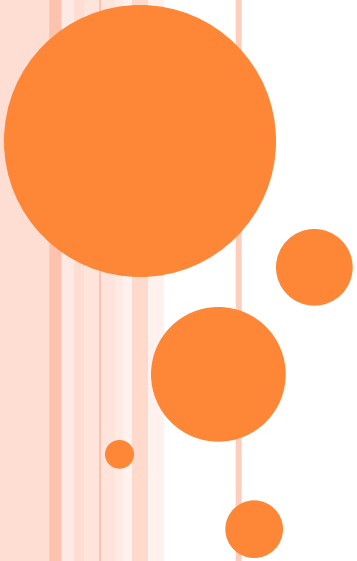
Unit 4
Lecture 3



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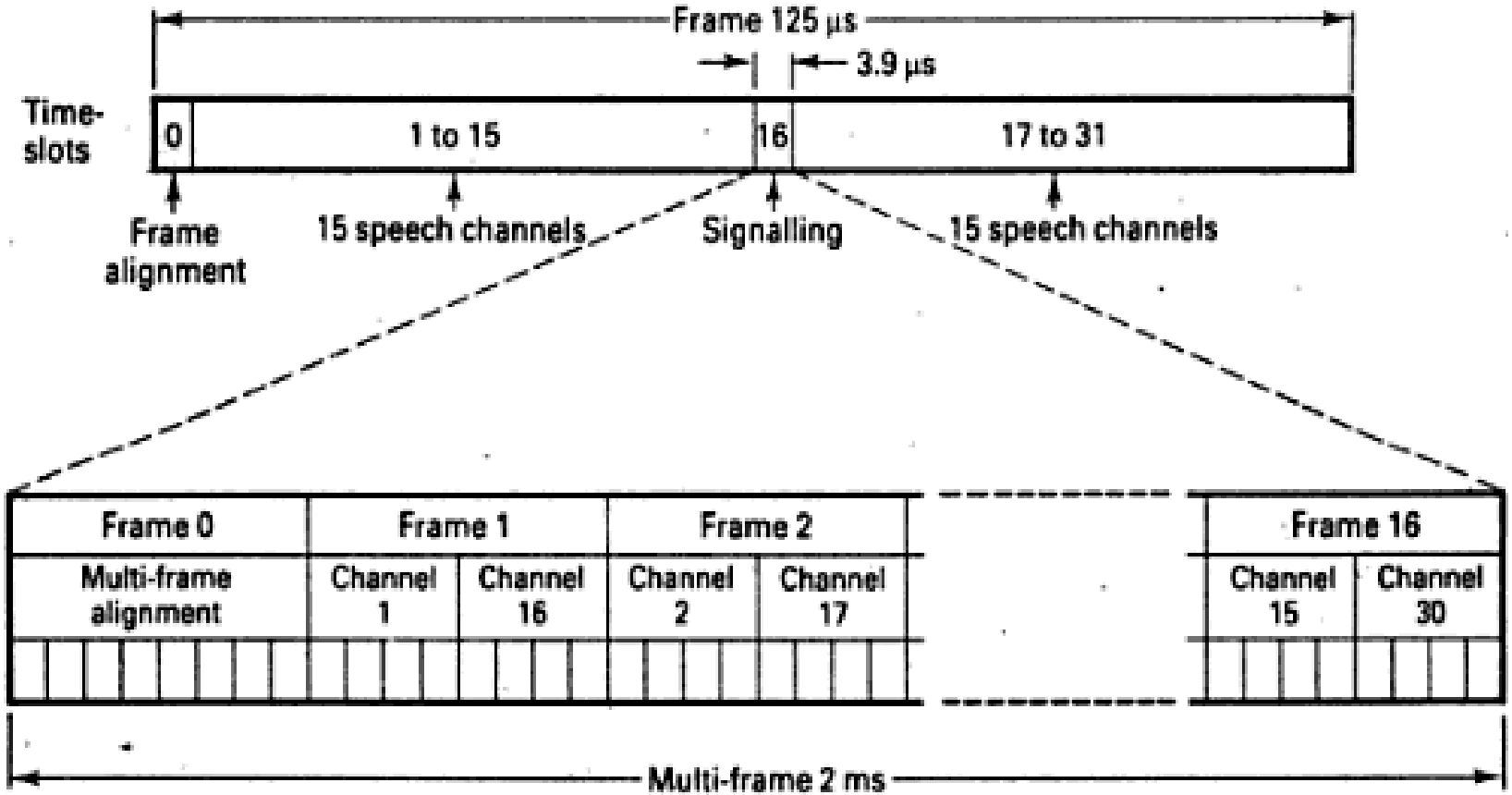
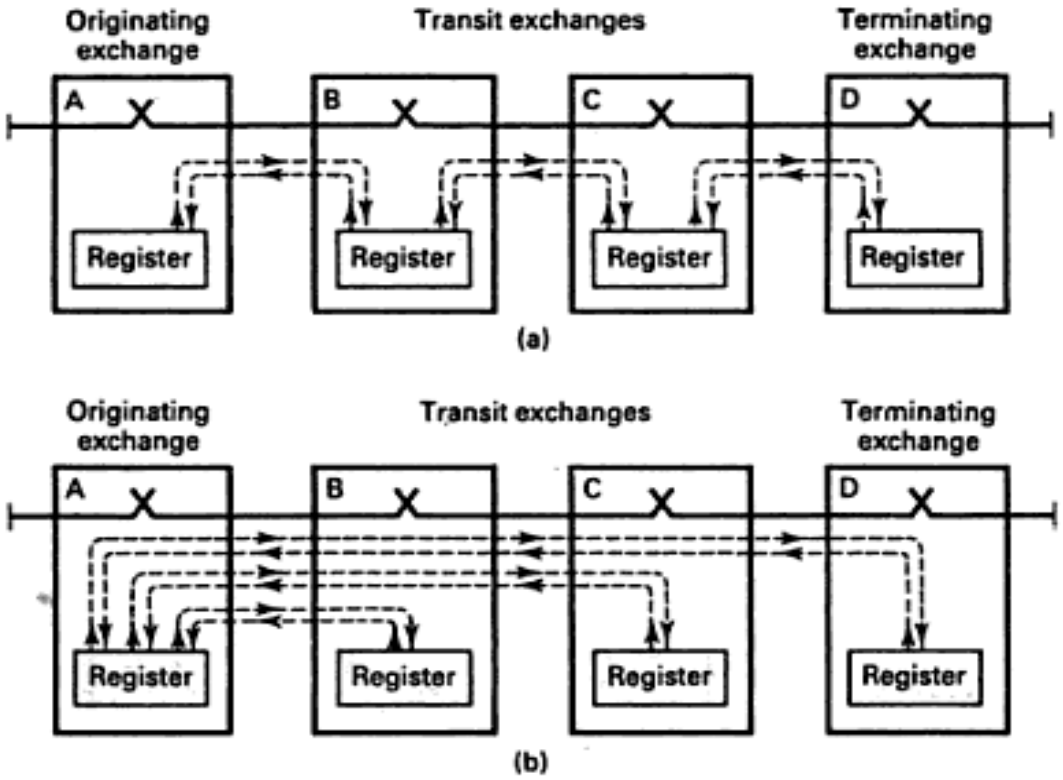
PCM AND INTER REGISTER SIGNALLING

