Municipal Broadband: Demystifying Wireless and Fiber Optic Options

Communities can greatly benefit from owning municipal broadband networks and opening them to multiple providers. But implementing such networks takes time and careful planning.

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In the absence of a national broadband strategy, many communities have invested in broadband infrastructure, especially wireless broadband, to offer their residents broadband choices.

But wireless alone cannot offer the speeds required by a city wishing to compete in the global digital economy – and neither can DSL or cable. Business, government and citizens all need affordable and fast access. The confusion about these competing technologies diverts resources and attention away from building the necessary long-term broadband foundation: fiber optic networks. Wireless solves the mobility problem; fiber solves the speed and capacity problems; and public ownership offers a network built to benefit the community.

Today's decisions will lay the foundation of telecommunications infrastructure for decades.

Minnesota's capital city, St. Paul, recently considered building a wireless network in order to quickly offer all 285,000 residents an affordable broadband connection. With the summer 2008 Republican National Convention approaching, the City Council created a Broadband Advisory Committee and pressed it to move quickly. The committee refused to act hastily and studied several broadband options for the city. Over the course of a year, the committee decided a wireless network would not serve St. Paul's long-term interests and called for a fiber optic network, built in phases, that could have wireless as an add-on.

One might see St. Paul's actions as confirming the death of wireless. But spending on municipal wireless networks in 2007 has increased and is projected to continue increasing in 2008. Earthlink's WiFi abandonment merely signaled the end of a flawed business model. Cities can no longer find partners willing to shoulder the cost of the network solely for future subscriber revenue. With few exceptions, private providers will build networks only where the city government will guarantee a revenue stream for the network owner by purchasing a set amount of services. Such networks depend on city funds to exist, while not offering any accountability to the city.

Many cities continue moving forward with publicly owned systems – where the public both pays for the system *and* has input on how it is managed and priced. Cities look to wireless networks to allow police officers to submit reports from the squad car, firefighters to quickly download building blueprints at the scene, and building inspectors to access plans and forms from the field. However, these mobility needs have

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not diminished the need for wired infrastructure, with its unmatched speeds and capacity.

The question should not be whether to invest in fiber *or* wireless, any more than one would ask whether shoes are "better" than hats. Ultimately, they solve different problems and neither offers a one-size-fits-all solution. Fiber networks can actually lower the cost of building a wireless network. Once the fiber network is completed, wireless nodes can easily be connected, offering considerably faster speeds than those without ubiquitous wired backhaul.

WIRELESS FOR "ANYWHERE" CONNECTIVITY

The key benefit of a wireless network is mobility. All laptop computers are now built with WiFi connectivity, and can jump on the Internet anywhere a WiFi network is available. Many companies make phones that can use WiFi networks as well. As these devices become more common, users will want to connect everywhere.

WiFi networks do not require expensive radio spectrum licenses. However, costs have been much higher than anticipated for both public and private networks. Network designers first believed that 18 to 22 nodes (WiFi radios mounted on utility poles) per square mile would provide sufficient coverage but are now suggesting 40 to 60. Even so, areas with heavy foliage and houses with stucco walls may need to invest in external antennas.

Aside from WiFi's inherent mobility advantage, some cities are attracted to it as a quick and less expensive way to offer broadband connections over a large geographic area. The price tag for a WiFi network varies greatly depending on size, density and geography, but the initial investment is generally an order of magnitude less than the initial investment for a fiber build.

The Wireless Minneapolis network, covering more than 55 square miles, will cost $24 million and be built in under two years. That puts the price tag at $250,000 to $450,000 per square mile. Once the network is built, an ongoing commitment is required for operation and maintenance. Radios will need upgrading and repairing. Due to the rapid pace of technological change, cities can expect to start replacing radios after two or three years. These expenditures can run from 20 to 40 percent of the initial capital cost (or more in rare circumstances) each year. Over the course of five years, every wireless radio will likely be replaced.

When calculating their return on investment for publicly owned wireless networks, cities should include cost savings and productivity increases along with revenue from subscribers. Building inspectors will be able to access plans from the field, saving considerable time and resolving issues quickly. Police officers are increasingly free to complete paperwork in the field rather than behind a desk. Water, electric and gas meters can use the network to report usage or problems, saving time and wasted resources from leaks undetected for too long. Many of these efficiencies are difficult to quantify but will benefit the community and reduce municipal budgets.

