



NC Broadband Matters Zoomcast:

THE REAL COST OF FIBER

February 22

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The Real Cost of Fiber - Aerial Construction

Gene Scott

General Manager OSP

City of Wilson

Things to Consider when constructing a new fiber optic facility as all factors affect cost



- Who owns the poles: Pole ownership can affect cost due to permitting fees. These fees can be reoccurring each year for every attachment.
- Condition of the pole line: This will affect the make ready costs as factors such as height and class of pole, age of pole, can proper clearances be obtained (from other utilities on pole and over streets / highways), can pole be accessed by trucks or will it have to be climbed.
- Will your organization have the resources to maintain plant in house or will it be contracted out.



Considerations continued



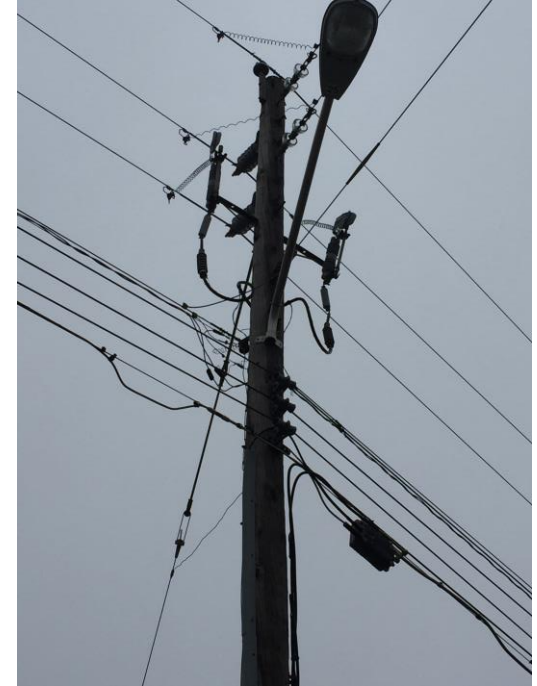
- Permitting Fees: pole attachment fees can range from \$5.00 to \$15.00 per attachment – per pole
- For example using 22 poles per mile and a single attachment \$110.00 to \$330.00 in fees could be incurred per mile each year.
- Make Ready Cost (cost to bring pole in compliance with NESC and / or owners specifications) to be able to make the new attachment vary widely. There may be no cost for some poles and considerable cost for others



Considerations Continued



- One actual example was a make ready charge of \$42,000.00 for seven pole attachments
- If trucks can access pole then speed of construction increases and cost per mile drops. If each pole has to be climbed by a lineman (mountainous areas for example) then production drops and costs increase
- Another permitting fee example would be railroad crossings. \$10,000+ to prepare and submit the required engineering drawings.



Examples of Aerial Construction Costs Materials and labor excluding Splicing Based on a 288F Cable



- \$15,420.00 to \$21,588.00 per mile for stand and lash method. Note – this type of construction would be located in the communications space on the pole.
- \$23,647.00 to \$33,106.00 per mile for ADSS construction. Note – Based on being constructed in the supply space on the pole.



THE REAL COST OF FIBER UNDERGROUND CONSTRUCTION

**GREG COLTRAIN – VP BUSINESS DEVELOPMENT
FEBRUARY 22, 2021**

Buried Fiber

- Fiber Count/Network Design
- Installation Labor
- Urban vs Rural
- Terrain
- Other Factors



- Size of Cable
- Placement of Electronics
- Active Network
- Passive Optical Network (PON)
- Splitter Types (32/16/8)

Buried Fiber

- Fiber Count/Network Design
- Installation Labor
- Urban vs Rural
- Terrain
- Other Factors



- In House vs. Contract Labor
- Davis Bacon (Prevailing Wage)
- Trenching, Plowing, Boring

Buried Fiber

- Fiber Count/Network Design
- Installation Labor
- Urban vs Rural
- Terrain
- Other Factors



- What Is In My Path
- Locates
- Permits
- Easements / Right of ways

Buried Fiber

- Fiber Count/Network Design
- Installation Labor
- Urban vs Rural
- **Terrain**
- Other Factors



- Mountain, Piedmont, Coastal
- Rock Boring (\$150-\$200)
- Steep Inclines
- Little to No Shoulder
- Clay, Swamp, Sand

