MOBILE COMMUNICATIONS TECHNOLOGY

Mobile communications worldwide are based on a number of technological standards which all rely on the use of radio frequency spectrum and differ in the modulation principles applied in utilising the allocated radio frequencies. Frequency spectrum is a limited resource and is usually allocated to mobile operators by a relevant statutory authority, normally under a number of licence conditions in respect of minimum coverage and performance criteria. Since frequency spectrum is limited, operators must design and maintain their radio networks to provide for the efficient use of the allocated frequencies.

Mobile phone operators maximise the efficiency of spectrum usage by adopting a cellular approach that divides the geographic area into coverage areas known as cells. Allocated spectrum is divided into carriers of distinct bandwidth and these carriers are assigned to the cells in a specific pattern. The physical radio coverage provided by a cell is limited by physical constraints, or its propagation characteristics. An important feature of mobile telephone systems is that it is possible to re-use a carrier repeatedly in a network within adequately separated cells. This allows a large number of customers to be served on the same radio frequency across different geographic locations. Planned assignment of carriers, in order to reduce interference between carriers of the same or adjacent frequencies, further improves the efficient utilisation of the allocated frequency spectrum.

A base station equipped with a number of TRUs is utilised in each cell which is directly connected to a controlling hub, known as a BSC, by landline or microwave link. BSCs will in turn be connected to an MSC from which traffic can be efficiently and effectively routed to other mobile phone users, and through interconnection, to the public switched network, the IDD network, or various service platforms, including voice mail servers, short message centres and multimedia service centres.

In addition to the bandwidth of radio frequencies available for transmission in a network, the number of cells in a network, and the number of transceivers in each cell, the capacity of a mobile network depends on the dimensioning of the BSCs and MSCs.

Voice and data communications utilise frequency carriers which require the use of transmitters and receivers. For an individual mobile user this will be the mobile handset. Customers wishing to use data-only services can install a PC modem card in their PC. Modern handsets are designed with multi-band capability so that they will operate in the various frequency bands used by different operators. For example, the GSM tri-band handsets operate for 900/1800/1900 MHz GSM network operators. Multi-mode handsets are also now entering the market whereby they operate on different modulation types like GSM and CDMA.

NETWORK PLATFORMS

All mobile telephone radio and switching networks which are currently in use in Hong Kong, save for Hutchison 3G's network, are 2G digital systems, which transmit voice and data by digital means. In comparison to the older analogue systems, digital systems provide greater voice and data communication capacity using comparable bandwidth, and provide enhanced security through encrypted and improved data transmission capabilities. Digital mobile communications systems can be implemented using various technology standards including GSM 900, GSM 1800 and CDMA (IS-95).

Frequency allocations for 2G systems can be made in a number of bands and generally fall into 800/900 MHz and 1800/1900 MHz bands. While the lower frequency ranges offer marginally better propagation characteristics than the higher bands, tighter reuse and hence efficient use of the spectrum can be achieved with the higher bands. In Hong Kong, the 900 MHz band is referred to as the GSM frequency and the 1,800 MHz band is referred to as the PCS frequency.

Enhanced 2G systems such as 2.5G or 2.75G systems offer data capabilities that allow for high speed data transfer applications like video streaming and video downloading in addition to conventional voice services. 3G systems will allow for video conferencing.

There are several technology upgrades that can be applied to 2G GSM networks to provide higher data transfer speed, including primarily GPRS and EDGE. Full compatibility of the networks and handsets will enable inter-working between GSM-GPRS-EDGE-3G with a seamless overlay and roaming functionality.

Both GPRS and EDGE are packet bearer technologies that increase the data throughput, or speed of the GSM network data transmission, allowing enhanced applications like video streaming and video downloads. The service capabilities of EDGE and 3G are similar (although EDGE provides lower data rates) and include evolution towards IP-based multimedia services.

EVOLUTION OF MOBILE COMMUNICATIONS TECHNOLOGY

GPRS

GPRS is a packet-switched data transmission technology that offers higher data transmission speeds and improved radio network efficiencies in comparison to GSM. Previous circuit switched data transmission required that one subscriber occupied a radio resource (known as a time slot) for the entire duration of a call. GPRS allows many subscribers to share a common radio resource, or time-slot, with occupancy only taking place when data is being transmitted.

