

**REMARKS OF
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NETWORK OF THE FUTURE
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Good morning. It's terrific to be here and join you in Texas. Let me start by noting that I love what you've titled your gathering here in Dallas—Network of the Future. Because that's exactly what I want to talk about today—the future of connectivity, the future of wireless—and the future of next generation wireless services, or 5G.

But before I get to the future, a quick nod to the past. Thirty years ago this week, the first consumer mobile phone went on sale. It was clunky and brick-like. It had an extractable antenna like the ones found on old handheld radios. And three decades ago it could all have been yours for \$4000. But within the decade more graceful and lower-cost devices made their way to the market, like the Motorola Star-Tac. It had a slim clam-shell shape that snapped closed with a satisfying clack. It was the device everyone wanted. It was modern. It was cool. But as futuristic as it seemed, it was built for voice calls. After all in 1996 wireless service meant one thing: telephony.

Twenty years later our mobile devices are even more popular and far more powerful, with data capabilities that have changed modern life. Today, the United States leads the world in deployment of the current generation of wireless technology—known as 4G. While we are home to less than five percent of the globe's population, we have one-third of all 4G subscriptions worldwide.

So far, so good. But if we want our wireless future to be bold, we need to do more than rest on our 4G laurels. We need to focus on what's next. 5G services are poised to provide speeds more than 10 times faster than today's 4G networks. The increased speeds of 5G service will change the way we communicate, multiplying the ways we use video, with images increasingly replacing text. The reduced latency of 5G service will clear the way for augmented and virtual reality—creating new teaching tools and entertainment experiences. The lower energy demands of 5G service will lay the groundwork for new efficiency gains from the Internet of Things.

The race to 5G is on. The world's wireless economies are busy planning for 5G service. South Korea and Japan have plans to deploy 5G service by the time they hold the Olympics in 2018 and 2020, respectively. The European Commission committed to support 5G research with South Korea and last year signed up for the same with Japan. It also has reached an agreement with China, where three of the nation's ministries have jointly established a group to promote the development of 5G technologies.

So even though standardization is still underway and commercialization may not take place until the end of the decade, the race is on. It's one we want to win. But we need a framework. So let me offer you my five ideas for 5G.

Idea #1: To find spectrum for next generation networks we need to look high.

Today, the bulk of our 4G wireless networks are built on spectrum frequencies from 600 MHz to 3 GHz. This is our current sweet spot for mobile communications.

However the 5G future will look different—very different. We will need to bust through this old 3 GHz ceiling and create new possibilities for millimeter wave spectrum—in the airwaves at 24 GHz and above. This is spectrum that is way, way up there. These are the airwaves that take us to infinity and beyond.

But with stratospheric frequencies there are propagation challenges. While these super-high signals carry a significant amount of data, they do not go far. But we can turn this limitation into a strength by combining these frequencies with small cells packed close together, densifying our networks at lower cost. All of this, in turn, can mean service that reaches further into buildings at faster speeds than ever before. This is especially useful in urban corridors and fast-growing areas with the greatest traffic demands.

It won't be simple to put these bands to use. But the Commission has already taken an important first step with a rulemaking last year proposing action in high-band spectrum.

Now it would be best if we could harmonize these efforts globally, which will enhance economies of scale. But there are some places where when we look high, I believe the United States will need to go it alone. This includes the 28 GHz band. Unfortunately, at the World Radio Conference in Geneva last year this band was left off the table. It was not included in the study list of 5G spectrum. But because this band has a global mobile allocation I think the United States needs to move on this spectrum frontier. Tests on this band are already underway in South Korea and Japan. We need to put in place a plan for this band—now.

While we're at it we should lead in the 37 and 39 GHz bands, too. Unlike the 28 GHz band, these bands were designated for 5G study at the World Radio Conference last year. So we should identify a way forward now that makes it possible for these two bands to be easily combined by licensees.

Idea #2: When we look high for new spectrum, we cannot forget that we also need to look low.

This idea is not complicated—or especially new. But we have to remember that while we explore the possibilities of millimeter wave, we need to continue to look for opportunities in low-band spectrum below 3 GHz. This spectrum is essential for coverage today. It will continue to be essential for coverage in the 5G future. 5G networks will incorporate multiple radio access technologies, and for seamless connectivity we will need more than millimeter wave spectrum.

Idea #3: We need not just licensed airwaves, but unlicensed airwaves too.

Good spectrum policy involves a mix of licensed and unlicensed airwaves. This is true today with 4G services—and will continue to be true with 5G as well.

Today, unlicensed spectrum supports Wi-Fi—and Wi-Fi has helped democratize Internet access.

Unlicensed spectrum also helps carriers manage their networks. After all, today more than half of all wireless data connections are offloaded at some point onto unlicensed airwaves.

