OVER VIEW OF OCB 283
DIGITAL SPC SWITCHING SYSTEM

Digital Electronic SPC Switching Concept

1. Introduction

All new technology switching systems are based on Stored Programme Control concept. The call processing programmes are distributed over different control organs of the system and are stored in ROM/RAM of the units. Data required to handle the calls are also managed in the RAMs of different control units. Processor in the control units by using the programme and data stored in unit ROM/RAM process and handle calls. Handling or processing a call means to ultimately establish a connection in a switch between I/C and O/G ends. Depending on the system the name and architecture of control units and switch may change but basic criterion for switching remains more or less the same.

2.0 OVERVIEW OF OCB 283 DIGITAL ELECTRONIC SYSTEM

2.1 Introduction.

OCB 283 is digital switching system which supports a variety of communication needs like basic telephony, ISDN, interface to mobile communication, data communication etc. This system has been developed by CIT ALCATEL of France and therefore has many similarities to its predecessor E-10B (also known as OCB 181 in France).

The first OCB 283 exchanges of R11 version were commissioned in Brest (France) and Beijing (China) in 1991. The first OCB-283 exchange came to India in 1993 . Subsequently, the sysytem has been upgraded and current version R 20 was fully validated in January 1994. The exchanges which are being supplied to India belong to R20 version. At present, R21 and R22 versions are also being supplied. The basic architecture remaining same, more facilities both to subscribers and administration are supported by later versions.

2.2 Salient Features of the system.

i. It is a digital switching system with single ‘T’ stage Switch . A maximum of 2048 PCMs can be connected.

ii. It supports both analogue and digital subscribers.

iii. The system supports all the existing signalling systems, like decadic, MF (R2), CAS and also CCITT #7 signalling system.

iv. It provides telephony, ISDN, Data communication, cellular radio and other value added services.

v. The system has ‘automatic recovery’ feature. When a serious fault occurs in a control unit, it gives a message to SMM (O & M Unit). The SMM puts this unit out of service, loads the software of this unit in a back up unit and brings it into service. Diagnostic programmes are run on the faulty unit and the diagnostics is printed on a terminal.

vi. OCB 283 has a double remoting facility. Subscribers access unit CSND can be placed at a remote place and connected to the main exchange through PCM links. Further, line concentrators can also be placed at a remote location and connected to the CSNL or CSND through PCMs. This special feature can meet entire range of necessities viz. urban, semi-urban and rural.

vii. Various units of OCB 283 system are connected over token rings (IEE 802.5 standard). This enables fast exchange of information and avoids complicated links and wiring between various units.
viii. The charge accounts of subscribers are automatically saved in the disc, once in a day. This avoids loss of revenue in case of total power supply / battery failure.
ix. The traffic handling capacity of the system is huge. It can handle 8,00,000 BHCA and 25,000 erlangs of traffic. Depending on the traffic, a maximum of 2,00,000 subscribers or 60,000 circuits (or trade off between these two) can be connected.
x. The exchange can be managed either locally or from an NMC through 64 Kb/S link.
xi. All the control units are implimented on the same type of hardware. This is called a station. Depending on the requirement of processing capacity, software of either one or several control units can be located on the same station. For all these control units, only one backup station is provided., enabling 'automatic recovery' in case of fault.
xii. The OCB 283 system is made up of only 35 types of cards. This excludes the cards required for CSN. Because of this, the number of spare cards to be kept for maintenance, are drastically reduced.
xiii. The system has modular structure. The expansion can be very easily carried out by adding necessary hardware and software.
xiv. The SMMs (O&M Units) are duplicated.with one active and other hot standby. In case of faults, switch over takes place automatically. Moreover, as discs are connected to both SMMs, there is no necessity of changing cables from one system to another.
xv. The hard disc is very small in size , compact and maintenance free. It has a very huge memory capacity of 1.2 Giga bytes. The detail billing data are regularly saved in the disc itself, from where they can be transferred to magtape for prcessing.
xvi. The space requirement is very small. No seperate room is required for OMC.
xvii. There is no fixed or rigid rack and suite configuration in the system. It povides great flexibility and adjustment in the available space.
xviii. The environment requirements of the system are very flexible. False floor and ceiling are not essential. Air conditioning requirements are also not stringent. The system can work at temperatures 5 to 45^0 C, though the optimum temperature is 22^0 C.

2.3 SUBSCRIBER FACILITIES PROVIDED BY OCB 283

OCB 283 provides a large number of subscriber facilities. Some facilities are available to only digital subscribers and as such they can not be availed by analogue subscribers. To avail these facilities subscriber number are given special categories by man machine commands.

Facilities to analogue subscribers.

i. A line can be made only out going or incoming.
ii. Immediate hot line facility - The subscriber is connected to another predetermined subscriber on lifting the handset, without dialling any number.

iii. Delayed hot line facility - When subscriber lifts the handset, Dial Tone is provided he can dial any number. If he does not dial a number, within a predetermined time, he is connected to predetermined number.
iv. Abbreviated dialling - The subscriber can record a short code and its corresponding full number in the memory. Later to dial this number, he has to only dial short code.
v. Call forwarding - When activated, incoming calls to the subscriber gets transferred to the number mentioned by the sub while activating the facility. The facility is especially very useful for the people who are on the move.
vi. Conference between 4 subscribers - The subscribers A and B while in conversation, can include two more subscribers by pressing 'flash button' and dialling their numbers.
vii. Call waiting indication - When a subscriber is engaged in conversation and if gets an incoming call, an indication is given in the form of a tone. Hearing this, the subscriber has option, either to hold the subscriber in conversation and attend the waiting call or to disconnect this subscriber and attend to the waiting call. In the former case, he can revert back to the earlier subscriber.
viii. Automatic call back on busy - If this facility is activated and if the called subscriber is found busy, the calling subscriber simply replaces the receiver. The system keeps watch on the called subscriber and when it becomes free, a ring is given to both the subscribers. On lifting they can talk to each other.
ix. Priority line - Calls from this line are processed and put through even when the number of free channels are within a threshold or when the system is operating in a catastrophic mode.
x. Malicious call identification - When this category is given to a subscriber, the number of calling subscriber (to this number) is printed on the terminal.
xi. 12 or 16 kHz meter pulses - The system can send 12 or 16 kHz meter pulses on the subscriber line for the operation of the home meter.
xii. Battery reversal - The system extends battery reversal when called subscriber answers. This is useful in case of CCBs.
xiii. Detailed billing - The system provides detailed bills giving details of date, time, metered units etc.
xiv. Absent subscriber service- When activated, the incoming calls are diverted to absent subscriber service for suitable instructions or information.

FACILITIES TO DIGITAL SUBSCRIBERS.

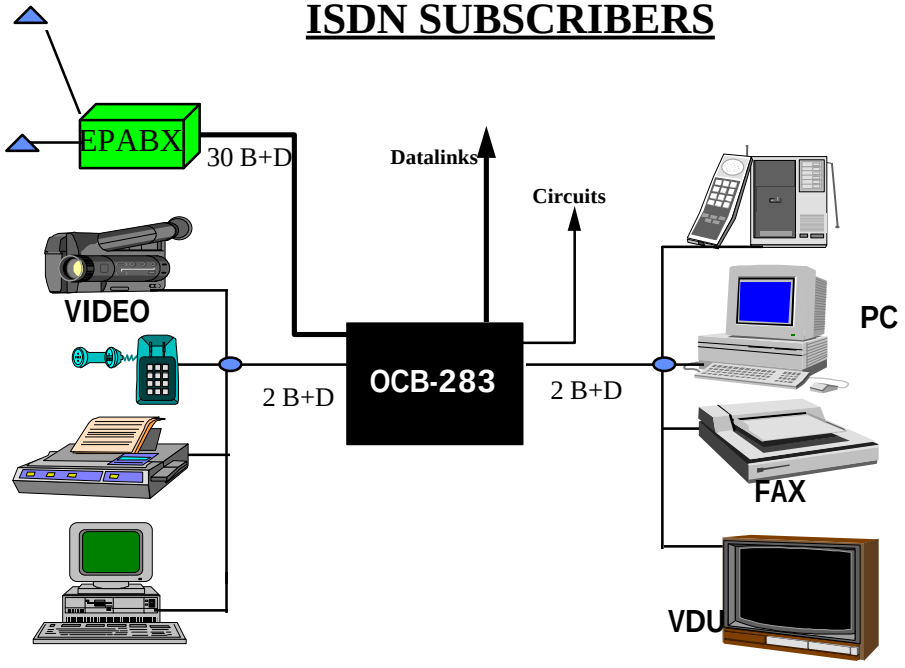
Digital subscribers are provided all the facilities available to analogue subscribers. In addition, they are provided following facilities which are called ISDN services An ISDN subscriber can use many electronic devices on its telephone line and can utilise them for 2 or more simultaneous calls of either

- VOICE
- DATA
- VIDEO

The ISDN or Digital Subscribers of OCB-283 can be provided the following types of connections

- 2 B +D Line :- 2 Voice Channels of 64 kbps & 1 Data channel for 16 kbps
- 30 B+D Line :- 30 Voice channels of 64 kbps & 1 Data channel of 64 kbps

ISDN SUBSCRIBERS



The following is the list of some of the services to Digital subscriber s

a) It provides 64 Kb/s digital connectivity between two subscribers for data communication.
b) The system can provide Group 2,3 or 4 Facsimile (FAX) services.
c) It provides videotext services.
d) The system provides display of calling subscriber number on called subscribers telephone.
e) The system also provides the facility for restriction of the display of calling subscriber number on called subscriber's terminal. To avail this facility, the subscriber has to be given a category.
f) The system provides the facility of displaying connected number on the calling subscribers terminal. This is especially useful when called subscriber has activated 'call transfer facility'. The calling subscriber can choose to speak on forwarded number or disconnect the call.
g) The above facility can be restricted by giving special category to the subscriber.

h) Charging advice - The system is capable of providing charging advice either in real time or at the end of the call.
i) User to user signalling - The system permits transfer to mini messages between calling and called subscribers during call set up and ringing phase.
j) Terminal portability during the call - A subscriber (calling subscriber as well as called subscriber) can unplug terminal, carry it to some other place or room and resume the call within 3 minutes.
k) Listing unanswered calls - The number of calling subscribers, who calls during the absence of called subscriber, are recorded in called subscriber's terminal. The called subscriber can then check up these numbers and call them back if, he so wishes.

OCB 283

GENERAL ARCHITECTURE

EXCHANGE FUNCTIONAL ARCHITECTURE

- OCB-283 EXCHANGE IS ALSO CALLED ALCATEL 1000 E-10
- Exchange has got Three basic subsystems :-

1. Subscriber access subsystem
2. Connection & control subsystem
3. Operation & maintenance subsystem

1. SUBSCRIBER ACCESS SUBSYSTEM:-
   - This is treated as an independent entity
   - Every Subscriber Connecting Equipment Rack is given a Signalling Point Number to operate in Common Channel Signalling mode with rest of the exchange Subsystems.

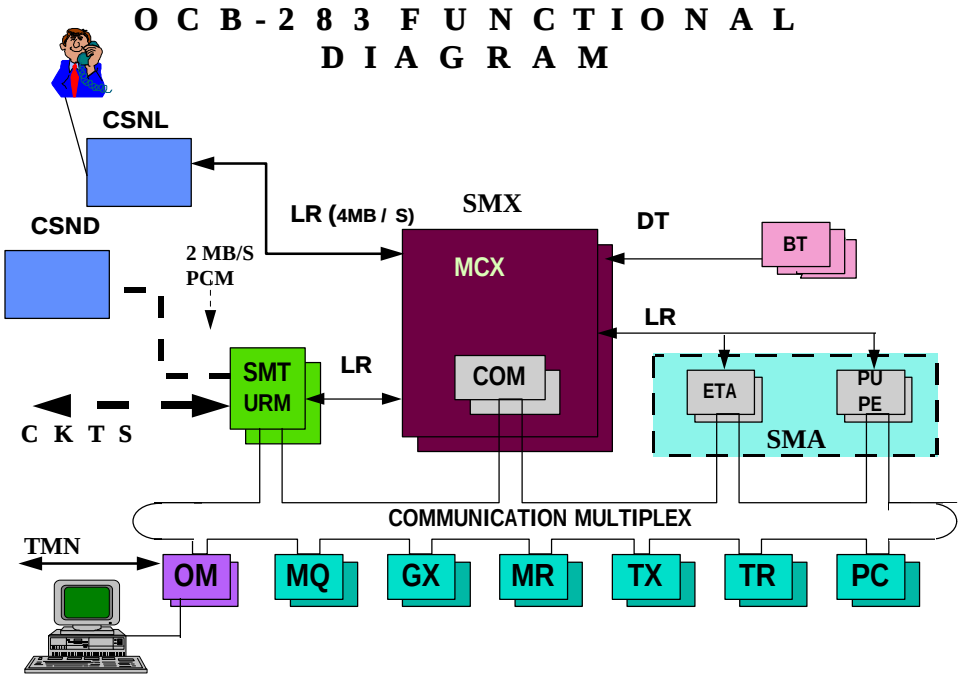
2. CONTROL & CONNECTION SUBSYSTEM IS THE BLOCK CONSISTING OF
   - -Control functions
   - -connection & switching equipments

   Control functions comprise of common control equipments which;
   - process
   - monitor
   - & control the call set-up & release

   CONNECTION & SWITCHING BLOCK COMPRISES OF
   - Switching matrix equipment for performing digital time switching of speech path .
   - Connection equipments for connecting PCM (digital) Junctions from;
   - other exchanges & RSU's
   - Auxiliary Equipments for Tones ,Frequencies & other auxiliaries for signalling protocol handling .

3. OPERATION & MAINTENANACE SUBSYTEM :-

- For Operation & Maintenance of exchange by operators / remote NMC.



OCB-283 SWITCHING SYSTEM

The functional architecture of the OCB-283 System comprises in general of following distinct components :--

Connection Units

-These provide facility to connect a subscribers loop or circuits from an external PCM and transfer these Speech samples on to selected Time Slots called voice channels on a LR link (internal PCM) towards switching matrix & viceversa ; These units are

NAME	FUNCTIONAL NAME
Subscriber Connection units	CSNL,CSND, CSED
Circuit Connection Units	SMT (URM)
FREQUENCY GENERATOR , Sender & RECEIVER & Common	SMA (ETA)
Channel Signalling Protocol Handler	SMA (PUPE)

Switching Network -

These provides facility for CONNECTING the LRs (internal PCM's) coming from connection units and performs Switching Operation for Calling Subs TS onto Called Subscriber TS & vice versa for a two way connection per call of telephony.

