San Antonio and Greater Bexar County Community Digital Equity Plan and Roadmap

Initiative Details: Infrastructure

August 2021

Disclaimer:

The information found in this portal is intended for public use. It reflects work produced and provided by the SA Digital Connects team and community members starting in January 2021 to the present.

Some information will reflect the moment in time when the work was done. Data, funding, maps and assumptions may fluctuate in the everchanging digital ecosystem.

Initiative Details

Infrastructure

Nature of the problem

Recall | Broadband Access varies significantly across zip codes

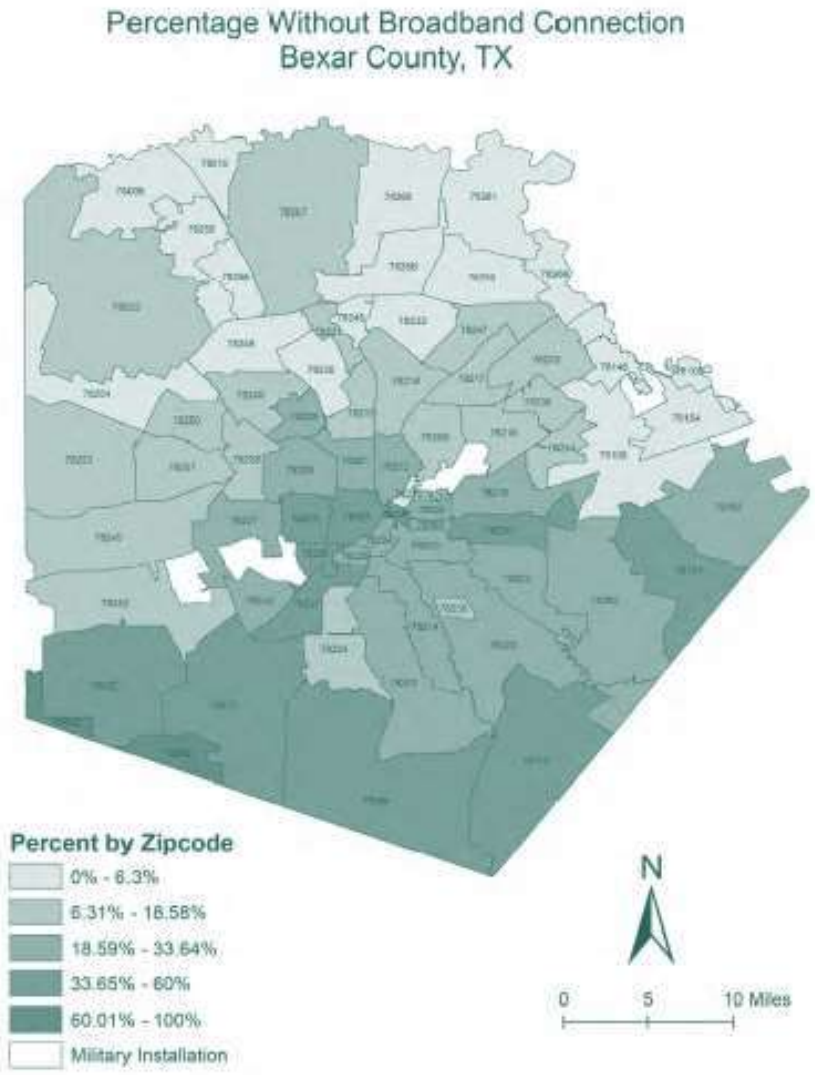


Figure 5: Percentage of Households without Broadband by Zip Code

Source: Digital Inclusion Survey and Assessment (2019)

The Southside and Westside of Greater Bexar County disproportionately lack access

Lack of Broadband Access by Zip (SASpeakUp)

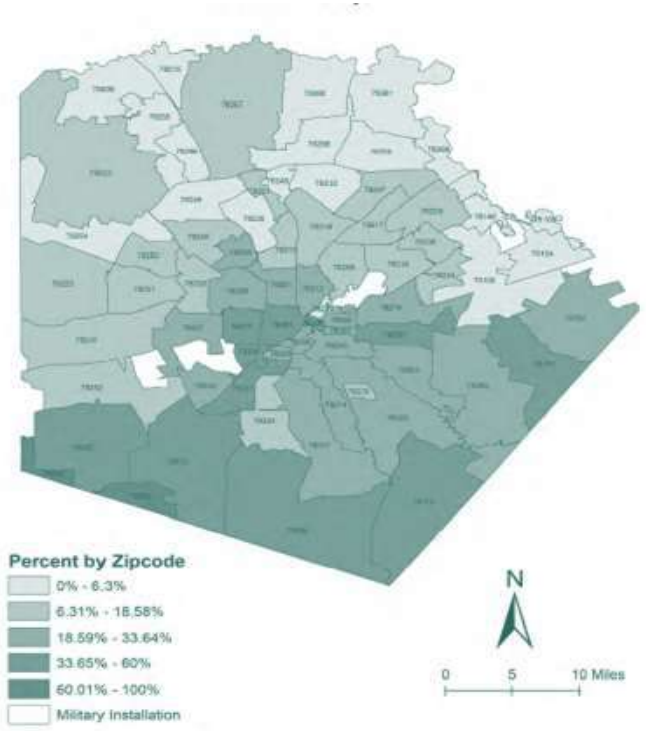
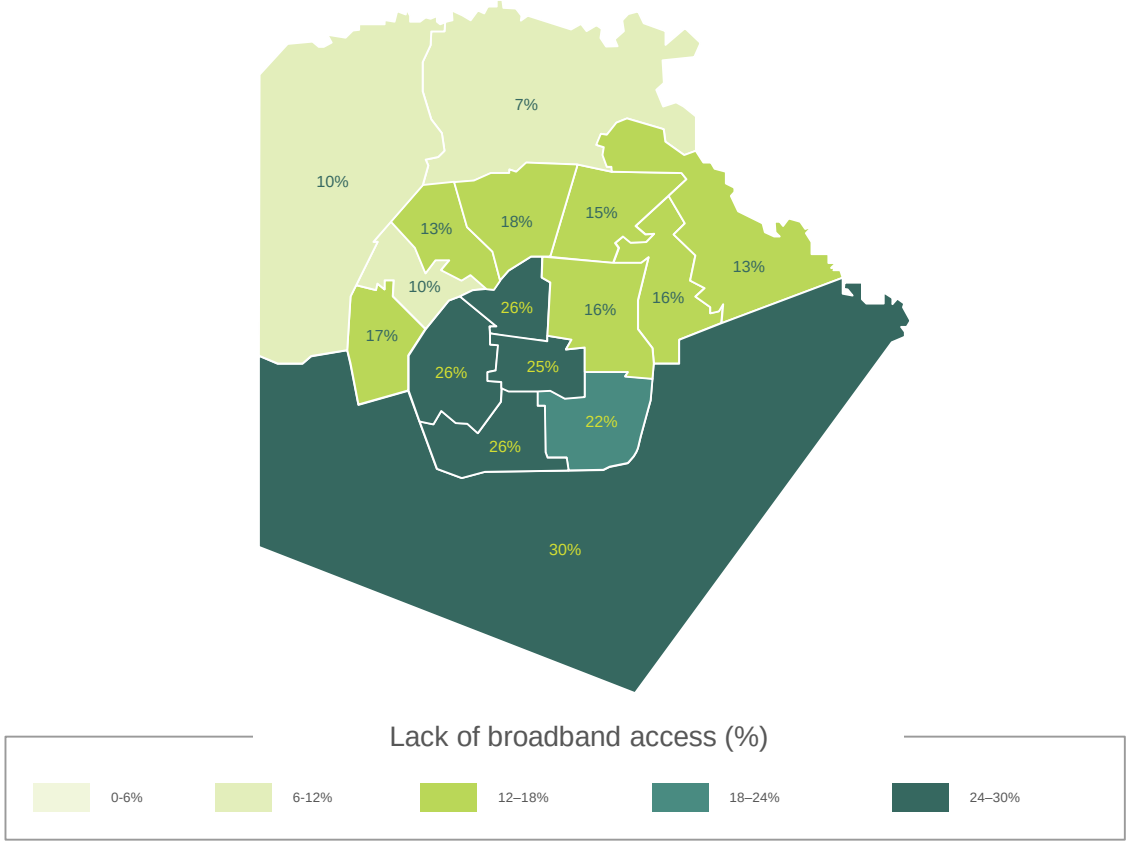


