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5G Deployment Faces Unique Challenges Across the U.S.

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Wireless technology, on the cusp of rolling out next-generation 5G technology, stands at a critical point. The deployment of 5G wireless technology will bring about transformational economic benefits, spark the growth of smart cities and enable significant innovations in health care, transportation and public safety. The unique technological aspects of 5G (and the spectrum that will be used to provide it) mean that these antennas are small and relatively low-powered, making the term "small cell" an apt moniker for these facilities. The flip side of this tradeoff is that each antenna has a very short range. To reach the full potential of 5G technology, wireless providers will thus need to deploy hundreds of thousands of small cells in communities across America. Rights-of-way, used for a variety of existing infrastructure like street lamps and utility poles, provide an ideal location for many of these small cells.

But the wireless industry reports that in many cases they are hitting roadblocks: local jurisdictions that are hesitant to allow small cell deployment in public rights-of-way, or that view the explosion of these facilities as a lucrative new revenue stream. In filings with the Federal Communications Commission and elsewhere, the industry is warning that this hesitation will slow down the realization of 5G technology, which may render these communities, and the United States at large, less competitive in the global economy as other countries, such as South Korea and Japan, rapidly push toward 5G. The wireless industry argues that it is critical for communities throughout the United States to appreciate the unbounded benefits of 5G technology, and to work together with carriers and policymakers to facilitate the deployment of necessary infrastructure needed to make the United

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States the global leader in 5G.

What is 5G Wireless Technology?

The transition to 5G wireless technology from today's 4G technology will be transformational.[1] Each generation of wireless innovation has brought significant changes and benefits for consumers. The jump from 4G to 5G technology may be the largest yet. To illustrate the improvements from 4G to 5G, CTIA analogizes 4G technology to a four-lane highway, while 5G expands to a ten-lane superhighway.[2] As compared to 4G, 5G will provide quicker and increased data capacity, lower latency — the delay between your request for data and when your device receives it — and increased connectivity.[3] 5G will not replace 4G, but instead will work side by side with 4G to provide a range of services that 4G cannot perform, such as facilitating the interconnectivity of the Internet of things and smart cities.

Today's 4G LTE technology, first launched in 2010, has familiarized consumers with pervasive high-speed wireless broadband. Consumers using 4G LTE technology receive speeds of 10-20 Mbps, with network latency of 50 milliseconds end-to-end, and a network density of 2,000 active devices per square kilometer.[4] Consumer demand for wireless services, driven by the ubiquitous use of 4G services, keeps growing. In fact, wireless traffic is expected to grow by six times by the end of the decade.[5] Carriers are rolling out 5G to satisfy this demand.

While 4G technology has already reshaped the way consumers use the Internet by providing nearly ubiquitous wireless broadband, 5G will provide further benefits to consumers in three key ways: 5G will be very fast, it will connect everything and because of reduced latency rates, it will allow real-time applications that to date have simply been impossible.[6] In terms of speed, 5G, using millimeter wave technology, will generate a throughput 10 times faster than 4G, possibly over 1 Gbps.[7] The full benefits of 5G, however, extend much further than just fast speeds. A key innovation of 5G is increased connectivity — 5G will offer connection density up to 100 times greater than 4G.[8] Such an increase in connectivity allows for a large-scale increase in wireless Internet of things connected devices, such as wearables, wireless healthcare devices and self-driving cars.[9] In fact, CTIA notes that 5G connectivity capabilities will facilitate "connectivity of virtually all of our physical world."[10] Reduced latency in 5G wireless technology is also a key improvement over 4G. While 4G latency rates are quite low, it is predicted that 5G rates will be five to 10 times lower.[11] Verizon has already demonstrated what this can mean for new applications by demonstrating a Camaro with blacked-out windows being driven using VR goggles and a real-time wireless link.[12]

Benefits of 5G Wireless Technology: Smart Cities

5G technology will allow for sustained economic growth by facilitating the development of smart cities.[13] Smart Cities will draw on key features of 5G technology, including higher speeds, more connections, reduced latency, and ultra-low-power connections.[14] Smart Cities will strongly benefit particular fields such as health care, energy, transportation, and public safety.

