

2015 Governor's Task Force on Broadband—Report Outline

**Emphasize the five year theme throughout*

**Emphasize that there is no one-size-fits-all solution*

- Letter from Task Force Chair
- Executive Summary
- List of Task Force members

I. Broadband – A Primer

1. Definitions –Shannon

Use **Text Boxes** over the pages that contain Sections I. and II. to highlight the stories of five counties and the enabling conditions that made it possible for broadband development to succeed (SEE TEXT AT END OF DRAFT). Additional text box suggestions at end of draft.

Task Force Report Definitions

2G: Second generation wireless service. This level of wireless service was fundamentally used for voice communication and very basic data communication.

3G: Third generation mobile system. This level of wireless service includes voice communication and data service that provides up to 2 megabits per second or roughly equivalent to a DSL service.

4G: Fourth generation cellular wireless network.

Bandwidth: The capacity of a telecom line to carry signals. Bandwidth is measured in bits per second.

Broadband: Evolving digital technologies that provide consumers a signal switched facility offering integrated access to voice, high-speed data service, video-demand services, and interactive delivery services.

Cable Broadband: High-speed internet access provided by a cable TV company over its cable network.

CAF: Connect America Fund. The FCC replacement program for traditional universal service funding. Reforms have not been completely implemented for the smallest, rural carriers.

DEED: Department of Employment and Economic Development.

Download: To receive data from another computer or host computer (commonly referred to as the Internet) into your computer.

DSL: Digital Subscriber Line. A generic reference to the broadband provided by local telephone companies and competitors over a traditional copper network.

E-Rate: A federal discount program to assist schools and libraries afford telecommunications infrastructure and services. The program has transitioned from voice service to broadband and Wi-Fi services.

FCC: Federal Communications Commission. Federal agency responsible for regulating telecommunications carriers and the services they provide.

Fiber Network:

FTTH: Fiber to the Home.

Gigabyte:

Landline: Traditional wired telephone service.

Lifeline:

LTE:

Megabyte:

MNPUC: Minnesota Public Utilities Commission

OBD: Office of Broadband Development. Governor Dayton created the OBD in 2013 to facilitate border to border broadband connectivity in Minnesota.

RBE: Rural Broadband Experiments.

RUS: Rural Utilities Service. Division of the United States Department of Agriculture that provides critical grant and loan support for rural broadband.

Terabyte:

Universal Service: The financial mechanism which helps compensate telephone companies or other communications entities for providing access to telecommunications services at reasonable and affordable rates throughout the country, including rural, insular and high costs areas, and to public institutions.

Upload Speed:

USAC: Universal Service Administrative Company. USAC is the non-profit company that manages the contributions to and distributions from the Universal Service Fund. USAC oversees several programs, including Lifeline, E-Rate, and Rural Health Care.

Wi-Fi: Incorrectly believed to mean "Wireless Fidelity" when in actuality it is not an abbreviation. Wi-Fi is the wireless networking technology that allows computers, phones, and other devices to communicate via wireless signal.

- 2. Technologies (include description of technology, examples of deployment in MN, broadband speeds, what the future holds for the specific technology)*

Fiber

DSL (Andy?)

Cable (Dick)

Second Quarter 2015 - North American broadband usage is growing at a 56% Compound Annual Growth Rate.

The new Ford GT race car processes 100 Gb of data per hour.

This is a chart of various scenarios employing DOCSIS 3.0 and 3.1. This demonstrates the speed capabilities of the existing DOCSIS 3.0 and new DOCSIS 3.1 technology which will be deployed in 2016.

Service Group Capacity (Mbps)	down/up	Peak Product Speed	down/up
Baseline D3.0	961 72		506 36
Baseline 32 Channels	1,280 72		640 36
D3.1 minimum	1,200 174		638 87
100 MHz D3.1, Passive HFC	2,051 222		1233 111
384 MHz D3.1	5,147 222		3296 111
1.2 GHz, Full Spectrum, Mid-Split	12,099 607		9,679 337
1.2 GHz, Full Spectrum, High-Split	10,464 1591		8,371 1060

A typical CMTS (Cable Modem Termination System) is a device which hosts downstream and upstream ports. Downstream and upstream communications travel on a shared coax line in the customer premises, and connect to a single F connector at the modem. Because of the noise in the return (upstream) path, an upstream port is usually connected to a single neighborhood (fiber node), whereas a downstream port is usually shared across a small number of neighborhoods. Thus, there are generally more upstream ports than downstream ports on a CMTS. A typical CMTS has 4 or 6 upstream ports per downstream port.

DOCSIS (Data Over Cable Service Interface Specifications) 3.0 is deployed by most cable systems in Minnesota.

The highest DOCSIS 3.0 bandwidths for the number of bonded channels are listed in the table below.

Channel configuration		Downstream throughput		
Number of downstream channels	Number of upstream channels	DOCSIS	EuroDOCSIS	Upstream throughput
4	4	171.52 (152) Mbit/s	222.48 (200) Mbit/s	122.88 (108) Mbit/s
8	4	343.04 (304) Mbit/s	444.96 (400) Mbit/s	122.88 (108) Mbit/s
16	4	686.08 (608) Mbit/s	889.92 (800) Mbit/s	122.88 (108) Mbit/s
24	8	1029.12 (912) Mbit/s	1334.88 (1200) Mbit/s	245.76 (216) Mbit/s
32	8	1372.16 (1216) Mbit/s	1779.84 (1600) Mbit/s	245.76 (216) Mbit/s

DOCSIS 3.1

DOCSIS 3.1 specifications were first released in October, 2013 and updated several times since. The DOCSIS 3.1 suite of specifications supports capacities of at least 10 Gbs downstream and 1 Gbs upstream using 4096 QAM. The new specs do away with 6 MHz and 8 MHz wide channel spacing and instead use smaller (20 kHz to 50 kHz wide) [orthogonal frequency-division multiplexing \(OFDM\)](#) subcarriers; these can be bonded inside a block spectrum that could end up being about 200 MHz wide.^[9] DOCSIS 3.1 technology also includes some new energy management features that will help the cable industry reduce its carbon footprint.

HFC-Hybrid Fiber Coax

The coaxial portion of the network connects 25–2000 homes (500 is typical) in a tree-and-branch configuration off of the node. RF [amplifiers](#) are used at intervals to overcome cable attenuation and passive losses of the electrical signals caused by splitting or "tapping" the coaxial cable.

Trunk coaxial cables are connected to the optical node and form a coaxial backbone to which smaller distribution cables connect. Trunk cables also carry AC power which is added to the cable line at usually either 60 or 90 V by a power supply (with a lead acid backup battery inside) and a power inserter. The power is added to the cable line so that optical nodes, trunk and distribution amplifiers do not need an individual, external power source.

From the trunk cables, smaller distribution cables are connected to a port of the trunk amplifier to carry the RF signal and the AC power down individual streets. If needed, line extenders, which are smaller distribution amplifiers, boost the signals to keep the power of the television signal at a level that the TV can accept. The distribution line is then "tapped" into and used to connect the individual drops to customer homes.

These taps pass the RF signal and block the AC power unless there are telephony devices that need the back-up power reliability provided by the coax power system. The tap terminates into a small coaxial drop using a standard screw type connector known as an "F" connector.

The drop is then connected to the house where a ground block protects the system from stray voltages. Depending on the design of the network, the signal can then be passed through a splitter to multiple TVs.

Fiber Deep and Passive Coax

Coaxial cable has a theoretical upper bandwidth of 6 gigahertz. Current technology allows for 6 bits per hertz meaning that coaxial cable is capable of moving 36 Gbs in one direction or 18 Gbs symmetrically. Cable television providers are now moving closer to the customer with fiber. Two newer protocols are Fiber Deep and Passive Coax. Fiber Deep, as the name implies, places fiber deep into the neighborhoods and business areas. This reduces the amplifier cascades and improves performance and reliability.

Passive Coax brings the fiber to the curb so that there are no active devices other than the node. Since there are no additional electronics to maintain, reliability and bandwidths are further enhanced.

Passive optical networks

Cable operators are now beginning to use PON (Passive Optical networks) as a method of delivering specialized higher and symmetrical bandwidth to customers who need high capacity services today. The PON is used as an extension of the company's existing fiber network. These PON networks are the following capacities.

BPON -A typical BPON provides 622 megabits per second (Mbs) of downstream bandwidth and 155 Mbit/s of upstream traffic, although the standard accommodates higher rates.

GPON -The standards permit several choices of bit rate, but the industry has converged on 2.488 gigabits per second (Gbs) of downstream bandwidth, and 1.244 Gbs of upstream bandwidth.

EPON/10G EPON -This standard uses current 802.3 Ethernet frames with symmetric 1 gigabit per second upstream and downstream rates. EPON is applicable for data-centric networks, as well as full-service voice, data and video networks.

10 Gbs EPON or 10G-EPON was ratified as an amendment IEEE 802.3av to IEEE 802.3. 10G-EPON supports 10/1 Gbs. The downstream wavelength plan support simultaneous operation of 10 Gbs on one wavelength. The upstream channel can support simultaneous operation of IEEE 802.3av and 1 Gbs 802.3ah simultaneously on a single shared (1,310 nm) channel.

Many cable providers in Minnesota are using Radio frequency over glass (RFOG). It is a type of passive optical network that transports RF signals over fiber that were formerly transported principally over the hybrid fiber cable. In the forward direction RFOG is either a standalone Point 2 MultiPoint system or an optical overlay for existing PON such as GEAPON/EPON. The overlay for RFOG is based on Wave Division Multiplexing (WDM) -- the passive combination of wavelengths on a single strand of glass. Reverse RF support is provided by transporting the upstream or return RF into on a separate wavelength from the PON return wavelength. One of RFOG's advantages is that it does not require a new type of technology

in the Headend/central office, nor does it require new test equipment or comprehensive training of the tech staff.

Wireless (Paul)

Consumers have adopted new, Internet-based technologies and mobile connections at an unprecedented rate. Internet-based products and devices, including smartphones and tablets, allow mobile access to applications like mobile Health, distance learning, social media and a host of video-conferencing services, and are providing consumers everywhere with new choices to connect, to communicate, and to access information and entertainment. IP (Internet Protocol) technology allows consumers to use a range of devices – anything from your TV, phone, laptop and tablet -- to seamlessly communicate using voice, data, and Internet applications on wireless and wireline networks—opening the door to boundless opportunities.

People are actively choosing new and innovative products, services and devices that require faster, more robust and more advanced technology—whether wired or wireless. Every month, 450,000 consumers switch to phone services that run on wireless and Internet-based networks. In fact, across America in 2013, two in every five American adults lived in homes that were wireless-only and 40.2 percent of homes utilized VoIP.

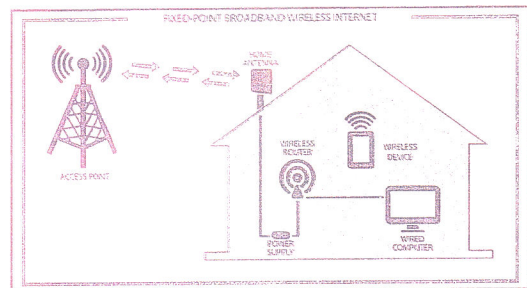
Consumers no longer just use a phone to make a voice call. Now we use our cell phones, smartphones, tablets, netbooks, e-readers, laptops and more to communicate using more than just voice – through these new products and devices we can now share our schedules, photos, business plans, documents,

contacts, location and thoughts. In 2013, Global Mobile Data Traffic grew by 81%, nearly 18x the size of the entire global Internet in 2000. By the end of 2014, the number of mobile-connected devices exceeded the number of people on earth. Increasingly, smartphones are the product of choice to perform these functions; as of January 2014, 58 percent of adults in the United States own a smartphone.

IP technology can also be a leading economic force. A 2013 study conducted by research firm Information Age Economics projects that wireless infrastructure investment will generate as much as \$1.2 trillion in economic growth while creating 1.2 million new jobs over the next five years.

Fixed Wireless (Dan and Tim)

Defining “fixed wireless” as an internet technology medium refers to a radio frequency based system comprised of radio transmitters and receivers that connect a customer (subscriber) to the Internet. A subscriber’s radio connects to the provider’s facility (access point or base station transceiver) most typically with an external radio/antenna; within certain systems, indoor radios and mobile devices may connect to a fixed wireless system. Fixed wireless systems can operate in both licensed and unlicensed radio frequencies.



Fixed wireless system may be designed with both point-to-point and point-to-multipoint topologies. A point-to-point being more similar to a dedicated connection, i.e. dedicated T-1, DS3, FTTH, while point-to-multipoint is considered a shared system, i.e. DSL, Cable, PON fiber systems. Point-to-point fixed wireless radios currently can sustain throughput greater than 1Gbps.

Performance of fixed wireless systems are dependent on the technologies employed and the selection of services offered. Wi-Fi or WLAN (Wireless Local Area Network) implementation, based on IEEE 802.11a/b and extensions, generally operate in the unlicensed ISM bands of 2.4GHz and 5.8GHz. Early implementation within FCC licensed spectrum of the 2.3GHz and 2.5GHz bands employed a converged platform utilizing the ITU DOCSIS (Data Over Cable Service Interface Specification) standard called wireless cable. Wireless Metropolitan Area Networks or WMAN, as defined in IEEE 802.16a-d and extension to 16e-2005 for mobility, represented the next generation of fixed wireless, TDD and WiMAX systems. Systems within this last group have been developed across a broad spectrum of frequencies; 700MHz, 2.4GHz, 2.5GHz, 3.65GHz, 4.9GHz, and 5.8GHz comprise the majority of frequencies utilized by

these systems. Current subscriber radios can operate at speeds within the 10-20Mbps+ speeds across a 100Mbps interface.

