**1G:**

**1G** refers to the first generation of wireless cellular technology (mobile telecommunication).Theseare the [analog](https://en.wikipedia.org/wiki/Analog_signal" \o "Analog signal) telecommunications standards that were introduced in the 1980s and continued until being replaced by [2G](https://en.wikipedia.org/wiki/2G" \o "2G) [digital telecommunications](https://en.wikipedia.org/wiki/Digital_telecommunications" \o "Digital telecommunications). The main difference between the two mobile cellular systems (1G and 2G), is that the radio signals used by 1G networks are analog, while 2G networks are digital.

Although both systems use digital signaling to connect the radio towers (which listen to the handsets) to the rest of the telephone system, the voice itself during a call is encoded to digital signals in 2G whereas 1G is only [modulated](https://en.wikipedia.org/wiki/Modulation" \o "Modulation) to higher frequency, typically 150 MHz and up.

**2G:**

**2G** (or **2-G**) is short for second-generation [cellular](https://en.wikipedia.org/wiki/Cellular_network" \o "Cellular network) [technology](https://en.wikipedia.org/wiki/Technology" \o "Technology). Second-generation 2G cellular networks were commercially launched on the [GSM](https://en.wikipedia.org/wiki/GSM" \o "GSM) standard.

Three primary benefits of 2G networks over their predecessors were that:

* phone conversations were digitally encrypted
* 2G systems were significantly more efficient on the spectrum allowing for far greater wireless penetration levels
* 2G introduced data services for mobile, starting with [SMS](https://en.wikipedia.org/wiki/Short_Message_Service" \o "Short Message Service) text messages.

2G technologies enabled the various networks to provide the services such as text messages, picture messages, and MMS (multimedia messages). All text messages sent over 2G are digitally encrypted, allowing for the transfer of data in such a way that only the intended receiver can receive and read it.

**2.5G(GPRS):**

1. **General Packet Radio Service** (**GPRS**) is a [packet oriented](https://en.wikipedia.org/wiki/Packet_oriented" \o "Packet oriented) [mobile data](https://en.wikipedia.org/wiki/Mobile_data" \o "Mobile data) service on the [2G](https://en.wikipedia.org/wiki/2G" \o "2G) and [3G](https://en.wikipedia.org/wiki/3G" \o "3G) [cellular communication](https://en.wikipedia.org/wiki/Cellular_communication" \o "Cellular communication) system's [global system for mobile communications](https://en.wikipedia.org/wiki/Global_System_for_Mobile_Communications" \o "Global System for Mobile Communications) (GSM).
2. It is now maintained by the **[3rd Generation Partnership Project](https://en.wikipedia.org/wiki/3rd_Generation_Partnership_Project" \o "3rd Generation Partnership Project) (3GPP)**.
3. GPRS usage is typically charged based on volume of data transferred, contrasting with [circuit switched](https://en.wikipedia.org/wiki/Circuit_switching" \o "Circuit switching) data, which is usually billed per minute of connection time. Sometimes billing time is broken down to every third of a minute.
4. GPRS is a [best-effort](https://en.wikipedia.org/wiki/Best-effort" \o "Best-effort) service, implying variable [throughput](https://en.wikipedia.org/wiki/Throughput" \o "Throughput) and [latency](https://en.wikipedia.org/wiki/Latency_(engineering)" \o "Latency (engineering)) that depend on the number of other users sharing the service concurrently.
5. In 2G systems, GPRS provides data rates of 56–114 kbit/second.
6. [2G](https://en.wikipedia.org/wiki/2G" \o "2G) cellular technology combined with GPRS is sometimes described as *[2.5G](https://en.wikipedia.org/wiki/2.5G" \o "2.5G)*, that is, a technology between the second ([2G](https://en.wikipedia.org/wiki/2G" \o "2G)) and third ([3G](https://en.wikipedia.org/wiki/3G" \o "3G)) generations of mobile telephony.

**2.75G(EDGE):**

Edge means ****Enhanced Data Rates**for GSM Evolution** (sometimes also called EGPRS). This is a technology for data transmission. It works on existing GSM networks. It is an extension of GPRS and allows for speeds up to 384 Kbps.

