Understanding Rural Broadband Technology Options

AN APA TECHNOLOGY DIVISION WEBINAR

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Bill Coleman, Community Technology Advisors

JUNE 15, 2018
Agenda

• Transformative Technology Trends Driving Digital Data Production
• What That Means for Small Town and Rural Communities
• Broadband, Small Cell and Other Technologies for STaR Communities
• Results from the APA STaR and Economic Development Survey
Four Big Technology Trends Driving Digital Data Production

1. **Data Storage and the Private Cloud**: Biggest growth area in economy: one-third of overall IT infrastructure spending for the year
   - Amazon Web Services (between 3 and 5 million servers)
   - Apple iCloud (300 million people store files)
   - Dropbox (175 million)
   - Microsoft OneDrive (250 million)
   - Google Drive (120 million)

Source: Bain Analysis, Forrester, IDC, Gartner, Cisco
Data Storage and Cloud Business Applications
2. The Internet of Things: Home and Industrial...

- Wearables and health monitoring
- T-Commerce and Smart TV
- Smart Grids and Collaborative Supply Chains
- The connected phone/home/car/office
Changing Attitudes and Demographics Driving New Technologies

- Young committed to online technologies/schools
- Aging population and healthcare = Telemedicine
- Multiple Dwelling Homes (MDU) - 90% of seniors who own MDUs are demanding faster Internet
- Telecommuting
- Only at the beginning of Smart Phone technology

![Image of young person using a smartphone and an elder person using a smartphone and a tablet.]

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MDU (multi-dwelling units)

- Townhouses
- Condos
- High Rise Condos
- Hotels
- Motels
- Apartment Buildings

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**Consumer internet traffic**

Internet video traffic will rise from 60 to 75 percent of total consumer internet traffic by 2018, according to estimates by Cisco.

**BY SEGMENT**

- In thousand petabytes per month

**BY NETWORK**

- Mobile
- Fixed line

**BY GEOGRAPHY**

- Middle East and Africa
- Latin America
- Central and Eastern Europe
- Western Europe
- North America
- Asia Pacific

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Source: Cisco, "Petabyte is equivalent to 1,000 terabytes."

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3. Smart City/Smart Government Services

- Traffic management
- Large file transmission (e.g., building permits)
- Two-way video streaming:
  - Courts
  - Local government services
- Smart signs
- Public safety and resiliency
- Road repair reporting
- Booking/availability and paying for parking
4. From the Gig Economy to the Autonomous Vehicle Economy

- Ride hailing and the rise of TNCs
- Electrification
- Self-driving AVs:
  - Private individuals
  - Fleets
- Robo Taxis and Micro-transit
- Trucks, Buses and Delivery
- Mobility-as-a-Service and Cross-functional Software Platforms
- Data transfer from car to “edge” and V2I
- DSRC (Dedicated Short Range Communications) and/or LTE and 5G
2020 Vision: The Gigabyte Economy...

Source: OpenText
Connectivity is Everything...

Smart city technology
- From LTE/4G and Small Cell to DSRC and/or 5G
- Shift in sensors from vehicle to infrastructure
- Data Management: Safety and performance
  - Fiber, fiber, fiber...

Physical Inventory and Built Infrastructure
- Poles, towers, small cell
- Traffic and intersection management
- Road sensors
- Right of ways and dedicated zones for AVs and pedestrians

Requires public sector involvement: V2I infrastructure on the public right-of-ways, the private sector can’t build, own, or control… but mostly it requires fiber, fiber, fiber….
A change in approach to broadband provision in rural areas is on its way...

- Internet traffic in NA will grow 20% per year
- Shift *from download to upload*
- Cities and suburbs moving to symmetrical/Gigabyte level service within 5 years
- Developing “edge” computing
- Changing attitudes about rural broadband among providers and in DC
- AV Economy will break the deadlock...
Broadband 101

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Broadband at the FCC
- Recently reaffirmed by the FCC:
  - Anything less than 25 Mb/3 Mb is not broadband
  - Mobile cellular is not a substitute for a fixed connection
  - The FCC standard increased 30-fold between 2008 and 2016
  - There is no federal broadband goal, only a current standard

Broadband goals in Minnesota
- 25/3 by 2022
- 100/20 by 2026

Broadband in the marketplace
- Some ISPs increased speeds 100-fold between 2008 and 2016
- Comcast just raised all speed tiers by 50 Mb
- Gigabit service is increasingly available

Household use
- Use more than 250 GB of data/month and rising
- Have 13 connected devices; 50 devices by 2022
- Computers, phones, fitness devices, home security, medical devices, thermostats, personal assistants, watches, home appliances, cars, farm animals, sensors, tractors
Assessing Broadband Technologies
Why it matters!
How do we know what we have?