Figure 5: Percentage of Households without Broadband by Zip Code

Lack of Broadband Access by Census Tract (ACS)



Source: Digital Inclusion Survey and Assessment (2019); ACS High-Speed Broadband Data for Bexar County (2019)

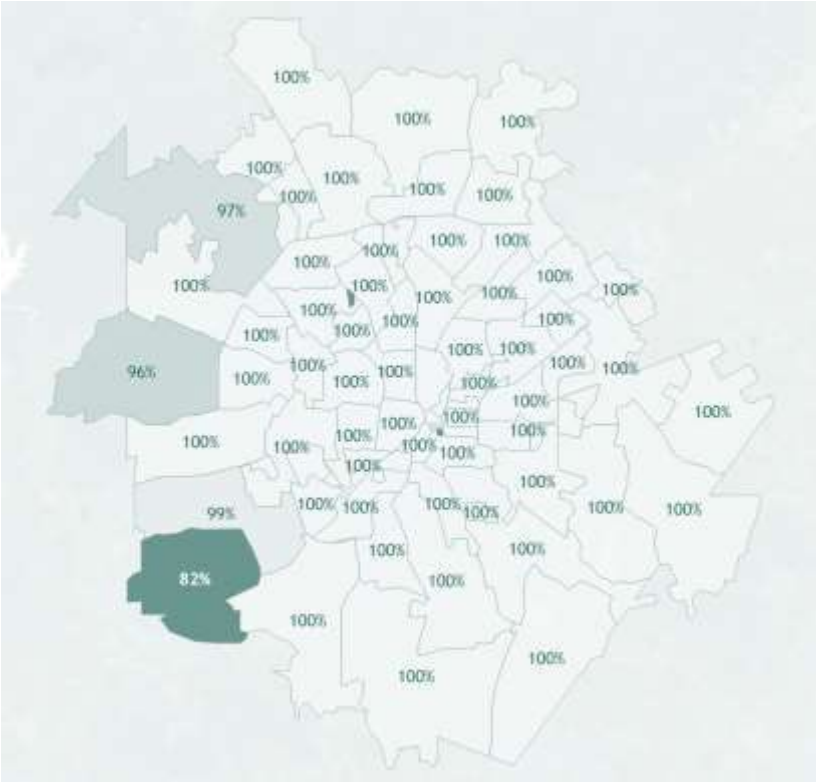
Average connectivity speeds experienced by consumers

Map based on Longitude (generated) and Latitude (generated). Color shows sum of Average Mbps. Details are shown for Zip. The data is filtered on County, which keeps Bexar.

Source: BroadbandNow - https://github.com/BroadbandNow/Open-Data ; https://broadbandnow.com/report/open-dataset-announcement/

Despite high reported infrastructure coverage in national data sources, lived experience shows gaps in actual service coverage and quality

While BroadbandNow shows average 99% coverage 100+ Mbps across Bexar …



Access to 100 Mbps+

82% 100%

… lived experiences tell a different story

> Some neighborhoods are still dealing with copper wire, meaning that if it rains they lose internet