Health Care. The applications provided by 5G technology will allow for further development of mobile health care (mHealth) and telemedicine. These improve patient care and provide the patient with more autonomy in the process.[15] For example, 5G technology will allow the use of sensors for health monitoring where the sensor will detect changes in a patient's vital signs and generate an automated report to a doctor's or nurse's station.[16] In addition, doctors can use high resolution video to assess and diagnose patients across the country.[17] 5G will improve both the quality of, and access to, health care for peoples of all socioeconomic backgrounds. 5G is, therefore, critically important to expanding the reach of health care.[18]

In addition to enhancing access, telehealth programs using 4G technology have been proven to reduce mortality rates. A Brookings Institute study of a telehealth program in Massachusetts showed that when using a combination of remote monitoring, social media, and data management applications, heart failure readmissions decreased by 51%.[19] The impact of such programs will only increase in a 5G world. Lastly, 5G technology lowers health care costs. The increased access detailed above allows for early interventions and preventive care.[20] A Goldman Sachs study notes that the U.S. health care industry could save upwards of $305 billion per year by adopting the digital health applications made available by 5G technology.[21]

Energy. The energy sector also stands to benefit greatly from 5G technology. Most notably, increased wireless connectivity will speed up smart grid adoption, which could provide economic benefits as high as $2 trillion over 20 years.[22] 5G technology lowers energy costs by integrating devices into the power grid via 5G connections. This allows devices to be more accurately monitored, which helps match the demand and supply of energy.[23] In addition to enhanced allocation of power through smart grid adoption, 5G will improve grid maintenance and monitoring. A Deloitte study notes that "moving from a predictive system to a real-time reporting system that leverages wireless solutions enables electric utilities to better serve a matching function."[24] Cities have already been exploring the benefits of smart grids using 4G technology.[25]

Transportation. Transportation systems will also benefit from 5G wireless capabilities.[26] Drawing on the increased interconnectivity offered by 5G, cities can reduce rider wait times and optimize efficiency in their public transportation systems by providing operators minute-by-minute information on the use of the system at any given moment.[27] This will allow operators to allocate resources, in real-time, to the points of highest use. In terms of reducing traffic, it is estimated that 5G wireless technology will aid in reducing traffic congestion by 40 percent.[28] This reduction will be the product of connected traffic management systems and car "convoys" able to safely ride close together because of their connectivity.[29] In addition, estimates show that self-driving cars will be able to reduce emissions (possibly up to 40 to 90 percent), and save over 20,000 lives and $447 billion per year.[30] Ford estimates that self-driving cars, in addition to saving lives, will also reduce travel times by 37.5 percent.[31]

Public Safety. The benefits of 5G wireless technology also extend to public safety. Predictive policing techniques and real-time alerts to first responders are both key applications of 5G technology in the public safety sphere.[32] Moreover, 5G technology better allows police departments to cover their respective jurisdictions while adhering to budgetary constraints. For example, Denver's police department has utilized a wireless camera system to monitor key locations to extend the reach of the department while not stretching its budget.[33] In such situations, wireless technology allows police, using a preventive approach, to accomplish

more with fewer resources. Lastly, 5G technology will improve decision-making by first responders. Emergency response vehicles can be connected to high resolution video feeds to better assess the needs of the situation facing them before they arrive.[34]