MAPS AND DATA
FCC National Broadband Map
South Central Minnesota Broadband Map
Pictures are nice, but what does it mean?

TECHNOLOGY OVERVIEW
## Broadband Technologies Overview

### WIRED

<table>
<thead>
<tr>
<th>Technology</th>
<th>Features</th>
</tr>
</thead>
</table>
| Fiber to the Premise        | ◦ Virtually unlimited capacity  
 ◦ Symmetric capacity  
 ◦ Low latency (delay) |
| Fiber to the Node           | ◦ Asymmetric capacity designed for download  
 ◦ Fiber - Coax  
 ◦ Cable modem urban densities  
 ◦ Fiber - Twisted Pair  
 ◦ DSL in urban, suburban & rural |
| Plain old Telephone Service | ◦ Long loop DSL  
 ◦ Rural |

### WIRELESS

<table>
<thead>
<tr>
<th>Technology</th>
<th>Examples</th>
</tr>
</thead>
</table>
| Fixed                  | ◦ Fiber to the Tower  
 ◦ Copper to the Tower  
 ◦ Wireless to the Tower |
| Cellular               | ◦ 4G  
 ◦ 3G  
 ◦ 5G (future) |
| Satellite              |                                                                                  |
Fiber Infrastructure Investment

Fiber to the Home costs between $4,000 and $12,000 per home

Seventy percent of homebuyers will not buy a home without a good broadband connection

A fiber-connected home increases in value by $3,000 to $7,000

Well-connected residents and businesses save money in many ways, conservatively estimated at $1,500 per year

Customers switching from satellite/cellular packages to triple play FTTH report savings of $300 - $400 per month!

Wireless is on fiber for most of its path
What else costs about $10,000?

Anyone can decide to buy some 10 year-old stuff on Craigslist!

But one person cannot buy their own broadband network...we have to do that together!
New Hybrid Copper Networks via FCC CAF II and ACAM

CAF II
- Capital subsidies to large Price Cap Carriers - CenturyLink, Frontier,
- $10\text{Mb} / 1\text{Mb}$ minimum

ACAM
- Operating subsidies to mid-size Rate of Return Carriers
- Requires minimum of $25/3$, $10/1$ or $4/1$ depending on costs

No requirement to serve everyone

Within 3,000 feet > 25 Mb or greater possible

At 10,000 feet = ~ 10 Mb

Copper condition affects carrying capacity over distance
# CAFII/ACAM Acceptance

<table>
<thead>
<tr>
<th>Service Provider</th>
<th>Provider Type</th>
<th>Funding Amount</th>
<th>Locations</th>
<th>Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. AT&amp;T</strong></td>
<td>Telco</td>
<td>$427M</td>
<td>2.2M</td>
<td>18 states</td>
</tr>
<tr>
<td><strong>2. CenturyLink</strong></td>
<td>Telco</td>
<td>$500M</td>
<td>1.2M</td>
<td>33 states</td>
</tr>
<tr>
<td><strong>3. Frontier</strong></td>
<td>Telco</td>
<td>$283M</td>
<td>650K</td>
<td>28 states</td>
</tr>
<tr>
<td><strong>4. Windstream</strong></td>
<td>Telco</td>
<td>$49M*</td>
<td>37K</td>
<td>2 states</td>
</tr>
<tr>
<td><strong>5. Verizon</strong></td>
<td>Telco</td>
<td>$175M</td>
<td>400K</td>
<td>17 states</td>
</tr>
<tr>
<td><strong>6. TDS</strong></td>
<td>Telco</td>
<td>$106.6M**</td>
<td>15K</td>
<td>1 state</td>
</tr>
<tr>
<td><strong>7. Consolidated</strong></td>
<td>Telco</td>
<td>$75.1M***</td>
<td>160K</td>
<td>25 states</td>
</tr>
<tr>
<td><strong>8. Hawaiian Telcom</strong></td>
<td>Telco</td>
<td>$51.4M****</td>
<td>130K</td>
<td>28 states</td>
</tr>
<tr>
<td><strong>9. Cincinnati Bell</strong></td>
<td>Telco</td>
<td>$26M</td>
<td>11K</td>
<td>1 state</td>
</tr>
<tr>
<td><strong>10. Cincinnati Bell</strong></td>
<td>Telco</td>
<td>$2.23M</td>
<td>7K</td>
<td>2 states</td>
</tr>
</tbody>
</table>
DSL Speed over Distance

