Alberta's SuperNet:
Connectivity in a High-Speed World

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Acknowledgements

In the very early 2000s, the Province of Alberta undertook one of the most ambitious and innovative digital infrastructure projects of its time: SuperNet. Some 12,000 kilometres of fiber optic and wireless infrastructure were installed across every region of the province, yet, today there is little in the way of a record of the effort. We wrote this paper to help fill that gap. Our goal was to provide an overview of the project that explains its objectives and rationale. Perhaps more importantly, we wanted to assess how well SuperNet had succeeded in achieving these objectives and what lessons might be learned for the future. Our research suggests that it has made a remarkable contribution to Alberta's development and to the continuing idea of the "Alberta Advantage." While we feel we've made real progress, much more remains to be said, but that must wait for another day.

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1. Introduction

Broadband is essential infrastructure for the 21st century, much as railways were for the 19th century and highways for the 20th century. Canada's telecommunications regulator agrees. The Canadian Radio-television and Telecommunications Commission (CRTC) recently declared that all Canadians should have high-speed internet access, regardless of where they live; and it backed up the claim with a $500 million fund to help achieve the goal.[1] How far are Canadians from realizing that goal?

On the question of internet access, we fare quite well. According to the Canadian Internet Registration Authority (CIRA), in 2013, nearly 87 per cent of Canadian households were connected to the internet, making us the 16th most connected country in the world.[2]

But this figure can be misleading. As CIRA goes on to note, not all Canadians get the same service. There is considerable disparity in their internet access speeds and speed is crucial. Tasks most users take for granted, such as downloading multi-media websites or video-conferencing, require high-speed access, which the CRTC defines as at least 50 megabits per second (Mbps) for downloads and 10 Mbps uploads — a tenfold increase on previous targets set in 2011.[3]

Not everyone has such access. For example, while 86% of households in British Columbia and Alberta have internet access above 25 Mbps that number drops below 10% in Nunavut. And while some 77 percent of large population centres in Canada have access to download speeds of over 100 Mbps, only 18 per cent of rural areas can expect the same service. Some have no service at all. In short, the country still has a "digital divide."

The CRTC's $500 million fund may be a welcome effort to help address this divide, but it is not nearly enough to overcome it. The cost of providing broadband to all Canadians has been estimated at $40 - $60 billion CAD.[4] According to some people, this can't come fast enough. Others think that building this capacity too quickly would be a waste of money. While it might improve video games or the quality of viewing on Netflix, they say, many communities are not ready to translate this kind of bandwidth into significant economic or social gains. Who is right?

The search for an answer starts by stepping back to look at the bigger picture. In the early days of the internet, access focused on a few basic tasks, such as the ability to download basic websites, send and receive emails or transmit moderate amounts of data. Users had only dial-up access, which was slow and unreliable, so speed was a primary concern for everyone.

Much has changed since then. Today, fibre optics and wireless technologies, huge new microchip capacity, cloud computing, and the Internet of Things are transforming the environment. With broadband access, a user can run multimedia websites, join colleagues around the globe in a video conference, or stream a high definition movie for the kids while traveling in the car. None of these are possible for communities without a broadband connection.

Moreover, broadband access is about more than a high-speed internet connection. While broadband is

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[1] *Telecom Regulatory Policy CRTC 2016-496*; available at: http://www.crtc.gc.ca/eng/archive/2016/2016-496.htm

[2] Available on CIRA's website, *The Canadian Internet*, at: https://cira.ca/factbook/2015/the-canadian-internet.html

[3] *Telecom Regulatory Policy CRTC 2016-496*; available at: http://www.crtc.gc.ca/eng/archive/2016/2016-496.htm

[4] *Broadband: the next essential utility*, page 10.

often used as a synonym for an internet connection, they are different things. Broadband infrastructure is a telecommunications system that can transmit huge amounts of data at high speeds, much of it outside the internet. For example, the traffic lights in a city may be connected by a broadband network – say, fibre optic cables – without routing the data through the internet.[5]

So, the debate over broadband is not just about video games or Netflix. It is not even just about the internet. It is about the role high-speed infrastructure plays in the creation of a **digital community** and what kinds of services communities will need in the next decade.[6] In this view, broadband connectivity is about social change and development. It is about how the movement of data and information can or should connect individuals, governments, businesses, and organizations in new ways to help them achieve their goals as a community and a society.[7]

This debate is underway across the country and around the world – and Alberta provides a unique and intriguing window on it. In 1999, the province took a bold step, resolving to lead the broadband charge in Canada. The government formed a partnership with Bell Intrigna and Axia SuperNet Ltd. and invested $193 million to help build a system of fibre optic cables and microwave towers that would connect every community in the province to the internet and ensure that every hospital, library, school, and government office had broadband access.

This new telecommunications system was call **SuperNet**. It was much more than a plan to provide Albertans with high-speed internet access. SuperNet was about a vision for the future where the province's communities had access to each other and the world; where their public institutions, including libraries, hospitals, and schools, were linked together to create new kinds of social networks that would serve the community in new ways; and where all communities – rural and urban – could participate in the new economy that was emerging. SuperNet was about connectivity, but connectivity was also about community-building.

By the time SuperNet was completed in 2005 it included over 12,000 kilometres of fiber optic and wireless infrastructure. Today, it links 4200 government, healthcare, education, library, and municipal facilities in 429 communities across Alberta, 402 of which are rural communities. Through SuperNet, all have a high-speed connection to the internet and much more. SuperNet is a state-of-the-art, broadband network that can transmit vast amounts of data of all types and for a wide range of purposes.

SuperNet is about to enter a new phase – *SuperNet 2.0*, as some have called it – and decision-makers are once again asking what broadband access means for Alberta's future, much as they did two decades ago. This paper joins that discussion by revisiting and re-examining the origins and evolution of SuperNet to remind ourselves why it was built; what communities, citizens, and businesses were told to expect from it;

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[5] *Understanding Community BroadBand: The Alberta BroadBand Toolkit,* page 5, by Dr. Michael B. McNally, Dr. Rob McMahon, Dr. Dinesh Rathi, Hanne Pearce, Jennifer Evaniew, Chardelle Prevatt; a paper sponsored by the Government of Alberta, Department of Economic Development and Trade, 2016.

[6] The Intelligent Communities Forum, for example, defines broadband access through nine guiding principles. These are about much more than ensuring the bandwidth to participate in a video conference or surf through multi-media websites. See B*roadband: the essential utility*, page 5, available at: https://d3n8a8pro7vhmx.cloudfront.net/icf/pages/391/attachments/original/1482476784/Broadband_Utility_ICF_Canada_Position_Paper_FINAL.pdf?1482476784

[7] See, for example, *Digital Futures 2015*, by Michael B. McNally PhD and Mark Wolfe PhD; Centre for Information & Communication, The Van Horne Institute, October 2015, page 12; available at: http://www.vanhorneinstitute.com/wp-content/uploads/2016/06/digital-futures-2015-final-report.pdf

and what they are likely to need and expect from broadband in the decades ahead.

If broadband really is to the 21st century what railways were to the 19th or highways to the 20th, we believe that a broader more searching discussion about connectivity is essential to making the right choices for the future. A reflective look back at the origins of SuperNet can make an important contribution to this.

Our plan for the paper is straight-forward. This Introduction sets the stage. Section 2 revisits the origins of SuperNet, asking why it was built, how key decisions were made, and how Alberta's leaders thought it would change the province's future. Section 3 examines how SuperNet has contributed to the transformation of Alberta's education sector and what this tells us about connectivity as a tool for social change and development. Finally, Section 4 asks what challenges lie ahead for digital societies and how well SuperNet positions Albertans to meet them.

Although our focus is on Alberta, the paper should be of interest to those in other parts of the country or abroad who are struggling with similar questions. While every community, province, or country has its own circumstances and must find its own solutions, the basic questions are often the same.

2. Building SuperNet

2.1 The Origins of the Idea

Alberta's fossil fuel deposits may be among its greatest assets, but they have come with a price. Frenzied growth can be halted suddenly by plunging markets: businesses shut-down overnight, the economy shrinks, and unemployment soars. Historian David Finch counts three such major downturns in Alberta's recent history: "one in the 1960s that nobody knows about, one in the 1980s that everybody seems to remember and this one [in 2016]."[8] Downturns like these expose the weakness of resource economies. Their growth is tied to the price these commodities will fetch in global markets, but those markets are notoriously unstable and subject to sudden price swings. Boom-and-bust cycles thus are common; they are the dark side of Alberta's oil patch.

Economic diversification has been a recurring theme in Alberta politics. In the 1970s, Premier Peter Lougheed famously tried to free the province from such downturns by investing in promising new businesses, from financial services to cell phones.[9] He believed opportunities like these would mature into full-fledged businesses, taking Alberta's economy in new directions. Notwithstanding some successes, however, the economy remained stubbornly dependent on oil. The mid '80s were a sobering reminder. Between 1983 and 1985, oil prices dropped from over $35 per barrel to under $10. Once again, businesses closed, and unemployment rose. Premier Don Getty, Lougheed's successor, tried to ease the hardship with hikes in government spending, this time to maintain government services. By the time Getty left office in 1992, provincial debt had reached $23 billion – yet another painful reminder of the boom-and-bust economy.

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[8] *Historian David Finch on Alberta's past booms and busts,* by Jeffrey Jones, The Globe and Mail, March 25, 2017. Available at: https://www.theglobeandmail.com/news/alberta/historian-david-finch-on-albertas-past-booms-and-busts/article27985702/

[9] See *Economic Diversification: Can the Notley government reduce our reliance on oil and gas?*, Donna Kennedy-Glans, Alberta Views, October 1, 2016; available at: https://albertaviews.ca/economic-diversification/

Entre Ralph Klein. When Klein ran for the leadership of the ruling Progressive Conservative Party in 1992, he was the underdog few expected to win, but he took his opponents by surprise. Rather than reaffirm the government's spending commitments – and the Party's traditional "Red Tory" roots – Klein campaigned on a promise to eliminate the deficit and pay down the debt.

As for diversification, the clear lesson from the past, argued Klein, is that governments cannot "pick winners," so they shouldn't try. In Klein's view, Alberta's real advantages were its low taxes and free enterprise spirit – something he called the **Alberta Advantage**. These were the assets he believed would get the Alberta economy rolling again and, ultimately, make it the most competitive in North America.[10]

In fact, Klein's views were in step with the times. Western Canadians were restless and agitated; and Alberta politics was gearing up for a sharp turn to the Right. Klein's approach stuck a chord with Conservative Party members. Many liked the sound of his fiscal conservativism and agreed with his view that government should get out of the "business of business." He won the leadership handily and, once installed as the new premier, set to work reducing government spending and refocusing its priorities. A federal election later that year confirmed Alberta's shift to the Right. The fledgling and highly-conservative Reform Party took 22 of the province's 26 ridings, routing the federal Progressive Conservatives.

