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# Boston Digital Equity Assessment

## Prepared for the City of Boston
## September 2022

# Executive summary

This study documents the rise of competitive broadband service in Boston; describes steadily increasing City efforts to close gaps in broadband affordability, devices, and skills; characterizes the remaining gaps in these areas as defined by stakeholders and available data; and makes near-term policy recommendations to address these gaps in light of current federal funding opportunities. This report also provides a high-level estimate of the cost of building a third competitive fiber network in the City, in addition to the residential services of Comcast and Verizon.[1]

## Summary of findings

This report presents three major findings:

**High-speed wired broadband is ubiquitously available in Boston, and a new competitive dynamic has emerged with Verizon's Fios service**

Boston is served by two competitive high-speed broadband providers—Comcast cable and Verizon fiber or Fios service—something that was not the case only a few years ago. Boston is an exception among large U.S. cities in getting a fiber provider to compete citywide with the existing cable company.

- Comcast service is effectively ubiquitous in Boston, with the company reporting that all premises are either served or serviceable within seven to 10 days without costs to residents other than in exceptional circumstances.

- Verizon's fiber buildout is in the late stages, with its Fios fiber service now available in 78 percent of the City. The major exceptions are Beacon Hill, the Financial District, and Downtown. In other neighborhoods, the company says individual apartment buildings may not be wired if Verizon could not obtain permission from the building's owner.

- Comcast and Verizon affirmed as part of this engagement that they offer identical services, service quality, and pricing everywhere they serve in Boston. Those offerings top out at 1.2 Gigabits per second (Gbps) download, 35 Megabits per second (Mbps) upload for Comcast and up to 940 Mbps download, 880 Mbps upload for Verizon Fios.

- The cable provider Astound (formerly RCN) and the fixed wireless providers Starry and NetBlazr also provide competition in many areas of the City.

- Mobile services are improving throughout the City, with some residents reportedly using mobile service as their primary service.

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[1] A future phase of this report will provide results of web-based and in-home tests of Comcast's service.

*A report on broadband availability in Boston begins in the [Task 1 report](#).*

## City programs were created and then expanded in recent years to address broadband gaps related to affordability, devices, and skills—but gaps remain

Accessibility of broadband—especially for low-income households in Boston—requires overcoming a range of challenges, including:

- Navigating enrollment for available low-cost programs and subsidies;

- Obtaining and maintaining well-functioning devices;

- Acquiring the skills needed to install, maintain, and effectively use broadband and computers; and

- Managing higher bills after introductory prices expire.

These challenges have led to digital inequities in Boston, as in all other cities. In response, the City has in recent years provided a range of programs and services. When the Covid-19 pandemic triggered a substantial rise in the need for broadband for remote schooling and work, the City greatly expanded these efforts. For example:

- The City launched a [Digital Equity Fund](#) in 2018. Last year it provided $478,900 to 19 Boston nonprofit organizations.

- Using funds from the federal Emergency Connectivity Fund (ECF)[2], created in response to the Covid-19 pandemic, Boston invested

  - $10 million to maintain large-scale distribution of Chromebooks, wireless hotspots (10,000 were distributed for home connectivity), and vouches for wired broadband subscriptions to Comcast's low-cost program, called Internet Essentials, through the Boston Public Schools, and

  - $2.2 million to support the deployment of 3,000 Chromebooks and wireless hotspots (also called wireless home routers) to Boston Housing Authority residents.

- The City funds Tech Goes Home (TGH), a nonprofit that provides training and free laptops to low-income residents including recent immigrants. The City provided $500,000 annually to TGH starting in 2012; in 2016, the City increased this funding to $1 million annually, and in 2022, the City granted TGH an additional $2 million in American Rescue

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[2] [https://www.fcc.gov/emergency-connectivity-fund](https://www.fcc.gov/emergency-connectivity-fund)

Plan Act (ARPA) funding. TGH reports that in the past three years, 11,561 Bostonians have graduated from a TGH program and received 8,186 devices.

