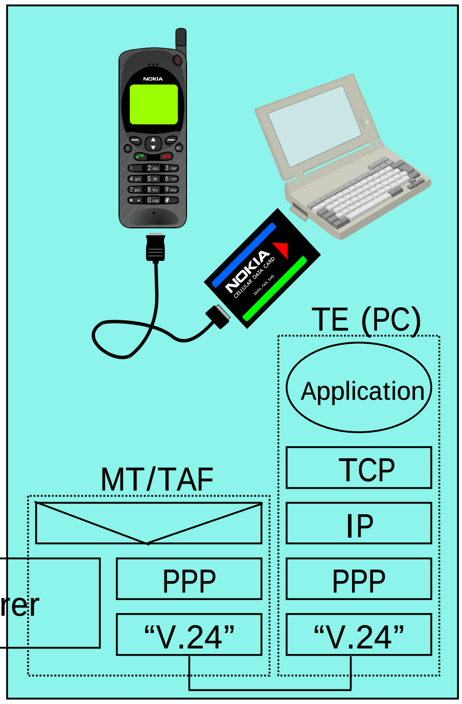
6.3 GSM Data Services

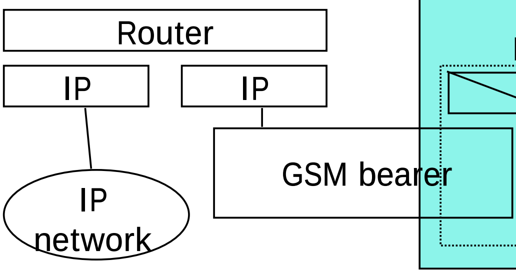
Connection MS - PC

- via cable und PC-card
- via Infrared (IrDA)
- via Bluetooth

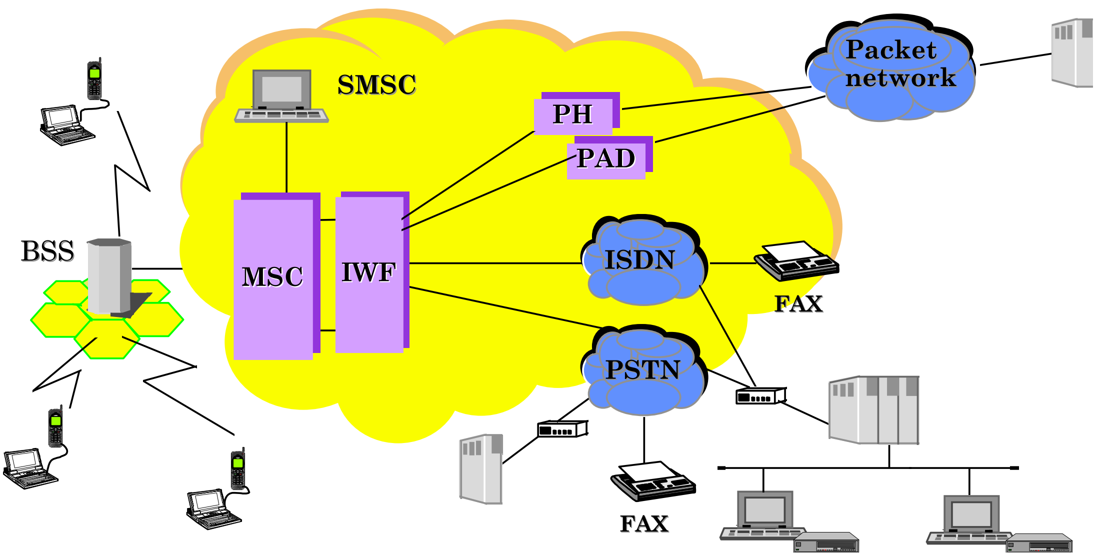
MT = Mobile Termination
TAF = Terminal Adapter Function
TE = Terminal Equipment

MS + PC as the data terminal





GSM Data Services



The **IWF (Interworking Function)** allows communicating with any "**data network**"

- PH = **Packet Handler**, transition to synchronous data network, e.g. X.25
- PAD = **Packet Assembler/Disassembler**, e.g. transition to the Internet
- via PSTN/ISDN to a **Fax**
- via PSTN/ISDN to a **modem dial-up server**

Properties of GSM Data

Circuit-Switched Operation

- **Channels** are allocated collectively for Uplink and Downlink **during the entire dial-up time**
- **Billing** is based upon the **dial-up time** and not the amount of data transmitted

Time for establishing a connection

- approx. **20...25 seconds** (end-to-end via PSTN/ISDN)

Link Capacity

- **9.6 kbits/s** (each with uplink and downlink)

Connection possibilities

- to any **modem dial-up server** (in PSTN/ISDN)

Properties of GSM Data

Connecting to the Internet

- ISP (**Internet Service Provider**) registration is necessary
- **Data call to dial-up number** of the ISP is necessary
- Communication with the ISP's **Terminal Server**
- Using PPP (**Point-to-Point Protocol**) or SLIP (**Serial Line Internet Protocol**)
- **Billing and Authenfication** of the user is done **separately** for the GSM bearer service and the ISP service

- Alternatively: **mobile network provider and ISP are identical**

Performance

- 9.6 kbits/s **nominal data rate** (decreased by error correction)
- **round-trip delay** 400...500 ms
- The **transparent mode** as well as the **non-transparent mode** is possible,

  - **transparent**: no error correction/ack-retransmission on link layer
  - **non-transparent**: with error correction on link layer

Improving Circuit-Switched Data Services

Without modifying the radio interface

Using an **ISDN connection** instead of a PSTN modem connection

- **decreases** the **time for connection establishment** to approx. 5 seconds
- supports the **caller's identification**
- most GSM **MSCs support ISDN Interworking**
- the ISP must allow **ISDN connections** from **MSC to Terminal Server**

Compression of user data according to V.42bis

- Increases **user data rate** up to **32 kbit/s**
- Compression **between MS and MSC/IWF**
- Compression of **text** is **typically 4:1** (does not apply to already compressed or encrypted data)
- **high processor usage**

ETSI Work Items (1)

GSM **14.4 kbit/s Data**

- standard completed in 1997

High-Speed (Circuit Switched) Data (**HSCSD**)

- standard completed in 1997

=> combining both

ETSI Work Items (2)

GSM Packet Radio System (**GPRS**)

- Phase 1 completed in 1998
- Phase 2 completed during UMTS (Release 1999, March 2000)

GSM 384 or EDGE (**Enhanced Data-rates for Global Evolution**)
(formerly Enhanced Data for GSM Evolution)

- Phase 1 completed in 2000 (also E-GPRS: Enhanced GPRS)
- Phase 2 completed during UMTS (Release 2000)
- since July 2000 new 3GPP TSG **GERAN** (GSM/EDGE Radio Access Network) to be released with future Releases

UMTS uses **Wideband-CDMA** as concept for multiple access

- Standardization process started, first Release (Rel 1999) March 2000
- Release 2000 (renumbered to release 4) March 2001
- Release 5 March/June 2002
- Release 6 December 2004 – March 2005
- Release 7 "Stage 3 freeze December 2007"
- Release 8 "*Stage 3 freeze December 2008 ?*"

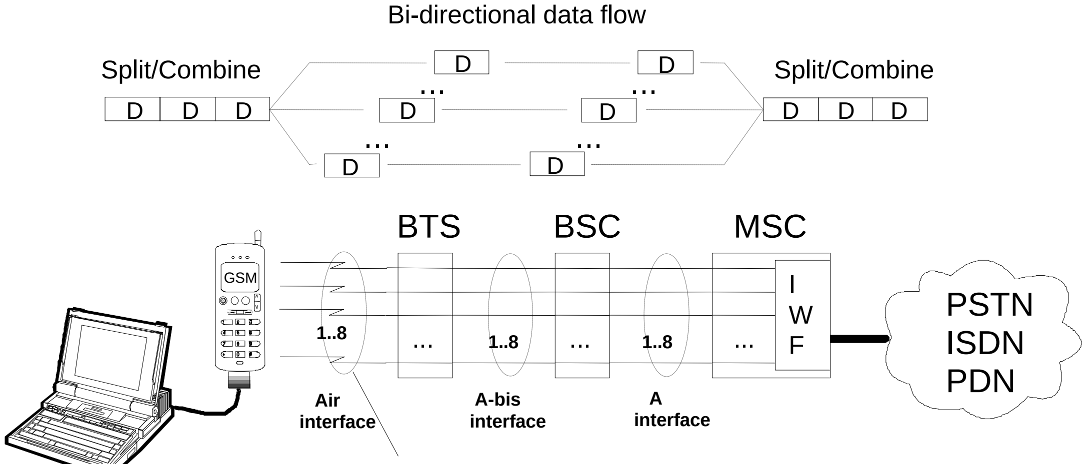
GSM 14.4 kbit/s Data

- **new channel coding** for data TCH
- **less protection** (more data) with **good radio reception**
- results in **reduced coverage** of the radio cells
  => mechanisms should switch back to a more efficient channel coding (9.6 kbit/s) at the border of a radio cell
- **compatible** with **High-Speed Data** and **V42.bis** compression
- **V34 modems** (28.8 kbit/s) may be realized by using **2 Time Slots** (2 TCHs) each with 14.4 kbit/s.
- **Standardization completed** in 1997

