EWSD

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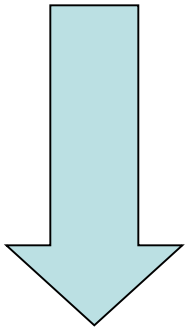
DIGITAL PUBLIC SWITCHING SYSTEM



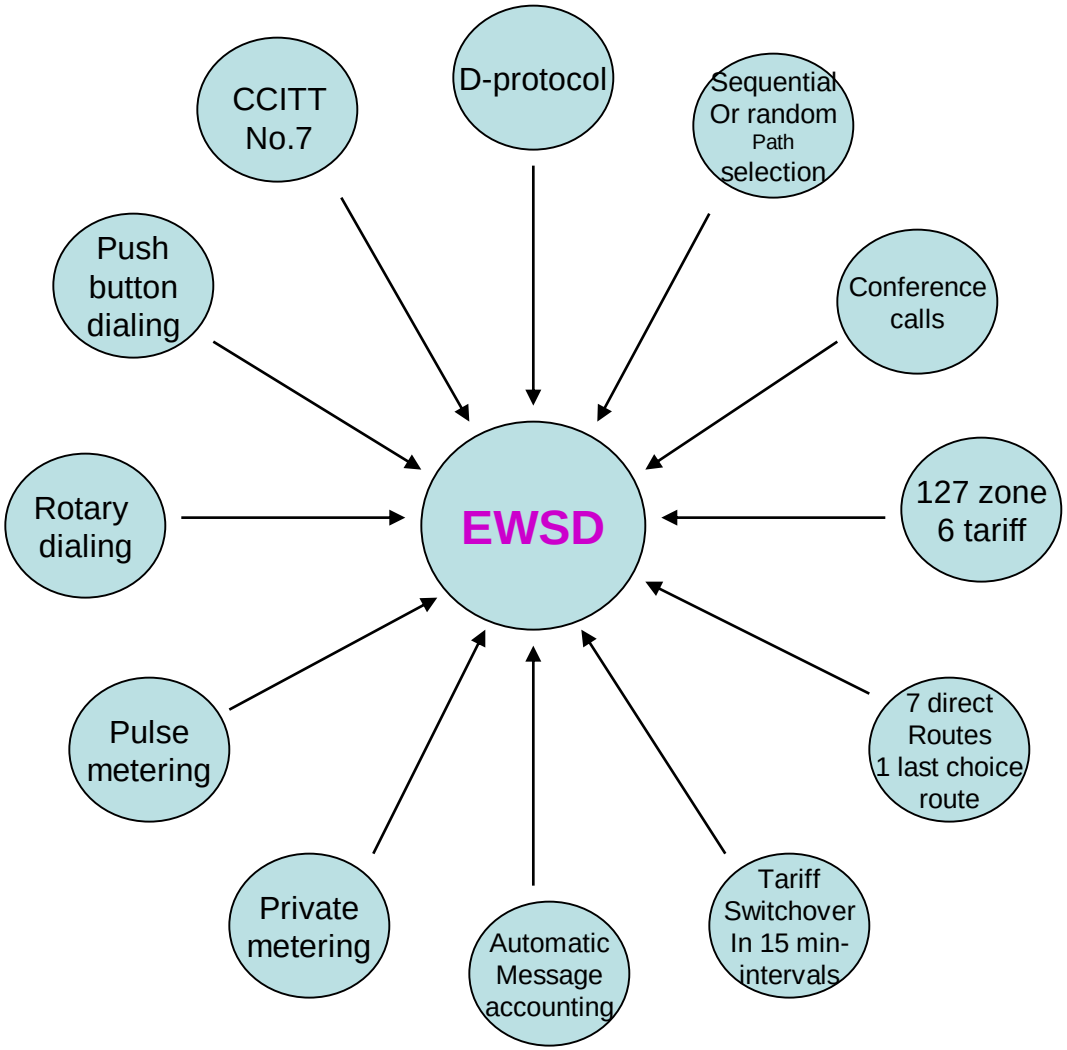
E lektronisches

W ahl (Switching)

S ystem

D igital

System Features

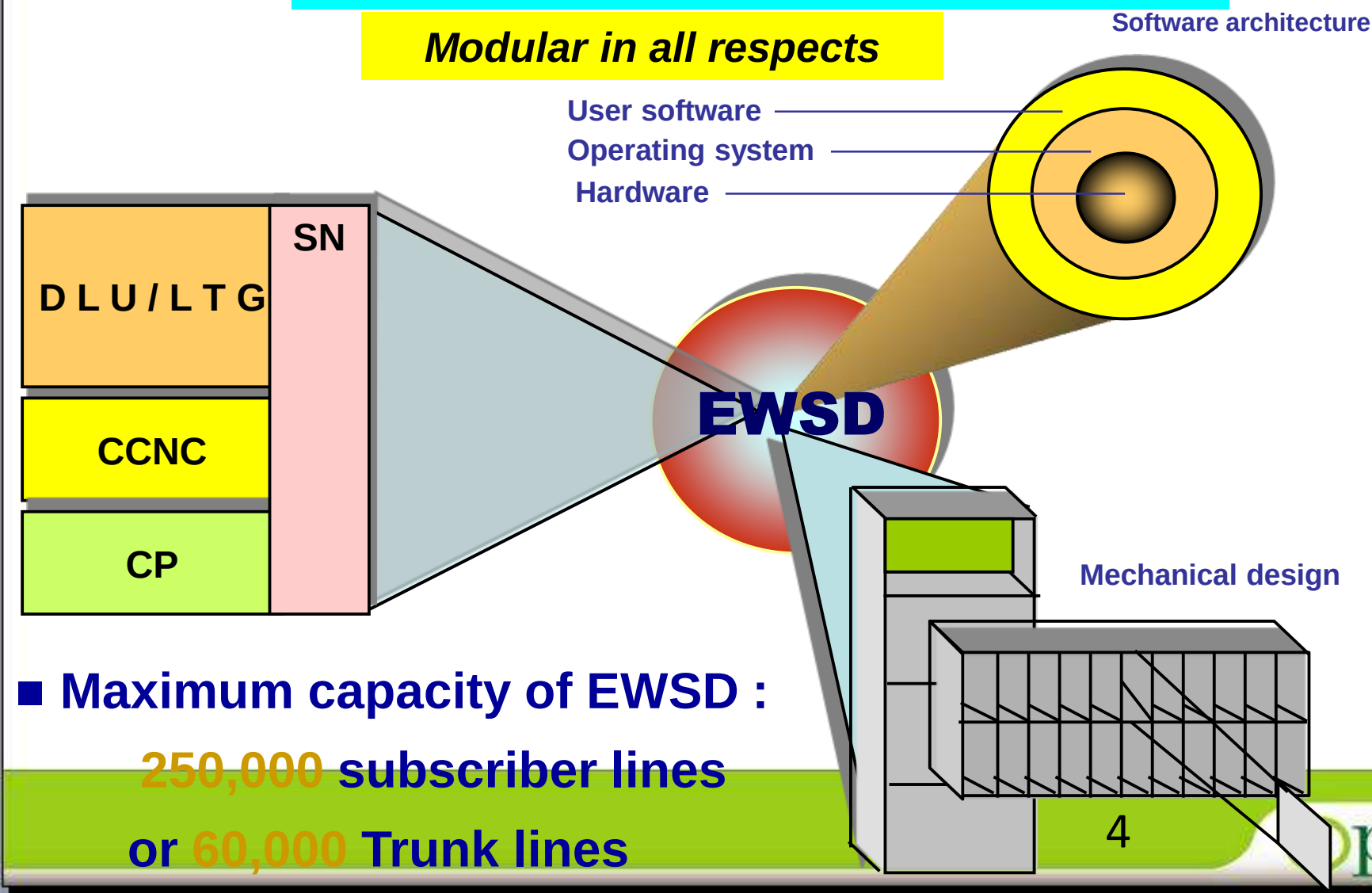


INTRODUCTION TO DIGITAL SWITCHING SYSTEM

EWSD (Electronics Switching System Digital)

EWSD SYSTEM ARCHITECTURE

Modular in all respects



- **Maximum capacity of EWSD :**

  250,000 subscriber lines

  or 60,000 Trunk lines

Advantages of EWSD

- Modularity
- Distributed control
- Fully electronic
- Extremely reliable

  (maximum system downtime:1h/20 years)

System structure

- Objective: The participants should be able to
  - State the 5 EWSD subsystems and their functions during an internal call setup
  - State the functional units of the subsystems involved in an internal call setup and explain their functions
  - Explain applied methods of safeguarding and their mode of operation
  - Specify, f0r an example, the number of each type of functional unit installed in the EWSD system

Subsystems of EWSD

DLU-Digital Line Unit)

