Hands-On

Ciena 6500 Maintenance and Troubleshooting

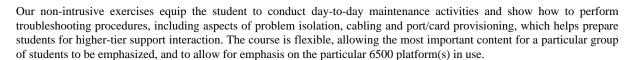Virtual Live Instructor-led or Available On-Site

Course Description

This Ciena 6500 Maintenance and Maintenance Course is designed to provide any student with a solid understanding of the 6500-series platform and its many features and options. The role of a 6500 network shelf within a modern switching & transport network is explored, with discussions on theory, maintenance, provisioning, and troubleshooting.

The hardware design of the system and its versions (standard ONT/WDM, Packet-Optical PTS, RLS, D, S and T-Series) are explained, along with optional port configurations, including various protocols and line speeds supported like SONET/SDH, Ethernet, DS3/E3, etc. and 10G-800G muxponders. Key concepts of optical switching and re-configurable add/drop multiplexers (ROADM) are explained, plus QoS, waveshaping and policing concepts are introduced. Transaction Language 1 (TL1), Site Manager GUI, and other input-output options are shown. Common maintenance functions like checking system health, air filters, and backups are discussed, along with tier-1 card-level repair. SFP/XFP use and Laser safety is included, along with fiber optic best-practices. Ciena-unique technology like WaveLogic and various Flexible service modules are also presented, including the latest 800Gbps interfaces. Universal concepts like fiber types, ferrule polish (PC, UPC & APC), optical transceivers, SMF/MMF, and connector types are also explained.

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. In addition to supporting independent problem-solving skills, the course helps provide an excellent background for NOC and TAC interaction.

Our non-intrusive exercises equip the student to conduct day-to-day maintenance activities and show how to perform troubleshooting procedures, including aspects of problem isolation, cabling and port/card provisioning, which helps 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, and to allow for emphasis on the particular 6500 platform(s) in use.

Students Will Learn

- **Optical Fundamentals**

- **Copper & Optical Protocols**
- **6500 Theory of Operation & Module Types**
- **System Access Ports**
- **How to use commands in CLI and the Site Manager GUI**
- **Find various types of OEM and third-party documents**
- **Auto & manual provisioning of cards and individual ports**
- **How to find the physical location of a fault**
- **How to change cards**
- **How to backup configuration files & restore the system**
- **Troubleshooting by previous examples**
- **And much more**

Target Audience

Technical staff such as CO Techs, combo-techs, and those who are responsible for the maintenance and troubleshooting of optical carrier systems, plus NOC/SCC personnel who must respond to alarms. No previous background is required, although some familiarity with optical or carrier equipment would be beneficial. Certain management and provisioning personnel will also benefit, providing a greater understanding of the resources needed for the system, and how to support it.

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

- Lines vs. Trunks

- Electrical vs. Optical Power

- Decibels

logarithmic scale

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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

    Triple-Play Services

    Line Coding & Transmission Protocols

    DS0, DS1, DS3

    E1, E3, EC1 CEM

    VT1.5, OC-1, OC-3

    STS-1, STS-3

    SONET, SDH, EoF, PL, G.709 OTN, BB

    AE, GPON

- Optical Light Bands

    Light vs. RF

    C, L

- Interconnections

    UTP, Coax, Fiber, DAC

    MMF, SMF, AOC

    Connectors (SC, LC, MTP/MPO, etc.) and Polish (PC, UPC, APC)

    SFP, XFP, QFP, GBIC

- OSI Model

- Quality of Service

    Speed vs. Latency

    QoS vs. CoS

    Timing & Jitter

- Carrier Signal Comparison

- A Converged PSTN with OTN

Module 2 : Ciena 6500 Theory of Operation

- Optical Transport Network Components:

    Colorless, Directionless, Contentionless

    ADM, ROADM, WSS, FIM

    Filters, Splitters, EDFAs

    Servers: DHCP, DNS, NTP, FTP, TFTP

    Interconnections & Terminations

- Ciena 6500-series Platforms

    Standard WDM & Packet-Optical Platforms

    RLS, D-2, D7, S8, D14/S14, S32, T12/24

    TDM Trunking/Links

    Transceivers: SFP/SFP+, QSFP/QSFP+, WaveLogic

- Hardware Modules:

    Processors: Shelf Processor

    Muxponders: 40-800G, GEth, Flex Services (2.5-32G, TDM), OPS, eMOTR

    Switching: WSS, ROADM, ADM, Smart Raman, ONT, PKT

    Amplifiers: OLA, external EDFA

    Encryption: protocol-agnostic, 10G-200G OTR or WaveLogic

    Maintenance Interface Card (MIC)

    Power Interface Modules, PSU

    Cooling Trays

- System Features

    Protocol Support, Flex

    Access/Edge Aggregation, Metro/Regional, Core

- End-to-End Network

Module 3 :   System Access

- I/O Ports

    LAN Types - Craft, CO, Interoffice

    Alarm, Telemetry Ports

    DSUB9 DTE Serial

    ESI A&B

- Access Methods

    Site Manager

    Manage, Control & Plan (MCP)

    OneControl

    TL1 CLI

    SAOS CLI

- CLI Commands

    Login, Logout, Version

    Status & Trouble

- Site Manager Commands

    Login, Logout, User Accounts

    Initial Views, Menu Options

- FTP, SFTP, TFTP

    File transfer & authentication servers

    Software loads & provisioning

Module 4 :   Commands

- OS & Command Structure

- Site Manager GUI

    Navigation Menu, Capabilities

    File - Login

    Faults - active alarms, history, disabled alarms

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Configuration - site inventory, nodes & equipment, routing, etc.

Performance

Security

Protection

- Sample CLI Commands

Login, Alarms, Status, Provisioning, etc.

- Command Line Interface

CLI Reference

login, alarms, status, provisioning, backup, etc.

- Service-Aware Operating System (SAOS) Overview

Sample SAOS commands

Module 5 : Documentation

- Document Types, Numbering & Revisions

- 6500 Documents

323 Series

NTRN Guides

D, S & T Series

Installation Guides - General, shelf-specific

Administration and Security

Configuration - Provisioning/Operation, Services, Control Plane

Fault Management - Alarm Clearing, Module Replacement

Module Docs

Logs

SAOS Docs

Product Data Sheets

Third-Party Documents (splitter, filter, EDFA specs)

- Ciena Website

Module 6 : Administration & Maintenance

    - System Status

        LED Status, GUI

        Status & Alarms

    - Module Replacement

        Product Engineering Codes (PEC), Circuit Packs

        Fan, Filter

        SFP/QFP Transceiver

        Warm & Cold Restart

        Module Replacement Procedures

    - Configuration & Provisioning

        Backplane ID

        Zero-Touch Provisioning (ZTP)

        Autoprovisioning, Autodiscovery

        Configuration - common, photonic & copper interfaces

        Configuration - bandwidth, data services

        Encryption

    - System Backup

        Database Save, Restore (GUI, CLI)

    - Software Upgrades

Module 7 : Troubleshooting

    - NOC/SCC Interaction, ESD Precautions

    - Tools & Resources

        Troubleshooting Documents

        Tools: OTDR, Optical Power Meters, ESD/PPE

Internal System Meter

- Alarms & Faults

Alarm States (GUI, CLI) & LEDs

Alarm Ports

Alarm Definitions: Pack Fails, Config Mismatch, Database, Errors, Power, etc.

SFP & Cabling - reflections, bend radius, abrasion

Maintenance Interface Card

- Maintenance and Troubleshooting Guides

First Line Maintenance

Alarm Clearing

Performance Monitoring

Other Alarm Clearing

- System Logs

Telco-viewable logs

Card logs

- Fault Clearing Strategy

Alarm Symptoms

Locating Procedures

- Troubleshooting Examples

Missing card

Bad interface card

Bad ports, transceiver, kinked fiber

Provisioning/Activation Issues

Student Examples

Notes

The course runs in a 5 day format, but can be combined or integrated with other topics like TDM Switching courses or other optical courses such as Flashwave 9500 for a full end-to-end training program.

The course is designed to run in ether a Live Instructor-Led Virtual Classroom or In-Person Classroom setting. Virtual Field Trips can be added to allow students an opportunity to see and understand where all the parts of the system are found, what they do, and provide a better end-to-end understanding of the system.

Delivery Method

LIVE Virtual Instructor-led with a flexible approach that adjusts content most relevant to students. Includes various non-intrusive labs, demonstrations, and exercises to help students focus on and retain the material presented.

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

Students must have Virtual and/or remote-access to a Ciena 6500 system 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 training using their specific equipment.

Course Length

5 Days

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