International Telecommunication Union

ITU-T Q.1708/Y.2805

(10/2008)

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

SERIES Q: SWITCHING AND SIGNALLING

Signalling requirements and protocols for IMT-2000

SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

Next Generation Networks – Generalized mobility

Framework of location management for NGN

Recommendation ITU-T Q.1708/Y.2805

ITU-T Q-SERIES RECOMMENDATIONS

SWITCHING AND SIGNALLING

SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE	Q.1–Q.3
INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING	Q.4–Q.59
FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN	Q.60–Q.99
CLAUSES APPLICABLE TO ITU-T STANDARD SYSTEMS	Q.100–Q.119
SPECIFICATIONS OF SIGNALLING SYSTEMS No. 4, 5, 6, R1 AND R2	Q.120–Q.499
DIGITAL EXCHANGES	Q.500–Q.599
INTERWORKING OF SIGNALLING SYSTEMS	Q.600–Q.699
SPECIFICATIONS OF SIGNALLING SYSTEM No. 7	Q.700–Q.799
Q3 INTERFACE	Q.800–Q.849
DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1	Q.850–Q.999
PUBLIC LAND MOBILE NETWORK	Q.1000–Q.1099
INTERWORKING WITH SATELLITE MOBILE SYSTEMS	Q.1100–Q.1199
INTELLIGENT NETWORK	Q.1200–Q.1699
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR IMT-2000	**Q.1700–Q.1799**
SPECIFICATIONS OF SIGNALLING RELATED TO BEARER INDEPENDENT CALL CONTROL (BICC)	Q.1900–Q.1999
BROADBAND ISDN	Q.2000–Q.2999
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR THE NGN	Q.3000–Q.3999

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T Q.1708/Y.2805

Framework of location management for NGN

Summary

Recommendation ITU-T Q.1708/Y.2805 specifies the framework of IP-based location management for next generation networks. The location management is responsible for mapping among user identifier and location identifiers of the user equipment. This Recommendation describes the design considerations, functional architecture, and information flows for the location management function.

Source

Recommendation ITU-T Q.1708/Y.2805 was approved on 14 October 2008 by ITU-T Study Group 19 (2005-2008) under Recommendation ITU-T A.8 procedure.

Keywords

Location management, NGN.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

CONTENTS

		Page
1	Scope	1
2	References	1
3	Definitions	1
	3.1 Terms defined in [ITU-T Q.1707]	1
	3.2 Terms defined in this Recommendation	2
4	Abbreviations	2
5	Design considerations	3
	5.1 MM identifiers	3
	5.2 LM operations	4
	5.3 LM for data packet delivery	5
6	Functional reference architecture	5
	6.1 Functional entities	5
	6.2 Reference points	6
7	Information flows for non-roaming UE	8
	7.1 Host-based LM	8
	7.2 Network-based LM	9
8	Information flows for roaming UE	10
	8.1 Host-based LM	11
	8.2 Network-based LM	12
Bibliography		13

Introduction

This Recommendation describes the framework of mobility management (MM) for next generation networks (NGN). This work has been motivated from the observation that NGN continues to evolve towards the convergence of fixed and wireless/mobile networks, and thus mobility management is an essential functionality needed to provide seamless mobility to NGN users and services.

This Recommendation is a part of the MM framework for NGN. The MM framework will be designed with a series of Recommendations, rather than a single Recommendation, as a suite of the framework of mobility management for NGN. The design of the MM framework includes a variety of technical issues to be addressed. Those design issues are associated with a wide variety of mobility scenarios and protocols. The MM framework Recommendations are:

- Recommendation Q.1707/Y.2804: Generic framework of mobility management for next generation networks;
- Recommendation Q.1708/Y.2805: Framework of location management for NGN;
- Recommendation Q.1709/Y.2806: Framework of handover control for NGN;

Recommendation ITU-T Q.1708/Y.2805

Framework of location management for NGN

1 Scope

This Recommendation describes the framework of IP-based location management (LM) for NGN, which includes design considerations, functional architecture, and information flows for location management. This Recommendation focuses on terminal mobility when mobile terminals move around and change their IP addresses in the NGN. This Recommendation also focuses on the mobility management (MM) schemes that operate in the network or IP layers, whereas the issues on the mobility support in the service stratum will be addressed in another Recommendation.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T Q.1706] Recommendation ITU-T Q.1706/Y.2801 (2006), *Mobility management requirements for NGN.*

[ITU-T Q.1707] Recommendation ITU-T Q.1707/Y.2804 (2008), *Generic framework of mobility management for next generation networks.*

[ITU-T Q.1709] Recommendation ITU-T Q.1709/Y.2806 (2008), *Framework of handover control for NGN.*

[ITU-T Y.2001] Recommendation ITU-T Y.2001 (2004), *General overview of NGN.*

[ITU-T Y.2011] Recommendation ITU-T Y.2011 (2004), *General principles and general reference model for Next Generation Networks.*

