B4B - *Build For Broadband* Webinar

Broadband Technology 101

June 13, 2019 Presenter: Joanne Hovis, CTC Technology and Energy

POWERFUL TECHNOLOGY SOLUTIONS
FOR THE CITY AND PUBLIC WE SERVE

Seattle
Information Technology

B4B - *Build For Broadband* Initiative

Practices that support access to competitive, high-speed broadband for the current and future connectivity needs of Seattle residents.

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Seattle B4B
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Broadband Infrastructure 101

Agenda

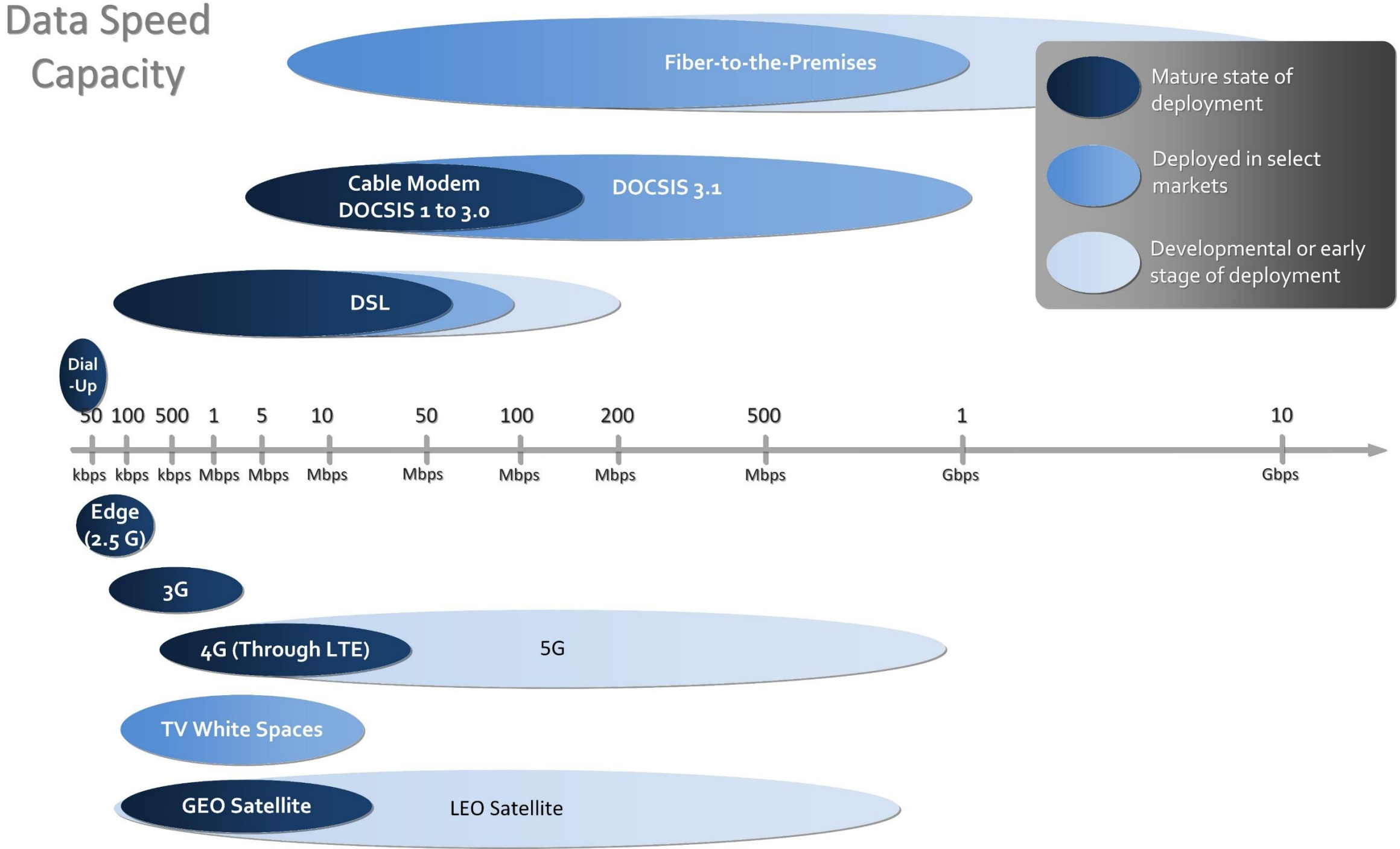
Where We Are

- The current state of broadband technology
- How we got here

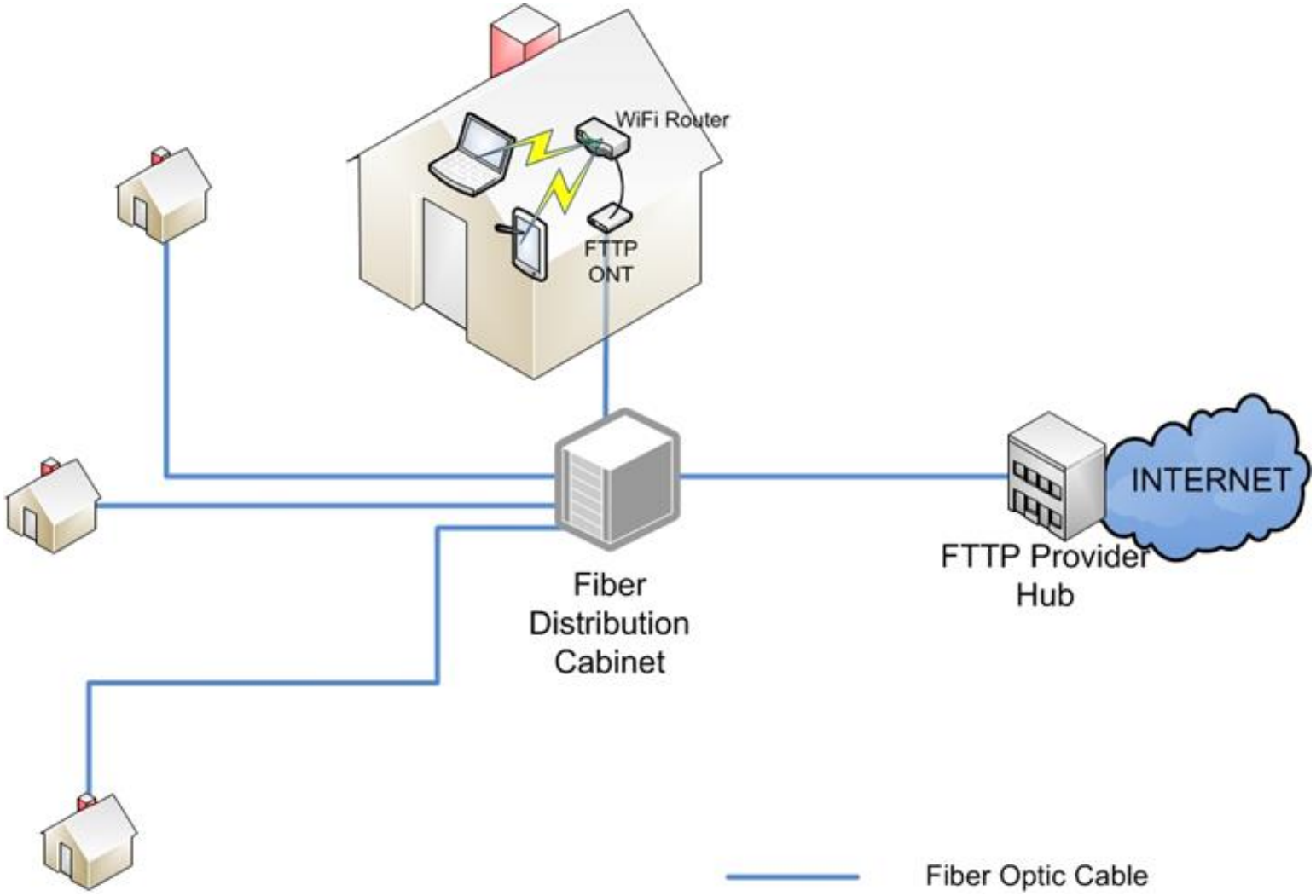
Where We're Going

- Wireline
- Wireless
- Satellite

Data Speed Capacity

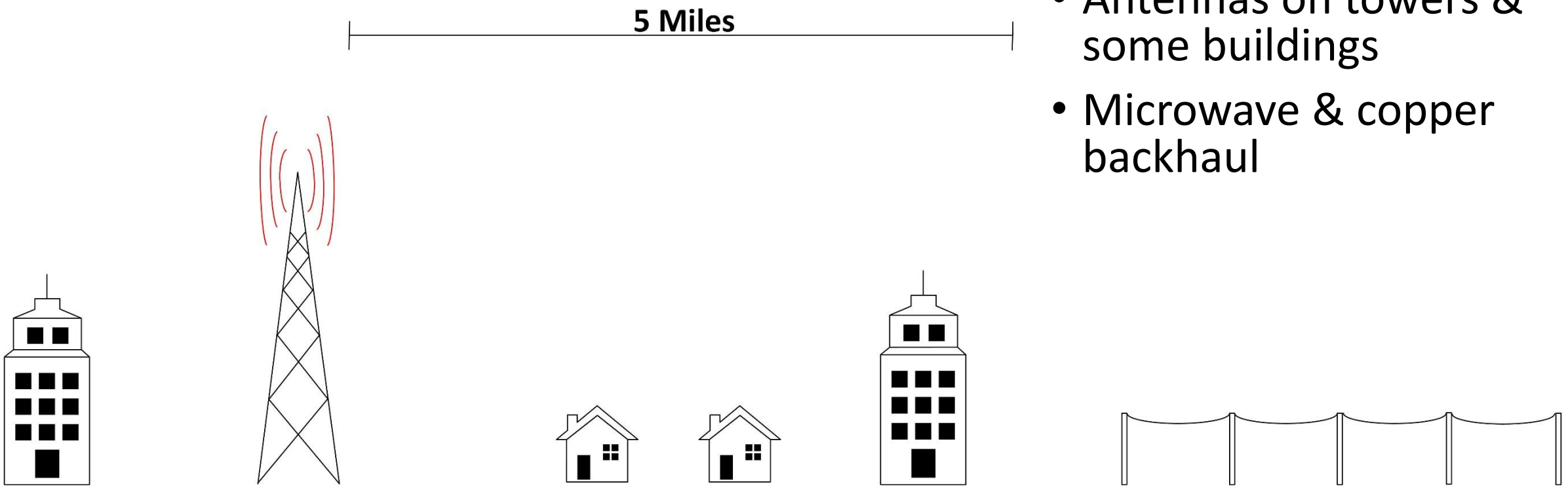


Fiber-to-the-Premises (FTTP)



