

## Introduction

Today's mission-critical applications rely heavily upon Gigabit Ethernet connectivity, since the downtime due to severance of a fiber link causes monetary losses.

In general, the restoration of failed lines between switching equipment can be performed by redirecting traffic via alternative paths using Layer 2 redundancy protocols (e.g., STP, RSTP, etc.) or Layer 3 protocols (e.g., VRRP, OSPF, etc.). The problem with this solution is that, in all cases a greater intelligence is required for the networking gear, and, in some cases, resiliency of seconds might be intolerable for highly sensitive applications where the question of packet loss is critical.

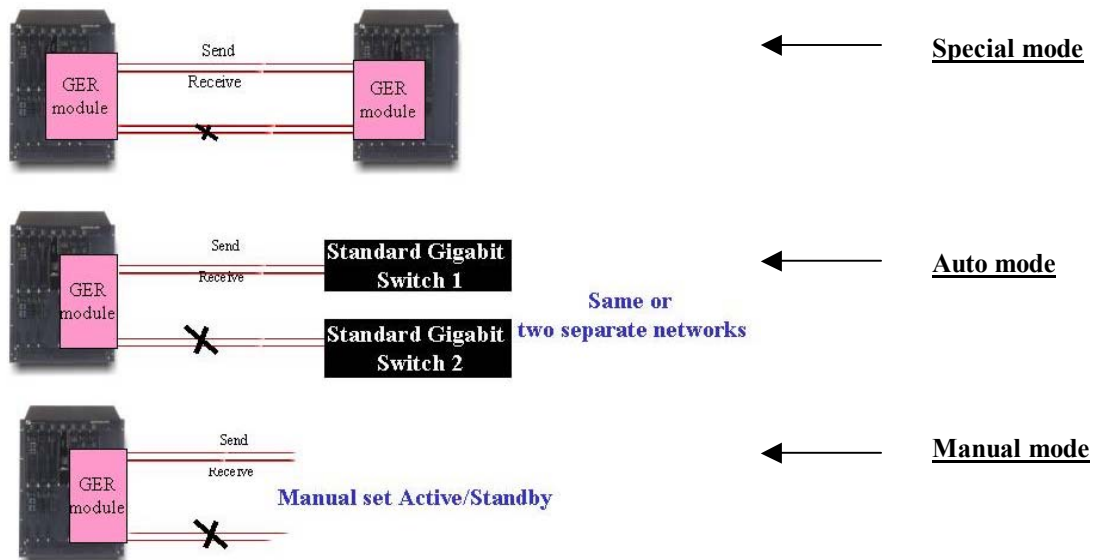
This problem can be resolved by incorporating MRV's Gigabit Ethernet Redundant Module (GER) which offers fast recovery (order of microseconds) on the physical layer.

## Key Features

- Fast (microseconds) recovery for Gigabit Ethernet
- Physical level signal sense to avoid ASIC process intervention in link fail over
- Two modes of operation for standard 3<sup>rd</sup> party interoperability and proprietary mode
- Manual mode for fiber link activation

## Applications

- Fiber link redundancy in point-to-point
- Fiber link redundancy in point to 2 separate points
- Manual setting of traffic path through specific fiber link
- Gigabit Ethernet xWDM O-BPSR and O-UPSR fiber protection



## Benefits

The greatest advantage of GER is the simplicity with which it is adaptable for different solutions. It's being implemented in standard design technology to deliver improved scalability and decreased provisioning time, making it a real winner -- at least where the explicit fiber lines have to be redundant and with superior availability.

The GER solution ensures a resiliency of less than 50 ms, the magic number commonly used in Telco, which is essential in mission-critical, time-sensitive applications.

## Technology Implementation

Technology implementation provides for the following three operational modes:

**Special** – This mode is used when the GER port of one switch is connected to a GER port of another switch.

**Auto** – This mode is used when one switch is connected to two switches required to operate in redundancy mode, i.e. providing an alternative path for network traffic in case a link from either of the two switches fails.

**Manual** – This mode is used when only one Gigabit Ethernet port of the module is activated, i.e. when there is no port redundancy.

The main purpose of Special and Auto modes is to reinforce a network, in which one fiber link functions as a primary path and the other as a secondary path. In the event of a link loss, the data will be automatically switched from the primary path to the secondary path.

These modules use a link detect mechanism that switches over to the secondary link within microseconds, directed by internal circuitry on the module itself. Doing this without any OSPF or Spanning Tree induced network topology modification eliminates long convergence times and the risk of data loss.

Special mode works as a full synchronized channel between two GER modules maintaining the connectivity. From the four strands (receive/transmit) only one pair will be activated through signal detection (receive) and will trigger link fail over through special internal integrated circuit in case of signal loss.

