Rising to the Challenge:

A CTIA Smart Cities Playbook

ctia™

The Emergence of the Connected Community

2020 was a year like no other. As the COVID-19 pandemic transformed every aspect of our lives, we needed connection and community more than ever. In North America, municipalities and the U.S. wireless industry rose to the challenge.

Public and private sector leaders proved anew that smart cities are not a futuristic concept, or a concept that can be put on hold. In communities of all sizes, smart cities solutions are helping people feel safe and connected.

As essential workers and other members of the community use public transit and public buildings, smart cities applications are helping to encourage social distancing and mask wearing. As remote work and distance learning became the new normal, smart cities partners are bridging connectivity gaps with solutions like mobile hotspots.

Concurrently, smart cities projects continue to address other areas of safety, service and quality of life. They're protecting vital utility infrastructure from encroaching vegetation, helping people with visual impairments navigate bus and transit systems and turning real-time weather and fire data into valuable intelligence for community safety.

Innovation and inspiration

As a follow-up to the *CTIA Smart Cities Playbook: Building Your Connected Community*, the CTIA Smart Cities Working Group created *Rising to the Challenge: A CTIA Smart Cities Playbook* to provide even more guidance and inspiration.

You'll learn how airports are reimagining safety, operations and economics and municipalities are navigating a safe return to public transit. You'll discover the potential of "smart water" solutions for monitoring water quality and maintenance and autonomous infrastructure for creating "intelligent byways." You'll also see how business districts and downtowns are balancing public safety with resiliency through use of contactless services and mobile security monitors, as well as smart traffic lights to help emergency vehicles get where they need to go faster.

We spotlight new models of procurement, like surveillance-as-a-service, and new types of partnerships, like utilities and cities working together for public safety. We also highlight the technologies that are bringing smart cities solutions to life: LTE-supported advanced metering infrastructure for utilities, public infrastructure network nodes for intelligent transportation infrastructure, SCADA, private LTE, 4G and 5G networks, AI, mobile edge computing and more.

Connectivity for all

As COVID-19 continues to shape our economies, small businesses and trust in the safety of public spaces, wireless innovation will continue to shape this "new normal." Now more than ever, becoming a smart city is accessible, achievable and desirable. Read on to find examples and resources for getting started in your community.

Connecting everyone and everything

As Americans rely on wireless networks more than ever to stay connected and continue learning and working from home, the U.S. wireless industry is working hard to increase capacity and address shifting demand. This includes investing over $20 billion each year and closely monitoring network performance to meet needs and provide consumers with more mobile data. Today's largest operators, including T-Mobile, AT&T, Verizon, U.S. Cellular and Boost Mobile, have announced hundreds of millions of dollars in new investment and other innovative solutions and are keeping public Wi-Fi hotspots open for unserved Americans.

Connectivity for All

Washington, D.C.

SCENARIO

In the Greater Washington, D.C. region, more than 300,000 residents live without broadband internet. As businesses and schools moved online during COVID-19, the need for connectivity reached new heights. Connected DMV (District of Columbia, Maryland, Virginia) established the Connectivity for All initiative to advance social and digital equity across the region.

SOLUTION

Initial COVID-19 relief efforts focused on K-12 students. As the pandemic progressed, however, Connectivity for All recognized the need to focus on adult learners, from community college students to seniors, and provide tools and pathways for jobs, education, health and human services.

Moving forward requires a comprehensive picture of all available resources and programs—such as free and low-cost devices, internet services and digital literacy training—and a view of how to orchestrate and optimize the disparate public-private initiatives into a scalable and sustainable model for the region.

In April 2020, Connected DMV launched the COVID-19 Strategic Renewal Task Force, bringing together 51 leaders who represent regional organizations, academia, the public sector, industry, the community and the federal government. In August, the task force approved the Connectivity for All initiative, establishing a formal regional partnership for shared delivery, measurement and tracking.

RESULTS

Under this partnership, Connectivity for All will define the customer experience, operating model, technology enablement and processes for efficiently and systematically harnessing public-private capacity to increase digital equity in the DMV. The initiative will bring a collaborative design thinking approach to problem-solving that will be tested and refined through a pilot phase.

The goal is to create a sustainable model that scales in the DMV, and ultimately nationally, so that in the future no one is left behind because they lack connectivity, a computing device or basic computer skills.
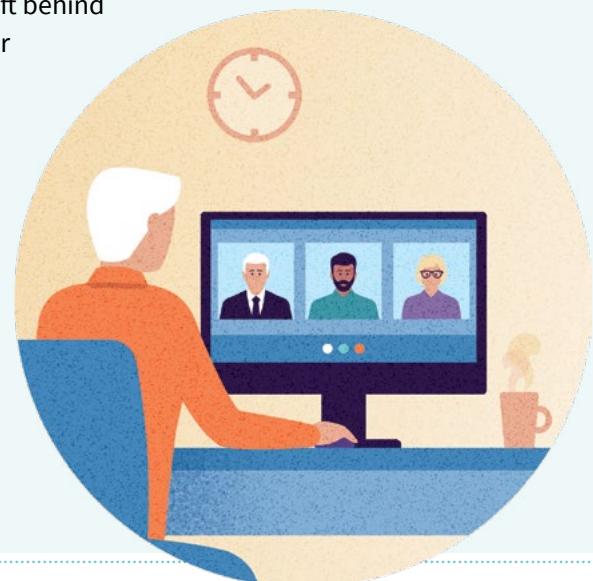
Infrastructure for Autonomous and Advanced Services

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.

A Connected Campus

Nextionwide

Nationwide

SCENARIO

Both during the COVID-19 pandemic and in "normal" times, colleges and universities must balance multiple priorities, from delivering a competitive student experience to operating more efficiently and cost-effectively. Throughout, they must keep students, faculty and staff safe—in the classroom, in dorms and while walking across campus at night.

How can institutions of higher education gain the situational awareness they need for swift, smart decisions?

SOLUTION

T-Mobile helps connect campuses with Internet of Things (IoT) solutions. T-Mobile works with colleges and universities to address these challenges and more through sensor-based solutions over 4G and 5G networks.

For safety and security, sensors can monitor the opening and closing of doors, triggering early warnings and security measures like automatic barricades. They can power unobtrusive "panic buttons" that send pre-defined alerts to security staff to let them know exactly when and where the incident is occurring. During COVID-19, connected campus solutions can also support wearables that remind students and faculty to maintain social distancing.

In the area of campus experience, service alerts for deliveries from the dining hall, maintenance requests, administrative assistance and beyond are just the beginning. Sensors in a lecture hall can help students locate open seats, maintain social distancing and even optimize air quality.

Concurrently, IoT solutions for a connected campus help facilities manage workflow and operate more efficiently. Where are waste receptacles full and toilets leaking? Which heavy equipment and machinery needs repair, and where does the HVAC system require adjustment? Wireless-connected sensors can lead campus staff to answers, for predictive maintenance and energy savings.

RESULTS

All of these applications add up to a consolidated view of what's happening and where across campus. Campus administrators can keep their fingers on the pulse of the community and take more informed, proactive action through an app or internet browser.
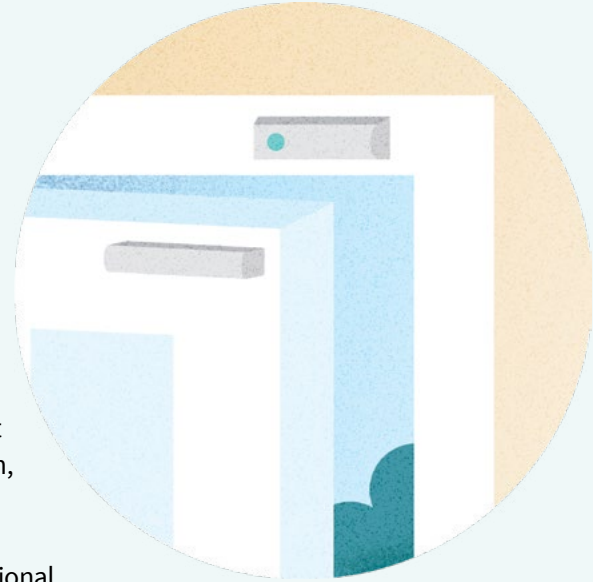
Converged Wireless Networks

Chicago, IL

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.

