



T SERIES CORE ROUTERS

Product Overview

Today's connected world depends on telecom infrastructure, and service providers require solutions with unprecedented flexibility and scale. In a networked economy, business performance is impacted by the quality of connectivity. Carriers must translate this dependence into profitability, find new ways to supplement traditional revenue, develop alternative services, and evolve business models to the changing network landscape.

Juniper Networks T Series Core Routers provide a unique solution that is flexible and scalable to tackle these new challenges. The T Series platform with the TX Matrix Plus provides unparalleled investment protection and an incremental in-service upgrade path to deliver system scale from a 640 Gbps single chassis system to up to 22 Tbps multichassis system. With the architecture designed to scale to 64 Tbps and beyond in the future, the T Series is the world's most flexible routing system, enabling customers to build scalable networks that adapt to changing business needs.

Product Description

Core networks must scale in multiple dimensions—on the forwarding, control, and service planes. A true multiservice 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) while minimizing both capital and operational expenditures. Juniper Networks® T Series Core Routers include the features, functionality, scale, flexibility and availability requirements for a multiservice core. The T Series Core Routers support the features, functionality, scale, flexibility and availability requirements for a multiservice core. The T Series Core Routers include the T640 Core Router, T1600 Core Router, and the T4000 Core Router. The T Series multichassis solution includes the Juniper Networks TX Matrix and TX Matrix Plus chassis to interconnect the core routers for increased scale and system capacity. T Series Core Routers deliver the features, functionality, and scale needed by high-end and core networks to meet current and future needs.

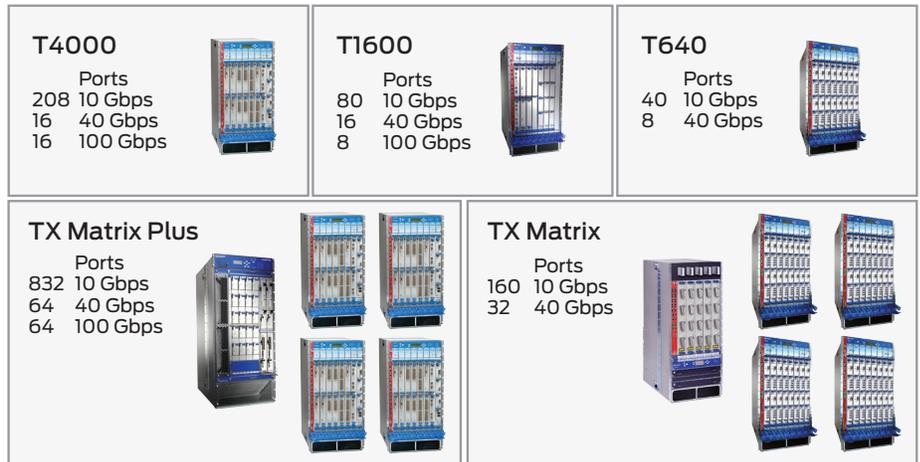


Figure 1: T Series Core Routers illustrating line rate port density per system

Architecture and Key Components

Juniper Networks T Series routers support the features that service providers need to handle today's massive growth in core bandwidth requirements. These features include MPLS Differentiated Services (DiffServ-TE), point-to-multipoint label-switched paths (P2MP LSPs), nonstop routing, unified in-service software upgrades (unified ISSUs), hierarchical MPLS, and service delivery with the Juniper Networks JCS1200¹ Control System and the Juniper Networks Junos[®] SDK.

T Series routers enable service providers to deliver stringent quality of service (QoS) and meet SLAs for multiservice transit and IP services. In addition, Juniper's industry-leading IP/MPLS capabilities guarantee that the service level and performance of critical services are maintained while extending the effective lifespan of legacy network assets. The T Series is ideal for creating network infrastructures that must scale to meet constantly growing Internet traffic for all types of applications. Furthermore, capacity-based power consumption for all T Series routers is the lowest in the industry. Table 1 illustrates the scaling characteristics of the T Series single chassis routers.

