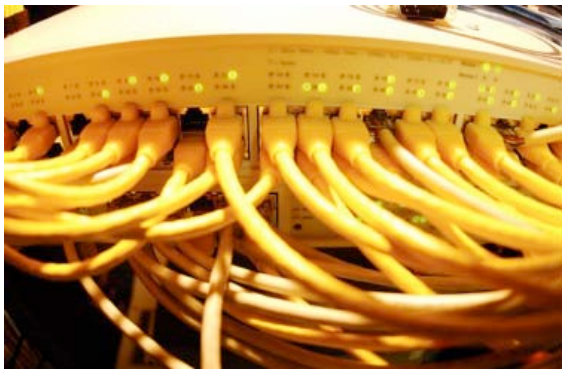
Broadband Strategies for the LDDs

Broadband Primer



Prepared for
The Local Development Districts of Pennsylvania

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The Impact of Broadband

We Have Been Here Before

Daniel Boorstin, the historian, notes in his book *The Discoverers* that the first technology-based public utility development began in the fourteenth century. Boorstin includes an excerpt from a citizen petition for the revolutionary new technology:

"*[we]....sorely feel the need for this.....[If we had this] more merchants would come to the fairs, the citizens would be very consoled, cheerful and happy, and would live a more orderly life, and the town would gain in decoration*."

One can imagine the town fathers discussing the investment:

"Our citizens don't have the necessary training to use it."

"We don't have people in the community who know how to maintain it–we'll have to bring in high-priced help from the big cities."

"It's not the town's responsibility to do this–let's leave it to the local merchants."

The controversial technology was the town clock. Things have not changed very much in the past 600 years. Local leaders are still trying to figure out how to add new citizen-requested services without unduly burdening the community. Publicly supported access to the correct time had begun to be important to support economic development. As merchants and business people began traveling more between communities, knowing what time it was (for a meeting) became important so that time was not wasted waiting for your appointment.

The first clocks just sounded the hour with bells because citizens were illiterate and could not read a clock face. Eventually, people learned how to read, and citizens demanded "clock upgrades" to incorporate the now standard clock face along with the traditional tolling bells.

For much of the twentieth century, communities and regions have been investing in infrastructure on behalf of the common good. Water, sewer, and road systems are all expensive, high cost projects that communities support.

Communities built paved roads as cars become more common in the early part of the century. Paved roads are built and managed on behalf of all users, public and private. However, communities do not try to control the commerce and business operations that use the roads. Once a business has paid the proper vehicle licensing fees and taxes, that business can use a truck to carry any kind of business product over that community-owned road.

The roads of the twenty-first century will be built of glass fiber. Just as good access to a modern highway system became a mainstay requirement of twentieth century economic development initiatives, twenty-first century economic development requires fiber highways in the community.

Characteristics of the Media-Rich Community of the Future

We are slowly making the first steps toward media-rich communities. In these communities, residents will have, literally, a world of information at their fingertips. Residents of media–rich communities will be able to access virtually any movie ever made with a few mouse clicks. They will be able to choose from a rich variety of music, search

the Web, and access massive archives of multimedia video and audio programming. The characteristics of media-rich communities of the future includes:

- Abundant, inexpensive bandwidth locally
- Massive connection to the rest of the world
- Community information utility vested in the community
- A knowledgeable and engaged citizenry
- Rich local content from a multitude of sources
- A wide variety of information devices, including video monitors, distributed audio systems, converged media centers (computers), PDAs, wireless handheld phones, and tablet computing devices.

These media–rich communities will be attractive to an emerging new group of businesspeople and entrepreneurs that typically are well-educated, own their own businesses, and are making choices about where they lived based on family needs and interests, rather than business interests. This new breed of entrepreneurs place a high value on the kinds of amenities that contribute to a good quality of life–traditional neighborhoods, ecologically rich greenspaces, walkable destinations for personal and business needs, good schools, and a sense of place.

These businesspeople and their families make relocation decisions based on quality of life only where there is abundant and affordable broadband, because broadband is the enabler of these new Knowledge Economy businesses. Many of these microenterprises are located in homes, and so neighborhoods are now business districts. Broadband is reshaping our communities in positive ways–less commuting, less need for high capacity transportation systems, more focus on community and civic life, and more emphasis on personal relationships.

These new communities will have neighborhoods, a downtown, beautiful public spaces, walking and biking trails, and a focus on those amenities and infrastructure improvements that create a real sense of community. And underneath the streets and walkways, a mesh of glass fiber will weave a web of information, data, entertainment, music, and news that brings people together.

Why invest in broadband?

There are several reasons why communities should begin to make investments in telecommunications:

- Create a competitive marketplace.
- Attract private investment that will offer necessary telecom services to residents and businesses.
- Reduce data and telecom costs for all in the community.
- Business and government save tax dollars by pooling demand and then spending less on telecom services.
- Reduce overbuilding and redundant facilities (We don't have 2 and 3 roads to each home).
- Conserve scarce resources (roads, easements, and rights of way).
- Create local markets for new services (creating jobs and increasing tax revenue).

A "connected" community has several characteristics.

- High bandwidth services into and throughout the community, for all businesses, organizations, and residents. The target bandwidth to the premises should be a minimum of 100 megabits/second.

- Affordable access community wide wherever it is needed. Fast access does not always mean affordable access. The two must both be available.

- An integrated fiber and wireless system. Fiber is required to meet near future needs to deliver high quality business and residential video-based services. Most people will have a portable wireless that they expect to work wherever they are in the community.

- A community–managed telecommunications infrastructure that creates a level playing field for local and regional access and service providers. This Open Service Provider Network (OSPN) infrastructure would include fiber, wireless towers, community telecommunications duct systems, collocation facilities, and very high bandwidth local peering points (MSAPs, or Multimedia Service Access Points).

Broadband and related technologies like wireless PDAs and relatively inexpensive computers provide a unique set of opportunities. What other single community investment can do these things?

- Improve delivery of health care services
- Improve and extend learning opportunities
- Improve delivery of government services
- Increase participation on the life of the community
- Create new work and job opportunities
- Improve the quality of life
- Help youth acquire Knowledge Economy job skills
- Save tax dollars
- Help make the community more prosperous

Broadband and Economic Development

Jobs Creation

Chad Moutray, who is Chief Economist, Office of Advocacy of the U.S. Small Business Administration, has data that shows that small business creates between two-thirds to three-quarters of the net new jobs in the U.S. economy. Small business employs half the workers in the country. Even more startling, 99.7 percent of the businesses in the United States are small businesses. If your only economic development strategy is to compete with every other community in the country for the three-tenths of one percent of the "big company" jobs out there, you are headed down the wrong path. What are you doing in your community to support the growth of existing small businesses in your community, and what are you doing to create new, local entrepreneurs?

The U.S. Department of Labor measures job growth monthly, using the data from two Census Bureau studies that the are conducted monthly. The Establishment Survey polls businesses and asks for the number of workers on that firm's payroll. The Household Survey asks a very different question; for the Household Survey, the Census Bureau visits homes and asks how many people are employed in that household, which

- The Establishment Survey says 718,000 lost jobs since 1991
- The Household Survey says 2.1 million jobs have been added
- The Establishment Survey measures only payroll jobs
- The Household Survey includes self-employed and LLCs
- Household survey says in 1991 self-employed jobs were 5.4% of growth

In the Wall Street Journal (page A18, 10/9/06), the paper reported on a U.S. Dept. of Labor revision to 2005-2006 job estimates. The Labor Department found that 810,000 "extra" jobs had been created from March, 2005 to March, 2006; this represents more jobs than all the workers currently employed in the state of New Hampshire. The growth has all been in the Household Survey, and the Wall Street Journal remarked that "...the Establishment Survey....is undercounting job creation from small businesses and entrepreneurs."

