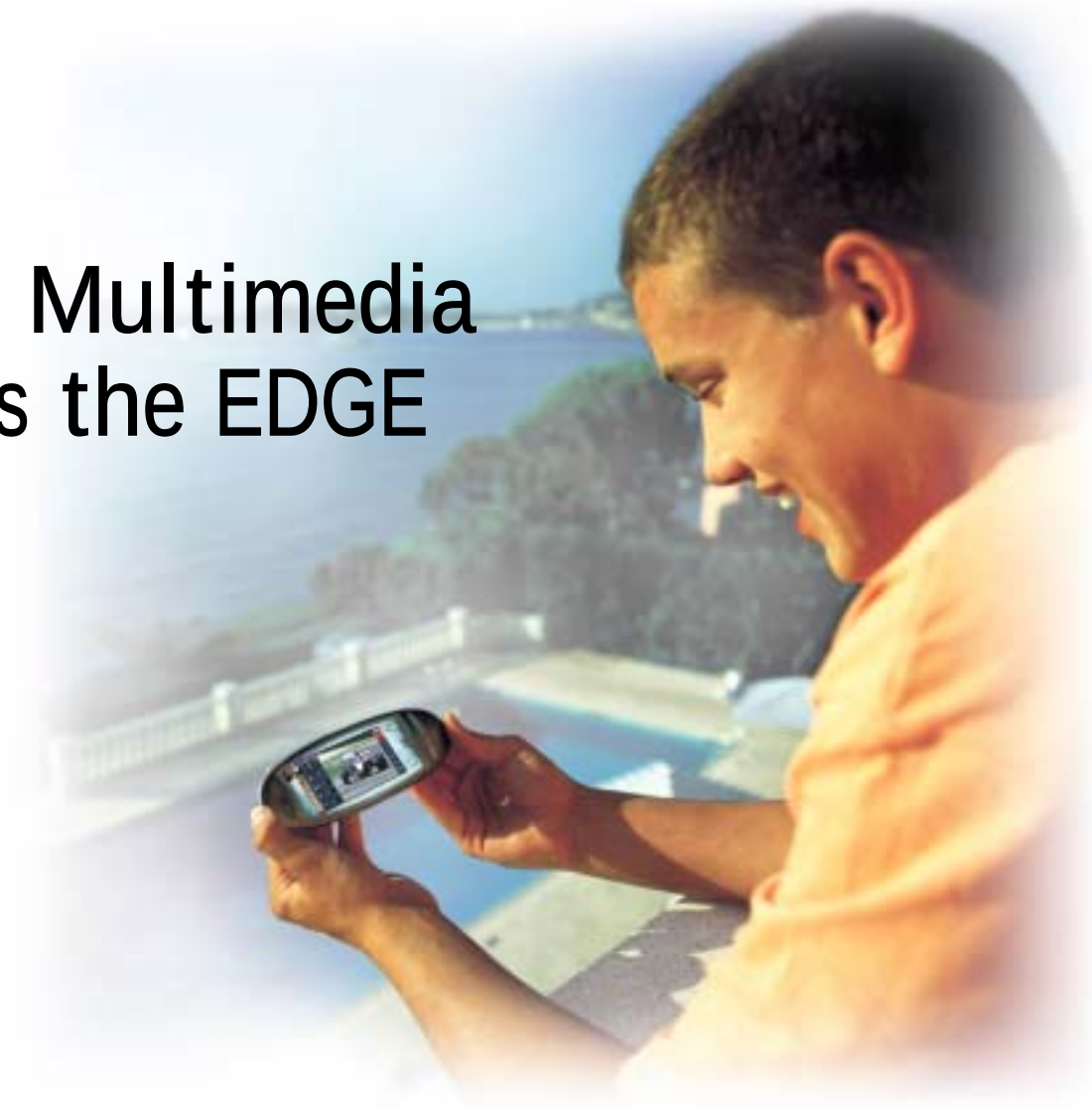
SubMenu

Go Mobile Multimedia
Nokia has the EDGE



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SubMenu

Nokia EDGE brings more speed and capacity when needed

- EDGE - Enhanced Data Rates for Global Evolution
- 3 times higher air interface rate with 8-PSK modulation
- For GSM800, GSM900, GSM1800 and GSM1900
- EDGE is also the 3G technology for IS 136 operators

NOKIA

SubMenu

DATA Solutions

Features in the DATA category are enhancing GSM technology to EDGE.

Features Under Development in BSS10:

DATA Solutions

- BSS10091 Enhanced Data Rates for Global Evolution, EDGE Optional BSS10.5 CD
- BSS10104 Nokia Smart Radio Concept for EDGE (Nokia SRC)
- BSS10046 Multi BCF Control BSS10.5
- BSS10045 Dynamic Abis Allocation for EDGE BSS10.5 CD
- BSS10074 Support of PCCCH/PBCCH BSS10.5
- BSS10084 Priority Class based Quality of Service BSS10.5
- BSS10089 System Level Trace BSS10.5

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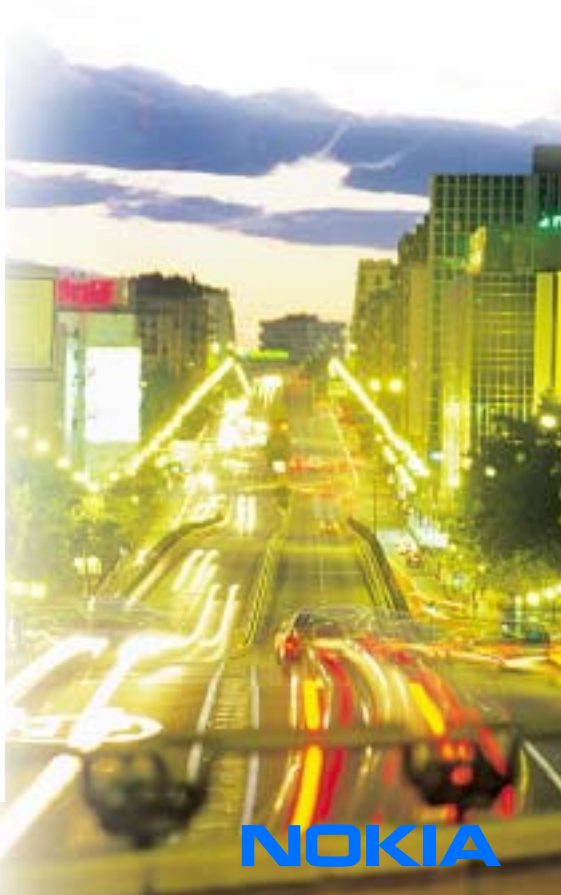
SubMenu

Nokia EDGE boosts GPRS

- Enhanced General Packet Radio Service, EGPRS
  up to 59 kbit/s with 1 time slot
  up to 473 kbit/s per carrier



SubMenu

EDGE builds on existing GSM network

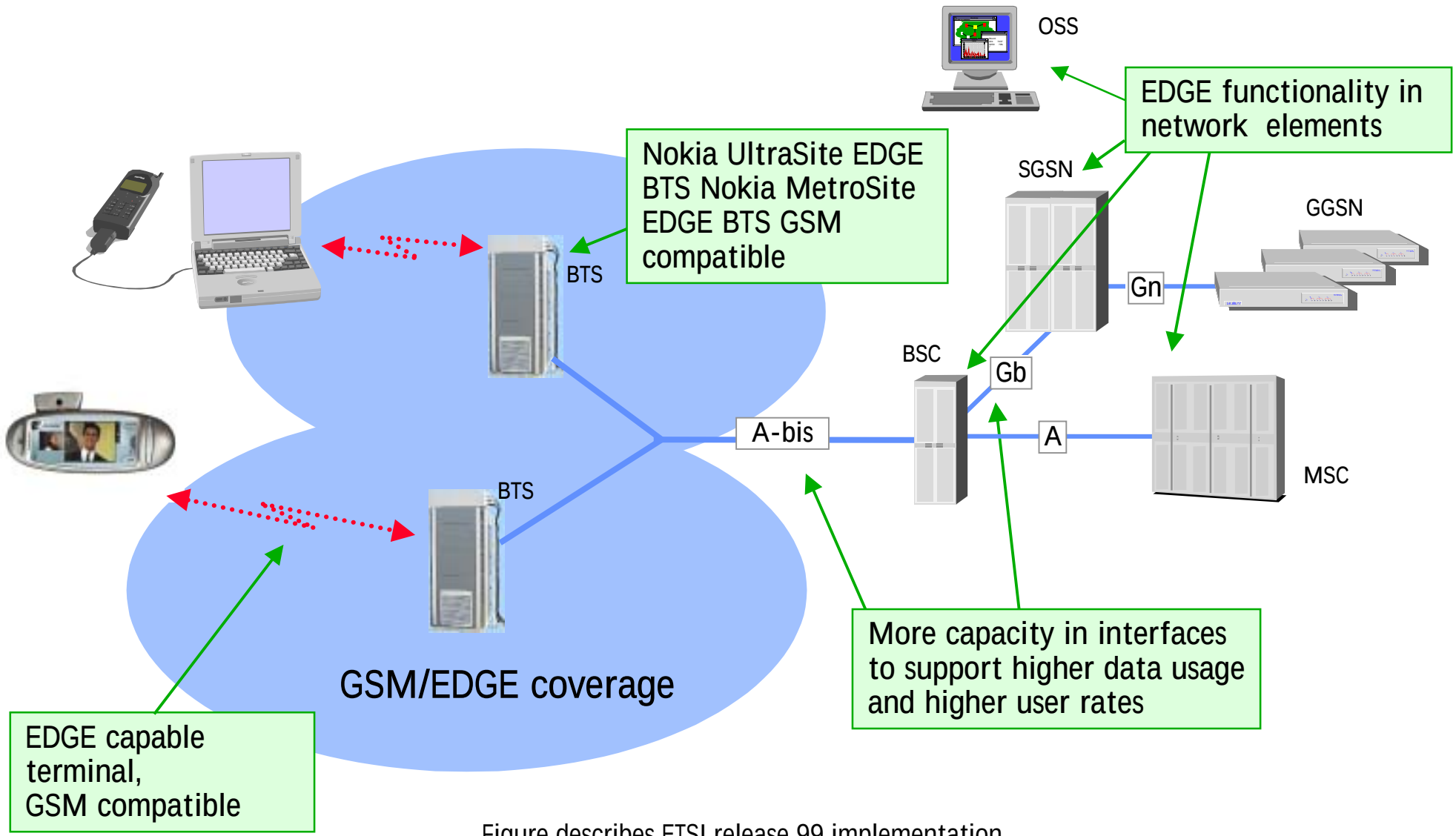


Figure describes ETSI release 99 implementation.

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SubMenu

EGRPS MCSs

	Modulation and coding scheme								
	MCS-1	MCS-2	MCS-3	MCS-4	MCS-5	MCS-6	MCS-7	MCS-8	MCS-9
Modulation	GMSK	GMSK	GMSK	GMSK	8-PSK	8-PSK	8-PSK	8-PSK	8-PSK
Modulation rate	22.8	22.8	22.8	22.8	69.6	69.6	69.6	69.6	69.6
Code rate	0.53	0.66	0.8	1	0.37	0.49	0.76	0.92	1
Time slots	bitrate [kbps]								
1	8.8	11.2	14.8	17.6	22.4	29.6	44.8	54.4	59.2
2	17.6	22.4	29.6	35.2	44.8	59.2	89.6	108.8	118.4
3	26.4	33.6	44.4	52.8	67.2	88.8	134.4	162.2	177.6
4	35.2	44.8	59.2	70.4	89.6	118.4	179.2	217.6	236.8
5	44	56	74	88	112	148	224	272	296
6	52.8	67.2	88.8	105.6	134.4	177.6	268.8	326.4	355.2
7	61.6	78.4	103.6	123.2	156.8	207.2	313.6	380.8	414.4
8	70.4	89.6	118.4	140.8	179.2	236.8	358.4	435.2	473.6

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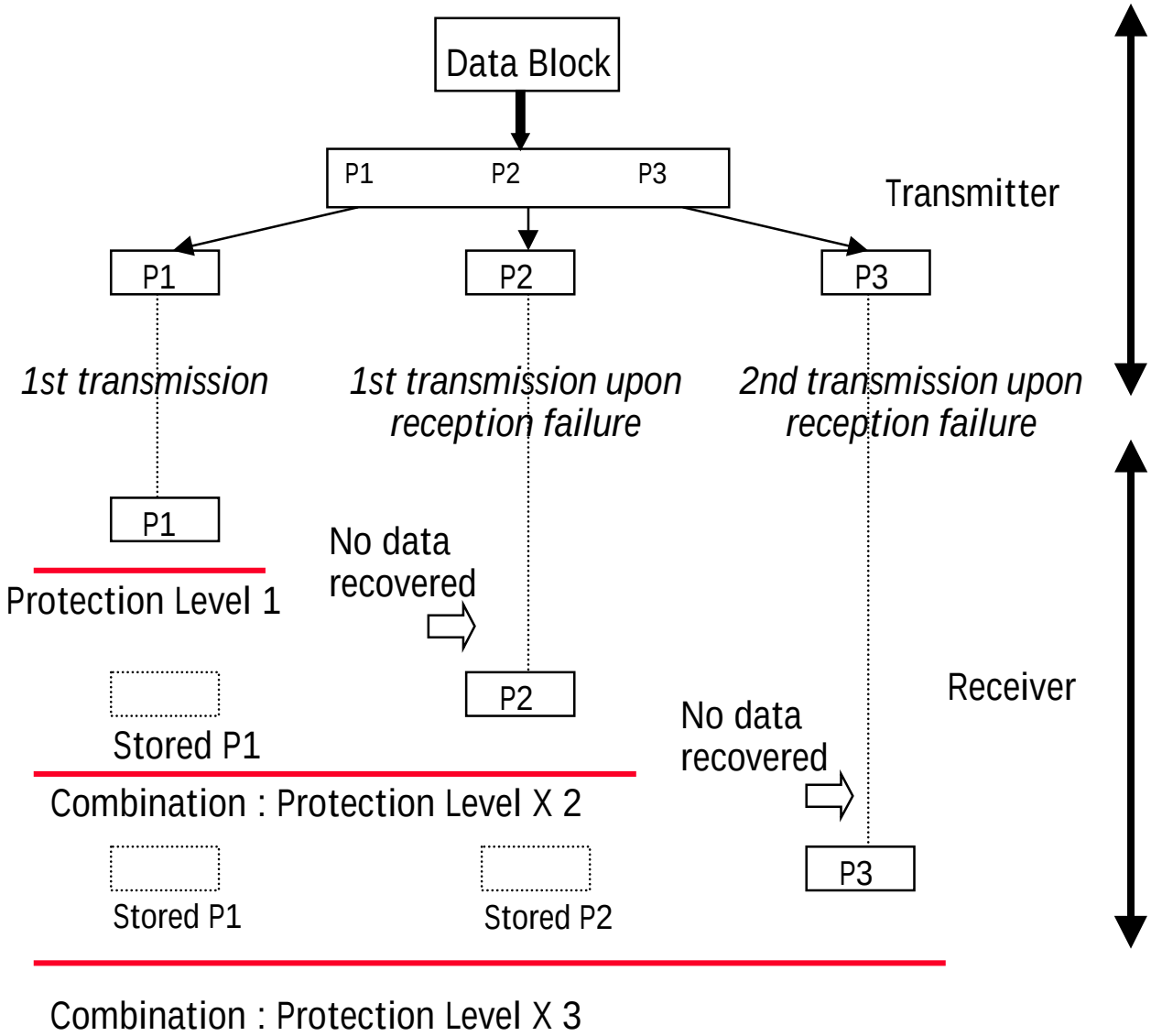
SubMenu