High-Speed Circuit-Switched Data

Principle of **Multi-Slot Access**

- Multiple Time-Slots (2..8) are allocated to a single MS



TCH/HSD
1...8 Time Slots
per TDMA-Frame

High-Speed Circuit-Switched Data (2)

Multi-Slot Access

- **Multiple (2...8) Time-Slots** are allocated to a **single MS**
- the normal traffic channels (n x TCH/F9.6) are combined to a **single (logical) High-Speed Channel** (TCH/HSD)
- Using the channel coding 14.4 allows multiples of n x 14.4 kbit/s

- **Splitting/Combining** data from higher layers need to be done in the MS and the MSC/IWF

- **BTSe** does not require **any knowledge** of the multi-slot access
- **BSCs** need to control **all sub-channels as a single channel**, e.g. during handover

- The **transparent mode** as well as the **non-transparent mode** is possible,

  As with GSM Data:
  - **transparent**: no error correction/ack-retransmission on link layer
  - **non-transparent**: with error correction on link layer

Data services in GSM (HSCSD rates summary) *JS*

- Data transmission standardized with only 9.6 kbit/s
  - advanced coding allows 14,4 kbit/s
  - not enough for Internet and multimedia applications
- HSCSD (High-Speed Circuit Switched Data)
  - mainly software update
  - bundling of several time-slots to get higher AIUR (Air Interface User Rate) (e.g., 57.6 kbit/s using 4 slots, 14.4 each)
  - advantage: ready to use, constant quality, simple
  - disadvantage: channels blocked for voice transmission

AIUR [kbit/s]	TCH/F4.8	TCH/F9.6	TCH/F14.4
4.8	1		
9.6	2	1	
14.4	3		1
19.2	4	2	
28.8		3	2
38.4		4	
43.2			3
57.6			4

Summary of Circuit-Switched Data

- GSM data services enable **Wide-Area Mobile Data Applications**
- **Improvements** to conventional **9.6 kbit/s data services** have been specified and are in use
- **Circuit-switched data** is suited for applications with a **continuous data flow** (e.g. file transfer of large files)
- **Billing** is based on the **dial-up time**, and **not** the amount of **transmitted data**
- A **limited number of mobile users** can be supported per frequency
- **Not well** suited for **packet-oriented protocols** (such as IP) and their typical applications (bursty and asymmetric data traffic)

=> **Demand for GPRS** is obvious

GPRS = **GSM Packet Radio System**
GPRS = **General Packet Radio Service**

6.4. Overview of GPRS

Design goal: Network

- GPRS uses a **packet-oriented allocation of resources**
  - resources are only allocated when data is to be sent or received
- **flexible channel allocation**
  - **one to eight time slots** of TDMA may be allocated
  - available resources **are shared by all active users**
  - **Uplink** and **downlink** are allocated **individually**
  - **GPRS** and circuit switched **GSM** may use the same **frequency/time slots** (allocated dynamically)
- Connections with **data networks**
  - **TCP/IP Internet** (and also **X.25**)
- More efficient transmission of **SMS over GPRS**

Overview of GPRS

Design goal: Applications

Conventional applications for data networks:

- **TCP/IP**: WWW, E-Mail, FTP, Telnet, …
- **WAP (Wireless Application Protocol)** over GPRS
- **X.25**: Packet Assembly/Disassembly (PAD) Applications

GPRS-specific applications:

- **Point-to-point (PTP) Applications**: toll billing for roads, ...
- **Point-to-multipoint (PTM) Applications**: weather information, traffic information, news, …
  push-to-talk

Overview of GPRS

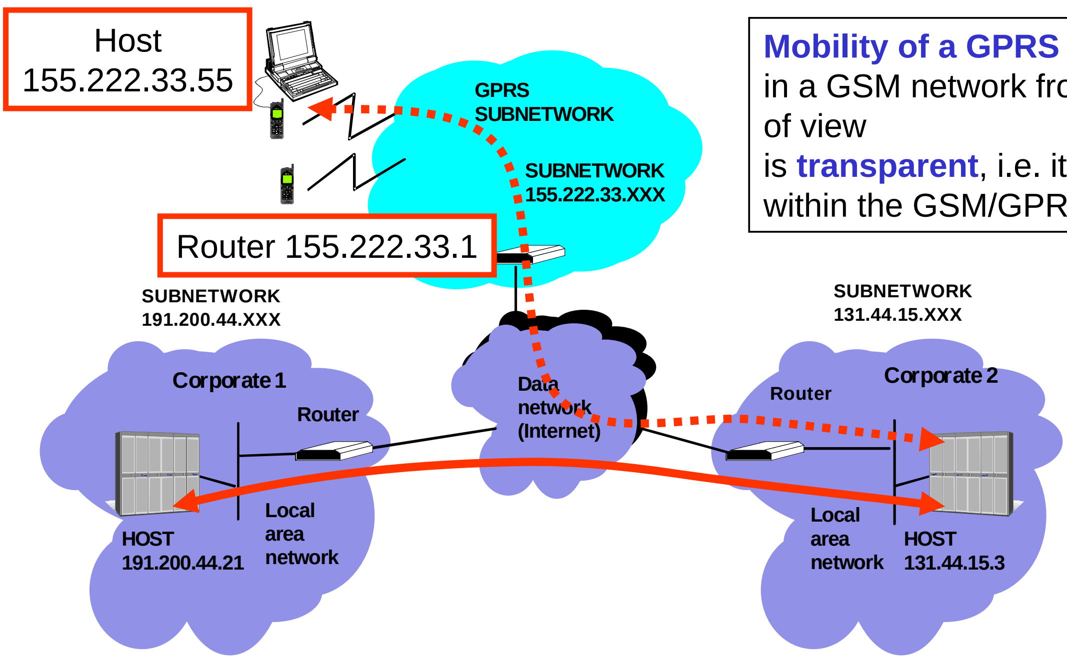
Design restrictions

- **Changes to Hardware** at BTSs should be **prevented**
- **Scalability** of GPRS networks
- there may/should be also **GPRS-only mobile terminals** (no speech)

- **Billing** should be based on the **actual amount of transmitted data**
- A **typical "Connection"** may last **several hours**
- **Several applications** may be **active simultaneously**

- **HLR** should **not** be contacted for **every single GPRS-packet**

User's view of a GPRS Network



Mobility of a GPRS user
in a GSM network from IP's point of view
is **transparent**, i.e. it's regulated within the GSM/GPRS network

Communication in the Internet between two hosts

Communication of a GPRS host (in GSM) with an arbitrary host in the Internet

GPRS Mobile Station

Three classes of different GPRS mobile stations:

Class A

- **simultaneous usage** of packet-oriented and circuit-switched services

Class B

- **Simultaneous logging into** GSM and GPRS system is possible
- **no simultaneous traffic** is possible (automatic sequential changeover)

Class C

- **Logging into** either GSM or GPRS is possible
- may be a **“GPRS-only” MS**

Examples for GPRS device classes *JS*

Class	Receiving slots	Sending slots	Maximum number of slots
1	1	1	2
2	2	1	3
3	2	2	3
5	2	2	4
8	4	1	5
10	4	2	5
12	4	4	5

