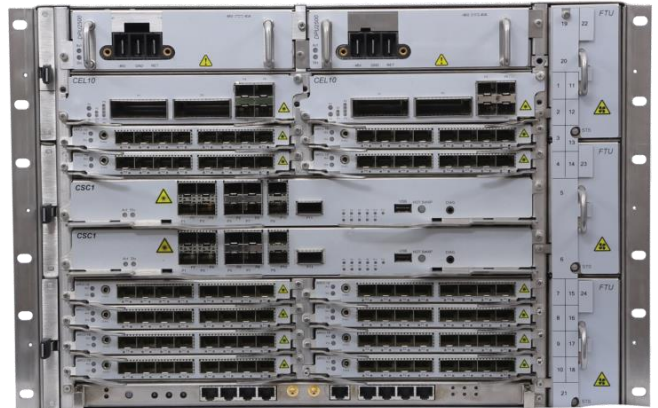


TEJAS[®]
NETWORKS

TJ1400 Modular Service Routers



TJ1400-7SR



TJ1400-18SR

Overview

The TJ1400 series of Aggregation and Core Service Routers are Telecom Grade systems that deliver carrier-class Ethernet, MPLS and IP capabilities to realize converged, multi-service Packet Networks. High availability is critical at Aggregation and Core layers and the modular construction with redundancy and hot-swap ability of various functional modules (Controllers, Fabrics, Line Cards, Power Modules, Fan), full front access, half-depth for back-to-back mounting in 19" racks are key benefits.

With a choice of Gigabit, 10G and 40/100G interfaces large amounts of Mobile Backhaul, Broadband, IPTV and Enterprise VPN services can be supported.

Carrier Ethernet capabilities by way of ERPS (G.8032), PBB/MAC-in-MAC along with a comprehensive OAM suite comprising CFM and PM allow operators to provide native Layer2 services, E-LINE, E-LAN and E-TREE compliant to MEF 2.0 specification.

Multi Protocol Label Switching (MPLS) is a scalable way of delivering services and the TJ1400 SR supports both Signaling and Provisioning to setup the Label Switched Paths (LSPs) and the L2/L3 service constructs, Pseudowires and VPNs.

A wide variety of protocols is supported to interoperate with existing deployments that use IP-Routing protocols like OSPF/IS-IS/BGP. In addition newer techniques that use centralized control / provisioning (broadly called SDN) are also supported to provide fast convergence, DiffServ aware traffic-engineering in a cost-effective and scalable manner.

Synchronization via Sync-E and 1588v2 allow these to be used in Mobile Backhaul and will be useful in upcoming 5G rollouts.

Legacy interfaces like E1/DS1, E3/DS3, SDH/SONET are also supported as clients for transport and service interface.

Key Features and Benefits

High Performance Design

State of art silicon powers the 1400-SR family of products ensuring low power consumption. The Multi-layer hardware datapath capable of Layer2, Layer3 processing along with 4-levels of MPLS label stack allow for line-rate lookup and forwarding at all packet sizes from 64bytes to 9K bytes.

The software has a modular, micro-kernel architecture that allows for in-service upgrade and feature enhancements as the needs of the network evolve.

All the pluggable optical modules are MSA compliant and meet IEEE 802.3 specification and definition.

Carrier Ethernet Switching

Comprehensive Layer2 feature set includes the ability to offer Ethernet services over double VLAN tagged frames (802.1ad), MAC-in-MAC (802.1ah) and over MPLS constructs (LSP / Pseudowires/VBI) along with Ring protection using ERPS for 50ms switching capability.

Multicast snooping and forwarding are supported for efficient Video and multicast applications.

Service OAM is essential in the Service Provider realm and CFM (802.1ag) and PM capabilities (Y.1731) provide tools for SLA enforcement and low downtime.

MPLS Framework

Multi Protocol Label Switching (MPLS) is a versatile networking technology on account of simple lookups and the ability to stack labels that can then provide different functionality. TJ1400 SR supports setting up of MPLS constructs via a Signalling Protocols or via centralized Path Compute Engines embedded in NMS or SDN controllers. The former, signalled MPLS, leverages protocols to distribute network state and service requirements while the latter is aligned to the new paradigms of separation of Control Plane and Data Plane to achieve better scaling.

IP Routing

Scalable implementation of IP routing is provided in the TJ1400-SR platforms. These include Unicast and Multicast Routing protocols like RIP, OSPF, IS-IS and PIM. Both IPv4 and IPv6 route looks are supported in hardware. Border Gateway Protocol (BGP) is used for scalable IP routing as well as signaling service constructs in the context of VPN setup and newer techniques like Segment Routing. IP routing supports both IPv4 and IPv6 routing in a mixed environment.

