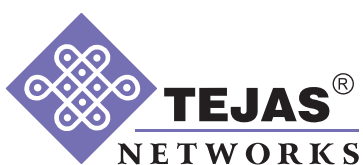# Leveraging Bharatnet Network for extending Last mile Access through GPON

TEJAS®
NETWORKS

Seamless high speed fiber optic connectivity for turning Digital India into reality

With the emergence of triple-play services (Internet + Television + Phone), more and more service providers are upgrading their existing networks to FTTH to deliver quality services and to attract more subscribers. The growth of fiber optics has led to optimized FTTx solutions providing cost-effective services and excellent bandwidth capabilities. This application note describes proposed FTTH network architecture by Tejas Networks which extends the existing BharatNet network to provide last mile connectivity to various villages

White Paper

Introduction

Digital revolution has heralded the arrival of significant bandwidth demands at access layer for enabling internet connectivity to Schools, Business enterprises & Govt offices. There is an explosive growth of applications requiring seamless connectivity. This rising demand for high speed internet is the key driver for the new access technologies. This in turn is bringing the optical fiber closer to the subscribers, which ensures faster connection and a true broadband experience. Further, bringing optical fibers closer to the subscribers will make the network future-proof and easier to scale to increasing bandwidth and changing application needs. Therefore, it is imperative to increase the utilization of network infrastructure by economically scaling network capacity through natural extension of the access network.

India Government has made significant investments during the last 3 years to deploy 'Digital India' concepts on a war footing with rapid and startling results. To fully realize this vision, the foremost requirement is to provide broadband connection to the facilities at affordable prices. This objective includes an on-demand availability of high-speed internet through FTTH in areas.

Extending the BharatNet connectivity beyond Gram Panchayat

The fiber connectivity is provided at each Gram Panchayat using GPON as a technology to cater to 2.5Gbps of Bandwidth at each location. OLTs procured as part of BBNL project has at most 32 OLT ports - 8xGE or 4x10GE uplinks with splitters(1:4) against every OLT port. Each OLT can support upto 25 Gram Panchayats hence giving immense scope to extend connectivity to villages on GPON. Various options for deploying village level connectivity are illustrated in detailed manner in this application note. Wi-Fi Access Points can also be deployed on GPON ONT which can serve regions up to 100+ meters..

With 5G set to be launched by early 2022, the bandwidth requirements exceeding 1Gbps can be catered only though fiber penetration as deeply as possible. BharatNet infrastructure ensures this by placing each ONT at Gram Panchayat level. The GPON ONT can be used to provide last-mile connectivity to various villages.

Deployment Methodologies

There are numerous implementation methodologies to extend BharatNet network to provide last-mile connectivity.. Some prominent methodologies are listed below:

1. Extending FTTH from existing Gram Panchayats using Mini-OLT

FTTH connectivity can be provided from Gram Panchayats by co-locating Mini OLT(8 Port or 16 Port). The GE(e) port of ONT located at Gram Panchayat backhauls the traffic from Mini OLT. With this schematic FTTH connections can be further provided to 1000 subscribers covering an area of 20kms.
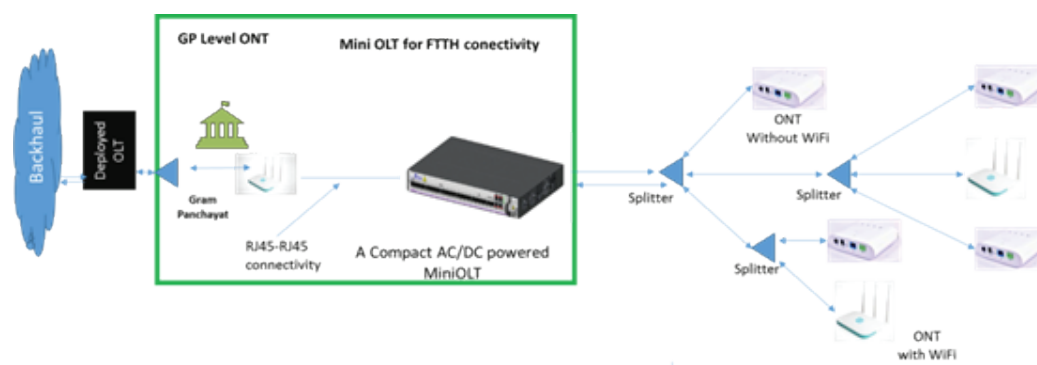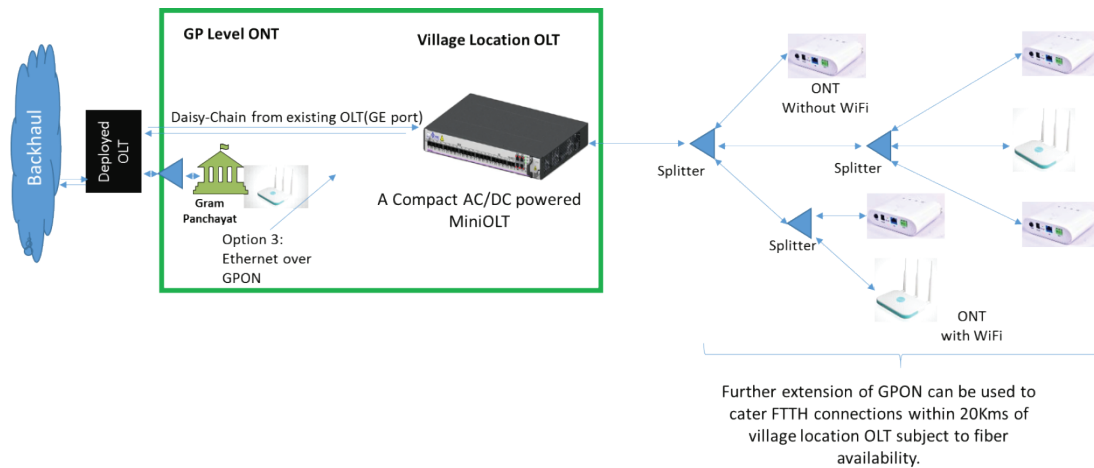
2. Extending BharatNet network using splitters and additional GPON ONTs

Villages can be directly connected to back-haul network by deploying GPON ONTs at Villages/institution/locations/ cluster through available splitter ports. GPON equipment deployed as a part of Digital India project is ITU-T standard based equipment & hence can interoperate with any ONT as per GPON standard.

GPON can be used to cater FTTH connections within 20Kms from OLT location (Block).
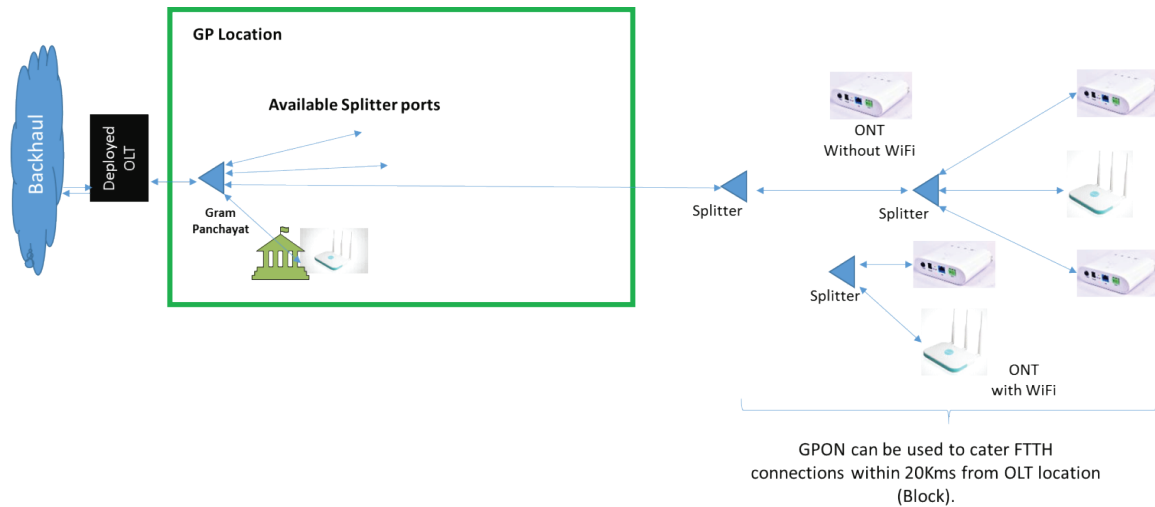
3. Daisy-Chain from existing OLT