Buried Fiber

- Fiber Count/Network Design
- Installation Labor
- Urban vs Rural
- Terrain
- Other Factors


RSN Buried Fiber Cost Per Mile Avg
\$28,000 - \$60,000 (Rural)



- Railways
- Bridges (Bodies of Water)
- Demand for Materials
- Demand for Labor
- Impacts of COVID-19

Drop and CPE Cost

- Avg Drop (175-250 ft)
- Optical Network Terminal
- Battery (8hr/20hr)
- Inside Wiring
- Wireless Router

- 
- Drop (\$1.25-\$1.95 per ft)
 - ONT (\$400-\$500)
 - Battery (\$35-\$65)
 - Wiring (\$375-\$450)
 - Router (\$65-\$150)

\$1,200-\$2,400 Per Cust.

Greg Coltrain

VP Business Development

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Questions?



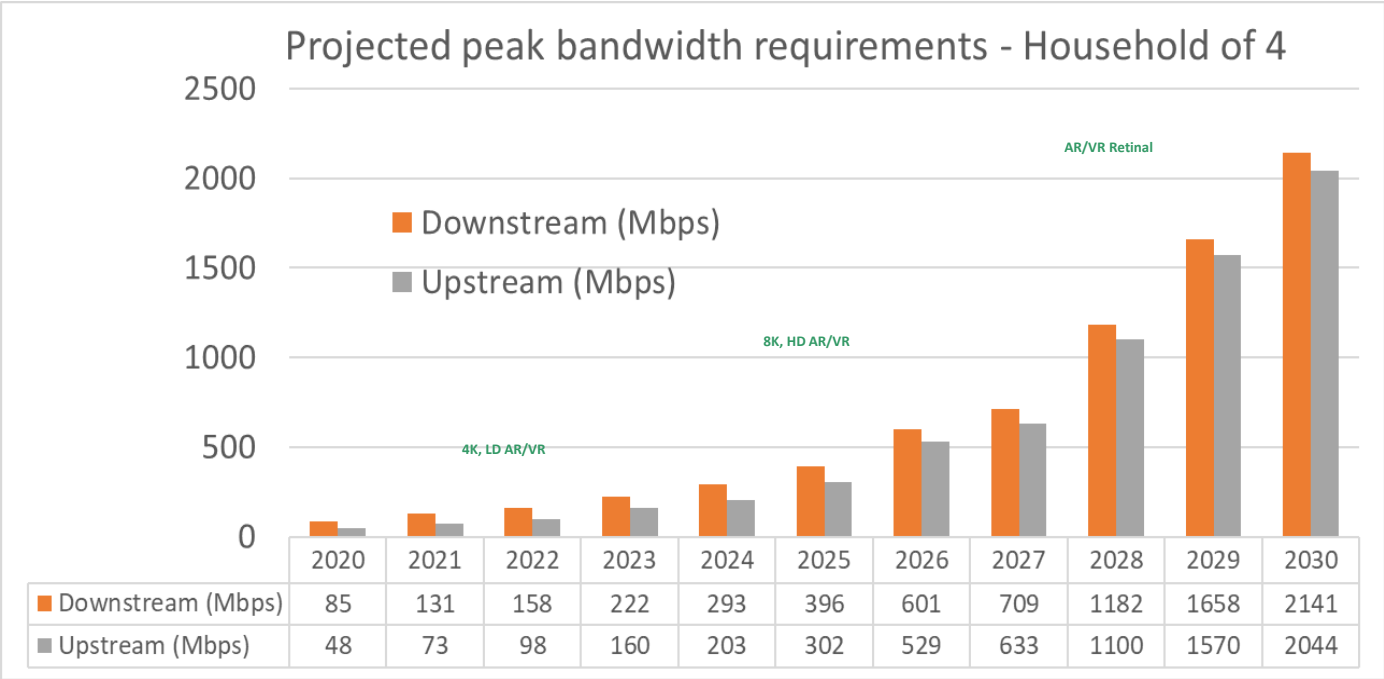
The Real Cost of Fiber – Additional datapoints

