Application to DHCD Submitted through CAMS

Stafford County Government

Stafford County - Comcast VATI 2022

Application ID: 86509032021134138

Application Status: Pending

Program Name: Virginia Telecommunications Initiative 2022

Organization Name: Stafford County Government

Organization Address:

Profile Manager Name: Tina Owens

Profile Manager Phone: (540) 658-4573

Profile Manager Email: tsuarez@staffordcountyva.gov

Project Name: Stafford County - Comcast VATI 2022

Project Contact Name: Michael Cannon

Project Contact Phone: (540) 658-8687

Project Contact Email: mcannon@staffordcountyva.gov

Project Location: 1300 Courthouse Road
Stafford, VA 22555-0339

Project Service Area: Stafford County

Total Requested Amount: $3,398,155.60

Required Annual Audit Status: Accepted

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Budget Information:

Cost/Activity Category	DHCD Request	Other Funding	Total
Telecommunications	**$3,398,155.60**	**$2,364,380.00**	**$5,762,535.60**
Construction	$3,398,155.60	$0.00	$3,398,155.60
Other: Stafford County Match	$0.00	$1,500,000.00	$1,500,000.00
Other: Comcast Match	$0.00	$864,380.00	$864,380.00
Total:	**$3,398,155.60**	**$2,364,380.00**	**$5,762,535.60**

Budget Narrative:

The total project cost is expected to be $5,762.535.60. On September 7, 2021, Stafford County Board of Supervisors approved a resolution for the County to apply for an FY2022 VATI grant with Comcast co-applicant and provide a match of $1,500,000. Comcast has committed to providing a cash match of $864,380.40. Note: Stafford County will provide in-kind support to waive permit fees and provide grants administration and project management as part of this project.

Questions and Responses:

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1. **Project Description and Need**

   Describe why and how the project area(s) was selected. Describe the proposed geographic area including specific boundaries of the project area (e.g. street names, local and regional boundaries, etc.). Attach a copy of the map of your project area(s). Label map: Attachment 1 – Project Area Map.

Answer:

Stafford County ("Partner" or "County") and Comcast of Virginia, LLC ("Comcast") appreciate the opportunity to respond to the Commonwealth of Virginia's Department of Housing and Community Development's ("DHCD") Virginia Telecommunication Initiative ("VATI") with respect to deploying broadband infrastructure to eligible service areas in the County. As detailed further below, we propose to deploy qualifying broadband service to 634 households, which also include 52 home businesses and three churches.

The geographic area for this project includes portions of the Western part of the County (Hartwood and Rockhill Districts) including approximately 68 miles of infrastructure generally dispersed throughout the area of Stafford County, as noted on the attached Project Area map and further detailed below.

The project area was selected after consultation between the County and Comcast and meets the eligibility criteria established by the Virginia General Assembly and the Department of Housing and Community Development for a VATI award. VATI eligibility criteria being more restrictive than that of some federal programs, the project area was also selected to meet eligibility criteria for the Coronavirus State Fiscal Recovery Fund and/or the Coronavirus Local Fiscal Recovery Fund established under the American Rescue Plan Act.

Comcast proposes to extend its network so that homes and businesses in the project area are serviceable with broadband speeds of up to 1.2 gigabits per second ("Gbps") over a hybrid fiber-coaxial network for residential customers and 10 Gbps for Business customers.

The County has researched internet service availability, including soliciting community engagement. The County has received many comments from citizens and businesses on the lack of adequate internet in areas of the County. In addition, the County has worked with various ISPs to identify areas where better internet service is needed. This information led to the need to develop a broadband plan that identifies unserved areas of the County that should be targeted for internet service.

The geographic area for this proposed project is within three districts within the County: Hartwood and Rock Hill in the Western part of the County and a small number of homes in the Eastern part of the County within the Griffis-Widewater district.

The County went through a process in July - early August 2021 and issued an RFI to solicit interest in partnering with the County to serve the above-mentioned areas. Four responses were received and a panel of County staff and a representative from County Schools selected Comcast to partner with the County to apply for this grant opportunity.

2. List existing providers in the proposed project area and the speeds offered. Please do not include satellite. Describe your outreach efforts to identify existing providers and how this information was compiled with source(s).

Answer:

AER Wireless is the only known service provider within the target area and they provide service to seven homes in the Walden Ten Home Owner's Association, which were added in the Summer of 2021. The County is not aware of any other broadband service available within the proposed project area.

3. Describe if any areas near the project have received funding from federal grant programs, including but not limited to Connect America Funds II (CAF II), ACAM, ReConnect, Community Connect, and Rural Digital Opportunity Funds (RDOF). If there have been federal funds awarded near the project area(s), provide a map showing these areas, verifying the proposed project area does not conflict with these areas. Do not include areas awarded to satellite broadband providers. Label Map: Attachment 2 – Documentation on Federal Funding Area.

Answer:

The County is not aware of any areas within the project area receiving Connect America Funds II,(CAF II), ACAD, ReConnect Community Connect, and Rural Digital Opportunity Funds (RDOF). The County did receive $525,000 in funding in November 2020 through the CARES ACT Fast Track Broadband program offered through the Governor's Office. The award provided funding to KGI Communications, LLC ("KGI") to place their fixed wireless radios on two towers in Stafford County, one at 151 Chriswood Lane and the other at 399 Poplar Road. While KGI initially indicated that this service would reach a large part of the Western area of the County, KGI has been unable to reach nearly all of the target areas for this grant application. KGI has indicated that wireline service would be required for these areas as the area has too much tree and foliage density for their radio signals to reach homes. Additionally, AER Wireless was the recipient of CARES ACT funds through Stafford County's Economic Development Authority in August 2020 to deploy fixed wireless service for up to 90 homes by no later than December 30, 2020. AER Wireless was unable to bring service to any homes during the contractual time period and to date only seven homes have been connected.

4. Describe if any blocks awarded in Rural Digital Opportunity Fund (RDOF), excluding those awarded to satellite internet service providers, are included in the VATI application area. If RDOF areas awarded to terrestrial internet service providers are included in the VATI application, provide a map of these areas and include information on number of passings in RDOF awarded areas within the VATI application area, and Census Block Group ID number for each block group in the project area. Label Attachment: Attachment 3 – RDOF Awarded Areas Form in VATI Area

Answer:

The project area does not contain Rural Digital Opportunity Fund (“RDOF”) eligible census blocks, as noted in Attachment 3.

5. Overlap: To be eligible for VATI, applicants must demonstrate that the proposed project area(s) is unserved. An unserved area is defined as an area with speeds below 25/3 mbps and with less than 25% service overlap within the project area for wireless projects and 10% for wireline projects. Describe any anticipated service overlap with current providers within the project area. Provide a detailed explanation as to how you determined the percentage overlap. Label Attachment: Attachment 4 – Documentation Unserved Area VATI Criteria.

Answer:

The project area is unserved based on data available through the FCC’s publicly available Form 477 website and from broadband providers. With the exception of seven homes within the Walden Ten HOA, the County is not aware of any existing wireline and wireless internet service providers providing broadband within the proposed project area. Comcast and Stafford County anticipate no service overlap within the project area. While the attached map of FCC Form 477 data shows providers offering internet service in this area, Stafford County is not aware of these providers offering service that would result in classifying the project area as served according to VATI guidelines with the exception of the seven homes previously mentioned.

In summary, the project area is unserved based on data available through the FCC’s publicly available Form 477 website, broadband providers, and according to Stafford County residents with exception of seven homes in the Walden 10 HOA.

6. Total Passings: Provide the number of total serviceable units in the project area. Applicants are encouraged to prioritize areas lacking 10 Megabits per second download and 1 Megabits per second upload speeds, as they will receive priority in application scoring. For projects with more than one service area, each service area must have delineated passing information. Label Attachment: Attachment 5 – Passings Form.
   a. Of the total number of VATI passings, provide the number of residential, business, non-residential, and community anchors in the proposed project area. (Up to 10 points for businesses and community anchor institutions)

   b. If applicable, of the total number of RDOF passings, provide the number of residential, business, non-residential, and community anchors in the proposed project area.

   c. If applicable, provide the number of passings that will require special construction costs, defined as a one-time fee above normal service connection fees required to provide broadband access to a premise . Describe the methodology used for these projections.

   d. If applicable, provide the number of passings included in the application that will receive broadband access because special construction costs have been budgeted in the VATI application. Describe the methodology used for determining which passings with special construction costs were budgeted in the application.

   e. Provide the number of passings in the project area that have 10/1 mbps or less. Describe the methodology used for these projections. (up to 15 points)

Answer:

Based on data available through the FCC's publicly available Form 477 website, Comcast estimates there are 634 passings in the Project Area that have access to Internet speeds of 10/1 Mbps or less.
Comcast and the County performed an internal analysis of passings without access to Internet speeds of 10/1 Mbps or less in census blocks from the Form 477 website showing existing Comcast service.

a. The total number of passing includes 634 residences and 52 home-based businesses, three churches and one fire station.
b. Not Applicable (see attachment 3).
c. The Stafford County project is to achieve universal coverage in the project are. None of the passings proposed will require special construction costs. However, Comcast will require any necessary permission(s) from residents to traverse or access private property to provide service.
d. State funds are needed to implement this project because private, at risk capital is not likely to be invested by a private provider in this area due to low population density. If undertaken alone, the extension of Comcast's plant proposed herein would not meet the criteria of Comcast's standard investment model. Comcast therefore anticipates all passings included in the application will receive access because special construction costs have been budgeted into the VATI application.
e. The FCC's Form 477 Website shows 10/1 coverage. Based on the 477 data we estimate that at least one-half (300+) of the residents have speeds less than 10/1.

7. **For wireless projects only:** Please explain the ownership of the proposed wireless infrastructure. Please describe if the private co-applicant will own or lease the radio mast, tower, or other vertical structure onto which the wireless infrastructure will be installed.

Answer:

This is not applicable since this application is for wireline service.

8. Speeds: Describe the internet service offerings, including download and upload speeds, to be provided after completion of the proposed project. Detail whether that speed is based on dedicated or shared bandwidth, and detail the technology that will be used. This description can be illustrated by a map or schematic diagram, as appropriate. List the private co-applicant's tiered price structure for all speed offerings in the proposed project area, including the lowest tiered speed offering at or above 25/3 mbps. (up to 10 points)

Answer:

To support the growing needs of the digital world, Comcast is working hard to make its network smarter, by leveraging cloud, backbone, and architecture advancements to provide a faster, stronger, and more flexible network. By optimizing traffic routing and moving resources closer to where they are needed, our network provides the key to managing the ever increasing traffic demands of today's Internet. The powerful combination of our broadband and Wi-Fi network and the cloud is enabling us to innovate and bring transformative products to market, redefining how our customers enjoy entertainment, connect, and communicate inside and outside of their home or office.

Upon completion of the project Comcast will offer the following services:

- High-Speed Internet Services
- Video Services
- VoIP Services
- Xfinity Mobile
- Comcast Business Services

Customer Service. In addition to Comcast's deep experience as a communications service provider offering a variety of services, Comcast also has the appropriate number of technicians, call center agents and backend support employees to care for additional customers. Comcast also maintains large, locally based engineering and technical operations teams that work around the clock to maintain service reliability and provide direct support to the company's business and residential customers. Moreover, Comcast proactively monitors and maintains its network 24/7 through its dedicated Network Operations Center (NOC). The NOC continuously monitors the network equipment, service health, and performance of the Comcast network, responds to network events and service degradations, dispatches local field technicians, and informs customers of service issues, in many cases before the customer has noticed the problem. The NOC group also provides technical support and responds to trouble calls from network service customers including carriers, TLS and Native ATM customers, and voice product customers, through a staff of Technical Support Representatives (TSRs). The NOC also operates a 24 x 7 x 365 Technical Customer Support helpdesk that responds to calls for all of Comcast's services.
As detailed in the table below, upon completion of the project, Comcast will be able to offer customers multiple choices of residential and commercial broadband services, depending on the customers' specific needs:

Residential Service Tiers

Tier	Speeds Up To	Standalone Pricing	With Xfinity TV or Voice Service
Performance Starter	50 Mbps / 5 Mbps	$54.95	$49.95
Performance	100 Mbps / 5 Mbps	$80.95	$64.95
Performance Pro	200 Mbps / 5 Mbps	$95.95	$79.95
Blast!	400 Mbps / 10 Mbps	$100.95	$84.95
Extreme Pro	800 Mbps / 15 Mbps	$105.95	$89.95
Gigabit	1.2 Gbps / 35 Mbps	$110.95	$94.95
Gigabit Pro	2 Gbps / 2 Gbps	$299.95	N/A

Comcast Business Tier

Tier	Speeds Up To
Business Internet 100	100 Mbps / 15 Mbps
Business Internet 200	200 Mbps / 20 Mbps
Business Internet 300 Plus	300 Mbps / 30 Mbps
Business Internet 600	600 Mbps / 35 Mbps
Business Internet 1G	1.2 Gbps / 35 Mbps

Note: Prices do not include equipment or applicable taxes, fees and surcharges.

More details can be found in Attachment 18.

9. Network Design: Provide a description of the network system design used to deliver broadband service from the network's primary internet point(s) of presence to end users, including the network components that already exist and the ones that would be added by the proposed project. Provide a detailed explanation of how this information was determined with sources. Provide information on how capacity for scalability, or expansion, of how the network can adapt to future needs. If using a technology with shared bandwidth, describe how the equipment will handle capacity during peak intervals. For wireless projects, provide a propagation map for the proposed project area with a clearly defined legend for scale of map. Label Map: Attachment 6 – Propagation Map Wireless Project.

Answer:

Comcast has built a fiber backbone at the core of its network that stretches across the country with more than 191,000 route miles of fiber– using the industry's most advanced optics/lasers and IP routing technologies. Dozens of converged regional area networks interconnect to create this fiber backbone that delivers video, voice, and high-speed Internet services to tens of millions of customers throughout the country. IP technology ties all of this together, creating a highly scalable connectivity platform or "IP core." Comcast has been building fiber into its network incrementally over the past decade. In 2015, Comcast introduced Gigabit Pro, the industry's first residential fiber-to-the-home 2 Gbps service ever offered by an Internet service provider in the United States.

Comcast proposes to construct the project with a highly scalable hybrid fiber-coaxial ("HFC") solution, emanating from the closest facility to the project. Fiber-optic cables would be constructed to the service area, commonly referred to as a serving node, where optical signals would be converted to electrical or radio frequency for distribution over the coaxial network to subscriber's homes, businesses, and/or community anchor institutions.

Currently, Comcast employs Data Over Cable Service Interface Specification (DOCSIS) 3.1 technology in its broadband network infrastructure, and plans to use DOCSIS 3.1 for this project. DOCSIS is an international telecommunications standard that permits the addition of high bandwidth data transfer to an existing cable TV system. The technology is employed by many cable operators to provide Internet access over existing HFC infrastructure. DOCSIS is a proven, flexible protocol which offers the technological foundation upon which Comcast can meet any current or future anticipated need. As a highly scalable technology, it has, to-date, allowed Comcast to enhance the residential broadband speeds it offers from 50 Mbps to 1.2 Gbps, an almost 25-fold increase.
DOCSIS 3.1 was introduced in 2013 and will support a maximum downstream capacity of 10 Gbps and maximum upstream capacity of 1-2 Gbps. DOCSIS architecture includes two primary components – a cable modem, located at a customer's home or business, and a cable modem termination system (CMTS), located at the cable system head end. Comcast leases the cable modem to customers as a component of the service, or customers can provide their own modem, and the CMTS for this proposed project is located in Comcast's head end serving the project area.

The design for the proposed project is based upon the current industry standards as developed by the Society for Cable Television Engineers (SCTE) and Comcast standards of broadband deployment. Comcast utilizes ARRIS cable modems and CMTS devices both of which have been certified by CableLabs for use with DOCSIS technology.

The industry continues to innovate, working through CableLabs, a joint non-profit research and development laboratory, to develop the next iteration of DOCSIS, named 10G. The 10G platform is a combination of technologies that will deliver Internet speeds 10 times faster than today's networks and 100 times faster than what most consumers currently experience. This technological development will allow Comcast to offer gigabit symmetrical service in the coming years over its existing HFC network throughout our entire footprint, as well as lower latencies, enhanced reliability, and better security in a scalable manner. Comcast began field trials of 10G earlier this year. This combination of technologies will result in much faster speeds, more reliability, stronger security, and even lower latency. The network will be able to transmit up to 50% more data, thereby augmenting the quality of video conferencing, telehealth, and connected devices, among many other things. Additional information about these exciting developments is available at https://www.cablelabs.com/path-10g-2020-update.

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10. Explain how the proposed project achieves universal broadband coverage for the locality or fits into a larger plan to achieve universal broadband coverage for the locality. If applicable, explain the remaining areas of need in the locality and a brief description of the plan to achieve universal broadband coverage. (up to 50 points)

Answer:

While it is not possible to know exactly how many residences within Stafford County lack broadband access, it is believed that if this application is awarded that the County will reach or exceed 97% of homes passed. The County recently awarded a contract to CTC Technology & Energy ("CTC") to conduct a comprehensive Telecommunications Strategy and Plan. See Attachment 19, which includes a copy of the statement of work, including a broadband study as a component of the plan. The County has three cable franchise agreements with providers offering broadband service, Comcast, Verizon, and Cox Communications. One area the County intends to look at as part of this plan is where gaps in service exist within the service areas of these three providers due to insufficient density (less than 20 homes/linear mile or setbacks in excess of 200' from the road where service runs down. DHCD staff has made the County staff aware of future funding later this year for long drops. Most of the gaps in service within these three providers' service areas are a result of setbacks, which the County with the assistance of CTC, intends to identify and apply for long drop funding.

11. **Project Readiness**

Describe the current state of project development, including but not limited to: planning, preliminary engineering, identifying easements/permits, status of MOU or MOA, and final design. Prepare a detailed project timeline or construction schedule, identifying specific tasks, staff, contractor(s) responsible, collection of data, etc., and estimated start and completion dates. Applicants must include Memorandums of Understanding (MOUs) or Memorandums of Agreement (MOAs) between applicants (drafts are allowable). Label Attachments: Attachment 7 – Timeline/Project Management Plan; Attachment 8 – MOU/MOA between Applicant/Co-Applicant; (up to 20 points)

Answer:

This grant will enable the partnership to extend broadband service at speeds ranging from 50 mbps to 1.2 Gbps to 634 unserved homes in the proposed service area. The proposed project area will have access to some of the fastest and most reliable broadband speeds available nationwide.

Comcast has completed the planning and preliminary engineering phase for the proposed project area. Final design and construction shall commence upon the award of the grant. Workflow is included in the attached project management plan. The specific initial tasks include project engineering and right of way preparation. Comcast will need to obtain the necessary permits from the Virginia Department of Transportation and any other government entities as needed. Comcast will work with the County to obtain the necessary permits and power supplies expeditiously. This coordination will need to begin immediately upon notice of the grant award. Comcast anticipates completing the project within 18 months after contract execution between the County and DHCD. As contemplated by the 2022 VATI guidelines, Comcast may request an extension if it encounters permitting, pole attachment, or other circumstances beyond its control which may delay the project timeline.

Comcast Service Delivery Major Milestones:
• Outside and Inside Surveys – Comcast will conduct outside plant and customer site surveys.
• Permits & Right of Entry Agreements – Comcast will obtain required permits and work with property owner to obtain Right of Entry/Access agreements.
• Service Configurations – Comcast National Team will implement Network Core Configurations.
• Outside and Inside Fiber/Coax Construction – Comcast will complete outside and inside construction.
• Customer Premise Equipment Installation/Plant Test Date (PTD) – Comcast will dispatch to the customer's premise to install CPE, connect CPE to Fiber, and call Comcast Test & Turn-up to complete plant test.

Comcast Responsibilities:
• Construct all OSP and ISP fiber optic and coaxial cabling up to the agreed upon locations from the site survey forms and connect [XX] locations.
• Call for locates of public utilities in the right of way.
• Restoration of disturbed grounds.
• Assemble, configure, and install all Comcast provided network equipment on customer premise.
• Test and verify all appropriate fiber and coaxial connections.
• Test and verify all appropriate data interfaces/connections and verify throughput.
• Provide 24x7x365 network monitoring.
• Provide contact list information including escalation procedures and NOC information.
• Provide documentation detail services including customer network interface drawings.
• And any additional agreements per site survey document. Detailed information regarding the customer responsibilities is available in the Technical Specifications section of the proposal. Additional information can be provided upon request.

12. Has the applicant or co-applicant received any VATI grants? If so, provide a list of these grants, with a detailed summary of the status of each.

Answer:

Stafford County received a 2020 VATI grant with KGI as the co-applicant. The project is over 95% complete, with the construction of the tower on Marlborough Point nearly complete. This project provides access to fixed wireless broadband to nearly 650 homes and businesses in the Eastern part of Stafford County and an additional 100 homes in King George County (within range of the Marlborough Point Tower).

Between 2017 and 2020, Comcast received four VATI grants from DHCD, and has now successfully deployed broadband to residences and businesses throughout each of the project footprints.

A summary list of projects is noted below:

2017: Albemarle County – 178 serviceable units - Complete
2017: Spotsylvania County – 153 serviceable units - Complete
2018: Clarke County – 97 serviceable units - Complete
2019: Charles City County – 2,350 serviceable units - Complete

13. Matching funds: Complete the funding sources table indicating the cash match and inkind resources from the applicant, co-applicant, and any other partners investing in the proposed project (VATI funding cannot exceed 80 percent of total project cost). In-kind resources include, but are not limited to: grant management, acquisition of rights of way or easements, waiving permit fees, force account labor, etc. Please note that a minimum20% match is required to be eligible for VATI, the private sector provider must provide10% of the required match. If the private co-applicant cash match is below 10% of total project cost, applicants must provide financial details demonstrating appropriate private investment. Label Attachments: Attachment 9 - Funding Sources Table; Attachment 10 – Documentation of Match Funding

Answer:

The proposed project represents a partnership between Comcast and Stafford County. Comcast, the co-applicant, upon award of the VATI grant, will be responsible for any matching funds and will provide the labor and materials to complete the provision of services to the area delineated in the attached map. Comcast will provide approximately 15% of the projected construction costs of $5,762,536, totaling approximately $864,380.40. Stafford County will provide approximately 26% or $1,500,000 in matching funds . Stafford County will also assist in providing in-kind contributions including application analysis and preparation, coordination with DHCD, project management, assistance with right-of-way permitting, and participating in further concert with Comcast as the project is approved and construction begins. The value of these services will depend on the level of activity occurring as the project commences, but is expected to exceed $100,000 in value.

14. Leverage: Describe any leverage being provided by the applicant, co-applicant, and partner(s) in support of the proposed project. (up to 10 points)

Answer:

Stafford County provides outreach to students to assist with broadband connectivity in a number of ways through the Stafford County School system and libraries.

- Stafford County Schools setup outdoor WIFI access points in the parking lots of all schools including ones serving students within the project area, Hartwood Elementary School and Mountain View High School
- Schools have setup WIFI access points at some of the locations where Free and reduced meal drop-offs occurred during the pandemic and remain in operation
- Schools provide Kajeet take home devices to provide connectivity including homes for children with the project area
- Stafford County provided funding to Schools to help support the purchase Chromebooks for each of the 29,000 students in the County and within the project area
- Libraries provide Kajeet devices available for check-out for children throughout the County

15. Marketing: Describe the broadband adoption plan.

a. Explain how you plan to promote customer take rate, including marketing activities, outreach plan, and other actions to reach the identified serviceable units within the project area. Provide the anticipated take rate and describe the basis for the estimate. (up to 10 points)

b. Describe any digital literacy efforts to ensure residents and businesses in the proposed project area sufficiently utilize broadband. Please list any partnering organizations for digital literacy, such as the local library or cooperative extension office.

Answer:

a. Comcast's business model is not dependent upon a particular take rate. Forecasting a take rate with a high degree of accuracy is most challenging as the actual number of customers who choose to subscribe is beyond the parties' control. Comcast's take rate estimate for the project areas is based upon several unique factors. The County's support for the project and involvement with the community is expected to add heightened awareness earlier than might otherwise occur. The public nature of the VATI program is also expected to add to the early awareness of residents of broadband availability and positively enhance the take rate.

All of the factors combined inform our estimate that, on the high end, some 45-55% of residents may take service within the first year after project completion. These projections for overall subscriber levels are dependent on several factors and even an initial prediction may change as the project progresses. Comparisons between applicants may not provide a useful measure of broadband access as each applicant will have different service offerings, marketing campaigns, and other intangibles that could drive take rates. For example, Comcast take rates may vary from those of other providers because Comcast offers more services than broadband alone – including video, telephone, mobile telephone, and ho me security –and the company offers bundled pricing promotions from time to time. These additional products and pricing options can change the value proposition of Comcast service for each household that is unique among providers.

Comcast does undertake various actions to make residents aware that service is available. During the construction phase, before the service is active, the presence of Comcast vehicles visually alerts residents that service is coming. Comcast personnel involved with the construction in the public rights of way are often asked about availability. Soon after completing construction, Comcast provides notice to potential customers of service availability on a rolling basis. It typically employs various communication tactics to inform residents of availability. These tactics can include direct mail pieces or event sponsorships. These efforts augment existing advertising campaigns already in place within Stafford County for Comcast's existing customer base. Once service is established, Comcast may communicate with these residents through direct mail, direct e-mail, radio ads, video ads, and other marketing tactics.

If conditions allow, a public meeting will be held in or near the proposed project area to inform the residents about the upcoming work and answer questions. Nearer the completion of the project a public meeting will be held to educate potential customers on the proposed services and to encourage sign-ups and answer questions. The County's Public

Information Office and Telecommunications Commission will promote the proposed internet service and educate residents and businesses on the opportunities of this service through email and social media.

b. Before and especially during the pandemic Stafford County Schools (Schools) purchased Chromebooks for each student and provided take home Kajeet devices to provide cellular WiFi in areas with available cellular service. Additionally, Schools setup WiFi hot spots in parking lots of each school, created Internet cafes in the cafeterias of elementary schools, and offered laptops for residents through the Virginia Star program at Brooke Point High School. Schools also partnered with Cox Communications to provide hotspots in low income housing areas adjacent to bus stops where free and reduced meals were dropped off during the pandemic. The Libraries within Stafford County offer Kajeet devices for check-out as well.

In addition, Comcast's Internet Essentials program has a significant digital literacy component. Since 2011, Comcast has made nine enhancements to our digital skills training portfolio, including developing Online Safety Toolkits, working with partners to design best-in-class curricula to engage senior citizens, and providing computer labs and other equipment to support digital participation at community centers across the country. We are proud to support digital skills training via a network of tens of thousands of partners who share our vision of bringing the Internet to everyone.
Since creating the program in 2011, Internet Essentials built up an online learning center (accessible at https://www.internetessentials.com/learning) that includes more than 200 digital literacy training videos, guides, and reports that are free to anyone to use, including non-customers.
Last year, we created our Internet Essentials Partnership Program to help schools, school districts, and other community organizations collaborate to fund and connect large numbers of low-income students and families to the Internet at home. Hundreds of schools and school districts have signed up already.

Additionally, we've instituted a number of COVID-19 response measures, including offering any new Internet Essentials customer 60 days of Internet service for free and waiving the requirement that customers not have back debt due so that even more families can get connected. All told, we have invested more than $700 million in digital skills training and awareness and reached more than 11 million people in the process. We have also either sold (at a heavy discount) or given away for free more than 150,000 laptops, desktops, and tablets in underserved communities. Of those customers we surveyed with children in the home, 90 percent reported that being connected to the Internet had a positive impact on their child's grades. 62 percent surveyed also said the Internet service helped someone in their household find a new job.

16. Project Management: Identify key individuals who will be responsible for the management of the project and provide a brief description of their role and responsibilities for the project. Present this information in table format. Provide a brief description of the applicant and co applicant's history and experience with managing grants and constructing broadband communication facilities. Please attach any letters of support from stakeholders. If the applicant is not a locality(s) in which the project will occur, please provide a letter of support from that locality. Attachment 11 – Letters of Support.

Answer:

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Name	Title	Responsibility
Nathan Daugherty	Senior Manager, Comcast Government Affairs	Project Coordination
Steve Hill	Senior Director of Network Engineering	Construction Supervision
Michael Cannon	Stafford County Chief Technology Officer	Project Management and Project Primary Contact
Tina Owens	Stafford County IT Specialist	Grants Administration
Randy Helwig	Stafford County Controller	Financial Grants Manager

Stafford County has significant experience managing state and federal grants including a FY2020 VATI grant. The County has also been the recipient of several other DHCD grants.

Comcast has significant experience constructing broadband communications facilities. It is a leading communications provider in Virginia, offering video, high-speed Internet, home security, and phone services to residential customers under the Xfinity brand and also providing services to businesses through its Comcast Business suite of products. Comcast has invested in technology to build an advanced network that delivers among the fastest broadband speeds, and brings customers personalized video, communications, and home management offerings. Comcast has invested billions of dollars to create a network across the U.S. that makes broadband widely available, as part of its commitment to provide superior services to its customers.

Since 2011, Comcast made more than $1.8 billion in technology and infrastructure investments in Virginia to offer reliably fast speeds even during peak use periods. The company has invested significant resources in both local and national Network Operations Centers (“XOC”) to ensure continued proactive monitoring of network health.

In Virginia, Comcast employs over 1,900 people. In 2019 it invested more than $216 million annually in payroll, benefits, and training for its Virginia workforce. The company maintains a large, locally based engineering technical operations team that works around the clock to maintain network reliability and to directly support the company’s business and residential customers. For many decades, Comcast, through its Beltway Region, has served over 140 communities in Virginia. Many of these communities are very rural in nature.
Comcast has experience partnering with public agencies to deploy broadband infrastructure in unserved areas. As noted above, Comcast was awarded four Virginia Telecommunications Initiative grants in 2018, 2019, and 2020.

In 2018 Comcast also earned a Last Mile Broadband grant from the Virginia Tobacco Region Revitalization Commission to provide broadband access to nearly 7,000 homes and businesses. With construction expected to be complete in 2020 and ahead of schedule, Comcast has already provided access to more homes and addresses than originally estimated.

In Massachusetts, Comcast was awarded a grant of $4,000,000 from the Massachusetts Technology Collaborative (“Mass Tech”) for construction of line extensions to areas in nine towns whose costs to construct exceeded Comcast’s economic standards. Comcast completed the project on time, on budget, and reached 20% more homes than the 1,000 originally anticipated. Comcast was also awarded a grant of $805,800 by Mass Tech for construction of approximately 27 miles of line extensions in Montgomery, Massachusetts, a town which is currently unserved. Comcast is currently deploying broadband in three additional unserved towns in partnership with the MBI.

In 2013 and 2014, Comcast received two grants from the Vermont Telecommunication Authority (“VTA”) totaling $336,558 to provide service to areas that were economically unfeasible for construction. In 2015 and 2017, the Vermont Department of Public Service (“DPS”) twice awarded Comcast funds from its Connectivity Initiative grant totaling $359,850. The DPS awarded Comcast another grant to deploy broadband in unserved areas of Cavendish VT. Comcast has either fulfilled or is on schedule to fulfill its grant obligations to the VTA and DPS.

17. **Project Budget and Cost Appropriateness**

Budget: Applicants must provide a detailed budget that outlines how the grant funds will be utilized, including an itemization of equipment, construction costs, and a justification of proposed expenses. If designating more than one service area in a single application, each service area must have delineated budget information. For wireless projects, please include delineated budget information by each tower. Expenses should be substantiated by clear cost estimates. Include copies of vendor quotes or documented cost estimates supporting the proposed budget. Label Attachments: Attachment 12 – Derivation of Costs; Attachment 13 - Documentation of Supporting Cost Estimates. (up to 10 points)

Answer:

"Comcast's Construction and Design team managed projects that added thousands of miles to Comcast's regional hybrid fiber coaxial network on 2020-2021. Comcast's construction estimates are determined though a detailed project analysis that includes a desktop survey, an analysis of permitting costs (internal or external), a network impact study to determine necessary hub site preparation and possible infrastructure requirements, and a financial evaluation for overall build costs and likely return-on-investment. When contract labor is utilized, costs are accrued according to the fee schedule in the contract. The design and construction process is standard within the telecommunications industry.

Examples of items that are included in the Material category are: power supplies, fiber conduit, splice enclosures, pedestals, and taps. Examples of items in the Labor category are in-house and contract labor to trench and backfill, lay conduit and fiber, perform administration of VDOT permits, and provide crew supervision."

Attachment 12 provides the cost estimates, which are $5,762,536.

18. The cost benefit index is comprised of state cost per unit passed. Individual cost benefit scores are calculated and averaged together to create a point scale for a composite score. Provide the following:
a. Total VATI funding request

b. Number of serviceable units
(up to 125 points)

Answer:

a. Total VATI funding request - $3,398,155.60
b. Number of Serviceable units - 634

19. **Commonwealth Priorities (Up to 40 points)**

Additional points will be awarded to proposed projects that reflect Commonwealth priorities. If applicable, describe the following:
a. Businesses, community anchors, or other passings in the proposed project area that will have a significant impact on the locality or region because of access to broadband.

b. Unique partnerships involved in the proposed project. Examples include electric utilities, universities, and federal/state agencies.

c. Digital equity efforts to ensure low to moderate income households in the proposed project area will have affordable access to speeds at or above 25/3 mbps.

Answer:

a. There are three schools located in the Western part of the county that will have a significant impact. Gauntlet Golf Club, The Glasgow Farm, Willowmere Park. The future site for Fire Station 15.

b. Stafford is the proud home of the Virginia Smart Community Testbed, developing smart technology for the Commonwealth funded through a partnership with the Center for Innovative Technologies and Stafford County.
An old convenient store was converted into Stafford's very own "smart" building where entrepreneurs can test their devices, products, and services for the nation.
The Testbed is the first in the nation built around an IoT platform and fully integrating 5G and other new and emerging technologies for Smart Cities. The Testbed will accelerate smart technology growth in the Commonwealth. It also provides a living laboratory for new innovations and foster business investments in the Downtown Stafford area.

The Virginia Smart Community Testbed is a public-private partnership involving industry partners who focus on relevant and practical use cases to produce innovative solutions using emerging and smart technologies. The Testbed provides an approachable place in the region to educate and introduce Smart technology and Smart capabilities used for the development of the public.

The Board also approved the reclassification of 6 acres and an agreement with a private developer that will be the first phase of Downtown Stafford, which the County intends to be one of the first smart cities in the Commonwealth. More information can be found in attachment 20 and on the Virginia Smart Community website: https://www.cit.org/virginia-smart-community-testbed.html.

c. Under Comcast's Internet Essentials offering – the most comprehensive and successful low-income broadband adoption program in the nation – qualifying residential customers can obtain broadband service at speeds of up to 50 Mbps/5 Mbps for $9.95/month plus applicable taxes, fees and surcharges, as well as free digital skills training in person and online. Customers also have the option to purchase a low-cost Internet-ready computer. Internet Essentials is open to virtually all low-income households within Comcast's footprint, including families that qualify for federal assistance (e.g., National School Lunch Program, Medicaid, housing assistance) and low-income veterans, senior citizens, and persons with disabilities.
Moreover, Comcast is proud to be an approved provider supporting the FCC's Emergency Broadband Benefit (EBB) subsidy program. Under the temporary EBB subsidy, qualifying customers may apply a credit of up to $50 per month ($75 per month in Tribal lands) to any Xfinity Internet service tier, including Internet Essentials.

Last year Comcast launching the new "Internet Essentials Partnership Program," which is designed to help accelerate Internet adoption as distance learning plans roll out across the county due to the coronavirus. The program relies on public-private partnerships and enables communities to work together to coordinate funding to help connect K-12 students, including two months of free Internet service for new Internet Essentials customers.

20. **Additional Information**

Provide the two most recent Form 477 submitted to the FCC, or equivalent, as well as point, polygon, and, for wireless providers, RSSI shapefiles for the project area **in .zip file form**. With attachments 17 through 20, attach any other information that the applicant desires to include. Applicants are limited to four additional attachments.

Label Additional Attachments as:
a. Attachment 14 – Two most recent Form 477 submitted to the FCC or equivalent

b. Attachment 15 - Point and Polygon shapefiles, in.zip file form, showing proposed passings and project area

c. Attachment 16 - For wireless applicants: shapefiles, in .zip file form, indicating RSSI projections in the application area

d. Attachment 17 – XXXXXXX

e. Attachment 18 – XXXXXXX

f. Attachment 19 – XXXXXXX

g. Attachment 20 – XXXXXXX

Answer:

Attachment 14 - These are the two most frequent Form 477 which have been submitted to the FCC: all facilities-based broadband providers are required to file data with the FCC twice a year on where they offer Internet access service at speeds exceeding 200 kbps in at least one direction.

Attachment 15 -Point and Polygon Shape File: which is used to represent areas such as a boundary of a city on a large scale map, lake, or forest.

Attachment 16 - RSSI Projection Shape File (Received Signal Strength Indicator): which is an estimated measure of power level that an RF client device is receiving from an access point or router.

Attachment 17 - Comcast Digital Literacy and Equity Materials

Attachment 18 - Rate Card for Stafford County: These are the standards rates that Comcast subscribers within Stafford County can choose from.

Attachment 19 - Stafford County Telecommunications Strategy and Plan SOW: This is the statement of work for an ongoing Telecommunications Strategy and Plan for Stafford County and a major part of the plan is a broadband study.

Attachment 20 - Virginia Smart Community Testbed in Stafford County: This is an overview of the Virginia Smart Community Testbed located in Stafford County and is a partnership with the County and the Center for Innovative Technologies

Attachments:

Application to DHCD Submitted through CAMS

Stafford County Government

Stafford County - Comcast VATI 2022

Map(s) of project area, including proposed infrastructure

Attachment1ProjectAreamap914202140617.pdf

Documentation of Federal Funding (CAF/ACAM/USDA/RDOF, etc…) in and/or near proposed project area.

