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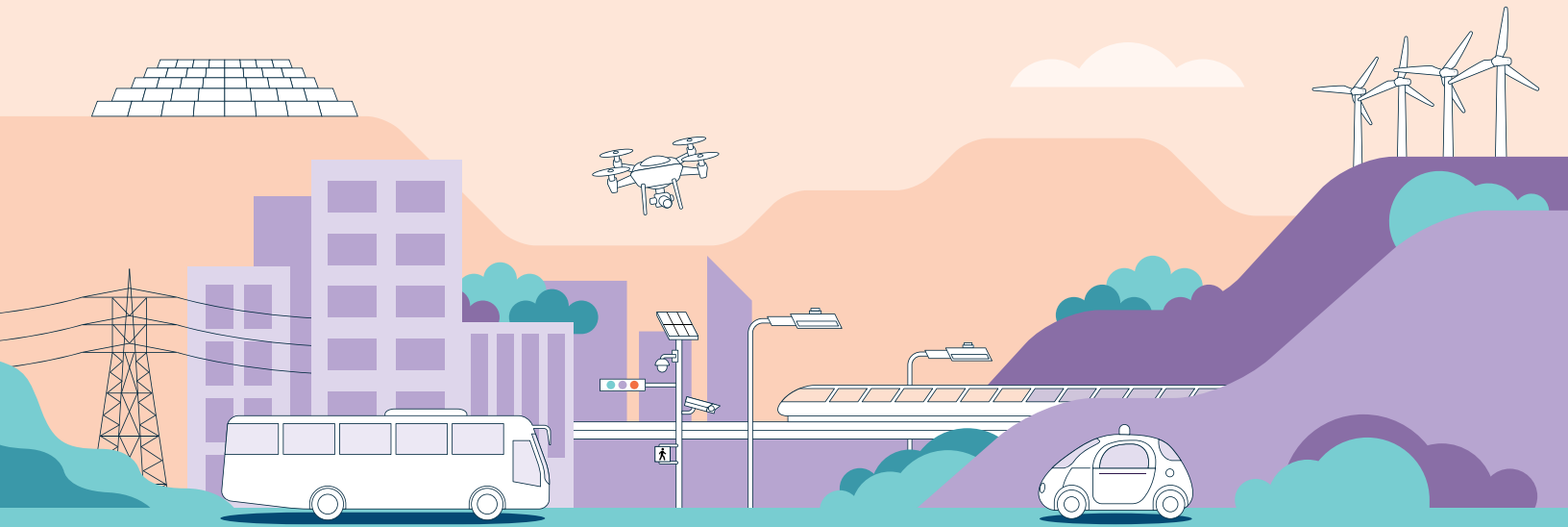
Connected Community Deployments: From Strategy to Reality

Your workshop discussion guide



A message from the CTIA Smart Cities Team

Congratulations on taking the next step in your journey to smart public services, connected utilities, and smart transportation solutions.

We're here to help. This workbook contains resources our team and member companies have created and compiled as a great starting point, including highlights from our Wireless Maturity Model assessment tool, an introduction to CTIA Certification™, real-world examples and helpful resources for connected community deployments, from initial strategies to RFPs.

We trust you find this useful for gaining insight into "wireless readiness" for these projects, guidance into the certification process (and why it's so important), and a picture of what's possible. Please don't hesitate to reach out to us with any questions, or if we can be of assistance.

Looking forward to working together, connecting solution strategies with deployment realities.

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More Helpful Resources at Town Square

Visit smartcities.ctia.org for even more resources and guidance, including our collaborative, educational series of Playbooks.

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 cities 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.

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Assessing Wireless Readiness

Which smart public services or transportation management solutions could you deploy to help residents? How could you use connected utilities to better serve customers?

CTIA Wireless Maturity Model

One big challenge in turning connected community visions into reality is knowing where to start, particularly in terms of wireless services and technology.

The CTIA Wireless Maturity Model is here to help, yielding insight into the status quo and where to focus next. Compiled by wireless technology experts and based on data from smart cities projects nationwide, it takes a look at:

+ Wireless technologies and systems currently in place
+ The infrastructure and deployments needed to move forward
+ 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
+ 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 it works

The CTIA Wireless Maturity Model involves two steps. First, you and your colleagues will go online to a detailed questionnaire to answer multiple-choice questions related to six key wireless capability areas: data communications, connectivity access, infrastructure, resilience, security, and equity.

Then you'll receive a roadmap for moving forward that includes:

+ A Wireless Maturity Assessment Report that includes a score of "Yesterday," "Today," or "Tomorrow" for overall wireless maturity and similar scores for key wireless elements
+ An in-depth and unique review of the focus areas, your answers, and your scores
+ Best-practice examples of how other communities are deploying advanced solutions

Read on for excerpts and examples for public services, transportation, and utilities.

PUBLIC SERVICES

Public service leaders across the United States are using wireless connectivity to take their smart public services to next level. Wayfinding apps, real-time weather and safety alerts, and immersive learning experiences are just a few examples of how communities are leveraging cellular connectivity to improve the quality of life for their citizens.

The CTIA Wireless Maturity Model helps communities find their path to these solutions by assessing a community's wireless maturity for:

+ Solid waste and recycling
+ Emergency response
+ Parks and recreational and community meeting spaces
+ Public buildings and venues
+ Public education
+ Smart poles and lights
+ Civic engagement

Here's one question evaluating a community's wireless infrastructure for emergency response services.

What communication infrastructure is in place to support emergency response?

- ☐ The locality has minimal wireless connectivity. Emergency callers place 911 calls in response centers using wireline and wireless telephony.
- ☐ The locality supports a mix of wireline and cellular connectivity for 911 calls.
- ☐ 4G LTE-A, 5G, and other high-speed wireless networks deliver rich data from sensors and other sources to inform and support emergency response.
- ☐ Not applicable

Use Case Examples:

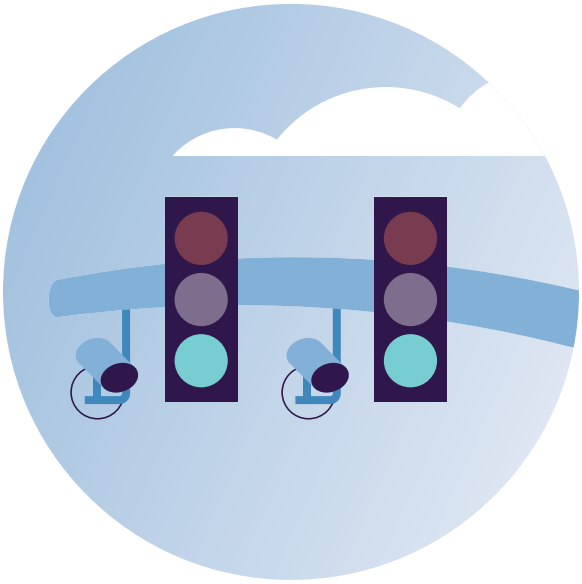
TrafficLink
Detroit, MI

Challenged by aging technology and funding constraints, the city of Detroit lacked modern traffic monitoring tools.

Traffic management teams didn't know when traffic signals were out, for example, which caused traffic congestion and potentially dangerous traffic conditions.

Sometimes it could take up to eight hours to resolve a situation. The city also worried about emergency vehicles being able to arrive swiftly to the scene during a signal outage.

Read about the solution, and results, on pg. 38.



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UTILITIES

Utilities in communities big and small are leveraging wireless connectivity to take their lighting, water, and electric solutions to next level. To assess where more knowledge or expert collaboration might be needed to deploy these solutions, the CTIA Wireless Maturity Model assesses wireless maturity in the areas of:

+ Electricity
+ Natural gas
+ Water and wastewater

Here's one question related to resiliency.

