JumboSwitch®

Multi-Service Ethernet/IP Platform

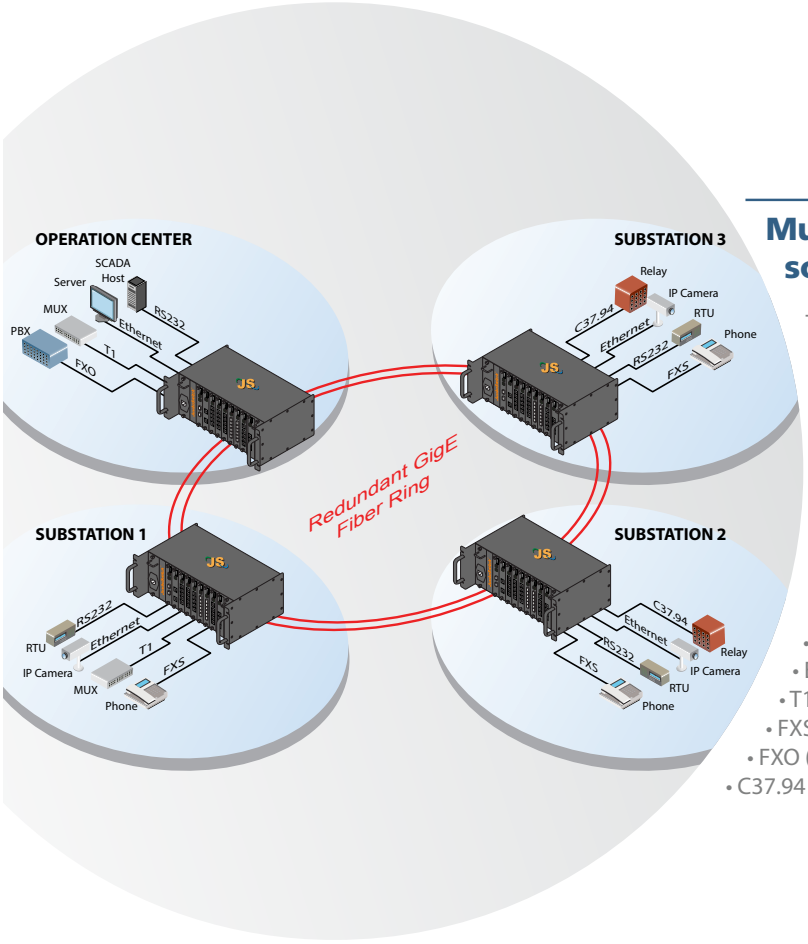
UTILITIES SOLUTIONS

TC Communications has been designing and manufacturing industrial hardened data and voice communications equipment for more than 20 years.

Its flagship product, the JumboSwitch Multi-Service Ethernet/IP Platform, was introduced in 2007. An integrated communications system that currently supports 25 different data and voice interfaces, the JumboSwitch is a modern, lower cost alternative to aging voice-centric SONET/SDH backbone communications systems.

JumboSwitch networks have been successfully deployed in a wide variety of critical network applications worldwide including the United States, Canada, Australia, Saudi Arabia, Jamaica, Mexico, Paraguay, Indonesia, Singapore, China, Belize,

BACKBONE Solutions



Multi-Service Ethernet solution on a fiber backbone

Typical Utility backbone applications combine Phone (FXS/FXO), T1, RS-232, C37.94, Ethernet and more. The JumboSwitch has been tested to support all popular legacy termination devices including RTUs, ARMs, protection relays, telephones, FAX machines, and data modems.

The JumboSwitch application to the left is using the following interfaces:

- RS232 (TC3847-1)
- Ethernet (TC3842)
- T1 (TC3845-1)
- FXS (TC3848)
- FXO (TC3848)
- C37.94 (TC3846-2)

Case

NIPCO

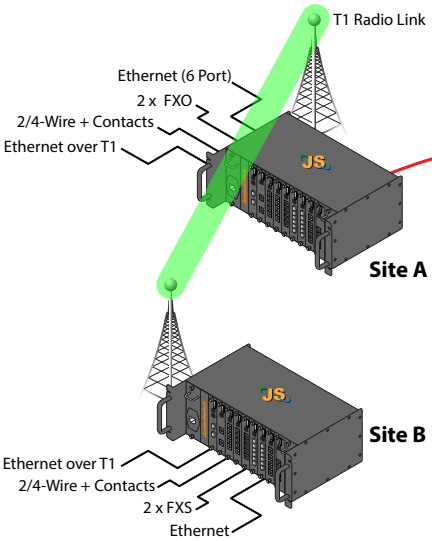
With extensive hands-on experience with both SONET and Ethernet, Northwest Iowa Power Cooperative (NIPCO) has successfully taken advantage of each technology's strengths.

NIPCO installed its first SONET ring network in the mid 1990s. In 2006, driven by the need to add network flexibility and bandwidth to its fast-growing telecommunications business, NIPCO opted for Ethernet and created a 650-mile Gigabit backbone network.

