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Trilliant®

WHITE PAPER

Flexible Strategies for the Smart City: Understanding modern challenges to plan for networked success

White Paper **Table of Contents**

Introduction

This white paper will discuss how the smart city can help to revolutionize urban areas, specifically using information and communication technologies. Some of the main purposes are to share information with the public, and ultimately improve the quality of government and public services in a community.

The term smart cities was coined back in 2005 when the Clinton Foundation challenged Cisco to make cities more sustainable. IBM also kicked off their vision of using information technology to make cities smarter. Since then, many companies have worked with municipalities and cities to offer improvements on public services by using information management and analytics. So, what is a smart city, and what can it help communities achieve?

According to Sue Weekes, News Editor of Smart Cities World, "Cities have an opportunity to improve quality of life by addressing major local issues such as air and water quality, resource scarcity, traffic congestion and road safety as well as digital inclusion. Cities are also stepping up as key leaders in environmental sustainability, sitting on the frontline of climate change action." (from SmartCitiesWorld Trend Report, Where's the ROI: How smart cities can deliver social, economic and environmental benefits, providing a three-dimensional return on investment (Itron)).

What comes to mind when you hear the term smart city? More importantly, what can a smart city do for your community? This can depend largely on the goals of an urban area, and the investment strategy. Some objectives of a smart city can be, for example, how it can improve public services, traffic and parking management, water management, and lighting. It may also be important to address how a smart city attracts new business through innovative public infrastructure. Also, how can it improve operational cost and drive new revenue.

The smart city, through new technologies, can "… create opportunities to develop new urban services that improve cities' operational performance, provide greater transparency and more interaction with citizens, and reduce the local environmental impact. By making use of data from connected objects (sensors, probes, meters, the Internet of Things), real-time water quality can be measured, network losses can be reduced, waste collection and treatment can be managed in real time, and the energy performance of urban services can be improved while also preserving resources."[1]

[1] Veolia, "Smart cities: when digital technology makes urban areas more attractive and competitive," www.veolia.com/en/market/municipal/smart-cities-digital-technology

Roadblocks to the Smart City

The phrase smart city is certainly buzzworthy and has much merit. There can be many benefits to implementing a smart city solution, depending upon the level of implementation. Municipalities desire to save money while improving public services; however, they need guidance and expertise to forge the road ahead. Funding services available through Trilliant can remove a huge roadblock to speed to value. The ability to quickly deploy solutions that offer significant return on investment through operational savings, such as Smart Street Lighting, allows for faster realized benefits and budget for additional solutions.

Management in Silos

One central issue is that traditionally all municipalities have separately managed services. The thought of combining services, and how they are updated and monitored, must be faced when a smart city comes to mind. For example, how can different departments come together to work in unison by bridging technology and breaking down barriers between different business areas? "Perhaps the hardest challenge to overcome is that of breaking silos between different disciplines and departments," notes Gary Mintchell, an industry-leading writer on automation, control, software, manufacturing, marketing, and leadership. "The famous 'IT/OT Convergence' that has been discussed for many years must happen."[2]

Many of the municipalities operate separately. "One of the biggest issues we see is that most of the cities still operate in silos. If you try and make these decisions in silos, if you're not operating with a centralized thought process, these things [IoT sensors] don't talk to each other,"3 Arvind Satyam, managing director of business development for smart and connected communities at Cisco.

When Trilliant works with partners and municipalities we make it a point to discuss how departments can reduce their costs for projects in convergence of resource and data. It is important when an organization can explain how expenses can be shared and new business insights gained by looking at data across departments. Through our infrastructure and data aggregation capabilities we can pull together data from new and existing sensors, actuators and other devices, and also aggregate data from existing legacy applications. Deep analysis of disparate data has provided unique insights enabling cities to operate more efficiently and to converge legacy and new applications to truly drive citizen value.

