Table of Contents

Table of Tables

Table of Figures

1. Applications

Although the focus of the strategy document is clearly the infrastructure needed within the City of Ottawa to provide broadband telecom services to all Ottawa residents, this infrastructure, once deployed, will be of very little value without residents and businesses in Ottawa making use of its capabilities. The following information is a brief summary of some of the "applications" available today and those planned by various sectors in the City.

Broadband networks have not achieved the usage levels envisioned when telecom industry analysts were predicting the broadband service required. This, of course, has had several repercussions in the overall telecom business sector with the most visible of those being the decline of some of the new firms established to meet that forecast need and the decline of some of the more established firms because of the lack of anticipated need for equipment to drive all of this new telecom traffic. The customers who choose to use today's generally available broadband services (when those services are available for them) ranges between 10% and 18%.

The dilemma for broadband service providers with this relatively low customer "take rate" for the service offered is that it currently takes many potential customers to have a reasonable business case. This means that providing services to small communities may not be justified on a straight business case basis. Capital costs for service implementation can be significant and for a small community may not be justified. This situation changes by:

1. Getting a consolidation of customers together in rural communities to justify the business (as has happened in several communities already with the first being North Gower)
2. Reducing the capital cost for the provision of services or
3. Having a higher percentage of customers want the service.

The third option is what applications are all about. Many people talk about the "killer app" that will make all of us want to have high-speed service so we can get access to this "killer app". One application is unlikely to do this since we all have individual interests and needs for information and/or services. In the following information we present the applications available today and planned by various sectors in Ottawa; education, health care, government and business. These applications or new ones under development will be the real drivers that make high-speed telecom services for all of us indispensable.

1.1. EDUCATION

1) e-pals is a public school application where students have an on line chat facility with their peers.

   a) It encourages younger students to become familiar with the technology so they will become future users of services and the capabilities of telecom applications.
   b) Homework applications by email are already in place in Ottawa where homework is assigned and completed on line.
   c) For socially disadvantaged students, this work can be done at Sm@rtCapital centres at the workstations provided. In that way, these children have access and become comfortable with the skills and applications of today's technology.

2) Many of the applications that make high speed connections important for homes are available today within the Ottawa Carlton District School Board

   a) Services for students in health care facilities to maintain their school work
   b) Home schooling
   c) Library type services
   d) E-learning and upgrade training for teachers can be more effectively accomplished with home users.
   e) There are some hardware issues with some applications such as video streaming to the schools. As time goes along these issues are being resolved.
   f) Applications and administrative data networking could be on-line
      i) Having this capability could change the way the OCDSB does business.
   g) Adult learning and the resulting revenue opportunities could be enhanced through high-speed services to the home.

3) The University of Ottawa has a desire to provide a "hybrid" teaching method with some classroom teaching and some home based learning. In order to effectively do this they need broadband services to the home available for all of their students.

   a) Applications for this technology:
      i) The two main needs for broadband home services are for library services and interactive instruction.

         (a) Library Services
         A significant amount of the library resource material is available in digital format. Particularly periodicals and publications. These are relatively large files and are not conducive to dial up speeds. Libraries available through this service include many of the Canadian Universities.
         (b) Interactive Instruction:

The University of Ottawa has tried two way video conferencing with home based students. Lack of synchronous service is a problem.

(i) Hasn't worked well because of the limited upload speeds available (average of 74 Kb). Download has been okay. Interactive sessions were not possible in most instances because of the upload limitations.

(ii) Multicasting equipment on the service provider's network is not available. Without the capability to multicast, bandwidth usage and cost is too high to make this service viable.

(iii) Local caching is needed to provide this service in a cost effective manner

ii) The University has done some videoconferencing (mainly with other schools) with 40% being done over Internet Protocol. This has generally been done over CANNET 3 or 4. Videoconferencing needs approx 386 Kb synchronous service. This application has not worked on Rogers or Videotron networks.

1.2. HEALTH CARE

1) Community Care Access Centres (CCAC).

Currently spend 42% of budget for administrative functions and 58% on health care. Much of the admin cost could be reduced and health care increased with tele-health applications.

2) Many applications are already in place for broadband to be required in the home and small offices (for neighbourhood health care facilities and offices):

a) Monitoring of equipment
b) Follow-up treatment including video facilities
c) Exercise regimens including video
d) Education programs
e) Medical imaging and file transfers

3) New coming applications:

a) Remote configuration of health devices
b) White boarding of training and information
c) Education for health care professionals
d) Virtual Private Network services for staff to access and work online with the health care facility information and servers.
e) Peer to peer apps are growing substantially with multi party video conferencing.

4) In the health care field all of these applications must be both reliable and secure.

5) Cost issues are significant for some of the community facilities in the field, particularly nursing homes and CCACs.

6) Many of the smaller community hospitals are already getting connected through the Smart Systems for Health initiative.

   a) This initiative also applies to health care professionals.
   b) Education in health care may be the main driver of broadband to the home and small offices.

7) Technical issues regarding health care applications:

   a) Quality of service is not acceptable today. Reliability of connections and bandwidth required is not consistent from the service providers.
   b) A minimum of 200Kbps is required for most applications in use today. Future requirements may be higher.
   c) In small communities, the comment was made that possibly the City should become the ISP if private firms will not provide that service.
   d) There is an advantage in being able to provide services to the Ottawa area without using the telecom network outside of the City. IP connectivity when going through a NAP (like Chicago) can become an issue with latency, reduced bandwidth capability and costs.

8) Some of the Provincial special care facilities are competitive with other parts of the Province. High speed connectivity is critical to be able to provide this special care beyond Ottawa. The Hospital network currently has 50Mbps of connectivity to HealthNet.

   a) This network is managed to provide prioritization for video services.

9) March Networks has a product available today in the video health field that deals with blood pressure, oxygen monitoring etc using high-speed network capability. http://www.marchnetworks.com/solutions/hometelehealth.asp

1.3. GOVERNMENT

1) Smart Facilities such as having City Hall enabled in all (most) meeting rooms for video and/or webcasting capabilities

   Having Smart meetings where the meeting at City Hall or a remote site could be video conferenced with other locations avoiding travel issues and getting the democratic process out to the residents of Ottawa.

2) The Vision of the city staff person working on applications and of Sm@rtCapital is to have a toolbox of offerings available. Services such as:

   a) Video conferencing
   b) Video on demand
   c) Caching of information so residents can access it at their leisure
   d) These services would be available for both internal staff use and for applications that meet a public need.

3) E-services

   a) Future e-services will be available through the City with 60% of the e-service efforts targeted at external users.
   b) E-democracy initiatives:
      i) Support official plan
      ii) Webcasts from the City and video conferencing to community facilities is planned for the future.
      iii) The goal is to have community video facilities and applications available for community members.

1.4. BUSINESS

There are many applications that drive the needs for bandwidth for business users today:

   a) Data backup services
   b) Video conferencing
   c) Emergency business backup services
   d) Supplier/customer training and technical support
   e) Network computing
   f) And many others.

2) Likely drivers of the need for bandwidth to the home are mainly file transfer applications[1].

   One typical application that is coming is DVD quality video files. A full (multi Gb file) is downloaded to local servers on the network and then when you wish to watch it, it just comes from those local servers.

[1] This opinion is of Bill St.Arnaud, of Canarie.

2. Technology

2.1. WHAT IS BROADBAND?

The Report of the National Broadband Task Force-"Networking the Nation for Broadband Access" defines Broadband, as "a minimum two-way or symmetrical, transmission speed is 1.5 Mbps per individual user". Several of the high-speed services available within the City today probably don't meet these criteria. Each of the access technologies will be examined and will be compared to this definition, both from capability and what is actually being delivered.

There are several key access technologies in use today to bring broadband service to business and residential users within the City of Ottawa. These are:

1. Direct fibre optic cable to a building or business.
2. T1 bearer services over copper to a building or business.
3. xDSL service over copper.
4. Cable Modem over CATV coax.
5. Wireless service to the business or home.
6. Satellite service to the business or home.

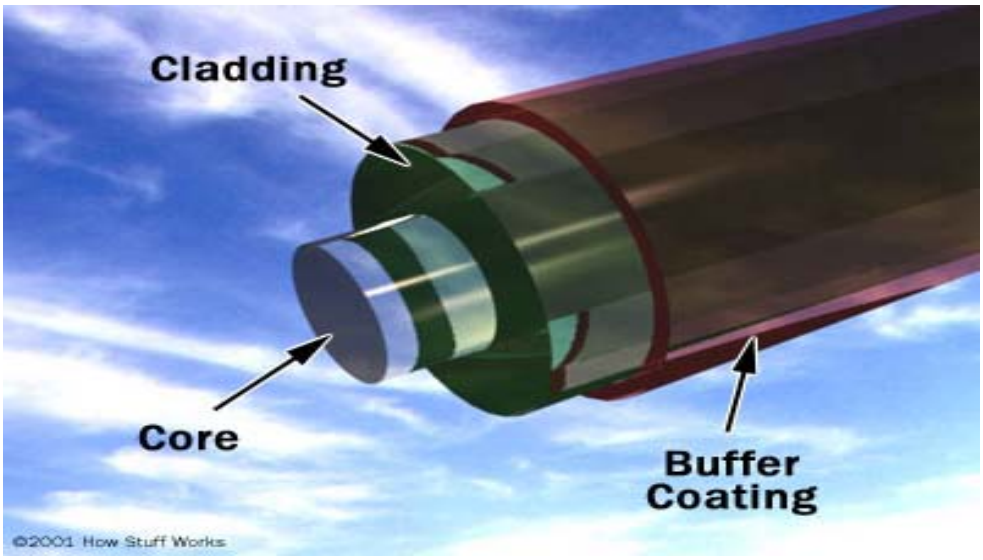
In addition, another technology called "Powerline Telecommunications" (PLT or PLC, Power Line Communications) is just emerging that will use the existing electrical distribution lines to deliver high-speed access.

Each of these will be described in the following sections.

2.2. FIBRE OPTIC CABLE

Fiber optics (optical fibers) are long, thin strands of very pure glass about the diameter of a human hair. They are arranged in bundles called optical cables and used to transmit light signals over long distances.

Figure 1: Fibre Cable Graphic



Parts of a single optical fiber

If you look closely at a single optical fiber, you will see that it has the following parts:

1. **Core** - Thin glass center of the fiber where the light travels
2. **Cladding** - Outer optical material surrounding the core that reflects the light back into the core
3. **Buffer coating** - Plastic coating that protects the fiber from damage and moisture

Hundreds or thousands of these optical fibers are arranged in bundles in optical cables. The cable's outer covering, called a jacket, protects the bundles.

Let's look at how an optical fiber works. Suppose you want to shine a flashlight beam down a long, straight hallway. Just point the beam straight down the hallway -- light travels in straight lines, so it is no problem. What if the hallway has a bend in it? You could place a mirror at the bend to reflect the light beam around the corner. What if the hallway is very winding with multiple bends? You might line the walls with mirrors and angle the beam so that it bounces from side-to-side all along the hallway. This is exactly what happens in an optical fiber.

Figure 2: Light Inside a Fibre

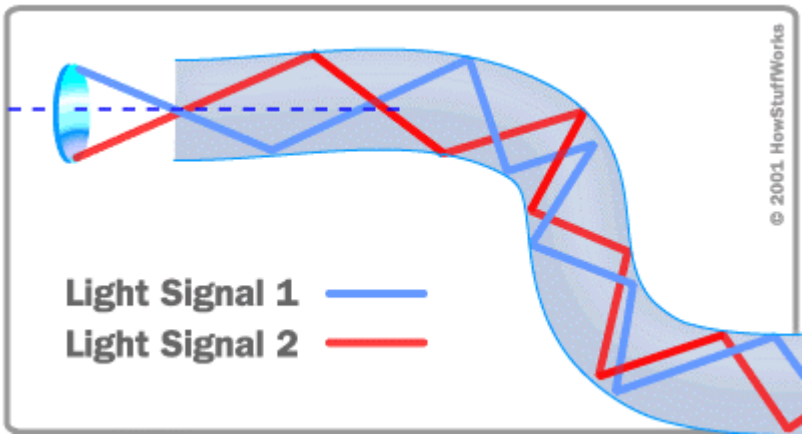


Diagram of total internal reflection in an optical fiber

The light in a fiber-optic cable travels through the core (hallway) by constantly bouncing from the cladding (mirror-lined walls), a principle called total internal reflection. Because the cladding does not absorb any light from the core, the light wave can travel great distances. However, some of the light signal degrades within the fiber, mostly due to impurities in the glass. The extent that the signal degrades depends on the purity of the glass and the wavelength of the transmitted light.

Fiber-optic systems are revolutionizing telecommunications. Compared to conventional telephone wire (copper wire), optical fibers are:

- **Less expensive** - Several miles of optical cable can be made cheaper than equivalent lengths of copper wire. This saves your provider (cable TV, Internet) and you money.
- **Thinner** - Optical fibers can be drawn to smaller diameters than copper wire.
- **Higher carrying capacity** - Because optical fibers are thinner than copper wires, more fibers can be bundled into a given-diameter cable than copper wires. This allows more phone lines to go over the same cable or more channels to come through the cable into your cable TV box**.**
- **Less signal degradation** - The loss of signal in optical fiber is less than in copper wire. Light signals - Unlike electrical signals in copper wires, light signals from one fiber do not interfere with those of other fibers in the same cable. This means clearer phone conversations or TV reception.
- **Low power** - Because signals in optical fibers degrade less, lower-power transmitters can be used instead of the high-voltage electrical transmitters needed for copper wires. Again, this saves your provider and you money.

- **Digital signals** - Optical fibers are ideally suited for carrying digital information, which is especially useful in computer networks.
- **Non-flammable** - Because no electricity is passed through optical fibers, there is no fire hazard.
- **Lightweight** - An optical cable weighs less than a comparable copper wire cable. Fiber-optic cables take up less space in the ground.

Because of these advantages, fiber optic cables are widely used in telecommunications and computer networks.

All fibre optic systems consist of light sources, cables, and light detectors. Repeaters are required for complex systems that span great distances, since attenuation of the signal decreases the probability of successful transmission. Repeaters regenerate the signal, so that signals can be transmitted over great distances.

Fibre Optic transmission offers the greatest bandwidth of any transmission system, often in excess of 2 Gbps in long-haul carrier networks. 10 and 20 Gbps have been deployed, and 100 Gbps has been laboratory tested. The theoretical capacity of fibre is in the Terabit (Tbps) range, with current single-mode fibre capacity being expandable to that level with subsequent generations of electronics.

Fibre is the most successful transmission medium in terms of error performance. Fibre is not susceptible to electromagnetic interference (EMI) or to radio frequency interference (RFI), nor does it emit EMI or RFI. Attenuation of a fibre optic signal is possible, due to scattering of the signal, bending in the fibre cable, translation of the light energy to heat, or splices in the cable system. Depending on the compression scheme utilized, error performance ranges between 10-9 and 10-14 – one errored bit in every 100 trillion.

It is difficult to place a physical tap on a fibre optic line without detection, and physical taps are the only means of signal interception. This physical security makes fibre optics highly secure.

Fibre Optic technology is the best transmission system available today, in terms of security and bandwidth requirements, and seems to be the best option for the future.

2.3. T1 BEARER SERVICES

Telephone companies move nearly all voice traffic as digital rather than analog signals. Your analog local line gets converted to a digital signal by sampling it 8,000 times per second at 8-bit resolution (64,000 bits per second). Nearly all digital data now flows over fiber optic lines, and the phone company uses different designations to talk about the capacity of a fiber optic line.

If your office has a T1 line, it means that the phone company has groomed 2 pairs of copper lines into your office. T1 line might also come in on fibre optic cable, if your building was so equipped. A T1 line carries 24 digitized voice channels, or it can carry data at a rate of 1.544 megabits per second. If the T1 line is being used for telephone conversations, it plugs into the office's phone system. If it is carrying data it plugs into the network's router.

A T1 line might cost between $1,000 and $2,200 per month depending on who provides it and where it goes. The other end of the T1 line needs to be connected to an ISP and the total cost is a combination of the fee the phone company charges and the fee the ISP charges.

A large company may need more than a T1 line. The following table shows some of the common line designations for T1 based services:

- DS0 - 64 kilobits per second-1 channel of a T1 line
- ISDN - Two DS0 lines plus signaling (16 kilobits per second), or 128 kilobits per second
- T1 - 1.544 megabits per second (24 DS0 lines)
- T3 - 43.232 megabits per second (28 T1s)
- OC3 - 155 megabits per second (100 T1s)
- OC12 - 622 megabits per second (4 OC3s)
- OC48 - 2.5 gigabits per seconds (4 OC12s)
- OC192 - 9.6 gigabits per second (4 OC48s)

While a T1 may be carried by copper wires, all other service types from a T3 up require fibre optic cable.

