

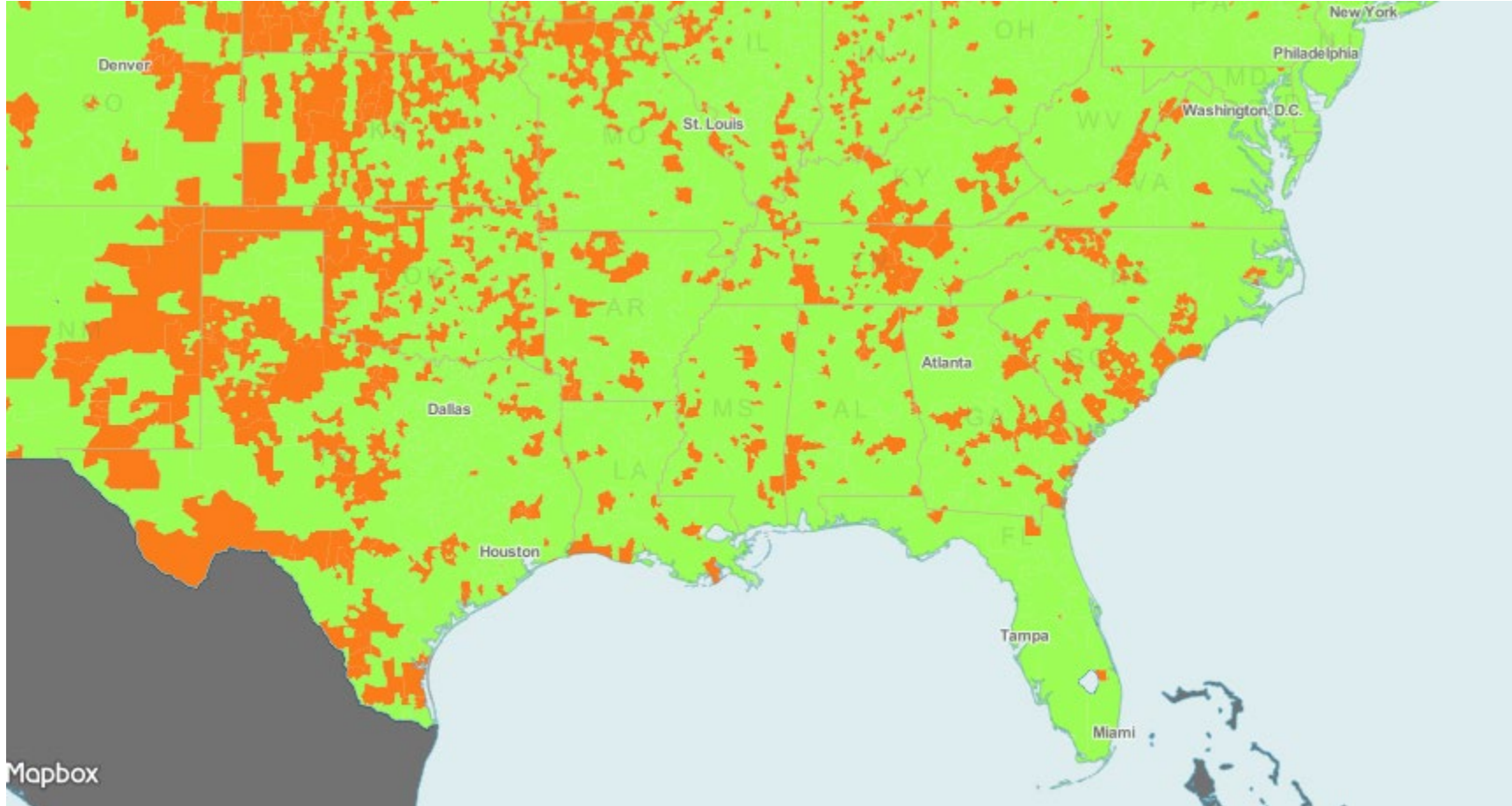
Broadband Internet: Access & Challenges in Rural America



