

Transition Guide from IPv4 to IPv6 Infrastructure - Carrier-Grade Infrastructure

Solution Brief: Deploying Transition Guide from IPv4 to IPv6 Infrastructure

CARRIER-GRADE INFRASTRUCTURE SOLUTION BRIEF: DEPLOYING
TRANSITION GUIDE FROM IPV4 TO IPV6 INFRASTRUCTURE

EXECUTIVE SUMMARY

The exhaustion of the IPv4 address space and the exponential growth of connected devices have necessitated a fundamental shift towards IPv6. This document serves as the definitive technical reference for network architects and engineering leaders planning the migration from legacy IPv4 infrastructures to a modern, dual-stack, and ultimately IPv6-dominant environment. Our solution provides a comprehensive, hardware-accelerated transition framework that ensures service continuity, investment protection, and a seamless user experience. The platform detailed herein is engineered to support the three primary transition mechanisms: Dual-Stack, Tunneling (6to4, ISATAP, Teredo), and Translation (NAT64/DNS64), all while delivering carrier-grade performance, reliability, and security. This brief outlines the hardware specifications, architectural design, and strategic advantages of deploying our next-generation routing and translation platform.



ARCHITECTURE & CHASSIS DESIGN

The foundation of the IPv6 transition solution is a modular, high-density chassis system engineered for maximum flexibility and throughput. The platform is designed to accommodate a mix of interface modules, including high-speed Ethernet ports (1GbE, 10GbE, 25GbE, 40GbE, and 100GbE) and legacy TDM interfaces for gradual migration. The chassis architecture is built around a high-speed, non-blocking backplane with a switching fabric capacity that scales to support multiple Terabits per second of traffic. This design ensures that the hardware can handle the increased header overhead of IPv6 and the processing demands of encapsulation and translation technologies without compromising line-rate performance. The system features field-replaceable power supplies and fan trays, all accessible from the front or rear for simplified maintenance in any datacenter environment.

HIGH-AVAILABILITY REDUNDANCY AND HARDWARE FEATURES

To meet the stringent five-nines (99.999%) availability requirements of modern telecommunications and enterprise networks, the platform incorporates comprehensive hardware redundancy. Key components are designed with 1+1 or N+1 redundancy, including:

- Redundant, hot-swappable AC or DC power supplies.
- N+1 redundant, variable-speed fan modules for optimal thermal management and energy efficiency.
- Dual hot-swappable Route Processor Modules (RPMs) with hitless failover capabilities.
- All forwarding engines are equipped with hardware-based protection switching to ensure sub-50ms convergence in the event of a link or module failure.

The hardware is purpose-built to accelerate the computationally intensive processes required for stateful NAT64 and stateless translation, offloading these tasks from general-purpose CPUs to custom Application-Specific Integrated Circuits (ASICs) or Network Processors (NPs). This provides deterministic low-latency performance and frees up the control plane to focus on routing protocol calculations and network management.

PROTOCOL INTEROPERABILITY AND TRANSITION MECHANISM SUPPORT

Seamless interoperability is the cornerstone of any successful IPv6 transition

strategy. The hardware platform is fully compatible with all major transition technologies, allowing network operators to choose the path that best fits their operational profile and timeline.

- **Dual-Stack:** The primary and recommended operational mode. The platform simultaneously runs IPv4 and IPv6 on all interfaces, providing native support for both protocols and facilitating a gradual phase-out of IPv4-dependent services. This mode requires no encapsulation or translation overhead, delivering the highest possible performance.

- **Tunneling (Automatic & Configured):** For isolated IPv6 networks or when traversing IPv4-only infrastructure, the hardware supports a comprehensive suite of tunneling protocols. This includes 6to4 (RFC 3056), ISATAP (RFC 5214), and Teredo (RFC 4380). The hardware-accelerated encapsulation engines can handle the full line-rate throughput of tunneled traffic with minimal CPU intervention.

- **Translation (NAT64/DNS64):** For the final phase of migration, where IPv6-only clients must communicate with IPv4-only servers, the platform provides a high-performance, carrier-grade NAT64/DNS64 solution. This enables stateful network address translation and protocol translation at scale, supporting millions of concurrent sessions. DNS64 functionality is integrated via a dedicated service module or can be offloaded to a virtualized service function.

