Wireless Broadband Technologies

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Our Agenda

- Currently available wireless technologies
  - Unlicensed
  - WiMAX
  - What's available now
- Challenges & Opportunities of 802.11x
- What's a City to do?
- Questions a City should ask
- Non-recurring & Recurring Costs
- Best practices of deploying a Broadband Wireless Technology

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Currently Available Wireless Technologies

- 802.11 a/b/g the X-Factor ~ WiFi within a campus, organization, building or home

- Unlicensed Radio Frequencies
  - 2.4 GHz
  - 5.7 GHz
  - 5.8 GHz

- 2.5 GHz MMDS

Currently Available Wireless Technologies

- WiMAX ~
  - 802.16 d (2004) fixed & 802.16e (the promise of mobility) Approved recently
    - Only two frequencies
    - Not mobile 802.16d (2004)
    - Not interoperable (Most, if not all technology is thus far proprietary)
    - Very expensive infrastructure & CPEs
  - 3.5 GHz ~ Not available in the US (Military RF)
    - Available worldwide
  - 5.8 GHz ~ wait a minute, isn't this also unlicensed?! Yes!
  - 802.20 promises mobility ~ but at what cost?!
  - WiMAX costs to install a customer = $ 250.00

Currently Available Wireless Technologies

- What are major telephone carriers using?
- Who offers Broadband Wireless Access (BWA) today?
  - Nextel/Sprint
  - Verizon
  - Cingular
  - T-Mobile
- Where do they offer BWA?
- How do they provide the service?

Currently Available Wireless Technologies

BWA Technologies of Major carriers

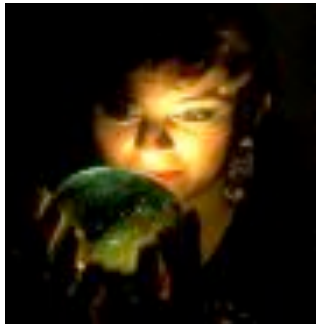
- Nextel/Sprint
  - 1xED-VO ~ Evolution Data Optimized
  - 1.5 - 3.0 Mbps x 375 - 750 Kbps speeds
  - 3G ~ Generation
- Verizon
  - Urban is based upon 1xED-VO
  - 300 - 500 Kbps x 128 Kbps
  - 3G

Currently Available Wireless Technologies

- Cingular
  - HSDPA (EDGE) ~ High-Speed Downlink Packet Access
  - Qwest actually uses this!
  - 700 Kbps - 1.8 Mbps x 90 - 175 Kbps
  - 3.5G
- T-Mobile
  - GPRS ~ General Packet Radio Service
  - 512 Kbps - 1.8 Mbps x 80 - 180 Kbps
  - 4G

Other Available Wireless Technologies

- Variety of proprietary MMDS WiMAX-like BWA solutions
  - Alvarion
  - Navini
  - IPWireless
  - NextNet
  - Arraycom



- Who is deploying these?
  - Clearwire - nationwide - St. Cloud, MN & Eau Claire, WI
- What is the technology?
  - 2.5 GHz FCC licensed RF bands in MMDS
  - IT ISN'T WiMAX!

802.11x: Challenges from use of unlicensed spectrum

- Challenges:
  - Multiple sources of common interference -
    - Other users of 802.11a/b/g
      - Neighbors or commercial users
    - Other users of same spectrum
      - Microwave ovens
      - High-end cordless phones
      - Bluetooth
      - Baby monitors, security systems
  - Uncertain business models when the City lacks "title"
    - Applications now largely apply where a municipality has control over relevant real estate
  - Security

802.11x: Opportunities from use of unlicensed spectrum

- Opportunities:
  - Use of unlicensed spectrum has liberated creativity
    - Home networking, without wires, without truck rolls
    - Rural data networks
    - Hotspots in cafes, airports, hotels
    - Street side 802.11 nodes
      - Buffalo, Chaska other Minnesota cities
  - Use of unlicensed spectrum has fostered new generations of low-cost devices
    - 802.11 support in all laptops, PDAs, home networking
      In-home use of 802.11 for video distribution, etc.

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The possible future of BWA -

- Increased unlicensed spectrum is expected to become available:
  - "White Spaces" spectrum at desirable frequencies below 700 MHz.
  - Possible 6-12 MHz of unlicensed spectrum in the 700 MHz band.
  - Use of allocated semi-unlicensed 3.65-3.7 GHz spectrum.
- 802.11n Wi-Fi with improved range and Quality of Service (QoS)
- WiMAX Systems for improved backhaul and Metro Area Networking
- Convergence of wireless on all IP/SIP based systems and services
- New types of location based services and content including advertising and information services.