- The City created the role of Digital Equity Advocate in 2015 within the Broadband & Cable office of DoIT to provide coordinated programmatic support to entities including the Boston Housing Authority, Boston Public Schools, Age Strong Commission, Boston Public Health Commission, and the Mayor's Office for Immigrant Advancement (MOIA).[3]

Significant gaps remain. Stakeholders interviewed as part of this study said households still face substantial challenges related to broadband affordability, devices, and skills. And national survey data illustrate a subscription and device gap. In data collected by the U.S. Census Bureau's American Community Survey between 2016 and 2020, 19.4 percent of Boston respondents said they did not own any desktop or laptop computer, and 13 percent of households reported lacking either a wired or mobile broadband subscription. This figure implies 35,000 Boston households lack any residential or mobile subscription. In other national surveys, 45 percent of respondents cite the high cost of broadband service and 37 percent cite the high cost of devices as reasons for not subscribing.[4]

The ACS survey data do not capture changes since 2020. Some Boston households counted in the ACS survey numbers as lacking residential or mobile service may be served through programs such as those outlined above. Additionally, the new federal Affordable Connectivity Program (ACP), which provides a $30 monthly subsidy for broadband bills, is now used by 29,192 Boston households.[5] However, CTC estimates that approximately 86,000 Boston households may be eligible based on income alone, though some are likely already be served by other programs and others do not wish to receive service. And stakeholders said many Boston residents face challenges with enrollment, affordability, devices, and skills.

Lastly, in the decade since it launched in Boston, Comcast says its Internet Essentials program (which now provides 100 Mbps download, 10 Mbps upload service to eligible low-income families) had enrolled 27,000 Boston households. This figure refers to all enrollments between 2011 and May 2022. Comcast declined to share the number of subscribers with active enrollments in Internet Essentials, making it difficult to assess the current impact of the program.

Although wired broadband is technically far superior to mobile service, many low-income users will choose free hotspots (which provide connectivity from mobile services) over free higher-

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[3] Mark Racine, CIO at Boston Public Schools, Lydia Agro, community relations at BHA, Commissioner Emily Shea, Age Strong, Yusufi S. Vali, Director, Mayor's Office for Immigrant Advancement, Kurt Mansperger, former CTO at the BPL.

[4] https://www.pewresearch.org/internet/2021/06/03/mobile-technology-and-home-broadband-2021/

[5] Data as of August 1, 2022

speed and more reliable wired connections if given the choice. For example, Tech Goes Home says its learners are 50 times more likely to take a free mobile hotspot than a free signup code for a Comcast Internet Essentials subscription.

Regardless of the connectivity choice, Boston Public Schools has substantial capacity in its hotspot and Internet Essentials subscription efforts to serve people in need. Student families in need of a free hotspot or a free subscription to a 100 Mbps download wired service can still obtain one or the other.

Table 1 presents a sampling of efforts to address Boston's digital divide efforts by the City, broadband providers, and through federal programs.[6]

Table 1: By the numbers: A sampling of major City, provider, and federal subsidy efforts in Boston

| Program or Source | Number | Description/Provider |
|---|---|---|
| Affordable Connectivity Program (ACP) | 29,192[7] | Number of Boston households receiving $30 monthly federal subsidy for household broadband as of August 1 |
| Emergency Connectivity Fund | 13,000 | Number of hotspots & wireless routers with Chromebooks made available by Boston Public Schools, Boston Public Library, and Boston Housing Authority. |
| City-funded Internet Essentials | 3,500 | Available codes (many not yet used) for Comcast Internet Essentials subscriptions offered through Boston Public Schools and Tech Goes Home |
| City-funded student Hotspots (2020-2021) | 10,000 | Number provided by the Boston Public Schools |
| City-funded Hotspots and Tablets (2020-2021) | 6,000 | Number funded through Verizon Smart City partnership |
| Total Internet Essentials (via Comcast, 2011 – 2021) | 27,000 | Historical total number of Internet Essentials subscriptions provided by Comcast since 2011, though the company will not provide current enrollment numbers |
| City-funded devices, connectivity, and training through Tech Goes Home, 2011-2021 | 15,000 | Households funded with these services and devices by Boston's 21st Century Access Fund |

Key observations and takeaways from stakeholders—representing the Boston Public Library, Boston Public Schools, Boston Housing Authority, Age Strong Commission, Mayor's Office for

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[6] Table summary provided by Boston's Broadband and Cable office and various City departments and Comcast.

[7] This number was calculated based on USAC's ACP enrollment and claims tracker which reports ACP enrollment numbers by zip code. To calculate the ACP enrollment for Boston as of August 1, 2022, we added the ACP enrollment for the following zip codes: 02108, 02109, 02110, 02111, 02113, 02114, 02115, 02116, 02118, 02119, 02120, 02121, 02122, 02124, 02125, 02126, 02127, 02128, 02129, 02130, 02131, 02132, 02134, 02135, 02136, 02199, 02210, and 02215.

