Comparison of Handover schemes for Next Generation Networks

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Abstract— **For seamless overhaul, mobility should be bear in the ngn. For this, there have been many contributions, such as mipv6, ip2, q.mmf, and ims. In mobility region, handover latency time is the first stricture to consider. However, above all are not evaluating up to now. Therefore this paper presents the performance comparison of handover latency period. For this, we use ns-2 simulator. In simulation results, we showed that ip2 has minimum value as compared with other mechanisms about the handover latency time**

Index Terms— NGN, Mobility, Mobile IP, IP2, Q.MMF, IMS.

I. INTRODUCTION

Next-generation network is international issue and is studied by ITU-T, 3GPP, IETF, and so on. Specially, FG-NGN (Focus Group on Next Generation Network) in ITU-T is now studying framework and mobility and etc for NGN.

As for the transport technology in the next generation mobile networks our shared vision is in ITU and all telecommunication networks are eventually going to shift packet based networks are eventually going to shift to packet-based network[1]. 3GPP members also discussed network evolution from IMT-2000 to all IP networks under the name of IP Multimedia Sub-system (IMS), which aims to provide IP-based real time multimedia services ([2], [3]).

For seamless service, mobility should be supported in the NGN. For this, there have been many contributions such as Mobile IPv6 (MIPv6) [4]. IP-based IMT Network platform (IP2) [5], QMMF[8], IP Multimedia Subsystem(IMS)[2], MIPv6[4] has been also standardized recently and it has been improved from MIP and supports IPv6. Although MIP and MIPv6 achieve MN's IP mobility, they are terminal –based mobility protocols that follow the fundamental rule of the Internet, the so-called End-to-End principle. Therefore, a number of issues such as handover performance degradation due to the IP address configuration by the MN have been raised [3].

The IP-bases IMT Network platform (IP2) has been proposed as the architecture for the next generation mobile communication network beyond IMT-2000, and its per standardization studies started in 2001. However, the IP2 should be able to support a great variety of devices, from a high performance PC or PDA to less sophisticated RF-tags and sensors, provide advanced and highly efficient mobility management, and accommodate multiple radio access systems provide seamless and ubiquitous services and address mobile carrier's requirements [7]. QMMF that recommended from ITU-T SG19 is to identify the generic framework and model for mobility management for system beyond IMT-2000 (SBI2K). QMMF has been developed based on QTRMMR (technical report on Mobility Management Requirements) where MM requirements for SBI2K have been identified and the respective assessments of the existing candidate MM protocols have been made [8].

The IP Multimedia Subsystem (IMS) is the standard network architecture for all IP networks. It assumes calls arrive as SIP INVITE requests, and requires SIP-enabled handsets. That is, the signaling is handled by the SIP. In addition, the IMs uses existing MIP mechanism for supporting mobility, which means that the IMS may have more problems than MIP in mobility support [9].

In mobility area, handover latency time is the first parameter to consider. However, above all are not compared up to now. Therefore this paper presents the performance comparison of handover latency times. For this, we use NS-2 simulator. The rest of this paper is divided in to five sections. After an introduction we sketch the operations of the mechanisms briefly in section 2 look in to simulation environments and models in section 3 and represent results of simulation using NS-2. Finally, we conclude the paper with compared performance of these mechanisms in Section-5.

II. II. EXISTING MOBILITY SCHEMES

2.1 Mobile IPv6 (MIPv6)

With the huge (128 bits long) address space of MIPv6 a tiny part is reserved for all current MIPv4 addresses. Another tiny part is reserved for link-local addresses, which are not routable but are guaranteed to be unique on a link. Design of MIPv6 is adjusted to account for the few special needs of MNs that can perform decapsulation.
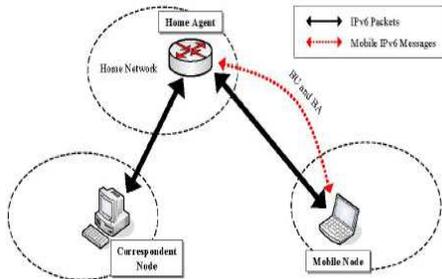
Figure 1. MIPv6 Mobility Management Architecture

