SECTION III

BUILDING A GIGABIT ISLAND

III

BUILDING A GIGABIT ISLAND

As data from the previous sections demonstrate, the Puerto Rico broadband market is maturing. Broadband providers are reacting to market demand and competitive forces by investing in higher capacity networks, particularly across the more urban centers of the Island and expanding their networks into rural and remote areas previously unserved.

This investment has largely been driven by the private sector - including mobile, cable, and providers offering fiber, DSL, and fixed wireless service – and is delivering substantial value to Puerto Rico consumers.

In 2011, no residential broadband provider was offering service at download speeds above 25 Mbps; in 2014, 53% of households across Puerto Rico have the choice of subscribing to broadband at speeds of 100 Mbps. This includes most urban areas (81% of urban households) as well as a significant portion of rural households (36%). In parallel, mobile broadband networks in Puerto Rico continue to grow, offering higher broadband capacity and robust service.

While this growth is positive, there remains a gap to achieving the gigabit connectivity challenge proposed in this Plan. The question is, therefore, whether investment will continue to grow so that:

- By 2018, 90% of Puerto Rico households will have broadband available at download speeds of 10 Mbps.
- By 2018, 50% of Puerto Rico households will have broadband available at download speeds of 1 Gbps.
- By 2020, 99% of Puerto Rico households will have broadband available at download speeds of 10 Mbps.
- By 2020, 70% of Puerto Rico households will have broadband available at download speeds of 1 Gbps.

The 2012 Puerto Rico Broadband Strategic Plan outlined a series of policy recommendations that aimed to accelerate investment in broadband capacity. These policy recommendations and following principles remain relevant today.

BUILDING A GIGABIT ISLAND

A Gigabit Community – Urbana-Champaign, Illinois

In late May 2014, nonprofit consortium, Urbana-Champaign Big Broadband (UC2B), announced a public-private partnership with iTV3 to operate and extend gigabit fiber services in Urbana and Champaign, Illinois.[90] UC2B was founded in 2010 to build, operate, and expand the UC2B fiber-optic network.[91] The UC2B network originally targeted low-income and low-adoption areas of the community and connected over 1,000 residences, 250 community anchor institutions, and 75 businesses using federal and state grants and local matching funds.[92] Under the new public-private partnership, iTV3 will invest in gigabit fiber build-out throughout Urbana-Champaign to expand ultra high-speed service to additional residents, institutions, and businesses, as well as maintain the current UC2B fiber optic network and connectivity to existing customers. UC2B anticipates that this expansion will enable community growth as well as attract and retain businesses and University of Illinois faculty, staff, and students.

"Congratulations to Urbana-Champaign Big Broadband (UC2B) and iTV-3 on making gigabit services over fiber available throughout the community. This public-private partnership provides a valuable model for communities and companies throughout the country and a demonstration of the creativity that is stimulated when localities are free to work with the private sector to improve broadband offerings."

-FCC Chairman Tom Wheeler

MONITOR, MEASURE, AND ASSESS THE IMPACT OF BROADBAND ACROSS THE PUERTO RICO ECONOMY

Over the last five years, in partnership with the federal government, public and private stakeholders have collaborated to assess, evaluate, and map various aspects of the Puerto Rico broadband market. Granular information collected and published by Connect Puerto Rico through broadband inventory maps and technology assessment research have enabled a better understanding of the Puerto Rico broadband market and proven to be effective tools to inform and help define public policy at the federal and local levels.

Transparent, accurate data is a key instrument to helping steer growth and investment in the Puerto Rico broadband market. As further described below, this data has resulted in unprecedented federal investment of more than $31 million to support broadband network expansion to unserved areas of the Island.

In order to help meet and accelerate the Gigabit Island goals, it is imperative that Puerto Rico continues to monitor and measure developments in the broadband market. Further, broadband stakeholders should collaborate to develop additional tools and metrics to better understand market trends and the impact of broadband and the knowledge economy on the overall Island economy.

CONTINUE AND EXPAND BROADBAND MAPPING

Puerto Rico has benefited greatly from various federal and local efforts to measure broadband capacity, adoption, and use across the Island. The data and maps collected by Connect Puerto Rico, with the support of the federally funded State Broadband Initiative grant program and presented in this Plan, are the result of those efforts. These tactical instruments are essential to inform Puerto Rico broadband public policy and effectively leverage federal resources aimed at expanding broadband infrastructure in locations where it is lacking.

Local stakeholders and the Puerto Rico government should continue to support Island-wide broadband mapping. Moving forward, maps should track broadband developments that impact residential markets, similar to those created by Connect Puerto Rico, as well as the developments that impact the business sector and community anchor institutions. As such, maps should reflect middle-mile network infrastructure, both lit and unlit, in support of those connections.

> "Since our confirmation to preside the PR Telecommunications Regulatory Board, we have reiterated the importance of mapping to better understand and plan for state actions with respect to broadband deployment. Connect Puerto Rico's contributions to this project have been invaluable. We envision taking this roadmap to the next level by including broadband infrastructure adoption, not just on a residential level, but on the commercial side as well."
>
> Javier Rúa, President TRB

This interactive inventory will enable community stakeholders to better understand the broadband landscape and address residential and commercial concerns anecdotally. Similarly important, this information will enable communities to initiate informed discussions with local providers to address gaps in coverage and collaborative build-out plans.