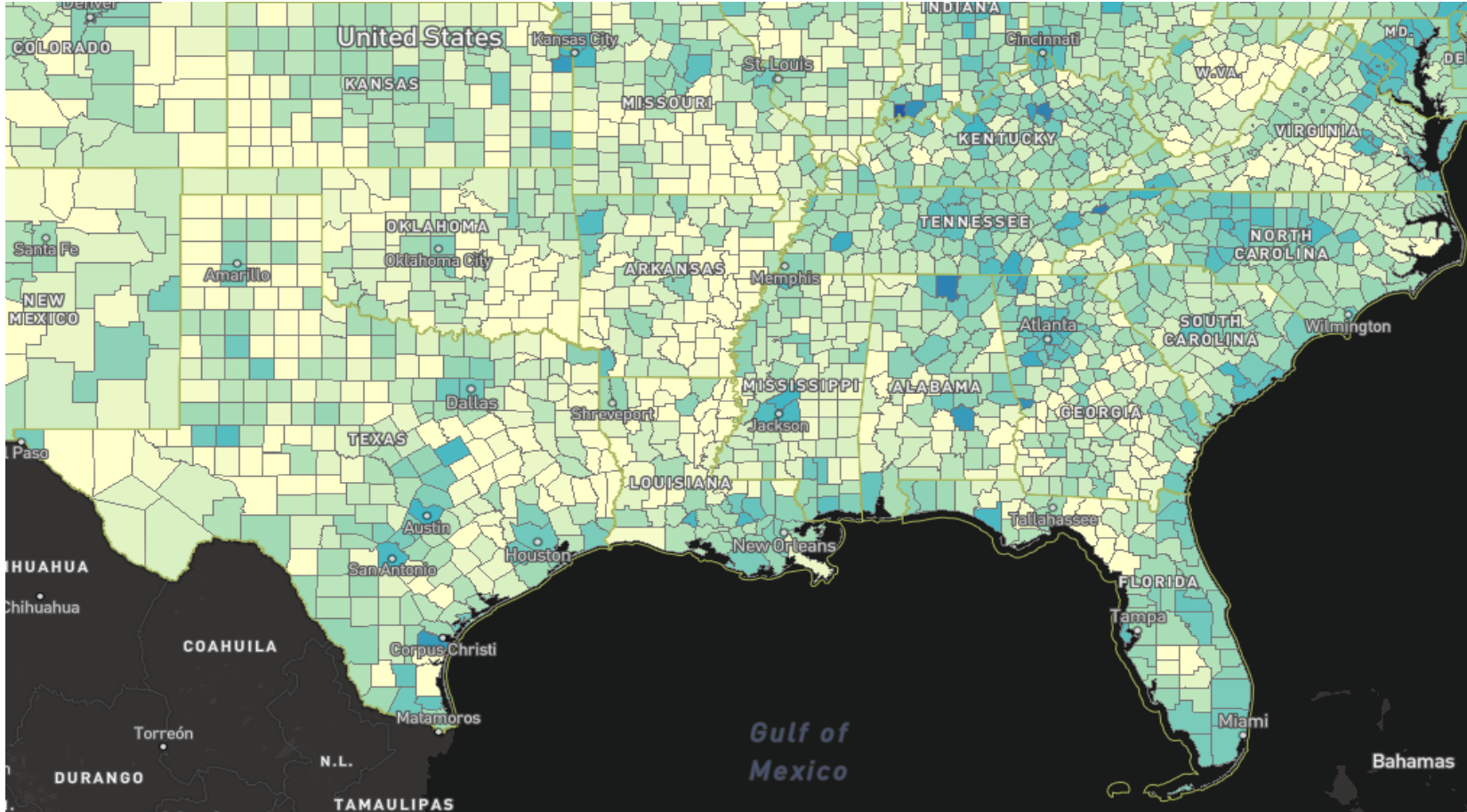
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How Did We Get Here?



