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Gigabit Internet in Seattle

Sam Méndez

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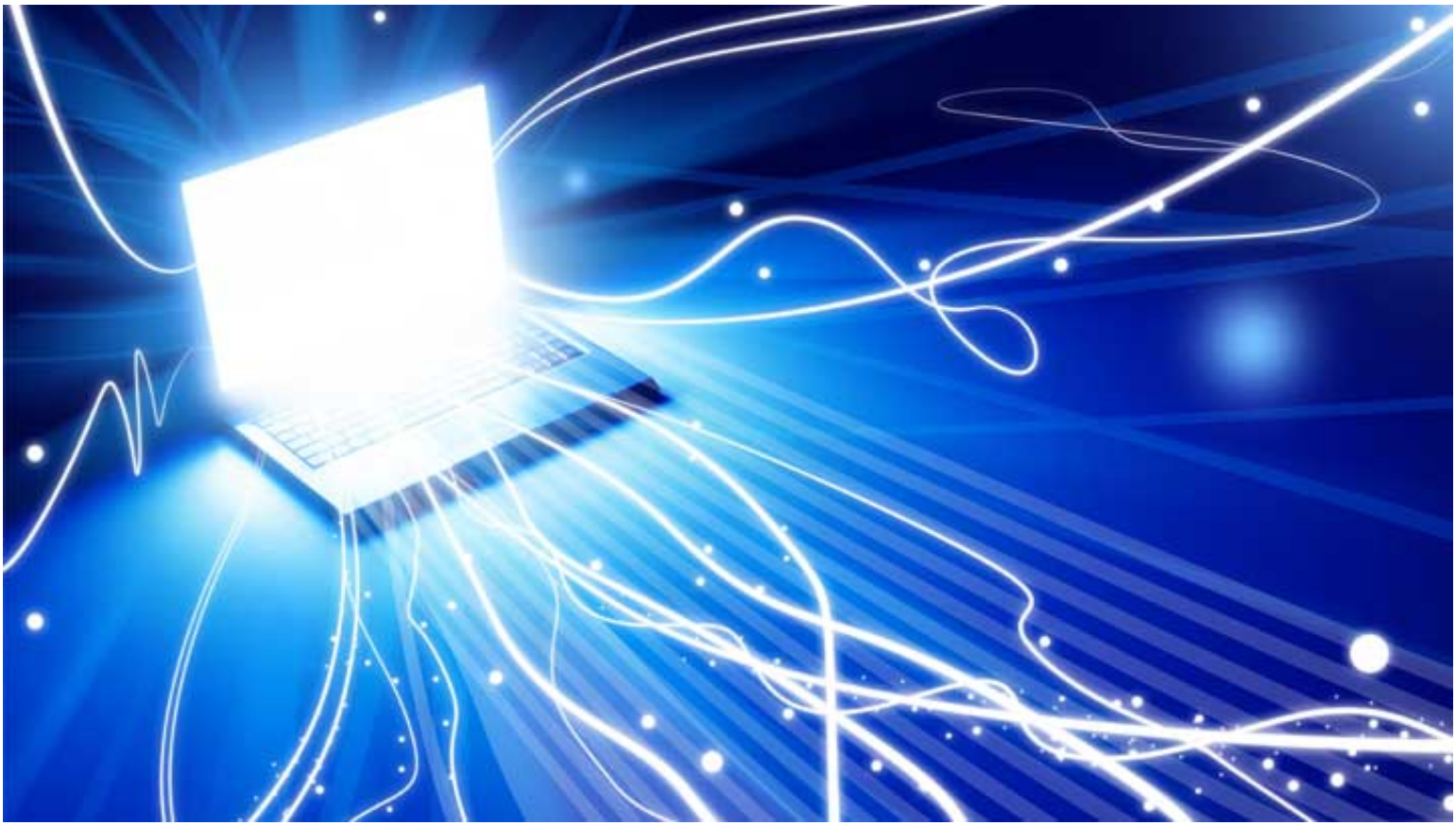

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Introduction

On December 13, 2012 then-Mayor Mike McGinn announced a partnership between the City of Seattle, the University of Washington, and a company called Gigabit Squared that was to bring ultra high speed Internet connections to twelve neighborhoods within Seattle.[1] Called Gigabit Seattle, the plan promised a fiber-to-the-premises (FTTP) network to 50,000 city households and businesses, serving over 100,000 residents.[2] The letter of intent between the city and Gigabit Squared stated the company would seek $25 million in capital with the network built and operational within 24 months that would provide connection speeds to customers of up to 1000 megabits per second (Mbps).[3] The announcements were high-profile and grandiose, with eruptions of applause and whistles at Mayor McGinn's announcement of the project to a standing-room only crowd at Seattle Tech Meetup.[4] But barely a year after the announcement, on January 7, 2014, the project had apparently entirely fallen apart, with the newly elected Mayor Ed Murray declaring the project dead and Gigabit Squared owing the city $52,250 in unpaid bills for work the city did for the company. What happened?

Were the initial promises too good to be true? Had the parties grossly underestimated the massive scope of the project? Had Gigabit Squared misrepresented its position to the city, over-promising and under-performing as the project stumbled? While definitive answers are hard to come by, it seems the answers to all of these questions are yes. But that does not mean ultra high speed Internet connections cannot come to Seattle. The desire from both the city government and residents seems to be present, and some individuals are picking up the pieces to see another project come to fruition. But it must be understood just how important the project is for Seattle to continue as a leader in technology, medicine, and business.

The arrival of the Internet to the public and it's relatively quick adoption in the 1990s was nothing short of a technological revolution, transforming the way people live and destroying old business models almost as fast as it allowed new ones to flourish. The Internet was reported in 2011 to have contributed $1.67 trillion to world domestic product, with almost $8 trillion exchanging hands through e-commerce.[5] Underestimating the power of the Internet is how, for example, the music industry failed to see rise of file sharing, causing major music labels to lose billions of dollars. Now other sectors such as film, television, and printed media are facing similar threats as newer companies from Apple to Amazon move in to provide consumers with better goods and services. The power of being online was also not lost on the 2008 presidential election, in which Barack Obama was credited with reaching youth with massive help by

[1] "City of Seattle, University of Washington, and Gigabit Squared announce plan to develop ultra-fast broadband network," Dec. 13, 2012. http://mayormcginn.seattle.gov/city-of-seattle-university-of-washington-and-gigabit-squared-announce-plan-to-develop-ultra-fast-broadband-network.
[2] "Letter of Intent," Dec. 12, 2012, 16. http://www.seattle.gov/archive/mcginn/seafi/docs/2012-12-13SignedLetterOfIntentGB2-CoS.pdf.
[3] *Id.* at 1.
[4] "Seattle turns to private companies to bring fast internet fiber to more people," Apr. 5, 2013. http://www.bizjournals.com/seattle/print-edition/2013/04/05/city-turns-to-private-companies-to.html.
[5] "Internet matters: The Net's sweeping impact on growth, jobs, and prosperity," Full Report 1, 24. http://www.mckinsey.com/insights/high_tech_telecoms_internet/internet_matters

his campaign's embrace of the new communicative avenues the Internet offered. Not was it lost to the battles raged in the Arab Spring, pitting dissidents who used Twitter and Facebook to communicate against the governments of Egypt and others who tried to tamp these technologies down. Few could argue about the awesome potential the Internet holds to better the lives of its users.

