

DSA TECH ACTION WORKING GROUP MUNICIPAL BROADBAND NETWORK REPORT

July 2021

www.InternetForAll.nyc

TABLE OF CONTENTS

INTRODUCTION.....	3
-------------------	---

INTERNET ACCESS IN NEW YORK CITY

Overview	4
Current State of the Internet.....	4
Consequences of Public-Private Partnership.....	6
ISP Details.....	7

BENEFITS OF A MUNICIPAL NETWORK

Benefits for Residents.....	11
Benefits for Workers	13
Benefits for the City in the Future.....	14
Next Steps.....	15

INFRASTRUCTURE AND WORKERS

Existing City Owned Infrastructure.....	16
Closely Aligned Institution Infrastructure.....	16
Privately Owned Infrastructure.....	17
Workers.....	17

NETWORK DESIGN

Overview.....	18
Detail	19

NETWORK COSTS

Overview.....	20
High Cost Estimate	20
Tools to Drive Down Construction Costs.....	20
Low Cost Estimate	24
Commercial Service Estimate.....	24
Operational Costs	25
Cost Summary	25

PHASED DEPLOYMENT

Three Year Plan and Beyond	26
Household and Commercial Subscriber Summary.....	28

PAYING FOR THE NETWORK

Costs	29
Revenue	
Summary	

Appendix A: Summary of Tools to Drive Down Network Costs.....	32
---------------------------------------------------------------	----

Endnotes.....	34
---------------	----

INTRODUCTION

A municipal broadband network that provides free internet for everyone that needs it and creates good union jobs is within our reach.

Internet service providers have failed New Yorkers. The COVID-19 crisis highlighted how critical internet access is to New Yorker's lives in going to school, finding employment, accessing government services and healthcare, connecting with loved ones, and engaging with our democracy. Internet access in New York City, however, remains expensive and slow, and barriers to access fall disproportionately along lines of race, age, disability, immigration status, and economic status.

In order to remedy existing internet access inequities, create good union jobs and build a more prosperous City for all New Yorkers, we must completely reorient our approach to internet service delivery away from private providers that are focused on short term, investor returns, and towards a reliable, universal delivery of municipal utility services approach.

A free or low cost, lighting fast, fully unionized, democratically run, and municipally owned universal fiber to the premises network that prioritizes marginalized New Yorkers and creates good union jobs is within our reach. We have the infrastructure, workers, and money to build the network. What we need now is the will to begin the process of breaking free from the private provider stranglehold to start building a public internet network that will serve all New Yorkers, now and into the future.

**** This report was written in the Spring of 2021 and may be updated as the local, regional and national broadband landscape changes****

INTERNET ACCESS IN NEW YORK CITY

New York City's reliance upon public-private partnerships with greedy internet service providers and unwillingness to hold them accountable for their failures is responsible for high subscription costs, slow speeds, barriers to access that fall hardest upon marginalized communities, and widespread anti-worker tactics. Rather than repeating and rewarding past failures, the City should cut out the unreliable partner and deliver internet itself.

OVERVIEW

There is much blame to go around that led to this breaking point of dysfunctional internet service in New York City amidst a pandemic. The City is at fault for handing over the City's streets and other public spaces to Verizon, Spectrum, Altice and other internet service providers (ISPs) for the installation of infrastructure to deliver broadband and other services like cable tv hoping that "competition" amongst them would lead to expanded access, faster internet speeds, and lower subscription costs.

The failures of the ISPs and the City's misplaced reliance upon them has had dire consequences with 46% of NYC households living in poverty not having broadband at home,¹ access to internet service in NYC deeply segregated by race,² New Yorkers paying some of the highest subscription prices relative to internet speed amongst big cities worldwide,³ and hundreds of thousands of students, elders and shelter residents lacking a home broadband connection in the midst of a pandemic.⁴

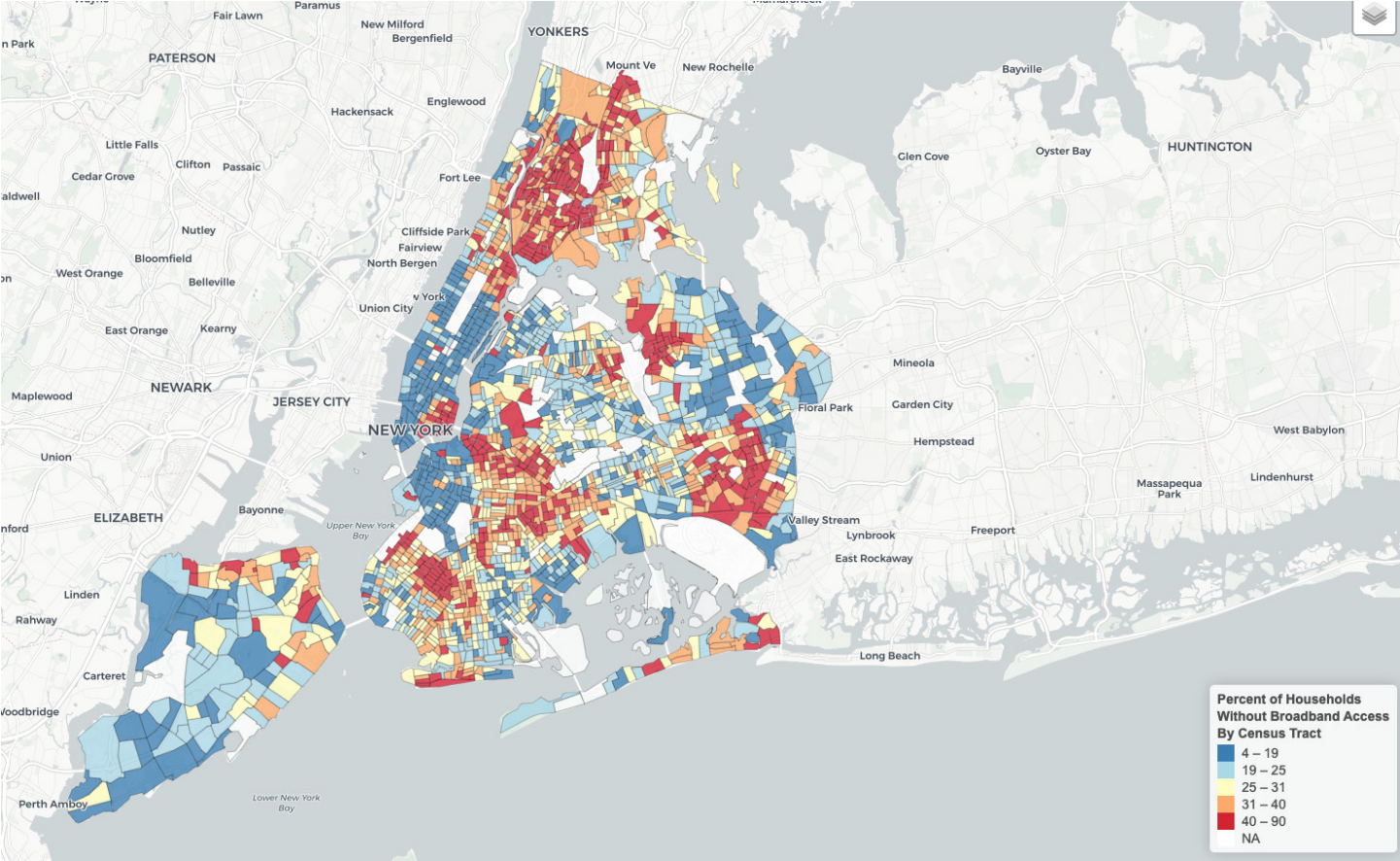
Millions of New Yorkers don't have access to broadband internet at home.⁵ Barriers to internet access are the result of high subscription prices and an unwillingness by greedy ISPs to expand their services to some neighborhoods or buildings they deem unprofitable.

The municipal broadband utility would provide a fiber-to-the-premises connection to every New Yorker, that delivers fast symmetrical download and upload speeds.

CURRENT STATE OF THE INTERNET

The internet is an interconnected network of wires and cables that only moves as fast as the infrastructure that carries it, and New York City's infrastructure is outdated and slow. In 2020, many New Yorkers fortunate enough to have home internet service barely exceeded the United States' inadequate definition of "broadband" internet which is 25 Mbps download speed and 3Mbps upload speed.⁶ By domestic and global standards, the City is failing to ensure the ability of its citizens to stay apace with the world's increasingly fast internet speeds.⁷ And at the center of the connectivity crisis in New York are the households and individuals that cannot even obtain access to internet services, however inadequate, due to high prices that average around \$65 per month (promotional pricing) without fees, and an unwillingness by the greedy ISPs to expand their services to some neighborhoods or buildings deemed unprofitable.⁸

FIGURE 1.1: Percent of Households Without Broadband Access by Census Tract



Borough	Median Average Download Speed in 2020 (Mbps) ⁹	Median Average Upload Speed in 2020 (Mbps)
Bronx	32	16
Manhattan	44	10
Queens	61	11
Brooklyn	45	12
Staten Island	62	18

New Yorkers fortunate enough to have home broadband are paying high prices for awful internet service. High bandwidth activities and multiple people using multiple devices cannot function properly with the speeds most New Yorkers experience. As technology continues to

advance, these inadequacies will only get worse.

The City of New York has long relied on public-private partnerships in the form of non-exclusive “franchise” agreements with companies to provide internet service in the five boroughs. The hope was that competition between ISPs would increase access and internet speeds while driving down prices. The uneven access, slow speeds and high prices New Yorkers face reveals just how misplaced this hope was. Even where some neighborhoods where more than one ISP operates, private ISPs have demonstrated reluctance to compete over individual buildings.¹⁰

There are currently three primary franchise agreements for internet service in New York — Verizon, Spectrum and Altice.¹¹ Each company’s agreement with the City covers partially

overlapping territories that entitles each to dig up and occupy the City’s streets and other real estate assets to install infrastructure to deliver internet and other services to households and businesses.

Initially, these companies connected households to the internet, the so called “last mile” connection, using copper (“DSL”) or cable lines that connected to an already existing telephone or television line. While this is cost-effective for ISPs to rollout, it has consequences — slow internet speeds. Cable systems like those utilized by Spectrum and Altice force customers to share the total bandwidth available in their neighborhood with other Spectrum and Altice customers, which results in highly variable download speeds and is coupled with severe limitations on the maximum available upload speeds.¹²

Last Mile Technology	Typical Maximum Advertised Download Speed ¹³	Typical Maximum Advertised Upload Speed
Fiber	1000 Mbps	1000 Mbps
Cable	1000 Mbps (subject to neighborhood usage)	35-50 Mbps (subject to neighborhood usage)
Fixed Wireless	200 Mbps (subject to line of sight and good weather)	200 Mbps (subject to line of sight and good weather)

That means Spectrum and Altice subscribers are left with unpredictable, slower-than-advertised speeds dependent on their neighbor’s internet usage, and upload speeds that aren’t equipped to *send information* such as a video consultation with a healthcare provider or participation by a child in a live classroom with a teacher and fellow students that requires video to be sent and received simultaneously. Multiple individuals in one household engaging in these activities at the same time strains the inadequate cable system infrastructure even more, and as technology continues to progress,

these issues will only get worse. Agreements by the ISPs to significantly upgrade their legacy last mile technology, specifically to bring fiber optic cable connections to households (“fiber to the premises”), has been uneven in the case of Verizon, and nonexistent for Spectrum and Altice, despite public statements to the contrary.¹⁴ The municipal broadband utility would bring a fiber-to-the-premises connection to every New Yorker, delivering fast, symmetrical download and upload speeds.

Last mile fiber is the only future-proof internet service delivery technology that can consistently permit high bandwidth activities by multiple users and devices, especially those that require sending information. Alternative last mile solutions, like fixed wireless service lack the capacity and certainty of a fiber to the premises connection and are subject to the vagaries of weather and line of sight, while also lacking the future-proof characteristics of fiber.¹⁵

More recently, the City, with its Internet Master Plan, has taken the first steps towards building some internet infrastructure that doesn’t rely exclusively on the major franchisees. Specifically, the City is spending significant sums of money to increase the total amount of broadband infrastructure like fiber and conduit available in the public rights of way for private companies to leverage to deliver internet service to end-users (“open access infrastructure”), in addition to giving away publicly owned real estate assets like building rooftops to private entities so that they can leverage the assets to reach more end-users.¹⁶ But make no mistake—whether it’s a non-exclusive franchise with a major ISP or a new form of public-private partnership under the Internet Master Plan, status quo is maintained and the end-result is the same: after a giveaway of public money, real estate and other assets, the greedy private partners fail to deliver on their commitments, with negative effects that disproportionately fall on the most marginalized communities.

The City needs to move beyond a reliance

on partners to solve our multiple, intersecting internet connectivity issues, and mistreatment of workers, by delivering universal service to all New Yorkers itself as a utility service.

CONSEQUENCES OF PUBLIC-PRIVATE PARTNERSHIP

The wrongheadedness of the public-private partnership model is that the City will spend billions of dollars, give away public infrastructure, and then still be left hoping that competition emerges to solve the digital divide and connectivity issues that plague our City. As we’ve seen with the public-private partnership model in the past, when our partners fail to deliver, and the City fails to hold the ISPs accountable, the consequences are dire.

DIGITAL REDLINING

One consequence of the public-private partnership model has been “digital redlining”, the standard business practice of the ISPs where they focus their services—especially the faster ones—in high-income areas while only partially rolling out services in lower-income neighborhoods with a high percentage of non-white residents.¹⁷ Obscenely high-priced internet subscription prices are one key driver of low home broadband adoption rates in many lower

income neighborhoods, but the ISPs and the public-private partnership model that empowers them are also guilty of simply avoiding some neighborhoods or buildings with their services.

The dynamic is pervasive across the City—it’s not a coincidence that many of the areas Verizon failed to connect with its FiOS service under the terms of its franchise agreement also happen to be areas with a large number of lower income, non-white residents, or that over one full year into the pandemic, thousands of students experiencing homelessness who need internet to attend remote school are still unable to do so.¹⁸ Nor is it a coincidence that the neighborhoods with the slowest internet speeds in 2020 in Brooklyn, the Bronx and Manhattan were respectively, Brownsville, West Farms and Chinatown, all neighborhoods with a high percentage of non-white, lower income residents.¹⁹

These systemic inequities in access to education, healthcare, work, housing resources, government benefits, communications and more, that are afforded by a high-speed internet connection, are a direct result of the public-private partnership model that subsidizes private ISPs and then permits them to seek profits, with little oversight or accountability.

FIGURE 1.2: New York Congressional District 12 (One of the Wealthiest Districts in the US)

Sample Community	Median Average Household Income (2019) ¹³⁶	Median Average Download Speed (Mbps) (2020) ¹³⁷	Median Average Upload Speed (Mbps) (2020)	Households Without Home Broadband ¹³⁸
Upper East Side (10065)	\$148,441	116	19	14%
Lower East Side (10002)	\$36,982	59	10	52%

FIGURE 1.3: New York Congressional District 15 (The Poorest District’s in the US)

Sample Community	Median Average Household Income (2019)	Median Average Download Speed (Mbps) (2020)	Median Average Upload Speed (Mbps) (2020)	Households Without Home Broadband
Parkchester (10462)	\$54,278	48	29	27%
Mott Haven (10454)	\$21,447	25	15	47%

Digital redlining has impacted lower-income neighborhoods in all five boroughs, but the negative impacts have fallen disproportionately on dozens of neighborhoods in the Bronx, Brooklyn and Queens, where dozens of neighborhood have some of the lowest home broadband adoption rates relative to the rest of the City. ISPs do not offer faster services to households among a shamefully high percentage of blocks within these neighborhoods, and commercial fiber providers that could service businesses also do not exist.²⁰

Given the widely acknowledged unreliability of ISP data indicating where internet service is available, the actual number of blocks where high speed service exists in NYC, and more importantly, the reality of which specific buildings on a block have higher speed services available is likely an even more damning indictment of the ISPs systematically avoiding lower-income, majority minority neighborhoods and residents across the City.²¹ *And even if the services were available, subscription prices would still be far too high for many households and businesses to afford.*

Absent massive subsidies and strict oversight, there is every incentive for private profit making entities to focus services on higher income neighborhoods and residents. It poses the question—if the plan to fix the connectivity crisis in New York is to spend billions of dollars while committing large amounts of additional municipal resources like real estate assets and administrative oversight, why doesn't the City just cut out the unreliable partner and deliver internet itself?

THE TROUBLE WITH OVERSIGHT

The business practices of the City's private ISP partners has been egregious, and the City's track record of oversight and accountability towards the ISPs has been abysmal. Many of the workers who built and operated the ISP broadband networks like the IBEW Local 3 Spectrum workers have been subjected to anti-

worker tactics like union busting and denied fair wages and benefits,²² and the ISPs have failed to expand their networks to underserved communities as promised, and rewarded customers with ever-increasing monthly costs, slow speeds, mystifying fees and horrible customer service. Time and again, the City has failed to hold the ISPs accountable.