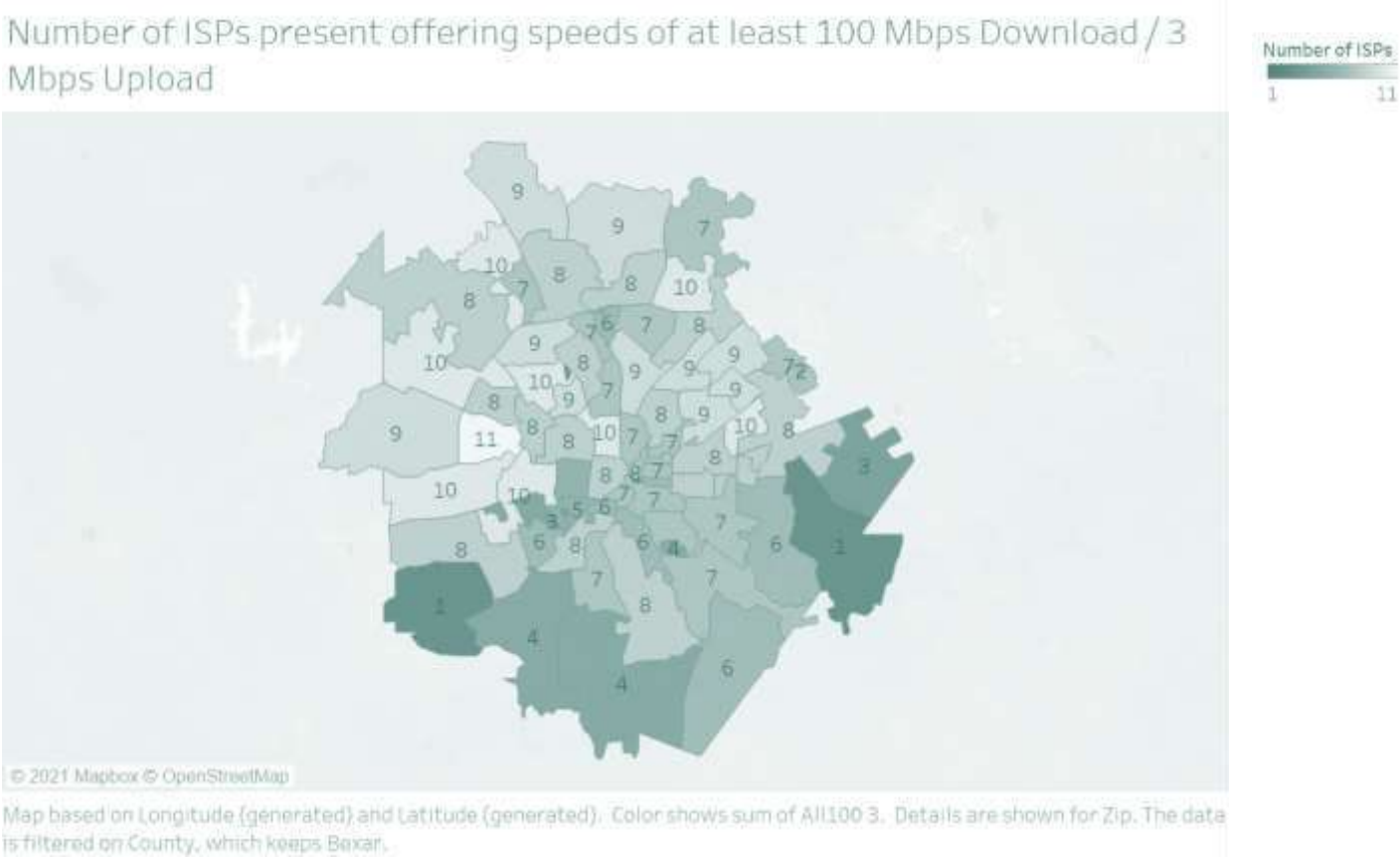
> Lack of adequate housing compounds access problems. Some roofs are so short you can't even put a booster on the house. Others are covered by tree canopies that block signal from reaching the home

> There's no shared definition of what basic service even means, so ISPs can claim coverage, but the quality of service isn't there

> A provider can service one house in a zip code and call it covered, but that does not mean every house is served

Some areas on the Southside are served by few providers

Number of providers offering speeds of 100+ Mbps

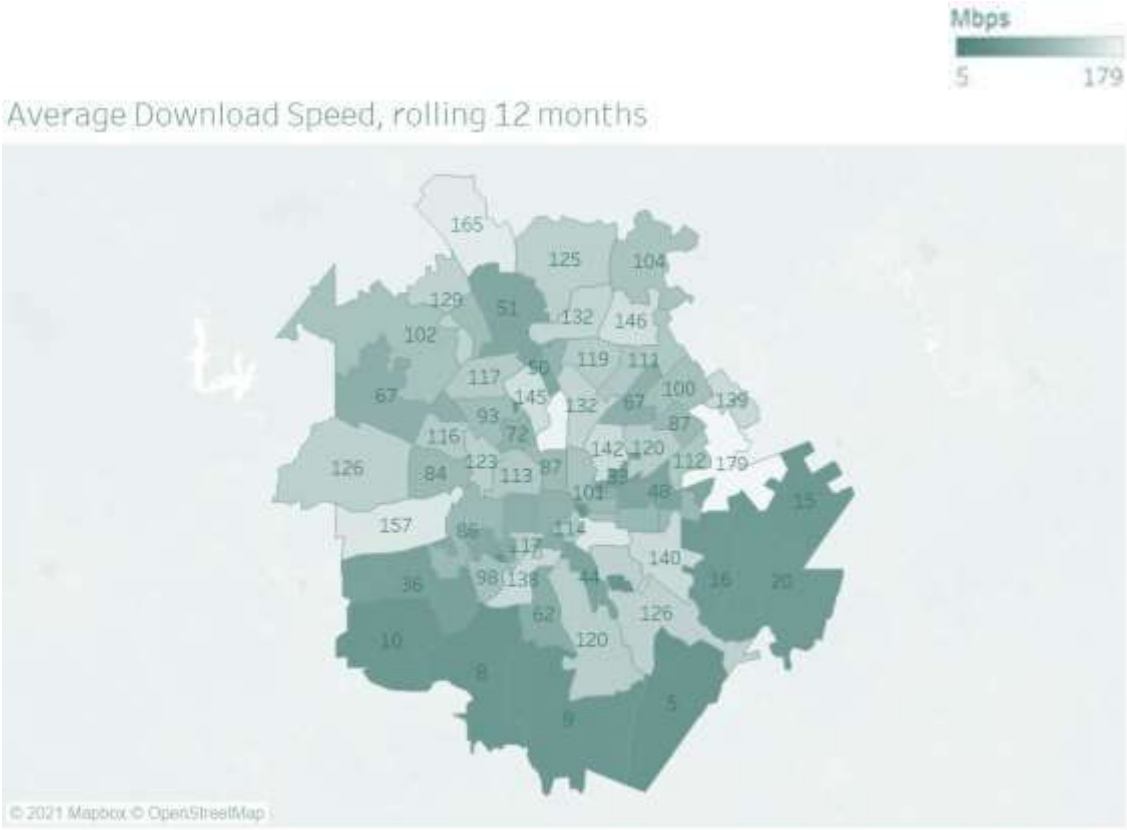


Implications for households

- In areas with only one provider, some houses may not be served at all
- Areas with limited provider choice often leads to challenges around affordability and cost of service

Source: BroadbandNow - https://github.com/BroadbandNow/Open-Data ; https://broadbandnow.com/report/open-dataset-announcement/

Experienced quality in many zip codes is inadequate for basic internet usage



Map based on Longitude (generated) and Latitude (generated). Color shows sum of Average Mbps. Details are shown for Zip. The data is filtered on County, which keeps Bexar.