Table 1: Juniper Networks T Series Single Chassis Scaling Characteristics

Platform	Throughput	Rack Space	10-Gigabit Ethernet Density	Fully Redundant Hardware	Multichassis Capable
T640	640 Gbps	1/2 rack (19 in)	40	Yes	Yes
T1600	1.6 Tbps	1/2 rack (19 in)	80 (line rate) 160 (oversubscribed)	Yes	Yes
T4000	4 Tbps	1/2 rack (19 in)	208 (line rate) 384 (oversubscribed)	Yes	Yes

T640 Routing Platform

At 19 inches wide and a half rack in height, Juniper Networks T640 Core Routers address 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, 40 10 Gbps ports (10GbE or OC-192/STM-64), 128 OC-48c/STM-16 ports, and an industry-leading 320 1GbE 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, providing added flexibility to combine high-speed core routing with dedicated access aggregation in a single platform.

T1600 Routing Platform

Also at 19 inches wide and a half rack in height, the multichassis capable Juniper Networks T1600 Core Routers address the need for highly scalable, high-performance core routing at a fraction of the size of competitive offerings. The T1600 delivers up to 1.6 Tbps of capacity (100 Gbps/slot) with the ability to forward up to 1.92 billion pps.

Juniper provides unique capabilities for upgrading T Series routers 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 only using fractionally more power.

The packet forwarding and switching complex of a T1600 supports 100 Gbps per slot. Current interface configurations include up to 8 100GbE ports, 16 OC-768c/STM-256 ports, 64 OC-192/STM-64 ports, or 80/160 10GbE (line rate/oversubscribed). The T1600 also supports lower speed interfaces, providing added flexibility to combine high-speed core routing with dedicated access aggregation in a single platform.

T4000 Routing Platform

Juniper Networks T4000 Core Routers are the highest capacity half rack routers in the T Series family, extending Juniper's proven history of innovation and investment protection. The T4000 system more than doubles the per-slot capacity of existing T1600 systems from 100 to 260 Gbps—and with only 25% increase in power. Existing T640 and T1600 systems can be upgraded in-service to a T4000 system, offering ultimate investment protection for a T Series installed base.

A fully loaded T4000 system can support up to 208 ports of 10GbE, or 16 ports of 100GbE interfaces, making it the densest line-rate IP/MPLS routing system. With a pay-as-you-grow model, service providers can migrate in-service and scale a single T4000 from 4 Tbps chassis to a multichassis configuration with the TX Matrix Plus to support up to 16 Tbps². The T4000 is a true multiservice core system that is designed to deliver a reliable, high-performance, and flexible architecture to carry a wide breadth of services over a common IP/MPLS infrastructure.

T Series routers enable service providers to deliver stringent QoS and meet SLAs for multiservice transit and IP services. In addition, Juniper's industry-leading IP/MPLS capabilities guarantee that the service level and performance of critical services are maintained, while extending the effective life span of legacy network assets. The T Series is ideal for creating routed infrastructures that must scale to meet constantly growing Internet traffic for all kinds of applications. Furthermore, capacity-based power consumption for all T Series routers is the lowest in the industry.

¹ For more details, please refer to the JCS1200 datasheet at www.juniper.net/us/en/local/pdf/datasheets/1000218-en.pdf.

² Refer to Juniper technical documentation for details about upgrading from a T4000 single chassis system to a multichassis system with the TX Matrix Plus.

T Series Multichassis System

Juniper Networks TX Matrix Plus is the central switching and routing element that interconnects multiple line-card chassis (LCC) to build a multichassis T Series system. With enhanced Switch Interface Boards (SIBs), the TX Matrix Plus can interconnect 4 T4000s or 8 T1600s or a hybrid configuration of T4000 and T1600 LCC (see Figure 2). Table 2 lists the different combinations of TX Matrix Plus systems.

TX Matrix Plus systems deployed with the SIB-TXP-F13/SIB-TXP-F2s can be upgraded in-service to the enhanced SIBs (SIB-TXP-3D-F13 and SIB-TXP-3D-F2S) to build the higher capacity multichassis systems³. This upgrade enables customers to more than double the system scale depending on the mix of T1600 and T4000 LCCs in the multichassis. See Figure 2 for all of the different multichassis TX Matrix Plus configurations. The result is increased system capacity and scale with carrier-class reliability that delivers non-blocking bandwidth and port density expansion options to address the growing bandwidth and service needs.