- PCM primary multiplexers were designed from the outset to incorporate signalling. The DC signals associated with the audio frequency baseband circuits in each direction are sampled and the signal samples are transmitted within the frame of PCM channels.
- The 2 Mbit/s system has 32 8bit time slots but it only provides 30 channels. Time slot zero is used for frame alignment and time slot 16 is used for signalling.
- The 8 bits of channel 16 are shared between the 30 channels by a process of **mutliframing.**
- The first contain multiframe alignment signal and each of the subsequent 15 time slots contains 4 bits for each of two channels.
- Thus every speech circuit can have either a single signalling channel operating at 2 kbit/s or four independent signalling channels at 500 bit/sec.



Use of multiframe for signalling in 30-channel PCM system.

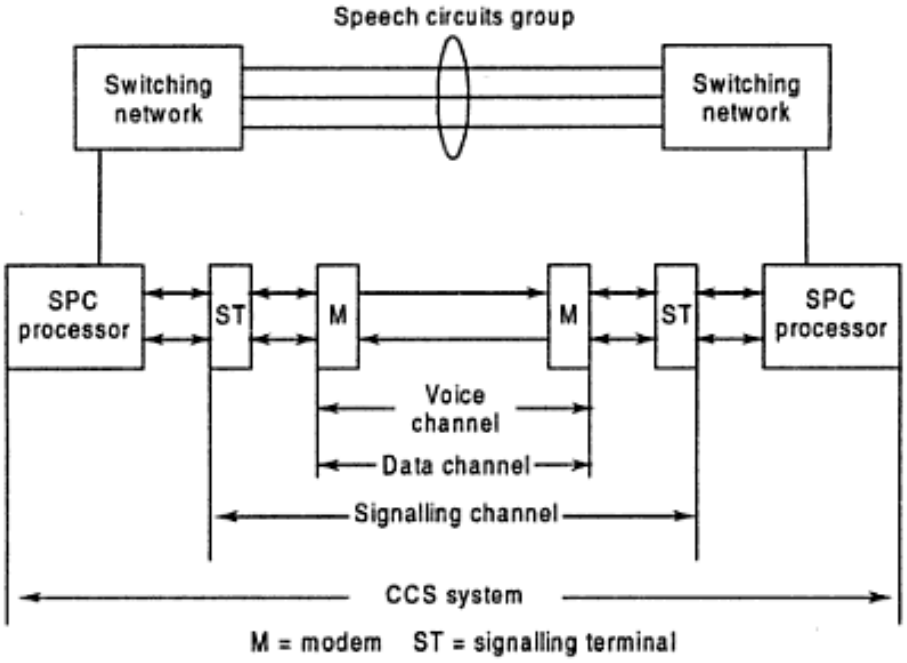
INTER REGISTER SIGNALLING



Link-by-link and end-to-end signalling between registers. (a) Link-by-link signalling. (b) End-to-end signalling. (Note, backward sigalling is not always provided.)

1. Signals suffer only the transmission impairments (e.g. attenuation, distortion and noise) of a single link.
2. Different signalling systems may be used on different links. Thus, if a network is being modernized, all registers do not need to be modified simultaneously.

COMMON CHANNEL SIGNALLING (CCS)



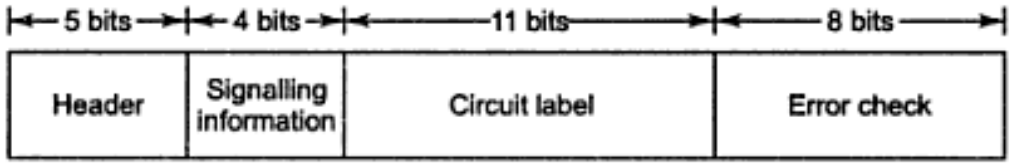
Basic scheme for CCS

