CASE STUDY

Powering a Bright Future with Carrier Ethernet

One of the nation's largest electricity generators replaces SONET technology with modern, easy-to-manage infrastructure designed to provide reliable performance for years to come

A utility company communities count on

This investor-owned utility in the United States owns one of the nation's largest electricity transmission systems and can generate over 25,000 megawatts of capacity. They deliver electricity to millions of customers in multiple states over a network that spans thousands of miles.

Keeping the lights on

The utility puts considerable effort into designing and maintaining an efficient, reliable, and sustainable electrical generation and transmission network. It is something most of their customers can take for granted, but a lot of factors—including weather events, fire, accidents, and unusual spikes in demand—can conspire to disrupt delivery and cause outages.

This utility has a large network of sensors in place to monitor the state of its power grid. These sensors relay messages back to centralized control centers so the utility can isolate breaks and prevent further outages from cascading from the original

The stakes can be high

During the Northeast Blackout of 2003, 55 million people in the U.S. and Canada lost power for two days, resulting in $6 billion in economic damage. This event provides the entire industry a stark look at what can happen when the power grid is not properly monitored. A combination of factors started the Blackout, including key monitoring systems being offline, generators not responding as anticipated or requested, and an overloaded line sagging to a tree and short-circuiting.

In the wake of the Blackout, Federal regulators and utilities worked together to create rules that govern interconnection and security across the generation, transmission, and distribution sectors. The resulting regulations increased the number of sensors and synchrophasers (or synchrophasors) in the network, along with the volume of communications to customers.

outage to affect other regions, or even adjacent utilities. With a service territory of more than 200,000 square miles (518,000 square kms), however, there is a lot of territory to cover.

Key challenges

Build for the future while supporting the past

For decades, utilities have used SONET equipment to carry their teleprotection and SCADA messages, used to communicate network monitoring information, back to their control centers to provide insight into the power grid. SONET supported all the TDM services used by the utility and met their requirements for performance, redundancy, reliability, fast restoration times, low latency, and ease of use.

Most of the SONET equipment in the utility's network, however, was at or approaching end of life, spares were not available, and employees with SONET expertise were reaching retirement age, making the technology difficult to maintain in good working order.

At the same time, demands on the network were increasing. The utility wanted the ability to support new services such as video surveillance, which uses much more bandwidth than the legacy SONET network was designed to accommodate. Nevertheless, the network still had to handle legacy SONET traffic while scaling for newer applications. These included substation and grid automation and smart meters, which help avoid in-person visits to measure power consumption, while also providing the ability to track consumption more accurately and in real time to instantly identify usage spikes, outages, and more, so the grid could react accordingly.

They also had heightened security concerns due to an increased threat of cyber-attacks on electricity networks across the United States, so they wanted their network to have built-in encryption right out of the box.

Another key consideration for this customer was the use of Carrier Ethernet—as opposed to MPLS—to replace their SONET technology. SONET and Carrier Ethernet are managed similarly, so there would be less of a learning curve for their network administrators to overcome during the transition. In addition, Carrier Ethernet has the advantage of simplicity, resulting in lower OPEX, reduced latency, easier scalability to 10 gigabits, more control over network routes, and simpler network management compared to MPLS.

Finally, they wanted to achieve operational efficiency by consolidating its vendor network down from many to one key supplier with whom they knew they could build a relationship that would last for decades.

Protect in-flight data from cyber attacks
Learn what it takes

The solution

A network built for the needs of today and tomorrow

Ciena worked with the utility during several day-long workshops to obtain a complete understanding of their existing network topology, its strengths and weaknesses, and the customer's plans and requirements for the network in the short, medium, and long terms.

Based on that information, Ciena proposed and delivered a mix of solutions, including the Ciena 3932 Service Delivery Switch, an advanced Carrier Ethernet packet switch focused on high-bandwidth, multiservice applications requiring sophisticated Quality of Service (QoS).

The Ciena solution architecture relies on proven G.8032 technology. This provides protection and restoration parameters similar to SONET, without requiring the redundant fiber or networking equipment of other approaches.

Gain insights into network modernization

Results

Since deploying the new network architecture and Ciena Carrier Ethernet equipment, the utility has uncovered the following benefits:

- **Reduced costs.** The new network converges all services over a common network infrastructure, which greatly simplifies operations and controls costs.
- **Reduced staffing requirements.** The new network features automated provisioning and remote turn-up, testing, and verification. Faults can be detected and isolated remotely and changes are simpler to make, which means network management and maintenance reduce demands on their network operations team.

