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Fiber versus copper

There is definitely still room for both, but the shrinking price gap, coupled with increasing bandwidth demands, makes fiber worth looking at in more situations than ever before.

By Grant Buckler

For Toronto Hydro Telecom Inc. there's no comparison. "One hundred per cent of our network is fiber," says Ian Miles, president of the data networking company. "We don't use any copper at all."

A subsidiary of the municipally-owned utility Toronto Hydro Corp., the company has taken advantage of the utility's rights of way to build a communications network of more than 450 kilometres of fiber linking more than 400 buildings in the city.

Its customer base consists primarily of large companies with multiple locations and lots of data to move, and of other telecommunications carriers using Toronto Hydro Telecom's network to augment their own.

"Both of those customer groups require huge amounts of bandwidth and fiber is the only medium that can support the amount of bandwidth those customers require," Miles says. Some use multiple gigabits per second of bandwidth. And since some of those customers' bandwidth requirements have been growing exponentially in the past few years, Miles also likes the fact that an all-fiber network leaves lots of headroom for future growth.

But for most organizations, the choice between optical fiber and twisted-pair copper cabling isn't so clear-cut.

Slim cost differential

A few years ago, the over-all cost of cabling with fiber was 20-25% higher than that of copper, says Roberta Fox, president and senior partner of Fox Group Consulting in Markham, Ont. Now the difference is only about 10%.

The cost differential is not in the cabling itself — that costs about the same whether you choose fiber or Category 6 twisted pair, according to Jason Grouette, national business development manager at 3M Canada Co. in London, Ont. — but in the associated electronics.

Grouette says 3M's Volition fiber cabling system makes the over-all cost of fiber competitive with Category 6. At any rate, the shrinking price gap, coupled with increasing bandwidth demands, makes fiber worth a look in more situations than ever before.

Yet copper refuses to die. Despite years of predictions that the era of fiber to the desktop was imminent, most enterprises still use fiber mainly for backbones, as well as for desktop connections to users with exceptionally high bandwidth needs, such as engineers working with computer-aided design applications.

"We haven't seen any move toward fiber to the desktop," says Neil Osipuk, directing analyst for enterprise routers and switches at Infonetics Research Inc. in San Jose, Calif., noting that those desktops that do require very high bandwidth were wired with fiber long ago.

"It really depends on how much bandwidth is going to be required by a desktop user," Miles says, but he doubts that fiber to the desktop will gain much ground in the next few years.

And copper keeps proving itself more capable than expected. Every time new, higher-speed network standards appear to be forcing a move to fiber, someone finds a way to pump more data through the old copper pipe.

Fiber was once expected to be the only choice for Gigabit Ethernet, but now Category 5e copper cable is considered adequate enough.

And there is even work under way on standards that would allow 10-Gigabit Ethernet to run — admittedly over very short distances — on copper cable.

It's still doubtful whether this will catch on, though. Grouette says fiber has been dominant in data centres for years, making a switch to copper unlikely, and the distance limitations of the copper standards will be a handicap.

Fox says there won't likely be an advantage to using copper instead of fiber in data centres unless the associated hardware is cheaper, which she says is unlikely.

Some say fiber can be made even more economically attractive by rethinking the way the network is physically laid out.

Because fiber can run for longer distances than copper, Fox suggests that networks could be laid out without the wiring closets full of additional gear that are common in copper-based networks.

Instead, fiber might run directly from the desktop back to the server or to the backbone connecting floors of a building, and the savings on intermediate gear might more than cancel out the higher cost of installing the fiber.

Fiber to the zone

Running fiber to small enclosures close to users, then covering the last short distances with copper, may be an economical alternative that minimizes the length of twisted-pair cable used, says Brad Masterson, product manager for Canada at Fluke Electronics Canada, a Mississauga, Ont.-based subsidiary of network equipment provider Fluke Corp.

"There are all kinds of ways you can put numbers together to make that look cost-effective."

Fiber to the desktop may still be rare, Grouette says, but fiber to the zone is quite popular, especially in industrial applications, which often involve interference issues as well as long cable runs with only a couple of devices at the end. "For industrial Ethernet, certainly that's the best way to do it," Grouette says.

And the increasing use of wireless networking opens up a variation on fiber to the zone — run fiber to a wireless access point that can then be used to serve a work group, so you eliminate copper altogether without actually taking fiber to every machine.

"I think there will certainly be buildings, situations where that will be the case," Osipuk says.

In the office, while fiber remains largely a technology for the backbone and for desktops with particularly high bandwidth needs, other uses are at least on the radar screens of some organizations considering their long-range plans.

And oddly enough, Grouette says, higher-performance copper cabling standards deserve some of the credit for that.

The arrival of the Category 6 twisted-pair standard, he says, "got people looking at the long term." In many cases, that leads to considering the merits of fiber.

Preparing for the future is one thing, but replacing existing cabling is another. "In today's environment, for a company to say my hardware is no good any more and to rip it all out and replace it with fiber just doesn't make good business sense," Masterson says.