Speed	Supported Users	Description
5 Mbps	<1	Unable to support basic internet usage (e.g., group Zoom calls, web browsing, messaging etc.)
25 Mbps	1-2	Supports basic internet usage (e.g., a zoom call)
100 Mbps	3-4	Supports basic and some premium internet usage (e.g., HD streaming)
200+ Mbps	4-5	Support ultra premium usage (4k video streaming, gaming, very large file download)

Source: BroadbandNow - https://github.com/BroadbandNow/Open-Data ; https://broadbandnow.com/report/open-dataset-announcement/

Several inputs give a directional understanding of where fiber exists today

Reported coverage from BroadbandNow

Reported % coverage

Number of providers

Average speeds

Coverage/service

Low High

Publicly available fiber lines

Zayo Fiber

Crown Castle

Fiber Light

Unite Private Networks

Source: BroadbandNow; Zayo; Crown Castle; Fiber Light; Unite Private Networks

Layered approximation of fiber coverage and number of households without access to fiber

Approximation of extent of fiber by area

Fiber availability

High | Medium | Low

Approximation of the number of households without access to fiber

Households without broadband access

<5k | 5-10k | 10k+

Source: BroadbandNow; SASpeakUp (2019); US Census (2021)

Comparison city research and local efforts

Preliminary

Key themes from infrastructure deployment (fiber)

An incremental approach to fiber deployment can ease financial burden of buildout on municipalities

- Danville, VA's community-wide fiber network (nDanville) connected businesses before residential, the more expensive segment to serve directly

For an open access network to succeed, having at least one established ISP on board from the beginning is critical

- New York's open access network partners with providers to install, operate, and maintain infrastructure and equipment

Making use of existing municipal fiber can significantly improve economic viability of deployment

- Colorado invested regional fiber network (Project THOR) leveraged 400 miles of existing municipal middle-mile fiber, significantly reducing costs

Local market context should determine whether municipalities pursue middle-mile v. last-mile access

- Seattle's initial attempt at a $2B city-wide fiber network was intended to deliver last-mile internet and services directly to households

Source: Seattle IT Department; NYC IT Department; Community Networks; Institute for Local Self-Reliance

Case study | Mont Belvieu offers model for legally building a public utility

Overview

Mont Belvieu proactively asked the District Court to address the issue of whether the city could run fiber direct to residents' homes

Mont Belvieu believed it was legally able deploy a community-wide fiber network as a public service. The court sided with the city

Mont Belvieu issued $14M in certificates of obligation (COs) to outside investors to fund the deployment of MB Link

MB Link was established as Texas' first municipally owned and operated gigabit internet utility, provides all residents gigabit internet service at $75/mo. with no data caps

Court reasoning

A municipal broadband network should be considered a public utility (e.g., electricity and water)

"Local exchange telephone service" excludes "non-voice data transmission service" (e.g., standalone broadband)

Fiber optic broadband does not qualify as a "basic telecommunications service"

Source: Community Networks; Institute for Local Self-Reliance; BroadbandNow

Case study | Open Access—Danville, VA

The city's public utility company (water, gas, electricity) launched nDanville, an open access network offering businesses/households speeds between 50 Mbps and 10 Gbps. The network is self-sufficient and returns $300k/year to the city in profit

Incremental approach

To mitigate risk and lower capex costs, nDanville slowly built out from least to most expensive segments to serve (i.e., from commercial to residential) over 11 years

Established first partner

Gamewood, nDanville's network operator, had an established presence that helped the city attract other ISPs to the network and support residential buildout with triple-play offerings (e.g., phone, internet, TV)

Dig once for future scaling

When permitting various construction projects, Danville includes laying fiber conduit to meet future data demand at scale

Community engagement/marketing

City goes into communities to hold meetings and distribute promotional material ahead of any network expansion to support word-of-mouth marketing and increase take rate

Takeaways

An incremental approach to fiber deployment can ease financial burden of buildout on municipalities

For an open access network to succeed, having at least one established ISP on board from the beginning is critical

Triple-play offerings are vital to retain residential customers who expect more than standalone internet

Source: Community Networks; Institute for Local Self-Reliance

Case study | Project THOR - Colorado

A group of local governments and private partners launched Project THOR, a middle mile fiber network providing backhaul to public facilities, schools, hospitals, and other community anchor institutions

Regional network

Multiple cities share both revenue and cost for deployment / maintenance in addition to aggregating demand across several localities, enabling THOr to charge prices at half the rate of competitors

Repurposing existing municipal fiber

Much of THOR network is made up of dark fiber segments sourced from carriers and public agencies, making the project affordable for the localities involved

Middle-mile access

Rather than enter the fiercely competitive last mile market, THOR's position in middle-mile allows the network to provide access across segments

Network redundancy

The THOR network's rung design prevents a single fiber cut from knocking an entire city offline, which has been a significant attraction to providers

Takeaways

A regional approach to fiber deployment can ease financial /operational burned of buildout on any single municipality

Making use of existing municipal fiber can significantly improve economic viability of deployment

Local market context should determine whether municipalities pursue middle-mile v. last-mile access

Source: Community Networks; Institute for Local Self-Reliance

LOCAL EFFORTS

Three distinct pilots underway, with Texas A&M SA providing support and evaluation across pilots

CBTC (COSA)

Leveraging existing ISD / COSANet network offer in-home connection via WiFi; current focus on 13K students in SAISD, Edgewood, and Harlandale

CBTC (City Education Partners)

Building a private LTE network on Edgewood's 10 gig circuit and small cells to offer in-home connection via routers

BiblioTech Connect Pilot (County)

Deploying a private LTE network with small cells on water towers to extend wireless service to homes for 100 Southwest ISD students

Evaluation/help desk (Texas A&M SA)

Providing continuous evaluation of pilots through data collection, interviews, and household surveys; piloting a help desk model to support digital adoption / skills

Preliminary

Many efforts are underway to expand broadband infrastructure

Key policies	Description
Connected Beyond the Classroom City Pilot	• Initiative to leverage and supplement existing ISP/municipal infra. and provide holistic support to connect 20K students; includes 8 ISDs, 3 ISDs and 13K students selected for pilots
BiblioTech District Pilot	• Initiative to offer free digital library services to children and families. Targeting 100 students; ~50 successfully connected to date
SAHA Public Housing	• Housing units are being retrofitted to accommodate public Wi-Fi, connecting 30K households
Operation Connectivity	• Statewide initiative since March to offer device and connectivity to students for free; commitment to support affordability and infra. build-out post pandemic
National hotspot programs	• Includes 10 GB/mo from Sprint 1 million; 100 GB/year from T-Mobile Project 10 million or 5 GB/mo through ConnectED
VIA Hotspots	• Transit authority set up free mobile hotspots though fleet of VIAtrans equipped with high-speed Wi-Fi networks

Preliminary

Local Efforts: Broadband Infrastructure

Organizations supporting this type of work

- Good Samaritan Community Services
- UT Health San Antonio
- YMCA of Greater San Antonio
- SAISD/AYVP/ Project SEARCH
- SAISD
- San Antonio Housing Authority
- Madonna Center, Inc.
- Alamo Colleges District
- City Education Partners

Examples of how orgs have supported this initiative

- We provide free public wifi at our properties – City Education Partners
- We have fund raised and built a private wireless network that extends a school districts existing Internet connection into the neighborhoods and households directly surrounding for school sites in Edgewood ISD – City Education Partners
- We have advocated for funding and the creation of a broadband plan in the Texas Legislature, and encouraged our members to do the same – San Antonio Chamber of Commerce

