Voice over IP: LAN–like Quality on the WAN

Most major enterprises have Voice over IP (VoIP) projects either under way, or in the testing and evaluation stage. According to a recent ComputerWorld survey, VoIP deployments will grow faster in the next 18 months than any other category of enterprise applications, with a full 16% of enterprises planning to implement VoIP in that time period.

Requirements for Supporting Voice

VoIP is a real-time application, based on UDP, that is highly sensitive to WAN traffic quality — jitter, latency, and packet loss. As a result, companies considering VoIP and consolidation projects will require an acceleration platform that is specifically structured to support UDP, including advanced QoS capabilities to minimize jitter, latency, and packet loss.

It is not enough to simply reduce the bandwidth usage of other applications in order to make room for VoIP traffic over the WAN. Rather, it is a requirement to maintain LAN–like network characteristics over what will be an over-subscribed or congested WAN, without inducing added latency.

Silver Peak achieves this using a variety of technology components:

- Silver Peak provides a variety of **Quality of Service (QoS)** options to enterprises, enabling them to deploy VoIP in conjunction with other enterprise applications. In addition to honoring existing QoS markings, the Silver Peak solution provides native support for advanced QoS, including sophisticated classification logic, a variety of packet marking techniques, queuing, and traffic shaping. In addition, Silver Peak ensures that specific applications, like VoIP, are guaranteed appropriate WAN bandwidth

- Silver Peak employs advanced **header and payload compression** to reduce the amount of voice traffic traversing the WAN. This saves on WAN bandwidth and improves application response time.

- Silver Peak uses adaptive **Forward Error Correction (FEC)** to improve VoIP performance during periods of high packet loss. By dynamically adding FEC packets, Silver Peak can recreate lost packets with extremely low latency. This ensures voice quality during periods of congestion.

- Silver Peak uses **packet coalescing** to repackage multiple smaller packets into a single larger packet. By doing this in connection with header compression, Silver Peak reduces the amount of bandwidth required for voice.

- **Network Memory**™ is used to reduce the amount of repetitive information traversing the WAN. This can be broadcast voice traffic, such as audio streaming or voice mail, as well as redundant bits of information that accompany normal voice calls (for example, silence suppression). In addition, Network Memory can reduce the amount of non-voice traffic on the WAN, freeing up the total amount of available resources.

- Network Memory is the only data reduction solution to work on both UDP and TCP applications. In addition, it performs pattern matching in real time, minimizing network latency. This makes the Silver Peak solution ideal for all enterprise traffic — from web and e-mail to Citrix® and voice.

Making the "Toll" Grade

In the VoIP world, voice quality is measured by a Mean Opinion Score (MOS), which is a number between 1 and 5 used to

Turning up the Volume on Enterprise VoIP

quantitatively express the subjective quality of speech in communications systems, especially digital networks that carry VoIP traffic. Anything above a 4.0 is considered toll grade.

Silver Peak engaged Miercom, an independent consulting group, to test voice quality across the NX Series appliances. Miercom used conventional VoIP testing equipment to collect baseline MOS scores for voice traffic in both LAN and WAN (256 kbps with 100 ms latency) environments. Acceleration appliances from Silver Peak and another vendor ("J") were then added to the equation to see if they had an effect on VoIP quality over the WAN.

As the graph below shows, it is easy to achieve a MOS of 4.4 on the LAN. On a WAN link with congestion, MOS drops to 3.0. This is well below toll quality. Vendor J's acceleration appliance only made matters worse, lowering the MOS to 2.8. Silver

Peak, on the other hand, was able to get the MOS up to 4.3, well above toll grade.

Getting Jitter Under Control

Miercom also measured the effect that each acceleration solution has on jitter. On a congested WAN link with no acceleration products present, jitter was 120 msec on average, with peaks as high as 249 msec. When Silver Peak was added to the equation, average jitter was dramatically reduced to 0.6 msec; peak jitter was reduced to 9.1 msec. The alternative acceleration appliance, on the other hand, actually reduced voice quality by increasing network jitter to 164.5 msec on average and 384.5 msec during peaks. These jitter numbers would likely result in voice services that are well below toll quality.