MEASURE AND PUBLISH INDUSTRY-WIDE INVESTMENT TRENDS

Puerto Rico broadband stakeholders should track and publish aggregate data regarding industry-wide investment in broadband expansion. Timely release of such information, which is not currently available, will shed light on the significant financial commitments that telecommunications and broadband providers, both public and private, are making to strengthen Puerto Rico's infrastructure and create jobs.

Mindful of the commercial sensitivity of such data, this effort should aim to protect confidential, provider-specific data. All data should be collected and aggregated by a neutral, non-competitive entity to be defined by stakeholders who would protect individual confidential data while publishing meaningful, industry-wide investment metrics.

MEASURE AGGREGATE BROADBAND USE

To complement and encourage ongoing network development, Puerto Rico should also measure and publish aggregate broadband use patterns. Metrics on the overall Internet Protocol (IP) traffic across the Island will help public and private stakeholders better understand market trends and knowledge economy developments on the Island.

To do so, Puerto Rico broadband stakeholders should collect and release quarterly and annual metrics, such as:

- Total monthly or quarterly consumption of IP data across Puerto Rico for fixed and mobile broadband networks.
- Mean and median monthly or quarterly consumption of IP data for fixed and mobile broadband subscribers. Metrics should capture both download and upload data usage.
- Peak IP traffic composition data for fixed and mobile broadband networks, both download and upload. Categories of data to be monitored could include enterprise-to-enterprise traffic, entertainment, web browsing, social networking, and communications, among others.
- Top ten peak period applications used for both download and upload traffic.

Network solution management companies publish similar data and have demonstrated that doing so is feasible and does not reveal confidential company-level data about broadband network providers or Internet Service Providers.[21] To date, however, these data sources rarely provide granular information pertaining to Puerto Rico, which is

instead typically bundled with U.S. or Latin America statistics. Puerto Rico-specific information would be a powerful tool for all broadband stakeholders and would significantly impact the industry's ability to monitor and project usage trends on the Island.

The broadband stakeholder community should, therefore, work together to define what ought to be measured and how to do so. Importantly, because of the data's commercially sensitive nature, protocols should also be developed to collect and protect confidential information. For example, aggregate data would provide meaningful market trend metrics while still protecting confidential data from any and all providers.

ESTIMATE AND MONITOR THE IMPACT OF BROADBAND ON PUERTO RICO'S OVERALL ECONOMY

As broadband and the knowledge economy continue to expand, metrics on aggregate broadband use can help uncover drivers of overall economic trends on the Island. Puerto Rico's economic indicators should be adjusted to reflect this new twenty-first century reality.

Assessing and monitoring aggregate broadband use for this purpose is not straightforward; indeed, determining the economic impact of Puerto Rico's IP traffic is a complex endeavor. Working under the umbrella of the current Puerto Rico Broadband Taskforce, a sub-committee of experts should be established to include public and private broadband stakeholders, residential and commercial broadband providers, the Telecommunications Regulatory Board, the Office of the CIO of Puerto Rico, as well as the Puerto Rico Institute of Statistics and the Planning Board.[22] This committee should contemplate several possible strategies, including:

- Monitoring trends in IP traffic in and out of Puerto Rico in relation to import and export statistics. Outflowing IP traffic information, particularly if classified by category (e.g., enterprise-to-enterprise, entertainment, communications, etc.), could help predict trends in the Puerto Rico export market and the Island's overall economic growth.
- To achieve such metrics, the appropriate indicator would be a measurement of all IP traffic to and from the Island. Such information is obtainable from Internet Peering Exchange(s) on the Island and can be complemented and contrasted with overall IP traffic flowing through the relatively limited number of submarine cables to and from Puerto Rico.
- Based on this data, the impact of the knowledge economy in Puerto Rico could be measured by the ratio of IP traffic flowing in and out the Island. An underlying hypothesis is, therefore, whether growth in traffic leaving the Island (export data) relative to that consumed on the Island (import data) correlates with import and export metrics and/or other economic growth indicators. This data will also enable the ranking of the Puerto Rico knowledge economy worldwide and monitor growth relative to peer economies.

- One key challenge to building these metrics is the elimination of "noise" resulting from so-called "boomeranged traffic." Boomeranged traffic refers to intra-Island traffic that originates and terminates within Puerto Rico; however, broadband network design is routed through Internet Exchange Points outside of the Island. Eliminating this circular traffic from overall IP traffic metrics would help derive more accurate information that better reflects Puerto Rico's economic activity.
- This can be done by examining the network routes used by leading network providers and filter out those that are "boomeranging" their intra-Island traffic, or by looking at the source and destination IP addresses of all flowing traffic through Island Peering Exchanges and filtering out the intra-Island traffic. Such tools are routinely used by broadband network managers to help monitor traffic patterns and more effectively plan for network adjustments.
- For more granularity, a further refinement could include measuring traffic by the destination domains (e.g., amazon.com, youtube.com, etc.) using a network probe. Another refinement could include measuring IP traffic flows by category type or application groups, similar to those discussed above and periodically published by companies such as Sandvine, Cisco Systems, and others.