OLT getting deployed as a part of BharatNet supports license based Carrier Ethernet feature sets ensuring the connectivity possibility to Village level OLTs at Network Interface ports. There are 8 Network uplink ports(8xGE) for connectivity towards back-haul. Hence two uplink ports of deployed ONT can be used to form any topology (Linear, Ring or Garland) as per network architecture. For realizing the same one fiber pair from existing OLT location to new location OLT would be used.

Further extension of GPON can be used to cater FTTH connections within 20Kms of village location OLT subject to fiber availability.

4. Extending reach to an institution upto 40 km using L2 Switch

Existing ONT Location at GP has 4xGE Ethernet LAN port. In order to cater to a location within 40 km, it is required to use GE(o) signal for which switch is required to be place at GP location & institution so that requisite bandwidth can be delivered. Single Fiber bidirectional ports (SFPs) would be used on switches at GP as well as Institution location. It is recommended to use extended temperature (up to 55 deg C), ruggedized switches.
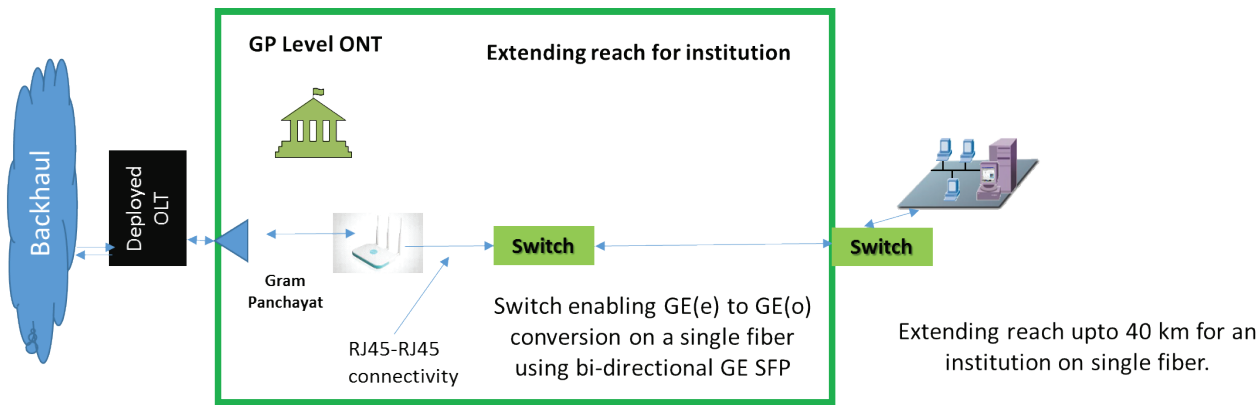
Key Application drivers for extending last mile connectivity.