But every train needs its tracks, and every water faucet needs its pipes. The Internet can only be as powerful as the bandwidth capable of supplying it. So much of the new and yet-to-be invented technologies that are developing require the foundational communications cables and wires. Coaxial cables and fiber optics may not be as exciting as Netflix or iTunes, but simply put, the latter category cannot exist without the former category. Wireless communications are developing, but those technologies cannot be expected to replace wired communications any time soon. Wireless has its technological limits.

Currently, the greatest potential for a faster Internet lies in fiber optic technology. Fiber is often called a "future proof" technology because the data travels via light, meaning theoretically the speed of light is really the only true limit for how fast data can travel via fiber. FTTP technology is considered by many in the ISP industry to maintain demand for many decades to come.[6] For example, in 2009 Bell Labs set an optical transmission record of over 100 Petabits per second (equivalent to 100 million Gigabits per second), transmitting the data over at that speed over 7000 kilometers.[7]

Wired communications have their limits too. Laying down wire, either underground or over utility poles, to thousands of homes and businesses is expensive. Adding to the issue is the question of whether this infrastructure is best implemented by governments or the private sector. The interesting issue of wired communications is that its potential is not stymied by a lack of technological development; the potential for fiber optics to create Internet superhighways is based on technology that has been around since the 1970s, and fiber optic connections are already used when organizations can justify their cost. What has kept fiber optics from being connected to millions of consumers has been problems of logistics and economics. A study completed in 2007 estimated it would cost nearly $500 million to build a fiber optic network in Seattle,[8] and given the study's age and unforeseen costs, one can expect the cost to be much higher. Deepening the difficulty is the lack of demand for such a project in Seattle. Plenty of Seattle consumers are unhappy with their Internet service from the major Internet providers in the area (also called incumbents), Comcast and CenturyLink. Both companies have been some of the lowest ranked Internet service providers on consumer satisfaction.[9] But the demand for better service and more competition within the market seems low. Gigabit Seattle was

[6] "Why Fiber Is Future Proof," http://www.bbcmag.com/2010mags/march-april10/BBP_MarApril_FiberIsFuture.pdf.
[7] "Bell Labs breaks optical transmission record, 100 Petabit per second kilometer barrier," Sep. 29, 2009. http://phys.org/news173455192.html.
[8] "Financial Feasibility of Building and Operating a Fiber Network in the City of Seattle," May 15, 2007, 29. http://www.seattle.gov/broadband/docs/080422FeasibilityReport.pdf.
[9] "Internet Service Providers Are Now The Most Hated Companies In U.S.," May 22, 2013. http://www.huffingtonpost.com/2013/05/22/internet-service-providers-hated_n_3320473.html.

announced with limited fanfare, and its failure was met with even less publicity.[10] Despite the heightening dissatisfaction among consumers, one should be cautionary in assuming an expensive project like a FTTP network in Seattle will be widely embraced, especially if the city itself will pay for it.

This paper will examine the potential gigabit Internet speeds have for Seattle, with the main thrust being that Seattle could and should be one of the first major cities in the United States to implement a FTTP network for its residents. Section 1 will further explain the necessity for an Internet connection by detailing current Internet use, costs, and the difficulty of maintaining competitiveness in the Internet service provider market. Section 2 of this paper will examine the recent failure of Gigabit Seattle; the proposal itself, what went wrong, and how the proposal's failure need not be indicative of the potential for a successful FTTP network in Seattle. Section 3 will detail some of the obstacles for implementation such as the high cost, opposition from incumbents, and government policies that can be either helpful or harmful. Section 4 will explain the networks that have been built in Chattanooga and Kansas City—the former being a public utility-owned network and the latter being a private network—as examples that Seattle can follow. And finally Section 5 will conclude the paper by examining whether the Seattle should push for a publicly owned network or whether it should try to attract a private company, with some final recommendations for moving forward.

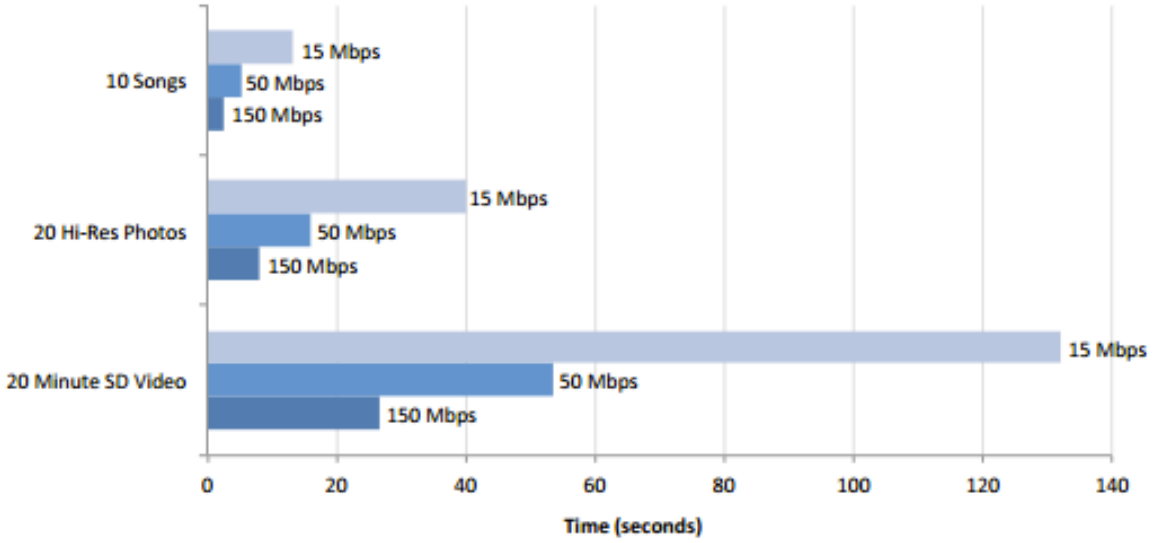
The Internet is here to stay, and it will only grow from here. Fiber optic technology is the best (and, really, the only) option for a modern communications infrastructure. Given the potential and desire for greater connectivity, the implementation of these networks in every major city in the coming decades is inevitable. It is just a question of when. Seattle can be one of the leaders, or it can be one of the stragglers.

The Need to be Connected

Benefits From High Speed

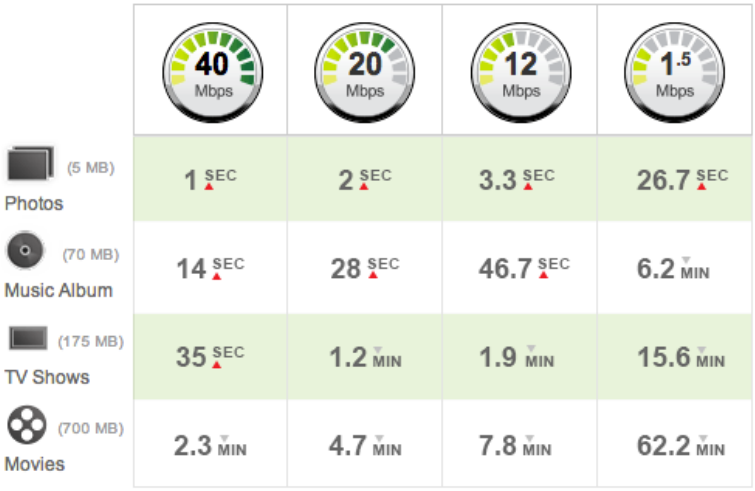
Before discussing Internet services around the world and services in Seattle, it may be helpful to understand what one can do at these speeds. The table below shows how long it takes to download songs, photos, and videos at speeds of 15 Mbps, 50 Mbps, and 150 Mbps.[11]

[10] "SeaFi Initiative," http://www.seattle.gov/archive/mcginn/seafi.
"Gigabit project in Seattle reportedly dead, leaves trail of unpaid bills," Jan. 8, 2014.
http://arstechnica.com/business/2014/01/gigabit-project-in-seattle-reportedly-dead-leaves-trail-of-unpaid-bills.
[11] "The Cost of Connectivity 2013," Oct. 2013, 8.
http://newamerica.net/sites/newamerica.net/files/policydocs/The_Cost_of_Connectivity_2013_Data_Release.pdf.