Control Units

These units provide control of calls on the basis of Stored programmes. They process the calls on reception of dialled digits from calling subscriber/ circuit & take part in handling

of call set-up & release by processing , monitoring, measuring charging of call s & all other common control function s needed for working of an Automatic Common Control Exchange.

These Control units can comprise of following Functions

NAME OF FUNCTION		FUNCTION
MR :	Multiregister	Call handler SET UP & RELEASE OF CALL
TR :	Translator	Translation of digit , Databank of subs & circuits in files
MQ :	Marker	Message distribution between Common Control & Connection units
TX :	Charger	Computing the charge of a call , keeping meters
GX :	Matrix System Handler	Processes & makes connections in Switching matrix on the orders from MR or MQ
PC :	Common Channel Signalling Network Controller	Manage the CCS7 network for signalling

O& M Units & Maintenance Peripherals :-

In an Electronic Stored Programme Control Digital Exchange like OCB-283, all operation & maintenance activities are performed by a unit called O & M unit or OMC (Operation & Maintenance Centre)

This provides access for Man Machine dialogues for the human operators to interact and command the working of Exchange Equipments.

OCB 283

HARDWARE DESCRIPTION

OCB-283 HARDWARE ARCHITECTURE

An OCB 283 exchange comprises following hardware units.

i) Subscriber Access Units (CSNL, CSND, CSED)

ii) Trunks and Junction connection Units (SMT)

iii) Switching Matrix (SMX)

iv) Auxiliary Equipments (SMA)

v) Control Units (SMC)

vi) Communication multiplexes(MIS &MAS Token rings)

vii) Time base generator(STS)

viii) Operation and Maintenance Unit (SMM)

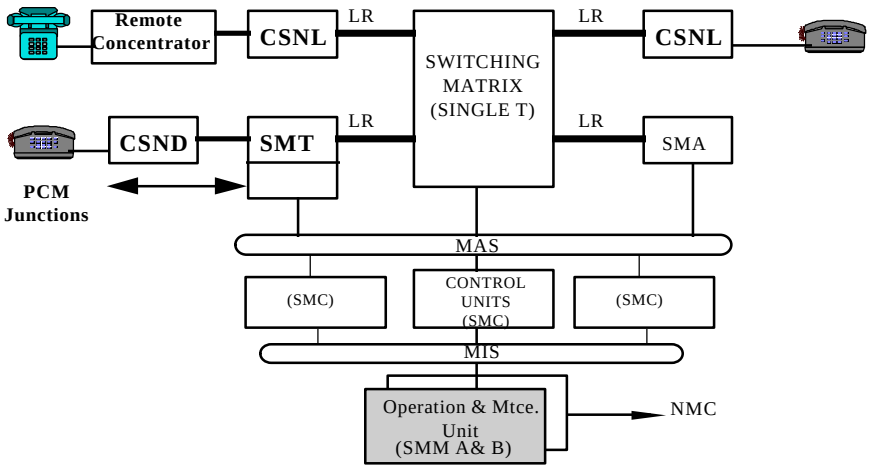


Fig. 1 - General Architecture of OCB-283

The subscriber connection units CSN, SMTs, and SMAs, are connected to switching network through PCM links.

The interchange of messages between SMT, SMX, SMA and control units SMCs takes place on 'MAS' token rings. The control units interchange messages with one another and with SMM on 'MIS' token rings.

The SMM is the O&M function unit & is duplicated as SMMA &SMMB. These work in Pilot/Standby mode.

The SMCs are the units which hold control functions MR,TR, TX, MQ, PC, GX . these FUNCTIONAL units are in software form and are duplicated except MR which can be more than two.

The duplicated functions work in Load sharing mode (except PC which works in Pilot /Standby mode.) hence SMCs can be minimum 2 & maximum 32 as per design.

The SMA stations hold the ETA & PUPE functions & these are also minimum 2 to max 32.

SMT station which is the interface for the external PCMs is made of duplicated hardware and can handle either 32 PCMs if SMT1G or 128 PCMs if 2G. The SMT 's hardware is fully duplicated and functions P/R mode.

1 THE BRIEF DESCRIPTION OF HARDWARE UNITS

SWITCHING NETWORK

The switching network in OCB 283 is single 'T' Stage system. It is made up of :

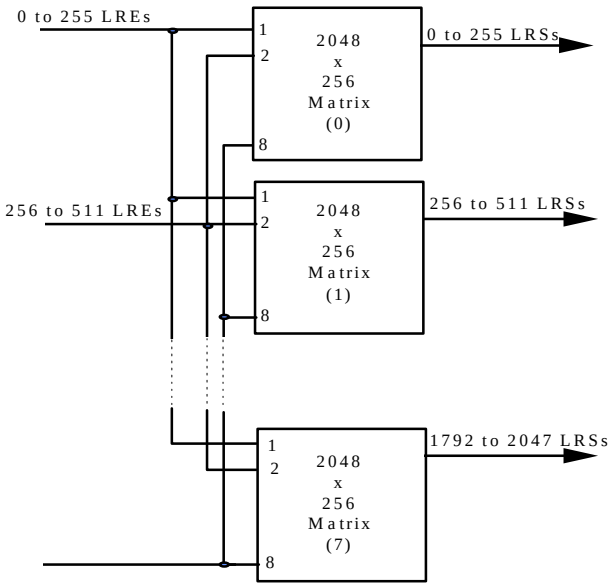
a) Host switching Matrix
b) Branch selection and amplification (SAB) function

Host switching matrix

The host switching matrix consists of two identical branches A and B. The host switching matrix is implemented on the hardware units known Matrix Control Stations (SMX) . Each host switching matrix can have upto 2048 incoming PCM links (LRE) and 256 outgoing links LRS. Out of 2048 incoming links, only 256 links are directly coming from this Matrix Control Station, the remaining links are coming from the other seven SMXs. In full configuration, the host switching matrix is 2048 x 2048 matrix. This is illustrated in figure.

A Matrix Control Station can establish connection between any TS on 2048 LRE and any TS on 256 LRS. Similarly, a host switching matrix can establish connection between any TS on 2048 LRE and any TS on 2048 LRS. Three standard configurations with 256 LRs, 1024 LRs and 2048 LRs are available.

The Matrix control station is built around a processor, which implements software machine MLCOM functions., to establish and break connections between time slots. It also carries out two way communication with other units in the system over MAS rings.

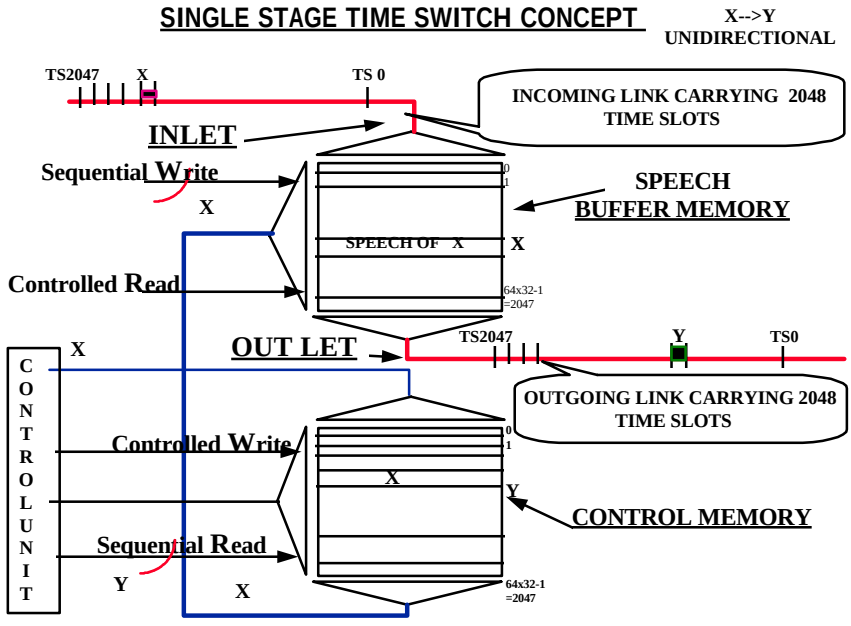


- Switching matrix configuration

TIME SWITCH CONCEPT

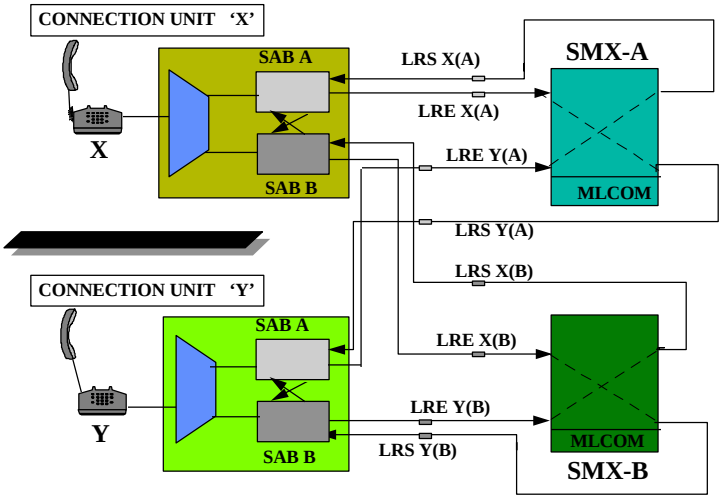
The time switch comprises of A SPEECH BUFFER MEMORY, A CONTROL MEMORY , AN INCOMING HIGHWAY OF DIGITAL SPEECH IN PARALLEL BITS & AN OUTGOING HIGHWAY as shown in the diagram below. This is a INPUT ASSOCIATED CONTROLLED TIME SWITCH

In this switch the BUFFER MEMORY & CONTROL MEMORY are controlled write type i.e. the writing in it is controlled . The control function writes in the control memory at the location corresponding to the INCOMING TIME SLOT NUMBER the location where it should be written in the Buffer Memory.. Both these memories are sequential read type .Reading of control memory gives the address in BUFFER MEMORY for writing the INCOMING TS BYTE. Thus reading of Buffer memory sequentially the TS will be read from the location given by the control memory . Thus a one way TIME switching has taken place. Similarly a both way switching requires two sets of such switches.



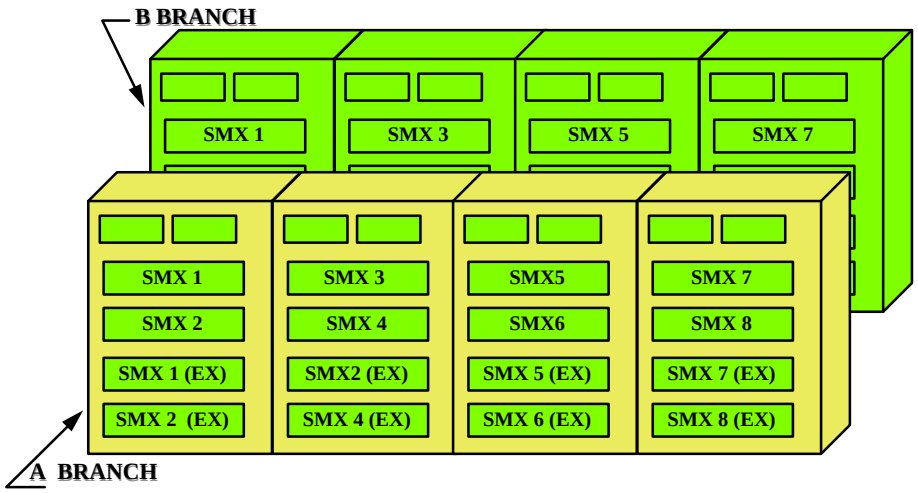
DUPLICATED SWITCHING

The switching is done in OCB-283 in two fully duplicated branches simultaneously. For this purpose from each connection units the LR links originate in two parallel branches towards two parallel sets of switching matrices called SMX A & SMXB .The branches of such network are called A & B branches. Also the receive side LR links come from both the SMXs A & B and are terminated on the respective connection units. (Referred to as UR in figure below). The duplicated branches of switching have been designed to provide high reliability of switching path for such diverse purposes as DATA SWITCHING, VIDEO CONFERENCE, ISDN APPLICATIONS etc. With the duplicated paths of switching if there is error in one path the other path which is good can be used continuously without interrupting the call in progress.



SWITCHING IN OCB-283
IN TWO BRANCHES OF SMX

SWITCHING RACKS OF OCB-283 (FOR 1024 LRS)
4 SMX SWITCHES IN EACH BRANCH



SAB FUNCTION

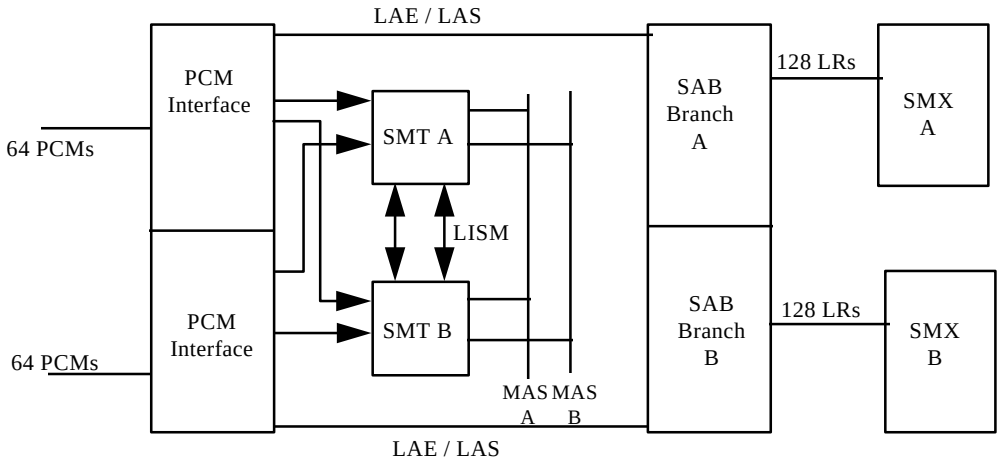
The connection units have their internal duplicated hardware which is called CONTROL LOGIC, which work in PILOT /RESERVE arrangements . Also they have non duplicated hardware such as subscriber cards & PCM termination cards The duplicated LR s originate from a function in connection units called SAB - Selection &Amplification of Branches. Its role is to generate two sets of LRs in trans direction with calculation of parity etc. In receive direction it gets data from both the branches which it checks for parity etc. and compares to detect any error in the two branches .In case of error the samples from only the good branch are taken after automatic testing of the quality of transmission of both the branches by the common control & the faulty branch is withdrawn from the service.

