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Self-Organized Management Trend of LTE

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2008-10-14   Miao Baotong

Long Term Evolution (LTE) is a new emerging technology that has been under the study of 3GPP for the recent two years. As a 4G technology, it has many enhancements over the 3G wireless technologies. It adopts OFDM and MIMO techniques for the transmission over the wireless carrier. LTE provides a data rate of 100Mbps for the downlink and 50Mbps for the uplink over a spectrum of 20MHz, with an improved cell-edge performance, increased capacity and reduced latency.

The mobile communication industry has great expectations with LTE and will provide long-term investments for the wireless communication industry. Most of the biggest operators such as Vodafone, T-Mobile, France Telecom and Sweden TeliaSonera are ready to launch LTE in near future. It is expected that LTE-based network systems will be put into commercial use in the fourth quarter of 2009.

Self-organized management of LTE has evolved toward a new automatic management trend. To reduce the complexity in LTE network management, ZTE simplifies its network management architecture by combining the Element Management Layer (EML) with the Network Management Layer (NML). Therefore, some complicated network management functions are transplanted to the EML, making the standard southbound interfaces possible.

Introduction to LTE EPS

The Core Network (CN) of LTE is evolved and defined as Evolved Packet Core Network (EPC) consisting of the Mobility Management Entities (MME) and Serving Gateway (S-GW). The Universal Terrestrial Radio Access Network (UTRAN) is evolved to Evolved UTRAN (EUTRAN). The EPC and EUTRAN together are called Evolved Packet System (EPS). The general architecture of LTE EPS is shown in Figure 1.
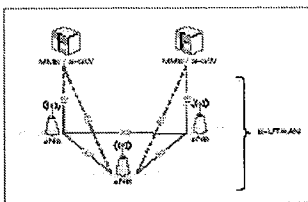

Figure 1 EPS architecture

ZTE/HTC v. Evolved Wireless IPR2016-00757
Evolved Wireless, LLC Exhibit 2003-001

advantages: high data rate, packet transfer, low latency, high capacity and backward compatibility. LTE accomplishes revolutionary change to the whole 3GPP network structure and incorporates typical IP broadband network properties. In the LTE EUTRAN, the Radio Network Controller (RNC) is eliminated from the data path and its functions are incorporated into the evolved NodeB (eNB). This structure simplifies network construction and thus satisfies the operators' requirements of low latency, low complexity and low cost.

LTE SON Standards and Development Trends

In addition to existing UMTS management standards, the management of EPS will follow the Self-Organized Network (SON) mechanism such as self-configuration, self-optimization, information model discovery and development of P2P interfaces. The general architecture and interfaces of EPS Network Management (NM) system are illustrated in Figure 2. It is the top priority of telecom industry that the EPS NM system supports multi-vendor equipment management capabilities. The itf-s southbound interfaces between OMCs and eNBs should be standardized. But some equipment suppliers are not ready to be agreeing with this open standard. The southbound interface standardization finally depends on how operators endeavor to convince the suppliers of that.
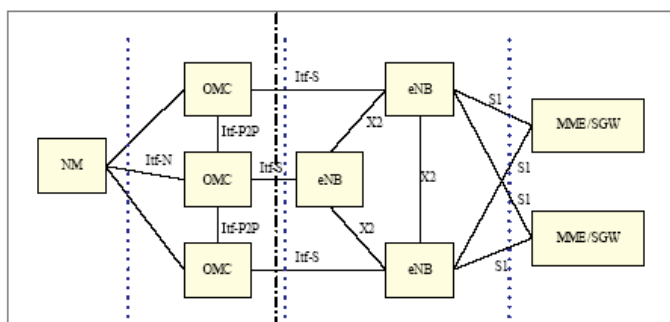

Figure 2   Architecture and interfaces of ESP NM system

3GPP has four Technical Specification Groups (TSGs): Core Networks and Terminals (CTs), Radio Access Network (RAN), Services and Systems Aspects (SAs) and GSM EDGE Radio Access Network (GERAN). The 3GPP SA working group 5 (SA5) is in charge of telecom management, aiming to keep pace with 3G mobile network technologies and specify the relative management framework and requirements.

At the 3GPP TSG SA Plenary Meeting #34 held in Budapest, Hungary in December 2006, the LTE special topic proposed by Ericsson was approved.

At the 3GPP TSG SA5 Meeting #59 held in Chengdu, China in April 2008, the SON working group was established to discuss the relevant topics concerning eNB self-discovery, self-installation, self-configuration, self-optimization and self-recovery. Major carriers like Vodafone and T-Mobile requested that suppliers should complete their standards as quickly as possible.

