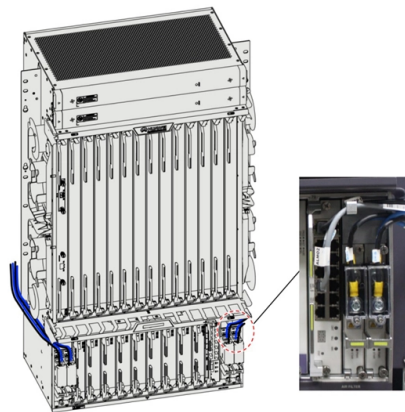


Why are optical modules so prone to failure



AI Overview

Optical modules are generally reliable, but they can fail due to environmental, mechanical, or operational factors rather than inherent defects.

Reliability Overview Optical modules, including SFP, SFP+, QSFP, and QSFP28, are designed for high reliability in modern networks. However, failures do occur in real-world deployments, often leading to intermittent connectivity, high error rates, or complete link loss (flapping links) due to factors beyond manufacturing defects.

Common Causes of Failure

- Environmental Factors:** Modules are sensitive to temperature extremes, voltage spikes, and power fluctuations. Excessive heat or improper power supply can degrade laser diodes or photodetectors over time.
- Contamination and Physical Damage:** Dust, oils, fingerprints, or scratches on fiber connectors can scatter or block light, causing signal attenuation or errors. Even microscopic imperfections on ferrules can lead to link instability.
- Electrostatic Discharge (ESD):** ESD can damage optical components, leading to performance degradation or complete loss of optoelectronic functionality. Proper handling with ESD gloves, wrist straps, and anti-static packaging is essential.
- Compatibility Issues:** Not all third-party modules perform equally with major vendor equipment. Mismatched modules can cause intermittent failures or reduced link performance.
- Fiber Infrastructure Quality:** Poor cabling, damaged connectors, or misaligned fibers can prevent modules from operating at full capacity, regardless of module quality.
- Aging Components:** Over time, laser diodes and photodetectors naturally degrade, leading to gradual increases in bit error rate, reduced optical power output, and eventual failure.

Preventive Measures

- Inspection and Cleaning:** Always inspect ferrules with a fiber optic microscope and clean with approved lint-free wipes and optical-grade solutions before installation.

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Failure Analysis of Optical Modules

The failure of the optical module function is divided into the failure of the transmitting end and the failure of the receiving end. After analyzing the specific reasons, the most common problems

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The annual failure rate of traditional optical modules can be as high as 4%. Using a cluster of over 10,000 computing cards as an example, each year, about 60 training interruptions are

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