Mark Boxer

Technical Manager, Solutions and Applications Engineering

OFS

Demand continues to increase



FBA 2020 Technology Committee Analysis

Fiber is a long-lived asset



UNIVERSITY OF OULU

6G FLAGSHIP

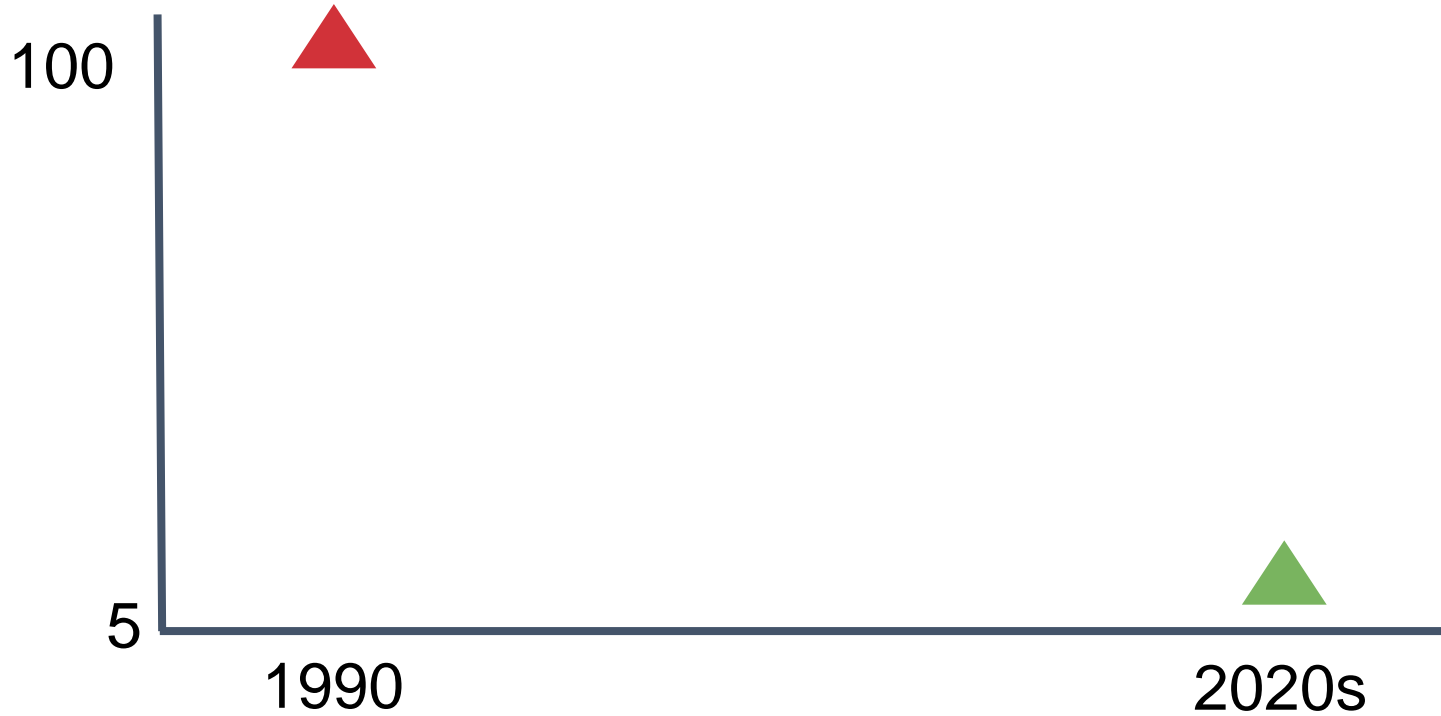
6G Flagship In Brief Events Research Ecosystem Join Us Contacts

Discover how 6G will change our lives

The image shows a screenshot of a website banner for "6G FLAGSHIP" at the University of Oulu. The banner has a dark blue background with a glowing, abstract shape in the center. The text "6G FLAGSHIP" is in the top left, and a navigation menu is in the top right. The main headline reads "Discover how 6G will change our lives".

Fiber stands the test of time.