Convergence is occurring within the next evolution of fixed wireless coinciding with the 3GPP (3rd Generation Partnership Project) standards. 3GPP has defined an all-encompassing roadmap (GSM through LTE; 2G-4G cellular technologies) with LTE-Advanced standardization. Fixed wireless systems are currently being deployed under the LTE umbrella with a roadmap to LTE-Advanced. The long-term objective of the LTE-Advanced standard is to sustain a subscriber interface at 1000Mbps (1Gbps) of throughput and maintain/expand all current services for voice, video, data.

3. Applications Blandin: infographic continuum

II. Five Years Ago to the Present

1. History/goals of task forces OBD

There have been three broadband task forces in Minnesota.

2008-2009

The first task force was created in statute, SF1918, and consisted of 23 members representing designated categories. The charge of that task force was to submit a report with recommendations for a comprehensive statewide plan for achieving a state ultra high-speed broadband goal. The recommendations were to include a level of broadband service that would be reasonably needed by all citizens by 2015, as well as policies and actions necessary to achieve that goal, a description of opportunities for the public and private sectors to cooperate, an evaluation of strategies used in other countries and states to support broadband, recommendations to assure the reliability of broadband service, an estimate of the costs to reach the recommended speed goals, a description of the economic benefits made possible by wide availability of broadband, and an evaluation of how broadband benefits education, healthcare, community based organizations and government.

The report from that task force can be found at

<http://archive.leg.state.mn.us/docs/2009/mandated/091056.pdf>

Based on the information contained in that report, the Minnesota legislature adopted broadband speed goals for Minnesota which expired in 2015. The goals, including that all households and businesses should have access to broadband at speeds of at least 10 to 20 Mbps download and five to ten Mbps upload, can be found at Minn. Stat. § 237.012.

2010

The Minnesota Broadband Advisory Task Force was a commissioner created task force to advise and assist the Minnesota Department of Commerce in the submission of its annual report on the state of broadband in Minnesota. This advisory task force consisted of 15 members from a variety of backgrounds. Its report can be found at

http://mn.gov/commerce/images/Broadband_Report_2010.pdf

2011-Current

By Executive Order (<http://www.leg.mn/archive/execorders/11-27.pdf>), Governor Mark Dayton created the Governor's Task Force on Broadband on August 25, 2011. The charge of the task force is to develop, implement and promote state broadband policy, planning and initiatives to achieve state broadband needs and goals. The task force consists of 15 members from varying backgrounds. Task force members were appointed in the fall of 2011. Numerous reports were prepared by this task force. Those reports can be found at <http://mn.gov/deed/programs-services/broadband/task-force/index.jsp>.

Upon the beginning of his second term in office, the open appointments process was used to appoint/reappoint task force members. This report is the first from the task force appointed in 2015.

2. Programs during that time (Examples: infrastructure like ARRA, CAF I; adoption and community efforts) Blandin

Rural communities understand the importance of broadband infrastructure. They also recognize that the true value of broadband is realized when residents, businesses and organizations increase their use of broadband to be more efficient and effective.

Five years ago...

Blandin Foundation has led statewide rural broadband efforts over the past decade with resources directed towards stimulating and supporting both community-based infrastructure and adoption. Blandin's efforts significantly accelerated just over five years ago when an American Recovery and Reinvestment Act (ARRA) grant award funded the Minnesota Intelligent Rural Community program (MIRC). Statewide partners included the Regional Development Commissions, DEED, University of Minnesota (UM) Extension, Minnesota State Colleges and Universities System (MnSCU), PCs for People and Minnesota Renewable Energy Marketplace (MNREM). Eleven demonstration communities created teams and implemented broadband adoption programs. School districts and various non-profits within the MIRC demonstration communities used MIRC funds to provide significant amounts of digital inclusion training to older adults, new Americans, and people with disabilities.

The ARRA funding also provided opportunity for prepared communities to obtain grants and loans for infrastructure through the Broadband Initiatives Program or BIP (USDA) and Broadband Technology Opportunities Program or BTOP (NTIA) programs. Northeast Service Cooperative, Southern Minnesota Broadband Services (Bingham, Heron Lake, Jackson, Lakefield and Round Lake), and Cook (via Arrowhead Electric Cooperative), Lake and Lac qui Parle Counties each received funding for county-wide FTTH projects.

Several regions began to be active in the broadband issue area. The Northwest Initiative Foundation's Impact 2020 effort included a focus on broadband. Region Five Development's Resilient Region initiative has broadband at the center of its eleven themes and has benefitted from strong participation by the cooperative broadband providers within the region.

Many libraries and community education programs offered computer and Internet basics courses to community members

Today...

Blandin Foundation continues its community efforts through its Blandin Community Broadband Program; at this time, ten new communities and 13 alumni communities, mostly counties, are in relationship with the Foundation and are benefitting from convening, planning and grant assistance. Additional communities benefit from the Robust Network Feasibility Fund and Broadband Innovation grant programs.

MIRC statewide partners continue their efforts in expanded and new ways. PCs for People continues to expand its relationships with rural communities for collection and distribution of used PCs. PCs for People has grown from supplying just over 1,000 computers to low-income families per year to just under 10,000 computers per year and now work in multiple states. DEED Workforce Centers continue to provide online resources and computer access to those seeking work opportunities. University of Minnesota Extension continues to offer its e-marketing expertise to business through recorded webinars and on-site workshop delivery methods.

Regionally, both the Northwest Minnesota Initiative Foundation and Region Five continue their efforts to promote broadband network deployment and adoption efforts. Upper Minnesota Valley RDC is working on both network development and online inter-governmental collaboration.

Today, most community broadband efforts are organized at the county level, generally seeking ubiquitous broadband services including in the rural countryside. The DEED OBD Border to Border Broadband grant program is viewed as the primary tool for closing the financing gap on these projects, generally in some type of partnership, ranging from market development assistance to financial grants, with a private sector provider.

The new RS Fiber Cooperative is an innovative approach. This new cooperative will deliver FTTH services in rural communities and provide high-speed wireless services to the rural countryside. The cooperative has a plan to ultimately deliver fiber-based services throughout its service territory. This project is a collaboration that includes support from the city and township governments, the local agricultural cooperative and the area electric cooperative.

Annandale has been pursuing improved broadband services and has recently reached agreement with Midcontinent to build a new network providing a more competitive situation for triple play services in the community.

A blend of quality leadership, ready broadband partners, federal and state financing and good luck are some of the success factors.

Counties that continue to pursue better broadband include Aitkin, Itasca, Kanabec, Pine, Mille Lacs, Sherburne, Redwood, Martin, Nobles and Todd Counties. It is likely that a significantly longer list of places with less visible broadband efforts exists. The Association of Minnesota Counties has a broadband committee formed with regular, well-attended meetings. The Minnesota Public Broadband Alliance was formed in 2015 to promote collaboration among publicly funded broadband providers.

Chisago Lakes is now in the midst of the America's Best Communities' competition sponsored primarily by Frontier Communications. They are one of 50 quarter-finalists competing to be one of eight semi-finalists, each of which will receive \$100,000 to implement their economic revitalization plan over the next year with the top three performing communities winning \$3, \$2 or \$1 million dollars. Chisago Lakes' plan includes a community technology center, social media marketing, and community Wi-Fi hot spots.

3. Creation of the Minnesota Office of Broadband Development OBD

In the 2013 legislative session, an Office of Broadband Development was created and included in the Omnibus Jobs, Economic Development, Housing, Commerce, and Energy Bill ([HF729](#)). The Office is located within the Minnesota Department of Employment and Economic Development and began operating in January 2014. The Office is funded with an annual appropriation of \$250,000. The purpose of the Office is to encourage, foster, develop, and improve broadband within the state. Responsibilities for the Office are outlined in Minn. Stat. [§116J.39](#) and include:

- Serve as the central broadband planning body for the state;
- Coordinate with state, regional, local and private entities to develop a uniform statewide broadband access and usage policy;
- Develop, recommend, and implement a statewide plan to encourage cost-effective broadband access, and to make recommendations for increased usage;
- Coordinate efforts to meet the state's broadband goals in Minn. Stat. §237.012;
- Develop, coordinate, and implement the state's broadband infrastructure development program;
- Provide consultation services to local units of government or other project sponsors in connection with any broadband deployment projects;
- Encourage public-private partnerships to increase deployment and adoption;
- Monitor broadband development efforts of other states and nations;
- Monitor broadband-related activities at the federal level in consultation with the commissioner of Commerce;
- Serve as an information clearinghouse for federal programs providing financial assistance to institutions in rural areas seeking to obtain access to high-speed broadband services;

- Provide logistical and administrative support to the Governor’s Task Force on Broadband; and
- Coordinate an ongoing collaborative effort of stakeholders to evaluate and address security, vulnerability and redundancy issues in order to ensure the reliability of broadband networks.

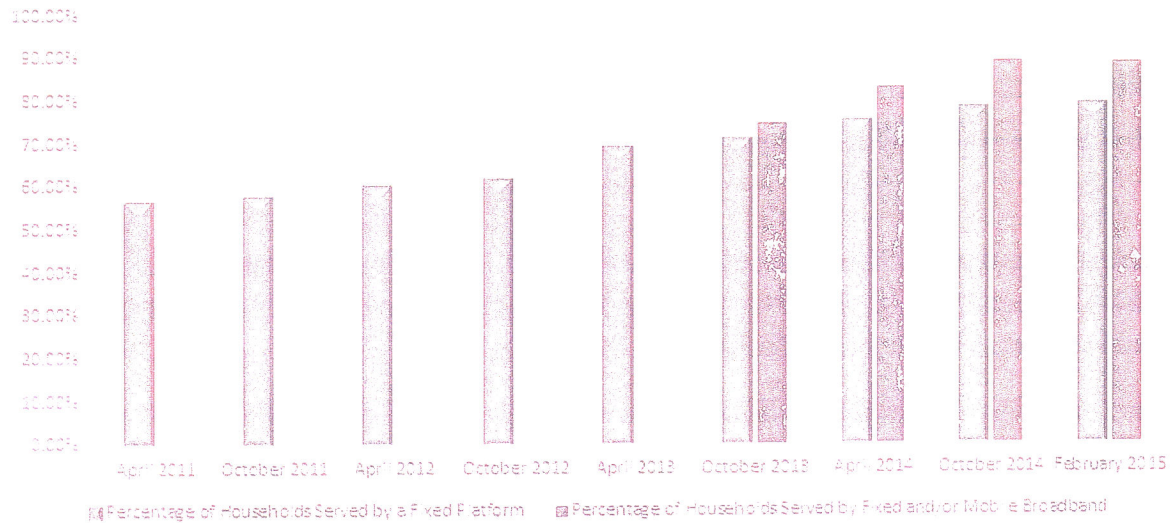
In 2014, the legislature established the Border-to-Border Broadband Development Grant Program with an initial funding allotment of \$20 million. In 2015, the legislature continued the program with a funding level of \$10.588 million. The funding is to be used to award grants for broadband deployment to unserved and underserved areas. Up to three percent of the funding may be used for administration, broadband mapping, and to conduct business and residential surveys measuring broadband adoption and use in the state.

III. Where we are now: Availability and Adoption

1. Availability and adoption five years ago – then and now. *(Separate graphics on availability and on adoption)* OBD

Broadband availability has increased across the state since measurement began approximately five years ago. The following bar chart shows that progress, measured in terms of household broadband availability at speeds of 10Mbps download and 6Mbps upload. (Note that the chart shows broadband availability at 10Mbps download and 6Mbps upload, whereas the state broadband speed goals are at least 10Mbps download and at least 5Mbps upload. However, because data under the State Broadband Initiatives program, funded by ARRA, was collected using federal parameters, we did not have the ability to measure broadband with an upload speed of at least 5Mbps until the fall of 2014. To enable the bar chart to show the growth trend at a constant speed, we retain the 10Mbps download/6Mbps upload for purposes of this comparison.)

% of Minnesota Households with High Speed Broadband Access at the Statutory Speed Goal of >10 Mbps Download and >6 Mbps Upload



	Apr 2011	Oct 2011	Apr 2012	Oct 2012	Apr 2013	Oct 2013	Apr 2014	Oct 2014	Feb 2015
% of HH	56.44	57.40	59.92	61.57	69.19	71.04	74.53	74.93	82.72
% Growth	0.00	0.96	3.48	5.13	12.75	14.60	18.09	18.49	26.28

Figure X: Percent of Minnesota Households Served at 10Mbps/6Mbps (Source: Connected Nation)

FIND/CREATE A FIVE YEAR PICTURE OF BROADBAND ADOPTION INCREASE

2. More detail on current availability in MN (CN, Akamai, FCC 706) OBD

The state broadband speed goal, as presented in Minnesota Statutes, provides:

237.012 BROADBAND GOALS.

Subdivision 1. Universal access and high-speed goal.

It is a state goal that as soon as possible, but no later than 2015, all state residents and businesses have access to high-speed broadband that provides minimum download speeds of ten to 20 megabits per second and minimum upload speeds of five to ten megabits per second.

