April 30, 2008

GOVERNMENT'S ROLE IN BROADBAND

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About the DTC

• Regulate telecommunications and cable industries according to federal and Massachusetts law
  – Promote competition in telecommunications
    • Review tariff filings from carriers
    • Investigate and respond to carrier inquiries and complaints
    • Arbitrate interconnection disputes
    • Investigate service quality complaints
  – Oversee level of E911 surcharge
  – Set basic cable rates in towns without effective competition

• Investigate consumer inquiries and complaints related to utility services
  – Consumer hotline (1-800-392-6066 or 617-305-3531)
  – Consumer advisories on website (www.mass.gov/ dtc)
  – Consumer education and outreach regarding DTV transition
  – “Slamming” complaints (unauthorized switch of telecom service)

• Provide expert input to Administration, upon request
  – Broadband
How I got involved

• **Industry**
  – Software engineer and development manager (1982-92)
  – BBN Communications (Bolt, Beranek & Newman); Thinking Machines, Inc.

• **Academia**
  – Student, researcher, advisor, program manager, lecturer, … (1992-2007)
  – Massachusetts Institute of Technology, Boston University
  – Technology and Policy; Business / Management
  – Research at MIT primarily focused on broadband technology and policy

• **Government**
  – Member of Boston Wireless Task Force (2006)
  – Massachusetts Commissioner of Telecommunications and Cable (since spring 2007)
Why should government care about broadband?

• MIT/CMU study of broadband’s economic impact
  – Funded by Department of Commerce and matching funds from industry sponsors of MIT’s Communications Futures Program
  – Conducted by William Lehr, Marvin Sirbu, Carlos Osorio and Sharon Gillett
  – National-scale statistical study, comparing 2002 economic indicators by zip code, distinguishing communities by their BB availability in 1999 (as reported by FCC)

• Data consistent with conclusion that broadband positively affects economic activity
  – Even after controlling for community-level factors known to influence BB availability and economic outcomes
  – Controls: urban, income, education, growth in previous period
  – Usual academic caveats: data early and limited; potential methodological refinements

<table>
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<tr>
<th>Economic Indicator</th>
<th>Results</th>
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<tr>
<td>Employment (Jobs)</td>
<td>BB added about 1% to growth rate 1998-2002</td>
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<td>Property Values</td>
<td>Housing rents more than 6% higher in 2000 where BB available by 1999</td>
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<tr>
<td>Number of Firms</td>
<td>BB added nearly 0.5% to growth rate in number of business establishments, 1998-2002</td>
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<tr>
<td>Industry Mix</td>
<td>BB added over 0.5% to share of establishments in IT-intensive sectors, 1998-2002</td>
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Study summarized in December 2005 Broadband Properties Magazine (www.broadbandproperties.com)
Broadband Availability in Massachusetts Municipalities
June 2007

- **Unserved:** entire town has no access to broadband
- **Underserved:** broadband available in a limited area
- **Monopoly:** one broadband provider
- **Duopoly:** two broadband providers
- **Competitive:** three or more broadband providers
Governor Patrick’s Broadband Initiative

- **Funding**: Up to $25 million in long-term bond authorization
- **Goal**: Serve the Commonwealth’s unserved citizens, within 3 years
- **Approach**: seed public-private partnerships by investing public funds into long-lived elements of broadband infrastructure, motivating private co-investment in remaining components of broadband service
  - Examples of long-lived elements: conduits, fiber, wireless towers
  - Examples of “everything else:” electronics, wireless devices, billing, customer support
  - Commonwealth will not be a service provider to the public
  - Fund, partnerships to be administered by Massachusetts Technology Collaborative
- **Rationale**: address fundamental market failure in low-density regions
  - Learn from failures of loan programs in other states
  - Similar co-investment model in process in northern Vermont (North-link project)
  - Co-investment unfamiliar in telecoms, but not in other infrastructure projects familiar to economic development officials, e.g. sewer hookups
**Taxonomy: Role of Gov’t vis a vis Broadband**

- **Attract Private Sector**
  - Buyer/User
  - Neutral
  - Rule-maker
  - Financier

