

Chapter 5

Long Term Evolution (LTE): An IPv6 Perspective

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ABSTRACT

The main characteristic of 4th Generation (4G) Networks is being based on all IP architecture, operating mainly on IPv6. This includes services such as voice, video, and messaging. LTE is considered to be a 3rd Generation (3G) network and one of 4th Generation (4G) roadmap mobile access technologies. LTE-Advanced (LTE-A), on the other hand, is a 4G technology concept with evolving features. Therefore LTE is the key feature in the understanding of LTE-A evolution. The main focus of LTE is the enhancement of the packet-switched (PS) mechanisms on top of the UMTS enhancements, based on All IP Network (AIPN). IPv6 networking provides maximum service delivery flexibility, user decoupling, and scalability improvements, while leveraging the existing IETF standards. This requires major focus on network simplification, end-to-end delay reductions, optimal traffic routing, seamless mobility, and IP-based transport provisioning. This chapter aims to present a survey and highlight specific IPv6-based features presented mostly in the 3GPP standard literature, and to provide a high-level discussion on the LTE-IPv6 requirements.

1. INTRODUCTION TO IPV6

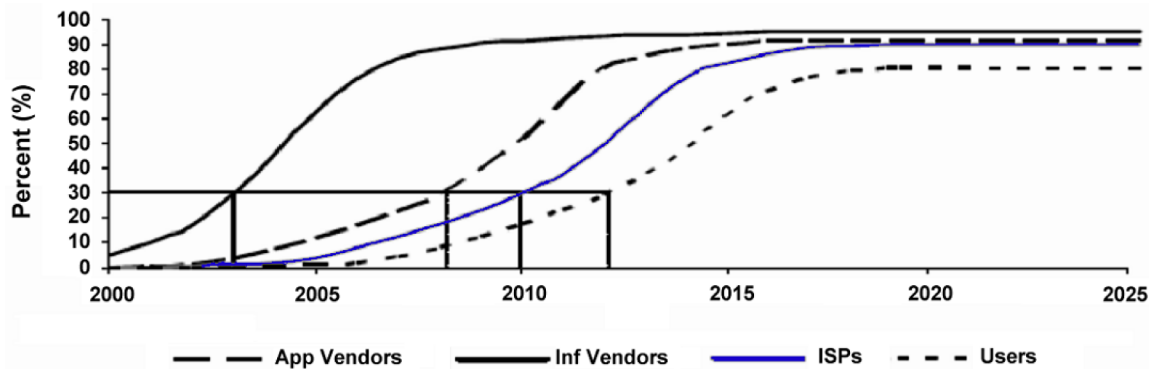
IPv6 is, by far, one of the most important and significant technology and network upgrades in the communication history. This upgrade is growing slowly and will eventually terminate IPv4's network deployment at the end of the transition phase. IPv6

is designed to work with high speed network and low bandwidth networks, particularly suitable for wireless networks. The IPv6 design accommodates new technology requirements, such as QoS, security, and of course extended addressing (Cisco Systems, 2008; Esposito, R., et al.).

Since the mid 90's many developers and researchers have been working on IPv6 and many RFCs are directly or indirectly discussing this technology.

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Figure 1. IPv6 penetration in vendors, ISPs, and users (adapted from Gallaher & Rowe, 2005)



RFC 1883, released in 1995, is the first RFC in regards to IPv6. These efforts have been initiated and monitored by the Internet Engineering Task Force (IETF) (Deering & Hinden, 1995).

In the past several years IPv6 has deeply penetrated into the architecture of the Internet. Figure 1 (adapted from Gallaher & Rowe, 2005) presents a penetration estimates of IPv6 in the United States, which shows that by year 2010, almost 30% of ISPs and 18% of the users will be switching to IPv6.

The main issue with IPv6 integration is its interoperability with IPv4. IPv4 is going to be around for at least a decade before all the networks are purely running over IPv6. Therefore it is essential to ensure IPv6 traffic flows are not going to have any negative impacts on IPv4 and vice versa. Dual-stack systems are considered a solution for the IPv6/IPv4 interoperability issue, which are going to be utilized in the design and implementation of systems for sustaining both IPv4 and IPv6 parallel processing to guarantee interoperability amongst the two protocol suites (Punithavathani & Sankaranarayanan, 2009).

Mobility is another major features that is going to be impacted by this transition. 3G networks have been growing immensely in the past few years and IP connectivity has become an inseparable part of the 3G networks. The involvement

of IP is going to increase more as 4G networks are becoming realizable. These requirements are being considered in the IPv6 applications (Ericsson Inc., 2009).

This chapter will explore IPv6 features, in particular, in conjunction with LTE architecture. At first, IPv6 is going to be discussed and compared to IPv4. Following this introduction, IPv4-to-IPv6 transition, IPv6 security, Mobile-IPv6, and QoS-IPv6 are covered. Various interactions of LTE and IPv6 will conclude this chapter.

1.1 IPv6 versus IPv4

Internet Protocol version 6 (IPv6), also known as the Internet Protocol next generation (IPng) is intended to sustain constant Internet growth with consideration of the number of users and functionality. The legacy IP version, IPv4, was implemented in the early 1980's based on stationary wired communication infrastructure (Postel, 1981). The IPv4 supports less than 2^{32} (over 4 billion) individual addresses, hence IPv4 suffers some limitations that may be inhibitors to growth of "tomorrow's" Internet, and use of the Internet as a global networking solution. Therefore, IPv6 is under development to take over IPv4's position by providing a greater expansion of IP address space; nonetheless, incorporating features of such

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