

UMTS

Universal Mobile Technology System

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2009.06.23.

Declaration

I, Wang Junxi, hereby declare that this paper is my own work and all the related work cites are shown on the references page.

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Introduction

Universal Mobile Telecommunications System (UMTS) is one of the third-generation (3G) mobile phone technologies. It uses W-CDMA as the underlying standard, is standardized by the 3GPP, and represents the European/Japanese answer to the ITU IMT-2000 requirements for 3G Cellular radio systems.

To differentiate UMTS from competing network technologies, UMTS is sometimes marketed as 3GSM, emphasizing the combination of the 3G nature of the technology and the GSM standard which it was designed to succeed.

I. Preface

This article discusses the technology, business, usage and other aspects encompassing and surrounding UMTS, the 3G successor to GSM which utilizes the W-CDMA air interface and GSM infrastructures. Any issues relating strictly to the W-CDMA interface itself may be better described in the W-CDMA page.

Due to the rapid nature of UMTS development in the market place, some information on this page may become quickly outdated. Readers' discretion and additional independent research is strongly advised; you are encouraged to return and add updates to this page. Contributors are also advised to timestamp their contributions when appropriate in order to help readers to determine the age of the information.

II. Features

UMTS supports up to 1920 kbit/s data transfer rates (and not 2 Mbit/s as frequently seen), although at the moment users in the real networks can expect performance up to 384 kbit/s - in Japan upgrades to 3 Mbit/s are in preparation. However, this is still much greater than the 14.4 kbit/s of a single GSM error-corrected circuit switched data channel or multiple 14.4 kbit/s channels in HSCSD, and - in competition to other network technologies such as CDMA-2000, PHS or WLAN - offers access to the World Wide Web and other data services on mobile devices.

Precursors to 3G are 2G mobile telephony systems, such as GSM, CDMA, PDC, PHS and other 2G technologies deployed in different countries. In

the case of GSM, there is an evolution path from 2G, called GPRS, also known as 2.5G. GPRS supports a much better data rate (up to a theoretical maximum of 140.8kbit/s, though typical rates are closer to 56kbit/s) and is packet switched rather than connection oriented (circuit switched). It is deployed in many places where GSM is used. E-GPRS, or EDGE, is a further evolution of GPRS and is based on new "coding schemes". With EDGE the actual packet data rates can reach around 180 kbit/s (effective). EDGE systems are often referred as "2.75G Systems".

In 2006, UMTS networks in Japan will be upgraded with High Speed Downlink Packet Access (HSDPA), sometimes known as 3.5G. This will make a downlink transfer speed of up to 14.4 Mbit/s possible. Work is also progressing on improving the uplink transfer speed with the High-Speed Uplink Packet Access (HSUPA)

In 2006, Vodacom in South Africa is also working towards implementing High Speed Downlink Packet Access (HSDPA).

In Austria, Mobilkom Austria already implemented and deployed HSDPA for public usage.

Marketing material for UMTS has emphasized the possibility of mobile videoconferencing, although experience in Japan and elsewhere has shown that user demand for Video calls is not very high.

Other possible uses for UMTS include the downloading of music and video content.

III. UMTS Network Architecture

A UMTS network consists of three interacting domains; Core Network (CN), UMTS Terrestrial Radio Access Network (UTRAN) and User Equipment (UE). The main function of the core network is to provide switching, routing and transit for user traffic. Core network also contains the databases and network management functions.

1. Core Network

The Core Network is divided in circuit switched and packet switched domains. Some of the circuit switched elements are Mobile services Switching Centre (MSC), Visitor location register (VLR) and Gateway MSC. Packet switched elements are Serving GPRS Support Node (SGSN) and Gateway GPRS

Support Node (GGSN). Some network elements, like EIR, HLR, VLR and AUC are shared by both domains.

The Asynchronous Transfer Mode (ATM) is defined for UMTS core transmission. ATM Adaptation Layer type 2 (AAL2) handles circuit switched connection and packet connection protocol AAL5 is designed for data delivery.

The architecture of the Core Network may change when new services and features are introduced. Number Portability DataBase (NPDB) will be used to enable user to change the network while keeping their old phone number. Gateway Location Register (GLR) may be used to optimise the subscriber handling between network boundaries. MSC, VLR and SGSN can merge to become a UMTS MSC.

2. Radio Access

Wide band CDMA technology was selected to for UTRAN air interface. UMTS WCDMA is a Direct Sequence CDMA system where user data is multiplied with quasi-random bits derived from WCDMA Spreading codes. In UMTS, in addition to channelisation, Codes are used for synchronisation and scrambling. WCDMA has two basic modes of operation: Frequency Division Duplex (FDD) and Time Division Duplex (TDD). UTRAN interfaces are shown on UMTS Network page.