2.4. ADSL SERVICES

Bell Canada, DSL resellers and some ISP's provide DSL service. All use Bell Canada copper wire runs to the business or residential customer.

The copper wires that are used have more than is required for a phone conversation -- they are capable of handling a much greater **bandwidth**, or range of frequencies, than that required for voice. DSL exploits this "extra capacity" to carry information on the wires without disturbing the line's ability to carry voice conversations. The entire technology matches particular frequencies to specific tasks.

Plain Old Telephone Service (voice) can be carried in a frequency range of 0 to 3,400 Hertz. This range of frequencies is small compared to the wires potential to handle frequencies up to several million Hertz. The use of such a small portion of the wire's total bandwidth is historical as the telephone system has been in place, using a pair of copper wires to each home, for about a century. Modern equipment that uses digital encoding rather than analog can use much more of the telephone line's capacity. DSL does just that.

Most DSL services provided today are **Asymmetric DSL** (ADSL). ADSL divides up the available frequencies in a line on the assumption that most Internet users look at, or download, much more information than they send, or upload. Under this assumption, if the connection speed from the Internet to the user is three to four times faster than the connection from the user back to the Internet, then the user will see the most benefit (most of the time).

Precisely how much benefit the user will see greatly depends on how far the user is from the central office of the company providing the ADSL service. ADSL is a **distance-sensitive technology**: As the connection's length increases, the signal quality decreases and the connection speed goes down. The limit for ADSL service is 5,460 meters, though for speed and quality of service reasons Bell Canada places a limit of approximately 3700 meters for the service. At the extremes of the distance limits, ADSL customers may see speeds far below the promised maximums, while customers nearer the central office have faster connections and may see extremely high speeds in the future. ADSL technology can provide maximum downstream (Internet to customer) speeds of up to 8 megabits per second (Mbps) at a distance of about 1,820 meters, and upstream speeds of up to 640 kilobits per second (Kbps). In practice, the best speeds widely offered today are 1.5 Mbps downstream, with upstream speeds varying between 64 and 640 Kbps.

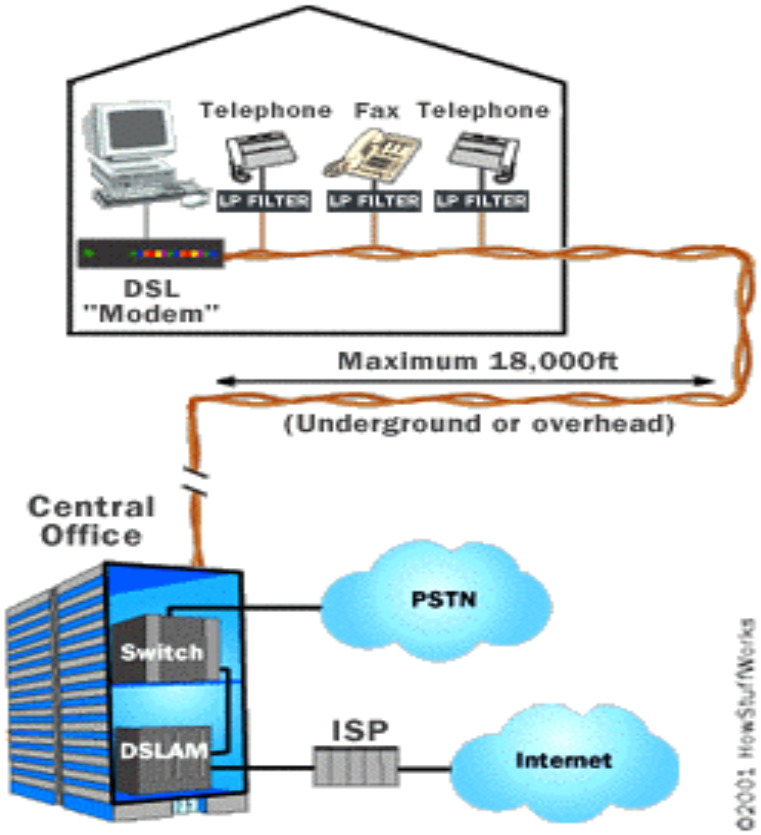
www.dslreports.com reports on the average speed of various high-speed providers from various countries. **Bell Canada "Sympatico" DSL service was quoted to have a performance of 999 Mbps download and 274 Mbps upload on Sept. 18, 2002.**

Factors that might disqualify a user from receiving ADSL include:

- **Loading coils** – These are inductors that the telephone puts in the copper line to the user that optimizes the line for voice and won't pass high-speed data.
- **Bridge taps** - These are extensions, between the premise and the central office, that extend service to other customers. While the user wouldn't notice these bridge taps in normal phone service, they may take the total length of the circuit beyond the distance limits of the service provider.
- **Fibre Optic cables** - ADSL signals can't pass through the conversion from analog to digital and back to analog that occurs if a portion of the telephone circuit comes through fiber-optic cables.
- **Distance** – The distance from the user premise exceeds the wire distance specified by the telephone carrier. The more distant the central office the lower the speed of the service.

ADSL uses two pieces of equipment, one on the customer end and one at the Internet service provider, Telephone Company or other provider of DSL services. At the customer's location there is a DSL **transceiver**, which may also provide other services. The DSL service provider has a **DSL Access Multiplexer** (DSLAM) to receive customer connections.

Figure 3: Digital Subscriber Line



ADSL is competing with technologies such as cable-modem and wireless access for high-speed connections from consumers to the Internet.

According to kinetic Strategies, a market-analysis firm based in Phoenix, AZ approximately 1,412,628 households in Canada were connected to the Internet via DSL in 2001, compared to 1,780,900 households with cable modems.

Bell Canada has had a new version of DSL called VDSL in trial in the Toronto area in high rise residential buildings.

The chart below provides a comparison of the two Bell Canada DSL technologies:

Table 1: Digital Subscriber Line Nominal Statistics

DSL Type	Max. Send Speed	Max. Receive Speed	Max. Distance	Lines Required	Phone Support
ADSL	800 Kbps	8 Mbps	5,500 m	1	Yes
VDSL	16 Mbps	52 Mbps	1,200 m	1	Yes

As the table shows, VDSL provides a significant performance boost over ADSL. The problem with VDSL is the distance of service availability drops significantly from ADSL.

A VDSL rollout requires that the telephone company replace its main feeds with fiber-optic cable. In fact, some phone companies are planning **Fiber to the Curb** (FTTC), which means that they will replace all existing copper lines right up to the point where your phone line branches off at your house. At the least, most companies expect to implement **Fiber to the Neighborhood** (FTTN). Instead of installing fiber-optic cable along each street, FTTN has fiber going to the main junction box that serves a neighborhood.
A **VDSL gateway** is located in the junction box and the distance limitation is overcome.

2.5. CABLE MODEM OVER CATV CABLE

Cable TV subscribers can get a high-speed connection to the Internet from their cable provider. Cable modems compete with technologies like ADSL.

Each television channel is carried in a 6-megahertz (MHz, millions of cycles per second) slot on the coaxial cable. The coax used to carry cable television can carry hundreds of megahertz of signals and channels.

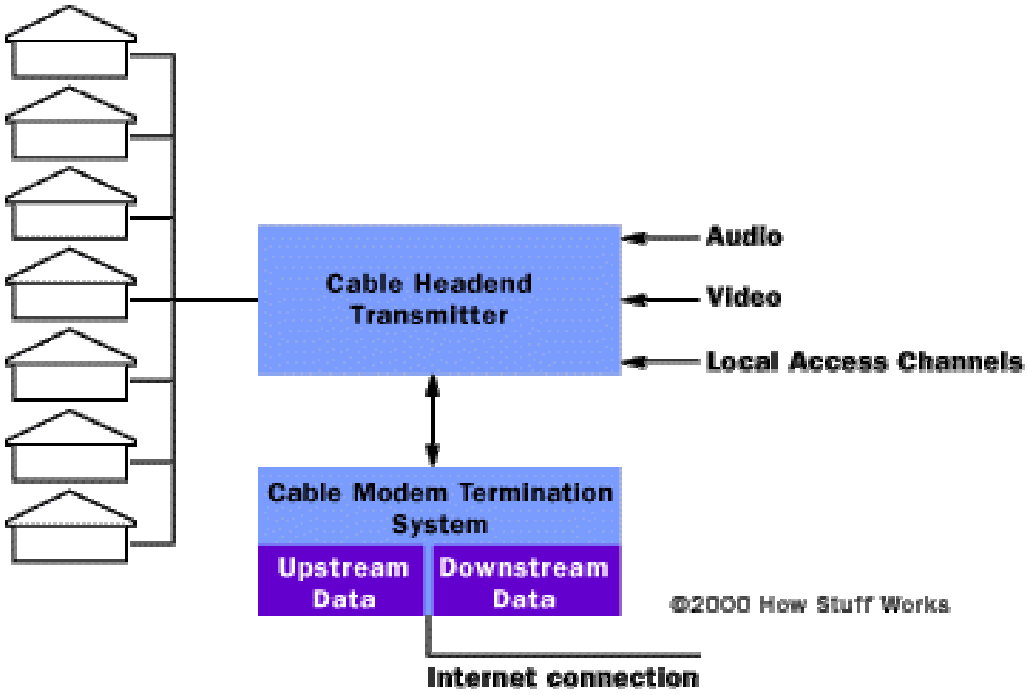
In some systems, **coaxial cable** is the only medium used for distributing signals. In other systems, fibre optic cable goes from the cable company head end to different neighborhoods or areas. Then the fiber is terminated and the signals move onto coaxial cable for distribution to individual houses.

When a cable company offers Internet access over the cable, Internet information can use the same cables because the cable modem system puts **downstream** data -- data sent from the Internet to an individual computer -- into a 6-MHz channel. On the cable, the data looks just like a TV channel. So Internet downstream data takes up the same amount of cable space as any single channel of programming. **Upstream** data -- information sent from an individual back to the Internet -- requires even less of the cable's bandwidth, just 2 MHz, since the assumption is that most people download far more information than they upload.

The quality of a cable broadband service can generally be influenced by the amount of subscribers, which are allocated to each 6-MHz channel.

Putting both upstream and downstream data on the cable television system requires two types of equipment: a cable modem on the customer end and a Cable-Modem Termination System (CMTS) at the cable provider's end. Between these two types of equipment, all the computer networking, security and management of Internet access over cable television is put into place.

Figure 4: Cable TV Service Schematic



A CMTS will enable as many as 1,000 users to connect to the Internet through a single 6-MHz channel. The single channel aspect leads to one of the issues some users experience with cable modems.

If you are one of the first users to connect to the Internet through a particular cable channel, then you may have nearly the entire bandwidth of the channel available for your use. As new users, especially heavy-access users, are connected to the channel, you will have to share that bandwidth, and may see your performance degrade as a result. It is possible that, in times of heavy usage with many connected users, performance will be far below the theoretical

maximums. The good news is that this particular performance issue can be resolved by the cable company adding a new channel and splitting the base of users.

Another benefit of the cable modem for Internet access is that, unlike ADSL, the performance doesn't depend on distance from the central office. A digital CATV system is designed to provide digital signals at a particular quality to customer households.

Rogers Cable is the primary cable TV provider in the City. www.dslreports.com reports on the average speed of various high-speed providers from various countries. **Rogers Cable Internet service was quoted to have a performance of 768 Mbps download and 176 Mbps upload on Sept. 18, 2002.** This is an indicator only but shows the requirement for additional network grooming and capacity adds to ultimately meet the broadband definition of 1.5 Mbps.

2.6. WIRELESS SERVICE

Another opportunity for high-speed local loop access is available with "fixed wireless" service. This technology relies on line of sight radio wave transmission, where the transmitting tower must be in the line of sight of the receivers.

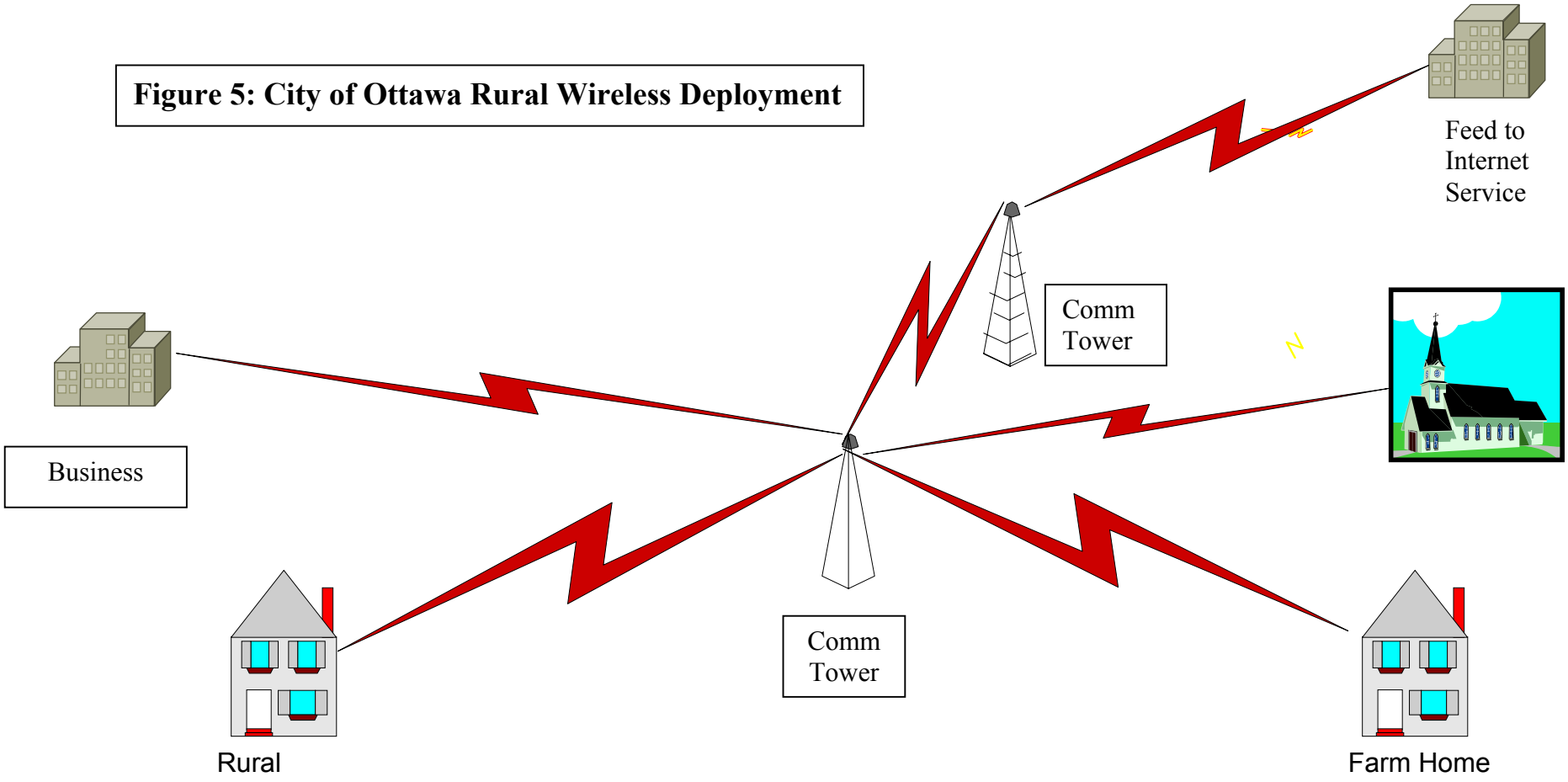
For the rural areas of the City there are few current options for high-speed connectivity. The incumbent telcos or cablecos do not have the facilities in place to offer either DSL or cable service across the whole City. This is not unusual or the situation solely in the City since both of the above technologies are either restricted by distance from the telco's Central Office switches or in the case of cable by the basic service not being available everywhere. The approach to serve these residents is to employ alternative technologies. In the following information we will outline two alternative technologies. One of them in particular, fixed wireless, is a realistic option in the City.

Wireless communication technologies have matured in the past few years. Reliability and speed/bandwidth capabilities have improved a considerable amount. As with any other type of installation, the quality of the workmanship often determines the reliability of the service. Choosing the right firm to provide the service desired is often the most critical decision to be made, possibly even more important than price for a user who requires a reliable, high-speed communication link. Other past concerns about security of information and the security of the wireless signal have been addressed. Wireless communication links can be as secure as "wired" communication links through the same types of security methods as those used in traditional telecommunications circuits.

Figure 5 shows the type of network deployment possible for the rural areas of the City. This example of a network within the City can be in place in a short time period since the network deployment is relatively quick because of the nature of wireless installations.

Appendix B
Research and
Technical Information

Figure 5: City of Ottawa Rural Wireless Deployment



The diagram also shows that a point-to-point wireless link can used to further increase the distance to the local distribution communication tower from the ISP central location..

