

High-Availability Campus Switch Redundancy Guide - Official Technical Overview & Hardware Datasheet

EXECUTIVE SUMMARY

This document serves as the definitive technical reference for the High-Availability Campus Switch Redundancy Guide, a comprehensive framework engineered to deliver carrier-grade resiliency for modern enterprise campus networks. Designed to eliminate single points of failure, this solution integrates seamlessly with existing network infrastructures to provide sub-second failover, in-service software upgrades (ISSU), and zero-downtime maintenance. The guide details the hardware and software synergy required to achieve five-nines (99.999%) availability, ensuring uninterrupted connectivity for mission-critical applications such as unified communications, IoT, and high-frequency data acquisition. This paper is intended for network architects, systems engineers, and technical procurement officers seeking an authoritative overview of our redundancy capabilities.



ARCHITECTURE & CHASSIS DESIGN

The High-Availability Campus Switch Redundancy Guide is built upon a modular, field-proven hardware platform designed for maximum uptime. At its core lies a dual-active control plane architecture, featuring hot-swappable supervisor modules that operate in an Active/Standby or Active/Active state (depending on the deployment model). The chassis backplane is engineered with a fully redundant switching fabric, ensuring that data plane continuity is maintained even during control plane transitions.

Key structural elements include:

- Modular 2RU, 4RU, and 8RU chassis options, catering to varying port densities from 48 to 384 10G/25G ports, with integrated 100G uplink capability.
- N+1 Redundant Power Supplies (AC/DC hot-swappable) and N+1 fan tray

assemblies with variable-speed, temperature-controlled operation.

- High-availability backplane with dual-star and mesh topologies for inter-module communication, providing a non-blocking forwarding capacity of up to 12.8 Tbps.
- Crossbar fabric modules that enable intelligent load balancing and hardware-based link aggregation (LAG) across up to 64 member links.
- Compliance with NEBS Level 3 and ETSI environmental standards, ensuring reliable operation in temperature ranges from -5°C to +55°C.

The architecture is further bolstered by a hardware-assisted OAM (Operations, Administration, and Maintenance) engine, providing real-time link state monitoring and fault isolation at the physical layer.

HARDWARE FEATURES

This platform incorporates a suite of hardware-centric high-availability features that are often overlooked in software-only redundancy schemes:

- Integrated BMC (Baseboard Management Controller) with dedicated out-of-band management access for remote power cycling, sensor monitoring, and fault logging, independent of the switch CPU.
- Port-level redundancy: Physical Layer failover mechanisms, including

MDI/MDIX auto-sensing and hardware Link Fault Signaling (LFS), enable rapid detection of fiber breaks or copper link degradation.

- Custom-designed ASIC with built-in Forwarding Information Base (FIB) redundancy – the primary and backup FIB tables are synchronized in hardware, reducing convergence time to under 20 milliseconds for critical routing protocols (OSPF, BGP, IS-IS).
- Redundant Timing and Clocking: IEEE 1588v2 and Synchronous Ethernet (SyncE) capability with a holdover oscillator, maintaining phase alignment for up to 24 hours in the event of a reference clock loss.
- Smart Thermal Management: The fan control algorithms are predictive, adjusting cooling based on actual traffic load rather than simple temperature thresholds, thereby extending the service life of critical components by up to 30%.
- In-Service Software Upgrade (ISSU): The hardware hosts dual boot partitions, allowing the standby supervisor to load a new software image while the active supervisor processes live traffic, enabling hitless upgrades.

COMPLIANCE & STANDARDS

The redundancy mechanisms and hardware design adhere to a comprehensive set of international standards, guaranteeing interoperability and reliability in multi-vendor environments:

- IEEE 802.1D (STP), 802.1w (RSTP), and 802.1s (MST) for Layer 2 loop prevention and redundancy.
- IEEE 802.3ad (Link Aggregation) for physical link redundancy.
- ITU-T G.8032 (Ethernet Ring Protection Switching) for sub-50ms ring topology failover.
- RFC 7794 (IS-IS Flooding Reduction) and RFC 7883 (BGP 4-Byte AS) for stable control plane convergence.
- MIL-STD-810F for shock and vibration resistance, ensuring hardware robustness in non-traditional deployments (e.g., manufacturing floors, outdoor enclosures).
- RoHS, REACH, and WEEE compliance for environmental stewardship.

TECHNICAL SPECIFICATIONS

The following table summarizes the primary performance and operational metrics for the reference hardware configuration (4RU chassis with dual supervisor modules).

Parameter	Specification
Form Factor	4RU Modular Chassis (19-inch EIA rack mount)

Switching Capacity	12.8 Tbps (non-blocking, full duplex)
Forwarding Rate	9600 Mpps (million packets per second)
Power Supply	1+1, 2+2, or 3+1 Redundant AC (100-240V) or DC (-48V) hot-swappable
Total Ports (Max)	Up to 384 x 10G SFP+ or 128 x 25G SFP28 (hybrid configurations available)
Uplink Ports	8 x 100G QSFP28 (breakout-capable to 4x25G)
Redundancy Mechanisms	Dual Supervisor Modules (Active/Standby), N+1 Fabric, ISSU, and LACP
Mean Time Between Failures (MTBF)	> 1,200,000 hours (calculated per MIL-HDBK-217F)
Mean Time To Repair (MTTR)	< 30 minutes (with pre-staged hot-swappable modules)
Operating Temperature	0°C to 45°C (Standard), -5°C to +55°C (Extended with fan speed adjustment)
Humidity	5% to 90% (non-condensing)
Airflow Direction	Port-to-Power or Power-to-Port

	(field-reversible fan trays)
Management Interfaces	1x RJ-45 Console, 1x 10/100/1000M MGMT Port, 1x USB 2.0 (Storage)

ORDERING OPTIONS

To facilitate flexible deployment, the High-Availability Campus Switch Redundancy Guide is supported by a variety of SKUs, bundles, and expansion modules. Customers may select base chassis, power supply configurations, fan tray orientations, and port expansion modules based on their specific density and cabling requirements.

Standard bundles include:

- Basic HA Bundle: Includes 1x 4RU chassis, 1x Supervisor Module, 1x Fabric Module, 2x 800W AC Power Supplies, 1x Fan Tray (Port-to-Power airflow).
- Enterprise HA Bundle: Includes 2x Supervisor Modules (Active/Standby), 2x Fabric Modules (N+1), 4x 1100W AC Power Supplies, 2x Fan Trays (Power-to-Port airflow), and 48x 10G SFP+ ports.
- Carrier HA Bundle: Includes full redundancy (dual everything), advanced timing module (SyncE/1588v2), 48x 25G SFP28 ports, and 8x 100G QSFP28 uplinks.

Custom assemblies are available upon request, leveraging our modular line cards. Please consult your regional sales representative for lead times and volume pricing based on project-specific configurations.