These "found" jobs highlights that the nature of many businesses is changing--small businesses and entrepreneurs are outsourcing more and more work--often to other consultants and self-employed business people. Charleston, South Carolina's very successful Digital Corridor program is worth careful study. Ernest Andrade, the manager of the program, understands that economic development today is about making and nurturing relationships, not water and sewer. Here is a short excerpt from Andrade's article that summarizes where economic development should be focused today:

"*Three key pieces of statistical data reinforce an argument that communities should spend more of their economic development resources on business formation. First, approximately 80% of all job creation occurs from within the community; second, a majority of the businesses being formed today have five or fewer employees; and third, there is an inverse relationship between high wage, knowledge-based companies and their physical space requirements*."

It is the last item that is particularly worthy of careful analysis: high wage knowledge companies don't need a lot of real estate. They don't need vast tracts of empty land. They often don't even want to be in business parks. They often want to be in rehabbed downtown lofts, close to other small businesses, and close to good restaurants, where the deals are so often made. They want to be close to good coffee shops so they can meet casually with co-workers and clients. They want to be near vibrant and active downtown areas. Charleston is a shining example of what is possi-

ble in community revitalization, and if you have never visited the city, it would be worth it to pack up all your economic developers and spend a couple of days there.

There is one more overlooked phenomenon that is changing the face of economic development in communities, and that is the increasing number of people working out of the home. These are not people selling kitchen utensils or addressing envelopes. Instead, there are two trends in work at home: the first is business professionals and entrepreneurs working from the home. These are people who typically earn six figure incomes and collectively, can contribute millions to a community's business bottom line. The two key decision points for these people, when making a relocation decision, is quality of life and the availability of affordable broadband in a community's neighborhoods. The second group is wage and salary employees working from home but who are employed by a company in another location. The best example of this is Jet Blue reservation agents, who all work from home. The low cost airline has no reservation or call center, and never has. From the first day the company started business, they have employed home-based workers. Any one who wants to work for Jet Blue has to have a computer and a broadband connection. The broadband connection is used not only to provide access to the reservation system, but also each worker has a VoIP (Voice over IP) phone; when someone calls to make a reservation, the Jet Blue telephone system automatically forwards the call to the next available agent. The VoIP system allows workers anywhere in the country to appear to customers to be working from a single location.

What does this mean?

Neighborhoods are business districts, and need the same kind of broadband connectivity and choice that is available in traditional business parks and commercial areas.

What Has Changed?

The Manufacturing Economy had a long run, starting in the mid-1700s and finally ran out in the late Twentieth Century, as the IT sector of the economy overtook the manufacturing sector in size. We are now in the Knowledge Economy, and new Internet-based digital information networks no longer require that we continue to use information network models based on the older, analog telephone and cable TV networks.

	Manufacturing Economy		Knowledge Economy
	Telephone	Cable TV	Varied
Infrastructure	Monopoly control of twisted pair cable to the home or business	Monopoly control of the coaxial copper cable to the home	Multiple delivery systems: copper, fiber cable, wireless, and satellite. No inherent monopoly control.
Access	Monopoly control of the connection to the Telephone Network (PSTN)	Monopoly control of the connection to the cable head end	Open access network provides multiple vendors for an IP address and bandwidth.
Services	Monopoly control of dial tone – the ability to make a telephone call	Monopoly control of the TV signal–ability to watch a TV channel	Choice of service vendors for VoIP, video, audio, Web site hosting, etc.

In the Manufacturing Economy, our telecommunications systems were, by necessity, vertically integrated. The infrastructure (how the service was delivered to the residence or business) was tightly coupled to access (the source of the content or service--a telephone switch or cable TV head end). The service (the ability to make a phone call or to watch a channel of television) was tied to the infrastructure and access.

In the Knowledge Economy, the Internet has made this vertical integration irrelevant and unnecessary. We can get infrastructure from one entity (like a community broadband system), purchase access to the Internet from a completely different and separate company, and get the service (like dial tone or television) from yet another company. This separation of infrastructure and access from services allows greater efficiency in operations, lower costs of service, and enables competition among service providers. Lower cost of delivery and competition combine to lower prices. In community systems designed to support multiple service providers in each category of service, businesses, residents, and local government are typically seeing reductions of 15% or more in telecommunications expenditures.

The Pie Gets Bigger

A oft-repeated myth is that government involvement in telecommunications automatically diminishes the opportunities of private sector companies. Designed properly, community investments in telecommunications infrastructure can actually increase private sector business opportunities, which can lead to new local jobs and new local and regional business ventures. The critical issue for communities is to select the correct business model for operations. Unfortunately, some of the early community telecommunications ventures selected business models that do compete with the private sector. Today, with new systems and vendors in the marketplace designed specifically for community broadband, governments have a wonderful opportunity to create new business and market opportunities for private sector companies. One Cleveland, a community fiber initiative in Ohio, enabled the local cable company to increase its commercial business 60% in a single year.

What is Broadband?

The Definition of "Real" Broadband

Broadband may be one of the most misunderstood concepts in the United States today. Broadband is not so much a technology but rather is a revitalizing tool that gives towns, rural communities and underserved urban neighborhoods a chance to create opportunities.

Although the FCC continues to define broadband as access speeds of 200 kilobits or more on both directions, this bar is set too low for future growth and economic development. South Korea's target bandwidth to the home is 155 megabits, or 775 times faster. Hong Kong recently announced plans to provide Gigabit Ethernet (GigE) fiber service to more than a million homes.

Many other countries are also developing high capacity fiber and/or wireless broadband transport systems. The target is a ***minimum*** capacity to deliver a sustained throughput to a single home or business of 100 megabits/second, and there should be no upper limit on bandwidth at all. The reason all that capacity is needed to support entertainment and business needs. Among the uses for that bandwidth will be:

- Three channels of High Definition TV (15-20 megabits/second per channel)
- Voice and video phone service
- Radio programs, music, and movies
- Online interactive gaming, chat, small group collaboration, and Web surfing
- Business information -- business servers, video streaming, videoconferencing, work at home connections to corporate offices
- Personal and civic information -- local government meetings, community activities, family pictures and videos, personal videoconferencing

Note that the capacity has to be symmetric. That is, the upstream data capacity should be equal to the downstream data capacity. This is essential, because we all should have the ability to produce and deliver our own data streams of text, pictures, sound, and video. Some companies are fond of the idea that we should be regarded as passive consumers of information with little or no need to push data upstream from our homes and businesses. However, our digital road systems should not be designed to limit our opportunities but rather to enhance our ability to create, sell, or share our own information--the ultimate effect is to limit economic development in a community.

As one example of an emerging application that is likely to become commonplace, Accenture is busy designing a new home to home video system that allows family members in different locations to enjoy meals together. The three essential ingredients are High Definition cameras, HD flat panel monitors, and a high performance broadband connection between the two locations. A single channel of high quality HD video requires 18 to 20 megabits per second each way, for a total of about 40 megabits per second.

This kind of system is well beyond the capacity of DSL and cable modem systems, can't run at all on WiFi, and would overwhelm the Passive Optical Networks (PONs) being rolled out by the phone companies. This system also requires symmetric bandwidth; both users need to be able to push a 20 megabit video signal up their broadband pipe

to the home on the other end. This is another inherent weakness of PON systems; they are intentionally designed to prohibit this kind of upstream data use.

Once in production, these systems are expected to sell for $500 to $1000, and have great promise in telehealth for the elderly. Regular contact with distant family members and with health care professionals promises to delay moving some older people into assisted living facilities or nursing homes for months or years, making the systems a real bargain--the typical monthly cost for assisted living or a nursing home is upwards of $3000 per month.

Is your community attracting retired people because of the good quality of life? These folks are prime candidates for this kind of system in a few years, and high capacity, affordable broadband is needed. High performance broadband is going to change our lives in many small and large ways, and communities need to invest in the right kinds of open service provider networks to ensure that their citizens and businesses have the right kind of broadband.

Economic development bonus: There will be lots of business opportunities for local entrepreneurs to install and maintain these new kinds of systems--if the community has the right infrastructure in place to support them.