Hiking subscription fees, short changing workers and defrauding New Yorkers has allowed private ISPs to amass staggeringly high amounts of concentrated wealth²³. As of May 2021, Verizon's concentrated wealth is estimated at \$243 billion; Charter Spectrum's is at \$134 billion; and Altice's \$17 billion. Still not satisfied, the ISPs still send their armies of lobbyists to Washington, Albany, and City Hall to try and slash taxes further, avoid regulations, paper over their predatory practices, explain away their broken promises, and extract sweetheart deals to further subsidize the services they provide to less than full-paying customers.²⁴

It's a disgraceful (though common) business model amongst our partners: keep the staggeringly high profits private, socialize the losses, avoid taxes at all costs, provide horrible-to-middling service depending on the means of the customer, and treat your workers poorly.

Why would the City want to continue to rely on these companies that have proven time and again to be so unreliable? More importantly, why would the City continue to rely on a public-private partnership model that has proven to be so fundamentally flawed? The time has come to radically shift our approach of internet service in New York City away from the private ISPs focused on short-term returns, for their investors, and towards a reliable, universal delivery of critical utility services approach. We have the resources we need to begin the process of breaking away from the ISPs in order to achieve equitable internet access that puts all New York internet users and workers first.

ISP DETAILS

It's striking just how similar the details of each ISPs performance over the last decade have been: segregated service delivery, union busting, high prices, slow speeds, horrible customer service and absolutely no one holding the company's accountable. While it's critical to highlight that the flaws in internet

service in New York City are not just a product of the specific companies that have received franchises in the past, but the public-private partnership approach itself, it is also critical that we honestly assess the practices of our existing partners so that the next ten years of internet access in New York City isn't a repeat of the past.

FIGURE: Comparison data of the three major private ISPs in New York City

	Verizon	Altice	Spectrum
Franchise	Covers all five boroughs	Covers Brooklyn and the Bronx	Covers Manhattan, Brooklyn, Queens and Staten Island
Franchise Expiration	July 16, 2023	July 18, 2020	July 18, 2020
Available to	More than 2.7 million households ²⁵	More than 1 million households ²⁶	More than 2 million households ²⁷
Broadband Technology	Primarily fiber to the premises	Primarily provides service through a hybrid fiber-coax network. Multiple subscribers share the total bandwidth that can be transmitted through the "last mile" of cable to the home, that results in slower service. ²⁸	Primarily provides service through a hybrid fiber-coax network. Multiple subscribers share the total bandwidth that can be transmitted through the "last mile" of cable to the home, that results in slower service. ²⁹
Internet Speeds	200/200 Mbps – 940/880 Mbps	300/35 Mbps – 940/50 Mbps	200/10 Mbps – 940/35 Mbps
Fiber Availability	QNS: 93% ; BK: 76% ; BX: 88% ; SI: 99%; MAN: 82% ³⁰ (reliance on FCC data) ³¹	BX: 4%; BK: n/a ³² (reliance on FCC data) ³³	Qns: 1.6% ; BK: 00.55% ; SI: 00.64% ; Man: 15.5% ³⁴ (reliance on FCC data) ³⁵
Intro Subscription Price	\$40/mo - \$80/mo (plus \$15/mo for modem w/ WiFi rental and \$100 installation fee)	Intro \$40/mo - \$75/mo (plus \$10/mo modem fee) and goes up after 1 year	Intro \$50/mo - \$109/mo (plus \$10 router fee, \$50 installation fee) and goes up after 1 year
Low Cost Offering	200/200 Mbps for \$20/mo (plus \$15/mo for modem w/ WiFi rental and \$100 installation fee) to those who are eligible ³⁶	30/3 Mbps for \$15/mo (\$30 installation fee) to those who qualify ³⁷	30/4 Mbps for \$15/mo (plus \$5/mo for WiFi router) to those who qualify ³⁸

	Verizon	Altice	Spectrum
Key Assets	Controls the underground conduit through which fiber is installed in the Bronx and Manhattan through its Empire City Subway subsidiary, ³⁹ and is by far the largest owner of utility poles outside Manhattan on which fiber is installed. ⁴⁰	Owns underground conduit including in Brooklyn; ⁴¹ some last mile fiber lines for residential and enterprise service; INET infrastructure from franchise agreement.	Owns underground conduit including in Brooklyn, Queens and Staten Island; some last mile fiber lines for enterprise service; INET infrastructure from franchise agreement.
Service Repair Charges	Upwards of \$100 for many technician visits	Charges \$7.99/mo for service protection so customers can avoid \$80 charges for individual service calls. Paying the fee also grants priority status in the queue for customer support calls. ⁴²	Upwards of \$50 for many technician visits

FIGURE: Similarities between the big three NYC ISPs with regard to labor, business, and COVID-19 practices

	Verizon	Altice	Spectrum
Labor Practices	Hostilities with unionized workers in 2016 that resulted in a significant strike ⁴³	Much of the company is not unionized, in part because of a year's long union busting campaign and other anti-worker tactics. ⁴⁴ Transitioned many technical workers into a separate company with a contract worker type of wage structure. ⁴⁵	Spectrum's anti-worker stance and union busting tactics has resulted in the longest current strike in the nation with the IBEW Local 3 Spectrum workers having been on strike since 2017. ⁴⁶
Covid-19 Practices	Excluded many low-income households from emergency pandemic programs ⁴⁷	Workers at the company called out the lack of safety protections given to them while trying to keep quarantining households connected. ⁴⁸ Blocked NYC families with unpaid bills from remote learning deals. ⁴⁹	Workers at the company called out the lack of safety protections given to them while trying to keep quarantining households connected, and the company insisted on call center and other office workers go into crowded offices despite social distancing guidelines, only changing course upon public criticism. Many workers got sick and some died. ⁵⁰ Blocked NYC families with unpaid bills from remote learning deals. ⁵¹

	Verizon	Altice	Spectrum
Expansion Issues	Was supposed to make it's FiOS service available to all New York City households in 2014. After the City sued the company for noncompliance with the terms of the franchise agreement in 2017, the company finally agreed in late 2020 to start delivering FiOS to some of the underserved communities it previously avoided. ⁵²	Dangled fiber to the premises in NYC footprint in 2015 to appease NYC/NYS officials after it purchased Cablevision and made big layoffs. ⁵³ Fiber to the premises rollout in NYC barely noticeable.	In 2018 New York State almost kicked Spectrum out of the state for lying about the expansion of its service to underserved communities ⁵⁴
Poor Customer Service	Responsiveness of customer service based in part on customers wealth. ⁵⁵	2 nd lowest customer satisfaction rating of all ISPs in the Northeast. ⁵⁶	Customer service rated amongst the lowest of all ISPs in the Northeast ⁵⁷
Service Outages	At least hundreds of significant outages over the life of the current franchise agreement. ⁵⁸ Major service outage in January 2021. ⁵⁹	Many significant service outages over the life of the current franchise agreement. ⁶⁰	Thousands of significant service outages over the life of the current franchise agreement. ⁶¹
Service Repair Charges	Upwards of \$100 for many technician visits	Charges \$7.99/mo for service protection so customers can avoid \$80 charges for individual service calls. Paying the fee also grants priority status in the queue for customer support calls. ⁶²	Upwards of \$50 for many technician visits
Fraud	Had to pay a \$17 million fine in 2017 for its role in a fraudulent scheme involving federal subsidies to connect New York City public schools with the internet (E-Rate), and resulted in the City having to pay a \$3 million fine and being barred from collecting \$120 million dollars in federal reimbursements it was otherwise entitled to. ⁶³	In 2019 the City accused Altice of being in violation of its franchise agreement for overcharging customers. ⁶⁴ In 2018 New York State fined Altice for lying about the speeds of the service it was providing. ⁶⁵	In 2018 New York State fined Spectrum more than \$174 million for defrauding New York customers by lying about the speeds of the service it was providing. ⁶⁶

BENEFITS OF A MUNICIPAL NETWORK

Bringing free or low cost fiber-powered internet to every New Yorker as a municipal utility service will allow all New Yorkers to receive reliable, affordable internet access for years to come, serviced by a transparent, publicly-managed organization that creates good union jobs.

BENEFITS FOR RESIDENTS

Every single New Yorker, no matter who they are or where they live, will receive symmetrical gigabit service, i.e., 1000 Mbps download and upload speeds, delivered directly to their home.

OVERVIEW

A municipal broadband fiber to the premises network will be a transformational utility service for New York City. Every single New Yorker, no matter who they are or where they live, will receive symmetrical gigabit service, i.e., 1000 Mbps download and upload speeds, delivered directly to their home. That means all children will have the internet access they need to succeed in school; all adults will be able to access critical online resources relating to work, housing searches, and government benefits; and all New Yorkers will be able to access critical health information and care.

New Yorkers need access to symmetrical gigabit speeds because of the download and upload speed demands of crucial daily activities like online school and homework, telemedicine, video conferencing for work, interactive entertainment, and more. Fiber-to-the-premises and the symmetrical gigabit speeds it delivers, as opposed to inferior cable system and fixed wireless service, is especially essential to households with multiple people using multiple devices, performing high-bandwidth activities like video calls and streaming. By bringing fiber to every New Yorker now, we will ensure that they can benefit from future technological developments and meet future technological demands—the need for reliable high-speed internet will only increase.

One of the great benefits of last mile fiber is its singular ability to be easily upgraded in the future to deliver speeds faster than symmetrical gigabit service. Once the last mile fiber is installed, these significant improvements to increase speed and performance simply require a straightforward swap-out of the transmitters that help power data through the fiber wires. The actual fiber cables themselves will last for decades without the need for significant additional investment as long as they are maintained. A fiber to the premises connection is the only future-proof internet access solution.⁶⁷

Universal fiber-to-the-premises infrastructure that reaches every corner of the City will also allow for a massive expansion of free outside the home connectivity options like WiFi in streets, parks, on transportation and in-stores. It is crucial that internet connectivity serves all New Yorkers wherever they are, especially those that may be unhoused or unable to afford costly cellular data plans.

PRICE AND SPEED

Unlike the private ISPs, who offer deceptive promotional rates and charge exorbitant fees for equipment purchase, rental, data overages, installation, activation, termination, and service charges, the municipal network will have one straightforward low price of \$40 per month for households that can afford it, and be free for those who cannot. All customers will receive the same great service regardless of ability to pay. Nor will there be any fees with the municipal network for households.

Small non-profits and businesses with little or no resources will also receive free service and have zero fees. Non-profit or commercial entities

with significant resources, should they want the service, would be required to help shoulder some of the costs by covering their reasonable equipment fees along with higher subscription costs than households of around \$100 per month. Many non-profits and businesses that can afford to pay will save hundreds of dollars per month in internet subscription fees as commercial internet service in New York City can be extremely expensive.⁶⁸

Fiber to the premises with the gigabit upload and download speeds delivered by the municipal network for free to households that need it, and \$40 for households that can afford it, will be orders of magnitude faster than the services that Spectrum, Verizon and Altice provide at comparable prices. The ISPs introductory low speed offerings may start out at \$40 or \$50 per month plus fees, while their higher speed services are often above \$100 per month, with prices rising even further after the one year promotional period ends and factoring in the additional monthly fees. Even worse, most

of the private ISPs' services, including the most costly ones, offer extremely inadequate upload speeds even when offering adequate download speeds. As upload speeds become increasingly important because of the demands to send information for school, telemedicine, work, entertainment, and more, these inadequacies will only become more pronounced.

The municipal network will also be a vast improvement over the low-income plans offered by the ISPs that provide grossly inadequate download and upload speeds at prices of \$15 or \$20 per month plus fees that are out of reach for many consumers. The municipal network will be free for those that cannot afford to pay, and the free service will be the same exact great service those that pay receive. Unlike the ISPs that notoriously make it difficult and frustrating to receive lower priced services by design,⁶⁹ one of the guiding principles of the municipal network is to bring fast, free internet to those who need it while making it as easy as possible to sign up.

Figure 2.1: Municipal network cost per month vs Private ISP Introductory Subscription costs

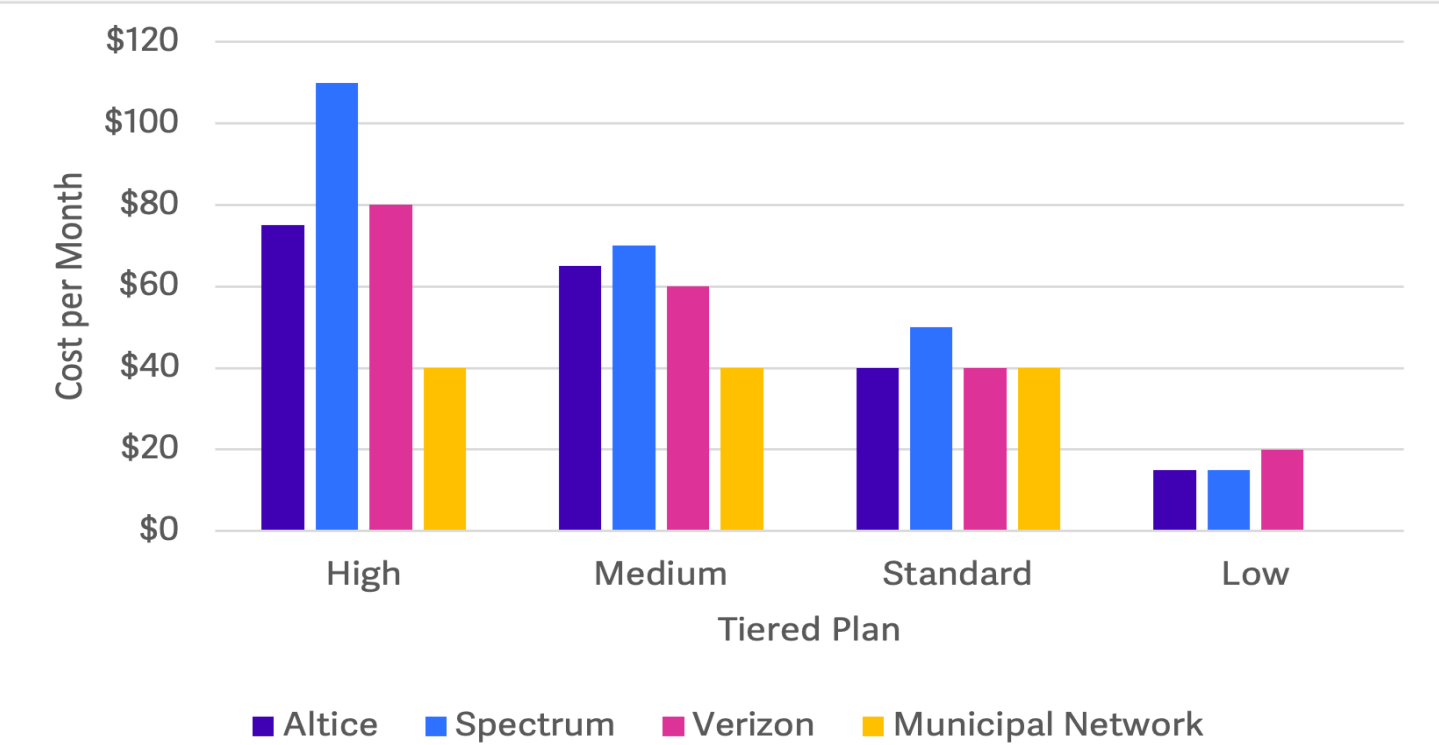
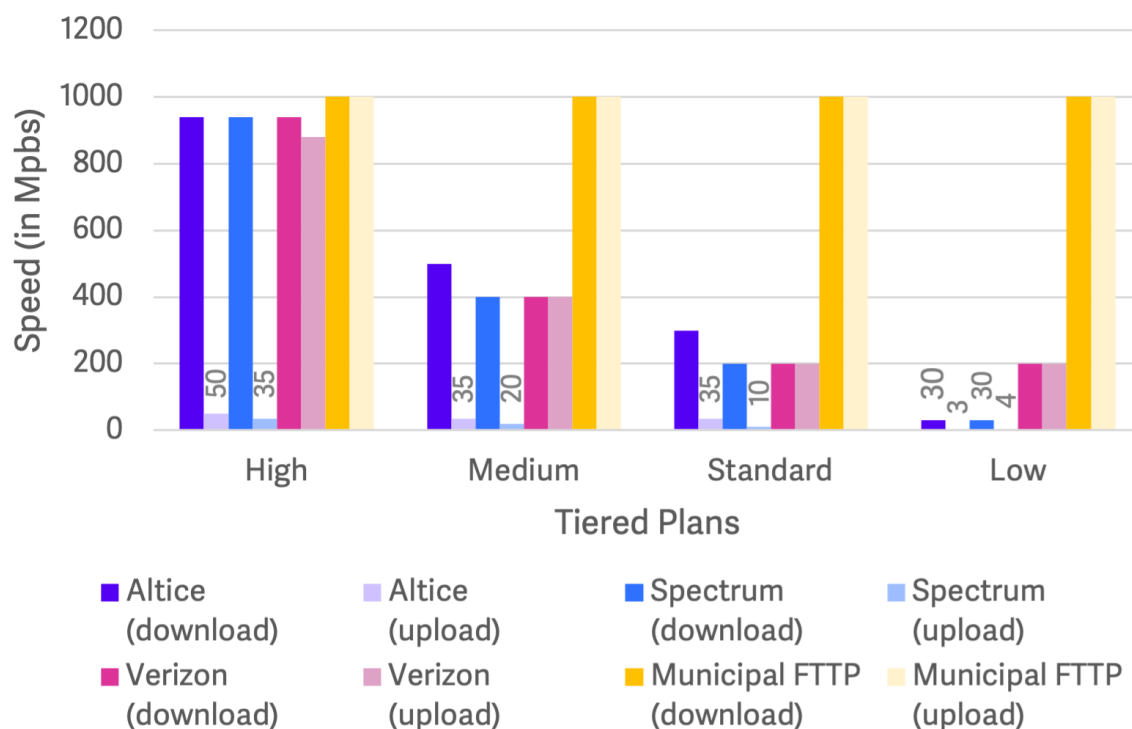


Figure 2.2: Municipal network speeds vs Private ISPs tiered speeds



NET NEUTRALITY AND PRIVACY

With the municipal network, users won't have to worry about violations of net neutrality, meaning all data that flows through the municipal network will be treated equally, and the municipal network won't engage in shady business practices like allowing the network to become congested with traffic and then using that congestion as leverage to extract payments from network users as private ISPs have done.⁷⁰

Formal classification of internet services as a utility is a political football,⁷¹ and one benefit of the municipal network is that the City at the local level can secure both now, and into the future, universal access and equal treatment of network traffic.

