

## Juniper Networks T-series Core Routing Platforms

Service providers are scaling and converging multiple networks into a single intelligent network, capable of handling high-revenue applications such as multiplay and video over IP.

A multiservice, traffic-engineered core requires a reliable, high-performance, and flexible architecture that can carry a wide breadth of services over a common IP/MPLS infrastructure. This enables service providers to deliver stringent service-level agreements (SLAs) at scale—while minimizing both capital and operational expenditures.

Juniper Networks accelerates the deployment of this ideal next-generation network with the T-series family, a complete portfolio of core routing platforms that includes the T320, T640, T1600, and the TX Matrix for multichassis operations.

### Key features

- Multi-terabit Capacity and Multi-chassis Scalability
- High-availability Hardware
- High-availability Software
- Superior Packet Processing via Programmable ASIC-based Packet-forwarding Engine (PFE)
- Wide Range of Interfaces
- Optical Transport Integration
- Logical Routing Capability



### TX Matrix Platform

The TX Matrix is the central switching and routing element that interconnects up to four T640 chassis into a single routing entity with 32 slots and a sustainable throughput rate of 2.5 Tbps (up to 3 billion pps). The TX Matrix scales logarithmically as more ports are added; additional routers and slots are connected to the centerstage fabric over optical interfaces. With this system, the TX Matrix expands with nonblocking bandwidth.

The scalable configurations of TX Matrix increase equipment lifespan and further reduce capital expenditures (CapEx) costs. Designed with no single point of failure, and utilizing the same system design and robust JUNOS routing software as all M-series, J-series, and T-series platforms, TX Matrix has been designed from the ground up to achieve the highest levels of system availability.

### T1600 Routing Node

Also at 19" wide and a half-rack in height, the multichassis-capable T1600 Routing Node addresses the need for highly scalable, high performance core routing at a fraction of the size of competitive offerings. Delivering up to 1.6 Tbps of capacity (100 Gbps/slot) with the ability to forward up to 1.92 billion pps, the T1600 Routing Node is the fastest, most flexible and most operationally friendly router on the market today.

Juniper provides unique capabilities for upgrading T-series routing platforms to accommodate the changing requirements of service providers. For example, the T640 can grow in-service into a T1600 by only replacing the power module and switch fabric. Following such an upgrade, the T1600 provides more than double the capacity of T640 while utilizing only 40 percent more power.

The packet forwarding and switching complex of a T1600 supports 100 Gbps per slot. Current interface configurations include up to 16 OC-768c/STM-256 ports or 64 10-Gbps ports (10 GE or OC-192/STM-64). The T1600 also supports lower speed interfaces for those wishing to combine high speed core routing with dedicated access aggregation in a single platform.

### **T640 Routing Node**

At 19" wide and a half-rack in height, the T640 Routing Node addresses the need for highly scalable, high-performance core routing at a fraction of the size of competitive offerings. Each of the eight slots in the T640 delivers 40 Gbps with the ability to scale well beyond that capacity, fulfilling the need for the high-bandwidth services of today and tomorrow.

The T640 supports up to 8 OC-768c/STM-256 ports, 32 10-Gbps ports (10 GE or OC-192/STM-64), 128 OC-48c/STM-16 ports, and an industry-leading 320 GE ports. It delivers up to 640 Gbps of capacity with the ability to forward up to 770 million packets per second (Mpps). The T640 also supports lower speed interfaces for organizations looking to combine high-speed core routing with dedicated access aggregation in a single platform.

### **T320 Router**

The T320 is designed for use where rack space is at a premium and a wide range of interface speeds are needed. The T320 consumes one-third of a standard 19" equipment rack and uses less power for efficient small core applications. Yet the T320 router still offers unprecedented density compared to competing high-end platforms, while providing double the power efficiency.

Each T320 router can support up to sixteen 10-Gbps ports (OC-192c/STM-64 or 10-Gbps GE) while allowing lower-speed connectivity down to channelized increments within the same chassis. Power consumption is very low, requiring only 60 A at -48 VDC with 2,880 watts maximum and even lower for typical configurations.

Combined with its 320-Gbps throughput and its 385-Mpps forwarding rate, the T320 delivers non-blocking, any-to-any connectivity and uncompromising performance with numerous features enabled across multiple interfaces. Its density, speed, and size make it ideal for small to medium cores, as well as for aggregating access routers, peering, and metro Ethernet applications.

### **Architecture and Key Components**

The T-series architecture allows all JUNOS features and services to operate across many interface types without compromising performance. All platforms are highly secure with large filter lists (hundreds of thousands of firewall filter terms) and rate limiting to mitigate denial of service (DoS) attacks. Consistent hardwarebased QoS features such as deep packet classification, filtering, and granular queuing are deployable at large scale for many interface speeds.

From its inception, JUNOS software was developed for rigorous service provider needs. For example, JUNOS is completely modular so that in the unlikely event one module experiences a problem, it is isolated to that specific section of code and does not bring down an entire system. On the hardware side, all major components—including Routing Engines, Control Boards, Switch Interface Boards (SIBs), and Power Equipment Modules (PEM)—are redundant. This provides for graceful degradation and continuous throughput while running standby components.

The Juniper Networks multiservice, traffic-engineered core is the premier core routing option in the industry. T-series and JUNOS functionality offer the most resilient, high performance and flexible applications for backbone carriage of content-intensive consumer and business traffic. In the following

diagram, T-series routers form the backbone of a pan-provider network carrying revenue-generating tunneled services such as voice, video, and MPLS virtual private networks (VPNs).

The core network is the heart of any next-generation network or multiplay deployment. With the growth of distributed content in metro networks, the core network must deliver high speed transport at five 9's reliability, while providing rich service delivery features.

Juniper's products provide the leading features demanded by service providers today to handle the massive growth in core bandwidth requirements. These features include MPLS DiffServ-TE, point-to-multipoint label switched path, nonstop routing and in-service software upgrade (ISSU), hierarchical MPLS, and service delivery coupling with Juniper SDX. Using the network-wide policy and control capabilities of SDX, operators can determine when to allow or deny—with flexibly defined parameters—new requests from users or applications to a service tunnel. This degree of control is impossible with MPLS TE or with any network element OS.

### Typical applications