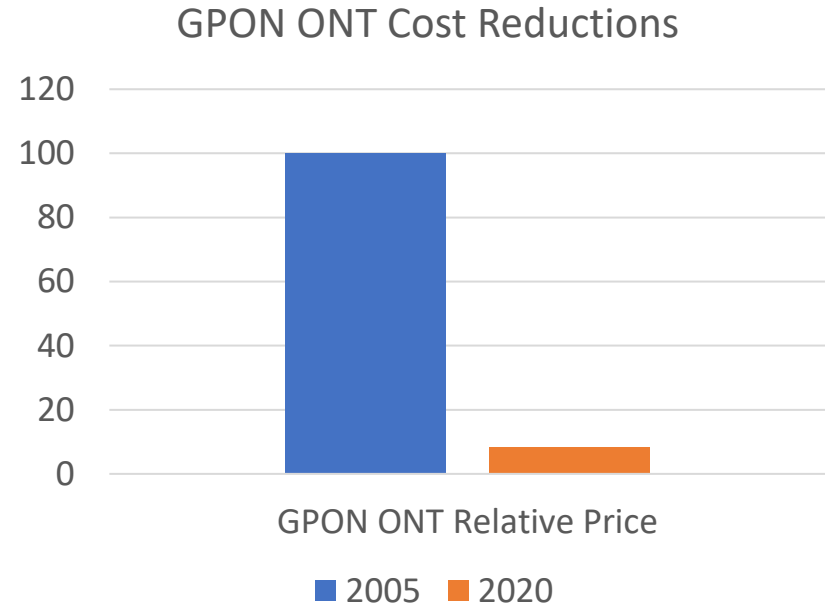
Price of fiber



Additional cost improvements over the years



- GPON ONT (device that converts light to electricity at the home) Cost reduction by 90+%
- Adoption of fiber optic ribbons – requires 1/12th the splicing
- Plug and play pre-connectorized connections reduce installation time
- Splicer machine cost reductions by 67% from 2000s



Fiber is rugged and reliable



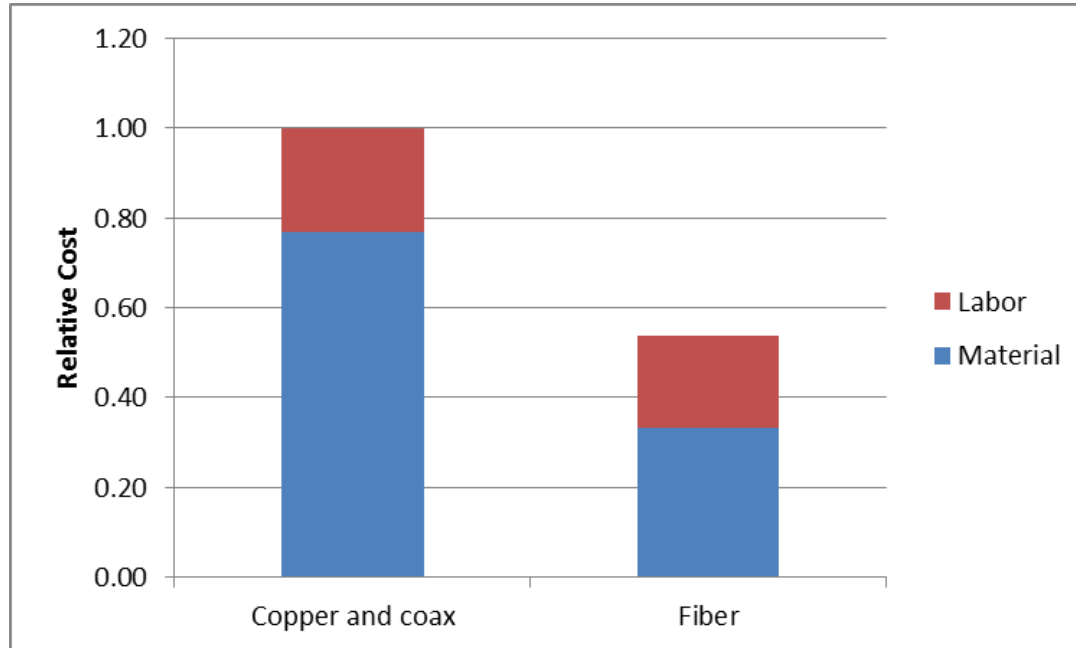
- Ultra bend insensitive fibers enable deployments previously in areas previously unattainable by fiber