And unlike the ISPs, for the municipal network, the privacy of users is paramount. Private ISPs are able to sell customers' web browsing history, device location information, and other sensitive data to third parties.⁷² The municipal network would explicitly prohibit such practices and collect as little information as necessary to operate the network, be transparent about what information is collected,

store the information securely, and maintain confidentiality between individuals and the municipal broadband network. And because the network will be democratically run with privacy advocates having a hand in all operational aspects of the network, encroachment from law enforcement and other governmental or private persons or entities who may seek to utilize the network to put individuals or the City at risk will be thwarted.

For the municipal network, the privacy of users is paramount

NETWORK INVESTMENT

Private ISPs are also notorious for underinvesting in their networks, and customer service,⁷³ including multiple language services and outreach to marginalized communities because it's costly to do so and investors prefer short term profits.⁷⁴ In turn this leads to slow service, significant service outages, long customer service wait times,⁷⁵ and coupled with high costs, lower adoption by immigrants,⁷⁶ those with disabilities,⁷⁷ and other marginalized communities. The problem isn't the

business practices of one unsavory ISP; rather, it is inherent to the ISPs and public-private partnerships.

The municipal network's only mandate is to deliver a universal, inclusive, reliable service while finding a sustainable path forward over the coming decades that doesn't impact the delivery of other critical services - this is a path that we know is well within our reach.

BENEFITS FOR WORKERS

WAGES AND BENEFITS

The municipal network will be democratically run with workers having an actual seat at the table, and be 100% staffed and worked on by local union labor. From the person who builds the network next year to the customer service rep you call in ten years when you are moving away, the worker you interact with will be a member of your community which means good, local union jobs and better customer service.

The municipal network will also have a significant positive impact on the take home pay and benefits provided to network workers as the ISPs will be forced to compete with the municipal network on wages and benefits or risk losing workers. As one example, field technicians with the municipal network would likely be guaranteed through collective bargaining to make more than the prevailing wage for telecommunications workers after a negotiated period of time. The prevailing wage in New York City for a telecommunications worker, i.e., the fair local wage for public works projects guaranteed under law is \$45.88 per hour with a Supplemental Benefit Rate of \$23.15 per hour that covers payments for health, pension and other benefits.⁷⁸

Experienced Verizon field technician workers have the benefit of being unionized, and have collectively bargained for raises that are guaranteed to meet the prevailing wage,⁷⁹ unlike Spectrum and non-union Altice technicians that

do not have such certainty.

As for benefits, a defined benefit pension would be available to the municipal network workers,⁸⁰ and workers would receive a range of competitive health care options with free or low cost employee contributions for individual and family coverage, and lower deductibles and copays than private ISPs.⁸¹ That means higher take home pay for workers every two weeks and less costly health care coverage for what is likely comparable if not better health coverage with the municipal network.

The municipal network will also have a significant positive impact on the take home pay and benefits provided to network workers as the ISPs will be forced to compete with the municipal network on wages and benefits, or risk losing workers.

GROWING THE RANKS OF UNIONIZED TELECOMMUNICATIONS WORKERS

It is also important to emphasize that the municipal network will create jobs, specifically union jobs, in New York City. Rhetoric about municipal broadband "crowding out" private investment and thereby eliminating existing or future jobs is a cable and telecom lobby falsehood aimed at fighting off competition so the monopolies can be left alone to continue milking big profits from crumbling infrastructure. The same tired lies about government action or regulation stifling private investment and by extension jobs has been debunked countless times before.⁸²

With the exception of Verizon's past FiOS rollout, and commitment to hook up an additional 500,000 plus homes due to a lawsuit settlement,⁸³ none of the ISPs have made significant progress towards providing last mile fiber to households in New York City, particularly in lower-income neighborhoods. It's not clear how investment by the ISPs would be "crowded out" and jobs would be eliminated now or in the future for a business practice, last mile

fiber deployment with a focus on lower-income neighborhoods, that the ISPs have no designs on doing at scale in the first place (with the exception of Verizon).

The municipal network will set the standard for a worker and customer centric network that the ISPs will be forced to compete with. Many New York households, non-profits and businesses will sign up for the municipal network and many won't. All the while, the ISPs will continue to provide service to households, enterprise customers, wireless customers, invest in 5G expansion and more. The sky-high profits of the ISPs will suffer as they lose some customers and are forced to provide services and wages and benefits at levels they would not absent the existence of the municipal network. But the ranks of unionized telecom workers will continue to grow as competition increases in America's largest and most lucrative market, and new positions and opportunities are created.

BENEFITS FOR THE CITY IN THE FUTURE

Not only will the money invested to build the network today directly translate to increased access, lower prices and immediate benefits for local workers, but the long-term economic benefits to New York City as a whole will be significant. A few billion dollars spent in the near term on a municipal network and repaid over decades seems like a fantastic deal when you compare it with the City's estimates of jobs and wealth created through universal broadband,⁸⁴ to say nothing of a municipal fiber to the premises network that would likely push these estimates even higher, with incredible monetary savings for subscribers, an increase in wages and benefits for workers, and with the expansion of internet access, educational, health and economic benefits that will flow to all New Yorkers.

Universal fiber-to-premises infrastructure that reaches every corner of the City will also allow for the City to save money over the long term. Not only will the City save money by

ensuring that future proof fiber technology is in place that won't require costly upgrades in a couple years, but the City will also save money by forgoing or limiting costly contracts with ISPs, such as those to connect public schools, shelters, the City's hospitals, and much more.⁸⁵ Since 2010, the City has spent billions of dollars with telecommunications companies on communications infrastructure and services, and a ubiquitous City-owned fiber-to-the-premises network will allow for the City to avoid many of these costly contracts.⁸⁶

The ISPs underinvestment in their networks also has a critical public safety element beyond the everyday outages. As the City and region becomes more vulnerable to extreme weather events due to climate change, pandemics and other unforeseen disasters, affirmative steps and investment must be taken immediately to ensure that when the next event arrives, we have resilient, durable networks in place that are widely distributed to all New Yorkers so that the City and everyone in it can remain safe and connected. We rely on the private ISPs to install and maintain critical wireline and wireless communications infrastructure which are especially vital lifelines in times of disaster like Superstorm Sandy and the Covid-19 pandemic, yet the ISPs track record shows their unwillingness to do the bare minimum to make sure their networks are resilient and widely distributed, which has had dire consequences for New Yorkers, especially in the most vulnerable communities.⁸⁷ As is too often the case, the worst impacts of communications network failures in times of crisis falls hardest on low-income, predominantly non-white communities—the very communities that face the greatest barriers to internet access in the first place.⁸⁸

Ensuring the resiliency of New York City's communications infrastructure for all New Yorkers, especially against the effects of climate change, must be seen as a mission critical, ongoing investment given that experts

consider New York City's internet infrastructure to be amongst the most vulnerable in the U.S. to the effects of climate change.⁸⁹ The ISPs simply aren't willing to invest in universal network access or long-term network resilience against the impacts of climate change. Only the municipal network with its long-term preparedness mindset free from short-term investor demands can place universal access and ongoing network resiliency at the center of its strategy.

NEXT STEPS

New York City has the benefit of learning from other localities that made the smart decision to break free from their reliance on the private ISPs to start delivering internet to all residents as a straightforward utility-like service. Nationwide, these municipal broadband networks have proven to be faster, more affordable, and more transparent than private ISPs.⁹⁰

The sooner the Mayor and City Council take the necessary steps to stand up an entity that can begin to leverage the existing infrastructure, and building out new infrastructure to begin delivering fiber to the doorstep of every New Yorker, the sooner we as a City can start to realize the immediate and long term benefits of a municipal universal gigabit service.

INFRASTRUCTURE AND WORKERS

There is a vast amount of publicly and privately owned internet infrastructure available that the City can leverage to help launch the municipal broadband network. Experienced union workers are ready to leverage the available infrastructure to build out and begin operating the network that connects all New Yorkers.

EXISTING CITY OWNED INFRASTRUCTURE

New York City would not be building a municipal fiber to the premises network from scratch. There is a vast amount of infrastructure that the City owns or may use immediately to launch the municipal network. Given the failures of the ISPs, the City should utilize its existing internet infrastructure to help launch the municipal network.

The City already operates multiple massive fiber networks for municipal purposes that span the five boroughs, connecting thousands of miles of fiber optic cable with thousands of separate buildings.⁹¹ These existing networks include the ones operated by New York City's Department of Information Technology and Telecommunications (DoITT),⁹² Department of Education,⁹³ Health and Hospitals,⁹⁴ Fire Department,⁹⁵ and Police Department.⁹⁶

In addition to these existing networks, there are massive amounts of additional City owned infrastructure that can be leveraged immediately to launch a municipal fiber to the premises network. Many of these assets like City owned buildings are already connected with the above mentioned networks. The infrastructure, much of which is detailed in the City's Universal Solicitation for Broadband Assets List,⁹⁷ spans everything from existing fiber pathways in public housing buildings (NYCHA),⁹⁸ to hundreds of fiber connected libraries spanning all five boroughs.⁹⁹

Add to this fiber connected and conduit dense intersections with traffic signals, cameras, sensors, lights, readers and poles, operated by the Department of Transportation,¹⁰⁰ and the

open access fiber backbone and additional infrastructure the City will own in 2021 through the recently issued Broadband RFP,¹⁰¹ and you can start to get a sense of the massive amount of existing infrastructure available to leverage in order to provide affordable, lightning fast internet to every single New Yorker as a utility service.

CLOSELY ALIGNED INSTITUTION INFRASTRUCTURE

Other City owned, closely affiliated, or ideologically aligned institutions may have excess capacity on their existing networks or other infrastructure that can be leveraged to help scale a municipal broadband network. Many of these institutions like the City University of New York's 25 campuses are connected through a combination of the fiber network provided by the New York State Education and Research Net (NYSERNet)¹⁰² and leased infrastructure from local ISPs.¹⁰³

Many other non-profit service providers, arts, and academic institutions may be able to aid in the launch of the municipal broadband network through infrastructure and knowledge sharing, and will be able to benefit from the expansion of the municipal network as their broadband subscription costs go down, potentially as low as \$0 per month, that will free up funds and advance their ability to care for, educate and enlighten the communities they serve.

PRIVATELY OWNED INFRASTRUCTURE

There is a vast amount of privately owned infrastructure like utility poles,¹⁰⁴ conduit,¹⁰⁵ and

fiber spread across the five boroughs that the City can also leverage to deploy the municipal fiber to the premises network. The key piece of infrastructure is the Verizon subsidiary Empire City Subway's (ECS) underground conduit system in the Bronx and Manhattan that the City can use for free and direct ECS to expand in the public rights of way at ECS's expense.¹⁰⁶ The presence of preexisting infrastructure like underground conduit can reduce construction costs for the municipal network significantly. Though much of the privately owned infrastructure with the major exception of ECS conduit is not free for the City to use just yet, there are a variety of tools available to make this infrastructure free or low-cost for the City to utilize.

WORKERS

Even with all the existing infrastructure, it means nothing without the experienced workers ready to leverage it to quickly launch and build out the network to connect all New Yorkers.

The experienced IBEW Local 3 Spectrum workers who have been on strike for over four years are ready to hit the ground running to use their expertise to help launch the municipal network. IBEW Local 3 has deep experience constructing fiber optic networks, maintaining the networks, and troubleshooting issues when they arise. Who better to spearhead the process of deploying the municipal network to every residence and some non-profits and businesses in New York, and then continuing to maintain and operate the network once it has been constructed.

The City, as previously mentioned, already operates multiple massive fiber networks through agencies like DoITT and DOE's DIIT, and internally building up the capacity to gradually widen the scope of service beyond the existing municipal purposes to include residential and enterprise service would be manageable. Additional existing City workers like the 24/7 rapid response multilingual 311 Call center

workers, and the multi-agency efforts put into the recently issued Broadband RFP, all point to a wealth of valuable existing talent and experience that could immediately be put to use bringing fast, affordable internet to every New Yorker in a few years with amazing customer service.

NETWORK DESIGN

The municipal broadband network team will be tasked with identifying the publicly and privately owned infrastructure available in the City and leveraging it as the network is designed and constructed.

OVERVIEW

The municipal broadband fiber-to-the-premises entity would be responsible for a number of network design, construction and operational tasks in order to provide New Yorkers with internet access. During the construction phase, the municipal network entity would be responsible for hiring workers to plan, procure materials, and install fiber optic cables in the New York City public rights of way ("outside plant"), get the fiber from the public rights of way into individual buildings ("service drops"), and install equipment in each housing unit or business that connects each individual subscriber with the municipal

network ("customer premises equipment"). The municipal network entity would also be responsible for identifying free space in City owned or controlled facilities across the five boroughs to install network electronics like routers and switches that facilitate traffic on the municipal network and connect the network to the internet. Overlapping with and extending past the construction phase of the network will be the day-to-day operational tasks performed by the municipal network entity. These tasks will include reaching out to prospective subscribers, signing up new users, troubleshooting subscriber issues, billing, network operations, long-term planning and strategy, fiber network upkeep and more.

See next page for illustrative graphic

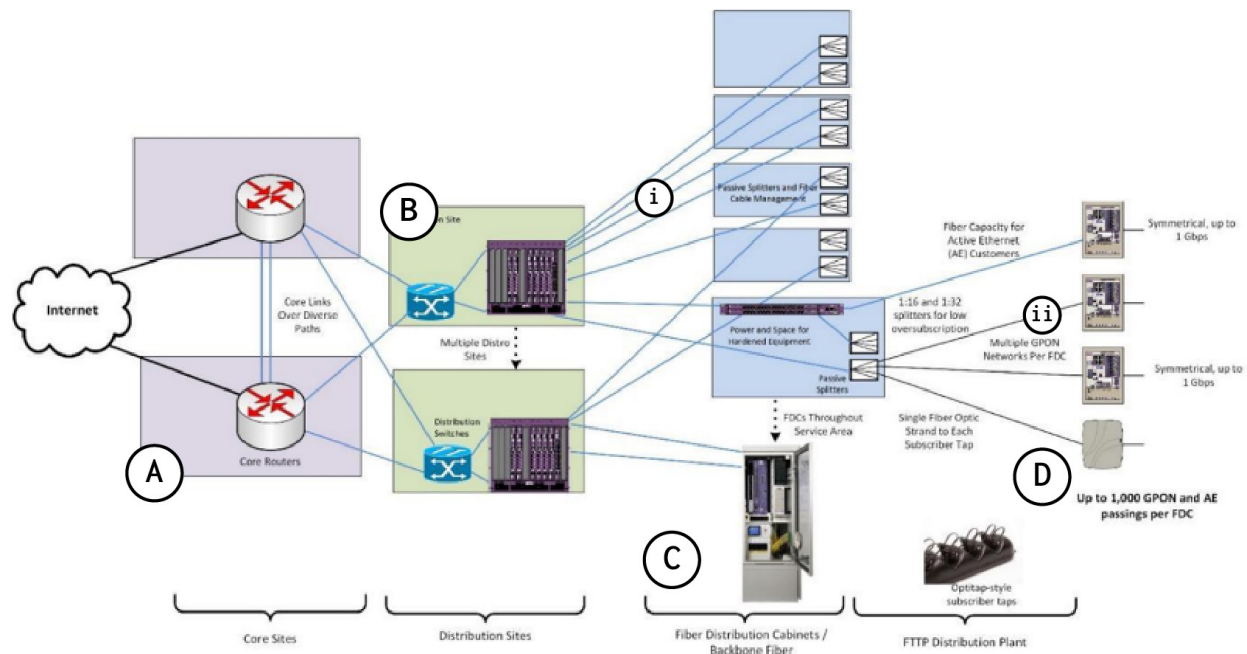


FIGURE 4.1: The basic construction tasks that lie ahead in order to launch the municipal broadband fiber to the premises network.¹⁰⁷

- A. Find space in a small number of City-owned facilities to house network electronics like routers that will connect directly to the public internet (backhaul). From here, we will need to install fiber (i) that connects these core facilities to:
- B. A larger number of City-owned distribution facilities throughout the five boroughs to house network electronics like switches. More fiber lines (i) will connect these distribution facilities to:
- C. A larger number of distribution cabinets in every neighborhood; and install fiber (ii) from the cabinets that connects directly to:
- D. Every housing unit and some businesses. Every unit also receives customer premises equipment.