Traffic Engineering and QoS

Restoration of traffic on a network outage is achieved via Ethernet, MPLS and IP techniques. Similarly the setting up of paths to meet the service constraints can be done via provisioning or signalling, the former by the management APIs and the latter with DiffServ aware RSVP-TE and IP FRR.

Hierarchical Quality of Service (QoS) allows for flexibility in meeting various bandwidth requirements. Policing and Shaping can be done at flow, VLAN or port level. Additionally scheduling disciplines like Strict Priority, Weighted Round Robin (WRR) and congestion avoidance techniques like WRED are available.

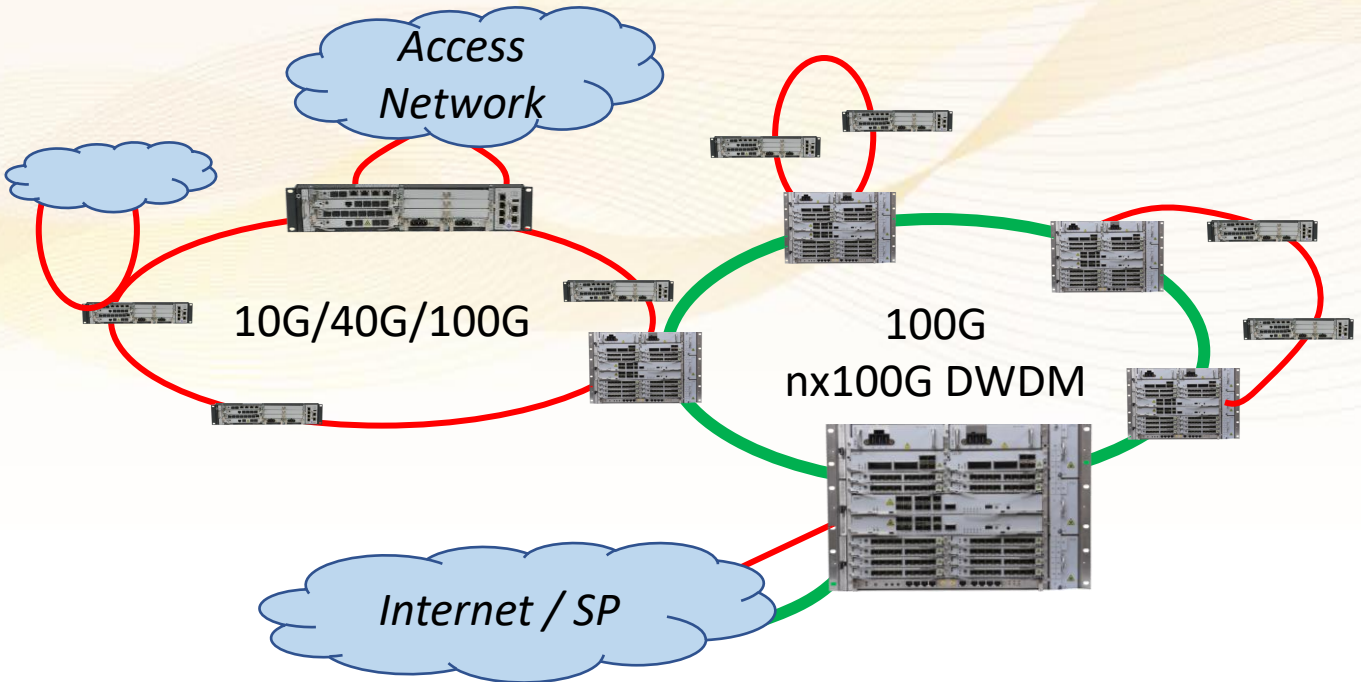
Synchronization

IEEE 1588 and SyncE provide the required timing synchronization over Ethernet interfaces for carrying TDM applications.

Management

Management of the nodes can be done locally using the console port or remotely using Secure access. Access to the switch via CLI commands, SNMP interface and Netconf is available for integration with EMS/NMS and SDN controllers. Commands can be authorized via RADIUS/TACACS+ so that all operations are authorized and logged. The nodes have extensive logging that is available locally and can also be directed to syslog servers.

Sample Deployment



System Switching Components

The TJ1400 series of Service Routers has flexible Interface modules (Line Cards) and Fabric Capacity options that can be used to match deployments. The following table lists the modules in terms of the ports available. Note that Fabric cards can have traffic interfaces for higher density and these run the TejNOS (Tejas Network Operating System) high-availability software.