To achieve these goals, public and private stakeholders should work together to define meaningful broadband use metrics on the Island and develop clear protocols for how, what, and when such data should be collected. For this endeavor to fully reflect the impact of the broadband industry across the Island and serve as a meaningful tool for economic planners, it is imperative that data is collected from all major broadband providers on the Island, including all voluntary peering partners, as well as the cable and mobile industries, Claro, and PREPA Net.

LOWER COST OF BROADBAND BUILD-OUT

Building broadband infrastructure is costly. According to the National Broadband Plan, deploying fiber can easily cost more than $100,000 per mile and "the largest element of deployment costs is not the fiber itself, but the placement costs associated with burying the fiber in the ground (or attaching it to poles in an aerial build)."[23] In certain cases, these placement expenditures can account for almost three-quarters of the total fiber deployment.

However, with adequate planning, these costs can be decreased substantially. For example, the National Broadband Plan noted that "the cost of running a strand of fiber through an existing conduit is 3-4 times cheaper than constructing a new aerial build."[24] In addition, joint trenching of infrastructure projects can cut placement costs dramatically by distributing the costs of digging among broadband providers and other infrastructure projects.

The FCC's National Broadband Plan also concluded that, "the rates, terms, and conditions for access to rights-of-way [including pole attachments] significantly impact broadband deployment." The costs associated with obtaining permits and leasing pole attachments and rights-of-way are one of the most expensive cost functions in a service provider's plans to expand or upgrade service, especially in rural markets where the ratio of poles to households is off the charts. Furthermore, the process can be time

consuming. For example, the process of attaching equipment to an existing pole, such as moving wires and other equipment and coordinating with electric and safety codes, can take months to complete.

Community and provider collaboration to problem solve around local pole attachment and other rights-of-way issues is one of the most effective opportunities to encourage faster, new deployment of infrastructure.

Placement costs, which include stringing fiber or attaching equipment to utility poles, are a significant component of broadband deployment expenditures. In addition, since these charges generally consist of per-pole or distance-based rental charges, high costs for leasing access to poles and rights-of-way affect deployment in distant, rural areas more than dense urban areas.

To facilitate broadband build-out, encourage higher investment, and invigorate more competition, the 2012 Broadband Strategic Plan recommended a number of strategies to help lower the cost of broadband network expansion, including to:

- **streamline construction permitting and planning;**
- **ensure ready and cost-effective access to poles, ducts, conduits, and rights-of-ways, both privately and publicly owned;**
- **leverage existing public assets to incent public and private broadband expansion; and**
- **establish a "Dig Once" protocol.**

These recommendations remain relevant today. Since publication of the 2012 Strategic Plan, public and private stakeholders have worked to advance these recommendations. The following ventures stand as examples of these efforts.

LEVERAGE UNUSED STREETLIGHT CONDUITS TO DEPLOY FIBER - PROJECT VIA DIGITAL

The Puerto Rico Department of Transportation and Public Works (DTOP) and the Telecommunications Regulatory Board (TRB) have established a new venture called Vía Digital that will make vacant underground duct infrastructure owned by DTOP available for broadband expansion. The vacant conduits were originally constructed to house infrastructure supporting the streetlight system across the Island but remained unused. The project was inspired by the Corredor Digital initiative, described in more detail in later sections, which seeks to bring faster connectivity to the Santurce neighborhood of San Juan with minimal disruption to residents.

Under the Via Digital project, DTOP will establish short- and/or long-term leases that will permit eligible entities to use these ducts to construct telecommunication systems that use fiber optic cable as their main transmission medium for deployment of broadband services. Participating providers would then invest their own financial capital to deploy fiber along these conduits and commercialize the network offering high-capacity broadband service to residential, corporate, and public customers.

III BUILDING A GIGABIT ISLAND

In August 2014, DTOP and TRB signed a Memorandum of Understanding (MOU) outlining key aspects of Vía Digital. The project's primary objectives include:

- Establishing a fair and competitive qualification and bidding process to encourage active participation of qualified entities that operate and/or provide telecommunications, cable television, and/or Internet access services.
- Guaranteeing that the winning bidder selection process is made within a nondiscriminatory scope and allows for broad participation and fair competition.
- Maximizing the use of this infrastructure by installing inner ducts allow duct space capacity to quadruple, enabling up to 12 inner ducts for fiber installation across routes.
- Recovering part of the total capital investment made by DTOP in the construction of the duct infrastructure, estimated between $4.5 and $5 million.
- Reducing the impact and damage to public streets and sidewalks during construction by exercising policies that mitigate or eliminate excavation, commonly referred to as Dig Zero policy.
- Contributing to the improvement of the quality of life of the community by establishing new and advanced telecommunications technologies to allow for deployment of new and improved broadband services in the areas where the underground duct infrastructure runs.
- Encouraging the rebirth of commercial and economic activity of Santurce and surrounding areas.

In its initial phase, Vía Digital will focus on a pilot launch across areas of San Juan in the Rio Piedras, Hato Rey, Santurce, and Miramar neighborhoods. The pilot conduit included in this first phase extends approximately 55,000 linear feet and runs through the Ponce de León, Fernández Juncos, and Muñoz Rivera Avenues from Miramar in Santurce and to the Rio Piedras area. The nearby map illustrates the route of this first pilot (contour in red). The pilot route is a closed loop that enables connection with existing last mile broadband infrastructure across the entire route.