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 order and dispatch processes—to minimize disruptions and to shorten time to recovery. DA systems perform automated switching to isolate faults and restore service to the maximum number of customers.
- ☐ Not applicable

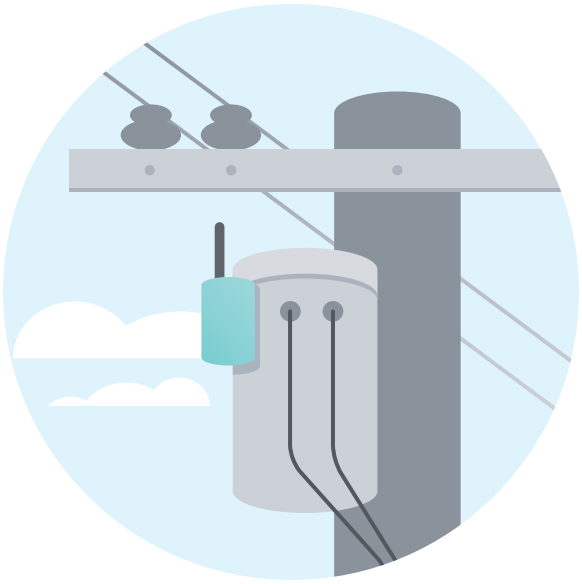
Use Case Examples:

Getting Ahead of Distribution Transformer Damage and Repairs South Florida

With high lightning and storm activity putting equipment like circuits and transformers at risk, Florida Power & Light (FP&L) operates in one of the most challenging environments in the country.

How could the utility more effectively spot problems, conduct repairs, and make its grid more resilient—without spending more on operations and maintenance?

Read about the solution, and results, on pg. 30.



TRANSPORTATION

Transportation departments are using advanced wireless connectivity and solutions to manage fleets, help first responders communicate more quickly and effectively, and power intelligent traffic management systems and smart parking solutions.

To help transit agencies understand their ability to scale, respond, and communicate through advanced wireless deployments, the CTIA Wireless Maturity Model assesses wireless maturity in the areas of:

+ Traffic lights and management
+ Parking
+ Micromobility
+ Public transportation

Here's one question related to data communication.

How is wireless data communication used to support intelligent traffic systems (ITS) and intersection signals?

- ☐ Signal control, phase, and timing is manually set or programmed to a specific single intersection or group of intersections. Minimal wireless data communication is utilized to manage and monitor signal controllers.
- ☐ Signal controllers utilize wireless data communication to support some programming remotely. Operators manually monitor controllers and systems across the network and can respond to basic alert notifications.
- ☐ Data from intelligent IoT sensors onboard vehicles communicate across wireless networks to signal control, phase, and timing dynamically based on real-time conditions. Analytics interpret data for reporting and decision-making.
- ☐ Not applicable

Use Case Examples:

Improving Safety with V2X Technology
Utah Department of Transportation

The Utah Department of Transportation (UDOT) has long believed in the potential of digital technologies like vehicle-to-everything (V2X) solutions to radically improve transportation safety and help the state achieve its "Zero Fatalities" mission on its roadways.

V2X technology enables vehicles to communicate in real time with each other, roadside infrastructure, and other travelers like pedestrians and bicyclists.

Users of V2X solutions leverage data collected, analyzed, and processed in the cloud to better understand roadway activities in real time, so they can deploy responders to incidents within seconds and transmit safety alerts directly into connected vehicles, preventing crashes altogether.

Read about the solution, and results, on pg. 41.

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Take the next step.

Now it’s your turn. Discover your own unique wireless maturity score by scanning the QR code to access the online assessment.

Certification

Learn about industry certification programs and why they're so important for connected community deployments.

Since 1991, CTIA Certification™ programs have set the standard for devices, test labs, technicians, and repair facilities and played a crucial role in advancing the wireless industry.

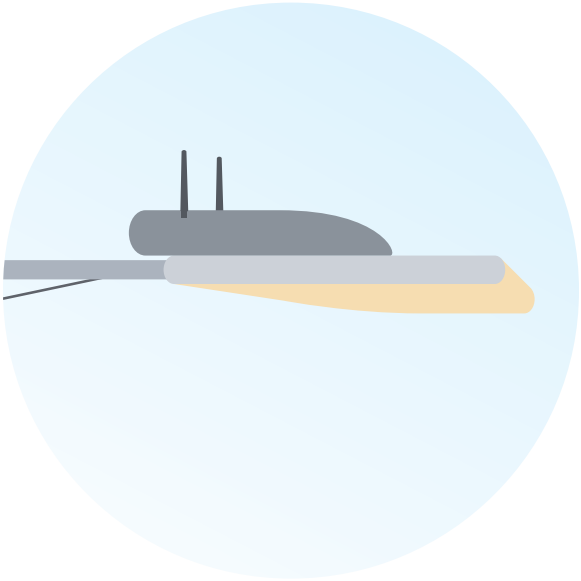
These world-class programs, standards, and best practices are developed and maintained by the 100-plus companies throughout the wireless industry who participate in CTIA Certification Program Working Groups. Devices are tested to conformance, interoperability, and performance standards at over 100 third-party Authorized Test Labs around the world.

We continuously customize our certification programs to address the needs of sectors who use connected infrastructure. As this growth continues, it's vital to ensure trusted devices for both the companies manufacturing them and for those procuring them.

The IoT Network Certified™ Program

IoT Network Certified™ is 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 pre-certified 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 incorporates additional IoT device and cybersecurity testing, which are key to bolstering the robust and secure critical infrastructure network demanded by communities and device vendors.

IoT device testing:

+ Ensures successful deployment of the device on a cellular network
+ Accelerates acceptance 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 device data security through robust pre-testing
+ Accelerates the deployment process, as devices that have undergone rigorous security testing may be accepted faster by a community's cybersecurity team

CTIA Certification developed this program together with Ericsson's Device and Application Verification Services (EDAVS) team. 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.

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In the utility sector, for example, 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, NB-IoT, and LTE-M radio technologies. 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 manufacturers and communities

Speed: The IoT Network Certified for Smart Connected Infrastructure certification process is rapid, so device vendors and communities 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 offer certified devices. 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 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.

Next Steps & Resources

Standards-based cybersecurity testing should be an ongoing priority for any network being used: private or commercial 4G LTE, 5G, and beyond.

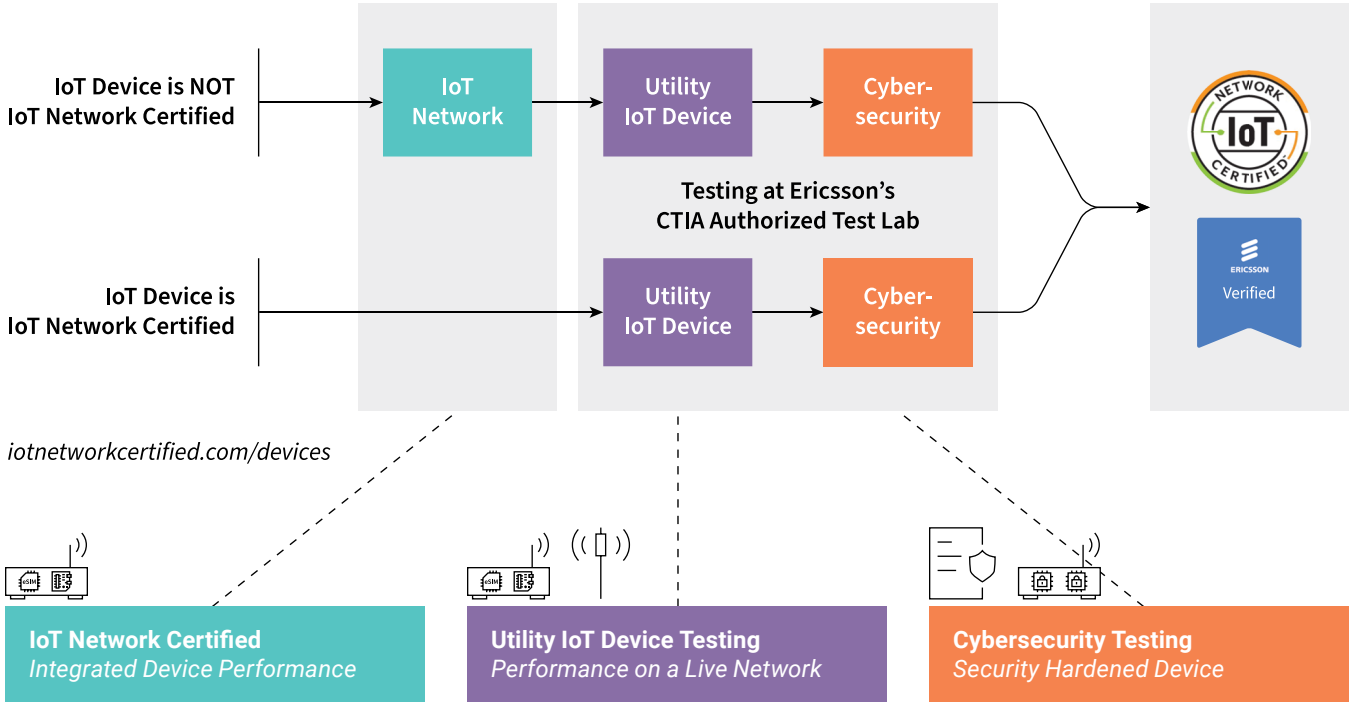
The CTIA IoT Cybersecurity Certification Test Plan, an integral part of IoT device certification, protects consumers and wireless infrastructure while also creating a more secure foundation for smart cities, connected cars, and other IoT applications. It draws from widely recognized NIST (National Institute of Standards and technology) and ETSI (European Telecommunications Standards Institute) security standards.

