



2018

**CABLE COMPANIES
AND MUNICIPALITIES:**

Natural Smart Community Partners





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Executive Summary

Municipalities and cable companies are natural partners in the Smart Community/IoT space. A growing number of municipal leaders recognize the promise of Smart Community/IoT projects to expand economic opportunity and improve the standard of living for residents in their communities.

- The US Department of Transportation reported that nearly 80 US cities responded to its Smart City Challenge in 2016.
- The Global City Teams Challenge, an initiative established by the US Department of Commerce boasts participation of 200 local governments from across the globe.
- In 2017, Bloomberg Philanthropy announced a “Mayors Challenge” designed to help more than 300 cities solve their most urgent problems.
- In 2018, City Innovate established a Start-up in Residence program with 80+ startup-friendly government contracting opportunities from 30 government organizations including SF, Las Vegas, Miami, LA, and Portland.

Given the complexity and cost of Smart Community/IoT deployments, most municipalities will benefit from public-private partnerships that can help bring scale to Smart & Connected Community efforts.

Research conducted by Connected Communities LLC: supports a conclusion that there exist underappreciated affinities between local governments and cable companies and that cable companies are uniquely well suited partners to local governments in Smart & Connected Community initiatives.

Three key findings help support this conclusion.

- 1. Cable networks have the capability to support Smart Community/IoT applications both now and in the future.** There is no need for communities to wait for “5G” or other wireless networks to be deployed before pursuing Smart & Connected Community initiatives. Cable providers possess wired and wireless facilities to deliver Smart Community/IoT solutions. Moreover, decades of experience deploying and supporting network-enabled applications and services means that cable companies bring critical expertise to Smart Community/IoT deployments.

- 2. A rapid expansion of the number of homes where gigabit service is available means that the *smart home* will be an increasingly viable platform capable of advancing Smart & Connected Community objectives.** According to analysis conducted by NCTA, the number of housing units where cable providers offer gigabit service will increase to a projected 72% as of December 2018. The success of applications, including the remote delivery of social services, support of residents choosing to ‘age at home’ and distance education initiatives, depends on reaching a critical mass of customers have access to a *smart home* where data collection and dissemination occurs seamlessly. For this reason, current efforts by cable providers to expand the availability of gigabit services will be an important driver of the Smart Community/IoT efforts and will be incorporated into effective Smart and Connected Community planning.
- 3. Smart and Connected Community partnerships between cable providers and local governments reflect new and evolving approaches to collaboration.** Rather than approach their local government partners with a one-size fits approach to Smart Community/IoT deployments, cable providers are working with partners from the local community to co-create approaches that best achieve common goals. The most effective Smart and Connected Community partnerships between municipalities and cable providers will build upon decades of experience working together and a shared commitment to the prosperity of the communities they serve but will also reflect new approaches to collaboration.

Recommendations: Several recommendations for cable companies and municipal leaders are drawn from the report’s key findings.

- Local governments, when planning for Smart and Connected Community, IoT and 5G/Small Cell deployments, will benefit from efforts to engage cable providers and encourage local cable providers to provide input and participate in the process.
- Local government leaders and cable companies alike should recognize that anticipated Smart Community, IoT and 5G/Small Cell deployments provide a unique opportunity to expand and evolve their relationship to include innovative and impactful Smart Community partnerships.
- Cable companies should educate community leaders so that there is a better appreciation of the end-to-end consumer connectivity, facilities and expertise cable companies possess and how these resources can be used to advance Smart & Connected Community objectives.
- Local governments should evaluate carefully whether existing connectivity (e.g., LoRaWAN) can support the desired functionality of Smart and Connected Community applications and deployments.
- Cable companies should evaluate opportunities for public private partnerships (“PPPs”) with municipalities, universities and non-profits as a means to grow economic activity in the communities they serve and, ultimately, serve new customers and existing customers in new ways.

Introduction

Municipal leaders across the country are working to develop and deploy strategies that will advance efforts to become smart and connected. Examples of municipal efforts range from the deployment of water level and flooding sensors in Norfolk (VA), a network of “Fitbits for the City” in Chicago, and the deployment of the state of the art pedestrian safety sensors in Portland (OR).¹ The “Smart City” sector is a large and growing market for telecommunications, IT and software companies, totaling \$425 billion in 2017 and projected to grow to \$1.2 trillion by 2022.²

It is difficult to quantify with precision how many municipalities are pursuing Smart Community efforts. A 2017 survey of government leaders from 350 jurisdictions found that 200+ respondents reported either a fully operational “Smart City” initiative, a “Smart City” pilot in their city or a Smart City planning effort underway.³ The number of local governments participating in Smart and Connected Community programs administered by Federal agencies and national foundations supports a conclusion that larger American cities (with the resources to apply for grants) are pursuing resources to make their communities smart and connected.

- The US Department of Transportation reported that nearly 80 US cities responded to its Smart City Challenge in 2016.
- The Global City Teams Challenge, a “Smart City” initiative established by the US Department of Commerce’s National Institute of Standards and Technology (NIST), boasts participation of more than 200 local governments from across the globe.
- In 2017, Bloomberg Philanthropy announced a “Mayors Challenge” designed to help more than 300 cities solve their most urgent problems.
- In 2018, City Innovate established a Start-up in Residence program with 80+ startup-friendly government contracting opportunities from 30 government organizations including SF, Las Vegas, Miami, LA, and Portland.

