

# NØRTEL

#### White Paper

### T-Mobile International and Nortel Long Term Evolution Trial Bonn, Germany - October, 2008

The objective of this paper is to provide a basic overview of the Long Term Evolution (LTE) trial system operating in Bonn, Germany through cooperation between T-Mobile International and Nortel. Nortel has additional technical papers on LTE available for those readers seeking more detailed information on LTE.

#### Introduction

In June 2008, the NGMN (Next Generation Mobile Networks) Alliance announced that "based on intensive and detailed technology evaluations, 3GPP LTE (Long Term Evolution) is the first technology which broadly meets its recommendations and is approved by its Board.

T-Mobile International and Nortel have established a LTE mobile network trial showcase in Bonn, Germany. LTE is a set of new mobile network technologies, standards and architectural principles that should allow operators to cost effectively deploy wireless broadband mobile Internet services. The trial publicly demonstrates progress on the implementation of technical milestones and provides an early view of a significantly enhanced subscriber experience.

The trial system provides continuous LTE radio coverage over a 4 km route in Bonn, Germany between Deutsche Telekom AG's headquarters building and T-Mobile's headquarters building.

## ••**T**••Mobile•



It operates in the 2.1GHz band using multiple radio cell sites providing true mobility (including handover) between the different sites at vehicular speeds over public roadways. A van has been equipped to allow passengers to experience LTE enabled services while the vehicle moves between these locations. An indoor demonstration area has been established in the T-Mobile facility for people to experience LTE enabled services from a stationary location. The trial system is a dynamic environment where Nortel, with the agreement of T-Mobile, continues to introduce the expanding set of LTE capabilities as they become available from Nortel's and its partners' product development teams.

Nortel is providing the complete end-toend solution, including the LTE network components, terminals, and subscriber applications delivered. The trial network is implemented with Nortel's LTE radio and packet system products, its Adaptive Application Engine delivering Voice over IP and multimedia services, terminals from the partner LG Electronics, and a variety of commercially available clients and applications to deliver a range of user experiences of interest to business and consumer subscribers.

T-Mobile International contributed extensively on the definition of the user experience and trial format, while also providing key logistical and facility support. T-Mobile's key insight into both the subscriber and operator requirements guides the trial definition and implementation. The trial is operated by T-Mobile with support from Nortel.

As announced in the press release of September 18, 2008, the trial represents a number of significant milestones with T-Mobile being the first network operator worldwide to take LTE from the laboratory to the field in a live test under everyday conditions.

#### **Trial Applications**

Prior mobile network technologies that brought data to subscribers, such as GPRS, UMTS, and HSPA, were closely architected to align to the legacy network architectures and standards designed for optimal interconnect to the legacy mobile voice networks. LTE is designed for the optimal delivery of IP based services and interconnection to next generation fixed and mobile networks. the ability to enable HD video communications between users.

- Web browsing illustrates that wireless broadband can deliver services comparable to fixed broadband for the most comprehensive Internet experience.
- Fast file transfer applications showcase that users can transfer files very fast which gives benefit to popular applications like mail download with attachments and Web 2.0 applications.



The applications in the trial provide T-Mobile and Nortel an opportunity to demonstrate the customer experience using these applications in a real world environment as follows:

- The ability to cost effectively support and deliver video streaming, e.g. from social media platforms and entertainment sites, is a key requirement for next generation mobile networks.
- The demonstration incorporates high definition video transfers as this represents the most demanding video bandwidth requirement and is of increasing popularity.
- Direct connection of high definition video cameras in the van and the stationary location demonstrates

#### Long Term Evolution (LTE)

Long Term Evolution (LTE) is one of the next generation network technology standards identified by NGMN that will allow operators to offer new and enhanced subscriber services based on a cost effective wireless broadband mobile Internet architecture. LTE is designed to better support IP (Internet Protocol) standards which are used in many of today's applications, such as web browsing, email, IP telephony and video conferencing.

The radio efficiency of LTE is greatly improved through the incorporation of two key enabling technologies. Orthogonal Frequency Division Multiplexing (OFDM) is already widely deployed in digital video broadcast, wireless local area networks (WLAN) and wireline Asynchronous Digital Subscriber Loop (ADSL/ADSL2+) products. It is a very robust technology that scales easily to fit different bandwidth requirements and with inherent properties that allow a more cost effective implementation of broadband wireless equipment than other radio air interfaces. The second key technology is Multiple Input/Multiple Output (MIMO) capabilities. MIMO allows LTE radio equipment to receive and transmit over multiple antennas at the same time, providing a significant increase in end-user bandwidth.

LTE is the first technology available to mobile operators that provides great flexibility in the bandwidth and frequency that can be used in deployments. Carrier widths of 1.4, 3, 5, 10, 15 and 20 MHz allow it to be deployed in a wide range of current and future frequencies available to mobile operators. This provides operators a great range of deployment options, including the reuse of existing 2G & 3G spectrum for LTE services.

Additionally, advanced network operation concepts such as Self Organizing Network (SON) principles are being introduced with LTE so that mobile operators can reduce operational costs, improve services and deploy base stations in less time. LTE enables operators to build the next generation mobile network optimized to provide Internet Protocol based services that will inter-work with existing 2G & 3G services.

LTE's definition and delivery timelines are heavily influenced by a number of industry organizations which have provided strong guidance from operators so that key performance and economic considerations are embedded in the standards and vendor offerings. T-Mobile International has been a leader in these efforts through its involvement in NGMN Ltd and LSTI (LTE/SAE Trial Initiative). Nortel recognized early the potential for this disruptive technology and has been actively working to establish key partnerships for a strong ecosystem.

#### About NGMN Alliance (www.ngmn.org)

The Next Generation Mobile Network (NGMN) Alliance currently consists of 53 world leading global network operators, technology vendors and universities. The network operators represent more than half of all mobile phone users worldwide and technology vendors represent more than 90 percent of implemented mobile wireless infrastructure. The key objective of the Alliance is to provide a platform for innovation for mobile broadband communications that enables an exceptional mobile user experience - cost-effective and user-friendly services and a range of end user devices like mobile phones and embedded mobile devices for laptops, consumer electronics, game consoles, etc. The NGMN White Paper summarizes the vision for mobile broadband communications and includes common operator recommendations as well as requirements for the standards for the next generation of mobile broadband networks, devices and services. Nortel is an active NGMN Partner.

#### **About LSTI**

The LTE/SAE Trial Initiative (LSTI) is a global, collaborative technology trial initiative focused on accelerating the availability of commercial and interoperable next generation LTE mobile broadband systems. Nortel is a founding member of LSTI and plays an active role as a permanent Steering Board member and leader of LSTI's LTE performance analysis work group.



In the United States: Nortel 35 Davis Drive Research Triangle Park, NC 27709 USA

In Canada: Nortel 195 The West Mall Toronto, Ontario M9C 5K1 Canada

In Caribbean and Latin America: Nortel 1500 Concorde Terrace Sunrise FL 33323 USA In Europe: Nortel Maidenhead Office Park, Westacott Way Maidenhead Berkshire SL6 3QH UK Phone 00 800 8008 9009

In Asia: Nortel United Square 101 Thomson Road Singapore 307591 Phone: (65) 6287 2877

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