

US Ignite Forum Playbook: Community Initiatives to Drive 5G, Small Cell, and IoT Deployment

On February 27, 2018, US Ignite convened a one-day workshop on deploying wireless networking equipment, including small cell sites, public Wi-Fi, and Internet of Things (“IoT”) sensors. The Forum workshop included 50 participants drawn from local government, industry and nonprofit organizations. Municipal leaders from five cities—Austin, Chicago, Lincoln, Los Angeles and Pittsburgh—presented their cities’ efforts to prepare for and facilitate wireless deployments of the future.

US Ignite convened the workshop with the City of Chicago and the City Tech Collaborative to facilitate sharing among municipal leaders with this Playbook offered as a summary of those lessons learned.

BACKGROUND

Wireless data traffic has grown exponentially over the past decade. According to Cisco’s Virtual Network Index (VNI), mobile data traffic has grown 18-fold over the past 5 years alone.¹ Industry analysts forecast a continuation of this trend, with a new generation of wireless devices (“5G”) and services becoming available as early as 2019. These new 5G deployments, along with fiber networks, will help support IoT sensors and other smart city infrastructure. The convergence of 5G and IoT deployments will result in a dramatic increase in the amount of wireless networking equipment that is deployed throughout our communities.

The new 5G and IoT networks will carry more data, provide internet services at higher speeds and support applications that require real-time response from the network (e.g., connected vehicles). To support 5G, IoT, and other wireless technologies, wireless companies have started densifying their networks through the deployment of so-called “small cell” equipment.

Where there were previously a limited number of macro-towers providing wireless connectivity to a wide geographic area, 5G wireless service will require an increase in the number of sites where wireless network equipment is deployed. According to FCC Commissioner Brendan Carr, wireless networks of the future will be very different from the networks of today:

“Right now, there is a global race to deploy the next-generation of wireless broadband, known as 5G. This is not just about getting faster wireless speeds. 5G networks will

WHAT ARE SMALL CELLS?

Small cells (mini base stations with microcells) are low-powered radio access nodes that can be deployed indoors or outdoors. They are being deployed in densely populated urban environments to increase network capacity. They operate in both licensed or unlicensed spectrum, with coverage ranging from a few meters to a few kilometers. Small cells can be linked through wired or wireless backhaul—with ranges in speeds and costs.

¹ Cisco Virtual Networking Index. Updated March 28, 2017, <https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.html>.

help unleash a new wave of American innovation—from self-driving cars and remote surgery to smart cities and the industrial Internet of Things. The networks of tomorrow will look very different from the networks of today. Those tall, 100-foot towers that many people associate with their wireless service will be supplemented by thousands of new small cell facilities, many of which will be no larger than a backpack. Indeed, small cells will account for about 80 percent of all wireless deployments going forward.”²

Network densification and the deployment of remote computing and storage capacity closer to end-users, so-called “edge computing,” ensures that wireless networks can support growth in innovative applications and services that require real-time responses (e.g., connected and autonomous vehicles).



MUNICIPAL APPROACHES RELATED TO 5G, SMALL CELL AND IoT WIRELESS DEPLOYMENTS

At the US Ignite Forum workshop, municipal leaders outlined actions their cities are taking related to 5G, small cell and IoT wireless deployments including the following:

- Creating a comprehensive approach designed to accommodate multiple use cases (e.g., Public Safety, Transportation, Environment, etc).
- Updating municipal policies regarding wireless deployments in municipally-controlled rights-of-way, street lights, traffic lights and other vertical real estate.
- Developing inventories of municipally-controlled vertical real estate and other assets.
- Coordinating IoT deployments from non-traditional telecom partners, including university-based researchers and startups.
- Developing innovative public-private partnerships to address industry objectives while supporting community smart city goals.

Municipal leaders made clear that industry efforts to densify their wireless networks and the deployment of IoT and other sensors create a series of opportunities and challenges for cities and communities. These municipalities shared their communities’ experience preparing for and facilitating 5G, small cell and IoT wireless deployments.

