Performance Analysis of Robust Hierarchical Mobile Using MHMIP

S. M. Kumbar

Department of Computer Science & Engineering, SVERI's College of Engineering, Pandharpur

Faculty Members

Abstract:

In Datagram network, the parameters like time delay and bandwidth are crucial factors for various mobile data and wireless networking. The Mobile Internet Protocol (MIP) has been proposed to support global mobility in IP networks by standard IETF. An analytic model is adopted to propose for evaluating the mean signaling delay and the mean bandwidth per call according to the type of mobility MT(Mobile Terminal).Whenever their care of addresses (CoAs) changes in new MT's attached to Mobile Server(MS),it registers with an agent representing it at its home agents(HA). An analytic model is adapted to propose for evaluating the mean signaling delay and the mean bandwidth per call according to the type of MT mobility. In this analysis, the Multicast Hierarchical MIP outperforms the Dynamic Hierarchical MIP (DHMIP) and MIP strategies in almost all the studied cases. The main contribution of this paper is the analytic model that allows the Mobility management performance evaluation and comparison between implementations based on MIP, DHMIP and MHMIP protocols, to yield for high mobility.

INTRODUCTION:

IP multimedia applications are becoming popular in the packet-based wireless networks. The integration of these applications in wireless networks requires the support of seamless terminal mobility. Mobile IP (MIP) has been proposed by the Internet Engineering Task Force (IETF) to provide global mobility in IP networks[1]. It allows maintaining mobile terminals ongoing communications while moving through IP network[1,2]. In the MIP protocol, Mobile Terminal (MT) registers with its home network from which it gets a permanent address (home address). This address is stored in the Home Agent (HA). It is used for identification and routing purpose. If MT moves outside the home network visiting a foreign network, it maintains its home address and obtains a new one from the Foreign Agent (FA). This Foreign address is called Care-of-Address (CoA). To allow continuity of ongoing communications between the MT and a remote end point, the MT shall inform the HA of its current location when it moves outside the home network. The HA delivers to MT the intercepted packets by tunneling them to the MT's current point of attachment. IP mobility in wireless networks can be classified into macro- and micro-mobility. The macro- mobility is the MT mobility through different administration domains. The micro-mobility is the MT movements through different subnets belonging to a single network domain. For micro-mobility where the MT movement is frequent, the MIP concept is not suitable and needs to be improved. Indeed, the processing overhead related to location update could be high specifically under high number of MTs and when MTs are distant from the HAs yielding to high-mobility signaling delay[4]. Hierarchical Mobile IP (HMIP) has been proposed to reduce the number of location updates to HA and the signaling latency when an MT moves from one subnet to another. In this mobility scheme, FAs and Gateway FAs (GFAs) are organized into a hierarchy. When an MT changes FA within the same regional network, it updates its CoA by performing a regional registration to the GFA. When an MT moves to another regional network, it performs a home registration with its HA using a publicly routable address of GFA. The packets intercepted by the HA are tunneled to a new GFA to which the MT is belonging. The GFA checks its visitor list and forwards the packets to the FA of the MT. This regional registration is sensitive to the GFAs failure because of the centralized system architecture. Moreover, a high traffic load on GFAs and frequent mobility between regional networks degrade the mobility scheme performance. In order to reduce the signaling load for interregional networks, mobility dynamic location management approaches for MIP have been proposed: A Hierarchical Distributed Dynamic Mobile IP (HDDMIP), Dynamic Hierarchical Mobile IP (DHMIP) and Multicast Hierarchical Mobile IP(MHMIP).

MOBILE IP AND DYNAMIC MOBILE IP

When an MT moves from one subnet to another subnet it reduces the signaling so that bandwidth per call and delay per call would be high during mobility from FA to GFA.

Once FA fails it affects to GFA as well as mobile server of the system. This regional registration is sensitive to the GFAs failure because of the centralized system architecture [7, 8]. Moreover, a high traffic load on GFAs and frequent mobility between regional networks degrade the mobility scheme performance [4].

In wireless networks, efficient management of mobility is a crucial issue to support mobile users. The Mobile Internet Protocol (MIP) has been proposed to support global mobility in IP networks. Several mobility management strategies have been proposed which aim reducing the signaling traffic related to the Mobile Terminals (MTs) registration with the Home Agents (HAs) whenever their Care-of-Addresses (CoAs) change. They use different Foreign Agents (FAs) and Gateway FAs (GFAs) hierarchies to concentrate the registration processes. For high-mobility MTs, the Hierarchical MIP (HMIP) and Dynamic HMIP (DHMIP) strategies localize the registration in FAs and GFAs, yielding to high-mobility signaling. The Multicast HMIP strategy limits the registration processes in the GFAs. For high-mobility MTs, it provides lowest mobility signaling delay compared to the HMIP and DHMIP approaches. However, it is resource consuming strategy unless for frequent MT mobility. Hence, we propose an analytic model to evaluate the mean signaling delay and the mean bandwidth per call according to the type of MT mobility. In our analysis, the MHMIP outperforms the DHMIP and MIP strategies in almost all the studied cases. The main contribution of this project is the analytic model that allows the mobility management approaches performance evaluation.