GPRS user data rates in kbit/s

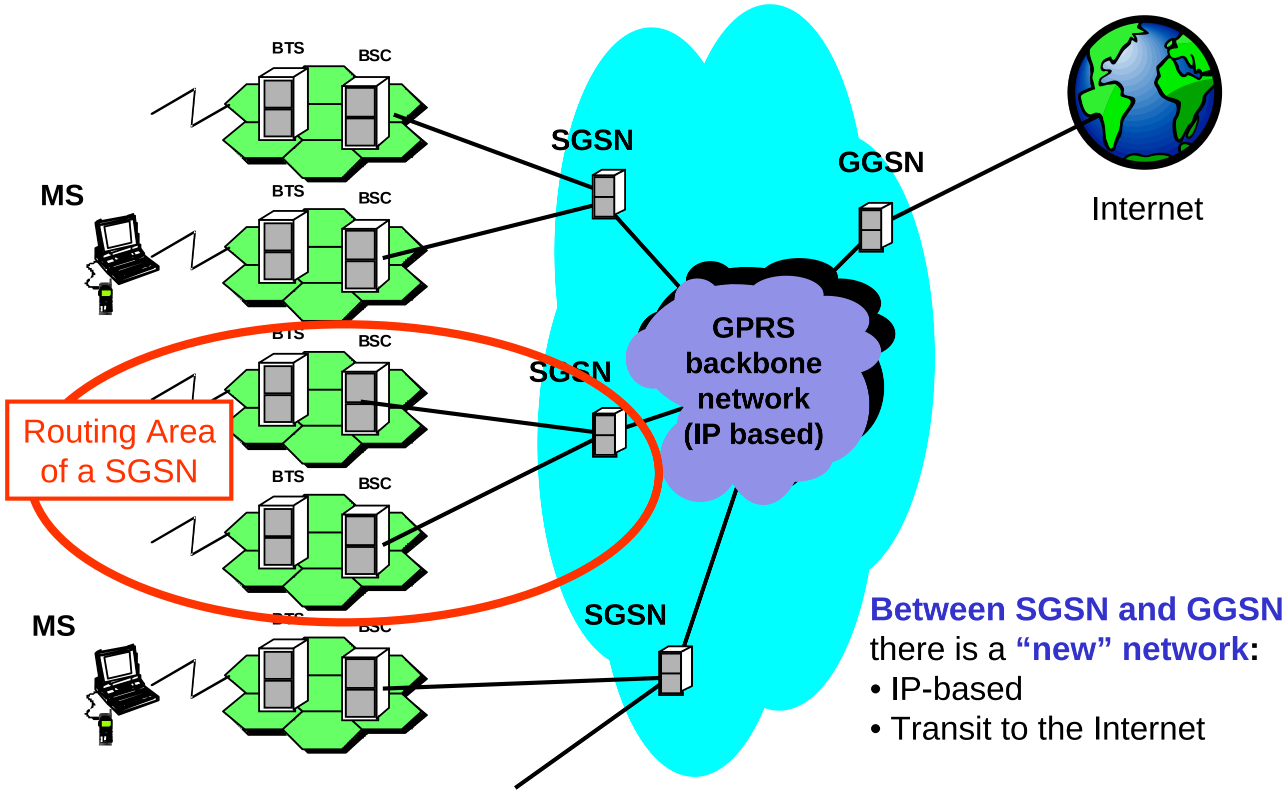
JS

Coding scheme	1 slot	2 slots	3 slots	4 slots	5 slots	6 slots	7 slots	8 slots
CS-1	9.05	18.1	27.15	36.2	45.25	54.3	63.35	72.4
CS-2	13.4	26.8	40.2	53.6	67	80.4	93.8	107.2
CS-3	15.6	31.2	46.8	62.4	78	93.6	109.2	124.8
CS-4	21.4	42.8	64.2	85.6	107	128.4	149.8	171.2

Different/new coding schemes compared to GSM data CSD/HSCSD

Architecture of a GPRS System

Between MS and SGSN „conventional“ **GSM network** (minor modifications)



Between SGSN and GGSN there is a **"new" network**:
- IP-based
- Transit to the Internet

Two new Network Components

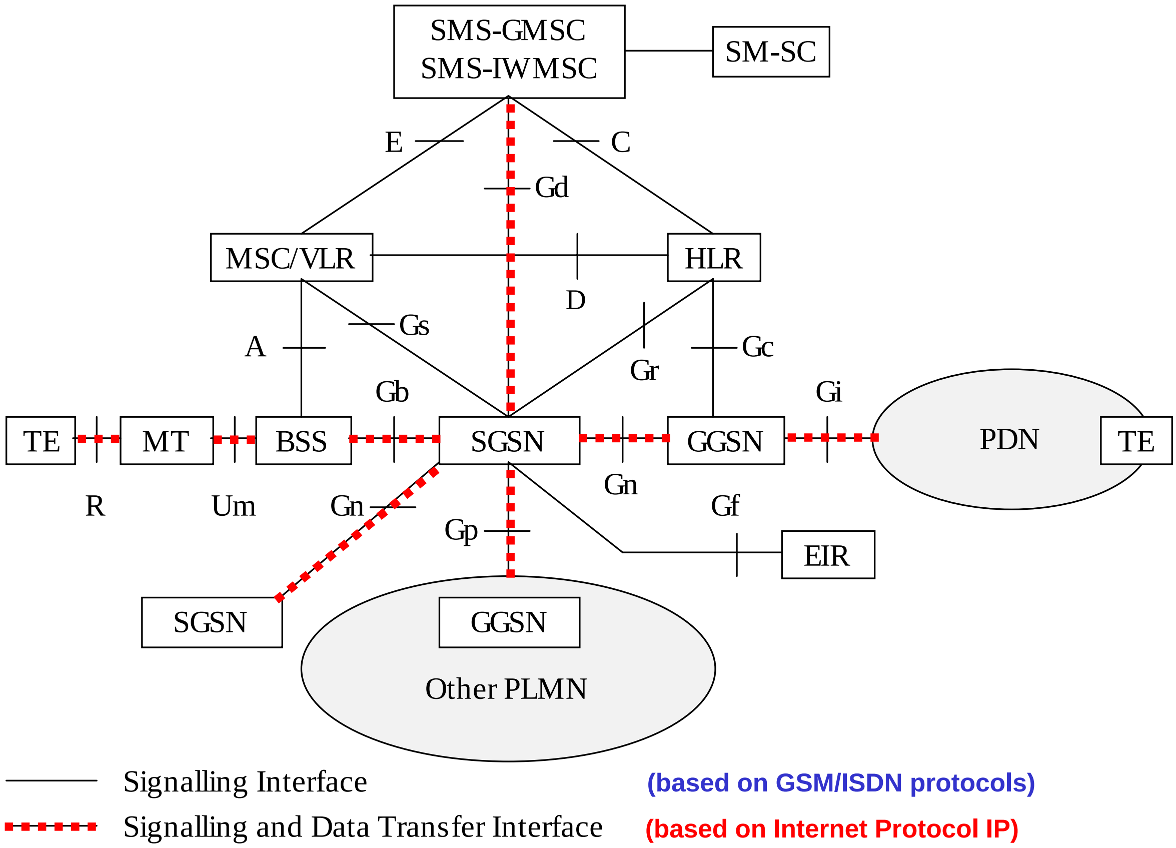
GGSN - Gateway GPRS Support Node

- comparable to GMSC (Gateway MSC)
- access point to an external data network (e.g. access to the Internet)
- centralized network component, does not change with mobility of the MS
- GGSN keeps track of routing-information to the SGSN corresponding to the MS

SGSN - Serving GPRS Support Node

- comparable to MSC/VLR (responsible for a Location Area)
- SGSN responsible for a Routing Area (typically a subset of a Location Area)
- Parting point between GSM-BSS and GPRS-backbone
- decentralized network component, changes with mobility of the MS
  (change of the Routing Area)

Architecture and Interfaces of a GPRS Network



(based on GSM/ISDN protocols)

(based on Internet Protocol IP)

Interfaces of a GPRS Network

GPRS Network Signalling interfaces

Gb LLC (User Plane) and BSSGP (Signalling) over Frame Relay
Transition from the "new net" to the "old net" (GSM-BSS)

