

Metropolitan Broadband Explained: A Unique Opportunity for Cities

Times Have Changed

Both *telecom infrastructure deployment* and *Internet access* are poised for dramatic change based on recent advances in technology. Over the years, large telecom and cable companies built networks that provide service to individual homes and businesses and rely on monopoly or duopoly leverage and dense urban markets (Tier One in the diagram below). Incumbents now face dwindling revenue from declining voice telephony business, but the large companies are buoyed by cellular revenues. To remain competitive, all will offer a "triple play" of broadband Internet access, video, and voice telephony. These network giants are faced with a time-consuming and expensive rollout of new generation wired and wireless infrastructures and a pitched battle for customers with high marketing costs. Some, like global giant at&t, are even entering the municipal wireless space. Impatient for change (lower costs and faster speeds), pioneer municipalities have many choices to take advantage of new wireless broadband technologies and deploy city-wide networks, either on their own or in partnership with service providers (new smaller "WISPs," incumbent phone or cable companies, or giant ISPs like at&t). They can work with - or go around - incumbents. Now that's a radical change! By being first in line, cities can get in on a good deal, transferring much of the risk to private partners. As more cities become aware of this opportunity, we'll see more RFPs, for sure.

Ironically, markets less attractive to the incumbents (cities and regions with lower income areas, smaller or less dense populations) that fall out on the right side of the diagram below (Tier Two and Tier Three) present the best business opportunity of all. Governments and businesses can take advantage of these new wireless technologies and new business approaches in these regions with less fear of competition from the giant telecom and cable companies. Instead, they will enter a market by joining with smaller traditional telecoms and cables, old and new technologies, and newer ISPs and WISPs, starting with broadband access, then moving on to digital voice and video.