Refer to these helpful industry resources before your next deployment:

+ When choosing devices for 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.

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



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A cybersecurity blueprint

When implementing cybersecurity protocols and working toward cybersecurity goals, consider a cybersecurity blueprint with the following elements:

1. **Both defense-in-depth and Zero Trust security:** Traditional defense in depth security protects the internal network and perimeter. Zero Trust security augments and complements it by building security into all components: users, devices, applications, data, and the network itself.

2. **Traffic separation and asset isolation:** Separating different traffic types, like Operations Administration and Maintenance (OAM) and Radio Access Network (RAN), enables protection of more sensitive traffic with more stringent security policies and security levels. Security gateways and firewalls play an important role in traffic separation, as do the virtual routers in the cellular core.

3. **Encryption to protect data in transit and at rest:** Use methods such as Advanced Encryption Standard (AES), Transport Layer Security (TLS), Internet Protocol Security (IPsec), and Datagram Transport Layer Security (DTLS) to protect nodes and control plane traffic and the user plane payload. The network's externally facing Surface Gateway interface (SGi) will require a firewall to give the user plane advanced security. Make sure mobile devices only talk with required applications.

4. **Holistic security management:** This is essential to ensure network security and privacy from end to end, especially as connected community deployments increasingly involve virtualization, automation, and the Internet of Things. Be sure to encrypt all protocols.

5. **An identity and access management system:** Use access controls, identity administration, and user provisioning to authenticate and authorize network users and roles.

6. **System-verified network security:** As security threats and attacks escalate, it's important to strengthen the protection of critical network assets, services, and data in transit and be prepared to mitigate risk for each network area potentially under attack. Ensure quick, effective action by testing these solutions in a range of scenarios.

7. **Secure solutions and operations:** CTIA recommends aligning security blueprints with the specifications of the Third-Generation Partnership Project (3GPP), which unites seven telecommunications standards development organizations and has policies and procedures in place for secure equipment, deployment, and management.

8. **Supply chain security:** Leverage best-in-class practices to comply with governmental and customer requirements and maintain trust in an evolving geopolitical landscape.

Performance Metrics for Cellular IoT devices

	LPWA 4G		
	NB-IoT	**LTE-M**	**Broadband 4G**
Battery Life	Up to 10 years	Up to 10 years	Use case dependent
Uplink Peak Throughout/UE	~151 kbps	~1,119 kbps	UE category dependent
Downlink Peak Throughout/UE	~118 kbps	~500 kbps	UE category dependent
Cell Range	Up to 120 km	Up to 100 km	Up to 200 km

Use Cases: Previewing What's Possible

Read on for examples of connected community deployments in action, powered by wireless technologies and cellular networks. They're just a sample from our extensive collection—you can find even more at smartcities.ctia.org.

Radar Technology for Smart Waste Management

New Orleans, LA

SCENARIO

The New Orleans sanitation department was doing admirable work collecting refuse for residents, businesses and hundreds of thousands of tourists. Yet trash remained an issue for the city—particularly illegal dumping.

SOLUTION

As part of the mayor's CleanUpNOLA initiative, the sanitation department installed HDTV-resolution cameras, integrated with radar detectors, at locations identified to be chronic illegal dumping sites.

The system identifies illegal dumping activity and automatically tracks the vehicle or person that has triggered an alert. When they're not detecting sanitation crime, the cameras augment video monitoring managed by the New Orleans Office of Homeland Security and Emergency Preparedness at the city's Real-Time Crime Center.

RESULTS

Video evidence helps the city collect hefty fines from illegal dumping activity, and the system's radar detection technology gives the sanitation department the ability to use cameras more flexibly, doubling the city's return on investment.

The SDG&E Weather Awareness System

San Diego, CA

SCENARIO

San Diego Gas & Electric (SDG&E) hired its first meteorologist in 2009 and created the first weather utility network in the world to proactively respond to dangerous weather conditions and identify high-risk areas in its infrastructure.

SOLUTION

In California, this quest begins with wind, temperature and humidity data. SDG&E deployed 200 weather stations across the San Diego region to capture this information. Connected via wireless networks, these stations capture real-time data every 30 seconds.

The SDG&E Weather Awareness System consolidates sensor data into a user-friendly, one-stop online map and dashboard. Meanwhile, the system sends 200 gigabytes of data to a supercomputer center every day for any researcher in the world to access.

RESULTS

Through these wireless-enabled weather stations, SDG&E gleaned several valuable insights—that the Santa Ana winds originate around specific slopes, for example—and was able to outfit high-risk areas with grid management infrastructure to “power down” during extreme weather events.

In addition to making the utility’s infrastructure more resilient, data from the network has helped SDG&E develop weather models to forecast fires and predict extreme weather.

Finally, the Weather Awareness System has helped SDG&E bring community outreach online during the COVID-19 pandemic. In fact, the utility has been able to reach even more people with valuable information on everything from storm safety to keeping cool during rising temperatures.

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Mobile Security Solutions

Atlanta, GA

SCENARIO

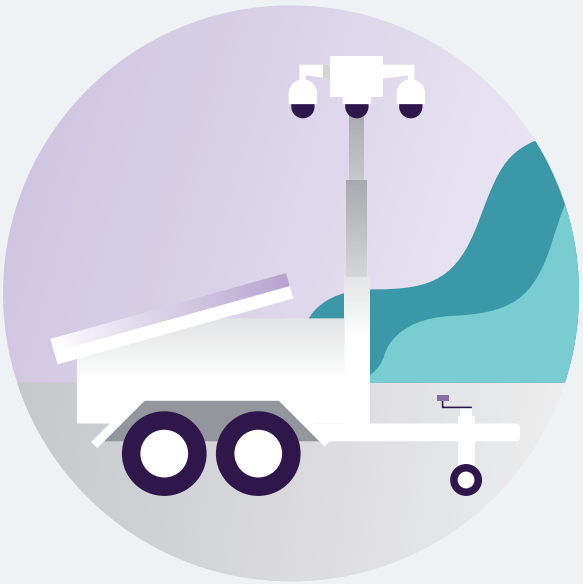
Atlanta is a global epicenter of culture, sports and business. To monitor safety at its growing roster of parades, concerts, championships and industry conferences, the city needed to supplement its extensive public-private network of cameras with mobile security assets.