Source: http://www.wimaxtrends.com/features/special/sfeature_031306.htm

The possible future of BWA -

- Community/local video services such as school event video webcasting.
- IPTV and DVB-H video content
- Among services that can be extended to local governments and utilities:
  - Meter reading services
  - Police and Emergency VPNs and backup communications
- Low cost VoIP including wireless VoIP and multi-mode phones
- Disaster recovery 'First Responder' communications: The distributed nature of WBB results in less 'single points of failure'.

Source: http://www.wimaxtrends.com/features/special/sfeature_031306.htm

What's a City to do?

- If a city wants a wireless solution - learn from the successes of others -
  - Buffalo - 1.4 Mbps via license-exempt 900 MHz industrial, scientific and medical (ISM) frequency band over a one-mile range
  - Chaska - Meshed network topology - 802.11x
  - St. Louis Park - In development
- Resources -
  - Use Google of course!
  - Muniwireless.com ~ case studies, deployment guides, etc.
  - Unstrung.com ~ technology developments
  - Broadband Wireless Exchange ~ bbwexchange

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Questions a City should ask -

What are the Broadband Wireless planning variables?

The TOP 8 -

1. What's the purpose of the Municipal Wireless Network?
   - Public Safety, Residential/Business?
2. How many square miles will be covered?
3. How will the network be funded/financed?
   - Bond?
   - Vendor financed?
4. What wireless technology is being considered?
   - Unlicensed or Licensed
5. Are their existing broadband wireless options availa
6. Who will subsidize the Customer Premise Equipme
7. What are the hidden costs?
   - Who pays to install the CPE?
   - Who subsidizes the installation cost - truck roll?
   - ISP infrastructure - it isn't easy and certainly not free
8. How is the vendor held accountable?

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Questions a City should ask -

What are the known costs?

- Wireless equipment ~ radios, POE, miscellaneous;
- Backhaul ~ in place INET and can you use it?
  - If not, a 20 Mbps MOE from Qwest is $ 3,185.00/month
- Tower right-of-way issues/costs?
  - Use existing utility poles ~ technology and utility will drive this cost
- Project creep ~ your city wants a wireless network and the vendor wants to sell radios!

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Cost Questions a City should ask -

What are the real costs?

Non-Recurring Costs (Per Tower Site)

- Cost per square mile ~ radios, mounting hardware, brackets, etc. $ 48,000.00
- Cell site development Cost per square mile $ 37,000.00

Total Initial Cost for a square mile of Broadband Wireless Access $ 85,000.00

Monthly-Recurring Costs (Per Tower Site)

- Backhaul ~ Backhaul, Maintenance, etc. $ 21,000.00

Total MRC for single BWA Site $ 21,000.00

* Hidden Costs - assuming the Customer Premise Equipment will NOT be subsidized

- Customer Premise Equipment (1 Site) $ 679.88 x 1500 subs = $ 1,019,820.00
- CPE installation $ 200.00 x 1500 subs= $ 300,000.00

Total Residential Hidden Costs $ 1,319,820.00

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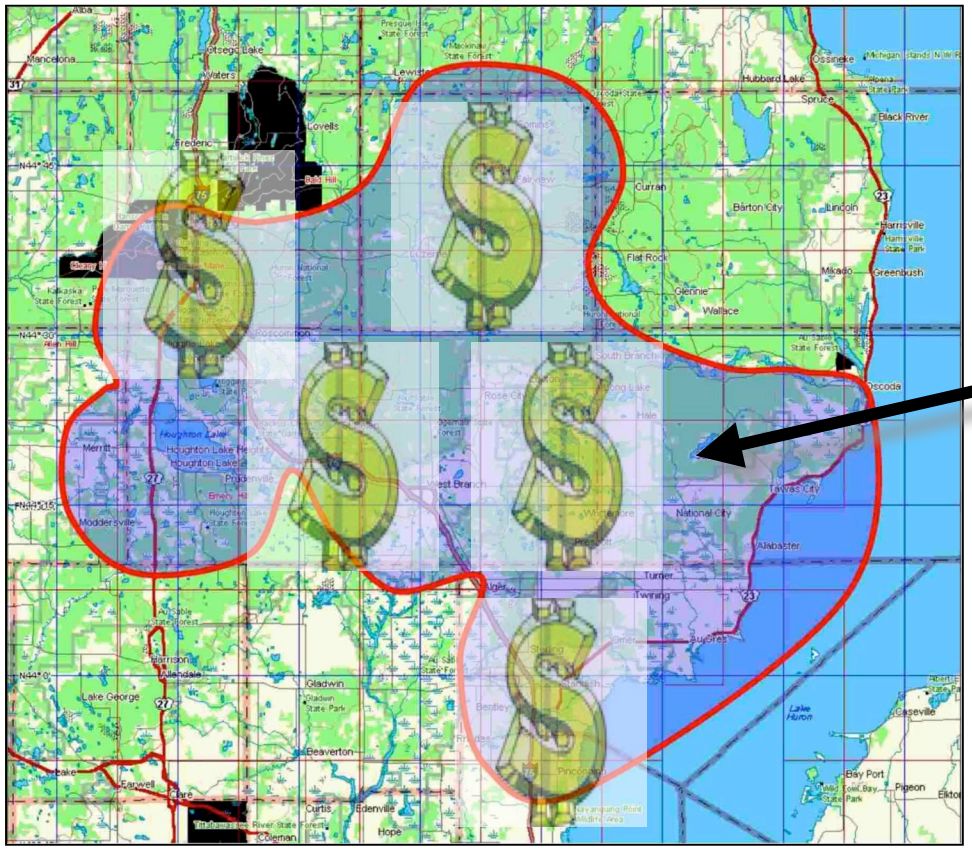
Wi-Fi Non-Recurring Installation Costs



