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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

Generic framework of mobility management for next generation networks

Recommendation ITU-T Q.1707/Y.2804

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Recommendation ITU-T Q.1707/Y.2804

Generic framework of mobility management for next generation networks

Summary

Recommendation ITU-T Q.1707/Y.2804 describes a generic framework of mobility management for next generation networks. This Recommendation describes the design considerations, conceptual framework, functional architecture, and high-level information flows for mobility management in the NGN.

Source

Recommendation ITU-T Q.1707/Y.2804 was approved on 29 February 2008 by ITU-T Study Group 19 (2005-2008) under Recommendation ITU-T A.8 procedure.

Keywords

Framework, handover control, location management, mobility management, NGN.

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Introduction

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

This Recommendation is a part of the MM framework for NGN. The MM framework is designed with a couple of Recommendations, rather than a single Recommendation, as a suite of the framework of MM for NGN. This is because the design of the MM framework includes a variety of technical issues to be addressed. Furthermore, those design issues are associated with a wide variety of mobility scenarios and protocols. In this respect, the MM framework for NGN is described with a family of the following Recommendations:

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

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Recommendation ITU-T Q.1707/Y.2804

Generic framework of mobility management for next generation networks

1 Scope

The purpose of this Recommendation is to describe a generic framework of mobility management (MM) for next generation networks (NGNs), which will include:

- Design issues common to both location management and handover control;
- Functional architecture for mobility management in the NGN perspective;
- High-level information flows for mobility management.

It is noted that there are a variety of mobility types such as terminal mobility, network mobility, services mobility, etc. This Recommendation focuses on the terminal mobility in the IP or higher layer among those MM types. MM schemes associated with a specific link-layer or lower-layer technology might be applied to the functions described in this Recommendation. However, the access-technology specific details are outside the scope of this Recommendation.

This Recommendation describes a two-level architecture for MM functionality. For a scalability enhancement of MM in the NGN, the functional architecture can be extended to the architecture with more than two levels. This Recommendation also describes a high-level relationship between the MM control functions and the other functions defined in the NGN-FRA Release 1 so as to provide a guideline for further work on adding MM control functions to the NGN-FRA architecture.

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.1708] Recommendation ITU-T Q.1708/Y.2805 (2008), *Framework of location management for NGN*.

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

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

[ITU-T Y.2091] Recommendation ITU-T Y.2091 (2008), *Terms and definitions for Next Generation Networks*.

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3 Definitions

This Recommendation uses the definitions and terms that have been described in [ITU-T Q.1706].

In addition, this Recommendation uses the following terms:

3.1 access network: A network that is characterized by a specific wired/wireless access technology. Refer also to [b-ITU-T Q.1742.2].

3.2 core network: An architectural term related to the part of an NGN network, which is independent of a specific-access technology. Refer also to [b-ITU-T Q.1741.2].

3.3 host-based mobility management: A mobility management scheme in which the MM signalling is performed based on (or controlled by) the user equipment (UE).

3.4 network-based mobility management: A mobility management scheme in which the MM signalling is performed (or controlled) by the network entities, on behalf of the UE.

3.5 home network: The network (or service provider) to which a user has subscribed. The user's subscription information is managed in the home network. Refer also to [ITU-T Q.1706].

3.6 visited network: The network (or service provider) outside the home network. Refer also to [ITU-T Q.1706].

3.7 user identifier: 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].

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

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

AAA	Authentication, Authorization, and Accounting
A-HCF	Access HCF
A-LMF	Access LMF
A-MMCF	Access MMCF
AN	Access Network
AP	Access Point
AR	Access Router
BS	Base Station
BWA	Broadband Wireless Access
CDMA	Code Division Multiple Access
C-HCF	Central HCF
C-LMF	Central LMF
C-MMCF	Central MMCF
CN	Core Network
DHCP	Dynamic Host Configuration Protocol
FA	Foreign Agent
FE	Functional Entity

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HA	Home Agent
HC	Handover Control
HCF	Handover Control Function
ID	Identifier
IPSec	IP Security Protocol
IMS	IP Multimedia Subsystem
IP	Internet Protocol
L2	Layer 2
LID	Location Identifier
LM	Location Management
LMA	Localized Mobility Agent
LMF	Location Management Function
LTE	Long Term Evolution
MAG	Mobile Access Gateway
MIH	Media Independent Handover
MIP	Mobile IP
MM	Mobility Management
MMCF	Mobility Management Control Function
NAI	Network Access Identifier
NACF	Network Attachment Control Function
NGN	Next Generation Network
NGN-FRA	Functional Requirements and Architecture for NGN
PMIP	Proxy MIP
PoA	Point of Attachment
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RADIUS	Remote Authentication Dial-In User Services
SIP	Session Initiation Protocol
SSID	Service Set ID
UE	User Equipment
UID	User Identifier
URI	Uniform Resource Identifier
VoIP	Voice over Internet Protocol
W-CDMA	Wideband-Code Division Multiple Access
WLAN	Wireless Local Area Network
WPAN	Wireless Personal Area Network

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5 Design considerations

5.1 Network environments

The network environments in NGN can be illustrated as in Figure 5-1. As shown in the figure, the MM framework will be designed to support the mobility for NGN users across a wide variety of heterogeneous access networks.