Future-Proofing Our Communities

The chart below shows the average transmission times required for different kinds of data when traversing some of the common broadband systems available today. The problem with relying on DSL and cable modem systems to "solve" a community's broadband needs is evident when looking at the time required to send just a portion of a High Definition movie: it takes almost ten hours to transmit 30 minutes of video, or almost two full days to send an entire two hour movie. It is only when the broadband network gets up to the Fast Ethernet and Gigabit Ethernet speeds that the network is able to transmit video at acceptable speeds. The problem will become more acute as HD videoconferencing systems become more widely used. Businesses large and small will use HD videoconferencing as routinely as they use the telephone today, and these systems, like HP's Halo Studio, are already in use. Future-proofing the communities means selecting systems that will still be useful 30 or 40 years, which is the conservative lifespan of fiber.

Content	Size of File	Dial up 28 kilobits	DSL/cable modem/WiFi 1 megabit avg.	T1 1.5 megabits	T3/DS3 45 megabits	Fast Ethernet 100 megabits	Gigabit Ethernet 1 gigabit
Text (one email)	2 K	.7 s	.019 s	.013 s	.00044 s	.0002 s	.00002 s
640x480 picture	92 K	32.9 s	0.9 s	.61 s	.02 s	.0092 s	.00092 s
30 minutes of video (1/4 screen, 320x240)	67 meg	6h 39m	10m 51s	7m 27s	4.9 s	6.6 s	.67 s
30 minutes of video (full screen, 640x480)	269 meg	26h 41m	44m	29m 53s	59.8 s	26.9 s	2.69 s
30 minutes of video (compressed HD format 1920x1080)	3.63 gig	360h 7m	9h 51m	6h 43m	13m 26s	6m 6 s	36.6 s

Broadband as Essential Infrastructure

A Brief History of Infrastructure

Perhaps one of the most interesting ways to understand the current debate about the best way to migrate to a public/private enterprise model for telecommunications is to read *Empires of Light* (Jill Jonnes). Jonnes' book covers the early development of community electric systems, and the fights between Edison and Tesla about the best way to design such systems. The development of this community infrastructure has it all--intrigue, mystery, monstrous egos, untested technologies, unethical behavior, unscrupulous business practices, and huge fortunes at stake. You might think this book is about the last ten years of the telecom and Internet revolution. Instead, it chronicles the race to make electricity a commodity available to every home, and the furious war between Edison and the Tesla/Westinghouse partnership.

Edison wanted to use the safer but problematic DC electric power, while Tesla and Westinghouse were pushing the easier to deploy AC power. Who was right? Ironically, if Edison had won, we would not be having massive black-outs today, and the electrical industry probably would not be the regulated mess it is (but there would have been many other problems. This book is worth reading to provide perspective on the current machinations and upheaval in the telecom industry. There we have the copper-based companies (cable modems/DSL) fighting the community-managed fiber projects. The book clearly demonstrates that the notion of communities taking on new infrastructure services is not a new concept, and that it is possible to migrate from an all private model to a public/private model.

American Infrastructure Development over the Past 200 Years		
Infrastructure Type	**Financing Approach**	**Issues**
Canals	Public/Private	Financing and right of way required government assistance.
Railroads	Public/Private	Financing and right of way required government assistance from the very first railroad developments in the 1700s.
Roads	Public	Entirely private at first. Toll roads were private ventures in the 1700s and 1800s, and only after the development of the automobile did communities start to own and maintain roads, because of economic development issues.
Airports	Public/Private	Financed with use fees, and operated as a community-owned facility that is used by private sector companies to lower the cost of service.
Water	Public	Entirely private at first, moved to community control. Most water systems started out as private sector ventures in the late 1800s and became public ventures because of health and economic development issues.
Sewer	Public	Health and economic development required public investment.
Electricity	Public/Private	Some public systems (community owned cooperatives) were built because the private sector would not build in certain areas.
Telephone	Public/Private	Some public systems (community owned cooperatives) were built because the private sector would not build in certain areas.

Use Surveys Appropriately

"If I had asked people what they wanted, they would have said faster horses." --Henry Ford

Communities interested in broadband almost automatically decide that the first step is to ask residents what they want. But Henry Ford's comment from decades ago still rings true. If you are trying to prepare your community for the future, you need to remember that not everyone thinks much about it (the future).

Broadband surveys still routinely show that half of dial up Internet users don't see any need for broadband, and I have sat in more than one meeting where one or more public officials have used such data to "prove" that a community investment in broadband is wrongheaded. The fact that people, around 1900, were still convinced that faster horses were all they needed to improve local transportation was not an accurate predictor of the emerging importance of the automobile.

People see the "need" for Internet access when they are able to identify a business or personal need for such connectivity. This identification takes place at different times for different people and different businesses. If you stop and think about it, why would one rely on predictions of what technology might be needed in the future by asking people that do not use it at all? That group of non-users are likely to be very poor at such predictions, yet many communities do just that--ask people that do not use computers or the Internet if broadband is "needed." It is not surprising when those folks say they do not want broadband.

Even elected officials are guilty of this faulty logic. How many people have heard an elected official say, "I don't use the Internet and don't know why we need to spend any money on broadband."

Surveys, done properly, can provide useful data, but they survey needs to be designed well and administered by a professional polling firm. Just mailing out surveys to the Chamber members and asking them what they want may not help, and it may hinder the effort.

Broadband is Just Like Roads

There are many similarities between community road systems and broadband, which can be thought of as digital road systems. Both are used to support and facilitate commerce both within the community and to connect the community to other regions. Like physical roads, broadband has become a business essential and an economic development issue. Communities without good roads were not competitive economically during the Manufacturing Economy of the twentieth century, and communities without good digital road systems are not going to be competitive in the Knowledge Economy of the twenty-first century.

Current broadband policy is like asking Fedex, UPS, and Airborne to each build their own roads to customers. If road-building was left entirely to the private sector, most homes and many businesses would not have paved road access at all, because there would not be enough business to an average home to justify the expense of building a private road. Yet that is exactly how we are managing telecom right now: each firm that wants to sell services must finance and build an entirely private infrastructure to each customer. Naturally, some customers do not justify the expense, especially in rural areas.

The table on the next page illustrates the ways that roads and broadband are similar.

Similarities of Roads and Open Access Broadband		
Characteristic	**Roads**	**Open Access Broadband**
History	Before the rise of the automobile, most roads were built largely by the private sector. After cars became important to commerce and economic development, communities began building and maintaining roads	Before the rise of the Internet, digital networks were built largely by the private sector. As broadband has become critical to commerce and economic development, communities with digital roads are more competitive globally.
Infrastructure	Roads are built and maintained by the community for the use of all, including private firms that want to use them to deliver goods and services.	Telecom duct, fiber, and wireless sites and towers are built and maintained by the community for the use of all, including private firms that want to use them to deliver goods and services.
Access	Access to the community road system is provided by parking lots and driveways, built by property owners, developers and builders. Developers often build roads and turn them over to the community to maintain.	Access to the communitywide network is provided by duct, fiber, and wireless systems, built by property owners and/or developers and builders. Developers begin to install telecom, and turn the duct over to the community to maintain.
Services	The local government uses roads only to deliver government services. Local government does not offer services like overnight package delivery. Private sector businesses use roads so that their own cars and trucks can deliver goods and services to customers. Because businesses do not have to build and maintain roads, all businesses benefit directly by being able to reach more customers at less expense.	Local government uses the digital transport system only to deliver government services. Government does not offer services like Internet access or Voice over IP. Private sector businesses use the digital transport system to deliver goods and services to customers. Because businesses do not have to build and maintain a digital road system, all businesses benefit directly by being able to reach more customers at less expense.
Fees	There are no "road connection" fees, and anyone may "connect" to the road system for free. Governments pay for the cost of maintaining roads largely from those that use the roads. Fees are proportional to use, from taxes on tires and gasoline.	There are no "network connection" fees; a qualified service provider may connect to the digital road system for free. Governments pay for the system by charging service providers a small fee that is based on a percentage of their income from services offered over the system.

