

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



## Course Description

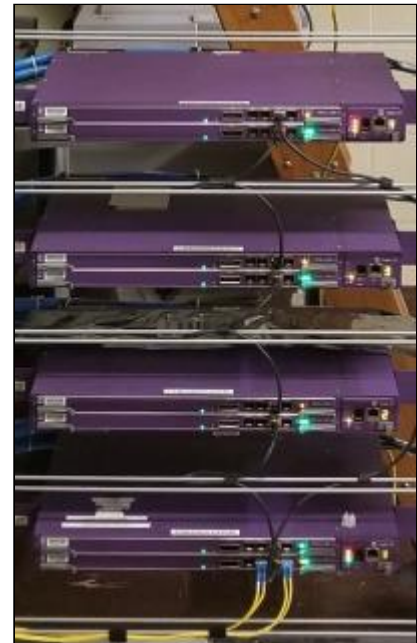
This extensive Virtual Live Instructor-led course provides the skills required to perform detailed maintenance and troubleshooting on the Calix E7 system, including with various OLTs and ONTs found within a typical network. It also discusses the theory and general system architecture used by various broadband systems, including the latest GPON, AE, VDSL, and Ethernet-over-Fiber transport. While the course focuses on the original EXA card and feature set, the latest AXOS units are also discussed to help see the differences between the two series.

The E7 & C7 combination is also discussed as a legacy GR-303 TDM Gateway interface for traditional TDM switches, where examples are shown for switches like the DMS-100 or GTD-5 EAX. Primary network elements are discussed including the OLT cards, ONT types (SFU, SBU, MDU), and various ONT options found within Calix's P-Series like the GX and GE, along with other needed components like Erbium-Doped Fiber Amplifiers (EDFA's), filters, splitters, transceivers, and different fiber cable and connector types. Both the E7-2 and E7-20 are described, including the different card versions used within each platform, plus the E7-20's SCP/SCP2 processors. Features like Gigabit Ethernet, POTS, T1, and IPTV/RFoG video (including RF-RTN) are explained, along with typical testing and use scenarios.

System management interfaces are described, and well as various administrative options, like the Web GUI/EWI Interface, the Command Line Interface, and the Calix Management System (CMS). ONT activation and status is shown via local-PC connections, RONTA, Embedded Web GUI, and CLI, etc. along with discussion on provisioning of profiles, services, and VLANs. System backup and recovery is also described via external FTP/TFTP servers. The newer features of AXOS are introduced and compared to original EXA systems. AXOS is not emphasized in this course due to time constraints, but is found in the Calix E7 AXOS and/or E9 AXOS course.

Symptom investigation and troubleshooting is demonstrated using previous troubles as examples, as well as actual troubles which may exist in the system during training. Common fault types and best practices are presented, to help prevent troubles from occurring in the first place.

Our non-intrusive exercises equip the student to conduct day-to-day maintenance activities and show how to perform troubleshooting procedures, including problem isolation, cabling, and provisioning. The course is flexible, allowing the most important content for a particular group of students to be emphasized.



## Students Will Learn

- **DSL & Optical Fundamentals**
- **TDM Gateway Interface (GR-303)**
- **FTTP Network Elements**
- **ONT Types & Features like POTS, ENET, RF-RTN, and T1**
- **How to use commands in CLI, EWI/WebGUI, and CMS**
- **Understand other elements like EDFAs, splitters, trays, and filters**
- **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 & Switching 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)

#### Carriers & Protocols

- Line Coding & Transmission Protocols
- DS0, DS1, DS3
- SONET & BITS Timing

#### 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

#### OSI Model

- Layers 1-7

#### Quality of Service

- Speed vs. Latency
- QoS vs. CoS
- Timing & Jitter

### Module 2 : E7 Operation

#### Calix OLTs & ONTs

- B, C, & E Series
- OLTs & ONTs
- TDM Gateway & C7, GR-303, EOC/TMC links  
System Capabilities
- POTS, HPNA, HSI (Eth), Video, T1
- Service Profiles

#### FTTP: AE & GPON

#### ONT Types

- GPON & 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

- Optical Network Terminals: P-Series, T-Series
- SFU, SBU, MDU

### Module 3 : System Access

#### MGT Interfaces

- MGT-1 thru MGT-4
- RS-232 Serial Console, Ethernet, VLAN, EWI
- Calix Management System (CMS), TL1

- SMx Introduction
- Authentication Servers (RADIUS, TACACS+)
- CLI Commands
  - Login, Logout, Version, Time
  - Status, Trouble
- EWI Login
  - Login, Logout
  - Initial Views, Menu Options
- Telnet, FTP, TFTP
  - Configuration Files
  - ONT CLI

