Why Being First in 5G Matters

The U.S., China, South Korea and Japan all see a big payoff from winning the battle for the wireless future

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The race to be the first 5G country has begun—and the winner stands to gain a lot.Around the world, giant wireless-technology companies are coordinating with their governments to come up with winning strategies to implement 5G, the next generation of cellular networks that promise to deliver ultrafast speeds and open up a range of new applications.

The U.S., China, South Korea and Japan are leading the early rounds. AT&T T -0.57% and Verizon plan city-by-city 5G launches starting later this year, while China expects national coverage by 2020. While wireless-industry executives say applications that tap the full potential of 5G—self-driving cars, virtual reality and remote surgery—are several years away, leading the way does matter for a country's economy, if the race to 4G is a guide. If the U.S. hadn't led the way on 4G, the country might not dominate mobile technology, and its platforms, such as Instagram, Snapchat and perhaps even Facebook and Netflix might not have become global powers.

"The Ubers, the Airbnbs, the Netflixes of the world came about because of 4G," says Rob McDowell, a Republican former Federal Communications Commission commissioner. "No one foresaw the app economy coming. What's exciting about 5G is that nobody can really fathom what's going to happen." Being slow to 5G, he says, would put "the U.S. at a competitive disadvantage globally."

Letting innovation happen

Short for fourth-generation cellular technology, 4G was designed to zap video and other gobs of data from cell towers to smartphones. Having easily accessible 4G on AT&T and Verizon networks helped entrepreneurs test ideas like Snapchat. It also persuaded people to use data-intensive smartphone apps, when they might have lacked the patience to wait for Instagram videos and pictures to load on slower 3G networks.

"The proverbial guys in the garage have a shot" to test business ideas if the newest wireless technology is available, says Roger Entner, lead analyst at telecom research-firm Recon Analytics. "If the network is not there, they don't have a shot at all."

In a study commissioned by U.S. wireless trade association CTIA, Mr. Entner concluded that America's 4G leadership led to roughly $125 billion in revenue for U.S. companies that could have gone elsewhere had the country not been at the technology's forefront. He says the 4G launch increased wireless-related jobs in the country by 84%, to 4.6 million in 2014 from 2.5 million in 2011.

Fifth-generation technology promises to be even more transformative. Consumers won't notice a difference until they upgrade to phones compatible with 5G technology, which won't become widely available until at least 2019. But when 5G is fully functioning in several years, it will be so fast that people can download full-length movies on their phones in a few seconds instead of several minutes currently. The data will travel nearly instantaneously, perhaps fast enough to mimic human reflexes

to help self-driving cars avoid accidents. In fact, some auto experts say, 5G could be crucial to the success of autonomous vehicles. The technology could also reshape the landscape for telecommunications firms. If people can download huge amounts of data at ultrafast speeds, wireless connections could be powerful enough to replace cable and internet providers that need to plug wires into homes.

A device revolution

What's more, 5G will allow many more objects to connect to cellular towers, enabling the long-promised Internet of Things, in which everything from home appliances to implanted medical devices are connected to the network.

Accelerating Change

- The next generation of wireless service, 5G, will deliver peak download speeds about 100 times faster than 4G. It will also eliminate most of the latency, or reaction time, when phones and other devices connect through the network. Consumers will see the difference in much more than just their smartphones:

- **Downloading media**
  A two-hour movie that takes six minutes to download on 4G will need three or four seconds on 5G.
- **Autonomous vehicles**
  Self-driving cars could get a boost. They could "talk" with other cars and with road sensors with human-reflex-like responsiveness.
- **Virtual reality**
  Consumers will get smoother and more seamless VR experiences.
- **Health care**
  5G will better enable services such as remote patient monitor-ing and remote surgery through connected health-care devices.
- **Internet of Things**
  5G will allow virtually anything, including sneakers and heart monitors, to be internet-connected. 5G could connect perhaps a trillion devices in the next decade and enable smarter homes, cities and energy grids.
- "The most important issue is enough capacity," says Marty Cooper, the former Motorola executive credited with inventing the cellphone. "5G is going to be an important element in running factories."

With 5G, manufacturers can more easily put chips in every part of their machines that can let engineers know when a part needs repair or replacement. Farmers can put internet-connected sensors on livestock to figure out when they're sick or giving birth, or all over their soil to tell when it needs more or less water. Some researchers are testing the idea of remote surgery, in which a doctor could operate on a patient on another continent, using a robot arm.

At home, people could connect components of their refrigerators or laundry machines to the internet, so they can detect when it needs servicing. Runners can connect sneakers to the internet to track mileage and speed. And people could have implanted heart or blood monitors automatically send readings to doctors via cellular networks.