But if Klein was skeptical of government's ability to pick winners, he never wavered on the need to diversify the economy; nor did he deny that government had a role in making it happen. In fact, he viewed diversification as a priority and, as we'll see, he proved quite willing to spend large amounts of government money to advance it. However, he did bring new views to the table on how diversification and government investment would proceed.

The 1990s were a period of explosive growth in information and communications technologies (ICTs). Globalization and the rise of high-speed internet service fueled speculation about a new, knowledge-based economy, serviced by the Information Superhighway. Something big and promising was on the horizon and Klein wanted Alberta to be a part of it. He was eager to learn about the new economy and how his government could best support it, but he didn't see government officials as the right people to advise cabinet on how to create business opportunities. The new premier wanted advice from the people he believed were on the front lines of the economy and whose views were informed by first- hand experience – and for that he turned to business.

Thus, in September 1994, the new premier established the Alberta Science and Research Authority (ASRA), a board of business leaders, researchers, and government officials whose role was to advise the government on how science and technology was affecting resources and industry in Alberta; and on strategic investments to support Alberta's growing ICT sector.

From the start, ASRA had a close and cordial relationship with the Klein government. It provided advice on a wide range of projects, which the government often heeded.[11] Throughout its first term in office, ICTs were a topic of recurring interest. The government's understanding of the sector and its issues grew, as did its confidence in ASRA and its willingness to experiment in the area. By 1997, the premier and his

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[10] Speech from the Throne, Aug 31, 1993, *Alberta Hansard*. 7. Legislative Assembly of Alberta; available at: http://www.assembly.ab.ca/ISYS/LADDAR_files/docs/hansards/han/legislature_23/session_1/19930831_1500_01_han.pdf

[11] See *Sustaining the Alberta Advantage: 1997-1998 Accomplishments of the Alberta Science and Research Authority*, Alberta Science and Research Authority, 1998.

cabinet were actively looking for ways to advance the ICT agenda. Lorne Taylor, the Minister of Science and Innovation, was officially assigned responsibility for ICTs, in effect, giving him a mandate to search out new ideas. Taylor, in turn, looked to ASRA for help, and the organization responded by striking an ICT Task Force to examine Alberta's position in the sector and propose a government strategy to capitalize on opportunities for growth.

Over the next year, the ASRA Task Force consulted widely with business, industry, universities, and government departments. Its final report, *Information and Communications Technology – A Strategy for Alberta*, was released in October 1998. It contained an ambitious plan to make Alberta a serious competitor in the global ICT industry.

By 1997, Alberta's ICT sector had made significant inroads in this burgeoning new field. It held about .03 – .04 percent of the $2 trillion global market, with some 40,000 workers in place. ASRA saw this as an opportunity for Alberta to expand aggressively into this market. It believed the province could capture 0.5% of the global market within a decade. In real terms, this would have meant about 140,000 people working in the sector, with annual revenues of $30 billion – and that was just the beginning.[12] With a permanent place in the new economy, the opportunities would be limitless. The first step was to establish a beachhead for Alberta businesses.

ASRA's strategy assigned the government a major role. Its job was to help create the physical and human infrastructure to support rapid expansion of Alberta's ICT sector.[13] Specifically, the report called for public sector leadership and investment in four key areas:

1. Education
2. Research and Development
3. Infrastructure
4. ICT Business Growth

There was a compelling logic to these priorities. In a knowledge-based economy, knowledge is, of course, a critical condition for the creation of products and services. New technologies such as pharmaceuticals, skills like metallurgy or genetic engineering, and services like radiology or geo-surveys, are all knowledge-intensive products. Because a well-educated workforce is essential to producing them, ASRA deemed education a priority.

But a well-educated workforce must, in turn, be supported by vibrant and well-funded research and development capabilities. They are the tools of knowledge-creation, so R&D was also a priority.

Finally, the circulation of data and information is also vital. These are the raw materials on which research is based and out of which new knowledge is formed. If economic opportunities are to be maximized, they must be able to move around the community quickly and easily to where they are needed. In a knowledge economy, the mobility of data and information is as essential to wealth-creation as the flow of oil in the industrial economy, so infrastructure was a third priority.

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[12] *Alberta SuperNet Connects*, by Melanie Collison, *Focus on IT*, Fall 2003, page 2.

[13] Alberta Innovation and Science, News Release, November 2, 2000.

ASRA's essential insight thus was that these three priorities are interdependent and work together to create the basic conditions for a high-performing ICT sector: Skilled individuals are needed to create new products and provide new services. And they, in turn, need lots of data and information to support innovative work. And that requires a state-of-the-art, high-speed information network.

ASRA's report was a milestone in the government's reckoning on the new economy. It was also a decisive step in the creation of SuperNet. Once the Task Force had connected these dots, it was a small step to the conclusion that serious growth in Alberta's ICT sector – the strategy's fourth and final priority – depended on its ability to meet these first three priorities. That, however, raised a problem.

Businesses won't invest big dollars in ICT infrastructure unless there is a profit to be made from it. At the end of the 1990s, the 350 or so towns outside Alberta's Highway 2 corridor (Fort McMurray to Calgary) were scattered across 660,000 square kilometers of territory – much of it mountainous or marshy. Connecting them with fibre optic cable would be hugely expensive and almost certainly unprofitable. Business therefore would not be building a province-wide, high-speed network anytime soon, yet the strategy depended on it.

ASRA recognized that the only way to get the information superhighway built was for government to take the lead; so, it challenged the Klein government to commit to building "a ubiquitous, affordable, high-speed communications infrastructure" – SuperNet – to support the new industry. It was a huge Ask and a massive undertaking, but the goal of making Alberta a global leader in ICTs depended on the government's willingness to commit.[14]

2.2 ICTs and The Alberta Advantage

The Klein government received ASRA's report warmly and shortly afterward embraced **the goal of building a globally competitive ICT sector,**[15] which, of course, meant buying into the three other priorities of the strategy, including building SuperNet. Delivering on this commitment would require considerable revving up of the government's engines and that now began in earnest.

One challenge was organizational. Many of the initiatives needed to promote the three priorities were already underway in government but were scattered across different ministries. They had to be brought together and aligned around the new goal. A major government reorganization in May 1999 provided an opportunity. While the reorg was about more than ICTs – it has been called "the Klein Revolution: Part II"[16] – ASRA's strategy was a clear priority. A new Department of Innovation and Science (INNSCI) was created and the initiatives needed to start implementing the strategy were brought together under its roof.

INNSCI's 1999-2000 business plan identified the necessary changes. It called for the amalgamation of core businesses of the old Ministry of Science, Research, and Information Technology (SRIT) with a lengthy list of new core businesses related to ICTs.[17]

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[14] *Alberta SuperNet Connects*, Page 2.

[15] Government of Alberta Press Release: "Global technology leaders celebrate Alberta roots by advising province on becoming world leader in ICT," November 9, 1999.

[16] See https://albertaviews.ca/klein-revolution-part-ii/

[17] Available at: https://open.alberta.ca/dataset/a50bad57-abc3-4eaa-9d0d-66438b94a79b/resource/864e299f-5bdd-470f-80de-48080054aa25/download/science-1998-01.pdf

The business plan's sharp focus on "e-government" is especially noteworthy. INNSCI clearly interpreted the third priority in ASRA's strategy (building infrastructure) to include more than SuperNet. It also involved using SuperNet to transform government from a bricks-and-mortar institution to a state-of-the-art information-based organization. This commitment was defined in a new Information Management/Information Technology (IM/IT) Strategy, which contained a roadmap to make government a model user of information, knowledge, and technology.

It's worth pausing here to ask why e-government had such a prominent place in a strategy to promote business opportunities in the ITC sector. The answer is threefold:

1. Government services like licensing and land registry play a critical role in business transactions of all sorts. Services like these needed to be "digitized" to support Alberta's expansion into the knowledge economy.

2. Government has large and important data holdings, from vital statistics to land surveys. This data was a critical resource for Research and Development (the strategy's second priority) and needed to be able to move quickly and efficiently around the research community to support innovation.

3. E-government provided opportunities in this new and growing field for the development and marketing of new technologies and information systems that could grow the Alberta economy and create business opportunities.

E-government thus reflected INNSCI's view that government services were an integral part of the information superhighway. Within a year, an E-Government Services Working Group had been created to oversee alignment between SuperNet's objectives and the evolution of e-government services.

In sum, once the decision to build SuperNet had been made, organizational change became a high priority for the Klein government. As it entered the new millennium, visible signs of its new priorities were everywhere. New programs were created, and old ones moved and rebranded. Spending priorities at INNSCI became highly focused and references to ICTs and the knowledge economy peppered government press releases and speeches.

But that wasn't all; there was another side to these changes that was less visible, though no less far-reaching. All this reorganization and consolidation also involved a fundamental change in the policy process – that is, in how the government got and developed its ideas on ICTs. At the core of the Alberta Advantage lay a new partnership with business and research that gave them a highly influential place in the policy process – one that had been traditionally reserved for government officials.

As we've seen, Klein didn't look to government officials for key advice on how to create business opportunities in the new economy. He looked to business. ASRA, for example, quickly emerged as a leading light on the knowledge economy. But ASRA was not a conventional advisory body. Such bodies are usually created for a specific purpose – typically, a special committee, blue-ribbon panel, or task force – and once their work is done they are dissolved.

ASRA had a very different status. It was a provincially incorporated organization that was designed to give Alberta's business and research communities a permanent and authoritative voice in government planning on ICT issues, and other areas in which it was involved. Indeed, although ASRA reported to the Minister of

INNSCI, the minister was himself a member of ASRA's Board of Directors.

ASRA thus was much more than a consultative body. It institutionalized Klein's view that business leaders were best positioned to advise the government on how to use public funds to build the economy. It also became the model for a series of new vehicles to engage business and the research community more deeply in the policy process.