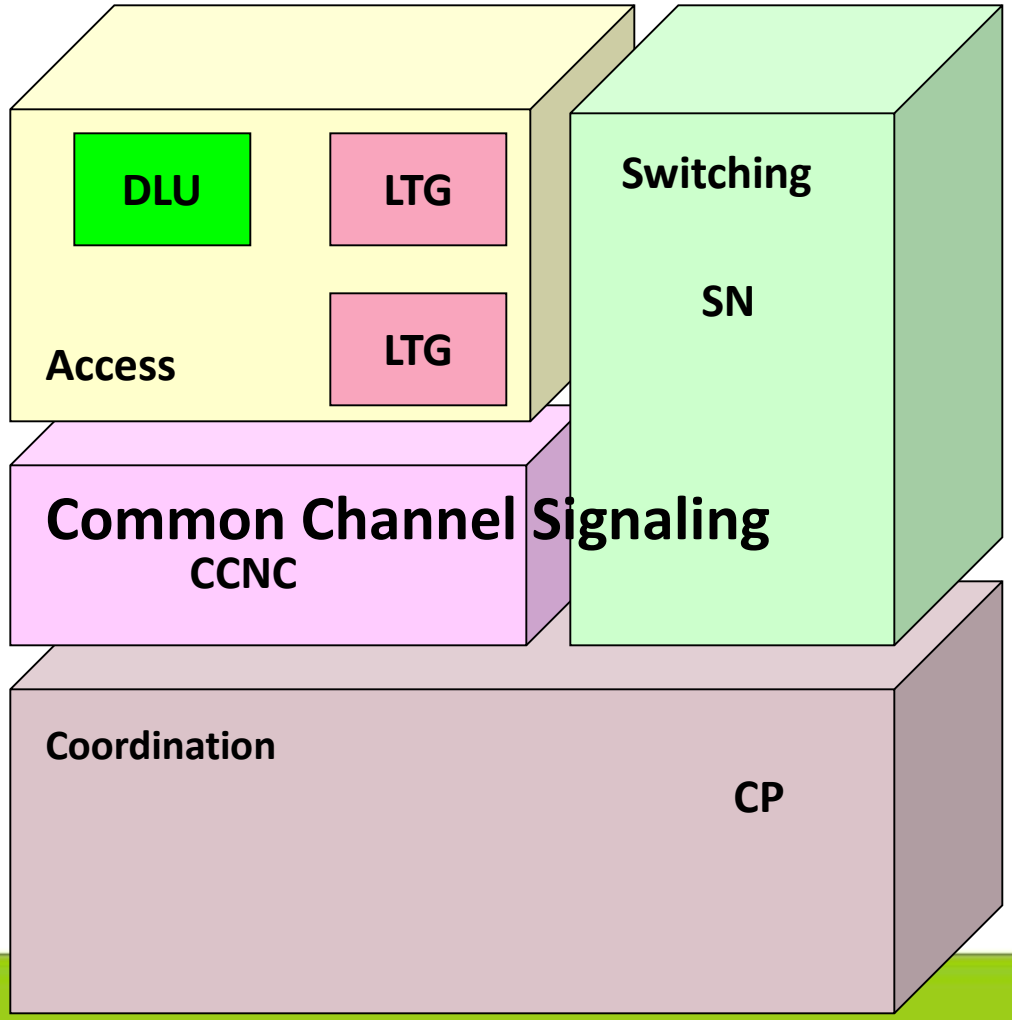
LTG-Line / Trunk Group

SN-Switching Network

CCNC- Common Channel signaling Network Control

CP-Coordination Processor

Hardware of subsystems



What are the tasks of the subsystems?

Main tasks of DLU

- To provide the physical connections to the various types of subscribers (max.952)
- To convert the speech and signaling information into PCM signals
- To provide BORSCHT(analog to digital conversion and tdma) function

What are the tasks of the subsystems?

Main tasks of LTG

- To provide the physical connections to the various types of lines.
- To process and convert the speech and signaling information from a maximum of 2000 subscribers or 120 lines with a maximum traffic capacity of 100 Erl.

What are the tasks of the subsystems?

Main tasks of SN

- To switch speech channels by means of electronic cross points between LTG with a congestion of <5*10 -5 and full availability
- To switch message channels between LTG,CCNC, and CP without congestion

What are the tasks of the subsystems?

Main tasks of CP

- To control the call processing
- To process supplementary and administrative tasks
- To provide the basis for exchange synchronization

What are the tasks of the subsystems?

Main tasks of CCNC

- To process and to convert the CCITT No.7 signaling information for a maximum of 256 signaling links
- To control and to manage the signaling network

General Information

- **The hardware of an EWSD system is organized in subsystems that are linked through uniform interfaces.**

The Digital Line Unit (DLU) combines a number of analogue and digital subscriber lines. Max 952 Subscriber lines can be connected to one DLU. The DLU is connected to the Line/Trunk Group (LTG).

The Line / Trunk Group (LTG) not only terminates Digital Line Units (DLUs).

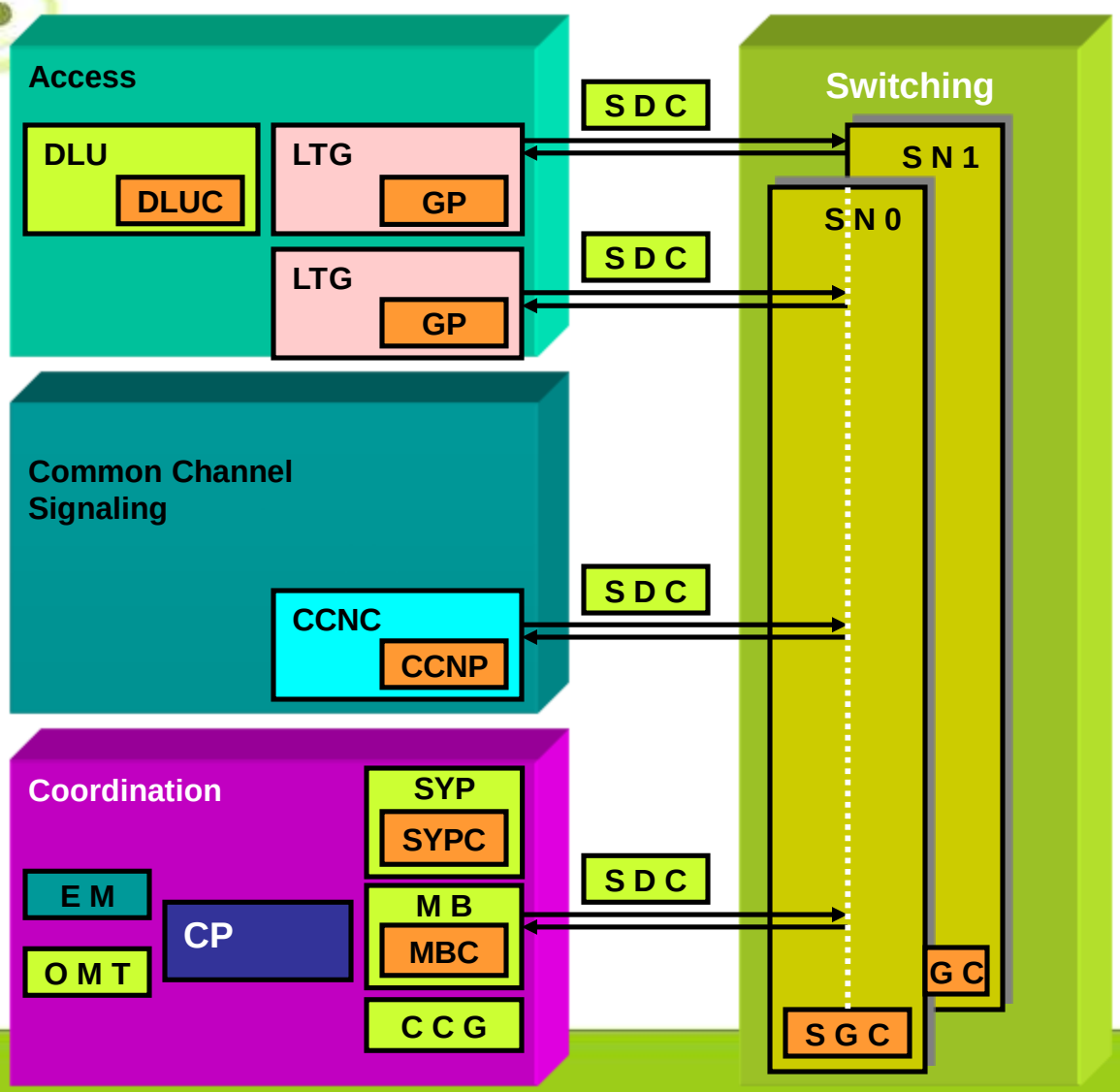
It is also linked to:

- **Other exchanges**
- **Digital Switching Board (DSB).**

The Switching System (SN) provides the inter-connections between two subscriber lines.

To handles the Signalling System No.7, the EWSD exchange requires a Subsystem Common Channel Signalling Network Controller (CCNC).

EWSD SUBSYSTEMS



- Digital Line Unit (DLU)
- Line Trunk Group (LTG)
- Switching Network (SN)
- Common Channel Network Control (CCNC)
- Coordination Processor (CP)

Distributed controls in an EWSD exchange

Since the processing workload is distributed over several microprocessors within the EWSD system, a common processor for Coordination tasks is extremely useful. These functions are handled by the Coordination Processor (CP).

The CP consists of the:

- Coordination Processor (CP)
- External Memory (EM)
- Operation and Maintenance Terminal (OMT)
- System Panel (SYP)
- Message Buffer (MB)
- Central Clock Generator (CCG)

Load Distribution

In order to reduce the workload of the Coordination Processor (CP) and to achieve faster processing times, some processing functions are distributed over autonomous control devices.

Subsystem Controllers

Since the EWSD subsystems independently execute all necessary tasks within their respective areas, they require their own control devices, such as the:

- **DLU Digital Line Unit Controller (DLUC)**
- **LTG Group Processors (GP)**
- **SN Switch Group Control (SGC)**
- **SYP System Panel Control (SYPC)**
- **MB Message Buffer Control (MBC)**
- **CCNC Common Channel Network Processor (CCNP)**

Who does what in EWSD?

- The tasks to be performed are distributed among peripheral processors in the individual subsystems:
  - SLMCP and DLUC in the DLU
  - GP in the LTG
  - SGC in the SN
  - CCNP in the CCNC
- To reduce the load of the CP and to provide a clearer definition of tasks
- The CP coordinates and monitors the distributed functions and performs the central functions

How does subsystems inter work?

