“The secret of change is to focus all of our energy, not on fighting the old, but on building the new”

- Socrates

How 5G Works

Like other cellular networks, 5G networks use a system of cell sites that divide their territory into sectors and send encoded data through radio waves. Each cell site must be connected to a network backbone, whether through a wired or wireless backhaul connection.

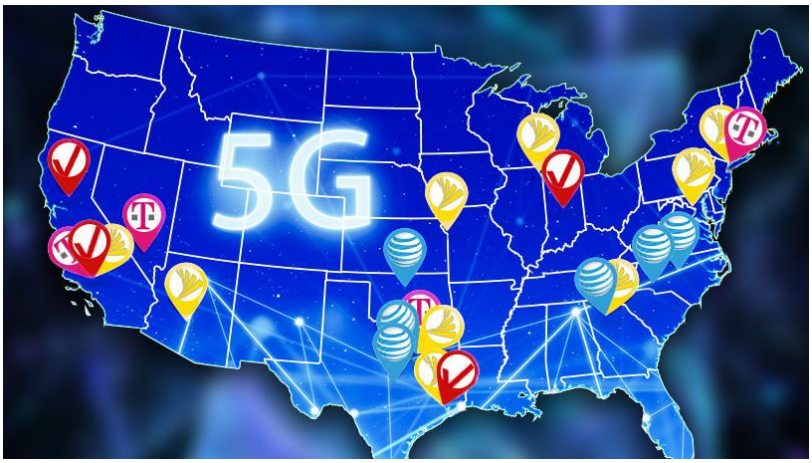
5G networks use a type of encoding called OFDM, which is similar to the encoding that 4G LTE uses. The air interface will be designed for much lower latency and greater flexibility than LTE.

The new system is also designed to operate on much larger channels than 4G is, to carry higher speeds. While most 4G channels are 20MHz, bonded together into up to 160MHz at a time, 5G channels can be up to 100MHz, with Verizon using as much as 800MHz at a time. That's a much broader highway, but it also requires larger, clear blocks of airwaves than were available for 4G.

5G networks need to be much smarter than previous systems, as they're juggling many more, smaller cells that can change size and shape. But even with existing macro cells, Qualcomm says 5G will be able to boost

capacity by four times over current systems by leveraging wider bandwidths and advanced antenna technologies.

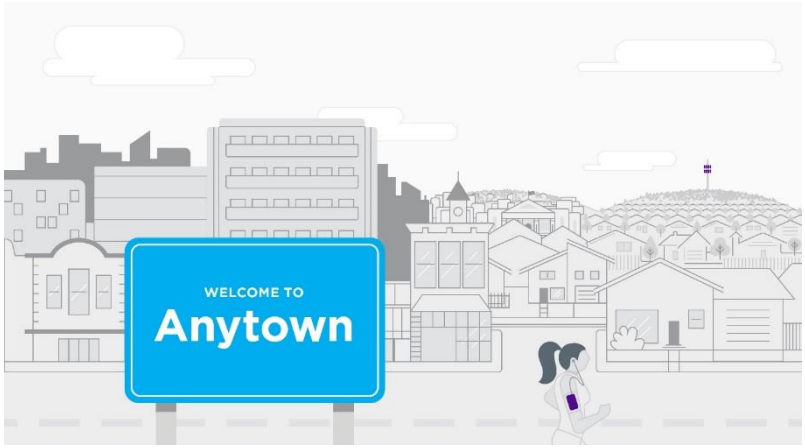
The goal is to have far higher speeds available, and far higher capacity per sector, at far lower latency than 4G. The standards bodies involved are aiming at 20Gbps speeds and 1ms latency, at which point very interesting things begin to happen.



Living in the country gives you clean air, lots of space, and quiet. But for the latest technology, you probably will still have to go to town.