Ubiquitous wireless networks are so new that no one can predict how they will be used in a few years as more network-aware devices become commonplace. Still, those who expect a future without wires are sadly mistaken. Existing WiFi networks are perfectly adequate for voice, e-mail, or Internet surfing, but their limitations preclude high-quality videophone applications and other bandwidth-intensive applications.

Current WiFi networks offer theoretical speeds up to 54 Mbps but the real world of interference and physical barriers results in far slower speeds. Additionally, each node must share its bandwidth among multiple users; each user receives only a slice of the available connection. In practice, citywide wireless users are generally looking at no more than 1 to 2 Mbps, and often less depending upon the signal strength at their location.

These speeds are comparable to wired connections (as experienced by users) from phone and cable companies. Future standards will bring faster connections but new applications constantly increase demand for faster speeds in a perpetual cycle. WiMAX (Worldwide Interoperability for Microwave Access) has been expected to offer faster, more reliable wireless connections. WiMAX networks should offer stronger signal strength, faster speeds, and better penetration, but require an FCC license to effectively deploy (specifically 2.5 GHz in the US). A licensed vendor may be able to offer a city faster wireless access that easily reaches inside buildings using fewer access points.

In order to offer this technology, a provider needs to secure a license in the geographic area in which it plans to operate. In the US, Sprint Nextel and Clearwire control the overwhelming majority of licenses, making WiMAX somewhat less attractive for municipal deployments.

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Additionally, few laptops and devices currently support WiMAX networks. Until WiMAX networks are operational, no one knows how interoperable they will be – whether the Sprint WiMAX cards (marketed as Xohm) will work on other WiMAX networks. The WiMAX Forum and companies like Motorola and Intel have claimed that WiMAX products will be interoperable,

but Sprint and Clearwire, while reportedly back in negotiations, have not finalized a deal.

Cellular companies also offer a mobile, though slow, option for data transfer. First responders in many cities rely on cards from cellular carriers. These connections tend to be considerably slower than the options discussed above. When the I-35W bridge in Minneapolis collapsed, emergency personnel relied on the WiFi network to use applications too bandwidth-intensive to operate over cellular networks.

DSL AND CABLE NETWORKS ARE OVERSUBSCRIBED

Neither cable nor DSL can offer the necessary bandwidth to be competitive in the digital economy. Understanding this important point requires some understanding of both the technology and the "oversubscription" model.

Nearly all types of networks are oversubscribed. Not all vehicles can drive on roads at the same time, not everyone can draw water from the pipes at the same time, and the electrical grid will fail if everyone turns on every appliance and light at the same time.

Network designers have to make assumptions when creating a network. The electrical grid is built to handle the likely load on the hottest day of the summer and then padded for security. Historically, the telephone network was built to survive Mother's Day, its busiest day of the year. Phone companies built their systems assuming the average call would be three minutes long, based on years of similar patterns.

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When households started using the Internet, they would use a computer modem to dial a local Internet service provider over their phone lines. In most areas, they could choose from multiple service providers. As the Internet became more popular, phone companies began to fear for their networks because the connections lasted considerably longer than three minutes. They had to change their oversubscription assumptions and re-engineer their networks.

Over time, modem speeds increased slowly while expectations increased rapidly. Following the Telecommunications Act of 1996, phone companies rolled out DSL (short for digital subscriber line, but almost universally known by its acronym) over their wires. Because the telephone networks were then regulated as common carriers, phone companies had to compete with other Internet service providers for subscribers.

Many households and businesses used a DSL connection from their incumbent phone company to connect to a different service provider for Internet access.

DSL connections use phone lines, but carry data at frequencies above human voices to avoid disrupting voice quality. Unfortunately, these frequencies cannot travel far, so subscribers must be physically close to the phone company's central office to subscribe. Even in large cities, many neighborhoods may be outside the reach of DSL, although this situation is becoming less common.

Cable companies began offering cable modem services to compete. Though the networks were designed initially for a one-way transmission of information to subscribers, providers have invested over $100 billion to date in order to upgrade their networks to offer broadband Internet access to subscribers.

The vast majority of broadband users in the US still connect using DSL or cable. Though the speeds they once offered were unimaginably fast, these technologies have not kept pace with increasing bandwidth demand.

