Multi-Vendor QinQ Stacking and VLAN ID Translation Compatibility Framework - Official Technical Overview & Hardware Datasheet

MULTI-VENDOR QINQ STACKING AND VLAN ID TRANSLATION COMPATIBILITY FRAMEWORK

OFFICIAL TECHNICAL OVERVIEW & HARDWARE DATASHEET

EXECUTIVE SUMMARY

The relentless expansion of metropolitan area networks (MANs) and data center interconnect (DCI) services demands a sophisticated, carrier-grade approach to VLAN segmentation and service demarcation. The Multi-Vendor QinQ Stacking and VLAN ID Translation Compatibility Framework represents a paradigm shift in network scalability, enabling service providers and large enterprise operators to overcome the inherent 4K VLAN limit of traditional 802.1Q networks. This framework, embodied within our next-generation switching and routing silicon, facilitates the transparent stacking of multiple 802.1Q tags (QinQ) while providing an intelligent, hardware-accelerated translation engine that ensures seamless interoperation with legacy equipment from leading third-party vendors. This document serves as the definitive technical overview and hardware datasheet, detailing the architectural innovations and performance specifications that make this the premier solution for modern, multi-tenant network infrastructures.



HARDWARE ARCHITECTURE & SILICON

At the heart of this compatibility framework lies a purpose-built, programmable forwarding ASIC designed to handle the computational overhead of double-tag manipulation and translation at line rate. The architecture is partitioned into three primary functional planes: the Data Plane, the Control Plane, and the Management Plane.

DATA PLANE: The core of the system utilizes a high-throughput, non-blocking shared-memory switch fabric. The ASIC incorporates dedicated Ternary Content-Addressable Memory (TCAM) engines for accelerated table lookups. These engines are subdivided into specific logical segments for Source VLAN (S-VLAN) and Customer VLAN (C-VLAN) processing. The datapath supports

simultaneous processing of up to 256,000 unique translation entries, facilitating dynamic 1:1 and N:1 VLAN ID mapping strategies. A critical feature is the 'Tag Preservation and Rewrite' engine, which is capable of stripping, stacking, or translating up to two VLAN tags in a single pass through the pipeline, ensuring no performance degradation irrespective of the complexity of the QinQ policy applied.

CONTROL PLANE: Powered by a multi-core x86 processor complex with high-speed memory bus, the control plane is responsible for protocol learning, table population, and network adjacency discovery. It runs a hardened, modular operating system designed for sub-second convergence. The control plane processes critical dynamic protocols such as GARP VLAN Registration Protocol (GVRP) and Multiple Registration Protocol (MRP) to streamline VLAN provisioning. Furthermore, it maintains the 'Interoperability Database', which stores pre-defined and user-customizable translation profiles for over 50 different OEM vendor platforms, simplifying integration into brownfield deployments.

MANAGEMENT PLANE: The framework is accessible via a comprehensive set of interfaces, including industry-standard CLI, SNMPv3, and a RESTful API. The management plane includes a unique 'Configuration Translator' utility that allows network administrators to import vendor-specific configurations (e.g.,

Cisco, Juniper, Huawei) and automatically map them to the native policy language of this platform, dramatically reducing migration complexity and human error.

KEY FEATURES & ROUTING LOGIC

This framework’ s superiority is defined by its unique combination of hardware capabilities and intelligent software logic, ensuring operational simplicity without sacrificing performance.

- Feature 1: Dynamic Dual-Tag Translation (D2T): Unlike simple statically configured QinQ implementations, the D2T engine allows for the simultaneous translation of both the S-VLAN and C-VLAN tags. This is crucial for interconnecting disparate data centers where VLAN IDs conflict. The system can be programmed to translate S-VLAN X to Y while simultaneously translating C-VLAN A to B, ensuring end-to-end layer-2 adjacency without manual renumbering on customer edge (CE) devices.

- Feature 2: Vendor-Neutral Interoperability Profile (VNIP): The VNIP database contains operational parameters and frame-formatting requirements for a vast array of competitor equipment. When a link is established, the control plane can autonomously negotiate or be manually configured to apply a specific VNIP,

ensuring that frame sizes (accounting for double-tags up to 1522 bytes or Jumbo frames) and encapsulation formats are compliant with the remote peer, thus eliminating interoperability black boxes.