Subd. 2. State broadband leadership position.

It is a goal of the state that by 2015 and thereafter, the state be in:

- (1) the top five states of the United States for broadband speed universally accessible to residents and businesses;
- (2) the top five states for broadband access; and
- (3) the top 15 when compared to countries globally for broadband penetration.

Regarding the goal established in subdivision 1 above, data collected by Connected Nation as of February 28, 2015, indicates that 91.45% of Minnesota households have broadband access available at a speed of at least 10Mbps download and 5Mbps upload.

For the state broadband leadership position goals included in subdivision 2 above, the Task Force has in the past reported measurements that enable a national or international comparison.

With regard to the goal that Minnesota be in the top five states for broadband speed universally accessible to residents and businesses, Minnesota’s average connect speed was 12.9 Mbps, placing the state 21st amongst other states. Under the Akamai measurement¹, the average connection speed is a reflection of what customers choose to purchase and not necessarily the speeds that are available. While Minnesota’s average connection speed has increased, that increase is not at a rate greater than other states which would enable Minnesota to move up in the rankings.

Rank	State	3Q 2015 Avg. Mbps
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
21	Minnesota	12.9

Figure X: States with the Highest Average Broadband Speed (Source: Akamai 3Q15 State of the Internet)

The Task Force has traditionally reported Akamai’s average broadband speed as a measure of Minnesota’s standing for broadband speed universally accessible, however, Akamai indicates that the

¹ Akamai’s average connection speed is a metric calculated by taking an average of all of the connect speeds calculated during the quarter from the unique IP addresses determined to be in a specific state.

average peak connection speed is more representative of Internet connection capacity. By using the fastest measurement observed from each unique IP address, Akamai indicates it is capturing just those connections that reach maximum throughput rates. Unfortunately, under this measure, Minnesota's average peak connection speed of 55.5Mbps results in a ranking of #32 compared to other states.

In addition to Akamai, there are other data sources that can be used to measure broadband access and adoption.

- Minnesota is amongst the 18 states listed as having 100 percent availability at speeds of 3Mbps download and 768kbps upload according to the National Broadband Map (Data as of June 30, 2014.)
- Add Form 477 ranking for 3/200k if released as of 12/31/14
- Add Form 477 ranking for 10/200k if released as of 12/31/14
- Minnesota is 42nd (between the US at #41 and Slovenia) out of a combined 109 geographies (108 qualifying countries plus Minnesota) with an 80.49% adoption rate as measured by Akamai. This number looks at broadband connections at 4Mbps and above (download) compared to all connections in that state or country, to determine its broadband adoption rate. Thus, it is not a measure of adopters versus non-adopters but does allow for an adoption comparison to other countries.

INSERT 3Q 2015 TABLE WHEN REPORT IS RELEASED.

The Office of Broadband Development, through a contract with Connected Nation (parent company of Connect Minnesota, the SBI designated entity for Minnesota) and the participation of broadband providers in Minnesota, was able to update maps showing broadband availability as of February 28, 2015. A few of the maps resulting from that effort are provided here. Additional information on broadband availability can be found on the Office of Broadband Development website at <http://mn.gov/deed/programs-services/broadband/maps-tests/index.jsp>.

Insert maps:

<http://mn.gov/deed/images/InfrastructureGrant.pdf>

http://mn.gov/deed/images/households_wireline.pdf

In its 2015 Broadband Progress Report and Notice of Inquiry on Immediate Action to Accelerate Deployment, adopted January 29, 2015 by the FCC, the FCC found that having access to advanced telecommunications capability requires access to actual download speeds of at least 25Mbps and actual upload speeds of at least 3Mbps. To show the progress of the nation in achieving access at this new definition of advanced telecommunications capability, the below map was released (based on December 2013 data).

INSERT FCC 25/3 national map.

~~Breakdown by geographic area: (Note depends on data availability)~~

- ~~a. Urban—Andy pull out seven county metro area; Kevin—can you pull out metro and compare to another state?~~
- ~~b. Suburban~~
- ~~c. Rural~~

As a general rule, rural areas are less likely to have broadband service available. While several providers in Minnesota have made an extraordinary effort to deliver service—even gigabit service—in the state’s rural areas, data confirms that rural areas must remain a focus in order to meet the state’s broadband speed goals.

Rural Availability Estimate of Broadband Service of at Least 10Mbps Download and 5Mbps Upload				
Platform Type	Total Rural Households ('000)	Unserved Rural HH ('000)	Percent of Rural HH Served	Percent HH Served Statewide
Fixed, Non-Mobile Broadband Service	897	221	75.38	88.98
All Broadband Platforms, Including Mobile	897	178	80.16	91.45

Figure X: Source Connected Nation (February 2015)

d. Tribal—Hannah and Maureen working with Sally Fineday

3. Current availability elsewhere Neela to do some write-up on Gig deployments

Announcements are made every week of communities where gigabit service will be newly deployed. Three communities, partners in US Ignite, are featured below as examples of what exceptional broadband service can do for a community.

Red Wing, MN

When the **City of Red Wing, Minnesota** and Hiawatha Broadband Communications (HBC) formed a public private partnership to provide gigabit data services to the Red Wing community, the goal was not to download movies faster, it was to change the way the community works, learns and lives.

Because of its high-speed fiber-optic network, Red Wing was included in the original 25 national partners of US Ignite (an initiative of the White House and the National Science Foundation to keep the US globally competitive). Red Wing and Red Wing Ignite (a non-profit created to advance innovation,

technology and entrepreneurship) have been hard at work in an effort to develop next-generation applications. These applications are designed to provide public benefit in six areas of strategic importance: education and work force development, health care, advanced manufacturing, public safety, clean energy, and transportation.

Red Wing has helped launch and implement public safety, healthcare and other applications that assist individuals in their daily lives. Red Wing believes the gigabit network is like electricity. When electricity was developed, no one knew our world would become completely dependent on it for daily life. As the development of gigabit applications continues, broadband networks will also become indispensable.

The gigabit network will:

- **Keep Seniors Connected** Through implementation in numerous organizations, the network will enable elderly individuals and their families to remain connected real-time with people, organizations, and services that are important to them and their quality of life. This will allow the elderly to feel more connected to the community while obtaining needed support that will allow them to live independently through video and data connections.
- **Improve City Safety** Red Wing assisted a public safety application, which helps emergency responders evacuate and manage chemical emergencies. The real-time information enabled by this technology includes: weather, wind, landscape and chemicals. The knowledge of all these factors allows responders to implement a safe and efficient evacuation in a time of emergency.
- **Access to Healthcare** Telemedicine and residential support services extend independent living, which will drive down healthcare costs, increase access, and improve outcomes. Services will include secure video conferencing with providers and other support resources at all service levels.

Once communities become aware of and then dependent on gigabit applications which keep them safe, provide greater access to healthcare and keep seniors independent longer, individuals will need and will settle for nothing less than gigabit connectivity.

Through the power of high-speed connectivity, Red Wing Ignite is beginning to change the way individuals work, learn and live!

Chattanooga, TN

Chattanooga, Tennessee is leveraging the fastest citywide network, with 10 Gig speeds and is a vibrant city for various professionals and new opportunities. The city has capitalized on its current assets by building an innovational culture in a mid-sized city with special help from the fastest city-wide network. With countless startups, new technology, and initiatives to build and maintain inclusion in urban and rural areas, the benefits of creating accessibility of this resource provides Chattanooga the opportunity

to become a nation-wide leader. From attracting individual talent to additive manufacturing, the gig continues to be a viable resource.

- **Over 4,000 new jobs created within past five years, with over half attributed to gig network.** The gigabit fiber network influenced Volkswagen, Amazon and two new global players to make Chattanooga home. Broadband is becoming the foundation for economic growth.
- **Creation of Innovation Center** which serves as a collaborative space for different businesses and individuals with the intent to create collisions and create more out of Chattanooga.
- **Startup weeks and other events are driving new applications.** Chattanooga's entrepreneurial community features various events that highlight the city's growing startup scene and inspire entrepreneurial thinking.
- **GigTank accelerator driving development of entrepreneurial ecosystem and dozens of startups.** GIGTANK provides guidance from industry experts, business mentors, and national thought leaders in broadband and entrepreneurship. The program is designed to connect high-speed entrepreneurs with the tools, capital, and connections to go to market.

Kansas City, MO

Kansas City, Missouri is leveraging Google Fiber. A key partner of US Ignite, KC Digital Drive is a 501c3 non-profit organization whose mission is to make Kansas City a digital leader to secure our economic prosperity and improve the quality of life for all people in the region. This is accomplished by:

- **Closing the digital divide** by connecting everyone to affordable broadband Internet, and make emerging technology equitably accessible.
- **Driving digital innovation** by giving everyone the opportunity and resources to create new technology ventures and applications that will improve lives and grow the economy.
- **Building Kansas city's reputation** by making Kansas City a capitol of civic innovation and thoughtful adopter of technology known the world around.

The outcome of this work: (Question: is this Kansas City info or US Ignite statistics?)

- Generated **\$1.25 million** in direct financial support for programming and technology projects in digital inclusion, health care, education, events and community investment
- **\$550,000** of the above directed to 20 distinct pilots in healthcare, education and digital inclusion
- Attracted **250 delegates** from **49 U.S. cities** to the **2015 Gigabit City Summit**, our smart-city conference for cities seeking to leverage broadband Internet for community benefit
- Organized **5 hackathons** attracting **300 participants** and leading to the creation of **3 startup companies**

~~4. Maps (CN, FCC)~~

4. Current adoption (Pew, Census Bureau survey, FCC 706 report, etc.) OBD

Adoption Disparities

Simply having broadband speeds available in an area does not necessarily make broadband accessible. Examining adoption disparities clearly shows that a digital divide exists.

2015 Pew Research Center² data shows that 87% of all adults use the internet at home. However, low income, elderly, and rural Americans are not using the internet at the same rate as others.

- 22% of low income adults don't use internet at home
- 35% of the elderly population doesn't use internet at home
- 25% of rural adults don't use internet at home

Of those adults not adopting internet use at home, 26% cited reasons that could be reduced over the next five years with proper investment. According to Pew Research Center³, 19% cited price (price of internet, or the price of a computer), and 7% cited lack of service. The broadband availability gap closed in America by 3% last year⁴. With proper investment, Minnesota could be setting an example for the nation to follow on how to utilize investment to increase adoption rates.

Although those numbers are taken from national research, the 2013 Connect Minnesota⁵ data shows that these issues are reflected in Minnesota as well.

- 41% of low income Minnesotans don't use internet at home
- 41% of elderly Minnesotans don't use internet at home
- 27% of rural Minnesotans don't use internet at home

Being that those numbers are from 2013, undoubtedly they have improved over the last few years. However, this shows that the national adoption issues are present in Minnesota.

Investing in Adoption

By investing in broadband, Minnesota is investing in all of the positive outcomes that follow when people are able to adopt broadband use at home.

- Telehealth is expected to be a \$2.8 billion industry by 2022, with the possibility of reducing hospital visits, thus producing a 27% reduction in costs⁶.
- Telecommuting continues to become more popular. Currently 50% of the workforce holds a job which would allow at least part time telecommuting⁷. Furthermore, 80% to 90% of the current workforce says that they would like to be allowed to telecommute part time⁵.

² See Digital Divide 2015 available at <http://www.pewinternet.org/2015/09/22/digital-divides-2015/>

³ Ibid.

⁴ See 2015 Broadband Progress Report available at <https://www.fcc.gov/reports/2015-broadband-progress-report>

⁵ See Connect Minnesota available at <http://www.connectednation.org/residential-survey-data?state=Minnesota>

⁶ U.S. telehealth market analysis-size, share, growth, trends and forecasts to 2022: Grand view research. (2015, Nov 02). M2 Presswire Retrieved from <http://search.proquest.com/docview/1728606341?accountid=44771>

- The economic impact of broadband availability can be felt in a number of areas. Small business accounts for 1.2 million new jobs over the last 10 to 15 years⁸. Giving rural, economically distressed areas the ability to adopt broadband can open a number of possibilities for job creation. Broadband availability will allow economically distressed areas to compete for investment in their areas.
- As a whole, households with school age children are far more likely to adopt internet at home. According to Pew Research Center⁹, 82% of household with children adopt internet use at home. Meaning, 18% of school aged children do not have internet access at home. Unfortunately, low income families make up a large portion on that 18%. Low income households are 4 times more likely to be without broadband access. Furthermore, one third of households with an income lower than \$50,000, and with children between 6-17 years old, do not have broadband access at home. Without closing this gap, low income students are forced to face a serious disadvantage in school.
- With greater broadband adoption, come higher levels of civic engagement. Having broadband available at home can help inform individuals and increase the level of citizen participation by presenting opportunity to integrate citizens' ideas through innovative partnerships¹⁰. Likewise, it allows communities to promote programs and communication within the community.

Minneapolis Example

Having broadband available in an area doesn't automatically make it accessible. In order to make broadband truly accessible, it must be affordable. By examining the results of the Minneapolis survey¹¹ it is clear that even in areas of the state where there is an abundance of broadband available, adoption disparities still exist.

- Over 15% of households do not have a computer with internet access
- 78% of non-internet users have an income below \$25,000
- 31% of minorities do not have a computer in their home
- 24% of minorities do not have internet access in their home

These results highlight the importance of low income programs, to insure that broadband is accessible, thus making the statement that affordability is a key to adoption. While this study makes that case for Minneapolis, affordability is not exclusively a Minneapolis issue. As shown in the Connect Minnesota survey results above, 41% of low income households in Minnesota do not adopt broadband at home.

