Wireless Services Abound in the Multifamily Space

5G, CBRS and Wi-Fi wireless services all have a place. Building owners and developers can choose one that best meets their specific needs.

By Richard Sherwin / *Spot On Networks*

Late last year, the National Multifamily Housing Council (NMHC) published some interesting statistics. Of the 120 million households in the United States, including renters and owners, 43 million renter households represented 109 million people, or about 34 percent of the U.S. population. A key finding was the age of renters. NMHC found 73 percent of the people in rental housing are under the age of 44.

Over the last 20 years, telephone and television viewing habits have changed significantly for that cohort. Many multifamily building residents in that age group no longer subscribe to video cable services, and more than 90 percent do not have landline telephone service.

It's no wonder that today's multifamily housing residents have several unique characteristics:

- They rely primarily on smartphones for voice and data communications.
- They hardly ever use landlines.
- Wireless high-speed internet access, especially for video streaming, is a very high priority.
- They value seamless, propertywide wireless connectivity.
- They want to live in tech-savvy buildings with keyless entry, remote temperature control and other such amenities.

Building owners and developers can choose how to provide for such services in their buildings. Careful consideration of the wireless environment will help attract new residents and keep existing residents.

In-building wireless voice services, providing voice calling on smartphones, is a high priority for residents' comfort and safety. Often, especially in LEED-certified buildings, cellular signals do not penetrate from the outside base stations. Because more than 80 percent of all mobile traffic originates indoors, according to the Cisco Visual Networking Index, wireless connectivity services for smartphones inside buildings are critical.

The approaching utilization of 5G, or fifth generation cellular (as opposed to existing 4G/LTE), has been promoted as significantly improving cellular services. Though this may be true, if the 4G/LTE signal cannot penetrate a building's walls, a 5G signal will not penetrate either.

The choices available to a building owner or developer will depend upon several factors. To introduce the considerations, a brief outline of each service follows.

CELLULAR SERVICE AND 5G

Cellular services started with the famous telephone call that Marty Cooper, the inventor of the portable cellular telephone, made to the then president of Ameritech in 1982. Dubbed

1G, the service began to proliferate in the 1980s with a voice service, sometimes using a portable cellphone from Motorola called "the brick." It was a 2-pound phone with 20 minutes of talk time. 1G had a maximum data rate of 2.4 Kbps.

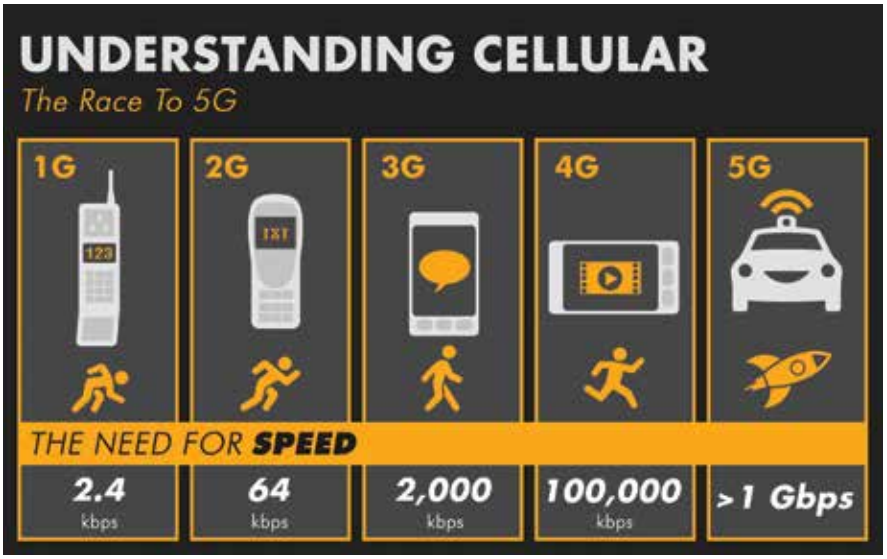
Third-generation (3G) cellular service had the ability to provide voice, text, and low-capacity and low-speed data with data rates up to 2 Mbps. The graphic at right provides a description of the evolution all the way to 5G.

4G/LTE offered a new coding structure with 10 times the speed of 3G and much greater capacity.

5G will offer much lower latency (delay time), greater speed and greater capacity. This will be accomplished in two ways: with new coding techniques and with the use (in the United States) of millimeter wave spectrum.

