Ultra-Low Latency Packet Buffering Engine Factsheet: OEM 24-Port Gigabit Managed Switch Internal Memory Buffer Architecture Guide

ULTRA-LOW LATENCY PACKET BUFFERING ENGINE FACTSHEET: OEM 24-PORT GIGABIT MANAGED SWITCH INTERNAL MEMORY BUFFER ARCHITECTURE GUIDE

EXECUTIVE SUMMARY

This document serves as the definitive technical reference for the Internal Memory Buffer Architecture of the OEM 24-Port Gigabit Managed Switch. Designed for enterprise edge, campus aggregation, and carrier-grade access networks, this switching platform integrates a high-performance, low-latency packet buffering engine that ensures deterministic forwarding behavior under diverse traffic loads. The architecture leverages a shared-memory buffer pool with dynamic queue management, providing a non-blocking fabric that supports line-rate forwarding across all 24 Gigabit Ethernet ports, plus four dedicated SFP+ uplink interfaces. This factsheet details the hardware implementation, internal topology, performance parameters, and operational advantages of the buffer architecture, underscoring its role in enabling reliable, high-throughput network services.



HARDWARE ARCHITECTURE & SILICON

The switching engine is anchored by a purpose-built ASIC that integrates a centralized 12 MB internal memory buffer pool. This memory subsystem is architected to absorb micro-bursts and alleviate head-of-line blocking, critical for maintaining application performance in converged networks. The buffer is partitioned logically to support 802.1p and DSCP-based queuing, with eight priority queues per egress port. Flow control mechanisms, including IEEE 802.3x pause frames and priority-based flow control (PFC), are supported to manage congestion proactively. The following architectural characteristics ensure robust traffic management:

- 12 MB Shared Buffer for dynamic allocation across all ports, preventing packet drops during transient congestion.

- 8 Priority Queues per port for granular traffic differentiation and

latency-sensitive service delivery.

- Auto-Negotiating Flow Control that adheres to IEEE 802.3x and 802.1Qbb standards for lossless Ethernet.

INTERNAL PACKET ENGINE & FORWARDING LOGIC

At the core of the packet engine lies the buffer manager, which implements a sophisticated cell-based memory allocation scheme. The memory is divided into 256-byte cells, allowing efficient use of the buffer space for a mix of frame sizes. The forwarding logic operates in a store-and-forward mode, ensuring data integrity via CRC checking before transmission. A cut-through mode is also available for low-latency applications, configurable via software. The internal memory bus operates at a peak bandwidth of 48 Gbps, sufficient to support full-duplex, line-rate switching on all ports. The dynamic buffer threshold mechanism utilizes a weighted random early detection (WRED) algorithm to manage congestion before buffers become full, mitigating the risk of TCP global synchronization.

KEY FEATURES & ROUTING LOGIC

- Low-Latency Cut-Through Forwarding: Reduces packet latency by up to 30% compared to store-and-forward for frames under 64 bytes.

- Advanced Congestion Avoidance: Supports 802.1Qaz Enhanced Transmission

Selection (ETS) for bandwidth allocation and strict priority queuing.

- Non-Blocking Architecture: Delivers a 56 Gbps switching capacity, ensuring no single port becomes a bottleneck.

- Extensive Routing Protocol Support: Full support for static and dynamic routing protocols including RIPv2, OSPFv2, and BGP-4, enabling flexible Layer 3 segmentation.

- Jumbo Frame Support: Handles frames up to 9,216 bytes for high-throughput data transfers.

- Comprehensive Security Features: Supports Port Security, DHCP Snooping, IP Source Guard, and Dynamic ARP Inspection.