The connection Units' LR links are formed into group of 8 LR s at the factory into cables with both ends terminated with Plugs for the convenience of installation. Such groups of LR s are called GLR. The figure shows how GLRs are terminated at the two branches of SMX in OCB-283 .

TRUNK AND JUNCTION CONNECTION UNIT(SMT)

This is also known as PCM trunk control station. This unit is an interface between PCM junctions coming from other exchanges (or CSND, CSEDs) and the switch. The current version of SMT being supplied to India is SMT 2G.

In each SMT 2G, there are 8 modules and in each module there are 16 PCMs. Thus, there are 128 PCMs, in a single SMT 2G. SMT 2G is built around microprocessor 68030.



- General architecture of SMT 2G

General Architecture

SMT 2G consists of duplicated processing subsystems.

SMT A and SMT B which are connected through internal links LISM. Both of them are connected to PCM interfaces as well as to MAS token rings. PCMs are connected to PCM interfaces, which are not duplicated. SMT 2G is connected to SMX A and SMX B through 128 PCMs which are connected to SAB branch A and SAB branch B. Speech samples are sent on both the branches from SMX, but one which is better is selected and connected to the concerned PCM TS by SMT. The SAB function (branch selection and amplification) is also not duplicated. Out of the two processing logics, SMT A and SMT B, one remains active and other standby. In case of fault in active logic, automatic switch over takes place providing an uninterrupted service. Also locavar is activated on the faulty logic and the diagnostic is printed on a terminal for the information of the maintenance staff.

Functions

The software MLURM is loaded on SMT to perform functions of a PCM controller.

The functions performed on receive side-

i) Converts HDB 3 code to binary.

ii) Extracts channel associated signalling.

iii) Manages CCS 7 messages carried on TS 16.

iv) Cross connects a channel on PCM to a TS on LR.

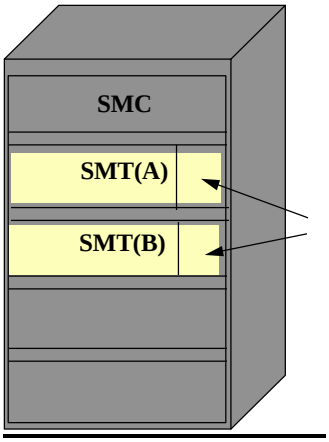
The functions performed on transmit side-

i) Converts binary code to HDB -3 (line) code.

ii) Injects channel associated signalling.

iii) Manages CCS 7 messages on TS 16.

iv) Cross connects a TS on LR to a channel on PCM.



PCM TERMINATIONS

UC RACK

CARDS LAYOUT IN SHELVES:-

SMTA (A SHELF)

AE5V40	ACALA	ACAJB	ACAJA	ICDIM	ICCLA	ICDST	ICPRO2	ICMEC	ICMOD0	ICID	ICMOD1	ICMOD2	ICID	ICMOD3	ICPR	ICMOD4	ICID	ICMOD5	ICMOD6	ICID	ICMOD7	ICTRM	ICTRM	AE5V40

SMTB (B SHELF)

AE5V40	ACALA	ACAJB	ACAJA	ICDIM	ICCLA	ICDST	ICPRO2	ICMEC	ICMOD0	ICID	ICMOD1	ICMOD2	ICID	ICMOD3	ICPRO2	ICMOD4	ICID	ICMOD5	ICMOD6	ICID	ICMOD7	ICTRM	ICTRM	AE5V40

Auxiliary Equipments Control Station (SMA)

The SMA contains the following two functional units -
i) ETA & ii) PUPE

ETA

The ETA contains following sub-components-

a) Frequency receiver / generators
b) Conference call circuits
c) Tone generators

The frequency receivers / generators recognises the digits dialled through DTMF instrument and also the MF (R2) signals received on junctions. They also generate the various frequencies required for MF (R2) signalling and testing etc.

The conference circuits are used to set up connection between a maximum of 4 subscribers. These 4 subscribers can hold conference on the telephone i.e. they can talk to each other.

Tone generators generate various tones required to be connected during call processing. These tones are Dial Tone, Busy Tone, Ring Back Tone, processing tone etc.

PUPE

The PUPE performs level 2 and part of level 3 functions for CCITT No.7 signalling. The rest of the level 3 functions performed by PC. The various functions performed by PUPE are as below.

Transmit side

i) It sends ‘flag’ and ‘check bit’ in the HDLC frame while transmitting CCS 7 messages. It also inserts zeros, when there are more than 5 consecutive Ones (1s) in the message.

ii) PUPE sends ‘fill in signal units’ (FISU) automatically, when there are no messages to be sent.

iii) PUPE also sends ‘link status signal units’ (LISU) when commanded.

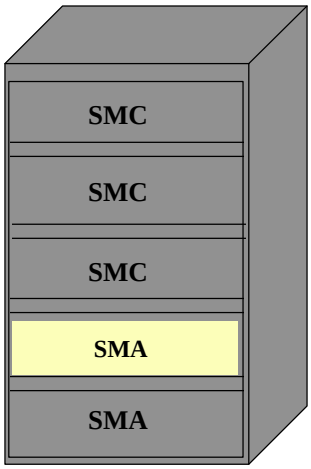
iv) It re-transmits a signal unit on receipt of negative acknowledgement.

Receive side.

i) On receipt of CCS 7 signalling messages, it eliminates zeros which were inserted after five consecutive Ones (1s)

ii) It detects the flag and also computes the checksum and compares them with check bits. If these two match, it sends positive acknowledgement otherwise it sends a negative acknowledgement.

iii) It eliminates ‘fill in signal units’ as they do not carry any information.



Implementation of ETA and PUPE on SMA

Either ETA or PUPE or both can be implemented on the same SMA. When both are implemented on the same SMA, MLPUPE (logic machine PUPE i.e. PUPE software) is loaded on the principal processor (PUP) and MLETA is loaded on secondary processor (PUS).

When only PUPE is implemented on SMA, it is loaded on PUP and when only ETA is implemented, it is loaded on PUS.

Only first two ETAs have tone generators. CCFs and RGFs are provided as per requirements. The PCB used is common for RGF, CCF and tone generators, only the software is different. When no CCF or tone generators is required, an ETA can have a maximum of 96 RGFs.

An SMA is connected to SMX by 8 LR links. The following table illustrates the capacity & modularity of SMA.

SMA Units equipped with	Capacity	MAX & MIN. No
ETA alone	96 RGF	2 to 32
PUPE alone	64 CCS-7 Channels	2 to 15
ETA and PUPE both	64 RGFs / 32 CCS 7 Channels	2 to 15

CARDS LAYPUT IN SHELF

14	23	29	33	41	47	53	59	65	71	77	81	85	89	93	97	01	05	13	25	42
AE5V40	ACALA	ACAJB	ACAJA	ACUTR	ACMCQ	ICTSH	ICTSH	ACHIL	ACHIL	ICTSH	ICTSH	ICTSH	ICTSH	ICTSH	ICTSH	ICHOR	ACUTR	ICID	ICID	AE5V40

PUP/MC /CCF/GT <----------RGF----------> CK/PUS

CONTROL UNITS

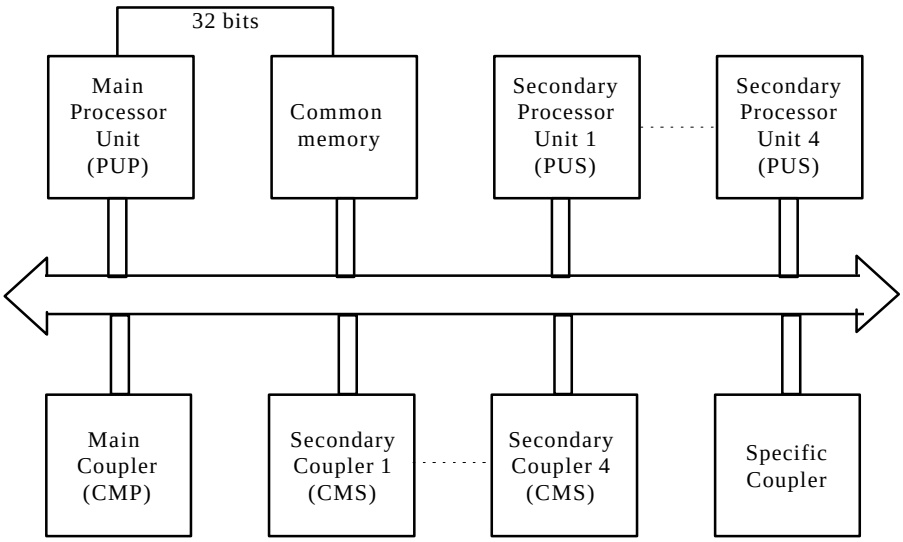
Architecture of Station (SMC)

Since all the control units like MR, MQ, TX, TR, etc and SMA are implemented on a common type of hardware architecture, known as station, it is worth while to understand the architecture and concepts of station.

A station is built around a multiprocessor station bus 'BSM'. One or more processors and one or more intelligent couplers can be connected to this bus. They interchange data through the common memory. The principal or main processor is connected to common memory through a 32 bit private bus, apart from through BSM. All the processors are Motorola 68020 processors and operate at 15.6 MHz. clock. Multi processor station bus BSM is a 16 bit bus which operates at 44.8 Mbs. A block schematic of a station is shown in the figure.

There can be one principal processor (PUP) and 4 secondary processors (PUS) in a station. Similarly, there can be one main coupler (CMP) and up to 4 secondary couplers (CMS). Specific couplers can be equipped for specific purposes.

A station can function as MR, TR or any other unit when a particular software is loaded in the station. Depending on traffic and processing requirements, software of either one or several functional units can be loaded in the same station. Also, depending on the above requirements, a functional unit can be implemented on principal or secondary processor and on main or secondary coupler.

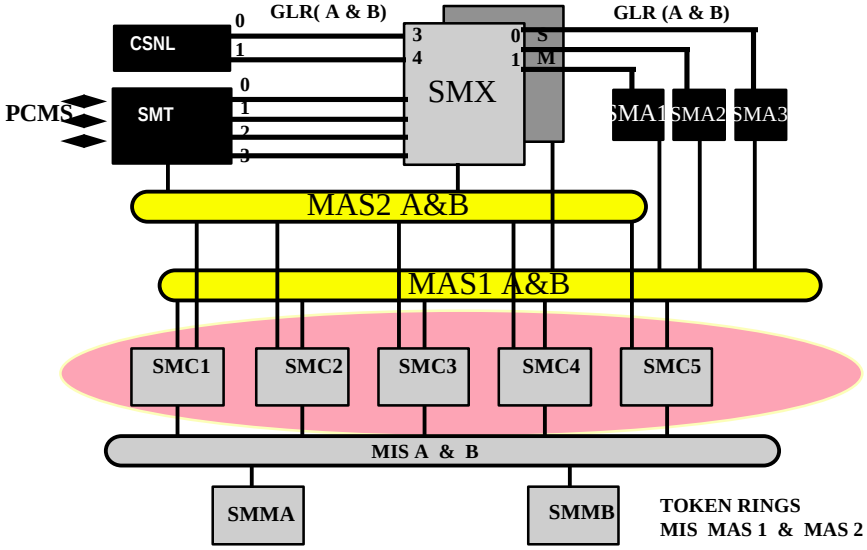


SMC Station Configuration

To permit co-habitation of many software machines on the same station, a basic software known as hypervisor is provided on the station. Another software, known as supervisor provides communication and loading facilities.

The station is generally known a s SMC.

CONTROL STATIONS OF OCB-283



OCB-283 BLOCK DIAGRAM

Implementation of Control Functions on SMC Stations

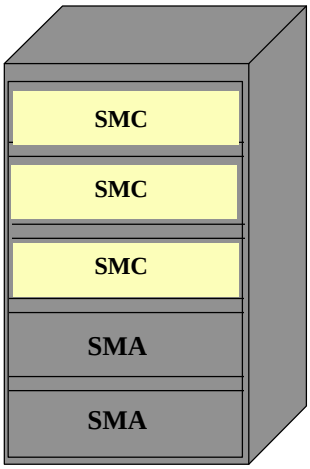
There are 6 common control functions in a OCB-283. The following list illustrates their minimum and maximum numbers.

Sl. No.	Name of Unit	Minimum	Maximum
1.	MR	**2**	**7**
2.	TR	**2**	**2**
3.	TX	**2**	**2**
4.	MQ	**2**	**2**
5	PC	**2**	**2**
6	GX	**2**	**2**

They are known as LOGICAL MACHINES in software form These Logical machines 'ML' are implemented on the hardware of SMC (Station) by loading suitable software on it. An SMC can support any one or many MLs or functions in defined combinations .

Accordingly depending upon exchange configurations & traffic requirement there can be minimum TWO SMCs required & maximum number of SMC can be 32 but no more than 15 are needed .The required number of SMCs is decided by the planners & manufacturers based upon traffic data. In addition to this, there is a provision of one 'back up SMC station'. This back up station is not loaded with any software.

Whenever, any SMC becomes faulty, it sends message to SMM. The SMM blocks this unit and informs all control units regarding non-availability of this unit. SMM, then loads the software of all the functional units on the back up station and brings it into service. Thus, there is automatic recovery. SMM also runs diagnostic program on the faulty station and prints diagnostics on a terminal.



CB RACK

Functions of various common control software MLs.

Multiregister (MLMR)

The MR establishes and releases the calls. It takes real time decisions for processing of a call. The MR also consults TR to find out subscribers entitlements and stores digits dialled by subscriber. It also orders for connections and disconnections of various tones and subscribers.

In addition to call processing functions, MR also carries out testing of circuits and observation functions.

Translator (MLTR)

The TR stores exchange data base in its memory. On request, it tells MR the characteristics and entitlements of subscribers and circuits.

The TR also stores routing and analysis data. It converts (or translates) the received digits into equipment number of the called subscriber.

Marker (MLMQ)

The marker carries out messages between common control functions MLs & connection units for subscribers or circuits. It also acts as 'gate' for messages which pass from one communication domain to another. The MQ also supervises semi permanent connections in the network.

Charging Unit (MLTX)

As the name suggests, the TX carries out charging for each communication set up. It also keeps charge account of all subscribers. The TX also prepares and sends detail billing messages to SMM. In addition, it also carries out subscriber and circuit observation functions.

Matrix system handler (MLGX)

The GX monitors the connections in the switching network and in case of fault, carries out appropriate defence functions. It also periodically or on request monitors internal links in the switching network.

CCS 7 Controller (MLPC)

The PC carries out 'routing and traffic' management functions (part of level 3 functions) for CCITT No.7 signalling. It also carries out the defence of PUPE, i.e. if a PUPE develops fault, it is automatically blocked, the semipermenant link is reconfigured and the standby PUPE is brought in service. The PC also carries out observation functions.