The municipal leaders highlighted several common themes:

- Municipalities are updating and revising their processes for permits and planning to facilitate wireless deployments in their community.
- Several municipalities see the anticipated wave of 5G/small cell/IoT wireless deployments as an opportunity to develop industry and other partnerships that

“ 5G networks will help unleash a new wave of American innovation—from self-driving cars and remote surgery to smart cities and the industrial Internet of Things.

**— BRENDAN CARR
FCC COMMISSIONER**

² Brendan Carr, “FCC rules could lead to more broadband for more people” (March 20, 2018), <http://www.baltimoresun.com/news/opinion/oped/bs-ed-op-0321-broadband-rules-20180320-story.html>.

advance municipal goals.

- For municipalities, there remain several unresolved questions related to planning for and facilitating wireless deployments.

The best practices and lessons learned associated with the common themes constitute the key-takeaways and are summarized below.

KEY TAKEAWAYS, BEST PRACTICES AND LESSONS LEARNED

Key Takeaway #1: Municipalities are updating and revising their processes for permits and planning to facilitate wireless deployments in their community.

Kiana Taheri, from the City of Los Angeles, caught the attention of many leaders when she shared her city's projections that Los Angeles will receive "8,000 to 10,000 wireless permit applications over the next 5 years." Like Ms. Taheri, leaders from Austin, Lincoln, and Pittsburgh indicated that their cities anticipate a dramatic increase in the number of wireless permits and are working to prepare.

In addition to recognizing the increased number of permits related to wireless deployments, Alex Pazuchanics, from the City of Pittsburgh, noted that the permits are more nuanced in nature than previous permit requests. Whereas a complex permit request might have previously included considerations related to road resurfacing, permit requests related to 5G/small Cell/IoT can involve issues such as the weight of wireless equipment, power source(s) for the equipment, need for and location of new cabinets on sidewalks and in municipal rights-of-way, aesthetic considerations and policies governing collocation. David Young from Lincoln highlighted that effective municipal permitting and planning related to wireless deployments is very attractive to wireless providers and that his city modernized their permitting processes as part of an innovative approach to encourage more telecom-related investment. **In Lincoln, providers can receive approval from the city in as little as 10 days.**

Best practices related to updating wireless permitting and planning processes:

- City of Lincoln's innovative approach to short circuiting some of the issues that can delay the evaluation of 5G/small cell/IoT deployments. The City of Lincoln's approach is that providers seeking to deploy wireless equipment can receive approval from the city in as little as 10 days, if providers replace an existing pole with a pole that meets Lincoln's specifications for replacement poles and meet the other conditions of Lincoln's broadband partnership.
- City of Austin indicated that Austin is working to conduct an audit of the city's vertical real estate, including light poles, traffic poles and buildings. An inventory is extremely valuable as it allows municipal leaders to be efficient when reviewing permitting applications (both new and renewals) and facilitates wireless deployments that are executed with a comprehensive and strategic approach.
- City of Pittsburgh has recently concluded a reorganization that resulted in one department—a newly formed *Department of Mobility and Infrastructure* (DOMI)—with responsibility for effective inter-agency cooperation related to use of the city's infrastructure assets and efficient evaluation of wireless permitting requests. Looking forward, DOMI will work on changes to city code and regulation updates to further facilitate wireless deployments and innovative partnerships. DOMI will also spearhead an inventory and evaluation of the city's vertical real estate assets.

Lessons learned:

Leaders from Lincoln and Pittsburgh referenced their cities use of GIS/visualization software to create dashboards that provide municipal leaders with access to a map of the city, its polls and other vertical assets. Both cities use a dashboard to track wireless permit requests. In Lincoln, the new electronic permit review system has helped facilitate interdepartmental cooperation and replaced three separate systems that were previously part of the permit review process.

Key question: If your city is planning to invest in a visualization dashboard to facilitate evaluation and tracking of wireless deployments, are there existing software systems that can be retired?

- The City of Lincoln has established a specification for a new pole that allows it to expedite permitting requests. The City of Pittsburgh is working to establish specifications related to the aesthetics of wireless equipment deployed on municipal poles in a similar effort to facilitate permit application review.

Key observation: the development of clear and published specifications can be an important element of a city's effort to expedite permit reviews.