The Advantages of Community Investment

Customer aggregation is a key advantage to a shared, community-owned telecommunications infrastructure. By building an integrated fiber and wireless system to every home and business, the community maximizes the market potential for private providers who want to sell services. The community investment allows these businesses to reach more customers than any single company could reach on its own. Some of the outcomes are:

- More customers -- When a community builds the transport layer of a digital road system (the roadway), each provider has a much lower cost of infrastructure needed to enter a market. In smaller towns and regions, this is a critical difference. Community investments allow more companies to profitably offer services in smaller markets than a firm could do on its own.

- Lower costs -- When a firm can reach more customers via a community broadband system, lower costs of service usually results. Typical reductions in cost in open access systems are usually on the order of 15%, and are frequently much more than that. It is not unusual to see the cost of telephone service decline by 40% or more.

Services aggregation occurs when communities build open service provider networks, meaning that any qualified service provider can offer services using the community digital roadway. In this business model, there are usually several service providers competing for customers in each category of services (e.g. voice telephone service, TV, Internet access).

- More services-- A natural outcome of more services is more choice for purchasers of services. Instead of a single monopoly provider of telephone or television, customers can pick and choose among a variety of service plans at various price points.

- More services -- When more services are available, there is more competition for customers, which requires that service providers sell services for the lowest possible price, and also creates incentives to provide excellent service to customers. Compare this to a monopoly environment where there is no competition and hence little pressure for a company to provide good service--customers have no other service options.

- More services -- When there is a wider choice of services on the community system, there is more opportunity to use more services. This is, in part, what makes open service provider networks financially sound investments for communities: OSPN systems create a bigger market for telecom services, and thereby creates more revenue flowing through a community revenue sharing plan.

Universal Service

Universal service is a core issue in the debate about broadband. If we leave broadband connectivity entirely to the private sector, we are unequivocally accepting the notion that some homes and businesses will have better and more affordable access than other homes and businesses. Further yet, we are ensuring that in many regions, some homes and businesses will have no wireline broadband access available (while satellite broadband is available anywhere in the country, it is vastly inferior, costly, and poorly suited to routine business needs).

Universal access to affordable broadband makes good sense from both an economic and community development perspective:

- It is less expensive to go to every home and business than to "cherry pick" a few big customers. By making a day one commitment to universal service, a community guarantees that every institution in the community, large and small, will pay the lowest possible fees for telecommunications services. This includes local government and K12 schools, which use tax dollars to buy such services.

- If it is worth doing, it should be worth doing for everyone. If affordable broadband is worth some community investment (for business, as an example), it should be worth it to do it for everyone, so that every home and business in the community has an equal opportunity to prosper.

- Limited aggregation is creating new, structural digital divides. The much debated "digital divide" has been largely a product of an immature marketplace, and the fault of no single party. But when communities intentionally decide to "leave it to the private sector," knowing that not all residents and businesses will receive equal services and equality of pricing, then government is intentionally creating a digital divide. A community commitment to universal access avoids this very uncomfortable position.

- Only aggregating business and/or institutional broadband services makes it difficult if not impossible for a community investment to be financially viable. Unfortunately, many communities have taken the route of building fiber only to a few big customers like K12 schools and business parks, and are discovering that the systems quickly become financially insolvent. Building to everyone creates the largest possible pool of potential customers and creates the largest pool of fees flowing through the system.

- Business aggregation only limits economic development to those areas that are served. This makes it more difficult for existing businesses and start-up businesses outside the conventional service areas (like business and industrial parks) to obtain affordable rates for services. It also reduces the potential to start or maintain a business out of a home, where there has been rapid growth. A commitment to universal service helps to maximize the economic development potential of community broadband investments.

Broadband Systems

Definitions

Open System – Community builds open access network and provides fully automated Layer 3 service provisioning, which dramatically lowers costs. Many different providers offer multiple services in many different categories. Local government typically does not directly own or manage the network. An appropriate community enterprise like a broadband coop or regional authority provides oversight and management.

Triple Play – Triple play usually refers to a bundled service offering of voice telephony, TV programming, and Internet data access. Customers do not always have to purchase all three services. Customers usually have no choice of service providers, and must buy from whatever provider is offered by the network operator.

Closed System – Typically provided by private incumbent telephone and cable companies. Let existing incumbents provide traditional, mostly old-fashioned copper-based infrastructure. Users have limited choice in voice, video, and broadband. Muni Retail broadband systems are also usually closed systems.

Active System – An "active" system is typically based on Ethernet and TCP/IP (Internet) standards. "Active" refers to electronic components that require power. Active systems are more likely interoperate with a variety of components and devices from different manufacturers.

Passive System – "Passive" systems are really a misnomer as they contain just as many active devices as any other (active) network. They also contain unpowered optical splitters that require the use of less fiber, hence the "passive" name.

Muni Retail – Also known as Muni Triple Play. Local government builds the network and sells services in direct competition with the private sector, offering only traditional "triple play" voice, video, and broadband.

Muni Wholesale – Local government builds the network and provides access to service providers, who must use Layer 2 Virtual Private Networks (VPNs). Services must be provisioned individually for each subscriber. Not a true open access model because of system complexity.

Copper Systems – Copper systems include both telephone and cable TV networks. Typical copper-based telephone systems used twisted copper pair cabling that can provide dial up Internet access and various flavors of DSL. Cable TV systems use coaxial copper cable and use TV channels to carry Internet data.

Fiber Systems – Fiber systems use optical glass fibers to carry data, telephone, and TV signals. Fiber cable can be hung on poles or placed underground, either buried directly or installed in duct. Fiber systems have very high capacity, but the amount of capacity depends on the electronics attached to each end of the fiber cable.

Wireless Systems – Wireless systems use radios to transmit and receive data. Most off the shelf wireless systems that are used for broadband require line of sight between the sending and receiving antennas. Low cost systems like WiFi suffer from signal degradation caused by trees and walls, among other problems.

Open vs. Closed Systems

Open systems, in this document, refer to service-oriented networks with multiple providers of services for popular categories of service like Internet access, telephone, and television programming. Open Service Provider Networks also have many other categories of services like network backups, home security, network management, and telehealth, as some examples. Closed systems usually limit customers to a single provider in each of those categories, and may not offer any other services at all.

Characteristics	Closed	Open
Service provider selection	Gatekeeper/network owners pick providers	Customers pick providers
Competition	Very limited. One provider for each class of service.	Service providers compete for customers.
Choice	Very limited. A single provider for voice, video, and data (triple play).	Many kinds of services, not just triple play, with multiple providers in many categories.
Pricing	Little or no competition keeps prices high. Encourages cartel-like pricing.	Competition forces providers to compete by keeping prices as low as possible.
Customer service	Lack of competition means service providers have little incentive to offer good service.	Competition forces providers to offer good customer service.
Business risk	High. Network operator must sign long term contracts with service providers. If a provider does not work out, it is difficult to change providers.	Low. No need for long term contracts. If a provider does not work out, there are other providers already offering similar services.
Local business opportunities	None. Big companies usually get the three contracts.	Unlimited. Anyone with a good idea can become a service provider inexpensively.
Revenue Potential	Limited by fixed margins on just three services.	Unlimited. Wide variety of services with different profit margins does not cap revenue.