[ITU-T Y.2012] Recommendation ITU-T Y.2012 (2006), *Functional requirements and architecture of the NGN release 1.*

[ITU-T Y.2014] Recommendation ITU-T Y.2014 (2008), *Network attachment control functions in next generation networks.*

[ITU-T Y.2091] Recommendation ITU-T Y.2091 (2007), *Terms and definitions for next generation networks.*

[ITU-T Y.2111] Recommendation ITU-T Y.2111 (2006), *Resource and admission control functions in next generation networks.*

3 Definitions

3.1 Terms defined in [ITU-T Q.1707]

This Recommendation uses the following terms defined in [ITU-T Q.1707]:

3.1.1 location identifier (LID): A topological location identifier of a UE. An IP address can be used as a location identifier. Refer also to [ITU-T Y.2091].

3.1.2 user identifier (UID): A series of digits, characters and symbols or any other form of data that are used to identify a subscriber (user) or user equipment in the NGN. Refer also to [ITU-T Y.2091].

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 persistent LID (PLID): A LID that does not change even when a mobile user equipment (MUE) moves across different access networks or IP subnets.

3.2.2 temporary LID (TLID): A LID that changes when a mobile user equipment (MUE) moves across different access networks or IP subnets.

3.2.3 LID binding update (LBU): An operation of location management to manage the mapping between persistent LIDs (PLIDs) and temporary LIDs (TLIDs).

4 Abbreviations

This Recommendation uses the following abbreviations:

ALM	Access Location Management
ALM-FE	Access Location Management Functional Entity
CLM	Central Location Management
CLM-FE	Central Location Management Functional Entity
CoA	Care of Address
CUE	Corresponding User Equipment
DHCP	Dynamic Host Configuration Protocol
FE	Functional Entity
FRA	Functional Requirements and Architecture for NGN
HCF	Handover Control Function
HoA	Home Address
HSDPA	High Speed Downlink Packet Access
ID	Identifier
IMSI	International Mobile Subscriber Identifier
IP	Internet Protocol
L3	Layer 3
LBU	LID Binding Update
LID	Location Identifier
LM	Location Management
LMF	Location Management Function
LM-FE	Location Management FE
MIP	Mobile IP
MIPv6	Mobile IPv6
MM	Mobility Management

MMCF Mobility Management Control Function

MUE Mobile User Equipment

NACF Network Attachment Control Function

NAI Network Access Identifier

NGN Next Generation Network

PLID Persistent LID

RACF Resource Admission Control Function

TF Transport Function

TLID Temporary LID

UE User Equipment

UID User Identifier

URI Uniform Resource Identifier

Wi-Fi Wireless Fidelity

WiMAX Worldwide interoperability for Microwave Access

5 Design considerations

5.1 MM identifiers

The identifiers for MM can be classified into user ID (UID) and location ID (LID). The location ID can be further classified into persistent LID (PLID) and temporary LID (TLID).

5.1.1 User identifier (UID)

A UID represents a user or UE in the NGN. The UID can be in a variety of formats such as uniform resource identifier (URI), network access identifier (NAI), international mobile subscriber identifier (IMSI), etc. In this Recommendation, it is assumed that a UID is given to a user that has subscribed to the NGN mobility service.

5.1.2 Location identifier (LID)

The location management (LM) functionality is used to keep track of mobile user equipments (UEs) in the network by identifying and maintaining the location information of the concerned mobile UEs. Such location information or location identifier (LID) is classified into 'physical' LID and 'logical' LID. The physical LID represents the geographical location of the mobile UE. The logical LID includes an IP address for routing/forwarding IP packets to the mobile UE in the network.

This Recommendation does not consider the physical or geographical LID. This Recommendation considers only the logical LID, and focuses on the use of the IP address as LID. From the point of view of IP-based LM, a logical LID, or IP address, can be further classified into persistent LIDs (PLIDs) and temporary LIDs (TLIDs).

5.1.3 Persistent LID (PLID)

A typical example of PLID is the home address (HoA), which is defined in the mobile IP (MIP). When a mobile UE (MUE) is connected to the network at the initial power-on, a PLID should be statically or dynamically allocated to the MUE.

In order to support session continuity of MUEs, the PLID may not be changed, even if an MUE moves into another IP subnet. In this sense, this LID is called 'persistent'. In some cases, however, a

PLID may be newly configured, for example, when the MUE is reconnected to the network after a failure or power-off, or when it enters a new local domain in a localized MM scheme.

5.1.4 Temporary LID (TLID)

A typical example of TLID is the care-of address (CoA) of MIP. When an MUE moves into another IP subnet, it will obtain a new TLID, as seen in the example of MIPv6 CoA.

In host-based LM, a TLID should be dynamically allocated to the MUE, possibly through DHCP. In network-based LM, an IP address of the concerned access router may be used as TLID of an MUE.

5.2 LM operations

IP-based LM is used to manage the mappings between UID and PLID, and between PLID and TLID for each MUE. In this respect, LM operations consist of:

- UID binding operation for mapping between UID and PLID;
- LID binding operation for mapping between PLID and TLID.

