Carrier-Grade Infrastructure Solution Brief: Deploying Bulk Network Routers

CARRIER-GRADE INFRASTRUCTURE SOLUTION BRIEF: DEPLOYING BULK NETWORK ROUTERS

EXECUTIVE SUMMARY

ApexTel™ Bulk Network Router Series (BNR9000) represents a paradigm shift in high-density, carrier-grade edge and core routing. Designed for telecommunications providers, large-scale data center interconnect (DCI), and national research networks, the BNR9000 series decouples control plane intelligence from the forwarding ASIC, delivering deterministic sub-microsecond latency and JEDEC-qualified hardware reliability. This document provides a comprehensive technical overview, performance specifications, and deployment architecture guidance for network architects and procurement specialists.

SYSTEM ARCHITECTURE & CHASSIS DESIGN

The BNR9000 is architected around a fully non-blocking, Clos-based switching fabric deployed across a 5RU or 12RU modular chassis. The system separates the control plane (running on dual, hot-swappable supervisor modules with 2.8 GHz octa-core processors) from the data plane (forwarding engines based on the ApexTel Titan-III programmable ASIC). Key architectural highlights include:

- **Virtual Output Queuing (VOQ):** Eliminates head-of-line blocking, ensuring line-rate performance under 95%+ load.
- **In-band Network Telemetry (INT):** Real-time per-packet latency and queue-depth monitoring without external probes.
- **Synchronous Ethernet & IEEE 1588v2 PTP:** Carrier-grade timing delivery for mobile backhaul and 5G transport.

HARDWARE FEATURE SET

- **Forwarding Capacity:** 12.8 Tbps (BNR9000-5RU) | 25.6 Tbps (BNR9000-12RU) full-duplex.
- **Port Configurations:** Up to 48 x 400GE (QSFP-DD), 96 x 100GE (QSFP28), or 192 x 25GE (SFP28) per chassis.
- **Redundancy:** N+1 fabric modules, 1+1 supervisor, and 3+3 power supply units (AC or DC -48V).
- **Packet Buffer:** 48 GB of shared buffer with intelligent congestion management (WRED, PFC).
- **Security Co-processor:** Line-rate MACsec (IEEE 802.1AE) on all front-panel ports with 256-bit encryption.

COMPLIANCE & INDUSTRY STANDARDS

The BNR9000 series is validated against the following regulatory and interoperability standards:

- NEBS Level 3 (GR-63-CORE, GR-1089-CORE) for central office deployment.
- European Union: CE, RoHS, REACH.
- Global safety: IEC 62368-1, UL 60950-1.
- MEF 3.0 (Carrier Ethernet 2.0) certified.
- OpenConfig & gNMI support for streaming telemetry.

Parameter	Specification
Form Factor	5RU or 12RU Modular Chassis
Switching Capacity	12.8 Tbps (5RU) / 25.6 Tbps (12RU) full-duplex
Power Supply	3+3 Redundant, 3000W AC or -48V DC modules
Operating Temperature	0 °C to 45 °C (NEBS: -5 °C to 55 °C short-term)
Packet Buffer	48 GB shared buffer
Control Plane	Dual hot-swap Supervisor (2.8 GHz octa-core, 64 GB RAM)
Forwarding ASIC	ApexTel Titan-III programmable
MACsec Support	Yes, IEEE 802.1AE on all front-panel ports
Max 400GE Ports	48 (QSFP-DD)
Max 100GE Ports	96 (QSFP28)

ORDERING INFORMATION & SKU STRUCTURE

Base Chassis SKUs

- BNR9000-5RU-CHAS: 5RU chassis (6 line card slots, 2 fabric slots, 2 supervisor slots).

- BNR9000-12RU-CHAS: 12RU chassis (12 line card slots, 4 fabric slots, 2 supervisor slots).

Line Card Options

- BNR9K-LC-36QDD: 36 x 400GE QSFP-DD ports.

- BNR9K-LC-48QSFP28: 48 x 100GE QSFP28 ports.

- BNR9K-LC-96SFP28: 96 x 25GE SFP28 ports.

Accessories

- BNR9K-FAN-5RU: Fan tray unit, front-to-back airflow.

- BNR9K-PSU-3KW-AC: 3000W AC power supply.

- BNR9K-PSU-3KW-DC: 3000W DC power supply (-48V).

Software Licensing

- BNR9K-SYS-ADV: Advanced routing (BGP, OSPF, ISIS, MPLS, Segment Routing).

- BNR9K-SEC-MACSEC: Line-rate MACsec license per chassis.

- BNR9K-TELE-INT: In-band Network Telemetry license.

TARGET NETWORK TOPOLOGIES

The BNR9000 series is optimized for three primary deployment scenarios:

1. **Service Provider Edge (PE):** Aggregating 10G/25G subscriber traffic onto 100G/400G core uplinks with MPLS-VPN and EVPN-VXLAN.

2. **Data Center Interconnect (DCI):** Low-latency, high-throughput links between metro data centers with integrated DWDM optics and MACsec.

3. **Research & Education Backbone:** Large-scale BGP route tables (up to 4 million IPv4 routes) and high jitter tolerance for scientific data transfers.

LIFECYCLE ASSURANCE (MTBF & WARRANTY)

- **Calculated MTBF:** 1,250,000 hours (Telcordia SR-332, Issue 4, Ground Benign, 40°C).

- **Warranty:** 5-year hardware advance replacement with 10 business day turnaround.
- **Support Add-ons:** 24/7 TAC support (4-hour on-site available in 42 countries).