
Appendix 2: Summary Description of Innovative Bandwidth Initiatives

Table 1: Summary Description of Innovative Bandwidth Initiatives

INITIATIVE	BRIEF DESCRIPTION	DISTINGUISHING FEATURES
<p>Alberta SuperNet, Alberta, Canada</p>	<p style="text-align: center;"><i>CANADA</i></p> <p>During 2000, the Government of Alberta determined the outcome of an RFP calling for a strategic alliance with a consortium to achieve a full range of cost-effective high-speed telecommunications network service options across Alberta. The initial term of the alliance would be for five years with the option to extend for up to another five years.</p> <p>Innovative proposals were sought that could include the government telecommunications business as anchor tenant plus a possible one-time capital investment by the Government of Alberta. Specific three-year targets for providing ‘reasonably priced’ high-speed Internet access throughout the province included 10 Mb/s or greater bandwidth to individual learning institutions and health facilities, 100 Mb/s or greater bandwidth to all school board and regional health head office locations, plus means for connecting the LANs of such sites into wide area networks or WANs for no initial cost of cabling to users.</p>	<ul style="list-style-type: none"> • A public/private partnership, with the government investing in the deployment of fibre in specific rural and remote areas considered uneconomic by carriers. • Government network ownership to be vested in an arms length, not-for-profit body. • A whole-of-province initiative led by the government under the banner of economic development. • Of close to 4,500 government entities to be served by SuperNet, about 2,500 are of an educational nature and comprise the largest component of government telecommunications traffic. • To employ ‘condominium’ fibre that is to be accessed by private sector carriers on an open access basis. • Almost all schools to gain fibre to their front door, with a few in the more remote areas possibly served by radio. • Rural high-speed charges to be comparable to urban charges.

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<p>Canadian National Broadband Task Force</p>	<p>In announcing a national commitment to achieving the goal of high-speed broadband access to all communities by 2004, the Canadian government established a National Bandwidth Taskforce in October 2000. Its mandate included consideration of:</p> <p>Communities unlikely to access private sector-delivered high-speed services by 2004;</p> <p>Barriers which could delay provision of such services by the private sector;</p> <p>Roles of governments in overcoming these barriers.</p> <p>The Task Force report 'The New National Dream: Networking the Nation for Broadband Access' was tabled on 18 June 2001. Although it's scope extends far beyond the matter of the provision of broadband to educational institutions, the following conclusions are relevant in that context:</p> <p>'Broadband' should be defined as a high-capacity, two-way (i.e. symmetrical) link between an end user and access network suppliers capable of supporting full-motion, interactive video applications.</p>	<ul style="list-style-type: none"> • At least government agencies will attract charges that are postalised, i.e. made distance independent. • All charges for schools and government agencies, regardless of location, will be heavily subsidised to levels below that for business and private users. • Quite detailed information can be drawn from submissions, consultancy reports and progress reports of various sub-groups. • Current ADSL or Cable Modem technologies are unable to meet future needs for high-speed service delivery in any context. • Dark fibre builds, generally by communities, are less likely to proceed beyond more populated areas. • As broadband delivery becomes a commodity, competition will move to that of content. • There is clear identification of instances of market failure in sparsely populated areas. • Community ownership of new broadband networks through not-for-profit cooperatives may be an answer to address strategic needs in areas of market failure. • In rural and remote areas, wireless provides the most scalable and affordable access technology, with licensed wireless providing higher bandwidth potential than unlicensed, though unlicensed is of lower cost.