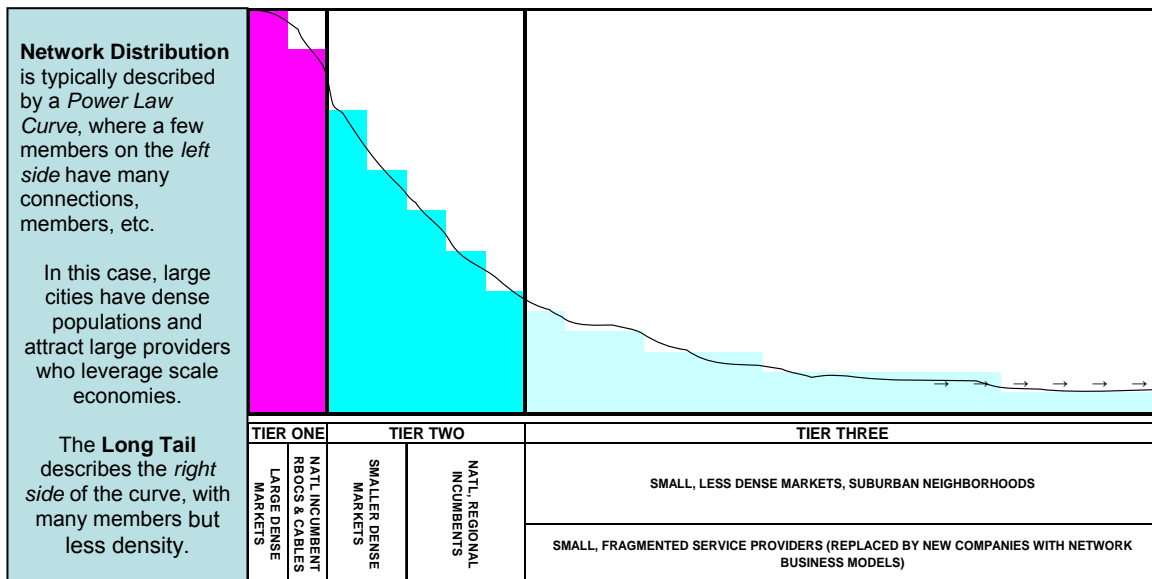


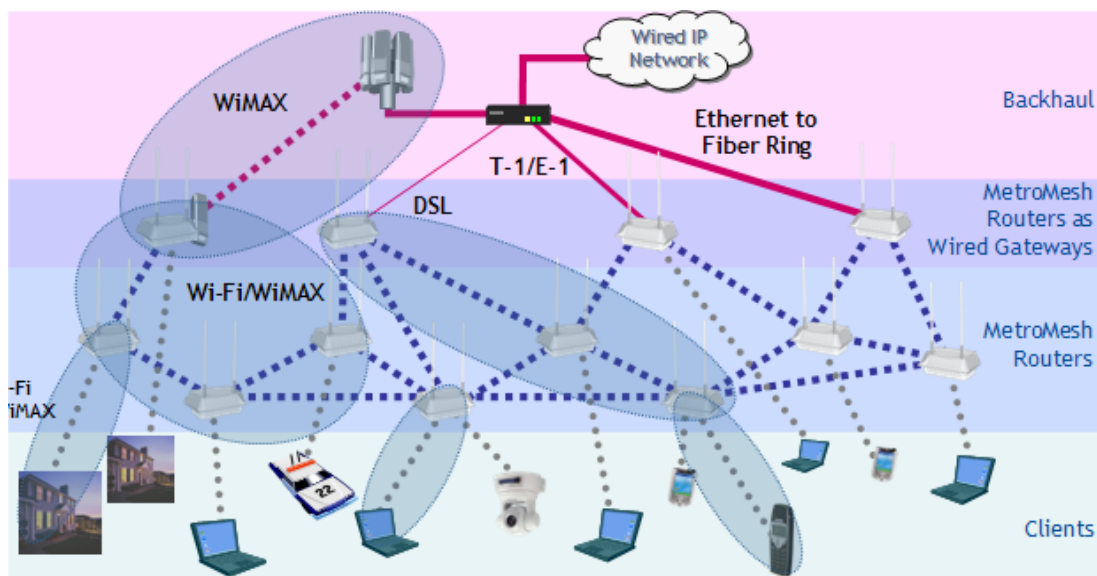
Figure 1. Wireless Broadband Internet & other technologies enable new competitive business models that better serve smaller, more fragmented markets out in the "Long Tail"

Wireless Broadband Explained

What makes wireless broadband in underserved lower tier markets such a special opportunity? First, standardization has brought equipment prices down to the point that Wi Fi chips are imbedded in a variety of devices, and more and more network infrastructure equipment using Wi Fi (and soon, WiMAX) is coming on line. Second, the use of unlicensed spectrum for radio transmission removes the need for the large amounts of capital needed to win spectrum auctions. Finally, marquee projects in cities like Philadelphia and Houston have gained considerable press attention over the past two years, spreading the word far and wide, generating interest among municipalities and businesses.

The Internet is a disruptive network, but the high cost of wiring “the Last Mile” to each home and business has limited competitive alternatives, keeping market penetration low and prices high. Wi Fi, the same technology that lights up Hot Spots and provides connectivity inside homes and businesses, has been reconfigured into multi-node mesh networks that enable city-wide coverage, and a cost-effective Last Mile solution, as in the diagram below. Shoe box-size Wi Fi mesh units on street light poles (or rooftops) pass data signals to and fro, providing communication between end users and the Internet at ever faster speeds. Fiber links and/or point-to-multipoint wireless (soon, WiMAX) provide the Middle Mile, connecting “gateway” wireless nodes to the Internet.

Unlike traditional wired networks, these new modular and scalable networks enable small targeted cost-effective projects to be deployed: small downtown networks confer “digital” status for cities and chambers of commerce, while neighborhoods can band together to share a broadband connection to get the same benefits of scale that enterprises do. Mesh networks are “self-healing,” routing around obstacles. Because they are “IP” networks, they are open to any digital application that works on the Internet. Governments gain cost reductions, new service capabilities and increased flexibility with these new networks. Smaller, more targeted network businesses can experiment with new business models to gain market share over traditional competitors. Local businesses can attract knowledge workers and customers to the downtown areas of smaller towns.



- **Wi-Fi: Unlicensed; already ubiquitous**
- **WiMAX: Licensed, improved mobility and QoS; Intel promise of ubiquity**

Open Standard Radio Mesh Today/Tomorrow

Figure 2. This graphic from wireless network equipment vendor Tropos Networks shows that Wi Fi Mesh (and WiMAX) not only make the Last Mile affordable, but also create brand new connectivity options

Benefits and Uses of Metropolitan & Community Networks

To date, the benefits of this new technology have been viewed through the prism of traditional telecommunications. As a substitute for cable or DSL broadband, or for T-1s for businesses, the benefits of wireless broadband are confined to *lower priced Internet access*. Of course, wireless broadband brings *mobility* to the table, and its bandwidth and price compare favorably to newer cellular technology such as “3G” data options. And because of its economy, wireless broadband can provide affordable *service in “hard-to-serve” markets*, where DSL and cable do not go. Moving beyond broadband access, to video and voice, the other legs of the “triple play,” wireless holds its own, with adequate bandwidth and quality-of-service to provide *voice over Wi Fi*, and *short video options*, with *video downloads and video streaming* on the horizon.

But a host of other benefits await the metropolitan area or community that installs a wireless broadband network (see table below). To start, having broadband connectivity swimming in the air like an FM radio signal puts many solutions in reach that cannot be imagined without such a network. For instance, *video surveillance options* are much more affordable when hard-wiring is not required. Small cameras hooked to cheap storage transform the potential of video-based property security. *Sensor network options* abound once a network is in place (e.g., RFID-tagged assets can be tracked using a Wi Fi mesh network). Consumer telephones, music and gaming devices now have Wi Fi capabilities. Mobile video and location-based services are now possible using Wi Fi.

