

FUTURE-PROOF:

Economics of Rural Broadband Technologies

Evaluating technologies from both short and long-term perspectives is important to ensure networks will satisfy demand without wasteful repetitive re-building.

Important considerations:

Broadband demand **is increasing**.



The average broadband download speed could exceed 1 Gbps within the next 6 years if the increase in demand remains consistent.

New networks should have **30 year useful lives**.



A new build should be capable of satisfying user demand **over the useful life of the facilities** rather than rebuilding repeatedly to keep pace with demand.

Though towers have a lifespan of 30 years, much of a wireless network consists of electronics with a 5-7 year lifespan.

FTTP networks are primarily fiber cable, which has a 30 year lifespan.

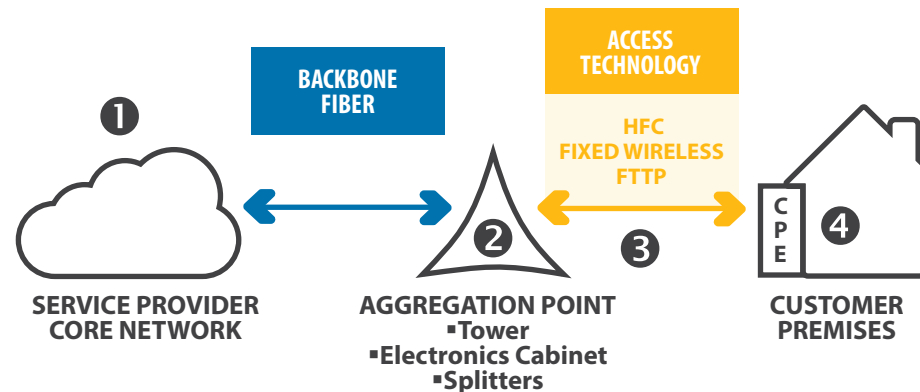
Rural is different.



Population density is a critical factor when evaluating technology options. A technology that may be feasible in an urban area **may not be feasible in a rural area** where users are scattered thousands of feet or even miles apart.

Understanding Network Basics

Network topology in both fiber optic & wireless technologies consists of:

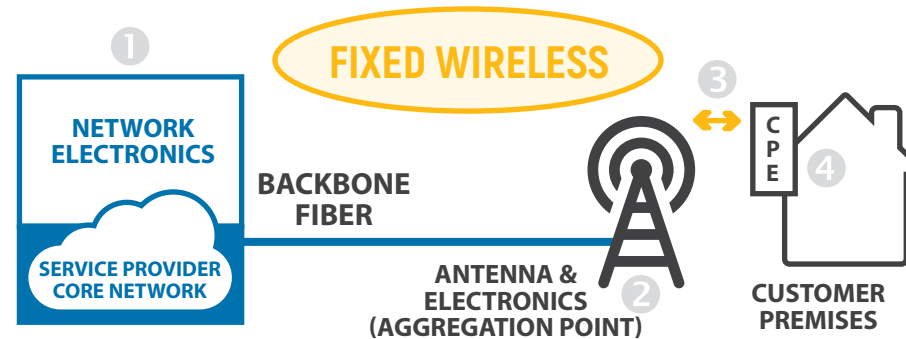


- ① Fiber Optic backbone ("second mile")
- ② Aggregation point in the field
- ③ Access network ("last mile")
- ④ Customer Premises Equipment

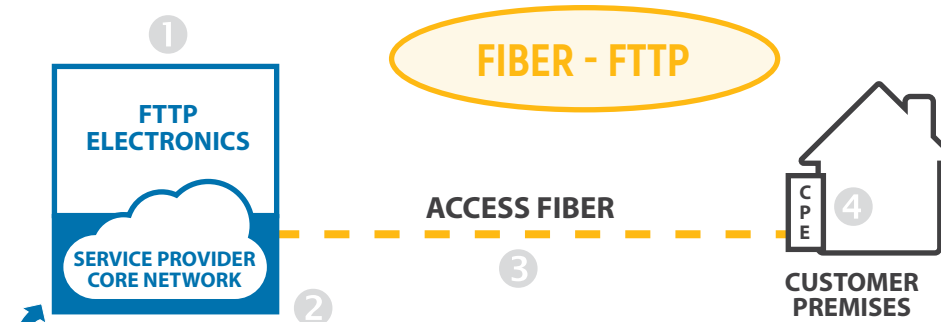
The key distinction between networks is which technology - **fiber or wireless**- is used in the "**last mile**" access network.

The technology chosen determines the number of aggregation points needed, the initial and long-term CapEx, and the ongoing expenses.

Increasing aggregation points is costly and reduces network reliability.



On a basic level, there is an inverse relationship between the amount of data carried and the distance travelable. High frequency spectrum, like mmW 5G, can carry tremendous amounts of data for very short distances. Lower spectrum frequencies can carry smaller amounts of data for longer distances.



The characteristics of passive fiber networks allow the broadband signal to travel much further (20+ miles) without requiring additional field electronics. This makes the "last mile" longer, removes bottlenecks, and increases network reliability while eliminating costly field power needs.

In many FTTP networks, the aggregation point isn't in the field at all - it's the Central Office, shown here housing the core network and FTTP electronics.

