NBCSL
National Black Caucus of State Legislators

Next Generation Wireless Networks for Cities and Communities of Color:

THE PATH FORWARD

Published by the NBCSL Inter-Governmental Task Force

NEXT GENERATION WIRELESS NETWORKS FOR CITIES AND COMMUNITIES OF COLOR: THE PATH FORWARD

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NEXT GENERATION WIRELESS NETWORKS FOR CITIES AND COMMUNITIES OF COLOR: THE PATH FORWARD

I. Introduction

The social, economic, and political disruptions caused by cutting-edge wireless communications technologies impact people of color more profoundly than most other groups.[1] While using these technologies benefits anyone who possesses the skills to apply them in a meaningful way, communities of color are harnessing internet connectivity to address the many unique challenges that they alone face – disadvantages that have accrued after decades of benign neglect, urban blight, economic struggle, and structural racism. Technology is not a cure-all, but it has proven to be an effective equalizer and enabler of opportunity.[2]

Foremost among the technology being wielded for these purposes is mobile broadband communications and the myriad of services and applications it enables. Wireless connectivity has become central to everyday life for millions of people of color, and the demand for more information at higher speeds is insatiable. Smartphones and other mobile devices double as platforms for delivering critical education, healthcare and government services, while also helping to facilitate entrepreneurship and employment opportunities.[3] These benefits are enhanced in urban areas, where communities of color have deep roots. Cities are increasingly seeking to leverage the benefits of mobile broadband communications by exploring how to use wireless technology and the burgeoning "internet of things" to improve quality of life, streamline government operations, support high-tech ecosystems, and provide citizens with better social services.[4] In short, mobile broadband has quickly become, and remains, a game-changer for minorities and the cities in which they live.

Incredibly, given the significant gains it has delivered to date, the full potential of mobile broadband communications has yet to be capitalized. Although the benefits stemming from increased connectivity have already proven to be substantial for people of color, who are among the most ardent users of wireless services, there are many reasons to believe that what's to come

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[1] For an historical perspective, *see* Joycelyn James *et al.,* "On the Path to the Digital Beloved Community." MMTC (January 2012), *retrieved from* http://mmtconline.org/lp-pdf/BELOVEDBOOK.pdf.

[2] Ibid. *See also* Chanelle P. Hardy *et al.*, "With Broadband Equity for All." National Urban League (March 2014), *retrieved from* http://nulwb.iamempowered.com/sites/nulwb.iamempowered.com/files/BROADBAND%20PRINCIPLES%20MARCH%202014%20FINAL_0.pdf.

[3] *See, e.g.,* James Prieger, "The Broadband Digital Divide and the Benefits of Mobile Broadband for Minorities." The Journal of Economic Inequality, Vol. 13, Issue 3 (Sept. 2015) (hereinafter "Benefits of Mobile Broadband for Minorities").

[4] *See, e.g.,* Bernard Marr, "How Big Data and the Internet of Things Create Smarter Cities." Forbes (May 19, 2015), *retrieved from* http://www.forbes.com/sites/bernardmarr/2015/05/19/how-big-data-and-the-internet-of-things-create-smarter-cities/#3c37c3f063d8.

in the mobile arena will be exponentially better.[5] As discussed in this paper, the innovation, empowerment, and economic creation sparked by the next generation of mobile broadband networks will likely be fundamentally transformative for both communities of color and the cities where they reside. Achieving this potential, though, will require significant effort by policymakers to create an environment within which these networks can be leveraged.

This paper begins by evaluating the importance of mobile broadband communications to communities of color and examining the significant promise of next generation wireless networks for minority users and the cities in which they live. This promise will manifest itself most tangibly in improved delivery of services – healthcare, education, employment, and government services, among many others – that are of foundational importance to communities of color. These networks will also allow for more robust interaction between residents and city government, further empowering people of color by providing them with a more powerful outlet for making their voices heard. The paper concludes by detailing the many areas where policymakers will have to act in order to accelerate the deployment of next generation wireless networks. A range of existing policies and practices at every level – federal, state, and local – will have to be revisited and reformed in order to assure the rapid build out of this essential infrastructure. Collaboration and progressive thinking will be key to realizing these necessary reforms.

II. The Significance of Mobile Broadband Networks to Communities of Color

Over the last decade, mobile broadband internet access has become an indispensable lifeline for millions of people of color in the United States. This is notable because communities of color have lingered on the wrong side of the digital divide for far longer than most other demographic groups. While many surveys still find that home broadband adoption rates within communities of color trail those of other user groups, there is growing recognition that the enthusiastic embrace of mobile broadband by this group represents significant progress toward universal access.[6]

This section analyzes recent trends in mobile broadband adoption within communities of color and examines the impact mobile broadband networks have on users, the cities in which they live, and the delivery of services that improve overall quality of life.

A. Adoption Trends

Beginning in the mid-1990s, national surveys of computer and internet usage consistently found that people of color, especially those living in urban areas, were adopting and

[5] *See, e.g.,* "Mobile Broadband Transformation: From LTE to 5G." Rysavy Research (August 2016), *retrieved from* http://www.rysavy.com/Articles/2016-08-Mobile-Broadband-Transformation-Rysavy.pdf (hereinafter "Mobile Broadband Transformation").

[6] *See, e.g.,* Aaron Smith, "U.S. Smartphone Use in 2015." Pew Research Center (April 1, 2015), *retrieved from* http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/ (hereinafter "Smartphone Use in 2015").

using these technologies at far lower rates than most other demographic groups.[7] Similar findings were reported well into the early part of the 21st century.[8] The reasons for low adoption rates revolved primarily around the intertwined notions of relevance and affordability: even when available, many simply saw little need to invest in an internet connection or access device.[9] By the late 2000s, however, it became evident that, unlike their cohorts in other demographic groups, African Americans and Hispanics were gravitating towards wireless data technologies at much higher rates, suggesting an alternate route to closing the digital divide.

This trend began in earnest in the mid-2000s. As cellular service became more reliable and affordable, minorities were on the leading edge of households that were "cutting the cord" and opting to rely only on their cellphone for telephone service.[10] This preference for mobile voice service thus stoked early demand for and usage of wireless-enabled internet access, which began to emerge in the late 2000s with the widespread deployment of third-generation (3G) networks.[11] Surveys from 2008, 2009, and 2010 found communities of color to be among the most fervent users of mobile data services.[12] One such survey from 2009 concluded that "African

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[7] For a snapshot of data from the late1990s, *see* "Falling Through the Net II: New Data on the Digital Divide." National Telecommunications & Information Administration, U.S. Department of Commerce (July 28, 1998), *retrieved from* https://www.ntia.doc.gov/report/1998/falling-through-net-ii-new-data-digital-divide.