SOLUTION

The Atlanta Police Foundation partnered with Compass Security Solutions to procure “surveillance trailers” outfitted with cameras, audio and analytics from Axis Communications and its partners. These mobile assets are designed for quick relocation and set-up, with batteries and solar panels that let them operate for up to five days without power infrastructure. Data communications via an LTE router allow for complete stand-alone functionality.

RESULTS

Surveillance trailers have supported public safety at multiple large gatherings, from regional cultural festivals to high-visibility college and professional sporting events with international dignitaries and celebrities. They also have made neighborhoods safer, as public safety teams move the wirelessly connected mobile assets to areas with spiking crime and violence.



Outdoor Lighting Team “Breaks the Mold”

North Carolina

SCENARIO

To build out 5G small cell infrastructure for today’s mobile devices, smart tablets, and Internet of Things (IoT), wireless providers have specific requirements for where their network devices can be located to provide maximum coverage while remaining cost-effective. In one North Carolina city, maximizing connectivity was a top priority.

SOLUTION

Streetlights presented an efficient and aesthetically pleasing solution. To leverage this infrastructure for 5G rollout, Duke Energy partnered with wireless providers to develop an integrated pole.

“We showed that Duke Energy is not only sensitive to customers and their needs but can also provide immense value in areas outside of the historical core offerings of a utility,” said Duke Energy Director of Outdoor Lighting Jim Cowling.

The Outdoor Lighting team, led by Jim Edmonds, worked with the wireless providers to identify pole locations for maximum coverage and cost effectiveness.

RESULTS

Today, over 1,600 integrated small cell poles provide enhanced wireless service for residents and visitors.

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Accessibility App

Springfield, IL

SCENARIO

The city needed better navigation options for people with visual impairments.

SOLUTION

The city commissioned Sensible Innovations to deploy a network for the AWARE mobile app, an audible wayfinding tool. Sensible Innovations worked with certified orientation and mobility specialists to map street corners, create detailed descriptions of street crossings and street blocks, and facilitate easy navigation between historic sites.

The project uses wireless beacons (iBeacons) to provide detailed, real-time walking directions and audible descriptions of downtown destinations. The iBeacons use Bluetooth low-energy technology to send location information from street corners and intermediate locations to the wireless device of the user walking down the street. This constant communication lets AWARE app users orient themselves in relation to their desired destination. Unlike many other similar tools, AWARE app delivers data on downtown facilities: opening and closing times, current exhibits, details about the cost of a ticket and layout description.

RESULTS

As AWARE app users explore the streets of downtown Springfield, they hear details about roads, intersections, historical sites and businesses around them as they walk, negating the need to memorize routes and landmarks and encouraging more confident, independent exploration of the city.

Increasing Accessibility at Southern Oregon University

Ashland, OR

SCENARIO

Southern Oregon University (SOU) sought an inclusive, accessible, and scalable way to provide audible navigation assistance to students, employees, and visitors with sight impairments.

SOLUTION

SOU partnered with Sensible Innovations to install Aware™, a campus-wide wayfinding system. Sensible Innovations worked with SOU to map the campus, install 300 strategically placed proximity sensors, and train authorized staff on how to use the administrative portal.

Through Aware™, users receive audible announcements of rooms, landmarks, and services along the way. The app also notifies users about safety alerts, construction updates, classroom changes, and class cancellations.

RESULTS

By delivering real-time information about campus surroundings, Aware™ helps members of the SOU community who are visually impaired achieve greater independence and inclusion and enjoy a more complete, enriched campus experience. SOU has been able to scale Aware with additional proximity sensors and continual updates of information and descriptions.

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SmartBlockPHL

Philadelphia, PA

SCENARIO

The City of Philadelphia sought to make better-informed decisions in high-traffic areas, improving safety for residents, vehicles, and businesses.

SOLUTION

As part of the SmartCityPHL Roadmap initiative, the City, Comcast, and US Ignite created the SmartBlockPHL innovation corridor. For the corridor, teams installed retrofitted luminaries and sensors onto streetlights to monitor pedestrian and roadway traffic, environmental health conditions, and parking use.

A Comcast 1 Gbps EDI circuit connects streetlights to a lighting management solution, and a smart cities platform collects data. Completely anonymized data is processed on the edge, then displayed for city officials on an interactive dashboard.

RESULTS

SmartBlockPHL enables Philadelphia's city leaders to understand the day-to-day realities of high traffic areas and address a wide range of quality-of-life and safety matters. The solution also includes managed Wi-Fi for increased internet access.

Getting Ahead of Distribution Transformer Damage and Repairs

South Florida

SCENARIO

With high lightning and storm activity putting equipment like circuits and transformers at risk, Florida Power & Light (FP&L) operates in one of the most challenging environments in the country. How could the utility more effectively spot problems, conduct repairs, and make its grid more resilient—without spending more on operations and maintenance?

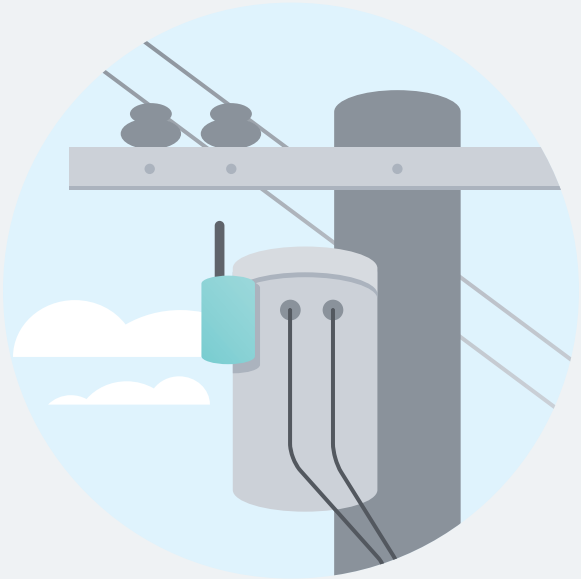
SOLUTION

The answer: retrofitting transformers with new technology to monitor their condition in real time. This gives FP&L the ability to proactively address circuit-level electrical issues driving many maintenance and repair tickets.

FP&L partnered with Ubicquia to develop GPS-equipped wireless sensors. Mounted onto existing pole and pad-mounted distribution transformers, these sensors report location, electrical and mechanical information, and oil pressure and temperature readings every few minutes via an LTE network, providing immediate alerts when a threshold is breached.

RESULTS

Data from the 5,000-plus sensors FP&L has installed to date has provided much insight into both distressed transformers and the root causes of transformer failure. The sensors show true transformer utilization and load on specific parts of the grid. They also notify the utility of actual voltages and the current delivered to customers, to verify that both are within proper limits.



Looking ahead, FP&L plans to deploy sensors that measure primary circuit currents and sensors for larger three-phase transformers that serve critical customer loads. The utility is also working with Ubicquia to create alarms for early signs of dielectric breakdown within the transformer in order to identify damaged transformers needing replacement before they fall and cause customer outages.

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Remote Monitoring that Reduces Leaks and CO2 Emissions

Nationwide

SCENARIO

More than 2.6 million miles of oil and gas pipelines crisscross the United States. As oil and gas companies transition to less emission-intensive energy sources, they must monitor and maintain these pipes to address safety concerns and limit leaks. In fact, the Pipeline and Hazardous Materials Safety Administration (PHMSA) requires pipeline inspections every two months.

But inspection points are typically five to 10 miles apart, and the actual driving distance between them can be much longer. Even for just a few onsite inspections a day, the hours, fuel costs, GHG emissions, and environmental impact add up.