Spread spectrum wireless

Spread spectrum wireless can be either a licensed or an unlicensed wireless medium. Both are what are referred to as Multipoint Communication Systems (MCS), one base antenna communicating with multiple customer locations. LMCS is the term used for the licensed spectrum providers. As the name implies, a range of the frequency spectrum is used. Spread spectrum is relatively inexpensive compared to satellite or microwave. Licensed carriers are slightly more expensive than unlicensed carriers. The unlicensed providers have ongoing monthly costs of $100 or lower possible and initial installation costs of $1,500 or less. These prices are becoming lower as the equipment is reducing in price. Nominal bandwidth of spread spectrum equipment is as high as 100 Mbps however, 10 Mbps systems are common to deploy lower cost services. Actual usable bandwidth of a 10 Mbps system is approximately 5 to 6 Mbps because of network "overheads" and losses.

Spread spectrum is a technology that is ideal for a rural area wireless deployment. It is a "line of sight" medium (the base antenna must be able to have an unrestricted "view" of the receiving antennae) and is typically restricted to about 10 km from the base site to a customer site. Actual usable bandwidth declines with distance with a spread spectrum network. At a distance of 20 km, a bandwidth of 1.5 Mbps can be achieved.

Two main differences between licensed and unlicensed frequencies are as follows:

1. Competing suppliers within the unlicensed band can interfere with each other and disruption of signals will occur. This interference will be unlikely with licensed spread spectrum. This becomes a significant concern in urban areas where unlicensed wireless providers could be deploying their systems and thus interfering with signals from the others. In rural areas there will be very few competitors sharing the spectrum so this concern will be reduced.
2. The available bandwidth in the licensed frequencies is significantly greater than that in the unlicensed frequencies, hence higher speed services can be delivered by the license frequency providers.

Area Deployments

Wireless options can be deployed quickly and they can meet the needs of most, if not all, of the non-urban customers in the City. A mix of technologies may be involved with this deployment and that mix may change over time as the business requirements change and the technology and price points change.

There are several providers of these types of service available in the City today. Some of them have systems in service already and others are planning implementation of services. Information follows about some of the competitors in wireless that can/have deployment in The rural area of the City.

Unlicensed Spectrum

There are two unlicensed spectrums available for these companies: at 2.4 Ghz (83 Mhz wide) and at 5.8 Ghz (125 Mhz wide). Storm and Upper Canada Networks operate in Ottawa and the area immediately south of the City, respectively. Storm operates in The rural area of the City and has completed several projects in conjunction with ORCnet.

Licensed Spectrum

Terago has 70 licenses in the 24 and 38 Ghz spectrum across Canada but have not implemented services in the City to our knowledge (they do have services in London, St. Catharines, Windsor, Toronto suburbs and Barrie). They offer service up to100 Mbps primarily to the commercial sector.

2.7. SATELLITE SERVICE

Two types of satellite service are commonly available to Canadian communities. These are:

1. VSAT service-generally for commercial applications
2. Direct broadcast via satellite through Bell Expressvu.

VSAT Satellite Service

This technology uses a dedicated 1.2-meter satellite dish and dedicated transponders in a geosynchronous satellite. The service is for end-to-end communications. It is most cost effective in areas where there are large distances between connections and the bandwidth requirements are not very large. In this application they are most cost effective. These networks have been traditionally used for diverse multi-drop networks such as department store chains, automobile distribution networks, etc. Also in terrain where the use of direct terrestrial wireless is not possible, satellite avoids the problems that terrain can cause.

Broadband Satellite works by a dish on the ground sending an encrypted transmission to a satellite in orbit and this satellite then relaying it back to earth, to the receiving dish.

VSAT service will cost from $200 per month for basic service which is 300Kbs download and 60 Kbs upload to $1199 for 700 Kbs download and 235 Kbs upload.

Direct Broadcast Satellite Service

Another emerging technology is “Direct Broadcast Satellite” (DBS) two-way service. The terminal equipment is capable of up and down loads of up to 45 Mbps. The true throughput will be subject to many variables, such as the number of subscribers per channel, down stream bandwidth, etc.

In the USA Hughes is offering a new service named "Direcway". This is a two-way home and commercial service available through direct broadcast satellites. There is a special dish slightly larger than the current "pizza-sized" dish mounted on the home and high-speed service is made available to the residential or commercial user. They are selling it for US$59.95 per month. This service begins to fall within the reach of many rural residential users. This service is also available in Canada from MacTeks of Vancouver for Can. $139.95 per month.

A new generation of satellite services are just appearing. These use the new Ka band satellites, such as Telesat's Anik F1. A US Company-Wild Blue Communications Inc. has announced a residential service and will commence service in 2002 in the US. Service to Canada will come later. Download speeds are expected to be up to 3 Mbps. Prices have not yet been announced. Telesat is an investor in Wild Blue with a 20% interest.

In Canada, Bell ExpressVu is currently offering a satellite-based service which is one-way download through a satellite and upload through a dial-up telephone line and modem. Bell has not announced a full two-way service at this time. Bell is however planning to offer a 2-way service at some future point (no specific time lines are available for this service launch)

2.8. POWERLINE TELECOMMUNICATIONS

PowerLine Telecommunications (PLT) is an emerging technology that may bring an alternate solution to the bandwidth deprived market place. The PLT network is comprised of three critical pieces. These are the backbone network, the medium voltage lines and the low voltage line to the home.

This technology seems to be positioned in direct competition to traditional DSL and cable modem service providers. The economics of the transformer-bridging device seem to make this unsuitable as a rural high-speed network strategy so it has not been considered as an alternative technology that could be implemented in Ottawa.

In addition to the technical issues and business economics of PLT, there are significant regulatory hurdles to overcome before this type of implementation could occur. Issues surrounding the use of the electrical infrastructure, who can use it, is it open for competitors, how is the electrical utility to be compensated for this use and, not insignificantly, how are safety issues addressed are yet to be resolved.

This technology will continue to evolve and should be monitored as an alternative in the future keeping in mind the need to resolve regulatory, safety and business issues.

2.9. BROADBAND TECHNOLOGY SUMMARY

Industry experts and sources, such as the "Report of the National Broadband Task Force" indicate that there will be an increasing need for bandwidth over the next few years as additional applications are delivered to the user. The "Report of the National Broadband Task Force" states that:

Appendix B
Research and
Technical Information

"Based on today's technology and applications, high-speed broadband is defined as a high-capacity, two-way link between user and access network suppliers capable of supporting full-motion interactive video applications delivered to all Canadians on terms comparable to those available to urban markets by 2004. ***A minimum symmetrical speed of 1.5 megabits per second per individual user is currently required to support these applications. Leading up to 2004 and beyond, new applications such as peer-to-peer file interaction and video conferencing will increase individual user demand for symmetric bandwidth in the 4 to 6 Mbps range.*** *Public and commercial facilities will require much higher bandwidth ranging from this minimum to several hundred times more bandwidth, depending on their size and user needs."*

The technologies that have the most promise of meeting this future requirement are:

1. Fibre-optic cable.
2. Cable TV systems.
3. VDSL over copper.
4. Licensed spectrum wireless.

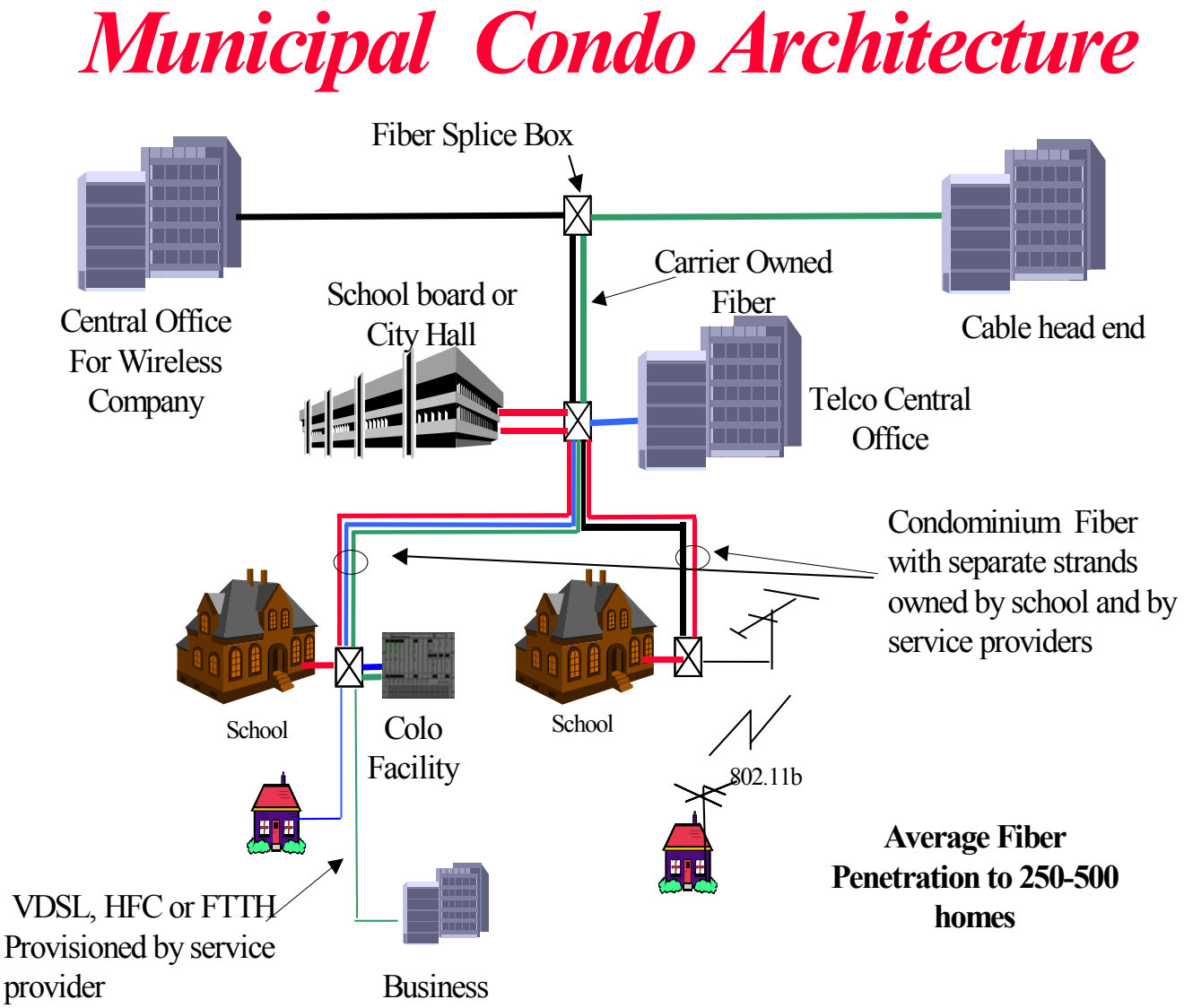
However technology is only part of the puzzle that has to be solved. A key concern to the long range strategy for universal broadband availability to the residents of the City is the network topology that is ultimately deployed within the City.

3. Access Network Topologies

The various industry pundits have various views on how the future of broadband access to the home will unfold. The current model is that the ILEC (Bell Canada) and the cable television operator (Rogers Cable) each build their own copper wires and coax cable respectively to the home. The emerging view for very high-speed service to the home is that fibre-optic cable will be required to service the home. There is in excess of 50 "Fibre to the Home" (FTTH) initiatives underway in the USA and at least one beginning in Canada. The other commonly held belief is that the current model of each service provider owning its own infrastructure will not work as there isn't enough revenue from the home to support two or more fibre-optic feeds.

The current deployments that are underway are generally municipal, city, county or regional initiatives. A possible scenario for FTTH is shown in the following diagram. This view has the Fibre to the Neighbourhood (FTTN) either owned by the service provider or shared in some fashion and the fibre to the home shared by all.

Figure 6: Municipal Condo Architecture



Source: Canarie

There seems to be consensus from the small carriers/service providers that the fibre to the home could be shared in some fashion, however, the ILECS and Cable TV providers aren't generally amenable to such an arrangement. The model seems to be further along the development path in the USA. We believe that once a solution is developed in that market, a Canadian version will ultimately be agreed to and sanctioned/ordered by the CRTC.

3.1. INSTALLATION TECHNIQUES AND ISSUES

All of the access technologies covered in Paragraphs 3.2 through 3.6 require various build techniques. The physical signal carrying elements such as copper cables and fibre-optic cables are installed in 3 typical ways. These are:

1. Direct Buried cables
2. Cables installed in buried duct banks.
3. Aerial cables attached to poles

These 3 methods each have their particular issues and costs. Also, the cost of installation of each varies with the instance of installation. If a cable or duct is buried at the time of a road or development build, the costs of each are fairly similar. Aerial installations are generally a build in an already established area so will have costs in relation to the quality and age of the supporting structures (poles).

Two new methods to install fibre-optic cables are emerging. These are installing cables in:

1. Sewer Lines and
2. Low pressure gas mains.

Sewer Line Installation

Stream Intelligent networks have had a project approved by the City to install fibre-optic cables in sewers in Ottawa. Unfortunately Stream has since gone bankrupt and their Toronto assets were sold to Videotron. Stream was purported to have held the Canadian license for a European sewer robot for Canada. It is unknown at this time if Videotron bought the license or it has reverted to the technology owner Ka-Te Holdings of Switzerland.

Stream had installed some services in Mississauga and Toronto Ontario with reported success.

CityNet Telecommunications Inc. of Maryland USA has several of these robots and is busily installing fibre-optic cables in several US cities such as Dallas, Houston, Pittsburg, Indianapolis and Albuquerque. The model they are apparently using is that they pull dark fibre via the sewer into buildings or for city street construction and make the dark fibre available to other carriers. The model used in Dallas is that CityNet owns the fibre and pays a franchise fee of 2.5% of their gross revenue as well as an access fee to the city.

The following is a direct quote from the Albuquerque press release.

"Albuquerque's Director of Public Works, Larry Blair, noted that CityNet allows his city to make dual use of its subterranean infrastructure and turn a system that typically costs the city money into one that will generate new-found revenue. CityNet pays the city a percentage of its gross revenue generated from leasing the network to carriers and broadband service providers.

CityNet's deployment process avoids trenching and permanently damaging streets," Blair said. "And, their non-invasive robotic technology doesn't negatively impact the sewer system in any way. It's a terrific win-win for everyone concerned – the City of Albuquerque, businesses and consumers, building owners, and the companies providing broadband services."

The patented robots are capable of installing fiber optic networks in sewer pipes as small as eight inches in diameter.

http://www.citynettelecom.com/index.swf

Low Pressure Gas Main Installation

Another promising technology for retrofitting existing neighbourhoods and buildings is the installation of fibre-optic cables in low-pressure gas mains.

Sempra Fiber Links, a subsidiary of Sempra Energy announced the first installation of its proprietary technology that allows fibre-optic cable in live natural gas distribution lines. The new fibre line has been installed in a portion of the service territory of Frontier Energy, a natural gas distribution utility in North Carolina. They also have recently completed a pilot project in Fort Worth Texas.

The key to the Sempra technology is the ability to install the fibre, wrapped in a polyethylene conduit, into the gas pipelines without interrupting the energy lines' operation in lengths of 500 to 1,250 feet so cutting into streets is reduced significantly.

Sempra have talked to Enbridge about using the technology and had a project targeted to trial the project with Group Telecom. On June 26, 2002 Group Telecom filed for protection under the Companies Creditor Arrangement Act (CCAA) and has recently announced that they have been granted an extension until November 4, 2002 to complete re-organization of the company. Group has also filed to seek a sale or merger of the company. This leaves enough unknowns about the project that Enbridge have put the project on hold.

The technology has great promise to expedite the laying of fibre for rings in metropolitan areas and building access when required.

The City should pursue this option with Enbridge to see what is their interest in such a product. This may be a less intrusive way to install fibre reducing the disruption and associated costs of open trenching and cutting the streets.