[8] *See, e.g.*, "A Nation Online: Entering the Broadband Age." Table 1. National Telecommunications & Information Administration, U.S. Department of Commerce (September 2004), *retrieved from* https://www.ntia.doc.gov/files/ntia/editor_uploads/NationOnlineBroadband04_files/NationOnlineBroadband04.pdf (hereinafter "Nation Online"); John B. Horrigan, "Home Broadband Adoption 2008." Page 3. Pew Internet & American Life Project (July 2008), *retrieved from* http://www.pewinternet.org/2008/07/02/home-broadband-2008/.

[9] *See, e.g.*, Nation Online, at page 14, figure 10.

[10] *See, e.g.*, "The Cell Phone Challenge to Survey Research." Page 3. Pew Research Center (May 15, 2006), *retrieved from* http://www.people-press.org/files/legacy-pdf/276.pdf. This trend has continued to the present: The Centers for Disease Control reports that, as of the end of 2015, Black and Hispanic adults are more likely than Whites to live in households that have gone "wireless-only" for voice service. *See* Stephen J. Blumberg and Julian V. Luke, "Wireless Substitution: Early Release of Estimates from the National Health Interview Survey, July–December 2015." Table 2. National Center for Health Statistics, Centers for Disease Control (May 2016), *retrieved from* http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201605.pdf.

[11] Even though plans for 3G deployments by wireless carriers were announced as early as 2000, it wasn't until later in the decade that these services were widely available. Previously, with the shift to digital networks, carriers offered only basic online services like email to subscribers. For additional discussion, *see* "Sixth Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services." Page 5. Federal Communications Commission (July 17, 2001), *retrieved from* https://apps.fcc.gov/edocs_public/attachmatch/FCC-01-192A1.pdf; "Twelfth Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services." Pages 67-70. Federal Communications Commission (February 4, 2008), *retrieved from* https://apps.fcc.gov/edocs_public/attachmatch/FCC-08-28A1.pdf.

[12] *See* John B. Horrigan, "Data Memo: Mobile Access to Data and Information." Pages 3-4. Pew Internet & American Life Project (March 2008), *retrieved from* http://www.pewinternet.org/~/media//Files/Reports/2008/PIP_Mobile.Data.Access.pdf.pdf; John B. Horrigan, "Wireless Internet Use." Pages 3-4. Pew Internet & American Life Project (July 2009), *retrieved from* http://www.pewinternet.org/~/media//Files/Reports/2009/Wireless-Internet-Use-With-Topline.pdf (hereinafter

Americans are the most active users of the mobile internet – and their use of it is also growing the fastest. Indicating that the digital divide between African Americans and white Americans diminishes when mobile use is taken into account."[13] These trends continued to proliferate into the smartphone age: in 2011, Nielsen found that communities of color were far outpacing Whites when it came to smartphone ownership.[14]

Today, Blacks and Hispanics remain the most avid users of mobile broadband services, so much so that people of color are more dependent on their smartphones for internet access than Whites.[15] This dynamic is especially evident among younger people of color, who use their mobile devices more intensively than older counterparts of all races.[16] As a result, younger users are even less likely to own a non-mobile computing device than older people of color.[17] These trends mean that home broadband adoption among people of color, as traditionally measured by survey firms (adoption constituting subscription to a wired internet connection like cable or DSL), continues to lag behind the national average: a 2015 survey found that the home broadband adoption rate for African Americans was 54%, compared to 72% for Whites.[18] Some have attempted to argue that mobile broadband internet access is only a supplement to, rather than a substitute for, a wired connection in the home.[19] Others have highlighted the potential downsides of smartphone dependence, noting, among other things, that many mobile data plans come with monthly data allowances that levy costly overage penalties.[20] However, when asked why they choose to be dependent on their smartphones for internet access, "users say that the reason they do not have broadband at home is because their smartphone lets them do

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"Wireless Internet Use"); Aaron Smith, "Mobile Access 2010." Page 3. Pew Internet & American Life Project (July 7, 2010), *retrieved from* http://www.pewinternet.org/files/old-media/Files/Reports/2010/PIP_Mobile_Access_2010.pdf.

[13] Wireless Internet Use, at page 4.

[14] *See* Lance Whitney, "Nielsen: U.S. Smartphone Ownership Higher Among Minorities." CNET (Feb. 1, 2011), *retrieved from* https://www.cnet.com/news/nielsen-u-s-smartphone-ownership-higher-among-minorities/.

[15] *See* Aaron Smith, "U.S. Smartphone Use in 2015." Pages 17-18. Pew Research Center (April 1, 2015), *retrieved from* http://www.pewinternet.org/files/2015/03/PI_Smartphones_0401151.pdf (hereinafter "Smartphone Use in 2015").

[16] *See* "Young, Connected and Black." Page 18. Nielsen (October 2016), *retrieved from* http://www.nielsen.com/us/en/insights/reports/2016/young-connected-and-black.html (hereinafter "Young, Connected and Black").

[17] Ibid.

[18] *See* John B. Horrigan and Maeve Duggan, "Home Broadband 2015." Page 8. Pew Research Center (December 21, 2015), *retrieved from* http://www.pewinternet.org/files/2015/12/Broadband-adoption-full.pdf (hereinafter "Home Broadband 2015").

[19] *See, e.g.,* Susan Crawford, "The 3 Big Myths that are Holding Back America's Internet." Backchannel (December 16, 2016), *retrieved from* https://backchannel.com/the-3-big-myths-that-are-holding-back-americas-internet-1d96dd47e944#.fp79mnm4v.

[20] Home Broadband 2015, at page 3.

all they need to do online, underscoring the device's utility for those without a home high-speed subscription."[21]

B. Impact

The implications of such robust mobile broadband adoption within communities of color encompass a broad range of benefits, the common thread amongst them being empowerment. Minorities are using their wireless devices and mobile broadband internet connections more intensely and in a more varied number of ways than most other groups.[22] One overreaching benefit is that, because of the increasing primacy of mobile advertising as a revenue generator for a growing number of firms, people of color now find themselves with newfound economic power.[23] Beyond appealing to marketers, though, this group of consumers has also helped shape the market for mobile services itself. The appetite for wireless services within communities of color, combined with their unique demands for pricing and data usage flexibility, has hastened the development of many new service offerings like more prepaid options and so-called free data programs.[24]

Because it is oftentimes their primary or exclusive on-ramp to the internet, people of color use their mobile broadband connections to engage in a much more diverse set of activities than other users. Minorities, for example, use their smartphones more than Whites for educational, health, financial, and employment purposes.[25] These usage trends are notable because of the historic disparities in access to quality services in these sectors, a dynamic that has long yielded poorer outcomes in communities of color: on average, Blacks and Hispanics earn less, have lower graduation rates, and develop more chronic diseases than Whites.[26]

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[21] Ibid.

