
BSC architecture and functions
BSS S14
Soc Classification level
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Objectives

After this module you should be able to:

- Explain the BSC architecture
- Explain the BSC computer units and their function
- Explain the main functions of the BSC

Refer to S13 Documentation:

- Descriptions\ Product descriptions\ Product description of BSC2i , BSCi High Capacity Base Station Controller
- Descriptions\ Product descriptions\ Product description of BSC3i High Capacity Base Station Controller

Required equipment: One working VDU terminal for each work group.

Note:

This document consists of different BSC types and there architecture. The slides could be selected depending on customer needs

S14 Software

Nokia BSC S14 software consists of Operating Software and Application Software

- Operating Software: Includes the basic functionalities and enhancements
- Application Software: Consists of value-adding functionalities

- **S14 release supported NSN BSC product variants:**
  - BSC3i 660, 1000/2000
  - Flexi BSC (BSC3i 3000)
  - BSC2i
  - BSCi
  - TCSM3i
  - TCSM2

- **S14 release non-supported NSN BSC product variants:**
  - BSCE
  - TCSME
  - BSC2E
  - BSC2A

BSC SW release S11.5 will be the last compatible software level for these old BSC and TCSM product models. see more details in BSC Technical Note 796 publication date on 10th of May 2004.

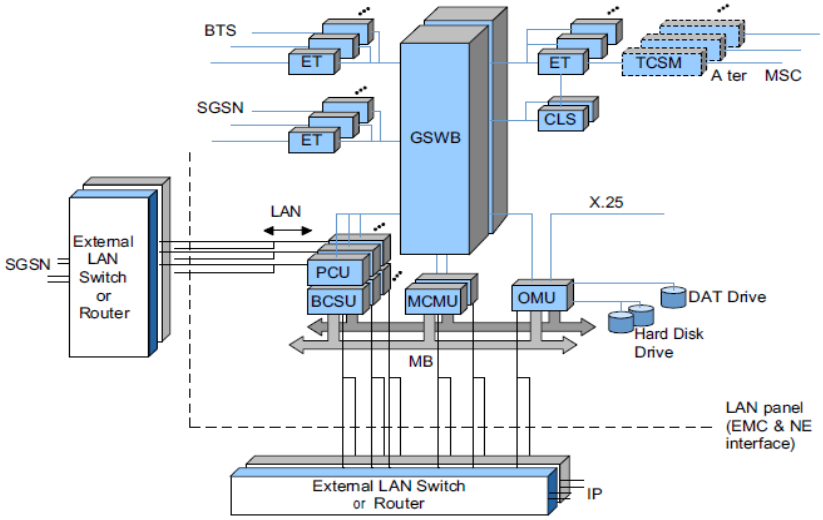
Old BSCE, BSC2 and TSCME products are not supported any more with S13 software release. For further information on old BSC/TCSM products please see also the following Technical Notes: BSC TN 531: Availability of Nokia BSCE and TCSME Equipment, BSC HW TN 87: Availability of Nokia BSC2E and BSC2A Equipment and BSC SW TN 796: SW Support for Nokia BSCE, TCSME, BSC2E and BSC2A Products.

BSC Product Naming on S14 level

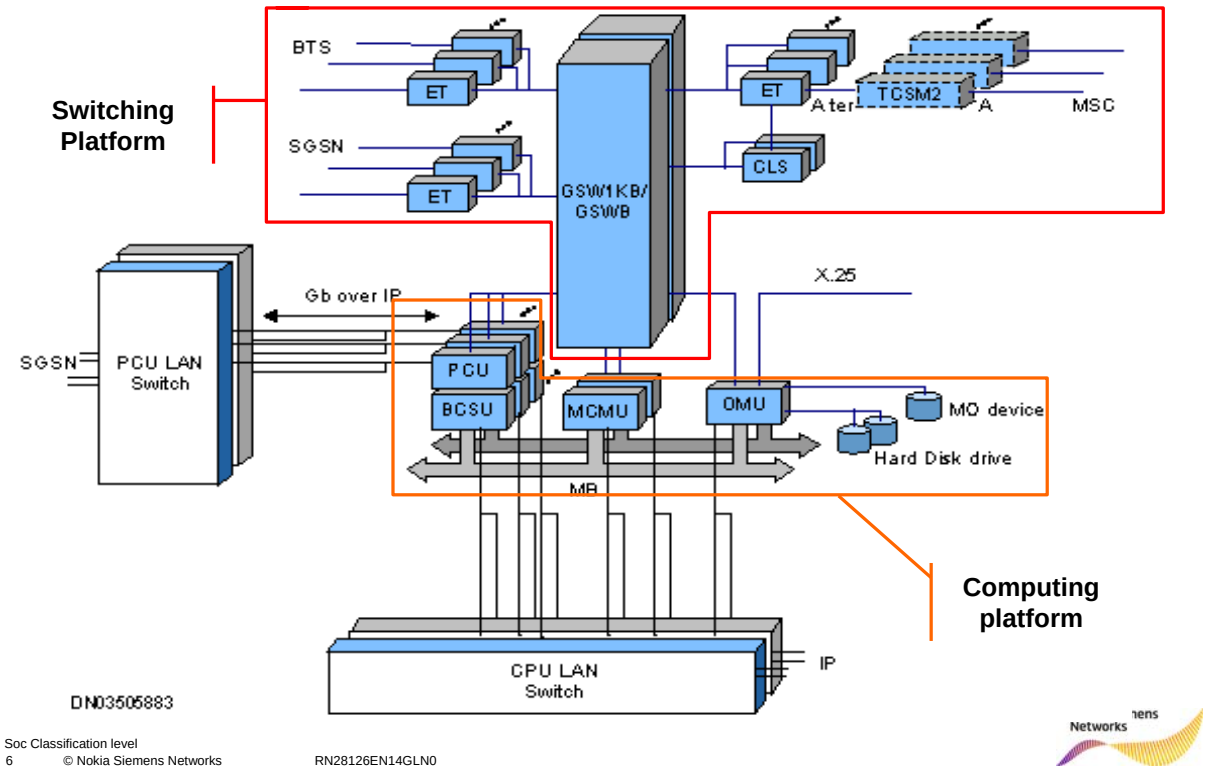
BSC = Base Station Controller, a general term for all BSC versions		
General name	Product name	Explanation
BSCi/2i	BSCi	High Capacity (upgraded) version of the first generation Nokia DX 200 BSC (BSCE)
	BSC2i	High Capacity version of the second generation Nokia DX 200 BSC2
Flexi BSC product family	BSC3i 660	660 TRX one cabinet configuration, upgradeable to Flexi BSC
	BSC3i 1000/2000	1000 TRX one cabinet or 2000 TRX two cabinet configuration, upgradeable to Flexi BSC
	Flexi BSC	3000 TRX one cabinet configuration (S14)

- Flexi BSC product family is a general term for all versions upgradeable to Flexi BSC configuration
- Flexi BSC as product name is specific for the 3000 TRX one cabinet product/configuration

BSC2i Block Diagram



BSC3i 660 Block Diagram



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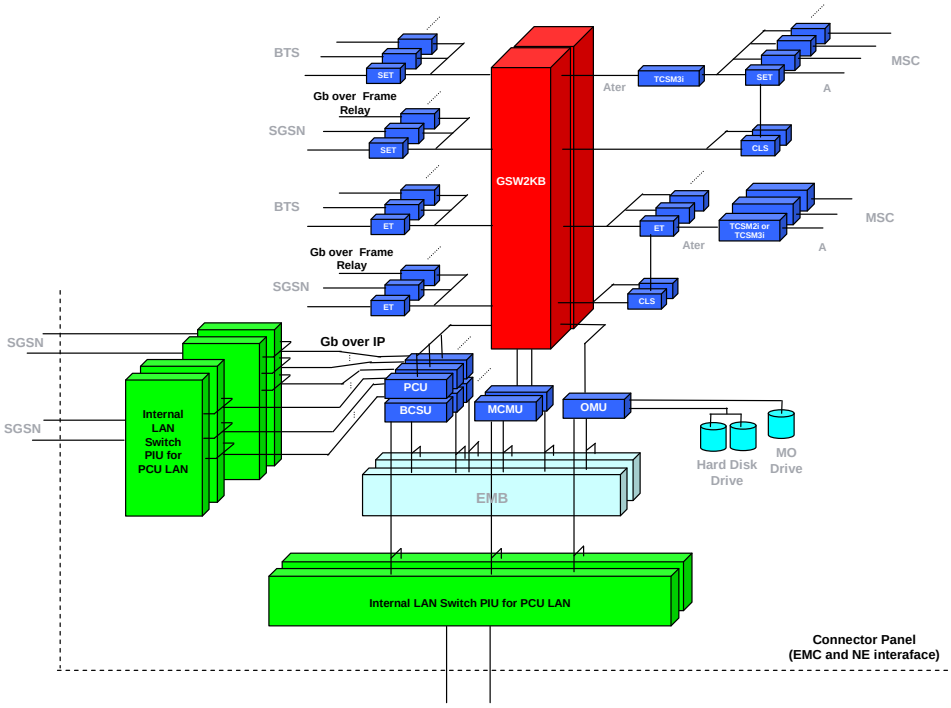
BSC3i 1000/2000 Block Diagram



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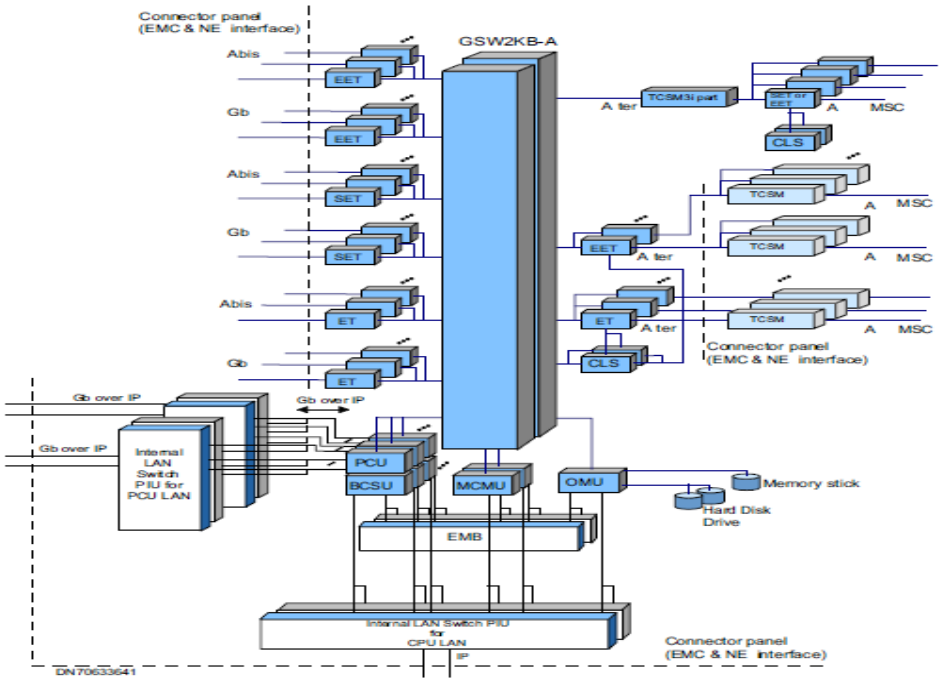
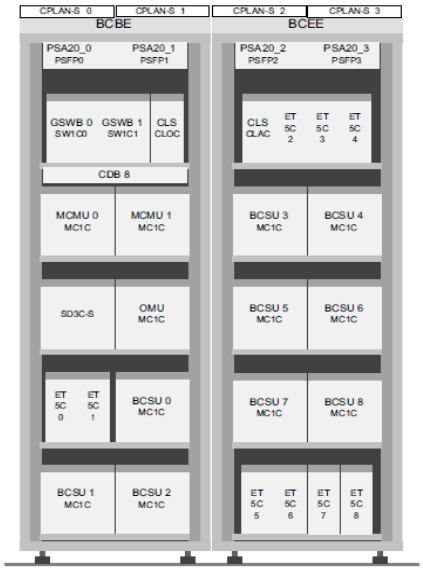
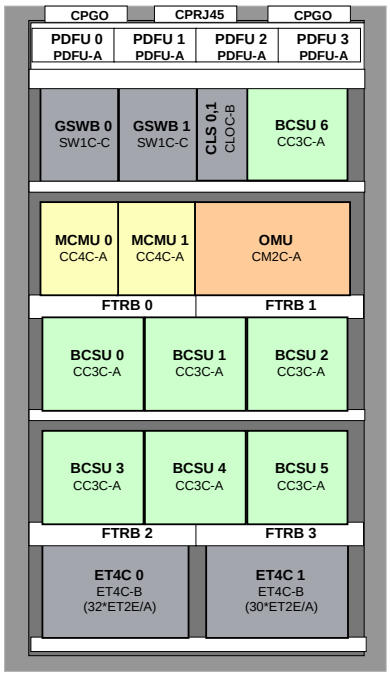
Flexi BSC Block Diagram



BSC2i Cabinet Configuration



BSC3i 660 Cabinet Configuration



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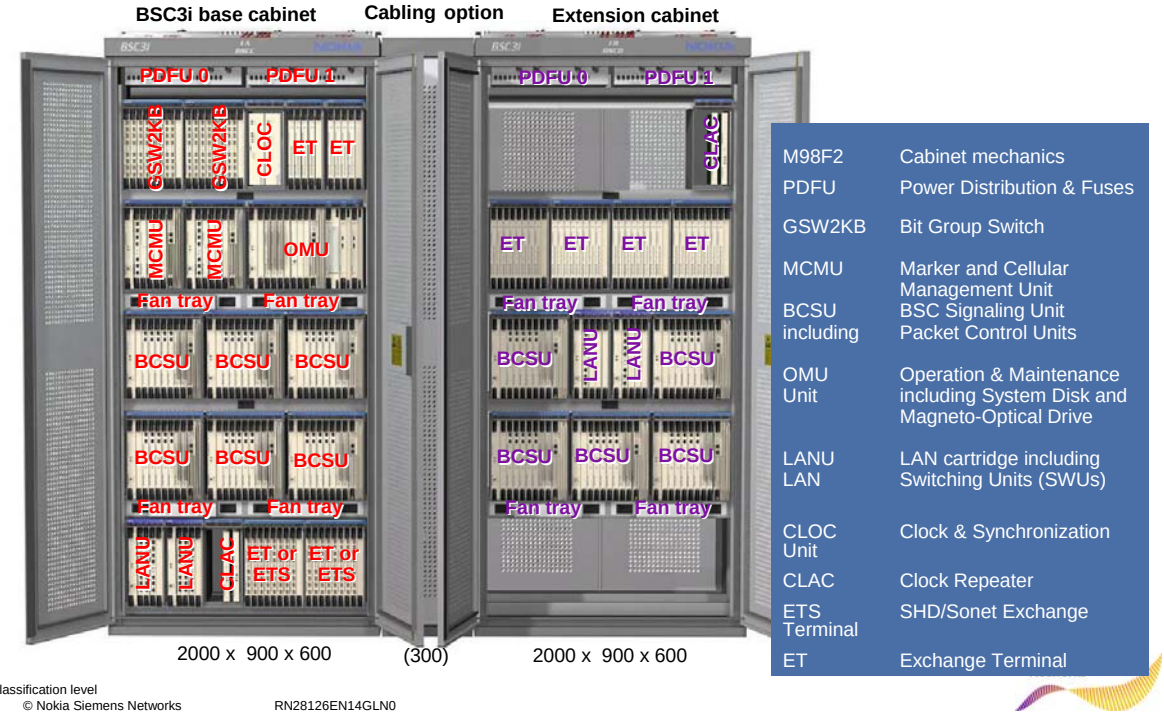
Refer to S11 Documentation:

• Descriptions\ Product descriptions\ High Capacity Base Station Controller, (ETSI/ANSI),\ Mechanical Design and power supply of the BSC3i BSC3i

Major changes:

- BSC3i consist of up to seven Base Station Controller Signalling Units (BCSU)
- There is no extension rack available
- I/O Devices moved to Operation and Maintenance Unit (OMU) cartridge
- four LAN switches (ESB20) installed in the MCMU cartridges
- BSC3i has included cooling system
- Four Power Suppliers

BSC3i 1000/2000 cabinet configuration



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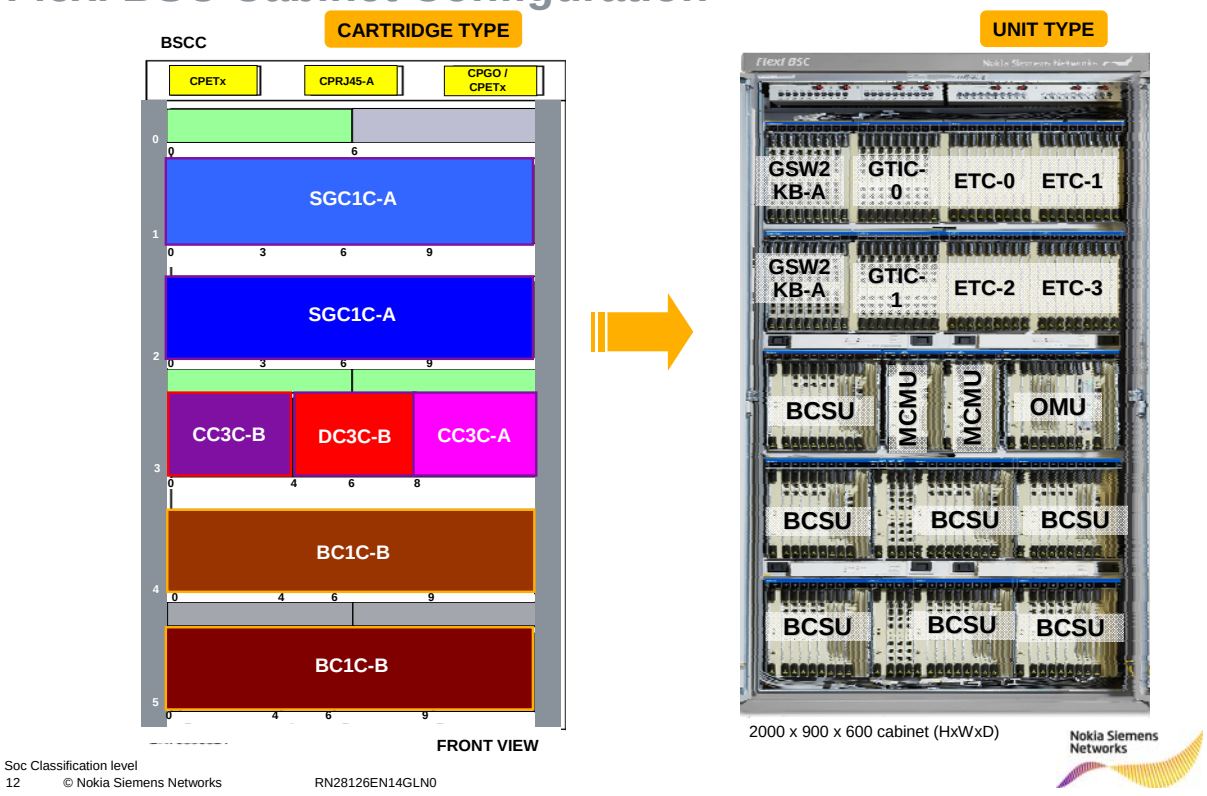
Mechanics: M98F2

IC209-A with FTRB-A
(enhanced fan tray unit)

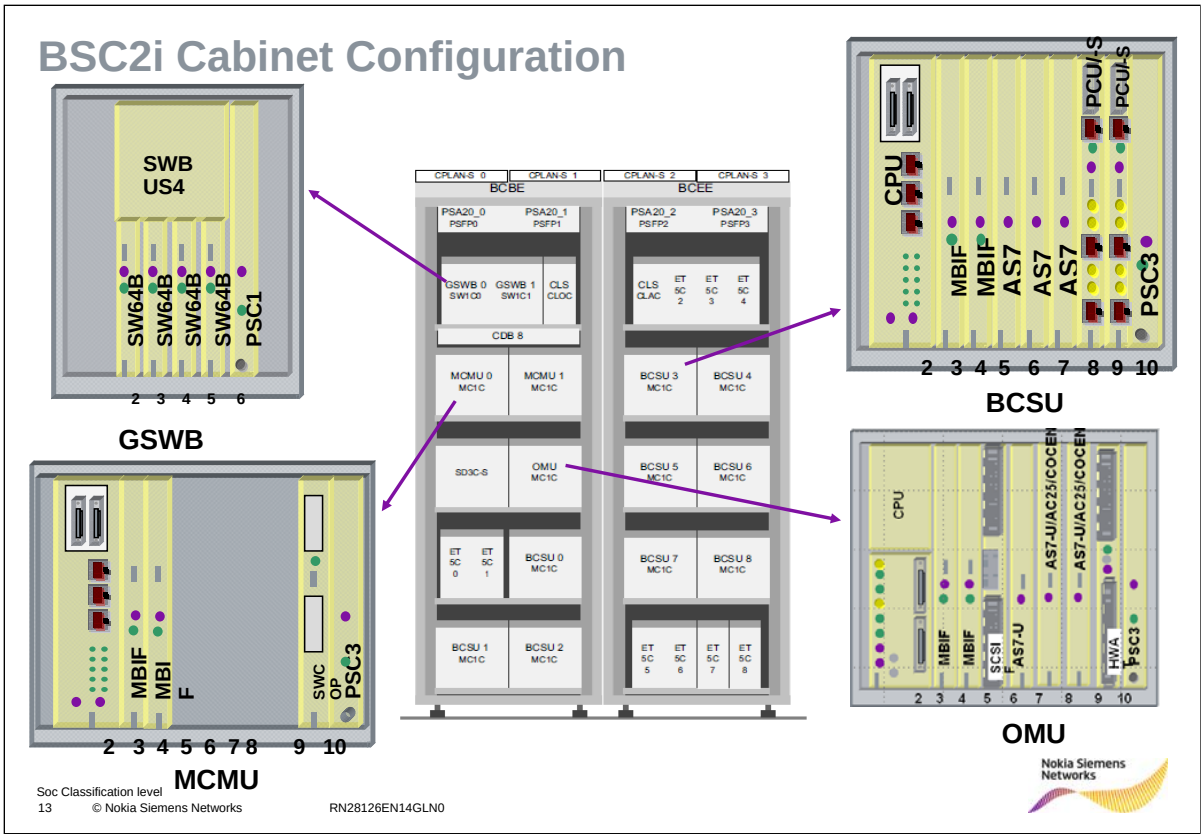
Cabinet level max. power 2,7 kW

Flexi BSC Cabinet Configuration



The S14 first-delivery Flexi BSC features an equipment cabinet (BSCC) and an optional cabling cabinet (CC).

The cabling cabinet is needed whenever the number of external E1/T1 PCM interfaces in use exceeds 48.



Group Switch GSWB

•makes the 8 kbit/s switching function for: traffic channels, CCS7 signalling channels, LAPD signalling channels, internal signalling channels.
•Redundancy: 2n
•The **GSW** is controlled by the SWCOP unit in MCMU cartridge.
•The maximum capacity of the GSW is 256 PCMs: 8 kbit/s switching, max. 4 SW64B PIU, each PIU can handle 64 PCM lines, total: 256 PCM lines.