COMMON CARRIERS AND REGULATION

Roads have been common carriers for centuries, with everyone allowed to use them equally. The same principle can be applied to telecommunications networks: A common carrier network is one that different service providers are allowed to use. Roads, like telecommunications networks, are expensive to build, creating a natural monopoly for the first mover. New competitors face serious barriers to entry because an existing network can temporarily lower prices until the competitor files for bankruptcy. Without competitors, monopolists tend to stagnate because they have little incentive to innovate.

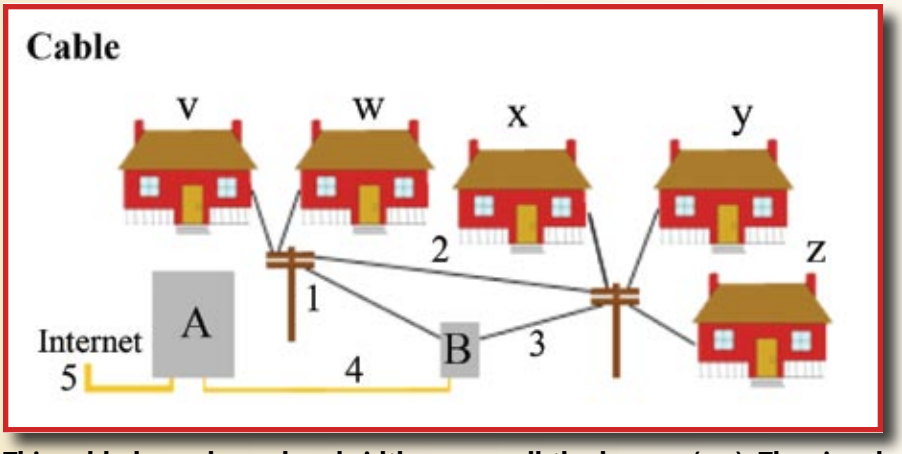
Until 1968, the phone company was the sole provider of phones, renting them to generate revenue. In that year, the FCC required AT&T to allow others to attach non-damaging devices to the network (the Carterphone decision). Carterphone opened the phone network and led to decades of innovation, which resulted in fax machines, computer modems, answering machines, cordless phones and more. Open networks create spaces for entrepreneurs and new technologies.

Unfortunately, modern trends are pushing networks back toward closed, monopolistic models. Broadband over DSL is no longer a common-carrier service. Publicly owned networks can reverse this trend by opening the network to innovators and competition among service providers.

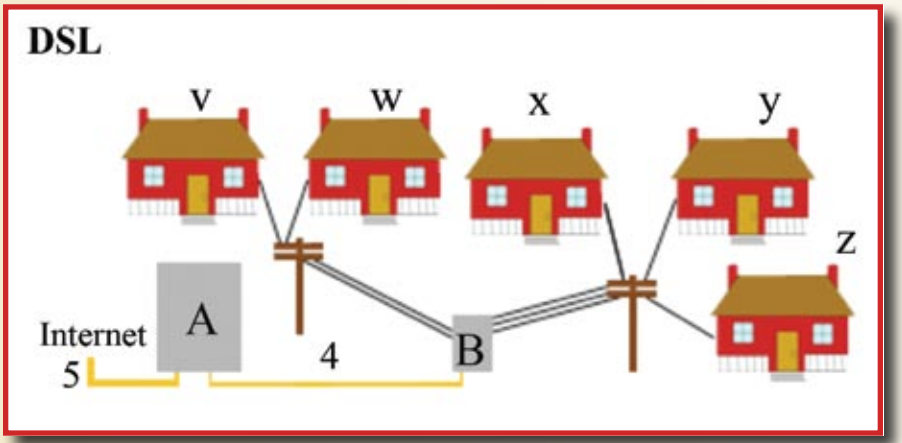
DSL oversubscribes at the core of the network, while cable oversubscribes at the edge. Speeds are limited both by bottlenecks and by the subscriber's distance from the central office.

The cable network shares bandwidth among the hundreds of users in a neighborhood that share a loop. If a few subscribers are constantly using their connection to its full capacity, the connection becomes congested for everyone. Broadband cable advertisements therefore must use the "up to" language when describing network speeds. A user may experience "up to" 6 Mbps if very few of the neighbors are using it. However, when the neighbors come home from work and many users are on the Internet, they are lucky to see speeds of 1 to 2 Mbps. As more neighbors use the Internet more frequently, using increasingly bandwidth-intensive applications, everyone will suffer from slower speeds.

