Reliable Ethernet
Flexibilis Redundant Switch

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The Flexibilis Redundant Switch (FRS) is a triple-speed (10Mbps/100Mbps/1Gbps) Ethernet Layer-2 switch that supports new protocols, providing seamless redundancy for Ethernet networking: High-availability Seamless Redundancy (IEC 62439-3 Clause 5) and Parallel Redundancy Protocol (IEC 62439-3 Clause 4). FRS also includes IEEE1588v2 Precision Timing Protocol (PTP) transparent clock functionality.

Easy Implementation

To make it easier to add Industrial Ethernet to your design, Altera and Flexibilis provide an out-of-the-box solution with no upfront licensing fees, no per-unit royalty reporting and no license negotiations. The Flexibilis Redundant Switch can be easily implemented on an Altera® FPGA and is fully compliance tested on the Altera Cyclone® family.

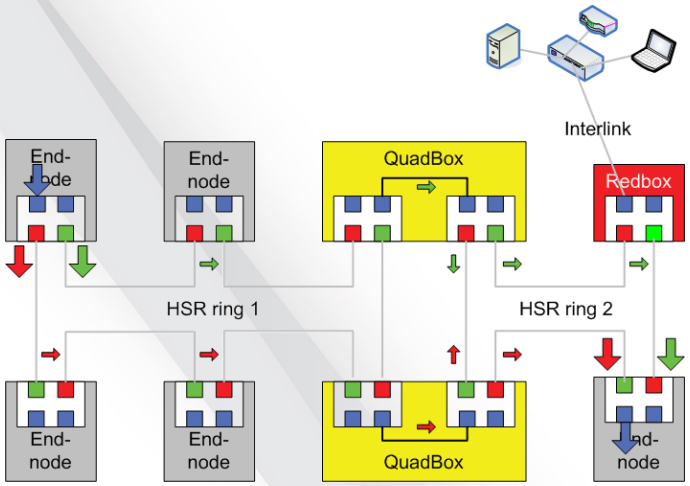
High-availability Seamless Redundancy

With High-availability Seamless Redundancy (HSR), there is no single point of failure in the network, and time to recovery is zero in case of a failure. Single network faults in the ring will not result in any frame loss. The network is fully operational even during maintenance, as any device can be disconnected and replaced without breaking the network connectivity. All this leads to cost savings as well as more efficient operations.

HSR is suitable for applications that require short reaction times and high availability. Originally HSR was targeted for smart grid electrical substation automation, but it can also be employed in other critical networking applications, such as industrial automation, motion control and military communication.

The typical HSR topology is a ring. The source node duplicates all the frames it has to send, and transmits them using two different paths to their destination. If either one of the paths is broken, due to link or node failure, the frames are still able to reach their destination.

End-nodes are individual devices connected to the network, and RedBoxes are used to connect non- HSR nodes to HSR rings. QuadBoxes connect two HSR rings to each other.



Parallel Redundancy Protocol

The Parallel Redundancy Protocol (PRP) employs two LANs: each node is connected to two separated, parallel networks. The nodes send two copies of the same packet, one over each network. As in HSR, the first packet is accepted and the second one is discarded. The two networks are assumed to be fail-independent. The destination node will always receive at least one packet as long as either one of the two networks is operational. HSR provides the same level of redundancy as PRP, but as less cabling is needed, the costs are lower.

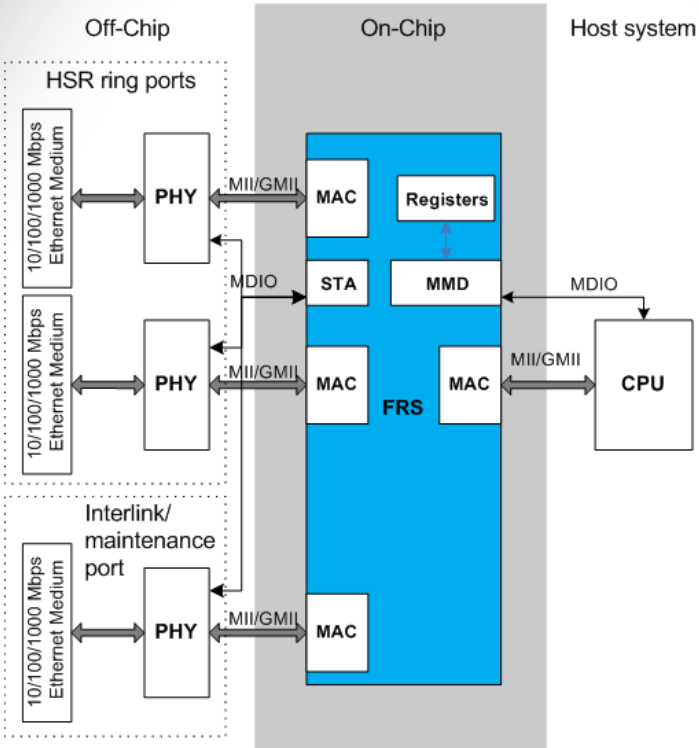
Precision Time Protocol

HSR is typically used in applications where time synchronization is also needed, and therefore Precision Time Protocol (PTP) support is an integral part of the Flexibilis Redundant Switch. PTP enables precise synchronization of device clocks in packet based networks. Devices are automatically synchronized to the most accurate clock in the network. When using Gigabit fiber Ethernet, FRS is able to achieve nanosecond class accuracy in clock transfer.

Configuration

The Flexibilis Redundant Switch is available in several different configurations, from 3-port to 8-port.

For example, a 4-port FRS can be used to implement End-nodes and RedBoxes. A suitable device for the 4-port FRS is for example the Cyclone IV EC4CGX50. One of the Ethernet interfaces is typically internal, for the device internal CPU to be able to access the network. Two external Ethernet interfaces connect to the HSR ring, and the fourth interface is an interlink port.



Evaluation

The Flexibilis Redundant Switch can be evaluated by customers for free for an unlimited time period. The evaluation platform is Altera Cyclone IV or Cyclone V evaluation board. FRS IP can be downloaded from the Altera webpage http://www.altera.com/smartgrid. The reference design for a 4-port FRS can be downloaded from http://www.flexibilis.com/products/downloads. When you are ready to go into production, there is no need to download the FRS again; only a security CPLD that can be purchased from Altera is needed.

For further inquiries and instructions, please visit our website at http://www.flexibilis.com or contact your Altera sales representative.

Standard features

- Triple-speed (10Mbps/100Mbps/1Gbps), full-duplex operation on all ports
- Compatible with IEC 62439-3 Clause 5 "High-availability Seamless Redundancy (HSR)"
- Compatible with IEC 62439-3 Clause 4 "Parallel Redundancy Protocol (PRP)"
- Time and frequency synchronization using IEEE1588-2008 Precision Time Protocol v2
    - IEEE1588v2 End-to-end one-step Transparent Clock Functionality
    - IEEE1588v2 Peer-to-peer Transparent Clock support functions
- Ethernet packet filter and prioritization on each of the ports
- HSR RedBox, HSR End-node, HSR QuadBox, PRP RedBox and DANP support
- Register interface for accessing control and status registers

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