This Recommendation focuses on the LID binding operation.

On the other hand, it is noted that paging management is one of the essential functionalities that can be used with location management. However, the IP-based paging function is for further study. The paging function is outside the scope of this Recommendation.

5.2.1 UID binding operation

The UID binding operation is used to manage the mapping between the UID and the PLID for each mobile UE. A UID is assigned to an NGN user on the subscription basis, whereas a PLID represents an IP address.

The UID binding information should be registered when an MUE gets a PLID. Such information will be updated if the PLID is re-configured by the MUE. It is noted that UID binding operation schemes are quite dependent on the type of UID associated with the user (e.g., URI, IMSI, or UE identifier, etc.). This implies that there may be a variety of schemes or scenarios for UID binding management. This Recommendation does not deal with the details of UID binding management schemes.

5.2.2 LID binding operation

The LID binding operation is used to manage the mapping between PLID and TLID for each mobile UE. The LID binding update (LBU) operation will be used for LID binding management. This Recommendation focuses on the LID binding operation, rather than on the UID binding operation.

When an MUE is initially connected to the network, an 'initial' LBU operation is performed. In host-based LM, when the MUE gets a TLID from the network, it should register its TLID with the LM-related functional entity. In network-based LM, in which the IP address of a network agent is used as TLID, the LBU operation will be performed by the corresponding LM-related functional entity in the network. Each time an MUE moves into a new IP subnet and thus its TLID changes, the LBU is performed.

5.2.3 Consideration of multiple interfaces

An MUE may have multiple PLIDs when an MUE gets access to the different NGN service providers in which the mobility services are offered to the MUE. An MUE may also have multiple TLIDs. For example, one TLID per each interface may be allocated to an MUE with multiple interfaces, which allows the MUE to use various types of network interfaces to maintain a wide area

network connectivity. Note that an MUE may have one TLID even when it has multiple PLIDs and also may have one PLID even when it has multiple TLIDs.

If multiple PLIDs are allocated to an MUE, the LBU operation for each PLID may be performed with different CLM-FE. In addition, if multiple TLIDs are allocated to an MUE, the LID binding operation should be able to bind multiple TLIDs to each PLID.

As a typical example, an MUE with multiple interfaces may have one PLID and multiple TLIDs, one TLID per interface. When the MUE is initially connected to an access network through one of its interfaces, its PLID is bound to a TLID for the interface. Then, if there is another available interface for the MUE, the MUE may also be connected to an access network through that interface and its PLID is also bound to the TLID of the interface. Note that when another TLID is bound to a PLID, the existing TLIDs bound to the PLID should not be overwritten. In addition, there should be a proper mechanism to revoke the binding between PLID and TLID. The detailed architecture and signalling flow are out of scope of this Recommendation and are for further study.

5.2.4 Dynamic assignment of LM functional entity

The dynamic assignment mechanism of the LM functional entity (LM-FE) may be supported during the location registration according to the requirements of load balancing, administrative policies and so on. If an LBU request (LBU_Request) to a location management functional entity is responded to by an LBU response (LBU_Response) with failure notification or redirection information, an LBU_Request to the other location management functional entity will be tried.

5.3 LM for data packet delivery

For data packet delivery or call/session establishment between corresponding UE (CUE) and MUE, the current location information of the MUE needs to be identified. The LM or LM-related functional entity will be used to provide the location information of MUE for data packet delivery or call/session establishment.

The detailed scheme of data packet delivery or session establishment may depend on the associated service control functions or mechanisms (e.g., with or without the session setup signalling). By this, there may be a variety of operational scenarios for finding the location information of MUE (e.g., PLID or TLID) via interworking between the LM-related functional entity and the service control function. The details of the scenarios for data packet delivery or session establishment are outside the scope of this Recommendation.

This Recommendation focuses on the functional architecture and information flows only for the LBU operation in terms of LM functionality.

6 Functional reference architecture

6.1 Functional entities

As described in [ITU-T Q.1707], the MM control function (MMCF) consists of the location management function (LMF) and the handover control function (HCF). The LMF can be achieved with the following functional entities (FEs):

- Access LM-FE (ALM-FE);
- Central LM-FE (CLM-FE).

These are the logical FEs defined for location management. These FEs may be located on a single physical entity, or may be implemented into one or more physical FEs. From the NGN-FRA point of view, an LM-FE may be further divided into one or more FEs, but that is outside the scope of this Recommendation.

Figure 6-1 shows the architectural model of the LM function with the related LM-FEs.

