

LTE Overview – An Australian Perspective

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Long Term Evolution or LTE, otherwise known as 4G, is a major upgrade to the mobile network. Work on LTE standards began in 2004, by 2008 LTE infrastructure was available. Commercial LTE networks are now widely deployed.

This report outlines key LTE technical features and describes Australian LTE rollouts.

Background

Widespread Third Generation (3G) mobile network deployment began in 2003. The initial 3G technology has been Universal Multimedia Telecommunication Service (UMTS), an upgrade to the 2G GSM network.

The UMTS radio interface is called Wideband CDMA (WCDMA). It uses two 5 MHz radio channels, one incoming, one outgoing. The original UMTS system, known as “Release 99” or R99, provided peak rates of only 384 kbps. UMTS radio channel efficiency has improved dramatically since then, with most 3G networks offering 21 Mbps peak rates. This newer UMTS version is called High Speed Packet Access Plus or HSPA+

Despite these improvements, the WCDMA interface has disadvantages. It is optimised for 5 MHz radio channels, however available radio spectrum is often less than 5 MHz, sometimes more. A new interface which adapts to varying channel widths is needed. LTE provides this.

Key LTE Features

The LTE radio interface is based on Orthogonal Frequency Division Multiplexing (OFDM), the same system used in WiFi (802.11) and WiMAX (802.16). OFDM was not sufficiently mature when the 3G radio interface was determined (1998), hence WCDMA was chosen.

OFDM comprises many non-interfering (or orthogonal) sub-carriers, each with a portion of the user data. Increasing (or decreasing) the OFDM radio channel width is relatively simple: just use more (or fewer) subcarriers.

Hence LTE operates over a range of radio channel widths, from 1.4 MHz to 20 MHz. Mobile data capacity depends on radio channel width, hence increasing the radio channel from 5 MHz (the default UMTS channel) to 20 MHz (the maximum LTE channel size) increases data capacity by a factor of 4, other things being equal.

Also, LTE operates over single radio channels. This technique, known as Time Division Duplex (TDD) alternates uplink and downlink transmissions over a single channel. This greatly increases greenfield LTE deployment possibilities, as many potential operators have access to a single frequency band only (e.g. 3.5 MHz). Single channel LTE is known as TD-LTE.

LTE was initially specified to support a minimum 100 Mbps peak rate downlink and 50 Mbps uplink for a 20 MHz radio channel. Actual LTE rates have exceeded this, with LTE trials achieving peak rates exceeding 250 Mbps for 20 MHz channels.

LTE also introduces a new core network architecture, the combined LTE radio interface and core network known as “System Architecture Evolution” or SAE. A key feature is that LTE is “all IP”, unlike 3G UMTS, which separates IP data traffic and circuit switched voice traffic.

LTE voice calls will eventually operate over this IP interface. However, in the first instance LTE is likely to be used for high speed mobile data services, with existing 3G (and GSM) networks providing voice services.

Australian LTE Rollouts and Trials

In recent years Telstra has been an early mover with new mobile technologies. In February 2009 Telstra released the world’s first 21 Mbps HSPA+ service, in 2010 Telstra was one of the first carriers to release dual carrier HSPA+ services.

In September 2011 Telstra launched an 1800 MHz band LTE service in all capital cities and some regional areas. By the end of 2013, the Telstra LTE network covered around 85% of the population.

Optus launched its LTE service in Newcastle in April 2012, with capital city coverage available through 2013. Optus also has 98 MHz in the 2.3 GHz band in capital cities, a band previously used by Vivid Wireless. In April 2013 Optus launched a 2.3 GHz TD-LTE service in Canberra, since expanded to other capital cities. The Optus 2.3 GHz TD-LTE service is called “4G plus”.

VHA launched an 1800 MHz band LTE service in mid 2013, based on a 20 MHz channel.

NBN-Co is rolling out a 2.3 GHz band TD-LTE broadband service in regional areas.

Summary

Long Term Evolution (LTE) is a key mobile network upgrade. Unlike current 3G networks, which mostly use paired 5 MHz radio channels, LTE operates over a range of channel widths. This allows great LTE deployment flexibility, as operators can more easily obtain spectrum. The initial LTE peak downlink rate target was 100 Mbps, however much higher rates have been achieved. Telstra, Optus and Vodafone now offer 4G LTE services, mostly in the 1800 MHz band.