Module	GigE	1/10G	40/100G	TDM
Line: CEL6	8 x SFP	-	-	-
Line: CEL10	-	4 x SFP+	2 x CFP2	-
Line: CEL12	-	8 x SFP+	-	-
Line: CEL13	-	4 x SFP+	-	-
Line: ST63DS1	63 E1/DS1			
Line: ST24DS3	24 E3/DS3			
Line: CEM1	8xSTM1 / 8xSTM4 / 2xSTM16			
Fabric: CEF4 (64 Gbps)	2 x SFP	2 x XFP	-	-
Fabric: CEF8-1 (200 Gbps)	-	5 x SFP+	-	-
Fabric: CEF8-2 (360 Gbps)	-	2 x SFP+	1 x CFP2	-
Fabric: CSC1 (1 Tbps)	-	10 x SFP+	1 x QSFP28	-
Fabric: CSC2 (4 Tbps)	-	-	8 x 100G	-

Hardware Characteristics

There are currently two Chassis in the TJ1400 family, a 7-slot Chassis and an 18-slot Chassis. The chassis support a dual-star connectivity between the Line cards and the Fabric cards that also have the controller functionality built into them. All line-card and Fabric modules are hot-swappable and removal of a line card does not affect the traffic on the other cards or router performance. The TJ1400-18 slots are half-width and have 200+ Gbps slot capacity suitable for the core, while the TJ1400-7 slots have a capacity of 20Gbps/40Gbps in the same form factor and are suitable for Aggregation.

Parameter	TJ1400-7	TJ1400-18
Number of Fabric Slots	2 (CEF4, CEF8)	2 (CSC1, CSC2)
Number of Line Card Slots	5 (CEF4) / 3 (CEF8)	16
Slot Capacity	20Gbps (CEF4)/40Gbps(CEF8)	240 Gbps
Line Card Modules Supported	CEL6, CEL13, TDM	CEL6, CEL12, CEL10, TDM
PSU Redundancy	1+1, Hot Swappable , DC -36 to -60V	
Field Replaceable Fan Tray(s)	1 (Redundant Fan config)	3 (Redundant Fan config)
Timing and OAM	NMS, Console, USB, BITS, Alarm IN/OUT	
Dimensions (WxHxD)	444 x 88 x 235 mm	444 x 311 x 240 mm
Max DC Power PSU rating	400W	2500 W

Environmental Range

Operating Temperature	TJ1400-18 : 0 degC to +50 degC TJ1400-7 : 0 degC to +65 degC
Storage Temperature	-40 degC to +70 degC
Operating Altitude	Up to 3000 meters
Humidity	5% to 90% non-condensing

Certifications and Compliances

Safety	CE Marking: LVD Directive 2014/35/EU IEC 60950-1 / EN 60950-1
EMI	CE Marking: EMC Directive 2014/30/EU FCC Part-15, Subpart B, Class-A CISPR-22/CISPR32 Class-A, EN55022/EN55032 Class-A
EMC	IEC/EN61000-4-2 for ESD : Electrostatic discharge IEC/EN61000-4-3 for RS : Radiated susceptibility IEC/EN61000-4-4 for EFT : Electrical Fast Transient IEC/EN61000-4-5 for Surge IEC/EN61000-4-6 for CS : Conducted susceptibility IEC/EN61000-4-8 for PFMF : Power frequency magnetic field
Environmental	RoHS Directive 2011/65/EU

Feature Scalability

Parameter	TJ1400-7 (CEF4)	TJ1400-7 (CEF8)	TJ1400-18 (CSC1)	TJ1400-18 (CSC2)
Full Duplex Switching	64 Gbps	360 Gbps	1 Tbps	4 Tbps
Forwarding Rate	96 MPPS	475 MPPS	1448 MPPS	2500 MPPS
Max Packet Buffer	192 MB	3GB	6 GB	8 GB
MAC Addresses	32K	250K	750K	1M
VLANs (.1Q, .1ad)	4K,	4K	4K	4K
IP Routes (IPv4/IPv6)	32K / 16K	64K / 32K	2M / 512K	2M/512K
Multicast Routes	4K	8K	64K	64K
Pseudowires	4K	16K	64K	128K
MPLS Label Stack	Up to 3 Labels		Up to 4 Labels	
VRF	128	4K	16K	32K
VFI	2K	2K	4K	4K
Classification Rules	2K	24K	48K	48K
H-QoS (Levels/Queues)	4 / 32K	4 / 32K	5 / 128K	5 / 128K
Frame Size supported	64 to 9216 bytes			

Overview of TejNOS software

The TJ1400 series of Service Routers run the TejNOS (Tejas Network Operating System) software that provides scalable, feature-rich, high-availability software to ensure high network availability. TejNOS has a modular architecture with memory protection allowing software modules to be upgraded/restarted without rebooting the system and providing In-Service Software Upgrade (ISSU). As part of the high-availability framework Statefull Switch Over (SSO) and Non Stop Forwarding (NSF) are supported for controller failure, and failure of a switch fabric results in no loss of capacity on any line card and only packets in transit in the failed fabric are lost.