So very few organizations are removing existing copper cable and replacing it with fiber. It is in new buildings, or when facili-

> **"Fiber is a very secure medium. It's very difficult, almost impossible to tap into."**
> **— Ian Miles**

ties are being refurbished for other reasons, that network managers look at fiber.

And since it is the electronics involved in fiber networking that cost more rather than the cable itself, some organizations updating their facilities or opening new offices are installing fiber even if they leave it dark initially — just as a future-proofing measure. "They've had enough foresight to pull their fiber with their Category 6," Grouette says. That way, when the fiber is needed later it's already there, avoiding the potentially costly and disruptive job of pulling new cable.

Yet while the idea of future-proofing seems wise, there are no guarantees it will always turn out well. Masterson points out that changing technology means some fiber installed several years ago isn't well suited to today's applications.

New light-source technology may not work as well with older fiber as it does with today's cable. "Just because you put fiber in doesn't mean that technology is going to be 100 per cent for the future," he warns.

Masterson says the choice between copper and fiber has to depend on several factors, including the applications being run on the network and the organization's future plans.

A key issue is how long you plan to remain in the building. A company with a short-term lease, or one whose growth is likely to call for new quarters in a couple of years, has less reason to plan for the long haul when making cabling decisions.

"If they own the building and they plan on being there for the next 20 years, then you want to put in the best technology," Masterson says. If not, then what works for the near term may be all there is any point worrying about.

To help with these decisions, Masterson suggests engaging a good consulting engineer and a reputable cabling installation firm with plenty of experience.

There are some specific situations where fiber has advantages over copper. For one, fiber is immune to electrical interference.

Totem Building Supplies Ltd. found that fluorescent lighting caused interference problems with copper cabling running across the ceilings of its stores, so the Cal-gary-based building-supplies chain switched to fiber.

The length of the cable runs was also an issue, says Mike Morel, systems administrator at Totem, and there had been problems with underground copper cabling between buildings. "It seemed like if a dark cloud even loomed overhead, it would fry the equipment," he recalls. "We switched to fiber, and we never had any problems after that."

Totem has been satisfied enough with the results it has seen from optical fiber that the company is planning to run fiber to the desktop at its Calgary head office eventually, Morel adds.

In manufacturing plants with plenty of electrical noise — not to mention long cable runs — fiber may be the best choice although Masterson notes, shielded twisted pair might solve the interference problem.

Security concerns may also lead some organizations to choose fiber. "It's a lot harder to tap fiber from a security perspective," Fox says. "The test gear to tap it is a lot more expensive than a sniffer."

"Fiber is a very secure medium," agrees Miles at Toronto Hydro Telecom, "in that it doesn't radiate any radio waves as copper can do. It's very difficult, almost impossible to tap into."

This is at least one reason why fiber is used extensively in the headquarters of such organizations as the Royal Canadian Mounted Police and Corrections Canada.

Installation and maintenance considerations were once major factors in choosing between copper and fiber.

When fiber was newer, installing it called for skills that few cabling installers had, and required expensive equipment that was not found in most cabling installers' tool kits. This has changed a good deal.

Fox says the technology for terminating optical fiber has improved since its early days, to the point where it is arguably faster to terminate fiber than to install the RJ-45 connectors used for twisted-pair cabling.

Morel at Totem Building Supplies doesn't go quite that far — he says terminating fiber still takes a little longer — "but other than that, there doesn't seem to be a whole lot of difference."

Morel does say inexperienced installers can make mistakes in pulling fiber that lead to problems later, and for that reason Totem Lumber still usually runs twisted pair alongside fiber, providing a backup. "We're just a little gun-shy," he explains.

3M claims its Volition system makes fiber as easy to install as copper. It uses plug-in connectors "very much like an RJ-45 copper jack," Grouette says, and he says termination takes about two minutes.

Whether copper or fiber is easier to install depends largely on what the installer is used to, Masterson says.

Category 6 is trickier to install than earlier twisted-pair standards, and installers who lack experience with it may find it as hard to install as fiber. Installers whose experience is mainly with copper will struggle with fiber.

When it comes to testing, Masterson says, fiber still requires some fairly sophisticated equipment — but the newer standards for copper cabling are starting to have the same issues. Testing Category 6 cabling requires multiple frequency sweeps, he says.

On the other hand, while troubleshooting a fiber installation may call for sophisticated equipment, the basic testing of fiber can be less expensive than doing all the testing required for full certification of a Category 6 installation.

Although fiber calls for more sophisticated tools, Miles says, installation, testing and support are no longer the stumbling blocks they once were.

Now that fiber has been in use for quite a long time and is widely deployed, he says, technicians experienced in dealing with it are much easier to find than in its early days.

In the end, the choice between the two media comes down to the organization's networking requirements, the needs of individual users, and budget.

"Fiber tends to cost more than copper," says Miles, "but the tradeoff is the higher bandwidth, the higher reliability and the better security." **CNS**

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