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Reliable for the traffic of the future

With an intelligent transportation system, Stamford in Connecticut masters future challenges in the transportation sector. The basis for this is a modern, fiber optic-based Ethernet network with RUGGEDCOM products from Siemens.

Stamford, Connecticut is a vibrant, diverse community overlooking Long Island Sound, within commuting distance of New York City. Stamford hosts the largest financial district in the greater New York metro area outside Manhattan and it is home to a high concentration of large corporations and corporate headquarters. With a population of 130,000, Stamford is Connecticut's third-largest city and the fastest growing municipality in the state.

Stamford's dedication to its citizens' quality of life, the local economy, and its proximity to New York City requires it to pay close attention to urban functions such as traffic congestion. Stamford recently invested in its own forward-looking Intelligent Transportation System (ITS), which relies on an advanced communications network to optimize traffic signals at the city's 200-plus intersections.

Like many American cities, Stamford had previously relied on an antiquated traffic system. A twisted pair, copper-based serial communications network relied on 2400 baud Bell modems at traffic signals to provide an operations center with minimal data at low speeds. This approach produced a murky, delayed view of traffic signal functionality and traffic flows. Field crews manually set traffic signals, returned to tweak settings, and moved on to the next intersection.

The old system lacked remote access for monitoring and control and its low data speeds and bandwidth limited its functionality. As a result, city-wide traffic optimization was more of an art than science.

Stamford recognized that it needed to migrate from its legacy, serial data network to a future-facing Internet Protocol (IP)-based network that could deliver higher data speeds and bandwidth to support advanced sensors and video at its traffic signal-equipped intersections. The new network would enable remote monitoring and control of traffic signals, optimize traffic flows, identify problems in real time, and support future applications such as autonomous vehicles.

"Transportation plays a big role in the local economy and quality of life because of our own needs in Stamford, our inter-city and inter-state needs, and our proximity to New York City," said Veera Karukonda, Signal Systems Engineer for Stamford. "So, we had to design and build a new IP-based network to achieve any meaningful transfer of data for a reliable, forward-looking ITS."

First, Stamford needed a trusted advisor with market-leading solutions, including custom design of an IP-based Ethernet network supported by proven hardware and software. The resulting traffic data network would enable operators to monitor and control the city's traffic from a remote operations center. The solution also had to integrate legacy serial devices and third-party sensors and provide headroom for future application needs. That's a tall order.

Challenge: *Select a trusted advisor to design an IP-based network for Stamford's current and future needs and support it with robust hardware and software for optimal ITS reliability.*

Stamford's challenge in finding a trusted advisor was based on experience. The city staff had previously used traffic control and communications equipment that relied on cooling fans, which failed to perform 24/7 and were not reliable for the safe operation of its traffic control system. The city started its search for a reliable fiber optic switch for its new fiber optic communications system. One well known switch manufacturer had its switches designed with 30 to 60 cooling fans and was using that as a sales promotion to market its product. In addition, the vendors the city looked at did not have dedicated expertise for a custom network design or system integration capability for a successful project. "The fans scared me," said Karukonda. "And [that vendor's] system integration and ongoing support system was obsolete. So there goes the reliability of the switches and my trust in their ability to support a new network."

"In my 30 years' experience in traffic control," Karukonda added, "I've learned that if the fans on a switch go out, the equipment will fail, and we lose control of the system. For a city-wide new communications infrastructure project, that scenario is a non-starter."

After assessing vendors, Karukonda selected Siemens in part because, he said, it is "the network-based supplier" whose Professional Services division could design a city-wide fiber-based Ethernet network from scratch. That network would be supported by Siemens' RUGGEDCOM line of robust, passively cooled multi-service platforms, routers and switches. RUGGEDCOM components have no moving parts, a high Mean Time to Failure (MTTF) and feature redundant or hot-swappable power supplies and application modules. The solution was backed by Siemens' standard after-sale support and five-year warranties.

Siemens Professional Services listened and responded not just to Stamford's technical requirements but to its future needs as well. According to Karukonda, Siemens provided "positive interactions with the right people at the right time."

"We needed one simple platform to establish a new system without any guesswork," Karukonda said. "And we really needed ongoing support from the 'day after' [the network went live]."