Marker and Cellular Management Unit

•Redundancy: 2n
•Functions of the **Marker** part in the MCMU:
- controls and supervises the GSW
- responsible for reading and writing of the GSW
- finds free circuits (hunting), connects and releases all connections

•Functions of the **Cellular Management Unit** part in the MCMU:
- controls and supervises the cellular network (circuit swiched Traffic)

Base Station Controller Unit

•Redundancy: n+1
•Functions of the **Base Stadion Controller Unit** part in the BCSU:
- power and handover control algorithms

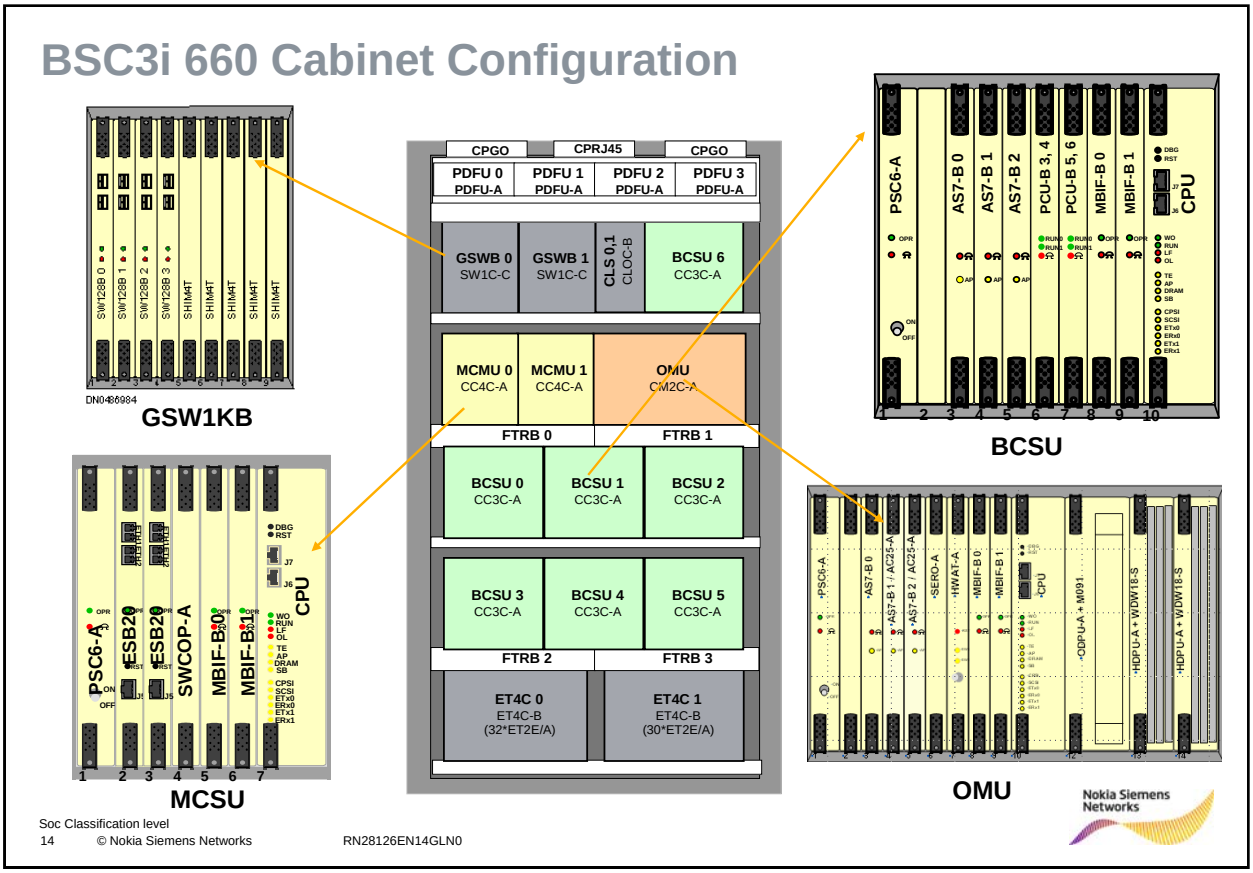
•Functions of the **Signalling Unit** part in the BCSU:
- CCS7 towards MSC
- LAPD to BTS (BCFSIG & TRXSIG)
- TSL 0 handling (ET-control)

•Additionally the MCMU cartridge contains the **Packet Control Unit PCU**
- controls and supervises the cellular network for packed swiched Traffic
- GPRS radio connection establishment and management

Operation and Management Unit

Redundancy: no
Functions of the OMU:

- controls the MMI-system
- provides the interface for user and peripheral devices
- handling of internal and external hardware alarms
- controls the clock and synchronisation unit



Refer to S11 Documentation:

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Major changes:

- BSC3i consist of up to seven Base Station Controller Signalling Units (BCSU)
- There is no extension rack available
- I/O Devices moved to Operation and Maintenance Unit (OMU) cartridge
- Four LAN switches (ESB20) installed in the MCMU cartridges
- BSC3i has included cooling system
- Four Power Suppliers

Marker and Cellular Management Unit

•Redundancy: n+1

•Functions of the **Marker** part in the MCMU:

- controls and supervises the GSW
- responsible for creating and running of the GSW
- finds free circuits (hunting), connects and releases all connections

•Functions of the **Cellular Management Unit** part in the MCMU:

- controls and supervises the cellular network (circuit swiched Traffic)

•Additionally the MCMU cartridge contains the **LAN Switch unit:**

- Simplex access to the Operators IP Network
- Provides IP interfaces available for both control plane (O&M IP) and user plane traffic (Gb/IP) to be carried over
- IP connectivity readily available for future Lb/SMLC and BSC-BSC interfaces

Base Controller Signalling Unit (BCSU)

•Redundancy: n+1

•Functions of the **Base Station Controller System** part in the BCSU:

- power and handover control algorithms

•Functions of the **Signalling Unit** part in the BCSU:

- CCS7 towards MSC
- LAPD to BTS (BCFSIG & TRXSIG)
- TSL 0 handling (ET-control)

•Additionally the MCMU cartridge contains the **Packet Control Unit PCU**

- controls and supervises the cellular network for packed swiched Traffic
- GPRS radio connection establishment and management

•Hint: Maximum four logical Packet Control Units (PCUs), composed of two physical PCU-B plug-in units, per BCSU. A logical PCU is an entity handling the same functionality in the BSC as a physical PCU plug-in unit in older Nokia BSC models. In the Gb interface, one logical PCU handles one NSE.

OMU

Operation and Management Unit

Redundancy: no

Functions of the OMU:

- controls the MMI-system
- provides the interface for user and peripheral devices
- handling of internal and external hardware alarms
- controls the clock and synchronization unit

Hint:

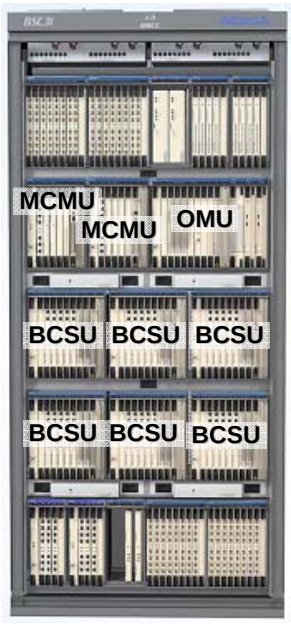
Hard disks and Magneto Optical Disk located in the OMU cartridge. No DAT Tape and Floppy Disk available any more.

BSC3i 1000/2000 Cabinet configuration in 1st Cabinet (Computer Units)

MCMU

BCSU

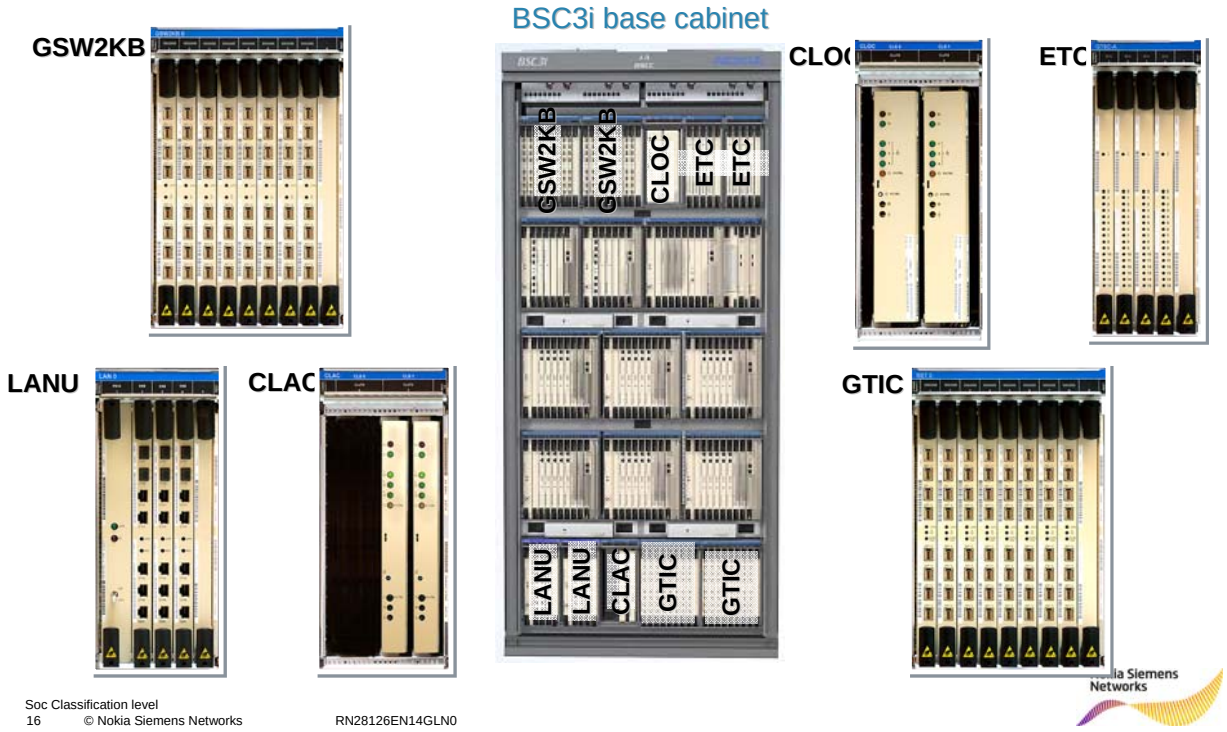
BSC3i base cabinet



900 x 600 x 2000

OMU

BSC3i 1000/2000 Cabinet Configuration in 1st Cabinet (Other Units)

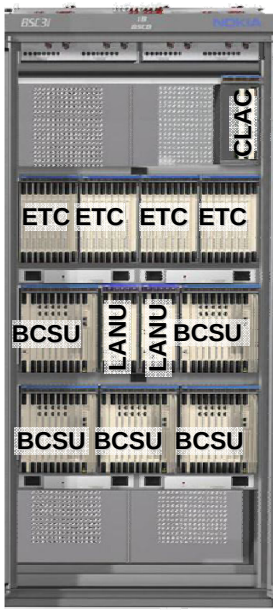


BSC3i 1000/2000 configuration in 2nd Cabinet

ETC

BCSU

Extension cabinet



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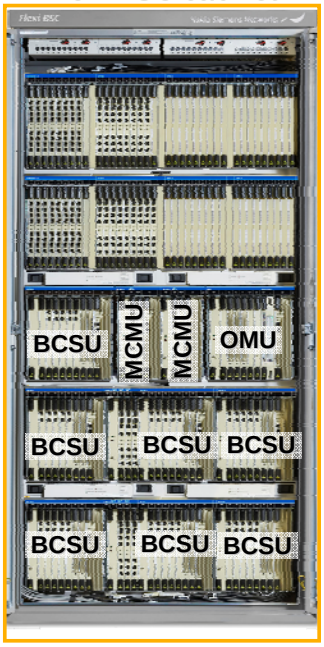
Flexi BSC Cabinet Configuration
Computer Units

MCMU

BCSU

Flexi BSC cabinet



2000 x 900 x 600 cabinet (HxWxD)

In the Flexi BSC, the call control functions are executed by micro-computers, called Call Control Computers

OMU

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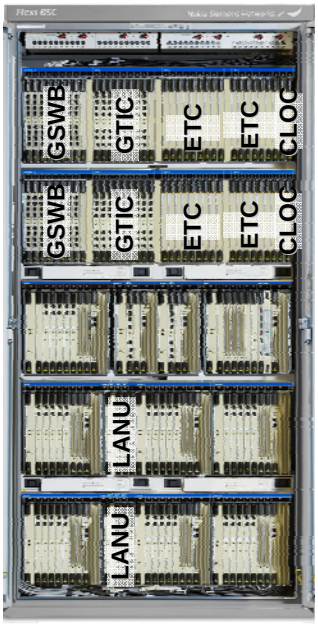
Flexi BSC Cabinet configuration (Other Units)

Flexi BSC cabinet

GSW2KB



CLOC

ETC

LANU

GTIC

BSC3i 1000/2000 Hardware and Functionality
BSC3i Processing Unit - CP816-A/AC, Pentium III Central Processing Unit

Mobile Pentium®III with approx. 1.6 GHz frequency

- 512 MB SDRAM

Provides standard V.24/V.28 based Service Terminal interfaces in front panel

The unit is connected to the back plane via Compact PCI bus, SCSI and Ethernet based Message bus

- one CPCI 33Mhz, 32 bits
- two Wide Ultra3 SCSI
- four 10/100/1000 Mbit/s Ethernet ports

For all computer units in BSC3i 1000/2000:

- OMU, MCMU and BCSU

The CP816-A with full performance can be used in M98F mechanics. With reduced performance the CP816-A can be used in M98N mechanics.

approx. **1.6**GHz frequency acts as the central processing resource in the DX200 system computer units (actual processor speed is selected by SW according to the thermal operating enviroment 600MHz – 1.6GHz).

CP816-A supports standard external interfaces like Wide Ultra3 SCSI (backward compatible to current Ultra2) and four 10 Base-T /100 Base-TX / 1000 Base-T Ethernets. The unit is connected to the back plane CompactPCI bus. However, it can be used without the CompactPCI connection.

Two of the ethernet ports are used for EMB LANs and two other ethernet ports for the IP traffic LANs.

Since the two ethernet controllers are dual-port devices, the Ethernet Address (MAC address) found at word offset 0x00 – 0x02 will be assigned to LAN A. The Ethernet Address for LAN B is the Ethernet Address for LAN A + 1. Please make sure there aren't any (indirectly) doubled MAC addresses assigned!E.g. if MAC addr. of LAN A is 00:00:50:11:22:FF then the MAC addr. of LAN B is automatically 00:00:50:11:23:00. In other words 00:00:50:11:23:00 must not be assigned to other devices. E.g. for EMB.

The following settings are made with micro switches:

•Interchangeability code

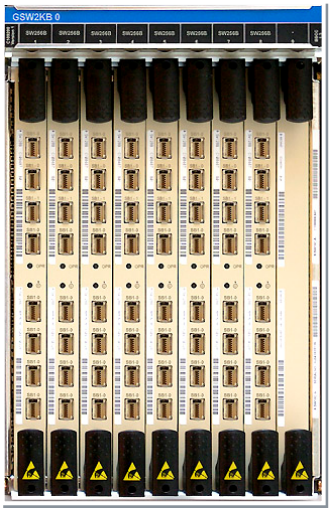
•MBIF in use / not in use status

CP710-A CPU PIU (used in Bsc3i 660)in the computers had only two ethernet ports and can not be used when EMB is needed. -> BSC3i 1000/2000

EMB can only be used with the CP816-A CPU PIUs or later, which have four 1 Gbit Ethernet ports in the back plane.

BSC3i 1000/2000 Hardware and Functionality
GSW2KB

- 2048 real PCM’s
- 16384 virtual PCM’s
- Switching on 8kbit/s level
- Max. 65536 8kbit/s channels for one SW256B
- 8 x SW256B Units
- 8Mbit/s serial connections towards ET16
  - via back panel
- 2 HotLinks / SW256 towards ETS2
  - via front panel



GSW2KB is a congestion-free, full-availability single-step switching network based on time-space architecture. The maximum capacity of related hardware is 2048 PCM lines. The switching network switches 8 kbit/s channels. The network also supports switching of channels that consist of more broadband 8 kbits/s sequential channels.

SW256B supports the existing 4 Mbit/s serial bus connections for units that make use of the network. Additionally, SW256B supports as a new feature 8Mbit/s serial bus connections to use instead of existing 4 Mbit/s connections in order to decrease number of PCM cables. Also, SW256B supports integration of broadband interfaces with an exchange (such as STM-1). This interface is called as Serial Broadband Interface, SBI-bus. (HotLink). Hotlink interface bit rate 320 Mbit/s

Hotlink interfaces are located in the front panel of SW256B unit
Interface 0 and 1 in each SW256B can be used as Hotlink to ETS2
Max 16 Hotlinks.

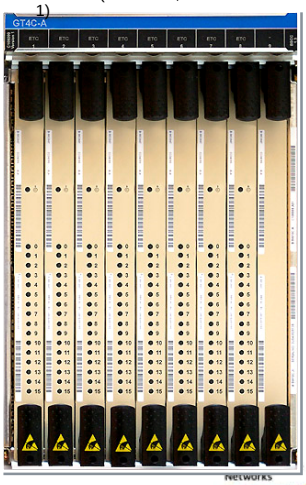
The core of the switching network consists of a maximum of eight SW256B plug-in units with a combined capacity of 2048 PCM lines The capacity of one SW256B is 256 bidirectional 2.048 Mbit/s internal PCM lines. The capacity of one internal 2M PCM line is 256 time-division multiplexed 8 kbit/s channels, yielding a maximum capacity of 65536 channels for one SW256B.(256 2M line * 256 8kbit/s channel per 2M line) A maximum-sized switching network can be equipped in a single SW10C-A cartridge.

BSC3i 1000/2000 Hardware and Functionality
ET16 – E1/T1 Interface

- Full height ET interface plug-in unit
- E1/T1 interfaces in steps of 16, max 800 E1/T1s
- Only one variant of ET16 that fulfills E1, T1 requirements

GT6C-A (ETC 0 & 1)

GT4C-A (ETC 2…7, GTIC 0 & 1)



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Cartridges ETC 0-1 house only 4 ET16 units. Located in first row in base cabinet. Next to CL3TG clock&tone generator units.

Cartridges ETC2…7 house 8 ET16 units each.

Cartridge GTIC0&1 can house either 8 ET16 units or 8 ETS2 units each

There are no front connectors on ET16. E1/T1/JT1 lines are connected through external connector panel to the backplane connector of ET16.

ET16 is an exchange terminal unit for DX200 environment. It has sixteen E1/T1/JT1 interfaces (through the backplane connector), interface to switching network, power supply and clock system. ET16 can be installed in GT4C-A/GT6C-A type cartridges.

ET16 Exchange Terminal plug-in units are installed in GT6C-A (ETC 0 & 1) and GT4C-A (ETC 2…7, GTIC 0 & 1) cartridges.

Note! When GTIC 0 & 1 cartridges are equipped with ET16 pius, ETC 2 & 3 cartridges are left empty. And when GTIC 0 & 1 cartridges are equipped with ETS2 pius (STM-1/OC-3 interface pius), then ET16 pius can be equipped to ETC 2 & 3 cartridges.

Note! In cartridge ETC 7 only two first slots are cabled to GSW

Example of 800 external pcm's

ETC0&1 fully equipped

GTC0&1 fully equipped

ETC2&3 left empty

ETC4-6 fully equipped

ETC7 two first slots equipped

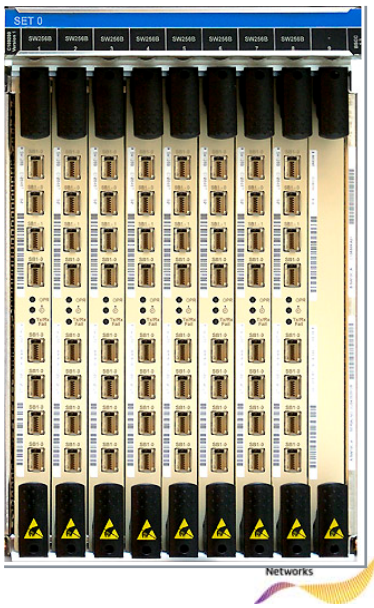
= 50 ET16 PIU's = 800PCM's

There is only one variant of ET16 that fulfills E1, T1 and JT1 requirements. Line protection circuitry is implemented in the external connector panel.

ET interface type DIP switch (SW1) setting must be set to the right setting on ET16 piu.

BSC3i 1000/2000 Hardware and Functionality
ETS2 – SDH/SONET Interface

- ETS2 provides an optical STM-1 or OC-3 interface to SDH network
  - STM-1 = 63 x E1 PCM (ETSI)
  - OC-3 = 84 x T1 PCM (ANSI)
- STM-1/OC-3 optical interfaces with bit rate of 155,52 Mbit/s *
- 2 separate interfaces per unit
  - + Optical interface redundancy
- Up to 16 ETS2 units in BSC3i 1000/2000
- Max. 16 STM-1/OC-3 interfaces
- Connected to GSW2KB via Hotlink



ETS2 plug-in unit is an STM-1/OC-3 Terminal Multiplexer for DX200 based network elements. It has two STM-1/OC-3 optical interfaces and is responsible for framing, mapping and multiplexing of two times sixty-three 2.048 Mbit/s or 1.554 Mbit/s tributaries into SDH STM-1 frame and vice versa. In SONET OC-3 mode ETS2 is responsible for framing, mapping and multiplexing of two times eighty-four 1.544 Mbit/s tributaries into SONET STS-3 frame and vice versa.

ETS2 has a 1+1 (=2N) protection support for both equipment and transmission. The transmission protection complies with MSP 1+1 protection described in reference [G.841] for SDH and 1+1 linear APS described in reference [GR253] for SONET. In B12 based NE releases (like S13) only transmission protection is available.

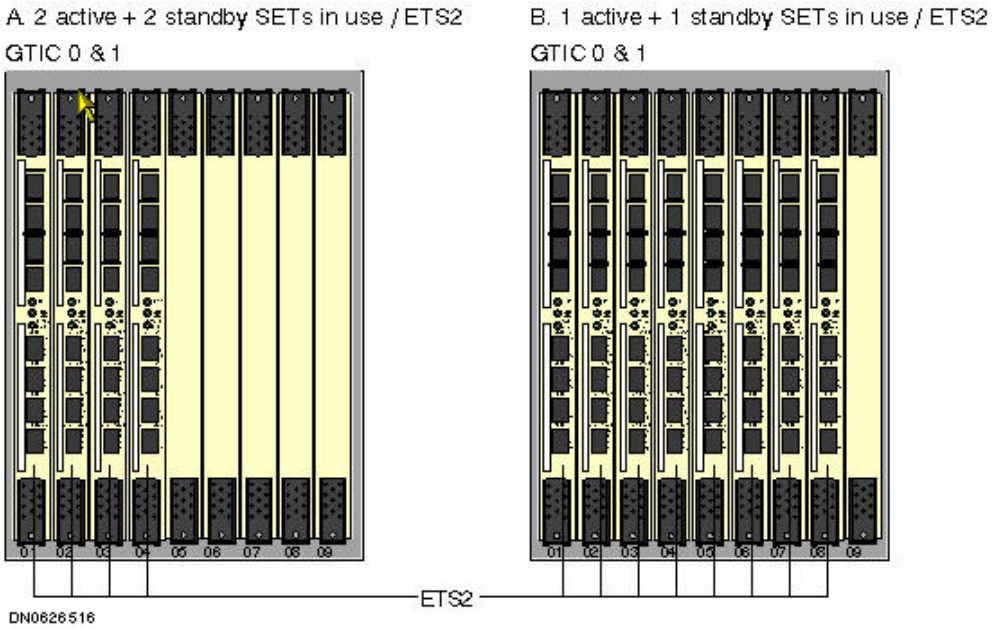
ETS2 has capabilities for various generation/processing of overhead bytes of STM-1/OC-3 frame. Performance management and error monitoring of various transfer levels are supported. ETS2 has extensive maintenance capabilities including detection of error situations and support for loopbacks in both transmission directions in various transmission levels. Connection to computer unit that handles maintenance of STM-1/OC-3 link is carried out through LAPD/HDLC channel.