Lessons learned from this initial phase will help streamline expansion of the Vía Digital project across the Island.

LEVERAGE SEWAGE AND AQUEDUCT CONDUITS TO DEPLOY FIBER - PROJECT ZUM

The ZUM fiber initiative was developed through a partnership between the Puerto Rico Aqueduct & Sewer Authority (PRASA) and the Office of the Chief Information Officer of Puerto Rico to leverage existing public infrastructure and lower the cost of broadband build-out. Utilizing robotic technology, the initiative will install an underground fiber optic network through PRASA's existing sewage pipeline. Like the above mentioned Vía Digital project, ZUM embraces a "dig zero" policy. Leveraging existing conduit infrastructure, the project eliminates the need for costly excavation work, which will ensure a safe and expedited process that will minimize traffic delays and other inconveniences that impact public roads.

The first phase is expected to deploy in the Isla Verde neighborhood in San Juan in early 2015. This phase will supply an open access fiber network to Puerto Rico's Internet service providers and carrier operators, serving approximately 8,500 residential units and 140 businesses. The network, comprised of a mix of infrastructure elements, will be capable of delivering ultra-high-speed data, video, and voice services providing Ethernet access bandwidth from 10 Mbps up to 1 Gbps.

Although like Vía Digital, the ZUM fiber project leverages existing infrastructure to eliminate the need for excavation and construction, resulting in lower costs, the two projects propose significantly different business models and partnership arrangements.

Under Vía Digital, private partners will gain use rights of the DTOP signaling conduits in exchange for a fee, then will invest capital to lay down fiber infrastructure through these conduits. Further, the project is designed to incent competition and facilitate the build-out of up to 6 redundant cables. Providers would, hence, bear the financial risk of the fiber deployment and be able to freely commercialize the capacity as they see fit.

By contrast, under the ZUM project, PRASA will provide the capital to invest in its own fiber network and will resell wholesale service connectivity to participating broadband providers who would then commercialize the service in the retail market. Under this model, the private partner would bear low financial risk of the venture, but will be limited to commercialize services supported by the wholesale offerings of ZUM.

ADVANCE EFFECTIVE "DIG ONCE" LEGISLATION

The "Dig Once" concept and related policies aim to facilitate joint trenching cost savings and ensure that broadband infrastructure improvements are considered alongside other infrastructure and public works projects. To this end, Dig Once legislation aims to establish that every infrastructure project includes notification and facilitation of opportunities to lower the costs of broadband infrastructure investment. There are two main benefits to Dig Once legislation:

1. Lower costs of infrastructure deployment when completed in conjunction with other infrastructure improvements (such as highway construction).
2. Promote and facilitate integration of broadband infrastructure as part of local and regional economic development infrastructure initiatives.

On June 14, 2012, President Obama issued Executive Order (E.O.) No. 13616, "Accelerating Broadband Infrastructure Deployment," to facilitate wired and wireless broadband infrastructure deployment on federal lands, buildings, and rights-of-way, federally assisted highways, and tribal and individual Indian trust lands, particularly in underserved communities. The E.O. specifically calls for increased accessibility and usability of federal broadband information to help promote and facilitate broadband deployment and encourages broadband infrastructure deployment by urging states to adopt policies that promote "dig once." [25]

Many states and municipalities have also adopted Dig Once policies. These policies range in scope and nature. The United States Department of Transportation, Federal Highway Administration has listed several best practices for Dig Once state and local policies, noting that "Dig Once and joint use of trenches have been practices recognized by state and local stakeholders as sensible solutions to expedite the deployment of fiber along main routes when implemented as part of a cooperative planning process."[26]

The U.S. Department of Transportation specifically noted the Utah Department of Transportation (UDOT) as an example. UDOT installs empty conduit suitable for fiber optic placement during highway construction, and then coordinates with providers on their need and demand for space in that conduit. UDOT meets with telecom companies every two months regarding infrastructure projects and has established a single point of contact for broadband providers. Annually, providers submit a list to UDOT with areas of need, and UDOT provides interactive online tools, maps of roads, fiber, and conduit.

Mirroring practices at the federal level and across many municipalities and jurisdictions, and heading recommendations of the 2012 Broadband Strategic Plan, the Puerto Rico Senate is also taking action. In October 2014, Senator Ramón Luis Nieves introduced a bill that establishes a Dig Once policy framework in Puerto Rico.[27] Debate of this bill is expected in the 2015 legislative session.

PROMOTE PUBLIC-PRIVATE PARTNERSHIPS TO STIMULATE AND AGGREGATE LOCAL DEMAND AND EXPAND MARKET OPPORTUNITIES

The 2012 Puerto Rico Broadband Strategic Plan recommended promoting public-private partnerships at the local and national levels to overcome barriers to broadband expansion and ensure that citizens and enterprises benefit from this capacity. Such public-private partnerships can showcase aggregate demand to potential investors and reduce the cost of network build-out by facilitating planning and partnerships across various agencies to leverage existing assets, such as public conduits and pole attachments.