Gc MAP Protocol for **Location Information Retrieval**

Gd MAP Protocol for **Short Messaging over GPRS**

Gf MAP Protocol for **verifying the ME identity**

Gn **GPRS Tunneling Protocol** (GTP) for intra-PLMN traffic treatment

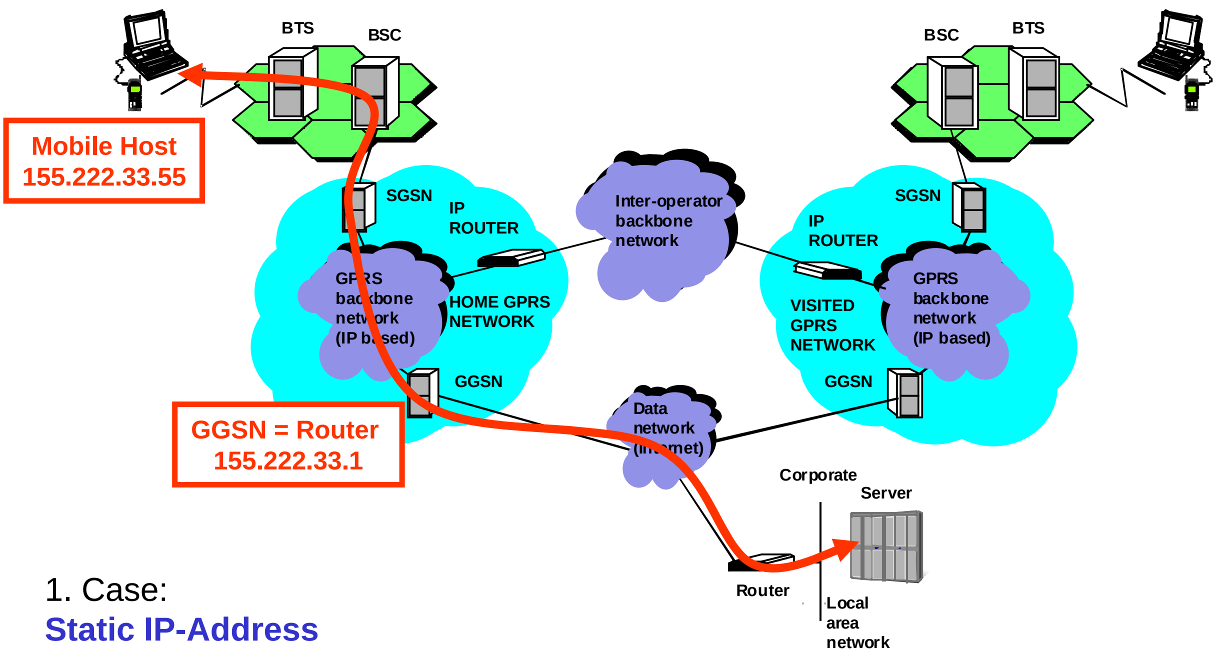
Gp **GTP** (over IP) for **inter-PLMN traffic**

Gr MAP Protocol access to **Subscriber Information**

Gs BSSAP+ Protocol for **Normal Location Updates** and **Paging** via MSC/VLR

Gi IP (oder X.25) Protocol **Interface to external data networks**

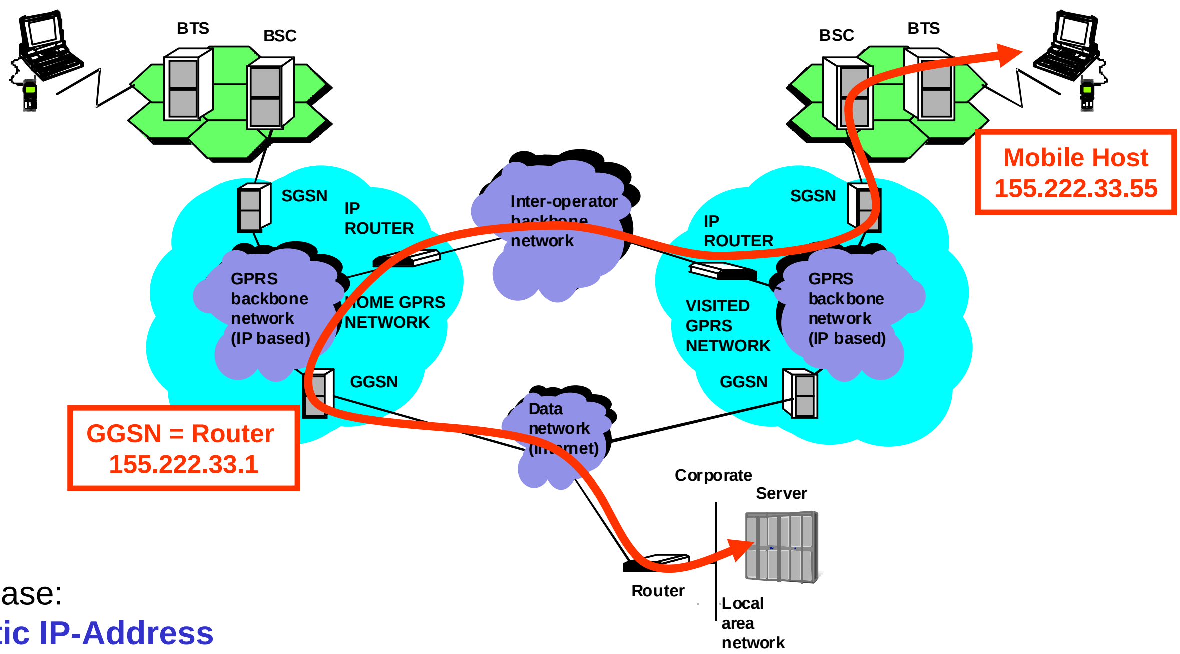
Scenario: Roaming with GPRS (1)



1. Case:
Static IP-Address
assigned by the home GPRS network

User is located in his home network

Scenario: Roaming mit GPRS (2)

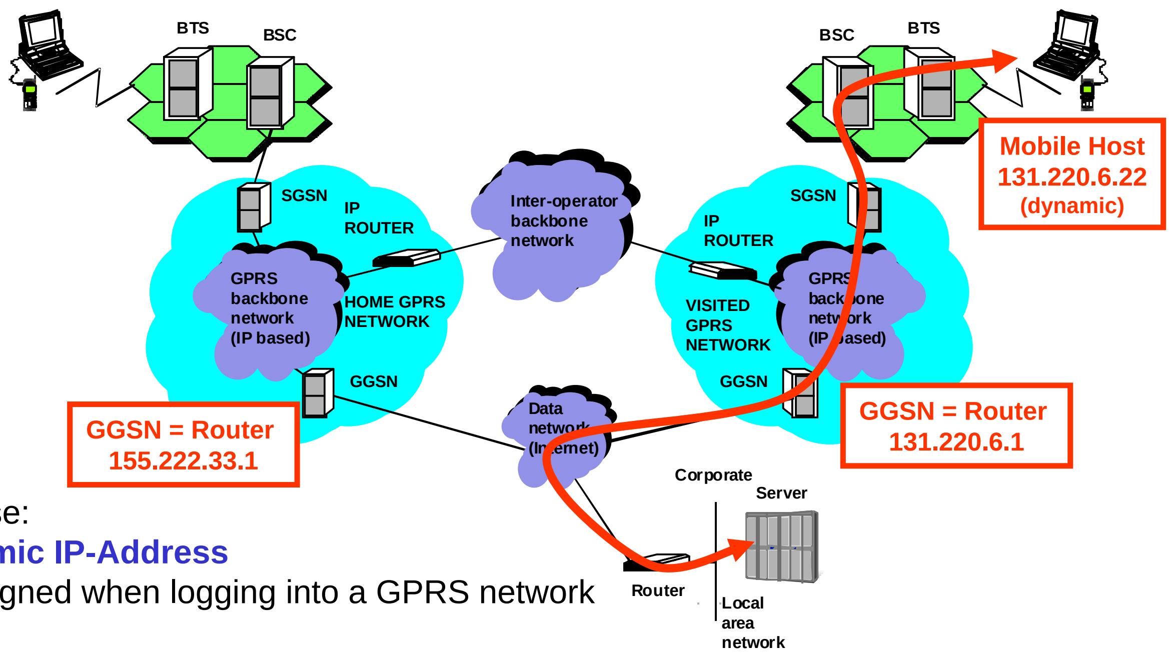


2. Case:
Static IP-Address
assigned by the home GPRS network

User is located in a foreign network

- Host xyz.55 communicates with GGSN xyz.1 in its home net
- „foreign“ SGSN tunnels with GTP over Inter-Operator Backbone to „home“-GGSN

Scenario: Roaming with GPRS (3)



