Hybrid CIP/M&M for micro-mobility management under the multilayer wireless network

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Abstract-- We reference the EVOLUTE [1] (Information Society Technologies, IST project) that mingles Session Initiation Protocol (SIP) with Mobile IP (MIP) to support macro-mobility management and provide seamless multimedia services for roaming users. In the part of micro-mobility, we utilize Multicast-based mobility (M&M) to assist with Cellular IP (CIP) infrastructure. They cooperate not only provide fast handoff and deal with various kinds of handoff, but also suit the macro-mobility management (proposed by Evolutes) to support real time and non-real time data flows.

Keywords：micro-mobility management、integration of heterogeneous wireless network、hierarchical mobility management

1 Introduction

For carry out the transition to the wireless communication network the era of instant video-information, we must be on the basis of inherent technology and economic benefits. So, what we must consider has three points at least:

1. Mobile communication systems need to support terminal mobility, but also session, service and personal mobility. Further this mobility must be available over heterogeneous networks such as UMTS, WLAN even fixed networks.
2. Integration of simple yet efficient authentication, authorization, and accounting (AAA) mechanisms with the service architecture. Such integration providers will necessary, and it controls services types and make bills for the users.
3. The system need to create flexible and powerful service architectures. Next generation networks need higher bandwidth rates and wider range of services. Such a variety of services can only be realized by using distributed and simple to use and enhance service creation paradigms.
4. Mobile users need a good mobility management to achieve the objective that any people could connects to Internet to do anything in anyplace by any way at any time. In other words, mobility management architecture needs to provide mobile users seamless roaming which is not only efficient but also scalability and robustness.

IST had developed a project that is EVOLUTE to achieve the first three items of above-mentioned accepts. But, the fourth aspect a is lack for explicit discussion in EVOLUTE. EVOLUTE project had proposed the idea that chooses CIP [2] to support micro-mobility management in their mobile communication network. We revise the above-mentioned architecture in the micro-mobility management to deal with the challenge giving by the future mobile network.

In this paper, we propose an approach which to utilize M&M to associate with CIP infrastructure to support micro-mobility management. The micro-mobility management of our proposal can match up with the macro-mobility management in hybrid

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SIP/MIP in EVOLUTE and offer satisfactory multimedia service (real-time and non-real time) with seamless roaming for mobile users.

The reminder of the paper is structured as follow: in the section 2, we will introduce some related technologies, including section 2.1: Hybrid SIP/MIP approach for macro-mobility management in EVOLUTE and section 2.3: Multicast-based Mobility (M&M). Section 3 the operation tactics in hybrid CIP and M&M micro-mobility. And final section is our conclusions.

2 Background Or Related Technologies

2.1 Hybrid SIP/MIP approach for macro-mobility management in EVOLUTE

EVOLUTE proposed the inter-domain mobility by is based on the synergy of SIP with MIP. Traffic from/towards a MH is separated on the domain edge routers; SIP signaling is used to support inter-domain mobility for real-time traffics (RTP over UDP), and MIP supports non-real-time traffics, as shown in Fig. 1

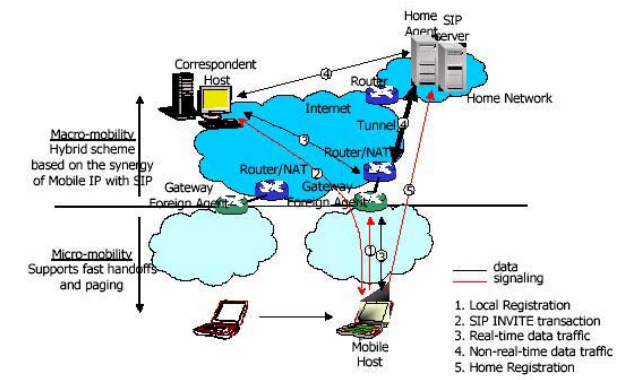

Fig.1: Hybrid SIP/MIP approach for macro-mobility management in EVOLUTE

Although MIP and SIP could work complementary as above-mentioned to support inter-domain mobility (mobility across administrative domains), they are both unsuitable for handling intra-domain mobility (micro-mobility). With the advent of WLAN and IP-based cellular networks, high mobility within a single domain or Intranet is becoming common. Therefore, a solution is needed to allow mobile users to move between wireless access points and base stations without informing the distant HA or redirect server for every movement, while keeping connections, performing handoffs and allowing idle movement. Currently researched about micro-mobility management protocols, include Hierarchical MIP and several improvements to Hierarchical MIP (Fast Handoff, Proactive Handoff and TeleMIP), HAWAII, CIP and Cellular IPv6 (CIPv6) , Edge Mobility Architecture (EMA), etc. Furthermore, in this paper we reference a novel architecture for efficient micro-mobility management: Multicast-based Mobility (M&M) [3].

