GPRS - Overview

General Packet Radio System is also known as **GPRS** is a third-generation step toward internet access. GPRS is also known as GSM-IP that is a Global-System Mobile Communications Internet Protocol as it keeps the users of this system online, allows to make voice calls, and access internet on-the-go. Even Time-Division Multiple Access (TDMA) users benefit from this system as it provides packet radio access.

GPRS also permits the network operators to execute an Internet Protocol (IP) based core architecture for integrated voice and data applications that will continue to be used and expanded for 3G services.

GPRS supersedes the wired connections, as this system has simplified access to the packet data networks like the internet. The packet radio principle is employed by GPRS to transport user data packets in a structure way between GSM mobile stations and external packet data networks. These packets can be directly routed to the packet switched networks from the GPRS mobile stations.

In the current versions of GPRS, networks based on the Internet Protocol (IP) like the global internet or private/corporate intranets and X.25 networks are supported.

Who owns GPRS ?

The GPRS specifications are written by the European Telecommunications Standard Institute (ETSI), the European counterpart of the American National Standard Institute (ANSI).

Key Features

Following three key features describe wireless packet data:

- **The always online feature -** Removes the dial-up process, making applications only one click away.
- **An upgrade to existing systems -** Operators do not have to replace their equipment; rather, GPRS is added on top of the existing infrastructure.
- **An integral part of future 3G systems -** GPRS is the packet data core network for 3G systems EDGE and WCDMA.

Goals of GPRS

GPRS is the first step toward an end-to-end wireless infrastructure and has the following goals:

- Open architecture
- Consistent IP services
- Same infrastructure for different air interfaces
- Integrated telephony and Internet infrastructure
- Leverage industry investment in IP
- Service innovation independent of infrastructure

Benefits of GPRS

Higher Data Rate

GPRS benefits the users in many ways, one of which is higher data rates in turn of shorter access times. In the typical GSM mobile, setup alone is a lengthy process and equally, rates for data permission are restrained to 9.6 kbit/s. The session establishment time offered while GPRS is in practice is lower than one second and ISDN-line data rates are up to many 10 kbit/s.

Easy Billing

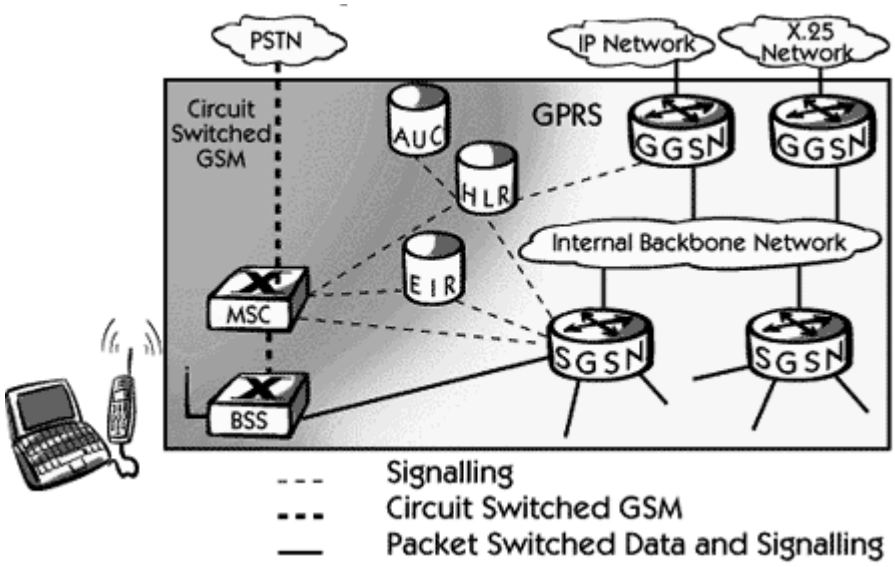
GPRS packet transmission offers a more user-friendly billing than that offered by circuit switched services. In circuit switched services, billing is based on the duration of the connection. This is unsuitable for applications with bursty traffic. The user must pay for the entire airtime, even for idle periods when no packets are sent (e.g., when the user reads a Web page).

In contrast to this, with packet switched services, billing can be based on the amount of transmitted data. The advantage for the user is that he or she can be "online" over a long period of time but will be billed based on the transmitted data volume.

