

GET SMART

THE GROUND-UP REVOLUTION TO CONNECT AND TRANSFORM AMERICAN COMMUNITIES



**MOBILE
FUTURE**

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OVERVIEW

Picture a world where cities and towns control and monitor their bridges, parks, pipelines and roads remotely, identifying potential infrastructure, environmental and safety issues before they occur and gaining incredible energy, cost and time-saving efficiencies through the continual flow of actionable data across a myriad of community services. A world where communities are safer, the cost and quality of public services are much improved and people have more time in the day thanks to more efficient commutes and parking.

The typical U.S. household owns five mobile devicesⁱ. By 2022, the average home may include 500ⁱⁱ connected devices, as the world rapidly ushers in the age of the Internet of Things (IoT). Much of the mobile revolution to date has focused on empowering and improving the lives of individuals via our smartphones, tablets, wearable fitness trackers and other personal wireless devices. The revolution ahead will render sentient and of service virtually every "thing" around us—some 28 billion devices worldwide by 2021ⁱⁱⁱ.

Already consumers are experiencing—and increasingly expecting—mobile-enabled apps that connect them to local services, such as to report potholes, pay parking meters or call for senior transportation. But this is just the beginning. From cars and buses, street lights and schools, public fountains and community parks—all the way down to the trash bins—everything will be connected and automated.

With 5G technologies on the horizon, the promise is virtually limitless. New and emerging mobile broadband applications and products offer enormous opportunities to improve public services, lower costs and foster a more attractive environment for both residents and businesses.

This is the connected future of communities, and it is fast-arriving in leading cities around the world. Smart communities are locally defined, and no two will evolve along the same pathway. However, they are likely to share several characteristics: They focus on the needs and priorities of their residents; they allow data to drive their processes; they reach well beyond the halls of government to engage the private sector and others, including local citizens; they make generous use of IoT devices and high-speed mobile broadband connectivity; and they value and welcome investment and deployment of robust and resilient connected infrastructure.

From mapping a cohesive, long-term vision to procuring and deploying integrated systems that work across departments and local priorities to approving local rights of way and other wireless network infrastructure deployment, local leaders are at the center of the smart community movement. This report shares the stories and lessons of a diverse array of communities—large and small—as they strive to bring home the opportunities of the IoT era for their citizens—and get smart.

“When you get to a critical mass, the data on the benefits is so compelling: a 50% reduction over a decade in energy consumption, a 20% decrease in traffic, an 80% improvement in water usage, a 20% reduction in crime rates. The concept of smart cities really sells itself.”

-The Smart-City Solution, McKinsey & Co.

A MODERN MANDATE TO GET SMART

The race is on to bring massive scale to what this next wave of wireless connectivity can do for the economy, environment and quality of life of communities. As leaders look to mobile technologies to foster more sustainable, livable environments, there is a rising modern mandate to "get smart."

The goal of the smart community is to cultivate a sustainable, livable and growth-oriented environment. Increasingly, leaders in communities of all sizes are recognizing the importance of leveraging ever-faster mobile broadband networks—and the technologies, applications, products and services they make possible—to more efficiently allocate limited government resources, improve services, build community and foster a more attractive environment for both residents and businesses.

Spurred on by advanced 4G LTE and ultimately next-generation 5G wireless networks, integrated mobile broadband technologies offer the potential to enhance public safety through smarter street light management, road and traffic monitoring, and networked sensors delivering incident data in real time. They are helping law enforcement become more effective by detecting incidents, reducing false alarms and improving response times.

They are helping communities become more energy-efficient while improving air and water quality. Water pipes, gas meters and trash receptacles are all becoming intelligent conduits for cultivating a more healthful and sustainable environment.

If well-executed, the promise is virtually limitless: More livable communities that include safer city streets, more efficient transit systems, energy savings, water conservation, cleaner air—all at significant cost savings.