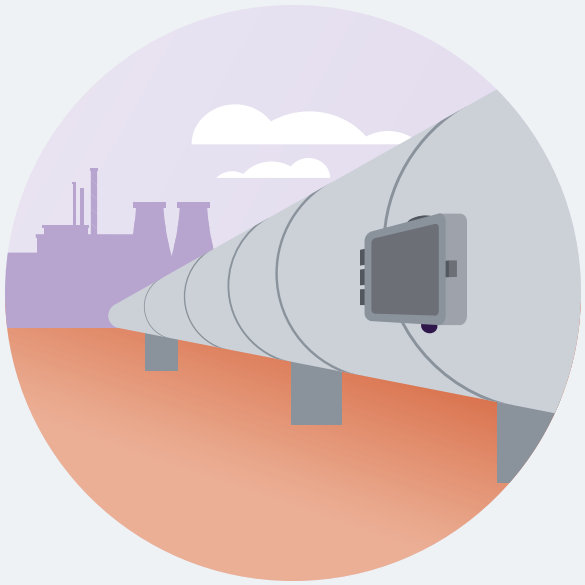
SOLUTION

OmniMetrix has found a more efficient—and energy-efficient—way. This provider of critical asset management services uses an AT&T Internet of Things (IoT) remote monitoring solution to help customers monitor the condition of their steel pipelines. This system both reduces the GHG emissions associated with inspectors driving from site to site and collects detailed, timely information about pipeline health, helping companies reduce leakages.

RESULTS

Across multiple pipeline companies and thousands of sensors, the AT&T IoT solution not only reduced inspection travel time, labor, and fuel costs, remote monitoring shrunk fuel usage by around 22,000 gallons of gas a year—equivalent to almost 200 metric tons of CO2e4.

The solution team noted that it is currently very difficult to collect data on methane emissions, as many factors impact the reduction of these emissions from pipeline infrastructure.



Water Loss Controls

Gainesville, GA

SCENARIO

The Gainesville Department of Water Resources sought to expand the capabilities of its Sensus, a Xylem brand, smart utility network, with a specific focus on water and pressure monitoring to quantify water loss and optimize operations.

SOLUTION

Gainesville started with one district metered area (DMA) in its northern service territory, installing four Sensus Hydroverse™ Insertion flow meters to account for water loss on an hourly basis. The meters work through simply tapping an existing pipeline, without any interruption to the water supply.

Gainesville is also using Xylem/Sensus technology for advanced pressure monitoring, important for both maintaining asset durability and measuring water loss. Sensus ally® water meters and the Sensus® Smart Gateway Sensor Interface with pressure transducers across several service zones. A Sensus FlexNet™ communication network connects smart meters and sensors for all of the above applications.

RESULTS

By quantifying water loss in the first DMA at around twenty-three percent, Gainesville was able to determine that leak detection and other water loss detection methods in that zone made sense.

Meanwhile, advanced pressure monitoring allowed the city to see anomalies within minutes so they could be addressed the same day when possible. For example, when a tie-in at a new water main accidentally created a bypass of a pressure-reducing valve, increasing pressure in the system, monitoring sensors at nearby valves alerted Gainesville to the situation within an hour.

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Starting a Smart Cities Journey with the Zhaga-D4i Industry Standard

New York

SCENARIO

With smart sensors and connected lighting infrastructure, cities and utilities can improve services, safety, and security while benefiting from more efficient planning and operations, significant energy savings, cost reductions, and enhanced potential for sustainability.

Yet engaging with this digital revolution and using IoT data is easier said than done. When and how can utilities and cities opt in, especially smaller ones with fewer resources, like Mount Vernon, New York?

SOLUTION

The Zhaga Consortium created an industry standard to help.

Zhaga D4i enables streetlights to become the backbone of a smart city, for safety, maintenance, public services, sustainability, and data collection. Sensor Ready streetlights leverage the Zhaga D4i standard for a plug-and play-way to extend streetlight infrastructure over cellular networks.

Mount Vernon began its smart cities journey by upgrading its streetlights to 4000 Sensor Ready LED streetlights and connected lighting controls. The city's streetlights were already sensor-ready, which allowed Mount Vernon to install the sensors easily and securely on the luminaires with a simple twist-lock mechanism. The city then added Signify's Zhaga D4i-certified Outdoor Multisensors—which deliver data on motion detection, ambient noise, and temperature—to a subset of the streetlights.

Mount Vernon's solution uses LTE-M technology and a standardized smart interface with industry- recognized LED drivers and outdoor luminaries, cellular controllers and communication nodes, and sensors. In addition:

+ Smart street light control nodes, certified to D4i TypeA for multimaster control capability, work with Type B-certified sensors.

+ Control nodes plug into the NEMA socket, and sensors plug into the Zhaga socket Book 18 interface.

+ When certified nodes and sensors are attached to a luminaire, Mount Vernon can transport the sensor data into the cloud and remotely configure sensing functions.

RESULTS

Smarter street lighting with sensors has helped Mount Vernon “go above and beyond to make our city the best it can be,” according to Mayor Shawyn Patterson Howard. The solution delivers:

+ Noise detection for reinforcing city ordinances
+ Environmental data for city planning and communications related to extreme heat and cold
+ Motion detection to trigger the optimal streetlighting for pedestrians and drivers
+ The ability to easily set lighting schedules for different neighborhoods
+ Data for quick response to outages or other lighting issues

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Improving Services with a Multipurpose Network

Chicago, IL

SCENARIO

Commonwealth Edison (ComEd) had a mandate to improve overall system reliability and several other goals: improve energy efficiency and asset management, give city managers more control over streetlight operations, and deliver new and better services to its customers.

To accomplish all the above, the utility needed multiple smart grid and smart cities services, partnerships across Chicago area municipalities, and a common network that would support it all.

SOLUTION

The Itron multi-purpose IPv6 IIoT network platform offered such intelligent connectivity.

Comprised of RF mesh, cellular, programmable logic controller (PLC), Wi-Fi, and distributed computing intelligence, it would be able to support an open ecosystem of smart utilities solutions.

For ComEd, this included:

+ Centralized streetlight management
+ AMI for delivering customers more choices and lower energy costs
+ Distributed automation for faster fault detection and power restoration

Through this shared network, ComEd has been able to implement a range of smart utilities solutions, from using smart controls to upgrade 140,000 streetlights to LEDs to bringing in a neighboring utility to support gas AMI.

RESULTS

For streetlights alone, increased efficiencies in operations and maintenance and decreased energy costs reduced management costs by 65%, savings ComEd intends to return to customers each year.

Smarter utility services have resulted in less uncollectable debt. Here ComEd was able to reduce these costs by $30 million—126% of its target.

In the critical area of outage management, ComEd was able to avoid millions of customer interruptions and reduce the frequency of these interruptions, lifting its J.D. Power scores for customer satisfaction.

Further, since ComEd began deploying smart grid and advanced metering infrastructure technology in 2012, overall reliability has improved by more than 80%, with customers avoiding more than 19 million interruptions and saving more than $3.3 billion in outage- related costs through YE 2022.

In 2022, ComEd was named the most reliable electric utility in America.

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Net Zero Microgrid

Denver, CO

SCENARIO

With a booming population, the City and County of Denver and Xcel Energy needed new solutions to address the congestion pains and environmental impacts of growth. Specifically, they sought a way to evaluate emerging technologies, model operational and economic benefits, and test out deployments.

SOLUTION

Xcel Energy partnered with Panasonic CityNOW to deploy a net zero microgrid as part of a living lab for smart cities innovation. Peña Station NEXT is a 400-acre, transit-oriented, public-private development located outside Denver International Airport on the A Line light rail.

Stakeholders include the City and County of Denver, Denver International Airport, Xcel Energy, RTD, Colorado Department of Transportation, land developer Fulenwider and Panasonic. The net zero microgrid required 15 separate contracts, underscoring the importance of stakeholder alignment.

Xcel's portion of the investment was funded from R&D funds, and Xcel expects to rate base the assets, or to value the assets toward a specific rate of return, when the initial technology evaluation phase is completed.

The battery in the microgrid supports multiple value streams, including smoothing ramp control and time shifting for integration of solar energy into the grid, peak demand reduction activities, energy arbitrage and frequency regulation.

