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AT MOBILE WORLD CONGRESS-LOS ANGELES

"THE YEAR OF 5G AND BEYOND"

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Thank you for the kind introduction, Scott. And thank you for inviting me to Mobile World Congress-Los Angeles. Coming to events like these gives all of us in government the chance to learn more about the industries we regulate and the policies that will bring more broadband to more Americans. As I've said before, you don't want government officials regulating in the dark. This Commission has focused on modernizing our regulations, bringing sometimes 2G and 3G regs into the 5G era. So it's invaluable to hear from the inventors, the suppliers, the climbers, and the rest of you who work to connect Americans to each other and the world.

2019 has been the Year of 5G. In January, I started using the hashtag #YearOf5G. Sadly, it did not go viral. But while the hashtag may not have taken off, the technology sure did. 2019 saw the first standards-based 5G deployments, which now cover over 30 American communities. That number will head above 40 by year's end. 5G brought fast home Internet access to places that had one or no choice for that vital service. Today, consumers can choose from three 5G phones and a host of other connected devices, with more to be unveiled in the coming months. In short, what engineers and scientists have been working on for a decade is coming to life. And it's about to change how we live, work, and connect.

Most Americans know something about 5G by now. Some notion of the technology has escaped the telecom bubble. A PC Magazine poll conducted in April revealed that only five percent of respondents were <u>not</u> sure what 5G is—or at least were willing to cop to not knowing. A Harris poll from a few months earlier dug into what people thought 5G would mean to them. Nearly half thought 5G's lead characteristic would be faster downloads. About a third cited higher quality video streaming, and a quarter pointed to better voice and video calls. Overall, not bad, considering that we're just in Year One of the technology getting into the commercial marketplace. But clearly 5G is a lot more than those things. I don't think you would go to all of the trouble of inventing and deploying a new wireless standard for better FaceTime chats—let alone invest the quarter-trillion dollars that's projected over the next few years.

So we need to do a better job of explaining 5G in plain terms. It's important that we meet this communications challenge. We have to shift our audience from those who are immersed in tech and telecom to ordinary people who aren't interested in the latest 3GPP release but who are very interested in how new tools can make their jobs more rewarding, their kids' schools more enriching, and their families closer.

Part of the challenge is that people tend to underestimate the pace and nature of technological change. We suffer from a status quo bias. We tend to think that the next big thing will just be a faster version of what we have today. We can lack the vision to see the disruptive and transformational shift that an upgrade in technology will enable—the innovative new businesses it will support. Or, more importantly to everyday Americans, the pain points in our daily lives that will be eliminated.

This is not a new phenomenon. We called the first cars "horseless carriages." Our vision can be anchored and limited by what we see in front of us today. And we have seen this story repeat itself throughout even modern shifts in technology.

Think back 10 to 15 years ago. Back then, we were moving from 3G to 4G and providers were building out high-speed fiber lines on a new scale. Look at what was being written back then. Analysts and Bellheads alike were wringing their hands and doubting whether Americans would want to upgrade from copper to fiber. Articles were legion with headlines like "3G to 4G: Is it worth it?" Many people did not see any use cases for 4G beyond those already enabled by 3G. Sound familiar?

In fact, a lot of analysts were searching around for the "killer app" that would finally convince Americans to upgrade to broadband. What did some of the best minds in technology seize on back then? VoIP. A telecom consulting firm published a white paper arguing that VoIP would finally provide the necessary incentive for consumers to upgrade to broadband. The report said that not accounting for, and I quote, "rogue P2P companies such as Skype . . . [whose] calls are free," ditching the copper home line and adopting broadband-powered VoIP would save people $8 per month. This savings would pay for broadband, making the upgrade make sense.

Everyone now knows what happened. And it's far more than VoIP. Look no further than the roughly $1 trillion app economy we now have. Look at all of the streaming services we enjoy today. Smartphones became one of the most rapidly adopted technologies in history. And all of this was powered by the first and world-leading 4G network that providers built out across America.

It's amazing to look back today and realize that there was an entire class of telecom professionals and financial analysts who made the bear case that broadband wasn't worth the investment. These digital deniers didn't imagine how Venmo would transform banking. They were stuck in the era of walking to a brick-and-mortar bank, waiting in one of those rope lines to fill out deposit slips, and using those pens chained to the desks, perpetually out of ink. VoIP wasn't going to change that. The connection critics didn't predict what Uber would do for mobility. They were stuck in the era of arguing with a taxi dispatch about your cross-streets, quarrelling over the A/C and radio through that tiny hole in the plastic divider, and arguing about the fuel surcharge that suspiciously never seemed to go away. VoIP wasn't going to change that. The progress pessimists didn't foresee that Tinder would disrupt dating—how it would impact future generations; how it would literally create future generations. They were stuck in the era of mustering courage to actually talk to someone and ask them out on a date. What bleak, anxious times those were. VoIP wasn't going to change that.