Specifically, in 1999, INSCII created three new committees to oversee and advise the government on implementation of the ICT Strategy. At the top of this structure was the ICT Advisory Committee, which was chaired by a Calgary MLA, Denis Herard, but included mainly business leaders, officials, and academics.[18] The Committee's lifespan was undefined, and its mandate was broad. Basically, it was charged with providing recommendations and advice to the Minister of INNSCI on both strategic and operational aspects of the province's ICT strategy, including building ICT infrastructure, growing the industry, and making the province a leader in e-government.

This Committee was supported by two sub-committees, which focused on ICT infrastructure and ICT business growth, respectively.[19] Like the main committee, they were heavily populated with business and research leaders.

There was one more piece to come. The jewel in the government's ICT crown was the Premier's External Advisory Committee on ICT. Launched in November 1999, it included a collection of world-class leaders in ICT from industry and academia. Klein personally chaired this committee and his Minister of Innovation and Science, Lorne Taylor, was a member.

The Committee's role was to provide an informed view of long-term trends and of the drivers at work in the knowledge economy. It was created to help the premier arrive at a vision for ICT research and development that would make Alberta a global competitor in the industry; and to help him define the policies and programs to achieve it.[20]

The Committee was supposed to meet twice a year and its work was conducted primarily through in-person meetings. In theory, its advice would complement the local and regional perspectives of the three ICT implementation committees, while ensuring the premier had the most up-to-date, informed, and strategic advice possible on the implementation of the ICT strategy.

While there is little in the way of public records from these meetings, the Committee is reported to have been a strong advocate for SuperNet and, according to some, it was the decisive factor in the government's decision to build SuperNet. Perhaps this shouldn't come as a surprise, given SuperNet's vital role in the overall ICT strategy. The members of this Committee surely understood that without SuperNet that strategy was a nonstarter. If so, business, it appears, was not only a trusted advisor to the government, but the critical spur to action. This new partnership was Klein's way of tapping Alberta's "entrepreneurial spirit" and putting the Alberta Advantage to work in government decision-making.

In sum, the combination of ASRA and the new committee system were a testament to the premier's deep commitment to the ICT strategy; and of his belief that business was best positioned to point the way

[18] See https://www.alberta.ca/release.cfm?xID=8297
[19] Ibid.
[20] See https://www.alberta.ca/release.cfm?xID=8391

forward. Klein's overall approach to the strategy can be distilled into four basic principles:

1. Where possible, let business do the heavy lifting.
2. Look to business for strategic and operational advice on government's role.
3. Provide the leadership and investment needed to ensure development of critical infrastructure, a skilled workforce, and a highly-engaged research sector.
4. Make government a model user of ICTs in its operations and the delivery of public services.

By the time INNSCI produced its business plan for 2001 – 2004, these principles had been fully absorbed into the department's vision:

> Innovation and Science is unique in its organizational make-up. Department staff work closely with advisory boards whose representatives come from the private sector and academia. This structure allows for increased integration and efficiency of government research and development investments, technology commercialization and development of knowledge industries. Innovation and Science…also provides leadership and focus to the planning and implementation of information technology initiatives to support the government's vision of being a model user of technology in serving Albertans.

If in 1993 Ralph Klein ruled out trying to achieve diversification by jump-starting specific industries, by 2000 his government was ready and willing to support a major expansion of Alberta's economy into the ICT sector by investing in critical infrastructure, building human capital, and redesigning government. Klein may have been inherently skeptical of government's ability to succeed at business, but he had a remarkably high level of confidence in Alberta's business community, which he believed had the entrepreneurial skills to become a world leader in the ICT sector. The premier and his cabinet accepted the argument from business that government had a key role in making this happen and that it had to work hand-in-glove with business and academia to get this right.

Committee Chair Denis Herard captured the ethos around the new partnership and SuperNet when he declared that: "This is us planting our stake in the ground to say, "we're players," we get it and we are and will be leaders in the rapidly changing economy."[21] Or, as Lorne Taylor succinctly put it, "This is *the* Alberta Advantage in the 21st century." The future seemed to be within reach and, with business and academia as its advisors, the government was eager to reach out and grab it.

2.3 SuperNet's Objectives

Once the premier's guiding theme of the Alberta Advantage had been fused with the four priorities of ASRA's ICT strategy, the next step was to build SuperNet; and for this the government needed the right partners and a detailed plan. These would be worked out against the backdrop of four basic objectives for SuperNet that had emerged from nearly a decade of discussions:

(i) Prosperity – SuperNet would be an enabler and catalyst to drive growth

To secure a significant place in the global ICT market, Albertans needed their own information superhighway. SuperNet promised to make high-speed access available to businesses and residences throughout the province. Such access would, in turn, act as a catalyst and enabler, helping businesses of all sorts take advantage of new opportunities, from start-ups looking for venture capital to rural businesses seeking to market their wares in Edmonton or Calgary, Europe or Asia. E-commerce promised to level the

[21] Government of Alberta Press Release, November 2, 2000.

playing field for all Albertans, making distance and borders increasingly irrelevant to market access.

(ii) The Digital Divide – SuperNet would ensure high-speed access to rural and non-serviced urban communities

The decision to build SuperNet may have been motivated by the new economy and the business opportunities it would create, but it would be wrong to conclude that SuperNet was designed merely to serve the interests of business. The project involved important social goals to which the government was committed. Perhaps the clearest example was the commitment to erase the growing urban/rural digital divide. This was about more than building the infrastructure for Alberta's future. It was also about raising awareness about these changes – it was about culture change.

In 1999, only 30 communities had some form of high-speed service in Alberta. Rural areas outside these communities often had no service at all. Nevertheless, broadband wasn't a burning issue in most of rural Alberta. Many people had little knowledge of the internet. For them, the idea of spending $200 million of public money to bury fibre optic cable in trenches around the province seemed like a waste. In the early days, the government got serious push-back on SuperNet from rural folks, including many members of its own caucus.

The government, however, was convinced that high-speed access was essential to the province's future, and that without SuperNet rural areas would be shut out of the new economy for many years to come. So, rather than back down, it doubled down. It worked to engage and educate the skeptics – especially those in its own ranks. INNSCI Minister Lorne Taylor and Committee Chair Denis Herard were not only leaders on building SuperNet. They were educators within the caucus, spending many hours explaining to caucus colleagues how the internet could benefit their communities and warning of the risks of being shut out of the new economy.

(iii) E-Government – SuperNet would transform public services and build new skills

One way the government "sold" SuperNet to skeptics was to emphasize the benefits around public services. We've already seen how INNSCI planned to put government services such as licenses and land transfers online, making them faster and more accessible. In fact, this was part of a larger network of public institutions that would be linked through SuperNet, including schools, universities, libraries, and hospitals. Giving the institutions high-speed broadband access and linking them online would act as a catalyst that would transform them.

In the health sector, for example, the government talked about how SuperNet would lead to the adoption of new administrative and diagnostic tools. Examples included real-time ultrasound, instantaneous access to health records, a comprehensive pharmaceutical information network, telehealth and telepsychiatry.

In education, distance learning was invoked to show how students in remote communities like High Level or Fort Vermillion would benefit. The government claimed SuperNet would give them access to teachers and professors from the main universities and technical schools. Linking libraries would let students and communities access resources from around the world.

By the late 1990s, tools and practices like these were evolving quickly and dial-up was far too slow to support them. The government pointed out how high-speed access would make them possible, transforming public services, while also reducing costs.

There was another benefit. These new services would support Alberta's participation in the new economy by upgrading people's skills as they used them in their jobs. Basically, transforming public services would create a virtuous circle of innovation and learning that would provide better services to Albertans, while educating and training a new generation of knowledge workers.

(iv) The Alberta Advantage – Building Opportunities for Alberta Business

Modern governments have a long history of building infrastructure to support development of their communities and Alberta is no exception. Over the years, the province and local governments have invested in roads and highways, water plants and sewers, electrical systems, and telephones, to name only a few examples. Typically, governments invest in infrastructure when markets fail to spur private sector investment. As we've seen, this was the case for SuperNet.

Klein's Alberta Advantage left room for this kind of government investment in ICT infrastructure. However, the principle that, where possible, business should do the heavy lifting put limits on this commitment. The government and its advisors agreed that its involvement should end where/when markets could step in and provide a competitive solution. They believed that building SuperNet would create these conditions.

For the most part, they seemed to have been right. Within the EAN communities served by SuperNet, Internet Service Providers (ISPs) – which included the large carriers like Telus – were given equal access to bandwidth and at the same wholesale cost. This provided the incentive for them to offer last-mile services to individual homes and businesses at costs comparable to those in urban areas. As a result, at the peak and prior to some consolidation of the ISPs, Axia reports that there were 97 local ISPs providing services .

2.4 Defining the Model

With the objectives of SuperNet in place, the government was ready to launch a process to identify the partners and develop a full-fledged plan to build SuperNet. In February 2000, INNSCI released a Request for Proposals inviting businesses to submit a plan to work with the government to build and operate SuperNet.

The conditions were daunting. For starters, building the infrastructure posed huge engineering challenges. Then there were the policy objectives to be realized, including eliminating the digital divide, the requirement that key government buildings, schools, and hospitals get high-speed service, and the goal of making services in rural areas comparable to those in urban centres and available at a similar cost. In addition, the government insisted on a system that was secure, scalable, and self-sustaining. Finally, the government did not want to become entangled in a long-term commitment to fund or operate SuperNet.

Many of these terms posed challenges no one had faced before, so there was no existing model the contractors could rely on to solve them – and they all had to be solved at once. Everyone was in uncharted waters and the only real guideline was that a successful proposal was going to involve a lot of imaginative thinking. In the end, nine submissions made it to the second stage of the process, where teams of officials engaged teams of consultants in ongoing rounds of questions and demands for further clarification. The subsequent stage of the review process saw the proponents reduced to three; namely, the Bell Intrigna/Manitoba Tel consortium, Telus, and the AXIA Netmedia/Cisco/Microsoft consortium.

On Nov. 2, 2000 Lorne Taylor, Minister of Innovation and Science, announced the winning proposal – a

new consortium led by Bell Intrigna, with Manitoba Tel as its major shareholder and the AXIA Netmedia consortium. The partners involved included Cisco Systems, Microsoft, Nortel Networks, and 360 networks, Total Telecom, WiLan, and Netricom.

The key players were identified as Bell Intrigna and Axia Netmedia. Bell Intrigna's role was identified as working with the consortium members to create and build the network, with AXIA Netmedia playing the key role of managing the service access component. Its job was to ensure open access to the network was available to all at local access points in rural Alberta. This followed the open-access network concept that had initially been proposed by the AXIA Netmedia/Cisco/Microsoft consortium.

