Building End-to-End Networks using Tejas Ethernet Switches

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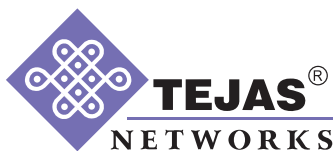
Reliable and Efficient network implementation through Ethernet Switching Portfolio

With the rise in urbanization, applications like video surveillance, WiFi, Metro railway, Defense, smart Cities, and proliferation of IP networks, Ethernet Switching solutions have attained more significance in today's world. This application note describes how Tejas Ethernet switches can provide an efficient & secure solution for bandwidth sensitive applications across industries

White Paper

Introduction

Modern world is witnessing digitalization of various services & modernization of infrastructure with the emergence of multiple Smart City applications like Smart Transportation, Digital Surveillance and Municipal Wi-Fi to name a few. Information and communication technologies (ICT) is enhancing the quality and performance of urban services such as energy, transportation and utilities resulting in reduced resource consumption, wastage and overall costs. These applications need an efficient network that can efficiently handle the connectivity needs to match the stringent SLA requirements.

Key features of a state-of-the-art network that can handle the connectivity requirements for all these applications are:-

- **Availability and Reliability:** Mission-critical traffic demands 99.999% availability without any single point of failure. These applications require sub 50ms protection switching to ensure that the five 9s availability is ensured.
- **Network virtualization:** Network equipment can interoperate in a multi-tenant environment and is compliant with various international standards (IEEE, MEF).
- **Scalability and Flexibility:** The network should be extremely flexible in terms of bandwidth, number of end devices, multicast flows, applications etc.
- **Reliability and Performance:** Different applications have different performance requirements and network should be able to handle the performance requirements and SLAs needed for each application.
- **Security:** The network should have adequate security features to ensure protection against hackers and DDoS attacks.
- **Environmental Ruggedness and Low-power Operation:** The network elements should be able to work in environmental conditions with ambient operating temperatures ranging up to 50 deg C.
- **Centralized Management:** Administrator should be able to manage the entire network remotely from a centralized management system.

Typical Network Scenarios deploying Tejas Ethernet Switches

Smart City

For realizing seamless connectivity, the Smart City entities are connected to Managed Ethernet Switches. Tejas provides a wide range of Ethernet switches that align with the market requirement. These are an ideal fit for Smart City networks where massive amount of data generated across the city makes availability, scalability and efficiency a critical challenge.
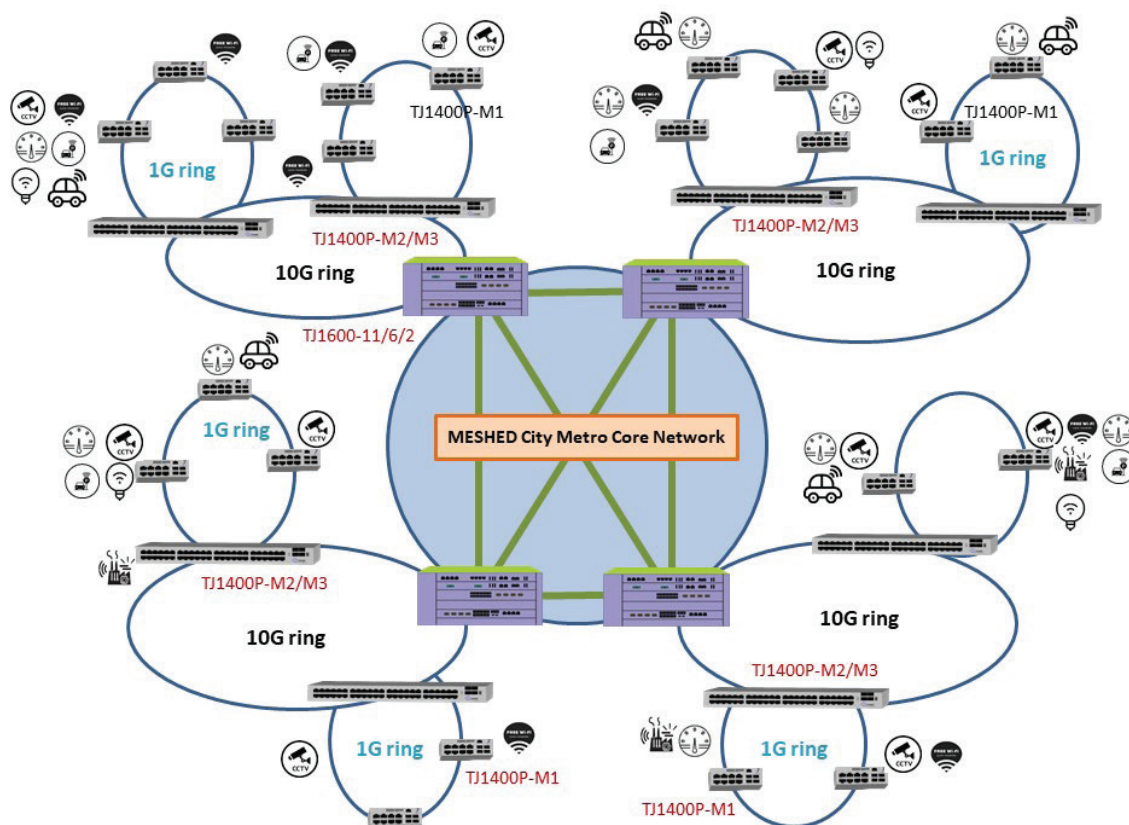
Figure 1 - Positioning of Tejas Ethernet switches inSmart City networks