Active vs. Passive Systems

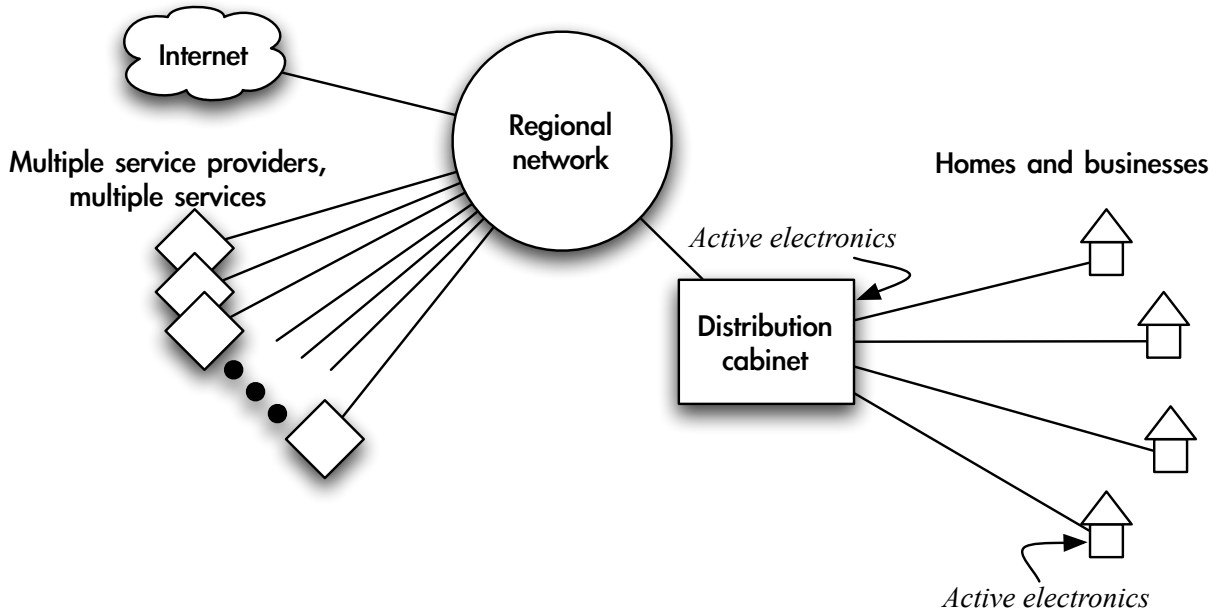
The two diagrams below show the essential components and differences between active and passive optical networks. The term "passive optical network" is really a misnomer, since "passive" networks have just as many active components in a typical design as an active network. But in addition to the active (powered) components, they also have passive, or unpowered components, called optical splitters.

Passive Optical Networks (PONs) were developed in the nineties, when fiber cable was more expensive, and there was some motivation for limiting the amount of fiber that had to be deployed to homes and businesses. PON systems were also designed to enable telephone companies to continue to seamlessly support old, copper-based telephone systems.

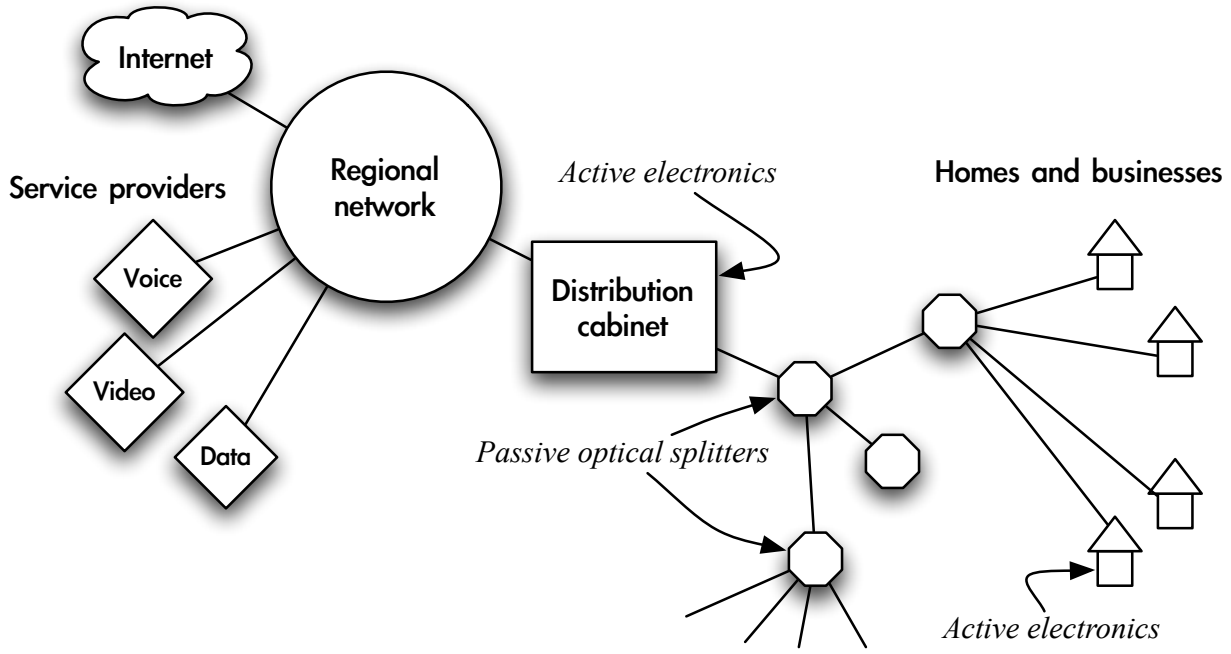
Today, the cost of fiber has fallen dramatically, and is now just slightly more expensive than copper cable. The cost of trenching and/or hanging cable on poles represents the majority of the cost of a fiber build out, not the cost of fiber cable, and from a pure technology perspective, there is no longer any cost advantage to deploying PON systems.

PON systems are favored by telephone companies because they can be used to more easily create "walled garden" or closed broadband systems that let the network operator control what services residents and businesses can use. PONs are not inherently closed, but do tend to favor the monopoly business models of telephone companies.

A key disadvantage of PON systems is that there are three fixed channels in a PON system: one channel is dedicated to phone service, one channel is dedicated to TV service, and one channel is dedicated to data (Internet) services. This partition of system capacity is troublesome for communities that want to ensure that residents and businesses have adequate bandwidth in the future. As more and more services are migrating to a data/Internet model, demand for Internet bandwidth is likely to grow as it has over the past ten years, where we have seen a consistent 50% to 100% increase in the amount of Internet bandwidth needed year to year. PON systems do not scale well over decades, and communities that end up with PON systems are likely to find themselves with a structural economic development disadvantage in as little as five to seven years.



Conceptual Model of an Active Network



Conceptual Model of an Passive Optical Network (PON)

	Passive Networks (PONs)	Active Networks
Technology	Designed to allow telephone companies to preserve investment in legacy systems	Designed to support current and future high bandwidth applications and services
Bandwidth	Limited by hard wired partitioning into three channels: voice, video, and data	Dynamic bandwidth allocation allows each service to have as much bandwidth as needed, up to the maximum available
Future Capacity	Limited by partitioning. Difficult to expand capacity for future needs.	Easily swap electronics to increase capacity as customer demand grows.
System Simplicity	Just as many "active" components as active systems, but also has passive components that limit capacity and growth.	The same number of active components as passive systems, and no passive components to complicate upgrades.
Interoperability	All equipment has to be purchased from a single vendor.	Active networks can mix and match equipment from different vendors that provide Ethernet-standard products.
Cost	Cost per home passed is nearly identical to active systems.	Cost per home passed is nearly identical to passive systems.

Muni Triple Play vs. Open Systems

Muni triple play systems are usually closed systems that offer little choice to customers. Muni triple play systems compete directly with the private sector, and tend to have very low take rates. Opponents of community broadband often cite the low take rates of muni triple play projects to "prove" that community broadband is a poor investment. But the low take rates only show that muni triple play business models are not financially viable over the long term.

Characteristics	Muni Triple Play	Open Systems
Basic Concept	Only three services (voice, video, data) with little or no sharing of network.	Very high efficiency achieved by end to end automated service provisioning. All providers share network capacity.
Government Involvement	Government competes directory with the private sector. Government decides what services are offered.	Government does not compete with private sector. Government provides high performance digital road system that benefits all public and private users. Buyers have rich set of choices.
Governance	Owned and operated by local government. Limited triple play services sold directly by local government.	May be owned by local government or by a community enterprise like a broadband coop. Wide variety of services sold by private sector companies.
Competition	Government bureaucrats pick providers of each service. No incentive to lower prices.	Level playing field creates robust competition. Service providers drive down costs and provide great service to get customers.
Service Options	Limited. Government resells triple play services.	Unlimited. Low cost of market entry and high level of service automation attracts service providers and encourages innovation.
Revenue	Limited by low returns on the triple play services.	Unlimited. Revenue directly linked to demand. Revenue increases with demand.
Service Area Expansion	Limited by triple play approach, which keeps funds for expansion low.	Unlimited. Expansion completely supported by revenue sharing. OSPN systems can provide funding for community and economic development projects.