Now the successful bidders had to sit down with the government, roll up their sleeves, and draft a detailed plan. A process was launched in late 2000, with Bell, Axia and the Government of Alberta as the key parties at the table. The talks were difficult and went on significantly longer than expected. They were also punctuated by a provincial election on March 12, 2001, which returned the Klein government with a strong majority and 62% of the popular vote. It was a victory for the government and its post-election cabinet responded by signaling some new priorities and directions, including a new minister at Innovation and Science, Victor Doerksen.

By early summer, the new minister was satisfied that conditions had been met and a plan for SuperNet was finally in place. The new model was very different from the conventional model used by other telecos of the day. Their approach was based on *infrastructure competition*, where each carrier/provider built its own infrastructure, then used it to offer services to customers. However, because the cost of construction in rural areas was so high, only firms with very deep pockets could get into the business; and the fees they charged their customers were often exorbitant. Many areas had no service at all.

The plan for SuperNet was meant to change this situation by changing the model. Basically, any qualified service provider would be able to *rent* space on the new infrastructure *at wholesale prices*. It could then use this capacity to provide internet and/or broadband services to homes and businesses within the designated area at a preset price. This would eliminate the "geographical surcharge" (i.e. the high cost of services in remote areas) that existed in most of rural Alberta.

The SuperNet contracts were signed on July 24th, 2001. The plan divided SuperNet into two distinct networks, a Base Area Network (BAN) and an Extended Area Network (EAN). The BAN included the 27 communities where high-speed infrastructure had already been built. As the map below shows, the BAN (highlighted in green) included mainly urbanized areas with higher concentrations of people. Infrastructure investment was profitable in these areas, so the private sector had already stepped in to build and operate systems. The much more extensive EAN is designated in blue on the map below.

Zama City
Meander River
High Level
Rocky Lane
Garden Creek
Fort Chipewyan
Rainbow Lake
La Crete
Fort Vermilion
Keg River
Fort Mackay
Chipewyan Lake
Fort McMurray
Worsley
Peace River
Little Buffalo
Loon Lake
Trout Lake
Cadotte Lake
Gregoire Lake I.R. 176
Fairview
Rycroft
Peavine
Atikameg
High Prairie
Slave Lake
Grande Prairie
Valleyview
Grassland
Lac La Biche
Swan Hills
Cold Lake
Boyle
Grande Cache
Whitecourt
Edmonton
Sherwood Park
Vegreville
Edson
Spruce Grove
Vermilion
Lloydminster
Hinton
Drayton Valley
Camrose
Viking
Jasper
Alder Flats
Wainwright
Forestburg
Amisk
Nordegg
Lacombe
Provost
Stettler
Condor
Red Deer
Castor
Caroline
Veteran
Hanna
Sundre
Delia
Drumheller
Acadia Valley
Banff
Airdrie
Cessford
Calgary
Strathmore
Empre
Brooks
High River
Longview
Ralston
Stavely
Medicine H
Grassy Lake
Irvine
Fort Macleod
Burdett
Crowsnest Pass
Lethbridge
Stirling
Foremost
Manyberries
Cardston
Coutts
SUPERNET
Extended Area Community
BASE AREA COMMUNITY
First Nation Reserve
Metis Settlement
Extended Area Fibre
Base Network Fibre
Extended Area Wireless

Building SuperNet in the EAN was going to be a huge undertaking. As the map above shows, the territory stretched across the province and included 395 communities, some of them in areas where fibre-optic cables couldn't be laid. In these areas, state-of-the-art wireless would be used. Where existing fiber was already in place, the government saw no reason to duplicate this infrastructure or these services. It would negotiate with the owner to purchase or lease the cable from its owner and incorporate it into SuperNet. Telus, for example, ultimately provided $30 million worth of fiber through this arrangement. Similar deals were worked out with 360 Networks, and Monarch fiber, as well as others.

The goal of providing broadband access to learning institutions and health facilities presented another challenge. The government viewed SuperNet as a platform for delivering new services in e-learning, e-health, e-government, and e-commerce. This meant that key public institutions needed reliable and affordable high-speed broadband service and the partners had to agree to provide it.

Some 4,700 facilities in 422 communities across the province were identified. This set the bar high, but it had to be cleared if the government was to transform the delivery of public services. This was a critical part of its plan to build the skills needed for workers in the new economy. The cost was significant. Alongside the government's $193 million, Bell had to commit at least $115 million to develop high capacity broadband connections to government, healthcare, and educational facilities in the BAN

Bell's financial commitment was partially offset by a decision from the government to purchase $169 million worth of telecommunication services from Bell over ten years – about half the government's expected telecommunications expenditure during that period.

As already noted, a key and unique element of the plan was to ensure that, within the communities served in the EAN, all carriers and ISP service providers had equal access to SuperNet. Axia NetMedia's role was to manage their access to SuperNet, based on this principle. This commitment to equal access at wholesale prices was a major departure from usual practice. It was and is something that differentiates SuperNet from a huge majority of the other networks.

SuperNet would create the infrastructure (the "backbone" of the system) that would link the province together and to the world. Each community would have a unique point of contact (i.e. a "Point of Presence") with SuperNet – a connection point that "plugged" it into the system. SuperNet would not provide the actual links between individual homes or businesses (the "last mile"), on one hand, and the point of contact with SuperNet, on the other. This was left to the ISPs.

As part of the contractual arrangements, the government agreed to license Axia to act as the gatekeeper or Access Manager for SuperNet. ISPs, including any carriers who wished to use SuperNet, would have to contract with Axia for access to the SuperNet point-of-contact in a given EAN community. These ISPs, including larger carriers, could then offer to connect individual businesses or homes in the same region to SuperNet for a fee that was predetermined and consistent across the province. As the Access Manager, Axia was prohibited from using SuperNet to provide services that would give it an unfair advantage or benefit over any of the other commercial users of SuperNet.

In sum, the Government of Alberta negotiated an agreement with Bell and Axia to design, build, operate, and manage SuperNet, using a Private-Public Partnership (P3) model. The model was designed to ensure commercial access to service providers in the EAN who wished to offer services to the public. ISPs in all

402 communities would be able to access SuperNet at a uniform rate. They would then provide high-speed access to homes and businesses at rates comparable to urban services. Schools, hospitals, government users, libraries and municipalities would also benefit from attractive rates.

Finally, SuperNet was intended to be self-sustaining over the longer term. Revenue collected by Axia would be used for operational costs and capital maintenance. Bell assumed responsibility for the sustainability of the network over the initial 10 years of operation.

In sum, the result of the Private-Public Partnership was what might fairly be described as a **public broadband utility for rural Alberta** that equalized the wholesale costs of services, so that rates in rural Alberta were now comparable to those in Edmonton and Calgary. This effectively removed the geographical surcharge created by the competition-based models of the telcoes. We'll return to this "public utility" model in section 3.5 below.

2.5 Construction of SuperNet and Evolution of the Partnership Arrangements

The partnership agreements between the three main parties – the Government of Alberta, Bell Canada and Axia Netmedia – were based on a set of 12 basic Development Principles, which are set out in the box below. These principles were agreed to by all three parties and reflect a shared understanding of how the public private partnership was intended to work. The partners agreed these principles would serve as a primary point of reference in the event disputes or disagreements developed over the life of the agreements. In the 13 years since they were formulated, the principles have guided management of the partnership. They codify the partners' basic understanding of the project and, as such, provide a useful lens through which to consider the business model, as well as the design, construction, and long-term operation of SuperNet. They are also interesting for the wisdom and practical learning they contain and, as such, are a kind of highwater mark for the partnership.

SuperNet Development Principles

Purpose of SuperNet
The SuperNet initiative is to establish an IP-network infrastructure for Alberta. The intent of this network infrastructure is to promote competition, promote rural development and ensure affordable and timely services are available for GOA and LHL programs as well as to Alberta communities.

Sustainable Network
SuperNet will be sustainable over the long term with respect to Service Levels and capacity, financial and technical capabilities.

Open and Equal Participation Opportunity

- Existing infrastructure will be utilized where commercially feasible.
- Open and equal opportunities will be provided to participate through acquiring a share of the fiber (through purchase or swaps), leasing bandwidth or otherwise utilizing SuperNet.
- No company will receive preferential treatment in pricing or access to SuperNet.

Pricing

- SuperNet Customer Services will be reasonably priced and will eliminate the distance disparity in cost between rural and urban Alberta. User rates for SuperNet Customer Services to GOA/LHL Customers will be standard across the province.
- User rates for SuperNet Customer Services will be based on Bell's committed rates for service level objectives and service level agreements.

Scaleable Network

- SuperNet must be scaleable through reasonable incremental cost.

GOA's Maximum Total Commitment

- $169 million revenue commitment to Bell for telecommunication services provided within a 10-year period as described in the Master Telecommunications Services Agreement
- $193 million onetime costs to be applied towards the build

Bell Build Investment

- Bell will invest a minimum of $102 million in the Base Network build.

Encourage Rural Economic Development

- Rural economic development will be encouraged through the GOA's investment in SuperNet. This will reduce infrastructure costs for telecom and ISP providers and encourage companies to provide local SuperNet Customer Services in the Extended Network Communities.

Encourage Participation

- The GOA and Consortium Members will participate in programs that facilitate and encourage Alberta communities (businesses and residences) to use and benefit from SuperNet.

High Speed Internet

- Within three years of the Effective Date, high-speed Internet services will be available to businesses and residences in the Service Communities.

Clear Financial Accountability Model

- The financial model for SuperNet will clearly indicate the responsibilities, accountability and commitments by all Parties.

"**Open Book" Model**

All construction and operational costs of SuperNet will be auditable and available to GOA at any time.

After the SuperNet agreements were signed in the summer of 2001, the parties spent the winter working on a detailed design of the two interconnected networks. Bell assumed overall accountability for the design and construction of the EAN and the BAN, while Axia undertook the actual EAN design and provisioning of electronics. Where fiber optic cable already existed, the parties negotiated with the owners to purchase or lease the use of this existing infrastructure. Government staff negotiated and acquired the necessary rights of way to accommodate the fiber optic and wireless infrastructure and to facilitate the process of identifying and accessing the myriad of government facilities that would be served by SuperNet.

Construction was initially slated to begin in the spring of 2002 and proceed to completion by the end of 2004. The EAN was to be built in discrete segments, with the first one running from Red Deer to Rocky Mountain House. At the same time, Bell would build out the BAN, connecting schools, hospitals, government buildings, and libraries in the 27 larger Alberta centers. Axia Netmedia provided the interconnecting electronics required to tie into SuperNet.