A set of new destination options, called binding update and binding acknowledgement, manage the cache entries of CNs. MNs must be able to send binding updates and receive binding acknowledgements. Based on the life time field in the binding updates it sends, every MN must keep track of which other MNs may need to receive a new binding as a result of any recent movement by the MN.
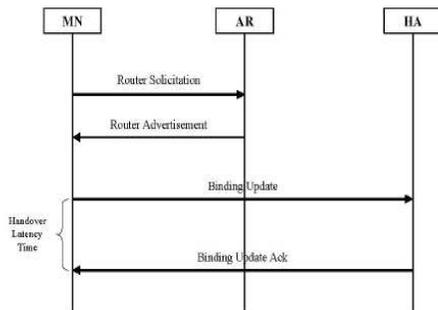

Figure 2. Binding Update of MIPv6

In MIPv6, the Home Address (HoA), which is assigned by the home network, is used in the upper layers above Transport to identify the terminal, where the care-of Address (CoA), which the MN configures at the currently connected network, is used for actual packet transportation in the Network layer. Controlling these two different IP addresses and concealing IP address changes from its application, MN provides IP mobility by itself. MIPv6 introduces Home Agent (HA) in the home network, and the mapping of the HoA and the CoA, which is called Binding Cache, is managed by the HA as location information. Sending Binding Update periodically and when the MN moves to another network, the MN update its location information maintained in HA.

HA also has the function to forward a packet designated to the HoA of the MN, which is currently away from home, to its CoA by referring to the Binding Cache. In this case, packet transmission between the MN and the correspondent node (CN) is performed through the tunnel between MN and HA that is called bi-directional tunneling. In MIPv6, the route

optimization function is also provide by MN informing its CoA to the CN after handling the Return Rout ability procedure [3].

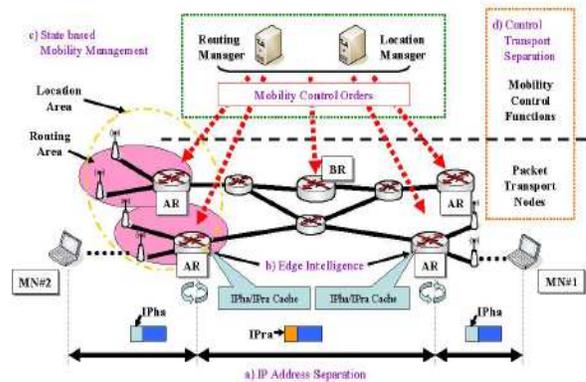## 2.2 IP based IMT Network platform (IP2)

Figure 3. IP2 Mobility Management Architecture

As shown in Figure3, IP2MM transports a packet using the IPha between the MN and the AR, whereas the AR translates the IPha with the corresponding IPra and the routers in the network transport the packet by the IPra. Therefore, the sending and receiving ARs are both required to maintain the information of the MN's IPha/IPra mapping. This information consists of two different caches , one is the cache for source terminal (CST) that is the IPha/IPra of the source MN, and the other is the Cache for destination Terminal(CDT) that is the IPha/IPra of the destination MN. These caches are maintained only for Active MNs. To transit the MN's sttes IP2MM uses two procedures: Activation and Deactivation. The other two procedures are defined afor the Dormant MN: one is paging that forces the MN to transit to the Active state, the other is location Registration that is used when the MN registers its location [3].
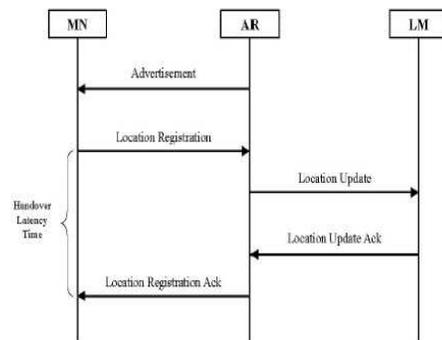