To manage its scarce bandwidth, Comcast enforces non-transparent transfer limits for Internet subscribers. This means subscribers cannot use "too much" bandwidth. Comcast refuses to publish the limit, but it is thought to vary between 100 and 200 GB per month depending on the loop. As few users even approach this number currently, the practice is not well known among the general populace.



This cable loop shares bandwidth among all the houses (v-z). The signal travels along the lines in an oversubscribed circular path: 1-2-3 (servicing 350-700 houses typically). The loop has 40 Mbps available, and each subscriber has "up to" 6 or 8 Mbps. After returning to the node (B), the signal travels back along fiber to the routers at the centralized hub (A), which connects to the Internet.



Each of the houses (v-z) has a dedicated connection to the central office (B). Oversubscribed fiber cables connect B to the regional switching center (A), which connects to the Internet. Their fastest speeds are limited by the distance from B to the home and by any bottlenecks on 4 and 5.

However, as subscribers begin downloading high-definition movies (via Xbox LIVE or Netflix in the future), they will easily approach the cap. A single HD movie may be between 5 and 10 GB, depending on compression and quality. Subscribers downloading two movies a week may start seeing letters from their cable company, depending on how bandwidth-intensive their everyday usage is.

Every year subscribers download more data and the trend is likely to continue into the foreseeable future. DSL and cable networks cannot handle the surge of traffic because they are built for a different era and do not have enough surplus capacity.

Cable companies have long promised faster cable speeds as they roll out a new standard (DOCSIS 3.0). They claim it will offer speeds up to 160 Mbps as needed. Comcast plans to use DOCSIS 3.0 to offer faster speeds in some 20 percent of its footprint by the end of 2008. But DOCSIS 3.0 cannot keep up with the rise of Internet traffic. The cable networks were built to solve a different problem (distributing video) and have limits. With massive investments to reduce the number of subscribers per loop, cable companies could increase bandwidth, but few appear likely to make that commitment. Incumbent cable providers should not be blamed for maximizing returns to their existing investments any more than communities should be blamed for seeking networks that meet their needs.

As private providers will undoubtedly deploy first to competitive markets, investing in a publicly owned fiber system may put a community at the head of the list in its region. Ironically, fiber systems may help cable companies by reducing the number of subscribers on the loop, thereby reducing competition for the shared bandwidth and improving the speeds of those still on the cable network.

ANOTHER FLAW: ASYMMETRY

Slow speeds are not the only fatal flaw in cable and DSL systems; these networks

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are usually configured to maximize the downstream connection while skimping on the upstream. These asymmetrical connections mean subscribers can receive information faster than they can send it. The entire model is premised on the outdated idea that users need to request and consume information rather than create and distribute it.

Asymmetrical connections pose a problem because the Internet has moved beyond text and images. If parents on a cable or DSL connection attempt to participate in a simple video chat with their daughter on a fast network at college, they may be able to see and hear her clearly while she receives garbled and choppy video. The parents' connection is fast enough to receive video but not fast enough to send it over the network.

Businesses are also disadvantaged by slow upload speeds. Whether employees need access to the Internet to answer questions or to share large files with clients, they depend upon fast, reliable and affordable connections. When typical cable and DSL connections are insufficient, they have to turn to more expensive connections. Too many businesses have to make a difficult tradeoff between employee productivity and telecommunications expenditures. This is not a tradeoff shared by competitors in the more connected US cities or in many other developed countries.

T1 lines are a common form of commercial connection, offering 1.5 Mbps. Though the cost of T1 lines is decreasing, businesses must bundle more of them together to satisfy increasing bandwidth needs. The rise of telecommuting means that speeds to the home also need to be fast and symmetrical in order to fully support modern business needs. As network access becomes more important, companies increasingly favor locations that offer fast, affordable connectivity everywhere.

PEER-TO-PEER CHALLENGES NETWORK ASSUMPTIONS

When the Internet started becoming popular among non-computer geeks, it was based on a server-client model. Most of the Internet traffic consisted of consumers visiting Web sites. Distributing content, especially audio and video, was expensive. Though more people could produce and distribute content, the high prices prevented most from participating.

