

# Qubit GPON Operations KIT

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**Abstract- Deployment and operations of FTTH GPON network includes brownfield operations- customer and internal work order management, alarm management, customer trouble tickets management, financial management and marketing. Qubit GPON Operations Kit provides a solution to manage all these aspects efficiently and systematically.**

**Keywords- OLT, ONU, GPON, FTTH, BOM, CTTS**

## I. Introduction

A passive optical network (PON) is a point-to-multipoint, fiber to the premises network architecture in which unpowered optical splitters are used to enable a single optical fiber to serve multiple premises, typically 16-128. A PON consists of an optical line terminal (OLT) at the service provider's central office and a number of optical network units (ONUs) near end users. First of all PON was, ATM PON (APON) which evolved in Broadband PON (BPON). BPON is backward compatible with APON. Ethernet PON (EPON and newer GePON) is alternate solution for PON networks. It is IEEE standard not compatible with A/BPON. It is PON exclusively for Ethernet and IP traffic. Gigabit Passive Optical Network (GPON) is defined by ITU-T recommendation series G.984.1 through G.984.4.

GPON has enhanced capability comparing with APON and BPON and is backward compatible. G.984 standard series define general characteristics of GPON (G.984.1) as well as physical layer specification (G.984.2), transmission layer specification (G.984.3) and ONU (Optical Network Unit) management and control specification (G.984.4). GPON can transport not only Ethernet, but ATM and TDM (including PSTN, ISDN, E1 and E3) traffic by using GPON encapsulating method (GEM).

## II. Brownfield operations in FTTH GPON Network

### OA & M Operations

- Customer work orders
- Internal work order
- Routine operational maintenance
- General Repairs, Upgrades and Replacement

### Capacity planning

- Take rate for POPs covered
- Capacity growth- resource availability: optical elements and their ports, fiber and fiber carrying elements
- Capacity growth- Available BW, Forecasted traffic growth
- Customer experience- Usage, Peak demand by busy hour and experience by application
- Managed capacity through provisioning intelligence

- Better SLAs management and service plan offerings

### Business Operational Excellence

- Material, inventory and resource planning and management
- Revenue management by fiber, port, customer
- Cost management by resource, activity and service
- Inventory control of non-performing assets such as damaged fibers and elements, dark fiber, legacy network elements

### Network Utilization

- Managing the differentiated services and applications to Committed Information Rate
- Traffic shaping to manage capacity between SLAs for fixed, guaranteed, non-assured and best effort traffic volumes at instances of time
- Alarm and trouble ticket management and dis-positioning

A Brown Field operation for FTTH GPON network refers to using an existing FTTH GPON network to perform changes, build or expand. Work can be created by customer, marketing or network operations. Each of these operations can be done systematically to minimize the cost and utilize the existing GPON network efficiently.

Brown Field operation can be categorized into customer work order management, internal work order management, alarm management, customer trouble tickets (CTTS) management, and inventory management, finance and marketing management. Provisioning Intelligence is a smart way of preventing future

troubles and is a necessary tool for operational excellence.

### III. Customer and Internal work order management

Customer work order management includes request from customers about new connections and deployment of FTTH connections to the customers based on the priority assigned to request and desired service plan.

Qubit GPON Operations Kit eases the planning and deployment of network and physical elements by providing map based control on a canvas to a network planner. Network planner can plan a change in network based on work order request. Network planner can place, splice or connect any set of physical and logical elements towards changes in FTTH network. Plan can take decisions based on route guides for optimum path manually or automatically.

UIs helps planner to see the complete existing and built network elements, status of ports of each network elements and all its specifications. Paths through which fiber is traversing including all fiber hierarchy – micro-duct, sub-duct, duct, tube, and trench is easily displayed. Provision to verify link budget to make sure that link will be operational will also been done.

Planned changes are queued to the field team, if necessary, for verification and approval.

Basic steps needed to configure and test for final network connectivity based on programmed rules of business policy engine to ensure excellence in customer fulfillment. These set of activities may require the field technical team to co-ordinate with the NOC.

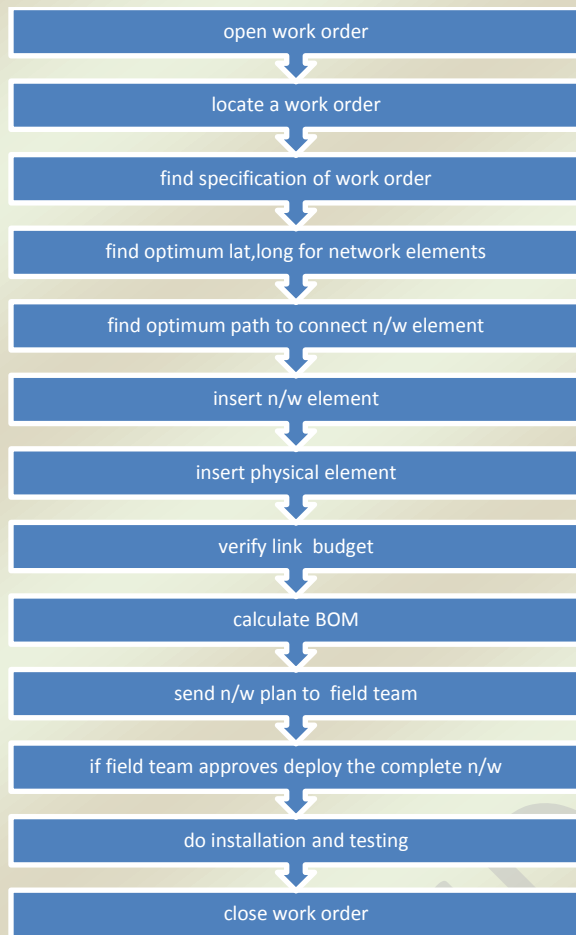


Figure3.1 Customer Work order management

It is clear that several teams need to coordinate to fulfill the work order requirements. Therefore, the tool provides a work portal for each functional with contextual controls and information for their set of activities.