Figure 4. Location Registration of IP2

Figure 4 illustrates the location Registration procedure in IP2MM. when the Dormant MN detects a change in its location, MN sends Location Registration to AR. Upon

receivingit, the AR sends the location update to LM, and LM updates the entry of MN in the Location cache table. Then LM sends a Location update Ack to AR, and the AR sends a location Registration Ack to the MN. In this way, the Location Registeration procedure is completed [3].
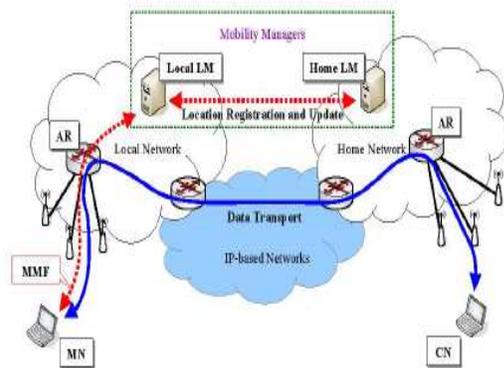
2.3 QMMF

Figure 5. QMMF Mobility Management Architecture

As shown in Figure5 the control plane of MM shall be separated from the data transport plane for data packet transfer. Especially, the MM will operate in the control plane using any control scheme or protocol. Specifically, the MMF will govern the control operations for the Location Management and Handover Management, whereas the data transport may be performed with its own data routing principles (eg. By a standard IP routing schemes).

The MMF can be basically viewed as a set of the control operations for MM, which is performed between the mobile terminals and mobility managers. The mobility managers are logical and functional entities that will be deployed in the networks of the SBI2K. Depending on the specific deployment, the mobility managers may be implemented with one or more sub-entities. In this Recommendation, the Mobility Managers is classified in to the Location Manager (LM) and Hand over Manager (HM). The LM is used to support the location registration and location update (tracking), etc, in the control plane. Each mobile terminal should register its current location (IP address) with the local and /or home LM, each time it moves into a new region and thus changes its IP address. Each LM will keep and maintain a table of mapping between user ID and Location ID (IP address) for the respective MTs. With the help of the LM, a (external/internal) caller could send the data packets to the callee MT. When a caller wants to send a data packet to the MT, it will first contact with the LM so as to obtain the current location of the MT. In this query process, a user ID (such as SIP URI, E.164 number and Home IP address) could be used to identify the calee MT. In response to the location query, the LM will inform the caller about the current location of the calee MT.

After the application session had been established, the caller will send data packets in the session by using the standard IP routing protocols. When the data transport goes on in the session if the MT changes its location ID (IP address), the HM will be used to support the seamless and fast handover for the active session of the MT. The handover management (and HM) is purposed to minimize the data loss and handover delay while the IP handover is performed.
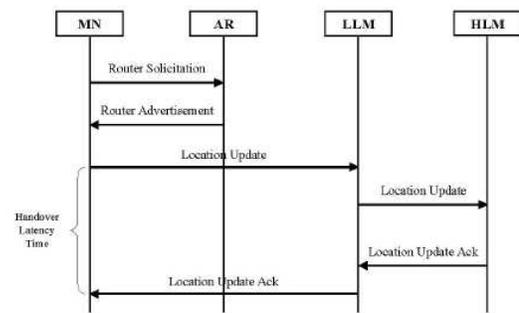

Figure 6. Location Registration of QMMF

Figure 6 illustrates the location registration procedure for the MT. In the figure, after an MT changes its subnet and when it gets and IP address, the MT registers it's current IP address and its user ID with the local LM by sending the location Update (LU) message. Based on the LU message received from the MT, the local LM will add a new entry of the mapping table that contains relationships between User ID and Location ID for the MT.