Local community leaders will be at the vanguard of this ground-up revolution. Their success is essential to the future competitiveness of our nation, and a wide array of collaborators—at all levels of government, in the private sector and in research/academia stand ready to help ensure their collective success.

Los Angeles: *Partnering to manage traffic*

With more than 1.3 million drivers using the traffic navigation app Waze, Los Angeles worked to partner with the app's parent company, Google, in April 2015.^{iv} Waze now provides the city with aggregated traffic and accident data, which city officials use to refine traffic strategies and incorporate into its 311 system. In return, the city gives Waze data about road closures and safety hazards to share with its users—helping make the commute better for everyone. Waze has similar agreements with Boston, New York and Rio de Janeiro.

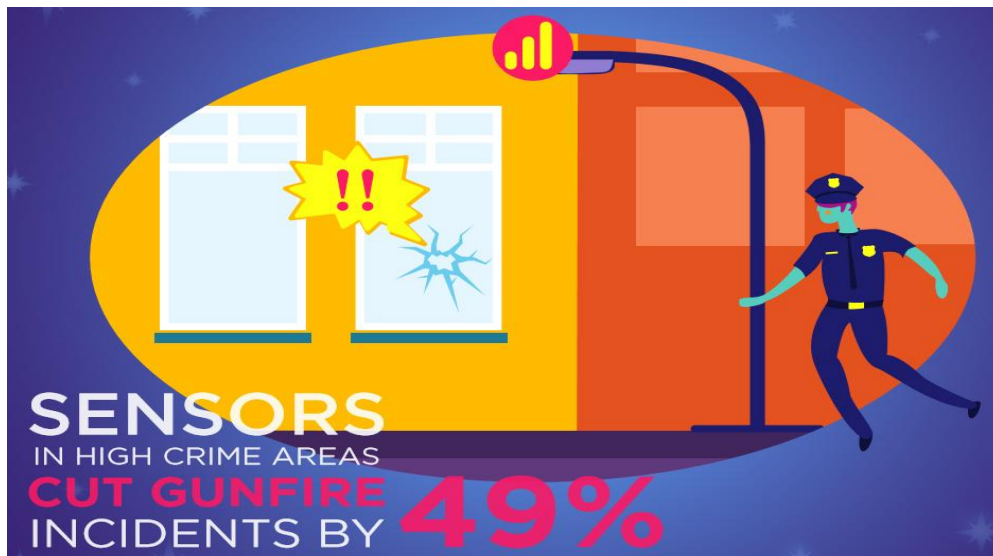
Smart Fact: Smart city traffic management and parking projects will reduce global CO2 emissions between 2014 and 2019 by 164 million metric tons—the annual equivalent of taking 35 million vehicles off the road.^v

Chicago: *Deploying sensors to spot gunfire*^{vi}

To fight back against the devastating gun violence in Chicago, city leaders are pioneering innovative ways to keep their citizens safe. Most gun-related incidents in Chicago occur in two districts on the south and west sides. There, the Chicago Police Department is using a wide-area acoustic surveillance system called ShotSpotter to detect and dramatically increase response times relating to gunfire. The system uses multiple wireless sensors to calculate in real-time the location of gunshots and instantly transmit the information to police dispatch centers and nearby patrol cars.

More than 60 U.S. cities now use ShotSpotter. This gives police and other first responder's greater lead time to respond to gun violence compared to waiting for 911 calls. Getting to the scene faster is critical both for collecting evidence and apprehending suspects as well as helping those who may be injured.

Smart Fact: Gunfire sensors reduce shooting incidents in high-crime areas by up to 49%.^{vii}



Kirkland, WA: *Cutting waste by making collection more efficient*^{viii}

The City of Kirkland partnered with Finnish-based Enevo in 2015 to pilot a system for making trash collection more efficient and cost-effective. Sensors were installed on trash and recycling containers at city facilities. After that, waste management was called to make a service run only when a container was at least 70% full. At two sites - City Hall and the Justice Center - trash had been regularly picked up two or three times weekly, but it turned out the containers reached capacity only once a week. Reducing the collection cycle at these two sites alone will save the city nearly \$8,000 annually.