Fiber is less intrusive and easier to install



Cost comparison

Metal cables vs. fiber in a building



NRTC experience – 36 electric coops



Rural Electric Cooperative Broadband Benchmarking Report

Results and insights from a comprehensive data gathering exercise

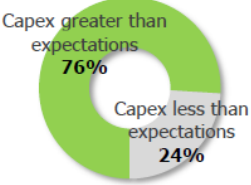
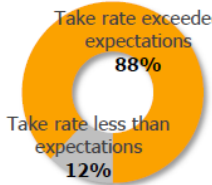
November 10, 2020



Deployment statistics and cost/revenue metrics

	Miles	Sites	Homes	Take Rate	ARPU ⁽²⁾
Min	50	6	3K	11%	\$45
25th % ⁽¹⁾	1,100	25	12K	43%	\$60
50th %	2,000	50	23K	46%	\$74
75th %	3,050	74	32K	52%	\$92
Max	14,000	825	285K	80%	\$130

	Capex per mile					IRR
	Aerial	Make Ready	Under-ground	Capex/ Drop	Total Capex	
Min	\$13K	\$0.6K	\$24K	\$400	\$5M	1%
25th %	\$17K	\$1.4K	\$36K	\$834	\$29M	8%
50th %	\$20K	\$2.5K	\$49K	\$1,385	\$65M	10%
75th %	\$26K	\$3.8K	\$59K	\$2,051	\$84M	13%
Max	\$33K	\$12.0K	\$120K	\$3,200	\$176M	14%



(1) Represents the 25th percentile; (2) Residential ARPU

Case study – Gibson EMC, Western TN/KY



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Gibson Connect Wi-Fi Hotspots
This map was created by a user. Learn how to create your own.

The map displays a geographical area in Western Tennessee and Eastern Kentucky, including cities like Jackson, Lexington, and Paris. Numerous green Wi-Fi hotspot icons are scattered across the region, indicating the locations of internet service points.

Case study – Gibson EMC, Western TN/KY



- 21 communities, 12 counties, no WalMart
- Service area includes 13th poorest county in the nation

The screenshot shows a video player interface. On the left, there are three small video thumbnails of speakers. The main content is a slide with the title "Building Out Fiber to Rural Communities". The slide lists details for Gibson EMC and Gibson Connect, LLC. A red box highlights the Gibson EMC statistics. The Gibson Electric Membership Corporation logo is also present, along with a photo of a rural farm scene. At the bottom of the slide, there is a "Fiber Broadband" logo. The video player controls at the bottom show a play button, a progress bar at 15:15, a total duration of 32:44, and volume and full-screen icons.

Building Out Fiber to Rural Communities

Gibson EMC

- 39,000 meters
- 3550 miles of distribution
- 18 substations, 21 communities, 12 counties

Gibson Connect, LLC

- Phase 2 of 5 under construction
- 1000 miles of cable constructed
- 5000+ service drops/customers completed
- Connecting 80 new subscribers per week
- GPON-Distributed split infrastructure with 32:1 split
- Power space install
- Triple play services