![Graph showing the relationship between distance from the street cabinet and downlink connection speed (Mbps). The speed decreases significantly as the distance increases.]
Frontier’s Lindstrom Exchange

Red circles = 3,000 foot radius = 25 Mb/3 Mb and higher

Blue circles = 9,000 foot radius = between 25 Mb/3 Mb to 10 Mb/1 Mb
Frontier’s Lindstrom Exchange

Those within the circles, about 10% of land area, would likely meet the 2022 state goal of 25 Mb/3Mb; no one would meet the 100 Mb/20 Mb 2026 state goal.
Wireless
Fixed Wireless

Improvements
◦ Increasingly robust with fiber-fed towers, especially on the prairie
◦ Many combinations of technologies and spectrum
  ◦ Balancing of power and bandwidth
  ◦ Licensed, lightly licensed and unlicensed

Challenges
◦ Trees can eat wireless
◦ Hills can hide wireless
◦ Availability and cost of Internet backhaul
Cellular Issues

4G/3G coverage can be spotty in rural away from highways

Bandwidth decreases with distance from tower

Beware of ** on “unlimited” data plans

5G will require fiber to within 1,000 feet of customer
Satellite

Improvements
- Increased speeds
- Increased affordability

Challenges
- Latency/delay affects advanced use
  - Virtual private networks
  - Teleworking
  - Skype/Facetime video apps
- Weather affects reliability
- Same unlimited** considerations as cellular
What’s good enough?

LOCAL LEADERSHIP DECIDES!!
Economic Development and STaR Municipal Broadband Survey

Background

- Sent to Economic Development and STaR Division members
- Addressed access to gigabyte-level broadband, impact on economic development, role of planners, and need for educational resources
Does your city, town or community have access to Gigabyte-level broadband services?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>Yes (Community Anchor Institutions Only)</th>
<th>Not Yet (Expected)</th>
<th>No (Not Expected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>37.06%</td>
<td>17.48%</td>
<td>19.58%</td>
<td>25.87%</td>
</tr>
</tbody>
</table>
As a planner/economic development officer, to what extent do you believe the lack of high-speed broadband in your town or community is affecting local economic development?
Do you anticipate your town or community will be involved in a municipally-sponsored broadband project (fiber-to-the-premises or Wi-Fi) in the next three years?

- Yes: 22.76%
- No: 34.96%
- Don't Know: 23.58%
As a planner, what level of participation and leadership do you expect to play in a municipal broadband project?

ECONOMIC DEVELOPMENT AND STAR MUNICIPAL BROADBAND SURVEY

<table>
<thead>
<tr>
<th>Level of Participation</th>
<th>Percent of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Little</td>
<td>16.67%</td>
</tr>
<tr>
<td>Some Support</td>
<td>30.83%</td>
</tr>
<tr>
<td>Moderate Support</td>
<td>29.17%</td>
</tr>
<tr>
<td>Significant Support</td>
<td>18.33%</td>
</tr>
<tr>
<td>Project Champion</td>
<td>5.00%</td>
</tr>
</tbody>
</table>
What types of education, training, and resources would be helpful to you?

- Webinars (76.7%)
- Online Courses (46.6%)
- On-site education or seminars (45.7%)
- A best practices database (77.4%)
Interested in Participating in a Pilot “Connected Autonomous Vehicle 101” Education and Strategic Planning Workshop?

• Basic “101” level education/planning for towns and small cities on policy and infrastructure implications of Autonomous Vehicles
• Can be multi-town, regional
• Planners, Economic Development, City Managers, Elected Officials
• Looking for pilot volunteers
Q&A
Understanding Rural Broadband Technology Options

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