Source: survey of businesses and organizations in San Antonio (n=58)

Details | Progress update on CBTC rollout

	SAISD	Edgewood ISD (COSA)	Harlendale ISD	Edgewood ISD (CEP)
Fiber source	COSAnet	ISD fiber		ISD fiber (Conterra Networks)
Deployment	4 posts (fire station, radio tower, 2 libraries)—limited capacity/ capacity mgmt.	Point-to-multi-point from school to home		
Current state	Launched • Launched once SAISD could fund PMO • Slow adoption due to recent school breaks, awareness building on benefit vs. hotspots, manual sign-up process	Completed site assessments; awaiting approval to build		Launched • Live at 4 sites with only 12 students connected • Manual outreach processes has slowed adoption
Target reach	• 3 neighborhoods • 9K target students	• 3.2K students	• 2 neighborhoods • 800 students	• 800 students

Currently capacity constrained to 1.2K students

ISD using own funds to extend access to full district

Deep Dive | Connected Beyond the Classroom model

Benefits

- No data caps vs. ISP hotspot programs
- More cost effective ($8/mo cost vs. $50/mo ISP rack-rate)
- Addresses both availability and affordability

Limitations

- Lower avg speeds (15/1 mbps for City pilots; 25-50 mbps for CEP pilot) better for individual usage
- Localized deployment limits capacity, capacity management (e.g., on libraries, fire houses)
- Potential municipal headwinds expanding beyond students

CBTC offers model to get households from “none-to-some”, extending overage where none exists and offering services at an affordable rate (vs. existing options)

Learnings

Engage the community, district to support adoption and offer 1:1 support

Assess efforts for ROI

- CEP pilot: $325K investment for 800 students ($400/student)
- COSA pilot: $27M for ~13K students ($2K/student)

Consider structural aspects of deployment (e.g., 120 ft tower has the strongest coverage, able to cut through tree canopy)

Recommendation

Preliminary

1

Infrastructure solutions

Detailed recommendations

1A Develop a granular map (e.g., household, neighborhood level) to identify areas without adequate broadband infrastructure today

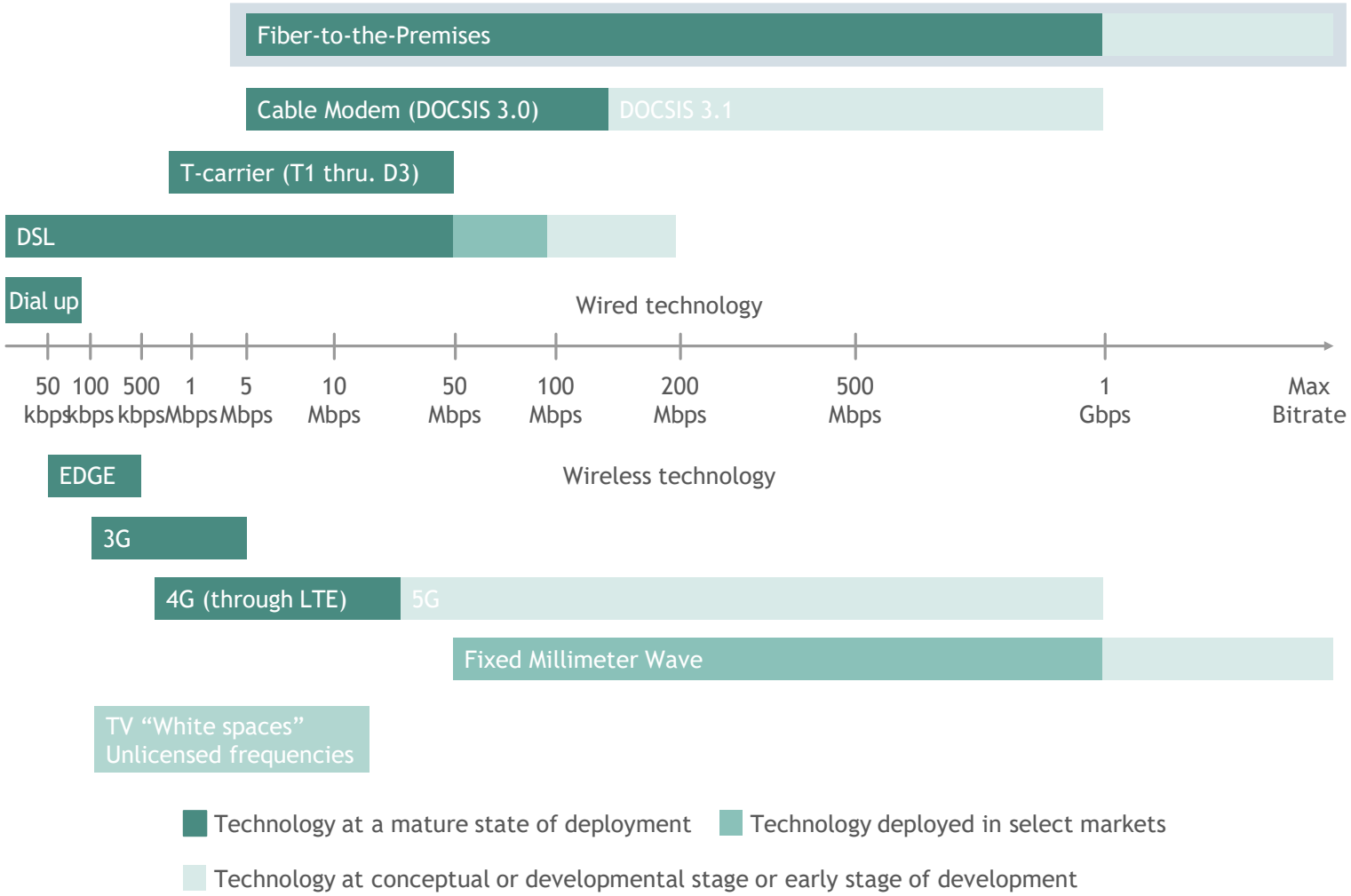
- Identify areas where fiber availability is insufficient, sufficient and affordable, or sufficient but unaffordable
- Identify other 'hard' assets (e.g., vertical assets, cell/radio towers) that could be leveraged to extend broadband infrastructure
- Conduct household speed tests to assess quality of service and internet speeds

1B Develop deployment and network design strategies, working collaboratively with internet providers that achieve key metrics (e.g., speed, reliability, cost)

- Partner with ISPs to identify and remove barriers to deployment (e.g., legacy copper) in unserved or underserved areas (fiber exists but unaffordable),
- Deploy municipal open-access network and lease to ISPs for residential service
- Define standards for adequate service quality to meet the needs of households (e.g., education, telehealth, online job applications)
- Utilize other financial and policy levers to incentivize ISPs to participate in deployment (e.g., grants, dig once, cost sharing, demand aggregation)
- In areas where fiber deployment is not feasible, determine and deploy the appropriate mix of alt. last mile tech (e.g., fixed wireless, mesh, satellite)

While ensuring universal access will require a **portfolio of solutions** based on service quality, cost, and local context…

… Fiber should be deployed where feasible given its maturity and speed potential



Source: Columbia Technology Corp. 2017

Key questions to inform fiber deployment

What areas lack access to affordable fiber today?

