

## SONET / SDH FUNDAMENTALS

**S**ynchronous optical network (SONET) and synchronous digital hierarchy (SDH) have become global and North American standards, respectively, for optical fiber communications since 1988. SONET optical networks have been widely deployed across USA since 1992 while SDH has found its global applications since 1995.

The course starts with the discussion of rationale for SDH/SONET. It then discusses the SDH/SONET signal hierarchy (OC-1, OC-3, OC-12, ..., STM-1, STM-4, STM-16, etc.) and signal frame structure. The definitions/functions of path, path overhead bytes, line (or multiplex section) overhead, section (or regenerator section) overhead bytes are described in detail. SDH/SONET applications for transporting plesiochronous digital hierarchy (PDH) signals are discussed. SDH/SONET network management functions are also discussed.

### *Audience:*

This course is important for managers, sales forces and technical persons in the telecommunications field to become familiar with the SDH/SONET and optical networking. This course is basically designed for technical persons. However, it can be easily modified and tailored for managers and sales and marketing persons. For highly technical persons, two separate courses on SONET and SDH are recommended instead of this course on the combined topics of SDH and SONET.

### *Prerequisites:*

There are no prerequisites for this course.

### *Objectives:*

At the conclusion of this course the student will be able to describe the:

- Rationale for using SDH/SONET
- SDH/SONET signal hierarchy and frame structures
- SDH/SONET path, line (MS) and section (RS)
- SDH/SONET overhead functions
- SDH/SONET applications
- SDH/SONET network management, network elements and their functions

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### COURSE OUTLINE

#### Day 1

##### 1. SONET/SDH Digital Hierarchy

- SONET OC Building Blocks
- SDH STM Building Blocks

##### 2. SDH/SONET Applications

- High-speed transport systems
- Enhanced network management
- Point-to-point applications
- Linear add-drop
- Linear regeneration
- Network access
- Ring add-drop
- Network restoration

##### 3. SDH/SONET Overview

- SDH/SONET and DWDM
- An Optical Fiber Link
- Higher Order Versus Lower Order Tributaries

##### 4. STM Mapping and Pointers

- Composition of STM-1 Signal
- Mapping/Multiplexing of C-4s onto STM-N
- Building blocks: C-4, VC-4, etc.
- E4 (139.264 Mbps) onto C-4
- STM-N for N C-4 mapping
- Mapping/Multiplexing of C-3s onto STM-N
- Building blocks: C-3, VC-3, etc.
- DS3 (44.736 Mbps) onto C-3
- E3 (34.368 Mbps) onto C-3
- AU-4, AU-3 and TU-3 Pointers
- Concatenation Signals
- ATM Mapping

#### Day 2

##### 5. Multiframe Concept

- Building blocks: TU-11, TU-12, TU-2, etc.
- The need for multiframe
- Mapping/Multiplexing C-11s onto STM-N
- Mapping/Multiplexing C-12s onto STM-N
- Mapping/Multiplexing C-2s onto STM-N 17. TU-11, TU-12 and TU-2 Pointers
- Concatenation of TU-2s

##### 6. SONET/SDH Management

- Performance Management
- Fault Management

##### 7. Network Protection Architectures

- Linear MS protection
- MS shared protection rings

##### 8. Network Synchronization

- Clock Hierarchy
- Applications