[22] For a recent overview, *see* Smartphone Use in 2015. *See also* Monica Anderson, "Racial and Ethnic Differences in How People Use Mobile Technology." Pew Research Center (April 30, 2015), *retrieved from* http://www.pewresearch.org/fact-tank/2015/04/30/racial-and-ethnic-differences-in-how-people-use-mobile-technology/ (hereinafter "Differences in How People Use Mobile Technology").

[23] *See* "The State of African American Consumers." Page 12. Nielsen (September 2011), *retrieved from* http://www.nielsen.com/content/dam/corporate/us/en/conference/StateOfTheAfricanAmericanConsumer_FINAL pdf.pdf; "State of the Hispanic Consumer: The Hispanic Market Imperative." Pages. 8-10. Nielsen (Quarter 2, 2012), *retrieved from* http://www.nielsen.com/content/dam/corporate/us/en/reports-downloads/2012-Reports/State-of-the-Hispanic-Consumer.pdf; Young, Connected and Black, at page 45.

[24] *See, e.g.,* "Understanding and Appreciating Zero-Rating: The Use and Impact of Free Data in the Mobile Broadband Sector." Multicultural Media, Telecom and Internet Council (May 2016), *retrieved from* http://mmtconline.org/WhitePapers/MMTC_Zero_Rating_Impact_on_Consumers_May2016.pdf (hereinafter "Understanding and Appreciating Zero-Rating").

[25] Differences in How People Use Mobile Technology.

[26] *See, e.g.,* Benefits of Mobile Broadband for Minorities; Nicol Turner-Lee *et al.*, "Minorities, Mobile Broadband, and the Management of Chronic Diseases." Joint Center for Political & Economic Studies (April 2012), *retrieved from* http://jointcenter.org/sites/default/files/Minorities%20Mobile%20Broadband%20and%20the%20Management%20of%20Chronic%20Diseases_0.pdf (hereinafter "Management of Chronic Diseases").

Properly wielded, mobile broadband has delivered many gains to people of color in the management of their health and in bolstering educational outcomes.[27] The proliferation of mobile broadband networks has also sparked the rise of the app economy and hastened the general expansion of the high-tech sector, which has created a range of new employment and entrepreneurship opportunities for people of color.[28] For younger users, smartphones have proven to be important "catalysts in bringing a heightened awareness of social issues via social media."[29]

These many benefits tend to accrue most immediately in urban communities of color.[30] Because of their high population densities, cities are usually the first areas where cutting-edge mobile services are deployed. In addition, city governments and innovators working in local high-tech sectors are increasingly attempting to leverage the popularity and ubiquity of mobile broadband in an effort to enhance quality of life via the development of apps and other online services aimed at making government more responsive and its services more widely accessible.[31] Taken together, these and related efforts represent the foundation for the emerging "internet of things" that will facilitate the rise of even more responsive "smart" cities, an outcome that promises to yield additional benefits for people of color.

III. The Promise of Next Generation Networks for Cities and Their Communities of Color

The next generation of mobile broadband networks promises to accelerate much of the forward progress described in the previous section. These networks, which are still un devised by standards-setting agencies, service provides, innovators, and other experts, will be noteworthy in that they will deliver exponentially more capacity and other enhancements to

[27] *See, e.g.,* Management of Chronic Diseases; David Honig and Nicol Turner-Lee, "Refocusing Broadband Policy: The New Opportunity Agenda for People of Color." Pages 16-18. MMTC (November 21, 2013), *retrieved from* http://mmtconline.org/wp-content/uploads/2013/11/Refocusing-Broadband-Policy-112113.pdf (hereinafter "Refocusing Broadband Policy").

[28] Refocusing Broadband Policy, at pages 18-19.

[29] Young, Connected and Black, at page 18.

[30] Although demographic trends have begun to change in recent years, with more Blacks and Hispanics moving to the suburbs and more Whites returning to cities, a significant share of minorities still live in urban areas. *See* John R. Logan, "Separate and Unequal in Suburbia." US2010 Project (Dec. 1, 2014), *retrieved from* http://www.s4.brown.edu/us2010/Data/Report/report12012014.pdf; Ana Swanson, "Why 'Urban,' 'Suburban,' and 'Rural' are Almost Racial Categories." Washington Post (May 28, 2015), *retrieved from* http://knowmore.washingtonpost.com/2015/05/28/why-urban-suburban-and-rural-are-almost-racial-categories/.

[31] *See, e.g.,* "How Cities Score." The Economist (March 26, 2016), *retrieved from* http://www.economist.com/news/special-report/21695194-better-use-data-could-make-cities-more-efficientand-more-democratic-how-cities-score.

users.[32] Speeds could exceed a gigabit per second;[33] where today, the average 4G connection in the United States is just over 10 megabits per second.[34] The implications of such increased capacity – for people of color and the cities in which they live – are explored below.

A. Transformative Impact on Cities

One of the leading "use cases" for next generation wireless broadband networks is that this infrastructure will serve as the foundation for smart cities and the internet of things that will enable disruptive innovation in civic technology, transportation, public safety, government operations, social service delivery, and nearly every other aspect of modern urban life.[35] Together, these innovations will serve as critical drivers for cities when addressing issues related to income equality, digital equity, employment disparities, and other challenges with roots in historically disadvantaged urban communities.

The successful rise of the much-touted internet of things will hinge on the rapid deployment of next generation networks because the sundry of sensors comprising this web of interconnected devices will require massive amounts of bandwidth.[36] By the end of this decade, the number of such devices worldwide could eclipse 200 billion; today, there are about 6.4 billion connected devices.[37] Such rapid growth highlights the ease with which a device can be connected to the internet of things: cheap wireless sensors are increasingly being built into nearly every component of the physical infrastructure of cities, rendering them more intelligent and allowing them to collect and relay data in real time. As a result, "smart" lampposts[38], traffic

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[32] For an overview of recent and ongoing planning efforts in support of these networks, *see* ITU, IMT-2020, http://www.itu.int/en/ITU-R/study-groups/rsg5/rwp5d/imt-2020/Pages/default.aspx.