Unfortunately, implementation proved far more difficult than anyone expected. Issues arose between the parties and construction moved at an exceedingly slow pace. Tensions between Bell and Axia had been developing for some time and by the end of 2002 they had reached a level that was jeopardizing successful completion of the project. By the spring of 2003, the partnership looked like it might collapse, and the government was seriously considering direct intervention to salvage the project.

Before such intervention occurred, however, the disputes between Axia and Bell were decided in Axia's favour through binding arbitration. During the same time interval, there were changes in the senior management levels at Bell Canada and Stephen Wetmore assumed Bell's responsibilities on the project. An understanding was subsequently reached between the project leadership, represented by Dan Bader for the Government of Alberta, Stephen Wetmore of Bell Canada, and Art Price of Axia Netmedia. The parties agreed to take a fresh approach to the project's delivery and, in the best interests of the project, to move forward to successfully complete their mutual goal.

Because of this concerted effort, SuperNet was successfully completed in late 2005 and, about the same time, the parties arrived at and signed an agreement to amend some key terms in the original contract. Shaped by the stresses and strains of the last few years, these changes aimed at ensuring the network would be completed, that any performance issues would be addressed, and that the system could and would be scaled up to meet demand. Specifically, the agreement made the following key changes to the ownership model for the EAN:

- Bell assumed outright ownership of the infrastructure that was funded by the government, thereby assuming long-term responsibility and accountability for the performance of the network. This addressed the government's potential concerns regarding limited warranties and guaranteed minimum service levels.

- The Government of Alberta, in lieu of an ownership position of the network infrastructure, retained an "indefeasible right of use" or IRU for the EAN, as well as a discretionary right to buy the infrastructure back, including the components comprising the microwave sections at a future date for a nominal amount. It also retained outright ownership of the rights of way and the conduit that was used to construct the initial EAN network.

- AXIA continued to own the network elements that it funded and was accountable for providing province-wide services to the Government of Alberta, as well as services to all parties other than Axia affiliates at the EAN access points.

3. SuperNet's Impact on Education in Alberta

3.1 Connecting Alberta Schools

Having deliberated for several years on how best to help Alberta prosper in the new economy, the Klein government finally opted to build SuperNet. The plan included a high-speed link to every hospital, school, and library in the province. It could have been otherwise. The government could have left these institutions out. It chose to connect them because it thought they would help build the skills and knowledge Albertans need for the future; and that SuperNet was the catalyst and enabler that would make this happen. Connecting these public institutions thus was part of a bigger government plan, but was it good policy?

Education provides an interesting case study here. Under the leadership of Minister Lyle Oberg, Alberta Education was the first ministry to commit to using the new network. It seemed to get SuperNet's potential from the start. Fifteen years later, Alberta's education sector is making a vital contribution to overcoming the digital divide and to building the educated workforce the province needs for the future. Klein, it seems, had the right idea – but it hasn't been an easy ride and things might have turned out differently.

At first, SuperNet did little to change how schools operated. Most saw it as a high-performing administrative network that made things faster, but not very different. Schools continued to work pretty much as they had before. Teachers taught, children learned. Administrators tended to the needs of their district and kept the wheels turning. The main difference with SuperNet was that documents and files circulated faster.

Then something happened. Axia, Alberta Education, and the Discovery Network banded together and devised a project to show the sector just how formidable SuperNet was **as a learning tool**. This provided the nudge educators needed to see SuperNet as more than just an administrative network and start talking about how it could change things **in the classroom**. As they talked, attention shifted from circulating documents and files around their districts to exchanging information and ideas between educators and students across the province.

The talk today in Alberta's school districts is all about the relationship between technology and learning. Over the last decade, a new philosophy has taken hold that sees technology as a catalyst for change and a powerful enabler for a new **student-centred approach to learning**:

> One of the key roles technology can serve in K–12 education is to shift the focus from the system, school and content toward learning and the learner, building competencies and enabling the learner to create and share knowledge. Technology is recognized as playing an integral role in creating student-centred, personalized, authentic learning environments.[22]

SuperNet has been a huge catalyst and enabler here. While educators in other provinces are equally excited about technology and student-centred learning, only Alberta has the infrastructure to support this goal in every school, regardless of its location. Alberta is now a leader in student-centred learning, supported by a bustling, province-wide learning network. Laptops, tablets, and smart phones are replacing blackboards and chalk in the classroom. Computer labs are a thing-of-the-past. Students can now stream videos and collaborate with others around the province. Increasingly they, not their teachers, are the authors of the content that drives the learning process.

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[22] *2013: Learning and Technology Policy Framework*, Alberta Education, Page 15. Available at: https://education.alberta.ca/media/1045/ltpf-quick-guide-web.pdf

Rural schools have been full participants in this revolution. SuperNet connects them to the world, so the distinction between rural and urban is no longer the barrier to opportunity it once was. Indeed, thanks to SuperNet, some rural schools have leap-frogged over their urban counterparts to become high performers in provincial assessments.

In this section of our paper, we look at SuperNet's role in the emergence of this new education environment. The story is interesting and eye-opening. It not only shows how educators are using SuperNet to produce the kinds of new skills sets the Klein government hoped they would, but just how powerful a catalyst broadband infrastructure can be in bringing about social change.

3.2 From 64 Districts to One Province-Wide Network

By the late 1990s and very early 2000s, Alberta school districts already had local networks in place. Each district formed its own network made up of the schools in that district. These networks were then "locked down" or secured behind firewalls to prevent hackers from entering. While content could circulate among the schools in a network, nothing moved across the boundaries, either inside or out, without passing through the district office, which controlled the network.

Few rural districts had fibre optic cables. At that stage, almost everyone relied on copper wires and dial-up connections. The networks were slow, but most users didn't worry about that. Schools weren't collaborating on projects or sharing teaching resources the way they do now. It would be several years before Alberta schools had any significant capacity for video conferencing. The technology to stream videos didn't exist yet, nor did any significant form of social media. Where collaboration did occur, it happened inside the network and was limited in scope. In those early days, district networks were used mainly for administrative purposes, such as sharing files or circulating memos within the district; transmission speed was not a high priority.

When SuperNet went live in 2005, its architects thought the new infrastructure would quickly transform the old networks. They imagined it as a layer of mesh that would stretch across these boundaries and connect the different school districts and the individual schools within them. Their vision was to create a new **Provincial Learning Network,** comprised of students and educators who would share information and ideas and work together to improve education. SuperNet would be a catalyst for change and innovation.

The reality was different. SuperNet may have provided a physical connection to all these districts and schools, but administrators saw little reason to reach out to other districts. In their eyes, the network was still an administrative tool. High-speed access made this more efficient, but it didn't change their habits or their thinking. Technicians continued to lock down networks behind firewalls, so nothing could get in or out except through the district offices.

In short, rather than transforming the old networks, the new technology fortified them. If SuperNet was a single, province-wide network, 64 separate networks continued to run on it. Several years after its completion, little had changed in urban or rural Alberta. SuperNet was hosting a system of silos. The question of how it could change things in the classroom was barely considered.

Alberta Education was an exception. LearnAlberta.ca was an early version of a provincial learning network that had been up and running since 2001. Its role was to provide teachers and students with a variety of learning resources to enhance learning in the classroom. Typically, these were small instructional videos,

such as a learning segment on how to measure an angle with a protractor. This may sound primitive by today's standards, but the ministry was not just making videos. These were early attempts to create **shared learning resources** for the province – and that was an innovative idea.

However, sharing these resources with schools across the province was a challenge. Before SuperNet, the ministry used something called the "Content Delivery Network." Some 1600 servers in Alberta schools were connected to this network. The ministry would post its content on a centralized LearnAlberta.ca server, then push it out to the servers in the schools, which would then download it for use in the classrooms. Unfortunately, fast, reliable delivery of the content required much greater internet bandwidth than most schools had. In those days, internet bandwidth was very costly, and few schools could afford much of it. As a result, it often took hours for them to download a couple of simple videos. If everything went well, students and teachers could access the LearnAlberta.ca content for use in the classroom. Often, it did not.

Maintaining this system of servers was not only inefficient, it was costly. Axia estimated that Alberta Education was paying about $900,000 to a million dollars a year for the Content Delivery Network and Content Delivery Devices. But the biggest cost by far was in opportunity. The inefficiency and expense of the system effectively undermined SuperNet's power as a catalyst for change and blunted any real efforts at experimentation and innovation.

The system needed change and SuperNet had the power to provide it. The new infrastructure had the capacity to deliver content in a new way. Now that each school was connected through SuperNet, Alberta Education could send content directly to the schools on this new Superhighway, bypassing the internet and the Content Delivery Network altogether. Unfortunately, as we've seen, at that point, people on the front lines in education didn't necessarily see SuperNet as an enabler for change. On the contrary, they were using it to reinforce the old practices and silos. Real change had to begin with people's view of the technology.

This wasn't going to be easy. It meant challenging a lot of entrenched views and practices, and that called for leadership and learning. A special team was assembled inside Axia, Axia Innovation Services (AIS), to help achieve this. Its mandate was to work with Alberta Education, the schools, and districts to explore how SuperNet could be used more effectively. The fastest way to change the culture, it concluded, was to show people what SuperNet was capable of. AIS needed a project that would clearly demonstrate its potential.

It didn't have to look far. During the late 2000s, Discovery Channel had a popular streaming service for its documentaries called Discovery Education Streaming. Alberta teachers liked using the videos in their classes but pulling them down using the internet was time consuming and often frustrating. A video might buffer for 20 minutes or so before playing – if it played at all.

AIS recognized that Discovery's videos could be delivered in a much simpler and faster way. SuperNet, they pointed out, was a genuine, provincewide learning network that operated at extremely high speeds. They could link a Discovery content server to SuperNet, then use it to carry the data directly to all the schools in the network.

Because this approach would bypass the internet, the schools at the receiving end wouldn't need to download the content onto their servers. They would connect directly to Discovery's server through

SuperNet. The challenge thus was to disentangle SuperNet from the old system, with its 64 firewalls and 1600 servers, and free up SuperNet to work its magic.

In 2008, AIS teamed up with Alberta Education and Discovery to do a pilot project that showed how this could work in classrooms. Axia created the technologies necessary to deliver content directly to schools, which they called "SuperNet Direct." Discovery supplied the content and Alberta Education provided access to the schools. In the pilot, buffering time dropped from over 20 minutes to about five seconds and no other servers were needed.

