Investing in Next Generation Wireless Networks

Meeting the Needs of Customers Today, and Preparing for the Future of Innovation

verizon

Confidential and proprietary materials for authorized Verizon personnel and outside agencies only. Use, disclosure or distribution of this material is not permitted to any unauthorized persons or third parties except by written agreement.

A wireless network is like a highway system…

We need to add capacity to the existing wireless network infrastructure to stay ahead of ever increasing traffic demands.

More wireless traffic needs more wireless facilities just like more vehicle traffic needs more lanes.

- Many wireless users share each cell site and congestion may result when too many try to use it at the same time.
- Wireless coverage may already exist in an area, but with data usage growth increasing exponentially each year, more capacity is needed.
- To meet capacity demands, we need to add more wireless antennas closer to users and closer to other cell sites to provide the reliable service customers have come to expect from Verizon.

Wireless subscribers used almost 10 trillion megabytes of data in 2015, more than double what they consumed in 2014.*

*Fortune, May 23, 2016.

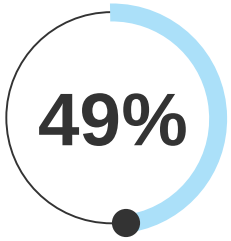
verizon

Why are we expanding the wireless network?

More people than ever before rely on wireless connections to manage their lives and businesses.

Verizon is expanding its 4G wireless network and laying groundwork for next generation 5G technology in order to meet the growing demands of today and tomorrow.

U.S. mobile data usage is projected to grow nearly five-fold through 2021.[1]



More than 49 percent of American households are wireless-only.[2]

In North America, the average household has 13 connected devices with smartphones outnumbering tablets 6 to 1.[3]

1. Cisco VNI Mobile Forecast Highlights, 2016 – 2021, February 2017
2. CDCs 2016 Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, January-June
3. IHS Markit Connected Device Market Monitor: Q1 2016 , June 7, 2016

verizon

Confidential and proprietary materials for authorized Verizon personnel and outside agencies only. Use, disclosure or distribution of this material is not permitted to any unauthorized persons or third parties except by written agreement.

Every day, people depend on a reliable wireless network.

The reliability of your cell phone is never more important than when crisis strikes. That's when a simple call or text message can make the difference between life and death.

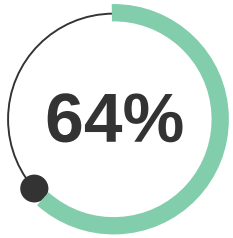
We recognize the need to build reliability into every aspect of our wireless network to keep customers connected when they need it most.

Reliability starts when we choose the safest, most secure locations available for our wireless equipment. The likelihood of earthquakes, and risk from floods, tornadoes, hurricanes and more are all considered.

When disaster strikes, we coordinate with first responders and can mobilize charging stations, special equipment, emergency vehicles and more to support local, state and federal agencies in all 50 states.

It's who we are.

of wireless subscribers have used devices in an emergency.[1]



of all 911 calls are made from wireless devices, with half of those made indoors.[2]