⁷ See Latest Telecommuting Statistics *available at* <http://globalworkplaceanalytics.com/telecommuting-statistics>

⁸ See Broadband and Economic Opportunity *available at* <http://www.broadband.gov/issues/economic-opportunity.html>

⁹ See The Numbers Behind the Broadband 'homework gap' *available at* <http://www.pewresearch.org/fact-tank/2015/04/20/the-numbers-behind-the-broadband-homework-gap/>

¹⁰ See Broadband and Civic Engagement *available at* <http://www.broadband.gov/issues/civic-engagement.html>

¹¹ See 2014 Community Technology Survey *available at* <http://www.minneapolismn.gov/it/inclusion/WCMS1P-118865>

Minnesota needs to work to make broadband accessible for all income levels, and residential locations, in order to successfully increase adoption rates.

~~6.—Community efforts Blandin; Neela writing up Red Wing Ignite Other stories/case studies?~~

IV. Where we are going: Applications

1. Applications and the bandwidth they consume (chart)—*Insert in report (from Brainerd meeting) emphasis on growth – exponential?*
2. IOT (Kevin Hanson, Dick Sjoberg)

Possible IoT infographics:

What is IOT from Goldman Sachs - <http://www.goldmansachs.com/our-thinking/pages/iot-infographic.html>

IOT and Mobile from Mobile Future - <http://resourceclips.com/2015/10/20/infographic-the-internet-of-things-and-our-mobile-future/>

Intel talking about the intelligent car -

http://download.intel.com/newsroom/kits/ces/2014/pdfs/TheIntelligentCar_infographic.pdf

Examples of Machine to Machine & Machine to Human Applications from Deloitte- http://dupress.com/wp-content/uploads/2015/08/DUP_1102_Figure16.jpg

Apps for Smart Home & Smart Car from Deloitte -

http://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology-media-telecommunications/us-tmt-Internet-of-things-GMCS_Infographic-2015.pdf

https://www.ncta.com/sites/prod/files/UPDATED_IoT-800w-2.png

https://g.foolcdn.com/editorial/images/148306/iot-infographic_large.jpg

3. Residential

4. Business/Economic Development (Kevin and Don)

Broadband connectivity has always been a key factor to a business's ability to drive growth. Whether it be communicating with their suppliers or selling products to their customers, a reliable, high speed connection is vital. While the reliance on connectivity may be obvious to see for large businesses, small to medium sized businesses (SMBs) need it just as much.

One costly barrier for SMBs has been access to technology. Traditionally, businesses buy fixed technology assets that have fixed capacity. This has a significant upfront expense that limits options for many SMBs. The emergence of cloud technologies is a game changer for this segment. Now SMBs can pay for only what they need. And they can stop paying for it when they are done using it. A Deloitte survey¹² found that SMBs utilizing the cloud to meet their technology needs grow 26% faster and are 21% more profitable than their peers who do not. Reliable, high-speed connectivity is one key to enable SMBs to successfully utilize the cloud.

Another area that is heavily reliant on this connectivity is our new 'gig' economy. According to a 2014 study for Freelancer's Union by Edelman Berland¹³, more than 53 million people are freelance workers. The workforce consists of independent contractors, moonlighters, and small freelance business owners and has grown nearly 25% since 2004. This population adds over \$700 billion annually to the economy.

The result of more freelance workers is more business generation outside of a traditional office. This suggests that reliable, high-speed connectivity at homes, farms, and while mobile is critical to the success of this workforce. In fact, this connectivity is important not only in performing the job – 42% do all of their work online – but, is critical to finding work. Sixty-nine percent of the survey participants found their employment on the Internet and nearly a third found jobs within 24 hours.

Telecommuting strategies continue to be popular with many employers. Studies show increased productivity and improvements in work quality and morale can be achieved with a properly implemented plan. In addition to the benefits employers and employees receive, the environment benefits with less miles being driven/fuel consumed resulting in lower CO2 emissions and lower amounts of congestion on roadways. One program that is promoting this model is Minnesota's eWorkplace¹⁴. Over 4,000 employees across 40+ Twin Cities employers participate in their program. The success of these telecommuting strategies depends on reliable, high-speed connectivity.

5. Education (Denise)

The Governor's Task Force on Broadband has dedicated meeting time to exploring the broadband connection to K-12 schools in Minnesota. Over the past few decades, technology has played an increasingly important role in our Minnesota schools. Digital learning has the potential to leverage technology to transform our educational system by providing students, parents, and educators more

¹² <http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Technology-Media-Telecommunications/gx-tmt-small-business-big-technology.pdf>

¹³ <https://www.upwork.com/press/2014/09/03/53-million-americans-now-freeance-new-study-finds-2/>

¹⁴ <http://www.eworkplace-mn.com/>

flexibility over time, place, path and pace of learning and increase student engagement. Access to affordable broadband is the cornerstone to unlocking and sustaining these learning opportunities.

The information gathered by the task force falls into four categories:

- Modernization of E-rate and Impact on Minnesota
- Connectivity Gap
- Minnesota Connectivity Report by Education SuperHighway
- Looking Ahead - Future Needs

The Office of Broadband Development has been charged by the Legislature and the Governor to measure and track the connectivity rates and any gaps for the K-12 schools in Minnesota. The Governor's Task Force has an interest in this information as well. In response we have brought together the Department of Education and Education SuperHighway to gather data so that we get an accurate understanding of K-12 broadband connectivity which will lead to responsible policy recommendations.

Modernization of Federal E-rate

PUT IN TEXTBOX: One of the original architects of the program, Sen. Jay Rockefeller, mentioned the program in his farewell speech on Thursday. "We have worked to give children a fair shot through E-Rate, a program which introduces even the most rural classrooms and smallest libraries to the world through the Internet," he said. "Access to a foreign language class, or scientific research a world away, won't guarantee success, but gives every child the key to unlock their potential."

The E-rate program, also known as Schools and Libraries Discount Program was created as a part of the Telecommunications Act of 1996. The goal of the E-rate program is to make telecommunications and information services more affordable for schools and libraries in America. The amount of E-rate funding to a school/library depends on the level of poverty and location of the school (or library). The discounts range from 20 to 90 percent, with higher discounts for higher poverty and more rural schools.

The growing importance of the Internet in connecting students to digital learning and information are creating increasing demands for bandwidth in schools. In response to this need, in 2014, the FCC adopted the E-rate Modernization Order and the Second E-rate Modernization Order as a part of a comprehensive review to modernize the program.¹⁵

The modernization of the E-Rate Program includes \$1.5 billion in additional funds for broadband access and digital learning opportunities for schools and libraries across the country. The current level of funding for E-rate has been virtually the same since the program was authorized in 1996. This historic move will help provide a foundation to help school districts keep pace with the demands and opportunities of our 21st Century economy.¹⁶

¹⁵ www.fcc.gov/e-rate-update

¹⁶ For additional information on E-rate reform, see: <http://www.edweek.org/ew/section/multimedia/the-e-rate-overhaul-in-4-easy-charts.html>

The E-rate program consists of two categories:

- Category 1 funds Internet access, the cost of fiber optics or other means of transporting data, and some local and long-distance voice/telephone services. The funding for voice/telephone services is being phased out over the next few years, which will result in a funding gap for schools.
- Category 2 funds wireless access points, firewalls, routers, switches and other similar equipment used to distribute Internet access within a school building.

PUT IN TEXT BOX quote by Denise Dittrich – MSBA -

“This historic FCC decision in support of \$1.5 billion increase in the E-Rate program funding will help level the playing field in Minnesota by helping our students in low-income and rural communities have access to today’s digital learning environment.”

Impact on Minnesota:

Minnesota schools receive state funding to subsidize the cost of Internet access that remains after the federal E-rate discount has been applied. The current annual appropriation for public schools is capped at \$3.75 million through the Telecommunications Access Revenue Aid. To access Telecommunication Access revenue, districts must apply for federal E-rate funding. This state revenue falls short of the need; the shortfall is estimated between \$5 and \$6 million. In the 2015 legislative session, bills to address the shortfall for education were introduced but did not pass.

In funding year 2015, the Minnesota schools and libraries E-rate commitment is over \$41.5 million in funding. That represents about 1.6% of the national total.¹⁷

Quote by Marc Johnson, Executive Director

ECMECC (Marc OK—prefers 2nd quote.)

"Minnesota schools will benefit from the additional E-Rate funding recently authorized by the FCC; however, the E-rate program still does not cover all of the ongoing costs of broadband connectivity. In addition, there continue to be inequities in the costs to deliver Internet access (bandwidth) to many areas of the state."

AND/OR another quote

¹⁷ <http://e-ratecentral.com/us/stateInformation.asp?state=MN>

“The combination of E-Rate and TEA funding is vital to the success of Minnesota schools, especially those in areas of the state that are harder and more costly to service with high-speed, quality telecommunications and Internet access.”

Connectivity Gap:

The bigger issue for schools and bandwidth is more about the cost than access. Schools generally can access what they need, but there is a great disparity across Minnesota in how much it costs schools to obtain that access.

School districts purchase commercial-grade (not residential) service that is dedicated (not shared) and often need to buy transport (usually leased fiber) to get the service to the school since most schools, especially those in rural areas, don't own fiber out to any Internet service providers.

Below are some examples of the disparities by geographical regions in the state.¹⁸

First a comparison of Internet Access Fee costs:

- Some areas in south-central Minnesota can obtain Internet Access for as little as \$1.00 per Megabyte per month.
- In the southwest and west-central part of the state, Internet Access costs average \$9.72 per Megabyte per month.
- In east-central Minnesota, Internet access costs average \$5.00 per Megabyte per month.
- In northeast Minnesota, Internet access costs can be as high as \$11.67 per Megabyte per month.

That's a range of \$1.00/Mbps/mo. to \$11.67/Mbps/mo.

Another comparison for Transport (fiber leases):

- Cost for fiber leases in the southwest part of the state average \$23.46 per Megabyte per month.
- Cost for fiber leases in east-central Minnesota average \$2.32 per Megabyte per month.

As an example of total costs to get Internet service to a district which includes transport and Internet Access, in Northwest Minnesota, fees can range from \$17.26 per Megabyte per month to \$302.99 per Megabyte per month because of geography. At the same time, the total cost can be as low as \$7.32 per Megabyte per month in other areas of the state.

E-rate reimbursements and Minnesota Telecommunication Equity Aid help to offset the disparities, but there is still a large gap that exists, and costs and will continue to rise as districts need more and more bandwidth.

Education Superhighway:

¹⁸ Provided by Marc Johnson of East Central MN Educational Cable Cooperative (ECMECC).

The Education SuperHighway (ESH) is a non-profit, non-partisan organization working to upgrade the Internet access in every public school classroom in America so that all students can take advantage of the promise of digital learning.

ESH has gathered and analyzed E-rate data for public school districts in Minnesota and have presented a Statewide Connectivity Report. They provide an accurate statewide picture of K-12 connectivity in our public schools. A copy of the ESH report is available at _____.

Education Superhighway has made two presentations to the Governor's Task Force on Broadband during our monthly meetings throughout 2015. The first meeting was an introductory presentation about who they are and what they are doing to help schools across the nation. Their mission is to:

Upgrade the Internet access in every public school classroom in America so that every student has the opportunity to take advantage of the promise of digital learning.

They address the issue by:

- Inspire State Action
- Ensure Wi-Fi Access
- Close the Fiber Gap
- Make Broadband Affordable

After that initial meeting, Education Superhighway pursued gathering baseline Minnesota school information in regards to digital learning in Minnesota. The [Education Superhighway Presentation](#) contains the information from this second meeting with the Task Force. EducationSuper Highway has also released a *State of the States* report, which provides high level comparisons across the country around K-12 connectivity. This report will is available at _____.

Minnesota Online and Digital Learning Advisory Council:

Minnesota also has an Online and Digital Learning Advisory Council, created by the Minnesota Legislative Online Learning Options Act ([124D.095](#), subd. 10 in 2005 and reauthorized in 2009 and again in 2013). The statutory purpose of the advisory council is to bring to the attention of the commissioner and the legislature any matters related to online and digital learning. In its report, [Removing the Barriers to Digital Learning in Minnesota](#), the advisory council stated, "Having high speed broadband internet outside of school and with a mobile device 24/7 is essential for teaching and learning in the 21st century." And, the advisory council also called out the work of this Task Force:

Building and sustaining a digital learning infrastructure will take contributions and involvement from many sectors, including K-12 and higher education institutions, business and government. Thus the work of the Governor's Broadband Taskforce must guide the collaborative work that is necessary to ensure delivery of digital learning to all students, teachers and schools in the state.

Similar to previous recommendations by this Task Force, the advisory task force has also recommended expanded funding for the Telecommunications Equity Access program to ensure cost-effective, high-speed broadband access to schools.¹⁹

Legislative Action or Looking Ahead:

Telecommunications Equity Aid need is approaching \$9 million annually. There were several bills introduced in 2015 that requested various amounts of additional funding; unfortunately none of them were included in the final education omnibus bill. Advocating for an increase in Telecommunications Equity Aid will be a priority for the Task Force in 2016.