#### Module 4 : Commands

- Calix Access Methods (EXA)
  - Session Settings
  - Special Keys & Shortcuts
- Command Line Interface
  - E7 CLI Reference Document
  - add, clear, create, delete, disable, enable, remove, show, set, test, help commands
  - Options: alarms, eth-port, gpon-port, ont, ont-port, pots-svc, sip-gw, system, etc.
  - Services: system, interfaces, GPON, POTS, Eth, Video, DSL, T1, AE
- Sample CLI Commands
  - Login, Alarms, Status, Connected ONTs, Power Measurements, etc.
- Embedded Web Interface (EWI)
  - Navigation Menu, Capabilities
  - Status & Alarms
  - Activation Options
  - Backups (OLT, ONT config files)
- Sample EWI Commands
  - Login, Alarms, Navigation, ONT Features, ONT Profiles, measurements, etc.

#### Module 5 : Documentation

- Document Types, Numbering & Revision
- Calix E7 Documents
  - E7-2 & E7-20 Installation Guides
  - E7 User Guide
  - E7 Applications Guides (AE, GPON, xDSL)
  - E7 Services Guides (AE, GPON, xDSL)
  - E7 Software Upgrade Guide & Release Notes
  - E7 Engineering & Planning Guide
  - E7 Maintenance & Troubleshooting Guide
  - Product Data Sheets
  - Transceiver/SFP Documents
  - Third-Party Documents (splitter, filter, EDFA specs)
- Calix Website, Calix Community

#### Module 6 : Maintenance & Administration

- Backup & Restore
  - showing backups
  - CLI & GUI methods
- System Status
  - Alarms, severity

- show: alarms by device, ont-port, eth-port, interface
- ONT conditions: disc, unas, quar

#### Line & Fiber Testing

- Test Types
- POTS, optical, RFC2544 loop (VoIP/PWE3)

#### T1 Testing

- jacks, loops, BERT

#### Changing an ONT

- via CLI & GUI
- Manual Configuration (CLI, Web GUI)

#### Statistics & Performance Monitoring

- show: ont real-time-data, stats, pm, power level, etc.

#### Fan Tray Assembly

- Replacement
- Filter maintenance

#### Course-Specific Topics

### Module 7 : Troubleshooting

NOC/SCC Interaction, ESD Precautions

#### Types of Faults

- E7 fault types
- fiber problems

#### Tools

- VFL, LFI
- Inspection tools
- OTDR, Optical Power Meters

#### Cleaning

- wet & dry methods, inspection

#### System Logs

- Syslog: Web GUI, CLI
- show syslog-server
- TFTP Server Setup
- show log

#### Troubleshooting Actions

- reset: ont, card, system
- reboot: card, system
- Outage restoration
- Key Troubleshooting Commands

#### Examples

- Missing ONT/kinked fiber
- Bad ONT CPU
- Bad port (POTS, ETH)
- Student selection

### Module 8 : Glossary & Status Codes

Glossary

Alarm Status Codes Reference

Provisioning Notes

Block Diagram

## Notes

### Module 1 Optical & Switching Fundamentals

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- Wavelength Division Multiplexing (CWDM, DWDM)

#### Carriers & Protocols

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#### - Line Coding & Transmission Protocols

- DS0, DS1, DS3
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#### PSTN GR-303

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- Login, Logout, Version, Time

- Status, Trouble

#### EWI Login

- Login, Logout

- Initial Views, Menu Options

Telnet, FTP, TFTP

- Configuration Files

#### ONT CLI

#### Module 4 Commands

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- Session Settings

- Special Keys & Shortcuts

#### Command Line Interface

- E7 CLI Reference Document

- add, clear, create, delete, disable, enable, remove, show, set, test, help commands

- Options alarms, eth-port, gpon-port, ont, ont-port, pots-svc, sip-gw, system, etc.

- Services system, interfaces, GPON, POTS, Eth, Video, DSL, T1, AE

#### Sample CLI Commands

- Login, Alarms, Status, Connected ONTs, Power Measurements, etc.

#### Embedded Web Interface (EWI)

- Navigation Menu, Capabilities

- Status & Alarms

- Activation Options

- Backups (OLT, ONT config files)

#### Sample EWI Commands

- Login, Alarms, Navigation, ONT Features, ONT Profiles, measurements, etc.

### Module 5 Documentation

#### Document Types, Numbering & Revision

##### Calix E7 Documents

- E7-2 & E7-20 Installation Guides

- E7 User Guide

- E7 Applications Guides (AE, GPON, xDSL)

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Module 8 Glossary & Status Codes

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Alarm Status Codes Reference

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## 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