TJ1600
Terabit Packet Optical Transport

TEJAS® NETWORKS

Product Highlights

Advanced Packet Optical Transport	**MPLS-TP: Traffic Engineered Pseudowires**
OTN and SONET/SDH Switching	**Sub-50ms Protection: 1:1, UPSR, ERPS**
Advanced DWDM Transport	**Carrier Ethernet : VLAN and Q-in-Q**
High Capacity: 10G-600G Per Channel	**TDM Circuit Emulation**

Key Features and benefits

Network Evolution: Networks designers are constantly looking to drive the lowest cost per bit for transport while providing high reliability. Leveraging the advantages of statistical multiplexing while minimizing the number of protocol layers used at each node helps to minimize costs. The TJ1600 allows network designers to use the most cost effective transport technologies for each service type.

One device for Packet, TDM and DWDM: The TJ1600 balances Packet and TDM transport in way unique to the industry. Its hybrid architecture allows for three configurations; TDM with Packet Transport, Hybrid TDM and Packet Transport and all DWDM Optical Transport using the same hardware, software and features. This flexibility creates a unique opportunity for network designs by allowing every service to be optimized based upon the service requirements, not the limitations of a particular transport technology. In addition, the TJ1600 reduces operations costs by having a

single platform for all services requirements preventing the need for multiple devices at any site.

Flexible Packet and TDM switching: With a scalable Packet switch provisioned separately from the TDM switch, the TJ1600 can quickly and easily adapt to changes in service types and bandwidth.

Optimizing Services: With the TJ1600, services can be matched to the best transport technology whether it is maximizing efficiency with Stat-muxing, reducing costs by using OTN switching to by-pass routers, maximizing fiber utilization with DWDM or minimizing latency with optical / OTN switching.

Optimizing Packet to DWDM interworking: To provide the lowest cost Packet to DWDM interworking the TJ1600 use a unique blend of technologies including 10GE interfaces

With OTN wrappers and direct interconnection between Packet and TDM switches to simplify router by-pass in regional / long haul networks.

Lower Packet transport costs: The TJ1600 optimizes 1G and 10G transport by using OTN switching to efficiently pack and route traffic through the network. The use of OTN switching also reduces the complexity of the Packet network by offloading high bandwidth services directly onto the OTN/DWDM optical layer.

DWDM reach greater than 2500kms : With DWDM available for all high speed interfaces, the TJ1600 can optimize fiber utilization using the latest technology for reliable transport in metro, regional and long haul networks.

SONET/SDH/front-haul: With a complete suite of SONET/SDH capabilities the TJ1600 provides the reliability and performance expected of your transport network; exceptional performance, deterministic routes, predictable latency, low protection switch times and easy network planning. SONET/SDH/ CPRI to OTN and Packet gateway capabilities are available to ensure a seamless interworking of services in the network.

MPLS-TP: MPLS label based Connection Oriented Ethernet allows packet traffic to be easily and precisely routed through the network. The TJ1600 provides MPLS-TP based pseudowires for traffic engineered flows on trunks, which optimizes the network by providing the right amount of control. The cost benefits of stat-muxing are combined with traffic engineering and capacity planning to lower CAPEX by right sizing the network. OPEX reductions come through faster provisioning, robust protection and quicker root cause analysis during failures. With mesh protection capabilities, latency and protection switch times are minimized.

Network Management: With Tejas Networks' suite of management tools network evolution is much easier to manage. Point and Click technologies for Packet, SONET/SDH, OTN and DWDM traffic allow for more accurate service designs, more efficient routing and better fault correlation. Accurate alarming and "fault to affected service mapping" enables fault resolution prioritization. Enhanced network element backups and simple remote software upgrades reduce operational costs while enhancing reliability. NMS server redundancy and geographical diversity ensure faster disaster recovery.

Advanced Ethernet Features: The TJ1600 provides best in class packet switching to create networks with the highest performance. Ingress rate limiting prevents any one service/application from congesting/choking the network. Each packet is classified so that the appropriate network policies (like prioritization and scheduling) can be applied. Eight CoS queues and scheduling algorithms ensure that there are sufficient options available to manage the data traffic efficiently. The TJ1600 provides sub 50ms protected packet rings for greater resiliency. Multiple ringlets and multiple ring topologies are supported.