The slowest speed on the above chart is 15 Mbps, which is actually above the average speed in the United States. As expected, the faster the speed, the less time required to complete tasks.

Seattle Internet service provider (ISP) CenturyLink provides the graphic below on their website of the download time for different activities at 40 Mbps, 20 Mbps, 12 Mbps, and 1.5 Mbps, which are more in line with typical speeds used in the United States.[12]



Being online has also proven to be a huge boon to businesses large and small. One study states that small and medium sized businesses that extensively use Internet technologies see twice as much productivity compared to those that do not.[13] High speed connectivity enables videoconferencing, telecommuting, cloud computing, file sharing, and innumerable other business activities that today are taken for granted, such as e-banking and stock trading.

[12] CenturyLink. http://www.centurylink.com/home/internet.
[13] Internet matters: The Net's sweeping impact on growth, jobs, and prosperity," Full Report 17.

Many benefits may not be directly felt in residents' living rooms, but gigabit speeds have a huge impact on business. In a report promoting the construction of a fiber optic network in Portland, Oregon, the Office for Community Technology discussed the benefits Lafayette, Louisiana has seen with its own fiber optic network,

> Pixel Magic, a special effects studio, built an office in Lafayette to support its work while making the movie "Secretariat," which was filming nearby. The LUS Fiber connection allowed the studio to be so productive that it ultimately established a permanent office in the community, providing 100 to 200 full-time jobs. The company acknowledged the existence of the network supported its decision: "The fact that we have the high-speed Internet between here and there is a big plus so we can show the clients the work in progress—production companies and studios.

Internet connectivity is incredibly important to doing business both large and small, but it is also something that can be glossed over and not well understood. It can be hard to quantify just how much a particular business (or city) is affected by being online, so it can be even more difficult to quantify how much a business (or city) would benefit by increased connectivity through better service. But before explaining what occurred with Gigabit Seattle and why Seattle needs a FTTP network, it will help to first explain some metrics and services offered in Seattle, the United States, and in other countries.

The energy grid can benefit significantly from gigabit speeds as well through smart grid technologies, saving a city millions of dollars in reduced power outages. This is another benefit that may not be easily understood to the typical residential consumer, but still has a very real impact on them. Chattanooga, Tennessee enjoys a publicly owned FTTP network, operated by the city's energy utility EPB, and it is discussed more in detail later in this paper. After visiting Chattanooga, reporter Craig Settles of news blog Gigaom wrote, "EPB's new smart grid, enabled by a gigabit of digital horsepower, can reduce hour-long power interruptions down to a few seconds. When eight twisters hit Chattanooga within 24 hours, the smart grid saved an estimated 730,000 outage minutes, as well as 250 unnecessary truck rolls."[14] Seattle may not have to worry about twisters like the South does, but it can still benefit hugely from increased efficiency as the price of energy increases.

The city would benefit by connecting Seattle residents to a grid that can utilize time-of-use pricing, that can automatically determine where increased supply and demand exists in real time, and that can quickly detect faults in the system. Wired Magazine interviewed EPB's Chief Operating Officer and wrote,

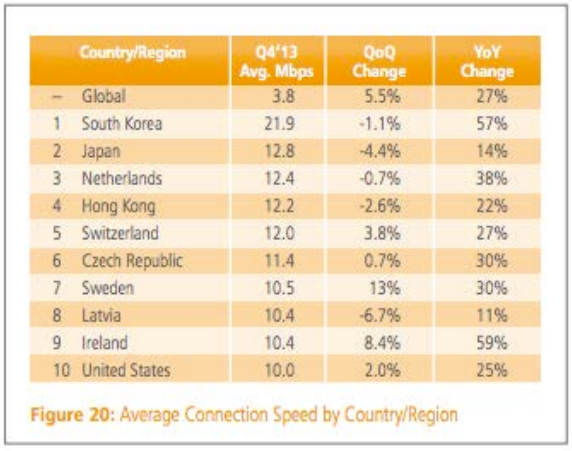
[14] "What a Gigabit Network Can Do? Find Out," May 30, 2011. http://gigaom.com/2011/05/30/chattanooga-shows-what-a-gigabit-network-can-do.

> Smart-grid management technologies from Bell Laboratories will enable EPB to harvest millions of data points on energy usage, helping it to better understand when and where energy is used. The utility has a distribution capacity of 3,000 megawatts but peak demand of just 1,320 megawatts, creating inefficiencies in the system, Wade said. EPB loses 3.5 percent to 4 percent of its energy in distribution and transmission, mostly due to transformers that are often larger than necessary for their load. Software can help EPB optimize equipment for actual usage patterns.[15]

The potential that lies with smart grid technologies such as advanced electric metering can only be fully maximized with a city that is connected via fiber optics. Systems such advanced electric metering and fiber optics may not be easily explained to city residents, but residents would appreciate the real benefits an FTTP network would bring.

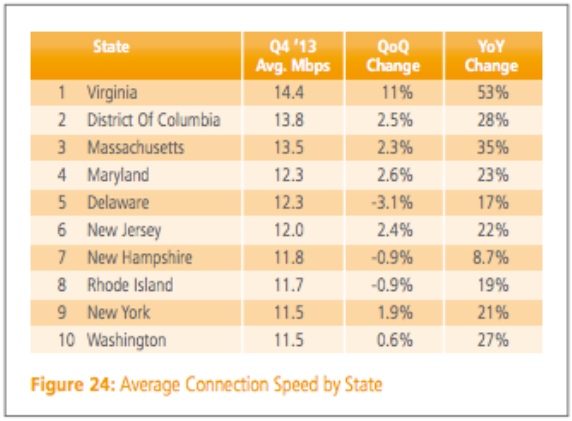
Comparing Internet Services Internationally

Being connected to the Internet is no longer a luxury, it is a necessity. 80% of Seattle residents are connected to the Internet,[16] and Washington has an average download speed of 11.5 Mbps.[17] That is above the national average of 10.0 Mbps, but far below South Korea, which at 21.9 Mbps has the highest average connection speed.[18]



	Country/Region	Q4'13 Avg. Mbps	QoQ Change	YoY Change
–	Global	3.8	5.5%	27%
1	South Korea	21.9	-1.1%	57%
2	Japan	12.8	-4.4%	14%
3	Netherlands	12.4	-0.7%	38%
4	Hong Kong	12.2	-2.6%	22%
5	Switzerland	12.0	3.8%	27%
6	Czech Republic	11.4	0.7%	30%
7	Sweden	10.5	13%	30%
8	Latvia	10.4	-6.7%	11%
9	Ireland	10.4	8.4%	59%
10	United States	10.0	2.0%	25%