Muni Retail vs. Muni Wholesale

Muni wholesale is also confusingly called "open acces" by some parties. Muni wholesale systems may have some competition for some service categories, but the technical complexity of these systems (technically, most "open access" systems are managed at what is called Layer 2. The limitations of Layer 2 open access tend to keep the cost of providing services high, compared to a true Open Service Provider Network (OSPN) that provides fully automated, end to end provisioning of services.

Characteristics	Muni Retail	Muni Wholesale
Basic Concept	Only three services (voice, video, data) with little or no sharing of network.	Network efficiency is limited by requiring VPNs (Virtual Private Networks) for each service provider.
Government Involvement	Government competes directory with the private sector. Government decides what services are offered.	Government provides relatively low performance digital road system with high cost of operation. Buyers have limited choice of services.
Governance	Owned and operated by local government. Limited triple play services sold directly by local government.	Owned and operated by local government. Limited selection of services offered by the private sector.
Competition	Government bureaucrats pick providers of each service. No incentive to lower prices.	Limited. High cost of administering services using VPNs limits market competition.
Service Options	Limited. Government resells triple play services.	Limited. High cost of providing services and support effectively limits service options
Revenue	Limited by low returns on the triple play services.	Limited by low returns on the triple play services.
Service Area Expansion	Limited by triple play approach, which keeps funds for expansion low.	Limited by small number of service providers.

Copper vs. Fiber

Some companies with a large existing investment in copper cable continue to insist that copper delivery systems are "good enough," but communities that have only copper-based broadband services are going to suffer from a lack of economic competitiveness compared to communities with fiber delivery systems.

Characteristics	Copper	Fiber
Technology	Based on one hundred year old technology (DSL) or fifty year old technology (cable modems)	Active fiber systems use electronics designed specifically for high bandwidth applications and services.
Quality of Service	The quality and age of the copper cable affects service.	Fiber provides high reliability end to end.
Distance limitations	Dependent upon the distance from telephone switches. Higher speed DSL services are limited to as little as a few hundred feet.	Fiber signals can travel many miles.
Capacity	Copper has very low capacity and has trouble delivering even a single channel of HD TV unless the subscriber is very close to network distribution points.	Off the shelf fiber systems can deliver several channels of HD TV today, and can be upgraded easily.

Wireless vs. Fiber

Wireless and fiber systems are both part of a well-designed community broadband system.

Characteristics	Wireless	Fiber
Mobility	Wireless provides excellent mobile services to portable devices like phones, PDAs, and laptops.	No mobility.
Capacity	Limited capacity. Vendors use very large, theoretical capacity when discussing wireless products. Actual capacity is often as little as 10% of vendor claims.	Actual capacity of active fiber systems is usually about 80% of published capacity. PON capacity is calculated by dividing published capacity by the number of users on a single splitter. Typically this number is 32.
Cost	Lower initial cost, but total life cycle cost over 30-40 years is higher than fiber.	Higher initial cost, but total life cycle cost of 30-40 years is lower than wireless.
Utility	Wireless services are needed for our mobile phones, PDAs, and laptops.	Fiber services are needed to power high bandwidth services like video, telemedicine, business applications, and home security.

Good Enough vs. Future Proof

There is occasionally some sentiment to simply invest in systems that are better than dial-up, but the the notion hides a false economy, since the cost of "good enough" systems are very close to the cost of systems that can be easily upgraded over the forty year expected life span of fiber. "Good enough" systems also put communities at risk economically, compared to communities with more robust systems.

Characteristics	Good Enough	Future Proof
Concept	"Many of our residents only have dial-up, so let's just get them something better than that."	"If we are going to invest, let's make sure our residents and businesses have what they need to compete in the world economy."
Cost	Cost per home passed for a "good enough" fiber PON system is the same as for a "future proof" system.	Cost per home passed for a "future proof" system is the same as for a "good enough" fiber PON system.
Economic Development Potential	Limited. "Good enough" triple play systems restrict work at home and home-based businesses, and are not attractive to entrepreneurs.	Excellent. World class affordable broadband services attracts entrepreneurs and businesses to a region.
Risk	High. How long will a "good enough" system be good enough? Looking only at what is needed today while making a 30-40 year investment is very risky.	Low, given that costs are virtually equal. Investing in a system that can be easily expanded and upgraded as demand grows protects the initial investment.

Opening Up Broadband to Competition

Characteristics of an Open System

Open Service Providers Networks are financially sustainable over the long term because they have strengths in several different areas:

- Communitywide OSPN systems allow easy aggregation of customer demand, which in turn attracts service providers and increases competition.
- In OSPN systems, government officials do not have to pick winners and losers from among private sector providers. The open marketplace of an OSPN system does this more efficiently and with much less risk.
- OSPN systems support continuous innovation because of the high level of automation coupled with a very low cost of introducing new services. It is much less risky for a service provider to try new services.
- All services provided by the private sector in an OSPN system, which eliminates the issue of government competing with the private sector. Incumbent service providers (e.g. the telephone and cable companies) are invited to sell to their existing customers on the new system, which allows them to preserve their existing customer base.

Typical Services Profile

OSPN systems, in contrast to the existing model of selling "broadband," provide free access to many kinds of local services and information resources. This ties in with the goal of universal access: every home and every family should have some free access to government services and local school resources, so that economically challenged families with children are not on the wrong side of a government-sponsored digital divide.

- Basic connectivity to local services is free, including local government services and local education resources
- Every business and home connected to the network gets free local transport to community and local government services
- School children have a free 1 megabit connection to local school services
- Displaced workers would have a free 1 megabit connection to GED programs and other local distance learning programs
- Citizens have free access to government information and services
- Citizens have free access to community Web portal, community Web sites
- Homes that meet needs-based criteria could get subsidized 128 kilobit connection to the Internet for basic lifeline email and Web access. This lifeline access will support a single VoIP telephone line

An OSPN system provides much more than the traditional triple play of voice, video, and data. Service options typically include a wide range of traditional and innovative new services, including:

- Internet access. Residential offerings might include 1 meg, 5 meg, 10 meg services, and business services might include 1 meg, 10 meg, 25 meg, 50 meg options.
- Automated 2-way meter reading and opt-in power management, which can result in an immediate 5% savings in utility costs.
- Telephone services (VoIP) for business and residents
- TV packages from multiple providers (typically 2-3)
- Computer backups over the network
- Gaming services
- IP-based home and business security
- Telehealth, telemedicine, video on demand, business videoconferencing, and more

Funding Open Systems

Communities that rely on cable franchise fees to finance local government initiatives like a public access TV channel may have to find other ways to pay for those services. As the FCC (Federal Communications Commission) continues to level the playing field for telecom services, cable franchise fee revenues will likely disappear. Communities will have to reposition this as a right of way fee, instead of a tax on the cable franchise but not on other right of way users. It can't just be regarded as easy money from a single company.

Communities will also have to do a better job of tying the fees to the actual cost of managing right of way. Communities have to catalogue and track what is in public right of ways, and then begin to track how much public works and planning money is spent on managing private uses of public right of way--otherwise there is no way to justify a right of way fee. It's more a land use issue than a technology issue. And they aren't making more right of way, so it is perfectly appropriate for communities to have an active right of way management program--that's one key role of government--management of scarce resources on behalf of the entire community. What happens to public access TV? One option is to go all digital and deliver the content via IP TV, rather than the old-fashioned cable system. It could end up costing less, and the public would benefit since the public access "channel" would no longer have any restrictions on the amount of content available. Communities would just put all the programming on a server, and it would be available all the time.