Peer-to-peer technology stepped into this void. Users could connect directly to each other rather than routing traffic through a central server. File-trading programs like Napster and Kazaa first gained popularity by allowing users to share music; later they gained notoriety for easily allowing copyright infringement.

Though some have used these technologies for illegal purposes (copyright violations), they are also used commonly for legal activities. Skype uses peer-to-peer connections to make phone calls. Viacom is starting to use Joost, a peer-to-peer product, to distribute some of its content. Video game company Blizzard distributes patches with BitTorrent.

NET NEUTRALITY

Technically, a neutral network treats all packets equally. However, because information networks are oversubscribed, treating all packets equally may not be the optimal solution. Some applications (games, video and voice among them) require packets to arrive in a specified order within a certain time limit. Other applications, such as e-mail and file downloads, are less time-critical. For optimal results, networks must be able to discriminate between the two types of needs.

Ideally, any prioritization would be based upon application need. However, some network owners want to prioritize their own traffic to disadvantage competitors. An incumbent offering broadband may degrade Vonage or Skype connections in order to sell its own voice services. This is the problem most network neutrality advocates are attempting to solve. The problem is not theoretical. Late in 2007, Comcast was caught forging reset packets, effectively disrupting and slowing some file-sharing applications over its network. In 2005, the FCC fined a North Carolina telco for blocking competitive VoIP on its network.

Former AT&T CEO Edward Whitacre famously suggested that his company wanted to start charging companies for access to their users. Under this scenario, Google, Yahoo, Vonage, and other application providers would have to pay twice – once to put their content online and again to let AT&T's users access it. It is hard to imagine a better way of slowing innovation or undermining the democratic nature of the Internet by advantaging those who can afford to pay for access to more users.

Though some in Congress are crafting legislation to mandate neutral networks, the technology is rapidly evolving and many fear that any legislation will be overreaching or difficult to enforce.

Under current regulations, it is not clear that a municipality could prevent a private network owner from blocking competing services. Network owners are afforded significant latitude in running and managing the network. This is one reason the Institute for Local Self-Reliance favors publicly owned networks, over which multiple service providers compete.

BitTorrent may be the most promising peer-to-peer technology. A user downloads multiple chunks of a file from many users simultaneously while also uploading previously received chunks to other users. This distributes the load, saving content producers significant costs. As HD cameras and studio recording equipment become available at affordable prices to everyone, BitTorrent could remove the last barrier – distribution.

Unfortunately, the impact of peer-to-peer technologies was not included in oversubscription models. These technologies redistribute the load, but the first-mile of DSL and cable is ill-equipped to deal with the increased demand. Without faster networks, distributing media cannot continue democratizing.

FIBER CAN HANDLE THE LOAD

Some cities have built their own citywide fiber networks to ensure that their residents and businesses would not be stuck on slow, asymmetrical networks. In Utah, a publicly owned fiber network built by UTOPIA has introduced competition to several cities, including the city of Murray and its 45,000 residents.

Due in large part to price cutting by incumbents, UTOPIA has attracted fewer residential customers than expected. But there is another benefit. In September 2007, Kyle Waters testified before Utah's Government Competition and Privatization Subcommittee on behalf of his company, Venture Data, which subscribes to the UTOPIA network in Murray. He noted that both people and businesses are moving into UTOPIA's footprint for its faster speeds at lower prices.

Venture Data uses two service providers – one for a 30 Mbps Internet connection at $109/month and another for its voice services. Without UTOPIA, it would be paying considerably more for a slower connection.

The price advantages are so great that Venture Data, when considering a new location, realized it could not leave the UTOPIA boundaries. Elsewhere in UTOPIA, an accounting firm switched from leasing a T1 line at 1.5 Mbps for $650/month to using a 30 Mbps connection from a UTOPIA service provider for $150/month.

Businesses across the country are paying attention to these fiber networks. When Nucomm International needed to locate a new call center – one that would add 1,000 jobs with benefits to the local economy – it chose Lafayette, Louisiana, because the city is building a massive fiber network to connect everyone.

Fiber optic cables are called the gold standard – the best long-term investment for wired networks. The immense capacity of fiber (which is limited almost entirely by the budget for electronics), coupled with a modern network designed for future needs, make these networks far superior to DSL and cable.

