

Tucson Power Deploys Multiple Teleprotection-over-IP Links

Case Study

The Challenge: Merging Legacy Applications with a Backbone Network

As Power Utilities continue to integrate legacy applications into their Ethernet/IP substation communication backbone networks, they are increasingly using TDM over IP/Ethernet instead of traditional TDM-based solutions for latency sensitive applications such as teleprotection. TDM over IP/Ethernet is a reliable, proven solution for teleprotection communications that produces deterministic results.

Tucson Electric Power Co.'s (TEP) initial search for a suitable product for teleprotection-over-IP communications was lengthy. Its goal was to find a low-latency industrial hardened Ethernet serial server to connect protective relays using mirrored bits® between

substations over fiber and microwave. It soon discovered that Ethernet teleprotection products vary greatly between communication vendors.

Solution: Low Latency Serial over IP Done Right

TEP has been successfully using multiple TDM over IP/Ethernet links for protective relay communications between substations over fiber and microwave communications since 2011.

TEP's teleprotection-over-IP links are based on a multi-service Ethernet platform, the JumboSwitch® from TC Communications, using a special "Turbo Serial" TDM over IP/Ethernet interface card to connect its protective relays with RS-232 (mirrored bits®) interfaces. (See diagram on page 2).

Objective

Establish protective relay communications between substations over fiber and microwave communications via TDM over IP/Ethernet

Products Used

- [JumboSwitch®](#)
- [TC3847-3: Turbo Serial over IP](#)

Key Benefits

- Exceeded stringent latency requirements
- Solved connection issues when RTUs were not available.
- Satisfied power redundancy requirements



We quickly learned to rely on our test results rather than vendor spec sheets. Many hardened serial servers are unsuitable for teleprotection applications. For example, one popular hardened serial server from a major industrial Ethernet switch manufacturer tested out at 250 msec. of delay. When testing the delay, you must also ensure the measurements are consistently taken round trip or relay to relay; TEP's standards are based on relay to relay.

- Jon Otteman
Communications Engineer for TEP

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Deployment of the JumboSwitch for TEP's teleprotection links, SCADA, and metering over IP and conventional TDM links are part of TEP's multi-service Fiber and Radio backbone for the Distributive Generation Projects. This frees up rack space and lowers the cost of deploying multiple boxes to provide the same function.

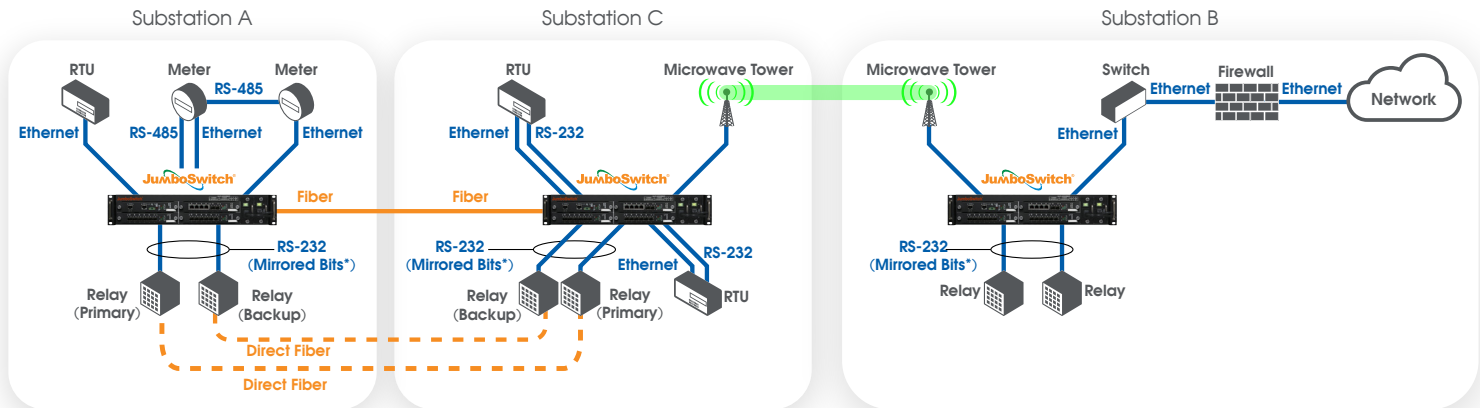
Results: Exceeding Expectations at Every Turn

TEP's specs called for a delay (excluding relays) of less than 10 msec. and the IC3847-3 JumboSwitch Turbo Serial card passed every TEP latency tests with typical readings of around 3 msec. delay.

In addition to meeting TEP's stringent latency specifications for teleprotection, the JumboSwitch solved connection issues for RS-232, RS-485, Ethernet, and serial and dry contacts to monitor certain alarm points when an RTU is not available. It also provided a redundant power supply, required by TEP's standard. Changing from 48VDC, 125VDC to 115VAC can be easily accomplished by switching the power module.

The JumboSwitch offers 25 different interface cards, including all popular interfaces used for teleprotection-over-IP applications. The G.703, C37.94, T1, and Turbo-Serial (RS-232, RS-422/485) teleprotection interface cards meet stringent real time requirements for protective relay communications in the Power Utility industry.

**Mirrored Bits® is a registered trademark of Schweitzer Engineering Laboratories Inc.*



Tucson Electric Power diagram with JumboSwitch® 2U devices

About TC Communications

TC Communications designs industry focused communications products in Power, Public Safety, Rail, Military, Aviation, and Oil & Gas. Our products assist in the evolution of legacy networks and specialize in bridging the gap in the transition to IP networks. Our mission is to design products that are easy to use and won't break. All TC products are designed, tested, and supported in Irvine, California since 1991.



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