4. Community Initiatives

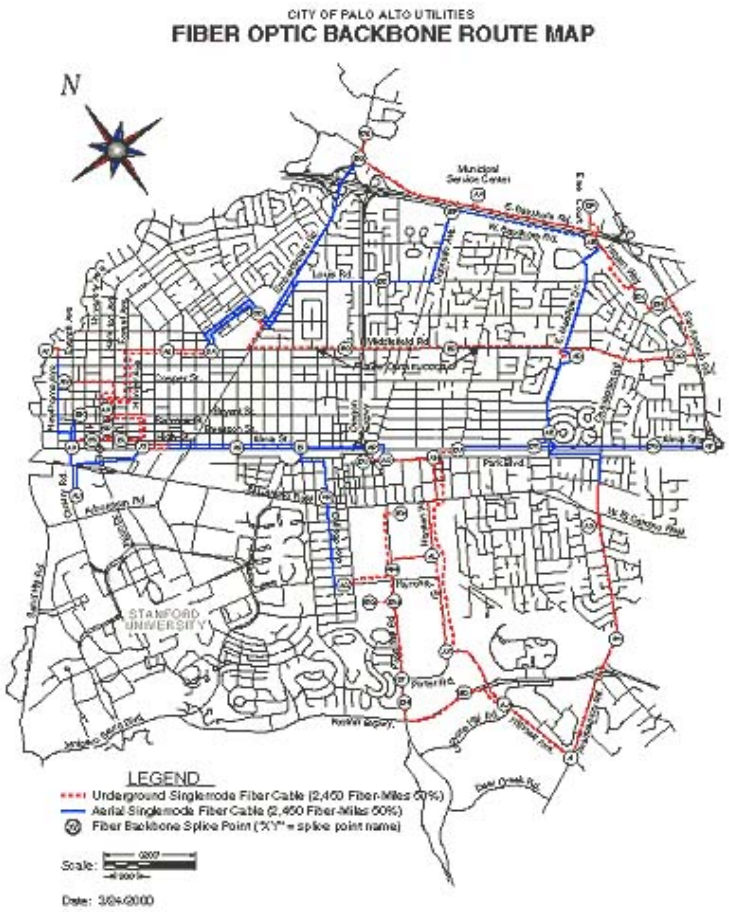
Municipalities have a critical role to play in the deployment of broadband services. They must be part of the solution and ensure that they are not part of the problem. This does not necessarily imply that municipalities must build and operate their own broadband networks.

The following sections provide an outline of various initiatives aimed wholly or in part at enhancing the delivery of broadband communications in their respective communities. This outline is not intended to be an exhaustive list but instead to provide an overview of the activities being sponsored or encouraged by municipalities.

4.1. Outside of Ontario

Palo Alto, California, USA

Figure 7: Palo Alto Fiber Optic Route Map



The City of Palo Alto is active in providing broadband services through the City of Palo Alto Utilities, (CPAU). CPAU is the only municipal utility in California that operates city-owned utility services that include electric, gas, water, and wastewater collection services.

In addition to conventional utilities, CPAU has an offering called Fibre-optic Services, based on the Palo Alto fibre backbone.

Dark fibre can be leased directly from CPAU or managed services, carried over the network, can be obtained from independent service providers. Services available include voice, data and video.

With the fibre backbone, customers gain direct fibre access to Internet service providers of choice. They interconnect telephone systems and computer networks across multiple Palo Alto

locations. They connect directly to local and/or long distance carrier(s) of choice for a full range of telecommunications services. They also provision redundant telecommunications connections for enhanced reliability.

CPAU offers the following benefits of connecting to the fibre backbone:

Competition - With CPAU's fibre backbone, customers have access to their choice of service providers. They are no longer limited to a single source for telecommunications services.

Reliability - The ring-based design of the fibre backbone allows for highly reliable network configurations.

Flexibility and Control - With CPAU's dark fibre, customers are in control. They design their networks, install their choice of equipment, and provision the network to meet their needs.

Flat Fee without Bandwidth Limitations - Customers pay a flat fee for the dark fibre. The only bandwidth limits are those imposed by the customers' hardware.

More information is available at www.cpau.com/fiberservices/ .

In addition to the CPAU fibre backbone, which is targeted at commercial and institutional customers, the City of Palo Alto has undertaken a fibre-to-the-home, (FTTH), trial. The FTTH trial was approved in its current form on November 13th, 2000, by the Palo Alto City Council. There are approximately 70 residential participants in the FTTH trial. In addition, several FTTH installations were located in public buildings to allow public review and interaction with the project. The city expects to derive real benefit through the experience gained while deploying the network as well as real hard data for modeling a business case for a citywide deployment of FTTH.

Construction of the network for FTTH was financed by the City of Palo Alto. Participants are responsible for service fees.

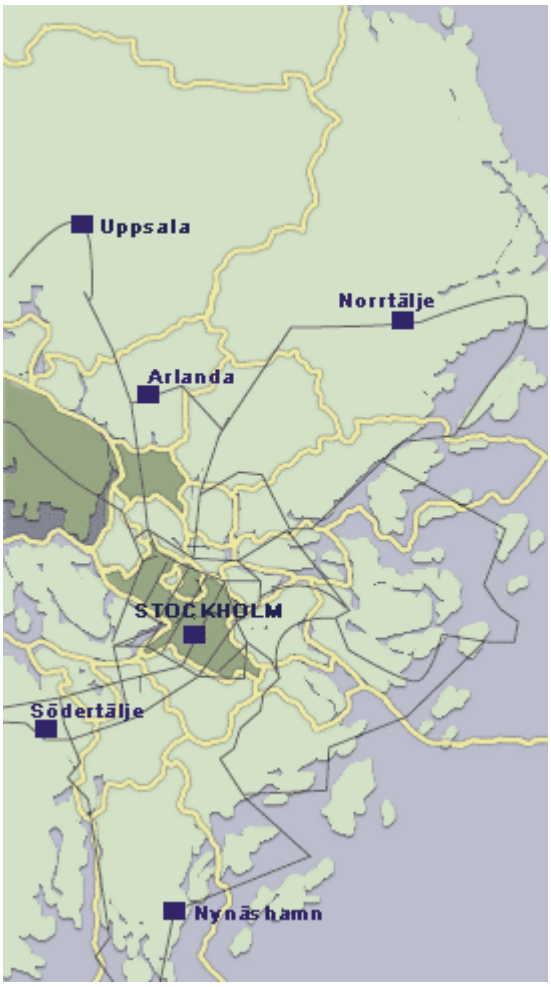
A variety of services were planned to be provided through FTTH. Planned services included Fast Internet access, Broadcast video (CATV/DBS) and Telephony (Carrier class quality).

Stockholm, Sweden

The City of Stockholm has actively encouraged the development of high-speed communications since 1994 through a wholly owned commercial enterprise known as AB Stokab. The members of the Board of Directors of Stokab are political appointees representing the City of Stockholm. Stokab's operations commenced at a time when Sweden had begun de-regulation of the telecommunications market. Stokab now has approx. 4,000 km of fibre cable for a total of 500,000 fibre kilometres. More information is available at www.stokab.com .

The key elements of the Stokab business model include:

Figure 8: StockAB Network Map



- Building and operating a secure, accessible fibre-optic network.
- Leasing dark fibre to a various organisations including carriers, commercial such as Banks and technology companies, and municipalities, (Stokab does not offer any managed services).
- Contributing to the economy of the Stockholm region by ensuring that deficiencies in network capacity or availability do not impede business development.

Stokab has an additional goal of leveraging municipal facilities such as tunnels and ducts in order to reduce the impact of excavation on city streets.

The development of the fibre-optic network started in the commercial district of Stockholm. Later, it was extended to the major industrial areas of the city. Finally it was extended to serve other municipalities, in the region.

Stokab has approx. 60 telecom companies as customers. They include carriers, Internet service providers, cable companies and mobile telephone operators. Rather than constructing their own facilities, these companies lease dark fibre from Stokab. It is noteworthy that Telia, the ILEC, does not use the network.

Other commercial enterprises needing high-speed telecommunications lease dark fibre from Stokab. Such enterprises include banks, insurance companies, retailers, media companies, universities and computer and IT companies.

High-speed communications have made telecommuting, training, video conferencing, and telemedicine available. The Stockholm County Council's network, SLLnet, links emergency and local hospitals as well as some of the major medical centres in the county, from Södertälje and Nynäshamn via Stockholm to Norrtälje.

SLLnet is the County Council's common infrastructure for data, voice, and graphics communications. It is a service network accessible by The County Council's own operations as well as other forms of operations procured by The County Council.

Through connections via Stokab's fibre-optic network, it is possible for the operations of the County Council to work in entirely new ways. Organisations and companies working on behalf of the County Council within the area of healthcare enjoy secure and convenient communications.[2]

Chicago, Illinois, USA

The City of Chicago is actively involved in a major project to encourage and directly participate in the development of high-speed fibre-optic communications in the City. Mayor Daley announced the project in February 1999 and stated the following vision:

"I envision the entire City -residents, businesses, and institutions - using the network to access on-line education programs, video-on-demand services, telecommunicating, and on-line community organizing."

CivicNet intends aggregates the communications requirements of the City, Chicago Public Schools, Chicago Park District, Chicago City Colleges, Chicago Housing Authority, and Chicago Transit Authority

Chicago's internal requirements will be offered as an anchor tenant for the development of the new communications infrastructure. The City intends to partner with multiple entities in the private sector to build out this infrastructure, that will be managed and operated by the City's private sector partners and marketed by them to all interested parties in the private, public, and institutional sectors.

The intent is to create a new communications infrastructure throughout the City for the Internet age, for everyone to use and to spur economic development.

The City seeks partners to finance, build, manage, operate, and market CivicNet. The City also seeks partners to be co-tenants. Corporations, businesses, banks, universities, healthcare organizations, community technology centres, etc. that have locations throughout the City are offered the opportunity to participate in CivicNet, to procure high-speed communications at a lower cost than might now be possible.

The project went out to RFP in December 2001 with proposals due March 29 2002. The city has not yet announced the successful bidders.

The key elements of the Chicago business model include:

1. Put current assets and ROW's such as Chicago Transit Authority (CTA) into CivicNet venture.
2. Leverage the city's total expenditure of $25 million to become an anchor tenant on the network.
3. Seek out a variety of partners that will complement the network build.
4. Don't put any City dollars into the build.

[2] www.stokab.com The Market, County Councils

A prime tenant in the network is the fact that the City has specified that the network will have **"Equal access-The City expects equal access throughout the network. All information content and service providers requesting access to the network infrastructure shall be treated equally. Facilities, wholesale, and retail services should be made available in a fair, reasonable and non-discriminatory manner". "Irrevocable rights to use (IRUs) (of dark fibre) should be made available on a reasonable, fair and non-discriminatory manner".**

Montreal, QC[3]

Montreal has the reputation across the carrier industry of "getting it right". All carriers that operate there praise the ease of access and the low cost of duct rental.

Montreal created an agency called the "Commission des Services Électriques de la Ville de Montreal" (CSEVM) in 1907 to emphasize urban design and to adapt to changing technological requirements as the city grew and to contribute to the beautification of the city's streets and public places.

The CSEVM has the mandate to operate the whole underground space. It builds, manages and operates the system of underground conduits.

Since that beginning the City now has 19.2 million metres of linear conduits, covering 623 of the city's 2,123 kilometres of streets. It provides direct accesses to 38,500 private and public buildings through more than 18,000 access facilities.

The City operates in the role of standardizing construction, consolidating demand from various sources and building additional space for the City to rent out to others. The City shares the capital cost with all and engineers additional capacity for resell. The City is also very active on retrofitting duct banks that are filled by adding additional internal ducts to be used.

The primary advantage to the building partners is in cost reduction of duct construction. The primary advantage to the City is the minimization of infrastructure disruption (road cuts) and the resulting social disruption.

The end result is that the carriers have only the highest of praise for Montreal as a territory in which they operate and the costs of duct rental are $3.65 per metre. This compares with Toronto Hydro's duct rental rate of $12.00 and Telecom Ottawa of $8.00 per metre. This is a key ingredient of making a city "telecom friendly" so that services will be extended to its constituents.

[3] Information courtesy of XIT Telecom

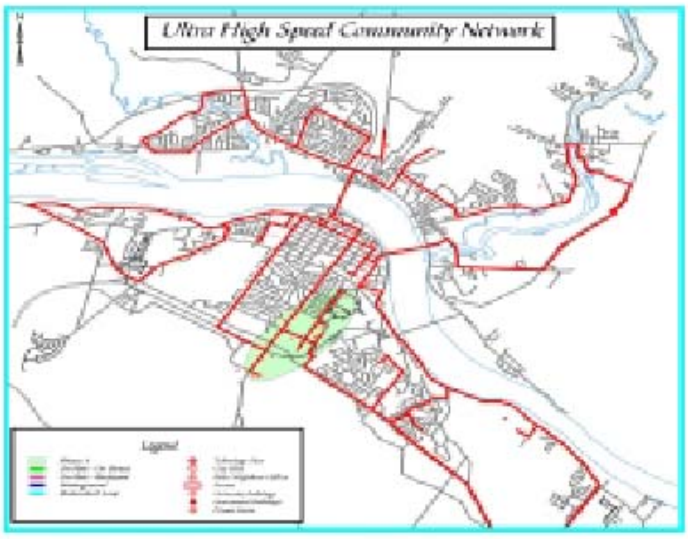
Fredericton, NB

The City of Fredericton has undertaken to build a Community Network through a Municipal Corporation, e-Novations Inc. The Community Network is a combination of fibre optic cable and wireless technology available to all businesses and citizens of the city. The objective of the project is to make available a network that has next to unlimited speed and capacity for the lowest cost and to maintain the city's position in the world of economic development as one of the most desirable places to live and conduct business. The Corporation, e-Novations Inc., was created with the approval of the Council of the City of Fredericton. E-Novations has applied for, and been granted, a Non-Dominate Carrier License from the CRTC, which permits it to build and maintain a communications system. The city gave the corporation a repayable loan of $50,000.00 and services in kind to assist with the start-up. The corporation is a not-for-profit organization and any excess revenues realized from its operations will be used to support and expand the network. The network will allow high-speed connections to destinations within the city as well as to service providers that are connected to other networks.

Communication technology and connectivity are quickly becoming key drivers in energizing community development. Over the past few years, a number of drivers have been contributing to the rising profile of connectivity as an enabling technology for development, business and innovation. In fact, the City of Fredericton's Smart Communities initiative was built on the premise of innovation through information and communication technology.

The City of Fredericton has been paying close attention to the rising profile of communication technology and "connectedness" with communities, government and educational institutions and in the private sector. This, coupled with Fredericton's strong IT sector provides an opportunity to clearly establish Fredericton as Silicon Valley East. This is not about technology; it is about economic development, high-paying jobs, and the quality of life.

Figure 9: Fredericton Community Network



The Community Network is being built using a combination of leasing existing fibre network, purchasing existing fibre network and constructing new fibre network in areas where fibre network currently does not exist. This will mean that many businesses can be connected to the fiber backbone almost immediately. The opportunity for Community Network Members to connect to a second office, to a business partner or to the Internet can now be accomplished very quickly. The construction part of the network commenced in the fall of 2001. Building will take place to connect areas of the city where no fiber currently exists and areas that will need fiber to connect to the

wireless portion of the network. Initial connections directly to the fiber backbone will run at 100 megabits/second. Each commercial location/firm will be charged an annual membership fee to use the network.

The City of Fredericton's Information Technology Division currently manages a Municipal Area Network (MAN) consisting of 6 major and 13 minor sites spread across a 100 square kilometre area. This MAN consists of a combination of some privately owned fibre, some leased circuits and wireless (RF) technology. While able to serve most of Fredericton's immediate needs, this configuration is lacking and expensive. On one hand, the lower speed and RF connections are barely adequate while the faster leased circuits result in very high ongoing costs. By moving its MAN to the Fredericton Community Network, approximately $250,000 per year in current ongoing charges would be freed up and could be redirected to this project. In the meantime, this change would mean that the City of Fredericton's network performance would be dramatically increased (every employee could be connected as if they were in the City Hall building, no matter where they were located). Finally, this would open the door to new possibilities not considered with our current configuration. Video conferencing, broadband Internet/Intranet and IP telephony are just some of the new possibilities.

The last, and probably most exciting layer of this project is that of the connection of residents to the Community Network. Access to the Community Network for residents will be made available on a membership basis. This would offer members a quantum leap in connectivity for a small membership fee. This is 10 to 100 times faster than DSL or Cable Modem. Membership charges would be tiered and will vary from least expensive for private residences to most expensive for business wanting to offer services to this Community Network. These revenues will be used to offset costs and reinvest in the network. This component of the Community Network is planned to be in place early 2003.

4.2. WITHIN ONTARIO

4.2.1. Simcoe County

The installation of a broadband network has just been completed in Simcoe County. This initiative provides an excellent example of MUSH, (Municipalities, Universities, Schools & Hospitals), sector participants becoming a catalyst for the deployment of broadband services in a community. The Simcoe Community Access Network (SCAN)[4] is a Non-Profit cooperative. SCAN was founded by[5]:

1. Land Information Network Cooperative
2. County of Simcoe
3. Town of Collingwood
4. Simcoe County District School Board
5. Georgian College

[4] www.scannet.on.ca What is SCAN?
[5] www.scannet.on.ca Founding Members

6. Royal Victoria Hospital
7. North Simcoe Hospital Alliance
8. County of Simcoe Library Co-operative
9. Nottawasaga Economic Development Corporation
10. Simcoe Muskoka Catholic District School Board

The SCAN mission statement is:
SCAN'S mission is to provide a sophisticated community based telecommunications network infrastructure which will facilitate the delivery of services through IT applications for the benefit of citizens and businesses of Simcoe County that might not be enjoyed without this cooperative effort. This is achieved through co-operation across both public and private sectors, and community involvement and participation[6].