[33] *See, e.g.,* Stephen Shankland, "How 5G Will Push a Supercharged to Your Home, Phone, Car." CNET.com (March 2, 2015), *retrieved from* https://www.cnet.com/news/how-5g-will-push-a-supercharged-network-to-your-phone-home-and-car/.

[34] *See* Stephen Lawson, "U.S. Drops to 55th in 4G LTE Speeds." PC World (Sept. 24, 2015), *retrieved from* http://www.pcworld.com/article/2985916/mobile/us-rank-drops-to-55th-in-4g-lte-speeds.html.

[35] *See, e.g.,* Doug Brake, "5G and Next Generation Wireless: Implications for Policy and Competition." ITIF (June 2016), *retrieved from* http://www2.itif.org/2016-5g-next-generation.pdf (hereinafter "5G and Next Generation Wireless").

[36] Ibid.

[37] *See* David E. Sanger and Nicole Perlroth, "A New Era of Internet Attacks Powered by Everyday Devices." New York Times (October 22, 2016), *retrieved from* http://www.nytimes.com/2016/10/23/us/politics/a-new-era-of-internet-attacks-powered-by-everyday-devices.html?_r=0; "Gartner Says 6.4 Billion Connected "Things" Will Be in Use in 2016, Up 30 Percent From 2015." Gartner (November 10, 2015), *retrieved from* http://www.gartner.com/newsroom/id/3165317.

[38] *See, e.g.,* Lily Hay Newman, "Sheesh, Even Streetlights are Getting Cameras and Internet Connections." Slate (October 2, 2015), *retrieved from* http://www.slate.com/blogs/future_tense/2015/10/02/ge_intelligent_lamp_posts_have_cameras_sensors_may_come_to_new_york_city.html.

lights[39], parking meters[40], and water pipes[41], among other innovations, are coming online in cities across the country. The information generated by these smart devices will allow for greater efficiency in managing key municipal services, thereby lowering administrative costs for cities. When made available to the public, this data can also seed innovation in the development of apps aimed at improving municipal services: in many cities, apps allow residents to notify local agencies about potholes, unplowed streets, public transportation delays, crime, trash, and a range of other events.[42]

Smart urban infrastructure will be essential to facilitating the emergence of more intelligent, responsive, and affordable transportation systems. The vast majority of cars will likely be connected to the internet via wireless broadband by 2020, allowing for safer driving in urban environments.[43] However, many see the most promise in leveraging the internet of things to support autonomous vehicles, which can help decrease congestion and increase access to transportation alternatives across cities. Effectively piloting these vehicles will require a significant amount of bandwidth and rapid network responsiveness: by one estimate, the average autonomous car could generate 4,000 gigabytes of data each day, or about 0.75 gigs a second.[44] Data-enabled autonomy will likely also be integrated into public transportation options like subways, commuter rail, and buses, further increasing the amount of data being generated in the simple act of moving people around. Overall, better, cheaper, more reliable, and more ubiquitous transportation options are of critical importance in urban communities of

[39] *See, e.g.*, Keith Barry, "The Traffic Lights of Tomorrow Will Actively Manage Congestion." CityLab (September 11, 2014), *retrieved from* http://www.citylab.com/commute/2014/09/the-traffic-lights-of-tomorrow-will-actively-manage-congestion/379950/.

[40] *See, e.g.*, Erik Engquist, "Parking in New York City Stinks. Here's How to Fix it." The Insider, Crain's (April 22, 2015), *retrieved from* http://www.crainsnewyork.com/article/20150422/BLOGS04/150429958/parking-in-new-york-city-stinks-heres-how-to-fix-it.

[41] *See, e.g.*, Kevin Ebi, "How to Plug Your Water Supply's (Money) Leaks." Smart Cities Council (June 3, 2015), *retrieved from* http://smartcitiescouncil.com/article/how-plug-your-water-supply%E2%80%99s-money-leaks.

[42] *See, e.g.*, Teena Maddox, "Smart Cities: The Smart Person's Guide." Tech Republic (May 12, 2016), *retrieved from* http://www.techrepublic.com/article/smart-cities-the-smart-persons-guide/.

[43] *See, e.g.*, Leo Sun, "Internet of Things in 2016: 6 States Everyone Should Know." The Motley Fool (January 18, 2016), *retrieved from* http://www.fool.com/investing/general/2016/01/18/internet-of-things-in-2016-6-stats-everyone-should.aspx.

[44] *See* Damon Beres, "Autonomous Cars Will Make Your Data Plan Look Tiny." Mashable (August 17, 2016), *retrieved from* http://mashable.com/2016/08/17/intel-autonomous-car-data/#kOtt.XbH3qq3.

color given their outsize dependence on them[45] and the continued legacy of disparate access to private alternatives.[46].

These types of smart city services will deliver a number of practical benefits to people of color and other communities that have long lived on the margins in urban America. Examples include:

- *Relevance.* Mobile apps delivering important government services or autonomous cars that make affordable rides available in areas historically underserved by taxis, for example, could help those who remain unconnected see the relevance of a mobile broadband subscription.[47]

- *Investment in communities.* Cost-savings arising from more efficient management of municipal services could allow for more investment in communities of color.[48]

- *Quality of life.* Real-time crime data, including information about shootings, and maps plotting this information can help to reduce crime and increase quality of life in neighborhoods long plagued by violence.[49]

- *New employment opportunities.* An embrace of next generation networks will allow cities to rebrand themselves as centers of innovation and supportive of high-tech, which could in turn attract new businesses, encourage local entrepreneurship, and otherwise create new job opportunities for people of color. In addition, actually building the internet of things and deploying next generation networks will create a number of new jobs.[50]

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[45] *See, e.g.,* Mike Maciag, "Public Transportation's Demographic Divide." Governing.com (February 25, 2014), *retrieved from* http://www.governing.com/topics/transportation-infrastructure/gov-public-transportation-riders-demographic-divide-for-cities.html.

[46] *See* Gillian B. White, "Uber and Lyft are Failing Black Riders." The Atlantic (October 31, 2016), *retrieved from* http://www.theatlantic.com/business/archive/2016/10/uber-lyft-and-the-false-promise-of-fair-rides/506000/.

[47] Relevance remains the biggest barrier to greater adoption in these communities. *See* Maureen Lewis, "Digitally Unconnected in the U.S.: Who's Not Online and Why?" NTIA (September 28, 2016), *retrieved from* https://www.ntia.doc.gov/blog/2016/digitally-unconnected-us-who-s-not-online-and-why (hereinafter "Digitally Unconnected in the U.S.").