CARDS LAYOUT IN SHELF

15	24	30	34	42	46	54	58	66	70	78	82	90	96	02	08	14	20	26	32	38
AE5V40	ACALA	ACAJB	ACAJA	ACAJB	ACAJA	ACAJB	ACAJA	ACAJB	ACAJA	ACAJB	ACAJA	ACUTR	ACMCS	ACMCS	ACMCS	ACUTR	ACUTR	ACUTR	ACUTR	AE5V40
		CMS4		CMS3		CMS2		CMS1		CMP			PUP	MC		PUS0		1	2	3

EXCHANGE CONFIGURATIONS

OCB-283 can have FOUR configurations depending upon its size & traffic. One or several MLs can be implemented on one SMC station. Taking advantage of this flexibility the following 4 configurations are designed.

COMPACT C' CONFIGURATION
SMALL 'P' CONFIGURATION
MEDIUM'M' CONFIGURATION
LARGE 'G' CONFIGURATION

In the COMPACT configuration, all the six control units are implemented on a single SMC, where as in a large configuration MQ, GX and PC are implemented on the same station and MR, TR, TX are each implemented on separate SMCs.

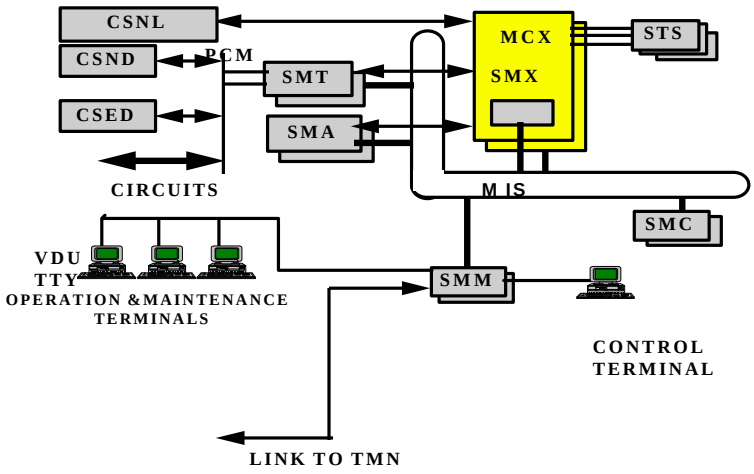
COMPACT (C) CONFIGURATION

SMC : 2
SMA : 2
SMT : 1
SMX : 1 (48 LR)

SMC CAN BE LOADED WITH MR,TR,TX,MQ, GX &PC SOFTWARE

SMA CAN BE LOADED WITH ETA,PUPE SOFTWARE

PERFORMANCE DATA:-
5 CA/S OR
18000 BHCA



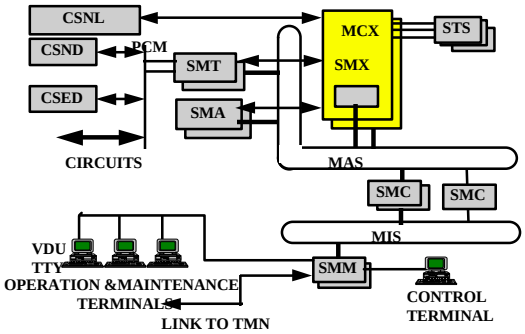
SMALL (P) CONFIGURATION

SMC : 2 +1 BACKUP
SMA : 2
SMT : 1
SMX : 1

SMC CAN BE LOADED WITH MR,TR,TX,MQ, GX &PC SOFTWARE

SMA CAN BE LOADED WITH ETA,PUPE SOFTWARE

PERFORMANCE DATA:-
36 CA/S OR
1,30000 BHCA



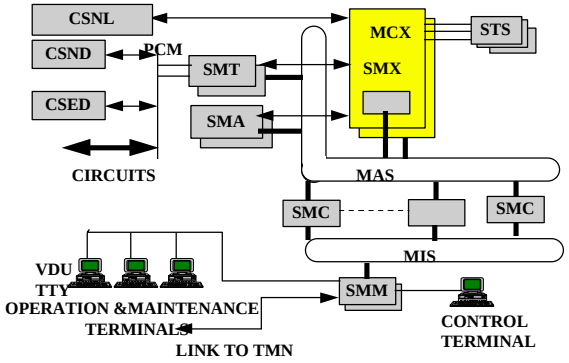
MEDIUM (M) CONFIGURATION

SMC : 2 OR 3 MR+2=5
SMA : 2 OR MORE
SMT : 1 OR MORE
SMX : 1 OR MORE

2 SMC'S CAN BE LOADED WITH TR,TX,MQ,GX &PC SOFTWARE

SMA CAN BE LOADED WITH ETA,PUPE SOFTWARE

PERFORMANCE DATA:-
100 CA/S OR
3,60000 BHCA



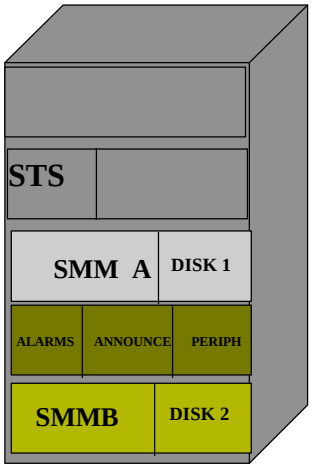
LARGE G CONFIGURATION.

SMC : 4 TO 7 MR+2 TX+ 2 SMC for others
SMA : 2 OR MORE SMT : 1 OR MORE
SMX : 1 OR MORE 2 SMC CAN BE LOADED WITH TR,MQ,GX &PC SOFTWARE
SMA CAN BE LOADED WITH ETA,PUPE SOFTWARE

PERFORMANCE DATA:- 220 CA/S OR 800,000 BHCA

MAINTENANCE STATION SMM A&B

SMM station in OCB-283 performs the O & M functions
The SMM station has full duplicated hardware SMM A & SMMB
One of the two SMM is pilot & other works as hot stand-by
For both SMM there are two mirror image hard disks of 1200 MB capacity-
Pilot SMM is able to access either of disks
There are terminations for peripherals TTY, VDU for operation & maintenance
SMM dialogues with all SMCs over **MIS** token ring
Adjacent to SMM rack there is one MAG-TAPE DRIVE UNIT : **DBM**
There is one **STREAMER** for cartridge drive in SMM rack
There are up to 4 alarm reception rings for handling exchange alarms
SMM receives all alarms from whole exchange on **alarm rings MAL**
SMM station occupies **3 shelves** of a CA. rack
SMM rack also has DIGITAL VOICE ANNOUNCEMENT SYSTEM MPNA in 4th shelf



FUNCTIONS OF MAINTENANCE STATION (SMM)

SMM is provided to supervise the functioning of various exchange equipments and to take suitable action in case of malfunctioning of any equipment. As stated earlier, it does the defence of control units in case of fault. All the files and data are stored in SMM hard disks , which can be loaded in any unit. SMM also carries out the re-initialisation of the exchange, when required.

The SMM process man machine commands and executes them. SMM also collects the alarms from various units and process them. SMM stores detailed billing data in the disk, which can be periodically transferred to mag tape for processing. SMM runs diagnostic programs (LOCAVAR) on the faulty units and indicate the faulty PCB. In nutshell, the SMM executes all the functions related to operation and maintenance of the OCB-283 exchange .

Architecture of SMM

The SMM (Maintenance Multiprocessor Station) is built around two identical microprocessor 68030. These multiprocessor station work in pilot and hot standby mode. Each of the processor has 4 M bytes private memory and 16 M bytes primary memory. All the components viz. processor, memory and couplers are connected on the X bus. The secondary memory devices like disc, magtape devices, streamer etc. are connected on the SCSI buses

which are connected to the X bus through couplers. The two SMMs are connected through HDLC for exchange of switch over and other messages. The SMMs are connected to MIS token ring through couplers for interchange of messages with control units. Various terminals for man machine communication and alarm couplers are connected to X bus through communication coupler.

Each disk has a capacity of 1.2 Giga bytes and both of them are connected to active SMM. In the normal operation, data is read from and written into both the disks simultaneously, but whenever one of them goes faulty, the other disk is available for read and write operation. The contents of one disk can be updated from other by command.

Streamer has a memory capacity of 525 M bytes. It is used to load system data into disk and for taking backup of the disk. Two magtape drives are provided. Charge account data and detailed bill data are transferred from disk to magtape for further processing in the billing centre.

Digital recorded announcement card is also equipped in the SMM shelf. The announcements are connected to up to 2 PCMs of first SMT from where they are connected to subscribers or circuits as per requirement.

One SMM (Pilot and standby) is provided at each OCB283 exchange. However, the SMM can be connected to Network Management Centre (NMC) for remote management.

CARDS LAYOUT IN SHELF

ABUTP SHELF

AE5V40	ACALA	ACAJB	ACAJA	ACUTG	ACMGS	ACUTG	ACMGS	ACUTG	ACMGS	ACUTG	ACMGS	ACBSG	ACBSG	ACCSG	ACFTD	ACFTD	ACDDG1	ACDDG1	AE12V	AE12V	AE5V40

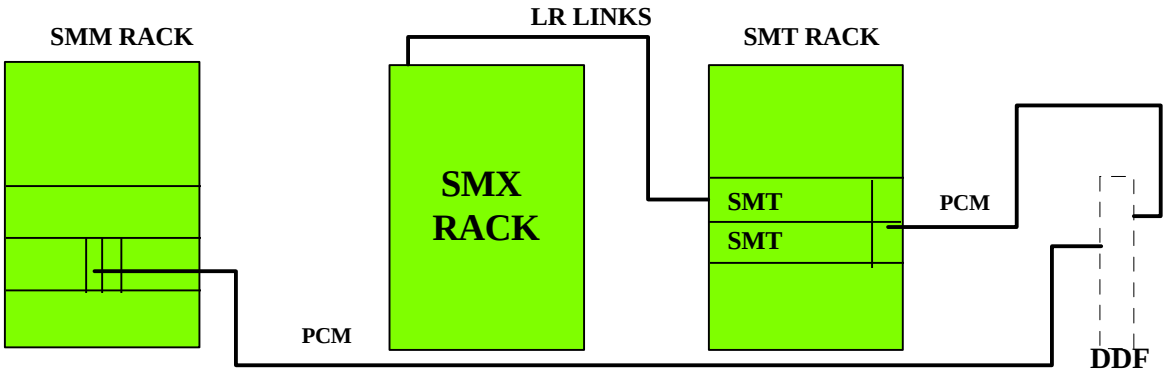
ABLAS SHELF

ACALA	ACALA	ACALA	ACALA	ACALA	ACREBA	ACALA	ACTLC	ACTLC	ACALA	ACALA	ICMPN2	ICSMP	ACSTG	ACJ64	ACJ64	ACTUJ	ACTUJ	ACTUJ	ACTUJ	ACRAL	ACRAL	AE5V40	AE5V40

DIGITAL ANNOUNCEMENT MACHINE MPNA

- Automatic announcements are provided in OCB-283 at the switching matrix in the form of a PCM coming from MPNA which has digital recorded voice messages stored in PCBs
- There are two PCBs :-
  - ICMPN2 ->RAM VOLATILE MEMORY GIVES PCMs
  - ICSMP ->EPROM SAVES VOICE-ANN. (DIGITAL)
- These two cards are situated in SMM rack & the announcements are carried by one PCM link from ICMPN 2 and are connected to one SMT; from SMT the LRs go to SMX.

- At SMX its time slots are used for getting the respective announcements.
- The MPNA is controlled by a small hand held control device called MICRO TERMINAL for storing & modifying of announcements using microphone /earphone.



COMMUNICATION MLTIPLEXES (MIS , MAS & MAL) TOKEN RINGS

In OCB283 exchange the communication multiplexed highways are utilised for interchange of messages between various equipments of exchange .These communication multiplexes work on the principle of computer's circular LANs using TOKEN RING protocols.

There are three types of communication multiplexed highway according to their use

1. **MIS** INTERSTATION MULTIPLEX
2. **MAS** STATION ACCESS MULTIPLEX
3. **MAL** ALARM MULTIPLEX

The MIS token ring is provided for interchange of messages between two SMC s and between an SMC and SMM .

The maximum and minimum number of MIS is only one (duplicated as A&B).

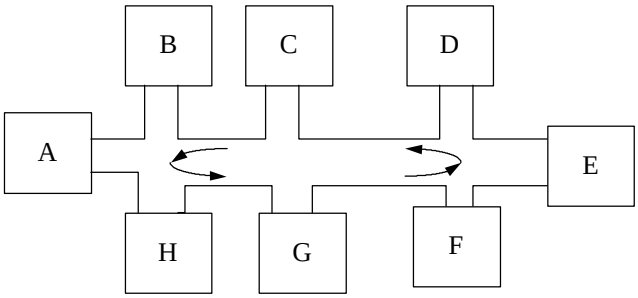
The MAS are provided for interchange of messages between CSNL, SMT, SMA & SMX on one hand and control units (SMC) on the other hand. A maximum of four MAS token rings can be provided in a large size exchange, where as no MAS token ring is provided in compact configuration. While SMCs are connected on all the MAS token ring, the other units are connected only on one of the MAS rings

MAS token ring can be minimum nil & maximum FOUR duplicated as A&B.

MAL token ring is provided to handle exchange alarms from all the hardware stations of exchange except CSNL.

The token rings conform to IEEE 802.5 Standard and operate at 4 Mbps

. Operating principle of TOKEN RING



An empty token circulate on the ring when there is no message to be sent. A Token contains starting flag, access control byte and end flag of one byte each as shown below.