While Smart and Connected Community initiatives present opportunities for municipalities, the initiatives also present new challenges. Many Smart and Connected Community projects cut across technical sectors, involve multiple municipal departments and touch the lives of many different community stakeholders. Traditional workflows may not be well-suited to adopting projects that represent new approaches to addressing long-standing issues. Deploying new technologies and applications can involve risk. Municipal leaders seek to be innovative while at the same time being good stewards of taxpayer

1 See <https://www.norfolk.gov/index.aspx?NID=3617>, <https://arrayofthings.github.io/faq.html>, and <https://www.portlandoregon.gov/transportation/71733>.

2 MarketandMarkets.com, “Smart Cities Market by Focus Areas,” <https://www.marketsandmarkets.com/Market-Reports/smart-cities-market-542.html>.

3 CompTIA, “Building Smarter Cities and Communities,” <https://www.comptia.org/resources/building-smarter-cities-and-communities>.

funds. The most innovative projects – those with the greatest potential to transform a community – may require pilot deployments to validate the technologies' return-on-investment (ROI). Due to these many challenges, the municipal leaders able to most successfully achieve their communities' smart and connected objectives will leverage strong partnerships. Partners help municipalities explore and examine innovative technologies and applications, develop approaches that balance risk and reward and deliver positive impacts for community residents.

Cable companies have an interest in the "Smart City" sector and are uniquely well-suited to Smart and Connected Community partnerships with municipalities. For initial deployments and pilot projects, cable companies can use existing wired and wireless networks to actualize evaluative pilot projects rapidly. To facilitate large-scale deployments of connected IoT devices, cable companies have facilities including dense networks of fiber, Wi-Fi networks (inside and outside of a consumer's home) and customer support resources. The connectivity that cable companies provide to residential and commercial premises enable providers to disseminate data and support transformative applications including telehealth, aging-in-place and distance learning applications. Finally, cable companies have a long-standing commitment to the prosperity of the communities they serve.

As the title of this White Paper suggests, cable companies have capabilities and facilities that position them as natural Smart Community partners to municipalities. This paper explores the role that cable



companies can, do and will play as a partner to municipalities pursuing smart and connected community initiatives. Drawing-on the author's experience working with dozens of municipal leaders on Smart Community/IoT projects, the paper initially identifies the common elements in Smart and Connected Community deployments and then describes the attributes of a "Smart City" network of the future. The paper's third section examines partnerships between cable companies and local governments in the Smart Community space. This section includes several key takeaways drawn from Comcast's machineQ partnerships, Cox's Smart Gigabit Community partnership in Phoenix and San Diego and Charter Communications' plans for a "6G" network. The final section outlines a series of recommendations for cable companies and local governments to expand their partnerships and make the case that – for many reasons – cable companies and municipal leaders are natural partners in the Smart and Connected Community space.⁴

Smart Community Overview

'Smarter planet,' 'cyber-physical systems,' the 'industrial internet' are just a few of the buzzwords in the so-called "Smart City" space.⁵ The explosion of "smart" everything, can make challenging the development of a serviceable and understandable definition of "Smart City." Behind the buzzwords, however, there is something very real occurring. Namely, a convergence of 1) ubiquitous communications networks, 2) the wide-spread availability of low cost sensors and 3) the advancement of analytics software. This convergence has technologists and municipal leaders alike confident that innovative and cost-effective technical solutions can be developed and deployed to make our communities more livable.

For the purposes of this paper, the phrase Smart Community shall refer to a segment of the marketplace for Internet of Things (IoT) solutions designed to help local government leaders meet challenges – and realize opportunities – present in their communities. To be certain, this definition is narrowly crafted. For some, a Smart Community is function of effective urban planning. For others, a Smart Community is an energy-efficient and sustainable city. Still others recognize a Smart Community by its 21st century trappings, including: open data portals, multi-modal transportation options and on-line access to municipal services.

The section below describes in detail three primary components of the Smart Community definition for this paper: 1) Internet of Things, 2) high quality and ubiquitous communications networks and 3) the multiple municipal objectives and responsibilities that influence the deployment of Smart Community/IoT solutions.

⁴ The author would like to acknowledge that NCTA's support helped make possible this white paper. The arguments, conclusions and any errors made herein are the author's and the author's alone.

⁵ So as to be inclusive of the fact that rural and suburban areas—in addition to urban areas—are pursuing Smart and Connected Community objectives, this paper will use the term "Smart Community" instead of the more commonly used "Smart City."

The Internet of Things

The Internet of Things (IoT) is a rapidly growing marketplace for connected devices. Popular IoT devices include thermostats, measurement and motion sensors of all kinds, security cameras and, of course, smart phones. Wired and wireless connectivity creates networks of connected devices and software applications help transform sensors and actuators into smart devices around which new products and services are developed.

The “Internet of Things”

A techie term describing a happening that is occurring all around us. The security services provided by many cable companies are a widely-adopted example of new services/solutions that can be developed for – and delivered by – the Internet of Things. Motion sensors, sound sensors and cameras, often connected by a residential customer's home Wi-Fi network, are connected to a customer's phone or to a remote security monitoring service via the Internet. The Wi-Fi enabled home security systems in our homes provide an illustration of a co-mingling of tangible things present in the physical world, computers, software, networks and the bits and bytes that travel across networks.

According to industry forecasts, connected IoT devices are both a current reality and will become increasingly ubiquitous in coming years. Analysts predict growth in IoT sales and deployments will be especially dramatic between 2018 and 2021. With respect to deployment of connected IoT devices, Gartner, Inc. estimates that 8.4 billion connected things were in use in 2017 (worldwide) and that more than 20 billion connected IoT devices will be in use by 2020.⁶

⁶ International Data Corporation (IDC), “Worldwide Semiannual Internet of Things Spending Guide,” <https://www.idc.com/getdoc.jsp?containerId=prUS42799917>.