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<p>Commission Scolaire des Affluents, Quebec, Canada</p>	<p>By 2004, broadband facilities and services should be deployed to and within all Canadian communities and thus be made available to all businesses and households as well as public institutions, regardless of location.</p> <p>The school board of des Affluents was recently formed from merging the two school boards of des Manoirs and le Gardeur. The amalgamated board administers 75 education centres housed in 70 buildings, encompassing 54 primary, 15 secondary, 2 adult, 2 professional schools and 2 administrative centres. In all, there are some 3000 PCs of which 80 per cent are used for teaching purposes. CS des Affluents serves 40,000 students across 10 municipalities. The area is on the mainland immediately north of the island city of Montreal.</p> <p>Problems with the provision of telecommunication services to the merged school board were solved by creation of a dark fibre network via an innovative partnership involving a local carrier, QuebecTel, and an engineering consultancy firm, IMS Experts-Conseils.</p> <p>Groupe Secor, a firm of economists in Montreal, was commissioned by Industry Canada to undertake a post implementation review of this dark fibre network.</p> <p>Affluents had to overcome the objections of other telecommunications companies, and these were eventually settled by formal decisions of an administrative tribunal of the CRTC.</p>	<ul style="list-style-type: none"> • The technical requirement is to support video, voice and data including distributed video transmission. Above all the one network had to support rapidly increasing throughput. • The only viable economic solution was that of Fast-Ethernet on optical fibre. Network installation and management costs are shared with three partners, viz. the municipalities of Terrebonne and Repentigny, plus a post-secondary college. QuebecTel, a CRTC-approved carrier, technically owns the fibre cable. • The combined school board committed CDN\$1.5 million to network capital and \$1.3 million in operating costs; it now controls via an IRU 179 km of fibre (six strands) linking 70 school sites, with 20 per cent underground and 80 per cent installed on power poles. • LAN access within each school is to Ethernet 10Base-T standard, reticulated via twisted copper pairs with a capacity of 10 Mb/s. The schools are linked by fibre operating under Ethernet 100Base-F standard with a capacity of 100 Mb/s and connected to two administration centres. These centres then connect to the Internet via a 1

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Peel Region Public Sector Network (PSN), Ontario, Canada	<p>(The Canadian Radio-television and Telecommunications Commission or CRTC is the appropriate regulatory agency for the telecommunications services involved.)</p> <p>(An Indefeasible Right of Use or IRU is a legal agreement between the dark fibre partners and the responsible carrier that provides the partners between 10 and 20, or more, years of sole access to prescribed fibre strands.)</p> <p>The Region of Peel is a higher level of local government that administers the provision of arterial roads, police and water. It incorporates the Cities of Brampton, Mississauga and the Town of Caledon – with a combined population of just under 1 million. The region is immediately to the west of Toronto. The Public Sector Network or PSN was built from 1993 to reduce communication costs, improve service offerings and meet the needs of public sector agencies within the Region. It comprises some 200 route km of municipally owned dark fibre with a 96-strand backbone and smaller rings, structured for redundancy. Almost all of the fibre is</p>	<p>Gb/s (1000 Mb/s) capacity link.</p> <ul style="list-style-type: none"> • The economic analysis was based on the following assumptions: <ul style="list-style-type: none"> – Costs are shared four ways; – LANs within schools are pre-existing and sunk costs; – Eight of the 40 LAN technician positions were saved; – Based upon carrier offerings, the best available alternative technology considered was ADSL, however the cost benefit analysis also scoped a ‘wait and switch’ alternative strategy. – A fibre optic solution was found to have an absolute benefit advantage over ADSL and breaks even after 44 months. Thereafter the massively under-used capacity of the fibre is fully paid for! • The prime justification for creating the PSN was cost avoidance: more than CDN\$2 million is being saved annually, based on current leasing charges and current traffic levels. • The payback period is about three years, and even greater economies of scale are expected as the network grows with more sites and more partners. • Savings not originally envisaged have come from the consolidation of file servers.

