Future Ready. Today.
Transport is a key element of a fiber optic network backbone. Optical transport technology has evolved over time. Traditional SDH/SONET has been enhanced to enable Ethernet interfacing. Carrier Ethernet has evolved as a transport standard, with DWDM in the core for regional and long-haul transport. Numerous standards have been developed to support these technologies and the standards continue to evolve. Telecom networking, being a capital intensive business, a robust transport architecture should enable carriers to building new capabilities over an installed base as well as build green field networks. Transport solutions need to be innovative to enable customers to migrate to next generation networks while optimizing their capital expenditure (capex) and operating expenses (opex).

Tejas Networks offers end-end transport solutions to customers worldwide to help migrate them to next generation networks. Designed and built in world-class R&D facilities in India, Tejas products are deployed in every major telecom network in the world’s fastest growing and second largest telecom market, India and in over 60 countries around the world. Tejas has developed & delivered a range of high quality Optical Transmission and Carrier Ethernet equipment. Our Next-Gen SDH/SONET equipment is available in line rates ranging from STM-1/OC-3 to STM-64/OC-192, with a very rich set of service interfaces and optics options. In addition to this, Tejas also offers a range of Carrier Ethernet, Packet Optical and C/DWDM platforms.

Tejas R&D has been awarded with the top R&D awards such as the CSIR, DSIR award and the ELCINA Dun & Bradstreet award. Tejas products have won innovation awards and ‘Best Electronic Product’ awards from renowned bodies like NASSCOM and Indian Semiconductor Association. Tejas has been recognized as a ‘Distinguished Product Company’ and has received global recognition as a ‘Red Herring 100 company’. In 2010, Tejas won the Silicon India-Mentor Graphics Best Electronic System Design Company award as well as the National Telecom Award for leadership in exports from India.
Our customer segments include Telecom, Defence, Media and Utilities. Our products support a variety of applications for these segments. Prominent among our segment and application specific solutions are fixed line carriers, 2G/3G mobile operators, LTE/WMX, content distribution networks, retail and mobile broadband, utility applications like SCADA deployed over oil, gas, rail and telephone networks, wholesale bandwidth solutions.

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<th>Segments</th>
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<td>Telecom - Fixed Line Carriers</td>
<td>Versatile configurations with high density PDH drops</td>
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<td>2G Mobile operators</td>
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<td>Seamless migration from 100% TDM to 100% packet with Tejas Future Proof Transport Architecture</td>
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<td>Content Distribution Networks</td>
<td>Static Multicast &amp; E-Tree services, Dynamic Multicast with IGMP snooping and proxy</td>
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<td>Retail/Mobile Broadband providers</td>
<td>High capacity data switching with 1GigE trib interfaces for backhaul from DSLAMs, CMTS and Wimax base stations</td>
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<td>Utilities (Oil, Gas, Rail, Power)</td>
<td>High availability systems with fast protection switching, low latency, for SCADA and mission critical applications. Support for multiple traffic profiles for medium and low priority traffic (Video Surveillance, VOIP, Enterprise LAN)</td>
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<td>Wholesale bandwidth providers (Carrier of Carriers)</td>
<td>High Density DXCs (80-320Gbps) with variety of TDM and Data Interface, High density (80 wave) DWDM systems</td>
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<td>Defence (Armed forces communications)</td>
<td>Ruggedized routers, switches and transmission products for strategic communications, tactical communications and platforms for partner organizations</td>
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Tejas has four product families around four main technologies deployed in telecom networks today: NG SDH, Packet Optical Carrier Ethernet and WDM. TJ1xxx provide Next-Gen SDH/SONET capabilities with a very rich set of service interfaces and Optics options covering entry level CPE (customer premise equipment), access boxes, aggregation and core equipment. TJ2xxx utilize Carrier Ethernet standards to help build scalable packet transport networks with Carrier Ethernet advantages like 50ms packet ring protection, OAM, QoS to name a few. TJ3xxx enable Service Providers to build carrier-grade, high-capacity CWDM/DWDM backbones for metro and regional applications. TJ1400 and TJ1600, belonging to the Tejas XTN series are Packet Optical products with industry leading switching density that enable operators to migrate from 100% TDM to 100% Packet based transport with minimal capex and opex. TJ5xxx series is a set of Network Management Software which offers centralized provisioning and control of the network elements to manage all the four families of Tejas products. Tejas Networks provides 24x7 support to its products globally.
**MSPP (Multiservice Provisioning Platforms)**