Figure 20: Average Connection Speed by Country/Region



	State	Q4 '13 Avg. Mbps	QoQ Change	YoY Change
1	Virginia	14.4	11%	53%
2	District Of Columbia	13.8	2.5%	28%
3	Massachusetts	13.5	2.3%	35%
4	Maryland	12.3	2.6%	23%
5	Delaware	12.3	-3.1%	17%
6	New Jersey	12.0	2.4%	22%
7	New Hampshire	11.8	-0.9%	8.7%
8	Rhode Island	11.7	-0.9%	19%
9	New York	11.5	1.9%	21%
10	Washington	11.5	0.6%	27%

Figure 24: Average Connection Speed by State

The numbers are even more stark when looking at average peak connection speeds (defined by an average of maximum measured connection speeds across users): The United States lies in 10th place globally at 43.7 Mbps, South Korea lies in 2nd 64.4 Mbps,

[15] "Where High Speed Internet Meets Smart Grid," Jan. 23, 2011. http://www.wired.com/2011/01/internet-meets-smart-grid/2.
[16] Internet Access Local, http://www.internetaccesslocal.com/states/washington/seattle.
[17] "Akamai's State of the Internet Q4 2013 Report," 19. http://www.akamai.com/dl/akamai/akamai-soti-q413.pdf?WT.mc_id=soti_Q413.
[18] *Id.*

and Hong Kong is 1st at 68.0 Mbps.[19] Washington's average peak connection speed is 57.7 Mbps.[20] What these figures show is that the United States, with politicians that often trumpet the country as the most technologically advanced in the world, actually trails a number of other countries in Internet speeds. And while Washington is better off than most states, it still trails Hong Kong, South Korea, and a number of other countries.

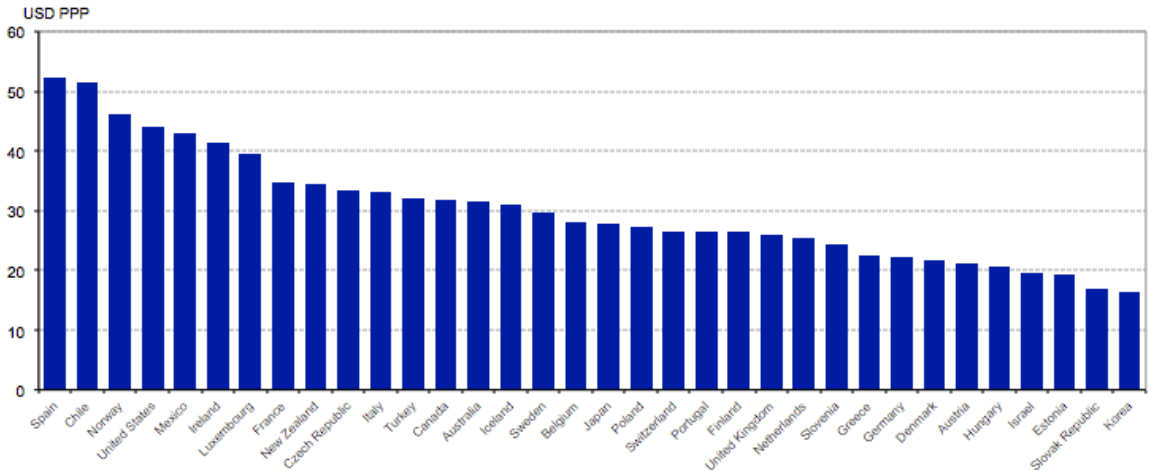
	Country/Region	Q4 '13 Peak Mbps	QoQ Change	YoY Change
–	Global	23.2	30%	38%
1	Hong Kong	68.0	3.9%	16%
2	South Korea	64.4	1.3%	31%
3	Singapore	59.1	18%	56%
4	Israel	54.6	14%	68%
5	Japan	53.7	3.4%	22%
6	Taiwan	50.9	19%	74%
7	Romania	50.6	11%	15%
8	Latvia	48.8	13%	22%
9	Switzerland	44.2	15%	23%
10	United States	43.7	18%	32%

Figure 21: Average Peak Connection Speed by Country/Region

	State	Q4 '13 Peak Mbps	QoQ Change	YoY Change
1	Massachusetts	63.8	23%	60%
2	New Jersey	60.8	24%	48%
3	Virginia	59.2	21%	54%
4	Washington	57.7	24%	62%
5	Maryland	57.0	15%	44%
6	Connecticut	56.9	33%	57%
7	New Hampshire	56.7	24%	43%
8	District Of Columbia	54.8	14%	26%
9	New York	54.2	20%	38%
10	Delaware	52.8	9.7%	38%

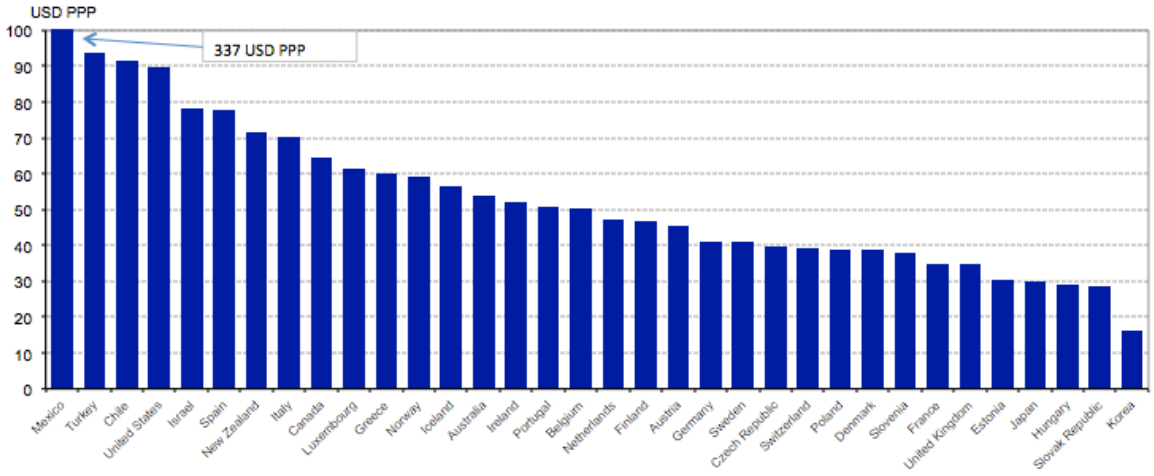
Figure 25: Average Peak Connection Speed by State

Even worse, Americans pay more than other countries for these slower speeds. Looking at figures provided by Organization for Economic Cooperation and Development, the United States citizens consistently pay some of the highest prices for their Internet connection, in some cases twice or even three times as much as the cheapest countries. For example, for services 2.5 Mbps and above, the average price in the United States is $43.95 compared to South Korea at just $16.35 (based on an average prices within each country per Mbps).[21] 18 other countries including Germany, the United Kingdom, and Japan all were priced below $30.[22]



[19] *Id.*
[20] *Id.*
[21] OECD Broadband Portal, http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm.
[22] *Id.*

Just as with connection speeds, the numbers look even more stark when looking at higher speeds. The chart above is based on speeds 2.5 Mbps and above, which is a decidedly low speed and quickly becoming obsolete. One can barely stream video or other media at that speed, and that is well below the average speeds listed in the last section. Looking at OECD figures for Internet services 45 Mbps and above (see chart below), the average price in the United States was $89.82 compared to South Korea at $16.35, less than 20% of what Americans pay.[23] 13 other countries including Germany, the United Kingdom, and Japan all priced at just above or below $40.[24]



It is true other factors are at play. Different countries have different costs of living, wages, and other economic factors that affect prices and services for their citizens. South Korea's low prices also benefit from a very densely populated country and a far more centralized government than the United States. But the point stands that the United States cannot consider itself a leader when it comes to affordable high speed internet. And just because the United States as a whole has these dismal figures does not mean densely populated Seattle must be shackled to them as well.