On a final note, Minnesota will soon have statewide information to report to the legislature by February 1, 2016 on best practices in developing and implementing 1:1 device initiatives in our school districts. In the 2015 legislative session a bill was passed that required the Commissioner to survey school districts and create a report on 1:1 device programs in schools. According to the Department of Education, 267 traditional school districts, 71 charter schools and five Special School Districts responded to the survey. The information obtained is being processed; the department will be sharing more of the data with the Task Force when the report is fully developed and approved by the Commissioner.

Future Needs -- where are we going?

The cost of broadband and Internet access are rising due to school district needs for additional bandwidth and services required to support learning in a time where education resources and connections are increasingly used online.

Internet access is crucial for schools and learning. Digital content and increasing use of mobile devices all require higher levels of bandwidth. In addition to educating, schools use the internet for daily operations for food service, communication, transportation, accounting and procurement. Our schools need to continue to meet the bandwidth needs of today and the demands of the future. Appendix X includes a sample listing of how schools consume bandwidth.

6. Higher Ed -John Dukich

Broadband plays an important role in today's higher education infrastructure. There are a number of applications that render broadband a necessity in today's higher education classroom. Indeed, many of Minnesota's colleges and universities now offer distance learning programs or online degrees that offer the student to ability to remotely connect to the class in real-time. These programs, which are

¹⁹ [Online and Digital Learning Advisory Council Report 2014](#)

particularly helpful for students located in rural areas of the state or who are not able to attend class in-person, require a broadband connection for both students and higher education institutions.

Minnesota State Colleges and Universities

The need for broadband in education has never been higher than it is today and continues to increase as more and more content is being delivered digitally. From a higher education perspective, the need for broadband is to extend the classroom beyond the campus and drive content to the student in their home or to their mobile device while they are on the go. This is a particular challenge for the Minnesota State Colleges and Universities (MnSCU) systems, whose students may have broadband available to them in the cities but cannot afford the cost – or students in rural or underserved areas that need the connectivity but it is not available.

The types of content being driven to the student range from online courses to fully immersive video presentations and remote hands on training using simulators. A noteworthy example of remote hands on training is South Central College's iMEC program. South Central College developed iMEC- a distance learning model using online, simulation, and remote access delivery methods which allow institutions to share curriculum and specialized equipment across multiple campuses as well as with other education and industry partners. Through this approach, students can attain their Mechatronic Industrial Maintenance Certificate anywhere they have internet access.

Minnesota Private Colleges and Universities

Broadband is also important for Minnesota's private colleges and universities. Indeed, the ability of students to connect to the classroom in real-time is a critical component of these schools. The College of St. Scholastica, for example, has started to build best practices and pedagogical guidelines using Adobe Connect and other synchronous web conferencing tools to provide quality, virtual classroom experiences. The technology is less expensive than telepresence technology and can be accessed from any computer on the Internet with a browser, web cam, and microphone.

The University of St. Thomas and St. Catherine University offer an online doctorate in social work. Part of the design of course delivery in this particular program is the use of synchronous meetings—real time web conferencing, with full audio and video connectivity needed for participation. This type of communication is broadband intensive; speeds that deliver basic Internet (e-mail, web browsing) connectivity are at many times inadequate for this type of instruction. Often, the support team will have to contact students who are participating from their homes and using their personal broadband services to try and troubleshoot issues deriving from audio and video freezing, dropouts, and actual disconnections. Even when the student has put a moratorium on any other home usage during their sessions, significant problems often exist, especially in more rural areas where the broadband options are minimal and not robust enough for this sort of usage.

The College of Saint Benedict and St. John's University are in the final stages of a massive redesign of the nursing department learning spaces. The newly created spaces feature seven simulation areas and two classrooms, all of which utilize video and audio streaming to improve the educational outcomes for nursing students. Students in the classroom will watch live video feeds of other students who engage in simulations in the nearby rooms enacting scenarios they will encounter in the practice setting. The technology is connected to a central control room, where educators can watch the unfolding simulations, record video, and provide feedback to the students. The use of this technology is essential in providing nursing students the opportunity to bridge theory and clinical learning to enhance patient safety and improve quality of nursing care.

University of Minnesota

Like MnSCU and Minnesota's private colleges and universities, the University of Minnesota uses broadband to enhance learning opportunities for its students. The University of Minnesota's Office of Information Technology,²⁰ for example, offers training to its students, staff and instructors on how to use technology in the classroom, including courses in Adobe, Drupal, Google Apps, web development, among others.

The University of Minnesota also offers instructors the ability to record classroom demonstrations using TechSmith Relay and in-room video conferencing. Using a software platform known as Milestone, the University also provides researchers with the ability to record, archive, and playback video content traditionally used for lab environments. Web-conferencing also enables users to connect with up to 1,000 participants.

As institutions of higher education prepare students for careers and life in the 21st Century, broadband is more important now than ever before. If colleges and universities are to equip our students with the skills they need to thrive in today's economy, they must have access to adequate technologies and the broadband infrastructure to support those technologies.

7. Libraries –Hannah

Minnesota's libraries are critical components of digitally inclusive communities. Across 87 counties and 7 reservations, 356 public libraries and 8 tribal libraries provide broadband connections, computer access, and technology training to people who may not otherwise be able to access or afford these essential services. As detailed by the Pew Research Center,²⁰ 27% of Americans who have visited a public library in the past 12 months report having used a library computer or broadband connection while there. People of color and people from low-income households are more frequent users of libraries' technology services, with African Americans and Hispanics reporting library technology usage rates of 38% and 32%, respectively. Regardless of their personal reliance on library technology services, 78% of Americans agree that public libraries "should definitely" offer outreach "to teach people, including kids and senior citizens, how to use digital tools such as computers, smartphones, and apps." In this environment, libraries and librarians have become natural leaders.

Libraries throughout Minnesota—where annual public library use is 4.5 visits per capita—are especially active providers of broadband access, public computers, and technology training. In 2014, Minnesota's public libraries offered broadband access over a combined total of 5,759 desktop computers and 529 mobile devices; from these access points, library users statewide conducted 5,594,135 Internet sessions. Wireless Internet access, available at 97% of public libraries, receives similarly high usage: About 30% of reporting public libraries indicated a total of 918,102 Internet sessions conducted wirelessly during 2014. Over 60% of public libraries offer download speeds equal to or greater than 10 Mbps, and 47% offer comparable upload speeds. In only two years—from 2012 to 2014—the number of public libraries with download speeds over 20 Mbps has increased from just 3 to 123. Likewise, while fewer than 150

²⁰ <http://www.pewinternet.org/2015/09/15/libraries-at-the-crossroads/>

public libraries had fiber optic broadband connections in 2012, 211 public libraries (62%) boasted the same in 2014. These infrastructure improvements and speed increases all support library activities.

Beyond providing broadband and computer access, libraries also drive digital literacy development. Digital literacy—which refers to the knowledge needed to use digital devices, such as desktop computers, laptops, tablets, and smartphones—is a critical skill in today’s workforce. In Minnesota, 680 FTE public librarians work to improve people’s digital literacy skills while helping them connect with information and services. For example, as mobile device ownership increases, librarians provide free technology training in the use of all devices and programs. People submitting online job applications or accessing e-government services receive technical guidance from librarians while using library computers. Adult students completing online degrees or job certifications ask librarians for assistance with course assignments, technology use, and exam proctoring. As K-12 schools integrate technology into classrooms, often through 1:1 device programs, librarians collaborate with educators to provide support and learning opportunities beyond the classroom walls. Libraries are hubs of activity; increasingly, these activities focus on improving digital literacy.

As libraries’ technology needs expand, so do their technology costs. The Hennepin County Library, for one, has seen technology expenditures rise nearly 33% since 2012, now representing 12% of their total annual expenditures. While revenue from property taxes covers some of these costs, core support through E-Rate discounts of up to 80% and Regional Library Telecommunications Aid (RLTA) allows Hennepin County Library to provide faster broadband connections throughout its 41 locations. This improvement in speed, correlative to RLTA support, is seen in libraries throughout the state: In June of 2015, 304 out of 317 public libraries (96%) eligible for RLTA reported contract download speeds equal to or greater than 10 Mbps. Moving forward, a 2015 statutory change to RLTA, aligning the program directly with E-Rate, will help ensure 100% of eligible telecommunications expenditures at public libraries are covered between the combination of E-Rate and RLTA. When libraries receive more funding through E-Rate and RLTA, they can use property tax and other revenues to innovate and implement new services and outreach, directly enriching the lives of the people they serve.

8. Healthcare-Maureen

- a. **How broadband used in healthcare** *(Include info from Jon Linnell from 2/18/15 TF meeting and wireless and emergency response presentation from 3/19/15 TF meeting)*
- b. **Telemedicine bill passage in MN**

9. Agriculture -John Dukich

- a. **Precision Ag—visual of cover of Farm Ag magazines**

Applications requiring a high-speed Internet connection are becoming increasingly common in agriculture. Twenty years ago, individual farmers had to have a physical presence in their crop fields in order to get a status report or apply fertilizer or insecticide. Now, the same farmer can accomplish these tasks from the comfort of his or her home.

Demand for broadband will only increase over time, for businesses, schools and families. From precision agriculture to remote monitoring of machines in fields, broadband Internet plays an important role in agriculture. Today, farmers are using Big Data and the Internet-of-Things to analyze and manage productivity, crop yield, and improve energy efficiency. The Internet-of-Things allows different devices or equipment, including farm equipment, to communicate with one another remotely.

To gain a better appreciation and understanding of how broadband impacts agriculture in Minnesota, the Task Force visited Farm Fest in August of 2015. During the first day of the event, which organizers dubbed “Broadband Day,” the Task Force heard from a number of companies and individuals about the importance of broadband in farm fields and rural areas of the state. For example, the Task Force heard from a manufacturing facility based in Jackson, Minnesota, who noted that all new tractors come equipped with the ability to connect wirelessly to each other, with the focus on helping make equipment operate more efficiently.

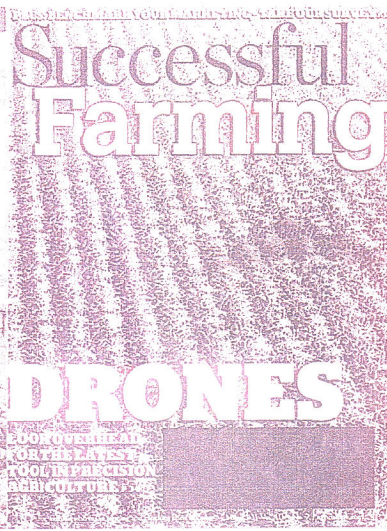
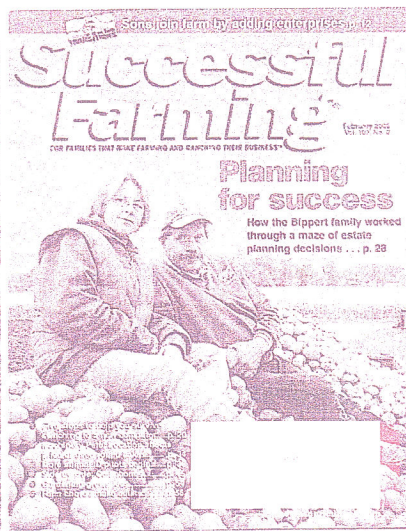
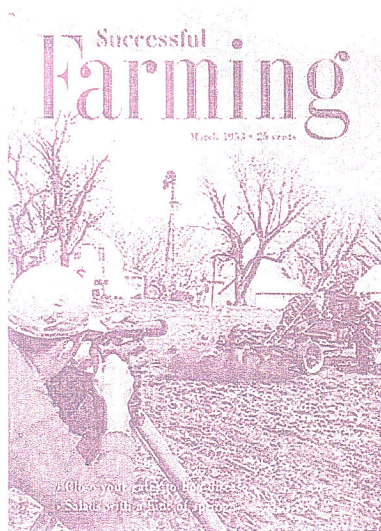
The ability to connect tractors and devices to one another, what is sometimes called the Internet-of-Things, or remotely monitor machines in the field with global positioning service, was heard throughout the day at Farm Fest. These technologies – all of which require high-speed broadband – can help farmers operate more efficiently and cost-effectively.

A survey of covers of the farming magazine, *Successful Farming*, illustrates the degree to which Internet-based technology is taking hold in today’s agricultural sector. Consider a cover from March 1953, which depicts someone surveying a plot of land and highlights stories about hog disease and salads. Now consider the February 2005 issue which features a cover story about estate planning and other stories about “Five steps to help you survive switching to a new computer” and “Side by side: Cell phones”.