An OSPN system is funded by revenue sharing, which means that each service provider using the community broadband system pays a percentage of revenue back to the community to help pay for the cost of building and operating the system. Revenue sharing is a fairer way of managing community broadband as it is applied equally to all users, and is directly proportional to demand.

Franchise Fees vs. Revenue Sharing

Characteristics	Franchise Fees	Revenue Sharing
Regulatory Issues	Very complicated as the U.S. makes a rocky transition away from regulated telecom. Many communities tied up in lawsuits over inequitable franchise fees.	Many fewer issues. All service providers are treated exactly the same way.
Right of Way Issues	Businesses that actually invest locally end up getting charged more, creating disincentives to offer services in smaller and rural communities.	All service providers using a community digital road system are assessed equally.
Competition	Tends to limit competition and the number of service providers because of high legal costs and up front financial commitment.	Encourages competition because of the low cost to enter new markets and low up front financial commitment.
Revenue Potential	Limited. Often capped at some negotiated maximum. Limited number of service providers also limits revenue.	Unlimited. Payments are tied to the financial success of companies. Wide variety of service providers and low cost of market entry increases revenue over time.

Comparative Costs of Infrastructure

It is a myth that fiber broadband systems are expensive. In fact, fiber systems are much less expensive than many other kinds of infrastructure that are routinely designed and built by communities. In the example below, the cost of water and sewer infrastructure (real number from the Town of Blacksburg, Virginia) are compared to the typical cost of fiber infrastructure.

Costs	Water	Sewer	Fiber
Pass-by or availability fee	$1,146	$6,287	$600
Connection, drop, or "lateral" fee	$447	$624	$500
Water meter or network electronics	$550	$0	$619
Total	**$2,143.00**	**$6,911**	**$1,719.00**

Do the Math

Another telecom myth that is widely repeated is that "there is no money in the community for telecom." In fact, most communities or regions of any size already spend hundreds of millions of dollars on telecom. Virtually all of that money is placed in envelopes and mailed out of the region and usually out of the state. The table below shows the twenty year cost of traditional triple play voice/video/data services.

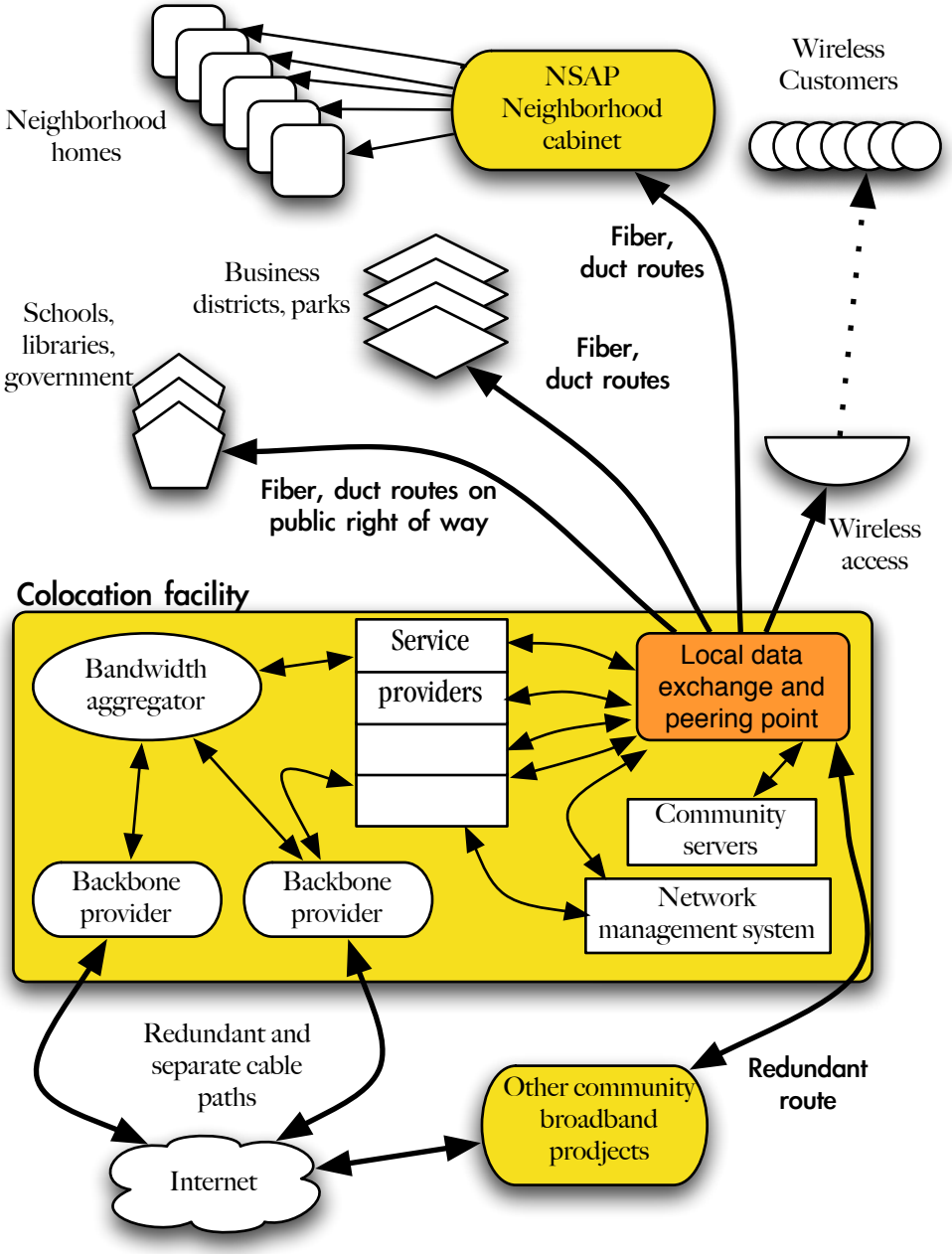
	Moderate to low income household	Moderate to high income household
Number of households	5000	5000
Typical monthly telecom cost	Local phone: $25 Long distance: $25 Cable TV $45 Dial up Internet: $20	Local phone: $25 Long distance: $25 Cable TV $55 Broadband Internet: $40
Total monthly cost	$115	$145
Total annual cost	$1,380.00	$1,740.00
Telecom costs over 20 years	$27,600.00	$34,800.00
Regional cost over 20 years	$138,000,000.00	$174,000,000.00
Total 20 year telecom cost	$312,000,000.00	

The $312,000,000 cost of telecom services does not include government and business use, which typically adds about twenty percent to the residential total, so the full twenty year cost of telecom for a community or region of just 10,000 households is approximately $374,400,000. Fiber has a conservative life span of forty years or more, so the

forty year cost of telecom for this community would be about $750,000,000, or three quarters of a billion dollars. So there is plenty of money for telecom. The real issue is how to spend that money. In the highest cost scenario of an all rural build out, where the cost per home passed for a state of the art, integrated fiber and wireless Open Service Provider Network is $3,500, the cost for the entire community broadband system is just $35,000,000, or less than 5% of the forty year community expenditures on telecommunications. With an appropriate revenue sharing business plan, this cost is easily paid off in ten to fifteen years.

Elements of an Open Community Broadband System

The diagram below provides a high level conceptual overview of a community broadband system using an OSPN architecture and incorporating both cabled (fiber) and wireless services.



Right of Way

Right of way is a scarce resource, and as such, it is important that the community manage it fairly and equitably, and to the maximum extent possible, ensure that it is used wisely. In the past, communities rarely paid much attention to

right of way. The electric company, the phone company, and the cable company had local crews that knew where the cables were and right of way management was done casually, and that worked fairly well in a monopoly environment. With deregulation, most local crews are gone, and the companies use out of town and often out of state contractors to install cable. Communities need to not only certify these cable installers, but must insist on being provided data suitable for the government GIS system so that cable installations can be tracked and managed. As the number of third party telecom providers increases, the number of cables being installed, even in smaller communities, has proliferated.