1. 2016 National 911 Progress Report, December 2016
2. EMS World, April 24, 2014

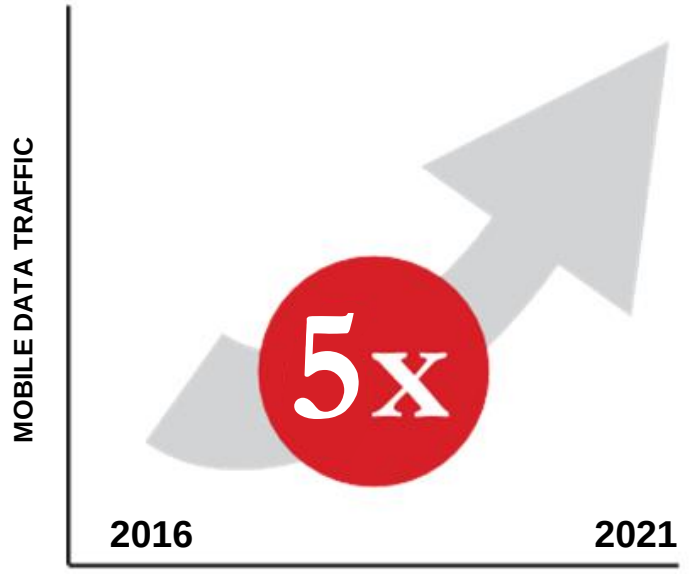
verizon

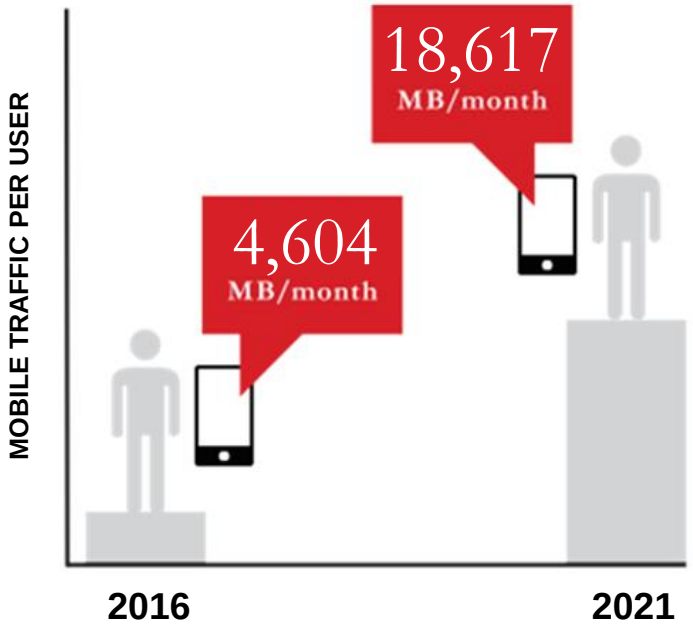
Confidential and proprietary materials for authorized Verizon personnel and outside agencies only. Use, disclosure or distribution of this material is not permitted to any unauthorized persons or third parties except by written agreement.

Why are small wireless facilities important?

In some places, this growing demand for data is congesting the available capacity of the 4G cellular network.

- The demand crunch tends to be greatest in urban areas where it is difficult and expensive to deploy large macro towers.
- Cisco reports that in North America, just in 2016, mobile data traffic grew 55 percent and mobile data traffic in the U.S. is expected to grow 5-fold from 2016 to 2021, a compound annual growth rate of 30%.





verizon

Confidential and proprietary materials for authorized Verizon personnel and outside agencies only. Use, disclosure or distribution of this material is not permitted to any unauthorized persons or third parties except by written agreement.

Wireless facilities and property values.

Cell service in and around the home has emerged as a critical factor in home-buying decisions.

National studies demonstrate that most home buyers value good cell service over many other factors including school district when purchasing a home.

75%

More than 75% of prospective home buyers said a good cellular connection was important to them.[1]

83%

The same study showed that 83% of Millennials (those born between 1982 and 2004) said cell service was the most important fact in purchasing a home.

90%

90% of U.S. households use wireless service. Citizens need access to 911 and reverse 911 and wireless may be their only connection.[2]

1. Money, "The Surprising Thing Home Buyers Care About More than Schools," June 2, 2015
2. CTIA Facts and Infographics, June 2015

verizon

Confidential and proprietary materials for authorized Verizon personnel and outside agencies only. Use, disclosure or distribution of this material is not permitted to any unauthorized persons or third parties except by written agreement.

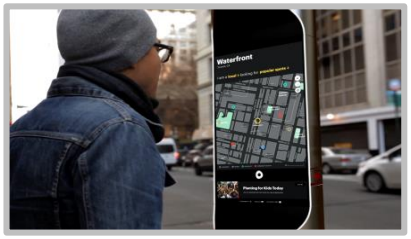
Making our cities more livable.