RESULTS

The microgrid went from concept to completion in 17 months. It features a 1.6 MW solar photovoltaic (PV) canopy above a city-owned parking lot, a 1 MW /2 MWh battery storage system and 259 kW of solar PV on the roof of Panasonic's smart cities headquarters facility. The solar carport currently produces about 5 MWh per day, which makes the development carbon neutral. The solar PV on Panasonic's roof recharges the battery and can maintain operations indefinitely depending on available sunshine when islanded.

TrafficLink

Detroit, MI

SCENARIO

Challenged by aging technology and funding constraints, the city of Detroit lacked modern traffic monitoring tools.

Traffic management teams didn't know when traffic signals were out, for example, which caused traffic congestion and potentially dangerous traffic conditions. Sometimes it could take up to eight hours to resolve a situation. The city also worried about emergency vehicles being able to arrive swiftly to the scene during a signal outage.

SOLUTION

To address these challenges, Detroit implemented a remote traffic management system based on TrafficLink, an intelligent Amazon Web Services (AWS)-based transportation system platform from Miovision.

TrafficLink added connectivity and video-capture capabilities to Detroit's existing traffic signal management system, with AWS technology routing intersection data to other data processing and storage pipelines.

This smart transportation solution lets the operations team easily monitor each intersection and make data-driven decisions that improve traffic. Engineers receive SMS or email alerts about signal problems, such as light outages, timing issues or signal failures. Teams use Miovision Traffic Insights, a web-based analytics suite, to evaluate signals based on real-time data.

RESULTS

Detroit has deployed the new traffic management system at 450 intersections so far and has recently added advanced analytics capabilities to 30 percent of those intersections. The system is already seeing results. For example, Detroit Public Safety used TrafficLink to preempt signals for emergency vehicles and give them a green light. During testing, this improved emergency response times by almost 20 percent.

The traffic system has also reduced travel times by 30 percent and helped the city resolve traffic problems in less time, from eight hours to less than two.

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Smart Mobility Hubs

Columbus, OH

SCENARIO

Vibrant, thriving neighborhoods depend on transportation, which is why the City of Columbus proposed a concentration of smart transportation demonstration projects in the community of Linden. The area has suffered decades of disinvestment and isolation from interstate construction, and many residents today are lower-income and underserved.

The City of Columbus focused on the "first-mile/last-mile" problem: transportation options to fill the gap between bus stops and homes, jobs, and other destinations.

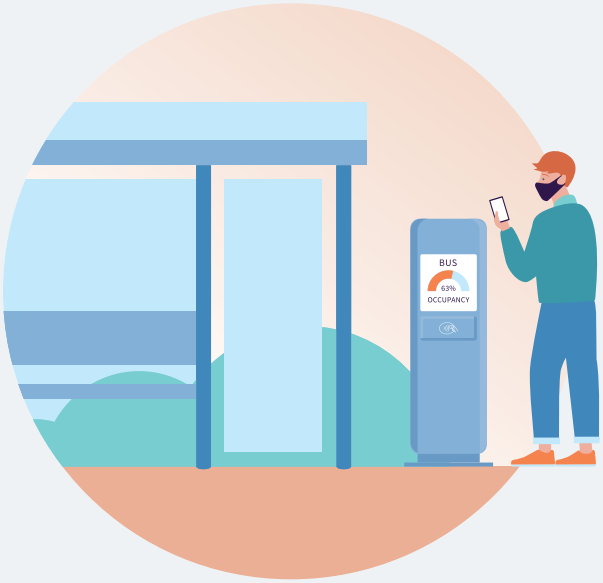
SOLUTION

Smart Mobility Hubs offered a powerful solution, connecting residents with bike- and scooter-sharing as well as ride-hailing services via six locations near bus stops. Utilizing 4G networks, a real-time, interactive information kiosk ("IKE") anchors each hub and provides information about mobility options, free Wi-Fi, community resources, and Pivot, an app with a variety of trip-planning tools.

RESULTS

Smart Mobility Hub services make it easier and more convenient for residents to make multimodal trips and coordinate first-mile/last-mile connections. Hubs required only concrete, signage, and pavement markings for construction, with staff deploying them via bike-share stations and bikes.

The City of Columbus Department of Public Service plans to eventually take ownership of the Smart Mobility Hubs to continue operations and is studying expansion into additional neighborhoods and mobility corridors.



Smart Parking for Fewer Emissions and Smoother Driving

Redwood City, CA

SCENARIO

Before the pandemic, finding parking in Redwood City's central business direct was a frustrating, fossil fuel-inefficient experience, costing drivers valuable time and convenience. For a more seamless return to restaurants, entertainment venues, and corporate campuses, Redwood City aimed to deploy smart parking solutions across 4,500-plus spaces.

SOLUTION

Redwood City worked with Cleverciti on a comprehensive smart parking guidance and wayfinding solution featuring:

+ 23 Circ® 360 floating LED signs affixed to lampposts that deliver 360-degree live parking information
+ IoT/artificial intelligence (AI) powered overhead sensors that detect available spaces and guide drivers to them
+ Automated enforcement of non-payments and "overstays"
+ Data-driven efficiencies like parking fee optimization and dynamic pricing

Cleverciti integrates with Redwood City's mobile app MyRWC, PayByPhone® for mobile payments, IPS Multi-space pay stations, EnSight Technologies AI/camera-based garage counts, and legacy parking systems, for a connected and seamless experience across public garages, private garages, on-street parking, and beyond.

RESULTS

With IoT/AI- powered overhead sensors and floating digital "turn-by-turn" guidance, Redwood City's accurate, driver-friendly wayfinding solution efficiently guides drivers to open spots, setting off a cascade of benefits:

+ Decreased search times, for reduced driver frustration and greenhouse gas emissions
+ A more frictionless parking experience, for improved parking payments and compliance as well as increased foot traffic at restaurant and retail establishments
+ Improved parking utilization and space turnover, for increased revenues and reduced need for additional spaces or garages

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Improving Safety with V2X Technology

Utah Department of Transportation

SCENARIO

The Utah Department of Transportation (UDOT) has long believed in the potential of digital technologies like vehicle-to-everything (V2X) solutions to radically improve transportation safety and help the state achieve its "Zero Fatalities" mission on its roadways.

V2X technology enables vehicles to communicate in real time with each other, roadside infrastructure, and other travelers like pedestrians and bicyclists. Users of V2X solutions leverage data collected, analyzed, and processed in the cloud to better understand roadway activities in real time, so they can deploy responders to incidents within seconds and transmit safety alerts directly into connected vehicles, preventing crashes altogether.

SOLUTION

UDOT partnered with Panasonic to build a connected vehicle ecosystem on the Cirrus by Panasonic™ V2X platform, equipped its fleet vehicles with V2X onboard units, and installed hundreds of V2X roadside units along state roadways to enable vehicle-to-everything communications. A cloud-based system collects, analyzes, and processes all of this communication data for roadway operators to view via an easy-to-use dashboard.

RESULTS

By deploying V2X technology throughout Utah, UDOT has enhanced situational awareness of the state's roadways. Traffic operators can now view the location of traffic incidents in real time, monitor weather conditions on the road, and more. This decision-guiding information empowers UDOT to reduce emergency response times, improve congestion, and make progress toward the state's Zero Fatalities goal.

Infrastructure for Autonomous and Advanced Services

Austin, TX

SCENARIO

Congestion on corridors like the 865-plus miles of roadways connecting Austin, Dallas-Fort Worth, Houston and San Antonio pose many challenges to mobility, freight and the safe movement of goods and services.

Intelligent byways powered by autonomous infrastructure can help. Such solutions improve mobility by relaying to drivers real-time traffic and safety information regarding accidents, severe weather activity or roadside hazards to drivers. Autonomous infrastructure also holds many benefits in fleet tracking, deployment and operations. Yet this infrastructure is both complicated and capital-intensive.

SOLUTION

To address these challenges and deliver these benefits in Austin, Texas, the Autonomy Institute is standing up intelligent and autonomous infrastructure labs and mobility corridors.

