



GPRS Survey

General Packet Radio Service

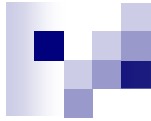
Computer Science 5402

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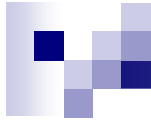
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Introduction

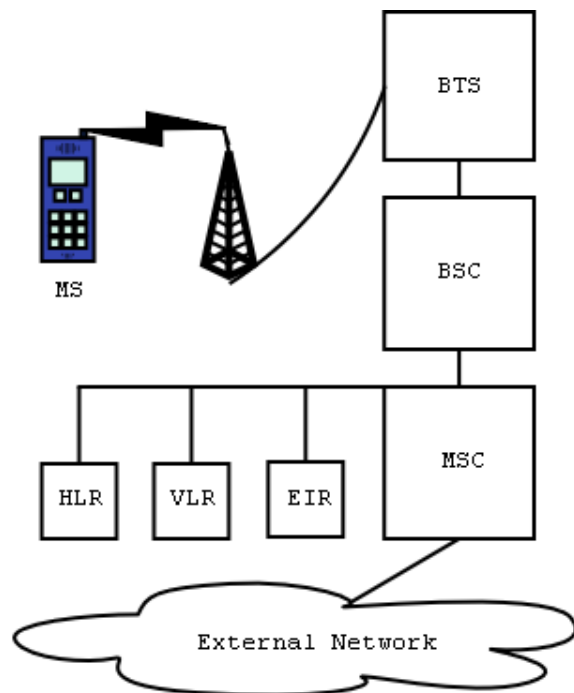
- GPRS stands for General Packet Radio Service
- Developed and standardized by the European Telecommunications Standards Institute (ETSI)
- Sometimes referred to as 2.5G
- Works on all current mobile network bandwidths (in Canada Rogers/AT&T uses 1900 MHz)



Motivation for GPRS

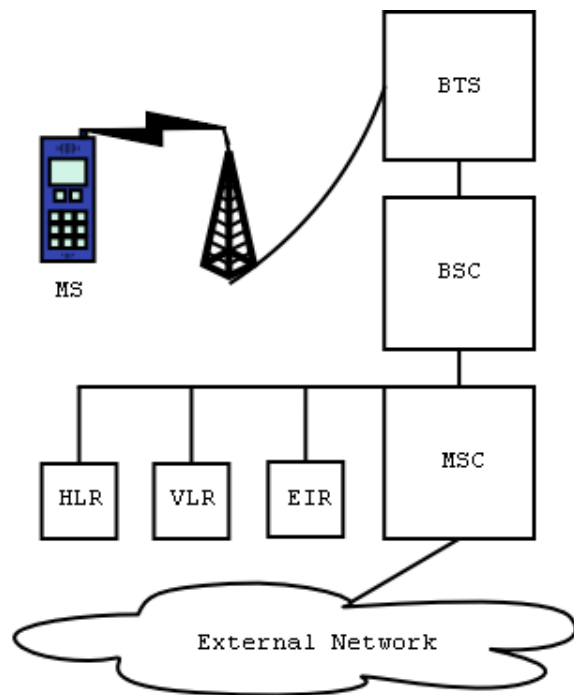
- As mobile devices become smaller and more powerful demand for data service grows
- Packet switched data network with speeds of 9 to 115 kilobits/second
- Designed to integrate with existing mobile networks, such as GSM
- Ability to be deployed incrementally
- Requires very little upgrade to the underlying network.

Architectural Overview of GSM



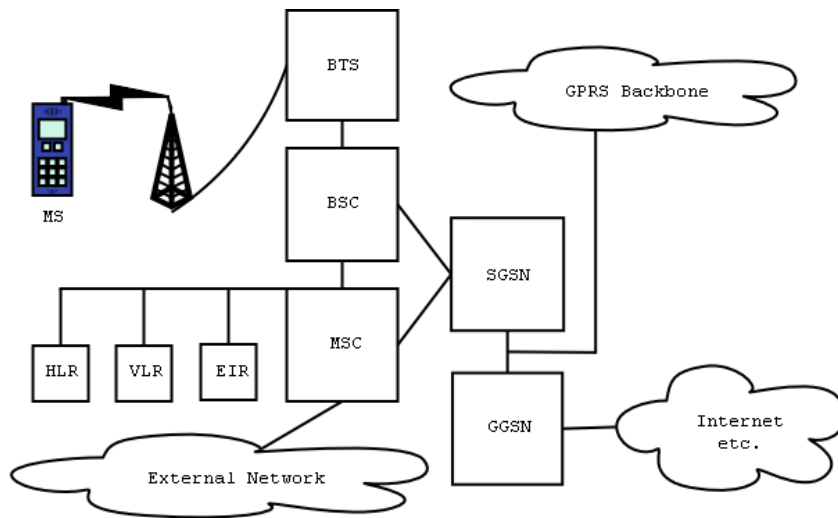
- The Mobile Station (MS), is the actual end user equipment, such as PDA, mobile phone, etc.
- MSs are identified by a IMEI number, however the user of the MS is identified by the SIM card
- The MS connects to the network, via the Base Transceiver Station (BTS)
- The Base Station Controller (BSC) typically controls hundreds of cells and is responsible for registration and MS handover (cell to cell) among other tasks