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<ul style="list-style-type: none"> UNITED STATES 	<p>strung above ground on power poles of the 'hydro' utility that in turn is owned by the municipality. Each partner to the PSN constructs its portion, retains ownership of what it builds and must grant access (via separate control of fibre strands) to all other partners and subscribers. The PSN is not a cooperative but critically relies on close cooperation between all involved. Private sector clients are specifically not served although some non-profit organisations are connected.</p> <p>District School Boards and Colleges are close to settling the terms of their connection into the PSN, involving over 250 additional sites. Many schools are currently connected by wireless networks.</p>	<ul style="list-style-type: none"> The partners have no philosophical objection to private sector ownership/service provision provided the economic goals could be met (but which would be unlikely). In retrospect, the PSN only came about because the partners trusted each other – there is really no legal entity as such; the philosophy was “Build it once for the benefit The main drawback for the school boards to join the PSN is the necessity for them to outlay scarce capital funds to install new fibre to each school site (which becomes a greater problem with elementary schools which are generally located deep within residential areas, whereas high schools are typically near arterial roads and so more easily served).
<p>Connecting Minnesota/State Education Network, Minnesota, USA</p>	<p>Initiated by the State government, Connecting Minnesota (CM) was planned as a public/private partnership to create a new fibre optic backbone network throughout most of the State for government, education and small business use. Part construction of conduit and fibre was completed by Denver-based ICS/UCN between East Grand Forks and Minneapolis/St Paul but thereafter the initiative was terminated due to intense lobbying and legal action by incumbent carriers, plus uncertainty from a FCC ruling. CM was to serve, in part, some 1400 public schools that are controlled by 430 independent school districts.</p>	<ul style="list-style-type: none"> The fibre network was to provide a new statewide high-speed backbone capability that was not otherwise available at an affordable cost from the incumbent long-distance carriers; nevertheless the initiative did not address the matter of access tails that were still the province of monopoly control by local exchange carriers. By granting exclusive access to the State's interstate freeway rights of way yet without spending it's own money, the State was to receive: <ul style="list-style-type: none"> 20 per cent of the initial network capacity;

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<p>Greater Austin Area Telecommunications Network (GAATN), Texas, USA</p>	<p>The Minnesota Integrated Network has now been created via a Joint Powers Agreement or JPA between the state government, colleges and universities for the purpose of leveraged purchasing and shared operation of a high-speed network private to those parties. Though K-12 schools are not part of the JPA, some 80 districts are now buying discounted capacity.</p> <p>Notwithstanding the Minnesota Integrated Network, the State Department of Administration is still keen to avoid payments to carriers for leasing transmission lines. In contrast with the original whole-of-state approach, a CM 'version 2' is now being conceived by means of a series of RFPs addressing individual network segments that retain the option of the state obtaining access to dark fibre.</p> <p>The Austin Independent School District (AISD) were the originators of GAATN; subsequent partners were the City of Austin, Travis County, the State of Texas, the University of Texas; Community Colleges & the Lower Colorado River Authority. (Note: 'independent' schools are state or public schools.)</p> <p>The City, through its municipal utility (Austin Energy) granted rights-of-way to AISD and in lieu of payment, 12 optical fibre strands were given to the City. Subsequently 10 fibre rings eventuated, separately owned by various partners and all</p>	<p>DISTINGUISHING FEATURES</p> <ul style="list-style-type: none"> – 20 per cent of any future additions; – 20 per cent off the best customer rate for any capacity required beyond the initial 20 per cent; plus – 10 dark fibres to use for public service telecommunications. <ul style="list-style-type: none"> • Through buying bulk transmission capacity from the open market and operating its own switches, the JPA has instead demonstrated its effectiveness by delivering bandwidth capacity to its partners at one-eighth of the previous prices; future price falls are expected to be even more significant. • Despite the above achievements, no affordable solution has yet been found to address the need for high-speed access tails to schools; wireless means are now being explored. • Through trading its utility pole franchise rights, the City became the catalyst for the creation of an extensive multi-owner optical fibre network; control of the franchise rights were the unique strategic advantage exploited and are lost once such utilities are privatised. • GAATN is constituted under the State of Texas Interlocal & Cooperation Act that facilitates collective purchasing between governmental agencies. Private schools are therefore excluded under this arrangement; furthermore GAATN serves public librarians but not library patrons! • One entity acts as the managing partner but each fibre