Connected to GSW2KB via HotLink. Hotlink interface bit rate 320 Mbit/s. One hotlink has capacity of 64 E1's or 96 T1's.

Number of SET units having optical interface redundancy in S13 BSC3i new delivery: 0 - 32 (16 active + 16 standby; in step of 1 pcs active + 1 pcs standby at a time)

Optical interface redundant SET units are equipped so, that active & standby SET units are on same ETS2 plug-in units. All SETs have a unique index of their own.

BSC3i 1000/2000 Hardware and Functionality
2 Alternatives of ETS2:



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In S13 there are 2 alternatives to equip ETS2 pius to GTIC cartridges. The default alternative is to equip 4 pcs ETS2 pius to both GTIC catridges (GTIC cartridges powered by different PDFU-Bs) and use both STM-1/OC-3 interfaces (2*active + 2*standby SETs per STM-1/OC-3 interface) of ETS2 pius. The other alternative is to equip 8 pcs ETS2 pius to both GTIC catridges (GTIC cartridges powered by different PDFU-Bs) and use only the 1st of the STM-1/OC-3 interfaces (active SET + standby SET) of ETS2 pius.

One STMU unit (= one ETS2 plug-in unit) has 4 * SETs in use in the default alternative and in the other alternative one STMU unit has 2 * SETs in use. STMU indexes are so in optical interface redundancy situation, that only even indexes are used; either 4 pcs (default alternative) or 8 pcs (other alternative) in GTIC 0 cartridge and 4 pcs (default alternative) or 8 pcs (other alternative) in GTIC 1 cartridge.

The SETs of the S13 BSC3i are housed in GT4C-A cartridges. One GT4C-A cartridge can contain up to 8 ETS2 plug-in units.

To avoid confusion:

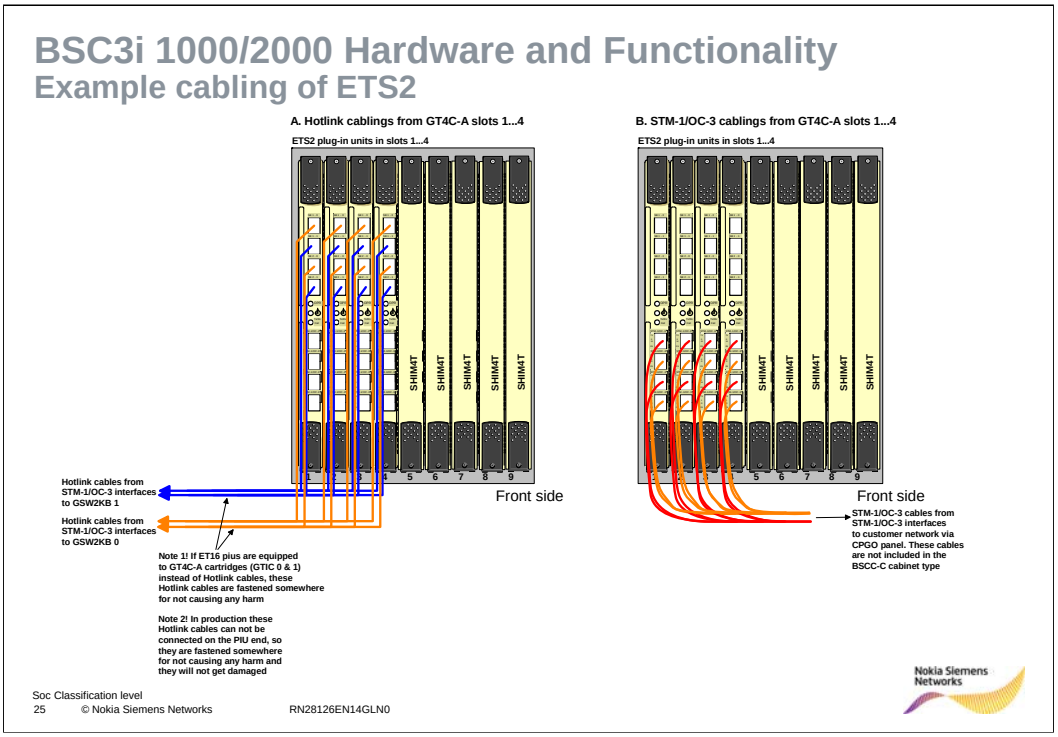
ETS2 is called in some documents a STMU

Single STM-1/OC-3 interface on ETS2 is sometimes called a SET

Wide HDLC/LapD link support for ETS2 O&M ->

512kbit/s or 1024kbit/s links

When 1024kbit/s link used 16 x 64kbit/s timeslots are allocated



This is default equipping alternative in BSC3i 1000/2000

Blue lines on left:
Hotlink cables from STM-1/OC-3 interfaces to GSW2KB 1

Orange lines on left:
Hotlink cables from STM-1/OC-3 interfaces to GSW2KB 0

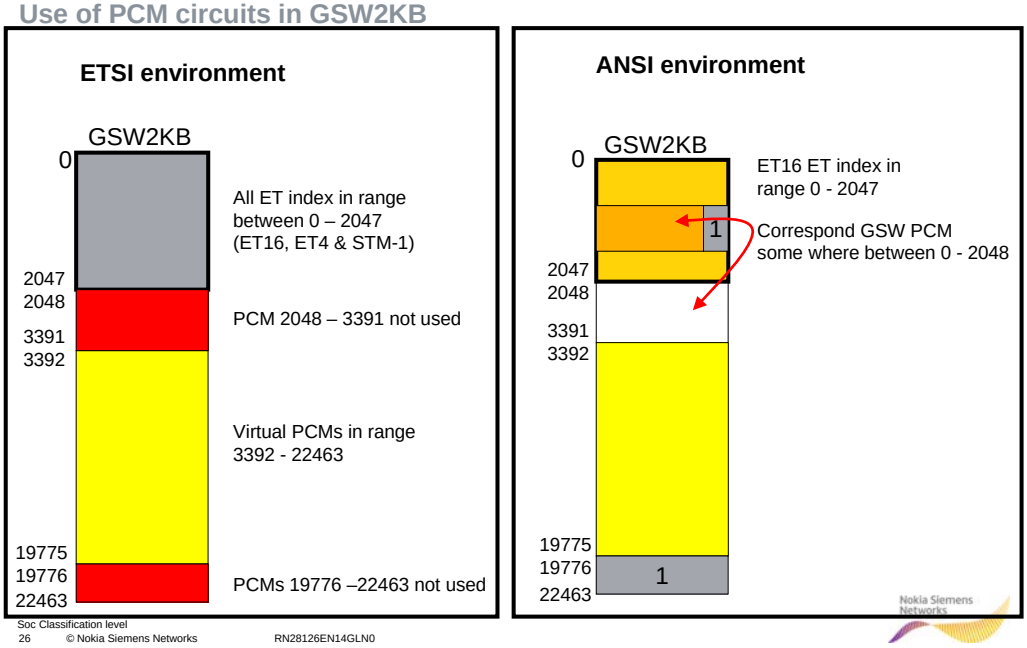
Red lines on right:
STM-1/OC-3 cables from STM-1/OC-3 interfaces to network.

Orange lines on right:
STM-1/OC-3 cables from STM-1/OC-3 interfaces to network. Redundancy!

For creating the ETS2 , please refer to the S13 Documentation:
\ Administer\ Hardware management\ Configuring STM-1/ OC-3 hardware!

BSC3i 1000/2000 Hardware and Functionality

Use of PCM circuits in GSW2KB



BSC3i 1000/2000 Hardware and Functionality

PDH and SDH/Sonet Connectivity

BSC3i		1000	2000
Cabinets		1	2
PCM Connectivity (max.)	E1/T1	384	800
SDH/Sonet Connectivity (max.)	STM-1/OC-3	16 + 16*	16 + 16*
Mixed examples 1	E1/T1 STM-1/OC-3	256 16 + 16*	288 16 + 16*
Mixed examples 2	E1/T1 STM-1/OC-3	320 8 + 8*	736 8 + 8*

Note: *) for redundancy

Note! When GTIC 0 & 1 cartridges are equipped with ET16 pius, ETC 2 & 3 cartridges are left empty. And when GTIC 0 & 1 cartridges are equipped with ETS2 pius (STM-1/OC-3 interface pius), then ET16 pius can be equipped to ETC 2 & 3 cartridges.

Note! In cartridge ETC 7 only two first slots are cabled to GSW

Example of 800 external pcm's

ETC0&1 fully equipped

GTC0&1 fully equipped

ETC2&3 left empty

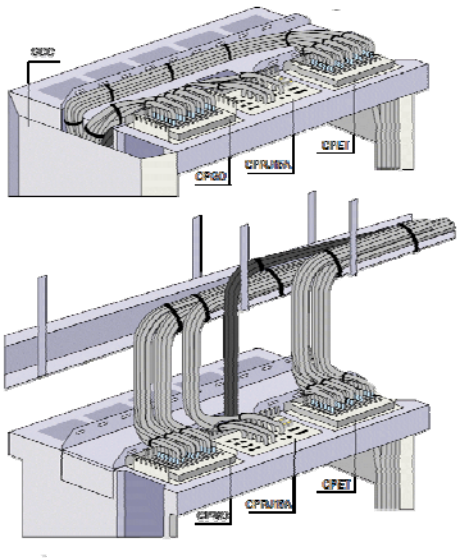
ETC4-6 fully equipped

ETC7 two first slots equipped

= 50 ET16 PIU's = 800PCM's

BSC3i 1000/2000 Hardware and Functionality

BSC3i Cabling to environment



- Cabling to environment can easily be done with cable ladders or raised floor
- Cables are directed under raised floor via cabling cabinet or via side cabling conduit
- Optical STM-1/OC-3 cables are directed through the CPGO panel
- Trunk cables (E1/T1) are directed through CPET panels on the top of the cabinet and in the cabling cabinet
- CPRJ45A panel on top of the cabinet is used for
  - External synchronization
  - Ethernet (LAN) uplinks
  - Alarm cabling

Without optional cabling cabinet it is possible to use/cable only maximum of 48 ET interfaces (ET amount 1…48) via CPETS-E panel on the roof of the BSCC cabinet. When more than 48 ET interfaces are needed optional cabling cabinet must be equipped & used.

A cabling cabinet variant IC203-A is attached next to BSCC-C, *if* optional cabling cabinet is delivered. In raised floor deliveries, when optional cabling cabinet is selected/delivered (ET amount > 48), no side cable conduit SCC is equipped. But, when optional cabling cabinet is not delivered (no ET interfaces or ET amount 1…48), side cable conduit SCC is equipped in raised floor deliveries to the left-handed (BSC3i 1000 or BSC3i 2000) or right-handed side (BSC3i 1000) of BSCC-C cabinet.

BSC3i 1000/2000 Hardware and Functionality
Second Generation Packet Control Unit PCU2-D

Two PCU functions are integrated in one plug-in unit; 2 microprocessor blocks are identical and work independently to handle the tasks

Includes Power PCs assembled to the same plug in-unit with 2 x 256 MB SDRAM memory

Includes also DSPs with 16 MB memory

Supports standard external interfaces

- two 10 Base-T /100 Base-TX Ethernet

Supports high speed internal interfaces

- two 8 Mbit/s PCM line to GSW2KB

BSC3i 1000/2000 Hardware and Functionality
BSC3i Hard Disks

Standard Hardware Unit in BSC3i

Duplicated Hard disk units per BSC to ensure high reliability

Easy to change or upgrade without traffic interruption

Hard disk type/size in new BSC3i configuration is normally updated yearly due to relatively short availability time of hard disk types used also in PC industry. 36G units (WDW36) were taken into use on January 2003. Thus very fist BSC3i deliveries have included 18G (WDW18-S) type.

- disk contains several BSC SW packages and backup, i.e. operative software, fallback software, and backup software from one or several SW releases containing each for example 120-130 Mbytes
- disk contains also BTS software (different versions and releases) including the BTS HW database
- measurement files are also stored on the system disks as buffers before they are transferred to Nokia NetAct and therefore require disk space for example 500Mbytes

BSC Hard disk require correct hard disk adapter to be used. HDPU-A type adapter is accepted in S10.5 based BSC3i. Latest accepted units are updated in BSC HW Revisionlist document.

BSC3i 1000/2000 Hardware and Functionality
BSC3i Magneto Optical (MO) Unit

Standard Hardware Unit in BSC3i

Optical disk will provide reliable means for backup copying SW and database on a transferable media in BSC

Provides even better reliability and performance with longer media life cycle compared with Digital Audio Tape (DAT) technology.

New BSC3i deliveries are configured with 9.1G MO units

Recommended solution for SW backups and for other additional disk storage

Easy, practical and fast to use compared to diskettes or DAT tape:

- More reliable compared to Cartridge Tape (DAT) units
- Media is more durable (compare Tape against CD-Rom)
- MO has better heat endurance
- MO is fast especially due to random Access -> Information can be read from media very fast
- Maintenance is easier than with existing DAT solution
- Drive and media has simple mechanical structure
- Media is long-lasting
- Disk drive is maintenance free
- It is recommended that disk is cleaned at least every third month

BSC MO disk require correct MO disk adapter to be used. Currently ODPU-A adapter is accepted in BSC3i. Accepted units are updated in BSC HW Revisionlist document.

MO 91 specifications:

- Manufacturer: Sony
- Model: SMO-F561-70 (Nokia Specific equipment)
- Unformatted Capacity: 9.1GB (4.5GB/side)
- Standards: SCSI-2
- Rotational speed: 3000 rpm
- Seek time (ms): min 2, ave 25, max 45
- Internal transfer rate: 3.07 – 6.14 MB/s
- SCSI transfer rate: async 3MB/s, sync 20 MB/s
- Buffer size: 8 Mbyte
- Rewritable media

Unformatted capacity of MO91 is 4.5GB per side of the media. Total unformatted capacity is 9.1GB. The drive has read/write head only on side of the media. So disk needs to be turned around manually. Information is saved to the disk using MSDOS/FAT 16 or MSDOS/FAT 32 format.

BSC3i 1000/2000 Hardware and Functionality
Clock unit (CLOC) and Clock repeater (CLAB)

2 x CL3TG units
(2N redundancy)

- **Clock and Tone Generator (CL3TG)** plug-in units
  - Allows external synchronization input via connector panel
  - Housed in the CLOC-B cartridge

- **Clock and Alarm Buffer (CLAB-S)** plug-in units
- Housed in the CLAC-B cartridge

2 x CLAB-S units in base cabinet
2 x CLAB-S units in extension cabinet
(2N redundancy)

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The CLS generates the clock signals necessary for the BSC. The oscillator of the CLS is normally synchronized to an external source, usually an MSC, through a PCM line. Up to three additional PCM inputs are provided for redundancy.

Plug-in Unit: CL3TG (Clock and Tone Generator)

Interfaces:

- Synchronization input from Transcoder
- External synchronization input
- Synchronization output
- Wired alarm interface to OMU via GSWB

The Clock&Tone Generator (CL3TG) plug-in unit meets the requirements of the ITU-T Q.500 Series Recommendation with respect to the Time Interval Error (TIE), the jitter, the wander, and the transfer function. In the plesiochronous operation mode, the frequency shift of the CL3TG is 5 * 10-9 within each 24-hour period, if the temperature of the environment does not vary. CL3TG with external synchronised input is available by using the external synchronisation input connector from the CPRJ45 panel. It can be implemented either by symmetrical or asymmetrical PCM connection (RJ45 or BNC connector).

BSC3i 1000/2000 Hardware and Functionality
CLAB-S overview

CLAB-S offers the following cartridge-specific services to the functional units and PIUs of the exchange.

Collection of wired alarms

- CLAB-S collects the wired alarms from the cartridges and conveys them in message format to the maintenance computer via supervision bus . All CLAB-S PIU in the exchange are connected to the same supervision bus.

Distribution of basic timing signals

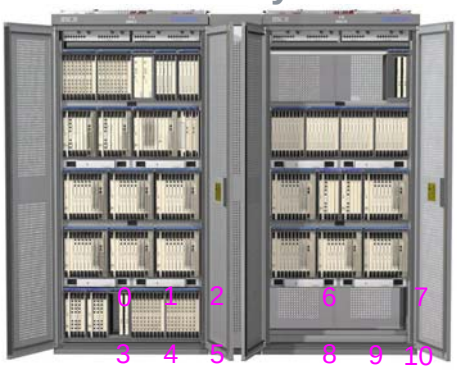
- CLAB-S receives the timing signals (16MHZ and 8KHZ)from synchronization unit over the basic timing bus and uses them to generate the basic timing signals to be distributed to the cartridges (8 MHZ and 8KHZ)

Distribution of switch changeover signal

- CLAB-S receives the switch changeover signal and buffers it before it is distributed to the cartridges.

BSC3i 1000/2000 Hardware and Functionality
10 + 1 BCSU units

5 PSU plug-in units per BCSU
- 1-2 PCU-B's
- 1-5 PCU2-D's



Plug-in units in BCSU
- PSC6-A power supply
- 1-2 x PCU-B or1-5 x PCU2-D
- 2 x AS7-C
- CP816-A

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Max 5 working BCSU's in basic cabinet + spare = 1000 TRX max. capacity
+ max 5 working BCSU's in extension cabinet = 2000 TRX max. capacity

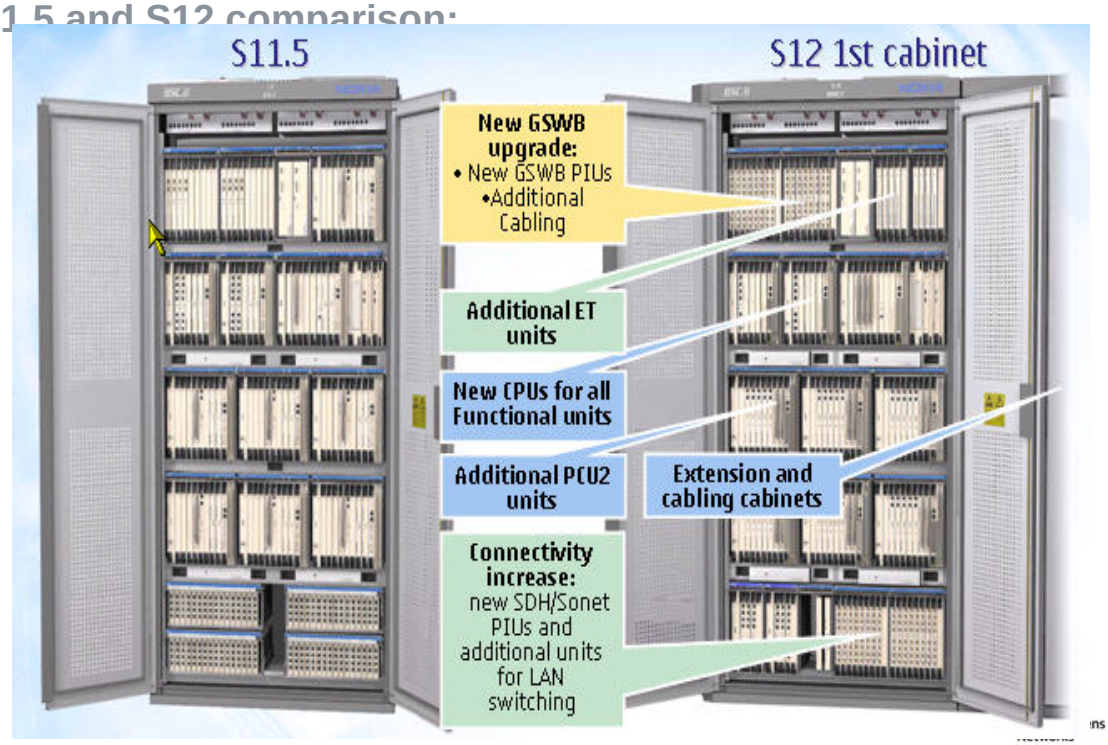
PCU-B can be equipped only to racks 06&07
PCU2-D can be equipped to tacks 03&&07
It is possible to have mixture of PCU variants in same BCSU
E.g. PCU-B in rack 06&07 and PCU2-D in rack 03&&05

100 logical PCU's /BSC
16 DAP's /BCSU
Max PS throughput capacity 200 Mbit/s

Max 200 TRX per BCSU
(PCU-B has 2 log PCU, PCU2-D has 2 logical PCU)

BSC3i 1000/2000 Hardware and Functionality

S11.5 and S12 comparison:



BSC3i 1000/2000 Hardware and Functionality
LANU

2N redundant LANU unit in basic cabinet
- Contains 3 ESB26 units

2N redundant LANU unit in extensin cabinet
- Only if more than 6 working BCSU's in use
- Extension to LANU in basic cabinet
- Contains 1 ESB26 unit

BSC3i 1000/2000 Hardware and Functionality

ESB26 Ethernet Switch

MCMU **LANU**

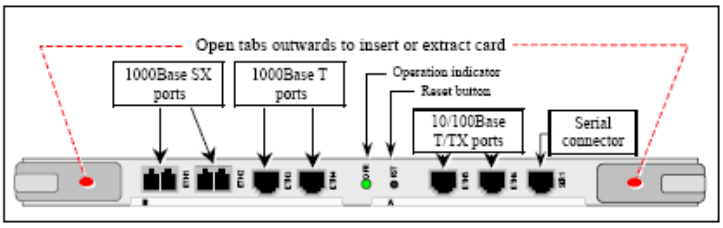


Figure 2-1 ESB26 Front Panel

- Used in BSC3i 1000/2000 for EMB and IP LAN switching
- ESB26 unit located in MCMU is used for EMB switching
  - Connects all CPU's
- ESB26 units located in LANU are used for IP LAN Switching
  - 3 in base cabinet LANU and 1 in Extension cabinet LANU
  - Connects together all CPU's and all PCU's

ESB26 switch has the following Ethernet ports:

•20 full duplex 10/100Base-T/Tx Ethernet ports in back panel to be used for connecting the switch to the computer units.

•2 full duplex 10/100Base- T/Tx Ethernet Ports

•2 full duplex 10/100/1000Base-T ports

•2 full duplex 1000Base-SX ports for connecting switch to the second stage LAN switch.

•ESB26 contains also one RS-232 interface (RJ45) on the front panel for management purposes.

The two 1000Base-T ports support all the 10/100/1000 Mbit/s link speeds. Speed mixing is supported, too, e.g. it is possible to use one of the 1000Base-T ports in gigabit mode while the other runs in 100Mbit mode.

The intended use of the ESB26 is to collect the Ethernet links of different computer units and preprocessor units of DX200-based network elements, and allow access to them from the upper levels. The ESB26 can be used in all M98F DX200 based network elements.

The ESB26 can be assembled into a place of ESB20/ESB20-A by using the existing cabling.

