Network-Based Mobility Management in the Evolved 3GPP Core Network

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Introduction

- Overview of the EPC specifications that use a network-based mobility mechanism based on PMIPv6 (Proxy Mobile IPv6) to enable mobility between access networks
- SAE (system architecture evolution) has two primary objectives
  - Create a new radio access network: Evolved-universal mobile telecommunications system (UMTS) terrestrial radio access network (E-UTRAN), based on orthogonal frequency division multiplexing (OFDM) radio technology
Introduction (Cont.)

- Create a common packet core network: Evolved packet core (EPC) to support mobile services, 3GPP defined-radio access technologies and non-3GPP defined-radio access technologies
- The EPC also is required to provide quality of service (QoS) support as user equipment (UE)
Network-based IP Mobility Management

- There are two basic approaches to providing IP-based mobility management:
  - Network-based mobility management
  - Client-based mobility management
- To provide handover capability within and between access systems with no perceivable service interruption has been identified
- Efficient use of wireless resources is another requirement for mobility management
- It is generally desirable to minimize UE involvement in mobility management to improve the battery life of the terminal
Network-based IP Mobility Management (Cont.)

- Because network-based mobility management fulfills these requirements well
- PMIPv6 was adopted as the IP mobility protocol for mobility between 3GPP and non-3GPP accesses and as an option for intra-3GPP access mobility
- PMIPv6 introduces two new functional entities
  - Local mobility anchor (LMA)
  - Mobile access gateway (MAG)
Network-based Mobility Architecture of the EPC

- The PMIPv6-based mobility architecture of the evolved packet system
Network-based Mobility Architecture of the EPC

- Proxy Mobility Internet protocol (PMIP)
- Policy and Charging Control (PCC)
- Authentication Authorization Accounting (AAA)
- Packet Data Network Gateway (PDN GW)
- Serving Gateway (S-GW)
- Access Gateway (A-GW)
- Evolved Packet Data Gateway (ePDG)
PCC and QoS Provisioning

- Subscription Profile Repository (SPR)
- Policy and Charging Rules Function (PCRF)
- Policy and Charging Enforcement Function (PCEF)
- Bearer Binding and Event Reporting Function (BBERF)
- Home Subscriber Server (HSS)
Non-Optimized Handovers

1. UE decides to attach to non-3GPP
2. L2/L3 attach trigger
3. Access authentication
4. BBERF registration with PCRF
5. Proxy binding update
6. PCEF registration with PCRF
7. LMA registration with AAA
8. Proxy binding Ack (IP addr)
9. L3 attach completion (IP addr)
10. SIP signaling to setup VoIP call
11. Request for access QoS (SDP)
12. Policy decision
13. Download PCC rule
14. Download QoS rule
15. QOS bearer setup
16. Acknowledge QoS setup

Default access bearer
PMIPv6 tunnel
IP connectivity
Optimized Handovers
Optimized Handovers (Cont.)

- Mobility Management Entity (MME)
- Evolved High Rate Packet Data (eHRPD)
- HRPD Access Network (HRPD AN)
- HRPD Serving Gateway (HSGW)
- Evolved Universal Terrestrial Radio Access Network (eUTRAN)
To describe the different phases of an optimized handover, the following terms are introduced:

- A. Pre-Registration
- B. Preparation
- C. Execution
Optimized Handovers (Cont.)

- **A1.** UE decides to pre-register
- **A2.** Authentication and authorization
- **A4.** Target BBERF registration with PCRF
- **A5.** IP session establishment
- **A7.** Target BBERF interaction with PCRF
- **A6.** Session maintenance
- **B1.** E-UTRAN decides to trigger HO
- **B2.** HO initiation
- **B3.** HO initiation
- **S101 tunnel**
- **3GPP AAA server HSS**
- **IP connectivity**
- Default access bearer
- VoIP access bearer
- PMIPv6 tunnel
- UE
- E-UTRAN
- MME
- S-GW (MAG, BBERF)
- HRPD AN
- HSGW (MAG, BBERF)
- PDN GW (LMA, PCEF)
- PCRF
- CRF

- **Default access bearer**
- **VoIP access bearer**
- **PMIPv6 tunnel**
- **IP connectivity**
Optimized Handovers (Cont.)

Diagram showing the process of optimized handovers with labels such as C1, C2, C3, etc., and various network components like UE, E-UTRAN, MME, S-GW, HSRPAN, HSGW, PDN GW, PCRF, and 3GPP AAA server HSS.
Summary and Future Work

- This article presented the motivation, design, and realization of inter-access system mobility support based on Proxy Mobile IPv6 for the 3GPP EPC.
- The document also addresses the issues of QoS provisioning and seamless handover support.
- Release 8 is the first release of the EPC specification.
- As operational experience for “always best-connected terminals” increases, optimizations, and lessons learned from the field will drive additional enhancements of the EPC.