Pipeline Knowledge is Power.

Gig-E vs. SONET
By Bert Latamore

Gigabit Ethernet (Gig-E) is about to enter the long-haul data and voice network market with a compelling story that may prove as devastating to the competition, mainly Synchronous Optical Networking (SONET), as the original Ethernet was to Token Ring on the local area network (LAN) two decades ago.

Gig-E is the new darling of long-haul data transmission for one reason speed. Just as SONET was designed to handle the huge bandwidth of optical voice transmission, so can Gig-E manage the enormous capacity of optical cable on the data side. And since both are low-level transmission protocols, level 2 (Data Link) in the seven-layer OSI, both can support packet networking, a level 3 protocol that will continue to dominate long-haul data transmission and which is rapidly capturing an increasing share of the voice market. SONET, however, has never crossed from voice to data, chiefly due to its high price.

What makes Gig-E particularly compelling, says Jerald Murphy, Senior Vice President and Service Director for the Robert Frances Group, is its price tag. While there is variation among equipment suppliers, Gig-E can cost as little as a quarter of the price of an equivalent SONET system. Furthermore, it is much easier to add capacity to a Gig-E network than to SONET. The trade-off, however, is in transmission quality. Gig-E is more vulnerable to interruptions and signal quality problems.

Behind these differences are two different design philosophies. SONET was designed to guarantee high quality voice service, including a 50-millisecond recovery rate from a transmission line failure. To achieve those quality guarantees, it has a double-ring architecture, with one ring usually running in the opposite direction from the other. This gives it a physical fail-over -- if one ring fails the other can take over the entire transmission and the session is never interrupted.

In contrast, Ethernet was developed for data LANs at a time when short-range transmission quality had improved to the point that the Ethernet designers could presume that the data would get through, says Murphy. They eliminated the parity checking and redundancy features of earlier LAN protocols and left data quality assurance to higher levels in the OSI stack, creating a streamlined data transmission solution.

Ethernet was confined to the LAN for two reasons: its lack of capacity to handle WAN traffic loads and the low quality of longer-distance data transmission over twisted pair and early cable types, which required the quality checking that Ethernet had eliminated.

Gig-E solved the speed problem, and its lack of quality assurance makes it a better

match for packet networking than SONET, because the packet architecture builds its quality control into Level 3. The packet network protocol includes quality checking of each packet at each data switch it passes. If something is wrong with a packet, the protocol can request a retransmission from the previous switch. If a transmission line is cut or a switch fails, the network can automatically reconfigure a new transmission path around the problem and reestablish the session

These capabilities in large part duplicate the signal quality features built into SONET. What they do not do, since packet networking was designed for data rather than voice, is guarantee voice quality or a 50-millisecond recovery from a line failure or voice-quality transmission, which is unnecessary for data. Computers can tolerate transmission interruptions better than humans.

Tell-tale Difference

On the voice side, as optical cable replaced twisted pair in the voice arena, SONET became the dominant technology for high-quality transmission. Ironically, however, optical transmission also eliminated many of the quality issues of long haul, with the result that today data carriers are switching their metropolitan data networks to Gig-E to get maximum benefit from the higher speeds of optical cable.

This, however, is putting SONET, and the long haul voice carriers, at a potential disadvantage. Voice over Internet Protocol (VoIP) is a reality, not just in WANs but in metropolitan area networks and across the Internet as well. Certainly, VoIP lacks the quality of SONET-managed voice over the switched network, as anyone who as tried Internet telephone knows. However, steady improvements in transmission quality and speed, plus new features such as data packet prioritization, have created a good enough voice signal quality for many uses.

“We are already seeing businesses switch their long distance voice to the Internet,” says Murphy. "They are finding that the quality is acceptable and the cost/benefit ratio favors the lower-cost service.

"Eventually the people building the metropolitan Gig-E loops will want to connect them to other cities, and they will create Gig-E long-haul links to do that.” Inevitably voice, as well as data, will travel those Gig-E packet networks.

As this happens, the voice carriers will be caught in a hard place. On the one hand they cannot abandon SONET and its guarantees of high-quality voice transmission. Legally, they are charged with guaranteeing a specific voice quality, and they cannot do that with Gig-E, says Murphy. Also, a large portion of the important residential voice market will be very resistant to adopting Internet telephone both for quality and technical reasons. People like the simplicity of the phone system. They lift the headset and it works.

On the other hand, increasing numbers of businesses are likely to be attracted to Gig-E packetized voice. While the quality is noticeably less and the connections more sensitive to network interruptions, that quality is comparable to cellular in many areas, and the lower cost will make a noticeable impact on business bottom lines.
The voice carriers cannot afford to lose either market. Therefore, their best defense may well be to offer their own Gig-E long-haul data and VoIP packages to their business customers at prices competitive to the Internet-based competition. They can differentiate their services by offering to bundle in traditional SONET voice so that, for instance, a business could use VoIP solution internal long-distance but SONET for A-list customers. In this way, with strong marketing the carriers could turn the tables on the Internet voice carriers, preserve their market dominance, and increase their flexibility to provide the service that the marketplace demands.