EMPTY TOKEN :-

8 bit	8 bit	8 bit
End flag	Access control AC	Start flag

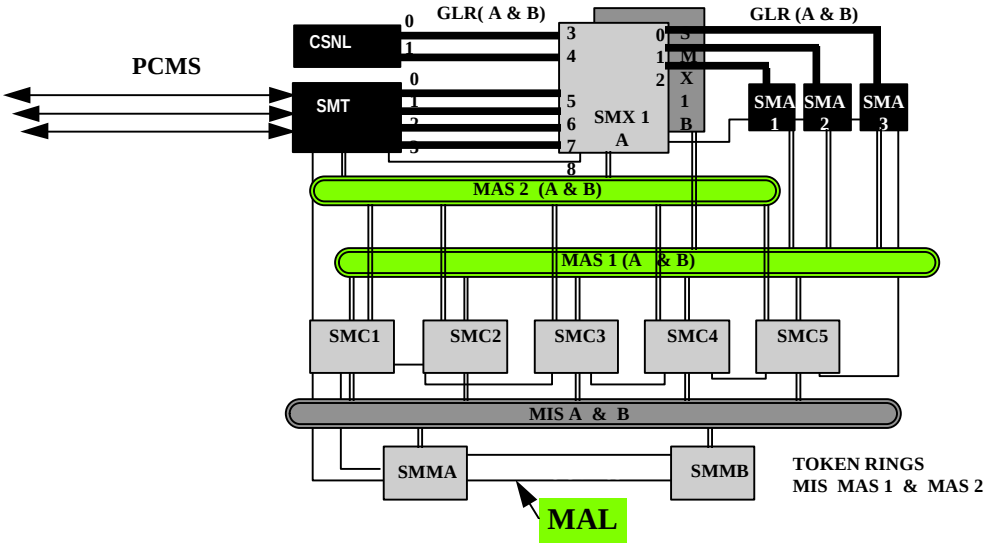
								P	P	P	T	M	R	R	R								

TOKEN WITH A MESSAGE

SD	AC	FC	DA	SA	INFO	FCS	ED	FS	FL

Whenever, a station wants to send a message, it checks the status of T bit. If T bit is zero the Token is free, so the station inserts its message in the token and sets T = 1, the station books the token to the next message. However if the token is busy, which is indicated by T=1, the station books the token by writing its priority in reservation field. Whenever a station receives the token, it compares its own address with the 'destination address' written in the token. If the address matches, the station receives this message and sends acknowledgement. On receipt of acknowledgement, the transmitting station clears the token and sets the T bit to zero.

If a station has booked a token, it can send the message only after it has been released by the transmitting station.

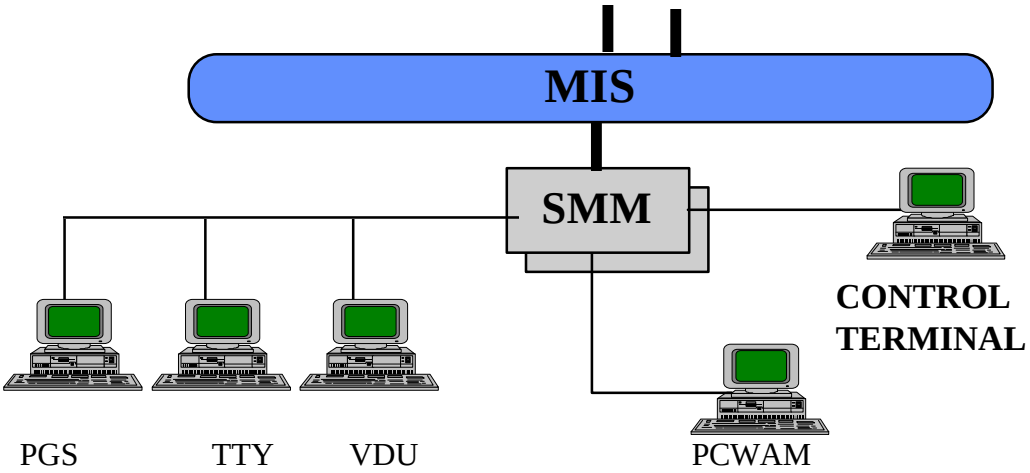


Time Base Generator(STS)

Tim e base is required to synchronise PCM links connected to connection units like CSNL, SMT, SMA etc. The time base is generated by synchronisation and time base station (STS) and distributed to the two branches of the switching network. These branches, then, redistributes the time base to above mentioned connection units along with LRs. STS has three oscillators, all generating '8 MHz' and 'SBT' time base. The switching network selects the time base as per majority logic. So, even if one of the oscillator is out of order, the system is not affected. STS receives 'SBT' and '8 MHz' but supplies 'SBT' and '4 MHz' to connection units.

There is a facility to synchronise these oscillators with an external source by equipping external synchronisation network. This facility is useful when the exchange has to be synchronised with the network.

O&M PERIPHERALS OF SMM



PCWAM:-

Personal Computer Work Access Method
It is a special software loaded IBM PC
It is the terminal of SMM which is connected to specific LAS links 1 and/or 9 of SMM.
It is used for hardware testing/locavar of SMM staions and components like hard disk, magtape, streamer etc.

PGS / TI:-

General Visual Display Cum Intelligent Terminal
It is a special software loaded IBM PC
It is one of the peripheral terminal of SMM working on asynchronous line for O & M
It shows the general display of alarms in exchange
It provides assistance in man-machine commands in TI: intelligent mode

CONSOLE TERMINALS

These are system video terminals connected to SMM
These are used for manual restart & stopping of SMM
These interact directly with 'real time operating system' of SMM computer

TTY /VDU

These are ordinary video terminals connected to SMM on LAS links
These are used by the operators for giving man-machine commands for normal operation & maintenance of the OCB-283 exchange.
These are provided with a printer for taking the hard copy
Up to 32 operators terminals can be provided in a exchange

POWER DISTRIBUTION

DCDB , ACDB , SDE RACK & CDE CLADDING

OCB-283 exchange works on -48.5 volt DC power supply from the battery backed power plant. This plant must have a sufficient current rating battery , Battery chargers , rectifiers , Float rectifiers & Knife edge distribution cubicles.

DCDB:-

The power supply cables from this distribution cubicle are brought in SWITCH ROOM where a special Steel cabinet is installed it is called DC DISTRIBUTION BOX DCDB.

A thick cable from exchange earth pit is also brought to DCDB & terminated there.

In switch room for distribution of power to the racks the cables of positive , negative & earth are taken to a rack called SDE or CDE (cladding) from DCDB.

SDE & CDE:-

The SDE rack is one of the standard size rack equipped with FUSES & has terminations for cables going to the racks of the exchange . The SDE rack can be installed any where in the SUITE . There can be more than one SDE racks each serving racks of one or more rows or Suites.

The CDE is an end Cladding in the rows of the rack & is equipped with FUSES similar to SDE.

The racks receive DC supply of -48 V .Every shelf of racks is equipped with CONVERTER cards which convert this DC supply into + 5V or -5V or +12 V etc. suitable for electronic cards.

ACDB:-

Apart from DC supply the exchange also needs Stable & Reliable 220 V AC supply for powering up the devices like , Personal computers of PCWAM, PGS/TI , TTY, VDUs, PRINTERS , & running the MAGTAPES etc.

Since this supply should be Uninterrupted therefore this is drawn from an INVERTER of at least 3 KVA operating on exchange battery. The supply from this INVERTER is brought in switch room to a box called ACDB. This box has got electrical SWITCHES & termination points. This box is equipped with relay for detecting AC failure alarm. This relay is powered by a -48v DC through a cable from SDE.

IRP

IRP is a termination BOX for terminating in any place in the exchange the ASYNCHRONOUS LINE CABLES coming from SMM rack . These cables are having

RS-232 C Plugs on both the ends . One PLUG is terminated on the backs side of SMM. The other end PLUGS are fixed in IRP. From IRP further more PLUGGED cables are taken to any of the TTY ,VDU ,PCWAM or PGS/TI terminals. Hence IRP provides a convenient place for termination of O&M terminals plugs & also provides flexibility.

OCB 283

Subscriber Access Units

SUBSCRIBER ACCESS UNITS (CSN)

Subscriber connection units (CSN) are so designed that they can be equipped with either analogue or digital subscriber or both. The cards for analogue and digital subscribers are different, but can be equipped in any slot of the shelf.

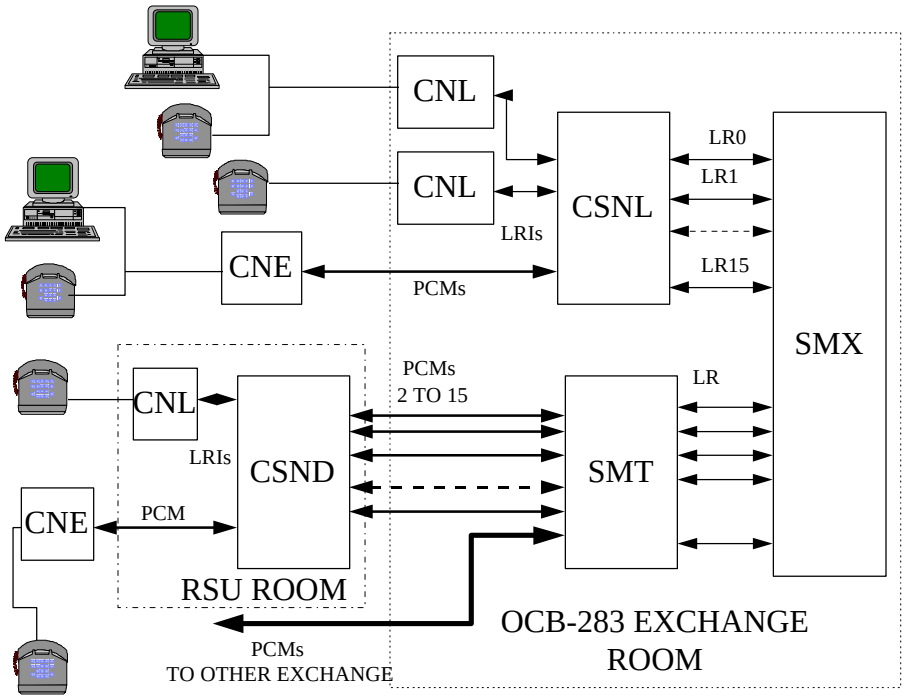
CSN can be either placed in the exchange switch room or at a remote location.

Further, subscriber card shelf known as concentrator can also be placed at the rack or at a remote location. These features provide great flexibility to meet any type of requirement of dense or sparse connection densities.

Depending on their location, CSN is known as CSNL or CSND and the subscriber shelf is known as local or remote concentrator. CNL or CNE

The CSNL is connected to switching matrix (SMX) through a minimum of 1 GLR or a maximum of 2 GLRs. (Group of 8 LR is called as a GLR and each LR is a PCM link having 32 Time Slots).

The CSND is connected to SMT rack through a minimum of 2 PCM and a maximum of 16 PCMs.



CSED of E-10B system can also be connected to an SMT.

DIALOGUE WITH CSN :-

The message interchanges between CSN and control units take place on common signalling channel using local version of CCS#7 signalling. The CSN is so designed that it can be connected to any switch supporting CCS#7.

ARCHITECTURE OF CSN.

The CSN can have one BASIC RACK & up to three EXTENSION RACKS . Its architecture can be broadly divided into 2 parts.

(i) Digital control unit (UCN).

(ii) Concentrators (CNL or CNE)

(I) Digital Control Unit (UCN)

The Digital Control Unit (UCN) is the interface between concentrators and the exchange. It is in BASIC RACK . The basic rack is placed in switch room for CSNL and at a remote location for CSND

. It can be further broken down into ,

a) Control and connection Units (UCX)

There are two such units which are the controlling logics of the CSN .These operate in the pilot standby mode. The active UCX controls the working of CSN and also updates standby UCX. In case of any fault in the active UCX, the switch over takes place without interruption to existing traffic.

b) Auxiliary Equipment Processing Group (GTA)

This component performs the following functions :-

In case of stand alone operation (i.e. when CSND is isolated from main exchange)

i) Generates tones and recorded announcements for local communication

ii)Decodes DTMF dialling

Tests the subscriber lines connected to local concentrators.

(II) Concentrators

The shelf which accommodates subscriber line cards is known as concentrator. The concentrators can either be co-located with the digital control unit in which case they are known as local concentrators CNL or at a remote location in which case they are known as remote concentrators CNE .

When a remote concentrator is used than to connect its PCMs to digital control unit an interface shelf ICNE is required.

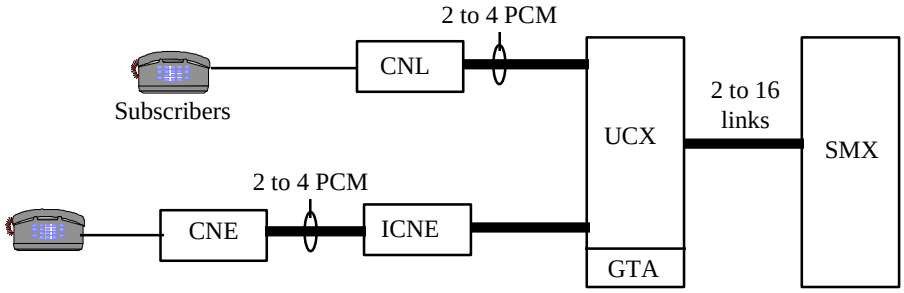
The maximum capacity of a concentrator is 256 subscribers.

