CAROLINA TECHNOLOGY CONSULTANTS

Tech Brief

February 2010 *Architectural Issues in IT and Data Communications*

Topic

LTE 4G Wireless Data

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Summary

Long Term Evolution (LTE) is a standardized architecture for fourth generation (4G) wireless data networks, providing connectivity for data driven mobile devices such as smartphones, eReaders, tablets and laptop computers.

Discussion

Rapid growth in the use of mobile handsets for data intensive applications such as web browsing, email, photo sharing and social networking has saturated the existing wireless network infrastructure operated by mobile carriers. The 3rd Generation Partnership Project (3GPP) was originally chartered in 1998 to develop GSM technology, but has undertaken work on a new wireless architecture called “Long Term Evolution” (LTE) to provide a high speed mobile data network environment.

LTE competes with mobile WiMax, which has some support in developing countries. In the U.S., LTE appears to be emerging as the mobile architecture of choice because it offers better performance than mobile WiMax and offers carriers an incremental upgrade path for their networks.

LTE

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* A specification of the 3GPP
* Enables up to 100Mb/s per node
* Competes with Mobile WiMax

RF Architecture

LTE uses small bandwidths of 2.5 MHz, 5 MHz, 10 MHz, 15 MHz and 20 MHz. These are available across the entire spectrum legally allocated to wireless carriers. In practice, there are a limited number of these operating bands available and competition for spectrum is intense.

Carriers using spectrum in the 1700-2500Mhz range experience the familiar in-building penetration losses that cause poor reception indoors at many locations. New spectrum recently made available in the 700MHz range vacated by U.S. analog television broadcasters is beginning to be used for LTE deployments. This is significant because these lower frequencies are able to better penetrate buildings to bring reliable high speed data services to business and residential customers.

LTE utilizes orthogonal frequency division multiplexing (OFDM) for downlinking from the network to mobile devices and the more power efficient Single Carrier-Frequency Division Multiple Access

(SC-FDMA) scheme for mobile devices to uplink back to the network.

LTE specifies the use of Multiple Input Multiple Output (MIMO) antennas. Mobile devices have several antennas built into them for improved selectivity and performance.

The system is designed to support mobile device speeds of up to 350km/hour. Speed above this are considered a special case.

Data Speeds and Network Architecture

LTE uses a variety of modulation schemes, from simple QPSK to the more phase sensitive 16QAM and 64QAM to achieve high data throughputs.

With this scheme a single sector is capable of carrying a maximum of 100Mb/s down to the device and 50Mb/s up from the device. Each sector can support several hundred users who all share this bandwidth.

To achieve greater capacities, mobile operators must narrow the focus of their sectors and overlap them by using multiple RF carriers. While this bandwidth is a vast improvement over current mobile networks, it does not achieve the throughput of developing WiFi architectures. Because of this, many mobile operators are pursuing a dual strategy of offering in-building femto-cells or allowing customers to ride WiFi networks when available using Unlicensed Mobile Access (UMA).

LTE is designed as a flat all IP network and expects all traffic to be delivered in this manner. Thus, voice over IP is mandatory and there is no alternate voice provision. This is a radical shift from the current complex 3G architecture. The RF system is tuned to provide sub 5 millisecond delays for small packets, ensuring good performance for real time applications.

LTE supports Enhanced Multimedia Broadcast/Multicast Service (eMBMS) for one to many applications like live mobile television.

QoS opportunities in LTE are richer than in current data networks. The RF environment provides very fine control over the physical layer. Carriers can assign individual bearer to handsets for specific users or applications as necessary. The licensed RF environment of LTE provides greater control over client participation than does the unlicensed WiFi environment, in which bandwidth contention by poorly-behaved endpoints can create service problems for users.

Future Developments

3GPP and ITU-T have begun work on an “LTE-Advanced” profile which will bring 1Gb/s speeds to the mobile environment.

Strategy Considerations

LTE promises to provide an environment in which portable devices have excellent connectivity at home, while traveling and in the office. It has ample bandwidth to support web applications in these environments. With the use femto cells and UMA, LTE provides sufficient bandwidth to support general computing applications for business.

Enterprise and campus networks that have traditionally provided service to the wallplate may find that footprint receding to the network core, with most users choosing LTE for their connectivity needs. This depends in large part on whether mobile carriers follow through on robust network build outs, customer service and reasonably priced data plans.

A shift toward remote connectivity for most users will have implications for IT architectures. Security schemes that are built around the assumption of local connectivity will have to be redeveloped. Applications that make heavy use of bandwidth (for example, nightly backups), will be reengineered to work more effectively in a cloud-like environment.

For Further Information

1. LTE design goals are describe by 3GPP TR 25.913 V9.0.0, http://www.3gpp.org/ftp/Specs/archive/25_series/25.913/25913-900.zip
2. User Equipment (UE) radio transmission and reception are specified in 3GPP TS 36.101 V9.2.0, http://www.3gpp.org/ftp/Specs/archive/36_series/36.101/36101-920.zip
3. 3GPP LTE website, http://www.3gpp.org/LTE
4. 3GPP LTE-Advanced website, http://www.3gpp.org/LTE-Advanced