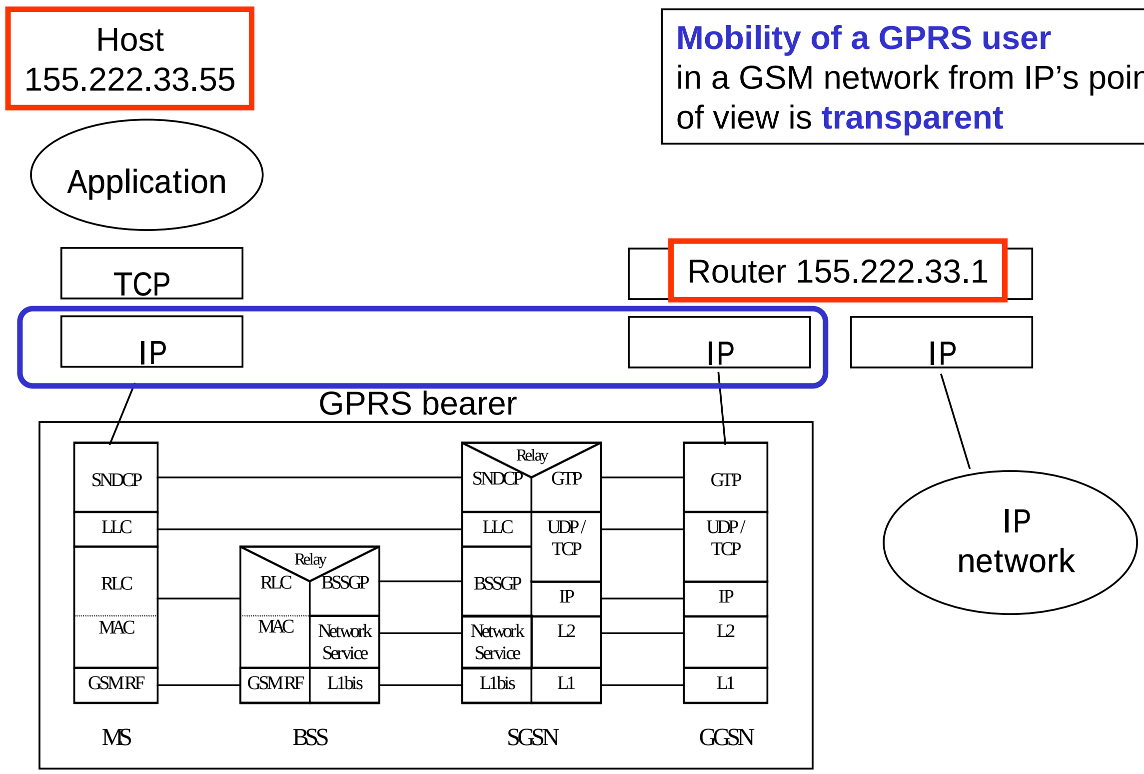
3. Case:
Dynamic IP-Address
is assigned when logging into a GPRS network

User is located in a foreign network
allows optimal routes across GPRS-IP-Backbone and Internet

“Roaming” between two GPRS networks is not possible when using dynamically assigned IP-addresses

GPRS User Plane Protocols

Mobility of a GPRS user in a GSM network from IP's point of view is **transparent**



Handovers between different SGSN is supported within the GSM/GPRS network

GTP – GPRS Tunnel Protocol

- IP to/from MS **without tunnelling over the Air-Interface**
  Next hop Router is GGSN
- **GTP tunnels** IP datagrams to/from MS between SGSN and GGSN
- IP-Addresses of SGSN and GGSN are only internally used
- **Comparison to Mobile IP**:

  GGSN is Home Agent: Does not change after movement of MS
  All traffic is routed through GGSN

  SGSN is Foreign Agent: Changes with movement of MS
  Home Agent routes to corresponding SGSN

Advantages and Disadvantage of GTP

\+ IP datagrams on the Air-Interface do not need "mobility-overhead"

\- "complex" protocol stack + overhead in Backbone (IP/GTP/UDP/IP)

GPRS Media Access

Accessing Traffic Channel TCH is "**circuit-switched**",
previous data traffic (as well as speech) is "**connection-oriented**"

For "**connectionless**" GPRS

⇒ **"emulate" a connectionless service across a connection-oriented media**

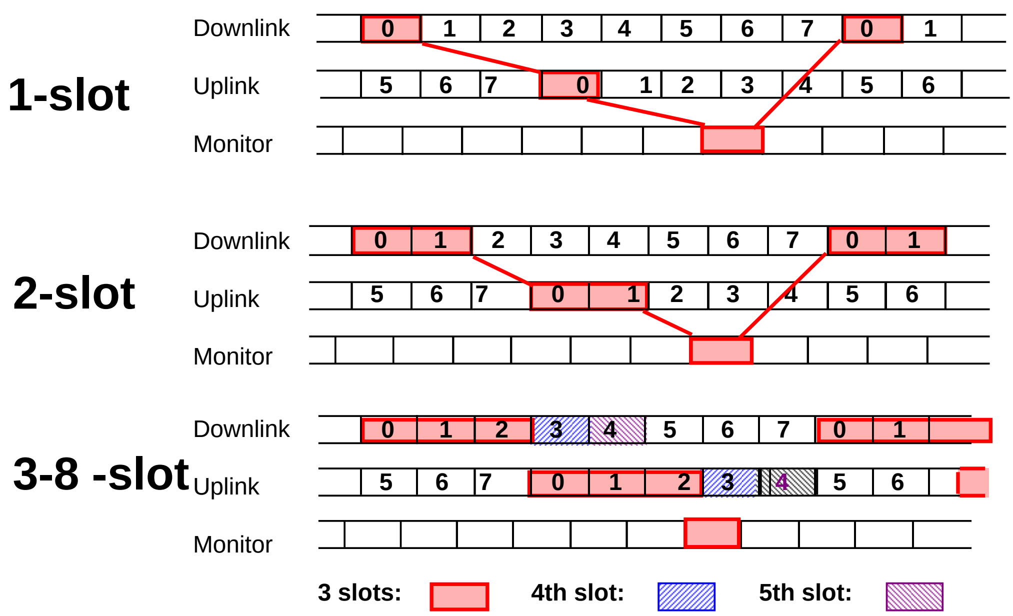
However: Some kind of "**connection**" is needed!

- **GPRS Attach and Detach** = Logging into the GPRS network
  - "Registering" with the mobility management
  - with movement of the MS a "Routing Area Update Request" is applied
  - MS is reachable

- **Packet Data Protocol (PDP) Context** activation and deactivation
  - PDP Context between MS and SGSN/GGSN
  - choses the supported data protocol (e.g. IP, X.25)
  - required in order to enable data communication to/from MS
  - binds misc. parameters (routing, QoS, Identity of MS, Status, ...)
  - may be initiated by the MS or the network

How does GPRS Media Access work in TDMA?

Using several TDMA-Slots is now possible



The figure suggests that the same slots are used in a regular interval.
This is not the case! They are dynamically assigned to different MS!!!

Use of TDMA slots with CSD

CSD (Circuit Switched Data) = same as telephony, one fixed channel

Downlink 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7
Uplink 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4

Example: Time-Slot No. 5 has been assigned as data channel

Downlink 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7
Uplink **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4

Downlink 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7
Uplink **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4

Downlink 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7
Uplink **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4

During passive time slots, MS is able to measure reception of other cells.

Downlink 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7
Uplink **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4 **5** 6 7 0 1 2 3 4

Use of TDMA slots with HSCSD

HSCSD (High Speed Circuit Switched Data) = same as CSD, several fixed channels

Downlink 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 **3** **4** **5** 6 7 0 1 2 **3** **4** **5** 6 7
Uplink 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 **4** 5 6 7 0 1 2 3 **4**

Asymmetric example: Time-Slot No. 3+4+5 (D) + 4 (U) assigned for data channel

Downlink 0 1 2 **3** **4** **5** 6 7 0 1 2 **3** **4** **5** 6 7 0 1 2 **3** **4** **5** 6 7 0 1 2 **3** **4** **5** 6 7
Uplink 5 6 7 0 1 2 3 **4** 5 6 7 0 1 2 3 **4** 5 6 7 0 1 2 3 **4** 5 6 7 0 1 2 3 **4**

Downlink 0 1 2 **3** **4** **5** 6 7 0 1 2 **3** **4** **5** 6 7 0 1 2 **3** **4** **5** 6 7 0 1 2 **3** **4** **5** 6 7
Uplink 5 6 7 0 1 2 3 **4** 5 6 7 0 1 2 3 **4** 5 6 7 0 1 2 3 **4** 5 6 7 0 1 2 3 **4**

Downlink 0 1 2 **3** **4** **5** 6 7 0 1 2 **3** **4** **5** 6 7 0 1 2 **3** **4** **5** 6 7 0 1 2 **3** **4** **5** 6 7
Uplink 5 6 7 0 1 2 3 **4** 5 6 7 0 1 2 3 **4** 5 6 7 0 1 2 3 **4** 5 6 7 0 1 2 3 **4**

During passive time slots, MS is able to measure reception of other cells (but now only 4 out of 8 slots).

