

Setting the Standard for Connected Utility Deployments

Your workshop discussion guide

A message from the CTIA Smart Cities Team

Thank you for joining us at DISTRIBUTECH 2025 to talk about connected utility deployments: mapping connectivity, exploring the maturity of your current solutions, and seeing what's new in security, certifications, IoT devices, and real-life use cases.

This workbook is the next step in putting these conversations into action to implement connected utility solutions smoothly, securely, and sustainably in your community.

Ready to get started?

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Connectivity unlocks a wealth of opportunities for utilities. Explore ways to leverage your LTE/5G network to its fullest potential.

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This overview of the CTIA Wireless Maturity Model includes sample assessment questions for electric, natural gas and water/wastewater utilities, along with use cases illustrating each of the evaluation areas:

- + Data communications
- + Connectivity access
- + Infrastructure
- + Security
- + Resilience
- + Equity

Securing Connectivity 39

Learn all about CTIA initiatives like the IoT Network Certified™ program, the IoT Network Certified for Smart Connected Infrastructure™ program, and the CTIA IoT Cybersecurity Certification Test Plan, along with Cyber Trust Mark, for which CTIA is an authorized administrator.

IoT Best Practices Roundup 47

Discover ways to address potential challenges, streamline operations, and unlock the full potential of connected infrastructure.

About CTIA

CTIA represents the U.S. wireless communications industry and companies throughout the mobile ecosystem. Our members provide the wireless networks, devices, equipment, and solutions that make smart cities possible. This includes the connectivity solutions behind smart utility deployments. CTIA members are also drivers of 5G, the next generation of wireless. As advanced networks roll out across the nation, 5G will allow up to 100 times more simultaneous connections, up to 100 times faster connectivity, and lower latency, which is key for innovations like intelligent transportation systems. Due to the tremendous amount of private investment necessary to bring advanced networks to life, collaboration between industry and the public sector is paramount. As we look ahead to the exciting possibilities of smart cities technologies, CTIA is committed to helping communities of all sizes become the cities of the future.

Acknowledgments

This guide was created in collaboration with:



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Navigating Connected Utilities

Explore these six common deployment challenges related to connected utilities and how utilities are creating more efficient grids, networks, and operations than ever before.

Integration of legacy infrastructure

Many utilities still rely on outdated infrastructure and systems, making it challenging to integrate new, connected technologies such as smart meters, IoT sensors, and real-time monitoring systems.

- How to navigate new technology deployments on existing infrastructure, even if this infrastructure is outdated?
- Network-provider insights

Data security and privacy

As utilities adopt connected systems, they collect vast amounts of data about customer usage patterns, operational performance, and more—and are challenged to ensure cybersecurity measures to protect this sensitive information.

- How to protect digital and mission-critical infrastructure?
- Additional security insights

Network connectivity and coverage gaps

Effective connected utility deployments rely on extensive, reliable network connectivity, especially in rural or remote areas—and seamless connectivity between devices, sensors, and communications networks.

- How to identify weak signal areas or limited coverage?

Scalability and future-proofing

As demand for connected utilities grows, scalability becomes a key challenge. Utilities want to ensure their deployments can scale to accommodate increasing numbers of connected devices and the growing volume of data.

- Best practices for adopting solutions that are both flexible and scalable to future advancements

Network and device compatibility

This can often appear straightforward in utility IoT deployments: connect a device to a network, and you're good to go. However, the reality is far more complex.

- Overcoming challenges like device compatibility and interoperability across private communication networks and proprietary spectrum bands

Managing power consumption in IoT devices

This is a common challenge for smart water solutions, where IoT devices often rely on batteries—and longer-life batteries in particular—for both functionality and communication.

- Best practices for managing IoT power consumption in implementations

“This is an ongoing multi-industry effort. We hope today’s conversation is only just a beginning for those of you joining us and continues well beyond today.

These challenges faced by connected utilities highlight the complexity of modernizing infrastructure and adopting IoT technologies.

Addressing these challenges effectively is essential for utilities to harness the full potential of connected technologies and wireless networks—ensuring enhanced service delivery, operational efficiency, and long-term viability.”

– Michelle James, Vice President of Strategic Industry Programs, CTIA

Mapping Connectivity

Improve your ability to make data-driven decisions that optimize infrastructure, improve services, and ensure equitable access to digital resources.

As cities become more connected, the ability to assess and visualize mobile network performance at a granular level becomes essential for many reasons: to identify gaps in coverage, target underserved areas, and to maximize the efficiency of telecom investments, to name a few.

Mapping connectivity helps utilities build more efficient, resilient, and customer-focused infrastructure while supporting advanced technologies like smart grids and IoT. It also provides the data needed to make informed decisions, improve service delivery, and future-proof operations.

By mapping connectivity, cities can both enhance their telecom infrastructure and support broader goals, such as digital inclusion, sustainability, and economic growth. This proactive approach to urban planning ensures that digital networks are integrated seamlessly into the fabric of city life, driving smarter, more resilient communities.

Connectivity mapping for utility IoT solutions:

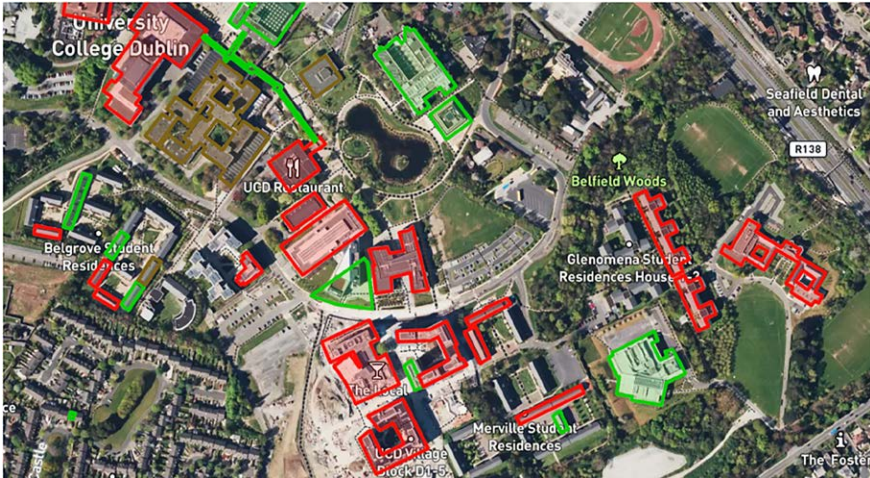
- 1. Optimizes infrastructure deployment:** By mapping connectivity, utilities can identify areas with poor or insufficient network coverage, especially in remote or underserved locations. This allows them to strategically plan and prioritize infrastructure investments, ensuring that their networks reach all areas that need them most while avoiding redundant or unnecessary deployments.
- 2. Improves monitoring and maintenance:** With a detailed map of connectivity, utilities can track the performance of their communication networks in real time. This is particularly important for managing power grids, water distribution systems, or other critical infrastructure that requires constant monitoring to detect issues, predict failures, and minimize downtime. Mapping connectivity over time helps utilities identify and proactively address weak spots in their networks and infrastructure.
- 3. Enhances data collection and analysis:** Mapping connectivity enables utilities to collect more accurate and granular data about their network performance, from mobile sensor data to smart grid communication networks. With access to high-quality data, utilities can make better decisions regarding system upgrades, maintenance schedules, and consumer demand patterns, leading to more efficient operations and better resource management.
- 4. Supports smart grids and IoT integration:** As utilities increasingly adopt smart grid technologies and IoT solutions, connectivity mapping becomes essential to ensure seamless communication between devices. By identifying coverage gaps, utilities can ensure that IoT devices like smart meters or remote sensors are able to communicate effectively with central systems, improving the overall performance of the utility network.
- 5. Fortifies disaster preparedness and resilience:** Connectivity mapping helps utilities understand how their communication networks will perform during emergencies or natural disasters. By analyzing coverage and performance in real time, utilities can develop systems that are better equipped to handle disruptions and ensure continuity of service, even in challenging circumstances.
- 6. Facilitates regulatory compliance and reporting:** Utilities are often required to meet regulatory standards for service quality, particularly in areas like power outages or water distribution. Connectivity mapping can support regulatory reporting by providing a clearer view of service gaps or network issues. This helps utilities comply with government mandates and demonstrate their commitment to service improvement.
- 7. Improves customer experience and satisfaction:** By improving their connectivity mapping, utilities can ensure that customers, especially those in rural or underserved areas, experience reliable service for programs like smart meters or remote monitoring solutions. Mapping connectivity allows utilities to identify and rectify coverage issues that might affect customer satisfaction, such as slow data speed or poor signal quality.

Connectivity Mapping in Dublin:

A data-driven model for smarter urban telecom planning

SCENARIO

With new regulatory initiatives pushing European cities to take a more active role in telecom infrastructure, Dublin City Council established a strategic one-stop-shop “Telecoms Unit” to transform its approach to urban connectivity. However, as it sought to strengthen industry collaboration, drive better outcomes, and “telecoms-proof” future capital investments, the City Council encountered significant challenges.



Building-level analysis of crowdsourced signal strength and download speed performance data enabled Dublin City Council to identify major indoor connectivity gaps at Ireland’s largest university, University College Dublin, and new residential developments.



Without access to high-quality, granular data on the availability and performance of local mobile network infrastructure, the City Council was forced into a reactive approach, operating in an information vacuum when engaging with industry on telecoms issues. The mobile coverage maps it used from Ireland's telecom regulator were not designed to reflect on-the-ground user experience in every corner of Dublin—particularly in high-density residential areas and newly developed social housing.

To help industry drive better infrastructure outcomes and advance the City Council's broader goals of digital inclusion and world-class connectivity, Dublin wanted a different way to track mobile network performance over time, quantify the extent of the digital divide, benchmark its telecom competitiveness against leading global cities, and strategically leverage policy interventions and city assets to prioritize improvements where they are needed most.

SOLUTION

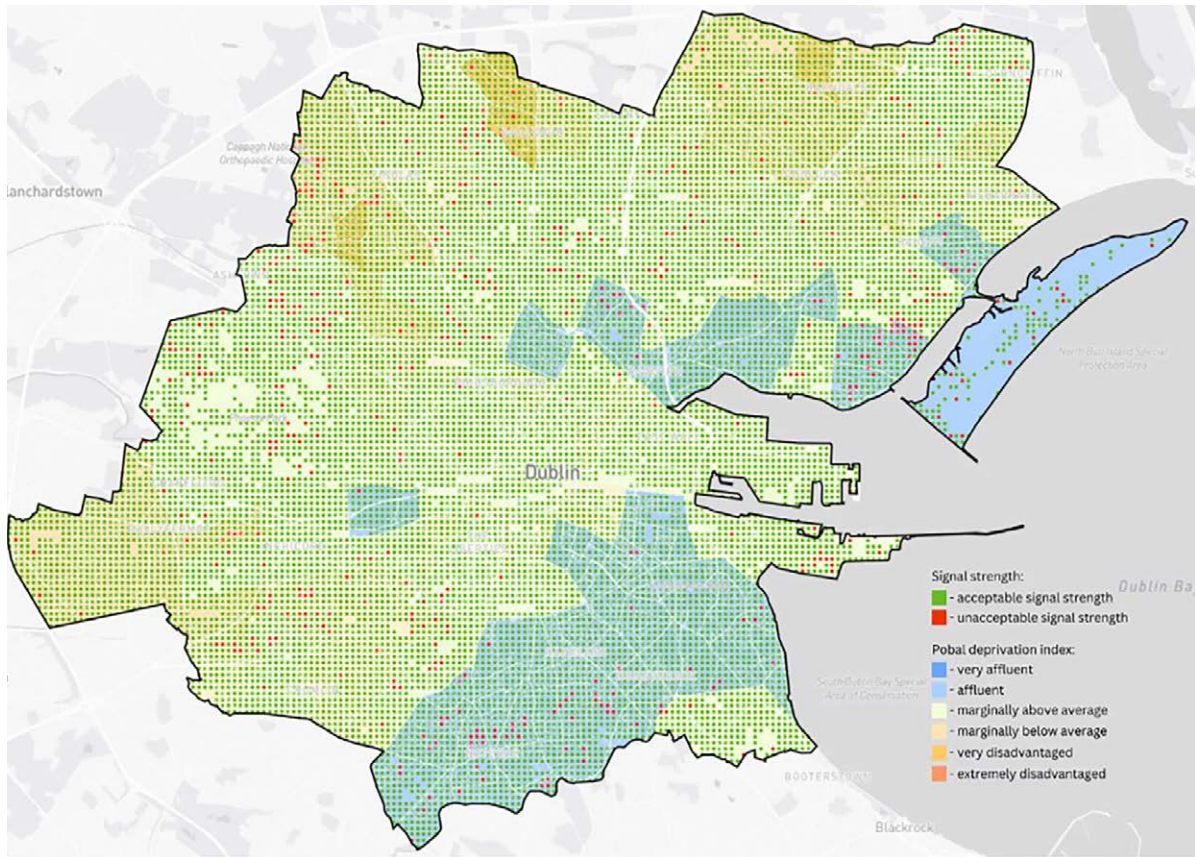
In a strategic effort to address these connectivity challenges, reinforce competitiveness, and offer a replicable blueprint for other cities around the world, Dublin City Council partnered with Ookla and the City Telecoms Association.