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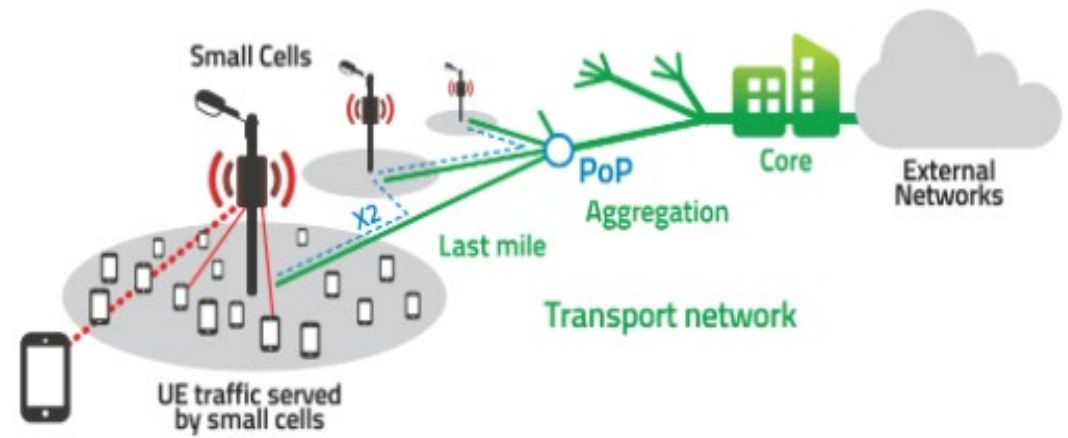
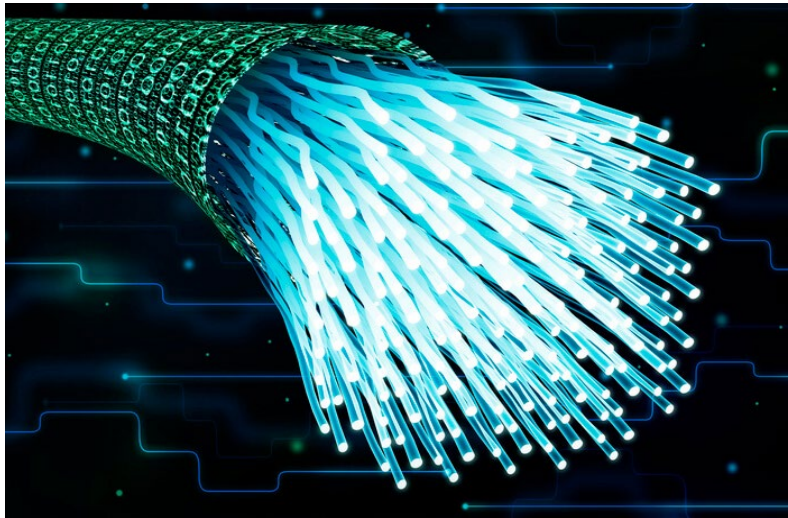


Two Fundamental Challenges

- Distance
- Density



A Brief Detour on Broadband Networks



Source: NGMN Alliance

Wireless Needs Wires – 5G Needs Fiber

“[F]uture 5G wireless networks will only use wireless in a small portion of the network - probably the last 300-500 feet of the network. When constructing a broadband network, one may consider a 5G network where fiber is run to within 300-500 feet of the customer premises or simply run fiber all the way to the customer in a FTTP network. We will discuss the economics of these approaches in the following sections.”

- Evaluating 5G Wireless Technology as a Complement or Substitute for Wireline Broadband, Vantage Point Solutions (Feb. 2017)

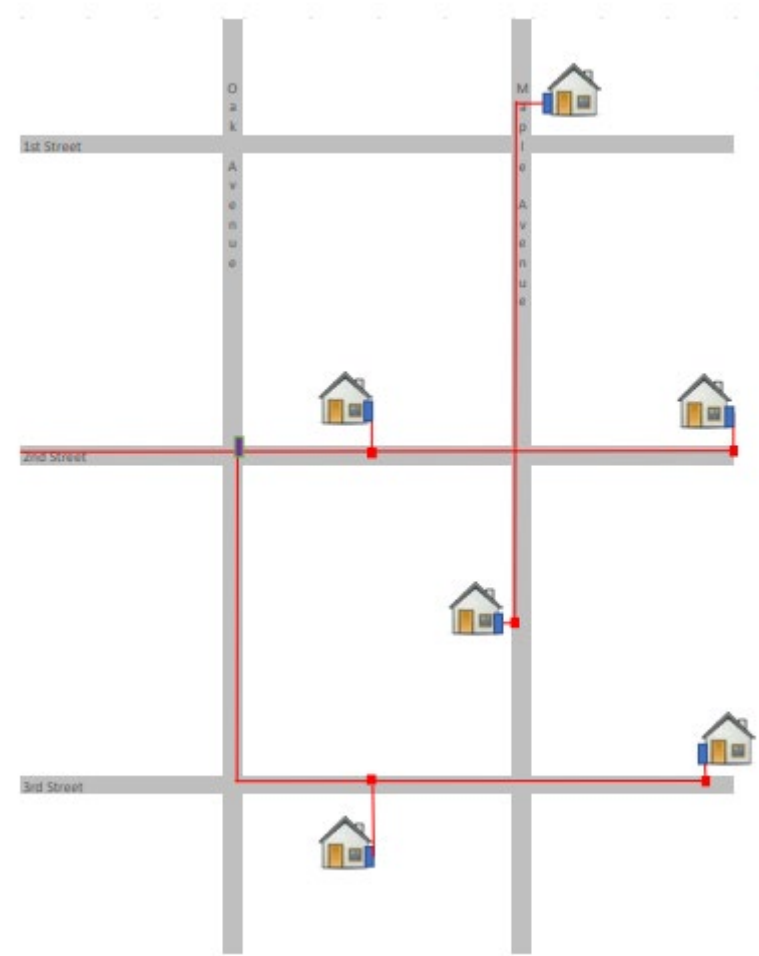
“Consumers are preparing for the new opportunities offered by the rollout of fifth-generation (5G) technology and the broader Internet of Things it enables. The backbone of these new communications tools is fiber connectivity. Fiber that is deployed both aerially and underground is essential to 5G.”