In this multi-layered Smart City network architecture using Tejas Ethernet Switches, each layer aggregates traffic from the layer below it. TJ1400P-M1 switch is located at the street level (at smart / street poles). The traffic from multiple Network traffic from TJ1400P-M1 access switches are aggregated to TJ1400P-M2 aggregation/ TJ1400P-M3 stackable switch which in turn are aggregated to metro aggregation network. The entire series of Tejas switches can be centrally managed using Tejas NMS/ EMS management system.

Tejas switches have PoE+ capability and can act as the Power Source Equipment (PSE) to power end devices. TJ1400P-M1 industrial switch with features like ERPS, routing and DHCP server capability support secure deployment. It is a ruggedized switch which can operate in extreme environmental conditions. It also supports a comprehensive set of security features like authentication, authorization & accounting, DHCP snooping and Dynamic ARP inspection. TJ1400P-M2 aggregation and TJ1400P-M3 core switches have a wide coverage in terms of port-configurations, capacities, feature scalability and provide a rich palette for Smart City network. The switches support line-rate, non-blocking architecture for predictable performance. For higher aggregation levels, TJ1400P-M3 supports dedicated 200G stacking ports that provide a high availability based virtual chassis architecture at Core Layer.

Key Differentiators:

- Access Switches generally have 8 PoE ports with 2x1GE uplinks while Tejas Switches have a variant with 8 PoE+ port and 4x1GE uplink to support certain edge configurations.
- Aggregation Switches generally operate at ambient temperature of 0 to 45 deg C while Tejas platform can operate at temperatures up to 55 deg C.
- Layer 3 Core Switch usually use modular chassis while Tejas Layer 3 Core Switch architecture is a set of dual switches configured in active-active cluster to support high availability and resiliency with requisite GE/10GE/40G Optics.

- Switches generally support command line interfaces for management and are not centrally managed however Tejas has a state-of-the-art Centralized Management system with a user-friendly GUI to ensure complete functionalities of FCAPS (Fault Management, Configuration, Accounting, and Performance & Security Management).

