**What is 4G?**

**4G is the fourth generation** of mobile phone technology that follows on from the existing 3G and 2G mobile technology.

2G technology launched in the 1990s and was capable of making digital phone calls and sending texts. Then 3G came along in 2003 and made it possible to browse web pages, make video calls and download music and video on the move.

4G technologies builds upon what 3G currently offers, but does everything at a much faster speed.

When 4G was first introduced, and even when it started to become widely available, many networks weren’t up to the speed of 4G. However some carriers sold 4G-compatible phones, even though customers weren’t truly getting 4G unless they were in an area covered by a 4G network. Most places offer 4G now, but when users with 4G devices are in areas offering only 3G, smartphones and other devices will switch over to 3G. If this happens you won’t have any talk/voice issues, you will just have slower Internet and downloading speeds.

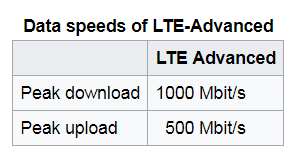
In March 2008, the International Telecommunications Union-Radio communications sector (ITU-R) specified a set of requirements for 4G standards, named the International Mobile Telecommunications Advanced (IMT-Advanced) specification.

**IMT-Advanced Requirements**

* Be based on an all-IP packet switched network.
* Have peak data rates of up to approximately 100 Mbit/s for high mobility communication (such as from trains and cars) and up to approximately 1 Gbit/s for low mobility communication (such as pedestrians and stationary users).
* Be able to dynamically share and use the network resources to support more simultaneous users per cell.
* Use scalable channel bandwidths of 5–20 MHz, optionally up to 40 MHz.
* Smooth handovers across heterogeneous networks.
* Seamless connectivity and global roaming across multiple networks.
* High quality of service for next generation multimedia support (real time audio, high speed data, HDTV video content, mobile TV, etc.)

In September 2009, these technology proposals were submitted to the International Telecommunication Union (ITU) as 4G candidates and were approved in October 2010:

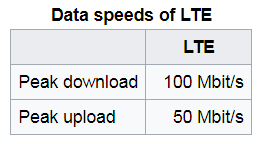
* [LTE Advanced](https://en.wikipedia.org/wiki/LTE_Advanced) standardized by the [3GPP](https://en.wikipedia.org/wiki/3GPP)
* LTE Advanced or 3rd Generation Partnership Project (3GPP) is essentially an enhancement to LTE. It is not a new technology, but rather an improvement on the existing LTE network.



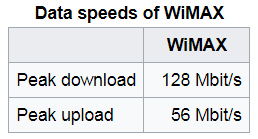
* [802.16m](https://en.wikipedia.org/wiki/802.16m) standardized by the [IEEE](https://en.wikipedia.org/wiki/IEEE) (i.e. WiMAX)
* The IEEE 802.16m or WirelessMAN-Advanced evolution of 802.16e of [Institute of Electrical and Electronics Engineers](https://en.wikipedia.org/wiki/Institute_of_Electrical_and_Electronics_Engineers) (IEEE) is under development, with the objective to fulfill the IMT-Advanced criteria of 1 Gbit/s for stationary reception and 100 Mbit/s for mobile reception.
* IEEE 802.16 is a series of wireless broadband standards.

**Forerunner versions**

* 3GPP Long Term Evolution (LTE)
* The pre-4G 3GPP Long Term Evolution (LTE) technology is often branded "4G - LTE", but the first LTE release does not fully comply with the IMT-Advanced requirements.



* Mobile WiMAX (IEEE 802.16e)
* The Mobile WiMAX is sometimes branded 4G network even though the current version does not fulfil the IMT Advanced requirements on 4G systems.



* TD-LTE
* It is China's 4G standard that was amended and published by China's largest telecom operator – China Mobile.

**Key Features**

The following key features can be observed in all suggested 4G technologies:

* Physical layer transmission techniques are as follows:
  + [MIMO](https://en.wikipedia.org/wiki/MIMO): To attain ultra-high spectral efficiency by means of spatial processing including multi-antenna and multi-user MIMO
  + Frequency-domain-equalization to exploit the frequency selective channel property without complex equalization
  + Frequency-domain statistical multiplexing, having variable bit rate by assigning different sub-channels to different users based on the channel conditions
  + [Turbo principle](https://en.wikipedia.org/wiki/Turbo_code) [error-correcting codes](https://en.wikipedia.org/wiki/Error-correcting_code): To minimize the required [SNR](https://en.wikipedia.org/wiki/Signal-to-noise_ratio) at the reception side
* [Channel-dependent scheduling](https://en.wikipedia.org/wiki/Channel-dependent_scheduling): To use the time-varying channel
* [Link adaptation](https://en.wikipedia.org/wiki/Link_adaptation): [Adaptive modulation](https://en.wikipedia.org/wiki/Adaptive_modulation) and error-correcting codes
* [Mobile IP](https://en.wikipedia.org/wiki/Mobile_IP) utilized for mobility
* IP-based [femtocells](https://en.wikipedia.org/wiki/Femtocell" \o "Femtocell) (home nodes connected to fixed Internet broadband infrastructure)

<http://www.4g.co.uk/what-is-4g>

<https://www.tccrocks.com/blog/what-is-difference-between-4g-and-4g-lte>

<https://en.wikipedia.org/wiki/4G>

<https://en.wikipedia.org/wiki/IEEE_802.16>

<https://www.slideshare.net/kuncoro/4g-mobile-network-applications>