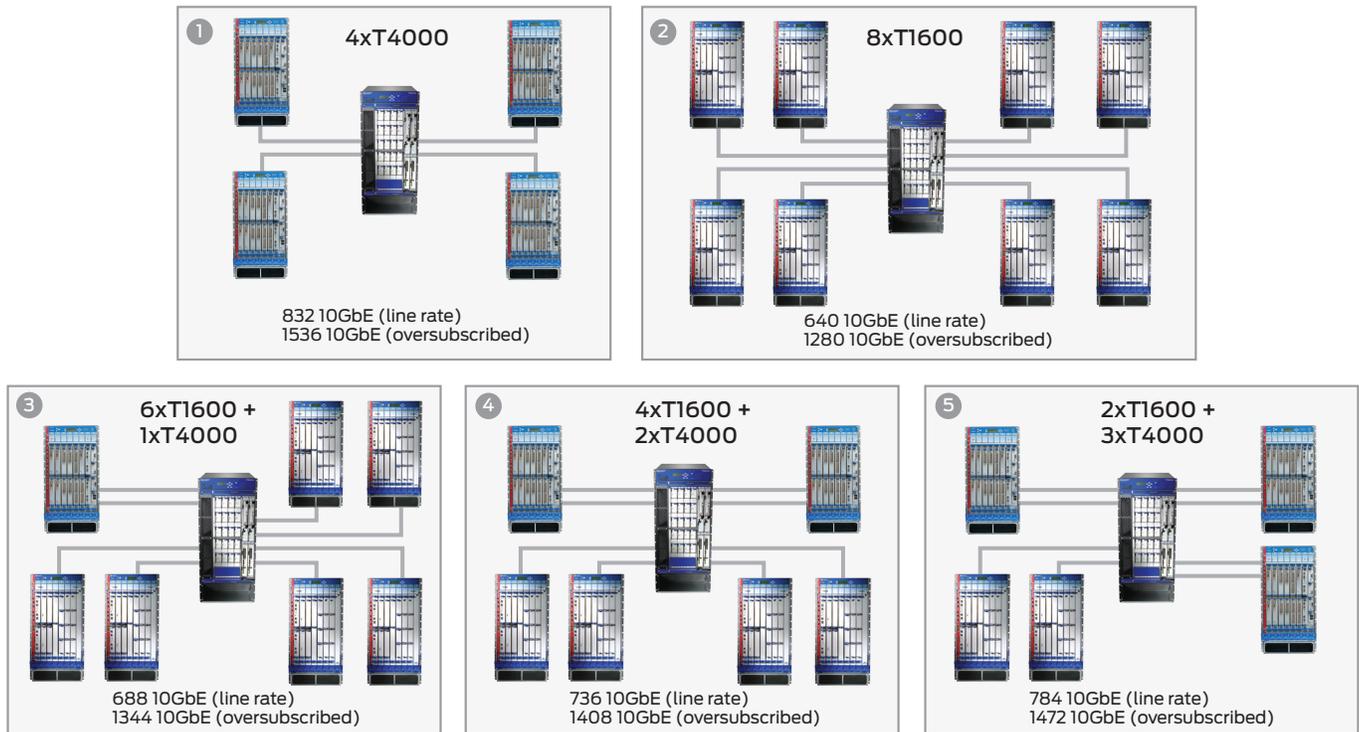


Figure 2: Multichassis system configuration with TX Matrix Plus SFC and T4000/T1600 LCC

Table 2: T Series Multichassis Configurations with the Enhanced Switch Fabric Cards

Platform	System Throughput	Rack Space	10GbE Density	Fully Redundant Hardware
1 TX Matrix Plus with 4 x T4000	16 Tbps	3 racks (1x23 in for TX Matrix Plus, 2x19 in for T4000)	832 (line rate) 1,536 (oversubscribed)	Yes
2 TX Matrix Plus with 8 x T1600	12.8 Tbps	5 racks (1x23 in for TX Matrix Plus, 4x19 in for T1600)	640 (line rate) 1,280 (oversubscribed)	Yes
3 TX Matrix Plus with 6 x T1600 and 1 x T4000	13.6 Tbps	4.5 racks (1x23 in for TX Matrix Plus, 3x19 in for T1600) and half rack for 1 T4000	688 (line rate) 1,344 (oversubscribed)	Yes
4 TX Matrix Plus with 4 x T1600 and 2 x T4000	14.4 Tbps	4 racks (1x23 in for TX Matrix Plus, 3x19 in for T1600 and 2x19 in for T4000)	736 (line rate) 1,408 (oversubscribed)	Yes
5 TX Matrix Plus with 2 x T1600 and 3 x T4000	15.2 Tbps	3.5 racks (1x23 in for TX Matrix Plus, 2.5x19 in for T1600 and T4000)	784 (line rate) 1,472 (oversubscribed)	Yes

³ Refer to Juniper Technical documentation for upgrade procedure and details.