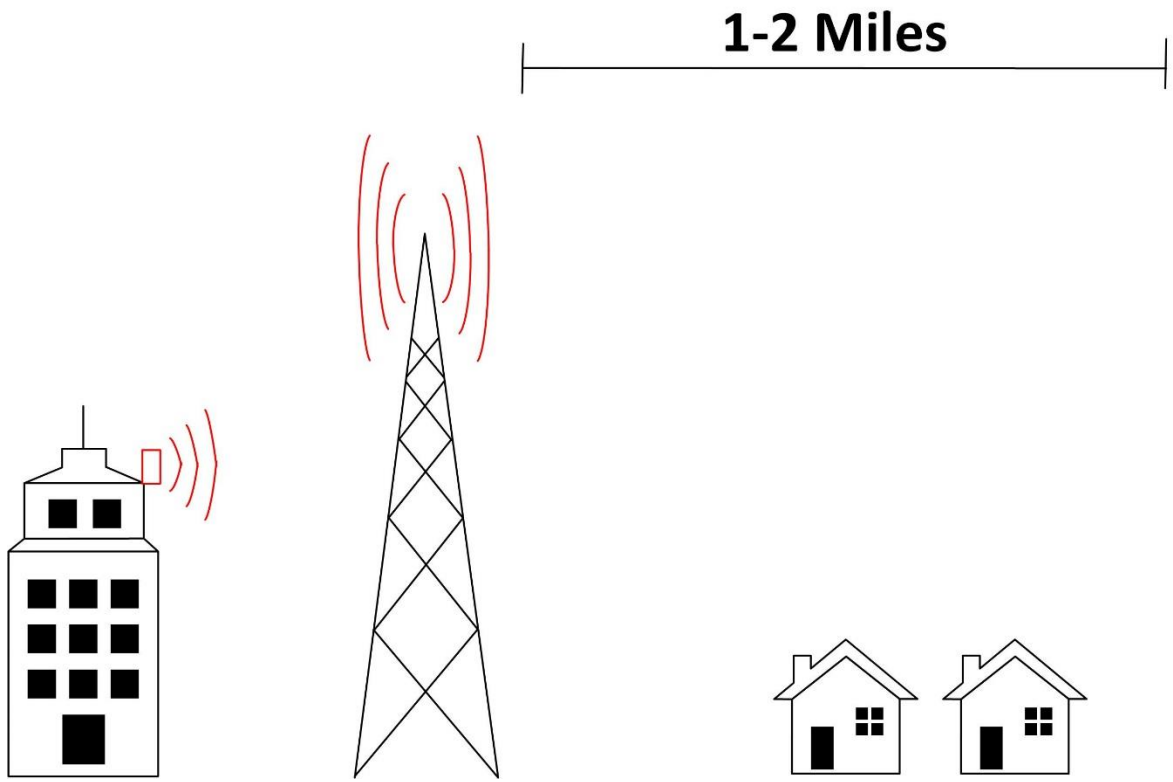
1G/2G

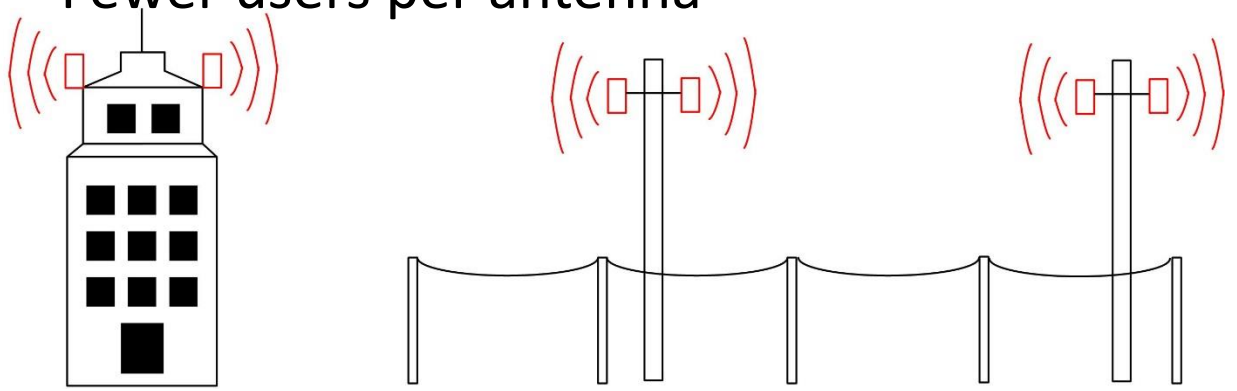
- 1990s urban/suburban
- 2000s/2010s rural
- Voice, text
- Low-speed data
- Antennas on towers & some buildings
- Microwave & copper backhaul



3G

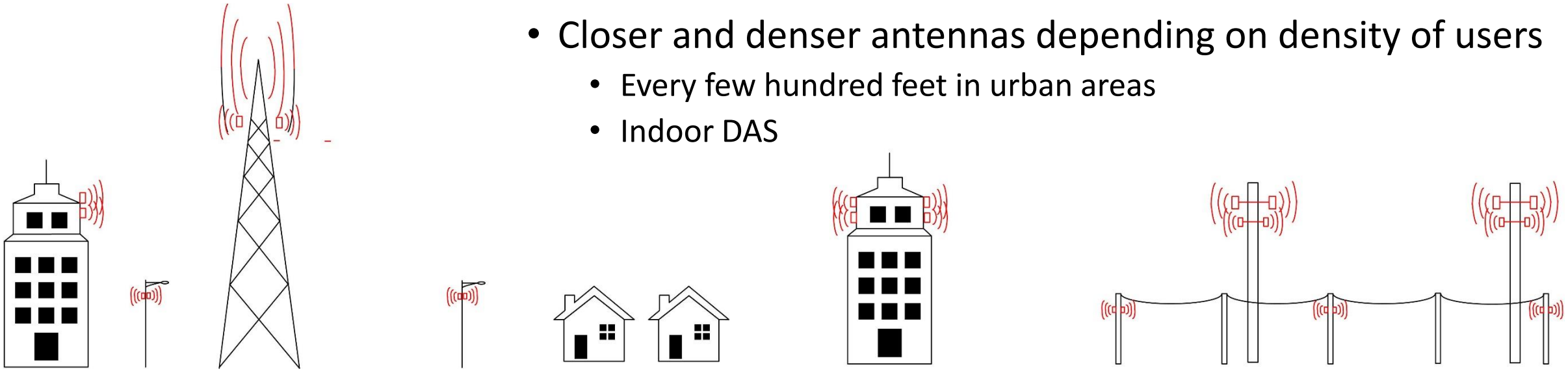
- 2000s urban/suburban
- 2000s/2010s rural
- Voice, text
- Medium-speed data
- Antennas on towers & buildings
- Fiber or microwave backhaul, copper in some areas
- Closer and denser antennas
- Fewer users per antenna