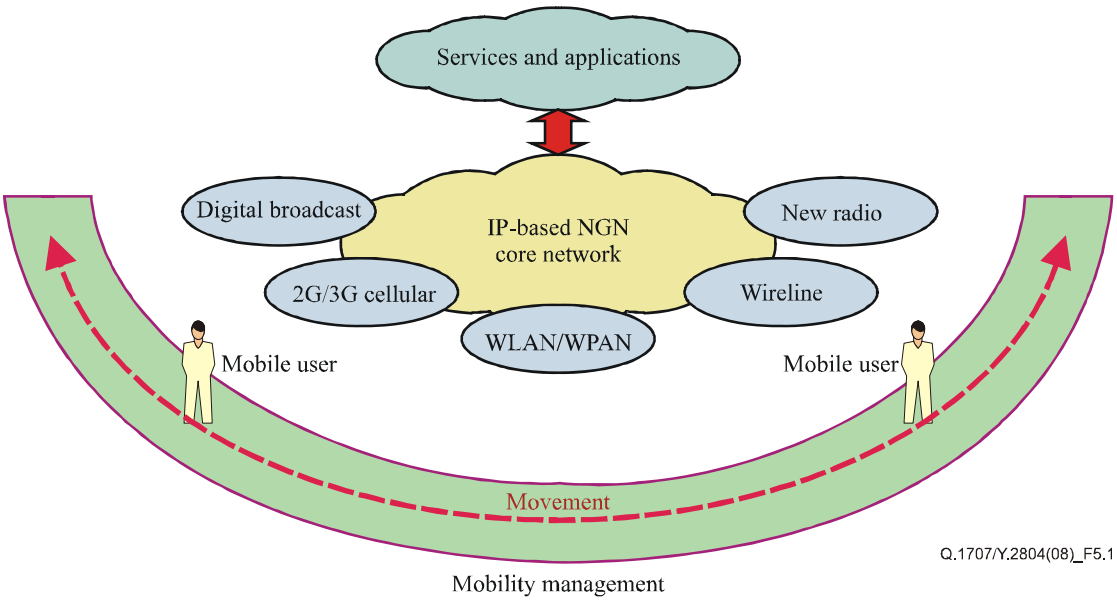

Figure 5-1 – NGN environments

From the NGN point of view, the MM framework will be designed to provide a set of the signalling and control operations for MM. Those signalling and control operations will be performed among a variety of MM-related functional entities. In NGN, an operator may implement those MM-related functions in the core network (CN) and a variety of its access networks (ANs). With the help of the appropriate signalling operations for MM, an NGN user could benefit from the continuation of the services in the seamless manner, while it moves around the various access networks in NGN.

5.2 Design principles

In this Recommendation, the MM framework will be designed with the following principles.

5.2.1 IP-based MM framework

One of the major requirements for MM in NGN is that the MM schemes can operate over the 'IP-based' networks, so as to support the mobility across a variety of heterogeneous access networks in NGN. The IP-based framework will ensure that the MM functionality could be commonly applied to the various networks or systems, independently of the underlying link-layer access technologies. The 'IP-based' MM framework will also facilitate that a variety of the well-defined existing IP-based protocols, such as AAA and DHCP, could be reused to support the MM.

5.2.2 Separation of MM control function from transport function

It is noted that MM functionality can be viewed as the transport control function, rather than the transport function. MM control function will be designed as a self-contained scheme, not depending on the specific data transport scheme. This feature will make it easier to implement and deploy the MM control functions to a variety of transport networks in NGN.

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5.2.3 Location management and handover control functions

The MM framework is designed to provide the location management (LM) functionality. For this purpose, the latest information of the location of a mobile user will be registered and updated, each time it continues to move around in the network. The MM framework is also designed to provide the handover control (HC) functionality. With the help of this HC function, a mobile UE can seamlessly continue the data communication during the session, even though it changes the associated IP address in the network.

5.2.4 Separation of user ID and location ID

In the MM framework, user ID (a.k.a., identifier) is separated from location ID (a.k.a., locator). An NGN user has its own unique user IDs (UIDs) that may be associated with the user's subscription or services. The NGN user may have one or more location IDs (LIDs), depending on the specific MM scheme. A typical example of LID is an IP address. It is noted that a user ID is statically assigned to an NGN user by the services provider on the subscription basis. On the other hand, a location ID is dynamically assigned to the UE in the network, and it may change in time.

5.2.5 Cross-layer interaction for optimized MM

To optimize the MM functionality, a cross-layer interaction may be required between different protocol layers. This cross-layer optimization will be taken to enhance the MM operations such as movement detection, network discovery, network selection, and proactive handover signalling. In particular, the MM between heterogeneous ANs may require an open interface for cross-layer interaction. For example, the open interface can be used for an IP-layer MM function to utilize the underlying link-layer services/functions for a wide variety of access technologies.

5.2.6 Harmonization of different MM protocols

It is expected that the MM control functionality such as LM and HC will be realized with a set of MM protocols, rather than a single MM protocol. In this respect, it is required to effectively harmonize different MM protocols so as to optimize the overall MM functionality.

5.2.7 Interworking with other protocols

The MM functionality could be accomplished with the help of protocols for authentication, security, call/session establishment, and so on. Accordingly, the MM framework is designed to ensure that the MM functions could effectively interwork with the relevant protocols to the extent possible. For example, a user should be able to be authenticated via the AAA protocols, such as RADIUS or Diameter, without any modification of those protocols. For security purposes, the MM signalling may be protected with the help of protocols such as IPSec. For call/session establishment and maintenance, the SIP protocol might be used by MM functions.

5.2.8 Support of network-based MM

The MM framework needs to consider the network-based MM as well as the host-based MM. A host-based MM may not require any MM functionality in AN, if MM control functionality is located in CN. On the other hand, a network-based MM can minimize the functional overhead of UE such as the amount of MM signalling. A network-based MM can also support the legacy UE that does not have any MM capability.

5.2.9 Policy-based MM

A policy-based MM can be considered to enhance or optimize the MM functionality. For example, the handover decision might be made as per the pre-configured user/operator policies which may be possibly contained in the user profile or policy server.

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