Metro Railways

In this multi-layered network architecture, each layer backhauls traffic from the layer below it. Traffic is backhauled from various applications and devices to Industrial Ethernet access switch. The traffic from multiple access switches is aggregated to stackable Distribution switch which in turn is aggregated to metro Railways Core network. The entire series of switches can be centrally managed using EMS management system.
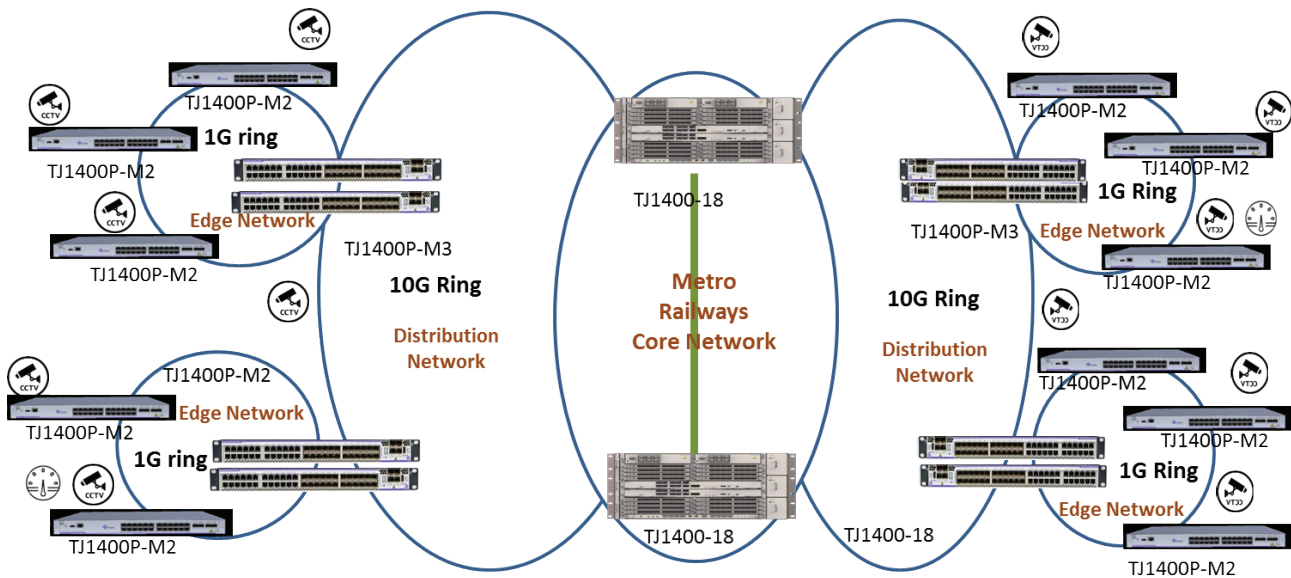

Figure 2 - Network connectivity in Metro Railways using Ethernet Switches

Traffic is backhauled from various applications and devices to TJ1400P-M2 Ethernet access switch. The traffic from multiple TJ1400P-M2 access switches is aggregated to TJ1400P-M3 stackable switch which in turn is aggregated to metro aggregation network. The entire series of Tejas switches can be centrally managed using Tejas EMS management system.

TJ1400P-M2 switches use features like static routing and DHCP server capability which makes it extremely simple and easier to manage. It is extremely rugged and can operate in extreme environmental conditions. It also hosts a comprehensive set of security features like authentication, DHCP snooping and Dynamic ARP inspection. Tejas switches have PoE+ capability which acts as the Power Source Equipment (PSE) to power end devices.

TJ1400P-M3 distribution switches provide wide options in terms of port-configurations, capacities, features and scalability which make it an ideal fit for Metro Railways network. The switches support line-rate, non-blocking switching for predictable performance. Dedicated 200G stacking links provide 400Gbps of stacking bandwidth with fast failover and high utilization. TJ1400P-M3 variant of 24 GigE (e) & 24 GigE (o) with minimum four 10GE interfaces as uplinks offers an unmatched scalability in terms of connectivity to Layer 2 Ethernet Switches as well as multiple GigE rings homing on to this platform.

TJ1400-18 Core Switch has a highly resilient modular redundant architecture with multiple of 100G, 40G, 10G & 1G interfaces catering to 1 Tbps of Fabric capacity. The platform has 18 slots with capability to house dense GigE, 10GigE modules. The platform can work on the temperatures ranging from 0 deg C to 50 deg C while its peers across industry can operate up to 45 deg C only. It has multiple fan trays with each having multiple fans. This enables seamless preventive maintenance for the equipment in the field.