Smart Lighting

- LED conversion
- Lighting controls
- Increased savings

Smart Traffic

- Real-time info
- Traffic optimization
- Reduced congestion



Citizen Engagement

- On-line access
- Transit schedules/way-finding
- Local business development

Smart Video

- Advanced streaming
- Proactive alerts
- Enhanced security

verizon

Sustainability

Resiliency

Livability

Support for 4G and setting the stage for 5G deployment

Policymakers can encourage ongoing investment in mobile broadband data technology that consumers, business and government increasingly demand, while maintaining local governments' oversight of the public rights-of-way.

- 99.6% of Americans now have access to a 4G LTE network thanks to nearly $150 billion invested since 2012 by wireless operators
- "Small Cells" will accelerate the benefits of 4G LTE, next generation 5G, the Internet of Things, machine-to-machine technology, and smart cities solutions for consumers and businesses.

verizon

What is 5G?

Fifth generation wireless technology, also known as "5G", will deliver enhanced mobile broadband capabilities that are up to 100 times faster than speeds today with immediate responsiveness.

5G will be transmitted over higher wave frequency spectrum bands.

- Higher frequency bands do not propagate well – they typically require "line-of-sight" and do not pass through obstacles.
- This will require a high level of cell densification via "small cells" in locations such as lampposts, buildings, and utility poles.

5G will:

- Significantly increase speed and provide real-time information.
- Connect everything

5G trials:

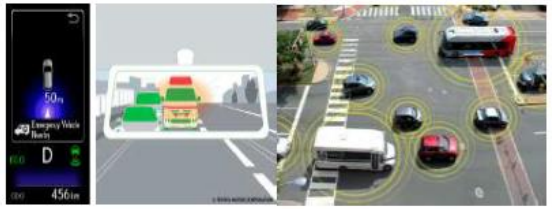
- Brockton is one of 11 sites nationwide to pilot 5G service
- Pilot is testing equipment, network, and signal propagation
- Partnering on chipsets, infrastructure products and consumer devices

verizon

Confidential and proprietary materials for authorized Verizon personnel and outside agencies only. Use, disclosure or distribution of this material is not permitted to any unauthorized persons or third parties except by written agreement.

5G Possibilities: Smart Communities and Internet of Things

Public Safety
- Collision Avoidance
- Hazard Warnings



Command & Control
- Traffic Management
- Emergency Management

Smart Farming
- Water Management
- Crop Analytics

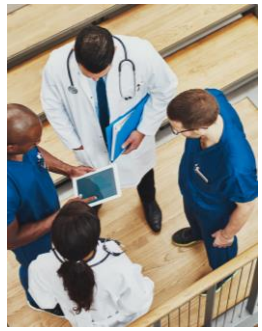
Connected Homes
- Smart appliances
- Security systems

Movies & Media
- Information kiosks
- Download stations

5G

Energy & Environment
- Smart Grid
- Environmental monitoring

Wearable & Tag Devices
- Fitness Monitors
- Location Sensors



Tele-Health
- Robotic Surgery
- Remote Health Care

Smart Infrastructure
- Tolls & Access
- Connected Infrastructure

Future Transportation
- Autonomous Vehicles
- Advanced Driver Assistance

verizon

Confidential and proprietary materials for authorized Verizon personnel and outside agencies only. Use, disclosure or distribution of this material is not permitted to any unauthorized persons or third parties except by written agreement.

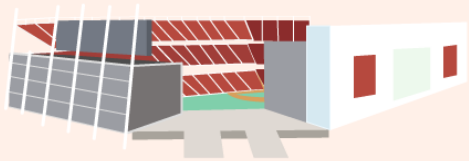
Different locations require different solutions.

Verizon uses a balanced approach to engineering the best possible network given the local community's needs.

Macro sites are traditional cell sites or towers that provide capacity and coverage to a broad area, up to several miles.

