

Hands-On LIVE Virtual Calix E7 Maintenance and Troubleshooting (AXOS)



Course Description

The Calix E7-2 Maintenance and Troubleshooting (AXOS) Virtual Live Instructor-led course provides the skills required to perform detailed maintenance and troubleshooting on the Calix E7 system, including with various OLTs and ONTs found within the latest XGSPON and NG-PON2 networks, as well as AE and Ethernet networks. It discusses the theory and system architecture used by the latest Calix AXOS-enabled networks, and compares this to previous EXA networks.

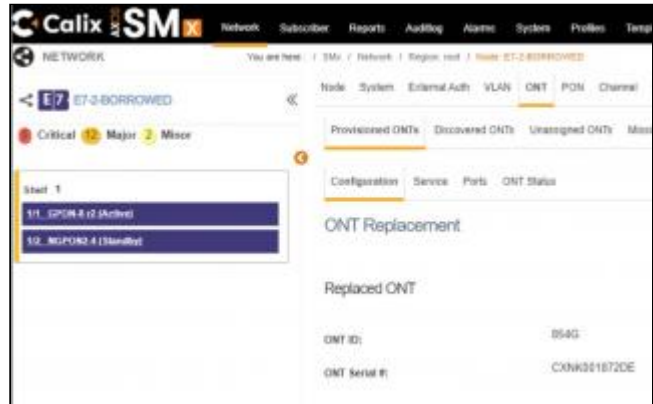
Multiple new features are discussed, including the latest 10G-capable ONTs, as well as existing GPON & AE ONTs. The GR-303 TDM Gateway interface for a traditional TDM switch is explained, which is still used in many networks. Primary network elements like the latest OLT cards are introduced, including GPON/XGS/NG-PON, plus CE201 and other AXOS-enabled GE cards. FTTP components are discussed, including Erbium-Doped Fiber Amplifiers (EDFA's), filters, splitters, transceivers, and different cable and connector types. Both the E7-2 and E7-20 are described, although a focus is placed on the E7-2 which supports the latest AXOS offerings. Features like 10G Ethernet, POTS, T1, Pseudowire, and IPTV are explained, along with Ethernet-over-Fiber uplink options including LAG, and fiber ring protection schemes.

The latest Services Management Connector (SMx) is shown, and compared to the existing Calix Management System (CMS) and the limited EWI web interface, along with Command Line Interface (CLI). ONT activation, status, and replacement procedures are shown using local-PC connections and SMx. The various types of logs, plus performance monitoring options are shown.

System backup and recovery are also described, as well as basic provisioning steps. The newer features of AXOS are introduced and compared to original EXA systems. EXA is not emphasized in this course due to time constraints, but is found in the Calix E7 EXA maintenance course.

Symptom investigation and troubleshooting is demonstrated using previous trouble examples, and through actual troubles which may exist in the network. Common fault types and best practices are also presented, to help prevent troubles from occurring in the first place, including fiber and transceiver inspection and cleaning using modern equipment.

Our non-intrusive exercises help equip the student to conduct day-to-day maintenance activities and show how to perform troubleshooting procedures, including problem isolation, module replacement, and provisioning, all of which help prepare students for higher-tier support interaction. The course is flexible, allowing the most important content for a particular group of students to be emphasized



Students Will Learn

- **Optical & Ethernet Fundamentals**
- **TDM Gateway (GR-303) Interface**
- **FTTP Network Elements**
- **10G ONT Types & Features like High-Speed PONs**
- **How to use AXOS commands in CLI and SMx**
- **Understand other elements like EDFAs, splitters, filters, CE's**
- **Compare AE and GPON/XGS/NG-PON networks**
- **How to find the physical location of a fault**
- **How to change cards in the OLT or change ONTs**
- **How to backup configuration files**
- **Understanding uplinks and transport options**
- **And much more**

Target Audience

Technical staff such as Central Office Technicians, combo-techs, and those who are responsible for the maintenance and troubleshooting of FTTP/VDSL systems, plus NOC/SCC personnel who must respond to alarms

Prerequisites

A basic understanding of telecommunications and networking principles is helpful due to the accelerated nature of the course. Any of our BTS fiber optic courses or our TDM Switching Fundamentals Course are available for students with little or no previous telecom background.

Course Outline

Module 1 : Optical & Networking Fundamentals

Optical Safety

- Laser Power Levels & Class System
- Visible & Non-Visible Wavelengths

Decibels

- Logarithmic scale
- Copper & optical measurements

Digital: A/D & D/A Conversion

Time Division Multiplexing (TDM)

Pulse Code Modulation (PCM)

Frequency Division Multiplexing (FDM)

- Wavelength Division Multiplexing (CWDM, DWDM)

- Time/Wavelength Division Multiplexing (TWDM)
- Carriers & Protocols
 - Line Coding & Transmission Protocols
 - DS0, DS1, DS3
- DSL Carriers
 - DMT
 - Telco HDSL transport
 - Customer ADSL/VDSL
- PSTN: GR-303
- Fiber Optics
 - Characteristics, Advantages, Disadvantages
 - Windows, Optical Bands
 - MMF, SMF
 - Transceivers - SFP, SFP+, XFP, QSFP
 - Ferrule Types (PC, UPC, APC)
 - Connectors (SC, LC, MTP, etc.)
 - AE, GPON, XGS, NG-PON
 - Protection schemes: 1+1, ring types
- Networking
 - OSI Layers 1-7
 - VLAN tagging
 - Security: RADIUS, TACACS, Diameter
 - Link Aggregation
 - Ethernet-over-Fiber
- Quality of Service
 - QoS vs. CoS
 - Timing & Jitter