2.2 Multicast-based Mobility (M&M)

The M&M mechanism proposes a paradigm for multicast-based micro mobility, where a visiting mobile is assigned a multicast address while moving within a domain. The multicast address is obtained using algorithmic mapping, and handover is achieved using multicast join/prune mechanisms. However, it is assigned only within a domain and is used for micro mobility. While moving between domains, an inter-domain mobility protocol is invoked.

When a MN connects to a domain, it is assigned a unicast care of address that is unique within the domain, called regional care of address (RCoA) in M&M system. It is also be assigned a multicast care of address (MCoA). The RCoA is a globally routable address which is used to route packets (destined to the MH) between the Internet and the domain which is the position where MN location. The MCoA is used for routing packets within the domain which the position where the MN location.

Figure 2 shows that a MN moves into a new domain it is assigned RCoA in the domain and it performs inter-domain handover;

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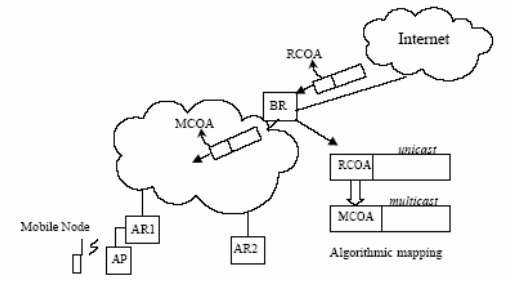

Fig.2: M&M Algorithm Mapping architecture

Furthermore, the adjacency can be established based on the adjacency of the radio coverage area of the serving AR (SAR) in M&M mechanism, it is similar to the case in cellular wireless network. The serving AR is called the Head of the Candidate Access Router Set (CAR-set). Thus, there is a unique CAR-set defined for every AR. For example, AR1 to AR7 constitute a CAR-set for AR1 show as Figure 3, which is the SAR for the mobile. The CAR-set members join the multicast group by MCoA to receive the packets destined to the MN. Hence, the mobile can move to any router in the CAR-set without interrupt_ tion in the packet

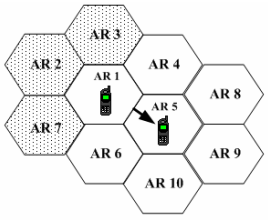

Fig. 3 CAR-set model in M&M

The memberships of CAR-set are dependent upon a number of factors, such as the handover types and the prediction accuracy, and so on. The membership is determined by the CAR-set prediction algorithm. For example, if handover can predict new AR to pass the algorithm of performing, the CAR-set contains only one member that is the new AR.

One major contribution of M&M is the introduction of a handover framework, using the CAR-set protocols, that may be tuned to perform efficient proactive, reactive and gap handoffs especially. M&M is very obvious to surpass CIP and HAWAII because of the CAR-set path setup capability.

3 The hybrid CIP/M&M micro-mobility management

CIP and M&M coexist and cooperate to support MN's mobility in a domain in our proposed micro-mobility management architecture. On the whole, the radio communication infrastructure is supported by CIP. The CIP plays the role of normal micro-mobility management method and be responsible for packets route that normal application, e.g. telecommunication and non-real time connection. In addition, the function of M&M is employed to route special packets like video conference. Figure 4 diagrams the CIP and M&M how to work if the packets incoming the domain including two types which is real-time and non-real time at the same time.

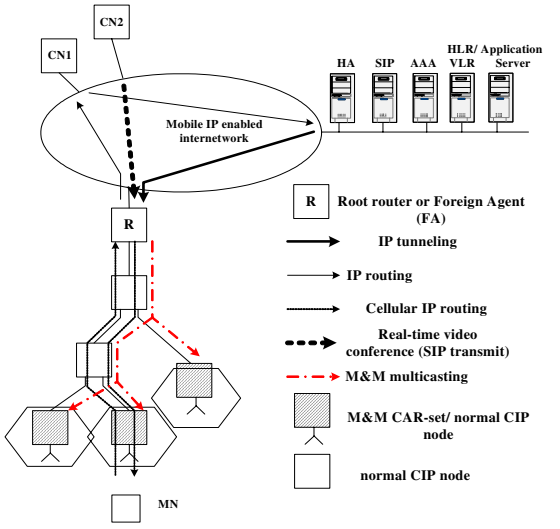

Fig.4 **O**verview of CIP/M&M cooperation policy

In Figure 4, there are two Correspond Node (CN1 and CN2) communicate with MN simultaneously. CN1 communicates with MN in non-real time connected, and CN2 communicates with MN in real-time connected. Part in macro-mobility management, the real-time packet is routed by SIP, and the non-real time packet is routed by MIP. Part in micro-mobility management, the real-time packet is routed by M&M, and non-real time packet is routed by CIP.