Link Quality Control

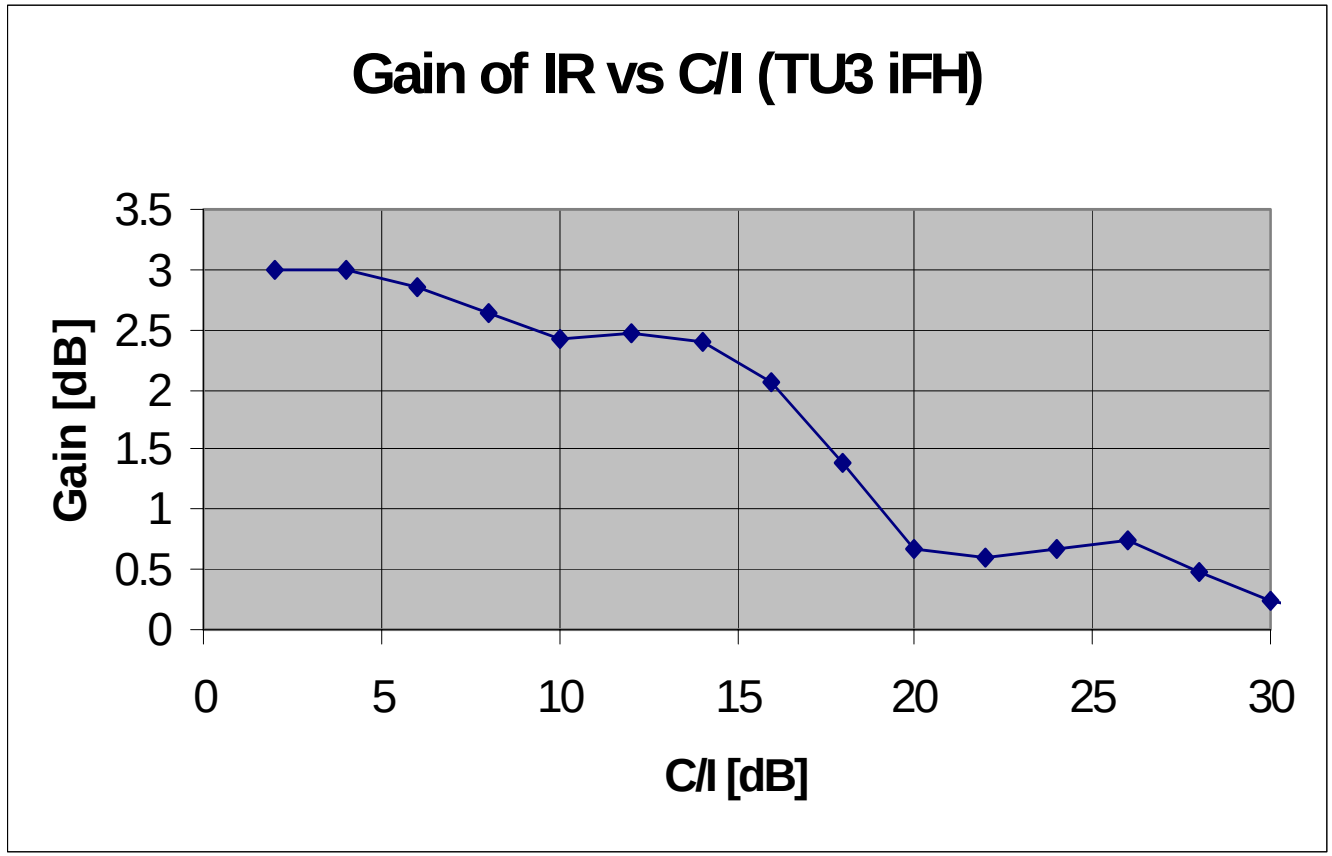
Incremental Redundancy



SubMenu

Incremental Redundancy Gain

TU3 channel and ideal FH conditions.



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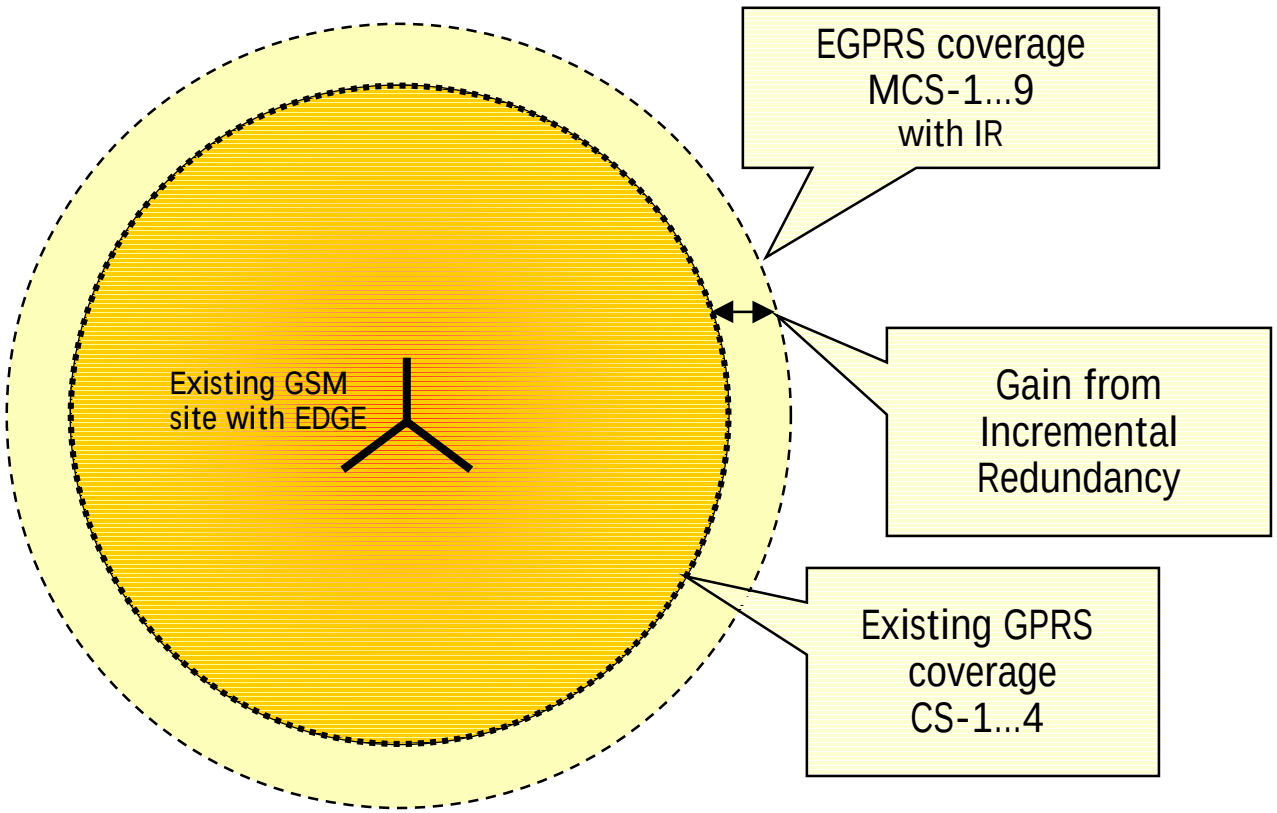
SubMenu

EDGE Coverage

- EDGE has app. 20% better coverage than the existing GSM
  - EGPRS coverage 3dB better



→ very good EGPRS data throughput in whole cell area

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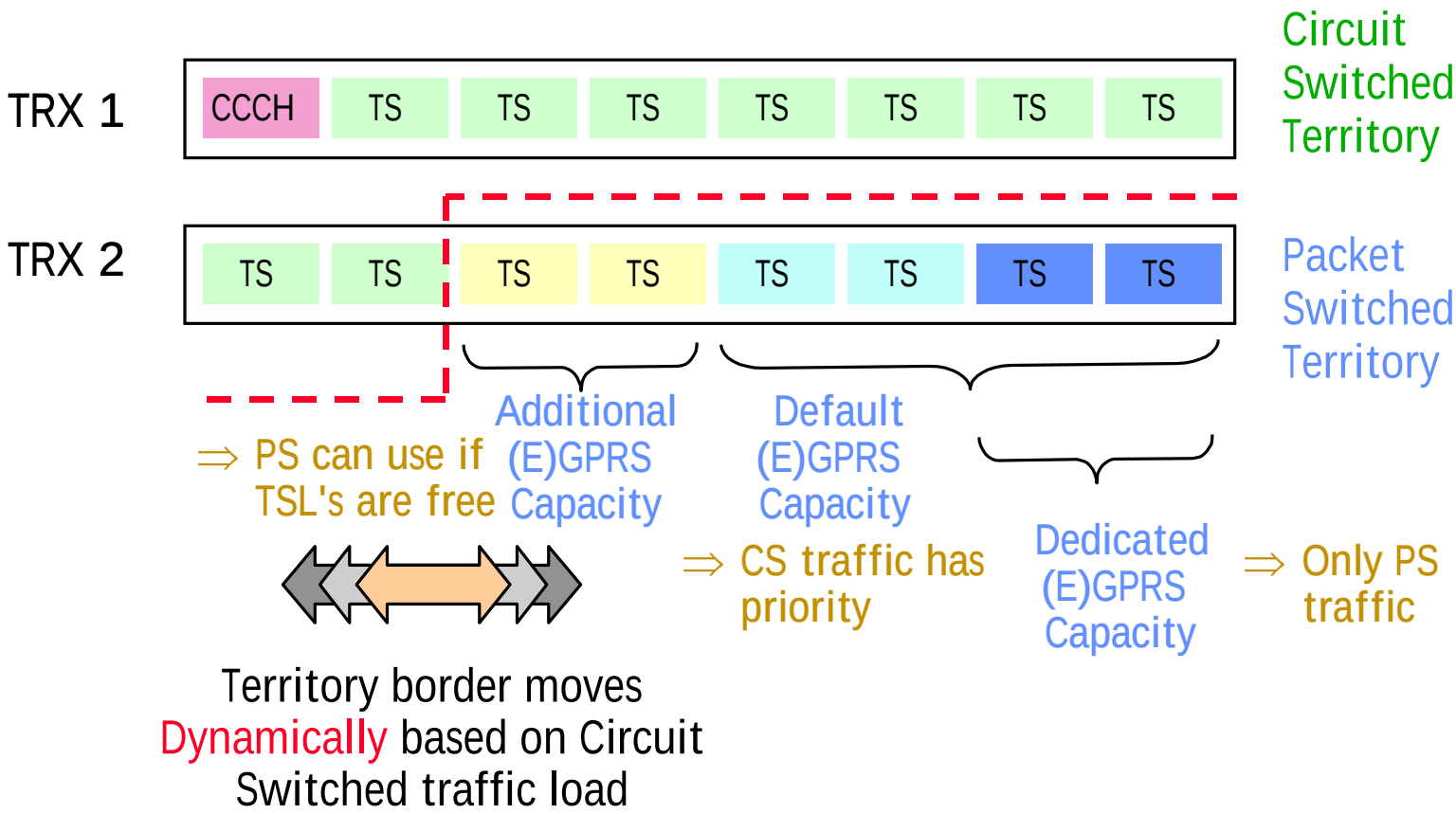
SubMenu

EGPRS Territory Method



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SubMenu

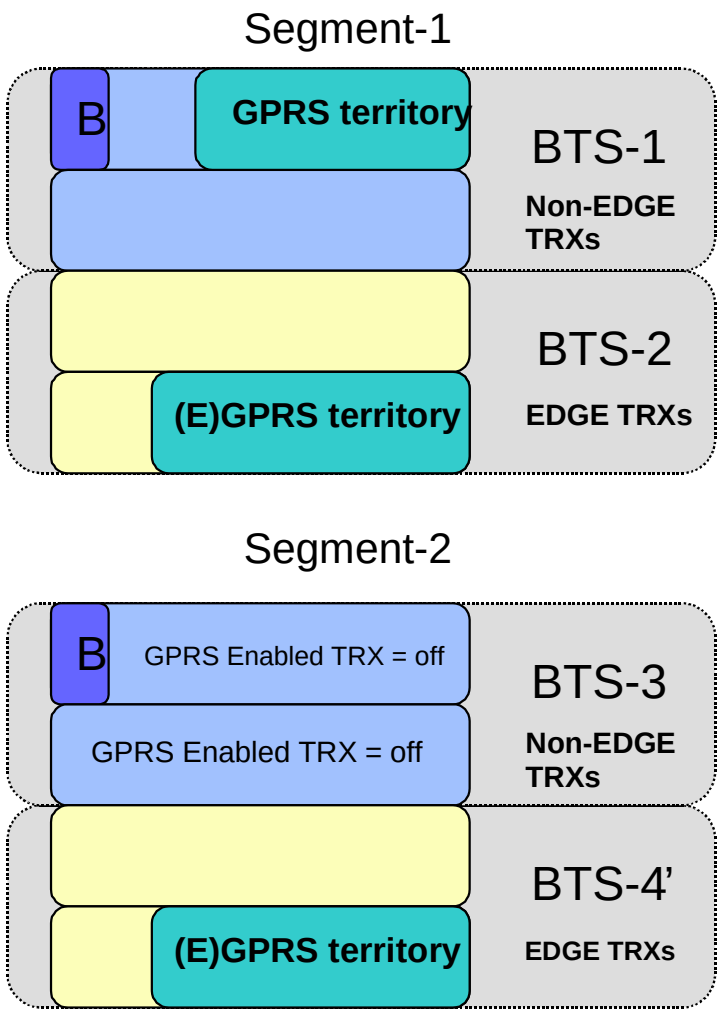
Territories - EDGE and non-EDGE

Where separate EDGE and non-EDGE ‘layers’ exist, territories can be defined for each.

BTS Synchronisation permits ‘intelligent’ resource management.

EDGE mobiles will be using EGPRS cells and GPRS mobiles will be kept on GPRS territory.
Load based intelligence on both ways to guarantee capacity

EGDE TRX and non-EDGE TRX must be configured under different BTS



SubMenu

Building the EGPRS network with minimum investments

- Best-effort type applications
  - WAP, mail downloading, internet surfing
  - QoS depends on location and network load
- No changes to existing frequency plans or site density
  - Minimal investment

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SubMenu

Nokia High Capacity EDGE Solution

- MetroSite and UltraSite base stations are EDGE upgradeable
- UltraSite is site compatible with TALK base stations
- Dynamic Abis saves in transmission expansion
- GSM and GPRS network support
- EDGE terminals
- EDGE planning services and tools

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SubMenu

Mobile Multimedia Capacity with Nokia MetroSite

- Enables high capacity multimedia capability with microcells
- Nokia MetroSite EDGE Base Station houses up to 4 multimode EDGE/GSM transceivers per cabinet
- High-density access at 58 GHz with Nokia MetroHopper Radio and Nokia MetroHub Transmission Node
- Lowest cost of ownership for capacity

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SubMenu

Mobile Multimedia Coverage with Nokia UltraSite

- Up to 12 EDGE TRX's per cabinet
- EDGE TRXs support GMSK and 8-PSK modulation
- Nokia UltraSite EDGE BTS provides enough transmission capacity for EDGE needs
- Support for Dynamic Abis for transmission concentration
- Site level downward compatibility with Talk-family BTSs (Synchronization, Rx sharing, same antennas and feeders)

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SubMenu

Mobile Multimedia Capacity and High Flexibility with Nokia BSCs

- The design target is that BSS9 GPRS HW and PCUs can be used with EDGE in BSC
- Additionally the 2nd PCUs, 8+1 can be added to increase the BSCs packet switched connectivity - They can be included also to new deliveries from S10 onwards
  - Then BSC maximum packet switched connectivity is 2 PCU/BCSU x 8 BCSU x 256 channels = 4096 16kbit/s Abis channels towards Abis interface.
  - Then towards Gb interface the maximum connectivity is 2 PCU/BCSU x 8 BCSU x 31 TSL = 496 x 64 kbit/s Gb interfaces (31.74 Mbit/s).