Key Differentiators:

- Edge Switches are generally 18 port switches with 16x10/100/1000 and 2x1GE uplink. However Tejas offered platform have 24x10/100/1000 which is 150% of the normal Ethernet switches.
- Edge Switches have generally 2x1GE(o) uplinks while Tejas switches have 10GE uplinks port implying 10 times the backhaul capacity than its peers
- A generic distribution Switches offered in Metro Railways has 24 Combo ports with 4x10GE uplink which gives the capability of catering to maximum 24 ports (combination of GigE (optical) & GigE (electrical) ports). However Tejas solution provides 48x1GE ports implying 100% additional capacity for Metro Rail offerings.
- Modular Layer 3 Core Switch offered in Metro Railways usually have 40G uplinks & 12 slots however Tejas offered Layer 3 Core Switch has 100G uplinks and 18 Slots. Tejas switches have higher scalability in terms of bandwidth & number of slots.

Defense Services

Defense Services are building IP/MPLS Network in multi layered architecture wherein MPLS national backbone is being designed to transport multi service QOS enabled voice, video & data traffics. The network should have end-to-end traffic engineering features providing sub 50ms resiliency. The Access Network is a very critical part as end users & devices are getting connected to national backbone via this network. It constitutes multi homed resilient optical network at each Defense station/establishment. The architecture is based on Metro Aggregation Routers (MAR) and Metro Ethernet Ring (MER) Switches with Carrier grade features. Diagrammatic representation of typical network is given below:
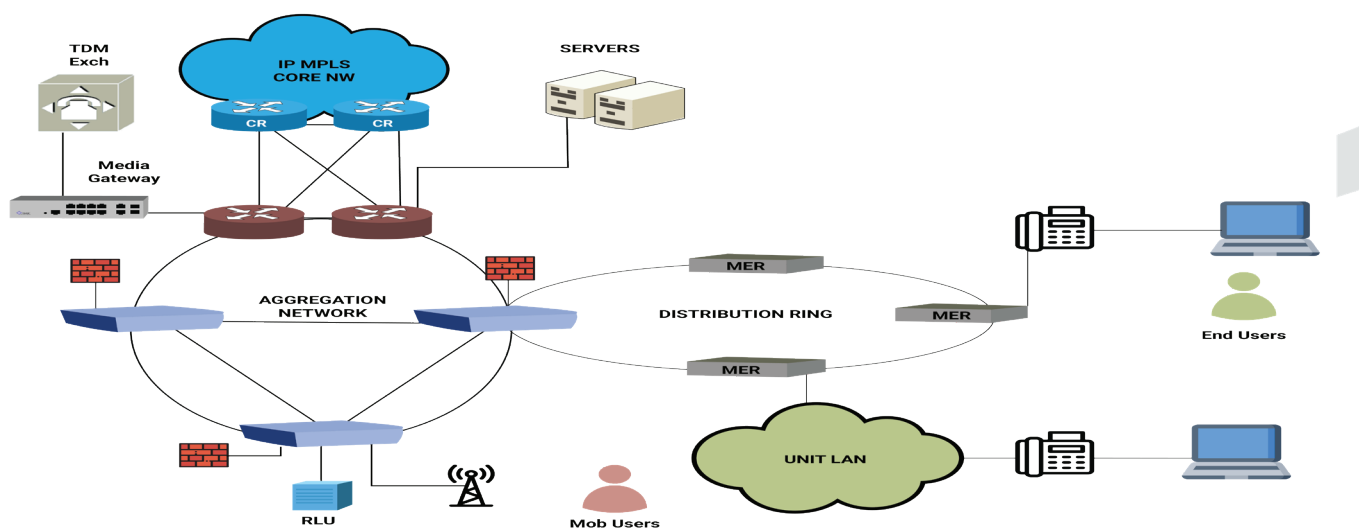

Figure 3: Access Network Architecture

Metro Ethernet Ring (MER) Switches form a resilient optical network providing sub 50ms failover, bandwidth guarantee, service assurance and QoS on per port, per subscriber, per service basis. The MER Switches shall aggregate traffic from unit LANs and hand over the same to MARs. All devices and users are getting connected on the Metro Ethernet Ring switches. Hence these switches must be highly reliable and secure with capability to work in harsh environmental conditions. These switches need to be certified by various national standardization bodies.