The Importance of Small Cells

The realization of 5G's benefits hinges on effective infrastructure development. As CTIA states, "if spectrum is the fuel for wireless networks, infrastructure is the foundation."[35] Wireless infrastructure encompasses the antennas and other equipment used to send and receive signals between wireless devices and the networks that connect them.[36] The next generation of wireless technology, which will bring innovative applications made possible by increased connectivity, requires a wireless infrastructure that is significantly denser than that utilized by 4G technology. Getting to 5G technology calls for an estimated 10 to 100 times more antennas than used to power 4G today.[37] Moreover, 5G technology will, in part, utilize millimeter wavelength spectrum, which while providing a stronger connection, supports service over shorter distances.[38] In fact, high-band spectrum is generally only useful for covering about 200 meters, roughly equivalent to a city block.[39] To make high-quality 5G technology widely available, then, carriers must deploy many antennas in locations both closer to the ground and closer to consumers than those used to power 4G.[40]

This is where the small cell comes in. Small cells are wireless base stations that are physically much smaller than macro cell towers. Traditional macro towers are dozens of feet tall and can cover geographic areas extending out for miles. Small cells, on the other hand, can be the size of a shoe box or pizza box, but can only transmit signals a couple hundred meters.[41] The wireless industry notes, however, that because of their size, small cell deployment is much less intrusive than traditional macro towers — small cells can be placed nearly anywhere with little disruption, such as on utility poles or street lights.[42]

Wireless carriers estimate that to achieve the densification needed to unlock the potential of 5G technology, they must deploy hundreds of thousands of small cells across the country in the coming years.[43] For example, T-Mobile estimates that, by the end of 2018, carriers will construct between 100,000 and 150,000 new small cells.[44] These estimates balloon to over 400,000 by 2020 and upwards of 800,000 by 2026.[45] AT&T alone has plans to site over 1,000 new small cells in the Bay Area in 2017.[46]

Infrastructure Impediments — Municipal Pushback

The wireless industry notes that despite the importance of infrastructure development to the realization of 5G technology, some municipalities have resisted infrastructure deployments, particularly small cells sites. Wireless providers contend that these municipalities pose significant roadblocks to the rollout of 5G technology, as their siting and zoning policies — in many cases designed to address the deployment of traditional tall towers that allowed for 3G and 4G technology — prevent or delay critical infrastructure deployments.[47] Carriers such as AT&T, Sprint, T-Mobile and Verizon have all described experiencing significant regulatory barriers from municipalities across the country. These include excessive fees, prohibitions on small cell placement, unreasonable aesthetic restrictions and prolonged permitting processes.[48] The FCC has taken notice of these local regulatory barriers. FCC Chairman Pai noted that, "without a paradigm shift in

our nation's approach to wireless siting and broadband deployment, our creaky regulatory approach is going to be the bottleneck that holds American consumers and businesses back."[49]

These local regulatory barriers can be particularly troublesome when applied to small cell siting in public rights-of-way. As mentioned above, the nature of 5G technology requires denser infrastructure than that used for 4G applications. Small cells need to be placed around the country to connect all Americans to the benefits of 5G. Yet, as the wireless industry reports, in many municipalities antiquated requirements prohibit the siting of small cells on public rights-of-way, or even on state or municipally owned utility, light or traffic poles.[50] These regulations are especially troublesome when applied to small cells because the regulations were designed and implemented with traditional macro towers in mind. According to AT&T, "there is no sound reason for any municipality to subject small cell deployments to the same review processes that apply to macro cells. Because of their unobtrusive size, small cells simply do not pose similar considerations as to environment or aesthetic impacts."[51]

Furthermore, to the wireless industry, accessing public rights-of-way is essential to robust 5G wireless deployment via small cell technology. [52] Siting small cells in public rights-of-way presents at least three key benefits: (1) most people live and work adjacent to a right-of-way, so small cells sited on these locations will connect most Americans to the power of 5G; (2) rights-of-way are the optimal way to roll out the hundreds of thousands of small cell sites needed for 5G; and (3) siting small cells in public rights-of-way reduces transaction costs otherwise incurred by carriers in negotiating with private landowners to site small cells on their property.[53] Without access to public rights-of-way, carriers argue that the vast and necessary deployment of small cell sites will be unreasonably difficult, if not impossible, to effectively carry out.

