

Fiber optic ring network switch 2 optical layer 2



Overview

The Fiber Optic Association - Tech Topics What is the OSI (Open Systems Interconnection) Network Model?

Key Takeaways

A fiber optic ring network using Layer 2 switches provides high-speed, redundant connectivity with self-healing capabilities, ensuring minimal downtime in industrial or enterprise environments. Overview of Fiber Optic Ring Networks

A fiber optic ring network is a topology where switches or nodes are connected in a closed loop using fiber optic cables. Each node connects to two other nodes, forming a ring that allows data to travel in both directions. This design ensures redundancy, so if one link fails, traffic can be rerouted the opposite way, maintaining continuous network operation. Fiber rings are widely used in industrial automation, power systems, railway communications, and large campus backbones due to their reliability and high-speed performance.

Layer 2 Switching in Ring Networks

Layer 2 switches operate at the data link layer, forwarding frames based on MAC addresses. In a fiber ring, Layer 2 switches can participate in redundancy protocols to prevent broadcast storms and ensure fast failover. Common Layer 2 ring protocols include:

- **Device Level Ring (DLR):** Designed for industrial Ethernet, DLR provides millisecond-level fault detection and reconfiguration. It requires at least one ring supervisor node and supports redundant gateways for external network connections. DLR rings can operate on access or trunk interfaces and allow multiple isolated rings in a network .
- **Ethernet Ring Protection Switching (ERPS):** Based on ITU-T G.8032, ERPS uses a blocking-forwarding mechanism to achieve self-healing. When a link fails, the protocol reconstructs the topology within 50 milliseconds, ensuring uninterrupted data transmission .

Redundancy and Self-Healing

Fiber optic ring networks often implement dual-ring or primary-backup link designs. Each switch may have two fiber connections forming primary and backup paths. If the primary link fails due to fiber cuts or switch issues, the backup link activates automatically, minimizing downtime . This is critical in real-time applications like SCADA, smart grids, and industrial control systems.

Design Considerations

When designing a Layer 2 fiber ring network:

- **Ring Topology:** Connect three or more switches in a closed loop for basic redundancy .
- **Dual Rings:** For higher reliability, implement dual parallel rings to allow traffic rerouting if one ring fails .
- **Central Switch Integration:** A core switch can participate in multiple independent rings, centralizing control while maintaining segmented traffic .
- **Branch Rings:** Secondary rings can connect to a main ring at a single switch to extend coverage without fully integrating all nodes .
- **Port and Fiber Planning:** Ensure each switch has at least two fiber ports and consider SFP+ modules for high-speed links (10 Gbps or higher) for backbone connections .

Applications

Layer 2 fiber ring networks are ideal for:

- **Industrial Ethernet:** Fast failover for automation and control systems.
- **Campus Networks:** High-speed backbone connecting multiple buildings.
- **Metropolitan Area Networks (Metro Rings):** Connecting data centers and offices across a city .

- **Critical Infrastructure:** Power grids, railway signaling, and surveillance systems requiring uninterrupted communication. By combining Layer 2 switching with fiber ring topology and redundancy protocols, networks achieve high availability, fast recovery, and scalable expansion, making them suitable for demanding industrial and enterprise environments .

Article Content

Fiber Optic Ring Redundancy Design for Industrial Ethernet Switches

The workshop deploys two independent fiber optic ring networks (Ring A and Ring B), each containing eight USR-ISG-8G industrial

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Layer 2 Fiber Switches are perfectly suitable for FTTx Ethernet based deployments providing features like VLAN (port based and

Using a fibre ring topology to ensure resilience in the

It is in effect a star topology achieved with a ring infrastructure. Fibre ring topology diagram In the event of

Generic topologies

A single fiber cut can break the ring if both cable directions use the same physical path. Additionally, adding and removing devices

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Fast, Gigabit, and 10 Gigabit Ethernet Switches with SFP+ Modules

Managed and unmanaged Layer 2 and Layer 3 fiber optic Ethernet switches. With 10G SFP+ fiber optic transceiver modules, they

Fiber ring topology provides both distance and resilience

The key to the ring topology is spanning tree protocol. One switch-in this case, the switch in the central office-is the

TC3820datasheet-010C.ai

Ideal for mission critical fiber optic ring networks, the TC3820 Redundant Ring Gigabit Ethernet Switch provides maximum reliability

Ethernet Switches

Moxa provides a wide range of industrial Ethernet switches that feature industrial-grade reliability, network redundancy, strengthened

A switchable high-speed fiber-optic ring net topology and its method of ...

The main defects in the single fiber-optic ring net topology are that the whole serial fiber-optic communication ring net

Multi-Drop Ethernet Fiber Optic Switch

The TC3720 10/100M 6-Port Self-Healing Ring Ethernet Switch is a low cost solution for linking multiple RTUs & PLCs in industrial

Optical Switching Data Center Networks: Understanding

Considering this, fast optical switches-based network topologies supporting nanoseconds optical packet switching offers a potentially

Fiber Optic Ring Redundancy Design for Industrial Ethernet Switches

The fiber optic ring redundancy design for industrial Ethernet switches is precisely engineered to address this pain point—achieving

10 port managed Ethernet to multimode fiber optic switch, EL1000

The EL-1000-4GM is a 10-port managed Industrial Ethernet Layer 2 switches. Compact Ethernet switch with 2 fiber optic and 8 RJ45

Fiber Ring Design Considerations

The second image below shows the proposed combining of the 2 existing fiber rings. Currently these are simply flat

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