TJ1400P-M2 Switch series is designed to provide a wide range of capabilities to meet diverse deployment requirements that value continuous operation and comprehensive Layer2, Carrier Ethernet, Layer3 features, flexibility of PoE/PoE+ and management capabilities.

Key Differentiators:

- Tejas Switches are certified by Telecom Equipment Certification body against stringent specifications.
- Tejas switch platform allows 24x10/100/1000 and 4x10GE uplinks which allow these switches to home rings.
- Tejas Switches support ITU-T G.8032 protocol required for attaining sub 50ms protection switching as a basic feature in its software stack.
- Tejas offers Centralized Management system which is user-friendly GUI based platform with complete functionalities of FCAPS (Fault Management, Configuration, Accounting, and Performance & Security Management).

Govt Institutions & Education Campus

Government Organizations and Educational Institutions require end-to-end secure & reliable connectivity with lots of surveillance cameras & Wi-Fi Access Points. The underlying network infrastructure should provide reliable, secure & resilient conection to all end devices & users. The entire network needs to be centrally managed and must meet all certifications, control requirements and audits.

Tejas has a complete suite of switching solution for building resilient, reliable & secure networks state-of-the-art centralized management system. Tejas Ethernet switch series TJ1400P-M1, TJ1400P-M2, TJ1400P-M3 and TJ1400P-M4 cater to Access, Distribution, Core & Datacenter requirements respectively.

Key Differentiators:

- Normal 10GE Access Switches usually support 2x10GE uplinks while Tejas 10G switches enable 4x10GE uplink to support more than one ring for certain cases.
- Tejas Access, Distribution & Core Switches operate at temperatures up to 55 deg C thus not requiring stringent air conditioned environment.
- Tejas Distribution and Core Switches are certified by Telecom Equipment Certification body against stringent specifications Tejas switches have 400 Gbps of stacking bandwidth compared to 40Gbps for normal distribution switches.
- Tejas switches support Command Line Interfaces (CLI) as well as GUI based management. Moreover Tejas offers Centralized Management system which is a user-friendly GUI based platform with complete functionalities of FCAPS (Fault Management, Configuration, Accounting, and Performance & Security Management) for end-to-end management of all its product portfolio.

Tejas Carrier Ethernet Switch Portfolio

TJ1400P Enterprise Switch series is a set of Layer 2 / Layer 3 Managed switches designed to provide a wide range of capabilities to meet diverse deployment requirements. The comprehensive Layer 2 and Carrier Ethernet feature set and management capabilities provide excellent performance benefit.

		TJ1400P-M1	TJ1400P-M1	TJ1400P-M2	TJ1400P-M3	TJ1400P-M4
Highlights	Mounting and Packaging Option	DIN Rail and IP30 rated construction for extended temperature support	Rack Mount	Rack Mount	Rack Mount	Rack Mount
	Ports	4/8	8/24/48	24	24/48	48
	Power	POE+	POE/POE+	PoE/PoE+/ non-PoE	PoE, non-PoE and Optical Interfaces	Optical Interfaces
	Type	Industrial switch series	Access switch	Modular Multi-layer Distribution switch series	Modular Multi-layer Stackable switch series,	Top-of-Rack Switches
Supported Applications	Surveillance	✓		✓	Fiber Aggr, Server Farm	
	Retail WiFi/ Security		✓	✓		
	Small Biz		✓	✓	All-in-One	
	Medium Biz		✓	✓	Core Switch	
	Enterprise		✓	✓	24/48 port	✓
	e-Gov		✓	✓	24/48 port	✓
	Metro Rail	✓	✓	✓	IT, Fiber Aggregation	
	Smart City	✓	✓ (Access Layer)	✓	IT and NOC	✓

TJ1400P-M1 portfolio of Layer2+ switches is suited for realizing an efficient access layer for enterprise, campus and industrial networks. Over and above the standard set of Layer2 features in managed switches, these switches have Static routing, DHCP server capability and a comprehensive set of security features. All switches support Gigabit client ports (electrical or optical) and uplinks that can be optical, combination of optical or electrical or 10 Gigabit.