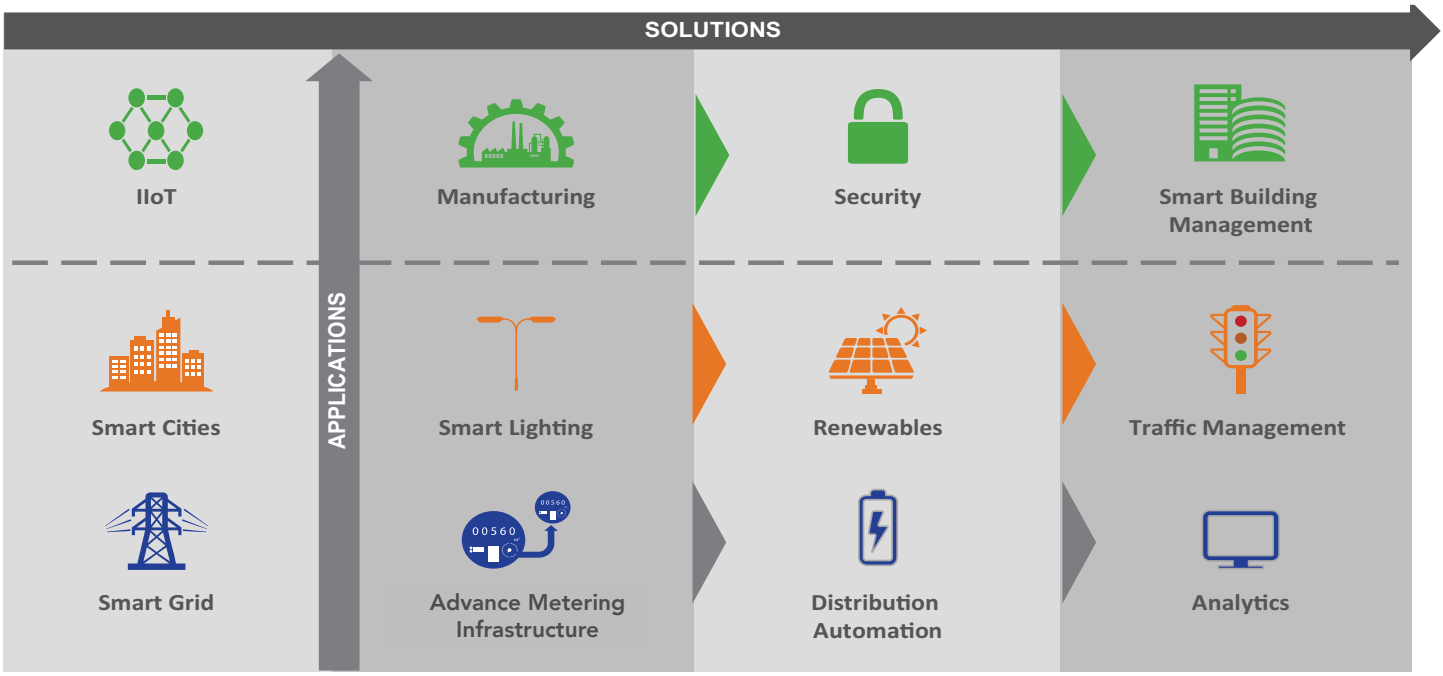


Figure 1: Smart Communication Application Expansion

[2] Tripwire, "5 Key Challenges for the Industrial Internet of Things (IIoT)," www.tripwire.com/state-of-security/featured/5-key-challenges-for-the-industrial-internet-of-things-iiot/
[3] ZDNet, "Five essential steps to becoming a smart city," www.zdnet.com/article/five-essential-steps-to-becoming-a-smart-city/

Disconnected IT Systems

A second concern is that when technologies do not use standard schemas for identification on a network, integration is difficult, and makes tracking data analytics impossible. "Unlike IP addresses in the IT world, many industrial things don't use standard addressable schemes for uniquely identifying themselves on the network. Instead, their schemes vary by vendor and type, and they may or may not have built-in discovery mechanisms. Innate knowledge by an integration expert is required to connect the things in a way that makes them function as a whole."[4]

In addition, a more challenging issue is that different IT technologies simply do not connect to the Internet. "Consequently, a hodgepodge of industrial networks has been created with no attention made to the future possibility of being connected to the Internet. As a result, organizations must develop a plan to enable such disparate communication mediums to work together to achieve a successful IIoT strategy."[5]

Trilliant's experience in integrating proprietary technologies in the Utilities market has enabled us to take a unique perspective on bringing together legacy and new IT technologies. We have integrated for example SCADA systems with cloud technologies to deliver Smart Energy solutions for Automated Metering and Distribution Automation. Migrating to truly plug and play environments is ultimately the goal in IIoT as new standards are socialized but Trilliant has a way of bridging the gap as we support the adoption of those new standards.