There will be some form of 5G in the more rural areas but it will not be 5G technology. (*source – PC Magazine April 2019)

SMALL CELL TECHONOLGY

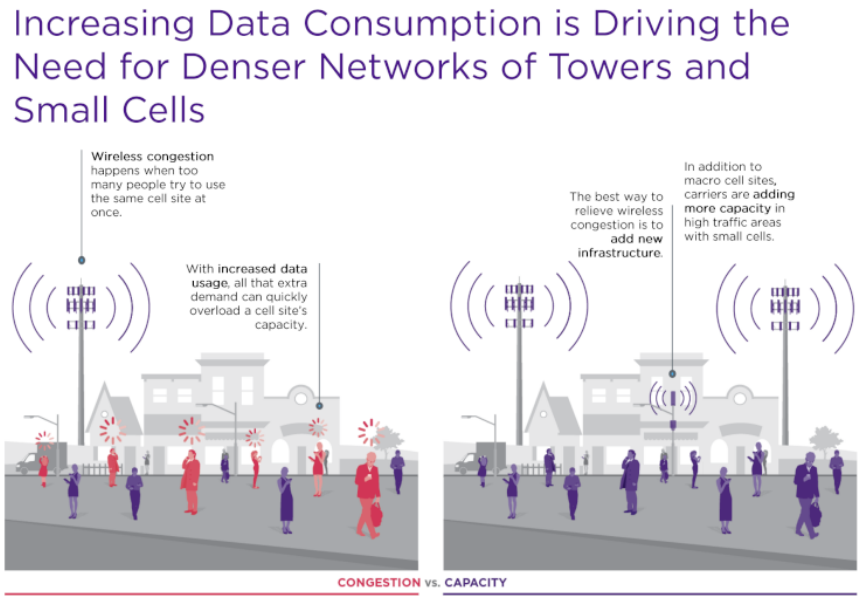


Affixed to this tower are several antennas owned by the wireless carriers that serve Anytown. They broadcast and pick up signals from residents' devices, send the data it receives to adjacent equipment near the tower and then a wired connection sends the information on to the internet or phone system.

Twenty-five years ago, when this tower was built, it served the residents of Anytown well. People were using cell phones to talk, and later, text with hardly any issues. With the possible exception of a few dead spots and limited coverage areas, Anytown's tower has reliably provided good, dependable service that kept residents connected. (Source *Anytown is a product of Crown Castle)

LET'S TALK ABOUT COVERAGE AND CAPACITY.

<u>Coverage</u>



This is the area that a particular type of communications infrastructure covers. In other words, it's how far the signal reaches. Anytown's tower is able to send its signal across the entire town. There are a few areas with hills and tall buildings, which can cause the signal to drop in some cases.

But Anytown's coverage hasn't changed.

Capacity

If you've ever had full bars on your device, but can't place a call or load a web page, you have coverage, but not capacity. You aren't having any issue connecting, but for some reason your data is not getting through.

To understand why this happens, we have to introduce one more new term: wireless density. The wireless signals that connect the tower to Anytown residents' devices are only capable of carrying so much data at once. The more data people use on the network, the slower everyone's connections become. To solve this problem, we need to find a way to add more wireless density to the networks that serve Anytown.