Leveraging crowdsourced network performance data through Speedtest Insights™, the collaboration produced the first comprehensive, city-wide view of telecom infrastructure availability and real-world network performance—detailed down to the street and building levels.

The City Council developed a first-of-its-kind methodology, integrating tens of millions of real-world Speedtest™ samples collected over two years with internal asset registries, infrastructure maps, and mobile site location data. Using geospatial analysis and computer vision techniques, it created a localized, tile-based grid of mobile network performance across the city, categorizing areas as good or bad based on key metrics like download speed and signal strength.

By using this map, the City Council systematically identified connectivity gaps in specific areas and evaluated whether city-owned rooftop assets could support new deployment of telecom equipment. This mapping data also informed discussions with operators about enhanced multi-network sharing during future site renewals to improve citizen outcomes.

Additionally, by integrating network performance data with social deprivation metrics, the Council was able to examine the digital divide and support targeted policy initiatives to boost connectivity in the most underserved areas.



Map of aggregate signal strength performance in Dublin (2024), overlaid with HP Pobal Deprivation index data for electoral areas



Map of aggregate signal strength performance in Dublin (2024), overlaid with Dublin City Council rooftop assets and mobile site locations

Dublin City Council combined Ookla's crowdsourced network performance data with social deprivation data to quantify the extent of the digital divide in Dublin and support targeted policy interventions.

RESULTS

Dublin City Council's partnership with Ookla has transformed its urban telecom planning strategy, placing the Telecoms Unit firmly in the driver's seat of industry collaboration while enhancing community outreach for improved awareness of this infrastructure's benefits. Working with the City Telecoms Association, the City Council and Ookla developed a [flagship guide book](#) capturing the outputs of the partnership, to support other global cities in data-driven approaches to telecom infrastructure.

Connectivity Mapping in Action

Tracking the evolution of mobile network

performance: Dublin City Council identified localized declines in mobile download speeds and signal strength over time in new residential areas that lacked provisions for telecom infrastructure. The finding: poor indoor coverage in new residential developments.

In response, the Council collaborated with operators on options for retrofitting these residential developments or leveraging nearby city-owned rooftops for mobile site deployments. It's also examining modifications to the planning system, along with policy options to encourage telecom infrastructure deployment as part of large-scale residential development.

Identifying targeted connectivity gaps and building data-driven cases for policy

intervention: Dublin City Council identified five key areas within the city where multi-operator connectivity gaps were most pronounced, along with strategic national buildings such as universities and hospitals that suffered from significant indoor coverage issues.

After analyzing the factors contributing to these challenges, the Council is now exploring opportunities for enhanced multi-operator site sharing in applications for future mobile sites. This aims to improve connectivity outcomes for citizens across all operators and preserve healthy telecoms competition in Dublin.

Assessing the impact of new site deployments to improve citizen engagement and increase community understanding and buy-in:

buy-in: Dublin City Council leveraged Ookla's crowdsourced data to evaluate mobile network performance improvements before and after deploying small cells in targeted local areas in the city.

This analysis has played an important role in demonstrating the benefits of telecom infrastructure investments to local communities. In collaboration with other local government authorities across Ireland, the Council launched a major ["Telecoms for Everyone"](#) public communications campaign, delivered through a series of [informational videos](#), to enhance community engagement and promote understanding of telecom initiatives.

Assessing and Maturing Connectivity

The CTIA Wireless Maturity Model

Compiled by wireless and technology experts and based on data from smart cities projects nationwide, this in-depth assessment takes a look at:

- + Wireless technologies and systems you currently have in place—and how they measure up to what’s available in the marketplace today
- + The infrastructure needed to move forward, including ways to tap into the power of 4G/LTE networks
- + Ways to ensure resilience, security, and equity along the way

Why it’s useful

Whether you are assessing your entire community or the areas focused on transportation, public services, or utilities, the Wireless Maturity Model assessment can help identify your wireless readiness and next steps towards a more connected tomorrow.

You can:

- + Gain insights on your city’s technology strengths, challenges, and opportunities
- + Evaluate your city’s current data communications, connectivity access, infrastructure, security, resilience, and equity
Which smart utilities solutions could your organization deploy to better serve customers?
How about 5G-enabled leak and outage alerts or interactive apps to help residents?
- + Identify the physical assets and infrastructure needed to deploy and maintain smart cities solutions
- + Determine ongoing next steps to achieve your smart cities goals

How the CTIA Wireless Maturity Model works

Information entered into a detailed online questionnaire yields an overall maturity score for wireless connectivity and the ability to deliver, operate, and maintain smart utilities solutions.

YESTERDAY Your wireless-readiness is less advanced than what’s currently available in the marketplace, positioning your community to gain the most from advanced wireless investment.

TODAY Your community is right on track in terms of wireless infrastructure and adoption, with even more opportunities ahead for wireless-enabled efficiencies and impact.

TOMORROW Congratulations—you’re a leader in this field! Advanced wireless solutions and new use cases are rolling out every day for your community to consider for continued growth.

Multiple-choice questions related to natural gas, water and wastewater, and electricity services feed into this overall maturity score, as well as individual scores for each sector. Read on for examples.

What infrastructure is in place to support electric service delivery?

- Distribution transmission assets are managed and controlled wirelessly using microwave and SCADA technologies.
- Close proximity point-to-point radio may be used to support AMR. Electrical grid assets are managed using RF mesh based AMI, LTE cellular point-to-point and point-to-multipoint radio.
- Electrical grid assets are managed using next-generation cellular technologies including CAT-M1, NB IoT and 5G.
- Not applicable

How is wireless connectivity leveraged for the utility's communication system?

