Link-Loss-Learn on Magnum Managed Ethernet Switches . . . a Technical Brief

Introduction

GarrettCom's Link-Loss-Learn™ feature, designed to simplify and speed up recovery for Ethernet switches used in redundant LAN topologies, is implemented in the Magnum™ Managed Ethernet Switches and ES42 unmanaged switches. It addresses the time delay associated with changing the network addresses that are normally stored in a switch's memory. With Link-Loss-Learn (patent pending), Magnum 6Ks, mP62s, and ES42s are better able to handle some fault recovery situations, and they may improve network reliability and provide faster fault recovery accordingly.

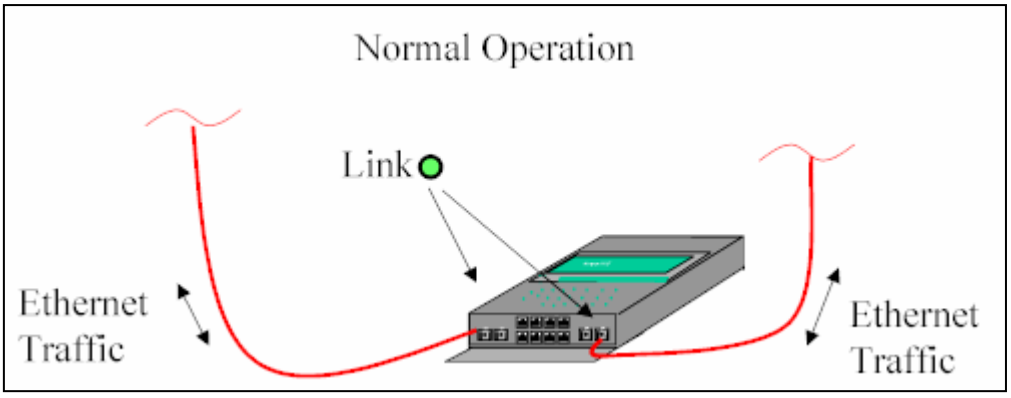
The managed Magnum mP62 Hardened Ethernet Switch, designed for "edge" applications where data devices connect into the LAN, was the first Magnum product to offer the Link-Loss-Learn feature. The unmanaged ES42 designed for "edge" applications where data devices connect into the LAN, has Port 1 and Port 2 set for LLL operation as a factory default setting.

The Link-Loss-Learn feature is placed into operation in a Magnum Managed Switch under the users control. It is not "automatic," but rather it is turned on with software commands by the user at initial set-up of the Magnum MNS management software. If Link-Loss-Learn is not turned on, the Magnum Switch operates and functions the same as an ordinary Ethernet Switch, learning the MAC addresses of attached nodes and retaining those addresses in memory until they eventually age out or power is turned off. The Link-Loss-Learn feature will improve fault recovery in ring topologies, but it can never hurt by going into operation unexpectedly.

Users may enable Link-Loss-Learn on a port-by-port basis in managed switches. A typical configuration selection enables Link-Loss-Learn on the Ring Member ports (usually two fiber ports) since these ports are normally used to connect into the redundant network upstream. However, the Link-Loss-Learn feature may be enabled on any combination of copper and fiber ports of any speed - - or it can be totally inactive.

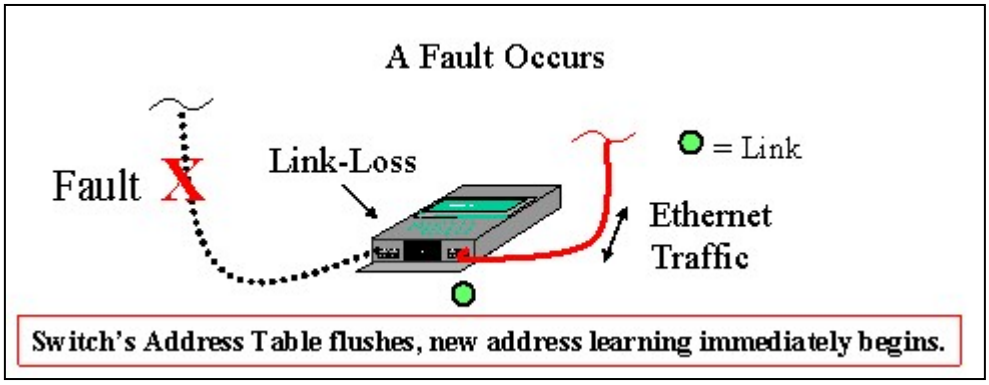
How does Link-Loss-Learn assist with Fault Recovery?

When a LAN is functioning normally, the LINK indicator is present for each port in use. A fault (a cable cut, or a unit losing power, or a unit failing while in operation) will usually cause LINK to be lost on one or more ports. Therefore, the loss of LINK during normal operation is interpreted as a signal that something has gone wrong, and in a redundant LAN, recovery operations must be brought into action to restore Ethernet traffic to its expected performance level.



