

Wide area wireless network or wireless WAN technologies present a confusing array of protocols and radio technologies, each identified by an acronym. Adding to the confusion, new technologies are developed and discussed years before becoming widely available.

Despite the large number of specific protocols and technologies, all are components of one of three distinct families. The three families are:

- GSM/UMTS
- cdmaOne/CDMA2000
- WiMAX

The GSM/UMTS and cdmaOne/CDMA2000 families were originally developed for cell phones but have added support for data. Both are widely deployed throughout the world. The WiMAX protocols were specifically developed to support high-speed data with voice carried as VoIP. They are currently deployed in only limited locations.

Wireless WAN -- from generation to generation

The original wireless WAN technologies in both the GSM/UMTS and [cdmaOne/CDMA2000](#) families are now referred to as first generation or 1G. A second generation of technologies in each family replaced analog with digital transmission. These 2G technologies are now being replaced by 3G technologies. 2G provided limited support for data, but 3G provides much higher data rates. Work is currently under way to design and specify the next generation, [4G](#).

More on wireless WAN technologies

[Wireless Internet access -- 3G vs. Wi-Fi](#)

[UMTS: The 3G upgrade path to GSM](#)

[3G: The CDMA alternative](#)

[EV-DO expands in the face of WiMAX](#)

[Mobile Telephony Protocols: Glossary](#)

Upgrading equipment simultaneously across an entire network to introduce a new protocol is not feasible. Network providers typically upgrade in a few large cities first. Upgrades beyond the city center and to smaller metropolitan areas follow. A complete upgrade may require several years. The result is that network suppliers often support multiple overlapping networks, each based on a different protocol generation.

GSM/UMTS

Development of the GSM/UMTS protocols was begun in the early 1980s by a confederation of European national phone companies. As a result, these protocols are used by most large European network providers. They are also in wide use throughout the rest of the world. In the U.S., [AT&T/Cingular](#) and [T-Mobile](#) use GSM/UMTS.

Cingular, now renamed AT&T, maintains both the EDGE and BroadbandConnect networks. The EDGE protocol is an early 3G protocol, sometimes described as 2.75G. It was designed to be added to an existing 2G network with minimal effort and expense. The EDGE network is offered throughout the U.S. AT&T advertises typical download and upload rates from 70 to 135 Kbps.

BroadbandConnect service utilizes a more recent 3G protocol, HSDPA. BroadbandConnect is currently available in major metropolitan areas. AT&T promises download rates from 400 to 700 Kbps and upload rates up to 384 Kbps.

cdmaONE/CDMA2000 family

The cdmaONE/CDMA2000 family has developed through a similar sequence of generations. Development began at Qualcomm in the late 1980s. The 2G protocol, IS-95, marketed by Qualcomm as cdma/ONE, was replaced by [1xRTT](#) and subsequently by [EV-DO](#). 1xRTT is considered a 2.5G protocol, and EV-DO is 3G.

In the U.S., [Verizon](#) and [Sprint](#) use the cdmaONE/CDMA2000 family, but throughout the rest of the world, GSM/UMTS is much more widespread.

Verizon supports two national networks. Its [NationalAccess](#) network is based on the older 1xRTT technology. The BroadbandAccess network is based on EV-DO. NationalAccess is supported throughout the U.S.; BroadbandAccess is available only in metropolitan areas.

The original EV-DO Rev 0 technology has been further improved to create EV-DO Rev A. Verizon has now upgraded to EV-DO Rev A in all locations where BroadbandAccess is offered. EV-DO Rev A provides typical download rates from 600 Kbps to 1.4 Mbps and upload rates from 500 to 800 Kbps. Achieving these rates requires that the user have a Rev A-compatible device. Users with Rev 0 devices will be limited to Rev 0 rates. Rev 0 download rates typically vary from 400 to 700 Kbps, with bursts to 2 Mbps. Typical upload rates are 60 to 80 Kbps, with bursts to 144 Kbps.

Sprint is also in the process of upgrading its earlier 1xRTT network with EV-DO. Currently, EV-DO is available in metropolitan areas and in some rural areas. The upgrade from EV-DO Rev 0 to Rev A is under way and is expected to be complete by the end of 2007. Sprint reports data rates for both Rev 0 and Rev A similar to those reported by AT&T.

WiMAX

[WiMAX](#) developed from work in the mid 1990s aimed at reducing the cost of connecting homes and businesses to the Internet by eliminating the cost of running cable or DSL to each location. Instead, a central antenna would provide a high-bandwidth wireless connection to each subscriber. Equipment cost was high because of a lack of an industry standard that would enable high-volume manufacture.

As a result, the IEEE chartered a committee to develop standards, and a group of equipment vendors and network providers created the [WiMAX Forum](#) to promote standards adoption and to certify equipment designed to meet the standard. The standards committee, [IEEE 802.16](#), produced IEEE 802.16-2004, also known as 802.16d, followed by 802.16e-2005. IEEE 802.16-2004 supports the original goal of the work: to provide wireless communication between fixed locations. IEEE 802.16e supports mobile users.

WiMAX is often described as a 4G technology. Theoretical data rates could be as high as 70 to 75 Mbps, but the WiMAX Forum expects total data rates of approximately 40 Mbps for stations within a radius of three to ten kilometers of the central antenna. This rate would be shared by all of the stations within the radius. The Forum expects a total of 15 Mbps for mobile users within a three-kilometer radius.

Currently, WiMAX support is offered in the U.S. by [Clearwire](#) and [Towerstream](#) in a limited number of metropolitan areas. Both support subscribers at fixed locations only. Sprint has announced support for mobile users in 2008. Intel and Motorola have announced PCMCIA cards and chips for embedded laptop support.

Both GSM/UMTS and cdmaONE/CDMA2000 are proven technologies with millions of users worldwide. Some backers of WiMAX have predicted that it will provide performance far superior to the other technology families and eventually replace them. Whatever the outcome, users are sure to enjoy improved data rates and wider availability as the three differing technologies compete.

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