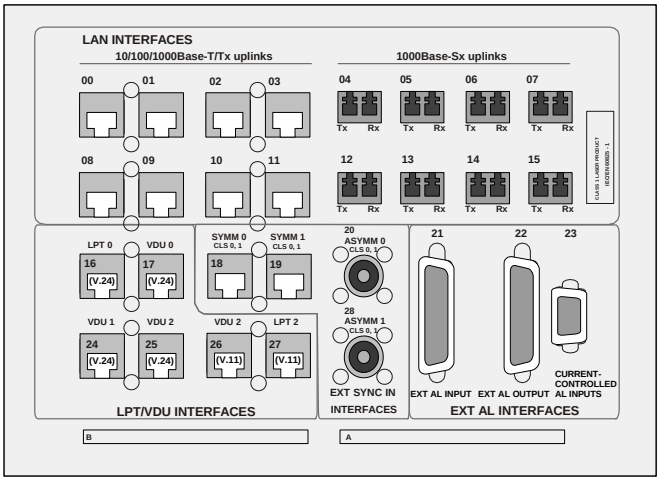
BSC3i 1000/2000 Hardware and Functionality
LANU – External Connections

Both 1000Base-Sx LAN interfaces (ports 04…07, 12…15) for 1 Gbit/s uplinks and 10/100/1000Base-T/Tx LAN interfaces (ports 00…03, 08…11) for 10/100 Mbit/s & 1 Gbit/s copper uplinks in CPRJ45-A panel will be used in S13 new delivery BSC3i. Uplinks can be chosen from 3 uplink alternatives:

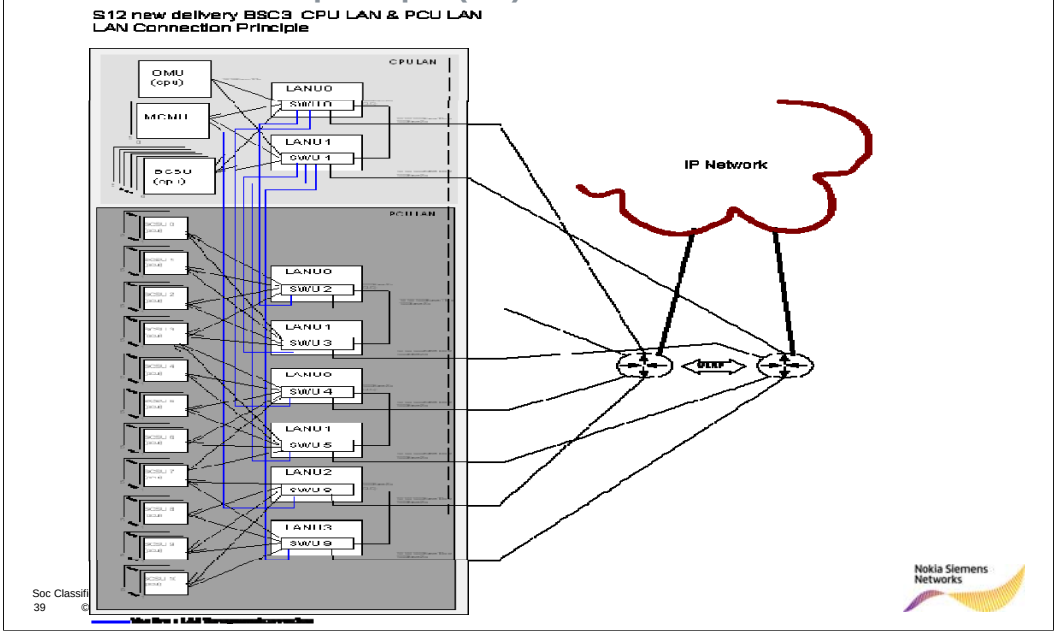
10 Mbit/s uplink (copper)

100 Mbit/s uplink (copper)

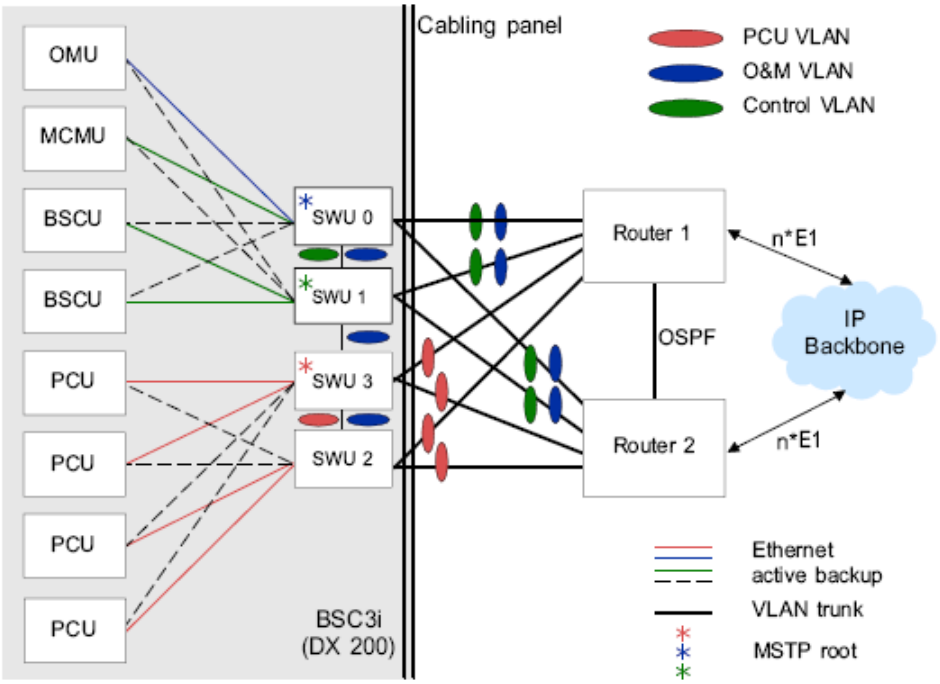
1 Gbit/s uplink (both copper and optical available).

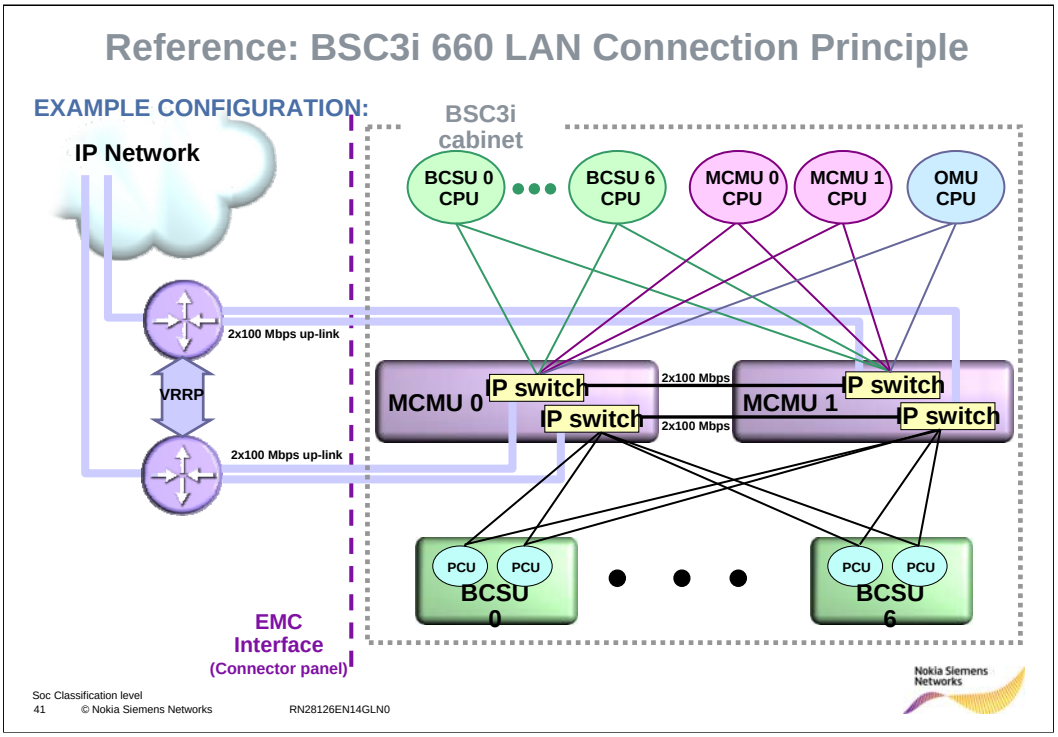


BSC3i 1000/2000 Hardware and Functionality
LANU connection principle (1/2)



BSC3i 1000/2000 Hardware and Functionality
LANU connection principle (1/2)



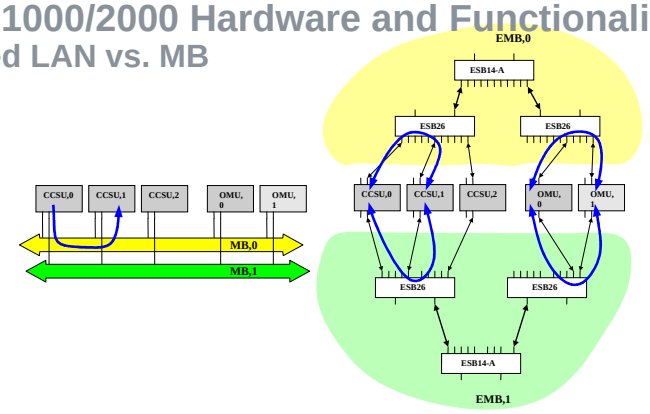


Picture presents the IP connectivity in **BSC3i 660 S13**

The integrated LAN switch provides access to the operator's IP network as a first level LAN switch. It provides uplink interfaces to the IP network (router) or to an additional LAN switch via the BSC3i connector panel. The LAN switch collects data from the computer and packet control units and sends it further to external routers and the IP network via 100 Mb/s uplink connections. Redundant LAN switch units provide ports of 10/100BaseT/Tx interfaces with RJ45 connectors via the BSC3i connector panel. There are in total 4 + 4 10/100BaseT/Tx uplink ports to the operator's IP network.

The hardware implementation of a LAN switch contains 2 pcs of LAN switch plug-in units (ESB20) situated in both MCMU cartridges. An active MCMU unit is backed up by a redundant MCMU containing a similar configuration. The active MCMU and its LAN switch interconnects the active LAN-connections and the redundant MCMU connects the redundant LAN-connections. One LAN switch plug-in unit is dedicated for collecting user-plane traffic from packet control units and another for collecting data from computer units.

BSC3i 1000/2000 Hardware and Functionality
Switched LAN vs. MB



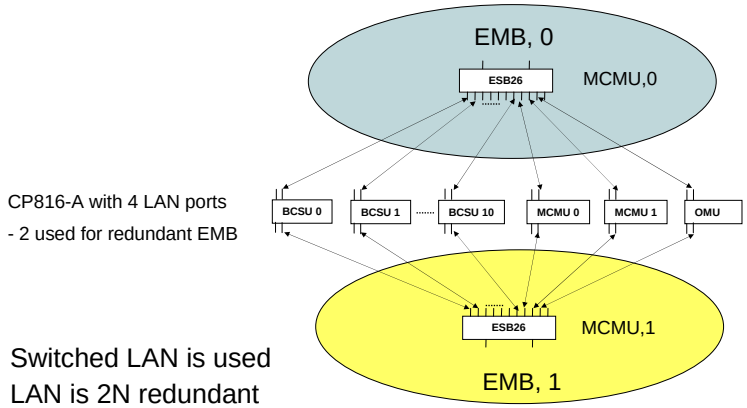
In MB, at most one message transfer is happening at any given moment

- A single transfer may address several receivers

With switched LAN, several message transfers may be occurring simultaneously

- A single transfer addresses, most of the time, just a single receiver
- With EMB, most messages are send to both EMB,0 and EMB,1. This is done in order to improve reliability and is known as mirroring

BSC3i 1000/2000 Hardware and Functionality
Ethernet based Message Bus (EMB)



Switched LAN is used

LAN is 2N redundant

EMB LANs are physically separate from the internal LAN

- cabling & LAN-switches used by the internal LAN have been excluded from the picture

Each computer reads its EMB address from EMB address plug

- EMB address has same value as MB address

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EMB requires that CPU PIUs in the computers have four Ethernet ports, two ports for EMB LANs and two ports for the IP traffic LANs. EMB can only be used with the CP816-A CPU PIUs or later, which have four 1 Gbit Ethernet ports in the back plane. In addition CP816-A recognizes the EMB address plug connected to cartridge back plane pins.

ESB26 switch for EMB is located in MCMU slot 2

ESB26 switch is going to be used as a cabinet level switch and it has the following Ethernet ports: /12/

•20 full duplex 10/100Base-T/Tx Ethernet ports in back panel to be used for connecting the switch to the computer units.

•2 full duplex 10/100Base- T/Tx Ethernet Ports

•2 full duplex 10/100/1000Base-T ports

•2 full duplex 1000Base-SX ports for connecting switch to the second stage LAN switch.

the used LAN configuration in EMB doesn't behave like a shared bus. In other words: EMB doesn't use traditional coaxial cable type of Ethernet but so-called switched LAN.

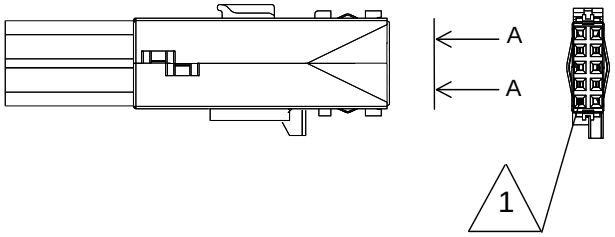
NOTE!
In BSC3i 660 ESB26 or ESB20 unit in MCMU handles the IP traffic LAN switching.
In BSC3i 1000/2000 IP traffic LAN switching is handled by ESB26 units in LANU
In BSC3i 1000/2000 ESB26 unit in MCMU handles now the EMB switching.

Note:
Every CPU has backplane EMB connector to connect to backplane of MCMU ESB26.
MCMU ESB26 front panel eth port no use!
LANU 0 SMU0 and LANU 0 SMU 1 back plane ports connected to all CPUs for CNW lan.
The front panel ports can be used by ext PC to access the CNW lan.

BSC3i 1000/2000 Hardware and Functionality
EMB Addressing

ADMODxx, Address Module connector

- ADMODxx is going to be connected into rear of CP816-A PIU to make Ethernet MB address.
- There are total of 32 different ADMOD address module connectors available: ADMOD00 … ADMOD31.
- ADMODxx has 2x5 size 2mm Z-pack HM cable connector.



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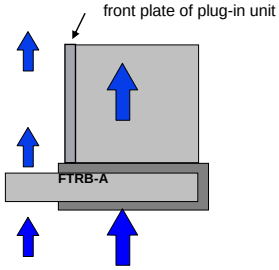
EMB interconnects the functional units of BSC. The EMB consists of a redundant L2 LAN Switch and LAN cables from computer units.

For commands to create EMB LAN, please refer to S13 Documentation:

\Commissioning\ Commissioning BSC3i

BSC3i 1000/2000 Hardware and Functionality
FTRB-A (enhanced fan tray unit)

BOTTOM



TOP

New part – air flow also in front of plug-in unit front plates.

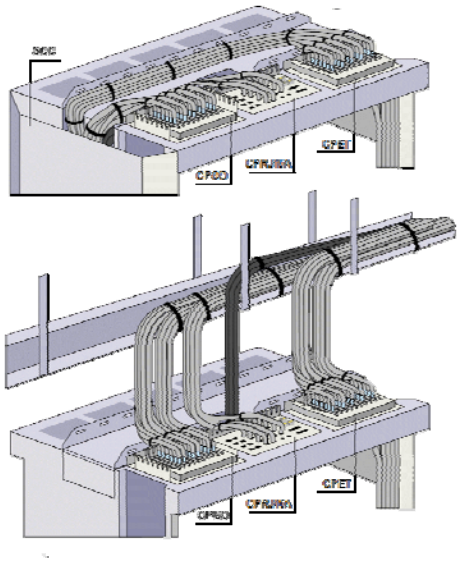
New fan tray unit FTRB-A is based on FTRB unit but there are five fans instead of three. FTRB-A has also temperature controlled rotation speed besides the full speed operation, which is controlled with wired alarms. More effective diagonal fans are also used and two additional fans enhance Plug-in unit front plate cooling.

New additional fans come out of the cartridge shelf and finger guards are needed for safety reasons.

FTRB-A units are compatible with both IC209-A and IC209-B cabinets. Only one fan tray type inside one cabinet is allowed.

BSC3i 1000/2000 Hardware and Functionality

BSC3i Cabling to environment



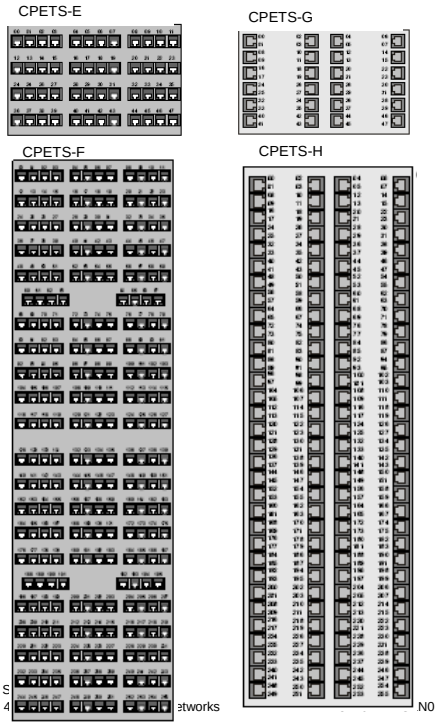
- Cabling to environment can easily be done with cable ladders or raised floor
- Cables are directed under raised floor via cabling cabinet or via side cabling conduit
- Optical STM-1/OC-3 cables are directed through the CPGO panel
- Trunk cables (E1/T1) are directed through CPET panels on the top of the cabinet and in the cabling cabinet
- CPRJ45A panel on top of the cabinet is used for
  - External synchronization
  - Ethernet (LAN) uplinks
  - Alarm cabling

Without optional cabling cabinet it is possible to use/cable only maximum of 48 ET interfaces (ET amount 1…48) via CPETS-E panel on the roof of the BSCC cabinet. When more than 48 ET interfaces are needed optional cabling cabinet must be equipped & used.

A cabling cabinet variant IC203-A is attached next to BSCC-C, *if* optional cabling cabinet is delivered. In raised floor deliveries, when optional cabling cabinet is selected/delivered (ET amount > 48), no side cable conduit SCC is equipped. But, when optional cabling cabinet is not delivered (no ET interfaces or ET amount 1…48), side cable conduit SCC is equipped in raised floor deliveries to the left-handed (BSC3i 1000 or BSC3i 2000) or right-handed side (BSC3i 1000) of BSCC-C cabinet.

BSC3i 1000/2000 Hardware and Functionality

CPET– Roof cabling panel for ET



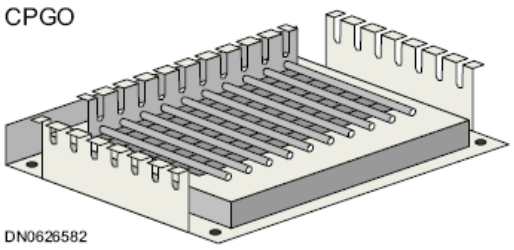
- The small CPETS-E connector panel and the large CPETS-F connector panels are used for E1/T1 (PCM) balanced trunk cables (with RJ45).
- The CPETS-E is installed at the BSCC cabinet top (one panel)
- Type CPETS:
  - **CPETS-E & CPETS-F(*)** for balanced trunk cable panel with RJ45 connector → 1 connector = 1 PCM
  - **CPETS-G & CPETS-H(*)** for balanced trunk cable panel with RJ45 connector → 1 connector = 2 PCMs
  - **CPETC-E & CPETC-F(*)** for unbalanced trunk cable panel with D37 connector packs

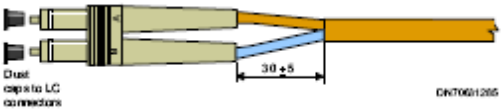
Note :

* the panels are installed in optional cabling cabinet

BSC3i 1000/2000 Hardware and Functionality

CPGO – Roof cabling panel for SET/EET





Optical LC connector

- The cabling panel with grounding outlets (CPGO) is installed at site at the BSCC cabinet top of the Flexi BSC.
- The CPGO is used for **STM-1/OC-3 (SET)** trunk cables and **GigE Ethernet (EET)** interface cables.

Flexi BSC Hardware and Functionality

BSC peripheral options

Visual Display unit, VDU

A visual display unit is used as a user interface at BSC site. By using a VDU terminal, the user can perform normal operational functions, using MML commands and diagnostic tests on various units.

External Alarm Unit, EXAU

The alarm lamp panel shows the BSC HW alarms and it can be installed to a place where the observations of alarms can be noticed easily.

Line Printer, LPT

A printer can be connected to the OMU. The interface complies with the ITU-T Recommendation V.24.

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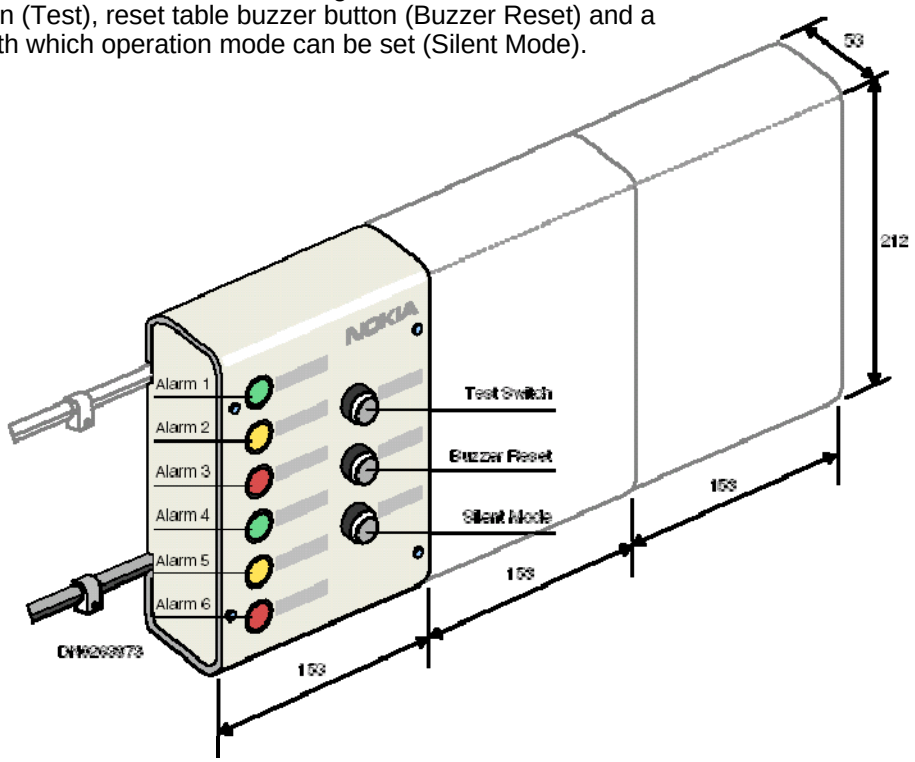
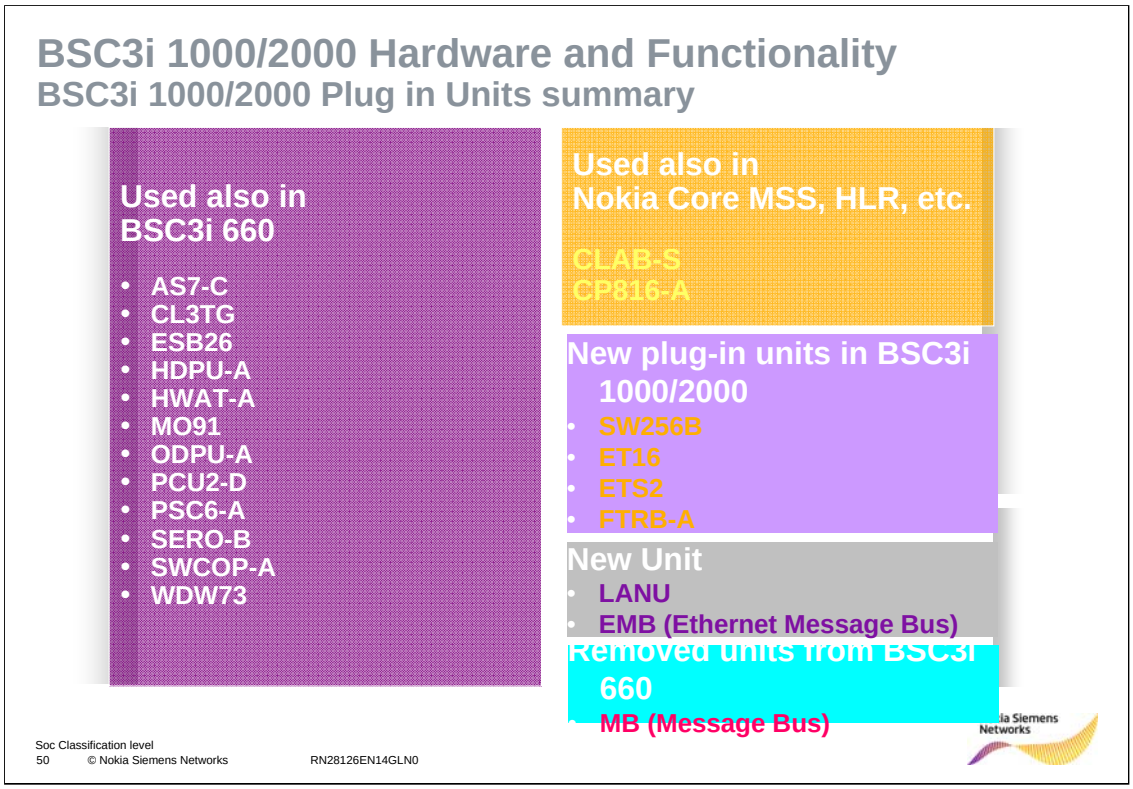
The BSC3i network elements can be equipped with an alarm unit to make the alarm monitoring more efficient. The External Alarm Unit (EXAU) is a small device controlled by the HWAT-A plug-in unit in the CM2C-A (OMU and mass memory) cartridge of the BSC3i cabinet. The EXAU indicates alarms from the network element with indicator lights and a buzzer.
EXAU is located in the control room of the sitel, and it is easy to install to all common wall materials. The dimensions and installation options of the EXAU are presented in the figure below.
The alarm unit contains six indicator lights and three buttons: test button (Test), reset table buzzer button (Buzzer Reset) and a button with which operation mode can be set (Silent Mode).





