The City of Seattle
Seattle Community Broadband Initiative

Defining the Strategic Vision, Goals, and Objectives, and Building the Business Case

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1. Executive Summary

Seattle's businesses and residents experience marginal communications infrastructure and essentially no real choice in service providers, which results in stifled technological innovation and substandard service.[1] These are symptoms of the core problem—well-entrenched incumbent providers that have few incentives to make new infrastructure investments or allow access to alternative providers. The lack of investment manifests itself in Seattle (and the rest of the United States) in international rankings that consistently show that the United States is falling further behind the rest of the industrialized world in advanced communications infrastructure.

The cable companies (Broadstripe or Comcast, depending on location[2]) and the local telephone company Qwest (CenturyLink) that serve the broadband market in Seattle connect businesses and residences to Internet and data services over their "infrastructure" (i.e., cables and equipment). These incumbent entities are the sole providers of broadband service over their respective infrastructures. And both entities enjoy legislative/regulatory protection that provide little to no incentive to open their infrastructures to other potential providers—a scenario commonly known as "open-access." Because of the high cost of building new infrastructure, potential competitors are effectively barred from entering the market, leaving the incumbent providers firmly entrenched. These favorable conditions for the incumbents incent the market to advance the status quo, ensuring a continuation of limited investment and effectively stifling competition. This condition is not unique to Seattle; it is prevalent throughout the United States.

To address the need in Seattle for a better-functioning communications market and for a foundation for economic growth and societal prosperity, we propose that The City build a new communications infrastructure following a "community access" business model that asserts:

- That communications infrastructure is a public asset, which should be owned and financed by the public—like other critical common-purpose infrastructure. And, most importantly, it must be available to all. It must be ubiquitous.

- That there is a distinct division between infrastructure owners and content providers. That for technological innovation to occur, content providers need a competitive market and an updated infrastructure.

- That there is a distinct division between infrastructure owners and service providers. For consumers to have real choice, multiple service providers should share a common infrastructure.

These attributes are common to the communications infrastructure models in many parts of the industrialized world where broadband availability and speed are markedly superior to levels in Seattle and most of the United States.

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[1] When compared to leading cities and nations in Europe and Asia.
[2] Broadstripe and Comcast each serve a portion of The City. Their service areas and infrastructures do not overlap.

The technology and architecture necessary to fully support The City's vision is fiber-to-the-premises (FTTP), which:

1. Creates a platform for next-generation technology to stimulate innovation and job creation.

2. Creates a platform that enables private sector competition and, in turn, leads to expanded consumer choice and improved value.

The City requires an FTTP infrastructure because no other technologies—not leased circuits, DSL, cable modem, or wireless connections—are capable of meeting the future capacity needs of The City's residents and businesses. These requirements have been well established in extensive previous research commissioned by The City and are supported both by significant international studies and the results of infrastructure projects in the United States, Europe, and Asia.

The estimated $700 million to $900 million investment required to plan and build this Community Access Infrastructure would deliver the true benefits of unfettered competition; the proposed business model would create an infrastructure that eliminates (or greatly reduces) market *entry* barriers and market *exit* barriers for service providers, ensures that consumers are empowered with service provider options; and provides ubiquitous network access to all residences and businesses—not just a select few.

The Community Access Infrastructure business model represents a unique approach that would severely disrupt the communications marketplace status quo. If The City were to pursue this project, it would likely face extreme opposition from not only local incumbents but also the entire broadband services industry. In addition, a host of other stakeholder groups would likely weigh in, making the debate highly political. To further complicate matters, the subject matter is quite complex and could be easily manipulated to sway public opinion through sound bites and misinformation. A prolonged legal and political battle should be expected, too.

It may be tempting for The City to consider building a communications infrastructure under a more traditional municipal business model to avoid the anticipated legal and political battle. These models, however, fall short of meeting The City's vision—and most are not financially sustaining. The traditional business models address a market condition by building more fiber—treating the symptom (lack of fiber) not the underlying problem (the key market structure). The City would be better served by doing nothing in lieu of following one of these traditional business models.

The City's long-term strategic vision demands an infrastructure that will support broadband applications that are yet to be developed. Only high capacity and ubiquitous access for all residents and businesses will encourage innovation and new applications. Only an open-access infrastructure can open the door to private sector competition. Only FTTP will provide that capacity.

2. The City's Vision

Requiring companies such as Federal Express, United Parcel Service, and the U.S. Postal Service to build their own roads to reach customers would be an expensive and inefficient model—yet it is the same model guiding the delivery of Internet access, cable television, landline telephone, and other connectivity services in Seattle and elsewhere in the United States: Every new competitor must build its own physical infrastructure to reach potential customers.

Market conditions like those seen in Seattle have driven other governments—federal, state, and local—to promote the construction of new broadband networks. An influential 2010 report on the worldwide state of broadband connectivity (the "Berkman Report") sums it up as follows:

> Fostering the development of a ubiquitously networked society, connected over high-capacity networks, is a widely shared goal among both developed and developing countries. High-capacity networks are seen as strategic infrastructure, intended to contribute to high and sustainable economic growth and to core aspects of human development.[3]

The City's vision is to transform its communications market into one of economic, societal, and environmental opportunity. To realize this vision, businesses and residents need access to a communications infrastructure and market structure that, like The City's public roads, will enable competition among private sector providers and ensure fair and equal access to an unobstructed, open communications marketplace for all residents and businesses.

The City also has related goals for its communications market, which include:

- Recognizing its communications infrastructure as a core, essential public good.
- Enabling equal access to essential community services for all people of Seattle, regardless of economic status or physical location, through a community-wide educational, governmental, healthcare, and institutional network.
- Enabling equal access to a broad marketplace of communications service providers for all people of Seattle, regardless of economic status or physical location, to ensure consumer choice and service provider accountability.
- Facilitating entrepreneurship, innovation, and the development of technologies, services, and applications to be used in Seattle and worldwide.

To reach the above vision and goals, The City's initiative must address three core issues with the existing communications market. Its business model must:

1. Provide ubiquitous availability of advanced communications services
2. Facilitate competition among a variety of service and application providers
3. Support an infrastructure that enhances performance of available services and delivers scalable capacity for future services

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[3] Berkman Center for Internet & Society at Harvard University. "Next Generation Connectivity: A Review of Broadband Internet Transitions and Policy from Around the World." 2010. http://cyber.law.harvard.edu/pubrelease/broadband/ (accessed October 18, 2010).

3. Seattle Residents' and Businesses' Communications Needs

In order to transform its communications market structure, Seattle needs to ensure that its residents and businesses have access to a ubiquitous open-access infrastructure—meaning one that connects every structure in The City, and that any qualified service provider can use to provide communications services to customers.

Further, that infrastructure must be a fiber-to-the-premises (FTTP) design to enable not just today's high-bandwidth applications, but all applications in the foreseeable future (i.e., "future-proof capacity"). Among current communications technologies (including wireless, cable, and copper), only fiber optic cable has the capacity to adequately meet long-term community communications goals. While the capacity of other types of infrastructure is physically limited, the only limit to the capacity of fiber is the electronic equipment connected to it. [4]

In basic terms, an FTTP infrastructure would be a system of fiber optic cable running to every residence and structure within The City—either on utility poles or underground, just like the electric and telephone lines. The fiber optic cable would connect houses and businesses to the larger world of Internet and cable systems. A single entity would own and operate the fiber infrastructure on an open-access basis, and would lease space (capacity) to private retail providers. Thus, the operator would increase the availability of high-speed connectivity and foster competition not by selling services itself, but by offering the underlying infrastructure that would enable the private sector to sell services.

Access to those services would be provided via a portal (website) that contains links to retail providers, as well as access to community services from City government agencies, Seattle Public Schools, the University of Washington, and medical and other nonprofit and educational entities. Because the portal would not require connections to outside networks or Internet capacity, it would be able to deliver bandwidth-rich applications without creating overwhelming bottlenecks in the network.

As mentioned earlier, Seattle's roads offer an apt comparison here. The public streets (which are the original "municipal infrastructure") enable FedEx, UPS, the U.S. Postal Service, and countless small businesses to compete in the package-delivery market. A ubiquitous open-access communications infrastructure would also be a platform for enabling commerce—but the

[4] The capacity needed for future applications (and many current applications, for that matter) should not be underestimated. Anyone tempted by the lower cost of less-capable infrastructure technologies would be wise to consider previous communications pioneers. America Online, for instance, did not imagine supporting Skype computer-to-computer calling when it rolled out dial-up Internet access across the country. Neither, for that matter, did the engineers at Apple imagine that their iPhone and similar devices would result in the creation of 300,000 applications (and counting). Consumers' already great demand for broadband capacity will only grow in the future, as the range of bandwidth-intensive applications (e.g., streaming video, data backup, telemedicine) grows. Even some of the "modern" ways of delivering media are becoming old hat: According to a recent report, "Even though Netflix's arch rival Blockbuster has filed for bankruptcy protection, the victory lap will have to wait. The company that filled American mailboxes with red envelopes containing DVDs is already fighting the next war. Netflix's competition with Blockbuster is an artifact of another age—the DVD era. The main battlefront has shifted online, where consumers are streaming movies and television." (Verne G. Kopytoff, "Shifting Online, Netflix Faces New Competition," New York Times, Sept. 26, 2010.)

packages would be "packets" of the virtual variety, arriving at computers and other devices rather than curbside mailboxes. In numerous European cities, this structure has not only encouraged competition but has virtually eliminated the debate over "net neutrality," or whether network operators can favor some Internet traffic over others.

3.1 Seattle Residents and Businesses Desire Choice and Competition

Market research conducted in Seattle in 2008 found that residents are feeling the constraints of the current broadband offerings, and they are not satisfied. The research also demonstrated that a majority believes The City should play a role in addressing the shortcomings of the market structure (i.e., limited choices of providers and lack of availability of innovative products and services). Most significantly, the research documented a significant, unmet market for high-speed, high-capability Internet/data services. Specifically, the market research found that:

- **Consumers value choice more than bundling or purported "convenience."** Both the residents and businesses surveyed consider the ability to choose services from a variety of providers more important than the "convenience" of bundled telephone, cable television, and Internet services.

- **A majority of respondents believe there is a role for The City to play in addressing the shortcomings of the broadband market.** The market research demonstrates that 85 percent of Seattle residential respondents believe The City should have some role in the development of a broadband communications infrastructure. Sixty percent believe The City should install an infrastructure[5] and 25 percent believe The City should encourage a private firm to build a fiber infrastructure. Approximately 75 percent of business respondents believe The City should have a role in broadband access; 55 percent believe The City should install an infrastructure[6] and 18 percent believe it should encourage a private firm to build a fiber infrastructure.

- **The greatest market opportunity for a new entrant is Internet/data services.** The market research demonstrates that residential consumers are dissatisfied with the value of their current Internet services. Consumers are looking for higher reliability, greater capacity, and faster speeds. Residential respondents to the surveys demonstrate a clear need for unfettered, high-reliability, high-capacity, symmetrical (upload and download) 100 Mbps Internet offerings for about $40 per month.[7] The market is not meeting these needs with respect to price, symmetry, speed, reliability, or openness.

3.2 Seattle Has Thoroughly Established Its Need for Enhanced Infrastructure

The City has recognized the need for high-capacity, high-performance infrastructure since 2004, when the Mayor and Council convened a Task Force, with broad stakeholder representation, to

[5] A fiber network (42 percent) or a wireless network (18 percent)
[6] A fiber network (41 percent) or a wireless network (14 percent)
[7] Such residential offerings may seem like wishful thinking to many Americans, but in major European and Pacific Rim cities, such prices and service attributes are standard. Indeed, in Tokyo, approximately $45 per month buys a reliable, symmetrical one gigabit per second product—500 to 1,000 times the speed of many broadband services in the United States.

evaluate The City's "technology future." In 2005, the Task Force concluded that only FTTP could deliver the bandwidth and security necessary to ensure Seattle's broadband future.[8]

Significantly, the Task Force noted the dramatic impact technology has had on The City's development and nature. It further noted that a lack of true broadband competition could relegate The City "to second tier status in terms of its technological sophistication and [The City could] lose its edge to cities that are better positioned to compete in the emerging global economy."[9]

In that light, the Task Force set a goal of bringing high-capacity broadband to the entire City by 2015. The Task Force articulated its vision in this way:

> Within a decade all of Seattle will have affordable access to an interactive, open, broadband network capable of supporting applications and services using integrated layers of voice, video and data, with sufficient capacity to meet the ongoing information, communications and entertainment needs of the city's citizens, businesses, institutions and municipal government.[10]

The key elements of that vision are phrases such as "capable of supporting applications and services" and "sufficient capacity to meet the… [City's] needs…." While currently available broadband connections can support some applications and services, the history of communications networks illustrates that the "high-speed" network of today is the antiquated connection of tomorrow.

The Task Force Report concluded that Seattle would require symmetrical (both upload and download) speeds of 20 Mbps to 25 Mbps in the short run and 100 Mbps and more in the longer run. More than five years after the release of that report, the long-term speed requirements remain possible only with an FTTP infrastructure.[11]

In addition, a follow-up report found that the value to the community of a high-capacity, high-performance infrastructure would be tremendous. Indirect community benefits represent a significant potential payback on investment in an FTTP infrastructure—more than $1 billion *annually* in benefits could accrue to all of the stakeholders in The City. (For additional detail on this benefit potential, please see Exhibit I.)

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[8] "Report of the Task Force on Telecommunications Innovation: How The City of Seattle Can Promote Development of an Advanced Communications Network," City of Seattle, May 2005, http://www.seattle.gov/cable/docs/SeaBTF.pdf (accessed December 2, 2010).
[9] Ibid.
[10] Ibid.
[11] The Task Force recognized the mobility benefits and important complementary role of wireless technologies, but noted that wireless was no substitute for FTTP.

4. The Existing Market Structure Does not Encourage Competition

The private sector broadband marketplaces in Seattle and much of the rest of the United States have not delivered high-capacity infrastructures because the markets are simply not competitive.[12] In most cases, consumers are served by an incumbent cable provider and an incumbent telephone provider—a two-competitor market structure known as a duopoly that does not offer or support true competition. And while federal policy required open-access for broadband infrastructure in the early days of the Internet, that policy has given way to new regulations (or lack thereof) that have actually hampered competition and innovation in the communications marketplace.[13]

So while The City's residents, businesses, schools, libraries, public safety agencies, healthcare providers, and other institutions need high-capacity, high-speed data connections to support a wide range of current and future applications, there are no regulatory or competitive pressures spurring the incumbent providers to invest in higher-capacity infrastructures. Further, not all households and businesses have access to or can afford the full range of available services.

4.1 The Communications Market Lacks Incentives for Competition

The Federal Communications Commission (FCC) and incumbent communications firms claim the communications market is competitive. Market data, however, does not support their claims (see Exhibit II). The market does not offer adequate consumer choice, and the communications market in Seattle will not correct the lack of ubiquitous, high-capacity infrastructure on its own.

Existing industry regulations do not encourage or facilitate competition. This state of affairs has developed over time as business imperatives and government regulations have combined to shape the U.S. telecommunications industry. In the early 1990s there was an amazing growth of Internet Service Providers (ISPs). Across the country thousands of ISPs emerged to offer not only dial-up access to the Internet, but Internet Protocol (IP) support and other related services. Those early ISPs had unrestricted access to the communications infrastructure used to connect to the Internet—consumers' telephone lines. And because ISPs did not have to lease infrastructure from incumbent communication providers, nor undergo the time-consuming and expensive proposition of installing their own communications infrastructure, consumers enjoyed a competitive marketplace.[14]

As applications continued to evolve and as personal computers' processing speeds accelerated, dial-up services became too slow to meet expanding consumer expectations. Cable, wireless, and telephone companies responded to the need for increased speed by enabling their networks to support cable modem, DSL, and other technologies. Many of the dial-up-based ISPs quickly adapted and began offering DSL-based ISP services over telephone lines. This situation was unfortunately short-lived for the ISPs, however. Through business practices and regulation, the

[12] Please see Exhibit II for an overview of some tools to evaluate market concentration and competition.
[13] Please see Exhibit III for an overview of how federal policies eliminated the ability of small businesses to provide innovative and competitive broadband services.
[14] Columbia Telecommunications Corporation, "The Impact of Broadband Speed and Price on Small Business." U.S. Small Business Administration, Office of Advocacy. http://www.sba.gov/advo/research/rs373tot.pdf.

upgraded cable and telephone network operators were able to restrict access to their infrastructure, rendering competitive ISPs unable to operate.

4.2 Private Sector Infrastructures Will Not Meet Future Needs

The incumbent cable, wireless, and telephone companies will continue to advance the capabilities of their respective infrastructures, but they will be maximizing the life of their existing infrastructures, not making expensive capital investments in new technologies.[15] In other words, consumers are limited to whatever services the incumbents are willing to offer. To further maximize profits, existing providers also often limit where services are available in a community (particularly to areas where revenues and return on investment are highest), so some Seattle consumers will not have access to services. These approaches are predictable and reasonable for an entity that is pursuing the most profits rather than the most community benefits. (That is why our primary road systems are publicly owned.)

Compounding this problem is the growing issue of broadband network capacity. As more people watch movies online, participate in distance learning, access medical records, and receive remote medical diagnostics—among other bandwidth-intensive applications—Internet Service Providers (ISPs) face the challenge of meeting the demand for bandwidth. Put another way, consumers want a fire hose of Internet content, but the cable and phone companies are only able or willing to deliver a water bucket brigade.

As Seattle's 2008 report noted, "Frankly, it is unlikely that these market deficiencies will be addressed absent City action, in light of the existing market structure, the legacy copper and coaxial networks operated by Qwest [now CenturyLink], Broadstripe, and Comcast, and the incumbents' political efforts to protect old business models."

4.3 International Experience Illustrates the Need for Government Involvement

The communications marketplace will not deliver the capacity that The City's residents, businesses, and institutions need—but comparative studies of countries with leading and lagging broadband markets illustrate a solution: Open-access regulations/policies, and government involvement in telecommunications infrastructure development.

A 2008 ranking of 30 nations, for example, found that the broadband success of many of the highest-ranked countries can be attributed to government initiatives and policies.[16] (The U.S. ranked just fifteenth on the list, which was calculated using a composite measure of household broadband penetration, speed, and price.) A fundamental and often overlooked lesson from Asia and Europe is the impact of regulation. Most markets in Asia and Europe that are ahead of the United States in broadband access operate under open-access and infrastructure unbundling requirements that foster competition and encourage ubiquity. Regulations in the United States have had the opposite effect.

[15] The incumbents' existing infrastructures have significant limitations when compared to fiber-to-the-premises (FTTP)—so even extensive upgrades will not enable those technologies to match the capacity of FTTP.

[16] Atkinson, Robert D., Daniel K. Correa, and Julie A. Hedlund. *Explaining International Broadband Leadership.* Report, Washington, D.C.: Information Technology and Innovation Foundation, 2008. www.itif.org/index.php?id=142 (accessed September 30, 2010).

South Korea, which ranked first for broadband in that study,[17] was the first nation to establish a national information technology policy, in 1987. That plan was followed by a series of initiatives to construct and promote a national fiber infrastructure. In 2004, the government also launched the "u-Korea Master Plan," with the goal of creating a ubiquitous information infrastructure by 2010. And the government announced plans in 2009 to further improve its infrastructure, aiming to achieve upload and download speeds of 1 Gbps by 2013.[18] Penetration is likewise extremely high, with 95 percent of homes subscribing.[19]

The Berkman Report echoed the same core finding, noting that "the leaders in fiber deployment—South Korea, Japan, and Sweden—are also the leading examples of large, long term capital investments through expenditures, tax breaks, and low cost loans that helped deployment in those countries."

Importantly, the Berkman Report also explores the issue of when a government should become involved in the telecommunications market—and again finds support for government investment. Examining guidelines issued by the European Commission in 2009, the authors note:

> …government funding can be appropriate even where there are two present facilities-based incumbents, offering triple-play services, including 24Mbps broadband service, as long as there are no discrete plans for deployment of next generation connectivity, with truly high capacity, within three years, by both incumbents. Moreover, building on the experience of Amsterdam's CityNet, the European guidelines permit government investment where it is shown to be on terms equivalent to what a market investor could have undertaken. Public investments in next generation networks, permissible under these conditions, should be oriented towards providing "passive, neutral, and open access infrastructure."

The government of New Zealand is one of the latest entrants into FTTP. Guided by those best practices, it has embarked on an open-access FTTP project that it expects to connect 75 percent of residents with ultra-fast broadband within 10 years.[20]

For additional information on international efforts, please see the case studies presented in Exhibit IV. When reviewing these case studies and other international efforts it is important to understand the context of the model. For example, in some of the European and Asian examples the FTTP infrastructure has become or is planned to be the only data infrastructure available; this in turn minimizes the required funding from taxes and encourages private investment in the fiber infrastructure.

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[17] Atkinson, Correa, and Hedlund, 6.

[18] Paul, Ian. "South Korea to Get Super High-Speed Broadband." *PCWorld.* February 3, 2009. http://www.pcworld.com/article/158799/south_korea_to_get_super_highspeed_broadband.html (accessed September 30, 2010).

[19] "South Korea Tops in Broadband Penetration Study." *PhysOrg.com.* June 19, 2009. http://www.physorg.com/news164595432.html (accessed July 21, 2010).

[20] "Ultra-Fast Broadband Initiative," New Zealand Ministry of Economic Development, http://www.med.govt.nz/templates/ContentTopicSummary____41902.aspx (accessed September 25, 2010).

5. Analysis of Business Models

With its vision and goals established—and with a clear understanding of the market's failures—The City analyzed three core business models for municipal communications infrastructure to determine the best fit for its project:

1. **Retail:** In this model, the municipality becomes a retail provider of voice, video, and data services. To deliver the services the municipality constructs communications infrastructure and installs connections to the homes or businesses of consumers who subscribe to a service. The municipality's infrastructure remains closed to other retail providers. The municipality's primary funding source is revenues from the retail services it sells.

2. **Competitive access:** The municipality constructs communications infrastructure that is open to qualified retail providers, which can lease access from the municipality and sell services directly to consumers. Infrastructure is built to consumers who subscribe to a service. The municipality's primary funding source is access fees paid by retail service providers.

3. **Community access:** The municipality constructs communications infrastructure that is open to retail providers. Infrastructure is built to every household and business in the community. The municipality's primary funding source is assessments (such as property taxes), supplemented with access fees paid by retail service providers.

This analysis focused on The City's strengths and core competencies, especially its ability to fund large capital projects, such as infrastructure, that require a relatively long payback period and serve the public good. (This is a weakness of the private sector.) The process of selecting a business model also took into consideration The City's other key strengths, such as its expertise in operating and maintaining infrastructure like streets, water systems, and the electric distribution system; its experience operating data networks; and its solid history of serving as a public educator.

The model selection process sought to avoid the potential pitfalls of The City's identified weaknesses—including its lack of experience operating data networks at a retail level and its lack of experience as a marketing organization.

Given these strengths and weaknesses, and The City's identified goals and objectives, the community access model is the best fit for The City. To understand why, it is important to understand the history of municipal initiatives, the benefits and risks presented by competing business models, and why The City is better prepared to address certain types of risks than others. So while the need for a ubiquitous open-access fiber-to-the-premises (FTTP) infrastructure is clear, so, too, is the potential basis for The City to make the investment—to take on the traditional municipal role of ensuring access to an essential service, just like water and public roads.

5.1 History of Municipal Models

Most municipal communications operators in the United States have been "over-builders"—that is, they built new communications infrastructure "over" the wires and cables in areas (neighborhoods or whole regions) where there were existing broadband, cable, and telephone systems.

- Some over-builders have followed a "retail model," using their infrastructures to sell their own retail voice, video, and data services to customers.

- A few municipal over-builders have constructed infrastructures and offered access (for a fee) to any qualified retail provider that wants to sell services to customers—a so-called "competitive-access model."

Among municipal over-builders who have followed either the retail or the competitive-access model, most have entered the business with the expectation that theirs would be a stand-alone enterprise—one that would be able to cover its debt service, operating expenses, and expansion costs—based solely on customer revenue.

In order to sustain itself solely on revenues, however, such a stand-alone enterprise must capture the majority of the voice, video, and data market in its service area. In other words, a municipal retail or competitive-access over-build enterprise would have to convince the majority of the area's residents and businesses to drop their current cable and Internet services and sign up with the new municipal service. For over-builders entering a mature market such as Seattle, this level of market share is virtually impossible to attain.

Further, projects that have followed the retail and open-access models have limited municipal networks' community benefits by making them only selectively, not ubiquitously, available. To control costs and maximize revenues, private and public providers have often "red-lined" neighborhoods (i.e., built only to neighborhoods where residents are likely to buy services). Even among neighborhoods that the private or public providers selected for build-out, network connections are only available to the businesses and households that buy service.

In short, most over-build efforts have not addressed the total breadth of "core problems" with the existing connectivity models and the marketplace, including ubiquitous availability, unfettered competition, and consumer choice. Further, these efforts have often not generated sufficient revenues to remain stand-alone enterprises. (Please see Exhibit V for additional details.)

5.2 Alignment of Business Models to City's Objectives

This analysis focused on the points of differentiation among the three business models in terms of how each of the models fit The City's objectives, and what risks the models entailed.

The retail model, for example, can bring higher-performance services to a community, but does so by adding a service option (i.e., a single additional provider from which a consumer can buy services)—not by creating a competitive market. It also typically requires significant "hands-on" involvement, is difficult to cash flow (especially because margins on telephone and cable are collapsing), and is not ubiquitous.

The competitive-access model focuses on creating a market of service providers, so it can deliver higher performance and more competition in a market—but it has not provided ubiquitous access (one of The City's core goals) in any U.S. deployment. This model is also difficult to make cash flow, because the funding models are predicated on service provider revenues and connection fees.

The community access model recognizes communications infrastructure as a public good and is therefore funded by the public. It is open to all eligible service providers; offers ubiquity for residences, businesses, and providers; and is more likely to create a competitive market and platform for innovation. This model has not yet been attempted in the United States, so there is no first-hand experience on which to draw.

Table 1 illustrates the alignment of the three business models to The City's objectives.

Table 1: Alignment of Business Models to Stated Objectives

Objectives		Business Model		
		Retail	Competitive Access	Community Access
Economic Benefit	Provide foundation for innovation and economic development.	Limited platform for innovation and economic development.	Limited platform for innovation and economic development.	Provides communications marketplace with a platform for innovation due to ubiquity.
Availability	Provide ubiquitous availability.	Available to subscribers.	Available to citizens based on projected take rates.	Available to all citizens.
Competition	Create a competitive market.	Offers one alternative.	Offers limited alternatives	Offers multiple alternatives (likely to attract higher number of retail service providers due to ubiquity)
Financial Sustainability	Make a sustainable and sound financial investment.	Physical investment sound. Financially unstable.	Physical investment sound. Financially unstable.	Physical investment sound. Financially stable.
Core Competencies	Leverage City's strengths.	Limited experience at direct competition.	Leverages financing strengths.	Leverages financing strengths.
Community Benefit	Provide foundation to support education, medical, and other institutions	Limited- available only to those acquiring service.	Limited- available only to those acquiring service.	Provides opportunity for all citizens and businesses.
Performance	Provide foundation to meet future capacity requirements	FTTP provides the foundation to meet future capacity requirements.	FTTP provides the foundation to meet future capacity requirements.	FTTP provides the foundation to meet future capacity requirements.

As the table illustrates, the community access model best fits The City's goals and objectives. The community access model also addresses all three of the key failures of the communications market (Table 2):

1. Performance: Does the selected business model support consumers' current and future capacity and speed requirements?

2. Competition: Does the selected business model provide a foundation to encourage competition?

3. Ubiquity: Does the selected business model provide access to all households and businesses in the community?

Table 2: What Market Failures Does Each Model Address?

Retail	Competitive Access	Community Access
Performance	Performance	Performance
	Competition	Competition
		Ubiquity

5.3 Business Model Risks

Each of the business models entails different types of risk, including:

- **Political:** Political risk is the risk that political forces—whether local, statewide, or national—will create or support opposition to a project from individual citizens, interest groups, or corporate entities. This type of risk may affect an individual elected official, a council, or a larger group of supporters (whether elected officials or their staff).

- **Legislative/Regulatory:** This is the risk that legislative or regulatory action will create hurdles, lengthy delays, or even an outright prohibition on some aspect of a proposed project. For example, legislative action could prevent public financing of a certain type of infrastructure project. Like political risk, legislative and regulatory risk can be created by opponents within a municipality or region, or it can be supported by national operatives.

- **Legal:** Legal risk is the risk from uncertainty due to legal actions or uncertainty in the applicability or interpretation of contracts, laws, or regulations.

- **Market/Competitive:** This is the risk of withstanding the likely responses of a competitor through a planned technology improvement, invention, acquisition, price reduction, or similar actions.

- **Operational:** Operational risk is the risk of loss resulting from inadequate or failed internal processes, people and systems, or from external events. Other risk terms are seen as potential consequences of operational risk events. For example, reputational risk (damage to an organization through loss of its reputation or standing) can arise as a consequence (or impact) of operational failures—as well as from other events.

- **Financial:** Financial risk[21] is the risk that an enterprise will not have adequate cash flow to meet financial obligations once the infrastructure is constructed. The community access model recognizes that the retail or open-access model does not work on a stand-alone basis. The financial risks with the retail and open-access models are considerably higher because those models are dependent on subscription rates. Given that it provides ubiquitous access and an equal access platform for private sector access and innovation, community-based funding is appropriate (just like it would be for a road project).

Clearly, the three business models entail different types and levels of these risks—and because the risks have some dependency on each other, comparing models involves making tradeoffs. For example:

- The retail model does not work as a stand-alone municipal enterprise without financial support; it largely avoids political risk, but incurs significant financial and competitive risks.

- The competitive access model does not provide ubiquitous access (i.e., it does not meet one of The City's core goals). And, because it is supported by subscribers, the model creates significant financial risk for the operator.

- The community access model incurs political, legal and legislative risk, but it minimizes competitive, operational, and financial risks. In addition, the community access model aligns best with The City's vision and objectives.

The relative risks of the three business models are shown in Table 3.

[21] The risks associated with issuing significantly large bonds are out-of-scope in this analysis.

Table 3: Business Model Risk Assessment[22]

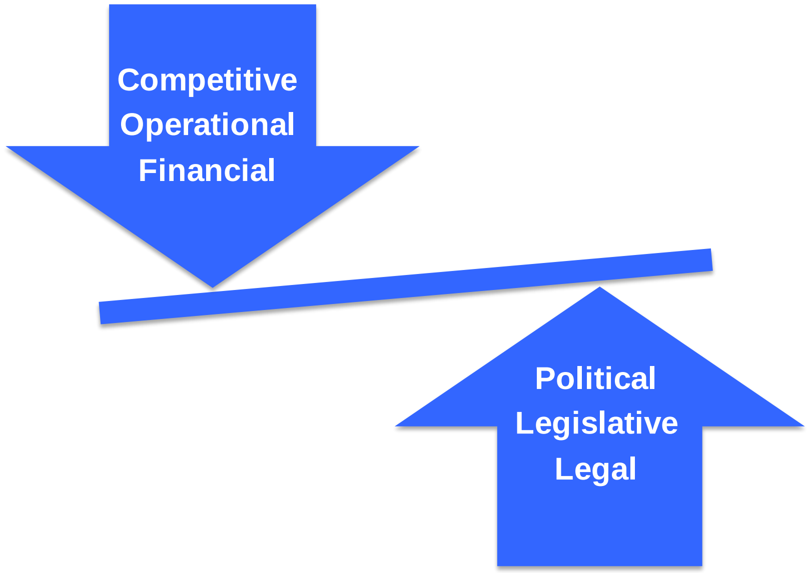
Risk Element	Business Model			Comment
	Retail	Competitive Access	Community Access	
Political	Moderate	Moderate to High	Very High	Local and national providers will fight the community access model. With the other models the fight will remain mainly local.
Legislative/ Regulatory	High	High	Very High	Local and national providers will seek legislation to prohibit community access model and attempt to introduce legislation prohibiting the required financing with the community access model. With the other models the fight will remain mainly local.
Legal	High	Moderate	Moderate	Legal restrictions and regulation apply to primarily the retail providers
Market/ Competitive	High	High to Moderate	Moderate	With the retail model City is responsible for obtaining customers. With other models City focus is on attracting retail providers to the community
Operational	High	Moderate	Moderate to Low	Retail providers manage network end-to-end, including set top boxes and other premises equipment located inside consumers premises.
Financial	High	High	Low	Funding for Community Access not dependant upon attracting new consumers., i.e. financial risk shifted to political.

For The City, the political, legislative, and legal risk inherent in the community access model may be preferable to the competitive, operational, and financial risk (i.e., market-driven risk) inherent in the retail and competitive access models. That is because The City may be better equipped to deal with political, legislative, and legal risk (which are among the core competencies of municipal government entities) than it is to deal with competitive, operational, and financial risk (which are typically faced by corporations and other business entities).

[22] To fully understand the legal risks, The City would need an experienced communications lawyer to evaluate the proposed model and explain more specifically what legal opposition, if any, could be made under federal law.

Figure 1 illustrates the trade-off of risks in comparing the retail model to the community access model.

Figure 1: The Risk Tradeoff – Retail to Community Access



6. The Proposed "Seattle Community Access Infrastructure"

The proposed Seattle Community Access Infrastructure has four main elements:

1. **Physical Plant:** The physical fiber plant and the connections (hardware and fiber drop) to residents and businesses.

2. **Services:** Direct services include the delivery of Internet access, telephone, cable television, and other services by retail providers. The City would also provide a connection service to participating community institutions. Indirect services include The City's monitoring of retail service delivery, including customer service policies and guidelines for retail service providers. The City would also ensure that residents, businesses, and providers have unfettered access to the broadband market.

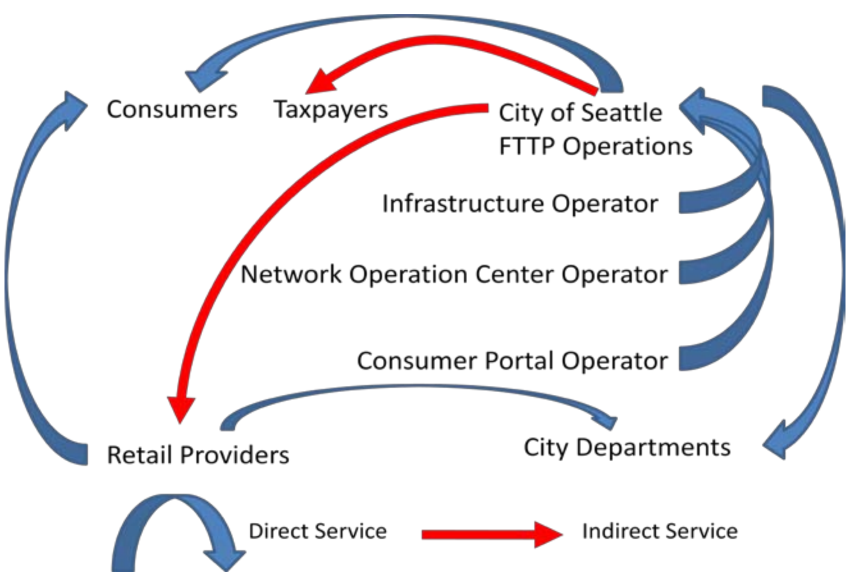
3. **Operations:** The City's oversight of the day-to-day business operations would include:
    a. Operations and maintenance of the physical plant.
    b. Operations and maintenance of network connections to the residential and business consumers.
    c. Operations and maintenance of the consumer access portal (interface) at each consumer location.

    The above operations functions can be performed by The City (i.e., employees) or conducted by private providers under a contract with The City.

4. **Financing:** This includes the funding of the construction of the physical plant, collection of fees and assessments, and funding of ongoing operational and maintenance expenses.

Figure 2 illustrates the above elements and their interactions.

Figure 2: Elements of the Community Access Model



Four basic attributes of this model make it unique:

1. It would be the first community access infrastructure in the United States that connects every residence and business—not just another competitive public or private infrastructure that connects only customers who pay for service. Every residence and business would have access to selected educational, governmental, and healthcare services, as well as a menu of retail services that they can choose to purchase.

2. It would be funded by the community, with a portion of the cost offset by access revenues and governmental/institutional applications.

3. It would explicitly recognize the value of "societal benefits" and account for those benefits in the cost/benefit analysis and business model.

4. It would explicitly assert that advanced technology infrastructure is a public asset, and engage the community as a partner to fund a portion of the infrastructure cost.

6.1 Physical Plant

The physical plant includes the outside plant and the connection to the consumer. These are described below.

6.1.1 Physical Outside Plant

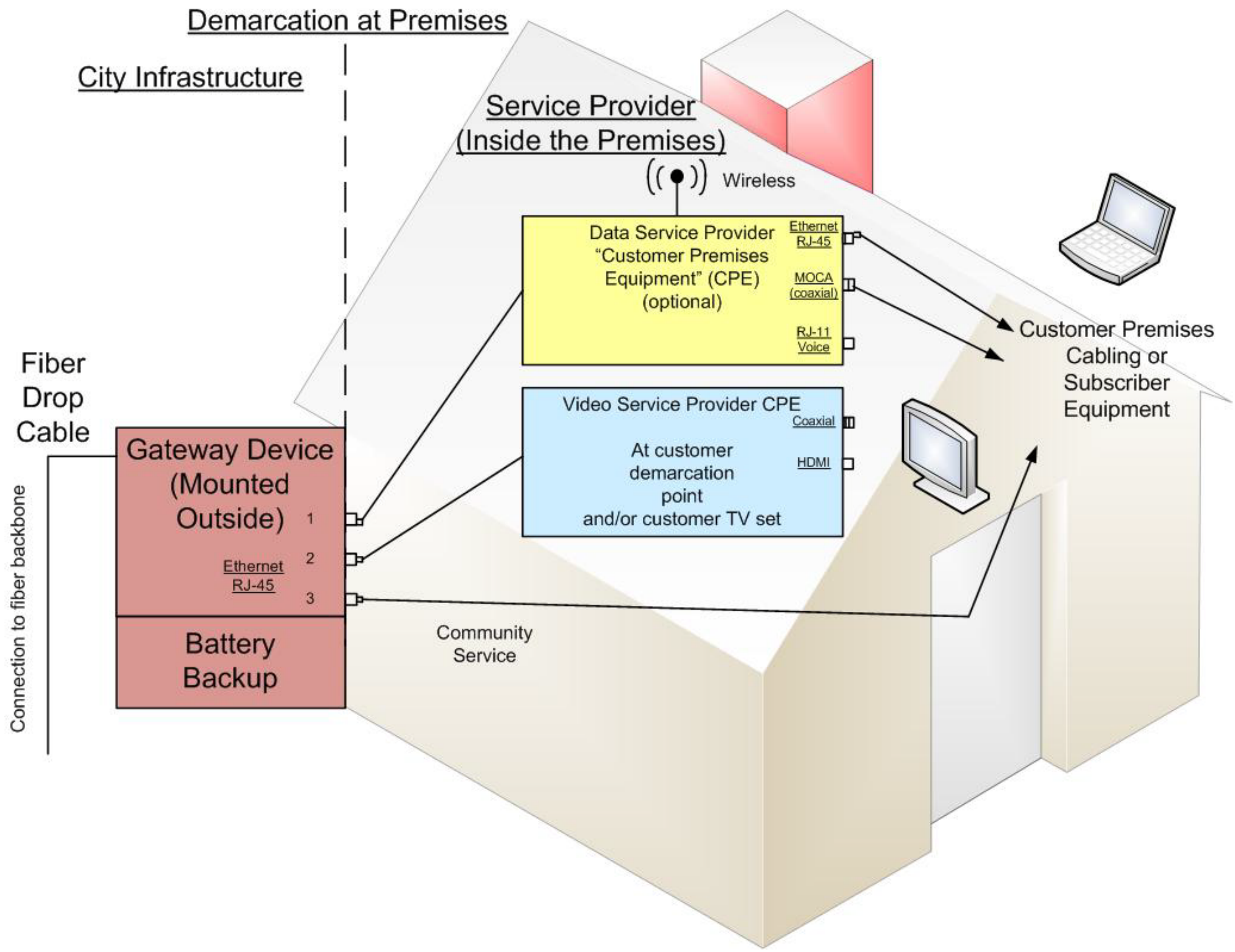
If a network is compared to a house, physical outside plant is the foundation. It includes building entry, central office facilities, physical interconnection, outside cabinets, underground conduit, utility poles, pole attachments, and power. The physical plant architecture must take into account the relationships between the network and relevant entities such as building owners and operators, utility pole owners, easement owners, regulators, and other utilities.

Physical outside plant is generally the portion of the system with the longest lifetime, and therefore can be the most challenging to correct system-wide if it is found lacking, because it is the layer least frequently refreshed and replaced through regular procedures. Fiber based physical plant can last as long as 50 years, with 20 or 30 years as a typical depreciation baseline.

6.1.2 Physical Consumer Interface

In order to provide the desired level of network openness, the infrastructure would terminate at residences and businesses with an electronic device that provides two or more Ethernet interfaces—one for community services, and one or more for private sector service providers (Figure 3). Service providers can provide their own customer premises equipment (CPE) and interface with customers through twisted pair, coaxial, and wireless media, providing data, video, and/or voice services. The City would provision connectivity from the interconnection point to the customer. The service provider would have the relationship with the customer, install services to the customer, and pay a fee to The City for access to the network.

Figure 3: Demarcation Between City and Service Provider at Customer Premises



6.2 Services

The Community Access Infrastructure, an open-access infrastructure that connects every home and business in The City,[23] would be a platform available for use by all qualified public and private service providers. It would serve and support two primary functions:

- "Traditional services" (Internet access, telephone, and cable television) would be sold to residents and businesses by retail providers that have paid The City for access to the infrastructure. In other words, the Seattle Community Access Infrastructure would facilitate a competitive market for these services over a shared platform.

- "Community services" would be offered by local educational, governmental, healthcare, or similar intuitional entities through a free "community portal" website, provided by The City, that is available to all City businesses and residents, even if they do not subscribe to any retail services. Like the "welcome" screen you see when you turn on the TV in a hotel room, the portal would be a free page that lists a menu of options for third-party

[23] Please see Exhibit VI for additional details on the proposed fiber-to-the-premises (FTTP) infrastructure.

content or services. (The City would operate the portal and the infrastructure, but would not create any of the content or services.) Because the institutional entities that offer services would be accessible to every business and residence that has a computer connected to the infrastructure (rather than just those who can afford to pay for high-speed Internet access), those institutions would be able to improve service delivery and efficiencies.

As a result of these services, the Seattle Community Access Infrastructure would provide innumerable "societal benefits" to the community (e.g., economic development and positive social and environmental impacts) in the same way our highway system is the foundation for benefits that flow to all citizens. These benefits would be supported by taxpayers, just like other City infrastructure.

6.3 Operations

Operations include maintaining the physical infrastructure, network operations, and the consumer access portal. These are described below.