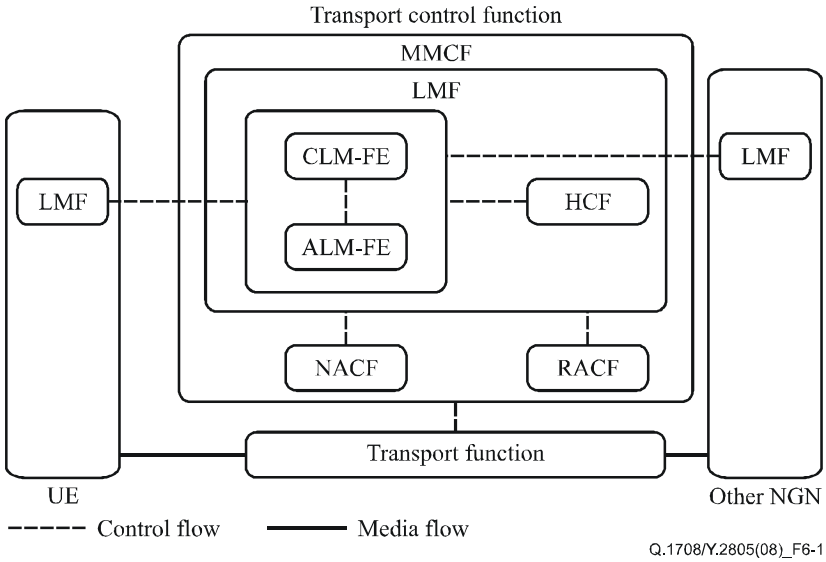

Figure 6-1 – Functional architecture of location management

As described in the figure, a UE may perform its own LMF function with the LM-FEs of the network in the host-based LM scheme. The LM-FEs in the network are organized into a two-level hierarchy of ALM-FE and CLM-FE. Each LM-FE performs the LBU operation for location management.

In terms of MM, the LM-FEs can interact with the handover control function (HCF). Moreover, each LM-FE may have interaction with the following NGN functions:

- Network Attachment Control Function (NACF);
- Resource Admission Control Function (RACF);
- Transport Function (TF).

6.1.1 ALM-FE

The ALM-FE is responsible for:

- LBU operation with MUE and CLM-FE in host-based LM;
- LBU operation with CLM-FE in network-based LM.

6.1.2 CLM-FE

The CLM-FE is responsible for:

- LBU operation with MUE and ALM-FE in host-based LM;
- LBU operation with ALM-FE in network-based LM.

6.2 Reference points

This clause identifies the reference points or interfaces used to describe the information flows for LM.

6.2.1 Non-roaming case

In the non-roaming case, the reference points for LM operations (L_{UA}, L_{AC}, L_{UC}) are shown in Figure 6-2.

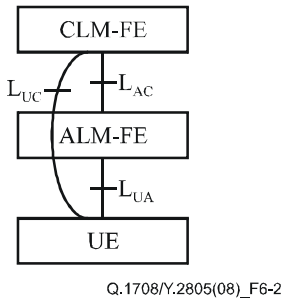

Figure 6-2 – Reference points for LM in the non-roaming case

In the non-roaming case, the LM scenarios can be classified as follows:

- Host-based LM with ALM-FE
- Host-based LM without ALM-FE
- Network-based LM

In the case of host-based LM using ALM-FE, two reference points are used: L_{UA} between UE and ALM-FE, and L_{AC} between ALM-FE and CLM-FE. In the case of host-based LM without ALM-FE, the reference point L_{UC} between UE and CLM-FE is used. In the case of network-based LM, the reference point L_{AC} between ALM-FE and CLM-FE is used.

6.2.2 Roaming case

In the roaming case, this Recommendation assumes that a roaming agreement has already been made between a home NGN provider and a visited NGN provider. The issues on authentication and authorization for roaming are outside the scope of this Recommendation.

The reference points for LM operations in the roaming case (L_{UA}, L_{AC}, L_{UC}) are shown in Figure 6-3.

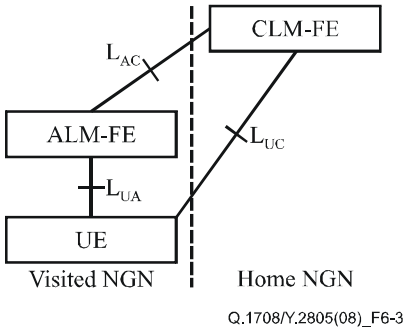

Figure 6-3 – Reference points for LM in the roaming case

In the roaming case, the LM scenarios can be classified as follows:

- Host-based LM with visited ALM-FE
- Host-based LM without visited ALM-FE
- Network-based LM

In the case of host-based LM using the visited ALM-FE, the two reference points used are: L_{UA} between roaming UE and visited ALM-FE, and L_{AC} between visited ALM-FE and home CLM-FE.

In the case of host-based LM without visited ALM-FE, the reference point L_{UC} between roaming UE and home CLM-FE is used.

In the case of network-based LM, the reference point L_{AC} between visited ALM-FE and home CLM-FE is used.

7 Information flows for non-roaming UE

An MUE or ALM-FE starts the initial LBU procedure when it is initially attached to its home network. There are two architectures for describing the procedure, as follows.

- Host-based location management

  An MUE starts performing the initial LBU procedure by exchanging LID binding update (LBU) messages with CLM-FE directly or via ALM-FE.