Yet past remains prologue. The VoIP-as-killer-app crowd is still with us. And they're still at it. They say we're already living the "golden age of wireless." They push back on the FCC's efforts to accelerate 5G builds through modernized infrastructure rules. They wring their hands over the 5G upgrade because they cannot see the life-changing innovations—the pain points in our daily lives that will be eliminated with this generational shift in technology. There is a magnetic attraction to the status quo, to be sure. But we need to lean into the future. We must meet the Gretzky test and move not to where the puck is but where the puck is going.

Knowing all of this—knowing the lack of vision that has always been out there—we need to communicate and shift the conversation. We can do a better job of talking about the 5G use cases that will improve the lives of everyday Americans.

The first and maybe most obvious way 5G will deliver tangible value to Americans is by offering them another choice for high-speed, home Internet. It's through their home Internet connection that they increasingly stream video content, so much so that broadband progress is often still measured by the

Netflix test. It's the way kids do their homework; it's the way home businesses get off the ground. And whether it's widely realized or not, offloading traffic to home broadband is a key way that our wireless networks continue to perform and remain affordable.

Many Americans feel like they have only one choice for this essential service, and this ticks them off. It seems to verge on un-American. When there are 70 flavors of sparkling water at the grocery store, they are not content with just one option for home Internet. And rightly so. When I talk to regular people who do not spend their lives pondering telecom policy, I can tell you they get very excited about simply having another choice. They are pumped about 5G delivering it. So it's great that home Internet is one wireless provider's first 5G offering. And another provider has pledged to offer 5G home Internet to nearly 30 million households.

Beyond the home, there is a tremendous amount of investment and research going into VR and AR, and we know 5G's low latency will be a critical ingredient to those categories. Technologists are especially excited about VR and AR because at bottom they reduce friction between tech and living. Smartphones have changed so many aspects of our lives that many of us are never more than a foot or two away from our phones. A friction point is taking the phone out of our pockets and staring at them, which distracts us from what's going on around us—from living. Amazon Echo, Google Home, and Apple's Siri are trying to solve this problem with voice, but imagine if it could be solved visually with AR glasses or contact lenses. VR in turn advances AR's solutions a step further by collapsing distance, especially for spatial and hands-on experiences.

But what does all of that mean to the Americans we serve? Let's think about common pain points in our own lives.

For example, people hate going to grocery stores. I hate going to grocery stores. The problem is I need food. We all know that Peapod and Fresh Direct have put grocery selection and delivery online. Still, there's something useful in seeing all of the choices in front of you, and that's particularly true for fresh produce. Imagine putting on VR glasses, walking down a virtual grocery aisle—quickly, and without any other people around to hit you with their carts—looking at, picking up, and choosing items; instant check out, and immediate delivery.

Home buying can be another pain point. Redfin and Zillow have made buying a house more accessible and have reduced transaction costs by bringing home data directly to the consumer. Yet few people would want to make the largest purchase of their lives without seeing the place first. This traditionally has required hiring an agent, scheduling an appointment, and devoting scarce weekend hours driving from open house to open house, rather than spending much more quality time with family. There's a group of start-ups right now focused on the tech and contracting to allow buyers to conduct their own self-guided tours of homes; but that only addresses part of the problem. What if the entire home buying experience could be done virtually? Feel the house's space and layout from across town or around the world. VR home-buying could make homes available to waves of new buyers while putting more pressure on transaction costs, which eat into families' equity. It's easy to see this solution's application to home design and remodeling—or any other kind of project that requires walking around a space.

So many start-ups and established brands alike have tried to crack the code for selling clothes online. So far, they've done it on the back of free shipping and returns. Shipping can contribute 15 percent to an item's cost, and an exchange online often makes the sale unprofitable. Rent the Runway, the clothes rental unicorn, tries to solve this pain point by incenting subscribers to post to the app photos of themselves wearing the clothes. Yet even Rent the Runway and Bonobos have resorted to opening up

retail locations in major cities so customers can try on clothes before making online orders. Imagine if VR could map your figure and allow you to turn around and see how the clothes fit you virtually.

At Quantico today, our country's military and law enforcement officers are being trained using VR. Quantico has VR-equipped Humvees that simulate driving and firing weapons in hostile environments. We all get immediately how this is training that you can't learn from a book. Certain heavy artillery and rifle training also is done virtually today to increase safety and reduce costs. Imagine the applications for police, fire, ambulance, and other first responders.

Or think about any education that's better done hands-on. Plumbers can read a manual on how to fix pipes, but nothing beats trying with your own hands. VR could allow a trainee to see and fix a problem in 3D, and some day with the development of advanced haptics, she or he could practice turning virtual pipes with connected gloves. Many tradesmen make solid middle-class livings, and reducing the time and cost of becoming a tradesman would give many an opportunity to improve their lives.

