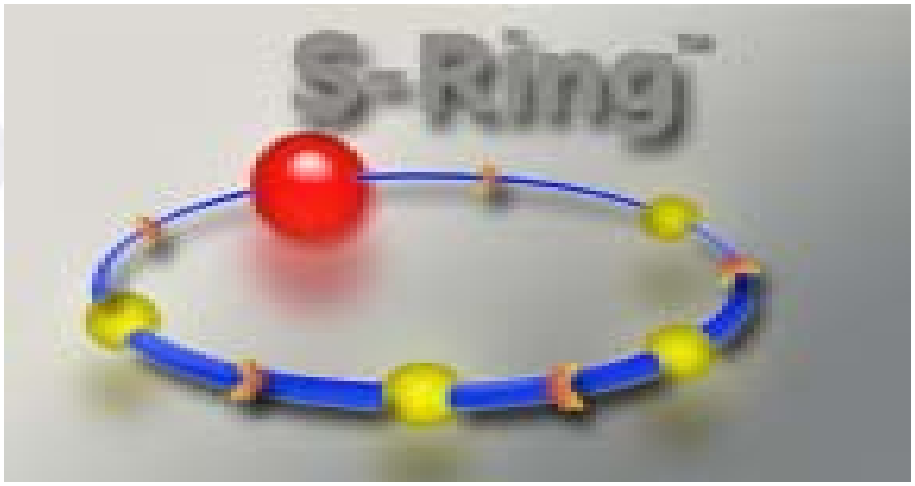
Magnum S-Ring

S-Ring for Magnum 6K Switches

Features

- Fast fault recovery in Industrial Ethernet LANs using a ring structure
- Operates with extensions to industry-standard Spanning Tree
- Multi-vendor switches and hubs supported in the rings
- Supports large rings over long distances using fiber media
- User controlled set-up for ring management via software commands



Magnum™ S-Ring (patent pending) Redundancy Manager software product, built upon networking industry standards including IEEE 802.1d Spanning Tree Protocol (STP), enables Magnum 6K Managed Switches to simplify and speed up recovery from faults in Industrial Ethernet LAN configurations that use a ring structure. With S-Ring, fault tolerant LANs finally can have both standards and speed.

The S-Ring product supports multi-vendor Ethernet switches and hubs in the rings. While fault recovery times will vary with the particular ring topology and ring member devices selected, almost any ring using standard Ethernet products will experience recovery speed improvements over STP using S-Ring. In addition, S-Ring makes Ethernet ring-topology LANs more reliable because fault recovery is less complex and much faster.

Industrial LANs often extend over great distances using fiber media, and a ring structure provides fault tolerance at low cost because it minimizes cabling expenses. The number of ring members or "drops" may be 10 or 20, even 50 or more in some cases such as in energy and transportation systems. Pipelines, railroads, windmill farms, oil and gas producing fields, waterways and canals, tunnels, highways and city traffic control systems are all good examples of redundant ring applications covering large areas and long distances. Other industrial facilities that benefit from large rings include water treatment plants, mines and quarries, forest product mills, agricultural buildings, and warehouses. With S-Ring, fault recovery speed is as fast for large rings as it is for small rings.

S-Ring software operates in a Magnum 6K Switch from specifically defined port pairs that have ring-topology Ethernet devices attached. It builds upon the foundation of STP, but offers an additional option related specifically to ring topologies. S-Ring acts to recover the ring traffic from faults at sub-second speed, over-riding the STP analysis delay but without conflicting with standard STP. The user configures and controls the S-Ring set-up as part of the 6K Switch's managed networks software, MNS-6K. A Ring-Scan feature simplifies ring definitions and makes reliable installation easy.

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Specifications

Ring-Closed:
The two ring-control ports, interconnected by the ring members in a daisy-chain, form an otherwise-illegal redundant path. Standard STP causes one of these two ports to block traffic in order to enable normal Ethernet traffic flow. All ring traffic goes through the non-blocking port for normal LAN operation. Meanwhile, there is a regular flow of status-checking multi-cast packets (called BPDUs or Bridge Protocol Data Units) sent out by STP at fixed intervals of time that move around the ring to show that things are functioning normally. This normal status is designated as RING_CLOSED. For the RING_CLOSED state, STP and S-Ring operate the same.

A fault occurs, Ring-Open:
A fault anywhere in the ring will interrupt the flow of standard STP status-checking BPDU packets, and will signal to STP that a fault has occurred. According to the standard STP-defined sequence, protocol packets are then sent out, gathered up and analyzed to enable STP to calculate how to re-configure the LAN to recover from the fault. After the standard STP reconfiguration time period, the STP analysis will conclude that recovery is achieved by changing the blocking port of the ring port-pair to the forwarding state. With this action, the fault is effectively bypassed and there is a path for all LAN traffic to be handled properly. This abnormal status is designated RING_OPEN. For the RING_OPEN state, STP and S-Ring operate the same, except that S-Ring acts faster.