TejNOS delivers traditional IP/MPLS capabilities based on distributed in-node control plane to interoperate with legacy deployments. The key differentiation of TejNOS is the addition of recent MPLS Transport Profile support that aligns with the modern network design approach of using a controller to provision the services in the network to provide agility, ease of deployment and upgrade of the network.

Leveraging the hardware support for fast-BFD (Bidirectional Forwarding Detection) along with bidirectional setup of LSPs makes TejNOS an ideal platform to migrate the network to SD-WAN (Software Defined Wide-area networking) and providing Traffic Engineering and the right amount of control plane on all the nodes of the network. A REST API using Netconf and YANG models is supported to create the service constructs (Pseudowires, L2VPN, L3VPN, MVPN) in addition to CLI and an HTTP-base management interface. Currently, the SD-WAN applications are provided as part of the TejNMS software.

As with any Network OS, secure remote management, in-service software upgrades, persistent configuration store, user authentication and command authorization using RADIUS/TACACS+, time synchronization and debug support using SNMP and Syslog are available .

Feature detail of TejNOS software

Layer2 Switching	
Flow Control	Supports flow control as per IEEE 802.3x
Layer2 Discovery	Supports 802.1ad to discover links to neighbouring devices
MAC Learning and Switching	<ul style="list-style-type: none"> Dynamic Learning of MAC addresses with configurable Aging Timers and Learning limits on every port Static MAC addresses that are not subject to aging Whitelisting of MAC addresses
VLAN support	<ul style="list-style-type: none"> Supports 802.1Q and the ability to configure a port to receive packets that are untagged, tagged or both (Hybrid port) 4K VLANs are supported
Provider Bridging	<ul style="list-style-type: none"> Double VLANs tag (Q-in-Q, 802.1ad) allows S-VLAN to be added to distinguish different customer's traffic which could use the same CVLAN (.1Q tag) 4K VLANs are supported Tagging/Untagging/Swapping of VLAN tags is supported Switching on outer tag is supported
Provider Backbone Bridging (PBB)	Support of MAC-in-MAC as per IEEE802.1ah allows for a simpler and scalable Core by reducing the MAC addresses needed
Link Aggregation	<ul style="list-style-type: none"> Multiple Links (up to 32) can be combined into a higher-capacity interface as per IEEE 802.3ad Supports Static LAG as well as Dynamic LAG using LACP
Spanning Tree	Loop-free Layer2 topology can be created using any of: <ul style="list-style-type: none"> Standard Spanning Tree 802.1d Rapid Spanning Tree (RSTP) 802.1w Multiple Spanning Tree (MSTP) 802.1s BPDU Filter, Root Guard, Loop Guard, BPDU Guard
Ring Protection	50-ms Protection switching on a per VLAN basis is supported in accordance the ERPS specification of ITU-T G.8032
Ethernet Services	Ethernet services (E-Line, E-LAN, E-Tree) are supported as per the MEF CE2.0 specifications
Ethernet OAM	Connectivity Fault Management (CFM) as defined in IEEE 802.1ag allows for in-band Operation and Management (OAM) of the Ethernet Services.
Ethernet PM	Performance Monitoring (PM) as defined in ITU-T Y.1731 allows for the monitoring of the Packet Loss, Delay, Packet Delay Variation (Jitter) monitoring of the Ethernet Services. PM data is available for network monitoring and optimization
IGMP Snooping	Supports snooping of IGMP v2/v3 requests to deliver the bandwidth intensive IPv4 multicast traffic only to the requesters
MLD Snooping	Delivers IPv6 multicast packets only to the required receivers who have made IPv6 Multicast requests