On a private campus without congestion, jitter measurements can be as low as 1–5 msec. Connections over public
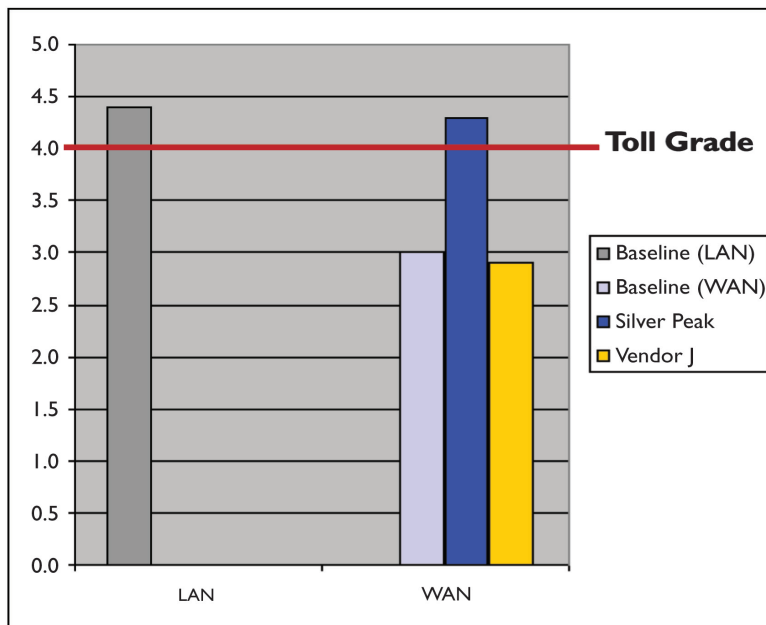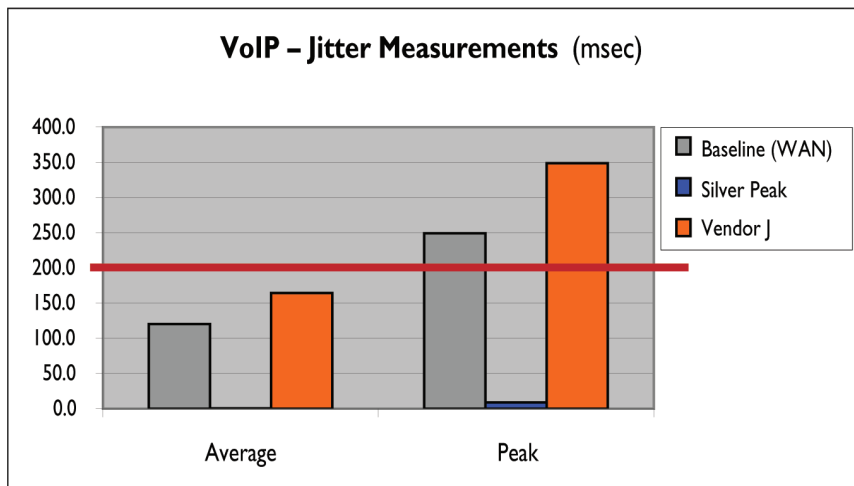

Source: Miercom 11/05

networks can range from 5 to 40 msec. Most VoIP gateway products can compensate for jitter up to 160 msec with dynamic buffering. When network jitter exceeds these buffer tolerances, packets are typically dropped, resulting in poor voice quality for end users. As a general rule of thumb, jitter should remain below 200 msec to avoid noticeable degradation in VoIP quality. Silver Peak makes jitter a non-issue in enterprise VoIP scenarios.

Silver Peak – The Right Solution for VoIP

Silver Peak enables enterprises to easily and cost-effectively deploy VoIP to branch offices. By combining innovative data reduction techniques with advanced Quality of Service, compression, and loss mitigation, Silver Peak delivers LAN–like toll quality across most WAN links. From real-time conversations to audio streaming, Silver Peak is the answer when enterprise VoIP is calling.

VoIP – Jitter Measurements (msec)

Legend: Baseline (WAN), Silver Peak, Vendor J

Source: Miercom 11/05

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