 At the 3GPP TSG SA5 Meeting #59bis held in June 2008, over 20 carrier and supplier representatives attended the meeting, and about 25 proposals were submitted. The topics for discussion include self-establishment of eNodeB, ANR management, self-optimization and SON for Home NodeB. At the meeting, some carriers recommended that OMCs should be cancelled and eNodeBs should be connected directly to the upper NMS, but some agreed to keep the OMCs by cutting the cost.

ZTE has been playing an active role in studying and drafting the 3GPP SON standards since its 3GPP Standards Research Department was founded in 2007. Being the chairman of SA5 OAM working group, ZTE earned firstly a reporter's seat in the 3GPP for study of LTE/SON related topics. Its topic of "Study on Self-Healing" won the full support of all major carriers such as Vodafone, T-mobile, Telecom Italia and Telefonica. At the 3GPP TSG SA5 Meeting #60 held in July 2008, ZTE's proposal of "Self-Healing Overview" was approved by all attendants, and its use cases including Software Self-recovery, Data Self-recovery and Alarm Self-recovery were submitted for discussion. ZTE will continue their study and give the specific solutions.

nodes to reduce the costs. The OMCs may be finally eliminated and the eNBs will be connected directly to the upper NMS. But presently unified access and management, easy operation and maintenance, and high performance are still our major concern.

ZTE's Unified EMS SON Solution

To manage different types of Network Elements (NEs), ZTE adopts a unified Element Management System (EMS) that can provide all EML and some NML functions except the upper Service Management Layer (SML) and Business Management Layer (BML) functions. The unified EMS solution helps operators implement flexible networking, unified deployment and centralized management while lowering the costs. ZTE puts forward the SON solution based on the unified EMS and its architecture is shown in Figure 3.
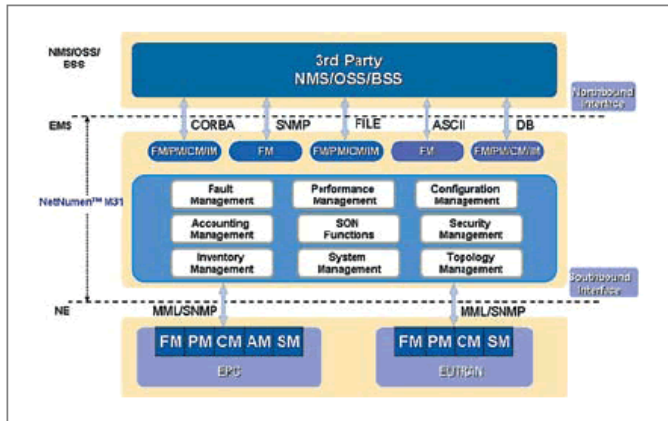

Figure 3   Architecture of ZTE's unified EMS SON solution

ZTE's unified EMS platform delivers comprehensive set of functions such as fault management, performance management, configuration management, log management and system management. For the LTE SON, corresponding SON functions will be added. These SON functions include:

Self-configuration: The self-configuration contains Plug-and-Play of eNBs, auto software installation, auto radio/transmission configuration, auto detection and auto adjacency management, which helps minimize the workload of maintenance staff.

Self-optimization: Network quality has always been the primary concern of carriers that require network optimization. However manual network optimization usually requires a long time and a great deal of manpower. The self-optimization feature of SON will reduce the extra efforts needed to implement adjacent cell optimization, coverage optimization, parameter optimization, MBMS network optimization, and dynamic switchover.

Self-recovery: ZTE has submitted the use cases of Software Self-recovery, Data Self-recovery and Alarm Self-recovery to the 3GPP TSG SA5 working group for approval, and will persist in the study of this domain to provide the final solution.

ZTE's unified EMS platform with uniform user interfaces and ease-of-use features makes possible unified access and management of EPC and eNBs. ZTE keeps a close watch on and intends to be very supportive of the standardization work on southbound interfaces.

The SON solution is flexible enough to be transplanted to other existing NM products or wireless NEs to boost their competitiveness. ZTE keeps tracing the development of LTE SON standards and enhances communication with carriers so that users' demands can be better satisfied.

Conclusion

The ultimate goal of future Network Management System (NMS) is to enable unified access and management

it possible for carriers to move from distributed maintenance to centralized management. With additional SON functions, it helps carriers enhance their competitiveness while considerably lowering the operation and maintenance costs.

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