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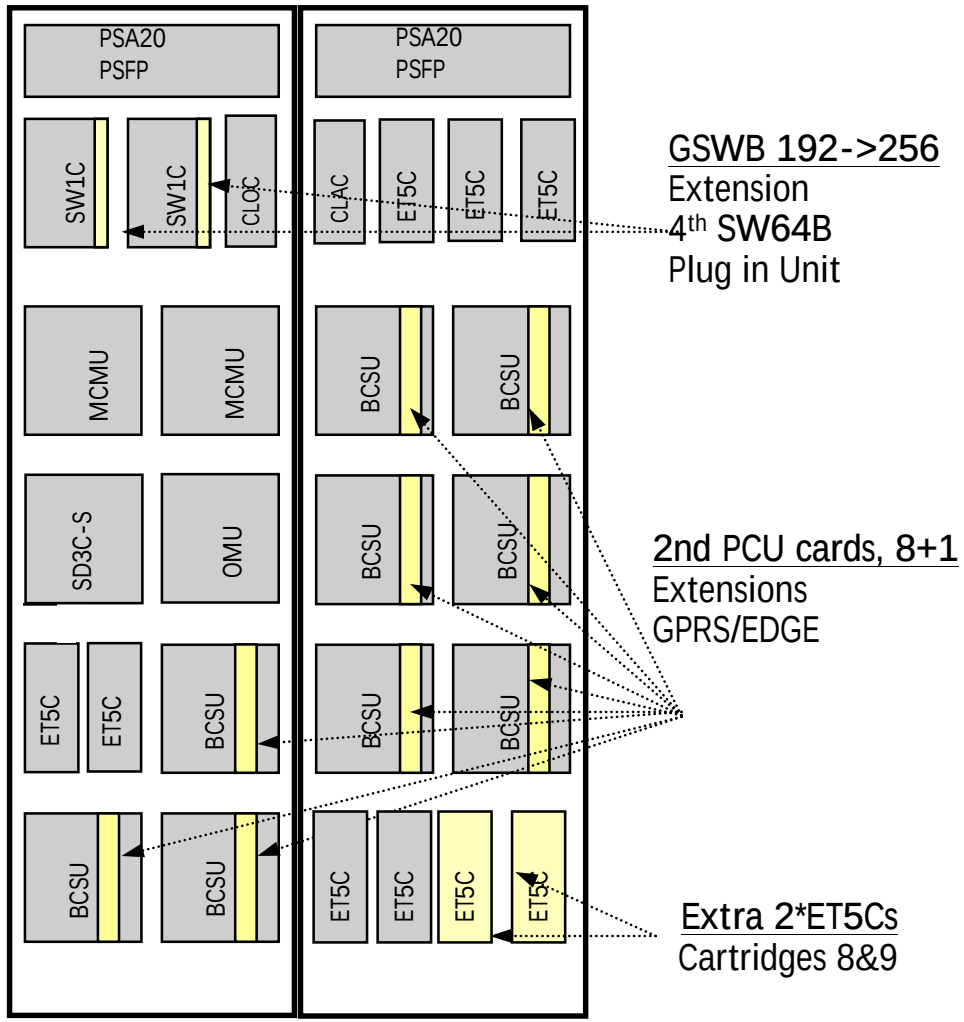
SubMenu

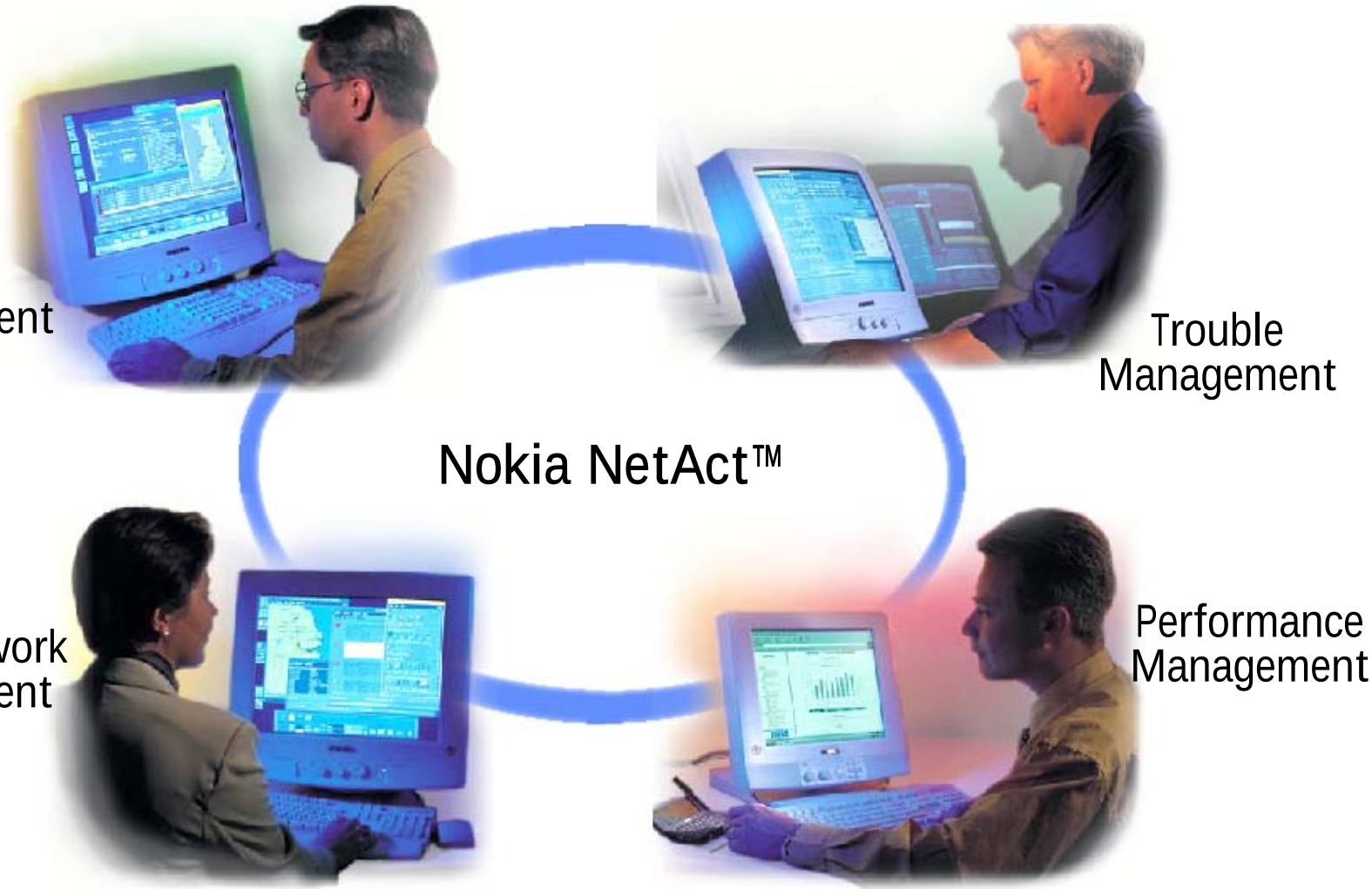
PCU Capacity Extensions in BSC2i, Optional

- 2nd PCU for BCSUs
- Requires GSWB extension kit (192->256 PCMs)
- Optional addition: External PCM extensions to increase PCMs in BSC2i from 112 to 144, ET5Cs 8&9, requires GSWB (256)



SubMenu

Nokia NetAct™ application products utilizing EDGE



SubMenu

EDGE benefits to the operator

- Migration to Mobile Multimedia services
- Improves end user satisfaction
- Possibility to early market deployment of 3G applications
- Fast & easy network implementation
- Optimised network investment as GSM/GPRS enhancement
- Complements to 3G-WCDMA technology

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SubMenu

EDGE benefits to the end user

- Improved quality of service
- Mobile Multimedia services
- Potentially lower price per bit

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Nokia Smart Radio Concept for EDGE

Boosts both Uplink and Downlink

Nokia SRC in BSS10 consists of

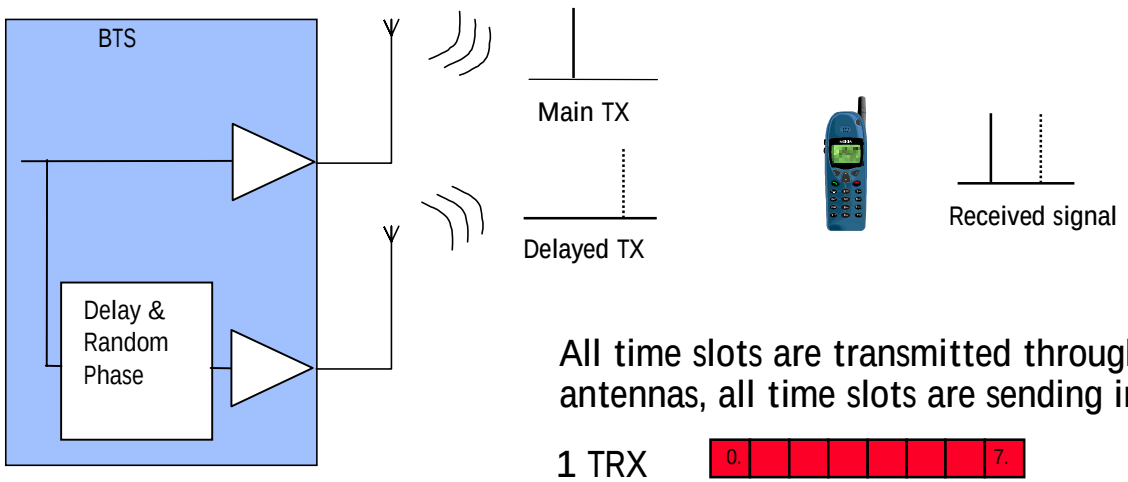
- Downlink link enhancing feature
  - Intelligent Downlink Diversity (IDD)
- Uplink enhancing features
  - 4-way Diversity
  - Interference Rejection Combining (IRC)

Up and downlink features can also be implemented separately

NOKIA

Downlink enhancement - Intelligent Downlink Diversity (IDD)

- For extending the cell coverage by boosting BTS downlink transmission performance up to 5 dB (min. 3 dB).
- Minimum two EDGE transceivers and two antennas (or X-polarised antenna) needed for one cell. The same downlink signal is transmitted through two antennas.
- Auxiliary transmission is delayed 1-1.5 symbol periods which gives good performance for all modulation schemes. Random Phase hopping degreases correlation between the main and auxiliary transmitter. Correlation between the antennas have to be low.



All time slots are transmitted through two transceivers and antennas, all time slots are sending in BCCH

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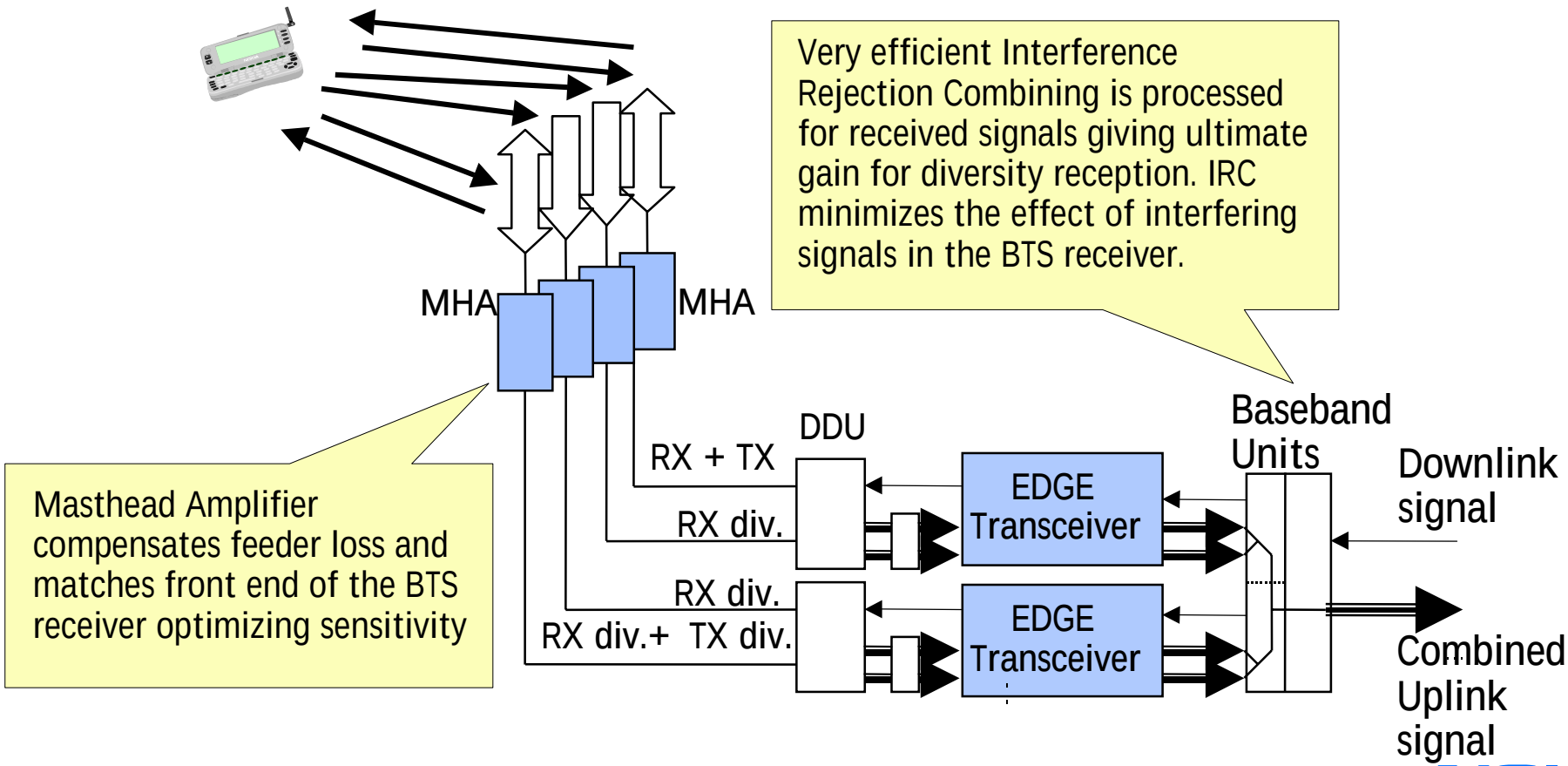
Uplink enhancement - 4-way Diversity and Interference Rejection Combining (IRC)

- The uplink performance (BTS reception) is enhanced with
  - 4-way diversity reception with Interference Rejection Combining
  - sensitivity optimised high-gain Nokia UltraSite Masthead Amplifiers (already in BSS9).