Attachment2DocumentationforFederalFunding9142021105247.pdf

RDOF Awarded Areas included in VATI Application (Use template provided)

Attachment3RDOFAwardedAreasIncludedinVATIApplication912202193113.pdf

Documentation that proposed project area is unserved based on VATI criteria

Attachment4DocumentationUnservedAreaVATICriteria912202194120.pdf

Passings Form (Use template provided)

Attachment5PassingsForm914202142616.pdf

Propagation Map if Wireless Project

Attachment6PropagationMap914202141310.pdf

Timeline/Project Management Plan

Attachment7TimelineProjectManagementPlanStafford914202141342.pdf

MOU/MOA between applicant/co-applicant (can be in draft form)

Attachment8MOUMOAbetweenComcastandStaffordCountydraft914202141412.pdf

Funding Sources Table (Use template provided)

Attachment9FundingSourcesTable914202141501.pdf

Documentation of Match Funding

Attachment10DocumentationofMatchFundingStafford914202141927.pdf

Letters of Support

Attachment11LettersofSupport914202141019.pdf

Application to DHCD Submitted through CAMS

Stafford County Government

Stafford County - Comcast VATI 2022

Derivation of Cost/Project Budget (Use template provided)

Attachment12DerivationofCosts914202141539.pdf

Documentation of Supporting Cost Estimates

Attachment13DocumentationofSupportingCostEstimates914202140018.pdf

Two most recent Form 477 submitted to the FCC or equivalent

Attachment14TwomostrecentForm477submittedtotheFCCorequivalent914202140033.pdf

Point and Polygon shapefiles, in.zip file form, showing proposed passings and project area

Attachment15PointandPolygonShapefiles914202140604.zip

For wireless applicants: shapefiles, in .zip file form, indicating RSSI projections in the application area

Attachment16RSSIProjectionShapefiles914202140045.pdf

Optional

Attachment17ComcastDigitalLiteracyandEquitymaterialsfull914202142938.pdf

Optional

Attachment18ComcastServicesandSpeedsStafford914202155301.pdf

Optional

Attachment19StaffordCountyTelecommunicationsStrategyandPlanSOW9142021110751.pdf

Optional

Attachment20VirginiaSmartCommunityTestbedinStaffordCounty9142021114334.pdf

Stafford County, VA - VATI Project Area

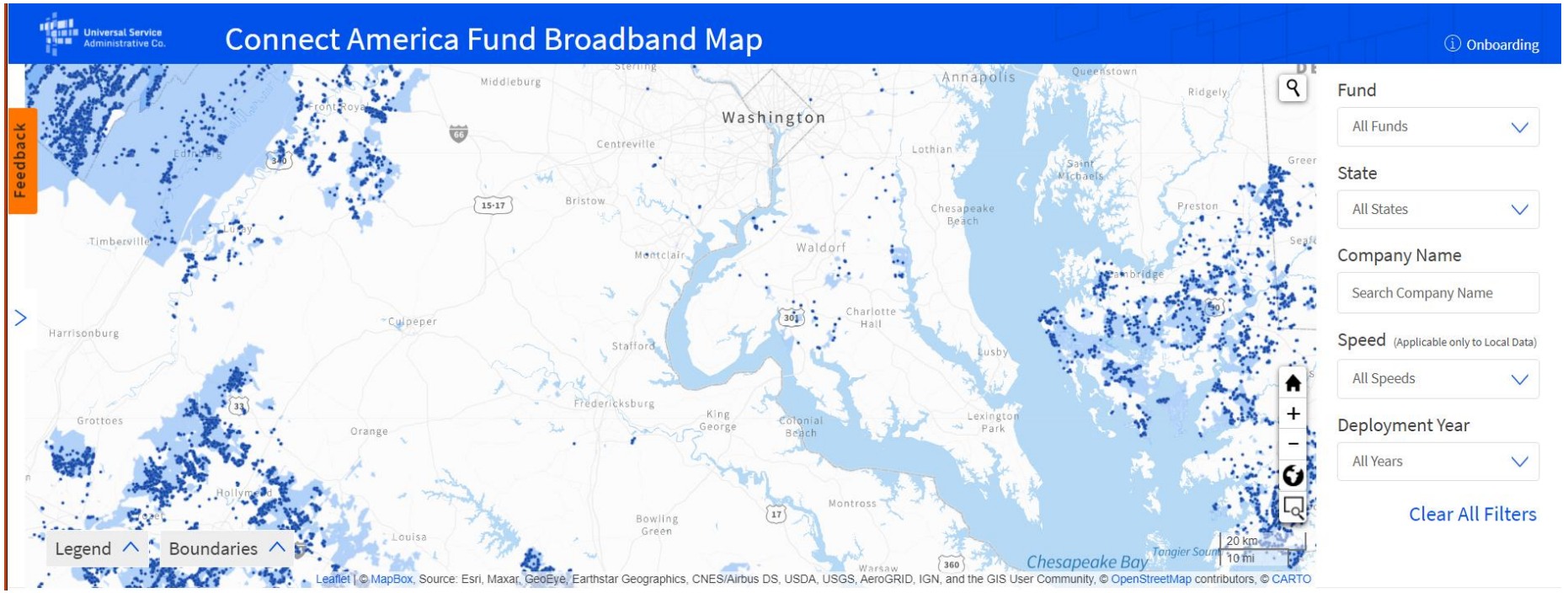
- Proposed Passings (634)
- Proposed Routes
- Proposed Project Area
- Western Zone

N

0 0.75 1.5 3 Miles

COMCAST

Sources: Esri, HERE, Garmin, Int
GeoBase, IGN, Kadaster NL, Ord
OpenStreetMap contributors, and the GIS User Community



This map shows that there were no Federal Connect America Funds awarded in Stafford County

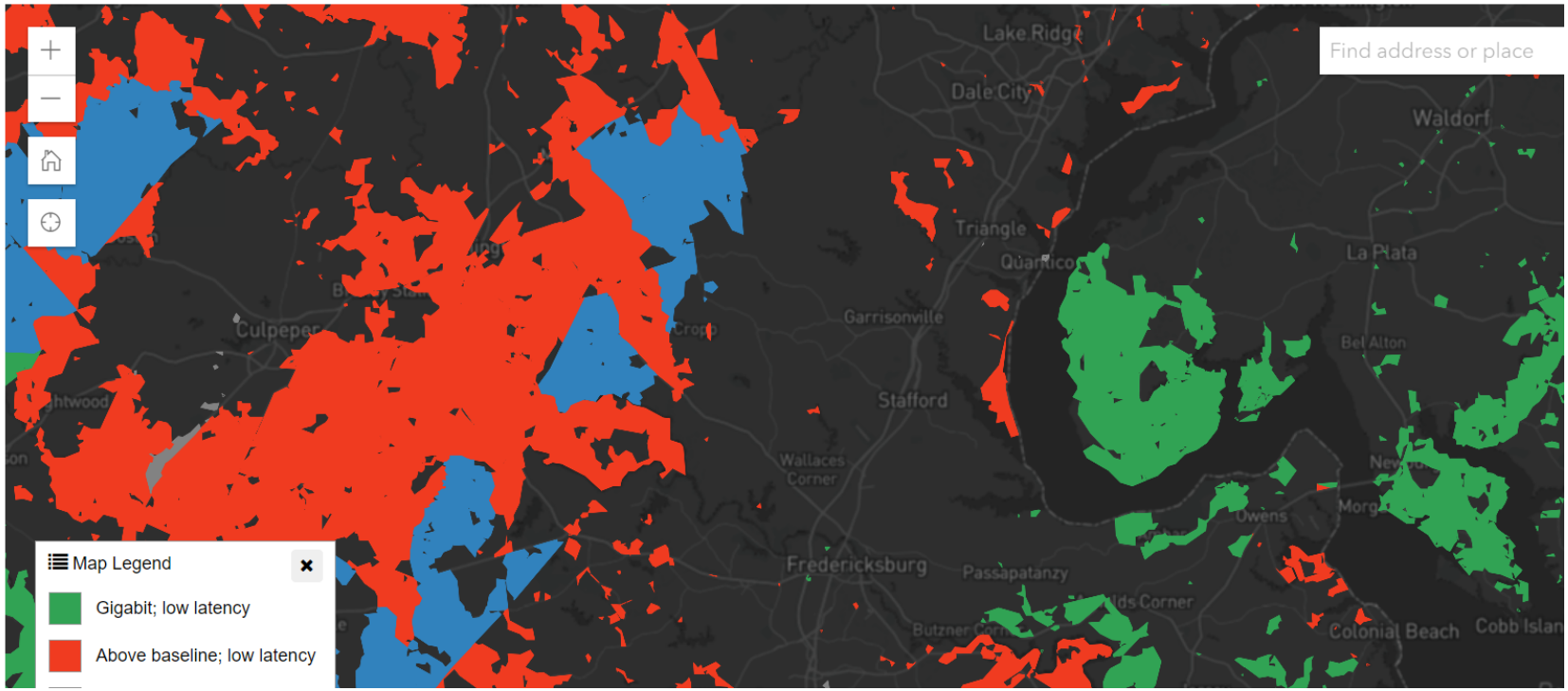
Rural Digital Opportunity Fund P

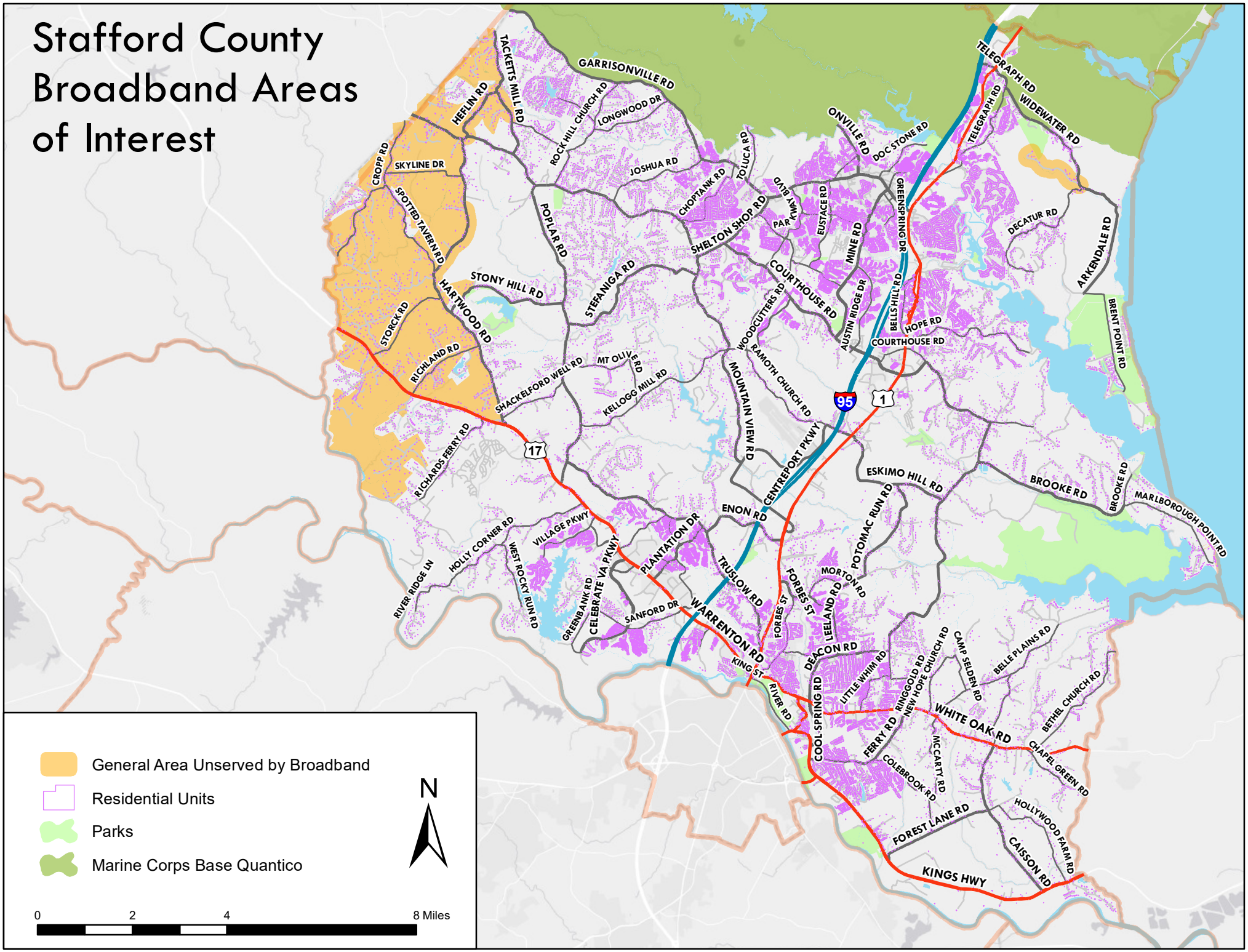
fcc.gov/reports-research/maps/rdof-phase-i-dec-2020/

Apps | New Tab | Buy Microsoft Holo... | Electronic Voting Sy... | ELECTroVOTE - CO... | ControlWorks Votin... | Logon to the Indivi... | SQL Server Report...

Rural Digital Opportunity Fund Phase I Results

Data as of 12/07/20




Stafford County
Broadband Areas
of Interest
General Area Unserved by Broadband
Residential Units
Parks
Marine Corps Base Quantico
N
0
2
4
8 Miles
GARRISONVILLE RD
TACKETTS MILL RD
HEFLIN RD
ROCK HILL CHURCH RD
LONGWOOD DR
JOSHUA RD
CHOPTANK RD
TOLUCA RD
ONVILLE RD
DOC STONE RD
TELEGRAPH RD
WIDEWATER RD
CROPP RD
SKYLINE DR
SPOTTED TAVERN RD
POPLAR RD
SHELTON SHOP RD
PARKWAY BLVD
EUSTACE RD
MINE RD
GREENSPRING DR
DECATUR RD
ARKENDALE RD
BRENT POINT RD
STONY HILL RD
HARTWOOD RD
STEFANIGA RD
COURTHOUSE RD
WOODCUTTERS RD
AUSTIN RIDGE DR
BELLS HILL RD
HOPE RD
COURTHOUSE RD
STORCK RD
RICHLAND RD
SHACKELFORD WELL RD
MT OLIVET RD
KELLOGG MILL RD
MOUNTAIN VIEW RD
RAMOTH CHURCH RD
95
1
17
RICHARDS FERRY RD
CENTREPORT PKWY
ESKIMO HILL RD
BROOKE RD
MARLBOROUGH POINT RD
ENON RD
POTOMAC RUN RD
VILLAGE PKWY
HOLLY CORNER RD
PLANTATION DR
RIVER RIDGE LN
WEST ROCKY RUN RD
CELEBRATE VA PKWY
GREENBANK RD
SANFORD DR
TRUSLOW RD
MORTON RD
FORBES ST
LEELAND RD
WARRENTON RD
KING ST
DEACON RD
RIVER RD
COOL SPRING RD
LITTLE WHIM RD
RINGGOLD RD
NEW HOPE CHURCH RD
CAMP SELDEN RD
BELLE PLAINS RD
WHITE OAK RD
BETHEL CHURCH RD
FERRY RD
MCCARTY RD
CHAPEL GREEN RD
COLEBROOK RD
HOLLYWOOD FARM RD
FOREST LANE RD
CAISSON RD
KINGS HWY

Type of Passings	Total Number of Passings in the Project Area [1]	Passings in the Project Area, without Special Construction Costs Required[2]	Passings with Special Construction Costs budgeted in the Application [3]	Number of Passings with Speeds at 10/1 or below in Project Area [4]
Residential	634	634	634	634
Businesses (non-home based)	0	0	0	0
Businesses (home-based)	52	52	52	52
Community Anchors	0	0	0	0
Non-residential	0	0	0	0
Total	634	634	634	634

***Note** : The Total Number of Passings **MUST** be equal to the Residential, Business (non-home based), Non-residential and Community Anchors sum.*

***Note** : Do not include passings in RDOF awarded areas that were awarded to the co-applicant; these passings should be included in the RDOF Passings Form. Passings included in this application in RDOF awarded areas that were not awarded to the co-applicant, unless successfully challenged, are considered unserved and should be counted as passings in this form.*

[1] The total number of structures in the project area that can receive service. See definition of passing below for more detail.

[2] The number of structures in the project area that will not require special construction costs to provide service to. These passings fall within the broadband provider's standard service connection drop length and do not require nonstandard equipment or any additional fees above normal service connection fees required to provide broadband access to a premise.

[3] The number of structures in the project area with all construction costs budgeted in the application. These passings will not require any additional special construction costs beyond those budgeted for in the VATI application.

[4] The number of structures in the project area that do not have access to internet at speeds of at least 10 mbps download and 1mbps upload.

Business – An organization or entity that provides goods or services in order to generate profit. Businesses based in residential homes can count if they are a registered business (BPOL, LLC, etc.).

Community Anchor - schools, libraries, medical and health care providers, public safety entities, community colleges and other institutions of higher education, and other community support organizations and agencies that provide outreach, access, equipment, and support services to facilitate greater use of broadband service by vulnerable populations, including low-income, unemployed, and the aged.

Non-Residential Passing – places of worship, federal, state, or local facilities or other potential customers that are neither a residence, business or a community anchor as defined above.

September 14, 2021

ATTACHMENT 6. Propagation Map if Wireless Project

Attachment 6 is not applicable to this grant application.

STAFFORD COUNTY

ATTACHMENT 7

Timeline Project Management Plan

1215 E. Fort Avenue
Suite 103
Baltimore, MD 21230

Comcast - FY22 Virgnia Telecommunication Initiative Estimated Project Schedule																								
		2021				2022												2023						
Task	Responsible Entity	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Application submission	Comcast / County																							
Award announcement	VA DHCD																							
Finalize grant agreement(s)	Comcast, County, VA DHCD																							
Project engineering	Comcast																							
Obtain necessary permits for right of way access and/or pole attachments	Comcast / County																							
Materials procurement	Comcast																							
Construction/installation of fiber	Comcast																							
Turn-up, test and database work	Comcast																							
Service availability notification to potential customers	Comcast																							
Final field inspection	Comcast																							

MEMORANDUM OF UNDERSTANDING

The parties to this Memorandum of Understanding (MOU) are Stafford County and Comcast. The purpose of this MOU is to establish a commitment by the parties to participate in the development of a grant proposal in 2021 for the FY22 Virginia Telecommunication Initiative (VATI) program established by the Virginia Department of Housing and Community Development (DHCD). Stafford County and Comcast agree to work jointly to coordinate a complete VATI application, making decisions on roles and responsibilities where necessary to facilitate an effective submission of necessary information. Although a partnership between Stafford County and Comcast has not yet been formalized for this proposed project, both parties are collaborating on an agreement to be executed if DHCD awards them a VATI grant. An agreement would cover the following areas:

Comcast commits to:

a. Draft a Project Management Plan;
b. Complete all Grant Activities described in pertinent DHCD agreements, as mutually agreed;
c. Provide regular updates to Stafford County on the status of the project;
d. Notify Stafford County if its assistance is needed;
e. Submit requests for payment (no more frequently than monthly) to Stafford County as work is completed;
f. Complete all work within the required timeframe;
g. Provide Stafford County information on the locations where broadband had been enabled; and
h. Propose any required nondisclosure agreements if Comcast were requested to share confidential information.

Stafford County commits to:

a. Processing requests for payment in a timely manner;
b. Review information provided by Comcast and submit requests for additional information in a timely manner;
c. Complete any necessary non-disclosure agreements;
d. Complete all Grant Activities described in pertinent DHCD agreements;
e. Assist Comcast in obtaining necessary rights of way within the scope of Stafford County's authority; and
f. Assist in contacting residents and others as appropriate to foster completion of the project within the required timeframe.

COMCAST	STAFFORD COUNTY
Name (printed):_____	Name (printed):_____
Title:_____	Title:_____
Signature:_____	Signature:_____
Date:_____	Date:_____

VATI FUNDING SOURCES TABLE

Please fill in the chart below with a description of the project funding source (local, federal, state, private, other), the amount from that source, the percentage of total project funding that source represents, and a description of the current status of the funds (pending, secured, etc.).

Source	Amount	%	Status
REQUESTED VATI	$ 3,398,153	59	Pending
PRIVATE	$864,383	15	CONFIRMED
LOCAL	$ 1,500,000	26	CONFIRMED
	$		
	$		
	$		
	$		
TOTAL	**$ 5,762,536**	**100 %**	

COMCAST
1215 E. Fort Avenue
Suite 103
Baltimore, MD 21230

September 14, 2021

Fred Presley
Stafford County Administrator
1300 Courthouse Road, 3rd Floor
Stafford, VA 22554

Dear Mr. Presley:

The purpose of this letter is to provide documentation regarding the in-kind contributions for the projects proposed to the Virginia Telecommunication Initiative ("VATI") program.

The proposed project represents a partnership between Comcast and Stafford County. As indicated in the application, Comcast will provide approximately 15% of the projected construction costs of $5,762,536, totaling approximately $864,383. Stafford County will provide approximately 26% of the projected construction costs, totaling $1,500,000, will assist in providing in-kind contributions including application analysis and preparation, coordination with the Department of Housing and Community Development, assistance with right of way permitting, and participating in further concert with Comcast as the project is approved and construction begins. The value of these services will depend on the level of activity occurring as the project commences.

Should you have any questions regarding the information listed above, please do not hesitate to contact me.

Sincerely,

Misty Allen
Regional Vice President, Government & Regulatory Affairs

R21-322

BOARD OF SUPERVISORS
COUNTY OF STAFFORD
STAFFORD, VIRGINIA

RESOLUTION

At a regular meeting of the Stafford County Board of Supervisors (the Board) held in the Board Chambers, George L. Gordon, Jr., Government Center, Stafford, Virginia, on the 7th day of September, 2021:

MEMBERS:	VOTE:
Crystal L. Vanuch, Chairman	Yes
Cindy C. Lamb, Vice Chairman	Yes
Tinesha O. Allen	Absent
Meg Bohmke	Yes
Thomas C. Coen	Yes
L. Mark Dudenhefer	Absent
Gary F. Snellings	Yes

On motion of Ms. Lamb, seconded by Mr. Coen, which carried by a vote of 5 to 0, the following was adopted:

A RESOLUTION TO AUTHORIZE A FY2022 VIRGINIA TELECOMMUNICATIONS INITIATIVE (VATI) GRANT APPLICATION WITH COMCAST CORPORATION AS CO-APPLICANT TO BRING BROADBAND INTERNET SERVICE TO VARIOUS UNSERVED AND UNDERSERVED AREAS OF THE COUNTY

WHEREAS, the County seeks to provide service to 634 unserved and underserved homes and businesses mostly in portions of the Hartwood, Rockhill, and Griffis-Widewater Election Districts; and

WHEREAS, the Virginia Department of Housing and Community Development (DHCD) has implemented the Virginia Telecommunications Initiative (VATI), which provides grants to supplement construction costs by private sector broadband service providers in partnership with local governments; and

WHEREAS, the County seeks to apply for the fiscal year (FY) 2022 VATI grant, which will award projects in an amount not to exceed 10% of DHCD's total available VATI funds in FY2022; and

WHEREAS, the County identified Comcast Corporation (Comcast) as an eligible co-applicant for the VATI grant through Request for Information #22-01-1245-RFI; and

WHEREAS, Comcast has proposed to construct and bring wireline broadband service to 634 unserved and underserved homes and businesses in the County with an anticipated total project cost of $5,762,536; and

WHEREAS, based on the proposed project costs, the request for VATI grant funds would include a minimum local match of 41% of the total project cost, of which 15% or $864,380 would be provided by Comcast and 26% or $1,500,000 would be provided by the County; and

WHEREAS, American Rescue Plan Act (ARPA) funds can be used for the County's portion of the local match; and

WHEREAS, pursuant to Resolution R21-263, the Board previously appropriated $3,000,000 in ARPA funds for the County-wide Fiber Project; and

WHEREAS, if the FY2022 VATI grant is awarded, staff desires to reallocate the prior appropriation to cover the County's portion of the local match associated with the FY2022 VATI grant; and

WHEREAS, the VATI grant application deadline is September 14, 2021;

NOW, THEREFORE, BE IT RESOLVED by the Stafford County Board of Supervisors on this the 7th day of September, 2021, that the County Administrator be and he hereby is authorized to submit a FY2022 Virginia Telecommunications Initiative grant application with co-applicant Comcast Corporation to extend wireline broadband service to approximately 634 unserved and underserved homes and businesses primarily in the Hartwood, Rockhill, and Griffis-Widewater Election Districts; and

BE IT FURTHER RESOLVED, that if awarded, Comcast Corporation will provide 15% or $864,380 in matching funds, and Stafford County would provide $1,500,000 in American Rescue Plan Act (ARPA) funds previously appropriated for the County-wide Fiber Project, as a local match, plus an undetermined in-kind match for a minimum of 41% total local match.

A Copy, teste:

Frederick J. Presley
County Administrator

FJP: MQC

MARK R. WARNER
VIRGINIA

COMMITTEES:
FINANCE
BANKING, HOUSING, AND URBAN AFFAIRS
BUDGET
INTELLIGENCE
RULES AND ADMINISTRATION

United States Senate
WASHINGTON, DC 20510–4606

September 14, 2021

Ms. Tamarah Holmes
Director
Office of Broadband
Virginia Department of Housing and Community Development
600 East Main Street, Suite 300
Richmond, VA 23219-2430

Dear Ms. Holmes,

I write today in support of Stafford County's grant proposal to the Virginia Department of Housing and Community Development's (DHCD) Virginia Telecommunication Initiative (VATI) grant program. Stafford County, along with Comcast, will utilize grant funding to bring high-speed broadband internet access particularly to the unserved residents in the western, rural part of the county.

Stafford County's rural areas have unserved and underserved residents that have spotty cell service and internet access. Stafford's proposed deployment of broadband in these areas will provide educational and economic development opportunities as well as access to online health options for the surrounding community. Additionally, as proven during the Coronavirus epidemic, access to high speed internet is the key to equity in education for today's schoolchildren. It is part of the essential infrastructure for a modern community, particularly in Stafford County, home to many defense contractors as well as their employees and federal employees.

I ask that you give this proposal every appropriate consideration. Thank you for your service on behalf of my constituents.

Sincerely,

Mark R Warner

MARK R. WARNER
United States Senator

MRW/bc

180 West Main Street
Abingdon, VA 24210
Phone: (276) 628-8158

101 West Main Street
Suite 7771
Norfolk, VA 23510
Phone: (757) 441-3079

919 East Main Street
Suite 630
Richmond, VA 23219
Phone: (804) 775-2314

110 Kirk Avenue, SW
Roanoke, VA 24011
Phone: (540) 857-2676

8000 Towers Crescent Drive
Suite 200
Vienna, VA 22182
Phone: (703) 442-0670

http://warner.senate.gov

ROBERT J. WITTMAN
1st District, Virginia

HOUSE ARMED SERVICES COMMITTEE
Ranking Member, Seapower and Projection Forces
Tactical Air and Land Forces

NATURAL RESOURCES COMMITTEE
Water, Oceans, and Wildlife

CO-CHAIR, CONGRESSIONAL
SHIPBUILDING CAUCUS

CO-CHAIR, CONGRESSIONAL
CHESAPEAKE BAY WATERSHED TASK FORCE

CO-CHAIR, CONGRESSIONAL
PUBLIC HEALTH CAUCUS

CO-CHAIR, CONGRESSIONAL
RURAL BROADBAND CAUCUS

Congress of the United States
House of Representatives
Washington, DC 20515

WASHINGTON OFFICE:
2055 Rayburn House Office Building
Washington, DC 20515
(202) 225-4261

DISTRICT OFFICES:

Stafford Office
95 Dunn Drive Suite 201
Stafford, VA 22556
(540) 659-2734

Mechanicsville Office
6501 Mechanicsville Turnpike Suite 102
Mechanicsville, VA 23111
(804) 730-6595

Middle Peninsula Office
508 Church Lane
P.O. Box 3106
Tappahannock, VA 22560
(804) 443-0668

www.wittman.house.gov

September 14, 2021

Tamarah Holmes, Ph.D.
Director, Office of Broadband
Department of Housing and Community Development
600 East Main Street, Suite 300
Richmond, VA 23219

Dear Director Holmes:

I am writing in support of the Stafford County FY 2022 Virginia Department of Housing and Community Development Virginia Telecommunication Initiative (VATI) grant application to expand high-speed broadband availability in the First Congressional District through a partnership with Comcast. Approval of this application would help meet the critical need to buildout high-speed broadband service to residents of Stafford County.

Rural residents in Virginia's First Congressional District appreciate the value of high-speed broadband access. Providing reliable broadband access is vital for commercial stability, job creation, distance learning, and telehealth service expansion. Throughout the First Congressional District of Virginia, as in other largely rural areas, economic incentives are needed to expand broadband access, and the VATI program has been a successful vehicle of meeting that need. VATI encourages private telecommunications providers to enlarge their coverage and gives localities the ability to design the expansion that is right for their communities. This eases the financial burden associated with construction costs, broadens service, and creates a successful public-private partnership (P3) for the awardees and for the Commonwealth.

The western part of Stafford County is very rural and has unserved and underserved residents who also have spotty cell service. Deployment of broadband in these areas will provide enormous educational and economic development opportunities as well as access to online health options for the surrounding community. Additionally, as proven during the Coronavirus epidemic, access to high-speed internet is the key to equity in education for today's schoolchildren. It is part of the essential infrastructure for a modern community, particularly in Stafford County, a bedroom community of Washington, D.C., and home to many defense contractors as well as their employees and federal employees.

Thank you for your consideration of the Stafford County application. Moreover, if you have any concerns or questions, please do not hesitate to contact my office.

Sincerely,

Robert J. Wittman
Member of Congress

SENATE OF VIRGINIA

JILL HOLTZMAN VOGEL
27TH SENATORIAL DISTRICT
ALL OF CLARKE, FAUQUIER, AND
FREDERICK COUNTIES; ALL OF THE CITY OF
WINCHESTER; AND PART OF CULPEPER,
LOUDOUN, AND STAFFORD COUNTIES

332 WEST LEE HIGHWAY
PMB 312
WARRENTON, VA 20186
(540) 662-4551

COMMITTEE ASSIGNMENTS:
FINANCE AND APPROPRIATIONS
GENERAL LAWS AND TECHNOLOGY
PRIVILEGES AND ELECTIONS
RULES

September 9, 2021

Mr. Frederick J. Presley
County Administrator
Stafford County Government
1300 Courthouse Road
Stafford, VA 22554

Dear Mr. Presley:

I am writing to you in support of the Virginia Telecommunications Initiative (VATI) grant which provides financial assistance to supplement construction costs by private sector broadband service providers extending service to areas currently unserved by any broadband provider and the underserved. I support the efforts of Stafford County and Comcast in bringing high-speed broadband internet access particularly to the unserved residents in the western part of the county.

The western part of Stafford County is very rural and has unserved and underserved residents who also have spotty cell service. Deployment of broadband in these areas will provide enormous educational and economic development opportunities as well as access to online health options for the surrounding community.

Additionally, as proven during the Coronavirus epidemic, access to high-speed internet is the key to equity in education for today's schoolchildren. It is part of the essential infrastructure for a modern community, particularly in Stafford County, a bedroom community of Washington, D.C., and home to many defense contractors as well as their employees and federal employees.

Thank you so much for working on this effort on behalf my constituents. Again, I confirm my intention support your request of the VATI grant.

Sincerely,

Senator Jill H. Vogel

COMMONWEALTH OF VIRGINIA

HOUSE OF DELEGATES
RICHMOND

MARK L. COLE
POST OFFICE BOX 41965
FREDERICKSBURG, VIRGINIA 22404-1965

EIGHTY-EIGHTH DISTRICT

COMMITTEE ASSIGNMENTS:
PRIVILEGES AND ELECTIONS
EDUCATION
GENERAL LAWS

September 8, 2021

Mr. Frederick J. Presley
County Administrator
Stafford County Government
1300 Courthouse Road
Stafford, VA 22554

Dear Mr. Presley:

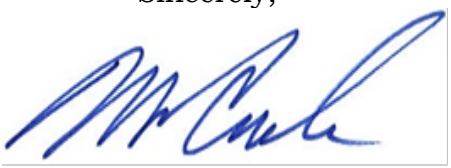
I am writing to you in support of the Virginia Telecommunications Initiative (VATI) grant which provides financial assistance to supplement construction costs by private sector broadband service providers extending service to areas currently unserved by any broadband provider and the underserved. I support the efforts of Stafford County and Comcast in bringing high-speed broadband internet access particularly to the unserved residents in the western part of the county.

The western part of Stafford County is very rural and has unserved and underserved residents who also have spotty cell service. Deployment of broadband in these areas will provide enormous educational and economic development opportunities as well as access to online health options for the surrounding community.

Additionally, as proven during the Coronavirus epidemic, access to high-speed internet is the key to equity in education for today's schoolchildren. It is part of the essential infrastructure for a modern community, particularly in Stafford County, a bedroom community of Washington, D.C., and home to many defense contractors as well as their employees and federal employees.

Thank you so much for working on this effort on behalf my constituents. Again, I confirm support of your request of the VATI grant.

Sincerely,



Mark L. Cole

STAFFORD COUNTY

ATTACHMENT 12

Derivation of Costs

COMCAST

1215 E. Fort Avenue
Suite 103
Baltimore, MD 21230

Product	Total	VATI	Non-VATI	Source of Estimate	Date
EXAMPLE					
Construction					
Broadband Construction – 67.79 miles	$5,762,536	$3,398,153	$2,364,383	Comcast	9/14/2020

STAFFORD COUNTY

ATTACHMENT 13

Documentation of Supporting Cost Estimates

COMCAST

1215 E. Fort Avenue
Suite 103
Baltimore, MD 21230

September 14, 2021

Fred Presley
Stafford County Administrator
1300 Courthouse Road, 3rd Floor
Stafford, VA 22554

Dear Mr. Presley:

The purpose of this Letter is to provide information and supporting documentation for cost estimates for the Stafford County Project proposed to the Virginia Telecommunication Initiative ("VATI") program. Comcast's Construction and Design team managed projects that added thousands of miles to Comcast's regional hybrid fiber coaxial network in 2020-2021. Comcast's construction estimates are determined though a detailed project analysis that includes a desktop survey, an analysis of permitting costs (internal or external), a network impact study to determine necessary hub site preparation and possible infrastructure requirements, and a financial evaluation for overall build costs and likely return-on-investment. When contract labor is utilized, costs are accrued according to the fee schedule in the contract. The design and construction process is standard within the telecommunications industry.
The total build is estimated to be 68 miles of infrastructure and laterals. Estimated budget costs for construction are:

Project	Number of Passings	Material Costs	Labor	Project Management	Total Project Cost
Stafford County	634	$1,728,760.80	$3,457,521.60	$576,253.60	$5,762,536.00

Examples of items that are included in the Material category are: power supplies, fiber conduit, splice enclosures, pedestals, and taps. Examples of items in the Labor category are in-house and contract labor to trench and backfill, lay conduit and fiber perform administration of VDOT permits and provide crew supervision.
The precise amount to be spend on contract labor versus in house resources will be determined when the grant is approved, and the work commences. The allocation of work will depend on the level of construction activity at that time. Any contracted engineering and design work outlined in this proposal will be performed by Comcast approved contractors.

Should you have any questions regarding the information listed above, please do not hesitate to contact Nathan Daugherty at Nathan_daugherty@comcast.com or 434-238-0729.

Sincerely,

Steve Hill

Steve Hill
Senior Director, Network Engineering

September 14, 2021

Tamarah Holmes, Ph.D.
Director, Office of Broadband
Virginia Department of Housing and Community Development
Main Street Centre
600 East Main Street, Suite 300
Richmond, Virginia 23219

Re: Attachment 14 – Two most recent Form 477 submitted to the FCC or equivalent

Dear Dr. Holmes,

The purpose of this letter is to provide information regarding the recent Form 477 submissions or equivalent by Comcast to the Federal Communications Commission. Data from Comcast's submissions can be located at https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477.

Should you have any questions regarding the information listed above, please do not hesitate to contact me.

Sincerely,

Kevin Broadhurst
Vice President of Government and Regulatory Affairs

September 14, 2021

ATTACHMENT 16. RSSI Projection Shapefiles

Attachment 16 is not applicable to this grant application.

internet essentials
FROM COMCAST

Pathways to Connection

Connectivity opens the door to a world of opportunity.

At Comcast, we believe deeply in the power of connection. That is why we recently announced a $1 billion commitment over the next 10 years to reach up to 50 million people from low-income families and provide them with the training, tools, and resources they need to succeed in a digital world.

We have always said closing the broadband adoption gap would take a comprehensive movement, and that is exactly what is happening today. There are more pathways than ever for students, families, and individuals to get connected and learn digital skills, at little or no cost to them.

If you or someone in your community needs to get connected today, the good news is there are a variety of resources available, including billions of dollars in federal benefits to cover the costs. These include:

RESOURCES FOR INDIVIDUALS & FAMILIES

Internet Essentials

Internet Essentials is the nation's largest and most comprehensive broadband adoption program, providing high-speed Internet service to low-income families. Over the past ten years, Internet Essentials has connected a cumulative total of more than 10 million people to the power of the Internet at home. The program has expanded its eligibility more than a dozen times, now including Federal Pell Grant recipients. New customers who sign up for Internet Essentials before June 30, 2022 will receive 60 days of complimentary service. Visit **InternetEssentials.com** on any web-enabled device or call 1-855-846-8376 to learn more about eligibility and apply today.

Emergency Broadband Benefit

Comcast is proud to participate in the federal government's Emergency Broadband Benefit program. This temporary benefit provides up to a $50/month credit per household for their Internet bill (up to a $75 credit in Tribal areas). To date, the Federal Communications Commission has enrolled more than 4.2 million U.S. households. While this program is set to expire 6 months after the Department of Health and Human Services declares an end to the pandemic, the federal Infrastructure bill calls for a permanent plan, which would provide $30/month for eligible applicants. Visit **www.xfinity.com/EBB** or call 1-855-846-8376 to learn more. call 1-855-846-8376 to learn more.

Lift Zones

Comcast Lift Zones are a first-of-their-kind digital equity initiative in community centers across our service area. Partnering with local organizations, non-profits, and city leaders, we are equipping community centers with complimentary WiFi, called "Lift Zones," where students and families can access the Internet. Lift Zones allow students, veterans, seniors, and other individuals, customers and non-customers alike, to get online and do their schoolwork, look for a job, stay in touch with family and friends, and so much more. Comcast has pledged to open more than 1,000 Lift Zones in underserved communities by the end of this year.
Visit **https://internetessentials.com/learningsearchpage** to find a Lift Zone near you.