The local LM will the forward the LU message to the corresponding home LM. If the LU message does not indicate the location of the home LM, the associated information may be configured in the local LM in the system-wise manner, which may depend on the implementation. When the home LM receives the LU message from the local LM, it will add or update the associated entry in the mapping table for the MT. On the successful update of the mapping table, the home LM will respond with the Location Update Acknowledgement (LU-ACK) message to the local LM. In turn, the local LM will respond to the MT with the LU-ACK message. By implementation depending on the specific LM scheme, some additional information may be added to the LU and LU-ACK message for security and authentication.

2.4 IMS

The IMS is the standard network architecture for all-IP networks. It assumes calls arrive as SIP INVITE requests, and requires SIP-enabled mobile terminal. Our migration plan bridges the gap between a purely circuit switched and a fully IMS complaint UMTS network. Here we briefly summarize the migration step form the SIP-enabled backbone architecture we have described so far to the IMS network architecture [9].
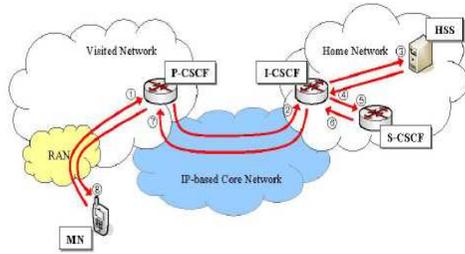
Figure 7. IMS Mobility Management Architecture

In essence, an IMS network works as follows. When a user register with the IMS, their user data is downloaded from the home subscriber server (HSS) to a serving call state control function (S-CSCF) that controls all outgoing and incoming calls of this user. All incoming calls first arrive at an interrogating CSCF (I-CSCF). The ICSCF first queries the HSS for the addressed user's current   S-CSCF and then forwards the SIP INVITE request to it. The S-CSCF executes the users application services and then passes the INVITE request to the SIP enabled mobile. The SIP-enabled mobile network architecture we proposes as the last step before handsets become SIP-enabled on the other hand, consists of SIP-enabled GMSCs (for PSTN originated calls), the UMM acting as SIP proxy and registrar, and IP-enabled SMSC.

As soon as SIP enabled devices are used, SIP enabled SMSCs will be replaced by S-CSCFs, and the UMM will act as a combined ICSCF and HSS. The latter change does not require major modification of the UMM, as the external SIP interface remains the same. What will need to be added to the UMM is a diameter-based interface to make the HSS user data accessible   for   the   S-CSCFs. Consequently, the main change for this final migration step is the replacement of the IP enabled SMSCs by S-CSCFs. This replacement is due to the protocol change in the last hop of the call path. The IP-enabled GMSCs, however, will still be used as ingress points to the all-IP mobile network for PSTN originated calls [9].
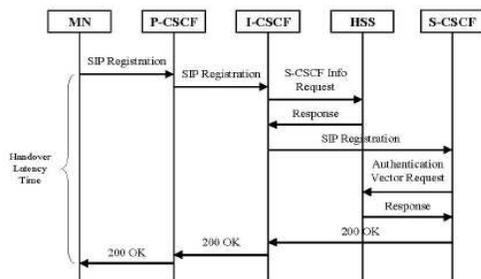
The performance evaluation is done with NS-2 simulator [12]. We consider a system consisting of 1 mobile node and 8 wired nodes. 2 access routers are indicated by wired nodes. The mobile node moves between access routers. The bandwidth of the channel is 2Mbps, and the link is 5Mbps. We use the NS-2 simulation components to set up network, such as channel model, propagation model, network interfaces [13]. In addition, for simple comparison of handover latency time, it is assumed that the routing algorithm is not considered, which means that the number hops for registration or something like that for handover signaling is the same for each scheme. However, as the difference of each mechanism, although the topology of network is the same, the position of each component like LM in IP2, HA in MIPv6 and so on comes to be different, as shown in figure 9
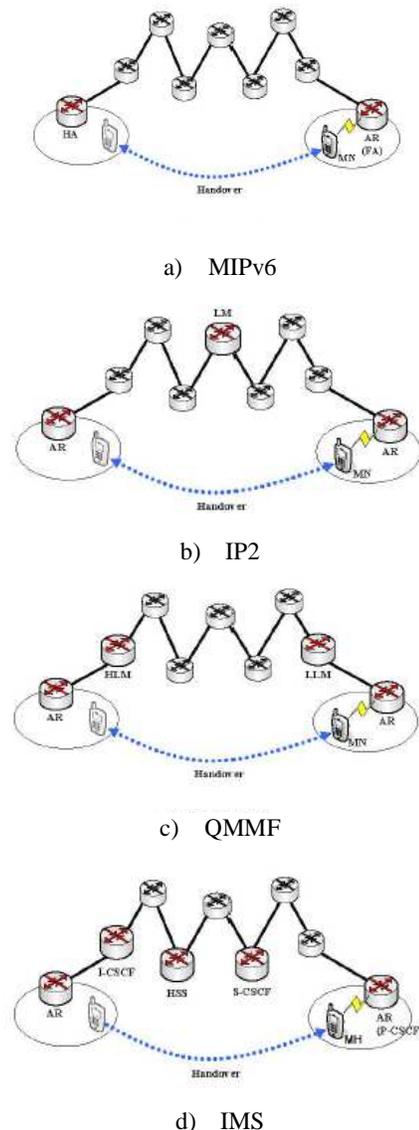