Right of way is not unlimited. Government must actively manage right of way as a scarce resource. Investments in community duct and fiber reduce demand for right of way, and help future proof the community.

Colocation

A colocation facility as illustrated in Figure 4-1 is a controlled environment (i.e. heated and air-conditioned) room with Internet access via wired and/or wireless systems. The colocation facility will be a place where fiber, wireless, and copper-based network facilities meet. It will accommodate new economic models for ownership of last mile infrastructure. It will be equipped to house high-end network equipment, servers, and other electronic gear. A variety of middle layer network components and services can be located within the colo including, for example, directory services, replicated content servers, routing services, and other elements needed to deliver new multimedia services to the home and small office from multiple, competing providers. Characteristics of a colocation facility include:

- A reliable source of AC electric power is required, with backup UPS (Uninterruptible Power Supply) service available by an onsite generator.
- Controlled access to the facility (e.g. by electronic keycard) 24 hours/day, seven days a week.
- Racks for locating network equipment and servers, and optionally locked cages for equipment racks.
- Functions of colocation facilities include:
- Hub for new broadband infrastructure development at the community and corporate campus level.
- Location for an MSAP, which is an exchange point for local service providers to peer reducing costs and increasing performance in a win-win-win scenario (keep local traffic local).
- Insertion point for multimedia services from multiple competing providers to reach subscribers over single broadband medium (fiber, wireless, other).
- Community, campus, or building point of presence for new middle layer components required to implement next generation Internet (directory services, caching, routing).
- Focal point for technical resources and management of community infrastructure.
- Aggregation point for low cost access to gigabit scale network services.

Duct and Transmission Routes

Telecom duct, cable, and cable/duct routes throughout the community are determined by need and customer demand. Fiber routes tend to be located along public rights of way. Fiber can be direct buried, installed in duct, in microduct, or hung from utility poles (aerial installation). Telecom duct varies, but is typically 4" plastic duct, "quad" duct (four 1" tubes enclosed in a 4" pipe), or microduct. Microduct is especially suitable for community projects. It is smaller than conventional duct, and contains from one to 32 very small tubes, through which fiber bundles can be blown with compressed air at a later time. Studies have shown that microduct is often no more expensive than conventional duct because fewer pull boxes and pedestals are required, so construction and design costs for microduct tends to be lower. Microduct also allows the community or fiber owner to install fiber as needed, and makes repairs simpler and less expensive, especially when compared to direct buried (unprotected) fiber cables. Emtelle (www.emtelle.com) is the leading world manufacturer of microduct, and provides design and engineering services with its products. Communities should include a fiber overlay in their GIS systems that identifies future, desirable fiber routes. When street repaving or water/sewer projects take place along those routes, fiber or duct should be installed at the same time, which can dramatically lower the cost of installation. Over several years, the community will develop a robust fiber backbone system.

Aerial fiber routes typically follow existing pole routes. Poles are usually owned by the electric utility or the telephone company, or a route may have a mix of pole ownership. Installing fiber on poles is typically faster than underground burial, but make ready costs and pole rental fees often offset installation and construction savings. Some communities have found that the poles they wish to use are "full," in the sense that there is no space for additional cables. In that case, the pole owner often includes pole replacement in the make ready costs. Pole replacement may be $500 to $1500 per pole. Microduct can be used in aerial installations, which gives the fiber owner more flexibility in installation and capacity planning.

Towers

Wireless systems (WiFi, WiMax, licensed frequencies) are inexpensive, and can provide broadband access quickly, especially in denser population areas (e.g. downtown areas, residential neighborhoods). However, wireless providers must procure access to tower sites and rights to mount antennas on existing structures and/or towers. This can be a significant time and money expense, especially when the potential customer base is low (e.g. in rural areas). Communities that perform site surveys to identify good locations for antennas and simplify procuring access to public structures (e.g. water towers, rooftops of municipal buildings, etc.) lower the cost of market entry for wireless providers.

Fiber

Fiber provides the highest bandwidth capacity, but tends to have the highest initial cost for installation, since few communities have any existing fiber infrastructure. Fiber is future-proof, since the capacity of fiber can be increased by simply swapping the equipment located at each end of the fiber. Fiber is an excellent investment if the funds are available to install it. Dark fiber refers to fiber that does not have electronics at each end to "light" the fiber.

Fiber services, as opposed to dark fiber, include electronics at each end of the fiber cable, and fiber service names (e.g. DS1, DS3, OC3, Fast Ethernet, Gigabit Ethernet, etc.) refer to the capacity of the electronic equipment, not the fiber cable itself.

Neighborhood Service Access Points

Neighborhood Service Access Points (NSAPs) give service providers (wired and wireless) a place to locate equipment cabinets, small huts, generators, and other equipment and facilities needed to provide broadband, cable TV, and telephone services to a neighborhood. The colocation facility will typically be a raised cabinet, enclosure, or small building designed to meet applicable industry standards such as Telcordia Distribution Components specifications and Network Equipment-Building Standards (NEBS). NSAP requirements include:

- Minimum of 100 square feet of level, usable ground.
- Should be located above flood-prone areas.
- Immediately adjacent to public right of way and accessible to service vehicles.
- Access to AC electric power.

Network Management Systems

A key component of an Open Service Provider Network is a network management system that automate the process of ordering and provisioning services. In a typical OSPN network, customers order services right from their computer using a Web portal. Within seconds of placing the order, the network management system has provisioned the appropriate bandwidth, Quality of Service (QoS), and other service parameters and the new service is immediately available in the home or business. This high level of automation (no manual provisioning required) reduces costs substantially for service providers, which in turn allows them to lower costs and to keep prices competitive. Some community systems deemed “open access” do not have a network management system that provides end to end service provisioning, and the the process of setting up and taking down services is done by services providers using a more costly and more technically complex effort.

Getting Started

For communities and regions interested in exploring the potential of community broadband investments, there are several activities that help lead to a decision to invest:

- **Identify Community Goals and Objectives -** Determine needs from a community and economic development perspective to ensure that any investments support long term community goals and aspirations.

- **Broadband Management Team** - Assemble a group of key stakeholders and interested parties that have a strong interest in community broadband. Members should be willing to make regular commitments of time and energy to move the effort forward.

- **Focus on Open Service Provider Networks** - OSPN systems solve several long-standing issues with community broadband investments, particularly the criticism that such investments "compete" with the private sector. A properly designed OSPN system creates new business and job opportunities for private sector companies, and makes it possible for local and regional service providers to compete for customers against much larger firms.

- **Financial Engineering** - Get a full financial engineering analysis performed by a qualified firm to show how money will flow through the system. This is a primary step towards deciding whether or not to invest. A full financial analysis examines the cost to build a system, the cost of operation, staffing, debt management, estimates of revenue, and estimates of service prices. An appropriate financial analysis should also show what funds will be available to support other community activities and economic development projects.

- **Examine Financing Strategies**--Get help from a qualified firm to examine financing options that are available (options vary from state to state and region to region).

- **Local Asset Assessment and Demand Aggregation** - Identify local assets already in place that can be used to reduce costs of building the system, and identify anchor tenants (public and private) that will commit to use the network.

What not to do:

- Do not go directly to equipment vendors to ask for a quote on the cost of the system. Vendors tend to sell what they have available, which is not always what the community needs. Vendors are rarely able to provide any advice about appropriate management and business models, and simply quote a large price tag for a system without explaining how to set up and run the enterprise sustainably.

- Do not debate the merits of various technical solutions. Many members of the IT industry have little familiarity with the unique characteristics and requirements of a communitywide broadband system, and often simply recommend using whatever products or systems are used in their institution or business. A full financial analysis should be performed before vendor, equipment, and management software selection begins.

- Do not assemble a management team and meet unless there is full support from a critical mass of elected officials and private stakeholders to act on the recommendations of the management team.

