

# IoE-Based Services Help San Antonio Cut Costs, Boost Revenue, Increase Safety, and Stretch Resources



## EXECUTIVE SUMMARY

### Objective

- Use technology to deliver city services more efficiently

### Strategy

- Leverage city's fiber-optic network backbone to offer a broad range of programs for citizens and municipal workers

### Solutions

- Networked traffic light control system
- Remote, video-conference-based (telepresence) municipal court program
- In-car video and transaction technologies for law enforcement officers
- Sensor-based smart streetlighting

### Impact

- Prior to synchronization of traffic lights, an estimated \$2 billion was lost due to longer commutes, higher fuel expenses, safety issues, and other factors
- Remote court system drives more efficient delivery of judicial resources and city services, while also freeing up parking, shortening wait times, and stretching judicial resources
- Integration of technology into law enforcement vehicles has dramatically reduced the administrative burden on police officers
- Smart streetlights have increased safety while conserving energy and public funds

## Background

In January 2014, Cisco released the results of an in-depth analysis of the economic benefits of the Internet of Everything (IoE) for the public sector. Cisco's model revealed that some \$4.6 trillion in "Value at Stake" would result from the adoption of IoE capabilities across 40 key public sector use cases over the next 10 years, including smart water, smart buildings, smart energy, smart parking, and more (<http://bit.ly/1aSGIzn>).

As a next phase of its analysis, Cisco engaged Cicero Group, a leading data-driven strategy consulting and research firm, to undertake a global study of IoE capabilities across these 40 use cases – how the best public sector organizations are "connecting the unconnected," as Cisco terms it. To that end, Cicero Group conducted interviews with dozens of leading public sector jurisdictions – federal, state, and local governments; healthcare organizations; educational institutions; and non-governmental organizations (NGOs) – to explore how these global leaders are leveraging IoE today.

The research examined real-world projects that are operational today, are being delivered at scale (or through pilots with obvious potential to scale), and that represent the cutting edge of public sector IoE readiness and maturity. The aim of the research was to understand what has changed in terms of the jurisdictions' people, processes, data, and things, and how other public sector organizations can learn from (and replicate) the trail blazed by these global IoE leaders. In many cases, these jurisdictions are Cisco customers; in others, they are not. The focus of these jurisdictional profiles, therefore, is not to tout Cisco's role in these organizations' success, but rather to document IoE excellence, how public sector entities are putting IoE into practice today, and to inform a roadmap for change that will enable the public sector to address pressing challenges on multiple fronts by drawing on best practices from around the globe.

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Chief Technology Officer,  
City of San Antonio

## About the San Antonio Smart City Project

San Antonio, Texas, the seventh-largest city in the United States, is a leader in the implementation of Smart City technology. Current programs include an advanced synchronized traffic light program and a live video system for remote court hearings. San Antonio is currently expanding a sensor-based LED streetlighting system and planning a citywide smart parking initiative.

Underlying this progress is the installation of miles of fiber-optic cabling and a wireless mesh network throughout the city. While much of the technology is still being developed, most of the infrastructure is in place to further leverage the network’s vast capacity for streamlined collection, transfer and management of city-wide data.

Hugh Miller is chief technology officer for the City of San Antonio. He and his team design and support the network functions that allow the flow of data among the city’s various systems. He manages a staff of roughly 340 IT and administrative personnel throughout all city departments.

Mr. Miller has a background in both electrical and computer engineering, and prior to his current position worked as an IT manager and network engineer. He has worked for San Antonio since 2004, and has been an integral part of the city’s smart initiatives.

## Objectives

When Mr. Miller took over as CIO in San Antonio nearly 10 years ago, he found the city had a lot of technological catching up to do. “We were really far behind when I got here, and we had to take this rapid leap forward to update everything, and also to build stuff for tomorrow,” he recalled.

A network engineer, Mr. Miller describes his first goal as coordinating the central management of San Antonio’s data. With an operating budget of \$63 million, he began by partnering with municipally owned CPS Energy and circling the city in fiber-optic cabling. He then started development of a citywide wireless mesh network.