6.3.1 Infrastructure Operations

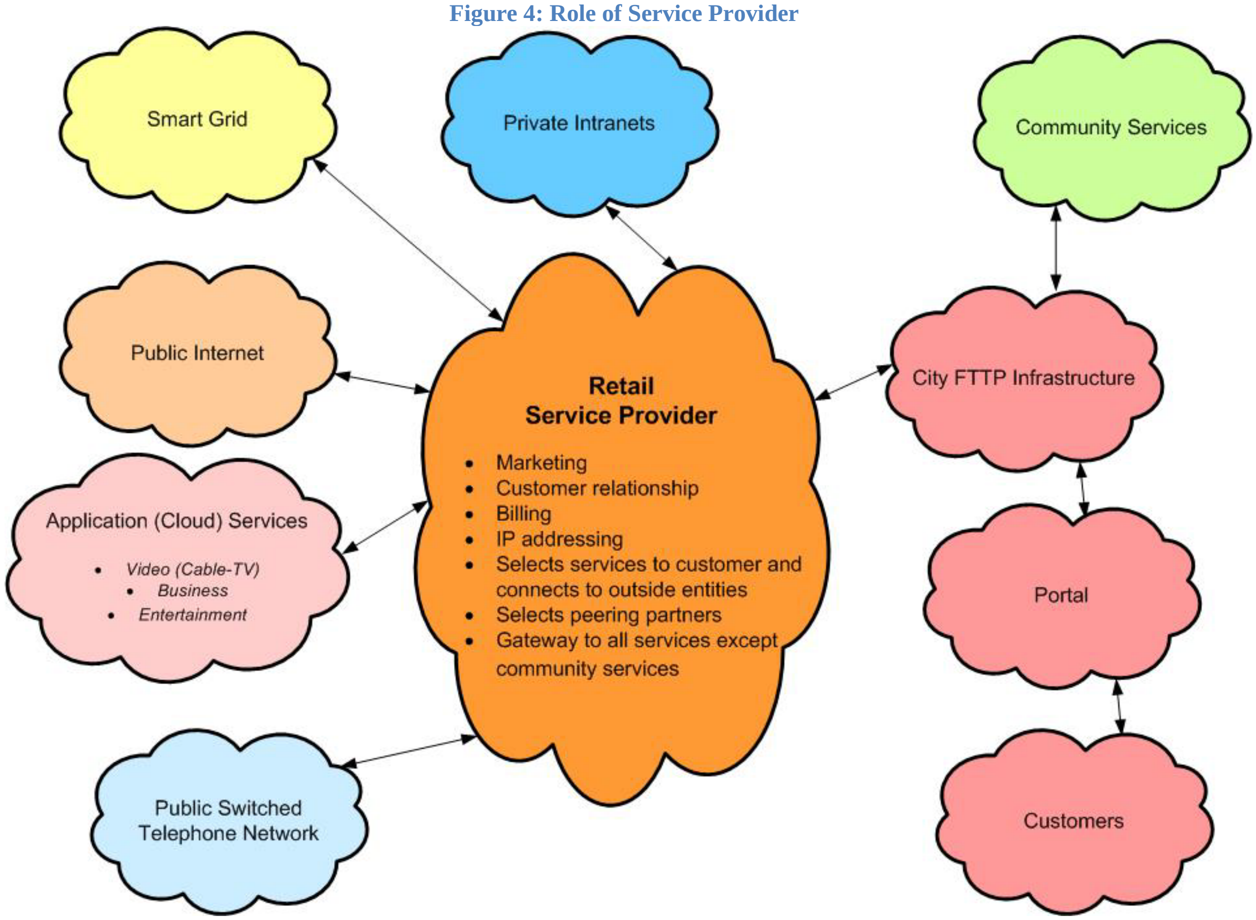
The physical fiber plant requires monitoring for fiber cuts, conducting cable locates for any underground portion of the plant, coordination of relocation of pole attachments and routes in conjunction with road and street maintenance, and maintaining fiber splice and routing records. The infrastructure operator would work closely with the network operations.

6.3.2 Network Operations

The network requires operation and maintenance of all systems from the customer demarcation to the handoff to the service provider at The City's interconnection point. Additionally, The City would operate systems to make community services available to the customer.

The network operation center (NOC) would receive and respond to communications from service providers regarding physical plant and the transport network and would be responsible for establishing and maintaining secure communications pathways according to service agreements between customers and from customers to their service providers (Figure 4). The City and its NOC would be responsible for providing transport services between interconnection points and customers on a wholesale basis according to agreed service levels. The NOC would respond only to service providers and not directly to customers.

Figure 4: Role of Service Provider



The NOC would not provide global Internet protocol (IP) addresses to customers or purchase or maintain connections to the Internet or outside networks. It would not prioritize traffic based on content or be responsible for virus control, e-mail, or other services—in other words, the transport network would be content-neutral. It would not provide value-added applications or user accounts. These roles would be the responsibility of the retail service providers. The retail service providers, in turn, would work directly with the customer, respond to customer requests, and contact The City if maintenance or repairs are necessary.

6.3.3 Consumer Portal

The City would operate a website that provides links to retail providers and access to community services from City government agencies, Seattle Public Schools, the University of Washington, and medical and other nonprofit and educational entities. Because the portal would not require connections to outside networks or Internet capacity, it would be able to deliver bandwidth-rich applications without creating overwhelming bottlenecks in the network.

The portal service would be available to all customers, even those who are not subscribing to the Internet through a private sector service provider.

The portal may include the type of information and government services available on the Web, plus bandwidth-rich applications including live classroom video feeds, telemedicine, energy management, and digital media.

The role of The City would include hosting the Web content portal where customers access community services. It could also include assisting agencies with development of content, and maintenance of content in City data centers.

The proposed portal is described in Figure 5 below. As shown, the portal allows access to community services.

Figure 5: The Community Access Portal

6.4 Financing

It is estimated that The City would spend $700 million to $900 million to build the Seattle Community Access Infrastructure, including costs for planning, design, approval, legal defense, and implementation. Access fees are envisioned to provide a portion of the revenue required to pay for the initiative, but only a share that is justified based on all the other benefits that the infrastructure makes possible. An attempt to fund the infrastructure solely through access fees would place an unfair burden on retail providers (because there are many other benefits as well), constraining competition and therefore adding investment risk to The City. A proportional, balanced approach would yield the best value with the least risk.

Many public investments lead to benefits for society as a whole, the economy, and the private sector. These include highways, sewer systems, parks, and the military to name a few. These public investments are evaluated on their overall merits, not simply on a traditional return-on-investment basis. While the societal benefits are overwhelming, and can be quantified, debate over the value of those benefits is likely. That debate is welcomed, but the risk of a prolonged debate is that The City would slip further and further behind other cities, regions, and countries, both economically and environmentally.

City departments' use of the infrastructure to support their internal operations and distribute applications to residents may provide an additional revenue stream to support the infrastructure.

6.5 Benefits

An important distinction to make is that this is not an infrastructure that just provides another option for selected households and businesses. It is an advanced technology infrastructure that provides ubiquity, consumer choice, and a platform for private sector innovation. As envisioned, many networks and multiple providers would leverage the infrastructure.

With the exception of a few open-access infrastructures, all other public networks models are predicated on competing in the retail marketplace with incumbent providers. While that model offers some limited advantages in some settings, it still only offers a singular alternative and does not create a competitive marketplace. Furthermore, splitting the marketplace and competing head-to-head with well-heeled incumbents has proven financially challenging.

To stimulate The City's economy, innovation must thrive and opportunity must be prevalent. Offering a singular alternative may bring some limited economic benefit, but it does not create conditions for private sector job growth.

The importance of ubiquitous access from the citizens' perspective is its ability to create a level playing field. The service provider's perspective would vary depending on whether the service provider is a retail provider delivering traditional services (phone, video, and data), a City agency, or an innovator/entrepreneur.

The ability for new retail service providers to compete is very limited, primarily due to the high cost of building competing infrastructure. The Seattle Community Access Infrastructure would remove this barrier and allow competitors access to all citizens of Seattle. These competitors would bring both innovation and new jobs to Seattle, and citizens would benefit from real market prices and improved service.

Governmental, educational, healthcare, and other institutional services providers in Seattle could leverage the new infrastructure for "all-inclusive" or ubiquitous service delivery to all citizens of Seattle. The efficiency gains and ability to provide better services are significant. Examples include 24/7 educational opportunities for all citizens, which would create economic stimulus through a citizenry with higher skill sets; real-time access to healthcare applications that can improve quality of life; and the efficiencies gained by governmental/institutional providers that could deliver services over common and shared platforms.

Developing applications and services around constrained infrastructure is a key challenge for technology innovators. A recent example of technology unleashed for the private marketplace is the iPhone, which has spawned more than 250,000 applications—generating a whole new market and economic activity. The Seattle Community Access Infrastructure offers a similar platform for economic growth and innovation.

7. Costs and Financing Options

Financing is one of the largest challenges for fiber-to-the-premises (FTTP) projects. A vast majority of U.S. municipal FTTP projects has been financed with bonds, secured either with established municipal electric or water revenues (revenue bonds), by the general obligation of the community (General Obligation bonds), or with sales tax revenue. The funding of the bonds is typically through subscriber fees. In many FTTP projects constructed in the United States, the net revenues generated by the project have fallen short of expectations—so other municipal financial resources have then been required to support the bond payments.

7.1.Funding Models

We recommend that The City consider funding the Seattle Community Access Infrastructure through bonding supported by assessments on property owners or a similar assessment. Access fee funding is recommended to help offset a portion of operational and maintenance expenses.

Private financing through a partnership with the municipality is often discussed, but no such partnerships have financed FTTP in the United States to date. The common lingering question in these efforts is the type of financing guarantees required by the municipality. For example, in 2006 The City issued a Request for Interest (RFI) for private investment in FTTP. The City offered enticements such as access to various assets, expediting permitting, and other non-cash contributions—yet none of the responses to the RFI offered financing absent City financial guarantees. The City of Palo Alto, California pursued a similar approach and entered into negotiations with a consortium of companies for FTTP financing, construction, and operations. These negotiations broke down when the private consortium required investment guarantees from The City.

If The City moves forward with the Community Access Infrastructure, it will likely go through many iterations during the planning stage—including the possibility of some private investment. Efforts to date to attract private investment in Seattle and other communities in the United States have not worked. In order to make an FTTP project more attractive for a private investor, the ubiquity goal would likely need to be dropped in favor of indirect redlining through the implementation of initial hook-up fees and waiting to build neighborhoods until pre-subscription targets are reached. The more likely participation from the private sector is the design/build/operate (DBO) concept for the network operations, portal, and FTTP plant.

We recommend the following regarding private investment:

- Private investment in the infrastructure is risky. Private entities can largely operate it, but some level of private ownership presents philosophical questions The City must consider.

- Private ownership may be an option, but it may be best to move forward based on the philosophy of “robust public infrastructure supporting an applications market.” That way, the goal and intent is clear. Private investment opportunities may materialize when the initiative is underway; it can be considered as a fallback position at that time.

- Finally, private investment can take a number of forms, including operating the infrastructure (as indicated above) and providing financial support in waging the expected legal, legislative, and public relations battles. This type of investment would offer The City a significant benefit without requiring it to give up infrastructure ownership.

Absent private sector financing, four potential funding models are available to The City. The advantages and disadvantages of each of these are outlined in Table 4.

1. **Equity funding:** Under the equity funding (also known as "co-op" or "customer ownership") model, a combination of private, public, and consumer investment is used to build various parts of the FTTP infrastructure. Generally, subscribers pay an upfront fee of approximately $2,000 to $3,000 for their "drops" (the connection from their home to the cable on the utility pole or underground). Subscribers may also obtain a loan for that up-front fee and make smaller monthly payments over time, possibly rolled into a traditional mortgage. The build-out of the FTTP network is phased by neighborhood and requires neighborhoods to reach a predetermined subscriber level.

   In order to initiate this model, the municipality or infrastructure provider constructs fiber to centrally located equipment cabinets ("nodes") in the target neighborhoods in a configuration designed to support FTTP. In the municipal example, the fiber-to-the-neighborhood (FTTN) financing is accomplished through General Obligation or revenue bonding. Although municipal-backed financing is still required, the total amount of required financing is substantially less than it would be otherwise because consumers are bearing the cost of the attachments to their homes or businesses.

   In the event that the provider is from the private sector, financing for the backbone infrastructure into the neighborhood is presumably private as well—but customers receive some kind of ownership interest in the connection to their homes.

   There are quite a few possible variations of this model, with some difference as to how far customer ownership reaches into the infrastructure and how the ownership is structured.

   This type of financing emerged first in Sweden, where it is referred to as the "co-op" model. The Utah Telecommunications Open Infrastructure Agency (UTOPIA) network followed this model as a strategy to improve the cash flow of its FTTP enterprise and reduce the financing exposure of each participating community; to our knowledge, UTOPIA is the first user of this model for a residential FTTP network in the United States. Variations on this model of customer fiber purchase and ownership appear to have met with some success in Europe, as well.

2. **Bonding supported by access fees:** Under this model, the municipality charges service providers a monthly access fee to cover the required FTTP infrastructure investment, customer drops, and installation costs. Because these costs are presumably passed on to subscribers (in the form of the service providers' monthly bills to them), only customers who

use the infrastructure pay for the infrastructure. Residents who do not subscribe are not charged.

The municipality determines the rate it charges service providers based on the infrastructure's estimated market share. As a result, failure to meet projected market share leads to cash flow shortages, while exceeding projected market share results in cash flow reserves.

Significantly, under this model, General Obligation or other secured bond financing is likely required. Historically, the investment community is leery of securing bonds based on anticipated new revenues.

3. **Bonding supported by property owner assessment:** Under this model, The City assesses all property owners for proportionate shares of the costs of the FTTP infrastructure (including consumer drops, customer premises equipment, and installation). Consumers pay for services directly to the provider of their choice.

   The assessment approach to financing FTTP infrastructure arises from the growing consensus that broadband constitutes an essential infrastructure for the community. Similarly, roads, water supply, and wastewater are all considered essential infrastructure and are publicly financed through an assessment-type approach. In the case of water and waste water, the infrastructure is "bundled" with the service. In the case of toll roads, infrastructure costs are "unbundled" from use (i.e., drivers pay fees only when they use the roads) in a mechanism comparable to that contemplated here for FTTP infrastructure.

4. **Bonding supported by retail subscriber fees:** The majority of municipal FTTP projects in the United States are financed through General Obligation or revenue bonding. Bond payments (principal and interest) are covered by revenues from subscriber fees. Frequently, the municipality seeks a three- to five-year moratorium on principal payments to allow for system expansion and acquisition of a critical mass of paying consumers.

Table 4 presents the advantages and disadvantages of each of the funding models.

Table 4: Funding Model Advantages and Disadvantages

Funding Model	Advantages	Disadvantages
Equity Funding	• Fees apply only to consumers acquiring services	• Low-income areas will require supplemental financing • Multiple dwelling unit (MDU) building owners and condominium association boards must agree to participate for apartments and condos to be included • Does not support ubiquity objectives
Bonding Supported by Access Fees	• Fees apply only to consumers acquiring services • Some investment risk shifted to service provider	• Market will require revenue bonds backed by proven revenues or with General Obligation bonds backed by The City • City absorbs majority of investment risk
Bonding Supported by Property Owner Assessment	• Treats fiber and broadband as essential infrastructure • Lowers investment risk of FTTP	• Potential for legal, political, and regulatory challenges • Voter approval likely required • City absorbs majority of investment risk
Bonding Supported by Retail Subscriber Fees	• Fees apply only to consumers acquiring services	• Market will require revenue bonds backed by proven revenues or General Obligation bonds backed by The City • City absorbs all investment risk

7.2 Bonding Considerations

A variety of bonding types and taxing authorities are available to The City. The regulatory approvals and authorizations will vary between the bonding and taxing alternatives. The City will need to more thoroughly vet these alternatives as this plan unfolds—though it should be noted that the type of bonding chosen will have minimal impact on the initiatives' financial forecast because interest rates, reserve requirements, and issuance costs will be similar (see following section).

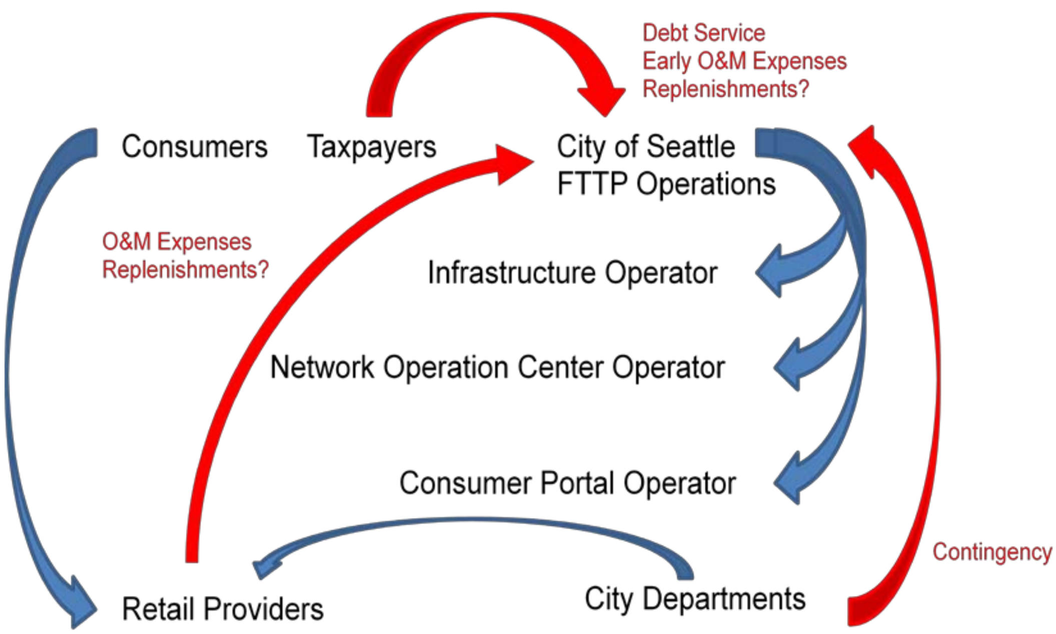
The use of revenue bonds for The City is likely limited. A handful of early municipal efforts were financed through revenue bonds guaranteed solely through anticipated data, video, and voice revenues. However, the willingness of the market to issue bonds on projected revenues quickly closed because the actual results of private and public over-builders did not meet the projected revenues. This market was virtually shut down after a wave of debt restructuring by most private over-builders, as well as the City of Alameda, California's default on revenue certificates used to finance its broadband infrastructure. Further, leveraging Seattle Public Utilities (SPU) water revenues or Seattle City Light (SCL) electric revenues is not recommended given the State of Washington's limitations on the use of these revenues for non-water or non-electric purposes.

7.3 Characteristics of Revenue Generation

One of the most common misconceptions about FTTP over-build projects is that they will be stand-alone enterprises generating sufficient revenue to pay for debt service, infrastructure expansion, replenishments, and operations and maintenance expenses. This is not the case. These enterprises require funding from a variety of sources, including subscriber revenues, City use fees, and tax-based collections in recognition of external benefits.

Figure 6 shows the flow of payments for such services. As seen in the diagram, revenues from general funds will be critical to maintaining the Community Access Infrastructure. These funds will be supplemented by access payments from the retail providers and usage fees collected from other City departments. The relative percentages of these revenue areas will be further vetted in the detailed business plan development.

Figure 6: Community Access Model Revenues



7.4 Financial Analysis

This section provides an overview of The City's estimated funding requirements and ongoing operating and maintenance expenses. In the financial analysis, years 1 to 3 are for planning and implementation. Retail services began at the end of year 3; services, connections to the premises, and subscriptions to retail services ramp up through year 5.

7.4.1 Total Estimated Costs

The cost to implement the FTTP infrastructure is estimated to range from $700 million to $850 million, not including planning, design, legal, lobbying, and other expenses, which could range from $20 million to more than $50 million. Ongoing operating and maintenance costs are estimated to be $23 million to $30 million in year 10. Ongoing equipment replacements could range from $12 million to $24 million per year.

7.4.2 Capital Costs and Financing Requirements

Financing the capital costs of $700 million to $850 million for the Community Access infrastructure would be a significant undertaking for The City. For planning purposes, we have made the following assumptions:

- The City would make three bond issuances,[24] with approximately 80 percent of the amounts issued with the first two bonds.
- The cash financing requirements for each issuance would be determined by The City.
- The bonds would be paid off in equal principal and interest payments over the remaining years of the 20-year project life.
- Issuance costs would be equal to 1.0 percent of the bond principal. A debt service reserve account would be maintained at 5.0 percent of the total issuance amount. An interest reserve account equal to interest expenses for years 1 and 2 would be maintained for the first two years.
- No bond principal payments would be made until year 6.

7.4.3 Ongoing Funding Estimates

One of the key assumptions required in developing a community access model is whether or not an access fee will be charged to retail providers. Our analysis assumes a $10 per month access fee for each voice, video, and data service offered. Using the penetration rates from the feasibility study conducted by Seattle City Light (SCL) in 2008, this assumption yields annual gross revenue of $15 to $20 million by year 5 (i.e., the second year of service offerings).

The bulk of the funding is proposed to be from property tax assessments. Once the infrastructure is completely built, the tax assessment is estimated to be $114 million to $127 million per year, which averages to between $380 and $420 per property. The estimated tax assessments would need to be increased periodically to adjust for inflation and regular increases in expenses.

Interest on excess cash is assumed to be 2.0 percent of the previous year's ending cash balance.

7.4.4 Operating and Maintenance Expenses

Year 10 low-medium-high operating and maintenance expenses are presented in Table 5. The listed expenses are for The City's FTTP operations, the infrastructure operator, the consumer portal operator, and the network operations center (NOC) operator. The City may choose to outsource all functions—except for the FTTP operations—under a design/build/operate (DBO) arrangement or another contract methodology.

[24] This Report does not include a review of The City's bonding capability or review of local or state bonding restrictions. A more detailed review and opinion from The City's accountants of bonding capability and restrictions will be completed in the next business planning phase.

Operating expenses include billing, fiber maintenance, insurance, legal fees, marketing, office leases, utilities, and education and training.

Table 5: Estimated Operating and Maintenance Expenses

	Year 10		
	Low	**Mid**	**High**
Operating Expenses	$11,100,000	$12,700,000	$14,300,000
Labor Expenses	$6,000,000	$6,700,000	$7,300,000
Low-Income Assistance	$6,300,000	$7,000,000	$7,700,000
Total	**$23,400,000**	**$26,400,000**	**$29,300,000**

Operations staffing would be needed to maintain the core network and customer drops, maintain portal operations, handle consumer inquiries, and conduct marketing efforts. The retail providers would handle day-to-day subscriber inquiries. Operational staffing requirements would be minimal for the first two years because much of the planning effort would be done by external resources and non-operations staff. The mid-range operations staffing estimate[25] has the first Seattle staff person added in year 2, growing to 100 staff positions in year 2, 150 in year 3, and 190 in year 5 and beyond. If The City were to pursue a DBO or other contracts for the portal, network, and infrastructure operations, the majority of these positions would be contractor personnel, not City employees.

Salaries and benefits are based on estimated market wages; the analysis assumes benefits equal to 35 percent of base salary. Inflation and salary cost increases were not used in the analysis because it is assumed that cost increases will be passed on in the form of increased assessments.

The expenses include approximately $7 million per year[26] to provide subscription assistance to qualifying low-income households, similar to existing SPU and SCL programs.

This initiative may also have an impact on franchise fees and property taxes collected by The City from Comcast, Qwest (CenturyLink), Broadstripe, and other carriers. Included in the financial model projections is that once the network is completely built (year 6) the new entity would make payments-in-lieu-of-taxes (PILOT) and pay other fees of approximately $20 million per year. These fees and mid-range principal, interest, and expenses are shown in Table 6.

Specific policy recommendations regarding the low-income assistance, PILOT, and other fees will be addressed in the next planning phase.

[25] Estimates are based on experience with other municipal and private initiatives.
[26] The subscription assistance is based on the retail subscribers and ramps up to $7 million by year 6.

Table 6: Expense and Debt Service Summary (Mid-Range Estimate)

	Year 1	Year 5	Year 10	Year 15	Year 20
Operating Expenses	$1,900,000	$12,700,000	$12,700,000	$12,700,000	$12,700,000
Labor Expenses		$6,700,000	$6,700,000	$6,700,000	$6,700,000
Low-Income Assistance		$3,300,000	$7,000,000	$7,000,000	$7,000,000
Principal and Interest		$38,700,000	$80,100,000	$80,100,000	$80,100,000
Taxes		$0	$20,800,000	$20,800,000	$20,800,000
Total	**$1,900,000**	**$61,400,000**	**$127,300,000**	**$127,300,000**	**$127,300,000**

8 The Challenges Ahead: Risks and Sources of Support

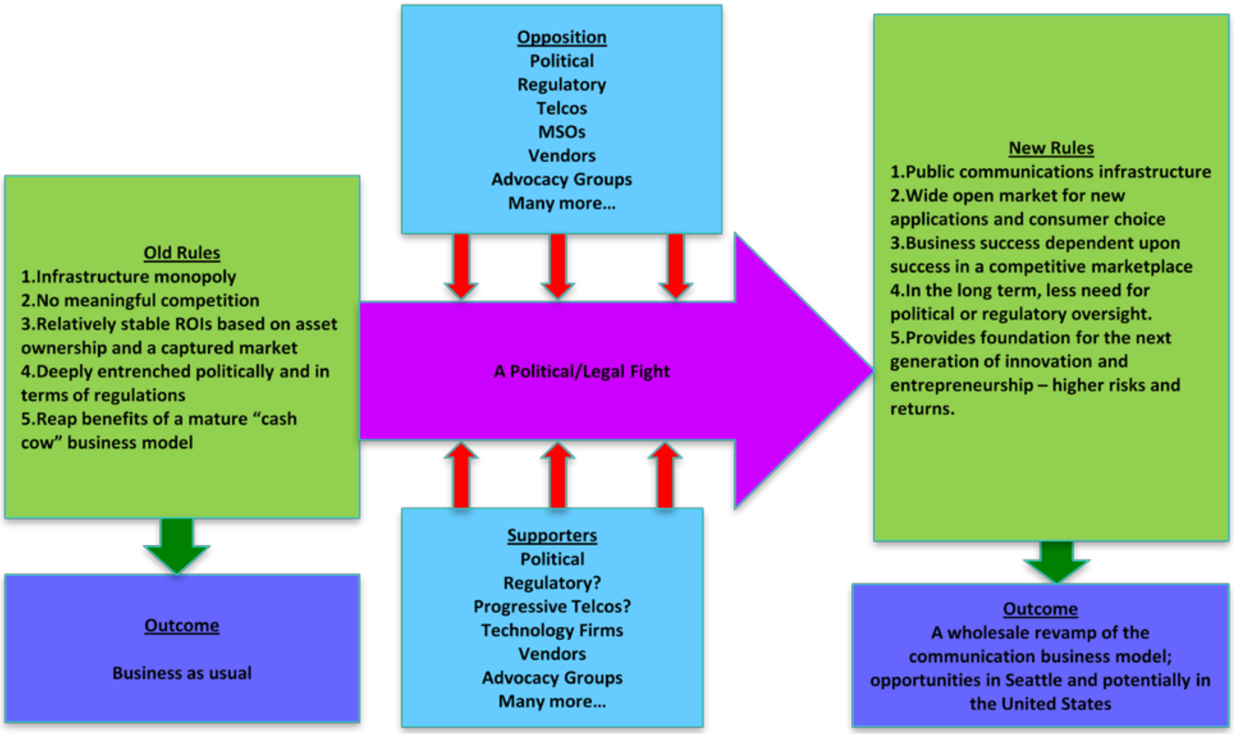
The community access model would be transformational in the communications marketplace for two overarching reasons:

1. It explicitly states that communications infrastructure is a public asset—not a private asset to be manipulated for private gain.

2. It explicitly asserts that, as a public asset, the communications infrastructure should be publicly financed (as is other shared infrastructure).

The seismic shift these changes would bring to the communications market in the United States creates some risk conditions that can be anticipated (and thoroughly investigated) but are not yet empirically tested. The major expected risk elements are political, legislative/regulatory, and legal. Figure 7 below provides a framework for envisioning these risks.

Figure 7: The Community Access Infrastructure Risk Conditions



8.1 Risks

Risk categories were introduced in Section 5.3. The expected risk of the community access model as defined by each risk element is summarized in Table 7 and discussed below.

Table 7: Community Access Model Risk Assessment

Risk Element	Risk Level
Political	Very High
Legislative/Regulatory	Very High
Legal	Moderate [a]
Market/Competitive	Moderate
Operational	Moderate to Low
Financial	Low

[a] To fully understand the legal risks, The City would need an experienced communications lawyer to evaluate the proposed model and explain more specifically what legal opposition, if any, could be made under federal law.

8.1.1 Political, Legislative, and Legal Risk

The political, legislative, and legal risk (here referred to as "political risk") of attempting to deploy any publicly owned communications infrastructure—regardless of the model—is significant. However, in the case of the community access model, the relative political risk as compared to other models considered in this report is expected to be much higher simply because of the scale of the resources likely to be levied against the effort.

Historically, efforts to deploy retail and open-access model networks in other communities have attracted significant local incumbent opposition. This opposition has manifested itself through efforts to sway local policymakers to vote against the venture, by forcing public referendums, and by leveraging the influence of incumbent trade associations to introduce new or amended legislation to block the effort. What's worth noting here is that these infrastructures are rarely publicly funded, nor are they ubiquitous; each is simply a competitive option built under the assumption that the business will be self-sustaining. In addition, the high financial risks these models present to the network operators severely limit the networks' potential expansion, so the networks pose little overall risk to incumbent providers.

An example of the above is the legal and political opposition experienced by Lafayette Utilities System (LUS) when it entered the communications market:[27]

- LUS announced it was considering entering the communications market in April 2004. Rather than sending out surveys to the general public first, and then demonstrate interest, LUS strategically timed going public by announcing its intent and sending out surveys the following day.

- Within two weeks, AT&T introduced state legislation to stop the effort. LUS aggressively opposed the legislation, which in June 2004 yielded a compromise entitled the “Local Government Fairness in Competition Act.” The compromise came with significant restrictions, including requirements for public hearings and independent feasibility studies.

- In November 2004, shortly after the feasibility study indicated that the project should commence, The City Council approved issuing bonds. In December, one month later, AT&T filed suit claiming that public elections were required to approve the bond issuance. A two-year legal battle ensued. Finally, in February 2007, the State Supreme Court found in LUS’s favor allowing the bond issuance to proceed. The legal battle cost in excess of $4 million and, in the G.M.’s words, LUS had “nothing to show for it.” The bonds were finally issued in June 2007, three years after LUS announced its interest in entering the communications market.

- Following AT&T’s loss, AT&T has largely given up any further activity in opposition to LUS. However, the battle rages on with Comcast on a political, marketing, pricing and political front. Comcast has hired a journalist to glean what data they can from LUS, resulting in weekly FOIA requests for financial and other data. In addition, Comcast has filed a claim with the FCC asserting that there is effective competition in the Lafayette market. This removes any consistency requirements in pricing—which allows Comcast to sell services at up to a 50 percent discount.

- Other competitive issues include Comcast’s network upgrades, which allow it to deliver more high-definition (HD) channels than can LUS, and LUS’s inability to acquire programming at reasonable costs since the not-for-profit National Cable Television Cooperative (NCTC) closed its doors to new members. Also, Comcast has poured money in the community to buy favor.

In contrast to the retail and competitive access models, which attract local opposition and attention, the community access model will attract the attention of the entire national communications industry and related industries. That is because publicly financing a high-capacity ubiquitous infrastructure with the expressed intent of fostering real competition and innovation will destroy the status quo. At risk are the entrenched interests of numerous players supported by the current market structure. It is anticipated that every opposition resource (political and otherwise) will be launched against The City.

[27] Based on a conversation with Terry Huval, Director of LUS, on February 14, 2011

As indicated in Figure 7 (above), the scope of stakeholders is wide. In some cases the positions held by these stakeholders can be anticipated; in others the interests they seek to protect are less certain. Selected major stakeholder groups include:

- *Political challengers.* Given the magnitude of industry change that could result from Seattle's community access model, there is no question that nearly every political challenger, at every level and many with very deep pockets, will weigh in. Given the complexity of the issue and modern "sound bite" reporting, the debate is likely to be filled with posturing, emotion, and attacks to sway public opinion. Keeping the debate on point and relevant to the issue at hand may prove challenging.

- *Incumbent telecommunications companies and multiple system operators (MSO).* Incumbents are expected to protect their duopolies at all costs—not only because the Community Access Infrastructure poses a local competitive threat, but also because this model promises a wholesale industry change. Therefore, it is expected that non-Seattle-based providers will aggressively join in opposition for fear of the model gaining a foothold. Their tactics and resource commitment should not be underestimated.

- *Regulators.* Regulation is primarily a tool to balance investment returns (i.e., ensure a return, but not an excessive one) in non-competitive industries. The community access model, which promises to bring a host of retail service providers to the market, may reduce the need for regulation as market forces take root. Whether or not regulators will view the model as a positive step or as a threat is unknown.

- *Vendors.* The engine behind the communications industry is the vendor community, which is the driver of technology and innovation. Vendors may be placed in a somewhat conflicted position in which they must balance short-term sales requirements (dependent on sales to incumbents) with the promise of much larger sale opportunities in a "Community Access world" that opens the doors to public capital dollars and greatly expands the potential for growth. It is possible vendors may play on both sides of the fence.

- *Advocacy Groups.* Advocacy groups are the wild card. They may include literally hundreds of interests ranging from the Chamber of Commerce to AARP. Early efforts to identify these groups to garner support are critical. Bringing them into the fold prior to a public announcement would allow The City to strategically include them as an ally or to prepare counter arguments as the debate becomes public.

8.1.2 Operational, Financial and Marketplace Risk

A key attribute of the community access model is that it limits the project's operational, financial, and marketplace risks. If the Community Access Infrastructure were to be built, its risks in these areas would be low to moderate:

- **Operational risk:** The operation of the Community Access Infrastructure would be split between internal City staff and contracted services with the private sector. As the owner of the infrastructure, The City would retain only those functions that are deemed inherent City strengths or necessary for oversight to ensure system integrity and prudent asset management. Given these constraints, it is likely the majority of the day-to-day network management and operation of the network would be contracted.

- **Marketplace risk:** Marketplace risk with existing business models occurs at the combined infrastructure and service level. An infrastructure investment is required to compete, and the services delivered over that infrastructure are the competitive offering. By explicitly separating the two (infrastructure and services), the marketplace competition occurs at the service layer.

  The threat of competitive entrants into the communications infrastructure market is very low. The City's state-of-the-art, future-proofed infrastructure would be the platform of choice and easily accessible to any qualified service provider—including the incumbents. In other words, the infrastructure would allow service providers to avoid the prohibitive costs of building their own infrastructures. Therefore, the likelihood that the infrastructure would be replicated is low.

- **Financial risk:** Removing market risk (i.e., service revenues are not necessary to recover infrastructure costs) and leveraging public financing greatly reduces financial risk. This is the major element of the community access model that differentiates it from more common models in the market today.

8.2 Potential Sources of Support and Strategic Approach

Preparing a separate analysis of existing conditions and possible scenarios for each stakeholder group will help identify supporters and challengers, and their interests and possible reactions. A high-level look at content providers offers just one example of a stakeholder group's motivations and concerns.

A significant feature of the community access model (outside of ubiquity and public financing) is the clear division between infrastructure ownership and content services. Sharing common public infrastructure has long been a cornerstone of civil society. (Imagine the competitive implications if Ford had built the nation's roadways and only permitted Ford vehicles to access them?) Here, we're applying a well-established model to a new sector.

The current content delivery model is illustrated in Figure 8. The "Marketplace Content" is defined as all non-incumbent content. A view from the content provider perspective yields the following observations:

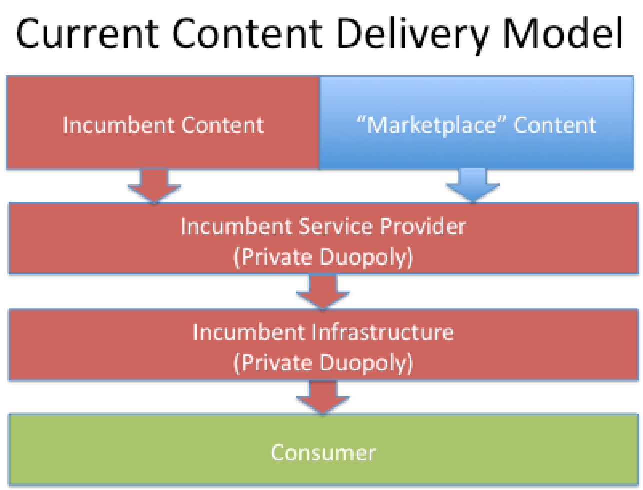
- Marketplace content providers are isolated in the value chain because consumers have to use an infrastructure owned by a competing content provider.

- The incumbents use their advantage as service providers and infrastructure owners to both promote and protect their own content by vigorously opposing net neutrality and limiting third-party access to their content (primarily video).

- The current model likely causes significant lost economic opportunity for marketplace content providers and severely hampers innovation.

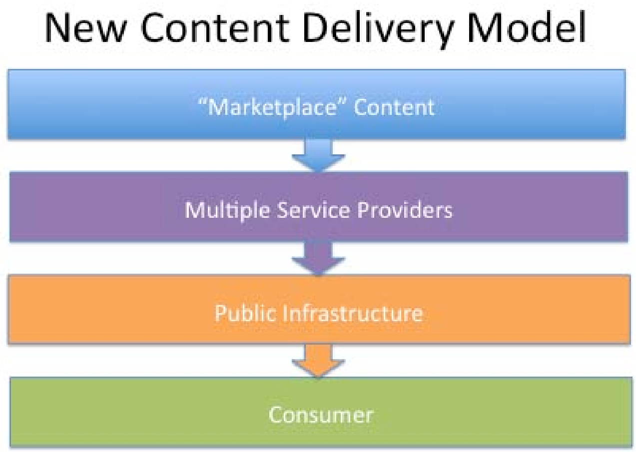
- Infrastructure investment is also "throttled" to not exceed the incumbents' content requirements.

Figure 8: Current Content Delivery Model



The new content delivery model made possible by the community access model (Figure 9) clearly places the marketplace content provider in the value chain as unencumbered and free to deliver value and innovate. The marketplace content providers range from Google and Microsoft to "two guys in a garage with a server and an idea." The potential to build significant support among this stakeholder group is considered very high.

Figure 9: New Content Delivery Model



9 The Planning Process

This section provides a high-level roadmap of next steps. The next steps are predicated on three activities that are likely to occur in parallel:

1. Retain a team with the requisite skill sets.
2. Immediately begin a detailed and accurate—yet swift—business planning process.
3. Defend against an immediate reaction from the industry.

Incumbent providers and, possibly, the entire industry will likely attempt to prevent the project from moving forward. The scale of the opposition effort may be unprecedented. If The City's plan has not yet been fully developed, those who oppose the project may claim The City is incapable of a successful project (not to mention objecting on legal and philosophical grounds). Successfully defending against industry opposition long enough to develop a detailed business/operating plan is expected to be the first key hurdle. With this challenge in mind, we recommend that The City's first step should be to quickly develop an internal team that can take the project to launch.

9.1 Project Team Requirements

All decisions that lead to ultimate project success reside with the experience, skill and dedication of the team. While the assistance of external resources is critical and will be required, the core team is needed both in the development stage and during ongoing operations. The external resources should be deployed as a matter of scale—for example, a pending legal battle or intensive lobbying effort. But as a matter of scope (the subject matter expertise to meet the challenges of owning and operating an advanced communications infrastructure), it is strongly encouraged to retain those skills on a full-time basis.

The team described below is recommended to take the project to launch. Following system launch, many of these skill sets would be required as long as The City owns the infrastructure—though the responsibilities of some members may vary during the ongoing operations phase.

1. Overall Team Leader
    a. *Status:* Internal full time direct report to the Mayor
    b. *Qualifications:* Broad experience with a proven track record in all facets of the project, exceptional leadership, communication and organizational skills.
    c. *Responsibilities:* Provide strategic leadership and coordination of all facets of the project. Provide direct supervision to all other team leaders. Balance needs of competing internal and external interests with overall project goals. Serve as primary advisor to the mayor.
    d. *Recommended support staff:* 1

2. Political/Lobbying Team Leader
    a. *Status:* Internal full time.

   b. *Qualifications:* Deep relationships with the lobbying community, state government/legislators and local government. Well-versed in communications and broadband marketplace and players.
   c. *Responsibilities:* Lead the entire lobbying effort at the local/state and federal level.
   d. *Recommended support staff:* 2-3
   e. *Recommended contract lobbyists:* Unknown. 40-75 estimated.

3. Legal/Regulatory Team Leader
   a. *Status:* Internal full time.
   b. *Qualifications:* Strong, demonstrated knowledge of communications, broadband marketplace, and related law/regulations on the state and federal levels. Possesses a successful, proven track record in successfully advocating for and defending public infrastructure projects.
   c. *Responsibilities:* Lead entire legal effort at the state and federal levels. Direct and lead bond-counsel and financing efforts.
   d. *Recommended support staff:* 2-3
   e. *Recommended contract attorneys:* Unknown. 10-20 estimated during peak activity.

4. Offensive Strategy Team Leader
   a. *Status:* Internal full time.
   b. *Qualifications:* Former executive level private carrier/cable leader with extensive legal/regulatory/strategic experience.
   c. *Responsibilities:* Create strategies and tactics to challenge opposition efforts.

5. Business Plan/Operations Team Leader
   a. *Status:* Internal full time
   b. *Qualifications:* Demonstrated technical and financial leadership in the management, construction and operation of large fiber-optic communication systems. Exceptional communication and organizational skills required.
   c. Responsibilities: Lead development of business plan. (See section below for further detail)
   d. *Recommended support staff:* 2-4
   e. *Recommended consultants:* 2-4

6. Public Relations/Messaging Team Leader
   a. *Status:* Internal full time
   b. *Qualifications:* Demonstrated success with developing successful public messaging strategies for complex controversial projects for the public sector. Strategic and tactical expertise in message crafting, testing and delivery.
   c. *Responsibilities:* Lead public relations effort and coordinate all external-facing activities.
   d. *Recommended support staff:* 1-2
   e. *Recommended public relations consultants:* Unknown. Estimated 5-10.

7. Customer Portal Team Leader
    a. *Status:* Internal full time
    b. *Qualifications:* Strong knowledge in the use of advanced communication technologies across industry sectors. Excellent communication skills. Knowledge of local institutions, economics and business leadership strongly preferred.
    c. *Responsibilities:* Lead development of the customer portal including technologies; provide guidance to institutions regarding applications and potential efficiencies; monitor, test and expand customer adoption.
    d. *Recommended support staff:* 1-2
    e. *Recommended consultants:* 2-4

9.2 Business Planning Next Steps

Completion of a detailed business plan done in a timely manner is critical to maintain momentum and to have the ability to answer questions posed by legislators, incumbents and the public. Clearly, the challenge is that when the plan is announced, many of these questions beyond the vision, goals and model selection will not yet be developed.

The high-level recommended business planning action steps are:

1. Develop refined capital costs
    a. Develop RFI for system infrastructure design and cost
    b. Develop RFI for network design and cost
    c. Develop RFI for physical facilities needs analysis

2. Develop refined operations costs
    a. Define The City's role in detail, including policies and associated costs
        i. Overall system management strategy
        ii. Customer portal
        iii. Retail service provider management
        iv. Institutional services
        v. Refine and define The City's core competencies.
            1. Establish guiding principles and parameters for City involvement.
            2. Consider developing a "self check" team to scrutinize The City's planned involvement at each step of the project, keeping in mind that less direct involvement may mean less scrutiny.
    b. Define role of private sector contractors/operators and associated costs
    c. Define all other standard operating costs

3. Develop and refine revenue forecasts
    a. Assemble team to evaluate revenue split alternatives and price points, and to choose revenue model

4. Assemble and coordinate all other business-planning elements developed by the team leaders of each respective discipline

9.3 Immediate Legal, Legislative, and Public Relations Activities

Given the nature and profile of the proposed project, The City's leadership can expect an extreme drain of time and resources. In addition to the additional staff dedicated to the effort, the sheer volume of expected activity will impact City leadership significantly.

As soon as possible, City leadership and the project team (as they come on board) must develop a strategy to:

- Begin development of public messaging. Based on known missteps with similar launches, the public-facing communication needs to be tightly managed and controlled. During the early stages, we recommend sticking to a simple message and avoiding over-promising.
- Share vision with leaders of the local business community. These high-level discussions are critical to gaining private sector support. The commitments required will demand significant effort and time from the highest levels of City government.
- Build a base of support among small, local, and entrepreneurial Internet service providers (ISP)—which would greatly benefit from The City's plans and can help to counter the inevitable incumbent message that this infrastructure is unfair to the private sector.
- Develop and implement a strategy to secure support and protection both in Olympia and in Washington, D.C.