RESULTS

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 communications
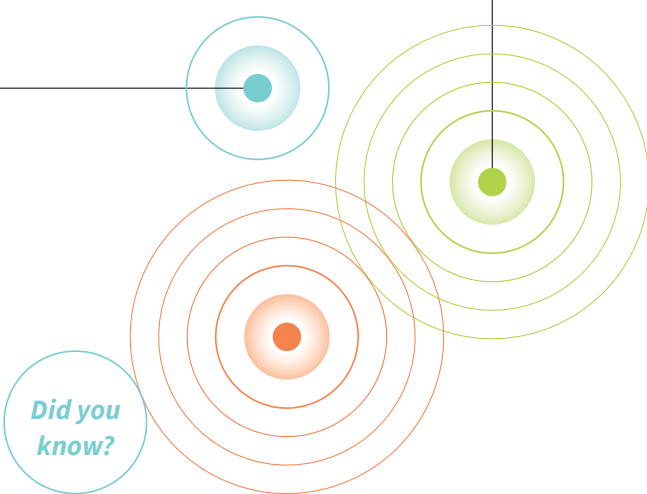
Putting smart connectivity to work in your community

Projects to consider:

- ☐ Digital equity initiatives
- ☐ Free/low-cost devices
- ☐ Digital literacy training
- ☐ Real-time traffic information, safety and weather alerts
- ☐ Fleet tracking, deployment and operations
- ☐ Intelligent transportation systems
- ☐ Sensor security systems
- ☐ Predictive maintenance
- ☐ Energy monitoring and savings
- ☐ Mobile campus/community experience
- ☐ Smart buildings
- ☐ Biometric sensing
- ☐ Thermal screening
- ☐ Contactless services

Resources to assess/investigate:

- ☐ 4G and 5G networks
- ☐ Regional task forces
- ☐ Public-private partnerships
- ☐ Innovation labs and institutes
- ☐ Partnerships with school districts, colleges, community colleges and universities
- ☐ Autonomous/intelligent infrastructure
  - – Public infrastructure network nodes
  - – 5G wireless
  - – Edge computing
  - – Enhanced GPS
- ☐ Smart sensors

### The collaborative effort of smart cities projects

Communities of all sizes are utilizing LTE and 5G networks along with other forms of connectivity to deploy their smart cities projects.

CTIA members are hard at work helping to bring these networks to life to enable differentiated services on the same infrastructure.

Did you know?

The benefits of 5G network slicing

The availability of new technology called network slicing allows operators to provide virtual managed service capabilities from a single network. For example, one can provide very high speed mobile broadband for high-definition camera use cases and very low latency capabilities for sensor applications. All of these can be provided with increased security enabled by 5G.

They can be enabled by national operators, network vendors, or third-party providers of private networks. Decisions will be determined on a case by case basis with network reliability, security, coverage and costs in mind.
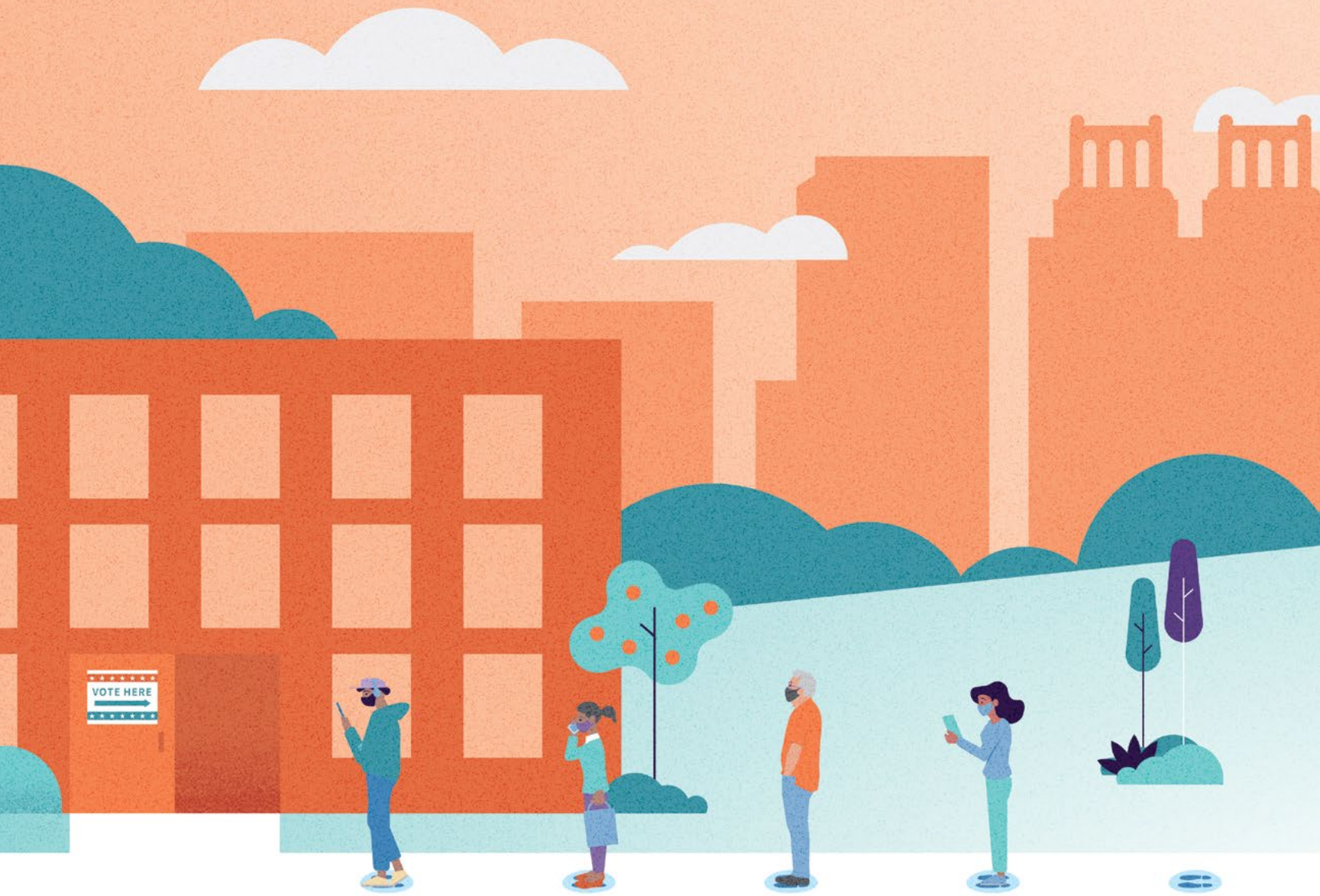
Smart Public Services, Education and Safety

Communities of all sizes have long been using smart cities technologies for public services and safety, from video intelligence to remote learning support. Every time you use an app that connects people with visual or hearing impairments to public transportation or benefit from a system that mobilizes city services, you're seeing this innovation in action.

How can communities mobilize their resources and workforces for public safety? How can they deliver services that support health, economic progress and quality of life?

To address urgent challenges and enduring needs, communities are responding through innovation, with mobile solutions offering students, workers and businesses ways to stay connected and informed.

Consider, for example, remote learning. Connectivity, access to the right technology and the skills required to use that technology are essential to success. Wireless industry leaders are using their expertise in this area to help classrooms nationwide overcome their connectivity and technology hurdles.

Through evolving smart cities technologies, America's communities have been keeping buses moving, residents safe and kids engaged during COVID-19.

As municipalities and schools around the country work to mitigate the risk of COVID-19, wireless providers have quickly stepped up to make sure homebound children have the tools they need to participate in distance learning and stay engaged with their classmates and teachers from afar. To date, the industry has helped connect 2 million students by providing free and discounted devices and data plans, as well as millions of dollars in donations and resources.

Mobile Wi-Fi Hotspots

Georgia

SCENARIO

When Georgia's schools moved to remote learning during COVID-19, the shift highlighted that many children in the state lack access to the high-speed internet required for online learning. According to the Georgia State Department of Education, over 80,000 student households cannot access a wireline service.