GPRS - Architecture

GPRS architecture works on the same procedure like GSM network, but, has additional entities that allow packet data transmission. This data network overlaps a second-generation GSM network providing packet data transport at the rates from 9.6 to 171 kbps. Along with the packet data transport the GSM network accommodates multiple users to share the same air interface resources concurrently.

Following is the GPRS Architecture diagram:



GPRS attempts to reuse the existing GSM network elements as much as possible, but to effectively build a packet-based mobile cellular network, some new network elements, interfaces, and protocols for handling packet traffic are required.

Therefore, GPRS requires modifications to numerous GSM network elements as summarized below:

GSM Network Element	Modification or Upgrade Required for GPRS.
Mobile Station (MS)	New Mobile Station is required to access GPRS services. These new terminals will be backward compatible with GSM for voice calls.
BTS	A software upgrade is required in the existing Base Transceiver Station(BTS).
BSC	The Base Station Controller (BSC) requires a software upgrade and the installation of new hardware called the packet control unit (PCU). The PCU directs the data traffic to the GPRS network and can be a separate hardware element associated with the BSC.
GPRS Support Nodes (GSNs)	The deployment of GPRS requires the installation of new core network elements called the serving GPRS support node (SGSN) and gateway GPRS support node (GGSN).
Databases (HLR, VLR, etc.)	All the databases involved in the network will require software upgrades to handle the new call models and functions introduced by GPRS.

GPRS Mobile Stations

New Mobile Stations (MS) are required to use GPRS services because existing GSM phones do not handle the enhanced air interface or packet data. A variety of MS can exist, including a high-speed version of current phones to support high-speed data access, a new PDA device with an embedded GSM phone, and PC cards for laptop computers. These mobile stations are backward compatible for making voice calls using GSM.

GPRS Base Station Subsystem

Each BSC requires the installation of one or more Packet Control Units (PCUs) and a software upgrade. The PCU provides a physical and logical data interface to the Base Station Subsystem (BSS) for packet data traffic. The BTS can also require a software upgrade but typically does not require hardware enhancements.

When either voice or data traffic is originated at the subscriber mobile, it is transported over the air interface to the BTS, and from the BTS to the BSC in the same way as a standard GSM call. However, at the output of the BSC, the traffic is separated; voice is sent to the Mobile Switching Center (MSC) per standard GSM, and data is sent to a new device called the SGSN via the PCU over a Frame Relay interface.

GPRS Support Nodes

Following two new components, called Gateway GPRS Support Nodes (GSNs) and, Serving GPRS Support Node (SGSN) are added:

Gateway GPRS Support Node (GGSN)

The Gateway GPRS Support Node acts as an interface and a router to external networks. It contains routing information for GPRS mobiles, which is used to tunnel packets through the IP based internal backbone to the correct Serving GPRS Support Node. The GGSN also collects charging information connected to the use of the external data networks and can act as a packet filter for incoming traffic.

Serving GPRS Support Node (SGSN)

The Serving GPRS Support Node is responsible for authentication of GPRS mobiles, registration of mobiles in the network, mobility management, and collecting information on charging for the use of the air interface.

Internal Backbone

The internal backbone is an IP based network used to carry packets between different GSNs. Tunnelling is used between SGSNs and GGSNs, so the internal backbone does not need any information about domains outside the GPRS network. Signalling from a GSN to a MSC, HLR or EIR is done using SS7.

Routing Area

GPRS introduces the concept of a Routing Area. This concept is similar to Location Area in GSM, except that it generally contains fewer cells. Because routing areas are smaller than location areas, less radio resources are used While broadcasting a page message.

Bluetooth Technology : Introduction

Bluetooth is one of the major wireless technologies developed to achieve WPAN (wireless personal area network). It is used to connect devices of different functions such as telephones, computers (laptop or desktop), notebooks, cameras, printers, and so on.