The BSC3i is constructed by using a total of 15 plug-in unit types, including the DC/DC converters. Additionally mass memory adapters (HDPU-A & ODPU-A) and memory modules (MR256M) are sometimes interpreted as plug in unit for example in BSC3i hardware revision list document.

The size of these plug-in units is either 233 mm x 220 mm, 100 mm x 220 mm, 262 mm x 226 mm, or 235 mm x 247 mm.

The printed circuit boards (PCBs) of plug-in units are multilayered. They are covered with a protective coating that makes the PCBs easy to handle and protects the foils from scratches. The connectors are of the Euro-connector, and 2 mm Hard Metric type.

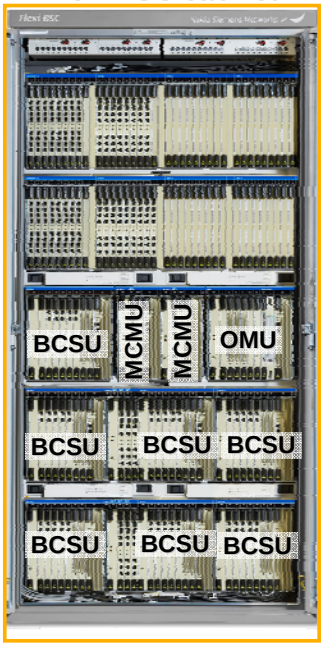
For further information on BSC3i plug in unit see plug in unit descriptions or BSC HW revisionlist document.

Flexi BSC Hardware and Functionality
Computer Units (1/4)

MCMU

BCSU

Flexi BSC cabinet



2000 x 900 x 600 cabinet (HxWxD)

In the Flexi BSC, the call control functions are executed by micro-computers, called Call Control Computers

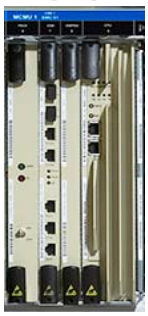
OMU

Soc Classification level

Flexi BSC Hardware and Functionality

Computer Units – MCMU (Marker and Cellular Management Unit) (2/4)

MCMU



Plug-in units
- CP816-AC
- SWPRO-C
- ESB24-A
- PSC6-AB

- The Marker and Cellular Management Unit (MCMU) controls and supervises the Bit Group Switch and performs the hunting, connecting and releasing of the switching network circuits.
- The cellular management functions of the MCMU are responsible for cells and radio channels that are controlled by the BSC. The MCMU reserves and keeps track of the radio resources requested by the MSC and the handover procedures of the BSC.
- MCMU also manages the configuration of the cellular network.
- Redundancy 2N

Flexi BSC Hardware and Functionality

BSC3i Processing Unit CP816-AC, Pentium III Central Processing Unit

- Mobile Pentium®III with approx. 1.6 GHz frequency
  - 512 MB SDRAM
- Provides standard V.24/V.28 based Service Terminal interfaces in front panel
- The unit is connected to the back plane via CompactPCI bus, SCSI and Ethernet based Message bus
  - One CPCI 33Mhz, 32 bits
  - two Wide Ultra3 SCSI
  - four 10/100/1000 Mbit/s Ethernet ports
- For all computer units in Flexi BSC
  - OMU, MCMU and BCSU

The CP816-A with full performance can be used in M98F mechanics. With reduced performance the CP816-A can be used in M98N mechanics.

approx. **1.6**GHz frequency acts as the central processing resource in the DX200 system computer units (actual processor speed is selected by SW according to the thermal operating enviroment 600MHz – 1.6GHz).

CP816-A supports standard external interfaces like Wide Ultra3 SCSI (backward compatible to current Ultra2) and four 10 Base-T /100 Base-TX / 1000 Base-T Ethernets. The unit is connected to the back plane CompactPCI bus. However, it can be used without the CompactPCI connection.

Two of the ethernet ports are used for EMB LANs and two other ethernet ports for the IP traffic LANs.

Since the two ethernet controllers are dual-port devices, the Ethernet Address (MAC address) found at word offset 0x00 – 0x02 will be assigned to LAN A. The Ethernet Address for LAN B is the Ethernet Address for LAN A + 1. Please make sure there aren't any (indirectly) doubled MAC addresses assigned!E.g. if MAC addr. of LAN A is 00:00:50:11:22:FF then the MAC addr. of LAN B is automatically 00:00:50:11:23:00. In other words 00:00:50:11:23:00 must not be assigned to other devices. E.g. for EMB.

The following settings are made with micro switches:

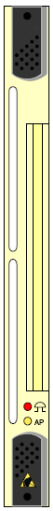
•Interchangeability code

•MBIF in use / not in use status

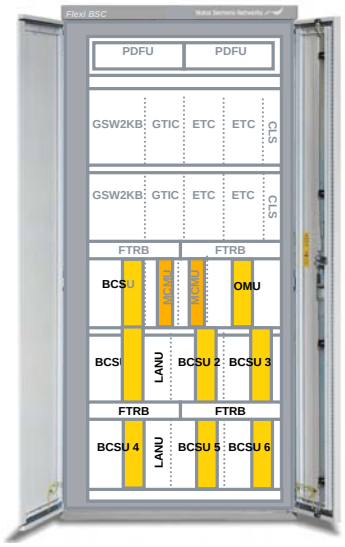
CP710-A CPU PIU (used in Bsc3i 660)in the computers had only two ethernet ports and can not be used when EMB is needed. -> BSC3i 1000/2000

EMB can only be used with the CP816-A CPU PIUs or later, which have four 1 Gbit Ethernet ports in the back plane.

Flexi BSC Hardware and Functionality
New SWPRO-C

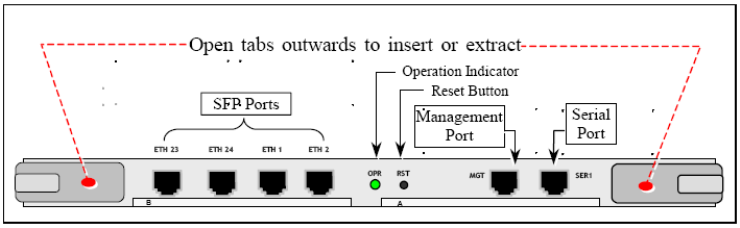


- The SWPRO-C plug-in unit is used as a control unit for a bit-oriented group switch (GSWB).
- The GSWB control unit functionality provides two control bus interfaces through the backplane connection.
- Processor Intel Celeron 1.0 GHz, 400 MHz with SDRAM: 1 GB (with x8 memory configuration)
- **SWPRO-C** allows to control higher amount of connections and generates less load to the **MCMU** CPU in comparison to **SWCOP-A**



SWPRO-C

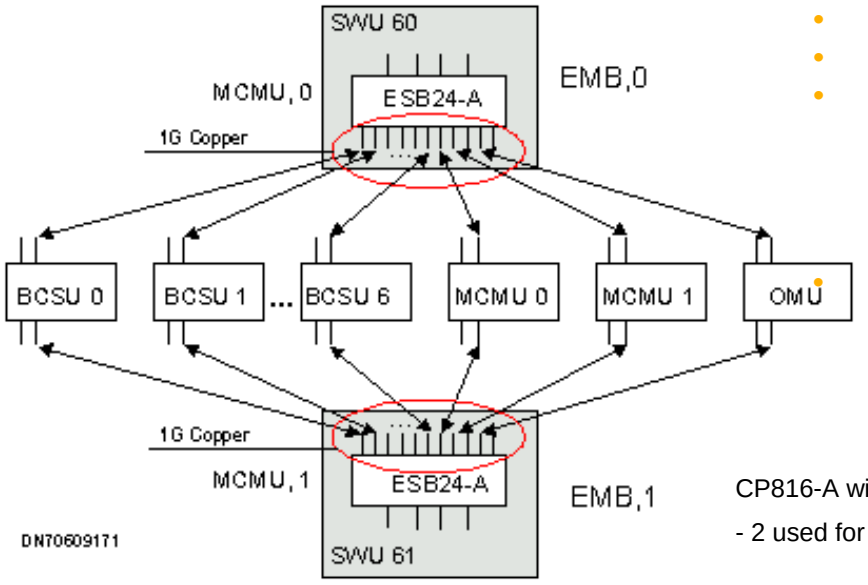
BSC3i 1000 & 2000 – Hardware and Functionality
ESB24 Ethernet Switch



- Used in Flexi BSC first delivery for EMB and IP LAN switching
- In front panel there are:
  - 4 SFP Ethernet ports (ETH1,2 & ETH23,24) → 1000Base-T ports in Gigabit mode
  - 1 MGT ports (RJ45) → serial port for switch menagement
  - 1 SER1 ports (RJ45) → console connector used for initial configuration
- In back panel there are:
  - 20 Full-duplex 10/100/1000Base T/TX ethernet Ports
- ESB24 unit located in MCMU is used for EMB switching
  - Connects all CPU's
- ESB24 units located in LANU are used for IP LAN Switching
  - Connects together all CPU's and all PCU's

Flexi BSC Hardware and Functionality

Flexi EMB connection principle – Flexi BSC

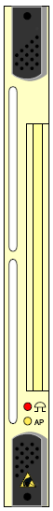


- Switched LAN is used
- LAN is 2N redundant
- EMB LANs are physically separate from the internal LAN
  - cabling & LAN-switches used by the internal LAN have been excluded from the picture
- Each computer reads its EMB address from EMB address plug
  - EMB address has same value as MB address

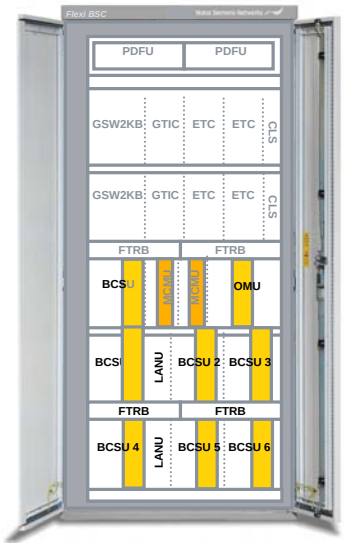
CP816-A with 4 LAN ports

- 2 used for redundant EMB

Flexi BSC Hardware and Functionality
New SWPRO-C



- The SWPRO-C plug-in unit is used as a control unit for a bit-oriented group switch (GSWB).
- The GSWB control unit functionality provides two control bus interfaces through the backplane connection.
- Processor Intel Celeron 1.0 GHz with SDRAM: 1 GB
- **SWPRO-C** allows to control higher amount of connections and generates less load to the **MCMU** CPU in comparison to **SWCOP-A**
- Processor and capacity Performance:



SWPRO-C

Soc Classification level
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Processor: Intel Celeron M ULV 1.0 GHz, 400 MHz FSB (Data quad pumped, 3.2 GB/s).
- L1 Instruction cache: 32 kB
- L1 Write Back Data Cache: 32 kB
- L2 Cache: 512 kB

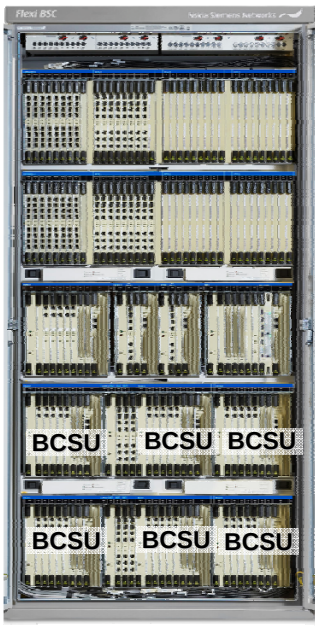
Memory::SDRAM: 1 GB

Capacity:
- Channels: 512
- 2M PCMs: 16 (32)

Flexi BSC Hardware and Functionality
Computer Units – BCSU (BSC SIgnalling Unit) (3/4)

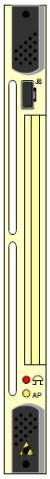
BCSU

Plug-in units
- CP816-AC
- AS7-D
- PCU2-E
- PSC6-D



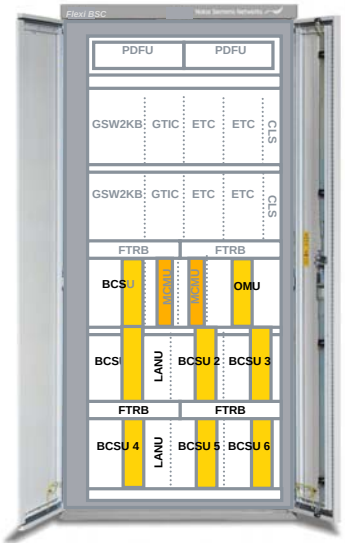
- The BSC Signalling Unit (BCSU) performs those BSC functions that are highly dependent on the volume of traffic.
- Consists of two parts, which correspond to the A and Abis interfaces
- Packet Control Units (PCUs) are housed in the same cartridge.
- The A interface part of the BCSU is responsible for performing all message handling and processing functions of the signalling channels connected to it
  - Performing the distributed functions of the Message Transfer Part (MTP) and the Signalling Connection Control Part (SCCP) of SS7
  - Controlling the mobile and base station signalling (Base Station Subsystem Application Part, BSSAP)
- The Abis interface part of the BCSU controls the air interface channels associated with transceivers (TRXs) and Abis signalling channels.
- The handover and power control algorithms reside in this functional unit.
- Redundancy N + 1

Flexi BSC Hardware and Functionality
New AS7-D (1/2)



AS7-D PIU

- The AS7 plug-in unit function as a general purpose peripheral slot computing engine
- 512 HDLC channels (2x that of AS7-C), 8x more memory, data processing performance is estimated to be ~1.4x that of AS7-C
- an interface to OMC (X.25), then it is installed in **OMU**.
- Processor and capacity Performance:
  - **Processor**: Intel Celeron M ULV 1.0 GHz, 400 MHz FSB (Data quad pumped, 3.2 GB/s).
    - L1 Instruction cache: 32 kB
    - L1 Write Back Data Cache: 32 kB
    - L2 Cache: 512 kB
  - **Memory**::SDRAM: 1 GB
  - **Capacity:**
    - Channels: 512
    - 2M PCMs: 16 (32)



Soc Classification level
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Compare to AS7-B:

•Processor : Intel Mobile Celeron 650 MHz, 100 MHz FSB (800 MB/s)

L1 Instruction cache: 16 kB

L1 Write Back Data Cache: 16 kB

L2 Cache: 256 kB

•Memory : SDRAM: 128/256 MB

•Capacity:

Channels: 256

2M PCMs: 10

Flexi BSC Hardware and Functionality
New AS7-D (2/2)

```
AS7_D   14  TRACK:  8
 MS:FA000000  ME:FBFFFFFF   IS:E240  IE:E27F
 INT:20H     SW:0649005E
                    TSLS 30      20      10      0
 LAPD          8M   PCM:  400   B 11111111111111111111111111111111
                         R 11111111111111111111111111111111
 CONNECTOR SIDE:    HOR:    VER:    POINT:  1

 LAPD          8M   PCM:  401   B 11111111111111111111111111111111
                         R 11111111111111111111111111111111
 CONNECTOR SIDE:    HOR:    VER:    POINT:  1

 LAPD          8M   PCM:  402   B 11111111111111111111111111111111
                         R 11111111111111111111111111111111
 CONNECTOR SIDE:    HOR:    VER:    POINT:  1

 LAPD          8M   PCM:  403   B 11111111111111111111111111111111
                         R 11111111111111111111111111111111
 CONNECTOR SIDE:    HOR:    VER:    POINT:  1

 LAPD          8M   PCM:  404   B 11111111111111111111111111111111
                         R 11111111111111111111111111111111
 CONNECTOR SIDE:    HOR:    VER:    POINT:  1

.........

 LAPD          8M   PCM:  415   B 11111111111111111111111111111111
                         R 11111111111111111111111111111111
 CONNECTOR SIDE:    HOR:    VER:    POINT:  2
```

```
AS7_D   13  TRACK:  7
MS:F8000000  ME:F9FFFFFF   IS:E200  IE:E23F
INT:22H     SW:0649005C
                    TSLS 30      20      10      0
CCS7          8M   PCM:  416   B 11111111111111111111111111111111
                         R 11111111111111111111111111111111
CONNECTOR SIDE:    HOR:    VER:    POINT:  1

LAPD          8M   PCM:  418   B 11111111111111111111111111111111
                         R 11111111111111111111111111111111
CONNECTOR SIDE:    HOR:    VER:    POINT:  1

LAPD          8M   PCM:  419   B 11111111111111111111111111111111
                         R 11111111111111111111111111111111
CONNECTOR SIDE:    HOR:    VER:    POINT:  1

LAPD          8M   PCM:  420   B 11111111111111111111111111111111
                         R 11111111111111111111111111111111
CONNECTOR SIDE:    HOR:    VER:    POINT:  1

.........

LAPD          8M   PCM:  431   B 11111111111111111111111111111111
                         R 11111111111111111111111111111111
CONNECTOR SIDE:    HOR:    VER:    POINT:  2
```

Above is example of internal PCM connection for BCSU-1:

- **On track 8** : PCM 400 – PCM 415 (**16 PCMs**) all TSL (0-31) used for **LAPD**
- **On track 7** : PCM 416 (**1 PCM**) all TSL (0-31) used for **SS7,** PCM 418-431 (**14 PCM**) all TSL (0-31) used for **LAPD**

Flexi BSC Hardware and Functionality

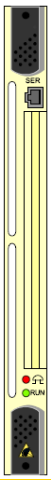
Flexi BSC PCU Solution

- Controls (E)GPRS radio resources and acts as the key unit in the following procedures
  - (E)GPRS Radio resource allocation and management
  - (E)GPRS radio connection establishment and management
  - Data transfer
  - Coding scheme selection
  - PCU statistics
- Independent processing unit, embedded in BCSUs of BSC for redundancy purposes
  - Takes advantage of BSCs O&M and overload protection mechanisms
- Provides flexible choices for transport method between BSC and SGSN
  - IP and Frame Relay as transport alternatives for Gb – Interface

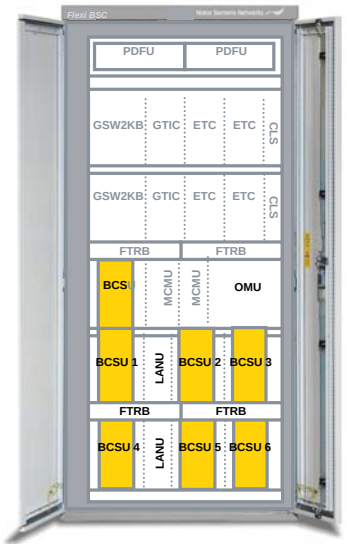
Flexi BSC Hardware and Functionality
New PCU2-E

- **PCU** functionality in **Flexi BSC** can be realized by: **PCU2-E**
- New PCU2-E offering significant capacity enhancements:
  - Consist of **1 logical PCU**
  - 1 logical PCU can handle **1024 Abis Channel @ 16 Kbps**
  - up to **5 PCU/BCSU x 6 BCSU/BSC** = **30 logical** PCU/BSC => **30720 Abis channels / BSC3i 3000**
- **If compared with PCU2-D**:
  - :Consist of **2 logical PCU**
  - 1 logical PCU can handle **256 Abis Channel @ 16 Kbps**
  - In BSC 2000, the capacity =

    10 (active) BCSU/BSC x 5 PCU2-D/BCSU x 2 logical PCU/PCU2-D 256 Abis Channel / logical PCU = **25600 Abis Channel**



PCU2-E PIU



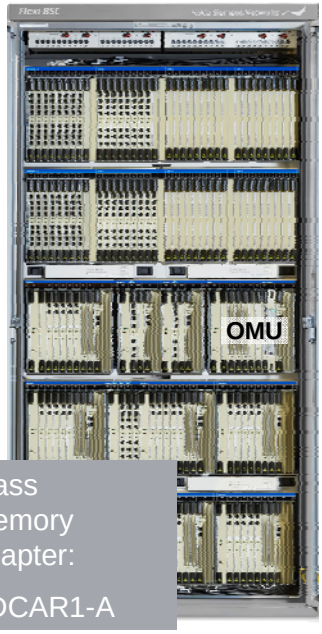
PCU2-E Capacity

BTS Objects	TRX Objects	Abis Channels
Up to 30 x 384	Up to 30 x 1,024	Up to 30 x 1,024

Flexi BSC Hardware and Functionality

Computer Units – OMU (Operation and Maintenance Unit) (4/4)

OMU



Plug-in units

- CP816-AC
- AS7-D
- HWAT-B
- SERO-B
- PSC6-AB

Mass memory adapter:

- DCAR1-A

- OMU is an interface between the BSC and a higher-level network management system and/or the user. The OMU receives fault indications. It can produce local alarm printouts to the user or send the fault indications to NetAct
- In a fault situation, the OMU automatically activates appropriate recovery and diagnostics procedures. Recovery can also be activated by the MCMU if the OMU is lost.
- The OMU consists of microcomputers and contains I/O interfaces for local operation.
- The tasks of the OMU can be divided into five groups:
  - traffic measurement functions
  - maintenance functions
  - system configuration administration functions
  - system management functions
  - LAN topology management

Flexi BSC Hardware and Functionality

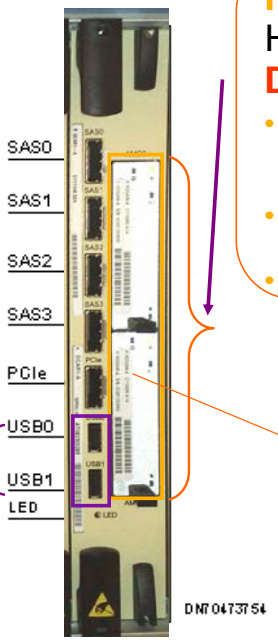
DCAR1-A Plug in Unit

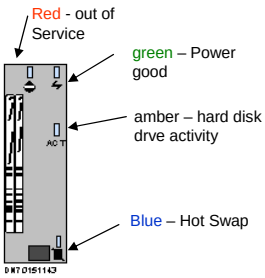
USB port in **DCAR1-A** PIU

- USB memory stick will provide reliable means for backup copying SW and database on a transferable media in BSC
- Capacity of memory stick is 4 GB

HDSAM (contained HSD07) also in **DCAR1-A** PIU

- Duplicated Hard disk units are installed with carrier adapter per BSC to ensure high reliability
- Easy to change or upgrade without traffic interruption
- Capacity of HSD07 is 73 GB





Hard disk AMC front panel (HDSAM-A)

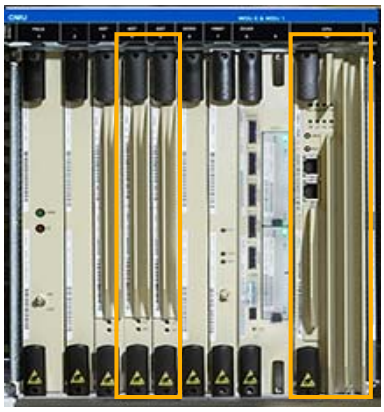
LED indicator on DCAR1A :

green → normal operation

red → failure condition

Soc Classification level

NetAct link options in Flexi BSC



LAN (Ethernet) interface

- LAN Ethernet interface according to IEEE802.3 for faster access
- This is the default NetAct link interface
- Connected via CPRJ45 panel on top of the cabinet

Digital X.25 interface, AS7-D
(PCM time-slot-based O & M interface via A Interface, G.703)

- An O&M interface via transcoders and transmission equipment
- Network management interfaces in PCM time slots
- Should be used only if LAN is not available

The LAN interface redundancy is implemented by providing a redundant LAN connection

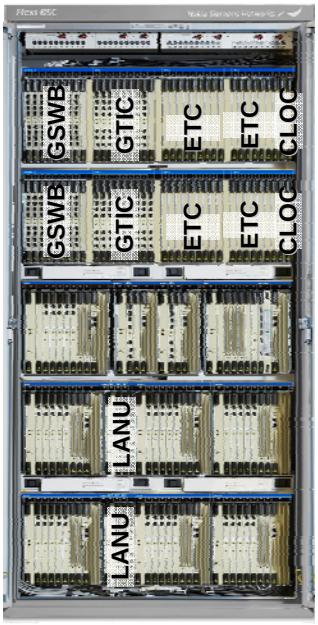
The digital X.25 interface can optionally be redundant by using duplicated units

The BSC has an X.25 and a LAN connection to the Nokia NetAct Operations Support System (OSS). The interface between these two network elements is based on the OSI protocol. Nokia NetAct interface plug-in unit are housed either with AS7 plug-in units or with AC25 plug-in unit. LAN/Ethernet connection is always available in default BSC configuration via connector panel with CP710-A in OMU.

Flexi BSC Hardware and Functionality
Other Units (1/8)

Flexi BSC cabinet

GSW2KB



CLOC

ETC

LANU

GTIC

Flexi BSC Hardware and Functionality
Other Units – GSW2KB-A (Group Switch) (2/8)

- Conveys the traffic passing through the BSC
- Establishes needed connections to the signalling units and the internal data transmission channels
  - 8Mbit/s serial connections towards ET16 → via back panel
  - 2 HotLinks / SW256 towards ETS2 / ETIP → via front panel
- Is responsible for the submultiplexing functions of the BSC
- Characteristic of GSW2KB-A:
  - 2048 real PCM's
  - 16384 virtual PCM's
  - Switching on 8kbit/s level
  - Max. 65536 8kbit/s channels for one SW256B
  - 8 x SW256B Units

Configuration includes 8 x SW256B plug-in units

Soc Classification level
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The duplicated Group Switch (GSWB) 256 is the switching fabric of the BSC3i. The GSWB is housed in two identical SW1C-C cartridges, and it conveys the traffic passing through the BSC3i and switches the tones to the subscribers of the exchange and to the trunk circuits. It also establishes the needed connections to the signalling units and the internal data transmission channels, and is responsible for the submultiplexing functions of the BSC3i.

The operation of the GSWB is controlled and supervised by the Marker and Cellular Management Unit (MCMU; SWCOP-A).

Redundancy: 2n with MCMU

Type: Functional unit, sub-unit of the Marker and Cellular Management Unit

Plug-in units:

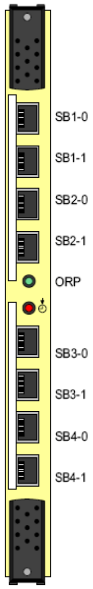
• SW64B Switching Network (8 Bit/s channels)

• PSC1-S Power Supply for Cartridge

The dimensions of an SW1C-C cartridge are (height x width): 270 mm x 198 mm

The dimensions of the plug-in units are (height x width): 233.4 mm x 220 mm; or 9.19 in x 8.66 in.

Flexi BSC Hardware and Functionality
SW256B PIU



- The GSW2KB is a congestion-free, full availability single-step switching network based on time-space architecture.
- The maximum capacity of GSW2KB related hardware is 2048 PCM lines, which realized by having 8 x SW256B piu.
- Interfaces:
  - 64x8Mbit/s serial interface OR
  - 32x4Mbit/s,32 x8Mbit/s serial interfaces OR
  - 64x4Mbit/s serial interface
  - 4 x 2N redundant Serial Broadband Interface (SBI) 524 MBit /s for connecting the Hotlink from SET/ETIP

Flexi BSC Hardware and Functionality
Other Units – CLS (Clock unit) (3/8)

- Clock and Tone Generator (CL3TG-UA) plug-in units generates the basic timing signals needed by the exchange, either independently or synchronized to a frame alignment signal received from the Exchange Terminal (ET) or external Frequency Standard (FS).
- Number of synchronization inputs: four from PCM (ET), and two from expernal input (FS) via connector panel
- Housed in the SGC1C-A cartridge

2 x CL3TG units (2N redundancy)

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The CLS generates the clock signals necessary for the BSC. The oscillator of the CLS is normally synchronized to an external source, usually an MSC, through a PCM line. Up to three additional PCM inputs are provided for redundancy.

Plug-in Unit: CL3TG (Clock and Tone Generator)

Interfaces:

- Synchronization input from Transcoder
- External synchronization input
- Synchronization output
- Wired alarm interface to OMU via GSWB

The Clock&Tone Generator (CL3TG) plug-in unit meets the requirements of the ITU-T Q.500 Series Recommendation with respect to the Time Interval Error (TIE), the jitter, the wander, and the transfer function. In the plesiochronous operation mode, the frequency shift of the CL3TG is 5 * 10-9 within each 24-hour period, if the temperature of the environment does not vary. CL3TG with external synchronised input is available by using the external synchronisation input connector from the CPRJ45 panel. It can be implemented either by symmetrical or asymmetrical PCM connection (RJ45 or BNC connector).

Flexi BSC Hardware and Functionality
Other Units – SET Unit (5/8)

- Provides the external SDH / Sonet line connections for BSC
- Each ETS2 plug-in units contain two separate STM-1 / OC-3 interfaces
- Flexi BSC includes in maximum 2 x 8 ETS2 units providing 16 external interfaces (STM-1/OC-3)
- ETIP1-A/ET16 units can be equipped to the same cartridge alternatively

0 - 16 x ETS2 units
0 - 16 x ETIP1-A units
0 - 16 x ET16 units

Soc Classification level
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The ETs are housed in ET4C-B cartridges. One ET4C-B cartridge can contain up to 32 ET2E-S, ET2E-SC or ET2A plug-in units. The total number of ET plug-in units in the BSC3i is 62 (32 in ET4C0, 30 in ET4C1) and the total number of PCMs is 124.

The ET2 plug-in units are installed in the order presented in the Equipment list in the site documents. The ET2E plug-in unit connects BSC to a 2.048 Mbit/s PCM transmission system. The ET2E is equipped with two PCM circuit interfaces (2x2M).

Different connector types used in ET2-units are following:

- ET2E-S Exchange Terminal with Euroconnector (balanced E1interface, 120 ohm) in ETSI environment
- ET2E-SC Exchange Terminal with coaxial connectors (unbalanced E1 interface, 75 ohm) in ETSI environment
- ET2A Exchange Terminal with RJ-45 connectors (balanced T1 interface) in ANSI environment

The dimensions of a ET4C cartridges are (height x width): 270 mm x 360 mm

The dimensions of the ET2 plug-in units are (height x depth): 100 mm x 220 mm; or 3.94 x 8.66 in.

Flexi BSC Hardware and Functionality
Other Units – EET Unit (6/8)

- Provides the external GigE Ethernet line connections for BSC
- Each ETIP1-A plug-in units contain one IP interfaces
- Flexi BSC includes in maximum 2 x 8 ETIP1-A units providing 8 redundant external interfaces (GigE)
- ETS2/ET16 units can be equipped to the same cartridge alternatively

0 - 16 x ETS2 units
0 - 16 x ETIP1-A units
0 - 16 x ET16 units

Soc Classification level
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The ETs are housed in ET4C-B cartridges. One ET4C-B cartridge can contain up to 32 ET2E-S, ET2E-SC or ET2A plug-in units. The total number of ET plug-in units in the BSC3i is 62 (32 in ET4C0, 30 in ET4C1) and the total number of PCMs is 124.

The ET2 plug-in units are installed in the order presented in the Equipment list in the site documents.

The ET2E plug-in unit connects BSC to a 2.048 Mbit/s PCM transmission system.

The ET2E is equipped with two PCM circuit interfaces (2x2M).

Different connector types used in ET2-units are following:

- ET2E-S Exchange Terminal with Euroconnector (balanced E1 interface, 120 ohm) in ETSI environment
- ET2E-SC Exchange Terminal with coaxial connectors (unbalanced E1 interface, 75 ohm) in ETSI environment
- ET2A Exchange Terminal with RJ-45 connectors (balanced T1 interface) in ANSI environment

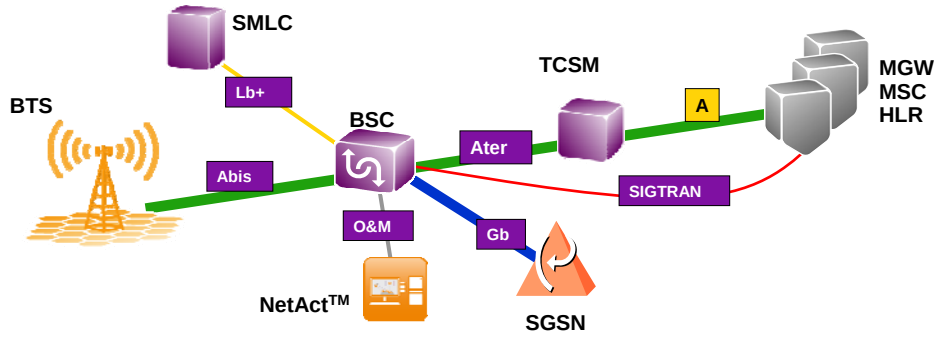
The dimensions of a ET4C cartridges are (height x width): 270 mm x 360 mm

The dimensions of the ET2 plug-in units are (height x depth): 100 mm x 220 mm; or 3.94 x 8.66 in.

•ETS2 provides an optical STM-1 or OC-3 interface to SDH network
STM-1 = 63 x E1 PCM (ETSI)
OC-3 = 84 x T1 PCM (ANSI)
•STM-1/OC-3 optical interfaces with bit rate of 155,52 Mbit/s *
•2 separate interfaces per unit
+ Optical interface redundancy
•Up to 16 ETS2 units in BSC3i 1000/2000
•Max. 16 STM-1/OC-3 interfaces
•Connected to GSW2KB via Hotlink

Flexi BSC Hardware and Functionality

Economical BSS Transmission Solutions with Integrated IP/Ethernet Interfaces



All BSC interfaces are capable for IP/Ethernet connectivity with RG10

Native IP based Packet Abis and A over IP (3GPP Rel 8) with additional benefits in RG20

Flexi BSC Hardware and Functionality
Other Units – ET Unit (7/8)

ETC 0-4 and GTIC 0-1

- Provides the external PCM line connections for BSC
- Each ET16 plug-in units contain 16 separate PCMs (E1/T1)
- Only one ET16 plug-in unit type
  - Interface specific characteristics are changed with cabling and cabling panels
- Flexi BSC includes in maximum 50 ET16 units providing 800 external PCMs (E1/T1)

ETC 0-4
GTIC 0-1

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Flexi BSC Hardware and Functionality
Other Units – LANU Unit (8/8)

ETC 0-4 and GTIC 0-1

- 2N redundant LANU unit in basic cabinet
  - Contains 3 ESB24 units
- In ESB24 SW port numbering is as follows:

  - Port 1, 2, 23 and 24 are LAN ports on the front plate.

  - Port 3 to 22 are LAN ports on the back plane.

LANU- 0 & 1

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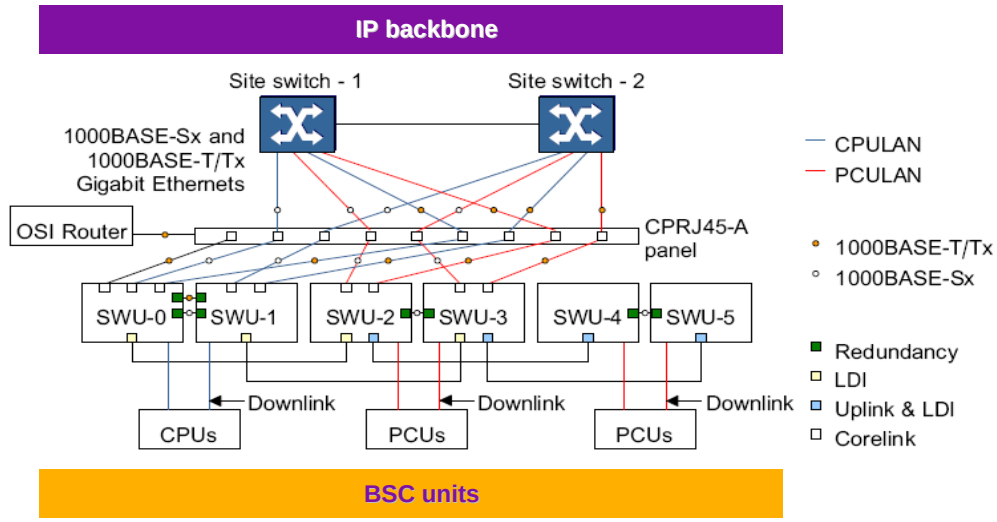
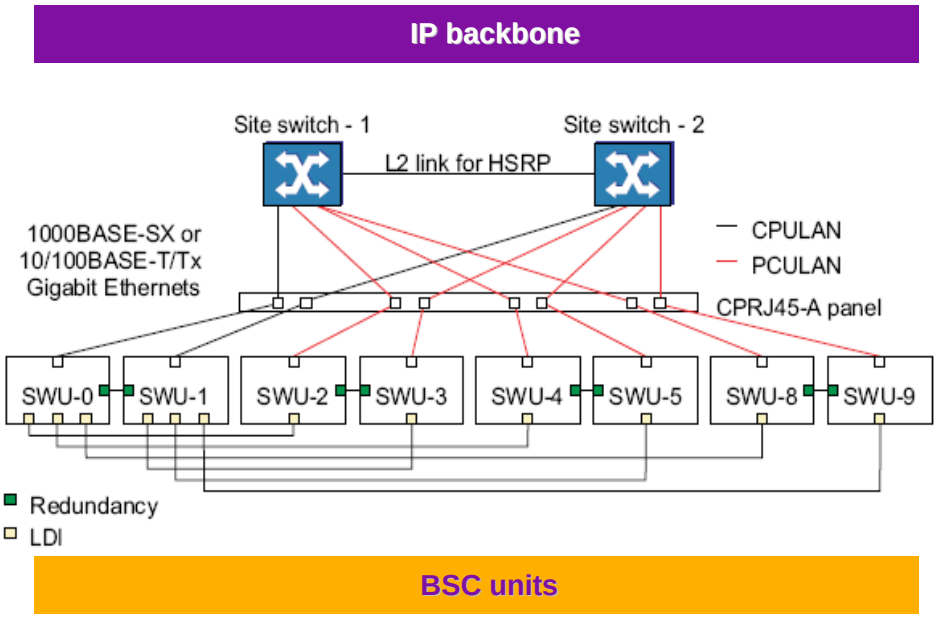
Flexi BSC Hardware and Functionality

Flexi BSC PCULAN & CPULAN connection principle – Flexi BSC



Flexi BSC Hardware and Functionality

Flexi PCULAN & CPULAN connection principle – BSC3i 2000



Flexi BSC Hardware and Functionality

Flexi BSC Plug-in Units summary

Common units with earlier BSC product configurations and Core Network products

- DCAR1-A
- HWAT-A
- PSC6-AB/CB
- SERO-B
- HDS07-A
- CP816-AC
- SW256B
- ET16
- ETS2

Common units with Nokia Siemens Networks Core MSS, HLR, SGSN, etc.

- AS7-D
- SWPRO-C
- ESB24
- CL3TG-UA

New plug-in units:

- ETIP1-A
- PCU2-E
- PSC6-D

The BSC3i is constructed by using a total of 15 plug-in unit types, including the DC/DC converters. Additionally mass memory adapters (HDPU-A & ODPU-A) and memory modules (MR256M) are sometimes interpreted as plug in unit for example in BSC3i hardware revision list document.

The size of these plug-in units is either 233 mm x 220 mm, 100 mm x 220 mm, 262 mm x 226 mm, or 235 mm x 247 mm.

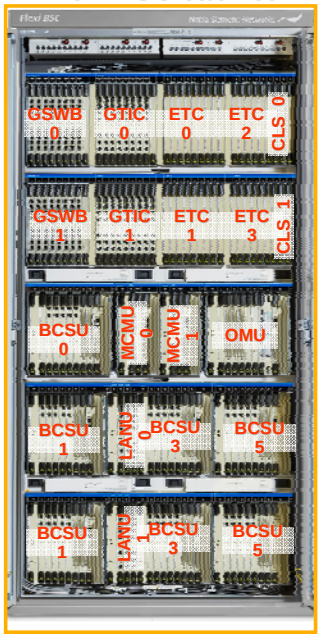
The printed circuit boards (PCBs) of plug-in units are multilayered. They are covered with a protective coating that makes the PCBs easy to handle and protects the foils from scratches. The connectors are of the Euro-connector, and 2 mm Hard Metric type.

For further information on BSC3i plug in unit see plug in unit descriptions or BSC HW revisionlist document.

Flexi BSC Hardware and Functionality

Hardware Changes compare to BSC3i 1000/2000

Flexi BSC cabinet



2000 x 900 x 600 cabinet (HxWxD)

New Plug In Unit:

- ETIP1-A for EET interface
- PCU2-E for Packet data
- PSC6-D for power supply in each
- ESB24-A for ethernet switch
- SWPRO-C for controlling GSWB

Common Unit:

- FTRB-A enhanced fan units
- CP816-A CPU for all computer units
- Bit based group switch for 2048 PCMs (GSW2KB)
- ET16 for E1/T1 interface
- ETS2 for STM-1 or OC-3 interface
- DCAR-A for mass memory
- LANU
- Ethernet Message Bus (EMB)

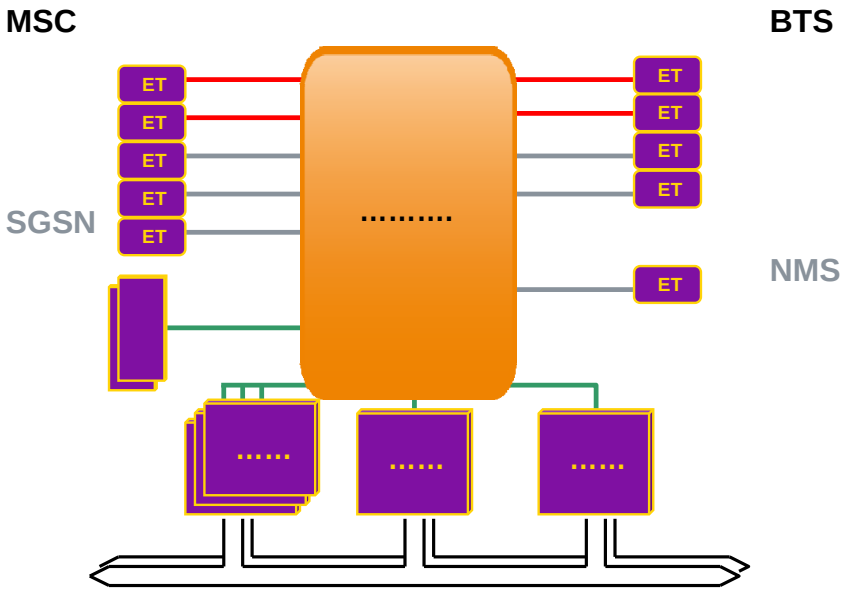
Removed Units:

- ESB26 Ethernet Switch
- CLAB for clock repeating

Architecture changes

- 6 + 1 BCSU units
- No extension cabinet

Exercise: BSC interrogation



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Exercise: BSC Interrogation, duration ~ 30min
Required equipment: one working VDU terminal for each workgroup.

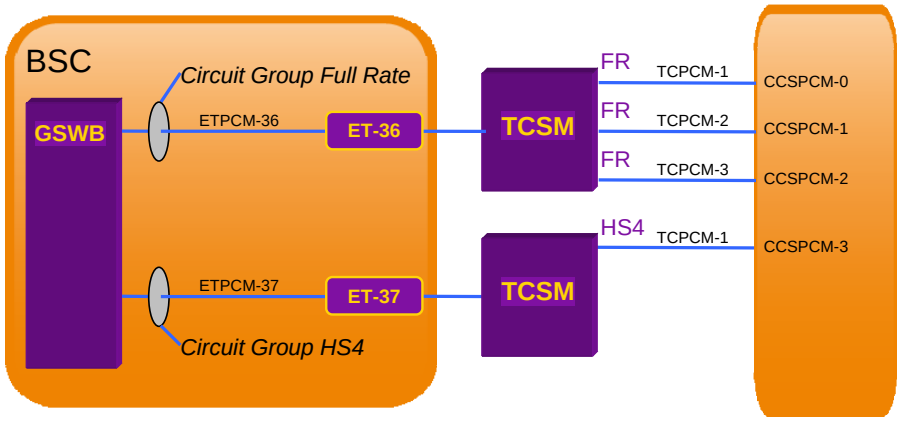
Complete the picture above according to your classroom BSC!
Write down the used MML commands!