In summary, the challenge of the next steps is the three activities that must occur nearly simultaneously. And these activities will play out in the public arena. No amount of time, resources, and preparation will be too much.

9.4 Estimated resources

The cost for annual staffing requirements, as recommended above, ranges from $2.5 million to over $3 million. Annual outside services to include lobbyists, legal staff, a public relations firm, and consultants might range from $20 million to well over $50 million depending upon level of activity. Clearly, the project planning phase can quickly drain resources so focus and dedication to launching as early as possible is critical.

10 Reference Material

The following reports and studies provide background and support for the points raised in this document:

Beloit College. (2010). *Beloit College Mindset List for the Class of 2014.*

Berkman Center for Internet & Society at Harvard University. (2010. http://cyber.law.harvard.edu/pubrelease/broadband/ (accessed January 27, 2011).). *Next Generation Connectivity: A Review of Broadband Internet Transitions and Policy from Around the World.*

CTC. (2010. http://www.sba.gov/advo/research/rs373tot.pdf (accessed December 9, 2010).). *The Impact of Broadband Speed and Price on Small Business.*

CTC. (2009). *Benefits Beyond the Balance Sheet: Quantifying the Business Case for Fiber-to-the-Premises in Seattle.* City of Seattle.

CTC. (2008). *Evaluation of Potential Risks and Benefits of Municipal Broadband.* Seattle City Light.

Division of Health Interview Statistics, National Center for Health Statistics. (2010). *Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, July–December 2009.* U.S. Centers for Disease Control and Prevention.

Federal Communications Commission. (2010). *National Broadband Plan: Executive Summary.*

Palmer, B. (2010, September 7). Green Lantern: Environmental benefits of telecommuting are not universal. *Washington Post*.

Pew Internet & American Life Project. (2010). *Cell Phones and American Adults.*

Pew Internet & American Life Project. (2010). *Home Broadband 2010.*

Pew Research Center for the People & the Press. (2010). *Assessing the Cell Phone Challenge to Survey Research in 2010.*

Pew Research Center. (2010). *The Fading Glory of the Television and Telephone.*

Washington State Broadband Programs Office (2010). *Creating Opportunities for Washington.*

Exhibit I
Excerpt: Benefits Beyond the Balance Sheet

Seattle Community Broadband Initiative

The benefits of a fiber-to-the-premises (FTTP) network in Seattle fall into two distinct categories: Direct and indirect benefits. While both represent the return on a potential investment, the indirect benefits would not accrue to the City's balance sheet. That said, indirect benefits represent a potentially significant pay-back on the City's investment in a fiber network—more than $1 billion *annually* in benefits accruing to all of the stakeholders in the City (as well as, in some cases, King County, the state of Washington, and beyond).

Indirect benefits include a range of quality-of-life improvements, such as reduced traffic congestion and enhanced quality of healthcare. As described in a 2009 report (*"Benefits Beyond the Balance Sheet: Quantifying the Business Case for Fiber-to-the-Premises in Seattle")*, the indirect benefits of a fiber network also represent quantifiable savings to residents, businesses, institutions, and the City itself. These fall into three general categories: Cost avoidance, monetary savings accruing to stakeholders, and environmental benefits.

Cost Avoidance

These are budget items that the City would otherwise have to fund, but that it avoids with a fiber network. These items include both current and future expenditures. For example, the Department of Information Technology (DoIT) spends approximately $4 million annually on leased communications services, and estimates that approximately $1 million could be avoided by transferring services to an FTTN network.[1]

Monetary Savings Accruing to Stakeholders

This category represents the largest quantifiable benefit of an FTTN network in Seattle, primarily related to increased telework ($324 million) and reduced healthcare expenditures ($602 million). As indicated in Table 1 the annual estimated savings approaches $1 billion.

[1] Using the FTTP infrastructure for SCL Smart Grid/AMI and SPU AMI could lead to potential cost avoidance-benefits. However, a substantial investment in Smart Grid and AMI technologies would be required to realize these benefits. Please see Exhibit V for additional details.

Table 1: Estimated Annual Stakeholder Savings ($000,000)

Benefit Area	Annual Savings Estimate ($000,000)
Environmental Benefits	
Increased Telework	
Vehicle Expenses	$ 52.80
Time Savings	48.40
Traffic Congestion	215.30
Electricity Savings	0.15
Teleconferencing	7.40
Total Environmental Benefits	$ 324.05
Reduced Cost and Enhanced Quality of Healthcare	
Lowered Transportation Costs	
Emergency Department Transfers	$ 1.05
Correctional Department Transfers	0.16
Avoided Benefits- Nursing Homes	0.92
Improve Medical Efficiencies	100.90
Medical Cost Savings	
Asthma	1.12
Diabetes	108.00
Cardiovascular	390.00
Total Health Care Benefits	$ 602.15
Miscellaneous Benefits	
Enhanced Competition	$ 33.07
Total Miscellaneous Benefits	$ 33.07
Total Estimated Benefits	$ 959.27

The calculation of savings that are related to telework—mostly reduced automobile expenses—are based on statistically valid market research CTC conducted in Seattle, though they do depend to some extent on real-world consumer behavior and other externalities.

The healthcare cost savings may be somewhat more optimistic, given that realizing all of them would require a range of intermediate steps, including the installation of network infrastructure at hospitals and the development of a critical mass of residents who are both fully computer literate and have necessary computer hardware in their homes. Direct benefits in this category include cost savings related to aging-in-place for senior citizens, enhanced video surveillance and security, more efficient government services, "in-sourcing" of tele-jobs, and enhanced competition in the retail broadband market.

Many of these savings would be offset to some degree by savings that are or could be realized through currently available cable modem or DSL "broadband" service. However, it is important to put that term in perspective: The Federal Communication Commission's 2008 definition of "basic broadband" is downstream—not symmetrical—speeds between 768 Kbps and 1.5 Mbps. That's higher than the previous definition of 200 Kbps but still laughably low. As one observer has noted, it would take 8.16 hours to download a movie under the old broadband definition; at the new definition, an American with basic broadband would still need 2.12 hours to complete the download.[2] So the high *symmetrical* speed of 100 Mbps or more delivered by a fiber network

[2] The FCC recently redefined broadband by setting a universal benchmark 4 Mbps downstream and 1 Mbps upstream (actual, not advertised) speed. While this is an improvement over the 2008 definition, it is still *orders of*

would enable many applications and services—especially related to telework and healthcare—that simply would not be possible with cable modem or DSL service.

Positive Environmental Impact

Though there are no quantifiable direct benefits to be derived from an FTTN network (e.g., selling carbon credits), the potential environmental benefits are significant. Reduced automobile travel related to increased telework, among other sources, could lead to an annual reduction of approximately 535 million kilograms of CO_2 of emissions. The detail of the projected emission reductions are shown in Table 2.

Table 2: Estimated Annual Emission Reductions

Benefit Area	Annual CO_2 Reduction Estimate (million kilograms)
Increased Telework	
Vehicle Emissions	40.30
Traffic Congestion	481.36
Teleconferencing	13.04
Total Environmental Benefits	534.70

magnitude slower than the speeds that can be delivered by a fiber network using existing, off-the-shelf technologies. See: Federal Communications Commission. "In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion (GN Docket Nos. 09-137, 09-051)." *Sixth Broadband Deployment Report*. July 20, 2010. http://www.fcc.gov/Daily_Releases/Daily_Business/2010/db0720/FCC-10-129A1.pdf.

Exhibit II
Tools to Evaluate Market Concentration and Competition

Seattle Community Broadband Initiative

Evaluating Markets

A market, generally speaking, is a place where sellers offer products or services to buyers. The bazaars found in ancient cities provide the blueprint for this sort of commerce. But catalogs and Internet "storefronts" mean that the market for most products is now a concept rather than a physical location; and because buyers can order just about any product from a range of different sellers, they can search out the best price for whatever it is they want.

In contrast, the market for broadband service to a home or business is severely restricted. Because broadband service requires installed infrastructure rather than just package delivery, buyers are limited to whatever services are offered to their locations—and to whatever price those sellers are charging. Government regulators and business analysts have devised a variety of tools and approaches to analyzing concentration and competition in markets like this, including the Herfindahl-Hirschman Index and Porter's Five Forces Model.

The Herfindahl-Hirschman Index

The most commonly used measure of market concentration or market competition is the Herfindahl-Hirschman Index (HHI), which is used by the U.S. Department of Justice (DOJ) when reviewing potential mergers.[1] The HHI, which is an index to define the level of market concentration, sums the squares of market share percentage for all companies in a market. In proposed revised guidelines released for public comment on April 20, 2010, an HHI of less than 1,500 represents a relatively unconcentrated market. An HHI between 1,500 and 2,500 represents a moderately concentrated market. Any industry with an HHI greater than 2,500 is considered to be "highly concentrated." In markets with an HHI greater than 2,500 there would be serious anti-trust concerns over a proposed transaction that would increase the HHI by more than one hundred points.

Calculating the HHI on a market-by-market basis clearly shows that broadband Internet service is heavily concentrated and that such limited competition means that consumers have few choices. Many providers will disagree with this conclusion and attempt to "prove" their position by looking at market shares on a national basis; however, national market share is not a valid aspect of an HHI calculation. Competition must be measured from the consumer's perspective—that is, the alternatives available to an individual consumer at a given location, noting that consumers do not have access to the services offered by all national providers, only those available at their home or business address. (See, for example, Figure 73, which indicates the variability of service availability in different regions of the county.) In other words, the HHI must be calculated on a market-by-market basis. Further, the addition of another provider in a

[1] U.S. Department of Justice, "Herfindahl-Hirschman Index."

market will not necessarily make the market competitive; a competitive market must not only offer a choice of providers, but those providers must each have a reasonable share of the market.

As an illustration, consider the Internet services market in the city of San Francisco. Given that the city has multiple Internet providers one might expect that residences and business enjoy the benefits of a competitive Internet market. Market research conducted in the summer of 2008 enabled computation of the HHI for San Francisco's residential Internet market. As seen in Table 3, given that AT&T and Comcast had a combined 85% market share, the HHI was quite high (over 3,230). If AT&T and Comcast were to reduce their market share to 34% each and if AT&T's and Comcast's lost market share were spread evenly among other providers, the HHI would drop dramatically to approximately 2,400—a level the DOJ would consider moderately concentrated. However, if AT&T's and Comcast's lost market share were to shift to only one other provider, the HHI would drop only to approximately 2,540—and the market would still be considered "heavily concentrated" or one with limited competition under the proposed DOJ definition.

Table 1: HHI Calculations for San Francisco

Provider	Market Share (%)	Square of Market Share
AOL	4.40	19.40
Astound (RCN)	1.86	3.44
AT&T	44.30	1,962.44
Comcast	34.69	1,203.67
Earthlink	4.12	16.96
Meraki (Free-the-Net)	0.41	0.17
Other	4.51	20.36
Covad	0.75	0.56
DSL Extreme	0.37	0.14
Net Zero	0.82	0.67
People PC	0.32	0.10
Sonic	1.05	1.09
Speakeasy	0.97	0.94
Verizon	0.37	0.14
Web Pass	1.06	1.13
Total	100.00	3,231.22

Source: Market research conducted by CTC

In order for a market to be competitive, then, consumers need a choice among a range of providers, no single provider can have a majority market share, and many providers (not just two or three) must have significant market presence. When the infrastructure is bundled with the retail service and left largely unregulated—as it is with cable modem and DSL services—

reaching a competitive market in a given community will be difficult, if not impossible, to obtain.

The Porter Five Forces of Competition

We are dealing with an industry that is dominated by large firms with large sunk costs. It was not so long ago many of these firms were regulated utilities. In a majority of markets where broadband is available, competition has essentially been reduced to a duopoly between telephone and cable companies. Moreover, the industry is typically, in effect, an unregulated duopoly with little to no oversight. While there are a number of different phone and cable providers in the United States (which, it could be argued, constitutes a “market”) there is in fact typically only one cable company and one phone company serving a given geographic area. When available wireless providers do offer another alternative, however, they provide services that are not as robust as cable modems or DSL and they still do not make the market competitive. Whether these providers offer retail services directly to the consumer or indirectly by providing connectivity and backhaul to smaller independent service providers (wireline or wireless), they are well entrenched in the value chain.

Examining existing market conditions in the United States with the Porter’s Five Forces Model—the framework developed by Michael Porter,[2] a professor at Harvard Business School—provides insight into broadband market conditions for small business customers. It is critical to distinguish the difference between the transport (infrastructure) and the service. The lack of competitive open access to infrastructure limits the ability of competitive ISPs and other information service providers to offer new and creative services to small businesses.

According to Porter, competitive rivalry within an industry is determined by conditions related to five factors. These factors and their relationship to infrastructure are:

- **Intensity of the Rivalry.** The U.S. broadband market contains, at best, a few service providers in a given market; essentially one or two infrastructure providers in markets where service is available; high fixed costs (for building and maintaining infrastructure), resulting in high market-entry barriers; and high exit barriers (for existing providers to leave the market). Furthermore, incumbent providers do not have an “obligation to serve” and face little to no threat to market share or profits because the barriers to entry are very high.

  The rivalry between incumbent broadband providers may be evident at times (on a price basis), but other rivalry considerations indicate that the market otherwise lacks competition. When consumers have only one or very few service provider options for an essential service, the industry is typically regulated. Absent regulation, the fewer the service providers, the higher the prospect of excessive profits, poor service, or both—which is the condition seen in the United States for Internet service.

[2] Porter, *Competitive Advantage*.

- **Threat of New Competitors.** The barrier to entry for potential infrastructure overbuilders is cost. Duplicative infrastructure costs make the prospect nearly impossible due to a number of factors, including limited rights-of-way, pole congestion, access to existing internal building or home wiring, and material and labor costs.

- **Threat of Substitute Products.** While it may seem that satellite is a substitute for wireline broadband infrastructure (see discussion in Appendix E) the limited capability and high cost of connecting to the satellite network as compared with a wireline network dispels that notion. Likewise, the relatively limited speed of wireless networks, their caps on bandwidth usage, the difficulty providers are having keeping up with growth in demand, and the fact that wireless traffic is ultimately handed off to wireline infrastructure mean that wireless networks are not full competitors with wireline networks.

- **Bargaining Power of Buyers.** Alternative Internet providers that want to enter the market also have limited buying power, in terms of access to the Internet (capacity) and access to existing infrastructure. The alternative providers must acquire this access from the incumbent providers with which they compete in the retail marketplace. The incumbent providers will price wholesale access to the Internet and their existing infrastructure at a level similar to what they charge on a retail basis—making it difficult or impossible for new entrants to offer a competing retail service.

- **Bargaining Power of Suppliers.** Suppliers (owners) of Internet infrastructure are few and they have substantial market power. As indicated above, the suppliers are often the incumbent retail cable and DSL providers. This condition exists both in metro and rural markets. Without access to competitive wholesale and infrastructure markets, small business providers will not be able to offer competitive and innovative retail services.

Exhibit III
The Closing of the Broadband Market to Small Business Providers

Seattle Community Broadband Initiative

One of the unfortunate byproducts of recent broadband regulatory change has been the exclusion of small businesses from the broadband provider/ ISP market. While this outcome was likely unintended by regulators, tens of thousands of existing U.S. small business ISPs were effectively removed from the market over the course of the past decade—resulting in a far less robust competitive market and in the decimation of a small business economic sector.[1]

To understand how this change happened, the history of small businesses in the Internet market must be understood. The early commercial Internet offered small businesses enormous opportunity as the Internet experienced explosive growth in the 1990s, with the number of households subscribing to dial-up access increasing from one million in 1990 to nearly fifty million in 2001.[2] This growth was enabled in part by the access to an unrestricted communications network that thousands of independent ISPs—many of which were small businesses—used as the basis of their offerings. This competition-rich market fostered innovation and lowered the prices that small businesses *consumers* paid for Internet access, as well as creating a dynamic small business *provider* market.

In the formative days of the commercial Internet, customers used their computers' modems to access the Internet over dial-up telephone circuits. Subscribers plugged their modems into their standard telephone line and dialed their chosen ISP; this was just like making a regular telephone call, but instead of a person talking to a person, the subscriber's computer used the phone line to "talk" to the ISP. Customers paid separately for their telephone service and their ISP's dial-up Internet access.

This system (in which Internet service could be purchased separately from the "pipe" that transported it) fostered competition among ISPs, including many small businesses. Indeed, the ISP industry—mirroring the number of households subscribing to dial-up Internet access—experienced remarkable growth in the 1990s. The number of ISPs increased from roughly four hundred to five hundred in the late 1980s to between seven thousand and eight thousand providers in the late 1990s—on the order of ten to fifteen ISPs per one hundred thousand subscribers.[3] Because a successful dial-up ISP required no more than a few hundred customers to finance a modem pool and Internet connection,[4] many of these ISPs were small businesses.[5]

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[1] Advocacy expressed its concern over the impact that FCC rulings would have on the Internet market in letters submitted to the FCC in 2002 and 2003. See Sullivan, Menge, and Saade, 2002, and Sullivan, Menge, and Saade, 2003.
[2] Cooper, "Importance of ISPs."
[3] Cooper, "Importance of ISPs," 6.
[4] Cooper, "Public Interest," 58.
[5] Ibid., 55.

The large number of ISPs also benefited small business customers by helping to expand the Internet based businesses (eBay, Amazon, Yahoo) and providing Internet access that was previously unavailable to them. The explosion of ISPs brought the Internet to homes and small businesses. By competing with one another for market share, providers opened markets that were ignored by larger ISPs, prompting dominant firms to provide services that might have been unavailable absent the competition.[6]

Competition also reduced subscription rates, making Internet access more affordable for small businesses. To further compete, the ISPs offered personalized customer service and hands-on support, such as house calls and complimentary software installation.[7] As a consequence, there were few "plain vanilla ISPs"; instead innovative providers offered customized services to satisfy particular customer interests.[8] Moreover, because of their localized knowledge, these small business providers were uniquely positioned to address site-specific user needs. Small ISPs also provided intangible benefits. As a Sonic.net subscriber wrote in 2000, "[I]f I bailed out of this small, familiar place tomorrow and signed on with AOL, or AT&T Worldnet… I would miss the satisfaction I get whenever I drive into town and pass the Sonic.net offices and imagine them in there."[9]

Over time, the Internet—and ISPs—evolved. The bandwidth needed to access the newest types of online content exceeded the capabilities of dial-up modem connections, prompting consumers to seek the higher-capacity service offerings of advanced telecommunications networks. Digital Subscriber Line (DSL) ISPs, which bundled Internet service and the "pipe" through which it was delivered, emerged as a promising alternative. DSL providers leased wholesale circuits from the incumbent telephone company, provisioned the circuits for DSL, and sold basic Internet access along with specialized applications and services to subscribers.

The ability of ISPs to lease circuits from the telephone company promoted competition among DSL providers. DSL providers were recognized as "common carriers" under The Telecommunications Act of 1996.[10] As such, the Federal Communications Commission required telephone companies to grant DSL providers open architecture and nondiscrimination in access to their networks, allowing DSL providers to use the networks on terms and conditions identical to other carriers.[11] This "open, ubiquitous" access led to an emergence of an industry of DSL ISPs, including small businesses, and was thought to be "among the most critical conditions for the success of the Internet" at that time.[12]

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[6] Ibid., 7.
[7] Hafner, "In Praise."
[8] Cooper, "Public Interest," 58.
[9] Hafner, "In Praise."
[10] *Telecommunications Act of 1996*, Public Law 104-104, *U.S. Statutes at Large* 110 (1996).
[11] U.S. Congress, "Conference Report, Telecommunications Act of 1996" (stating that the Act is intended to open up markets to competition by removing unnecessary regulatory barriers to entry: "to provide for a pro-competitive, de-regulatory national policy framework designed to accelerate rapidly private sector deployment of advanced services and information technologies and services to all Americans by opening all telecommunications markets to competition....").
[12] Cooper, "Public Interest," 1-2.

As cable operators deployed cable modem service, however, and evolved from video providers to providers also of interactive Internet service, they resisted providing access to their lines. In contrast to the open telephone networks available to dial-up and early DSL service providers, cable operators sought to close their networks to competitive providers by creating proprietary rules. The nature of these restrictions is embodied in a term sheet Time Warner offered to ISPs seeking to access its cable lines, which stipulates "the following:

(1) Prequalification of ISPs to ensure a fit with the gatekeeper business model
(2) Applying ISPs must reveal sensitive commercial information as a precondition to negotiation
(3) Restriction of interconnecting companies to Internet access sales only, precluding a range of other intermediary services and functions provided by ISP to the public (e.g. no ITV [interactive TV] functionality)
(4) Restriction of service to specified appliances (retarding competition for video services)
(5) Control of quality by the network owner for potentially competing video services
(6) Right to approve new functionalities for video services
(7) A large nonrefundable deposit that would keep small ISPs off the network
(8) A minimum size requirement that would screen out niche ISPs
(9) Approval by the network owner of the unaffiliated ISP's home page.
(10) Preferential location of network owner advertising on all home pages
(11) Claim by the network owner to all information generated by the ISP
(12) Demand for a huge share of both subscription and ancillary revenues
(13) Preferential bundling of services and control of cross marketing of services
(14) Applying ISP must adhere to the network operator's privacy policy"[13]

Unable to satisfy these conditions and because of an FCC determination that DSL would be exempt from common carriage requirements (see next page), small ISPs were not able to compete.[14]

From an infrastructure perspective Internet access in the United States is controlled by a relative handful of telephone and cable companies. These companies operate closed proprietary networks, on which they can limit or restrict access to competitive ISPs, and give affiliated ISPs preferential location, interconnection, and traffic prioritization. This situation is amplified because in a given market typically only one or two terrestrial infrastructures are available. Satellite and wireless services may be available in those markets, but those providers, too, operate closed networks. And in addition, wireless services do not offer bandwidth equivalent to DSL or cable modem service.

The above observations are supported by the findings of the Berkman Report. Based on comparing the impact of the market structures on the availability, performance, and cost of access in various countries, the report's authors recommended consideration of several open

[13] Cooper, "Importance of ISPs," 21.
[14] Cooper, "Public Interest," 63-64.

access policies and practices.[15] Current policies and practices in the United States are contrary to these recommendations.

In the past decade, a series of regulatory and court decisions eliminated the open, dynamic market for ISPs that had existed in the dial-up days in favor of the closed model pioneered by the cable industry. In *National Cable & Telecommunications Association v. Brand X*,[16] the Supreme Court held that cable companies need not share their infrastructure with Internet Service Providers such as Brand X and EarthLink, thereby exempting cable providers from many of the regulations that phone companies must follow.[17] As a result, cable companies are not required to provide access to their networks such that other providers can reach consumers. Soon thereafter, the FCC determined that DSL would also be exempt from common carriage requirements on the theory that deregulation of DSL services is necessary for deployment of broadband technology.[18] These decisions represented a marked departure from the common carrier rules that led to the success of myriad small ISPs in the early days of the Internet.

These decisions preclude true broadband competition because of the impracticability of constructing numerous physical broadband networks. While there may be significant competition in provision of programming and services such as telephone, e-mail, and video, there is no significant competition in provision of the infrastructure over which all of those services operate. Competitors, including small businesses, can now reach customers only by building their own facilities—at a prohibitive cost that effectively precludes the participation of small businesses. This situation is akin to a scenario in which the national road network were owned by UPS and closed to competitors; in order to provide service, small competitors (and even large ones such as FedEx and DHL) would be forced to build their own network of roads and highways—a prohibitive bar to competition. The result in the communications context is comparable: a broadband monopoly or duopoly of incumbent cable and telephone companies.

As a result, many ISPs have gone out of business because they cannot access the distribution networks, at any price. The dynamic small business provider market of the early commercial Internet era has ceased to exist, with the disappearance of many of the smallest providers.[19] In fact, while there had been ten to fifteen ISPs per one hundred thousand customers for dial-up services, there are now fewer than two ISPs per one hundred thousand customers on the high-speed Internet and less than one ISP per one hundred thousand customers for cable modem service.[20]

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[15] Berkman, "Next Generation Connectivity," 8-10.
[16] 545 U.S. 967 (2005)**;** see also Noguchi, "Cable Firms."
[17] The Court addressed the classification of cable modem service providers with respect to the Communications Act of 1934 and the Telecommunications Act of 1996, deferring to the FCC's determination as to whether cable companies provide "information services" rather than "telecommunications services." 545 U.S., 986–1000.
[18] Specifically, the ruling reclassified DSL as an information service. Federal Communications Commission, FCC 05-150, 2005 WL 2347773. *S*ee also Mohammed, "FCC May Let Phone Companies Off DSL Hook," and Orlowski, "FCC Opens Door to ISP Wipe-Out."
[19] Hafner, "In Praise."
[20] Cooper, "Public Interest," 8.

Exhibit IV
Case Studies — International

Seattle Community Broadband Initiative

When reviewing the Asian and European FTTP deployments it is important to keep in mind the differences in both the governments' regulations and the attitudes of incumbent providers. In many Asian and European countries, for example, the benefits of open access infrastructure are understood and embraced; this creates a foundation for both private and public investment in infrastructure. Business models and fiber penetration are obviously important considerations, but they build on the fundamental regulatory and competitive environment in a given city.

For example take a look at the Amsterdam project called Citynet. It is a venture between the city and two private investors (the largest being Reggefiber). The initial build-out passes about 40,000 to 45,000 homes. Citynet has a "home-run" type architecture, which means that a pair of fibers is dedicated to each household passed but the ONT's are not installed until service is acquired and the resident has made a substantial payment. Another key to Citynet is that regulators in the Netherlands favor open-access policies; existing telecommunication firms have also recognized the value of a single infrastructure that all providers have access to. Reggefiber's business plan appears to need a 60 percent penetration for its FTTP model to cash flow. Further, Reggefiber has substantial infrastructure investments throughout the Netherlands, not just in Citynet.

To learn more about Amsterdam and other international efforts, we recommend reading a notable 2010 report, "Next Generation Connectivity: A review of broadband Internet transitions and policy from around the world" (also called "the Berkman Report") in its entirety.[1] Selected verbatim excerpts from the Berkman Report regarding activities in Australia, Canada, Denmark, France, Germany, Japan, The Netherlands, South Korea, Sweden, Switzerland, and the United Kingdom follow. (Please see the report for related footnotes and references; we quote this material here as an introduction to the insight Berkman presents.)

Key points to consider when reviewing efforts in Europe and Asia include:

1. Many incumbent telecoms are or were either fully or partially state owned. When the telecoms have been privatized they operate under regulations that require open access. The state has much more influence.
2. Using regulation to incent infrastructure investment has a hit-or-miss success rate. Mostly miss.
3. Few of the global attempts to spur competition and investment appear to address ubiquity or state clearly that the infrastructure is a public asset—so they do little to spur an applications marketplace.

[1] "Next Generation Connectivity: A review of broadband Internet transitions and policy from around the world," The Berkman Center for Internet and Society at Harvard University, 2010, http://cyber.law.harvard.edu/pubrelease/broadband/ (accessed January 27, 2011)

4. Private-public partnerships often are a public investment with a private company operating the network, not a partnership of joint funding.

Australia[2]

Under a plan announced in April 2009, the federal government is establishing a public-private partnership to build and operate a national, wholesale-only, fiber-to-the-premises (FTTP) network. Many have welcomed this as a visionary response to slow, expensive broadband and the continuing power of the once state-owned incumbent, Telstra. But the plan has also been strongly criticized by those unconvinced of the universal demand for these fixed access speeds, and skeptical about the likely commercial return on the huge investment, especially given the rapid growth of mobile broadband. Stalled plans for wider-scale private deployment of fiber access networks have been at the center of the government plans for public investment in FTTx networks. Fixed broadband became more competitive as providers installed equipment in Telstra's exchanges, taking advantage of local loop unbundling (LLU) and line sharing services.

According to the OECD's September-October 2008 data, Australia's broadband speeds were in the second quintile of OECD countries (7th), though well behind Japan, Korea, and France, measured by the average advertised speed of surveyed plans.

The overall communications regulatory framework emphasizes competition (local loop unbundling, other) to ensure high quality services at affordable prices, but regulatory measures also support this goal. A Customer Service Guarantee sets standards for service connections, fault repairs and attending appointments with customers.

The centerpiece of the Government's strategy is the National Broadband Network (NBN) announced in April 2009. Costing up to AUD 43 billion (USD 36.5 billion), around USD 1800 per head of population, the plan will deliver download speeds of 100 Mbps to 90% of homes and workplaces within eight years.

A company has been established to build and operate the NBN. Substantial private sector participation is intended, but the government will remain the majority shareholder. The Government now says AUD 43 billion figure has "got a pretty sizeable chunk of contingency built into it." Its contribution will be around AUD 11 billion. This assumes 50/50 debt/equity for the whole project with half of the equity held by government. Of the AUD 11 billion, AUD 4.7 billion will be direct public subsidy and AUD 6.3 billion will come from Infrastructure Bonds offered to institutional and retail investors on terms yet to be settled. The network will be privatized five years after construction ends. The company will have no retail customers, but will offer wholesale access to all on fair and non-discriminatory terms. Much of the detail of its

[2] All material excerpted from the Berkman Report, "County Overviews: Australia" http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/Berkman_Center_Broadband_Final_Report-Country_Overviews_15Feb2010.pdf (accessed January 27, 2011).

structure and operation, including any non-government shareholdings and the terms and conditions of access to its facilities, has not been settled.

Canada[3]

Though it was among the first nations in the world to provide widespread, retail broadband service, Canada's recent broadband development has lagged behind other developed nations. Canada's broadband penetration rates are often lauded, but the country is a poor performer on price and speed and a declining performer in penetration. Recently, Canada's regulatory bodies have pushed for deregulation of the broadband market in the hopes of promoting a more efficient and affordable broadband market. Despite its early broadband leadership, Canada has most recently lagged peer nations in broadband penetration, speed, and price. Though it was in the top OECD quintile in penetration in 2002, it is no longer. Canada has little fiber-to-the-home (FTTH) deployment.

In recent years, both the residential and business markets for Internet access seem to have undergone consolidation, with incumbent telecommunication service providers (TSPs) and large cable companies picking up market share at the expense of new entrants and incumbent TSPs operating outside of their traditional geographic regions.

The Canadian Radio-television Telecommunications Commission (CRTC) exercises the main regulatory control over telecommunications. The CRTC has begun to reduce regulation in some parts of the industry in response to an interpretive order, codifying a recommendation of Industry Canada's Telecommunications Policy Review Panel in 2006, that requires the CRTC to "rely on market forces to the maximum extent feasible" to achieve policy objectives.

The CRTC's regulatory regime over broadband service providers has varied in breadth and intensity over the last two decades. The political economy of the broadband market over this period can be characterized as a struggle between a government seeking to increase competition and dominant broadband providers seeking a reprieve from such policies, which they argue can stifle innovation and investment.

In 2001, the National Broadband Task Force was created by the Minister of Industry to establish a policy on Canadian broadband services. Its mandate was "to map out a strategy for achieving the Government of Canada's goal of ensuring that broadband services are available to businesses and residents in every Canadian community by 2004." The task force recommended a strategy that had four main components: (1) linking all communities in Canada to scalable high-speed networks; (2) emphasizing affordable broadband links to remote and rural communities; (3) ensuring that local broadband infrastructure linked together local education, health, and library facilities; (4) extending local broadband within a community to encompass business and residential users.

[3] All material excerpted from the Berkman Report, "County Overviews: Canada" http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/Berkman_Center_Broadband_Final_Report-Country_Overviews_15Feb2010.pdf (accessed January 27, 2011).

The Government of Canada has stressed that improvements in educational outcomes are partly a result of broadband availability. A particularly successful example of this was SchoolNet, a partnership formed between Industry Canada designed to link all Canadian public schools and libraries to the Internet. While the site was eventually taken down as broadband became more mainstream, the educational dimension of broadband has been underscored as a driving force for increasing broadband provision. As recently as March 2009, the Government of Canada has justified provision of broadband connectivity to more remote areas as enhancing, among other things, the availability of distance learning through broadband access.

Network neutrality has been, and remains, a controversial issue in Canada. Notably, in 2005, Telus blocked access to Voices for Change, a website that supported the Telecommunications Workers' Union. The union, at the time, was in a labor dispute with Telus. In October 2009, the CRTC released its net neutrality framework. The framework outlines the process by which users can lodge complaints with the CRTC about an internet provider's traffic management practices (ITMPs).

Canada opened the decade as an extremely strong performer on broadband. Over the course of the decade, its penetration rates have grown more slowly than those of other countries, its prices have remained high, and its speeds are still low in comparison to other OECD countries. In the area of competition policy, Canada implemented unbundling rules formally in 1997, but its regulated rates were high relative to the rest of the OECD, and it consistently imposed sunsets on all or some category of regulation.

Denmark[4]

Denmark is among the world's leading nations in broadband penetration, even though some of the country's regions are sparsely populated. The government has emphasized the public sector's role in demand for broadband while not making any direct investments on the supply side. The regulatory framework poses very low barriers to entry into the broadband market while newly introduced sharing of costs for shared future infrastructure is supposed to attract new investment.

The development of broadband in Denmark started with liberalization of telco services and the abolition of the exclusive right of Tele Denmark (now TDC) to establish broadband networks within the boundaries of the municipalities in 1995.

Broadband and the telecommunication industry does not fall under one single law but is regulated by several different acts, including primarily the Act on Competitive Conditions and Consumer Interests in the Telecommunications Market, the Act on Cable Laying Access and Expropriation etc. for Telecommunications Purposes, and the Act on Radio Frequencies.

[4] All material excerpted from the Berkman Report, "County Overviews: Denmark" http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/Berkman_Center_Broadband_Final_Report-Country_Overviews_15Feb2010.pdf (accessed January 27, 2011).

The regulatory framework poses very low barriers to entry. Neither licenses nor registration are required by the regulatory body, except for operating fixed-wireless connections. The main focus of legislation is on the promotion of competition in the telecommunications market.

Denmark's broadband development is based on a plan issued by the Danish Government in 2001.The plan laid out the ambitious aim "that Denmark should be the world's leading IT nation." One of the goals articulated in the plan is to "have fast, cheap and secure internet for support and further development of the Danish welfare society." Even in 2009, Denmark sees great potential and advantages in being a leader in the digital world and "the Government's target is for all Danes to have broadband access by the end of 2010 at the latest."

The strategy by which Denmark seeks to promote broadband access is based on four principles: a market-driven infrastructure without the use of public funding, technology neutrality in the regulation of the market, transparent regulation, and the public sector as a contributing force behind demand for IT. Denmark's broadband strategy has proven to be successful; Denmark leads the OECD in broadband penetration rates.

In accordance with its broadband strategy, which emphasizes a market-based approach to broadband development, the Danish central government has neither invested substantially in the deployment of backbone infrastructure nor carried out any other major investments in broadband networks for business and residential connectivity. Instead, it has applied a philosophy of establishing fast IT infrastructure in the public sector which in turn boosts public sector demand for broadband connections.

Denmark has invested considerable energy in improving the technological proficiency of its populace, initiating a number of government programs designed to promote the use of information technology and enhance user skills. In 1993, an educational network was established, linking 470 primary and secondary schools as well as universities to a conference and learning environment and later to the internet. In 1997, research institutions were able to connect to Forskningsnettet, a research network, which in 1999 allowed downstream speeds of up to 10 Mbit/s.

As an early adopter of local loop unbundling, Denmark has actively pursued open access policies to promote competition in broadband markets. The principal instrument that guides competition policy in the telecommunications sector is the Act on Competitive Conditions and Consumer Interest in the Telecommunications Market, which is applied by Telestyrelsen (in some cases in consultation with the Danish Competition Authority). Network neutrality is not currently at the center of any political debates.

France[5]

The development of broadband access in France has been driven primarily by the deployment of DSL. Broadband penetration rates increased markedly after a shift in the regulatory environment and the implementation of local loop bundling. This allowed competitors access to the network of France Telecom and helped to drive down broadband prices in France; consumer broadband prices in France are now among the most affordable in the world. France is not among the highest performers in terms of broadband penetration rates. However, after strong improvements over the past six years, broadband penetration rates in France are now higher than the OECD average.

The broadband strategy in France has historically relied on private investment and the promotion of market competition. Competition in broadband markets has helped to spur innovation in retail markets, particularly in broadband offering that combine fixed and mobile coverage. This appears likely to change, as the French government has announced its intention to help finance the deployment of fiber networks. The current broadband policy debate in France focuses on the issues of access and sharing of fiber networks. Each of the major players is investing in fiber infrastructure.

Compared to its European neighbors, France was slow to adopt widespread broadband Internet. In 2001, penetration rates in France stood at about one-third of the overall average for OECD countries. However, following an overhaul of the regulatory regime, broadband penetration rates in France have improved substantially over the past six years. Broadband penetration rates in France are higher than the OECD average.

Actual investments in fiber roll-out have been somewhat delayed. In part, this may be due to the public controversy regarding access to the infrastructure of France Telecom. In part, it may be due to demand for high speed services still being fulfilled by the relatively high speeds and low costs of DSL in France. The delayed investment is also consistent with the argument that requiring open access to incumbent facilities delays investment.

As in other European markets, the French regulatory framework is driven by implementation of European directives on liberalisation of telecommunications sector, with the Framework Directive 2002/21/EC as a starting point. ARCEP has relied primarily on *ex ante* intervention into wholesale broadband markets. Through access rules and the regulation of tariffs, ARCEP actions have been aimed at ensuring that France Telecom's rivals could compete effectively against the previously state-owned monopolist, which controlled household access via the copper network.

The infringement proceedings opened by the European Commission modified substantially the behavior of ART, which then introduced sub-loop unbundling and significantly reduced the rate charged for local loop access. However, price was not the only consideration. ARCEP also

[5] All material excerpted from the Berkman Report, "County Overviews: France" http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/Berkman_Center_Broadband_Final_Report-Country_Overviews_15Feb2010.pdf (accessed January 27, 2011).

moved to dismantle other obstacles to access unrelated to price. It defined in detail a number of service quality indicators and put forward a protocol for migration to unbundled loops to ensure that the incumbent and new entrants could work together.

In 2008, the Prime Minister F. Fillon created a new ministry dedicated to the digital economy. E. Besson was appointed as a minister of State "in charge of the development of digital economy." He was later replaced by N. Kosciusko-Morizet, who remains the current minister of State. In 2008, E. Besson presented the new broadband strategy for France "France Numérique 2012." This plan aims, among numerous other goals, to provide universal access to broadband Internet throughout France before the end of 2010. To achieve this goal, the French government will contract at a local level with private operators to provide universal access for the 2 to 3% of citizens who do not have broadband access, with the specification that connectivity should be no less than 512 kbps and at a cost of no more than EUR 35 per month.

The government has never directly invested in infrastructure, whether for DSL or fiber technologies, but limited its role to setting the regulatory framework through the creation of an independent regulatory authority (ART, later ARCEP).

Investments in infrastructure have been made at the local level. Using the loans from the Caisse des Dépôts et Consignations (CDC), the financial arm of the French state, many local governments have developed broadband infrastructure in the areas without adequate broadband coverage in order to reduce the disparity between urban and non-urban broadband penetration rates.

The decision by French authorities to address the anticompetitive practices of FT regarding broadband access had a profound impact on broadband markets in France. They penalized the incumbent operator for practices aimed at pre-empting the emerging DSL market between 2001 and 2002 and benefiting its Wanadoo subsidiary. Their practices included predatory prices, discriminatory conditions in access to the local loop, and smear campaigns against the alternative operator. The incumbent was also accused of impeding effective competition in broadband markets in overseas departments through margin squeeze. In bringing its case against FT, the French competition authority argued that the low penetration of broadband access was a direct consequence of the practice.

Germany[6]

Germany was an early leader in liberalizing telecommunications markets, and was the first European country to implement local loop unbundling. However, it struggled for years to fully implement these policies. The national regulatory agency has faced pressures from the incumbent Deutsche Telekom (DT), on the one hand, and ongoing pressure from the European Commission to more effectively implement its policies, on the other.

Germany is Europe's largest broadband market by raw numbers, but its penetration per household and per 100 inhabitants lags behind most of its neighbors. The state of broadband in the country is best understood in the context of the gradual privatization of DT.

Fiber-to-the-Home (FTTH) has developed slowly in Germany. The two leading regional projects, MNet and NetCologne, continue to serve a small portion of the market. Germany is primarily a DSL country. DT owns the last-mile copper infrastructure as a result of its former-monopoly status. The German government still owns a portion of DT.

Germany's national regulatory agency for telecommunications is the Bundesnetzagentur (BnetzA). The communications sector's previous regulator, the Regulatory Authority for Telecommunications and Post (RegTP), was merged with the BnetzA in 2005. Germany's overall broadband market is governed by the Telecommunications Act (Telekommunikationsgesetz, or TKG), which was revised in 2004 to bring it in line with the European Union's legislative framework for telecommunications. Under the Act, the BnetzA can impose obligations on companies with "significant market power" in individual markets regarding the services they offer in those markets.

The German government's history of effectively implementing its regulatory goals has been checkered. For instance, various hiccups and delay tactics in the unbundling process allowed DT to continue to exercise control over potential competitors for many years. In 2004, the OECD observed, "DT has successfully used judicial review of regulatory decisions to delay, indeed block, the enforcement of regulatory decisions. While unbundling of the local loop was mandated back in 1997, through delays in the provision of leased lines, price-squeeze tactics, artificially low retail prices for DSL services, etc., DTAG has virtually precluded competition and retained or even recently established a dominant position such as in broadband services."

The German government published a high-level broadband strategy in February of 2009 that sets a goal of nationwide broadband access to every home in the country by the end of 2010. It also aims at transmission rates of at least 50Mbit/s by 2014 for 75% of German households.
The February 2009 broadband plan includes a four-pillar strategy:

1. Capitalize on synergies from infrastructure projects: Public and private infrastructure providers have to become more open to collaboration in the near future. If they were to

[6] All material excerpted from the Berkman Report, "County Overviews: Germany" http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/Berkman_Center_Broadband_Final_Report-Country_Overviews_15Feb2010.pdf (accessed January 27, 2011).

allow third-party access to their own systems, costs could be reduced significantly and there would be a win-win situation for business as well as for the economy as a whole.

2. Establish supportive spectrum policies: These policies aim in particular on making optimum use of the frequency band of 790 to 862 MHz, made available in the digital television transition. This dividend should be used to close broadband gaps, especially in rural areas.
3. Financial aid: There is often poor immediate broadband uptake in rural areas without government support. Therefore, the government will provide incentives in these areas through support programs to enable internet access in households that do not yet have broadband access.
4. Regulation geared to growth and innovation: Regulation is seen as having promoted competition in the telecommunications market and fostering investment and growth. There will be no significant change in the national legal framework in the near future.

All telecommunications companies deemed to have "significant market power" (SMP) are subject to rate regulation. Furthermore, SMP providers are now obliged to offer line access and interconnection agreements if these remedies are essential for a competitive market. In 1998, Germany became the first of the European countries to introduce local loop unbundling to foster intramodal competition. But since that time, German regulators have struggled to ensure that DT offers competitive LLU fees such that DT still served close to 90% of the market in 2004. Since 2006, however, unbundling-based access increased significantly, although the following years saw continuous skirmishing.

Japan[7]

Japan is often cited as a global leader in broadband technology, speed, and price. The Japanese government has maintained and adapted an aggressive broadband policy since the late 1990s, which has included low-interest loans and tax deductions for infrastructure build-out. Both NTT, the formerly government-run monopoly, and MIC, the regulatory agency, were reorganized in 1999 in order to facilitate removal of legacy technology-specific regulations and to add safeguards to ensure competition.