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SubMenu

Nokia Talk-family/EDGE evolution
Multi-BCF Control

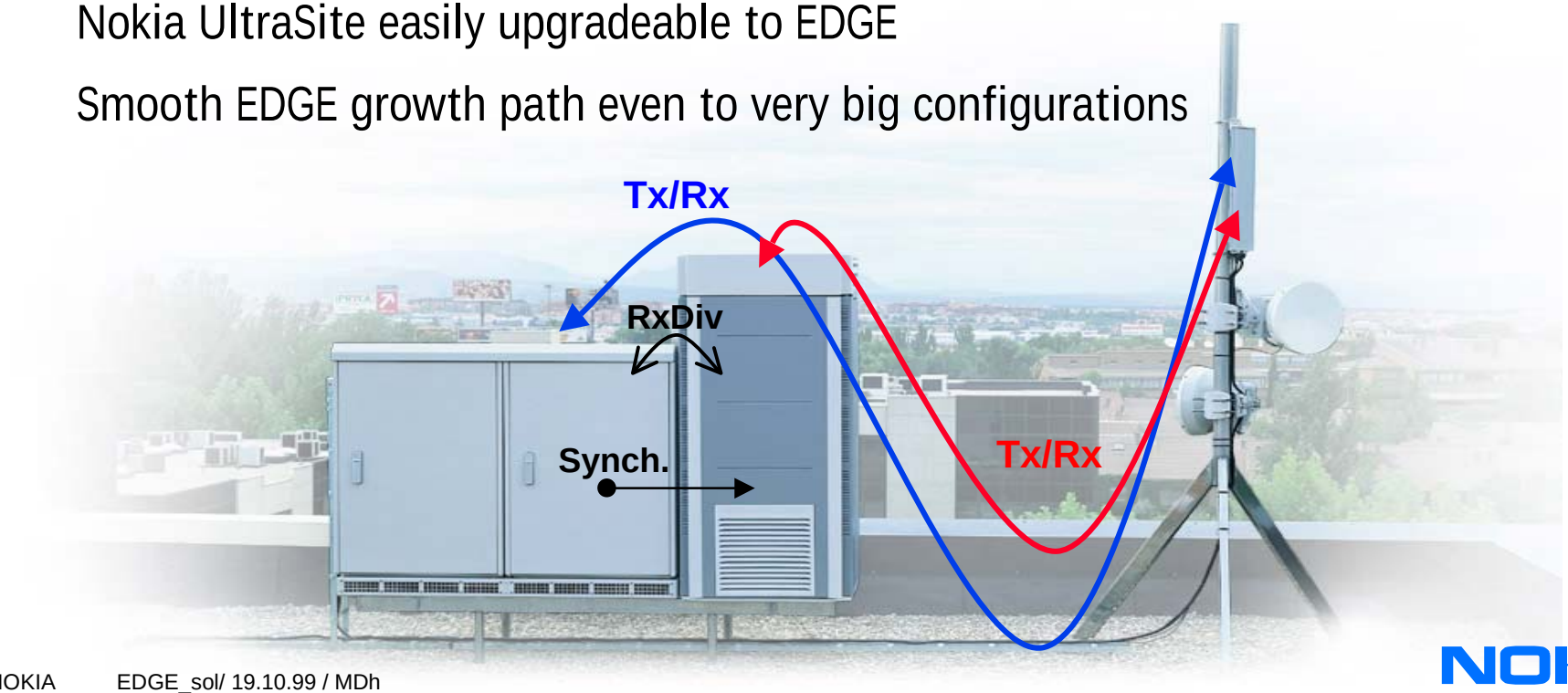
- Nokia UltraSite as extension cabinet for Talk-family BTS
- Synchronization, Rx sharing, same antennas and feeders

  Transmit and receive to the same cell

  2 dB improvement with Nokia UltraSite gives better data coverage

  Nokia UltraSite easily upgradeable to EDGE

  Smooth EDGE growth path even to very big configurations



SubMenu

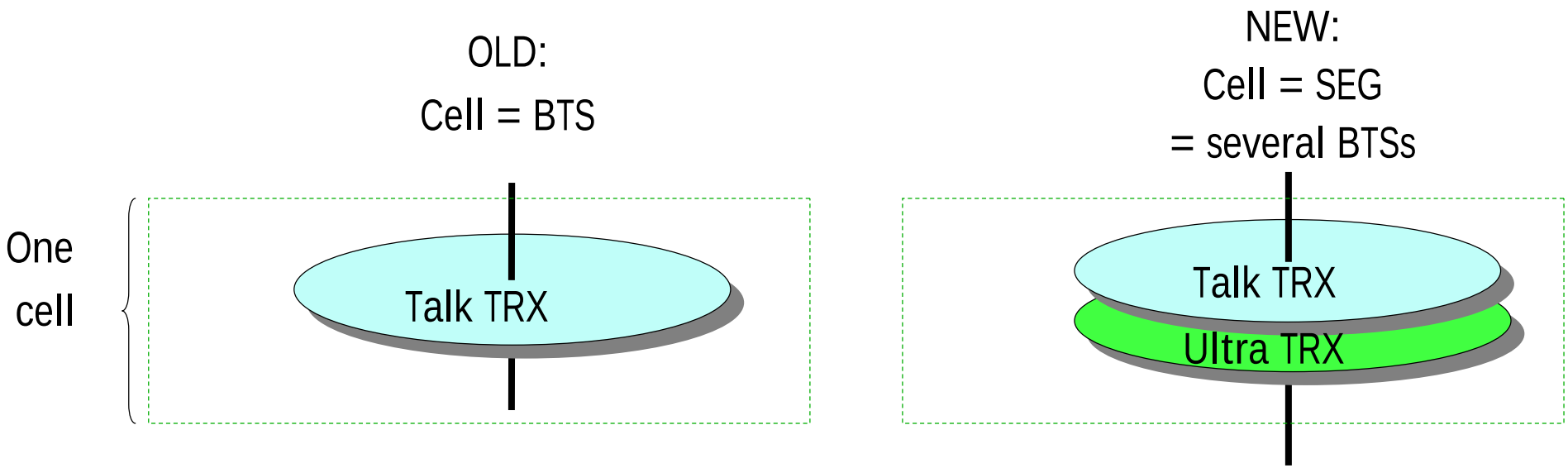
Multi BCF Control

- Allows combination of several BTSs into one logical cell
- All TRXs are of same frequency band
- Allows the operator to increase the capacity of a cell up to 36 TRXs while maintaining the maximum spectral efficiency (no extra BCCH)
- Site expansion path from Talk-family to UltraSite
- Evolution path to EDGE (operator can take EDGE in use in Talk-family cell by expanding it with UltraSite base station that will have EDGE capability)
- BSC supports Multi BCF for Talk-family and UltraSite base stations
- BCCH can be either on Talk-family or UltraSite TRX
- Introduces "Segment" concept

SubMenu

Segment in Multi BCF Control

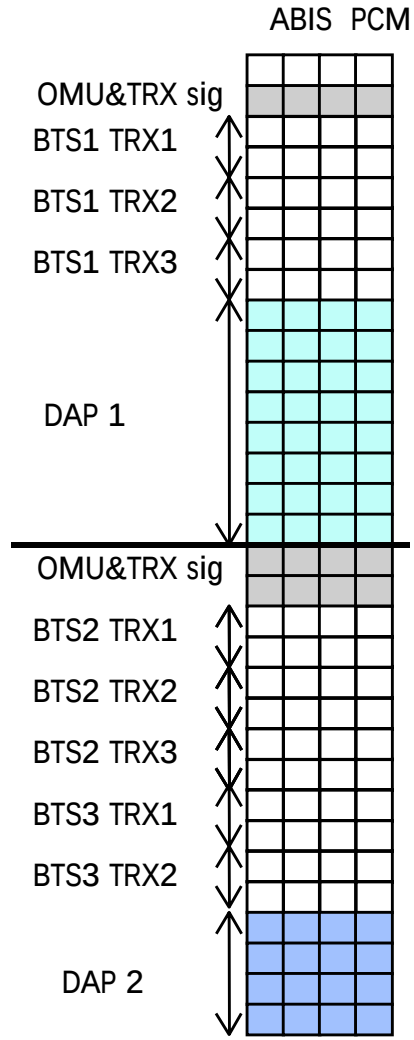
- Segment consists of several BTS objects
- BTSs of a segment are co-located and synchronized
- BTS in a segment is a group of HW-wise similar TRXs
  - BTS in a segment must consist of TRXs of the same base station site type (UltraSite, Talk-family BTS)



SubMenu

Nokia Dynamic Abis solution

- The Dynamic A-bis feature optimizes the loading of A-bis by splitting PCMs into permanent time slots for signalling/voice and a dynamic pool for data
- Savings in the A-bis transmission expansion cost
  - normal signalling links (TRXSIG and O&M SIG) and Abis channel allocation for TCHs allocated from the Abis fixedly as previously
  - Abis channel allocation for EGPRS demand will be made by BSC on a call basis from the transmission pool.
- The pool can be shared by max. 20 transceivers
- One PCU can have up to 16 Dynamic Abis pools
- Abis loop test works also with Dynamic Abis pool
- New measurement to control the usage of pool

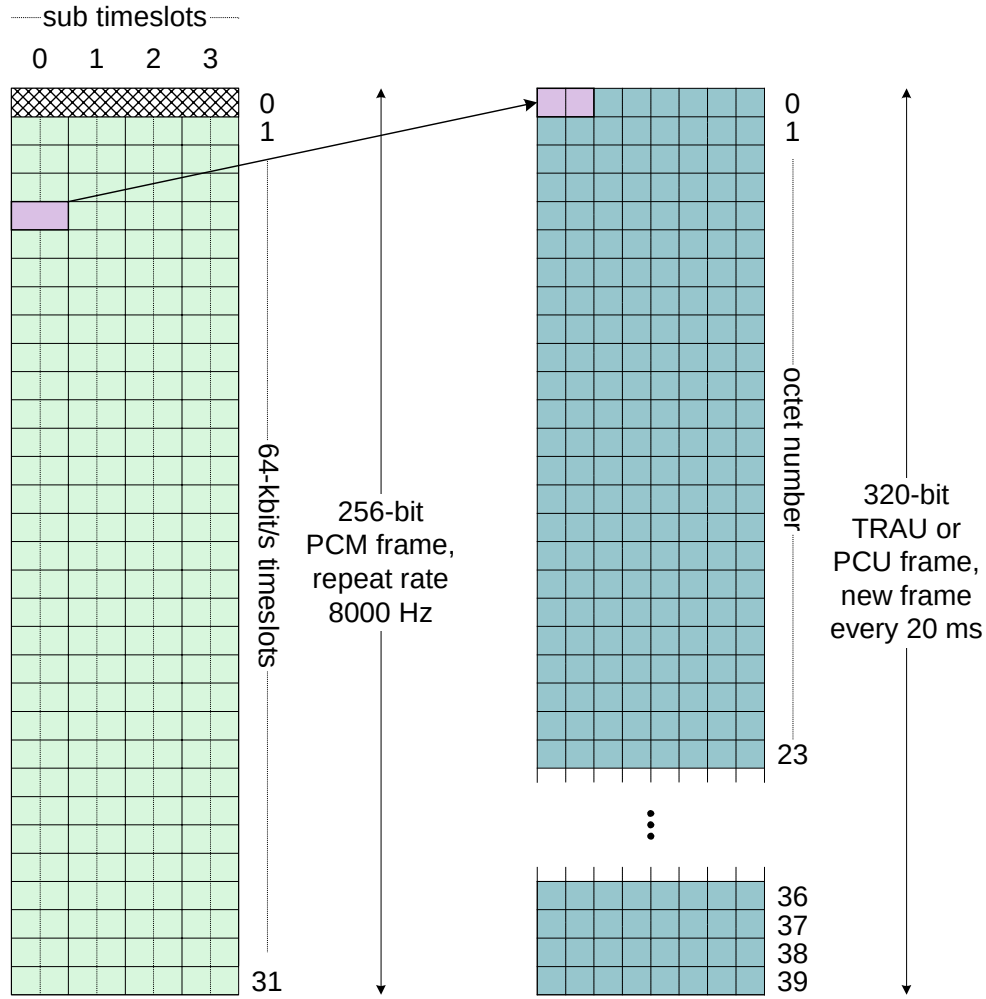


SubMenu

Nokia Dynamic Abis solution

PCM frame structure

- The figure shows the PCM frame structure for E1 (2048 kbps).
- Each frame of 256 bits includes 8 bits for each 64-kbps timeslot or 2 bits for each 16-kbps sub-timeslot.
- The sub-timeslots of 160 PCM frames form a TRAU or PCU frame that has 320 bits and includes the data for a radio block of 20 ms.

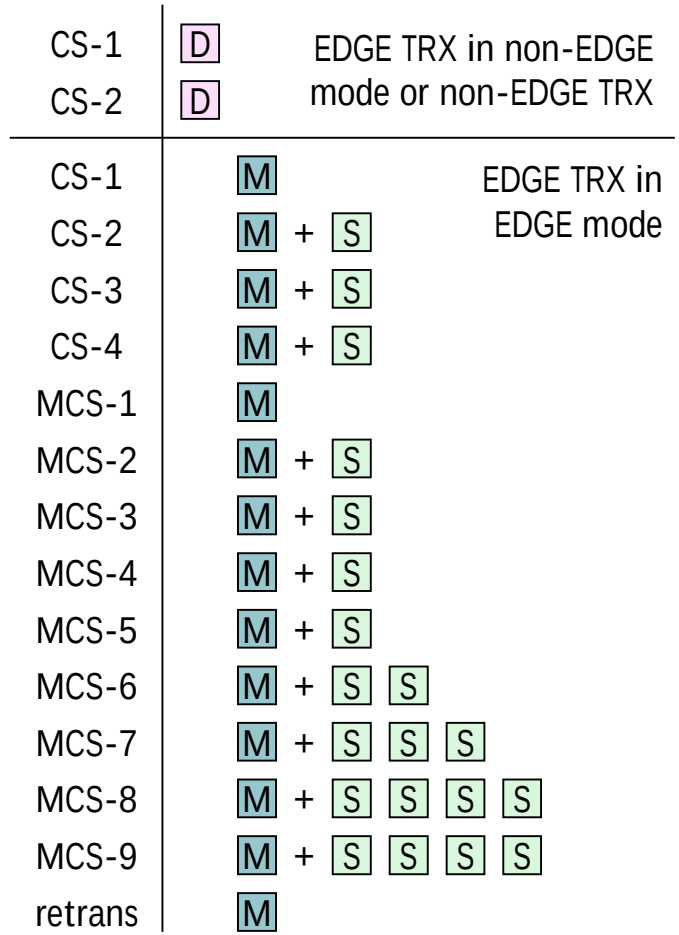


SubMenu

Nokia Dynamic Abis solution

PCU frame types

- PCU data frame
  - used when TRX not in EDGE mode
  - only able to carry CS-1 and CS-2
- PCU master data frame
  - used when TRX is in EDGE mode
  - carries CS-1 or MCS-1 on its own and CS-2...CS-4 and MCS-2...MCS-9 with the help of slave frame(s)
  - includes pointers to the slave frames
- PCU slave data frame
  - carries additional data that does not fit in PCU master data frames
- PCU random access frame
- PCU synchronisation frame



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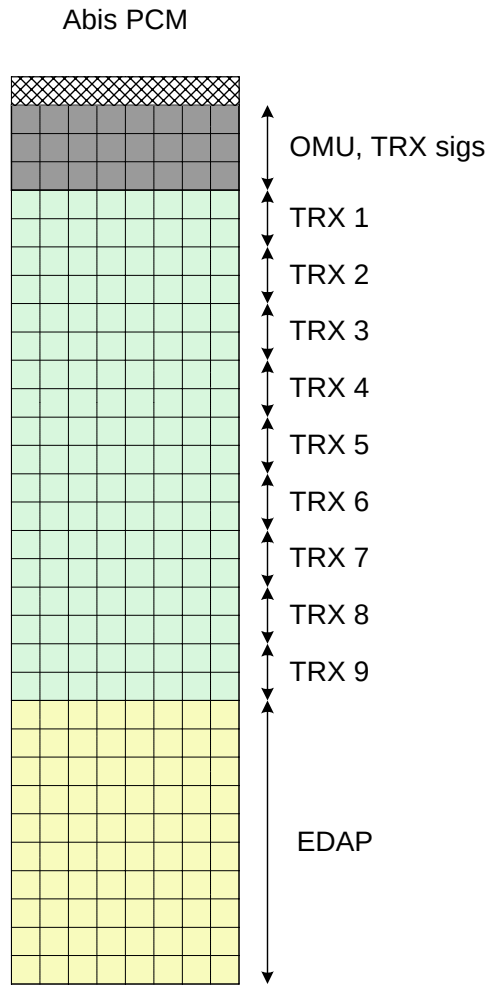
SubMenu

Nokia Dynamic Abis solution

Fixed channels and EDAP

- For each GPRS radio timeslot on each EDGE TRX, one fixed 16-kbps channel is allocated on the Abis for the transfer for PCU master data frames.
- PCU slave data frames are allocated in a common pool, the EDAP (EDGE Dynamic Abis Pool).
- EDIBA ASIC in BTS can transmit / receive 64 16-kbps channels of which 16 are reserved for circuit switched use or for PCU master channels. This leaves 48 16-kbps channels = 12 PCM timeslots as the maximum size of EDAP.
- A master channel and its slave channels and therefore the entire EDAP must be on the same Abis PCM.