Gibson Electric Membership Corporation
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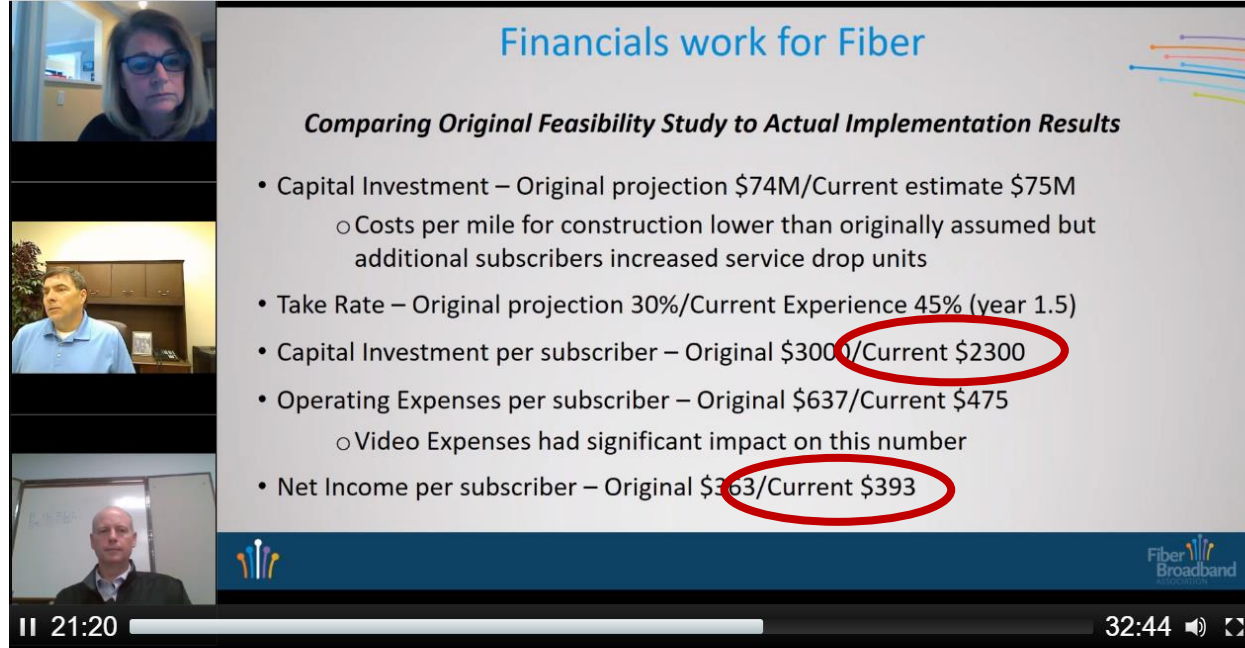
Fiber Broadband

|| 15:15 32:44

Fiber for Breakfast, Week 10_Building out Fiber Networks to Rural Communities.mp4

Gibson EMC - Tennessee

- 40% subscription rate
- \$18,000/mile construction costs (material + labor)
- Opex – driven significantly by video expenses



Financials work for Fiber

Comparing Original Feasibility Study to Actual Implementation Results

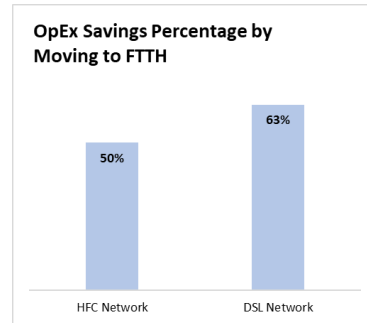
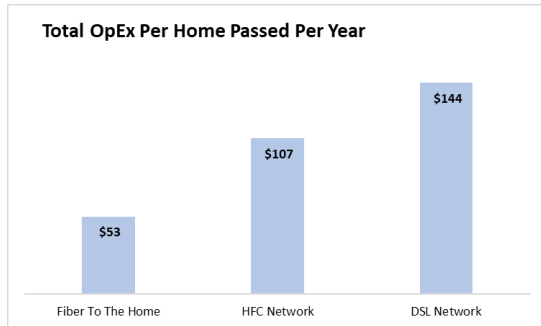
- Capital Investment – Original projection \$74M/Current estimate \$75M
 - Costs per mile for construction lower than originally assumed but additional subscribers increased service drop units
- Take Rate – Original projection 30%/Current Experience 45% (year 1.5)
- Capital Investment per subscriber – Original \$3000/Current \$2300
- Operating Expenses per subscriber – Original \$637/Current \$475
 - Video Expenses had significant impact on this number
- Net Income per subscriber – Original \$363/Current \$393

Video player controls: || 21:20 | 32:44 🔊 🗄

Fiber for Breakfast, Week 10_ Building out Fiber Networks to Rural Communities.mp4