Some of this technology is available now on 4G, though devices must typically connect to a Wi-Fi network or smartphone. 5G would let these devices be always internet-connected, as long as there is a cellular signal, and would theoretically let many more objects connect to cellular networks without slowing down traffic. Mr. Entner says 4G can connect up to 2,000 devices per square kilometer, while 5G could support up to one million devices in the same area.

It isn't just greater speed and connectivity that make this possible: 5G technology also requires less power than before, which means people don't have to constantly reload those tiny transmitters with new batteries. "5G has a layer specifically built around the Internet of Things, built around longer battery life, so now batteries last 10 years instead of one year," says Glenn Lurie, a former AT&T Mobility chief who is now CEO of wireless-technology company Synchronoss Technologies Inc.

All of this is why 5G has underpinned recent actions not just in the mobile industry, but also in the U.S. government. Verizon recently chose a 5G equipment expert, former Ericsson Chief Executive Hans Vestberg, as its new boss. T-Mobile and Sprint say the government should approve their merger if the U.S. wants to keep pace with China in 5G. The carriers are salivating at the prospect of selling services to manufacturers, utility companies and regular people.
U.S. tech giants including Intel are trying to persuade the White House that higher tariffs on China could threaten American 5G leadership, by raising the costs of goods required to build 5G networks.

Considering the benefits

For their part, U.S. officials have said that winning the 5G race is critical to both the economy and national security. That is, in part, how the government has justified the extraordinary steps it has taken to curb Chinese wireless-electronics giant Huawei, preventing its sales in the U.S., among other actions.

Officials believe Huawei could spy on behalf of the Chinese government, which becomes an even greater risk in a 5G era, in which exponentially more machines and everyday objects are connected to the internet. Huawei says it would never spy on behalf of any country.

Another worry is that if China develops widespread 5G first, it could be in a better position to experiment with autonomous vehicles and other emerging technologies—and displace Silicon Valley as the hub for the leading engineers. But some 5G skeptics question how great an impact the new technology will have. For instance, William Webb, a former Motorola director of corporate strategy who is now a telecom consultant, doesn't see huge promise in the technology.

"5G doesn't bring anything I can imagine that you can't deliver with 4G," he says. He compares the 5G to the Concorde, the innovative passenger jet that was a commercial failure because not enough people were willing to pay for the extra speed it offered to justify its expense. Autonomous vehicles can't rely on cellular connectivity in tunnels or even bad weather, since rain or extremely high humidity could distort 5G signals even more than it does with 4G, he says. That means most of the brains of self-driving cars will be inside the car's computer instead of over a mobile network.

Mr. Webb says that virtual-reality headsets and remote-surgery machines are more likely to be connected to Wi-Fi routers, which are connected to land lines that will still be faster than 5G.

Like some other skeptics, Mr. Webb also says it doesn't matter which country comes first, especially in an increasingly globalized world where multinational companies have offices everywhere.

If entrepreneurs need a 5G connection to work on applications, they can easily set up a lab that mimics 5G, or travel to labs, such as one at England's University of Surrey, Mr. Webb says.

Some observers argue that there is another point that gets lost in discussions of the race to 5G: No matter which region of the world develops 5G first, whether it is America, Europe or Asia, the companies that will benefit the most are patent holders, says Dimitris Mavrakis, an ABI Research analyst.

He says those companies include Qualcomm and InterDigital in the U.S., Huawei in China, Finland's Nokia , and Sweden's Ericsson . "If we want to talk about economic impact, we have to look at the big patent holders," he says.
In fact, those big patent holders may be even better poised to benefit from 5G than they did from past wireless advances. The U.S. wireless group's study said Japan—which led the way on 3G—failed to capitalize on the social-networking and music services it developed in the early 2000s, in part because those businesses were Japan-centric.

But the study's author, Mr. Entner, says foreign companies today are better suited to export their products internationally. He points to Huawei, which turned itself from a company focused on the domestic Chinese market to one that is now the world's biggest maker of cellular-tower equipment and related infrastructure, as well as the world's No. 2 smartphone brand.

Who's in the lead

In a separate study it commissioned earlier this year, the CTIA trade association found that China, South Korea and the U.S. were leading the 5G race, in that order.

CTIA considers China the front-runner because its wireless carriers have pledged large-scale 5G launches by 2020, while the government is supporting the effort.

South Korea tested 5G during the Winter Olympics earlier this year, and in July the government said Korean carriers will all launch 5G at the same time in March 2019 to avoid competition that could drive up marketing costs. The U.S. is likely to have the first working 5G networks by the end of this year, but only in a few cities. AT&T plans to launch in Dallas, Atlanta and other cities, while Verizon has picked Sacramento, Calif., and elsewhere.

Mr. Entner says being first doesn't matter that much, if the runners-up are only a few months behind. But a longer lag risks serious economic losses. "Not winning the network race guarantees you to lose," he says.

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