- **Supply Publicly**
  - Infrastructure Developer

**Partnerships**
**Key Takeaways from Muni Wireless/BB Research: Then and Now**

<table>
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<tr>
<th>2006</th>
<th>2008</th>
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<tr>
<td>• Small but growing # of muni wireless / bb communities</td>
<td>• Shakeout, Earthlink exit</td>
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<td>• Cities have adopted three basic models</td>
<td>• Predictions borne out re self-provisioning vs. serving public directly vs. PPPs</td>
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<td>• Partnerships typically leverage existing city resources</td>
<td>• Many practical barriers to use of city assets</td>
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<td>• Concern about cities locking out later providers through exclusive franchises with first partner</td>
<td>• Valid concern, but in practice few successful partnerships in the first place</td>
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U.S. Muni Electric Utilities Doing Communications

Of about 2,000 MEUs in U.S.
Source: American Public Power Association
U.S. Muni Wireless Deployments

Source: MuniWireless.com Anniversary Reports (Esme Vos)
Non-U.S. Muni Wireless Deployments

Source: MuniWireless.com Anniversary Reports (Esme Vos)
Model 1: Self-provision Wireless to Meet City’s Own Needs

- Part of broader “Customer-owned Network” trend (fiber and wireless)
- Enabled by unlicensed wireless spectrum
- Motivation: More bandwidth and/or more ubiquitous coverage => more efficient city services for less money
- Dominated by public safety today, but future possibilities limited only by imagination
  - Homeland security and emergency preparedness in addition to day-to-day policing
  - Other mobile city workforce (inspectors, meter readers, …)
  - Sensor (RFID)-based applications (parking meters, traffic lights, rubbish bins…)
  - Urban traffic and parking management (e.g. Denver, CO)
  - Road maintenance (potholes)
City’s Own Use: Customer-Owned Network in San Mateo, CA

- **Public Safety Network**
  - Wi-Fi mesh network, on city-owned light poles
  - All HQ broadband applications now mobile
    - Mug shots, fingerprints, Amber alerts, GIS data, HazMat data
  - New applications easily enabled
    - Real-time video surveillance, VoIP
    - Mobile, tactical broadband networks

- **Low cost**
  - $50k grant funding
  - Lower cost than the 19.2Kbps data radio system it replaced
  - “Edge” investments replace recurring costs
  - Same user equipment works in car and at HQ

**Significant Productivity and Efficiency Improvement**

Sources: Ron Sege, Tropos; Muniwireless.com
The view from 2008

• **Use of wireless for city’s own needs is a powerful motivator**
  – Example of success in Brookline where this was the main driver of the project

• **But, deploying new municipal IT systems, reliably, at scale, is not the same as experimenting in a university lab**
  – Tight budgets push emphasis to cost savings rather than quality improvements
  – Technical expertise less plentiful, with more reliance on vendors
  – Security, reliability concerns paramount
  – Anchor tenant strategies make sense but require standardization across city departments
  – Success more likely in mid-size cities?
Model 2: Serve the Public Directly

- Hotspots, businesses, or homes

- Motivation: digital divide, economic development

- Dominated by communities with publicly owned electric utilities
  - E.g. Chaska, MN and Scottsburg, IN
  - Already have all the customer-service staff and infrastructure in place
  - Can often build on a municipally owned fiber ring already in place

- These communities are “special” and not particularly good templates for larger, non-MEU communities like Boston
  - 2006 conclusion, remains true in 2008
Serving the Public Directly: Ellaville, Georgia Municipal Electric Utility

- Population <2,000
- 3 antennas on City’s main water tank
  - 2.4 GHz LOS (Alvarion) + 900 MHz N-LOS (WaveRider) – trees!
- $200,000 upfront cost
- Users pay for service (~1 Mbps @ $30-45/mo), modem ($200) + antenna ($100-150)
- 1.5 Mbps backhaul (ouch)

Small Cities Serve Their Own
June 25, 2002

www.epride.net
Model 3: Public Private Partnerships (PPP)

• Hybrid approaches typically addressing needs of both city and community

• Motivation: “Economies of scope”
  – Leverage city resources to reduce cost, improve quality of city services and facilitate entry by non-muni actors (private sector and non-profits)