**3G:**

* **3G**, short for third generation, is the third generation of [wireless](https://en.wikipedia.org/wiki/Wireless" \o "Wireless) mobile telecommunications technology.It is theupgrade for [2G](https://en.wikipedia.org/wiki/2G" \o "2G) and [2.5G](https://en.wikipedia.org/wiki/2.5G" \o "2.5G) [GPRS](https://en.wikipedia.org/wiki/GPRS" \o "GPRS) networks, for faster internet speed.
* 3G finds application in wireless voice telephony, [mobile Internet](https://en.wikipedia.org/wiki/Mobile_Internet" \o "Mobile Internet) access, fixed wireless Internet access, video calls and mobile TV.
* It provides better browsing speeds and data speeds 2Mbps max and it provide support for video conferencing.
* Later 3G releases, often denoted [3.5G](https://en.wikipedia.org/wiki/3.5G" \o "3.5G) and [3.75G](https://en.wikipedia.org/wiki/3.75G" \o "3.75G), also provide [mobile broadband](https://en.wikipedia.org/wiki/Mobile_broadband" \o "Mobile broadband) access of several [Mbit/s](https://en.wikipedia.org/wiki/Mbps" \o "Mbps) to [smartphones](https://en.wikipedia.org/wiki/Smartphone" \o "Smartphone) and [mobile modems](https://en.wikipedia.org/wiki/Mobile_modem" \o "Mobile modem) in laptop computers.
* This ensures it can be applied to wireless voice telephony, mobile Internet access, fixed wireless Internet access, video calls and mobile TV technologies.

**3.5G and 3.75G:**

3.5G and 3.75G are HSPA and HSPA+ respectively. They provide downlink speeds of 14Mbps and 168Mbps respectively. 3.75G is able to achieve this kind of speed and low latency using MIMO (Multiple Input and Multiple Output).

**4G:**

* 4G is the short name for fourth-generation wireless, the stage of broadband mobile communications that will supercede the third generation ([3G](http://searchtelecom.techtarget.com/definition/3G) ).
* 4G is actually deployed in 2 forms one is WiMAX (Worldwide Interoperability for Microwaves Access) and LTE (Long Term Evolution).
* LTE is a better adoption as WiMAX supports voice calling via VoIP. LTE provide data transfer speeds of 300Mbps.
* LTE-Adavnce is there as it provide data transfer rate of 450Mbps. LTE also bring VoLTE which is voice over LTE Network this will provide HD voice calls over LTE Network.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameters** | **1G** | **2G** | **3G** | **4G** |
| **Image** | IMG_256 | IMG_257 | IMG_258 | IMG_259 |
| **Name** | 1st Generation Mobile Network | 2nd Generation Mobile Network | 3rd Generation Mobile Network | 4th Generation Mobile Network |
| **Introduced in year** | 1980s | 1993 | 2001 | 2009 |
| **Location of first commercialization** | USA | Finland | Japan | South Korea |
| **Technology** | AMPS (Advanced Mobile Phone System), NMT, TACS | IS-95, GSM | IMT2000, WCDMA | LTE, WiMAX |
| **Multiple Address/Access system** | FDMA | TDMA, CDMA | CDMA | CDMA |
| **Switching type** | Circuit switching | Circuit switching for Voice and Packet switching for Data | Packet switching except for Air Interface | Packet switching |
| **Speed (data rates)** | 2.4 Kbps to 14.4 kbps | 14.4 Kbps | 3.1 Mbps | 100 Mbps |
| **Special Characteristic** | First wireless communication | Digital version of 1G technology | Digital broadband, speed increments | Very high speeds, All IP |
| **Features** | Voice only | Multiple users on single channel | Multimedia features, Video Call | High Speed, real time streaming |
| **Supports** | Voice only | Voice and Data | Voice and Data | Voice and Data |
| **Internet service** | No Internet | Narrowband | Broadband | Ultra Broadband |
| **Bandwidth** | Analog | 25 MHz | 25 MHz | 100 MHz |
| **Operating frequencies** | 800 MHz | GSM: 900MHZ, 1800MHz CDMA: 800MHz | 2100 MHz | 850 MHz, 1800 MHz |
| **Band (Frequency) type** | Narrow band | Narrow band | Wide band | Ultra Wide Band |
| **Carrier frequency** | 30 KHZ | 200 KHz | 5 MHz | 15 MHz |
| **Advantage** | Simpler (less complex) network elements | Multimedia features (SMS, MMS), Internet access and SIM introduced | High security, international roaming | Speed, High speed handoffs, MIMO technology, Global mobility |
| **Disadvantages** | Limited capacity, not secure, poor battery life, large phone size, background interference | Low network range, slow data rates | High power consumption, Low network coverage, High cost of spectrum licence | Hard to implement, complicated hardware required |
| **Applications** | Voice Calls | Voice calls, Short messages, browsing (partial) | Video conferencing, mobile TV, GPS | High speed applications, mobile TV, Wearable devices |

**PACKET SWITCHING:**

Packet switching is a digital network transmission process in which data is broken into suitably-sized pieces or blocks for fast and efficient transfer via different network devices. When a computer attempts to send a file to another computer, the file is broken into packets so that it can be sent across the network in the most efficient way. These packets are then routed by network devices to the destination.