[48] *See, e.g.,* Adam Stone, "How to Make Smart City Investments Count." GovTech.com (September 19, 2015), *retrieved from* http://www.govtech.com/dc/articles/How-to-Make-Smart-City-Investments-Count.html.

[49] *See, e.g.,* John M. Kamensky, "Fighting Crime in a New Era of Predictive Policing." Governing.com (November 5, 2013), *retrieved from* http://www.governing.com/blogs/bfc/col-crime-fighting-predictive-policing-data-tools.html.

[50] *See, e.g.,* Teena Maddox, "16 Tech Jobs That Will be Needed for the Future of Smart Cities." Tech Republic (January 22, 2016), *retrieved from* http://www.techrepublic.com/article/16-tech-jobs-that-will-be-needed-for-the-future-of-smart-cities/.

B. Transformative Impact on Communities of Color

Increased mobile broadband capacity arising from the deployment of next generation wireless networks such as 5G will transform the user experience, assist in addressing the digital divide, and bolster how key services (e.g., healthcare and education) are delivered and consumed.

The amount of data being sent over mobile networks continues to increase each year. Monthly mobile data traffic nearly doubled between 2015 and 2016; by 2020, it is expected to grow by 800 percent.[51] This rise in traffic, coupled with the lack of additional spectrum resources to support existing mobile broadband networks, has led some wireless service providers to impose data allowances on customers.[52] As a result, people of color are more likely to exceed these allowances and incur additional charges – or have their service canceled – than other users.[53] Higher capacity next generation networks could greatly change this dynamic by either eliminating allowances altogether or allowing carriers to increase them to a point where few would ever be exceeded.[54] These types of offerings could attract new users who perceive much more value in these seemingly unlimited connections.[55]

Beyond improving basic communications and entertainment options for users by dramatically reducing latency (i.e., the delay in responsiveness to an input) and enhancing the overall quality of mobile service, next generation networks and the innovations they engender, notably a more robust internet of things, will greatly enhance the delivery and reach of essential services like healthcare and education. Examples include:

- *Healthcare.* The current generation of mobile broadband networks facilitated the emergence of a vast array of mobile healthcare services. Wearable devices, health-specific apps, and a range of similar offerings provided users with deeper insights into and control over their healthcare. The next iteration of mobile health services will likely leverage the enhanced capacity of next generation networks to develop a broader range of video-enabled offerings like more robust remote consultations.[56] In

[51] *See* Colin Gibbs, "Cisco: Mobile Data Traffic to Increase 800% within 5 Years." Fierce Wireless (February 3, 2016), *retrieved from* http://www.fiercewireless.com/wireless/cisco-mobile-data-traffic-to-increase-800-within-5-years.

[52] Understanding and Appreciating Zero-Rating.

[53] Smartphone Use in 2015, at page 16.

[54] *See, e.g.*, 5G and Next Generation Wireless.

[55] A similar dynamic and impact on the digital divide is evident in the context of free data offerings, where the ability to consume as much of a particular kind of content as desired without it counting against a data allowance offers a compelling value proposition to non-adopting people of color. For further discussion, *see* Understanding and Appreciating Zero-Rating.

[56] *See, e.g.*, "Towards converged 5G mobile networks — Challenges and current trends." ITU News (2014), *retrieved from* https://itunews.itu.int/en/5228-Towards-converged-5G-mobile-networks-Challenges-and-current-trends.note.aspx.

addition, there is much enthusiasm about harnessing these new networks to support an "internet of medical things" comprised of wearables, smartphones, and wireless sensors that can track movement and health metrics in real-time.[57] The greater variety and quality data generated from these services will allow for more timely diagnoses and accurate treatments. For people of color, these services are of immediate relevance given their likelihood of developing chronic diseases: better preventative care could reduce healthcare costs and increase life expectancy.[58]

- *Aging in place.* The mobile broadband-enabled healthcare benefits arising from next generation networks will have a profound impact on the rapidly growing senior adult of color population.[59] Members of this segment are less likely than their white counterparts to have adequate health insurance to cover the array of chronic diseases they are likely to develop.[60] A large and growing number of these seniors live alone, and many, given their lower-than-average annual income and higher-than-average poverty rate, cannot afford private nursing homes or other such care.[61] Access to next generation mobile broadband networks would enhance the lives of older adults of color, thus allowing them to receive quality care, like real-time monitoring of vital signs and video consultations, in a more affordable and convenient way.

- *Education.* Video and real-time data collection enabled by next generation networks also promises to further disrupt the ways in which students of all ages receive educational services. Mobile broadband network technology has stoked the development of a broad range of educational apps and services (e.g., MOOCs) that are available anytime, anywhere, allowing learning to occur in many more places than just inside the classroom.[62] In addition, ubiquitous, high-capacity next generation mobile broadband networks could help deliver high performance and more affordable connectivity to schools, libraries, community centers, and other key

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[57] *See* Darrell M. West, "How 5G Technology Enables the Health Internet of Things." Center for Technology Innovation at Brookings (July 2016), *retrieved from* https://www.brookings.edu/wp-content/uploads/2016/07/5G-Health-Internet-of-Things_West.pdf.

[58] Ibid.; Management of Chronic Diseases.

[59] *See* "A Statistical Profile of Black Older Americans Aged 65+." Administration on Aging, U.S. Department of Health and Human Services (September 30, 2015), *retrieved from* http://www.aoa.acl.gov/Aging_Statistics/minority_aging/Facts-on-Black-Elderly-plain_format.aspx; A Statistical Profile of Hispanic Older Americans Aged 65+." Administration on Aging, U.S. Department of Health and Human Services (September 30, 2015), *retrieved from* http://www.aoa.acl.gov/Aging_Statistics/minority_aging/Facts-on-Hispanic-Elderly.aspx.

[60] Ibid.

[61] Ibid.

[62] *See, e.g.,* "Future Ready Schools: Building Technology Infrastructure for Learning." Office of Educational Technology, U.S. Department of Education (November 2014), *retrieved from* https://tech.ed.gov/wp-content/uploads/2014/11/Future-Ready-Schools-Building-Technology-Infrastructure-for-Learning-.pdf (hereinafter "Future Ready Schools").

anchor institutions in communities of color. A stark digital divide remains in "schools where 75 percent or more of students are either Latino or African American," which means that greater access via next generation networks can significantly reduce the digital divide.[63]

Combined with the positive impacts described in the previous section, communities of color stand to benefit immensely from the next generation of mobile networks. The anticipated gains have the potential to be truly transformative, providing users young and old access to technology, services, and apps that will undoubtedly improve nearly every aspect of their daily lives. However, these benefits will remain theoretical until new networks are built. Although next generation mobile broadband networking standard and technology development activities are ongoing, new policies will be necessary to ensure its successful deployment in cities of color.