Interface DLU – LTG PDC

2Mbit/s: 31 Channels of 64kbit/s (PCM30)
4-Wire *speech information
*signaling information DLUC-GP
(CCITT No.7)

How does subsystems inter work?

Interface LTG – SN SDC

8Mbit/s: 128 Channels of 64kbit/s (PCM30)

4-Wire *speech information

*signaling information CCS(CCITT No.7)

*signaling information GP-GP

GP-CP

GP-CCNP

How does subsystems inter work?

Interface SN – CP

8Mbit/s:	128 Channels of 64kbit/s	Highway 0
4-wire	*signaling information	GP-GP
		GP-CP
		GP-CCNC
8Mbit/s:	1 Channel of 64Kbit/s	
4-wire	*signaling information	CP-SGC

How does subsystems inter work?

Interface CCNC – SN SDC

8Mbit/s: 128 Channels of 64kbit/s

4-Wire *signaling information CCS

(CCITT No.7)

How does subsystems inter work?

Interface CCNC – CP

170Kbyet/s: byte-serial handshake interface

Bidirectional

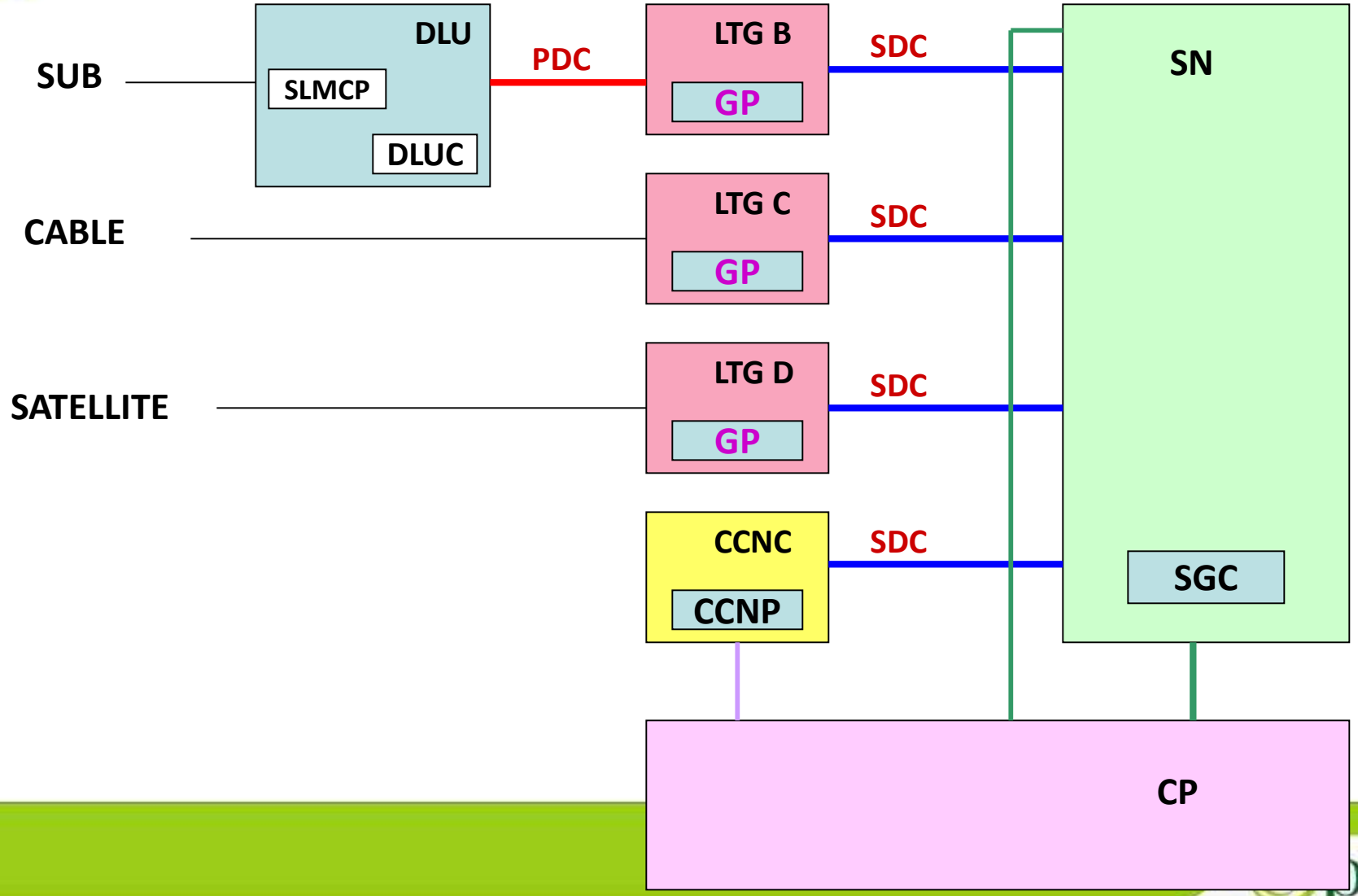
*signaling information CCITT No.7

*signaling information CCNP-GP

CCNP-GP

CCNP-CP

Interfaces


SUB
CABLE
SATELLITE
DLU
SLMCP
DLUC
PDC
LTG B
GP
LTG C
GP
LTG D
GP
CCNC
CCNP
SDC
SDC
SDC
SDC
SN
SGC
CP

DLU Overview

The main components of a DLU also include :-

- **Subscriber line module SLM : SLMA & SLMD**

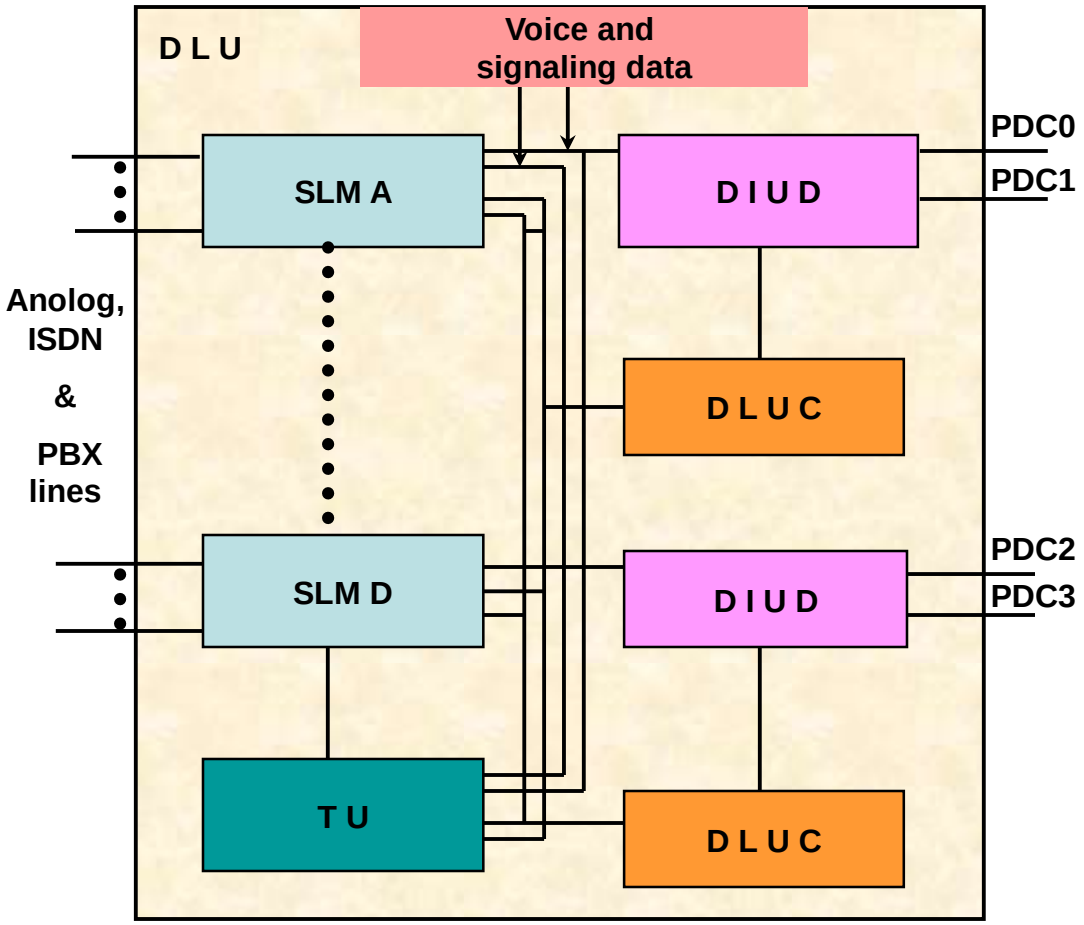
- **Two DIUD for connection of PDC's**

- **Two controls DLUC's**

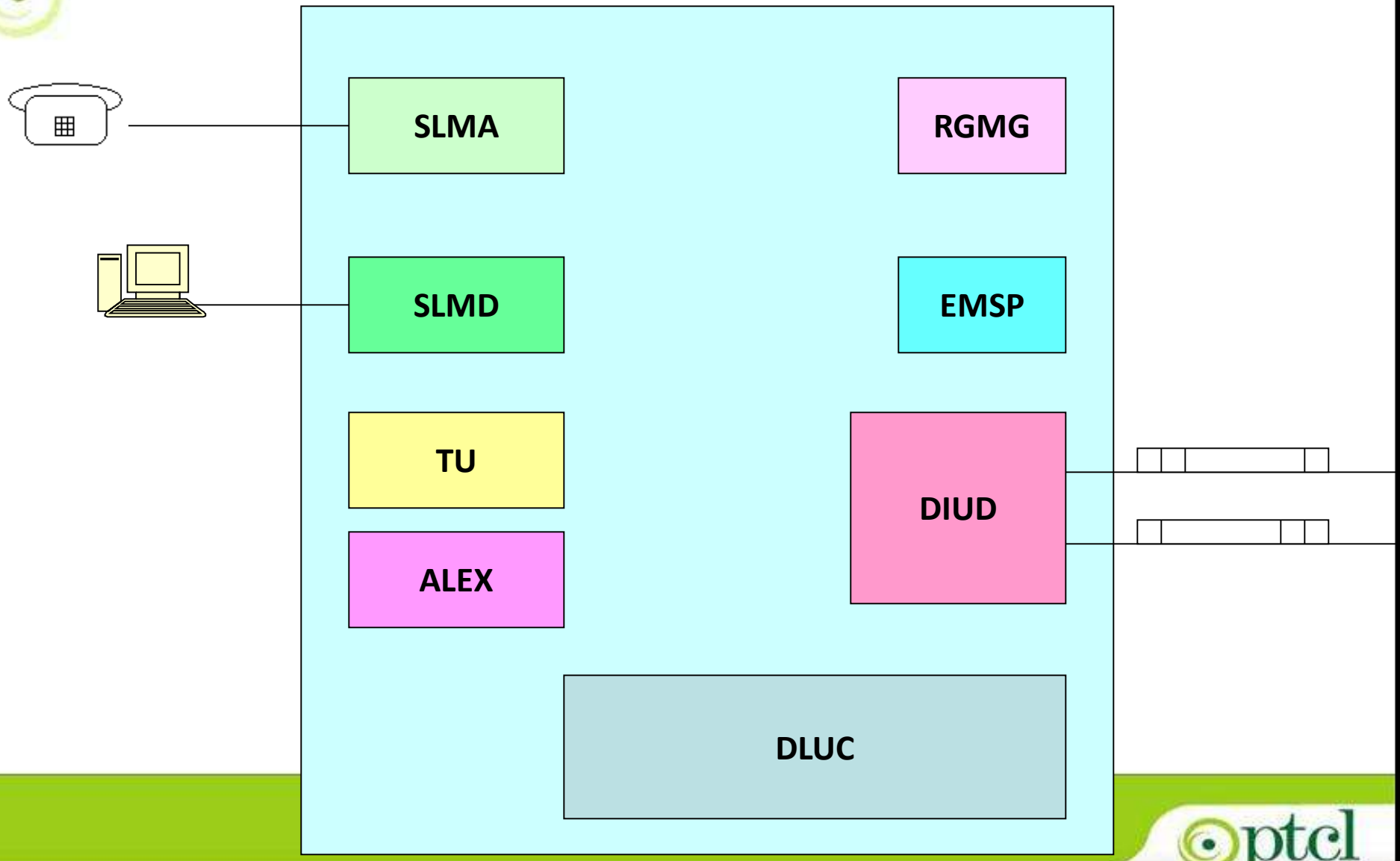
- **Two 4096kbit/s networks for the transmission of voice and signaling data between the SLMs and the Digital Interface Units (DIUDs).**

- **Two 136 kbit/s control networks for the transmission of control data between the SLMs and the DLU Controls (DLUCs).**

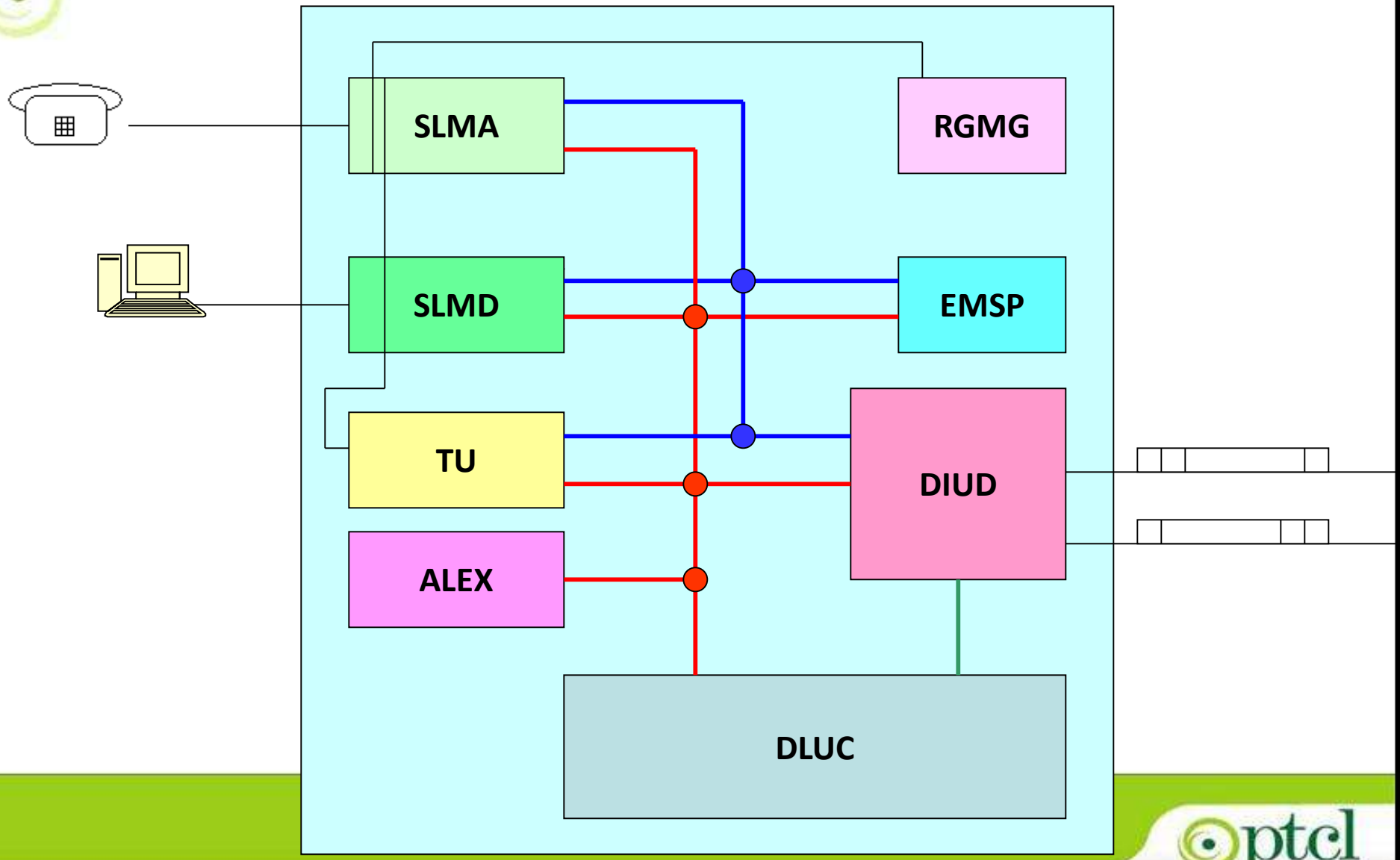
- **A TU for testing telephone, subscriber lines & circuits.**