This signalling technique use a separate channel for passing control signals for a group of trunk or information paths. This channel is totally different from the one which carries the voice or data. Signalling CCS is digital in nature , modems are used for carrying data over analog lines.

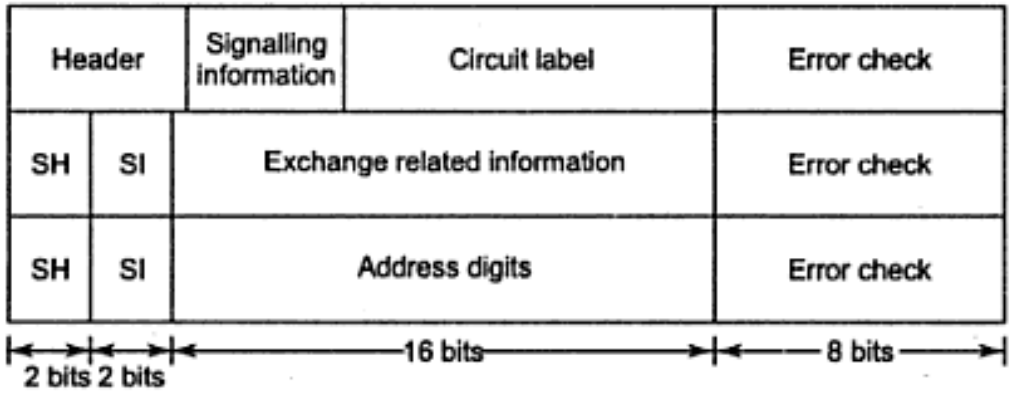
Basic Principle

The basic working principle of CCS depend upon the link-by-link basis along the route and store and forward network technique. In CCS, the data link sends messages that identify specific trunks and events. Two signalling channels, one for each direction are used in a dedicated manner to carry signal information so they are capable of carrying information for a group of circuit. CCS can carry signals for 1500 to 2000 speech circuits at the bit rate of 2.6 kbps. The CCS technique is also known as transparent mode for signalling.

The signalling information in CCS is transferred as messages of varying length usually defined as one or more fixed length signalling units (SUs). A message of one signal unit length is known as single unit message (SUM) and the one with multiple signal units is referred as multiunit message (MUM). A typical CCS signalling message format is shown in Fig. (5.16).



(a) Single unit message (SUM)



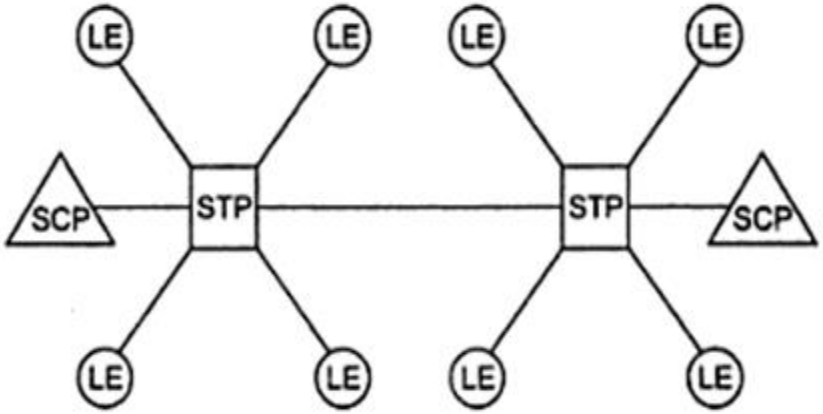
(b) Multi unit message (MUM)

A typical CCS signalling message format

CCS Network

CCS network establish a platform for the introduction of new facilities *i.e.*, improve the performance of the existing network. It consist of two types of nodes— signal transfer points (STP) and signal control points (SCP), that are intereconnected by signalling links.