**CIRCUIT SWITCHING:**

Circuit-switched is a type of network in which a physical path is obtained for and dedicated to a single connection between two end-points in the network for the duration of the connection. Ordinary voice phone service is circuit-switched. The telephone company reserves a specific physical path to the number you are calling for the duration of your call. During that time, no one else can use the physical lines involved.

|  |  |
| --- | --- |
| **CIRCUIT SWITCHING** | **PACKET SWITCHING** |
| In circuit switching there are 3 phases i) Connection Establishment. ii) Data Transfer. iii) Connection Released. | In Packet switching directly data transfer takes place . |
| In circuit switching, each data unit know the entire path address which is provided by the source | In Packet switching, each data unit just know the final destination address intermediate path is decided by the routers. |
| In Circuit switching, data is processed at source system only | In Packet switching, data is processed at all intermediate node including source system. |
| Delay between data units in circuit switching is uniform. | Delay between data units in packet switching is not uniform. |
| Resource reservation is the feature of circuit switching because path is fixed for data transmission. | There is no resource reservation because bandwidth is shared among users. |
| Circuit switching is more reliable. | Packet switching is less reliable. |
| Wastage of resources are more in Circuit Switching | Less wastage of resources as compared to Circuit Switching |

**VOICE:**

**MO(MOBILE ORIGINATE):**

MO, mobile originated messaging, means the message that the customer sends in to the system, from their own mobile phone.The message is **ORIGINATED** at the **mobile**/cellphone end.It is an **OUTGOING** call.

**MT(MOBILE TERMINATE):**

MT,refers to a message being sent to a **mobile** handset. The message is **TERMINATED** at the **mobile**/cellphone end.It is an **INCOMING** call.

**APN:**

* An **Access Point Name** (**APN**) is the name of a [gateway](https://en.wikipedia.org/wiki/Gateway_(telecommunications)" \o "Gateway (telecommunications)) between a [GSM](https://en.wikipedia.org/wiki/Global_System_for_Mobile_Communications" \o "Global System for Mobile Communications), [GPRS](https://en.wikipedia.org/wiki/General_Packet_Radio_Service" \o "General Packet Radio Service), [3G](https://en.wikipedia.org/wiki/3G" \o "3G) or [4G](https://en.wikipedia.org/wiki/4G" \o "4G) [mobile network](https://en.wikipedia.org/wiki/Cellular_network" \o "Cellular network) and another [computer network](https://en.wikipedia.org/wiki/Computer_network" \o "Computer network), frequently the public [Internet](https://en.wikipedia.org/wiki/Internet" \o "Internet).
* A mobile device making a data connection must be configured with an APN to present to the carrier. The carrier will then examine this identifier to determine what type of network connection should be created, for example:

1. which [IP addresses](https://en.wikipedia.org/wiki/IP_address" \o "IP address) should be assigned to the wireless device.
2. which security methods should be used.
3. and how or if, it should be connected to some private customer network.

More specifically, the APN identifies the [packet data network](https://en.wikipedia.org/wiki/Packet_switching" \o "Packet switching) (PDN) that a mobile data user wants to communicate with.

**PDN(Packet Data Network):**

PDN is a generic description for a network that provides data services. Packet switching is a mode of data transmission in which a message is broken into a number of parts that are sent independently, over whatever route is optimum for each packet, and reassembled at the destination. The Internet is a Packet Data Network.

**FDN:**

* **Fixed Dialing Number** (**FDN**) is a service mode of a [GSM](https://en.wikipedia.org/wiki/GSM" \o "GSM) phone's [Subscriber Identity Module](https://en.wikipedia.org/wiki/Subscriber_Identity_Module" \o "Subscriber Identity Module) (SIM) card. Numbers are added to the FDN list, and when activated, FDN restricts outgoing calls to only those numbers listed, or to numbers with certain prefixes.
* Incoming calls are not affected by FDN mode.
* Not all SIM cards have this feature. PIN2 must be entered beforehand or when applying such settings, which is unique to each card and initially provided by the network operator. Doing so prevents unauthorized users disabling the FDN list.
* This code is separate from the main PIN1 number which can lock and unlock the SIM card for both inbound and outbound calling.

