Ultra-Low Latency Packet Buffering Engine Factsheet: Cisco Nexus 9300-FX3 Switch Sub-Microsecond Forwarding Latency Test Report

DESIGN PHILOSOPHY

The Cisco Nexus 9300-FX3 Series represents a purpose-built evolution of the Cloud Scale ASIC architecture, engineered specifically to address the deterministic timing requirements of modern financial trading floors, AI/ML training clusters, and real-time analytics pipelines. Unlike general-purpose switching silicon that prioritizes feature depth over forwarding determinism, the FX3 platform adopts a latency-first design philosophy. The forwarding engine is architected to minimize serialization delay and lookup overhead, enabling cut-through forwarding decisions that bypass the store-and-forward buffering penalties inherent in legacy designs. This document serves as the authoritative test report and architectural overview for the sub-microsecond forwarding capabilities of the Nexus 9300-FX3, validated under controlled laboratory conditions with 64-byte packet streams at line rate.



PACKET BUFFER RETENTION DYNAMICS

The Nexus 9300-FX3 employs a 40 MB shared system buffer architecture that is dynamically partitioned across ingress and egress queues to absorb microbursts without introducing head-of-line blocking latency. Under uncongested conditions, the switch operates in cut-through mode, forwarding packets after destination MAC lookup without awaiting full packet reception. This mechanism achieves the stated sub-microsecond latency (approximately 950 ns for 64-byte frames) by eliminating the store-and-forward delay that would otherwise add approximately 0.5 microseconds per hop for small packets. The buffer management subsystem incorporates Cisco’ s Approximate Fair Dropping (AFD) with Elephant Trap (ETRAP) to distinguish latency-sensitive mice flows from bandwidth-intensive elephant flows, ensuring that short transactional bursts receive prioritized queue treatment even during periods of

incipient congestion.

ENTERPRISE SOURCING ADVANTAGES

The FX3 platform delivers measurable operational advantages for latency-sensitive procurement categories. For high-frequency trading (HFT) environments, the deterministic forwarding pipeline reduces order execution jitter, with internal Cisco testing indicating a 22% reduction in order execution times relative to Broadcom-based alternatives when processing multicast market data feeds. The platform supports Precision Time Protocol (PTP) Telecom Profile G.8275.1 with SyncE and boundary clock functionality, enabling nanosecond-level synchronization accuracy required for regulatory timestamping and cross-venue arbitration. Hardware-based MACsec (IEEE 802.1ae) and Cloudsec encryption operate at line rate without introducing forwarding latency penalties, preserving security posture without compromising the sub-microsecond forwarding budget.

CERTIFICATIONS MATRIX

The Cisco Nexus 9300-FX3 Series complies with the following standards and certifications:

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

AS/NZS 60950-1

- EMC Emissions: 47CFR Part 15 Class A, AS/NZS CISPR22 Class A, CISPR22 Class A, EN55022 Class A, ICES003 Class A, VCCI Class A

- EMC Immunity: EN55024, CISPR24, EN300386, KN 61000-4 series

- RoHS: RoHS-6 compliant (exemptions for BGA lead balls and lead-prefit connectors)

- Telecommunications: PTP Telecom Profile G.8275.1, G.8273.2 Class B

EXACT SPECS

The following table summarizes the verified hardware and performance parameters of the Cisco Nexus 93180YC-FX3 model under test.

Parameter	**Specification**
Form Factor	1RU fixed configuration
Switching Capacity	3.6 Tbps
Forwarding Rate	1.2 billion packets per second (bpps)
Latency (64-byte, cut-through)	Approximately 950 ns (sub-microsecond)
System Buffer	40 MB shared
Downlink Ports	48 x 1/10/25 Gbps SFP28
Uplink Ports	6 x 40/100 Gbps QSFP28

Power Supplies	Dual hot-swappable redundant (650W AC / 930W DC / 1200W HVAC/HVDC)
Fans	4 x hot-swappable fan trays (N+1 redundancy)
MAC Address Entries	512,000
IPv4 LPM Routes	1,792,000
IPv6 LPM Routes	896,000
Multicast Routes	128,000
VRF Instances	1,000 (up to 16,000)
ECMP Paths	64-way
MTBF	288,760 hours
Operating Temperature	0°C to 40°C (32°F to 104°F)
Airflow Options	Port-side intake or port-side exhaust
PTP Support	IEEE 1588v2, G.8275.1 with SyncE, G.8273.2 Class B
Security	IEEE 802.1ae MACsec, Cloudsec (VTEP-to-VTEP encryption)

NETWORK ROI MATRIX

The economic case for the Nexus 9300-FX3 in latency-sensitive deployments

rests on three quantifiable vectors. First, reduced execution latency directly correlates with improved fill rates and reduced market impact for trading applications. Second, the platform’ s 3.6 Tbps switching capacity and 1.2 billion packets-per-second forwarding rate eliminate the need for oversubscribed aggregation tiers, reducing capital expenditure on intermediate switching layers. Third, the dual-mode operating system support (Cisco ACI and NX-OS) future-proofs the investment against architectural transitions, as organizations can migrate between policy-driven intent-based fabrics and programmable NX-OS environments without hardware replacement. The 288,760-hour MTBF rating provides a statistically robust foundation for five-year total cost of ownership calculations, with hot-swappable redundant power supplies and fans minimizing planned downtime windows.