Cable was the leading source of broadband access early in Japan, but it was eclipsed by the rapid growth of DSL. DSL took off after the establishment of local loop unbundling, interconnection, and "dark fiber" backbone leasing rules for dominant firms in 2000 and 2001. New entrants like Softbank took advantage of these rules to roll out DSL that was both faster and cheaper than NTT's service. NTT's service had up to that point focused on more expensive ISDN services. As DSL proved successful, others entered the market and NTT followed suit, triggering a period of aggressive price-slashing and deployment. By this time, NTT's fiber network had begun to reach most urban households, and the company planned to charge a premium for a proprietary non-IP service. However, it quickly faced facilities-based IP competition from utility company

[7] All material excerpted from the Berkman Report, "County Overviews: Japan" http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/Berkman_Center_Broadband_Final_Report-Country_Overviews_15Feb2010.pdf (accessed January 27, 2011).

subsidiaries like K-Opticom and TEPCO. This pushed NTT to abandon their proprietary plans and compete on open Internet service. NTT's fiber-to-the-home facilities are bound by unbundling and interconnection rules due to their status as a dominant wireline carrier, and thus NTT is also subject to service-based competition from firms like Softbank.

NTT's legacy as a formally state-owned monopoly continues to be reflected in its market share, which hovers above 50% in the wireline access business. Softbank is the largest competitor, with approximately 14% of the market made up primarily of DSL subscriptions (although fiber subscribership over NTT's Flet's Hikari service is beginning to grow), followed by eAccess (DSL).

Wireline broadband access falls under Japan's Telecommunications Business Law, regardless of the technology in question. This regulatory approach reflects a "layers" oriented approach that distinguishes between physical (access), service, platform, and content. Jurisdiction belongs to the Ministry of Internal Affairs and Communications (MIC), which is exploring how to further modify the underlying legal structures to an explicitly layers-based approach. The result of this framework is that competition, speed, availability, and discrimination are examined within each layer, but integration between services in different layers is not prohibited. The MIC sees this as a deregulatory approach that nevertheless maintains market and social safeguards.

The history of the telecommunications political economy in Japan is defined primarily by the battle between the government and NTT. After NTT was privatized in 1985, the company began to wrestle with its regulator, the Ministry of Posts and Telecommunications (MPT). MPT argued for the breakup of NTT in 1990 and 1996, and, although it never succeeded, it did manage to force NTT to be transformed into a holding company and to give certain concessions.

As Japan took major steps to empower its regulatory agencies and to establish new competition rules, the Cabinet Office and the MIC cooperated on broadband strategy. In November 2000, the government issued its "Basic IT Strategy" that described Japan as "backwards" with respect to IT, and proposed a high-level strategy. In January 2001, in order to enable the rapid and efficient implementation of its strategy, the Japanese government set up the IT Strategy Headquarters. The headquarters is led by the Prime Minister and consists of all Cabinet members plus a number of industry experts. Soon after its inception, the IT Strategic headquarters announced the "e-Japan Strategy," a policy program that focused on broadband infrastructure and also set specific penetration and price targets. In 2003, the e-Japan Strategy II was adopted, which noted that many of the infrastructure targets of the initial e-Japan Strategy had been met, and turned to usage and uptake.

The Japanese government has offered loans and tax deductions designed to incentivize broadband buildout since the mid 1990s, but its efforts dramatically accelerated in 2000 as the Basic IT Law went into effect and the national strategies began. The policies introduced over the next several years included a series of tax incentives, including a highly accelerated depreciation schedule for capital investments in telecommunications. Several of the policy packages that were part of Japan's national broadband strategies have included skills and demand programs. For instance, the u-Japan strategy described one of its goals as, "By 2010, 80% of the population to appreciate the role of ICT in solving social problems." It then spelled out specific policy interventions to promote the use of information technology in health care, public security, education, and the environment. The government also aggressively pushed its services online, resulting in a high percentage of internet-based citizen-to-government transactions.

The government generally views competition in a layered model, and tends to work more aggressively to preserve competition at the physical layer. After the long battle to break up NTT resulted in a compromise that left the company intact, the government focused heavily on these service-based competition measures. This motivated copper unbundling, dark fiber open access, and the 2009 rules intended to ensure unbundling of Next Generation Networks (NGNs). The government sees no evidence that these policies have diminished NTT's incentives to invest in infrastructure.

The Japanese government has articulated clear principles of neutrality that will guide its policy making process and evaluation of network providers, including:

- Free access to the content and application layer;
- Use of networks at an affordable price;
- Free connection with any terminal that meets technical standards.

These principles drive specific interventions that seek to preserve open access between layers, and especially access to the lower telecommunications layer.

The Netherlands[8]

The Netherlands has been a global leader in broadband deployment, with longstanding high rates of penetration and near-ubiquitous wireline availability via both DSL and cable. In line with EU rules, the Dutch government has unbundled both copper and fiber lines to the home.

Strong competition between the platforms persists today complemented by infra-platform competition enabled by unbundling. The copper infrastructure was largely built out by KPN, but the initial cable build-out was often done locally and later purchased by cable firms. Municipal public-private partnerships to promote investments in FTTH have played an important role in shaping the Netherland's strategy for deploying next generation networks, with an emphasis on cooperative open access models.

Some copper local loop unbundling had been mandated by OPTA as early as 1997, but the regulator did not initially implement "full unbundling." By 2002, however, the Netherlands was in compliance with the European Commission unbundling regulations. That same year, KPN was forced to offer bitstream access as well. Since then, the cost of unbundled copper services has dropped dramatically. DSL overtook cable in 2003, enjoying roughly a 60% share of subscribership since. In the meantime, the many smaller cable operators were mostly consolidated in companies like Ziggo and UPC.

[8] All material excerpted from the Berkman Report, "County Overviews: The Netherlands" http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/Berkman_Center_Broadband_Final_Report-Country_Overviews_15Feb2010.pdf (accessed January 27, 2011).

Fiber has been slower to deploy in the Netherlands than in some other countries, in part due to the ability of the cable and copper infrastructure to be stretched to support higher speeds.

FTTH still constitutes a small portion of broadband subscriptions nationwide, but it is showing some signs of more rapid growth. KPN has stated its intentions to build out fiber nationwide and phase out its copper infrastructure. KPN has entered into a joint venture with leading fiber operator Reggefiber (KPN has a 41% stake in the company). The Amsterdam CityNet project is an example of a fiber public-private partnership that won buy-in from commercial providers. In Phase 1 of the project, serving 43,000 homes, Draka Comteq won the rights to build out the "passive" physical layer of the network, and BBned won the rights to provide the "active" internet service. In Phase 2, Reggefiber/KPN won the rights to provide these services to another 100,000 homes and also acquired a majority stake in the group that owns the fiber project.

Wireline regulation in the Netherlands is primarily done via the OPTA (Independent Post and Telecommunications Authority), with help from competition authority NMa and some additional oversight from the Ministry of Economic Affairs. In the 1990s, the government shifted from a regulated monopoly model to a liberalized approach that allowed open competition across sectors.

The Dutch government describes its approach as being market-oriented. This commitment is implemented through engaged regulation: unbundling and competitive requirements, and regular reviews by the regulator. OPTA has set maximum prices for unbundled services, and reviews these and other requirements on a regular schedule to determine whether significant market power is being used to extract rents that are substantially higher than actual costs.

Much of the political economy in the Netherlands involves the regulator's attempt to balance the benefits of the incumbent's infrastructure and the creation of incentives to stimulate competitive entry. OPTA and KPN regularly spar over terms of interconnection, tariffs, and the like. The regulator has generally managed to carve out jurisdictional and enforcement powers to mandate the terms of competition in the presence of significant market power (which almost invariably is assumed to exist in the case of KPN, but not others). These efforts have controlled profits for KPN and encouraged opportunistic entry by alternatives.

The broadband strategy of the Netherlands has been roughly articulated in a series of documents released by the government or government-convened expert panels. These planning documents are largely coherent in their vision and prescriptions, but because they are authored by various groups, they often differ in particulars or emphasis. Broadband is generally defined as consisting of a lower tier from 1Mbps to 10Mbps, and a higher tier that supports the full range of broadband activities.

Historically, the Dutch government has offered considerable aid for the build-out of new technologies. This was inherent in the era of the public monopolist, but the government has also actively invested in cable and fiber. In the "Kenniswijk" (Knowledge District) project, the government designated one geographical region as a test bed for residential fiber rollout. From

2000 to 2005, it offered subsidies up to 50% of the cost of build-out and helped with the formation of public-private partnerships. This included the fairly successful OnsNet project in Nuenen and Eindhoven.

However, government-funded models have been encumbered by measures at both the EU level and the national level that have sought to limit state investment in the interest of avoiding market distortion. From the time of the updated EU Regulatory Framework in 2002, there has been confusion regarding what would be permitted under state aid guidelines. For example, in 2005, the European Commission ruled against public investment by the city of Appingedam, but permitted a public-private joint venture in Amsterdam a year later.

The overarching competition philosophy of the Netherlands consists of managed facilities-based competition. These competitive facilities do not include the access networks in the last mile, but rather the backbone up to the unbundled copper or fiber lines to the home. OPTA has maintained unbundling controls on the incumbent, and has extended these controls to new fiber networks.

Network discrimination has not been a prominent issue in the Netherlands. There has, however, been recent discussion of the issue in the context of cable operator UPC's protocol-specific bandwidth caps. The Dutch consumer organization Consumentbond has accused UPC of unfair business practices due to lack of disclosure of traffic management practices.

South Korea[9]

Due to a regulatory regime based on competition, privatization, and aggressive government programs focused on boosting demand, South Korea has become a world leader in broadband by several measures. After the privatization of the state-run telecommunications provider (Korea Telecom, or KT) and the encouragement of new entrants into the broadband market in the late 1990s, DSL and cable broadband services expanded rapidly. KT has since regained its majority market share in fixed broadband, and both the fixed and mobile markets have consolidated in recent years.

Over 80 % of Koreans live in dense, urban housing, an arrangement that has produced significant economies of scale for the expansion of broadband service. Moreover, because landlords, rather than incumbent KT, own local loop facilities, competitive carriers are able to negotiate with multi-dwelling unit owners rather than KT. Today, South Korea is moving toward a fiber-to-the-home (FTTH) model. Although development has been slowed by high costs, ADSL and VDSL subscriptions continue to decline as Ethernet connections to fiber nodes grow in popularity.

By the end of 2007, fiber connections constituted one-third of all South Korean Internet connections. The South Korean government is now promoting the Broadband Convergence Network and the IT839 program, both of which envision the convergence of wireline, wireless,

[9] All material excerpted from the Berkman Report, "County Overviews: South Korea" http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/Berkman_Center_Broadband_Final_Report-Country_Overviews_15Feb2010.pdf (accessed January 27, 2011).

and RFID networks to allow ubiquitous connectivity through a panoply of mobile and fixed devices.630 The combined plan calls for a network aimed to support a list of eight services, three infrastructures, and nine growth engines. By 2013, the program expects speeds of both fixed and wireless broadband to be up to 10 times faster than at the beginning of 2009.

In March 1992, the Korea Communications Commission was established under the Framework Act on Telecommunications, which was originally enacted in December 1983. The creation of the KCC coincided with the initiation of a competition policy that emphasized deregulation and privatization in South Korean telecommunications markets.

South Korea categorizes service providers as facilities-based providers, resale providers, or value-added service (VAS) providers. These classifications govern the type of services providers may offer and other legal obligations, such as contribution to the universal services fund. In 2009, the KCC announced that it would begin working on a new regulatory framework to take account of IP-based services.

The first major step in the privatization and deregulation of South Korean telecommunications markets took place between 1987 and 2002 with the privatization of KTA, the state-owned incumbent wireline provider. The government, with strong support from elected officials, gradually divested itself of KTA, later renamed KT, and concluded a bargaining agreement with KTA's labor union to limit foreign ownership.

Despite its emphasis on privatization and deregulation, the KCC has proven an aggressive regulator. Prior to 2007, Korean regulators resisted SK Telecom's and KT's desire to offer bundled services by citing the providers' dominant market positions in the mobile and wireline markets, respectively. Though the regulatory bodies clashed on this issue, the ban was dropped in April 2007. In an effort to accelerate the deployment of converged services, further rate deregulation of bundled services followed.

In 1987, South Korea passed the Framework Act on Information Promotion in support of the development of information technology.657 This legislation established the National Information Society Agency (NIA) to oversee network construction.

Since the early 1990s, South Korea's broadband deployment strategy has focused on the cultivation of a "knowledge-based society." In 1993, the NIA launched the plan for the Korea Information Infrastructure (KII), which ran from 1995 to 2005. In 1995, South Korea enacted legislation to drive the KII comprehensive plan for a national broadband backbone. After KII, South Korea implemented a series of 5-year programs to invest government funds in broadband deployment.

South Korea has provided numerous loans to broadband service providers in support of the deployment of broadband networks. These include: an initial USD 77million in preferred loans to facilities-based providers in 1999, an additional USD 77 million in loans for non-urban areas in 2000, USD 70 billion in loans through the IT839 and Broadband Convergence Network programs, (an investment that recipients pledged to match), and USD 926 million for rural broadband to KT as a condition of its privatization. In 1997, the government began the Cyber Building Certificate system, under which residential and commercial buildings are certified as providing specified tiers of broadband access speeds. This program has motivated builders to invest in broadband, as many Koreans apparently want to live in buildings with high-speed broadband capacity.

South Korea has long sought to boost demand in the information technology sector via various government-supported educational programs, such as the PC for Everyone program in 1996, a computer literacy program in 1998, and Cyber Korea 21, a program focused on digital literacy, in 1999.

Competition policy has governed South Korean telecommunications regulatory approaches from the late 1980s especially in the wake of the privatization of KTA (later renamed KT). In 1997, the MIC instituted procedures for selecting a competitor to challenge KT, which Hanaro Telecom won. Competition in the broadband market exploded in the late 1990s with the entrance of Hanaro and cable provider Thrunet, but re-regulation following KT's resurgence shows that the government has kept a close eye on market competition.674 The government identified KT's dominance as a barrier to competition and, since 2004, has subjected the company to stricter regulations relative to its competitors. South Korea did not mandate the unbundling of local loop network elements until 2002, well after DSL and cable broadband offerings had gained significant ground. The relatively late unbundling mandate partly reflects the strong platform-based competition that characterized the South Korean market in the early years of broadband development. The absence of unbundling in Korean broadband development should not, however, be overstated, given that initial entry by Thrunet depended on infrastructure leased from Kepco, the government-owned cable company, which was required to lease access to its cable facilities. South Korea has also mandated open access conditions on cable providers and the opening of South Korea's two largest mobile data networks.

South Korea has no strict network non-discrimination rules but has mandated open access and line-sharing, which may have obviated the need for a more rigorous net-neutrality regime. Despite these policies, however, South Korea has not been free from non-discrimination controversy in recent years.

Sweden[10]

Sweden committed a decade ago to providing comprehensive national broadband coverage and has subsequently emerged as one of the top performers in broadband provision and adoption, scoring well in terms of broadband penetration, speed, and affordability. The Swedish government has been actively involved in rolling out broadband infrastructure through public investments, both at the federal and municipal levels, and public-private partnerships that have

[10] All material excerpted from the Berkman Report, "County Overviews: Sweden" http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/Berkman_Center_Broadband_Final_Report-Country_Overviews_15Feb2010.pdf (accessed January 27, 2011).

contributed to the deployment of a broadband internet infrastructure that now reaches 98% of the country's residential population.

Swedish regulators have intervened at several junctures in broadband markets to enact strong open access rules in the telecommunications sector, starting with the introduction of a local loop unbundling requirement in 2001 in accordance with EU regulation. This was consolidated further in 2004 with a mandate that TeliaSonera, the incumbent telecommunications company, provide bitstream access for broadband entrants. In 2007, the regulatory authority went a significant step further, proposing legislation that would require TeliaSonera to functionally separate its network and retail services divisions. This legislation entered into force on 1 July 2008, but has not been used by the regulator as a result of TeliaSonera's voluntary compliance. Open access provisions in Sweden now apply both to the copper and high-speed fiber infrastructure.

The Swedish market for local, long-distance and international telephony was liberalized in 1993 opening up telecommunications markets to competition. In 1996, three years after liberalization, the government-owned former monopoly operator, Telia, had a share of 71% of the telecommunications market. At that point, Telia was the only operator in Sweden that offered a public ISDN network.

TeliaSonera is the largest single owner of fiber, accounting for approximately 45% of the whole optical fiber coverage in 2009. Publicly-owned fiber-infrastructure in the hands of government, the Swedish National Rail Administration, Vattenfall, Svenska Kraftnät, and municipal enterprises jointly accounted for 45% of the total.710 Municipal networks alone control 20 to 25% of the coverage. Among the more than 150 local fiber/LAN networks in 2008, a majority are owned by municipal authorities or municipally run companies.

The 2003 Electronic Communications Act (EkomL) lays out the regulatory structure for all electronic communication networks and services in Sweden, covering both wireline and wireless communications systems. The passage of this act, enacted during a period of rapid growth in broadband, represented the transposition of the 2002 EU Regulatory Framework to Swedish law and provided a regulatory framework to promote wide-scale broadband internet coverage and adoption.

The act of 2003 aimed to "ensure that electronic communications are as accessible and efficient as possible and are open to free competition." The act further states, "We wish to give an authority power to force market-dominating companies to allow competitors access to their networks or to limit their prices to the end-customer to what is reasonable."

The political economy of Sweden's broadband industry is dominated by the interplay between state controlled former monopoly TeliaSonera and industry watchdog PTS. As the incumbent telecommunication provider, TeliaSonera owned a large majority of the nation's copper and fiber networks and benefited from significant market power in different industry sectors. The PTS in turn began to exert its regulatory power to promote competition by ordering local loop unbundling or through price setting. TeliaSonera has consistently sought to maintain its competitive advantage and preserve control over its network infrastructure, resisting PTS plans to open the incumbent's networks to competitors. Frustrated with the slow progress in opening up TeliaSonera's networks to other entrants, PTS has progressively enacted a series of more stringent open access measures designed to enhance competition.

Sweden initiated its current broadband policy more than a decade ago. With the 1999 release of IT Bill 1999/2000:86, the country embarked on a plan to create "an information society for all." The policy described a reliance on market forces in conjunction with public-private partnerships to deploy broadband across the large and sparsely populated country.

An updated IT policy, published in 2004, lays out three central objectives:

1. IT must contribute to a better quality of life and help improve and simplify everyday life for people and companies.
2. IT must be used to promote sustainable growth.
3. An effective and secure physical infrastructure for IT, with high transmission capacity, must be available in all parts of the country so as to give people access to, among other things, interactive public e-services.

In 1999, the Swedish government committed over EUR 600 million for the installation of a national backbone, "which has resulted in the deployment of some 200 metro networks in more than one hundred towns." The roll out was carried out by Svenska Kraftnät, the Swedish National Grid operator. The government allocated an additional EUR 700 million to regional and local broadband projects. Tax breaks were also used as an incentive to promote the spread of broadband. Consistent with the stated goal of coordinating public and private investments, private operators spent an estimated USD 1 billion between 2001 and 2007 as part of the process.

In addition to the large public investments in infrastructure, the Swedish government also supports initiatives to promote demand for broadband access by fostering digital literacy, increasing access to personal computers, and encouraging the use of broadband for education. As early as 1998, tax breaks were introduced for companies that supplied employees with personal computers. In a later push for digital literacy in education, the government "introduced a USD 25 million project to raise IT literacy among schoolteachers." In addition, the government also carries out initiatives pursuing quality and sustainable growth—two other sub-goals of its IT policy—by promoting, for example, improvement of e-services in the health care sector and promotion of IT skills in SMEs, which, among other things, are likely to boost demand for broadband.

Swedish government regulators have acted aggressively to open up broadband markets to competition with a focus on providing competitors access to TeliaSonera's network. Unbundling was introduced in 2001, though it was slow to take hold. In 2003, PTS ordered TeliaSonera to lower the wholesale price for access to its network, asserting that TeliaSonera had engaged in discriminatory pricing practices that favored some operator over others. In 2004, TeliaSonera accepted a PTS ruling clarifying further unbundling requirements of its last mile copper network, but chose to appeal to the courts the ruling that required it to provide wholesale bitstream access to its competitors. TeliaSonera eventually complied with this mandate in 2007 after losing in the courts.

Network neutrality violations have not been the source of any complaints to PTS and the agency therefore has not seen any reason to take action in this space.

Switzerland[11]

Switzerland has experienced strong results in broadband deployment taking a substantially different approach than other countries that have performed well in this space. Until recently, Switzerland has relied primarily on inter-platform competition between the incumbent telecommunications company that offers DSL and cable companies. Unlike the majority of its European neighbors, Switzerland chose not to require local loop unbundling throughout much of the first broadband transition, although it did ultimately adopt this policy in 2007.

The political discourse about broadband over the past two years has centered around three core themes: first, the likely effects of local loop unbundling as introduced in 2007; second, a possible amendment to the Law on Telecommunications to allow ex-ante regulation and to recast the regulatory framework into one that is technology-neutral; and third, extension of the regulatory power of the Federal Communications Commission (ComCom) to the regulation of fiber networks.

Although optical fiber connections are not as widespread as in other European countries, there has been much activity in that area recently that illustrates fiber's growth potential. Swisscom already operates a network with optical fiber lines, although this network usually ends at street cabinets (FTTC, fiber-to-the-cabinet) and doesn't yet extend to homes or small and medium-sized enterprises. However, more than 10 local power utilities—mostly (but not exclusively) owned by municipalities and cantons—have announced plans to invest in fiber-to-the-home (FTTH) networks. These relatively small power companies are becoming new players in the broadband market and have challenged Swisscom, which, in response, announced plans in 2008 to bring fiber to 100,000 homes by the end of 2009 along with large investments in fiber-to-the-home networks over the next six years.

Swisscom is by far the most important provider of wireline and wireless services in the Swiss market. The company is the former national telephone company. Although the liberalization of the telecommunications market took place in 1998, the federal government still holds a 56% stake in the company. Complete privatization had been planned at that time, but the Swiss parliament decided against a full implementation in 2006. Since 1998, four major wireline and wireless providers have competed with Swisscom in the broadband market, namely Sunrise (formerly TDC Switzerland), Tele2 (now merged with Sunrise), Cablecom, and Orange.

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[11] All material excerpted from the Berkman Report, "County Overviews: Switzerland" http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/Berkman_Center_Broadband_Final_Report-Country_Overviews_15Feb2010.pdf (accessed January 27, 2011).

Although Switzerland is not a member of the European Union, the regulation of the Swiss telecommunications market is highly influenced by the EU telecommunications framework. The legislative framework is intended to serve the goal of universal service: broad access to reliable and affordable telecommunication services.

The most important law governing the telecommunications market in Switzerland is the Law on Telecommunications (LTC) and the corresponding Ordinance on Telecommunications and Services (TIO).Since its amendment in 2007, key elements of the LTC regime include local loop unbundling and an ex-post mechanism to set prices for network access.

The political economy of broadband policy in Switzerland revolves primarily around the efforts of Swiss regulators, with the support of newer entrants into the telecommunication markets, to secure additional regulatory powers that would allow them to act more forcefully in opening up Swisscom’s infrastructure to competitors. The struggle over local loop unbundling, described in more detail below, dragged on for many years before Swisscom was ultimately forced to open its copper wire to its competitors.

Today, a newer version of the same debate is underway regarding further amendments to the LTC that would offer regulators expanded power to intervene in broadband markets, again pitting entrants against the incumbent. Swisscom seeks to avoid any further regulations, whereas its competitors, including the local power providers, want further amendment of the LTC to regulate fiber deployment.

The Federal Council formulated an initial Strategy for a Swiss Information Society in 1998, which was updated and enhanced in 2006. The Federal Council's paper sets forth the basic principles of such a society and identifies the areas where action is most urgent. These guidelines are intended to inform the development of agency- and department-specific sub-strategies. In 2008, the Federal Council decided to renew the mandate of the Interdepartmental Information Society Committee (ISSC). The committee has until 2011 to implement the Federal Council's strategic goals.

The Swiss strategy regarding broadband development has four core areas and principles:

1. Universal Service: An economical, reliable, and high-quality technical infrastructure should be offered to all in Switzerland.
2. Non-discriminatory Access: Equal and unimpeded access to information and communication technologies should be granted to all.
3. Federalism: Clear legal regulations and voluntary cooperation should eliminate inefficiencies typical for a federal country.
4. Cooperation: The government seeks to promote and facilitate an effective partnership among government, business, civil society, and science.

The Swiss federal government does not directly invest in broadband infrastructure. The primary task of the government is to build a sound regulatory framework that creates incentives and favorable conditions for market development.

In contrast to many other countries, the Swiss government has not made a commitment to use parts of the country's stimulus packages to invest in the national broadband infrastructure. A motion by a Swiss parliamentarian asked the Federal Council to support the regional development of the fiber rollout. The Federal Council responded that it was too early to consider such measures.

The federal government has introduced a variety of different programs and strategies to support development towards an open information society. However, due to the strong federal system, cantons play a key role when it comes to educational or cultural initiatives and measures.

Broadband competition in Switzerland has been most active at the intermodal level, principally between cable operators, led by Cablecom, and the incumbent, Swisscom, offering DSL service over copper lines. Proponents of intermodal competition can point to the fact that a large majority of Swiss households have access to both cable and DSL connections. Moreover, competition from cable service providers is likely to have played an important role in Swisscom's decision to invest in upgrading its Internet offerings, seen by some as a direct response to the entry of cable operators into broadband markets. More recently, Cablecom has started the process of upgrading its system to offer increased transmission rates with Swisscom responding with investments in fiber.

Despite these signs of viable competition among different proprietary platforms, Swiss regulators, in step with their European counterparts, have also pursued open access policies. The Swiss government decided to open the "last mile." Reasons can be found in the telecommunications market: Swisscom, the former monopolist, was still dominating the market and new entrants were struggling to find a way into the market. Swisscom's dominance was particularly overwhelming in the wireline telecommunication market. Although the situation looked better on the broadband market, where competition came from a relatively strong cable provider, the main problem was the dependence of the service providers on Swisscom's wholesale products. The Federal Council feared that this fact could have negative effects on future innovation in the broadband market.

Net neutrality has not become a major issue in Switzerland. No complaints regarding discriminatory practices have been lodged with ComCom, and the agency has therefore not taken any action in this respect. None of the relevant agencies of the Swiss government, such as the Federal Council, ComCom, and OFCOM, have made any official statement regarding their position on network neutrality.

United Kingdom[12]

Approximately two-thirds of households in the UK have access to the internet via a broadband connection. DSL is available to nearly the entire country and cable available to slightly over half. Fixed broadband prices are competitive in the UK having fallen by over 16% each year between

[12] All material excerpted from the Berkman Report, "County Overviews: United Kingdom" http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/Berkman_Center_Broadband_Final_Report-Country_Overviews_15Feb2010.pdf (accessed January 27, 2011).

2006 and 2008. UK's performance on speed has lagged as measured by both advertised and actual speed.

Two UK companies, British Telecom (BT) and Virgin Media, have plans to roll-out "super-fast" fixed broadband networks in the coming years. As of July 2009, Virgin Media has made fiber-based broadband of speeds "up to" 50 Mbps available to 12.5 million homes. This is the only fiber service currently available in the UK. BT plans to deploy its super-fast broadband product of 40 Mbps via fiber- to-the-home or fiber-to-the-cabinet (node) to 40% of the UK by 2012. Though no other companies have announced such significant investments in next generation networks, some have begun discussions with Openreach, BT's functionally separated, wholesale open access provider, to upgrade access networks to support higher speeds.

Although BT provides 65% of wireline connections in the UK, their broadband retail arm now holds just over one quarter of the broadband retail market. The cable provider, Virgin Media, accounts for 23% of the market. Carphone Warehouse serves about one quarter of the UK market after acquiring AOL UK and Tiscali; prior to being purchased by Carphone Warehouse, Tiscali had acquired several competitors. The television company, BskyB, commands 12% of the market and Orange Home 5%. Many smaller ISPs serve the remainder of the market.

The UK was an early leader in reforming telecommunications markets. The first version of Britain's independent telecommunications regulator, Oftel, was created in 1984 and oversaw the transition to a duopoly market. The duopoly approach was abandoned in 1991 and four years later, Oftel had made significant strides towards promoting service-based competition in UK with an agreement with BT for accounting separation and interconnection based on unbundled components, which had their most immediate effect on international calls competition. Between 1998 and 2000, Oftel issued a series of reports, and managed a series of consultations, that set the terms for wholesale and bitstream access to BT's network. Initially, Oftel and BT were planning to include only wholesale access, but in response to the EU process that later produced the 2002 Directives, Oftel expanded the process to encompass local loop unbundling as well.

UK telecommunications were highly regulated under the BT monopoly. Today, the regulatory landscape is largely pro-competition. Nonetheless, Ofcom's current administration is viewed as highly aligned with the Labour Party, and UK Conservatives are eager to reduce the regulator's powers. In a recent speech, British Tory leader David Cameron stated, "[w]ith a Conservative Government, Ofcom as we know it will cease to exist. Its remit will be restricted to its narrow technical and enforcement roles." In that speech, Cameron proposed to vest the Department for Culture, Media, and Sport with many of Ofcom's current responsibilities. The European Union would likely welcome a reduction in Ofcom's power. In 2007, the European Commission launched a proposal to subject telecommunications regulatory decisions of member states to a new, Europe-wide authority.

In addition to the regulatory measures described above, the UK is now planning to ensure (1) universal broadband service in the UK of at least 2 Mbps and (2) the deployment of next generation, "super-fast" broadband networks. The universal service commitment, outlined in the June 2009 *Digital Britain* report prepared by former Ofcom head Lord Stephen Carter, aims to provide universal availability of broadband at speeds of at least 2 Mbps by 2012 using existing copper and wireless networks. Upgrades to these networks will be supported by £200m of direct government investment from funds leftover from the Digital Switchover, “commercial gain through tender contract and design, in-kind contributions from private partners,” and more extensive obligations on mobile carriers, among others.

The deployment of next generation networks will rely primarily on private investment. However, *DigitalBritain* concludes that the market alone will lead to the deployment of next generation networks to only one-half to two-thirds of the UK. To reach the “final third,” the report proposes a “Next Generation Fund” consisting of a 50 pence “supplement” on all fixed copper connections.

The UK has relied largely on market forces to deploy broadband service. Consequently, direct government investment in infrastructure is limited.

Digital Britain highlighted an urgent need for greater IT skills training to satisfy the needs of British businesses. The report recommended a £30m funding increase851 for the Technology Strategy Board, a public body established in 2007 that “stimulates technology-enabled innovation” through technology research and development, and commercialization. Since 2006, the Train to Gain program, which provides some government funding for worker training, has helped 127,000 UK businesses train over 1 million workers, albeit primarily in “lower level skills.” In February 2009, the government began the Home Access Programme, a pilot project that provided grants for online access to homes with children attending state-run schools. *Digital Britain* reports that the program has been a success and that grants will be unlimited during the rollout of the national program in December 2009. The government also supports a network of 6,000 UK Online Centres, established in 2000. Each day, two million Britons use the centers, which are concentrated in “areas of high deprivation,” to access online government services or to take courses in digital learning. The UK is developing a national curriculum to provide digital learning opportunities in schools to ensure that future workers have essential digital skills. Curricular revisions will include “information and communications technology” (ICT) to a new “core competence” parallel to more traditional curriculum subjects.

In 2007, Ofcom maintained that given the remedies for anti-competitive conduct available through the European framework, net-neutrality non-discrimination regulations in the UK were unnecessary. In May 2009, the European Parliament voted to allow ISPs the discretion to shape traffic over their networks in the Telecoms Rules of 2002, and the issue is unlikely to be debated again at the conciliation procedure in late 2009.

Exhibit V
Municipal Communications Networks — Financial and Market Highlights

Seattle Community Broadband Initiative

Most municipal communications operators in the United States have been "over-builders"—that is, they built new communications infrastructure "over" the wires and cables in areas where there were existing broadband, cable, and telephone systems.

While a few municipal over-builders have constructed infrastructures and offered access (for a fee) to any qualified retail provider that wants to sell services to customers—the "competitive-access model"—most have followed a "retail model," using their infrastructures to sell their own retail voice, video, and data services to customers.

Regardless of which model they pursued, municipal over-builders have typically expected that theirs would be a stand-alone enterprise—one that would be able to cover its debt service, operating expenses, and expansion costs—based solely on customer revenue.

In order to sustain itself solely on revenues, however, such a stand-alone enterprise must capture the majority of the voice, video, and data market in its service area. Because this level of market share is virtually impossible to attain, over-builds generally are not financially sustainable as stand-alone enterprises.

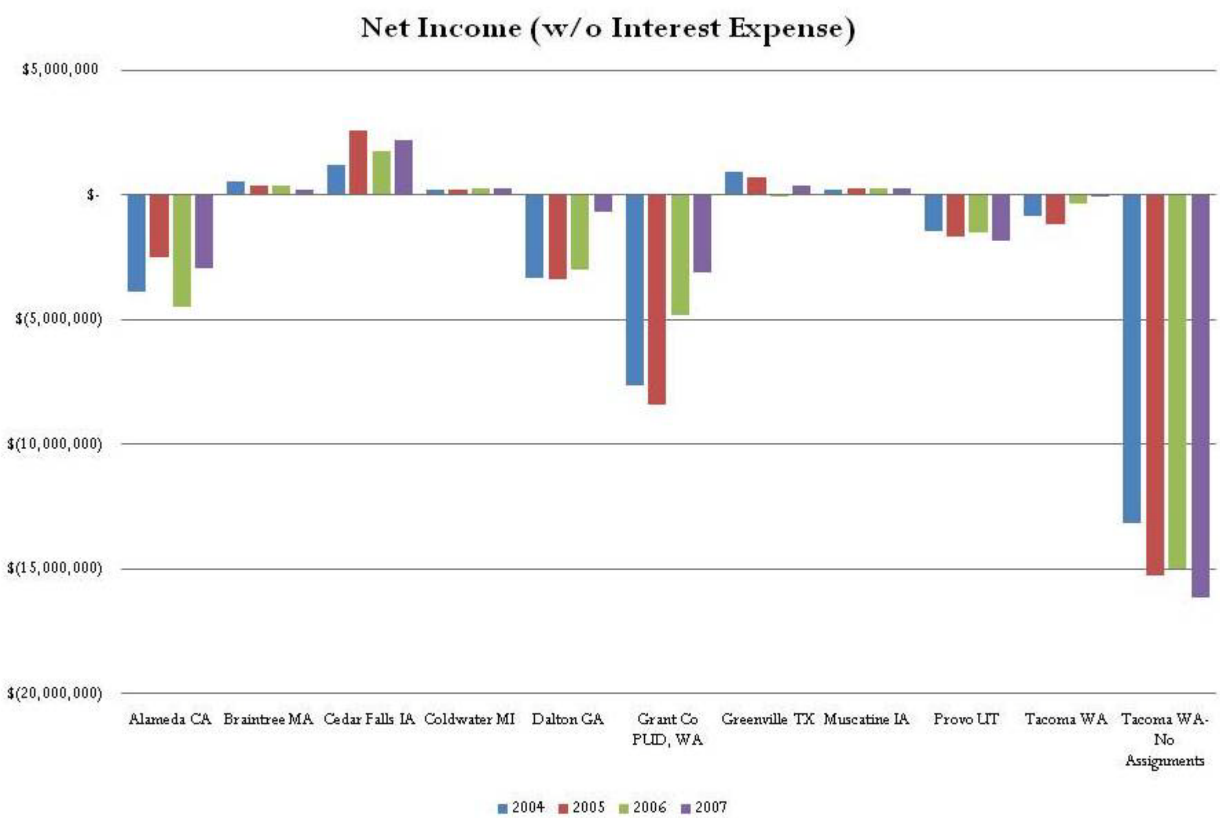
The following pages illustrate the challenges for municipal over-builders in terms of financial performance, cable industry data, and individual market data. While some of the charts include data that is a few years old, the data generally still hold true today.

Financial Performance

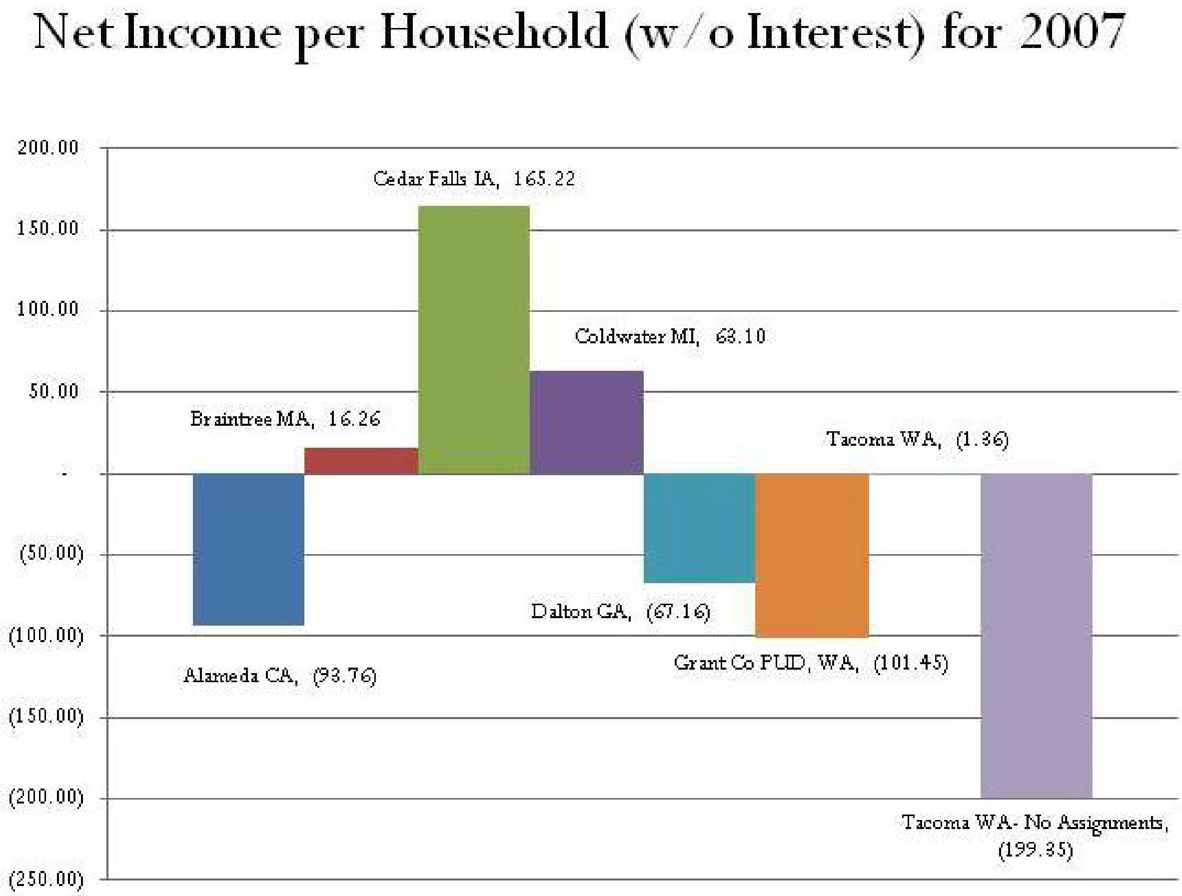
The data in this section illustrate the net income of municipal over-builders in 10 cities, from Braintree, Massachusetts to Tacoma, Washington to Alameda, California. Most of the operators have a negative net income over the time period examined.

Net income is a reasonable basis for comparison because, while depreciation is a non-cash expense, a funded depreciation account is essential for replacing equipment as it becomes obsolete. These examples do not include interest because not all of the systems made interest payments.

In the chart below, Tacoma, Washington is represented twice—once "with assignments" and once without. "Assignments" are the amounts of funding that Tacoma's municipal electric utility provided to cover the cable system's operating expenses. Thus, the "without assignments" data represents Tacoma's results if it had been a stand-alone enterprise—and the difference between the two sets of data (about $15 million in 2007) is the amount of the cable system expenses the electric department covers.



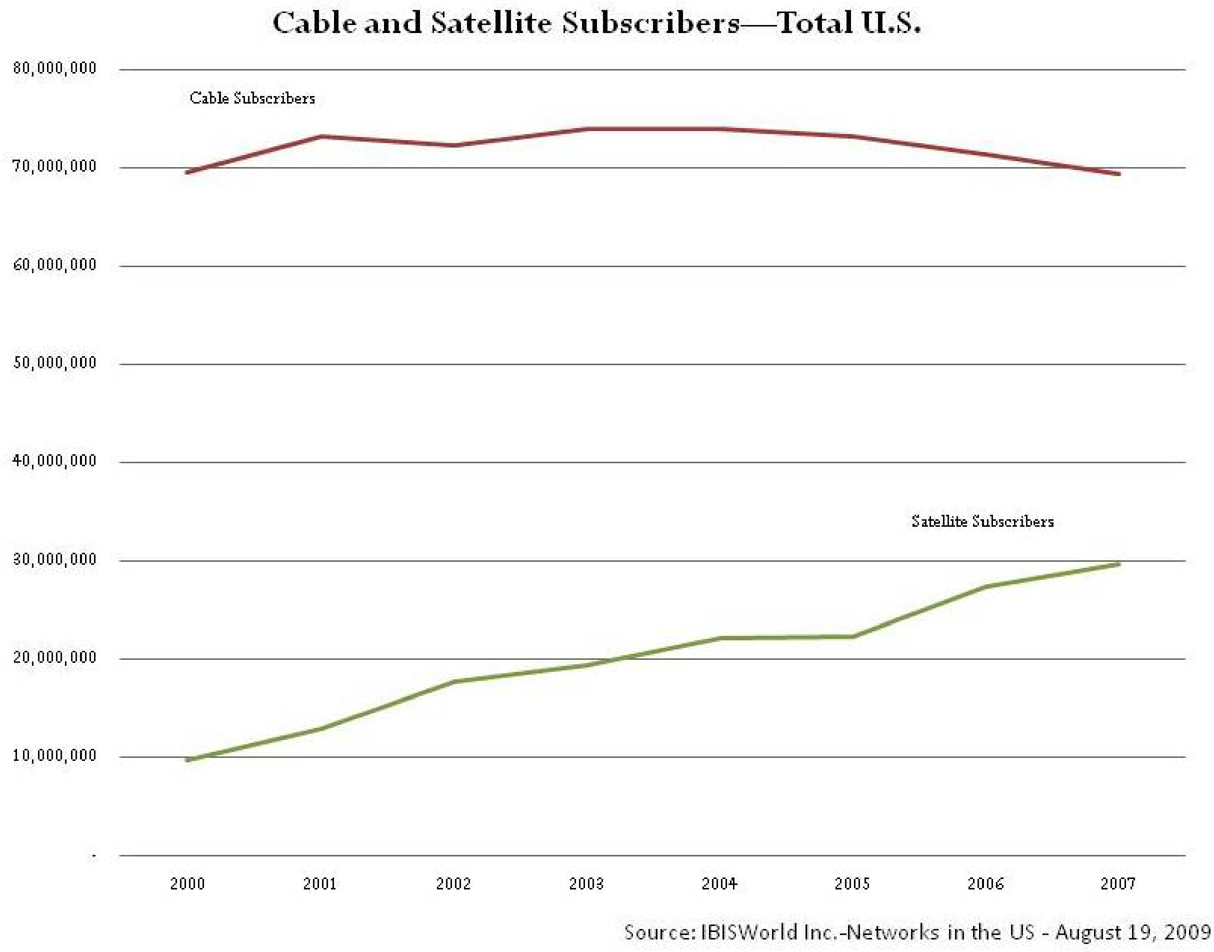
Examining the net income *per household* shows the magnitude of a system's net income divided among the total number of households in a city or service area—in other words, each household's share of the net income. The following chart illustrates that in 2007, the system in Tacoma, Washington "without assignments" (i.e., without the electric utility's subsidy) showed a net income loss of almost $200 per household.