The VR use case is just one chapter in the 5G story. By lowering barriers to education, we can provide opportunities to young people who, because of family circumstances or the unique way that they learn, wouldn't be able to fulfill their goals. By shrinking distances virtually, rural America can participate in Big City offerings in ways that would have required a move before. Kids who learn through more hands-on or immersive experiences can sit, virtually, in a medieval village and learn about the Middle Ages in an entirely new way. I just wouldn't recommend that for learning more about Dante's *Inferno*.

But the 5G story is not just about these use cases. It's about the jobs that are created building the 5G platform. When I've been on the road, I've visited with this set of 5G workers. They're your coworkers—just not the ones in bespoke blazers clicking through Powerpoints. They're not in zip-up hoodies or sporting Beats headphones, either. Instead, I've had the privilege to hang out with your coworkers who wear hardhats and put on harnesses. They work with their hands. And without their work, none of the other 5G jobs and opportunities would exist.

So I announced a jobs initiative a few months back that looks to community colleges as pipelines for 5G jobs. Over the course of a few weeks or months, community college programs can take someone with little to no skills today and train them up so they can land a good-paying job in the tower industry building out the next-gen infrastructure America needs for 5G. My initiative aims to stand up more community college programs like the one I learned about on the road in Aiken, South Carolina.

The good news is that we're already seeing success. A few months back, in Sioux Falls, South Dakota, I visited Southeast Technical Institute, and talked with the trade school's administrators about the opportunities that a tower training program could bring to the community. I am pleased to report that just a few weeks ago the school announced that they are starting a program this January for tower techs in partnership with Vikor Teleconstruction.

Now, the jobs and services I've been discussing will make up only the first wave of value that will be created in America using 5G. What's critically important to me is that as much of that value creation as possible occurs here, in America. I want those jobs, the education, the healthcare, and the productivity to benefit the Americans I serve. Much like America's dominance in 4G was critical to the success of Uber, Airbnb, and Venmo, I want our leading position in 5G to spawn the next wave of technology, here.

Of course, the U.S. is not the only country that wants to benefit from superior 5G investment. Many of my regulatory counterparts very naturally want their countries to be on the leading edge of 5G.

They want the investments, the benefits, and the economic opportunities that will flow from this next-gen platform. China is one country that wants far more than that. Beijing sees 5G as a chance to seize and then exert economic dominance for the next decade.

And like the tech pessimists that doubt 5G will be a significant upgrade over 4G, there are some who doubt the U.S. can extend our global leadership in 4G into the 5G era. I do not share those doubts.

So at the outset, let's review the facts. They confirm that the U.S. is winning the race to 5G.

- The U.S. is home to the first commercial 5G deployment in the world.
- 14 U.S. communities went live with commercial 5G in 2018, compared to zero in China.
- More than 30 U.S. communities are live with commercial 5G today, compared to zero in China.
- By year's end, commercial 5G service will be live in at least 42 U.S. communities.
- By 2022, the U.S. will have more than double China's 5G adoption rate.
- And one provider alone has committed to build out 5G to 99 percent of the U.S. population. I have heard no such plan out of China.

While conceding that the U.S. is now in the lead, some see advantages in China's system. And I think we have to recognize that, at the end of the day, this is a competition between two very different systems of government, two very different views of the world.

There are some who see advantages in China's centralized control. They point out that Beijing bureaucrats can snap their fingers and command that thousands of 5G cells be deployed seemingly overnight. They snap their fingers again, and spectrum is cleared and allocated—no need to fuss with incumbents or debate interference into satellite sensors that never left the ground.

But when you scratch below the surface of those perceived advantages, the U.S. lead grows; our 5G leadership looks even more secure.

Start with spectrum. Beijing has decided that 5G means mid-band, and only mid-band apparently. They've licensed zero high-band spectrum for 5G. That's a big problem for Beijing because high-band spectrum delivers the fiber-fast Internet speeds that are key to many 5G use cases, as we've seen already with 5G home Internet. High-band will be key for the massive amounts of capacity needed for VR, AR, and many other next-gen applications. Our approach in the U.S., in contrast, has been to put all spectrum bands to use and let the 5G builders and operators choose the right combination for the services Americans want. And that is why experts predict that the U.S. will have a faster 5G network than China.

We have low-band spectrum for wide coverage, including across rural America. We have mid-band spectrum for fast mobile 5G. And we have high-band for the highest quality services, including the most high-band spectrum freed up anywhere in the world. We cannot rest on our laurels, to be sure. That's why I have pushed hard for at least 300 MHz of the C-Band to be cleared promptly for mobile use. That's why we have expedited a 3.5 GHz auction. And that's why we're pursuing more options, including in the 6 GHz band. This is demand-driven, not bureaucrat-driven, spectrum policy.

