OEM Dual-Mode ONU Bridge Mode to Router Mode Firmware Switching Protocol - Official Technical Overview & Hardware Datasheet

EXECUTIVE SUMMARY

This document presents the comprehensive technical overview and hardware datasheet for the OEM Dual-Mode ONU (Optical Network Unit) Firmware Switching Protocol. This advanced solution is engineered to provide seamless, hitless transition between Layer 2 Bridge Mode and Layer 3 Router Mode operation within a single, cost-optimized hardware platform. Designed for global Telecom and MSO (Multiple System Operator) deployments, this protocol-enabled ONU empowers service providers with unprecedented operational flexibility, enabling dynamic service provisioning, CPE (Customer Premises Equipment) consolidation, and simplified logistics without compromising on carrier-grade performance, security, or manageability. The dual-mode architecture is a paradigm shift in access network design, allowing a single hardware SKU to serve both residential and enterprise service delivery models.



HARDWARE ARCHITECTURE & SILICON

The OEM Dual-Mode ONU is built upon a purpose-designed, high-performance network processor architecture that integrates a powerful CPU complex with a dedicated hardware-accelerated packet forwarding engine. The core silicon features a 2+2 core ARM-based application processor, clocked at 1.2 GHz, coupled with a 64 Gbps non-blocking internal switching fabric. The architecture is specifically optimized to support the dual-boot firmware partition and the in-service software upgrade (ISSU) mechanism that underpins the bridge-to-router mode switching protocol. Memory subsystem is robust with 4 GB of DDR4 SDRAM for control plane operations and 256 MB of NAND flash for redundant firmware image storage. The hardware is fully passive-cooled for silent operation in customer premises environments, while also featuring a thermal sensor array to monitor internal component

temperatures, ensuring high reliability across diverse operating conditions.

KEY FEATURES & ROUTING LOGIC

- Dual-Mode Firmware Switching Protocol: The core intellectual property of the platform is the proprietary firmware switching protocol. This protocol enables an ONU to operate in a pure Layer 2 Bridge Mode (transparent to subscriber networks, ideal for legacy ISP deployments) or to switch, via a remote or local command, to a fully-featured Layer 3 Router Mode with support for NAT, DHCP server, firewall, and advanced QoS policies. The switching process is non-disruptive to active services, leveraging a hitless stateful synchronization mechanism.

- Hitless Service Migration: The protocol employs a 'Make-Before-Break' approach. When a switch command is initiated, the system pre-initializes the target mode's data plane in a shadow state. Once synchronization with the network management system (NMS) is complete, the forwarding context is atomically switched from the bridge instance to the routing instance, with zero packet loss and sub-50ms service disruption, aligning with carrier-grade fault recovery benchmarks.

- Intelligent Traffic Steering: In Router Mode, the ONU supports advanced

policy-based routing (PBR), enabling service providers to define granular traffic steering rules based on Layer 2 through Layer 4 packet headers. This is crucial for service chaining, traffic offload, and optimized content delivery network (CDN) peering.

- TR-069 & TR-369 (CWMP/USP) Management: Full compliance with Broadband Forum's TR-069 and TR-369 User Services Platform (USP) standards ensures robust remote management and service provisioning. The ONU acts as a fully manageable ACS (Auto-Configuration Server) client, providing comprehensive fault, configuration, accounting, performance, and security (FCAPS) functionality.

- Advanced QoS and Traffic Management: The hardware packet engine provides sophisticated hierarchical QoS (HQoS), enabling policy-based traffic shaping, policing, and queuing at the service flow level. This includes 802.1p prioritization, DSCP marking, and WRED (Weighted Random Early Detection) for optimal bandwidth utilization during network congestion.

- Security Hardening: The platform incorporates a secure boot chain, hardware root of trust, and secure key storage to protect against firmware tampering. Furthermore, it supports 802.1X port-based network access control for stringent subscriber authentication and secure MAC address filtering.

COMPLIANCE & STANDARDS

The OEM Dual-Mode ONU is designed to meet and exceed the most rigorous global industry standards for telecommunications equipment. Key compliance includes:

- IEEE Standards: 802.1D (Bridging), 802.1Q (VLAN Tagging), 802.1ad (Provider Bridging/QinQ), 802.1X (Port-based Network Access Control), 802.3ah (Ethernet in the First Mile), 802.3az (Energy Efficient Ethernet).
- ITU-T Standards: G.984.1/G.984.2/G.984.3 (GPON standards compliance), G.987 (XG-PON compatibility), ensuring full interoperability with OLTs from leading vendors.
- Broadband Forum: TR-069 (CPE WAN Management Protocol), TR-098 (Internet Gateway Device Data Model), TR-104 (Voice Service Provisioning), TR-135 (Data Model for TR-069 Enabled Devices).
- Environmental & Safety: RoHS 2.0 (Restriction of Hazardous Substances), WEEE (Waste Electrical and Electronic Equipment) compliant, CE Mark, FCC Part 15 Class B, and EN 55032/55024 for EMC.

Parameter	**Specification**
Form Factor	Compact Desktop (1 RU x 1/2 RU) / 1RU Rack-mountable

Switching Capacity	64 Gbps (Non-blocking internal fabric), 40 Gbps Full-Duplex Line Rate
Forwarding Rate	58 Mpps (Million Packets Per Second) for 64-byte packets
WAN Interfaces	1 x 10/100/1000Base-T (Copper) RJ45, 1 x SFP/SFP+ (Combo Port for Fiber) or 1 x SC/APC GPON OLT Port
LAN Interfaces	4 x 10/100/1000Base-T (Gigabit Ethernet) with Auto-MDI/MDIX support
Memory (RAM)	4 GB DDR4 SDRAM (with ECC support for enhanced reliability)
Flash Storage	256 MB NAND Flash (Dual Firmware Image Partition)
Power Supply	External, Universal 12V/2A DC Adapter (Input: 100-240V AC, 50/60Hz) or Optional -48V DC
Power Consumption	Typical: 12W, Maximum: 18W
Operating Temperature	0°C to 45°C (32°F to 113°F)
Storage Temperature	-40°C to 70°C (-40°F to 158°F)
Humidity	10% to 90% (Non-condensing)
Dimensions (WxDxH)	190mm x 130mm x 38mm (7.5in x

	5.1in x 1.5in)
Weight	0.75 kg (1.65 lbs)
MTBF	> 200,000 hours at 25 ° C (Telcordia SR-332)
Management Protocols	TR-069 (CWMP), TR-369 (USP), CLI (SSHv2), SNMP v2c/v3, Web GUI (HTTPS)

ORDERING SKU INFORMATION

The OEM Dual-Mode ONU is available under a streamlined, global ordering model to facilitate simplified supply chain management. The base SKU includes the hardware unit, a universal AC power adapter, and a Quick Start Guide. Customers can select from a range of transceiver options (SFP/SFP+) and antenna configurations (for Wi-Fi variants) to tailor the solution to specific deployment needs.

- Base Ordering Code: OM-ONU-DM-01 (Includes main chassis, passive heatsink, AC power supply, and mounting hardware).
- SFP Module Options: OM-SFP-GE (Gigabit Ethernet SFP), OM-SFP-GE-EX (Extended Reach Gigabit SFP), OM-SFP-10G-LR (10 Gigabit SFP+ for backbone

uplink).

- Cables and Accessories: OM-CABLE-PATCH-* (Various single-mode/multi-mode fiber patch cables).

- Standard Lead Time: 4-6 weeks (A2) for high volume orders. Rush order service available (A1) for critical deployments.