Following an RFP process, SCBN Telecommunications built a hybrid network servicing all of Simcoe County. SCBN is a telecommunications joint venture corporation composed of Hydro One Telecom Inc., Barrie Hydro Energy Services Inc., Orillia Power Generation Corporation, Innisfil Energy Services Limited. and Tay Utility Contracting Inc. [7]

SCAN is expected to attract new and high tech business to Simcoe County by providing easier access to government and community resources. SCAN is expected to enhance tourism through easy to navigate interactive web pages. In addition for the first time rural communities will be able to compete on an even scale with large urban centres.

The SCAN project provides a mechanism for the delivery of sophisticated telecommunications services and network based applications to the people of Simcoe County. Some of the key applications include Virtual Town Hall, Surgical Pre-Admission Clinic, Telemedicine (applications for patient assessment, consultations, education and meetings), Land Information Network Cooperative GIS applications, Connectivity for Schools and Libraries. Key objectives are to enhance telecommunications services throughout Simcoe County, to capture benefits and synergies of stakeholders and to encourage service providers and governments to enhance availability and affordability of services in the county.

The technical solution is a hybrid of landlines and wireless technologies (5 sites are connected via 100 Mbps wireless technology.). The current telecommunications infrastructure in Simcoe County is highly diverse. In urban areas such as the City of Orillia, fibre optics at high speeds are available as is wireless in the City of Barrie, and the Towns of Collingwood and Midland.

The new high-speed fibre backbone is available to users in the City of Barrie up to the City of Orillia, Alliston, Tottenham, Midhurst, Collingwood, Midland, and Penetanguishene. Upon completion of the new network infrastructure, all users in Simcoe County have access to the fibre optic backbone and connect through high bandwidth local loop facilities at speeds of 100Mbps.

[6] www.scannet.on.ca Mission Statement
[7] www.hydroonetelecom.com Newsworthy

This robust, resilient, scaleable and open network will provide users in the County of Simcoe with access to a high-speed network that will easily meet their connectivity needs of today, and allow for future expansion within our community and connectivity to future neighbour broadband networks as they emerge[8].

4.2.2. Waterloo Region

The following information is taken from the Waterloo Region Education and Public Network (WREPNet) website http://www.wrepnet.on.ca/frames-home.htm

WREPNet[9] is a high-speed, high-capacity information network that gives public sector organizations in Waterloo Region access to the technology needed to be at the forefront of information, education and business demands.

WREPNet uses fibre optic cables instead of the standard telephone or cable networks. This technology dramatically speeds up data communications between sites on the network and provides cost-effective access to improved information services and emerging technology applications and solutions.

4.2.2.1. Who is involved?

The idea for WREPNet began in 1998 when the Waterloo Region District School Board and Waterloo Catholic District School Board put forward a joint proposal to the Ministry of Education to build an information network that could be shared with other public organizations. The Ministry approved a one-time infrastructure grant of $10 million, and an alliance of public sector organizations was developed to plan and manage the network. The WREPNet partners are:

- Waterloo Region District School Board (WRDSB)
- Waterloo Catholic District School Board (WCDSB)
- Region of Waterloo
- City of Kitchener
- City of Waterloo
- City of Cambridge
- Conestoga College
- Kitchener Public Library
- Waterloo Public Library
- Cambridge Public Library

The network has been designed and built with extra capacity that will allow other public sector partners to join.

[8] www.scannet.on.ca Network Design
[9] http://www.wrepnet.on.ca/frames-about_wrepnet.htm About WREPNet

4.2.2.2. Governance Model

WREPNet has a governance model comprised of committees and teams of appropriate representatives of WREPNet partner organizations. The Governance Model was established to facilitate business and technical planning processes. It was also established to ensure the thorough participation of all WREPNet partners in the processes used to define technical solutions and make business decisions about the approach used in defining, implementing and managing WREPNet.

The governance model consists of the following committees:

- Steering Committee
- Business Planning Group
- Technical Team
- Project Management Office

4.2.2.3. Steering Committee

The Steering Committee, co-chaired by the Superintendents of Business from WRDSB and WCDSB, is composed of CFO level representatives of the WREPNet participant organizations. The committee provides corporate direction and oversight to the project and program resources. It is the top approval body.

4.2.2.4. Business Planning Group (BPG)

The Business Planning Group (BPG), co-chaired by the WCDSB CIO and the City of Kitchener Director of IT, is comprised of IT Directors and managers from the participant organizations and Prescient International. The BPG provides operational direction to the project, reviewing all technical and business subjects and making recommendations to the Steering Committee for approval.

4.2.2.5. Technical Team

The Technical Team (TT) is composed of IT technical staff of the WREPNet participant organizations and Prescient International. Technical experts from Prescient International and vendor organizations provide direct consultation to the Technical Team and participate regularly at TT meetings. The Technical Team is co-chaired by the City of Kitchener Technical Support Supervisor and the WCDSB Manager of Technical Support Services. The purpose of the TT is to solve technical problems and make recommendations to the BPG on technical issues and subjects.

4.2.2.6. Project Management Office

As WREPNet moved through the negotiations, planning and prototype network stages, the need for a focused structure to manage the full WREPNet implementation emerged. As a result, a Project Management Office (PMO) was formed. The PMO is composed of key representatives of the WREPNet partnership and the business partners. To ensure the utmost continuity between the Business Planning Group, Technical Team and the PMO, the co-chairs of both committees sit on the PMO. One Technical Team representative from the Waterloo Region District School Board also sits on the PMO given the number of board sites to be implemented. The PMO is responsible for the day-to-day management of the network implementation and will end once full implementation has been achieved.

4.2.2.7. Success to Date[10]

The WREPNet network is one of the few initiatives in Ontario where a dark fibre network has been established by a public sector consortium. Similar groups have initialized many other network connectivity projects but they have generally been a managed telecom service of some type. The only other network in the province of this magnitude that is a dark fibre network is the PSN in Peel Region.

The network has been very successful through the implementation phase. Sites continue to be added as the members expand the facilities they have connected. In addition, new members, particularly the Health Care sector, are being encouraged to connect to WREPNet.

Challenges for WREPNet going into the future include sustainability of the network (ongoing funding sources to minimize costs for the participants), operational issues (managing the ongoing requirements for maintenance and upgrades required to keep the network providing services and functions needed by the partners) and the need for a long term business strategy to provide directions for decision makers.

WREPNet has won several awards for public sector technical achievements and continues to provide an extremely valuable service to its partners.

[10] This section is editorial comments by the authors about the success to date of WREPNet and is not taken from the information on their website.

4.2.3. PSN, Peel Region

The Peel Region Public Service Network (PSN) is a fibre network connecting public (MUSH) partners within the Region. Partners initially included:

- Region of Peel,
- City of Mississauga,
- City of Brampton and
- Town of Caledon

The following is a press release from November of 2000 regarding this implementation:

For Immediate Release
November 14, 2000

LARGEST MUNICIPALLY OWNED FIBRE OPTIC NETWORK IN NORTH AMERICA BRINGS SAVINGS OF MORE THAN $2 MILLION

(Brampton) - The City of Brampton, City of Mississauga and the Region of Peel stand at the leading edge of modern technology with the largest municipally owned fibre optic network in North America. The Public Sector Network (PSN) consists of more than 200 kilometers of primarily 96-strand fibre, or approximately 14,000 strand-kilometers. Laid end to end, this is more than enough fibre to reach from St. John's, Newfoundland to Victoria, British Columbia, and back again.

A joint effort of the partner organizations over several years, the fibre optic network provides high speed, high capacity telecommunications for municipal facilities and services.

Savings from PSN are estimated at more than $2 million annually for the partners, and will be even greater in the future, as telecommunications is increasingly relied upon to improve delivery of municipal services.

PSN, which recently won a Showcase Ontario Award of Excellence and a silver medal at the national Technology in Government Distinction awards, was conceived more than five years ago. In addition to meeting the needs of the partners, the network was built with excess capacity that could be made available to all public sector agencies in Peel Region.

The PSN partners are now making their initial vision a reality by negotiating access agreements with the William Osler Health Centre, Trillium Health Centre, Credit Valley Hospital Corporation, Community Care Access Centre of Peel, the Peel District School Board, the Dufferin-Peel District Catholic School Board and Sheridan College.

Up to 200 additional facilities of these potential subscribers can be added to PSN. In some cases this can be done at minimal additional cost and with substantial benefits to local residents. Just one of these benefits will be the ability to move X-rays, MRI results and other digital information between the hospitals.
By offering affordable, high-speed telecommunications access to other Peel public sector agencies, at a fraction of the cost of other equivalent services, they will be able to share in the benefits provided by PSN. The net result is that taxpayers pay only once but benefit repeatedly from the partners' initial investment.

PSN Endorsements:

"Our involvement with and investment in the PSN is evidence of our commitment to using new technology in ways that provide tangible returns to the community by enabling more cost-efficient, convenient, effective or timely service delivery from their public sector service providers."

Peter Robertson, Mayor, City of Brampton

"The PSN is a significant tool in holding the line on the cost to deliver vital public services that make our community an attractive place for business to locate and for individuals to live and raise their families. The PSN is an important part of our overall service delivery strategy."

Hazel McCallion, Mayor, City of Mississauga

"The PSN is a shared resource that benefits our communities in many ways and also ensures we have the ability to benefit from the new technologies of tomorrow. It's also an outstanding example of inter-government collaboration and co-operation."

Emil Kolb, Peel Regional Chair and CEO

Since the original PSN was built some of the planned expansion has occurred:

Regional Council Minutes: June 21, 2001	Public Service Network (PSN) Expanded

Regional Council approved the expansion of the Public Service Network (PSN) to include a partnership with the Town of Caledon. The expansion will allow Town Offices in Caledon East and Bolton to be connected to the Network through fibre-optic wiring providing high-speed internet connections. The Town of Caledon has contributed $250,000 to cover the expansion costs.

In addition to this expansion into Caledon, agreements are in place for services to:

- Peel Living
- Peel Police Services Board

- William Osler Health Centre,
- Trillium Health Centre,
- Credit Valley Hospital Corporation,
- Community Care Access Centre of Peel,
- Peel District School Board,
- Dufferin-Peel Roman Catholic School Board, and
- Sheridan College

Although the press release of November 2000 is somewhat out of date (there are larger networks now in place in Ontario), the initial goals of the PSN to serve the MUSH group in Peel Region have been accomplished.

4.2.4. Upper Canada Network (UCNet)

UCNet is a network established to serve a large mainly rural area southwest of Ottawa. It is one of the only community networks in Ontario providing wireless services over a broad area. UCNet is also one of the very few not-for-profit community networks that has been set up to provide services, not only for the public sector, but also for the commercial business sector in their territory. In the following information we outline: Community Groups involved, Governance, Funding Programs, Economic Model and comments on critical success factors from the UCNet perspective[11]. A brief summary of UCNet will then follow.

4.2.4.1. Community Groups involved

The MUSH group were the core members of UCNet originally. However, membership does not mean that all of the MUSH group currently receives services from the UCNet telecom network

About 20 customers are on network now (started in mid-May of 2002 providing services). They have yet to launch a marketing campaign. Customer knowledge is limited. IT people tend to be very knowledgeable about computing but tend to have more limited knowledge about telecom. Despite the demarcation of services (ending at the telecom connection to a facility), customers expect assistance right to the desktop. That has been a challenge for UCNet to provide that service.

A user group is currently being assembled so the customers can share in opportunities together.

There is difficulty in operating as a co-op (membership requirement). Member context is central to the community philosophy at UCNet. Practical application of this community idea is that the "customer"

[11] The information provided came from an interview with Vic Allen, the "founder" of UCNet.

now looks on UCNet as a commercial provider and expects comparable services as he would get from a traditional Telco.

School Boards are members but now that the service is ready to be available, they are uncertain that UCNet should be their second connection. Because of delays in getting the wireless service operational (about 1 year behind schedule) there is a lack of UCNet credibility with some customer groups. Need to make a special case for education of the customers.

From the UCNet perspective, to become a self-sustaining business they need the MUSH group as customers. Generally, they do not have them as customers today.

4.2.4.2. Governance

Others community networks tend to have elected officials on the Board. UCNet whose preference is to have local business people involved at the Board level making the policy and main business decisions for the corporation has avoided this.

On an interim basis there are three people on the official board today. The business is functioning almost as a virtual corporation. So far, the UCNet business has been run as a project with lots of volunteers.

UCNet has an advisory board with a person in the high technology area, two educators, others in the Applications area, and one of the local mayors.

Because of some of the start up issues and the challenges dealing with them, the advisory board has been neglected over the last 6 months while staff have been dealing with operational.

4.2.4.3. Funding Programs

$1.1 million has been received of $1.8 million in funding through the TAP program. $725,000 is yet to come and has been held back to this point because of the lateness of installation etc.

In order to get this remaining funding an inventory of equipment has been completed and a financial audit has been required. At about this time (mid-October) a Provincial auditor is expected to be looking at the UCNet financial information.

4.2.4.4. Economic Model

Only cost effective solution has been fixed wireless into wireline. They can use DSL but don't because of focus on business and public sector and the need for synchronous traffic capability.

Among community based groups like UCNet, there needs to be an understanding of the CRTC regulations and a broader understanding of how a community network should evolve.

They did not realise the degree the business model would be constrained by Internet pricing from incumbents. This issue became a major cost barrier to providing low cost services and building a sustainable business.

Currently at UCNet they are in a cash challenged situation with positive cash flow being a ways off yet (likely a few months). Vic commented that "The model does work from the services side but financing is difficult as a not for profit organization." It is difficult to find external sources for cash as a not-for-profit.

4.2.4.5. Comments on Critical Success Factors

Thorough understanding of technology to be used is required. Because they did not have this technical capability initially, they were approximately 1 year late in implementation of services. (The integrator they ended up using was not a wireless expert).

Customer education and application development is critical to help establish the need for the services. At UCNet it has been done in the following 6 clusters (with comments on the status of each).

1) Schools
   a. Did very well because of person/volunteer doing it.
2) Health Care
   a. Broad scene for Eastern Ontario was attempted with other groups in that part of the Province. Individual hospital clusters did not work well together. Doctors (older) are not comfortable with PCs. Doctors seem to distrust the Provincial Government and the process has not worked well. It is getting better now. Provincial Health Net initiative is now helping to drive it.
3) Agriculture
   a. Nothing much yet. OFA initiative in Elgin may help to establish a model and the need. Excitement yet to come.
4) Tourism
   a. Web portal in Atlantic Canada. Offered a group of tourist related businesses that UCNet could set up the portal and operate it through UCNet. Two main groups would not work together. The St Lawrence and Rideau Valley Groups. The Rideau Valley group went and did it themselves using the Atlantic Canada Portal design. 12 people supporting the portal in Merrickville over the UCNet pipe into the community.
5) Small Business
   a. Did several seminars on e-business. Not much interest generated. No follow through yet.
6) Big Business
   a. Early meetings, now being resurrected

4.2.4.6. Summary

UCNet is a rural community model that the Provincial Government is very excited about. Mr. Allen attends numerous conferences throughout North America doing presentations about the UCNet business, the model and factors influencing success.

The challenges faced by UCNet are significant. Being a not-for-profit business with members supporting the initiative has created challenges. Funding issues, the credibility of the business and its ability to deliver the services required by "members" are real issues and the resolution of these challenges will ultimately determine the viability of UCNet.

4.2.5. South Dundas

After recognizing the vital importance of providing high-speed, broadband communication capability to the community South Dundas implemented the South Dundas Fibre Project in the summer of 2000. The first business was hooked up to this network in February of 2001. Public and private sectors are working together in this venture to create a progressive and prosperous economic environment.

Commercial access to the South Dundas Fibre Network is available through South Dundas Networks. Note comments on South Dundas as a part of CEONET.

4.2.6. CEONet[12]

The Communities of Eastern Ontario Network is a not-for profit corporation and was formed in March 2002 to pursue Information Technology projects in Stormont, Dundas & Glengarry and Prescott-Russell. Because this initiative took place after the province's TAP programme had been prematurely brought to an end, CEONET has not been involved in building network infrastructure. It should be noted that neither the United Counties of SD&G nor the United Counties of P-R, nor their respective Community Development Corporations applied for funding under TAP. For this reason, the provision of high-speed networks for this rural has been fragmented and inconsistent, ranging from the remarkable initiative taken by the Township of South Dundas, to the frustration of virtually no infrastructure development in the Townships of North Stormont or East Hawkesbury.