> Collaboration — among policy makers across every level of government, private firms throughout and beyond the broadband ecosystem, community leaders, consumer advocates, and consumers themselves— is essential to addressing the many barriers to more robust broadband adoption and use.
>
> There are numerous examples of communities benefiting from more collaborative local leadership on these issues. Public-private (PPPs), for example, are bringing broadband networks to unserved areas, while direct engagement with service providers is yielding creative approaches to bolstering existing services. Similar efforts are also proving successful on the demand side, where communities are leveraging local social infrastructures to promote adoption and more informed use of broadband services. Such approaches allow local policy makers to take a more organic, data-driven assessment of broadband connectivity in their municipality and design strategies to address actual needs. As discussed here, embracing this model could yield enormous community benefits.[28]

There are several examples of collaborative efforts in Puerto Rico that are leveraging broadband and other information technologies to reinvigorate local economic growth.

CORREDOR DIGITAL DE SANTRUCE

The Corredor Digital de Santurce initiative is a noteworthy example of private-public partnership between local stakeholders for economic and social growth.[29] Corredor Digital was formed in 2013 by local entrepreneurs and members of Puerto Rico's technology ecosystem to transform Ponce de Leon Avenue in the Santurce neighborhood in San Juan into an innovation district and business hub. Once the commercial heart of San Juan, Ponce de Leon Avenue has experienced great economic decline and is now surrounded by graffiti-filled walls and abandoned buildings, despite being located in the bustle of one of the most populated areas of San Juan. The vision of the companies and entrepreneurs behind Corredor Digital, a nonprofit corporation, is to revitalize and transform the former Theater District into a sustainable economic development model, utilizing the availability of broadband and recruitment of technology companies.

III BUILDING A GIGABIT ISLAND

Inspired by projects in Medellín, Boston, Seattle, Charleston, and Barcelona, Corredor Digital will utilize the infrastructure, buildings, and activities available to transform Santurce into a "tech district." One aspect helping attract businesses to the area is the high concentration of fiber optics that runs from Sacred Heart University to the residential area of Miramar. While technology companies on the Island continue to face broadband speed, price, and quality of service challenges, this fiber optics network rivals that of Google Fiber in Kansas City. Plus, leveraging the network of pipes readily available will avoid street trenching and additional disruptions that numerous other cities experience when installing fiber optics networking.

Redevelopment of the Santurce area is anticipated to spark the local economy, create new businesses, and open opportunities for permanent jobs. However, Corredor Digital has recognized that this dynamic transformation requires more than connectivity; it necessitates creativity and greater business integration with the local community and its residents. Therefore, funds garnered by the organization will be used to help emerging organizations create successful business models and offer better service delivery. Corredor Digital, organized under a 6-member board, is also:

- working with the owners of the abandoned facilities to rehabilitate, recondition, or make the facilities available for sale;
- advocating for improved lighting, signage, parking, and transportation legislation; and
- encouraging incentives offered to technology companies that locate in the area.

An ecosystem of digital companies has already located in the area - twenty companies reside from Park Street to Roberto H. Todd Avenue, offering services in design, content and publishing, communications media, Internet service, and more. The companies that have settled in the area appreciate the collaborative mentality, mutual purpose, and collective efforts to monitor local opportunities and demands. By promoting the district as the epicenter of technological innovation and creating a vibrant community with spaces for living, working, and socializing, this multi-sector initiative seeks to catalyze other signs of revitalization such as enhanced property values.

Corredor Digital serves as an example of public and private cross-sector collaboration to revitalize a community. Taking advantage of local information technology and broadband connectivity resources, Corredor Digital hopes to bring attention to the Island and showcase Puerto Rico as a potential location for companies wishing to establish services in the Caribbean and throughout Latin America. Although much remains to be done, the new digital infrastructure and joint initiatives among local government leadership and effective community planning are a strong foundation to achieving its objectives and setting a worldwide example.

Health-Tech Corridor – Cleveland, Ohio

Existing within The Cleveland Connected Collaboration Corridor (4Cs), the Health-Tech Corridor (HTC) encompasses over 40 city blocks and 9 neighborhoods in the MidTown area of Cleveland. While the HTC corridor already hosts a concentration of world-class healthcare and academic institutions, business incubators, and high-tech companies, HTC has become the focus of collaboration among the city, the Cleveland Foundation, and others to grow and develop the area to attract technology start-ups, healthcare "spin-offs," and cloud service providers. Over 15 public institutions, developers, government, and business partners collaborated with the city of Cleveland to apply for a grant awarded through the U.S. Economic Development Association (EDA) to enable the installation and operation of 3 miles of fiber optic networking within the HTC at speeds up to 100 Gbps.[93] This award is part of a $1,021,230 project anticipated to leverage $35 million in private investment and create 115 jobs in Cleveland.

As demonstrated by these examples, gigabit connectivity is a key component to attracting corporate investment and retaining commercial and individual talent in Puerto Rico. The transition to a "Gigabit Island" stands to create local jobs, retain skilled workers, and enhance real estate values in Puerto Rico, leading to supplemented personal incomes, more spendable dollars on the Island, and long-term community and economic growth. Numerous industries in Puerto Rico stand to benefit from this economic development ripple effect.