Three Technologies Compared:

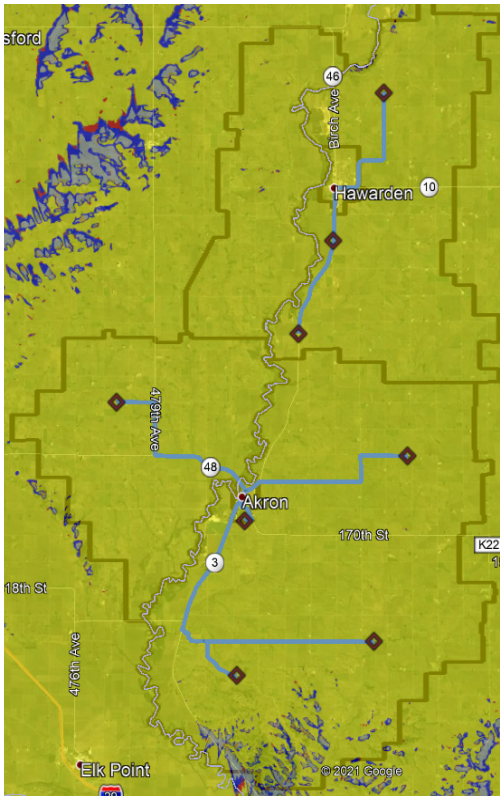
A greenfield case study.

Network layouts and cost-estimates are shown here for a real, typical rural area located in southeast South Dakota and northeast Iowa.

Broadband deployment involves more than a map.
These networks serve real communities with real stories. Hawarden, shown here, hosts Big River Sioux Days every Labor Day Weekend. And Akron, Iowa is the childhood home of Alan J. Heeger, who received the 2000 Nobel Prize in Chemistry.

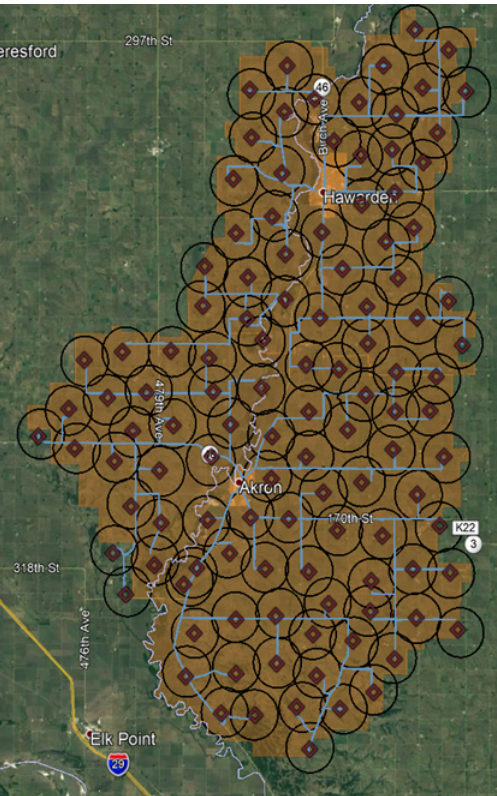
Wireless (Mid-Band)

Low cost, short future: Mid-band spectrum (shown in lime) covers the whole area but would be unable to meet demand in a few short years.



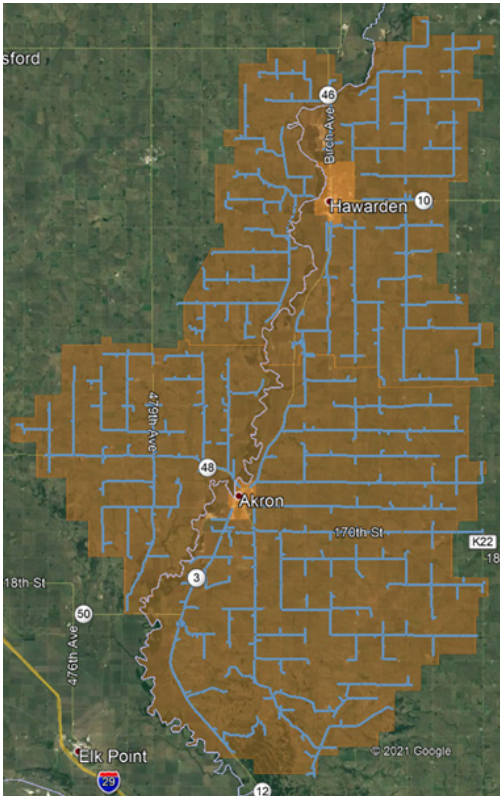
Wireless (mmW)

Because mmW cannot travel long distances, many towers (170) are needed.



Fiber - FTTP

No aggregation point? That's no accident: Fiber networks can be "passive," requiring no power in the field.



LEGEND

Fiber

Aggregation Points

Shaded Areas = territory served with Broadband

Proposed Wireless Coverage

1000 Mbps = 1 Gig

INITIAL COST & PERFORMANCE

Speed: 100/20Mbps
CapEx: \$4.2M

Speed: 1000/500 Mbps
CapEx: \$44.8M

Speed: 1000/1000 Mbps
CapEx: \$12.6M

30-YEAR COST & PERFORMANCE

Speed: 0.6/0.012 Gig
CapEx: \$10.2M

Speed: 6/3 Gig
CapEx: \$78.2M

Speed: 2500/2500 Gig
CapEx: \$14.4M

In the long term, FTTP is **>400x faster** than mmW wireless and **<20%** of the cost.

FTTP is comparable to mid-band wireless in terms of cost, but **4000x faster**.



FOUNDATION FOR RURAL SERVICE

The Foundation for Rural Service (FRS) was established in 1994 as a non-profit 501(c)(3) by NTCA-The Rural Broadband Association. The FRS mission is to sustain and enhance the quality of life in rural America by advancing an understanding of rural issues. Through scholarships, community grants, and a variety of educational programs, FRS focuses on educating rural youth, encouraging community development, and introducing policymakers to challenges unique to rural communities.



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