The challenge of this rural region to bring high-speed to its citizens is considerable. Apart from the City of Cornwall, geographically located within SD&G but falling outside its political structure, there is only one town of any size, Hawkesbury (about 10,000 population). Its industry and commerce are widely scattered throughout the region though their location is arguably influenced by Highways 401 and 417. Agriculture is a significant economic activity (worth $900 million) but by implication the rural population of 130 million has a low density over more than 6,000 sq km of territory. The relative proximity of Ottawa and Montreal is attractive to home workers who value living and working in the country but want to be near the cities. Many businesses compete with their urban counterparts, are

[12] Provided directly by CEONET.

branch operations of national/international companies, or require access to professional databases (insurance, real estate). Other major users are predictably the schools, libraries, health and environmental authorities.

4.2.6.1. Governance

CEONET has a 15-person Board of Directors, broadly drawn from the community it serves. There do not appear to be any other community advocacy groups promoting high-speed for the region though at least one local broadband action committee is known to have been formed (in Embrun).

For the Connect Ontario project, CEONET proposed a partnership based on the two United Counties, the City of Cornwall and Mohawk Nation Akwesasne. Working together for possibly the first time, the United Counties decided in favour of forming a Steering Committee comprised of representatives from the counties/partners offices, but no others. Uncomfortable in working with an independent not-for-profit corporation, CEONET was become a guest of the Steering Committee for its own project, and faced at least one attempt to be dislodged as lead partner. This was eventually resolved by the Ministry responsible for the project.

The Steering Committee displayed its strength in managing the RFP for writing the business case and subsequent deployment of the contractor but the narrow representation has contributed to a lack of communication with municipal councils, other groups such as health and education, and with the community at large.

The CEONET Board of Directors recently formed a Broadband Committee with community representation. For the moment, this committee acts in an advisory capacity to the Board for future projects.

4.2.6.2. Local initiatives taken to build infrastructure

1. Township of South Dundas

   The Township of South Dundas is located along Highway 401 on the St. Lawrence River. Although agricultural land, it has some industry in the two larger towns of Morrisburg and Iroquois.

   South Dundas took the unusual step of investing its own funds to build a community-owned hybrid network infrastructure in three largest rural communities: Morrisburg (pop. 2400), Iroquois (pop. 1200) and Williamsburg (pop. 800). Engaging Prophet Technologies, the township first carried out an engineering study, then built its network. The network was designed to bring fibre optic cable to all businesses, giving each the option of paying for and making the media connection. As of October 2002, about 24 businesses have chosen to do so. By a Council decision, the community-owned network does not serve residential areas, some of which have access to cable Internet service. Wireless radio provides the link between the three communities.

The strategy was simple.

- By over-building, the Township could provide for its anticipated and future needs. It also followed advice to build a robust, high-standard network.
- By moving faster and more boldly than its neighbours, the Township gave itself a competitive advantage.
- By owning its own network, the Township found it could control
    - The network topology, i.e. it ensured the placement of fibre along every roadway where businesses were located and thus potentially provide for all businesses along the network in contrast to building on demand with variable installation costs and delays.
    - Monthly charges. Since the network had been built using its own funds from a tax reserve, the Township decided against a recovery of the capital expense charges for designing and building the network. This meant it could reduce monthly charges for bandwidth. This factor also added to its competitive advantage.

Township of South Stormont

The adjacent Township of South Stormont is very similar to South Dundas: a small industrial base in Ingleside and Long Sault, backed by an agricultural hinterland. South Stormont took a conventional approach. After weighing the perceived merits of the South Dundas model and hearing the arguments of commercial providers, its Council chose to sign agreements with two commercial providers to provide wireless service. Although the intent was to introduce competition, only one of the two companies has responded to date. Wireless high-speed service is now delivered from water tower mounted antennas within two small towns. Some distribution is available through fibre optic cable, partly by agreement with a cable television company. The infrastructure is owned by the respective commercial interests.

The advantage to South Stormont is that it has been spared having to invest its own capital to build the network. However, it has neither control over rates nor network topology, both of which are determined by market forces. Companies that are located at a distance from existing cable face installation surcharges for bringing fibre optic cable to them. Time will tell which model serves as the best choice.

Elsewhere in the region

Commercial interests have been left to develop the infrastructure on their own. At times, political representatives have had to intervene. One example is the Town of Hawkesbury where last year the hospital faced an unexpected crisis without high-speed. Outside intervention by the local MPP brought in a wireless company that resolved the problem. But where there is a weak business case, development falters. Both North Stormont and East Hawkesbury are largely agricultural, have several villages but no towns or industry of any size. Neither is likely to have much interest from commercial providers of broadband access in the near future.

Here then are two models. The first is the unusual enterprise of a rural community that took action out of concern for its future. The second is a commercial model that works reasonably well where there are acceptable returns but poorly where those returns are in doubt. For areas that are largely agricultural with widely dispersed populations, the best model is probably self-help where such enterprise still exists in the social psyche. For the rest, the achievement of a vision of uniform access to broadband services seems to require an intervention from a higher level of government.

As for a model of how a community-based not-for-profit organisation should organise itself for a project of this kind, we do not have an answer other than to watch your example very carefully.

4.3. CITY OF OTTAWA AGENCY-LED ACTIVITIES

OCRI

OCRI was started in 1983. OCRI was formed by the City to address issues for the Ottawa high tech community including things like telecom needs and applications in the entire community. OCRI members, the City and other funding sources provide the resources for the various initiatives underway at OCRI. Funded by an original TAP grant for community initiatives. Additional funding came from the Smart Communities initiative (Sm@rtCapital)(two communities in Ontario received funding). OCRI has been particularly successful in supporting the high tech community in Ottawa. They were used as the primary model for a similar group, Communitech, in Waterloo Region. Current staffing of approx. 130 people.

ORCnet

Chris Cope looks after the ORCnet (Ottawa Rural Communities network). ORCnet was formed to coordinate and create a demand for high-speed services in the rural area. They have hosted community meetings etc to make a business viable for wireless (or other) high-speed service providers. It has worked well in North Gower with 500 attendees at the community meeting and 120 or so signing up for Storm wireless services. It also drove Bell to provide DSL services in Richmond and they are considering doing similar things in other areas (like Osgood). The rural initiative (ORCnet) goal is to enable service providers to make a business case to justify provisioning in rural communities. It is focused on residential with the hope by the service provider that business customers will buy the service as well. To date, very few business customers have signed up. This is the initiative to facilitate broadband services throughout the rural/under/un services areas of the City. Initiatives that are underway include the community meetings etc that accumulate demand to get a service provider to go to a rural community (Storm in North Gower and Bell in Richmond and Metcalf, see below). There are some long-term funding issues with the ORCnet initiative because of a lack of long-term commitment by the City. Currently the City funds one staff member for 2 days a week at this work ($30,000 every 6 months) with no longer-term plan.

Appendix B
Research and
Technical Information

The ORCnet rural initiative:

North Gower Pilot, The Plan

1) It initially had two components:
   a. Organize the group, set up a governance structure for this group initiative and then do market analysis and basic business planning in proposed target communities.
   b. Do a pilot project (that was North Gower) with a local community champion. ORCnet would work with the service providers and other providers to get the service available.
   c. The service provider would have the service in place and ready to connect customers before any community meetings would be held. Storm, as a part of the pilot agreed that 12 – 15 residential customers and 3 – 5 commercial customers would be enough for them to provide service.
   d. The City had a tower available and a lease was arranged for Storm that was similar to other tower lease agreements in the area.
2) Planning and arrangements:
   a. A press person was hired to attract the press to the community meeting. ($3,000)
   b. Brochures were created and dropped at 6,000 mail drops (local champion assisting)
   c. Posters were put up in the community.
   d. Several ads were placed in local papers.
   e. Other than the media person, average budget for each open house has been $2,000 – 3,000. This was funded for the North Gower pilot project from Councilor Brooks' budget.
3) Results
   a. The open house expected approx 100 people. 500 arrived.
   b. Of those 500, 120 have signed with Storm initially and 30 more subsequently.
   c. Approx 50% of those who signed could be served because of line of sight and/or cost issues. Initial installation costs for Storm service were $400. This was not mentioned on the sign up sheet. The SOHO and teleworkers were about 50% of the customers signing up for service. The others were regular residential users.
   d. The customers using the service are a target group from the City's perspective. If people are working at home, there is less need for infrastructure expenditures (like roads) and many of these SOHO people may be starting viable businesses that could bring future employment etc to the area.
4) Other Communities since the Pilot
   a. Carp (600-800 people) and Kinburn (300-400 people) had a joint open house and now have Storm services in their area. Approx 200 attended their community meeting.
   b. Richmond now has Bell DSL service. Technical issues were not resolved before the Bell service offering causing some problems. Bell has about 170 DSL subscribers in Richmond. Rogers is planning to provide service in Richmond in the near future. Storm is a Bell DSL reseller and has about 30 customers through their service in Richmond.
   c. Metcalf has Bell DSL and Storm wireless service available. Not much promotion has been done there and they have had limited take rates.
   d. For the farm community there are approx 1200 farms in Ottawa. Mostly dairy with an average size of 600 acres.

   i. Only about 50% of the farms have a computer. Main use by farmers that was identified in a survey was for word processing.
   ii. Education will be key to getting the farm community demand for high speed services to increase.

5) What has been found to be critical for success in community initiatives:
   a. A local community champion who is willing to put in the efforts, knocking on doors, doing posters etc to make it happen on a local basis
   b. Involvement and support of the local councilor. Financially through some funding for open houses, physically through his/her presence and vocal support and at the City hall helping to cut through red tape and make it happen.
6) Comments on Success and Challenges
   a. Success in North Gower had a lot to do with the community size and the residential make-up with a significant amount of high tech.
   b. Challenges to the number of people to ultimate connect had a lot to do with the connection fee of $400 by Storm. Many people were unwilling to pay this fee when they saw Sympatico advertised with a very low install fee.
   c. City should put more permanent support in place for ORCnet (not the 2 days a week funding for one staff person that is currently temporarily in place). For this effort to succeed, more effort is required.
7) Lessons learned from the OCRInet experience:
   a. A network needs to be production oriented to achieve sustainability in the long term and
   b. A sustainable technology must be employed.
8) Moving forward:
   a. Education of the residents is critical. Many do not know what they would use a high speed connection for. Residents include small business in the rural communities and the farm community.
   b. Once people are educated, sales of high speed connections would rise (even in urban areas where "take rates" vary from 10 to 18% even though high speed is available to all).
   c. ORCnet's focus should be on:
      i. Marketing, promoting
      ii. Use of the network
      iii. Value of the services to the customers
      iv. Application development
      v. Aggregating demand has been shown to work and it should continue:
   d. Issues of the funding for ORCnet. There is no sustained funding commitment to keep the ORCnet initiatives in place. ORCnet funding from the City is currently about $60,000 per year but it is not committed future funding. OCRI staff feel this funding should be increased because the initiatives and coordination role of ORCnet is crucial to keep the rural initiatives going.
   e. On the negative side approximately 40% of the people wanting service could not get it because of line of sight issues.
      i. OCRI would like to try a test case/pilot of the Nokia technology with wireless devices that do not need to see the tower directly as long as they can see another device in the network. (Mesh technology)

f. In smaller communities Telecom Ottawa has become both an initiator and a barrier to success:
   i. Telecom Ottawa has been very successful in providing service for schools, libraries and municipal facilities.
   ii. These locations are often the "money makers" for the alternate service providers in smaller villages and hamlets. Once they are not available, the business case does not justify offering services for the residential customer base.
   iii. With a Telecom Ottawa broadband backbone service available to a small community, service providers have an opportunity to acquire a low cost connection through this link.

ORAN

The ORAN (Ottawa Regional Advanced Network) project is a new initiative set up to provide a vehicle for the MUSH group to have consolidated services and to connect them together through an advanced network. This connection will likely be at the ORION POP that is being installed at City Hall. Intention is that services will be kept simple (up to Layer 2 VLAN services only initially) with additional complex/value added services to come later as comfort and credibility are established. In the area of governance for this strategic plan, it was suggested that ORAN could provide an advisory function organizing the sector groups and facilitating the process.

ORAN background. Original plan was to implement a dark fibre local backbone network within Ottawa. Last mile connectivity would then be the only issue that would have to be resolved. Videotron submitted a proposal to provide the dark fibre. Videotron then underwent ownership changes and the offer was no longer available. Telecom Ottawa then proposed that they could provide all of the network needs for ORAN. This eliminated the network issues for ORAN and was at a reasonable cost. ORAN could then operate with one or two staff to deal with operational issues. Network issues would be dealt with by Telecom Ottawa. Claude Dufresne chairs ORAN at this time.

Sm@rtCapital Project

Sm@rtCapital was an OCRI initiative that received significant funding from the Smart Communities Program to develop applications and community services enabled through community access points funded by the federal Smart Communities Program.

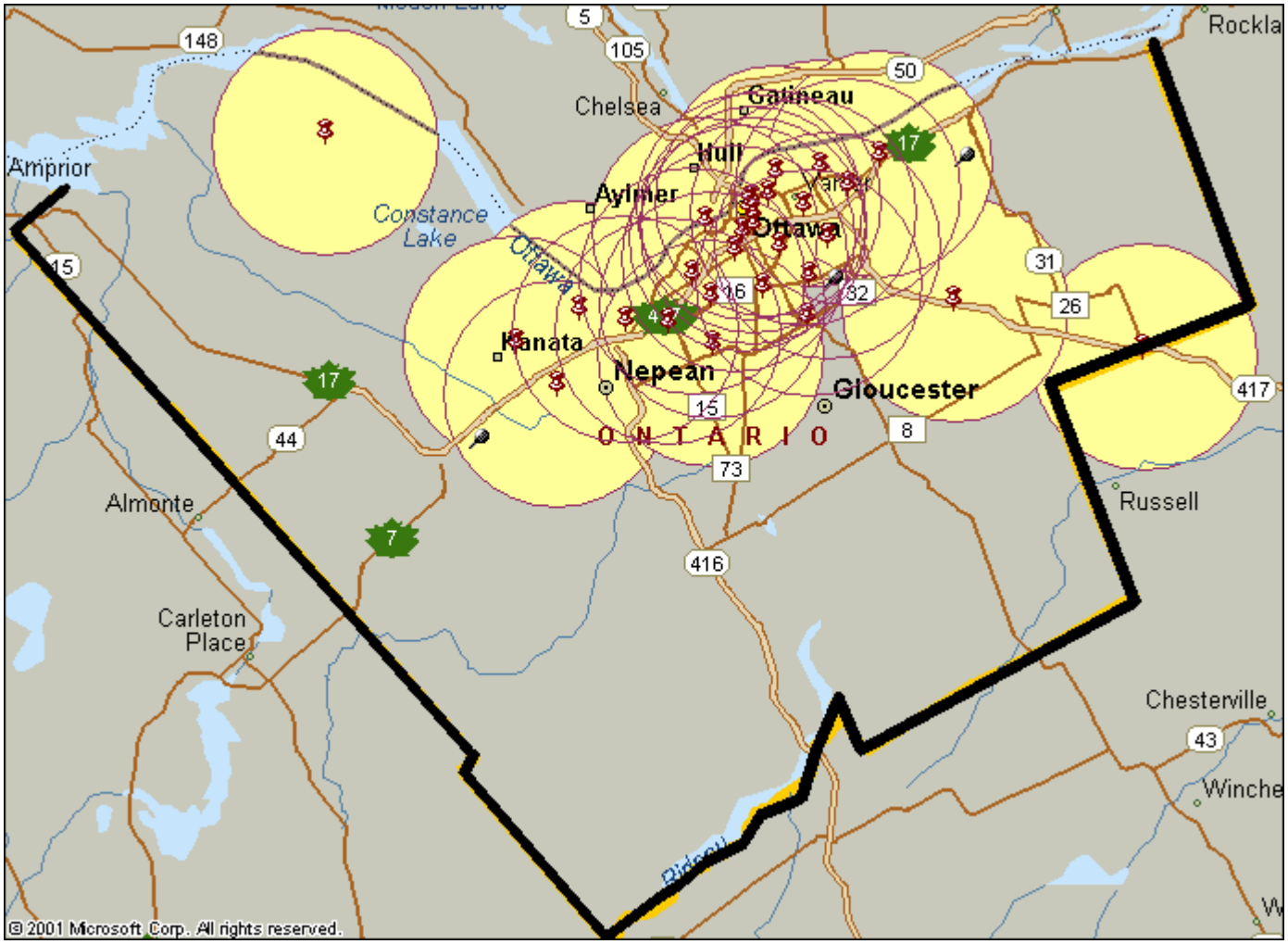
Among many other initiatives and services Sm@rtCapital is starting to develop applications and uses for community networks to benefit all community members; e-Government, e-Business, e-Commerce etc. It has 12 more months to accomplish its goals. E-democracy through applications being developed Video and webcasting are the main bandwidth drivers of this program. Smart Facilities such as having City Hall enabled in all (most) meeting rooms for video and/or webcasting capabilities and having Smart meetings where the meeting at City Hall or a remote site could be video conferenced with other locations avoiding travel issues and getting the democratic process out to the residents of Ottawa. The vision is to have a tool box of offerings available. Services such as Video conferencing, Video on

demand, Caching of information so residents can access it at their leisure would be enabled through this initiative. These services would be available for both internal staff use and for applications that meet a public need. A budget would allow for staff to pick and choose the services from the toolbox that they should use, allowing staff to prioritize their needs and the associated costs.