How many BCSUs are available?
_____
How many ETs are in use?
_____

With the ZWIP-Command you can check whether an ET is used for A-IF, Abis-IF or Gb-IF. How?
_____
_____
_____
_____

Interrogate the plug-in units of the OMU (ZWTI)!
Track .....:_____ Track .....:_____ Track .....:_____ Track .....:_____ Track .....:_____ Track .....:_____ Track .....:_____ Track .....:_____ Track .....:_____ Track .....:_____

Speech circuits



Refer to S13 Documentation:

- Descriptions\ Product descriptions\Product description of BSC2i (ETSI/ANSI), BSCi High Capacity Base Station Controller \ Functionality of BSC2i and BSCi
- Descriptions\ Product descriptions\ Product description of BSC3i High Capacity Base Station Controller \ Functionality of the BSC3i

For more detailed information about routing, see S13 Documentation:

- Descriptions\ Functional Area Descriptions\ Routing, Analyses and Announcements\ Routing in BSC\ BSC Routing overview

CCS7 signalling

Refer to S13 Documentation:

- Descriptions\ Product descriptions\Product description of BSC2i , BSCi High Capacity Base Station Controller \ Functionality of the BSC2i and BSCi
- Descriptions\ Product descriptions\Product description of BSC3i High Capacity Base Station Controller\ Functionality of the BSC3i

For more detailed information about CCS7 Signalling, see S13 Documentation:

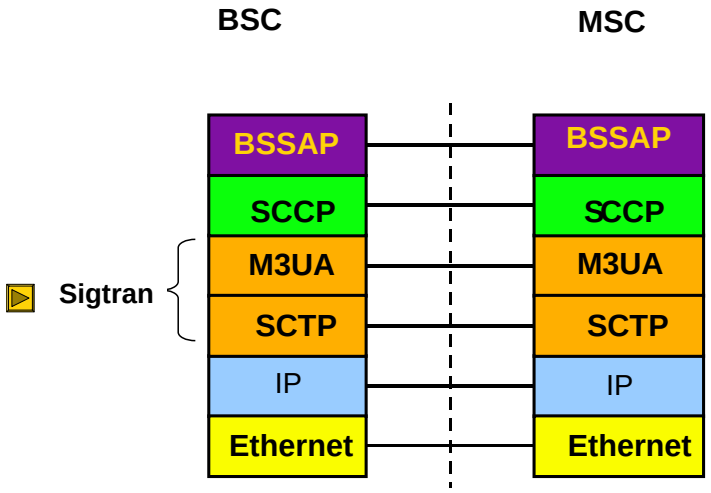
- Descriptions\ Functional Area Descriptions\ Signalling and O&M Connections\ SS7 Signalling\ SS7 Signalling overview.

MTP: Transmits signalling data to a destination. The MTP consists of at least one signalling link, a signalling link set, and a signalling route set.

SCCP: Two SCCP services are used in GSM: connectionless service and connection-oriented service. The SSCP uses the MTP's services and offers its own services to the upper layers.

BSSAP: The application part of the base station subsystem. The BSSAP consists of BSSMAP (BSS Management Part), for messages between BSC and MSC; and DTAP (Direct Transfer Application Part), for messages to and from the mobile station.

A Interface using SIGTRAN protocol stack

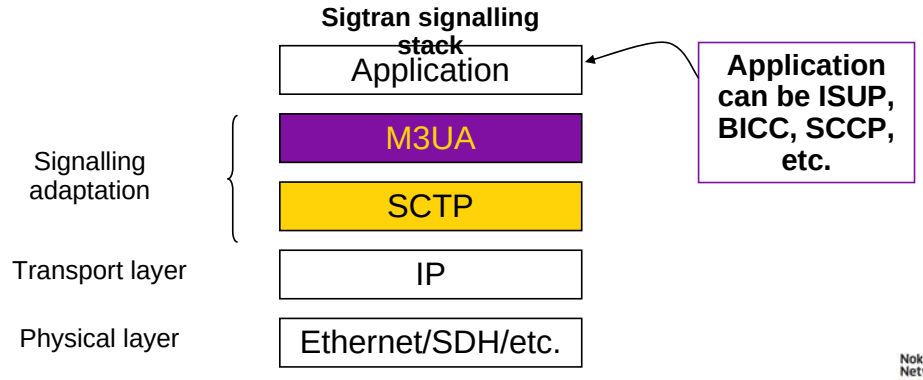


Sigtran - Signalling over IP

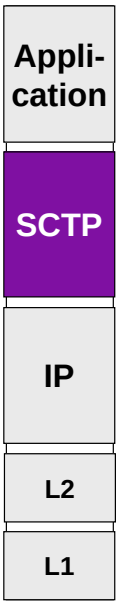
Sigtran defines a standardized way of carrying any SS7 signalling over IP networks

Defines retransmission and reordering functionalities

Physical layer can be any layer 1 technology



Stream Control Transmission Protocol (SCTP)



Services by SCTP:

- provides **reliable** data transfer between two IP end points
- It offers acknowledged error-free non-duplicated transfer of datagrams (messages).
- Detection of data corruption, loss of data and duplication of data is achieved by using checksums and sequence numbers.
- A selective retransmission mechanism is applied to correct loss or corruption of data.

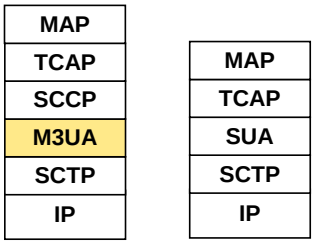
M3UA – MTP3 User Adaption Layer

Different adaptation layers possible

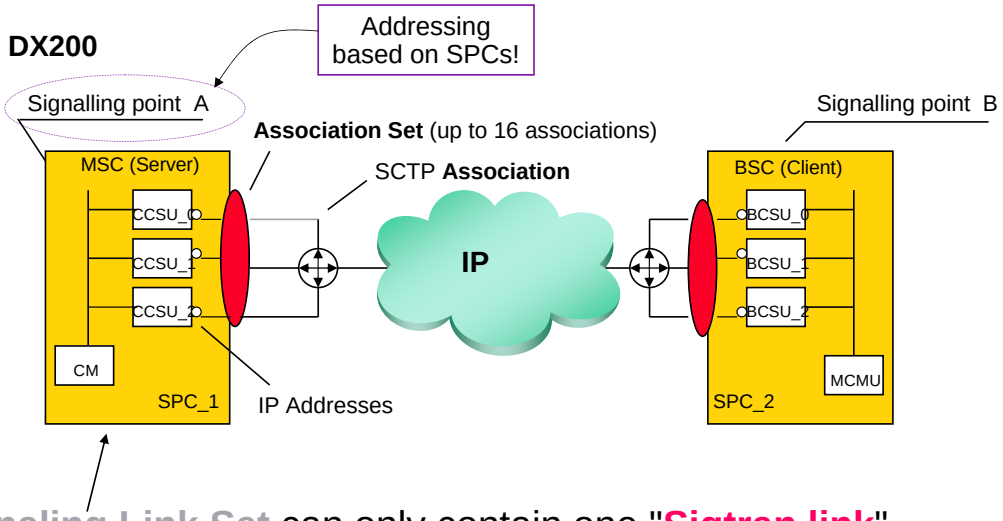
- - M2UA (MTP2 user adaptation layer)
- - M3UA (MTP3 user adaptation layer)
- - SUA (SCCP user adaptation layer)

M3UA supported in the 1st implementation of Rel4

M3UA (MTP3 User Adaptation) provides MTP3 user adaptation for upper layers to use

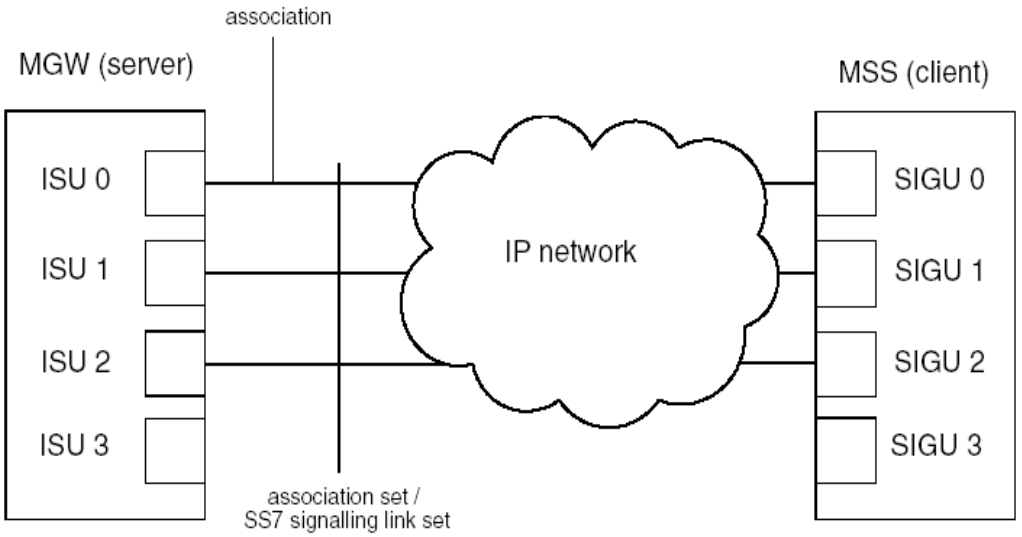


Sigtran Terms and Concepts



Signaling Link Set can only contain one "**Sigtran link**". "Sigtran link" consists of one **SCTP association set**. **Association** is identified by the computer unit and destination address. Only one association allowed per computer unit.

Sigtran Terms and Concepts

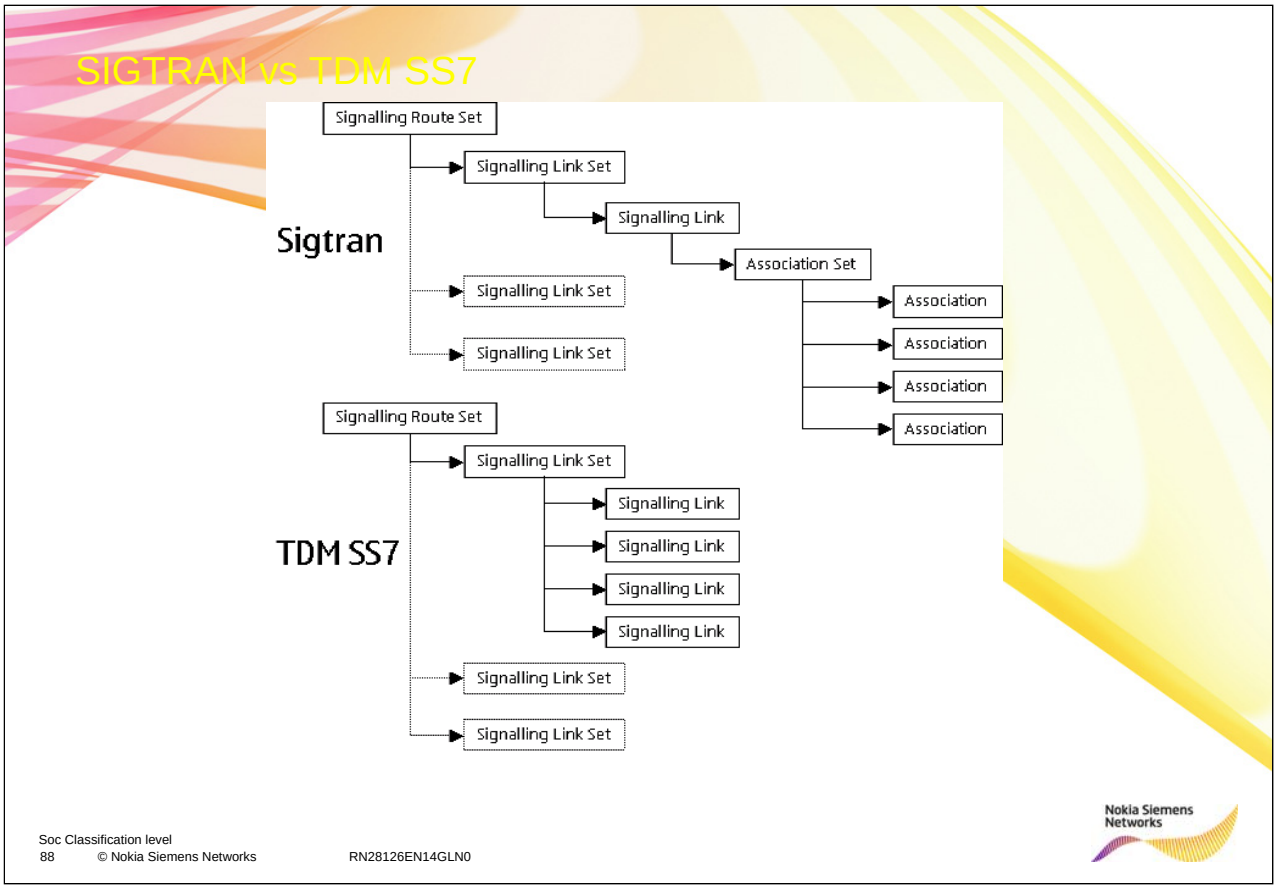


Each association inside an association set can be in the following states:

- SCTP-DOWN
- UP - PROCEEDING
- ASP-DOWN
- ASP-INACTIVE
- ASP-ACTIVE

Note

Association set is related to Nokia distributed architecture, and it is a Nokia-specific concept.


SIGTRAN vs TDM SS7
Sigtran
Signalling Route Set
Signalling Link Set
Signalling Link
Association Set
Association
Association
Association
Association
Signalling Link Set
Signalling Link Set
TDM SS7
Signalling Route Set
Signalling Link Set
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Signalling Link Set
Soc Classification level
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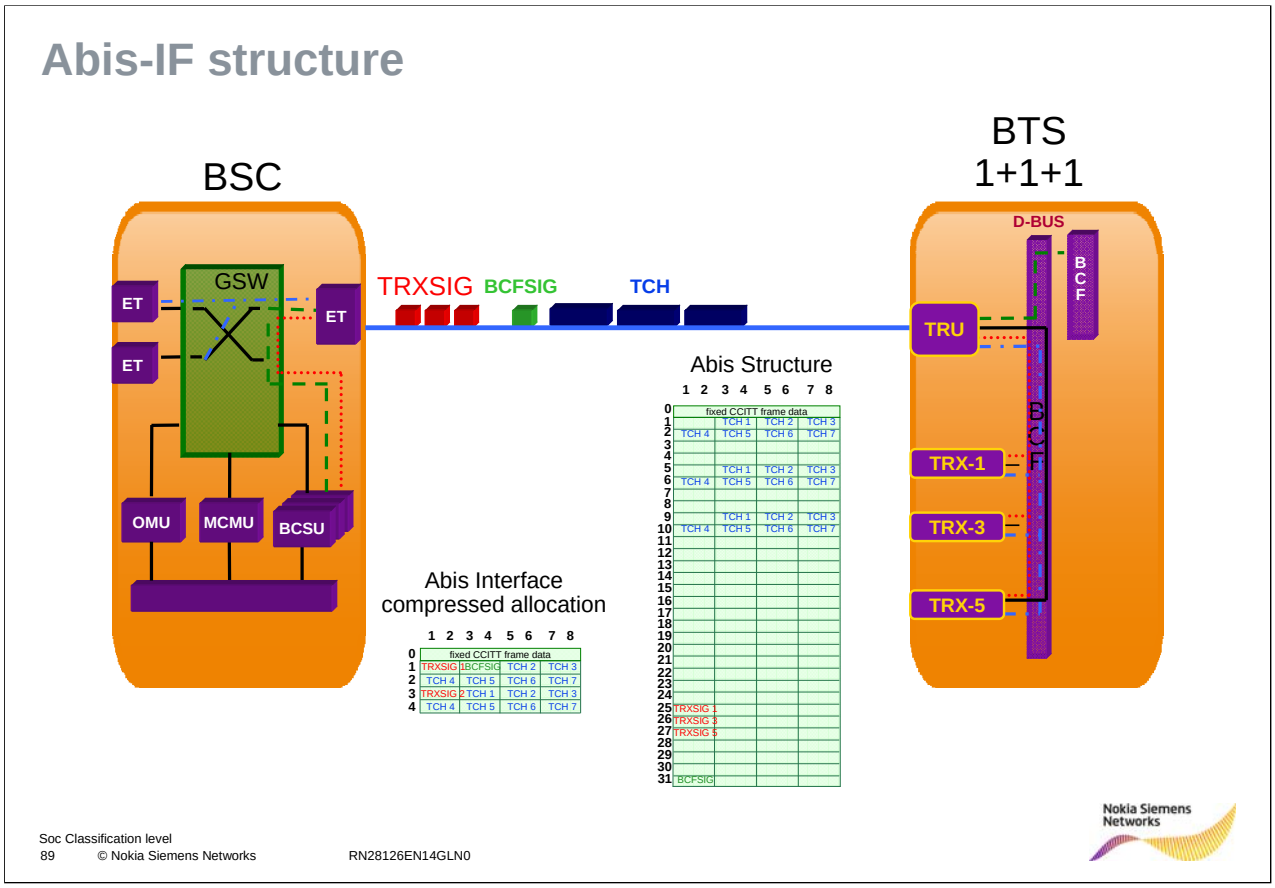


Refer to S11 Documentation:

- Descriptions\ Product descriptions\ Base Station Controller, BSC2E/A, BSCE\ Interfaces relating to the BSC2E/A and BSCE\ Abis interface
- Descriptions\ Product descriptions\ High Capacity Base Station Controller, BSC2i (ETSI/ANSI), BSCi\ Interfaces relating to the High Capacity Base Station Controller, BSC2i (ETSI/ANSI), BSCi\ Abis interface
- Descriptions\ Product descriptions\ High Capacity Base Station Controller, BSC3i (ETSI/ANSI),\ Interfaces relating to the BSC3i\ Abis interface

Abis interface

Each BTS has one O&M channel, BCFSIG (or OMUSIG):

- it is an LAPD link connected to the BCF unit in the BTS
- the bit rate is 16, 32 or 64 kbit/s

Note: In Metrosite equipment the function of the BCF is taken over by a TRX.

One TRX can handle 8 x 16 kbit/s traffic channels, TCHs:

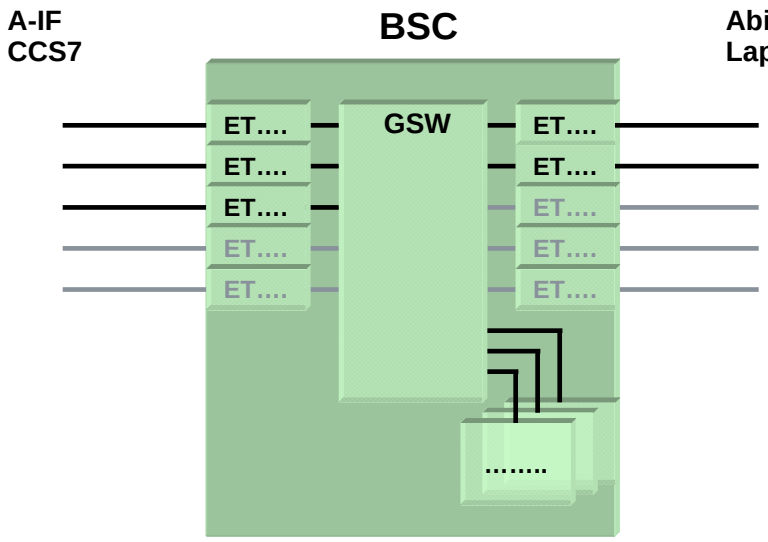
- it needs two PCM timeslots for TCHs in Abis
- one TRX has one LAPD link, TRXSIG with 16, 32 or 64 kbit/s bitrate

Note: Metrosite, Ultrasite and Insite are able to manage a combined TRXSIG/BCFSIG SAPI:63!

For creation of LAPD links, see S11 Documentation:

- Integrate\ BSS integration\ Initialising base stations\ Creating LAPD links

Exercise: Interrogation of signalling and circuit switched traffic



Exercise: Interrogation of Signalling, duration: ~30min

Required equipment: one working VDU terminal for each work group.

Write down the used MML commands!

How many CCS7 channels exist between MSC and BSC (ZN…)? Draw their location (PCM and TSL) into the picture above!

_____

Interrogate the D-Channel (Lap-D) in your BSC (ZD….)! Which Computer unit is managing them? Draw the signalling flow through the BSC into the picture above!

_____

Interrogate the existing circuit groups for speech in BSC (ZRC…)!

Which ETs are in use?