Synchronization	
SyncE	Ethernet physical layer timing synchronization as per ITU-T standards G.8261/G.8262/G.8264 is supported to distribute accurate frequency reference for the network
PTP	Accurate timing to Precision Timing Protocol (PTP) grandmaster via IEEE 1588v2 is supported Boundary Clock (Client) and Transparent Clock (transit) modes
NTP	Time synchronization with NTP server as per RFC 5905 is supported for the Application level timing
Clock Stability	The node supports Stratum3 clock and in case of loss of timing reference the clock holdover is provided as per standard.
Layer3 Switching Support	
Routing Interfaces	The following are supported as routed interfaces <ul style="list-style-type: none"> • Port • VLAN • Virtual Sub-interfaces (for VPNs) • Link Aggregation Groups
VRRP	Virtual Router Redundancy Protocol is supported as per RFC 5798 for IPv4 and IPv6
Static Routes	<ul style="list-style-type: none"> • IPv4 and IPv6 Static Routes can be defined and distributed via other Dynamic routing protocols. • Policy Based Routing (PBR) using Filter-based forwarding to direct or indirect next-hop or VRF based on IP Source / Destination, IP protocols and TCP/UDP Port Numbers
RIP	<ul style="list-style-type: none"> • Routing Information Protocol (RIP) as per RFC 2453 is supported along with Authentication as per RFC 4822. • IPv4 and IPv6 addresses are supported
OSPFv2	<ul style="list-style-type: none"> • Open Shortest Path First Version 2(OSPFv2) for IPv4 is supported as per RFC 1583 and RFC 2328 • Stub Areas are supported along with NSSA option RFC 3101 • Opaque LSA as per RFC 2371/RFC 5250 are supported • Graceful Restart of OSPF as per RFC 3623 is supported • MD5 based OSPF authentication as per RFC 2154 • Traffic engineering (OSPF-TE) extensions as per RFC 3630
OSPFv3	<ul style="list-style-type: none"> • Open Shortest Path First Version 3 (OSPFv3) for IPv6 is supported as per RFC 2740 / RFC 5340 • Supports Authentication and encryption of OSPFv3 messages as per RFC 4552 • Supports Graceful restart of OSPFv3
IS-IS	Intermediate System to Intermediate System (IS-IS) Protocol as standardized in ISO/IEC 10589 Standard is supported

BFD	<ul style="list-style-type: none"> • Support of Bidirectional Forwarding Detection (BFD) allows fast detection of network failures and aids convergence and is supported as per RFC 5880 • Single hop BFD (RFC 5881), multi-hop BFD (RFC 5883), and LSP BFD (RFC 5884) are supported • BFD generation is supported in HW with timer as low as 3.3ms, 10ms, 100ms, etc. • BFD mechanism is used for triggering 50ms-protection switching in addition to fast protocol convergence
BGP	<p>Border Gateway Protocol version 4 (BGP-4) as per RFC 4271 is supported. Multiple BGP sessions are supported with multiple peers and any session can be reset if desired. Both Interior and Exterior sessions can be established (iBGP/eBGP/MP-iBGP).</p> <p>BGP has many extensions which are used to carry information between routers to establish other functionality. Notable among these, and supported on TejNOS, are</p> <ul style="list-style-type: none"> • Multi-protocol Extensions as per RFC 4760 (M-BGP) • Route Refresh capability as per RFC 2918 • RFC 3107 for carrying MPLS Label information in BGP-4 for VPN setup including Inter-AS VPN • Capabilities Advertisement as per RFC 3392 • Graceful Restart mechanism for BGP-4 as per RFC 4724 • Outbound Route Filtering of Address prefixes as per RFC 5292 • BGP-PIC (Prefix Independent Convergence) and Next hop tracking (NHT) for fast convergence
Multicast Routing	<p>TejNOS supports the following</p> <ul style="list-style-type: none"> • IGMPv2 as per RFC 2236 • IGMPv3 as per RFC 3376 • MLDv2 as per RFC 4604 • Protocol Independent Multicast – Sparse Mode (PIM-SM) • PIM-SSM, Source-Specific Multicast • Multicast Routing for IPv6 • MSDP (Multicast Source Discover Protocol) as per RFC 3618
ECMP	<p>Equal Cost Multi-path for Load balancing/protection with traffic being distributed across multiple paths. ECMP is enabled in protocols like OSPF and BGP</p>
IP Tunnelling	<p>Generic Routing Encapsulation (GRE) is supported as per RFC 2784 and RFC 2890 to support overlay networks, especially for Mobility. Both IPv4 and IPv6 packets can be payload. mGRE for multicast tunnels is also available.</p>
Segment Routing	<p>TejNOS supports Segment Routing along with Path Compute Engine (PCE) implemented in the Centralized controller. Link State import to PCE done through BGP-LS. Support for Traffic Engineering (SR-TE), Fast Reroute using Topology independent Loop Free Alternate (TI-LFA) is also available and IPv6 support will be added.</p>