- What areas have no areas to fiber today?
- What access may have some fiber but lack affordable access due to low population density, competition?

What will it cost to deploy in each area?

- Whare middle mile costs are necessary?
- What last mile costs are necessary?
- How does this vary by population density?

What are the tools and resources do we have at our disposal?

- What federal, state and local funds do we have right to win?
- What laws and policies can enable deployment (e.g., circumventing municipal restrictions, capacity leasing)?
- What modes of demand aggregation can induce private sector engagement?

COSA/Greater Bexar has several tools at its disposal to engage ISPs and encourage fiber deployment

Illustrative, non-exhaustive

Fiscal levers

- Grants: Target federal funding applicable to broadband deployment (e.g., Broadband Infrastructure Deployment Grant, EDA Appropriation)
- Municipal bonds: Issue municipal bonds backed by COSA / BC assets to finance fiber deployment
- Cost sharing: Divide costs of fiber buildout between COSA / BC and ISPs to reduce financial burden
- CRA loans: Apply to receive bank loans under Community Reinvestment Act to finance deployment
- Demand aggregation: Combine service areas to favorably shift economics for ISPs and encourage investment

Policy levers

- Permitting: Ease ISP permit application requirements to expedite broadband expansion
- Open Access: Sell wholesale access of municipal network to ISPs who, in turn, offer retail services to residents
- Right of way: Allow providers to construct and maintain facilities in the right of public highways
- Dig once: Provide ready-made, buried conduits, enabling providers to more easily and cheaply install fiber

Source: BroadbandNow; Pew State Broadband Policy Explorer (2019)

Recall | Municipalities can also support middle and last mile fiber deployment in several ways

Municipal provider

Build infrastructure for city /county to own and operate and provide access directly to residents

- Mont Belvieu, Texas: Developed MB Link, Texas' first municipally owned and operated gigabit internet utility

Wholesaler/Open Access

Build infrastructure but lease/offer access to multiple providers for last mile delivery[1]

- Lincoln, Nebraska: Starting in 2012, laid 500 miles of fiber leased to 8 ISPs to become a Smart Gigabit Community

Lease-to-own/ sell off

Build infra. and transfer management to ISPs who split revenue and costs to deploy with municipality

- Oconee County, South Carolina: Entered 20-year lease-to-own agreement with OneTone for $6.3M

Grants

Auction grants where ISPs can bid to build broadband infrastructure, with relevant requirements

- Alabama: Provides grants to ISPs to build minimum threshold broadband service (25/3 Mbps) in unserved areas

1. There are a range of models of wholesaler and open access with varying degrees of retail competition. Source: Community Networks; Institute for Local Self-Reliance; BroadbandNow

Recall | Municipalities can also support middle and last mile fiber deployment in several ways

Municipal provider

Build infrastructure for city /county to own and operate and provide access directly to residents

- Mont Belvieu, Texas: Developed MB Link, Texas' first municipally owned and operated gigabit internet utility

Wholesaler/Open Access

Build infrastructure but lease/offer access to multiple providers for last mile delivery[1]

- Lincoln, Nebraska: Starting in 2012, laid 500 miles of fiber leased to 8 ISPs to become a Smart Gigabit Community

Recommended

Lease-to-own/ sell off

Build infra. and transfer management to ISPs who split revenue and costs to deploy with municipality

- Oconee County, South Carolina: Entered 20-year lease-to-own agreement with OneTone for $6.3M

Grants

Auction grants where ISPs can bid to build broadband infrastructure, with relevant requirements

- Alabama: Provides grants to ISPs to build minimum threshold broadband service (25/3 Mbps) in unserved areas

1. There are a range of models of wholesaler and open access with varying degrees of retail competition. Source: Community Networks; Institute for Local Self-Reliance; BroadbandNow

Recall | Considerations on choosing a path for fiber deployment

Municipal provider

Benefits

- Autonomy in deployment
- Highest demand aggregation
- Maximize use of existing municipal infrastructure

Drawbacks

- Potential legal conflicts
- Greatest ongoing financial burden on city
- Lacks ISP expertise, infrastructure and scale

Wholesaler/Open Access

- Minimizes friction of middle mile costs
- Fosters competition among providers
- Reduces prices through provider capex savings

- City bears financial burden of buildout and maintenance

Recommended

Lease-to-own/ sell off

- Encourages deployment while maintaining accountability
- Reduces up front investment hurdles

- May create financial risk for the municipality
- Requires a high degree of ongoing collaboration

Grants

- Fosters competition on innovation, customer service, and price
- Fully leverages ISP expertise and infrastructure

- Limited ability to drive accountability and ensure universal access
- Limited ability to change the provider economics model

1. There are a range of models of wholesaler and open access with varying degrees of retail competition. Source: Community Networks; Institute for Local Self-Reliance; BroadbandNow

How open access works

Owner
(Owns the Network)

Pays Bond

Funds Construction. Responsible for payment of bond or loan. Contracts with and pays operator. No direct contact with retailers or end users

Pays Flat Fee

Operator
(Runs the Network)

Pays Wholesale Fees

Hired by owner to oversee construction, maintain network and, on the part of owners, sell and support network service on a wholesale basis with retailers. All revenues are turned in to owner. Operator works with retailers and does not have direct contact with end users

Retailer
(Provides Consumer Services)

The retailer purchases raw transit on the network from operator and sells consumer services like Internet, telephone or TV to end users. Retailers market and brand. They do consumer sales and provide customer service