- The utility uses SCADA, telemetry, microwave and polling technologies for monitoring and control of electrical network system assets.
- 4G LTE enables telemetry at lower latencies, higher bandwidths and higher throughputs to support near real-time situational awareness across the utility's territory.
- 5G and other advanced communication technologies enable IoT edge applications. They may incorporate local energy markets that are inclusive of independent power producers, energy aggregators and prosumers.
- Not applicable

How is wireless data used to support electric utility assets and service delivery devices?

- Power quality measurements and data collection are manual, requiring physical, walk-by or drive-by meter reads. Substations and other critical infrastructure centers have wireless monitoring and some remote operational control.
- AMI is incorporated throughout the community leveraging wireless mesh networks. Energy Management System (EMS) and Distribution Management System (DMS) operators remotely operate the grid using wireless communications.
- AMI is ubiquitous throughout the community. EMS, DMS (or Advanced DMS) and Distribution Automation (DA) use high-speed wireless communication to enable analytics to optimize grid operations. This includes the use of non-utility-owned renewables, energy storage and controllable loads.
- Not applicable

How is due diligence managed for access controls, information security and physical security?

- Critical assets have been identified, as well as the criticality and sensitivity of the information each asset accesses, processes, stores or transmits.
- Critical assets have been assigned risk and impact metrics, with tailored and appropriate controls and mitigation schemes.
- A comprehensive risk management program, in accordance with NIST publications, is used for categorizing critical assets, selecting and implementing security controls and mitigation schemes, and continuously monitoring processes.
- Not applicable

What wireless technologies and processes are in place to help the utility withstand and recover from an unplanned electrical service disruption?

- The utility has prioritized its communication system recovery process and dispatches crews to address issues when they are manually identified and reported.
- The utility monitors its communications networks using analytics to detect anomalies or disruptions in communication systems. Wireless AMI systems are alerted by "last gasp" meter messages to report outages of service delivery to the control room and customers in real time.
- The utility leverages integrated tools and systems such as predictive analytics, AMI and automated workflow—including work orders and dispatch processes to minimize disruptions and to shorten time to recovery. When disruptions occur, DA systems perform automated switching to isolate faults and restore service to the maximum number of customers.
- Not applicable

How does wireless technology help electric service providers deliver service to all community members?

- Electric service providers wirelessly manage customer programs that incentivize the use of demand response controllable load devices, such as smart thermostats, water heaters and pool pumps.
- Electric service providers wirelessly manage customer programs that incentivize distributed power generation, energy storage capacity and electric vehicles.
- Electric service providers wirelessly manage customer programs that are available to all community members.
- Not applicable

What natural gas infrastructure exists within your city or community?

- Many analog manual systems still exist, with SCADA systems used to poll and control key transmission and distribution assets.
- Emergency shut-off valves are automated, with some use of wireless technologies (including 4G LTE connectivity and/or mesh networks) and the majority of key assets instrumented and controlled through centralized SCADA systems. Digital instruments, including meters, provide real-time data and some situational awareness.
- Wireless leak identification sensors and predictive analytics catch issues before they occur, reducing greenhouse gas emissions and increasing efficiency and safety. Automated equipment manages shutoff valves and gas compression equipment. Wireless digital instruments, including meters, provide realtime data and system-wide situational awareness.
- Not applicable

How are natural gas assets and service delivery equipment operated and maintained?

- Customer metering is measured by manual reads; as wireless connectivity is not available to perform automated meter reading (AMR). Compressor stations and gate stations use SCADA polling systems to report to control room operators (CRO), who manually manage equipment to maximize efficiency and safety.
- Customer metering is through AMR or advanced metering infrastructure (AMI) using wireless mesh, point-to-point or tower-based networks. Compressor stations and gate stations maximize efficiency and safety through automated equipment and local control solutions.
- IoT technologies automatically report customer metering data to the cloud for rich, system-wide situational awareness. Wireless technologies enable predictive analytics, and automated control systems maximize safety and efficiency, reporting outages and supply failures and automatically creating maintenance work orders and customer notifications when power delivery issues arise.
- Not applicable

What is the natural gas communication system availability and latency?

- SCADA telemetry microwave and polling technologies monitor and control critical compressor station and gate station system assets.
- The majority of the gas operator's territory is connected with 4G LTE.
- The majority of the gas operator's territory is connected with 5G technology.
- Not applicable

To what degree does the natural gas provider exercise due diligence in managing access controls, information security and physical security for its critical assets?

- The natural gas provider has identified its critical assets and determined the criticality and sensitivity of the information each asset will access, process, store or transmit.
- The natural gas provider has determined the risks and impact levels associated with its critical assets and has designated tailored controls and mitigation schemes commensurate with the assigned risk.
- The natural gas provider has established a comprehensive risk management program, in accordance with NIST standards, for categorizing critical assets, selecting and implementing security controls and mitigation schemes that meet mission and business needs, continuously assessing control effectiveness, authorizing the systems for operation and continuously monitoring the systems.
- Not applicable

In the event of an unplanned gas outage, what tools and processes are in place for identifying, communicating and recovering quickly from the outage?

- The natural gas provider has prioritized its communication system recovery process. It dispatches crews when issues are manually identified and reported to a central office.
- The natural gas provider uses data analytics to monitor its communications networks for anomalies or outages. Mesh network AMI systems locate outages, and “last gasp” meter messages alert subscribers. Situational awareness systems, meter systems and workforce management systems are not yet fully integrated.
- The natural gas provider leverages wireless technologies, integrated tools and systems such as predictive analytics, AMI and automated work order and dispatch workflows to minimize outages and shorten time to recovery. Situational awareness systems, meter systems and workforce management systems are integrated.
- Not applicable

How does wireless technology help gas providers deliver service to all community members?

- Wireless technologies are not widely leveraged to help deliver natural gas service.
- Wireless technologies enable operational efficiencies, improving natural gas service delivery to high-volume customers.
- Wireless technologies are used ubiquitously for natural gas service delivery, specifically for low latency monitoring, AMI, command and control, and overall situational awareness.
- Not applicable

What wireless communications infrastructure exists to accommodate water and wastewater management?

- The use of wireless sensors is limited, but Automated Meter Reading (AMR) is used. SCADA systems are used to poll and control pump stations and intake points.
- AMI that leverages mesh networking technology is widely adopted throughout the service territory. Wireless meters and sensors provide real-time data and improved situational awareness.
- AMI is ubiquitous throughout the service territory. Wide use of wireless sensors supports real-time detection and AI-enabled predictive analytics.
- Not applicable

How does wireless connectivity impact water and wastewater management?