= $ 85K per square mile

= $ 425K for 5 square miles

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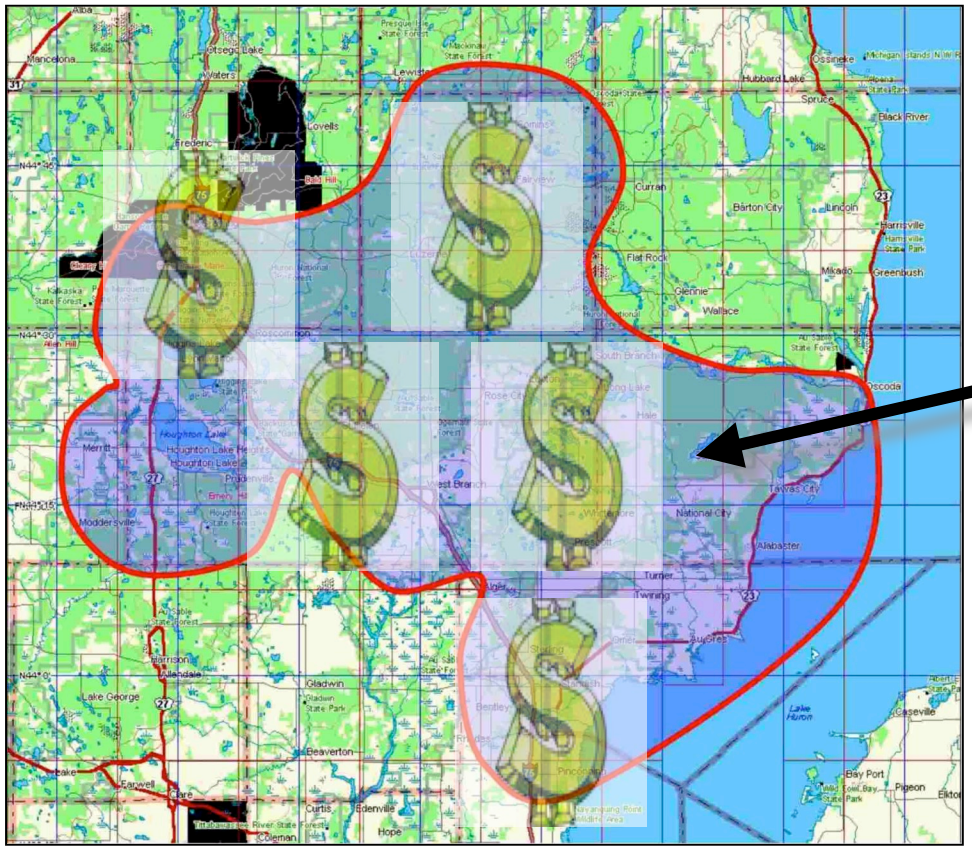
Wi-Fi Monthly Recurring Installation Costs



= $ 21K per square mile
for Monthly Recurring Costs

= $ 105K for 5 square miles monthly

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The Cost of being an ISP -

- The Internet Services Costs -
- To provide 6,000 residents with:
  - Internet access
  - E-mail
  - Web hosting/pages, etc.

Will cost $ 160K a month or $ 2M annually

Broadband Wireless Access Best Practices

- Identify locations with good wireless visibility
  - Roof and tower rights
- Understand application requirements
  - Bandwidth
  - Quality of service ~ what SLAs do you want to offer?
    - Triple play? Video, VoIP
- Deployment/vendor partner
  - Integration experience with specific vendors & deployment venues
  - Single vendor, especially for complex BWA installations
    - Assures total system integrity

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Questions?

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Thank you!

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