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Iowa Communications Network (ICN), Iowa, USA	<p>interconnected. A total of 275 sites are involved, extending over 800 miles in route length.</p> <p>The AISD network involves 36 fibre strands connecting 110 campuses with 80,000 students and 10,000 staff; each site being served by 4 x 155 Mb/s transmission capacity. In practice, the 100 campuses are connected to just 11 'server farms'.</p> <p>Video services to schools (apart from two broadcast channels operated by AISD via cable television) include 2-way point-to-multipoint video, videoconferencing and fully interactive or on-demand video (about to be introduced).</p> <p>Out of 51 states, Iowa ranks as the fifth most rural. Established in 1993/94, ICN is a state-managed and operated fibre optic network that connects government, education and medical facilities with high bandwidth transmission services. The network extends over 4,800 km and terminates with fibre at each user site. The operations and main switching centre for ICN is located below the headquarters of the state National Guard. Authorised users include all accredited K-12 school districts and private schools, all accredited public and private colleges and technical educational institutions, state agencies, federal agencies, the Iowa National Guard, US post offices, public libraries and hospitals and physician clinics (which are private and so are not provided with voice services via ICN). ICN is now legally regarded as a carrier. However, it does not serve businesses or residential customers.</p>	<p>strand is owned and fully controlled by one of the partners. In effect, the separate fibre networks merely share a common cable sheath.</p> <ul style="list-style-type: none"> • AISD borrowed much of the capital expenditure from a finance company arranged by the incumbent Texas carrier at the time, SW Bell. Building LANs were funded through municipal bonds. All operational services are out-sourced. • For AISD, whilst the initial driver was that of cost saving, the potential for application functionality is now the key opportunity to be exploited; nevertheless teachers have been slow to accept the new technology. • AISD has no system for charging costs back to users. • The State of Iowa became the owner and administrator of the ICN following a Request For Proposal exercise that was boycotted by the incumbent carriers. • Contrary to usual North American practice, the fibre cable is almost totally buried in the ground for improved security. However, ICN fibre terminates at each school district (and typically at every high school) but not individual schools other than high schools; high-speed access connections are the responsibility of school districts – some employ fibre, others wireless links. • Over each of the last four years, the ICN has achieved a 25 per cent rate of return on the gross investment by the state government and therefore the state has totally recovered its

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Spokane E-MAN, Washington, USA.	<p data-bbox="521 371 1104 403">http://www.icn.state.ia.us/about/story/story.htm</p> <p data-bbox="521 427 1294 592">The hallmark service provided by ICN is that full-motion bi-directional interactive video available to over 705 sites (primarily schools), as well as a mix of full-motion and on-demand compressed video to more than 85 sites for telemedicine application.</p> <p data-bbox="521 616 1319 783">Iowa Public Television is responsible for distance learning applications, coordination of educational activities and second-line technical assistance of interactive video. Local and regional bodies provide and maintain local access and the LANs, and manage local video scheduling.</p> <p data-bbox="521 818 1319 1118">Spokane School District 81, in association with 12 other education agencies in the area (including college and university campuses), issued an RFP in 1998 for the construction of an educational metropolitan area network or E-MAN. The outcome was to lease dark optical fibre from the local electricity utility, Avista Corporation, a subsidiary of Washington Water Power and construct what was then claimed to be the first major application of extended-distance Gigabit Ethernet technology into an integrated services MAN.</p> <p data-bbox="521 1142 1319 1310">By 1999, 54 buildings and 32,000 students within the school district were connected by 65 route miles of backbone fibre plus 105 route miles of distribution fibre to provide a mix of voice over IP, data and Internet services. The whole deployment was completed in 12 months.</p>	<p data-bbox="1451 371 1805 403">investment in that time alone.</p> <ul data-bbox="1406 427 2145 1358" style="list-style-type: none"> <li data-bbox="1406 427 2145 491">• Rates charged to users are postalised and by law only recover operational expenses. <li data-bbox="1406 515 2145 608">• The network has enabled Iowa to become a leader within the US in applying distance learning, telemedicine and telejustice. <li data-bbox="1406 632 2145 791">• ICN now claims to be an important tool in causing private sector telecommunications providers to invest in advanced services for Iowa. Specifically, the network is commonly used as an R&D test bed for advanced services from equipment and service providers across the US. <li data-bbox="1406 815 2145 951">• The six-strand dark fibre network is leased for 15 years from the local privately-owned power utility and maintained by their skilled staff; five separate fibre rings are deployed. <li data-bbox="1406 975 2145 1038">• Capital finance came from a Facilities Improvement Bond (US\$3M) and the federal E-Rate (US\$1.5M). <li data-bbox="1406 1062 2145 1222">• The initiative was driven by a need for more cost-effective telecommunications services, particularly in view of the rapidly increasing demand for data, Internet and voice services, not to mention the new requirement for video service delivery. <li data-bbox="1406 1246 2145 1310">• For the first time, a telephone has been provided in every classroom and conference room. <li data-bbox="1406 1334 2145 1358">• A significant element was to rewire every classroom for