- Fiber: An Essential Facet of the Connected Community, Wireless Infrastructure Association (July 2020).

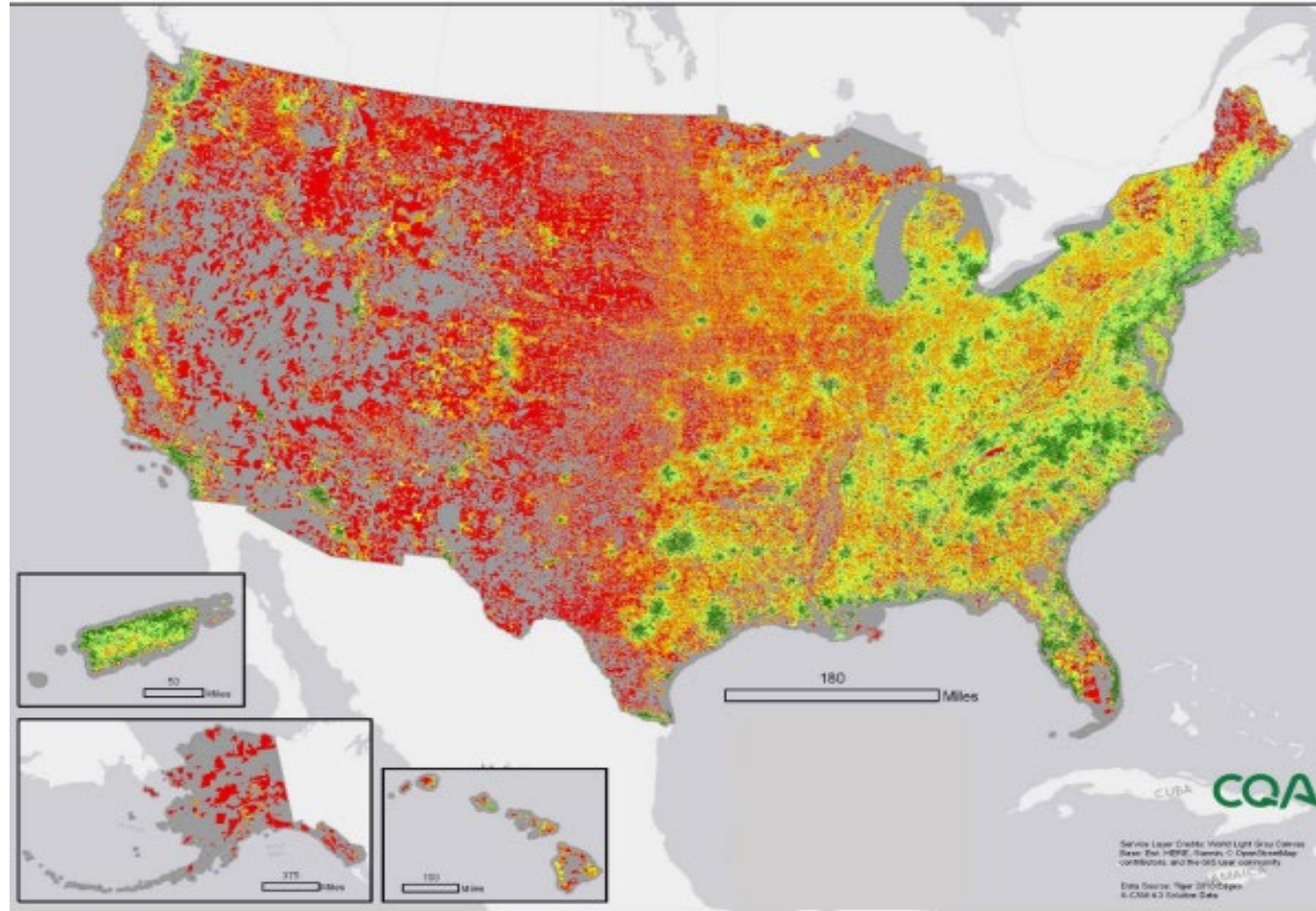
Why Is Rural Broadband So Hard?