IV. Realizing the Transformative Potential of Next Generation Networks

Policy has played an integral role in the development and deployment of wireless communications networks since their initial launch over three decades ago. This is because the physical infrastructure of mobile networks is comprised of a number of inputs that implicate government oversight and require government approval. These range from federal oversight of the airwaves used to deliver data, to state and local management of the rights-of-way where wireless towers are built and antennae are installed. In general, officials at every level of government have assiduously adjusted public policy in an effort to facilitate new network deployment as mobile systems passed from one generation to the next. This section details the range of laws, regulations, and other public policies that policymakers will have to address in order to facilitate the deployment of next generation networks and assure the realization of their full potential in communities of color and beyond.

A. Necessary Federal Policy Adjustments & Activities

The Federal Communications Commission (FCC) plays several critical roles in wireless network deployment: among other things, it manages the spectrum that enables mobile connectivity; it provides guidance to state and local entities about how to grant siting approvals in a timely manner; and it possesses the power to influence whether and how investments are made in network infrastructure. In short, the FCC is and will remain a key entity in hastening the deployment of next generation networks. Specific areas where it will have to act in the advancement of these networks are as follows.

Spectrum. Even though next generation mobile networks are being designed to be more efficient in their use of spectrum, deployment on a nationwide scale will require the auction of a

[63] *See* John Horrigan, "Schools and Broadband Speeds: An Analysis of Gaps in Access to High-Speed Internet for African American, Latino, Low Income, and Rural Students." Page 3. Report Prepared for the Alliance for Excellent Education and the LEAD Commission (October 2014), *retrieved from* http://www.leadcommission.org/sites/default/files/Schools%20and%20Broadband%20Speeds%20Final.pdf.

sizeable swath of the airwaves to service providers and other innovators.[64] In particular, these networks will likely be built by combining existing network architectures with so-called high-band spectrum, which allows for the delivery of more information but over shorter distances (compared to other spectrum bands, which allow have longer reaches but lesser capacity).[65] As such, the FCC has an opportunity to begin the arduous process of freeing up the spectrum resources that will be needed to support next generation network deployment (it can take as long as 13 years to do so).[66] Recent efforts aimed at making available sizeable portions of the airwaves for this purpose signal a promising commitment to addressing the difficult task of meeting insatiable demand for more spectrum.[67] To the extent possible, the Commission should embrace the experimental nature of these early efforts to deploy next generation networks and encourage innovators to be creative in how they use these resources. Such innovation will likely unlock new ways of using spectrum more efficiently.[68]

Regulatory environment. The FCC must also foster a regulatory environment that is conducive to continued innovation, experimentation, and investment. Certain regulatory actions, especially those that artificially limit the range of business activities, can dampen investment. For example, restrictions placed on spectrum bands during previous FCC auctions resulted in lower demand for these otherwise valuable and much-needed resources.[69] More recently, some have argued that newly imposed network neutrality rules have begun to depress investment in broadband networks.[70] A likely cause of the hesitancy to invest among service providers is uncertainty about the exact scope of the net neutrality rules, in particular whether and to what extent they might be applied to new business models and service offerings (like zero-rated products).[71] The deployment of next generation networks will require significant investment: one estimate pegs the total cost of building out fifth generation (5G) mobile network infrastructure at over $100 billion.[72] Regulation must not deter these needed investments. Consequently, the FCC must clarify its regulatory regime for mobile broadband

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[64] 5G and Next Generation Wireless.

[65] Mobile Broadband Transformation, at page. 6.

[66] *See* "National Broadband Plan." Chapter 5. FCC (March 2010), *retrieved from* http://www.broadband.gov/plan/5-spectrum/.

[67] 5G and Next Generation Wireless, at page 14.

[68] Mobile Broadband Transformation.

[69] *See, e.g.,* Coleman Bazelon, "Expected Receipts from Proposed Spectrum Auctions." Pages 11-12. Brattle Group (July 28, 2011), *retrieved from* http://www.brattle.com/system/publications/pdfs/000/004/687/original/Expected_Receipts_From_Proposed_Spectrum_Auctions_Bazelon_Jul_28_2011.pdf?1378772120.

[70] *See, e.g.,* Ajit Pai, "Remarks Before the Heritage Foundation." FCC (February 26, 2016), *retrieved from* http://transition.fcc.gov/Daily_Releases/Daily_Business/2016/db0226/DOC-337930A1.pdf.

[71] Understanding and Appreciating Zero-Rating.

[72] *See* Iain Gillott, "The Cost of 5G and the Next New Shiny Thing." 5G World News (January 26, 2016), *retrieved from* https://5gworldnews.com/2016/01/26/the-cost-of-5g-and-the-next-new-shiny-thing/.

and make clear that it will not interfere unnecessarily with the organic evolution of this vibrantly innovative space.

Connecting the unconnected. By focusing less on micromanaging innovation and investment in the mobile broadband space, the FCC will have more resources available to address long overlooked demand-side issues. Even though significant progress has been made toward closing the digital divide, especially in communities of color via above-average mobile broadband connectivity, far too many people of color – well over a quarter of the adult population – remain offline. Many continue to cite the related issues of relevance and cost as the primary reasons for being offline.[73] The FCC has acted to address the cost issue by extending federal Lifeline subsidies to broadband connections,[74] but more needs to be done, especially with regard to digital literacy education. Working in communities to demonstrate the true value of a broadband connection and providing training opportunities are essential to not only closing the digital divide but also to creating more digitally ready and empowered users.[75] These kinds of efforts need to be prioritized in urban communities of color.[76] The FCC should take more of a leadership role on these issues and seek to partner with other relevant agencies at every level of government to ensure that new broadband subsidies are supplemented with training opportunities.

B. Necessary State and Local Policy Adjustments and Activities

Policymakers and government bodies at the state and local levels also play important roles in the deployment of wireless networks. Depending on the state, a central regulatory authority or individual municipalities administer the use of public rights-of-way and public infrastructure and oversee the siting of wireless antennae, towers, pole attachments, and other network equipment. These entities also have the ability to influence the demand for and use of advanced communications services by adjusting policies in sectors, like education and healthcare, where new technologies are transforming the delivery of key services. In short, rational policy at the state and local levels will be essential to facilitating new network deployment. The following examines the areas where these decision-makers will have the greatest impact.