The STP's, the packet switching nodes receive and route incoming signalling messages towards the destination and SCP's are data bases that provide information required for advanced call processing capabilities. SCP also serves how to route calls, verify credit cards and special services. The basic structure of CCS is shown in Fig. (5.17).

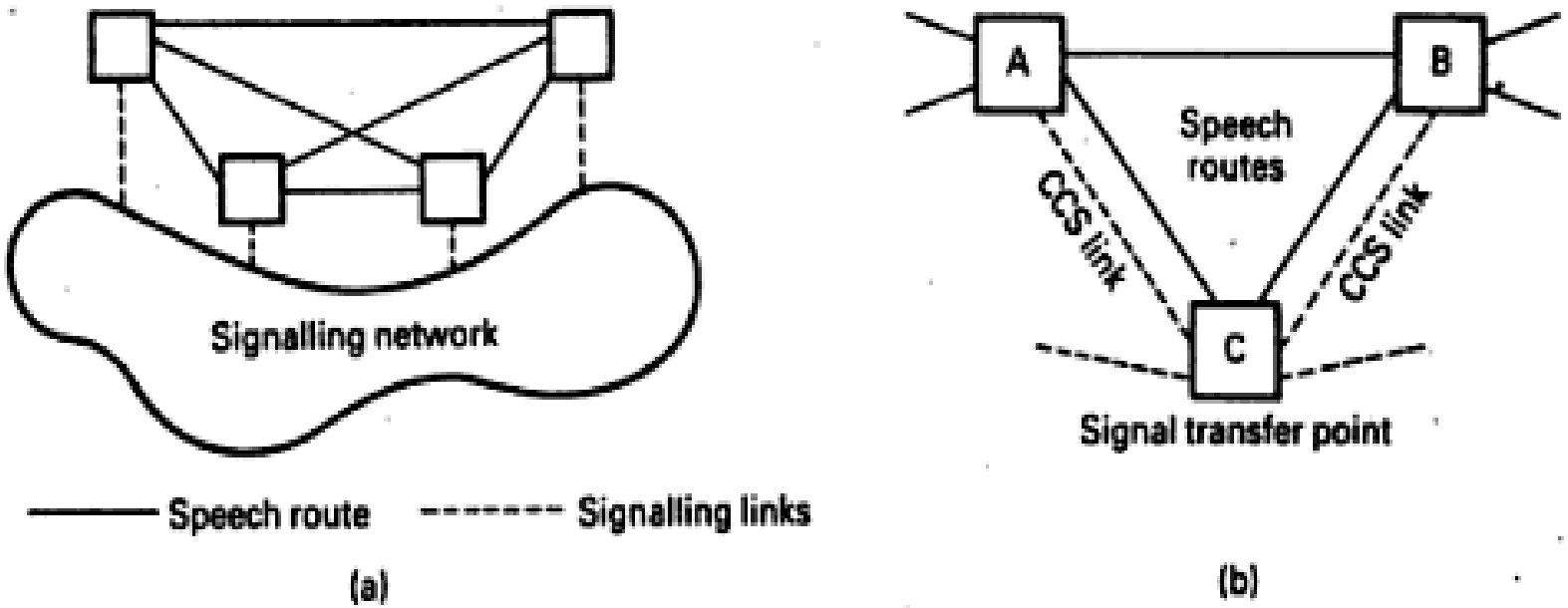


Basic structure of CCS

There are three modes by which the CCS implementation is done

1. Channel associated mode.
2. Channel non-associated mode
3. Quasi associated mode

Modes of CCS implementation



Signalling networks. (a) Use of non-associated signalling. (b) Use of quasi-associated signalling. (Associated signalling)

Advantages

1. CCS allows for signalling at any time within the entire duration.
2. Information can be exchanged between processors at high speed.
3. There is no chance of interference during transmission as separate channels are used for voice and control.
4. For each associated trunk group, only one set of signalling facility is required.
5. Efficient routing procedure and error rate is very low.
6. Cost is low as line signalling equipments are not necessary for every functions and inter-office trunk signalling cost can be removed.
7. CCS provides acceptable quality for network related signalling tones such as DTMF, MF and SF achieved.
8. Flexible to add more services.