As with any wired network, the installation costs are high. Fiber cabling is frequently installed underground in public rights-of-way, but some cities have hung the cables from existing utility poles. Either way, the installation takes significant time, labor and capital. However, once the fiber is there, it lasts many decades.

Much of the cost of installing fiber comes from having to bury it. Forward-looking communities have been installing ductwork and conduit (tubing through which fiber will eventually pass) wherever they are working underground. When streets or sidewalks are torn up, the costs of installing conduit are minimal. Fiber can later be pulled or blown through the conduit when it is needed. Similarly, many developers install conduit and fiber into new housing developments because it can be done at practically no cost when roads and sidewalks are not yet even built.

The costs of a fiber network vary greatly from community to community, depending on the size of the community, population density, the fiber optic technology employed, whether the lines are installed aerially on poles or buried,

E-RATE AND I-NETS

Municipal governments also require fast connections to govern effectively. Many cities currently lease connections to meet their bandwidth needs. Each community has a different arrangement. Some cities have negotiated discounted network connectivity as part of their cable franchise agreements. At first, these Institutional Networks (or I-Nets) tend to meet municipal needs. However, the franchisee rarely has incentive to maintain and upgrade the network as frequently as the municipality would prefer.

I-Nets have been a nice perk of franchise agreements but are increasingly a relic of the past as states adopt new statewide cable franchising laws. These laws allow video providers to deal with the state as a whole, rather than community by community, when offering video services. Such deals rarely include any I-Net provisions. However, the I-Net legacy lives on. Many communities remain dependent on their I-Net even when it contains little excess capacity, leaving them unable to take advantage of high-bandwidth applications such as remote training or videoconferencing.

In 1997, the FCC established the E-Rate program by setting aside a maximum of $2.25 billion each year from the Universal Service Fund to subsidize school and library Internet connections. Discounts range from 20 to 90 percent. Over the past 10 years the program has distributed $19 billion to service providers.

Though E-Rate has clearly succeeded in increasing school and library connectivity, it has not solved the problem of connecting the schools. If the program ended tomorrow, thousands of schools and libraries would be unable to afford their connectivity. E-Rate should be structured to incentivize self-sufficiency so that communities could invest in a long-term solution to connectivity, rather than relying upon a federal fund year after year.

and so forth. Generally, however, there are three major costs associated with building such a network.

1. Electronics: Municipal fiber networks are often built with a centralized hub to house sophisticated electronics. Larger networks will also require aggregation points in the field with expensive electronics.

2. Fiber passing through the neighborhoods: The fiber cables must run from the central office to every neighborhood and business district. This frequently runs between $500 and $1500 per passed premises.

3. First-mile connection and electronics: Each house or building must be connected to the fiber passing by, and perhaps internally networked to take advantage of the bandwidth. This cost covers both the electronics and the actual fiber drop from the premises to the network. Costs here can range from $500 to $1000 per household. These costs are incurred when customers are connected.

Reedsburg, a community of 9,000 residents near Madison, Wisconsin, built a network for $13.5 million. The central office cost $2.5 million. Monticello, Minnesota, will soon start building a network for its 10,000 residents at an expected cost of between $20 and $25 million. Lafayette, Louisiana, has already broken ground on a $110 million network for its 110,000 people. Though fiber networks are considerably less expensive to maintain than cable networks, the network owner must budget for some operational and maintenance cost.

These costs vary based on the network, but each year will likely hover around 3 to 5 percent of the initial capital cost. Municipal deployments frequently use 20-year financing to pay off the network. Fiber is commonly expected to last at least 20 to 30 years but may last considerably longer. If new fiber is needed, pulling it through existing conduit is easy and well below the cost of the original install. Network electronics should be budgeted for replacement every three to seven years depending on the device. The electronics can last longer but changes in technology and increased efficiencies generally encourage replacement in that time frame. The cost of the electronics (and the amount of electricity required) is constantly dropping due to technological innovations.

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CHALLENGES FOR MUNICIPAL OWNERSHIP

Though many municipalities have had financial success with carefully planned broadband investments, cities should not rush into this arena with a get-rich-quick mentality. Broadband systems are large investments with finicky technologies that require specialized expertise to run efficiently. Once the system is correctly configured, it requires an advertising/promotional strategy and technical support, requirements that may be outside the city's existing expertise. Cities frequently deal with this by recruiting experienced people, contracting parts of the job out, or turning to consultants.