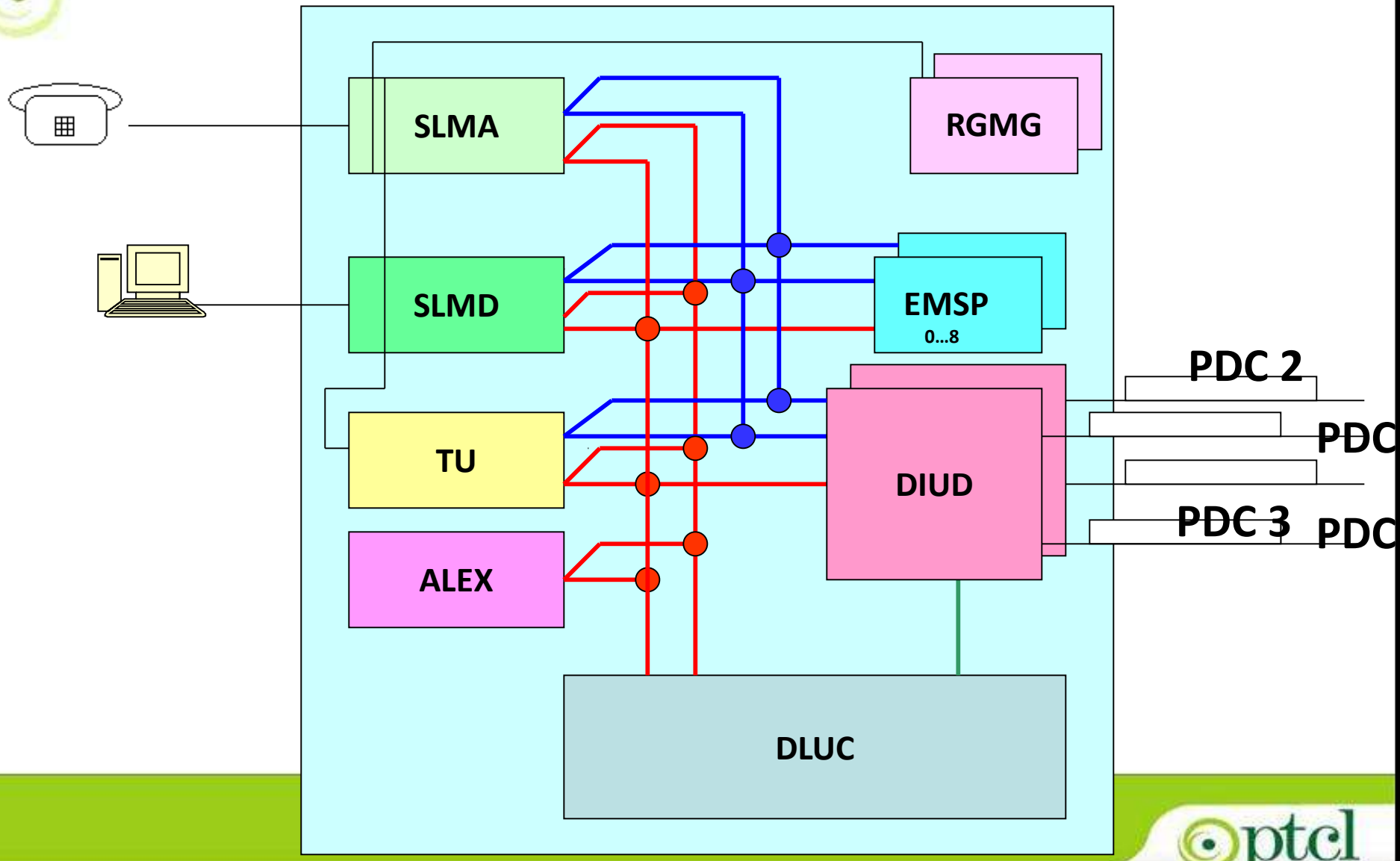
Functional units of the DLU



Interfaces of the DLU



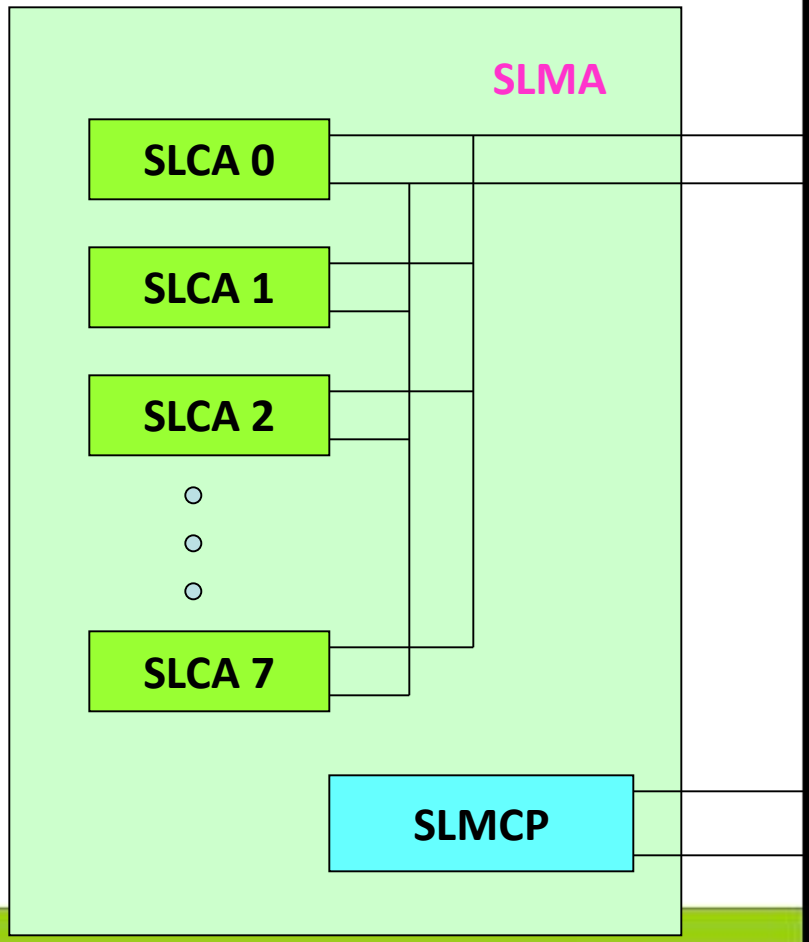
Interfaces of the DLU



Functions of the DLU Components

1.SLMA

- Each SLMA has
  8 SLCA s which
  are controlled by
  a processor SLMCP
- SLMA-COS
- SLMA-CMRL
- SLMA-ITF



Digital Line Unit (DLU)

Overview

DLU is responsible for terminating subscriber lines and concentrating subscriber line traffic.

Function of DLU Units

Subscriber Line Module Analogue (SLMA)

Every Subscriber Line Module Analogue (SLMA) has eight Subscriber Line Circuit Analogue (SLCA) which are controlled by a processor Subscriber Line Module Processor (SLMCP).

The Subscriber Line Module, Analogue provides:

BORSCHT summarises the general tasks of subscriber line modules.

- **Battery Supply**
- **Over voltage Protection**
- **Ringing**
- **Signalling**
- **Coding**
- **Hybrid 2/4-Wire**
- **Testing**

The subscriber Line Module Digital (SLMD)
is used to connect digital subscriber lines & provides the interface to the subscriber line.
The SLMD contains eight Subscriber Line Circuit Digital (SLCD) which are controlled by a processor SLMCP.

The Digital Interface Unit for the DLU (DIUD):

- **Receives and transmits speech information from and to the SLMs and distributes this information.**
- **Extracts control information for the DLUC from the PDC that links the DLU to the LTGB.**
- **uses signals from the PDC for pulse synchronisation**

DLU Control (DLUC)

The DLUC controls the DLU internal sequences of operation and distributes or concentrates control signals between subscriber line circuits and the DLUC.

Test Unit (TU)

The Test Units test the following :

- **analogue and digital subscriber lines,**
- **Subscriber line circuits**
- **Telephone Set of Analogue Subscriber.**

Emergency Service

Even if all outgoing PDC links of a Remote DLU fails, it is still possible to establish calls between subscribers served by the same DLU. This is called Emergency Service.

The DLU emergency operation is made possible through a combination of EMSP emergency units and specialized software modules.

Line/Trunk Group (LTG)

The Line/Trunk Groups (LTGs) are the interfaces between the digital Switching Network and the network environment of the exchange, which may be analogue or digital.

For reasons of safety a LTG is always connected to both Switching Network (SN) plane. If the link between the LTG and the Switching Network, or even one plane of the Switching Network fail, call processing will continue without interruption.

LTG TYPES:

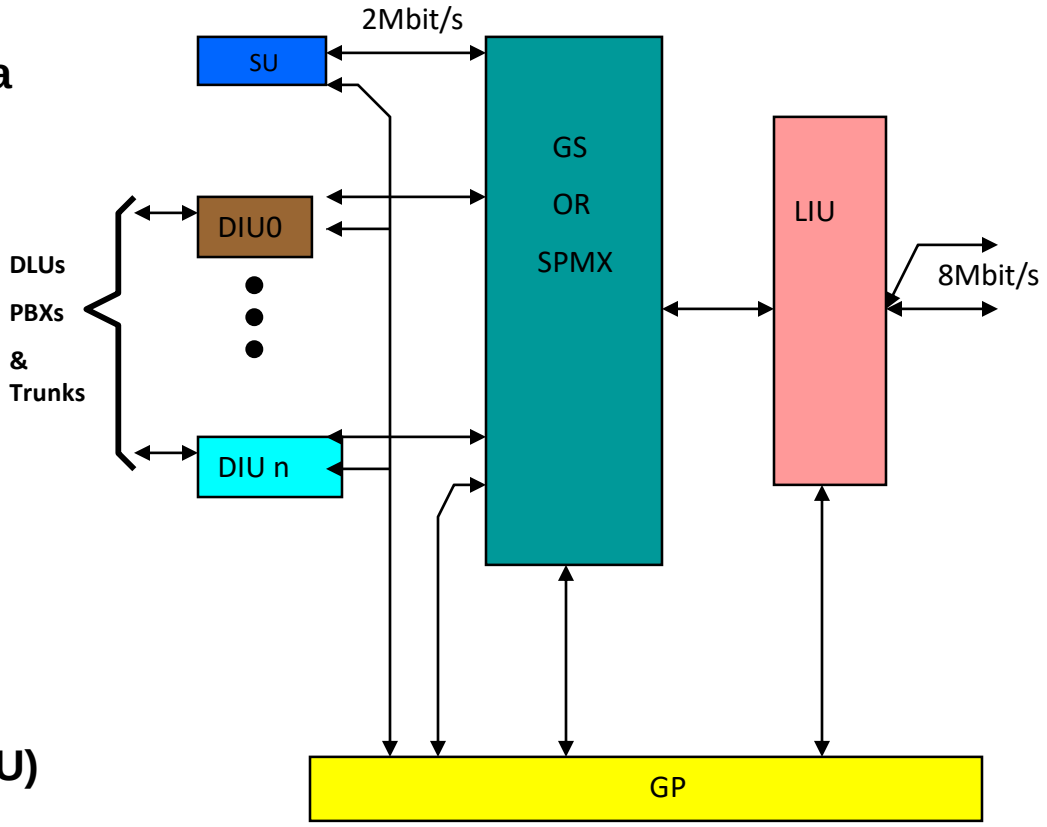
- **Line/Trunk Group (LTGA)**
- **Line/Trunk Group (LTGB)**
- **Line/Trunk Group (LTGC)**
- **Line/Trunk Group (LTGD)**

} **Functional Types**

LINE TRUNK GROUP

The main components of a LTG are :

- **Group Processor (GP)**
- **Group Switch or Speech Multiplexer (GS)or (SPMX)**
- **Link Interface Unit (LIU)**
- **Signaling Unit (SU)**
- **Digital Interface Unit (DIU)**



Main Functional Units of LTG.

- up to 8 line/Trunk Units (LTUs)
- signalling Unit (SU)
- Speech Multiplexer (SPMX) or Group Switch (GS)
- Link Interface Unit between LTG and Switching Network (LIU)

The Line/Trunk Units (LTUs) can be connected to:

- Digital Line Units (DLUs)
- Other exchanges.
- Digital Switchboards (DSBs)

An LTGB can interface 60 Digital Switchboards (DSBs) via digital access lines.

