What is 5G and why did Trump nix a huge tech deal to boost America's lead in its development?

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Self-driving cars. Internet-connected homes. Smart cities. Innovations like these are expected to reshape the technology industry and society at large—but none will take off without stronger wireless infrastructure, known as 5G.

The fifth-generation mobile network will vastly expand the speed and volume of data that can be shared wirelessly, bringing the world closer to the autonomous age and generating enormous wealth and power for the companies that supply the equipment.

That's what made the Trump administration and other federal agencies so skittish about a hostile takeover of Qualcomm by Singapore-based Broadcom—leading to the White House's unprecedented move Monday to block the proposed $117-billion deal because of national security concerns.

Qualcomm, the Trump administration argues, is needed to boost America's lead in 5G research and development. Should the San Diego chipmaker fall behind, Chinese manufacturers could fill the void in U.S. and global markets.

That would be a blow for U.S. innovation, as the mass market could be beholden to foreign hardware. Worse, Beijing could have an advantage in discovering vulnerabilities in the technology that it could turn into so-

called backdoors used for spying.

"Having a well-known and trusted company hold the dominant role that Qualcomm does in the U.S. telecommunications infrastructure provides significant confidence in the integrity of such infrastructure as it relates to national security," said the Committee on Foreign Investment in the United States, or CFIUS, a panel of federal agencies charged with scrutinizing foreign deals that raised major concerns about Broadcom's bid.

What makes the introduction of 5G so sensitive is that its chips will be included in anything that requires access to the internet. That makes it a bigger source of risk than software. The discovery of security flaws called Spectre and Meltdown this year affected virtually all computers because of the ubiquity of the compromised chips made by Intel, AMD and Arm.

Once adopted, 5G stands to revolutionize communications. If 4G's breakthrough was enabling people to stream high-definition video on handheld devices, then 5G might be remembered for ushering in an age when we can power the most intricate technologies like drones, robots and city grids from devices we carry in our pockets.

The new standard is 10 times faster than 4G and is expected to make buffering video a thing of the past. Its connectivity is also superior, resulting in less aggravation for people seeking a cell signal.

A rollout of 5G probably won't gain momentum until next year, though providers have recently been teasing the technology. Samsung and Intel showcased the new standard at last month's Winter Olympics in Pyeongchang, South Korea. (The technology was used to direct a fleet of 1,200 LED-affixed drones that put on a light show during the opening ceremony.)

Whether any Chinese telecommunications companies will get to wow U.S. audiences remains to be seen. Tensions are rising between Washington and Beijing over trade and protection of intellectual property rights.

Though some Chinese firms have made inroads in Europe, they have failed to gain traction in the U.S. because of national security concerns. A bill was even introduced in Congress that would ban the U.S. government from doing business with two of China's market leaders, Huawei and ZTE.

ZTE was fined $1.19 billion by the U.S. Department of Commerce a year ago after pleading guilty to breaching sanctions by selling equipment to Iran and North Korea. Huawei, meanwhile, has been hitting roadblocks in the U.S. for years, most recently with American cell carriers that refuse to sell its phones.

Huawei and ZTE say they are independent of the Chinese government. But Chinese companies, particularly those in strategically important sectors like telecommunications, have to work closely with Chinese authorities because they also supply equipment to China's mobile network. Those close ties have raised red flags given China's history of corporate espionage.

Last month, U.S. lawmakers and spy chiefs warned a Senate hearing that China was trying to steal U.S. technology and intellectual property through contact with universities, business joint ventures and telecommunications firms such as Huawei and ZTE.

"The reality is that the Chinese have turned more and more to more creative avenues using nontraditional collectors," FBI Director Christopher Wray told the panel.

Still, some analysts say the threat posed by the Qualcomm takeover bid, which would have been the biggest-ever tech acquisition, has been overstated—suggesting Monday's executive order was driven by protectionism, one of Trump's signature campaign platforms, as much as it was by national security.

A chief point of disagreement is the assertion by CFIUS that Broadcom wasn't interested in long-term investment in 5G.

"The narrative that Broadcom was not investing in (research and development) is a gross oversimplification," said Mark Hung, an analyst for Gartner. "They've been very diligent in terms of investing in technology and products that have profitable commercial applications. 5G fits that bill. To say it would acquire Qualcomm and not invest in 5G is ludicrous."

Broadcom was in the process of redomiciling to San Jose when the deal was shot down—a move that would have made it an American company again (it was founded in Westwood) and free of CFIUS' jurisdiction. The company also pledged it would continue Qualcomm's investment in 5G if the deal went through. It also promised a $1.5-billion fund to train U.S. engineers with the goal of making the country the leading innovator in wireless technology.

Qualcomm isn't the only U.S. company that can be counted on to advance 5G technology. Its much larger rival Intel is also working on 5G chips, though it's playing catch-up to Qualcomm, which has focused on mobile equipment longer. Qualcomm chips can be found in most leading Android phones and many iPhones.

Patent filings loosely suggest Chinese brands are working just as hard, if not harder.

The most recent statistics available through the World Intellectual Property Organization show ZTE led the world in patent applications in 2016 with 4,123, a 91 percent increase from the year before. Huawei was second with 3,692 applications and Qualcomm was third with 2,466.

A massive effort is needed to upgrade the world's wireless network to 5G, which will be a global standard. That's unlike its predecessors, which often varied from country to country. That means all 5G devices will be able to communicate with one another seamlessly. The standard is set by an international body called 3GPP.

"It will eventually be a game-changer," Hung of Gartner said of 5G. "But the amount of investment required means it won't happen overnight. It will take many years of development in infrastructure."

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