MULTICAST HIERARCHICAL MOBILE INTERNET PROTOCOL

- MIP Analytic Model:

The MIP mobility approach is based only on the path reestablishment protocol. This latest allows maintaining the call connectivity when the MT moves between FAs. In this case, events that may occur at each time i= 1,2,3,.. are 1) path reestablishment and 2) call termination.

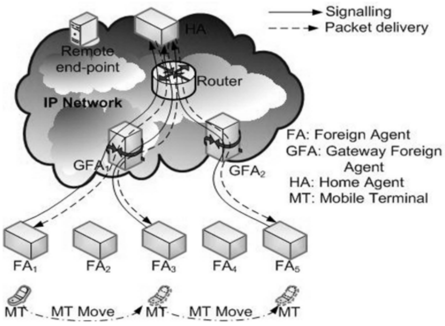


Figure 1. Architecture of MIP.

DHMIP Analytic Model:

The DHMIP mobility approach combines the path reestablishment and the connection extension protocols. The path reestablishment protocol is invoked to set up a new FAs hierarchy. This protocol allows a path establishment between the HA and a new FA in the new hierarchy. In this latest, the path extension is used to maintain the mobile connection when mobile moves through the FAs to this hierarchy. The path reestablishment may occur after each new FAs hierarchy setup. Events that may occur at each time i=1,2,3 . . . are 1) path reestablishment, 2) path extension, and 3) call termination.

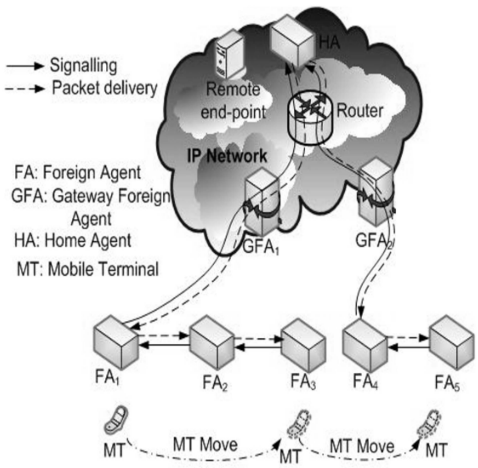
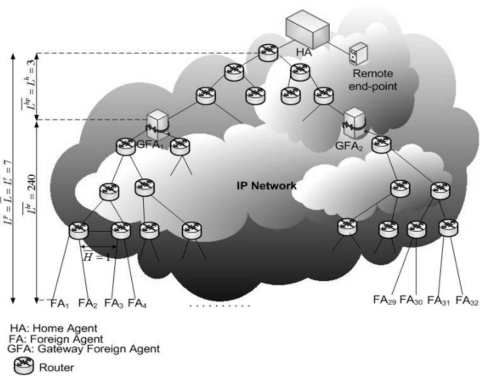


Figure 2. Architecture of DHMIP

MHMIP Analytic Model:

The MHMIP mobility approach is based on the path reestablishment and the multicast protocols. When the MT moves within a GFA group, the mobile connection is maintained using the multicast protocol. When the MT moves outside this hierarchy, a combination of the path reestablishment and the multicast protocols allows maintaining the call's connection. Events that may occur at each time i=1, 2.... are 1) path reestablishment and 2) call termination.



Modules:

- Mobile Terminal

In the MIP protocol, Mobile Terminal (MT) registers with its home network from which it gets a permanent address (home address). This address is stored in the Home Agent (HA). It is used for identification and routing purpose. If MT moves outside the home network visiting a foreign network, it maintains its home address and obtains a new one from the Foreign Agent (FA). This Foreign address is called Care-of-Address (CoA).

B. ***Foreign Agent***

In the HDDMIP approach, each FA can act either as an FA or GFA according to the user mobility. The traffic load in a regional network is distributed among the FAs. The number of FAs attached to a GFA is adjusted for each MT. Thus, the regional network boundary varies for each MT. This number is computed according to the MT mobility characteristics and the incoming packet arrival rate. This number is adjustable from time to time according to the variation of the mobility and the packet arrival rate for each MT.

- Gateway Foreign agents:

We propose to build hierarchical multicast groups. In each group, FAs are connected to each other through a GFA. A set of GFAs are connected to an HA. When an MT moves through FAs belonging to the same group, the GFA of this group multicasts the received packet (coming from the HA) to the MT.

- Mobile Server:

In this module we collect the information given by mobile terminal through foreign agents and gate way foreign agents, and here we calculate the bandwidth and which protocol is used and between MIP, DHIMP, MHIMP.

Mobile server includes MIP, DHMIP and MHMIP modules code; from mobile server we can calculate the comparison of mobility performance analysis.