**Dense and Modular Multiservice Aggregation**

Tejas MSPP products form an end-to-end, NG-SDH/SONET based optical transport portfolio for a full range of network speeds up to 10 Gbps. Tejas has developed products that transition legacy networks into intelligent, Ethernet-enabled networks that can be used to offer many new revenue-generating data services.

The Tejas MSPP portfolio has the following attributes:

- **Capex Optimized** - Tejas provides sufficient choice and flexibility in form factors and interface modules to allow an optimal, cost-effective platform for any application or network location to be chosen.

- **Reduced Opex** - The same traffic cards can be reused on multiple platforms within the portfolio. By maximizing sub-system reuse our approach significantly reduces inventory management costs.

- **New Revenue Streams** - Tejas’ award-winning Carrier Ethernet over SDH/SONET cards (ELAN) can be used by large Metro Ethernet operators to profitably deliver a full suite of Business Ethernet services, DSL Broadband, VoIP and IPTV with SLA guarantees.

- **Maximize Asset Utilization** - Irrespective of the nature of the future traffic mix, the same chassis can be repurposed to function as a regular circuit-switching platform, for hybrid packet optical transport or as a pure-play packet switching platform.

- **Interoperable Systems** - A variety of pathways are provided to transport or tunnel management information either in overhead bytes or selected data channels to ensure seamless interoperability. MSPP products are designed based on industry standards defined by ITU-T, IEEE, IETF, MEF and ETSI and certified as per CE, RoHS and NEBS mandates.

**STM-4/OC-12**

Compact bandwidth provisioning products designed to manage and deliver services from the optical core to the access. TJ1100, TJ1270

Can be configured as a Terminal Multiplexer (TMUX), Add-Drop Multiplexer (ADM), Regenerator, In-Line Amplifier or as a stand-alone Cross-Connect.

Feature non-blocking cross-connect at VC-3, VC-4 and VC-12 granularity and support drop and continue functionality.

![Diagram of MSPP and STM-4/OC-12 products](image)
**Packet Optical Transport**

Native TDM and Packet transport with industry leading switching density

Tejas XTN provides a smooth transition path to operators by supporting next generation SDH/SONET and Carrier Ethernet functionality on the same platform. Operators can use the packet capability in

a. Same configuration for redundant and non-redundant configurations (same aggregate cards, universal trbs)

b. End-to-end packet transition (circuit emulation, SyncE, 1588v2)

c. Low power consumption and energy efficiency

d. PDH tributary protection

**TJ1400**
- High capacity PoTP for Metro Core
- Scalable Packet and Circuit Switching – 80G LOXC, scalable to 320G H0XC/20G LOXC
- Full OTN switching capability
- Integrated WDM Transponders and Muxponders with OTN interfaces – OTU-2, OTU-3, OTU-2e
- 2×156G Carrier Ethernet Switch capability with 10GE interfaces – PBB/PM-TE/ERPS/MPLS-TP standards
- Unmatched aggregation in 9U – 1008, 112xFE, 144xSTM-1, 128xSTM-4, 72xSTM-16 – 32xSTM-64, 32xOTU2, Up to 24x10GE, 128xGE
- ASON/GMPLS control plane

**TJ1600**
- Corporate Office
- Access
- STM 4
- STM 16
- STM 64
- Aggregation
- Corporate Office
- Access
- STM 4
- STM 16
- STM 64
- Aggregation

TJ1600 has won the NASSCOM Innovation Award 2011, ISA Best Electronic Product of the Year 2011 and Economic Times Innovative Telecom Product Award 2011
Power of packet transport with resilience of SDH/SONET

Tejas’ MSPP solutions enable cost-effective rollout of revenue-generating Carrier Ethernet services on an installed base of SDH/SONET equipments. This is achieved by using a series of award-winning Ethernet over SDH/SONET Switching and Transport cards called ELAN that can be supported on Tejas’ TJ1000 multi-service provisioning platforms. ELAN is a Best Electronic Product winner for the year 2010 from the Indian Semiconductor Association and also the winner of the NASSCOM Innovation award for “New Technology Advancement”.