**DSDS(Dual Sim Dual Standby):**

* ****Dual standby**** means both SIM cards can connect (listen) to their own mobile networks. These two SIM cards in the same phone can even be from one carrier. In this case, both are connected to the same mobile network independently, just like from two different phones.
* In dual standby Android phones, there is only one set of hardware (mainly receiver)  to serve two SIM cards. In other words, two SIM cards share one set of hardware through time sharing algorithms implemented in the software level.

**DSDS(Dual Sim Dual Standby):**

****Dual active**** Android phones, there are usually****two**** sets of receivers. Each SIM card uses its own receiver.

**Disadvantage:** More power ,more cost and more RF because of two receivers.

* ****CSFB** (CS Fall Back):**

1. whenever the UE have the need to place a call, make it revert (fallback) for legacy networks.
2. At CSFB scheme, whenever there is a demand for a new voice call, the LTE user is 'backed' for a CS legacy network, assuming that this provides an overlapping coverage.
3. In other words, with CSFB, a voice call is never active in LTE, but in legacy networks.
4. At the end of the call in the legacy network, the UE can re-register the LTE network.
5. To CSFB be possible, users must be using dual mode devices, ie able to operate both in LTE network and in the legacy network.

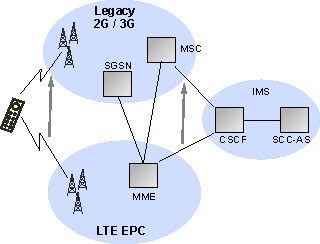
* ****VoLTE** (Voice over LTE):** make voice over LTE itself. In this case, the voice is pure IP - VoIP LTE.
* ****SRVCC** (Single Radio Voice Call Continuity):**

1. It provides an interim solution for handing over [VoLTE](https://en.wikipedia.org/wiki/VoLTE" \o "VoLTE) (Voice over LTE) to 2G/3G networks.
2. The voice calls on LTE network are meant to be packet switched calls which use [IMS](https://en.wikipedia.org/wiki/IP_Multimedia_Subsystem" \o "IP Multimedia Subsystem) system to be made. To make it inter operable with existing networks, these calls are to be handed over to Circuit switched calls in GSM/WCDMA networks.
3. Ensure that purely LTE (VoLTE) calls are transferred (via handover) to the legacy networks in a transparent manner.

**LTE to legacy network handover**  
Handover from LTE to the legacy network is required when the user moves out of the LTE coverage area. Using SRVCC, the handover is undertaken in two stages.

* ***Radio Access Technology transfer:***The handover for the radio access network and this is a well-established protocol that is in use for transfers from 3G to 2G
* ***Session transfer:***  The session transfer is the new element that is required for SRVCC. It is required to move the access control and voice media anchoring from the Evolved Packet Core, EPC of the packet switched LTE network to the legacy circuit switched network.

During the handover process the CSCF within the IMS architecture maintains the control of the whole operation.

  
**Voice handover using SRVCC on LTE**

The SRVCC handover process takes place in a number of steps:

1. The handover process is initiated by a request for session transfer from the IMS CSCF **(Call Session Control Function)**.
2. The IMS CSCF responds simultaneously with two commands, one to the LTE network, and the other to the legacy network.
3. the LTE network receives a radio Access Network handover execution command through the MME and LTE RAN. This instructs the user device to prepare to move to a circuit switched network for the voice call.
4. The destination legacy circuit switched network receives a session transfer response preparing it to accept the call from the LTE network.
5. After all the commands have been executed and acknowledged the call is switched to the legacy network with the IMS CSCF still in control of the call.

**Legacy network to LTE**  
When returning a call to the LTE network much of the same functionality is again used.

To ensure the VoLTE device is able to return to the LTE RAN from the legacy RAN, there are two options the legacy RAN can implement to provide a swift and effective return:

* Allow LTE information to be broadcast on the legacy RAN so the LTE device is able to perform the cell reselection more easily.
* Simultaneously release the connection to the user device and redirect it to the LTE RAN.

**SIM pins:**

### **Using your PIN1 code:**

When the PIN1 code ON/OFF setting is set to ON, you are required to enter the PIN1 code when you turn on the handset power. If you enter the PIN1 code incorrectly, you will not be able to make or receive calls or use various communications functions. If the wrong PIN1 code is entered three times in a row, PIN Lock will be automatically activated.

### **Using your PIN2 code**

When the PIN2 code ON/OFF setting is set to ON, you are required to enter the PIN2 code when making user certificate operations. If the wrong PIN2 code is entered three times in a row, PIN Lock will be automatically activated.

**PIN Lock Disable Code (PUK):**

The PIN Lock Disable Code (PUK) is used to unlock a PIN1 or PIN2 for which PIN Lock has been activated after the wrong PIN code is entered three times in a row.