

**REMARKS OF FCC COMMISSIONER AJIT PAI
AT 4G AMERICAS' TECHNOLOGY SYMPOSIUM:**

**“THE FUTURE OF MOBILE BROADBAND IN THE AMERICAS
LTE TO 5G NETWORK INNOVATION”**

WASHINGTON, D.C.

NOVEMBER 5, 2015

I would like to thank 4G Americas for organizing today's symposium and for the opportunity to talk about our nation's transition to 5G, or the next generation of mobile service.

Now, I understand that some might be a bit confused. After all, this is 4G Americas, the event is about 5G, and the 3GPP works closely with this group in the transition from 4G to 5G. That's certainly a lot of Gs to keep track of. But I think any confusion could be cleared up by one of Apple's newest hires, Dr. Dre. His 1992 debut solo album, *The Chronic*, featured the iconic lyrics “Ain't nuthin' but a 'G' thang, baby,” and I think those words have proved quite prophetic when it comes to mobile.

But in all seriousness, 5G holds the potential to be something other than just another G thing. To be sure, there is currently no consensus definition of 5G. But research is well under way to make the technology a reality. And that research is being fueled by an unprecedented growth in the number of connected devices and amount of mobile data usage—trends that are testing the outer limits of our 4G technologies. Consider this: By 2020, when some expect 5G standardization to be complete, experts predict that there will be over 9 billion mobile subscriptions and over 50 billion connected Internet of Things devices worldwide. In the U.S. alone, there will be a 9-fold increase in mobile data traffic between now and then, with 60% of that traffic coming from mobile video.

To meet this extraordinary growth in the demands that will be placed on our mobile networks, engineers are working on 5G solutions that could support data rates in the range of 10 to 50 megabits per second, low latency connections of around 1 millisecond, mobile devices that can use spectrum from below 1 GHz to well above 24 GHz, and networks that can integrate different air interfaces and technologies.

These engineering breakthroughs could make a real difference to consumers. Just put yourself in the shoes of the typical mobile consumer in a 5G world. When you're thrilled that America's Team, the Kansas City Royals, has won yet another World Series, you might stream replays of their latest run in 4K or even 8K Ultra-HD while still in the stadium. When you've been celebrating their win late into the night, you might rely on a driverless car to get you home. And when the team's victory parade rolls through downtown, connected Smart City applications might make sure that the traffic signals in the Power & Light District are all synched up. And those are just a few of the possibilities. We simply can't envision every innovation that we will see in 2020 and beyond.

This progress, of course, won't happen on its own. First and foremost, it'll require investment, creativity, and commitment from the private sector. And industry is rising to the challenge. I've seen it firsthand. Over a year ago, I visited Samsung's research lab near Dallas, Texas, where engineers are hard at work developing 5G base stations and mobile technologies. Using multiple-input, multiple-output antennas no bigger than a Post-it note, they have already demonstrated that 5G technologies can deliver mobile speeds well in excess of 1 Gbps. More recently, I attended Intel's demonstration of its 5G research at the FCC's headquarters. Intel showed me how it can beam signals off tables, buildings, or other objects to find the most efficient, highest-capacity connection.

But the private sector's efforts alone will not be enough to make a successful transition to 5G. The FCC has an important role to play as well. While there is still a lot of running room left with 4G, we

must put a framework in place now that will allow 5G to develop in the United States as quickly as the technology and consumer demand allow. So I'd like to focus my remarks today on what I see as three key pieces of that 5G framework: freeing up more spectrum, removing barriers to infrastructure deployment, and encouraging innovation and investment in the network and mobile technologies. And in all three of these areas, there is more that the federal government can do and should be doing to ensure that America continues to lead the world as we move from 4G to 5G.

1. Spectrum.—Let's start with spectrum. To enable our 5G future, we must free up more of this invisible resource for consumer use. Unfortunately, we have fallen behind our own goals for repurposing spectrum for mobile broadband. The FCC's 2010 National Broadband Plan called for the agency to make 300 MHz of spectrum available by 2015. But it's almost 2016, and the Commission has moved less than half of that amount into the commercial marketplace. I point this out not to assign blame, but to focus attention on the fact that we need to redouble our efforts and refill the spectrum pipeline.