Smart Fact: Intelligent waste management systems could cut related city costs by 80%.^{ix}

Montgomery County, MD: *Equipping smart buses*^x

The county and the University of Maryland are working with AT&T, Deloitte and others to outfit buses and bus stops with advanced communications and sensor technology to improve riders' experience. The county's smart transit project—just one of its IoT-related projects—collects a variety of data from air quality to the status of trash receptacles. Buses may also gather information, such as real-time capacity and road conditions.

Smart Fact: Smart traffic management and parking will save about 4.2 billion hours annually by 2021—saving every city driver an entire work day per year.^{xi}



Centerville, GA: Piloting “smart” glasses to record traffic stops^{xii}

The Centerville Police Department began piloting a CopTrax Smart Glasses deployment in 2015. The glasses serve as body cameras, automatically uploading the video via an officer’s smartphone to a cloud storage site. Typically the glasses are used to record traffic stops, burglaries in progress and calls for service, but officers can also see text messages and get directions when the glasses are connected to their smartphones.

Smart Fact: 60% of Americans believe community and police tensions would be reduced if officers wore body cameras.^{xiii}

Charlotte, NC: Using data to trim energy use^{xiv}

Smart energy technologies are the fastest growing component of the smart city market. In Charlotte, 61 downtown high-rises agreed to have meters and public kiosks installed to track and illustrate energy costs and consumption levels. Using data analytics from the real-time energy usage, building managers, tenants and occupants turned off lights, unplugged monitors, adjusted thermostats and revised janitorial practices to help reduce their energy bills by \$18 million and cut consumption by more than 17%.

Smart Fact: Smart buildings can reduce energy consumption by 40%.

Gwinnett County, GA: Safer school zones^{xv}

Gwinnett County has the largest school system in the state, with approximately 178,000 students. Working with AT&T and Applied Information, the school system installed 270 connected beacons - a.k.a., flashing signs - in its school zones. The beacons are equipped with cellular modems, which enable officials to adjust the beacon schedules according to weather, holidays or emergencies.



Schenectady, NY: *A smarter downtown keeps its character*

Schenectady has expanded its smart city control system to include 42 core nodes and 16 video nodes covering several streets close to its City Hall, partnering with Verizon subsidiary Sensity. The primary goals of this system are to: Reduce energy costs and carbon emissions, increase public safety with smart lighting and cost-effective expansion of video surveillance, improve traffic flow and decrease congestion by using sensor data to optimize traffic signals and engage its citizens through technology

In keeping with the historic character of its downtown, Schenectady opted to integrate the internal core nodes into decorative post-top fixtures that provide smart city functionality without sacrificing aesthetics. Photocells and smart algorithms turn on lights only when needed and are coupled with occupancy-based lighting control that automatically dims late at night but brightens when cars or pedestrians are present. This dynamic lighting increases energy savings and public safety. The Wi-Fi network that supports the smart city control system also benefits police and city workers who can connect to complete paperwork and access online resources without having to return to the office.

Based on this early success, Schenectady is currently planning an expansion to additional parts of the city and is exploring adding environmental sensors and applications like parking space management.

Las Vegas, NV: *Conserving water in the desert*^{xvi}

In a prime example of public-private collaboration, IBM, Mueller Water Products and AT&T joined forces with the Las Vegas Valley Water District in 2015 to help save water. The district operates more than 4,000 miles of pipeline, providing water to more than one million residents and 40 million visitors annually. Sensors installed along the pipes monitor for water pressure, leaks and temperature. Data is sent over the AT&T LTE network and collected at the IBM Water Management Center, where city managers can see current and past performance, as well as modeling of future performance. The project is part of the Global City Teams Challenge, which is a collaborative network of public, private and non-profit entities working on smart community IoT applications.