How could the state most effectively use CARES Act funding to increase digital equity? The power of 4G networks and mobile hotspots with Wi-Fi offered one solution.

SOLUTION

To deploy these hotspots in a way that would serve the most students, the department had to answer many questions: Where were there gaps in connectivity? Where should they place the Wi-Fi transmitter devices, and what carrier networks should they use?

The department used Ookla® Cell Analytics™ to find answers. Signal strength and quality are essential for remote learning, especially when multiple students are using the same hotspot for the same virtual classroom. Cell Analytics data helped the department evaluate the coverage and signal strength for all network operators in the area, as well as cell site locations to determine the optimal locations and carriers for the mobile hotspots with Wi-Fi.

RESULTS

Today in Georgia, 2,500 buses with 4G hotspot devices are providing high-speed internet to students all over the state, guided by Cell Analytics data on the best locations to park the buses. This expanding program is allowing children who lack home internet services the ability to connect to virtual classrooms and continue their education.

Maps and mobile hotspots

Communities are using signal strength mapping and 4G mobile hotspots with Wi-Fi to deliver connectivity to those who need it most in Georgia.

Connecting America's students

Verizon's distance learning program has offered discounted connectivity to more than 38 million students across 40 states and the District of Columbia since September 2020. Since February, T-Mobile has connected more than 1.6 million students through a $10.7 billion initiative to provide wireless hotspots, high-speed data and access to laptops and tablets. AT&T has committed $10 million to free hotspots and data plans, in partnership with Connected Nation, and offers discounted and low-cost wireless plans to schools across the country.

Simplifying hotspot acquisition for school districts

Did you know?

In 2020, CTIA launched Connecting Kids to simplify the process of finding hotspots for remote learning. The new program connects school districts with wireless operators who are working to provide broadband access to kids and families in their areas.

SMART PUBLIC SERVICES IN ACTION

The RideKC Navigator

Kansas City, MO

SCENARIO
Navigating a new public transit route or complex station with insufficient signage can be frustrating—with delays putting a rider at risk of a missed bus or train. The difficulties are worse for riders with visual impairments. As a result, cities are seeking effective, affordable smart solutions to make their public transportation systems more inclusive and user-friendly.

SOLUTION
The Kansas City Area Transportation Authority (KCATA) partnered with Sensible Innovations to develop the RideKC Navigator, a free mobile app that helps users locate bus stops, pedestrian pathways, real-time transit information and more. It also alerts them when to board or get off a bus.

The solution uses Bluetooth low energy sensors placed at bus stops and street corners to deliver precise navigation assistance along a rider's entire transit trip. Users simply walk and listen, no smartphone screen required. Meanwhile, KCATA can edit and add content on the fly via an easy-to-use administration portal.

RESULTS
By delivering real-time transit and navigation data where and when it matters most, the app provides independence, inclusivity and freedom for visually impaired users and convenience for all riders. Finally, the network infrastructure has the ability to quickly expand in the future to meet the changing needs of any transit system.

Adding mobility, connectivity and visibility to public safety

Who's at the door? For decades, people have had to walk to the door to answer this question. Today, camera-empowered smart doorbells do the looking for you.

Just as evolving technologies are making homes safer, communities are benefiting from smart cities innovation. Traffic lights integrated into connected city platforms are helping emergency vehicles navigate through busy interactions safely and efficiently. Wireless networks are delivering real-time emergency alerts for weather emergencies. And streetlights equipped with intelligent visual sensors are capturing real-time information, like video data of a public park to enforce community rules and regulations.

Artificial intelligence (AI) and machine learning amp up these solutions' power. Consider a community parking lot with a network of visual sensors. Add AI for accelerated image processing—from monitoring capacity and access to tracking stolen vehicles—and you have near-real-time situational awareness.
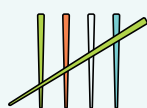
Putting video analytics to work in your community

Combining IoT sensors and devices, data, analytics, AI and more over wireless networks, smart cities solutions can help your community:
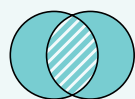
Detect overcrowding in buildings

Locate objects that enter or leave a scene

Count the number of vehicles on roads and parking garages

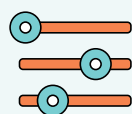**Match** license plates with public databases for parking lot access control and tracking stolen vehicles

Measure constituent wait times

Monitor carpool or parking violations

Check smart cities cameras themselves for tampering or declining image quality

Optimize images and video by removing rain, fog and falling snow and pixelating humans and vehicles for privacy protection

GoSafe

San Diego, CA

SCENARIO

Keeping municipal services operating as normally as possible during COVID-19 is critical but difficult. As communities prepare to reopen their businesses and public buildings, wireless innovation can help them monitor social distancing and public health practices.

SOLUTION

OneScreen and Qualcomm developed GoSafe to help communities monitor safety in public areas. GoSafe uses AI and thermal cameras to conduct temperature readings and encourage mask usage as individuals enter buildings.

RESULTS

Fluid Sound is implementing the GoSafe solution in San Diego. While the accuracy of thermal scanning is still being refined, AI provides a non-contact alternative for monitoring the safety of people in public places. It's one way communities can restore confidence as they start reopening their public buildings.
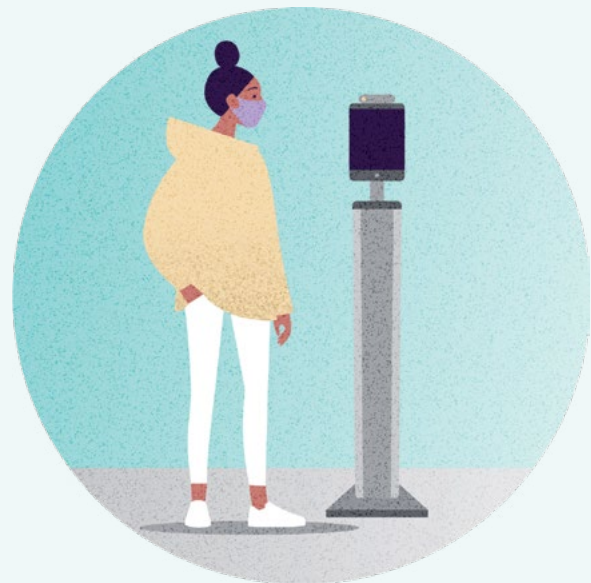
Mobile Security Solutions

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.

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.

> In September 2020, when a network of wireless-enabled weather stations captured record-breaking temperatures across the greater Los Angeles and San Diego counties, Woodland Hills reached 121 degrees, the **hottest temperature ever recorded** at an official weather station in Los Angeles County.

Surveillance as a Service

Birmingham, AL

SCENARIO

Communities nationwide face budget constraints and recruitment challenges in the quest for public safety. The City of Birmingham partnered with Alabama Power on ways to use technology to address these challenges and enhance public safety in an economic, sustainable and scalable manner.

SOLUTION

Alabama Power worked with ISO Network, Axis Communications and Genetec to create rapidly deployable "surveillance bundles" that can be used for:

+ **Automatic license plate recognition,** alerting officials and first responders to stolen vehicles

+ **Paired audio analysis and video surveillance,** which allows public safety teams to first analyze a suspicious event by sound patterns—which protects an individual's privacy—and then verify the event with video if needed

+ **Cameras at public rights-of-way,** giving emergency first responders relevant, accurate information as they approach a scene

Alabama Power and its partners designed the bundles' power and data communications infrastructure to minimize connectivity challenges. Features include system health checks and remote support to notify operators of outages and reduce their duration.

RESULTS

Surveillance bundles are quick to deploy and offer new tools for deterring crime and keeping communities safe. For budgeting flexibility, public safety officials can procure them through a traditional purchase/capital expenditure or as a service/operating expense.