Immigrant Advancement, Tech Goes Home, and Boston Neighborhood Network—include the following:

- Significant progress has been made but the need for programs of all kinds remains large, with ACP enrollment support emerging as a top need.

- Residents have difficulty signing up for the ACP and other low-cost programs. These challenges include confusion over the process, issues getting the required documents together, language and accessibility barriers, and mistrust and hesitancy based on past interactions with broadband providers.

- Community-based organizations are among the most effective conduits for digital equity initiatives because they have established relationships. This is particularly significant for residents who have limited English ability and those who are older. However, many organizations are constrained by time, staff, and available funds.

- Outreach materials and programs must be offered in multiple languages, and the Mayor's Office for Immigrant Advancement also stressed that these materials must be culturally appropriate.

- Although online versions of classes and enrollment support services are useful, older adults often need digital skills training or reduced-price internet program sign-ups to be offered in person.

- Different personal situations require different connectivity solutions, with mobile hotspots often being the best solution for people having an unstable home situation.

*A report on digital equity barriers, efforts to mitigate them by the City and others, remaining gaps, and recommendations appear in the [Task 2 report](#).*

## Building a new City-owned fiber-to-the-premises (FTTP) network would cost an estimated $825 million to $961 million, depending on the number of households who elect to take service

At the City's request, CTC developed a conceptual, high-level fiber to-the-premises (FTTP) network design and cost model for all of Boston that is aligned with industry best practices and would be able to support a variety of architecture options and business models.

Such an effort would cost an estimated $721.6 million for the backbone and distribution network capable of serving 399,864 passings in Boston, or $1,800 per passing. The cost for the network electronics, subscriber drops, and customer premises equipment (CPE) would vary based on the number of households taking service (the "take-rate"). These network elements are estimated

to cost between $103.3 million and $239.8 million, depending on the take-rate. In total, the overall cost of the network is estimated to be between $824.9 million and $961.4 million, or between $3,430 and $6,880 per subscriber.

This network would be built as a separate network from the existing City fiber, which is leased from private providers and cannot be put to commercial uses by the City. And though substantial federal funds for broadband are now available, as noted below, these funds would not be available for a new citywide municipal fiber network in Boston. The funding streams are intended for unserved or underserved areas, most of them rural; Boston is already universally served according to the definitions in the legislation.

*A report on this fiber design and cost estimate appears in the* [Task 3 report](Task 3 report)*.*

## Summary of recommendations

Recent federal funding streams create significant near-term opportunities to expand broadband enrollment and reduce device and skills gaps through the expansion of a variety of City and nonprofit programs.

The Infrastructure Investment and Jobs Act (IIJA) provides $65 billion for broadband-related projects and cybersecurity grants, including $42.45 billion in Broadband Equity, Access and Deployment (BEAD) grants available to states that apply for grants for deployment, data collection and mapping, provision of affordable broadband to multi-family buildings, and broadband adoption programs.

In addition, the IIJA's Digital Equity Act creates the following new programs:

- State Digital Equity Planning Grant Program ($60 million)

- State Digital Equity Capacity Grant Program ($1.44 billion)

- Digital Equity Competitive Grant Program ($1.25 billion)

The IIJA also allocated $14.2 billion to provide a $30-a-month voucher to low-income residents to pay for internet service (the Affordable Connectivity Program or ACP). Other than the ACP, all monies will be channeled through the states, which must first create plans for making subgrants.

The release of the IIJA's funds by the National Telecommunications and Information Administration (NTIA, the federal agency administering the programs) will mean the City will likely be able to fund digital equity plans by working with the state's Broadband Office—the Massachusetts Broadband Institute (MBI) within the MassTech Collaborative. City officials have already begun to collaborate with that office and the Massachusetts Department of Telecommunications and Cable (MassDTC).

However, as noted above, a citywide municipal fiber buildout would not receive any federal funds, which are intended mainly for rural unserved or underserved areas; Boston is already universally served. Moreover, the addition of Verizon's Fios service means most Boston consumers now enjoy genuine competition among high-speed wired broadband providers. Residents will soon have full access to both Comcast and Verizon, both of which built out citywide. And all of the City's major providers are offering services eligible for the ACP subsidy.

