SpectraLink Voice Priority

Quality of service for voice traffic on wireless LANs

Introduction

The emergence of Voice-over-IP (VoIP) technology has presented network managers with a practical solution for combining voice and data over one network. This opportunity to unify network infrastructure and management now exists for wireless local area networks (WLANs), as well as in the wired network.

The WLAN market is growing at a 40 to 60 percent annual rate and is expected to reach $1 billion by the year 2000, according to the Wireless LAN Alliance (WLANA). The international IEEE 802.11 standard for WLANs is the driving force behind this predicted growth. As WLANs become more prevalent, companies are looking to leverage their wireless infrastructure investment by placing voice and data traffic over the same backbone.

The Need for Voice Prioritization

Packet-based network protocols now used in local area networks are designed to efficiently transmit bursty, unpredictable asynchronous data. As a result, packets experience variable delays caused by congestion on the network. Although packet delays can adversely affect throughput of data traffic, there is no perceptible degradation of quality to the end user.

In contrast, voice traffic is isochronous – it requires the timely delivery of a constant stream of packets to maintain good audio quality. Unlike circuit-switched voice connections, packetizing voice for transmission over a shared voice and data network offers no timing assurance on the delivery of packets. In fact, all packets will receive equal treatment as they compete for available bandwidth. Therefore, when all types of packets contend for network resources, some method of voice prioritization must be implemented to ensure timely delivery and good audio quality.

The challenge of providing good voice quality when packetizing voice is increased by operating in a WLAN environment, where the wireless media provides as little as 1Mbps of shared capacity. In this case, telephones contend with other client devices, such as handheld scanners, barcode readers, and laptop computers for access point (AP) resources. Current WLAN standards provide no quality of service (QoS) guarantees for the isochronous voice streams.

SpectraLink Voice Priority

SpectraLink Corporation, a manufacturer of workplace wireless telephone systems, has devised a voice priority mechanism for WLANs which is implemented in the AP and NetLink Wireless Telephones. SpectraLink Voice Priority (SVP) is an open, straightforward QoS approach for prioritizing voice traffic on the WLAN that has been adopted by several leading vendors. Voice priority favors isochronous voice packets over asynchronous data packets when contending for the wireless medium and when transmitting packets onto the wired LAN. The wired LAN should be designed so that latency is minimized for voice through traffic isolation and established prioritization techniques.

The basis of the SpectraLink approach is that random backoff intervals and unprioritized queuing at the AP can cause significant delays to voice traffic. Modifying AP behavior to recognize and prioritize voice packets increases the probability of better performance while continuing to treat asynchronous traffic normally.

SVP is fully compatible with the 802.11 standard and is not intended to replace future QoS mechanisms that may be ratified by the IEEE committee. However, at this time, no generally accepted standard for isochronous traffic prioritization has been validated or accepted by the market. In the absence of an agreed-upon or proven standard, SpectraLink has developed SVP in order to provide customers with a practical telephony solution today. SpectraLink is committed to working with the IEEE and other 802.11 vendors to deliver superior voice quality over wireless LANs.

Implementing SVP on 802.11 APs

In 802.11 networks, packet delays of varying lengths will occur due to the random backoff periods required in the standard. As part of the MAC layer implementation of carrier sense multiple access/collision avoidance (CSMA/CA), random backoff is required after every packet transmission. The intent is to provide equal access to the media. With voice devices, the resulting variable delays are undesirable. The SVP approach specifies a backoff value of zero for the AP whenever the next packet to be transmitted is a voice packet. This implementation is compatible with the 802.11 standard, as zero is a valid backoff number.

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The second modification required to ensure timely delivery of voice packets is to avoid letting them sit in queues, where they may wait for transmission until after their useful lifetimes have expired. The SVP approach is simply to prioritize voice packets to the head of the transmission queue. This can be done either by implementing two separate queues or by forwarding prioritized packets to the head of a single queue; the functional result is equivalent. The method for transmission queuing is unspecified in the 802.11 standard as long as packets delivered to a single endpoint are not reordered. Therefore, the SVP approach is fully compatible with the standard.

The two operations which comprise SVP, minimizing random backoff and priority queuing, require a packet filtering mechanism from the AP. Packet filtering requires recognizing the IP packet's protocol identifier, namely the "protocol" field in an IPv4 header or the "next header" field in an IPv6 header. Basic packet filtering is already implemented in most APs and can be easily extended in order to identify voice packets.

The inherent result of prioritizing voice packets is possible delays in data packet throughput. To mitigate the impact on data performance the number of simultaneous voice calls per AP can be limited so that some bandwidth is always available for data packets.

The NetLink Wireless Telephone System

The NetLink Wireless Telephone System™ (NetLink WTS) is SpectraLink's VoIP product for wireless LANs. NetLink Wireless Telephones operate with either frequency hopping or direct sequence 802.11 access points.

Because the NetLink WTS operates over 802.11 WLANs, customers are required to install SVP-enabled APs throughout the coverage area to provide adequate bandwidth capacity for Wireless Telephones and all other wireless clients. The APs receive IP voice packets from Wireless Telephones and forward them to the Telephony Gateway over the wired LAN.

SpectraLink does not sell WLAN APs. SVP-enabled APs are available from several manufacturers.

The system controller of the NetLink WTS is the Telephony Gateway, which provides an interface between the Ethernet LAN and the host telephone switch using digital and/or analog line interfaces. SpectraLink's exclusive LinkPlus™ digital interface technology emulates proprietary digital telephone sets making advanced switch functionality, such as multiple line appearances and display features, available to Wireless Telephone users. With LinkPlus, the NetLink WTS digitally interfaces with more than 90% of the installed base of PBXs and 50% of installed key systems.

Each Wireless Telephone has a unique port assignment on the telephone switch, the same as a wired telephone set. SpectraLink handsets are designed for workplace use; they are lightweight, simple to use, and durable.

Conclusion

SpectraLink is committed to standards compatibility. Therefore, the NetLink WTS will interoperate with all 802.11 WLANs. However, voice quality is only assured with the implementation of SVP. SVP is a simple QoS method that benefits voice packets in the wireless medium by minimizing delay and enforcing priority packet handling. Without these mechanisms in place, voice quality will deteriorate in a mixed wireless client environment. Even in a voice-only network, packet prioritization is necessary within the AP. SVP allows Wireless Telephones to get the most capacity out of the wireless medium by minimizing the delay between packets and avoiding unintended traffic, such as broadcasts.

SpectraLink has more than eight years of experience developing, manufacturing, and selling wireless telephone systems for the workplace. Because of this experience SpectraLink is able to provide the industry's most advanced wireless LAN telephony product. By working in cooperation with WLAN vendors, we have developed a practical approach to ensuring excellent voice quality. SpectraLink is committed to progressive engineering efforts and market-based product development that assures high-quality wireless telephony solutions.

For more information visit www.spectralink.com or call 1.800.676.5465

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