IMT-2000:

In all, these technologies fall under the ITUs generic name of IMT-2000 (International Mobile Telecommunications 2000). But when the ITU tried to unify and standardise 3G technologies, no consensus was reached. There were thus five terrestrial standards developed as part of the IMT- 2000 program. Instead, depending on where in the world 3G will be implemented, the 3G standard will be based on CDMA variants cdma2000 or W-CDMA.

3G:

3G or 3rd generation mobile telecommunications is a generation of standards for mobile phones and mobile telecommunication services fulfilling the International Mobile Telecommunications- 2000 (IMT-2000) specifications by the International Telecommunication Union. Application services include wide-area wireless voice telephone, mobile Internet access, video calls and mobile TV, all in a mobile environment.

Several telecommunications companies market wireless mobile Internet services as 3G, indicating that the advertised service is provided over a 3G wireless network. Services advertised as 3G are required to meet IMT-2000 technical standards, including standards for reliability and speed (data transfer rates). To meet the IMT-2000 standards, a system is required to provide peak data rates of at least 200 kbit/s (about 0.2 Mbit/s). However, many services advertised as 3G provide higher speed than the minimum technical equipments for a 3G service. Recent 3G releases, often denoted 3.5G and 3.75G, also provide mobile broadband access of several Mbit/s to smart phones and mobile modems in laptop computers.

The following standards are typically branded 3G: □□the UMTS system, first offered in 2001, standardized by 3GPP, used primarily in Europe, Japan, China (however with a different radio interface) and other regions predominated by GSM 2G system infrastructure. The cell phones are typically UMTSand GSM hybrids. Several radio interfaces are offered, sharing the sameinfrastructure: □□The original and most widespread radio interface is called W-CDMA. □□The TD-SCDMA radio interface was commercialised in 2009 and is only offered in China.

The latest UMTS release, HSPA+, can provide peak data rates up to 56 Mbit/s in the downlink in theory (28 Mbit/s in existing services) and 22 Mbit/s in the uplink.. The CDMA2000 system, first offered in 2002, standardized by 3GPP2, used especially in North America and South Korea, sharing infrastructure with the IS-95 2G standard. The cell phones are typically CDMA2000 and IS-95 hybrids. The latest release EVDO Rev B offers peak rates of 14.7 Mbit/s downstream.

The above systems and radio interfaces are based on kindred spread spectrum radio transmission technology. While the GSM EDGE standard ("2.9G"), DECT cordless phones and Mobile WiMAX standards formally also fulfill the IMT-2000 requirements and are approved as 3G standards by ITU, these are typically not branded 3G, and are based on completely different technologies.

A new generation of cellular standards has appeared approximately every tenth year since 1G systems were introduced in 1981/1982. Each generation is characterized by new frequency bands, higher data rates and non backwards compatible transmission technology. The first release of the 3GPP Long Term Evolution (LTE) standard does not completely fulfill the ITU 4G requirements called IMT-Advanced. First release LTE is

not backwards compatible with 3G, but is a pre-4G or 3.9G technology, however sometimes branded "4G" by the service providers. Its evolution LTE Advanced is a 4G technology. WiMAX is another technology verging on or marketed as 4G.

TMSI:

The Temporary Mobile Subscriber Identity (TMSI) is the identity that is most commonly sent between the mobile and the network. TMSI is randomly assigned by the VLR to every mobile in the area, the moment it is switched on. The number is local to a location area, and so it has to be updated each time the mobile moves to a new geographical area.
The network can also change the TMSI of the mobile at any time. And it normally does so, in order to avoid the subscriber from being identified, and tracked by eavesdroppers on the radio interface. This makes it difficult to trace which mobile is which, except briefly, when the mobile is just switched on, or when the data in the mobile becomes invalid for one reason or another. At that point, the global "international mobile subscriber identity" (IMSI) must be sent to the network. The IMSI is sent as rarely as possible, to avoid it being identified and tracked.
A key use of the TMSI is in paging a mobile. "Paging" is the one-to-one communication between the mobile and the base station. The most important use of broadcast information is to set up channels for "paging". Every cellular system has a broadcast mechanism to distribute such information to a plurality of mobiles.
Size of TMSI is 4 octet with full hex digits and can't be all 1 because the SIM uses 4 octets with all bits equal to 1 to indicate that no valid TMSI is available

Roaming:

Roaming is one of the fundamental mobility management procedures of all cellular networks.
Roaming is defined as the ability for a cellular customer to automatically make and receive voice calls, send and receive data, or access other services, including home data services, when travelling outside the geographical coverage area of the home network, by means of using a visited network. This can be done by using a communication terminal or else just by using the subscriber identity in the visited network. Roaming is technically supported by mobility management, authentication, authorization and billing procedures.

Location area:

A "location area" is a set of base stations that are grouped together to optimise signalling. Typically, tens or even hundreds of base stations share a single Base Station Controller (BSC) in GSM, or a Radio Network Controller (RNC) in UMTS, the intelligence behind the base stations. The BSC handles allocation of radio channels, receives measurements from the mobile phones, controls handovers from base station to base station.

To each location area, a unique number called a "location area code" is assigned. The location area code is broadcast by each base station, known as a "base transceiver station" BTS in GSM, or a Node B in UMTS, at regular intervals.

In GSM, the mobiles cannot communicate directly with each other but, have to be channeled through the BTSs. In UMTS networks, if no Node B is accessible to a mobile, it will not be able to make any connections at all.

If the location areas are very large, there will be many mobiles operating simultaneously, resulting in very high paging traffic, as every paging request has to be broadcast to every

base station in the location area. This wastes bandwidth and power on the mobile, by requiring it to listen for broadcast messages too much of the time. If on the other hand, there are too many small location areas, the mobile must contact the network very often for changes of location, which will also drain the mobile's battery. A balance has therefore to be struck

Routing area:

The routing area is the PS domain equivalent of the location area. A "routing area" is normally a subdivision of a "location area". Routing areas are used by mobiles which are GPRS-attached. GPRS ("General Packet Radio Services"), GSM's new data transmission technology, is optimized for "bursty" data communication services, such as wireless internet/intranet, and multimedia services. It is also known as GSM-IP ("Internet Protocol") because it will connect users directly to Internet Service Providers (ISP).

The bursty nature of packet traffic means that more paging messages are expected per mobile, and so it is worth knowing the location of the mobile more accurately than it would be with traditional circuit-switched traffic. A change from routing area to routing area (called a "Routing Area Update") is done in an almost identical way to a change from location area to location area. The main differences are that the "Serving GPRS Support Node" (SGSN) is the element involved

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