Multi Protocol Label Switching (MPLS)	
MPLS Framework	TejNOS supports MPLS Architecture as per RFC 3031 and MPLS encoding as per RFC 3032
LDP	Label Distribution Protocol as per RFC 5036 is supported along with Graceful restart for LDP, RFC 3037. For Multicast traffic mLDP is used.
RSVP-TE	LSP setup with Traffic engineering is supported using RSVP-TE as per RFC 3209 and applicable extensions as per RFC 3210
MPLS Transport Profile	TejNOS supports the Transport Profile of MPLS (RFC 5921) to deliver OAM, Protection switching capability to deliver large MPLS networks with the appropriate level of control plane features
PseudoWire	<ul style="list-style-type: none"> • PseudoWire Emulation Edge to Edge (PWE3) as per RFC 3916 and RFC 3985 is supported (for EoMPLS, ATOM) • Multi-Segment Pseudowire as per RFC 6073 is supported • Support for Pseudowire Redundancy as per RFC 6718 • Pseudowires can be provisioned from the EMS/NMS • Pseudowire signalling via RFC 4447 is also supported • TDM Pseudowires using CESoPSN and SAToP (RFC 4553) are supported
Fast Reroute (FRR)	LDP based Fast reroute (LDP-FRR) as well as Remote-Loop free Alternate (R-LFA) FRR is supported
L2VPN	<ul style="list-style-type: none"> • Signaled L2VPN via RFC 3107 is supported • VFI instances can also be provisioned over the appropriate PW constructs from the EMS/NMS
L3VPN	<ul style="list-style-type: none"> • Signaled L3VPN via RFC 3107 is supported • Inter-AS L3VPN is supported • VRF instances can also be provisioned over the appropriate PW constructs from the EMS/NMS
IPv6 over MPLS	Support for IPv6 connectivity over an IPv4 MPLS network is provided, both at a port level (6PE as per RFC 4798) and at a VPN level (6VPE as per RFC 4659)

Security	
Secure Shell (SSH)	SSHv1 and SSHv2 are supported for secure remote access to the router
Secure Socket Layer (SSL)	The browser based access to the router is secured by encrypting the http traffic using SSL
802.1X	<ul style="list-style-type: none"> • IEEE802.1X: RADIUS authentication, authorization and accounting, MD5 hash, guest VLAN, single/multiple host mode and single/multiple sessions • Supports IGMP-RADIUS based 802.1X • Dynamic VLAN assignment
Port Security	Locks MAC addresses to ports
uRPF	Unicast Reverse Path Filtering as per RFC 2827 is supported as a form of protection from spoofed IP addresses
RADIUS/TACACS+	Per user AAA (Authentication, Authorization and Accounting)
Storm Control	Prevents traffic on a LAN from being disrupted by a broadcast, multicast, or unicast storm on a port
ACLs	Dynamic and Time-based rules for Drop, Rate Limit based on: <ul style="list-style-type: none"> • Physical Port, VLAN, • Source-Destination MAC, IP address, Protocol Port • Differentiated services code point (DSCP) / IP precedence • Protocol Type (IP/TCP/ UDP0, 802.1p priority , Ethernet type • Internet Control Message Protocol (ICMP) packets, TCP flag
DoS Mitigation	CPU bound traffic is shaped to prevent Denial of Service attacks
Quality of Service	
Queuing	8 Hardware Queues per Port Hardware support for Hierarchical Queue Management
Classification	Static and Time-based Queue assignment based on <ul style="list-style-type: none"> • Physical Interface • 802.1p VLAN priority based • IPv4/IPv6 precedence / DSCP based • MPLS EXP bits • Differentiated Services (DiffServ) • Classification and re-marking ACLs
Bandwidth Control	<ul style="list-style-type: none"> • TrTCM Ingress Policer and marking (per port, and per Queue) • Egress Shaper and Rate Control (per port, and per Queue)
Scheduling Disciplines	<ul style="list-style-type: none"> • Strict Priority • Weighted Deficit Round Robin (WDRR) for Bandwidth profiles • Choice at each level of Queue Nesting
Congestion Management	<ul style="list-style-type: none"> • Weighted Random Early Discard (WRED)

