WHITE PAPER

Deploying Integrated and Scalable Ethernet Redundancy with PRP/HSR

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Abstract

An optimized IEC 61850 PRP/HSR architecture should provide scalable integration for easy modification of functionalities and extension of the substation. Upgrading SANs (single attached nodes) and DANs (dual attached nodes) to a PRP/HSR network will require an efficient and cost effective solution in order to construct a seamless/bumpless communication infrastructure to ensure maximum system availability.

Background

Some of the first power substations in the 1920's were simple adaptations of devices used for monitoring and control of electrical systems. In today's complex substation automation industry, network and system reliability is paramount in ensuring onsite safety and consumer quality of service. One solution to ensure highly-reliable system communication is to implement network redundancy without the impact from a single point of failure. In this article, we will examine existing substation topologies and possible integral and scalable methods to achieve efficient redundancy with PRP (parallel redundancy protocol) and HSR (high-availability seamless redundancy).

Major Challenges

Existing end devices in a SAS (Substation Automation System) perform different communication capabilities, which can include SANs (single attached nodes), DANs (dual attached nodes), DANPs (dual attached nodes for PRP) and DANHs (dual attached nodes for HSR). Constructing/upgrading to a PRP/HSR redundant communication network infrastructure will provide seamless redundancy and minimize system downtime. But with so many varieties of communication devices and characteristics, ensuring network interoperability will be a substantial challenge for SAS engineers.

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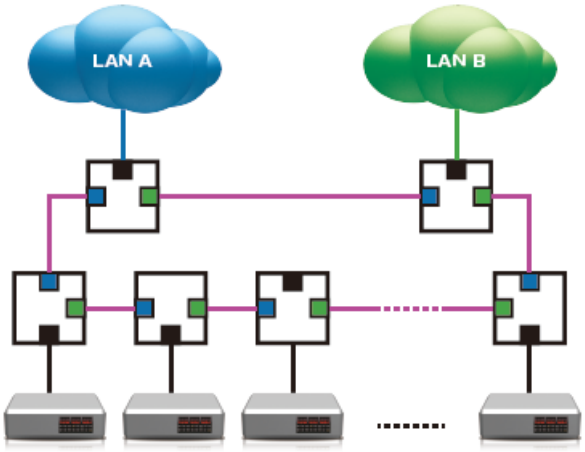
- **Costly 1:1 seamless network deployment**

  Applying a 3-port RedBox is one way to integrate legacy devices to a PRP/HSR network. Connecting each end device to a RedBox will construct independent traffic flow to provide higher SAS reliability and is ideal for critical system communication, which should not be impacted by other connections/devices. However, this type of deployment will not only be very costly to implement, it will require a considerable increase for maintenance and rack/cabinet space.