- Manual or wireless AMR is performed via walk-by or drive-by on a monthly or quarterly basis.
- AMI provides daily or hourly meter readings. Some wireless sensors are available to provide near real-time metrology and alarms for volume, flow, flood levels, etc.
- AMI and sensors provide real-time situational awareness and historic data to identify, predict and take appropriate actions on water and wastewater events.
- Not applicable

How is wireless data used to support water management?

- Customer metering is measured manually or by near-field wireless meter reading. Tank and pump station measurements and basic alarms use Supervisory Control and Data Acquisition (SCADA) communications for remote monitoring.
- Meter reads are performed using Advanced Metering Infrastructure (AMI) via mesh wireless networks using some fiber or cellular connectivity to backhaul data to an operation center. Water towers, pump stations, leak detectors and other sensors are wirelessly connected to help manage water quality, pressure and flow.
- Customer metering data is automatically reported to the cloud using key data points and wireless connectivity at pump stations and water intake points—providing robust, system-wide situational awareness as well as data on water consumption and quality.
- Not applicable

How is due diligence managed for access controls, information security and physical security?

- Critical assets have been identified, as well as the criticality and sensitivity of the information each asset accesses, processes, stores or transmits.
- Critical assets have been assigned risk and impact metrics, with tailored and appropriate controls and mitigation schemes.
- A comprehensive risk management program, in accordance with NIST publications, is used for categorizing critical assets, selecting and implementing security controls and mitigation schemes, and continuously monitoring processes.
- Not applicable

What wireless technologies and processes are in place to withstand and recover from an unplanned water disruption?

- Service disruptions are reported manually. The water provider has prioritized its recovery process and dispatches crews to address issues as reported.
- The water provider monitors its systems using analytics to detect anomalies or outages. Mesh network AMI systems use "last gasp" meter messages. Some automated outage reporting to the control system and subscribers is available. Situational awareness systems, meter systems and workforce management systems are deployed, though not fully integrated.
- The water provider leverages integrated tools and predictive analytics (weather, performance and usage data) using AMI and automated workforce management processes to facilitate rapid recovery.
- Not applicable

How does wireless technology help the utility deliver service to all community members?

- Wireless communications services are not used to monitor assurance of clean water and wastewater.
- Some wireless communication sensors monitor clean water and waste water services for some populations within the community.
- Wireless communication sensors are deployed throughout the community to ensure clean water and wastewater services are equally available to all community members.
- Not applicable

Wireless Maturity for Data Communications

From water usage to power outages to infrastructure in need of repair, valuable information exists across every aspect of a utility's operations. Wireless networks help utilities leverage it in real time for safety, efficiency, and customer service.

This score in the CTIA Wireless Maturity Model assessment defines the data currently available across your utility operations and community via wireless networks. It also shows how wireless technology currently supports data for electric, natural gas, and water services.

Data communications in Virginia:

A new communication path for digital fault recorder data

SCENARIO

Utilities need data to know if electrical faults and other events threaten their power systems and when and where to send field crews for diagnosis and repairs. Dominion Energy Virginia uses high-resolution voltage and current measurements from digital fault recorders (DFRs) and traveling wave systems (TWS) to collect this information. Data flows over optical fiber networks at substation sites where possible. But last-mile optical fiber isn't always available—and can't be economically justified—through some areas of Dominion's territory, like the mountainous terrain in the west.

SOLUTION

Dominion's solution: Use cellular 4G LTE modems to connect with DFRs, TWS, power relays, and substation clocks, for real-time responses to emergency events and data analysis afterwards. For continuously streaming data and large data sets, Dominion recommends a faster 5G wireless network. This captures data and achieves the low latency needed for testing synchrophasor systems. To maximize bandwidth requirements for telecom utility circuits at substations, the team explored vendor upgrades to 100 MB and integrated its control center to a Software-Defined Wide Area Network (SDWAN).

RESULT

With the new solution, Dominion is now able to access field measurements and verify equipment status without sending technicians on site. Dominion discovered that cellular modems are often a cheaper solution than installing new fiber for smaller bandwidth, low-data applications. What's more, the low-cost model of cellular modems enables multiple modems and networks within the same site—effectively making bandwidth extensible and giving multiple groups the ability to independently manage their own traffic.

Wireless Maturity for Connectivity Access

This score assesses the availability of wireless networks and systems for electric, water, and natural gas services. Wireless networks provide the backbone

of smart utilities operations, enabling smart grids, remote monitoring, integrated troubleshooting and repair systems, and more.

Connectivity access in Chicago:

Improving services with a multipurpose network

SCENARIO

Smart cities start with smart buildings. To create a more efficient environment for people to live, work and play, Chicago has embraced this concept head-on, seeking out public-private wireless partnerships to digitize operations, streamline transportation and enhance live events at key locations and attractions—connecting the Windy City from the inside out.

SOLUTION

The city launched hyperconnected, converged wireless networks from Boingo Wireless at high-traffic venues: Chicago O'Hare International Airport, Midway International Airport and Soldier Field, home of the NFL's Chicago Bears and the MLS Chicago Fire FC, as well as the Donald E. Stephens Convention Center and the 50-story One North Wacker building. The end-to-end networks feature 5G over millimeter wave and Wi-Fi. In addition, private LTE, powered by CBRS 3.5 GHz spectrum, offers the city more coverage and capacity, has strong network security and is scalable for private 5G connectivity.

RESULT

By consolidating segregated networking solutions, Chicago can realize cost savings. Meanwhile, converged networks, a mobile edge computing architecture and a strong public-private partnership with Boingo enables the city to reduce traffic congestion, improve safety and enhance the civilian experience. Now and after COVID-19, the converged networks can support capabilities like biometric sensing, thermal screening and touchless experiences like contactless entry and concessions, giving large venues the foundation to create healthier and safer environments. The private LTE and private 5G connectivity also offer the potential to:

- + Reduce congestion and prevent accidents at airports via IoT sensors that allow traffic conditions to be analyzed in real time
- + Equip stadiums with real-time security through 5G-powered video surveillance systems that use 4K cameras and biometrics devices
- + Help commercial real estate enterprises improve efficiencies and decrease operational costs via private, secure communication

Wireless Maturity for Infrastructure

This score represents the ability of your community's wireless infrastructure to make connections, process traffic, and respond in a timely manner.

Every minute counts when it comes to delivering safe, reliable water and power. Addressing outages is critical to quality of life. Detecting leaks can save millions for a water utility or be a matter of life and death in the case of natural gas services.