The IoT Technology Stack

Across many use cases and market verticals (e.g., consumer, healthcare, utilities), IoT solutions share similar technological elements; elements technologists often refer to as a “stack.” Networking experts refer to the elements in a technology stack as “layers.” Depending on the specific IoT solution, distinctions between key elements of the stack can blur, but it is nonetheless helpful to identify and describe the four primary layers of the IoT technology stack.



COMMUNICATIONS



DEVICES



DATA/ANALYTICS



APPLICATIONS



Communications. At the foundation of the IoT technical stack is the communications layer. The communications layer establishes connections between devices (“things”) and/or between devices and a central hub that connects the things to the Internet and/or a private network. Depending on the requirements of the application, connections between things can be wired, wireless (Wi-Fi, LTE, 5G) or a hybrid combination of both wired and wireless.



Devices. The device layer is the most tangible, physical element of an IoT deployment. The devices (sensors, cameras, etc.) collect data and have the capability to store the data, transmit the collected data or both. In some cases, an IoT solution’s device layer may also include a computer that enables processing power required for on-site data analysis.



Data Processing/Analytics. Once the data is collected, data processing and analytics can occur at a data center or, if the device includes a storage and compute functionality, it can occur in or physically near the data collection device. Data analytics software filters, processes and/or aggregates data to support decisions and recommendations that can have an impact in the physical world. Algorithms at the core of the analytics layer provide the smarts of an IoT solution.



Applications/Services. The application layer refers to the software that receives the collected and analyzed data as an input. Applications use and combine available data to generate an action, recommendation and/or service that has an impact in the physical world.

The IoT Feedback Loop

A post on IBM's Internet of Things corporate blog observes a distinguishing feature of IoT projects: IoT deployments often establish a *feedback loop*.⁷ In a general sense, IoT projects enable data to be collected, analyzed and used as an input into an application that can recommend or actuate a change in the physical world. The impact of a given action or recommendation can itself be evaluated and refined. The interaction between the devices, computers and data analysis algorithms can create a "feedback loop" where data-driven results continue to improve an IoT application's performance.

Smart Garbage Pick-up: An Example of an IoT Feedback Loop

Cities including Boston, Philadelphia, and Washington DC have deployed smart garbage bins as a step toward route optimization for garbage collection trucks. The trashcans include sensors that collect data quantifying the weight and trash level of the can. This data is fed into an application that evaluates the data versus previously collected data (trends) and business rules established by the project managers to determine which cans will be part of a particular garbage truck's collection route. UPS vehicles use similar technologies and the company reports hundreds of millions of dollars in cost savings and significant reductions in CO2 emissions.

Reliable connectivity between computers and devices is a critical component of the IoT feedback loop. Current IoT projects related to vehicle and commuter route optimization, air quality notifications for asthmatics and HVAC energy efficiency strategies in the built environment, to name just a few, all require dependable and real-time connectivity to be most effective. Projects such as these analyze data from multiple sources and combine them with trend data (e.g., previously collected traffic data, weather forecast data) and depend on wired and/or wireless connectivity to move data seamlessly to/from sensors, servers and computers. While sensors, computers and algorithms constitute the brain of IoT deployments, communications networks constitute a Smart Community/IoT deployment's nervous system.

Demand for Ubiquitous Connectivity and the Importance of Edge Computing

During the last decade, network providers have experienced a dramatic increase in the volume of video traffic that runs across their networks. Increased demand from customers has meant that providers have sought to upgrade, enhance and augment networks originally designed to support web surfing, email and file downloads. Forecasters, including Cisco's Virtual Networking Index, predict that consumer demand for applications including virtual reality, augmented reality, connected/autonomous vehicles and

⁷ Andrea Reale, "A Guide to Edge IoT Analytics" IBM's Internet of Things Blog (February 23, 2017), <https://www.ibm.com/blogs/internet-of-things/edge-iot-analytics/>.

massive networks of IoT devices will require another series of network upgrades and enhancements.⁸ Virtual reality, augmented reality, connected/autonomous vehicles and other IoT applications share a common requirement: ultra-fast response times from a communication network. For these applications to function most effectively, the network supporting the application will require dense deployment of facilities, including computing power and storage at the “edge.”

When asked about the opportunities and the challenges associated with the anticipated growth in consumer demand for advanced applications, Joshua Sommer, Inventor and Strategist in Cox Communications’ New Growth & Development organization, observed that cable companies like Cox Communications are very well positioned. According to Mr. Sommer, “massive IoT deployment creates challenges related to device and user density for connectivity providers.” He pointed to his company’s experience deploying heterogeneous networks in stadiums and venues with hundreds of access points serving tens of thousands of devices/users and concluded that “for decades, cable companies have been solving complex challenges for our customers.”⁹



8 Cisco, “Cisco Visual Networking Index Forecast Methodology, 2016-2021, <https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.pdf>.

9 (J. Sommer, personal communication, March 28, 2018).

Mr. Sommer's point about Cox Communications' experience deploying heterogeneous networks is a significant one. For decades, cable companies have been deploying dense and geographically distributed network infrastructure in the communities they serve. According to NCTA data, high speed broadband from cable companies is available in 93% of households and there exist more than 500,000+ cable Wi-Fi hot spots across the country.¹⁰ Cable companies have both the experience and access to facilities required to deploy and support wired, wireless and hybrid networks to meet customer demand for advanced IoT applications.