I'd like to offer some thoughts this morning on some different spectrum bands we should be moving on. I will start at the top, with spectrum above 24 GHz. Because these millimeter wave bands are extremely wide—up to multiple gigahertz in some cases—they could play a key role in a 5G network. They could be used for anything from small cell, capacity-based plays to wireless backhaul.

At the FCC, we just proposed to open up some of the millimeter wave bands for flexible, mobile use. I'm certainly pleased that we took this step. But our decision was a mixed bag and I fear that we missed an opportunity to show greater leadership in the 5G space.

In particular, I thought the Commission left far too many spectrum bands on the cutting room floor. For instance, I identified 12,500 MHz of spectrum in the 24 GHz, 32 GHz, 42 GHz, and the 70 and 80 GHz bands that we should have teed up for commercial use. Many innovators that are leading the charge on 5G research and development, from companies to individual entrepreneurs, asked the FCC to move now on these additional bands. But the Commission chose not to do so. I thought that sitting on this spectrum was the wrong call, so I disagreed with that part of the decision. After all, we don't know which spectrum bands will prove to be good homes for 5G technologies. In my view, we should think big and let engineers and innovators tell us what will work and what won't. I hope the Commission will do just that in a Further Notice of Proposed Rulemaking.

At the same time, 5G technologies will certainly not be limited to spectrum above 24 GHz. So we need to take steps to make more mid- and low-band spectrum available as well. One prime example is the 5 GHz band. Since 2012, I've been calling on the FCC to make up to 195 MHz of 5 GHz spectrum available for unlicensed use. We should try to open up this spectrum to unlicensed use as soon as possible. Along those lines, I applaud the leadership that has been shown by Chairman Thune, Senator Rubio, and Senator Booker with respect to making available the 5.9 GHz band and hope that the path they set forth a couple of months ago will lead to tangible results.

Speaking of spectrum that is primed for Commission action, the agency now has about 200 AWS-3 licenses in our spectrum inventory. These licenses were recently returned to the FCC by the designated entities controlled by DISH after the agency determined that they were not eligible for any small business discounts. The licenses cover a number of major markets where spectrum could be put to consumer use, including New York, Chicago, and Boston. And because the DISH entities defaulted on those licenses, the FCC's rules guarantee that any reauction will make the American taxpayer whole, meaning that DISH is on the hook if the reauction doesn't raise the \$3.3 billion that DISH's designated entities bid but did not pay to the Commission. We should not let this spectrum gather dust. In fact, I think the FCC should reauction those licenses in 2016, immediately after the conclusion of the incentive auction. This spectrum should be put to use as quickly as possible.

Continuing to move down the spectrum chart, I'd like to mention the 600 MHz band. The incentive auction is now just around the corner. It presents a prime opportunity to get additional low-

band spectrum out into the commercial marketplace. Now, it's no secret that I didn't agree with every decision the Commission made in the incentive auction proceeding. In my view, the agency has made it more difficult than it had to be for us to have a successful auction. But those decisions are now in the past, and I don't see much chance that they will be changed. So going forward, I am focused on the steps we can take to increase our chances of success.

One of those steps is making sure that we complete and test all of the new bidding and repacking software well ahead of the auction's start date. I realize that the nuts and bolts of IT implementation isn't a glamorous issue. But it is critically important. When it comes to the incentive auction, we don't have any margin for error. That is why we must double-check and triple-check all of the software. That should include rigorous testing by neutral third-parties. And it should include multiple mock auctions as well. CTIA has suggested that the Commission hold three mock auctions and that they be scheduled far enough in advance of the start of the incentive auction so that there will be time to fix any mistakes that they uncover. These are excellent ideas.

