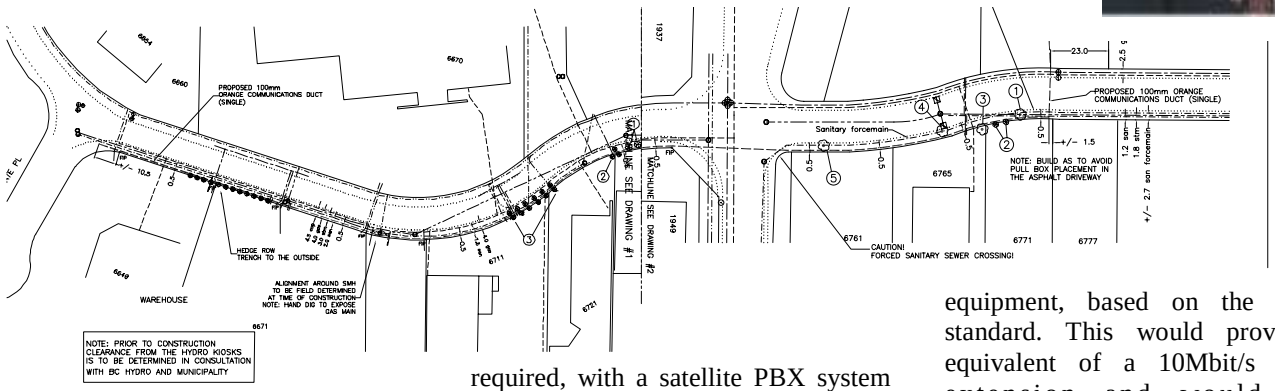
TMC'S ADVISOR

Practical Advice on Data/Voice/Video from Telecommunications Management Consultants Inc.

Consultant Casebook—Inter Site Fibre

By Peter Aggus

In late 2001, TMC was approached by a client near Victoria to review some options for linking two of its buildings. The distance involved was around 500m and the recommended approach had been to use a short-haul 802.11b radio link to extend the LAN to the new building. TMC looked at some of the wider issues and explored the possibility of using a more secure fibre link rather than radio. This casebook tells the story of what developed.



Background

The client has a head office building containing their main PBX and IT systems. This building also serves as their distribution warehouse. In late 2001, they were planning to extend their administrative offices into a new building some 500m away. This administration outpost required access to the head office telephone system and also to the LAN.

Telco leased line services were investigated, but the cost projections were very high – particularly for such a short distance. The basic problem is that Telco services are routed via the local Central Office. Whilst it may seem to be only 500m, the route distance is more like 10 times that. Either a digital T1 link would be required, with a satellite PBX system at the new location, or individual analog lines could link the phones as OPX (Off-Premise eXtension) locals. The LAN link would require either a narrow-band data link, needing servers at the new site, or an expensive wideband link in order to use the facilities already in use at the head office. The ongoing cost for this level of communications would be several thousand dollars per month.

It would be easy to make do with basic phone services and avoid the cost of voice links between the sites – at least to start with. However, data connectivity was unavoidable.

Radio Links

An attractive method was to use relatively inexpensive radio equipment, based on the 802.11b standard. This would provide the equivalent of a 10Mbit/s ethernet extension and would allow workstations at the new site to use existing servers and gateways at the head office.

The cost is low – around $15,000 for a good quality system designed for this purpose. The payback over a leased line option was less than a year.

However, information security over 802.11b radio links leaves a lot to be desired. There was also a tree canopy interfering with the roof-level direct line-of-sight, so significant antenna structures were going to be required.

Alternatives

The first option considered was to use a free-field laser system. The cost turned out to be very high because of the relatively short distance. The

equipment is better suited to links around 4 times the distance on this project.

One interesting side-effect of telecommunications deregulation has been that the provision of services over public land is now an option not exclusively reserved for the monopoly

telephone companies.

TMC suggested that the client should consider providing their own underground duct bridging the 500m between the buildings. This duct could carry fibre and telephone cables.

A contract was eventually given to an excavating contractor who already had a lot of local experience installing gas piping. The cost, including the cables, worked out less than three times the cost of radio and less than twice the cost of the free-field laser option. By installing a phone cable as well as a fibre cable, the payback period of the project became between 2 and 3 year when compared to telco circuit rentals.

The preferred option would have been to lease fibre from the local cable or phone company. Both Telus and Shaw / Group Telecom have fibre in the area – however neither will yet consider "dark fibre" services. Only managed bandwidth is available from any of the telcos.

Planning the Route

Any service installation on public property requires planning consent from the local municipality, as well as conformance with many local, provincial and federal codes. ***TMC*** oversaw the preparation of draft drawings and then amended the proposal to meet the requirements laid down by the municipality.

The project moved into fields more often associated with long-haul utility installation – road crossings, trench backfill, asphalt, careful excavation around sewers and water mains.