Effective response in such scenarios depends on availability and latency. Availability, or uptime, represents a network's ability to make connections, process traffic, and respond to user requests. Latency is the reaction time of a connection, or how quickly a device gets a response after a request has been sent out.

Infrastructure in San Francisco:

EV charging

SCENARIO

San Francisco needed a network of charging stations to serve a growing number of electric vehicles.

SOLUTION

Black & Veatch, whose vehicle-charging infrastructure portfolio includes more than 163 MW of capacity in North America, partnered with San Francisco-based Volta Charging to significantly expand Volta's network of free public charging stations in the city. Black & Veatch assisted with engineering, design and permitting. The partnership worked together to obtain dozens of local government permits, address the needs of businesses where stations are located, and consider variable construction requirements at every physical location.

RESULT

In some cases, new charging stations were brought online in roughly a month. With this project, Volta joins a growing list of industry leaders leveraging Black & Veatch's ability to execute seamlessly on large-scale, geographically dispersed project.

Wireless Maturity for Security

This score represents the wireless communication protocols and physical security measures your community has in place for privacy and security.

While more data and new technologies expand what's possible for water, electricity, and natural gas services,

some innovations can open utilities up to risk. How secure are utility assets from damage or compromise? When collecting data like customer meter or energy usage information, what measures are in place to safeguard privacy? How do investments in wireless security help safeguard utility services?

Security in Syracuse, NY:

Power substation monitoring

SCENARIO

Today over 1.6 million small drones are registered with the Federal Aviation Administration. With this increase in drone activity, having greater awareness of the airspace near critical infrastructure, such as power substations and transmission lines, is key.

SOLUTION

With help from C&S Companies, Hidden Level is deploying a network of sensors to provide real-time location data of drone activity in Syracuse. Sensors installed on rooftops and cell towers collect data so that drone activity can be correlated geographically to power substations and transmission lines. This enables the utility company to understand the density and frequency of drone operations near critical equipment, alert authorities of issues and understand drone activity in the area.

RESULT

Hidden Level's drone project has provided real-time alerts for security and law enforcement teams and generated historical reports for assessing the infrastructure most likely to be affected by drone activity. The local government now has backup data on drone behavior near critical infrastructure, and utility providers who use their own drones for inspections can ensure that no one else is operating in the same airspace at the same time.

Security across the U.S.:

Drone-powered water tank inspections

SCENARIO

Every three to five years, water tanks receive a comprehensive inspection. Inspection teams take the tank out of service and drain the water to examine the interior for structural integrity, sanitation, safety and security. Between these routine inspections, inspectors use cherry pickers or scaffolding to look for corrosion or coating issues. These methods have many drawbacks: tanks taken out of service, billions of gallons of water lost to spillage, multiple trips to the site and safety concerns for inspectors, to name a few.

SOLUTION

AT&T found a solution: using drones and remotely operated vehicles to capture real-time information on water tank integrity. Such secure IoT connectivity, supported by a video analysis platform, could help utilities keep tanks in service, reduce inspection time and avoid unnecessary risk of injury.

RESULT

By reducing operational costs and increasing inspection safety today and collecting valuable data for asset maintenance tomorrow, the connected drone-remote operation vehicle solution offers great potential to help utilities save water, energy, time, and money. If used on 10 percent of water tanks in the United States, the estimated benefits are: + 1 billion gallons of water saved + 2,000 metric tons of CO₂ avoided + \$12 million in inspection costs saved + 300,000 out-of-service hours saved.

Wireless Maturity for Resilience

This score represents the wireless tools and processes you currently have in place to withstand and recover quickly from service disruptions and

outages. Like security, resilience is essential for maintaining safe, dependable water, electric, and natural gas services.

Resiliency across the U.S.:

FirstNet deployable resiliency solutions

SCENARIO

AT&T deployed FirstNet® SatCOLTs (Satellite Cell on Light Trucks) to rural locations to improve first responder and critical worker connectivity. After large wildfires in 2020, however, fire officials and utilities realized a gap in SatCOLT emergency communications: work crews had difficulty accessing voice and data in more rugged territory. Emergency managers, utility operators, line crews, and contractors needed a smaller, more mobile communications system.

SOLUTION

AT&T responded with the FirstNet® Compact Rapid Deployable (CRD™) and Cell-On-Wheels (COW) products. CRD™ is a pre-configured cell tower that generates an area of FirstNet® Cellular and Wi-Fi coverage virtually anytime and anywhere. It supports voice, LTE, data, and IoT communications for emergency response, local citizens, and community engagement.

RESULT

When deployed, the CRD™ becomes operational in just seven minutes. The COW can be deployed by a single person within minutes wherever it is needed and can be transported with a standard Class 2 hitch or by helicopter.

Wireless Maturity for Equity

This score represents the wireless tools, provisions, and systems your community has in place right now to support the more equitable delivery of water, wastewater, electricity, and natural gas services.

It also gauges your current ability to ensure the smart utilities solutions you develop will serve your community equitably.

Equity in Montgomery, AL:

Reliability infrastructure for economic development

SCENARIO

Alabama Power, the City of Montgomery, Montgomery County and the Montgomery Area Chamber of Commerce aimed to improve alignment and collaboration on smart community projects.

SOLUTION

The four organizations created the Montgomery Smart Community Alliance and made its first priority increasing the reliability of the electric grid. In the Montgomery Area fiber and reliability project, Alabama Power sectionalized segments of distribution power lines to isolate fault locations and improved crew deployments for troubleshooting scenarios. Alabama Power also provided dark fiber connectivity for buildings at the Montgomery Area Chamber of Commerce and used the same fiber to improve the city's public Wi-Fi network.

RESULT

The Montgomery Area fiber and reliability project increased the overall reliability of the electric grid—reducing outages from unplanned events and weather—while reducing city connectivity costs, enhancing economic development downtown and improving the overall quality of life for residents and visitors alike.

Equity in Denver:

Delivering 5G with dual-use streetlight poles

SCENARIO

As communities roll out 5G nationwide, increasing bandwidth and densifying networks were top priorities in Denver, Colorado. Streetlight infrastructure offered an opportunity for increasing network capacity while also collocating small cells and upgrading the city's lighting.