Cyber Security

When dealing with IT and upgrading to a smart city, companies should think about laying an important foundation for cyber security protection. "Any 'thing' or device that is controlled by network communication that 'faces' the Internet is vulnerable to being hacked," observes Ron Carr, President and Managing Member of Access Control Technologies LLC (ACT), as well as a Business Development Partner for Tripwire with over 40 years of experience in pipeline SCADA communications..."[6] Additionally, outdated operating systems that do not include up-to-date security patches could cost a company millions. Cohesive IT standards and regulations are key, unifying and securing old, out of date fragmented security solutions.

Trilliant's wireless communications platform is designed to address the demanding security requirements of the Utilities market and therefore deliver a more secure communications network than public cellular communications platforms. We also have the unique ability to integrate proprietary solutions and data into a common repository for analysis. Our willingness to address the tougher integration scenarios required for legacy platforms enables data and information to provide significant insight from for example traffic systems, transportation systems, parking platforms, utility metering with new solutions for environmental monitoring, street lighting, waste management, water management and leak detection. Connecting these solutions makes it possible to deliver deep dive analytics across a highly secure private platform.

Juggling Funding Issues

A fourth important issue of a smart city is funding. How can funding be allocated and reallocated from other important projects, without losing months or years? Also, taking a technology risk for the first time may be difficult financially. "One common obstacle involves technology risk: the project may be the first to deploy a particular technology, reducing investor confidence in the integration and usability of the technology in the absence of demonstrable proof of concept. It may also be hard to secure financing for a smart city project where it is difficult to monetize the benefits of the project.[7] Return on investment (ROI) should be as a clear outcome of a financial investment. Smart city projects are complicated in nature, since managed services are typically separated, along with the budgets.

Through public/private partnerships, Trilliant can assist in funding these projects, making the investment affordable while delivering the cost savings and revenue improvements from new IIoT solutions.

[4] Control Engineering, "Four IIoT connectivity challenges for businesses," www.controleng.com/articles/four-iiot-connectivity-challenges-for-businesses/
[5] Control Engineering, see footnote number 4
[6] Tripwire, "5 Key Challenges for the Industrial Internet of Things (IIoT),"
www.tripwire.com/state-of-security/featured/5-key-challenges-for-the-industrial-internet-of-things-iiot/
[7] Skowon, John, (2018). The challenge of paying for smart cities projects, (PDF file), Deloitte, p. 5

Evolution of the Smart City

Plan, Plan, Plan

So that a municipality or an urban area can be revolutionized into the future, a thorough plan needs to be developed and revisited on an ongoing basis. "Cities now recognize that becoming a 'smart city' is not an end state, but rather a process, which enables an efficient and ongoing evolution of technical solutions across city services." (from SmartCitiesWorld Trend Report, Where's the ROI: How smart cities can deliver social, economic and environmental benefits, providing a three-dimensional return on investment (Itron)). Understand what strengths and weaknesses your municipality has, which obstacles there are to overcome, and identify and map out a plan which incorporates all possible stakeholders.

