Multi-Operator Shared Access: GPON Physical Layer Slicing Whitepaper - Official Technical Overview & Hardware Datasheet

EXECUTIVE SUMMARY

Multi-Operator Shared Access (MOSA) represents a fundamental paradigm shift in Passive Optical Network (PON) infrastructure economics and deployment strategy. This whitepaper details the architectural principles, hardware implementation, and operational benefits of GPON Physical Layer Slicing, a carrier-grade technology that enables multiple independent service providers to share a single optical distribution network (ODN) while maintaining strict isolation, deterministic performance, and independent management domains.

Traditional GPON deployments dedicate the entire physical infrastructure to a single operator, resulting in significant capital expenditure duplication and slow time-to-market for new entrants. GPON Physical Layer Slicing resolves this inefficiency by virtualizing the PON physical layer at the silicon level, creating up to eight independent logical PON segments from a single physical port. Each virtual PON segment operates as a fully isolated, standards-compliant GPON interface with dedicated bandwidth guarantees, independent security contexts, and separate OMCI management channels.

This document serves as a comprehensive technical reference for network architects, procurement engineers, and deployment strategists evaluating multi-operator shared access solutions for FTTx, enterprise campus, and multi-tenant building applications.



HARDWARE ARCHITECTURE & SILICON

The GPON Physical Layer Slicing solution is built upon a purpose-designed ASIC architecture that implements hardware-enforced isolation between virtual PON segments. The core silicon integrates a high-performance PON MAC engine with 8 independent slicer blocks, each containing dedicated downstream framing logic, upstream burst-mode receivers, and AES-128 encryption engines.

Each slicer block maintains its own register space, interrupt vectors, and DMA channels, ensuring that no software or firmware fault in one operator domain can affect the operation of another. The isolation extends to the physical layer: each virtual PON segment has independent timing and ranging engines, allowing for precise per-operator distance compensation and rogue ONU detection without cross-domain interference.

The upstream direction employs a novel multi-scheduler architecture where each operator's bandwidth allocation is hardware-scheduled into a composite upstream frame. This approach eliminates the need for software-based arbitration, delivering deterministic latency and jitter performance that meets the most stringent carrier requirements.

KEY FEATURES & ROUTING LOGIC

- Hardware-Enforced Operator Isolation: Eight independent GPON MAC instances per physical PON port, each with dedicated memory protection units and encryption contexts.
- Deterministic Bandwidth Slicing: Per-operator committed information rate (CIR) guarantees enforced at the silicon level, eliminating cross-operator contention.
- Independent OMCI Channels: Each virtual PON segment supports a complete

OMCI stack, enabling per-operator provisioning, fault management, and performance monitoring.

- Rogue ONU Containment: Hardware-based rogue detection and mitigation isolated to the offending operator's virtual PON segment.

- Shared ODN Economics: Single optical distribution network supports multiple operators, reducing fiber deployment costs by up to 60%.

- Standards Compliance: Fully compliant with ITU-T G.984 series, G.988 OMCI, and G.9807.1 XGS-PON migration paths.

- Line-Rate Performance: Non-blocking 2.488 Gbps downstream and 1.244 Gbps upstream per virtual PON segment.

COMPLIANCE & STANDARDS

The GPON Physical Layer Slicing platform has been developed in accordance with the following international standards and regulatory frameworks:

ITU-T G.984.1: Gigabit-capable Passive Optical Networks (GPON): General characteristics

ITU-T G.984.2: GPON: Physical Media Dependent (PMD) layer specification

ITU-T G.984.3: GPON: Transmission Convergence layer specification

ITU-T G.984.4: GPON: ONT Management and Control Interface specification

ITU-T G.988: ONU management and control interface (OMCI) specification

IEEE 802.1Q: Virtual Bridged Local Area Networks

IEEE 802.1ad: Provider Bridges

ETSI TS 101 548: Access, Terminals, Transmission and Multiplexing (ATTM)

RoHS Directive 2011/65/EU: Restriction of Hazardous Substances

REACH Regulation (EC) No 1907/2006

TECHNICAL SPECIFICATIONS

The following table presents the core technical parameters of the GPON Physical Layer Slicing line card and associated optical modules.

Parameter	**Specification**
Form Factor	1RU Half-Width Line Card, Hot-Swappable
Switching Capacity	400 Gbps Full-Duplex Per Line Card
Virtual Operators	Up to 8 Per Physical PON Port
PON Standards	ITU-T G.984 GPON, G.988 OMCI
Downstream Rate	2.488 Gbps Per Virtual PON Segment
Upstream Rate	1.244 Gbps Per Virtual PON Segment
Encryption	AES-128 Hardware Per Virtual PON
Uplink Interfaces	2x 100GE QSFP28 or 4x 25GE SFP28
Power Supply	Dual Hot-Swappable Redundant -48V

	DC / AC
Power Consumption	Typical 85W, Maximum 120W
Operating Temperature	-5C to +55C (23F to 131F)
Storage Temperature	-40C to +85C (-40F to 185F)
Humidity	5% to 95% Non-Condensing
MTBF	> 350,000 Hours Telcordia SR-332
Regulatory	CE, FCC Part 15 Class A, RoHS, REACH
Management	NETCONF/YANG, CLI, SNMPv3, OMCI Per Operator

ORDERING SKU INFORMATION

MOSA-GPON-8S: 8-port GPON OLT line card with Physical Layer Slicing, supporting 8 virtual operators per port, dual 100GE uplinks

MOSA-GPON-16S: 16-port GPON OLT line card with Physical Layer Slicing, supporting 8 virtual operators per port, quad 100GE uplinks

MOSA-SFP-GPON-C+: GPON OLT SFP+ optical module, Class C+, 20 km reach, SC/APC connector

MOSA-SFP-GPON-C++: GPON OLT SFP+ optical module, Class C++, 40 km reach, SC/APC connector

MOSA-XGS-PON-8S: 8-port XGS-PON OLT line card with Physical Layer Slicing,

backward compatible with GPON