*(A timeline of the City's federal advocacy and outreach on broadband and digital equity and inclusion funding from 2020 to 2022 is provided in Appendix A*: Timeline of federal advocacy and outreach on broadband and digital equity and inclusion by the City of Boston (2020-2022).*)*

With these opportunities in mind, this report makes the following recommendations, provided in Section 0 at the end of the Task 2 report and summarized here:

**Accelerate enrollment efforts in the Affordable Connectivity Program:** The FCC's Affordable Connectivity Program (ACP) can help ensure affordable, reliable internet options for residents. The City has already begun accelerating enrollment efforts, and we concur with this strategy and recommend directing available monies or future state or federal funds to this purpose— especially by leveraging the efforts of community-based organizations (CBO).

**Build coordination among various agencies in the City to further increase impact:** The Digital Equity Fund has proven as a successful collaboration between the Department of Innovation and Technology, the Age Strong Commission, and the Equity & Inclusion Cabinet. The Boston Public Library has partnered with the Boston Housing Authority to distribute devices to patrons. Boston Public Schools has made 10,000 hotspots available to students for school use.

Furthering collaboration between entities on a larger scale will make it possible to efficiently streamline and address areas of need and will align with ACP enrollment support efforts. We recommend the City establish bi-monthly meetings to synthesize efforts among these entities and standardize metrics to monitor progress over time.

**Coordinate with the Commonwealth as the rules for obtaining federal funds take shape:** As new federal funding is granted to the state, the bulk of these funds will go to the Commonwealth of Massachusetts and then be distributed to local municipalities or specific programs.

Though not available for citywide municipal broadband, these funds can advance digital equity in other ways. As noted above, funding will be distributed to localities through the rules and programs described in a forthcoming Massachusetts state plan. As noted, the Massachusetts Broadband Institute will be the Commonwealth's lead agency; and the City has already connected directly with MBI to communicate the City's digital equity concerns and funding priorities. The City should continue this direct line of communication to potentially help shape the state plan.

For example, federal funding could be applied to supporting a new iteration of the Digital Equity Fund, enabling the City to expand the fund size and total number of awardees. Among other things, this funding can be used to get CBOs to promote and enroll residents in the ACP.

**Continue to foster relationships with CBOs to further impact on the ground:** The City has a strong track record of working with CBOs to engage within the City's wide range of communities. Programs funded through the Digital Equity Fund and partnerships like Tech Goes Home champion collaboration and promote success in community-based work. Given this track record, we recommend the City continue to invest in this work and to work with CBOs to formulate strategies to increase their reach and impact.

**Promote participation in existing device subsidy programs to free up City resources for other digital equity efforts:** Devices, while an integral part of the digital equity framework, should be de-emphasized in City funding efforts so that the City's resources can be put toward other efforts like funding CBOs to support ACP outreach, which covers broadband subsidies as well as a subsidy of up to $100 for a "connected device" (e.g., laptop, desktop, or tablet computer). The ACP is the major new opportunity in this area, and its funds are finite. Other programs—such as Comcast's Internet Essentials $149.99 laptop program and similar programs from other providers—are also supporting device acquisition without a need for City funds.

**Build more comprehensive reporting requirements for City-funded programs to measure digital equity efforts over time:** The City has captured the importance of reaching certain demographics and addressing problems through the Digital Equity Fund. To further and quantify this impact, we recommend using available monies or future state or federal funds to supporting thorough, comprehensive data collection about the impact of these efforts.

## ANALYSIS OF BROADBAND AVAILABILITY

# 1   Summary of task report

This report section analyzes the residential broadband market in the City of Boston, explains how that market has changed over the past six years, and assesses the present availability of broadband across the City.[8] In early 2016, most residents only had one option: Comcast. Some also had access to a smaller competitive cable provider, Astound (formerly RCN), and in certain buildings, the fixed-wireless provider NetBlazr. Today a new fiber provider is Boston's incumbent local exchange carrier, Verizon. Verizon is in the final stages of a citywide buildout for their fiber product, Fios, that Verizon reports now reaches 78 percent of premises. And a new fixed wireless provider, Starry, is making aggressive inroads, making the Boston broadband market highly competitive. Verizon is working toward a full buildout. Starry would not discuss its plans but appears to be expanding.

## 1.1   An overview of fixed broadband

This task report is concerned mainly with fixed residential broadband, but we also provide a report on how mobile services have improved in Boston in recent years. Fixed residential broadband is delivered by the following technologies.