NETWORK COSTS

Leveraging publicly and privately owned internet infrastructure and using legislative and enforcement tools available to City and State lawmakers will ensure that the costs to deploy the municipal broadband utility remain reasonable. We cannot tolerate ISPs, landlords and reluctant lawmakers blocking New Yorkers from gaining access to the affordable, fast internet they need

OVERVIEW

The biggest costs to build the municipal fiber to the premises network are the outside plant construction of installing fiber in public rights of way, and the service drop and customer premises equipment costs of bringing fiber into every building and connecting each individual

subscriber with the municipal network.

There are a variety of tools available to the City to drive down these costs significantly, and it is up to the City, local and state legislators to relentlessly use every available tool at their disposal to see to it that every single New Yorker has the affordable, fast internet access they need, now and into the future.

FIGURE 5.1: High-cost Estimate

Borough	Street Miles	Passings	Households	Outside Plant Cost	Cost Per Passing	Central Network Electronics	Service Drop and Customer Premises Equipment Costs	Total Cost
Bronx	1353	102,123	499,728	\$204,246,000.00	\$2,000.00	\$149,918,000.00	\$599,573,500.00	\$853,838,000.00
Manhattan	1037	155,921	758,133	\$311,842,000.00	\$2,000.00	\$227,439,000.00	\$609,759,600.00	\$1,449,041,500.00
Brooklyn	2111	332,685	950,856	\$1,330,740,000.00	\$4,000.00	\$285,256,000.00	\$1,141,027,200.00	\$2,757,024,000.00
Queens	3228	355,089	799,234	\$1,450,356,000.00	\$4,000.00	\$239,770,200.00	\$859,080,000.00	\$2,659,207,000.00
Staten Island	1189	130,553	156,152	\$522,212,000.00	\$4,000.00	\$49,395,000.00	\$199,382,400.00	\$771,446,000.00
Total	8928	1,086,371	3,174,103	\$3,825,396,000.00	\$3200 Citywide Average	\$952,230,900.00	\$3,808,923,500.00	\$8,590,550,500.00
		Tax lots by borough used as the passing figure which excludes buildings that don't pay property taxes	Figures from NYC Internet Master Plan: Adoption and Infrastructure Data by Neighborhood	Assumes 50% construction cost savings in Manhattan and Bronx because of ECS franchise. If some Bronx passings were to rely on existing poles instead of existing or soon to be built ECS franchise conduit, cost estimates assumed to be the same.	Assumes 50% construction cost savings in Manhattan and Bronx because of ECS franchise.	Assumes \$300 per household	Assumes \$1200 per household service drop and customer premises equipment installation costs, \$500 per household is the assumed cost of customer premises equipment. Commercial buildings not included in service drop/equipment assumption, but included in passing assumption.	

TOOLS TO DRIVE DOWN CONSTRUCTION COSTS

DRIVING DOWN OUTSIDE PLANT COSTS

The status quo estimated outside plant construction costs are significantly higher in Brooklyn, Queens and Staten Island because there is no equivalent agreement in place with a private provider like the ECS franchise that covers the Bronx and Manhattan requiring that it build out and absorb some of the construction costs of installing infrastructure in the public rights of way through which fiber is run. However, there is still massive amounts of existing private conduit and utility poles in Brooklyn, Queens and Staten Island on which fiber can be installed, and federal and state

law requires that providers make their conduit and utility poles available to requestors like the municipal broadband network for a fixed rental fee.¹⁰⁸

Utilizing existing available conduit and utility poles in Brooklyn, Queens and Staten Island will drive down outside plant construction costs significantly. The existence of conduit, as compared to building new, has been estimated to result in savings on outside plant construction costs by as much as 87% in dense, high-cost metro areas like New York City, and available utility pole space by as much as 63%.¹⁰⁹

Despite the potential for significant savings in utilizing existing utility poles and conduit, there are often "make ready" and

preparation costs to prepare utility poles and conduit to safely receive additional wires like the municipally owned fiber because many poles and conduit have multiple wires and other attachments from multiple providers or utilities. Pole and conduit owners like Verizon are notorious for using the necessity of some preparation work as a pretext to drag their feet in accommodating new providers, while arbitrarily driving up the total costs of installation, which allows the incumbent provider like Verizon to avoid competition.¹¹⁰

Given the health, educational and public safety concerns of the ongoing digital connectivity crisis, we cannot tolerate the ISPs dragging their feet and making the costs of utilizing existing conduit and utility poles prohibitively expensive.

Given the health, educational and public safety concerns of the ongoing digital

connectivity crisis, we cannot tolerate the ISPs dragging their feet and making the costs of utilizing existing conduit and utility poles prohibitively expensive.

By amending state law to make all pole owners whether of utility poles or underground conduit and other private attaching entities responsible for their own expenses and preparation costs to accommodate the municipal networks attachment on a strict enforced timeline, we can save on construction costs while speeding up deployment.¹¹¹ We can also follow the lead of neighboring states¹¹² and amend New York State law to make the rental costs for the City's fiber network \$0 on the existing conduit and utility poles that would bring the rental costs in Brooklyn, Queens and Staten Island in-line with the free rental in ECS conduit in Manhattan and the Bronx.

FIGURE 5.2: Cost estimate factoring in potential cost savings of using existing conduit and utility poles wherever it is available, and making the costs of "make ready" and conduit preparation work be covered by the owners and other private occupants. Savings in yellow. \$2.5 billion in outside plant construction costs compared with the new build, status quo estimate of \$3.8 billion results in cost savings of almost 36%!

Borough	Street Miles	Passings	Outside Plant Cost (NO SAVINGS)	Cost Per Passing (NO SAVINGS)	Existing Conduit Construction Costs (SAVINGS)	New Conduit/Utility Pole Construction Costs (SAVINGS)	Existing Utility Pole Construction Costs (SAVINGS)	New Cost Per Passing (SAVINGS)	Total Outside Plant Cost (SAVINGS)
Bronx	1363	102,123	\$204,246,000.00	\$2,000.00	n/a ECS	n/a ECS	n/a ECS	\$2,000.00	\$204,246,000.00
Manhattan	1037	155,921	\$311,842,000.00	\$2,000.00	n/a ECS	n/a ECS	n/a ECS	\$2,000.00	\$311,842,000.00
Brooklyn	2111	332,685	\$1,330,740,000.00	\$4,000.00	\$166,342,500.00	\$332,685,000.00	\$332,685,000.00	\$2,500.00	\$831,712,500.00
Queens	3228	365,089	\$1,460,356,000.00	\$4,000.00	\$182,544,500.00	\$365,089,000.00	\$365,089,000.00	\$2,500.00	\$912,722,500.00
Staten Island	1189	130,553	\$522,212,000.00	\$4,000.00	\$65,276,500.00	n/a	\$195,829,500.00	\$2,000.00	\$261,106,000.00
Total	8928	1,086,371	\$3,829,396,000.00	\$3200 Citywide Average	\$414,163,500.00	\$697,774,000.00	\$893,603,500.00	\$2200 Citywide Average	\$2,521,629,000.00
Tax lots by borough was used as the passing figure which excludes buildings that don't pay property taxes			Assumes 50% construction cost savings in Manhattan and Bronx because of ECS franchise. If some Bronx passings were to rely on existing poles instead of existing or soon to be built ECS franchise conduit, cost estimates assumed to be the same.	Assumes 50% construction cost savings in Manhattan and Bronx because of ECS franchise.	Assumes 25% of passings will be in areas with existing conduit coverage which results in savings of 50%. Cost of conduit preparation covered by owner.	Assumes 25% of passings will be in areas without available conduit or utility poles. Assumed that no new construction is needed on Staten Island.	Assumes 50% (and 75% in SI) of passings will be in areas with existing utility poles and the cost of "make ready" will be covered by pole owner resulting in savings of 50%.		

DRIVING DOWN SERVICE DROP COSTS CONDUIT AND POLES

Under the ECS franchise agreement, ECS is required to install, maintain and expand the underground conduit network in the Bronx and Manhattan as directed by the City.¹¹³ This

includes the requirement to install conduit up to the private property line of each building, the point at which the public right of way becomes private property. The City must demand that ECS start living up to the terms of the franchise agreement and run conduit up to the private property line of each building for the municipal

network's use.

Much like the outside plant, construction utilizing existing available conduit that runs up to, and into each building, and utility pole "aerial drops" to each building wherever available in the five boroughs, will drive down service drop costs significantly. The previously mentioned pole attachment amendment to state law would make the rental costs for the City's fiber network \$0 in the existing conduit that runs up to each building (ECS is already free), and utility pole aerial drops.

LANDLORDS

There is also much that can be done to drive down service drop costs and facilitate the deployment of the municipal network by requiring landlords to accommodate the municipal network in their buildings. Currently, there is a variety of tactics used by landlords and ISPs to keep out competition,¹¹⁴ particularly in buildings with multiple tenants, and the existing federal and state laws permit landlords and ISPs to excessively delay and keep out competition,

FIGURE 5.3: Potential cost savings if ECS will comply with the terms of its franchise agreement, and we take an aggressive approach to using existing entrance methods into buildings wherever it is available, and requiring landlords to open up their buildings to the municipal network. Savings in yellow.

Around \$3.1 billion in service drop and customer premises equipment costs compared with \$3.8 billion in the new build, status quo estimate results in cost savings of almost 20%!

Borough	Street Miles	Passings	Households	Service Drop and Customer Premises Equipment Costs (NO SAVINGS)	Existing Service Drop Construction Costs (underground/aerial) and Customer Premises Equipment (SAVINGS)	New Service Drop Construction Costs (underground/aerial) and Customer Premises Equipment (SAVINGS)	Total Service Drop and Customer Premises Equipment Costs (SAVINGS)
Bronx	1363	102,123	499,728	\$599,673,600.00	\$337,316,400.00	\$149,918,400.00	\$487,234,800.00
Manhattan	1037	155,921	758,133	\$909,759,600.00	\$511,739,775.00	\$227,439,900.00	\$739,179,675.00
Brooklyn	2111	332,685	950,856	\$1,141,027,200.00	\$641,827,800.00	\$285,256,800.00	\$927,084,600.00
Queens	3228	365,089	799,234	\$959,080,800.00	\$539,482,950.00	\$239,770,200.00	\$779,253,150.00
Staten Island	1189	130,553	166,152	\$199,382,400.00	\$112,152,600.00	\$49,845,600.00	\$161,998,200.00
Total	8928	1,086,371	3,174,103	\$3,808,923,600.00	\$2,142,519,525.00	\$952,230,900.00	\$3,094,750,425.00
		Tax lots by borough was used as a placeholder for passings which excludes buildings that don't pay property taxes	Figures from NYC Internet Master Plan: Adoption and Infrastructure Data by Neighborhood	Assumes \$1200 per household service drop and customer equipment installation costs. \$500/household is the assumed cost of customer premises equipment. Commercial buildings not included in installation assumption, but included in passing assumption.	Assumes \$900 per household and that 75% of passings would completely or primarily utilize existing building entrance methods (aerials drops, entrance conduit, ECS running conduit up to private property line, etc). Assumes \$500 for customer premises equipment, installation and materials.	Assumes \$1200 per household and that 25% of passings would require new or mostly new entrance methods. Assumes \$500 for customer premises equipment, installation and materials.	

but they also permit complementary local action at the municipal level.¹¹⁵

By amending local law to require buildings to have entrance conduit or alternative suitable pathways connecting the building with the public right of way, it can work in tandem with the ECS demands, utilization of existing entrance methods, and the state pole attachment amendment to drive down construction and operational costs.

In addition, passing a local law with real teeth that requires landlords to permit the municipal network to perform installations and prohibits all forms of exclusivity deals and delay tactics from landlords and ISPs will help to open up buildings to the municipal network. The local law can require buildings make available and have sufficient non-exclusive in-building pathways and wiring to the extent permissible to run the municipal network which will also help to drive down service drop costs and make the adoption rates of the municipal network proceed without unnecessary delay.¹¹⁶

FIGURE 5.4: Low Cost Estimate Assuming the city uses all of the tools outlined above to drive down costs. **\$6.6 billion in total costs compared with the high estimate of \$8.6 billion in the status quo estimate results in cost savings of almost 25%!**

Borough	Street Miles	Passings	Households	Outside Plant Cost	Cost Per Passing	Central Network Electronics	Service Drop and Customer Premises Equipment Costs	Total Cost
Bronx	1363	162,123	499,728	\$204,246,000.00	\$2,000.00	\$149,918,400.00	\$487,234,800.00	\$841,399,200.00
Manhattan	1037	155,921	750,133	\$311,042,000.00	\$2,000.00	\$227,439,900.00	\$739,179,675.00	\$1,278,461,575.00
Brooklyn	2111	332,685	950,856	\$391,712,500.00	\$2,500.00	\$285,256,800.00	\$327,084,600.00	\$2,044,053,900.00
Queens	3228	365,089	799,234	\$312,722,500.00	\$2,500.00	\$239,770,200.00	\$779,253,150.00	\$1,931,745,850.00
Staten Island	1189	130,553	166,152	\$261,106,000.00	\$2,000.00	\$49,345,600.00	\$161,998,200.00	\$472,949,800.00
Total	8928	1,086,371	3,174,103	\$2,521,629,000.00	\$2200 Citywide Average	\$952,230,900.00	\$3,094,750,425.00	\$6,568,610,325.00
		Tax lots by borough was used as the passing figure which excludes buildings that don't pay property taxes	Figures from NYC Internet Master Plan: Adoption and Infrastructure Data by Neighborhood	Assumes 50% construction cost savings in Manhattan and Bronx because of ECS franchise. Assumes 25% of passings will be in areas with existing conduit coverage, and the cost of prep is covered by conduit owner resulting in 50% savings. Assumes 50% of passings will be in areas with existing utility poles and the cost of "make ready" will be covered by pole owner resulting in savings of 50%. Assumes 25% of passings will be in areas without available conduit or utility poles. Assumed that no new construction is needed on Staten Island.		Assumes \$300 per household	Assumes 75% of passing's would completely or primarily utilize existing building entrance methods (aerials drops, entrance conduit, ECS running conduit up to private property line, etc.) and cost \$900 per household. Assumes remaining 25% of passing's would require new or mostly new entrance methods and cost \$1200 per household. Assumes \$500 for customer premises equipment, installation and materials throughout.	

COMMERCIAL SERVICE ESTIMATE¹¹⁷

Extending the network to non-profit service providers, arts and educational institutions and small to medium sized businesses is a cost effective strategy to bring the benefits of the network to a vital segment of the New York ecosystem. Doing so will also help bring

in additional revenue by charging those organizations with means, whether non-profit or for-profit more than residential customers, while also requiring they cover the cost of their equipment. **Like households, non-profit organizations or small businesses that cannot afford the service, will not be charged anything.**

FIGURE 5.5: Commercial Service Estimate. Commercial properties are passed under the high and low estimates detailed in the sections above, but unlike the household utility service model, commercial organizations are only hooked up to the municipal network upon request.