The Multiple Roles of the Municipality in Smart Community Projects

The potential of Smart and Connected Community projects to transform a community has caught the attention of mayors, city council members, city managers and local government leaders. Forward-looking municipal leaders are developing and ratifying "Smart City" plans to prioritize the specific opportunities they will pursue and guide their community's efforts.¹¹ A review of "Smart City" plans ratified recently illustrates that municipalities do not see Smart and Connected Community initiatives in terms of IT or Telecommunications projects alone, but as a larger effort to improve fundamentally the standard of living in their communities.

It is significant to recognize that local governments (including government representatives from suburban and rural communities) participate in these projects via several different pathways, including:

- As an entity controlling valuable real estate or other property, municipalities are responsible for issuing franchises to communications network providers and make it possible for IoT devices and appliances to be deployed in or on municipally-controlled buildings, on municipally controlled property such as light poles and buses, and in municipally-controlled Right-of-Way.
- As an end-user of technology solutions designed to advance municipal goals in areas including public safety, resilience, and transportation, municipalities purchase telecommunications services and equipment, engage in public private partnerships and procure the IoT solutions necessary to advance municipal objectives.
- As an entity working to advance economic development and job growth in its community, municipalities seek opportunities to facilitate and spur economic activity in their communities.
- As an entity that contributes to and – in many cases – leads efforts to plan for their community's future direction, municipalities engage key stakeholders and build support for short and long-term strategic plans.

¹⁰ See <https://www.ncta.com/industry-data/>.

¹¹ For illustrative "Smart City" plans developed by the cities of Albuquerque, Atlanta, Pittsburgh and San Jose see <http://smartatl-wp-e2.azurewebsites.net/#strategy>, <http://smartpittsburgh.org>,

- As a regulator with responsibility for public safety, community aesthetics and appropriate use of community assets, municipalities enforce laws and regulations that govern Smart Community/IoT deployments.

Recent research on the impact on Smart and Connected Community projects illustrates that these initiatives intersect with many – if not all – of the municipal goals and responsibilities outlined above. According to industry analysts, the fastest growing “Smart City” verticals include use cases that traverse multiple municipal departments including EV charging stations and micro-grids, smart waste management, environmental sensors, smart parking, and smart street lighting. A 2018 study by ABI Research forecasts the cumulative impact of Smart Community/IoT technologies will drive \$20 trillion in economic benefits by 2026.¹² Another study measures the impact of Smart and Connected Community projects not in terms of dollars spent or economic development activity generated, but instead in terms of the impact of Smart Community projects on citizens’ daily lives. This study concludes that communities deploying Smart and Connected projects have the potential to save each citizens 125 hours a year.¹³



12 Interdigital press release, January 2018, <http://ir.interdigital.com/File/Index?KeyFile=391873435>.

13 Intel press release, March 2018, <https://newsroom.intel.com/wp-content/uploads/sites/11/2018/03/smart-cities-whats-in-it-for-citizens.pdf>.

In addition to engaging with Smart Community/IoT projects around specific use cases to improve living standards for residents, municipalities engage Smart Community/IoT projects as the projects relate to municipal permits and public private partnerships. Municipalities are examining “climb once” policies aimed to make efficient the deployment of wireless equipment on poles, buildings and towers. Other municipalities are pursuing public-private partnerships with telecommunications providers.¹⁴

Along with issuing permits and exploring partnerships, municipalities are responding to administrative and policy concerns regarding the wireless and IoT deployments. Even in the early days of the next-generation wireless deployments, concerns being raised by residents regarding aesthetics and digital equity foreshadow that municipal governments will increasingly be called upon to engage in community outreach and consensus-building related to the deployment of networking facilities and equipment.¹⁵ Cybersecurity concerns related to connected IoT devices highlight another responsibility for local governments.¹⁶ As regulators, property-owners, providers of municipal services, and agents of public safety and economic activity, it is not an exaggeration to suggest that municipalities will be at the center of Smart Community/IoT deployments.

Existing Smart Community Partnerships between Cable Companies & Municipalities

To appreciate the central role that cable companies can and will play in Smart Community/IoT deployments, it is helpful to return to the IoT technical stack outlined in Section II. The foundation of Smart Community/IoT projects is the connectivity layer. Cable companies own dense fiber networks and robust Wi-Fi networks. They operate communications networks that provide reliable and resilient connectivity to residential, business and wireless customers. At the device and analytics layers, cable networks provide elements that are central to cost-effective and, thus, sustainable deployments of connected devices. These key project elements include:

- **Access to Right of Way (ROW).** Cable companies can help partner IoT device companies locate connected devices and the equipment required for edge computing.
- **Access to Power.** Network nodes that cable companies have deployed throughout their service areas include access to AV power. If an IoT application requires computing at the edge, the equipment requires access to a source of power.

14 Benjy Egel, “Verizon 5G internet service coming to Sacramento by 2018,” Sacramento Bee (November 30, 2017), <http://www.sacbee.com/news/business/technology/article187303503.html>.

15 See Kevin McCallum, “Santa Rosa puts Verizon wireless network upgrade on hold amid blowback from residents,” (March 6, 2018) <http://www.pressdemocrat.com/news/8080858-181/santa-rosa-puts-verizon-wireless?sba=AAS> and Yosef Getachew, et al, “5G, Smart Cities and Communities of Color,” Joint Center for Political and Economic Studies (June 2017), www.jointcenter.org.