When LINK fails on a port in a redundant LAN, another back-up port is expected to take over and keep the network packets flowing. The back-up port is connected and ready to provide service. However, a normal Ethernet Switch engine will continue to use its old address table, and will continue to try to

forward packets to the failed port. This will go on until the address table aging time expires for the addresses whose connection was lost, which can be as much as 4 or 5 minutes.

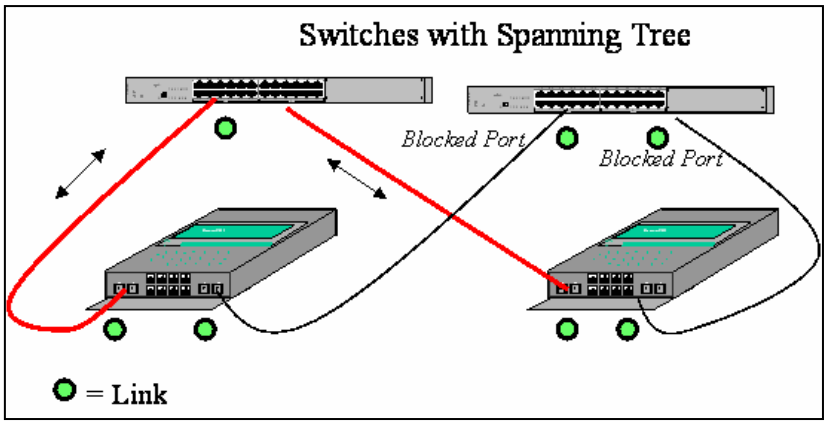


When standard 802.1d Spanning Tree Protocol is implemented, once a topology change is detected, the STP aging timer is set to 15 seconds until the topology is re-computed and / or reconfigured. The process of re-computing as well as reconfiguring the LAN can take equally as long, even in a simple set-up. (Note - complex set-ups such as multi-level meshes take much longer). For some industrial networks, this time of less than a minute for fault recovery is an acceptable delay, and standard Spanning Tree is an acceptable solution. For faster fault recovery and restoration times, Link-Loss-Learn can help.

The Link-Loss-Learn feature improves the recovery time by forcing the Magnum Switch's address table to be flushed when LINK is lost on any designated port. The effect on the operation of the Switch is the same as upon power up. The first packet is broadcasted and its address is learned. This continues rapidly until all addresses are learned and operation is normal . . . but with new information now in the address table on how to switch packets. Some bandwidth is used unnecessarily during the re-learning, but the recovery process is not delayed. Thus, the immediate re-learning of the addresses of attached devices results in fast re-routing of the network traffic passing through the Switch.

Because the Link-Loss-Learn feature is very fast (it takes just a few milliseconds), the Magnum Switch will not be the gating item for fault recovery in a redundant LAN. Whether the redundant paths upstream are controlled by 802.1d Standard Spanning Tree Protocol (STP), or by 802.1s Tagged VLAN Spanning Tree Protocol, or by 802.1w Rapid Spanning Tree Protocol, or manually such as in a bench-test situation, Magnum Switches with Link-Loss-Learn can reset their address table and participate in the LAN configuration change and network recovery faster than the other Ethernet elements.

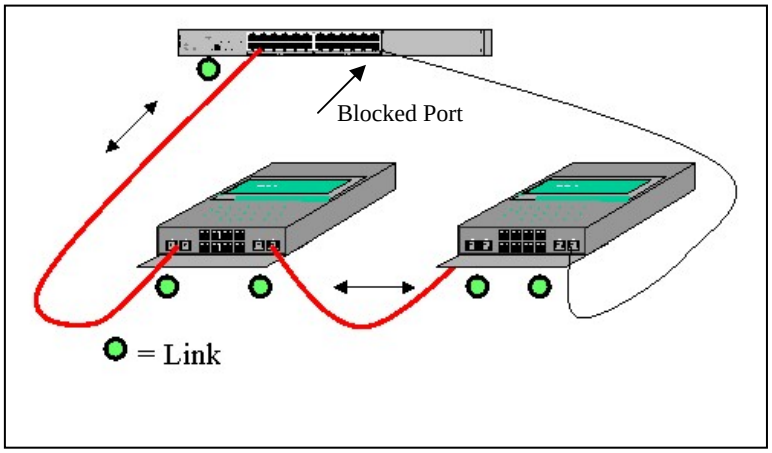
For redundant systems, simplicity is a virtue. Redundant LANs and fail-over scenarios are necessarily complicated, but complexity can also add to the risk that not all will go well when the critical time arrives.