This infrastructure includes public infrastructure network nodes (PINN), which provide a unified open standard to support 5G wireless, edge computing, radar, sensors, enhanced GPS and intelligent transportation systems. Intelligent and autonomous infrastructure is also composed of edge computing on PINN and at cell towers/ substations and open software platforms that support intelligent and autonomous systems.

All of these nodes and systems require substantial funding. In this area, the Autonomy Institute is creating public-private partnership programs to fund intelligent transportation systems and infrastructure by reaching out to infrastructure partners.

RESULTS

The intelligent transportation infrastructure will offer many smart cities solutions—starting in Texas and ultimately nationwide. GNSS antenna, radars, RF analysis, C-V2X, LIDAR, environmental sensors, E-GPS, 360 cameras and beacons are just some of the PINN applications for intelligent and autonomous transportation systems.

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Tools and Resources

You've seen what's possible with connected community deployments. Now start bringing your own projects to life.

Here are a few of the resources CTIA has developed offering guidance on strategy, community collaboration, selecting vendors and navigating the technical details.

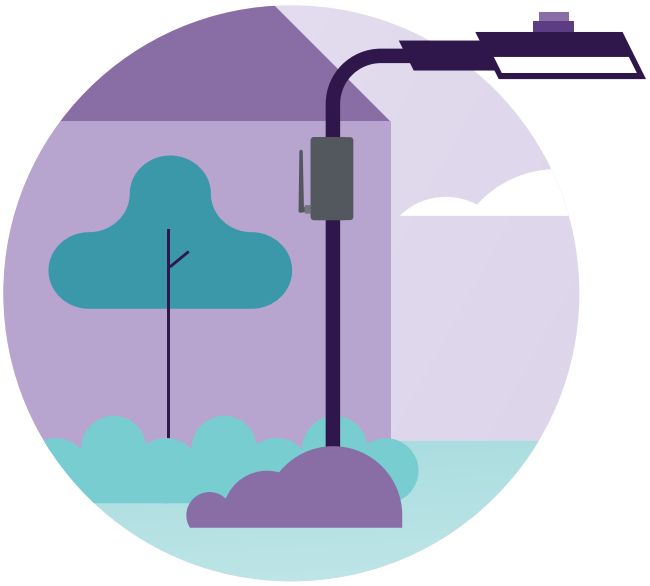
Getting Started: Smart Public Services

Projects to consider:

- ☐ Automated city services
- ☐ Autonomous vehicles such as shuttles
- ☐ Charging stations
- ☐ Environmental monitoring
- ☐ Mass notification systems
- ☐ Records management systems
- ☐ Safety monitoring and emergency response
- ☐ Smart buildings
- ☐ Smart lighting and streetlight management
- ☐ Smart parking
- ☐ Smart warehousing
- ☐ Touchless payments and services
- ☐ Wayfinding systems and apps
- ☐ LTE and Wi-Fi hotspots

Resources to assess/investigate:

- ☐ 4G and 5G networks
- ☐ Advanced metering infrastructure (AMI) for water, power, solar, and wind
- ☐ Air filtration systems
- ☐ Check-in kiosks
- ☐ Connectivity mapping and analysis tools
- ☐ Digital signage
- ☐ Drones for safety and sanitation
- ☐ Edge computing
- ☐ Online portals
- ☐ Robotics for services and communication
- ☐ Sensors, cameras, and other data collection tools
- ☐ Signal testing
- ☐ Virtual reality/augmented reality (VR/AR) applications



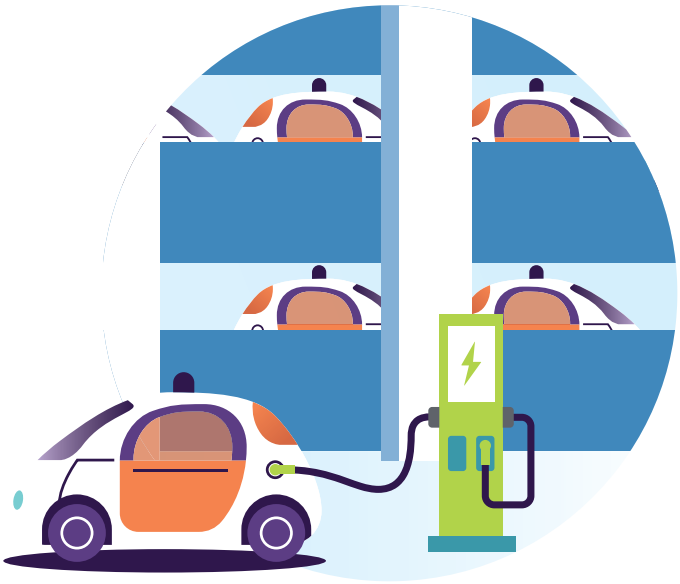
Getting Started: Smart Transportation

Projects to consider:

- ☐ "First- and last-mile" solutions
- ☐ First responder communications
- ☐ Fleet management solutions
- ☐ Public notification and alert systems
- ☐ Public transit safety, sanitation, and social distancing solutions
- ☐ Smart parking
- ☐ Smart transportation dashboards
- ☐ Touchless payments
- ☐ Traffic management, including data collection, dynamic express lanes, on-ramp metering, "wrong way driver alerts," and traffic prioritization
- ☐ Wayfinding solutions
- ☐ Weather alerts

Resources to assess/investigate:

- ☐ 4G and 5G connectivity
- ☐ Artificial intelligence (AI) platforms
- ☐ Autonomous shuttles
- ☐ Augmented and virtual reality (AR/VR) solutions
- ☐ Cloud-based platforms
- ☐ Connected vehicles
- ☐ Converged connectivity solutions
- ☐ Data analytics
- ☐ Digital signage
- ☐ High-connectivity fiber optic networks
- ☐ Smart digital signage
- ☐ Smart mobility hubs
- ☐ Vehicle to everything (V2X) solutions



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Getting Started: Smart Utilities

Here are some examples of projects to consider:

- ☐ Alerts and notifications
- ☐ Connected utilities solutions
- ☐ Customer-behind-the-meter asset utility integration
- ☐ Demand response and flexibility programs
- ☐ Electric vehicle charging infrastructure
- ☐ Energy market participation
- ☐ Falling wire and wildlife mitigation
- ☐ Infrastructure inspections
- ☐ Integration of renewable energy sources
- ☐ Sewer and stormwater overflow management
- ☐ Smart lighting
- ☐ Smart water
- ☐ Security
- ☐ Water loss detection
- ☐ Water usage tracking
- ☐ Wireless utility networks

For further guidance, explore current capabilities and future possibilities related to:

- ☐ 4G and 5G
- ☐ Advanced metering infrastructure (AMI)
- ☐ Artificial intelligence and machine learning
- ☐ Automation (substations, field force operations transmission, distribution, etc.)
- ☐ Drones
- ☐ Dual-use streetlight poles
- ☐ Home-area networking
- ☐ Microgrid monitoring, coordination, and control solutions
- ☐ Sensor networks (for weather, lines, phasor measurement units, etc.)
- ☐ Supervisory control and data acquisition (SCADA)
- ☐ Wireless utility solutions

Setting Your Project Up for Success

It's important to narrow your scope, prioritize your projects and line up funding sources. This requires a comprehensive evaluation of the following areas:

Past projects

- ☐ What smart projects have already been executed?
- ☐ What were the results, positive and negative, particularly in the area of data sharing?
- ☐ Have technology platforms been launched that serve more than one department or agency?
- ☐ How successful were they?

Pain points

- ☐ What are your community's main pain points related to public services, transportation and utilities?
- ☐ Does the pain point affect only one part of your community or does it cross municipal boundaries?
- ☐ Which public and private entities does the pain point involve?
- ☐ Do you have a relationship with a public or private entity that can be leveraged again?

Processes

- ☐ Does a common smart cities vision exist in your community?
- ☐ What are your current constraints in procurement—e.g. difficulties collaborating across departments?
- ☐ Do you have open policies for data and processes for governance?
- ☐ Do you have a marketing plan? Think about how you plan to share updates publicly to raise awareness, increase visibility and build momentum.
- ☐ Do you have a modernized infrastructure plan?