Putting smart public services, education and safety to work in your community

Projects to consider:

- ☐ Wireless and mobile Wi-Fi hotspots
- ☐ Transit navigation apps
- ☐ Smart street lights
- ☐ Weather and emergency alerts
- ☐ Parking lot, carpool and traffic monitoring
- ☐ Situational awareness for public parks, spaces and buildings
- ☐ Mobile security solutions
- ☐ Online maps and dashboards
- ☐ Traffic rights-of-way management

Resources to assess/investigate:

- ☐ 4G and 5G networks
- ☐ Federal funding programs
- ☐ Wi-Fi transmitters
- ☐ Cellular data analytics
- ☐ Public-private partnerships
- ☐ Bluetooth low-energy sensors
- ☐ Video analytics
- ☐ IoT sensors and devices
- ☐ Artificial intelligence and machine learning solutions
- ☐ Thermal scanning
- ☐ Partnerships with universities and research institutions
- ☐ Audio sensors and analytics
- ☐ Partnerships with industry innovators
- ☐ Partnerships with utilities

Smart Utilities

Communities have been quick to adopt smart technologies to keep workers safe and power and utilities running, from drones for power station monitoring and water tank inspections to smart meters that reduce the need for field deployments.
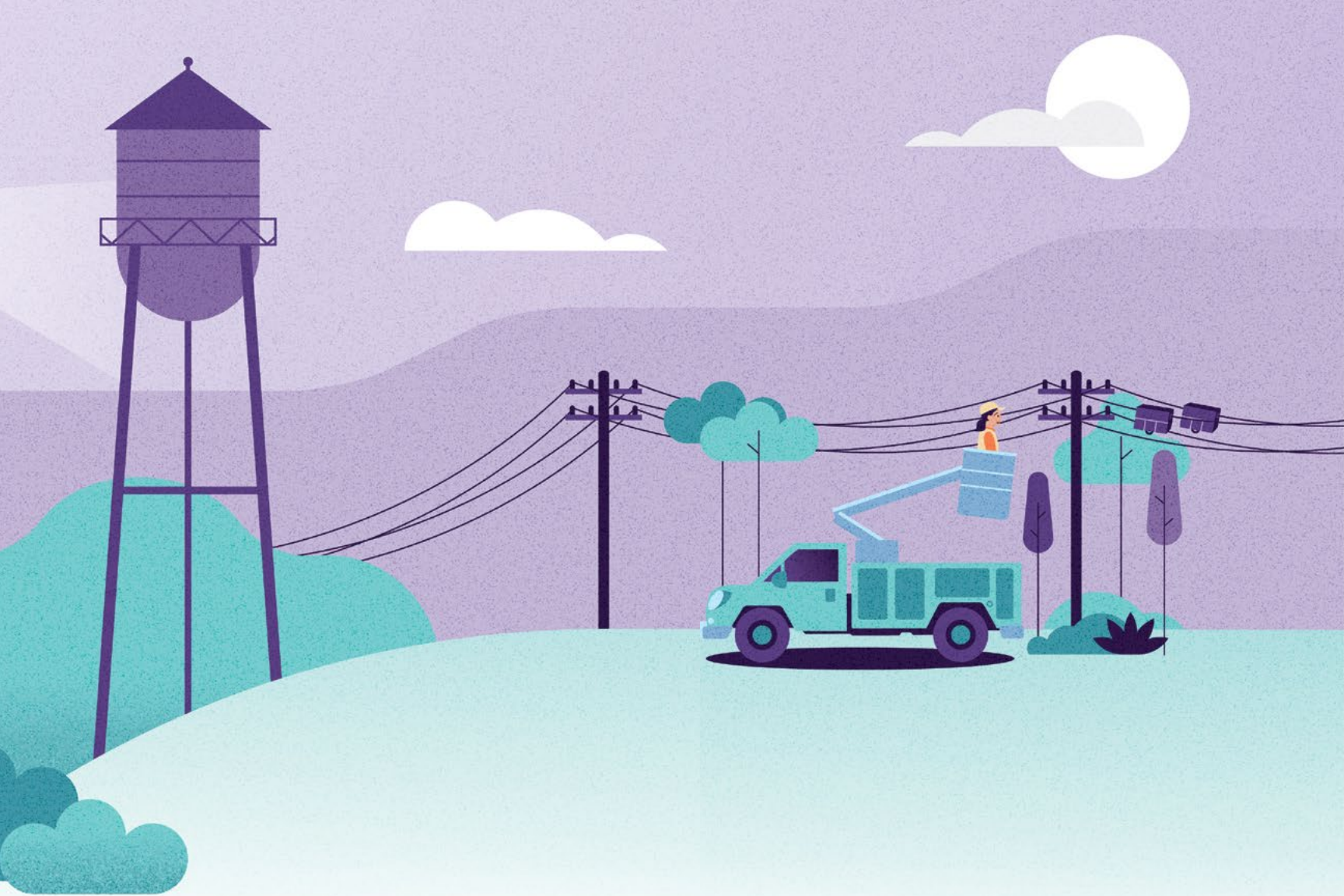
Looking to the future, they have a wide variety of innovations, intelligent tools and resources at their disposal to keep people protected and progress moving: LTE-powered advanced metering infrastructure, modernized SCADA infrastructure, "intelligent water" solutions and more.

Smart metering and monitoring

Extreme weather and aging infrastructure can impact utilities and threaten their mission to keep lights on and water running. In the ongoing struggle to maintain resilience—and especially during a global pandemic— knowledge is power.

To reduce carbon footprints, secure their networks, preserve precious water and streamline efficiencies, utilities are investing in advanced metering infrastructure and smart sensors. These technologies combine real-time data and analytics, connected via wireless networks, for more informed utility operations and asset management.

Power Substation Monitoring

Syracuse, NY

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.

RESULTS

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.
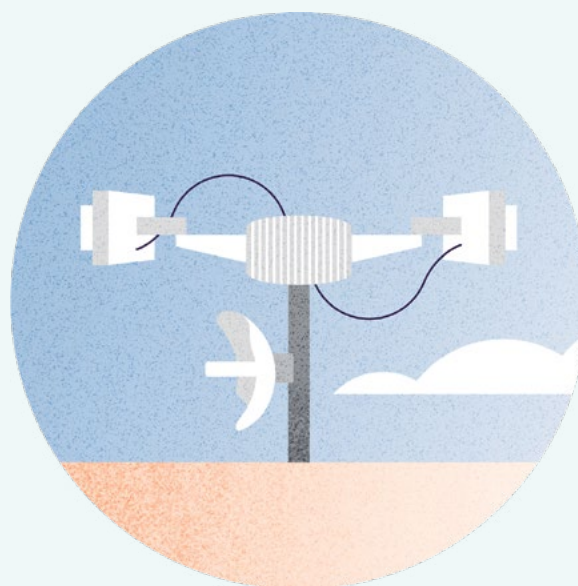
Drone-Powered Water Tank Inspections

Nationwide

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.

RESULTS

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.

Estimated annual benefits if used on 10% of water tanks in the United States

+ 1 billion gallons of **water saved**
+ 2,000 metric tons of **CO_2 avoided**
+ $12 million in inspection **costs saved**
+ 300,000 out-of-service **hours saved**

Grid Analytics

New Braunfels, TX

SCENARIO

Community-owned New Braunfels Utilities (NBU) provides electric, water and sewer services to residential and commercial customers in New Braunfels. After implementing significant changes to its processes and forming a systems control group, NBU sought ways to use technology to further improve grid reliability and customer service. One key focus is gaining visibility into line disturbances—small spikes in power that can lead to outages.

SOLUTION

NBU reached out to Sentient Energy® to gain a better understanding of what was happening on its distribution grid. The solution: Sentient Energy's Grid Analytics System™, which uses intelligent line sensors, distributed apps and analytics to detect disturbances and faults.

After the initial deployment identified the worst-performing feeders, NBU chose to deploy the intelligent sensors across their entire system—622 miles of primary overhead lines and 324 miles of primary underground lines.

RESULTS

Data from the intelligent line sensors (up to three per meter) and Ample Analytics™ feeds into NBU's outage management system, allowing the utility to more accurately detect and pinpoint the location of possible faults.

In one instance, sensors detected spikes in line disturbances indicating vegetation encroachment. Instead of patrolling the entire feeder, crews were able to use this data to narrow their search to a one-mile area. This one example resulted in a System Average Interruption Duration Index (SAIDI) reduction of 2.6 minutes and a cost savings of almost $17,000, based on the value of lost load to more than 880 customers. Utility crews now routinely ask for line sensor information to help them efficiently target their time and efforts.