Module 2 : E7 Operation

Calix OLTs & ONTs

- B, C, & E Series
 - E3, E5, & E7
 - TDM Gateway & C7, GR-303, EOC/TMC links

System Capabilities

- POTS, 1G & 10G Ethernet, Video/IPTV, T1/PWE3
- Service Profiles

FTTP Network Design

ONT Types

- GPON, 10G & AE
 - P-Series: G, GX, GE, SFU, MDU, SBU, MBH, RSG
 - 10G ONTs: GP, GPR

OLT Components

- E7-2, E7-20 Chassis Types
 - Modular Chassis Controller (MCC)
- Switch Control Processor (SCP, SCP2)
- GPON, GPON-x, AE, GE, 10GE, VDSL2, release 2 variants
 - Transceivers: Optical, Copper, form factors

System Components

- Optical Splitter
- Optical Filter/Combiner
- EDFA
- Set-Top Box (STB)

ONT Feature Comparison

Module 3 : System Access

MGT Interfaces

- MGT-1 thru MGT-4
 - RS-232 Serial Console, Ethernet, VLAN, EWI
- Calix Management System (CMS), TL1
- Services Management Connector (SMx)
- Authentication Servers (RADIUS, TACACS+, Radius)

CLI Commands

- Login, Logout, Version, Time
- paginate, terminal screen length

SMx

- Using SMx, comparison to CMS/EWI
- Navigating the GUI, capabilities, login, search

EWI Login

- Login, Logout
- Initial Views, Menu Options

Telnet, FTP, TFTP

- Configuration Files
- ONT CLI

Module 4 : Commands

System Access

- Session Settings
- Special Keys & Shortcuts

Command Line Interface - AXOS Configuration

- alarm: customization, suppression
- system: ae-mgmt, gpon-behav, location, logging, upgrade, clock set, etc.
- interface: craft, ethernet, lag, loopback, ont, pon, t1, etc.
- ont: profile, upgrade, quarantine

Command Line Interface - AXOS Operational

- clear: history, interface, ont, subscriber, subscriber-state
- clock, configure, ont config-file, ont-install, ont-upgrade, perform backup
- perform ont: optical test, pots test, self-test, reboot, reset, unlink, profile load
- show: alarm, card, clock, diag, discovered-onts, file, health, info, inventory, logging, quar, subs, system, unas, version

Services Management Connector (SMx)

- System: alarms, status
- ONT: activation, deleting, quarantine, profiles
- Backups (OLT, ONT config files)
- Performance monitoring, measurements, logs, etc.

Embedded Web Interface (EWI) - limited support

Module 5 : Documentation

Document Types, Numbering & Revision

Calix E7 Documents

- E7-2 & E7-20 Installation Guides
- AXOS System Turn-Up Guide
- AXOS Monitoring, Maintenance, and Troubleshooting
- AXOS docs: Active Ethernet, CLI References
- AXOS everyPON Services Guide
- AXOS Software Upgrade
- AXOS Subscriber Management Guide

- SMx Documentation: Management Guide, System Admin, Releases
 - Product Data Sheets
 - Transceiver/SFP Documents
 - Third-Party Documents (splitter, filter, EDFA specs)
- Calix Website, Calix Community

Module 6 : Maintenance & Administration

Backup & Restore

- creating a backup, restoring via backup
- CLI & SMx methods

System Status

- Alarms, severity
- show: alarms by device, ont, port, interface
- ONT conditions: disc, unas, quar, rogue

Changing/Moving an ONT

Replacing A Transceiver

Fan Tray Replacement

Line & Fiber Testing

- Test Types
- POTS testing, optical power

T1 Testing

- jacks, loopbacks, RFC2544 loop (PWE3)

Statistics & Performance Monitoring

Notifications

Course-Specific Topics

Module 7 : Troubleshooting

NOC/SCC Interaction, ESD Precautions

Types of Faults

- E7 fault types
- fiber problems

Tools

- VFL, LFD
- Inspection tools
- OTDR, Power Meters

Cleaning

- wet & dry methods, inspection

System Logs

- Syslog, Technical Log
- CLI & SMx

Adding & Removing OLT Cards

Troubleshooting Actions

- reset: ont, card, system
- reboot: card, system
- outages: analysis, restoration steps

Examples

Module 8 : Glossary & Status Codes

Glossary

Alarm Status Codes Reference

Provisioning Notes Block Diagram

Notes

The course can be combined or integrated with other topics like TDM Switching courses or Wi-Fi Best Practices which includes further study with Calix wireless access points like the 844G and GigaSpire, or other integrated ONTs.

Those interested in understanding more about AXOS-enabled hardware and the features of AXOS may be interested in the Calix E7/E9 AXOS version of the course, which emphasizes these features over the standard EXA version.

Delivery Method

LIVE Virtual Instructor-led with a flexible approach that adjusts content most relevant to students, including various non-intrusive labs, demonstrations, and exercises.

Equipment Requirements

(This apply's to our hands-on courses only)

Students must have Virtual and/or remote-access to a Calix E7 OLT for this training.

BTS always provides equipment to have a very successful Hands-On course. BTS also encourages all attendees to bring their own equipment to the course. This will provide attendees the opportunity to incorporate their own gear into the labs, and gain valuable experience using their specific equipment.

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Course Length

5 Days