Millimeter wave (mmWave) spectrum sits in the high band, above 25 GHz. It offers a greater amount of frequency, providing greater data and device capacity and greater speeds. However, mmWave spectrum has various limitations. Because mmWave spectrum has a very short wavelength, it is unable to pass through objects and travels a shorter distance. This reduces the coverage area compared with mid-band and lower-band spectrum, which have much less frequency available to each wireless carrier. Radio frequency interference is kept at a minimum because cellular services generally use licensed spectrum.

5G will have 10 times the data rate and 200 times the device counts of 4G in addition to very low latency, making it ideal to offer services to devices needing extremely fast response times (think self-driving vehicles, telemedicine, factory robots, etc.).



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CITIZENS BROADBAND RADIO SERVICES

Citizens Broadband Radio Service (CBRS) uses an additional frequency band at 3.5 GHz of 150 MHz. It provides additional capacity for cellphones because it supports 4G/LTE devices and will support 5G devices in the future. The U.S. military currently occupies this band, especially in coastal areas, but much of the spectrum is available. Entities that currently occupy the frequency will continue to do so, but spectrum will be allocated to two additional categories: Priority Access Licenses and General Authorized Access. A spectrum-sharing arrangement will be implemented for all operators of CBRS through an automated Spectrum Access System.

Low-powered devices for indoor use, installed by users or private operators, and higher-powered devices for outdoor use installed by cellular operators and other professional radio companies will become available.

Priority Access Licenses users will have priority over General Authorized Access users in the sharing arrangement. Though interference may be greater than standard cellular, it will be less than with unlicensed-frequency driven services.

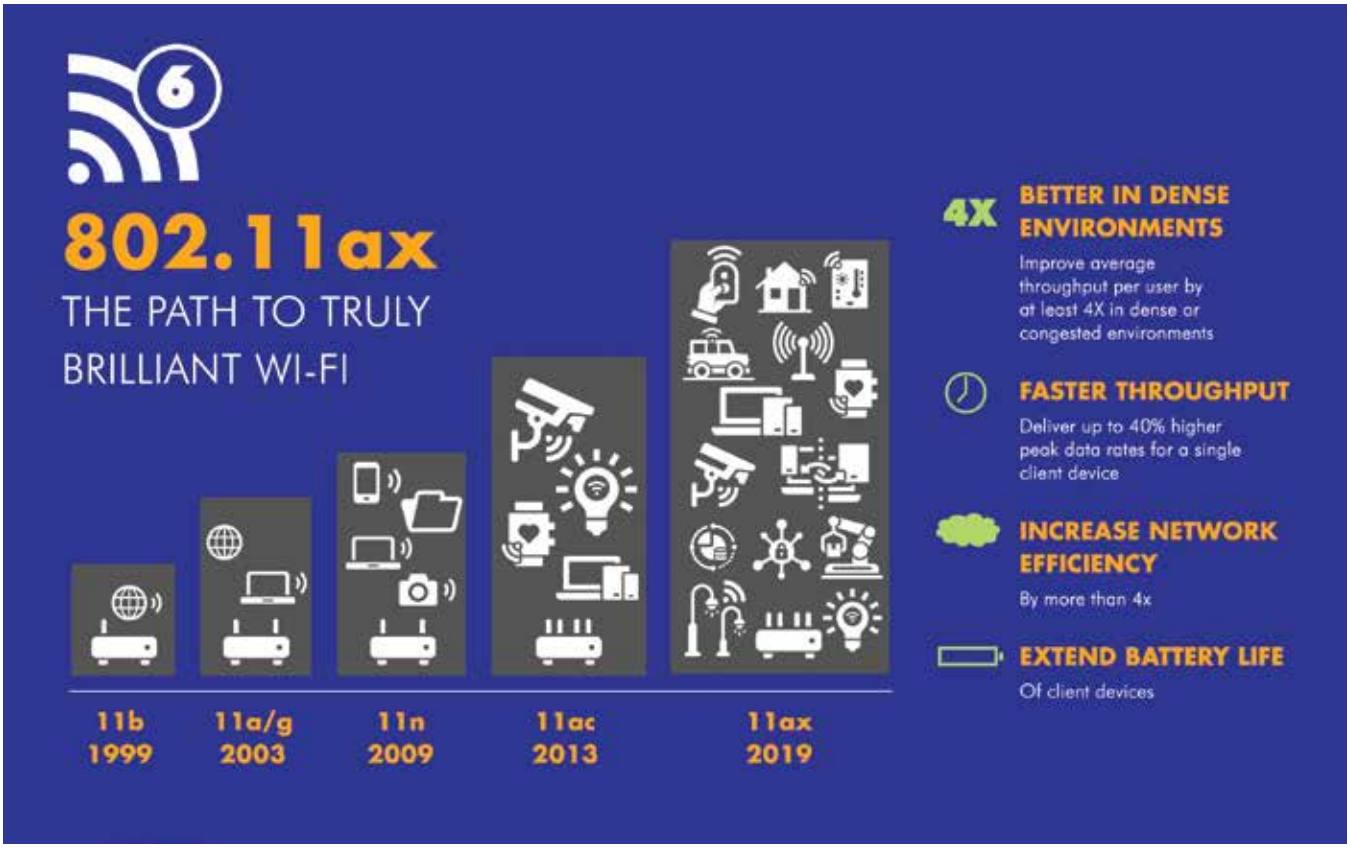
CBRS was promulgated by the Federal Communications Commission (FCC) to increase the available spectrum for cellular services and provide a mechanism to make indoor wireless services available as an adjunct to existing cellular services. Initially, private LTE networks will be available, making "closed" networks such as shop floor control more cost-effective, and once "neutral host" networks are available, the CBRS service will be more cost-effective for cellphone support than the implementation of distributed antenna systems in multitenant buildings.