The TX Matrix Plus with the enhanced SIBs now support standards-based CXP pluggable optics modules for the LCC to SFC fabric interconnect. The system also supports an option of Active Optical Cable (AOC) that seals optics and cable into one package for ease of installation and maintenance.

Juniper Networks actively supports the TX Matrix multichassis system introduced in 2004 and the TX Matrix Plus multichassis system introduced in 2009, see Table 3 for the configurations supported.

Table 3: TX Matrix for T640 Multichassis and TX Matrix Plus System Capacity with up to 4 x T1600

Platform	System Throughput	Rack Space	10GbE Density	Fully Redundant Hardware
TX Matrix Plus with 4 x T1600	6.4 Tbps	3 racks (1 x 23 in for TX Matrix Plus, 2 x 19 in for T1600)	320 (line rate) 640 (oversubscribed)	Yes
TX Matrix with 4 x T640	2.5 Tbps	3 racks	160	Yes

The scalable configurations with T Series multichassis offerings increase equipment lifespan and further reduce CapEx costs. Designed with no single point of failure, and utilizing the same system design and robust Juniper Networks Junos operating system as other Juniper routing platforms, these central switching stage platforms are designed from the ground up to achieve the highest levels of system availability.

Features and Benefits

The core network is at 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 9s reliability, while providing rich service delivery features. The T Series family with TX Matrix Plus offers the premier core routing option in the industry—ultra high capacity core with nonstop operations. Junos OS functionality offers the highest resiliency, high performance, and flexible applications for backbone networks carrying content intensive consumer and business traffic.

The T Series architecture allows all Junos OS 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 hardware-based QoS features such as deep packet classification, filtering, and granular queuing are deployable at large scale for many interface speeds.

Junos OS is designed to meet stringent service provider requirements for operational simplicity and efficiency. Junos OS modular architecture supports maximum network uptime with features such as process restart, graceful Routing Engine switchover (GRES), and in-service software upgrades. On the hardware front, all major components—including Routing Engines, Control Boards, Switch Interface Boards (SIBs), and Power Entry Modules (PEMs) are redundant.

Backed by the industry's widest breadth of software services, T Series Core Routers are designed on a foundation of IP/MPLS optimized hardware that offers unique packet handling functionality unmatched for its flexibility and scale. The result is robust QoS for rich and scalable voice transport, video distribution, multicast replication, traffic engineering, ATM-to-MPLS migration, and IP transit and peering services.

Juniper's core solutions deliver unparalleled investment protection with PICs that are portable between Juniper Networks M Series Multiservice Edge Routers. These include the M40e, M120, and M320 Multiservice Edge Routers, and the T640, T1600, and T4000 multichassis systems. PICs cover diverse interface types (ranging in speed from DS3 to 100GbE) including SONET/SDH, ATM, GbE, dense wavelength-division multiplexing (DWDM), and advanced security services. From dense GbE and 10GbE configurations (including two 12x10 GbE Type-5 PICs in a single T4000 slot), to high-speed trunk applications at 40 Gbps, and 100 Gbps (two 1x100GbE Type-5 PICs in a single T4000 slot), T Series routers satisfy every core application up to the 16 terabit realm. The OC-768c and 100GbE options are ideally suited for intra-POP (point of presence) locations. The 4-port OC-192 with inverse multiplexing provides 40 Gbps inter-POP links up to a distance of 80 Km.

Leveraging Junos OS, service providers can enjoy operational simplicity and feature superiority, while alleviating the need for complex and costly mapping of software releases to hardware versions. The top service providers worldwide all rely on the power of Junos OS, and its unique agility and ability to scale services across all interfaces helps speed the rollout of new service deployments while simplifying management and operations.

One of the key architectural choices in the T Series family of routers is the nondisruptive hardware upgrade. This is seen in the simple migration from T640 to T1600 (Figure 3), from T640/T1600 to T4000 (Figure 4), and from T1600 to the large, virtualized systems consisting of the TX Matrix Plus.