Internal work orders pertaining to company's General Repairs, Upgrades and Replacement can be dealt with in similar series of planned steps.

#### IV. Network operation & Alarm management

Efficient network operation is fundamental to business. Network operational efficiency can be prognostic- alerts, information, or reactionary-alarms and shutdowns.

These alerts, configured based on Key performance indicators (KPIs), give information about monitored activity and set thresholds' crossings' in an operational GPON network. This information can be remotely recovered from ONT and OLT in GPON using managed entities to complement OMCI MIB with remote log features. OSS logs recovered in timely intervals also provide this level of information. In these cases, Qubit kit can integrate with the data sources directly.

GPON FTTH network contains various alarms associated with network elements OLT and ONT/ONUs. These alarms are divided into various types minor, major and severe. Depending upon type of alarms various actions are taken to rectify it. Alarm management is a key feature of Qubit GPON Operations Kit. It takes alarm status remotely from ONUs using remote log and displays these alarms on a map for a particular region based on severity of these alarms and also suggests actions that needs to be done. Business policy engine can lay down rules for suppressing, clearing or fixing of these alarms.

The kit offers communication, coordination and tracking mechanisms for each trouble ticket till dis-positioning throughout its traversal along work functions of the organization.

#### V. CTTS management

CTTS stands for customer trouble tickets which are complaints from customers about any malfunctioning of their services like call failure, poor voice quality, internet access failure, no connectivity etc.

These CTTS are managed by using various steps ranging from monitoring alarms and LEDs of networking elements , finding the fault in optical fiber is using OTDR (optical time domain reflectometer ) and also by using power meter

to check whether received and transmitted power is in recommended range or not.

The kit offers communication and tracking mechanisms for each trouble ticket till dis-positioning throughout its traversal along work functions of the organization.

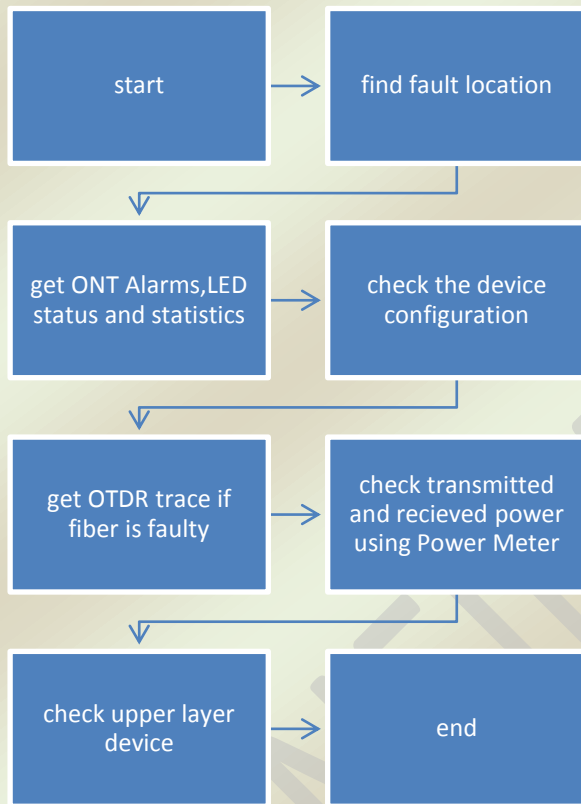


Figure 5.1 CTTS Management

Qubit GPON KPI Kit gives all the steps needed to solve CTTS by providing the necessary actions needed to be taken for each type of customer trouble tickets.

## VI. Finance

Finance control is an important aspect in brown field FTTH network operation to keep an eye on

business bottom line. Cost of operations can make or break a business model in a very competitive market.

Qubit operational kit offers financial analysis upwards from work order level. Analysis can be on revenues, costs, utilization rates or down times. The information can be organized my many dimensions such as by time, by area of operations etc.

For example, financial operations that affect the bill of material (BOM) include cost of new network elements, new physical elements, cost of testing, labor cost etc. Operations Kit gives complete BOM calculation for each activity and material in work order. This along with provisioning intelligence gives an idea to both network and finance planners on total costs incurred for a customer connection and if that connection is going to lead to customer fulfillment.

## VII. Marketing

Major effort of marketing is to steer the efforts to those POPs that are most promising in terms of 'Take rate', making the conversions happen and predicting requirements on the network.

Qubit GPON operational kit along with the KPI kit provides up to date information on provisioned customers for analysis and prediction. Some planning with location intelligence can be performed on capacity expansion.

Qubit Greenfield kit provides the complete planning and validation software for major expansions or Greenfield planning.