Ethernet OAM: allows real-time monitoring of end-to-end circuits, connections or trunks enabling quick detection and isolation of faults to a particular subnet, trunk, link or node. The TJ1600 supports BFD based Fault OAM and ping/traceroute at tunnel/pseudowire level. It also supports MPLS-TP based performance OAM for MPLS-TP based PW services. For .1q/.1ad based MEF services, Y.1731/802.1ag based CFM OAM   (Port level down MEP) and Y.1731 PM counters are supported.

Circuit Emulation: Circuit Emulation provides an alternative transport method using an all Packet Transport Network. The TJ1600 supports E1 SAToP and STM-1 CEP for carrying this traffic with the reliability of TDM networks while providing a seamless gateway between Packet and TDM networks.
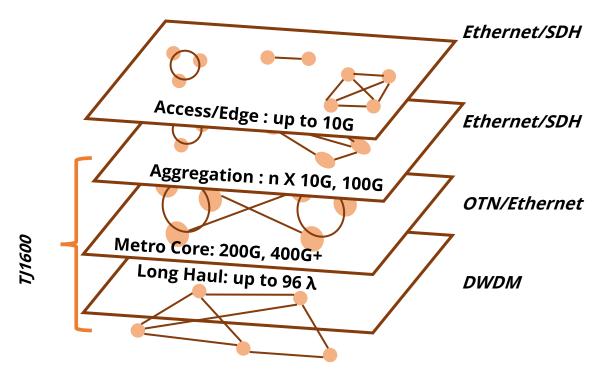
ASON and WSON GMPLS control plane: With Tejas Networks' ITU-T G.8080 based GMPLS control plane software, highly resilient networks with multiple levels of protection can be created with ease. The TJ1600 supports 1+Reroute and 1+1+ Reroute options by implementing standard protocols. Tejas GMPLS control plane enables this capability for OTN (L1) as well as DWDM (L0) enabling most flexible and resilient optical network deployments.

Flexible Network Architectures: The TJ1600 has a flexible architecture that allows it to build the network best suited for all services linearly for rapid deployment such as hub and spoke for cost effective build outs at the edge of the network, ring and ringlet for high utilization and resiliency, meshed for low latency and flexible protection. This is achieved with a unique

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combination of functionality including the ability for traffic to be switched at Packet,

TDM or the optical layer depending on service requirements

Ethernet/SDH

Access/Edge : up to 10G

Ethernet/SDH

Aggregation : n X 10G, 100G

OTN/Ethernet

Metro Core: 200G, 400G+
Long Haul: up to 96 λ

DWDM

TJ1600

High Density Switching and Optical Transport

Technical Specifications

SDH/OTN Switch Capacity

- 900G OTN (1:1 fabric)
- 640G OTN/HO (1:1 fabric)
- 360G OTN/HO, 120G LO (1:1 fabric)
- 80G HO/LO (1:1 fabric)

Network Protection

- Unprotected, 1+1 APS, 1+1 MSP
- UPSR, 2F BLSR, SNCP-I/N
- ODUk/ODUj SNCP
- OLP
- 1+1 network port protection
- L1-GMPLS/ASON
- L0-GMPLS/WSON

Enhanced Services

VLAN to ODUFLex Mapping
Revertive and non-revertive switching

Network Management

- Web-based Craft UI
- Network Management System
- SNMP

SDH/OTN Switch Capabilities

- VC12, VC4, STS-nc
- ODU2, ODU0, ODU1, ODUFlex
- LO and HO Virtual Concatenation
- Hairpinning
- Ethernet GFP-mapped; VCAT and LCAS
- 640 G Hybrid SDH/OTN or SONET/OTN XC
- 900G OTN XC

DWDM Cards and Components

- **Amplifier Types**: Low Gain, Fixed Gain, High Gain, Variable Gain, Mid-stage Variable Gain, Raman, Booster amplifiers
- **Amplifier usage types**: Pre-, Post-, inline
- **ROADM** - CDCG: 9 degree*, 8 degree, 4 degree and 2 degree
- **Optical Mux/ DeMux**: 1Ch, 4 Ch, 8 Ch, 16 Ch, 40Ch/80 Ch, 64 Ch*, 96 Ch
- **Dispersion Modules**: Fiber and Bragg-Grating Based
- **Optical Channel Monitors** – OSNR, Power
- **OTDR** – traces, fiber attenuation, fiber cut info