The SU is equipped with code receivers (CR) &Tone Generator (TOG) for generating audible tones

The SPMX is used if the LTG interfaces with trunk lines. The Group Switch (GS) is used if the LTG interfaces with subscriber lines. The GS also handles the 3 party conference calls. SPMX/GS is also multiplexed 4x2 Mbit/sec into 8 Mbit/sec and vice versa.

The Link Interface Unit (LIU) is the interface between the LTG and the Switching Network (SN). It :

- **duplicates the channels to both SN planes (SN 0 and SN1).**

The Group Processor (GP) is an independent periphery controller.

GP functions are:

- **controlling all functional units in the LTG**
- **exchange data with the Coordination Processor (CP) and other LTGs,**
- **self-diagnosis and safeguarding**

Line/Trunk Group C & D

As the LTGC is used to terminate inter-office trunks while LTGD is used in International Gateway exchange.

Switching Network (SN)

The actual switching process that establishing a call connection between two subscribers takes place in the hardware subsystem called switching Network (SN).

SN Overview

For safeguarding reasons, the Switching Network (SN) is always duplicated.

The External interface of the Switching Network are the same. They are Secondary Digital Carriers (SDCs) its data rate is 8 Mbit/s.

Switching

SN consist of Time Stages and Space Stages.

A time stage consists of Time Stage Module (TSM) and space stage consist of Space Stage Module (SSM).

Each stage consists of its own controller Switch Group Control (SGC)

SWITCHING NETWORK

- **The main components of a SN are :**

Time Stages

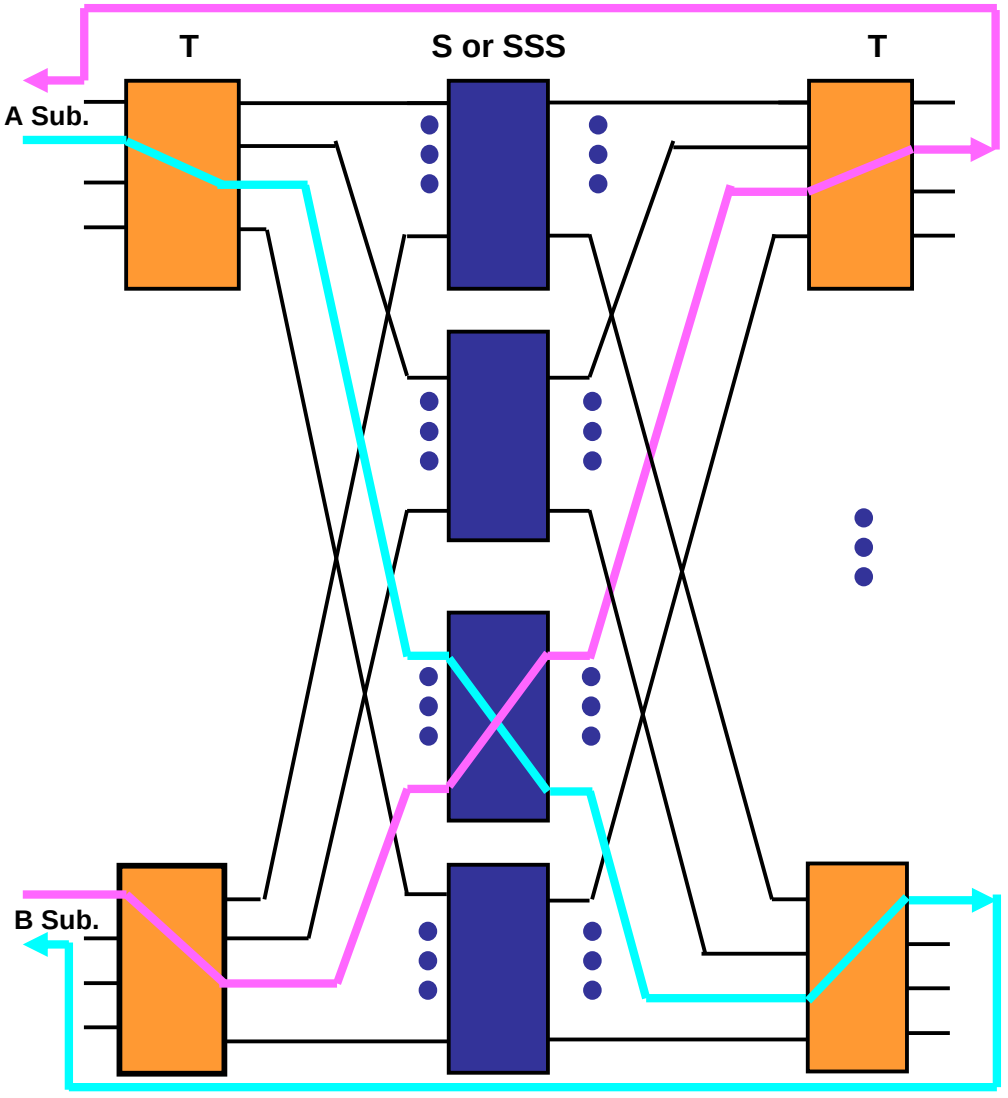
In time stages octets to be switched change time slot and highway according to their destination

Space Stages

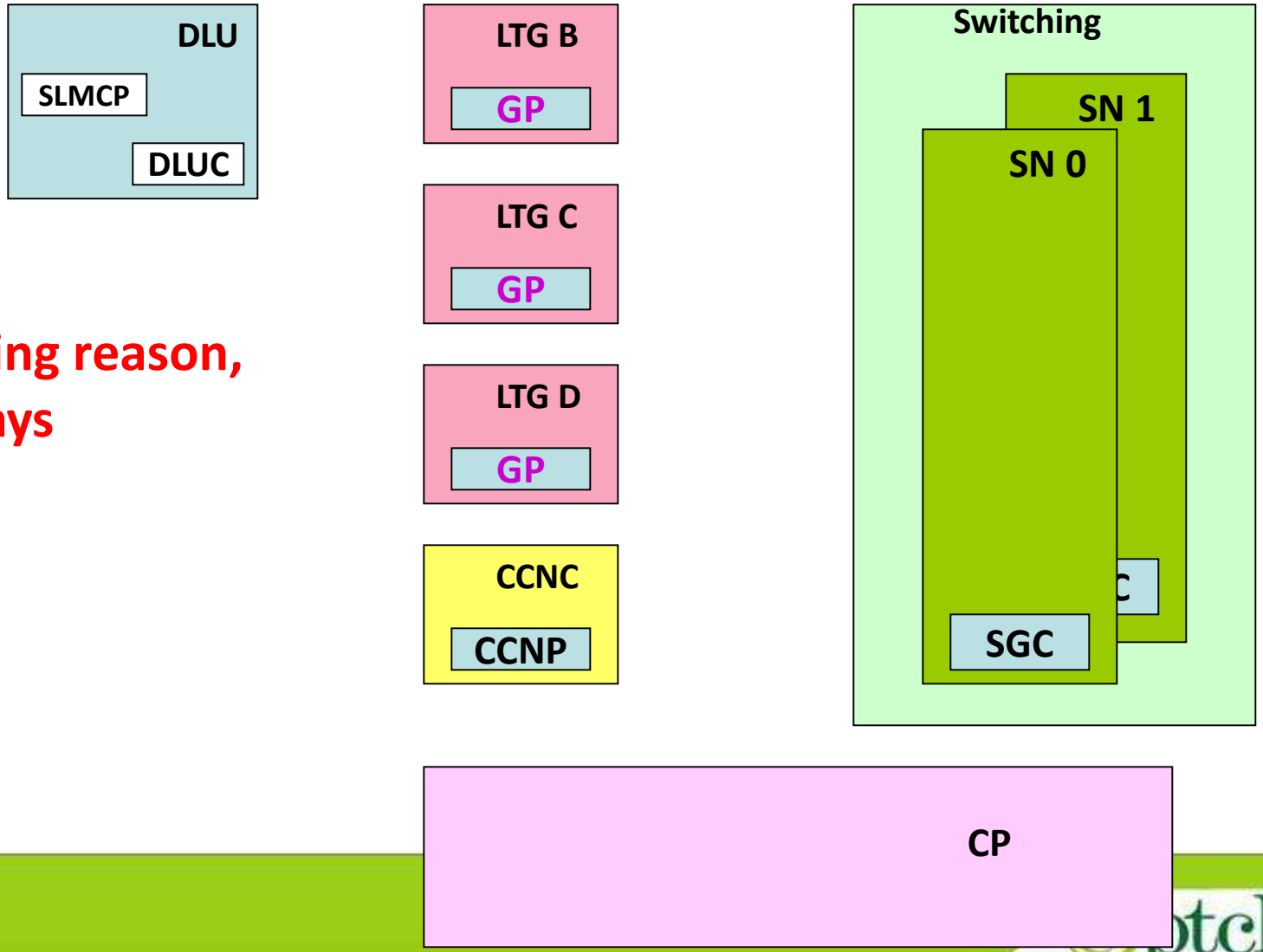
In space stages they change highway without changing time slots

Switch Group Control (SGC)

Connection paths through the time & space stages are switched by the SGC in accordance with the switching information from the CP.



