High-Density Fiber Infrastructure Application Note: Central Office Modernization - Replacing Legacy Copper with High-Density FTTH Systems

TECHNOLOGY OVERVIEW

Legacy copper access networks present a critical bottleneck for service providers seeking to deliver multi-gigabit residential and enterprise services. The Central Office Modernization: Replacing Legacy Copper with High-Density FTTH Systems platform represents a carrier-grade, purpose-built optical access solution designed to displace aging copper plant with a scalable, non-blocking fiber-to-the-home architecture. This application note details the hardware, optical interface mapping, redundancy systems, and compliance framework of a high-density FTTH system engineered for central office and outside plant deployment.

The core value proposition centers on maximizing subscriber density per rack unit while minimizing power, cooling, and floor space overhead. By consolidating Optical Line Terminal (OLT) functions, passive optical splitting, and Layer 2/3 aggregation into a single modular chassis, operators can accelerate copper retirement timelines and reduce total cost of ownership across the access network.



SFP+/QSFP INTERFACE MAPPING

The FTTH system supports a flexible mix of optical and copper interfaces to address both legacy backhaul and modern aggregation requirements. Uplink interfaces are provided via QSFP28 and QSFP+ ports, enabling 100GE and 40GE connectivity to the metro aggregation layer. Downlink PON interfaces are delivered through SFP+ form-factor OLT transceivers supporting GPON, XGS-PON, and NG-PON2 standards on a per-port basis.

Management and out-of-band control are supported through dedicated 10/100/1000BASE-T RJ45 ports and console interfaces. The system also supports copper-based 10GBASE-T for legacy aggregation handoff, allowing phased migration from copper to fiber without service interruption. Each interface is hot-swappable and supports digital diagnostic monitoring (DDM)

for proactive optical link health management.

Interface mapping follows a non-blocking architecture: every PON port has a dedicated backplane path to the switching ASIC, ensuring line-rate forwarding regardless of subscriber load. QSFP uplinks may be configured as independent links or aggregated using LACP or MC-LAG for resilient backhaul.

REDUNDANT POWER SYSTEM

The system employs a dual-redundant, hot-swappable power supply architecture. Each power module supports AC and DC input options, with automatic load sharing and failover. In the event of a single power module failure, the remaining module assumes full system load without service interruption.

Power input ranges are designed for central office environments, supporting -48VDC and 100-240VAC nominal inputs. The chassis includes integrated surge protection and EMI filtering to meet carrier-grade requirements. Alarm reporting is provided via SNMP traps and dry-contact relay outputs for integration with existing CO alarm systems.

CAPABILITY METRICS

Key performance indicators for the FTTH system include subscriber density, forwarding capacity, and PON split ratio support. The system is capable of supporting up to 16,384 subscribers per chassis with a 1:128 split ratio per PON port. Switching capacity scales to 3.2 Tbps in a full chassis configuration, with packet forwarding rates of up to 1,200 Mpps.

Latency is maintained below 10 microseconds for Layer 2 forwarding and below 20 microseconds for Layer 3 routing, ensuring support for latency-sensitive services such as VoIP and IPTV. The system supports jumbo frames up to 9216 bytes and provides per-port and per-flow QoS with eight priority queues.

Parameter	**Specification**
Form Factor	Modular Chassis, 10RU to 14RU
Switching Capacity	Up to 3.2 Tbps
Forwarding Rate	Up to 1,200 Mpps
PON Ports per Line Card	8 to 16 ports, SFP+ form factor
Uplink Ports	4x QSFP28 (100GE) + 8x QSFP+ (40GE)
Max Subscribers per Chassis	16,384 (1:128 split)
Power Supply	Dual Hot-Swappable Redundant AC/DC
Operating Temperature	-40°C to +65°C (ODC); 0°C to +50°C

	(Indoor)
Latency	<10 µs Layer 2; <20 µs Layer 3
Compliance	ITU-T G.984/G.987/G.989, IEEE 802.3ah, MEF 3.0, NEBS Level 3

COMPLIANCE AUDIT

The platform complies with major telecom and safety standards, including ITU-T G.984 (GPON), ITU-T G.987 (XG-PON), ITU-T G.989 (NG-PON2), IEEE 802.3ah, IEEE 802.1Q, IEEE 802.1ad, and MEF 3.0 CE/EPL/EVPL. Safety certifications include UL 60950-1, IEC 60950-1, EN 60950-1, and CE marking. EMC compliance includes FCC Part 15 Class A, EN 55032 Class A, and EN 55024.

Environmental compliance includes RoHS, WEEE, and REACH directives. The system is designed for NEBS Level 3 compliance in central office environments, with operating temperature ranges from -40°C to +65°C for outside plant cabinet variants and 0°C to +50°C for indoor CO chassis.

SCALING STRATEGY

Scaling from copper to FTTH is achieved through a phased, chassis-based

approach. Operators may begin with a partially populated chassis and add PON line cards as subscriber demand grows. Each line card supports hot-swap insertion and removal, enabling in-service capacity expansion without downtime.

The system supports virtual chassis stacking for multi-chassis management under a single control plane, simplifying operations as the network grows. Uplink capacity can be scaled from 10GE to 100GE via transceiver upgrades without replacing the chassis or line cards.

For legacy copper displacement, the system provides POTS emulation and VoIP gateway functions on select line cards, allowing existing voice services to be migrated to the FTTH platform. This dual-mode capability ensures service continuity during the transition period.