- The City of Austin highlighted the importance of producing a Master Development Plan related to 5G/small cell deployment. The plan should reflect industry input and define an online application process. The plan could include documented design criteria (for the wireless equipment) and address issues including procedures associated with providing commercial power to a 5G/small cell deployment (e.g., trenching, metering and placement of cabinets, etc.).

Key observation: a process for evaluating permitting applications should be certain to consider whether and, if so, how the site will access power lines.

Key Takeaway #2: Several municipalities perceive the anticipated wave of 5G/small cell/ IoT wireless deployments as providing an opportunity to develop partnerships that advance municipal goals.

In the City of Chicago, a partnership between Argonne National Laboratory, the University of Chicago, the City of Chicago, the National Science Foundation and multiple private sector partners has resulted in city-wide IoT deployment sensors. The Array of Things (AoT) project provides the City of Chicago with data that enables it to examine municipal challenges in innovative ways; indeed, Chicago Mayor Rahm Emanuel refers to as AoT sensors as "*Fitbits* for the city." In the City of Sacramento, a recently-announced \$100 million partnership will mean that Sacramento will become among the country's "first 5G cities."

The importance of partnerships—such as the three referenced above—was a common theme sounded by several city leaders. Through effective partnerships related to wireless deployments, municipalities advance goals such as expanding the availability of wireless services (as in Sacramento) or harnessing the power of municipal data to develop refined approaches to city-wide challenges (as in Chicago). At the workshop, the presenters highlighted several best practices and lessons learned related to their development of partnerships involving wireless deployments.

Best practices for new partnerships related to 5G/small cell and IoT deployments:

- Via partnership with Verizon, 27 public parks in Sacramento will receive 10 Mbps Wi-Fi access. Verizon will accept 20 high school interns per year and host at least 5 STEM workshops over five years. Verizon will also install intelligent traffic solutions at 15 selected intersections and deploy hundreds of miles of fiber that the city can use throughout the city. In return, Sacramento will waive up to \$2 million in lease payments related to 101 small cells deployed on municipally-owned assets and agreed to implement a streamlined permitting process for Verizon’s network deployment.
- According to Maria MacGunigal, CIO of Sacramento, a key best practice related to the development and negotiation of the partnership agreements is for municipal leaders to identify their top priorities. For Sacramento, priorities related to the partnership with Verizon included expanded educational opportunities for Sacramento students, access to innovative intelligent traffic systems and to more fiber miles in order to support the City’s traffic operations center and free Wi-Fi access in the City’s parks.
- In Chicago, the Array of Things (AoT) partnership provides the city with access to a state of the art IoT platform that is both a traditional sensor network (collecting data on temperature, light, vibration and sound) and an experimental platform enabling the assessment of new sensor technologies. Additionally, the AoT’s embedded compute function enables development and easy deployment of new smart city applications.

The data collected by the AoT is used by the city and project partners to develop and test efforts to improve services to residents (e.g., public health services). The Array of Things Operating Policies (<https://arrayofthings.github.io/final-policies.html>) govern the use and release of data collected by the AoT sensors. Chicago CIO Dannielle DuMerer observed that the community engagement efforts that the city and the city’s Array of Things (AoT) project partners have developed and implemented are a key best practice related to municipal IoT projects. The AoT deployment included proactive outreach soliciting input, feedback and suggestions from city residents. Based on input from the community and project stakeholders, the AoT project has implemented a Rule of Three for smart city deployments:

1. Community leaders need to identify specific use cases
 2. Researchers need to say how they will use the data
 3. City leaders have to see value
- The City of Lincoln has made access to any of its 25,000 poles a straightforward process. Via one agreement, telecommunications providers agree to replace the existing pole with a new pole, connect the new pole to public fiber and create a public access port on the pole. With the signed agreement, the City of Lincoln provides approval in 10-days. Ten private companies have invested in the community, bringing 1-Gbps broadband to Lincoln, installing it at the rate of one mile of fiber-optic cable per day. According to the City of Lincoln, all 110,000 homes in the city will have access to 1-Gbps per second broadband service by the end of 2018.