The Excavation

The contractor was able to use a mini-excavator for most of the route, along the boulevard border of the road. Unfortunately, most of the route was too close to other services to permit much use of faster drilling techniques. A vibrating drill was used twice to get under tree roots over a short distance in order to avoid excavation damage. At one stage, the drill became completely entangled in a root base much larger than the consulting arborist had expected. It turned out that the tree was actually growing out of the base of a much deeper old tree – which we were unknowingly trying to thrust-bore through. A rotary cutting drill had to be used for that short section. At least the contractor was pleased that no unexpected rock had been encountered.

One main road crossing was required, along with a minor road crossing. These proved to be the most complex part of the route because the new duct had to be "threaded" through a maze of water, sewer, electrical, phone and drainage pipes – all with minimal disruption to road traffic. The municipality also added a requirement for the trench to be backfilled with a non-compressible aggregate – almost like dry concrete. This local policy reduces road settlement and improves the structural strength of the trench-damaged roadbed. Also the asphalt road surface had to be repaved twice – once with cold-rolled material by the excavation contractor, then a second time by a repaving contractor who was required to mill off half the thickness of the asphalt with a clean cut wider than the trench. The cut was bedded with fibre matting and over paved with hot asphalt to produce a new surface that bonded with the trench and the old road on both sides. Had it not been for the large number of services to be crossed, the preferred road crossing would have used a four-inch pneumatic drill – much faster and cheaper.

Pull boxes were provided either side of the road crossings and at 100m intervals on the long runs. This reduced the strain pulling in the fibre cable and also allowed for possible future repair by splicing in 100m of

replacement cable.

From the last pull box at each end of the run, the duct route turned 90º to run from the boulevard to the building wall, at which point a long 90º bend at the new building end took the route up the wall to a last pull-box mounted just above ground level. From there, two smaller pipes ran up into the roof space, painted to look like rainfall pipes. At the old head office, the duct was laid under the wall, sharing a trench with a new electrical inlet duct installed at the same time. The external duct was terminated in an internal wall-mounted pull box.

Route Registering

In the Province of BC, as with many other jurisdictions, there is an organisation dedicated to sharing knowledge of underground plant for the benefit of future excavation planning.

The contractor had to check with BC One Call what utilities were known to be in the area of the planned excavation. He then went to the municipality (who know the locations of all the water, sewer and drainage pipes); and to BC Hydro, Telus and Centra Gas (the only other utility owners in the area). They were each able to indicate where our planned duct route would cross or come close to their pipes. Part of this service included each utility coming out and using route tracing tools to paint mark

the exact location of their conflicting services.

Once the project was completed, we supplied details of the route to BC One Call and became probably the first private "utility" to so register. This, combined with a tracer wire installed in the duct and made available at each pull box, gives the client the confidence that the exact route of his new service will be made known to anyone digging in the area. The tracer wires enable accurate duct location with a special detector.

Internal Cabling

There is always a dilemma when routing underground cable into a building. The heavy exterior grade cable is gel-filled and sheathed in polyethylene to make it waterproof. This cable is not fire-rated for internal exposed cable runs.

Running bulky pipe work to contain exterior-grade cabling was not an option in the old head office building, so a fibre patch point was installed just next to the interior duct termination. From that point, internal-grade fibre was installed to the IT room, along existing raceways, and also to the PBX room a short distance away. The telephone cable, however, was continued in its external form right into the PBX room because the distance was short enough. In the new building, two-inch pipes were run across the roof space to carry exterior-grade cable right into the equipment room.

Termination

The fibre cables presented the least difficulty. The copper telephone cables, however, represent an electrical hazard if not terminated correctly because they can potentially form a ground-loop with the electrical system and could allow dangerous fault currents to pass from one building to the other via the phone systems. Correct procedures exist to handle this termination, indeed telcos face the problem all the time. What was unusual about this installation was the length of the run and the fact that the buildings were fed from independent electrical supplies – unlike a campus system.

The PBX contractor was made aware of the situation and advised that the correct interface would need to be used when the cables were terminated.

Conclusion

This project has broken new ground in many ways, not just literally. It has shown that dark-fibre links CAN be provided economically between buildings. It has confirmed that commercial organisations CAN indeed get planning consent to route their own inter-building services. It has presented the client with a project payback period under 3 years, which is excellent for this type of installation.

For the future, ***TMC*** is looking into other projects involving running private cabling along utility pole routes or possibly leasing duct space from other utilities or municipalities. It is our aim to serve our clients by the most economical services possible to meet their identified needs. ***TMC*** always holds out hope that the demand for short-haul dark fibre will be recognized by telcos and cable TV companies. We look forward to a future service where such capacity can be leased at realistic rates.

The client was pleased that ***TMC*** was able to introduce them to an innovative solution that local suppliers had not considered. The opportunity is now there to use the newfound capacity to provide CCTV security systems etc without extra charge for networking.

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