The most important part is the client specific information in the table in BR. The function of the agreement information between the user and serving provider is used to distinguish the incoming packets which needs to route by M&M from route by CIP. The

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function of the table in Serving AR (and in the membership of CAR-set) is employed to transform the packet form of multicast to unicast, which the packet is destined to MN and routed by M&M. Besides, we should stress that M&M isn't working anytime in our proposed architecture. Figure 5 shows that how network to work if the MN starts a video conference which is needed routing by M&M. It shows the overhead causing by M&M which is controlled in a temporal.

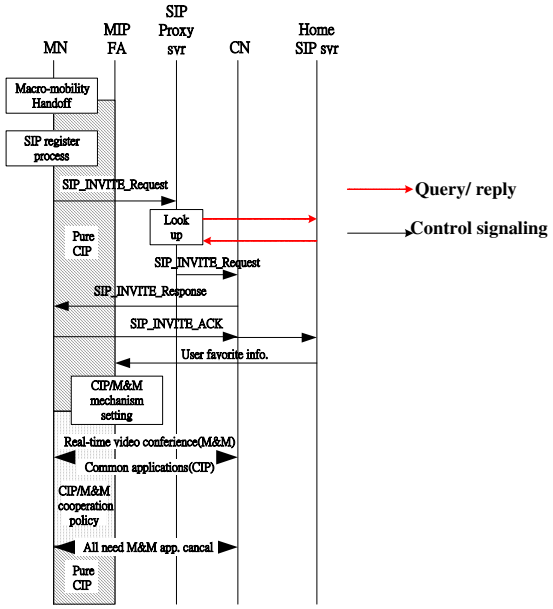

Fig. 5: CIP/M&M cooperation policy flow

In fact, CIP and M&M are two independent mobility management mechanisms to provide different communication quality for MN. Both CIP and M&M have their own independent transmission system. But, they would not affect each other when they are working in a domain simultaneously. With the terminal users view, they would not aware of the communication management changing whether the M&M initiating or terminating. M&M mechanism starts when user starts an application (e.g. video conference). Network requires the related information for starting M&M mechanism is sent by the BR (or the FA) automatically to look up the database in the SIP server and to build up the M&M mechanism for terminal user.

As a matter of fact, CIP and M&M will prepare handoff process individually if network could detect the handoff condition in advance. In order to simplify the description of handoff, we only discuss the situation of proactive handoff. The handoff mechanism is based on CIP (e.g. hard handoff or semi-soft handoff), and make M&M subsidiary for micro-mobility management in our thesis. M&M has to initiate the CAR-set predication algorithm which is triggered by special trigger to predict the members of CAR-set which is consisted by new Serving AR before producing new CAR-set. In fact, it is independent handoff no matter by CIP or by M&M for MN and would not affect each other.

4. Conclusion

There are many benefits in our proposed network architecture. But the most important contribution of this paper is that this architecture can properly to support mobility management for integrating heterogeneous network in the future. Because of the M&M scheme can not only work in cellular system but also in wireless LAN system. And M&M can combine with other micro-mobility management schemes easily. It can provide a flexible choice for the network provider to set up their own service circumstances but not to cause an obstacle to communicate with other network providers. In other words, it can provide a simple solution for remaining problem.

Reference

[1] Pierre Reinbold and Olivier Bonaventure (2003), "IP micro-mobility protocols". http://citeseer.nj.nec.com/566653.html

[2] T. Dagiuklas1, D. Gatzounas1, D. Theofilatos1, D. Sisalem2, S. Rupp3, R. Velentzas4, R. Tafazolli5, C. Politis5, S. Grilli6, V. Kollias3 and A. Marinidis7, "Seamless Multimedia Services Over All-IP Based Infrastructures: The EVOLUTE Approach", http://evolute.intranet.gr/evolute.pdf

[3] Ahmed Helmy, Muhammad Jaseemuddin and Ganesha Bhaskara, "Multicast-based Mobility: A Novel Architecture for Efficient Micro-Mobility", http://citeseer.nj.nec.com/597117.html

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