SubMenu

Support of PCCCH/PBCCH

Benefits

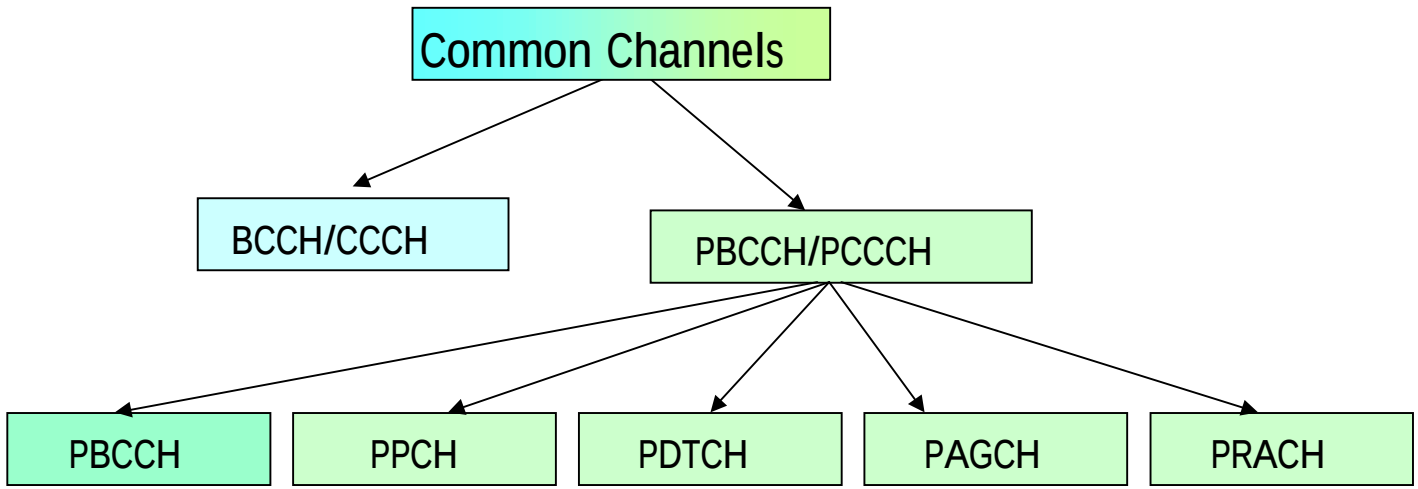
- More signalling capacity for (E)GPRS traffic
- Own neigbour cell list for (E)GPRS
- Own cell re-selection parameters for (E)GPRS:

  C31/C32 cell selection criteria

  – They are used to direct the GPRS traffic on the cells, which can serve EGPRS most efficiently and interference free to CS traffic

  – C31/C32 apply in cells using PBCCH/PCCCH, otherwise existing C1/C2 are used

- PBCCH is in the same TRX as BCCH
- PBCCH/PCCCH is hopping inside the hopping group the timeslot belongs to (Base Band Hopping)



SubMenu

Priority Class based Quality of Service

- At a system level the concept of 'Priority Class' is introduced

  This is based on combinations of GPRS Delay class and GPRS Precedence class values. Packets having higher 'Priority' are send before those packets having lower 'Priority', I.e. only scheduling will be affected in the first phase.

- Channel allocation

  Connections having same priorities will be scattered evenly to TLSs in GPRS territory, i.e. if possible, TBFs of higher QoS classes wouldn't be gathered in the same TSL.

- The number of served customers will not be affected

- In line with 3G QoS specification

  In 3G QoS 4 traffic classes are defined. The priority based GPRS classes can be mapped to 2 lowest 3G QoS classes: Interactive Class and Background Class, which are used for non real-time applications.

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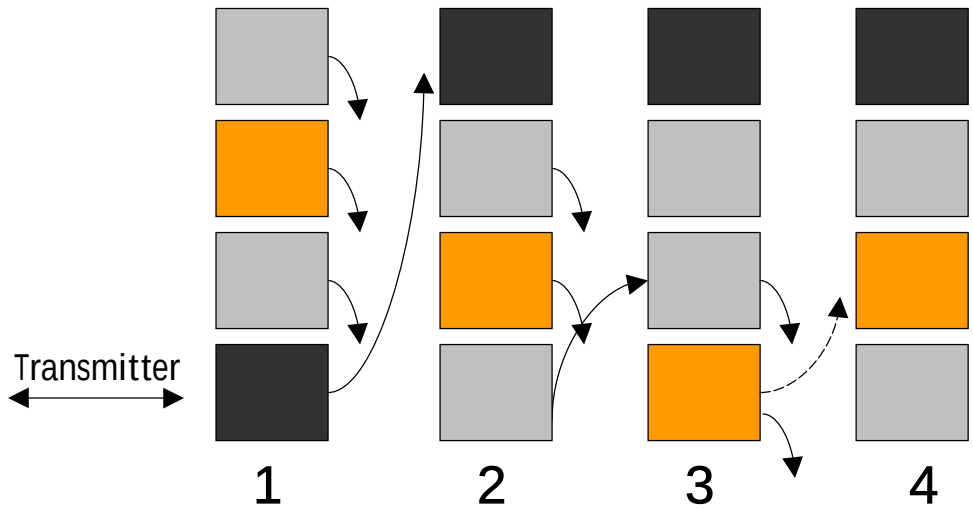
SubMenu

Algorithm description

- Channel allocation: Connections having same (highest) priorities will be scattered evenly to TLSs in (E)GPRS territory
- Scheduling: Each time slot has a queue in which the TBFs wait for their transmission turn after the TSL has been selected for the TBF
- The queue is ordered with a scheduling number that each TBF has
- The first TBF in the queue transmits
- After transmitting for a predefined time the TBF increases it's latest serving time with a predefined step
- Queue of four TBFs:

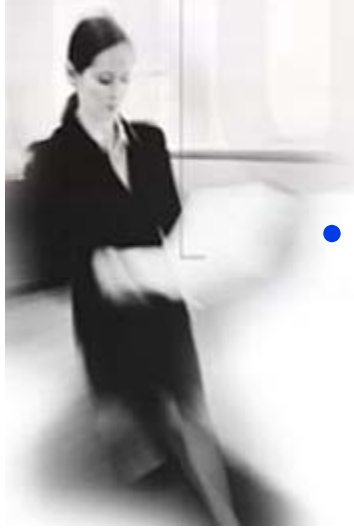


SubMenu

Priority Class based Quality of Service Benefits

With Prioirty class bassed QoS, operatores are able to:

- Create different service level for different user groups
- Provide a variety of services to the customers with a higher level of service prioritisation
- Ensure the high quality of the GPRS services



SubMenu

System Level Trace

- Trace facility is a useful maintenance aid and development tool, which can be used during system testing (cell 'footprint', network integrity and also the network quality of service can be monitored)
- Trace is activated by OSS
- HLR, SGSN, GGSN and BSS send trace records to OSS, when invoking event occurs
- Traces can be activated for home subscribers, foreign subscribers, and equipment

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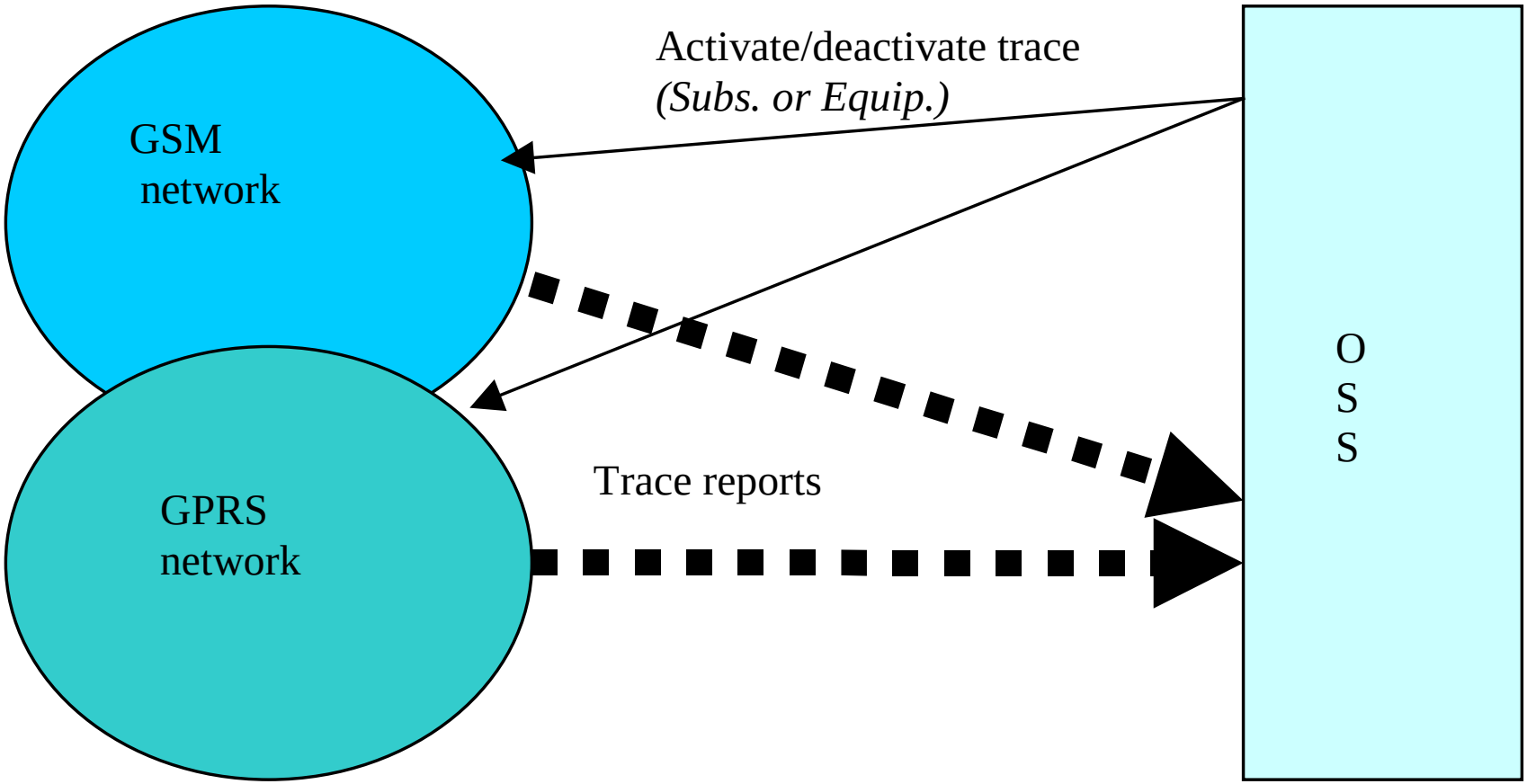
SubMenu

System Level Trace



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SubMenu

MICROCELLULAR

Microcellular features allow totally new solutions for GSM operators. Advanced features present new, more effective ways to increase network capacity, flexibility and quality issues.

Features Under Development in BSS10:

- BSS10102 Chaining of Nokia MetroSite Base Station

SubMenu

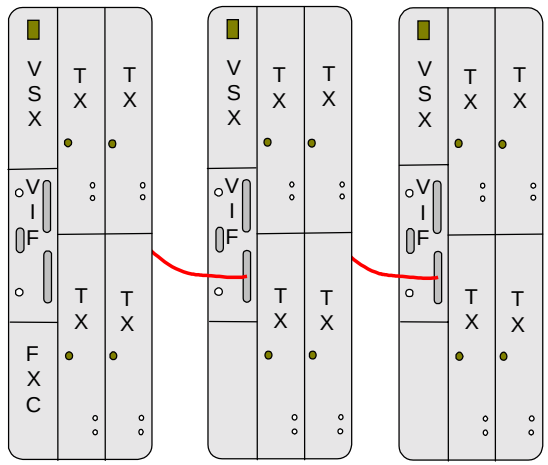
Chaining of Nokia MetroSite BTS

- Three Nokia MetroSite BTS cabinets can be connected together by using an extension cable

Master BTS
- controls O&M functionality

Slave BTS
- No FXC transmission unit
- No BCF

- The maximum configuration is 4+4+4 in three cabinets
- The TRXs are numbered sequentially numbered, i.e. from 1 to 4 in the master BTS, from 5 to 8 in the second BTS and from 9 to 12 in the third BTS



SubMenu

MACROCELLULAR

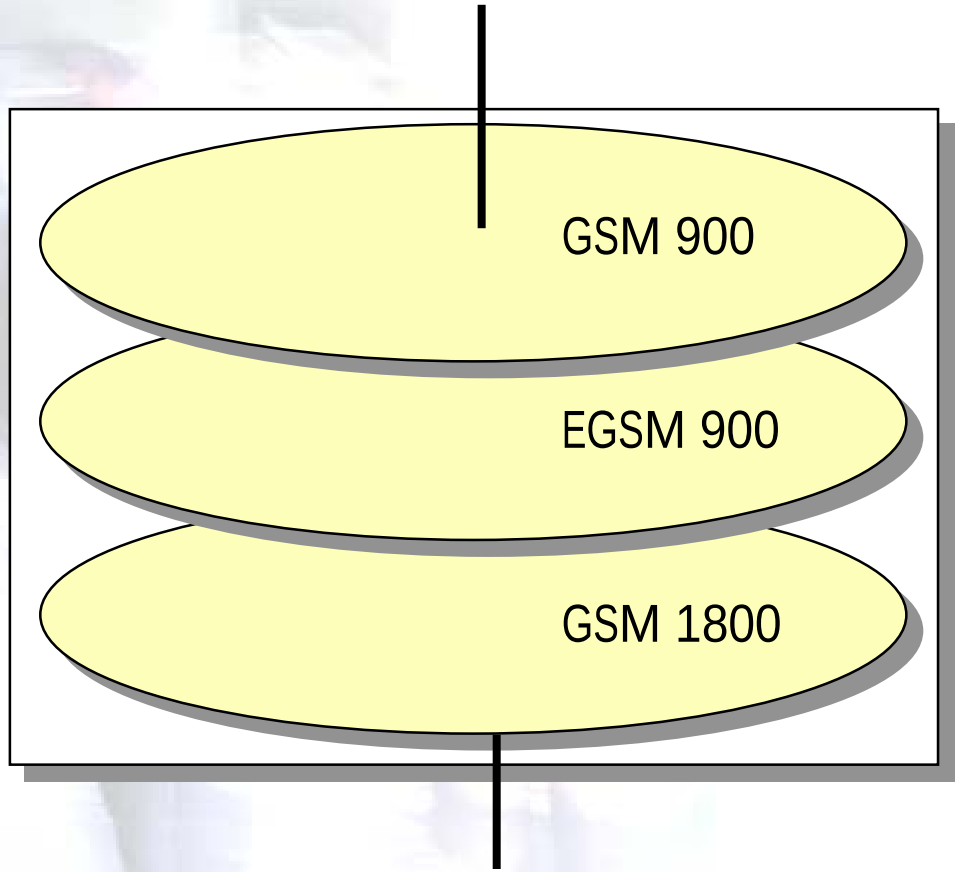
Macrocellular features allow totally new solutions for GSM operators. Advanced features present new, more effective ways to handle network flexibility, coverage and quality issues.