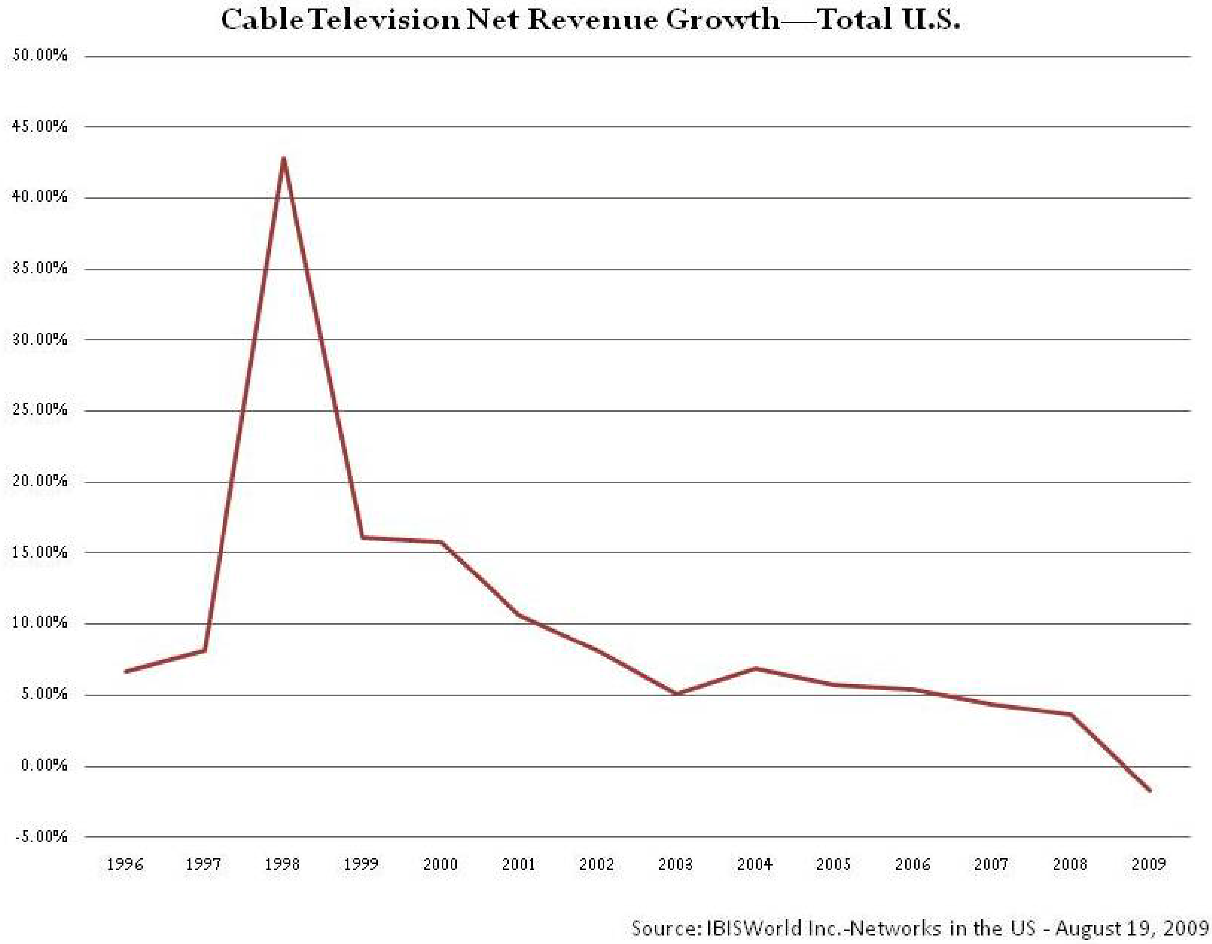
Industry Data—Cable

One of the factors that contribute to the financial difficulty of the retail over-build model is the decline of subscription rates and net margins of cable television services.

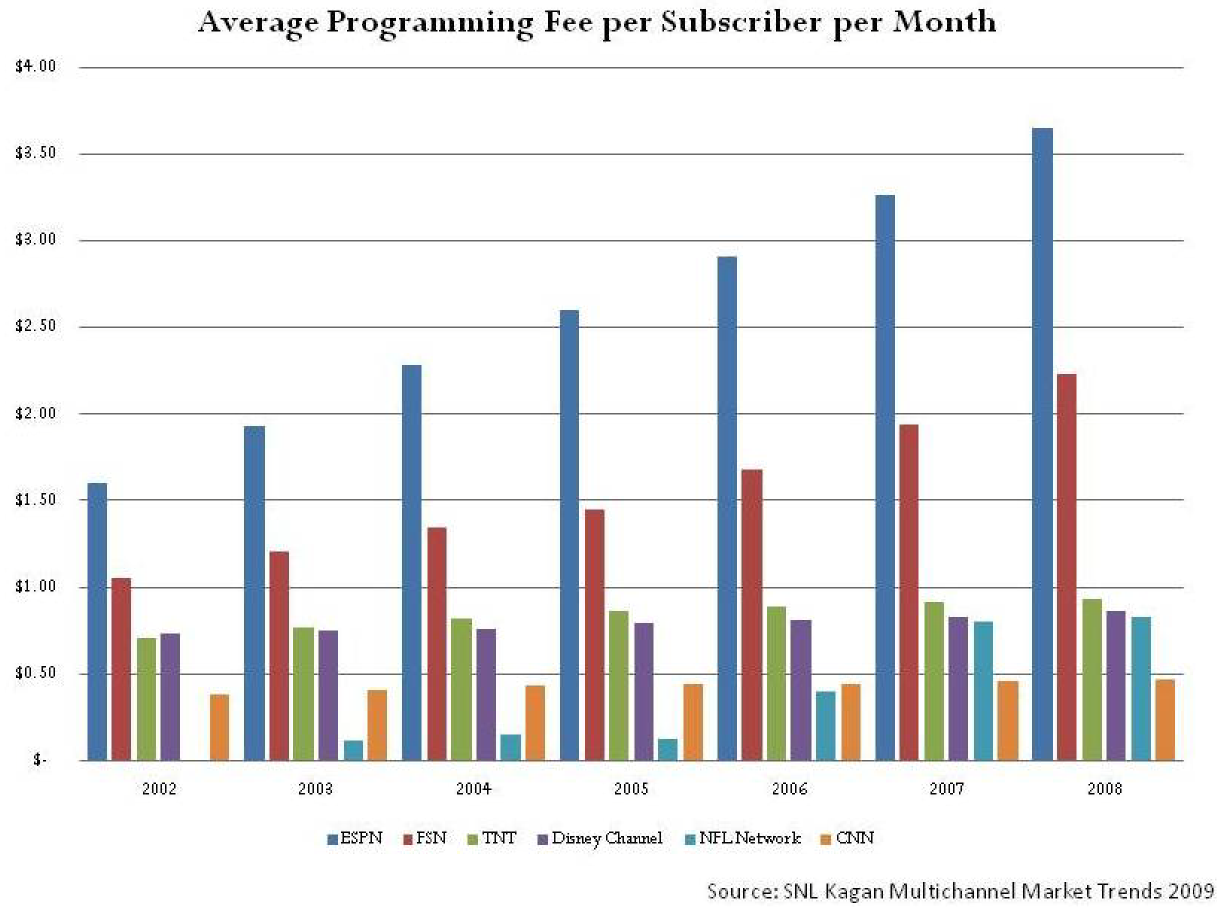
Cable subscribership is declining nationwide, while satellite subscription (and, anecdotally, free and lower-cost "substitution" services like Netflix and online video) are on the rise.



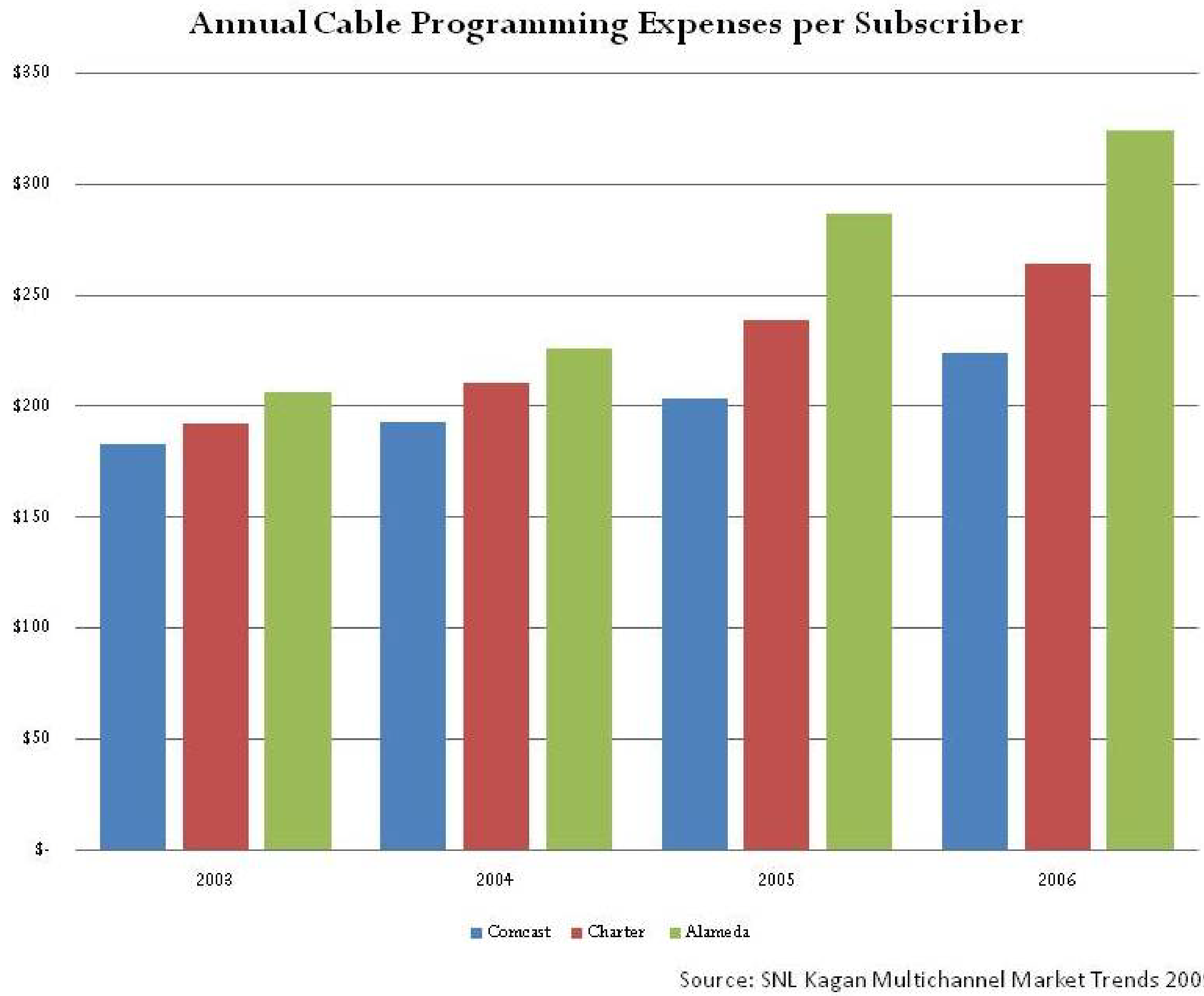
Along with a shrinking subscriber base, the cable industry's net revenue growth is also dropping.



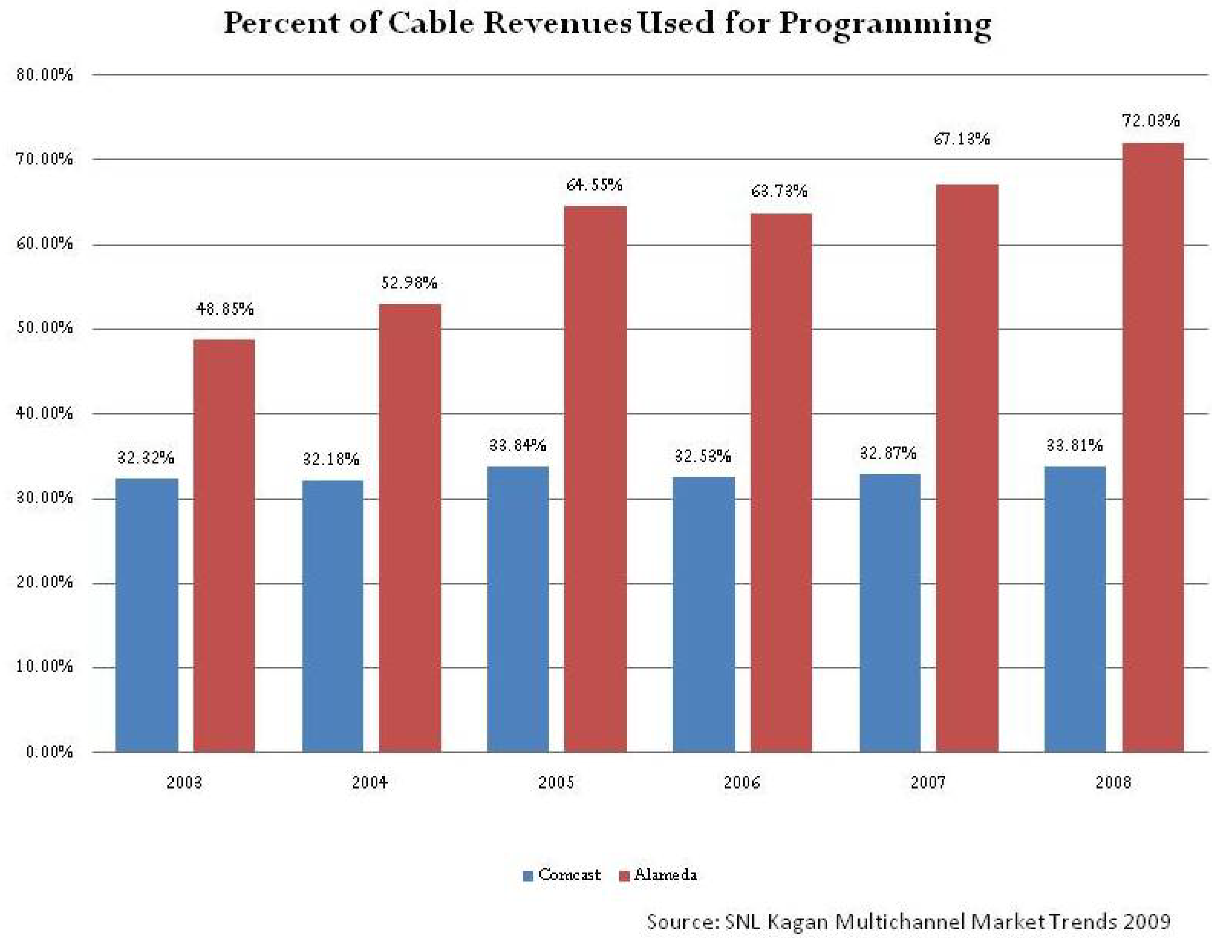
For cable operators, the loss of subscribers is not the only financial pressure. Cable television programmers—the companies that own the "content"—exert a great deal of price control. Cable operators must pay the programmers for every subscriber who gets the program (whether the subscriber watches it or not), and many programming fees continue to rise. The chart below, for example, illustrates the steady increase in monthly fees for ESPN and other channels.



The price of programming is more of an issue for smaller operators than for large incumbents like Comcast, which own programming (either directly or through investments in other programming owners) and also have greater buying power. The following chart, for example, compares annual cable programming expenses for Comcast, Charter (a smaller incumbent provider), and the small Alameda, California cable system. All of the operators saw their prices increase, but the smallest operator's prices rose the most (more than 50 percent) over the time period.

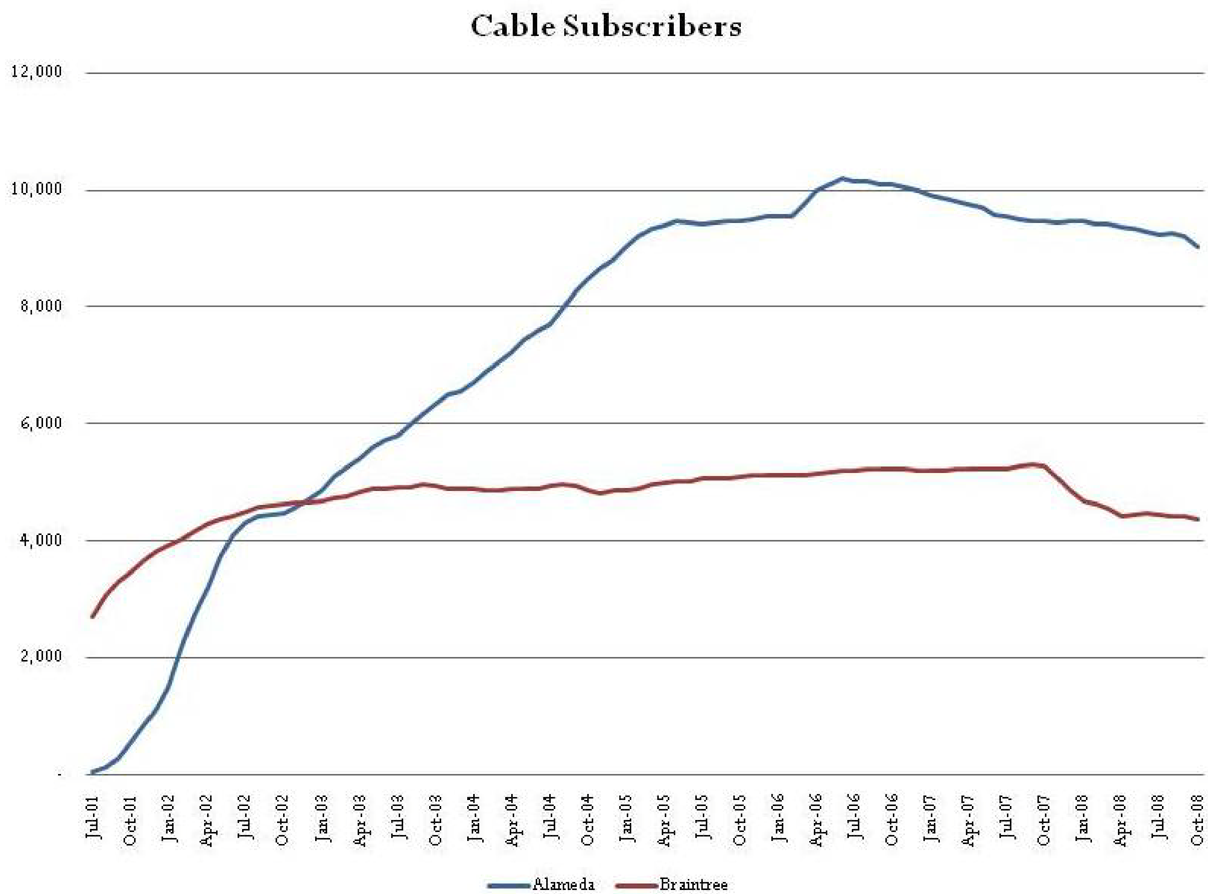


Looking at programming costs from another angle, the Alameda system spent more and more of its revenues on programming as prices increased (thus shrinking its net margin from about 50 percent to less than 25 percent). Over the same time period, even with programming price increases, Comcast was able to keep its net margin fairly constant. Ultimately, Comcast had greater than a two-to-one advantage in net margin over Alameda.

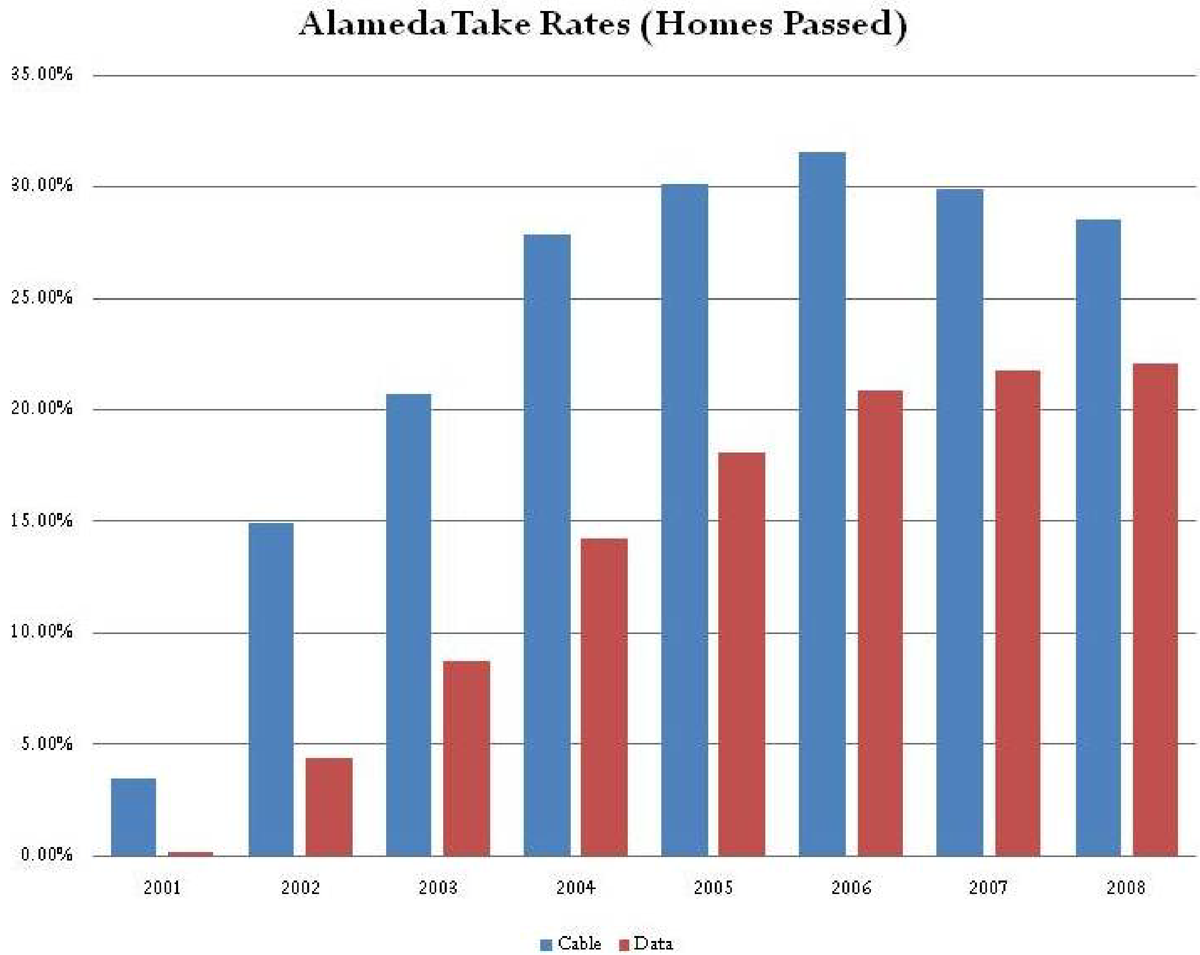


Market Data

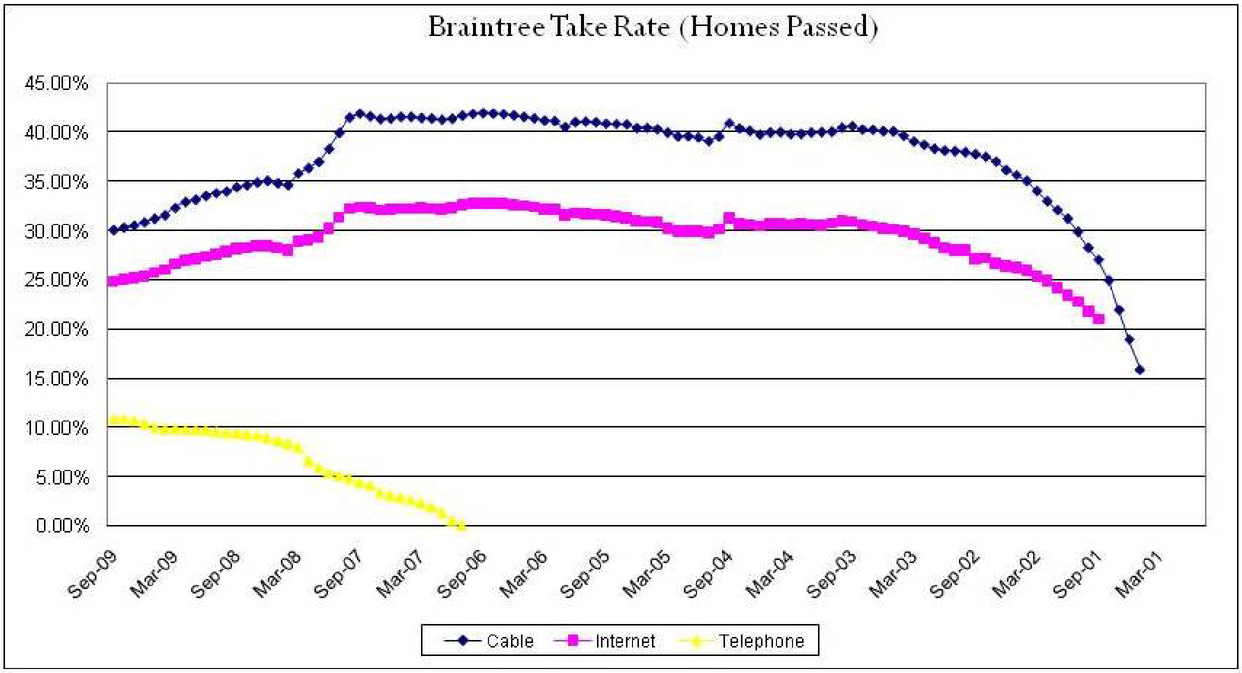
Specific markets illustrate the national trends in cable industry subscribership. In Braintree, Massachusetts and Alameda, California, the cable systems' subscribership peaked and then began to decline.



In Alameda, the take rate for cable services began to decline even as the take rate for data continued to increase (slightly).



When cable take rates reached a plateau in Braintree, the city introduced telephone service as an attempt to solidify the customer base. Telephone take rates were very low, and a decline in cable and data take rates continued unabated.



Cedar Falls, Iowa is an example of a municipal over-build cable operator that has continued to grow and take market share. However, Cedar Falls was first on the market with cable and data services—and its competitor, Mediacom, did not respond with any competitive action. In other words, this successful municipal operator was able to increase its market share in large part because it became the incumbent provider, and it faced no competition.

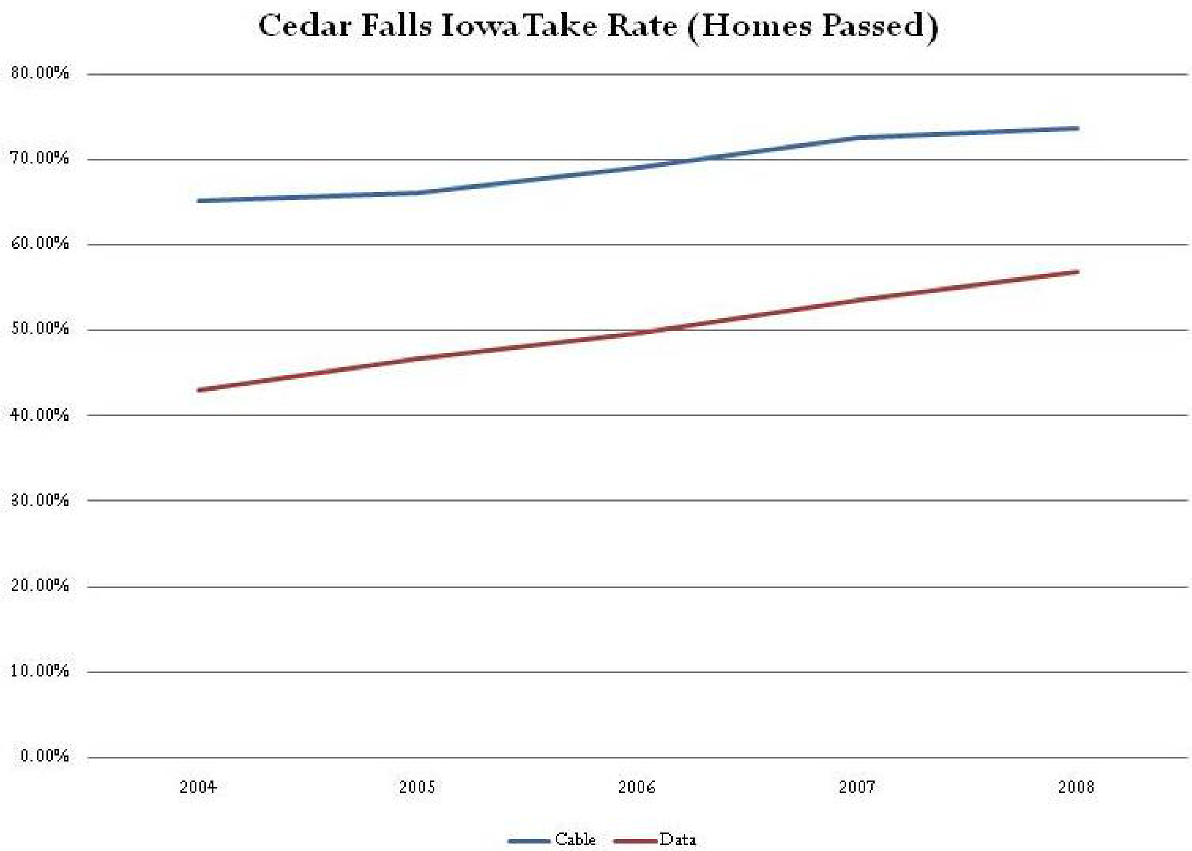


Exhibit VI
FTTP Infrastructure Requirements Overview

Seattle Community Broadband Initiative

City of Seattle Network Physical Plant

Background

If a network is compared to a house, physical outside plant (infrastructure) is the foundation. It includes building entry, central office facilities, physical interconnection, outside cabinets, underground conduit, utility poles, pole attachments, and power. The physical plant architecture must take into account the relationships between the network and relevant entities such as building owners and operators, utility pole owners, easement owners, regulators, and other utilities.

Physical outside plant is generally the portion of the system with the longest lifetime, and therefore can be the most challenging to correct system-wide if it is found lacking, because it is the layer least frequently refreshed and replaced through regular procedures. Fiber-based physical plant can last as long as 50 years, with 20 or 30 years as a typical depreciation baseline.

Physical plant choices will fundamentally determine the cost, reliability, and scalability of the network. Reliance on aerial or underground outside plant, for example, will be one of the key factors in determining construction cost. The type of outside plant construction and the portions of the rights-of-way used will determine the build timeline and the capital and ongoing costs. The degree to which physical redundancy is built into the network will be a critical factor in the network's availability and the time to restore after an outage. The design practices chosen for construction of outside plant will determine how resilient the plant will be to cuts and damage from the elements.

Construction choices should be cost-justifiable and balanced against the benefit they provide. There is also the possibility of leveraging existing infrastructure—buildings, utility poles, attachments, conduit, sewer lines, and building entry—to lower costs. The usefulness of existing infrastructure will depend on what is available in The City, and the ability of The City to cost-effectively make use of it.

Costs

Physical Plant

Based on the prevailing mix of aerial and underground utilities and the total plant mileage, the estimated cost of constructing the network will be $700 million to $850 million. Approximately 55 percent is for construction of physical plant in the public right-of-way, comprising the network core and the fiber through each neighborhood, passing each home and business. Approximately 45 percent is for the construction from the right-of-way to the customer premises, including the terminal user equipment. The remainder is for constructing network hubs near

SCL’s existing electric utility substations or other City properties, and for core network electronics.

Table 1: City of Seattle Fiber-to-the-Premises Cost Estimate

Category	**Total**
Headend Costs (including portal and network operation center)	$27,000,000 to $32,000,000
Hub Costs	$12,250,000 to $14,700,000
FTTP Fiber Network	$279,000,000 to $335,000,000
Subscriber Costs	$385,000,000 to $460,000,000
Total	*$700,000,000 to $850,000,000*
Per Passing	*$2,200 to $2,600*

There is considerable uncertainty in the cost of citywide physical plant construction. Aerial construction requires attachment to often crowded utility poles and relocation of existing utilities. However, SCL’s ownership of the utility poles may make aerial construction a better option for Seattle than for other cities (which would need to negotiate new agreements with incumbent providers to attach to the poles). Typically, aerial construction is only an option where the existing utilities are aerial. In Seattle, 72 percent is aerial and 28 percent is underground.

Underground construction is always costly unless existing underground conduit (pipes) are available; according to The City, relatively little conduit is available for new communications. Additionally, the prevalence of rocks in the soil makes it especially costly to build underground communications plant in Seattle (as well as adding to the uncertainty in construction cost). We advise incorporating a range of 30 percent in the cost estimates to account for the uncertainty.

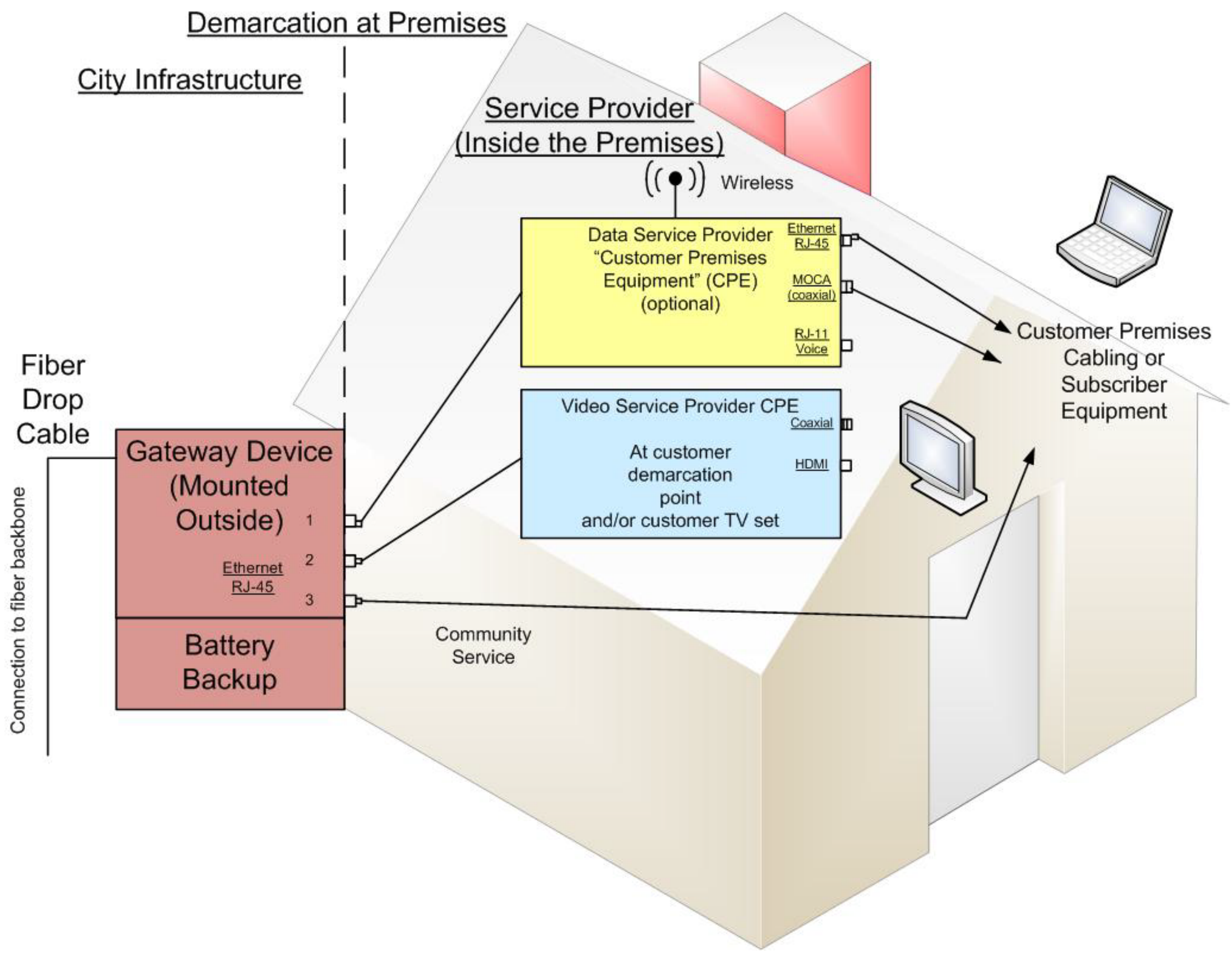
User Installation

This analysis assumes installation of service to all homes and businesses. User installation has two major components: 1) construction of fiber optics from the right-of-way to the premises, including building entry, and 2) installation of terminal customer premises equipment (CPE).

Like construction in the right-of-way, installation costs vary widely depending on whether the drop is aerial or underground. The range is $1,200 to $1,600.

In order to provide the desired level of network openness, the service terminates with electronics providing two or more Ethernet interfaces—one for “community services,” and one or more for private sector service providers (Figure 1). Service providers can provide their own CPE and interface with customers through twisted pair, coaxial, or wireless media to deliver data, video, and/or voice services. The City would provision connectivity from the interconnection point to the customer. The service provider would have the relationship with the customer, install services to the customer, and pay a fee to The City for access to the network.

Figure 1: Demarcation Between City and Service Provider at Customer Premises



Because it is possible to provision multiple virtual interfaces through a single physical Ethernet interface, it is not absolutely crucial to have multiple physical Ethernet interfaces in order to have open access to the premises. An additional router can be provided by The City at the premises to add ports for service provider connection. However, it provides a cleaner demarcation and reduces the number of devices (and also potential points of failure) to have the same number of physical ports on the premises equipment as the number of service providers simultaneously accessed at a premises.

Battery Backup

Unlike telephone and cable service, fiber services will cease to operate unless there is power at the premises. Battery backup is typically physically separate from the fiber terminal equipment. Different service providers have different arrangements for backup power, ranging from providing none, to providing a battery backup as part of the installation (but making its maintenance and repair the customer's responsibility), to taking full responsibility for backup power.

The cost estimate for battery backup is $75 for industry-standard backup power, typically providing four hours of operation for telephone and, depending on configuration, shorter periods of operation for Ethernet service.

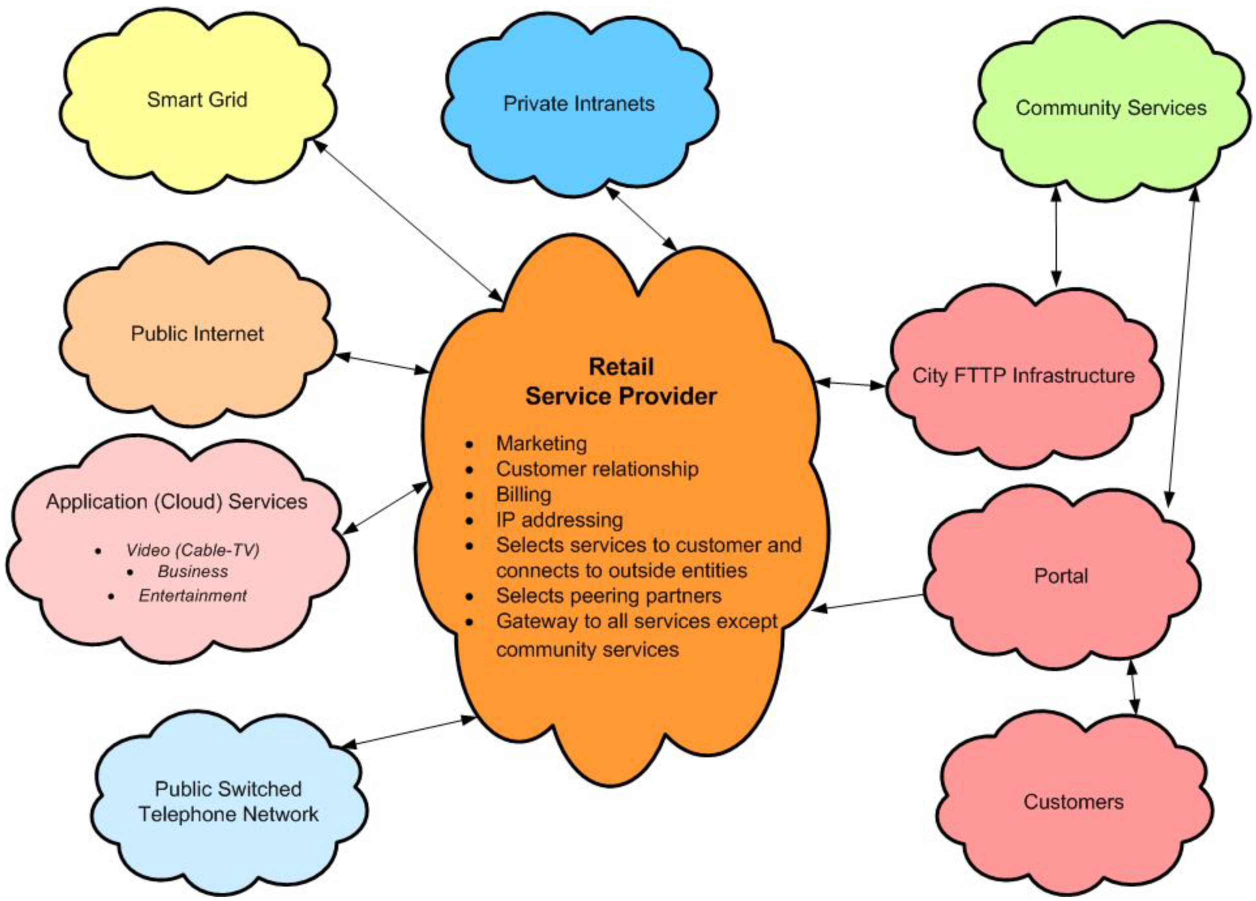
Network Operations Center

The network requires operation and maintenance of all systems from the customer demarcation to the handoff to the service provider at The City's interconnection point. Additionally, The City will operate infrastructure to make community services available to the customer.

Therefore a network operations center (NOC) must monitor all connected devices (such as core equipment and City-operated terminal equipment), the interfaces to the service providers, outside networks, physical plant, and power. It must document the transport network and all moves, adds, and changes. It must coordinate all repairs and maintenance. It must track performance relative to service-level agreements (SLA).

The NOC will receive and respond to communications from service providers regarding physical plant and the transport network and will be responsible for establishing and maintaining secure communications pathways according to service agreements between customers and from customers to their service providers (Figure 2). The City and its NOC will be responsible for providing transport services between interconnection points and customers on a wholesale basis according to agreed service levels. The NOC will respond only to service providers and not directly to customers.

Figure 2: Role of Service Provider



The NOC will not provide global Internet protocol (IP) addresses to customers or purchase or maintain connections to the Internet or outside networks. It will not prioritize traffic based on content or be responsible for virus control, e-mail, or other services—in other words, the transport network will be content-neutral. It will not provide value-added applications or user accounts. These roles will be the responsibility of retail service providers. The retail service providers, in turn, will work directly with the customer, respond to customer requests, and contact The City if maintenance or repairs are necessary.

Portal

The City will operate a website that provides links to retail providers and access to community services from City government agencies, Seattle Public Schools, the University of Washington, and medical and other nonprofit and educational entities. Because the portal will not require connections to outside networks or Internet capacity, it will be able to deliver bandwidth-rich applications without creating overwhelming bottlenecks in the network.

The portal service will be available to all customers, even those who are not subscribing to the Internet through a private sector service provider.