The STP time interval for BPDU packets may be set by the user in the range of 2 seconds to 15 seconds. This is defined as part of the STP standard, IEEE 802.1d. Today, the minimum value of 2 seconds is almost always chosen. S-Ring provides for fault recovery to be triggered by either the BPDU packet interruption or by Link-Loss, whichever occurs first. This enables S-Ring to recover fast, even less than 200 milliseconds, See timing data below.

Ring Restoration upon Fault Repair:
Ring restoration, i.e., moving from RING_OPEN back to the normal RING_CLOSED state, is a mirror image reversal of the fault recovery process, and normally takes the same amount of time. (The difference is that restoration is a planned event while a fault incident is usually a surprise). After restoration, it is necessary for ring operation to be maintained for 4 to 5 seconds in order to stabilize timers and buffers, synchronize BPDUs, and reset Link sense circuits.

Initiate Ring-Learn:
This command causes the scanning of all ports in the 6K Switch for the presence of rings. This command can be a handy tool in setting up the S-Ring feature for correct initial operation. During a ring-learn scan, if any port receives a BPDU packet that was also originated by the same Switch, the source and destination ports are a ring port-pair and are automatically added to the S-Ring port-pair list. The user can also manually enable or disable port pairs that are on the S-Ring list.

Definitions:
Path Recovery (or "ring recovery") is defined as the operating state such that a new node can come on and find a working path enabling use of the ring elements to communicate with another new node.

Fault Recovery is defined as the operating state such that all existing nodes that previously communicated using the ring elements can communicate again.

Fault Timing Measurements:
Lab measurements using Fault Time Analysis (FTA) software with random faults manually generated. A minimum of 10 sample points are taken in each instance.

STP only Timing Data:
Standard 10Mb hubs in the ring: 48.3 sec (47.0-49.4) qty 3
Standard 100Mb hubs in the ring: 48.3 sec (46.9-49.6) qty 3
Unmanaged 100Mb switches in the ring, quantity 5:
Path Recovery: 48.5 seconds (47.5 to 49.8 range)
Fault Recovery, P62F: 424 seconds (308 to 570 range)
Fault Recovery, QS: 186 seconds (130 to 217 range)
Fault Recovery, 4K24: 423 seconds (299 to 566 range)
Managed switches in the ring, quantity 5:
Path Recovery, 100Mb: 48.7 seconds (48.0-49.8 range)
Fault Recovery, mP62, 100Mb: 504 seconds (319 to 573 range)
Fault Recovery, 6K, 100Mb: 389 seconds (299 to 531 range)
All switches in ring with Link-Loss-Learn (LLL) enabled, qty 7:
Path Recovery: 48.4 seconds (42.8 to 49.6 range)
Fault Recovery: 48.5 seconds (45.1 to 50.1 range)
Fault Recovery, 6K, Gigabit*: 48.6 seconds (45.6 to 50.7 range)
Quantity 50 mP62 Fault Recovery: 48.8 sec (48.1-50.2)

S-Ring Timing Data:
Standard 10Mb hubs in the ring: 0.853 sec. (0.792-1.70) qty 3
Standard 100Mb hubs in the ring:1.12 sec. (0.979-1.85) qty 3
Unmanaged 100Mb switches in ring, quantity 5:
Path Recovery: 0.936 seconds (0.140 to 2.21 range)
Fault Recovery, P62F: 424 seconds (308 to 570 range)
Fault Recovery, QS: 186 seconds (130 to 217 range)
Fault Recovery, 4K24: 423 seconds (299 to 566 range)
Managed switches in the ring, no LLL, quantity 5:
Path Recovery, 100Mb: 0.936 seconds (0.140 to 2.21 range)
Fault Recovery, mP62, 100Mb: 504 seconds (319 to 573 range)
Fault Recovery, 6K, 100Mb: 389 seconds (299 to 531 range)
All switches in ring with Link-Loss-Learn (LLL) enabled, qty 7:
Path Recovery: 0.182 seconds (0.140 to 0.210 range)
Fault Recovery: 0.214 seconds (0.145 to 0.275 range)
Fault Recovery, 6K, Gigabit*:0.447 sec. (0.280-0.490 range)
Quantity 50 mP62 Fault Recovery: 0.208 sec. (0.200-0.215)

*: Fiber GBICs with Gigabit Ethernet protocol, IEEE 802.3z

Ordering Information

S-Ring Key	S-Ring licensed software for redundant ring management in Industrial Ethernet LANs. Extends standard Spanning Tree Protocol (STP) to enable faster ring recovery and larger ring configurations. One S-Ring key is for licensed use on one 6K Switch. S-Ring supports multiple rings on one 6K Switch, with any standard Ethernet hubs or switches used to form the ring or rings.

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