

FIBER TO THE FROZEN NORTH

Canada's SaskTel is experimenting with outside plant to find out what FTTH parts and materials work best in Saskatchewan's forbidding climate.

by Mike Nijman ■ SaskTel

To the north of Montana and North Dakota lies the Canadian province of Saskatchewan, a land of snowdrifts and windswept plains. Even in the south of the province, where most of the 1 million residents live, winter temperatures routinely plummet to 40 degrees below zero. In this forbidding climate, the incumbent telephone company, SaskTel, is conducting trials of fiber to the home – and solving problems that most other FTTH providers haven't even encountered.

SaskTel, the only telco in Canada owned by a provincial government, is committed to modernizing its plant and providing next-generation services to its customers. In the province's 10 urban centers, the company has already reduced the size of its local loops to 900 meters and installed ADSL2+. By the end of 2007, the ADSL2+ will be complemented with VDSL2 cards in the existing DSLAM shelf, using pair bonding technology to provide additional bandwidth up to 40 Mbps.

SaskTel began applying for broadcast service provider licenses back in 2000, and is now licensed to provide video in all 10 urban centers. And because we implemented a strong IP security infrastructure from the outset, we were able to negotiate content deals with most of the major content providers. Currently more than 50,000

customers are receiving SaskTel MAX-brand IPTV services with high-definition channels – one of the largest IPTV installations in North America. SaskTel also has more than 100,000 high-speed xDSL customers.

Over the next five years, we plan to extend fiber from the curb all the way to homes, in areas where this makes economic sense. Greenfield areas are fairly straightforward as far as outside-plant build. But bringing fiber to the home in areas with existing buried cable is enough of a challenge that we decided to take a slow and cautious approach with several test phases.

For our first foray into fiber, in 2005-2006, SaskTel didn't even worry about providing services. The project's only goal was to establish the best way to bring fiber up to the outside of the customer's home. This first phase of FTTH included 200 homes in brown-field areas, half with buried plant and half with aerial plant.

As we expected, the aerial plant didn't present major problems, but buried fiber in existing areas is a whole different story that few telco people are talking about. And since more than half of SaskTel's customers live in buried-plant areas where we can't install telephone poles, the story of buried fiber was one we couldn't afford to ignore.



Directional boring in a customer's front yard.



Using a hydrovac in a handhole.



A hydrovac hole for a FTTH pedestal.

PVC, the standard building material for FTTH installations, cracks in cold weather. Sasktel has had better results with high-density polyethylene and concrete.

The Right Stuff

One of the first problems we encountered was with materials used for some outside plant products – particularly PVC (polyvinyl chloride), which is widely used in parts ranging from conduit to handholes and pedestals. We tried using PVC handholes in front yards, but even though they were designed specifically for FTTH, they shattered when they were accessed in temperatures below freezing.

All the PVC pedestals we tried were also unable to withstand cold weather. Now, all of the pedestals we use are made from metal by a local manufacturer. Our smaller handholes are made from HDPE (high-density polyethylene), and the larger ones (say, 36 by 48 inches) are custom-designed polymer concrete vaults from a small manufacturer in Alden, Iowa.

In general, however, we found pedestals to be a better solution than handholes. Even though handholes are an economical and efficient way to get to

the customer, they fill up with rain and snow and then freeze solid. These freeze-thaw cycles cause even high-quality HDPE boxes to shift and deform to the extent that they fail to close properly. And trying to connect a new drop when the fiber access terminal is frozen in a block of ice is no easy task.

On the other hand, the above-grade pedestals that we used in backyards successfully keep all the conduit and access terminals dry. With hardened fiber connectors in the pedestals, we feel confident that the solution we've found won't have to be replaced during the life of the fiber.

And as for using PVC conduit in the winter – it is not advisable! Instead of using PVC, SaskTel decided to place all service drops in 1-inch internal diameter HDPE conduit. This proved to be a workable solution, since the HDPE is cold resistant, easy to work with and,

Cross-connect cabinets posed innumerable problems in a winter climate. Sasktel may decide to use dedicated connections instead.

at about \$15 (Canadian) per home, relatively inexpensive. It also provides a simple way to repair cut drops – all you have to do is remove the damaged drop, replace the damaged section of pipe, attach with two couplers and pull in a new drop. Two-inch HDPE is also placed between each pair of service pedestals for future fiber or repairs.

A Farewell to Cross Connect

Fiber cross-connect cabinets in the field posed yet another problem. First, SaskTel had a limited choice of patch cords

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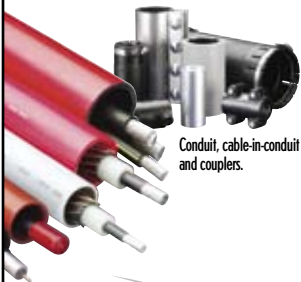
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that met military-type specifications of -50 degrees Centigrade, since no major vendors produce such cords. Most patch cords get so stiff below freezing temperatures that they are impossible to route or reroute through the cable management system in the cross-connect pedestals.