SOLUTION

To help build Denver's 5G network, Xcel Energy selected the Comptek Technologies' CityPole® smart pole for its modularity, flexibility, and track record of hundreds of seamless installations across the metropolitan area with minimal downtime. With a pole-ordering strategy designed to streamline the process and address deployment and delivery challenges, Comptek deployed, engineered, manufactured, and delivered an integrated pole solution within eight weeks of the order. "We have carefully calibrated with Comptek when the orders are issued, and when the poles are fabricated and delivered to our contractor's bucket," said Tony DiCamillo, small cell project manager for Xcel Energy. "As a result, our contractor is installing between twenty-four and thirty poles per week, which is notable and unheard of." Xcel Energy and Comptek also communicated with city leaders and residents to address deployment questions or concerns.

RESULT

Xcel Energy has deployed more than 150 dual-use streetlight poles in 2019, an additional 350 in 2020, and over 620 in 2021. The project has expanded statewide to municipalities including Aurora, Boulder, and Grand Junction.

"We couldn't be more pleased with this project and that we were able to deliver a best-in-class, dual-use streetlight product. We're proud of this project's success,"

Said Ed Bieging, Vice President of Utility Relations,
Aero Wireless Group.

Now It's Your Turn

Take the Wireless Maturity Model assessment to gauge your own utility's maturity and how it measures up to what's available in the marketplace today.



Securing Connectivity

A robust, scalable network is only as reliable as its ability to withstand security threats. With more devices and data points connected than ever before, ensuring the integrity and safety of the network becomes a critical priority.

As utilities mature their connected infrastructure, the next vital step is securing that connectivity.

Protecting against cyber threats is just the beginning. Utilities must also ensure that sensitive data remains safe, networks are resilient, and operational continuity is maintained. And to truly ensure long-term resilience and trust, they must adopt a common baseline of cybersecurity standards.

In practice, this involves:

- + Trusted, secure device provisioning protocols and processes
- + Tactics, including certification, utilities can use to improve cybersecurity for private networks
- + Ericsson's CTIA Certified Authorized Test Lab and the benefits of the IoT Network Certified for Smart Connected Infrastructure™ program
- + The impact a cyber trust mark could make for both enhancing security and helping utilities demonstrate their commitment to protecting system integrity and maintaining public trust

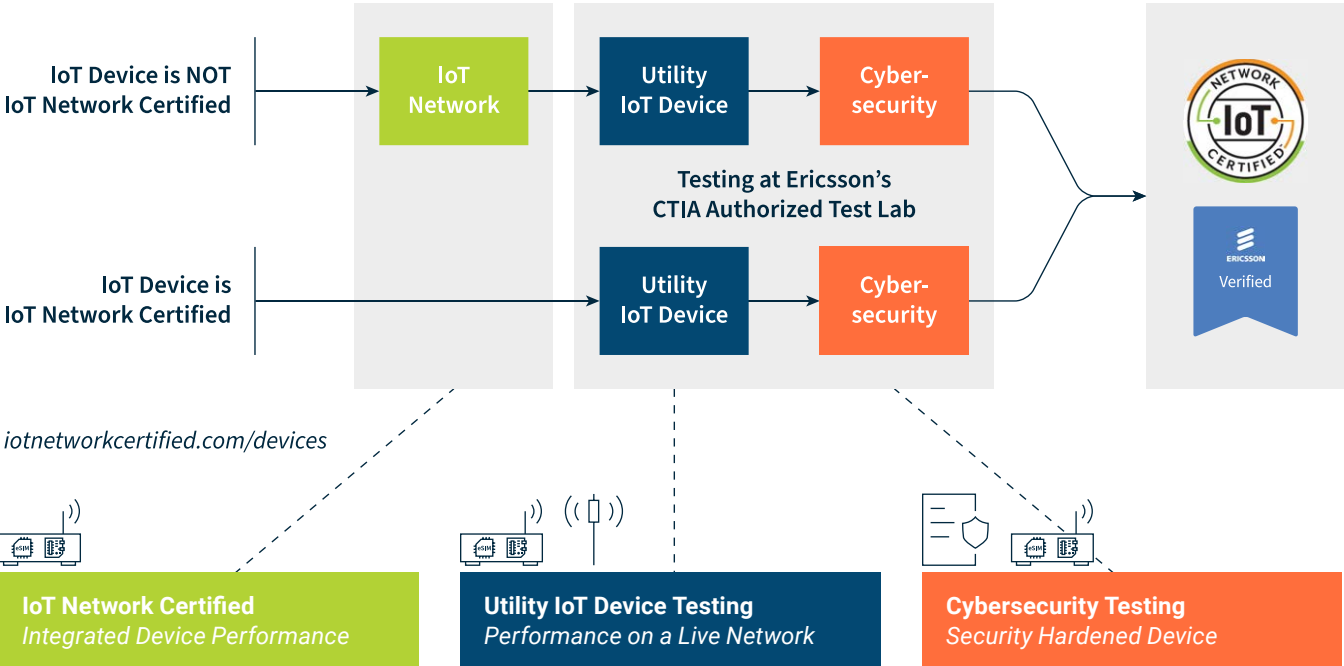
By setting the standard for devices, test labs, technicians, and repair facilities, certification programs play a crucial role in advancing the wireless industry. As more and more utilities worldwide pursue connected IoT projects and connected infrastructure, these programs ensure that devices are standardized, interoperable, and trusted, for both the companies manufacturing them and the organizations procuring and deploying them.

The CTIA IoT Cybersecurity Certification Test Plan

The CTIA IoT Cybersecurity Certification Test Plan, an integral part of utility IoT device certification, protects consumers and wireless infrastructure while also creating

a more secure foundation for smart cities, connected cars, and other IoT applications. It draws from widely recognized NIST (National Institute of Standards and technology) and ETSI (European Telecommunications Standards Institute) security standards.

Device-Testing Scenarios and Paths to IoT Network Certified for Smart Connected Infrastructure™



Refer to these helpful industry resources before your next deployment:

- + When choosing devices for utility network deployment, check the Certified Devices Directory to see which devices have been certified.
- + Explore the CTIA Certification Utility IoT Device Test Plan, which details CTIA Certification Program test requirements specific to utility IoT devices.
- + Explore the CTIA IoT Cybersecurity Certification Test Plan, which establishes an industry baseline for device security on wireless networks.
- + Ericsson's CTIA Certification Authorized Test Lab supports the Utility IoT Device Test Plan and the IoT Cybersecurity Test Plan.

Other things to consider include full end-to-end security to protect information, infrastructure, users, and devices from threats and authorization protocols for maintaining data integrity and confidentiality. Healthy cybersecurity practices leverage robust controls to avoid congestion and effectively prioritize data according to your mission and needs.