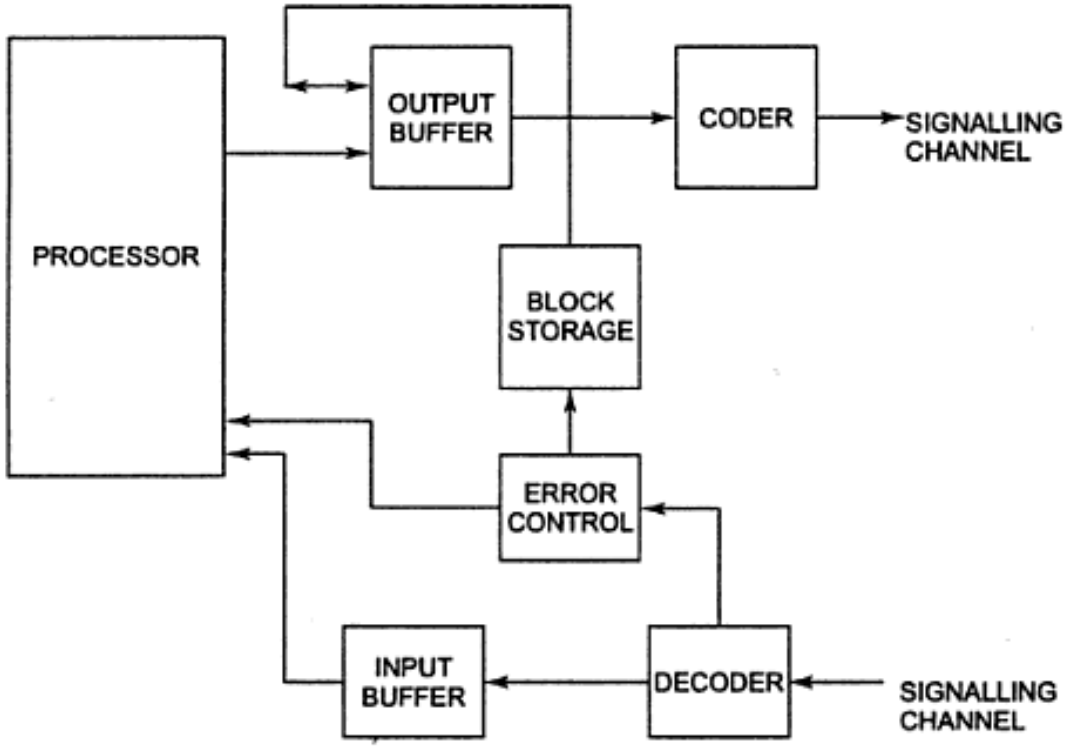
Disadvantages

1. The CCS network works on S/F basis so causes additional overhead and disconnect the continuity.
2. If any node fails to transmit properly then there will be a question of reliability. So, high degree of reliability is required.
3. Proper inter facing facility is necessary as sometime CCS network is equipped with inchannel signalling.
4. The integrity of the speech path is not assured as signalling information is not sent over speech path.
5. With CCS, all the trunks are first terminated to the local central office and then forward to the different destination not in different switches.

DIFFERENCE BETWEEN INCHANNEL AND COMMON CHANNEL SIGNALLING

In Channel Signalling	*Common Channel Signalling*
1. Automatic propagation of signalling information enables the simultaneous process and release of associated facilities.	1. Signalling information must be relayed from one node to the next in store and forward (SF) fashion.
2. Trunks are held up during signalling	2. Trunks are not required for signalling.
3. Interface between voice and control signal may occur.	3. No interference occur because the channels are separated physically.
4. Signal repertoire is limited.	4. Extended signal repertoire is possible.
5. Separate signalling equipment is required for each trunk and hence expensive.	5. Only one set of signalling equipment is required for whole group of trunk circuit and therefore economical.
6. Voice channel being the control channel so customers may misuse it.	6. In general control channel is in accessible to users.
7. Signalling is slow.	7. Fast signalling.
8. Reliability of the signalling path is not critical.	8. Reliability of the signalling path is critical.
9. It is difficult to change or add signals.	9. Flexible to change or add signals.
10. Speech circuit reliability is assured.	10. There is no automatic test of the speech circuit.
11. During speech period it is difficult to handle signalling	11. There is freedom to handle signals during speech.
12. Transfer of information such as address digits is from common control network originating office— voice channel—receiving office—common control network.	12. Transfer of information is directly between control elements (processors of SPC systems).