Along these lines, it is critical that we not rush the process. If we can get everything done in time to start the auction as scheduled on March 29, that would be great. But March 29 wasn't etched onto a tablet, Biblical or electronic. If we are not 100% confident that the software will perform flawlessly as we make our way to the end of March, we must have the courage to postpone the auction rather than charging ahead and courting disaster. We have seen what happens when the federal government rushes ahead with flawed IT systems. Indeed, Chairman Wheeler himself acknowledged in December 2013 that we want to avoid a software debacle of the kind the country witnessed during Obamacare's rollout.

Last month, the Commission was reminded of the potential for things to go wrong in this area when an incentive auction webinar was delayed for half an hour because of technical glitches. But in my opinion, this delay will have been worth it if it refocuses the Commission on making sure that our incentive auction software is ready for prime time before the auction commences.

2. Infrastructure.—As important as spectrum is to making 5G a reality, we cannot lose sight of another key piece of the regulatory framework, which is removing barriers to infrastructure deployment. To support 5G, providers will have to densify their networks. And to help them do that, we need to expedite the siting of wireless infrastructure. There are going to be many more small cells in a 5G network, and greater densification means better wireless coverage, capacity, speed, and reliability.

Carriers are already moving in that direction. Sprint, for instance, has announced that it plans to deploy tens of thousands of small cells in the coming years. The FCC should promote the deployment of this type of infrastructure.

Thankfully, we took some steps in the right direction last year. We reformed our environmental and historic preservation rules to make it easier to deploy small cells and collocate antennas on existing structures. We made it clear that our shot-clock rules apply to small cells and distributed antenna systems (DAS). And we adopted a bright-line test for determining which equipment modifications qualify for section 6409's deemed-grant remedy.

But there is more work to be done. Our 2014 order called on the FCC to work with historic preservation officers and other stakeholders to develop what is known as a "program alternative" that could further streamline and expedite the process for deploying small cell technologies. Agency staff is currently working on that program alternative with the goal of completing the process within the 18–24 month deadline set out in the 2014 order. I'm optimistic that we will have good news to report on those efforts in a few more months. I also hope that the Commission will revisit my suggestion that we adopt a deemed granted remedy when local governments don't meet the 90-/150-day shot clock we adopted and that the Supreme Court has approved. This could help further expedite the siting process.

In addition, Chairman Greg Walden and a bipartisan group on the House Energy and Commerce Committee's Communications and Technology Subcommittee are working on legislation that could

remove additional barriers to infrastructure deployment. Those efforts include making it easier to deploy broadband on federal lands. This is particularly important because the federal government owns roughly 30% of all land in the U.S., and right now it takes four years, on average, for providers to successfully site wireless infrastructure on federal land—far longer than it does to locate facilities on private property. I applaud the efforts that Chairman Walden and his colleagues are making on these issues.

In the meantime, the FCC should explore additional ways to streamline the process of deploying infrastructure. Over the last few years, our infrastructure proceedings have focused primarily on the wireless side: on antennas, base stations, and the like. And that makes sense, given the substantial increase in small cells envisioned for 5G. But the bulk of wireless traffic does eventually travel over wireline infrastructure. High-capacity fiber connections, for example, are key to linking wireless facilities with the rest of the network.

So we need to make it easier for the private sector to deploy fiber. One tool we have is section 253 of the Communications Act. Section 253 bars any state or local regulation from prohibiting or having the effect of prohibiting the ability of any entity to provide service. For the lawyers, in the room, it also has a rare, express preemption provision: “[T]he Commission shall preempt the enforcement of such statute, regulation, or legal requirement.”

We should take a fresh look at what the agency can do under section 253 to help streamline the process of adding fiber to our networks. Even in the 5G world, wireless will need wires.

3. Innovation and Investment.—I’d like to turn now to what I think is a third key piece of the 5G regulatory framework—promoting innovation and investment in our networks and mobile technologies.

