scenarios must overcome the following WAN challenges to ensure optimum performance:

- **Latency**, which is the time it takes for data to travel from one location to another. Latency is bound by the laws of physics (that is, the speed of light), and exacerbated by chatty protocols that require many back and forth acknowledgements when communicating across a WAN. The higher the WAN latency, the more time it takes for a host machine to respond to client activity. As a result, WAN latency has a direct impact on the performance of virtual applications and VDI.

- **Packet loss** occurs on shared network infrastructure (for example, MPLS and IP VPN WANs) when packets get dropped or delivered out of order due to network congestion. When loss occurs, packets must be retransmitted across the WAN, which can add considerable latency. For example, packet loss can turn a 200-millisecond roundtrip into one second. To end users, the virtual application or desktop seems unresponsive when packets are lost and subsequently retransmitted. They start to re-hit the keys on their client machine, which compounds the problem by sending even more data across an already congested WAN.

- **Bandwidth**. Most virtualized applications are fairly efficient when it comes to bandwidth consumption. However, some activities like large file transfers and print jobs can consume significant WAN bandwidth. Therefore, there are some scenarios where WAN bandwidth can limit the performance of a virtual application or desktop (although this is typically not the primary cause for poor performance in a virtualized environment).

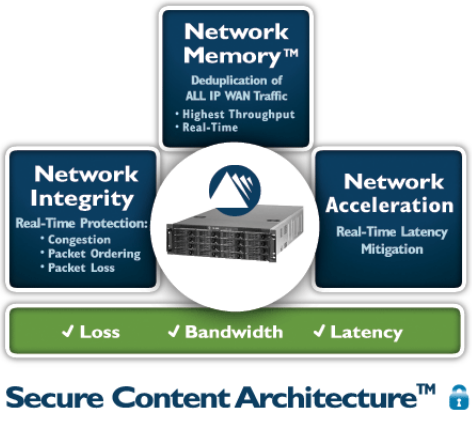
WAN OPTIMIZATION TECHNIQUES

WAN optimization devices are deployed on both ends of a WAN to improve the performance of enterprise applications traversing that WAN. Silver Peak provides the following WAN optimization techniques to improve the performance of virtual applications and desktops:

- **Network Acceleration**. Silver Peak overcomes latency by mitigating the "chattiness" of TCP, the transport protocol used to by virtual applications for communication across the WAN. More specifically, Silver Peak appliances use various network acceleration techniques to send more data within specific windows and minimize the number of back and forth acknowledgements required prior to sending data. This improves the responsiveness of keystrokes in a virtual environment.

- **Network Integrity**. Silver Peak fixes WAN quality issues with its Forward Error Correction (FEC) and Packet Order Correction (POC) technologies. FEC is used to rebuild dropped packets on the far end of a WAN link; POC is used to resequence packets that are delivered out of order. Both techniques are performed in real-time, eliminating the need to retransmit data when packet delivery issues occur. This improves the responsiveness of virtual applications and desktops for a better end-user experience.

  Because the average enterprise has over 80 applications traversing the WAN, Silver Peak's extensive Quality of Service (QoS) capabilities also play an important role in virtual environments. With Silver Peak, virtual applications and desktops can be prioritized over less important traffic, like Internet browsing. In addition, QoS can guarantee that VDI and virtual applications get enough bandwidth across the WAN.



- **Network Memory™**. All Silver Peak NX appliances are equipped with Network Memory™ technology, the industry's premier solution for WAN deduplication. Network Memory is used to inspect all inbound and outbound WAN traffic in real time, storing a single local instance of data on each appliance. Prior to sending information across the WAN, NX Series appliances compare real-time traffic streams to patterns stored using Network Memory. If a match exists, a short reference pointer is sent to the remote Silver Peak appliance, instructing it to deliver the traffic pattern from its local instance. Repetitive data is never sent across the WAN, saving bandwidth and enabling LAN-like application performance.

Silver Peak dedupes WAN traffic without adding a significant amount of latency (typically under 10 ms). This is an important differentiation because it enables Silver Peak to work on virtual applications and desktops. Other WAN deduplication solutions are forced to bypass this traffic because they add too much latency.

DEPLOYMENT BEST PRACTICES

Oftentimes host machines compress information prior to transmission. This is meant to improve bandwidth utilization in a virtual environment. However, compression obfuscates visibility into the actual data, which makes it difficult for downstream WAN optimization devices to provide their full value. While WAN optimization is possible when compression is performed on the host, the best performance will be achieved when compression is turned off on the virtual host (if possible) and instead enabled in the WAN optimization device.

Moving compression into the WAN optimization device has another added benefit—it frees up CPU cycles within the host machine. This leads to better performance and scalability throughout a virtual environment.

IT staff should also consider where encryption takes place in a virtual infrastructure. If data are encrypted at the host, downstream devices are limited in the optimization techniques that can be performed. In addition, encryption consumes precious CPU cycles in the host, which limits scalability. Therefore, to get the best possible results, it is also recommended that encryption take place within the WAN optimization device (if it is required at all).