16 Dante Disparte, “Cities held for Ransom – Lessons from Atlanta’s Cyber Extortion” Forbes (April 2, 2018)

- **Experience working with connected device partners and customers.** The millions of connected IoT devices that forecasters expect will be deployed throughout our country will require service and maintenance. Moreover, customers that rely on these connected devices will require support. Cable companies have resources to both deploy/service the connected devices and provide support for the end-user.

At the application layer, cable companies have a keen interest in facilitating the development and deployment of advanced Smart Community/IoT applications. Central to efforts by cable companies to support the deployment of Smart Community applications is an industry-wide commitment to network upgrades that are driving greater throughput to consumers. Via network upgrades including the installation of fiber optics closer to the homes and businesses served by their networks and the utilization of innovative network management technologies, cable providers have expanded rapidly the number of the customers who can receive broadband connections at gigabit per second speeds. At these speeds, futurist "smart home" and telepresence applications that can support community objectives related to education, chronic disease management and services for elderly residents are possible.

Looking beyond the wired connectivity provided by cable providers, Comcast's machineQ networks and Cox Communications' Cox2M initiatives, support innovative approaches for municipalities and their selected solutions providers to develop, test and evaluate IoT applications using wireless technologies. Using the LoRaWAN protocol, a standards-based communications protocol designed to deliver smaller amounts of data wirelessly over large geographical areas, cable providers are enabling solutions that provide municipalities with ubiquitous wireless connectivity between devices on the LoRaWAN network.



Cox Communications' Smart Gigabit Community partnerships in Las Vegas, Phoenix and San Diego illustrate Cox Communications' support efforts to grow application development ecosystems in the communities they serve. Cable companies provide support for stakeholder engagement efforts and hackathons and provide opportunities for application developers to deploy their apps on a network that serves a large, addressable market. Existing partnerships between cable companies – some of which are examined in detail below – illustrate well the valuable contributions cable companies can make to Smart and Connected Community projects and the common objectives that municipalities and cable companies share with respect to the successful deployment of Smart Community/IoT projects.

Commitment by the Cable Industry to Expand the Availability of Broadband Services offering Gigabit Speeds

According to an April 2018 analysis conducted by CableLabs, cable providers offered broadband service at gigabit per second speeds (hereafter “gigabit service”) to 56% of US homes in March 2018, up from 4% as of December 2016. And per an NCTA analysis,¹⁷ the number of housing units where cable providers offer gigabit service will increase to a projected 72% as of December 2018. Several cable providers will offer gigabit service nearly throughout their footprint.¹⁸ This remarkable expansion in the availability of gigabit service is a function of an industry-wide effort to deploy fiber closer to the customer and employ in neighborhoods network management approaches and technologies that were previously used in the management of long-haul (regional, national and global) network traffic.



For the purposes of this paper, the dramatic increase in the number of homes with access to gigabit service reflects a commitment on behalf of cable providers to provide customers with a platform able to deliver connectivity, entertainment and services. Because of the network upgrades, as cable company customers adopt gigabit service, cable companies will have an increasingly large base of customers with access to a platform through which end-to-end services and innovative applications will be provided.

The Smart and Connected Communities of the future will be comprised of smart businesses and smart homes. Use cases and applications centered on mobility, digitization of government services and public

¹⁷ See <https://www.ncta.com/positions/the-future-of-super-fast-internet>.

¹⁸ See e.g. <https://corporate.comcast.com/press/releases/comcast-now-nations-largest-provider-of-gigabit-internet>; and, <https://www.telecompetitor.com/charter-spectrum-gigabit-reaches-4-million-new-homes/>.

safety are the current focus of many current Smart Community efforts.¹⁹ In the future, municipalities will focus their Smart Community efforts on additional municipal functions including the remote delivery of social services, support of residents choosing to 'age at home' and distance education and training. The success of use cases and applications such as these will depend on reaching a critical mass of homes and businesses with broadband connections capable of disseminating and collecting data seamlessly.

Because of the important role that smart homes and businesses will play in the in the Smart and Connected Communities of the future, the current efforts by cable providers to expand the availability of gigabit services should be acknowledged as an important driver of the Smart Community/IoT efforts. When developing Smart Community plans and Smart and Connected Community pilot projects, municipal and community leaders should recognize and seek to incorporate the fact that an increasing number of residents have access to a platform in their home that can deliver advanced services. Moreover, cable providers should work with community partners to showcase opportunities to integrate applications requiring a smart home platform within Smart and Connected Community initiatives.

Comcast's machineQ

Comcast's "machineQ" networks, originally launched in Philadelphia, San Francisco and Chicago in 2016, brought attention to the fact that cable companies can and do use wireless technologies to support Smart Community projects. The machineQ networks use a low-power, wide-area network technology known as "LoRaWAN" to create a wireless network specifically designed to support IoT applications. Described as Wi-Fi for IoT by LoRa-Alliance members, LoRaWAN is being deployed globally to connect wireless battery operated 'things' to the Internet.²⁰

Comcast is working with an array of partners to test the machineQ networks with applications and use cases, including:

- CareBand
- Flashnet
- Pansofik

CareBand is a wearable technology designed to reduce deaths and injuries due to dementia-related wandering. The technology provides caregivers precise location tracking both indoors and outdoors, a nurse call button and automated analysis of activity patterns to help caregivers identify early changes in condition. The machineQ network enables Care Band and its partners to improve the lives of approximately 20 million seniors living in the machineQ network service area.

19 See June 2018 Report by the McKinsey Global Institute, <https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/smart-cities-digital-solutions-for-a-more-livable-future>.