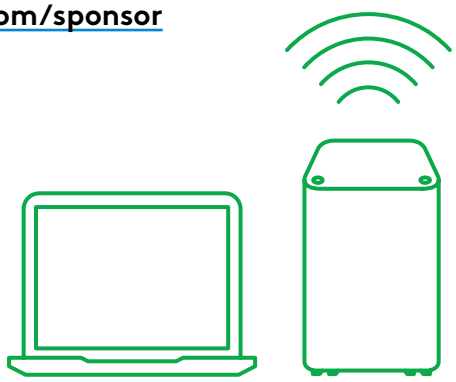
RESOURCES FOR SCHOOLS & PARTNER ORGANIZATIONS

Internet Essentials Partnership Program

The COVID-19 crisis created an urgent need for a scalable solution to support school districts and partner organizations across the country. The Internet Essentials Partnership Program (IEPP) is designed to help connect large numbers of households at a critical time. The program provides the opportunity for schools, school districts, government entities, foundations, and other organizations to pay for students' and families' broadband Internet service at home. Creating strong and innovative public-private partnerships enables entire communities to work together to coordinate funding for a few months or a few years. Organizations interested in becoming IEPP partners or partnering with Comcast on the Emergency Connectivity Fund can fill out **this form** to receive more information or begin the sponsorship process.

Emergency Connectivity Fund

The FCC's Emergency Connectivity Fund (ECF) is a $7.17 billion government program to help schools and libraries provide the tools and services needed for remote learning during the COVID-19 emergency period. Comcast is proud to support schools and libraries as they work to connect even more households to the power of the Internet at home through ECF. Leveraging IEPP, we have a streamlined process for eligible entities to seek ECF funds and quickly connect individuals in need to broadband access at home through our acclaimed Internet Essentials program. Schools and libraries interested in working with Comcast can visit **InternetEssentials.com/sponsor** to learn more.



Internet Essentials from Comcast

Bring low-cost, high-speed Internet home so you're ready for anything.

With a fast, reliable connection, you can work and learn from home, make video calls, stream movies and more.

Apply today if you qualify for programs like the National School Lunch Program, SNAP, housing assistance, Medicaid, and others.

$9.95
Per Month + Tax
after 2 free months

No credit check.
No term contract.
No cancellation fees.

APPLY NOW »
InternetEssentials.com
or call 1-855-846-8376

internet essentials
FROM COMCAST

Internet Essentials de Comcast

Trae Internet de alta velocidad y bajo costo a tu hogar para estar preparado para todo.

Con una conexión rápida y confiable, puedes trabajar y aprender desde tu hogar, hacer videollamadas, hacer streaming de películas y más.

Solicítalo hoy si calificas para programas como el Programa Nacional de Almuerzos escolares (NSLP), cupones para alimentos (SNAP), asistencia para viviendas públicas, Medicaid y otros.

$9.95
al mes + impuestos
después de 2 meses gratis

Sin revisión de crédito.
Sin contrato.
Sin cargos por cancelación.

SOLICÍTALO AHORA »

es.InternetEssentials.com
o llama al 855-765-6995

internet essentials
FROM COMCAST

Internet Essentials from Comcast

Get home Internet with 2 months FREE!

Promo ends 12/31/21

Get low-cost, high-speed Internet at home! With a fast, reliable connection, you can work and learn from home, make video calls, stream movies and more.

Apply today if you qualify for programs like the National School Lunch Program, SNAP, housing assistance, Medicaid, and others.

$9.95 Per Month + Tax after 2 free months

No credit check. No term contract.
No cancellation fees.

APPLY NOW »

InternetEssentials.com or call 1-855-846-8376

internet essentials
FROM COMCAST

¡AHORA EL DOBLE DE RÁPIDO!

Preparados para todo.

Internet Essentials de Comcast

¡Obtén Internet para el hogar con 2 meses GRATIS!

La promoción termina en 12/31/21

¡Obtén Internet de alta velocidad y bajo costo en el hogar! Con una conexión rápida y confiable, puedes trabajar y aprender desde tu hogar, hacer videollamadas, hacer streaming de películas y más.

Solicítalo hoy si calificas para programas como el Programa Nacional de Almuerzos escolares (NSLP), cupones para alimentos (SNAP), asistencia para viviendas públicas, Medicaid y otros.

$9.95 al mes + impuestos después de 2 meses gratis

Sin revisión de crédito. Sin contrato. Sin cargos por cancelación.

SOLICÍTALO AHORA »

es.InternetEssentials.com o llama al 1-855-765-6995

internet essentials FROM COMCAST

PRESS RELEASE
Comcast
One Comcast Center
Philadelphia, PA 19103
www.comcastcorporation.com

COMCAST COMMITS TO INVESTING $1 BILLION OVER NEXT 10 YEARS TO REACH 50 MILLION LOW-INCOME AMERICANS WITH TOOLS AND RESOURCES TO SUCCEED IN DIGITAL WORLD

Comcast's Internet Essentials Program Has Now Connected More Than 10 Million People Over the Past 10 Years

PHILADELPHIA, PA – MARCH 24, 2021 – On the 10th anniversary of its Internet Essentials program, Comcast today announced it would invest $1 billion over the next 10 years to help further close the digital divide and give even more low-income Americans the tools and resources they need to succeed in an increasingly digital world. The announcement coincides with the release of a 10-year Progress Report showing that, since 2011, the company, working in collaboration with its network of thousands of nonprofit partners, has connected a cumulative total of more than 10 million people in America to broadband Internet at home, the overwhelming majority of whom were not connected prior to signing up.

Comcast's $1 billion commitment will include investments in a number of critical areas, including: additional support for its ongoing Lift Zone initiative, which establishes WiFi-connected safe spaces in 1,000+ community centers nationwide for students and adults by the end of 2021; new laptop and computer donations; grants for nonprofit community organizations to create opportunities for low-income Americans, particularly in media, technology, and entrepreneurship; and continued investment in the company's landmark Internet Essentials program. It is estimated that these new commitments will impact as many as 50 million Americans over the next 10 years. In 2021 alone, Comcast estimates students will be able to complete more than 25 million hours of remote learning lessons to further address the "homework gap" at the hundreds of Lift Zone locations that have already opened or will open soon.

"Ten years is a remarkable milestone, signifying an extraordinary amount of work and collaboration with our incredible community partners across the country," said Dave Watson, Chief Executive Officer, Comcast Cable. "Together, we have been able to connect millions of people to the power of the Internet at home, and to the endless opportunity, education, growth, and discovery it provides. Today, we are rededicating ourselves to this mission to ensure that the next generation of students in America has the tools, resources, and abilities they need to succeed in an increasingly digital world."

"For more than a decade, Comcast has been a leader in working with communities to close the Digital Divide through its Internet Essentials program," said Marc H. Morial, President and CEO of the National Urban League. "From its beginning as a pilot program with the Wilmington Urban League to today, Comcast's Internet Essentials program has transformed millions of lives by connecting low-income households to the power of broadband. While the ongoing COVID-19 pandemic placed a spotlight on the digital divide, for the past decade Comcast, in partnership with organizations like the National Urban League, has been leading the effort to close the digital divide, address the homework gap, and ensure low-income communities have the necessary digital skills."

"Last year, we partnered with Comcast on a major campaign to encourage Americans to participate in the first-ever digital census," added Rebecca DeHart, CEO, Fair Count. "We are so proud to have partnered with Comcast on this valuable work—connectivity is incredibly essential to civic participation. It gives communities a voice and it enables individuals to take part in the cultural conversations that need to take place in this country. Broadband adoption, just like census participation, can mean the difference between communities growing and thriving or being left behind. For the past decade, the Internet

Essentials program has successfully helped to narrow these digital divides. We look forward to the next 10 years of Internet Essentials and join Comcast in celebrating this significant achievement."

"For a decade Comcast's Internet Essentials program has provided Latino families with tools and resources to access high speed Internet at home. Hispanic Federation has been proud to partner with Comcast and work with this program to bridge the digital divide and offer Latino communities the opportunity to access health, educational, and economic resources online," said Brent Wilkes, Senior Vice President at the Hispanic Federation. "We look forward to the next ten years of partnership with Comcast as we tackle more challenges in our ever-changing digital world."

In addition to capturing the total number of connections Internet Essentials has provided, the 10-Year Progress Report also highlights other key metrics about the program, including having:

- Increased the program's Internet speeds six times, from 1.5 Mbps in 2011 to 50 Mbps today, without ever increasing the price of the program, which has remained $9.95/month.
- Launched its Lift Zones program, which aims to connect more than 1,000 community centers with free WiFi by the end of 2021.
- Developed an Internet Essentials Partnership Program that has signed up hundreds of schools, school districts, and other organizations that have come together to help connect tens of thousands of students to the Internet during the COVID-19 pandemic.
- Offered 60 days of free Internet service to any new Internet Essentials customer who needed to get online during the coronavirus outbreak.
- Expanded the number of languages our Internet Essentials call center agents can speak to more than 240, plus American Sign Language, to help ensure we break down language barriers that can prevent people from applying or getting online.
- Built up an online learning center that includes more than 200 digital literacy training videos, guides, and reports that are free to anyone to use, including non-customers.
- Developed an employee network of 3,000 Internet Essentials Ambassadors who volunteer their time to help spread the word about the program in their communities.

This new commitment comes on the heels of a series of initiatives announced during the COVID-19 pandemic that reinforced the company's commitment to addressing the digital divide and the homework gap by upping speeds to 50 Mbps downstream without changing the program's $9.95/month price. The company also continues to offer 60 days of free Internet service to new Internet Essentials customers who sign up before June 30, 2021.

About Internet Essentials

Internet Essentials is Comcast's signature digital equity initiative and the nation's largest and most comprehensive broadband adoption program. In 10 years, it has helped connect 10 million low-income Americans to broadband Internet at home, most for the very first time. Internet Essentials has a comprehensive design that addresses each of the three major barriers to broadband adoption. This includes: multiple options to access free digital literacy training in print, online, and in person; the option to purchase a heavily subsidized, low-cost Internet-ready computer; and low-cost, high-speed Internet service for $9.95 a month, plus tax. The program is structured as a partnership between Comcast and tens of thousands of school districts, libraries, elected officials, and nonprofit community partners. Comcast has never raised the price of the program. For more information about Internet Essentials and Comcast's commitment to education and digital equity, please visit https://corporate.comcast.com/education. To apply, visit www.internetessentials.com or call 1-855-846-8376 for English or 1-855-765-6995 for Spanish.

About Comcast Corporation

Comcast Corporation (Nasdaq: CMCSA) is a global media and technology company that connects people to moments that matter. We are principally focused on broadband, aggregation, and streaming with over 56 million customer relationships across the United States and Europe. We deliver broadband, wireless,

and video through our Xfinity, Comcast Business, and Sky brands; create, distribute, and stream leading entertainment, sports, and news through Universal Filmed Entertainment Group, Universal Studio Group, Sky Studios, the NBC and Telemundo broadcast networks, Peacock, NBC News, NBC Sports, Sky News, and Sky Sports; and provide memorable experiences at Universal Parks and Resorts in the United States and Asia. Visit www.comcastcorporation.com for more information.

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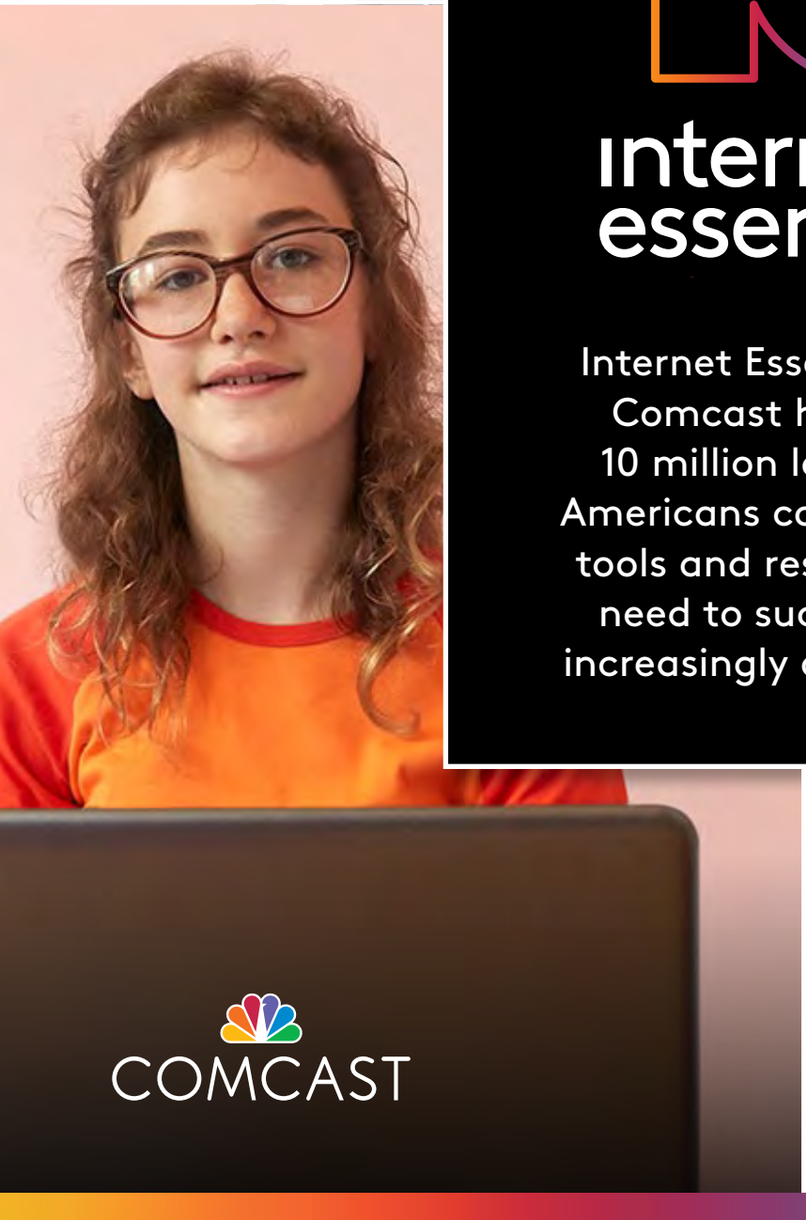
Media Contact:
Charlie Douglas
charlie_douglas@comcast.com
(215) 264-8020

10 YEARS

internet essentials

Internet Essentials from Comcast has helped 10 million low-income Americans connect to the tools and resources they need to succeed in an increasingly digital world.



COMCAST

Student from Northeast High School

TABLE OF CONTENTS

Letter from Dave Watson about Comcast's Commitment to Digital Equity

When we launched Internet Essentials 10 years ago, we began an ambitious journey to connect low-income Americans to the Internet. Thanks to the hard work and support of so many, Internet Essentials is now the largest and most comprehensive Internet adoption program in the country, connecting more than 10 million* people.

Ten million people over 10 years is an exciting milestone, but it's just the beginning of our next chapter. We are proud to share that over the next 10 years, Comcast is committing $1 billion to reach 50 million people from low-income families and provide them with the training, tools, and resources they need to succeed in a digital world. This investment will allow us to continue providing grants to nonprofit partners, supporting Internet adoption and digital skills training, and investing in underserved communities.

$1B

commitment over the next 10 years to reach 50 million people from low-income families with connectivity, skills, training, and resources.

This is not the first time we have accelerated our efforts to bridge the digital divide, nor will it be our last. Since the earliest days of the Internet Essentials program, we have partnered with incredible organizations to include more people, improve the program, and create a bigger impact. We have expanded the reach of Internet Essentials 12 times, most recently to include all low-income households in our service area, including veterans, seniors, people with disabilities, and more. We have increased speeds, from 1.5 Mbps in 2011 to 50 Mbps today, and subsidized or donated 150,000 desktop and laptop computers. Along the way, we have brought home the transformative power of connection to more than 10 million people and offered digital skills training and tools to millions more.

When the COVID-19 pandemic struck, we expanded again by launching a first-of-its kind connectivity initiative in community centers. Partnering with local organizations, non-profit partners, and city leaders, we equipped community centers across the country with WiFi-connected safe spaces, called "Lift Zones", where students and families can access the Internet. We plan to launch 1,000+ Lift Zones by the end of this year, reaching millions more people in our communities.

*Cumulative total since 2011

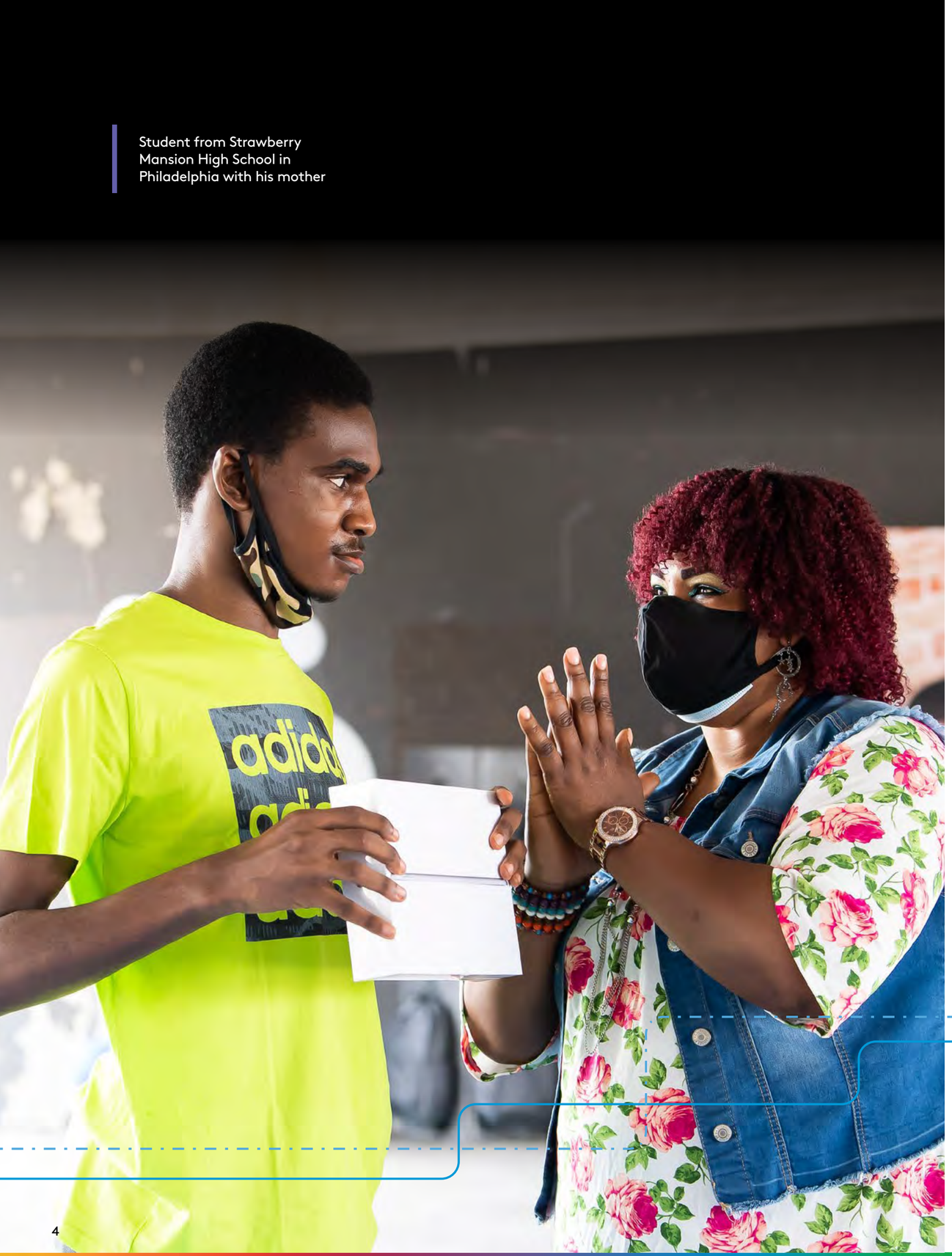
Students and Head of School of the Pennsylvania School for the Deaf

Ten years is a remarkable moment signifying an extraordinary amount of work, and we did not do it alone. The launch of Internet Essentials, as well as its tremendous growth and success over the past decade, is a result of those who paved the way through research, tireless advocacy for digital equity, and the creation and adaptation of digital skills training models to meet the needs of community members. I invite you to continue reading to learn more about the journey of Internet Essentials and the work of our team and our extraordinary partners.

We are proud of our progress, but we have more to do and more to learn. We are excited and energized to take these next steps, and we look forward to working with all of you to get there.

Sincerely,

DAVE WATSON
President and Chief Executive Officer
Comcast Cable



Student from Strawberry Mansion High School in Philadelphia with his mother

Digital Divide in the U.S.

We believe deeply in the power of connection. It is unacceptable that we have a digital divide in this country, which keeps so many families from the powerful skills, tools, and resources they need to succeed. Approximately 25% of American households do not subscribe to broadband Internet at home. Ten years ago, we created Internet Essentials to help address the digital divide and the homework gap and give low-income families the opportunity to experience the transformative power of the Internet in their own homes. Over the last decade, we've worked with thousands of partners across the country and have collectively made tremendous progress. **In our service area, 40% of the growth in broadband adoption among low-income households with school-age children can be attributed to the Internet Essentials program.***

CITY COMPARISON

Up to 95% of households

in affluent cities have a home broadband subscription.

VS.

Only 50% of households

in cities with high poverty rates have a home broadband subscription.

This 45-percentage-point gap represents the digital divide in the United States.**

*Zuo, G., 2021 (In Press). "Wired and Hired: Employment Effects of Subsidized Broadband Internet for Low-Income Americans." To be published in *American Economic Journal: Economic Policy.*

**U.S. Census 2019 American Community Survey

Program Timeline

For Comcast, addressing the need for digital equity has been a decade-long pursuit. In 2010, the Federal Communications Commission released the National Broadband Plan (NBP), articulating the barriers to broadband adoption and digital inclusion, and focusing attention on the importance of having a home Internet connection. In 2011, Internet Essentials was the first comprehensive programmatic response by a major Internet service provider to address the main barriers to broadband adoption.

For 10 years, we have worked closely with our partners to refine the program in meaningful ways and expanded the eligible population numerous times. Together, we are committed to creating and supporting digital equity within the communities we serve.

2011

- Program launch for public-school students receiving free lunch

2012

- Expanded to public-school students eligible for a reduced-price lunch

2013

- Expanded eligibility to include public, charter, parochial, private, cyberschool, and homeschooled students
- Included any family with a school-age student from Head Start through the 12th grade

2014

- Extended program indefinitely, beyond initial three-year commitment
- Provide amnesty to eligible families with past due Comcast debt older than one year

2015

- Pilot launch for low-income seniors
- Pilot launch for low-income community college students

2016

- Pilot launch for HUD-housing recipients
- Expansion of pilot to all HUD-housing recipients

2017

- Expansion of pilot for low-income seniors

2018

- Expansion to low-income veterans

2019

- Expansion to all low-income people including those with disabilities

2020

- Convened the first Internet Essentials National Impact Summit
- Implemented key COVID-19 response measures

2021

- Celebrating 10 years of advancing digital equity
- Increased speeds to 50/5 Mbps

and more to come...

COVID-19 Response

- 60 days free service offer for new Internet Essentials customers through December 31, 2021
- Increased speeds to 50/5 Mbps
- Waived bad-debt program eligibility requirement through December 31, 2021
- Suspended disconnects for late payments
- Launched the Internet Essentials Partnership Program to connect large numbers of students to Internet Essentials
- Introduced xFi parental controls to Internet Essentials subscribers at no additional cost
- Unlimited access for Internet Essentials customers to Xfinity WiFi hotspots
- Began the rollout of 1,000 Lift Zones

12 expansions of eligibility (available to all eligible low-income households)

18 innovations (including improving our streamlined application process and launching the Internet Essentials Partnership Program)

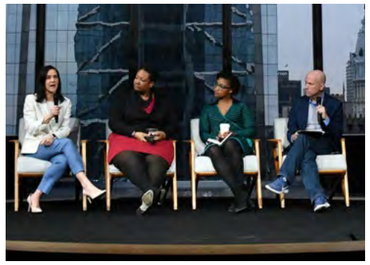
14 improvements to the value of the service (including speed, in- and out-of-home WiFi, computer options)

9 innovations in digital literacy, including the creation of 1,000+ Lift Zones

Program Retrospective

in 10 years, we have...

CONNECTED **MORE THAN** 10M LOW-INCOME AMERICANS TO THE INTERNET AT HOME



In 10 years, our commitment to bridging the digital divide has transformed into an enormous investment in advancing digital equity. Our newly created Internet Essentials Partnership Program and Lift Zone initiative are manifestations of this, as is our significant increase in investment in digital equity partners.

Program Design

Internet Essentials is about far more than bringing high-speed Internet into a home. From the beginning, we have designed our program based on comprehensive and consistent research which tells us there are three main barriers to broadband adoption: 1) a lack of perceived need for or interest in (and even fear of) the Internet, mostly stemming from limited digital skills, 2) not having functioning equipment, and 3) the cost of a monthly service subscription. Internet Essentials has been designed to address all of these barriers head-on. We continue to rely on external research, as well as sponsoring and conducting our own, to expand our understanding of these complex and evolving issues.

$700M

invested in the past 10 years to connect more than 10 million low-income people to the power of the Internet at home, provide digital skills training, and subsidize or donate devices.

A COMPREHENSIVE APPROACH

According to a 2019 U.S. Census Bureau and National Telecommunications and Information Administration survey, **among the top reasons people do not subscribe to Internet at home are:**

60% **cite lack of need for, or interest in, the Internet**

19% **cite cost of monthly service**

3% **cite no computer, inadequate equipment, or cost of a computer**

To address these barriers, Comcast designed Internet Essentials as a wraparound solution.

Awareness & Training

Comcast works with a network of partners to offer free in-person, online, and printed digital literacy training materials and classes.

Low-Cost Service

Comcast provides low-cost, high-speed Internet to low-income households across Comcast's service area for less than $10 per month.

Equipment

Internet Essentials customers can purchase a subsidized and discounted computer for less than $150

LOW-COST CONNECTIONS

We've made tremendous progress toward closing the digital divide. In ten years, we've connected millions of low-income people to the Internet at home, more than 80% of whom were not connected prior to signing up. The program is available to ALL low-income households including those participating in programs like NSLP, Medicaid, SNAP, SSI, and many more.

Since 2011, we've continued to improve our application process, including adding and expanding an expedited application review, and working to make the application and onboarding process easier and more convenient so that our customers have the best possible experience.

Just last year, we added two-factor ID verification to support applicants who are uncomfortable or unable to provide a social security number to verify their identity.

Continuous Improvement to Our Customer Experience

Since the beginning, we have pledged to listen to and learn from our partners, modify by trial and error, and rely on the best research in the field to build a program to reach as many people as possible.

240

languages available through our call center, seven languages available in our online application.

Expedited Review

Available to students attending Title I schools or those participating in the Internet Essentials Partnership Program, HUD housing residents, and households living in high-poverty areas.

Customer Satisfaction

90% of Internet Essentials customers surveyed are highly satisfied with the service they receive.

AWARENESS & TRAINING

Digital skills training is the most important facilitator for getting people connected. Since 2011, we have made nine enhancements to our digital skills training portfolio, including developing Online Safety Toolkits, working with partners to design best-in-class curricula to engage senior citizens, and providing computer labs and other equipment to support digital participation at community centers across the country. We are proud to support **digital skills training** via a network of tens of thousands of partners who share our vision of bringing the Internet to everyone.

8.5M

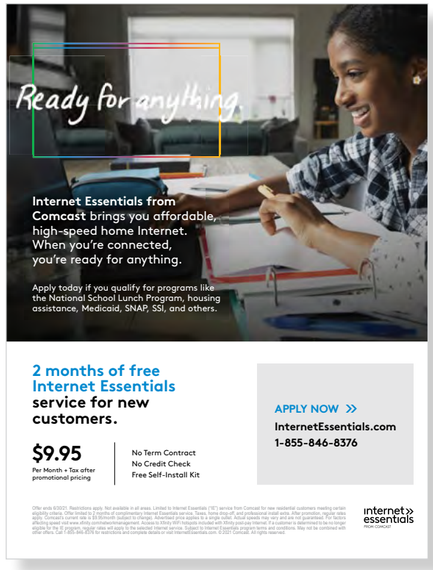
lifetime visitors to our online Learning Center, accessing more than 200 training videos, guides, and reports.

67M+

marketing materials have been sent at no cost to partners.

21M

PSAs aired valued at more than $255 million.



Dale

CUSTOMER SPOTLIGHT

Dale learned about Internet Essentials from the Ed Snider Youth Hockey Foundation in Philadelphia while he was still in high school. When he and his family connected, the service benefited both Dale and his five brothers and sisters. Dale is in his sophomore year at Kutztown University of Pennsylvania.

EQUIPMENT

An Internet connection is only as good as the device through which it is accessed. That's why we offer the option to purchase a low-cost computer for less than $150. Internet Essentials customers can choose an Internet-ready laptop with a 1-year mail in warranty to get up and running.

We also know that innovations in technology happen every day, and we strive to bring those same innovations to all of our customers. Since 2011, we have made nine enhancements to the value of the service under the Internet Essentials program, including improving the quality and options of our computer offering.

25K

laptops personally donated to the School District of Philadelphia by the Roberts family.

130K computers provided

Comcast has provided 130,000 low-income people with affordable subsidized computers.

20K computers donated

Comcast has donated more than 20,000 Internet-ready devices to households and community-based organizations since 2015.

GIVEAWAY SPOTLIGHT

In an exciting moment of Comcast NBCUniversal synergy, we partnered with TODAY and Craig Melvin to pull off the biggest laptop and connectivity surprise giveaway in Internet Essentials' history. On September 18, 2020, we surprised the McKeesport Area High School and Founders Hall Middle School in Pennsylvania with 2,500 Dell Technologies laptops and Internet Essentials Opportunity Cards for 12 months of complimentary service—enough for every high school and middle school student, as well as the faculty and staff, to connect to school from home.

CUSTOMER SPOTLIGHT

At the start of the pandemic, LaJoy Johnson-Law knew her daughter's education would depend on having home Internet and the technology through which to access it. Since connecting to Internet Essentials, LaJoy has also used the service to access information and resources related to her daughter's special needs and to become a fierce community advocate herself. While her 2020 DC State Board of Education campaign run was unsuccessful, LaJoy remains committed to ensuring that all families are represented and all students have the opportunity to achieve greatness.

Elements of Success

Comcast is focused on shaping the future by driving innovation through technology—and staying connected to the communities we serve. These principles are core to our company and form the driving ethos of our community impact philosophy, which was first established by our founder, Ralph J. Roberts: when the communities we serve thrive, the company thrives as well. Empowering communities, supporting prosperity, and advocating and building skills for social inclusion and participation are essential to the program's success and to the success of the company as a whole.

EMPOWERING COMMUNITIES

Nothing we do in the Community Impact space has as much effect on our communities as the Internet Essentials program.

Partners and Ambassadors

The ten years of tremendous success we have had with the Internet Essentials program belongs to our internal and external partners—the communities we collaborate with and our employee volunteers, all of whom work tirelessly to build honest, meaningful, and long-lasting relationships that raise awareness for the program and drive participation.

tens of thousands

of community partners

3K+

current volunteer Ambassadors

20K

outreach engagements by Ambassadors since 2013

We have taken a consistent and integrated approach to work with government and elected officials, school districts, libraries, nonprofits, community-based organizations, and other partners to address the digital divide. Our community partners range from large national nonprofits like the Boys & Girls Clubs of America, the YMCA, the National Urban League, and UnidosUS, to hundreds of local nonprofits who not only help promote the program, but also form the bedrock of our digital literacy training efforts.

Our local Internet Essentials partnerships are built, in large part, on the relationships our employees have developed and fostered. Nonprofit partners are supported by a corps of volunteer Ambassadors who give their most valuable resource—time—to support their communities.

> **The work I do as an IE Ambassador is not only a mission in helping to connect low-income families to affordable Internet, but also a personal journey in reconnecting with my roots. As a Chinese immigrant raised in a low-income family, I know first-hand what education and Internet means to these families.**
>
> Minzhi 'Jay' Chen, QA Lead, Xfinity Mobile

Minzhi 'Jay' Chen, Amrita Pannu, Justin Van Patten, and Jeanette Walton were selected as 2020 Internet Essentials Ambassadors of the Year for their commitment to advancing digital equity in their communities.

Internet Essentials Partnership Program

The Internet Essentials Partnership Program (IEPP) is designed to help connect large numbers of K-12 students at a critical time. The program provides the opportunity for schools, school districts, government entities, foundations, and other organizations to pay for students' and their families' broadband Internet service at home. Creating strong and innovative public-private partnerships enables entire communities to work together to coordinate funding for a few months or a few years. This sponsorship program enables more families to access all the benefits Internet Essentials has to offer, while allowing community-based partners to use their expertise to empower families to take on the challenges of today while preparing for the future.

IEPP began as a pilot in 2019, based on requests and feedback from partners. When schools around the country shifted to a virtual environment due to COVID-19, we were able to expedite formalization of the program in order to meet the extraordinary need.

Featured Partners

Chicago Connected

Atlanta Public Schools

Sacramento City Unified School District

PHL ConnectED

Pittsburgh Public Schools

PPS

Lift Zones

Working with our network of thousands of non-profit partners and city leaders, we are creating safe spaces for students and families to connect and learn. Together, we are creating more than 1,000 Lift Zones in community centers to provide internet connectivity and a safe place for students and families to get online.

Lift Zone at the Boys & Girls Club in Miami

25M homework hours

In 2021 alone, WiFi-enabled Lift Zones across the country will allow students to complete over 25 million hours of homework and remote learning.

1K+

Lift Zones to be operational by end of 2021.

SUPPORTING ECONOMIC PROSPERITY

By increasing digital adoption rates, we will improve educational achievement and workforce preparedness—and that will help generate greater economic growth in which all of our citizens can share.

8%+

increase in the employment rate among households who subscribe to Internet Essentials.*

$1,385

annual increase in earnings for households who subscribe to Internet Essentials.*

BUILDING SKILLS & ADVOCATING FOR SOCIAL INCLUSION & PARTICIPATION

With social and civic engagement activities increasingly moving online, it's vital that everyone have an opportunity to participate and a platform to be heard.

2020 Census Awareness Campaign

Comcast partnered with the U.S. Census Bureau and Telemundo on a campaign to encourage Americans to participate in the first ever digital census.

$120K donated toward the cost of print materials for hundreds of Census Partner Toolkits, tens of thousands of direct mailers that targeted hard-to-count communities, and doorhangers for field operations.

*Zuo, G., 2021 (In Press). "Wired and Hired: Employment Effects of Subsidized Broadband Internet for Low-Income Americans." To be published in *American Economic Journal: Economic Policy*.

Program Impact

Our work toward digital equity begins by connecting the unconnected, but it doesn't end there. Through our community partnerships to support educational success, build skills for a digital economy, access healthcare, and promote online safety, we are deeply committed to supporting positive change in our customers' lives.

EDUCATION

COVID-19 has more fully exposed systemic inequities across the board. Prior to the pandemic, we understood that access to an Internet connection was fundamental to the success of students and families around the country. As we started the 2020-2021 school year, many districts and states did not have students return to any form of in-person learning, while others returned with a hybrid approach. Because of existing digital inequities, combined with the global pandemic, low-income students suffer the most without a home broadband connection.

That's why in 2020, we launched two new initiatives: the Internet Essentials Partnership Program, allowing for a family's service to be sponsored by a third-party organization; and Lift Zones, 1,000+ WiFi-connected safe spaces in which students and their families can connect to the Internet. Our goal is to have launched all 1,000 of our Lift Zones by the end of 2021.

90%+

of parents surveyed say the service has a positive impact on their child's grades.*

5M

low-income students connected to the Internet via Internet Essentials.

*Comcast Annual Internet Essentials Customer Survey and internal application data

***Foundational Digital Skills for Career Progress*, Ian Hecker and Pamela Loprest, Urban Institute, August 2019

WORKFORCE

Prior to the COVID-19 crisis, there was a clear and pressing need to prepare the workforce for digitization. With the majority of education and business moving online, it is more important than ever to develop a workforce that is able to respond quickly to rapid shifts in a fast-evolving economy.

Workers who lack the digital skills required to create a resume, write an email, or apply for a job online face an ever-shrinking job market. The increasingly technological nature of work means that a baseline of digital skills is necessary to thrive in today's workplace—including in occupations that have not traditionally required technology, like home health aides or welders.**

Increasing digital adoption rates will improve both educational achievement and workforce preparedness, and that will help generate greater economic growth in which all Americans can share.

76%

of customers feel their service has already helped someone in the household locate or obtain employment.*

78%

of households say the service has helped them learn a new skill.*

CUSTOMER SPOTLIGHT

Everel and her family first learned about Internet Essentials from a community-based organization where her children received after-school care while she searched for employment. After receiving a certification in health management, Everel landed a job at a Baltimore hospital. She currently works and serves on the board of the same community organization where she learned about the program.

HEALTHCARE

Before COVID-19, telehealth was a less burdensome option for doctor visits, particularly for people or families managing multiple work schedules or struggling with reliable childcare and transportation. Opting for a telehealth appointment can reduce the total time spent on a doctor's visit from two hours to 15 minutes* and eliminate a number of the logistical barriers, especially for people with disabilities and those who have limited transportation.

The COVID-19 pandemic has led to a massive shift in healthcare delivery. Healthcare systems and physician offices have accelerated digital health solutions at record speed, making telehealth a critical component of flattening the COVID-19 curve.

As a result, telehealth is no longer a convenient option, but an indispensable option.

> **Recent events have made it abundantly clear that connectivity is a lifeline and an essential element in managing one's healthcare from home. Working with Comcast, a leader in making connectivity accessible for seniors, has allowed OATS to provide telehealth training and information on reliable online health resources to thousands of older adults sheltering in place.**
>
> Thomas Kamber, Executive Director
> Older Adults Technology Services (OATS)

88%

of customers say the service has helped them remain connected to healthcare during COVID-19.

Of those who experienced difficulty getting medical treatment,

90%

of customers say that having Internet service at home helped them access healthcare services.

*Ray, K.N., Chari, A.V., Engberg, J., Bertolet, M. and Mehrotra, A., 2015. *Opportunity Costs of Ambulatory Medical Care in the United States. American Journal of Managed Care,* 21(8), pp.567-574.

ONLINE SAFETY

With the COVID-19 crisis shifting so much of our lives to the virtual world, online safety concerns for at-risk populations, like children, seniors, and the underserved, are becoming even more pronounced.