• EXPERIMENTAL RESULTS:

By comparing of MIP, DHMIP & MHMIP protocols we come to conclusion on the basis of comparison between above three protocols. Finally we concluded that MHMIP protocol has been robust and good performance for mobility comparison.

Table 1 Mobile Performance and Comparisons.

	MIP	DHMIP	MHMIP
Bandwidth(kbps/sec)	14.62	9.26	2.68
Time Delay(ms)	63319.77	99917.44	34574.6
File Size(kbps)	21.27	21.27	21.27

CONCLUSION:

In this project, we have proposed an analytical model which evaluates the mean handoff delay per call and the mean bandwidth per call of three mobility management approaches: MIP, DHMIP, and MHMIP.

Numerical results show that the MHMIP mobility approach compares very favorably with the previously considered mobility approaches. More specifically, our analysis gives in almost all cases a lower mean handoff delay per call and a mean bandwidth per call than those offered by the DHMIP and MIP approaches. It also shows the robustness of the MHMIP approach in the sense that for critical scenario corresponding to the extreme situation where all handoff events are localized at the multicast group borders, this approach essentially yields to

1) A lower mean bandwidth per call than MIP and DHMIP
2) A lower mean handoff delay per call than that offered by the MIP approach;
3) A lower mean handoff delay than that offered by the DHMIP except in case of frequent inter-GFAs handoffs with a network configuration having a high number of links involved in the mobile internet protocol networks feasibility of strong signaling of lower bandwidth and and timing delay will be done by MHMIP approach.

REFERENCES:

[1] C.E. Perkins, “IP Mobility Support for IPv4,” IETF RFC 3344, Aug.2002.
[2] D. Johnson, C. Perkins, and J. Arkko, “Mobility Support in IPv6,” IETF RFC 3775, June 2004.
[3] R. Caceres and V.N. Padmanabhan, “Fast and Scalable Handoffs for Wireless Internetworks,” Proc. ACM MobiCom, pp. 56-66, 1996.

[4] C. Castelluccia, "Extending Mobile IP with Adaptative Individual Paging: A Performance Analysis," Proc. Fifth IEEE Symp.Computers and Comm., pp. 113-118, July 2000.

[5] H. Soliman, C. Castelluccia, K. El-Malki, and L. Bellier, "Hierarchical Mobile IPv6 Mobility Management HMIPv6," IETF RFC 4140, Aug. 2005.

[6] E. Fogelstroem, A. Jonsson, and C. Perkins, "Mobile IPv4 Regional Registration," IETF RFC 4857, June 2007.

[7] H. Omar, T. Saadawi, and M. Lee, "Supporting Reduced Location Management Overhead and Fault Tolerance in Mobile IP Systems," Proc. IEEE Symp. Computers and Comm., pp. 347-353, 1999.

[8] S. Pack, T. You, and Y. Choi, "Performance Analysis of Robust Hierarchical Mobile IPv6 for Fault-Tolerance Mobile Services," IEICE Trans. Comm., vol. E87-B, no. 5, pp. 1158-1165, May 2004.

[9] J. Xie and I.F. Akyildiz, "A Novel Distributed Dynamic Location Management Scheme for Minimizing Signaling Costs in Mobile IP," IEEE Trans. Mobile Computing, vol. 1, no. 3, pp. 163-175, July 2002.

[10] M. Song, J. Huang, R. Feng, and J. Song, "A Distributed Dynamic Mobility Management Strategy for Mobile IP Networks," Proc. Sixth Int'l Conf. ITS Telecomm., 2006.

[11] L. Yu, W. Yu-Mei, and Z. Hui-Min, "Modeling and Analyzing the Cost of Hierarchical Mobile IP," Proc. Int'l Conf. Wireless Comm., Networking and Mobile Computing, vol. 2, pp. 1102-1105, Sept. 2005.

[12] 3GPP-TR-23.923, "Combined GSM and Mobile IP Mobility Handling in UMTS IP CN," technical report, May 2000.

[13] 3GPP-TR-25.913, "Requirements for Evolved UTRA (E-UTRA) and Evolved UTRAN (E-UTRAN)," technical report, Mar. 2006.

[14] 3GPP-TR-23.882, "3GPP System Architecture Evolution: Report on Technical Options and Conclusions (Release 8)," technical report, Sept. 2008.

[15] 3GPP-TR-33.922, "Security Aspects for Inter-Access Mobility between Non 3GPP and 3GPP Access Network (Release 8)," technical report, Sept. 2008.

[16] A. Acampora and M. Naghshineh, "An Architecture and Methodology for Mobile-Executed Handoff in Cellular ATM Networks," IEEE J. Selected Areas in Comm., vol. 12, no. 8, pp. 1365-1375, Oct. 1994.

[17] S. Seshan, "Low-Latency Handoffs for Cellular Data Networks," PhD dissertation, Univ. of California, Mar. 1996.

[18] R. Ghai and S. Singh, "An Architecture and Communication Protocol for Picocellular Networks," IEEE Personal Comm., vol. 1, no. 3, pp. 36-46, 1994.