Streamlining processes impacting network construction. Unlike wired networks, which are generally comprised of cables buried beneath the ground in urban areas, wireless networks are built using a significant number of components that are in plain view. Elements like towers are erected on public and private property, while antennae and other equipment are attached

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[73] Digitally Unconnected in the U.S.

[74] *See* John Eggerton, "Divided FCC Votes for Lifeline Reform." Broadcasting & Cable (March 31, 2016), *retrieved from* http://www.broadcastingcable.com/news/washington/divided-fcc-votes-lifeline-reform/155130.

[75] *See* John Horrigan, "Digital Readiness Gaps." Pew Research Center (September 20, 2016), *retrieved from* http://assets.pewresearch.org/wp-content/uploads/sites/14/2016/09/PI_2016.09.20_Digital-Readiness-Gaps_FINAL.pdf.

[76] Ibid.

to a wide array of above-ground structures: utility poles, light poles, rooftops, and public and private buildings. Because state and local governments retain significant authority to oversee how these elements are deployed, the speed with which next generation networks are built out will hinge in large part on the reasonableness and receptiveness of policies at these levels.[77]

Administering the prevailing piecemeal approval process for wireless network deployment has not been without friction. To date, there has been good progress in cities that recognize the value of wireless networks, but many disputes have arisen between service providers and oversight authorities regarding a range of issues, including the speed with which siting proposals are reviewed, the reasonableness of rates charged for attaching antennae to utility poles and municipal infrastructure, and the legality of regulations directing how certain structures must look.[78] In some cases, the FCC has intervened to provide guidance; in others, parties have sought legal redress. As a result, the actual construction of wireless networks can be time-consuming and expensive if policies are unnecessarily intrusive, burdensome, or administered haphazardly.

The architecture of next generation mobile networks will be substantially different from their predecessors. For a number of technical reasons, these networks will require a much larger number of smaller antennae to be deployed.[79] The density of these so-called small cells, which will be critical to enabling much faster speeds for used, will be high relative to the density of antennae constituting today's networks.[80] This shift to a networking architecture dominated by small cells and other distributed approaches is already underway. Indeed, the number of small cells that will be deployed in the coming years as the shift to next generation networks accelerates will be considerable. In 2016, for example, two wireless carriers will have deployed 100,000 small cells; such a deployment "in only one year represents approximately one third of the total number of traditional cell cites deployed over the previous two decades."[81] These new networks will also require a substantial amount of fiber backhaul in order to transmit the larger amount of data that will result from greater capacity.[82]

To assure the timely deployment of the next generation of mobile networks and encourage continued investment in these services, state and local officials must act now to revisit and revise, as appropriate, the broad range of policies impacting wireless network construction. In short, new deployment methods require new policies that reflect the unique

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[77] 47 U.S.C. § 224.

[78] *See, e.g.,* "Enabling the Wireless Networks of Tomorrow: Rules of the Road for Pole Attachments in States Across America." CTIA (April 2016), *retrieved from* http://www.ctia.org/docs/default-source/default-document-library/enabling-the-wireless-networks-of-tomorrow.pdf (hereinafter "Enabling the Wireless Networks of Tomorrow").

[79] Mobile Broadband Transformation, at page 28.

[80] Ibid., at pages 34-35.

[81] Enabling the Wireless Networks of Tomorrow.

[82] 5G and Next Generation Wireless.

architectural attributes of next generation networks. Opportunities for immediate action include:

- *Rationalizing pole attachment policies*. Twenty states maintain their own regulatory regime for utility pole attachments, and the rest are subject to FCC rules.[83] But these rules generally don't apply to municipal utility poles or to light poles and other public infrastructure. In all of these states, those wishing to deploy elements of wireless networks face a host of disparate requirements, fees, and administrative delays, all of which increase costs for service providers and lengthen the amount of time it will take to complete construction.[84] Opportunities thus exist for states to align their policies with the FCC's pole attachment framework in order to enhance the efficiency and lower the costs of installing key network components. States like California, Kansas, and Ohio have already begun this process; more should follow suit in assuring timely, non-discriminatory, and affordable access to these critical inputs.[85]

- *Streamlining rights-of-way management*. At the local level, cities have the ability to speed or slow network deployment in how they manage their rights-of-way. Zoning laws and other local policies, for example, might place unintentional limitations on where a wireless tower can be built or where antennae can be deployed. The FCC on several occasions has acted to provide clarity and assure a somewhat more uniform approach to these issues, but localities nevertheless retain considerable authority to impact network construction decisions.[86] As such, there are opportunities for local officials to come together to develop a unified approach to how cities leverage their resources in support of next generation network deployment. Large cities like New York and San Francisco have already begun to experiment with how to accommodate the unique elements of new network architecture.[87] The lessons learned in these cities deserve serious scrutiny by policymakers in other, smaller cities.

- *Embracing small cells*. On many occasions in the past, mobile network deployments were met with local resistance in the form of NIMBYism, much of which revolved around a dislike or fear of placing wireless antennae and other equipment in close proximity to residences and schools even though this technology operates well

[83] Ibid., at page. 15.

[84] Enabling the Wireless Networks of Tomorrow.

[85] *See, e.g.,* "Decision Regarding the Applicability of the Commission's Right-of-Way Rules to Commercial Mobile Radio Service Providers." Rulemaking 14-05-001, California PUC (February 1, 2016), *retrieved* from http://www.tellusventure.com/downloads/cpuc/poles/cpuc_final_decision_mobile_row_28jan2016.pdf?017b96.

[86] *See* "In the Matter of Acceleration of Broadband Deployment by Improving Wireless Facilities Siting Policies, Report and Order." FCC (October 21, 2014), *retrieved from* https://apps.fcc.gov/edocs_public/attachmatch/FCC-14-153A1.pdf.

[87] *See, e.g.,* Martha DeGrasse, "6 DAS and Small Cells Case Studies." RCR Wireless (May 10, 2016), *retrieved from* http://www.rcrwireless.com/20160510/network-infrastructure/six-small-cell-case-studies-tag4-tag99.

within the safety guidelines set by the FCC.[88] Because next generation networks will be built using a larger number of antennae than previous networks, local officials should seek to partner with service providers in an effort to begin educating the public about small cells and other constituent parts of these networks. One way to do this might be to frame next generation networks as core components and enablers of smart cities and the burgeoning internet of things. Offering such a tangible value proposition to residents could help to quell any anxiety that might arise from the unique elements of new network architecture.