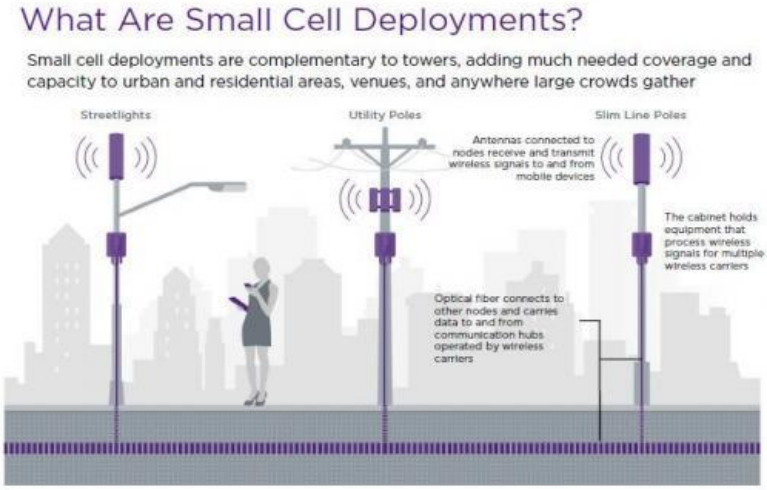
Challenges of the provider

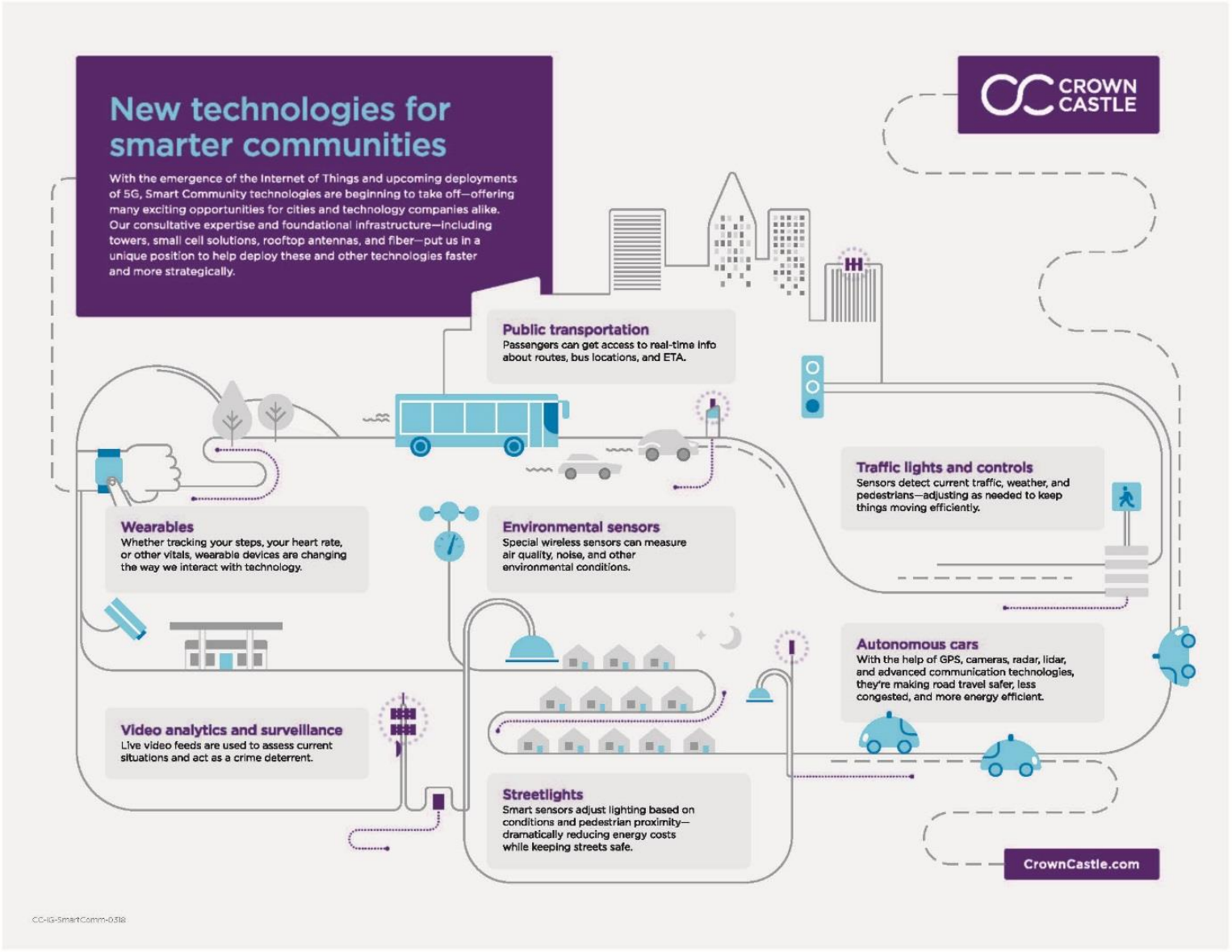
A small cell network consists of a series of small low-powered antennas—sometimes called nodes—that provide coverage and capacity in a similar way to a tower, with a few important distinctions. Small cells are always connected by fiber optic cable, and usually attached to existing infrastructure in the public right of way like utility poles or streetlights. This makes them more discreet, while also bringing them closer to smartphones and other devices—a benefit that will become clear as we go. Similar to a tower though, small cell nodes communicate wirelessly over radio waves, and then send the signals to the internet or phone system. One added benefit of small cells is because they're connected with fiber they are able to handle massive amounts of data at fast speeds.