Management	
System Monitoring	Monitoring of system Temperature, Input Voltages, Power Modules, Fans, Memory utilization
Logging	Extensive capability and memory to log events and crash dumps to local file-system and to syslog servers
Port Mirroring	Traffic on a port can be mirrored to another port for analysis with a network analyzer or RMON probe.
Remote Monitoring	Embedded RMON agent supports 4 groups 1,2,3,9 (history, statistics, alarms, and events) for enhanced traffic management, monitoring and analysis
sFlow	The switch allows traffic to be sampled in hardware and sent to a server for monitoring (RFC 3176).
Telemetry	Histograms, Thresholds, Flow recording to enable administrators to understand complex networks
SW Upgrades	Dual Images (independent primary and secondary) are supported along with validation of the image and rollback . Options to download image and boot from local external Flash or over the network using various methods including SCP, TFTP.
User Management	Security and control of User accounts
Job Management	Ability to define and execute periodic jobs/scripts/commands
Firmware Upgrade	Firmware is upgradable via Web Browser or local console port
SNMP	SNMP version1, 2c and 3 with support for traps. For enhanced security, SNMP version 3 user-based security model (USM)
Syslog	The events generated by the switch can be selected to be sent to a syslog server for further analysis and persistent storage
CLI	An Industry standard (Cisco-like) Command Line Interface (CLI) is available to configure and operate the switches. Configuration rollback capability is also provided.
NTP	The switch has Network Time Protocol (NTP) Client to sync to network clock information
Optical Port Monitoring	The Optical characteristics of the Pluggable optical modules can be monitored and threshold crossing alarms can be defined
IPv6 Management	The Management interface and utilities are IPv6 compliant. The Node IP address can be IPv6 and the Management traffic can be IPv6 based. Management interface is Dual stack (IPv4 and IPv6)

Standards Support

Ethernet	IEEE 802.3
Physical Layer	IEEE 802.3u, 802.3z, 802.3ab, 802.3ae, 802.3ba
Flow Control	IEEE 802.3x
Framing/QoS	IEEE 802.1Q, 802.1ad, 802.1p, 802.1ac, 802.1v
Discovery	IEEE 802.1b
Bonding/Trunking	IEEE 802.1ad (LLDP)
STP	IEEE 802.1d, 802.1w, 802.1s, 802.1D-2004
Security	IEEE 802.1x
Carrier Ethernet	ITU-T G.8032 v2, IEEE 802.3ah, IEEE 802.1ag, ITU-T Y.1731 MEF CE 2.0 compliant Ethernet services
System Support	RFC 768 UDP RFC 783 TFTP RFC 791 IP RFC 792 ICMP RFC 793 TCP RFC 826 ARP RFC 903 RARP RFC 854 Telnet RFC 906 TFTP Bootstrap RFC 951, 1542 BootP RFC 1027 Proxy ARP, RFC 1519 CIDR RFC 1591 DNS RFC 2131, 2132 DHCP RFC 1256 IPv4 ICMP Router Discovery (IRDP) IPv6 via RFC 2460, RFC 1981, RFC 4443, RFC 4861, RFC 4862 RFC 2068 HTTP server RFC 2030 SNTP, Simple Network Time Protocol RFC 2131 BOOTP/DHCP relay agent and DHCP server RFC 3315 and updates for DHCPv6 RFC 1492 TACACS+ RFC 2138 RADIUS Authentication RFC 2139 RADIUS Accounting RFC 3579 RADIUS EAP support for 802.1x RFC 5176 Dynamic Authorization Extensions to RADIUS
Security	The features of the router enable compliance to ISO 27001
Functional Spec	TEC GR No. TEC/GR/IT/TCP-006/01/AUG-16

Ordering Information

TJ1400-7-SYS	1400 7-slot System Chassis and Commons (Fan Tray, Fan Filter, Dual DC PSU) along with Installation kit (Mounting kit, NMS, Console, Earth cables)
TJ1400-7-DPU	Replacement 400W capable -48V DC power supply for TJ1400-7
TJ1400-7-FTU	Replacement Fan Tray Unit with OAM ports for TJ1400-7
TJ1400-7-FFU	Replacement Fan Filter Unit for TJ1400-7
TJ1400-18-SYS	1400 18-slot System Chassis and Commons (OAM card, Fan Trays, Fan Filter, Dual DC PSU) along with Installation kit (Mounting kit, NMS, Console, Earth cables)
TJ1400-18-OAM	Replacement OAM card with Management, Alarm and Timing ports for TJ1400-18
TJ1400-18-DPU	Replacement 2500W capable -48V DC power supply for TJ1400-18
TJ1400-18-FTU	Replacement Fan Tray Unit for TJ1400-18
TJ1400-18-FFU	Replacement Fan Filter Unit for TJ1400-18
TJ1400-TRIB-CEL6	Tributary Card: 8 SFP ports supporting IEEE compliant Ethernet 1000BASE-SX (850nm), LX/LH (1310nm), and ZX (1550nm) optics
TJ1400-TRIB-CEL10	Tributary Card: 4 SFP+ 10G-BASE and 2CFP2 100G-BASE ports supporting IEEE compliant optics
TJ1400-TRIB-CEL12	Tributary Card: 8 SFP+ 10G-BASE ports supporting IEEE compliant optics
TJ1400-TRIB-CEL13	Tributary Card: 4 SFP+ 10G-BASE ports supporting IEEE compliant optics
TJ1400-TRIB-ST63DS1	Tributary Card: 63 ports supporting E1/DS1 PDH Interfaces
TJ1400-TRIB-ST24DS3	Tributary Card: 24 ports supporting E3/DS3 PDH Interfaces
TJ1400-TRIB-CEM1	Tributary Card: 8 SFP port card with each port configurable as STM1 or STM4 independently OR port 1/Port5 can be configured as STM16 in which case neighboring 3 ports are unusable
TJ1400-CNF-CEF4	Control And Fabric: 64 Gbps Fabric and Controller with 2 GB RAM in 1 slot of TJ1400-7 along with 2 SFP and 2 XFP ports
TJ1400-CNF-CEF8-1	Control And Fabric: 200 Gbps Fabric and Controller with 4 GB RAM in 1 slot of TJ1400-7 along with 5 SFP+ ports
TJ1400-CNF-CEF8-2	Control And Fabric: 320 Gbps Fabric and Controller with 4 GB RAM in 2 slot of TJ1400-7 along with 2 SFP+ ports 10G-BASE and 2 CFP2 ports 100G-BASE
TJ1400-CNF-CSC1	Control And Fabric: 1Tbps Fabric and Controller with 8 GB RAM for TJ1400-18 along with 10 SFP+ ports 10G-BASE and 1 QSFP-28 port 100G-BASE
TJ1400-CNF-CSC2	Control And Fabric: 4 Tbps Fabric and Controller with 8 GB RAM for TJ1400-18