Features Under Development in BSS10:

- BSS10016 Tri Band - Common BCCH, Optional

SubMenu

Tri Band - Common BCCH



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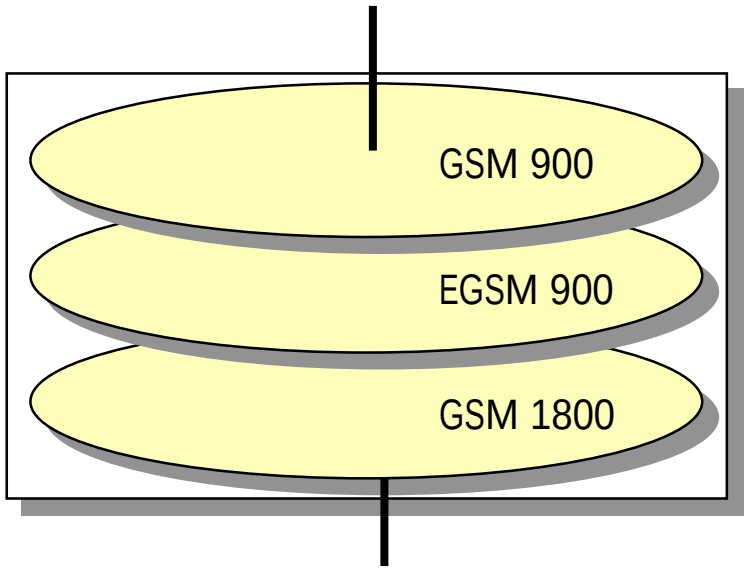
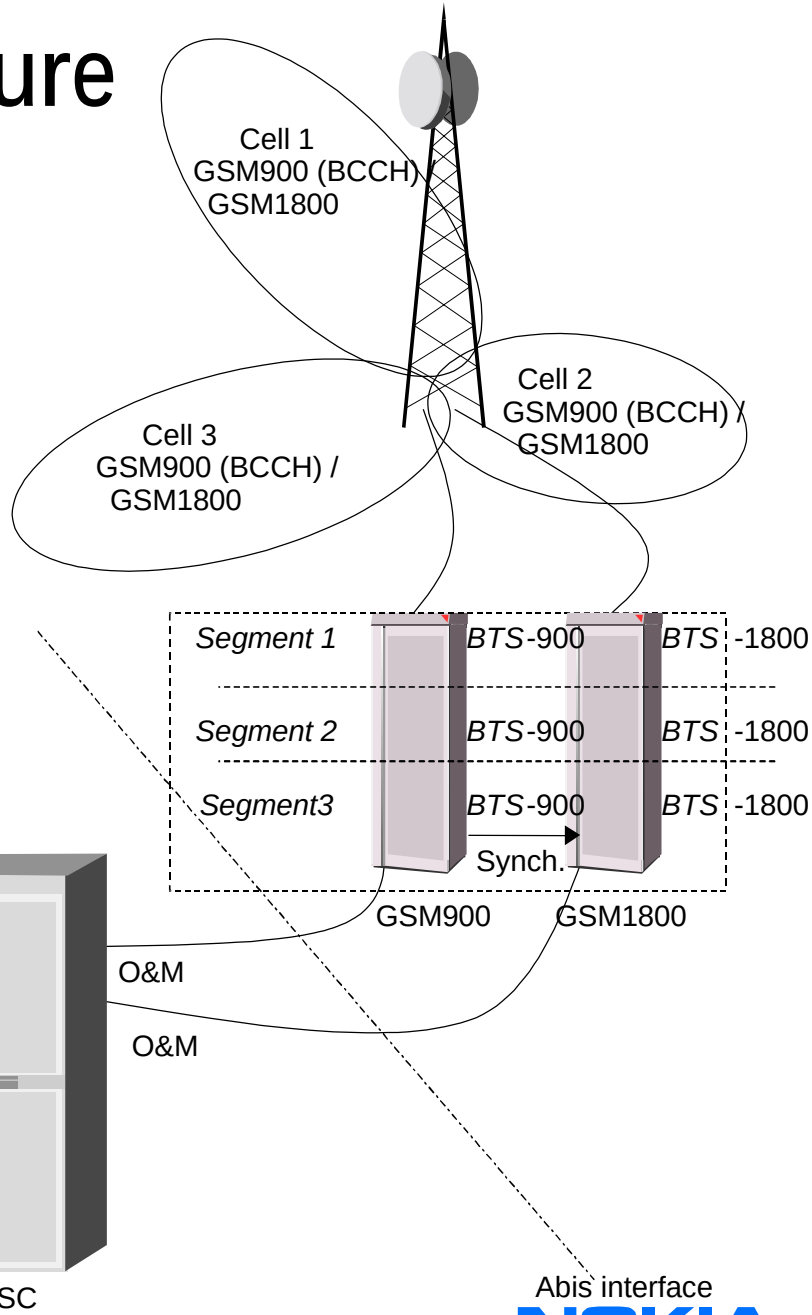
SubMenu

Common BCCH feature

- The basic idea behind the Common BCCH is to include the GSM900 (both PGSM900 and EGSM900) and GSM1800 TRXs into one cell with a BCCH allocated from one band used in cell.
- The TCH allocation between different band is made on cell basis by the BSC.
- New concept "Segment" is introduced

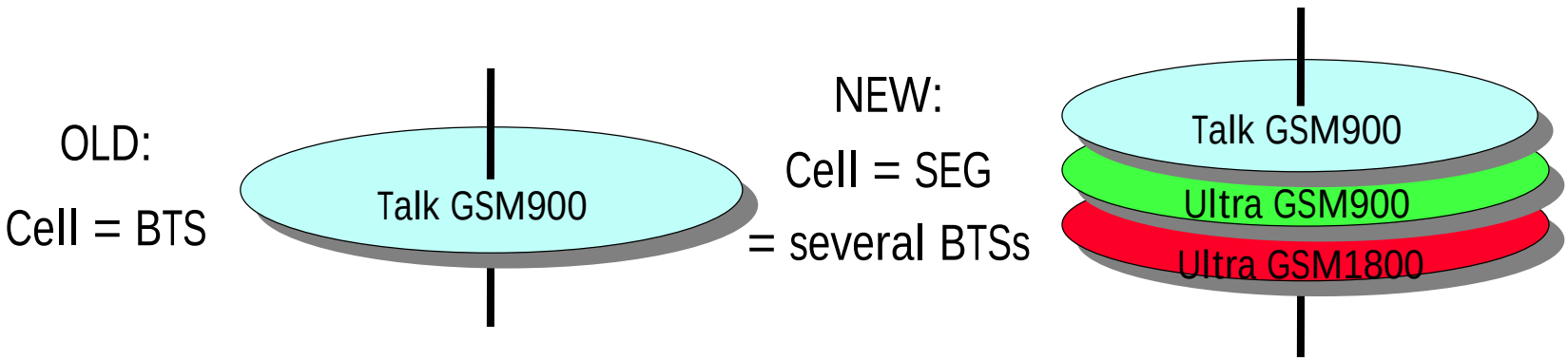




SubMenu

Segment for Common BCCH

- Segment may consist of several BTS objects
- BTSs of a segment are co-located and synchronized
- Segment usage is also an option of its own
- BTS in a segment is a group of HW-wise TRXs
  - BTS in a segment must consist of TRXs of the same frequency band (PGSM900, EGSM900, GSM1800 separated)
  - BTS in a segment must consist of TRXs of the same base station site type (e.g. UltraSite, Talk-family BTS)



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SubMenu

Common BCCH feature

- Common BCCH feature supports all BTSs excluding 2nd gen. BTS
- Frequency hopping is possible independently in all bands with 63 frequencies in MA lists
- IUO/IFH can be used independently in all layers
- GPRS territories are supported in all bands
- Call setup to GSM1800 based on signal level on GSM900 reduced by adjustable offset
- Load of bands controlled by band based load thresholds

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SubMenu

Benefits of Common BCCH

- Allows integration of PGSM900, EGSM900 and GSM1800 TRXs into one cell
- Provides service to MSs in all frequency bands which they support
- Improved spectral efficiency: different bands of a cell share the same BCCH
- Optimised use of signalling channels by sharing them between bands (BCCH, SDCCH)
- Tighter reuse of non-BCCH carriers
- Improved trunking gain
- Better quality due to decrease in number of handovers
- BSC supports Common BCCH for Talk-family, PrimeSite, UltraSite and MetroSite base stations

SubMenu

Nokia GSM/EDGE 800/1900 Solution

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GSM 800 in addition to GSM1900

- GSM is the most succesful mobile technology
  - GSM with best product portfolio, infra and terminals
    - Operators and end users benefit from economies of scale
  - GSM highly succesfull in Europe and Asia, very high amount of subsribers
    - 900 and 1800 MHz frequencies
  - GSM in Americas today relatively small subscriber base but expanding
    - So far only 1900 MHz has been feasible for U.S.
    - Operators in U.S. decided to go for GSM/EDGE evolution - starting domino effect
- GSM evolution to 3G with one system with GSM/EDGE/WCDMA
  - EDGE in existing 800, 900, 1800 and 1900 MHz frequencies
  - WCDMA to new 2100 MHz/UMTS frequencies
  - GSM/EDGE/WCDMA multi radio networks to All-IP

SubMenu

BSS10118

GSM benefits over TDMA and CDMA

- GSM technology evolution enabling revenue growth
  - GSM/EDGE and WCDMA well standardised and widely adopted
  - TDMA operators decided to go GSM/EDGE e.g. by AWS
- With GSM lower cost radio capacity and coverage
  - Continuous evolution, e.g. 3G with EDGE and WCDMA
  - GSM performance superior compared to TDMA
- GSM equipment and networks cost less than TDMA
  - Open system, global volumes, more suppliers, better performance
- GSM range of terminals is broader and increasing
  - Terminals from several mobile manufacturers

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Nokia GSM800/1900 Solution

- Nokia UltraSite EDGE BTS and MetroSite EDGE BTS
  - New GSM/EDGE 800 TRX
    - DL (BTS TX) 869-894MHz and UL (BTS RX) 824-849MHz
  - Triple mode UltraSite GSM/EDGE/WCDMA in one cabinet
- Nokia Base Station Controller
  - S10 Single band GSM/EDGE 800 MHz support
  - S10.5 Dual band 800/1900 MHz and Common BCCH 800/1900 MHz supporting all the existing Nokia BSS features
- Nokia NSS and GPRS core
  - No core changes when no separate charging info of 800 required
  - Otherwise radio network MML works and few changes to message definitions
- Nokia NetAct™
  - Nokia NetAct™ OSS 3.1 & 3.5

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SubMenu

VALUE ADDED SERVICES

Value Added Service features will offer a whole range of new kind of services for both the operators and the end-users

Features Under Development in BSS10:

- BSS10012 Nokia mCatch™ rel2.0 Location Services for E-OTD Phones, **Optional**
- BSS10112 Text Telephony (TTY)

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SubMenu

MS Location Based Services -

Nokia mPostion™ rel2.0 Location Services for E-OTD Phones

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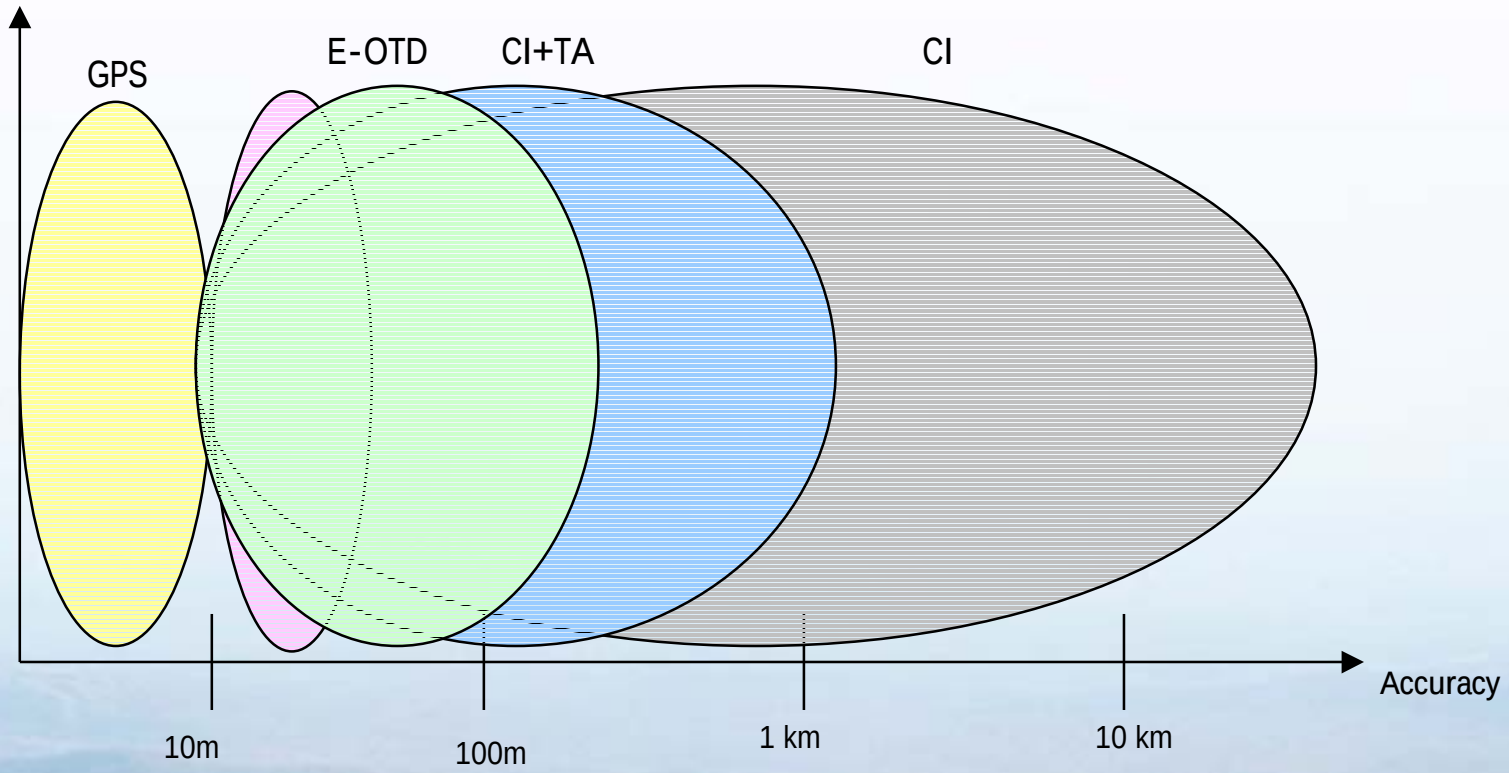
SubMenu

Summary of Location Method Feasibility by accuracy



SubMenu

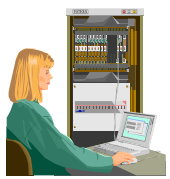
GSM Location Applications

- Regulatory requirement: Phase 2 emergency call

- Operator services

  Special traffic areas (e.g. home, office zones)

  Assistance for network planning (hot spots, tracking of dropped calls)



- Commercial applications

  Emergency roadside assistance

  “Where am I?”, “How do I get to...?”