The following type of subscribers can be connected to a concentrator, by equipping suitable kind of card.

i) Analogue subscriber (TABAS Card)

ii) 2B + D digital subscriber (TANAE card)

iii) 30B + D digital access (TADP card)

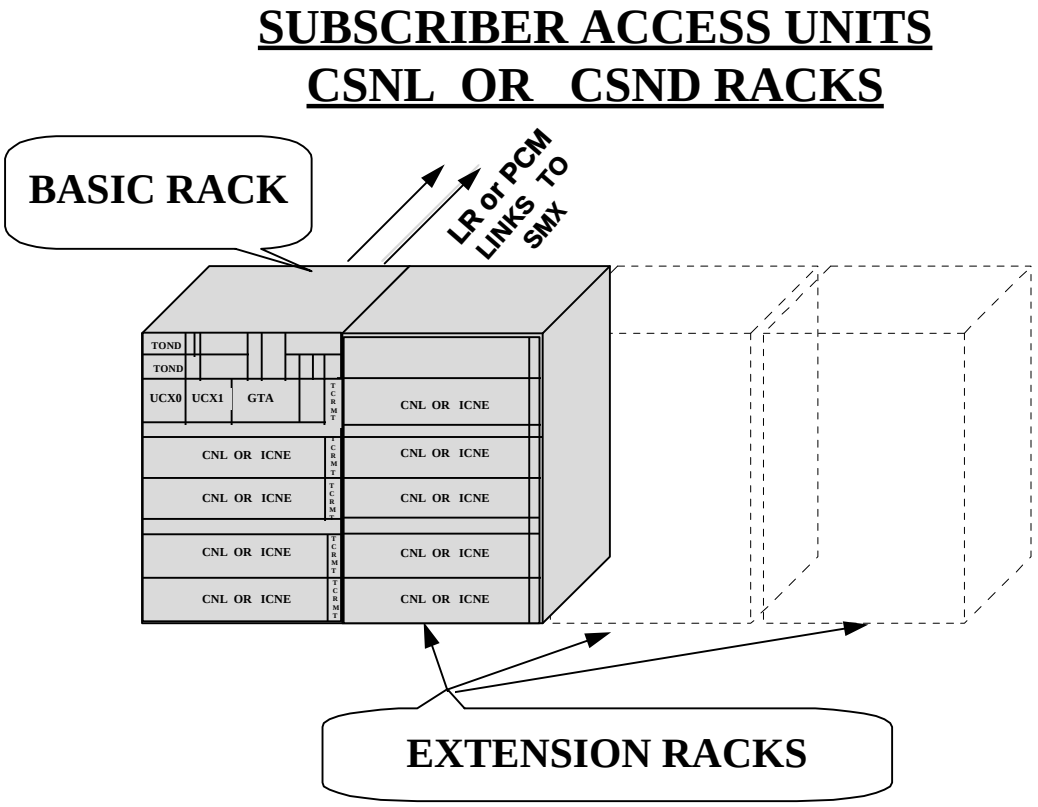


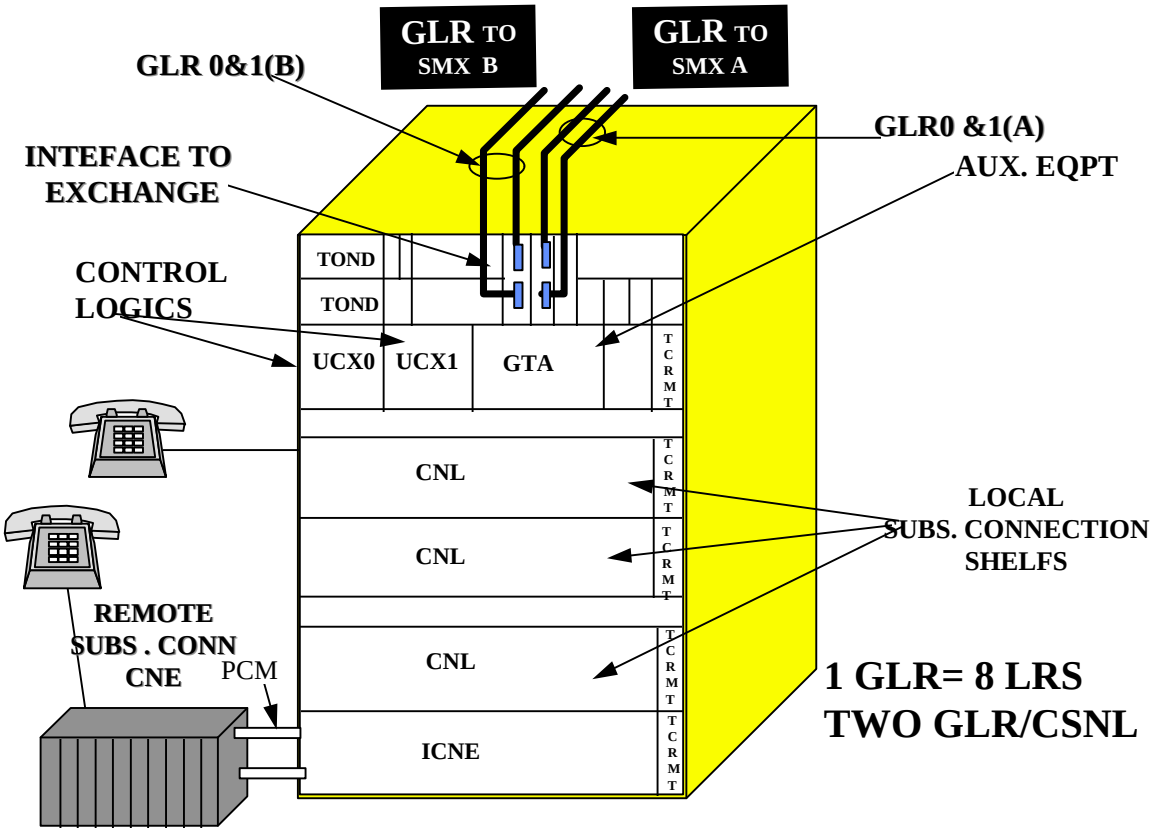
Connection of local & remote concentrators to CSNL

When all the concentrators are local, a maximum of 19 concentrators can be equipped in one CSN having 4 racks, where as if all are remote or if at least 2 are remote, a maximum of 20 concentrators can be equipped in one CSN.

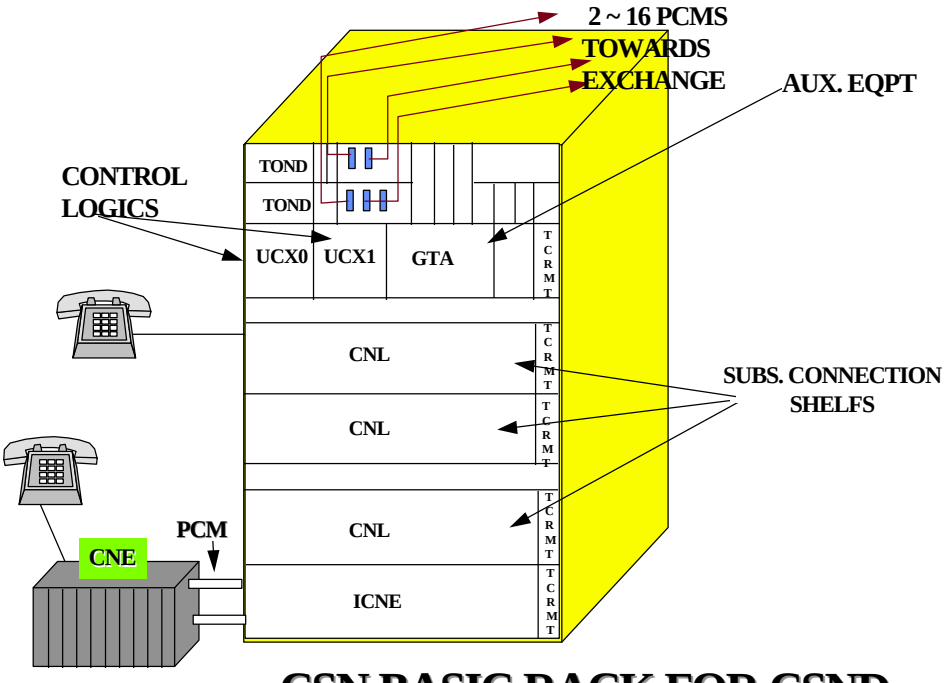
SIGNALLING BETWEEN CN & UCN AND WITH PUPE

The interchange of message between concentrators (local or remote) and digital control unit of CSN takes place through HDLC protocol whereas the signalling between CSN and the exchange is through local version of CCITT #7. The CSN has been so designed that it can be connected to any switch supporting CCS-7 signalling.

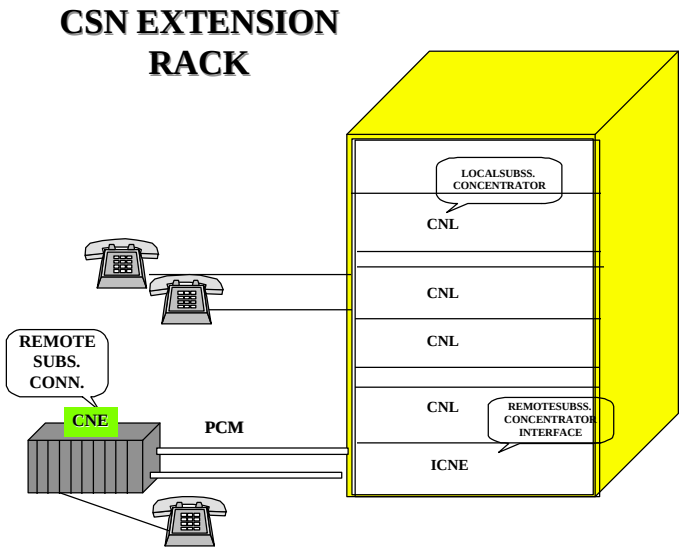


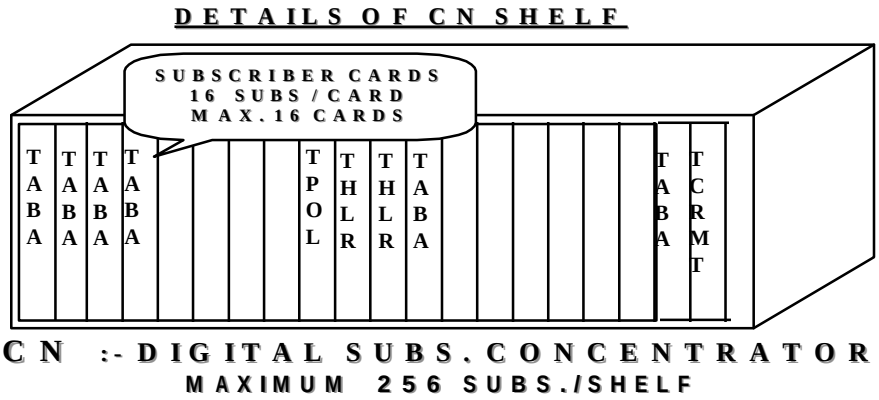


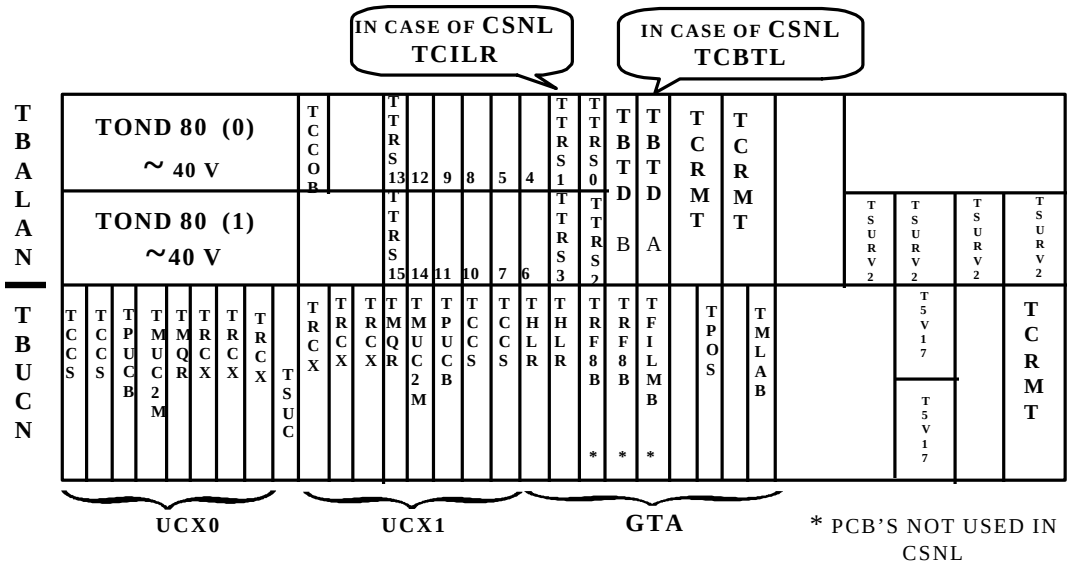
BASIC RACK FOR CSNL



CSN BASIC RACK FOR CSND


CSN EXTENSION RACK
LOCALSUBSS. CONCENTRATOR
CNL
CNL
CNL
CNL
REMOTESUBSS. CONCENTRATOR INTERFACE
ICNE
REMOTE SUBS. CONN.
CNE
PCM


DETAILS OF CN SHELF
SUBSCRIBER CARDS
16 SUBS / CARD
MAX. 16 CARDS
TABA
TABA
TABA
TABA
TPOL
THLR
THLR
TABA
TABA
TCRMT
CN :- DIGITAL SUBS. CONCENTRATOR
MAXIMUM 256 SUBS./SHELF


IN CASE OF CSNL TCILR
IN CASE OF CSNL TCBTL
TBALAN
TBUCN
TOND 80 (0) ~ 40 V
TOND 80 (1) ~40 V
TCCOB
TTRS13
12
9
8
5
4
TTRS1
TTRS0
TBTDB
TBTDA
TCRMT
TCRMT
TTRS15
14
11
10
7
6
TTRS3
TTRS2
TSURV2
TSURV2
TSURV2
TSURV2
TCCS
TCCS
TPUCB
TMUC2M
TMQR
TRCX
TRCX
TRCX
TSUC
TRCX
TRCX
TRCX
TMQR
TMUC2M
TPUCB
TCCS
TCCS
THLR
THLR
TRF8B *
TRF8B *
TFILMB *
TPOS
TMLAB
TSV17
TSV17
TCRMT
UCX0
UCX1
GTA
* PCB'S NOT USED IN CSNL

OCB 283
Common Channel Signalling

COMMON CHANNEL SIGNALLING NO. 7

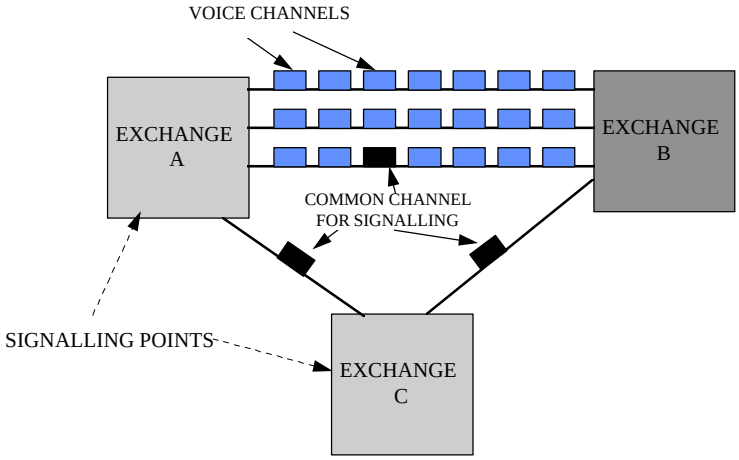
1. Introduction

The latest signalling being implemented world wide is now the COMMON CHANNEL SIGNALLING. This type of signalling is essential for the Setting up of the ISDN network.

In this type of signalling the SIGNALLING information is sent from one exchange to other exchange (called SIGNALLING POINTS) in the form of MESSAGE coded in BINARY which is understandable by the INTELLIGENT devices available in both the exchange . The CCITT organisation has recommended a standard protocol called CCITT #7 signalling.

The signalling message travels over a single TIME SLOT of the PCM connecting the two exchange (SIGNALLING POINT SP) . This TIME SLOT is called COMMON CHANNEL for Signalling, hence the name common channel signalling. The message over this common channel carry all relevant data for any of the other TIME SLOTS or CIRCUITS which carry VOICE or subscriber data. The channels for subs are called VOICE CHANNELS.