LEVERAGE FEDERAL SUPPORT FOR BROADBAND EXPANSION

The Federal Communications Commission's 2011 reform of its Universal Service Fund (USF) transitioned the USF High Cost program, historically subsidizing telecommunications service in rural areas, to a new Connect America Fund (CAF) that aims to support broadband infrastructure in rural regions.[30] The FCC disburses approximately $4.5 billion annually through the High Cost program across the nation.[31]

Puerto Rico has historically benefited from FCC USF support. In 2013, $160 million in High Cost subsidies were committed across Puerto Rico. From 1998 to 2013, the total amount of subsidies committed to Puerto Rico under this program was $2.22 billion.[32] Historically these subsidies have supported the deployment of communications infrastructure for voice service, but beginning in 2011, with the FCC's creation of the CAF program, began transitioning to support for robust broadband network deployment. As the CAF evolves, Puerto Rico must be vigilant in ensuring that federal universal service funds support widespread broadband access to all Puerto Ricans.

The FCC allocates CAF funds based on need for robust broadband infrastructure that can sustain twenty-first century online activities, as determined by the National Broadband Map.[33] In Puerto Rico, broadband availability data is collected on behalf of the Puerto Rico government by nonprofit organization, Connect Puerto Rico, which aggregates broadband network data from an array of broadband providers on the Island. This collaborative effort has enabled a transparent, reliable database depicting the broadband landscape, and has supported quick decisions by the FCC to fund network expansion in underserved areas of the Island. While the Puerto Rico broadband map is an essential tool in this process, so too is the willingness of broadband providers to partner with the FCC and commit to broadband build-out in remote locations, fueled by federal subsidies.

The 2012 Puerto Rico Broadband Strategic Plan addressed the new Connect America Fund opportunity and urged stakeholders to work collaboratively to secure maximum benefit from the transition. Specifically, the report recommended that "all broadband providers … collaborate with Connect Puerto Rico to ensure that broadband inventory data collected under the SBI (State Broadband Initiative) grant program and used by the FCC to determine the Connect America Fund transition is comprehensive and accurate."[34]

The Puerto Rico government and Puerto Rico Broadband Taskforce have been working to provide timely information and strategic planning support to broadband providers who can leverage FCC funding opportunities. Below are two examples of the impact of this public-private partnership approach.

FCC GRANTS CLARO $31.5 MILLION FOR BROADBAND EXPANSION IN RURAL PUERTO RICO

In May 2013, the FCC committed up to $485 million in one-time, per-location payments through the Connect America Fund Phase I to eligible price cap carriers willing to upgrade their networks and provide broadband in areas identified by the Commission as unserved. Unserved areas were defined as those not having broadband service at speeds of at least 3 Mbps download and 768 Kbps upload.

> "Our company has long been an advocate of broadband deployment in Puerto Rico and the region given the importance of Internet in the economic development, prosperity, and competitiveness of countries worldwide . . . This broadband investment marks an important day for all residents on the Island."
>
> -Enrique Ortiz de Montellano, President, Claro

The following October, the Commission approved $31.5 million of second round Connect America Fund Phase I funding to Puerto Rico Telephone Company, or Claro, to connect underserved homes and businesses. Since the FCC determined eligible areas for these funds based on data collected by Connect Puerto Rico for the National Broadband Map, the quick and decisive action in Puerto Rico speaks to the reliability of the underlying broadband maps in the area. Claro's request for funding was the second highest among the 44 applications received by the Commission, targeting 40,736 underserved homes and businesses across Puerto Rico.[35]

PUERTO RICO BIDS FOR THE FCC RURAL BROADBAND EXPERIMENT PROJECT

In 2014, the FCC expanded the Connect America Fund to include a pilot "Rural Broadband Experiments" program. Under this program, the Commission invited interested parties to present projects for broadband build-out in unserved areas of the country in exchange for a subsidy. This $100 million, one-time pilot program was designed to help the FCC better understand the type of companies that would be willing to invest in broadband build-out across rural America in partnership with the FCC and to better gauge the level of subsidies that would be needed to incent private construction in those remote – hence, more costly – rural areas. The Telecommunications Regulatory Board conducted various informational seminars regarding this opportunity and actively encouraged Puerto Rico broadband providers to leverage this opportunity.

The FCC received nearly 600 proposals from parties across the country. In December 2014, the FCC selected 40 of those projects to be funded. Among them, was a project submitted by Liberty Cablevision of Puerto Rico to expand very high-speed broadband in select unserved areas for a subsidy of just under $42,000.[36] Subsequently, however, the FCC announced that several projects, including the Liberty Cablevision bid, would not move forward. Notwithstanding the particulars of this case, all eligible broadband providers should assess the possibility of partnering with the FCC to help bring more robust broadband to remote areas of the Island.

IMPLEMENTATION OF CONNECT AMERICA FUND PHASE II

The FCC is now implementing Phase II of the Connect America Fund, which will target up to $1.8 billion in annual subsidies to support the deployment of 10 Mbps/1 Mbps fixed broadband infrastructure in underserved areas across the nation. Currently, Connect Puerto Rico estimates that approximately 300,000 households across Puerto Rico (22%) do not have access to 10 Mbps/1.5 Mbps fixed broadband networks.