_____

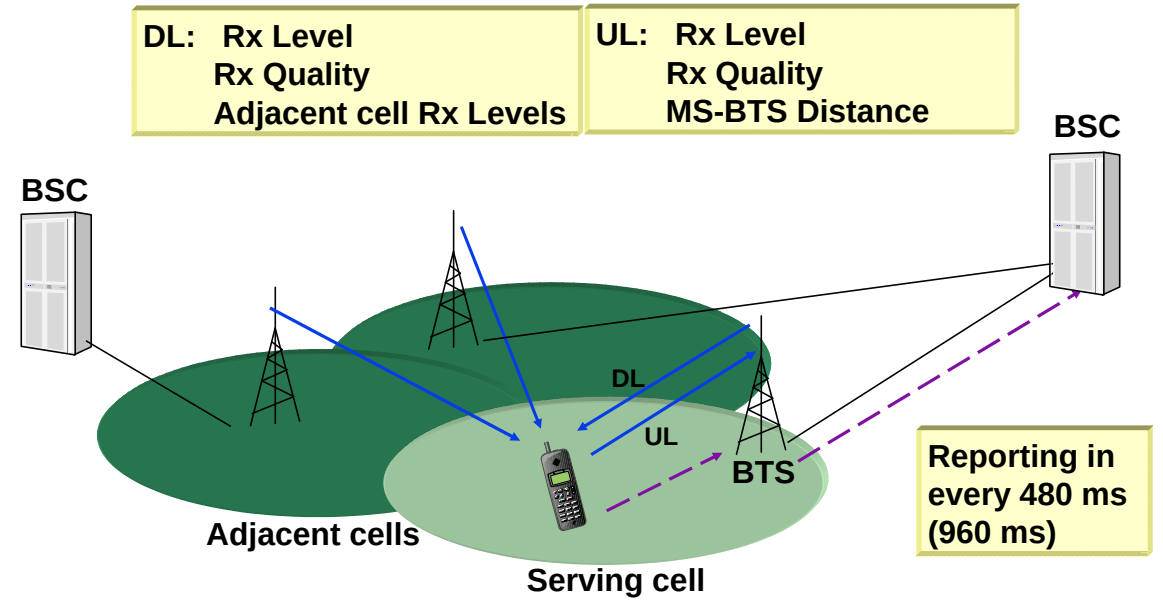
_____

_____

_____

_____

Radio link measurements



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Refer to S13 Documentation:

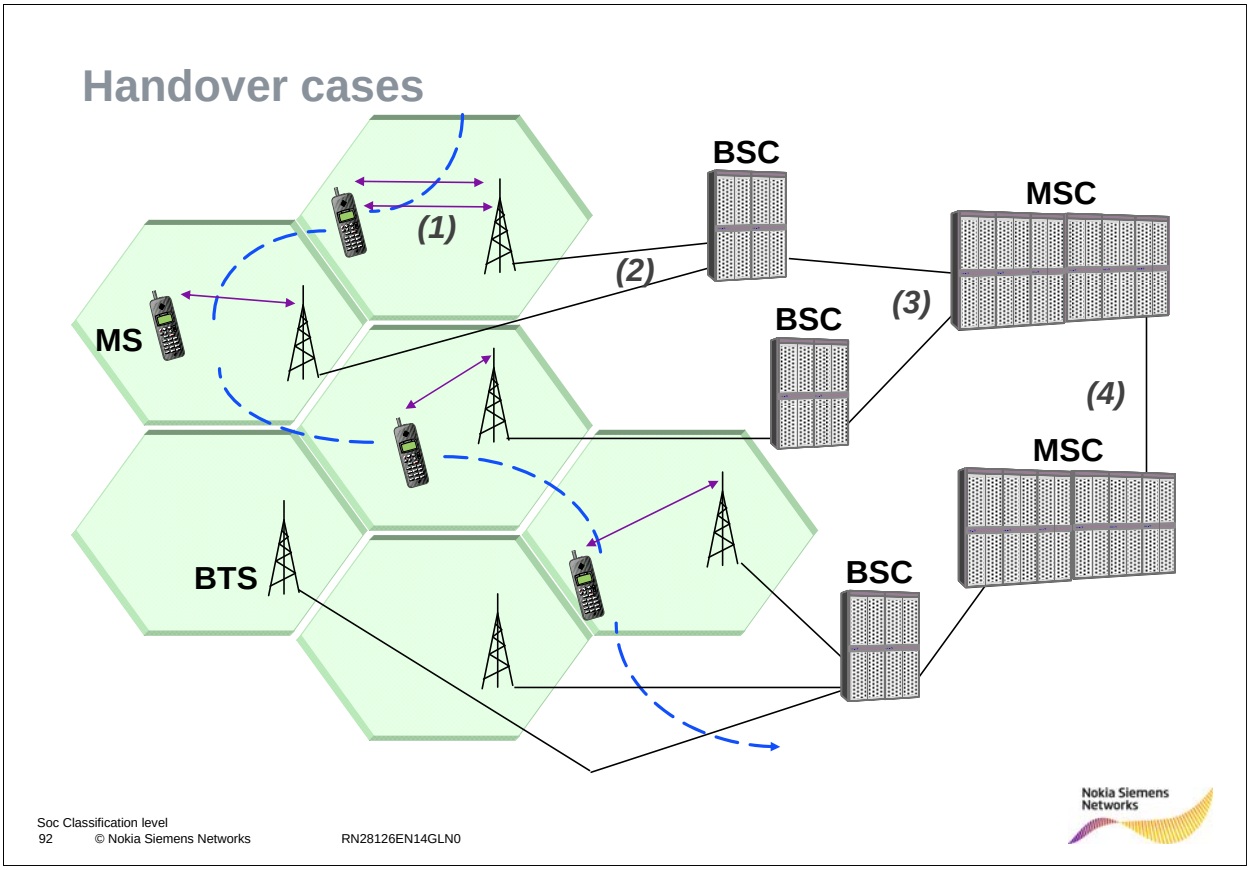
- Descriptions\ Functional Area Descriptions\Radio Network performance\ RF Power Control and Handover Alorithm\ Overview to RF Power Control and Handover Algorithm

Measurements are sent via SACCH every 480 ms.

Measurements are transferred via TRXSIG on Abis interface. The algorithms to handle the different types of measurements are located in the BCSU.

The BCSU provides the results.

The MCMU is responsible for further processing and decision-making concerning BSS resource management.



Refer to S13 Documentation:

- Descriptions\ Functional Area Descriptions\ Radio Network Perfomance\ Handover Signalling on BSC\ Overview of handover signalling in BSC

The handover decision is made by the BSC and is based on the measurements of the BS and MS. BSC evaluates the candidate according to the neighbouring cells. Handover can be done for SDCCH and TCH.

INTRA-BSC INTRA-CELL HANDOVER (same cell)
between two TS in the same carrier or two carriers in the same BTS

INTRA-BSC INTER-CELL HANDOVER (different cells)
between two carriers in different BTS's

INTER-BSC HANDOVER
between two BTS's in different BSCs via MSC

INTER-MSC HANDOVER
between two BSCs in different MSCs

Inter-BSC and Inter-MSC handover are determined by the BSC but executed by the MSC (signalling and call control needed)
Only ther high load Handover is initialised and executed by the MSC.

Power control in DX 200 BSC

Power control for MS and BTS (non-BCCH)

Averaging and threshold comparison as in handover cases

Causes for POC:

- high/low signal quality (ul/dl)
- high/low signal level (ul/dl)

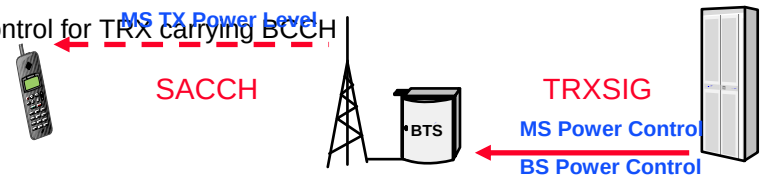
New power level determination by HOC&POC algorithm

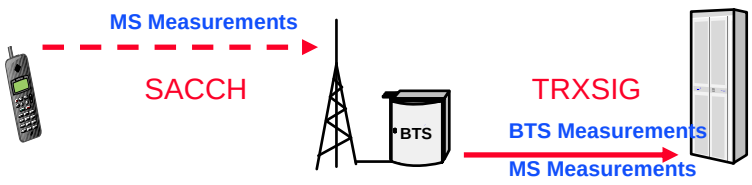
Refer to S13 Documentation:

• Descriptions\ Functional Area Descriptions\ Radio Network Performance\ RF Power Control and Handover Algorithm in BSC\Power control and handovers in BSC

Power control is done for:

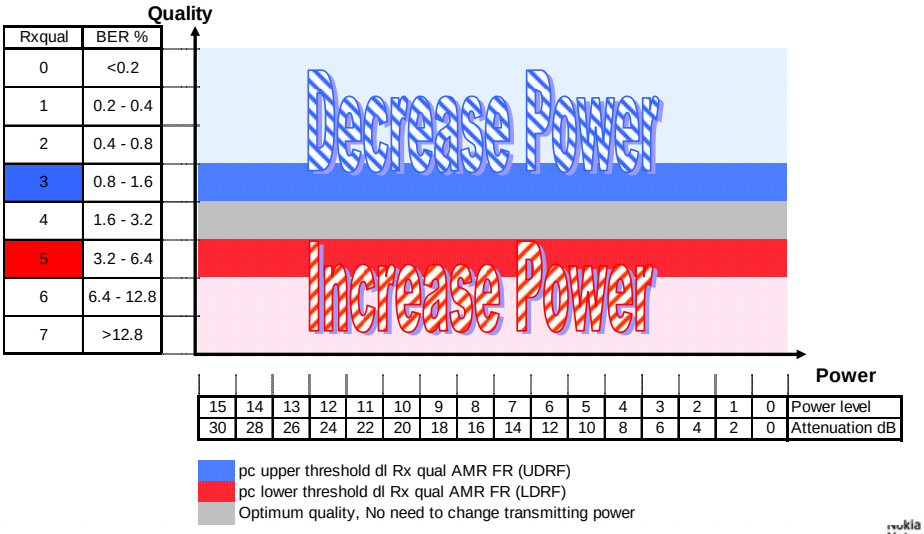
- MS
- BTS
- no power control for TRX carrying BCCH





AMR Progressive Power Control – Background

- In normal Power Control algorithm the quality thresholds for quality based PC are not changing according to actual transmitting power
- Example:



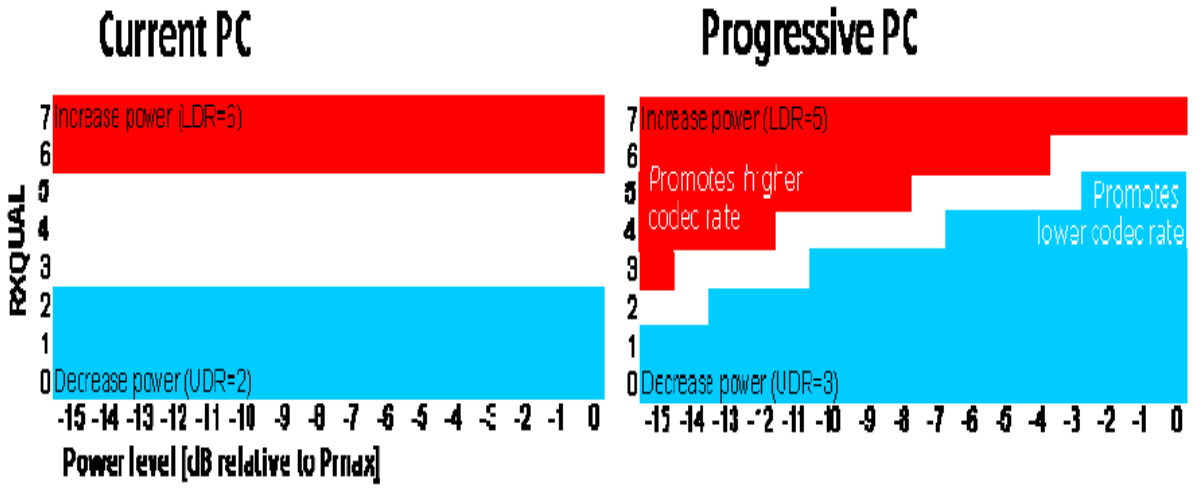
1. With current power control, voice quality (based on TCH FER) and drop call rate (based on SACCH RLT) cannot be optimised at the same time

2. For example RXQUAL low thresholds 5 and high thresholds 6 provides low drop call rate, but poor voice quality.

3. As a result, used power control algorithm AMR RXQUAL thresholds have to be selected so that trade-off between voice quality and system capacity is made

AMR Progressive Power Control - Concept

- Instead of using constant RX_QUAL threshold values, progressive power control uses higher RX_QUAL threshold values for higher TX power levels



Main principle of Progressive Power Control

1. Progressive AMR Power Control (AMR PPC) provides mechanism to change quality thresholds depending on used power level i.e. favor increase of power with low power levels and avoid increase of power with higher power levels and thus reduce overall interference

2. AMR PPC is an enhancement to the existing Power Control (PC) algorithm running in the BSC and controlling the transmitting power of the MS and BTS

3. AMR PPC is application software in S13 and it contains two separate functionalities which can be separately controlled with Licence and Feature Handling MML (LFHMML)

AMR PPC for MS power controlling

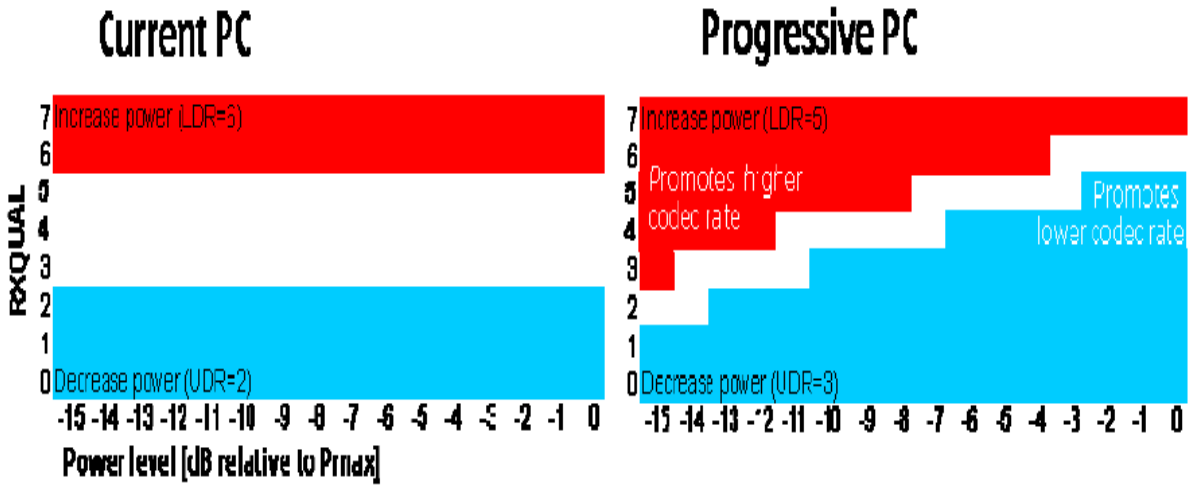
AMR PPC for BTS power controlling

4. AMR PPC algorithm will be used only for AMR calls. When the AMR PPC algorithm is disabled, the normal PC algorithm is used also for AMR calls

5. AMR PPC introduces one new measurement type, The AMR PPC Measurement. The new measurement is for measuring the average signal quality vs. power level distribution in TRX level

AMR Progressive Power Control - Concept

- Instead of using constant RX_QUAL threshold values, progressive power control uses higher RX_QUAL threshold values for higher TX power levels



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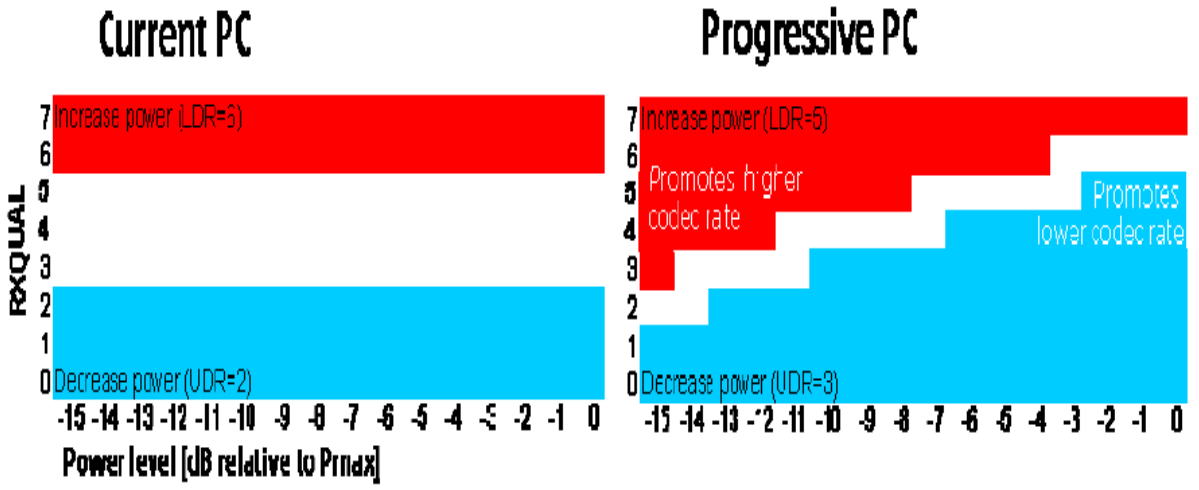


Main principle of Progressive Power Control

1. Progressive AMR Power Control (AMR PPC) provides mechanism to change quality thresholds depending on used power level i.e. favor increase of power with low power levels and avoid increase of power with higher power levels and thus reduce overall interference

2. AMR PPC is an enhancement to the existing Power Control (PC) algorithm running in the BSC and controlling the transmitting power of the MS and BTS

3. AMR PPC is application software in S13 and it contains two separate functionalities which can be separately controlled with Licence and Feature Handling MML (LFHMML)

AMR PPC for MS power controlling

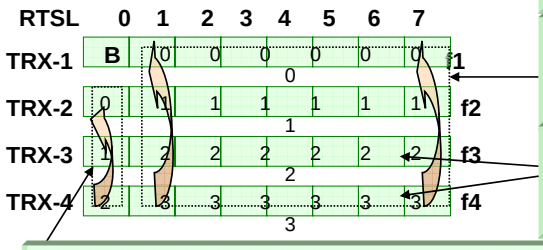
AMR PPC for BTS power controlling

4. AMR PPC algorithm will be used only for AMR calls. When the AMR PPC algorithm is disabled, the normal PC algorithm is used also for AMR calls

5. AMR PPC introduces one new measurement type, The AMR PPC Measurement. The new measurement is for measuring the average signal quality vs. power level distribution in TRX level

Frequency hopping

- **Base Band Hopping:**



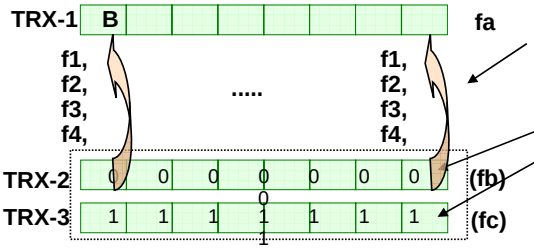
B = BCCH timeslot. It does not hop.

Time slots 1...7 of all TRXs hop over MA(f1, f2, f3, f4). This hopping group uses HSN-2.

MAIOs have to be different between same RTSLs in same hopping group.

Time slot 0 of TRX-2,-3,-4 hop over MA (f2, f3, f4). This hopping group uses HSN-1.

- **Synthesized Hopping:**



B = BCCH timeslot. TRX does not hop.

Non - BCCH TRXs are hopping over the MA -list (f1,f2,f3,...,fn) attached to the cell.

MAIOs have to be different between same RTSLs in same hopping group.

Only one hopping group. Only HSN-1 is meaningful.

Soc Classification level
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Refer to S13 Documentation:

- Descriptions\ Product descriptions\Product description of BSC2i , BSCi High Capacity Base Station Controller \ Functionality of the BSC2i and BSCi
- Descriptions\ Product descriptions\Product description of BSC3i High Capacity Base Station Controller\ Functionality of the BSC3i

For more detailed information, see S13 Documentation:

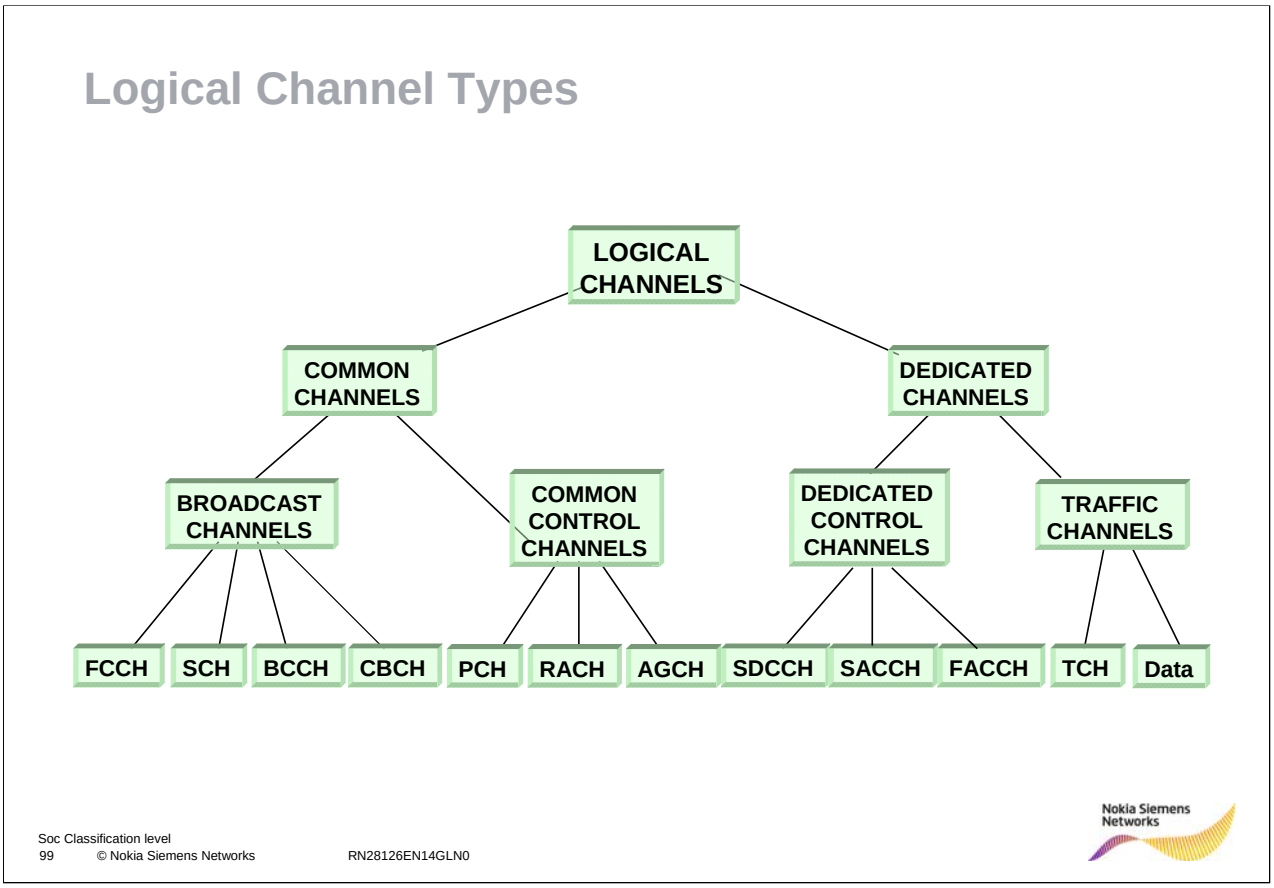
- Descriptions\ Feature Descriptions\ Radio Network Performance\ Frequency Hopping

The BSC is responsible for frequency hopping.

The BTS executes the frequency hopping.

The BSC determines the frequency hopping:

- frequencies
- order
- time cyclic



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A logical channel defines the type of information sent in a burst.

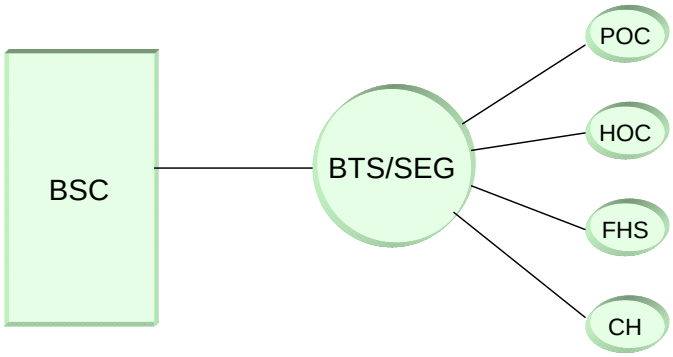
Logical channels are mapped onto physical channels.

One physical channel can carry more than one logical channel.

Abbreviations:

FCCH:	Frequency Correction Channel
SCH:	Synchronization Channel
BCCH:	Broadcast Control Channel
CBCH:	Cell Broadcast Channel
PCH:	Paging Channel
RACH:	Random Access Channel
AGCH:	Access Grant Channel
SDCCH:	Stand Alone Dedicated Control Channel
SACCH:	Slow Associated Control Channel
FACCH:	Fast Associated Control Channel
TCH:	Traffic Channel (FR, EFR, HR)
Data:	Data Channel (14.4KBit/S, 9,6kBit/S)

Exercise: Cell parameter interrogation



Exercise: Cell Parameter Interrogation, duration:~20min
Required equipment: working VDU terminal for each work group.
You are interrogating BTS ……/SEG……

Power Control (POC)
Interrogate parameters concerning Power Control (ZE….)
MML command:_____
How could you modify those parameters?
MML command:_____
Handover Control (HOC)
Interrogate parameters concerning Handover Control (ZE….)
MML command:_____
How could you modify those parameters?
MML command:_____
Frequency Hopping System (FHS)
Interrogate parameters concerning Hopping System (ZEQ….)
MML command:_____
How could you modify those parameters?
MML command:_____
Radio Timeslots (CH)
Interrogate parameters concerning Radio Timeslots (ZER….)
MML command:_____
How could you modify those parameters?
MML command:_____