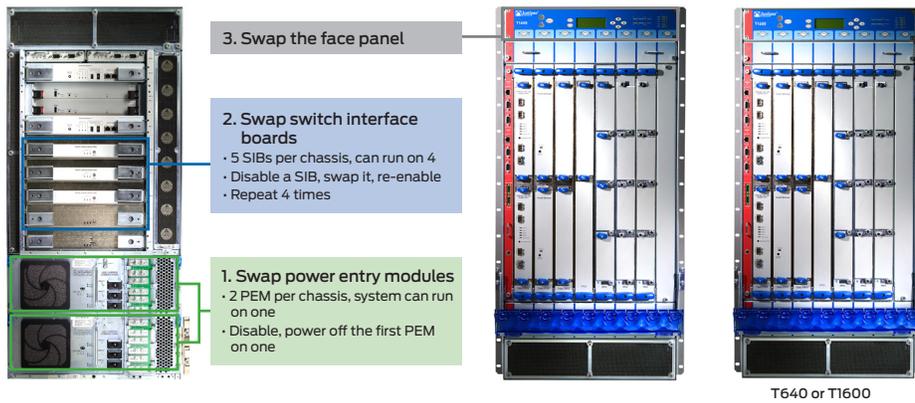


Figure 3: The in-service hardware upgrade of T640 to T1600

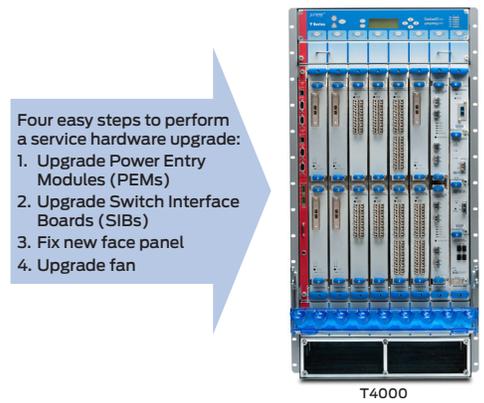


Figure 4: The in-service hardware upgrade of T640/T1600 to a T4000 system.

Table 4: T Series Features and Benefits

Feature	Description	Benefit
Multi-terabit capacity and multichassis scalability	T4000 scales to 4 Tbps and T1600 scales to 1.6 Tbps in a single chassis. The TX Matrix Plus allows incremental expansion up to a 16 Tbps system with 4 T4000s in one system. The future-proof architecture scales comfortably to well beyond this capacity as provider needs grow.	T Series scale and density features allow service providers to increase capacity without adding additional systems to the network. Multichassis architecture offers a single network element for ease of manageability.
High availability hardware	There is no single point of failure in T Series routers. Component-level redundancy is available for Routing Engines, Control Boards, and SIBs, as well as PEMs and the internal control plane.	High availability (HA) and continuous operation is critical in core routing, where loss of a single routing node can remove service for a wide geographical area.
High availability software	Nonstop active routing (the foundation for unified ISSU), as well as Junoscript commit script capabilities, mean continuous operation under maintenance conditions, and topological changes.	HA requirements in core networks include the elimination of planned downtime. Key benefits include higher operational network availability, better network stability, easier operations, and less operational risk.
Superior packet processing via programmable ASIC-based Packet Forwarding Engine (PFE)	Juniper's programmable ASICs deliver a comprehensive, hardware-based system for packet processing. To ensure a non-blocking forwarding path, all channels between the ASICs are oversized dedicated paths. Firewall filter capabilities are scalable to hundreds of thousands of entries, and include multiple matches and conditions.	Highly granular QoS, advanced filter-based forwarding, flow-based monitoring, and distributed denial of service (DDoS) prevention. All competing core routing implementations allow for a mere fraction of the total firewall filter terms supported on Juniper routers without performance degradation.
Wide range of interfaces	Interfaces on the T Series range from DS3 to OC-768 for SONET/SDH and 1GbE to 100GbE for Ethernet. Juniper provides the largest variety of interfaces among core routing platforms. This interface variety (both optical and copper) is unique in the market.	Combining the functions of previously disparate network elements offers greater network simplicity, and retains the service building advantages of overlay networks being replaced by the converged network.
Virtualization at scale	Virtualization capabilities include hardware logical routing with the JCS1200, taking control plane scalability to a new level by decoupling the control and forwarding planes and hosting them on separate platforms. Using logical routers, the applications, configurations, protocols, and routing tables assigned to a logical router belong to that one logical router. Juniper's state-of-the-art logical routing is the only implementation with shared uplink support.	With these capabilities, providers can manage their CapEx by consolidating the network hierarchy onto a single highly available router, or by scaling service offerings in midsize to large POPs with multichassis routers.
Solid, modular, feature-rich software	Each release of Junos OS runs consistently across all Juniper Networks routing platforms and feature sets. Junos OS was conceived and implemented as a modular design. Advanced features include P2MP MPLS, MPLS VPN, IPv6 provider edge, and many more unique features in core routers.	Each Junos OS process runs in protected memory to guard against system crashes and to ensure that applications do not interfere with each other. Junos OS provides the greatest breadth of features and most stable network operating system in the industry.
Optical transport integration	PIC support includes OTN G.709 at 10 Gbps, 10GbE tunable DWDM, OC768, 4-port OC192, 40GbE and 100GbE. Generalized MPLS (GMPLS) is continually enhanced along with Ethernet Operation, Administration, and Maintenance (OAM) functionality.	Integrating optical transport technology into routers provides flexibility in provisioning that leads to the rapid rollout of new services, while retaining Layer 3 intelligence to ensure prompt responses to topology changes.

