

# Fiber to the Home GPON Networks Analyzer with OLT Emulator

## Features

### Capture+Analyze+Evaluate in 1 click

Starting from the captured data, it is capable of inferring the network topology and applying a series of rules to verify the compliance with the ITU-T G. 984.x recommendation. Its automatic adaptive synchronization, automatic calibration and easy interface makes it easy to use from the first day.

### Precise detection of problems in a GPON network

Evaluates and detects problems in a GPON network, detailing the equipment and the cause of the malfunction.

### Real time user traffic extraction

GPON Doctor™ extracts decrypted user traffic in real time and at Ethernet layer. This traffic is made available at the 10/100/1000BaseT interface for its monitoring and upper layer analysis by external network analyzing tools and/or other application tools. Its hardware decoder fully supports AES automatic decryption combined with FEC encoding.

### Service regeneration and QoS Evaluation

GPON Doctor™ can regenerate services established over a PON network. i.e. Multicast video can be sniffed & reassembled in real time and watched on GPON Doctor's™ screen. This feature is perfect to evaluate QoS and QoE of configured services over a PON.

### Real time GPON Capture

GPON Doctor™ captures GTC and OMCI messages over the fibre in Real Time to help to keep track of negotiation processes and configurations, showing in real time the status of ONTs, GEM and TCONT.

### OLT Emulation

Emulates OLT functionality, allowing to build specific provisioning models and configure OMCI entities individually and sequentially, carrying real traffic at 10Gbp/s.

### Detailed diagrams of OMCI entities and BW allocation

Displays a detailed entity-relation OMCI diagram with alarms and errors, diagrams of the bandwidth allocation per ONT and TCONT and diagrams of the evolution in time of the bandwidth allocation.

### Chipset-Less Implementation

Capture hardware exclusively developed for this product. **Results are not biased by any vendor proprietary GPON hardware implementation.**



## Description

**GPON Doctor™ 8000** is a passive, chipset-less GPON FTTH protocol sniffer and analyzer. Connected to any location within your PON distribution network (ODN), will capture downstream and upstream bit-level information. Provides comprehensive analysis of the GTC layer: OAM, PLOAM, and OMCI.

GPON Doctor™ is mainly oriented for **problem detection, certification and interoperability tests**, being a perfect tool for lab application engineers engaged in GPON deployment phase or GPON active elements developers/integrators.

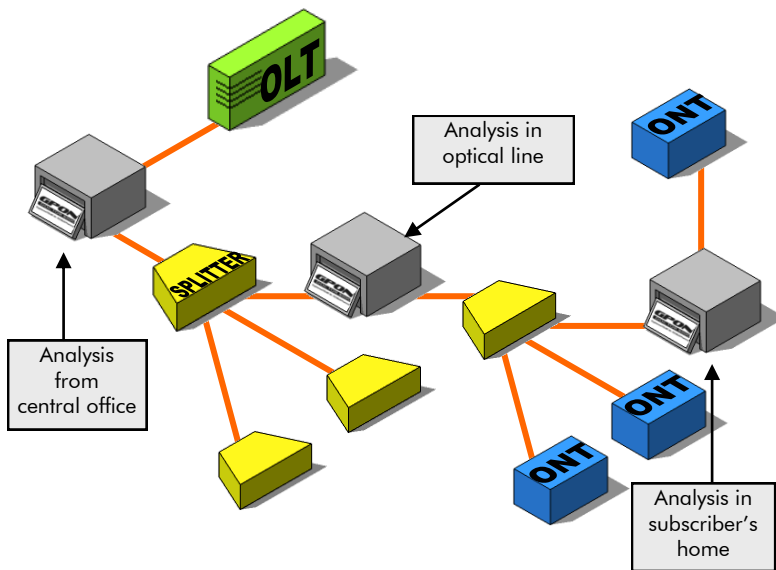
GPON Doctor™ is a complete and autonomous solution: Composed by a GPON capture + evaluator card, an "state of art" chassis and a processing software capable of analyzing and evaluating the captured data.

Based on our own implementation, the capture hardware includes last generation optical modules and great processing power. Capable of synchronizing with the Downstream and Upstream data flow of the GPON fiber and performing automatic calibration, and allowing long length captures. It also **extract and decrypt in real time Ethernet traffic** from the upper layer, allowing to regenerate services like video or VoIP.

