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WCDMA 3G: here, now and in the future

Third generation (3G) is the next phase in the evolution of mobile telephone technology that began some twenty years ago. 3G is now bringing advanced multimedia mobile services, such as infotainment services and mobile commerce, to the mass market of telecommunication consumers.

The first-phase technology, analog mobile networks (1G), was overtaken by more advanced digital networks such as GSM (2G), which has been the world's most successful mobile technology standard to date, with some 400 mobile operators currently providing GSM service to over 730 million customers in almost 180 countries. GSM is expected to pass the one-billion-subscriber milestone sometime in 2003.

GSM, like first-generation analog networks, has been dominated by voice communication. Although data over GSM is regularly used by a growing number of subscribers, GSM data-transmission speeds are limited to 14.4 kbps (or up to 43.2 kbps with High Speed Circuit Switched Data), far too slow for the type of advanced mobile services that many in the industry envisage for the future. Today's 2.5G systems, such as GPRS (General Packet Radio Service) technology, have boosted this speed higher, in practice up to 40 to 60 kbps, making possible the first true 3G services like MMS.

To accommodate even more advanced services in the future, 3G communication standards and technologies have been designed to provide data speeds above 384 kbps, even up to theoretical speeds of several Mbps, greatly increasing the network's capacity to send large amounts of data wirelessly. The availability of these higher-end data speeds in individual networks will depend on the services and configurations chosen by the networks' operators. In the early years of 3G deployment, most services can be implemented with data speeds in the range of 128 to 384 kbps.

Advanced mobile services

While early advanced mobile services such as MMS are clearly making inroads into today's market even at 2.5G speeds, the number of still more advanced mobile services will grow and their introduction and uptake will accelerate, requiring more network capacity. A growing reliance on data for revenue will drive the migration of current 2G equipment to the faster, high-capacity packet-switched networks of the future, in other words, to 3G networks.

This enormous boost in network capacity will be needed for widespread usage of large-scale mobile data services like multimedia messaging (MMS). The potential is huge. Current data and messaging applications will become more advanced and sophisticated, resulting in an explosion in multimedia messaging, mobile entertainment, mobile location services, corporate services, and m-commerce. In the mobile telecom landscape of tomorrow, subscribers will expect and demand seamless anytime/ anywhere access to voice, data, Internet and a growing universe of new multimedia services.

These services will require improved service capabilities to deliver services based on various Quality of Service (QoS) support. WCDMA technology has complete QoS support mechanisms built in, which means that it can also be used for real-time services such as video telephony and streaming, as well as differentiated services for various customer segments.

3G standards

The quantum leap to 3G speeds requires new network technology. Two families of standards have emerged to make possible data speeds over 384 kbps: WCDMA (Wideband Code Division Multiple Access), based on GSM/GPRS/EDGE evolution and benefiting from its global footprint, and CDMA2000 1xEV-DV, based on the IS-95 narrowband standard also called cdmaOne. When it comes to 3G network licensing, mobile operators have overwhelmingly adopted WCDMA as the preferred standard;

there have been more than one hundred WCDMA licences awarded to date in the 3G frequency band (2.1 GHz), whereas the CDMA2000 technology family has been licensed only in two cases.

WCDMA

WCDMA will use the 2.1 GHz band in Europe and other locations where this frequency is open. In the Americas, other frequencies will be used. WCDMA technology using the 2.1 GHz band is also often referred to in Europe as UMTS (Universal Mobile Telecommunications System).

The GSM family of technologies, which includes EDGE (Enhanced Data-rate for Global Evolution) and WCDMA, accounts for 70% of mobile subscriptions worldwide today. Nokia believes that by 2006 GSM/EDGE/WCDMA will represent 85% all mobile phone subscriptions, which means that WCDMA benefits from unparallel economies of scale.

WCDMA technology - like GSM and EDGE - is a fully standardized global solution with open interfaces, further leveraging the economies of standards-based product development. With WCDMA, operators will also be able to offer to their customers enhanced international roaming benefits and service portability, and therefore commercially benefit from the wide acceptance of WCDMA.

A key to the success of WCDMA is full interoperability between terminals and handsets. Dual mode handsets and GSM/WCDMA interworking are vital to the mass take-up of advanced mobile services. Such interoperability is based on the use of only 3GPP-compatible deployments. Extensive testing with commercial networks and handsets will allow operators and vendors to fine-tune interoperability and pave the way for seamless services for mobile customers.

The openness of WCDMA means operators can take advantage of best-of-breed products in a multivendor services environment, and at the same time ensure end-to-end interoperability across terminals, markets and bearer technologies.

This approach is well aligned with the mission of the Open Mobile Alliance, which aims to grow the market for the entire mobile industry by defining specifications for application interoperability for the mobile industry as a whole. This will remove barriers to interoperability and accelerate the development and adoption of a variety of new, enhanced mobile information, communication and entertainment services and applications. The definition of these common specifications and the testing of application interoperability will promote competition through innovation and differentiation.

In short, WCDMA benefits from being a truly global standard based on a truly open architecture, with all the advantages of global roaming and economies of scale. While CDMA2000 1X narrowband technology also has an evolution path to 3G speeds, it is not an open end-to-end solution and does not enjoy the benefits of WCDMA.

EDGE

To complement WCDMA, many operators are also opting to implement EDGE. EDGE is a mobile-network radio technology that makes current GSM networks capable of offering 3G mobile services within existing frequencies. EDGE is a set of enhancements that upgrade GPRS (data) and GSM (voice) networks. It can increase the capacity and data throughput typically up to 3-4-fold. Hence, EDGE puts a limited natural resource, the frequency band, to more effective use.

A true global technology, EDGE is part of ITU's family of 3G technologies and is currently standardized by the same 3GPP standardization body as WCDMA. The first EDGE networks will be deployed in the USA, and commercial volume deliveries have already started. Nokia expects to see the first commercial EDGE networks up and running in early 2003.

Nokia believes that most GSM and TDMA operators will implement EDGE as data and multimedia services become more popular and more network capacity is required. EDGE, together with WCDMA, will maximize the 3G market share and revenue for operators. WCDMA/EDGE is being adopted by a growing number of PDC/PHS operators in Japan, CDMA operators in Korea, and TDMA operators worldwide.

WCDMA 3G evolution

WCDMA will continue to evolve, promising higher data speeds for the future. The radio-access performance of WCDMA will be increased to 512 kbps and beyond. The next logical evolutionary step in the radio-interface is the introduction of High Speed Downlink Packet Access (HSDPA), which brings similar enhancements to WCDMA 3G as the EDGE standard has brought to GSM performance. HSDPA will improve the average throughput of the cell and, thus, provides more flexibility in capacity through higher data rates.

The WCDMA service capabilities will be improved not only by adding more data speed, but also by enhancing location techniques and new service capabilities. For example, the introduction of SIP-based person-to-person IP connectivity makes it possible to offer interactive services such as interactive gaming, group messaging, and a full rich-call environment where different media components such as text, images, audio, and video can be combined into single instantaneous real-time multimedia session.