EDGE

By utilising a new modulation technique (8PSK) EDGE improves data transmission speeds by a factor of 2.5 to 3 times as compared to GPRS utilising the same radio resources. This efficiency gain translates to increased capacity for the existing network resulting in the provision of mobile communications services to more users or using less radio resource for the same number of users.

AMR

Deployment of AMR provides additional radio spectrum flexibility for operators to address service mix and demand in growth requirements. The AMR speech codec technology contains a set of 8 fixed rate speech and channel capabilities with fast in-band signalling and link adaptation. This allows the network to adjust and adapt to radio conditions and traffic load as well as choosing the optimal mode of transmission. AMR provides significant improvement in error robustness and voice capacity over EFR and can operate in either Full Rate or Half Rate. It is expected that handsets supporting AMR will become available in commercial quantities in 2004.

3G

3G systems are aimed at upgrading mobile services to broadband capabilities with higher data rates than those offered by EDGE. 3G core technology is based on the GSM core platform and utilises W-CDMA or CDMA 2000 air interface technology. The technology allows for seamless operation between 2G and 3G networks thereby allowing hybrid networks and MVNO hosting of 2G operators.

3G technology currently operates on a new frequency band (2.0 GHz).

TECHNOLOGIES ENABLING CONVERGENCE OF THE INTERNET AND MOBILE TELEPHONY

World-wide use of wireless communications has grown rapidly as mobile and other emerging wireless communications services have become widely available and affordable for the mass business and consumer markets.

As people have become increasingly dependent on wireless data such as e-mail services, remote access to corporate intranets and other Internet-based services, mass market wireless telephones that provide mobile access to these resources have become increasingly useful tools.

A number of recent technological advances which are explained below, have improved the delivery of data from the Internet to wireless telephones using existing GSM networks.

WAP

WAP is a protocol and application environment that allows any WAP-enabled mobile phone to access Internet web sites written in WML. WML web sites minimise graphics and certain other functions so as to accommodate the limited screen size and functionality of mobile devices. By using WAP technology, mobile network operators will be able to deliver their own services and applications to users of mobile handsets or devices.

USSD

USSD is a unique GSM technology that is used to transmit information over the signalling channels between a mobile phone and an application programme in the network. Unlike SMS, which is a store-and-forward technology, USSD is session-based which results in a shorter turnaround response time for interactive applications. Customers do not need to use any particular phone menu to access services with USSD. They can enter the USSD commands directly from the mobile phone keypad which are routed back to the home mobile network's home location register ("HLR"). Generally, USSD works in exactly the same way even when customers are roaming.

MMS

MMS offers the ability to send messages comprising a combination of text, images, sound clips and ultimately, video clips to MMS-capable handsets. Richer applications and contents can be developed using MMS than is currently possible using the 160 Roman text characters available with SMS. To overcome the limited availability of MMS devices initially, MMS messages can be sent to and from e-mail applications. MMS functionality is now delivered over GPRS and in the future could be delivered over EDGE and 3G.

3GPP

3GPP refers to a new breed of standards for the creation, delivery, and playback of multimedia contents over high-speed wireless networks. 3GPP was defined by the 3rd Generation Partnership Project, a group of telecommunications standards bodies and suppliers, to provide uniform delivery of rich multimedia contents over the newly evolved high speed data mobile 3G networks to multimedia-enabled wireless devices. Many of the 3GPP standards are based on existing Internet standards, but are tailored to the unique requirements of mobile devices.

J2ME

The Java 2 Platform, Micro Edition, or J2ME, is a technology that allows programmers to use the Java programming language and related tools to develop programs for mobile devices such as cellular phones and personal digital assistants (PDAs).

J2ME is a set of standard Java APIs defined through the Java Community Process[SM] program by expert groups that include leading device manufacturers, software vendors and service providers.

J2ME delivers the power and benefits of Java technology tailored for consumers and embedded devices — including a flexible user interface, robust security model, broad range of built-in network protocols, and support for networked and disconnected applications. J2ME applications can be written once for a wide range of devices, can be downloaded dynamically, and can leverage each device's native capabilities.