According to the City of Lincoln, an innovative approach to public private partnerships related to wireless deployment in the City of Lincoln has resulted in **\$250 million of private investment by telecom providers in the city since 2012.**

The following photo illustrates one example of community engagement on small cells, IoT and 5G deployment.



Lessons learned:

- Discussing the process of working with telecommunication providers on small cell deployment, the City of Austin and the City of Sacramento offered a few lessons learned. For the City of Austin, it was valuable to establish and publish a Master Development Plan that includes input from the telecommunications industry. The City of Sacramento recommends that municipalities and their partners include in their agreements clear definitions of acceptable and unacceptable permit applications.

Key recommendation: Sacramento encourages municipalities to consider small cell pilot deployments that take one site through all phases of the project—from design to deployment. According to the City of Sacramento, project partners learned a lot via the first small cell deployment site.

- The AoT project in Chicago illustrates the importance of integrating educational opportunities into a municipal IoT deployment. Working with private sector partners, the City of Chicago and AoT project partners have created a program to train teachers and provide hands-on experience with the Internet of Things, coding and data science. Students have used sensors to complete more than 100 projects so far, investigating hallway traffic, greenhouse soil conditions, indoor and outdoor air quality and classroom sound levels. Key observation: small cell and IoT deployments may provide valuable educational opportunities for students in your community.

Key Takeaway #3: There remain several unresolved issues and outstanding questions that municipal leaders should keep in mind.

Presenters and workshop participants offered observations and raised issues related to 5G/small cell/IoT deployments that, although not accompanied by clear best practices or lessons, struck several common themes.

- The cities of Austin and Los Angeles emphasized that digital inclusion continues to be of paramount concern for municipal leaders. Over 30% of LA residents do not have high speed internet. Both Austin and LA are exploring approaches to resolve and mitigate access and adoption issues. Presenters shared that it is not yet clear how wireless deployments and potential public private partnerships might play a role.
- Collocation on poles and the industry's expectations regarding the specifications of small cell and IoT technologies remain outstanding issues. Municipal leaders indicated that it would be useful to have more information about the following: best approaches to collocation and "climb once" policies, as well as industry specifications for small cell and IoT devices.
- Municipal leaders participating in the workshop raised concerns about efforts to pre-empt local control of right of way with respect to 5G network deployments. For example, Austin's City Council approved Master License Agreement and equipment specifications related to small cell deployment. The passage of Texas SB 1004 has called into questions the Council-passed Master Agreement and equipment specifications.
- Workshop participants inquired about engaging third-parties, companies that help cities manage the complex issues related to wireless deployments, and working with industry partners on a city's behalf. Cities including Sacramento and Portland (OR) have agreements with firms to outsource their city's small cell operations. These entities work to help identify available assets and put in place a permit approval process.

RESOURCES

Atlanta RFP: <http://procurement.atlantaga.gov/wp-content/uploads/2017/12/FC-10262-Atlanta-SmartCity-Strategic-Infrastructure-Initiative.pdf>

Sacramento 5G Partnership with Verizon: <http://assets.fiercemarkets.net/public/007-Telecom/verizon-sacramento.pdf>

CTIA annual survey: <https://www.ctia.org/docs/default-source/default-document-library/ctia-wireless-snapshot.pdf>

GSMA: https://www.gsma.com/publicpolicy/wp-content/uploads/2017/05/tw_gsma_15_small_cell_deployment_booklet_Final.pdf

Globecom tutorial: http://globecom2012.ieee-globecom.org/downloads/t1/1SmallCellTutorialGlobecom12Jie_v1b.pdf

Huawei and Ericsson overview: http://www.huawei.com/minisite/hwmbbf16/insights/small_cell_solution.pdf

Wireless Infrastructure Association (small cells on pole facilities): <https://wia.org/wp-content/uploads/WIA-Small-Cells-on-Pole-Facilities.pdf>

Recommendations for the Development and Implementation of Distributed Sensor Networks: https://wiki.modelado.org/images/3/38/GCTC_BP_Sensor.pdf

Community Engagement Example on small cells, IoT and 5G deployment: <https://www.slideshare.net/smartchicago/101817-array-of-things-public-meeting-flyer>