The functions of Node-B are:

- Air interface Transmission / Reception
- Modulation / Demodulation
- CDMA Physical Channel coding
- Micro Diversity
- Error Handling
- Closed loop power control

The functions of RNC are:

- Radio Resource Control
- Admission Control
- Channel Allocation
- Power Control Settings
- Handover Control
- Macro Diversity
- Ciphering

Segmentation / Reassembly
Broadcast Signalling

Open Loop Power Control

3. UMTS User Equipment

The UMTS UE is based on the same principles as the GSM MS the separation between mobile equipment (ME) and the UMTS subscriber identity module (SIM) card (USIM). Figure 8 shows the user equipment functions. The UE is the counterpart to the various network elements in many functions and procedures.

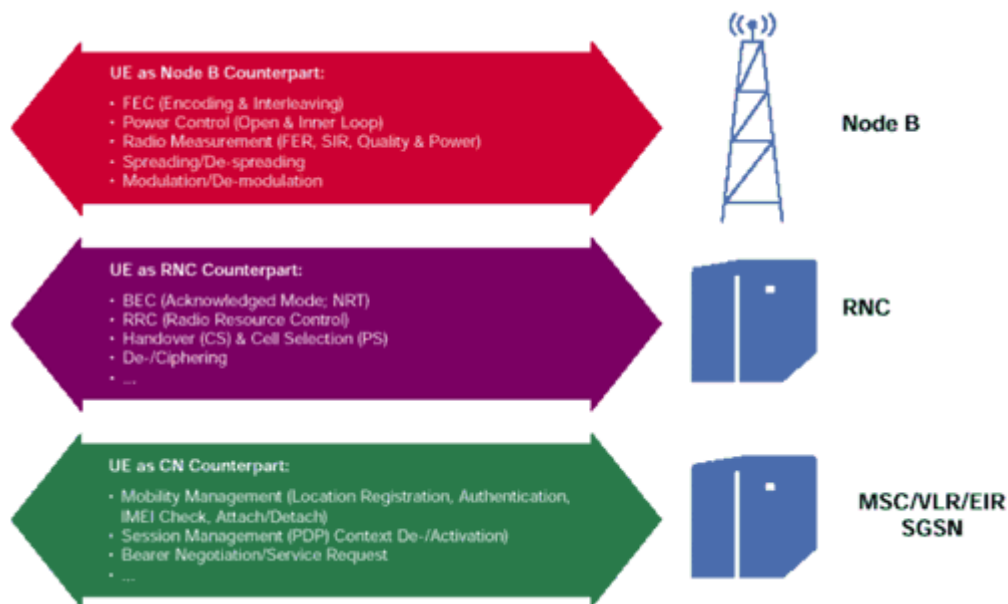


Figure 8. UE Functions

IV. Other competing standards

There are other competing 3G standards, such as CDMA2000 and systems including iBurst from Arraycom, Flarion and wCDMA-TDD (IPWireless).

Both CDMA2000 and W-CDMA are accepted by ITU as part of the IMT-2000 family of 3G standards, in addition to Enhanced Data Rates for Global Evolution (EDGE) and China's own 3G standard, TD-SCDMA.

CDMA2000, being an evolutionary upgrade to cdmaOne, does not require new spectrum allocation and will operate comfortably in existing PCS spectrums.

Most GSM operators in North America as well as others around the world have accepted EDGE as a temporary 3G solution. AT&T Wireless launched EDGE nationwide in 2003, Cingular launched EDGE in most markets and T-Mobile USA has launched EDGE nationwide as of October 2005. Rogers Wireless launched nation-wide EDGE service in late 2003 for the Canadian market. TIM (Italy) launched EDGE in 2004. The benefit of EDGE is that it leverages existing GSM spectrums and is compatible with existing GSM handsets. It is also much easier, quicker, and considerably cheaper for wireless carriers to "bolt-on" EDGE functionality by upgrading their existing GSM transmission hardware to support EDGE than having to install almost all brand-new equipment to deliver UMTS. EDGE provides a short-term upgrade path for GSM operators and directly competes with CDMA2000.

V. Problems and issues

Some of the rollout problems operators faced included:

- Overweight handsets with poor battery life;

- problems with handover from UMTS to GSM, connections being dropped or handovers only possible in one direction (UMTS->GSM) with the handset only changing back to UMTS after hanging up, even if UMTS coverage returns;

- initially poor coverage due to the time it takes to build a network;

- for fully fledged UMTS incorporating Video on Demand features, one base station needs to be set up every 1–1.5 km. While this is economically feasible in urban areas, it is impossible in less populated suburban and rural areas;

- competition for broadband access from Wi-Fi;

- lack of significant consumer demand for 3G.

References:

Peter Rysavy , Voice Capacity Enhancements for GSM Evolution to UMTS

<http://www.iec.org/online/tutorials/umts/index.asp>

http://en.wikipedia.org/wiki/Universal_Mobile_Telecommunications_System

<http://www.umtsworld.com/technology/overview.htm#a3>