CCITT SIGNALLING SYSTEM NO. 6

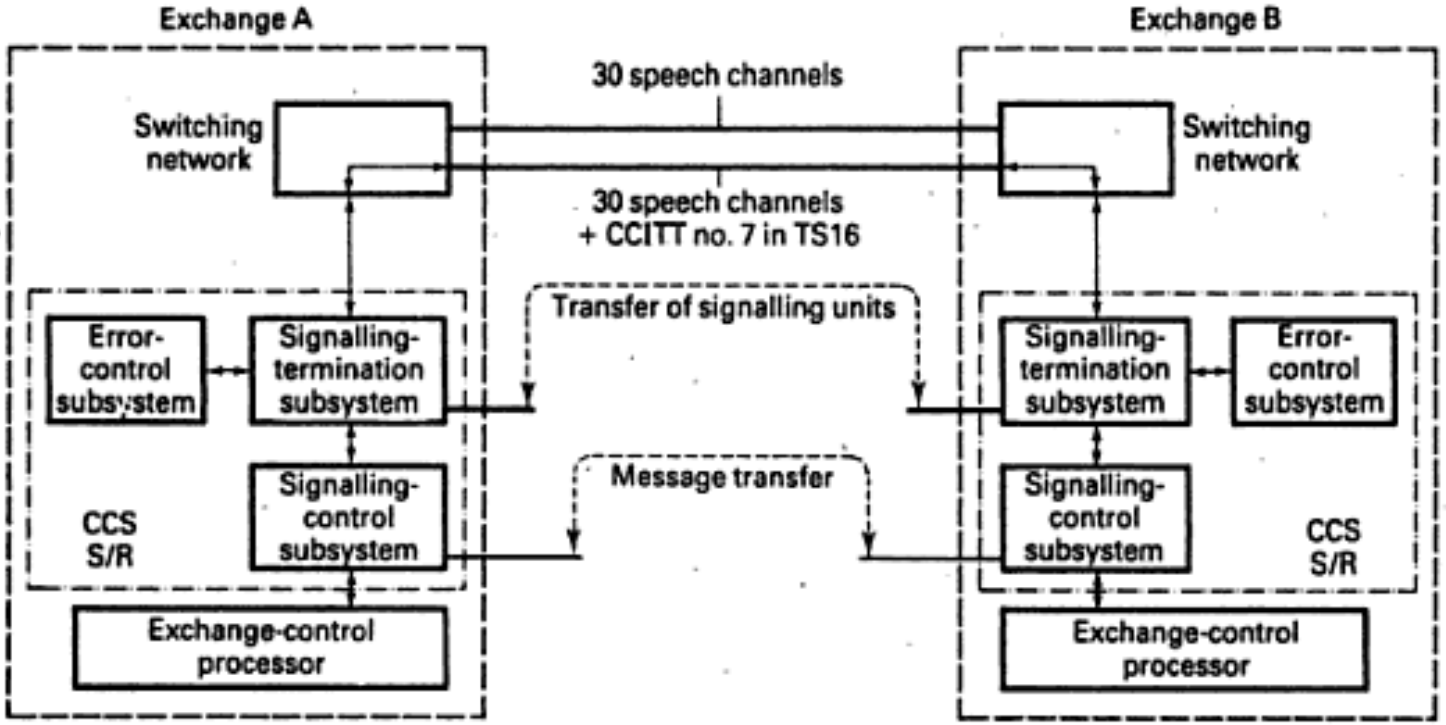


Exchange functions for CCITT no. 6 source

It is the first common channel signalling system to be standardized internationally. This system was designed for use in analog networks and used bit rates of 2.4 kbit/sec and 4.8 kbit/sec. In SS6 each SU is of size 28 bits of which the last eight bits are check bits. Signal units with in a block are either message signal units or synchronization signals units. Within an exchange, the functions performed in transmission, CCITT signal units are shown.

- Processor is responsible for call control with in the exchange i.e. conduct signalling communication. The processor pass the appropriate message to the next exchange.
- The coder adds 8 check bits to the message signal to detect, the corruption.
- At receiving unit, the decoder checks each signal unit for errors with the 8 check bits. The signal unit is discarded in case of error found otherwise it is the input buffer which stores the signal unit until processor analyze its contents.
- The corrupted signal unit may be retransmitted for detection.
- Successful acknowledgment allows detection of signal unit in block storage otherwise retransmit the signal unit by the outgoing buffer.