Borough	Commercial Passings	Total Businesses in NYC	Outside Plant Cost	Central Network Electronics	Service Drop Construction Costs	Customer premises equipment	Total Cost
Five Boroughs	100,079	220,000	n/a	\$26,400,000.00	\$88,000,000.00	\$22,000,000.00	\$136,400,000.00
Notes	Commercial tax lots by borough was used as a placeholder for passings which excludes buildings that don't pay property taxes	Figure provided by NYC	Each commercial building already passed under the high and low estimates but not hooked up to the network.	Assumes \$300 per business and 40% of businesses sign up.	Assumes \$1000 per passing to get fiber from right of way into the building, 40% of businesses sign up, and the network covers the full cost of service drop.	Assumes \$500 per business, 40% of businesses sign up, and 50% of businesses that sign up can afford to pay for their own equipment.	

OPERATIONAL COSTS

The municipal network team would grow over time as it expands its footprint and signs up new users. The employees would be spread across functions primarily consisting of service and network technicians, customer

service representatives, outreach/signup representatives, call center support, and more. This core team and overall operations would be steered by the democratically elected board that would consist of elected representatives of the workers and other individuals from within and outside government that could lend their

expertise across a variety of functions like network operations, expansion, government, privacy and more.

If there were 2000 employees¹¹⁸ of the municipal broadband network with a total labor cost (wages + benefits) averaging \$90,000 per year,¹¹⁹ that would be \$180,000,000 per year towards the municipal networks operational budget. Benefits and wages would be collectively bargained for, but likely in line with other municipal workers. Fiber network maintenance costs are approximately 1% of the total construction cost¹²⁰ per year, or approximately \$66-\$86 million per year based on the total cost estimates. There are additional overhead costs of running a large scale operation day to day, and we assumed approximately an additional 20% on top of the labor and network maintenance costs.

COST SUMMARY

- \$6.6-\$8.6 billion in construction costs to connect all households in NYC, paid back gradually. \$136 million to connect those non-profits and businesses that request the service.
- \$300 million per year in operational costs, labor and network maintenance, scaled gradually.

PHASED DEPLOYMENT

By installing the municipal broadband utility in all households and offering free service to households and businesses that need it, the benefits of the network will be available to all who want it.

THREE YEAR PLAN AND BEYOND

The municipal network is a utility meant to serve all households. That means all approximately 3.2 million NYC households are connected to the network in the three-year, gradual installation model proposed here. Two key aspects of the proposed model are that the roll-out must prioritize the most marginalized communities first, and that all households will be connected to the network regardless of whether the household actually wants to sign up for municipal network service or not.

Many households will choose to sign up for the municipal service because of the low prices, high speeds, great customer service and easy installation, but we also expect that many households may still prefer to keep their existing internet provider. Overall, we anticipate at least a 50% household penetration rate, meaning of the approximately 3.2 million households in NYC connected to the network, 1.6 million households will actually sign up for the municipal network service.¹²¹ Of the 1.6 million households that sign up for the municipal service during the initial three year residential rollout, our assumption is that by prioritizing installation in neighborhoods with the greatest need for the service in years one and two, the percentage of household subscribers able to pay the \$40 per month subscription fee will start out at around 30% in year one, and increase to around 40% in year two, before reaching 50% in year three as the network finishes connecting all households and penetrates higher income neighborhoods.¹²²

We recognize that a proposed network installation of around one million households for three years straight is ambitious; but given the

severity of the digital divide in New York City, a large scale mobilization of resources to end the divide rapidly is necessary. We have the existing infrastructure, money and workforce to get it done—what we need is a bold commitment from the City to take the necessary legislative, financial, and logistical first steps, and to stop accommodating ISPs, landlords, investors, and other actors that would prefer a piecemeal, half measure approach to the issue.

Extending the network to non-profits and businesses operating out of commercial spaces that request service starts in year two. Unlike with residential service, non-profits and commercial establishments will only be connected to the network when they request it. Small non-profit organizations and small businesses with limited resources will not pay anything for internet service. Larger non-profits and businesses with means will be charged a higher subscription fee of \$100 per month compared to the \$40 per month for households with the means to pay. Though the municipal network provides many of the same benefits for commercial service as household service, the fact that the service is only installed upon request and the reality that many businesses may prefer boutique providers, the estimated penetration rate is lower than residential service 40% commercial vs. 50% residential.

YEAR ONE

The focus of year one is bringing the network to the residential communities that need it the most.

YEAR TWO

The focus of year two is bringing the network to any remaining communities that lack

access. This is also the first year we anticipate connecting non-profits and businesses that request the service which will help to provide additional revenue for the network.

YEAR THREE

The focus of year three is bringing the network to the rest of New York, while continuing to supplement the network’s revenue by connecting additional non-profits, small businesses and other commercial establishments.

YEAR FOUR

With all households connected to the

network, the focus of year four is providing great customer service, trying to sign-up additional households, especially those that could benefit from free service, and to finish connecting non-profits and businesses that want the service.

YEAR FIVE

With all households and many non-profits, small businesses and other commercial connections to the network, the assumption is that while subscriber numbers may continue to go up, and trying to sign-up additional households that could benefit from free service is a priority, the focus is providing great customer service. The best way to make the

FIGURE: Commercial and residential subscriber 5-year summary (Assume 1 Subscriber per household)

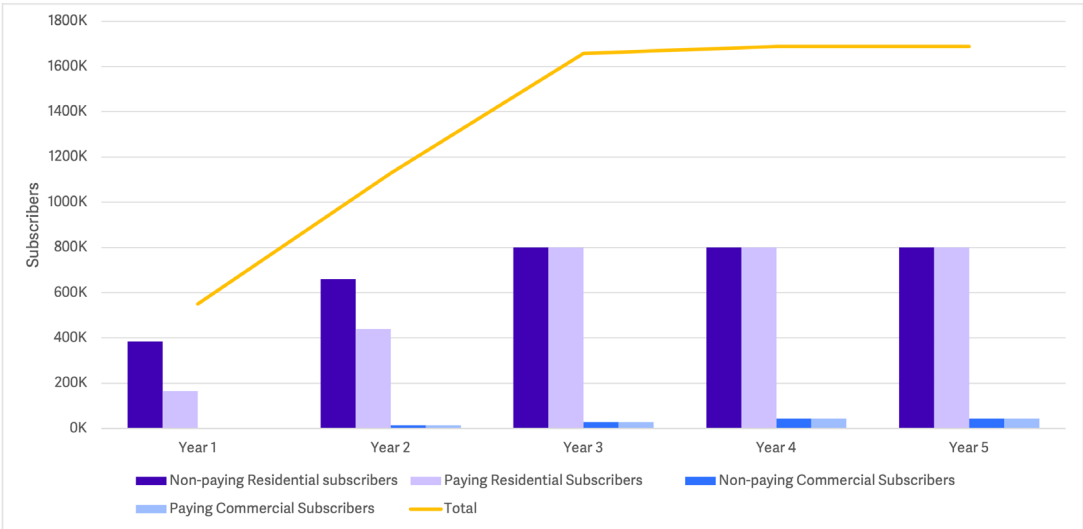
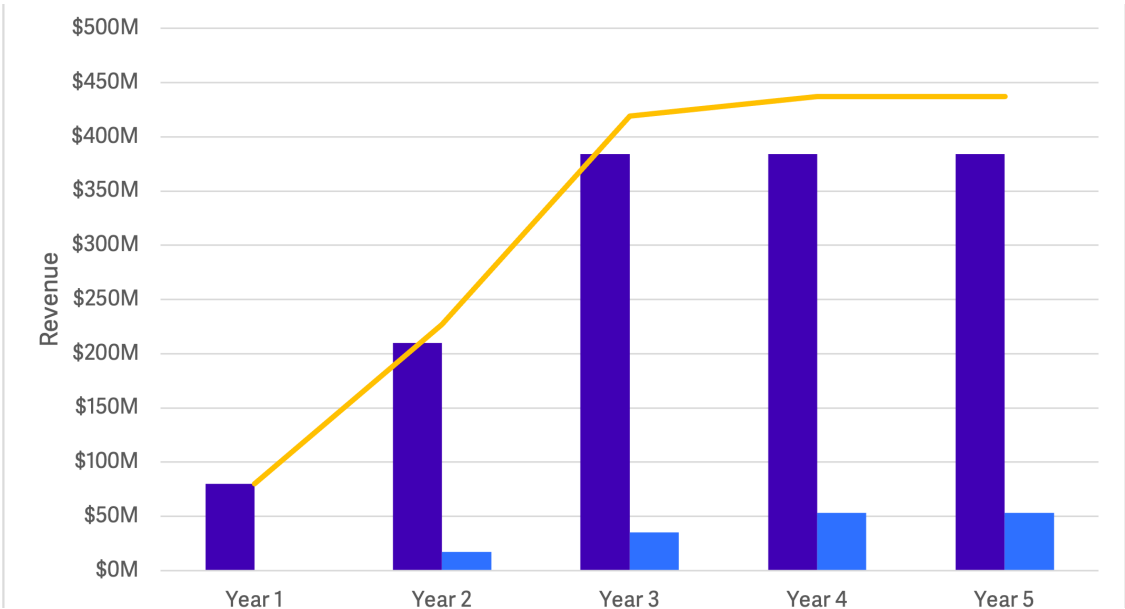


FIGURE: Projected 5-year revenue commercial & residential subscribers



PAYING FOR THE NETWORK

Unlike the ISPs and their demands for immediate profits, the municipal network can afford to take the long-term view. By leveraging all available infrastructure and legislative/oversight tools, costs to install and operate the network will remain manageable, with a variety of available funding sources, including affordable subscriber fees from those households and businesses that can afford it, along with federal, state, and local funds.

network appealing to existing and prospective
free and paying subscribers is to invest in the
network and prove what a great service it is!

COSTS

BORROWING:

Most of the money to build the network will likely need to be borrowed through the issuance of bonds, and while there are many ways this can be structured, our assumption is that \$6.6 billion in bonds are issued with a 30 year repayment. Such a bond will require over a \$220 million payment per year at its peak including interest ($\$6.6 \text{ billion} / 30 \text{ years} = \$220 \text{ million} + / \text{year}$). Here is one example for illustration (see figure 7.1 & 7.2):

Year 1: \$50 million/year repayment

Year 2: \$75 million/year repayment

Year 3: \$100 million/year repayment

Year 4: \$150 million/year repayment

Year 5: \$220 million/year repayment

**Year 6: over \$220 million/year repayment
(and will continue on until repaid)**

OPERATIONAL

The municipal broadband network team would grow as it expands its footprint and signs up new users. Assuming that the network ultimately has 2000 employees at a total labor cost of \$180 million per year (wages and benefits), the rest of the operational budget would go towards network maintenance, estimated at 1% of the total construction cost, and office overhead. These costs would grow gradually over the networks first years.

COMMERCIAL

As detailed in section VI (E), the total anticipated cost of connecting non-profits, and small and medium sized businesses that want service is around \$136 million. It is assumed that these costs would be evenly incurred in years 2-4 of the network, \$45 million per year.

REVENUE AND ADDITIONAL FUNDS

SUBSCRIBER FEES:

The estimated subscriber fees from households and businesses outlined in “Phased Deployment” can help to cover the majority of the anticipated construction and operational costs of the network, but they likely cannot cover the entire cost of loan repayment, commercial service and operations. The network will likely need additional funding sources available to the network to compensate for the manageable anticipated discrepancy between costs and revenues.

CITY FUNDS

Allocating City capital funds to help kickstart the network and bridging moderate gaps in the costs of providing a great, universal utility service, and the amount of revenue collected to help sustain the utility service seems like a very wise use of City funds. To start, the City should dedicate the yearly franchise fees that the City collects from ISP franchisees, which totaled nearly \$150 million in the 2021 fiscal year towards the launch of the municipal network.¹²³ There may be a need for additional sources of funding beyond City funds to help sustain the network and provide cushion should costs or subscriber numbers take time to meet expectations.

FEDERAL FUNDING

Federal money can help jumpstart a municipal broadband network rather than going right back to Verizon, Spectrum and other monopolistic ISPs that created the digital divide in the first place.

Major subsidies for broadband infrastructure and services have been passed and are being contemplated by Congress, and would be available to the municipal network to leverage.¹²⁴ There is even some indication that municipal networks may get prioritized in how infrastructure funds are distributed.¹²⁵ In relation to the \$6.6 billion low cost municipal network estimate, \$1 billion in federal funding for the municipal network would decrease

FIGURE 7.1: Combined Costs

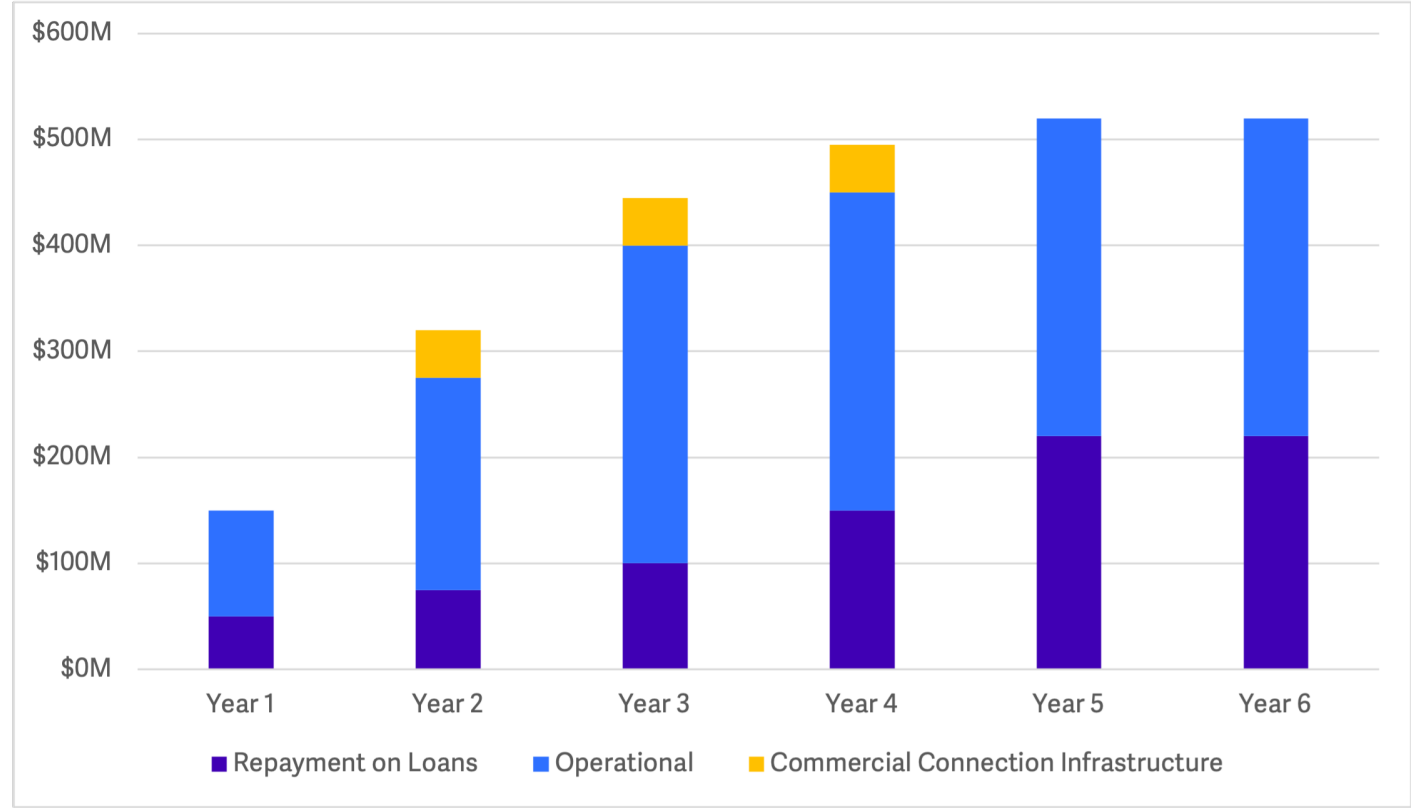
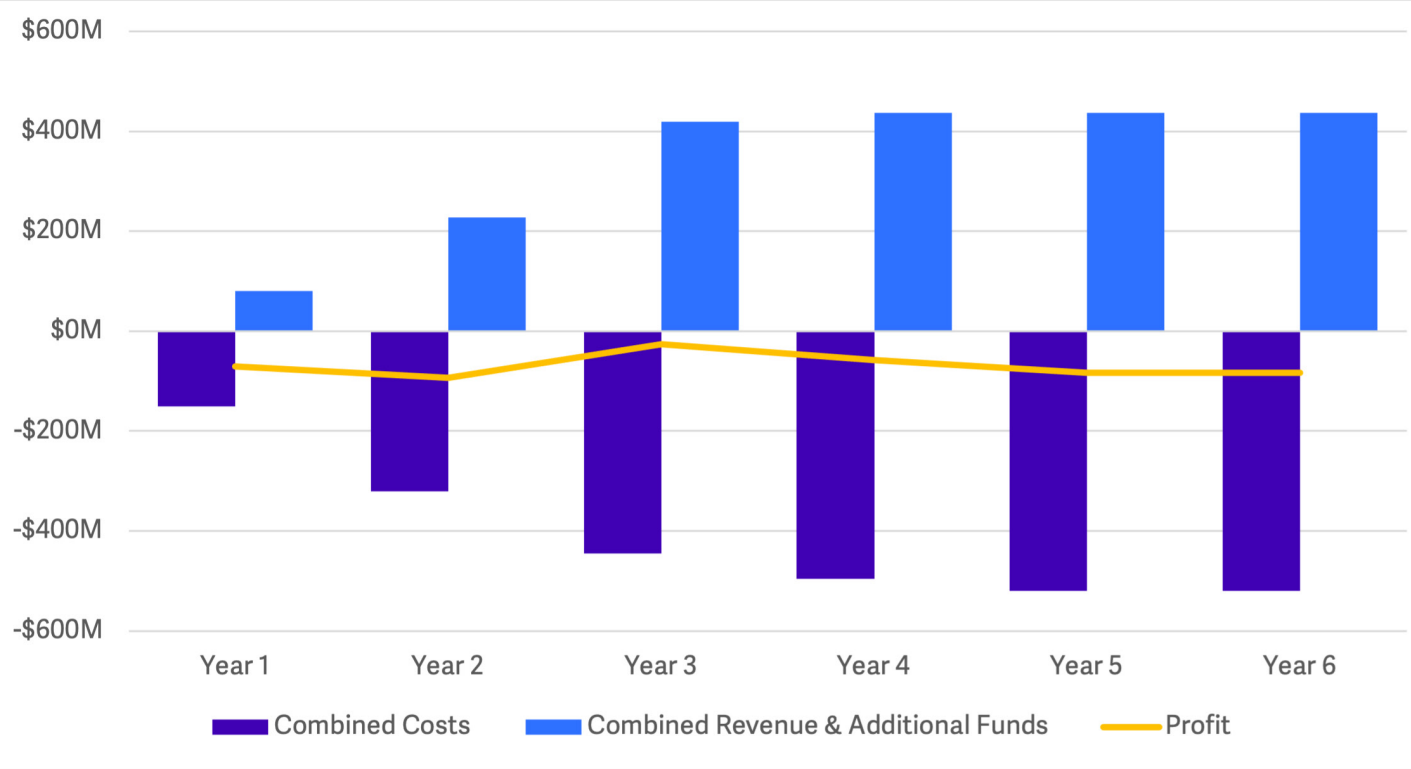