5. Telecom Carriers

5.1. Current Systems and Coverage[13]

Figure 10: Bell Mobility



[13] All map information about tower locations and coverage has been supplied by the City of Ottawa staff.

Figure 11: Rogers AT&T

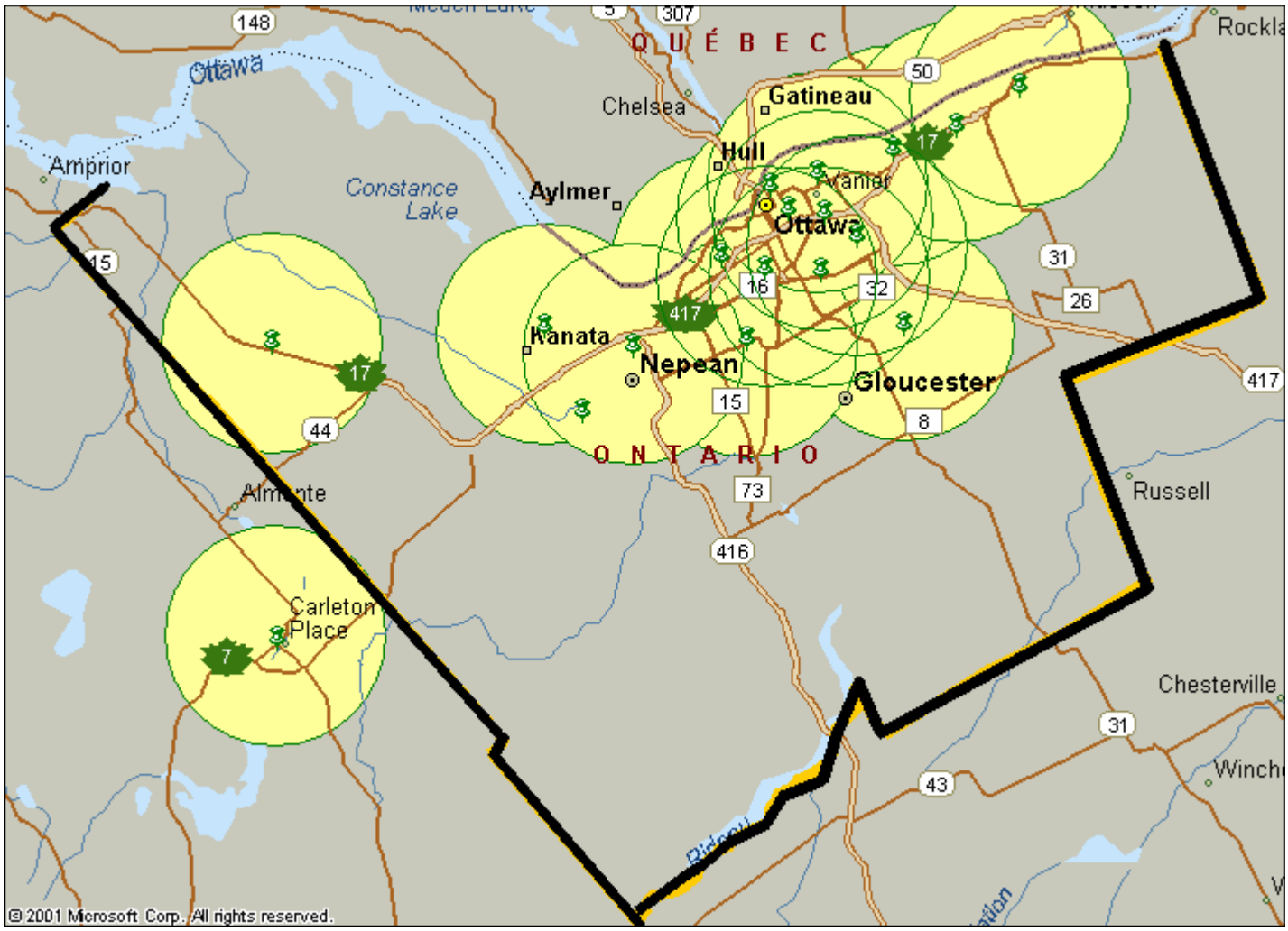


Figure 12: Telus Mobility

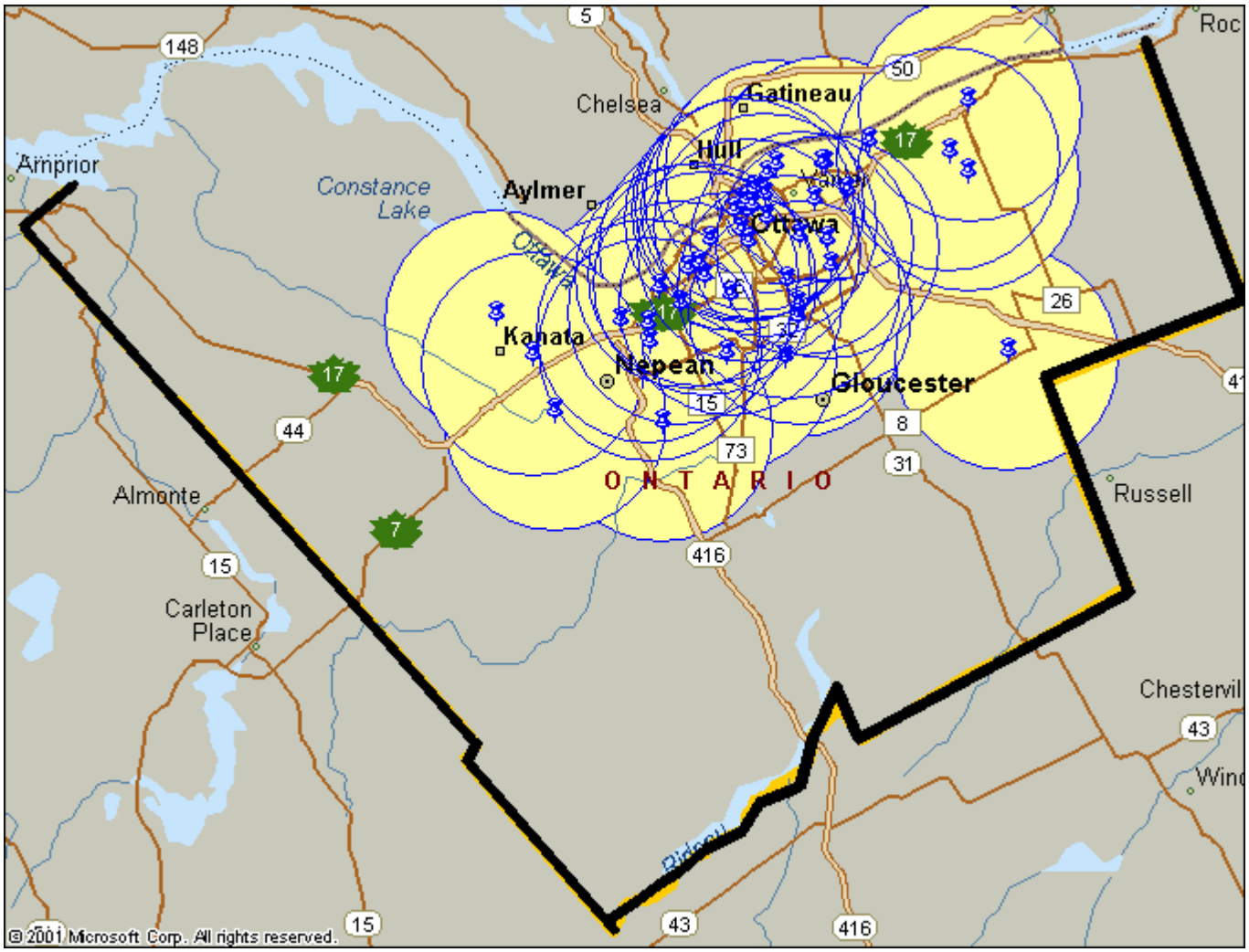


Figure 13: Microcell

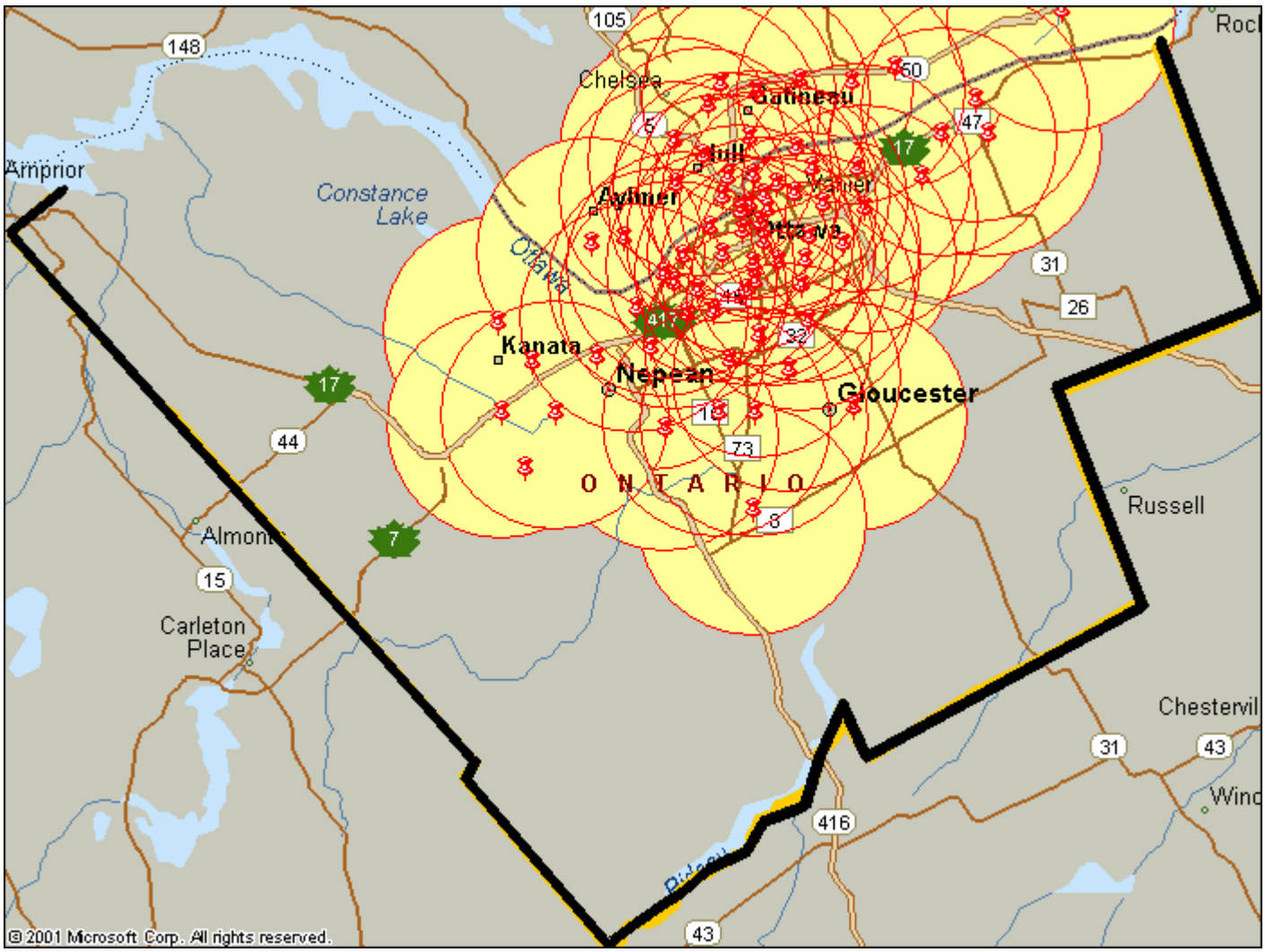


Figure 14: Overall map of coverage capabilities should all existing towers be used

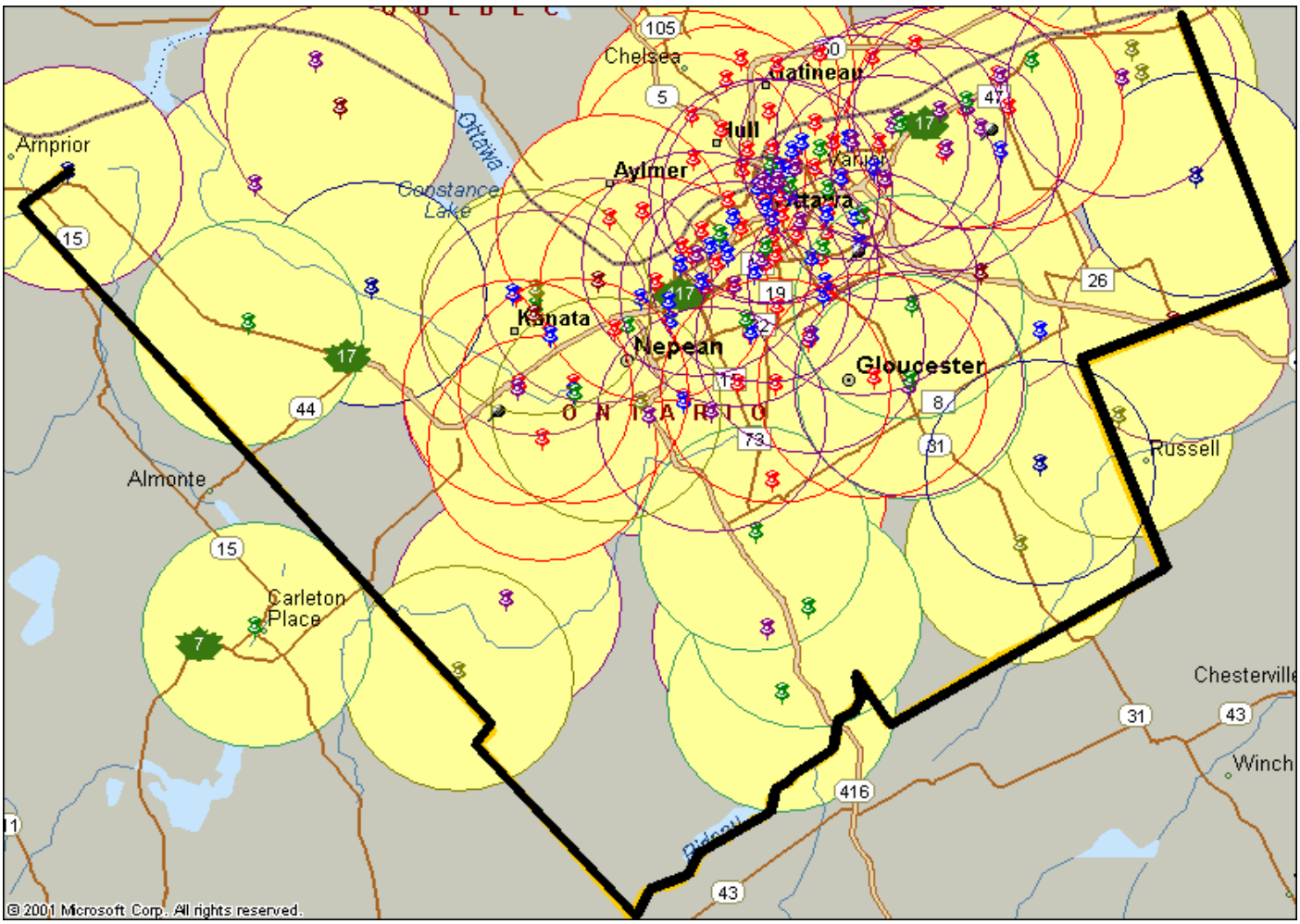
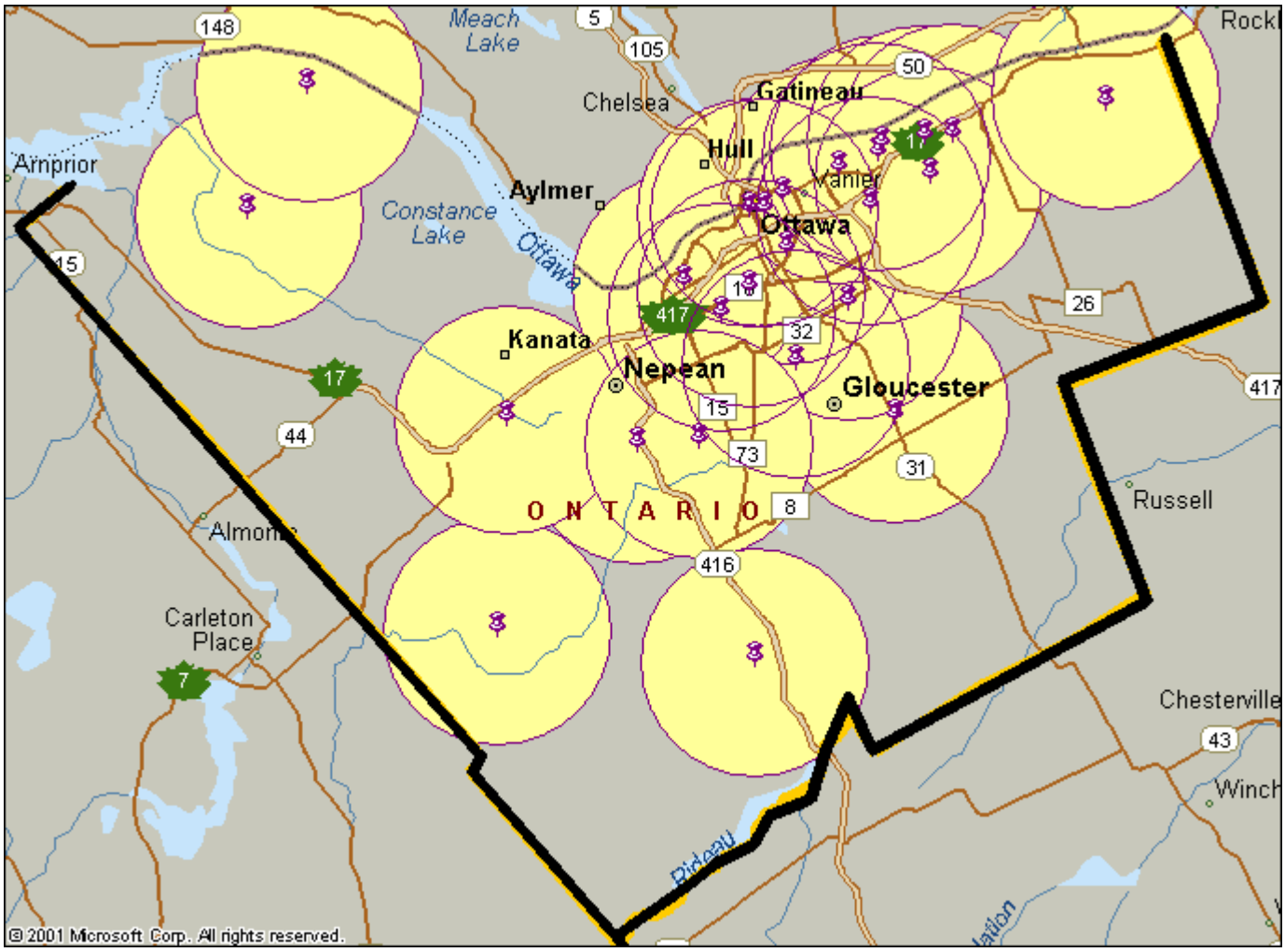