Pays for Service

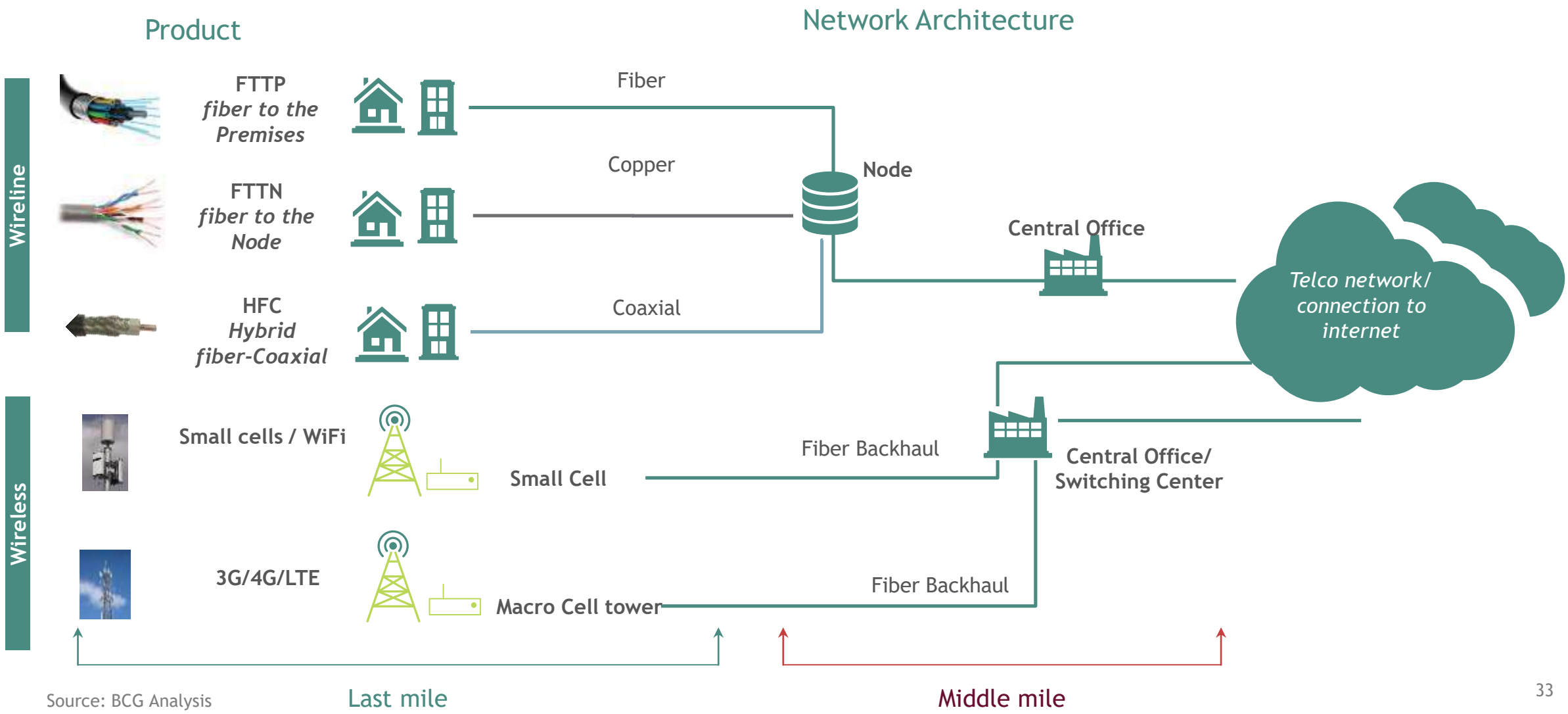
End User
(Gets Online)

The end user is the customer at the retail level, who buys services for their home or office. The end user gets bills and service from the retailer and may not be wholly aware of the owner or the operator

Residential customers are served on month-to-month terms. Business and Enterprise customers may have longer contracts up to 3 years

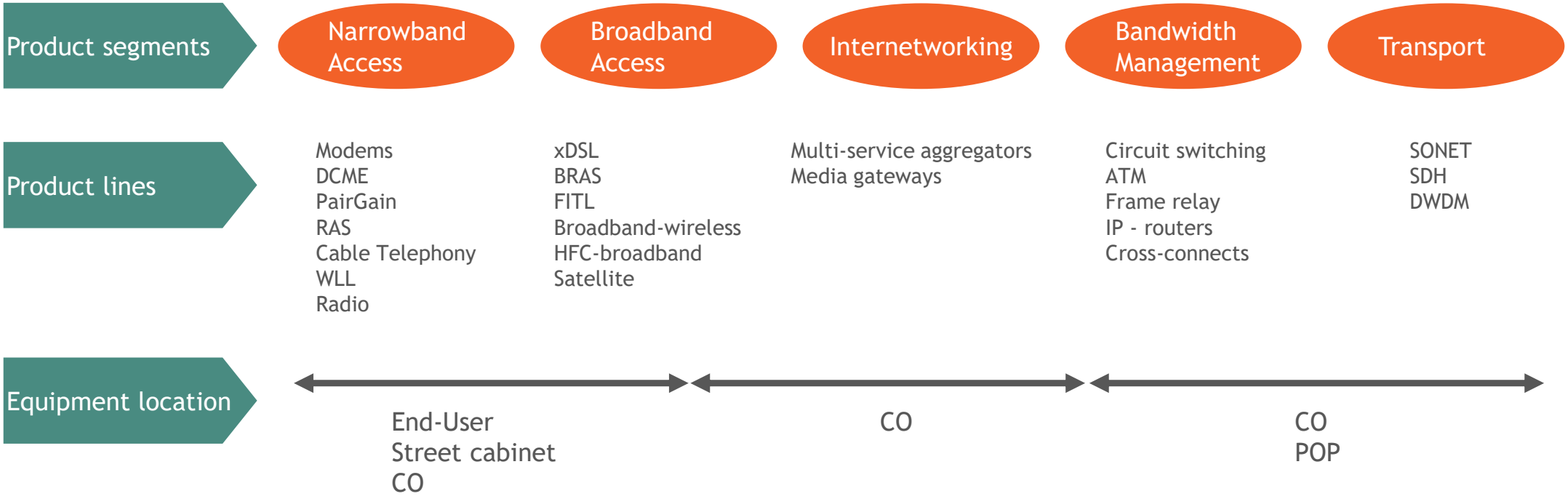
Source: Community Networks; Institute for Local Self-Reliance

Simplified version of telecommunication network to public internet



Source: BCG Analysis

A variety of equipment is required to deliver services from customer to core network



Range of open access models exist, with implications for ISP competition

Middle-mile only

Municipality builds and maintains fiber backbone and leases fiber to ISPs to build last-mile to homes and businesses

- Project THOR (CO): A group of local govt' and private partners provide backhaul to public facilities, schools, and hospitals

Build to commercial

Municipality builds/maintains fiber to individual businesses and leases out to ISPs who offer services (e.g., phone, internet) to customers

- Mount Vernon, WA: Started in 1995, fiber network serves government, schools, hospitals, and businesses

Build to residential

Municipality builds / maintains fiber to homes and leases out to ISPs who serve as sales & marketing to customers

- nDanville (VA): Open access fiber network serves businesses and households at speeds between 50 Mbps and 10 Gbps

Least competition from ISPs

Most competition from ISPs

Source: Community Networks; Institute for Local Self-Reliance

Recall | Several inputs give a directional understanding of where fiber exists today