Internet Services in Seattle

As pointed out in the beginning of the last section, Seattle enjoys peak Internet connection speeds well above the national average, but that comes at a price and subscribers are dissatisfied all the same. A large part of the problem in Seattle and the rest of the country is an utter lack of competition in the ISP market. Before explaining the services and the monthly prices, it should be noted that companies vary their prices depending on introductory offers and bundling Internet service with television or telephone services. Since special offers are rarely static, this paper focuses on base monthly prices and not special offers. Seattle residents essentially have a choice between two technologies and two companies: coaxial cable from Comcast, and digital subscriber line (DSL) from CenturyLink.

[23] *Id.*
[24] *Id.*

Perhaps the oldest form of high speed Internet service still commonly available, DSL is based on transmitting data over traditional telephone copper wires that can simultaneously transmit telephone signals for landline phone services.[25] While many still consider DSL to be high speed Internet, it is limited by the age of the technology, and generally cannot perform at the same level as cable or fiber. Unlike cable and fiber, DSL is affected by physical distance and performance falters when signals travel over long distances. Some advancements have been made to allow DSL greater speeds, but its future potential is limited.

CenturyLink is the only DSL provider offering services to residents of Seattle. They advertise five different speeds on their website: 40 Mbps ($70/mo.), 20 Mbps ($60/mo.), 12 Mbps ($50/mo.), 7 Mbps ($45/mo.), and 1.5 Mbps ($40/mo.).[26]

Speed Download/ Upload	Month 13 Monthly Rate* (Requires subscription to Home Phone or Home Phone plus)	Month 13 Monthly Rate* (Requires subscription to Home Phone Basic)	Month 13 Monthly Rate* (Internet only, No Home Phone Service)
1.5 Mbps/896K	$30	$40	$40
7 Mbps/896K	$35	$45	$45
12 Mbps/896K	$40	$50	$50
20 Mbps/896k	$50	$60	$60
40 Mbps/5M	$60	$70	$70

It is important to note these speeds are not available to all residents, and availability depends on the location. Research done for this paper found no homes in Seattle where 40 Mbps or 20 Mbps were available, and a number of homes had even fewer options. For example, the only speed CenturyLink offers the residence of this paper's author is 1.5 Mbps, which is likely due to DSL's physical distance sensitivities. So while DSL theoretically can offer higher speed services, in reality it is generally slower than cable.

Cable Internet service is provided via coaxial cable, the same kind of cable that transmits television to cable TV subscribers. Like DSL, cable benefits from infrastructure that has already been in place for earlier purposes; phone service preceded DSL, and cable television preceded cable Internet. Unlike DSL however, cable speeds are not always as fast they are advertised, since a subscriber's speed is affected by other cable subscribers in the vicinity. This is because generally all the subscribers on a city block are connected to a single node that transmits the signals along a single line into the network.

The cable market in Seattle actually consists of two companies: Comcast and Wave Broadband, but they operate in almost entirely different geographic areas, so it can hardly be said that they are competitors.[27] Further Wave serves a mere 13,000 subscribers compared to Comcast's 200,000.[28] Comcast offers four different speeds to residential customers in Seattle, each with different monthly pricing which are frustratingly cryptic

[25] "Types of Broadband Connections," http://www.broadband.gov/broadband_types.html.
[26] "High Speed Internet Offer Details," https://www.centurylink.com/common/popups/residential/pricing_details_popup.html.
[27] Seattle Cable Franchise Map, http://www.seattle.gov/cable/documents/Cable_Franchise_Map2013.pdf.
[28] Cable Franchises, Seattle Department of Information Technology, http://www.seattle.gov/cable/franchises.htm.

on Comcast's website.[29] Their bases prices are only stated in the fine print, and sometimes these prices are either unclear or not listed at all. For the 25 Mbps service Comcast states, "Comcast's current monthly service charge for Performance ranges from $42.95 to $66.95, and may vary depending on your area and other Comcast services subscribed to, if any."[30] Even worse, the 50 Mbps service lists an introductory offer price but the regular price is not even listed. The fine print only states, "After 12 months, or if any service is cancelled or downgraded, regular charges apply."[31] Despite those difficulties, these are the offered speeds: 105 Mbps ($115/mo.), 50 Mbps (actual monthly charge unclear), 25 Mbps ($43-$67/mo.), and 6 Mbps ($50/mo.).

Have speed improvements with cable actually slowed? Timothy Lee of the Washington Post thinks so. In an article he wrote late last year, Lee tracked cable speeds provided by Comcast since 2002 and noted how speeds for the standard package (dubbed "Performance" and the $43-$67 package listed above) was periodically doubled every year or two, but then improvements slowed.[32] Lee wrote,

> [T]he hallmark of competitive technology markets is that consumers are routinely given more than they think they need. Even entry-level smartphones today are dramatically more powerful than the best cell phones of a few years ago. Competition forces companies like Apple and Samsung to produce the most powerful phones they can build without worrying about whether customers "need" the faster speeds. In other words, Comcast's strategy only works because Comcast faces limited competition in many markets. If Comcast had more competitors, they would pressure Comcast to cut the price of its highest speed tiers and raise the speed of its cheapest offerings.[33]

Lee was referring to Comcast's claims that it offers a range of services catering to "different customer needs."[34] While Lee did not refute Comcast's claims, he argued that the company acts in a way to maximize profits at the expense of its customers, and that it can only do this because Comcast acts as a monopolist. Customers lack choice, so they have no leverage against a company that acts as a monopolist. Lee's assertions are correct, especially when it comes to a city such as Seattle.

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[29] Comcast xfinity. http://www.comcast.com/corporate/shop/productoverview.html.
[30] *Id.*
[31] *Id.*
[32] "These charts show Comcast acting more and more like a monopolist," Oct. 1, 2013. http://www.washingtonpost.com/blogs/the-switch/wp/2013/10/01/these-charts-show-comcast-acting-more-and-more-like-a-monopolist.
[33] *Id.*
[34] *Id.*

Gigabit Seattle

Given the lack of consumer choice in Seattle, a relatively affluent and technologically-oriented city, one would expect a project like Gigabit Seattle to succeed. As stated in the intro, Mayor McGinn's announcement was met with eruptions of applause and cheers. So how and why did it fail? The answer appears to be frustratingly simple, perhaps even insufficient. On January 8, 2014, the mayor's office stated,

> In November 2013 – prior to Mayor Murray taking office on January 1, 2014 – Gigabit Squared let the McGinn administration know they were having difficulties securing funding to bring the project to fruition. Due to that lack of private investment funding, Gigabit Squared, which has not yet delivered a broadband system in any city during their five years in business, could not continue their work. In addition, Gigabit Squared still owes the City of Seattle $52,250 for services provided to them by the City, including engineering fiber routes, conducting preliminary assessments for their wireless infrastructure, and permit planning.[35]

Like many businesses, it appears that Gigabit Squared simply failed to deliver. Gigabit Squared failed to obtain funding and was so cash poor that it could not even pay the relatively small amount of $52,250 it owed the city. On the same day that the mayor's office made that announcement, it was reported that Gigabit Squared's president and co-founder Mark Ansboury was leaving the company.[36] But given the massive potential and desire for better Internet service in Seattle, how could it fail to obtain private investment? The true answer is likely known only between Gigabit Squared and the investors it presumably met with.