- Network-based location management

  The ALM-FE that detects an MUE's attachment starts performing the initial LBU procedure by exchanging LBU messages with the CLM-FE in the home network.

Note that this initial LBU procedure may be omitted depending on where the MUE is initially attached in the host-based location management. For example, when the MUE's PLID such as the HoA in MIP is topologically correct in respect to its access network, the MUE does not need to proceed with the initial LBU procedure. The initial LBU procedure also needs a data path setup procedure which may require HCF functions. The data path setup procedure is the same as in the handover case, which is described in [ITU-T Q.1709] in detail. Therefore, this Recommendation focuses on the location management procedure itself.

7.1 Host-based LM

When an MUE is attached to an access network, the MUE performs the initial LBU procedure in the host-based location management architecture. As shown in Figure 7-1, the host-based location management in the non-roaming case is using the interaction among MUE, ALM-FE and CLM-FE in a home network. After a successful LBU procedure, the relevant LMF entity will maintain the mapping between PLID and TLID.

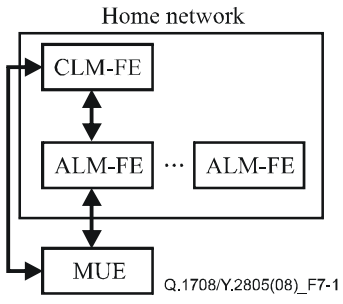

Figure 7-1 – Host-based LBU architecture in the non-roaming case

Figures 7-2 and 7-3 show the information flow for the initial host-based LBU procedure in the non-roaming case. The MUE attached to its home network initially starts the initial LBU procedure with the CLM-FE by exchanging LBU messages directly or via an ALM-FE. Figures 7-2 and 7-3 are the LBU procedures with and without ALM-FE involvement, respectively. If an ALM-FE is involved, the ALM-FE may act as a proxy for the CLM-FE. When the CLM-FE receives the initial LBU_Request message, it will respond with an LBU_Response message to the MUE directly or via

the ALM-FE. The LBU_Response message may indicate whether the registration is successful or not. The reasons for failure of the registration may be various, which may include the overload condition of the CLM-FE or administration policies. In case of registration failure, the CLM-FE may respond with additional information such as redirection indication and a new CLM-FE information for the redirection, which makes the MUE re-initiate the LBU procedure with the new CLM-FE. If the LBU_Response message is received with only redirection indication and without a new CLM-FE information, the MUE may try another candidate CLM-FE from the list of candidate CLM-FEs that the MUE maintains.

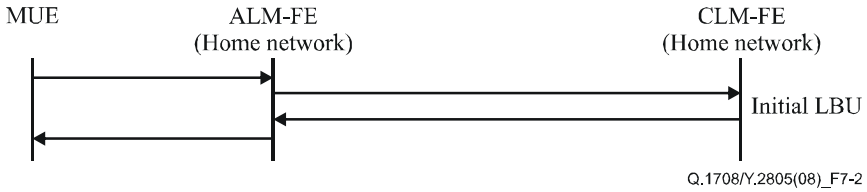

Figure 7-2 – Host-based initial LBU procedure with ALM-FE in the non-roaming case

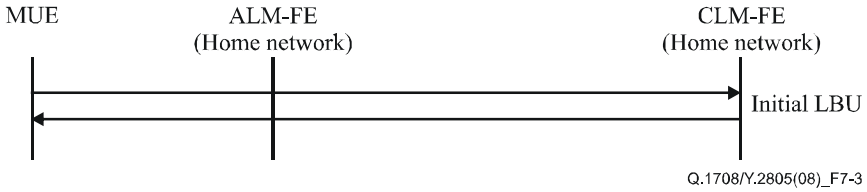

Figure 7-3 – Host-based initial LBU procedure without ALM-FE in the non-roaming case

If the MUE has multiple interfaces such as Wi-Fi, HSDPA, WiMAX, etc., and multiple TLIDs are allocated to each interface, it may perform multiple LBU procedures with the CLM-FE, and then the LID binding operation might bind multiple TLIDs to a PLID. In addition, if multiple PLIDs are allocated to the MUE, it may perform multiple LBU procedures with multiple CLM-FEs for each PLID.

7.2 Network-based LM

When an MUE is attached to an access network, the ALM-FE that detects the MUE's attachment performs the initial LBU procedure in the network-based LM. As shown in Figure 7-4, the network-based location management in the non-roaming case is based on the interaction between ALM-FE and CLM-FE. After a successful LBU procedure, the relevant LM-FE will maintain the mapping information between TLID and PLID.