Solution: *Siemens Professional Services designed a city-wide, IP-based data network for operators' remote access to an ITS based upon components with passive cooling.*

Several factors influenced the subsequent design of a city-wide, 10-gigabit (G) fiber network backbone, as well as hubs to handle multiple intersections in different parts of the city.

First, the backbone would have to serve current needs with an assumption that population, traffic, and complexity would grow in coming decades. Second, the increasing role of video detection and surveillance in ITSs and higher resolution cameras required significant network capacity, with significant "headroom" for future growth. (Video detection aids system operators in optimizing traffic signals, while video surveillance provides real-time visual information on potential problems.) Third, the network would need extra capacity to support both nascent and unforeseen applications.

"With the cost of sensors and video cameras dropping, and with the evolution of video camera capabilities requiring more bandwidth, and increasing year-over-year, we needed to build a network with lots of headroom," Karukonda said. "The 10Gs of bandwidth that we currently have with the Siemens-designed network backbone will be sufficient for a very long time to come."

Stamford's resulting ITS network relies on two RUGGEDCOM RX5000 multi-service platforms with high port density at each hub to provide redundant support to RS900 managed Ethernet switches for traffic signal monitoring and control and to support RSG2200s, 9-port managed gigabit Ethernet switches that handle each intersection's video feeds.

Stamford's concern for reliability was laid to rest. All RUGGEDCOM platforms, routers and switches are designed for harsh field conditions that include extreme temperatures, vibration, dust, and electro-magnetic interference (EMI). RUGGEDCOM components meet NEMA TS-2 standards for traffic control equipment, deliver error-free performance in high EMI environments, and are built to operate reliably from –40 degrees Fahrenheit (–40 degrees Celsius) to 185 degrees Fahrenheit (85 degrees Celsius). That guarantees functionality over Stamford's long hot summers, when temperatures sometimes exceed 100 degrees Fahrenheit (F), and the city's unpredictable winters, when temperatures can drop below 0 F.

The RX5000 multi-service platforms – the workhorses in this network topology – provide integrated router/firewall/virtual private network (VPN) and other cybersecurity functions and measures. A RUGGEDCOM Network Management System (NMS) allows operators to see and manage the functionality of every node on the network.

Results: *Stamford moved from an unreliable, low-visibility, manually operated traffic signal network to a secure, efficient, state-of-the-art network with remote monitoring and control.*

This arrangement enables secure remote access for monitoring and control by Stamford's traffic signal engineers at the city's operations center, which created a sea change in operational efficiencies.

"The NMS provides a tool to understand all that is happening in the ITS," Karukonda said. "With hundreds of intersections and controllers in our system, we need a screen that shows the system's status, the status of each sensor, camera and controller.

The NMS provides us with that information. It gives us a birds-eye view of our whole city on one screen. "For a traffic control engineer like me, remote access provides a real advantage," Karukonda added. "We can make instant modifications and change settings, from our operations center or while we're in the field, on the fly. That's a very efficient way of controlling an ITS."

Since embarking upon its future-facing ITS, the city of Stamford has methodically extended ITS functionality across the city in phases, with an eye on the future. "Since our experience has been positive, beginning with baby steps, we gained confidence in our chosen solution and the project proceeded," Karukonda said. "This has led to further appropriations to complete the entire citywide ITS by the end of 2018. At that point, we will have a complete ITS, A to Z."

These improvements do not simply serve city staff. Stamford is already sharing traffic data with its citizens so they can determine the most efficient commuting routes, avoid unforeseen delays, and improve their quality of life.

City officials were quick to grasp the value of data-driven solutions for future needs. "To illustrate the value of the new network, our city has approved the funding for a full-time position for 'traffic data analyst,'" Karukonda said. "Now we are in a position to analyze all that data and make the best use of it."

After years of work, Stamford's future is looking bright. "Exciting times are here," Karukonda said. "Connecticut's governor has announced that it will be a leading state for testing autonomous vehicles and City of Stamford has been chosen as one of the first cities to test them.

"In order for autonomous vehicles to navigate the city safely and efficiently, our traffic equipment must have the necessary radios and signal transmission capabilities running on dependable communications infrastructure and equipment. Our ITS provides a platform upon which we can build to aid the navigation of autonomous vehicles. Our primary goal is the safety of our citizens. The end result will be amazing."

Security information

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.
For additional information on industrial security measures that may be implemented, please visit **https://www.siemens.com/industrialsecurity**

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