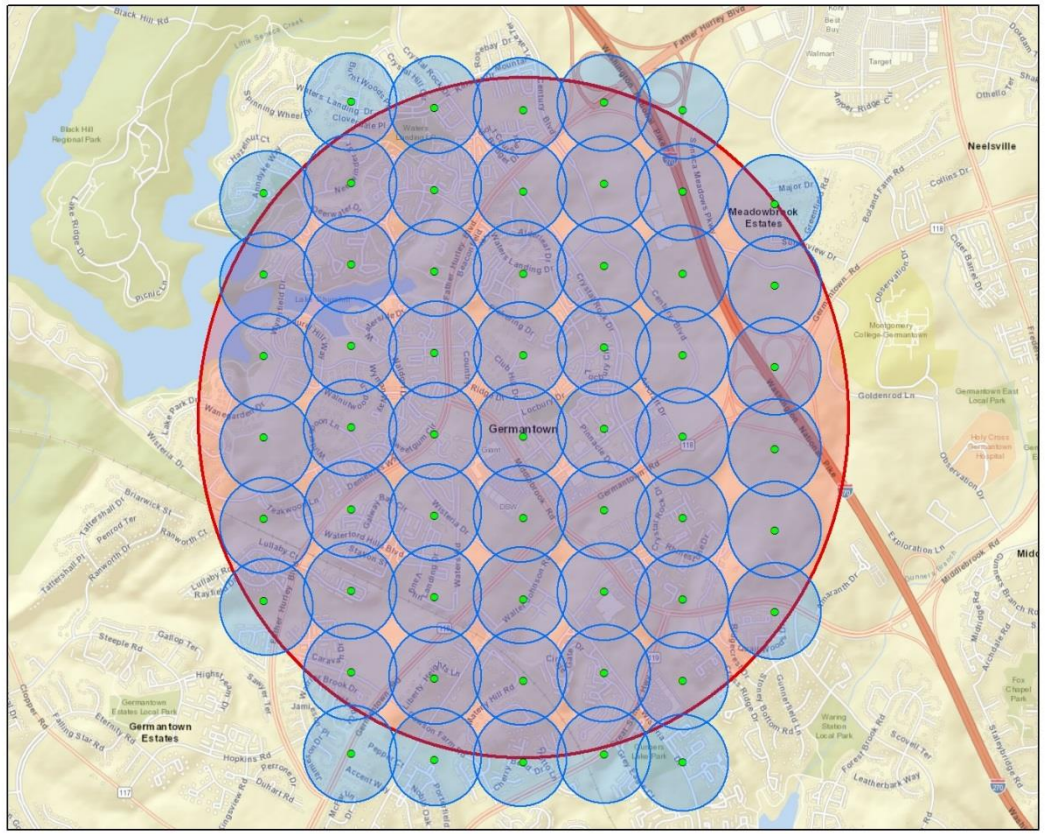
4G

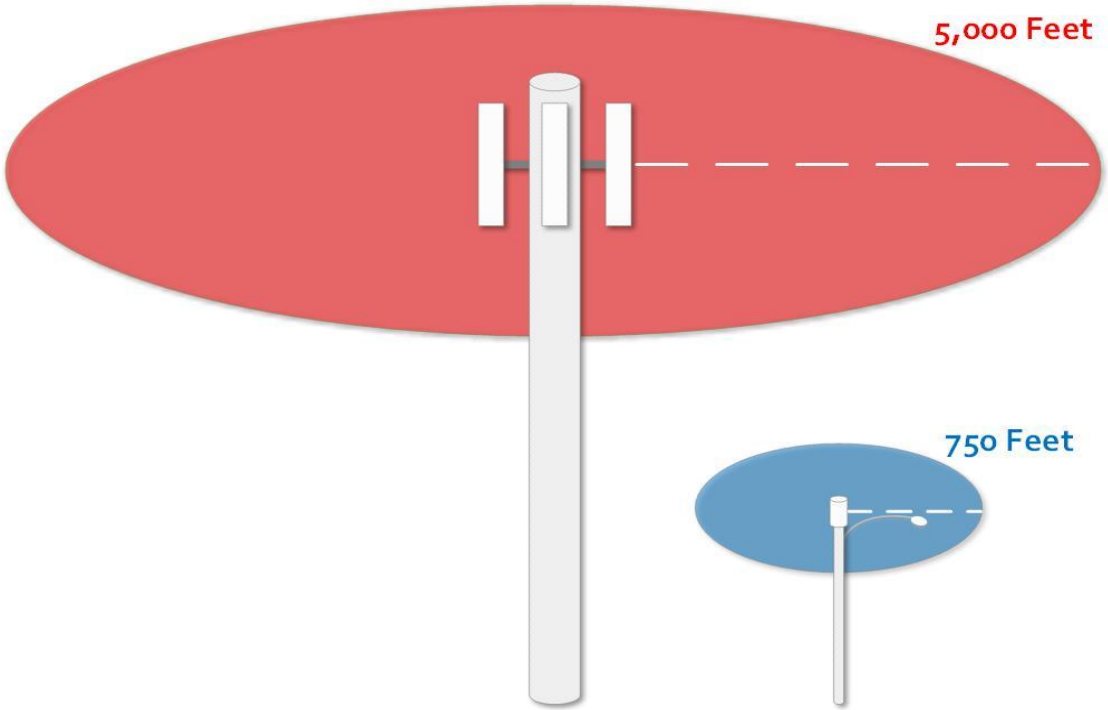
- 2010s urban/suburban, some rural
- Voice(VoIP), text (IP)
- Smartphone service, speed few to 50 Mbps
- Antennas on towers, poles and buildings
- Multiple spectrum bands on antenna
- Backhaul fiber, occasional wireless
- Closer and denser antennas depending on density of users
  - Every few hundred feet in urban areas
  - Indoor DAS



4G Densification

Small cell sites added where needed to boost capacity





Trends to understand

5G does not yet exist	• Current small cell land (pole) rush is for 4G “densification”
“5G” is marketing and lobbying term	• Almost any new wireless deployment is being called “5G” regardless of whether it aligns with 5G definition or standards
Risk that hunger for hyped “5G” will trump other considerations and local process	• Small cell deployment entails safety, interference, and other challenges • Requires utility oversight