Moreover, the wireless industry notes that current regulatory barriers, while slowing down 5G realization today, offer an opportunity moving forward. Communities that offer streamlined and flexible regulatory processes stand to benefit the most from the innovation and economic growth that 5G will bring.[54] Cities that take the initiative to work with carriers today will partake in shaping the future of 5G — a future that will benefit them greatly.

Recommendations

The benefits of 5G wireless technology depend on the deployment of 5G capabilities across the country. The wireless industry, therefore, contends that it is essential for regulatory processes to facilitate, rather than hinder, the rollout of innovative new wireless infrastructure such as small cells. Wireless providers highlight three main areas for reform: greater access, reduced costs and streamlined processes.[55] First, the wireless industry offers that the commission should work with local governments to improve access to government-owned infrastructure, such as utility poles and traffic lights, in order to facilitate the siting of small cells across the country.[56] Carriers point out that the existing siting limitations on public rights-of-way, designed for traditional, larger facilities, are not appropriate for today's small cells that are the size of a pizza box. Updating siting rules to allow for public rights-of-way access will greatly hasten the rollout of 5G technology.

Second, the wireless industry calls for the commission to work with local governments to ensure reasonable costs for accessing public rights-of-way to site small cells.[57] Wireless carriers contend that localities are charging unreasonable fees for carriers wishing to site small cells on public rights-of-way. For example, some municipalities assess separate fees for permission to access rights-of-way, for space on the municipal pole, for the application to site the small cell, and for consultants hired by the municipality to review the application.[58] In many instances, the fees charged to carriers are not in line with the costs incurred by the municipality in reviewing the application.[59] The wireless industry argues that this unreasonable fee structure stands as a significant impediment to the siting of small cells in public rights-of-way, and that therefore, to facilitate 5G technology, the Commission should work with municipalities to limit unreasonable fees and ensure that any fees in place are related to costs incurred by the municipality in the siting approval process.

Third, the wireless industry proposes that the commission work with municipalities to simplify the permit and zoning approval processes, ensuring reasonable timetables and uniform procedures throughout the country.[60] Wireless carriers suggest that the Commission work to facilitate the approval process in several ways: (1) reaffirming and expediting shot clocks applicable to small cell siting approval; (2) streamlining environmental reviews; (3) streamlining historic preservation reviews; and (4) taking steps to create a more efficient tribal review process.[61]

The wireless industry contends that these reforms aimed at increasing access to public rights-of-way, reducing costs to siting small cells, and streamlining the approval processes, will facilitate the realization of 5G technology and its accompanying benefits. The promise of 5G is close to becoming a reality. Its benefits will be transformational — 5G's increased connectivity capabilities will change the lives of nearly all Americans. Yet, to realize these benefits, municipalities must work together with carriers and with government at all levels to reach a consensus on common sense infrastructure policies that allow the United States to become the global leader in 5G.

NOTE: Jonathan Babcock, a 2017 Wiley Rein summer associate, co-authored this article with Mr. Turner and Ms. Gomez.

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[2] Id. at 3.

[3] Id. at 2.

[4] Thomas K. Sawanobori, CTIA, The Next Generation of Wireless: 5G Leadership in the U.S., 3, (Feb. 9, 2016), https://www.ctia.org/docs/default-source/default-document-library/5g_white-paper_web2.pdf.

[5] Id.

[6] Id. at 4.

[7] Id. at 4.

[8] Id. at 6.

[9] AT&T Services Inc., Comment Letter on FCC Proposed Rule to Accelerate Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment, WT Docket No. 17-78, at 5 (June 15, 2017) [hereinafter "AT&T Comments"].

[10] Sawanobori, supra note 4, at 6.

[11] Id. at 10-11.