Our company first launched its national Online Safety initiative in the fall of 2017, when we announced an Internet Essentials partnership with Pennsylvania Attorney General Josh Shapiro to educate seniors, parents, and children about how to stay safe online. In 2018, we built on this work by entering into an ambitious partnership with the Conference of Western Attorneys General (CWAG) to further promote Internet safety for seniors and families.

Partnering with **more than 20 State Attorneys General**, Common Sense Media, ConnectSafely, FOSI (Family Online Safety Institute), and WGBH, we have delivered a comprehensive Online Safety Toolkit for law enforcement officials, provided significant investments in cybersecurity training classes, produced public service announcements, and distributed tens of thousands of online safety brochures for seniors and parents.

50+

Online Safety Toolkits delivered to Attorneys General across the country.

The Online Safety Toolkit provides chief law enforcement officers with up-to-date materials to help spread awareness about the importance of online safety and digital citizenship, and contains information about the latest cybersecurity pitfalls.

7M+

views in 2020 of WGBH PBS KIDS "Search It Up", 2021 winner of NETA's Annual Public Media Awards for Best Short Form.

In collaboration with Internet Essentials, WGBH produced, **"Search It Up" A Mini-Series About Kids and Technology**, featuring nine unscripted, live-action, short-form videos where children explore online safety and best practices for Internet use. **Click here** to view.

What's Next

In 2020, Comcast's Internet Essentials launched the Impact summits, a series of national and regional virtual convenings, bringing thought leaders, public officials, subject matter experts, and nonprofit partners together to discuss digital equity and the challenges related to COVID-19.

The first in a series of virtual convenings, the Impact Summit in March 2020 amassed the knowledge, experience, and skills of our partners to drive greater impact in the communities we serve. The event focused on three areas—education, workforce development, and healthcare—for Internet Essentials to understand its impact and refine its outreach and partnership strategies.

Our second event, the Impact on Education Summit, held in the fall of 2020, focused on discussing and disseminating best practices for communities across the country to ensure every student, teacher, and school has the tools necessary to create a high-quality online learning experience. Soon after, a series of virtual regional summits were held which also focused on best practices for communities across the country such as K-12 education, veterans, telemedicine, and seniors.

We plan to continue in 2021 with events that explore our efforts to bridge the digital divide in education as well as in other areas including online safety and workforce development.

KEY INSIGHTS WE LEARNED

Click here to download our **Impact Summit Recap Report.**

1. One of the most impactful roles Comcast can play is as a convener for business, government, and nonprofits, all working to close the digital divide.

2. Connectivity is seen by our partners as only a part of a multi-pronged solution to economic mobility, driving education equity, improving healthcare outcomes, and generating innovation.

3. Even as Internet Essentials expands its scope and reach, we must continue to build and strengthen our partnerships and constantly refine our strategy to ensure the possibilities of the Internet are available to as many people as possible.

STRAWBERRY MANSION

Philadelphia's Strawberry Mansion High School received a grant from Comcast in 2020 to support its performing arts program. All 180 students also received free iPads along with 12 months of free Internet Essentials service.

IMPACT ON EDUCATION

MAURICE

Maurice Douyon, Internet Essentials customer and Florida Community Christian freshman, received a scholarship from Comcast in 2020 to help him achieve his academic dreams.

Commitment to Digital Equity

Since the program's inception a decade ago, Internet Essentials has connected more than 10 million people across the country to low-cost, high-speed Internet at home, and provided free digital skills training and subsidized devices. However, our commitment to addressing digital inequities in underrepresented communities extends beyond this work. That is why we are pledging to invest more than $1 billion over the next 10 years to empower an additional 50 million low-income Americans with the tools and resources necessary to succeed in today's digital world. We will continue working hand-in-hand with our network of community partners across the country as we accelerate our goals to innovate and expand upon the Internet Essentials program.

"Advancing digital equity has been core to our company's DNA and it's an issue we've recommitted to during this critical time. Our mission is to create a more connected and equitable society. That begins with ensuring that every student—and adult—has access to the training and education resources they need to build a brighter future.

Brian L. Roberts
Chairman & CEO
Comcast Corporation

$1B

committed by Comcast over the next 10 years to the critical work of advancing digital equity.

50M

Americans empowered to take advantage of a world of knowledge and opportunity through our initiatives by 2031.

Ummi, customer

Lift Zone at the Boys & Girls Club in Miami

1-855-8-INTERNET (1-855-846-8376)
1-855-SOLO-995 (1-855-765-6995)
InternetEssentials.com | es.InternetEssentials.com

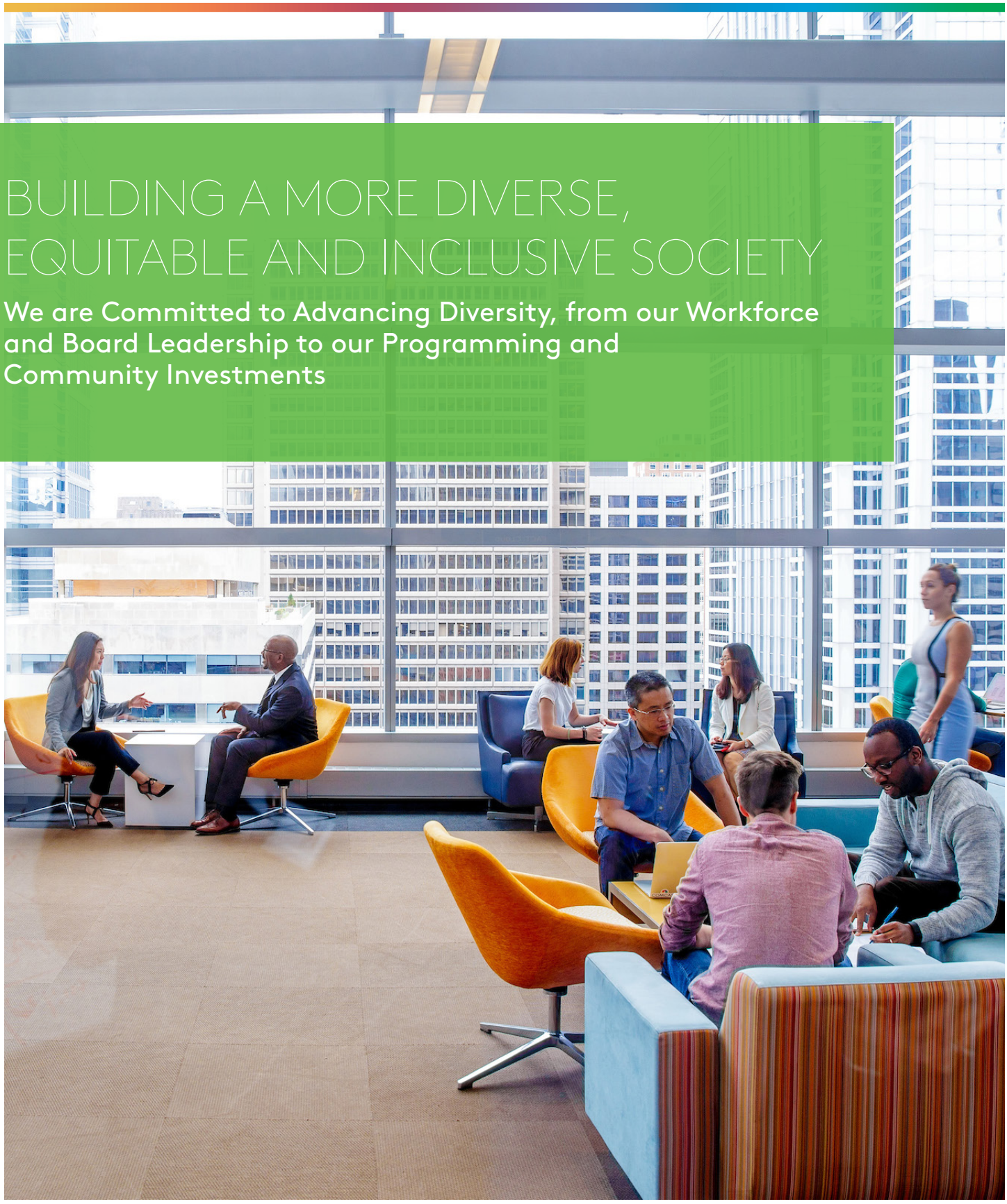
10 YEARS internet essentials

COMCAST

COMCAST

BUILDING A MORE DIVERSE, EQUITABLE AND INCLUSIVE SOCIETY

We are Committed to Advancing Diversity, from our Workforce and Board Leadership to our Programming and Community Investments



Comcast NBCUniversal embraces diversity of background, culture, and experience throughout every aspect of our business — from the people who power our teams to the products we create, the stories we tell, and the organizations we support. We believe that a diverse, equitable, and inclusive company is also a more innovative and successful one.

Our Multi-Year $100 Million Plan to Advance Social Justice

In the wake of growing public focus on issues of racial justice and equality in 2020, we pledged an additional $100 million to fight injustice and inequality. We also announced Dalila Wilson-Scott as our new Chief Diversity Officer to spearhead our Diversity, Equity, and Inclusion initiatives. We are partnering with, and providing significant grants to, organizations working to promote equity and inclusion. We are also accelerating our internal efforts in all areas of Diversity, Equity & Inclusion — including employee advancement, hiring, and training as well as highlighting underrepresented voices on our media platforms. We continue to deepen our long-standing commitment to promoting digital equity and supporting small businesses owned by people of color that have been affected by extended closures in the wake of COVID-19.

Our Longstanding Commitment to Diversity, Equity & Inclusion

Our company-wide **Diversity, Equity & Inclusion (DE&I)** initiatives are embedded in our business and culture and are shaped by our close and long-standing partnerships with many of the nation's leading civil rights organizations. Further, we commit to measurable goals in our board representation and governance, our programming, workforce, supplier diversity, and our community investment.

We also work in close partnership with our **Joint Diversity Advisory Council (JDC)**, which we founded a decade ago and which is composed of civil rights and political leaders representing the African American, Asian Pacific American, Hispanic, Native American, LGBTQ, military communities, women, and people with disabilities. These leaders monitor our progress and provide counsel on our DE&I initiatives. Nearly a decade after its founding, the JDC remains the largest external diversity council in corporate America, by a large margin.

Recognized as One of America's Most Inclusive Employers

Fortune: One of America's 20 Best Employers for Diversity in 2020

Fortune: One of America's 25 Best Large Workplaces for Women in 2020 and one of America's 30 Best Workplaces for Diversity in 2019

DiversityInc: #7 Company for Diversity in 2020

People Magazine: Named to "50 Companies that Care" list for the 3rd straight year in 2020

Human Rights Campaign: Received a score of 100 for "Best Places to Work for LGBTQ Equality" in 2020

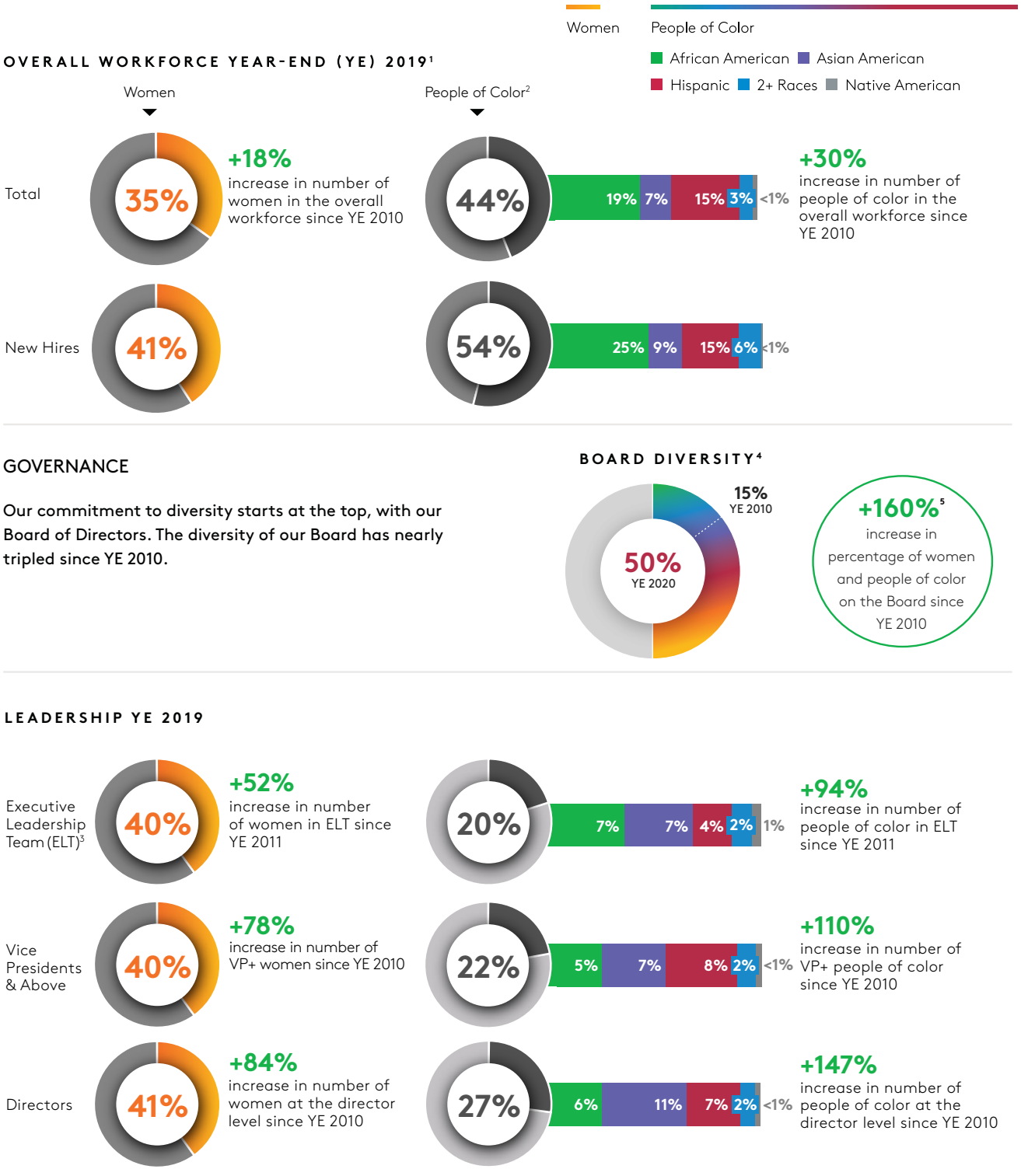
Disability Equality Index: Received a score of 100 for "Best Places to Work for Disability Inclusion" in 2020

Hispanic Association of Corporate Responsibility: Recognized as a "5-Star Company" on the 2020 Corporate Inclusion Index

Military Times: #1 Ranked Company on MT's "Best for Vets: Employers" 2020 List

Building a Diverse and Inclusive Workforce

We are proud that our workforce composition reflects the diversity of the communities we serve. In 2019, 62% of our workforce and 71% of new hires were women or people of color. Currently, 50% of our board of directors are women or people of color.



1 Workforce metrics are reflective of our U.S. full-time employees.
2 Ethnic diversity numbers may not sum to total due to rounding.
3 Our Executive Leadership Team includes the CEOs and their first- and second-level direct reports
4 "Diversity" data refer to people of color and women, without double-counting women of color.
5 Throughout this document, changes in percentage representation refer to the growth rate of percentage representation between a starting point and an ending point. For example, an increase from 10% to 15% is a growth rate of +50%.

A Commitment to Diverse Storytelling Across Our Platforms

We lead the entertainment industry in empowering diverse content creators and using our storytelling platforms to deliver programming that represents the audiences we serve and features stories and diverse casts that reflect real life experiences in diverse communities. We carry more than 100 diverse networks on Xfinity platforms, and we offered more than 24,000 hours of diverse content on our on-demand and online platforms in 2019.

Further, we also curate easy-to-browse special content collections on our X1 platform featuring thousands of hours of culturally relevant programming.

Recent X1 content collections include:

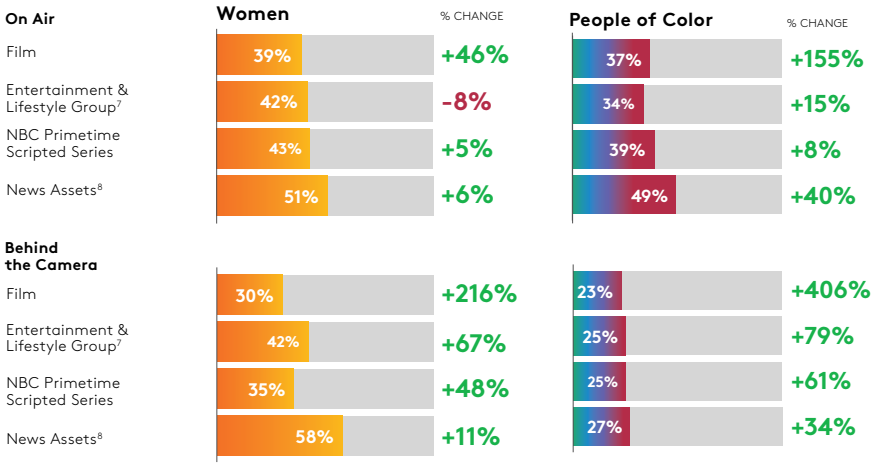
- **Black Voices. Black Stories.** — A collection of bold movies, documentaries, TV series, and specials reflecting the country's long history of racial discrimination and injustice, designed to educate and drive awareness.
- **Echando Pa'lante Juntos** — Thousands of hours of programming designed to amplify and celebrate Latinx voices and Hispanic culture, history, and community.
- **Native American Heritage Month Content Collection** — Movies, programs, and documentaries that pay tribute to Native American culture and history, including popular Native American dramas, thrillers, and westerns.

Additionally, this year we've entered into multiple content partnerships with diverse content creators including Lebron James, Ava DuVernay, Sean Combs, Justin Lin, and Tanya Saracho.

Expanding Diversity in Front of and Behind the Camera

At Comcast NBCUniversal, we take pride in creating opportunities in the media industry for women and people of diverse backgrounds and experiences — both in front of and behind the camera.

NBCUNIVERSAL DIVERSITY YE 2019[6]



** Increases and decreases next to each graph represent the growth rate of percentage representation. For women the numbers reflect the growth rate since YE 2013; for people of color they reflect the growth rate since YE 2010.
† Entertainment & Lifestyle Group includes USA and Syfy.
◊ News assets includes NBC News, MSNBC, CNBC, and NBC-owned stations, but does not include Telemundo Network News or Telemundo stations.

Addressing Digital Inequities

Our **Internet Essentials** broadband adoption initiative, launched in 2011, has connected more than 8 million low-income individuals to residential broadband — more than 90 percent of whom were not previously connected. The NAACP has hailed Internet Essentials as "the largest experiment ever attempted to close the digital divide."

In response to the unprecedented COVID-19 emergency, we've built on the success of Internet Essentials to launch the **Internet Essentials Partnership Program (IEPP)**, a new initiative that works with school districts, local government, and philanthropic partners to get unconnected students online at home.

In 2020, Comcast also launched **Lift Zones**, a cooperative effort with local community and government leaders to open 1,000 WiFi-connected facilities in community centers nationwide. These centers offer students free connectivity, digital literacy training, and support for online learning.

Since September, we've announced new partnerships with organizations that share our commitment to creating a more connected and equitable world, helping to provide critical skills training to youth and adults to ensure everyone has the opportunity to succeed. Examples include:

- **Saga Education:** We partner with Saga Education to bring their world-class tutoring online and invested in the organization to help expand their reach and impact.
- **Coded by Kids:** We support Coded by Kids, whose founder and CEO Sylvester Mobley and team recently launched OnE Philadelphia — a new initiative focused on transforming the city into a pipeline for high-level tech talent and tech startup leaders in communities of color in Philadelphia.

Building a Diverse Supply Chain

Since 2011, Comcast NBCUniversal has spent over $25 billion with diverse Tier 1 and Tier 2 businesses owned by women, people of color, veterans, individuals with disabilities, and members of the LGBTQ community members.

In that time, we've quadrupled our annual spending with diverse Tier I suppliers (vendors). We've also increased our spending with Tier II suppliers (subcontractors) by 221% since launching our Tier II program in 2012. We're proud to work with more than 3,000 diverse suppliers.

Comcast NBCUniversal Supplier Diversity at a Glance

$22.7B
spent with diverse Tier I suppliers since 2011

$2.9B
spent with diverse Tier II suppliers since 2012

3K+
diverse suppliers

Comcast RISE: Helping BIPOC-Owned Businesses Impacted By Covid

The COVID-19 pandemic decimated many minority-owned businesses. The National Bureau of Economic Research reported that just between February and April 2020, the number of active Black-owned businesses declined by 41%, Latinx-owned businesses declined by 32%, and Asian-owned businesses dropped by 25%, versus just 21% for the general population.

We recently announced Comcast RISE, a multi-year initiative to help thousands of small businesses impacted by COVID-19. Beginning in November 2020, all Black, Indigenous, and People of Color (BIPOC) business owners will be eligible to apply for Comcast RISE.

Through this initiative, we will give meaningful support to the small businesses that are shaping our communities, including:

- Advertising and marketing consultations
- Production of a 30-second TV commercial
- A 90-day TV advertising campaign
- Computer equipment and Internet, voice, and cybersecurity services for 12 months
- Monetary Grants

For more information:

- Comcast's 2020 Values Report
- Comcast Values: Diversity, Equity & Inclusion
- Comcast CEO Brian Roberts' open letter announcing our new $100 million commitment to fight inequality and injustice

What are **Lift Zones**?

In September of 2020, Comcast announced a multiyear program to launch more than 1,000 WiFi-connected “Lift Zones” in community centers nationwide for anyone to use, including students, adults, seniors, and veterans. We have since accelerated that commitment to establish 1000+ Lift Zones by the end of this year.

The COVID-19 crisis has put many low-income students at risk of being left behind and has accelerated the need for comprehensive digital equity and Internet adoption programs to support them. Lift Zones are designed to help those students who, for a variety of reasons, are unable to participate in distance learning at home.

This initiative will provide free hotspot connectivity, and also access to hundreds of hours of educational and digital skills content to help families and site coordinators navigate online learning. Lift Zones complement Comcast’s Internet Essentials program, which, since 2011, has helped connect more than 10 million low-income people to the Internet at home. A Lift Zone is a facility primarily designed to help provide low-income students with a safe, clean space to participate in distance learning during the day or to do homework before or after school. However, adults, seniors, and veterans can also use the site for remote work, to look for or apply for a job, or learn digital skills. Hundreds of Lift Zones are already up and running across the country in cities like Baltimore, Chicago, Philadelphia, Denver, Oakland, and the Twin Cities.

To find a Lift Zone near you, please visit:

https://internetessentials.com/learningsearchpage

internet essentials FROM COMCAST

COMCAST

COMCAST

ATTACHMENT 18 – Comcast Services and Speeds

Upon completion of the project Comcast will offer the following services:

High-Speed Internet Services. Comcast's robust high-speed Internet services provide a range of fast, reliable Internet speed tiers to fit customers' needs, as well as access to over 20 million secure Wi-Fi hotspots nationwide so that customers can stay connected on the go. Customers also have access to the Xfinity app to optimize their home connections, view their plans, pay their bills, and get 24/7 real-time support. And they also have access to xFi – a simple, digital dashboard for customers to control their home Wi-Fi network. In addition to parental control features like pausing Wi-Fi and screen time scheduling, xFi provides content filters that ensure younger children can only access age-appropriate content. xFi now also comes with xFi Advanced Security, that protects all the devices connected to a customers' home network from malware and other security threats.

Video Services. Comcast also offers a broad variety of video services, primarily through our X1 platform, an IP and cloud-enabled video platform that delivers the simplest, fastest, and most complete way for customers to access all their entertainment on all their screens. Video customers have access to hundreds of channels depending on the level of service, which typically range from limited basic service with access to between 20 and 60 channels to full service with access to more than 300 channels. Video services generally include programming provided by national broadcast networks, local broadcast stations, and national and regional cable networks, as well as government and public access programming. Our video services also include access to video on demand services and an interactive, on-screen program guide. Through the X1 platform, customers have integrated search functionality, including the use of the X1 Voice Remote, a voice-activated remote control that customers can use to change channels, search for shows, get recommendations, and more; and access to and the integration of Peacock, which X1 customers receive for no additional charge, certain third-party direct-to-consumer streaming services such as Amazon Prime Video, HBO Max, Hulu, Netflix, YouTube, and Disney+, and a variety of other Internet-based apps providing content and music. Customers have access to their video services through the Stream mobile app and an online portal that allow them to view certain live programming and OnDemand content and to browse program listings.

For high-speed Internet customers that prefer streaming content over the Internet rather than linear cable television, Comcast offers Flex, a streaming device that provides access to certain online programming on their television with integrated search functionality, including the use of a voice-activated remote control and personalized recommendations. Flex uses IP technology and our own cloud network servers to deliver video and advanced search capabilities, including through a voice-activated remote control, and that provide access to certain third-party internet apps. Flex programming includes Comcast's Peacock service and certain other Internet-based apps at no additional charge, access to pay-per-view and video on demand content, and access to and the integration of certain third-party direct-to-consumer streaming services such as Amazon Prime Video, HBO Max, Hulu, Netflix, YouTube, and Disney+. Additionally, a variety of music apps such as Pandora are offered through Flex.

VoIP Services. In addition, Comcast offers voice services using interconnected Voice over Internet Protocol technology. Service options provided include either unlimited or usage-based local and domestic long-distance calling, as well as options for international calling plans, voicemail, readable voicemail, nuisance call blocking tools and various call features such as caller ID and call waiting. Voice services also include the ability to access and manage voicemail and other account features through an online portal or mobile app.

Xfinity Mobile. Furthermore, Comcast offers wireless services for handsets, tablets and smart watches using mobile virtual network operator rights to provide the services over Verizon's wireless network and

our existing network of more than 20 million in-home and outdoor Wi-Fi hotspots. We currently only offer these services as part of our bundled service offerings to residential customers that subscribe to high-speed Internet service within our cable distribution footprint and to a limited group of small business high-speed Internet customers on similar terms. Customers may choose to pay for services on an unlimited data plan, shared data plans, or per gigabyte of data used. Customers have the ability to bring their own device or purchase them from us with the option to pay upfront or finance the purchase interest-free over 24 months.

Comcast Business Services. Comcast Business Services offers a variety of products and services to businesses. Our service offerings for small business locations primarily include high-speed Internet services, as well as voice and video services, that are similar to those provided to residential customers, cloud-based cybersecurity services, wireless backup connectivity, advanced Wi-Fi solutions, video monitoring services and cloud-based services that provide file sharing, online backup and web conferencing, among other features. Comcast also offers Ethernet network services that connect multiple locations and provide higher downstream and upstream speed options to medium-sized customers and larger enterprises, as well as advanced voice services, along with video solutions that serve hotels and other large venues. In addition, Comcast provides cellular backhaul services to mobile network operators to help them manage their network bandwidth. Comcast has expanded its service offerings to include a software-defined networking product for medium-sized and enterprise customers. Larger enterprises may also receive support services related to Wi-Fi networks, router management, network security, business continuity risks and other services. These service offerings are primarily provided to Fortune 1000 companies and other large enterprises with multiple locations both within and outside of Comcast's cable distribution footprint, where we have agreements with other companies to use their networks to provide coverage outside of our service areas.

Customer Service. In addition to Comcast's deep experience as a communications service provider offering a variety of services, Comcast also has the appropriate number of technicians, call center agents and backend support employees to care for additional customers. Comcast also maintains large, locally based engineering and technical operations teams that work around the clock to maintain service reliability and provide direct support to the company's business and residential customers. Moreover, Comcast proactively monitors and maintains its network 24/7 through its dedicated Network Operations Center (NOC). The NOC continuously monitors the network equipment, service health, and performance of the Comcast network, responds to network events and service degradations, dispatches local field technicians, and informs customers of service issues, in many cases before the customer has noticed the problem. The NOC group also provides technical support and responds to trouble calls from network service customers including carriers, TLS and Native ATM customers, and voice product customers, through a staff of Technical Support Representatives (TSRs). The NOC also operates a 24 x 7 x 365 Technical Customer Support helpdesk that responds to calls for all of Comcast's services.

As detailed in the table below, upon completion of the project, Comcast will be able to offer customers multiple choices of residential and commercial broadband services, depending on the customers' specific needs:

COMCAST

ATTACHMENT 18 – Comcast Services and Speeds

Current Residential Service Tiers

Tier	Speeds Up To	Standalone Pricing	With Xfinity TV or Voice Service
Performance Starter	50 Mbps / 5 Mbps	$54.95	$49.95
Performance	100 Mbps / 5 Mbps	$80.95	$64.95
Performance Pro	200 Mbps / 5 Mbps	$95.95	$79.95
Blast!	400 Mbps / 10 Mbps	$100.95	$84.95
Extreme Pro	800 Mbps / 15 Mbps	$105.95	$89.95
Gigabit	1.2 Gbps / 35 Mbps	$110.95	$94.95
Gigabit Pro	2 Gbps / 2 Gbps	$299.95	N/A

Current Comcast Business Tier[1]

Tier	Speeds Up To
Business Internet 100	100 Mbps / 15 Mbps
Business Internet 200	200 Mbps / 20 Mbps
Business Internet 300 Plus	300 Mbps / 30 Mbps
Business Internet 600	600 Mbps / 35 Mbps
Business Internet 1G	1.2 Gbps / 35 Mbps

Note: Prices do not include equipment or applicable taxes, fees and surcharges, and are subject to change.

In addition to the multiple residential broadband options above, Comcast also makes available its Internet Essentials program to qualifying low-income customers in its service areas, which is the nation's largest, most successful, and most comprehensive broadband adoption program for low-income households, and Comcast's number one community impact initiative. Internet Essentials currently provides customers with broadband service at speeds of up to 50 Mbps/5 Mbps for $9.95/month plus applicable taxes, fees and surcharges, as well as free digital skills training in person and online. Customers also have the option to purchase a low-cost Internet-ready computer.

Since launching in 2011, Comcast has made dozens of improvements to the program, including expanding eligibility 12 times—bringing Internet Essentials to new audiences such as public housing residents, low-income veterans, seniors, community college students, and most recently, to all

[1] Speeds of up to 100 Gbps for medium to large businesses available in certain areas

qualified low-income households living in Comcast's service area. Comcast has also increased the speeds for Internet Essentials, with the most recent speed increase to 50 Mbps/5Mbps occurring earlier this year. Since 2011, Internet Essentials has connected a cumulative total of more than ten million Americans to the Internet.

In addition, Comcast customers who subscribe to an Xfinity Internet package will have access to Xfinity WiFi hotspots, including those that would be newly added to the Project, for no additional cost. Moreover, these customers would be able to access any of Comcast's hotspots throughout Virginia and across the country. Comcast has the country's largest WiFi network, including more than 20 million hotspots nationwide. Combined with the company's recently launched Xfinity xFi platform, a new and personalized home WiFi experience, Comcast will provide its customers in the Project with the fastest speeds, the best WiFi coverage, and ultimate WiFi control in their homes. Xfinity Internet customers may also have the option to sign up for Xfinity Mobile service, which includes up to five lines with unlimited talk and text.

As is Comcast's usual practice through its footprint, Comcast will support all customers in the Project with call centers as well as self-service options such as digital and chat. Many customers take advantage of Comcast's different tools, including the MyAccount feature within the Xfinity app, which is available on the web and mobile devices. Customers can manage their service in many ways through the app, such as by troubleshooting a device in the home, managing programming options, and receiving important notifications.

Currently, Comcast employs Data Over Cable Service Interface Specification (DOCSIS) 3.1 technology in its broadband network infrastructure, and plans to use DOCSIS 3.1 for this project. DOCSIS is an international telecommunications standard that permits the addition of high bandwidth data transfer to an existing cable TV system. The technology is employed by many cable operators to provide Internet access over existing HFC infrastructure. DOCSIS is a proven, flexible protocol which offers the technological foundation upon which Comcast can meet any current or future anticipated need. As a highly scalable technology, it has, to-date, allowed Comcast to enhance the residential broadband speeds it offers from 50 Mbps to 1.2 Gbps, an almost 25-fold increase.

DOCSIS 3.1 was introduced in 2013 and will support a maximum downstream capacity of 10 Gbps and maximum upstream capacity of 1-2 Gbps. DOCSIS architecture includes two primary components – a cable modem, located at a customer's home or business, and a cable modem termination system (CMTS), located at the cable system head end. Comcast leases the cable modem to customers as a component of the service, or customers can provide their own modem, and the CMTS for this proposed project is located in Comcast's head end serving the Project area.

The industry continues to innovate, working through CableLabs, a joint non-profit research and development laboratory, to develop the next iteration of DOCSIS, named 10G. The 10G platform is a combination of technologies that will deliver Internet speeds 10 times faster than today's networks and 100 times faster than what most consumers currently experience. This technological development will allow Comcast to offer gigabit symmetrical service in the coming years over its existing HFC network throughout our entire footprint, as well as lower latencies, enhanced reliability, and better security in a scalable manner. Comcast began field trials of 10G earlier this year. This combination of technologies will result in much faster speeds, more reliability, stronger security, and even lower latency. The network will be able to transmit up to 50% more data, thereby augmenting the quality of video conferencing, telehealth, and connected devices, among many other things. Additional information about these exciting developments is available at https://www.cablelabs.com/path-10g-2020-update.

COMCAST

ATTACHMENT 18 – Comcast Services and Speeds

To support the growing needs of the digital world, Comcast is working hard to make its network smarter, by leveraging cloud, backbone, and architecture advancements to provide a faster, stronger, and more flexible network. By optimizing traffic routing and moving resources closer to where they are needed, our network provides the key to managing the ever increasing traffic demands of today's Internet. The powerful combination of our broadband and Wi-Fi network and the cloud is enabling us to innovate and bring transformative products to market, redefining how our customers enjoy entertainment, connect, and communicate inside and outside of their home or office.