Let's turn next to Beijing's vaunted infrastructure prowess. The state-owned wireless infrastructure company has a monopoly on tower builds. The country's three carriers are state-controlled. Their plans for deploying 5G are coordinated, reportedly scheduled in the next few weeks to honor China's National Day, when they celebrate the establishment of communist rule in China. The carriers are required to buy equipment from domestic suppliers at higher prices than charged by those same

equipment providers when they sell outside China, providing an indirect subsidy in the form of pricing power and higher margins.

This unity of action is perceived by some as a strength. State-controlled companies don't work through local zoning rules or local aesthetic requirements. They don't pause over environmental reviews or historic preservation. They don't even have the choice to negotiate with neutral host providers: the second and third-leading providers in China were told to collocate when deploying 5G. Beijing can act without debate and without resource limits. The argument goes that those are advantages over our democratic, free-market system.

So how's that strategy working for China? On this one, you don't have to believe me. Instead, I'll just tell you about a Chinese tech article that I ran across two weeks ago, with the help of Google Translate.

The Chinese outlet reported that local governments are bidding against each other to subsidize the build out of 5G. Shenzhen, the important commercial hub connected to Hong Kong, is handing out bonuses to providers that deploy 5G to the tune of $1,400 per 5G base station up to a total of over $20 million. A municipal government near Beijing did one better. It started with a 30 percent subsidy of companies' capex for deploying 5G, as well as expedited permitting. Its subsidies extend to a range of opex, as well. There are land use concessions that amount to rent subsidies. The government foots the 5G electric bill so that the price of power is about one-third of what we pay in the U.S. And it offers so-called 5G innovation incentives.

These lavish subsidies result in more deployments, to be sure. But that is not success. It shouldn't surprise us that if the Chinese government gives wireless operators free money to build cells, more cells will be built. But that doesn't tell you anything about value; it doesn't tell you anything meaningful about the race to 5G. One of the predictable downsides to government throwing money at a project is that the money will not be spent efficiently or in response to consumer demand. And, in fact, the Chinese outlet's own article points this out. One provider built 5G cells but didn't turn them on. It literally slapped metal boxes onto poles but didn't plug them in. That's because the operation and maintenance costs of some of the cells don't justify their use, or as the article says, the cells appear to be "burning money." China is building a Potemkin Village to 5G.

This shouldn't surprise any of us. What's happening in wireless in China has happened before. You can see it in the pristine, unused highways that cut through China's hinterland, and in the empty skyscrapers of China's ghost cities. China can run wasteful, debt-fueled construction projects better than anyone. And with unlimited government funding, you can build museums to bureaucrats' dreams that no one will visit. Would we rather have that in the U.S.? Would we rather have bridges to nowhere and smalls cells for no one?

To be clear, this failure—taking money from their own people to fund 5G cells that won't be used—is a systemic failure, not the failure of a particular bureaucrat or local government. The strategy's rot is at its core. If the Chinese government's version of the race to 5G is measured by the number of metal boxes it can attach to poles and sides of buildings, then it will throw up metal boxes, regardless of whether they're useful or even turned on. But China is not building the best 5G network in the world. It is not building the fastest 5G network in the world. And it is not capable of building one that responds to consumer demand.

So at bottom, this is a competition between systems. And it's a familiar one. We already know how and why China will lose.

In America, the private sector leads investment. You all lead the way. Having skin in the game makes investors more careful. It forces them to listen to everyday Americans, to create value for them, to win them as customers. Not all of the bets will work out. But that's OK, because no one failure—no one bet that doesn't pay off—will irreparably harm the country. Our private sector is nimble and can adjust. Indeed, these failures help all entrepreneurs learn and compete for Americans' business. If we get knocked down, we get back up.

And so when we assess this race to 5G, we're not just counting metal boxes. We're looking at the robustness of the networks, how consumers use them, the value that is being created, and the broader free market environment that is the oxygen for entrepreneurs to innovate on a 5G network.

Our government's approach has been to set the conditions for infrastructure investment and experimentation, and then let the market lead the way. We don't choose a particular band and call it "5G." We offer all of the spectrum bands and let providers craft offerings to leverage the performance of each band. We don't take money from our people so that bureaucrats can decide what infrastructure to spend it on. We require providers to cover their cost of deployment, and then it's up to them to win in the marketplace.

So China does have a different system. But I bet on ours. I bet on us and the disruptive innovations to come.

Thanks to your efforts, the U.S. had the first commercial 5G builds in the world, we have the best 5G networks in the world, and with the right policies in place we will extend our leadership as these networks continue to be built out.

Keep inventing. Keep building. And we in the government will keep at it, too.

Thank you.