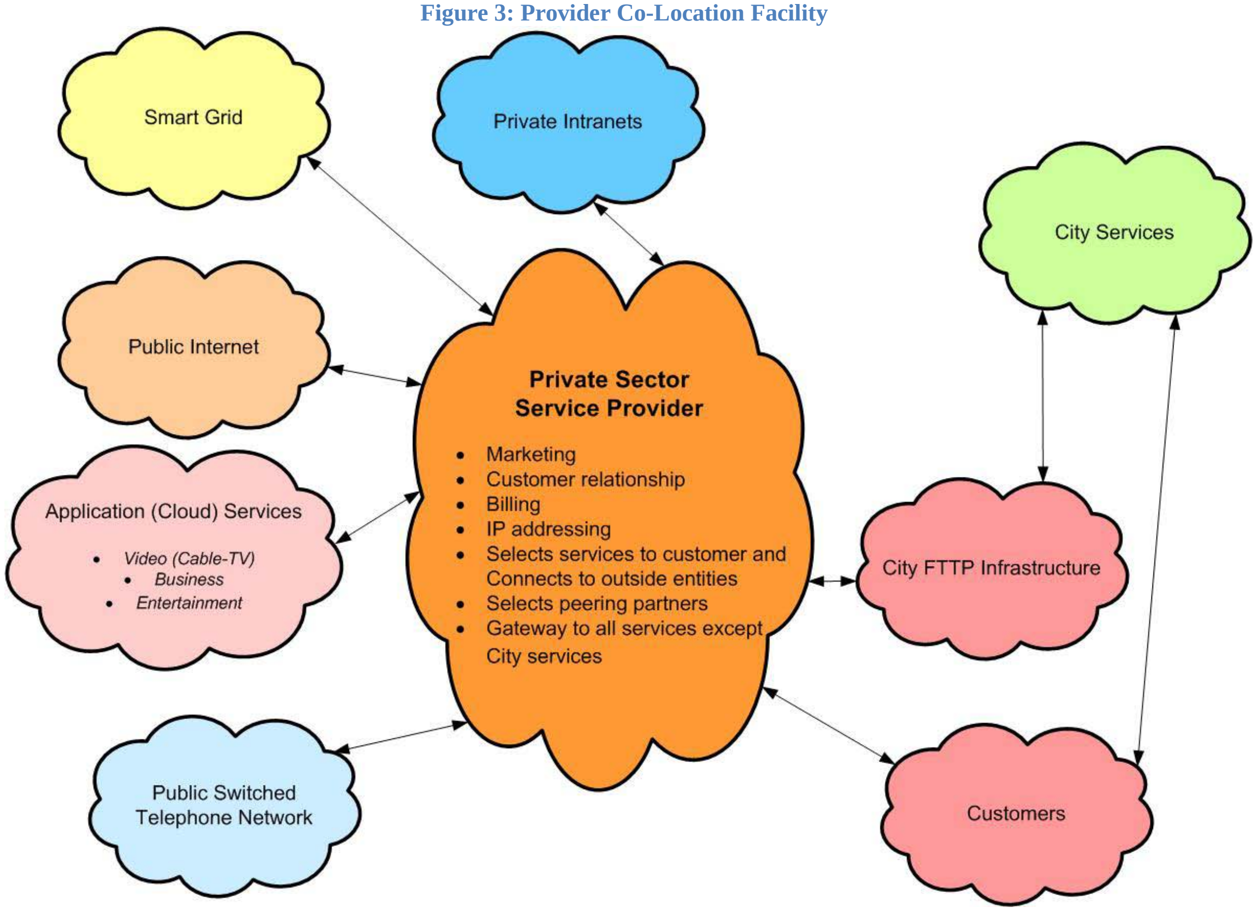
The portal may include the type of information and government services available on the Web, plus bandwidth-rich applications including live classroom video feeds, telemedicine, energy management, and digital media.

The role of The City will include hosting the Web content portal where customers access community services. It could also include assisting agencies with development of content, and maintenance of content in City data centers.

Access Facilities for Providers

Service providers will require a robust co-location facility for interconnection. Interconnection may take place at a data-center-grade facility owned and operated by The City or SCL, or may be located in a public interconnection facility (such as the Westin network access point). Service providers should be provided the opportunity to connect at multiple redundant co-location facilities. However, service providers should be provided connectivity over the backbone network infrastructure so that they do not need to be present at each hub facility in order to reach all subscribers (Figure 3).

Figure 3: Provider Co-Location Facility



The Ethernet service approach does not constrain The City to any particular physical network architecture (e.g., Active Ethernet, PON) and is compatible with service approaches proposed by the Federal Communications Commission (FCC) for video and broadband services to the home,[1] making it possible for service providers and customers to leverage a national market for compatible equipment.

A range of manufacturers and devices provide this interface, both at the premises terminal and at City-designated interconnection points for service providers. The cost per passing of premises equipment ranges from $400 to $800.

Multi-Dwelling Units

In Seattle, about 48 percent of dwellings are in multi-dwelling units (MDU).[2] Regarding outside physical plant, the effect of MDUs is to make it possible to reach more dwellings with a given amount of cabling in the outdoor right-of-way. The per-dwelling cost of installation will vary, depending on the age of the building and physical accessibility of the units, but will generally be less than the cost per single-family residence installation. Manufacturers are creating new and evolving technologies for fiber installation and electronics in MDUs, so it can be expected that the per-dwelling costs will continue to fall relative to the costs of single-dwelling service. Based on our experiences, we estimate a range of costs from 75 percent to 100 percent of the single-dwelling installation cost; at this stage, we conservatively estimate the installation cost to be 100 percent of the cost of single-dwelling installation.

[1] Federal Communications Commission. (FCC 10-60, PP Docket No. 00-67 (released April 21, 2010)). *In the Matter of Compatibility Between Cable Systems and Consumer Electronics Equipment*.
[2] U.S. Census Bureau. *DP-4. Profile of Selected Housing Characteristics: 2000, Seattle city, Washington*. Retrieved October 29, 2010, from American FactFinder Quick Tables: http://factfinder.census.gov/servlet/QTTable?_bm=y&-qr_name=DEC_2000_SF3_U_DP4&-ds_name=DEC_2000_SF3_U&-_lang=en&-_sse=on&-geo_id=16000US5363000.

The City of Seattle

Seattle Community Broadband Initiative

Companion Documents

January 31, 2011

Confidential: Pre-decisional and Deliberative Document

This document is a collaborative effort of the Department of Information Technology (DoIT), the Office of the Mayor of Seattle, Seattle City Light (SCL), Seattle Public Utilities (SPU), and the City's consultant (CTC). The Seattle project team included Carol Butler of SCL, Jorge Carrasco of SCL, Elliot Day of the Office of the Mayor, Erin Devoto of DoIT, Derek Farmer of the Office of the Mayor, Ray Hoffman of SPU, Bill Schrier of DoIT, and Melina Thung of SPU.

Frequently Asked Questions (FAQs)

Seattle Community Broadband Initiative

The Purpose

Why does the City wish to build a next-generation communication infrastructure in Seattle?

Seattle seeks to build a “Community Access Infrastructure”—the fiber optics and related equipment necessary to support communications networks and applications from a variety of public and private service providers—for three fundamental reasons:

- To create a platform for next-generation technology to stimulate innovation and opportunity. Creating economic stimulus for private sector job creation is the primary objective.

- To create a competitive market for current-generation communication services that we expect to expand consumer choice and lead to improved value.

- To provide ubiquitous service to all businesses and residents, and, in the process, to create a level playing field and equal access for all to an essential public infrastructure.

The Business Model – Overview

What is the model in a nutshell?

The City will spend $700 million to $900 million to build and operate an “open access” network infrastructure that connects every home and business in the City. The infrastructure, which will be a platform available to all qualified public and private service providers, will serve and support three primary functions:

- The Seattle Community Access Infrastructure will create a platform that facilitates a competitive market for “Traditional Services” (phone, Internet, and cable TV). These services would be offered competitively by retail providers, which would pay for infrastructure access.

- “Seattle Services” will be offered by local educational, governmental, healthcare, or similar intuitional entities through a “Community Portal” (like a website) that is available free-of-charge to all City businesses and residents, even if they do not subscribe to any retail services. Because these entities would have access to all businesses and residents, not just those who can afford to pay for high-speed Internet access, they would be able to improve service delivery and efficiencies.

- Finally, the Seattle Community Access Infrastructure will provide innumerable "Societal Benefits" to the community in the same way our highway system is the foundation for benefits that flow to all citizens. These may include economic, social, and environmental benefits. These benefits would be supported by taxpayers, just like other City infrastructure.

What are the basic attributes of this model that make it unique?

Three basic attributes of this model make it unique:

1. It is the first community access infrastructure in the United States that connects every residence and business—not just another competitive public or private network that connects only customers who pay for service. Every residence and business would have access to selected educational, governmental, and healthcare services, as well as a menu of retail services that they could choose to purchase.

2. It explicitly recognizes the value of "Societal Benefits" and accounts for those benefits in the cost/benefit analysis and business model.

3. It explicitly asserts that advanced technology infrastructure is a public asset, and engages the community as a partner to fund a portion of the infrastructure cost.

How did the City choose this model?

At the direction of the Mayor, a team comprised of representatives from the Mayor's staff, Seattle City Light, Seattle Public Utilities, the City's Department of Information Technology, and the City's community broadband consultant (CTC) developed this plan after carefully considering a range of objectives and business models. This model is the culmination of years of study by the City and lessons learned from other models deployed across the country.

Has this model been tried anywhere else?

Some elements of this model—for example, the open access for retail providers—exist elsewhere in the United States. Notably, the multibillion-dollar federal broadband grants authorized under the American Recovery and Reinvestment Act of 2009 require grantees to commit to open access policies—which means that many networks to be built over the next three years will be open access. The governments of Australia and New Zealand are also both pursuing the development of nationwide open access fiber networks. However, most elements of this model are new because they are based on the evidence that technology infrastructure is a public good that delivers societal benefits.

Why does the City have to build it? Won't somebody else build it?

The communications infrastructure in the United States is overwhelming privately owned. In the private ownership model, direct revenues flowing to the infrastructure owner generate the only return on investment (ROI). And because that ROI is perceived as being limited, the availability of capital for the construction of privately owned next-generation technology infrastructure is severely limited. Therefore, the private owner has no incentive to make anything but incremental improvements to the infrastructure.

The private model does not account for the overwhelming "societal benefits" that flow from communications infrastructure—not to the infrastructure owner, but to the average American. Recognizing the economic stimulus of innovation, opportunity, and efficiency from "societal benefits" leads the City of Seattle to the conclusion that advanced technology infrastructure is a public good and must be built based on that premise.

The Model – Services

Who are the retail providers and what will they offer?

Retail service providers may range from existing providers (using the new advanced infrastructure) to small start-up companies home-grown in Seattle. We expect that retail service providers will primarily offer traditional voice, video, and data services (the "triple play" package that customers have grown accustomed to seeing). However, using Seattle's advanced technology infrastructure, these service offerings will be able to support features and deliver speeds far exceeding any service available today. The infrastructure will also support multiple new service providers, which may create the type of robust competitive market that is needed to improve both quality of service and price.

Retail services and providers will be clearly listed on a customer website that will be accessible to every resident who has a computer. The same website (the "Community Portal") will provide access to educational, healthcare, and governmental services.

Will retail providers come if this network is built?

Yes. The current lack of service providers is a direct result of the lack of open access infrastructure, not a reflection of a lack of interest among entrepreneurial companies. When an open access network becomes available, we expect that providers will seek out the new business opportunities that such a network will enable. When DSL providers were recognized as "common carriers" under The Telecommunications Act of 1996,[1] for example, a robust DSL ISP market quickly developed. More recently, the open access UTOPIA network in Utah attracted 14 service providers[2] when it opened its network and created an opportunity for new retail providers to enter the market. The open access

[1] *Telecommunications Act of 1996*, Public Law 104-104, *U.S. Statutes at Large* 110 (1996).
[2] UTOPIA. *Our Providers.* Retrieved October 26, 2010, from: http://www.utopianet.org/utopia-providers

FTTP network in Västerås, Sweden (approximate population: 136,000) attracted more than 20 service providers offering more than 60 services.

Why does the City prefer not to offer retail services on this network?

Capital markets rooted in competition and innovation are the key to economic sustainability. Today's communication marketplace is anything but competitive. As a key objective, then, the City seeks to help create conditions for the private sector to flourish in the communications marketplace, not to compete with it. If the City of Seattle chose to offer retail services, it would simply be offering a singular provider option, not a market, and therefore would not be fostering competition and growth.

Why is it important that every business and residence in the city have access to the Infrastructure?

Imagine living in a home that was not connected to roads or sidewalks—unable to get to the places you need to go. While there was a time that the only things that flowed across communications infrastructure were phone calls and cable TV, the growth of Internet applications means that now every conceivable economic, educational, cultural, and social application flows through these pipes.

Broadband Internet access is as necessary to participate in American society as are electricity and roads. Those with limited or no access are severely disadvantaged. This disadvantage places a financial burden on both the individual and society; the individual suffers from the hampered ability to contribute to society, and society suffers for being forced to absorb that loss.

Americans believe in a level playing field. It's a fundamental value. By segregating the less advantaged from opportunity, we violate that value. The Community Portal will help level the field once more by providing access to community services, including educational, healthcare, and governmental applications.

What about Smart Grid? Is that a service that will operate on this infrastructure? If so, doesn't that help pay for its construction?

Smart Grid applications create value for Seattle City Light through operational efficiencies and other benefits; for the electric consumer by offering opportunities to lower cost; and for society overall by lowering the demand for electric energy. Seattle City Light is evaluating the opportunities for Smart Grid applications, including the potential benefits of purchasing capacity on the Seattle Community Access Infrastructure. Although Smart Grid and AMI can benefit from fiber access at certain locations, the solutions do not require FTTP. In addition, the communications portion of a Smart Grid implementation is actually a relatively small percentage of the total cost, so the availability of FTTP would not drive a project. From a Smart Grid perspective, the benefit of FTTP is determined by calculating the “cost-avoidance” based on the market price of the required service. SCL may choose to purchase access to the infrastructure if the benefits are economically justified and are within SCL’s overall strategic vision.

The Model – Economics

Why is this model preferred over other models in which public entities have built a network?

An important distinction to make is that this is not a network. It is an advanced technology infrastructure. As envisioned, there will be many networks and multiple providers leveraging the infrastructure at any given time.

With the exception of a few open access infrastructure networks, all other public networks models are predicated on competing in the retail space with incumbent providers. While that model offers some limited advantages in some settings, it still only offers a singular alternative and does not create a competitive marketplace. Furthermore, splitting the marketplace and competing head-to-head with well-heeled incumbents has proven financially challenging.

To stimulate the Seattle economy, innovation must thrive and opportunity must be prevalent. Offering a singular alternative may bring some limited economic benefit, but it does not create conditions for private sector job growth.

Why is it important that every business and residence in the City have access to the Infrastructure?

The importance of ubiquitous access from the citizens’ perspective is its ability to create a level playing field. Here we consider the service provider perspective. The service provider can be retail providers providing traditional services (phone, video, and data), “Seattle Services” providers, and innovators/entrepreneurs. Let’s consider each.

“Traditional Services” providers—the phone and cable companies—are currently essentially duopolies. The ability for new companies to compete is very limited, primarily due to the high cost of building competing infrastructure. The Seattle Community Access Infrastructure would remove this barrier and allow competitors access to all citizens of Seattle. We expect these competitors to bring both innovation and new jobs to Seattle, and we expect that citizens will benefit from real market prices and improved service.

Governmental, educational, healthcare, and other institutional services providers in Seattle could leverage the new infrastructure for “all-inclusive” or ubiquitous service delivery to all citizens of Seattle. The efficiency gains and ability to provide better services are significant. Examples include 24/7 educational opportunities for all citizens, which would create economic stimulus through a citizenry with higher skill sets; real-time access to healthcare applications that can improve quality of life; and the efficiencies gained by governmental/institutional providers that could deliver services over common and shared platforms.

Developing applications and services around constrained infrastructure is a key challenge for technology innovators. A recent example of technology unleashed for the private marketplace is the iPhone. In less than two years, there are 250,000 applications generating a whole new market and economic activity. The Seattle Community Access Infrastructure offers a similar platform for economic growth and innovation.

What are societal benefits? What does that mean?

Societal benefits are economic, environmental, and other benefits made possible by the infrastructure. The gains from those benefits do not flow directly to the infrastructure owner. Rather, the gains flow to the City, its residents, its businesses, and sometimes to the environment or society as a whole.

In the same way that the City's roads enable a broad range of activities and benefits—from commerce, communications, and recreation to public safety and pizza delivery—the Seattle Community Access Infrastructure would enable citizens to access educational opportunities, find new jobs, and achieve other goals that would have a positive impact on the City as a whole.

How do you know the value of Societal Benefits?

Placing a value on societal benefits demands the same rigorous approach as any other financial analysis. For example, if the Seattle Community Access Infrastructure enables a significant number of employees to telecommute rather than drive to their offices, the resulting decrease in daily traffic congestion could be quantified in terms of the value of the time saved by the remaining commuters, the amount of gas and vehicle wear-and-tear saved by the telecommuters, and the amount of tailpipe emissions saved.

Similarly, the societal benefits of improved aging-in-place opportunities for senior citizens could be quantified in terms of the amount of nursing home costs saved by those residents.

The Model – Finance

Why doesn't the City pay for the infrastructure through access fees only?

We expect access fees to provide a portion of the revenue required to pay for the Seattle Community Access Infrastructure, but only a share that is justified based on all the other benefits that the infrastructure make possible. An attempt to fund the infrastructure solely through access fees would place an unfair burden on retail providers (since there are many other benefits as well), constraining competition and therefore adding investment risk to the City. We believe that a proportional, balanced approach will yield the best value with the least risk.

Are societal benefits the basis for placing a portion of the infrastructure financing in the tax base?

Yes. This is a unique feature of this model. Many public investments lead to benefits for society as a whole, the economy, and the private sector. These include interstates, sewer systems, parks, and the military to name a few. These public investments are evaluated on their overall merits, not simply on a traditional return-on-investment basis. While the societal benefits are overwhelming, and can be quantified, debate over the value of those benefits is likely. That debate is welcomed, but the risk of a prolonged debate is that Seattle will slip further and further behind other cities and regions, both economically and environmentally.

Will City departments pay for use of the infrastructure as well?

Yes. City departments' use of the Seattle Community Access Infrastructure to support their own internal operations and for the distribution of applications to residents would provide a revenue stream to support the cost of the infrastructure. Each department would evaluate the improved efficiencies and value enhancements made possible and pay proportionally based on that value. In other words, a portion of the money the departments save by not buying voice or data service from outside providers would be redirected to pay for the new infrastructure.

The Model – Infrastructure

Why does FTTP make the most sense?

Fiber networks hold the advantage in capacity, robustness, and security. Fiber provides almost unlimited capacity. Each single fiber optic strand is theoretically able to duplicate the entire electromagnetic spectrum available to all wireless users. In a practical sense, a capacity limit is imposed by the capability of the electronics connected to the fiber—so capacity is constantly increasing as technology improves. At the current time, each fiber strand is capable of operating at hundreds of gigabits per second (Gbps) with off-the-shelf technologies—more than 1,000 times the capacity of backbone wireless technologies and 100,000 times the capacity of the fastest, most sophisticated wireless services available to consumers on PDAs and laptops. These speeds will grow dramatically as new technologies become available.[3]

Fiber is resilient and reliable. It can be armored. It can tolerate falling from utility poles or being pulled laterally by out-of-control vehicles. Further, fiber electronics can be configured to operate in a fail-safe mode (keeps network operating even if a failure or cut occurs on the network).

What about wireless? Isn't that cheaper?

While wireless Internet access is indeed popular, wireless networks will not make FTTP irrelevant. First, wireless technologies physically cannot provide the capacity and speed that FTTP delivers; thus, wireless Internet access will not be able to support many emerging applications. (Demand for wireless capacity is already so high that many service providers find it difficult to keep up—leading them to impose bandwidth caps on their users.) Also, wireless networks are themselves enabled by fiber "backbones" to carry data to and from the Internet. Thus, large-scale wireless networks require large-scale fiber construction deep into the service area.

How long does fiber infrastructure last?

Fiber has a life of decades, assuming adequate maintenance, and it can cost-effectively and simply be scaled to dramatically higher speeds as new electronics become available. Capacity can be increased by upgrading the electronics at the endpoints, which may be hundreds or thousands of kilometers apart and kept in secure indoor locations. There is typically no need to "touch" the outside fiber optic cables to add customers or capacity, and maintenance of outside plant is both relatively undemanding and, on average, inexpensive.

Will some other technology come along that will replace fiber?

At this time, no alternative to fiber exists or is on the horizon.

[3] Wireless speeds will also grow, but cannot keep up. As a matter of physics, each individual strand of optical fiber offers the entire electromagnetic spectrum for use in communications—comparable to the entirety of wireless spectrum, most of which is not available for public use under Federal Communications Commission and military restrictions. Even if the entire electromagnetic spectrum did become available for commercial wireless, the laws of physics dictate that this theoretical wireless capacity would still be less than the terabits per second (Tbps) currently available in one fiber optic cable with existing off-the-shelf technology. Moreover, most of the wireless communication would be limited by range and by line-of-sight, unlike transmissions over fiber. In addition, substantial backbone fiber optic capacity would be necessary to connect the wireless communication system to its core and to other networks.

Commonly Held Myths and the Uncomfortable Truths

Seattle Community Broadband Initiative

The providers (public and private) of connectivity services such as cable television, Internet, and landline telephone do an excellent job of “spinning” their promotional messages to the public, regulators, and the industry. The result is that, today, the analysis of the connectivity industry is typically based on sound bites rather than a careful and truthful review. Private providers claim they are competitive and providing world-class services. Public operators make claims of profitability and reduced costs. Both are misleading and have created confusion and a false sense of reality. Debunking the myths often means confronting uncomfortable truths.

Common Myth and Uncomfortable Truth 1 – Existing Competition

Myth: The existing market for connectivity services (cable television, Internet, landline[1] telephone) in Seattle and the United States provides consumers with a range of competitively priced, state-of the-art services.

Truth: The connectivity services market in Seattle or the United States is not competitive. Most consumers (residential and business) of Internet and data services, even in a progressive community such as Seattle, are essentially served by a duopoly. Many consumers have access to only one provider. In some cases, a given business may have additional choices, but these are typically limited to large data users located in business parks or downtown locations.

Common Myth and Uncomfortable Truth 2 – Creating Competition

Myth: The entrance of third facilities-based[2] cable television, Internet, or landline telephone retail provider (public or private) in a given market creates a competitive marketplace.

Truth: As long as one or two providers maintain large market shares, adding a third provider does not create a truly competitive marketplace. The U.S. Department of Justice evaluates potential mergers using an index that measures market competition; based on those metrics, effective competition requires a large number of providers that each have significant (but relatively small) market shares. In other words, a competitive marketplace does not have dominant providers.

[1] Landline telephone is the traditional fixed-location service provided to residences and businesses.
[2] Facilities-based means the provider builds and operates its own communications infrastructure to deliver services.

Common Myth and Uncomfortable Truth 3 – Need for FTTP

Myth: Wireless networks will replace the need for FTTP.

Truth: While wireless Internet access is indeed popular—a recent national survey found that "55 percent of American adults connect to the Internet wirelessly, either through a WiFi or WiMax connection via their laptops or through a handheld device like a smart phone"[3]—wireless networks will not make FTTP irrelevant. First, wireless technologies physically cannot provide the capacity and speed that FTTP delivers; thus, wireless Internet access will not be able to support many emerging applications. (Demand for wireless capacity is already so high that many service providers find it difficult to keep up—leading them to impose bandwidth caps on their users.) Also, wireless networks are themselves enabled by fiber "backbones" to carry data to and from the Internet. Thus, large-scale wireless networks require large-scale fiber construction deep into the service area.

Common Myth and Uncomfortable Truth 4 – Evolution of Existing Networks

Myth: Copper and coaxial cable-based networks are positioned to support next-generation connectivity services.

Truth: Copper and coaxial cable-based networks cannot physically meet the capacity requirements of next-generation connectivity services. Like a pipe that can only hold a given amount of water, hybrid fiber-coaxial (HFC) cable and copper wiring—the infrastructures used to support cable modem and DSL service, respectively—are simply limited in the amount of data that they can support. FTTP operators, in contrast, can readily increase capacity and connection speeds by replacing their network electronics. While advancements in cable modem technologies will likely extend the useful life of HFC networks, these systems will never achieve the capacity, speed, and scalability of FTTP networks (which can conceivably support many thousands of times the amount of total spectrum available in an HFC network).

[3] Pew Internet & American Life Project. (2010, January 5). *Internet User Profiles Reloaded: Updated Demographics for Internet, Broadband and Wireless Users.* Retrieved October 26, 2010, from Pew Research Center Publications: http://pewresearch.org/pubs/1454/demographic-profiles-internet-broadband-cell-phone-wireless-users

Common Myth and Uncomfortable Truth 5 – Availability

Myth: Cable modem and DSL services are ubiquitously available throughout Seattle and other communities.

Truth: While cable modem and DSL services are available to many Seattle residents, the City and surrounding communities do not have "ubiquitous" service, especially for businesses. Because cable companies typically built infrastructure to serve residential customers with cable television service, cable modem service is limited in areas with concentrations of office buildings and other businesses. And while DSL services are often advertised as being available to every home in a given neighborhood, the reality is that DSL availability depends on a home or business' distance from the provider's central office or DSLAM (Digital Subscriber Line Access Multiplexer) and the capacity of the provider's circuit—meaning that residents may not be able to buy DSL service even if their next-door neighbors can.

Common Myth and Uncomfortable Truth 6 – Municipal Advantage

Myth: Municipalities are always able to provide lower-cost retail cable television, Internet, and landline telephone services than their private counterparts because they do not have to show a profit or support shareholders.

Truth: Just as profit is only one line on a company's income statement, profit is only one small part of the price charged to consumers. The real issue here is the municipal provider's cost of doing business. And because a municipal service provider must (given the structural unfairness of the market) often pay more for the commodities it sells (e.g., cable television programming, Internet access, and landline telephone calls) than the dominant incumbent providers (which have far greater purchasing power because of their large size and because of anti-competitive efforts to limit the availability of programming), the municipality actually has less flexibility to lower the prices it charges. Municipal service providers are further limited in their ability to lower prices because of the competition for customers; without the volume of subscribers that incumbents generally enjoy, it is a challenge for them to lower their prices and still earn enough revenue to cover their costs.

Common Myth and Uncomfortable Truth 7 – New Entrant Profitability

Myth: A new facilities-based entrant (public or private) is able to deploy an FTTP network in a community and easily generate sufficient cable television, Internet, and telephone revenues to cover debt service, operational and maintenance expenses, and ongoing network replenishments.

Truth: This “retail overbuild” business model is extremely challenging to make work financially because of the challenges of launching a new “triple-play” (cable television, Internet, and landline telephone) service. Most notably, the costs of building and operating a network represent a tremendous barrier to new facilities-based entrants. And because the total number of subscribers in the service area remains static, the new provider must compete for subscribers against entrenched incumbent providers with dominant market shares. Using realistic assumptions to project business growth, most business leaders have chosen not to enter this type of market.

Common Myth and Uncomfortable Truth 8 – Smart Grid

Myth: Smart Grid and AMI (Advanced Metering Infrastructure) are the “killer applications” for FTTP.

Truth: Although Smart Grid and AMI can benefit from fiber access at certain locations, the solutions do not require FTTP. In addition, the communications portion of a Smart Grid implementation is actually a relatively small percentage of the total cost, so the availability of FTTP would not drive a project. From a Smart Grid perspective, the benefit of FTTP is determined by calculating the “cost-avoidance” based on the market price of the required service.

Common Myth and Uncomfortable Truth 9 – Open Access Providers

Myth: There are an insufficient number of retail providers of cable television, Internet, and telephone services interested in delivering services over an “open access” infrastructure.

Truth: The lack of interested service providers is a direct result of the lack of open access infrastructure, not a reflection of a lack of interest among entrepreneurial companies. When an open access network becomes available, it is likely that providers will seek out the new business opportunities that such a network will enable. When DSL providers were recognized as “common carriers” under The Telecommunications Act of 1996,[4] for example, a robust DSL ISP market quickly developed. More recently, the open access UTOPIA network in Utah attracted 14 service providers[5] when it opened its network and created an opportunity for new retail providers to enter the market. Similarly, when the

[4] *Telecommunications Act of 1996*, Public Law 104-104, *U.S. Statutes at Large* 110 (1996).
[5] UTOPIA. *Our Providers.* Retrieved October 26, 2010, from: http://www.utopianet.org/utopia-providers

City and County of San Francisco applied to the federal government for stimulus funding to build an open access "middle mile" network, more than a dozen small, local providers expressed interest in using that infrastructure. (The project was not ultimately funded by the federal government).

Common Myth and Uncomfortable Truth 10 – Open Access Profitability

Myth: An "open access" infrastructure will never work in the United States.

Truth: There is no fundamental reason that an open access infrastructure will not work in the United States. (In fact, the federal government's multi-billion-dollar broadband stimulus grant programs under the American Recovery and Reinvestment Act of 2009 required funded projects to commit to open access policies.) The UTOPIA network in Utah is often the primary example of an open access infrastructure in the United States. UTOPIA is making strides and has made significant changes with its business model. Lessons learned by UTOPIA illustrate the importance of designing an open access network around the unique circumstances of a given community or service area. Interestingly, the UTOPIA network's early mistakes helped the developers of many European networks to avoid certain pitfalls and design their own successful open access models.

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This financial analysis uses many assumptions derived from a variety of sources. The analysis has two purposes. First is to present a plausible outcome of the proposed broadband business. Second is to provide a guide to judge the progress of the broadband business as it unfolds. CTC does not warrant the analysis, the assumptions, or the success of the broadband business. CTC only offers this tool as a means of providing consultative advice. There will usually be differences between the projected and actual results, because events and circumstances frequently do not occur as expected, and those differences may be material.

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Income Statement

Year	1	2	3	4	5	6	7	8	9	10
a. Revenues										
Provider Fee	$ -	$ -	$ 9,658,800	$ 15,636,120	$ 18,394,560	$ 18,394,560	$ 18,266,280	$ 18,266,280	$ 18,138,000	$ 18,138,000
Tax Revenue	$ -	$ -	$ -	$ 24,080,000	$ 48,160,000	$ 121,905,000	$ 121,905,000	$ 121,905,000	$ 121,905,000	$ 121,905,000
Ancillary Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ 9,658,800	$ 39,716,120	$ 66,554,560	$ 140,299,560	$ 140,171,280	$ 140,171,280	$ 140,043,000	$ 140,043,000
			1	0.393697068	0.276383166	0.131109178	0.130313999	0.130313999	0.129517363	0.129517363
b. Content Fees										
Video	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
c. Operating Costs										
Labor Expense	$ -	$ 140,000	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000
Operation and Maintenance Expenses	$ 1,900,000	$ 12,805,600	$ 20,069,340	$ 12,121,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840
Low Income Assistance	$ -	$ -	$ 482,940	$ 1,985,806	$ 3,327,728	$ 7,014,978	$ 7,008,564	$ 7,008,564	$ 7,002,150	$ 7,002,150
Pole Attachment Expense	$ -	$ -	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000
Depreciation	$ -	$ 47,000	$ 26,033,286	$ 57,876,286	$ 82,042,000	$ 82,042,000	$ 82,042,000	$ 83,852,714	$ 87,450,643	$ 72,811,071
Total	$ 1,900,000	$ 12,992,600	$ 53,796,566	$ 79,194,932	$ 104,752,568	$ 108,439,818	$ 108,433,404	$ 110,244,118	$ 113,835,633	$ 99,196,061
d. Operating Income	$ (1,900,000)	$ (12,992,600)	$ (44,137,766)	$ (39,478,812)	$ (38,198,008)	$ 31,859,742	$ 31,737,876	$ 29,927,162	$ 26,207,367	$ 40,846,939
e. Non-Operating Income										
Interest Income		$ 4,000	$ 18,588	$ 649,290	$ 1,030,205	$ 1,037,489	$ 1,317,349	$ 1,601,138	$ 1,637,104	$ 1,415,330
Interest Expense (10 Year Bond)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest Expense (20 Year Bond)	$ -	$ -	$ (15,300,000)	$ (31,275,000)	$ (38,700,000)	$ (38,700,000)	$ (36,837,996)	$ (34,892,201)	$ (32,858,846)	$ (30,733,989)
Interest Expense (Loan)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ 4,000	$ (15,281,412)	$ (30,625,710)	$ (37,669,795)	$ (37,662,511)	$ (35,520,646)	$ (33,291,063)	$ (31,221,742)	$ (29,318,659)
f. Net Income	$ (1,900,000)	$ (12,988,600)	$ (59,419,178)	$ (70,104,522)	$ (75,867,803)	$ (5,802,769)	$ (3,782,770)	$ (3,363,901)	$ (5,014,375)	$ 11,528,280
g. Taxes (Franchise Fees & In Lieu Tax)	$ -	$ -	$ -	$ -	$ -	$ 20,868,368	$ 20,829,884	$ 20,829,884	$ 20,791,400	$ 20,791,400
h. Net Income After Fees & In Lieu Taxes	$ (1,900,000)	$ (12,988,600)	$ (59,419,178)	$ (70,104,522)	$ (75,867,803)	$ (26,671,137)	$ (24,612,654)	$ (24,193,785)	$ (25,805,775)	$ (9,263,120)

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Income Statement

Year	11	12	13	14	15	16	17	18	19	20
a. Revenues										
Provider Fee	$ 18,138,000	$ 18,138,000	$ 18,138,000	$ 18,138,000	$ 18,138,000	$ 18,138,000	$ 18,138,000	$ 18,138,000	$ 18,138,000	$ 18,138,000
Tax Revenue	$ 121,905,000	$ 121,905,000	$ 121,905,000	$ 121,905,000	$ 121,905,000	$ 121,905,000	$ 121,905,000	$ 121,905,000	$ 121,905,000	$ 121,905,000
Ancillary Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ 140,043,000	$ 140,043,000	$ 140,043,000	$ 140,043,000	$ 140,043,000	$ 140,043,000	$ 140,043,000	$ 140,043,000	$ 140,043,000	$ 140,043,000
b. Content Fees										
Video	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
c. Operating Costs										
Labor Expense	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000
Operation and Maintenance Expenses	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840
Low Income Assistance	$ 7,002,150	$ 7,002,150	$ 7,002,150	$ 7,002,150	$ 7,002,150	$ 7,002,150	$ 7,002,150	$ 7,002,150	$ 7,002,150	$ 7,002,150
Pole Attachment Expense	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000
Depreciation	$ 48,655,643	$ 24,501,357	$ 26,312,071	$ 29,933,500	$ 31,744,214	$ 28,122,786	$ 27,571,000	$ 29,381,714	$ 33,003,143	$ 34,813,857
Total	$ 75,040,633	$ 50,886,347	$ 52,697,061	$ 56,318,490	$ 58,129,204	$ 54,507,776	$ 53,955,990	$ 55,766,704	$ 59,388,133	$ 61,198,847
d. Operating Income	$ 65,002,367	$ 89,156,653	$ 87,345,939	$ 83,724,510	$ 81,913,796	$ 85,535,224	$ 86,087,010	$ 84,276,296	$ 80,654,867	$ 78,844,153
e. Non-Operating Income										
Interest Income	$ 1,185,372	$ 1,463,094	$ 1,746,530	$ 1,783,736	$ 1,568,185	$ 1,348,324	$ 1,627,775	$ 1,479,315	$ 1,509,416	$ 1,286,779
Interest Expense (10 Year Bond)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest Expense (20 Year Bond)	$ (28,513,515)	$ (26,193,118)	$ (23,768,304)	$ (21,234,374)	$ (18,586,416)	$ (15,819,300)	$ (12,927,665)	$ (9,905,905)	$ (6,748,166)	$ (3,448,330)
Interest Expense (Loan)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ (27,328,143)	$ (24,730,025)	$ (22,021,774)	$ (19,450,638)	$ (17,018,231)	$ (14,470,977)	$ (11,299,890)	$ (8,426,590)	$ (5,238,751)	$ (2,161,551)
f. Net Income	$ 37,674,224	$ 64,426,628	$ 65,324,165	$ 64,273,872	$ 64,895,565	$ 71,064,247	$ 74,787,120	$ 75,849,706	$ 75,416,117	$ 76,682,602
g. Taxes (Franchise Fees & In Lieu Tax)	$ 20,791,400	$ 20,791,400	$ 20,791,400	$ 20,791,400	$ 20,791,400	$ 20,791,400	$ 20,791,400	$ 20,791,400	$ 20,791,400	$ 20,791,400
h. Net Income After Fees & In Lieu Taxes	$ 16,882,824	$ 43,635,228	$ 44,532,765	$ 43,482,472	$ 44,104,165	$ 50,272,847	$ 53,995,720	$ 55,058,306	$ 54,624,717	$ 55,891,202

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Cash Flow Statement

	1	2	3	4	5	6	7	8	9	10
a. Net Income	$ (1,900,000)	$ (12,988,600)	$ (59,419,178)	$ (70,104,522)	$ (75,867,803)	$ (26,671,137)	$ (24,612,654)	$ (24,193,785)	$ (25,805,775)	$ (9,263,120)
b. Cash Outflows										
Debt Service Reserve	$ -	$ -	$ (17,000,000)	$ (17,750,000)	$ (8,250,000)	$ -	$ -	$ -	$ -	$ -
Interest Reserve	$ -	$ -	$ (30,600,000)	$ (31,950,000)	$ (14,850,000)	$ -	$ -	$ -	$ -	$ -
Funded Depreciation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Financing	$ -	$ -	$ (3,400,000)	$ (3,550,000)	$ (1,650,000)	$ -	$ -	$ -	$ -	$ -
Capital Expenditures	$ -	$ (329,000)	$ (281,679,000)	$ (322,676,000)	$ (169,160,000)	$ -	$ -	$ (12,675,000)	$ (25,514,500)	$ (25,702,000)
Total	$ -	$ (329,000)	$ (332,679,000)	$ (375,926,000)	$ (193,910,000)	$ -	$ -	$ (12,675,000)	$ (25,514,500)	$ (25,702,000)
c. Cash Inflows							$ -			
Interest Reserve	$ -	$ -	$ 15,300,000	$ 31,275,000	$ 23,400,000	$ 7,425,000	$ -	$ -	$ -	$ -
Start-Up Funds	$ 2,100,000	$ 14,000,000	$ 10,000,000	$ 2,500,000	$ -	$ -	$ -	$ -	$ -	$ -
10-Year Bond Proceeds	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
20-Year Bond Proceeds	$ -	$ -	$ 340,000,000	$ 355,000,000	$ 165,000,000	$ -	$ -	$ -	$ -	$ -
Operating Loan Proceeds	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ 2,100,000	$ 14,000,000	$ 365,300,000	$ 388,775,000	$ 188,400,000	$ 7,425,000	$ -	$ -	$ -	$ -
d. Total Cash Outflows and Inflows	$ 2,100,000	$ 13,671,000	$ 32,621,000	$ 12,849,000	$ (5,510,000)	$ 7,425,000	$ -	$ (12,675,000)	$ (25,514,500)	$ (25,702,000)
e. Non-Cash Expenses - Depreciation	$ -	$ 47,000	$ 26,033,286	$ 57,876,286	$ 82,042,000	$ 82,042,000	$ 82,042,000	$ 83,852,714	$ 87,450,643	$ 72,811,071
f. Adjustments										
Proceeds from Additional Cash Flows (10 Year Bond)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Proceeds from Additional Cash Flows (20 Year Bond)	$ -	$ -	$ (340,000,000)	$ (355,000,000)	$ (165,000,000)	$ -	$ -	$ -	$ -	$ -
Proceeds from Additional Cash Flows (Loan)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
g. Adjusted Available Net Revenue	$ 200,000	$ 729,400	$ (340,764,892)	$ (354,379,236)	$ (164,335,803)	$ 62,795,863	$ 57,429,346	$ 46,983,929	$ 36,130,368	$ 37,845,951
h. Principal Payments on Debt										
10 Year Bond Principal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
20 Year Bond Principal	$ -	$ -	$ -	$ -	$ -	$ 41,377,875	$ 43,239,879	$ 45,185,674	$ 47,219,029	$ 49,343,886
Loan Principal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ -	$ -	$ -	$ 41,377,875	$ 43,239,879	$ 45,185,674	$ 47,219,029	$ 49,343,886
i. Net Cash	$ 200,000	$ 729,400	$ (764,892)	$ 620,764	$ 664,197	$ 21,417,988	$ 14,189,466	$ 1,798,256	$ (11,088,661)	$ (11,497,935)
Cash Balance										
Unrestricted Cash Balance	$ 200,000	$ 929,400	$ 164,508	$ 785,272	$ 1,449,470	$ 22,867,458	$ 37,056,924	$ 38,855,180	$ 27,766,518	$ 16,268,584
Funded Depreciation Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest Reserve	$ -	$ -	$ 15,300,000	$ 15,975,000	$ 7,425,000	$ -	$ -	$ -	$ -	$ -
Debt Service Reserve	$ -	$ -	$ 17,000,000	$ 34,750,000	$ 43,000,000	$ 43,000,000	$ 43,000,000	$ 43,000,000	$ 43,000,000	$ 43,000,000
Total Cash Balance	$ 200,000	$ 929,400	$ 32,464,508	$ 51,510,272	$ 51,874,470	$ 65,867,458	$ 80,056,924	$ 81,855,180	$ 70,766,518	$ 59,268,584
Debt Service Balance (10 Year Bond)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service Balance (20 Year Bond)	$ -	$ -	$ 340,000,000	$ 695,000,000	$ 860,000,000	$ 818,622,125	$ 775,382,246	$ 730,196,572	$ 682,977,543	$ 633,633,657
Debt Service Balance (Internal Loan)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service (P&I)	$ -	$ -	$ 15,300,000	$ 31,275,000	$ 38,700,000	$ 80,077,875	$ 80,077,875	$ 80,077,875	$ 80,077,875	$ 80,077,875
Debt Coverage Ratio	-	-	-	-	-	2.45	2.18	1.81	1.46	1.39
Debt Service Coverage Ratio	-	-	-	-	-	1.52	1.33	1.04	0.77	0.77

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Cash Flow Statement

	11	12	13	14	15	16	17	18	19	20
a. Net Income	$ 16,882,824	$ 43,635,228	$ 44,532,765	$ 43,482,472	$ 44,104,165	$ 50,272,847	$ 53,995,720	$ 55,058,306	$ 54,624,717	$ 55,891,202
b. Cash Outflows										
Debt Service Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Funded Depreciation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Financing	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Capital Expenditures	$ (88,000)	$ (80,000)	$ (12,675,000)	$ (25,350,000)	$ (25,350,000)	$ (164,500)	$ (21,839,500)	$ (12,763,000)	$ (25,430,000)	$ (25,350,000)
Total	$ (88,000)	$ (80,000)	$ (12,675,000)	$ (25,350,000)	$ (25,350,000)	$ (164,500)	$ (21,839,500)	$ (12,763,000)	$ (25,430,000)	$ (25,350,000)
c. Cash Inflows										
Interest Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
10-Year Bond Proceeds	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
20-Year Bond Proceeds	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operating Loan Proceeds	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
d. Total Cash Outflows and Inflows	$ (88,000)	$ (80,000)	$ (12,675,000)	$ (25,350,000)	$ (25,350,000)	$ (164,500)	$ (21,839,500)	$ (12,763,000)	$ (25,430,000)	$ (25,350,000)
e. Non-Cash Expenses - Depreciation	$ 48,655,643	$ 24,501,357	$ 26,312,071	$ 29,933,500	$ 31,744,214	$ 28,122,786	$ 27,571,000	$ 29,381,714	$ 33,003,143	$ 34,813,857
f. Adjustments										
Proceeds from Additional Cash Flows (10 Year Bond)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Proceeds from Additional Cash Flows (20 Year Bond)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Proceeds from Additional Cash Flows (Loan)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
g. Adjusted Available Net Revenue	$ 65,450,467	$ 68,056,585	$ 58,169,836	$ 48,065,972	$ 50,498,379	$ 78,231,133	$ 59,727,220	$ 71,677,020	$ 62,197,859	$ 65,355,059
h. Principal Payments on Debt										
10 Year Bond Principal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
20 Year Bond Principal	$ 51,564,360	$ 53,884,757	$ 56,309,571	$ 58,843,501	$ 61,491,459	$ 64,258,575	$ 67,150,210	$ 70,171,970	$ 73,329,709	$ 76,629,545
Loan Principal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ 51,564,360	$ 53,884,757	$ 56,309,571	$ 58,843,501	$ 61,491,459	$ 64,258,575	$ 67,150,210	$ 70,171,970	$ 73,329,709	$ 76,629,545
i. Net Cash	$ 13,886,107	$ 14,171,829	$ 1,860,265	$ (10,777,529)	$ (10,993,080)	$ 13,972,559	$ (7,422,990)	$ 1,505,050	$ (11,131,849)	$ (11,274,486)
Cash Balance										
Unrestricted Cash Balance	$ 30,154,690	$ 44,326,519	$ 46,186,785	$ 35,409,255	$ 24,416,175	$ 38,388,734	$ 30,965,744	$ 32,470,794	$ 21,338,945	$ 10,064,458
Funded Depreciation Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service Reserve	$ 43,000,000	$ 43,000,000	$ 43,000,000	$ 43,000,000	$ 43,000,000	$ 43,000,000	$ 43,000,000	$ 43,000,000	$ 43,000,000	$ 43,000,000
Total Cash Balance	$ 73,154,690	$ 87,326,519	$ 89,186,785	$ 78,409,255	$ 67,416,175	$ 81,388,734	$ 73,965,744	$ 75,470,794	$ 64,338,945	$ 53,064,458
Debt Service Balance (10 Year Bond)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service Balance (20 Year Bond)	$ 582,069,297	$ 528,184,540	$ 471,874,969	$ 413,031,468	$ 351,540,009	$ 287,281,434	$ 220,131,224	$ 149,959,254	$ 76,629,545	$ -
Debt Service Balance (Internal Loan)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service (P&I)	$ 80,077,875	$ 80,077,875	$ 80,077,875	$ 80,077,875	$ 80,077,875	$ 80,077,875	$ 80,077,875	$ 80,077,875	$ 80,077,875	$ 80,077,875
Debt Coverage Ratio	1.82	1.75	1.46	1.18	1.12	1.46	1.08	1.16	0.94	
Debt Service Coverage Ratio	1.27	1.26	1.03	0.82	0.82	1.22	0.89	1.02	0.85	