COMMON CHANNEL SIGNALLING



The OCB-283 exchange uses COMMON CHANNEL SIGNALLING between its CSNs & the common control equipments also

Signalling is often referred to as the Glue, which holds a network together. It provides the ability to transfer information between subscribers, within networks & between subscribers & networks. Signalling is the life blood, the vitalising influence of telecommunications networks . Without signalling, networks are inert. By providing effective signalling systems, a network is transformed into a tremendously powerful medium through which subscribers can communicate with each other using a range of telecommunications services. Old signalling systems that were simple mechanisms for transferring basic information are being replaced by efficient data transfer highways.

It is signalling that provides the ability for the subscriber to indicate to the exchange that a call is required. It also allows the called subscriber to be identified e.g. by transferring the telephone number dialled by calling subscriber.

It allows the transfer of information between exchanges in the network to establish & release the call. It transforms the foundation of network into an active entity that can provide the required services to the subscribers. It consists of the instruction, which originate from the telephone user in the form of lifting the handset in order to make a call, the transmission of dial pulses generated by operating a dial & replacing a receiver at the end of the call. Instructions are also signalled by the exchange in the form of dial tone, ringing tone etc., to indicate the progress of the call. In addition, inter-exchange signalling takes place between a call is set-up, to control exchange operations & check on circuit availability.

2. Types of signalling

Telephony started with the invention of magneto telephones, which uses a magneto to generate the ringing current, the only signal, sent over a dedicated time between two subscribers. As the switching technology has undergone a vast change from manual switching to Digital switching, the inter exchange signalling techniques have also progressively changed from loop no loop signalling to MF signalling & finally digital signalling. The first digital Switching developed was channel associated signalling in which the signalling information is conveyed on a separate channel which is rigidly associated channel. The utilisation of such a dedicated channel for each speech channel is highly inefficient, as it remains idle during the entire speech phase. Hence a new signalling system was developed which is capable of providing all new services & is internationally standardised is known as Common Channel Signalling (CCS#).

3. Signalling in Pulse code modulation

Pulse code modulation (P.C.M.) is a method of converting information from an analogue form to a digital form for transfer over a digital transmission systems, the technique involves sampling the analogue waveform & coding the result in the digital format. Successive sampling allows the analogue waveform to be represented by a series of 8 bit code . 8 bit codes from numerous speech channels are assembled into blocks for transmission by inserting into time slots. The technique is called Time Division Multiplexing (TDM).

The bandwidth required to transmit signals is much less than that for speech, so the signalling for several speech channels in a PCM system can be handled by a small portion of the bandwidth. The signalling capacity can be used for CAS or CCS, the means of identifying to which speech channel a particular signal refers is to divide the signalling capacity into dedicated bit locations. Signals pertinent to a particular speech path are always transmitted in signalling bit locations dedicated to that speech channel. The means of conveying CCS is to compound the signalling capacity into a signalling channel that is available as & when required.

The CCITT has defined PCM standards for 30 channel & 24 channel systems. The capacity available for signalling in these two standards is different as a result of differing constraints applied by the PCM standards.

In 30 channel PCM system., the 8 bit codes relating to 30 speech channels are time division multiplexed into a frame .Each 8 bit code is inserted into a timeslot within the frame. Time slot 0 is used for alignment, time slots 1-15 and 17-31 are used for encoded speech relating to 30 channels. Time slot 16 is dedicated for the use of signalling.

The tenet of CAS system is that dedicated signalling capacity is available for each speech circuit. This is achieved in 30 channel PCM systems by allocating 4 bits in each 16 frame multi-frame to signalling for each speech channel.

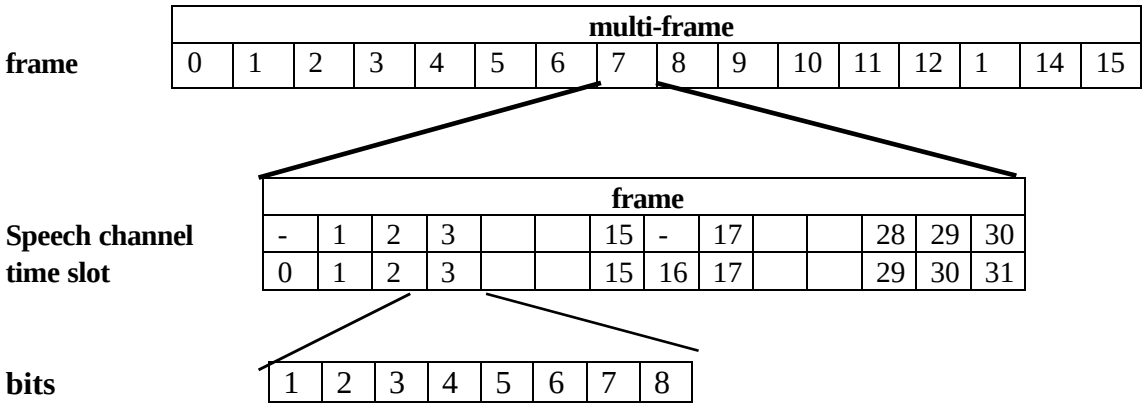


Fig. 1 : Frame structure of 30-channel PCM System

time-slot 16 of frame 1			time-slot 16 of frame 2			time-slot 16 of frame 15	
abcd for ch an ne l 1	abcd for ch an ne l 16		abcd for ch an ne l 2	abcd for ch an ne l 17		abcd for ch an ne l 15	abcd for ch an ne l 30

Fig. 2 : Allocation of signalling capacity in time-slot 1

4. Principles of CCS

In common-channel signalling (CCS) systems, the physical tie between the signalling path and the traffic circuit is removed. All signalling transfer relating to a transmission link takes place over a dedicated signalling channel (Fig. 3). Hence, a common-signalling channel handles the transfer of signalling information for numerous traffic circuits. Signalling capacity is not reserved for each traffic circuit, but signalling capacity is allocated dynamically as and when required. Fig. 3 shows the concept of CCS for both access and inter-exchange signalling. Exchanges A & B are connected by numerous speech circuits, denoted by solid lines. All the signalling that relates to the speech circuits is transferred between the exchanges using the common-signalling path (denoted by a dotted line). The common-signalling path can be regarded as a pipe between two exchanges, typically operating at 64 Kbit/s, into which all signalling information is funnelled. Similarly, all signalling information pertaining to the speech circuits between each subscriber and Exchange A is transferred via the access signalling channel.

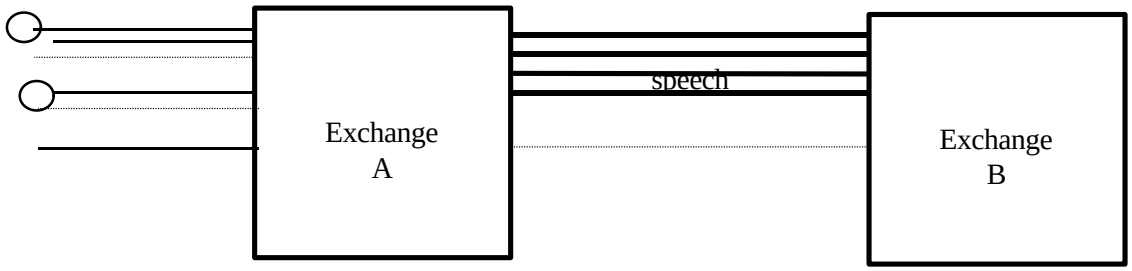


Fig. 3 : CCS Signalling : Associated mode of operation

The transfer of signalling information is achieved by sending message down the common-signalling path. The use of messages in CCS systems opens up a whole range of flexibility that is not present in CAS systems. Instead of being limited to a small no. of meanings for signals messages can be designed to cover a multitude of situations & services.

The signalling activity when setting-up & releasing a circuit is high; however on an average the signalling activity for a circuit is low because there are no signalling when the calls are not being made & during the conversation phase of the call. Hence, a single CCS channel can be used to handle numerous traffic circuits. The theoretical limit of the no. of traffic circuits handled by a CCS channel is very high, but a typical practical value is 2000 traffic circuits. The picture becomes more complex when non-circuit related signalling activity is taken into account. Non circuit related signalling can be intermittent (e.g. it is used during call establishment to interrogate a data base) or it can exhibit a high signalling activity (e.g. if it is used to transfer large amount of management data between nodes in a network.)

5. Modes of operation

CCS system can operate in a number of modes within telecommunications network. An exchange in telecommunications network that operates CCS is termed as a 'signalling point'. Any two signalling points with the possibility of signalling communication are said to have 'signalling relation'. The realisation of the signalling relation is by sending signalling messages between the two exchanges. The path taken by the signalling messages is determined by the mode of operation. Hence the modes of operation determine how signalling messages are routed between signalling points. The modes of operation can be 'associated', non-associated' or 'quasi-associated'.

In the associated mode of operation, the signalling messages transferred over transmission link directly connecting the relevant signalling points as shown in fig. 3 & fig. 4. In quasi-associated modes of signalling, the messages pertinent to a particular signalling relation are not transferred over transmission links directly connecting the relevant signalling points. Instead, the messages are transferred using intermediate signalling points. In this mode of signalling, the path taken by the messages through the signalling network is predetermined by information assigned by the network.

Exchanges A & B have a signalling relation and are interconnected by speech paths. However, the signalling path used to implement the signalling relation is via exchange C and not directly between A & B. In the case of failure of the A - B signalling link, the A - C - B signalling can be used to control the speech path between exchanges A & B. Quasi-associated modes of operation illustrate great flexibility and powerful nature of CCS system.

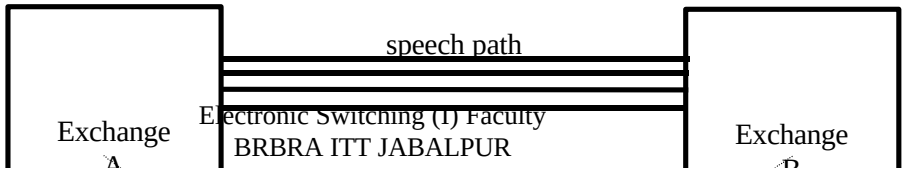


Fig. 4 : Quasi-associated mode of operation

6. Requirements of CCS

The CCS has the following addition requirements introduced in three areas:

(i)Reliability and security,

(ii)Speech continuity

(iii)Processing Overhead.

1. A signalling channel carried on a 64 K bites/sec. link has the practical capacity to control approximately 2000 traffic circuits. Hence the failure of an inter exchange signalling link would cause the loss of a significant amount of speech traffic. For access signalling, the loss of the signalling link would mean isolation of the subs. from the local exchange. It is therefore essential to take exceptional precautions to avoid such losses.

2. Signalling security can be improved by developing the signalling network itself. In the access network, it is possible to provide two signalling links to a subs.(preferably on physically-diverse transmission links) & to switch all switching traffic to one link when other links interrupted. Similar arrangements can be made for inter exchange signalling with automatic reconfiguration of signalling paths, even via different exchanges to maintain a signalling continuity in the event of the failure of a signalling link.

3. The unavailability of signalling communication between two exchanges is specified as a maximum of 10 minutes per year.

4. CAS systems that use the speech path to transfer signalling information provide the inherent feature of checking the continuity of speech path being established before conversation begins .If continuity is not achieved , the signalling transfer is not successful the call is aborted or a further attempt is made to connect call. This inherent continuity check s is absent in CCS systems, owing to separation of speech & signalling paths if considered desirable, separate speech-continuity checks can be provided.

5. The flexible manner in which CCS systems are structured & the implementation of complex -network features mean that extra processing is necessary to operate CCS .Even the inherent concept of funnelling all signalling on a transmission link in to CCS means that messages must be analysed to determine to which circuit they refer. However, this extra processing overhead is more than outweighted by the benefits of CCS systems.

4. Salient features of CCS

1. Signalling information for a no. of circuit is sent on a single channel. The physical tie between the signalling path & traffic circuit is removed. All signalling transfer relating to a transmission link takes place over a dedicated signalling channel. Hence it handles information for numerous traffic circuits.
2. Signalling is in the form of Data. A data channel operating at 64 K bits/sec. rate is provided.
3. Signalling is very fast .All the required digits can be simultaneously sent on data in the form of message.
4. It can also work on 4.8 Kb/s analogue link by providing Modems.
5. It is very economical between exchanges where large no. of circuits are provided.
6. It can cater for all new services such as Videotex, Data communication, Fascimile and ISDN services. etc.
7. In CAS systems, signalling capacity is dedicated to a traffic circuit. Limitation exist on when signals can be sent, depending on the status of the call. For example it is not possible to send voice frequency signals during the speech phase of a telephone call in some CAS system, unless special measures are taken (e.g. provision of filters)., because subs. are able to hear tones. However within these constraints, it is not possible to send signals instantaneously. In CCS each message take up whole of the signalling channel for a short length of time. It is possible for an exchange to send two messages relating to two circuit. from a transmission link at exactly same time, Each message may take a few microseconds to transmit. For this reason “buffers” are provided at each end of a CCS link to store each message until the link becomes available. As messages are generated by an exchange, they are stored in a buffer & transmitted in a specified order. When there are no messages to transmit, there is a need to maintain synchronisation of the signalling channel between the two exchanges. This is achieved by continuously transferring synchronisation information until a new message is ready for transmission.
8. CCS systems are specified in terms of “formats” & “procedures”. The specification of the formats defines the structure of messages used & meaning of each field within the message. The specification of the procedures defines the logical sequences in which messages can be sent. The procedures of CCS circuit- related systems are closely linked to functions within exchanges that control the set up & release outgoing calls. There is therefore ,a close relationship between CCS procedures & exchange call control & a major element in defining CCS systems is the need to achieve an optimum between these factors.
9. The drive to provide an unrestricted communication capability between exchange procedures eliminates per circuit. signalling termination costs. These costs are inevitable in per circuit. CAS systems but by funnelling all signalling information into a single common channel, only one signalling termination cost is incurred for each transmission link. These are cost penalties for CCS systems; the messages received by an exchange have to be analysed, resulting in a processing overheads. However these are covered by increased scope of inter processor communication & more efficient processor activity.
10. CAS systems possess limited information transfer capability due to:

(i) The restricted no. of conditions that can be applied (e.g. the limited variations that can be applied to a DC loop or limited no. of frequency combinations that can be implemented in a voice frequency system)

(ii) The limited no. of opportunity to transfer signals(e.g. it is not possible to transmit voice frequency signals during the conversation phase of call without inconveniencing the subs. or taking special measures).