Reported coverage from Broad band Now

Reported % coverage

Number of providers

Average speeds

Coverage/service

Low High

Publicly available fiber lines

Zayo Fiber

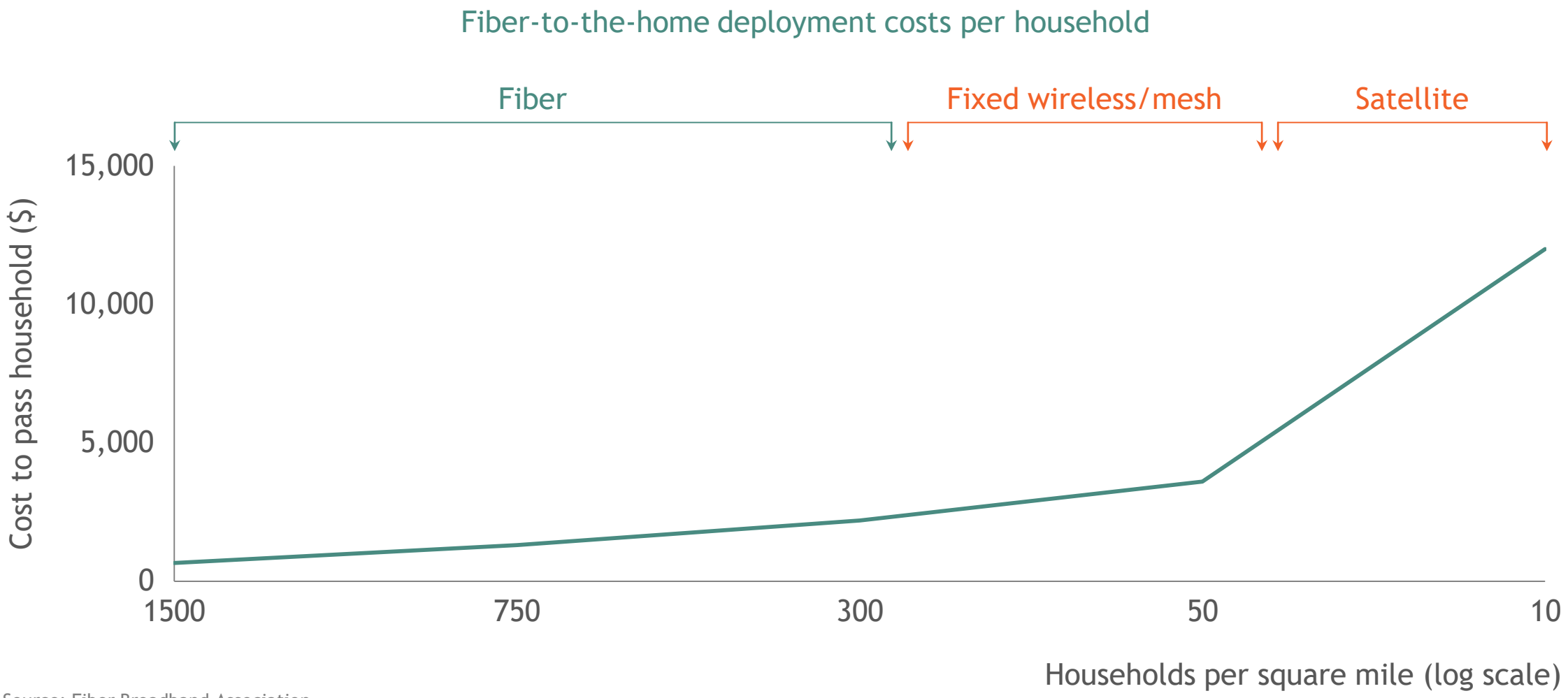
Crown Castle

Fiber Light

Unite Private Networks

Source: BroadbandNow; Zayo; Crown Castle; Fiber Light; Unite Private Networks

Other deployments should be considered where cost to deploy fiber not economically feasible



Source: Fiber Broadband Association

Three key alternative technologies to consider

5G point-to-multipoint (P2MP) fixed wireless

Delivers internet connectivity from the main access point to customer receivers via cellular networks

- Rocket Fiber—Detroit, MI: Delivers 1 Gbps P2MP connection shared among several multi-family residential units

Mesh network

Delivers internet connectivity via interconnected networks of devices acting as nodes

- SAHA Cassiano Homes: Delivers Wi-Fi to 1,800 residents over mesh network covering 50 acres

Low earth orbit (LEO) satellite

Delivers internet connectivity via fleet of low earth orbit satellites and customer antennas

- SpaceEx Starlink: Delivers internet to 10,000 customers through fleet of 1,500 LEOs

	5G P2MP	Mesh	LEO
Speed	Up to 100 Mbps	Up to 100 Mbps	50-100 Mbps
Reliability	High	Moderate	High
Range	3-5 miles	100-500 feet	250-1,000 miles

Speeds decrease with greater distance between customer receiver and base station

Source: Geolinks; High Performance Network Browsing; International Telecommunication Union; CNBC; BCG analysis

Considerations around deployment of each technology

	P2MP fixed wireless	Mesh network	LEO satellite
Deployment cost per household	$200-400 amortized cost for radio tower and equipment (e.g., base station, electronics)	~$50-100 for radio receiver/node placed on each home	$500-800 for antenna hardware / installation required for each home
Monthly household price for service	$40 to $100/mo.	$50 to $80/mo.	$60 to $150/mo.
Required proximity to fiber	Yes	Yes	No
Recommended usage	Dense urban/peri-urban areas where fiber trenching is not economically feasible	Short range/concentrated areas (e.g., industrial parks, university campuses, public housing) with excess capacity	Low density/rural areas with limited fiber availability
Recommended % of SA/ Bexar households covered	5-10%	<5%	<5%

Total of 20-30% of households covered with non-fiber solution

Source: Geolinks; BroadbandNow; GovTech; University of Glasgow; Department of Transportation; Fierce Wireless

Technology deployment will vary across San Antonio/Greater Bexar County

Potential deployments identified

Deployment type Fiber FWA + mesh Satellite

Categories for deployment

1

Fiber
Areas with sufficient pop. density (i.e., >250 hhds./sq. mile) to support last mile fiber deployment to homes/businesses

2

Fixed wireless/mesh
Areas with sufficient pop. density (i.e., 100-250 hhds./sq. mile) to support middle mile fiber deployment

3

Satellite
Areas with insufficient pop. density (i.e., <100 hhds./sq. mile) for fiber deployment for middle or last mile

Deployments for each technology will vary depending on available infrastructure funding and future unlocked fiber capacity

Source: BroadbandNow, 2020 US Census

Thank You