1953

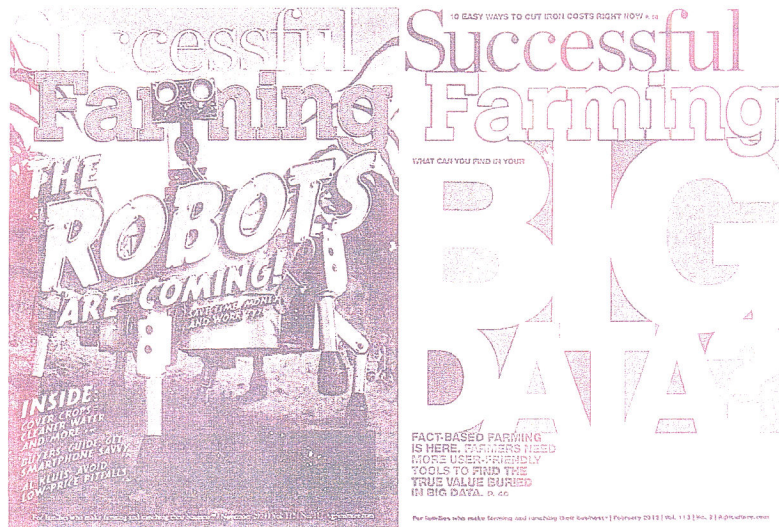
2005

2013



2014

2015



Over the next decade, the magazine covers have increasingly featured agricultural applications of technology. For example, the March 2013 edition of *Successful Farming* featured a story about the use of drones (unmanned aerial vehicles) in precision agriculture. Precision agriculture concerns the “application of geospatial techniques and sensors (e.g. geographic information systems, remote sensing, GPS) to identify variations in the field and to deal with them using alternative strategies” (Zhang and Kovacs 2012, abstract).

Indeed, there is an academic journal, *Precision Agriculture*, devoted to advancing precision agriculture. A 2012 article in *Precision Agriculture* notes that drones (see the below image for an example of a drone) have been used to detect small weed patches and water stress in crops, monitor crop biomass and nitrogen treatments, among other areas of application (p. 699).²¹

²¹ Zhang, C. and J. M. Kovacs (2012). “The application of small unmanned aerial systems for precision agriculture: a review,” *Precision Agriculture*, 13, pp. 693-712.



While remote operation of drones might require only a radio signal, the ability to monitor crop fields (via GPS or some other means) and transmit data from the drone to the user requires an Internet connection.

A related component of precision agriculture and the application of broadband in the field is the use of robots to improve operations and increase yields. Indeed, robots were featured in the November 2014 edition of *Successful Farming*. Minneapolis-based start-up, Rowbot Systems, for example, is using robots that “work in teams to apply nitrogen fertilizer in sync with corn needs, inter-seed cover-crops into tall corn, and collect data to inform both current and future work” (www.rowbot.com). Rowbot’s solution helps farmers efficiently apply nitrogen to their crops.

A 2009 article in the *Economist* notes “crop-tending robots that use vision systems, laser sensors, satellite positioning and instruments to measure things like humidity can build up a database of information about each plant”.²² This, in turn, can be used to help detect disease and predict crop yields. Collecting, storing, and processing this information requires a strong broadband connection, as information is transferred from one device to another or accessed via the cloud.

As the volume of data increases so too does the need to store, analyze, and make meaningful interpretations of the data. This is where the burgeoning field of Big Data comes to bear. Big Data has seen applications in retail, finance, and now, increasingly in agriculture.

Big Data, which is featured in the February 2015 issue of *Successful Farming*, concerns the collection, analysis, and interpretation of large, complex datasets – which often cannot be analyzed using traditional methods. Precision agriculture, robots, and drones all contribute to the collection and

²² “Fields of Automation,” *The Economist*, <http://www.economist.com/node/15048711>, accessed October 20, 2015.

storage of data and, as these methods of farming continue to take hold, with agribusiness finding value in such methods, the opportunity to glean insights from such data will also continue to grow.

As a September 2015 *Business Insider* article notes:

This is some of what big-data analytics make possible on the modern farm: Sensors can tell how effective certain seed and types of fertilizer are in different sections of a farm. Software will instruct the farmer to plant one hybrid in one corner and a different seed in another for optimum yield. It can adjust nitrogen and potassium levels in the soil in different patches.²³

As farmers produce and consume more data through precision agriculture, whether via robots, drones or connected vehicles, it is important to have in place the broadband infrastructure to support this changing landscape. A network of broadband connections is crucial to ensuring that farmers are able to access the technology of today and tomorrow.

For possible development and inclusion in TEXT BOXES:

- "We'd be much better stewards of the land if we had better broadband technology" presenter at Farmfest <http://blandinonbroadband.org/2015/08/05/minnesota-rural-broadband-day-at-farmfest-broadband-is-necessary-tell-a-friend>
- "Broadband for food traceability is important. So that we could trace a tomato from field to can on a shelf." Farmfest <http://blandinonbroadband.org/2015/08/05/minnesota-rural-broadband-day-at-farmfest-broadband-is-necessary-tell-a-friend>

V. Investments in Broadband

1. Legislative action: OBD and Border to Border grant program-John Dukich

Over the last five years there has been significant legislative action with respect to broadband, including the creation of the Office of Broadband Development within the Department of Employment and Economic Development (DEED) during the 2013 Legislative Session²⁴, and the establishment of the Border-to-Border Broadband Development Grant Program during the 2014 Legislative Session²⁵.

The Office of Broadband Development plays a critical role in helping develop Minnesota's broadband infrastructure, including working with partners on mapping broadband availability in an effort to more effectively direct state investment. The Office of Broadband Development also assists the Governor's Task Force on Broadband, the Governor's Broadband Subcabinet, and oversees the state's Border-to-Border Broadband Development Grant Program.

²³ Bobkoff, Dan (2015). "Big Data Comes to the Farm," *Business Insider*, <http://www.businessinsider.com/big-data-and-farming-2015-8>, accessed October 21, 2015.

²⁴ Minnesota Session Laws, 2013 regular session, chapter 85 at Article 3, sections 13, 14, and 26.

²⁵ Minnesota Session Laws, 2014 regular session, chapter 312 at Article 2, section 2, and Article 3, sections 3 and 4.



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²⁴ Minnesota Session Laws, 2013 regular session, chapter 85 at Article 3, sections 13, 14, and 26.

²⁵ Minnesota Session Laws, 2014 regular session, chapter 312 at Article 2, section 2, and Article 3, sections 3 and 4.

The Border-to-Border Broadband Development Grant Program, created by the Legislature in 2014 and initially funded at \$20 million, provides funding to build the state's broadband infrastructure and promote broadband access in unserved and underserved areas of the state. The grants provide a dollar-for-dollar match on funds, not to exceed \$5 million for any one project, and are distributed to qualified entities, including:

1. an incorporated business or a partnership;
2. a political subdivision;
3. an Indian tribe;
4. a Minnesota nonprofit organization organized under chapter 317A;
5. a Minnesota cooperative association organized under chapter 308A or 308B; and
6. a Minnesota limited liability corporation organized under chapter 322B for the purpose of expanding broadband access.

The Office of Broadband Development considers a number of criteria, as defined in statute, in evaluating and awarding the grants to eligible entities, including considerations of cost, community support, the number of households and community institutions impacted by the projected, among others.²⁶

During the 2014 grant period, the Office of Broadband Development received 40 applications for broadband projects across the state. After reviewing the applications, the Office funded 17 projects across the state (noted in the below map), totaling \$19.6 million.²⁷ More than half of the grant applications submitted in 2014 remained unfunded.

<<INSERT MAP OF FUNDED PROJECTS FROM 2014 APPROPRIATION>>

And 2015 APPROPRIATION

The 2015 Legislature allocated \$10,558,000 to the Border-to-Border Broadband Development Grant Program. The Office of Broadband Development is currently reviewing 44 grant applications which it received in competition for the funds allocated to the grant program in 2015. UPDATE

2. CAF II (describe impact accurately and emphasize how this is not a panacea/replacement for local/state/private investments)

The FCC's reform of the universal service program significantly changed the mechanism for funding telecommunications services in rural areas of Minnesota. The Connect America Fund (CAF) focuses support on broadband infrastructure construction in rural locations rather than supporting only voice communications. Although federal funding provides an important sources of funding, experience and industry research demonstrate that it is insufficient to adequately fund broadband investment. States

²⁶ Minnesota Session Laws, 2014 regular session, chapter 312 at Article 3, sections 3.

²⁷ For a complete list of grant applications and funded projects, visit <http://mn.gov/deed/programs-services/broadband/grant-program/index.isq>.

with the highest rate of broadband penetration also rely on public/private partnerships as well as vibrant state support.

Price cap carriers:

(From Shannon:) In CAF Phase II, the FCC offered each price cap carrier an annual support amount, derived from a cost model for six years. In exchange for funding, carriers commit to provide voice and broadband to a specified number of locations in its statewide service territory defined as high cost²⁸ that are not served by a competing, unsubsidized provider. The FCC released a map of the CAF Phase II eligible areas.²⁹

Minnesota's four price cap carriers all elected to receive the model-based funding, which totals more than \$85 million annually for six years.³⁰ The FCC model anticipates that more than 170,000 homes and businesses in rural Minnesota will get access to broadband infrastructure.

Rate of Return carriers: Shannon

In December 2014, the FCC adopted a Report and Order implementing interim CAF support for rate-of-return carriers.³¹ To continue receiving high-cost support, rate-of-return carriers must provide broadband at the standard of 10 Mbps download/1 Mbps upload upon reasonable request. If the request is unreasonable, but the carrier can reasonably meet the previous 4/1 standard, it must provide 4/1.

In July 2015, the FCC released preliminary results for its 100% overlap determination.³² The FCC will not provide high-cost support to any study area where an unsubsidized carrier provides services that meet the FCC's required service levels. Fifteen study areas were found to be 100% overlapped. None of these study areas were in Minnesota.

Reform efforts for rate-of-return carriers continues to evolve. The FCC and industry are working toward establishing equitable support mechanisms to address legacy network investment and provide adequate incentive to modernize networks to provide robust broadband. Permanent reform is expected by mid-2016.

²⁸ High cost locations are defined as falling above the specified cost benchmark, but below the extremely high-cost benchmark.

²⁹ See Connect America Fund Phase II – Accepted Areas Map, available at <https://www.fcc.gov/maps/caf-2-accepted-map>.

³⁰ See Connect America Fund Phase II Funding by Carrier, State, and County, available at <https://www.fcc.gov/document/connect-america-fund-phase-ii-funding-carrier-state-and-county>.

³¹ See *Connect America Fund, et al.*, WC Docket Nos. 10-90, 14-58, 14-192, Report and Order, FCC 14-190 (rel. Dec. 18, 2014).

³² See *Wireline Competition Bureau Publishes Preliminary Determination of Rate-of-Return Study Areas 100 Percent Overlapped by Unsubsidized Competitors*, Public Notice, DA 15-868 (Wireline Comp. Bur. July 29, 2015).

Rural Broadband Experiment Auction Areas in Minnesota: -Shannon

In 2015, the FCC awarded Rural Broadband Experiments (RBE) to test whether or not non-traditional providers, including wireless ISPs, rural electric cooperatives and competitive LECs could deliver broadband in rural areas in a more cost effective manner.³³ Following a single-round competitive auction, the FCC awarded \$100 million to bring broadband under this experimental process to rural areas.

LTD Broadband LLC (\$20 million), Lake County, (\$3.5 million), Paul Bunyan Rural Telephone Cooperative (\$1.9 million) and Federated Telephone Cooperative (\$1.5 million) were provisionally selected to receive RBE funding in Minnesota.³⁴ These projects will provide broadband at a speed of at least 25 Mbps download and 3 Mbps upload.

Gaps: Blandin

The CAF2 program targets specific locations that meet rather narrow requirements for subsidized broadband deployment. To be eligible, a census block must: 1) not have access to current broadband service that meets the (now outdated by two generations) 3 Mbps downstream/768 kbps upstream FCC broadband standard, and 2) Using the FCC's cost model, locations must have monthly deployment and operational costs of between \$52.50 and \$207.81.

To clarify, areas ineligible for funding:

- Have broadband services that exceeds 3 Mbps/768 kbps
- Lack broadband, but exceed the \$207.81 high cost standard
- Partially served census blocks

The impact of these criteria is significant. The implementation of CAF2:

- Solidifies the Price Cap incumbent's position as the monopoly wired broadband provider
- Requires providers to deliver only 10 Mbps/1 Mbps broadband service, not the current 25/3 FCC broadband standard or the emerging 1 Gb standard available in urban areas and via rural FTTH providers
- Ignores the growing bandwidth needs of those customers currently served by 3 Mbps/768k services
- Provides subsidies to the incumbent in the most lucrative portions of the rural countryside marketplace while doing little to provide broadband services in the highest cost areas

³³ See *Technology Transitions, et al.*, GN Docket No. 13-5, *et al.*, Order, Report and Order and Further Notice of Proposed Rulemaking, Report and Order and Further Notice of Proposed Rulemaking, Proposal for Ongoing Data Initiative, FCC 14-5 (rel. Jan 31, 2014).

³⁴ See *Wireline Competition Bureau Announces Rural Broadband Experiments Support for 13 Provisionally Selected Bids is Ready to be Authorized*, WC Docket Nos. 10-90, 14-259, Public Notice, DA 15-1024 (Wireline Comp. Bur. Sep. 15, 2015); *Wireline Competition Bureau Announces Entities Provisionally Selected for Rural Broadband Experiments; Sets Deadlines for Submission of Additional Information*, WC Docket No. 10-90, Public Notice, DA 14-1772 (Wireline Comp. Bur. Dec. 5, 2014).

- Inhibits competition while locking in inadequate broadband services for these rural areas for the foreseeable future

3. I-Nets (*Info from 2/18/15 TF meeting*)

4. E-Rate fiber potential (with state 10% match)

5. Continued private investment—Andy Schriener will try to get a total of private investment over past 5 years

6. Evolving public-private partnerships Blandin

The term “public-private partnership” only vaguely describes how the public and private sector may work together to deploy broadband. Historically, much of rural America was served with telephone and electricity only through public sector financing arrangements, clearly a public-private partnership. Today, there are a variety of mechanisms for government entities to encourage deployment of broadband services.