a)   MIPv6

b)   IP2

c)   QMMF

d)   IMS

Figure 9. Simulation models

Figure 8. Location Registration of IMS

III. SIMULATION ENVIRONMENTS AND MODELS

IV. SIMULATION RESULTS

Table.1 Handover Latency Time (HLT)

Mobile Technologies	Hand over Latency Time
MIPv6	38ms
IP2	21ms
QMMF	34ms
IMS	51ms

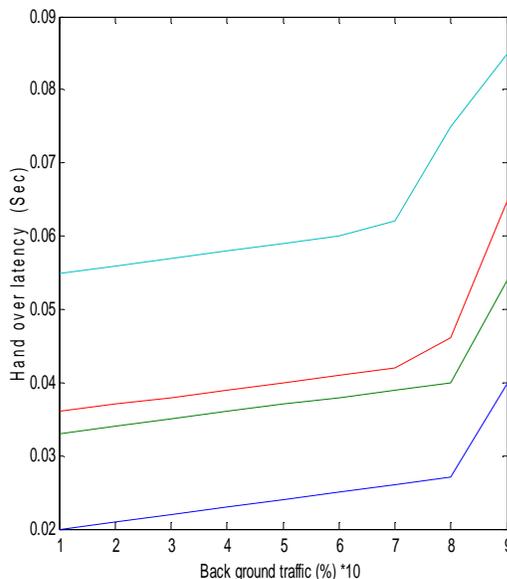Table1is simulation result by NS-2 without background traffic. The table 1 shows that the IP2 has the minimum value.

Figure10.HLTCurveinaccordancewiththebackgroundtraffic

Figure 10 shows the hand over latency time by increase of background traffic. IP2 has also minimum value as compared with other mechanisms.

V. Conclusion and Further Study

Next-generation mobile network is international issue and it is studied by ITU-T, 3GPP and so on. Mobility technologies that have developed focusing the NGN and Mobile IPv6, IP-based IMT network platform (IP2), IP Multimedia Sub-system (IMS), QMMF. Up to now, performance analysis or comparison of these mobility technologies does not exist.

This paper sketches the operation of the mechanisms briefly in section 2, look in to simulation environments and models in section 3. Finally this paper compares location Registration of several IP-based mobility mechanisms (MIPv6, IP2, IMS, QMMF) using NS-2 simulator. The figure 10 shows that IP2 has minimum value as compared with othe mechanisms. It shows that IP2 is a relatively better architecture about location registration.

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BIOGRAPHIES:

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