• Dominant model among planned initiatives in major cities
Public-Private Partnership: Cerritos, CA Dual-Use WiFi Mesh Network

- **Fast and simple**
  - Commodity 802.11b clients
  - Less than 1 month to install

- **True metro-scale**
  - 9 sq. miles
  - 17,000 homes passed
  - 50,000 residents

- **Low cost to own and to operate:**
  - <$600k total CAPEX
  - One wired backhaul link for the network
    - POP to Internet
  - No special CPE; no truck rolls
  - $15 opex/sub @15% penetration

- **Bands used:** 2.4 GHz

Source: Ron Sege, Tropos
Diverse PPP approaches

- **Philadelphia, PA**
  - City leases to Earthlink access to city fixtures for wireless antenna placement
  - City requires “open access” i.e. wholesale access for other ISPs on resulting Earthlink network
  - Earthlink agrees to invest $10-15m and charge “low” wholesale rates
  - Wholesale profits feed into digital divide funds (taxation by another name)
  - Analogous to cable franchise, but many details still not clear / public

- **Anaheim, CA**
  - Exclusive deal with Earthlink, but “open access”

- **Tempe and Chandler, AZ**
  - Non-exclusive deal with NeoReach

- **San Francisco, CA**
  - Six proposals
  - Google and SF Metro Connect both proposing free-to-end-user access + advertising support + options for paid service tiers
City’s Role in Narrowing Digital Divide: Public-Private Hotzones in Austin, Texas

Public Wi-Fi venues - AWCP only

Public Wi-Fi venues - City gov’t

AWCP=Austin Wireless City Project

Leveraging City Resources

• **Infrastructure-based resources**
  – Traffic and street light poles
  – Underground conduits
  – Rooftops of municipal buildings (antenna placement / real-estate model)
  – Towers (water, fire, etc.)
  – Fiber rings/backhaul connections
  – Essentially, any right-of-way or city property that facilitates wireless networking

• **City’s buying power is also an important resource**
  – Demand aggregation / anchor tenant strategies

• **Inventory of these resources is a critical first step**

• **Can Boston non-profit institutions be leveraged in analogous ways?**
  – Health, education, arts, housing, historical, community, etc.
  – Existing wireless networks (Boston Foundation report)
  – May be especially relevant to digital divide issues (San Francisco model)
The view from 2008: Use of City Assets in Boston

• **Light poles**
  – Powering issues (e.g. bank-switching)
  – Not all of poles owned by city
  – No systematic inventory / GIS

• **Rooftops**
  – Access to electric power
  – Controlled by city departments
  – If public building not available, private landlords may hold out

• **Fiber / backhaul**
  – In many cities this is provided as part of cable I-Net, not available for dual use purposes
  – Another reason why MEU communities are more successful at muni wireless

• **Partnerships with non-profits**
  – Many good intentions, but lots of meetings – hard to move quickly

• **In short: devil (and lots of time) lies in the details!**
Best Practice Partnerships Avoid Exclusivity

- In the process of facilitating the first wireless entrant, don’t accidentally hinder the next one
  - There can and will be many wireless networks, services, business models, etc.
  - Not all will look like traditional service providers (e.g. organic mesh networks)

- How to manage multi-party access to city facilities?
  - Consider treating like rights-of-way

- “Open Access” Model Proving Popular
  - Generally, means multiple competitors use a common shared network infrastructure, and customers can elect services from alternative suppliers
  - But requires clarification along many dimensions
The view from 2008

- Avoiding exclusivity is important to think about for the future, but practically speaking is not yet the real problem
  - Getting ANY partner is more of the issue, given uncertain returns

- **Municipal wireless as testing ground for innovative technology and business models**
  - In this context, many “failures” are to be expected
  - Example casualties: Earthlink’s municipal division; proprietary mesh networking
  - The new new thing: participatory networking, e.g. Meraki

- **TANSTAAFL!**
  - Can’t get something for nothing
  - If the problem is lack of infrastructure, can’t be solved without investment by someone
  - Problems of affordability and access (absorptive capacity) are different and admit a different set of solutions
  - In both cases, government has started where the need is greatest
Selected Publications on Municipal Broadband


http://cfp.mit.edu/groups/broadband/muni_bb_pp.html