Downlink 0 1 2 **3** **4** **5** 6 7 0 1 2 **3** **4** **5** 6 7 0 1 2 **3** **4** **5** 6 7 0 1 2 **3** **4** **5** 6 7
Uplink 5 6 7 0 1 2 3 **4** 5 6 7 0 1 2 3 **4** 5 6 7 0 1 2 3 **4** 5 6 7 0 1 2 3 **4**

Use of TDMA slots with GPRS

GPRS, packet-oriented, access via RLC/MAC protocol, using Master/Slave principle

Downlink 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7
Uplink 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 **0** 1 2 3 4

MS sends request in Uplink PRACH (Packet Random Access Channel)

Downlink **0** 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7
Uplink 5 6 7 0 **1 2 3** 4 5 6 7 0 **1 2 3** 4 5 6 7 0 **1 2 3** 4 5 6 7 0 **1 2 3** 4

BTS answers in PAGCH (P-Access Grant Channel)

MS uses slot assignment

Downlink 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7
Uplink 5 6 7 0 **1 2 3** 4 5 6 7 0 **1 2 3** 4 5 6 7 0 **1 2 3** 4 5 6 7 0 **1 2 3** 4

Downlink 0 1 2 3 4 5 6 7 0 1 2 3 **4 5 6 7** 0 1 2 3 **4 5 6 7** 0 1 2 3 **4 5 6 7**
Uplink 5 6 7 0 **1 2 3** 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4

packet transmission completed, now BTS sends packet to MS

Downlink 0 1 2 3 **4 5 6 7** 0 1 2 3 **4 5 6 7** 0 1 2 3 **4 5 6 7** 0 1 2 3 **4 5 6 7**
Uplink 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4

RLC/MAC Protocol

RLC - Radio Link Control

• for the radio interface MS - BSS
• segmentation of user data
• selective ARQ mechanism

MAC - Medium Access Control

• Downstream (BTS → MS) no challenge: BTS is the only sender

• Upstream (MSe → BTS): When is the MS allowed to access a specific slot?

• Master-Slave-mechanism: BTS is Master, MS are slaves
• Slaves indicate their wish for sending data to the master
(Collisions may occur!)

• Master informs slaves who has access to the media
Use the Uplink State Flag USF (12 Bit) to mark slots unused or reserved for a specific MS
(Here too, collisions may occur)

Summary of GPRS

- **Packet-oriented data transfer** with data rates up to **21.4 kbit/s per Time-Slot** and **up to 8 Time-Slots** per user
- Two new network components: **SGSN** and **GGSN**
- New network structure: **GPRS Backbone Network** transports user data between SGSNs and GGSN, **based on IP**
- **Conventional IP applications** may be used
- **Billing** may be based on the **amount of transferred data**
- **Costs for data transfer** may be negotiated (e.g. a better QoS is more expensive)

6.5. Mobility Management Internet vs. GSM/GPRS

Mobility in the Internet – Mobility GSM/GPRS

Basic difference between GSM and the Internet:

• GSM is a "**connection-oriented**" network for telecommunication

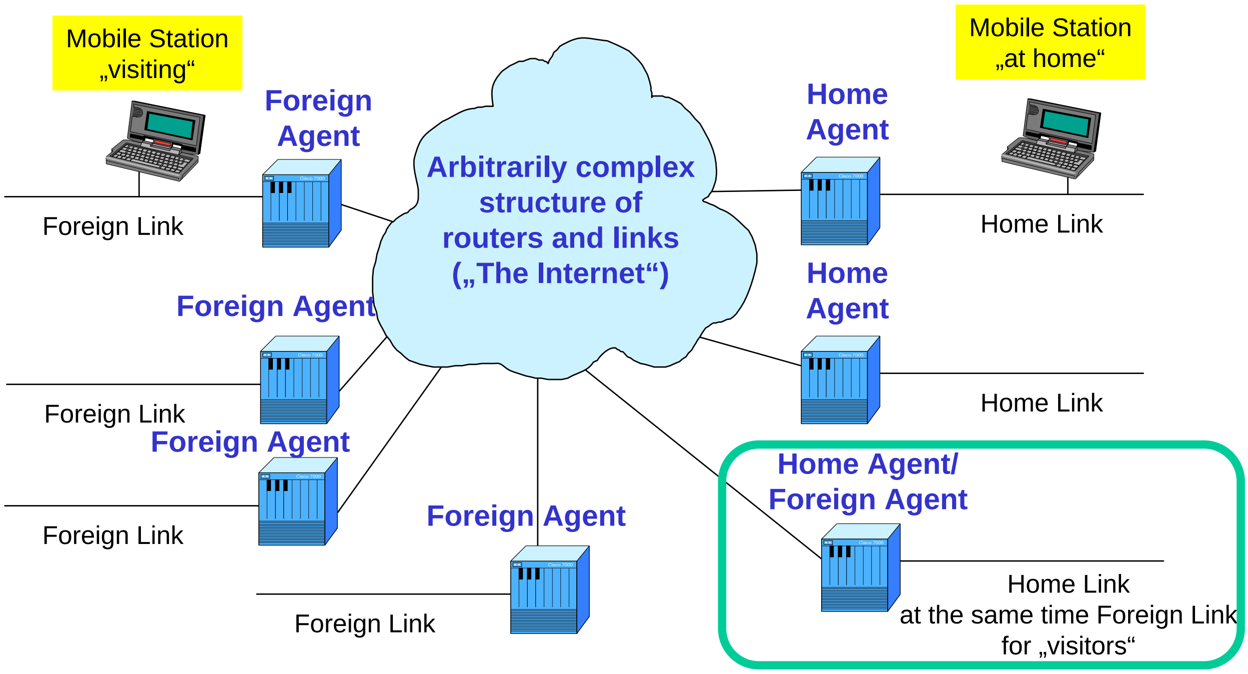
• The Internet is a "**connectionless**" network for data communication

In terms of mobility management, there are several issues in common!

Mobility Management in the Internet

Support of Macro Mobility

• when the IP subnetwork changes, the mobility configuration will be updated

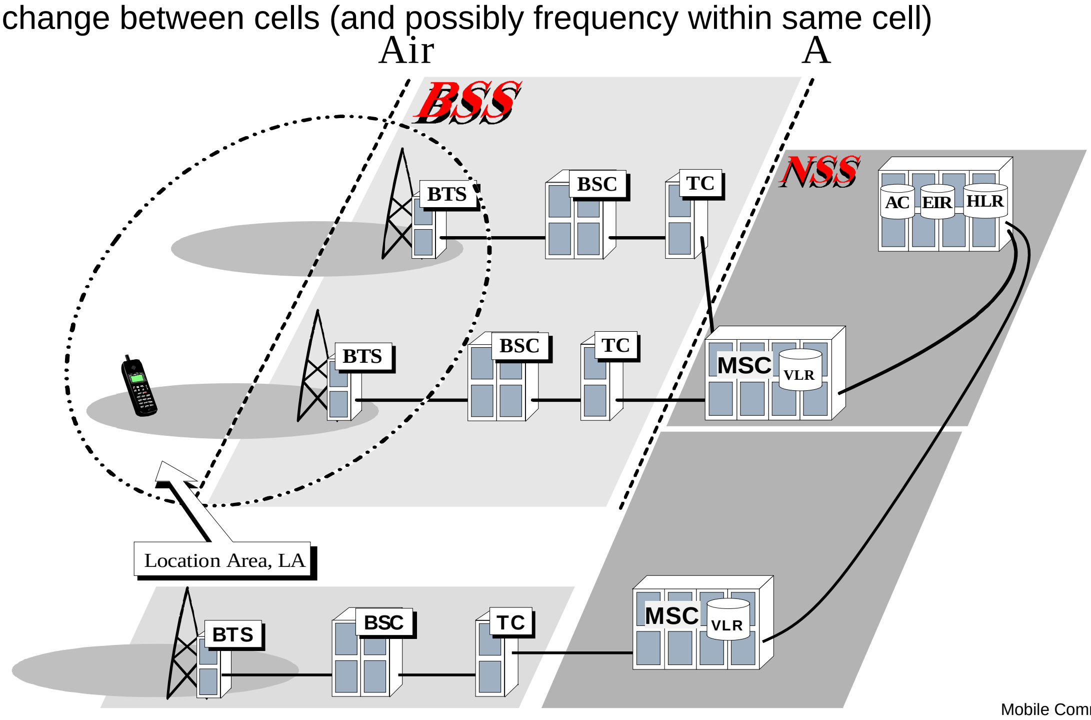


(Rem.: Foreign Agent with MIPv4 and IPv6 Router with MIPv6)

Mobility Management with GSM

Support of Macro and Micro Mobility

• international Roaming (between different GSM-PLMN)
• Mobility between MSC-Regions (Location Area)
• change between cells (and possibly frequency within same cell)



Comparison Internet - GSM

Mobility Internet	Mobility GSM
Home Agent	**Home Location Register** (HLR)
HA de-central: Each "Home Network" in the Internet has its own HA	**HLR is central** for all users of a PLMN (**de-central** when considering International Roaming: **Each PLMN has its own HLR**)
IP cares for **global addressing (world wide)**	ISDN numbering scheme cares for **global addressing** (e.g. +49-170-xxx leads to PLMN of T-Mobile)
Home Address of mobile device (IP Home Address)	MSISDN is "**Home Address**" of mobile user/SIM (but there is no physical home link)
Foreign Agent	Analogy in GSM: "Visited" MSC with its VLR (Visited Location Register)

Comparison Internet - GSM (2)