- **Permitting:** In accordance with all state and federal legislation as well as local ordinances, Crown Castle established which permits would be required, when they needed to be submitted, and when the town needed to respond.
- **Design considerations:** Some community members expressed concern about preserving the aesthetics of the community. In this instance, it was determined that the best solution will be to place the nodes on top of streetlights. Other times, they may be placed on utility poles. They'll be designed to blend in with the existing structures.
- **Safety:** Some citizens have questions about safety. Crown Castle has provided assurance that only licensed contractors with a proven track record for safety will work on the project. They also directed community members

to several reputable studies as well as the FCC's guidelines on safe radiofrequency exposure, which the equipment would operate well below.

- **Shared model:** Several wireless carriers serve Anytown. The small cell network will be designed so multiple carriers can use it—spreading the benefits as evenly as possible throughout the community.




New technologies for smarter communities
With the emergence of the Internet of Things and upcoming deployments of 5G, Smart Community technologies are beginning to take off—offering many exciting opportunities for cities and technology companies alike. Our consultative expertise and foundational infrastructure—including towers, small cell solutions, rooftop antennas, and fiber—put us in a unique position to help deploy these and other technologies faster and more strategically.
CROWN CASTLE
Public transportation
Passengers can get access to real-time info about routes, bus locations, and ETA.
Traffic lights and controls
Sensors detect current traffic, weather, and pedestrians—adjusting as needed to keep things moving efficiently.
Wearables
Whether tracking your steps, your heart rate, or other vitals, wearable devices are changing the way we interact with technology.
Environmental sensors
Special wireless sensors can measure air quality, noise, and other environmental conditions.
Autonomous cars
With the help of GPS, cameras, radar, lidar, and advanced communication technologies, they're making road travel safer, less congested, and more energy efficient.
Video analytics and surveillance
Live video feeds are used to assess current situations and act as a crime deterrent.
Streetlights
Smart sensors adjust lighting based on conditions and pedestrian proximity—dramatically reducing energy costs while keeping streets safe.
CrownCastle.com
CC-IG-SmartComm-0318

COUNTY CHALLENGES:

Legal:

- FCC *Streamlining Deployment of Next Generation Wireless Infrastructure Declaratory Ruling and Third Report and Order 2018:* 1) Declaratory ruling regulating the use of local fees, in short, limits the amount of money local governments can charge for the deployment of small cells, 2) "shot clock", limiting the response time of local governments to process applications for small cell, 3) limit recurring fees in public right-of-ways, and 4) limiting local aesthetic requirements. Source *NACO Blog Sept 2018
- FCC 2017 repeal of net neutrality
- South Carolina Small Wireless Facilities Deployment Act H. 4262 currently resides in senate judiciary committee
- Where does this leave Counties today?

Planning:

- Right-of-way
- Electrical permit or permitting
- Aesthetics
- Structures
- Review process
- Compensation
- Safety
- Location / spacing / density

Planning and Zoning Regulations:

- Not having a small cell ordinance in place
  - Interpret it two ways 1) not listed in regulations means council had no intention to regulated small cells as a separate entity or 2) since it is not listed as an allowable use they are not permitted.
- Follow a model ordinance or create an ordinance specifically designed for your jurisdiction

"We cannot solve our problems with the same thinking we used when we created them."

- Albert Einstein