- **Fiber** – also called fiber optic or fiber-to-the-premises (FTTP) or fiber-to-the-node (FTTN) – is the fastest broadband transmission technology. Like coaxial cables, fiber optic cables are attached to utility poles or installed underground, then connected to a subscriber's home. Fiber can deliver 1 Gbps now, though fiber ISPs also typically offer multiple service levels at lower speeds and costs. Although not yet widely offered, the current technologies enable 10 Gbps or faster service over fiber.

- **Cable** – internet service delivered over the same Hybrid Fiber/Coaxial (HFC) cable that brings cable TV into a home and is also called cable modem broadband service. In the case of Comcast's Boston plant, the company has upgraded its distribution networks to fiber twice over the last 15 years, allowing it to deliver very fast service—up to 1.2 gigabit per second (Gbps) download.

- **Fixed wireless** – internet service delivered via access point antennas mounted on towers (or rooftops) to a subscriber antenna at a home or business. Subscriber antennas can be located indoors or outdoors depending on the distance to the access point and the amount of "clutter" between the subscriber antenna and the access point. Outdoor

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[8] The Federal Communications Commission says that a broadband connection (as opposed to a lower-speed internet connection) provides download speeds of at least 25 megabits per second (Mbps) and upload speeds of at least 3 Mbps (or "25/3"). In practice, users may need much more than this, and higher speeds are widely available in Boston.

antennas may be attached to a building or a mast on the premises Fixed wireless is often an option in areas where ISPs have not constructed wires to users' homes. However, fixed wireless technologies may not consistently deliver broadband speeds.

- **DSL** (Digital Subscriber Line) – an older technology used to deliver internet service over copper telephone lines. In areas where the telephone company offers DSL, the service is available to homes and businesses that are within a certain distance from the phone company's local facility – usually limited to a range of a few miles. DSL is the slowest of the internet services delivered over wires and is now largely or completely phased out in Boston as the old, copper switched plant is almost completely retired by the incumbent telephone company with the approval/consent of the Mass. Department of Telecommunications and the Federal Communications Commission.

## 1.2   Key findings and preliminary assessment

The key findings of this report phase—which is focused on documenting fixed broadband availability and pricing—are as follows:

- **Wired broadband infrastructure:** Thanks to the aggressive construction and deployment schedule of Verizon, the Boston market is about to achieve ubiquitous broadband competition by two wireline providers – Verizon and Comcast. With the notable exception that Verizon Fios is not yet widely available on Beacon Hill, the Financial District, or Downtown Boston—and beyond isolated cases where building owners denied entry to broadband providers—the City of Boston has no gap in wired internet infrastructure or service availability and no disparity in the types of services or pricing offered by providers across neighborhoods they serve. Indeed, Boston is nearly to the point of ubiquitous high-speed broadband competition by two of the five fixed broadband providers, with a third competitor available in some areas.

- **Fixed wireless infrastructure**: Services continue to expand, but not enough data is available to make a clear determination about whether neighborhood-level disparities exist. It is important to note that fixed wireless deployments depend on clear lines-of-sight and access to high-elevation buildings, and thus, by their nature, fixed wireless services provide options where available, but typically are not comprehensive solutions in an urban environment.

The service territories, service offerings, and pricing of the major fixed broadband providers appear in the body of the report. We highlight two maps of the two largest market players—Comcast and Verizon— that illustrate Boston's newly competitive wired broadband market. **Both companies affirmed as part of this engagement that they offer identical service offerings, service quality, and pricing everywhere they serve in Boston.** Those offerings top out at 1.2

Gigabit per second (Gbps) download, 35 Mbps upload for Comcast and up to 940 Mbps download, 880 Mbps upload for Verizon Fios.

Figure 1 shows the Comcast coverage in Boston. The company asserted that all premises within the shaded area are serviceable within seven to 10 days without extraordinary construction or costs to residents except in exceptional circumstances where a contribution is necessary to bring service to a premises.

Verizon Fios is in the late stages of a fiber buildout. Verizon says fiber is now available in 78 percent of the City, with the exceptions of Beacon Hill, the Financial District, and Downtown, which present special construction challenges, as mentioned. In other neighborhoods, the company says individual apartment buildings may not be wired if Verizon could not obtain permission from the building owner. Figure 2 shows Verizon's fiber coverage through the end of 2020; updated maps showing coverage through the end 2021 will be made public later in 2022.