

# PRP/HSR GbE Switch on a Single FPGA

## Deliver Smart Grid Reliability with Increased Flexibility

### Flexibility to Meet High-Performance Communications and Redundancy Needs

- Evolve your design with changing PRP/HSR protocol standards
- Process communications with media redundancy in real time
- Add or change I/O interfaces

### Lower Cost Through Design Integration

- Switch efficiently with redundancy without an external switch device
- Integrate PRP/HSR switch with system functions on Cyclone V FPGA or Cyclone V SoC
- Save time and mitigate risk with no license negotiation, up-front licensing costs, and per-unit royalty tracking
- Spend more time on product innovation instead of on product life-cycle management with long FPGA life cycles

### Performance

- Support hardwired, real-time switch performance and reduced latencies
- Handle GbE traffic with PRP/HSR redundancy
- Integrate and accelerate system functions for cost/performance

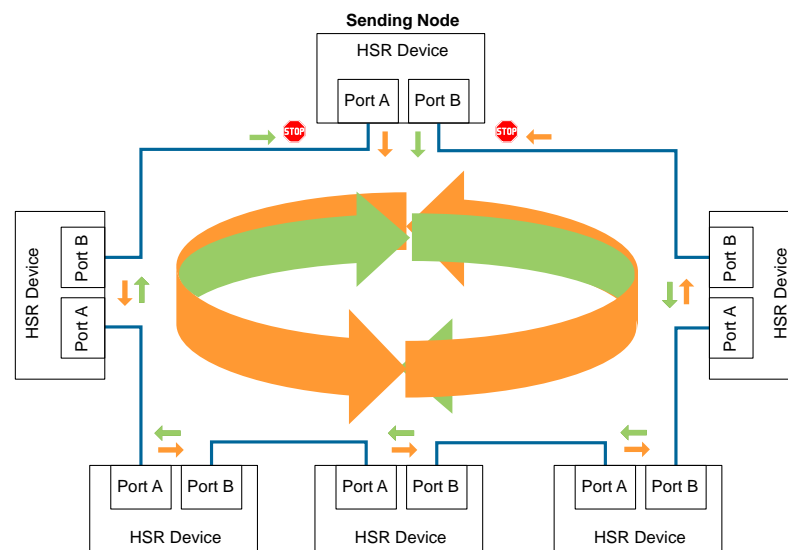
Many new smart grid designs, especially automation equipment in transmission and distribution substations, offer end-to-end communications in IEC 61850-compatible intelligent electronic devices (IEDs), such as industrial switches, protection relays, and reclosers. IEC 61850 over Ethernet is fast becoming the backbone of substation and utility automation designs.

The IEC 62439-3 Parallel Redundancy Protocol (PRP) and High-Availability Seamless Redundancy (HSR) standards used in such equipment enables:

- High-availability networking for mission-critical equipment
- Redundancy to guard against failures
- Resistance to node, link, and single points of failures

These evolving standards and performance requirements for a PRP/HSR switch work well with FPGA technology where the system can be hardwired with parallel processing capabilities to lower the switching latency. You can easily and cost-effectively deliver reliable, high-availability smart grid networking with our PRP/HSR Gbps Ethernet (GbE) switch intellectual property (IP) on a single Cyclone® V FPGA or Cyclone V SoC.

### IEC 62439-3.5 High-Availability Seamless Redundancy Ring



## No-Hassle PRP/HSR Switch Solution

To make it easier for you to implement your smart grid design, we teamed with Flexibilis, a leading networking equipment and IP provider. The combination of our FPGA with the Flexibilis Redundant Switch (FRS) IP provides an easy and inexpensive way for you to develop your PRP/HSR switch with:

- No license negotiation
- No up-front licensing costs
- No per-unit royalty reporting
- Simply purchase an FPGA and security CPLD from Altera and focus on your design



## Altera's Cyclone Portfolio

Our 28 nm Cyclone V FPGAs and Cyclone V SoCs are tailored for silicon convergence to meet your design requirements. You gain the best of all worlds, including application-specific IP, support for high-volume applications, embedded processing and DSP technology, and the flexibility to reconfigure systems and integrate system functionality on a single FPGA. Fewer components help reduce power consumption and increase system reliability as there are fewer failure points.

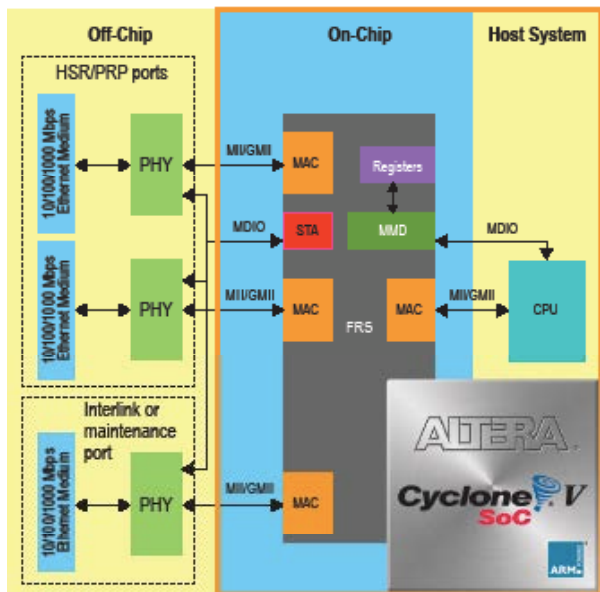
## Reference Design

The FRS is a 10/100/1000 Mbps—also known as triple-speed Ethernet (TSE)—Layer-2 switch with HSR and PRP support. The FRS is available on our Cyclone IV and Cyclone V FPGAs, as well as our Cyclone V SoCs. It is ideal for transmission and distribution substation automation for smart grid applications, as well as energy management applications in industrial automation.

## Want to dig deeper?

For more information about Altera's FPGAs and SoCs for smart grid substation automation applications, contact your local Altera sales representative, or visit [www.altera.com/industrial](http://www.altera.com/industrial).

### Example: Cyclone V SoC with 4-Port PRP/HSR GbE Switch



Key features:

- Scalable from three to eight ports
- Full-duplex 1000 Mbps (GMII<sup>1</sup>) and 10/100 Mbps (MII<sup>2</sup>) on all ports
- Wire-speed packet forwarding
- Non-blocking operations
- Reliable store-and-forward operation with data integrity checking
- HSR redundancy box (RedBox), end-node, and quadruple port device (QuadBox); PRP RedBox
- Compatible with IEEE 1588 Precision Time Protocol (PTP) transparent clock

<sup>1</sup>Gigabit Media Independent Interface

<sup>2</sup>Media Independent Interface

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