COMPLIANCE & STANDARDS

- IEEE 802.3, 802.3u, 802.3ab, 802.3z, 802.3ae (10 Gigabit Ethernet)

- IEEE 802.1D, 802.1w, 802.1s (STP, RSTP, MSTP)

- IEEE 802.1Q VLAN, 802.1p Class of Service

- IEEE 802.3ad Link Aggregation

- RFC 768 UDP, RFC 793 TCP, RFC 826 ARP, RFC 1058 RIPv1, RFC 2453 RIPv2, RFC 2328 OSPFv2, RFC 4271 BGP-4

- EMI/EMC Compliance: FCC Part 15 Class A, CE Mark, VCCI Class A

- Safety Compliance: UL 60950-1, CAN/CSA C22.2 No. 60950-1, EN 60950-1

TECHNICAL SPECIFICATIONS

- Form Factor: 1RU Rack-Mountable

- Fixed Ports: 24x 10/100/1000BASE-T RJ-45, 4x 1G/10G SFP+ Slots

- Switching Capacity: 56 Gbps (Non-Blocking)

- Forwarding Rate: 41.67 Mpps (64-byte packets)

- Jumbo Frame Support: 9,216 Bytes

- MAC Address Table Size: 16,000 Entries

- VLANs: 4,094 Active VLANs

- VLAN Types: Port-based, Protocol-based, MAC-based, QinQ

- Routing Table Size: 8,192 Entries (IPv4), 2,048 Entries (IPv6)

- Buffer Memory: 12 MB Shared

- QoS Queues: 8 per Port

- Flow Control: IEEE 802.3x (Full-duplex), Back Pressure (Half-duplex)

- Management Interfaces: 1x RJ-45 Console, 1x 10/100/1000BASE-T Out-of-Band Management, USB Type-C for File Transfer

- Layer 3 Protocol Support: Static Routes, RIPv2, OSPFv2, BGP-4, DHCP Relay, VRRP

- Security: RADIUS, TACACS+, 802.1X, ACL (L2/L3/L4), SSHv2, SNMPv3

- Cooling: 2x Smart Fans (Front-to-Back Airflow)

- Operating Temperature: 0 to 45 °C (32 to 113 °F)

- Storage Temperature: -40 to 70 °C (-40 to 158 °F)

- Operating Humidity: 10% to 90% (non-condensing)

- Storage Humidity: 5% to 95% (non-condensing)

- Mean Time Between Failures (MTBF): > 300,000 Hours

Parameter	Specification
Form Factor	1RU Rack-Mountable (19-inch standard)
Switching Capacity	56 Gbps (Non-Blocking, Full-Duplex)
Power Supply	Dual Hot-Swappable Redundant AC (100-240V, 50/60Hz) / DC (-36 to -72V) options
Memory Buffer	12 MB Internal Shared Memory Pool
Forwarding Rate	41.67 Million Packets Per Second (Mpps)
Management Ports	1x RJ-45 Console, 1x 10/100/1000BASE-T OOB, 1x USB Type-C

ORDERING SKU INFORMATION

- Product Name: OEM 24-Port Gigabit Managed Switch

- Base Unit: OEM-SW-24G-4SFP+-MGT

- Optional Accessories:

  - OEM-SFP-SX: 1000BASE-SX SFP Transceiver

- OEM-SFP-LX: 1000BASE-LX SFP Transceiver
- OEM-SFP-T: 1000BASE-T SFP Transceiver
- OEM-SFP-10G-SR: 10GBASE-SR SFP+ Transceiver
- OEM-SFP-10G-LR: 10GBASE-LR SFP+ Transceiver
- OEM-CBL-CON: Console Cable (RJ-45 to DB-9)
- OEM-PWR-AC-RED: Redundant AC Power Supply Module
- OEM-PWR-DC-RED: Redundant DC Power Supply Module (-48V)



DEPLOYMENT TOPOLOGIES & APPLICATION

The robust memory architecture and dynamic queuing system make this switch suitable for a wide range of demanding networking environments. In an enterprise campus, it can serve as a high-performance access or aggregation switch, delivering consistent performance for VoIP, video conferencing, and

large file transfers. Service providers and ISPs can leverage the switch in metro Ethernet deployments, supporting differentiated services via robust QoS. The hardware's non-blocking design with deep buffers ensures optimal throughput even under 100% line-rate traffic on all ports, making it ideal for bandwidth-intensive datacenter top-of-rack (ToR) deployments. Additionally, the integration of advanced Layer 3 features and robust security controls allows the platform to function effectively in secure network segments and extranet environments. For maximum resilience, a dual-redundant power supply configuration is available, and the stacking capability (where supported) allows for streamlined management and high-availability inter-switch trunking.