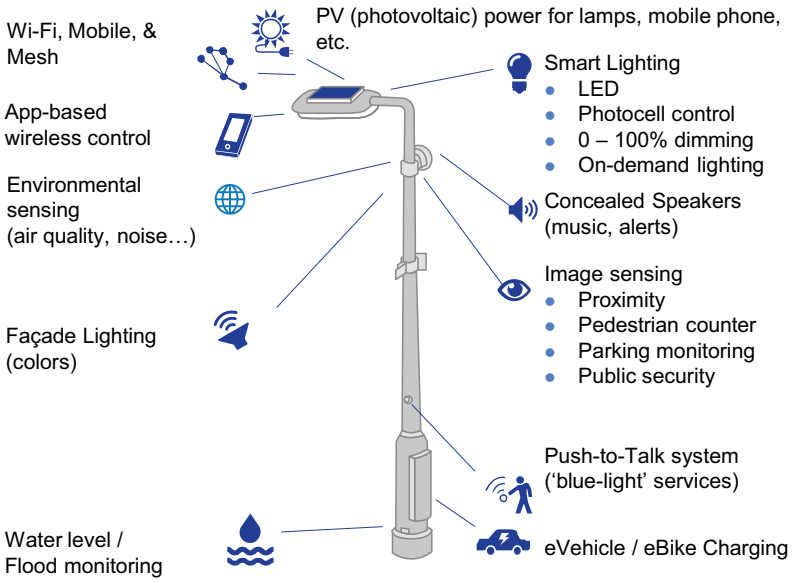


Figure 2: Street Lights can be the Gateway to Smart City Adoption

Trilliant works with both the end customer and an ecosystem of partners to plan and deliver. The foundation for innovation begins with the core communications platform. It is essential while laying out a city infrastructure to deliver IIoT solutions and ensure all parts of the city are reached while planning new solution deployments and integrations. Trilliant advocates for finding the right data and learning from it. Our ability to combine networks and to extend it long distances through proven technologies gives cities the to deploy applications and devices throughout a city. We enable multiple solutions to be layered onto the same network, ultimately reducing operational expenses. With street lighting, operating and maintenance costs can be reduced by 30-50% through the implementation of LEDs and dimming capability. The objective is to improve revenue through better use of resources like easily locating available parking spots, Zip Car rentals, bicycle rentals and other service usages that improve air quality and reduce traffic congestion, while continuing to attract new citizens because of the improved the quality of life.

Collaboration with Integration Partners

Collaboration with both public and private integration partners, and involving public citizens, has the best potential to realize an operating smart city, fulfilling a mission.

"In short, successful smart cities are built on platforms (integration partners) that bring all the right technologies together seamlessly for the benefit of all the partner organizations – citizens, commercial and non-commercial organizations – including integrated cloud-based ICT, artificial intelligence, analytics, security, automation and more."[8]

Integration partners have the knowledge to handle the details of integration technology and manage the change that needs to occur to turn a municipality into a smart city. "This massively reduces the obstacles to both offering and accessing all kinds of services – such as matching prospective tenants and property-owners, public or private, for example."[9] Also, they "...can help you steer clear of only looking at the technology alone and instead help you see how particular IIoT technologies fit in your overall operations and future efforts."[10]

Trilliant's partner ecosystem includes not only device and applications partners, but system integrators, civil engineering companies and analytics companies. This unique set of partners ensures we have expertise in city planning, integration of technologies, and security in data transmission. The combination ensures delivering a platform that delivers business value quickly and is future proofed.

[8] SmartCitiesWorld, "Smart cities will succeed through systematic planning and a focus on economic vitality," www.smartcitiesworld.net/special-reports/smart-cities-will-succeed-through-systematic-planning-and-a-focus-on-economic-vitality
[9] SmartCitiesWorld, see footnote number 8
[10] ROBOTIQ, "The IIoT, Its Challenges And Why It's Important," https://blog.robotiq.com/the-iiot-its-challenges-and-why-its-important

Involve the Public

Involvement of the public in smart city studies also helps to ensure success. Only the public's use of the smart city functions will guarantee a successful outcome. If citizens utilize the new technology and revolutionize their lives, then a municipality can stand on its' achievement.

Modernize the IT Infrastructure

To be able to collect and analyze data for a smart city, it is crucial to make a substantial investment in the modernization of the IT infrastructure. "Determine the largest return on investment (ROI) you can track and come up with an IIoT analytics plan that confirms what's working well and what (needs) to change. That information gives guidance for adjustments as the IIoT adoption period progresses."[12] The integration of IT should help to "seamlessly integrate different types of hardware and applications from a variety of vendors …. to meet the high demands of a smart city."[13]

The smart city IT infrastructure should be structured with a different purpose in mind, mainly to support data analytics. "… the focus must be around creating an infrastructure that is designed with data in mind. In order to be prepared for next generation governing, cities must focus on IT infrastructure from the bottom up, consider data a factor..."[14] One thought process is to consolidate the myriad of applications, and move away from supporting decentralized applications. This not only could help streamline the management of applications, but it also could create a more secure environment. Data should also be processed in real-time, "because it makes applications faster, time to action more instant and immersive, employees more productive and citizens safer and more satisfied."[15]

The speed of performance of Trilliant's communications infrastructure supports real time data gathering and responsivity.

"Smart cities approach works best when the citizen-centric approach is adopted. It can only be planned and developed when citizens have their views in front of their government as to how they want cities to function in a smarter way. It is all about the local municipalities listening to what citizens need and then applying technology-driven solutions to deliver services in most economical and sustainable way."[11]

Mahashreveta Choudhary – Author, Geospatial Magazine

[11] GEOSPATIAL WORLD, "Citizens at the heart of smart cities," www.geospatialworld.net/blogs/role-of-citizens-in-building-smart-city/
[12] ROBOTIQ, "The IIoT, Its Challenges And Why It's Important," https://blog.robotiq.com/the-iiot-its-challenges-and-why-its-important
[13] Cerium Networks, "Smart City Information Technology Infrastructure," https://ceriumnetworks.com/smart-city-infrastructure/
[14] SMARTCITIESDIVE, Supporting smart cities: The importance of building a strong IT infrastructure," www.smartcitiesdive.com/news/supporting-smart-cities-the-importance-of-building-a-strong-it-infrastruct/548930/
[15] SMARTCITIESDIVE, see footnote number 14