This paper's author interviewed Richard Frank-Huff, who was appointed to the Citizen's Telecommunications and Technology Advisory Board in 2007 and served as its chair for two years. Frank-Huff expressed that he was originally very encouraged by Gigabit Seattle, but that Gigabit Squared had a number of glaring flaws right from the beginning. First, Frank-Huff explained the company had not done any business modeling such as data collection, explanations of financing, or pricing. Second, at the original press conference announcing the project, the company was asked how much the whole project would cost but provided no clear answer, indicating that perhaps they did not even know. And third, soon after the press conference, Gigabit Squared released a pricing schedule that Frank-Huff said was naïve and nonsensical by having price levels that were linear and far too many in number, i.e. 10 Mbps, 20 Mbps, 30 Mbps, 40 Mbps, and so on. Frank-Huff claimed this pricing schedule was quickly updated to the more sensible three-

[35] "An update on the status of a fiber-to-home network in Seattle," Jan. 8, 2014. http://murray.seattle.gov/an-update-on-the-status-of-a-fiber-to-home-network-in-seattle.
[36] "Gigabit Squared co-founder stepping down after botched broadband deal in Seattle," Jan. 8, 2014. http://www.geekwire.com/2014/gigabit-squared-co-founder-stepping-botched-deal-seattle.

tiered schedule: 5 Mbps (no monthly charge, $350 installation fee), 100 Mbps ($45/mo.), and 1000 Mbps ($80/mo.).

But the factor that was likely the most crucial was Gigabit Squared's apparent failure to obtain capital. This seems especially strange in light of its claims that it had obtained $200 million in financing.[37] Frank-Huff speculated that if these claims were false, and that Gigabit Squared did not in fact have that financing, it could even have violated Federal securities laws. This claim cannot be substantiated, but the $200 million question is remarkable given the company's apparent inability to pay Seattle the relatively paltry bill of $52,250. As Todd Bishop of GeekWire stated, "The wrangling over the unpaid bill is noteworthy in part because the sum is so small — a tiny fraction of the many millions that would have been required to get the project off the ground."[38]

Long before the project fell apart, a few noted the lack of detail regarding the private financing. When Gigaom reported on Gigabit Squared's $200 million financing on May 23, 2012, writer Stacey Higginbotham wrote, "Gigabit Squared is providing the capital, although details of the financing model aren't clear."[39] Similar concerns were voiced a year later by a John van Oppen, a co-founder of Spectrum Networks, a Seattle-based wholesale provider of Internet services to businesses.

> The big problem is that they haven't built anything[.] Given that they don't have a product, their marketing is quite impressive . . . They are announcing pricing with no idea about the construction costs," he said of Gigabit Squared. "They have never built any fiber infrastructure anywhere, ever, in the U.S. Until you know what it costs to build something like this out, it's an awfully bold commitment to make.[40]

It is granted Spectrum was a competitor of Gigabit Squared, but van Oppen's points are well taken. It is notable these points were made on September 12, 2013, many months before Gigabit Squared's financing problems were reported.

So the project failed. Are there lessons to be learned from its failure? Is this a sign that a FTTP network is too expensive for Seattle? Richard Frank-Huff does not think so, and he is actively working in the private sector to launch another project. As for lessons from the failure of Gigabit Squared, perhaps it should be treated as just another business that failed, and that in the long run did not cause any great loss to Seattle aside from disappointment. Former Seattle chief technology officer Erin Devoto "likened the

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[37] "Groups launch gigabit-per-second broadband project," May 23, 2012. http://www.computerworld.com/s/article/9227409/Groups_launch_gigabit_per_second_broadband_project.
[38] "Gigabit Squared's legacy in Seattle: Unpaid bill of $52,250," Jan. 3, 2014. http://www.geekwire.com/2014/gigabit-squareds-legacy-seattle-unpaid-bill-52250.
[39] "An Ohio startup + $200M = Gigabit broadband for 6 towns," May 23, 2012. https://gigaom.com/2012/05/23/an-ohio-biz-200m-gigabit-broadband-for-6-towns.
[40] "Wave acquires Spectrum Networks, CondoInternet to bolster broadband reach," Sep. 12, 2013. http://www.geekwire.com/2013/spectrum-wave-condointernet.

situation to placing a bet on a startup, saying that the city understood the risks going in, and that its costs have been relatively low." It is true Seattle's expenses were relatively low. The defeat may have put a damper on future FTTP projects in Seattle, but it is hard to know what goes on behind closed doors in the private sector. Perhaps the only lesson to be learned is that cities should be more diligent about the private partners, and that they should not partner with companies that do not have sound financing.

Obstacles to Implementation

There are a number of obstacles towards an FTTP system in Seattle, though some are greater than others. This paper will discuss five: (a) high cost of implementation; (b) opposition from incumbents (i.e. competitors); (c) lack of political will and consumer demand; (d) build-out requirements; and (e) government regulations.

High Cost of Implementation

As mentioned in this paper's introduction, building a fiber optic network in Seattle would be very expensive. In 2007, CCG Consulting completed a report for the City of Seattle titled, "Financial Feasibility of Building and Operating a Fiber Network in the City of Seattle," and it explored in detail the various options for building an FTTP network in Seattle and costs associated with each option.[41] If the city were to build the network itself and be the sole retailer, the report estimated the city would need a $478 million bond, and that it would break even after 14 years. Other models were within the $400 million range as well.

The report recommended that the best case scenario would be if a commercial retail provider made the investment, but that there were no retail providers that could do so. The report recommended the city being the sole retail provider or a hybrid model[42] were better options than a wholesale model,[43] though the report did note either model could work). The report found that in order to be financially successful, a commercial retail provider would need a 30% market penetration (meaning 30% of potential subscribers were signed up), while the city could be financially successful with a 24% market penetration simultaneously giving a 20% discount over the market prices at the time.

Naturally, much has changed since the report was released in 2007, so these figures and the calculations they were based on are outdated. One can expect the cost to

[41] "Financial Feasibility of Building and Operating a Fiber Network in the City of Seattle," May 15, 2007. http://www.seattle.gov/broadband/docs/080422FeasibilityReport.pdf.
[42] Hybrid model described in the report: "[T]he City or a nonprofit business would build the network, likely with bond financing, and would be the only retail provider for five to seven years until the network had enough customers to ensure the ability to repay the bonds. At that point, the network would be opened to multiple competitive service providers who would bring innovation and additional competition," 2.
[43] Wholesale model described in the report: "[T]he City would build the network and sell access to the network to large service providers," 2.

build the network to be much higher. It would be a massive project; very costly but also with huge potential.

Opposition from Incumbents

The city can expect massive opposition from the ISPs already operating in Seattle: Comcast, Wave, and CenturyLink. As already discussed in Section 2(c), Timothy Lee of the Washington Post observed Comcast slowing its Internet speed improvements despite there being no technological reason for it. Representatives of Comcast have insisted customers do not need or care about faster speeds. Ron Main, a lobbyist for the cable industry, stated, "The fact is residential demand for speeds greater than what is now available is very limited. Most people take service around 20 Mbps to 50 Mbps. This is fast enough for typical residential uses, from streaming movies and working from home to Skyping with family."[44] This claim (and the rest of the article, published in the Seattle Times) makes no mention of the lack of competition in Seattle and that consumers have very little to choose from.