People

- ☐ Do you have an assigned smart cities champion?
- ☐ Do you have relationships with local universities or innovation councils?
- ☐ Does your project deliver value across the community or only to a specific segment?

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Community Collaboration

Industry-community collaboration is a key driver for success, and industry experts are here to help with best practices for connected utility deployments.

Step 1:
Know what you're working with.

- ☐ Does the city have any government-owned utilities that service residents?
- ☐ How much of the city's infrastructure is leased or shared by utilities?
- ☐ What are the modernization/IoT plans for the local utilities?
- ☐ What is the current relationship between the city and local utilities?
- ☐ Are there regular strategic planning meetings?
- ☐ What are the current financial arrangements between the city and utilities?
- ☐ What are the plans for future smart grid, distribution network and renewables projects?

Communities and utilities can leverage existing networks of poles and wires and existing rights-of-way to expedite deployment and reduce costs. For instance, utility poles, including light poles, can be used to mount various devices that enable other "smart" services. Partnerships with the wireless industry can provide the connectivity to power smart utility projects like:

- ☐ Remote-controlled LED street lighting
- ☐ Small cell sites
- ☐ Wireless LAN access points
- ☐ Audio sensors for gunshot detection
- ☐ Cameras for capturing photos of vehicle license plates
- ☐ Traffic enforcement
- ☐ Tracking systems for stolen vehicles/ fugitives/Amber Alerts

Step 2:
Get the technical specifications.

Is end-to-end encryption required?

- ☐ If a device is monitoring or controlling the grid or has access to critical information, enhanced end-to-end security features should be considered.
- ☐ End-to-end encryption can be built into the configuration as routers are deployed.
- ☐ If you are deploying modules/embedded chipsets into equipment like relays, capacitator banks and meter cans, the encryption must be developed and incorporated by the equipment manufacturer.

Are devices protected?

- ☐ Devices should be certified for supply chain protection.
- ☐ Ask who will have access to devices, from manufacturing to delivery.

How will you ensure system reliability?

- ☐ See if you will need a quality-of-service arrangement to ensure prioritization of utility traffic.
- ☐ Pay attention to antenna configuration, which is critical to increasing reliability, throughput, and capacity.
- ☐ Consider MIMO and cross-polarized antennas where applicable.

Step 3:
Prioritize security.

Security is paramount for reliable, resilient smart utility services. Implementing a cybersecurity plan during the design phase of your project can help keep your smart utility assets safe. Specific to wireless connectivity, smart utility devices should be IoT Network Certified for Smart Connected Infrastructure™—which includes a baseline of cybersecurity screening for your IoT devices being deployed on cellular networks.

Consider certifying devices that transmit over a cellular network, including:

- ☐ Gas, electricity, and water meters
- ☐ Industrial gateways
- ☐ Monitoring and control devices

An Example RFP Checklist

Make sure you have all your technical requirements covered with this checklist as a starting point.

☐	**Alarms/alerts**	Particularly for a utility management, public infrastructure or traffic management project, how does the vendor plan to handle remote monitoring and critical event detection?
☐	**Certifications**	What industry standards and certifications (3GPP, IEEE, IoT Network Certified for Smart Connected Infrastructure™, NIST, ETSI, etc.) will your technologies, such as network devices, need to achieve, and how does the vendor plan to address this? Including industry certifications, such as IoT Network Certified for Smart Connected Infrastructure™, as part of your vendor requirements can help establish a standards-based cybersecurity baseline for the cellular network you plan to use.
☐	**Cloud infrastructure**	If your project will be hosted in the cloud or manage data or handle analytics in the cloud, what cloud services and support does the vendor offer?
☐	**Cybersecurity**	How does the vendor plan to protect hardware, software or electronic data from theft, damage, disruption or misdirection of services? This includes achieving cybersecurity certification for devices touching your network and setting a baseline set of cybersecurity standards.
☐	**Data analytics**	What processes does the vendor have in place for inspecting, cleansing, transforming and modeling data and relaying it to you? The information that fuels a smart cities project is only as good as your capacity to interpret and respond to it.
☐	**Data ownership**	How does the vendor plan to handle possession of and responsibility for information, including data ownership, compliance and access management procedures?
☐	**Data retention**	What is the vendor's data retention policy? Does it align with your requirements (e.g., compliance with state and federal regulations), and what kind of plan and personnel will you need to collect and manage the data you need?
☐	**Equipment**	What type of equipment does the vendor plan to use to implement your project? Is it compatible with your existing/planned infrastructure, and does it meet your resiliency and sustainability standards?
☐	**Key Performance Indicators (KPIs)**	What kind of KPIs will the vendor use to evaluate the success of its service/solution?

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☐	**Lifecycle management**	How does the vendor manage the product lifecycle—from inception through design, manufacturing and service to disposal/end of life?
☐	**Maintenance**	What is the vendor's policy for hardware, network and software maintenance and support? Does this include preventive and remedial services? How much does it cost and how will you be charged (e.g., per incident)?
☐	**Managed services**	If you need to outsource certain processes and functions to augment your internal resources, what managed services does the vendor offer, and how much will they cost?
☐	**Metrics**	What measures, including and beyond KPIs, does the vendor plan to use to report key behaviors, activities and performance? How frequently will these be reported?
☐	**Operations**	How does the vendor ensure efficiency and high performance?
☐	**Physical infrastructure**	How will the vendor help you leverage current infrastructure?
☐	**Redundancy**	Duplicating or backing up critical components and functions, referred to as redundancy, is key to network reliability and system performance. What redundancy services does the vendor offer?
☐	**Reliability**	Reliability is a must-have feature for telecommunications networks, especially in public safety projects. How does the vendor plan to ensure reliability?
☐	**Support**	Help with specific problems is often an ongoing cost. What type of support does the vendor offer, and how much will it cost?
☐	**Systems integration**	How does the vendor plan to bring together components, subsystems, computing systems and software applications to act as a coordinated whole? What kind of experience does the vendor have in this area, and how will the vendor ensure that systems interact and perform as expected?
☐	**Universal design/ accessibility**	How does the vendor plan to make products and services usable by all individuals and communities? Evaluate the ability of a given technology to enhance access to services.
☐	**Use cases**	Can the vendor provide examples of previous deployments involving similar technologies, applications and goals?

A Glossary of Common Acronyms

AES	Advanced Encryption Standard
AMA	Advanced metering analytics
AMI	Advanced metering infrastructure
DER	Distributed energy resource
DFR	Digital fault recorder
DNP	Distributed Network Protocol
DSSE	Distributed system state estimation
DTLS	Datagram Transport Layer Security
EMS	Energy management system
EV	Electric vehicle
GOOSE	Generic object-oriented substation event
GPS	Global positioning system
IEC	International Electrotechnical Commission
IoT	Internet of Things
IIot	Industrial Internet of Things
IOU	Investor-owned utility
IPsec	Internet Protocol Security
IT/OT	Information technology/Operations technology
LAN/WAN	Local Area Network/Wide Area Network
LEDs	Light-emitting diodes
LMR	Land Mobile Radio
LPWA	Low-Power Wide-Area
LTE	Long Term Evolution
MWh	Megawatt hours
OAM	Operations administration and maintenance
PLC	Programmable logic controller
PMUs	Phasor measurement units
PQM	Power quality measurements
QoS	Quality of service
RAN	Radio access network
RF	Radio frequency
SDWAN	Software-Defined Wide Area Network
SGi	Surface Gateway Interface
SIM	Subscriber Identity Module
SLA	Service-level agreement
SV	Sampled values
TLS	Transport Layer Security
TVM	Tilt and vibration monitor
TWS	Traveling wave systems
UPS	Uninterruptable power source
VPN	Virtual private network
V2X	Vehicle-to-Everything
3GPP	Third Generation Partnership Project
4G	Fourth generation of broadband cellular network technology
5G	Fifth generation of broadband cellular network technology

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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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