Neither of these restrictions apply to CCS the flexible message-based approach allows a vast range of information to be defined & the information can be sent during any stage of a call. Hence, the reperoire of CCS is far greater than channel associated versions & messages can be transferred at any stage of a call without affecting the calling & called subs..

10. CCS system transfer signals very quickly. A message used to establish a call in a CCS system can contain all the address digits in an information field .

11. Techniques used in modern CCS systems can be further improve the flexibility proved to subs. 'User-to-user' signalling is a techniques whereby messages can be transferred from one subs. to another without undergoing a full analysis at each exchange in the network. Similarly 'end to end' signalling allows exchanges to transfer information to each other without intermediate exchanges having to fully process the messages.

12. One of the problems that prompted the development of CCS systems was 'speech clipping' in the international network. In some CAS systems, it is necessary to split the speech path during call set-up to avoid tones being heard by the calling subscriber. This results in a slow return of the answer signal and, if the called subs. starts speaking immediately after answer, then the first part of the statement by the called subs. is lost. As the first statement is usually the identity of the called subscriber, this causes a great deal of confusion and inconvenience. CCS system avoids this problem by transferring the answer signal quickly.

13. As a result of the processing ability of CCS system, a high degree of reliability can be applied with a resulting high confidence in the transfer of uncorrupted information in the case of an intermediate exchange failure, re-routing can take place within the signalling network, enabling signalling transferred to be continued.

Level structure of CCS#7

CCS#7 is optimised for use in a digital environment, but it can be used in any transmission medium. CCS is highly flexible, facilitates the evolutionary process & supports a variety of services & network features. These attributes result from an early decision to specify CCS in a 4-layer structure as illustrated in a fig.

A prime objective when formulating the design of CCS channel was to ensure that the signalling system flexibly handle the requirements for circuit-related applications. These applications include telephones & circuit-switched data (i.e. Data using circuit within transmission links in a similar way to telephone calls.) The functions performed by the 4 layers are described below.

Level 1 - Physical Function.

Any node with the capability of handling CCS is termed as "Signalling Point". The direct inter connection of two signalling points with CCS#7 uses one or more signalling links. Early versions will use variation of the installed copper local loops for connections between the local exchange & the subs. premises, later version will undoubtedly use fibre optic technology. Level 1 of the 4 level structure defines the physical & electrical functional characteristics of the signalling links. Defining such characteristics within level 1 means that rest of the signalling system can be independent of the transmission medium adopted. By keeping the interface between levels 1 & 2 constant any changes within level 1 donot affects the higher levels. In a digital environment the usual physical link is a 64 Kbits/sec. channel. This is typically within a digital transmission system using pulse code modulation. (P.C.M.). However other types of links (including analogue) can be used without affecting levels 2 to 4.

Level 2-Signalling Link Functions.

Level 2 defines the functions that are relevant to an individual signalling link, including error control & link monitoring. Thus level 2 is responsible for the reliable transfer of signalling information between two directly connected signalling point. If error occurs during transmission of the signalling information, it is the responsibility of level 2 to invoke procedures to correct the errors. Such characteristics can be optimised without affecting the rest of signalling systems, provided that the interface to levels 1 & 3 remains constant. This function is achieved by

(a) Initial link alignment, synchronization & proving to ensure that the links error rate performance is satisfactory.

(b) Continuous link error rate monitoring by sending fill in signal units during the idle time.

(c) Error detection by means of the FCS field in each signal units & error correction by retransmission of the message signal unit.

The above measures ensures that there are not more than 1 in 10^{10} signal units with undetected errors & not more than 1 in 10^{7} lost signal units.

Level 3 signalling network functions

The functions that are common to more than one signalling link i.e. signalling network function are defined in Level 3: this includes “message handling” functions & “signalling network-management” function. When a message is transferred between two exchanges, there are usually several routes that the message can take, including via a signal transfer point. The message handling functions are responsible for the routing of the message through the signalling network to the correct exchange. Signalling-network management functions control the configuration of the signalling network.These function includes network reconfiguration in response to status changes in the network, e.g. if an exchange within a signalling network fails, the level 3 of CCS#7 can reroute messages and avoid the exchange that has failed.

MTP Level 1 & 3 constitute a transfer mechanism that is responsible for transferring information in messages from signalling point to another. The combination of level 1 to 3 is known as message transfer part (MTP). MTP does not understand the meaning of the messages being transferred, but it controls a number of signalling messages, link & network messages. This means that message are delivered to appropriate exchange in an uncorrupted form & in the sequence that they were sent, even under failure conditions in the networks.

Level 4 Users Part

Layer 4 comprises the user parts, user is not confused with a subscriber. User part forms level 4 of the layered structure and include messages, message coding and protocols necessary to handle basic telephony & ISDN services. A key feature is that many different user parts may use the standardised MTP .Three user parts have been defined; the Telephone user part TUP, The ISDN user part & the Data user part DUP. The user part are defined in terms of message formats & procedures. The message formats defined meaning of a particular message & specify coding to be used The procedures define the sequence of messages to be exchanges to be followed are defined for each application.

Application of level structure

The application of the level structure is illustrated in Fig. 4 . Exchanges A & b are directly connected by speech circuits .A signalling link is also available between Exchanges A & b .It is shown that level 4 is closely associated with the control function of the exchange.

If the control function of exchange A needs to communicate with control function of exchange (e.g. to initiate the set up of a speech circuit between the exchanges), the control function of exchange A request the level 4 functions to formulate an appropriate message. Level 4 then requests the message-transfer part (level 1 to 3) to transport the message to exchange B . Level 3 analyses the request & determines the means of routing the message to exch. B .The message is then transported via level 1 & 2.

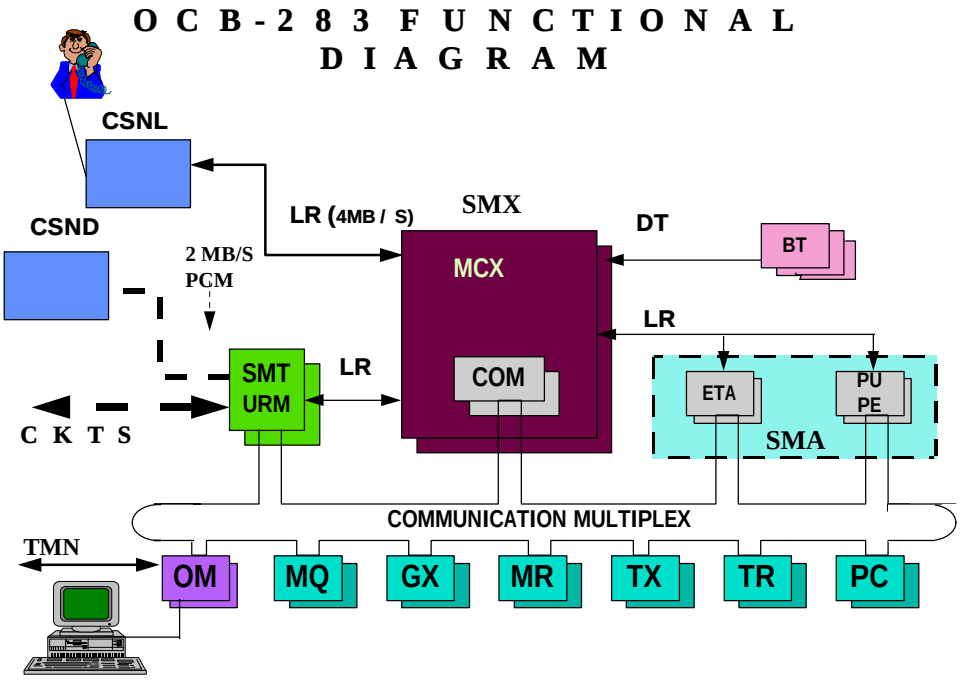
Upon receipt of the message by the MTP of exchange B, levels 1 & 2 deliver the message to level 3. Level 3 at exch. B recognises that the message has arrived at the correct exch. and passes message to level 4 .Level 4 in exch. B then interacts with the control function to determine appropriate action & response. If problem arises in the transmission process between exch. A & B ,causing message corruption, the level 2 functions are responsible for detecting the corruption & retransmitting the information. If the signalling link between exch. A & B is not available (e.g. failure of the link),the level 3 functions are responsible for rerouting the information through the signalling network to exch. B.

Using these techniques, exch. A & B can send each other appropriate messages until the need to communicate on a particular transaction ceases (speech circuit. between exchanges is released).

OCB 283

Call Processing

CALL PROCESSING IN OCB-283 EXCHANGE



Functional Architecture

Steps

(i) When a subscriber goes off hook, it is detected by line equipment. The change in loop state is detected by micro processor during its cycling scanning. The CSNL allots free TS on LR for this call. The CSNL prepares a new call message and sends it to PU/PE (in SMA) over a signalling link through MCX. The message is sent in local version of CCS7.

(ii) PE/PE receives this message and sends it to MR over MAS. It indicates UR no. UT no. (line card no.) and equipment no. and T/S allotted.

(iii) MR allots a free register to handle this call. It notes down UR no. UT no. Equipment no. and T/S allotted for the subscriber. Now MR obtains UR-LR to SMX-LRX correspondence from MQ.

(iv) MR obtains class of service data from TR.

(v) MR orders COM to connect dial tone to the free T/S allotted to subscriber. If sub. Has DTMF instruments it orders for connection of RCF to the T/S of subscriber and then orders for dial tone connection.

(vi) MR also sends acknowledgement message to CSN.

(vii) On receipt of dial tone, the subscriber dials called party's number. The UT (terminal unit i.e. subscriber line card) disconnects dial tone from the calling sub.

(viii) CSN sends these digits to PU/PE through the same path & signalling system.

(ix) PU/PE sends these digits to MR over MAS.

(x) On receiption of first digit, MR orders COM to disconnect dial tone. (The dial tone from sub has been already disconnected by UT).

(xi) on receipt of first two digits, MR calls TR for pre-analysis. TR, after analysis of first two digits tells MR, the type of call (i.e. local, STD etc.)

(xii) After receipt of adequate no. of digits (or all the digits in case of local call) MR again calls TR for analysis. TR supplies called party's address and charging information to MR.

(xiii) MRcarries out party's test to know whether it is free or not. (path MR-PU/PE-CSN).

(xiv) CSN tests the called party's equipment. If it is free, it connects ringing current to called subscriber. It also allots a free T/S on LR and sends a message to MR indicating LR-T/S of called subscriber.

(xv) MR orders COM for connection of ring back tone to calling sub. It also obtains UR-LR to SMX LRX correspondence for called sub. MR walls for called sub's reply.

(xvi) When called subscriber replies, the concerned CSN sends a message to PU/PE. PU/PE sends the message to MR.

(xvii) MR orders COM to disconnect ring back tone. MR orders MQ for connection of calling and called sub time slots. MR also orders TX for charging the calling sub. As per data supplied by TR. MQ and TX give compliance.

(xviii) The subscribers are now in conversation phase. MR hands over the surveillance of calling & called sub to respective CSNs & releases.

(xx) When calling sub. Goes off-hook, CSN informs PU/PE. PU/PE informs MR. MR releases the connection. If called sub. Goes off hook, MR sets a 1 minute timer and releases the connection after expiry of this time.

OCB 283

Equipment Interrogation

OCB-283 SYSTEM APPLICATION MANAGEMENT

There are various system application management functions included in the OCB-283 system. These help in monitoring the health of the exchange and carrying out some maintenance and administrative management functions. These functions include equipment interrogation, output of messages related to alarms faults, preparing magnetic tape for different type of data save like subs meters, detail billing , running diagonostic tests on various units etc. Various system application management functions are discussed hereafter.

1 Exchange Equipment Status Interrogations

This is one of the most important daily routine activity and gives a fare idea about the health of the exchange units and entities.

The units / entities for this purpose alongwith the commands to know the status are given below.

1.1 SM stations

ESMIN; ↵ for all stations liek SMC, SMT, SMA, SMX, SMM etc. Individually the stations can be found by ESMIN : ↵

AM = SMCn or SMT or SMA etc.

1.2 CSNs CSEDs etc.

@ TELIN :

@ AFUR = UR No. of CSN CSED etc.

1.3 Logics of CSN

@ TELINB :

@ AFPIL = UR No. for Pilot logic

or

AFRES = UR No. for reserve logic

1.4 LR Groups of SMX, SMT, SMA, CSN etc.

@ TELIN :

@ AFGRX = SMX No. – GLR No. for SMX GLR

(1 < 8) – (0 < 31)

or

AFGRU = CSNUR No. – GLR No. For CSN GLR

(1 < 63) – (0 < 1)

AFGRT = SMT No. – GLR No. For SMT GLR

- (0 < 7) (0<15)

AFGRA = SMA No. – GLR No. For SMA GLR

1.5 LR interrogation

TELIN :

@ AFLR = CSNUR No. – LR No.

1 < 63 – 0 < 15 for LR of CSN

AFLR = SMTUR No. – LR No.

e.g. 223 – 0 < 15 for SMT URs

1.6 Communication Multiplex interrogation

@ AMXIL; ↵ for all MISto MAS rings

or

@ AMXIL : ↵

@ AMX = MIS or MAS A1 to MASB4

1.7 ETU status interrogation

@ ETUIN : ↵↵

@ AMETU = SMT – ETU v

(1 < 16) – (1 < 32)

The various status that a station or unit may assume are –

ES, INDL, BLOM, NEQ, BLOS TEST

However there are some transient status that may be displayed due to the transition from one status to other e.g. a station / unit may assume status INIT in transiting from BLOM → INDL or ES or may assume status INDO in transiting from BLOM to INDL

Meaning of the status terms.

ES - In service

INDL- Unavailable, free

INIT- Being initialised

INDO- Unavailable, busy

BLOS- Blocked by defence mechanism of system due to some fault.

NEQ- Not equipped.

BLOM- Manually blocked if found faulty.

TEST- Unit under test either automatically by system or manually put to a diagnostic test by man machine command. Some times status of a station or entity may have to be modified for maintenance purposes or for running a diagnostic. For this following commands are used.

@ ESMMO : ↵ for station status change

@ AM = SMCI, STTUS = INDL; ↵

for bringing status of SMCI from ES to INDL. INDL is an intermediate status for bringing a unit to BLOM. If directly a unit carrying traffic is put to BLOM lot of calls under process by that unit may fail and may reflect a bad performance. It is, therefore, advisable to first come to INDL status so that during the transition from BLOM to INDL station will assume INDO status in which it continuous to process the calls in hand and after completing all calls in hand assumes INDL status. At this stage the unit can be put to BLOM by using same command.

Similarly commands liek TELEMO, TELBSC, ETUMO etc are available to modify status of different entities