CCITT SIGNALLING SYSTEM NO. 7

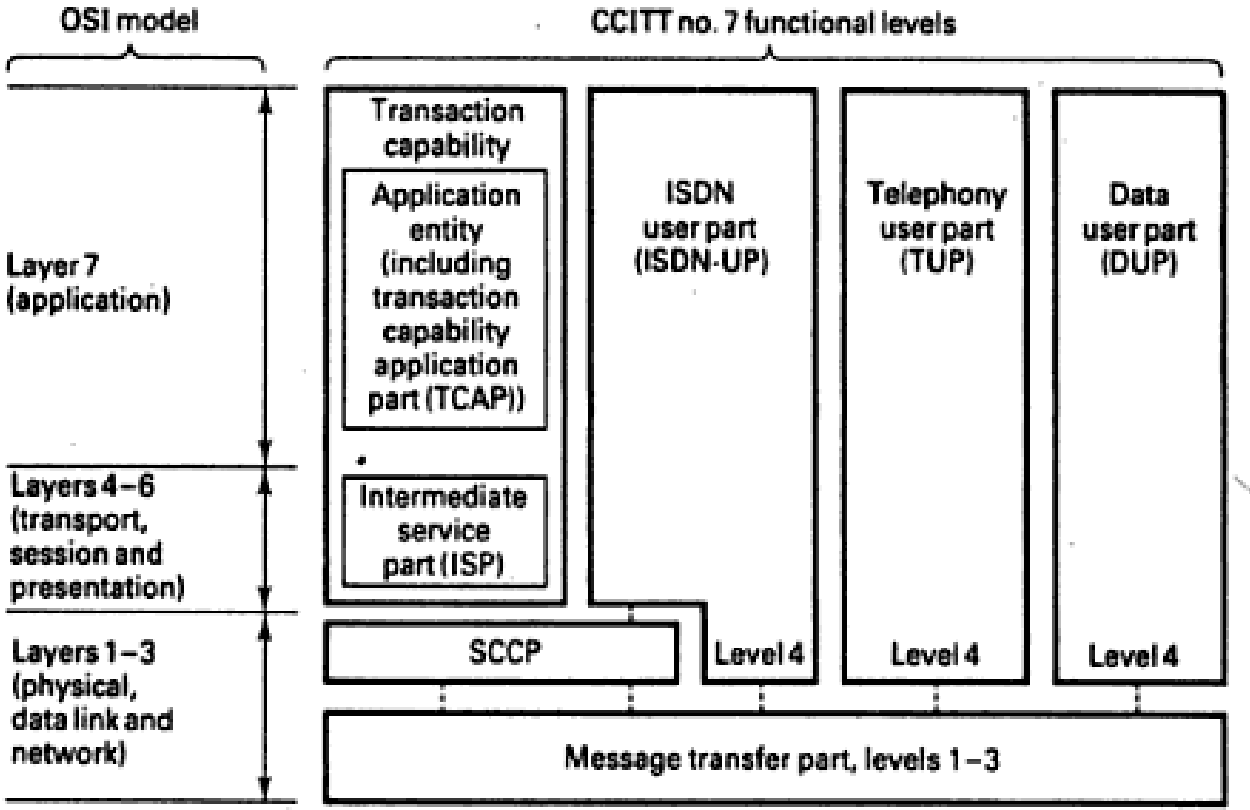


Block schematic diagram of CCITT no.7 signalling system.

Signals messages are passed from the central processor of the sending exchange to the CCS system. This consists of three microprocessor based subsystems:

- The signalling control subsystem
- The signalling termination subsystem
- Error control subsystem

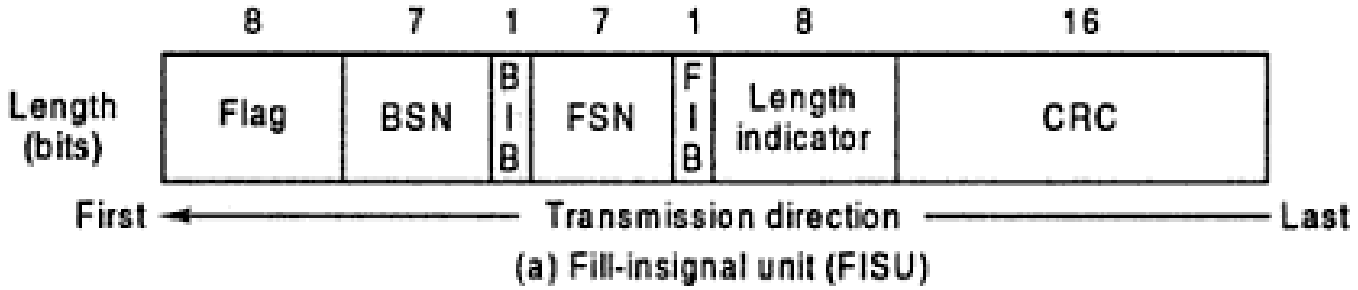
CCITT SIGNALLING SYSTEM NO. 7



Relationship between CCITT no.7 functional levels and layers of OSI seven-layer model.