Technology categories: 2 forms of wireless to consumers

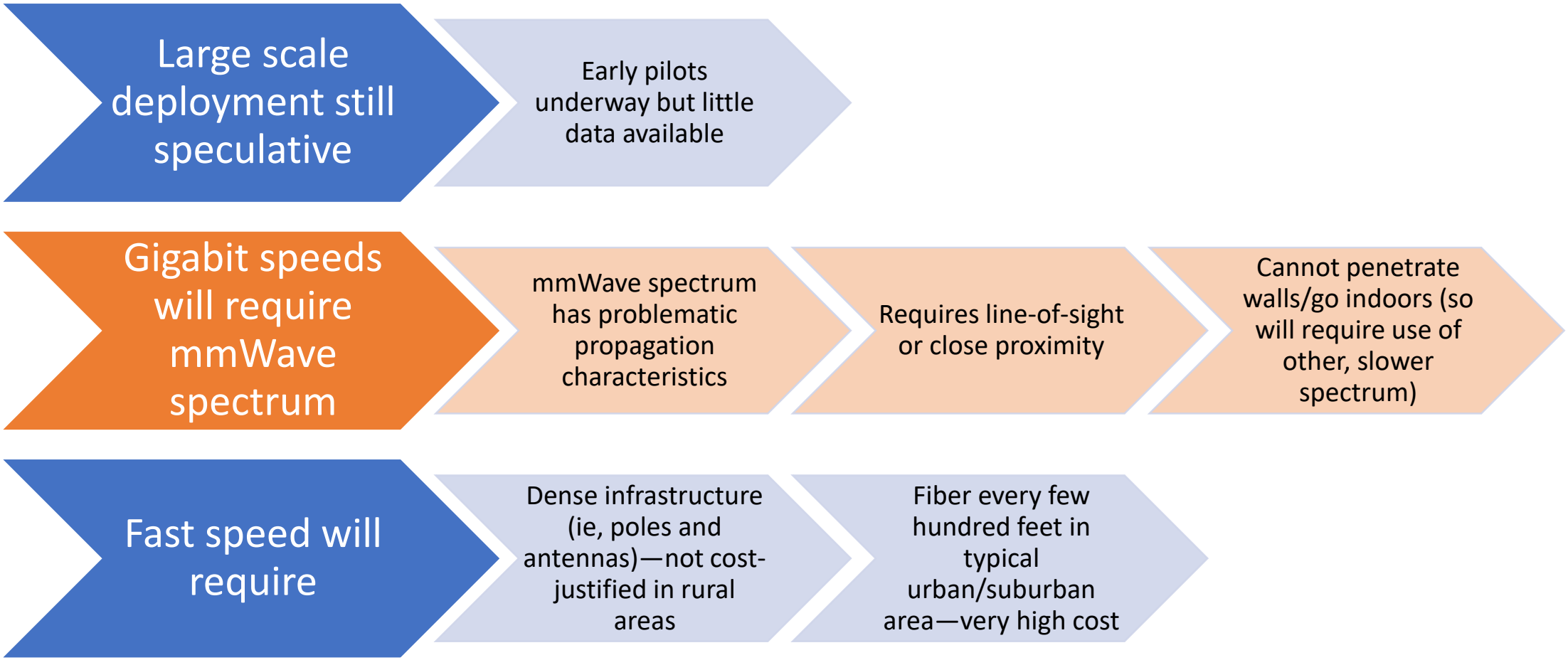
Mobile wireless

- Travels with us around town & around the country
- Service purchased is designed for mobility first (with speed a lesser goal)
- Comes with a price—usually slower and less reliable than “fixed”

Fixed wireless

- Attempts to replace a wire—is a service to a particular location
- Effort to compete with (or alleviate need for) cable or telco connection

5G technical challenges



5G economic challenges

High cost of deployment + fiber

- Unclear what the potential is in urban/suburban
- *No business case in rural areas*
- Wall Street thus far unconvinced

Market opportunity not yet apparent

- Fixed: Verizon pilots panned; AT&T holding back for now
  - Will compete with cable's huge advantages
- Mobile: Unclear whether consumers will pay more
  - Enormous incremental cost to deploy but modest incremental revenues (ie, 5G customers are not new customers; they are converted 4G customers)

5G timeline & development path

Still in development stages

- Emerging in coming year or two
- Standards-writing underway
- Manufacturing path uncertain & pricing undetermined

Deployment path unclear

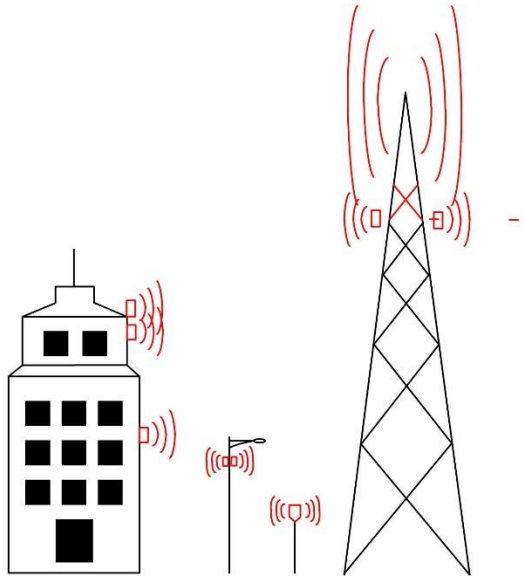
- Fixed: Verizon suggesting imminent deployment in some urban areas
- Mobile: Some deployment in 2020 for urban/suburban
- Neither mobile nor fixed deployment in rural, other than on major highways (possibly)