Delivering secured enterprise connectivity: Business offices require secured L2 services connectivity between their multiple offices.
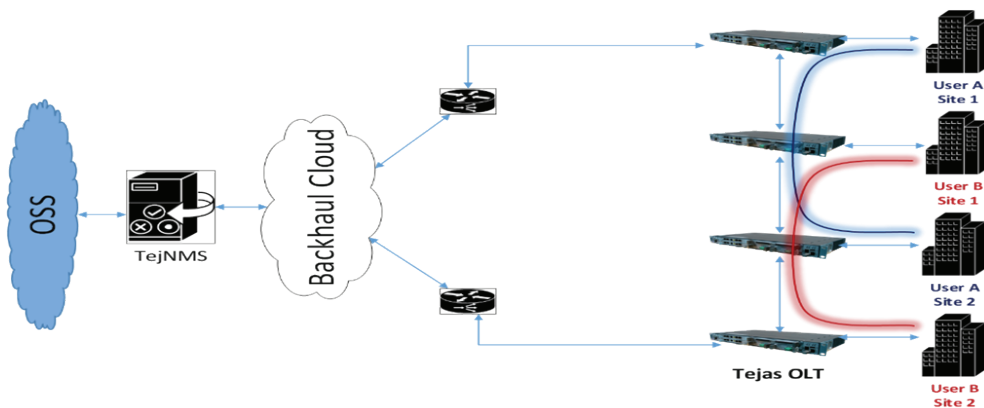
Surveillance Applications: CCTV cameras can be powered on & backhauled using Power over Ethernet ONTs on a single fiber.

Wi-Fi Internet: Wi-Fi Access Points can be powered on & backhauled using Power over Ethernet ONTs to cater to internet to citizens at various Hot-spots.

4G & 5G Backhaul: The bandwidth requirement of 1Gbps at gNode B(5G Base Station) & 100+ Mbps can best be catered by using GPON ONTs at these Base stations.

Residential Broadband: High Speed Internet connectivity at the scale of 1 Gbps to Homes.

Features of a future ready carrier class network:

In order to ensure state of art network there are minimal feature sets required on these platform. Some of the salient features are follows:

- **Carrier Ethernet functionalities:** Network OLT Devices should have multiple 10GE and GE uplink ports to be able to connect to each other. It should support Ethernet layer 2 feature sets along with QOS,802.1Q, 802.1ad, 802.1p,storm control and other carrier Ethernet feature sets..

- **Carrier class Resiliency:** Network OLT devices should support sub 50 ms protection switching independent of the backbone cloud.

- **Redundant & Modular Power Supply Modules:** Power Supply can be either AC or DC depending on the deployment scenarios. In order to ensure hassle-free deployment, the power supplies should be modular and administrators can dynamically adjust network-wide traffic flow by abstracting the control layer.

- **Power over Ethernet ONTs:** In order to ensure the power & bandwidth connectivity to CCTV cameras & Wi-Fi Access points, 4 Port PoE/PoE+ or 8 Port PoE/PoE+ ONTs are required to deliver surveillance & Internet over Wi-Fi Applications.
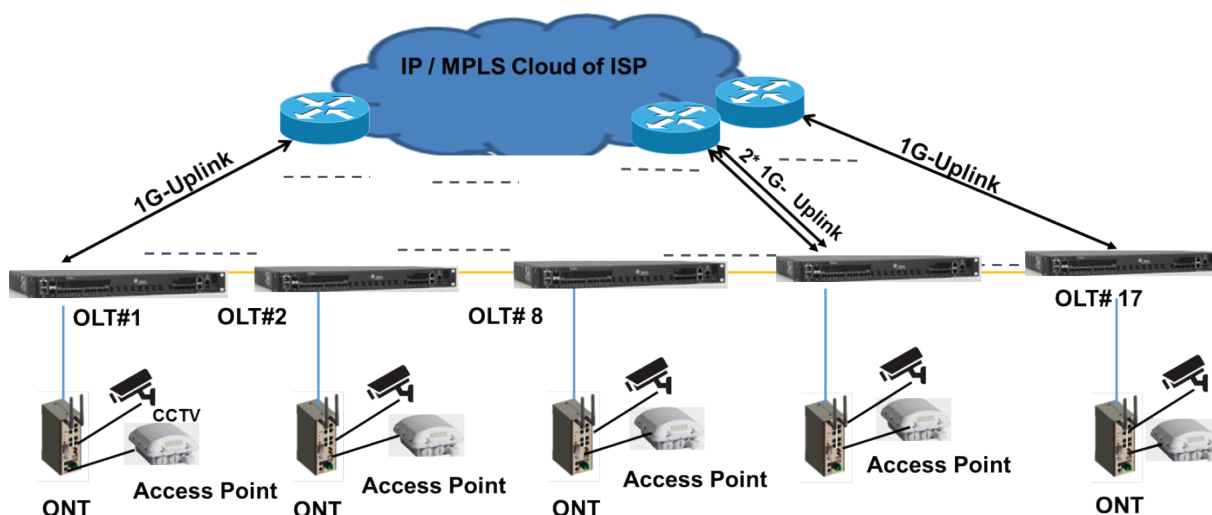
Tejas GPON Products