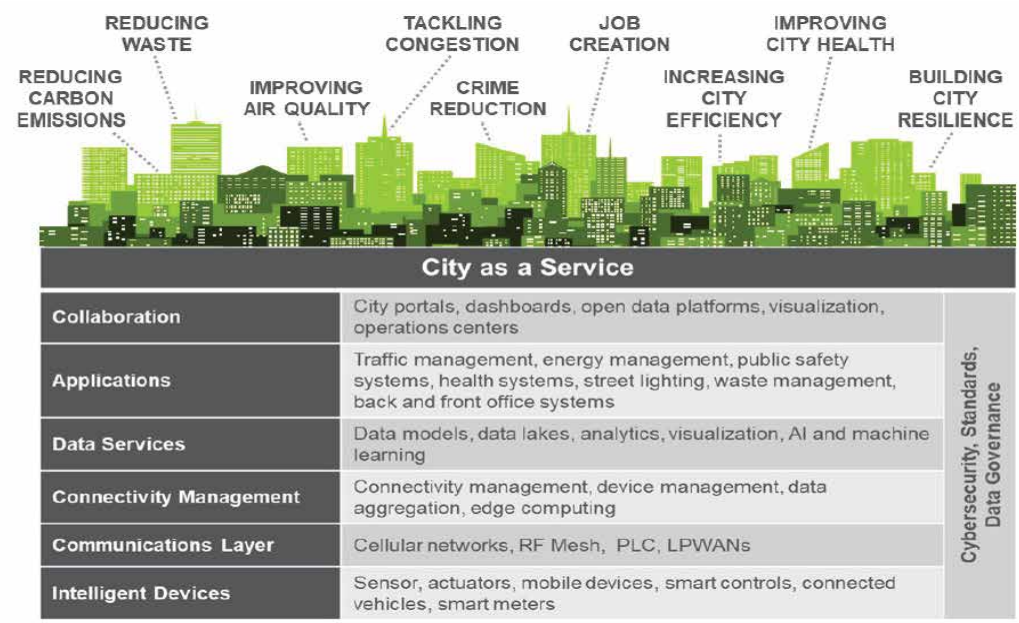


Figure 3: Displaying the City as a Service (CaaS)

(Source: Navigant Research)

Championing the City as a Service / Smart City

Trilliant champions the city as a service/smart city through several different core components. These are the ways in which we collaborate, the applications we offer, our data services, how we manage connectivity and different communications layers, and our intelligent devices. Trilliant's wide range of product offerings reflect these core modules of the smart cities' platform.

According to Navigant Research, collaboration is "a fundamental driver … (which) enable(s) better integration across siloed operations and data sources."[16] With this in mind, Trilliant's objective is to make customer data available through a common User Interface (UI) that is referred to as a "single plane of glass" view. This single pane of glass provides a consolidated, central location for users and managers to view real-time data from any number of devices across an entire connected system. Examples of this are city portals, dashboards, open data platforms, visualization, and operations centers. Bringing these various dashboards together for multiple users is the core mission for a "single pane of glass" solution.

The second core layer, applications, consists of the many business operations tools that could be used across a city or development: energy management, traffic and parking management, building systems, and others. To serve this layer, Trilliant builds ecosystems for sensors and application partners that need viable data. Through our work, we make it possible for data to become more consistent, more secure, and more readily available for customer applications. Navigant Research explains that, "Existing city operational areas will continue to be the main repositories for city data using vertical applications for operational management and service delivery as well the usual back and front office applications."[17]

The third feature is data services, which can consist of data models, data lakes, visualizations, artificial intelligence (AI), or machine learning. Trilliant adds value by providing analytics capabilities in our core application areas of Smart Energy and by managing the best of breed in partners to further enable deep analytics across multiple data sets identifying new business insights."

[16] Navigant Research Report, Smart Cities Overview, Smart Technologies and Infrastructure for Urban Innovation in Government, Energy, Water, Mobility, and Buildings: Global Market Analysis and Forecasts. (Published 2Q, 2019). Eric Woods (Research Director), Ryan Citron (Senior Research Analyst), (pp. 37-38)

[17] Navigant Research Report, Smart Cities Overview, Smart Technologies and Infrastructure for Urban Innovation in Government, Energy, Water, Mobility, and Buildings: Global Market Analysis and Forecasts. (Published 2Q, 2019). Eric Woods (Research Director), Ryan Citron (Senior Research Analyst), (p. 37).