This network is used for traffic, public safety, and justice applications. This range of network-based technology is aimed at improving customer service. “We’re using technology more and more to enhance how we deliver services,” said Mr. Miller. “That’s primarily the end goal: to deliver services in a much more efficient way than we have in the past.”

Mr. Miller worked with the San Antonio Transportation Division of Public Works to install a traffic light control system at each of the city's intersections. The system allows transportation personnel to monitor and control more than 1,200 traffic lights from a network-enabled terminal. The system can control cameras that provide visual information to traffic managers.

## Strategy

Working with the city's energy company CPS Energy, the City of San Antonio installed three concentric SONET rings around the city to form a fiber-optic backbone on which to deploy the city's technological solutions. This backbone supports a Wi-Fi mesh network that links traffic signals as well as some of the security and traffic cameras. The city also uses WiMAX technology for some of the network backhaul.

Capital-expense funding for San Antonio's Smart City initiatives came from a variety of public sources. Because the Smart City initiatives coincided with the original traffic synchronization project, Mr. Miller said that the initial expenses of the fiber-optic cabling installation and network infrastructure were covered by the Alamo Transportation District Fund. Ongoing maintenance and support is part of the city operating budget.

Mr. Miller indicated that many of the high-resolution cameras in public areas were paid for with funds from Homeland Security. The video court system, including imaging technology and kiosks, was funded through the Municipal Court Technology Fund, which is collected from a percentage of state-mandated fees on traffic fines and other infractions and criminal activity.

## Solution

### Networked Traffic Lights

Following installation of the fiber-optic network, Mr. Miller worked with the San Antonio Transportation Division of Public Works to install a traffic light control system at each of the city's intersections. The system allows transportation personnel to monitor and control more than 1,200 traffic lights from a network-enabled terminal. The system can control cameras that provide visual information to traffic managers.

Mr. Miller indicated that the city has moved toward using video cameras for traffic sensing in the traffic signal synchronization system. "Historically we've had weight sensors in the ground. They were very expensive and disrupted the street maintenance program," Mr. Miller explained. "Now we have motion cameras that are on the bulk of our traffic light poles. Those cameras also have the ability to shoot video. If there is an issue, we can view those cameras and see who we need to dispatch." Some of these cameras are hardwired to the network or connected wirelessly.

Crucial to the success of managing traffic is ensuring the exact timing of each light. "If we can have that time stamp accurate throughout, then whenever we configure a light sequencing, it can stay as accurate as possible," Mr. Miller explained.

Mr. Miller's department oversees communications for the city's Public Works Traffic Operations Division, which manages the traffic system. "We give them the ability to communicate," he says, "and they then work on the actual configuration of the lights." He stated that the system also can be accessed and controlled remotely after-hours. "The bulk of the team resides in a centralized location, but if someone got a call in the middle of the night and said, 'We're having an issue over here, can you log in and take a look at it?,' someone can do that," Mr. Miller explained.

Each of San Antonio's police cars is equipped with an in-car video system and DVR. Any time the police engage their lights and siren, the video system automatically records video of what is taking place. Video data captured on the vehicle's DVR is uploaded automatically via Wi-Fi into localized storage as each officer arrives at the substation.

## Municipal Court

Mr. Miller was also involved in the establishment of San Antonio's video court program, the result of a joint concept by Municipal Court Presiding Judge John Bull, Court Clerk Fred Garcia, and Mr. Miller. In an effort to improve service, reduce traffic to city offices, and extend judicial resources, Mr. Miller's team oversaw the implementation of a remote video system (telepresence). It allows court hearings via high-quality video conferences between San Antonio residents and Municipal Court judges at kiosks and link centers throughout the city. The program also helps resolve issues such as contested fines and traffic tickets through an online payment mechanism.

Mr. Miller indicated that other services are offered at the link centers as well, such as payment of utilities and fees, and the vending of permits. He plans to increase services available to the public in these venues as well as online. The system provides an opportunity, says Mr. Miller, "to both enhance our services and not force people to come downtown to handle their issue."