Parameter	Specification
Switching Capacity	12.8 Tbps
Forwarding Rate	3.2 Bpps
Maximum Concurrent NAT64 Sessions	40 Million+
NAT64 Session Setup Rate	500,000 CPS
MTBF	300,000+ Hours
Power Supply	1+1 Redundant 1600W AC/DC

PERFORMANCE PARAMETERS

Throughput and Performance: The platform is rated for a switching capacity of up to 12.8 Tbps and a forwarding rate of up to 3.2 Bpps (billion packets per second). NAT64 performance can handle over 40 million concurrent sessions with an average session establishment rate of over 500,000 CPS.

Quality of Service (QoS): The hardware supports comprehensive, multi-level hierarchical QoS, including strict priority queuing and weighted fair queuing. This ensures that business-critical and real-time applications (such as VoIP and video conferencing) receive the necessary bandwidth and low-latency treatment, regardless of the underlying transition mechanism in use.

Security: The platform integrates a hardware-based stateful firewall, access control lists (ACLs), and protection against network-based denial-of-service (DoS) attacks. These security features operate at line rate and are essential for protecting the network during the potentially more vulnerable transition period. The platform also supports the hardware-accelerated IPsec, which can be used to secure the management plane and remote access.

TARGET NETWORK TOPOLOGIES AND DEPLOYMENT STRATEGIES

This carrier-grade platform is designed to be deployed at various strategic points within the network to maximize its effectiveness. The most common deployment scenarios include:

- **Service Provider Edge (PE) Nodes:** Acting as the primary gateway for customer traffic, enabling the seamless delivery of dual-stack or IPv6-only services to residential and business subscribers.
- **Datacenter Edge/Internet Gateway:** Serving as the boundary between the IPv6-native datacenter and the legacy IPv4 internet, performing NAT64/DNS64 translations without becoming a performance bottleneck.
- **Enterprise Core and Distribution Layers:** Allowing large enterprises to modernize their internal network infrastructure while maintaining connectivity with legacy branch offices and external partners.
- **Mobile Core Gateway:** In 5G and LTE networks, the solution serves as a

critical component of the User Plane Function (UPF) or a standalone gateway to facilitate the transition of mobile data traffic.



LIFECYCLE ASSURANCE AND SUPPORT

The hardware is built with an anticipated Mean Time Between Failures (MTBF) exceeding 300,000 hours, demonstrating its suitability for demanding, 24/7 operational environments. It is backed by a comprehensive lifecycle management strategy, including a standard 5-year hardware warranty and a software maintenance subscription. Our global support infrastructure provides direct access to a dedicated team of Tier 3 engineers with deep expertise in IPv6 transition, ensuring rapid issue resolution. All hardware components are RoHS and WEEE compliant, aligning with our commitment to environmental sustainability. This solution brief provides a high-level overview of the platform's capabilities. For a detailed product datasheet, port matrix, and

ordering information, please refer to the full technical documentation suite or contact your regional account representative.

TECHNICAL SPECIFICATIONS

Chassis

- Form Factor: 4RU Modular Chassis
- Slots: 8 fixed interface slots, 2 dedicated Route Processor slots
- Dimensions (W x D x H): 17.3 x 22.5 x 7.0 inches (440 x 571 x 178 mm)
- Weight (fully loaded): 45 lbs (20.4 kg)

Route Processor

- Processor: 2.5 GHz 16-core x86_64
- Memory: 64 GB DDR4 ECC
- Storage: 2 x 480 GB M.2 SSD (RAID 1)
- Management Ports: 1x 10/100/1000Base-T (out-of-band), 1x USB 3.0, 1x

Console (RJ-45)

Interface Modules (Selectable)

- 8x 1GbE SFP
- 4x 10GbE SFP+
- 4x 25GbE SFP28

- 2x 40GbE QSFP+
- 2x 100GbE QSFP28
- 2x Channelized OC-3/STM-1 to OC-48/STM-16

Environmental and Power

- Operating Temperature: 32°F to 104°F (0°C to 40°C)
- Storage Temperature: -40°F to 158°F (-40°C to 70°C)
- Operating Humidity: 10% to 90% (non-condensing)
- Power Supply: Dual 1600W AC (100-240V, 50-60Hz) or DC (-48V)

hot-swappable, load-sharing

- Maximum Power Consumption: 2500W

Compliance and Certifications

- Safety: UL 60950-1, CAN/CSA C22.2 No. 60950-1, EN 60950-1, IEC 60950-1
- EMC: FCC Part 15 (Class A), EN 55032 (Class A), EN 55024, VCCI (Class A),

ICES-003 (Class A)

- Environmental: RoHS, WEEE, REACH