Switching Network Overview



For safeguarding reason, The SN is always DUPLICATED

External Interfaces of SN

- The external interfaces of the SN are the same, They are SDC s.
- Two SDC links connect each LTG to the SN.
- **Interfaces**

  SDC: LTG for the LTG to the SN

  SDC: CCNC for the CCNC to the SN

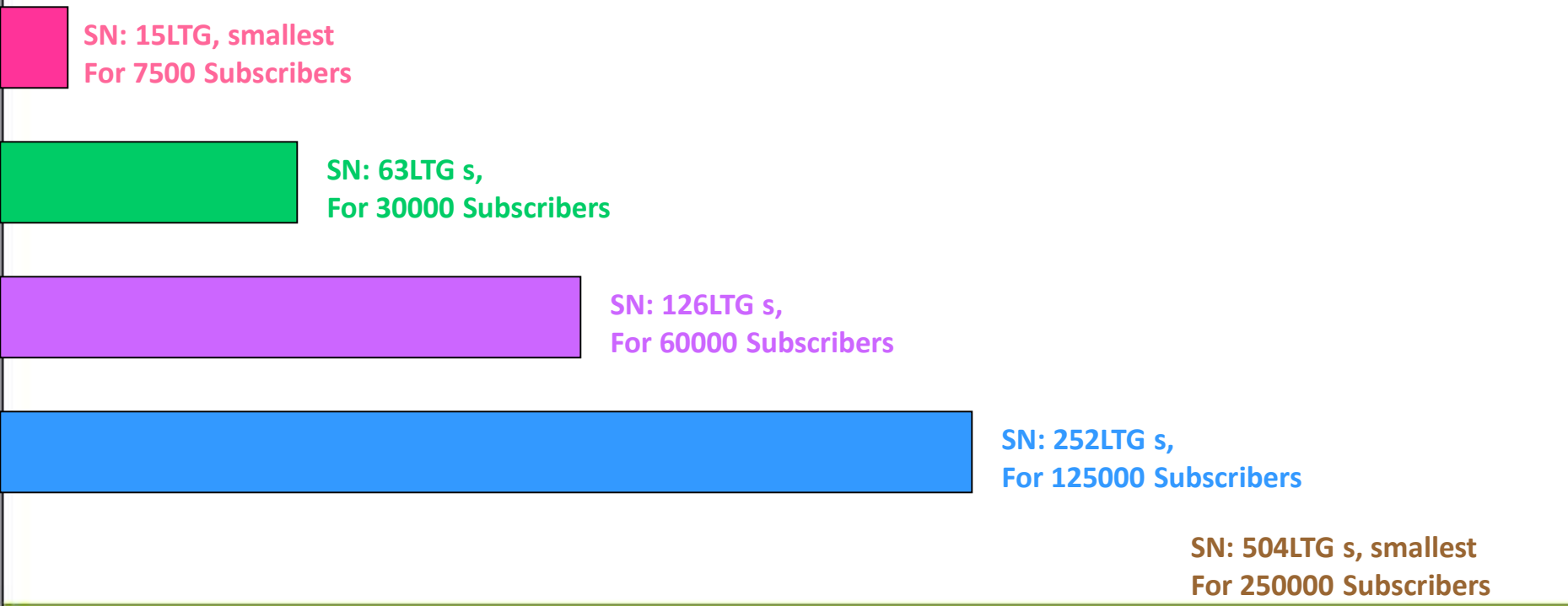
  SDC: TSG to the CP for data exchange with the LTG

  SDC: SGC to the CP for the exchange of data with the SGC

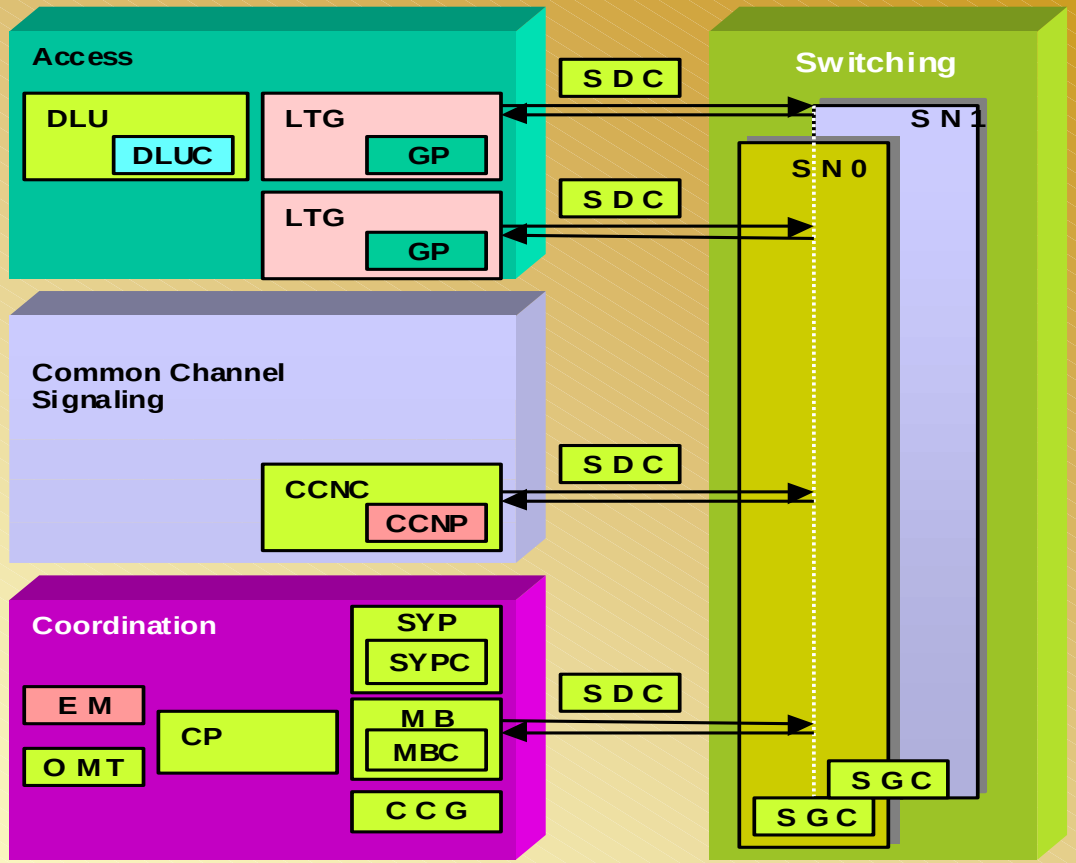
Application of SN

- The Switching Network uniform design and expansion modules permit its application in

  a wide range of exchange types and size.



COORDINATION



Co-ordination Tasks

In addition to the Co-ordination Processor (CP) with its External Memory (EM) and the Operation and Maintenance Terminal (OMT), the "Co-ordination" subsystem includes the following functional units:

- the Message Buffer (MB) with its micro processor control (MBC),
- the central Clock Generator (CCG)
- the System Panel (SYP) with its micro processor control (SYPC)

CP MAIN FUNCTIONS:

The CP performs the following functions

- Call Processing
- Operation & Maintenance
- Safeguarding

The Message Buffer (MB) serves as an interface adapter and transmission adapter for the internal information exchange between:

- CP
- SN
- LTGs

CENTRAL CLOCK GENERATOR (CCG)

For the transfer of digital information in a network, synchronized functional sequences in all participating units are an absolute requirement. Accurate clock pulses must be provided for all exchanges within the digital network. This task is handled by the Central Clock Generator (CCG).

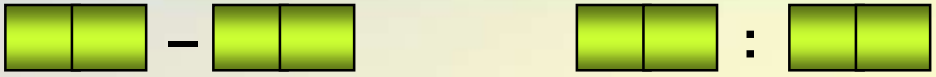
SYSTEM PANEL DISPLAY

SYSTEM PANEL ALARMS

Alarm Reasons

- HW-faults
- SW-faults
- Unavailability of network elements
- other problem which endanger system functions
- external alarms

SYSTEM PANEL DISPLAY



External alarms

Line/trunk Groups LTG

Maintenance Alarm

Service Alarm

External equipment

Switching Network SN

Entry Supervision

Fire

DC Power supply

Power failure

Aircon-ditioning

Coordination Processor CP

ERL

Processor Load

Central Units

Clock

Message buffer

Common Channel Signaling

System Panel SYP

Update

Test

Accept

Trunk Group alarm

Trunk Group blocked

External DLU Alarms

HW units

Line Lockout

Cat. 1

Administrative Alarm

Signaling links blocked

Signaling Lines

Cat. 2

Recovery

Alarm indications suppressed

Call Identification

System Operator

Time Insecure

All external alarm lines of ALEX → LED Ex. DLU alarms

Each of the 24 external alarm line of RM:EA → one LED of Ext. alarms

This assignment is stored in EPROM of SYPC (including the alarm priority and the voltage level of the alarm line indication an alarm

How is EWSD applied ?

The areas of application are:

- **Local exchanges**

-Analog subscribers with rotary dialing or pushbutton dialing, with private metering (including those connected via PABXs) and ISDN terminal can be connected directly or via concentrators.

- Calls between subscriber and trunk-or between two subscribers- are set up automatically.

Applications of EWSD

Transit exchanges

- Digital or analog trunks via SC (signaling convert)/ MUXs with various signaling protocols can be connected.
- Connection between trunks are set up automatically.

Combined exchanges

- These process both local and transit traffic.

Applications of EWSD

International exchanges

- International trunks including, for example, those via satellites are connected at these exchanges.
- A connection between trunks can be set up either automatically or via switchboard.

Rural (container) exchanges

- In areas of low subscriber density, the local exchange can be accommodated in a container.

