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You may have heard that fifth-generation wireless technology, better known as 5G, is coming, and it'll be awesome. If you don't know anything more than that, you are far from alone.

The Trump administration **recently blocked a takeover** of U.S. firm Qualcomm by Singapore-based Broadcom, on the grounds it would undermine U.S. strength in 5G technology and damage national security. Meanwhile, we've seen a drumbeat of 5G press releases from telecommunications companies, whose breathless hype about blistering speeds and **astounding applications** make 5G sound like it's right around the corner.

The shift is inevitable, but it'll take time. And the breathlessness **may be overblown**.

Like past generational shifts, the move from current 4G LTE wireless to next-gen 5G will be hugely expensive and will result in patchy coverage for **years to come**. What's different is that after all the infrastructure upgrades, much of the time your phone's connection to the internet might not be any faster. The biggest impact of 5G could be that the distinction between wired and wireless networks will blur, as America's two biggest "wireline" service providers, Comcast and Charter Communications, and the biggest wireless providers, AT&T and Verizon, adopt similar technologies and transform the way the internet reaches consumers.

To understand any of this, we have to start with what 5G is and how it will work. Today's 4G LTE wireless technology is enabled mostly by large cell towers of the sort used to create cell networks since the days of Gordon Gekko and Zack Morris. In rural areas these towers can be tens of miles apart; in Manhattan there are more than **50 per square mile**. The radio waves that come from these towers are in the **megahertz-to- low-gigahertz range** and vary according to which bits of spectrum a carrier has licensed from the FCC. These radio waves can travel long distances and penetrate buildings, so they can reach you wherever you are.

At its most basic level, 5G can be an upgrade to existing infrastructure like this. As a grab bag of the latest tricks for making wireless networks better—including targeting **radio beams** and **a huge increase in the number of antennas**—5G can operate across all the spectrum currently used by telecoms companies, from 600 megahertz on up. In theory, this would make any existing spectrum it's applied to

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more reliable—though not necessarily faster. The aspect of 5G that grabs headlines is its incredible speed. That comes from a rollout of wireless across new, higher-frequency spectrum.

Waves with a frequency in the tens of gigahertz—known as “millimeter waves” because their wavelength measures a few millimeters, rather than today’s longer-wave frequencies—can carry an order of magnitude more data, in theory. But these waves can’t travel very far or penetrate most building materials including glass, and they get absorbed by foliage and rain. If the old way of doing things was to set up widely spaced towers and pass longer-range wireless between them, the new approach is to turn the disadvantage of 5G—the short distance over which it operates—into an advantage.

By subdividing an area into many more cells, 5G could allow wireless companies to reduce the number of users connecting to any given tower, while simultaneously making radios in both our phones and on the towers faster. If that sounds familiar, it’s because this is similar to how a Wi-Fi network inside an airport or office building works. It’s true that 5G will go into cell towers. T-Mobile is building it out in 30 cities, and its customers will be able to access it in 2019 when the first 5G phones become available, a company spokeswoman says.

But what makes more sense for high-speed 5G is an ultradense web of radios, many not much bigger than a Wi-Fi access point. All of these must be physically connected to power and the internet and dwell where the network operator already has right of way. Initially, 5G will work much the way cable or fiber-optic internet service works now. A 5G wireless base station **will connect with an antenna hung on a home or office**, which will connect with a Wi-Fi network inside the home. Phones will appear later, in 2019, but the number of places where you’ll be able to get high-speed 5G access will be extremely limited. Because of this, wired networks are suddenly hot again, and cable carriers have an advantage at the start.

Telecom companies like Verizon and AT&T say this shift will only expand their business, as new applications for 5G, from self-driving cars to mobile augmented reality, stoke demand. But they need to keep building their fiber-optic networks to make it happen. AT&T plans to extend fiber near (but not directly to) 22 million homes and businesses **by July 2019**. Verizon currently has nearly six million customers for its fiber-optic home internet service, making it well-situated to roll out a dense, fiber-optic-powered 5G network in regions where it already offers its Fios service, says Bill Stone, vice president of network planning at Verizon.

Cable companies, which already have dense wired networks, see an opportunity to move into mobile, a Charter Communications spokesman says. Charter will be rolling out its **own mobile service** in the middle of 2018. Comcast already has a wireless service with 380,000 subscribers, but it hasn’t elaborated on future plans for it. Jonathan Chaplin, managing partner at New Street Research, which specializes in telecommunications, says cable companies do have the advantage: They are already focused on homes and offices, rather than mobile use. And even on mobile devices, more than 80% of our data use **happens over Wi-Fi**.

Given the complexity and expense of building out full-coverage 5G networks, expect a long, slow rollout of services like these. At some point, with enough nodes densely packed in across big cities, any of these carriers could go from offering wireless inside buildings to offering it outdoors, too. Eventually, that patchy Wi-Fi-like network will get good enough so that we can trust 5G—and then, maybe, you’ll get into an autonomous vehicle connected to it. But it could take years. – ***Wall Street Journal***

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Terri Fetherolf has two wishes for Vinton County: clean water and fast internet. The first is imperative for its safety and health. “But rolling out broadband is key to our economic survival,” said Fetherolf, Vinton County’s development director. Today, high-speed internet has become a utility as important as sewage systems, the electricity grid and highways.

