Mobility Management in the Evolved Packet Core

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***Abstract* – A key aspect facet of the System Architecture Evolution is the specification of the Evolved Packet Core which supports multiple access networks. While the user roams from one network to another, a seamless handover is required to provide superior quality of service. One of the crucial goals of the EPC is to provide seamless mobility across multiple radio access technology as the mobile terminal traverses networks. And with an increased demand in real time applications, means of handling large volumes of traffic are needed thus making route optimization important. This Work in Progress paper proposes an elementary hybrid client-network based mobility protocol to make FMC ascertain together with a route optimization solution to realize local breakout.**

***Index Terms*—SAE, EPC, PMIPv6, DSMIPv4**

I. INTRODUCTION

The 3GPP desire to provide a competitive wireless access technology in the years 2010-2020 has led to the standardization of the System Architecture Evolution (SAE). This standardization possesses two main objectives. One objective is to design a new access technology called the Long Term Evolution (LTE), based on Orthogonal Frequency Division Multiplexing (OFDM) radio technology which inherently increases data rates, reduces end- to- end latency for real time applications and also lowers set-up times when new connections are made. The other objective is to create an all IP packet core network, the Evolved Packet Core (EPC), an access independent core designed not only to support 3GPP radio technologies, but also non-3GPP radio access technologies such worldwide interoperability for microwave access (WIMAX) , wireless local area network (WLAN) and code division multiple access (CDMA2000) as examples.

One of the crucial goals of the EPC is to provide seamless mobility across multiple radio access technology as the mobile terminal traverses from one network to the other. The mobility is done on the network layer as it is a common platform all access networks. Two mobility approaches were specified by the 3GPP for the EPC for mobility between 3GPP and non-3GPP access networks, namely the network-based mobility protocol Proxy Mobile IPv6 (PMIPv6) [1] and the client-based based mobility protocols Dual-Stack Mobile IPv6 (DSMIPv6) [2] and Mobile IPv4.

The remainder of this document is organized as follows. The next section provides work related to this research. We then discuss the main motivations followed by a brief description of the core. The following section provides a concise background on mobility management, followed by the proposed framework and finally the paper is concluded.

II. RELATED WORK

Krishnan et al.[3] introduced a local anchor which would further enhance the flexibility of the EPS by allowing an independent evolution of the local and global mobility protocols. However no tests were done to actually validate the concept.

Sugimoto et al.[4] proposed a Network controlled Route Optimization for Heterogeneous Mobile IP Networks which aimed to satisfy important requirements such as an efficient network resources utilization, an improvement of the end-to-end quality of service and the capability to monitor user traffic for policy control and charging.

Kim et al.[5] investigates the primary issues in Network Localized Mobility Management.

III. MAIN MOTIVATIONS

The 3GPP supports both client-based and network-based mobility as mentioned earlier. Since local mobility is independent of global mobility, the mechanisms are currently not used simultaneously. This leads to a drawback which is significant to Fixed Mobile Convergence (FMC). As an example, a user is served by a residential Gateway equipped with a fiber modem and a WLAN AP. Assuming the subscriber is using a multi-access terminal with support for LTE & WLAN. If the subscriber initiates an IMS VoIP call in her home, it is more likely that the VoIP call will be carried over WLAN up to the Gateway. From the Gateway, the fiber access will be used to carry the voice data traffic. If the subscriber moves out of her door while on the call, the signal towards her WLAN AP fades thus a seamless handover to LTE is desirable. But when using PMIPv6 there is a problem! The EPS only sees the Fiber and LTE accesses. It has no knowledge about the existence of the WLAN. In this case a client based mobility protocol would have been desirable as the host would provide the seamless handover.

Because of an increasing demand in real-time applications, means to handle large volumes of traffic as aroused making routing an intrinsic factor. In the 3GPP EPC, there is a serious requirement for supporting local breakout by which the user traffic is routed without being transferred through a home network to avoid long and redundant packet transfer routes. Hence route optimization in IP networks is essential and more research is done in this area.