Architectural Overview of GSM



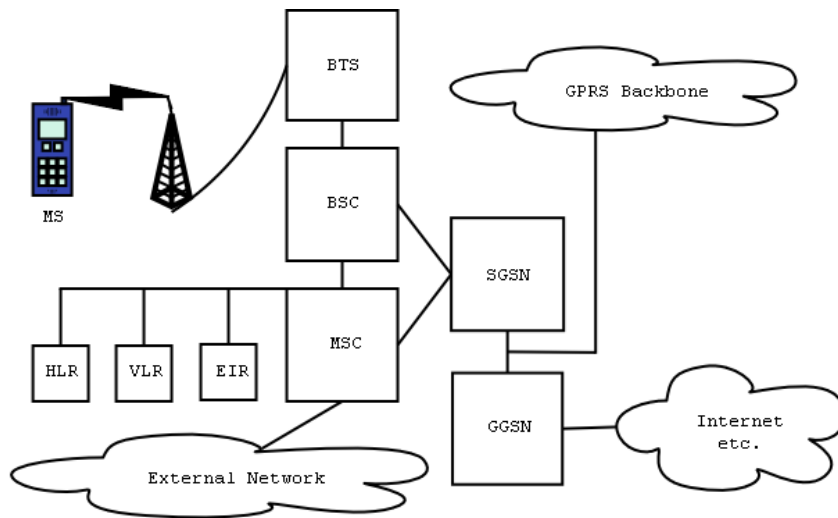
- After the BSC the data moves on to the Mobile Switching Center (MSC), and upgraded telecommunications switch, that acts as a bridge between the mobile networks and outside networks,
- The MSC also handles handover of the MS when it is moving between cells controlled by different BSCs
- Available to the MSC are three databases, the EIR and two location databases, the Home and Visitor Location Registers (HLR & VLR)

Architectural Overview of GSM/GPRS



- To support GPRS on a GSM network two new nodes are added, the Serving GSN (SGSN) and the Gateway GSN (GGSN)
- The SGSN is the only connection made between the underlying network and the GPRS network

Architectural Overview of GSM/GPRS



- GPRS defines three types of devices that can be used on the network
- Negotiated profiles for Quality of Service are also provided (based on 4 criteria)



Registration

- In order to use the GPRS network, a MS must first attach to the network
- During attachment the SGSN, checks the user's authorization, if this succeeds the user profile is downloaded from the HLR
- Symmetrically, when finished with the network the MS must detach, allowing allocated resources to be released.



Session Management

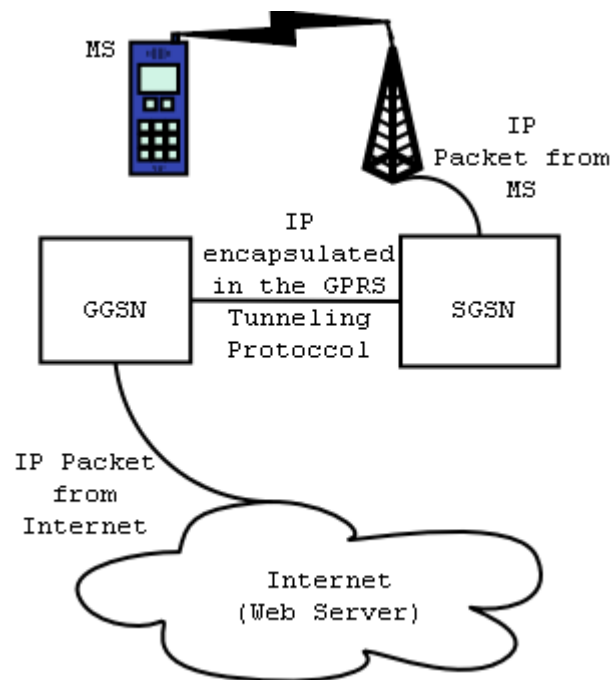
- After the MS is registered, it must request access to an external Packet Data Network (PDN), thereby creating a session
- This session is simply a Packet Data Protocol (PDP) context, containing
 - PDN type (such as IPv4)
 - PDP Address (the MS address on the PDN)
 - QoS profile (as negotiated)
 - The GGSN for the PDN (necessary for routing)
- The type of PDP address assigned to the MS can be either static or dynamic, as in other networks (i.e. DHCP)