The Grid Analytics System is now an integral part of NBU's grid hardening and storm planning, and NBU plans to leverage the Sentient Energy Grid Analytics System for load forecasting.
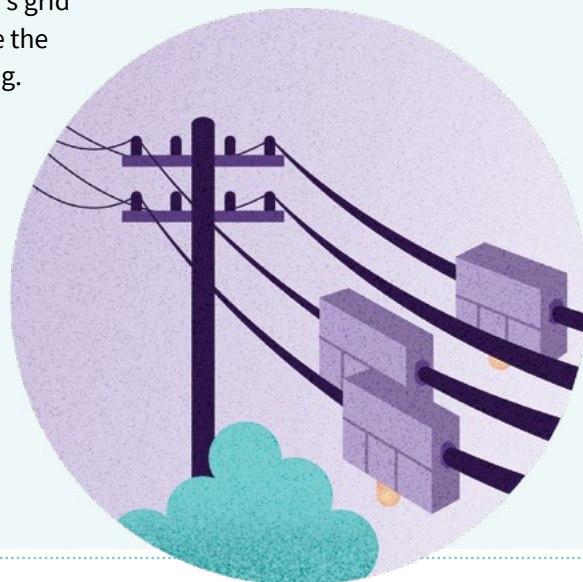
Wastewater Flow Monitoring

Miami-Dade County, FL

SCENARIO

Each year, an estimated 40,000 sanitary sewer overflows bring untreated sewage into U.S. homes and natural waterways, threatening water quality and public health. The Miami-Dade County Water and Sewer Department is using technology to assess, rehabilitate and improve its wastewater management process, for fewer overflows and stronger EPA compliance.

SOLUTION

The department worked with Itron and its partner US3 to address these challenges. The resulting flow reduction solution analyzes real-time data from US3's battery-powered wastewater flow sensors over Itron's industrial IoT network, to provide a more accurate and complete view of wastewater flows throughout the basin. This helps utility operators quickly identify and mitigate overflows, to reduce public health risk, minimize water contamination and avoid property damage.

RESULTS

The flow reduction solution has yielded many benefits. For example, automating the reporting process for regulatory compliance reduced truck activity for field surveys by more than 60 percent, increasing operational efficiency and reducing greenhouse gas emissions.

"With enhanced visibility into our operations, this solution equips us to better serve customers. It ensures our sewer collection system meets regulator standards, **it improves our level of service,** and in the future, it will assist us in identifying sewer overflows and mitigating inflow and infiltration into our wastewater collection system."

– Kevin Lynskey, director of the Miami-Dade County Water and Sewer Department

Smart Meters to Reduce Water Loss

Gwinnett County, GA
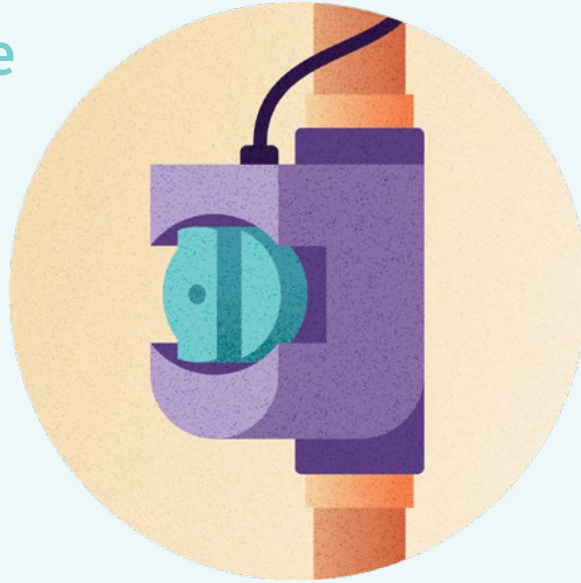
SCENARIO

The Gwinnett County Department of Water Resources hired consulting firm Jacobs, AT&T and Qualcomm for a pilot study. How could the county improve water resource management and cut its water loss in half?

SOLUTION

The solution involved smart meters, pressure sensors and advanced data analytics, to detect water loss more quickly and determine the source, such as pipeline breaks, leaks, bad meters or theft.

Gwinnett County replaced water meters at over 500 homes with state-of-the-art water meters sensitive enough to detect tampering, meter movement, water leaks and reverse flows. The Department of Water Resources receives this smart meter data in real time through a secure network. This data enabled the department to understand how water was being consumed and how it moves through the system, for leak detection and rapid response to issues.

RESULTS

Through this smart meter technology, Gwinnett County was able to identify plumbing issues that would have caused a loss of 4.8 million gallons of water annually if not fixed.

The meters also enabled the county to identify an improper valve-opening incident in real time, as well as three incidents associated with expanding hot water heaters. The pilot team has used pressure reduction to continue optimizing the system and has shared its successes with other utilities looking to address non-revenue water challenges.

Notably, the meters reported 100 percent reliability and zero cellular chip failures during the 12 months of the study.

## Advanced metering infrastructure and LTE for smart cities

Originally deployed to support smart meters relaying data for meter reading and billing, advanced metering infrastructure (AMI) equipped with LTE wireless connectivity can support a number of smart cities applications, including grid management, traffic light controls and public Wi-Fi.

These networks pose many questions for communities interested in leveraging them for smart cities solutions. How are they all connected? Will a local AMI network accommodate a new application, or will additional support be needed?

Various considerations for different LTE categories include:

+ **NB-IoT** is known as Cat NB1, with a low cost and throughput that makes it well suited for low-data devices with low power and latency requirements. NB-IoT operates at sub-gigahertz frequencies in all carrier frequencies.

+ **LTE Cat M1** has enough bandwidth for low-latency communication and mobile devices and is also appropriate for more battery-sensitive sensors and devices. It consumes more power than NB-IoT, but the protocol offers better downlink performance and immunity from interference. Most modems combine Cat M1 and NB-IoT into one module.

+ **LTE Cat 1,** offering affordable broadband capabilities, is suitable for many IoT/machine-to-machine applications and utility applications that need lower latency and more robust throughput. When throughput speed is capped at 10 Mbps, LTE Cat 1 requires significantly less power than traditional 3G or 4G cellular nodes.

+ **4G LTE and 5G** broadband wireless networks offer latencies as low as 10 milliseconds and bandwidth for even the most demanding video applications. A large ecosystem of manufacturers and vendors exists, and economies of scale have already been achieved for equipment and software systems.

LTE applications by category

Source: Ubicquia white paper co-published with Guidehouse Insights (formerly Navigant)
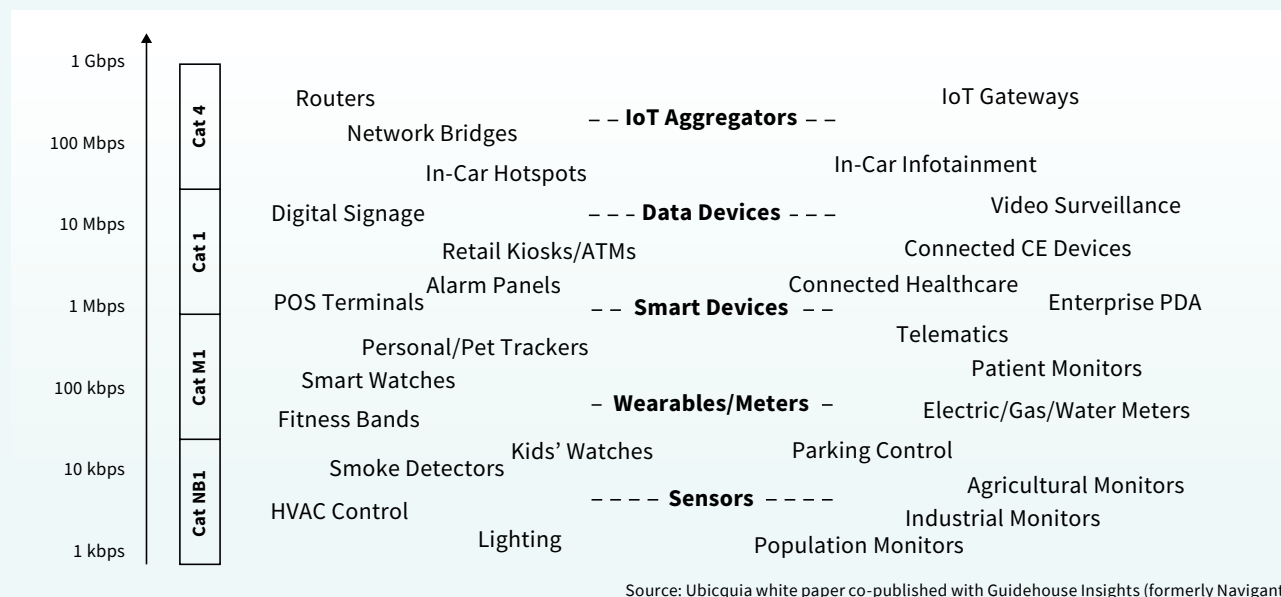
Intelligent water solutions for growing communities