The Analysis Software interprets the captured data and allows the operator to inspect the control flow from the first to the last frame, selecting and filtering data following configurable criteria. It also analyzes the content of the control information inferring the topology and state of a GPON network: ONTs detected, data channels established, configuration exchanged, **OMCI E/R diagram, bandwidth analysis and graphics for every ONT and by TCONT.**

In addition, it has an integrated **OLT emulator** that allows to configure different models depending on the OLT provisioning model desired to be emulated, allowing to send OMCI messages individually and sequentially.

Based in **Windows XP Embedded**, GPON Doctor can include (according to customer needs) other office and analyze tools for other service protocols used over GPON. Very intuitive and usable, with a very low learning curve that lets you start using it right from the start.



**Analysis and identification in GPON Networks**

### Problems in PON and GPON networks

With the aim of reducing the ONTs price it is important that any OLT is capable to interact with any ONT regardless its manufacturer. However, GPON has a number of intrinsic characteristics that could make difficult the interoperability among manufacturers:

- Commercial implementations from earlier versions of the standard.
- Problems during the activation process.
- Misinterpretation of the standard.
- OMCI, a very broad standard.
- Heterogeneity among operators.

Furthermore, the structure of a PON network is a fiber that is divided over using optical power dividers or splitters. At this point it appears the concept of "degree of splitting", defined as the number of divisions that suffers the fiber to reach an ONT. The degree of splitting indicates that the percentage of optical power arriving to an ONT. Attenuation in a GPON circuit can be very high due to the sum of fibre splitting, connectorization (Insertion loss), fusion splice, and distance in the fiber, and thus, some of the network active elements operate under stress conditions.

All these factors imply a great challenge in the deployment of GPON networks.

### Transparent analysis and Capture

The GPON-Doctor™ 8000 transparently analyze traffic within a FTTH network. Moreover, its automatic calibration and built-in touch screen into a high performance chassis, makes it possible with just one click to have a full capture of GPON network traffic.

The capture can be very long (e.g. 30 minutes) and allows captured data export to XML format for later analysis.

### Network analysis and evaluation

The analysis software interprets the captured data and translates it into a graphical and categorized format that can be easily used for in-depth analysis of GPON protocol compliance, interoperability evaluation, bandwidth assignments and field deployment troubleshooting.

The data captured by the GPON Doctor™ are analyzed to enable the view of:

- GPON network topology: ONTs detected, ONTs and OLT operational status, data channels established.
- Entities created and the detailed relationships among them, including errors and alarms generated.
- Bandwidth assignment graphics per ONT and TCONT and its evolution in time.
- Degree of standard compliance, by applying an evaluation system for the ITU-T G.984.x protocol based on contextualized dynamic rules.

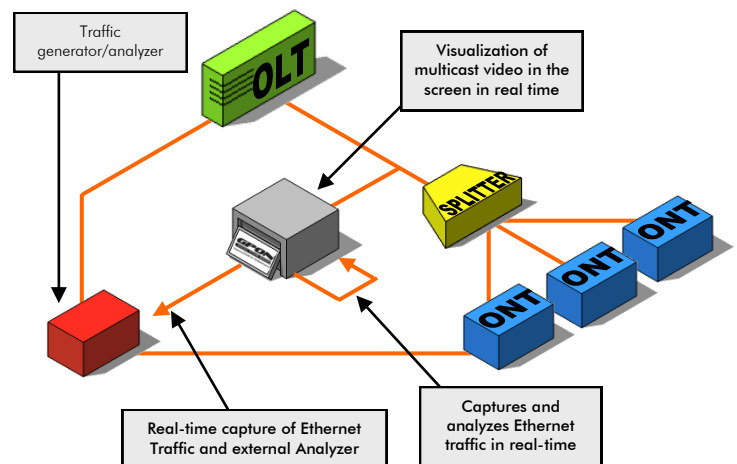
### Real time upper layer Ethernet traffic extraction

GPON-Doctor™ 8000 allows clear-text user traffic extraction in real-time for both upstream and downstream. The traffic is extracted at Ethernet layer.