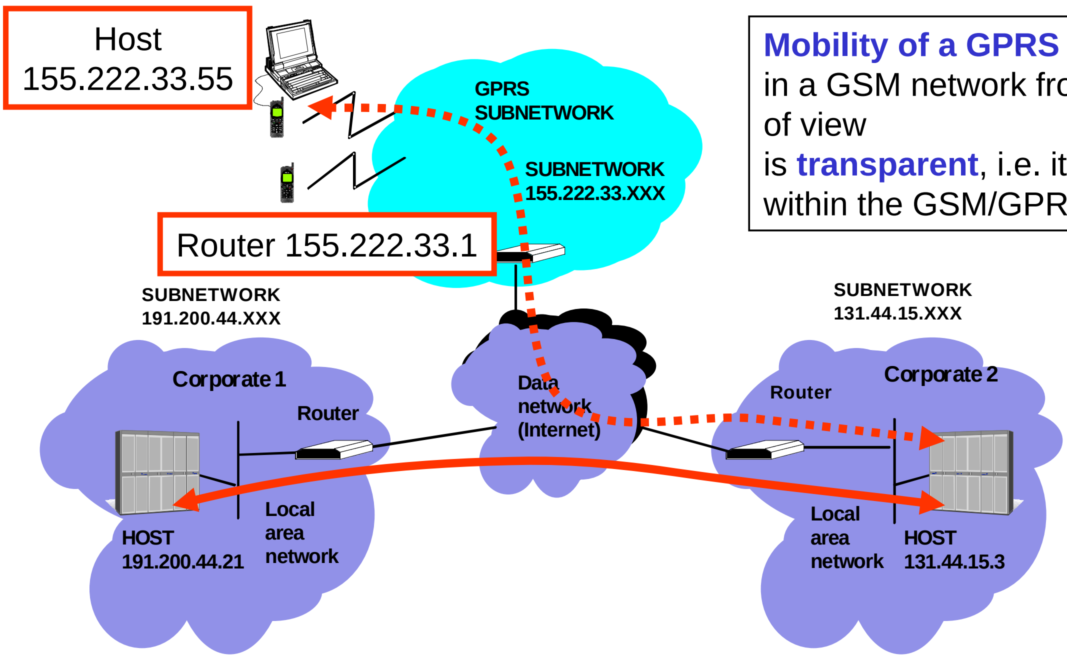
Note: cf. sl. 25
TMSI = Temporary Mobile Subscriber Identity
MSRN = Mobile Station Roaming Number
similar to Care-of-Address in Mobile IP

Mobility Internet	Mobility GSM
Reachability: **Care-of Address** is used for IP-Routing to the mobile station	Reachability: **TMSI/MSRN** allows for ISDN-Routing to the visited MSC, paging is used to determine detailed location within Location Area
Reachability (2): Care-of Address stored **in Home Agent**	Reachability (2): TMSI stored **in HLR** of Home PLMN (MSRN is only assigned when needed)
"**connectionless**" Communication	"**connection-oriented**" Communication
When changing the Link-Layer access (wired and/or wireless) to a different IP subnetwork, the configuration will be changed (FA, Care-of Address)	• with active call "Handover" between - frequencies and cells (BTS) - BSCs - MSCs • in Idle Mode a "Location Update" is performed when changing the Location Area
No advanced concept for detection of movement	Detection of movement by frequent measurement of current and alternative wireless reception of BTSs

Comparison Internet - GSM (3)

Mobility Internet	Mobility GSM
Macro-Mobility: = basic goal Mobile IP • change in configuration of Mobile IP upon change of network access to different IP subnetwork	**Macro-Mobility**: • International Roaming: Use of services in “visited” PLMN • Mobility in GSM on highest hierarchy level may also be seen as Macro-Mobility (MSC-Handover/Location update, changing TMSI and change information in HLR)
Micro-Mobility: • no support by Mobile IP (never was the goal of Mobile IP) • Support of mobility within a specific link technology (OSI layer 2) is transparent for Mobile IP (e.g. GSM seen as a single IP subnet)	**Micro-Mobility**: Advanced concepts for (“fast”) movement in cellular networks • overlapping cells • measurement of reception quality of current and neighbouring cells • “fast” mechanism (handover) for “fast” change between cells – without interruption

User’s view of a GPRS Network (slide 48 recalled)



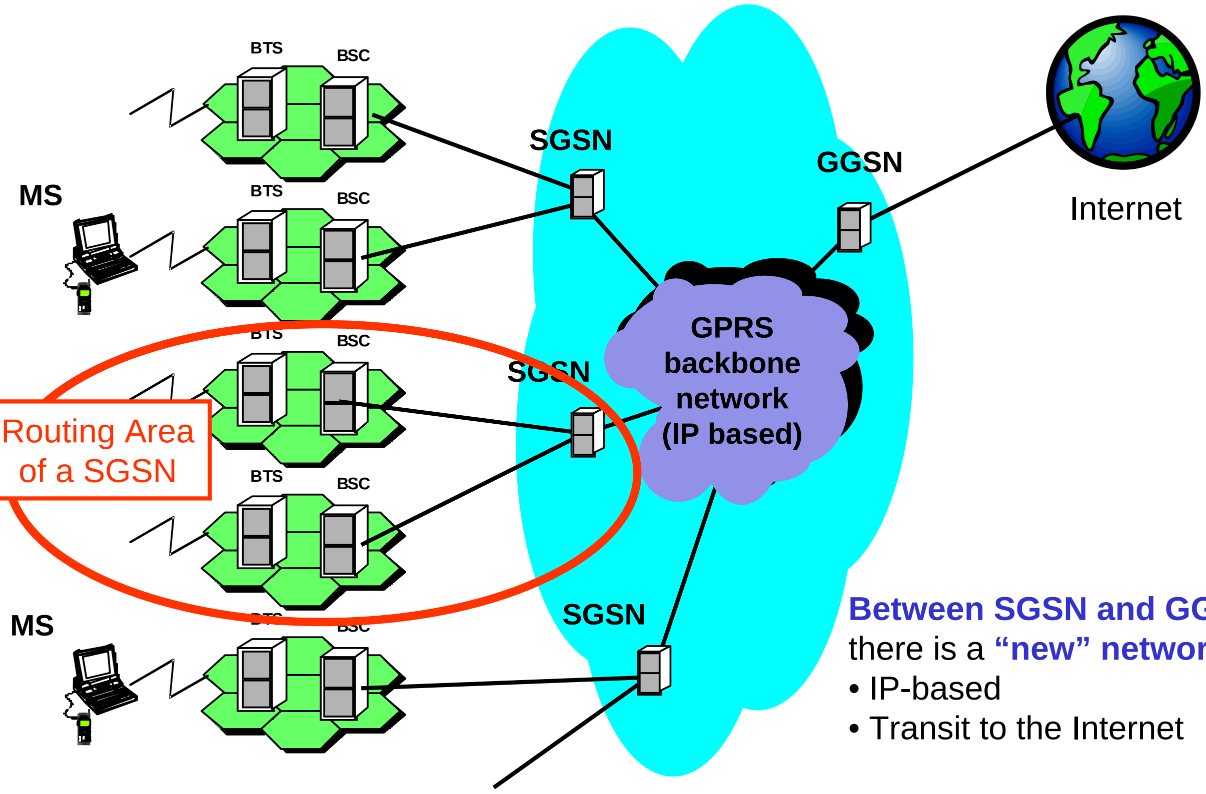
Mobility of a GPRS user
in a GSM network from IP’s point of view
is **transparent**, i.e. it’s regulated within the GSM/GPRS network

Communication in the Internet between two hosts

Communication of a GPRS host (in GSM) with an arbitrary host in the Internet

Architecture of a GPRS System (slide 52 recalled)

Between MS and SGSN „conventional“ **GSM network** (minor modifications)