Because CBRS, like 5G services, has low latency, providing wireless connectivity for internet of things (IoT) devices is an applicable use case, especially because IoT devices generally do not require large amounts of data transmission.

WI-FI

The FCC previously allocated radio frequency spectrum for Wi-Fi in the 2.4 GHz and 5 GHz bands. Though these are unlicensed frequencies and therefore do not protect users from interference, the amount of spectrum allocated within an individual building is approximately five times the amount cellular carriers in a city use.

Wi-Fi has evolved much the way cellular has evolved. Starting in 1999, IEEE 802.11a/b, now called Wi-Fi 1 and Wi-Fi 2, had a maximum speed of 11 Mbps with a very limited device capacity. In 2003, with the announcement of IEEE 802.11g, now called Wi-Fi 3, a maximum data rate



Wi-Fi 6 is expected to have a maximum aggregate data rate of 9.6 Gbps, with device capacity in the thousands within a small Wi-Fi cell.

of 54 Mbps was available with an increased device capacity.

In 2013, standards were announced for IEEE 802.11ac, now called Wi-Fi 5. This new technology had a maximum aggregate data rate of up to 3.5 Gbps, with hundreds of devices capable of being driven by a single access point.

Wi-Fi 6 (IEEE 802.11ax) standards were announced earlier this year, and the projected speed and capacity is mind-boggling. Wi-Fi 6 is expected to have a maximum aggregate data rate of 9.6 Gbps, with device capacity in the thousands within a small Wi-Fi cell. The chart above traces the evolution of Wi-Fi.

The FCC recently announced allocating an additional 1 GHz for Wi-Fi in the 6 GHz band. This means that Wi-Fi would have more than 1.5 GHz of spectrum available in every building in which service is available, providing greater throughput, higher speeds and greater device capacity than any service before it. With the addition of so much spectrum, interference in the unlicensed bands will be virtually eliminated.

Although Wi-Fi latency will not be as low as CBRS or 5G, Wi-Fi will handle typical IoT devices in multifamily residential buildings at a cost significantly less than that of other wireless connectivity methods. Because of the amount of spectrum available to Wi-Fi and the characteristics of a seamless managed Wi-Fi service, voice calling, video streaming, gaming applications and the like could be accommodated in a multifamily residential building on a single Network-as-a-Service (NaaS).

Research firm IDC projects that the number of Wi-Fi 6 chipsets will grow 10 times between 2019 and 2023. The Cisco VNI 2019 report projected that by 2020, Wi-Fi will be the primary method of voice communications, with more than 50 percent of voice calls carried over Wi-Fi.

If huge amounts of data are required, such as for video streaming, gaming or artificial intelligence applications, then 5G or Wi-Fi services may be best suited for wireless connectivity. If remote applications requiring instantaneous feedback and action are required, then CBRS or indoor 5G connectivity may be advantageous. Finally, if voice connectivity inside a building is lacking, Wi-Fi or CBRS may be the solution. Choices may depend on cost and levels of service.

All the wireless services – 5G, CBRS and Wi-Fi – have a place in a wireless-connected society. Selecting the right service depends on satisfying the requirements. ❖

Richard Sherwin is the CEO of Spot On Networks. He can be reached at rsherwin@spotonnetworks.com.