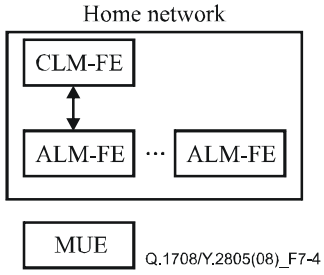

Figure 7-4 – Network-based LBU architecture in the non-roaming case

Figure 7-5 shows the information flow for the initial network-based LBU procedure in the non-roaming case. An ALM-FE that detects an MUE's initial attachment starts the initial LBU procedure with CLM-FE by exchanging LBU messages. When the CLM-FE receives the initial LBU_Request message from the ALM-FE, it will respond with an LBU_Response message to the ALM-FE. The LBU_Response message indicates whether the registration is successful or not. The reasons for failure may be various, which include the overload condition of the CLM-FE and administration policies. In case of registration failure, the CLM-FE may respond with additional information such as redirection indication and new CLM-FE information for the redirection, which makes the ALM-FE re-initiate the LBU procedure with the new CLM-FE. If the LBU_Response message is received with only redirection indication and without new CLM-FE information, the ALM-FE may try another candidate CLM-FE from the list of candidate CLM-FEs that the ALM-FE maintains.

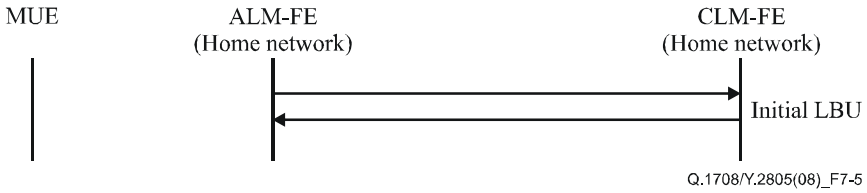

Figure 7-5 – Network-based initial LBU procedure in the non-roaming case

If the MUE has multiple interfaces such as Wi-Fi, HSDPA, WiMAX, etc., and each interface is attached to different ALM-FEs, each ALM-FE may perform its own LBU procedure with the same CLM-FE, and then the LID binding operation may bind multiple TLIDs to a PLID. On the other hand, if multiple PLIDs are allocated to the MUE, it may perform multiple LBU procedures with the respective CLM-FEs for each PLID or multiple LBU procedures with the same CLM-FE to create multiple mappings of TLID and PLID in the CLM-FE.

8 Information flows for roaming UE

When an MUE roams to a visited network, there are two possible scenarios from the IP address allocation point of view. First, a new IP address may be allocated, regardless of which IP address was allocated to the MUE in its home network. That is, a new PLID can be allocated to the MUE in the visited network. On the other hand, the PLID will be maintained as the same one, and only a new TLID is allocated to the MUE. This Recommendation focuses only in the case where the PLID is maintained and a new TLID is allocated, when an MUE is attached to a visited network.

An MUE or ALM-FE starts the initial LBU procedure when it attaches to a visited network. As in the non-roaming case, there are two architectures to perform the procedure:

- Host-based location management

  An MUE starts performing the initial LBU procedure by exchanging LBU messages with the home CLM-FE directly or via the visited ALM-FE.

- Network-based location management

  The visited ALM-FE that detects an MUE's attachment starts performing the initial LBU procedure by exchanging the LBU messages with the home CLM-FE in the MUE's home network.

Differently from the non-roaming case, the initial LBU procedure cannot be omitted for host-based location management in the roaming case since the MUE's PLID will never be topologically correct in respect to its access network, in the roaming case. As mentioned in the roaming case, the data path setup procedure is described in detail in [ITU-T Q.1709].

8.1 Host-based LM

When an MUE is attached to an access network in a visited NGN, the MUE performs the initial LBU procedure, in the host-based location management architecture. As shown in Figure 8-1, the host-based location management is using the interaction among MUE, visited ALM-FE and home CLM-FE. After a successful LBU procedure, the relevant LMF entity will maintain the mapping between PLID and TLID.

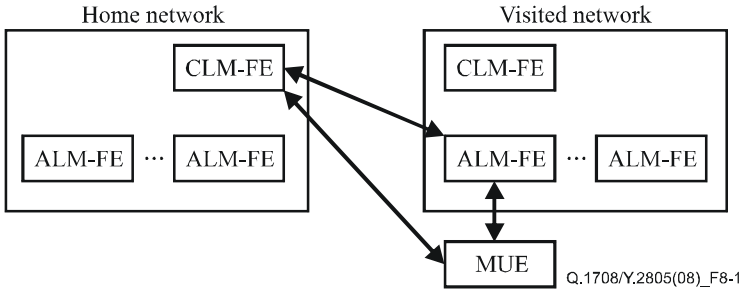

Figure 8-1 – Host-based LBU architecture in the roaming case

Figures 8-2 and 8-3 show the information flow for the initial host-based LBU procedure, in the roaming case. The MUE that is attached initially to a visited network starts the initial LBU procedure with its home CLM-FE, by exchanging LBU messages directly or via a visited ALM-FE. Figures 8-2 and 8-3 describe the LBU procedures with and without the visited ALM-FE involvement, respectively. If a visited ALM-FE is involved, the ALM-FE may act as a proxy for the home CLM-FE. When the home CLM-FE receives the initial LBU_Request message, it will respond with an LBU_Response message to the MUE directly or via a visited ALM-FE. The LBU_Response message may indicate whether the registration is successful or not. The failure reasons for the registration may be diverse, and may range from an overload condition of the CLM-FE to administration policies. In case of registration failure, the CLM-FE may respond with additional information such as redirection indication and new CLM-FE information for the redirection, which makes the MUE re-initiate the LBU procedure with the new CLM-FE. If the LBU_Response message is received with only redirection indication and without new CLM-FE information, the MUE may try another candidate CLM-FE from the list of candidate CLM-FEs that the MUE maintains.