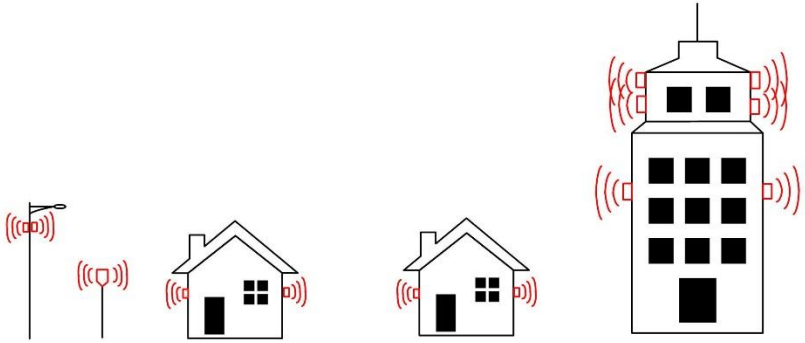
Even best case deployment will be uneven

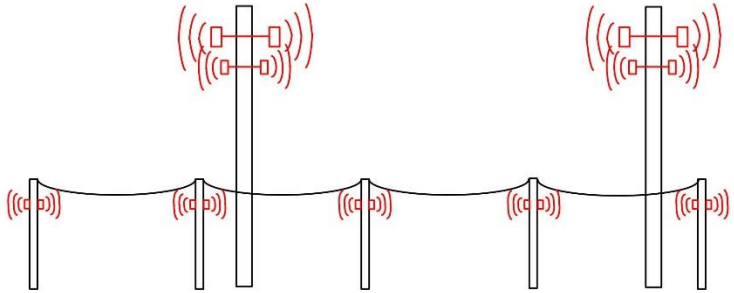
- Focused on “high value” areas
- Service available only to some locations
- Likely increase in rural/urban and have/have not divides

Potential 5G

- 2020 projected urban/suburban, unclear for rural
- Few hundred Mbps to Gbps (higher speeds require mmWave)
- Mixture of small & large multiple spectrum antennas
- Fiber every few hundred feet
- Closer and denser antennas depending on density of users
- mmWave requires line-of-sight or close proximity
- No building penetration