Figure 15: City Owned Towers



5.2. RESULTS OF SURVEY OF TELECOMMUNICATIONS FIRMS

The carriers interviewed fell into several categories. The respondents were as follows:

1 Incumbent Local Exchange Carrier
2 Cellular/Wireless Carriers
2 Cable Companies
1 Metropolitan Area Network Carrier
1 Wholesale/Carriers Carrier
2 Inter-Exchange Data/Long Distance Carrier
1 Wireless/DSL Internet Provider

There are several common themes that run through the various carriers responses. These are as follows:

1 Ottawa is not the easiest place for a carrier to do business. Ottawa appears to have a long approval process to get permits, etc. Of particular concern is the onerous task of getting approval for cabinets in "Green Spaces". There are claims that this is causing service introduction to be delayed.

Approvals take from 6-8 weeks. The carriers claim this is much longer than other municipalities.

One of the wireless carriers says that it is very difficult to get timely approval to get access to City infrastructure such as towers or rooftops.

2 Carriers provide service to rural areas, hamlets or villages only when there is a viable business case. The business case is generally influenced by the cost of connection to the rest of the network.

3 The incumbent carriers and cable companies are less likely to support a City sponsored Fibre To The Neighbourhood (FTTN) or Fibre To The Home (FTTH) initiative than the second tier carriers. The incumbents would rather provide the infrastructure themselves and the others would be allowed access to it under some unspecified terms and conditions.

4 Most carriers would like to see building codes amended to provide proper structures in new or renovated buildings. They would like to see mandatory common utility trenches and easements in sub-divisions. Developers could pre-install duct for future fibre and power for electronics. Especially, the quest to bring high-speed services to the residence means that electronics must be moved closer to the home. This means the City should revisit all restrictions on suitably landscaped cabinets.

5 Cellular carriers indicate they have joint us agreements in place today and where possible use each others towers. At least one indicated that towers are in the exclusive jurisdiction of the

Parliament of Canada as represented by the Minister of Industry. They recommend that the City use the Industry Canada "Client Procedure Circular" entitled Environmental Process, Radiofrequency Fields and Land-Use Consultation-CPC-2-0-03. This CPC summarizes the jurisdictional issue and provides a template for meaningful municipal participation as the supervising land-use authority.

6 The consensus of most of the carriers is that if the City wants service to the remote and rural areas then some sort of funding for providing service to an area that is not cost compensatory will be necessary.

7 The incumbent carriers and cable companies insist that their services are adequate today and will be upgraded as the requirement of the consumer changes. Technology is advancing and new technology will be deployed, as the consumer needs more bandwidth. Both Bell Canada and Rogers Cable feel that their services are adequate today.

8 One Inter-exchange carrier indicated that the best way for the City to foster more connectivity in the City is to give that carrier some of its business. That would cause more investment in that carrier's infrastructure in the City.

Conclusions from Carrier Surveys

The challenge that Ottawa is facing to get universal access to Broadband services for all of its citizens is an issue being faced by all the service providers. Their deployment of broadband is driven by the economics of each capital build. They do not see their mandate as being universal service in the high-speed arena. This approach will mean that the traditional service providers will not reach all homes in Ottawa in the foreseeable future unless they adopt non-traditional approaches to serve these areas.

The second or third tier of service providers, such as wireless providers, will serve more of the fringe areas than the first tier will, however, unless there is some intervention from the municipality to provide universal access still not all homes will have service.

Other services such as 2-way DTH satellite service is currently available in Canada and can be deployed in the rural area. This service has a price of $139.95 per month and significant hardware and installation fees. The monthly service fee is 3 times the price of a DSL or Cable modem connection.

5.3. FUTUREWAY

Futureway Communications Inc. is a facilities-based provider of voice, high-speed data, and video services to both commercial and residential customers. Futureway delivers digital telephone, high-speed Internet access and digital telephone over an up-to-date fibre optic network. Futureway is a fully certified Competitive Local Exchange Carrier (CLEC). The Futureway model is to primarily provide service to subdivisions that their major shareholders control.

Appendix B
Research and
Technical Information

Futureway provides services to residential and commercial customers in Peel Region and in York Region. In addition, Futureway has commercial customers in Toronto. Futureway works closely with developers, installing fibre to the homes in new developments. In some cases, Futureway is the sole supplier of services in a development. In other cases, Futureway shares the trenches with Bell and/or Rogers.

During discussions at Futureway, senior management of the company pointed out that, in order to be successful, a critical mass in population and a high rate of economic growth are essential. The management at Futureway does not believe that the Ottawa area has such a critical mass and rate of growth. Further, management indicated that if they were approached to enter the Ottawa market, Futureway would not do it.

Senior management at Futureway were very negative toward the concept of a third party building facilities with the intent to provide infrastructure to be used by the incumbent ILEC or Cable company. Futureway management believe that the incumbents feel it is critical that they control their own destiny and are not ready to share the last mile.

6. Future Requirements

6.1. Demand for Broadband Services

A key issue into the future is how much bandwidth will be required in 5 years. This is necessary to understand if the technologies that are being deployed will suffice for the future or will the City still be looking for carriers and service providers to fill the new need of the constituents.

The following table shows estimates of required bandwidth derived from various industry sources that summarizes this need by major market segment.

Table 2: Future Bandwidth Requirements

User Type	**Bandwidth Required Now**	**Bandwidth Required 5 Years**
Hospitals	1000 Mbps	10000 Mbps
Universities	1000 Mbps	10000 Mbps
Schools	100 Mbps	1000 Mbps
Municipal	100 Mbps	1000 Mbps
Government	100 Mbps	1000 Mbps
Multi-Campus Enterprise	100 Mbps	1000 Mbps
Small, Medium Enterprise	10Mbps	100Mbps
Residential-SOHO	1 Mbps	10 Mbps
Residential-Personal	1 Mbps	10 Mbps

As shown in this chart demand for bandwidth is expected to be 10 times what it is today to be able to employ the applications users will be using 5 years from now.

6.2. THE OTTAWA MARKET FOR BROADBAND SERVICES

The total Canadian residential market for broadband Internet has been growing at one of the highest rates in the world. Canada ranks 4th in the world for broadband penetration.

The total number of households[14] and Internet penetration in Canada is shown in the following table. Ottawa has the highest Internet penetration of total population of all of the major centres in Canada at 65.2%. For comparison in 2000, Toronto had 57.9% and Montreal had 46.6%

Table 3: Internet User Statistics

	2001	**2000**	**1999**
Total No. of Households (000's) in Canada	11,842	11,699	11,553
Total Households In Ottawa	310,132	305,000 (est)	NA
Total Internet Households in Canada	60.2%	51.3%	41.8%
Total Internet Households In Ontario	63.7%	54.2%	44.5%
Total Internet Households in Ottawa	NA	65.2%	56.7%
Total Internet Users in Ottawa			

Broadband penetration in the total Canadian market is reported by Kinetic Strategies is shown in the following table.

Table 4: Canadian Broadband Penetration

	2001	**2000**
Cable	1,596,800	935,000
DSL	1,145,600	455,000
Total	**2,742,400**	**1,390,000**

We have not been able to obtain the total number of broadband subscribers in the City of Ottawa.

On September 13 2002, eMarketer estimated that 14.9 million individuals currently use the Internet in Canada. According to their new forecast, the number of Internet users in the country will grow at a compound annual growth rate of 13.9 percent through 2004. eMarketer estimates that the Canadian Internet user population will reach 17,8 million by 2003 and 21.4 million by 2004.

On Sep 04 2002 a report by Point Topic suggested that the market for residential broadband may be limited to around 60 percent of households. This is corroborated by the experience in South Korea, which currently has the highest broadband penetration rate in the world. This market indicates that once a region's broadband penetration rate comes close to 60 percent, then it is unlikely to climb much further. South Korea is far ahead of other countries in terms of the take-up of DSL per 100 population. But South Korea's growth in DSL and cable modem installations is now beginning to slow down.

[14] Households includes apartments.

Statistics Canada indicated that in the total Canadian market, more than 8 million households, or about two-thirds of the total, contained someone in 2001 who had used the Internet at some time in their life from one location or another, either from home, work, school or a library.

Of these households, 7.2 million had at least one member who used the Internet regularly. This group represented 60% of all 12 million households, up from 51% in 2000.

In 2001, more than 5.8 million, 49% of all households had at least one member that **regularly** used the Internet from home, an increase of 1.1 million from the previous year. This was somewhat less than the gain of 1.4 million between 1999 and 2000.

Stats Can reported that an estimated 2.2 million households spent almost $2 billion shopping on the Internet in 2001, according to the electronic commerce component of the Household Internet Use Survey. These households placed 13.4 million orders over the Internet from various locations. This was up significantly from 2000 when 1.5 million households spent $1.5 billion.

Forrester Research reports that US e-commerce services market is expected to reach 64.8 billion in 2003.

Table 5: Broadband Cable Modem Users

	2000	**2001**	**Year over year growth percentage**
DEPLOYMENT	000's	000's	
Homes With Access to Internet By Cable			
Large Communities	6,567.7	7,529.6	14.7
Medium-sized Communities	898.9	1,512.1	68.2
Small Communities	143.1	363.4	253.9
Total	**7,609.7**	**9,405.1**	**23.6**
Penetration (adoption)	000's	000's	
Subscribers to Internet by Cable			
Large Communities	696.2	1,174.7	68.7
Medium-sized Communities	80.1	178.3	222.6
Small Communities	10.1	37.4	370.3
Total	786.4	1,390.4	176.8

The above indicates that the cable industry has been aggressively building service into smaller communities. However, in discussions with Rogers, it was stated that they have no specific plans in the near future to build into any of the villages and hamlets in their operating territory in Ottawa.

Appendix B
Research and
Technical Information

Persona Communications has recently purchased the cable system in Constance Bay. They are performing an audit of that system now with the intent of offering cable Internet service

The situation in the City today is that over 90% of the 310,132 households has high-speed Internet service available from Rogers and/or Bell Canada according to coverage information supplied by Rogers and Bell Canada. Ottawa had 65.2% of its households with access to the Internet in 2000. In 2001, it is probable that has increased to at least 70%. If the Korean peak penetration level of high-speed services of 60% of total Internet accesses is true for the Ottawa market, one could expect that the market will peak at 186,000 high-speed residential users. The rest of the households that require Internet will by economic choice use dialup access.

The problem is that the users that want and need high-speed access will be concentrated in those neighbourhoods and areas that have the necessary financial wherewithal to purchase high-speed services. This will include neighbourhoods across the rural landscape of the City.

The City is forecast to grow from a population of 743,00 in 1996 to 1,045,000 in 2011. The rural growth is forecast to grow from 74,662 population to 105,920 in 2011. The technologies that will address the rural market will be cable modems to some, xDSL to some and wireless and 2-way satellite to the rest.

6.3. GROWTH IN THE CITY

The following table presents projected growth rates for the sub-areas of the city as prepared by city staff.

Table 6: Ottawa Population Projections

City of Ottawa, Projection B, Total Population, 1996-2011

	Total Population				Compound Annual Growth Rates			
	1996	2001	2006	2011	1996-2000	2001-2005	2006-2010	2001-2011
Central Area	6,200	6,500	8,550	11,000	0.95%	5.64%	5.17%	5.40%
Inner Area	79,100	80,600	85,200	90,700	0.38%	1.12%	1.26%	1.19%
Ottawa West	38,800	38,400	40,000	42,400	-0.21%	0.82%	1.17%	1.00%
Bayshore	38,600	38,600	39,800	41,600	0.00%	0.61%	0.89%	0.75%
Ottawa East	52,300	51,400	53,200	55,800	-0.35%	0.69%	0.96%	0.82%
Beacon Hill	30,650	32,100	36,200	41,100	0.93%	2.43%	2.57%	2.50%
Alta Vista	74,300	73,100	74,600	76,900	-0.33%	0.41%	0.61%	0.51%
Hunt Club	58,900	61,900	67,100	73,400	1.00%	1.63%	1.81%	1.72%
Merivale	72,400	72,100	74,300	77,600	-0.08%	0.60%	0.87%	0.74%
Cedarview	49,000	48,000	49,200	50,700	-0.41%	0.50%	0.60%	0.55%
WUC	47,000	60,000	87,400	118,700	5.01%	7.81%	6.31%	7.06%
Stittsville	11,450	15,950	21,050	26,700	6.85%	5.71%	4.87%	5.29%
SUC-W	29,450	41,400	64,000	87,700	7.05%	9.10%	6.50%	7.80%
SUC-E	650	4,600	16,650	28,950	47.90%	29.34%	11.70%	20.20%
Leitrim	0	0	2,500	7,750			25.39%	
EUC	80,700	88,300	102,500	116,200	1.82%	3.03%	2.54%	2.78%
Rural - NE	10,750	11,450	12,500	13,850	1.27%	1.77%	2.07%	1.92%
Rural - SE	19,600	21,100	24,200	27,450	1.49%	2.78%	2.55%	2.67%
Rural - NW	19,450	20,800	23,600	26,750	1.35%	2.56%	2.54%	2.55%
Rural - SW	22,950	24,050	26,400	29,700	0.94%	1.88%	2.38%	2.13%
Total	742,250	790,350	908,950	1,044,950	1.26%	2.84%	2.83%	2.83%

Inspection of the above table generates the following points:

1. Overall for the City of Ottawa, the Compound Annual Growth Rate, (CAGR), for the period 1996-2000 was 1.26%. This is expected to more than double to 2.83% for the period 2001 to 2011.
2. The Sub-area SUC-E is projected to have the highest growth at 20.20%.
3. The Central Area is expected to enjoy healthy growth at 5.40%