The advantage of such an application is that four strands connecting two sites will statistically improve resiliency and decrease the risks of both receive or transmit strands being cut off.

The Auto mode works for connectivity to standard networking switches, i.e. when a GER module connects to two standard 3<sup>rd</sup> party separate Gigabit Ethernet ports. The “lock” of preferred link is on the first receive signal. In this mode, only one transmit signal is active but receivers are ready to sense reception and in the event the active side does not receive light, it will create circuitry fail over to the second pair of strands.

Another advantage of such an application is that the GER's microseconds-recovery capability is available with any 3<sup>rd</sup> party networking Gigabit Ethernet gear.

The manual mode does not support redundancy, but allows manual setting of traffic distribution through different paths to address predicted load distributions or security concerns on physical links.

## GER & Classification

GER functionality is enhanced by the power of the MRV unique Ethernet circuit switching technology that offers Layer 2-3-4 switching capabilities with QoS techniques. The 2004-GER module has an on-board switching engine that is capable of recognizing a series of frames as belonging to a specific flow (“Ethernet Circuit”), and applying policy based traffic classification and prioritization based on :

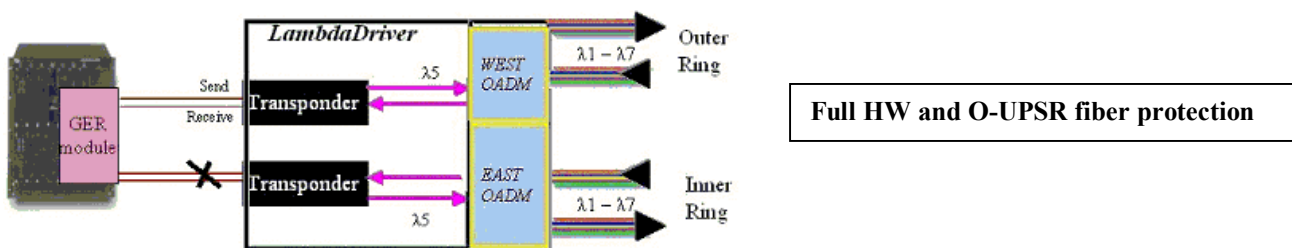
- DiffServ
- 802.1p queue mapping
- per VLAN membership
- per ingress PORT
- per MAC
- Per protocol
- Layer 2-3-4 traffic flows (source, destination)

Powerful bandwidth management allows rate limiting fractions from 64 Kbps up to Gbps on each flow (“Ethernet Circuit”) with a granularity of 1Kbps within GER line. Rate limiting allows multiple bandwidth provisioning policies to be applied and to provide maximum flexibility for network designers to build intelligent and resilient network with GER QoS solution.

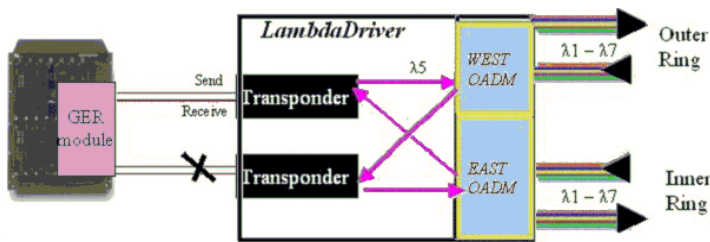
## GER & CWDM Ring Protection

The proliferation of xWDM based networks has become an emerging trend due to the increasing demand for optical services in various topologies. MRV LambdaDriver CWDM solution and GER can be used for full hardware redundancy as a network edge that is connected to the optical ring in two variations :

1. Optical Uni-directional Path Switched Ring (O-UPSR)
2. Optical Bi-directional Path Switched Ring (O-BPSR)



The GER providing redundancy all the way to the customer site and parallel connection to two Transponders with the same WDM wavelength is connected to a dual fiber ring for O-UPSR protection.



**Full HW and O-BPSR fiber protection**

The GER providing redundancy all the way to the customer site and parallel connection to two Transponders with the same WDM wavelength is connected to dual fiber ring for O-BPSR protection.

## Conclusion

GER enables maintenance of fast recovery (order of microseconds) of fiber links at the physical layer level and eliminates long convergence times resulting from Layer 2 and Layer 3 protocols. The reliable internal circuitry removes any CPU intensive interference and provides excellent resiliency. GER modules applications help service providers fulfill Service Level Agreements by allowing alternative paths in case of line failure and in enterprise networks by preventing loss of revenue due to downtime.

For more details, please contact your closest MRV representative, or

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