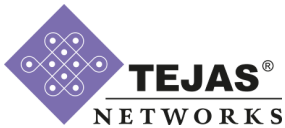
Pluggable Interface Modules

The Interfaces that carry traffic can take Pluggable Optical modules that are compliant with IEEE and ITU Standards (for Ethernet and SDH respectively) and are compliant to the Multi Source Agreements (MSA) that ensure that modules from different sources are interchangeable.

Tejas recommends that the Optical modules be ordered from Tejas as this ensures that the modules have been tested for Quality and functionality in Tejas equipment and their operation and performance is guaranteed. When a customer sources and installs optics without the consent of Tejas Networks, any network failure is not supported by Tejas.

The following pluggable interface modules may be ordered

TJ-SFP-1GE-T	Gigabit IEEE 1000BASE-T , Cat 6 cable, RJ45
TJ-SFP-1GE-SX	Gigabit, IEEE 1000BASE-SX, 850nm, Multi-Mode, 550m, LC
TJ-SFP-1GE-LX	Gigabit, IEEE 1000BASE-LX, 1310nm, Single Mode, 10Km, LC
TJ-SFP-1GE-LH	Gigabit, IEEE 1000BASE-LH, 1310nm, Single Mode, 40Km, LC
TJ-SFP-1GE-ZX	Gigabit, IEEE 1000BASE-ZX, 1550nm, Single Mode, 80Km, LC
TJ-SFP-10GE-SX	10Gig, IEEE 10GBASE-SR, Multi-Mode OM3, 300m, LC
TJ-SFP-10GE-LX	10Gig, IEEE 10GBASE-LR, Single Mode, 10Km, LC
TJ-SFP-10GE-LH	10Gig, IEEE 10GBASE-ER, Single Mode, 40Km, LC
TJ-XFP-10GE-LR	10Gig, IEEE 10GBASE-LR, 1310nm, Single Mode, 10Km, LC
TJ-XFP-10GE-ER	10Gig, IEEE 10GBASE-ER, 1310nm, Single Mode, 40Km, LC
TJ-XFP-10GE-ZR	10Gig, IEEE 10GBASE-ZR, 1550nm, Single Mode, 80Km, LC
TJ-CFP2-40GE-LR4	40G, IEEE 40GBASE-LR4, WDM, Single Mode. 10 Km, LC
TJ-CFP2-40GE-ER4	40G, IEEE 40GBASE-ER4, WDM, Single Mode. 40 Km, LC
TJ-QSFP-40GE-LR4	40G, IEEE 40GBASE-LR4, WDM, Single Mode. 10 Km, LC
TJ-QSFP-40GE-ER4	40G, IEEE 40GBASE-ER4, WDM, Single Mode. 40 Km, LC
TJ-CFP2-100GE-LR4	100G, IEEE 100GBASE-LR4, WDM, Single Mode. 10 Km, LC
TJ-CFP2-100GE-ER4	100G, IEEE 100GBASE-ER4, WDM, Single Mode. 40 Km, LC
TJ-QSFP-100GE-LR4	100G, IEEE 100GBASE-LR4, WDM, Single Mode. 10 Km, LC
TJ-QZFP-100GE-ER4	100G, IEEE 100GBASE-ER4, WDM, Single Mode. 40 Km, LC



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