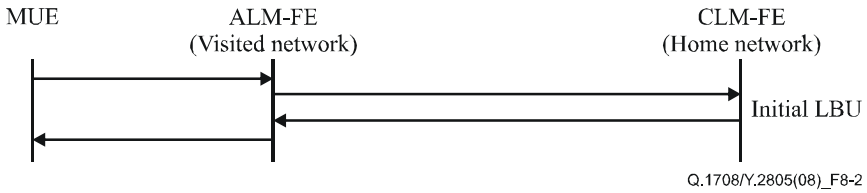

Figure 8-2 – Host-based LBU procedure with visited ALM-FE in the roaming case

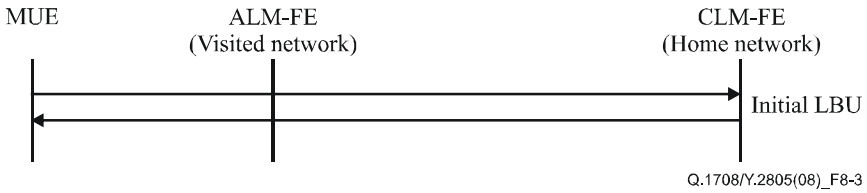

Figure 8-3 – Host-based LBU procedure without visited ALM-FE in the roaming case

As in the non-roaming case, the LID binding operation may bind multiple TLIDs to a PLID for MUEs with multiple interfaces such as Wi-Fi, HSDPA, WiMAX, etc., and an MUE may perform multiple LBU procedures with multiple CLM-FEs for each PLID, or multiple LBU procedures with the same CLM-FE, to create multiple bindings of TLID and PLID in the CLM-FE.

8.2 Network-based LM

When an MUE is attached to an access network in a visited NGN, the visited ALM-FE that detects the MUE's attachment performs the initial LBU procedure in the network-based location management architecture.

As shown in Figure 8-4, the network-based location management is based on interaction between visited ALM-FEs and the home CLM-FE. After a successful LBU procedure, the relevant LM-FE will maintain the mapping between PLID and TLID.

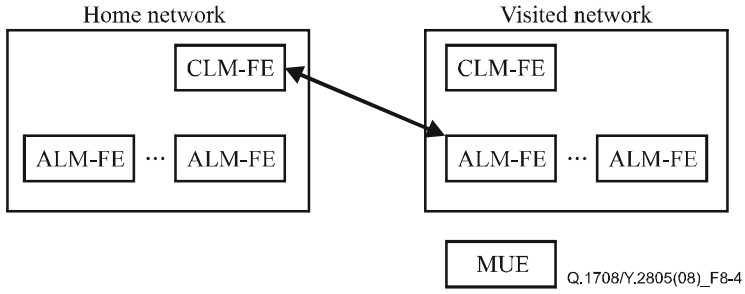

Figure 8-4 – Network-based LBU architecture in the roaming case

Figure 8-5 shows the information flow for the initial network-based LBU procedure in the roaming case. A visited ALM-FE that detects an MUE's initial attachment starts the initial LBU procedure with the MUE's home CLM-FE by exchanging LBU messages. When the home CLM-FE receives the initial LBU_Request message from the visited ALM-FE, it will respond with an LBU_Response message to the visited ALM-FE. The LBU_Response message may indicate whether the registration is successful or not. The failure reasons for the registration may be diverse, and ranged from an overload condition of the CLM-FE to administration policies. In case of registration failure, the CLM-FE may respond with additional information such as redirection indication and new CLM-FE information for the redirection, which makes the ALM-FE re-initiate the LBU procedure with the new CLM-FE. If the LBU_Response message is received with only redirection indication and without new CLM-FE information, the ALM-FE may try another candidate CLM-FE from the CLM-FE list that the ALM-FE maintains.

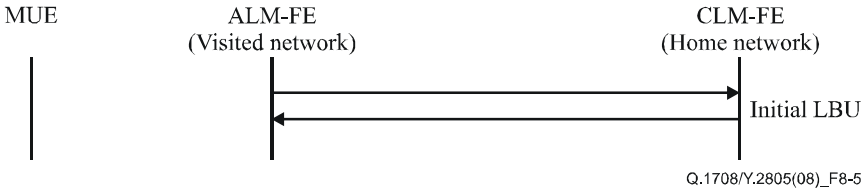

Figure 8-5 – Network-based initial LBU procedure in the roaming case

As in the non-roaming case, the LID binding operation may bind multiple TLIDs to a PLID for MUEs with multiple interfaces such as Wi-Fi, HSDPA, WiMAX, etc., and the ALM-FEs may also perform LBU procedures with multiple CLM-FEs for each PLID or multiple LBU procedures with the same CLM-FE to create multiple mappings of TLID and PLID in the CLM-FE.