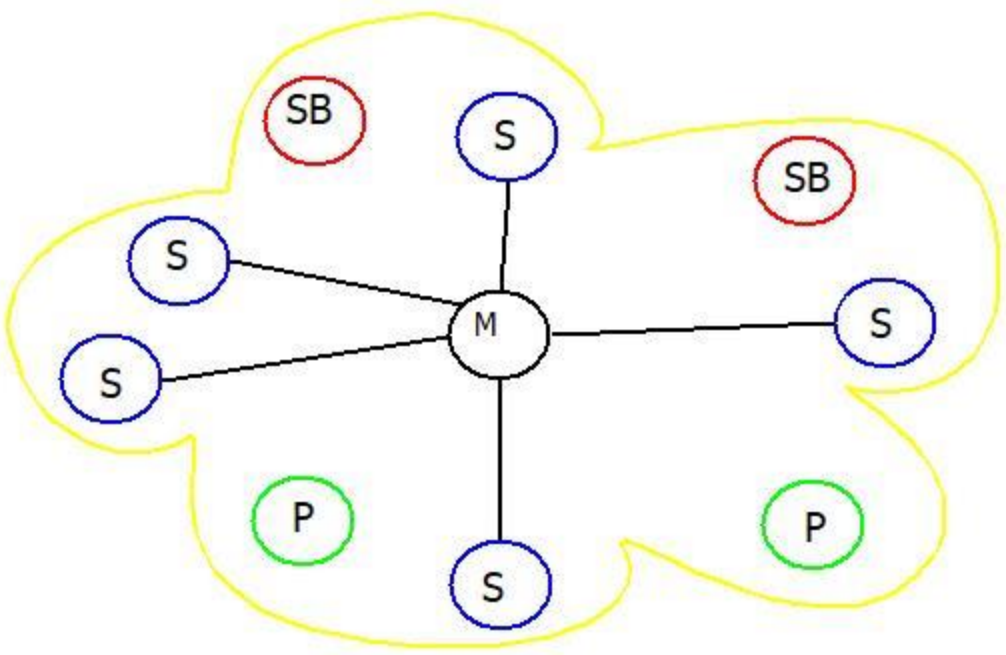
- **Bluetooth technology is a wireless technology based on mobile computing technology. Being an open wireless technology standard, it is used to send or receive data to connected devices present across a certain distance i.e. it uses a band of 2.4 to 2.485 GHz.**
- **Bluetooth is also known as IEEE 802.15 standard.**
- **The developing unit of this technology is a group of 5 companies called as Special Interest Group which was formed in 1998. The companies are Ericsson, Intel, IBM, Nokia and Toshiba.**
- **The range of Bluetooth technology over which data can be exchanged is less than 10 meters but, the latest version of Bluetooth i.e. Bluetooth 5.0 can exchange data in a range of about 40-400 meters.**
- **The speed at which data transmission occur is around 1 mbps.**

Bluetooth Technology : Architecture

- **An architecture of Bluetooth is called as a "Piconet".**
- **Piconet offers the technology with the help of which data transmission occurs, based on is nodes i.e. Master node and Slave Nodes.**
- **A master node is a node from which data is being sent and slave node is which the data is received.**
- **Ultra-High frequency and short wavelength radio waves, through which data transmission occurs.**
- **The Piconet used the concept of multiplexing as well as spread spectrum i.e. it is a combination of code division multiple access and frequency hopping spread spectrum.**

Conditions

- **Maximum number of Master Node → 1**
- **Maximum number of Slave Nodes → 7**
- **Maximum number of Nodes in a Piconet → 8**
- **Maximum number of devices that can be paired → $2^8 - 1 = 255$**
- **Number of devices that can be parked → Infinite(∞).**



Bluetooth Technology Architecture : Piconet

- **A parked node is a node which is ready to be connected and stand by node is a node which can either become a slave or parked node or either remains idle / disconnected.**
- **Also, data transmission can only occur between master and slave nodes and not between slave and slave nodes.**
- **If the connection from master node gets disconnected, the whole Piconet gets disconnected.**
- **If two master nodes are connected together, then that network is called as Scatter-net.**
- **We can thus conclude that with the increase in number of slaves/devices in a Piconet the data transmission speed decreases and if number of slaves/devices in a Piconet decreases then the data transmission speed increases.**

Advantages : Bluetooth Technology

- **Wireless technology.**
- **Very simple to form a Piconet.**
- **Cheap Technology.**
- **Robust.**
- **Low energy consumption.**

Disadvantages : Bluetooth Technology

- **Low in bandwidth.**
- **Data transmission range is a constraint as it is very less.**

Applications : Bluetooth Technology

- **Blue-tooth Speakers.**
- **Blue-tooth Headphones.**
- **Blue-tooth Headsets(for calling purpose).**
- **Wireless mouse and keyboard.**
- **Blue-tooth gaming consoles.**