Virtual CO Switch Fundamentals

Virtual Live Instructor-led

Course Description

This extensive Virtual "Live" Instructor-Led course provides the absolute foundation needed for any CO (Central Office) Personnel that plans on going through an specific Switch training.

Understanding new and existing switching equipment within a central office can be daunting. The CO Switching Fundamentals course was developed upon request to help techs with relatively little CO experience to become knowledgeable about various switching technologies found within a CO, how switches work, and how they connect with other network elements. Envisioned as a preparatory course for TDM Switching courses, this course can also be offered to prepare for Optical ROADM, MPLS, and/or IP telephony switching.

The course starts with an overview of the PSTN, and the equipment found within almost any typical Central Office. Common terms and mnemonics are used extensively to help immerse students with the lingo, and learn the terminology quickly. Analog and digital signals are explained, including the differences between TDM and FDM, the ADC/DAC process, and PCM which are foundations for nearly all switching technology. Common digital and optical carrier standards are presented including DS1, DS3, OC-1, OC-3, STS-1, line coding, clear-channel signaling, etc. NPAs, LATAs and Rate Areas are defined, along with CLASS & SS7 network topologies. Important nodes like the SSP, STP, and SCP are explained, along with definitions of links, link sets, and route sets. The OSI model is presented, comparing layers for SS7 and Internet networks.

Binary and Hexadecimal are then discussed, including MSB, LSB, and byte reversal. Exercises are used to reinforce Bin-Hex-Dec conversion, using register dumps from various switches as examples. The Time-Space-Time model is then presented in some detail, as it is the basis for any TDM switch. Multiplexing, switching, and sample phone calls through an SS7 network are shown, along with exercises to test retention of the key concepts.

Switch external connections are then shown, including many types of equipment that a switch may directly connect to, or gather alarms from, including voice mail systems, recorder announcers, AMA links, ringing generators, operator services, and building alarms. SLC-96 and GR-303 integration is taught, and particularly the capabilities of GR-303 which is used extensively as a voice packet interface to the PSTN.

A module on formal troubleshooting methodology is included, which presents several ways to investigate symptoms within a complex network, and how to investigate what resources are potentially available, and where to look for them. The course finishes with a module on typical telco operations, including NOC/SCC communication, support tiers, electro-static damage mitigation, reporting, escalation, and sample work checklists.

Students Will Learn

- **Components of the PSTN including switching, carrier, and packet**
- **Common terminology and lingo used within the CO**
- **Toll principles including NPA, LATA, and Rate Centers**
- **TDM/Time-Space-Time theory**
- **Binary, Hexadecimal, and Decimal conversion**
- **Access Tandem, CCS7, and AIN/LNP connections**
- **GR-303 & SLC integration**
- **CO equipment including power, alarming, grounding, AMA**
- **Troubleshooting methods**
- **Telco operations and typical structure including NOC/SCC role**
- **And more...**

Target Audience

Technical staff who are new to the Central Office environment and who must become competent in one or more CO systems relatively quickly.

Prerequisites

There are no prerequisites for the curriculum. Students may benefit from some existing inside- or outside-plant experience due to the faster pace of this course.

Course Outline

Module 1 : PSTN Fundamentals

Analog Signals

TR, EM, T1R1, SG/SB leads

Negative Talk Battery

Decibel Measurements

Digital Signals

PCM:

- ADC, DAC
- Nyquist Theorem
- Multiplexing

Carrier:

- DS1-DS5, E1-E3
- OC-x, STS-x
- D4/AMI, B8ZS, ZBTSI

DSL:

- Line Carriers
- Speed vs. Distance, Crosstalk
- DSLAM, ADSL2, VDSL2

Stored Program Control

The PSTN

- Trunk Types
- Converged Triple-Play Network

Access Tandems

- Class, Stratum, AT types
- Rate Centers
- NPA vs. LATA (USA)
- LIR, POI (Canada)

CCS7

- Why CCS7?
- SSP, STP, SCP
- Link Types - A-F links
- OSI CCS7 Protocol Stack
- Basic ISUP Signaling
- AIN & LNP
- CCS7 Terminology

Module 2 : Binary & Hexadecimal

- Binary
  - Word, Byte, Nibble, Bit
  - Bit Positions, MSB, LSB
  - Big & Little Endian byte Reversal
  - Convert Bin to Dec
- Octal
- Hexadecimal
- Conversions:
  - Hex to Bin to Dec
  - Dec to Bin to Hex
- Practice Exercises
- Bin/Hex/Oct/Dec Table

Module 3 : Switching Concepts

(TDM course shown -- MPLS, IP, ROADM topics can be substituted)

- Peripheral ADC/DAC Conversion
- Peripheral Interconnections
- Multiplexing PCM
- Time Switching, Time-Space-Time
- Switching Network (PCM)
- Typical Switch Block Diagram
- Sample Phone Call
- Switch Comparisons: 5ESS, DMS-100, GTD-5, EWSD, DCO, and AXE

Module 4 : External Equipment

- Central Office Layout
- Recorder Announcers
  - Vendors
  - Switch Connections
- Voice Mail Systems
  - Typical Systems
  - Switching Connections
- Office Alarms
  - Programmable Alarms
  - Alarm Extenders
- AMA/Billing Links
  - Telcordia GR-385 AMATPS, GR-1343 AMADNS
  - Sample Billing Platforms
- Other Equipment
  - Ringing Generators
  - MDF/CDF
  - Cable Pair, Cable Vault, Pressurization, Safety
  - Test Equipment
  - Power, Generator, Transfer Switch

Module 5 : GR-303 and SLC Remotes

- GR-303 Remotes
  - The GR-303 Standard

- EOC & TMC Channels
- Metallic Test Bus
- RDT Capabilities
- Access & Maintenance
- VoIP Integration with TDM

SLC Remotes

- The AT&T SLC
- Basic Capabilities
- SLC-96
- SLC-5

Module 6 : Troubleshooting Resources

Manufacturer Documentation

- Docs & Hidden Information
- Job Docs
- Tracing Utilities

Switch Data

- Input-Output Messages
- Switch Logs/Buffers
- Capture Files
- Photos

Troubleshooting Methodologies

- Predicted-Fault Lookup
- Divide-and-Conquer (D&C)
- Micro and Macro View
- End-to-End
- Change In Symptom
- Record Keeping & Precision

Persistence

Module 7 : Telco Operations

Precautions & Preparation

Do You Understand The Work?

NOC/SCC Communication

Next-Level Support

What If You Dont Have Something You Need

ESD

Modern Telco Networks

Organization & Reporting

Escalation Procedure

Sample Task Checklist

Notes

This suggested 2 Day course is customized based upon the needs and previous experience of the students. Switch Fundamentals would typically be combined with a switching Maintenance course, and/or a Translations or Support level course.

Delivery Method

LIVE Virtual Instructor-led with a flexible approach that adjusts content most relevant to students. Includes various nonintrusive 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)

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

2 Days