It is better to keep things as simple as possible and minimize complexity. The Link-Loss-Learn feature fits in with this philosophy. Typically, a Magnum Switch (such as an mP62, illustrated here) with LLL is used as an edge switch in a redundant LAN configuration. While an mP62 can run Spanning Tree and can participate in failure recovery schemes accordingly, it can also perform its role in a redundant LAN recovery scenario via the Link-Loss-Learn feature simply

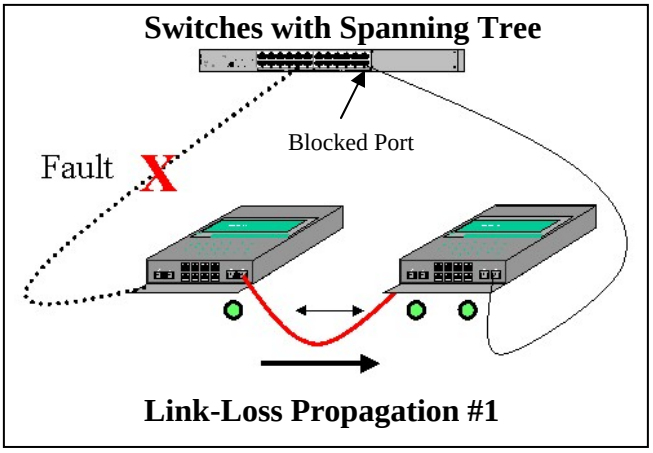
and independently of other things that are going on. One less thing to go wrong. Many applications are well served with the Magnum Edge Switch running the simple Link-Loss-Learn feature rather than a managed switch running the more complex Spanning Tree Protocol or Rapid Spanning Tree Protocol. Magnum products capabilities, with Spanning Tree and Rapid Spanning Tree and the Link-Loss-Learn feature available on many different models and price points, allows the user to choose.

Rings and Strings, and Link-Loss-Learn with Propagation



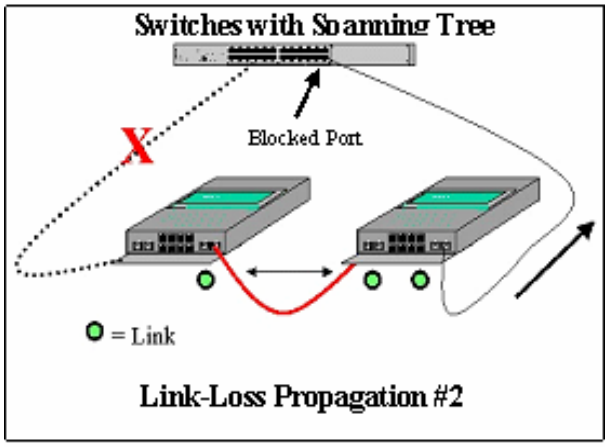
Frequently, a redundant system design using Magnum Switches as edge devices has the Magnums deployed over a distance and interconnected using the fiber ports hooked up in a string, i.e., daisy chained from one switch to the next with fiber media. It is common to continue from the last unit in a string, connecting the 2nd ring member port of the last switch in a given string back into a redundant LAN connection, thus forming a "ring" of switch units. Such a ring must have a port somewhere in the series operating blocked (i.e., not passing packets) so that a correct Ethernet topology exists. The Spanning Tree or similar logic controls which port is blocked in order to manage operating the network and to facilitate recovery from faults.

A Magnum Switch in a string or ring could experience a link loss on a ring member port, indicating a fault has occurred and the string has been broken. Recovery action needs to take place, and a Magnum Switch with the Link-Loss-Learn feature enabled would immediately dump its address table and be ready to relearn addresses and operate in a changed network configuration. But, what about the other switches in the string or ring . . . how will they know to do the same thing?



Link-Loss Propagation #1

For this reason, the Link-Loss-Learn feature in Magnum Switches includes a "propagation" function that, upon Link loss on one enabled (ring member) port, temporarily drops Link on any other Link-Loss-Learn enabled ports to propagate the action in the units in the string or ring.



Link-Loss Propagation #2

The Propagation function associated with the Magnum Link-Loss-Learn feature is always present, and its operation only affects those Magnum Switch ports that have the Link-Loss-Learn feature enabled. Users have control over the propagation accordingly, and can control their redundant LAN set-up with Magnum Switches to best suit their application.

Summary

Using the Link-Loss-Learn feature with Propagation, Magnum Managed Ethernet Switches with MNS software, and unmanaged ES42 Edge Switches with LLL, can simplify and speed up recovery from faults in redundant Ethernet LAN configurations. The Link-Loss-Learn feature is applicable to both mesh and string or ring topologies. Typically, using the simple Link-Loss-Learn feature will be better than running Spanning Tree or Rapid Spanning Tree on every Switch in a redundant LAN, increasing reliability by reducing complexity without compromising fault recovery performance.

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