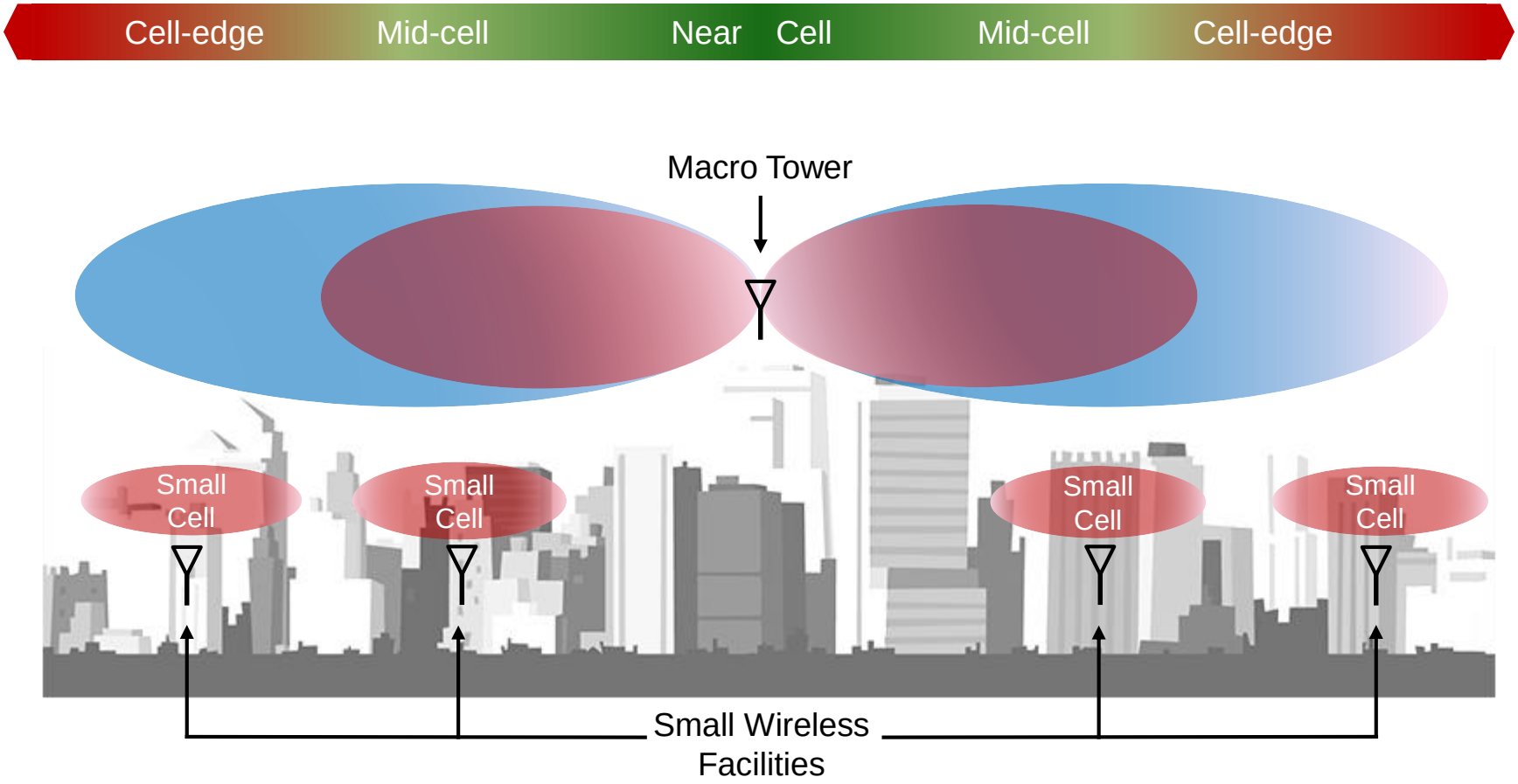
Small cells are just like the name implies – short range cell sites used to complement macro cell towers in a smaller geographic area ranging from a few hundred feet to upwards of 1,000 feet. These lower power antennas enhance capacity in high traffic areas, dense urban areas, suburban neighborhoods, and more. Small cells use small radios and a single antenna placed on existing structures including utility poles and street lights.