Even when we located appropriate patch cords, we found that cleaning the connectors on snowy or windy days proved nearly impossible without getting the cabinet and connectors full of snow. For proper running and cleaning of the jumpers and connectors, field personnel would still have to set up a

tent every time they ran a jumper cable in order to keep the weather out of the cabinet – a procedure that is very inefficient to perform for every jumper.

We also found that many cross-connect cabinets available on the market are too small to be practical in winter environments. They quickly get buried in snow and can be easily damaged by snow removal equipment.

In the end, SaskTel may decide to forgo cross-connect cabinets and use dedicated connections, with splitters placed inside fiber optic splice closures. Without cross connects, which enable more efficient use of OLT equipment (optical line terminals, or central-office electronics), we know we will need to buy extra OLTs. But as an incumbent phone company, SaskTel is likely to get a high enough take rate for its FTTH services that OLT efficiency becomes a minor issue. (Vendors usually advise that, with take rates higher than 50 percent, cross connects are not worth the effort.)

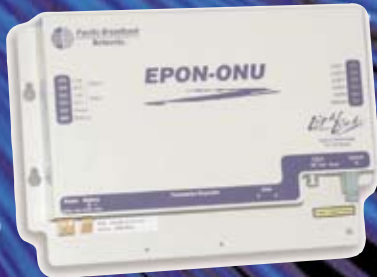
More Lessons Learned

The construction for our first FTTH test lasted through an entire winter. SaskTel doesn't normally build in wintertime, and we are unlikely to do so again. While winter digging avoided damage to gardens and flower beds (and provided information about how well some equipment would work during the winter), it also increased costs enormously.

Because about 90 percent of the digging is directional boring, contractors demand a premium in the winter, pushing rates up by 50 percent. At the same time, productivity is lower because of the frozen ground. The next phase of FTTH will avoid this "double whammy" with an April-through-November digging schedule.

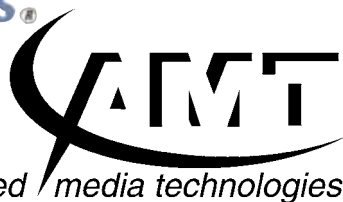
SaskTel also encountered a few problems that were unrelated to Saskatchewan's severe winters. For example, the easements in customers' yards are often narrow and already fully occupied by copper telephone wire, electric wire and television cable. We are forced to go to the time and expense of either widen-

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Will vendors decide to mass-produce cold-weather gear for FTTH? SaskTel's deployment decisions will depend on how many parts have to be custom-made.

ing the easement or of digging numerous daylight holes to avoid damaging existing plant. Having all this plant in small yards with pools, patios, decks and other obstacles has also made it difficult to bring in construction equipment and to find appropriate locations for customer premises equipment.

The Next Phase

While SaskTel never found any problems we couldn't solve, we did find that some of our solutions increased our costs. Using nonstandard materials and customized cabinets is bound to raise prices beyond what most other FTTH providers are experiencing. Ultimately, SaskTel's costs – and therefore the extent to which we decide to install FTTH – will depend on vendors' decisions about mass-producing cold-resistant equipment.

It isn't unlikely that vendors will enter this market. In the past, many vendors have proven, tested and developed products based on SaskTel's experimentation. But before we begin deploying

FTTH on a large scale, additional testing remains to be done. First, we will be subjecting vendors' ONTs (optical network terminals, or customer premises equipment) to the deep freeze in our lab to find out which of them can best withstand Saskatchewan winters.

A recent Request for Information for GPON equipment yielded about a dozen different ONTs for testing.

Second, a small number of the customers who now have FTTH pedestals in their yards will be hooked up to an Alcatel-Lucent GPON network and

will begin receiving services on an experimental basis.

Finally, we will be conducting a larger trial of outside plant, passing another 5,000 homes with fiber this year. Service delivery for these homes will not be started this year; the purpose of the trial is to familiarize a larger group of in-house personnel and contractors with the FTTH construction process – everything from warehousing to standards – in preparation for the largest capital infrastructure project we may ever undertake. **BBP**

About the Author

Mike Nijman is a network planner in SaskTel's Technology Development and Engineering division.

Vendor Spotlight:

The equipment that succeeded in SaskTel's trials included:

Corning Cable Systems: (www.corningcablesystems.com)

- Optifit Advantage Drop Assembly, connectorized at one end
- Multi-port Access Terminals with stub
- Aerial OptiSheath fiber terminal

Saskatoon Machine Works: (306-934-4441)

- Steel pedestals

Tunnel Mill Polymer: (www.tunnelmill.com)

- Cable vaults (polymer concrete, bottomless)



Preparing to pull conduit through a bore hole.



Steel pedestal placed with conduits.



A polymer concrete cable vault.