Lastly, network scalability can have an important impact on the performance of virtual applications and VDI. The average thin-client machine has 10–15 TCP flows open at any given time. If thousands of clients are accessing host machines in the same centralized facility, that location must be equipped to handle tens of thousands of simultaneous sessions. When it comes to supporting large numbers of flows, there are two "best practice" recommendations. First, as discussed above, it is recommended that compression and encryption be moved off the host machine to free up CPU cycles. Second, one should deploy a WAN acceleration device capable of supporting a large number of TCP flows. Silver Peak NX appliances, for example, support up to 256,000 flows, which is big enough for even the largest enterprise deployment.

Recommendations:

- *Turn off compression on host*
- *Turn off encryption on host*
- *Be prepared to support a large number of flows*

EXPECTED RESULTS

Silver Peak improves the performance and reliability of application virtualization and VDI across the WAN. This is especially true when communicating between geographically disperse locations (that is, WANs with latency), and when using MPLS and IP VPN technologies (that is, WANs with dropped and out-of-order packets).

Many of the benefits experienced with Silver Peak are qualitative—that is, faster rendering of screen images, better keyboard response, and faster page scrolling. These benefits are most apparent when dealing with high-resolution images, such as graphics, PowerPoint files (in presentation mode), and charts embedded within documents. Other benefits, such as the time it takes to transfer files, can be measured fairly quantitatively. While mileage varies, Silver Peak typically delivers a 50% – 70% improvement in these environments (See Figure 1).

Citrix ICA	Time without Silver Peak (seconds)	Time with Silver Peak (seconds)	Performance Improvement (%)
Picture Open 2.2 MB File	4.5	1.5	67%
PowerPoint 1.5 MB File	22	10	55%
File Copy 1.5 MB	121	42	65%
PDF open/Scroll 1.3 MB	23	8	65%

Figure 1. Silver Peak typically delivers over 64% average performance improvement when using Citrix ICA across the WAN.

In some instances, Silver Peak can also reduce the amount of data traversing the WAN in a virtual environment. Linklaters, the second largest law firm in the world, is seeing 50% reduction in WAN traffic using Silver Peak (after disabling compression and encryption on their host machines – See Figure 2).

Linklaters is optimizing the performance of over 6,000 Citrix users across 4 continents. Another Silver Peak customer, Prudential, is supporting over 13,000 virtual clients. These enterprises rely on Silver Peak as a key enabler for their global IT operations. Silver Peak, in turn, has helped them (and other leading businesses) reduce IT costs and improve employee productivity.

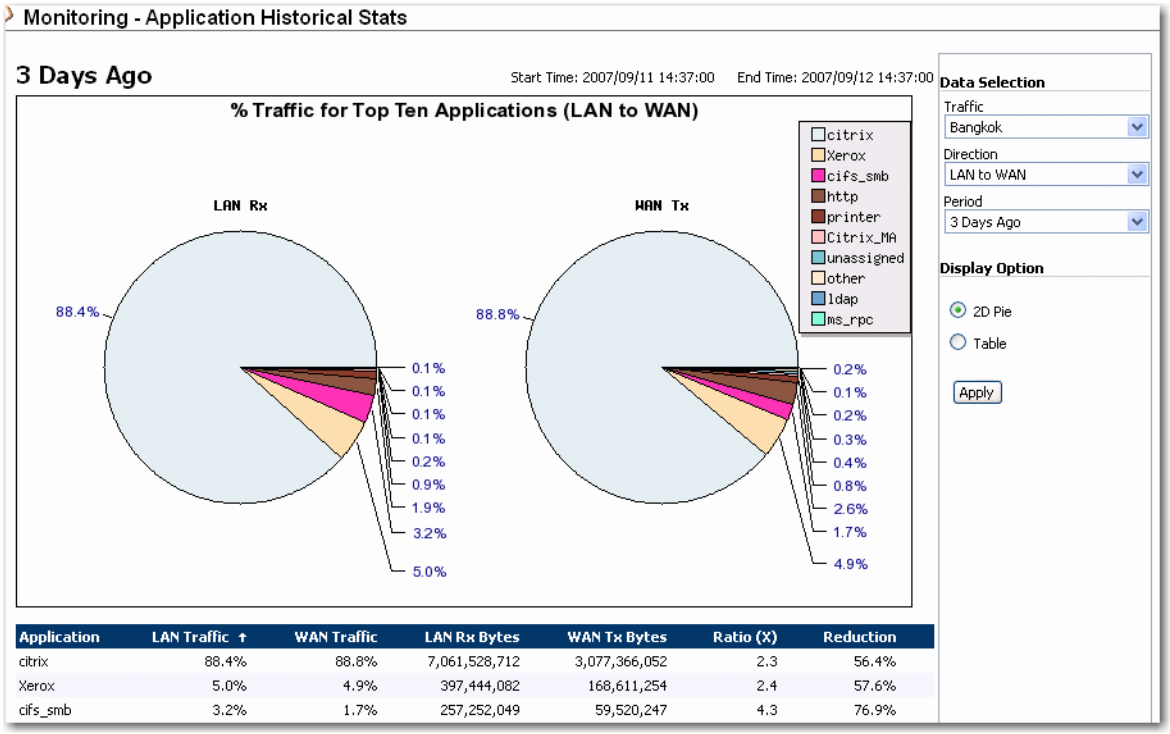


Figure 2: Linklater's success with optimizing Citrix performance worldwide.

For more information, visit http://www.silver-peak.com/infocenter.