Distributed Antenna Systems (DAS) are a group of antennas in outdoor or indoor locations that connect to a base station. DAS systems are typically used in large venues including stadiums and shopping centers.



verizon

Macro Towers vs Small Wireless Facilities

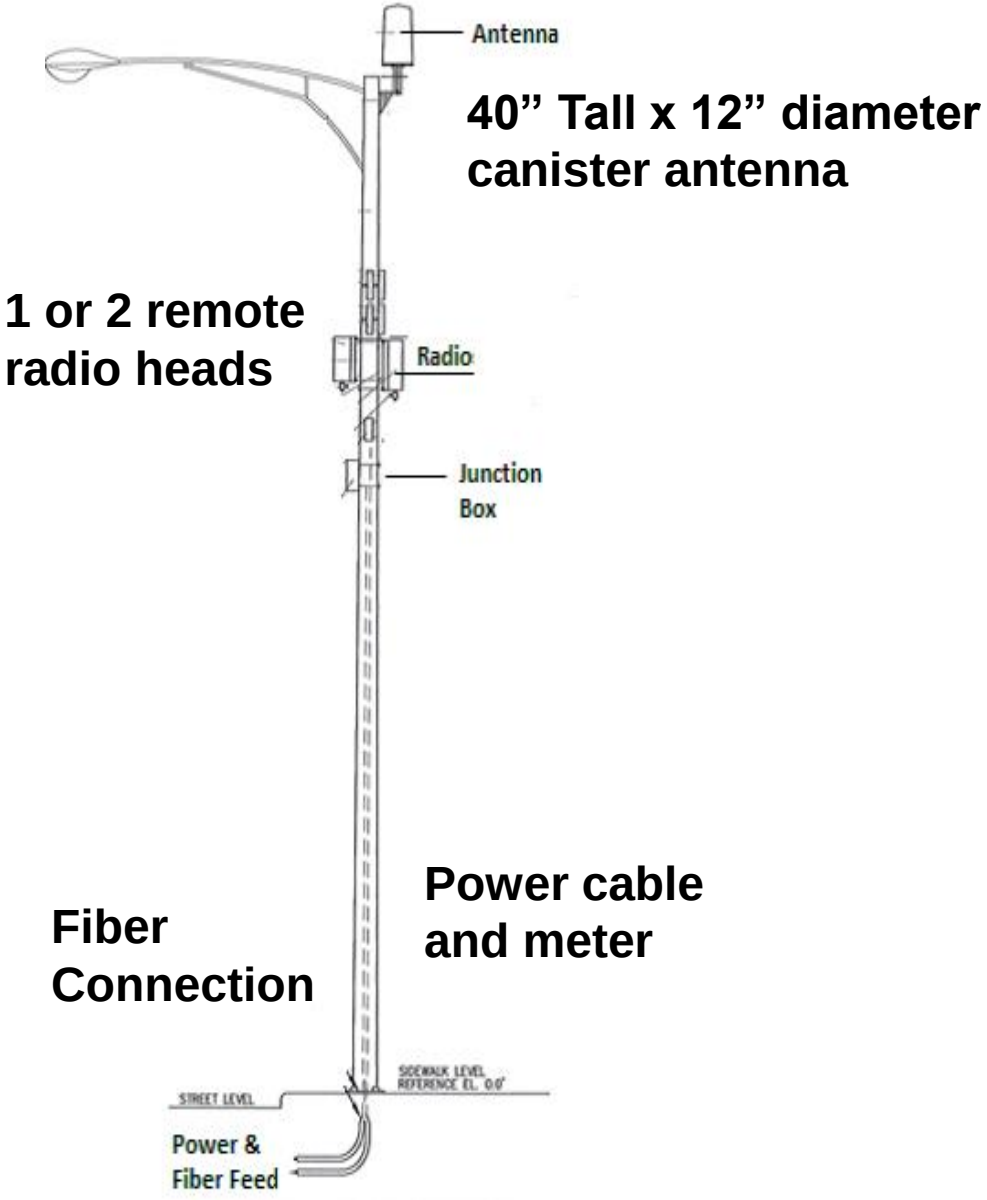


verizon

Confidential and proprietary materials for authorized Verizon personnel and outside agencies only. Use, disclosure or distribution of this material is not permitted to any unauthorized persons or third parties except by written agreement.

What is a small wireless facility?

Small wireless facilities, also called "**small cells**," are required to add capacity to existing wireless networks to meet the growing demand for wireless data.



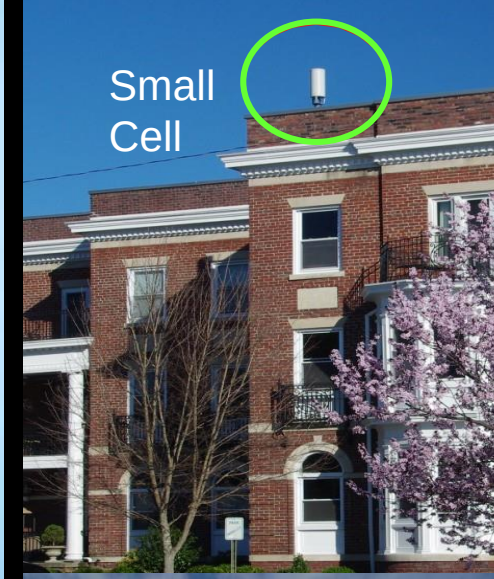
verizon

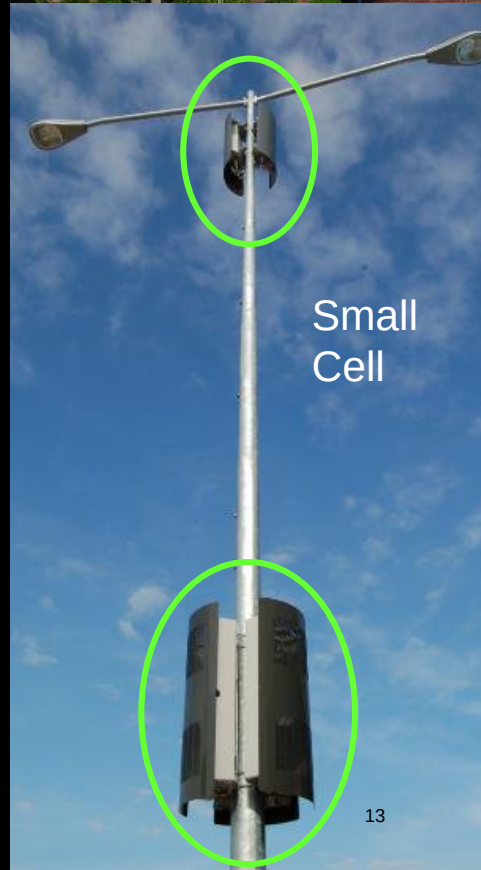
Confidential and proprietary materials for authorized Verizon personnel and outside agencies only. Use, disclosure or distribution of this material is not permitted to any unauthorized persons or third parties except by written agreement.

Accelerating small cell deployment

Forward-looking policies encourage carriers to upgrade and enhance next generation networks and improve speed, capacity and reliability using:

- Efficient processes:
  - Predictable permitting - local building or electrical permits provide the right balance and appropriate oversight over small cell deployment
    - Communities can deny building, electrical or ROW permits not meeting objective criteria
    - Allows for bulk permit applications
    - Reasonable and efficient timelines for approving applications
- Fees that are cost-based, fair and reasonable, competitive and nondiscriminatory.





verizon