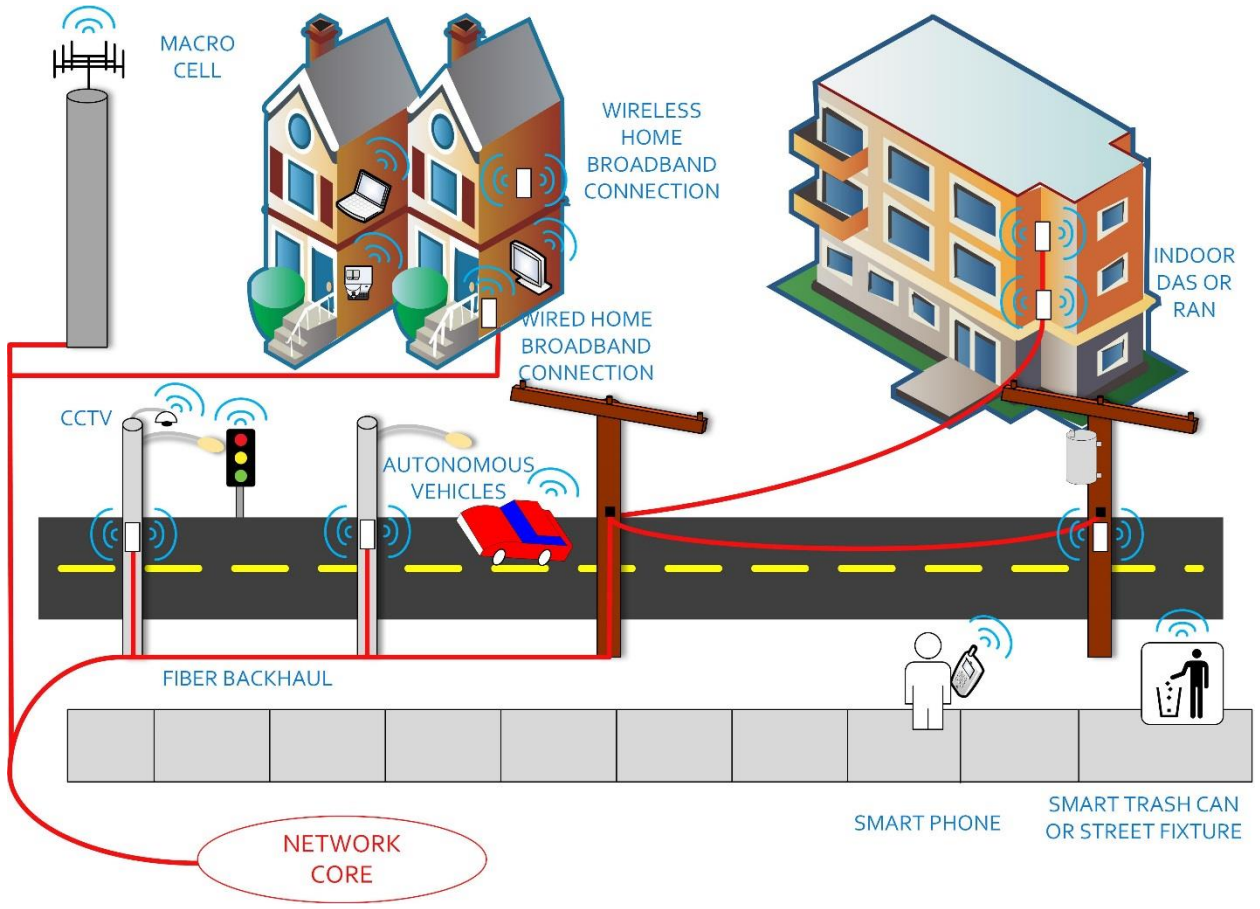






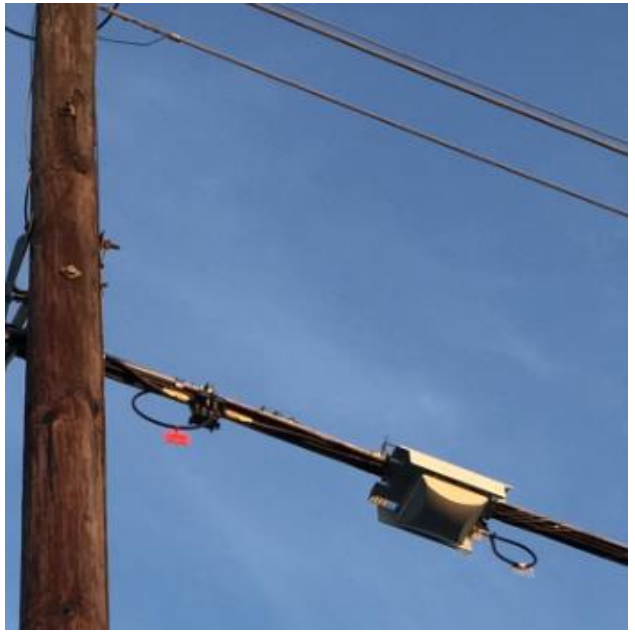
Emerging 5G architecture

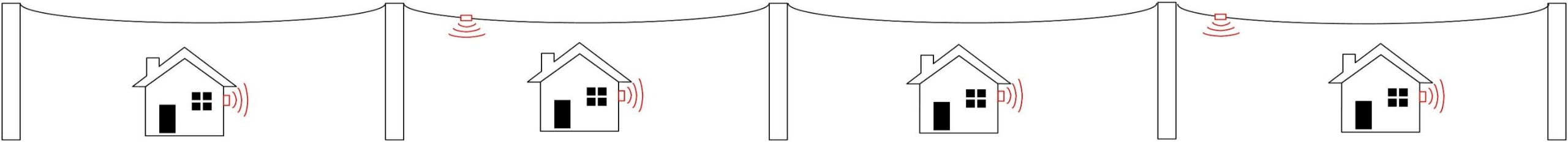
- Millimeter wave spectrum requires direct line of sight
  - Radios every two utility poles
  - Indoor & outdoor radios
  - Widespread fiber



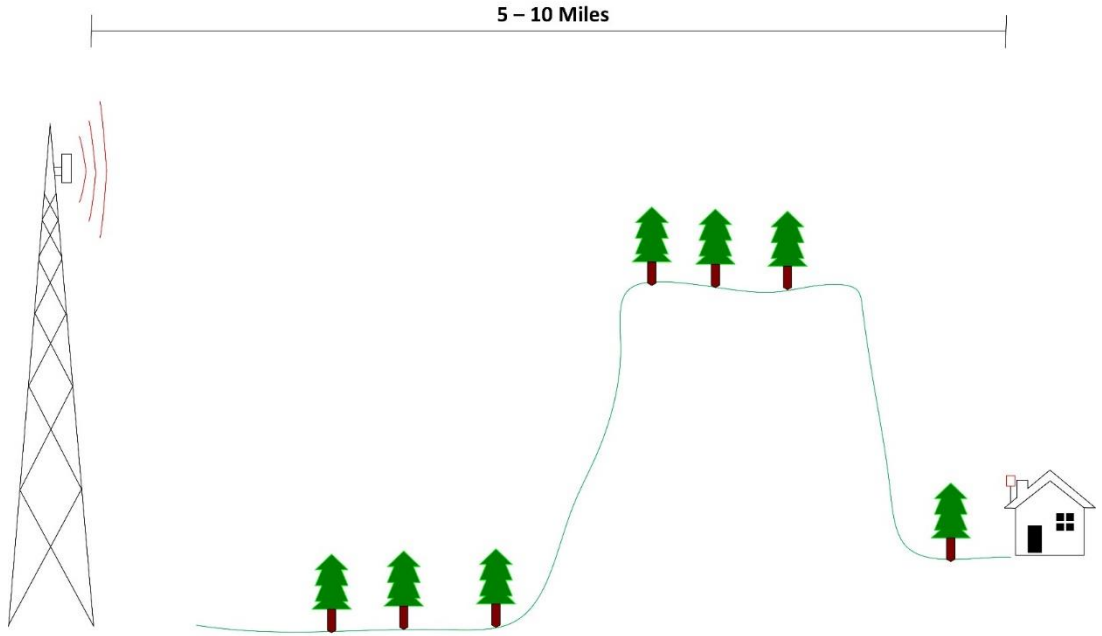
Cable cos poised to compete with 4G/5G in mobile

- Cable modem products now available
  - Marketed as Xfinity Mobile, Spectrum Mobile etc
- Spectrum
  - Uses WiFi and other unlicensed and lightly licensed
  - May soon use CBRS (3.5 GHz) and licensed (600 MHz)
- Backhaul
  - Uses existing cable (hybrid fiber/coax) networks as community-wide backhaul networks
- National footprint emerging
  - Roams to other cable networks in other cities and to carrier





Alternative rural wireless technologies



- TV White Spaces
  - can complement unlicensed
  - well suited for terrain and foliage
  - spectrum widely available in rural areas
  - long range may reduce need for fiber

Alternative rural technologies

Unlicensed spectrum

- 5 GHz similar to WiFi
- Longer-range 3.5 GHz CBRS spectrum potentially emerging
- 60/70/80/90 GHz mmWave for high-speed and backhaul
  - Unlicensed and lightly licensed, augments fiber