Arlington, Fauquier, Loudoun, Prince William, Spotsylvania, Stafford

BUNDLED PACKAGES[1,2]

QUAD PLAY PACKAGES

QUAD PLAY PACKAGE PRICING BELOW IS ADDITIONAL TO TRIPLE PLAY PACKAGE PRICING

with Xfinity Home Security add[24]	$30.00
with Xfinity Home Security Plus add[25]	$40.00

TRIPLE PLAY PACKAGES[40]

Standard+ More Includes Limited Basic, Expanded Basic and HD programming for primary outlet, 20 Hour DVR Service, Performance Pro Internet and Unlimited Voice	$130.99
SurePrice[35]	$124.99
- with Gigabit Pro Internet upgrade add[36]	$235.00
- with Xfinity Mobile save	$-10.00
- with DVR Service upgrade add	$10.00
- with Premium DVR Service upgrade add	$20.00
- with Blast! Internet upgrade add	$20.00
- with Extreme Pro Internet upgrade add	$25.00
- with Gigabit Internet upgrade add	$30.00
Select+ More Includes Limited Basic, Expanded Basic, Digital Preferred Tier and HD programming for primary outlet, DVR Service, Extreme Pro Internet and Unlimited Voice	$159.99
SurePrice[35]	$134.99
- with Gigabit Pro Internet upgrade add[36]	$235.00
- with Xfinity Mobile save	$-10.00
- with Premium DVR Service upgrade add	$10.00
- with Gigabit Internet upgrade add	$30.00
Signature+ More Includes Limited Basic, Expanded Basic, Digital Preferred Tier, Epix, and HD programming for primary outlet, Premium DVR Service, Gigabit Internet, Unlimited Voice and Netflix Standard HD Plan	$189.99
SurePrice[35]	$164.99
- with Gigabit Pro Internet upgrade add[36]	$235.00
- with Xfinity Mobile save	$-10.00
- with Netflix Premium UHD Plan upgrade add	$4.00
Super+ More Includes Limited Basic, Expanded Basic, Digital Preferred Tier, Epix, HBO Max, Showtime, TMC, More Sports & Entertainment Package and HD programming for primary outlet, Premium DVR Service, Gigabit Internet, Unlimited Voice and Netflix Standard HD Plan	$199.99
SurePrice[35]	$184.99
- with Gigabit Pro Internet upgrade add[36]	$235.00
- with Xfinity Mobile save	$-10.00
- with Netflix Premium UHD Plan upgrade add	$4.00

DOUBLE PLAY PACKAGES[34]

Choice Double Play[37] Includes Choice Limited TV and Performance Internet	$89.99
- with DVR Service upgrade add	$10.00
- with Premium DVR Service upgrade add	$20.00
- with Performance Pro Internet upgrade add	$15.00
- with Blast! Internet upgrade add	$20.00
- with Extreme Pro Internet upgrade add	$25.00
- with Gigabit Internet upgrade add	$30.00
- with Gigabit Pro Internet upgrade add[36]	$235.00
Standard+ Includes Limited Basic, Expanded Basic and HD programming for primary outlet, 20 Hour DVR Service, and Performance Pro Internet	$110.99
- with DVR Service upgrade add	$10.00
- with Premium DVR Service upgrade add	$20.00
- with Blast! Internet upgrade add	$20.00
- with Extreme Pro Internet upgrade add	$25.00
- with Gigabit Internet upgrade add	$30.00
- with Gigabit Pro Internet upgrade add[36]	$235.00
Select+ Includes Limited Basic, Expanded Basic, Digital Preferred Tier and HD programming for primary outlet, 20 Hour DVR Service, and Blast! Internet	$139.99
- with DVR Service upgrade add	$10.00
- with Premium DVR Service upgrade add	$20.00
- with Extreme Pro Internet upgrade add	$25.00
- with Gigabit Internet upgrade add	$30.00
- with Gigabit Pro Internet upgrade add[36]	$235.00
Signature+ Includes Limited Basic, Expanded Basic, Digital Preferred Tier, Epix, and HD programming for primary outlet, DVR Service, Extreme Pro Internet, and Netflix Standard HD Plan	$169.99
- with Premium DVR Service upgrade add	$10.00
- with Netflix Premium UHD Plan upgrade add	$4.00
- with Gigabit Internet upgrade add	$30.00
- with Gigabit Pro Internet upgrade add[36]	$235.00
Super+ Includes Limited Basic, Expanded Basic, Digital Preferred Tier, Epix, HBO Max, Showtime, TMC and HD programming for primary outlet, DVR Service, Extreme Pro Internet, and Netflix Standard HD Plan	$189.99
- with Premium DVR Service upgrade add	$10.00
- with Netflix Premium UHD Plan upgrade add	$4.00
- with Gigabit Internet upgrade add	$30.00
- with Gigabit Pro Internet upgrade add[36]	$235.00

XFINITY TV[1]

BASIC SERVICES

Limited Basic[7]	$24.95
Broadcast TV Fee[18]	$18.95
Expanded Basic[10] Includes Kids & Family, Entertainment and Sports & News	$42.32

XFINITY TV SERVICES

Choice Limited TV[31] Includes Limited Basic, Streampix, 10 hours DVR Service and HD programming	$30.00
Choice TV[32] Includes Limited Basic, Streampix, 20 hours DVR Service, HD programming and Broadcast TV Fee	$30.00
- with TV Box	$37.50
Genre Packs[23] Choose up to 2	
Kids & Family Includes kid and family-friendly channels including Disney Channel, Nickelodeon and Universal Kids	$10.00
Entertainment Includes entertainment channels including A&E, AMC, Bravo, Food Network, FX, TNT and VH1	$15.00
Sports & News Includes sports and news channels including CNBC, CNN, ESPN, Golf, MSNBC and NBC Sports	$30.00
Extra Includes Limited Basic, Expanded Basic, access to Pay-Per-View and On Demand programming and Music Choice	$67.27
Digital Preferred Tier[12] Includes over 65 channels including CBS College Sports, Destination America, Disney XD and Science Channel	$17.95

Digital Preferred Tier plus One Premium Includes Digital Preferred Tier and choice of Showtime, Cinemax, or The Movie Channel	$29.95
Digital Preferred Tier with HBO Max Includes Digital Preferred Tier and HBO Max	$32.94
Digital Premier Tier Includes Digital Preferred Tier, HBO Max, Showtime, Epix, Hitz and The Movie Channel	$64.95
More Sports & Entertainment Package[12] Includes over 15 channels including NFL Red Zone, ESPNews and TCM	$9.95
Deportes[10] Includes over 6 deportes channels including ESPN Deportes, FOX Deportes and NBC Universo	$5.00
Xfinity TV Latino[10] Includes over 50 channels of Spanish language programming	$17.95
With Choice Double Play or Standard, Select, Signature, Super Double or Triple Play Packages	$10.00
HBO Max[10]	$14.99
HBO[10]	$15.00
Showtime[10]	$12.00
Starz[10]	$8.99
Cinemax[10]	$12.00
The Movie Channel[10]	$12.00
Epix[22]	$5.99
Playboy[10]	$15.00
HD Technology Fee[9]	$9.95
DVR Service[30]	$10.00
Premium DVR Service[38]	$20.00
Service to Additional TV with TV Adapter[11]	$7.50

INTERNATIONAL SELECTIONS[27]

ART: Arabic	$9.99
TV Globo: Brazilian	$19.99
Brazilian 2 Pack Includes TV Globo and SporTV	$24.99
Brazilian 4 Pack Includes TV Globo, SporTV, Band Internacional and Record TV	$34.99
Mandarin 2 Pack Includes Phoenix Info News and Phoenix North America	$6.99
Mandarin 4 Pack Includes CTI Zhong Tian, CCTV4, Phoenix Info News and Phoenix North America	$19.99
Filipino 2 Pack Includes GMA Pinoy w/ GMA Video On Demand and GMA Life	$14.99
Filipino 3 Pack Includes GMA Pinoy w/ GMA Video On Demand, GMA Life and TFC	$22.99
TV5MONDE: French With Cinema On Demand	$9.99
DW Deutsche +: German	$9.99
Antenna: Greek	$14.99
The Israeli Network	$19.99
Rai Italia: Italian	$9.99
Italian 2 Pack Includes Rai Italia and Mediaset	$14.99
TV JAPAN	$24.99
SIC: Portuguese	$9.99
Portuguese 2 Pack Includes RTPi and SIC	$14.99
Impact TV: Russian Add-on With any International package	$6.99
Russian 2 Pack Includes Channel One Russia and NTV America	$14.99
Russian 4 Pack Includes Channel One Russia, RTN, TV1000 Russian Kino and NTV America	$26.99
Russian 5 Pack Includes Channel One Russia, RTVi, NTV America, RTR-Planeta and Rossiya 24	$26.99
Russian 8 Pack Includes Channel One Russia, RTN, RTVI, TV1000 Russian Kino, NTV America, RTR-Planeta, Rossiya 24 and CTC	$34.99
Willow: Cricket Add-on With any International package	$6.99
Willow: Cricket	$14.99
Zee TV: Hindi	$14.99
SET: Hindi	$14.99
Hindi 2 Pack Includes Zee TV and SET	$24.99
Hindi Pack Includes Zee TV, SET, TV Asia and NDTV 24x7	$29.99
Hindi Plus Pack Includes Zee TV, SET, TV Asia, NDTV 24x7, Eros Now and Willow	$39.99
SBTN: Vietnamese	$14.99
TVB Jade: Cantonese	$10.99
Record TV: Brazilian	$14.99
ABP News: Hindi	$7.99
TFC: Filipino	$11.99

PAY-PER-VIEW AND ON DEMAND SUBSCRIPTION SERVICES

Eros Now On Demand[29]	$12.99
Eros Now On Demand[29] w/a South Asian international selection	$9.99
here! TV On Demand[29]	$7.99
Filipino On Demand[29]	$7.99
Filipino On Demand[29] w/a Filipino international selection	$5.99
The Jewish Channel On Demand[29]	$6.99
Kidstream On Demand[29]	$4.99
History Vault On Demand[29]	$4.99
Gaiam TV Fit & Yoga On Demand[29]	$7.99
Grokker Yoga Fitness On Demand[29]	$6.99
UP Faith and Family On Demand[29]	$5.99
Lifetime Movie Club On Demand[29]	$3.99
Anime Network On Demand[29]	$6.99
Stingray Karaoke On Demand[29]	$6.99
DOGTV On Demand[29]	$4.99
Gaia On Demand[29]	$11.99
AMC + On Demand[29]	$6.99
Stingray Classica On Demand[29]	$6.99
TumbleBooksTV On Demand[29]	$4.99
FitFusion On Demand[29]	$6.99
CuriosityStream On Demand[29]	$2.99
PlayKids On Demand[21]	$6.99
MagellanTV History On Demand[21]	$5.99
Disney Story Central On Demand[29]	$4.99
Acorn TV On Demand[29]	$5.99
Daily Burn On Demand[21]	$14.99
Xive TV On Demand[21]	$4.99
Quark On Demand[21]	$4.99
Stephens Drum Shed On Demand[21]	$4.99
Pro Guitar Lessons On Demand[21]	$4.99
Touchfit TV On Demand[21]	$4.99
Lion Mountain TV On Demand[21]	$3.99
Craftsy On Demand[29]	$7.99
WE tv + On Demand[29]	$5.99
The Great Courses Signature On Demand[21]	$7.99
Pantaya On Demand[29]	$5.99
DJAZZ On Demand[21]	$6.99
Ride TV On Demand[21]	$4.99
Outside TV Features On Demand[21]	$4.99
The Reading Corner On Demand[21]	$3.99
Hopster On Demand[21]	$6.99
Brown Sugar On Demand[21]	$3.99
Echoboom Sports On Demand[21]	$5.99
Stingray Qello On Demand[21]	$7.99
GOLFPASS On Demand[21]	$4.99
Hallmark Movies Now On Demand[21]	$5.99
Dove Channel On Demand[21]	$4.99
Kocowa On Demand[21]	$6.99
WHAM On Demand[21]	$2.99

Gravitas Movies On Demand[21]	$4.99
MHz Choice On Demand[21]	$7.99
Hi-YAH! On Demand[21]	$2.99
True Royalty On Demand[21]	$5.99
Real Vision On Demand[21]	$14.99
Docurama On Demand[21]	$4.99
Con TV On Demand[21]	$4.99
Walter Presents On Demand[21]	$6.99
Dekkoo On Demand[21]	$9.99
ZooMoo On Demand[21]	$2.99
Miniteve On Demand[21]	$1.99
WildBrain On Demand[21]	$5.99
Cinemoi On Demand[21]	$2.99
Fox Nation On Demand[29]	$5.99
Wanderlust On Demand[21]	$9.99
Music Choice Karaoke On Demand[21]	$6.99
Music Choice Relax On Demand[21]	$5.99
Curious World On Demand[21]	$3.99
kweliTV On Demand[21]	$5.99
Marquee TV On Demand[21]	$8.99
Passionflix On Demand[21]	$5.99
Conspiracy TV On Demand[21]	$4.99
FlixFling On Demand[21]	$7.99
A&E Crime Central On Demand[21]	$4.99
CultFlix On Demand[21]	$4.99
CineFest On Demand[21]	$4.99
PREMO On Demand[21]	$5.99
MyOutdoorTV On Demand[21]	$9.99
One Day University On Demand[21]	$7.99
Hitz[26,29]	$12.00
Streampix[4,29]	$4.99
Pay-Per-View and On Demand Movies and Events[3,29] (per title or event)	Prices Vary
Revry On Demand[21]	$6.99
Too Much for TV On Demand[29]	$14.99
Vivid On Demand Subscription[13,29]	$19.99
Hustler On Demand Subscription[13,29]	$19.99
TEN On Demand Subscription[13,29]	$19.99
Urban Fantasy On Demand[13,29]	$19.99
Falcon On Demand[13,29]	$19.99
Homegrown Amateur On Demand[13,29]	$19.99
Evil Angel On Demand[13,29]	$19.99
Mature Lust On Demand[13,29]	$19.99
Penthouse On Demand[13,29]	$19.99
Girlfriends Films On Demand[13,29]	$19.99
Wicked On Demand[13,29]	$19.99
XTSY On Demand[13,29]	$19.99
Arouse On Demand[13,29]	$19.99
Vixen On Demand[13,29]	$19.99
Buku TV On Demand[13,29]	$19.99

SPORTS PACKAGES[28]

MLB Extra Innings	Call 1-800-XFINITY for pricing
NHL Center Ice	Call 1-800-XFINITY for pricing
NBA League Pass	Call 1-800-XFINITY for pricing

XFINITY TV EQUIPMENT

TV Box and Remote	$7.50
HD TV Box Limited Basic (Effective through 12/19/2020)	$1.90
TV Adapter (Limited Basic — Primary TV)	$0.00
TV Adapter (Limited Basic — 1st and 2nd Additional TVs)	$0.00
TV Adapter (Limited Basic — 3rd Additional TV)	$0.50
CableCARD (first card in device)	$0.00

INSTALLATION (PER OCCURRENCE UNLESS NOTED)	**Initial Installation of Service**	**After Initial Installation of Service**
Professional Installation[16,17]	$100.00	N/A
Self Installation Plus[39]	$39.99	N/A
In-Home Service Visit[33]	N/A	$70.00
Hourly Service Charge[16] (Custom Installation)	$50.00	$50.00
Xfinity Internet Gigabit Pro Professional Installation (per occurrence)		$500.00
Wireless Networking On-Site Professional Set-Up (Separate trip, per occurrence)		$99.95
Wireless Networking On-Site Professional Set-Up (each additional device over 4 devices per occurrence)		$29.95

REACTIVATION
(NO IN-HOME VISIT REQUIRED—PER OCCURRENCE UNLESS NOTED)

Reactivation - TV	$6.00
Reactivation - Internet	$6.00
Reactivation - Voice	$6.00

MISCELLANEOUS (PER OCCURRENCE UNLESS NOTED)

Regional Sports Fee[19] (per month)	$9.90
Returned Payment Item (each)	$25.00
Late Fee	5%
Agent Assisted Payment For payment made by phone with a Customer Care Representative	$5.99
Unreturned or Damaged Equipment Fees[5] (per piece)	Replacement Cost
Getting Started Kit Shipping and Handling (Standard Shipping)	$15.00
Getting Started Kit Shipping and Handling (Priority Shipping)	$29.95

XFINITY VOICE[1,6]

Xfinity Voice—Unlimited	$44.95
With TV and Internet Service	$39.95
Xfinity Voice—Local with More	$34.95
With TV or Internet Service	$24.95

XFINITY INTERNET[1,8]

	Xfinity Internet Service Only	**with Xfinity TV or Voice Service**[20]
Performance Starter	$65.00	$49.95
Performance	$80.95	$64.95
Performance Pro	$95.95	$79.95
Blast!	$100.95	$84.95
Extreme Pro[14]	$105.95	$89.95
Gigabit[14]	$110.95	$94.95
Gigabit Pro[14,15]	$299.95	$299.95
Modem Rental		$14.00
Wireless Adapter (each, one-time charge)		$30.00

Gigabit Pro Activation Fee (per occurrence)	$500.00
Unreturned or Damaged Equipment Fees[5] (per piece, per occurrence)	Replacement Cost

1 *Certain services available separately or as a part of other levels of service. Xfinity services are subject to Comcast's standard terms and conditions of service. Unless otherwise specified, prices shown are the monthly charge for the corresponding service, equipment or package. Prices shown do not include applicable taxes, franchise fees, FCC fees, Regulatory Cost Recovery, Public Access fees, other state or local fees or other applicable charges (e.g., per-call toll or international charges). Prices, services and features are subject to change. If you are an Xfinity TV customer and you own a compatible TV Box or CableCARD device, please call 1-800-XFINITY for pricing information or visit www.xfinity.com/equipmentpolicy. © 2021 Comcast. All rights reserved.*

2 *Requires a compatible modem and TV Box with remote, CableCARD or compatible customer owned device.*

3 *Price of Pay-Per-View and On Demand Movie or Event is displayed prior to the completion of the Pay-Per-View or On Demand ordering process.*

4 *Requires Limited Basic and TV Box and remote or compatible customer owned device. Requires HD Technology Fee to receive HD programming.*

5 *Contact 1-800-XFINITY for questions regarding equipment replacement charges.*

6 *Requires a compatible modem. Unlimited Local and Long Distance package pricing applies only to direct dialed calls from home to locations included in the plan. Plans do not include other international calls. For more information regarding Xfinity Voice pricing go to https://www.xfinity.com/Corporate/About/PhoneTermsOfService/ComcastDigitalVoice/cdvresidential.*

7 *Requires TV Box, TV Adapter, CableCARD or compatible customer owned device.*

8 *A compatible modem is required. For more information regarding Xfinity Internet go to http://www.xfinity.com/internet-service.html.*

9 *Not available to customers with Limited Basic only. Must subscribe to HD Technology Fee to receive HD programming.*

10 *Requires Limited Basic, TV Box, CableCARD or compatible customer owned device.*

11 *Includes TV Adapter and remote. Digital service tier on additional TV corresponds to digital service tier on primary outlet. Does not include access to On Demand content, premium channels or channel numbers above 1000 unless otherwise noted on the channel lineup. Not available to customers with Limited Basic only.*

12 *Requires Extra.*

13 *One month minimum purchase required. Not available in all areas.*

14 *Not available in all areas. May require installation and non-refundable installation charge.*

15 *Requires 2 year contract. Monthly rental of Gigabit Pro cable modem/router additional. Activation and professional installation fees additional. Gigabit Pro does not qualify for Comcast 30-day money back guarantee.*

16 *Standard installation includes installation of service line up to 125 feet from existing Comcast plant for the primary outlet only, except as otherwise required under local franchise agreement. Comcast does not perform custom installations, including installations which require in-wall wiring, wiring in extensive drop ceilings, basements, or crawl spaces.*

17 *Includes standard installation of Xfinity TV, Xfinity Internet and/or Xfinity Voice and installation of additional outlets and wireless networking set-up if requested at time order is placed. Does not include installations of Xfinity TV only, Xfinity Home Security or Xfinity Gigabit Pro Internet.*

18 *Applies to Limited Basic and Xfinity Instant TV.*

19 *Applies to Extra and above, and Sports & News.*

20 *Xfinity Internet discount does not apply to Xfinity Instant TV.*

21 *Requires Limited Basic with X1 TV Box and Xfinity Internet service.*

22 *Requires Limited Basic, HD Technology Fee and TV Box, CableCARD or compatible customer owned device.*

23 *Requires Choice Double Play, Choice Limited TV or Choice TV. Cannot be combined with Limited Basic only.*

24 *Equipment required at an additional cost. For additional information go to http://www.xfinity.com/homesecurity.*

25 *Includes Xfinity Home Security and 24/7 Video Recording for up to 4 cameras. Equipment required at an additional cost. For more information on 24/7 Video Recording go to http://www.xfinity.com/videorecording.*

26 *Requires Limited Basic TV service and a compatible Xfinity TV Box or customer owned device.*

27 *Requires Limited Basic with X1 TV Box or compatible customer owned device and Xfinity Internet service.*

28 *Requires Limited Basic, HD Technology Fee, X1 TV Box with remote or compatible customer owned device. Sports Package subscriptions can be billed at once or in 4 total payments. Call 1-800-XFINITY to cancel subscription within 30 days of first charge to bill. Charges are non-refundable after 30 days of first charge to bill. Restrictions may apply.*

29 *Requires Limited Basic, TV Box or compatible customer owned device with Xfinity Internet.*

30 *Requires HD Technology Fee and TV Box or compatible customer owned device. DVR Service with compatible customer owned device limited to 60 hours DVR Service.*

31 *Requires TV Box, CableCARD or compatible customer owned device. 10 Hours DVR Service available with X1 TV Box (X1 TV Box requires subscription to one Genre Pack) or compatible customer owned device. Cannot be combined with Xfinity Voice or Xfinity Home Security.*

32 *Requires minimum of Xfinity Performance Internet service and an Xfinity Flex Streaming device. Choice TV available for ordering through the Flex box only. 20 hours DVR Service available with X1 TV Box or compatible customer owned device. Not eligible for multiproduct pricing on Xfinity Internet, Xfinity Voice or Xfinity Home Security.*

33 *Applies to installation, relocation and activation of additional outlets as well as upgrade downgrades of service after initial installation of service and in-home visits. Does not cover installation or in-home visits for Xfinity Home Security.*

34 *20 Hour DVR Service requires Xfinity Internet Service and either an X1 TV Box or compatible customer owned device.*

35 *SurePrice only available for 12 months to customers with Standard+ More, Select+ More, Signature+ More and Super+ More packages after qualifying 12 month promotional pricing.*

36 *Requires 2-year contract. Monthly rental of Gigabit Pro compatible modem/router additional. Activation and professional installation fees additional. Gigabit Pro does not qualify for Comcast 30-day money back guarantee.*

37 *Cannot be combined with Sports & News genre pack.*

38 *Requires Xfinity TV Latino, More Sports & Entertainment Package, Choice TV Double Play with one Genre Pack, Choice TV, or Extra or higher, Xfinity Internet, TV Box or compatible customer owned equipment.*

39 *Includes delivery of up to a total of three Get Started Kits for Xfinity TV, Xfinity Internet, or Xfinity Voice and a network signal test. Requires service address activation for Xfinity services within in the last 2 years. Does not include installation or relocation of outlets, equipment installation, setup or troubleshooting, or installation of Xfinity Home or Xfinity Gigabit Pro Internet.*

40 *20 Hour DVR Service requires Xfinity Internet Service and either an X1 TV Box or compatible customer owned device.*

Xfinity Home Security License Numbers:
AL: *001484, 001504;* **AR:** *12-030;* **AZ:** *ROC 280515, BTR 18287-0;* **CA:** *CSLB 974291, ACO 7118;* **CT:** *ELC 0189754-C5;* **DE:** *FAL-0299, FAC-0293, SSPS 11-123;* **FL:** *EF0000921, EF20001002, EF0001095;* **GA:** *LVU406303, LVU406264, LVU406190, LVU406354;* **IL:** *PACA 127-001503;* **LA:** *F1691;* **MA:** *SS-001968;* **MD:** *107-1776;* **ME:** *LM50017039;* **MI:** *3601206217;* **MN:** *TS674412;* **NC:** *2335-CSA, 29443-SP-FA/LV;* **NJ:** *Burglar and Fire Alarm Business Lic. # 34BF00047700;* **NM:** *373379;* **NY:** *licensed by the N.Y.S. Department of State 12000305421;* **OH:** *LIC# 53-89-1732;* **OR:** *CCB 192945;* **SC:** *BAC-13497, FAC-13440;* **TN:** *ACL 1597, ACL 1604;* **TX:** *ACR-1672104,-1818, B16922, B02571;* **UT:** *8226921-6501;* **VA:** *2705145289, DCJS 11-7361;* **VT:** *ES-02366;* **WA:** *COMCABS892DS;* **WASHINGTON, DC:** *ECS 902687, BBL 602512000005;* **WV:** *WV049211.*

MS: 15018010

Valid 1/1/21. See www.xfinity.com/home-security for current list.

82996100: 0250;0260;0270;0280;0290;0300;0310;0340;0350;0360;0370;0380;0390;0400; 0410;0420;0430;0440;0450;0460;0470;0480;0490;0500;0510;0520

ctc technology & energy

engineering & business consulting

March 26, 2021

Michael Cannon
Chief Technology Officer
Stafford County, Virginia
Via email: mcannon@staffordcountyva.gov

Re: Proposal to develop Stafford County Telecommunications Strategy and Plan

Dear Mike:

CTC Technology & Energy (CTC) is pleased to present this proposal to develop a Stafford County Telecommunications Strategy and Plan (TSP). As we have discussed, the initial phase of developing the plan will focus on broadband and the needs of residents, K-12 students, and businesses; we anticipate completing that portion of the project within three months of notice to proceed. The final plan will include a separate section that can be shared with stakeholders, as well as a section that can inform the technology section of the County's Comprehensive Plan.

CTC works primarily for public entities and has no financial relationships with equipment manufacturers, construction companies, or systems integrators. We will be your independent, objective adviser—and will be guided by your goals, priorities, and risk tolerance. We specialize in making complex technical and business data about broadband networks accessible to policy-makers and County staff.

Please do not hesitate to contact me if you would like to talk further. We look forward to the opportunity to work with the County on this important initiative.

Best regards,

Joanne S. Hovis

Joanne S. Hovis | President | jhovis@ctcnet.us

Contents

1. Scope of Work

CTC will be the County's independent adviser throughout the project and will develop realistic recommendations for enabling the County to realize its broadband goals. As a matter of policy, we have no financial stake in the County's decisions; we do not seek to construct or operate your network.

Based on our discussions and your previously stated needs, we propose to perform the following tasks. We present our scope of work in a sequential order (beginning with data collection and needs assessments, and progressing through analysis and development of technical solutions and strategic recommendations). However, given the County's priorities, we will essentially conduct some tasks in two parts—producing a deliverable related to residential and business broadband within three months, and developing our analyses for public safety and economic development on a longer timeline.

Strategic Planning Workshop

Our project team will meet with County personnel and invited stakeholders to discuss project goals and objectives, review relevant maps and documents, establish project parameters, and confirm the County's expected timeline. We will also discuss in detail some of the key drivers behind the County's telecommunications strategic planning efforts, including economic development, data centers, and County operations.

In advance of this workshop we will prepare an information request for the County and the school system. We assume, for example, the County and the school system will provide network and fiber schematics (network diagrams and geolocated data respectively) as well as any documentation of future network needs, plans, and designs.

Task 1: Assess the County's current terrestrial broadband infrastructure (assets) and market (services) for residents and businesses

To the extent that the County has completed data collection and mapping to identify where residential and business broadband services are and are not available; we will use those data as the foundation for our analysis of the unserved and underserved areas of the County.

Analyze existing residential and business broadband infrastructure – desk and field surveys

We will evaluate the County's current supply of broadband assets through a combination of desk and field surveys. As an initial step, we will review any relevant maps, studies, documents, or data that the County can share with us—including the locations of communications towers and potential interconnection points, and the County's GIS files showing known business and governmental facilities. A CTC outside plant engineer will then conduct an extensive desk survey using the County's GIS maps, Google Earth imagery, and other relevant sources.

To supplement the desk survey, a CTC engineer will conduct a day of field verification of representative portions of the County. This will include evaluation of representative County sites, as well as general areas that we believe may be particularly challenging, based on discussions with the County. In our experience, field survey of representative sites augmented by use of maps and existing plans represents an effective, efficient strategy for estimating level of deployment effort.

CTC's engineer will survey pole lines in the sample area to determine their ability to support fiber or wireless attachments, the need for make-ready and pole replacement, and the estimated cost. The field survey will enable us to identify specific details related to using the County's rights-of-way, as well as targets of opportunity for connecting additional sites or providing physical path redundancy to enhance communications survivability between sites.

Assess the availability of wired and fixed wireless broadband services – online research of residential and business services

In this task, we will seek to determine what vendors are active in the area, what services are available, and what residents and businesses pay for varying levels of service. We will explore not just starter and enticement pricing, but also the actual pricing for established customers.

Our assessment will include:

- Developing a list of current broadband providers, including the costs for services, based on publicly available information
- Evaluating available FCC Form 477 data about services in the County (with an understanding that many small pockets of unserved locations are not reflected in the Form 477 data)
- Conducting outreach to local private providers to gather input on their service areas and their perceptions of service gaps (in conjunction with our discussions in later tasks)

Ideally, we will be able to use this multi-step analysis to develop a map that visually approximates what kind of services are available in each part of the County—to supplement and confirm the results of our desk and field surveys (see above). We approximate this inventory based on service and pricing information because the industry does not share data on its infrastructure. We will make highly educated estimates, based on our experience, of competition gaps, affordability gaps, and service gaps.

In developing the County's TSP, it is critical to look not only at the range of broadband needs, but also the gaps in available and affordable services for business and institutional users. We commonly find that regions that are reported to be "well-served" still have supply issues,

especially for small businesses. First, we typically find that broadband availability is not ubiquitous. Second, where service is available, the cost of getting a new "drop" connection to an office or other facility is often excessive, even for a large business. And third, the types of available services are not well suited to small businesses.

Often these regions have a range of available service options, including services such as dark fiber, cable modem, DSL (Digital Subscriber Line), Metro Ethernet, and MPLS (Multiprotocol Label Switching). But most of these services are tailored to either casual users (e.g., cable modem or DSL, which do not meet business or government performance needs) or large users (e.g., Metro Ethernet or MPLS, which meet business requirements but with unaffordable monthly costs that would represent a substantial portion of many business' ongoing operating costs).

Taken together, these issues and service gaps will drive the development of a strategy and roadmap for future County initiatives on residential and business broadband.

Evaluate school system data to bolster understanding of residential broadband gaps

To support our analysis of residential service availability, we will, to the extent feasible, evaluate data collected by Stafford County Public Schools (SCPS) on unserved and underserved locations in the County. We will engage with SCPS to seek to develop ways to get granular data with which to develop usable maps of unserved locations while also being in compliance with school privacy requirements.

Task 2: Host online speed test and survey

We will seek to collect standardized speed test results from County households, with a particular focus on identifying areas where broadband service is problematic. We will host, operate, and maintain a customized, proprietary speed test website for six months, and will prepare regular reports and analysis of the data for the County. The sample screenshot below illustrates the HTML5-based online tool.

Figure 1: Sample Speed Test Website

Our specific tasks will include the following:

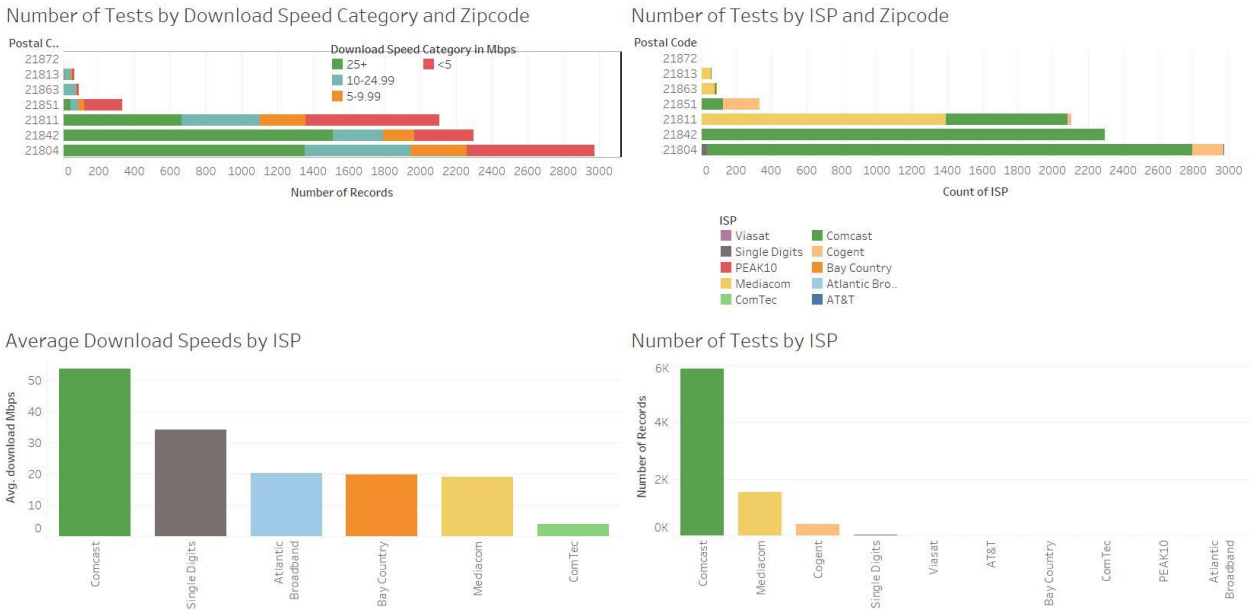
1. Prepare draft questions to be included on the speed test website; review text and layout with the County before the test goes live
2. Develop and launch the custom online speed test website (subject to our standard terms of use for our proprietary online tool)

3. Host the broadband speed test, which we assume the County will regularly publicize on its website, through social media platforms, and in other ways it communicates with the public—with a goal of encouraging high levels of participation among residents

4. Collect data submitted by respondents who run the speed test, with a focus on identifying areas where incumbent services are slow (and, by overlaying those data with demographic data, identifying where affordability may be a significant issue for residents)

5. Provide regular data reports to the County (including graphs such as the following, which represent data collected for another client)

Figure 2: Sample Speed Test Reporting



All data collected will be the property of the County. CTC will maintain a cloud-based MySQL database to store the test results. Our pricing proposed is based on use of a shared database; if the County requests a dedicated database, extra fees will apply.

CTC will host the speed test using Amazon Web Services (AWS) for a period of 12 months. During that time, CTC will furnish the raw results to the County in a weekly report delivered in an Excel table format. We will prepare maps and data analysis on a monthly basis; the maps will illustrate all responses, broken down by whether the location is served or not, with data points including speed ranges, type of technology, and carrier identity.

At the conclusion of the hosting period, CTC will deliver to the County a final set of all speed test data collected. The raw data can be archived and utilized in the future as a baseline for measuring progress and changes. We note that we cannot guarantee a participation level.

Task 3: Assess the County's cellular coverage and develop recommendations for improvement

We understand mobile wireless coverage is a major pain point for the County. Cellular service is important for residents' regular use but, anecdotally, there are many dead zones across the County. This is especially significant from a public safety standpoint: Lack of carrier towers in the County lead to e911 calls from mobile phones being routed to the wrong jurisdiction.[1]

We will undertake a number of steps to gather data and identify steps toward potential solutions:

Data analysis: We will analyze any relevant County GIS data and public crowd-sourced data related to cellular coverage, as well as anecdotal reports about cell coverage gaps.

Drive tests: We will conduct up to five days of drive testing to document the coverage along select County roads of the major cellular service providers: AT&T, T-Mobile, and Verizon Wireless. We will record the signal strength for each carrier's service along those routes. In addition, we will stop periodically along the routes to conduct speed tests to document the upload and download speeds delivered by the providers.

We will translate our data into a GIS-based map that illustrates the locations of cellular service gaps in the County. We will map the data and write an explanatory narrative that the County can share with the providers to facilitate discussions around improving signals in the unserved areas.

We will work with the County to determine the roadways that will be surveyed over two days of drive testing. We anticipate focusing on known trouble areas (especially according to Sheriff's office reports).

Provider outreach: We will interview representatives of the three cellular service providers regarding future plans for tower builds in the County.

Public safety outreach: Stafford switched from Verizon Wireless to FirstNet mobile coverage for its public safety responders. However, FirstNet utilizes AT&T service, which we understand has less robust coverage in the County than Verizon. We will engage with the Sheriff's office and FirstNet representatives to understand gaps and potential remedies in network coverage and tower locations.

SCPS outreach: We will interview SCPS representatives to understand network coverage and gaps related to Kajeet devices issued by the school system.

[1] This occurs frequently for calls in the eastern part of the County. Recent (one-year-old) versions of Android and IOS are supposed to fix this by giving the phone's GPS location rather than the location of the nearest tower to which the phone is connected, but there may be legacy cell phones that still misdirect calls. There may also be a delay in Stafford ESInet/NG911 migration that creates a transition problem.

5G planning: We will develop recommendations on how the County can spur the deployment of 5G and other anticipated mobile wireless innovation, such as 6G. To gather input, we will conduct up to six videoconference meetings to interview representatives of the economic development office, mobile providers, and the permit office on their plans. We will seek insight into planned small cell deployment and fiber strand availability and requirements.

Task 4: Assess tower infrastructure and public safety/microwave assets and needs

As a bridge between the asset identification and needs assessment phases of this project—and underscoring the importance of public safety communications planning—we will gather data and identify the County's needs around public safety communications, microwave infrastructure, and FirstNet.

We will build on previous studies and evaluate County-provided tower locations and specifications. We will also evaluate available space on County-owned and leased towers, and plans/needs articulated for tower extensions and/or reinforcement.

We will conduct up to two days of tower site surveys with a goal of identifying long term opportunities for tower replacements (i.e., a scenario in which the County would build towers and move assets to them as current leases expire).

We will also assess high-level costs for lease vs build scenarios for meeting the County's microwave needs. On the other side of the balance sheet, we will consider potential revenue opportunities that might be derived from County-owned towers.

Task 5: Conduct needs assessment to identify key concerns and evaluate current and future demand for broadband and telecommunications services

CTC's engineers and analysts will assess the needs of County and other public sector agencies and users for robust, resilient broadband connectivity—across socioeconomic divides as relates to residential users. Our experience with local governments nationwide is that group interviews and one-on-one discussions with stakeholders will produce important insights for the County's analysis of broadband needs. This approach allows for follow-up questions, in-depth discussion, and an exploration of nuanced needs and concerns related to the County's broadband planning.

We will work with the County to determine its list of stakeholders and will conduct videoconference discussion groups with representatives of the stakeholders with a goal of understanding their broadband needs, constraints, and challenges.

For all of these meetings, we request the County's assistance in identifying the participants, and scheduling and confirming the interviews.

Facilitate discussion groups with County government, schools, and other public entities

To assess public stakeholders' operational needs for telecommunications, including internal County transport requirements, CTC will conduct up to five discussion groups with representatives of County government, public safety, SCPS, and other related stakeholders identified in collaboration with the County.

For each of these sessions, we will seek to explore specific current needs and future goals. We may also have conversations, either in-person or through teleconferences, with representatives of other public sector stakeholders.

We will seek to discuss with County government representatives issues related to existing assets and bottlenecks; future plans and needs; and ways to efficiently manage current and future network assets such as allocation of fiber strands. In particular, we will conduct a technical review with County IT and SCPS representatives of current allocation designs and methodology in order to develop alternative, efficient options for using current and future dark fiber assets.

Our discussions with public safety representatives will complement our work in earlier tasks and include issues such as current service gaps and costs; the need for additional towers/upgrades; revenue-sharing opportunities; and FirstNet integration (i.e., fiber/microwave).

We will also seek to Identify potential synergies between County government (including schools and public safety) and residential and business broadband service deployment, including tower usage; middle-mile/backhaul options; and fiber and/or conduit sharing.

In our discussions related to residential services, we will seek to assess the needs for K-12 students and virtual learning, as well as the needs for residents working from home and running home-based businesses. We will focus on home broadband service, and will also seek to gather information about the adequacy of cellular service throughout the County.

We will seek to explore issues with SCPS related to better management of existing fiber. The school system funded and is responsible for the fiber used by the schools and the County government, but there are concerns that current management practices may be creating potential fiber scarcity in certain segments. We will interview representatives of the school system (as well as the fiber vendor and the County's Office of IT, as appropriate) to understand current practices in terms of fiber allocations, splicing, and policies and future layer 1 and layer 2 – 3 upgrades to develop high level recommendations for better management and allocations.

We will conduct one discussion group with representatives of other important stakeholders that might include community groups, organizations that have an interest in addressing digital divide issues, healthcare providers, non-profits, consumer groups, and other interested stakeholders and regional entities.

Finally, we will discuss issues with relevant County stakeholders related to funding and regulatory constraints. In particular, we will seek to the assess advantages and disadvantages of the County implementing a broadband authority (i.e., as related to delivering broadband service, applying for grants, and so on).) (CTC is not qualified to provide legal advice, so our discussions will be related to identifying issues and potential strategic approaches in regard to the organizational and operational elements of launching a broadband authority.)

Facilitate discussion groups with business and economic development entities

We will conduct up to five discussion groups with representatives of local businesses and business organizations (e.g., the Chamber of Commerce)—key private stakeholders in the County's broadband planning. Our goal will be to understand the broadband market for the County's business customers, and to identify the participants' specific broadband needs.

The economic development and business discussions will focus on key issues such as current broadband gaps for businesses and economic development locations; availability of commercial fiber and opportunities for data center businesses to locate in the County; what current and future economic development projects can include broadband; and how broadband components can be incorporated into economic development projects.

We understand the County wants to market itself as a potential data center location to Loudoun where providers are running out of space (in the Ashburn area). We will gather insight from the County's economic development office, and will seek to help the County identify commercial opportunities with preliminary discussions with representatives of up to seven communications and communications infrastructure providers (e.g., Crown Castle, Zayo, NOVEC, Dominion, Summit, Milestone and others). The interviewees will be identified by examining long-haul and metro fiber routes going through County with Fiber Locator or a similar service, in addition to interviewing the County's tower asset manager, Milestone.

Facilitate discussions with broadband providers

Discussions with broadband service providers represent an opportunity to explore potential partnerships and joint opportunities—and the shared benefit that might result from creative planning. While service providers are typically reluctant to discuss competitive details about their business (e.g., customer demand, take rates, future buildout plans), in our experience many providers are interested in partnering with the public sector under a variety of models.