Product Options

Table 5 shows key component options for T640, T1600, T4000, and TX Matrix platforms (PICs, FPCs, SIBs, Routing Engines, and Control Boards).

Table 5: T Series Key Component Options

Component	Description	Options
PICs	High-density PICs provide a complete range of fiber optic and electrical transmission interfaces to the network.	For a listing of available PICs, see the PIC Guides at www.juniper.net/techpubs/hardware .
FPCs	The FPCs house the PFEs and provide slots for carrying the PICs. The T Series "Enhanced FPCs" provide additional static RAM (SRAM) for increased scaling benefits as well as more granular class-of-service (CoS) capabilities.	<ul style="list-style-type: none"> Type-1 FPCs are rated at 4 Gbps full duplex for the T640/T1600 routers. Type-2 FPCs are rated at 16 Gbps full duplex for the T640/T1600 routers. Type-3 FPCs are rated at 40 Gbps full duplex for the T640/T1600 routers. Type-4 FPCs are rated at 40 Gbps full duplex for the T640/T1600 routers. The T1600 Type-4 FPC is rated at 100 Gbps full duplex and supports two Type-4 PICs. The T4000 Type-5 FPC is rated at 260 Gbps full duplex and supports two Type-5 PICs.
SIBs	The SIBs house the switch fabric silicon and provide any-to-any connectivity between the FPCs.	The T Series was designed to be highly resilient with 4+1 fabric plane redundancy. Each T Series router is designed to gracefully readjust performance in the unlikely event that more than one SIB failure occurs.
Routing Engines	The Routing Engines maintain the routing tables and control the routing protocols, as well as the Junos OS processes that control the platform's interfaces, the chassis components, system management, and user access to the platform.	The Routing Engines supported on the T Series product family are RE-A-2000, RE-DUO-C1800-8G-BB, RE-DUO-1800-16G-BB and RE-DUO-C2600-16G-BB. Specifications are described under Routing Engine Options below.
Control Boards (CBs)	A control board works with each Routing Engine to provide control and monitoring functions such as power, temperature, fans, and system resets.	The different Control Boards for the T Series family are listed below under ordering information



Specifications

	T640	T1600*	T4000	TX Matrix	TX Matrix Plus
Dimensions and Power					
Physical dimensions (W x H x D)	17.43 x 37.45 x 31 in (44.27 x 95.12 x 78.74 cm)	17.43 x 37.45 x 31 in (44.27 x 95.12 x 78.74 cm)	17.43 x 37.45 x 31 in (44.27 x 95.12 x 78.74 cm)	17.43 x 44.5 x 30 in (44.27x 113 x 76.2 cm)	21.4 x 52 x 36.2 in (54.4 x 132 x 91.9 cm)
Maximum weight	565 lb / 256.28 kg	606 lb / 274.88 kg	606 lb/274.88 kg	480 lb / 218 kg	925 lb / 420 Kg
Mounting	Front or center Rack-mount	Front or center Rack-mount	Front or center Rack-mount	Front or center Rack-mount	Front or center Rack-mount
Power system rating (agency label)	7,296 W (152 A @ -48 VDC) Delta: 28.3 A @ 240 VAC maximum (line-to-line) Delta: 34 A @ 200 VAC minimum (line-to-line) Wye: 16.4 A @ 415 VAC maximum (line-to-line) Wye: 20 A @ 346 VAC minimum (line-to-line)	8,352 W (174 A @ -48 VDC) Delta: 28.3 A @ 240 VAC maximum (line-to-line) Delta: 34 A @ 200 VAC minimum (line-to-line) Wye: 16.4 A @ 415 VAC maximum (line-to-line) Wye: 20 A @ 346 VAC minimum (line-to-line)	9,840 W maximum power @ -48 VDC: 9,840 W and maximum power per PEM PWR-T-6-60-DC as maximum capacity 306 A @ -48 VDC	4,560 W (95 A @ -48 VDC)	9,200 W 192 A @ -48 VDC
Standalone SIB	Yes	Yes	Yes	N/A	N/A
Matrix-enabled SIB	Yes	Yes	Yes	Yes	Yes