It goes against notions of capitalism for a company to make claims of what consumers want and do not want. Companies should fear consumers; that is to say, companies should be always striving to improve service and offer better goods and services to consumers based on the fear the consumer could go to the company's competitors. Such is the nature of a competitive market.

This can be shown further with what is occurring in Austin, Texas after Google announced in 2013 it would be expanding its Google Fiber service to the city. Within a week of Google's announcement, AT&T announced it would be implementing a fiber network of its own in Austin, promising speeds of up to 1 Gbps.[45] The example shows in perfect clarity how competition in the marketplace benefits customers, and how Comcast's claims that customers do not need such high speeds is false.

Still, the incumbents in Seattle are entrenched and powerful. Trying to implement a city-owned network at a cost of hundreds of millions of dollars would be met with huge firepower coming from the incumbents. That is partially why Richard Frank-Huff believes the city-owned option is unfeasible. Frank-Huff believes the combined high cost along with incumbent resistance would prevent the network from ever being built, and that is a logical argument.

Lack of Political Will and Consumer Demand

While it is clear customers have responded positively to FTTP networks (see the section later in this paper on success stories), cable lobbyist Ron Main is at least partially correct. Despite the massive potential, Seattle residents and the city government do not

[44] http://seattletimes.com/html/opinion/2022840437_ronmainopedbroadband05xml.html
[45] http://www.cnet.com/news/at-t-follows-google-with-gigabit-network-plans-for-austin/

seem too concerned with getting an FTTP network. While both Mayors Murray and McGinn have spoken positively on the subject, it can hardly be said to have been a top priority. Gigabit Seattle died with little media coverage, and there have yet to be any companies stepping into replace it or any proposals for a city-owned network.

Frank-Huff thinks Seattle residents are getting closer as frustration with incumbents grows, but that we simply are not there yet. This is another reason why, at least in the current political climate, it would probably be a mistake to pursue a city-owned network. A positive response can be expected similar to those had in Kansas City, Austin, and Chattanooga (discussed later) should a company decide to embark on the project, but there simply has not been the demand in Seattle (yet) to try to entice a company.

Build-out Requirements

Build-out requirements are defined by the requirement that a service be extended to a certain (typically high) percentage of a population within a specified time. These requirements can be set by the Federal Communications Commission (FCC), and have been enacted for services such as telephone connections both wired and wireless.[46] They could also be enacted by other entities—such as a city government—in return for allowing a company the right to provide service. The U.S. Government Accountability Office describes the FCC's four goals for build-out requirements: encouraging companies to provide services in a timely manner, preventing the warehousing of spectrum, promoting innovative services, and promoting services to rural areas.[47]

In the interests of equality, it is especially useful for a government to require that a service provider to expand to poorer neighborhoods and not just more profitable neighborhoods. But, of course, this raises costs and can reduce profits. In the case of an FTTP network in Seattle, having buildout requirements as part of the original proposal would probably be a mistake, as it could discourage companies. And since building such a network is so extensive, neighborhoods can be built out at different stages. Google Fiber has a strategy called "fiberhoods," in which it defines a number of different neighborhoods and then agrees to build fiber to those neighborhoods once a high enough portion of residents sign up.[48] The percentage of residents required depends on the neighborhood and is typically between 5 and 25 percent.[49] This model has worked in Kansas City, and it could be borrowed for use in Seattle.

[46] "SPECTRUM MANAGEMENT: FCC's Use and Enforcement of Buildout Requirements," Feb. 26, 2014. http://www.gao.gov/products/GAO-14-236.
[47] *Id.*
[48] "The economics of Google Fiber and what it means for U.S. broadband," July 26, 2012. http://gigaom.com/2012/07/26/the-economics-of-google-fiber-and-what-it-means-for-u-s-broadband.
[49] *Id.*

Government Regulations

Some argue that government regulations stand in the way of Seattle attracting a company to building an FTTP network. In an article titled "Four reasons why Google fiber will never come to Seattle," former city Chief Technology Officer Bill Schrier argues that "balky bureaucracy" stands in the way of Seattle getting an FTTP network.[50] Schrier's four reasons are: The Seattle Process (an informal pejorative term for describing Seattle government), pole attachments (a term for right-of-way use of utility poles), permits and rules, and build-out requirements.[51] Schrier explained,

> Some cities recognize the value of high speed broadband and are willing to become partners. Kansas City wanted Google Fiber so badly it agreed, in its contract, to review all permits within five days. The city gave Google space, power and related services for its equipment at no charge. They also gave Google access to all its assets and infrastructure without cost. These assets included conduit, fiber, poles, rack space, nodes, buildings, facilities … [and] available land. And the city did not charge Google for permit or inspection fees.[52]

While Schrier makes a good point regarding the significant concessions Kansas City made, he neglects to take into account how much larger Seattle is in comparison. Google Fiber has currently only been launched in three areas, and only Austin exceeds Seattle in city population size. Frank-Huff disputes Schrier's assessment that Seattle suffers from too much government regulation, arguing that Seattle has accomplished many things before and does not stand out in terms of bureaucracy any more than most cities.

If Seattle decides to make an FTTP network a priority, government regulations will probably not be a huge impediment. It is more a question of political will than regulations. Still if a company does submit a proposal, the city should consider the concessions that Kansas City made and whether they are necessary in order to get the network built.

Success Stories

FTTP networks appear to have been successful in a number of other cities across the United States, and high growth in this market is expected. Networks are already available in a number of different cities, but often they serve only a small population or

[50] "Commentary: Four reasons why Google fiber will never come to Seattle," March 4, 2014. http://www.geekwire.com/2014/commentary-four-reasons-google-fiber-will-never-come-seattle.
[51] *Id.*
[52] *Id* (internal citations omitted).

are very expensive.[53] On April 21, 2014, AT&T announced it was examining the possible implementation of fiber networks to 100 different cities and localities, including 21 major metropolitan areas.[54] Google also announced expanding its Google Fiber service to 34 cities in 9 metropolitan areas, including nearby Portland, Oregon (and five of its nearby suburbs).[55] Some cities, such as Lafayette, Louisiana and Chattanooga, Tennessee have implemented publicly owned services. This section will highlight two examples, one public and one private.