This traffic can be further analysed by upper layer protocol analyzers, either external or by a software network protocol analyzer installed within the GPON Doctor™.

The combination of the GPON Doctor™ with a traffic generator and, an external or internal analyzer that incorporates GPON-Doctor™ 8000, is a powerful setup to verify the correct transmission of data over the network.

**This feature can be also used to regenerate in real time services in GPON Doctor™ itself: watching Multicast Video flows in its screen, hearing sound of voice services, analyze QoS & QoE, etc.**



**Real-time user traffic extraction**

### OLT Emulation

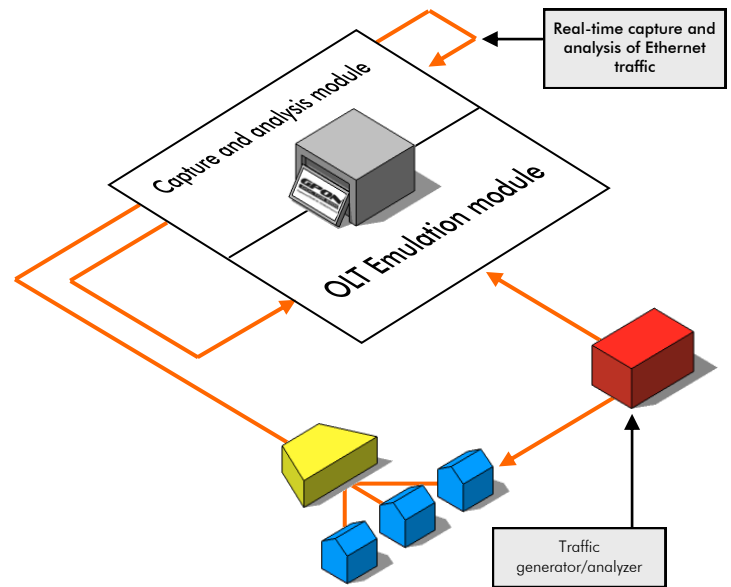
GPON-Doctor™ 8000 is capable of emulating a OLT. **Different configurations and templates can be generated to emulate commercial OLTs** with which to monitor and compare the behaviour of an ONT.

The OLT emulation module allows the **reception and report of events**, messages and alarms linked to the responses to each of the OMCI messages sent to the ONT.

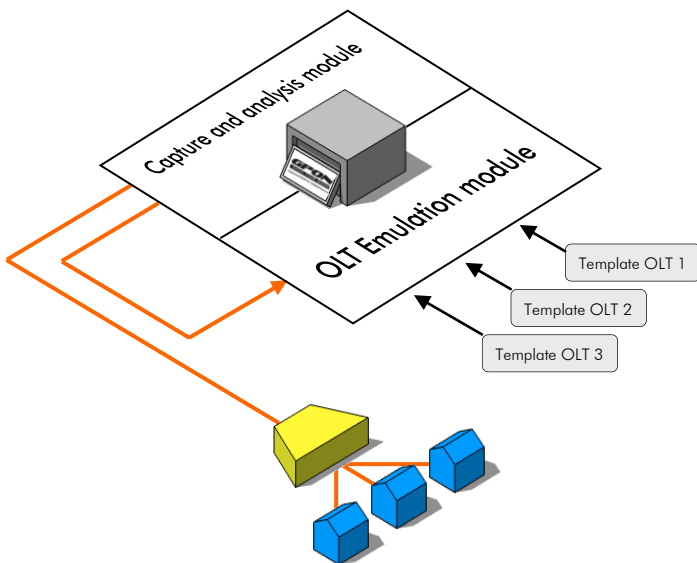
The module not only acts as OMCI master, it also supports **generation of PLOAM message to perform different functions at GTC level**: Enable and Configure the GEM OMCC port, password authentication tests, etc.

At OMCI level, the emulator behaviour can be programmed using operation templates, or it also offers the ability to **manipulate one by one, interactively, resident OMCI entities in each ONT**: Operations of Creation, Destruction, Reading, Writing, Test, etc.