But despite the internet’s tightening chokehold on technologies embedded in our pockets, homes, vehicles and public spaces, **more than 1 million Ohioans have zero access** to fast, reliable broadband at home. Almost a third of Ohio’s rural residents lack home access to broadband, compared with just 2 percent of urbanites, according to Federal Communications Commission estimates. Those figures are slightly better than the national rate.

Last week, a **legislative proposal** to establish a \$50-million-per-year broadband development grant program inched forward, fueling the hopes of advocates. “In Ohio, it’s just been an uphill battle. It’s been hard to rally enough attention,” said Stu Johnson, executive director of Connect Ohio, a broadband technology nonprofit group. “In the last year and a half, two years, there’s been more and more momentum.”

Currently, the burden of providing broadband falls on private industry, which doesn't stand to profit from expanding coverage in sparsely populated regions, Johnson said. State and federal governments finally seem willing, he said, to help patch holes in the country's broadband network. "Now we're asking, 'What's adequate access? And should it be any different than what we accept in urban areas?'" Johnson said. "Should they use candles? Gravel roads? Is half-clean water okay?" Local leaders say the digital divide has further isolated rural Ohio, already rendered remote by rolling hills, limited infrastructure and ongoing economic recovery from stagnated industries such as mining and logging.

Only about one in six of Meigs County's 24,000 residents live in its seat, Pomeroy, or its largest village, Middleport. The rest live in the country, where even mobile service is undependable. Across Meigs and Vinton counties, more than half of residents lack adequate home broadband and about one-third of businesses don't have a website. "In this day and age, it's hard to fathom that there's so many gaps in coverage. We've been a step behind since forever," said Perry Varnadoe, Meigs County economic development director. "We are rural and remote, which means it's more important for us to be connected."

In 2018, the implications of an internetless life — or one where connection is slow, expensive, limited and unreliable — are far-reaching. On weeknights, students who are expected to thrive in an internet-enabled world flock to the closest McDonald's to finish homework assignments using the chain's free WiFi. Other residents share the two-county region's 41 internet-enabled public computers to check email, apply for jobs, read online news or tap state services, such as employment or vehicle registration.

Law enforcement can't address cybercrimes such as identity theft, hacking, spam or ransomware. At one elementary school, teachers and staff members have no cellphone service in the building. Harrisville Township's fire department celebrated the arrival of broadband this month. Intellwave, a wireless internet service provider in 15 counties across southern Ohio, focuses on filling the gaps left by larger carriers that say there is no financial incentive to develop expensive rural broadband infrastructure. Hills, tree cover and sparse population still present barriers to connectivity, said Intellwave CEO Chris Cooper. "A lot of people see it as fly-over territory. That's left space for us," Cooper said.

Unlike other states, Ohio does not have dedicated broadband offices, task force or legislative committees. According to a 2017 Ohio State University study, Ohio lags significantly in rural broadband access compared to states with similar population densities in rural areas. Proposed legislation passed out of committee last week would create a program to provide \$50 million each year in grants to private businesses, political subdivisions, nonprofit organizations and phone and internet cooperatives. It would expand coverage to about 14,000 Ohio households annually without raising taxes or using money from the state's General Revenue Fund. Instead, it would use existing funding from Ohio Third Frontier bond revenue, an economic development initiative administered by the state.

In a [study released this month](#), Purdue University researchers found that areas with the largest digital divide lost prime working population and suffered from substantially lower job growth. "That is like trying to drive a car through the rearview mirror," said Roberto Gallardo, the assistant director of Purdue's Center for Regional Development. "They're being left behind." Rural connectivity poses problems for well-connected metropolitan residents, as well, if they want to shop for small-town goods online, video conference with rural colleagues or avoid having their driverless car buffer on country roads. "The internet is not a luxury anymore," Varnadoe said. "I'm a free-market person, but this is a place we need the government to step in. It's coming, we just don't know if it's one year away or 20." — ***Columbus (OH) Dispatch***

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About a century ago, there was vast skepticism about whether electricity ever could be brought to rural areas due to the low voltage of municipal systems, limited transmission technology and the industry's economics. It wasn't until 1935, when President Franklin D. Roosevelt created the Rural Electrification Administration by executive order, and 1936, when Congress created subsidies for companies to expand the power grid, that millions of rural residents began to receive electricity and all of its economic and social benefits.

Today a similar situation exists regarding broadband internet access. Like electricity a century ago, broadband is today's technological driver of economic and social equity. Access is not a luxury but a necessity. About 800,000 Pennsylvanians do not have access to high-speed internet service, 520,000 of them in the state's far-flung rural areas, largely due to the economics of extending networks.

Gov. Tom Wolf is on the mark with a new plan to make high-speed internet access available to every Pennsylvanian by the end of 2022. This week, he created the Office of Broadband Initiatives and

announced a program, the Pennsylvania Broadband Investment Incentive, to help drive broadband expansion. The state government will make available \$35 million in incentives to private-sector broadband providers. Those companies will be able to use the funds to bid on providing access in service areas through an impending Federal Communications Commission bandwidth auction.

Funds will come through PennDOT, which has its own goal of building out networks along its road systems, which traverse the entire state. Its interests are in connecting all of its facilities, and ensuring that broadband access is available for traffic controls, emergency communications and likely, in the near future, for systems to support self-driving vehicles. Broadband access is crucial to everything from entertainment to economic development to education. The state government should be engaged in ensuring that all Pennsylvanians have equal access to it. – **Hazleton Standard-Speaker editorial**