The IoT Network Certified™ Program

What safeguards should a utility keep in mind when deploying devices over LTE, and what new practices are needed for 5G?

In a constantly evolving universe of technologies, threats and cybersecurity considerations, certification programs can help utilities narrow down their research, to ensure their critical infrastructure is protected by industry best practices.

One example of such a program is IoT Network Certified,™ the baseline certification for IoT devices operating on cellular networks. Drawing on proven standards and specifically crafted for the needs of these devices, it is the first program of its kind for verifying the readiness of devices to connect to cellular IoT networks. The program provides a simple and affordable pathway for devices to demonstrate compliance with network operator requirements.

By designing around a precertified wireless module, manufacturers can take advantage of the rigorous testing and certification already done on that module. Additional testing is therefore minimal and consists of checking module integration within the device and its RF performance.

The IoT Network Certified for Smart Connected Infrastructure™ Program

The IoT Network Certified for Smart Connected Infrastructure™ program builds upon the baseline certification and incorporates additional utility IoT device and cybersecurity testing, which are key to bolstering the robust and secure critical infrastructure network demanded by utilities and device vendors.

Utility IoT device testing:

- + Ensures successful deployment of the device on the cellular network frequencies used by the utility
- + Accelerates acceptance by a utility by testing the device on commercial network infrastructure
- + Can identify issues that may not be found on an instrument-based simulation testbed

Cybersecurity testing:

- + Minimizes potential for disruption, intrusion, or data theft
- + Assures utilities of device data security through robust pre-testing
- + Accelerates the deployment process, as devices that have undergone rigorous security testing may be accepted faster by utility's cybersecurity team

CTIA Certification developed this program together with Ericsson's Device and Application Verification Services (EDAVS) team, a leading technology partner for the utility industry in mission-critical LTE networks across the globe.

Developed specifically for utilities with a growing number of cellular-connected IoT devices, the IoT Network Certified for Smart Connected Infrastructure program addresses the increasing demand for advanced IoT deployments by creating a set of standards to ensure the security and reliability of these devices.

Many use cases require broadband IoT connectivity, which is typically provided by Cat 1, Cat 4, or higher category LTE modems. These modems are either embedded directly into a utility grid device or integrated into an LTE gateway router connected via ethernet to multiple utility grid devices. Other use cases can be served by LPWA technologies such as NB-IoT and LTE-M. These use cases typically involve low-cost devices with long battery life, devices deployed in massive numbers, and very low data usage. The certification test scope can be selected based on device type and intended use (e.g., sensor, meter, camera, etc.).

With grid modernization programs leading utility innovation, cellular-enabled IoT devices and apps are increasingly common. The IoT Network Certified for Smart Connected Infrastructure program establishes the industry benchmark for these interconnected products as utilities increasingly demand third-party validation of network compatibility.

Multiple benefits for utilities and manufacturers

Speed: The IoT Network Certified for Smart Connected Infrastructure certification process is rapid, so device vendors and utility companies do not have to wait extended periods of time to ensure their mission-critical devices and networks are equipped for live network deployments.

Cybersecurity: By utilizing the IoT Network Certified for Smart Connected Infrastructure program, device manufacturers can verify that a device can operate successfully on critical infrastructure and present certified devices to utility service providers. Testing is rigorous and conducted by a CTIA Certification Authorized Test Lab.

Comprehensiveness: Advanced network testing includes scopes such as Fixed Broadband LTE, LTE-M, and NB-IoT. Cost-effectiveness: Because utility device

testing occurs at the 4G/5G Ericsson test lab and is operated by Ericsson engineers and employees, device vendors and manufacturers can consolidate testing and streamline costs.

To get a device IoT Network Certified for Smart Connected Infrastructure:

1. **Save time** by designing the device around one of the many modules already [certified for IoT applications](#).
2. **Verify** whether your device requires any additional operator-specific testing for your target markets.
3. **Comply** with government regulations in target markets.
4. **Begin** the certification process by submitting a request to the CTIA Certification database. Here you will select an authorized test lab to determine the testing appropriate for your device, coordinate the testing, and provide the test results.
5. **Pay** the certification fee and lab testing fee.
6. **Receive confirmation** of certification from CTIA once all requirements are met. You can then download the IoT Network Certified logo and certificate.

The U.S. Cyber Trust Mark

Just as the ENERGYSTAR logo became universally recognized for energy efficiency, the FCC's [Cyber Trust Mark](#) program aims to provide a similar "stamp of approval" for wireless consumer IoT products.

By qualifying approved IoT devices based on robust cybersecurity standards, this voluntary public-private program aims to help consumers make informed decisions about the products they bring into their homes, will differentiate trustworthy products in the marketplace, and create incentives for manufacturers to meet higher cybersecurity standards.

To bear the [U.S. Cyber Trust Mark logo](#), a manufacturer must have its product tested by an accredited and FCC-recognized CyberLAB. The logo will be accompanied by

IoT Best Practices Roundup

The next step in the deployment process is adopting IoT best practices to maximize the efficiency and effectiveness of connected utility systems. Five top trends and tips follow for helping utilities address potential challenges, streamline operations, and unlock the full potential of connected infrastructure.

① **eSIMs/GSMA SGP.32**

eSIM IoT technical specifications: It's important to understand what embedded Universal Integrated Circuit Cards (eUICC) are, what this new standard means for utilities, and best practices for navigating it all.

② **Best practices for SIM management**

These include proactively monitoring and streamlining SIM deployments to ensure compatibility with evolving network standards.

③ **Putting 4G & 5G wireless networks to work**

When navigating and reconciling emerging use cases and technologies with a 4G or 5G network, how do you know which pairs well? How are organizations like [water utilities](#) applying networks with advanced technologies and goals?

④ **Compliance and industry collaboration**

As industry consortiums and proactive certification opportunities continue to emerge, what considerations should you keep in mind when evaluating next steps for compliance and collaboration?

⑤ **Monitoring and understanding the network experience**

Consistent connectivity is critical for modern technologies like security cameras and connected vehicles. It's important to know how to use data like RF readings to gain insights into network performance and ensure assets and teams stay connected.

We hope you find these resources helpful!

Many thanks to CTIA Smart Cities member companies for their contributions.

If you have questions or need more information, please contact the CTIA Smart Cities Team at smartcities@ctia.org or visit Town Square at smartcities.ctia.org to view these resources and more online!

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