IV. EVOLVED PACKET CORE

The Evolved Packet System is a simplified flattened network architecture. For instance, there are only two types of nodes (base stations and gateways), while in current hierarchical networks there are four types, including a centralized Resource Network Controller (RNC). Another simplification is the separation of the control plane, with a separate mobility management network element [6]. EPC is an IP based core network with support for packet switch traffic only including voice. It supports seamlessness between heterogeneous access networks.

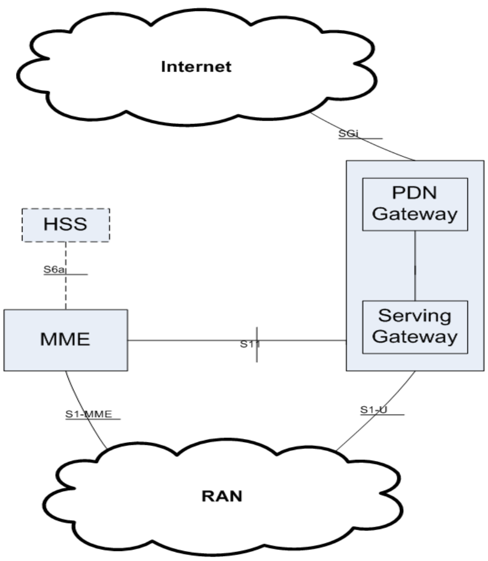

Figure 1: Simplified EPC

Figure 1, depicts a simplified architecture of the EPC. The core architecture of the System Architecture Evolution consists of the following functional entities:

Packet Data Network Gateway (PDN GW): a user plane node which connects the user to the Internet. It is responsible for several IP functions which include address allocation, policy enforcement, packet classification and routing.

Serving Gateway (S-GW): a user plane node which connects the core to different radio access technologies. It acts a local mobility anchor for intra-mobility in the LTE. **Mobility Management Entity (MME):** It is the control plane for the EPC. It is a signaling entity only which provides mobility for the user.

V. MOBILITY MANAGEMENT

Mobility management is subdivided into network (e.g. PMIPv6) and client based (DSMIPv6) mobility. Network-based mobility refers to the mobility where the network does all the mobility-related signaling. When the UE changes its point of attachment, the network provides the UE with the same IP address as it had on its previous attachment. The network handles updating the mobility anchor in the network so that the packets arrive at the new point of attachment of the UE. With host-based mobility, the UE obtains a care of address when it changes its point attachment. The UE is responsible for updating the home agent which maintains a binding between the care of address and the home address and it's therefore responsible for the mobility signaling within the network.

VI. PROPOSED FRAMEWORK

With the limitation and requirements exposed in section II, the proposed framework is a hybrid network-client based mobility node as shown in Figure 2

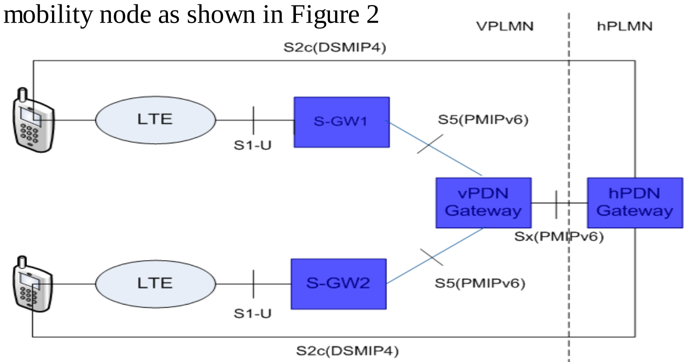

Figure 2: Proposed mobility framework

It makes route optimization possible and hence provides the possibility to reduce latency. When local breakout is realized, signaling back to the home network will be minimized.

VII. CONCLUSION

With this proposed architecture un-necessary routing will be avoided thus providing a better quality of service to the user. It provides enhancements to the 3GPP EPC by combining the advantages of both network and client based mobility protocols making Fixed Mobile Convergence becomes more attained.

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BIOGRAPHY

Francis M. Masuabi completed her B.Sc. Eng. (Hons) degree at the University of Cape Town in 2008. She is currently reading for an MSc degree in Electrical Engineering in the Communications Research Group at the same institution. Her research interests are in mobility management in next generation networks.