Environmental

Temperature	32° to 104° F (0 to 40° C)
Maximum altitude	No performance degradation to 10,000 ft (3,048 m)
Relative humidity	5% to 90% non-condensing
Seismic /earthquake	Designed to meet Telcordia Zone 4 requirements

Approvals

Safety	<ul style="list-style-type: none"> • CAN/CSA-C22.2 No. 60950-00/UL 60950 – Third Edition, Safety of Information Technology Equipment • EN 60825-1 Safety of Laser Products – Part 1: Equipment Classification, Requirements and User's Guide • EN 60825-2 Safety of Laser Products – Part 2: Safety of Optical Fibre Communications Systems • EN 60950 Safety of Information Technology Equipment
EMC	<ul style="list-style-type: none"> • AS/NZS 3548 Class A (Australia/New Zealand), BSMI Class A (Taiwan), EN 55022 Class A emissions (Europe), FCC Class A (USA), VCCI Class A (Japan)
Immunity	<ul style="list-style-type: none"> • EN 61000-3-2 Power Line Harmonics, EN 61000-4-2 ESD, EN 61000-4-3 Radiated Immunity, EN 61000-4-4 EFT, EN 61000-4-5 Surge, EN 61000-4-6 Low Frequency Common Immunity, EN 61000-4-11 Voltage Dips and Sags
NEBS	<p>All T Series platforms and components are designed to comply with the following NEBS standards:</p> <ul style="list-style-type: none"> • GR-63-CORE: NEBS, Physical Protection (including environmental parameters) • GR-1089-CORE: EMC and Electrical Safety for Network Telecommunications Equipment • SR-3580 NEBS Criteria Levels (Level 3 Compliance)
ETSI	TS-300386-2 Telecommunication Network Equipment Electromagnetic Compatibility

*For T1600, actual energy consumption measured under ATIS/Juniper Energy Consumption Rating (ECR) methodology is 5,640 W. For more information, see Energy Efficiency for Network Equipment at www.juniper.net, and for the ECR methodology itself, see www.ecrinitiative.org.

Specifications (continued)

Routing Engine Options

RE-A-2000	<ul style="list-style-type: none">• 2 GHz supported on TX Matrix, (redundancy required), T1600, and T640• 2 GHz Intel Celeron processor with integrated 256 KB, level 2 cache• 4 GB DRAM, 1 GB compact flash drive for primary storage• 40 GB IDE hard drive for secondary storage, 128 MB PC card for tertiary storage• 10/100ASE-T auto-sensing RJ-45 Ethernet port for out-of-band management• Two RS-232 (DB9 connector) asynchronous serial ports for console and remote management
RE-DUO-C1800-8G-BB	<ul style="list-style-type: none">• Supported on TX Matrix Plus line-card chassis (LCC), T1600, T4000• Dual core, 1.8 GHz Intel Celeron processor• 8 GB DRAM DIMM, 4 GB compact flash drive, and 4 GB USB• Front pluggable slots for two 64 GB SSD hard drives
RE-DUO-C1800-16G-BB	<ul style="list-style-type: none">• Supported on TX Matrix Plus LCC, T1600, T4000• Dual core, 1.8 GHz Intel Celeron processor• 16 GB DRAM DIMM, 4 GB compact flash drive, and 4 GB USB• Front pluggable slots for two 64 GB SSD hard drives
RE-DUO-C2600-16G-BB	<ul style="list-style-type: none">• Supported on TX Matrix Plus• Dual core, 2.66 GHz Intel Celeron processor• 16 GB DRAM DIMM, front pluggable 4 GB compact flash drive, and 4 GB USB• Front pluggable slots for two 64 GB SSD hard drives

Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the network to maintain required levels of performance, reliability, and availability. For more details, please visit www.juniper.net/us/en/products-services.

Ordering Information

This section lists only the base unit and basic options. PICs are not included in the base system and must be ordered individually. For PIC ordering information, see the PICs datasheets at www.juniper.net. For further details on bundles, options, and spares, contact the nearest Juniper Networks sales representative.