20 In addition to Comcast, members of the LORA Alliance include Alibaba Cloud, Cisco IBM and Google. <https://lora-alliance.org/board-officers>

Flashnet streetlight controllers send and receive data over the machine LoRaWAN network. During the holiday season in 2017/2018, The City of Philadelphia utilized the machineQ network and Flashnet devices to remotely turn holiday light displays on and off, set energy-saving dimming schedules, monitor energy consumption, and proactively manage outages.

Pansofik has developed a suite of sensor solutions that enable monitoring of building mechanical, environmental, electrical and plumbing systems. Using Comcast's machineQ network, Pansofik solutions help building managers improve tenant comfort and productivity while optimizing operations to lower utility costs. Public housing authorities, including the New York City Housing Authority which announced recently it will pilot Pansofik's solution, are examining Pansofik's smart technology to improve energy and operational costs.

While Comcast announced in June 2017 its intention to deploy machineQ IoT networks in 12 additional markets, the machineQ business model has evolved from one of building wide area networks, to providing cities, solutions providers, and others the technology tools – both hardware and software – to deploy and manage their own LoRa networks. The machineQ technology tools are now available to cities nationwide.

Among municipalities and application developers alike, there is demand for access to IoT platforms on which new sensors, applications and Smart and Connected Community pilot projects can be rapidly deployed and tested. By their nature wide area networks can provide significant geographic coverage and a robust testbed. MachineQ technology tools allow solution providers and system integrators the ability to offer the developers access to large, addressable markets of potential customers.

Smart Alert for Safety

At a June 2017 Hackathon in Philadelphia, more than 15 developer teams were given access to devices, sensors and software development tools to create open source solutions for Smart and Connected Communities using LoRaWAN technology. Each attendee received an Arduino-based dev board and an opportunity to win cash prizes. The winning app, Smart Alert for Safety, uses sensors to transmit seasonal and structural data to the machineQ service to save lives and prevent property damage. The concept features configurable, multi-lingual alerts that can text or call people if they're at risk, including elderly people on a hot day.

For municipalities, the machineQ technologies provide key building blocks that enable them to deploy best-in-class solutions developed and designed by their selected solutions providers and supported by Comcast's commitment to deliver network reliability and security. Significantly, the IoT applications supported by machineQ come on-line rapidly and are relatively inexpensive to deploy. Describing advanced water metering projects with municipality-owned water utilities in communities including Columbus, Georgia and Riverside, California, Alex Khorram, general manager of machineQ, writes:

“Cities and municipalities are no longer delaying their smart city programs based on the promise of future network technologies because they see the tremendous cost savings and efficiencies they can realize today from a broad range of existing IoT solutions that are capable of leveraging the machineQ cloud-based IoT network and platform services. We can deploy and manage a dense IoT network tailored to the unique needs of any organization very efficiently, so they can focus their resources delivering the best service possible to their end customers.”

MachineQ networks using LoRaWAN equipment can be rapidly deployed by cities and solutions providers with access to existing Rights-of-Way to quickly and relatively inexpensively establish the communications layer that serves as the basis of an IoT deployment. An additional factor explaining the low cost and availability of LoRaWAN IoT solutions is that fact that LoRaWAN networks utilize publicly available “unlicensed” spectrum.

Underlying the technological and logistical attributes of the machineQ solutions, is the long-standing working relationship between municipalities and cable providers. The willingness of municipalities to test LoRaWAN solutions reflects the decades-long working relationship municipalities have with their cable providers. The working relationship between cable providers and municipalities, and the confidence that cable providers will stand-by the new technology, plays no small role in enabling municipalities to evaluate innovative Smart Community/IoT solutions without having to wait for the deployment of a 5G network.

“Among the reasons our city is really excited about IoT networks, like machineQ, is the opportunity that such networks provide a platform for experimentation and development. There is a lot of energy and enthusiasm among municipal leaders to deploy, test and evaluate new applications and technologies. The pilot we are running in partnership with the machineQ network will provide the city with valuable opportunities to explore the potential of new IoT applications and technologies and identify those applications that yield the greatest impact.”

Ellen Hwang, Personal Communication, May 7, 2018

Cox Communications' March 2018 announcement of Cox2M suggests that other cable companies will also introduce wireless IoT services that draw upon existing facilities and expertise. Under the new initiative, Cox will provide access to “purpose-designed sensors that collect data from a variety of connected assets (everything from cars to power lines), enabling [customers] to track, monitor, and manage both mobile and fixed assets at an industry-leading price-point.”²¹ Through Cox2M, customers will be able to connect nearly any asset (inventory, equipment or infrastructure) at nearly any location.

21 See www.cox2m.com.

Cox Communications' Smart Gigabit Communities Partnerships

In April 2016, Cox Communications announced a three-year, \$300,000 grant to US Ignite, a non-profit organization based in Washington DC, that would enable Phoenix to join the organization's Smart Gigabit Communities (SGC) initiative. In September 2017, Cox Communications announced an additional three-year grant to US Ignite to bring the Smart Gigabit Communities program to San Diego. In March 2018, Cox Communications announced a third three-year grant to US Ignite for the City of Las Vegas to participate in the SGC program.

Established in 2015 by US Ignite, in partnership with the National Science Foundation, the SGC initiative is intended to build a network of municipal testbeds for smart gigabit applications. Through the SGC initiative, US Ignite has assisted in the development of 125+ next-generation applications since 2015. Each participating community receives access to an ultra-fast network with local cloud computing and storage capabilities. Through the SGC, US Ignite also supports efforts to engage key Smart Community stakeholders including community anchor institutions like hospitals and universities, municipal government leaders, and non-profit organizations. Participating communities recognize that efforts to develop smart gigabit applications that can address local community needs, such as education, workforce development, public safety and community health require both technological assets and effective stakeholder engagement.