- *Enacting policies that support rapid and cost efficient backhaul fiber deployment*. Cities and states should also focus on implementing policies impacting the installation of fiber backhaul for wireless networks. Examples include dig-once requirements and progressive micro-trenching policies.[89] Some estimate that such "smart local policies…can reduce deployment costs by 90 percent while adding less than 1 percent to total project cost and minimizing neighborhood disruption."[90]

Unlocking disruptive potential in key sectors. State and local policymakers must also address any legislative, regulatory, and public policy barriers that might impede further use of mobile broadband in key sectors. As discussed above, there are many "use cases" for next generation networks in the education, healthcare, and transportation spaces. To date, these and other sectors have been profoundly impacted by new mobile technologies, delivering many important benefits to people of color. Continued progress toward realizing the full transformative potential of mobile broadband networks, however, depends on recalibrating policies to encourage continued innovation and investment.

State policymakers in particular possess significant power in this context. Reforms to state laws have already bolstered some aspects of mobile healthcare, digital education, better and more responsive utility services, and cutting-edge transportation options.[91] Much more comprehensive reforms, though, are needed to foster an environment where next generation networks and the myriad of new service they enable can thrive. Specific examples include:

[88] *See, e.g.,* Steven J. Eagle, "Wireless Technology, Infrastructure Security, and the Nimby Problem." Catholic University Law Review, Vol. 54, Issue 2 (Winter 2005), *retrieved from* http://scholarship.law.edu/cgi/viewcontent.cgi?article=1219&context=lawreview.

[89] 5G and Next Generation Wireless.

[90] *See* Blair Levin and Adie Tomer, "National Broadband Policies: Brought to you by Cities." The Avenue blog, Brookings (January 13, 2015), *retrieved from* https://www.brookings.edu/blog/the-avenue/2015/01/13/national-broadband-policies-brought-to-you-by-cities/.

[91] *See, e.g.,* "Telehealth: Policy Trends and Considerations." National Conference of State Legislatures (2015), *retrieved from* http://www.ncsl.org/documents/health/telehealth2015.pdf.

- *Healthcare.* Additional state-level reforms are needed to ensure that mobile healthcare services like video-enabled remote consultations are reimbursable and to eliminate state restrictions on cross-border licensure and credentialing.[92]

- *Education.* Additional funding and other resources are needed to integrate next generation networks, services, and devices into schools; develop curricula that use these new technologies in impactful ways; and provide much-needed teacher development and training to ensure that these new tools are used as effectively as possible in the education of students of all ages.[93]

- *Transportation.* Experimentation with connected and autonomous cars is exploding in metropolitan areas across the country, creating a fair amount of uncertainty within state departments of motor vehicles and local taxi authorities, among many other entities. Some cities like Pittsburgh are embracing cutting-edge transportation options like autonomous taxis in an effort to position themselves as destinations for high-tech startups.[94] Other government entities, though, are taking a more measured approach.[95] Policymakers in states and cities of every size will eventually need to grapple with these issues, making it essential that these decision-makers be better informed about the costs and benefits of these new services. Accordingly, there is a critical need for the development and dissemination of case studies and best practices to ensure that policy development is informed by actual data and real-world experience.[96]

- *Utility services.* The internet of things tethered by next generation mobile broadband networks will also impact the delivery and consumption of gas, electricity and water services. Wireless technologies, for example, will serve as the glue for smarter utility networks, allowing service providers to generate and analyze real-time data that can be used to prevent outages, enhance service quality, and provide customers with more control over their utility bills.[97] Progress towards these ends, though, will hinge

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[92] *See, e.g.*, "State Policy Resource Center." American Telemedicine Association, *retrieved from* http://www.americantelemed.org/main/policy-page/state-policy-resource-center.

[93] Future Ready Schools.

[94] *See, e.g.*, Max Chafkin, "Uber's First Self-Driving Fleet Arrives in Pittsburgh this Month." Bloomberg (August 18, 2016), *retrieved from* http://www.bloomberg.com/news/features/2016-08-18/uber-s-first-self-driving-fleet-arrives-in-pittsburgh-this-month-iso6r7on.

[95] *See, e.g.*, "Autonomous/Self-Driving Vehicles Legislation." National Conference of State Legislatures (October 25, 2016), *retrieved from* http://www.ncsl.org/research/transportation/autonomous-vehicles-legislation.aspx.

[96] *See, e.g.*, "State Laws on Autonomous Vehicles." The Council of State Governments (2016), *retrieved from* http://knowledgecenter.csg.org/kc/system/files/CR_automomous.pdf.

[97] *See, e.g.*, Mohamed A. Ali and Ahmed A. Mohamed, "5G Cellular Technologies for Supporting Future Power Grid Communications Networks." IEEE Smart Grid Newsletter (October 2016), *retrieved from*

on state policy adjustments that permit such experimentation and allow utilities to garner a reasonable return on their investments.[98]

Leading by example. Cities and states should embrace the new communications technologies described above and seek to leverage next generation networks in an effort to enhance both inward-facing and outward-facing government operations. As discussed previously, the internet of things holds enormous promise for cities and their communities of color. Rather than be passive bystanders, state and local policymakers should become active participants in, users of, and advocates for these new services. Doing so will create a supportive environment for innovation and investment and demonstrate to residents that these new services are safe and useful. Embracing innovation in this manner will inevitably yield creative ways of harnessing these networks for government operations, social service delivery, high-tech entrepreneurship, and any number of other critical local activities.

V. Conclusion

The transformative potential of next generation broadband networks is significant for communities of color and the cities in which they reside. This paper has documented the many areas where these networks will prove disruptive and beneficial. No single technology can erase the many disadvantages that continue to plague these communities, but there is significant optimism that mobile broadband network technology will play a critical role in helping to bolster economic equality and assure more parity in the opportunities available to citizens young and old.

Realizing these benefits, though, will depend in large part on the willingness of policymakers at every level of government to ease the deployment of next generation networks. The unique architectural attributes and technical aspects of these networks make clear the need for adjustments in laws, regulations, and policies developed and applied by government entities at the federal, state, and local levels. This paper has identified many areas where action is required to support network construction and to encourage greater use of new technologies by people of color and in critical sectors. These are best seen as opportunities for forging partnerships and working with innovators and consumers in an effort to forge forward-looking policies. To assure timely deployment, policymakers must begin to address these issues now. Any delay in action will be felt most profoundly in the communities that stand to gain the most from next generation broadband networks.

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http://smartgrid.ieee.org/newsletters/october-2016/5g-cellular-technologies-for-supporting-future-power-grid-communication-networks.

[98] *See, e.g.*, "2014 Smart Grid System Report." Page 8. U.S. Department of Energy (August 2014), *retrieved from* http://energy.gov/sites/prod/files/2014/08/f18/SmartGrid-SystemReport2014.pdf.