As the incumbent local telephone company, Puerto Rico Telephone Company (Claro) will be given a right of first refusal to establish a partnership with the FCC. Under this partnership, in exchange for CAF subsidies, Claro would upgrade its network to meet the Commission's minimum fixed broadband availability target of 10 Mbps/1 Mbps to all households within its service footprint.

In December 2014, the FCC gave Claro the option to continue to accept the same subsidy levels it has been receiving under the High Cost USF program as "frozen support" in exchange for a commitment by Claro to upgrade its network across the Island to meet the minimum target of 10 Mbps/1 Mbps, as well as other service quality, capacity, and pricing commitments.[37] On December 22, 2014, Claro formally notified the FCC of its interest in the "frozen support" offer, pending details of that offer.[38]

Within the next few months, the FCC will develop "tailored service options" for Puerto Rico that will identify areas eligible for the subsidy, as determined using data from the National Broadband Map, and the corresponding service obligations. Once the specifics of those service obligations are established, Claro will have an additional 60 days to evaluate and accept or reject the offer. If Claro rejects the offer, the FCC will extend the subsidy opportunity to alternative providers for broadband infrastructure build-out in eligible areas across Puerto Rico. Allocation of the subsidies would be determined through a competitive bidding auction.

Puerto Rico public and private stakeholders should actively engage in this process and work with the FCC as it establishes the rules associated with these subsidies. In early 2015, the FCC will determine the scope of service obligations, including speed, quality, and price, that it will associate with these CAF subsidies. Those decisions will substantially affect the broadband landscape in Puerto Rico for the next decade; as a result, public input into these decisions will be especially important. Robust and timely data on broadband infrastructure and use across Puerto Rico will be essential to ensure that as the FCC moves forward on the Connect America Fund project, it will do so in a way that helps the residents of Puerto Rico.

BUILDING A GIGABIT ISLAND

The FCC's Universal Service Fund reform will continue to impact Puerto Rico's broadband sector. Private and public stakeholders on the Puerto Rico Broadband Taskforce have monitored this reform as it has unfolded and sought to work collaboratively with the FCC to ensure fair and effective allocations to unserved areas in Puerto Rico.

While the FCC's Universal Service Fund program is the largest federal program supporting broadband and telecommunications infrastructure, other federal agencies offer opportunities for grants and/or loans to accelerate broadband expansion. Collaborative efforts between Puerto Rico broadband entrepreneurs, local stakeholders, and national policy makers are essential to ensure that the citizens of Puerto Rico fully benefit from these opportunities.

The American Recovery and Reinvestment Act of 2009 (ARRA) appropriated $4.7 billion for the National Telecommunications and Information Administration (NTIA) to establish the Broadband Technology Opportunities Program (BTOP) to increase broadband access and adoption; provide broadband access, training, and support to schools, libraries, healthcare providers, and other organizations; improve broadband access to public safety agencies; and stimulate demand for broadband. In 2009 and 2010, NTIA invested approximately $4 billion in 233 BTOP projects.[39] Two of these projects, amounting to over $38 million, were awarded to entities in Puerto Rico: a project led by the not-for-profit regional development agency, INTECO, and the Puerto Rico Digital Bridge project.

INICIATIVA TECNOLÓGICA CENTRO ORIENTAL (INTECO)

The Iniciativa Tecnológica Centro Oriental is an economic development organization created in 2003 to improve the quality of life in nine Central Eastern Puerto Rico municipalities. INTECO received $12.9 million through BTOP to expand broadband access by deploying a multifaceted 515-mile network that leverages both wireless and fiber connections. The project originally planned to directly connect nearly 250 anchor institutions, including higher education facilities, hospitals, municipal facilities, police stations, and libraries, as well as enable local service providers to connect to the project's open network. INTECO has also focused on the development of Wi-Fi hotspots to further promote digital literacy among low-income adults and youth.

BUILDING A GIGABIT ISLAND

THE PUERTO RICO BRIDGE INITIATIVE

In April 2010, Critical Hub Networks was awarded $25.7 million under the American Recovery and Reinvestment Act for the creation of the Puerto Rico Bridge Initiative (PRBI), a project designed to bring fast, affordable broadband service to all of Puerto Rico, particularly underserved and impoverished areas. The overall goals of this network were to reduce the digital divide, boost economic growth, and improve broadband services on the Island.

Through the purchase of a 10 Gbps undersea fiber optic cable, the PRBI established a "broadband bridge" that linked Puerto Rico to Miami and connected to a high-capacity, middle-mile network back on the Island. This network created an ultra-high speed backbone connection, ensuring Puerto Rico's broadband providers have sufficient capacity to offer fast, affordable service to residents, businesses, and community anchor institutions. During the 20-month project, the PRBI collaborated with government, the Puerto Rico Broadband Taskforce, and other ARRA-funded projects such as the Puerto Rico Health Information Network and Iniciativa Tecnológica Centro Oriental.

The PRBI also played an integral role in promoting local peering – or interconnection – between Puerto Rico's broadband networks. Broadband providers now have 24 locations on the Island where they can interconnect their networks with PRBI's. By expanding upon interconnection agreements with 17 providers, Critical Hub has delivered local peering advantages that reduce costs for transit services; improve quality of service, including increased redundancy and capacity; and promote competition.