## Police Department

Each of San Antonio's police cars is equipped with an in-car video system and DVR. Any time the police engage their lights and siren, the video system automatically records video of what is taking place. Video data captured on the vehicle's DVR is uploaded automatically via Wi-Fi into localized storage as each officer arrives at the substation. Depending on the issue, these videos may become evidence in a particular case. "The officer's part of the process is to tag and put the metadata in the video," Mr. Miller explained, "and then it uploads into a database. We store it for 180 days if it's not part of a case, and forever if it becomes part of a case."

A valuable public safety enhancement was the installation of high-resolution surveillance cameras in areas at high risk for crime, such as city parks. Mr. Miller said that in addition to the cameras helping to decrease criminal activity, the video they produce can also provide a valuable tool for the prosecution of perpetrators. As the network's bandwidth grows, Mr. Miller intends to oversee further installation of these cameras throughout the city.

## Marshal's Office

Each of the court marshal's vehicles is equipped with a video-teleconferencing equipment and a credit/debit card scanner, which allow roadside resolution of outstanding warrants and unpaid fines. First, the cameras are equipped with automatic number plate recognition (ANPR) capability, which is a mass-surveillance method using optical character recognition to read vehicle license plates. ANPR can be used to store images captured by the cameras as well as the text from the license plate. Data from the ANPR capture is transmitted wirelessly to the network and checked against a database of vehicles and drivers with outstanding warrants or unpaid fines. The officer is informed in real time whether there are any issues with the vehicle or its registered driver. If so, the officer can connect the driver to a judge via a video-conference link from the officer's in-vehicle laptop computer. In many cases, the driver can immediately resolve his or her issues with the judge and, if necessary, pay a fine via an in-car electronic payment system. This has reduced the number of arrests and increased fine revenue for the city. "They've raised their

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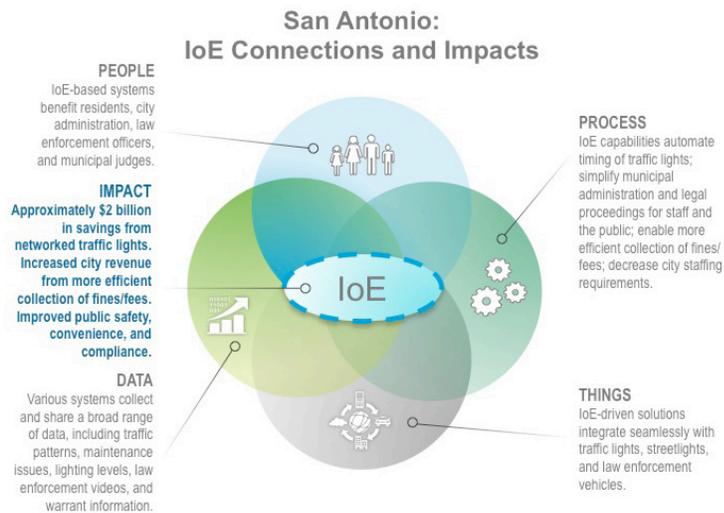
### Smart Streetlighting and Smart Parking

The city is currently upgrading the streetlighting system using sensor-based LED lighting technology. The system can automatically adjust the amount of lighting in less-frequented areas, depending on the level of activity.

Mr. Miller said that streetlight technology is currently being expanded. He said the sensors can use radio frequencies and IPv6 networking to allow the communication with lights within an area. The sensors can detect activity in little-used areas to automatically increase light levels as needed. “The LED light gives you a lot of options: some of them can change color, and on most of them you can change density,” Mr. Miller explained. The lights of the LED are split into quadrants, or more options, where [for example] one fourth of [the lights are on] if it’s not a heavily trafficked area, and if someone shows up, it then pops on full blast to give you the full light grid.”

In the future, a smart parking initiative that informs both citizens and officials in real time of citywide parking availability and meter information is also planned.

Figure 1. San Antonio: New and Better Connections.



Source: Cisco Consulting Services, 2014

San Antonio's remote court system has provided a more efficient way to deliver judicial resources and city services to inhabitants in or near their own neighborhoods.