  Nearest restaurant, gas station

  Car navigation

  Tracking packages, tracking of children, cars, stolen property

  Fleet management (trucks, taxis, buses)

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SubMenu

Commercial Services

COMMERCIAL SAFETY
- Roadside assistance
- Nearest medical center,
- Nearest doctor
 e.g. using 800 numbers

TARIFF SERVICES
- home zone: low cost calls
- office zone: low cost office calls + virtual PABX => wireless office
- "student phone" or "teenager phone"

TRACKING SERVICES
-fleet management
-tracking of cargo
-tracking of children
-tracking of elderly people

VALUE ADDED SERVICES
- information services
- nearest ATM, restaurant, gas station,...
- *WAP based* services

* can also use SMS or GPRS

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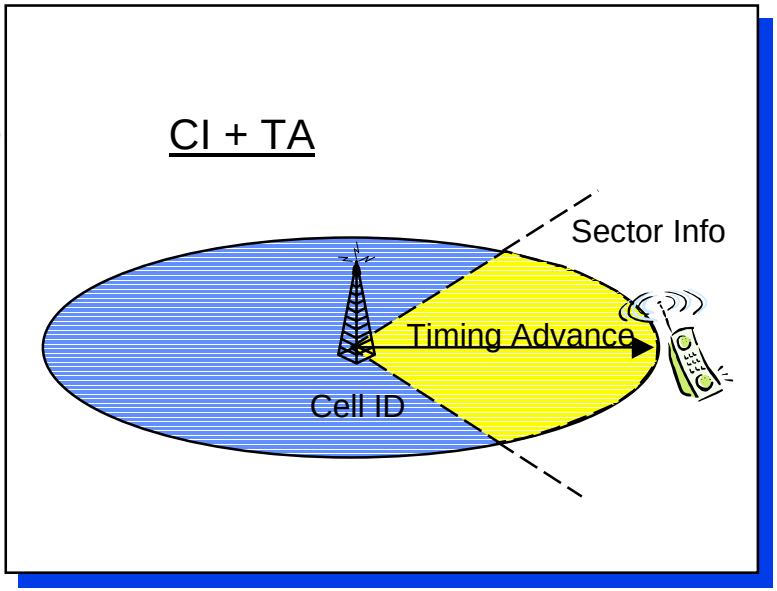
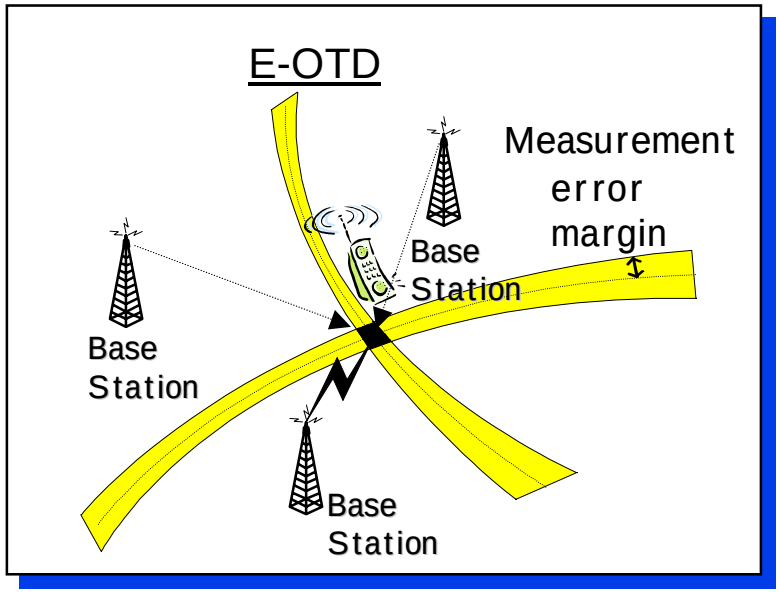
SubMenu

Positioning Method Alternatives

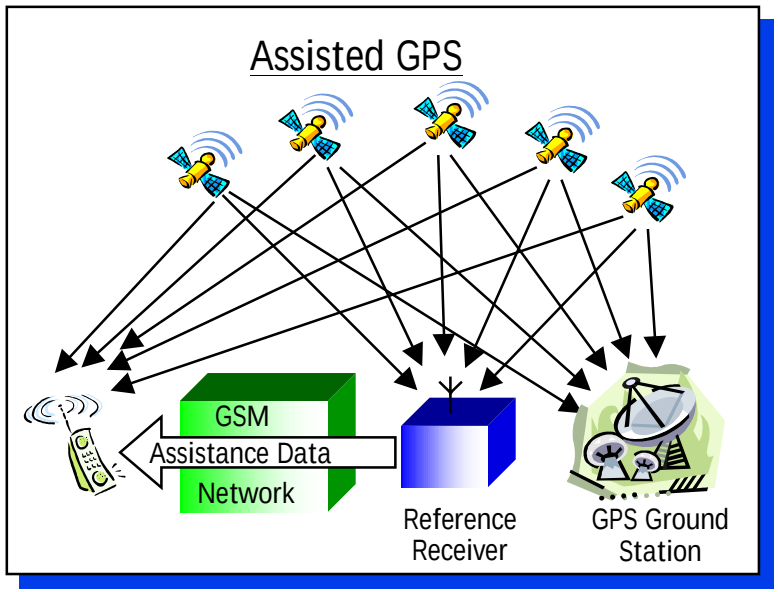
BSS9



BSS10



BSS11 candidate



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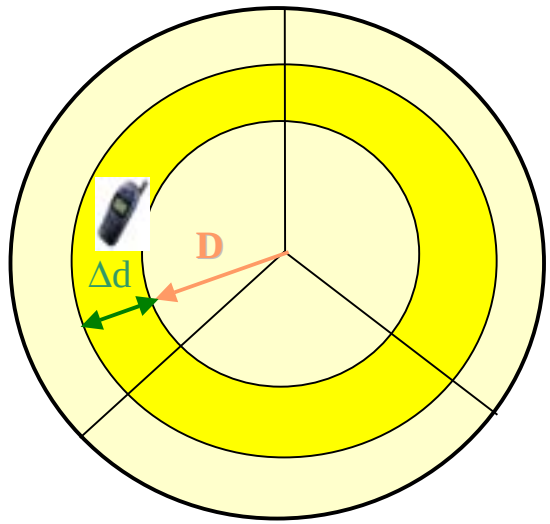
SubMenu

Cell ID + Timing Advance

The Cell ID+TA method is based on following:

- TA measurement performed by the BTS
- Serving cell identifier
- Co-ordinates of the serving cell
- Sector information



This is used as a backup solution where E-OTD cannot be used. e.g. in areas where the MS cannot hear broadcast channels of at least three cells and for MS that do not support E-OTD or standalone GPS methods

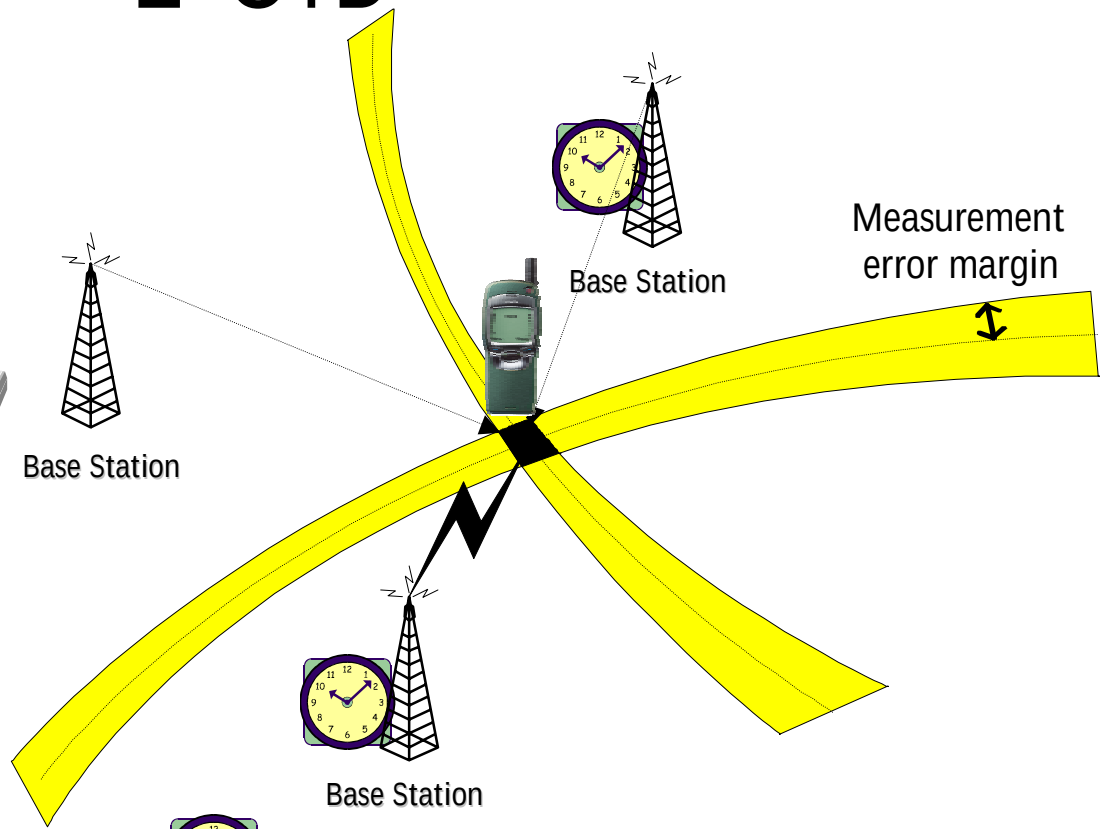
Also support for the stand-alone GPS method will be implemented in BSS10. The signaling between SMLC and MS is similar for E-OTD and stand alone GPS method.

SubMenu

Downlink Time Difference of Arrival Methods E-OTD

Unsynchronized Base Stations

- MS measures the TDOAs (=OTDs) of at least three base stations
- The base stations' timing differences in the air i/f (RTDs) are measured
- Location estimate is based on Geometric Time Differences (GTD = TDOA - RTD)



Location Measurement Unit (LMU) measures BTSs signals and keeps track of BTSs clocks

Real Time Difference (RTD) is relative synchronization difference between BTSs

Time Difference of Arrival (TDOA) or Enhanced Observed Time Difference (E-OTD) is time difference in reception of BTSs signals in MS

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SubMenu

Characteristics of E-OTD Location Method

- E-OTD requires SW support in MS (no additional HW needed to MS)
- Handsets perform the measurements, location calculated in network

  E-OTD is not capacity limited, thus enabling high capacity operator and mass market applications (e.g. continuous tracking of dropped calls, hot spot detection)
- Position can be calculated by MS in idle mode, no two-way network connection for positioning is required.

  Supplementary information (BTS coordinates, RTD values) is required from the network,
- Location Measurement Units (or its functionality integrated to BTS) needed only for every 3-5 cell sites.
- In GSM networks E-OTD works seamlessly with GPRS and EDGE
- GPS and E-OTD complement each other

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SubMenu

LCS Architecture in GSM
- New Network Elements/Functionality

Gateway Mobile Location Center (GMLC)

- Is needed to enable 3rd party applications to access subscriber location
- The first node an external LCS client accesses in a GSM PLMN
- The GMLC may request routing information from the HLR
- After performing registration authorization, it sends positioning requests to and receives final location estimates from the MSC

Serving Mobile Location Center (SMLC/BSC)

- SMLC manages the overall coordination and scheduling of resources required to perform positioning of a mobile.
- It also calculates the final location estimate and accuracy.
- SMLC controls a number of LMUs for the purpose of obtaining radio interface measurements to locate or help locate MS subscribers in the area that it serves.
- SMLC function requires S10 SW and new more powerful CPUs for MCMUs. This new CPU, requires also MBIF-UA upgrades (MCMUs, OMU, BCSUs) for the BSCE/BSC2E/A BSC models

Location Measurement Unit (LMU)

- LMU is like a one BTS's unit, so LMU maintenance is part of BTS maintenance
- Two versions: one to be implemented inside the BTS cabinet, other outside the cabinet
- LMU makes Radio Interface Timing measurements of the signals transmitted by BTSs

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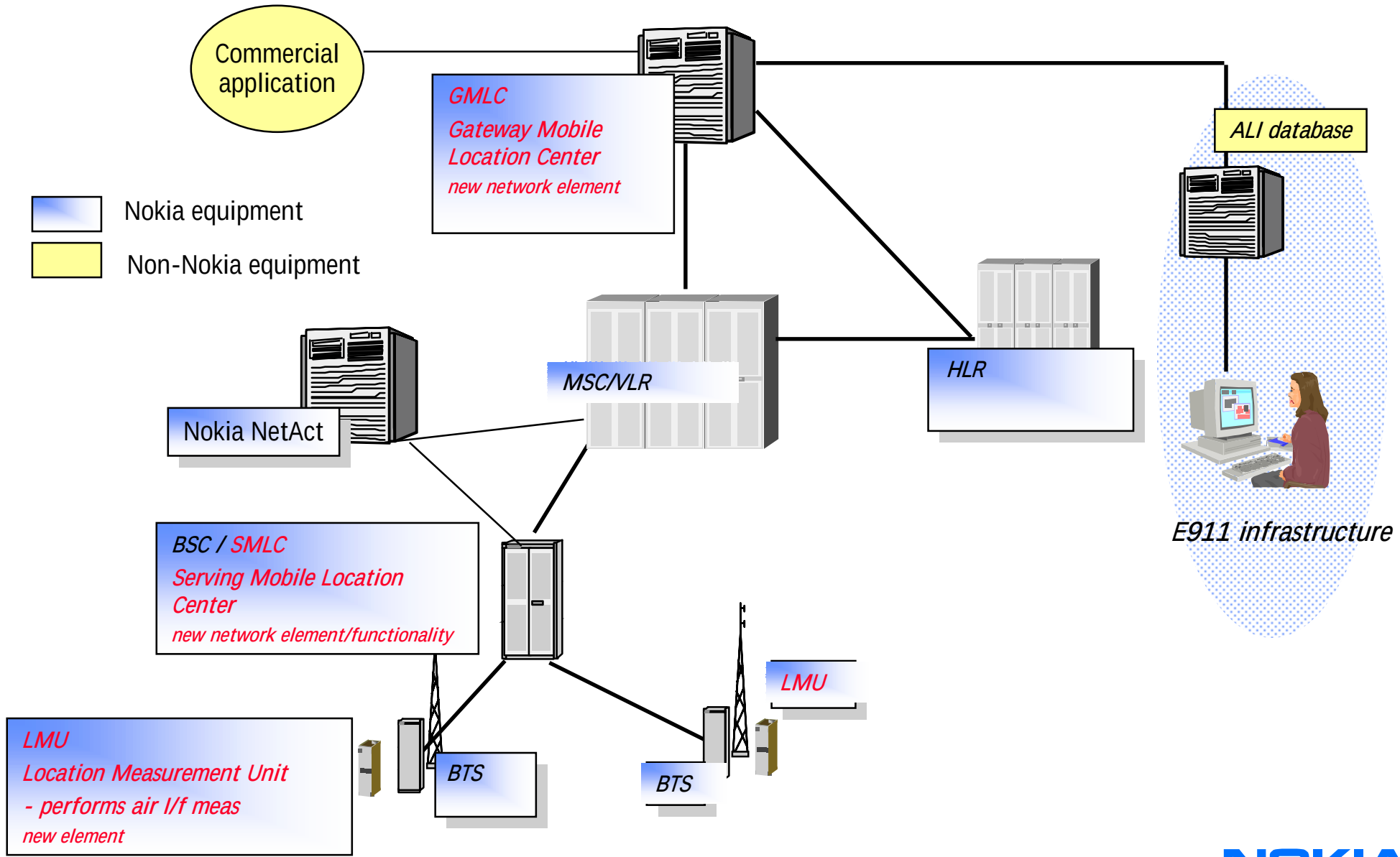
SubMenu

Nokia mCatch™ Release 2.0 Architecture



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SubMenu

BSC: SMLC Integration

- SMLC integrated into BSC, so BSC contains location calculation function
- S10 SW release is required
- More powerful CPU Card in BSC MCMU must be upgraded when LCS is taken into use and also MBIF-UA cards must be in use in BSCE/BSC2E/A (MBIF-UA needed also for high capacity level in BSC instead of MBIF-T)
- No separate SMLC maintenance (part of BSC maintenance)
- Tentative Capacity of E-OTD SMLC is 2 Location Requests (LR) per second and 7200 LR per BSC per busy hour. However these figures will be later confirmed after performance tests are done.