PRBI's initial project funding closed at the end of March 2013. That same month, Critical Hub Networks announced the project's expansion through the reinvestment of ARRA dollars to include a 17-kilometer fiber optic middle-mile segment in the San Juan Metropolitan area using the Tren Urbano rail system. The project was implemented in two phases over eight months and was completed in November 2013.

THE RACE FOR FIBER-TO-THE-HOME BROADBAND SERVICE IN PUERTO RICO - OPTICO FIBER

Competition drives investment and innovation within the Puerto Rico Broadband market. As the data in the previous segment indicates, providers, especially among the mobile and cable industries, have significantly invested in the Puerto Rico broadband landscape in recent years. By significantly upgrading the capacity of their networks and expanding connectivity into areas previously unserved, these providers are directly impacting consumers through more robust and faster services. Small and large providers throughout the Island are responding to market pressures to do the same.

III BUILDING A GIGABIT ISLAND

Optico Fiber is an example of competitive market forces working effectively to deliver gigabit connectivity in areas where there is sufficient demand. Harnessing this demand in advance of service delivery provides a clear return on investment as expected revenues justify the capital investment needed to construct FTTH networks. While these innovative fiberhood models have been developed and implemented elsewhere, Optico Fiber has demonstrated that consumers in Puerto Rico also have an appetite for gigabit service and that the private sector is willing and able to meet the challenge. Innovative ventures such as Optico Fiber are key to ensuring competitive market responses that, as has been the case in the U.S. mainland, will drive others to improve broadband capacity offerings and invest in network build-out, essential components to meeting the Gigabit Island goals.

Google Fiber

Google Fiber launched in Kansas City in 2012, delivering 1 Gbps, fiber-to-the-home connectivity.[94] This initiative demonstrated pent-up demand for gigabit connectivity in the home, and introduced an innovative marketing and deployment strategy that triggered a strong competitive response in the market. In 2010, Kansas City was selected among many candidate cities to launch the Google fiber pilot.

To guide service implementation, Google divided Kansas City into "fiberhoods" and dictated service delivery according to the fiberhoods that achieved a critical mass of pre-registrations over a 6-week period, with the highest pre-registration rates served first. Google Fiber offered residents three connectivity packages including: Gigabit + TV service, Gigabit Internet service, or free basic Internet service of up to 5 Mbps down/1 Mbps up.[95] Under Google Fiber's "Community Connections" program, community buildings are also able to receive free gigabit service for a minimum of ten years.[96] One year after the launch, fiber connectivity was available in over half of the fiberhoods. Within 18 months, Google Fiber's subscription rate was 75% in certain parts of Kansas City, typically those considered medium-to-high income, and around 30% among lower-income households.[97] Survey research estimates that Google Fiber could reach over 50% penetration among all Kansas City neighborhoods for its paid subscription services, with another 10% selecting the free monthly service, within 3-4 years.[98] Based on the success of the Kansas City pilot, Google is exploring 34 additional cities to expand this model.[99]

Competitive forces did not take long to respond to the Google Fiber market challenge. In April of 2014, AT&T announced plans to launch AT&T GigaPower fiber-to-the-premises (FTTP) network service in potentially 100 cities, including 21 metropolitan areas.[100]

BUILDING A GIGABIT ISLAND

STIMULATE BROADBAND ADOPTION TO ENCOURAGE FURTHER INVESTMENT

Ongoing growth is essential for the broadband market in Puerto Rico to sustain. The residential broadband subscription rate increase from 31% in 2010 to 46% in 2014, along with the growth in the business and mobile markets, has helped catalyze the broadband access and capacity growth observed during this period. Yet, broadband adoption in Puerto Rico still lags behind U.S. mainland trends in which 70% of U.S. households subscribe to broadband.

Demand for broadband services in Puerto Rico needs to grow in order to stimulate further investment and deliver gigabit speeds to Puerto Rico households. The following section comprehensively addresses the adoption challenge that Puerto Rico still faces, as well as opportunities to close this adoption gap, including expansion of education technology in the K-12 system.

STRATEGIES TO ACCELERATE BROADBAND INFRASTRUCTURE EXPANSION

SUMMARY RECOMMENDATIONS

This section provided an analysis of Puerto Rico's current broadband inventory and identified broadband infrastructure gaps, as well as recommendations for overcoming these challenges, in order for Puerto Rico to become the Gigabit Island.

Key Recommendations:

- Continue and expand Island-wide broadband mapping
- Monitor, Measure, and Assess the Impact of Broadband Across the Puerto Rico Economy
    - Measure and publish aggregate, industry-wide data regarding broadband investment trends
    - Measure and publish aggregate broadband use patterns
    - Adjust Puerto Rico economic indicators to estimate and monitor the impact broadband has on the overall economy
- Lower the costs of broadband build-out through community and provider collaboration, including:
    - Streamlining construction permitting and planning
    - Ensuring ready and cost-effective access to poles, ducts, conduits, and right-of-ways, both privately and publicly owned
    - Leveraging existing public assets to incent public and private broadband expansion
    - Advancing effective "Dig Once" legislation
- Promote public-private partnerships to stimulate local demand and expand market opportunities
- Leverage federal support for broadband expansion
- Stimulate broadband adoption to encourage further investment

CHAPTER ENDNOTES

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