Anonymous Access

- Used for things such as pre-paid services
- The MS is not required to attach to the network before creating a profile
- The network has no knowledge of the user, all it knows is the IMEI of the device used
- When using this method of access the user will be locked to current Roaming Area (RA)
- Regardless of access type, all MSs can access the PDN and the interface between the PDN and the MS remains the same

Routing of Packets



- Consider the routing of a packet from the MS to a server on the Internet and routing the response back
- The MS will send IP packets as if it were attached to the external PDN
- They will be intercepted by the controlling SGSN, encapsulated using the GPRS Tunneling Protocol (GTP)
- Once encapsulated, the packet will be sent to the GGSN listed in the PDP context
- At the GGSN, the packet is decapsulated and the original IP packet is delivered to the server
- Packets destined to the MS from the server will first stop at the GGSN where it will be encapsulated and sent to the SGSN (as looked up in the HLR)
- At the SGSN, the packet is decapsulated, buffered and sent to the MS (The buffer is deleted upon acknowledgement)

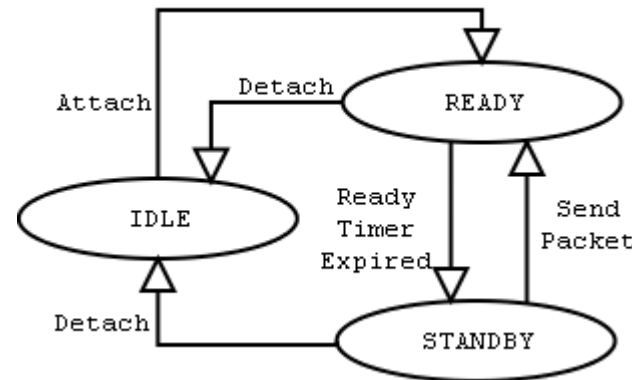


Mobility Management (Part 1)

- In order for to properly route packets to a given MS, it must know its location, this makes the task of mobility management critical to GPRS (and other mobile networks)
- GPRS uses “location update messages” (periodically sent from the MS) to keep track of current cell locations.
- There are two problems that arise in this scenario,
 1. If the messages are too infrequent, the SGSN will be required to “page” the network every time a packet needs to be delivered. Effectively doubling the amount of traffic on the network and introducing sever lag.
 2. However, if the messages are too frequent you run into the problem of inefficiency, wasting resource such as bandwidth and battery power. It is estimated that a typical user may change cells every 30 to 40 seconds!
- To solve this problem the ETSI developed a simple state machine to control the frequency of update messages based on the current activity of the MS

Mobility Management (Part 2)

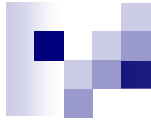
- An MS starts in the IDLE state
- When data is sent it attaches to the network and moves to the ready state, and creates a timer
- If more data is sent the timer is reset each time, however if the timer runs out, the MS transitions to the STANDBY state
- Once again a timer is created, if data needs to be sent, the MS transitions to the READY state. If the timer runs out before more data is ready the MS detaches and returns to the IDLE state
- When in the READY or STANDBY STATE, the MS informs the SGSN of every cell change
- In the IDLE state, the SGSN is informed only if the cell change occurs between cells controlled by different SGSNs





Summary

- GPRS is packet switched, not circuit switched; Billed by the amount of data transferred, not by the length of the session
- GPRS extends existing networks, such as GSM, it does not stand on its own
- Before a MS can use the GPRS network, it must first attach to the network; it must also detach from the network, when finished
- Once attached, a MS must create a session for each external PDN to be used
- The MS sends packets in the format of the external PDN, this is then encapsulated at the SGSN (using the GTP) and sent to the appropriate GGSN where it is decapsulated and forwarded on the PDN
- GPRS tracks a MS's location via "location update messages" sent by the MS.
- To regulate the frequency of the "location update messages" GPRS defines a simple state machine that tells the MS when to send such messages.

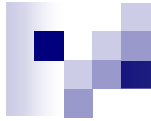


Questions?



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