For years, the U.S. has led the world on these metrics. We pursued a bipartisan, light touch approach to mobile broadband that resulted in massive private sector investment. In 2013 alone, U.S. providers made over \$33 billion in capital expenditures. A study that looked at 2011 and 2012 data showed that U.S. wireless providers invested twice as much per person as their counterparts in Europe (\$110 versus \$55). When compared to all regions, U.S. providers spent on average about four times more per subscriber on network infrastructure.

All of that investment made the U.S. wireless market the envy of the world. More than 98% of Americans now have access to 4G LTE. Nearly 50% of all mobile connections in the U.S. are 4G. In Europe, that figure is only 18%, and it’s a mere 10% worldwide. Network speeds are also 30% faster in the U.S. than in Europe and 50% faster than in the Asian Pacific.

America’s leadership in wireless broadband has helped us become the epicenter of mobile innovation. The app economy, where the United States stands at the forefront, is just one example. It has allowed anyone with an idea and a broadband connection to solve an everyday problem in a novel way. Take the public safety mobile app developed by a nonprofit foundation called PulsePoint. Nearly 1,000 people die every day from sudden cardiac arrest. PulsePoint aims to reduce that number through a free app that alerts potential first responders, who register with PulsePoint, when an emergency occurs within a quarter mile of the location of the emergency. By helping to direct nearby first responders toward emergencies—when seconds may mean the difference between life and death—PulsePoint is helping to save lives. I had the chance to see PulsePoint in action earlier this week. It’s one of the many impressive examples of mobile innovation enabled by our 4G networks.

As engineers and technologists work on 5G, it is important that they continue to be able to rely on permissionless innovation, which played a key role in the U.S.’s leadership in 4G. And that requires regulators to recognize something they often don’t, or won’t: that innovation is not limited to the so-called “edge” of networks. Innovation within networks is also critical, especially in the mobile space. I often hear broadband networks derided as “dumb pipes.” But that just doesn’t reflect reality. Nor does it reflect consumer expectations; rare is the consumer who would be happy with the narrowband access that

was the rage back in 1996. And it certainly doesn't suggest a friendly view of 5G, which will require networks to become even smarter.

I am therefore worried by emerging threats to permissionless innovation in the mobile space. First and foremost is the FCC's decision to apply Title II to the Internet, including mobile broadband. The FCC's decision has injected a tremendous amount of uncertainty into the wireless space. Take the FCC's creation of a never-before-seen "Internet Conduct" standard. FCC leadership itself has admitted that "we don't really know" what it means and that "we don't know where things go next." Engineers and technologists shouldn't have to guess whether a new network management practice or innovation will get vetoed by the Commission. But now they will.

Or take the impact that those rules are already having on investment. The U.S. has led the world in 4G because of the unparalleled levels of private sector investment we've seen over the past few years. But a recent study by the economist Hal Singer contains some pretty sobering data. Capital expenditures by the nation's largest broadband providers plunged 12% in the first half of 2015 compared to the first half of 2014. The decline among all major providers was 8%.¹ And the decline in broadband investment is not limited to the U.S.'s largest providers. Many of the nation's smallest broadband providers are also cutting back on their investments.²

So when it comes to spurring the innovation and investment in 5G networks, I think it's important that the FCC return to the light-touch approach we pursued for years. After all, those are the policies that allowed the U.S. to become the world leader in 4G, and I believe those are the policies will serve us well in the transition to 5G.

* * *

Thank you again for the chance to offer a few words on the regulatory policies that can help spur the 5G transition. It's nice to see that 4G Americas is not following Dr. Dre's advice to "jus' chill, 'til the next episode." Instead, you are doing the work that will make the transition to 5G a reality.

¹ See Remarks of FCC Commissioner Ajit Pai at the American Enterprise Institute's Roundtable Discussion on Decline in Investment Following The FCC's Title II Order (Sept. 9, 2015), <http://go.usa.gov/cVqx>.

² See, e.g., Statement of FCC Commissioner Ajit Pai on New Evidence that President Obama's Plan to Regulate the Internet Harms Small Businesses and Rural Broadband Deployment (May 7, 2015), <http://go.usa.gov/cVcV>.