

## Introduction

This course looks at the basics of telecommunications and provides a clear and straightforward understanding of many of the components and operation of telecommunication systems. Focussing very much on the voice side of telecommunications, we also delve into aspects of voice and data integration since it is such key importance today.

## Who should attend the course?

This course is designed as an introduction to telecommunications. It does not pre-suppose the knowledge of the students, but is obviously appropriate to those who wish to develop an understanding of the techniques used in telecommunications today.

## Course Length

2 days

## Course Agenda

- Introduction to Telecommunications
- Digital Voice (Analogue to Digital Conversion)
- Digital Voice Transmission and Multiplexing of Multiple Channels
- The 2Mbit/s Framed Interface
- Signalling System Number 7 (SS7)
- Integrated Services Digital Network (ISDN) and its Applications
- Transmission Systems - PDH and SDH
- Introduction to Data Communication Protocols
- Voice and Data Integration

## 1 Introduction to Telecommunications

The objective of this section is to give a brief introduction to the true fundamentals of telecommunications in order to build a foundation to be used throughout the rest of the course.

- How speech is generated and the sounds and frequencies that make up speech
- The telephone
- Telephone exchanges (public and private systems)
- Analogue transmission
- Digital transmission
- Signalling between telephone systems (how calls are set up)

## 2 Digital Voice (Analogue to Digital Conversion)

Today, voice is usually integrated into networks in a digital format. However, to be compatible with the human user, the signals must still be in an analogue form at some point, notably the telephone set. This section looks at how voice is converted from an analogue signal into a digital format and looks at some of the issues involved in its conversion.

- Comparison of analogue and digital voice

- PCM encoding: Analogue - Sample - PAM - Quantise - Compand - PCM (G.711)
- A law and mu law companding - Where should A law and mu law be used?
- The digital telephone set
- The digital telephone exchange and switching techniques

### 3 Digital Voice Transmission and Multiplexing of Multiple Channels

Today, practically all voice is carried across networks in a digital form. In order to make more efficient use of the transmission systems, it is normal to combine multiple channels onto the same transmission channel. The method used to perform this function is referred to as multiplexing.

- Introduction to multiplexing
- The Channel Bank

### 4 The 2Mbit/s Framed Interface

The predominant type of interface used for voice transport within a Wide Area Network today is the digital interface. The standard interface format operates at 2.048Mbit/s and is defined by the ITU-T. This section looks at the way in which the 2.048Mbit/s interface operates. Also investigated is the way in which signalling information is carried across the interface using both Channel Associated Signalling (CAS) and Common Channel Signalling (CCS).

- Electrical characteristics - G.703 - HDB3
- Framing - G.704
- Channel Associated Signalling (CAS) - Timeslot 16
- Common Channel Signalling (CCS)

### 5 Signalling System Number 7 (SS7)

Signalling System Number 7 (SS7), also called CCS7 and CCITT No. 7 is an International standard for the signalling of information between public telephone exchanges.

- Introduction to SS7
- Examples of telephone calls via an SS7 network

### 6 Integrated Services Digital Network (ISDN ) and its Applications

This section provides an overview of ISDN and some of the applications that it is used for from basic telephony calls through to more sophisticated use for dial-up Internet access and leased line backup.

- Introduction to and overview of ISDN
- Basic rate and Primary rate ISDN
- ISDN applications

### 7 Transmission Systems - PDH and SDH

Of key importance today is the use of systems referred to a transmission systems. Basically a method for the communication of bits of information, there are two main systems in use today namely the PDH and the SDH. This section looks at both systems but focuses of the SDH since this is rapidly replacing the older and less cable PDH.

- Introduction to Transmission Systems
- The Plesiochronous Digital Hierarchy (PDH)
- The Synchronous Digital Hierarchy (SDH)

### 8 Introduction to Data Communication Protocols

As a pre-cursor to the section on voice and data integration, this section provides a simple overview of some of the key data communication protocols in use today.

- Internet Protocol (IP)
- Frame Relay
- Asynchronous Transfer Mode (ATM)

## 9 Voice and Data Integration

It is very common in networking today to integrate voice and data communication requirements into a common network or onto a common technology. This section investigates some of the techniques that are commonly in use today and others that are developing.

- Why integrate voice and data?
- Voice/speech compression - ADPCM, LD-CELP, CS-ACELP, MP-MLQ, ACELP
- Voice and data in a Time Division Multiplexer (TDM) environment
- Voice over Frame Relay (VoFR)
- Voice over ATM
- Voice over IP (VoIP)

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