The project was a milestone. If SuperNet could deliver Discovery content to the schools, there was no reason it could not do the same for Alberta Education's programs and services. They too could be linked to SuperNet Direct, which could then deliver its content directly to schools across the province, just as AIS had done with Discovery. The LearnAlberta.ca Content Delivery Network no longer required 1600 servers. Indeed, in principle, any organization's servers could be used this way. The pilot revealed SuperNet's untapped power as an enabler and agent of change in the education space.

But, to be clear, this "new" network approach really wasn't new at all. It was more like a clearing on SuperNet, a space where the clutter of the old networks – the legions of servers, firewalls, and local controls – had been disentangled from SuperNet and cleared away. Freed from these shackles, SuperNet could function as a genuine, high-speed, provincewide network – as its architects had intended. Schools finally had a reason to get excited about SuperNet and to begin to think about how it could change their future.

3.3 SuperNet and Internet Access for Rural Schools

We can think of SuperNet as the physical, fibre optic network that connects all the schools in Alberta; it is like a layer of mesh that covers them. Data can be moved from any one point in the network to another, say, from a school in Golden Hills to one in Peace River, but moving data this way requires *SuperNet bandwidth*. Bandwidth is effectively the speed at which data can be transmitted and received between two points. Rural schools purchase their SuperNet bandwidth through Axia.

Users on the SuperNet network can also use internet services to connect with other networks around the world. For this, they need "internet bandwidth", which is available through a variety of internet providers including the major carriers. Typically, individual schools don't purchase their own internet services. This is usually done through the district office, which buys so much for the whole district and allocates some to each school.

In pre-SuperNet days, the "internet bandwidth" in most rural schools was very low and delivered through a dial-up connection. By 2005, with SuperNet in place, schools had the capacity to replace their old dial-up connections with high-speed internet connections, and most were eager to do so. However, in rural areas, internet service cost remained a big concern. Rural districts often kept the costs down by limiting internet bandwidth. As a result, lots of rural schools had very fast SuperNet infrastructure, but infuriatingly slow internet performance. Expanding it was prohibitively expensive, so for much of rural Alberta, "high-speed" internet access wasn't much better than a dial-up connection.

By comparison, the cost of internet in urban areas was about half that in rural Alberta. Market-wise, it was a different environment. There were lots more people available to buy internet service, which made it cheaper. And there was often more than one supplier, so the major internet service providers had to

compete for customers, which also drove prices down in the major centres.

As time passed, it became obvious to Axia that internet service rates for rural schools were not going to change significantly. As a result, in 2011, Axia responded by creating an arm's length company – Axia Connect. Its goal was to provide internet service to rural school locations at rates more comparable to those available in the major centers by accessing the internet gateway in Seattle directly through a dedicated fiber access connection. It was a big gamble, but the new company's business model proved to be sound.

The new venture had an unexpected, but very beneficial, consequence. Axia Connect's low prices set a new benchmark for rural Alberta school districts that other internet providers now felt they had to meet or even beat. In the early 2010s, prices had been hovering around $60 to $75 per Mbps, but in 2011 as Axia Connect published its rates, market rates started to fall; and by 2013, they had plummeted to about $10 to $15 per Mbps, finally making internet access affordable for all schools, rather than just those in the urban centres. Today Internet service bandwidth is available to rural school districts at below $2 per Mbps.

These lower prices were a boon to rural schools. Now they could afford to increase their internet bandwidth – and they did. Fortuitously, this decline in the price of internet access also coincided with an increase in financial support for SuperNet access. Alberta Education was already providing a monthly subsidy of about $500 per school to offset the cost of linking into SuperNet. At that time, this bought 5 Mbps of SuperNet bandwidth, which was as much as many rural districts could afford. Then in 2011, Alberta Education's subsidy was increased to enable each school to purchase 20 Mbps. Less than a year later, Alberta Education increased the funding again, this time allowing schools to boost their bandwidth to an impressive 100 Mbps.

By 2012, SuperNet was emerging as a force across the province. Thanks to Alberta Education, every school had significant SuperNet and internet bandwidth. Falling prices on internet bandwidth meant they also had a reliable internet connection to let them surf the web, download videos, access content, and collaborate. Now the ministry started gearing up for a major effort to leverage the technology.

3.4 Inspiring Education: Technology in the Classroom

The Discovery pilot of 2008 may have been a turning point for SuperNet, but things didn't change overnight. The old networks had evolved around the traditional educational system and, like the school districts that managed them, they were reflections of the community. They linked people who often knew one another personally and whose priorities and concerns were similar. The members of these networks were reluctant to give up control – even for something better.

Nevertheless, the Discovery pilot had turned the page. It had shown how parochial and outdated these rural networks were. A 21st century learning network had to get beyond administration and local concerns. Educators and administrators needed it to reach out beyond their districts and learn new things about the province, the world, and themselves. More importantly, students needed it for the same purpose. In 2008, however, school districts may have glimpsed the future, but they still weren't quite ready to embrace it – to break with the past. After Discovery, things went remarkably quiet in many districts – a worrying sign for those anxious to see change.

It wouldn't last. The forces of change were gathering across the sector and the province. Experimental

initiatives aimed at teaching students how to use the internet were creeping into schools everywhere.[23] "Bring Your Own Device" was one such program; it let students bring their own laptops, tablets, and smartphones into the classroom, hook them up to the network, and connect with others across the province.[24]

Social media was another force for change. By the end of the 2000s, it was bursting on the scene and changing established views about technology and learning. For example, so-called "m-learning" – learning mediated through mobile devices – saw the combination of mobile devices and social media as a new kind of learning environment, different from, say, using a laptop to search the internet. Pedagogically speaking, social media involved collaboration and group interaction, which, in turn, challenged some deep assumptions about how students learned.[25]

Trends like these were part of a growing wave of technology in education that by 2010 was already washing over the province. Government too was involved. In 2008, Alberta Education made $35 million available for schools to purchase classroom technologies that enhance teaching and learning, such as laptops, data projectors, and electronic whiteboards. By 2009, it had installed over 800 videoconferencing sites across the K-12 system. And, as we've seen, in 2010-11 the ministry twice provided funds for schools to upgrade their SuperNet bandwidth.

Internally, the ministry had been busy further digitizing its own programs. For example, it was expanding its Online Assessment program, so that by 2010 provincial exams, achievement tests, and diploma exams were being delivered over the SuperNet. Most importantly, however, in 2009 it had launched a province-wide dialogue on education.

Inspiring Education: A Dialogue with Albertans was led by the Minister of Education, Dave Hancock, whose final report defined the values and goals Albertans felt should guide education for the future and set out a vision for Alberta Education in 2030.[26] In the fall of 2012, the ministry expanded this work by launching a province-wide consultation to update its 2004 *Learning and Technology Policy Framework*. Some 1500 educators and administrators participated.

The new policy framework was released in 2013. It consolidates and systematizes two decades of thinking around the role of digital technology in learning. Technology is viewed as a critical enabler that opens the door to a new world of information, ideas, and contacts. This experience is "user-centred" in the sense that individual users must decide where to focus attention and what they want to learn – they must make choices about what they think is of value in this new and expansive world. This is neatly captured in the concept of **student-centred learning**:

> Access to appropriate devices, reliable infrastructure, high-speed networks and digital learning environments is essential to achieving the vision of student-centred learning. This access enables students to connect to other communities, experts, digital resources and authentic learning and provides opportunities for cultural and global exchanges. Digital learning environments…offer access, communication, resource libraries, file exchanges, learning and content management and web tools that

[23] See http://www.calgaryherald.com/news/Schools+grappling+with+best+technology+classroom/7568017/story.html

[24] See https://education.alberta.ca/media/3115434/byod-tech-briefing.pdf

[25] https://www.teachers.ab.ca/Publications/ATA%20Magazine/Volume-91/Number-1/Pages/Mobile-Technologies-in-the-Classroom.aspx

[26] https://open.alberta.ca/dataset/45370ce9-3a90-4ff2-8735-cdb760c720f0/resource/2ee2452c-81d3-414f-892f-060caf40e78e/download/4492270-2010-Inspiring-Education-Dialogue-Albertans-2010-04.pdf

> facilitate learning in school and beyond.[27]

Consistent with the new focus on student-centred learning, the new policy marks a significant shift in emphasis from 2004. Whereas the old policy saw technology's role more as a tool **to support teaching**, the new one sees it as an enabler to be **used by students** to create and share knowledge. The change is subtle, but it reflects a profound shift in thinking about the relationship between teachers and students.

In the past, teachers "taught" students, but now their job is to inspire, guide and help them build the skills and attitudes they need to support life-long learning. The challenge for educators is to foster **personalized learning**, that is, to create an environment where each student's pathway to learning reflects their special skills, aspirations, and needs, and the tools and resources needed to support this journey are available and accessible:

> In student-centred learning, the child is the centre of all decisions related to learning and education. Teachers are the chief architects of student learning. They plan, design and oversee learning activities as they consider the interests, passions, talents, abilities and natural curiosities of the learner. This calls for personalization of learning. Personalized learning encompasses meaningful connections, engaging learning experiences and flexible learning environments that support choice, collaboration, student voice and shared ownership in learning.[28]

The 2013 policy framework has had a major impact on education in Alberta. Recent research[29] reveals wide-ranging efforts to redesign the system around these ideas and highlights where students and teachers are focusing their attention:

- **Populating the Network:** Traditionally, students were passive consumers of content, but increasingly they are active creators of it. This is encouraged in classrooms around the province, where a huge shift is underway toward the use of online learning tools and the production of web content. Streaming is especially popular with students, much of which now relies on Netflix and YouTube. As videos become richer in content and design, the need for bandwidth grows.

- **Online Student Assessment:** Province-wide student testing has moved far beyond the multiple-choice tests of yesteryear. Much of the work is now focused on personalizing learning. This raises challenging and complex questions about how individuals' aptitudes, aspirations, and needs should shape their learning and how they can be reliably identified and assessed. Educators are hard at work on this.