[12] Monica Alleven, Editor's Corner — Verizon's 5G demo at Indy 500 race track is kind of mind-blowing, Fierce Wireless (May 25, 2017) http://www.fiercewireless.com/wireless/editor-s-corner-verizon-s-5g-demo-at-indy-500-race-track-kind-mind-blowing.

[13] Accenture Strategy, How 5G Can Help Municipalities Become Vibrant Smart Cities, 3, (2017), https://ctia.org/docs/default-source/default-document-library/how-5g-can-help-municipalities-become-vibrant-smart-cities-accenture.pdf (hereinafter "Smart Cities").

[14] Id. at 6.

[15] Brett Haan et al., Deloitte, Wireless Connectivity Fuels Industry Growth and Innovation in Energy, Health, Public Safety and Transportation, 7, (2017), https://www.ctia.org/docs/default-source/default-document-library/deloitte_20170119.pdf.

[16] Sawanobori, supra note 4, at 9.

[17] Haan, supra note 15, at 7.

[18] Id. at 7.

[19] Id.

[20] Id.

[21] Id.

[22] Smart Cities, supra note 13, at 7.

[23] Haan, supra note 15, at 5.

[24] Id.

[25] In Chattanooga, Tennessee, the city was able to reduce the duration of an outage by 50 percent during a storm. The utility company saved $1.4 million just from this 50 percent reduction. Smart Cities, supra note 13, at 7.

[26] Smart Cities, supra note 13, at 8.

[27] Id. at 8.

[28] Id. at 8.

[29] Id. at 8.

[30] Haan, supra note 15, at 11.

[31] Id.

[32] Id. at 9.

[33] Id. at 9.

[34] Id. at 9.

[35] CTIA, Infrastructure Policy Position, https://www.ctia.org/policy/policy-position-details/infrastructure (hereinafter "Infrastructure Policy Position").

[36] Id.

[37] Verizon Wireless, Comment Letter on FCC Proposed Rule to Accelerate Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment, WT Docket No. 17-78, at 4 (June 15, 2017) [hereinafter "Verizon Comments"].

[38] Id. at 4-5.

[39] Sawanobori & Anuszkiewicz, supra note 1, at 3.

[40] Verizon Comments, supra note 37, at 4-5.

[41] Smart Cities, supra note 13, at 11.

[42] Id.

[43] AT&T Comments, supra note 9, at 5.

[44] T-Mobile USA Inc., Comment Letter on FCC Proposed Rule to Accelerate Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment, WT Docket No. 17-78, at 5 (June 15, 2017) [hereinafter "T-Mobile Comments"].

[45] Id.

[46] AT&T Comments, supra note 9, at 5- 6.

[47] T-Mobile Comments, supra note 44, at 3.

[48] AT&T Comments, supra note 9, at 2.

[49] Mobilitie LLC, Petition for Declaratory Ruling in the Matter of Promoting Broadband for All Americans by Prohibiting Excessive Charges for Access to Public Rights of Way, WC Docket No. 16-421, at 10 (Nov. 15, 2016) [hereinafter "Mobilitie Petition"] (quoting FCC Commissioner Ajit Pai, Remarks at the Brandery: "A Digital Empowerment Agenda," at 2 (Sept. 13, 2016)).

[50] Verizon Comments supra note 37, at 1.

[51] AT&T Comments, supra note 9, at 7.

[52] Verizon Comments, supra note 37, at 6.

[53] Mobilitie Petition, supra note 49, at 7-8.

[54] Haan, supra note 15, at 3.

[55] Infrastructure Policy Position, supra note 35, at 1.

[56] Sprint Corporation, Comment Letter on FCC Proposed Rule to Accelerate Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment, WT Docket No. 17-78, at 11 (June 15, 2017) [hereinafter "Sprint Comments"].

[57] T-Mobile Comments, supra note 44, at 4.

[58] Verizon Comments, supra note 37, at 6.

[59] Id. at 6-7.

[60] AT&T Comments, supra note 9, at 2-4.

[61] T-Mobile Comments, supra note 44, at 4-5.