# BROADBAND CONNECTIVITY USING OPTICAL ACCESS FOR THE EASTERN PROVINCE OF SRI LANKA

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## Abstract

In Sri Lanka the widely used wired technology for broadband access is Asymmetric Digital Subscriber Line (ADSL). Fiber access is available in the Western Province with limited usage such as for business purposes. The Eastern Province is the focus for this research because it is one of the affected areas during the last two decades of war and therefore has limited facilities for the people living in that part of the country. The development work in the Eastern Province is in progress at present and it also includes facilities for broadband access.

ADSL broadband usage within Eastern Province is available but limited to city areas only. This work focuses on a system to implement Fiber to the Home (FTTH) for the Eastern Province and thus provide efficient broadband access for its people. The available Fiber Access technologies are analyzed and the most suitable one is selected for implementation. The thesis proposes a network based on Passive Optical Network (PON) technology to be employed with Gigabit PON (GPON) in order to provide FTTH to a wider area of the Eastern Province. The GPON technology includes Coarse Wavelength Division Multiplexing (CWDM) with Time Division Multiple Access (TDMA); known as Hybrid PON.

For the selected four cities Optical Line Terminal (OLT) locations are identified and Ring topology access is used with Remote Nodes which can be expandable when customer number increased.

A cost estimate using the current equipment prices and the payback of the capital are calculated and presented in the thesis. The performance of the proposed network is analyzed which includes the Link Power Budget and the Bit Error Rate (BER). The performance analysis shows that the proposed Optical Access Network using GPON is feasible for implementation in the Eastern Province.

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## LIST OF ABBREVIATIONS

| Abbreviation | Description |
|---|---|
| ADSL | Asymmetric DSL |
| AGC | Automatic Gain Control |
| AON | Active Optical Network |
| ATM | Asynchronous Transfer Mode |
| AWG | Arrayed Waveguide Gratings |
| BER | Bit Error Rate |
| CDR | Clock-and-Data Recovery |
| CMTS | Cable Modem Termination System |
| CO | Central Office |
| CWDM | Coarse Wavelength Division Multiplexing |
| DBA | Dynamic Bandwidth Allocation |
| DF | Distributed Fiber |
| DFB | Distributed Feedback |
| DSL | Digital Subscriber Line |

| | |
|---|---|
| DWDM | Dense Wavelength Division Multiplexing |
| EDFA | Erbium doped Fiber Amplifier |
| EPON | Ethernet Passive Optical Network |
| FDD | Frequency Division Duplex |
| FTTC | Fiber to the curb |
| FTTH | Fiber to the home |
| FWM | Four-Wave Mixing |
| GEM | General Encapsulation Method |
| GVD | Group –Velocity Dispersion |
| HDSL | Bit Rate DSL |
| HDTV | High High-Definition Television |
| HSBB | High Speed Broadband |
| IDI | ICT Development Index |
| IEEE | Institute of Electrical and Electronics Engineers |
| ITU-T | International Telecommunication Union-Telecommunication standardization sector |

| | |
|---|---|
| LMDS | Local Multipoint Distribution Service |
| MAC | Media Access Control |
| MMDS | Multichannel Multipoint Distribution Service |
| MPCP | Multiple-Point Control Protocol |
| O/E/O | Optical/Electrical/Optical |
| ODN | Optical Distribution Network |
| OFDM | Orthogonal Frequency Division Multiplexing |
| OLT | Optical Line Terminal |
| ONT | Optical Network Terminator |
| ONU | Optical Network Unit |
| P2P | Point-to-Point |
| PDF | Probability Distribution Function |
| PMD | Polarization Mode Dispersion |
| PON | Passive Optical Network |
| QAM | Quadrature Amplitude Modulation |
| QoS | Quality of Service |

| | |
|---|---|
| QPSK | Quadrature Phase Shift Keying |
| RMS | Root Mean Square |
| RN | Remote Node |
| SOA | Semiconductor Optical Amplifier |
| SONET | Synchronous Optical Network |
| TDD | Time Division Duplex |
| TDM | Time-Division Multiplexing |
| VDSL | Very high Bit Rate DSL |
| Wi-Fi | Wireless Fidelity |