

CRS Insights

Deploying 5G (Fifth Generation) Wireless Technology: Is the United States on Track?
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In 2018, when the XXIII Winter Olympic Games begin in PyeongChang, South Korea, the global competition for leadership of the mobile communications industry might be intensified by the introduction of a [prototype](#) 5G network. Commercial deployments of fifth-generation technologies by 2020 have been announced by wireless network officials in South Korea and Japan. In July 2014, [Ericsson](#), a global leader in communications technology, demonstrated the [speed](#) of its 5G network design to customers [NTT DOCOMO](#) (Japan) and [SK Telecom](#) (South Korea). The technological advances of these early roll-outs might leapfrog the technologies used by U.S. networks, eroding what is widely perceived as a American competitive advantage in mobile communications

The Evolution of 5G Technology

As discussed in CRS Report R43595, [Mobile Technology and Spectrum Policy: Innovation and Competition](#), the cellular networks that have provided steady progress in wireless communications capabilities (up to and including 4G) are evolving into new forms that rely increasingly on local communications over short distances (e.g., [small cells](#) or [millimeter wave](#) links). 4G Long Term Evolution ([LTE](#)) networks now incorporate small cells to increase capacity. Most announcements about future 5G network designs include some reference to small cell concepts, albeit at a more advanced level of technology than what is in use today.

Recent descriptions of 5G emphasize improvements in network speed and capacity and the introduction of new communications technologies. Speed and capacity will be needed to support the communications of potentially billions of wireless devices, from tiny sensors to unmanned aerial vehicles, many of which will connect to each other through the Internet. Industry leaders generally agree that 5G will combine LTE cellular network and IEEE [Wi-Fi](#) standards, supplemented by new technologies. Views diverge on whether 5G will remain within the suite of cellular technologies—a further advance of LTE—or represent a new direction in network architecture with an important role for breakthrough technologies in delivering 5G.

Collaborative Research and Global Agreements

Ericsson, Alcatel Lucent, and Nokia helped launch the industry development group [5G-PPP](#) in 2014. The 5G Infrastructure Public-Private Partnership was initiated by the European Union to partner with private sector companies. Other industry members are primarily European telecommunications companies, and include European research subsidiaries of DOCOMO and Huawei.

Many of the same companies in the 5G-PPP participate in a 5G project supported by the European Union, [METIS](#). According to its website, the main objective of METIS is to lay the foundation for 5G by 2020, including the identification of appropriate radio frequency spectrum. Among its activities, METIS has co-sponsored, along with state agencies, summits on 5G mobile technologies in China (October 2013) and South Korea (May 2014).

In China, 5G research and development is being sponsored by three ministries that jointly established the [IMT-2020](#) (5G) Promotion Group. The objectives of IMT-2020 include developing 5G technologies for China and facilitating cooperation with foreign companies.

In South Korea, the [5G Forum](#) is led by SK Telecom. Established to compete with cooperative efforts in Japan, Europe, and China, the stated mission of the 5G Forum is to achieve global leadership for Korea in 5G technologies. Participating steering committee members include Samsung, LG Electronics, and Ericsson-LG; other corporate members include Intel and Qualcomm.

The European Union has announced formal collaboration agreements with [Japan](#) and [South Korea](#) to develop and deploy 5G. South Korea has also announced a [similar program](#) with China.

The United Kingdom is actively involved in organizing 5G development groups, notably the [5G Innovation Centre](#), located at the University of Surrey. In addition to support from U.K. government programs, the center research programs are funded by participating industry members such as Huawei; Samsung; and wireless carriers BT, Telefonica, and Vodafone.

There are a number of other alliances and joint efforts to pursue 5G objectives as well as a number of 5G programs within pre-existing industry groups—mostly international in scope—such as the Next Generation Mobile Network ([NGMN](#)) organization.

Spectrum Needs and United States Actions

DOCOMO will deploy its first 5G network at 15 GHz and is considering 70 GHz for millimeter wave connections. In China, IMT-2020 has identified spectrum bands above 6 GHz for 5G deployment over the long term and various bands from 450-470 MHz up to 4800-4990 MHz as candidates for initial build-outs. Spectrum allocations for millimeter wave frequencies can range from 20 GHz up to 90 GHz. In the United States, Google appears to be considering moving into [5G](#) by connecting Google Fiber (high-speed Internet) with millimeter wave frequencies at 60 GHz. A recent [ruling](#) by the Federal Communications Commission (FCC) should release 100 MHz of unlicensed spectrum for high-speed Wi-Fi in the 5 GHz band. Some industry experts view the IEEE standards for 5 GHz as key in deploying 5G networks.

Because the United States is the leader in 4G LTE deployment, many believe that it will be able to maintain that leadership by moving quickly to 5G by [2025](#). In addition to unlicensed spectrum at 5GHz, the four wireless telecommunications companies with a national LTE footprint will likely be able to repurpose at least some of their licensed spectrum holdings. Possible opportunities for newcomers may depend on policy decisions, notably those of the FCC, which is the primary agency for allocating and assigning spectrum. The FCC relies heavily on competitive bidding systems (auctions) to assign spectrum licenses. Its authority to hold auctions expires in 2022.

On October 17, 2014, the FCC issued a Notice of Inquiry ([NOI](#)) to explore the use of millimeter wave technologies in expanding wireless coverage and capacity. One of the objectives of the NOI is to gain a better understanding of the development of 5G and future spectrum needs. Nonetheless, it appears that the FCC's [policies](#) continue to favor companies with existing investments in 4G cellular networks over new competition and innovation. Policy makers may wish to examine whether this strategy will maintain the current U.S. lead in mobile communications through 2025 and beyond.