Chattanooga, Tennessee

In 2010, Chattanooga's electric utility EPB became the first company to offer a 1 Gbps speed service in the United States, and it announced that it would connect its service to all 170,000 homes and businesses that it served by the end of 2010.[56] Originally priced at $350/month, the 1 Gbps is now priced at $70/month, with another plan of 100 Mbps at $58/month (EPB also offers packages with TV and phone services).[57]

The system was built with $220 million raised in bonds and a $111.5 million grant from the U.S. Department of Energy. EPB touts its system as the backbone for one of the country's most extensive smart grids, allowing the city to respond quicker to power outages, reduce inefficiencies, and a number of other benefits.[58]

The system appears to have been a success. After three years, it was reported in September of 2013 that EPB's fiber system had 56,000 subscribers, with about 2,500 subscribing to the 1 Gbps service. EPB boasts in its 2013 Annual Report that its fiber network earned $80.7 in revenue for the previous fiscal year.[59] While the report did not

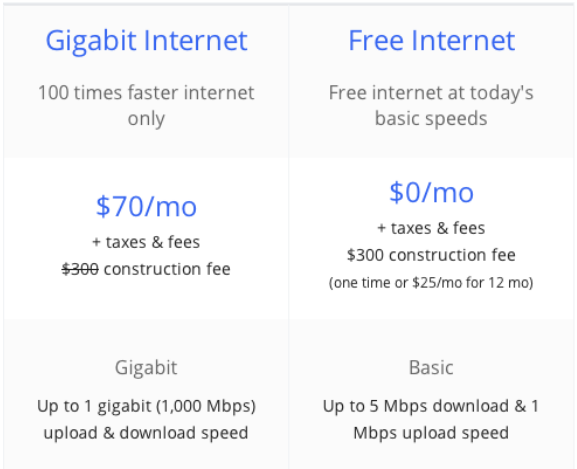
[53] "Want gigabit fiber home Internet? Move to one of these cities," Sep. 26, 2013. http://arstechnica.com/business/2013/09/want-gigabit-fiber-home-internet-move-to-one-of-these-cities.
[54] "AT&T Eyes 100 U.S. Cities and Municipalities for its Ultra-Fast Fiber Network," April 21, 2014. http://about.att.com/story/att_eyes_100_u_s_cities_and_municipalities_for_its_ultra_fast_fiber_network.html.
[55] Google Fiber, The Future of Fiber. https://fiber.google.com/newcities.
[56] "Fastest Net Service in U.S. Coming to Chattanooga," Sep. 12, 2010. http://www.nytimes.com/2010/09/13/technology/13broadband.html.
[57] epb Fiber Optics. https://epbfi.com/enroll/packages.
[58] epb Electric Power, Smart Grid. https://www.epb.net/power/home/products/smart-grid.
[59] epb Annual Report 2013. https://www.epb.net/flash/annual-reports/2013/downloads/EPB_AnnualReport_2013.pdf.

clearly state the utility's profits, it was reported that the FTTP network was profitable after 18 months.[60]

Could Seattle do the same? It certainly is possible, and Seattle's own public utility Seattle City Light puts it in a good position to emulate Chattanooga. However, Richard Frank-Huff believes Chattanooga was a special case in which vitriol towards the incumbent telecom providers was particularly high which spurred the project's inception. EPB did also benefit from the large federal grant. Frank-Huff advocates a private sector solution, though it should be disclosed that Frank-Huff is in the private sector actively trying to bring such a solution to Seattle. Seattle is far bigger than Chattanooga and the network would be far more costly. There is also no promise of federal grants. Still, one can look to Chattanooga to see a successful publicly owned FTTP network.

Google Fiber

Other cities are seeing private companies build FTTP networks. On February 10, 2010, Google announced what was called an experiment to offer an FTTP service to a U.S. city, and it asked for towns and cities across the country to apply.[61] Called Google Fiber, the company decided to build in Kansas City. In order to make the program more profitable and to being operations sooner, Google implemented the "fiberhoods" program discussed in the Build-out Requirements section of this paper. Google Fiber in Kansas City offers two options (a third option is available as well which bundles a TV service): 1 Gbps at $70/month and 5 Mbps at no charge, but the latter plan requires a $300 construction fee.



Unfortunately for this paper, Google has kept metrics about its FTTP networks private, so little is publicly known on its revenues, construction costs, or number of subscribers. But the system in Kansas City was successful enough to prompt Google

[60] "What a Gigabit Network Can Do? Find Out," May 30, 2011. http://gigaom.com/2011/05/30/chattanooga-shows-what-a-gigabit-network-can-do.
[61] "Think big with a gig: Our experimental fiber network," Feb. 10, 2010. http://googleblog.blogspot.com/2010/02/think-big-with-gig-our-experimental.html.

Fiber's expansion to Provo, Utah and Austin, Texas, the latter of which Google hopes to serve its first customers in mid-2014.[62] The expansion to Austin is particularly interesting given its comparable size to Seattle. And as mentioned previously, Google will be expanding to 34 other cities nationwide.[63] Seattle is not on the list.

Looking Forward – Gigabit Internet in Seattle

With Gigabit Seattle now dead, are there plans to build something in its stead? Seattle Mayor Ed Murray has stated his office is "actively engaged in finding a path forward" for improved Internet services in Seattle.[64] Mayor Murray wrote of a number of possible short term solutions, and of the need for Seattle's Internet connectivity to improve.[65] While no solid proposal for an FTTP network appears to be in the works, Mayor Murray wrote, "We may learn that the only way we can truly have the internet system this City needs, is by building it ourselves. If we find that building our own municipal broadband is the best way forward for our citizens and for our City, then I will help lead the way."[66] Mayor Murray seemed open to a private solution, but he was willing to explore the possibility of a municipal network as well. However, while his statements spoke of a need for improvement and a willingness to explore options, it did not come across that improved Internet service was a major priority for his administration. A city-owned network would be very expensive and would require a massive amount of political will in order to gather the support of the public.

Naturally, the private sector is reluctant to speak of future developments. Richard Frank-Huff is involved with a stealth mode corporation that hopes to accomplish what Gigabit Squared could not, but more information could not be stated in this paper. A company called CondoInternet already offers gigabit speeds to select condos and apartment complexes in Seattle via fiber to the building (so it is not true FTTP, as each subscriber is connected to the node via Ethernet).[67] However, CondoInternet and its parent company Spectrum Networks was recently acquired by Wave Broadband in late 2013.[68] Given that Wave is one of only two cable Internet operators in Seattle (the other being Comcast), it would be surprising to see innovation and market upheaval from one member of a duopoly. If a serious private entrant appears, Seattle should meet the entrant with a willingness to cooperate to complete the project. This may involve making concessions like Kansas City did with Google, but the ends would justify the means.

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[62] "Exploring new cities for Google Fiber," Feb. 19, 2014. http://googleblog.blogspot.com/2014/02/exploring-new-cities-for-google-fiber.html. Google Fiber Austin, https://fiber.google.com/cities/austin.
[63] "Exploring new cities for Google Fiber," Feb. 19, 2014.
[64] "Murray: 'Seattle must be a national leader in identifying innovative ways to make high speed internet available and affordable to anyone'," April 9, 2014. http://murray.seattle.gov/murray-seattle-must-be-a-national-leader-in-identifying-innovative-ways-to-make-high-speed-internet-available-and-affordable-to-anyone/#sthash.uYZDuBqC.4KOdINGp.dpbs.
[65] *Id.*
[66] *Id.*
[67] CondoInternet, http://www.condointernet.net.
[68] "Wave Acquires Spectrum Networks and CondoInternet, Accelerating Expansion of Broadband Service Offerings in Seattle and on West Coast," Sep. 11, 2013. http://www.wavebroadband.com/news/09-13_spectrum.php.

A fiber optic network connecting every residence and business would be a boon to Seattle. Even a pilot program involving select neighborhoods would be a huge step forward. Consumers would enjoy affordable truly high speed Internet that South Koreans and Japanese enjoy, as well as residents of Kansas City and Chattanooga. The beacon of high tech that Seattle has been known for would grow bright again, and investment from the private sector would pour in over a long period of time that cannot be fully quantified now. The energy grid would benefit through increased efficiency and shorter power outages. As said in this paper's introduction, the Internet is here to stay, and fiber optic networks are an inevitability. It is simply a question of whether Seattle wants to be a leader in the field, or whether it wants to be a straggler.