Will that be fiber or copper?

The reality is this: Fiber continues to rule in the WAN and the backbone and play a role in some specialized areas, but copper is going to be with us for a long, long time.

By Grant Buckler

Fiber may have not yet made it to the desktop in any sort of significant way, but its proponents have not given up. Copper cabling, meanwhile, still seems determined to keep up even with some of the most demanding high-bandwidth applications.

While optical fiber vendors keep looking for ways to make fiber viable in more of the enterprise network, copper continues keeping up with increased bandwidth demands by carrying data at speeds of 10 gigabits per second and even higher.

The networking industry has been talking about fiber to the desktop since ancient times, well, before the dot-com boom anyway, which is pretty much the same thing to some people, but you still won't find fiber at many desks.

However, fiber does continue to progress. The optical fiber itself has not changed much for years, notes Ian Miles, president of Toronto Hydro Telecom, a utility telecom company that serves customers in Toronto over an extensive all-fiber network, but the supporting electronics are becoming more sophisticated, supporting a wider range of protocols at lower and lower cost.

"We're able to deploy a private OC-48 system for a customer at a price that would have been unheard of even five or six years ago," Miles says.

"In some cases it's catching customers off guard. They're saying wow, I had no idea I could afford that much network."

But that is the wide area network. Fiber to the desk is a different matter.

"The question is why, because we can get the bandwidth that we seem to require over copper," says Terrence Verity, chief information officer at Seneca College in Toronto. "I don't think it's going to get a lot of traction."

Verity says Seneca uses fiber where it needs Fiber Channel architecture for high-speed applications such as intensive multimedia production.

For most desktops the college uses Category 6 copper cabling, supporting 100-megabit speeds. That is plenty, Verity says, and the cabling itself could deliver more if needed - the bottleneck, as for most users, is the network interface in the client.

FTTP initiatives

But major fiber vendors still believe they can make a case for taking fiber closer to the end user.

"We're trying to promote the use of optical connectivity to the desktop," says Doug Coleman, manager of technology and standards at Corning Cable Systems, a unit of Corning Inc. in Corning, N.Y. To do that, Corning has teamed up with networking equipment vendor 3Com Corp. of Marlborough, Mass.

With Corning's LANscape line of optical fiber, connectors and hardware, coupled with 3Com's IntelliJack Switch NJ240FX, the two vendors claim they can make it economical to install optical fiber to desktop PCs - or at least to within inches of them.

The trick is in the IntelliJack Switch, which connects to a fiber running to the wiring closet, but provides four output ports for copper connections.

That means it can serve two adjacent offices, Coleman says, and there is no need to replace the existing network interfaces in the desktop devices.

One of the main reasons fiber to the desktop has not caught on up to now has been cost - not the cost of the fiber cable itself, which is competitive with copper, but the cost of the electronics at either end.

Trey Wafer, senior product manager at 3Com, says his company's IntelliJack "brings it back to an apples-to-apples comparison." That is because it allows customers to use the existing interfaces, which are built into all new PCs, for copper Ethernet connections, rather than adding network interface cards (NICs) that support fiber.

According to Coleman, the IntelliJack approach brings the cost of home-run fiber cabling to one desktop to US$690 -- based on list prices -- whereas the same home-run connection with copper would cost US$770.

However, this offering doesn't give quite all the benefits of fiber, because it still uses the client's existing 10/100-megabit network connection. So there is no increase in the available bandwidth to the desktop.

However, says Coleman, fiber is more secure, it cuts down on the amount of cable that has to be run, and perhaps most important, if you install fiber now, increasing bandwidth later becomes a matter of upgrading the hardware at either end rather than pulling new cable.

And Wafer says 3Com could produce a version of the IntelliJack that provides a gigabit uplink when it decides the market demand justifies it.

Except for a small number of users with high bandwidth requirements -- computer-aided design users and the like -- future-proofing is the main reason for looking at fiber to the desktop today.

But if you believe at least one vendor, fiber may not be the only way to ensure your desktop connections are ready for increased bandwidth demands tomorrow.

The Telecommunications Industry Association (TIA) is working on a version of the Category 6 cabling standard that is expected to support 10-gigabit speeds over twisted pair.

Category 6 augmented

Known as Category 6 Augmented - or "augmented 6" - it is meant to be complete by the summer of 2006. But some cable vendors have already launched copper cable they claim will meet the specification without waiting for the final standard.

Minneapolis-based ADC Telecommunications Inc. claims its CopperTen cabling, which the company acquired as part of its takeover of Krone Inc. last spring, can be used anywhere in an enterprise network where customers want to future-proof their installations against future increases in bandwidth demands.

"When people install cable in the ceiling they expect it to last a very long time," says Bob Kenney, vice president of enterprise product lines at ADC, and with gigabit switch ports now outshipping slower ports, customers contemplating new cabling are going to be thinking about providing for higher bandwidth in future.

Although the electronics to push more data over CopperTen cabling are not available yet, ADC believes it can sell the product to such companies. Kenney admits it's difficult to make a case for 10 gigabits to the desktop, but he does believe CopperTen could have fairly broad applications. The point is not the immediate applications, he says - "it's trying to get more than five to 10 years out of the product."