***Smart Fact: Water systems typically comprise 50% of a community's total energy spending. Facilities equipped to gather actionable data can result in up to 30% energy savings and up to 15% reduction of water losses.*^{xvii}**

Kansas City, MO: Smarter transportation

Kansas City has ambitious plans to redevelop its downtown and revitalize its economy through technology and smart city services. Starting with a 2.2-mile length of newly built light-rail line through its downtown business and entertainment districts, Kansas City has deployed 125 video nodes and 170 core nodes to reduce energy costs for street lights, ensure the operational integrity of its light-rail system by detecting poorly parked vehicles, improve public safety, manage street parking and gather data on pedestrian and vehicle traffic to inform planning and economic development.

The smart city control system communicates on a new Wi-Fi network that has allowed Kansas City to offer public Wi-Fi as a citizen amenity throughout this high-traffic corridor. Kansas City has also installed several digital kiosks to provide timely, area-specific information to citizens and visitors. The kiosks also advertise local businesses and serve as a valuable source of city revenue. This combination of connectivity and smart city technology—made possible by Verizon subsidiary Sensity—is helping to attract new businesses and entrepreneurs to help create an innovation-driven economy.

Atlanta, GA: Rapid response for local water quality

The Chattahoochee River, which forms the southern half of the Georgia border, is the source of drinking water for more than four million people. One of its tributary streams, Proctor Creek, flows through residential and industrial areas of metropolitan Atlanta, past schools and parks. The stream is notoriously polluted. Working with the city of Atlanta and the non-profit Chattahoochee Riverkeeper organization, Ericsson deployed low-cost, wirelessly connected waterproof sensors that report real-time water quality information. The data automatically alerts officials of problems, such as sewage spills, agricultural runoff and algae bursts. This saves time and labor compared to the traditional manual method of collecting and monitoring water quality.

Smart Fact: Smart water sensors can provide cost effective early warning compared to devices priced between 10 and 50 times higher.

Barcelona, Spain: *Anatomy of a smart makeover*

Home to the annual Mobile World Congress, Barcelona has transformed into a model, data-driven metropolis. After deploying responsive technologies across its urban systems from public transit and parking to street lighting and the city's famous fountains, these innovations yielded significant cost savings, improved the quality of life for residents, and made Barcelona a thriving center for IoT innovators.

A sampling of outcomes to date:

- Sensors embedded in the city streets' asphalt help guide drivers to available parking spaces. This helps mitigate the nearly one-third of city traffic congestion created by drivers looking for parking, saving time and reducing emissions.
- More than 1,100 lampposts in the city automatically dim when the streets are empty. The improvements produced 30% energy savings.
- Remote monitoring and control of park irrigation as well as water levels in public fountains helped the city achieve a 25% increase in water conservation.

Barcelona estimates that IoT systems have produced annual savings of \$58 million on water, \$37 million through smart lighting and \$50 million in increased parking revenues, while also generating 47,000 new jobs^{xviii}.

Sao Jose Dos Campos, Brazil: *Public-private progress on safety*

In 2011, the city established a partnership with Ericsson to build a smarter public safety system. With visionary local leaders and an established technology park, Sao Jose Dos Campos engaged multiple stakeholders to develop a cutting-edge emergency response system, including a common coordination center and camera-based surveillance systems, that integrates police, ambulance, traffic and other departments.

Smart Fact: In areas of the city with camera surveillance, the crime rate fell by 70%.

Maintaining Public Confidence in Security, Privacy

The federal government offers resources that can be helpful to municipal leaders as they plan, deploy and manage their smart city infrastructure with security in mind. Every community will need to make its own decisions on how best to balance privacy concerns, while also gaining the benefits of data sharing. But federal resources can help navigate the decision-making process. For example, the U.S. Department of Commerce's National Institute of Standards and Technology (NIST) has developed a risk management-based Cybersecurity Framework, which can help local governments identify the right questions and point them toward proven and widely utilized standards and practices.