Perhaps the most significant benefit of these networks is regional *economic development*. not only do markets with competitive options for broadband enjoy lower prices for Internet access and greater network coverage, but just installing a wireless broadband network makes a statement to the local community and the rest of the world. By taking the first step with a downtown demonstration network, government, business, and community leaders send a signal about their vision for their metropolitan area or community to be on the cutting edge. When comparing regions, businesses and individuals increasingly place an emphasis on broadband connectivity options and long-term vision.

Stakeholder	Applications & Benefits
Local Governments	<ul style="list-style-type: none"> ○ Public Safety – video surveillance=lower crime rates ○ Infrastructure Mgmt – utilities, sensors, AMR, field data ○ Field Data (public safety & other departments) – mobile applications=more time spent out in the field being productive ○ Economic Development – affordable, ubiquitous broadband = lower cost of doing business, increased options re marketing, sales
State & Federal Governments	<ul style="list-style-type: none"> ○ Disaster Management & Recovery – common communications net ○ Border Security – affordable high tech monitoring options ○ Economic Development – affordable, ubiquitous broadband = lower cost of doing business, increased options re marketing, sales
Businesses	<ul style="list-style-type: none"> ○ eCommerce websites – reach world markets for local goods ○ Web 2.0 applications – cheap and easy for startups ○ Location-based services – new options for marketing and sales
Communities	<ul style="list-style-type: none"> ○ Neighborhood chat – Instant Messaging improves communication ○ Neighborhood eWatch – video surveillance of entrances & homes ○ Local video coverage – video coverage of local events
Individuals	<ul style="list-style-type: none"> ○ Affordable, Ubiquitous Broadband Access enables consumer applications and enhanced lifestyle: <ul style="list-style-type: none"> ○ Voice ○ Music ○ Video ○ Gaming ○ Social Networking

Figure 3. A general purpose communications network enables connection to a variety of digital appliances & applications

Prudent Steps into an Uncertain Future: How to Get Started

One of the biggest challenges in making an investment is timing: when is it right to jump into a fast-moving stream (if ever)? In general, a *conservative* financial analysis shows a *positive* return on investment (ROI) in a *reasonable* amount of time, making the investment *prudent*. But in this case, it's difficult to know all the details impacting an ROI analysis. In light of these unknowns, government and business leaders tend to defer investments and seek more information. Alternate low-risk paths involve regional collaboration and relatively small investments: an initial project planning and community mobilization consulting engagement can raise awareness and generate momentum; a "pilot" network can test a specific application; a "demonstration" network can be used to raise the level of awareness in a metropolitan region or community.

Because studying and attending conferences provides diminishing returns, MetroNetIQ recommends getting started now with an initial assessment and awareness program or pilot and demonstration networks. Knowledge and awareness of these new networks is not widespread among the general public, so leaders need to engage their communities in dialogue and share in their own learning process. Activity is newsworthy and will generate press coverage, promoting the economic development message at a fraction of the cost of a full deployment. Even a small network delivers initial economic development benefits to a downtown. Finally, small networks can be rapidly deployed (a month or less), for quick results and lessons.

MetroNetIQ recommends enhanced awareness and lowered risk with this process: 1) Initial consulting engagement to assess the environment, provide leadership briefings, and design a project plan; 2) Community websites with local content and background information that engage the community and gather feedback; 3) Deployment of a small downtown network or a small neighborhood network to showcase potential and enable experiential learning; and 4) Addition of applications of interest to the local community.

The benefits of such a deliberate, phased, prudent approach to metropolitan broadband networks are manifest: with success, small networks become the first phases of a larger network deployment; when problems are encountered, the networks serve as educational tools providing valuable real-world lessons.

What does this risk-management and education process look like? The chart below provides *general* information on networks, estimated expenses, and coverage, while the accompanying brochure drills down in more detail on specific Quick Start Packages and Starter Kits that describe the basics on getting started down a prudent, deliberate path to network acquisition.

Network Component	Estimated Price (US \$\$) / Number of Units	Coverage
Preliminary Consulting	depends on project scope	NA
Hosted Community Website Package	App. \$500/site/year	NA
Wi Fi Mesh Nodes	\$2-5,000 ea	300 meter radius: 100 residential or 10 commercial ISP subscribers/node
Nodes per Sq Mile (Sq Kilometer)	25 - 30 (15-20)	Square Mile (Square Kilometer)
Deployed One Sq Mile Network (all costs included)	App. \$100,000	Square Mile
Consumer Premise Equipment (CPE) – bridge unit to bring signal into the home or business	\$100-200 ea	One home or business
Optional VOWiFi phone handsets	App. \$200 ea	under network cloud
Optional video camera packages	App. \$1000 ea	under network cloud

Figure 4. Getting started with pilot or demonstration networks showcases potential, accelerates learning, and lowers risk