Result:

- Moved AMR, Teleprotection and telecommunications over to IP
- Simplify maintenance, monitoring and repair
- Simplify Ethernet rate limiting to customers
- Quickly provision and configure core T1 links
- Scalability for future network expansion

While updating its aging infrastructure to an IP network, this Utility network was able to preserve its legacy analog voice devices, dial-up meters, and T1 radios. See the below diagram.



EDGE Solutions

Installed as an edge solution for specialty applications

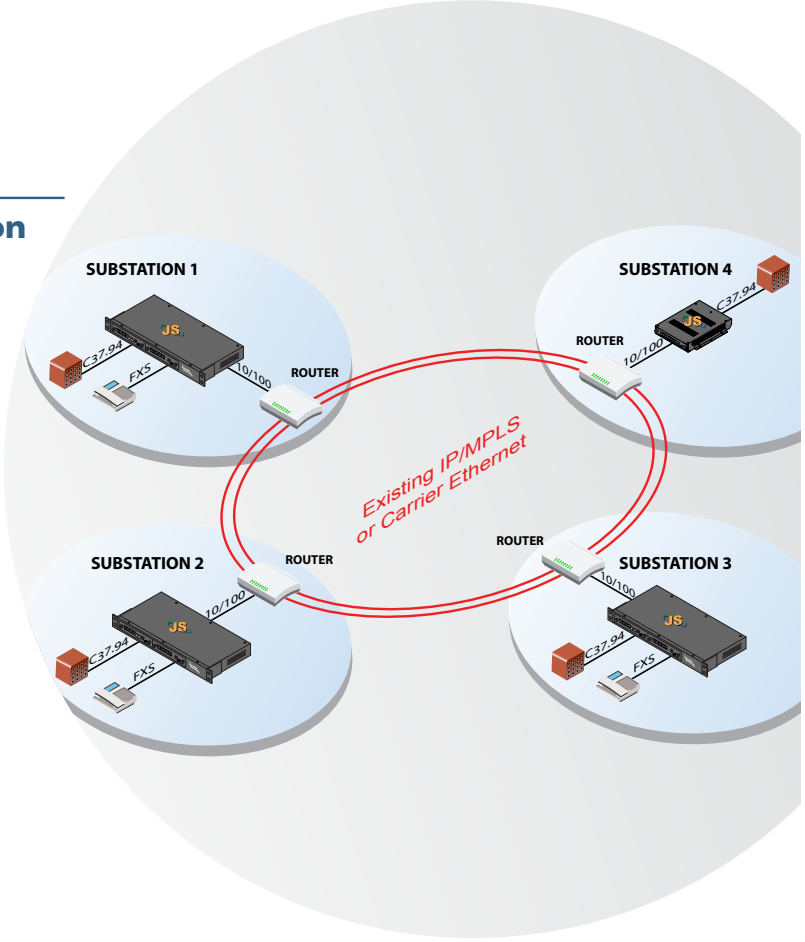
Many of the JumboSwitch interface cards are specifically designed for low latency utility applications. TC engineers targeted unique industry requirements such as C37.94 and Mirrored Bits®* for Teleprotection over IP applications and 64Kbps uncompressed DS-0 for Modem over IP applications.

Here we have an application where JumboSwitch provides the low latency C37.94 and phone transport, connected to an MPLS network.

Common edge solutions

- C37.94
- VoIP+
- Modem over IP
- 600ohm Analog

**Mirrored Bits is a registered trade mark of Schwitzer Engineering Laboratories, Inc.*

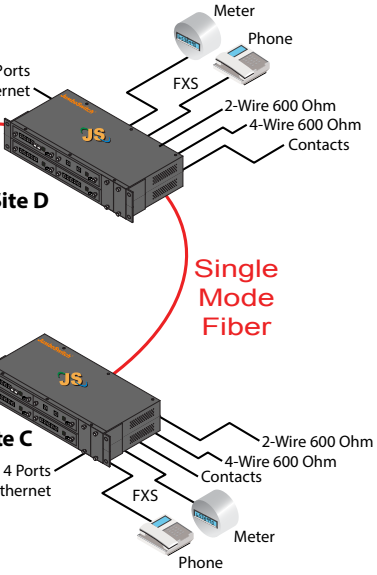


Case

Mid-Atlantic Gas & Electric

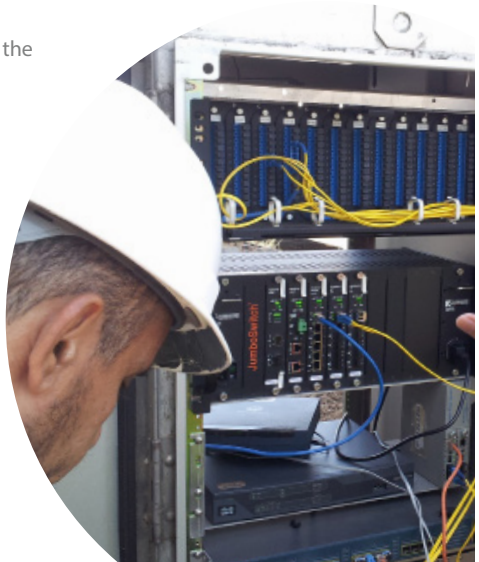
One Mid-Atlantic Power Utility, recently informed that support for its leased lines would end soon, chose a multi-service Ethernet solution from TC Communications to connect analog modems/RTUs and SCADA communications between its central office and remote substations and gas gates.