Tejas offers a series of advanced GPON ONT elements designed for next-generation Optical Access networks deployed in FTTH (Fiber-to-the-Home) and FTTB (Fiber-to-the-Building) formats. It addresses the rapidly growing service provider needs for flexible, high-capacity fixed-line broadband solutions to support emerging high bandwidth video applications (e.g., IPTV, Mobile backhaul, MTU, VOD) in enterprise, residential deployments, aggregation of backhaul traffic from LTE cell sites, enterprise VPN Services and SD-WAN networks based on NFV paradigm.

Tejas has as a full GPON solution that includes both TJ1400 OLT (Optical Line Terminal) and TJ2100N ONT (Optical Network Terminal) platforms.

TJ1400 Optical Line Terminal (OLT) is a Converged Broadband Access and Packet Transport platform that is designed to simultaneously deliver both new-age fiber broadband services and packet transmission services over an integrated platform. TJ1400 OLT integrates high-capacity optical backhaul with high-speed broadband access to reduce the total equipment footprint and lower the total lifecycle cost of ownership for telecom operators. TJ1400 OLT is built using advanced MPLS transport technology that offers a cost-effective alternative to expensive and complex IP routing technology for building networks that can optimally carry both mobile broadband (3G/4G/ LTE) and fiber broadband data traffic.

Types of TJ1400-OLT

Products	Mini-OLT		Medium-OLT
	TJ1400-1 8P	TJ1400-1 16P	TJ1400-7
Functionality	GPON 8xOLT with L2 switch —2x10G SNI	GPON 16xOLT with L2 switch — 4x10G SNI	GPON OLT with L2 switch
Connections	In 1RU, 1000/2000 terminal connections possible using 1:128 split.		In 2RU, 2000 Residential BB connections possible using 1:64 split per PON port
Uplink (SNI)	2x10GE+4xGE	4x10GE+4xGE	CEF8-1 Card: 5x10GE/5x1GE CEF7S Card: 2x1GE+ 1x10GbE/2x10GE CEF7X Card: 2x10G CEF7G Card: 4x1GbE (with Redundant Switch Fabric)
PON Ports (Max)	8*2.5	16*2.5	32 (with CEF7)/40 (with CEF8-1)
Temperature range	0 to 65 degC	0 to 50 degC	0 to 50degC
Power	Maximum = 70 W	Maximum = 110 W	Maximum = 425 W
Physical Dimensions (HxWxD)	44x414x204 (mm) (1RU)	44x414x204 (mm) (1RU)	88x444x237 (mm)

Conclusion

For realizing the vision of Digital India, it is imperative to extend the BharatNet network to provide last-mile connectivity to 6.5 lakh villages across the country. Proposed options can help in monetizing the BBNL infrastructure almost at no time hence ensuring high bandwidth roll-outs & 5G connectivity pan India at whatever location possible

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