With that approach as our framework, we will seek to have extensive conversations with incumbent and competitive service providers in the region. Our request to discuss broadband planning with local providers will reflect the County's openness to collaborating with these entities to mutual benefit. We will build on the outcomes of a broadband summit we understand

the County is currently planning, where the County will invite incumbent and other interested ISPs to offer their perspectives on how they can help improve broadband gaps in the County.

These discussions will ideally help create an ongoing dialogue with the service providers about potential partnerships with the County and will afford insight into the current footprints and operations of those ISPs as well as their future expansion plans.

Develop questions for the County's planned survey and analyze digital divide findings

The above discussions will identify needs and issues the County may want to explore more systematically. We will develop a limited number of questions (five to seven) the County can incorporate into the random sample survey of residents it plans to conduct.

Following the County's survey, we will analyze the responses to these survey questions to identify broadband-related issues that correlate with socioeconomic factors. We will assume that the County will provide the raw survey data required for such analysis, and/or will facilitate CTC working with the survey administrators to access correlation data.

As a more in-depth alternative to this task, we also propose a broadband-focused mail survey in Task 11, below.

Task 6: Prepare high-level design and cost estimates for broadband and County/public safety network deployments

CTC's engineers will develop a high-level candidate design and cost estimate for a fiber, fixed wireless, or hybrid network that might fill the broadband service gaps and requirements identified in the needs assessment—with a modular (but complementary) approach for residential and business broadband, County government, public safety, and SCPS needs. We will identify the most topography-appropriate and cost-effective infrastructure (reflecting, for example, the availability of vertical assets for mounting wireless equipment). This cost estimate will include tower constructions where long-term cost savings justify building such assets.

Our goal – to the extent feasible – will be to develop a synergistic design that meets the broad needs of the County, including for economic development and County network extensions and resiliency. To that end, we will examine key issues such as how best to close the fiber loop in the ring in the western part of the County (where there is apparently a gap) for connectivity and resilience. Similarly, we will explore the feasibility and cost of serving up to a dozen County fire and rescue stations that do not currently have fiber.

We will include in our engineering analysis existing infrastructure (including fiber, but also rights-of-way access and locations for network hubs and other necessary infrastructure) that we believe the County can use to support the deployment.

Based on that analysis, our engineers will develop a high-level estimate of likely costs and timelines for construction and implementation of a baseline network. We will identify incremental costs for enhancing construction methodology to include additional conduit capacity and access points to facilitate reduced-cost construction for potential future expansion and site additions and potentially leasing excess conduit capacity to private providers. We will also seek to identify areas of risk.

Our recommended network design and cost estimates will assume a phased approach to network deployment. To be clear, we will not be providing a blueprint-level network design or cost estimate. Rather, we will be providing an analysis of existing infrastructure, a conceptual design, high-level maps, and a system-level overview of the potential infrastructure—which in turn can become a roadmap for financial analysis and business modeling, and for future decisions (potentially including detailed engineering and contracting with private sector service providers).

As is typical in this phase of a fiber construction project, the cost estimates will not be based on a detailed design, environmental assessment, or geotechnical analysis of soil composition. As a result, actual costs may vary due to unknown factors, including costs of private easements and the presence of subsurface hard rock. We will incorporate suitable assumptions to address these items based on our experience.

Task 7: Evaluate funding options and develop a grant strategy

Public sector broadband network deployments reflect both an ambitious vision and, often, a public commitment to financing broadband access for all citizens. Many local governments have pursued grants or loans, taken out bonds, or otherwise sought funding for construction of publicly owned fiber networks.

Our goal in this task is to help the County determine whether it has a path toward at least partial funding for broadband deployment. We will seek to identify grant opportunities that can address the “Swiss cheese” gaps in coverage in the County. For example, we understand that Commonwealth VATI grants are based on FCC-provided census block level unserved data, which would mean no areas of the County qualify (because the FCC maps so badly overstate service in Stafford). RDOF Phase II could have granular enough maps to address the “holes in the broadband cheese,” but the challenge then would likely be the incumbents: Comcast does not do RDOF or ReConnect, while Verizon only seems interested in filling holes in existing coverage that is mostly in relatively dense areas.

We will help the County develop realistic options for funding. We will draw on our hands-on knowledge of broadband funding opportunities and our research capabilities in this area to conduct a high-level evaluation of existing state and federal grant programs that the County

might consider. We will consider a range of federal grant programs, including the opportunities included in the recent federal appropriations.

Task 8: Develop a public–private partnership strategy

In consultation with the County, and drawing on our experience developing public–private partnerships (P3) for local governments and our thought leadership in this fast-changing field,[2] we will determine an appropriate business model for the County's consideration.

We will consider partnerships with public, private, and membership-owned companies—and existing public and private networks—in the County's project service area.

These potential partners may include the Commonwealth electric utilities, incumbents, and competitive service providers.

We will consider, at a high level, issues related to risk, benefits, and control. We will focus on determining what role the County would play and what role the private sector would play in addressing broadband needs. Notably, we have singular experience in developing broadband P3s on behalf of public sector clients. Two brief, representative illustrations: for both the Town of Holly Springs, North Carolina, and the City of Westminster, Maryland, we assisted the municipal governments in identifying a private partner to assume operating risk in providing services to the public under two significantly different partnership models, each aligned with the unique needs of these communities.

Our goal in this task will be to evaluate a partnership approach that minimizes the County's costs and risks while achieving the County's broadband goals. Our discussions with representatives of incumbent providers in Task 2 will contribute to this analysis—potentially including both quantitative and qualitative requirements.

Following these discussions, we will also develop specifications that the County can incorporate into an RFI process to identify potential partners. (See also our optional Task 12 for a more comprehensive CTC-assisted RFI process.)

Task 9: Develop financial analysis and business plan

Our business analysts will next develop a business case and financial model based on the high-level engineering and cost estimates developed in Task 5, the partnership strategy identified in the previous task, and direction provided by the County.

[2] CTC President Joanne Hovis authored "The Emerging World of Broadband Public–Private Partnerships: A Business Strategy and Legal Guide"—a seminal work published by the Benton Foundation (https://www.benton.org/sites/default/files/partnerships.pdf).

Our focus here will be on making the County's investment in broadband infrastructure as modest as possible, and using it to leverage the largest possible private sector investment (whether from incumbent providers, new competitive entrants, or a non-traditional service provider) in last-mile broadband service to underserved parts of the County. Throughout, we will focus on scenarios in which the County remains in the infrastructure business rather than entering the service business.

The business case will evaluate and describe the critical operational benefits that can be delivered by the fiber network, including:

- Avoided costs and other savings to the County over time
- Economic development and community benefit
- Public safety
- Infrastructure resilience and reliability

The financial model for the County's proposed fiber construction will include all the data developed during the engineering and cost estimation phases of this project, as well as a full range of additional costs, such as financing, operations, maintenance, and management.

We will develop a narrative regarding required operational attributes and processes including policies, staffing levels, maintenance agreements, and other considerations. We will pay particular attention to financing and funding sources and approaches and to the potential impact of federal and state grants (or other federal funding streams) on the business model and financial forecasts.

Our analysts will discuss and provide cost estimates for operating requirements and working capital projections. They will also develop a strategy and cost estimates for fiber maintenance and management based on best practices and the particular circumstances in the County.

The model's assumptions will be clearly stated and justified. The model will be designed to provide the County with an order-of-magnitude estimate of the overall project cost, and will support the phased implementation roadmap by providing inputs for potential business models, financing options, and partnering opportunities.

Task 10: Prepare and present a comprehensive written project report

Our final deliverable will be a Telecommunications Strategy & Plan report that documents our gap analysis of the County's current and future broadband needs—and presents our candidate technical solution, partnership strategy, and financial analysis. We will also opine on the feasibility of the County organizing a broadband authority with the ability to build and maintain infrastructure for delivering affordable broadband services. (CTC is not qualified to provide legal advice; rather, our guidance will be related to identifying issues and potential strategic

approaches in regard to the organizational and operational elements of launching a broadband authority.)

As we illustrate in the timeline below, we intend to produce an interim version of this report within three months to meet the County's need for analysis and recommendations around residential and business broadband; we will then produce additional interim versions at six months and nine months that complete the deliverable.

The final report will include a summary chapter that can inform the County's Comprehensive Plan.

The report will include the data, insights, and recommendations developed in the previous tasks—including an evaluation of the key issues currently impeding broadband expansion in the County, as well as strategic guidance on broadband projects that might be cost-effectively implemented.

We will provide the County with an electronic draft of our report, which will include a concise narrative supported by tables, graphics, and maps as appropriate. We will incorporate feedback from reviewers and deliver an electronic version of the final report.

Task 11: Conduct a mail-based, scientific survey (optional)

To add rigor to the anecdotal information gathered through the outreach sessions, we will perform a mail-based survey of samples of the County's population to provide a benchmark on basic questions related to internet access and usage. This statistically valid survey approach can provide a baseline for measuring changes going forward, including the impact of County efforts and interventions.

The mail survey will gather data on barriers to accessing and using broadband, computers and other devices, and online resources. The questions will be designed to understand what kinds of training might be helpful, and if there exist language or cultural barriers to digital learning. The survey will also ask respondents whether they are enrolled in subsidized plans such as Comcast's Internet Essentials. The County will have an opportunity to review and provide feedback on the survey instrument.

Using a mailing list we will purchase from our data provider, InfoUSA, we will mail surveys to two sets of randomly selected residents:

1. A group whose income falls below an amount we collaboratively select with the County, so as to focus on lower-income households
2. A group whose income is above the low-income cutoff

This approach is designed to enable statistically meaningful comparison between the higher-income and lower-income populations, given that lower response rates are typical for low-income residents. While we cannot the accuracy of the income-level component of the mailing lists, this approach has proven successful in our experience conducting similar surveys.

We will mail a total of 6,500 surveys, distributed among the two groups in a way that would hopefully result in 400 responses from each group, to yield a 95 percent confidence level with a 5 percent confidence interval, thus enabling us to do cross-tabulations and subdivision within each group to support more granular analysis (such as, for example, to understand the relationship between broadband adoption and family size within each group).

The survey will be 16 pages, printed in English. (We can also translate and print in both Spanish and English, at an additional cost.) The survey will require an estimated 10 minutes to complete. To encourage participation, the survey will be printed as a booklet (which enhances readability) and mailed in a non-standard sized envelope (which increases the likelihood that it will be noticed and opened by the recipients). We will manage all aspects of survey distribution, return mailing, processing, and data analysis.

Survey responses will be entered into a database format and analyzed. The raw data will be reviewed and processed following our standard data-cleaning protocol. This might include coding missing responses, establishing new response categories, verifying skip logic, and other steps necessary to ensure a clean and valid dataset.

Data analysis will include, at minimum, development of frequency tables for all responses and selected cross-tabulations and/or comparisons of mean ratings by geographic area and key demographics.

We will seek to identify key target segments by examining demographic, income, and other relevant drivers.

As part of our final project deliverable, we will prepare a written summary that describes the survey process, results, and analysis. The report will include a detailed narrative analysis, supported by extensive tables and charts that illustrate the survey findings.

Task 12: Manage an RFI process to identify potential partners (optional)

We will develop and draft the technical and business components of a request for information (RFI) designed to solicit detailed responses from private sector entities that may have an interest in developing a public–private partnership with the County. The RFI will also serve to inform the private sector—enabling respondents to understand the potential business opportunity and, just as importantly, to understand the County's underlying policy goals.

The RFI will describe the County itself—its location, demographics, and attributes—as a way to build a basic picture of market opportunities for potential bidders. The RFI will then present the potential partnership opportunity in relatively simple business terms—without discussion of costs or legal structure, for example, because those are items about which we would seek input from the private sector.

After setting the stage, the RFI will then ask respondents to reply to a series of relatively high-level questions, followed by a series of much more specific and pointed questions. The more detailed questions will be designed to solicit useful information from potential partners about their interest in partnering with the County, their existing operations, their subscription plans and costs, any discounted programs and eligibilities for qualification, their experience, their financial stability, and their past experience and commitment to critical County goals.

Our deliverable in this task will be comprehensive narrative RFI language. (We may request the County's help in terms of certain descriptions.) We understand that there will be boilerplate and procurement language that needs to be added to the RFI to comply with County rules; we will only be providing the business and technical narrative elements of the RFI, and anticipate that the County will format and finalize the RFI document.

Once the RFI is released, we will assist the County to make sure it gets placed on the relevant lists and in other distribution channels where we know potential partners would be notified about it. We will also make sure it is received by the dozen or so companies that we would hope would be interested in responding.

Between the RFI release and due dates, CTC will assist the County in responding to questions from potential respondents. Once responses are received we will review and evaluate them on the County's behalf. We will rank the responses, identifying those we feel are most viable and worthy of follow-up. We will verbally advise County staff on our ranking and make recommendations on appropriate follow-up steps.

Based on the data collected through the RFI (written responses), we will write a summary memorandum and report of our assessment of the County's potential opportunities, how we think the market would react if the County were to issue an RFP, and how the County's interests

could be promoted and protected. The memo will include a set of recommendations for next steps.

2. Estimated Timeline

We will work with the County to determine a mutually agreeable timeline upon award of a contract. This timeline will prioritize residential broadband analysis within three months, followed by additional deliverables at approximately six and nine months, as shown in the following table for illustration purposes. (We anticipate revising this phasing and defining deliverables in consultation with the County.)

Task	Phase 1 (within 3 months)	Phase 2 (within 6 months)	Phase 3 (within 9 months)
Task 0: Strategic planning workshop	X		
Task 1: Assess broadband infrastructure and market	X		
Task 2: Host online speed test and survey	X		
Task 3: Assess cellular coverage	X		
Task 4: Assess public safety tower system			X
Task 5: Conduct needs assessment residential/ business/ government	X	X	X
Subtask 5a: Facilitate discussions with public stakeholders		X	
Subtask 5b: Facilitate discussions for economic development		X	X
Subtask 5c: Facilitate discussions with broadband providers	X		
Subtask 5d: Develop mail survey questions and analyze results	X		
Task 6: Prepare high-level design and cost estimates	X	X	X
Subtask 6a: Residential and business	X		
Subtask 6b: Public safety			X
Subtask 6c: Economic development			X
Task 7: Evaluate funding options and develop a grant strategy	X	X	X
Task B: Develop a public-private partnership strategy	X	X	X
Task 9: Develop financial analysis and business plan	X	X	X
Task 10: Prepare and present a comprehensive written project report	X	X	X
Task 11: Conduct a mail-based, scientific survey (optional)	(X)		
Task 12: Manage an RFI process to identify potential partners (optional)	(X)		

3. Estimated Cost

We estimate the following cost breakdown, though we reserve the right to shift hours among tasks as needed. As with the timeline, we anticipate confirming final pricing in consultation with the County.

Task	Estimated Cost[3]
Task 0: Conduct strategic planning workshop	$3,000
Task 1: Assess broadband infrastructure and market	$12,000
Task 2: Host and analyze online speed test and survey	$3,000
Task 3: Assess cellular coverage	$28,000
Task 4: Assess public safety tower system	$30,000
Task 5: Conduct needs assessment residential/ business/ government	$20,000
Task 6: Develop high-level design and cost estimates	$16,000
Task 7: Evaluate funding options and develop a grant strategy	$6,000
Task B: Develop a public-private partnership strategy	$8,000
Task 9: Develop financial analysis and business plan	$10,000
Task 10: Prepare and present a comprehensive written project report	$19,000
Total	$155,000
Task 11: Conduct a mail-based, scientific survey (optional)	$65,000
Task 12: Manage an RFI process to identify potential partners (optional)	$10,000

[3] We reserve the right to shift budget among tasks as long as the total project cost is not exceeded.

4. Project Team Qualifications and Expertise

We propose the following key team members—who will be supported by our staff of engineers and analysts. Resumes for key CTC team member are attached in Appendix A; additional resumes are available on request.

Key Personnel	Project Role
Joanne Hovis ***President***	Project adviser; strategic guidance; analysis
Andrew Afflerbach, Ph.D., P.E. ***Chief Technology Officer***	Project technical adviser; engineering oversight
Ziggy Rivkin-Fish, CGEIT ***Principal Analyst***	**Project manager, strategy development; analysis**
Mitch Hergett ***Principal Engineer***	Engineering lead
Jenna Schmaljohn ***GIS Engineer***	GIS engineering
Marc Schulhof ***Senior Analyst & Technical Writer***	Technical writer

Joanne Hovis, *President,* will be a project adviser. Joanne is a nationally recognized authority on local broadband market forces, the rural digital divide, digital inclusion/equity, cable franchise strategy, and innovative strategies for collaboration and partnership among the public and private sectors. Since 1997, she has directed CTC consulting services related to strategic planning, business modeling, and financial analysis for hundreds of clients nationwide—from state agencies and large cities to small rural communities.

Joanne has extensive experience conducting market assessments and developing business case and business model scenarios for public sector broadband initiatives. She also guides clients on federal and state broadband grant, loan, and universal service programs such as Economic Development Administration grants, ReConnect, the Rural Digital Opportunity Fund, E-Rate, and the Healthcare Connect Fund.

Joanne leads the CTC team that advises or has advised the states of Alabama, Connecticut, Kansas, Kentucky, Massachusetts, and New Mexico, the cities of San Francisco, Seattle, and Washington, D.C., and the statewide broadband networks in Maryland and Pennsylvania.

An attorney by training, Joanne is an experienced and polished communicator who has presented project reports, facilitated work sessions, managed stakeholder outreach efforts, and provided briefings for technical and non-technical audiences—including state legislatures, city and county councils, mayors of major American cities, and state and federal agencies and commissions.

Joanne has testified before Congress on many occasions regarding rural broadband, public-private networking strategies, and infrastructure solutions for bridging digital divides. She has provided expert presentations to the Federal Communications Commission, the U.S. Conference of Mayors, the National League of Cities, and other national organizations. She has been an invited facilitator and presenter at White House events on broadband.

Joanne is a member of the boards of directors of the Benton Institute for Broadband & Society, Consumer Reports, and the Fiber Broadband Association. She is a former board president of the National Association of Telecommunications Officers and Advisors (NATOA).

Andrew Afflerbach, Ph.D., P.E., *Chief Technology Officer*, will be the project's senior technical adviser. Andrew has designed fiber optic and wireless networks for large cities, counties, and regions, and conceived and developed the super-regional interoperable fiber optic network in the National Capital Region (including the District of Columbia, Maryland, Virginia, and 22 local jurisdictions). In a previous engagement, Andrew served as technical adviser to the government of New Zealand in its nationwide FTTP initiative, where he developed the reference architecture for the effort and led the specification and procurement strategy. He is an experienced network planner who understands the business and financial implications of various network designs.

Ziggy Rivkin-Fish, CGEIT, *Principal Analyst and Governance Specialist*, will be the project manager and the County's day-to-day contact. He has particular expertise in community broadband planning, public-private partnership strategies, grant strategies, public sector telecommunications network governance, and multi-agency/multi-stakeholder processes and planning. He specializes in conducting needs assessments and building frameworks for effective planning and governance of public sector communications projects with a focus on long-term viability and sustainability of operations. With a master's degree in organizational sociology from Princeton University and certification in Governance of Enterprise IT, Ziggy has advised multiple public clients on long-term planning efforts.

Mitch Hergett, *Principal Engineer*, is an experienced communications engineer who specializes in the design and implementation of broadband (video, voice, and data) telecommunications networks. Mitch's work focuses on project management and engineering analysis for public

sector clients. He provides ongoing project management support and engineering analysis for Anne Arundel County, Maryland's fiber network. He supports day-to-day operations and the County's initiatives to expand the network. Mitch's work also includes internal project management for many of CTC's consulting and engineering projects. In this role, he acts as the point person for clients nationwide; schedules CTC tasks and teams; and tracks project deliverables. Mitch has recently performed this work for CTC's projects in the cities of Seattle, San Francisco, and Virginia Beach.

Marc Schulhof, *Senior Analyst and Technical Writer,* has 25 years of experience in technical writing, financial journalism, and corporate communications. He previously was the worldwide editor-in-chief of CIO program websites at IBM, a global editor at PricewaterhouseCoopers Consulting, and an associate editor at *Kiplinger's Personal Finance* magazine. He specializes in writing project deliverables that make complex technical and financial analyses more easily accessible to non-technical audiences.

5. CTC Experience and Capabilities

Founded in 1983, CTC is an established national consulting firm headquartered in Kensington, Maryland. We have a staff of 50 analysts, engineers, GIS specialists, outside plant engineers, project managers, and administrative specialists. CTC's principals are Joanne Hovis (president) and Andrew Afflerbach, Ph.D., P.E. (chief technology officer).

We provide independent financial, strategic, and technical, guidance to local governments, state governments, non-profit consortia, universities, and cooperative and municipal utilities.

The following project descriptions illustrate CTC's demonstrated experience in broadband strategic planning, digital inclusion planning, cable franchise agreement negotiation, broadband speed testing, and related broadband studies—including stakeholder and community outreach, network planning, engineering, business modeling, business planning, and financial planning.

CTC has decades of proven experience on a national level supporting different types of municipalities on broadband strategy, grant strategy, needs assessments, business planning, and network engineering in rural, suburban, and city environments. The sample projects we describe below reflect our record of successful results in helping local governments assess, plan, and resolve broadband service gaps.

These projects also illustrate our history of innovation, including in areas such as cable franchise negotiation. For example, during the cable franchise renewal process in Montgomery County, MD, we identified as a high priority the need to obtain fiber-optic infrastructure from the cable operator; this outside plant would complement the County's existing infrastructure and become part of the County's FiberNet network—and enable the County to have high-availability services at a reasonable cost.

Charles County, Maryland

CTC engineers and analysts developed a broadband strategic plan for rural Charles County in 2019 and 2020. Drawing on a range of data sources, as well as our own extensive desk and field surveys, we identified gaps in broadband availability among the County's residents and businesses. We then developed sample fiber optic and fixed wireless designs as potential technical solutions, as well as total cost of ownership estimates. These elements demonstrated that in almost all areas of the county, fiber-to-the-premise constituted the most cost-effective and scalable solution over the long term.

The analysis also provided a baseline with which to evaluate potential partner cost estimates, and gave County leaders a sense of the overall costs and funding amounts that would incentivize such partners. With this analysis, CTC helped identify a suitable partner and a partnership model and supported the County in its partnership negotiations. We also presented recommendations

for how to strategically form a partnership that would be competitive for state and federal grant applications.

We helped the County develop its successful $2.9 million grant application to the State of Maryland Office of Rural Broadband in 2020,[4] and assisted the County in term sheet development and negotiations with its private partner.

Talbot County, Maryland

On July 31, 2020, the US Department of Agriculture announced that it had awarded a $13 million grant to Easton Utilities in Talbot County to deploy fiber-to-the-premises in all the unserved parts of the County. This grant is the culmination of years of work CTC did in partnership with Talbot County, which included developing strategy for addressing the County's rural broadband gaps; identifying and negotiating with Easton Utilities as the County's partner; supporting preparation of the grant application; testifying before the County Council regarding the potential and terms of the partnership; undertaking a scientific study of the market to support the grant application; and providing ongoing guidance to the County and Easton Utilities while the application was submitted and reviewed.

We previously assisted the County in evaluating its process for siting new cellular towers. We examined the areas of the County where cellular coverage existed, as well as areas where service was not available or where service was deemed to be inadequate. We assisted the County in developing a more systematic approach. Our report addressed a variety of factors that needed to be understood in order to provide for an intelligent and fair distribution of cellular communications towers within the County. The report focused on technical and engineering issues, zoning, the concerns of nearby residents, and land availability—all of which will need to be weighed to optimize voice and broadband service availability while minimizing the impact of wireless structures.

Garrett County, Maryland

CTC developed Garrett County's successful application to the U.S. Department of Commerce's Economic Development Administration (EDA) broadband grant program in fall 2020. We currently are engaged in broadband strategic planning efforts for this long-time client.

We previously helped the local government with engineering and strategic and business planning for expansion of middle-mile fiber—then helped the County negotiate with a private partner to leverage that fiber to support the deployment of a fixed-wireless broadband network.

The private partner is matching the public investment with its own capital and will assume operating risk. The County contribution (which was matched with development funds from the

[4] https://www.charlescountymd.gov/Home/Components/News/News/2437/400

Appalachian Regional Commission—following a successful grant application that CTC developed with the County) made the economics of this opportunity attractive to the private partner.

The fixed wireless "TV White Spaces" network will serve up to 3,000 currently unserved homes in the most remote parts of the County.

This innovative technical solution to the County's lack of broadband was featured in a "Motherboard" article, "Rural America Is Building Its Own Internet Because No One Else Will" (https://motherboard.vice.com/en_us/article/paax9n/rural-america-is-building-its-own-internet-because-no-one-else-will).

City of Westminster, Maryland

The Westminster model that CTC pioneered is the most influential broadband public–private partnership in establishing the model of city-owned fiber and private use of that fiber. This demand-driven model was the first of its kind. (For more details, see CTC's website: http://goo.gl/h14Lqi.)

The construction of the City's FTTP network and its groundbreaking partnership are the culmination of a multi-year engagement with CTC. CTC first prepared an FTTP feasibility study, cost estimate, and business case for the City in 2012 and 2013. Our report, which focused on maximizing available backbone network connectivity, included a technical design and cost estimates for two last-mile FTTP pilot projects (one focused on residential customers, one focused on businesses).

Based on the strength of the City's commitment to its principles, and the outcome of the feasibility analysis, the City decided to move forward with the small-scale pilot projects. As that focused construction began, CTC continued to work closely with the City to establish its principles and risk tolerance, then designed a potential public–private partnership model that would achieve a balance between those guiding forces. We established the City's preferred role in each aspect of network construction and operations, developed criteria for evaluating potential partnerships, and develop a financial analysis tool to model a range of assumptions.

We then wrote an RFP to identify a private partner that would assume operating risk in providing services to the public over the City's FTTP infrastructure. The RFP led to successful negotiations, led by CTC President Joanne Hovis, and the announcement of a first-of-a-kind partnership with Ting Internet.

CTC continues to support the 80-mile FTTP deployment over a range of tasks spanning fiber infrastructure engineering, network design, construction bidding, construction oversight, and quality assurance inspection.

Anne Arundel County, Maryland

CTC has provided the county with OSP fiber design and engineering for multiple large projects over more than a decade.

CTC currently provides the county with ongoing engineering support for various last-mile engineering projects and provides construction oversight and QA/QC work for the county.

In 2015, CTC provided OSP engineering for a county-funded project to connect schools and traffic signal locations and further extend the county-built fiber infrastructure by 90 miles.

CTC's work on both projects included field surveys, generating engineering prints and bills of materials, network and splicing design, permitting, and acceptance testing. CTC also developed RFP language for OSP construction and fiber maintenance.

From 2010 to 2012, CTC provided OSP engineering for a federally funded project to connect anchor locations (e.g., government buildings, schools) and expand the county's fiber infrastructure. The engineering for that project totaled over 70 miles, and included a rural FTTP network in the southern portion of the county.

Montgomery County, Maryland

CTC has provided technical, engineering, and strategic support to Montgomery County's Department of Technology Services on its most significant recent infrastructure initiatives, including:

- *FiberNet:* The CTC FiberNet Team Lead serves as CTC's on-site liaison to the FiberNet manager. At the FiberNet manager's direction, the team lead spends up to 20 hours per week at the FiberNet offices, supporting the FiberNet team on a range of significant short- and long-term design and planning engagements.

  CTC developed the initial design and architecture, in collaboration with the Department of Public Works and Transportation, for the network that would later become FiberNet. We did this in response to the immediate need to support traffic communications and cameras—but also in response to what we saw as the County's future needs for networking, video, data services, and the Internet.

  Later, during the County's cable TV franchise renewal, we identified as a high priority the need to obtain fiber-optic infrastructure from the cable operator; this outside plant would complement the County's existing infrastructure and become part of FiberNet—

and enable the County to have high availability services at a reasonable cost. As a result, the County has become a national leader in its network and enterprise capabilities.

CTC also assists the County by providing support for the technological evolution of FiberNet, so it can better meet the growing customer demand caused by the growth of the network's physical footprint.

Recently, CTC completed a preliminary analysis of optical network hardware platforms based on a high-level understanding of growing capacity demands and emerging requirements across FiberNet's increasingly diverse customer base. The analysis identified differentiating attributes among market-leading optical network platforms offering strategic advantages aligned with the County's objectives and developed baseline specifications and a system-level design for an initial upgrade phase. We also evaluated options for DTS to use FiberNet to expand service to Montgomery College and Montgomery County Public Schools.

CTC also completed an Organizational Governance Study that evaluated County goals and objectives against its current operational, technological, and organizational structure; to recommend a series of changes to improve its value delivery and operational efficiency; and to better align its operations and financial performance to key stakeholder objectives.

- *Wireless Facility Siting:* CTC was central to the development of the 500-square-mile County's wireless siting process, which has been identified by the Intergovernmental Advisory Committee at the FCC and others as providing notable examples of many best practices.[5]

  We have been the designated coordinator for the Montgomery County Telecommunications Facilities Coordinating Group (TFCG) from its inception in 1996 until today—marshaling DAS, small cell, and other wireless siting applications from filing to final action by the TFCG. We seek to balance the County's rights and regulations, the wireless industry's interest in delivering services, and the public's interest in minimizing the visual impact of wireless facilities in their neighborhoods.

  We provide technical engineering support, coordinate and review carriers' applications to site transmission facilities in the County, conduct physical inspections of proposed siting locations, review applicants' RF engineering submittals, and provide recommendations on each siting request based on zoning standards, the potential

[5] Report on Siting Wireless Communications Committee Presented to the Federal Communications Commission, July 12, 2016, https://transition.fcc.gov/statelocal/IAC-Report-Wireless-Tower-siting.pdf

visual impact of the installation, and other parameters. We also ensure the County's compliance with the FCC's "shot clock" for processing applications.

Over the course of this 20-year commitment and collaboration, we have drafted policies and procedures for review of applications, provided recommendations on related aspects of zoning text amendments, and informed the TFCG of changes in federal regulations governing the processing of applications to site wireless facilities in the County. We advise the County on approaches to enabling robust wireless service while being as mindful as possible of the impact of new antennas in the community.

- *UltraMontgomery*: To support development of the County's UltraMontgomery fiber infrastructure, CTC prepared a fiber market analysis, conducted a competitive assessment of the fiber market, developed a set of proposed in-building wiring standards, and identified a likely evolution path to guide the County's planning. During the initial stages of this ongoing project, we identified opportunities to cost-effectively expand County fiber to serve the Great Seneca Science Corridor and White Oak Science Gateway, as well as to link the area near NIST to the Equinix Data Center in Ashburn, Virginia.

- *Maryland Inter-County Broadband Network (ICBN):* CTC provided technical leadership and detailed outside plant design services for the ICBN. As the Portfolio Manager for this project, we oversaw and directed engineering and fiber network construction contractors—including the expansion of FiberNet with 132 additional miles of fiber constructed to 100 new sites.

- *NCRnet:* Through our engineering, planning, and integration efforts, the County continues to maximize the benefits of its interconnection with the National Capital Region interoperability network—supporting public safety, video conferencing, and other applications and ensuring reliable communications across jurisdictions.

Our ongoing support of the County's technical needs has included assisting the County in responding to economic development initiatives, such as planning fiber and broadband in downtown Silver Spring and strategies to bring broadband to unserved areas. We have also identified ways to support Montgomery County Public Schools and Montgomery College, and supported the implementation of public safety applications such as automatic vehicle location.

Maryland Inter-County Broadband Network

CTC was also the lead engineer, program manager, and project manager for the development of the Maryland Inter-County Broadband Network (ICBN) project—the largest sub-grantee of the One Maryland Broadband Network.

In that role, we designed and engineered approximately 360 miles of ICBN fiber routes for four large counties in the state; oversaw and directed engineering and fiber network construction contractors for the deployment of nearly 800 miles of fiber to 645 anchor institution sites; executed a strong management plan, staffing plan, and quality control plan; maintained the project plan for our work; allocated resources; tracked every aspect of the OSP process; oversaw the budgets and worked with the design team's Project Coordinators to manage deliverables and due dates; and oversaw $100 million in project funding.

During the ICBN design process, we conducted field walk-outs throughout the jurisdictions. We also worked with the State Highway Administration and the county departments of transportation to determine the availability of existing duct and cabinets, and included those in the design to cost-optimize the routes.

We played a key role in developing ICBN design principles such as fiber quantity, storage locations, access points, and building entry; developing bills of materials (BOMs); analyzing design options (e.g., use of aerial versus underground, use of existing infrastructure); and coordinating with the environmental assessment study.

Delaware Department of Transportation

CTC has provided communications engineering consulting services to the Delaware Department of Transportation (DelDOT) for almost 20 years—including, recently, guidance on DelDOT's use of the rights-of-way. Among our notable tasks are the following:

- We advised DelDOT about the viability, risks, and opportunities of developing collaboration with the private sector for deployment of communications infrastructure. We prepared strategic analyses and memoranda regarding the risks and opportunities of the potential collaborations and advised DelDOT regarding technical and business means by which to protect its assets and interests.

- CTC engineers currently are overseeing the deployment of a 4.9 GHz point-to-multipoint wireless network for traffic device interconnection and public safety communications. That high-speed, high-capacity wireless deployment will connect DelDOT's fiber network to critical and high-bandwidth devices located in remote areas unserved by fiber.

- We are advising the State of Delaware, through DelDOT, on its FirstNet public safety wireless network planning and implementation.

- CTC's engineers and business analysts wrote the statewide master plan for deploying an integrated broadband fiber and microwave network. That project included an evaluation

of DelDOT's existing use of technology and communications networks, and detailed recommendations for a technology strategy and hardware implementations.

- We have advised the State on its statewide 700 MHz narrowband mobile data network, including a requirements analysis, propagation studies, and system design.
- In a previous DelDOT engagement, our team developed specifications for and oversaw the implementation of a mobile traffic camera system utilizing standards-based 802.11b wireless Ethernet transmission and MPEG-2 video encoding for flexible deployments in construction zones and emergency situations.
- CTC engineers supported the implementation and operation of DelDOT's Travelers Advisory Radio System (TARS). Our design employed innovative technologies, including GPS synchronization, IP-monitored field devices, and backbone fiber optic transmission technology. We are providing ongoing maintenance and FCC compliance oversight on the statewide network.
- DelDOT filed our comments on the Federal Communications Commission's proposed spectrum rulemaking on 5.9 GHz communications for dedicated short-range communications (DSRC).[6]

State of Maryland – Maryland Transportation Authority

Over a number of years working for MdTA, CTC engineers have analyzed the Interstate 895 corridor to determine the best method of connecting CCTV cameras to the traffic management center, including such matters as use of existing physical plant and cable pathways, construction of new fiber optics, and use of wireless and microwave technologies. We also evaluated various methods of data and video signal transport in multiplexing and recommended a Gigabit Ethernet packet-based approach that was adopted by MdTA. Further, we performed fiber optic testing and review of fiber optic documentation to verify that that all fibers tested met the specifications required by MdTA's contract plans.

City of Albuquerque

CTC developed a strategy for connecting the City's key stakeholders and locations with a network that will have the most impact on its economic development and digital inclusion goals. CTC surveyed candidate network routes and developed a system-level design and pricing estimates for the construction and operation of fiber infrastructure. Our strategic design maximized potential economic

[6] "Reply Comments of DelDOT," July 22, 2016, https://goo.gl/sVtxjD

development, minimized budgeting risks, and positioned the City for future network expansion. CTC then prepared the technical portions of an RFP for the City's procurement process to identify an expert partner for the proposed fiber and wireless construction.

City of Bloomington, Indiana

CTC analysts currently are leading a study and analysis of "digital equity" gaps affecting the City's low-income or otherwise disadvantaged population in their use of the broadband internet. Our goal for the study, which includes a statistically valid survey, is to help the City better understand the gaps—including those related to broadband access, affordability, digital skills, and device ownership—that may be preventing some residents from making the most effective, meaningful use of broadband. Based on the research and data gathered, we will develop an actionable plan of steps that can be taken by both the public and private sectors to address those challenges.

CTC has also supported the City's efforts to develop ubiquitous, Gigabit-class broadband. We collaborated with City staff and other stakeholders to facilitate a public symposium and related communications materials on the value of next-generation infrastructure. We performed in-depth analysis of the local broadband market and fostered engagement with a range of public and private stakeholders. CTC's analysts and engineers also assessed the City's existing assets, prepared a competitive assessment of broadband services, benchmarked the City's broadband availability, and developed high-level engineering and cost estimates. Additionally, our team developed and administered an RFI to gauge public-sector interest in partnering with the City to achieve its broadband goals.

King County, Washington

CTC currently is engaged in a project comprising high-level strategic design, analysis, and business case development. That effort follows on a significant year-long effort to develop detailed mapping and related analysis of unserved and underserved areas of King County.[7]

King County is home to 2.2 million people and the dense city of Seattle, but also sparsely populated mountainous regions, unincorporated rural communities, multiple bodies of water, and many populated islands.

Given the County's challenging topography, range of local governing jurisdictions, and tremendously varied population density across its 2,100 square miles, we developed an innovative approach and methodology to developing the data and map insights the County needs. We are evaluating FCC Form 477 data about broadband services available in the County,

[7] https://www.ctcnet.us/publications/broadband-access-study/

evaluating Connect America Fund (CAF II) funding areas, identifying and analyzing relevant state, federal, County, and commercial datasets for insight into where communications infrastructure exists, reviewing existing cable franchise agreements throughout the County, analyzing the County's GIS-based population density data to identify areas where cable infrastructure is required, and estimating demand based on the results of our survey work in other communities, Pew research, and other reputable data sources.

Based on these inputs, we are building a comprehensive dataset and map of where there is broadband and where there is not within the unincorporated parts of the County. This mapping exercise will be a foundational element of our analysis and recommendations related to identifying potential solutions for expanding broadband service in unserved and underserved portions of the County.

City of Lexington and Fayette County, Kentucky

CTC prepared a broadband feasibility study to help the Lexington-Fayette Urban County Government (LFUCG) understand the challenge of meeting broadband needs in the rural areas of Fayette County, and to develop cost estimates and potential strategies for meeting those needs. CTC evaluated the County's current broadband supply and demand, and potential approaches to filling that gap—through public–private partnership, middle-mile fiber, or a fiber-to-the-premises (FTTP) network.

We found that businesses in the rural areas of Fayette County had very limited broadband connectivity options, and service providers had no active plans for widespread deployment. A major reason for the lack of service was the high cost of buildout in low-population-density areas; we estimated that the cost of network construction in the County was nine times higher than the cost of construction in the City of Lexington.