VS



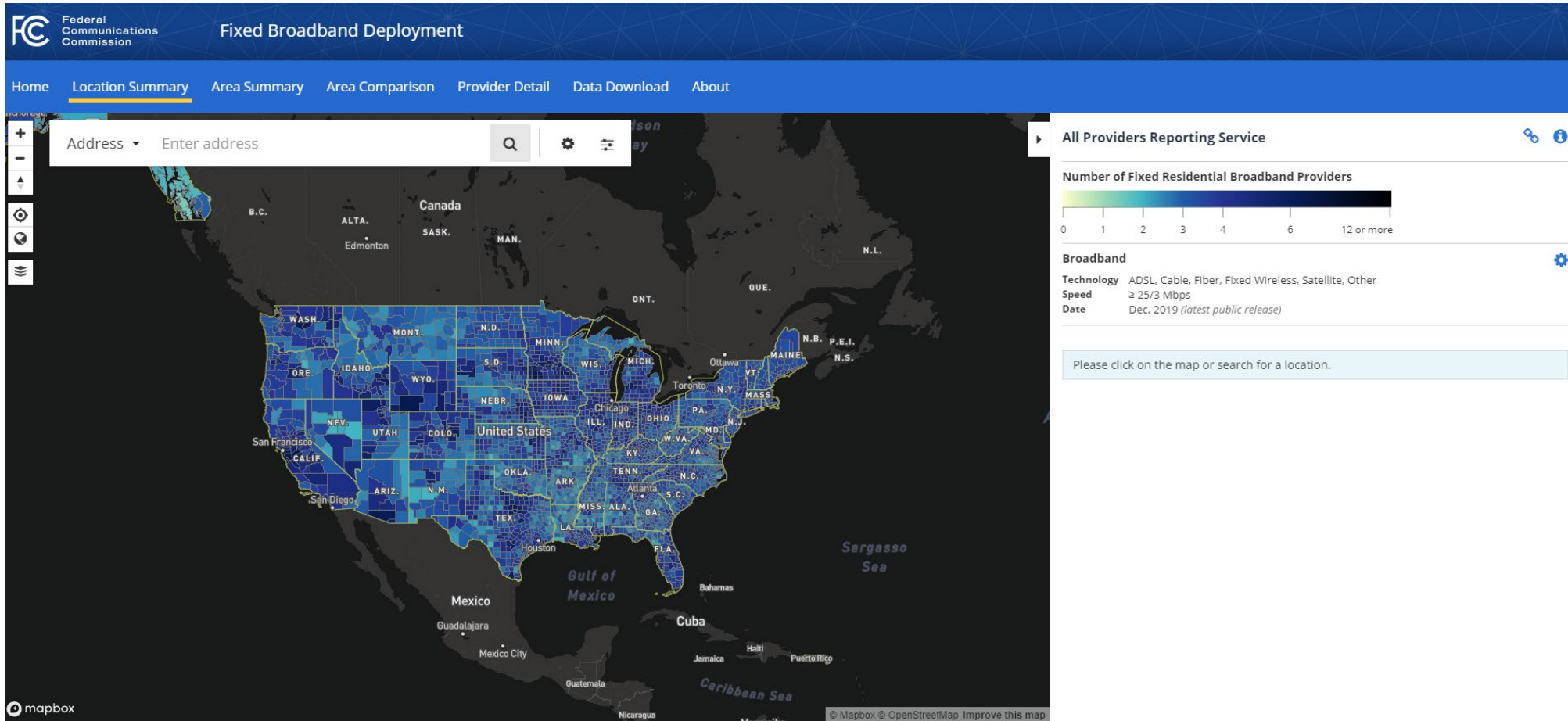
“Uneconomic” Areas



What to Do/What's Being Done?