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Tacoma Institutional Network (I-Net) & School District 10, Washington, USA.	<p>Dark fibre separation between the individual educational agencies provided for administrative advantage yet they are designed to come together over the common MAN backbone.</p> <p>Tacoma School District 10 is just about to commission a Gigabit Ethernet wide area network operating on dark fibre provided by the municipally owned Institutional Network or I-Net. Each of the 75 schools or offices is also served by a hybrid fibre coaxial or HFC network for purely video-related applications. (This access to the I-Net was granted as a community service, there being no specific relationship between the schools and the city government.)</p> <p>Operated by the City of Tacoma, the I-Net consists of both a fibre network (which, with the exception of the schools, offers only managed services) and a bi-directional HFC network. These networks were created under a franchise agreement between the City and <i>Click! Network</i>, although paid for by the City at a cost of about US\$1.4 million. <i>Click! Network</i> is a commercial data and cable television operator that is a business unit of the Tacoma power utility, itself owned by the City.</p> <p>Other I-Net clients include community and technical colleges, the housing authority, police, fire and City Hall.</p>	<p>the additional power loading service and a 10/100 switched Ethernet capability.</p> <ul style="list-style-type: none"> • Creation of the I-Net was greatly aided by the City being owner of the power utility, which in turn created the <i>Click! Network</i> that was to build the Institutional Network. Most of the fibre is installed on power poles. • The School District has exclusive access to 12 dark fibres as it specifically refused to accept managed services from I-Net. The annual fee paid to the City for use of these fibres is only US\$50,000; local access connection of fibre to each school ('the last ¼ mile') was a one-time charge totalling US\$400,000, paid for from bond funds. • School buildings were re-wired and LANs installed or upgraded, with 100 Mb/s capacity to each classroom, paid for from E-Rate funds. • Compared to the previous leased line charges from the incumbent carrier for one to two T-1 (1.5 Mb/s) services per school, annual savings are expected of the order of US\$0.5 million. The schools will still qualify for federal E-Rate subsidies. • The School District WAN initially supports the present data, voice and video H.320 service requirements as well as future packetised video H.323 services.