- **Distance Education**: Rural districts have some of the most enthusiastic advocates of student-centred learning. In part, this reflects special pedagogical challenges. While metro schools have teachers for specialized subjects, staff in rural Alberta tend to focus on core subjects, such as basic mathematics and social studies. In the past, subjects like physics often had to be done by correspondence. The network is changing this. It allows rural schools to start filling these gaps through video conferencing and other online tools. Provincial tests provide encouraging support

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[27] *2013: Learning and Technology Policy Framework*, Alberta Education, Page 37. Available at: https://education.alberta.ca/media/1045/ltpf-quick-guide-web.pdf

[28] *2013: Learning and Technology Policy Framework*, Alberta Education, Page 19. Available at: https://education.alberta.ca/media/1045/ltpf-quick-guide-web.pdf

[29] This information comes from interviews with Cam McNicol, Axia Innovation Services and Co-Founder of SchoolSoft Technologies, Calgary, Alberta, Canada.

for such initiatives. Historically, rural Alberta tended to score lower than urban Alberta. Now many early adopters are showing significantly higher scores. One district, Golden Hills, rose from below average to a provincial leader.

- **Maintaining the Network:** School districts face new technical challenges in supporting and maintaining the network. Being a connected school today takes more than a computer lab:

    - Students bring their own laptops, tablets, and phones to school and need to connect them to the network. WIFI connections must be installed in every part of the school and increasingly they need to be commercial grade. Providing these connections is a technological challenge and a growing expense for many districts.

    - Storage, back-up, and disaster recovery are also concerns. For example, as files get larger, students need lots of storage space, but they must be able to access these materials anywhere, anytime. This means they can't be kept behind a school firewall. One answer is to turn to tools like Google Drive and Drop Box, but there are questions whether these will continue to meet needs over the longer term.

    - Monitoring is a new and growing set of challenges. This includes video monitoring for security, as well as monitoring for maintenance purposes. Regarding the latter, sensors are now standard features in machinery of all sorts, from boilers to lighting systems. SuperNet provides the bandwidth to support new systems for this, but they are costly.

    - Cloud computing raises far-reaching issues around security and the protection of personal privacy, both for students and staff. Storing and accessing resources from the cloud moves content and operations into a zone that is beyond the control of the school district or even the government. How can adequate protection be established?

    - Telephone is another big issue. Turning to phone systems that operate over the network, rather than through the traditional telephone providers or telco's. We'll return to this in the next section.

These are only a few of the issues and opportunities occupying educators and administrators as they implement the policy framework and put SuperNet to work in new ways. These steps are part of a natural evolution of the system. They provide a snapshot of how education has changed over the last 15 years and the critical role SuperNet has played.

3.5 SuperNet as a Public Utility

Over the last 15 years, experiences like the one with Education have taught us a great deal about how broadband infrastructure can advance social goals. The Discovery Pilot opened the door to a new learning environment that challenged the status quo and forced administrators to reorganize their old networks around new principles. Without the Discovery Pilot, this might never have happened. Educators might still be struggling to break free of the inward-looking culture that defined the district networks. Instead, teachers today are working to redefine the education system around a student-centred approach, supported by a province-wide learning network. A very important lesson about the infrastructure can be drawn from this experience:

> Simply building the technology is not enough. It must be supported by a dynamic management model that is engaged with the community and has the flexibility and mandate to work with its members in ways that will help them discover the possibilities.

SuperNet's management structure and objectives allowed – even encouraged – Axia staff to experiment with SuperNet in ways that a normal private sector company, operating only under market conditions, likely would never have done. Businesses have no special interest in promoting social innovation, unless it contributes to their bottom line. Initiatives like the Discovery Pilot would be unlikely to get approval.

However, not all companies work this way. "Public utilities" are infrastructure organizations that are designed to achieve public goals that market forces may not produce on their own, such as safe drinking water or environmental protection. Utilities can be designed in different ways to meet different circumstances: they may be publicly or privately owned; services may or may not be provided directly by the managing organization; they may or may not operate for profit. But whatever form a utility takes, it will be subject to special rules and regulations generally set down by government.

Utilities have a long and venerable history in Canada and elsewhere. They are important public policy tools precisely because they can be regulated in ways that normal private sector organizations might resist or even reject. Examples include water and sewers, electricity, and sometimes transportation systems, such as roads, ferries, or trains.

There is wide agreement in Canada and elsewhere that broadband should be regarded as critical infrastructure for the 21st century. Like highways in the '50s and '60s, governments are being called on to ensure this infrastructure gets built. A growing number of people also believe broadband should be a public utility. They see it is a critical catalyst and enabler for a wide range of economic and social goals whose achievement requires special rules or guidelines and dedicated leadership.

Clearly, the Klein government saw SuperNet this way. While Premier Klein may have bristled at the thought of trying to diversify the economy by picking winners, he was quite willing to use what here we are calling a public utility to ensure that broadband would achieve the right kind of economic and social change in Alberta. Section 2.2 above identifies four such goals for SuperNet:

1. Eliminating the digital divide;
2. Enabling growth in Alberta's commercial ICT sector;
3. Transforming public services, such as health, education, and government services; and
4. Promoting a competitive advantage for Alberta business, both at home and on the world stage.

These goals required – and still require – significant government intervention in the economy. Klein's approach to achieving them was to create a utility that was empowered and designed to ensure the new infrastructure would be put to the right use. This involved a fundamental challenge to the conventional model then in use by the telcos.

As we saw in Section 2.4, the conventional model is based on infrastructure competition, which means that for a carrier/provider to compete in an incumbent's market, it must build its own infrastructure. By contrast, SuperNet allowed service providers of all sorts to rent capacity from it, which, in turn, let them

enter the marketplace and compete with one another and the big telecos, while providing services at a reasonable rate.

SuperNet is a public broadband utility for rural Alberta. The model was adopted to equalize the wholesale costs of services, so that rates in rural Alberta would be comparable to those in Edmonton and Calgary. This effectively removed the geographical surcharge created by the competition-based models of the telcos and allowed Alberta to make real progress on the digital divide.

In the interviews for this paper, we asked experts to compare other current practices in the telecommunications sector with the SuperNet Model. They told us that SuperNet's utility-type approach not only remains relevant but is likely to become even more so in the future, on a local, regional, and possibly even a national basis. We heard differing views on how this might best be accomplished but "open access" to either existing or purpose-built infrastructure was a recurring theme. We also heard that as this "open access" model becomes more relevant, the telecommunications infrastructure, although critical to connectivity, is becoming more beholden to the content providers it supports, such as Netflix, Google, Amazon, Disney, and so on. One only needs to look at the relative financial strength of the telecommunications components versus these content providers to appreciate the merits of this observation.

When Bell joined the consortium that bid on SuperNet, it had virtually no infrastructure in western Canada. Becoming a partner in the project thus was an opportunity to gain a foothold in Alberta without having to build an entire infrastructure of its own. In those early days, Bell and Telus both indicated that once SuperNet was built they planned to use its services in the EAN. This interest appears to have been short lived, as only a few years later, the companies agreed to share their network infrastructure across the county, rather than continuing to participate in the infrastructure- based competitive model with Bell building in western Canada and Telus building in eastern Canada. One wonders what catalyst SuperNet played in their decision that a non-competitive shared infrastructure model made more sense than the traditional infrastructure-based competition model?

One surmises, that buying into SuperNet in Alberta would have ceded too much ground to a model that not only supported strategic partnerships – not unlike that eventually established between Telus and Bell – but whose mandate was to make space available to *any and all* qualified businesses who wished to enter the marketplace to compete. In short, Bell and Telus were not ready to endorse a full-scale, public utility model. Indeed, shortly after SuperNet was completed, Telus resumed building its own networks in rural Alberta, often in places that put it in direct competition with SuperNet's services.

In summary, it seems that a utility model for broadband transport remains central to the debate over broadband and could very possibly play a major role in the future. If so, we think a serious effort should be made to assess where and how it might best be utilized to support making high-speed access ubiquitous and affordable across different regions, provinces, and indeed the country; and to consider the respective cost and benefits when compared with traditional telecommunications models. Such an exercise would require conviction, enlightened leadership, and a clear vision, not unlike that shown by the Klein government when it undertook to build SuperNet.

4. Future Directions

4.1 User-Centred Services: SuperNet as a Catalyst and Enabler

Student-centred learning didn't originate in Alberta. It is part of an international movement aimed at changing conventional teaching methods. Rather than *instructing* students, teachers take a partnership approach that encourages students to define their own learning pathway. The teacher provides direction, guidance, and inspiration. As a result, the student is more engaged, and learning is more personalized. SuperNet has been a critical enabler for this movement in Alberta. It allows students and educators across the province to exchange information and ideas; high-speed internet access provides them with a source of limitless content.

This new "user-centred" model has parallels in other public services. Health experts around the world now speak of **patient-centred healthcare**, in which patients are no longer just passive participants in the doctor/patient relationship. In the digital age, health systems are connected in complex ways, which allows information sharing and coordination across organizational boundaries. Doctors and patients participate in health networks of all kinds that connect them with a wide range of people, services, and information. This is changing the traditional doctor/patient relationship.

For example, rather than just treating patients for illness and injury and then sending them home, doctors are supposed to work with them to develop and execute a plan for managing the patient's health. Such a plan involves the patient in making important choices, setting goals, and executing the plan. The doctor can coordinate with others in the system to help support the plan. Ultimately, this should help organize the system's resources around each patient's circumstances and needs.

Government services, such as licensing and immigration, are also part of this trend. Governments everywhere have adopted a so-called client- or **citizen-centred approach to services**. Digital networks allow service providers to access programs from across the system and to work with each client to integrate a package of services around the client's needs, say, when he/she is starting a business or immigrating from another country. This treats the user less as a passive consumer of government services and more as an active and engaged partner in defining how services can support his/her special circumstances and needs.

At bottom, this shift to **user-centred public services** in education, health, and government services is about engaging users in ways that give them a direct role in shaping and managing the services they receive. This, in turn, creates a better fit between the services, on one hand, and a user's needs and goals, on the other – it *personalizes* services. The approach requires access to people, programs, and information from across the system in question – something system designers call an "enterprise-wide" approach.

SuperNet provides the basic infrastructure for this approach in Alberta. In hindsight, the decision to use SuperNet to connect schools, libraries, hospitals, and government offices was far-reaching. SuperNet turned out to be a powerful catalyst and enabler for the user-centred movement. It was a visionary idea that few at the time appreciated.

So, how successful has it been? Have these different sectors been transformed? Our review of Education suggests genuine progress. Getting beyond the silos in the school districts was a milestone. It opened the door to a new way of doing things; it changed people's views about the value of the technology and how it could be used to improve learning – but this journey, it seems, is far from over.

By contrast, we heard that Alberta's health sector is still struggling with its own version of traditional silos. According to one expert, while health organizations often use very sophisticated technology for research,

diagnostics, and treatment, services and information are still fragmented in ways that limit flexibility and innovation. Many of these silos, we were told, are built around professional roles, from doctors and nurses to radiologists and *anesthesiologists*.