- Feature 3: Hardware-Accelerated ACL and QoS on Encapsulated Frames: Security and traffic management policies are often challenging in QinQ environments due to the inner customer header being hidden. This platform's ASIC can perform deep packet inspection up to the inner VLAN header and IP header. This allows for granular QoS (e.g., mapping outer PCP to inner PCP) and security ACLs based on inner customer MAC/IP addresses, ensuring per-customer isolation and service-level agreement (SLA) enforcement without consuming valuable CPU resources.

- Feature 4: Hitless VLAN Translation Failover: To ensure carrier-grade availability, the translation table is stored in redundant TCAM partitions. In the event of a table update error or TCAM parity failure, the system instantly falls back to the secondary partition without any packet loss, ensuring that translation services remain uninterrupted.

COMPLIANCE & STANDARDS

Adherence to industry standards is paramount for any compatibility framework.

This platform is rigorously tested and compliant with the following specifications:

- IEEE 802.1ad (Provider Bridges / QinQ) – Full compliance including the handling of Ethertype 0x88A8 and 0x8100.
- IEEE 802.1Q (VLAN Bridging) – Full support for standard and extended VLAN ranges (1-4094).
- IEEE 802.3 (Ethernet) – Support for various physical interfaces including 10/100/1000BASE-T, 10GE, 25GE, 40GE, and 100GE.
- MEF 6.1 / MEF 10.3 – Compliant with Carrier Ethernet service definitions, specifically regarding class-of-service (CoS) and performance parameters for E-LAN, E-LINE, and E-TREE services utilizing QinQ as the service multiplexing layer.
- ITU-T Y.1731 – Support for performance monitoring and fault management in the context of VLAN-tagged networks.
- RoHS and WEEE – Compliance with environmental directives for hazardous substance reduction and electronic waste management.

TECHNICAL SPECIFICATIONS

The technical specifications below detail the hardware and environmental parameters that define the performance envelope of the switching/ routing

platform hosting the QinQ stacking and VLAN translation framework.

- Layer 2 Forwarding: Non-blocking wire-speed forwarding for all frame sizes.

- MAC Address Table: Support for up to 256,000 MAC addresses.

- VLAN Translation Entries: Up to 128,000 simultaneous translation rules.

- Jumbo Frame Support: Up to 12,000 bytes (configurable).

- CPU Complex: 16-core x86 processor, 32GB DDR4 RAM, 128GB SSD (mirrored).

- Management Ports: 1 x RJ45 Serial Console, 1 x 10/100/1000BASE-T Management Ethernet, 1 x USB 2.0 for file transfers.

Parameter	**Specification**
Form Factor	Modular Chassis (4-slot or 8-slot)
Switching Capacity	Up to 3.2 Tbps (Non-Blocking)
Forwarding Rate	Up to 2.4 Bpps (Billion packets per second)
Latency (64-byte)	Sub-3.5 micro-seconds (Store-and-Forward)
Power Supply	Dual Hot-Swappable Redundant AC/DC (100-240V AC / 48V DC)
Power Consumption	Max 1200W (Fully Loaded Chassis)
Operating Temperature	0°C to 45°C (32°F to 113°F)

Dimensions (WxHxD)	441mm x 178mm x 660mm (for 8-slot, 4RU)
Weight	28 kg (Fully populated chassis)
Mean Time Between Failures (MTBF)	> 300,000 hours at 25°C

ORDERING SKU INFORMATION

The framework is available across multiple hardware chassis form factors to suit diverse deployment scenarios, from enterprise edge to high-density service provider aggregation.

- Base Chassis (4-slot): Model MF-4804. Includes redundant AC power supplies, redundant fan trays, and backplane. (Does not include line cards).
- Base Chassis (8-slot): Model MF-4808. Includes a 3+1 redundant power architecture and advanced cooling for high-density deployments.
- Management Controller Module: Model MF-SUP. Includes the base operating system license and enables the full QinQ Translation Framework. Mandatory for all chassis.
- 10G Line Card: Model MF-48X. Features 48 x 10GE SFP+ interfaces. Ideal for edge aggregation and metrology.
- 100G Aggregation Card: Model MF-12Q. Features 12 x 100GE QSFP28

interfaces for high-capacity uplinks and DCI.

- Software License – Multi-Vendor Translation: Model LIC-MVT. Required to activate the advanced interoperability profiles and dynamic translation engine. Licenses are chassis-based and perpetual.