LOCAL CALL SETUP

Phase 1:-A-sub goes off hook &receives the dial tone

A-DLU * detects off-hock state
*** reports event to LTG**

A-LTG * informs the CP
*** supplies dial tone**

CP * marks the subscriber as busy

LOCAL CALL SETUP

Phase 2:- A-subscriber dials

A-DLU * forwards each digit to the LTG

A-LTG * collects and process the digits

*** forwards them to the CP**

CP *identifies the B-sub & marks him as busy

***selects and setup the path through SN**

***informs the B-LTG**

B-LTG *supplies ringing tone to A-subscriber

***informs the B-DLU**

B-DLU *activates the bell

LOCAL CALL SETUP

Phase 3:-B-sub goes off hook & speaks

B-DLU * detects off-hock state

*** informs the B-LTG**

***disconnects ringing current**

B-LTG * informs the A-LTG

*** disconnects ringing tone**

A-LTG * meters the charges

LOCAL CALL SETUP

Phase 1:-A-sub goes on hook

A-DLU * detects off-hock state

* reports event to LTG

A-LTG * informs the CP

* supplies dial tone

CP * marks the subscriber as busy

Hands On Session

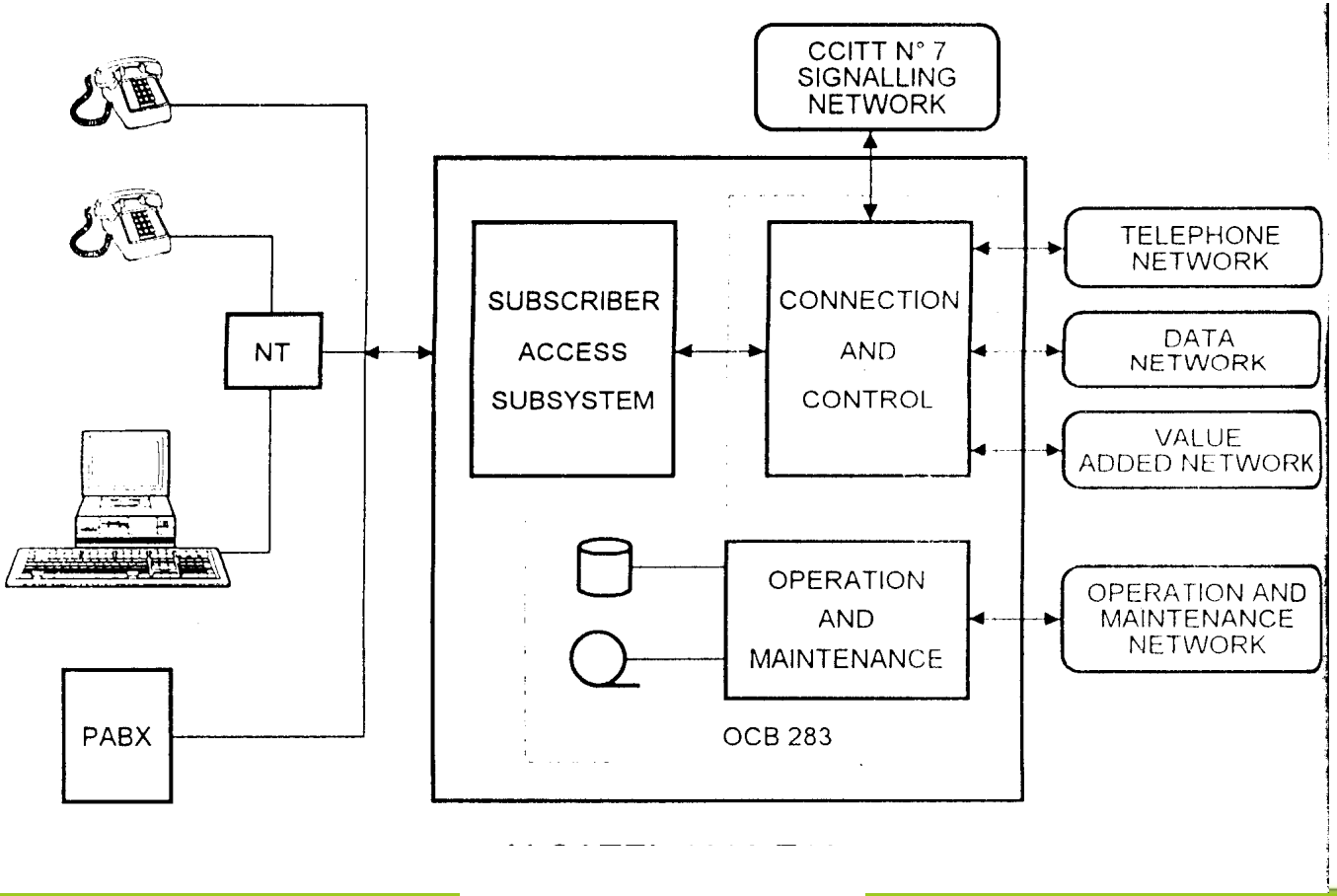
Operational Task

- Subscriber administration
- System administration

Maintenance

- Maintenance of subscriber lines
- Hardware maintenance
- Software maintenance

EXCHANGE ARCHITECTURE

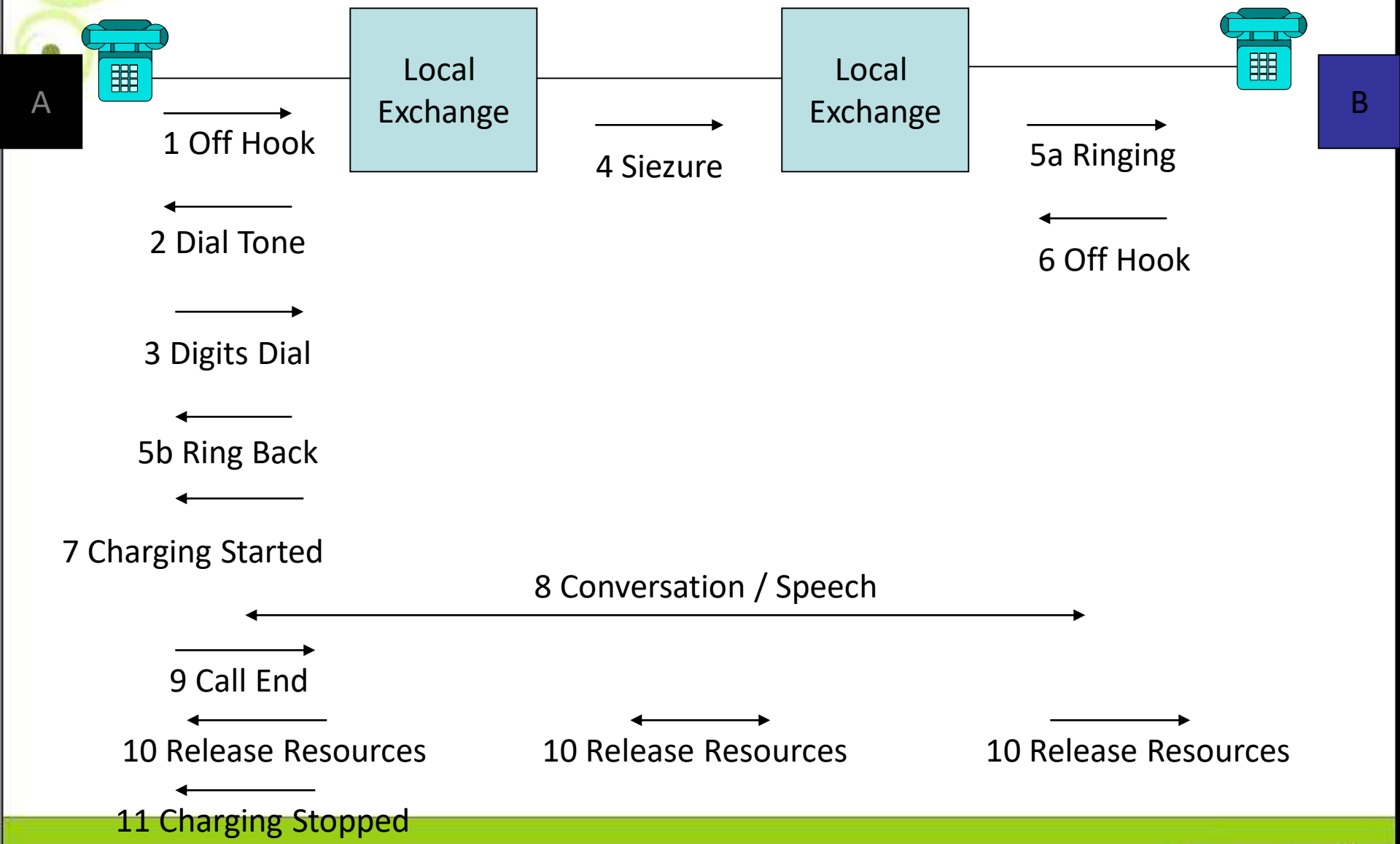


Call example in PSTN

Following steps are involved in the establishment and subsequent release of a call on PSTN:

1. *DETECTION OF HOOK OFF*
2. *PROVISION OF DIAL TONE*
3. *DIALING OF DIGITS*
4. *RESERVATION OF RESOURCES FOR CALL*
5. *RINGING OF CALLED PARTY AND RING BACK TO CALLING PARTY*
6. *DETECTION OF ANSWER FROM CALLED PARTY*
7. *NECESSARY CHARGING INITIATION*
8. *SPEECH*
9. *INITIATION OF CALL TERMINATION FROM EITHER END*
10. *CALL END, RELEASE OF ALL RESERVED RESOURCES*
11. *NECESSARY ACTION REGARDING BILLING*

GENERAL CALL SETUP



EWSD VERSION 12 DOCUMENTATION

- OPERATION MANUAL (OMN)
- MAINTENANCE MANUAL (MMN)
- NONSTANDARD MAINTANANCE MANUAL (NM)
- COMMAND MANUAL (CML)
- EMERGENCY CASES (EMCYMN)

Thank you!
Questions????