GPON Doctor™ 8000 supports the reception and transmission of traffic encapsulated in GEM frames, **carrying real Ethernet traffic through a 10Gbp/s transport interface**. Through this port, a traffic generator can be connected, and together with the capture and analysis module and its ability of real-time traffic extraction and analysis, enables the detection of traffic deviations within the data transmission among the ONTs and the OLT (Point of network with packet loss, error sources). This interface also supports various **configurations for filtering and VLAN tagging** both at ONT and OLT level.



Settings for ONT conformance testing



Using templates for emulation of different commercial OLT

### Technical features of OLT emulation module

Meets the requirements of ITU-T G.984.3

GPON B+ SFP optical interface according to ITU-T G.984.2 standard. Supports Up to 60 Km range and 1:64 splitting ratio.

Support for managing entities defined in ITU-T G. 984.4

10Gbps XFP Ethernet transport Interface

Setting of OMCI creation messages using programmable templates

Individually OMCI messages sending

OMCI master behaviour

Supports sending and receiving real Ethernet traffic encapsulated in GEM frames

Receiving messages, events and alarms from the ONTs into Ethernet/GEM frames

PLOAM messages generation to activate and configure a detected ONT.

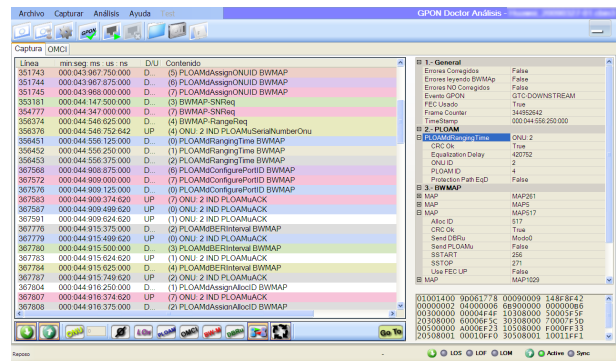
Simultaneous monitoring of multiple ONTs

GPON Analyzer and OLT Emulator integrated on a single equipment

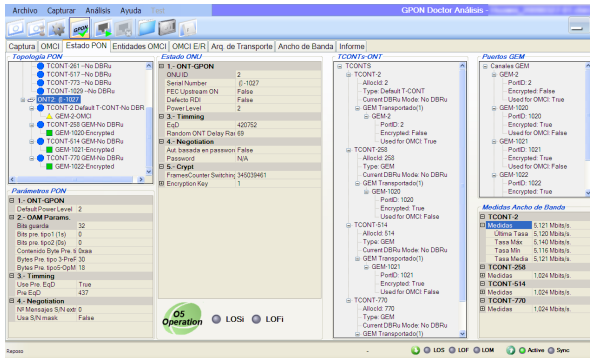
Supports 802.1ad, 802.1Q and 802.1p



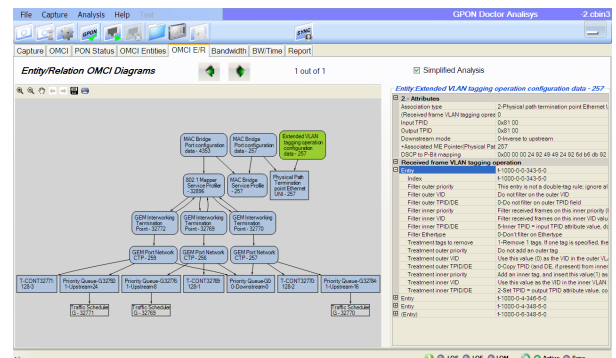
Start screen



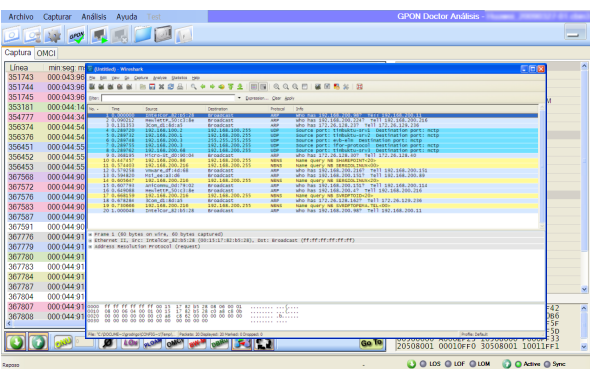
Control traffic analysis GPON 984.3 y 984.4