FIGURE 7.2: Projected Profits



yearly repayment costs by around \$33 million. \$500 million in federal funding would decrease yearly repayment costs by around \$16.5 million. The FCC has stood up programs like the \$50 Emergency Broadband Benefit,¹²⁶ and is extending broadband subsidies beyond school and library campuses to students struggling with connectivity at home to meet educational needs.¹²⁷ These programs, some of which may extend beyond the current moment can help to offset some of the costs of construction and operations of the network, now and into the future.

STATE TAXES

Taxation of ISP and technology monopolies at the New York State level can help provide a stable source of revenue to build out and operate the municipal network. The largest ISPs have millions of customers in New York State and billions of dollars in intrastate revenues. A modest ongoing tax on ISP intrastate revenues in the range of 3% could potentially bring in at least tens of millions of dollars per year for the NYC municipal network and other networks across the state.¹²⁸ A tax on the intrastate digital advertising revenues of large technology companies could also raise funds for municipal networks across the state.¹²⁹ Not only do monopolistic technology companies like Facebook, Google and Amazon rely on end-user internet connectivity to harvest user data to deliver ads that make them massive profits, but in many cases, the same big tech companies also provide internet access, for example, the LinkNYC kiosks owned by Google, Facebook's Connectivity group, and Amazon's Sidewalk.¹³⁰

LEASING

Upon completion of the network, the City will own a massive amount of excess fiber and other infrastructure that it can lease or provide for free or low cost to other service providers to help offset some of the build-out and operational costs. Ideally, other municipal service providers or non-profit community-based organizations that provide cable, telephone, IoT, or other internet connected or infrastructure reliant services would be able to leverage the City's assets to bring additional free or low-cost services to end-users.

SAVINGS

While the City spends funds on construction and operations it will also be saving money that it is otherwise spending on communications infrastructure and services with private entities. These costs are widespread and significant.¹³¹ But they wouldn't be necessary or would at least be significantly lower with the presence of a municipal network.

APPENDIX A: SUMMARY OF TOOLS TO DRIVE DOWN NETWORK COSTS

A summary of legislation and enforcement actions that the municipal network can pursue to drive down costs.

LOCAL ACTION

1. Empire City Subway

- Forcing ECS to comply with its franchise agreement meaning it is responsible for installing clean conduit in all Manhattan and Bronx rights of way and extending the conduit all the way to private property lines.

2. Passage of local legislation

- Requiring buildings to have entrance conduit or alternative suitable pathways connecting the building with the public right of way.
- Prohibition on all forms of exclusivity deals and delay tactics for installs from landlords and ISPs for the municipal network, and requiring buildings make in-building pathways and wiring available for the municipal network to utilize.

3. Franchise Agreements

- The City should seriously consider taking on the fight of not renewing the holdover Cable Franchise Agreements with Spectrum and Altice (and Verizon in 2023). But if it does move for renewal than it needs to demand open access infrastructure, in-kind fiber, conduit and other infrastructure with no strings attached, stringent labor protections, high performance standards on speed, price and privacy controls.¹³² And other consumer protections need to become more stringent, not less like in

ENDNOTES

1. NYC Internet Master Plan, Page 46. (<https://www1.nyc.gov/assets/cto/#/project/internet-master-plan>)
2. About 30 percent of Hispanic and Black New Yorkers lack broadband internet access compared to 20 percent of White New Yorkers and 22 percent of Asian residents. New York City Comptroller, "Census and The City: Overcoming NYC's Digital Divide in the 2020 Census," July 23, 2019. (<https://comptroller.nyc.gov/newsroom/comptroller-stringer-as-census-moves-online-new-york-citys-digital-divide-threatens-to-help-trump-undercount-communities-of-color/>)
3. Becky Chao, Claire Park, "Cost of Connectivity 2020," New America, July 15, 2020, Page 4. (<https://www.newamerica.org/oti/reports/cost-connectivity-2020/focus-on-the-united-states>)
4. Citizens Committee for Children of New York, "New York City's Digital Divide," April 24, 2020. (<https://s3.amazonaws.com/media.cccnewyork.org/2021/01/CCC-COVID-19-Series-NYC-Digital-Divide-Child-Well-being.docx.pdf>); Rachel Vick, "For 484,000 NYC seniors, digital divide complicates vaccine access," Queens Daily Eagle, January 22, 2021. (<https://queenseagle.com/all/for-484000-nyc-seniors-digital-divide-complicates-vaccine-access>); New York City Bar Association, "Close the Digital Divide!" October 26, 2020. (<https://www.nycbar.org/media-listing/media/detail/nyc-digital-divide-lack-of-internet-access-in-shelters>)
5. NYC Open Data: Adoption and Infrastructure Data by Neighborhood. <https://data.cityofnewyork.us/City-Government/Internet-Master-Plan-Adoption-and-Infrastructure-D/fg5j-q5nk>
6. The Federal Communications Commission's current definition of "broadband" internet is 25 Mbps download speed and 3Mbps upload speed — a low standard that was set over the objections of most internet companies. Consensus among experts is the United States should raise that standard to at least 100 Mbps for download and upload speeds, if not higher. STATEMENT OF FCC COMMISSIONER JESSICA ROSENWORCEL: <https://docs.fcc.gov/public/attachments/FCC-19-102A4.pdf>; Makena Kelly, "Senators call on FCC to quadruple base high-speed internet speeds," The Verge, March 4, 2021. (<https://www.theverge.com/2021/3/4/22312065/fcc-highspeed-broadband-service-ajit-pai-bennet-angus-king-rob-portman>)
7. EU plans to have 1000 Mbps in every home by 2025: <https://ec.europa.eu/digital-single-market/en/broadband-strategy-policy>; Zoey Chong, "South Korea gets super-duper fast internet," CNET, May 10, 2018. (<https://www.cnet.com/home/internet/south-korea-gets-super-duper-fast-internet/>); Niall McCarthy, "The U.S. Cities With The Fastest & Slowest Internet Speeds," Forbes, December, 17, 2018 (<https://www.forbes.com/sites/niallmccarthy/2018/12/17/the-u-s-cities-with-the-fastest-slowest-internet-speeds-infographic/?sh=5b69bc892ec4>); Canada defines broadband as 50 Mbps: <https://crtc.gc.ca/eng/internet/performance.htm>.
8. Becky Chao, Claire Park, "Cost of Connectivity 2020," New America, July 15, 2020, Page 6. (<https://www.newamerica.org/oti/reports/cost-connectivity-2020/focus-on-the-united-states>)
9. Measurement Lab, United States Dashboard, New York State Counties, Data collected: December 30, 2019-October 11, 2020. (https://datastudio.google.com/reporting/1djtGEUqV4Qwrj26GQTN_xzp3rsMYycmv?s=rzD5rHYkLT4) (<https://www.measurementlab.net/blog/mlab-data-policy-advocacy/>).
10. The reluctance of ISPs to compete is oftentimes executed in collaboration with landlords who profit off exclusive deals with specific ISPs. Susan Crawford, "The New Payola: Deals Landlords Cut with Internet Providers," Wired, June 27, 2016. (<https://www.wired.com/2016/06/the-new-payola-deals-landlords-cut-with-internet-providers/>)
11. New York City Cable Television Franchise Agreements: <https://www1.nyc.gov/site/doitt/business/cable-tv-franchises.page>. Spectrum's franchise is a legacy of the Time Warner franchise (past agreements in 2006, 1998) whom it merged with in 2016, while

Altice' franchise is a legacy of the Cablevision franchise (past agreements in 2006, 1998) that it purchased in 2016. The Verizon franchise was initially granted in 2008. NYC's Fourth largest ISP RCN is available in approximately 14% of the City. NYC Internet Master Plan, Page 15. Due to its significantly smaller size it will not be directly addressed in this report.

12. Bennett Cyphers, "The Case for Fiber to the Home, Today: Why Fiber is a Superior Medium for 21st Century Broadband," EFF, October 16, 2019. (<https://www.eff.org/wp/case-fiber-home-today-why-fiber-superior-medium-21st-century-broadband#fn40>)

13. Id. The speeds offered by each of the major NYC ISPs is listed in section D, ISP Details.

14. Jon Brodtkin, "Verizon wiring up 500K homes with FiOS to settle years-long fight with NYC," Ars Technica, November 30, 2020. (<https://arstechnica.com/tech-policy/2020/11/verizon-wiring-up-500k-homes-with-fios-to-settle-years-long-fight-with-nyc/>); Claire Atkinson, "Altice wants to expand Cablevision's Internet into NYC," NY Post, November 15, 2015. (<https://nypost.com/2015/11/15/altice-wants-to-expand-cablevisions-internet-into-nyc/>)

15. NYC Internet Master Plan, Page 58. (<https://www1.nyc.gov/assets/cto/#/project/internet-master-plan>); BroadbandNow, Fixed Wireless Overview: <https://broadbandnow.com/Fixed-Wireless>

16. NYC Mayor's Office of the Chief Technology Officer: Universal Solicitation for Broadband: Citywide RFP (<https://www1.nyc.gov/assets/cto/#/project/usb-citywide-rfp>)

17. Ernesto Falcon, "The FCC and States Must Ban Digital Redlining," EFF, January 11, 2021. (<https://www.eff.org/deeplinks/2021/01/fcc-and-states-must-ban-digital-redlining>)

18. Hamza Shaban, "Mayors Blast Verizon For Skipping Poor Neighborhoods, But Company Says It's 'PR Stunt'", BuzzFeed News, October 20, 2015. (<https://www.buzzfeednews.com/article/hamzashaban/mayors-blast-verizon-but-company-says-its-union-stunt>); Cailin Crowe, "NYC sued over homeless shelters' lack of Wi-Fi for students," Smart Cities Dive, January 6, 2021. ([https://www.smartcitiesdive.com/news/nyc-sued-over-](https://www.smartcitiesdive.com/news/nyc-sued-over-homeless-shelters-lack-of-wi-fi-for-students/592872/)

[homeless-shelters-lack-of-wi-fi-for-students/592872/](https://www.smartcitiesdive.com/news/nyc-sued-over-homeless-shelters-lack-of-wi-fi-for-students/592872/))

19. Jameson Zimmer, "HOW COVID-19 IMPACTED INTERNET SPEED IN NYC BY NEIGHBORHOOD", Untapped New York. (<https://untappedcities.com/2021/02/17/nyc-internet-speed-by-neighborhood/>)

20. NYC Open Data: Adoption and Infrastructure Data by Neighborhood. Compare: Home Broadband Adoption Rate; Percentage of Blocks with ISP Reported Speed Availability of >=900 Mbps; Percentage of Blocks without a Commercial Fiber Provider; Estimated Lifeline Eligible Households. (<https://data.cityofnewyork.us/City-Government/Internet-Master-Plan-Adoption-and-Infrastructure-D/fg5j-q5nk>)

21. Mike Conlow, "Congress Thinks New FCC Maps Will Fix the Digital Divide. But We Need Much More." Slate, April 6, 2021. (<https://slate.com/technology/2021/04/fcc-new-broadband-service-maps-homework-gap.html>)

22. New York City Central Labor Council, "LOCAL 3 RALLIES TO PROTECT PENSIONS AND BENEFITS OF STRIKING CABLE WORKERS", May 19, 2017. (<https://www.nycclc.org/news/2017-05/local-3-rallies-protect-pensions-and-benefits-striking-cable-workers>)

23. Market Capitalization in May 2021: Verizon: \$243 Billion; Charter/Spectrum: \$134 Billion; Altice: \$17 Billion (source: Yahoo Finance)

24. Tony Romm, "Lacking a Lifeline: How a federal effort to help low-income Americans pay their phone bills failed amid the pandemic," Washington Post, February 9, 2021 (<https://www.washingtonpost.com/technology/2021/02/09/lifeline-broadband-internet-fcc-coronavirus/>); Francine McKenna, "With deferred liabilities, Verizon will get earnings benefit from tax bill," MarketWatch, January 23, 2018. (<https://www.marketwatch.com/story/with-deferred-liabilities-verizon-will-get-earnings-benefit-from-tax-bill-2018-01-22>); New York City Office of the City Clerk, NYC Lobbyist Search: <https://bmp.nyc.gov/lobbyist/search> (search Verizon, Charter); New York State Joint Commission on Ethics Lobbyist Search: <https://webapps.jcope.ny.gov/public/> (search Verizon, Charter).

25. FiOS penetration rate has been reported at over 40% of households where service is available which would be over 1.1 million customers in NYC.