It's become more challenging than ever for communities to deliver water safely and equitably. Facility maintenance and operating costs are rising. Populations are growing. Utilities struggle to build resilience against water-related disasters and climate change with aging infrastructure and shifting workforce demographics. And water utilities are pressured to enable a secure remote workforce and remote operations/monitoring to keep their facilities running 24/7.

Innovations in "intelligent water" have evolved to meet these challenges. Communities nationwide have been integrating IT and OT (operations technology) and using digital networks and real-time data analytics to modernize infrastructure and gain real-time business intelligence. With a modernized network which integrates IoT sensors and devices, systems, applications and services, water utilities of all sizes are able to increase efficiencies, reduce costs, improve customer service and do more with less.

However, interconnected systems and improved visibility bring increased cybersecurity vulnerabilities. To mitigate these risks, communities should develop or update their risk assessments and emergency response plans as required by the America's Water Infrastructure Act of 2018. They should also develop a robust cybersecurity plan, including protection of operational technology, as the foundation of their modernization journey.

Ways to put "smart water" to work in your community

SCADA modernization and cybersecurity to enable secure access to real-time data and remote SCADA operations and monitoring
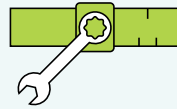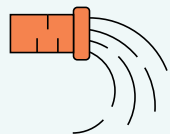
Condition-based monitoring for predictive monitoring and maintenance of rotating equipment

Advanced metering infrastructure (AMI) to detect leaks and water loss, maintain service quality and protect vital revenue streams

Flood monitoring to minimize the impact of floods on human lives and property

Quality monitoring for drinking water, wastewater, stormwater, watersheds and combined sewer systems to protect public health and the environment

Strengthening SCADA for data, visibility and insight

With many aspects of utility operations going remote during the COVID-19 pandemic, now is a good time to invest in modernizing Supervisory Control and Data Acquisition (SCADA) infrastructure and implementing a high quality end-to-end cybersecurity protocol.

Modernized SCADA software and hardware give utilities the flexibility to control processes remotely, access real-time data and interact with smart sensors and utility infrastructure. This increases efficiency, strengthens decision-making and improves responsiveness.

Modernized SCADA systems offer:

+ **Regulatory compliance,** from wastewater processing to sustainable delivery of safe drinking water

+ **Optimized water treatment** with connected systems that deliver end-to-end visibility and control

+ **System reliability** with integrated tools and applications that help utilities maintain network availability and troubleshoot issues quickly

+ **Risk management** with comprehensive physical and digital security and safety architecture that protects the network, intellectual property and workers

Using Citizens Broadband Radio Service (CBRS) in smart cities projects

In July 2020, the FCC auctioned 70 MHz of the 150 MHz band as Priority Access Licenses (PALs), for wireless use. If neither federal radar systems nor PAL holders are using the spectrum, it can be used by General Authorized Access (GAA) users.

Licensed spectrum is protected from interference and recommended for critical communications such as public safety data or notifications.

CBRS-licensed spectrum is well suited for numerous providers and entities, including enterprises and venue owners, for adding capacity to existing networks, both indoors and outdoors, and for controlling the quality of the user experience. Licensed CBRS spectrum can provide reliable coverage for critical use cases such as emergency services and critical communication needs in industrial IoT (IIOT) applications.

General Authorized Access (GAA) spectrum is typically used for information that is less sensitive but still important, like metering or equipment status.

CBRS GAA spectrum is well suited to smart utilities additions like:

+ Automated water meters, removing the need for manual measurements

+ Variable routers for dump trucks, to maximize route efficiency and reduce transport times

+ Modern lighting and monitoring systems

With smart cities network architecture that connects to treatment plants and municipal business systems, utilities can **remotely monitor and operate their assets** without compromising user access and control.
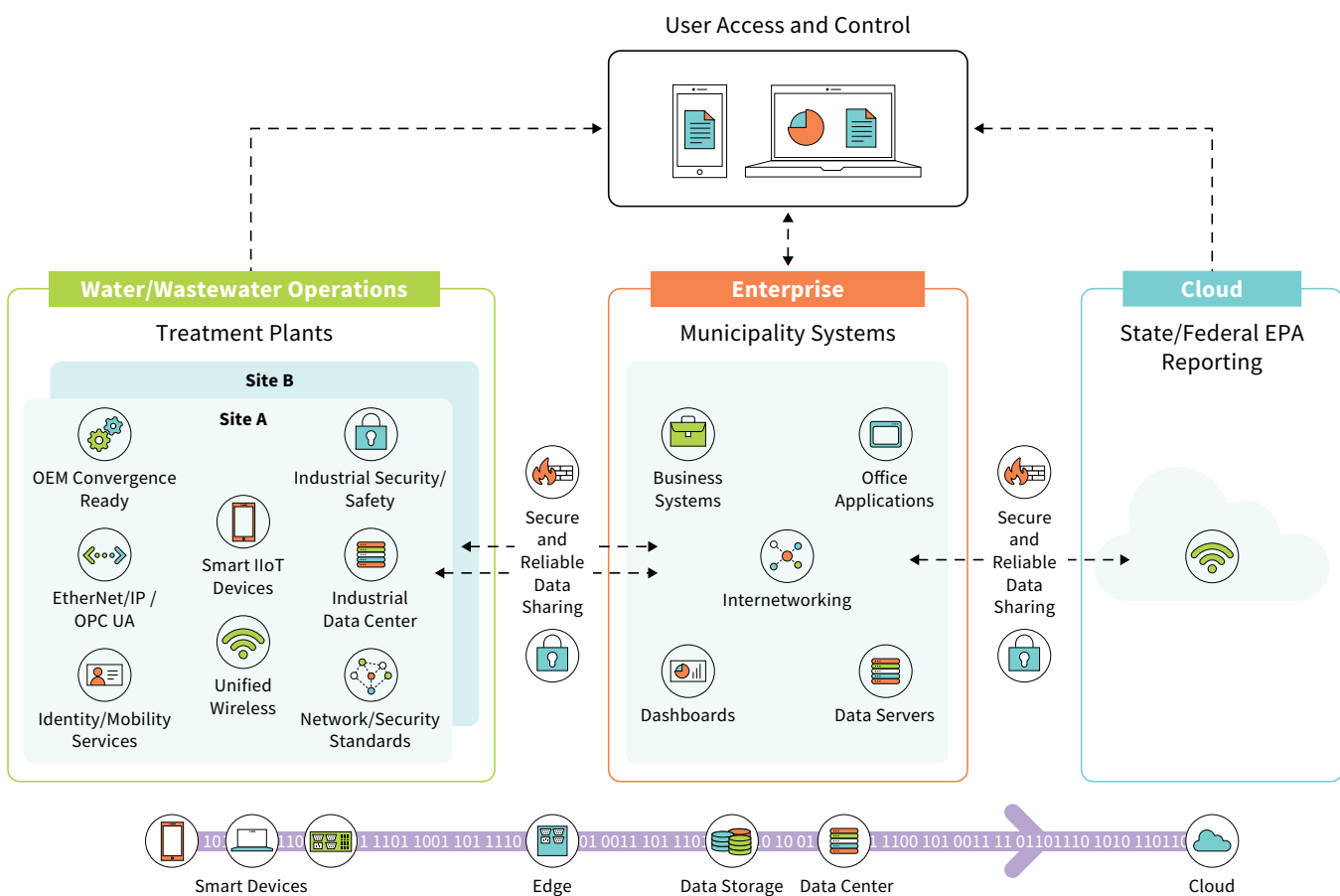
Source: CPwE Architecture Diagram