Like security and privacy, other data use considerations also are integral to city development. Key early questions local policymakers should ask: What types of citizen data are being collected? How are we deciding where to collect data? What is the opportunity for public discussion? How is the data used and shared? And how is data protected? These questions are based on the Fair Information Practice Principles that have long guided privacy programs across the economy, such as health care and education. Including these considerations from the early stages of planning and deployment will help foster and maintain public trust.

Federal Smart City Resources:

While local leaders are on the front lines of the smart community transformation, federal resources are available to add momentum to their efforts. Throughout the government, federal leaders have launched smart city initiatives leveraging more than 25 new technology collaborations to help local communities tackle key challenges, such as reducing traffic congestion, fighting crime, fostering economic growth, managing the effects of a changing climate and improving the delivery of local services.

These efforts are designed to target federal resources to meet local needs and support community-led, technology-fueled solutions. In just the last year, more than 70 communities are participating in this national effort to see communities of all sizes become “laboratories of innovation.”

Many federal agencies are unlocking resources as part of this effort. Among them:

- *The Department of Transportation is making \$165 million available to help communities use technology and data to tackle traffic congestion and other transportation-related challenges.*
- *The National Science Foundation will invest nearly \$100 million to develop testing platforms for wireless technologies, including 5G. Private partners to The Advanced Wireless Research Initiative include networking vendors like Juniper and Interdigital; device manufacturers such as Nokia-Bell Labs, Samsung and Qualcomm; and wireless*

carriers AT&T, Verizon, T-Mobile and Sprint, who have committed millions in in-kind offerings to deploy testing platforms in four cities.

- *The Department of Energy is making \$15 million available for communities to address energy and climate challenges.*
- *The Department of Homeland Security is offering \$10 million for smart disaster response initiatives.*
- *And, the Environmental Protection Agency launched its Smart City Air Challenge. Communities will be awarded up to \$40,000 each to develop and deploy air quality sensors to collect and share data.*

To convey a sense of the breadth and diversity of this work, here are a few recently announced partnerships: Mapbox Cities Lab will provide three cities with mentorship to help tackle issues from traffic safety to health. Microsoft and Genetec are giving 10 cities kits that will allow businesses to connect surveillance cameras to the cloud and law enforcement agencies. And, the City of New York is launching a digital platform to help local governments navigate the smart city marketplace. The platform helps local government employees identify innovative technologies, while encouraging interagency coordination by offering a repository of information on past and existing city pilots and contracts.

Rolling Out the Welcome Mat for Wireless Infrastructure

Accelerating the smart community revolution is going to require more cooperation between policymakers, citizens and industry than ever before in support of robust and ever-expanding wireless infrastructure. The Internet of Things requires the transmission of vast amounts of data, which will depend on high-capacity, high-speed networks. Since 2010, leading U.S. wireless companies have invested more than \$177 billion—\$32 billion in 2015 alone—in the nation's world-leading wireless infrastructure. Part of this challenge rests with federal lawmakers and regulators, but local governments will continue to play an important role. Cities must take a close look at what they are doing or not doing to facilitate infrastructure deployment.

ADVANCED NETWORKS: THE FOUNDATION OF CONNECTED COMMUNITIES

Smart community innovations already are being deployed around the country, and these projects are expected to multiply, accelerate and leap forward in their capabilities with the ongoing roll-out of advanced 4G LTE and ultimately 5G wireless networks.

5G networks will have greater capacity, higher transmission speeds and lower latency to support not only more mobile broadband users but also more real-time, data-intensive applications. One example is the connected vehicle, where connectivity 'in the blink of an eye' can be too slow. 5G response times will graduate from one-hundredth of a second to an all-but-non-existent one-thousandth, helping make our roads safer and transportation systems more efficient.