Item	Configuration	T4000	T1600	TX Matrix Plus
Base unit	T Series Base Unit	T4000BASE	T1600BASE-DC	TXPBASE-DC
Routing Engine	Primary	RE-DUO-C1800-8G-BB RE-DUO-C1800-16G-BB	RE-DUO-1800-8G-BB or RE-DUO-1800-16G-BB RE-A-2000-4096-BB	RE-DUO-C2600-16G-BB (SFC) RE-DUO-C1800-8G-BB (LCC)
	Redundant	RE-DUO-C1800-8G-R RE-DUO-C1800-16G-R	RE-1600-2048-R or RE-A-2000-4096-R	RE-DUO-C2600-16G-R (SFC) RE-DUO-C1800-8G-R (LCC)
Control board	Primary	CB-LCC-BB	CB-TX-BB	CB-TXP-BB
	Redundant	CB-LCC-R	CB-TX-R	CB-TXP-R
Junos OS	USA Worldwide	Junos OS Junos-WW	Junos OS Junos-WW	Junos OS Junos-WW
SIB	5 required per LCC (T1600 or T4000)	For single chassis operations, use SIB-I-T4000 For multichassis operations, use SIB-TXP-3D-LCC	For single chassis operations, use SIB-I-T1600 For multichassis operations, use SIB-TXP-T1600 or SIB-TXP-3D-LCC	For 4xT1600 multichassis only, use SIB-TXP-F13 (SFC) or SIB-TXP-F2S (SFC) For T4000/T1600 multichassis system, use SIB-TXP-3D-F13 (SFC) SIB-TXP-3D-F2S (SFC)
FPC	FPC Type3 FPC Type4 FPC Type5	T640-FPC3-ES T1600-FPC4-ES and T640-FPC4-1P-ES T4000-FPC5-3D	T640-FPC1-E2 T640-FPC2-E2 T640-FPC3-E2 T640-FPC3-ES T640-FPC4-ES T1600-FPC4-ES	N/A
Matrix cable arrays (For 4xT1600 multichassis system)	N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A	CBL-TXP-004M Also available in 6 (-006 m), 8, 10, and 12 (-012 m) meter lengths, then CBL-TXP-015M through CBL-TXP-100M representing 15 to 100 meter lengths (in increments of 5 meters)
Matrix cable arrays (For T4000/ T1600 multichassis system with SIB-TXP-3D-F13 and SIB-TXP-3D- LCC)	N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A	CBL-TXP-AOC-004M for AOC cables, and CBL-TXP-CXP-004M for CXP cables Also available in 6 (-006 m), 8, 10, and 12 (-012 m) meter lengths, then CBL-TXP-AOC- 015M or CBL-TXP-CXP-015M through CBL-TXP-AOC-030M or CBL-TXP-CXP-030M representing 15 to 30 meter lengths (in increments of 5 meters) Then CBL-TXP-AOC-040M or CBL-TXP-CXP-040M through CBL-TXP-AOC-100M or CBL-TXP-CXP-100M representing 40 to 100 meter lengths (in increments of 10 meters)

Ordering Information (continued)

Item	Configuration	T640	TX Matrix
Base unit	T Series Base Unit	T640BASE-DC	TXBASE-DC
Routing Engine	Primary	RE- A-2000-4096-BB	RE- A-2000-4096-BB
	Redundant	RE- A-2000-4096-R	RE- A-2000-4096-R
Control board	Primary	CB-TX-BB	CB-TX-BB
	Redundant	CB-TX-R	CB-TX-R
Junos OS	USA Worldwide	Junos OS Junos-WW	Junos OS Junos-WW
SIB	5 required per T640 or TX Matrix	For single chassis operations use: SIB-I-T640 For multi-chassis operations use: SIB-TX-T640	SIB-4-TX
FPC	FPC Type 1	T640-FPC1-E2	N/A
	FPC Type 2	T640-FPC2-E2	N/A
	FPC Type 3	T640-FPC3-E2	N/A
	FPC Type 4	T640-FPC3-ES	N/A
		T640-FPC4-ES	N/A
Matrix cable arrays	N/A	N/A	CBL-TX-SIB-XX available in 4, 5, 6, 10, and 12 meter lengths CBL-TX-SIB-XX available in 15 to 100 meter lengths (in increments of 5 meters)
	N/A	N/A	
	N/A	N/A	
	N/A	N/A	

About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net.

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