TJ1400P M2 switching family is specifically optimized for LAN and Metro applications. The TJ1400P M2 models are L2/L3 switches with Carrier Ethernet features for OAM and resiliency. They support GigE electrical and optical interfaces with 10GE uplinks and are available in several factory resiliency which makes them an ideal fit for enterprise applications fitted configurations.

TJ1400P M3 switching family is similar to M2 switching family but has advanced L3-features and stacking which makes it a versatile product for the core of a network.

TJ1400P-M4 Series of switches are designed for Data Center and Cloud Deployments. The TJ1400P-M4-48DQ-S model is a top-of-rack (ToR) switch with 48 SFP/SFP+ ports capable of supporting 1G/10G/25G Ethernet and 8 QSFP uplink ports of 40G/100G. The switch is compatible with the Open Compute Project Specifications and comes loaded with a software feature set required to support cloud and data-center deployments.

Tejas EMS for Switches

Tejas EMS for Switches is a state-of-the-art centralized management system offering FCAPS functionalities with capability of configuring EMS in HA mode. It has a web based Graphical User Interface (GUI) for easy access and monitoring of the network remotely. It comes with user-friendly dashboards, having extensive reporting comes with user-friendly can be easily integrated with new devices/applications and is extremely scalable making it ideal for multi-location expansion. Few functionalities of Tejas EMS system are illustrated below.

- Network Topology View ensures the topology & connectivity to be shown in a graphical representation.
- Monitoring View enables user at NOC to have a holistic view of the network.
- Services View enables the services to be depicted in a graphical representation.
- Inventory View enables NOC user to keep a record of the network inventory
- It supports REST API on North Bound interfaces to be integrated to higher layer Management Systems
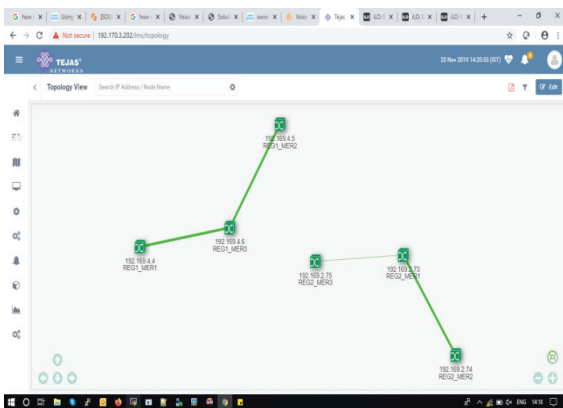
Network Topology View
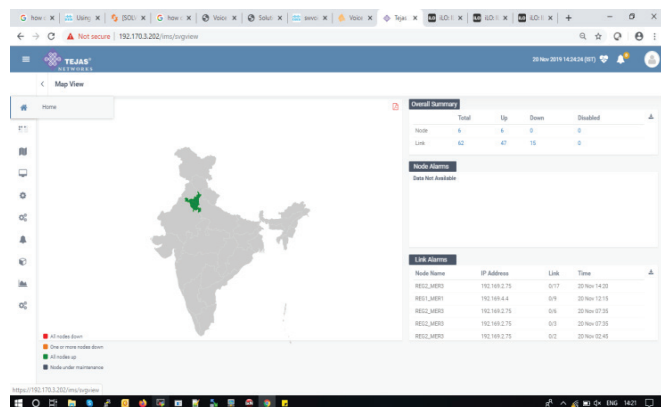
Monitoring Window

Conclusion

Network connectivity plays a major role in enabling interoperable access and interconnection among various elements and applications. Ethernet switches are a proven technology widely used for enabling high bandwidth applications in various networks across the world. Tejas Networks provide a wide range of Layer 2 & Layer 3 managed switches which are well suited for building Smart Cities, Defense, Strategic and Nationwide networks. Tejas "state of art" Management system ensures user friendly management from centralized location.