Sean Buckley, "Verizon Fios broadband reaches 40% penetration mark," Fierce Telecom, February 27, 2018. (<https://www.fiercetelecom.com/telecom/verizon-fios-broadband-reaches-40-penetration-mark>); Jon Brodtkin, "Verizon wiring up 500K homes with FiOS to settle years-long fight with NYC," Ars Technica, November 30, 2020. (<https://arstechnica.com/tech-policy/2020/11/verizon-wiring-up-500k-homes-with-fios-to-settle-years-long-fight-with-nyc/>)

26. NYC Internet Master Plan, Page 15. Altice penetration rate is reported at over 50% which would be over 500,000 customers in NYC. Mike Farrell, "Altice USA: We're Still on the Hunt," Multichannel News, November 9, 2020. (<https://www.nexttv.com/features/altice-usa-were-still-on-the-hunt>)

27. NYC Internet Master Plan, Page 15. Total number of customers in NYC has been estimated at over 1.5 million: Teke Wiggin, "New York City Has 'a Once-in-a-Lifetime Opportunity' to Create an Internet for All," The Nation, August 20, 2018. (<https://www.thenation.com/article/archive/new-york-city-has-a-once-in-a-lifetime-opportunity-to-create-an-internet-for-all/>)

28. New York State Attorney General, Investigation of Altice, December 21, 2018. (<https://acaconnects.org/wp-content/uploads/2019/01/Dec.-21-2018-Altice-Executed-AOD.pdf>)

29. BroadbandNow, Spectrum Coverage Map. (<https://broadbandnow.com/Charter-Communications>)

30. BroadbandNow, Broadband Maps: Coverage and Availability. (<https://broadbandnow.com/custom-maps>) (search Verizon FiOS)

31. FCC mapping data is flawed and the actual Verizon fiber coverage figures in the boroughs may be lower. See e.g., Mike Conlow, "Congress Thinks New FCC Maps Will Fix the Digital Divide. But We Need Much More." Slate, April 6, 2021. (<https://slate.com/technology/2021/04/fcc-new-broadband-service-maps-homework-gap.html>)

32. BroadbandNow, Broadband Maps: Coverage and Availability (<https://broadbandnow.com/custom-maps>) (search Altice)

33. FCC mapping data is flawed and the actual Altice fiber coverage figures in the boroughs may be

lower. See e.g., Mike Conlow, "Congress Thinks New FCC Maps Will Fix the Digital Divide. But We Need Much More." Slate, April 6, 2021. (<https://slate.com/technology/2021/04/fcc-new-broadband-service-maps-homework-gap.html>)

34. BroadbandNow, Broadband Maps: Coverage and Availability. (<https://broadbandnow.com/custom-maps>) (search Spectrum)

35. FCC mapping data is flawed and the actual Spectrum fiber coverage figures in the boroughs may be lower. See e.g., Mike Conlow, "Congress Thinks New FCC Maps Will Fix the Digital Divide. But We Need Much More." Slate, April 6, 2021. (<https://slate.com/technology/2021/04/fcc-new-broadband-service-maps-homework-gap.html>)

36. Customers must meet the requirements of the Lifeline program to qualify for the Verizon low cost offering: <https://www.verizon.com/info/low-income-internet/>. Lifeline Eligibility: <https://www.lifelinesupport.org/do-i-qualify/>

37. Customers must meet the requirements laid out by Altice to qualify for the low cost offering: <https://www.alticeadvantageinternet.com/>

38. Customers must meet the requirements laid out by Spectrum to qualify for the low cost offering: <https://www.spectrum.com/internet/spectrum-internet-assist>

39. New York City Comptroller, Audit On The Payment By Empire City Subway Of License Fees Due The City And Compliance With Certain Provisions Of Its License Agreement," June 6, 2010. (<https://comptroller.nyc.gov/reports/audit-on-the-payment-by-empire-city-subway-of-license-fees-due-the-city-and-compliance-with-certain-provisions-of-its-license-agreement/>)

40. Michael Pollack, "Questions on Telephone Poles and Subway Globes," New York Times, August 8, 2014. (<https://www.nytimes.com/2014/08/10/nyregion/questions-on-telephone-poles-and-subway-globes.html>)

41. New York City Special Initiative for Rebuilding and Resiliency, "A Stronger, More Resilient New York: Telecommunications," June 11, 2013, Page 4. (https://www1.nyc.gov/assets/sirr/downloads/pdf/Ch_9_Telecommunications_FINAL_singles.pdf)

42. Optimum Service Protection Program: <https://www.optimum.net/pages/service/protection-plan.html>
43. Jen Chung, "'What's Disgusting? Union Busting!' Verizon Workers Strike In Midtown," Gothamist, April 13, 2016. (<https://gothamist.com/news/whats-disgusting-union-busting-verizon-workers-strike-in-midtown>)
44. M.L. Nestel, "Inside Cablevision's War With Big Labor," The Daily Beast, June 23, 2015. (<https://www.thedailybeast.com/inside-cablevisions-war-with-big-labor>)
45. Mike Farrell, Altice USA Creating Tech Services Spinoff," Multichannel News, December 19, 2016. (<https://www.nexttv.com/news/altice-usa-creating-tech-services-spinoff-409757>)
46. Hamilton Nolan, "The Longest Strike in America Needs a Political Savior," In These Times, February 13, 2020. (<https://inthesetimes.com/article/spectrum-strike-labor-workers-new-york-picket-line>)
47. Jon Brodtkin, "Verizon refuses to give DSL users its low-income deals during pandemic," Ars Technica, April 7, 2020. (<https://arstechnica.com/tech-policy/2020/04/verizon-refuses-to-give-dsl-users-its-low-income-deals-during-pandemic/>)
48. Gabriel Sandoval, Brooklyn Cable Guy's Diagnosis Raises Worry Virus Is One House Call Away," The City, March 24, 2020. (<https://www.thecity.nyc/work/2020/3/24/21210414/brooklyn-cable-guy-s-diagnosis-raises-worry-virus-is-one-house-call-away>)
49. Reema Amin, "Cable Companies Relent After Pulling Internet Plug on Some Students," The City, March 27, 2020. (<https://www.thecity.nyc/2020/3/27/21210396/cable-companies-relent-after-pulling-internet-plug-on-some-students>)
50. Amber Jamieson, "Cable Repair Technicians Don't Want To Get Infected, Or Infect You, With The Coronavirus," BuzzFeed News, March 23, 2020. (<https://www.buzzfeednews.com/article/amberjamieson/coronavirus-cable-guys-repair-spectrum>); Rachel Abrams, "Spectrum Employees Are Getting Sick Amid Debate Over Working From Home," New York Times, April 21, 2020. (<https://www.nytimes.com/2020/04/21/business/spectrum-employees-coronavirus.html>)
51. Reema Amin, "Cable Companies Relent After Pulling Internet Plug on Some Students," The City, March 27, 2020. (<https://www.thecity.nyc/2020/3/27/21210396/cable-companies-relent-after-pulling-internet-plug-on-some-students>)
52. Jon Brodtkin, "Verizon wiring up 500K homes with FiOS to settle years-long fight with NYC," Ars Technica, November 30, 2020. (<https://arstechnica.com/tech-policy/2020/11/verizon-wiring-up-500k-homes-with-fios-to-settle-years-long-fight-with-nyc/>).
53. Claire Atkinson, "Altice wants to expand Cablevision's Internet into NYC," NY Post, November 15, 2015. (<https://nypost.com/2015/11/15/altice-wants-to-expand-cablevisions-internet-into-nyc/>)
54. Jon Brodtkin, "Charter avoids getting kicked out of New York, agrees to new merger conditions," Ars Technica, April 22, 2019. (<https://arstechnica.com/tech-policy/2019/04/charter-avoids-getting-kicked-out-of-new-york-agrees-to-new-merger-conditions/>)
55. Khadeeja Safdar, "On Hold for 45 Minutes? It Might Be Your Secret Customer Score," Wall Street Journal, November 1, 2018. (<https://www.wsj.com/articles/on-hold-for-45-minutes-it-might-be-your-secret-customer-score-1541084656>)
56. JD Power, "TV and Internet Providers Hold Strong with Performance and Reliability, J.D. Power Finds," September 24, 2020. (<https://www.jdpower.com/business/press-releases/2020-us-residential-wireline-satisfaction-studies>)
57. Danika Miller, "Spectrum TV Review", Reviews.com, November 19, 2020. (<https://www.reviews.com/utilities/tv-providers/charterspectrum-review/>)
58. NYC Department of Information Technology and Telecommunications, Cable Report Cards. (<https://www1.nyc.gov/site/doitt/residents/cable-report-cards.page>)
59. Jay Peters, "Verizon says Fios internet should be returning to normal in the Northeast after disruptive outage," The Verge, January 26, 2021. (<https://www.theverge.com/2021/1/26/22250571/verizon-fios-outage-problem-issue-east-coast-google-zoom>)
60. NYC Department of Information Technology and Telecommunications, Cable Report Cards. (<https://www1.nyc.gov/site/doitt/residents/cable-report-cards>)

[page](#));

61. NYC Department of Information Technology and Telecommunications, Cable Report Cards. (<https://www1.nyc.gov/site/doitt/residents/cable-report-cards.page>)

62. Optimum Service Protection Program: <https://www.optimum.net/pages/service/protection-plan.html>

63. Aaron Pressman, "Verizon Paying \$17 Million In FCC Fraud Case, But Could Have Been Docked Much More," Yahoo Finance, October 19, 2017. (<https://finance.yahoo.com/news/verizon-paying-17-million-fcc-190753730.html>).

64. Michael Gartland, "Cable company Altice overcharged customers, city alleges," New York Daily News, August 11, 2019. (<https://www.nydailynews.com/new-york/ny-metro-altice-agreement-overcharge-20190811-6tt2g57sx5gixd5isfayqwwhbi-story.html>)

65. New York State Attorney General, Investigation of Altice, December 21, 2018. (<https://acaconnects.org/wp-content/uploads/2019/01/Dec.-21-2018-Altice-Executed-AOD.pdf>)

66. Chaim Gartenberg, "Charter-Spectrum reaches \$174.2 million settlement in New York AG's speed fraud lawsuit," The Verge, December 18, 2018. (<https://www.theverge.com/2018/12/18/18146210/charter-spectrum-174-million-settlement-new-york-state-attorney-general-internet-speeds>)

67. Bennett Cyphers, "The Case for Fiber to the Home, Today: Why Fiber is a Superior Medium for 21st Century Broadband," EFF, October 16, 2019. (<https://www.eff.org/wp/case-fiber-home-today-why-fiber-superior-medium-21st-century-broadband#fn40>)

68. See e.g., Stealth Communications and Pilot Fiber rate cards: <https://stealth.net/services/internet/dedicated>; <https://www.pilotfiber.com/>

69. Geoffrey Fowler, "The government has a program to cut your Internet bill. Verizon was using it to force you onto a new data plan," Washington Post, May 21, 2021 (<https://www.washingtonpost.com/technology/2021/05/17/verizon-emergency-broadband-benefit/>); Reema Amin, "Cable Companies Relent After Pulling Internet Plug on Some Students," The City, March 27, 2020. (<https://www.thecity.nyc/2020/3/27/21210396/cable-companies-relent-after-pulling-internet-plug-on-some-students>)

nyc/2020/3/27/21210396/cable-companies-relent-after-pulling-internet-plug-on-some-students)

70. Jon Brodtkin, "AT&T whines about Calif. net neutrality law as ISPs' case appears doomed," Ars Technica, March 17, 2021. (<https://arstechnica.com/tech-policy/2021/03/att-whines-about-calif-net-neutrality-law-as-isps-case-appears-doomed/>)

71. Makena Kelly, "Democrats are gearing up to fight for net neutrality," The Verge, March 9, 2021. (<https://www.theverge.com/2021/3/9/22321995/net-neutrality-ed-markey-save-the-internet-open-ajit-pai-rosenworcel>); Casey Lede, "State Net Neutrality Laws May Lead to Federal Legislation," The National Law Review, March 1, 2021. (<https://www.natlawreview.com/article/state-net-neutrality-laws-may-lead-to-federal-legislation>).

72. Jon Brodtkin, "How ISPs can sell your Web history—and how to stop them," Ars Technica, March 24, 2017. (<https://arstechnica.com/information-technology/2017/03/how-isps-can-sell-your-web-history-and-how-to-stop-them/>)

73. Jonathan Stempel, "Altice reaches \$72 million settlement with New York over response to Tropical Storm Isaias," Reuters, March 18, 2021. (<https://www.reuters.com/article/us-new-york-altice-usa-settlement/altice-reaches-72-million-settlement-with-new-york-over-response-to-tropical-storm-isaias-idUSKBN2BA2G9>); Jon Brodtkin, "Verizon agrees to fix failing broadband networks to settle investigation," Ars Technica, March 12, 2018. (<https://arstechnica.com/information-technology/2018/03/verizon-agrees-to-fix-failing-broadband-networks-to-settle-investigation/>); Anton Troianovski, "A Look inside Verizon's Flooded Communications Hub," Wall Street Journal, November 1, 2012. (<https://www.wsj.com/articles/SB10001424052970204707104578091171538491386>)

74. See e.g., Altice explores selling off an NYC fiber unit to "repurchase shares or pay down debt." Gillian Tan, Gerry Smith, "Altice's Talks for Lightpath Stake Sale Collapse," Bloomberg Quint, August 8, 2019. (<https://www.bloombergquint.com/business/altice-usa-stonepeak-talks-for-lightpath-stake-said-to-collapse>)

75. Kate Murphy, "Why Tech Support Is (Purposely) Unbearable," New York Times, July 3, 2016. (<https://www.nytimes.com/2016/07/04/technology/why-tech->

support-is-purposely-unbearable.html)

76. Reema Amin and Shumita Basu, "For NYC students learning English, remote learning can come with steep barriers," Chalkbeat, April 20, 2020. (<https://ny.chalkbeat.org/2020/4/20/21230497/for-nyc-students-learning-english-remote-learning-can-come-with-steep-barriers>)

77. NYC Mayor's Office of the Chief Technology Officer, "Truth in Broadband: Access and Connectivity in New York City," April 2018, Page 15. (<https://tech.cityofnewyork.us/wp-content/uploads/2018/04/NYC-Connected-Broadband-Report-2018.pdf>)

78. New York City Comptroller, "CONSTRUCTION WORKER PREVAILING WAGE SCHEDULE," January 25, 2021, Page 90-91. (<https://comptroller.nyc.gov/wp-content/uploads/documents/ConstructionWorkerSchedule-2020-2021.pdf>)

79. Communications Workers of America, Local 1101, "Verizon NY Plant Wage Schedule," June 21, 2020, Page 8. (https://local1101.org/system/files/cba_164_cwa_district_1_ny_plant.pdf)

80. The New York City Employees' Retirement System (NYCERS) is a defined benefit retirement plan for public sector employees that offers benefits which are defined in law: <https://www.nycers.org/>

81. Compare the employee contributions, deductibles and copays of the City's largest municipal union DC 37 (as a proxy for the municipal network), with those of Spectrum and Verizon. DC 37: <https://www1.nyc.gov/assets/olr/downloads/pdf/health/employee-rates-march2021.pdf>; <https://www1.nyc.gov/assets/olr/downloads/pdf/health/sbc-dc37-medteam-2020-2021.pdf>; Spectrum (2018): https://cache.hacontent.com/ybr/R515/03843_ybr_ybrfndt/downloads/LearnAboutBenefitSummary.pdf; Verizon: https://local1101.org/system/files/cwa_nyne-verizon_mou-final-signed_2018_0.pdf

82. George Ford, "Does Municipal Supply of Communications Crowd-Out Private Communications Investment? An Empirical Study." Applied Economic Studies, February 2005. (<http://www.aestudies.com/library/crowdout.pdf>); Christopher Alex Hooton, "Testing the economics of the net neutrality debate,"

Telecommunications Policy, September 9, 2019.

83. NYC Mayor's Office, "Mayor de Blasio Holds Verizon Accountable to Connect Half a Million New York City Households to Broadband," November 24, 2020. (<https://www1.nyc.gov/office-of-the-mayor/news/807-20/mayor-de-blasio-holds-verizon-accountable-connect-half-million-new-york-city-households-to>)

84. NYC Internet Master Plan, Page 14: estimated economic impact of universal broadband is 165,000 new jobs, up to a \$49 billion increase in personal income, and up to \$142 billion in incremental Gross City Product by 2045.