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Circuit Emulation
- E1 SAToP RFC4553/MEF8

Client Interfaces (max per line card)
- 400GE* – up to 3 QSFP-DD ports
- 100GE/OTU4 – up to 12 QSFP28 ports
- 40GE – up to 2 QSFP+ ports
- FC32G – up to 2 SFP28 ports
- FC16G – up to 4 SFP28 ports
- 10GE/STM-64/OTU2/OTU2e/FC12G/FC8G – up to 40 SFP+ ports
- FC 4G/ FC2G/FC1G – up to 6 SFP+ ports
- STM-16 – up to 8 SFP ports
- STM-1/STM-4/1GE – up to 16 SFP ports
- 1000/100/10bT – up to 16 ports
- 100/10bT – up to 16 ports
- E3/DS3 unprotected – up to 3
- E1/DS1 unprotected - up to 126

Network Protection & Security
- Ethernet Ring Protection ITU-T G.8032
- 1:1 bidirectional Linear Protection LSP (RFC6378)
- 1:1 bidirectional PW
- MPLS-TP Mesh
- Link Aggregation Group (LAG)
- Port mirroring and loopback

Photonic Layer Capabilities
- eFEC/gFEC for 10G ports
- HD-FEC/ SD-FEC for Coherent Line ports
- FEC for 2.5G and 622M ports
- Up to 96 Channels/Lambda per fiber
- Amplified reach of 2500+ km
- Degradation based Switching on OLPs
- Grey/ Coherent/ DWDM optics supported
- Flex-grid Support*
- Fiber Protection Unit
- Optical Supervisory Channel

MPLS-TP
- MPLS-TP Connection Oriented Ethernet
- VPWS, VPLS, H-VPLS
- ELAN, EVLAN, EVPL, EPL, E-TREE*, E-ACCESS
- IGMP snooping v1/v2/v3*

Ethernet/MPLS-TP OAM
- MPLS-TP OAM RFC5860
- BFD based Fault OAM
- LSP Ping and Traceroute (RFC6426)
- PW Ping
- MPLS-TP
- Y.1731/802.1ag based CFM OAM
- On demand LM/DM based on Y.1731 IEEE802.3ah based

Ethernet Switch Capacity-single shelf
- 80 to 240 Gbps bidirectional

Interfaces to Ethernet Switch – single shelf
- 10 Gig E – up to 48 XFP/SFP+
- 1 GigE – up to 192 SFP ports
- 10/100/1000bT – up to 192 ports
- 10/100bT – up to 144 ports
- DS1 – up to 756 ports*

Transponders and Muxponders
- 12 x 100G / 8 x 100G + 40 x 10G -> 2 x 600G Muxponder
- 2 x 100G / 1 x 100G + 10 x 10G -> 1 x 200G Muxponder
- 20 x 10G -> 1 x 200G Muxponder
- 2 x 100G Transponder
- 10 x 10G / 2 x 40G + 2 x 10G -> 100G Muxponder
- 10 x 10G -> 1 x 100G Muxponder
- 10 x 10G Transponder
- 10G Muxponder

Ethernet Switching
- VLAN, QinQ based services
- Ingress Rate Limiting at 64kbps granularity
- Programmable Committed / Peak Rates
- Programmable Committed/Peak Burst sizes
- Egress rate shaping on all ports
- HQoS
- Every Ethernet port UNI/NNI

Environmental
- ETSI EN 300 019-1-1, Class 1.2 Storage
- ETSI EN 300 019-1-2, Class 2.3 Transportation
- ETSI EN 300 019-1-3, Class 3.2 Operating stationary use
- ETSI EN 300 019-1-3 V2.1.2 and ETSI EN 300 019-2-3 V2.1.2 for Environmental Class 3.1
- QM333 – Functional for Environmental testing of Electronic equipments for Transmission and switching use.

Power Supply (optional redundancy)
- -40V to -57V DC
- 2500 Watts maximum per unit

Dimensions
- 372mm x 446mm x 258mm (HxWxD)
- 178mm x 444mm x 258mm (HxWxD)
- 89mm x 483mm x 288mm (HxWxD)
- 19", 21" and 23" rack mount options
- All Front Access

upcoming release specifications subject to change without notice