Large advantage to infrastructure owners

- Cable companies on existing attachments
- Power companies on existing poles

Potentially low cost, low barrier to entry

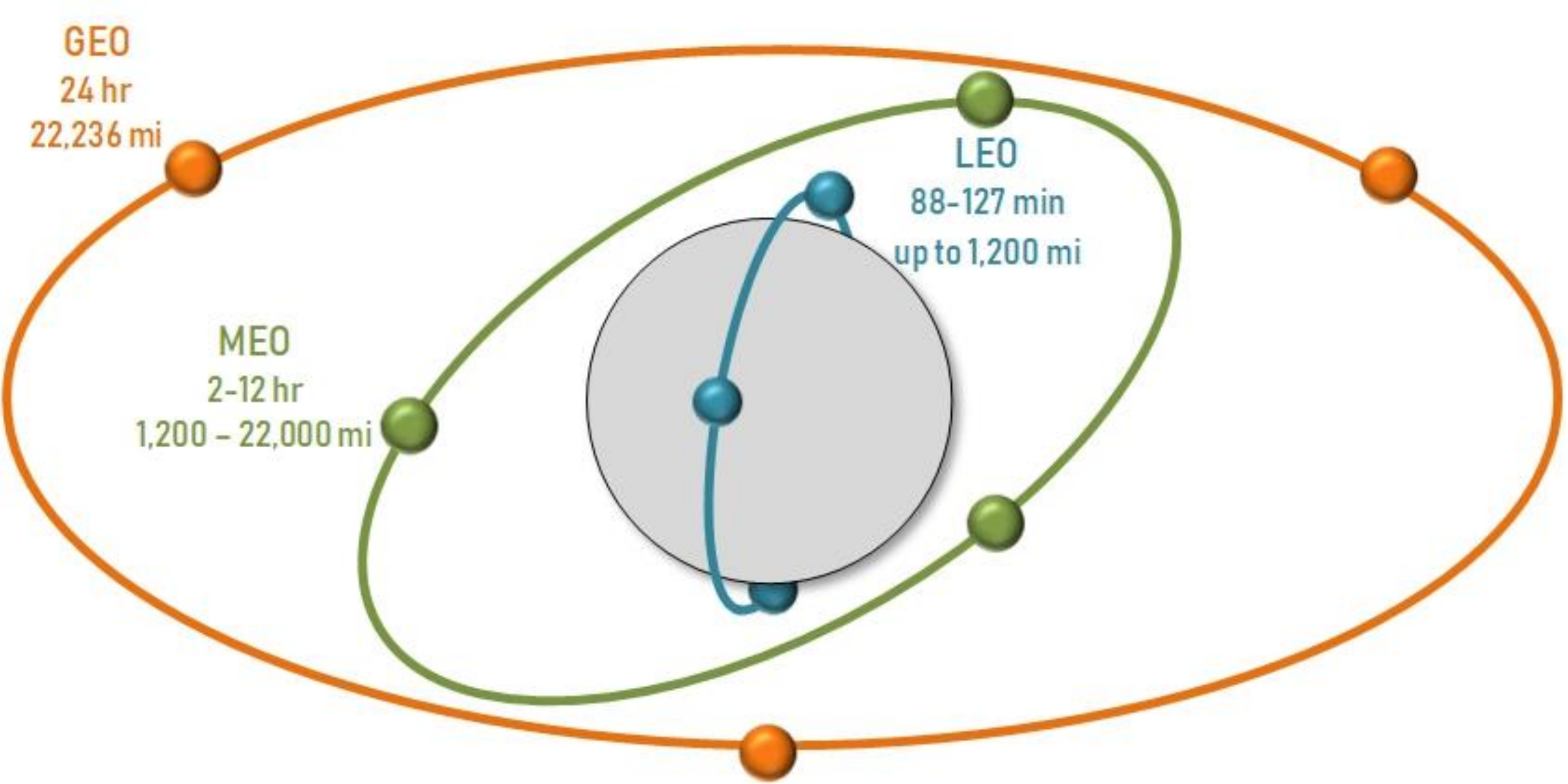
Satellite broadband potential

Historic challenges

- Latency
- Deployment (and service) cost
- Bandwidth limitation

Potential opportunity

- Move from GEO to LEO
- Reduction in deployment costs


GEO
24 hr
22,236 mi
LEO
88-127 min
up to 1,200 mi
MEO
2-12 hr
1,200 – 22,000 mi

Satellite broadband: orbit and latency

	Orbit	Broadband speed	Latency
Geostationary • Hughes • Viasat	22,236 mi	• 2 to 30 Mbps down • Far less up	600+ ms
Low earth orbit • SpaceX • Telesat • OneWeb	up to 1,200 mi	?	25+ ms

B4B-Build For Broadband Initiative

Tip 6000

Seattle Information Technology

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ENSURING BROADBAND SERVICE ACCESS FOR MULTIPLE-DWELLING-UNIT (MDU) DEVELOPMENT PROJECTS

Created April 23, 2019

This B4B Tip is designed to support planning for broadband service connections when constructing new MDU residences (e.g., townhomes, apartments, condominiums). It addresses planning for the *exterior* connectivity needed to serve a property and provides general guidance on how to approach the planning, helpful contact information and key terms.

BROADBAND SERVICE CONNECTIONS FOR MDU DEVELOPMENT PROJECTS

High-speed broadband access is a high priority for Seattle residents and a key consideration for MDU residents when selecting where they will live. Residents expect fast access to broadband service once they move into a new residence. To ensure your property can meet these expectations, it's critical to plan for broadband service connections like other key utilities, such as water or electricity – at the *start* of your development process.

PLAN EARLY TO INCREASE CHOICE AND SPEED TO SERVICE

MDU residents want broadband options. Providing

SMALL PROJECT ALERT

CONVERTING SINGLE FAMILY RESIDENCE INTO MDU

DON'T ASSUME ISP CAN SERVE YOUR BUILDING

Early broadband coordination is especially important when converting a single-family residence lot into multiple units (e.g., townhomes). The added number of residences increases the load on existing cable systems and may require system reengineering by the ISP. Waiting to contact an ISP until after your building is complete can result in:

- Residents having to wait months for service connectivity to be constructed;
- Increased construction costs for ISPs, which could change their Return on Investment (ROI) decision on bringing service to your building; and
- Increased costs to you if the ISPs require you to cover some of the non-standard installation costs associated with getting post-construction connectivity to your building.

WHEN YOU INITIATE A BUILDING PROJECT

RESEARCH BROADBAND SERVICE PROVIDERS OPTIONS

DETERMINE WHICH PROVIDERS CAN SERVE THE PROPERTY

Building Community Awareness

- Early Telecommunication Planning
- Benefits of Infrastructure Investments

Planning problems magnified by trying to design for something that's hard to predict

Tips

Website

Webinars

www.seattle.gov/tech/initiatives/broadband/build-for-broadband

Thanks for Participating!

www.seattle.gov/tech/initiatives/broadband/building-for-broadband

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