While the first 5G commercial deployments at scale are not expected until 2020^{xix}, the race is indisputably on today in 5G trials already underway. AT&T and Verizon started testing last fall. Google and Facebook also are evaluating the technology. Abroad, Korea has promised a form of the technology in time for its hosting of the 2018 Winter Olympics. Japan has made similar claims around the 2020 Summer Olympics in Tokyo.

The continued, rapid progression of U.S. wireless infrastructure in communities across the country is essential to achieving both local objectives and—collectively—advancing our nation's global competitiveness.

5G will require the densification of U.S. wireless infrastructure through the layering in of millions of additional small cell sites in addition to the now familiar larger towers. To give a sense of scale, one early use case being tested in the United States involves supporting one million Internet of Things devices—within just one square kilometer.^{xx}

Community leaders who want to leverage the power of these new technologies will need to be open to close partnerships with wireless infrastructure companies to facilitate the placement of the necessary network infrastructure.

The Federal Communications Commission has taken measures to streamline government clearances for the deployment of this infrastructure, including modifying some of its antenna siting rules. The FCC also has moved to free up additional spectrum for 5G services to ensure wireless capacity stays ahead of fast-growing consumer and community demand.

Municipal policymakers and other local leaders can help set the stage by cultivating an investment-friendly business environment, a predictable policy environment and by removing unnecessary obstacles to network infrastructure deployment.

Boston, MA: Building a state-of-the-art fiber optic network

In a partnership unveiled in the spring of 2016, Verizon announced that it is investing more than \$300 million over the course of six years to deploy a state-of-the-art fiber optic network platform in Boston. In return, the city agreed to expedite its permitting process for the build-out. The partnership includes a smart city trial using sensors and advanced traffic signal control technology that will help measure bicycle traffic, improve the flow of public transit and enhance safety. Verizon also gave the city a \$100,000 digital equity contribution that will support a mobile hotspot lending program at the Boston Public Library.

San Francisco Bay Area: Ready for 5G

The San Francisco Bay area is poised to serve as a testbed for next-generation LTE-M2 network technologies beginning in November 2016. The pilot program, by Sierra Wireless and AT&T, aims to facilitate LTE network connectivity for smart meters, wearable devices and other IoT gear. The city and its industry partners hope the pilot will demonstrate lower costs for network components, improved coverage in hard-to-reach places—below ground and inside buildings, for example—and longer battery life for IoT devices, setting the stage for types of smart city applications that will be enabled by 5G.

PUTTING THE "I" (INTELLIGENCE) IN TEAM

While each community will forge their own unique path, one maxim applies across the board: You can't go it alone. Preparing a community to leverage emerging smart city opportunities requires a thoughtful, concerted approach on the part of leaders from all corners of society. While each community will embark on its smart evolution in its own unique way, ideally the journey begins with a long-term, holistic vision.

Smart communities will require extensive collaboration among an array of public sector and private sector parties. Experts say that equally essential as funding is the willingness of various stakeholders, including those in government, industry, academia and community groups, to collaborate and build a common vision. Only together can ambitious goals of transforming public safety, transportation, resource management and civic engagement be fully realized. In short, it takes the smart integration of technology, policy and community objectives needed to propel smart communities forward.

Smart fact: By 2020, \$400 billion per year will be invested worldwide in smart cities.

Smart City Spotlight: Columbus, OH

Columbus, a city of approximately 850,000 people, is known affectionately by some as “Cowtown.” But it will soon become one of the world’s leading laboratories for smart city technologies. Columbus recently bested 77 other mid-sized cities to emerge the victor in the U.S. Department of Transportation’s Smart City Challenge.

The \$40 million federal prize will be combined with \$19 million of the community’s own public funds as well as \$90 million committed by an array of private partners. Columbus’ effort enlisted a wide-ranging roster of leaders from business, academia, non-profit organizations and multiple government agencies.^{xxi}

One key ingredient in the city’s winning formula: Columbus envisioned smart transportation as nothing less than a transformative opportunity to create an ecosystem with the potential to address a far broader array of challenges.