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SubMenu

MS Location Services HW Upgrades in BSC2i

- SMLC, kit (CP6MX Card)

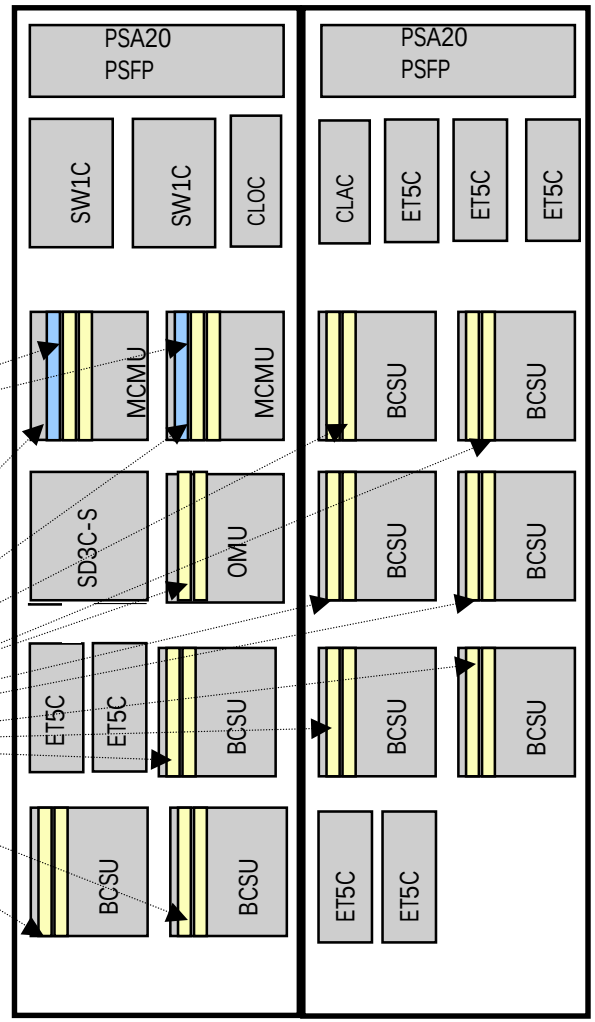
can be included from S10 onwards for new deliveries

- Message Bus, MBIF-UA upgrade is needed for

BSCE and BSC2E/A products

SMLC kit,
Upgrade
for MCMUs

MBIF-UA
Upgrade
for all BSC CPU units
max 2*12=24 units
Note: Not needed for BSC2i



SubMenu

LMU
Basic information

- Both for location services and for BSS synchronization
  - Location services for GSM900&1800 or GSM1900.
    - for E-OTD and NW assisted GPS
    - Implemented in every 2nd...5th BTS site.
  - Enables BSS synchronization. One LMU must be implemented in every BTS site in the synchronized area.
- Wire connection between BTS and LMU (B type LMU)
  - Easy and reliable O&M, SW downloading via cable
- Two versions: one to be implemented inside the BTS cabinet, other outside the cabinet. Wall and pole mounting kit's fit various installation positions
- GPS is integrated inside the LMU
  - for E-OTD AT (Absolute Time) and for NW assisted GPS
- Two separate and external antennas:
  - GPS
  - LMU RX
  - Designed to work with few lowcost GPS & RF antenna type's recommended by Nokia

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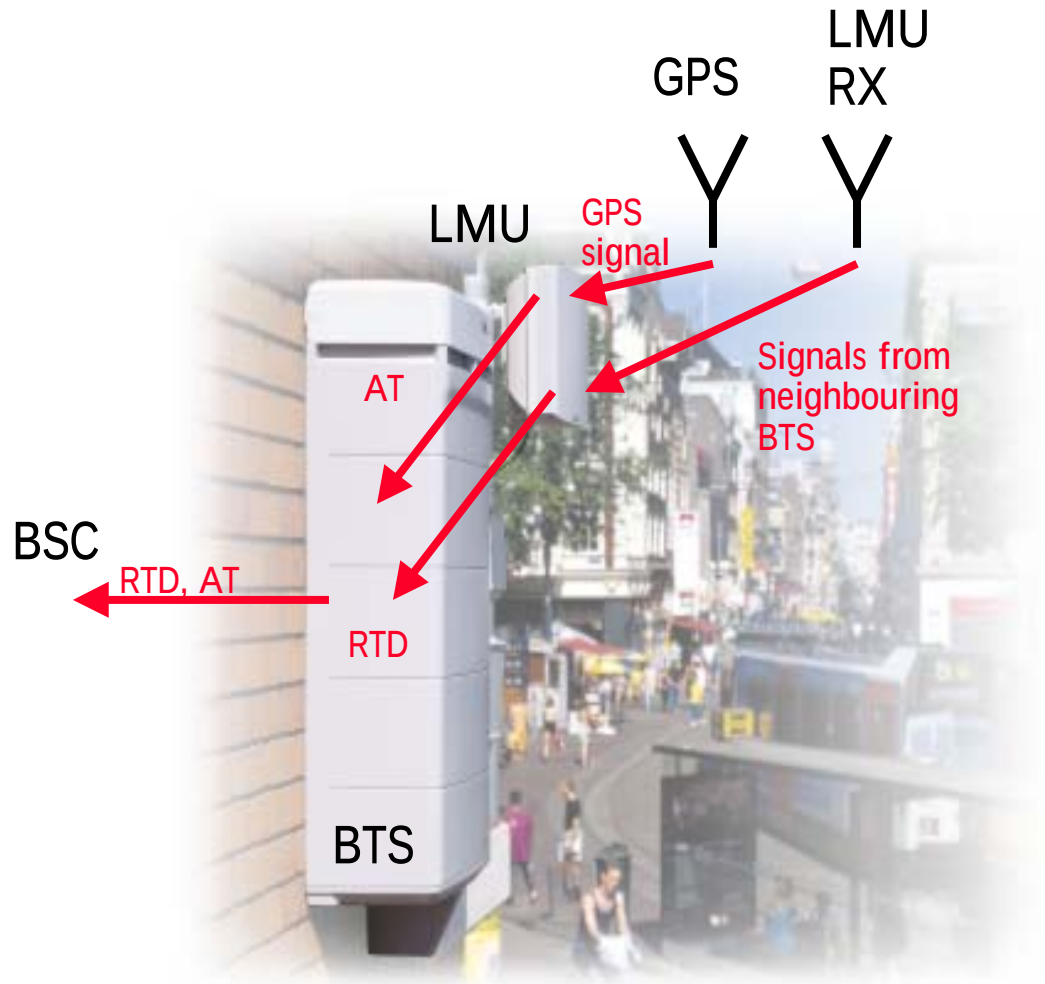
SubMenu

LMU
for Location Services

- External RX antenna receives the signals from neighbouring BTSs. Real Time Difference (RTD) values can be measured and reported
- By using accurate clock of GPS system, Absolute Time (AT) can be reported. Use of AT is recommended.
- Note! GPS antenna is not mandatory for every LMU unit. By using only relative measurements RTDs (via LMU RX) location can be calculated. However by using ATs (GPS) accuracy is improved and capacity is increased.
- LMU delivery package includes GPS antenna due to it being mandatory for BSS synchronization.



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SubMenu

Placing the LMU

BTS VERSION	LMU UNIT	Internal LMU	External LMU	Note
2nd Gen BTS Indoor	On the roof	X		Only MS Location, no synch support
2nd Gen BTS Outdoor	Under the weather-proof roof	X		Only MS Location, no synch suppor
IntraTalk	On the roof	X		
CityTalk	Under th e weather-proof roof	X		
FlexiTalk	Outside the BTS		X	Only MS Location, no synch suppor
PrimeSite	Outside the BTS		X	
MetroSite	Outside the BTS		X	
InSite	Outside the BTS		X	No synch support CI is enough for MS location
UltraSite	Inside the BTS	X		

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SubMenu

LMU's Technical Information

- SW support in BSS10 SW release
- SW downloading possible
  - excluding 2nd generation BTS
- Size
  - Indoor 30 mm*150 mm*90 mm
  - Outdoor 45 mm*240 mm*130 mm
- Weight
  - Indoor: 0.3 kilogram
  - Outdoor: 0.7 kilogram
- Power consumption
  - 3 Watts
- Connectors
  - 2 * 9 pin D connector
  - 15 pin D connector
  - 2* RF connectors
- Antennas
  - GPS
  - RX antenna
- User Interface

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SubMenu

Benefits of Nokia Solution

BSS Architecture

distributed calculation power, thus better calculation capacity

combination of different location methods

separate methods complements each other, so different mobiles (legacy, E-OTD capable, etc.) can be located and different applications can be supported (depending on accuracy requirement)

Smooth evolution path enables minimum investment in the beginning

- Minimum: only SMLC update to BSC (no LMU installations)
  - all MSs can be located with some accuracy (CI+TA)
- Recommended: LMUs implemented into certain areas at the beginning
  - E-OTD capable MSs can be located with high accuracy in the area
  - all MS can be located using CI+TA and the method can be used also as a backup for E-OTD phones
- More LMU implementation later on
  - better E-OTD coverage
  - support for the network assisted GPS
  - synchronized BSS areas are possible (LMUs are needed for BSS synch.)

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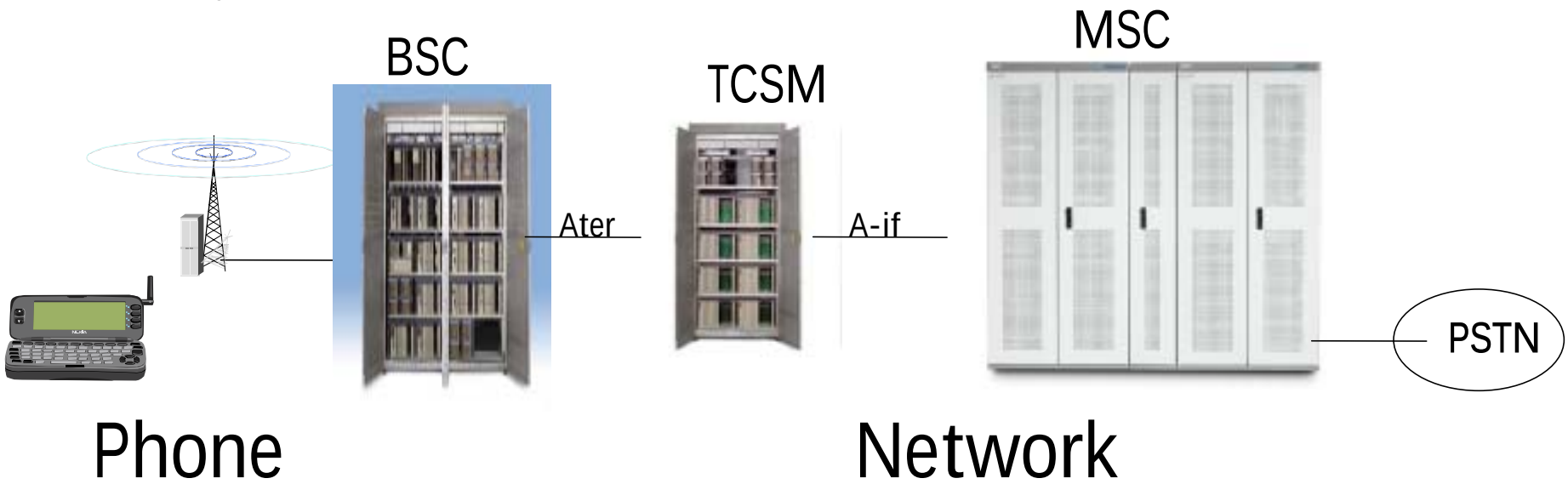
Text Telephone (TTY)

- Hearing impaired and speech-impaired persons have been using specific Text Telephone (referred to as TTY in North America) equipment in the fixed network to transmit text and speech through ordinary speech traffic channels
- Modern digital cellular systems do not provide satisfactory character error rates for text transmitted in the speech channel with the traditional modulation developed for the fixed network
- TTY functionality will enable people with hearing disability or speech impairment to communicate over mobile networks by transmiting text and speech through ordinary speech traffic channels with special TTY modems connected to the mobile phone

SubMenu

Nokia CTM Solution

- The GSM1900 Standards Body, T1P1, has selected and recommended Cellular Text Telephone Modem (CTM) solution to improve TTY/TDD signaling. This solution employs a modulation technique which passes through the speech coder with less distortion and includes error protection, interleaving, and synchronization
- Functionality is located in TCSM in Nokia's solution



SubMenu

TCSM2 Pool Configuration

- All the pools, except pool number 2, will support TTY
- TTY is exclusive with Noise Suppression in BSS10.

Supported codecs and features	Supported A-interface pools
FR, HR, EFR, AEC, HSCSD, NS	3, 7, 10, 13, 20, 21, 22 (DR, EFR&DR, HS2, HS4, EFR&DR&D144, HS2&D144, HS4&D144)
FR, EFR, AEC, TFO, NS	1, 5 (FR, EFR&FR)
HR, AEC, TFO, NS	2 (HR)
AMR, AEC, NS	23 (AMR)
FR, HR, EFR, AEC, HSCSD, TTY	3, 7, 10, 13, 20, 21, 22 (DR, EFR&DR, HS2, HS4, EFR&DR&D144, HS2&D144, HS4&D144)
FR, EFR, AEC, TFO, TTY	1, 5 (FR, EFR&FR)
AMR, AEC, TTY	23 (AMR)

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