Many cities with municipal utilities have enjoyed success when they expanded into telecom because they already have billing and customer support experience. Perhaps more importantly, the utility already has the trust and confidence of the community.

Though existing broadband providers have few competitors, they fight for each subscriber. Incumbent providers have launched many lawsuits against publicly owned projects while winning few judgments. Incumbents know lawsuits are a can't-lose prospect because the litigation costs, combined with months of lost revenue while the project must await a decision, greatly disrupt municipal business plans.

Additionally, new providers planning to offer video services are rarely prepared for the difficulties of negotiating contracts with the content providers. For example, ESPN's owners demand that any system carrying ESPN must also carry ESPN2 and a number of other channels. The owners of another popular must-carry channel may specify that two of its channels must be within two clicks of ESPN. Inevitably, putting a channel lineup together takes longer and costs more than expected. Open access systems can relieve the network owner of some of these hassles because the providers must work out the arrangements.

Communities considering a broadband network can be overwhelmed by the technical details. Because muni fiber networks are young but rapidly expanding, new firms and consultants are entering the arena, eager to "help."

Before trusting an engineering firm, vendor or consultant, be sure to talk to those who have built municipal networks before. A publicly owned municipal fiber network is not just like any other network. Network architecture is important and quite expensive to change after it is constructed – especially if a poor design results in revenues below forecasts. As each community is unique,

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COMMUNITY BENEFITS

Publicly owned networks offer more to a community than just affordable triple play offerings. Though new statewide cable franchising laws have preempted local authority and lessened funding for public, government and educational television, municipal fiber networks now offer new opportunities.

Rather than forcing community television into a few channels, these networks can create as many channels as needed. All government meetings can be recorded and archived for video on demand over the Internet or on the television. High school sports, plays and concerts are no different.

Local businesses may want to wrap advertisements around local content to cover the cost of capturing the video, though many parents would undoubtedly volunteer the needed time.

As applications and technology change, the community can decide when it needs upgrades for faster speeds, rather than hoping its needs coincide with incumbent provider shareholder interests. The technology has moved so quickly that few are prepared for a world of nearly unlimited bandwidth. The future is just beginning.

beware cookie-cutter solutions; consider hiring a network architect to maximize network value.

Make no mistake: Building a municipal broadband system is a difficult task, but cities wishing to remain competitive regionally, and certainly globally, have few alternatives.

Public ownership can take many forms, from a utility model to a city department to a cooperative. Each is linked by the common theme of local determination.

Too many cities are currently reliant on private providers for essential infrastructure – a point brought home to Michigan when Comcast chose to stop supplying some police and fire stations with free broadband and television services.

Comcast has also been in the news for disrupting network traffic for certain applications, though other cable companies also engage in the practice. While Comcast has refused to admit exactly what it is doing, investigators have determined that it actively disrupts some file-sharing applications, regardless of what content is being shared. The business application Lotus Notes was caught in the crossfire, leaving telecommuters unable to work effectively. Early this year, the F.C.C. announced that it would investigate the situation.

Cable providers, operating their shared-bandwidth network, are fearful that some users will use too much bandwidth and cripple access for other subscribers. This is a clear admission that existing cable networks are barely sufficient for today's needs, to say nothing of tomorrow's. In response to these fears, they may change the way the network operates without notifying anyone. Those who were dependent on Lotus Notes for their business received no explanation for the disruptions to their application.

Joseph Franell, Director of Information Technology for the city of Ashland, Oregon, explains why the cable companies do not respond to bottleneck fears with network upgrades: "Where there is a high rate of return on investment with old technology without any threat of competition, monopolistic incumbents have little reason to improve their networks and/or product offerings."

Private network owners simply have different motivations than do public network owners. Private companies are legally required to maximize profit for their shareholders. Public entities have a different mission; they are focused on maximizing social and economic benefit to the community. This distinction seems to have been lost in much of the discussion around municipal broadband systems.

Companies like Comcast and AT&T must look out for their bottom line, not the communities in which they operate. Communities should not shun such companies, but neither should communities rely upon them for critical infrastructure. Groups like the Heartland Institute and Pacific Research Institute frequently attack publicly owned systems as a waste of taxpayer money. "WiFi Waste: The Disaster of Municipal Communications Networks," a report from the Pacific Research Institute, uses figures out of context to suggest that all the publicly owned systems surveyed were failures. When one actually examines the context, labeling these systems as failures is absurd.