The Power Utility had several requirements. At the top of its list was to find a hardened, future-proof alternative to leased lines that would support 4/wire 600ohm analog and run over existing WIMAX and planned fiber networks. It also wanted the option of adding data and telephone in the near future.



The Telco's transition to IP/fiber and away from leased lines and PSTN services is good news in the long run for Power Utility network managers. Alternative Ethernet/IP transport methods for analog services like the JumboSwitch offer several important benefits including:

- Eliminating recurring telecom leased line costs
- Increasing overall network reliability
- Increasing network scalability for future growth
- Adjusting latency on demand
- Eliminating dependency on bandwidth providers



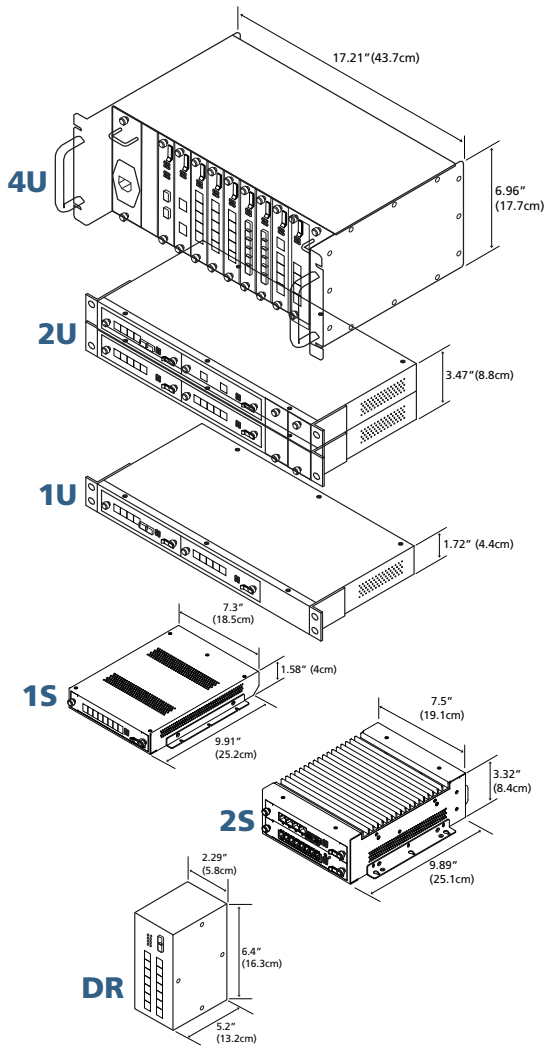
JumboSwitch® EDGE Solutions

JumboSwitch Design

The JumboSwitch family of products was created to help users migrate legacy equipment onto IP/Ethernet networks. During design, TC's engineers took into account mission-critical reliability requirements, limited access to remote locations, and extreme weather conditions. As a result, JumboSwitch is easy to setup and operate, monitors key statistics, manages remotely, and fits well into long-term future plans.

Flexible – Runs over existing infrastructure, whether it is fiber, T1/E1, T3/E3, microwave or SONET/SDH. Supports popular topologies including bus, ring, and mesh.
Scalable – Hot-swappable and fully modular interface cards, interchangeable between 4U, 2U, 1U, 1S and 2S chassis.
Self-Maintenance – Monitors critical parameters including optical launch and receive power and chassis temperature to prevent problems and avoid network downtime.
Reliable – Built on 20 years of experience designing quality industrial-grade products for mission-critical requirements and applications. Always 100% tested and quality components.

Power Options	DR	1U	2U	4U	1S	2S
12VDC	✔	✔	✔	✔	✔	✔
24VDC	✔	✔	✔	✔	✔	✔
-48VDC	✔	✔	✔	✔	✔	✔
125VDC		✔	✔	✔		
115-240VAC		✔	✔	✔		
115-240VAC Adapter	✔				✔	✔



C37.94

TC3846-2 Extends IEEE C37.94 over IP networks. Less than 5ms latency, one-way achieved with adaptive clock recovery, buffering and forwarding technology

Low Latency RS232

TC3847-3 Mirrored Bits*, DNP-3, Modbus, etc. Designed to meet stringent real-time requirements for protective relay communications. Supports RS-232, RS-422/485

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G.703/64K

TC3846-1 Extends 64Kbps G.703 co-directional circuits over IP networks. Less than 5ms latency, one-way achieved with adaptive clock recovery, buffering and forwarding technology.

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DESIGNED AND MADE IN
IRVINE CA SINCE 1992

JumboSwitch®
JumboSwitch Design