In one of its more intriguing plans, the city will not only measure the connectivity of its transportation infrastructure but utilize that same IoT infrastructure to address infant mortality. In a neighborhood where the infant mortality rate is four times that of the national average, the city will use data analytics to offer better transportation options to people in greatest need of prenatal care^{xxii}. In this instance, transportation and healthcare—two departments traditionally operating in almost entirely separate orbits—are linked to better serve the community’s most vulnerable residents.

Strategic, coordinated procurement

Not only is public-private collaboration essential, so is collaboration across government departments and agencies. The conventional approach of deploying technologies by department and for specific, isolated functions can be debilitating when building a technology-fueled smart community. The more components of the cityscape that are connected, the greater the potential cost savings and the larger the opportunities to leverage the infrastructure for wide-ranging public benefits.

Smart city purchasing ideally is made within an over-arching long-term strategy and with cross-functional integration and interoperability top of mind. The more use cases across city services and departments that the technology can offer, the better. The right, single technology implementation could bring benefits that span multiple priorities from energy, traffic, public safety, transportation and citizen engagement.

As an example, Chicago is in the process of installing 500 sensor nodes around the city by 2018. The urban-sensing project will collect data related to air quality, climate, traffic congestion and noise. The data will be transmitted to Argonne National Laboratory, where it can be applied to efforts to improve safety, energy efficiency, air quality and other challenges the city faces.

Smart Community Considerations

The smart vision can be realized in communities big and small, through bold leadership, partnerships and policies. Wherever your municipality is along the journey, cultivating an environment that encourages collaboration, investment and network infrastructure deployment will help guide your success. One of the keys will be advancing smarter policies that can enable communities to take full advantage of 5G opportunities and their inherent ability to propel the next wave of smart devices.

- ✓ **Smart Strategy.** Start by developing a cohesive, unifying strategy that defines your community's long-term objectives and opportunities. These often include setting goals about how to harness mobile broadband technologies to grow the local economy, enhance digital inclusion, increase access to educational opportunities, and improve access to public services.
- ✓ **Smart Infrastructure.** At the heart of every smart community is a vibrant wireless network that provides the network coverage, capacity and quality that a smart city needs to grow and prosper. Communities can begin taking steps today to accelerate 5G wireless opportunity tomorrow. To enable the kind of densified wireless infrastructure that smart communities need, local leaders can examine local policies to remove barriers to infrastructure investment by enabling access to rights of way; establishing forward looking non-discriminatory pole and tower-siting policies; and ensuring effective communication and a speedy review process for permitting applications.
- ✓ **Smart Data for Smart Apps.** Communities can take advantage of the growing open data movement to make more municipal data available to app developers. Launching app challenges that encourage app designers to develop apps that harness smart data streams to improve access to government services can be transformative and help engage the broader community in meaningful solutions and advancements.
- ✓ **Smart Businesses.** Wireless services can be a vital engine for local economic growth. One of the great advantages of this infrastructure is that it encourages innovation everywhere. To leverage this opportunity, communities large and small are supporting incubators and/or maker spaces to help speed development of a local ecosystem of smart, connected businesses and entrepreneurs.
- ✓ **Smart Government.** The smartest communities lead by example. They take advantage of strong wireless networks to enable public employees to work anywhere, anytime. They develop wireless apps to put community services in the palms of local citizens' hands. And they take advantage of the ubiquity of wireless connectivity to foster digital inclusion and spur economic growth.



Mobile Future is an association of cutting-edge technology and communications companies, consumers and a diverse group of non-profit organizations, working to support an environment that encourages investment and innovation in the dynamic wireless sector. Our mission is to help inform and educate the public and key decision makers in business and government on the broad range of wireless innovations that are transforming our society and the nation's economy.

www.mobilefuture.org

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