

# Evolution of mobile phone technology

[Technology](#), [Mobile Phone](#)



A mobile phone (also known as a cellular phone, cell phone and a hand phone) is a device that can make and receive telephone calls while moving around a wide geographic area. It does so by connecting to a cellular network provided by a mobile phone operator, allowing access to the public telephone network. By contrast, a cordless telephone is used only within the short range of a single, private base station.

In addition to telephony, modern mobile phones also support a wide variety of other services such as text messaging, MMS, email, Internet access, short-range wireless communications (infrared, Bluetooth), business applications, gaming and photography. Mobile phones that offer these and more general computing capabilities are referred to as smartphones. The first hand-held mobile phone was demonstrated by John F. Mitchell and Dr Martin Cooper of Motorola in 1973, using a handset weighing around 2.2 pounds (1 kg). From 1990 to 2011, worldwide mobile phone subscriptions grew from 12. million to over 6 billion, penetrating about 87% of the global population and reaching the bottom of the economic pyramid. In 2012, for the first time since 2009 mobile phone sales to end users is declining by 1.7 percent to 1.75 billion units which is dominated by Samsung for 385 million units (53.5 percent is smartphones) and Apple for 130 million units of all smartphones. History The first mobile telephone calls were made from cars in 1946. Bell System's Mobile Telephone Service was made on 17 June in St. Louis, Missouri, followed by Illinois Bell Telephone Company's car radiotelephone service in Chicago on 2 October.

The MTA phones were composed of vacuum tubes and relays, and weighed over 80 pounds (36 kg).. John F. Mitchell, Motorola's chief of

<https://assignbuster.com/evolution-of-mobile-phone-technology/>

portable communication products 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. Martin Cooper, a Motorola researcher and executive, was the key researcher on Mitchell's team that developed the first hand-held mobile telephone for use on a cellular network.

Using a somewhat heavy portable handset, Cooper made the first call on a handheld mobile phone on 3 April 1973 to his rival, Dr. Joel S. Engel of Bell Labs. As I walked down the street while talking on the phone, sophisticated New Yorkers gaped at the sight of someone actually moving around while making a phone call. Remember that in 1973, there weren't cordless telephones or cellular phones. I made numerous calls, including one where I crossed the street while talking to a New York radio reporter - probably one of the more dangerous things I have ever done in my life. Martin Cooper The new invention sold for \$3,995 and weighed two pounds, leading to a nickname "the brick". The world's first commercial automated cellular network was launched in Japan by NTT in 1979, initially in the metropolitan area of Tokyo. In 1981, this was followed by the simultaneous launch of the Nordic Mobile Telephone (NMT) system in Denmark, Finland, Norway and Sweden. Several countries then followed in the early-to-mid 1980s including the UK, Mexico and Canada. On 6 March 1983, the DynaTAc mobile phone launched on the first US 1G network by Ameritech.

It cost \$100m to develop, and took over a decade to hit the market. The phone had a talk time of just half an hour and took ten hours to charge. Consumer demand was strong despite the battery life, weight, and low talk time, and waiting lists were in the thousands. In 1991, the second generation (2G) cellular technology was launched in Finland by Radiolinja on the GSM standard, which sparked competition in the sector as the new operators challenged the incumbent 1G network operators. Ten years later, in 2001, the third generation (3G) was launched in Japan by NTT DoCoMo on the WCDMA standard.

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 U. S. by Sprint) and the LTE standard, first offered in Scandinavia by TeliaSonera. Handheld mobile phone

Prior to 1973, mobile telephony was limited to phones installed in cars and other vehicles. [13] Motorola and Bell Labs raced to be the first to produce a handheld mobile phone. That race ended 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 2.5 pounds and measured 9 inches long, 5 inches deep and 1.75

inches 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.

Analog cellular networks – 1G The first analog cellular system widely deployed in North America was the Advanced Mobile Phone System (AMPS). It was commercially introduced in the Americas in 1978, Israel in 1986, and Australia in 1987.