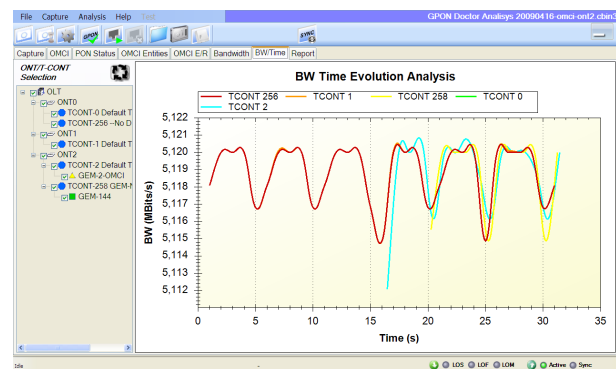
ONTs GPON state (GTC and OMCI)



Entity-relation diagram of OMCI entities



Real Time Extraction using Industry standard application



Analysis of bandwidth per ONT and TCONT

## Technical Specifications

### Application examples

- GPON problems identification in a FTTH network.
- Interoperability troubleshooting among different vendors equipment coexisting in a Telco access network.
- Diagnosis and Analysis of events, alarms and errors in already deployed GPON networks.
- Evaluation of protocol compliance during the development of GPON OLTs and ONTs.
- Analysis of user traffic and evaluation of quality of services in the GPON Networks through its Ethernet interface.
- GPON 984.x interoperability test.
- Fundamental tool for GPON new network deployment, equipment development and certification.
- Knowledge of the Network state and all its active elements (ONTs).

### Technical features

- Capture OAM + PLOAM control data and OMCI messages (full support).
- Real Time PLOAM + OMCI + Negotiation messages capture.
- Long duration captures (~30 minutes).
- Low attenuation (<1.5 dB) internal fibre tap module, perfect for field environment or optical lab analysis.
- Infers the GTC machines in ONTs state and the ONTs OMCI entities state/value.
- Infers network topology: ONU/ONTs, OLT.
- Evaluation of the compliance degree with the ITU-G.984.x standard, generating a list of standard inconsistencies and violations.
- Bandwidth distribution analysis per T-CONTs for every ONT and its evolution in time.
- Real time user's Ethernet traffic extraction and services decryption, regeneration and monitoring: Multicast Video, Voice...
- GPON Analyzer and OLT Emulator integrated in the same equipment.
- Adaptive synchronization and automatic calibration.
- Windows XP Embedded Operating System.
- Automatic behaviour: capture, analyze and evaluate in one click.
- Captures storage for further analysis by the GPON-Doctor™.
- Hardware/software customization upon request.
- Size: 435 x 220 x 390mm
- Weight with hardcase and complements: +30Kgs.

### Interfaces

- Touch screen (High definition colour TFT, 12", 1280x800).
- 2xGigabit Ethernet Capture/Management modules: QinQ Transparent/Stripping configurable..
- Gigabit Ethernet over GPON Real Time Extraction port: External network protocol analyzer plug in
- 6x USB 2.0 to easy transfer data, traces and reports export.
- GPON capture/extraction interfaces:
  - Downstream: SC-APC Single Mode 1490nm (2,5Gbps)
  - Upstream: SC- APC Single Mode 1310nm (1,25Gbps)



# GPON DOCTOR 8000

**Engineered TELNET-RI • TECNALIA Powered**

GPON-Doctor, GPON-Doctor 4000 & GPON-Doctor 8000 are registered trademarks owned by TELNET Redes Inteligentes S.A. and Tecnalia Corporación Tecnológica.

## Contact Information

### Headquarters

Polígono Industrial Centrovía  
c/ Buenos Aires, 18  
50196 La Muela, Zaragoza  
Spain  
Tel.: (+34) 976 14 18 00  
Fax: (+34) 976 14 18 10  
comercial@telnet-ri.es

### Commercial office in Madrid

Avda. Menéndez Pelayo, 85 - 1º A  
28007 Madrid  
Spain  
Tel.: (+34) 91 434 39 92  
Fax: (+34) 91 434 40 84

### Subsidiary in Portugal

NETIBERTEL  
Avenida da Liberdade, 110  
1269- 046 Lisbon  
Portugal