Cost comparison – OpEX and Reliability

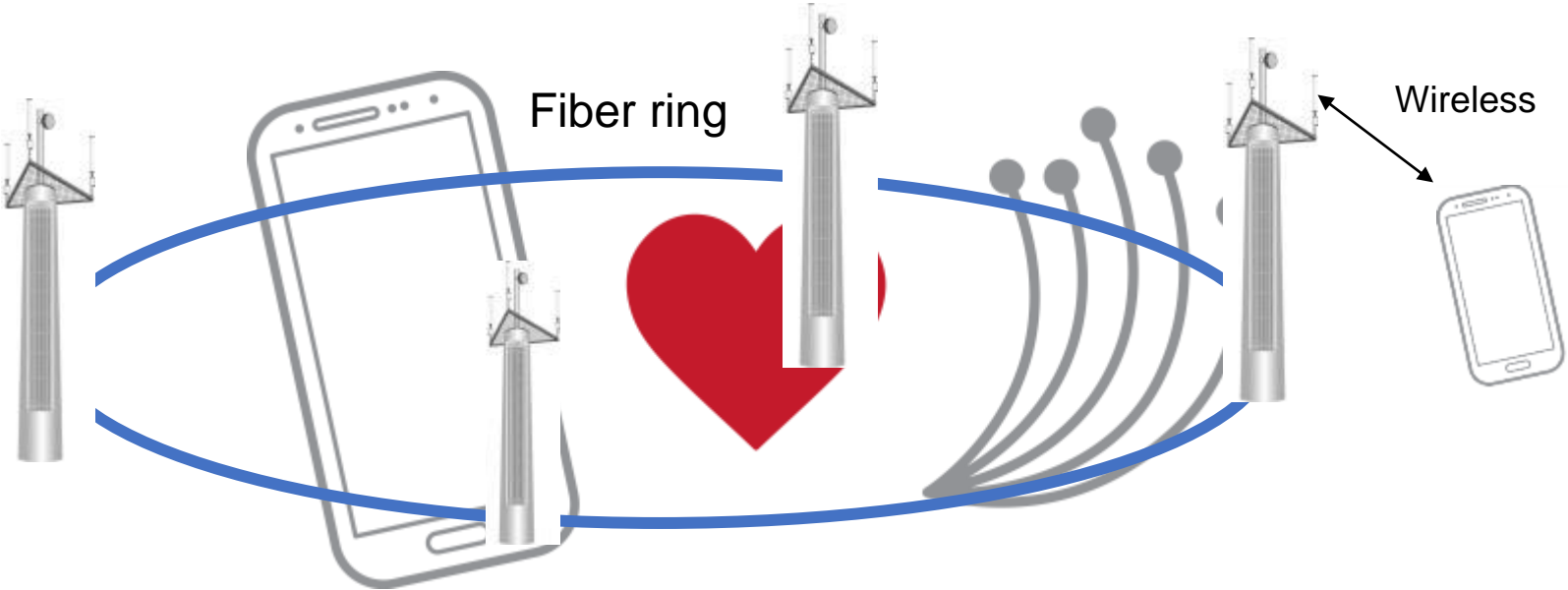
- Fiber networks are lower cost to operate
- Lower powering, churn, customer support calls than coax or copper
- Limited data on wireless
- No data on high speed satellite



Hypothetical powered items in a 40 Km area. Each powered item is a potential network failure point.

Source: FBA, Operational Expense in Access Networks paper, 2020

Wireless loves fiber – each does a different job



(and vice versa)

Total cost of ownership – fiber and wireless



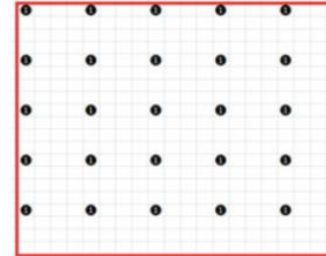
*to go from 3G to 4G requires 25X more fiber
and 5G requires at least 16X more fiber*

- Bandwidth decreases with distance from the wireless site
- More bandwidth requires closer wireless site spacings
- More wireless sites require more fiber to feed them