The grants to US Ignite illustrate the links between Cox Communications' deployment of gigabit networks, Cox Communications' and Cox's support for municipal goals related to Smart and Connected Communities. At the time of the Phoenix grant, John Wolfe, SVP and manager for Cox's Southwest Region, released the following statement:

“Cox Communications remains committed to deploying the latest gigabit infrastructure throughout our service areas, driving future innovations in education, healthcare and economic development that will benefit our communities. We are proud to continue our leadership in gigabit infrastructure and excited to partner with the City of Phoenix and US Ignite to leverage our infrastructure to drive innovation.”²²

Cox's sponsorship of the SGC program advances Smart and Connected Community objectives and establishes a strategic partnership between the participating cities and Cox Communications. In the City of San Diego, the goal is to create the largest city-based deployment of an IoT platform in the world. Current municipal efforts in this regard include efforts to deploy more than 3,000 smart nodes on light poles throughout the City's downtown area. The smart nodes run applications that will help the City of San Diego advance goals related to traffic management, public safety, air quality and other objectives.

²² Cox Communications, April 2016, <http://newsroom.cox.com/2016-04-19-Phoenix-to-become-a-Smart-Gigabit-Community>.

“San Diego’s booming innovation economy is leading the way on everything from drones to genomes. Now we’re using that same spirit of ingenuity to improve the lives of San Diegans across the city,” San Diego Mayor Kevin Faulconer said. “Through this new partnership [with US Ignite and Cox], local innovators will be able to create smartphone applications and other technologies that will help improve the quality of life for our residents and make our neighborhoods safer.”²³

In Phoenix, support from Cox has helped create a coalition of 22 communities working together to forge a smart region.²⁴ According to Dominic Papa, Executive Director of the Institute for Digital Progress (IDP) in Phoenix, the partnership is a win-win with significant benefits for both the community and Cox Communications.

“The SGC partnership is creating a new innovation infrastructure in Phoenix. The goal of the initiative is the development of advanced applications designed to solve real urban challenges. As important as the end goal, however, is the fact that the initiative is helping breakdown silos and create a process for collaboration within our community. With the support of US Ignite and Cox Communications, key stakeholders in Phoenix’s innovation ecosystem are coming together, developing partnerships and creating the roadmap Phoenix will follow to our smart and connected future.”²⁵

Charter’s plans to invest in and upgrade their networks will further support Smart Community/IoT projects

Already covered in this white paper is the fact that cable companies are contributing valuable assets and resources to Smart Community/IoT projects. Looking forward, cable companies plan to invest billions in their networks during the next five-years to enhance residential and business customers’ experience.²⁶

Statements from industry leaders make clear cable industry investments will result in networks that can support advanced applications, including IoT. In February 2018, Charter Communications, Inc. CEO Tom Rutledge used the term “6G” to describe tests that Charter is conducting related to integrating small cell architecture with advanced DOCSIS networks. According to Mr. Rutledge,

23 US Ignite press release, September 2017, <https://www.us-ignite.org/news/us-ignite-selects-cleantech-san-diego-and-cybertech-as-key-innovation-partners-for-san-diegos-smart-gigabit-community-program/>.

24 Drew Marine, “ASU involved in creation of Smart Region covering 22 cities and towns”, AZFamily.com (April 15, 2018) - <http://www.azfamily.com/story/37961481/asu-involved-in-creation-of-smart-region-across-22-cities-and-towns>.

25 (Dominic Papa, personal communication, March 19, 2018)

26 Hayley Ringle, “Cox Announces expanded gigabit internet speeds across the country at CES,” Phoenix Business Journal (January 9, 2018), <https://www.bizjournals.com/phoenix/news/2018/01/09/cox-announces-expanded-gigabit-internet-speed.html>, Charter press release, March 2017, <https://newsroom.charter.com/press-releases/statement-charter-communications-announcement-white-house-today/>

“We’re going to build a high-capacity, low latency, high compute network using the pathway we have... with massive capabilities, bi-directionally in every home we service. And we’re going to have that ubiquitously deployed across our entire footprint in a very quick and capital efficient way.”²⁷

The comments of the Charter Communications CEO are significant because they describe a network that is extremely well-suited to support Smart Community/IoT projects. Networks with computation capabilities that support ultra-fast uplink and downlink will be increasingly critical to the new applications that will be delivered by IoT networks.

Mr. Rutledge’s comments also emphasize that Charter is not starting from ground zero and will deploy across the company’s entire footprint and in every home that they serve. This announcement of Charter’s investment in their network across all the neighborhoods in all the communities they serve should be welcomed by municipal leaders with an interest in advancing digital equity objectives in their community.

Key Takeaways

TAKEAWAY #1 – Cable networks have the capability to support Smart Community/IoT applications both now and in the future.

There is no need for communities to wait for “5G” or other wireless networks to be deployed before pursuing Smart & Connected Community initiatives. Cable providers possess wired and wireless facilities to deliver Smart Community/IoT solutions today. Moreover, decades of experience deploying and supporting network-enabled applications and services means that cable companies bring critical expertise to Smart Community/IoT deployments. In many communities, planning efforts by municipal leaders with respect to Smart Community initiatives, IoT and 5G/Small Cell deployments are coinciding with massive investments in network upgrades that cable providers are making in their infrastructure. DOCSIS 3.1 and the additional fiber that cable companies are deploying in order to expand capacity means that cable networks have the capability to support Smart Community/IoT applications both now and in the future. In addition, wireless solutions, including LoRaWAN solutions supported by machineQ and Cox2M offer customers, including municipalities, access to wireless IoT platforms that make possible rapid deployment of cost-effective projects.