Putting smart utilities to work in your community

Projects to consider:

- ☐ Remote water tank inspection
- ☐ Remote monitoring for substations and transmission lines
- ☐ Smart metering
- ☐ Outage management
- ☐ Load forecasting
- ☐ Wastewater flow monitoring
- ☐ Flood monitoring
- ☐ Water quality monitoring
- ☐ SCADA modernization and cybersecurity

Resources to assess/investigate:

- ☐ 4G and 5G networks
- ☐ Drones
- ☐ Video analytics
- ☐ Public-private partnerships
- ☐ Rooftop and cell tower sensors
- ☐ Intelligent line sensors
- ☐ Partnerships with industry innovators
- ☐ Industrial IoT networks
- ☐ Data analytics
- ☐ Automation
- ☐ Smart meters
- ☐ Pressure sensors
- ☐ Advanced metering infrastructure
- ☐ Artificial intelligence and machine learning (AI/ML)
- ☐ LPWAN networks
- ☐ Cybersecurity

Smart Transportation

Our transportation systems were radically disrupted in 2020—and likely will look dramatically different in the years ahead.

With the COVID-19 pandemic, the public transit systems that have long been part of the urban experience, like New York City's iconic subway and tramcars shuttling visitors up and down the sloping hills of San Francisco, operated at a fraction of their previous capacity. Here and in air travel, many people were reluctant to spend time in confined spaces.

How can communities ensure safety and regain public trust?

Wireless innovation has been part of the solution, giving transportation agencies the opportunity to react quickly, implement contactless forms of interaction and create safer ways to move people and goods. Smart transportation solutions are also helping communities manage changing traffic patterns and shared mobility usage, as bustling offices and downtowns move to takeout and remote work, then transition into an evolving future.

Reimagining the safety, operations and economics of air transportation

In many ways, airports are cities of their own. They have their own governing bodies that determine budgets, capital investments, services and technology and often have their own law enforcement agencies. They are powerful engines for local economies.

In these roles, airports have long been using smart cities solutions to increase safety and efficiency, reduce their environmental impact and improve passenger experiences. Think apps that give customers real-time access to flight information and systems that help employees manage operations and reduce congestion.

Furthermore, the average airport in the United States is more than 40 years old. As many of these structures undergo capital improvement programs to compete with new airports in Asia and the Middle East, connectivity and digital innovation have been key components of this modernization.

COVID-19 accelerated many aspects of digital transformation. Airports have been investing in systems that accommodate social distancing and facilitate contact-free transactions, from the time a passenger or worker commutes to the airport all the way to their final destination. Concessionaires and retail shops have similarly been seeking solutions to remain economically viable while keeping customers safe and healthy.

Airlines, meanwhile, have been balancing safety concerns with the need to accomplish more with fewer employees, thanks to significantly depressed projections for long-term growth. Solutions like smart systems for employee safety checks, non-touch baggage handling and optimizing aircraft maintenance can help them adapt.

With the expansion of 5G systems, airports and airlines have even more opportunities to put smart transportation solutions to work. Health check kiosks, thermal fever detectors and touchless ticketing and security checks can increase safety and customer confidence. Autonomous vehicles, systems that manage traffic flows and video-based analytics can help airports monitor crowds and encourage social distancing. This connectivity, and the data these systems collect, will be particularly valuable for regulatory compliance, planning and demand management.

Navigating a safe return to public transit

Public transit's ability to move many people at the same time, efficiently, is one of its great strengths—and became one of its greatest drawbacks in 2020. Moving forward, transit agencies must make their services as safe as possible and restore public confidence in the transit experience.

Transit systems from BART in San Francisco to the Los Angeles Metro have been evaluating new technologies for the future, from thermal cameras for employee temperature readings to AI/deep learning-powered video analytics to understand occupancy levels, wait times and adoption of safety protocols.

They've also been using smart transportation solutions to protect employees and customers today. For instance, BART's 15-step plan includes:

+ **Contactless payment:** Riders can load funds onto their Clipper cards online before their trip or arrange for auto-loading. This reduces lines at ticket vending machines and reduces customer touchpoints. Looking ahead, BART plans to eventually eliminate the sale of paper tickets at some stations and expand the official BART app for parking from five stations to all stations.

+ **Data transparency:** BART has shared daily ridership numbers and train car loading data to address riders' fears of crowding. This information is not yet available in real time but is communicated frequently on BART's website and through social media in an easy-to-read format to help riders make informed decisions about their trips.

+ **New technologies and industry best practices:** BART is looking at transit agencies around the world to evaluate the safety, efficiency and cost effectiveness of solutions such as ultraviolet disinfecting and how practical implementation would be for its system.

# The next phase of shared mobility

As recently as February 2020, communities nationwide were bustling with people traveling to and from work, shopping and social activities via electronic scooters, bikes and ride-sharing services. From March onward, these streets were empty.

Rethinking and restoring shared mobility in your community

Creative use of microtransit vehicles, from shuttles and vans to rideshare services, can help communities serve vulnerable riders, fill revenue gaps and improve rider and driver confidence.

Include microtransit vehicles and services in public-private partnerships, with shared goals like minimizing ridership and congestion within each vehicle
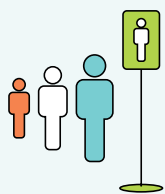
Add designated rideshare pickup and drop-off spots to busy areas, like what has been done in many airports, rail and transit stations. This gives drivers a safe spot and more time to clean and safeguard their vehicles before taking their next guest.

Designate more transit lanes for public transportation and transit, rideshare and taxi services
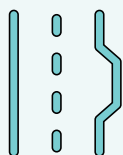
Reconfigure drop-off lanes/ street parking to accommodate rideshare pickups/drop-offs as well as social distancing on sidewalks

Add designated "parklets" for bikes, scooters and ebikes, ideally by bus and subway stations, for safer sidewalks and smoother travels

As offices, tourism, air travel, sporting events and gatherings shut down, cities have seen up to 80 percent reductions in Uber and Lyft rides. At the same time, several scooter, e-bike and other micromobility services suspended or even stopped their highly capital-intensive operations.

Even as some restaurants, shops and offices re-opened their doors, many people have been reluctant to use micromobility and shared mobility services to travel to them.

In a study published on May 1, 2020, based on an IBM survey, half of respondents said they would no longer use rideshare services, and 24 percent said they would no longer use taxis. A full one out of five said they would stop using public transportation altogether. Amid restrictions and concerns, many people were driving themselves to work or working from home— a trend that may become long-term or permanent for some workers and businesses.

At the same time, many people rely on public transportation and hope to use it in the future—which is why communities need supportive transit, shared mobility and micromobility solutions. Single-car transportation is not an option for many low-income, elderly and vulnerable residents and essential workers, and increases pollution and congestion in the long run. Changing traffic patterns are a particular concern as more meals, purchases and medical supplies, including tests, are transported via delivery service.

As cities struggle to fund and support transportation systems, drivers struggle to maintain incomes and riders worry about safety and cost. Smart cities solutions offer powerful and creative solutions to all of these challenges, particularly when facilitated by public-private partnerships.

This is a time to rethink our streets, parking and supporting infrastructure. How can we work together to make transportation easier, safer, more efficient and more economical moving forward?

This is also a time to explore new innovations, like applications that deliver transparency on pricing and safety measures or shared mobility services like "cargo bikes" and scooters designed for delivery.

Advancing Intelligent Transportation

Oklahoma City, OK

SCENARIO

During rush hour, inclement weather or emergencies, traffic volumes can surge and cause congestion and backups.

SOLUTION

Municipalities have long deployed infrastructure such as modern traffic light controllers that enable controllers to adjust traffic light timing, light intensity and more. Often cameras provide visibility of primary routes and major intersections.

Communities like Oklahoma City can deploy a private CBRS network to tie these pieces together and give the city centralized monitoring and control. Either manually or automatically, operators can change traffic light patterns to efficiently and dynamically route traffic.