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Capital Additions

	1	2	3	4	5	6	7	8	9	10
Network Equipment										
Headend Costs	$ -	$ -	$ 29,500,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Hub Costs	$ -	$ -	$ 13,475,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Additional Annual Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ 42,975,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Outside Plant and Materials										
Total Backbone and FTTP	$ -	$ -	$ 153,500,000	$ 153,500,000	$ -	$ -	$ -	$ -	$ -	$ -
Additional Annual Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ 153,500,000	$ 153,500,000	$ -	$ -	$ -	$ -	$ -	$ -
Last Mile and Customer Premises Equipment										
Customer Premises Equipment	$ -	$ -	$ 84,500,000	$ 169,000,000	$ 169,000,000	$ -	$ -	$ -	$ -	$ -
Additional Annual Replacement Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ 84,500,000	$ 169,000,000	$ 169,000,000	$ -	$ -	$ -	$ -	$ -
Miscellaneous Implementation Costs										
Splicing	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Vehicles	$ -	$ -	$ 250,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Emergency Restoration Kit	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Laptop Computers and Software	$ -	$ 4,000	$ 404,000	$ 176,000	$ 160,000	$ -	$ -	$ -	$ -	$ -
Fiber OTDR	$ -	$ 25,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Miscellaneous Tools and Other	$ -	$ 50,000	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Billing Software	$ -	$ 250,000	$ -	$ -	$ -					
Additional Annual Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ 329,000	$ 704,000	$ 176,000	$ 160,000	$ -	$ -	$ -	$ -	$ -
Replacement Costs for Depreciation										
Network Equipment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Last Mile and Customer Premises Equipment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$12,675,000	$25,350,000	$ 25,350,000
Miscellaneous Implementation Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 164,500	$ 352,000
Total	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$12,675,000	$25,514,500	$ 25,702,000
Total Capital Additions	$ -	$ 329,000	$ 281,679,000	$ 322,676,000	$ 169,160,000	$ -	$ -	$12,675,000	$25,514,500	$ 25,702,000

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Capital Additions

	11	12	13	14	15	16	17	18	19	20
Network Equipment										
Headend Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Hub Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Additional Annual Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Outside Plant and Materials										
Total Backbone and FTTP	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Additional Annual Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Last Mile and Customer Premises Equipment										
Customer Premises Equipment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Additional Annual Replacement Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Miscellaneous Implementation Costs										
Splicing	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Vehicles	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Emergency Restoration Kit	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Laptop Computers and Software	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fiber OTDR	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Miscellaneous Tools and Other	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Additional Annual Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacement Costs for Depreciation										
Network Equipment	$ -	$ -	$ -	$ -	$ -	$ -	$21,487,500	$ -	$ -	$ -
Last Mile and Customer Premises Equipment	$ -	$ -	$ 12,675,000	$ 25,350,000	$ 25,350,000	$ -	$ -	$12,675,000	$25,350,000	$ 25,350,000
Miscellaneous Implementation Costs	$ 88,000	$ 80,000	$ -	$ -	$ -	$ 164,500	$ 352,000	$ 88,000	$ 80,000	$ -
Total	$ 88,000	$ 80,000	$ 12,675,000	$ 25,350,000	$ 25,350,000	$ 164,500	$21,839,500	$12,763,000	$25,430,000	$ 25,350,000
Total Capital Additions	$ 88,000	$ 80,000	$ 12,675,000	$ 25,350,000	$ 25,350,000	$ 164,500	$21,839,500	$12,763,000	$25,430,000	$ 25,350,000

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Depreciation Schedule

External (FTTP) Plant

			Depreciation Expense by Year									
Year	Annual Investment	Total Accrued Investment	1	2	3	4	5	6	7	8	9	10
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-		-	-	-	-	-	-	-	-	-
3	153,500,000	153,500,000			7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000
4	153,500,000	307,000,000				7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000
5	-	307,000,000					-	-	-	-	-	-
6	-	307,000,000						-	-	-	-	-
7	-	307,000,000							-	-	-	-
8	-	307,000,000								-	-	-
9	-	307,000,000									-	-
10	-	307,000,000										-
11	-	307,000,000										
12	-	307,000,000										
13	-	307,000,000										
14	-	307,000,000										
15	-	307,000,000										
16	-	307,000,000										
17	-	307,000,000										
18	-	307,000,000										
19	-	307,000,000										
20	-	307,000,000										
	Total Annual Depeciation		-	-	7,675,000	15,350,000	15,350,000	15,350,000	15,350,000	15,350,000	15,350,000	15,350,000
	Total Accrued Investment		-	-	153,500,000	307,000,000	307,000,000	307,000,000	307,000,000	307,000,000	307,000,000	307,000,000
	Total Accrued Depreciation		-	-	7,675,000	23,025,000	38,375,000	53,725,000	69,075,000	84,425,000	99,775,000	115,125,000
	Total Depreciated Value		0	0	145,825,000	283,975,000	268,625,000	253,275,000	237,925,000	222,575,000	207,225,000	191,875,000

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External (FTTP) Plant

			Depreciation Expense by Year									
Year	Annual Investment	Total Accrued Investment	11	12	13	14	15	16	17	18	19	20
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	153,500,000	153,500,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000
4	153,500,000	307,000,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000	7,675,000
5	-	307,000,000	-	-	-	-	-	-	-	-	-	-
6	-	307,000,000	-	-	-	-	-	-	-	-	-	-
7	-	307,000,000	-	-	-	-	-	-	-	-	-	-
8	-	307,000,000	-	-	-	-	-	-	-	-	-	-
9	-	307,000,000	-	-	-	-	-	-	-	-	-	-
10	-	307,000,000	-	-	-	-	-	-	-	-	-	-
11	-	307,000,000	-	-	-	-	-	-	-	-	-	-
12	-	307,000,000		-	-	-	-	-	-	-	-	-
13	-	307,000,000			-	-	-	-	-	-	-	-
14	-	307,000,000				-	-	-	-	-	-	-
15	-	307,000,000					-	-	-	-	-	-
16	-	307,000,000						-	-	-	-	-
17	-	307,000,000							-	-	-	-
18	-	307,000,000								-	-	-
19	-	307,000,000									-	-
20	-	307,000,000										-
	Total Annual Depeciation		15,350,000	15,350,000	15,350,000	15,350,000	15,350,000	15,350,000	15,350,000	15,350,000	15,350,000	15,350,000
	Total Accrued Investment		307,000,000	307,000,000	307,000,000	307,000,000	307,000,000	307,000,000	307,000,000	307,000,000	307,000,000	307,000,000
	Total Accrued Depreciation		130,475,000	145,825,000	161,175,000	176,525,000	191,875,000	207,225,000	222,575,000	237,925,000	253,275,000	268,625,000
	Total Depreciated Value		176,525,000	161,175,000	145,825,000	130,475,000	115,125,000	99,775,000	84,425,000	69,075,000	53,725,000	38,375,000

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Depreciation Schedule

Headend Equipment

			Depreciation Expense by Year									
Year	Annual Investment	Total Accrued Investment	1	2	3	4	5	6	7	8	9	10
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-		-	-	-	-	-	-	-	-	-
3	42,975,000	42,975,000			6,139,286	6,139,286	6,139,286	6,139,286	6,139,286	6,139,286	6,139,286	-
4	-	42,975,000				-	-	-	-	-	-	-
5	-	42,975,000					-	-	-	-	-	-
6	-	42,975,000						-	-	-	-	-
7	-	42,975,000							-	-	-	-
8	-	42,975,000								-	-	-
9	-	42,975,000									-	-
10	-	42,975,000										-
11	-	42,975,000										
12	-	42,975,000										
13	-	42,975,000										
14	-	42,975,000										
15	-	42,975,000										
16	-	42,975,000										
17	21,487,500	64,462,500										
18	-	64,462,500										
19	-	64,462,500										
20	-	64,462,500										
	Total Annual Depeciation		-	-	6,139,286	6,139,286	6,139,286	6,139,286	6,139,286	6,139,286	6,139,286	-
	Total Accrued Investment		-	-	42,975,000	42,975,000	42,975,000	42,975,000	42,975,000	42,975,000	42,975,000	42,975,000
	Total Accrued Depreciation		-	-	6,139,286	12,278,571	18,417,857	24,557,143	30,696,429	36,835,714	42,975,000	42,975,000
	Total Depreciated Value		0	0	36,835,714	30,696,429	24,557,143	18,417,857	12,278,571	6,139,286	0	0

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Headend Equipment

			Depreciation Expense by Year									
Year	Annual Investment	Total Accrued Investment	11	12	13	14	15	16	17	18	19	20
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	42,975,000	42,975,000	-	-	-	-	-	-	-	-	-	-
4	-	42,975,000	-	-	-	-	-	-	-	-	-	-
5	-	42,975,000	-	-	-	-	-	-	-	-	-	-
6	-	42,975,000	-	-	-	-	-	-	-	-	-	-
7	-	42,975,000	-	-	-	-	-	-	-	-	-	-
8	-	42,975,000	-	-	-	-	-	-	-	-	-	-
9	-	42,975,000	-	-	-	-	-	-	-	-	-	-
10	-	42,975,000	-	-	-	-	-	-	-	-	-	-
11	-	42,975,000	-	-	-	-	-	-	-	-	-	-
12	-	42,975,000		-	-	-	-	-	-	-	-	-
13	-	42,975,000			-	-	-	-	-	-	-	-
14	-	42,975,000				-	-	-	-	-	-	-
15	-	42,975,000					-	-	-	-	-	-
16	-	42,975,000						-	-	-	-	-
17	21,487,500	64,462,500							3,069,643	3,069,643	3,069,643	3,069,643
18	-	64,462,500								-	-	-
19	-	64,462,500									-	-
20	-	64,462,500										-
	Total Annual Depeciation		-	-	-	-	-	-	3,069,643	3,069,643	3,069,643	3,069,643
	Total Accrued Investment		42,975,000	42,975,000	42,975,000	42,975,000	42,975,000	42,975,000	64,462,500	64,462,500	64,462,500	64,462,500
	Total Accrued Depreciation		42,975,000	42,975,000	42,975,000	42,975,000	42,975,000	42,975,000	46,044,643	49,114,286	52,183,929	55,253,571
	Total Depreciated Value		0	0	0	0	0	0	18,417,857	15,348,214	12,278,571	9,208,929

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Depreciation Schedule

Other Operating Equipment

			Depreciation Expense by Year									
Year	Annual Investment	Total Accrued Investment	1	2	3	4	5	6	7	8	9	10
1	-	-	-	-	-	-	-	-	-	-	-	-
2	329,000	329,000		47,000	47,000	47,000	47,000	47,000	47,000	47,000	-	-
3	704,000	1,033,000			100,571	100,571	100,571	100,571	100,571	100,571	100,571	-
4	176,000	1,209,000				25,143	25,143	25,143	25,143	25,143	25,143	25,143
5	160,000	1,369,000					22,857	22,857	22,857	22,857	22,857	22,857
6	-	1,369,000						-	-	-	-	-
7	-	1,369,000							-	-	-	-
8	-	1,369,000								-	-	-
9	164,500	1,533,500									23,500	23,500
10	352,000	1,885,500										50,286
11	88,000	1,973,500										
12	80,000	2,053,500										
13	-	2,053,500										
14	-	2,053,500										
15	-	2,053,500										
16	164,500	2,218,000										
17	352,000	2,570,000										
18	88,000	2,658,000										
19	80,000	2,738,000										
20	-	2,738,000										
	Total Annual Depeciation		-	47,000	147,571	172,714	195,571	195,571	195,571	195,571	172,071	121,786
	Total Accrued Investment		-	329,000	1,033,000	1,209,000	1,369,000	1,369,000	1,369,000	1,369,000	1,533,500	1,885,500
	Total Accrued Depreciation		-	47,000	194,571	367,286	562,857	758,429	954,000	1,149,571	1,321,643	1,443,429
	Total Depreciated Value		0	282,000	838,429	841,714	806,143	610,571	415,000	219,429	211,857	442,071

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Depreciation Schedule

Other Operating Equipment

			Depreciation Expense by Year									
Year	Annual Investment	Total Accrued Investment	11	12	13	14	15	16	17	18	19	20
1	-	-	-	-	-	-	-	-	-	-	-	-
2	329,000	329,000	-	-	-	-	-	-	-	-	-	-
3	704,000	1,033,000	-	-	-	-	-	-	-	-	-	-
4	176,000	1,209,000	-	-	-	-	-	-	-	-	-	-
5	160,000	1,369,000	22,857	-	-	-	-	-	-	-	-	-
6	-	1,369,000	-	-	-	-	-	-	-	-	-	-
7	-	1,369,000	-	-	-	-	-	-	-	-	-	-
8	-	1,369,000	-	-	-	-	-	-	-	-	-	-
9	164,500	1,533,500	23,500	23,500	23,500	23,500	23,500	-	-	-	-	-
10	352,000	1,885,500	50,286	50,286	50,286	50,286	50,286	50,286	-	-	-	-
11	88,000	1,973,500	12,571	12,571	12,571	12,571	12,571	12,571	12,571	-	-	-
12	80,000	2,053,500		11,429	11,429	11,429	11,429	11,429	11,429	11,429	-	-
13	-	2,053,500			-	-	-	-	-	-	-	-
14	-	2,053,500				-	-	-	-	-	-	-
15	-	2,053,500					-	-	-	-	-	-
16	164,500	2,218,000						23,500	23,500	23,500	23,500	23,500
17	352,000	2,570,000							50,286	50,286	50,286	50,286
18	88,000	2,658,000								12,571	12,571	12,571
19	80,000	2,738,000									11,429	11,429
20	-	2,738,000										-
	Total Annual Depeciation		109,214	97,786	97,786	97,786	97,786	97,786	97,786	97,786	97,786	97,786
	Total Accrued Investment		1,973,500	2,053,500	2,053,500	2,053,500	2,053,500	2,218,000	2,570,000	2,658,000	2,738,000	2,738,000
	Total Accrued Depreciation		1,552,643	1,650,429	1,748,214	1,846,000	1,943,786	2,041,571	2,139,357	2,237,143	2,334,929	2,432,714
	Total Depreciated Value		420,857	403,071	305,286	207,500	109,714	176,429	430,643	420,857	403,071	305,286

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Depreciation Schedule

Last Mile and Customer Premises Equipment

Year	Annual Investment	Total Accrued Investment	Depreciation Expense by Year 1	2	3	4	5	6	7	8	9	10
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-		-	-	-	-	-	-	-	-	-
3	84,500,000	84,500,000			12,071,429	12,071,429	12,071,429	12,071,429	12,071,429	12,071,429	12,071,429	-
4	169,000,000	253,500,000				24,142,857	24,142,857	24,142,857	24,142,857	24,142,857	24,142,857	24,142,857
5	169,000,000	422,500,000					24,142,857	24,142,857	24,142,857	24,142,857	24,142,857	24,142,857
6	-	422,500,000						-	-	-	-	-
7	-	422,500,000							-	-	-	-
8	12,675,000	435,175,000								1,810,714	1,810,714	1,810,714
9	25,350,000	460,525,000									3,621,429	3,621,429
10	25,350,000	485,875,000										3,621,429
11	-	485,875,000										
12	-	485,875,000										
13	12,675,000	498,550,000										
14	25,350,000	523,900,000										
15	25,350,000	549,250,000										
16	-	549,250,000										
17	-	549,250,000										
18	12,675,000	561,925,000										
19	25,350,000	587,275,000										
20	25,350,000	612,625,000										
	Total Annual Depeciation		-	-	12,071,429	36,214,286	60,357,143	60,357,143	60,357,143	62,167,857	65,789,286	57,339,286
	Total Accrued Investment		-	-	84,500,000	253,500,000	422,500,000	422,500,000	422,500,000	435,175,000	460,525,000	485,875,000
	Total Accrued Depreciation		-	-	12,071,429	48,285,714	108,642,857	169,000,000	229,357,143	291,525,000	357,314,286	414,653,571
	Total Depreciated Value		0	0	72,428,571	205,214,286	313,857,143	253,500,000	193,142,857	143,650,000	103,210,714	71,221,429

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Depreciation Schedule

Last Mile and Customer Premises Equipment

			Depreciation Expense by Year									
Year	Annual Investment	Total Accrued Investment	11	12	13	14	15	16	17	18	19	20
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	84,500,000	84,500,000	-	-	-	-	-	-	-	-	-	-
4	169,000,000	253,500,000	-	-	-	-	-	-	-	-	-	-
5	169,000,000	422,500,000	24,142,857	-	-	-	-	-	-	-	-	-
6	-	422,500,000	-	-	-	-	-	-	-	-	-	-
7	-	422,500,000	-	-	-	-	-	-	-	-	-	-
8	12,675,000	435,175,000	1,810,714	1,810,714	1,810,714	1,810,714	-	-	-	-	-	-
9	25,350,000	460,525,000	3,621,429	3,621,429	3,621,429	3,621,429	3,621,429	-	-	-	-	-
10	25,350,000	485,875,000	3,621,429	3,621,429	3,621,429	3,621,429	3,621,429	3,621,429	-	-	-	-
11	-	485,875,000	-	-	-	-	-	-	-	-	-	-
12	-	485,875,000		-	-	-	-	-	-	-	-	-
13	12,675,000	498,550,000			1,810,714	1,810,714	1,810,714	1,810,714	1,810,714	1,810,714	1,810,714	-
14	25,350,000	523,900,000				3,621,429	3,621,429	3,621,429	3,621,429	3,621,429	3,621,429	3,621,429
15	25,350,000	549,250,000					3,621,429	3,621,429	3,621,429	3,621,429	3,621,429	3,621,429
16	-	549,250,000						-	-	-	-	-
17	-	549,250,000							-	-	-	-
18	12,675,000	561,925,000								1,810,714	1,810,714	1,810,714
19	25,350,000	587,275,000									3,621,429	3,621,429
20	25,350,000	612,625,000										3,621,429
	Total Annual Depeciation		33,196,429	9,053,571	10,864,286	14,485,714	16,296,429	12,675,000	9,053,571	10,864,286	14,485,714	16,296,429
	Total Accrued Investment		485,875,000	485,875,000	498,550,000	523,900,000	549,250,000	549,250,000	549,250,000	561,925,000	587,275,000	612,625,000
	Total Accrued Depreciation		447,850,000	456,903,571	467,767,857	482,253,571	498,550,000	511,225,000	520,278,571	531,142,857	545,628,571	561,925,000
	Total Depreciated Value		38,025,000	28,971,429	30,782,143	41,646,429	50,700,000	38,025,000	28,971,429	30,782,143	41,646,429	50,700,000

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10 Year Bond Repayment Schedule

Amount	$ -
Principal Repayment Period Start	6
Term in Years	10
Annual Rate	5.00%

	Balance	Principal	Interest
FY 1	$ -	$ -	$ -
FY 2	$ -	$ -	$ -
FY 3	$ -	$ -	$ -
FY 4	$ -	$ -	$ -
FY 5	$ -	$ -	$ -
FY 6	$ -	$ -	$ -
FY 7	$ -	$ -	$ -
FY 8	$ -	$ -	$ -
FY 9	$ -	$ -	$ -
FY 10	$ -	$ -	$ -
FY 11	$ -	$ -	$ -
FY 12	$ -	$ -	$ -
FY 13	$ -	$ -	$ -
FY 14	$ -	$ -	$ -
FY 15	$ -	$ -	$ -
FY 16	$ -	$ -	$ -
FY 17	$ -	$ -	$ -
FY 18	$ -	$ -	$ -
FY 19	$ -	$ -	$ -
FY 20	$ -	$ -	$ -

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Fiber Bond Repayment Schedule

Amount	$ 860,000,000
Principal Repayment Period Start	6
Term in Years	20
Annual Rate	4.50%

	Balance	Principal	Interest
FY 1	$ -	$ -	$ -
FY 2	$ -	$ -	$ -
FY 3	$ 340,000,000.00	$ -	$ 15,300,000.00
FY 4	$ 695,000,000.00	$ -	$ 31,275,000.00
FY 5	$ 860,000,000.00	$ -	$ 38,700,000.00
FY 6	$ 860,000,000.00	$ 41,377,874.98	$ 38,700,000.00
FY 7	$ 818,622,125.02	$ 43,239,879.35	$ 36,837,995.63
FY 8	$ 775,382,245.67	$ 45,185,673.92	$ 34,892,201.06
FY 9	$ 730,196,571.74	$ 47,219,029.25	$ 32,858,845.73
FY 10	$ 682,977,542.49	$ 49,343,885.57	$ 30,733,989.41
FY 11	$ 633,633,656.93	$ 51,564,360.42	$ 28,513,514.56
FY 12	$ 582,069,296.51	$ 53,884,756.64	$ 26,193,118.34
FY 13	$ 528,184,539.88	$ 56,309,570.68	$ 23,768,304.29
FY 14	$ 471,874,969.19	$ 58,843,501.37	$ 21,234,373.61
FY 15	$ 413,031,467.83	$ 61,491,458.93	$ 18,586,416.05
FY 16	$ 351,540,008.90	$ 64,258,574.58	$ 15,819,300.40
FY 17	$ 287,281,434.32	$ 67,150,210.43	$ 12,927,664.54
FY 18	$ 220,131,223.89	$ 70,171,969.90	$ 9,905,905.07
FY 19	$ 149,959,253.98	$ 73,329,708.55	$ 6,748,166.43
FY 20	$ 76,629,545.43	$ 76,629,545.43	$ 3,448,329.54

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Internal Loan Repayment Schedule

Amount	-
Principal Repayment Period Start	3
Term in Years	20
Annual Rate	6.00%

	Balance	Principal	Interest
FY 1	$ -	$ -	$ -
FY 2	$ -	$ -	$ -
FY 3	$ -	$ -	$ -
FY 4	$ -	$ -	$ -
FY 5	$ -	$ -	$ -
FY 6	$ -	$ -	$ -
FY 7	$ -	$ -	$ -
FY 8	$ -	$ -	$ -
FY 9	$ -	$ -	$ -
FY 10	$ -	$ -	$ -
FY 11	$ -	$ -	$ -
FY 12	$ -	$ -	$ -
FY 13	$ -	$ -	$ -
FY 14	$ -	$ -	$ -
FY 15	$ -	$ -	$ -
FY 16	$ -	$ -	$ -
FY 17	$ -	$ -	$ -
FY 18	$ -	$ -	$ -
FY 19	$ -	$ -	$ -
FY 20	$ -	$ -	$ -

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Ancillary Revenues

Year	1	2	3	4	5	6	7	8	9	10
Advertising	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Data Storage Annual Revenue per Space	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Year	11	12	13	14	15	16	17	18	19	20
Advertising	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Data Storage Annual Revenue per Space	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

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Operation and Maintenance Expenses

Year	1	2	3	4	5	6	7	8	9	10
Annual Fixed Operating Expense										
Insurance	$ -	$ -	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000
Utilities	-	-	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Office Expenses	50,000	100,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Contingency	200,000	200,000	1,000,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Billing Maintenance Contract	-	-	100,000	200,000	250,000	250,000	250,000	250,000	250,000	250,000
Fiber Maintenance	-	-	2,302,500	4,605,000	4,605,000	4,605,000	4,605,000	4,605,000	4,605,000	4,605,000
Legal and Lobby Fees	400,000	10,000,000	10,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Planning	500,000	1,750,000	2,500,000	-	-	-	-	-	-	-
Consulting	750,000	750,000	150,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
Marketing	-	-	1,000,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Annual Variable Operating Expense										
Education and Training	-	5,600	266,840	266,840	266,840	266,840	266,840	266,840	266,840	266,840
Customer Handholding	-	-	-	-	-	-	-	-	-	-
Customer Billing (Unit)	-	-	-	-	-	-	-	-	-	-
Allowance for Bad Debts	-	-	-	-	-	-	-	-	-	-
Internet Connection Fee	-	-	-	-	-	-	-	-	-	-
PSTN Connection Fee	-	-	-	-	-	-	-	-	-	-
Total	$ 1,900,000	$ 12,805,600	$ 20,069,340	$ 12,121,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840

Year	11	12	13	14	15	16	17	18	19	20
Annual Fixed Operating Expense										
Insurance	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000
Utilities	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Office Expenses	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Contingency	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Billing Maintenance Contract	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Fiber Maintenance	4,605,000	4,605,000	4,605,000	4,605,000	4,605,000	4,605,000	4,605,000	4,605,000	4,605,000	4,605,000
Legal and Lobby Fees	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Planning	-	-	-	-	-	-	-	-	-	-
Consulting	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
Marketing	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Annual Variable Operating Expense										
Education and Training	266,840	266,840	266,840	266,840	266,840	266,840	266,840	266,840	266,840	266,840
Customer Handholding	-	-	-	-	-	-	-	-	-	-
Customer Billing (Unit)	-	-	-	-	-	-	-	-	-	-
Allowance for Bad Debts	-	-	-	-	-	-	-	-	-	-
Internet Connection Fee	-	-	-	-	-	-	-	-	-	-
PSTN Connection Fee	-	-	-	-	-	-	-	-	-	-
Total	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840

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Pole Attachment Expense

Year		1	2	3	4	5	6	7	8	9	10
Attachment Fees		$ -	$ -	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000
	Total	$ -	$ -	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000

Year		11	12	13	14	15	16	17	18	19	20
Attachment Fees		$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000
	Total	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000

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Taxes

Year	1	2	3	4	5	6	7	8	9	10
Franchise Fees	$ -	$ -	$ -	$ -	$ -	$ 5,518,368	$ 5,479,884	$ 5,479,884	$ 5,441,400	$ 5,441,400
Sales Tax	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ -	$ -	$ -	$ -	$ -	$ 5,518,368	$ 5,479,884	$ 5,479,884	$ 5,441,400	$ 5,441,400
In lieu of tax	$ -	$ -	$ -	$ -	$ -	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000
Total	$ -	$ -	$ -	$ -	$ -	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000

Year	11	12	13	14	15	16	17	18	19	20
Franchise Fees	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400
Sales Tax	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400	$ 5,441,400
In lieu of tax	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000
Total	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000	$ 15,350,000

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Projected Total Residential Customers

Year	1	2	3	4	5	6	7	8	9	10
Total Video Customers	0	0	19,246	38,492	37,422	37,422	36,353	36,353	35,284	35,284
Total Data Customers	0	0	24,057	48,114	72,171	72,171	72,171	72,171	72,171	72,171
Total Voice Customers	0	0	28,067	26,062	26,062	26,062	26,062	26,062	26,062	26,062
Bundling Take Rates										
Minimum Number of Customers	0	0	28,067	48,114	72,171	72,171	72,171	72,171	72,171	72,171
Maximum Number of Customers	0	0	71,370	112,668	135,655	135,655	134,586	134,586	133,517	133,517
Total Number of Customers	0	0	34,562	57,797	81,694	81,694	81,533	81,533	81,373	81,373
New Subscribers	0	0	34,562	23,235	23,897	0	0	0	0	0
Annual Billings	0	0	414,749	693,565	980,323	980,323	978,399	978,399	976,475	976,475

Year	11	12	13	14	15	16	17	18	19	20
Total Video Customers	35,284	35,284	35,284	35,284	35,284	35,284	35,284	35,284	35,284	35,284
Total Data Customers	72,171	72,171	72,171	72,171	72,171	72,171	72,171	72,171	72,171	72,171
Total Voice Customers	26,062	26,062	26,062	26,062	26,062	26,062	26,062	26,062	26,062	26,062
Bundling Take Rates										
Minimum Number of Customers	72,171	72,171	72,171	72,171	72,171	72,171	72,171	72,171	72,171	72,171
Maximum Number of Customers	133,517	133,517	133,517	133,517	133,517	133,517	133,517	133,517	133,517	133,517
Total Number of Customers	81,373	81,373	81,373	81,373	81,373	81,373	81,373	81,373	81,373	81,373
New Subscribers	0	0	0	0	0	0	0	0	0	0
Annual Billings	976,475	976,475	976,475	976,475	976,475	976,475	976,475	976,475	976,475	976,475

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Projected Total Commercial Customers

Year	1	2	3	4	5	6	7	8	9	10
Total Video Customers	0	0	506	1,011	1,011	1,011	1,011	1,011	1,011	1,011
Total Data Customers	0	0	5,581	11,162	11,162	11,162	11,162	11,162	11,162	11,162
Total Voice Customers	0	0	3,033	5,460	5,460	5,460	5,460	5,460	5,460	5,460
Bundling Take Rates										
Minimum Number of Customers	0	0	5,581	11,162	11,162	11,162	11,162	11,162	11,162	11,162
Maximum Number of Customers	0	0	9,120	17,633	17,633	17,633	17,633	17,633	17,633	17,633
Total Number of Customers	0	0	6,112	12,133	12,133	12,133	12,133	12,133	12,133	12,133
New Subscribers	0	0	6,112	6,021	0	0	0	0	0	0
Annual Billings	0	0	73,342	145,592	145,592	145,592	145,592	145,592	145,592	145,592

Year	11	12	13	14	15	16	17	18	19	20
Total Video Customers	1,011	1,011	1,011	1,011	1,011	1,011	1,011	1,011	1,011	1,011
Total Data Customers	11,162	11,162	11,162	11,162	11,162	11,162	11,162	11,162	11,162	11,162
Total Voice Customers	5,460	5,460	5,460	5,460	5,460	5,460	5,460	5,460	5,460	5,460
Bundling Take Rates										
Minimum Number of Customers	11,162	11,162	11,162	11,162	11,162	11,162	11,162	11,162	11,162	11,162
Maximum Number of Customers	17,633	17,633	17,633	17,633	17,633	17,633	17,633	17,633	17,633	17,633
Total Number of Customers	12,133	12,133	12,133	12,133	12,133	12,133	12,133	12,133	12,133	12,133
New Subscribers	0	0	0	0	0	0	0	0	0	0
Annual Billings	145,592	145,592	145,592	145,592	145,592	145,592	145,592	145,592	145,592	145,592

PROJECT ASSUMPTIONS

Page Title Information

Organization	City of Seattle
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Financial Assumptions

10 Year Bond Term Bond		
Finance Rate	5.00%	
Period (Years)	10	
Principal Repayment Period Start	6	
Bond Issuance Cost	1.00%	of issue
Debt Service Reserve	5.00%	
Interest Reserve	yes	
20 Year Bond Term Bond		
Finance Rate	4.50%	
Period (Years)	20	
Principal Repayment Period Start	6	
Bond Issuance Cost	1.00%	of issue
Debt Service Reserve	5.00%	
Interest Reserve	yes	
Internal Loan		
Finance Rate	6.00%	
Period (Years)	20	
Principal Repayment Period	3	
Principal Repayment Period Start		
Other		
Interest Earned on Available Cash	2.00%	
Discount Rate	5.00%	

Source of Funds	Amount Issued	Year 1	2	3	4	5	Yr 1 to Yr 4 percentage of total funding	Yr 1 percentage of total funding
Start-Up Funds	$ 28,600,000	$ 2,100,000	$ 14,000,000	$ 10,000,000	$ 2,500,000	$ -	3.22%	0.24%
10-Year Bond Proceeds	$ -	$ -	$ -	$ -	$ -	$ -		
20-Year Bond Proceeds	$ 860,000,000	$ -	$ -	$ 340,000,000	$ 355,000,000	$ 165,000,000		
Operating Loan Proceeds	$ -	Bonding for Yr1 and Yr2 not linked		3	Need to adjust P payments (L41 CF) and interest (line 34 IS)			
Sub-total	$ 860,000,000	Need to add to bond sheets and update interest reserve formulas						
Total	$ 888,600,000							

Depreciation (Straight Line)	Years	Annual Rate
External (FTTP) Plant	20	5.00%
Headend Equipment	7	14.29%
Operating Equipment	7	14.29%
Customer Premises Equipment	7	14.29%
Funded Depreciation	0%	

Replacement/Upgrade Costs (Percent of Total Costs)	Replacement 1	Replacement 2	Replacement 3
Headend Equipment	50%	50%	
Operating Equipment	50%	50%	
Customer Premises Equipment	15%	15%	15%

PROJECT ASSUMPTIONS

Revenues

Taxes

301,000 Total taxable properties	86.96%	$ 33.75	per month per property (taxes)
	13.04%	5.06	fees per property
		$ 38.81	average cost (per property)

	1	2	3	4	5	6	7	8	9	10
Annual Assessment	0	0	0	80	160	405	405	405	405	405
Unrestricted Cash Balance (yr 1 to yr 10)	$ 200,000	$ 929,400	$ 164,508	$ 785,272	$ 1,449,470	$ 22,867,458	$ 37,056,924	$ 38,855,180	$ 27,766,518	$ 16,268,584
Unrestricted Cash Balance (yr 11 to yr 20)	$ 30,154,690	$ 44,326,519	$ 46,186,785	$ 35,409,255	$ 24,416,175	$ 38,388,734	$ 30,965,744	$ 32,470,794	$ 21,338,945	$ 10,064,458

Other Revenues/Services Annual Retail Price

	Year 1	Year 2	Year 3	Year 4	Year 5+	
Advertising	$ -	$ -	$ -	$ -	$ -	(Revenue per year)

Provider Fee	$ 120	10.00	per residential Internet service per month
	$ 120	10.00	per business Internet service per month
	$ 120	10.00	per residential cable service per month
	$ 120	10.00	per business cable service per month
	$ 120	10.00	per residential telephone service per month
	$ 120	10.00	per business telephone service per month

			Year 1	Year 2	Year 3	Year 4	Year 5+
Data Storage Annual Revenue per Space	$ -	Spaces	0	0	0	0	0

Operation and Maintenance Expenses

Annual Fixed Operating Expense

	Year 1	Year 2	Year 3	Year 4	Year 5+
Insurance	$ -	$ -	$ 2,000,000	$ 2,000,000	$ 2,000,000
Utilities	$ -	$ -	$ 250,000	$ 250,000	$ 250,000
Office Expenses	$ 50,000	$ 100,000	$ 500,000	$ 500,000	$ 500,000
Contingency	$ 200,000	$ 200,000	$ 1,000,000	$ 1,500,000	$ 1,500,000
Billing Maintenance Contract	$ -	$ -	$ 100,000	$ 200,000	$ 250,000
Fiber Maintenance	$ -	Annual +			
	1.5%	Fiber Implementation Cost			

	Year 1	Year 2	Year 3	Year 4	Year 5+	
Legal and Lobby Fees	$ 400,000	$ 10,000,000	$ 10,000,000	$ 2,000,000	$ 2,000,000	
Planning	$ 500,000	$ 1,750,000	$ 2,500,000	$ -	$ -	
Consulting	$ 750,000	$ 750,000	$ 150,000	$ 300,000	$ 300,000	
Marketing	$ -	$ -	$ 1,000,000	$ 500,000	$ 500,000	$ 14,700,000

Annual Variable Operating Expense

Education and Training 4% percent of direct payroll

	Year 1	Year 2	Year 3	Year 4	Year 5+
Internet Connection Fee	$ -	$ -	$ -	$ -	$ -

Pole Attachment Expense

Attachment Fees 27,000 poles at $ 20.00 per year

Taxes

Franchise Fees	30%	percent of access fee revenue	Starts in year	6	30
Sales Tax	0%	percent of revenue (pass-through)			
In lieu of tax	5%	of installed Fiber	Starts in year	6	5

Low Income Assistance

Assistance Rate 50% for 10% of households based on assesment and access fee

PROJECT ASSUMPTIONS

Labor Expense

Labor (Direct)

New Employees	Year 1	Year 2	Year 3	Year 4	Year 5+	Labor Cost			
Business Manager	0	1	4	4	4	100,000			
Market & Sales Manager	0	0	0	0	0	85,000			
Broadband Service Manager & Administrators	0	0	3	3	3	85,000			
Headend Technician	0	0	1	1	1	70,000			
Telephone Technician	0	0	0	0	0	70,000			
Internet Technician	0	0	4	4	4	70,000			
Customer Service Representative/Help Desk	0	0	36	56	76	40,000	5000	4	Number of Customers per CSR-Number of Shifts
Service Technicians/Installers	0	0	36	56	76	40,000	5000	4	Number of Customers per Tech Number of Shifts
Sales and Marketing Representative	0	0	5	8	8	40,000			
Contract Administrator	0	0	2	3	3	65,000			
Fiber Plant O&M Technicians	0	0	11	11	11	50,000	100	Miles of line per technician	
TBD	0	0	0	0	0	-	2015	Miles of line	
Total New Staff	0	1	102	146	186		26598		

Existing Employees	Year 1	Year 2	Year 3+	Labor Cost
Total Existing Staff	0	0	0	$ -
Total Existing Staff	0	0	0	

Service Position Total	Year 1	Year 2	Year 3	Year 4	Year 5+	Year 1 Salary
Business Manager	0	1	4	4	4	$ 100,000
Market & Sales Manager	0	0	0	0	0	$ 85,000
Broadband Service Manager & Administrators	0	0	3	3	3	$ 85,000
Headend Technician	0	0	1	1	1	$ 70,000
Telephone Technician	0	0	0	0	0	$ 70,000
Internet Technician	0	0	4	4	4	$ 70,000
Customer Service Representative/Help Desk	0	0	36	56	76	$ 40,000
Service Technicians/Installers	0	0	36	56	76	$ 40,000
Sales and Marketing Representative	0	0	5	8	8	$ 40,000
Contract Administrator	0	0	2	3	3	$ 65,000
Fiber Plant O&M Technicians	0	0	11	11	11	$ 50,000
TBD	0	0	0	0	0	$ -
Total Existing Staff	0	0	0	0	0	$ -
Total	0	1	102	146	186	

Total Salaries	$ -	$ 100,000	$ 4,765,000
Benefits	40%	of base salary	
Total Direct Labor Cost	$ -	$ 140,000	$ 6,671,000

PROJECT ASSUMPTIONS

Penetration Rates - Video

Residential Video Services					
Number of Potential Subscribers	267,300	Applies to All Services			
Subscriber Growth Rate	0.00%				
Televisions per Household	2		Customer pays for	0	installs
	Year 1	Year 2	Year 3	Year 4	Year 5
Market Size	74%	74%	72%	72%	70%
	Year 6	Year 7	Year 8	Year 9	Year 10+
	70%	68%	68%	66%	66%
	Year 1	Year 2	Year 3	Year 4	Year 5
Market Share	0%	0%	10%	20%	20%
Percentage of Market	0.00%	0.00%	7.20%	14.40%	14.00%
	Year 6	Year 7	Year 8	Year 9	Year 10+
Market Share	20%	20%	20%	20%	20%
Percentage of Market	14.00%	13.60%	13.60%	13.20%	13.20%
Package Take Rate	Year 1	Year 2	Year 3	Year 4	Year 5+
Basic	3%	3%	3%	3%	3%
Expanded Basic	75%	75%	75%	75%	75%
Digital	22%	22%	22%	22%	22%
Digital plus a premium	12%	12%	12%	12%	16%
One Premium	5%	5%	5%	5%	6%
Two Premiums	2%	2%	2%	2%	3%
Three Premiums	2%	2%	2%	2%	2%
Four Premiums	3%	3%	3%	3%	5%
VOD	4%	5%	6%	8%	10%
PPV	3%	3%	3%	4%	5%
HDTV and Digital Recording	3%	3%	3%	4%	5%
Commercial Video Services					
Number of Potential Subscribers	33,700	Applies to All Services			
Subscriber Growth Rate	0.00%				
					1
Televisions per Business	2				
	Year 1	Year 2	Year 3	Year 4	Year 5
Market Size	15%	15%	15%	15%	15%
	Year 6	Year 7	Year 8	Year 9	Year 10+
	15%	15%	15%	15%	15%
	Year 1	Year 2	Year 3	Year 4	Year 5
Market Share	0%	0%	10%	20%	20%
Percentage of Market	0.00%	0.00%	1.50%	3.00%	3.00%
	Year 6	Year 7	Year 8	Year 9	Year 10+
Market Share	20%	20%	20%	20%	20%
Percentage of Market	3.00%	3.00%	3.00%	3.00%	3.00%
Package Take Rate same as Residential					

PROJECT ASSUMPTIONS

Penetration Rates - Data

Residential Internet Services

Existing Dial-up Customers	0
Number of Potential New Subscribers	267,300

	Year 1	Year 2	Year 3	Year 4	Year 5
Projected Market Size	88%	90%	90%	90%	90%
	Year 6	Year 7	Year 8	Year 9	Year 10+
	90%	90%	90%	90%	90%

	Year 1	Year 2	Year 3	Year 4	Year 5
Market Share	0%	0%	10%	20%	30%
Percentage of Market	0.0%	0.0%	9.0%	18.0%	27.0%
	Year 6	Year 7	Year 8	Year 9	Year 10+
Market Share	30%	30%	30%	30%	30%
Percentage of Market	27.00%	27.00%	27.00%	27.00%	27.00%

Package Take Rate	Year 1	Year 2	Year 3	Year 4	Year 5
1 Mbps	0%	0%	0%	0%	0%
10 Mbps	0%	0%	0%	0%	0%
100 Mbps (residential)	100%	100%	100%	100%	100%
100 Mbps (business)	0%	0%	0%	0%	0%
1 Gbps	0%	0%	0%	0%	0%

Commercial Internet Services

	Year 1	Year 2	Year 3	Year 4	Year 5
Projected Market Size	90%	92%	92%	92%	92%
	Year 6	Year 7	Year 8	Year 9	Year 10+
	92%	92%	92%	92%	92%

	Year 1	Year 2	Year 3	Year 4	Year 5
Market Share	0%	0%	18%	36%	36%
Percentage of Market	0.0%	0.0%	16.6%	33.1%	33.1%
	Year 6	Year 7	Year 8	Year 9	Year 10+
Market Share	36%	36%	36%	36%	36%
Percentage of Market	33.12%	33.12%	33.12%	33.12%	33.12%

Package Take Rate	Year 1	Year 2	Year 3	Year 4	Year 5
1 Mbps	0%	0%	0%	0%	0%
10 Mbps	0%	0%	0%	0%	0%
100 Mbps (residential)	0%	0%	0%	0%	0%
100 Mbps (business)	97%	97%	97%	97%	97%
1 Gbps	3%	3%	3%	3%	3%

PROJECT ASSUMPTIONS

Penetration Rates - Voice

Residential Phone Services

	Year 1	Year 2	Year 3	Year 4	Year 5
Projected Market Size	80%	75%	70%	65%	65%
	Year 6	Year 7	Year 8	Year 9	Year 10+
	65%	65%	65%	65%	65%

	Year 1	Year 2	Year 3	Year 4	Year 5
Market Share	0%	0%	15%	15%	15%
Percentage of Market	0.0%	0.0%	10.5%	9.8%	9.8%
	Year 6	Year 7	Year 8	Year 9	Year 10+
Market Share	15%	15%	15%	15%	15%
Percentage of Market	9.75%	9.75%	9.75%	9.75%	9.75%

Package Take Rate	Year 1	Year 2	Year 3	Year 4	Year 5	
Unlimited Local Calling	20%	20%	20%	20%	20%	
Unlimited Local and Long Distance	80%	80%	80%	80%	80%	
Business Package (Average)	0%	0%	0%	0%	0%	0%

Commercial Phone Services

	Year 1	Year 2	Year 3	Year 4	Year 5
Projected Market Size	60%	60%	60%	60%	60%
	Year 6	Year 7	Year 8	Year 9	Year 10+
	60%	60%	60%	60%	60%

	Year 1	Year 2	Year 3	Year 4	Year 5
Market Share	0%	0%	15%	27%	27%
Percentage of Market	0.0%	0.0%	9.0%	16.2%	16.2%
	Year 6	Year 7	Year 8	Year 9	Year 10+
Market Share	27%	27%	27%	27%	27%
Percentage of Market	16.20%	16.20%	16.20%	16.20%	16.20%

Package Take Rate	Year 1	Year 2	Year 3	Year 4	Year 5
Unlimited Local Calling	0%	0%	0%	0%	0%
Unlimited Local and Long Distance	0%	0%	0%	0%	0%
Business Package (Average)	100%	100%	100%	100%	100%

Bundling

Bundling Factor[1]	0.15

PROJECT ASSUMPTIONS

Capital Additions

	1	2	3	4	5		1	2	3	4	5
Network Equipment	Turn-Key Cost										
	1	2	3	4	5		1	2	3	4	5
Headend Costs	$ -	$ -	$ 29,500,000	$ -	$ -	$ 29,500,000	0.00%	0.00%	100.00%	0.00%	0.00%
Hub Costs	-	-	13,475,000	-	-	$ 13,475,000	0.00%	0.00%	100.00%	0.00%	0.00%
Additional Annual Capital	0%	(% of turn-key cost)		Starts in year	4						
Outside Plant and Materials	Turn-Key Cost										
	1	2	3	4	5		1	2	3	4	5
Backbone Fiber Ring	$ -	$ -	$ -	$ -	$ -	$ -	0.00%	0.00%	100.00%	0.00%	0.00%
FTTP Fiber Network	-	-	153,500,000	153,500,000	-	$ 307,000,000	0.00%	0.00%	50.00%	50.00%	0.00%
Total Backbone and FTTP	$ -	$ -	$ 153,500,000	$ 153,500,000	$ -						
	$ -	$ -	$ 153,500,000	$ 307,000,000	$ 307,000,000						
Additional Annual Capital	0%	(% of turn-key cost)		Starts in year	4						
Last Mile and Customer Premises Equipment											
	1	2	3	4	5		1	2	3	4	5
Customer Premises Equipment	$ -	$ -	$ 84,500,000	$ 169,000,000	$ 169,000,000	$ 422,500,000	0.00%	0.00%	20.00%	40.00%	40.00%
Additional Annual Replacement Capital	3.00%	(% of CPE's in service[2])		Starts in year	4	$ 772,475,000					
Miscellaneous Implementation Costs	Year 1	2	3	4	5						
Splicing	$ -	$ -	$ -	$ -	$ -						
Vehicles	$ -	$ -	$ 250,000	$ -	$ -						
Emergency Restoration Kit	$ -	$ -	$ -	$ -	$ -						
Laptop Computers and Software	$ 4,000	per employee									
Fiber OTDR	$ -	$ 25,000	$ -	$ -	$ -						
Miscellaneous Tools and Other	$ -	$ 50,000	$ 50,000	$ -	$ -						
Billing Software	$ -	$ 250,000	$ -	$ -	$ -						
Additional Annual Capital	0%	(% of Year 1)		Starts in year	4						

[1]Bundling Factor accounts for the percentage of customers who subscribe to two or more services. Total number of customers are calculated as (Max Customers - Min Customers)*Bundling Factor + Min Customers (see Sheets "Projected Total Residential Customers" and "Projected Total Commercial Customers").
[2]Approximate required additional annual capital, set to equal full reinvestment in replacement CPE.