Bibliography

[b-ITU-T Q.1701] Recommendation ITU-T Q.1701 (1999), *Framework for IMT-2000 networks.*

[b-ITU-T Q.1702] Recommendation ITU-T Q.1702 (2002), *Long-term vision of network aspects for systems beyond IMT-2000.*

[b-ITU-T Q.1711] Recommendation ITU-T Q.1711 (1999), *Network functional model for IMT-2000.*

[b-ITU-T Q.1721] Recommendation ITU-T Q.1721 (2000), *Information flows for IMT-2000 capability set 1.*

[b-ITU-T Q.1741.3] Recommendation ITU-T Q.1741.3 (2003), *IMT-2000 references to release 5 of GSM evolved UMTS core network.*

[b-ITU-T Q.1742.3] Recommendation ITU-T Q.1742.3 (2004), *IMT-2000 references (approved as of 30 June 2003) to ANSI-41 evolved core network with cdma2000 access network.*

[b-ITU-T Q.1761] Recommendation ITU-T Q.1761 (2004), *Principles and requirements for convergence of fixed and existing IMT-2000 systems.*

[b-ITU-T Q.Sup52] Supplement 52 to ITU-T Q-series Recommendations (2004), *NNI mobility management requirements for systems beyond IMT-2000.*

[b-ITU-R M.687-2] Recommendation ITU-R M.687-2 (1997), *International Mobile Telecommunications-2000 (IMT-2000).*

[b-ITU-R M.1034-1] Recommendation ITU-R M.1034-1 (1997), *Requirements for the radio interface(s) for International Mobile Telecommunications-2000 (IMT-2000).*

[b-ITU-R M.1168] Recommendation ITU-R M.1168 (1995), *Framework of International Mobile Telecommunications-2000 (IMT-2000).*

[b-ITU-R M.1224] Recommendation ITU-R M.1224 (1997), *Vocabulary of terms for Mobile Telecommunications-2000 (IMT-2000).*

[b-IETF RFC 3344] IETF RFC 3344 (2002), *IP mobility support for IPv4.* <http://www.ietf.org/rfc/rfc3344.txt?number=3344>.

[b-IETF RFC 3775] IETF RFC 3775 (2004), *Mobility support in IPv6.* <http://www.ietf.org/rfc/rfc3775.txt?number=3775>

[b-IETF RFC 4830] IETF RFC 4830 (2007), *Problem Statement for Network-based Localized Mobility Management (NETLMM).* <http://www.ietf.org/rfc/rfc4830.txt?number=4830>

[b-IETF RFC 4831] IETF RFC 4831 (2007), *Goals for Network-based Localized Mobility Management (NETLMM).* <http://www.ietf.org/rfc/rfc4831.txt?number=4831>

[b-IETF RFC 5213] IETF RFC 5213 (2008), *Proxy Mobile IPv6* <http://www.ietf.org/rfc/rfc5213.txt?number=5213>

ITU-T Y-SERIES RECOMMENDATIONS

GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

GLOBAL INFORMATION INFRASTRUCTURE	
General	Y.100–Y.199
Services, applications and middleware	Y.200–Y.299
Network aspects	Y.300–Y.399
Interfaces and protocols	Y.400–Y.499
Numbering, addressing and naming	Y.500–Y.599
Operation, administration and maintenance	Y.600–Y.699
Security	Y.700–Y.799
Performances	Y.800–Y.899
INTERNET PROTOCOL ASPECTS	
General	Y.1000–Y.1099
Services and applications	Y.1100–Y.1199
Architecture, access, network capabilities and resource management	Y.1200–Y.1299
Transport	Y.1300–Y.1399
Interworking	Y.1400–Y.1499
Quality of service and network performance	Y.1500–Y.1599
Signalling	Y.1600–Y.1699
Operation, administration and maintenance	Y.1700–Y.1799
Charging	Y.1800–Y.1899
NEXT GENERATION NETWORKS	
Frameworks and functional architecture models	Y.2000–Y.2099
Quality of Service and performance	Y.2100–Y.2199
Service aspects: Service capabilities and service architecture	Y.2200–Y.2249
Service aspects: Interoperability of services and networks in NGN	Y.2250–Y.2299
Numbering, naming and addressing	Y.2300–Y.2399
Network management	Y.2400–Y.2499
Network control architectures and protocols	Y.2500–Y.2599
Security	Y.2700–Y.2799
Generalized mobility	**Y.2800–Y.2899**

For further details, please refer to the list of ITU-T Recommendations.

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	Telecommunication management, including TMN and network maintenance
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	**Switching and signalling**
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks, open system communications and security
Series Y	**Global information infrastructure, Internet protocol aspects and next-generation networks**
Series Z	Languages and general software aspects for telecommunication systems

Printed in Switzerland
Geneva, 2009