RESULTS

If Oklahoma City proceeds with a CBRS-powered solution, traffic will be more fluid, saving commuters time and reducing their environmental impact. First responders will also be able to get to the scene more efficiently to provide essential support for accidents and injuries.
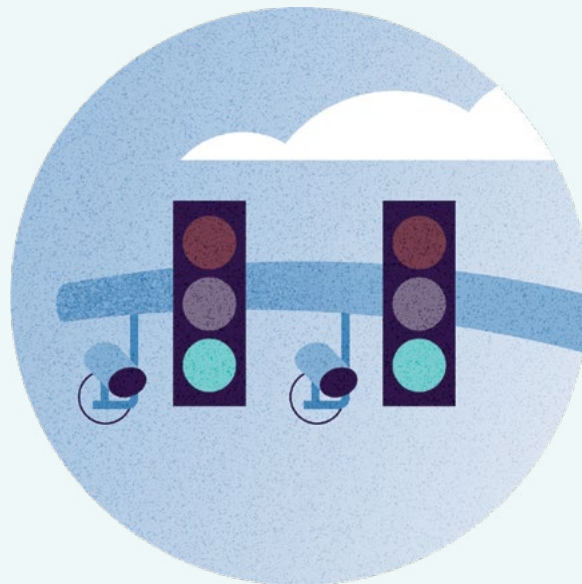
TrafficLink

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.

Putting smart transportation to work in your community

Projects to consider:

- ☐ Customer service apps
- ☐ Touchless services
- ☐ Maintenance optimization
- ☐ Situational/environmental monitoring
- ☐ Shared mobility services
- ☐ Smart traffic light systems
- ☐ Traffic monitoring
- ☐ Remote traffic management

Resources to assess/investigate:

- ☐ 4G and 5G networks
- ☐ IoT networks and data analytics
- ☐ Thermal sensors
- ☐ Video analytics
- ☐ AI/deep learning
- ☐ Public-private partnerships
- ☐ Partnerships with industry innovators
- ☐ Transportation system platforms
- ☐ Advanced analytics
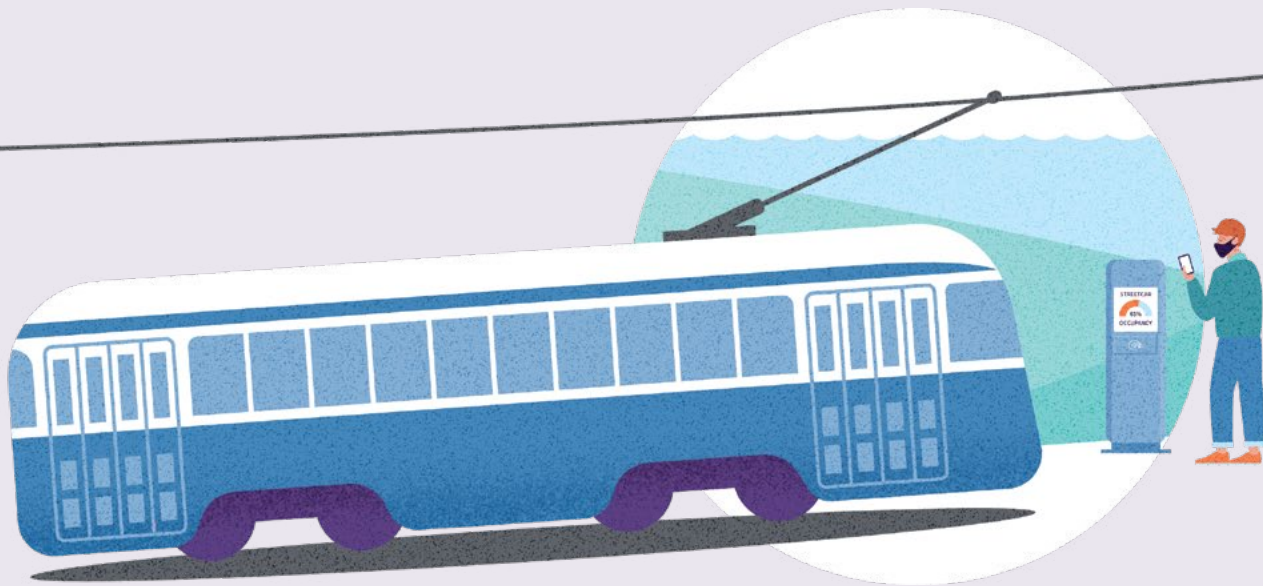
Smart Resources for Moving Forward

CTIA's Smart Cities resources help communities of any size use smart cities solutions to improve safety, efficiency, cost savings and quality of life.

"Innovation can be a very scary word for some people, but it really comes down to **solving real problems** for real people."

– David Graham, chief innovation officer, City of Carlsbad, CA

Town Square™

Town Square is an online platform for smart cities projects and technologies.

Just as a town square in a physical community serves as a gathering place for making connections and learning what's new, Town Square is the online hub for municipalities and members of the wireless industry working on smart cities projects, featuring:

+ Interviews with technology experts and the leaders of municipalities of all sizes

+ Examples of smart public-private partnerships and regional collaboratives in action—conserving energy, enhancing safety, fighting wildfires and more

+ Checklists, guides and a PDF of the Smart Cities Playbook for bringing projects to life

+ COVID-19 resources

Town Square offers two levels of experience: one for the general public and one for Town Square members. The public site features highlights of the work done by CTIA smart cities members, community leaders and partner organizations.

Members are able to delve even deeper, gaining access to exclusive content and notices for meetings, workshops and events. Members can create a profile and connect with peers, just like on a social network.

## The Smart Cities Playbook: Building Our Connected Communities

Which cities can become smart cities? All of them. That statement was the CTIA Smart Cities Working Group's north star for the *CTIA Smart Cities Playbook: Building Our Connected Communities.*

Across locations, technology types and goals, smart cities projects share many commonalities—and all can benefit from guidance on best practices, technology solutions, ways to forge vendor relationships and more.

This Playbook is a first step for getting started, providing:

+ Strategy considerations

+ Foundational planning ideas

+ Tips for navigating the procurement and RFP process

+ A glossary of technical terms

Throughout are real-life examples of real-life smart cities deployments in action— in public services, public safety, utilities, transit and beyond.

town
square™
● ctia initiative

smartcities.ctia.org
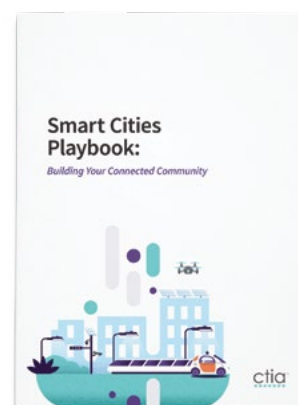
Smart Cities Maturity Model

How connected is your community right now—and where are you on the roadmap to becoming a smart city?

Smart cities solutions can help communities solve tangible problems and achieve greater efficiencies. Yet evaluating and prioritizing which wireless technologies to deploy can be daunting.

A cross-department "maturity assessment" can help. With such a tool, communities can understand exactly where they're at in their smart cities journey and juggle stretched resources, changing constituent priorities and competing budgetary demands to get where they want to go.

Created by CTIA's team of subject matter experts from the wireless industry, the Smart Cities Maturity Model Assessment helps cities identify the technologies and systems they have in place to connect their departments, agencies, business owners, residents and visitors. Do they rely on yesterday's technology to manage operations? Have they deployed current technologies? Are they exploring the wireless technologies of tomorrow?

Through a process like a personality test, communities measure themselves across three vertical applications of public and private services: transportation, public services and utilities. Within each, they answer specific questions relating to data communications, connectivity access, infrastructure, security, resilience and equity. The output helps them identify their current state and quantify how connected they are today.

Learn more about the Smart Cities Maturity Model Assessment and how to use it at **smartcities.ctia.org.**

Why CTIA created "Rising to the Challenge: A Smart Cities Playbook"

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 cloud and edge computing as well as the intelligent infrastructure that enables smart traffic management, modernization of utility operations and AI-powered visual sensors for increased public safety.

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 autonomous vehicles.

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.