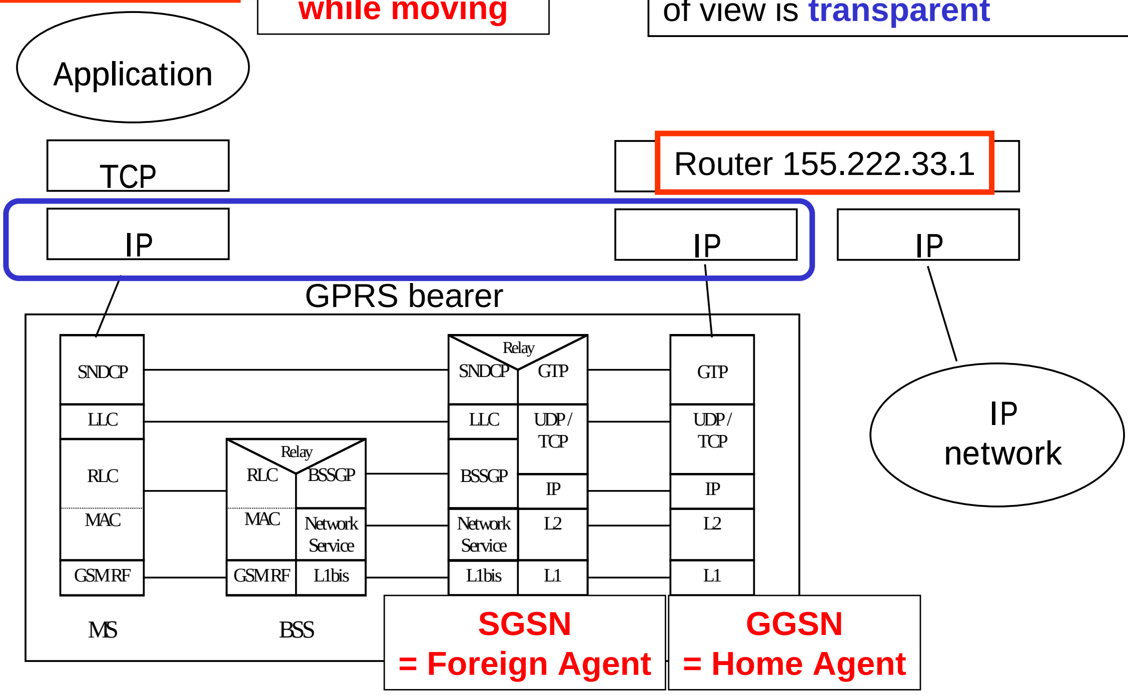
Between SGSN and GGSN there is a **“new” network**:
- IP-based
- Transit to the Internet

GPRS User Plane + IP Access (cf. slide 59)

Host 155.222.33.55

Home Address does not change while moving

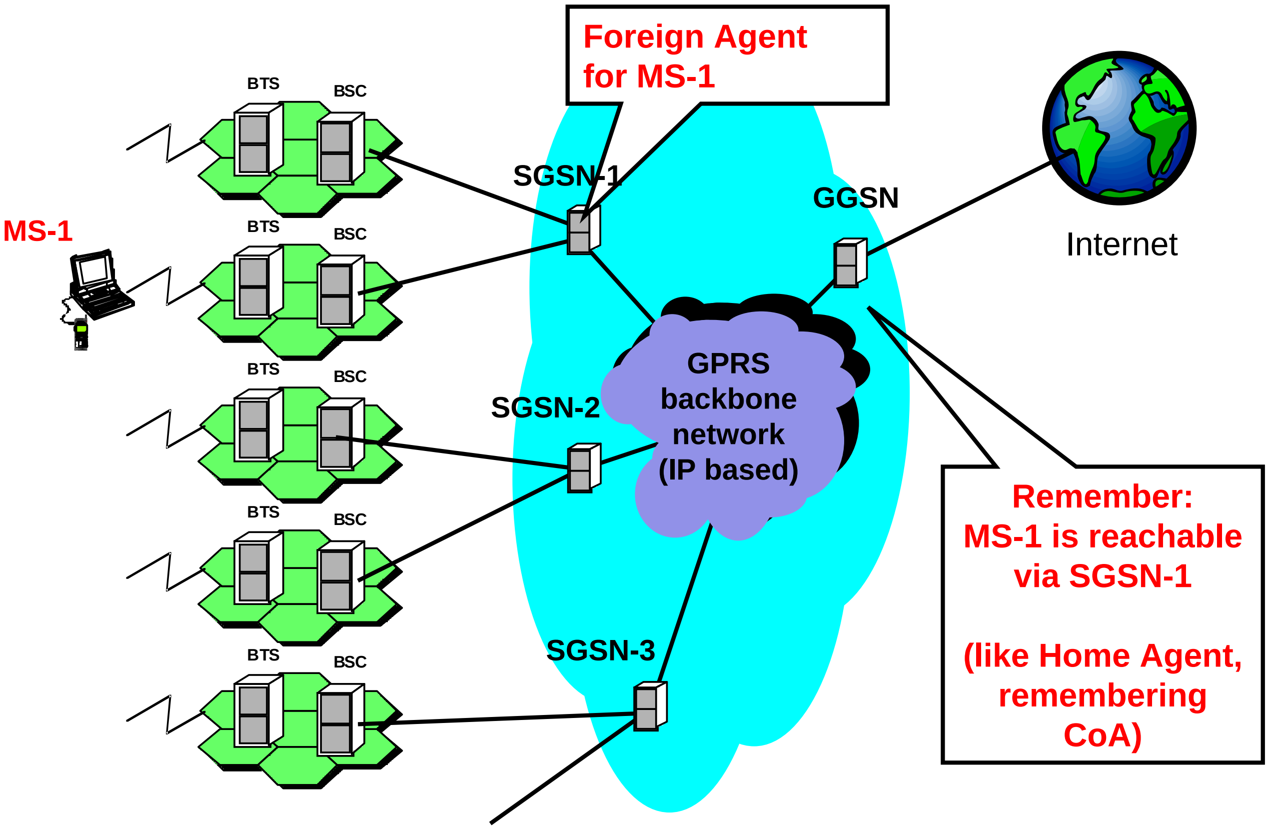
Mobility of a GPRS user in a GSM network from IP's point of view is **transparent**



Within the GPRS/GSM network mobility is supported internally.

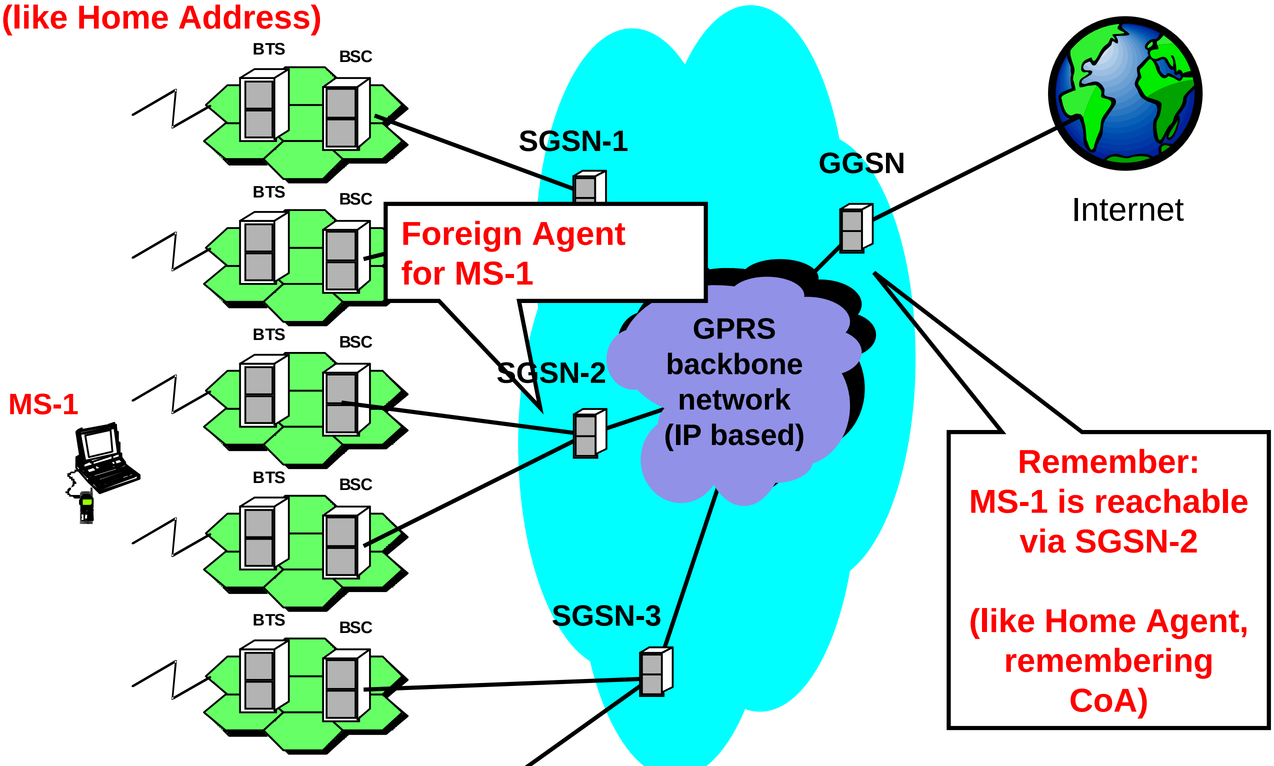
⇒ Functionality is identical to Mobile IP !!!

Mobility in GPRS – Example



Mobility in GPRS – Moving to SGSN-2

IP-Adress of MS unchanged!
(like Home Address)



GTP cares for transparent change of configuration !

Mobility in GPRS – Moving to SGSN-3