

Article Overview

A ring network connection of optical switches forms a closed-loop topology where each switch connects to two neighbors, enabling high-speed, redundant, and self-healing data transmission.

Physical Topology

In a fiber optic ring network, switches are connected in a loop using fiber optic cables, with each node linked to exactly two other nodes, forming a continuous ring . This setup allows data to travel in both directions, so if one link fails, traffic can be rerouted the opposite way, maintaining network uptime . Fiber loops are commonly used in industrial automation, power systems, railway communications, and large campus backbones due to their high-speed transmission and redundancy .

Redundancy and Fault Tolerance

Ring networks provide self-healing capabilities through redundancy protocols. Industrial Ethernet switches often implement dual fiber links forming primary and backup rings. If the primary link fails due to fiber cuts, switch failure, or human error, the backup link activates within milliseconds, ensuring uninterrupted data flow . Dual power inputs and hot-swappable modules further enhance reliability by preventing downtime from power failures .

Protocols for Ring Networks

Several protocols manage ring network redundancy:

- o Ethernet Ring Protection Switching (ERPS): Based on ITU-T G.8032, ERPS uses a blocking-forwarding mechanism to detect faults and reconstruct the ring topology within 50 milliseconds, ideal for real-time industrial applications like rail signaling .
- o Device Level Ring (DLR): A Layer 2 EtherNet/IP protocol for industrial networks, DLR requires at least one ring supervisor node and two Ethernet ports per node. It provides fast fault detection, automatic switchover to backup gateways, and supports access or trunk interfaces .
- o Dual Ring or Counter-Rotating Ring (C-Ring): Some networks implement a second ring in the opposite direction to maintain connectivity even if multiple points fail .

Advantages

- o High reliability: Continuous operation despite link or node failures .
- o Fast failover: Millisecond-level recovery ensures minimal disruption in critical systems .
- o Scalability: New switches or nodes can be added without major reconfiguration .

Optical Switch with Ring Network

- o Efficient fault isolation: Point-to-point connections make it easy to identify and isolate failures .

Practical Considerations

When designing a ring network with optical switches:

- o Ensure all switches support the chosen redundancy protocol (ERPS, DLR, or similar).
- o Use dual fiber links and consider geographically diverse routes to enhance resilience.
- o Monitor network traffic to prevent broadcast storms, which can occur in physical rings without proper protocol management .
- o Plan for future expansion by leaving spare ports and fiber capacity for additional nodes . This combination of physical ring topology, dual links, and intelligent redundancy protocols makes optical switch ring networks highly suitable for environments requiring continuous, high-speed, and fault-tolerant communication.

Real-time Redundant Ring Switch Cyber-Ring Ethernet Self-healing Technology ernet with high reliability and fault-tolerant capability.

We present the results of studies of fiber ring reflectors that are pulse excited in the negative dispersion regime. An

A DLR network with redundant gateways uses multiple switches to provide multiple

In the present communication, all-optical clocked J-K flip-flop is proposed and described using silicon waveguide

Fibre loops, also known as fibre rings, refer to a network setup where each node or building connects to

Cyber-Ring self-healing Ethernet technology is a proprietary developed by ICP DAS that can be used to

Abstract Recently there has been great interest in using the nonlinear property of optical micro-ring resonator for all

We design an elastic ring intra-DCN optical circuit switching architecture with flexible spectrum reconfigurable optical

Our ring structure systems are simple to design, and keeps costs down and reliability up. The key to the

Abstract Optical Packet Switched (OPS) technology is under study as a promising solution for addressing the rapid

Many ring networks will include the presence of an additional counter-rotating ring to protect their network against failure. If a network

Fiber Optic Ring Redundancy Design for Industrial Ethernet Switches: In-Depth Practice in Building the "Self-Healing Heart" of

Optical Ring Inter-Connection Ring Cover: set of closed paths covering all links in the meshed optical network at least once (every

11.2.2 Four-Fiber BLSRs two-fiber BLSRs. Because they allow span switching as well as ring switching, four-fiber BLSRs increase

Intended for Self-Healing Ring topologies, the TC3720 Ethernet Fiber Optic Switch

Use the Schneider Electric 499NOS17100 Ethernet switch to create a "fiber optic ring" Ethernet configuration. If you

Web: <https://www.in-au.co.za>