"The ability to combine data from multiple sources and particularly new demands for managing IoT data from a diverse range of devices is critical to developing insights from big data, real-time sensing, and the use of AI and other advanced analytic tools. This includes data sourced from beyond the city's firewall."[18]

Connectivity management, the fourth city as a service/ smart city factor, can be described as "The accelerating deployment of IoT-based solutions for diverse city operations means that device and connectivity management is becoming increasingly critical and sophisticated. As well as providing integrated data collection and device monitoring capabilities, the connectivity layer is an important enabler of advanced cybersecurity and edge computing capabilities."[19] Trilliant manages security through the ways in which devices are added and operate on a network, how data is aggregated, and by using edge computing. As important as edge device integration and management, the ability to securely transport and aggregate data is critical to feeding the analytics capabilities in the third feature described above.

Looking at the variety of communications technologies available, how do you establish a baseline network that can connect to data where it lives and extend new capabilities as needed? With smart cities, data is often communicated over either cellular or WiFi radio frequency (RF) infrastructures. Trilliant supports an integrated communication strategy that is both extensible and that employs multiple requirements for connecting to data and devices where they are. This approach includes utilizing, for example, a communications layer that can leverage both Wide Area Network (WAN) and Neighborhood Area Network (NAN), a mesh network for smart city needs within a city center, and enables the ability to extend RF connectivity over long distances to support lighting and traffic management, or utility information for metering or water management.

Through the communications core layer networks such as the cellular network, the RF network, and LPWAN (Low Power Wide Area Network), Trilliant is seen as a value proposition of the hybrid network. Trilliant brings cost savings, as well as support for LPWAN and cellular networks. Navigant Research explains that "Smart cities are deploying diverse networking solutions alongside existing communications infrastructure; the advent of low power networks and eventually 5G networks are adding to the range of options available."

The final element, intelligent devices, discusses how "Smart cities involve the deployment and exploitation of an expanding range of devices from connected streetlights to AI-enabled traffic lights, smart meters to waste bin sensors, air quality monitoring to citizen-sensing data using smartphones."[20] Trilliant has the ability to integrate and aggregate data from existing technologies. We possess the know-how to deliver it on a single platform, displaying all connected devices and associated applications on a single pane of glass, organized to the specifications of a business. Trilliant makes it easier for your business to carry on with work in a more efficient, effective manner, because of the oversight into more detailed data.

