How do I increase my inter-substation data capacity in under three hour's outage time?
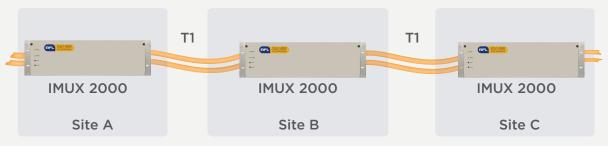
The Scenario:

A small utility had an existing IMUX 2000 T1 network in a linear configuration using single mode (9um) fiber optics as the communications medium (Figure 1). The inter-substation network carried revenue-generating data and critical protective relaying data. The utility had an immediate need for much more bandwidth between two stations to carry real-time video, an Ethernet link, and more T1 circuits for legacy point-to-point data.   Minimizing downtime on the network was essential as all the circuits are considered critical. Taking the network down to perform upgrades would cause the company to lose revenue and a transfer trip circuit will not be protecting during the outage.

The Solution:

The fiber optic link between the substation and the control room was targeted for upgrade from 1.544   Mbps T1 to 155.52 Mbps OC-3, which is sufficient bandwidth to carry all the additional traffic. In order to achieve this, a 2000s SONET module was installed into IMUX 2000 units at both locations (Figure 2). Provisioning the SONET module was performed ahead of time using a laboratory IMUX chassis with SONET Element Management Software (EMS). Provisioning the equipment upfront allows the transition from T1 to OC-3 to be faster and less obtrusive.
The next steps required the two units to be brought off-line. For each unit, the SONET module was inserted into the IMUX chassis at
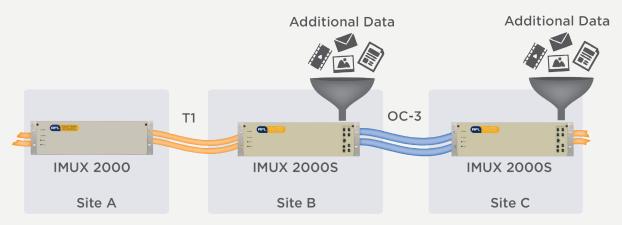

Figure 1: Original T1 Architecture

Figure 2: Single Link Upgraded to OC-3

slot location 17/18 and the IMUX 2000 firmware was updated. Simultaneously updating both sites further expedited the process. At the IMUX 2000 Visual NMS level, the IP addresses were assigned and the equipment was powered off. The fiber optic interface was then removed from the T1 connection and patched over to the SONET connection. The T1 fiber module at each site is then replaced with an electrical T1 module. Two cables are inserted to patch from the electrical T1 interface module to the SONET module and the units are again powered up. The OC-3 link was established and the existing T1 link returned but was now carried over the OC-3 link. The downtime was kept to a minimum during this upgrade and the existing network was not compromised. The customer had the ability to decide to establish new services instantly during the outage or defer to the future. To expedite the installation, the remaining OC-3 bandwidth was assigned to Ethernet services. 150 Mbps of Ethernet allows data from over ten high-resolution IP cameras to be fed to the control center for security purposes.

The Results:

The customer was able to upgrade a single hop of an existing T1 link to an OC-3 SONET link by rapidly repurposing the fiber optic cables. Furthermore, the downtime on the network was minimal. With the new OC-3 link up and running, the customer now had a high speed Ethernet link for use with IP cameras and access to their corporate LAN.   In addition to Ethernet, the utility had expanded its bandwidth between the two sites and was capable of connecting several more multiplexers, servicing the vast array of legacy equipment that is at the substation. As network demands grow, the link can quickly be switched over to OC-12 capacity with a single change to the SONET EMS configuration on each end of the fiber.

Related Products:

IMUX 2000s
The RFL IMUX 2000s SONET / SDH Multiplexer is an innovative and cost-effective solution from RFL that leverages your existing IMUX 2000 T1/E1 multiplexer and MDACS equipment to instantly expand your infrastructure for delivery of Gigabit Ethernet services, while continuing to support existing traditional TDM services.

About RFL

RFL designs and manufactures a comprehensive line of highly-reliable, mission-crit-ical, cost-effective communications and protection solutions for the electric utility and transportation markets, oil and gas markets, government agencies and engineering consulting firms. RFL is focused on guaranteeing mission-critical data will arrive on-time, every time.

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