Before actually examining numbers and context, remember that large networks require massive upfront capital investments. In the early years, all network owners lose money until they have enough subscribers to pay for operations and debt servicing – this usually takes several years. Therefore, any examination of municipal networks in the early years will show losses on the income statement. Some systems reach a positive cash flow faster than others. Both Burlington, Vermont, and Reedsburg, Wisconsin, required four years to achieve a positive cash flow.

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The question should not be whether to invest in fiber or wireless any more than one would ask whether shoes are "better" than hats. Ultimately, they solve different problems and neither one offers a one size fits all solution.

Cedar Falls, Iowa, built a municipal broadband cable system in 1997 and had a positive cash flow three years later. It has been building a cash reserve to pay off its debt ahead of schedule and finance its conversion to a fiber network.

Other systems have gone longer without being able to fund all operations and debt payments with subscriber revenue. Though groups ideologically opposed to public ownership are quick to pronounce them failures, the truth is that any business model expecting to break even from these investments in the first few years is bound to fail. It takes years to build the system and sign on customers. In many communities, the network adds subscribers as fast as possible with a take rate limited only by how fast they can physically connect eager subscribers.

In other cases, some networks have had lower take rates than forecast because incumbents lowered prices and locked in customers with long-term contracts. Though these systems may take longer to pay off their debt, all subscribers in the community benefit by paying significantly less for services. This money stays in the community and inevitably outweighs the costs from extending debt payments or tapping tax dollars.

Whether it is the funding they receive from incumbent providers, a rigidly libertarian philosophy or simply an intoxication with the private sector, groups like the Pacific Research Institute are quick to forget the many ways private businesses benefit from government's role in providing essential infrastructure. UPS, FedEx, and DHL can all compete with equal access to government-run roads. General Motors cannot buy the roads and prevent Nissan or Ford vehicles from using them.

The municipal decision may be between private and public ownership, but it actually pits incumbent providers against the thousands of businesses, residents, and public entities that all depend on competitive, affordable connections. This decision should be made based on what is best for the community.

Cities can start by building a publicly owned network to meet their own needs. Connecting government buildings with a city-owned network will immediately cut telecom expenditures by allowing the city to aggregate its needs into one contract for the network. When Burlington consolidated just its voice services (1,000 phone lines), it realized a savings of more than 35 percent. Phased business plans offer flexibility and offer a reasonable learning curve for the network owner.

When planning a publicly owned system, cities must be aware of a practice called "conditioning." Historically, fiber provided by cable companies for an I-Net came with certain provisos. The city could use it for official functions but was not allowed to share it with commercial traffic. Similarly, conduit is sometimes offered to public entities on the condition that the fiber running through it is only used for official city needs.

Though this seems a grand deal, if the city later decides to build a citywide network to share fast, affordable connections with citizens and businesses, it must find new fiber or conduit because it cannot use those conditioned assets. Plan ahead and negotiate for unconditioned infrastructure wherever possible. Communities have a variety of options for funding broadband networks. Some cities have turned to existing municipal utilities to expand operations or offer loans. Other cities have used their bonding authority – both general obligation and revenue bonds have been used to secure funding.

Burlington financed its network using a tax-exempt municipal capital lease from private investors. Though cities frequent use this mechanism to finance a variety of purchases from computers to fire engines, few have considered it for a citywide network. Yet many investors prefer this method because it requires a solid business plan, something every community should develop regardless of the source of funds. **BBP**

About the Author

Christopher Mitchell directs the Telecommunications as Commons Initiative at the Institute for Local Self-Reliance, a nonprofit research and educational organization that provides technical assistance and information to city and state governments, citizen organizations and industry. Since 1974, ILSR has researched the technical feasibility and commercial viability of environmentally sound state-of-the-art technologies with a view to strengthening local economies. He can be reached at christopher@ilsr.org. or at 612-379-3815. For more information, visit www.newrules.org.

His ILSR colleagues, especially David Morris, helped with this report. Eric Lampland and Bill Hagestad offered their expertise and review.

If parents on a cable or DSL connection attempt to participate in a simple video chat with their daughter on a fast network at college, they may be able to see and hear her clearly while she receives garbled and choppy video. The parents' connection is fast enough to receive video but not fast enough to send it over the network.