EPON (FTTx) NETWORK DESIGN

A Case Study

PROJECT OVERVIEW

The project involved the design of an EPON (Ethernet Passive Optical Network) to provide Fiber-to-the-Home (FTTH) connectivity for a residential service area. The objective was to design a point-to-multipoint passive optical network connecting the Central Office (Hub/OLT) to all subscriber locations using passive optical components. The design focused on optimizing fiber routing, splitter placement, optical power budget, and material utilization while ensuring scalability for future subscriber growth.

SCOPE OF WORK

- Review customer planning inputs, base maps, and engineering requirements.
- Prepare D1 planning by designing feeder and distribution fiber routes.
- Define PON segment boundaries.
- Place splitters, splice enclosures, MSTs, NAPs, and BUDI boxes.
- Perform D2 connectivity design, including splitter assignments and internal connectivity.
- Generate CAD Matrix, Bill of Materials (BOM), and project deliverables.
- Perform Quality Control (QC) and Quality Assurance (QA).

Design Process

Design Input Review

The engineering team reviewed customer inputs, including base maps, backbone MUX information, housing layouts, splitter ratios, PON segment boundaries, and planning instructions. The design approach was finalized based on customer engineering standards before beginning network planning.

D1 Planning

The feeder and distribution fiber network was designed by establishing PON segment boundaries and routing fiber from the Central Office/OLT to the distribution network. Splitters, splice closures, MSTs, NAPs, and BUDI boxes were strategically placed to optimize fiber utilization, reduce construction costs, and support future network expansion.

D2 Network Design

After D1 approval, detailed connectivity was completed by assigning splitter ports, updating splice enclosures, configuring internal connectivity, updating device attributes, and assigning customer drop connectivity. Housing annotations, MID text, RMPN propagation, and tail lengths were updated according to customer standards.

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Layer Informatics Pvt. Ltd.
Vision Through Mapping

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Network Optimization

The EPON network was engineered to:

- Provide complete subscriber connectivity from the OLT to every customer.
- Optimize splitter utilization and fiber assignments.
- Maintain optical power budgets within allowable limits.
- Reduce feeder and distribution fiber requirements.
- Minimize construction costs while supporting future subscriber growth and network scalability.

Bill of Materials and CAD Matrix

A comprehensive Bill of Materials (BOM) was generated to account for all network components, including fiber cables, splitters, splice closures, MSTs, NAPs, and BUDI boxes. A CAD Matrix was also prepared to graphically represent the complete internal connectivity, providing a clear reference for construction and future maintenance.

Quality Control

Each completed design underwent a comprehensive QC review to verify:

- Fiber routing continuity
- PON segment boundaries
- Splitter placement and splitter ratios
- Internal connectivity
- Splice enclosure updates
- Device labeling and attributes
- Optical connectivity
- Housing assignments
- BOM accuracy
- CAD Matrix accuracy
- Compliance with customer engineering standards

Any identified issues were corrected before Quality Assurance.

Quality Assurance

A final engineering review validated the complete design package, ensuring compliance with customer standards, connectivity requirements, drafting standards, and project specifications prior to delivery.

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Deliverables

The completed project included:

- D1 Design Before & After PDFs
- D2 Design Package
- Device Report
- CAD Matrix (DWG/PDF)
- Address List
- Footage & Passing (F&P) Report • Bill of Materials (BOM)
- Final Design Package

Key Design Considerations

- Optimized feeder and distribution fiber routing.
- Efficient splitter placement based on approved splitter ratios.
- Complete end-to-end connectivity from OLT to every subscriber.
- Compliance with optical power budget requirements.
- Accurate internal connectivity documentation through CAD Matrix.
- Optimized material utilization to reduce construction costs.
- Scalable network design to support future subscriber growth.
- Compliance with customer engineering, drafting, and naming standards.

Outcome

The EPON design project was successfully completed by delivering a fully connected passive optical network from the Central Office (OLT) to all planned subscriber locations. The network design optimized fiber utilization, splitter placement, and construction costs while maintaining optical performance within customer specifications. The final deliverables—including D1 and D2 designs, CAD Matrix, BOM, device reports, and construction documentation—enabled efficient field implementation, simplified future maintenance, and provided a scalable foundation for future FTTH network expansion.