- **Flexible mapping:** Ethernet traffic can be flexibly mapped into bundles of SDH/SONET virtual containers at 2/1.5 Mbps, 34/45Mbps and 140Mbps granularities and back-hauled over a 622Mbps/1.25/2.5Gbps transport pipe on the access/metro backbone.

- **Service Scalability:** ELAN has built-in support for rich layer 2 features for deployment of scalable Ethernet services and ease of provisioning in Carrier networks. CET ports can be configured either in “802.1Q” (IEEE 802.1Q), or “Q-in-Q (VLAN Stacking)” (IEEE 802.1ad) or “MAC-in-MAC” (IEEE 802.1ah) Modes.

- **Quality of Service:** ELAN implements a comprehensive hierarchical Traffic Management model as per MEF 14 including Ingress Rate Limiting, Traffic Flow Classification, Traffic Policing and Marking, Traffic Shaping and Congestion Management.

- **“SDH-like” OAM and Protection:** ELAN supports recent standards for enhancing Ethernet protocols in this area. IEEE 802.1ag (Connectivity Fault Management) and ITU Y.1731 (SLA Monitoring) standards are supported. ELAN can meet sub-50ms protection benchmarks for Carrier-Class services on complex network topologies based on one of the first implementations of Ethernet line and ring protection mechanisms (ITU G.8031 and ITU G.8032).

- **Traffic Engineering:** ELAN implements advanced mechanisms to deliver connection-oriented Ethernet services on native Ethernet or MPLS based transport. Service Providers can deterministically engineer, provision and protect their packet connections from the centralized management system to realize a true “Carrier-Class” service infrastructure.

Scalable and resilient packet based transport

TJ2000 is a series of Carrier Ethernet Switching equipment, consisting of access, edge and aggregation platforms. The TJ2000 series enables highly-scalable Ethernet switched networks to support services like Consumer Triple Play, IPTV, Mobile Video and 3G /WiMAX Backhaul, among others. With SONET/SDH-like comprehensive fault and performance management as well as support for the industry’s first standardized sub-50ms Ethernet protection, the TJ2000 series leads the way to an all-Ethernet Transport Network.

- **50ms protection:** With support for ITU-T G.8031 and G.8032, TJ2000 supports both path and ring protection within 50 ms. This enables reliable and disruption free connectivity for mobile base stations and high ARPU segments like banking & finance, and for VOIP and Video conferencing customers.

- **Connection oriented Ethernet:** The concept of a connection in a packet switched network is very useful for providing tunnels for specific applications, providing bandwidth and latency guarantees, and for security. TJ2000 supports connection oriented ethernet which enables traffic engineered end-to-end circuits to be provisioned across the network with sub 50 ms protection.

- **Ethernet OAM:** Allows real-time monitoring of end-to-end circuits, connections or trunks, enabling quick detection of faults and isolating of fault to a particular subnet, trunk, link or node. Leads to substantial Opex savings.

- **Hierarchical Quality of Service:** Allows Service Provider to control bandwidths and latencies on a per service and per application level. Thus within a single service, bandwidth, latency and reliability guarantees can be provided per application. By mixing and matching these parameters, new revenue generating services can be offered or existing services can be differentiated.
Compact Edge Switches for first mile aggregation
TJ2030, TJ2050, TJ2031 & TJ2051

Mid-sized and high density aggregator switches
TJ2110 & TJ2210
Tejas Networks’ TJ3000 portfolio of C/DWDM products enable Service Providers to build carrier-grade, high-capacity CWDM/DWDM Multi-Service Optical networks for metro and regional applications. These products are characterised by their unique ability to combine SDH/SONET, Ethernet Switching, CWDM and DWDM technologies in the same enclosure.