The table below provides a range of examples.

Key Partnership Elements	Relationship Between Government and Provider	Examples
Grants and loans to broadband providers	Provider must meet lender and grantor requirements	Border to Border Broadband Grants, IRRRB, RS Fiber communities, City of Little Falls
Joint build of broadband facilities	Fiber management, shared facilities, revenue sharing, possible competitors	Scott and Dakota Counties
Government as anchor tenant on fiber or wireless network	Government as provider customer	City of Minneapolis, Anoka and Carver Counties
Government owned fiber or conduit network w/provider lease/purchase of fiber	Provider as government customer, possible fiber management by providers	Cities of Eagan and Burnsville, Northeast Service Cooperative
Private provider hired as network operator	Provider is a contractor to the government	Original Monticello model, Pine City, Burnsville
Use of government water towers for wireless	Provider as government customer	Many communities

VII. Barriers to Expanding Access to Broadband

1. Telecom Reform – Paul and Andy

Over the last 20 years, advancements in telecommunications technologies have dramatically changed our world. Today, Minnesota families and businesses are not only using, but demanding, new and innovative products that require faster and more advanced broadband networks and technology.

Yet while technology has transformed our state, Minnesota’s communications laws remain stuck in the past. The state has not updated its communications laws in over 20 years. In order to remain competitive and attract new investment in broadband to our state, Minnesota must take action to update its telecom laws to reflect today’s world.

Today, two-thirds of Americans have chosen wireless or Internet-based (IP) services as alternatives to traditional telephone service – and another 450,000 people join them every month. Consumer and business demand for these new technologies is not only driving our economy, but advancing lives. A regulatory environment that encourages investment and innovation in broadband technologies is critical for future growth in Minnesota’s economy.

Already, over 30 states across the country have passed legislation to modernize their telecom laws and keep communications free from outdated rules not designed for today’s IP world. Minnesota should pass similar legislation to help spur innovation, attract high-tech investment, develop rural broadband and showcase the state as a good place to do business.

A recent study by the Pell Center for International Relations and Public Policy “State-Level Broadband Policy” (September 2015) cited telecom reform legislation as a major component to the elements of good broadband policy. “To serve the public good, states should consider telecom modernization bills ensuring that residents have access to affordable and reliable communication service, including broadband.”

We do not want Minnesota to be left behind as neighboring states and states across the country enact legislation to make their cities more attractive for investment in broadband and the latest IP technologies.

In 2015, the Minnesota Legislature considered two telecommunication bills that would have ensured regulatory certainty for VOIP (Voice over Internet Protocol)/IP based services and modernized the competitive structure of basic telephone service. Both bills received bi-partisan support as have similar bills across the nation. The Governor’s Broadband Task Force recommends passage of both bills in the 2016 legislative session.

2. Other barriers—Shannon

Bridging the Rural/Urban Digital Divide

Broadband access in rural areas continues to lag behind broadband access in urban settings. The Pew Research Center found that 87% of urban adults are internet users, compared to only 79% of rural

adults.³⁵ The National Broadband Map says that 99% of urban Minnesotans have access to broadband with download speeds greater than 25 Mbps, but only 66% of rural Minnesota have such access.³⁶

Extensive studies examine and document the reasons for this rural/urban divide.³⁷ Expanding existing wired or wireless service to increasingly difficult-to-reach rural areas is more costly than upgrading urban areas. It also offers a lower financial return to carriers because rural areas have a significantly lower population density. Rural carriers often require substantial government assistance in the form of grants, loans, or direct support to build and maintain broadband capable networks.

Broadband must be Affordable to All Income Levels

There is a clear correlation between access to broadband internet and household income level. The Pew Research Center shows that 96% of households earning greater than \$50,000 annually are internet users, compared to only 74% of households earning less than \$30,000 annually.³⁸ In Minnesota, more than 80% residents in the 10 wealthiest counties have access to broadband with download speeds greater than 25 Mbps; only three of the poorest counties can say the same.³⁹

Lower-income Minnesotans do not have sufficient disposable income to pay the often significant cost of broadband internet access. Almost 20% of non-internet users cite price as the reason they do not subscribe to the internet. Lower income Minnesotans must have affordable access to the internet for job searching, access to distance medical and educational opportunities.

VIII. Policy Recommendations—OBD

1. Speed Goals

- a. Baseline “definition” (25/3)
- b. Aspirational “Goal” (Numeric plus “Top 5s”?) and year
- c. K-12 goal (October meeting topic?)

2. Funding for Border to Border Infrastructure Grant Program

3. Funding for K-12?

Suggested Recommendations From Dick:

³⁵ See <http://www.pewinternet.org/2015/09/22/digital-divides-2015/>.

³⁶ See

<http://www.broadbandmap.gov/download/Broadband%20Availability%20in%20Rural%20vs%20Urban%20Areas.pdf>.

³⁷ See, e.g., NTIA, *Broadband Availability Beyond the Rural/Urban Divide* (May 2013), available at http://www.ntia.doc.gov/files/ntia/publications/broadband_availability_rural_urban_june_2011_final.pdf.

³⁸ See <http://www.pewinternet.org/2015/09/22/digital-divides-2015/>.

³⁹ See National Broadband Map, available at <http://www.broadbandmap.gov/rank/all/county/minnesota/percent-population/demographics-income-median-income/ascending/speed-download-greater-than-25mbps>.

Long Term Goals

The Task Force recommends that Minnesota model its state broadband goals after goals established in the National Broadband Plan. The outline below offers a number of comprehensive, measurable goals worthy of incorporation in Minnesota's long range plans. We should adopt those policies consistent with federal activity and benchmarks.

Minnesota Goal No. 1: Virtually all Minnesota homes should have access to actual download speeds of at least 25 megabits per second and actual upload speeds of at least 3 megabits per second.

Over the years since the state established its current speed goal set forth in Minnesota Statutes section 237.012, it has become clear that policy makers rely on Minnesota's progress toward broadband availability goals in making critical decisions about broadband legislation and state broadband investment. In February 2015, the FCC raised the bar for what can be considered "broadband" to a service providing 25Mbps download and 3 Mbps upload speeds. The incongruity between federal and state goals creates unnecessary confusion about Minnesota's broadband progress. Minnesota should adopt a speed goal that matches the FCC's updated definition of broadband. Doing so will provide policy makers a clear benchmark with which it can measure its progress toward its state goal as well as its relative progress compared to the national definition of broadband and other states.

Minnesota Goal No. 2: Minnesota should embrace mobile wireless internet service as "broadband," and lead the nation in mobile broadband investment, with the fastest and most extensive wireless networks of any state.

The Task Force recognizes that any viable plan for broadband deployment should endorse those policies which encourage wireless deployment options. The fact is there are millions of wireless devices in use by all segments of our population. Because mobility is a critical element in broadband adoption and usage, true border to border availability should be a key part of state goals.

Minnesota Goal No. 3: Every Minnesotan should have affordable access to robust broadband service, and the means and skills to subscribe if they so choose.

The Task Force should continue to recognize, promote, and support governmental and private sector programs that help make broadband service affordable and that provide Minnesotans the skills necessary to use the service productively. The FCC has several ongoing initiatives designed to make broadband more affordable, including the reform of the federal Lifeline program, and the Rural Broadband Experiments program. Broadband providers and non-profit groups are complimenting these efforts with successful programs of their own, including Comcast's Internet Essentials, PCs for People, and CenturyLink's Internet Basics program. State policy should continue to make broadband adoption one of its key measures of the overall quality of Minnesota's broadband picture.

Minnesota Goal No. 4: Every Minnesota community should have affordable access to at least 1 gigabit per second broadband service to anchor institutions such as schools, hospitals and libraries.

The Task Force recognizes the need for institutions of this nature to be well served with the most modern and state of the art facilities that are economically viable and competitively provided. Minnesota should ensure that all community anchor institutions are aware of opportunities under the reformed federal E-Rate program, which provides discounts to anchor institutions on broadband equipment and services. Moreover, Minnesota should encourage innovative and public-private partnerships that leverage private sector expertise without putting public resources at risk. Minnesota should further consider reforming its Telephone Assistance Program (TAP) similar to reforms to the federal Lifeline program.

Minnesota Goal No. 5: To ensure the safety of the American people, every first responder should have access to a nationwide, wireless, interoperable broadband public safety network.

Minnesota should continue its deep engagement in the federal FirstNet project. The Task Force urges the Minnesota Department of Public Safety and the state Emergency Communications Board to coordinate with federal efforts toward creating a dedicated national emergency communications network, and to provide the best possible public safety network that can adapt to new communications technologies. Minnesota's regulatory laws should ensure that all providers contribute equally to the state's 911 program.

Minnesota Goal No. 6: To ensure that Minnesota continues to lead in the clean energy economy, Minnesota should encourage and coordinate with the federal government to develop and implement improvements to Minnesota's energy grid that incorporate secure, advanced communications capabilities to make it more efficient, interactive, and dynamic.

The Task Force has not previously considered "smart grid" initiatives as a part of state long range broadband goals but recommends that this sector be considered in future planning by the Task Force and the Office of Broadband Development

Minnesota Goal No. 7: To reform Minnesota's regulatory climate over broadband and broadband-enabled services to attract broadband investment, ensure competitive neutrality, and provide vital protections to consumers.

America is undergoing a major transformation of its communications infrastructure. The public switched telephone network (PSTN) is rapidly becoming obsolete. It is being displaced by a borderless IP "network of networks" that erases traditional jurisdictional dividing lines that characterized the "public utility" regulation model that has governed "plain old telephone service" (POTS). Moreover, competitive alternatives to voice services are ubiquitous. Wireless voice and data services, text messaging, social media, video conferencing, and the so-called "internet of things" have reduced voice services from the predominant method of communication to one of many applications consumers use to communicate. Yet, Minnesota's telecommunications laws are stuck in an old world in which telephone was the dominant mode of communicating and was regulated as a local public utility. The public utility model discriminates against facilities-based providers and discourages investment in broadband infrastructure. Minnesota's telecommunications laws needs to be reformed to reflect the modern communications era, bringing regulatory certainty, competitive equity, and relevance to an industry in the midst of dramatic change.

FOR TEXT BOXES or some other format of inclusion in report:

**Snapshot of Six Minnesota Counties and the Factors that Contribute to the
Quality of Broadband Available**

Red Lake County – Strong Local Providers Leave Red Lake Well Served

Broadband Access: 99.99%

Red Lake has always been one of the top served counties in Minnesota, impressive given their population density is solidly rural with 4 homes per square mile and at \$47,569, their median income is considerably lower than the state median income of \$59,836.

What Red Lake does have is two local, independently owned broadband providers: Garden Valley Telephone Cooperative and Sjoberg Cable.

Lac qui Parle County – Public Private Partnership Entices Federal Funding

Broadband Access: 99.36%

In 2010, a partnership between Farmers Mutual and the LqP Economic Development Authority (EDA) received \$9.6 million in federal funding (ARRA funding) to deploy FTTH. It's a loan; both partners share responsibility for paying it back. In 2013, Farmers began signing up their first customers.

Farmers Mutual built and operates the network. The EDA has focused on building demand through digital inclusion efforts such as teaching businesses to use social media and the [Computer Commuter](#), a bus outfitted with computers and WiFi access that visits towns around the county on a weekly basis – bringing the tools and one-on-one training to patrons.

Lac qui Parle County has benefitted from broadband notably for being an area that attracts "[Brain Gain](#)" families or families who are returning to a rural area after a stint in more urban locations. Brain Gainers look for place with small town feel, high quality of life and broadband that allows them work remotely at jobs located anywhere.

Dakota County – Local Government Takes Lead, Residential and Business Access Follows

Broadband Access: 97.17%

Dakota County has worked with local providers to create a government fiber network that connects government building. It's an [ongoing investment](#) but County [telecom costs have dropped](#) from \$700,000 to \$15,000 and opens the door to a wide range of e-government services such as [improved traffic management](#).

Dakota County partners with other anchor tenants and has plans to work with third party providers who will be able to [offer services to local businesses and residents](#). In 2014, their broadband access was 64% now it is 97%, their investment is beginning to pay off in lower county bills and higher local access.

Kanabec County – Not Gaining Traction despite Community Efforts

Broadband Access: 28.05%

Kanabec County has been striving to improve coverage for years. [In 2012](#), they partnered up with other counties (Aitkin, Carlton, Mille Lacs and Pine) to address broadband access with regional planning and [convening](#). Their household density is higher than Red Lake (12 households per square mile) and median income is the same. Yet, incumbent providers have not worked out a business case to merit investment. There are five providers of wireline broadband in the area (and 8 wireless).

Kanabec has commissioned a broadband feasibility study, hosted conferences, worked on building demand with digital inclusion efforts and talked extensively with incumbent providers, but that has not led to better broadband. They have discussed cooperative models and other options but again nothing has come to fruition.

Three providers in the area (CenturyLink, Windstream and Frontier) have accepted CAF 2 (Connect American Fund) funding, which means the area is eligible to receive upgrades to at least 10 Mbps down and 1 Mbps up over the next five years. Unfortunately that will not get them to Minnesota's definition of broadband but the providers are not constrained to those speeds--they are encouraged to build more.