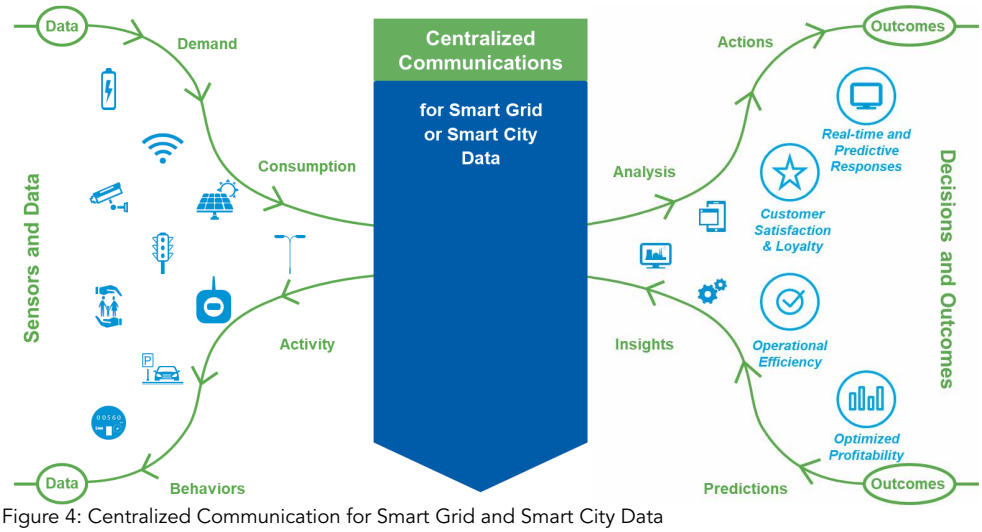


Figure 4: Centralized Communication for Smart Grid and Smart City Data

[18] Navigant Research Report, Smart Cities Overview, Smart Technologies and Infrastructure for Urban Innovation in Government, Energy, Water, Mobility, and Buildings: Global Market Analysis and Forecasts. (Published 2Q, 2019). Eric Woods (Research Director), Ryan Citron (Senior Research Analyst), (p. 37)
[19] See footnote number 18
[20] Navigant Research Report, Smart Cities Overview, Smart Technologies and Infrastructure for Urban Innovation in Government, Energy, Water, Mobility, and Buildings: Global Market Analysis and Forecasts. (Published 2Q, 2019). Eric Woods (Research Director), Ryan Citron (Senior Research Analyst), (p. 38).
Figure 4: Centralized Communication for Smart Grid and Smart City Data

How Trilliant Can Move You into the Future

Trilliant delivers both a flexible and scalable smart city structure that can be integrated with your existing systems. Our IIoT sensor integration capabilities can help connect to data, from whatever system you choose, all while expanding your technical communications into a full platform, and a single pane of glass.

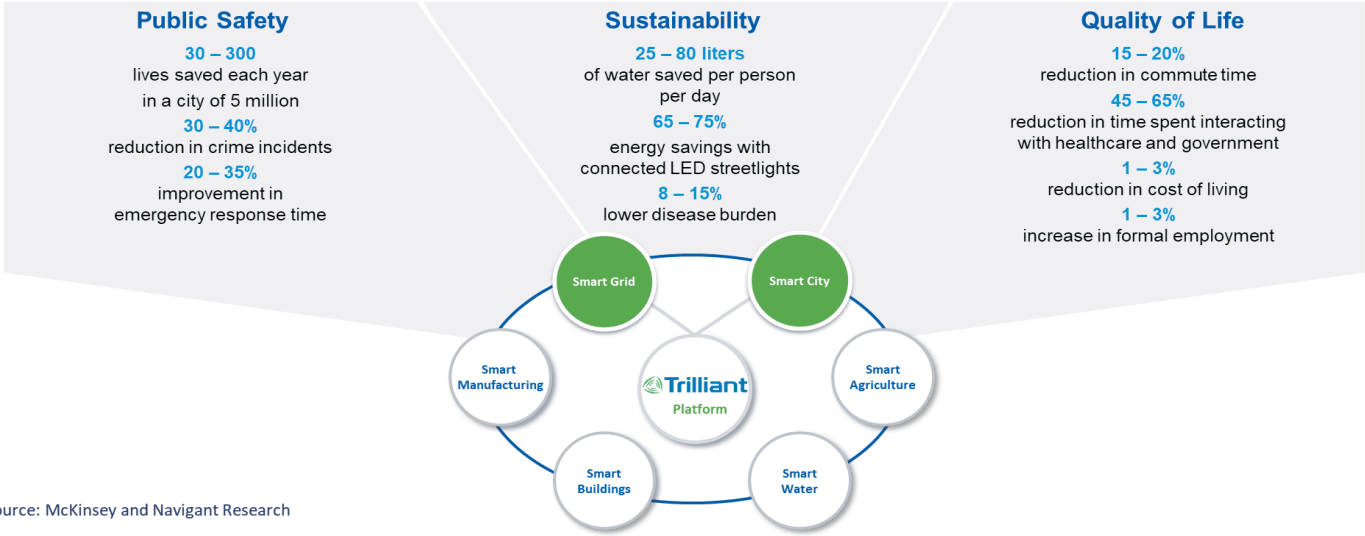
Our IIoT network enables the connection to many different types of existing and new sensor technologies through the Trilliant IIoT Gateway. The Gateway extends existing device integration over our capabilities with Trilliant SecureReach® Low Power Wide Area Networks (LPWAN) and Trilliant SecureMesh® networks by incorporating many existing IIoT devices supported by LoRA, Bluetooth Low Energy (BLE), Wi-Fi, and USB allowing cities to protect investment made in sensors. By combining our integration of Smart Energy devices with new technologies for IIoT solutions, Trilliant delivers a single platform that is the foundation for all solutions required for smart cities.

Consider the example of CCTV cameras, often used in cities for crowd sensing, traffic management, people counting or public safety. Trilliant's WAN technology enables the integration of Smart Video CCTV cameras without the need for Fiber. In those environments where Fiber is available, our network can integrate. Where Fiber is expensive and unavailable, Trilliant's network provides the speed needed to deliver streamed video or metadata from edge processed video devices without the cost or need for Fiber. The collected data can then be assessed using the single plane of glass approach, eliminating the need for multiple interfaces and programs to manage the system.