- **Highly resilient solution for Storage Area Networks:** offering interfaces such as Fiber Channel, ESCON and Ethernet.
- **Variety of interfaces:** Fast Ethernet (FE), Gigabit Ethernet (GE) and 10GE, DVB ASI interfaces for transmission of video from Studios to the Video Distribution sites.
- **Integrated support for Carrier Ethernet features:** such as EthOAM and PBB along with MEF Certification enables Service Providers to provide a rich suite of carrier-class data services.
- **Integrated multi-service delivery:** of SDH/SONET, Ethernet, Digital Video and Storage protocols protects investments and enables profitable revenue streams.
- **Lower first deployment costs:** by ~60% compared to traditional metro systems with patented DWDM architectures with single-fiber and fiber-pair configurations.
- **Multi-level protection:** including transponder protection, dual line interface protection and fiber protection which allows creation of differentiated services.
- **Carrier-grade network management system:** with support for a GMPLS control plane and unique iWDM technology. Leads to reduction in operational costs and increase in efficiency through lower provisioning time and operator intervention.
- **Supports 10Gbps speeds on standard CWDM:** grid wavelengths specified in ITU G.694.2 Enables potential savings of 50-70% over DWDM by using economical uncooled DFB laser technology and 4x the bandwidth of regular CWDM systems.
Network Management System

Intelligent, Insightful and easy to use

The Tejas Element Management System (TJ5100) provides integrated management of network elements across an intelligent optical network. Optionally, TejEMS enhances the power of integrated network management through the powerful Point-and-click provisioning (PNCP) application tool. This advanced tool utilizes latest Internet driven advances in signalling and optimization algorithms that enable service providers to roll out new revenue generating services in record time. This is accomplished through auto discovery of network elements as and when they are added to the network, and in addition, auto discovery of optimized network topology and path for a given end-to-end circuit.

In addition to offering full FCAPS support (Fault, Configuration, Accounting, Performance and Security Management) TejEMS enables new carrier services such as Bandwidth-on-demand, Time-of-Day provisioning, Dynamic Mesh Restoration services and Hot Standby support.

Since SNMP is an industry standard protocol to manage network devices and elements, TejNES provides connectivity to industry leading network management systems, including Tejas' own Tejas Element Management System (TejEMS).

Further, TejEMS can be easily customized to manage third party equipments through the use of industry standard SNMP interface protocol.

The Tejas Network Element Software (TJ5500), the embedded Network Element Software suite resident in each network element provides control and management of individual network elements. Service providers can individually configure and control Tejas network elements through a simple and easy to use World Wide Web (WWW) browser interface using the widely used and popular Hypertext Transfer Protocol (HTTP). The popularity of HTTP implies that configuration and control can be performed through the public Internet (with the provided security management), bringing unsurpassed flexibility to service provider operations.

Optionally, TejNES provides Simple Network Management Protocol (SNMP) interface that enables Element Management Systems (EMS) to provide centralized monitoring and control of network elements in a geographically dispersed network.
Service & Support

Trustworthy, responsive and consultative

Tejas Networks offers full life-cycle support to its customers ranging from Network Design, System Integration, Commissioning and Operations. Our support capability is enhanced by the fact that the intellectual property for the products we build reside within the organization. Our support teams are experienced and qualified to not only fix problems occurring in the field, but to also consult with you in planning and rolling out networks.

Tejas offers the following services:-

- Network Planning, Design and Optimization.
- Network Installation, Commissioning, Testing and Program Management.
- Customer Support and Post Sales Activities.
- Training.
- System integration: NMS, OSS integration and customizations.

About Tejas

Tejas Networks is a leading innovator of carrier grade communications equipment. Tejas pioneered the development of next-generation SDH/SONET as well as Carrier Ethernet products that enable telecom carriers to converge traditional voice-based transmission networks with new data-dominated networks. Tejas’ products are used in all major telecom networks in India and in over 50 countries around the world. A Red Herring Global 100 company, Tejas is amongst the leading companies in the MSPP market worldwide. Tejas has received the CSIR award for R&D excellence from the Indian Government, the country’s highest technology award for R&D excellence. For more information, visit http://www.tejasnetworks.com