To illustrate LFUCG's options, CTC's engineers undertook two system-level design and cost estimation efforts for networks in the Fayette County area of the LFUCG: middle-mile and FTTP.

Following the County's decision to move forward with a public-private partnership approach, CTC helped the City negotiate a partnership with MetroNet, which currently is constructing a fiber network under an agreement that shifts most of the financial risk to the private company.[8]

[8] For more details, see: https://www.kentucky.com/news/local/counties/fayette-county/article217385750.html.

City of Madison, Wisconsin

CTC wrote a fiber-to-the-premises (FTTP) feasibility study for the City in mid-2016.[9] Over the course of the engagement, CTC engineers and analysts inventoried the City's key physical infrastructure, including the Metropolitan Unified Fiber Network (MUFN); conducted interviews with representatives of City departments and stakeholders; researched the region's available broadband services and costs; evaluated potential public–private partnership business models; and developed pro forma financial statements for a City-owned fiber network. In addition to those tasks, CTC conducted residential market research to supplement the report's findings, and to help gauge the community's interest in broadband.

CTC recently began a citywide audit and inventory of conduit, fiber, and splice information for the Madison Unified Fiber Network (MUFN) outside plant network.

Summit County, Colorado

A rural county deep in the Rocky Mountains, Summit County is known for resorts that attract visitors year-round. Despite its proximity to significant communications infrastructure, and the demand created by its residents and visitors, some parts of the County lack sufficient access to reliable and robust broadband.

To identify strategies that will help the County reach its goals—improved broadband connectivity for residents, businesses, and public safety users; greater digital inclusion; the delivery of municipal services; governmental cost savings; and more efficient "connected government"—the County hired CTC to evaluate existing communications infrastructure, conduct outreach to the cellular carriers; evaluate potential solutions (including partnerships); and develop requests for information (RFI) to seek partners willing to engage on wireless or fiber-to-the-premises (FTTP) deployment in the County.

CTC and the County conducted a comprehensive needs assessment session to understand the County's goals and objectives for the project. CTC then evaluated the existing wired and wireless communications infrastructure and services; spoke with the town managers/mayors, affected citizens, and other stakeholders to gather insight and information; and facilitated discussions with cellular carriers and tower companies that could potentially fill the coverage gaps.

[9] The final report is available on our website: http://www.ctcnet.us/news/city-of-madison-releases-ctc-report/

To seek input on options for public–private partnerships, CTC developed and assessed responses to two requests for information (RFI): one for fiber-to-the-premises (FTTP) throughout the County and one for wireless broadband, primarily targeting the County's unserved areas. We also developed a high-level design and cost estimate for a County-implemented wireless broadband solution for the unserved areas.

CTC's work with the County resulted in igniting discussions with major carriers who may be able to fill the coverage gaps in the County. These conversations have been instrumental in the County establishing good relationships with private carriers that have the potential to provide additional coverage in areas of the County.

Cities of Urbana and Champaign / University of Illinois (UC2B Network)

CTC has been the strategic and business planning consultant to Urbana, Champaign, and the university for more than seven years—since the coalition conceived of constructing a middle-mile fiber network to connect community anchor institutions.

Following construction of the middle-mile fiber, we prepared a request for information (RFI) to enable the cities and the university to identify a private partner that would finance and operate an FTTP expansion of the network to serve 100 percent of the community. We evaluated potential partners' proposals, then helped to negotiate with two partners to reduce the community's risks and ensure that a partnership would achieve the coalition's policy goals for digital inclusion.

As a result of the coalition's partnership, UC2B secured an open access Gigabit FTTP network buildout that, based on the negotiated agreement, would protect its public policy interest by providing the same opportunity for access to the entire community. In return, UC2B's partner would have access to UC2B's existing middle-mile infrastructure (which the partner would operate) and the foundation of a significant last-mile consumer network.

Appendix A: CTC Staff Resumes

Joanne S. Hovis | President

Joanne Hovis is a nationally recognized authority on broadband markets and on the evolving role of public–private partnerships in the provision of communications services to the public. For more than 20 years, she has directed CTC's consulting services related to strategic planning, market analysis, business modeling, and financial analysis for localities, states, and tribal governments throughout the country.

Joanne leads the CTC teams that advise the states of Alabama, Connecticut, Nebraska, New Mexico, and New York; the cities of Atlanta, Boston, San Francisco, Seattle, and Washington, D.C.; and the statewide broadband networks in Colorado, Maryland, and Pennsylvania. She also leads CTC's advisory work regarding federal broadband funding programs such as E-Rate, ReConnect, the Connect America Fund, the Rural Digital Opportunity Fund, and the Healthcare Connect Fund.

Joanne has testified on multiple occasions before Congress on rural broadband, broadband public-private partnerships, and the digital divide, and has provided expert presentations to the Federal Communications Commission, the U.S. Conference of Mayors, the National League of Cities, and other national organizations.

Joanne is also CEO of the Coalition for Local Internet Choice (CLIC) and a member of the boards of directors of the Benton Institute for Broadband & Society, Consumer Reports, and the Fiber Broadband Association. She is a former president of the National Association of Telecommunications Officers and Advisors (NATOA).

<u>Public–Private Partnership Planning and Negotiations</u>

Joanne has spearheaded projects that explore a range of business models by which local and state governments can leverage their assets to build or expand fiber networks, and to incentivize private sector broadband expansion.

- Joanne has provided extensive business planning, market assessment, and strategic planning for the City and County of **San Francisco** over a dozen years. She played a key role in the project team that developed an innovative partnership strategy for deploying a ubiquitous fiber-to-the-premises network. In an earlier project that laid the groundwork for the city's current efforts, Joanne conducted an independent evaluation of the feasibility of San Francisco constructing and operating such a network.
- Joanne advises the State of **Alabama** Department of Economic and Community Affairs regarding Broadband public-private partnerships and planning. She designed the State of **New Mexico** Department of Information Technology's strategy for grant funding of public-private partnerships in rural broadband. She has developed strategy for broadband public-private partnerships for the Departments of Transportation for the state of **Delaware, Nebraska, Texas, and New Mexico**.
- Joanne has been the strategic and business planning consultant to numerous smaller cities as they have planned and negotiated broadband public-private partnerships,

including the **city of Tacoma, WA**; **Westminster, MD**; and the **Urbana-Champaign Big Broadband Coalition** (University of Illinois and the cities of Champaign and Urbana). For these projects, she developed strategy to enable the communities to identify a private partner that would finance and operate fiber deployment and expansion. She evaluated potential partners' proposals, then helped negotiate win-win partnerships that reduce risk to both parties and ensure achievement of economic development and digital inclusion goals.

Business Planning and Feasibility Analysis

Joanne is sought nationwide as an expert in municipal broadband business models and planning. Among the projects she has led are the following CTC engagements:

- Joanne advised the **City of Atlanta** on strategic and tactical approaches it can take to plan, build, and operate its own fiber network to cost-effectively serve its internal needs, promote private sector broadband investment, and enable competition in the City's residential and business broadband markets. She assisted the City in its discussions with telecommunications providers about options for joint build and partnership.
- Joanne advised the **City of Seattle** regarding business planning strategies for a citywide fiber enterprise and facilitating equitable access to wireless broadband services. In her report on citywide fiber, she analyzed the public subsidies a network would require and delivered a full assessment of opportunities and risks. The report included an internal needs analysis, statistically significant market research, an assessment of competing services and technologies, and an evaluation of the business case and financial risks. Joanne led further analysis of the benefits of FTTP beyond the traditional balance sheet, including cost avoidance.
- Joanne advises the **State of New Mexico's Department of Information Technology** on broadband planning. She developed the state's broadband strategic plan and a guidebook for New Mexico's local governments on the business, financial, and strategic planning necessary to implement city- or county-owned broadband networks. The guidebook discusses strategies for exploring public-private partnerships to facilitate broadband expansion.
- Joanne supported the **State of Kansas Department of Commerce** on a needs assessment of the state's network infrastructure. She conducted major market surveys of core sectors across the state (residents, businesses, and community anchor institutions) to evaluate the current uses and needs of broadband infrastructure. She also developed a strategy for the evolution of the state-created broadband program that serves schools, hospitals, libraries, and higher education institutions.
- Joanne has advised officials in the **District of Columbia** government on a range of telecommunications and fiber optic projects for almost a decade. She worked with the Office of the Chief Technology Officer to create a business plan and strategy for building a municipal fiber optic network with a wireless overlay in the least-served wards of the city**.** She performed a business case and technology analysis for DC-Net, a fiber optic

telecommunications network that provides voice and data services for the District. She analyzed governmental, educational, and public safety uses of the network.

- Joanne devised a business strategy and wrote a business plan for **KINBER**, the statewide backbone and middle-mile fiber infrastructure focused on the higher education and healthcare sectors in Pennsylvania. One highlight of the KINBER strategy was developing an actionable plan to increase early cash flow.
- Joanne developed a broadband feasibility study for **Garrett County, Maryland**, with a focus on maximizing the benefits and use of the state's grant-funded fiber backbone. That initial analysis led to strategic planning and support for the county's successful Appalachian Regional Commission grant funding and a pioneering public-private partnership that has deployed TV White Spaces wireless service to unserved rural parts of the county.

Federal Funding and Grant Planning

Joanne's expertise includes the funding opportunities available to local, state, and tribal governments and public-private partnerships through the federal government and other sources. She has guided clients through project planning, application writing, and fund management. Her work on behalf of clients has included successful applications for funding from a range of agencies, including the FCC/USAC, Rural Utilities Service, National Telecommunications and Information Administration, the Appalachian Regional Commission, and the Department of Homeland Security.

Speaking and Advocacy

Joanne is in wide demand as a speaker and expert source on broadband deployment and public–private partnership issues. She has testified before the U.S. Congress on matters of broadband deployment and policy; has been interviewed by publications including *Business Week*, *The Washington Post*, *The New Yorker*, and *The Baltimore Sun*; and has been featured on C-SPAN's "The Communicators."

She has provided expert presentations to the Federal Communications Commission, the U.S. Conference of Mayors, the National League of Cities, the Broadband Communities Summit, Technology Policy Summit, the University of Illinois, Case Western Reserve University, the New America Foundation, and the Congressional Internet Caucus.

EDUCATION
***Juris Doctor*, with honors**, University of Chicago Law School, 1994
***Bachelor of Arts*, with distinction**, University of Wisconsin, Madison, 1990

ORGANIZATIONS
- Coalition for Local Internet Choice, CEO
- Benton Institute for Broadband & Society, Director
- Fiber Broadband Association, Director
- Consumer Reports, Director

- United States Unified Community Anchor Network, Task Force on Community Anchor Network Economic Models, Charter Member
- National Association of Telecommunications Officers and Advisors, Past President

PRIOR TO COMING TO CTC IN 1997

1996–1997 Litigation/Communications Attorney
Mintz, Levin, Cohn, Ferris, Glovsky, & Popeo P.C., Washington, D.C.
1994–1996 Litigation Attorney
Jenner & Block, Chicago

SELECTED PUBLICATIONS

- "Public Fiber, Private Service: A Shared-Risk Partnership Model for 21st Century Broadband Infrastructure," published by the Benton Institute for Broadband & Society, 2020 (forthcoming)
- "The Broadband Lifeline in a Pandemic: How Your Community Can Quickly Connect the Unconnected," CTC Technology & Energy, April 2020
- "Closing the Digital Divide: Broadband Infrastructure Solutions," Testimony Before the United States House of Representatives Committee on Energy and Commerce Subcommittee on Communications and Technology, January 2018
- "Leaping the Digital Divide: Encouraging Policies and Partnerships to Improve Broadband Access Across North Carolina," co-author, published by the North Carolina League of Municipalities, 2018
- "The Emerging World of Broadband Public–Private Partnerships: A Business Strategy and Legal Guide," co-author, published by the Benton Foundation, 2017
- "The Atomic Age of Data: Policies for the Internet of Things," contributor as participant at the Aspen Institute Conference on Communications Policy, 2015
- "The Art of the Possible: An Overview of Public Broadband Options," published by the New America Foundation, 2015
- "Better Communities through Better Broadband: A Coalition of Public and Private Interests Affirms the Need for Local Internet Choice," Benton Foundation Blog, 2015
- "The Killer App for Local Fiber Networks," *Broadband Communities* magazine, November/December 2014
- "Gigabit Communities: Technical Strategies for Facilitating Public or Private Broadband Construction in Your Community," 2014
- "How communities can facilitate fiber construction," Google Fiber Blog, 2014
- "Facilitating Broadband Construction," *Broadband Communities* magazine, January/February 2014

Andrew Afflerbach, Ph.D., P.E. | CEO and Chief Technology Officer

Dr. Andrew Afflerbach specializes in the planning, designing, and implementation oversight of broadband communications networks, smart cities strategies, and public safety networks. His expertise includes state-of-the-art fiber and wireless technologies, the unique requirements of public safety networks, and the ways in which communications infrastructure enables smart and connected applications and programs for cities, states, and regions.

Andrew has planned and designed robust and resilient network strategies for dozens of clients, including state and local governments and public safety users. He has delivered strategic technical guidance on wired and wireless communications issues to cities, states, and national governments over more than 20 years. He has advised numerous cities and states, including New York City, San Francisco, Seattle, Atlanta, Washington, D.C., and Boston, and served as a senior adviser to Crown Fibre Holdings, the public entity directing New Zealand's national fiber-to-the-home project.

In addition to designing networks, Andrew testifies as an expert witness on broadband communications issues. And he is frequently consulted on critical communications policy issues through technical analyses submitted to the Federal Communications Commission (FCC) and policymakers. He has prepared white papers on:

- Streamlining deployment of small cell infrastructure by improving wireless facilities siting policies
- Limiting interference from LTE-U networks in unlicensed spectrum
- Developing technical frameworks for wireless network neutrality
- Estimating the cost to expand fiber to underserved schools and libraries nationwide
- Conducting due diligence for the IP transition of the country's telecommunications infrastructure

As CTC's Chief Technology Officer, Andrew oversees all technical analysis and engineering work performed by the firm. He has a Ph.D. and is a licensed Professional Engineer.

Wireless Network Planning and Engineering

Applying the current state of the art—and considering the attributes of anticipated future technological advancements such as "5G"—Andrew has developed candidate wireless network designs to meet the requirements of clients including the cities of Atlanta, San Francisco, and Seattle. In a major American city, Andrew led the team that evaluated wireless broadband solutions, including a wireless spectrum roadmap, to complement potential wired solutions.

In rural, mountainous Garrett County, Maryland, Andrew designed and oversaw the deployment

of an innovative wireless broadband network that used TV white space spectrum to reach previously unserved residents. To enhance public internet connectivity, Andrew provides technical oversight on CTC's Wi-Fi-related projects, including the design and deployment of Wi-Fi networks in several parks in Montgomery County, Maryland.

Andrew also advises local and state government agencies on issues related to wireless attachments in the public rights-of-way; he leads the CTC team that supports the Texas Department of Transportation (TxDOT) and many large counties on wireless attachment policies and procedures.

Public Safety Networking

Andrew leads the CTC team providing strategic and tactical guidance on FirstNet (including agency adoption and other critical decision-making) for the State of Delaware and Onondaga County, New York. In the District of Columbia, he and his team evaluated the financial, technical, and operational impact of building the District's own public safety broadband network, including the design of an LTE system that provided public-safety-level coverage and capacity citywide. This due diligence allowed the District to make an informed decision regarding opting in or out of the National Public Safety Broadband Network.

Andrew currently is working with the State of Delaware to evaluate LTE coverage gaps throughout the state to assist agencies in their choice of public safety broadband networks. On the state's behalf, he and his team are also conducting outreach to AT&T and other carriers to evaluate their public safety offerings. He is performing similar work as part of CTC's engagement with El Paso County, Colorado.

Earlier, Andrew led the CTC team that identified communications gaps and evaluated potential technical solutions for the Baltimore Urban Area Security Initiative (UASI), a regional emergency preparedness planning effort funded by the U.S. Department of Homeland Security (DHS).

He previously served as lead engineer and technical architect for planning and development of NCRnet, a regional fiber optic and microwave network that links public safety and emergency support users throughout the 19 jurisdictions of the National Capital Region (Washington, D.C. and surrounding jurisdictions), under a DHS grant. He wrote the initial feasibility studies that led to this project for regional network interconnection.

Fiber Network Planning and Engineering

Andrew has architected and designed middle- and last-mile fiber broadband networks for the District of Columbia (Washington, D.C.); the city of San Francisco; the Delaware Department of Transportation; the Maryland Transportation Authority; and many large counties.

He oversaw the development of system-level broadband designs and construction cost estimates for the cities of Atlanta, Boston, Boulder, Palo Alto, Madison, and Seattle; the states of Connecticut and Kentucky; and many municipal electric providers and rural communities. He is overseeing the detailed design of the city-built fiber-to-the-premises (FTTP) networks in Westminster, Maryland; Alford, Massachusetts; and Holly Springs and Wake Forest, North Carolina.

In Boston, Andrew led the CTC team that developed a detailed RFP, evaluated responses, and participated in negotiations to acquire an Indefeasible Right of Use (IRU) agreement with a fiber vendor to connect schools, libraries, public housing, and public safety throughout the City. This approach was designed to allow the City to oversee and control access and content among these facilities.

Smart Grid

Andrew and the CTC team provided expert testimony and advisory services to the Public Service Commission of Maryland regarding Advanced Metering Infrastructure (AMI). CTC provided objective guidance to the staff as it evaluated AMI applications submitted by three of the state's investor-owned utilities (IOUs). This contract represented the first time the PSC staff had asked a consultant to advise them on technology—a reflection of the lack of standards in the Smart Grid arena.

Broadband Communications Policy Advisory Services

Andrew advises public sector clients and a range of policy think tanks, U.S. federal agencies, and non-profits regarding the engineering issues underlying key communications issues. For example, he:

- Provided expert testimony to the FCC in the matter of the preparation of the **national broadband plan** as a representative of the National Association of Counties (NACo) and the National Association of Telecommunications Officers & Advisors (NATOA).
- Served as expert advisor regarding broadband deployment to the U.S. Conference of Mayors, NACo, National League of Cities, Public Knowledge, New America Foundation Open Technology Institute, and NATOA in those organizations' filings before the FCC in the matter of determination of the deployment of a **national, interoperable wireless network in the 700 MHz spectrum**.
- In connection with the FCC's ongoing **Open Internet proceeding**, advised the New America Foundation regarding the technical pathways by which "any device" and "any application" regimes could be achieved in the wireless broadband arena as they have been in the wireline area.
- Provided expert technical advice on the **700 MHz broadband and AWS-3 proceedings** at the FCC for the Public Interest Spectrum Coalition (including Free Press, the New America Foundation, Consumers Union, and the Media Access Project).

- Served as technical advisor to the **U.S. Naval Exchange** in its evaluation of vendors' broadband communications services on U.S. Navy bases worldwide.
- Advised the **U.S. Internal Revenue Service** regarding the history of broadband and cable deployment and related technical issues in that agency's evaluation of appropriate regulations for those industries.
- Advised the Stanford Law School Center for Internet and Society on the technical issues for their briefs in the ***Brand X* Supreme Court appeal** regarding cable broadband.

Broadband Communications Instruction

Andrew has served as an instructor for the U.S. Federal Highway Association/National Highway Institute, the George Washington University Continuing Education Program, the University of Maryland Instructional TV Program, ITS America, Law Seminars International, and the COMNET Exposition. He developed curricula for the United States Department of Transportation.

He taught and helped develop an online graduate-level course for the University of Maryland. He developed and taught communications courses and curricula for ITS America, COMNET, and the University of Maryland. His analysis of cable open access is used in the curriculum of the International Training Program on Utility Regulation and Strategy at the University of Florida.

Andrew has also prepared client tutorials and presented papers on emerging telecommunications technologies to the National Fire Protection Association (NFPA), NATOA, the National League of Cities (NLC), the International City/County Management Association (ICMA), and the American Association of Community Colleges (AACC). He taught college-level astrophysics at the University of Wisconsin.

EMPLOYMENT HISTORY

1995–Present	CEO/Chief Technology Officer, CTC Previous positions: Director of Engineering, Principal Engineer, Senior Scientist
1990–1996	Astronomer/Instructor/Researcher University of Wisconsin–Madison, NASA, and Swarthmore College

EDUCATION

Ph.D., Astronomy, University of Wisconsin–Madison, 1996

- NASA Graduate Fellow, 1993–1996. Research fellowship in astrophysics
- Elected Member, Sigma Xi Scientific Research Honor Society

Master of Science, Astronomy, University of Wisconsin–Madison, 1993

Bachelor of Arts, Physics, Swarthmore College, 1991

- Eugene M. Lang Scholar, 1987–1991

PROFESSIONAL CERTIFICATIONS/LICENSES

Professional Engineer, states of California, Delaware, Georgia, Illinois, Maryland, and Virginia

HONORS/ORGANIZATIONS

- Disaster Response and Recovery Working Group, FCC's Broadband Deployment Advisory Committee (BDAC)
- Association of Public-Safety Communications Officials (APCO)
- Board of Visitors, University of Wisconsin Department of Astronomy
- National Association of Telecommunications Officers and Advisors (NATOA) Technology and Public Safety Committees
- Armed Forces Communications and Electronics Association (AFCEA)
- Society of Cable and Telecommunications Engineers (SCTE)
- Institute of Electrical and Electronic Engineers (IEEE)
- Charleston Defense Contractors Association (CDCA)

SELECTED PUBLICATIONS, PRESENTATIONS, and COURSES

- "The Broadband Lifeline in a Pandemic: Strategies for Provisioning Fast Internet Service to the Most Remote Rural Areas," March 2020
- "The Broadband Lifeline in a Pandemic: Strategies for Provisioning Broadband to Temporary Emergency Sites," March 2020
- "The Broadband Lifeline in a Pandemic: How Your Community Can Quickly Deploy Free Wi-Fi to Meet Urgent Needs at Public Housing and Other Locations," March 2020
- "Small Cell Standards and Processes: Protecting Community Assets, Interests, and Public Safety," prepared for NATOA, Feb. 2019
- "SB 937: Wireless Facilities – Installation and Regulation," Testimony before the State of Maryland Senate, Feb. 2019
- "HB 654: Wireless Facilities – Installation and Regulation," Testimony before the State of Maryland General Assembly, Feb. 2019
- "The Three "Ps" of Managing Small Cell Applications: Process, Process, Process," Dec. 2018
- Declaration in Response to FCC's Order, "Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment," prepared for the Smart Communities and Special Districts Coalition, filed with the FCC, Sept. 2018
- Declaration in Response to the Proposed T-Mobile/Sprint Merger, prepared for the Communications Workers of America, filed with the FCC, Aug. 2018
- "A Model for Understanding the Cost to Connect Anchor Institutions with Fiber Optics" (co-author), prepared for the Schools, Health & Libraries Broadband Coalition, Feb. 2018
- "How Localities Can Prepare for—and Capitalize on—the Coming Wave of Public Safety Network Construction," Feb. 2018
- "Network Resiliency and Security Playbook" (co-author), prepared for the National Institute of Hometown Security, Nov. 2017

- "Mobile Broadband Service Is Not an Adequate Substitute for Wirelines" (co-author; addressing the limitations of 5G), prepared for the Communications Workers of America, Oct. 2017
- "Technical Guide to Dig Once Policies," April 2017
- "Streamlining Deployment of Small Cell Infrastructure by Improving Wireless Facilities Siting Policies," prepared for the Smart Communities Siting Coalition, filed with the FCC, March 2017
- "How Localities Can Improve Wireless Service for the Public While Addressing Citizen Concerns," Nov. 2016
- "LTE-U Interference in Unlicensed Spectrum: The Impact on Local Communities and Recommended Solutions," prepared for WifiForward, Feb. 2016
- "Mobile Broadband Networks Can Manage Congestion While Abiding by Open Internet Principles," prepared for the New America Foundation's Open Technology Institute – Wireless Future Project, filed with the FCC, Nov. 2014
- "The State of the Art and Evolution of Cable Television and Broadband Technology," prepared for Public Knowledge, filed with the FCC, Nov. 2014
- "A Model for Understanding the Cost to Connect Schools and Libraries with Fiber," prepared for Schools, Health & Libraries Broadband Coalition, filed with FCC, Oct. 2014
- "The Art of the Possible: An Overview of Public Broadband Options," prepared jointly with the New America Foundation's Open Technology Institute, May 2014
- "Understanding Broadband Performance Factors," with Tom Asp, *Broadband Communities* magazine, March/April 2014
- "Engineering Analysis of Technical Issues Raised in the FCC's Proceeding on Wireless Facilities Siting," filed with the FCC (http://apps.fcc.gov/ecfs/document/view?id=7521070994), Feb. 2014
- "A Brief Assessment of Engineering Issues Related to Trial Testing for IP Transition," prepared for Public Knowledge and sent to the FCC as part of its proceedings on Advancing Technology Transitions While Protecting Network Values, Jan. 2014
- "Gigabit Communities: Technical Strategies for Facilitating Public or Private Broadband Construction in Your Community," prepared as a guide for local government leaders and planners (sponsored by Google), Jan. 2014
- "Critical Partners in Data Driven Science: Homeland Security and Public Safety," submitted to the *Workshop on Advanced Regional & State Networks (ARNs): Envisioning the Future as Critical Partners in Data-Driven Science*, Internet2 workshop chaired by Mark Johnson, CTO of MCNC, Washington, D.C., April 2013
- "Connected Communities: How a City Can Plan and Implement Public Safety & Public Wireless," submitted to the International Wireless Communications Exposition, Las Vegas, March 2013
- "Cost Estimate for Building Fiber Optics to Key Anchor Institutions," prepared for submittal to the FCC by NATOA and SHLB, Sept. 2009
- "Efficiencies Available Through Simultaneous Construction and Co-location of Communications Conduit and Fiber," prepared for submittal to the FCC by NATOA and the City and County of San Francisco, 2009, referenced in the National Broadband Plan

Ziggy Rivkin-Fish, CGEIT | Principal Analyst | Strategy and Governance Specialist

Ziggy Rivkin-Fish has been a business and strategy analyst and project manager at CTC since 2005. He has managed multiple federal-grant-funded interoperability projects that interconnect jurisdictional communications networks, and has led broadband planning, strategy, and feasibility studies for local government clients nationwide. Ziggy has also applied his management, technical, and governance expertise to the implementation of large-scale network infrastructures, and has developed governance frameworks to manage small and large public broadband networks. His background in organizational sociology and certification in Governance of Enterprise IT has enabled him to advise multiple clients on structuring their operations to manage IT departments and fiber optic network services.

Ziggy specializes in strategic planning, including public-private partnership analysis and grant strategies. In that capacity, he has led or contributed to numerous projects leveraging federal and state grants to build or expand broadband networks around the country. His recent broadband strategic planning projects include engagements with King County, WA, Pierce County, WA, the State of Alabama, Greene County, PA, the State of New Mexico, Harford County, MD, Charles County, MD, and Queen Anne's County, MD.

Ziggy also leads CTCs digital inclusion and equity team, and is both leading projects specifically oriented toward addressing the digital divide and addressing those issues within the context of broadband strategy planning.

In addition to his work on broadband planning, government network interconnections, and governance consulting, Ziggy has played key roles in other large-scale projects, such as by overseeing the preparation of successful environmental assessments (EA) for major public sector fiber networks including the One Maryland Broadband Network (OMBN) and the Urbana-Champaign Big Broadband (UC2B) network; his work enabled those projects to proceed to the construction phase. Ziggy then oversaw the preparation of required addenda to the OMBN and UC2B EAs to address project revisions during the construction phase. In addition, Ziggy advised on the preparation of an EA for the State of Maryland Department of Natural Resources to enable construction of a radar support tower on state land.

Notably, Ziggy has served as the lead manager for all phases of deployment of NCRnet, the interoperable public safety communications network that interconnects 20 jurisdictions in the National Capital Region around Washington, D.C.; Ziggy's role with NCRnet includes oversight of fiber optic design, procurement, and implementation, as well as design, governance development, construction oversight, network operations, and long-term sustainment. Ziggy has also ensured project compliance with grant regulations, including environmental and procurement requirements. Currently, he is focused on facilitating public safety application rollouts on NCRnet, as well as on engineering feasibility studies and oversight roles for fiber optic and wireless extensions to new NCRnet clients.

Ziggy's past accomplishments include a full fiber optic network feasibility study, including a governance roadmap for the city of Highland Park, IL, which enabled the city to decide between ownership models and methods of operational governance. He conducted a large organizational governance study for Montgomery County, Maryland's FiberNet network to advise the county both on executive governance and on operational organization and business process improvement; following that project, he helped the county identify and implement key performance indicators (KPI) for the network.

Ziggy has consulted on governance frameworks for the Commonwealth of Kentucky, Harford County, MD, and the City of Vancouver. For Vancouver and for the City of Vallejo, CA, he also consulted on joint trenching policies and business process improvement.

Alongside his work on broadband planning and NCRnet, Ziggy also advises public interest-oriented networks on governance at all phases of deployment and operation. In addition, Ziggy supports and leads cable franchise technical and community needs assessments, most recently on behalf of Fairfax County, VA.

EDUCATION
Master of Arts, Sociology, Princeton University, 2000
Bachelor of Arts, Individualized Major in Social Theory, Rutgers University (4.0 GPA)

RELEVANT PUBLICATIONS

- "$1.5 Billion in New Grant Funding Available from Economic Development Administration for Broadband & Other Projects," CTC, May 2020.
- "Producing Value Through Effective Governance," CTC, April 2017.
- "NCRnet: How the National Capital Region is Building a 21st Century Regional Public Safety Communications Network" *NATOA Journal* 15(4):16-18. 2007.

CERTIFICATIONS
Certified in the Governance of Enterprise IT (CGEIT) certification, 2015

Mitchell Hergett | Principal Engineer

Mitchell Hergett is an experienced communications engineer with expertise in the design and implementation of broadband (video, voice, and data) telecommunications networks. Mitch's work focuses on project management and engineering analysis for public sector clients.

For example, he provides ongoing project management support and engineering analysis for **Anne Arundel County, Maryland**'s fiber network. He supports day-to-day operations and the County's initiatives to expand the network. His tasks include:

- Overseeing engineering design and deliverables
- Developing IFB documentation for fiber construction and maintenance
- Managing fiber allocations and splice design for the network
- Creating construction vendor task orders
- Coordinating with network stakeholders

Mitch manages CTC's ongoing outside plant (OSP) engineering and construction oversight services. He develops project plans, performs stakeholder outreach, manages staff, and reviews CTC work product. Working closely with clients, he ensures that every request for technical support is quickly addressed and that CTC's clients receive high-quality and responsive support from CTC staff.

Mitch has recently performed this work for CTC's projects in the following jurisdictions:

- **City of Alexandria, Virginia**
- **Arlington County, Virginia**
- **Town of Wake Forest, North Carolina**
- **City of Bozeman, Montana**

Mitch's work also includes internal project management for many of CTC's consulting and engineering projects. In this role, he acts as the point person for clients nationwide; schedules CTC tasks and teams; and tracks project deliverables. Mitch has recently performed this work for CTC's projects in the following jurisdictions:

- **City of New York, New York**
- **City of Seattle, Washington**
- **King County, Washington**
- **City of San Francisco, California**

He also provides project support for Montgomery County, Maryland's "ultraMontgomery" fiber network initiatives,. He works directly under the Project Director helping to create project plans, develop cost estimates and budget numbers, and coordinate with County stakeholders.

Mitch's experience includes supporting the design and implementation of a variety of fiber communications networks. Some select examples of his work include:

- Developing technical specifications for the construction of a fiber optic network in the **City of Atlanta**. The network will connect traffic signals, police cameras, and City facilities. The City is also looking to expand the network to support other government partners. Mitch has performed similar work for many public sector entities, including:
    - **Arlington County, Virginia**
    - **Baltimore City Public Schools**
    - **Delaware Department of Transportation**
    - **Town of Holly Springs, North Carolina**
    - **City of Westminster, Maryland**
- Performing engineering and construction oversight of a fiber optic network build out for **Leisure World of Maryland**. Mitch oversaw the field engineering work to connect all Leisure World facilities to allow the consolidation of its data and voice networks. After overseeing the design phase, Mitch developed technical specifications for fiber construction, helped choose a fiber optic construction contractor, and oversaw fiber construction.
- High-level design and cost estimate for the **Montgomery County**'s fiber expansion initiatives. Mitch developed fiber designs and cost estimates for several of the County's fiber projects including one to add over 60 new sites to the existing fiber network. He worked with the County's incumbent construction contractor to provide the County with capital cost estimates for a the most efficient fiber routes.

He has previously provided program-level support and project management for the $115 million statewide One Maryland Broadband Network (OMBN) project. In this role, he assists stakeholder jurisdictions with program compliance, stakeholder relations, budget management, and contractor management. His tasks included:

- Developing scopes of work for engineering and construction vendors
- Tracking and reporting on compliance metrics
- Documenting program scope changes
- Assisting in the RFP creation process
- Creating materials specifications

- Meeting with project stakeholders to discuss project status, governance matters, and network architecture issues
- Resolving conflicts with Pepco, Verizon, State Highway Administration, and other entities

Mitch has also supported the National Capitol Region (NCR) interoperable public safety communications network, which interconnects 19 jurisdictions around and including Washington, D.C. He has created process engineering deliverables including a detailed satellite phone user manual; a testing procedure to ensure equipment functionality and operator competence for multi-jurisdictional emergency satellite phone calls; and a detailed analysis of discrepancies between the processes presented and processes actually used by the network's service-level agreement (SLA) maintenance vendor. He also oversees the network's video teleconference (VTC) training course and budget, and provides Tier 1 technical support for the VTC systems.

In addition, Mitch works with the CTC outside plant engineering team; he provides project oversight to ensure that the OSP engineers are complying with project standards, meeting project timelines and he provides the engineers with essential project information. He performs quality control on the engineering work product, and coordinates with permitting agencies and sub-contractors.

In a previous engineering role at a major hospital in Montana, he:

- Developed workflow to help the hospital transition to an electronic health record system using Access e-forms and Image Now software
- Created visual diagrams detailing information flow to enable prototyping of a new system
- Gathered system requirements from hospital departments and individual users
- Assessed the capabilities and constraints of the new system's software
- Created training manuals for employees to better acclimate to the new system
- Presented the recommended implementation to the CFO
- Calculated potential savings of the new system at $250,000 per year

EDUCATION
Bachelor of Science, Industrial Engineering**,** Montana State University, 2008

CERTIFICATIONS/MEMBERSHIPS
- Institute of Industrial Engineers, Professional Member (2010–present)
- Institute of Electrical and Electronics Engineers, Professional Member (2008–present)

Marc Schulhof | Senior Analyst and Technical Writer

Marc Schulhof has 25 years of experience in technical writing, financial journalism, and public and corporate communications. As an analyst and editor, he plays an integral role in developing CTC's client deliverables, including:

- Strategic and master plans (business and engineering)
- Needs assessments
- Feasibility studies
- Requests for proposal (RFP) and requests for information (RFI)
- Survey instruments
- Expert witness testimony
- Federal and regional grant applications
- Wireless facility siting reports
- E-rate RFPs and bids
- Research reports
- White papers

Over the course of his nine years as CTC's senior technical writer, Marc has supported dozens of CTC clients—including the District of Columbia, the states of Connecticut, Delaware, Kentucky, Maryland, and New Mexico, and the cities of Atlanta, Boston, New York, Palo Alto, San Francisco, and Seattle. He has collaborated on white papers on topics related to fiber optic and wireless technologies, including technical reports filed with the Federal Communications Commission. He is the co-author, with CTC President Joanne Hovis, of "The Emerging World of Broadband Public–Private Partnerships: A Business Strategy and Legal Guide."

Prior to joining CTC, Marc was the worldwide editor-in-chief of CIO program websites at IBM, where he established editorial direction for 36 country-specific CIO websites and worked with local editors to update each site's mix of multimedia content. He also wrote and edited feature articles and white papers on information technology and business topics.

Earlier, as a global editor at PricewaterhouseCoopers Consulting, Marc wrote and edited reports on a variety of technology and business topics. He served as daily editor of the PwC-sponsored *BusinessWeek Online Handheld Edition,* a news summary service for mobile device users in the pre-smartphone era. Marc began his career at *Kiplinger's Personal Finance Magazine, where* he researched, analyzed, and wrote about a range of complex financial issues, first as a reporter and later as an associate editor.

EDUCATION
Master of Science, Journalism, Northwestern University
Bachelor of Science, Journalism, Northwestern University

Procurement Division
Phone (540) 658-8611
Procurement@StaffordCountyVA.gov

RIDER AGREEMENT NO. 21-068-1245CI

THIS RIDER AGREEMENT (hereinafter "Agreement") is entered into by and between the Board of Supervisors of Stafford County, Virginia ("County"), or its authorized agents and **Columbia Telecommunications Corporation dba CTC Technology & Energy**, ("Contractor"). The County and the Contractor, for the consideration and quantity(ies) specified herein or specified in a County Purchase Order referencing this Agreement, agree as follows:

1. Contract Documents.
The Contract Documents consist of this Agreement and the **Fairfax County Government Contract #4400007962 dated November 28, 2017** for telecommunications consulting services ("Originating Contract"), together with any exhibits and amendments issued or applicable thereto (collectively, "Contract Documents" or "Contract"). The following exhibit(s) shall be part of the Contract Documents:
a. Exhibit A: Fairfax County Request for Proposal #RFP2000002331
b. Exhibit B: Fairfax County Acceptance Agreement #4400007962 and Pricelist

This Agreement rides a contract awarded to the Contractor by **Fairfax County Government** and extended by the Contractor to the County on the same terms and conditions as the Contractor's agreement with **Fairfax County Government**. Where the terms of this Agreement vary from the terms and conditions of the other Contract Documents, the terms and conditions of this Agreement shall take precedence over any other Contract Document.

2. Scope of Work.
The Contractor agrees to perform and/or deliver telecommunications consulting services as described in **Exhibit A** (hereinafter "the Services"). No aspect of the Services shall be deemed complete until it is accepted by the using County department ("Department").

3. Contract Term.
The Contractor's provision of Services for the County shall commence upon the execution of the Agreement by the County, and shall be completed no later than **October 31, 2022** ("Contract Term"), subject to modifications by the Fairfax County Government and the County. The Contract may be renewed by Fairfax County Government and the County for five additional one-year terms, a period ending on **October 31, 2027**, if all renewals are exercised. All renewals are subject to the execution of a Stafford County Contract amendment.