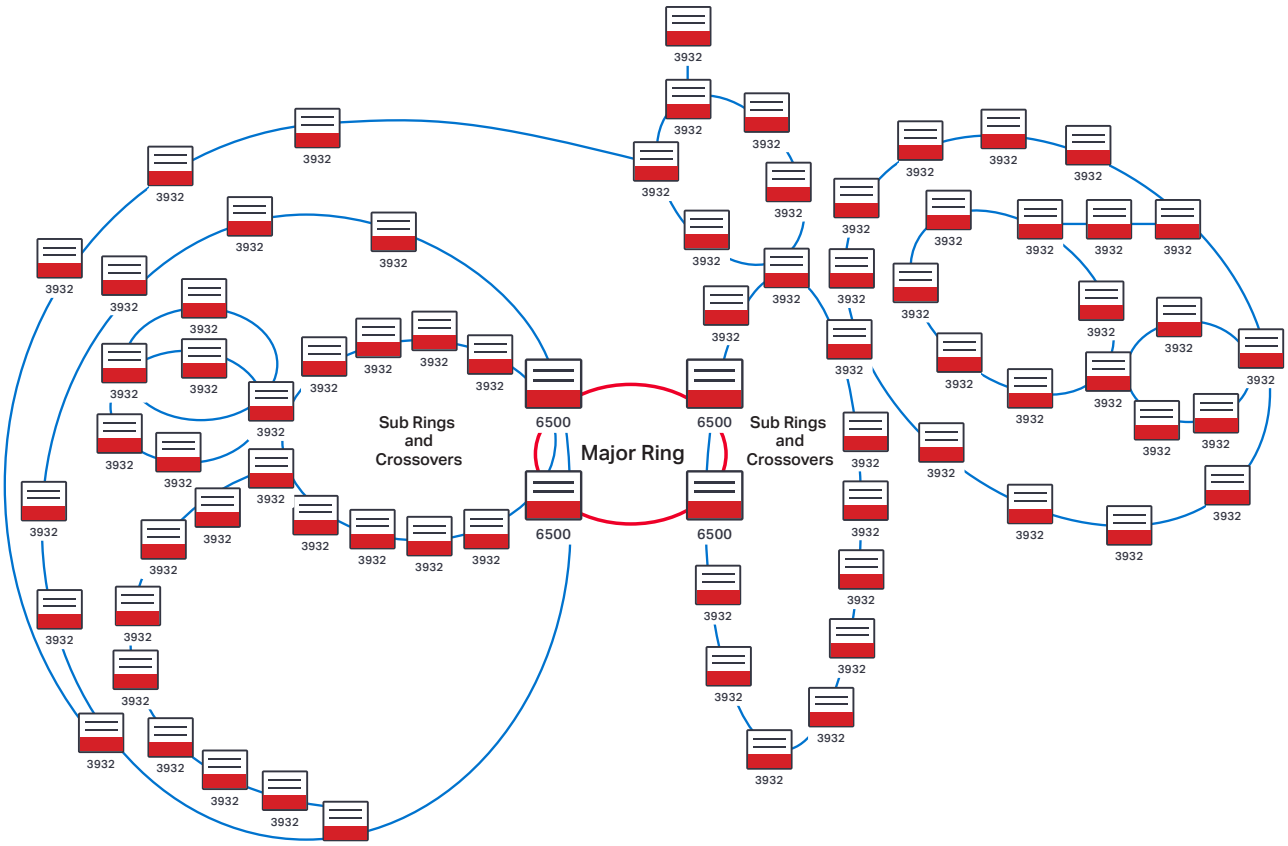

Figure 1. Utility communications network architecture. Modernizing with Ciena G.8032 or MPLS-TP

- **Improved network security and control.** An inherent layer of security is built in to the new Carrier Ethernet network because it is not a routable protocol, so address snooping is not a threat. The utility is also able to use Ethernet-based data encapsulation to ensure traffic is delivered to its proper destination.
- **Ability to deliver flexible, scalable bandwidth.** Unlike their legacy network, the Ciena solution has very granular scalability that allows for dynamic adjustments to capacity requirements on a per-site basis.
- **Improved network visibility.** The new network supports a rich set of standards-based Operations, Administration, and Maintenance (OAM) tools that provide advanced capabilities for network monitoring and management. These tools give them greatly improved insight into the status and performance of their network connections.

Summary

Utilities are implementing highly intelligent energy grids to improve operating efficiency, address consumer demands, and meet government mandates. These Smart Grids are powered by a two-way communications network that must be highly reliable and offer low latency, yet remain affordable to install and operate.

Network requirements continue to move rapidly since this utility's network was put in place. The bandwidth requirements have grown even faster than anticipated due to video surveillance and smart meter traffic, so the network's ability to scale to 10 Gb/s and potentially even further to 100 Gb/s, is already being utilized.

Ciena helps utility customers realize the full potential of a versatile, intelligent communications infrastructure. The company combines deep expertise with packet-optical networking and software innovation to make the integration of an intelligent communications infrastructure with the electric grid not only possible, but practical—offering an automated, deterministic, and resilient power-delivery system.