AMPS was a pioneering technology that helped drive mass market usage of cellular technology, but it had several serious issues by modern standards. It was unencrypted and easily vulnerable to eavesdropping via a scanner; it was susceptible to cell phone "cloning;" Many of the iconic early commercial cell phones such as the Motorola DynaTAC Analog AMPS were eventually superseded by Digital AMPS (D-AMPS) in 1990, and AMPS service was shut down by most North American carriers by 2008. Digital cellular networks – 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 U. S. 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. The rise in mobile phone usage as a result of 2G was explosive and this era also saw

the advent of prepaid mobile phones. In 1991 the first GSM network (Radiolinja) launched in Finland. In general the frequencies used by 2G systems in Europe were higher than those in America, though with some overlap. For example, the 00 MHz frequency range was used for both 1G and 2G systems in Europe, so the 1G systems were rapidly closed down to make space for the 2G systems. In America the IS-54 standard was deployed in the same band as AMPS and displaced some of the existing analog channels. In 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. The IBM Simon had a stylus you used to tap the touch screen with.

It featured predictive typing that would guess the next characters as you tapped. It had apps, or at least a way to deliver more features by plugging a PCMCIA 1.8 MB memory card into the phone. Coinciding with the introduction of 2G systems was a trend away from the larger "brick" phones toward tiny 100–200g hand-held devices. This change was possible not only through technological improvements such as more advanced batteries and more energy-efficient electronics, but also because of the higher density of cell sites to accommodate increasing usage.

The latter meant that the average distance transmission from phone to the base station shortened, leading to increased battery life whilst on the move. The second generation introduced a new variant of communication called SMS or text messaging. It was initially available only on GSM networks but

spread eventually on all digital networks. The first machine-generated SMS message was sent in the UK on 3 December 1992 followed in 1993 by the first person-to-person SMS sent in Finland. The advent of prepaid services in the late 1990s soon made SMS the communication method of choice amongst the young, a trend which spread across all ages. G also introduced the ability to access media content on mobile phones. In 1998 the first downloadable content sold to mobile phones was the ring tone, launched by Finland's Radiolinja (now Elisa). Advertising on the mobile phone first appeared in Finland when a free daily SMS news headline service was launched in 2000, sponsored by advertising. Mobile payments were trialed in 1998 in Finland and Sweden where a mobile phone was used to pay for a Coca Cola vending machine and car parking.

Commercial launches followed in 1999 in Norway. The first commercial payment system to mimic banks and credit cards was launched in the Philippines in 1999 simultaneously by mobile operators Globe and Smart. The first full internet service on mobile phones was introduced by NTT DoCoMo in Japan in 1999. Mobile broadband data – 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 services (such as access to the internet) was growing.

Furthermore, 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).

Inevitably this led to many competing standards with different contenders pushing their own technologies, and the vision of a single unified worldwide standard looked far from reality. The standard 2G CDMA networks became 3G compliant with the adoption of Revision A to EV-DO, which made several additions to the protocol whilst retaining backwards compatibility: \* the introduction of several new forward link data rates that increase the maximum burst rate from 2.45 Mbit/s to 3.1 Mbit/s. \* protocols that would decrease connection establishment time. the ability for more than one mobile to share the same time slot. \* the introduction of QoS flags. All these were put in place to allow for low latency, low bit rate communications such as VoIP. 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. Monet has since gone bankrupt.

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. In the mid 2000s (decade), an evolution of 3G technology begun to be implemented, namely High-Speed Downlink Packet Access (HSDPA). It is an enhanced 3G (third generation) mobile telephony communications protocol in the High-Speed Packet Access (HSPA) family, also coined 3. G, 3G+ or turbo 3G, which allows networks based on Universal Mobile Telecommunications System (UMTS) to have higher data transfer speeds and capacity. Current HSDPA deployments support down-link speeds of 1.8, 3.6, 7.2 and 14.0 Mbit/s. Further speed increases are available with HSPA+, which provides speeds of up to 42 Mbit/s downlink and 84 Mbit/s with Release 9 of the 3GPP standards. By the end of 2007, there were 295 million subscribers on 3G networks worldwide, which reflected 9% of the total worldwide subscriber base.