Unlicensed spectrum is also how we foster wide-scale wireless innovation. That's because the low barriers for entry make them perfect places for experimentation. And that experimentation has a bottom line. In the United States, unlicensed spectrum contributes more than \$140 billion to the economy annually.

Today, we have extensive unlicensed activity in the 2.4 and 5 GHz bands. But these bands are getting crowded. So going forward we need an unlicensed action plan. In other words, we need a cut for unlicensed in 5G spectrum policy. Call it the Wi-Fi- or Wi-Gig-dividend. And we have an opportunity to create one in millimeter wave spectrum in the 64-71 GHz band, which is located next to another swath of airwaves already used for unlicensed. This is big. So we should seize it—now.

Idea #4: To build a bigger wireless future, we need to focus as much on the ground as on the skies.

In wireless policy, spectrum gets all the glory. But the unsung hero of the wireless revolution is infrastructure. Because no amount of spectrum will lead to better wireless service without good infrastructure. So if we want a big and bold future for our airwaves, we need policies that support our efforts on the ground.

We can begin by taking a comprehensive look at tower siting practices and make them more consistent across the country. We can start with federal lands—which make up as much as 1/3 of our national real estate. We can expedite deployment here by creating an open data inventory of infrastructure.

But we need to think beyond traditional tower siting. 5G use of millimeter wave spectrum puts a new premium on small cells. Figuring how to get these microcells in place is a significant effort. For outdoor deployments, we need to find ways to harmonize municipal practices from coast to coast—and should work to develop model practices. To help this along, the Commission can engage with States and Tribal Nations to further streamline the siting process by modernizing what is known as the nationwide programmatic agreement.

Finally, fiber matters. It's important to remember wireless requires wires. Backhaul from macro towers and microcells will be important in 5G like never before. So we need policies that provide incentives for deployment and competition.

Idea #5: We need sandboxes for cities—and more experimental licenses.

5G technology will have applications everywhere—in rural areas, urban areas, and everything in between. But these applications hold special promise in our cities. That’s because 5G will bring high speed, low latency technology to densely populated areas, opening up a whole new range of civic and commercial services.

Last year, the Administration kicked off a Smart Cities Initiative. It features over \$160 million in federal research support to help our cities tackle future challenges. If you look closely you will get lost in the details. But stand back and squint. In these community collaborations wireless technology is front and center because so much is dependent on sensors, data, and public policy coming together in a powerful way.

The Commission needs to support these initiatives. Here’s how we can do just that:

Three years ago, the agency adopted an Order updating its experimental licensing program, putting in place new licenses for research labs, healthcare facilities, and more. These experimental licenses are important. They provide an early and upfront way to innovate and create. They provide a safe place to play with power levels, explore frequencies, and develop new services.

But for too long one of the ideas in this decision has been stuck in the starting gate. Three years ago, we proposed innovation zones—flexible experimental licenses that are virtual sandboxes for cities. But the Commission has yet to set up an innovation zone or take in an application to do so. It’s time to put this policy in place. Because it is tailor-made for smart city initiatives. It is ideal for 5G services and it can help demonstrate the dramatic opportunities of the next generation of wireless services.

Let me finish by highlighting that last point.

We have problems to solve, resources that are constrained, and communities that need help navigating what is possible in the digital age. There is no shortage of challenges ahead. But we are on the cusp of cars that drive themselves, streets that are safer, emergency services that are more effective, healthcare that is more personalized, and more capability across the board because we will be more connected.

Let’s talk about that. Because while 4G technology brought the smartphone to pockets and purses everywhere, the benefits of 5G technology are bigger, bolder—and more diffuse. They will be felt throughout the economy—but selling communities and consumers on their benefits will not be easy if all we can do is talk about spectrum, small cells, and beam forming. I mean, I get excited about that—and maybe you do, too—but hey, that has its limits.

Instead . . .

What if we rewarded the city that cut commute times the most? It would take sensors in streetlights, roadside architecture, and cars to see where traffic patterns could be more efficient and public transportation more effective. 5G technology can make it happen.

What if we introduced cameras in the helmets of firefighters? They could relay video back to colleagues outside who could direct a team of firefighters in real time, enhancing safety for first responders and those they rescue. 5G technology can make it happen.

What if we monitored urban trees with sensors to help assess air quality and develop strategies for dealing with drought? Los Angeles is already looking at this in a project called the Internet of Trees. And 5G technology can make it happen.

That's what the wireless future looks like. It is so much more than the device in our palm today. And we can get there and enjoy that future if we do more than rest on our 4G laurels. Because the race to 5G is on—and we need to get going—because the future belongs to the connected.

Thank you.