TAKEAWAY #2 – A rapid expansion of the number of homes where gigabit service is available means that the smart home will be an increasingly viable platform capable of advancing Smart & Connected Community objectives.

According to analysis conducted by NCTA²⁸, the number of housing units where cable providers offer

²⁷ Amy Maclean, “Case for Cable: Cable-Tec Expo is Looks at Where Industry is Headed,” CableFax (October 16, 2017) - <http://www.cablefax.com/programming/case-for-cable-cable-tec-expo-looks-at-where-industry-is-headed>.

²⁸ See <https://www.ncta.com/positions/the-future-of-super-fast-internet>

gigabit service will increase to a projected 72% as of December 2018. As cable provider customers adopt gigabit service, they will create a large base of customers with access to a platform through which end-to-end services and innovative applications will be provided. The success of applications, including the remote delivery of social services, support of residents choosing to 'age at home' and distance education initiatives, depends on reaching a critical mass of customers have access to a smart home where data collection and dissemination occurs seamlessly. For this reason, current efforts by cable providers to expand the availability of gigabit services will be an important driver of the Smart Community/IoT efforts and will be incorporated into effective Smart and Connected Community planning.

TAKEAWAY #3 – Smart and Connected Community partnerships between cable providers and local governments reflect new and evolving approaches to collaboration.

Rather than approach their local government partners with a one-size fits all approach to Smart Community/IoT deployments, cable providers are working with partners from the local community to co-create approaches that best achieve common goals. The Cox partnerships in Phoenix, San Diego and Las Vegas and the Comcast machineQ solutions reflect an evolving approach to working collaboratively with the municipalities they serve. This approach to working with municipalities is likely to be well-received by municipal leaders. A Smart City Playbook released by the City of Boston in 2017, provides guidance to potential partners to municipalities in Smart and Connected Community projects. Foremost among Boston's recommendations to potential partners: do not sell ready-made solutions, instead, work with the city to co-create solutions/projects that meet Boston's specific goals and objectives.²⁹ The most effective Smart and Connected Community partnerships between municipalities and cable providers will build upon decades of experience working together, as well as a shared commitment to the prosperity of the communities they serve, but will also reflect new approaches to collaboration.

Conclusion + Recommendations

A growing number of municipal leaders recognize the promise of Smart Community/IoT projects to expand economic opportunity and improve the standard of living for residents in their communities. Because of the complexity, cost and risk of at-scale Smart Community/IoT deployments, most municipalities will seek to advance their smart and connected community goals via partnerships.

From an examination of 1) the common technological elements in Smart and Connected Community deployments, 2) the attributes of a Smart Community network of the future, and 3) innovative partnerships in the Smart Community space, it is apparent that municipalities and cable companies share common interests with respect to accelerating the deployment of Smart and Connected Community projects. Indeed, this paper makes the case that cable companies are uniquely well-positioned to help local governments advance their community's smart and connected objectives; arguing that

²⁹ See <https://www.boston.gov/sites/default/files/imce-uploads/2017-04/smartcityrfupdated4.24.17.pdf>.

cable companies possess both dense network infrastructure across large service areas and valuable experience deploying and managing wired and wireless networks designed to solve complex connectivity challenges.

More than just well-qualified solution providers to municipal government, however, cable companies and municipalities share common objectives that make them natural partners with respect to advancing Smart Community/IoT objectives, including:

- Shared objectives related to the deployment of an advanced network that can support innovative and dependable Smart Community/IoT projects;
- Shared commitment to co-creating and implementing approaches to Smart Community/IoT that is tailored to the specific objectives of the community; and
- Common time-table between municipal efforts to plan for Smart Community, IoT and Small Cell/5G deployment and cable company plans to upgrade their network infrastructure to meet customer demand for advanced applications.

From observations drawn from current Smart Community/IoT initiatives involving cable companies and municipalities, the following recommendations for cable companies and municipalities emerge:

1. Local governments, when planning for Smart and Connected Community, IoT and 5G/Small Cell deployments, will benefit from efforts to engage cable providers and encourage local cable providers to provide input and participate in the process.
2. Local government leaders and cable companies alike should recognize that anticipated Smart Community, IoT and 5G/Small Cell deployments provide a unique opportunity to expand and evolve their relationship to include innovative and impactful Smart Community partnerships.
3. Cable companies should educate community leaders so that there is a better appreciation of the end-to-end consumer connectivity, facilities and expertise cable companies possess and how these resources can be used to advance Smart & Connected Community objectives.
4. Local governments should evaluate carefully whether existing connectivity (e.g., LoRaWAN) can support the desired functionality of Smart and Connected Community applications and deployments.
5. Cable companies should evaluate opportunities for public private partnerships (“PPPs”) with municipalities, universities and non-profits as a means to grow economic activity in the communities they serve and, ultimately, serve new customers and existing customers in new ways.



About the Author

Bill Maguire is the founder of Connected Communities LLC and an advisor and consultant to local governments, non-profit organizations and technology companies. Prior to his consulting work, Bill served as Chief of Staff for the Broadband Technology Opportunities Program (BTOP) at the National Telecommunications and Information Administration (NTIA). Bill is a graduate of Reed College and of Union Theological Seminary in New York.