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<p>Stokab & Stockholm Schools, Sweden</p>	<p style="text-align: center;">SWEDEN</p> <p>Fully municipally-owned (91 per cent City of Stockholm, 9 per cent County Council of Stockholm), Stokab provides a open access dark fibre optic network which all private carriers are now to utilise within Stockholm and surrounding region, in addition to managed services for the municipal or public agencies. The impetus for this initiative was to reduce the impact of ongoing civil construction in the streets of Stockholm, as well as to promote Stockholm and surrounding region as a haven for ‘new economy’ developments. Over 450,000 km of fibre is now deployed.</p> <p>The vice chairman of Stokab also heads the Swedish Urban Network Association or SSNf – a non-profit group of organisations and companies who cooperate on, among other things, matters such as principles for pricing models and standardised agreements.</p> <p>A major public user of the Stokab dark fibre is that of Stockholm’s 174 schools, each served by two fibre pairs (one for administration, the other for student traffic). Each of the 25,000 student and 15,000 administration PCs can receive both streaming and full motion video, with the latter being two-way capable on a classroom basis as required. The network is being prepared for IP telephony but this may wait until full implementation of the new IPv6 standard.</p>	<ul style="list-style-type: none"> • Stokab is understood to offer the largest truly open access dark fibre network in the world created at the behest of local government; in contrast the dark fibre networks in North America are typically limited to a specific user group such as local government or schools. • It is analogous to an urban railway system on which a number of competing rail operators are licensed to run their own trains. • Building on economies of scale, Stokab can sell fibre to the market at a cost below that of a new commercial entrant. • Stockholm schools pay Stokab about A\$50 per student per year for access to the fibre network that terminates at every school building. • The school IT department operates a Gigabit Ethernet WAN across the Stokab network whilst LANs within each school building offer a 100 Mb/s capacity to each PC. • Eleven Mb/s radio LANs are being considered for short connections to certain building annexes. • The benchmark IT offering to the teaching curriculum, apart from high-speed Internet access, is that of full motion video to every student PC.

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<p>Kanal Tierp, the Tierps Municipality, Uppsala County, Sweden</p>	<p>The Swedish telecommunications market was fully deregulated in 1993, long before the rest of Europe did likewise. (Australia fully deregulated in 1997.) Swedish local government reacted swiftly and now some 210 of the 289 Communes own a local fibre network of one type or another. These ‘City Networks’ can interconnect to extensive trunk fibre networks across Sweden (though generally not ‘dark’ to date) operated by companies such as the incumbent carrier Telia, new entrant carriers, the National Power Grid, local distribution power companies and the national railway.</p> <p>A typical City Network comprises a fibre WAN or MAN, plus a Community Access Network. To date, most do not serve customers other than schools and other municipal agencies – plans for broader access by these municipally owned networks are generally embryonic and depend a lot on settlement of national government funding support.</p> <p>Tierp provides perhaps the best example of how national IT policy has been applied in a rural region and of how competitive industry players have cooperated. Swedia Networks AB, the construction arm of the incumbent carrier Telia, designed and is currently constructing the mainly fibre network for Tierp – which also involves some wireless access links. The network is now known as ‘Kanal Tierp’.</p>	<ul style="list-style-type: none"> • Despite the penchant for national policy directives in a more socialistic manner, Swedish local and county governments are nevertheless fiercely independent of the national government. Quite a few still own their power distribution company. • With over 60 per cent of Swedish households being apartments or multi-dwelling units, the task of connecting residents to broadband services can be easier and cheaper than in Australia. Despite this, Swedes are realistic in not waiting for ‘top down’ penetration of broadband infrastructure and are now creating ‘broadband islands’ which grow from the bottom up, i.e. addressing the needs of local communities. These may not be initially interconnected. • The Tierp RFT initially sought commercial construction and ownership of a municipal-wide broadband network that was to be specifically ‘open access’. With no offers agreeing to the open access requirement, the local government decided to instead invest in and own the new network. Open access would allow users to choose their own service provider for telephony, cable television or Internet services. Open access is also a precondition for Swedish government financial support. • Swedia Networks AB has arranged for the company <i>DigiDoc-Open IP</i> to be the carrier for the Kanal Tierp and act under local government franchise as the open access

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	<p>Broadband service to schools has been a key criterion for the initial deployment of Kanal Tierp. The 13 schools throughout the municipality serve over 3,000 students. The area has some 20,000 inhabitants living in eight towns and the surrounding countryside.</p>	<p>facilitator.</p> <ul style="list-style-type: none">• National government funding or other support will be attracted according to the nature of the new broadband infrastructure:<ul style="list-style-type: none">– Between villages – direct funding contribution;– Within villages of fewer than 3,000 people – tax subsidy (no support where more than 3,000 people);– Local access and internal cabling – tax subsidy