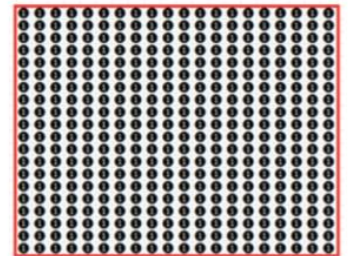
3G

1 site every 10 km
Cell density is 1 cell /
100 sq km



4G

1 site every 2 km
Cell density is 25 cells /
100 sq km

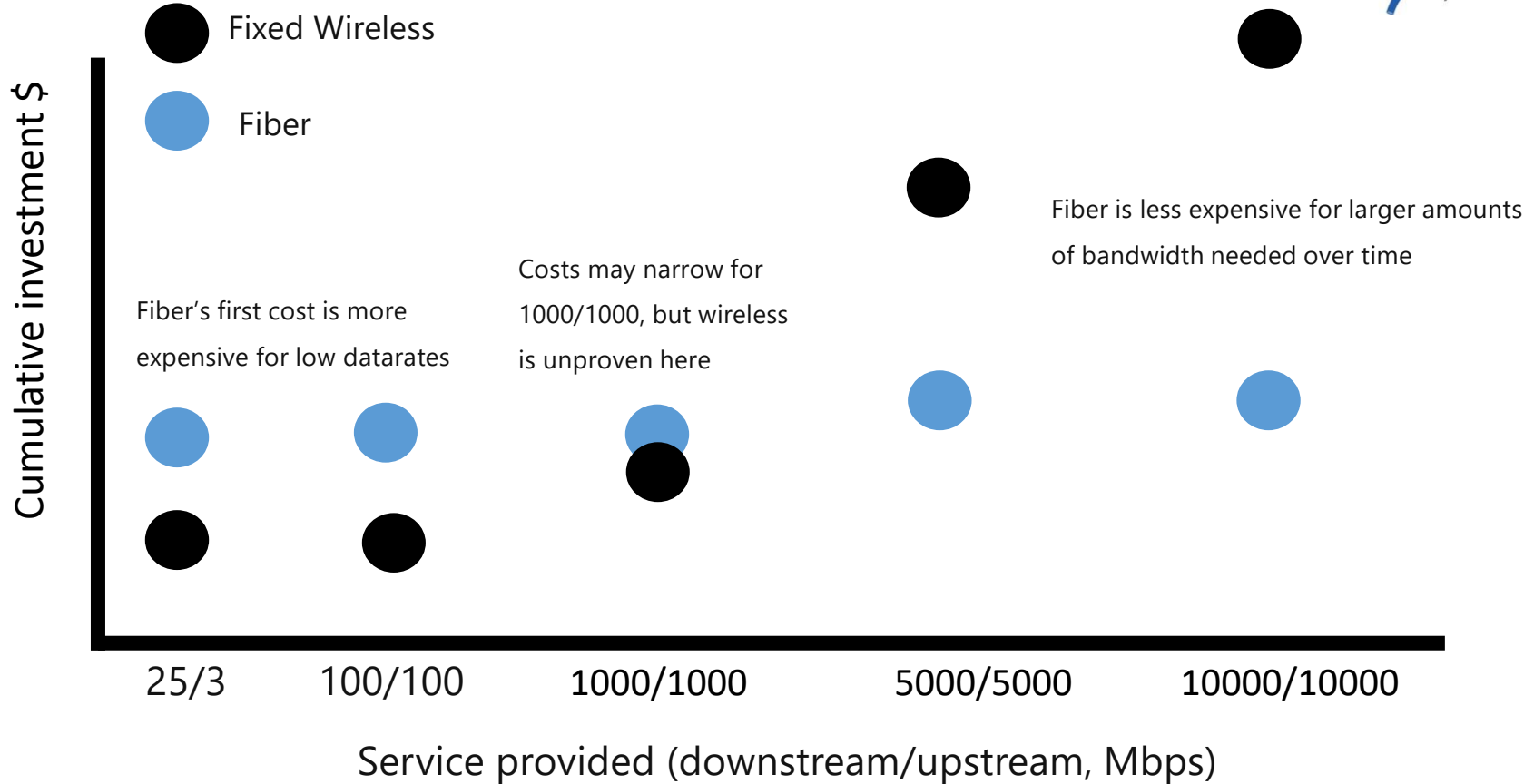


5G

1 site for every 0.5 km
Cell density is 400 cells /
100 sq km

SOURCE: Fiber Broadband Association 2017 Annual Report

Total cost of ownership – think long-term



Summary

- Many factors affect the “real” cost of fiber
 - Aerial construction factors
 - Underground construction factors
- Fiber is a long-lived asset
- Wireless and fiber are complementary technologies
 - Wireless shouldn’t serve as a substitute for fiber and vice-versa
- Fiber has the lowest cost of ownership over the long-term