4. Contract Pricing.
The County will pay the Contractor in accordance with the terms of the Payment paragraph below, at the prices set forth in **Exhibit B** for Work provided by the Contractor and accepted by the County.

Procurement Division
Phone (540) 658-8611
Procurement@StaffordCountyVA.gov

5. Payment.
Payment will be made by the County to the Contractor (1) after receipt by the Department of an invoice detailing the Services provided by the Contractor, and (2) after said Services have been accepted by the County. The Department will either approve the invoice or require corrections.

6. Purchase Orders.
County purchases are authorized only if a County Purchase Order is issued in advance of the transaction. The County will not be liable for payment for any purchases made by its employees without appropriate purchase authorization issued by the County Director of Procurement or designee ("Contract Officer"). If the Contractor provides goods or services without a signed County Purchase Order, it does so at its own risk and expense.

7. Non-Appropriation of Funds.
All funds for payments by the County to the Contractor pursuant to this Contract are subject to the availability of an annual appropriation for this purpose by the Stafford County Board of Supervisors. If funds are not appropriated for any fiscal year subsequent to the one in which this Contract is entered into, the Contract shall terminate effective at the end of the fiscal year for which funds were appropriated and the County will not be obligated to make any payments under the Contract beyond the amount appropriated for payment obligations under the Contract. The County will provide Contractor with written notice 30 days prior to the date of termination, but failure to give such notice shall be of no effect and the County shall not be obligated under this Contract beyond the date of non-appropriation.

8. Insurance Requirements.
The Contractor shall provide to the County Contract Officer a Certificate of Insurance in accordance with the insurance requirements of the Originating Contract.

In addition to the requirements in the Originating Contract, the County, its officers, employees, commissioners, officers, employees and representatives shall be named as an "Additional Insured" on the Automobile and General Liability policies and it shall be stated on the Insurance Certificate with the provision that this coverage is primary and non-contributing to all other coverage the County may possess. The Contractor agrees to maintain such insurance until the completion of this Contract or as otherwise stated in the Contract Documents. All required insurance coverages must be acquired from insurers authorized to do business in the Commonwealth of Virginia.

9. Contractor Status.
The Contractor is an independent contractor and neither the Contractor nor its employees or subcontractors will, under any circumstances, be considered employees, servants or agents of the County. The County shall not indemnify, defend against, hold harmless, or in any way be legally responsible for any negligence or other wrongdoing by the Contractor, its employees, servants or agents.

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Procurement@StaffordCountyVA.gov

To the extent any promise or term contained in this Contract, including any exhibits, attachments, or other documents incorporated by reference therein, includes an indemnification or obligation to defend by the County, that promise or term is stricken from this Contract and of no effect. Furthermore, the County will not provide to the Contractor any insurance coverage or other benefits, including workers' compensation, normally provided by the County for its employees.

10. Disputes.
Any dispute concerning a question of fact as a result of this Contract shall be decided by the County Administrator, or his/her designee, who shall render his/her decision in writing and mail or otherwise forward a copy to the Contractor within 90 days of the receipt of the claim. The decision of the County Administrator, or his/her designee, shall be final and conclusive unless the Contractor appeals the decision as provided in the Code of Virginia (1950, as amended). The Contractor may not institute a legal action, prior to receipt of the County Administrator's, or his/her designee, decision on the claim, unless the County Administrator, or his/her designee, fails to render such a decision within the time specified.

The Contractor's contractual claims, whether for money or other relief, shall be submitted in writing to the County Administrator or his/her designee, no later than 60 days after the final payment; however, written notice of the Contractor's intention to file such a claim shall have been given at the time of the occurrence or beginning of the work upon which claim is based. Nothing herein shall preclude the Contractor from submission of an invoice for final payment within a certain amount of time after completion and acceptance of the work or acceptance of the goods. Pendency of claims shall not delay payment of amounts agreed due in the invoice for final payment.

11. Governing Law, Venue, and Jurisdiction.
This Contract and its terms, including but not limited to, the parties' obligations, the performance due, and the remedies available to each party, are governed, construed, and interpreted in accordance with the laws of the Commonwealth of Virginia. Any jurisdiction's choice of law, conflicts of laws, rules, or provisions that would cause the application of any laws other than those of the Commonwealth of Virginia do not apply. Any and all disputes, claims, and causes of action arising out of or in any way connected with the Contract or its performance must be brought in the applicable court of Stafford County, or in the United States District Court for the Eastern District of Virginia, Alexandria Division.

12. Severability.
In the event that any provision shall be adjudged or decreed to be invalid, by a court of competent jurisdiction, such ruling shall not invalidate the entire Agreement but shall pertain only to the provision in question and the remaining provisions shall continue to be valid, binding and in full force and effect.

13. Non-Waiver.
No waiver of any provision of the Contract shall constitute a waiver of any other provision nor shall any

waiver of this Contract constitute a continuing waiver unless otherwise expressly provided.

14. Entire Agreement.
The Contract Documents set forth the entire agreement between the County and the Contractor. The County and the Contractor agree that no representative or agent of either of them has made any representation or promise with respect to the parties' agreement which is not contained in the Contract Documents.

15. Notices.
Contract administration of the Contract will be performed by the Contract Officer. Any questions pertaining to the Contract shall be directed to the Stafford County Procurement Office. Unless otherwise provided herein, all notices and other communications required by the Contract shall be deemed to have been given when made in writing and either (a) delivered in person, (b) delivered by an agent, such as an overnight or similar delivery service, or (c) deposited in the United States mail, postage prepaid, certified or registered, addressed as follows:

Contact information for the Contractor:
Columbia Telecommunications Corporation
Dba CTC Technology & Energy
10613 Concord Street
Kensington, MD 20895
Phone: 202-794-8949/ 301-933-3340
Email: Ziggy@ctcnet.us

Contact information for Procurement Office:
James DeLoatch
Stafford County Procurement Office
1300 Courthouse Road
P.O. Box 339
Stafford, Virginia 22555-0339
Phone: 540-658-8611/Fax: 540-658-5370
Email: Procurement@StaffordCountyVA.gov

Notice is deemed to have been received: (i) on the date of delivery if delivered in person; (ii) on the first business day after the date of delivery if sent by same day or overnight courier service; or (iii) on the third business day after the date of mailing, if sent by certified or registered United States Mail, return receipt requested, postage and charges prepaid.

16. Survival of Terms.

Procurement Division
Phone (540) 658-8611
Procurement@StaffordCountyVA.gov

Upon discharge of this Contract, terms and conditions related to Insurance, Indemnification, Disputes, Warranty, Notice, and Governing Law, Venue, and Jurisdiction shall continue and survive in full force and effect.

17. Counterparts.
This Agreement may be executed in one or more counterparts and all of such counterparts shall together constitute one and the same instrument. Original signatures transmitted and received via facsimile or other electronic transmission, (e.g., PDF or similar format) are true and valid signatures for all purposes hereunder and shall be effective as delivery of a manually executed original counterpart.

COLUMBIA TELECOMMUNICATIONS CORPORATION DBA CTC TECHNOLOGY & ENERGY	**BOARD OF SUPERVISORS OF STAFFORD COUNTY, VIRGINIA**
By: Joanne S. Hovis	By: Donna S. Krauss
Name: Joanne S. Hovis	Name: Donna S. Krauss
Title: President	Title: Deputy County Administrator
Date: July 6, 2021	Date: 07/06/2021

Virginia Smart Community Testbed Introduction

VIRGINIA SMART
COMMUNITY TESTBED
STAFFORD, VA

September 9, 2021

Funding for many of the technologies incorporated into the Virginia Smart Community Testbed has been provided by the U.S. Department of Homeland Security, Science & Technology Directorate, under contract number 70RSAT19CB0000025

Agenda

- Testbed Team Introductions and Roles
- Testbed Vision
  - Testbed Oversight Process
  - Community Resource – Downtown Stafford
  - Virginia Resource – Smart Communities
  - National Resource – Secure Digital Infrastructure
- Technology Baseline
  - Testbed Infrastructure
  - Extended Capabilities
  - Areas of Interest
- Discussion and Action Items

Testbed Partnership

The **Center for Innovative Technology (CIT)** and **Stafford County** are the Testbed's founding partners. **OST, Inc. (OST)** is the prime systems integrator and a founding partner. This public-private partnership makes up the Testbed Executive Committee.

CIT
CENTER FOR INNOVATIVE TECHNOLOGY

As part of the new Virginia Innovation Partnership Authority (VIPA), CIT accelerates next generation technologies and technology companies through commercialization, capital formation, and market development initiatives. The CIT Strategic Initiatives area focuses on defining and piloting emerging technology sectors that are important for economic growth in the Commonwealth. The Virginia Smart Communities Testbed is a key element of our Smart Communities initiatives, and provides a model and expertise for other communities seeking to adopt Smart Community technologies.

GO STAFFORD Virginia

Stafford is a smart place for innovation. Stafford will be the home for the development of smart and cyber technology in the Commonwealth and beyond. Smart Stafford will focus on improving the lives of our residents, businesses, and visitor experience. The Virginia Smart Community Testbed provides for technology that will nurture our diverse community. It will unlock critical new resources and foster business investments in Downtown Stafford. Learn more about Smart Stafford initiatives and Downtown Stafford.

OST

Based in McLean, VA, OST, Inc. (OST) is a systems integrator that has delivered innovative technology, project management, and consulting and engineering services for more than 20 years. Specializing in advanced technologies such as smart, cybersecurity, cloud, Artificial Intelligence (AI), Machine Learning (ML), predictive analytics, and data visualization, et al, OST consultants and engineers also optimize business processes and staffing to deliver a total business solution. As a strategic partner, OST provides systems integration services for Virginia Smart City Testbed (VSCT) in Stafford County, manages the Smart Airport Testbed at FAA's Tech Center in Atlantic City, and supports federal, state and local contracts for the Federal Aviation Administration (FAA), Department of Defense (DoD), Department of Homeland Security (DHS), Department of Energy (DOE), Federal Emergency Management Agency (FEMA), Commonwealth of Pennsylvania (PA), District of Columbia (DC), and others.

Stafford County and Downtown Stafford

- Downtown Stafford is an area off of Exit 140 envisioned as a new mixed-use urban and Smart development.
- The County has entered agreement for the first neighborhood called Fountain Park.
- The County will identify a private partner to develop 23 acres adjacent to Fountain Park.

CIT Role in the Commonwealth

Virginia Innovation Partnership Authority

Legal Authority of the Commonwealth

CIT
CENTER FOR INNOVATIVE TECHNOLOGY

Operating Not-for-Profit

Strategic Initiatives

CIT | Smart
CIT Smart Communities
https://www.cit.org/vasmart.html

SCITI LABS
https://www.dhs.gov/science-and-technology/st-smart-city-internet-things-innovation-sciti-labs

VIRGINIA SMART COMMUNITY TESTBED
STAFFORD, VA
https://www.cit.org/virginia-smart-community-testbed.html

Virginia Unmanned Systems Center at CIT
https://www.cit.org/unmanned-systems.html

OST Provides System Integration at Scale

Who We Are

OST
CONVERGING MISSION, INNOVATION, AND TECHNOLOGY

WHO WE SERVE

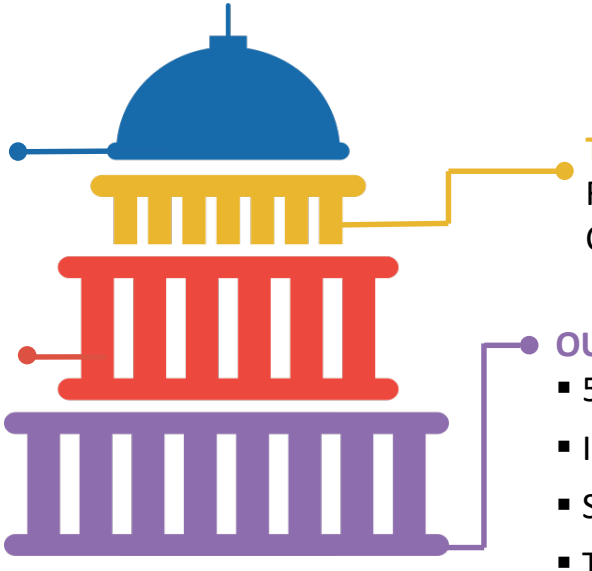
80% Federal Government
20% State and Local Government

CERTIFICATIONS & APPRAISALS

CMMI Level 5 | CMMI Service Level 3

ITIL V3-1 | DCAA Approved Accounting System

ISO:9001:2008 | ISO standards 27001, 20000, 10002



TOP SECRET
Facility
Clearance

OUR KEY POINTS

- 550+ Employees, 2000+ Total Staff
- In DMV for 19+ years
- Supporting Federal, State, Local
- Transformational and innovative solutions

Center of Engineering & Innovation

- Collaboration with R&D partners
- Capabilities:
  - Smart Infrastructure, IoT, Predictive Analytics, Artificial Intelligence, Deep Machine Learning, etc.

OST Provides System Integration at Scale

Our Core Capabilities

OST
CONVERGING MISSION, INNOVATION, AND TECHNOLOGY

Management Consulting & Strategic Innovation

We bring fresh, data-driven insights and apply a wide portfolio of tools to design programs and keep them on a ROI-positive trajectory.

Information Technology, C4ISR, Cyber

Help agencies reinvent delivery of their missions, improve customer service, maximize their ROI, and better plan for the future.

Research and Development & Engineering

We invest in understanding, and then integrate the best systems and solutions to meet our customers' challenges.

Smart Initiatives

We connect people, processes, data, and the environment through the Internet of Things (IoT) to realize the Smart City vision.

Managed Services & Staffing

We use advanced methods such as predictive analytics to simulate human capital management, and highlight risks that may have otherwise been overlooked.

Logistics

We provide cradle-to-grave solutions by forecasting future needs and enhancing the ability of our customers to meet performance requirements.

- AI/Machine Learning
- Data Fusion, Correlation & Visualization
- Anomaly Detection
- Cyber Security
- Asset/Resource Management

➢ Testbed Vision

Testbed Vision

https://www.cit.org/virginia-smart-community-testbed.html

Testbed Goals

- Virginia Smart Communities Testbed

  Direct Path: Testing to Implementation

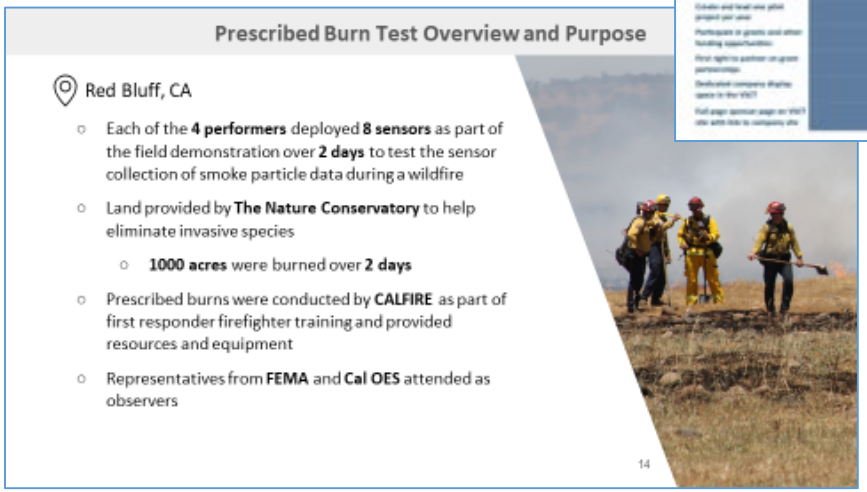
"Smart Stafford" new Town Center

https://www.youtube.com/watch?v=M9F875UnnrE&feature=youtu.be

- Demonstrate
- Educate
- Validate
- Transition
- Support
- Evolve

Testbed Oversight

- Executive Committee
- Types of Pilot Projects
  - Community Projects
  - Funded Projects
  - Sponsored Projects
- Contractual Agreements
  - Umbrella Agreement CIT-Stafford County
  - Pilot Projects and Sponsorships - CIT
  - Procurements – Stafford
  - Externally Funded projects – as appropriate



➢ Technology Baseline

Smart Community Testbed Connects Data to People

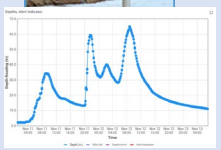
Collect

Connect

Converge

Correlate

Communicate

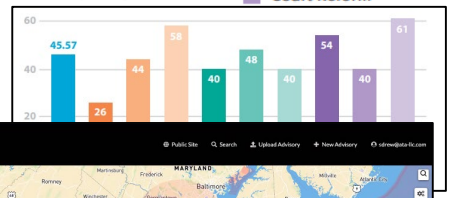


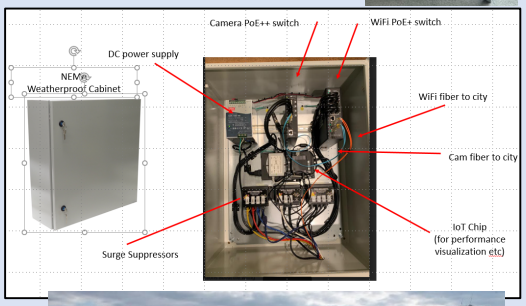
IoT Testbed Rack

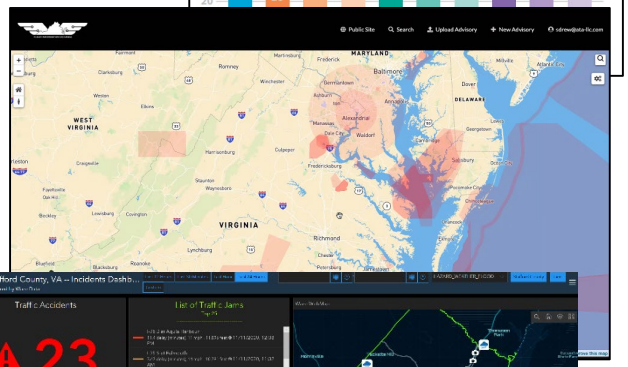
Commonwealth Data Trust

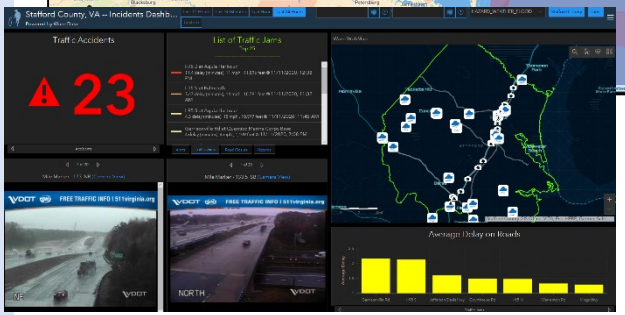
Overall City Score
Child Well-being
Education Quality
Educational Attainment
Financial Empowerment
Neighborhoods
Health and Safety
Policing
Court Reform

2018 Equity Scores







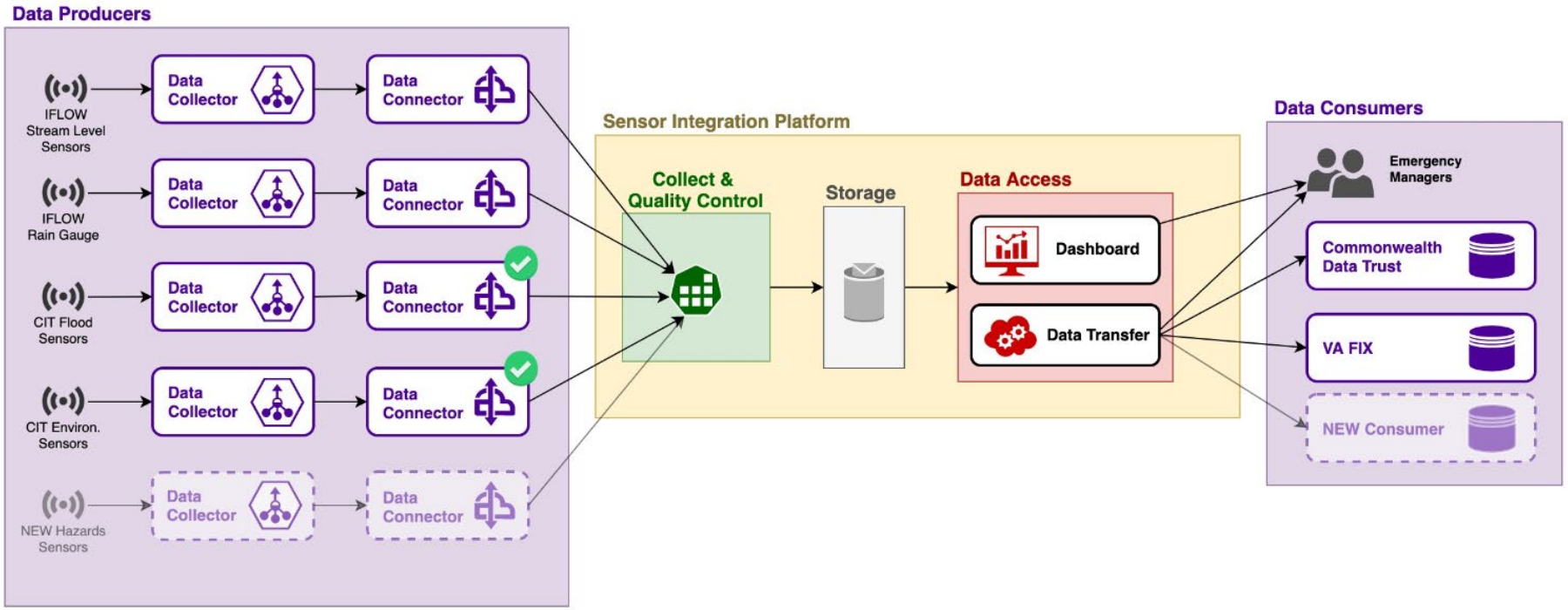


Security & Privacy

Smart Community Testbed Connects Data to People

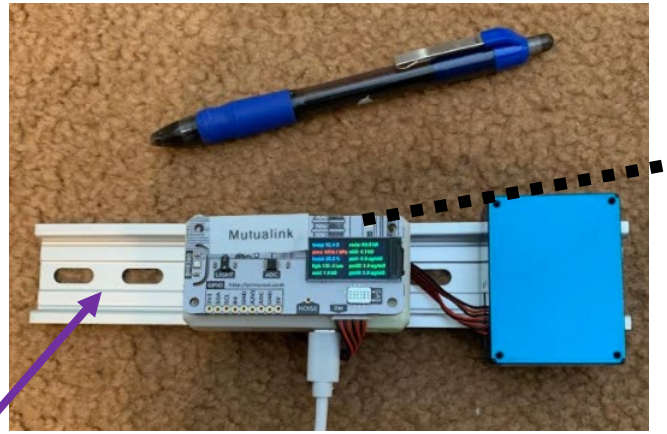
Data Flow Diagram

Initial Operating Capability



IoT Sensors Making Commercial Buildings Safer

IoT and Sensors



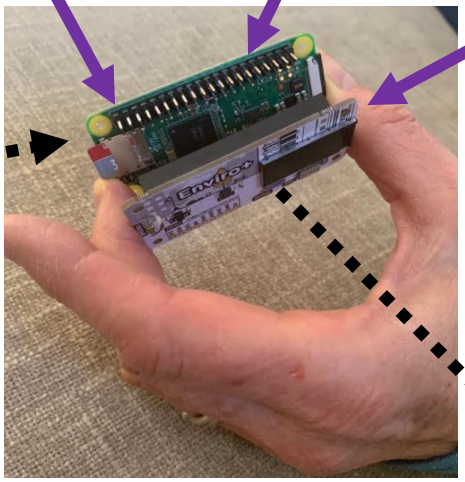
Any I2C Sensor goes here

BME280 temperature, pressure, humidity.
MICS6814 analog gas sensor
PMS5003 particulate matter sensor
LTR-559 light sensor
MEMS microphone
ADS1015 A/D convertor

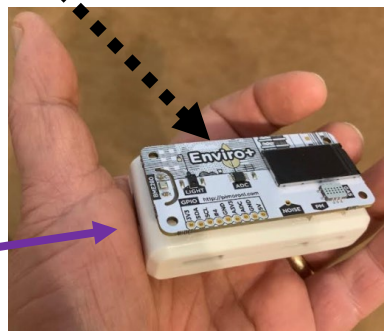
GPIO header

IoT board

Sensor DaughterBoard

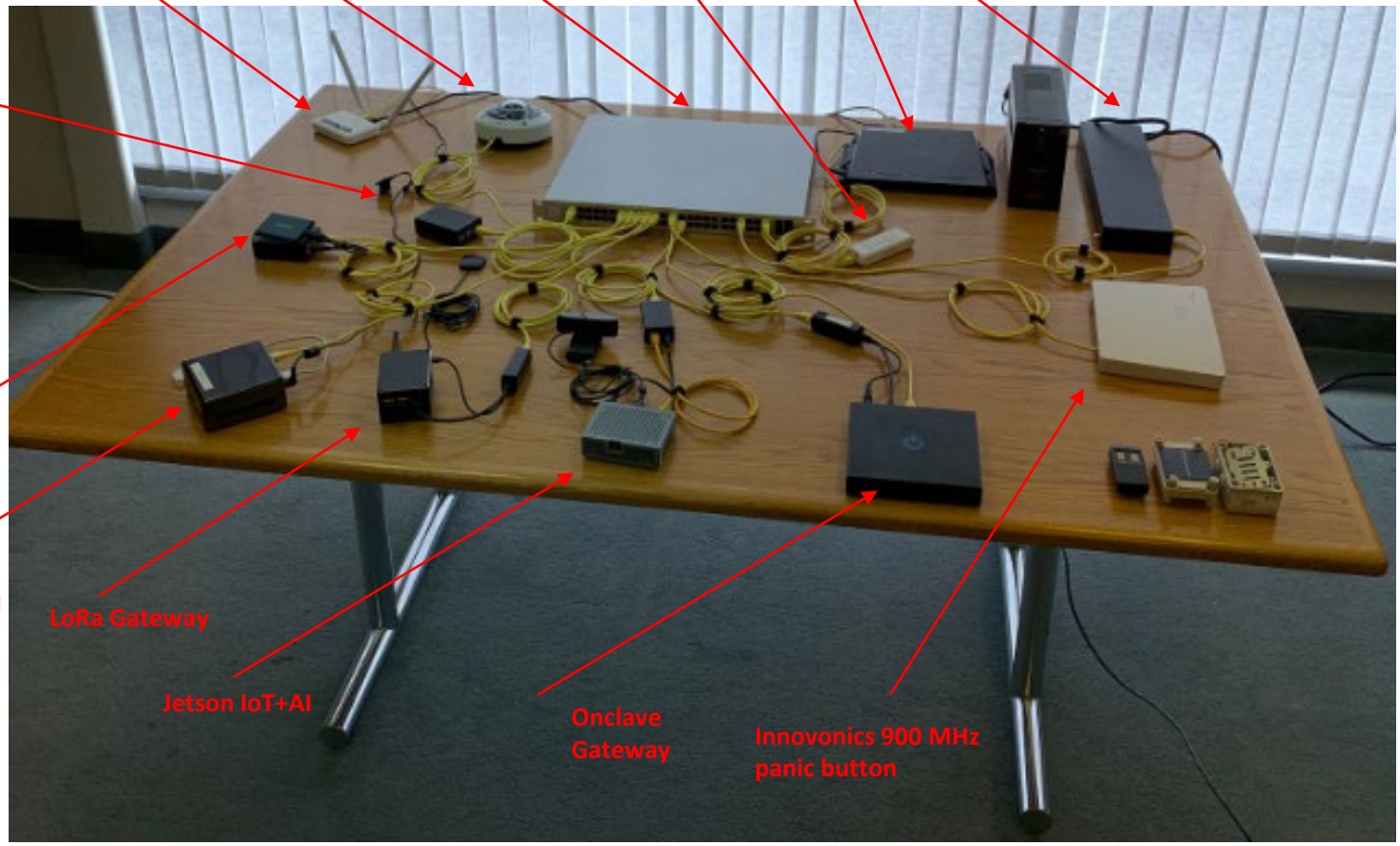


Enclosure



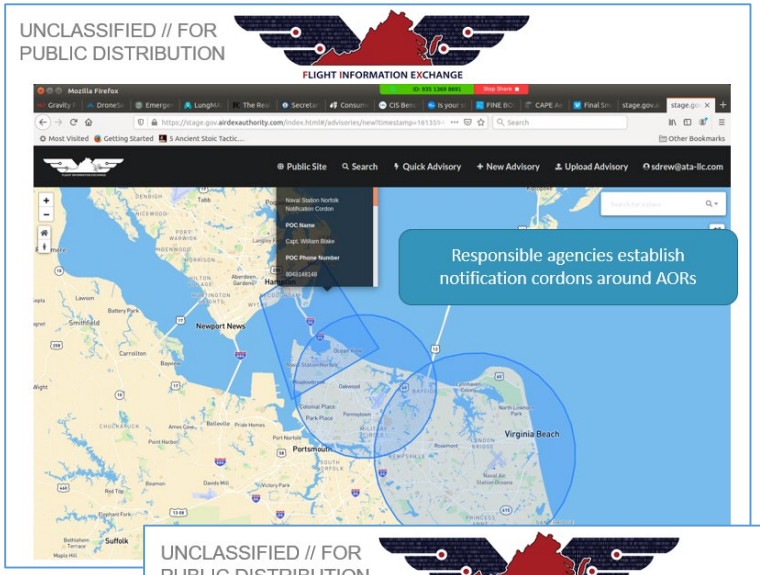
Smart Community Testbed Core Digital Infrastructure

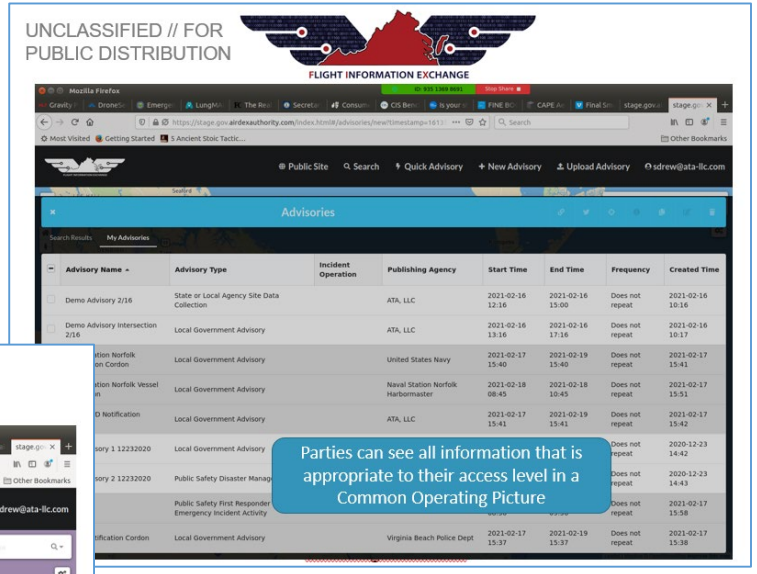
IoT Testbed Rack Breakout

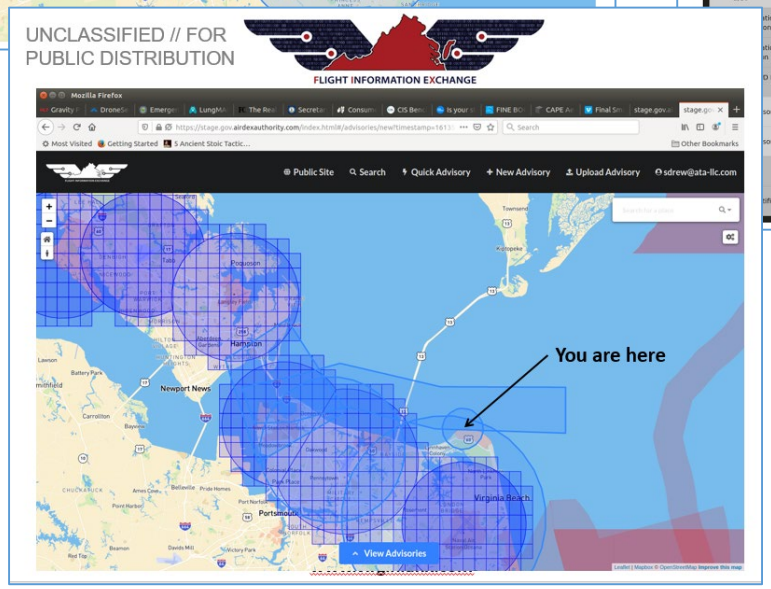


Drone Operations

Virginia Flight Information Exchange (VA-FIX)



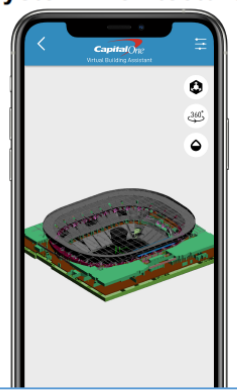


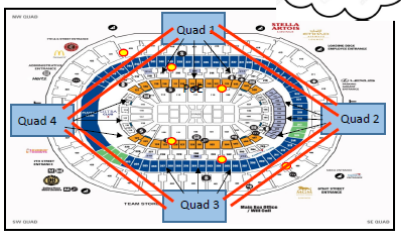


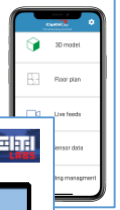
Smart Community Testbed Part of Living Lab Network

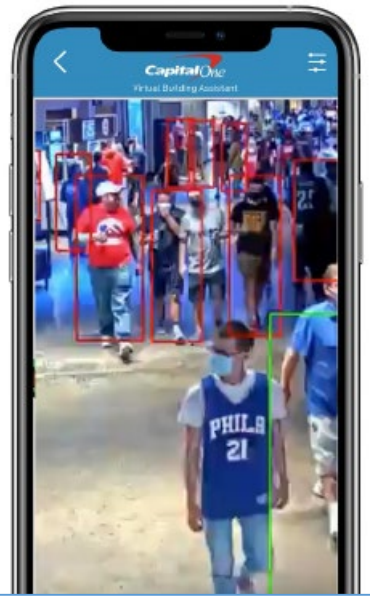
System Architecture:

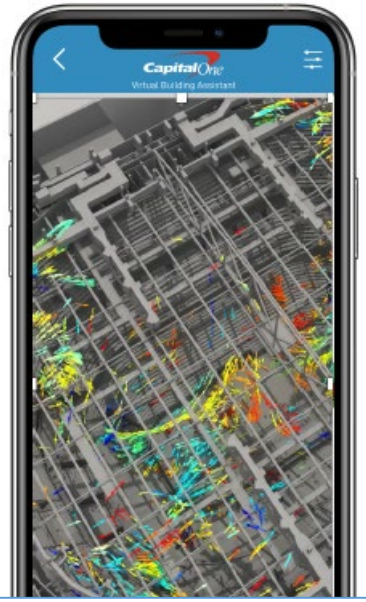
1. Sensor Pods
   (for data acquisition streamed via message queue)
2. VLAN Overlay
   (for data communications)
3. Cloud Platform
   (for streaming telemetry, visualizations, analytics and modeling)
4. Desktop / Mobile Apps
   (for user interface)





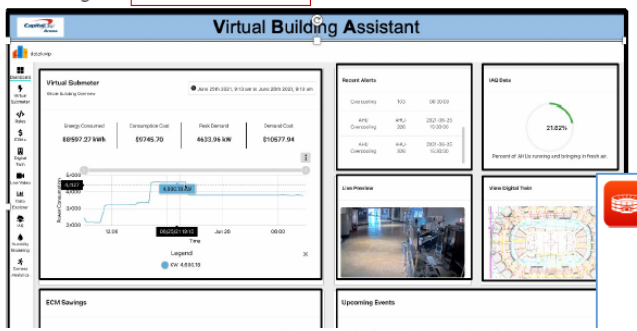


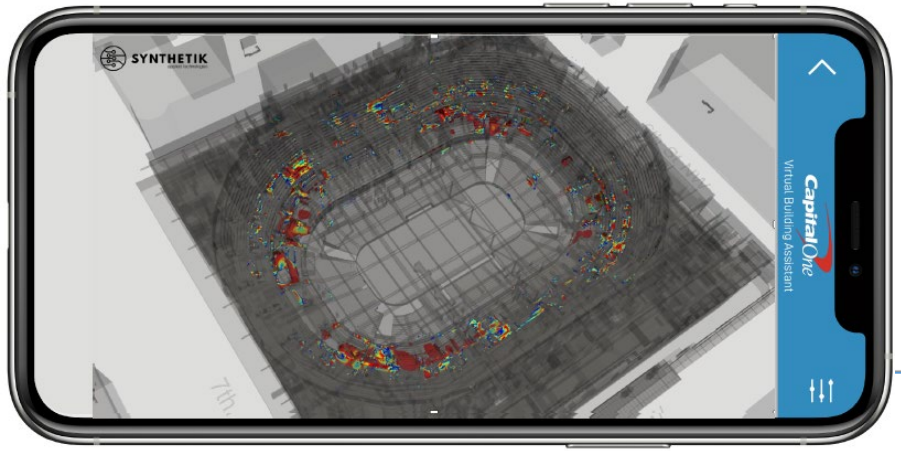




System Functions:

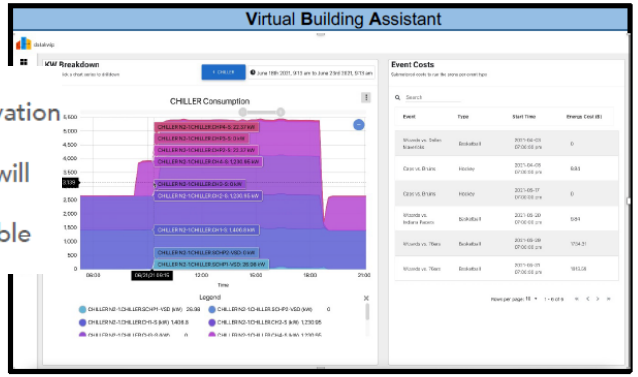
Building Monitoring | Building Performance | Building Safety





Testbed Use Case #1: Understand and predict performance/ costs

26 Energy Conservation Measures
Low and No Cost will save 1M$ annually
70% Savings possible



SYNTHETIK | datakwip | AKULAR | Mutualink | Smart City Works