The Future of 5G: A (not so) Brief History of Mobile Telephony

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New mobile generations have appeared about every ten years since the first move from 1981 analogue (1G) to digital (2G) transmission in 1992.

This was followed, in 2001, by 3G multi-media support, spread spectrum transmission and at least 200 kbit/s peak bit rate, in 2011/2012 expected to be followed by "real" 4G, which refers to all-Internet Protocol (IP) packet-switched networks giving mobile ultra-broadband (gigabit speed) access.

1G: Prior to 1973, mobile telephony was limited to phones installed in cars and other vehicles. Motorola was the first company to produce a handheld mobile phone. On 3 April 1973 when Martin Cooper, a Motorola researcher and executive, made the first mobile telephone call from handheld subscriber equipment, placing a call to Dr. Joel S Engel of Bell Labs. The prototype handheld phone used by Dr Cooper weighed 1.1 kg and measured 23 cm long, 13 cm deep and 4.45 cm wide. The prototype offered a talk time of just 30 minutes and took 10 hours to re-charge.

John F Mitchell, Motorola's chief of portable communication products and Cooper's boss in 1973, played a key role in advancing the development of handheld mobile telephone equipment. Mitchell successfully pushed Motorola to develop wireless communication products that would be small enough to use anywhere and participated in the design of the cellular phone.

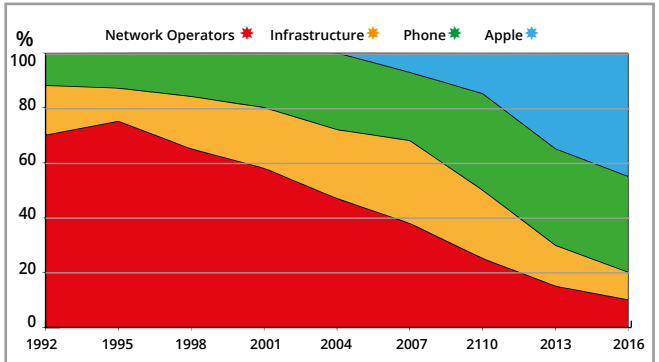
2G: In the 1990s, the 'second generation' mobile phone systems emerged. Two systems competed for supremacy in the global market: the European developed GSM standard and the US developed CDMA standard. These differed from the previous generation by using digital instead of analog transmission, and also

fast out-of-band phone-to-network signaling. In 1991 the first GSM network (Radiolinja) launched in Finland.mIn 1993, IBM Simon was introduced. This was possibly the world's first smartphone. It was a mobile phone, pager, fax machine, and PDA all rolled into one. It included a calendar, address book, clock, calculator, notepad, email, and a touchscreen with a QWERTY keyboard.

3G: As the use of 2G phones became more widespread and people began to utilize mobile phones in their daily lives, it became clear that demand for data (such as access to browse the internet) was growing. Further, experience from fixed broadband services showed there would also be an ever increasing demand for greater data speeds. The 2G technology was nowhere near up to the job, so the industry began to work on the next generation of technology known as 3G. The main technological difference that distinguishes 3G technology from 2G technology is the use of packet switching rather than circuit switching for data transmission. In addition, the standardization process focused on requirements more than technology (2 Mbit/s maximum data rate indoors, 384 kbit/s outdoors, for example).

The first pre-commercial trial network with 3G was launched by NTT DoCoMo in Japan in the Tokyo region in May 2001. NTT DoCoMo launched the first commercial 3G network on 1 October 2001, using the WCDMA technology. In 2002 the first 3G networks on the rival CDMA2000 1xEV-DO technology were launched by SK Telecom and KTF in South Korea, and Monet in the USA. By the end of 2002, the second WCDMA network was launched in Japan by Vodafone KK (now Softbank). European launches of 3G were in Italy and the UK by the Three/Hutchison group, on WCDMA. 2003 saw a further 8 commercial launches of 3G, six more on WCDMA and two more on the EV-DO standard.

4G: By 2009, it had become clear that, at some point, 3G networks would be overwhelmed by the growth of bandwidth-intensive applications like streaming media. Consequently, the industry began looking to data-optimized 4th-generation technologies, with the promise of speed improvements up to 10-fold over existing 3G technologies. The first two commercially available technologies billed as 4G were the WiMAX standard (offered in the US by Sprint) and the LTE standard, first offered in Scandinavia by TeliaSonera.



Influence in the Mobile Industry

One of the main ways in which 4G differed technologically from 3G was in its elimination of circuit switching, instead employing an all-IP network. Thus, 4G ushered in a treatment of voice calls just like any other type of streaming audio media, utilizing packet switching over internet, LAN or WAN networks via VoIP.

5G and Beyond: Next Generation Mobile Networks Alliance (NGMN Alliance) defined 5G network requirements as:

- Data rates of several tens of Mb/s should be supported for tens of thousands of users.
- 1 Gb/s to be offered, simultaneously to tens of workers on the same office floor.
- Spectral efficiency should be significantly enhanced compared to 4G.
- Up to Several 100,000's simultaneous connections to be supported for massive sensor deployments.
- Coverage should be improved
- Signaling efficiency enhanced.

1G	2G	3G	4G
			
1st Generation Wireless network	2nd Generation Wireless network	3rd Generation Wireless network	4th Generation Wireless network
• Basic voice service • Analog-based protocols	• Designed for voice • Improved coverage and capacity • First digital standards (GSM, CDMA)	• Designed for voice with some data consideration (multiedia, text, internet) • First mobile broadband	• Designed primarily for data • IP-based protocols (LTE) • true mobile broadband
The Speed			
2.4 kbps	**64 kbps**	**2000 kbps**	**100,000 kbps**

The development of the mobile phone signal - click to see a timeline infographic

Further Reading

- **A (not so) brief history of mobile telephony - *Read more.***
- **4G network protection until the arrival of 5G wireless - *Read more.***
- **On the use of mobile technology in business - *Read more.***

However, no international 5G development projects have officially been launched yet and there is still a large extent of debate on what 5G is exactly about. By 2020 it is thought that 50 billion to 100 billion devices will be connected to the internet. So, connections that run on different frequency bands will be established to cope with demand.

The huge rise in connected devices will be due to a boom in inanimate objects using the 5G network - known as the internet of things. It won't be just products like remotely controlling your heating or that mythical fridge ordering you more milk, trains could tell you which seats are free while they are in the station. Devices will be able to choose dynamically between which of three still-to-be-determined bandwidths they use to avoid any of frequencies from becoming overloaded. The aim is for the first of the frequency bands to come into use around the year 2020, with the other two to follow soon after.

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