## Impact

San Antonio's technology has attracted broad national recognition. The traffic light synchronization initiative garnered a 2011 ComputerWorld Honors Program Laureate Status award for its contribution to city technology. Code for America chose San Antonio as one of its 2014 Fellowship Cities, recognizing the city "for their dedication to innovation and forward-thinking staff."

Mr. Miller indicated that synchronization of the traffic light system has greatly facilitated smoother traffic flow. Prior to the traffic-light synchronization, the city estimated that \$2 billion was lost due to longer commutes, higher fuel expenses, safety issues, and other factors.

San Antonio's remote court system has provided a more efficient way to deliver judicial resources and city services to inhabitants in or near their own neighborhoods. Constituents are conducting routine municipal transactions – including court hearings – at kiosk locations. According to Mr. Miller, the system offers the additional benefits of freeing up parking, shortening wait times, and stretching judicial resources. It allows residents a convenient and efficient method for resolving legal issues and municipal business.

Integration of technology into law enforcement vehicles has dramatically reduced the administrative burden on police officers. Each officer has immediate access to data within the vehicle via the plate recognition program that assists law enforcement as well as legal staff. The ability to automatically record and store each encounter assists with both public and officer safety, and aids in the prosecution of criminals. The ability to collect outstanding fines has streamlined the collections process and reduced work for administrative and legal departments, resulting in increased revenue and reduced staff.

According to Mr. Miller, the immediate recording of – and easy access to – data means far less human error, contributing to a reduced administrative burden on officers and staff, thereby saving costs. Police have more time to serve the public, and the public can more conveniently discharge their obligations. Video surveillance contributes to the safety of both the officers and the public, and facilitates the prosecution of cases.

Advantages of San Antonio's smart streetlight technology include increased safety by providing brighter illumination where and when activity is present, and the conservation of both energy and public funds by decreasing light levels in low-traffic areas.

Mr. Miller explained that lights on the smart grid will be more efficiently maintained as well because maintenance personnel can detect exact locations of needed repairs when malfunctions occur. This contributes to both a timely and cost-effective response, and supports ongoing public safety efforts.

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## Lessons Learned / Next Steps

Mr. Miller advises other cities looking to upgrade technological infrastructure to be resourceful. “Don’t ever box yourself into how you think of things,” he advises. “There’s a creative way to leverage technology no matter how difficult the problem. Don’t restrict your thinking just because it either hasn’t been done before or that someone’s told you people have [already] tried over and over.”

San Antonio’s fiber-optic and wireless mesh network is currently one of the largest. Mr. Miller believes that along with increased connections, transfer speeds, and bandwidth, location-based technology is going to become increasingly important in city systems. “We’re doing a lot of GIS work for location components that are being leveraged in a lot of ways,” he said. “As I look in the next few years, there’ll be a lot more location-based information and analytics.”

Mr. Miller expects camera surveillance systems to continue to be installed as bandwidth and monitoring systems grow. He predicts that these improvements will result in real-time dispatch of police and emergency vehicles in response to road emergencies, eliminating the need for eyewitness phone calls and expediting the arrival of assistance.

Mr. Miller indicates San Antonio is currently developing additional technology to expand the municipal services available on kiosks, and plans a large-scale expansion of kiosk availability throughout the city’s largest grocery chain.

Mr. Miller continues to push for smart streetlighting throughout the city, and foresees the advantage of integrating a GIS mapping component for the precise identification and location of malfunctioning lights. “Right now one of the complaints of a lot of the council members is that a streetlight can be out and no one knows about it unless the constituent calls in,” he said. He believes that timely repairs will contribute to both public safety and constituent goodwill.

While acknowledging that an automated system to identify and ticket parking offenders has its critics, Mr. Miller is an advocate for the technology, citing the reduction of administrative burden and the decreased number of people spending time in jail.

Mr. Miller’s determination to pursue innovative change is a valuable contribution to the collaborative effort transforming San Antonio, and he is quick to share the credit: “We’re definitely always trying to be ahead of other places. At the end of the day, I have a team of people that continue to dig in and try to deliver what we can with the budget we have and with the level of delivery that’s available.”

## More Information

For more information, visit <http://www.sanantonio.gov>



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