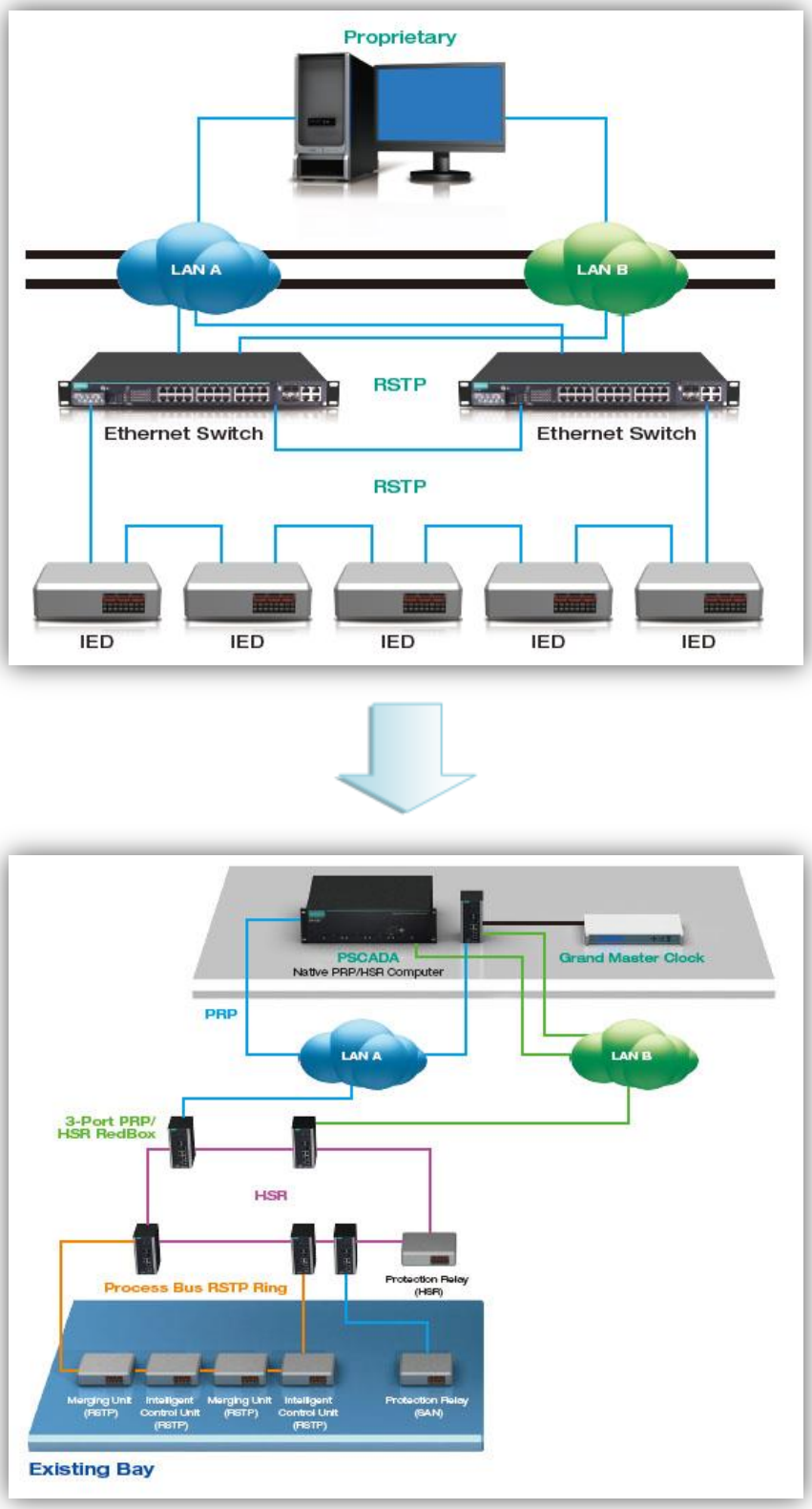
- **Interoperability concerns with multiple PRP/HSR solutions**

  A hybrid PRP/HSR network consists of various types of end devices. To select ideal devices for the network upgrade, engineers will need to consider factors such as form factor, function isolation, and scalability to ensure optimal system availability. However, without a complete communication platform to systems management solution, substation operators will be left with a network consisting of devices from multiple vendors/suppliers. This will severely complicate systems interoperability, maintenance, troubleshooting, and increase the total cost of ownership.

Recommended Solution

1. An economical way to integrate legacy devices to a highly-reliable communication backbone

Most existing end devices have dual access points to the network and are capable of using the RSTP redundant protocol. Under tolerated second-level recovery time, operators will prefer a cost-effective method to integrate these DANs to a more reliable backbone network to enhance system availability. Integrating existing ring networks with a PRP/HSR architecture using RSTP-transparent technology is an ideal method to achieve this objective. When applying RSTP-transparent technology, only 4 three-port RedBoxes will be required to bring multiple DANs to a seamless redundancy communication backbone.



2. A wide range of product options to deploy a scalable and highly interoperable deployment

Deploying redundancy has a direct impact on system complexity and cost, which will depend on system requirements and application criticality. With a limited budget allocation, engineers must meet substation requirements while optimizing system availability. Existing

device/ring networks must integrate easily into the PRP/HSR network and the system architecture must be scalable according to system needs.

A 3-port RedBox is an ideal device for the needs of critical communication, function isolation, and integrating many RSTP-supported DANs. High-port density PRP/HSR switches with a hot-swappable communication module design minimizes the mean time to repair and service for SANs, DANs, DANPs, and DANHs. PRP/HSR embedded modules enable legacy devices to natively support PRP/HSR protocols without the impact of having a single point of failure between the connection of the RedBox and the end device. PRP/HSR embedded computers will provide a management platform to enable visually-represented PRP/HSR network management.

There are many methods for integrating existing and new bays with a single supplier solution.

With IEC 61850-compliant devices specifically calibrated for PRP and HSR redundancy, seamless control and monitoring can be achieved by using a cost-effective hybrid network topology. For more information on how to integrate scalable Ethernet redundancy using PRP/HSR, please visit: http://www.moxa.com/Event/Vertical_markets/IEC61850-PRP-HSR/Overview.htm