- **FCC**
 - High-Cost Universal Service – RDOF, CAF, ACAM, etc.
- **USDA/Rural Utilities Service**
 - Telecom Infrastructure Loans, Broadband Loans, ReConnect, Community Connect, Smart Grid, etc.
- **NTIA**
 - \$300M pilot grant program; \$1B tribal connectivity program
- **States**
 - CARES Act; ARPA funds

Roadblocks - Where?



<https://broadbandmap.fcc.gov/#/>

Roadblocks - Who?



Roadblocks - What?



VS



Roadblocks - What?

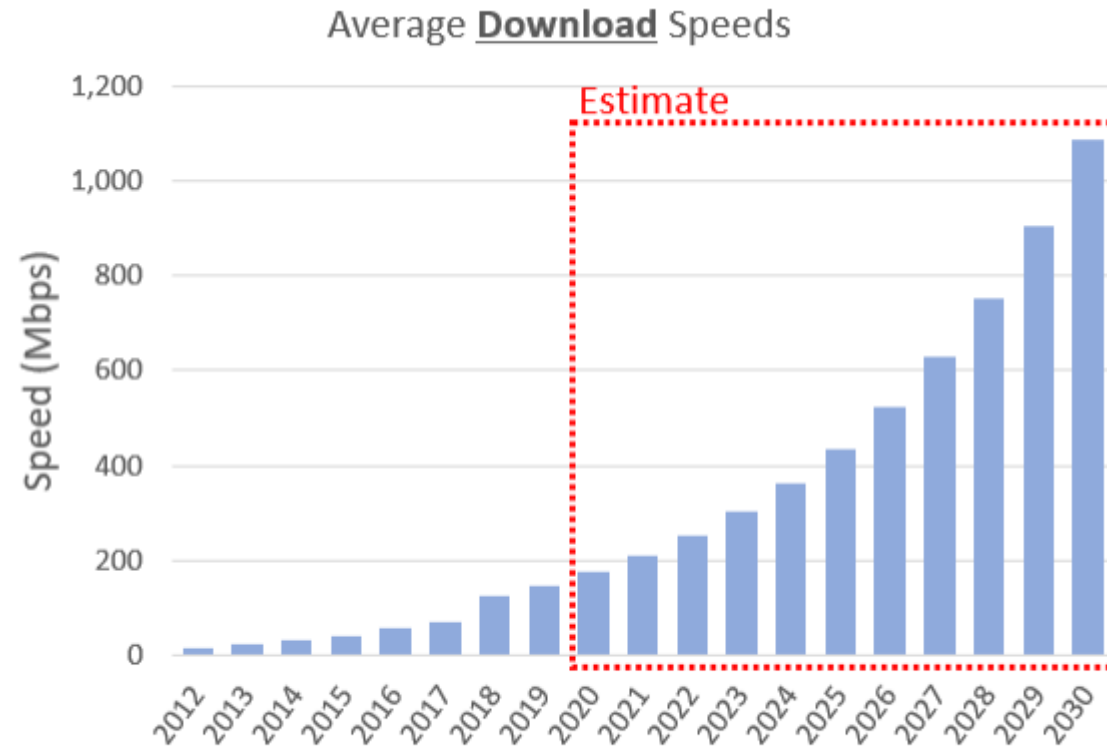


Figure 1: Estimated Broadband Speeds

Roadblocks - What?

	Initial Cost & Performance		30-Year Cost & Performance	
	Speed (Mbps)	Capex	Speed (Gbps)	CapEx
Wireless (Mid Band)	100/20	\$4.2M	0.6/0.012	\$10.2M
Wireless (mmW)	1,000/500	\$44.8M	6/3	\$78.2M
FTTP	1,000/1,000	\$12.6M	2,500/2,500	\$14.4M

Table 4: Cost Summary

Think Both Investment AND Sustainability

- **If Broadband is Infrastructure, Approach it From that Mindset**
 - Building 2-lane roads vs. 4-lane roads vs. 8-lane highways
- **What's Going to Keep Pace with Demand?**
 - Demands will change/grow
 - Networks must evolve
 - Costs will be incurred to continue to operate and maintain networks and keep services affordable – but what's most efficient over life of the asset?
- **Leverage Existing Programs and/or Coordinate**
- **Leverage Proven Providers**