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Cost Estimate

	low	middle	high
Headend	$ 27,000,000	$ 29,500,000	$ 32,000,000
Hub	12,250,000	13,475,000	14,700,000
FTTP Network (fiber)	279,000,000	307,000,000	335,000,000
Subscriber Costs	385,000,000	422,500,000	460,000,000
Sub- Total (Network)	$ 703,250,000	$ 772,475,000	$ 841,700,000
Miscellaneous	$ 1,232,100	$ 1,369,000	$ 1,505,900
Sub-Total (Misc)	$ 1,232,100	$ 1,369,000	$ 1,505,900
Total Implementation	$ 704,482,100	$ 773,844,000	$ 843,205,900

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Supplemental Tables

	Year 1	Year 5	Year 10	Year 15	Year 20
Insurance	$ -	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000
Utilities	-	250,000	250,000	250,000	250,000
Office Expenses	50,000	500,000	500,000	500,000	500,000
Contingency	200,000	1,500,000	1,500,000	1,500,000	1,500,000
Billing Maintenance Contract	-	250,000	250,000	250,000	250,000
Fiber Maintenance	-	4,605,000	4,605,000	4,605,000	4,605,000
Legal and Lobby Fees	400,000	2,000,000	2,000,000	2,000,000	2,000,000
Planning	500,000	-	-	-	-
Consulting	750,000	300,000	300,000	300,000	300,000
Marketing	-	500,000	500,000	500,000	500,000
Education and Training	-	266,840	266,840	266,840	266,840
Sub-Total	$ 1,900,000	$ 12,171,840	$ 12,171,840	$ 12,171,840	$ 12,171,840
Labor Expenses	$ -	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000
Low Income Assistance	$ -	$ 3,327,728	$ 7,002,150	$ 7,002,150	$ 7,002,150
Attachment Fees	-	540,000	540,000	540,000	540,000
Sub-Total	$ -	$ 10,538,728	$ 14,213,150	$ 14,213,150	$ 14,213,150
Total Expenses	$ 1,900,000	$ 22,710,568	$ 26,384,990	$ 26,384,990	$ 26,384,990
Principal and Interest	$ -	$ 38,700,000	$ 80,077,875	$ 80,077,875	$ 80,077,875
Taxes	-	-	20,791,400	20,791,400	20,791,400
Sub-Total	$ -	$ 38,700,000	$ 100,869,275	$ 100,869,275	$ 100,869,275
Total Expenses, P&I, and Taxes	$ 1,900,000	$ 61,410,568	$ 127,254,265	$ 127,254,265	$ 127,254,265

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Supplemental Tables

	Year 10		
	Low	**Mid**	**High**
Insurance	$ 1,800,000	$ 2,000,000	$ 2,200,000
Utilities	225,000	250,000	275,000
Office Expenses	450,000	500,000	550,000
Contingency	1,200,000	1,500,000	1,800,000
Billing Maintenance Contract	225,000	250,000	275,000
Fiber Maintenance	4,375,000	4,605,000	4,835,000
Legal and Lobby Fees	1,400,000	2,000,000	2,600,000
Planning	-	-	-
Consulting	255,000	300,000	345,000
Marketing	425,000	500,000	575,000
Education and Training	253,000	266,840	280,000
Sub-Total	$ 10,608,000	$ 12,171,840	$ 13,735,000
Labor Expenses	6,004,000	6,671,000	7,338,000
Low Income Assistance	6,302,000	7,002,150	7,702,000
Attachment Fees	513,000	540,000	567,000
Sub-Total	$ 12,819,000	$ 14,213,150	$ 15,607,000
Total	$ 23,427,000	$ 26,384,990	$ 29,342,000

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Supplemental Tables

Year 15

	Percent of Total Expenses (with no P&I and no taxes)	Percent of Total Expenses (with P&I , with no taxes)	Percent of Total Expenses (with P&I and taxes)
Insurance	7.58%	1.88%	1.57%
Utilities	0.95%	0.23%	0.20%
Office Expenses	1.90%	0.47%	0.39%
Contingency	5.69%	1.41%	1.18%
Billing Maintenance Contract	0.95%	0.23%	0.20%
Fiber Maintenance	17.45%	4.33%	3.62%
Legal and Lobby Fees	7.58%	1.88%	1.57%
Planning	0.00%	0.00%	0.00%
Consulting	1.14%	0.28%	0.24%
Marketing	1.90%	0.47%	0.39%
Education and Training	1.01%	0.25%	0.21%
Labor Expenses	25.28%	6.27%	5.24%
Low Income Assistance	26.54%	6.58%	5.50%
Attachment Fees	2.05%	0.51%	0.42%
Principal and Interest	na	75.22%	62.93%
Taxes	na	na	16.34%
	100.00%	100.00%	100.00%

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Supplemental Tables

		Year 1	Year 5	Year 10	Year 15	Year 20
a. Revenues						
Provider Fee		$ -	$ 18,394,560	$ 18,138,000	$ 18,138,000	$ 18,138,000
Tax Revenue		-	48,160,000	121,905,000	121,905,000	121,905,000
Ancillary Revenues		-	-	-	-	-
	Total	$ -	$ 66,554,560.00	$ 140,043,000.00	$ 140,043,000.00	$ 140,043,000.00
b. Content Fees						
Video		$ -	$ -	$ -	$ -	$ -
	Total	$ -	$ -	$ -	$ -	$ -
c. Operating Costs						
Labor Expense		$ -	$ 6,671,000	$ 6,671,000	$ 6,671,000	$ 6,671,000
Operation and Maintenance Expenses		1,900,000	12,171,840	12,171,840	12,171,840	12,171,840
Pole Attachment Expense		-	540,000	540,000	540,000	540,000
Depreciation		-	82,042,000	72,811,071	31,744,214	34,813,857
	Total	$ 1,900,000	$ 104,752,568	$ 99,196,061	58,129,204	$ 61,198,847
d. Operating Income		$ (1,900,000)	$ (38,198,008)	$ 40,846,939	$ 81,913,796	$ 78,844,153
e. Non-Operating Income						
Interest Income		$ -	$ 1,415,330	$ 1,415,330	$ 1,568,185	$ 1,286,779
Interest Expense (10 Year Bond)		-	-	-	-	-
Interest Expense (20 Year Bond)		-	(30,733,989)	(30,733,989)	(18,586,416)	(3,448,330)
	Total	$ -	$ (29,318,659)	$ (29,318,659)	$ (17,018,231)	$ (2,161,551)
f. Net Income		$ (1,900,000)	$ (75,867,803)	$ 11,528,280	$ 64,895,565	$ 76,682,602
g. Taxes (Franchise Fees & In Lieu Tax)		$ -	$ -	$ 20,791,400	$ 20,791,400	$ 20,791,400
h. Net Income After Fees & In Lieu Taxes		$ (1,900,000)	$ (75,867,803)	$ (9,263,120)	$ 44,104,165	$ 55,891,202

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Supplemental Tables

	Year 1	Year 5	Year 10	Year 15	Year 20
Net Income	$ (1,900,000)	$ (75,867,803)	$ (9,263,120)	$ 44,104,165	$ 55,891,202
Cash Flow	$ 200,000	$ 664,197	$ (11,497,935)	$ (10,993,080)	$ (11,274,486)

	Year 1	Year 5	Year 10	Year 15	Year 20
Principle Payments	$ -	$ -	$ 49,343,886	$ 61,491,459	$ 76,629,545
Interest Payments	-	38,700,000	30,733,989	18,586,416	3,448,330
Total Debt Service	$ -	$ 38,700,000	$ 80,077,875	$ 80,077,875	$ 80,077,875

	Year 1	Year 5	Year 10	Year 15	Year 20
Unrestricted Cash Balance	$ 200,000	$ 1,449,470	$ 16,268,584	$ 24,416,175	$ 10,064,458
Funded Depreciation	-	-	-	-	-
Restricted Cash Balance (Interest Reserve)	-	7,425,000	-	-	-
Restricted Cash Balance (Debt Service Reserve)	-	43,000,000	43,000,000	43,000,000	43,000,000
	$ 200,000	$ 51,874,470	$ 59,268,584	67,416,175	$ 53,064,458

Smart Grid Overview and Benefit Examples

Seattle Community Broadband Initiative

Defining the Strategic Vision, Goals, and Objectives

What is Smart Grid?
Some Popular Definitions

- Wikipedia:
  - “A smart grid delivers electricity from suppliers to consumers using two-way digital technology to … reduce cost and increase reliability and transparency.”
- DOE:
  - “Smarter grid”: Near-term, focused on data and communications within power system
  - “Smart grid”: Long-term, focused on transforming the way we use energy
- Commonwealth Edison Executive:
  - “A scratch for whatever itch you may have.”

There is no single definition or vision of “Smart Grid.”

Smart Grid/AMI Applications
Benefit Areas

SCL/SPU operation benefits:
Recorded on financial statements

Community and consumer benefits:
Do not impact SCL/SPU financial statements

- FTTP benefit (limit) determined by cost avoidance calculation
- Magnitude of benefit dependant upon AMI vendor

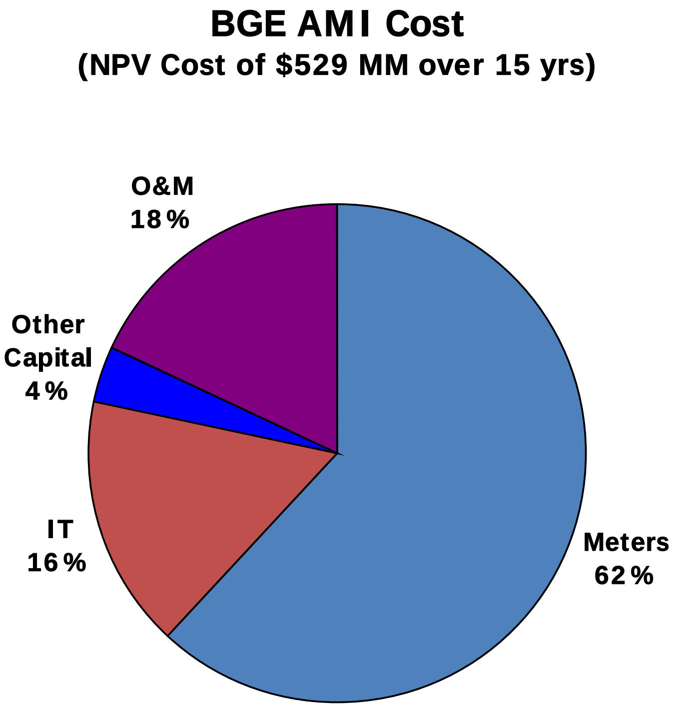
- Energy and demand savings for consumers
- Environmental reductions (carbon and other emissions)

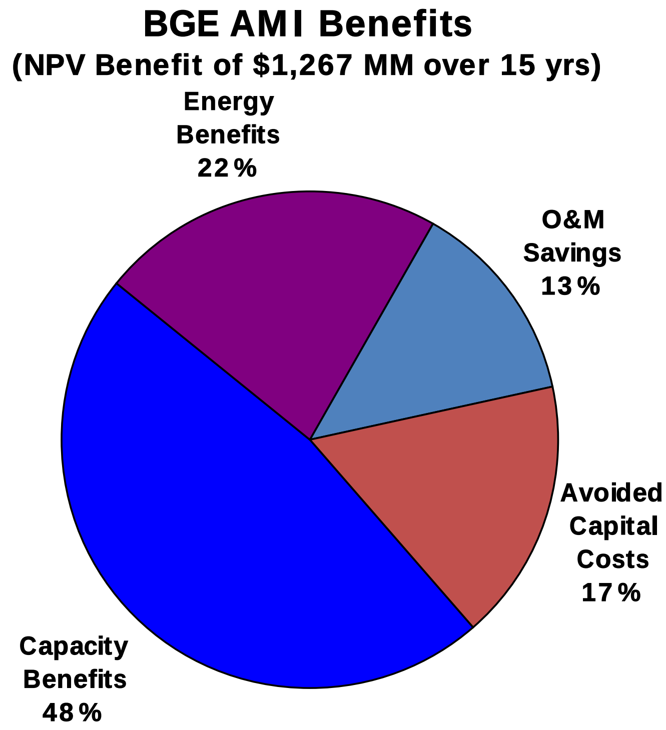
Customer of FTTP provider–SCL/SPU purchase decision

Societal benefits—provides basis for tax financing

Smart Grid Costs & Benefits

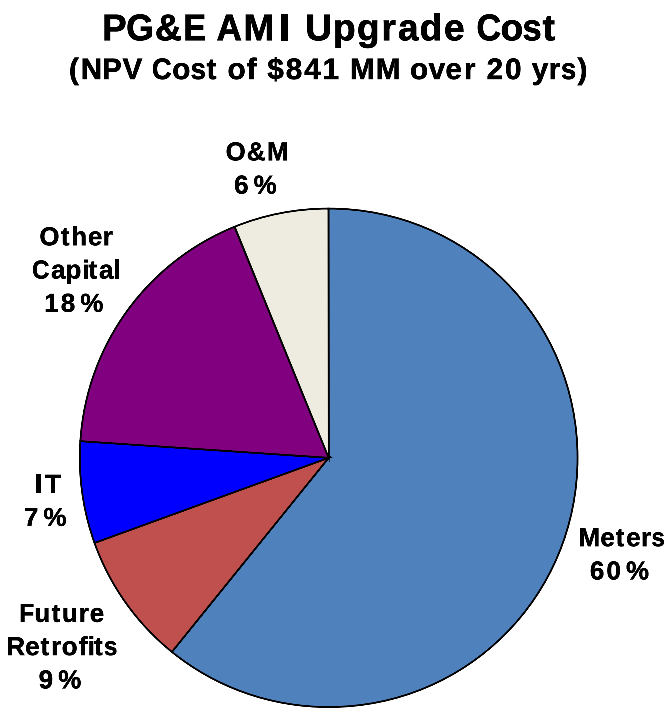
C&B Composition Example 1: BGE

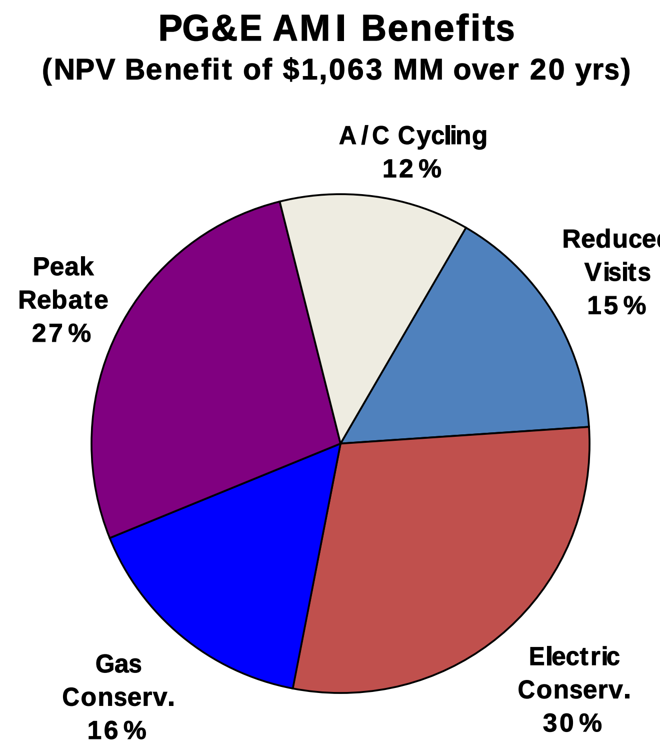




Note that the meters and installation comprise roughly two-thirds of the cost.
Benefits rely heavily on customer behavior modification and avoided demand and energy savings.
O&M savings are only 13% of total.

Smart Grid Costs & Benefits
C&B Composition Example 2: PG&E





PG&E's smart meter upgrade provides a good example of costs and benefits.
Note that 60% of costs are meters. Note that 85% of benefits are DSM-related.

Smart Grid/AMI Technologies
Technology Types (Categories)

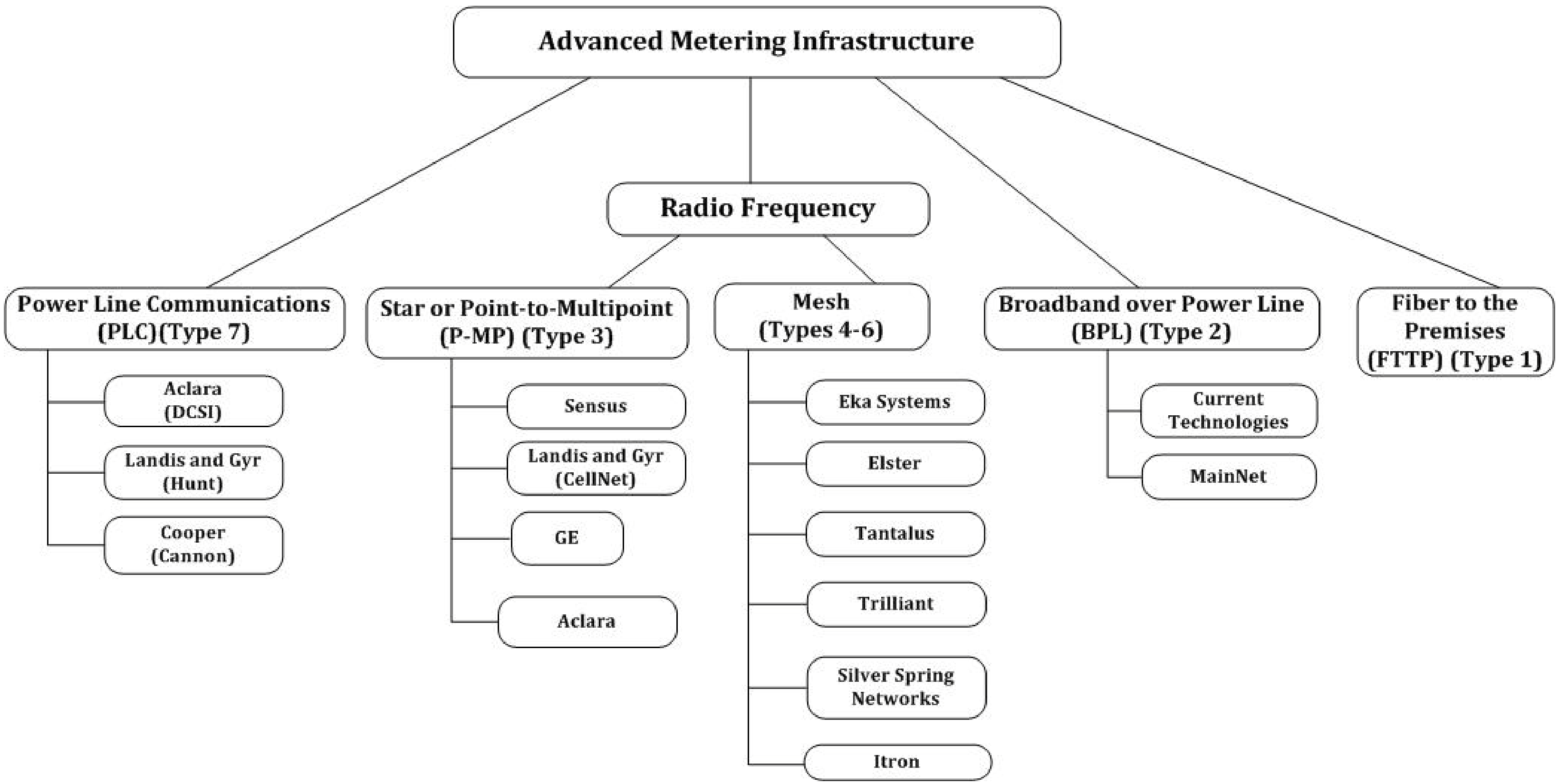
- Passive
  - Smart appliances automatically adjust if voltage drops or other conditions
  - No consumer action required
- Interactive
  - Two way communication of price & load
  - Requires active consumer behavior or pre-approval of utility action (load control)
- Combination of Passive and Interactive
  - Utility sends signals triggering a response, but consumer can bypass

Please see attached "Technical Appendix" for additional details.

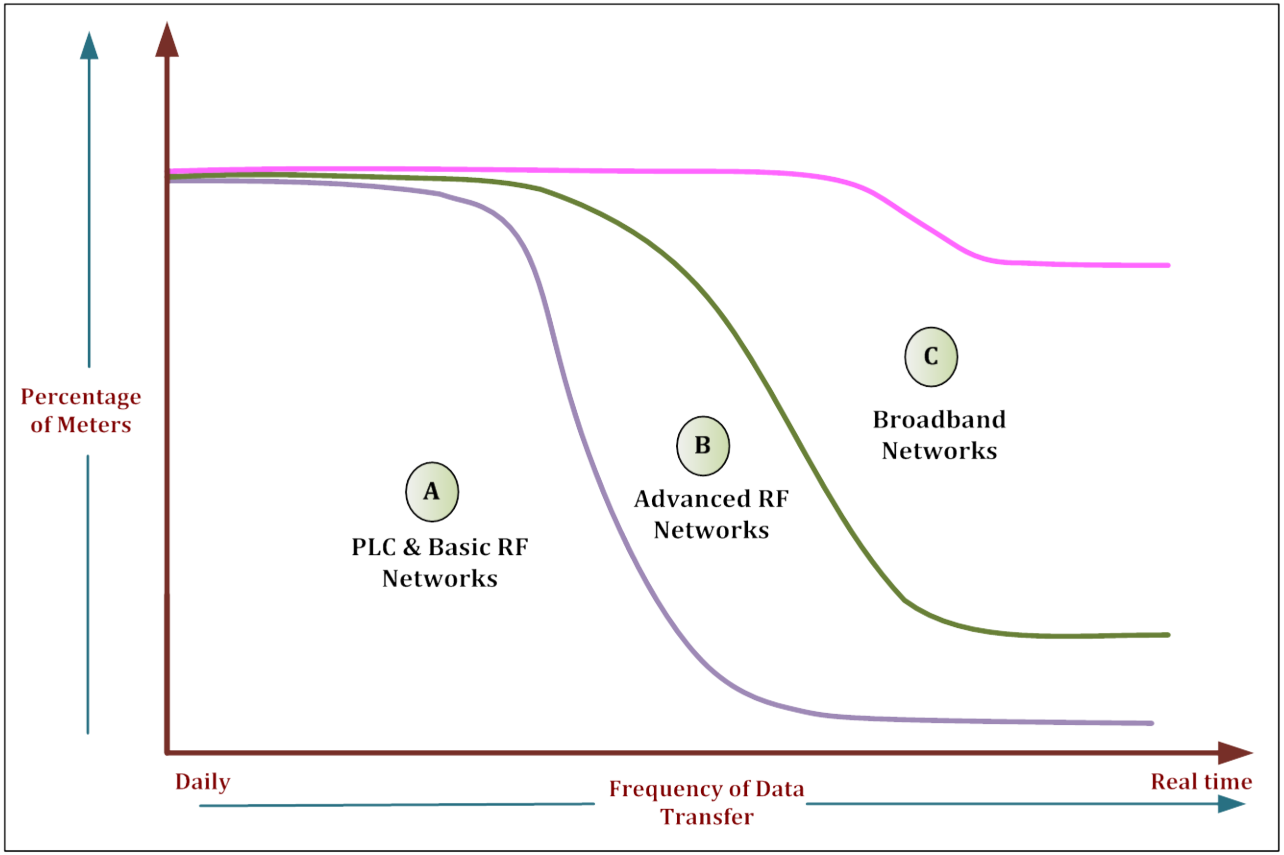
Smart Grid/AMI Technologies
Media Types

- Power Line Carrier (PLC)
- Broadband over Power Line (BPL)
- Radio Frequency (RF)
  - Star or Multi-point
  - Mesh
- Fiber-to-the-Premises (FTTP)

Smart Grid/AMI Technologies
Vendor Approaches



Smart Grid/AMI Technologies
Conceptual Characteristics



Key difference is not the level of data provided (15-minute), but how often that data is transferred (real-time vs. daily).

Smart Grid/AMI Technologies
AMI Viewpoint: Supplier vs. Customer

AMI Data Structured for Power Supplier ←

→ AMI Data Structured for Consumer

- Batch processing for consumer
- Consumer data collected 3 to 4 times per day
- Near real-time data for power supply
- Near real-time data from tie-points and feeders

- Near real-time processing for each consumer
- Consumer data collected every 15 minutes or every hour; near real-time data for power supply
- Near real-time data from tie-points and feeders

Smart Grid/AMI Case Studies
California (PG&E)

- Pacific Gas & Electric (PG&E) and other California IOUs are installing AMI system wide
- PG&E started with Aclara (PLC) in 2007-2008
  - Poor read performance and meter supply problems
  - Removed 145,000 Aclara meters
- Now installing Silver Springs network (RF mesh)
  - Began simultaneously with rate increase and extreme weather
  - Some missing data and errors, many from estimating missing data or inaccurate final reads of old meters
  - B/C ratio = 1.3 (over 20 years). See Slide 10 for details.
    - 85% of benefits are load-related (not O&M)
- Goal to install smart meters system wide by 2010
  - 5 million electric and 4.2 million gas customers

Smart Grid/AMI Case Studies
Texas (Oncor)

- Oncor began installing "smart" meters in late 2005
- Began with BPL technology from CURRENT
  - Texas PUC issued new standards in Oct-06; BPL meters did not meet the minimum standards (900,000 meters obsolete)
  - Texas PUC allowed them to recover $115 MM of $253 MM
- Now installing RF mesh and Landis+Gyr meters
  - Plans to complete 3.5 million meters by 2012
  - Estimated cost: $686 MM capital + $153 O&M = $839 MM
  - Estimated benefits: $204 MM (NPV over 10 years)
    - DSM benefits not included; would be realized by retail providers
- Customer complaints prompted detailed meter testing
  - Oncor recently reported meter errors on 25 of 1.1 million installed (better than old meters) and 1,827 inaccurate reads of old meters being replaced

Smart Grid/AMI Case Studies
Maryland (BGE)

- Baltimore Gas & Electric conducted pilot tests of smart meters and pricing options in 2008 and 2009
  - Using RF mesh technology
  - Offered multiple incentives for reduced peak use
  - Reported peak demand savings of 15%+ in pilot group
- DOE awarded $200 million for system-wide roll-out
- Maryland PSC rejected proposal
  - Customer charge and risk sharing
  - Mandatory "TOU" rates (actually, peak-time rebate)
  - Potential cost shifting to elderly and low-income (AARP)
  - "Grossly inadequate messaging…" and customer education
  - Uncertain and far-off consumer benefits
- BGE filed amended application July 12
  - Approved in August 2010

Smart Grid/AMI Case Studies
Norwich Public Utilities (NPU), CT

- Part of a DOE grant awarded to the Connecticut Municipal Electrical Energies Cooperative (CMEEC)
- Objective of developing time-based rates
- RFP issued stressing the long-term need of obtaining 15 min data every 15 minutes
- Vendor selected based on RFP response and interviews
- NPU insisted that contract included performance requirements. Vendor avoided commitments on details with desire to defer key performance issues to a planning session to be held after contract signing
- After several weeks of "negotiations", vendor admitted they misrepresented their capabilities in the RFP – NPU now in negotiations with another vendor

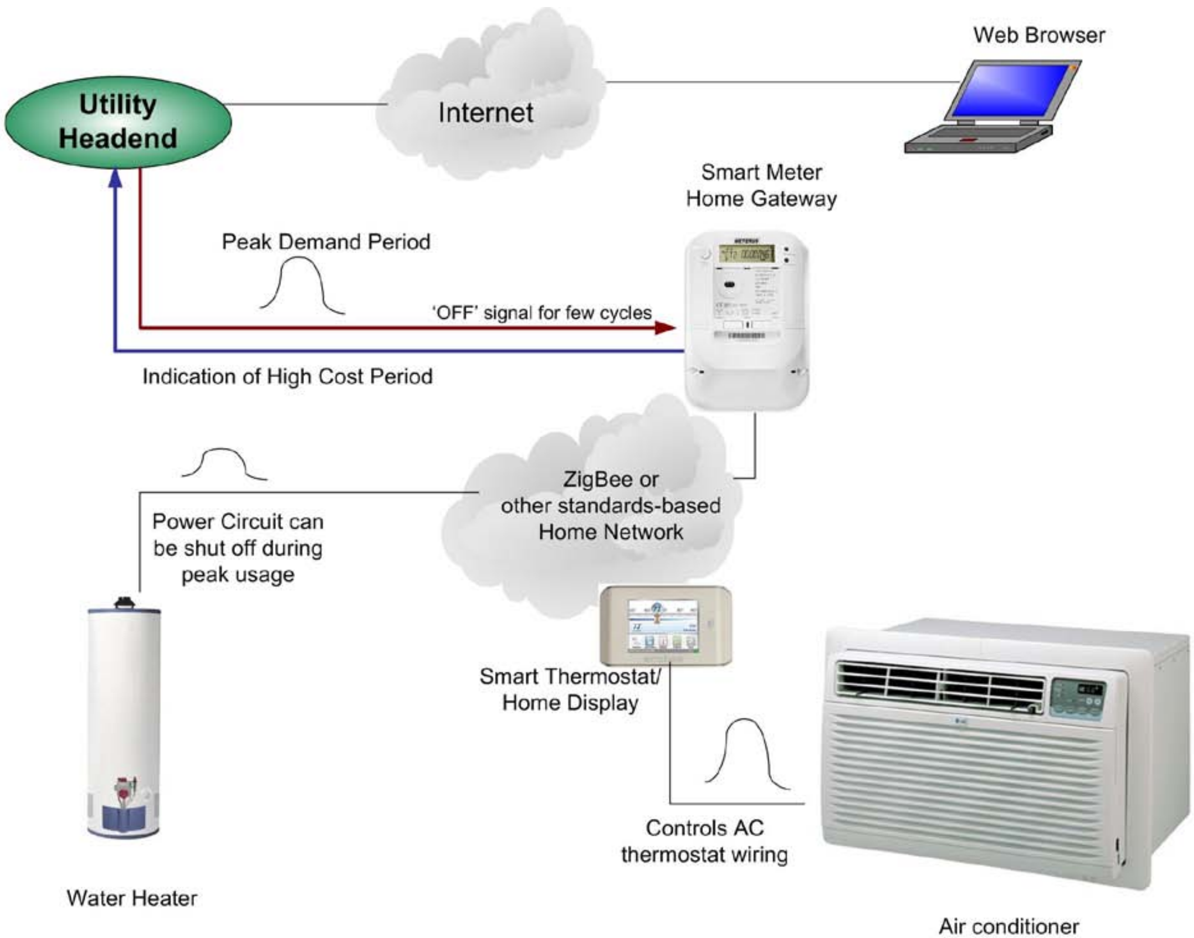
Technical Appendix
Passive Smart Grid Example

When voltage drops, dryer shuts off heating coil but keeps dryer rotation on

Electric Dryer

Picture Courtesy: PNNL Website (http://www.pnl.gov/)

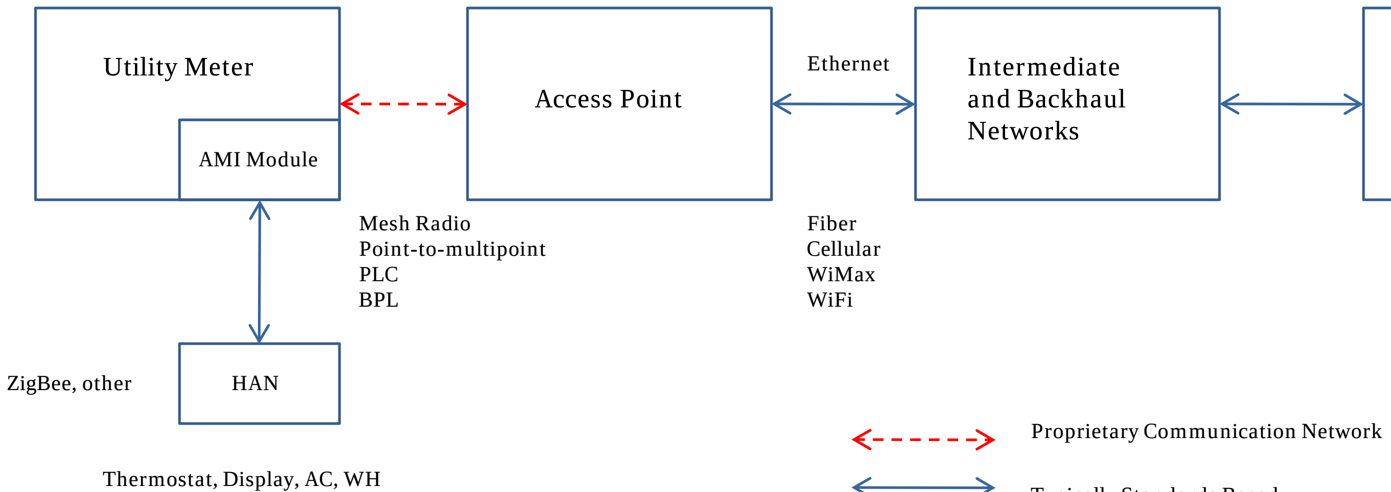
Technical Appendix
Interactive Smart Grid Example



Technical Appendix
Combination Smart Grid Example

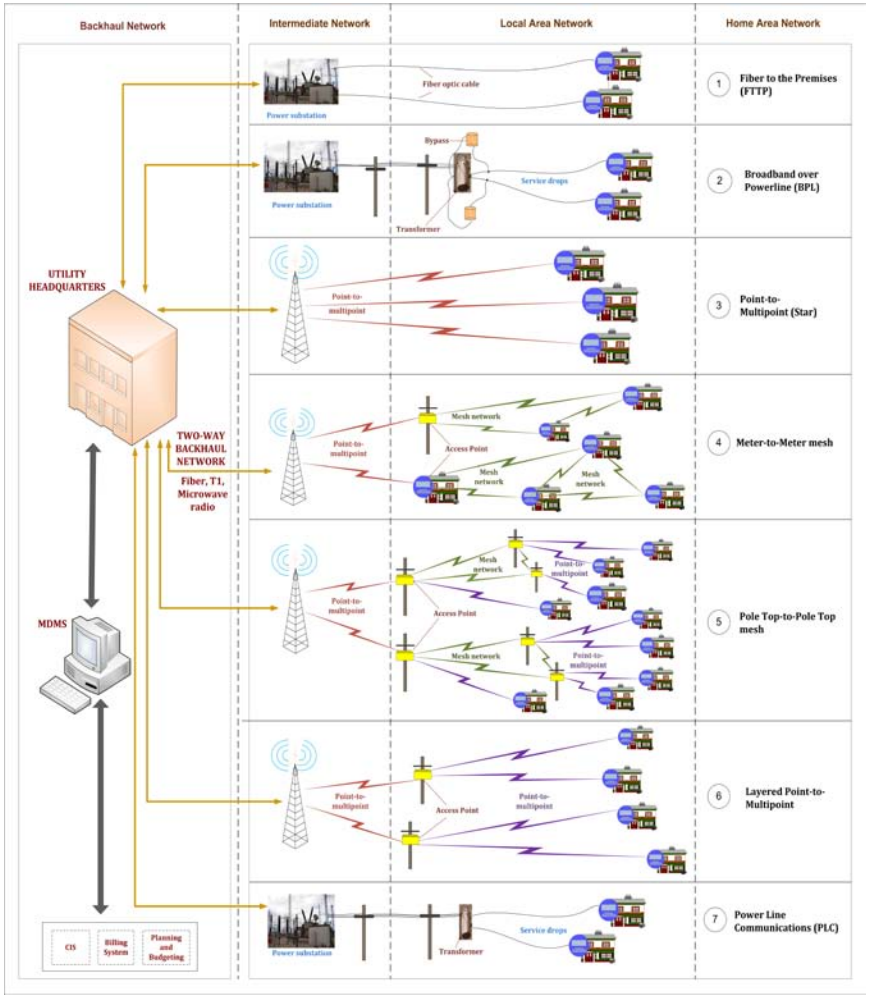
- Combination Passive and Interactive
  - Utility provides information regarding peak demand to consumer
  - Utility can control consumer load, and remotely record consumption/demand
  - Consumer can choose act on or bypass utility commands based on the information provided
- Example
  - Commands are sent to irrigation pumps and the consumer (irrigator) by the utility
  - Consumer (irrigator) can remotely bypass utility commands and run pumps during peak – with a substantial financial penalty

Technical Appendix
AMI Elements



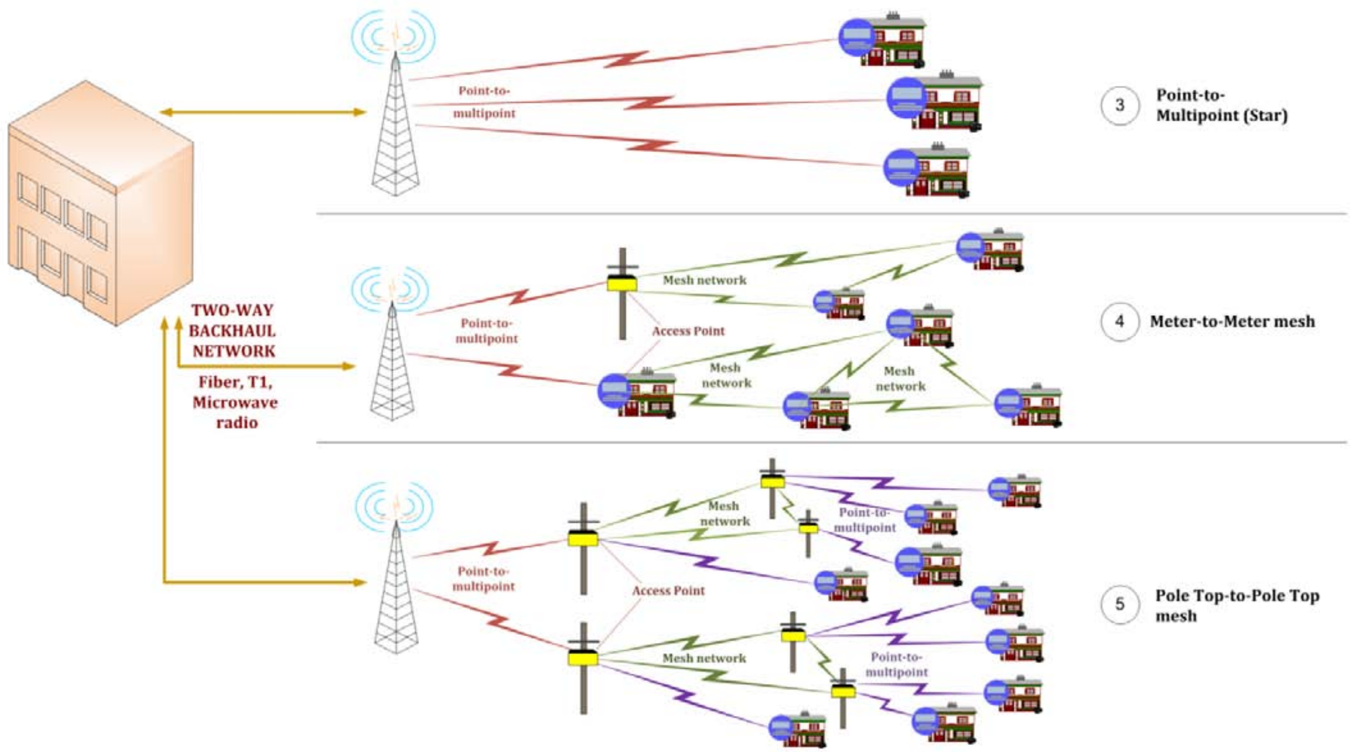
Technical Appendix

AMI Architectures



- Fiber-to-the-Premises (FTTP)
- Broadband over Power Line (BPL)
- Point-to-Multipoint (Star)
- Meter-to-Meter Mesh
- Pole Top-to-Pole Top Mesh
- Layered Point-to-Multipoint
- Power Line Carrier (PLC)

Technical Appendix
AMI Architectures (cont'd)



Technical Appendix
AMI Architectures (cont'd)