About two thirds of these were on the WCDMA standard and one third on the EV-DO standard. The 3G telecoms services generated over 120 Billion dollars of revenues during 2007 and at many markets the majority of new phones activated were 3G phones. In Japan and South Korea the market no longer supplies phones of the second generation. Although mobile phones had long had the ability to access data networks such as the Internet, it was not until the widespread availability of good quality 3G coverage in the mid-2000s (decade) that specialized devices appeared to access the mobile internet.

The first such devices, known as "dongles", plugged directly into a computer through the USB port. Another new class of device appeared subsequently, the so-called "compact wireless router" such as the Novatel MiFi, which

makes 3G internet connectivity available to multiple computers simultaneously over Wi-Fi, rather than just to a single computer via a USB plug-in. Such devices became especially popular for use with laptop computers due to the added portability they bestow. Consequently, some computer manufacturers started to embed the mobile data function directly into the laptop so a dongle or MiFi wasn't needed.

Instead, the SIM card could be inserted directly into the device itself to access the mobile data services. Such 3G-capable laptops became commonly known as "netbooks". Other types of data-aware devices followed in the netbook's footsteps. By the beginning of 2010, E-readers, such as the Amazon Kindle and the Nook from Barnes & Noble, had already become available with embedded wireless internet, and Apple Computer had announced plans for embedded wireless internet on its iPad tablet devices beginning that Fall.

Native IP networks – 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 U. S. by Sprint) and the LTE standard, first offered in Scandinavia by TeliaSonera.

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. Evolution 2G networks were built mainly for voice services and slow data transmission (defined in IMT-2000 specification documents), but are considered by the general public to be 2.5G or 2.75G services because they are several times slower than present-day 3G service. 2.5G (GPRS) 2.5G ("second and a half generation") is used to describe 2G-systems that have implemented a packet-switched domain in addition to the circuit-switched domain. It does not necessarily provide faster services because bundling of timeslots is used for circuit-switched data services (HSCSD) as well. The first major step in the evolution of GSM networks to 3G occurred with the introduction of General Packet Radio Service (GPRS). CDMA2000 networks similarly evolved through the introduction of 1xRTT. The combination of these capabilities came to be known as 2.5G.

GPRS could provide data rates from 56 kbit/s up to 115 kbit/s. It can be used for services such as Wireless Application Protocol (WAP) access, Multimedia Messaging Service (MMS), and for Internet communication services such as email and World Wide Web access. GPRS data transfer is typically charged per megabyte of traffic transferred, while data communication via traditional circuit switching is billed per minute of connection time, independent of whether the user actually is utilizing the capacity or is in an idle state. 1xRTT supports bi-directional (up and downlink) peak data rates up to 153.6 kbit/s, delivering an average user data throughput of 80-100 kbit/s in commercial networks. It can also be used for WAP, SMS & MMS services, as well as Internet access. 2.75G (EDGE) GPRS1 networks evolved to EDGE networks

with the introduction of 8PSK encoding. Enhanced Data rates for GSM Evolution (EDGE), Enhanced GPRS (EGPRS), or IMT Single Carrier (IMT-SC) is a backward-compatible digital mobile phone technology that allows improved data transmission rates, as an extension on top of standard GSM. EDGE was deployed on GSM networks beginning in 2003—initially by Cingular (now AT&T) in the United States.

EDGE is standardized by 3GPP as part of the GSM family and it is an upgrade that provides a potential three-fold increase in capacity of GSM/GPRS networks. Duplex A duplex communication system is a point-to-point system composed of two connected parties or devices that can communicate with one another in both directions. An example of a duplex device is a telephone. The people at both ends of a telephone call can speak at the same time, the earphone can reproduce the speech of the other person as the microphone transmits the speech of the local person, because there is a two-way communication channel between them.

Duplex systems are employed in many communications networks, either to allow for a communication "two-way street" between two connected parties or to provide a "reverse path" for the monitoring and remote adjustment of equipment in the field. Systems that do not need the duplex capability use instead simplex communication in which one device transmits and the others just "listen." Examples are broadcast radio and television, garage door openers, baby monitors, wireless microphones, radio controlled models, surveillance cameras, and missile telemetry.