Trilliant utilizes several industry standards to create a seamless approach to the smart city such as Bluetooth Low Energy (BLE), Ethernet, WIFI and the TALQ Smart City Protocol. Because of the number of LoRaWAN® devices in the marketplace, we support integration across a faster and more secure communications platform. The TALQ Smart City Protocol exchanges data between central management systems (CMS), lighting communication networks and other smart city applications. This protocol enables one CMS to control devices on different networks located in disparate areas of a city or region. "TALQ is an open industry consortium consisting of most of the leading smart lighting and smart city vendors. Version 2.1 of the Smart City Protocol was released in 2019."[21] Trilliant is certified on TALQ 2.1 of the standard.

Using Trilliant's smart city technologies, access points can be connected and consolidated faster through a secure communications network and across various communications technologies. Grids spaning over long distances can utilize Trilliant SecureReach to collect real-time streetlight data to improve the lighting schedule, smart parking solutions for parking availability, traffic flow data to aid in traffic management, leak detection, and water flow management.

[21] See footnote number 20 (p. 41)



Source: McKinsey and Navigant Research

Figure 5: Benefits of a Platform Across a City's Services

Trilliant's Cutting Edge Solutions

Trilliant's cutting edge technology will move you into the future. Our offerings provide solutions for Smart Energy, Smart Water, Smart Parking, Smart Lighting and Smart Government.

Smart Energy

Our Smart Energy solution is made up of Advanced Metering Infrastructure (AMI) and Distribution Automation (DA), and is one of our core solution areas. With over 15 years of experience in the Utilities market addressing unique requirements for security and customer data protection, Trilliant is well positioned to help broaden the use of IIoT technology beyond metering. Additional solutions include Asset Management for all devices, Workforce Productivity solutions, and home-based gateway technology for in home sensors to assist citizens in managing energy usage and security technology. IIoT is on a potential path to replace more Supervisory Control and Data Acquisition (SCADA) based solutions, with the energy industry being one of the largest users of this solution. This may have huge implications for the industry since it would let much of the proprietary technology to be replaced with more open technologies used in other markets.

Smart Water

Smart Water consists of applications such as water metering, leak detection, flow monitoring, and flood/drought detection. These applications provide critical services like protecting water reserves and identifying areas subject to flooding. Sensor technologies protect this valuable resource by leveraging acoustic leak detection, and through flow management. In addition, updated water meter systems enable sophisticated water management applications to be brought on board to leverage all existing sensor information. When placed in an around creeks and rivers, sensors can assist in virtually monitoring water levels, providing accurate and safe readings during times of potential flooding.

Smart Mobility

Smart Mobility applications include traffic monitoring and management, congestion management, electric vehicle charging, mobility as a service, public information systems, and smart parking. Smart parking represents a new area of revenue generation for cities and allows citizens to quickly locate available parking. When a single infrastructure provides information through mobile devices, it allows for quicker monitoring of essential services used by citizens. Having the ability to connect these different services is an important part of improving the quality of life for citizens. Through Trilliant's IIoT technologies, these programs can be seamlessly monitored from a single point while also providing the framework to support future applications.

Smart Government consists of Smart Lighting and Environmental Monitoring, among other solutions. Street Lighting is proving to be a foundational use case due to significant operational cost savings. Environmental Sensing is also vital to improve the health of citizens by using environmental readings to report air quality. They are also used to validate when new measures to reduce emissions are testing and to validate what is working. Many cities in various countries are fined if they cannot achieve a certain emission level and these metrics become critical for cities to prove their emission levels.

Conclusion

It's easy to see why solutions and smart city deployments are so disparate across the globe. While not a unique problem, entities wanting to implement smart technologies need to first determine their goals, and then decide what kinds of technology can help them achieve those goals. With the right technological backbone, cities can create a connected system that has the ability to support current and future needs. From street lighting to traffic management and environmental controls, the opportunities are endless when the right foundations are in place. By utilizing a communication network that offers flexibility, cities can begin to reap the benefits that come with better, more accurate access to data and increased control over essential city functions.

Trilliant has the experience to assist organizations with navigating the challenges that arise with implementing smart city technology. While many cities face unique needs and challenges, our expertise lies in helping you determine which solutions will be most effective for a city's unique challenges. Together with your team, Trilliant can guide you in Connecting the World of Things.

Questions, comments: info@trilliant.com