85. E.g., DOE: Department of Education and the School Construction Authority, Report of the Finance Division on the Fiscal 2019 Preliminary Capital Budget, March 26, 2018, Pages 27-29. (<https://council.nyc.gov/budget/wp-content/uploads/sites/54/2018/03/FY19-Department-of-Education-and-the-School-Construction-Authority.pdf>); Susan Edelman, DOE's \$269M iPad deal for remote learning is a 'waste of money,' says lawmaker," NY Post, April 25, 2020. (<https://nypost.com/2020/04/25/nyc-spends-269-million-on-ipads-for-students-amid-coronavirus-lockdown/>); Jessica Gould, "What It Will Take To Bring Strong Internet Service To Every NYC Student," Gothamist, May 13, 2021 (<https://gothamist.com/news/what-it-will-take-bring-strong-internet-service-every-nyc-student>); Hospitals: NYC Health and Hospitals, Information Technology Committee, January 14, 2016. (<https://www.nychealthandhospitals.org/wp-content/uploads/2016/07/201601-it.pdf>); Shelters: Andy Newman, "How the 3 Diallo Sisters Were Finally Able to Connect to Their Classes," New York Times, January 25, 2021. (<https://www.nytimes.com/2021/01/25/nyregion/wifi-home-shelters.htm>)

86. Total City spending 2010-present on contracts with Verizon, Charter/TWC, Altice/Cablevision, Crown Castle/Lightower, AT&T, others. Checkbook NYC. (https://www.checkbooknyc.com/spending_landing/yeartype/B/year/122)

87. Matthew Flamm, "Crossed Wires: Untangling NYC's broadband underground," Crain's New York, April 7, 2014. (<https://www.craigslistnewyork.com/article/20140407/TECHNOLOGY/304069996/crossed-wires-untangling-nyc-s-broadband-underground>);

Dante D’Orazio, INTO THE VAULT: THE OPERATION TO RESCUE MANHATTAN’S DROWNED INTERNET, The Verge, November 17, 2012. (<https://www.theverge.com/2012/11/17/3655442/restoring-verizon-service-manhattan-hurricane-sandy>); Tracy Samuelson, “After Sandy, Questions Linger Over Cellphone Reliability,” NPR, April 29, 2013 (<https://www.npr.org/sections/alltechconsidered/2013/04/29/179243218/after-sandy-questions-linger-over-cellphone-reliability>)

88. Kevin Lozano, “Can the Internet Survive Climate Change?” <https://newrepublic.com/article/155993/can-internet-survive-climate-change>, The New Republic, December 18, 2019 (<https://newrepublic.com/article/155993/can-internet-survive-climate-change>)

89. Ramakrishnan Durairajan, Carol Barford, Paul Barford, “Lights Out: Climate Change Risk to Internet Infrastructure,” ANRW ‘18: Proceedings of the Applied Networking Research Workshop, July 2018 (<https://ix.cs.uoregon.edu/~ram/papers/ANRW-2018.pdf>)

90. Becky Chao, Claire Park, “Cost of Connectivity 2020,” New America, July 15, 2020, Page 6. (<https://www.newamerica.org/oti/reports/cost-connectivity-2020/focus-on-the-united-states>)

91. The networks are made up of: (1) City owned infrastructure that may be leveraged to launch a municipal network after accounting for any technical or capacity limitations; (2) leased infrastructure that may be leveraged to launch a municipal network after accounting for any technical, capacity or contractual limitations; (3) free infrastructure (“INET”) from cable franchise agreements with Verizon, Spectrum, Altice that may not be possible to use to launch a municipal network due to restricted use for “noncommercial purposes of the City and for no other purpose” (Cable Franchise Agreements, Appendix D). These restrictions do not apply to in-kind fiber provided under the “information services” franchises and “mobile subway stations” franchise that the City owns and may leverage for a municipal broadband network (Appendix B in both). Infrastructure that has been “piggybacked” onto INET, e.g., ancillary fiber leased or purchased on top of and integrated with INET may not be subject to the same restrictions as INET itself. See e.g., Letter from DoITT to FCC re: INET. July 25, 2019. (https://ecfsapi.fcc.gov/file/107250624929019/Letter%20of%20Opposition_

[To%20FCC_Notice%20of%20Ex%20Parte_In%20Kind%20Services_7.24.19.pdf](https://ecfsapi.fcc.gov/file/107250624929019/Letter%20of%20Opposition_To%20FCC_Notice%20of%20Ex%20Parte_In%20Kind%20Services_7.24.19.pdf))

92. Operates CityNet, the City of New York’s institutional fiber network, that interconnects hundreds of City agencies and entities throughout the five boroughs: <https://www1.nyc.gov/site/doitt/agencies/citynet.page>

93. DOE’s Next Generation Network provides bandwidth to support 1800+ schools in all five boroughs. Department of Education and the School Construction Authority, Five Year Capital Plan 2020-2024, February 2021, Pages 38-41,

94. NYC Health and Hospitals, Information Technology Committee, January 14, 2016. (<https://www.nychealthandhospitals.org/wp-content/uploads/2016/07/201601-it.pdf>)

95. In the process of connecting 218 fire houses, 35 EMS stations and up to 40 support facilities to a fiber network. Report of the Finance Division on the Fiscal 2021 Preliminary Plan, Fire Department of New York, March 3, 2020, Page 29. (<https://council.nyc.gov/budget/wp-content/uploads/sites/54/2020/02/057-FDNY.pdf>)

96. 241+ facilities in all five boroughs connected to 750 mile proprietary fiber network. Susan Crawford and Laura Adler, “Culture Change and Digital Technology: The NYPD Under Commissioner William Bratton, 2014-2016,” Berkman Klein Center Research Publication No. 2016-13, September 12, 2016. Page 23. (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2839004); NYPD, “Developing the NYPD’s

97. Open Data: Universal Solicitation for Broadband Asset Dataset. (<https://data.cityofnewyork.us/City-Government/Universal-Solicitation-for-Broadband-Asset-Dataset/2bsr-c6qq>)

98. The number of NYCHA buildings that are fiber connected and have fiber pathways is set to grow dramatically through the City’s litigation settlement with Verizon, and the recently issued RFP and RFEI . Nolan Hicks and Natalie Musumeci, “NYC gets Verizon to expand Fios broadband to 500K more households,” NY Post, November 24, 2020. (<https://nypost.com/2020/11/24/nyc-gets-verizon-to-expand-fios->

broadband-to-500k-households/); New York City, "New York City Announces Free and Low-Cost Broadband Access for 13 NYCHA Developments, Serving Up to 30,000 Residents," May 6, 2021 (<https://www1.nyc.gov/office-of-the-mayor/news/338-21/recovery-all-us-new-york-city-free-low-cost-broadband-access-13-nycha>)

99. Connected facilities span the New York Public Library, Brooklyn Public Library and Queens Public Library.

100. NYC Department of Transportation, Infrastructure, (<https://www1.nyc.gov/html/dot/html/infrastructure/infrastructure.shtml>)

101. NYC Universal Solicitation for Broadband RFP, "Workstream" 1 and 3. (<https://www1.nyc.gov/site/sbs/about/rfp-80121p0001-broadband.page>)

102. NYSERNet is a non-profit that supports research and educational organizations with affordable data and networking solutions: <https://www.nysernet.org/about-us/member-institutions/>

103. City University of New York, Computing and Information Services: <https://www.cuny.edu/about/administration/offices/cis/core-functions/>

104. Verizon and Con Ed own most utility poles in Queens, Brooklyn, Staten Island and the Bronx. Michael Pollack, "Questions on Telephone Poles and Subway Globes," New York Times, August 8, 2014. (<https://www.nytimes.com/2014/08/10/nyregion/questions-on-telephone-poles-and-subway-globes.html>)

105. Verizon, Con Ed, Spectrum and Optimum own most of the conduit in Brooklyn, Queens and Staten Island. New York City Special Initiative for Rebuilding and Resiliency, "A Stronger, More Resilient New York: Telecommunications," June 11, 2013, Page 4. (https://www1.nyc.gov/assets/sirr/downloads/pdf/Ch_9_Telecommunications_FINAL_singles.pdf); Con Edison, For Telecom Partners Information Page: <https://www.coned.com/en/business-partners/telecom-application-management?facettab=89db1009-875f-431f-9dec-0bb1aaf34f90>. Verizon through Empire City Subway owns most conduit in the Bronx and Manhattan.

106. New York City and Empire City Subway Franchise Agreement. Susan Crawford, "I'm Suing New York City to Loosen Verizon's Iron Grip," Wired, June 21, 2017.

(<https://www.wired.com/story/im-suing-new-york-city-to-loosen-verizons-iron-grip/>).

107. Graphic Courtesy of CTC Technology and Energy

108. See Section IV, "Privately Owned Infrastructure"; 47 U.S.C. § 224; NYS Pub Serv L §119-a.

109. CTC Technology and Energy, "A Model for Understanding the Cost to Connect Anchor Institutions with Fiber Optics," February 2018. (https://www.ctcnet.us/wp-content/uploads/2018/08/SHLB_ConnectingAnchors_CostEstimate.pdf) (see comparison of Table 3.5 Metro Underground-Dense Urban—New vs. 3.6 Metro-Underground-Existing Conduit); CTC Technology and Energy, "A Model for Understanding the Cost to Connect Anchor Institutions with Fiber Optics," February 2018. (https://www.ctcnet.us/wp-content/uploads/2018/08/SHLB_ConnectingAnchors_CostEstimate.pdf) (see table 4, New Aerial Construction Cost)

110. Verizon has a variety of tactics to drag out and drive up the time and cost of using conduit in Queens and Brooklyn. Matthew Flamm, "Race is on to bring broadband to outer boroughs," Crain's New York, June 18, 2019. (<https://www.craigslist.com/features/race-bring-broadband-outer-boroughs>); Susan Crawford, Blame Your Lousy Internet on Poles," Wired, August 31, 2016. (<https://www.wired.com/2016/08/blame-your-lousy-internet-on-poles/?redirectURL=https%3A%2F%2Fwww.wired.com%2F2016%2F08%2Fblame-your-lousy-internet-on-poles%2F>)

111. Massachusetts has considered adopting a similar provision: <https://muninetworks.org/sites/www.muninetworks.org/files/An%20Act%20to%20establish%20municipal%20access%20to%20utility%20poles%20located%20in%20municipal%20rights-of-way.pdf>

112. Connecticut Code, Title 16, Chapter 283, Section 16-233.

113. New York City and Empire City Subway Franchise Agreement; ; Susan Crawford, "I'm Suing New York City to Loosen Verizon's Iron Grip," Wired, June 21, 2017. (<https://www.wired.com/story/im-suing-new-york-city-to-loosen-verizons-iron-grip/>)

114. Tyler Cooper, "Apartment Landlords Are Holding Your Internet Hostage," *BroadbandNow*, March 18, 2021. (<https://broadbandnow.com/report/apartment-landlords-holding-internet-hostage/>);

Jon Brodtkin, "NYC: Verizon demands exclusive deals from landlords before installing FiOS," *Ars Technica*, June 25, 2015. (<https://arstechnica.com/information-technology/2015/06/nyc-verizon-demands-exclusive-deals-from-landlords-before-installing-fios/>)

115. Federal Communications Commission, FCCCIRC 1907-04, NOTICE OF PROPOSED RULEMAKING AND DECLARATORY RULING, June 19, 2019, Pages 1-6. (<https://docs.fcc.gov/public/attachments/DOC-358068A1.pdf>); NYS Pub. Serv. L § 228.

116. San Francisco passed a similar local law, and NYC can learn from their experiences: <https://sfgov.legistar.com/View.ashx?M=F&ID=4880107&GUID=B5B52CDA-BF62-47A1-95E1-5F7A2D9F90B9>; Jon Brodtkin, "This is crazy": "FCC kills part of San Francisco's broadband-competition law," *Ars Technica*, July 10, 2019. (<https://arstechnica.com/tech-policy/2019/07/this-is-crazy-fcc-kills-part-of-san-franciscos-broadband-competition-law/>)

117. Estimate of the total number of NYC businesses based on figures provided by the City. New York City, "Small Business First." (<https://www1.nyc.gov/assets/smallbizfirst/downloads/pdf/small-business-first-report.pdf>). While the total number of non-profits in New York City would increase the total number of potential commercial subscribers by over 45,000 for a total of around 265,000, not all small businesses or non-profits operate out of a commercial space so the lower 220,000 figure was assumed as the total number of potential commercial users. Nonprofit New York, "Who is New York City's Nonprofit Sector," February 12, 2020 (<https://www.nonprofitnewyork.org/2020/02/who-is-new-york-citys-nonprofit-sector/>).

118. This is a rough estimate. Some benchmarks used for this figure include fiber the premises studies conducted for other municipalities adjusted for NYCs significantly larger size. See e.g., CTC Technology and Energy, Seattle FTTP Study, June 2015, Page 154. (<https://www.seattle.gov/documents/Departments/Broadband/2016-6SeattleReport-Final.pdf>); CTC Technology and Energy, San Francisco FTTP Study,

October 2017, Page 188. (<https://www.ctcnet.us/wp-content/uploads/2017/10/CTC-Deliverable-22-final-20171017.pdf>)

119. This is the Citywide average for municipal employees. Citizens Budget Commission, "The Cost of a Growing City Workforce," July 10, 2018. (<https://cbcny.org/research/cost-growing-city-workforce>)

120. CTC Technology and Energy, San Francisco FTTP Study, October 2017, Page 89. (<https://www.ctcnet.us/wp-content/uploads/2017/10/CTC-Deliverable-22-final-20171017.pdf>)

121. It is assumed that 50% of households will subscribe to the municipal network given the performance and low cost of service, as compared to the reported 40% penetration rate achieved by FiOS, and the more than 60% penetration rate achieved by other successful municipal networks like Chattanooga, Tennessee. Sean Buckley, "Verizon Fios broadband reaches 40% penetration mark," *Fierce Telecom*, February 27, 2018 (<https://www.fiercetelecom.com/telecom/verizon-fios-broadband-reaches-40-penetration-mark>); Lisa Gonzalez, Subs in Chattanooga Up to 100K," *Community Networks*, October 26, 2018 (<https://muninetworks.org/content/subs-chattanooga-100k>)

122. These estimates are supported by the fact that even under a hypothetical free service eligibility model whereby the total number of households eligible for free internet is doubled on a neighborhood basis, using the City's Lifeline program household eligibility estimates by neighborhood as a baseline, the penetration rate of the remaining households required to pay the \$40 per month subscription fee would still be well under 50% in year's one through three, which aligns with the assumption that sign-ups for the network will significantly skew towards households eligible for free service. NYC Open Data: Adoption and Infrastructure Data by Neighborhood. Compare: Home Broadband Adoption Rate (assuming a 3 year deployment with the lowest access neighborhoods connected first); Total Number of Households; Estimated Lifeline Eligible Households (doubled for each neighborhood under the hypothetical); (<https://data.cityofnewyork.us/City-Government/Internet-Master-Plan-Adoption-and-Infrastructure-D/fg5j-q5nk>)

123. New York City Council, "Note on the Fiscal 2021 Executive Budget for the Committee on Technology," May 29, 2020 (<https://council.nyc.gov/budget/wp-content/uploads/sites/54/2020/05/DolTT-Budget-Note.pdf>)

124. John Hendel, With \$100B internet plan, Biden commits to bring down 'overpriced' broadband bills," Politico, March 31, 2021. (<https://www.politico.com/news/2021/03/31/biden-internet-broadband-bills-478734>); Makena Kelly, "Rep. Jamaal Bowman introduces new bill to lower broadband costs," The Verge, March 16, 2021. (<https://www.theverge.com/2021/3/16/22333877/jamaal-bowman-broadband-internet-hud-subsidy>)

125. White House Press Release, March 31, 2021. (<https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/>)

126. FCC Emergency Broadband Benefit: <https://www.fcc.gov/broadbandbenefit>

127. FCC Emergency Connectivity Fund to Close Homework Gap: <https://www.fcc.gov/document/fcc-launch-717-billion-connectivity-fund-program-0>

128. See e.g., NYS Senate Bill S3184: <https://www.nysenate.gov/legislation/bills/2021/s3184>

129. See e.g., NYS Senate Bill S1124: <https://www.nysenate.gov/legislation/bills/2021/S1124>

130. Dana Rubenstein and Joe Anuta, "City Hall calls Google-backed LinkNYC consortium 'delinquent,'" Politico, March 3, 2020. (<https://www.politico.com/states/new-york/albany/story/2020/03/03/city-hall-calls-google-backed-linknyc-consortium-delinquent-1264966>); Richard Nieva, "Facebook, still on a mission to bring people online, announces Connectivity," CNET, August 10, 2018. (<https://www.cnet.com/news/facebook-still-on-a-mission-to-bring-people-online-announces-connectivity/>); Laurel Wamsley, "Your Amazon Echo Will Share Your Wireless Network With Neighbors, Unless You Opt Out," NPR, June 4, 2021. (<https://www.npr.org/2021/06/02/1002590964/your-amazon-echo-will-share-your-wi-fi-network-with-neighbors-unless-you-opt-out>)

131. See e.g., Section "Benefits for the City in the

Future."

132. Federal law may preempt some of these demands, but the scope of federal preemption on non-cable services isn't clear cut, and with some positive signals from federal regulators on deference to local action, now is the time to fight for more. See e.g., Congressional Research Service, The Cable Franchising Authority of State and Local Governments and the Communications Act, January 3, 2020. (https://www.everycrsreport.com/reports/R46147.html#_Ref26188715)

133. Joshua Breitbart, "What the Verizon Deal Does -- and Doesn't -- Do," Gotham Gazette, May 30, 2008. (<https://www.gothamgazette.com/open-government/3984-what-the-verizon-deal-does-and-doesnt-do>)

134. It's becoming increasingly clear that states and localities can regulate information services: Jon Brodtkin, AT&T whines about Calif. net neutrality law as ISPs' case appears doomed," Ars Technica, March 17, 2021. (<https://arstechnica.com/tech-policy/2021/03/att-whines-about-calif-net-neutrality-law-as-isps-case-appears-doomed/>); Stan Adams, "The D.C. Circuit's opinion in Mozilla v. FCC: What does it mean?," Center for Democracy and Technology, October 24, 2019. (<https://cdt.org/insights/the-d-c-circuits-opinion-in-mozilla-v-fcc-what-does-it-mean/>) 135. New York State Governor, FY 2022 Announcement, April 6, 2021. (<https://www.governor.ny.gov/news/governor-cuomo-announces-highlights-fy-2022-budget-reimagine-rebuild-and-renew-new-york>); NYS Senate Bill 4878B: <https://www.nysenate.gov/legislation/bills/2021/s4878/amendment/b>

136. Citizen's Committee for Children of New York, Keeping Track Online, 2019 Median Incomes Raw Data. (<https://data.cccnewyork.org/data/map/66/median-incomes#66/39/6/107/62/10002/0>)

137. Measurement Lab, United States Dashboard, New York State Zip Codes, Data collected: December 30, 2019-October 11, 2020. (https://datastudio.google.com/reporting/1djtGEuqV4Qwrj26GQTN_xzp3rsMYYcmv?s=rzD5rHYkLT4)

138. NYC Open Data: Adoption and Infrastructure