Wabasha County – Access in Towns But Limited in the Outskirts

Broadband Access: 75.34%

As early as [2007](#), parts of Wabasha County had FTTH, yet in 2010, Wabasha County made the [FCC list of the least served counties](#) in Minnesota. They are an example of Swiss cheese topology: there is connectivity in the towns but not in the space between. Their situation has improved greatly over the years, leaping to 70 percent soon after the FCC surveys followed by incremental increase over the years – climbing to 75 percent coverage.

They have a mix of locally owned (BEVCOMM, NU-Telecomm, Hiawatha Broadband), regionally owned (Midcontinent Communications) and national (CenturyLink) providers. [Hiawatha Broadband](#) has been recognized for their leadership in services in the area; [Mediacore](#) has announced a few major upgrades in the area. CenturyLink has accepted CAF 2 (Connect American Fund) funding, which means their coverage area is eligible to receive upgrades to at least 10 Mbps down and 1 Mbps up over the next five years but that does not meet Minnesota goal speeds. The question is whether CenturyLink will aim for the minimum coverage or look to bring speeds closer state goals or to the fiber available in neighboring towns.

Cook County – Federal Funding Supports Growth of Local Cooperative

Broadband Access: 43.57%

Cook County is poised to become a Cinderella story; they have gone from 20.70% coverage in 2014 to 45.57 percent in 2015 and access is increasing. Cook County's household density is .7 per square mile and it's built on rock. It was difficult to make a business case to serve the areas until one of the local providers ([Arrowhead Electric Cooperative](#)) received Federal support (ARRA funding) to deploy middle mile infrastructure. In January 2014, they announced the last built of buildout and predicted home access would soon follow.

Cook County has also been working on broadband adoption. They were early partners with the Blandin Foundation, participating in the federally supported (again ARRA funding) Minnesota Intelligent Regional Communities (MIRC) initiative. They encouraged greater use of technology with better tourism sites, health applications and training for residents and business owners.

Cook County is still on the far end of the digital divide but with federal funding, local business support and an engaged citizenry they are poised for an upward trajectory.

Other Suggestions for Text Box Quotes:

Quotable Quotes – for use in “side-bars” throughout the report

EDUCATION

- “One of the biggest problems faced by teachers attempting to integrate technology into their classrooms is a lack of Internet access at home for some students.”
<http://blandinonbroadband.org/2015/11/02/smart-use-of-technology-in-the-school-in-two-harbors>
- “Changes in curriculum require broadband. Five years ago much school material was still in books, but now so much of curriculum in is a digital format. They can learn from home and should be able to access those resources 24/7. Having the ability to access the Internet from where they are is a huge advantage.” Troy Anderson, ISD 728 (Sherburne)
<http://blandinonbroadband.org/2015/11/05/sherburne-county-video-on-need-for-broadband-in-the-community>

COOPS

- “With coops, there's direct accountability to the community because members can have a say in how the network is managed and used, as well as a share in the profits.” Mark Erickson, Winthrop, MN EDA Director and a key champion to a project headed by RS Fiber Cooperative in Minnesota. Daily Yonder <http://blandinonbroadband.org/2015/10/31/cooperatives-are-poised-to-increase-broadband-such-as-in-renville-and-sibley-counties>

RURAL NEED

- “We're not unimportant people; we should have some sort of access.” - resident in Morris (on video so I'm sure we could track down a name)

<http://blandinonbroadband.org/2015/08/10/legislators-ask-morris-minnesota-about-broadband-they-need-public-support>

- "It is extremely important that the people who live in rural MN have just the same sort of access as those who live in town. It's hard to do Township work without broadband. It is crazy that in town they pay about \$20 per month and we are forced to pay \$100 per month with limited data. It is important that the word gets out how much rural MN needs broadband Internet. I talk with people each day that can't get decent Internet or can't get any wired broadband service at all. Many refuse to or can't afford the high price of satellite Internet or 4G services with their very limited data plans. People want to move to our area, but can't because of the lack of Internet service. For a family of 5, capped data would never work." Patty Bauchard Ripley Township <http://blandinonbroadband.org/2015/10/27/success-story-a-competitive-local-provider-meets-the-need-of-an-unserved-rural-resident-in-need>
- "The broadband was so poor, I couldn't update software on my computer. The service technicians had to take my computer to another location to download Microsoft Office." Jean Spaulding, Willmar <http://blandinonbroadband.org/2015/10/22/representative-baker-and-representative-daudt-talk-broadband-in-willmar-co-ops-federal-funding-and-permit-costs>
- "We've got fiber running across the field, we've been trying to get a permit to get that over the highway to us. The provider on one side of the highway offers 100 Mbps; the provider on the other side offers 1.5 Mbps." San Romain, Haug Kubota, Willmar <http://blandinonbroadband.org/2015/10/22/representative-baker-and-representative-daudt-talk-broadband-in-willmar-co-ops-federal-funding-and-permit-costs>
- "Lack of broadband is hurting our youth hockey! Prospective parent volunteers aren't able to do the necessary online training to get approved to be coaches. The organizers in the cities don't understand it's not a matter of being too cheap to upgrade our home connections - there are no options for an upgrade!" Traci Gangl, Hockey mom in Grand Rapids <http://blandinonbroadband.org/2015/10/12/is-lack-of-broadband-hurting-hockey-in-northern-minnesota>
- "It is difficult for middle class households to understand not having a computer in their homes for personal and professional use. Yet the inability to own a personal home computer reminds us of the gaps in opportunities between those with and those without. 21st century skill development is necessary to navigate worlds in education, tele-health, employment, community connections, etc. PC4P @ The Shop, Brainerd <http://blandinonbroadband.org/2015/10/10/pc4p-youth-project-in-brainerd-at-risk-youth-working-to-refurbish-and-distribute-pcs>
- "People are frustrated. I need to get a land line because my cell phone doesn't work. Then I have to have a cell phone, satellite, and phone service to run my business. I used up half of my data allotment last night watching the presidential debate." Business owner in Aitkin <http://blandinonbroadband.org/2015/09/18/rep-thissen-talks-broadband-in-aitkin-cant-get-work-done-without-better-broadband>

- "Wireless isn't a solution either. Some folks around here have difficulty getting access to that. And it gets really expensive. Some schools do provide a hotspot that folks can checkout but that doesn't help if you're in a dead zone and the majority of students in the school district are outside of the city limits." Pine City resident <http://blandinonbroadband.org/2015/09/18/rep-thissen-in-pine-city-talking-broadband-area-is-underserved-and-providers-are-not-stepping-up-outside-city-limits>
- "We see the internet usage of our customers doubling every year. The more you have the more you use." Keven Larson, CTC, to Governor's Broadband Task Force, July 17, 2015.

ECONOMIC DEVELOPMENT

- "Our customer base is worldwide and we rely on the Internet for 100 percent of our customers. Our customers want digital information and our growth would not be possible without the Internet." Dennis Johnson, Natural Space Domes (Chisago County) <http://blandinonbroadband.org/2015/11/04/chisago-county-broadband-video-features-local-businesses>
- "Three years ago we started our online store, it is now half of our production. With our online presence we have been able to expand our business to \$3.5 million, which is incredible for such a small town." Marie Rivers, Sven Comfort Shoes. <http://blandinonbroadband.org/2015/11/04/chisago-county-broadband-video-features-local-businesses>
- "You have communities that are at an immediate disadvantage for economic development because a business won't start up or expand if there's not broadband access. I don't think it happens without some type of incentive or subsidy." Matt Kilian, president of the Brainerd Lakes Area Chamber of Commerce <http://blandinonbroadband.org/2015/08/31/senator-franken-talks-about-broadband-and-telehealth-in-brainerd>
- "The millennials are now the largest demographic in the workforce. They are digital natives. Rural areas need to reach them. Broadband isn't a pull technology - but lack of it will push." Lisa Hughes at Farmfest <http://blandinonbroadband.org/2015/08/05/minnesota-rural-broadband-day-at-farmfest-broadband-is-necessary-tell-a-friend>

PRECISION AGRICULTURE

- ***"We'd like to do precision agriculture processing in-house but we can't do it with the speed we have. In pipeline of data transfer, we're the choke point. We have the fastest connection we can get in Willmar - and it's good for most purposes but it doesn't meet our business needs. It

takes us up to 6 hours to upload our data. It would take 10 hours to upload in Litchfield. We joke with our farmers suggesting they bring their laptops to McDonald's. If we are to meet the food demand - we need better broadband. We're doing unique stuff. We are trying to be on the cutting edge of ag but we need broadband to be there."

<http://blandinonbroadband.org/2015/08/19/senator-klobuchar-talks-about-broadband-in-willmar-we-need-broadband-to-compete>

HEALTH CARE

- "Doctors can help detect congestive heart failure by having patients regularly weigh themselves and send in the results via the web. If the data shows a weight gain of several pounds in just a few days, that could mean the patient's heart isn't functioning properly. Telemedicine helps patients limit health care expenses and travel, and it allows them more freedom in their living situations." Maureen Ideker, Essentia Health
<http://blandinonbroadband.org/2015/08/31/senator-franken-talks-about-broadband-and-telehealth-in-brainerd>
- "We have residents who are unable to be remotely monitored for health concerns because they don't have home connections. That limits their access to healthcare and reduces quality of life. We pay a lot of money to have mobile hotspots in our vehicles, but that's costly. We will not be prepared for e911 and the next gen system - especially if we want to support video.
<http://blandinonbroadband.org/2015/08/19/senator-klobuchar-talks-about-broadband-in-willmar-we-need-broadband-to-compete>
- "We can take health care to the next level when we have broadband access." Bryan Linnick, Redwood Area Hospital (Farmfest) <http://blandinonbroadband.org/2015/08/05/minnesota-rural-broadband-day-at-farmfest-broadband-is-necessary-tell-a-friend>

BROADBAND JOY

- "As the installation of the hot spot in Rushmore was being completed, a resident came and tested it and thanked them for providing this service. It got used before the installation staff had left the site." Tom Johnson, Nobles County

ON NEED FOR FUNDING

- "We were interested in the border to border grants but we couldn't make it happen. Things like needing a certified engineer made it difficult to turn it around. We hope the funding continues. If there was a market case to build broadband here it would have happened. It hasn't so we

need help." Aitkin County resident." <http://blandinonbroadband.org/2015/09/18/rep-thissen-talks-broadband-in-aitkin-cant-get-work-done-without-better-broadband>

- "We need more state funding - we don't want good applications competing against each other. Many people were discouraged with the decrease in funding this year in broadband funding." Aitkin resident <http://blandinonbroadband.org/2015/09/18/rep-thissen-talks-broadband-in-aitkin-cant-get-work-done-without-better-broadband>
- "We're really disappointed because the funds were cut in half and we were told they'd increase." Farmfest attendee <http://blandinonbroadband.org/2015/08/05/minnesota-rural-broadband-day-at-farmfest-broadband-is-necessary-tell-a-friend>

TECH TIDBITS

- One problem is variations of costs. Tony Alsleben explains that in Willmar, cost for broadband is \$9.95/mg vs \$110/mg in Spicer vs \$118 in Litchfield. <http://blandinonbroadband.org/2015/08/19/senator-klobuchar-talks-about-broad>

APPENDIX X

Examples of How Schools are Consuming Bandwidth:

- Open Educational Resources (OER) are currently being developed to help districts tap into cost-effective, standards-based instruction.
- Teacher training programs need to include skill building classroom structures that cultivate individualized instruction for students.
- School districts require infrastructure to support state on-line testing requirements without interruption to classroom learning.
- Digital learning resources are a replacement of traditional textbooks.
- Increase use of student devices and school supplied tablet devices.
- Student access to online and distance learning opportunities.
- Student access to low-incidence classes: Advanced Placement or Foreign Language.
- Access to educational opportunities institutions such as historical society, zoos, creative arts and other virtual fieldtrips.
- Breaking down the walls of the classroom connecting students to students and teachers to teachers via videoconferencing.
- Parent, teacher, school communications are dependent on daily access to a student's status and achievement, managing lunch accounts and school activities, policies and calendars.
- Teacher training and development using internet-based curriculum and communication beyond the community and classroom.
- Creation of robust digital learning environments to improve student achievement
- Integration of wireless technology in k-12 classrooms
- Out of school access to high speed broadband: homework gap – 70% teachers assign homework requiring online access while 1/3 of households do not have access or subscribe to broadband. (fact check)
- Close the access gap and prepare to be open to new technologies that are on the horizon.
- On-line testing requirements.
- 1:1 initiatives
- Greater use of cloud applications
- On-line texts and curriculum – phase out purchase of textbooks in favor of digit e-books
- Deliver career college readiness
- Two-way interactive learning (ECMECC alone offers 35 interactive classes a day to over 600 students – including to schools in NW MN who would not otherwise have access to these courses – many college credit level
- Learning through simulations
- Virtual field trips for greater MN to visit MN zoo, historical Society, Great Lakes Aquarium and International Wolf Center in Ely among others that provide educational opportunities they would not normally have access to due to time constraints, transportation costs.
- Interactive experiences to classrooms from National Park Service, NASA, The Smithsonian, medical facilities and many more.
- On-line testing requirements for state's MCAs and other
- Measures of progress and growth (MAP testing). There are strict broadband and infrastructure requirements places on schools by the testing companies that schools MUST meets. Hard-wired – this is an issue technology gets tied up and interrupts teaching/learning process. Some

districts have to reduce their other uses of technology so that their full bandwidth is available for testing.