CopperTen does cost more than conventional copper cabling, Kenney admits, but he believes customers will pay a premium for something they believe will last longer. The cost of CopperTen is 30-50% higher than today's twisted-pair cabling initially, he says, and will gradually come down from there.

"It is as viable as Category 5e or Category 6 within the cabling infrastructure," agrees Stewart Munns, president of Innocan Technology Solutions Inc. in Palgrave, Ont., which represents Copper10 in Canada. Munns says copper has an advantage over fiber for future-proofing networks because of the lower cost of the electronics at either end of the cable. "As long as they continue to develop copper solutions," he says, "the economics dictate that copper's going to stick around."

Another company offering high-speed copper cabling is Richardson, Tex.-based Systimax Solutions, a unit of CommScope Inc. Systimax has some specific market segments in mind for its X10D (pronounced "extend") offering.

"Data centres are prime candidates," says Mike Barnick, Systimax's senior manager of solutions marketing. Large corporations may also have a few departments with high bandwidth needs, he says, and in certain corporate campuses, the high-speed copper may be used to aggregate 100-megabit connections to several users.

A key problem both these manufacturers had to solve was alien crosstalk - that is, crosstalk between separate cables rather than between wires within the same cable. The higher the speed of transmission, the more this becomes an issue.

Every manufacturer has taken a slightly different approach to dealing with alien crosstalk, Barnick says, but their answers are all based on the same principles. You reduce crosstalk by keeping the wires apart.

In Systimax's X10D cable, 'micro-teeth" inside the cable push the outer jacket away from the core, creating air space and increasing the distance between the cores of adjacent cables.

The cable also has an oval cross section, which prevents it being bundled together as tightly as round cable. In ADC's CopperTen, filler is wrapped around the cable core in a spiral pattern, also creating air space.

This high-speed cable is very new, but Munns says there have been a few installations of CopperTen in the U.S., and "we could see it go live within three months" in Canada. Kenney says financial institutions, universities and the health care industry are likely candidates - "people that are really maximizing their use today."

Barnick says Systimax has customers lined up for X10D, though none can be named at present.

Though the electronics are not available today to drive higher speeds through such cable, Barnick predicts the first prototype switches to support it will start appearing this fall, several months before the standard is finalized.

The cabling standard is only part of the puzzle. A task force of the IEEE 802.3 working group known as 802.3an is working on a protocol to allow 10-Gigabit Ethernet to work over Category 6 Augmented and possibly other twisted-pair cabling.

The 10GBase-T standard should be ratified late this year or early next, says Bob Grow, a principal engineer at Intel Corp. and chair of the 802.3 working group. It would allow 10-gigabit speeds over distances up to 100 meters over new cabling, and possibly over shorter distances on older cable.

In some circumstances, meanwhile, copper is already being used at bandwidths of 10 and even 30 gigabits per second over limited distances.

InfiniBand Architecture is a standard for interconnecting servers and storage at speeds of 2.5, 10 or 30 gigabits per second.

And according to Thad Omura, director of product marketing at Mellanox Technologies Inc. of Santa Clara, Calif. - a maker of InfiniBand products - more than 95% of InfiniBand traffic today travels over copper cable.

The difference is that this is not twisted pair but twin-axial cable, using at least four pairs. The standard four-pair InfiniBand cable carries 2.5 gigabits per pair for a total bandwidth of 10 gigabits, Omura says, and 12-pair cable is also available that can handle 30 gigabits.

The other difference is that the InfiniBand specifications for copper cable provide for distances of no more than 17 metres - quite enough for most data centres, but not for a lot of other applications. InfiniBand also includes specifications for fiber, Omura notes, and it is used mainly where the distance requirements exceed what copper can handle. The IEEE's 802.3ak task force has devised a standard called 10GBase-CX4, which allows 10-gigabit Ethernet to run over the same four-pair twin-axial cable used with InfiniBand.

Window of opportunity

"One of the things we frequently do in the IEEE is try not to re-invent stuff if we don't have to," Grow notes. 10GBase-CX4 is built for speed, not for distance - it is limited to 15 meters, and designed mainly for connecting equipment within a data centre.

Delivering high speeds over twisted-pair cabling is more complex than doing so over twin-axial, Grow says, which is why the 10GBase-T standard has yet to be completed. "There's a window of opportunity for a short-reach copper interface," he says.

Cisco Systems Inc. is on the verge of shipping modules to support 10GBase-CX4 connections to its equipment, and Bruce Tolley, product line manager for Cisco's transceiver module group, says there is significant customer interest. The modules will cost about a fifth of what comparable 10-gigabit fiber modules sell for, he says.

In spite of such efforts, Seneca College won't be beating down any cabling vendors' doors to get high-speed copper cabling.

Verity may see little value in fiber to the desktop, but he believes fiber has its place, and that place is in the core of the network and in the data centre, linking clusters of servers. For that kind of application, he says, fiber is better.

So in spite of fiber proponents' ongoing efforts to make the concept of fiber to the desk more attractive, and despite impressive innovations in making copper cabling support higher and higher speeds, the status quo is not changing much, for now at least.

Fiber continues to rule in the WAN and the backbone and play a role in some specialized areas, but copper will be with us for a good long time.

Fiber to the desktop remains limited to a relatively small number of users with particularly high bandwidth needs, while 100-megabit connections over twisted pair are still perfectly good enough for most users.

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