We also heard about the persistence of traditional silos in government services. While there has been much progress putting services online, and in reducing the number of forms, steps, or clicks needed to get information or complete a transaction *within* a program, traditional program silos, we were told, remain very difficult to bridge. They are often reinforced by legislation, privacy rules, budgeting practices, accountability relationships, and so on, which prevent officials from using the technology to align and personalize different services.

Our study doesn't examine health or government services in any detail, so we draw no firm conclusions here, beyond the following. A decade ago, the technology was a limiting factor. Officials often couldn't share information or align services across different silos because the technology wasn't good enough, or the networks weren't fast enough. Today, the capacity exists to cross organizational boundaries. If traditional silos are still a barrier, this is more a cultural or organizational problem than a technological one. If so, a key question for the future is: **How can planners put the technology to work to help them overcome these traditional barriers?** Our discussion suggests three basic principles that should help advance the user-centred movement in the next phase of SuperNet:

1. Recognize the Need for Dedicated Leadership
2. Support Innovation Through Engagement.
3. Treat Connectivity as a Form of Community-Building.

Let's briefly consider each one.

4.2 Recognize the Need for Leadership

Cybera CEO Robin Winsor, a leader in Alberta's technology movement, recently told the Canadian Radio-television Telecommunications Commission that, for all its achievements, SuperNet's potential has been vastly under-realized.[30] SuperNet, he said, is the product of a public-private partnership that is governed through contracts. These arrangements will be up for renewal in 2018, which, notes Winsor, is an excellent opportunity to strengthen the model to ensure the full potential of SuperNet 2.0 is realized. [Editor's Note: The contract for management of SuperNet has since been awarded to Bell Canada.]

Leadership is a key area where the model needs clarification. As we noted in Section 3, SuperNet is an **infrastructure utility**. Generally, utilities are created to achieve important public goals. In SuperNet's case, these include economic goals, such as competitive advantages for business, as well as broader social goals, such as eliminating the digital divide and providing quality education, healthcare, and public services. This paper has highlighted some of the challenges that can arise in the pursuit of these goals.

The 11 Development Principles included in the original P-3 agreements (see Section 2.5) provided a broad canvass against which SuperNet was initially envisioned. They provided essential guidance as it evolved and developed. Looking ahead, we think there would be real value in updating these principles to reflect the lessons learned over the past 15 years. Specifically, much has been learned about the actions and behaviors required to ensure that SuperNet realizes its potential as a catalyst for positive change in how

[30] See https://crtc.gc.ca/eng/transcripts/2014/tt1124.htm

Alberta is governed and how business is conducted.

We have suggested that a "community" oriented focus should be adopted for the future, as was the case in the Education example. SuperNet's ability to serve as a catalyst for positive change across our society makes it much more than just "infrastructure." It is a tool for social change and community development. Many organizations and individuals have informed views on how this tool can be leveraged. Given the significant investments made by the province, and the huge potential to leverage SuperNet as a catalyst for change, we believe further study and discussion would be extremely valuable in helping government, businesses, civil society, and citizens understand how SuperNet's potential can be fully realized.

4.3 Support Innovation through Engagement

Ralph Klein recognized the Government of Alberta's limitations as a policymaker, especially regarding the new economy. The issues often exceeded officials' expertise and so he reached out to people with hands-on experience in this new field, especially business leaders.

We don't view this as a snub to the public service. Globalization and the ICT revolution called for new approaches to policymaking. In this new environment, issues were increasingly cross-cutting; often they involved competing interests, sophisticated technologies, and stakeholders of all kinds. As a result, the government needed outside expertise.

This is even more true today. Consider the issues around patient-centred care. They range from technical questions about network design to cultural ones about the traditional medicine of Indigenous peoples. To find solutions, decision-makers must draw on different kinds of expertise and experience, some within the medical community – such as doctors or researchers – and some outside it, such as historians and economists.

Moreover, these experts often have a learning curve of their own to pass through before they can provide useful advice to government. This is a clear lesson from the Discovery Pilot, where school administrators and educators had to see SuperNet in action before they were ready to start talking about technology in the classroom.

There's a further point. As a recent study from the McKinsey Global Institute shows, future engagement should be about more than tapping experts and stakeholders. In a user-centred model, **it also requires the experience of users**.[31] Let us explain.

According to McKinsey, companies tend to approach digital transformation as a centralized planning exercise when, in fact, many of the most promising trends begin as small opportunities that pop up somewhere in the organization. Trying to drive change from the top down means many of these opportunities, perhaps most, simply get missed. The way to capitalize on them is to put digital tools in the hands of employees. An employee in the backroom, on the shop floor, or at the customer interface can often spot an opportunity that a more centralized planning team will miss. When they do, the McKinsey

[31] *Which Industries are the Most Digital*, by Prashant Gandhi, Somesh Khanna, and Sree Ramaswamy; The McKinsey Global Institute; *Harvard Business Review,* April 1, 2016; available at: https://www.mckinsey.com/mgi/overview/in-the-news/which-industries-are-the-most-digital

study finds, a successful business ensures they have the tools and authority to take advantage of it.

The lesson for businesses is clear: empower your employees and encourage and support them in their efforts to change the environment around them. We believe there is a parallel lesson for user-centred public services. **Real progress on patient-centred healthcare or citizen-centred services requires new ways to get users/customers involved and experimenting with the tools to help shape and change the service.** This is precisely what schools did when they introduced technology into the classroom and let students begin to experiment with them.

In fact, users are already transforming lots of public services. In the Canadian North, for example, health workers in remote communities are changing the way services are provided by tapping into local social media networks to promote public education, carry out online medical consultations, and collect medical information to analyze local needs and trends.

The simple but far-reaching lesson here is that, when people are given the tools to digitize the environment around them, they will do so – whether they are employees on the shop floor, students in the classroom, or members of a health network in a remote community.

User-centred services still require centralized planning and committed government leadership; and this will require the engagement of experts and stakeholders at various levels; but success in the future also requires the real and practical engagement of users in transforming the services.

Summing all this up, we believe that the future direction and management of SuperNet should recognize it as an **enabling utility for the growth and development of communities of all kinds**. As such, it is not just infrastructure, in the traditional sense that telcos have understood this term. It is a tool of community development and there are real and practical benefits from engaging the community organizations and members in the dialogue about SuperNet's future. In the end, they are the end users/customers whose innovative ideas and uses will unleash its real potential for change. The list of communities – in the broadest sense of that term – that could be engaged would likely include:

- Health
- Education
- Provincial Government Services
- Municipal Government Services
- Economic Development

Each of these communities can readily be subdivided into further categories and groups, but each has a defined constituency and presumably definable common goals. If not, the subset is likely a "special interest group" rather than a community.

4.4. Connectivity as a Form of Community-Building

In the early days of the automobile, roads and highways were a means to get from one place to another. As the network evolved, uses got more sophisticated. Businesses found that trucking was a cheaper, more flexible way to ship goods than rail. City planners realized that different kinds of roads contribute to different environments, such as shady streets or bustling boulevards. Today, people use roads for much more than traveling from one place to another. They connect us socially and economically. They shape and

define our communities.

Broadband has a similar story to tell. At first, we used it to move data from one point to another. Today, we know that networks can connect individuals, governments, businesses, and organizations in all kinds of different ways to help them achieve their goals as a community and a society. If broadband is about connectivity, increasingly, connectivity is about community-building.

This was the subject of a recent public forum in Calgary, where community members gathered to discuss the opportunities that broadband holds for their community. Generally, they felt that new opportunities are exploding around them– smart cities, medical services, research, and so on. What are the implications for SuperNet 2.0? How will this version differ from the first one? Discussions around the evolution of the World Wide Web shed light on these questions:

- **Web 1.0** (1990 – 2010) was about the growth of infrastructure to support the transmission of data, mainly through static websites, which could be downloaded on a home computer. Web 1.0 was essentially about "digitizing" content, from magazines to government information.

- **Web 2.0** (2010 – 2020) built on this base by making the relationship between providers and users interactive, so that people on both sides could communicate with each other, and users could contribute to the content on display. This launched a new generation of services and tools, including online shopping, distance health, and social media.

- **Web 3.0** is the next chapter and it is already being written. As with businesses, it is about what happens to content and services as individuals get access to a new generation of digital tools – in this case, increasingly "smart" ones.

Web 3.0 means that the web itself is becoming intelligent in the sense that it "knows" what users are looking for. It is more than a search engine. Web 3.0 is proactive and can quickly profile a user, identify his/her needs, then employ machine-to-machine communication to find the content and/or people the user needs to achieve a goal.

A simple example is the app on Amazon.com that suggests to users the next book they may want to read. If Web 3.0 can anticipate the content users want, it can also find other like-minded people who share an interest in the content. Thus, Amazon's app could link the user to an online community of readers who share his/her taste in books. This makes collaboration with them an easy and natural next step.

The example is a simple one, but it points the direction in which Web 3.0 is heading. As it evolves it will incorporate breakthroughs in Artificial Intelligence, connect to virtually every kind of device on the planet through the Internet of Things, and be powered by enough speed and memory to scan an avalanche of data in the blink of an eye.

As a result, tasks such as finding new business opportunities, conducting forensic investigations, mobilizing a community around a political goal, or searching for the right dating partner, will be supported with highly nuanced information, analyses, and connections. Basically, Web 3.0 promises to stitch together people and content to build complex and highly-informed communities of interest. Increasingly, governments, organizations, and individuals will use their computers and smart phones to join and engage with digital communities around the world. What does this mean for broadband and for communities?

Increasingly, broadband is recognized as a community development initiative, not just an economic development initiative. “It is as much about supporting a community’s health, education, connectivity, quality of life / social interaction, and environmental goals as it is about creating new jobs or higher levels of income.”[32]

Much as the Klein government used SuperNet to connect hospitals, schools, libraries, and government offices to form distinctive provincewide networks, communities are now asking how they can use it to support the development of community networks that define their distinct interests, needs, goals and aspirations.

SuperNet 2.0 may be to community-building what SuperNet 1.0 was to user-centred services: the catalyst and enabler that gets communities of all sorts – geographical and communities-of-interest – using these new tools to realize their potential. If the key themes of SuperNet 1.0 were business development and competition, perhaps the key theme of 2.0 will be centred on building the digital community.

[32] See *Notes of CRP Broadband Information Session*, June 17, 2015 – Okotoks Council Chambers, by Calgary Regional Partnerships.