Level 1: Physical Level
Level 2: Data Link Level
Level 3: The signalling-network level
Level 4: The user part

THE SIGNALLING UNIT OF SS7:



1. Message signal unit (MSU)
2. Link status signal unit (LSSU)
3. Fill in signal unit (FISU)

Formats of signal units in CCITT Signalling System 7

a Message signalling unit
b Link-status signalling unit
c Fill-in unit

BIB =backward-indicator bit
BSN =backward-sequence number
FIB =forward-indicator bit
FSN =forward-sequence number
LI =length indicator
SF =status field
SIF =signalling-information field
SIO =service-information octet

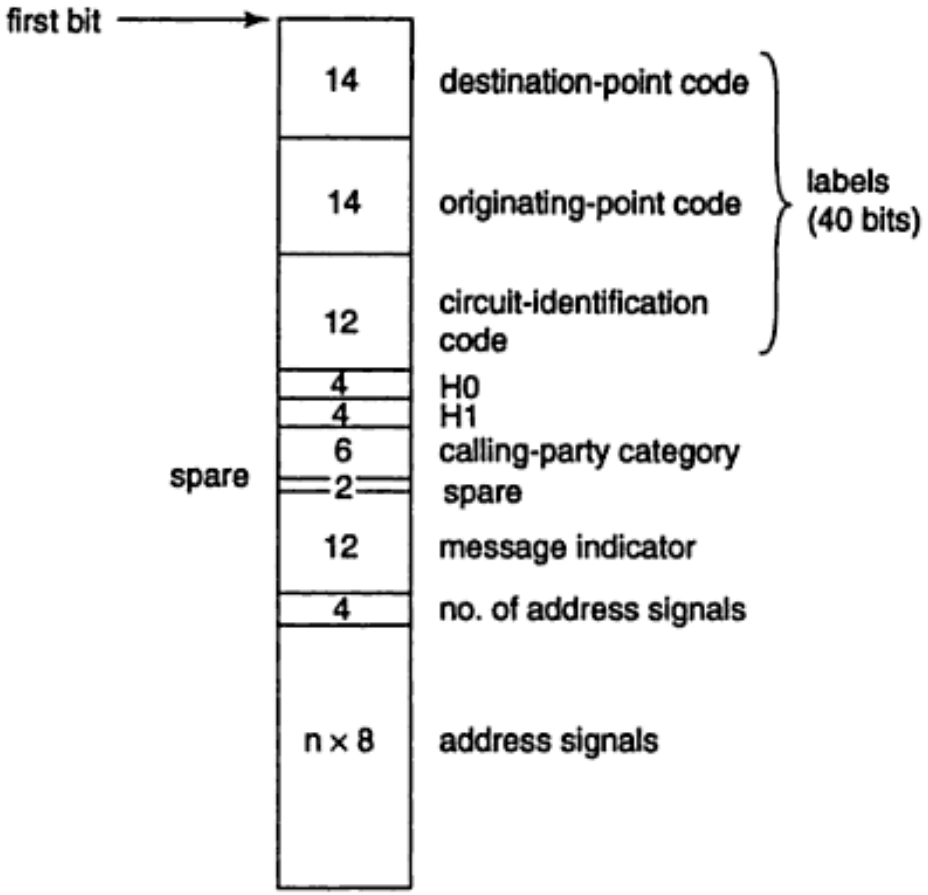
Features of SS7

1. Suitable for various communication services such as telephony, data, images and video.
2. SS7 is used to work with digital SPC exchange having 64 kbps digital channels, also suitable for operation over analog channels.
3. SS7 is suitable for any type of transmission medium *i.e.*, can be operated over both terrestial and satellite links.
4. Performance is high.
5. Flexible and much faster.
6. High reliability for message transfer.
7. Processor friendly structure of the message.
8. The mechanism of transmission is application independent.
9. Internationally standardised by the ITU.

DIGITAL CUSTOMER LINE SIGNALLING

- Digital transmission is used on customers lines to provide to an ISDN. Each line may give access to several terminals on the customer's premises and common channel signalling is used to serve them. Basic rates provides two B channels at 64 Kbit/s and a D channel at 16 kbit/s for signalling. Primary rate access provides, 30 channels or 23 channels, together with a 64kbit/s signalling D channel.
- The CCITT has defined the digital subscriber signalling no.1 for signalling over the D channel. The transfer of information in each direction between the customer's premises and the exchange is by messages called frames. Similar to CCITT no. 7 signal units.
- The control fields indicates the type of frame being transmitted. There are three types of frames:
    - I format for information transfer
    - S format for supervisory transfer
    - U format for un numbered transfer

TUP INITIAL MESSAGE FORMAT



TUP initial-address-message format in CCITT Signalling System 7

Messages used in I series

Abbreviation
Used to establish a call:
SET-UP
SET-UP ACKNOWLEDGE
INFORMATION
CALL PROCEEDING
Used to indicate that the called party is being alerted (e.g. rung):
ALERTING
Indicates that the call has been answered:
CONNECT
CONNECT ACKNOWLEDGE
Used to pass information back to the originating exchange or PBX during call establishment:
PROGRESS
Used to release a call:
RELEASE
RELEASE COMPLETE
DISCONNECT