이동 환경에서 효율적이고 신뢰적인 멀티캐스트 지원 방안

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The Improving Reliable Transport and The Efficient Multicast Support in Mobile environment

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Abstract

In this paper, we present a scheme for the improving reliable transport and the efficient multicast support in mobile environment. The proposed scheme solves a problem of TCP layer resulted from mobility by using a Representative FA. RFA has a mechanism like a snoop module which has a cache and can provide retransmission of a multicast packet lost and solve the ack implosion problem. Also, we present an additional IGMP message. By using it, We can remove a delay for IGMP query cycle and serve a multicast service more promptly.

1. Introduction

The recent advances in wireless communication technology and the unprecedented growth of the Internet have paved the way for wireless networking and IP mobility.

Although the mobile host moves to the other network, It is necessary to provide a continuous service of TCP layer without breaking off. The IETF Mobile IP[1] is intended to solve the general problem like this of host mobility in the Internet.

Mobile IP uses existing fixed network transport protocols such as UDP and TCP on the mobile hosts to communicate with the fixed network. This approach gives rise to TCP performance problems when the handoff happens. The TCP interprets delays and packet losses while handoff as signs of network congestion.

IP multicast is proposed for resource sharing and effective packet delivery. The existing multicast implicitly assumes that all hosts have link-layer connectivity. Therefore, there are many problems for support multicast in mobile environment.

The proposed scheme solves a problem of TCP layer resulted from mobility and provides a reliable and efficient transmission of multicast packet.

Also, The foreign agents are constituted hierarchically and Representative FA is responsible for not only a transmission of multicast packet in authoritative domain but a retransmission of multicast packet and duplicate ACK message. And We present an Additional IGMP message by which Mobile node can be served a multicast service more promptly.

The rest of the paper is organized as follows. Section 2 presents the previous works which is related of our work. Section 3 discusses some details of our scheme. Section 4 presents a conclusion and future works.

2. Previous works

The several reliable transport-layer protocols such as I-TCP, Fast Retransmission, Snoop[2][3][7] have been proposed to alleviate the problems of TCP layer resulted from mobility. But, these mechanisms did not include a consideration of multicast service. Also, The several algorithms such as MoM have been proposed to support multicast service in mobile environment. MoM based on bi-directional tunneling was proposed to solve the tunnel convergence problem. It uses the DMSP to avoid duplicate datagram being tunneled to the common FA. But there are many overheads resulted from DMSP management and It has not considerations of

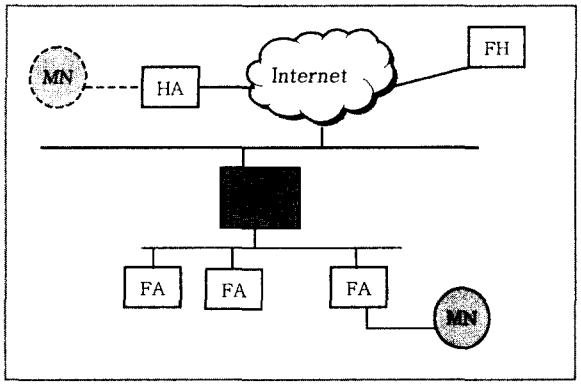
TCP layer' s problems. Besides, in [8] a protocol is proposed to use a new multicasting-based architecture to support Internet host mobility. Each mobile node is assigned a unique Class D address. This mechnism has an overhead resulted from an additional multicast address management and don' t have a consideration of a TCP Layer. Like this, there were little considerations of TCP layer' s facility and mutlciast service. So. In this paper, we intend to solve the problems of TCP layers and multicast service support together using a RFA.

3. The proposed scheme

3.1 Network architecture

transmitting and processing all the registration requests is through the remotely located HA may become inefficient due to the fact that the registration delay contributes to the time needed to complete the handoff process. So We constitute FA hierarchically[6] and RFA is responsible for the domain.

The assumed network architecture is shown in [figure 1]. And This paper handles only movements in the Domain. In the out of domain, we should use a normal IETF mobile IP.



[figure 1] network architecture

3.2 Solving Plan for problems of TCP layer

The TCP interpret delays and packet losses for handoff as signs of network congestion and then trigger the exponential backoff and congestion mechanisms. After all, TCP throttles its transmission, further degrading performance. To solve problem like this, We put a special mechanism such as Snoop module in RFA. RFA has a modified snoop module. The existing Snoop is that all the FA has a snoop module. Because the all FA has a cache, the overhead overhead exists. The proposed algorithm can remove overhead by putting snoop module in the only RFA. Basiclly, RFA has a cache. If RFA has the packet in its cach, It can retransmit the requested packet by using an ACK message without requesting sender. In this way, we can prevent the congestion mechanisms from being triggered and solved the problem of TCP layer. On retransmitting the packet, RFA creates the ACK message for the packet and then transmit to the sender to prevent sender from triggering a congestion mechanisms because of timer expiry. Also, RFA has a Module for ACK message. By using this module, RFA can process a duplicate ACK by transmitting only the first ACK and discarding the next same ACK. In this way, we can solve the ACK implosion problem.

3.3 Multicast supporting plan

The existing mobile IP proposes two approaches to provide a multicast service. remote subscription, bidirectional tunneling. In case of bidirectional tunneling, the mobile node always follows a sub-optimal routing path and FA may have a tunnel convergence problem. Therefore, we use a remote subscription approach. After movement to other network, MN should be served a multicast service from the new FA.

3.3.1 Packet loss for handoff

If the mobile node moves to the other foreign network in the same domain, the mobile node will lose not only a general packet but a multicast packet. After movement, mobile node can request a RFA to transmit the next packet by an ACK message. If RFA has the packet in its cache, It can retransmit the requested packet by using an ACK message without requesting sender. In this way, Mobile node can receive a multicast service reliably and continuously for handoff.

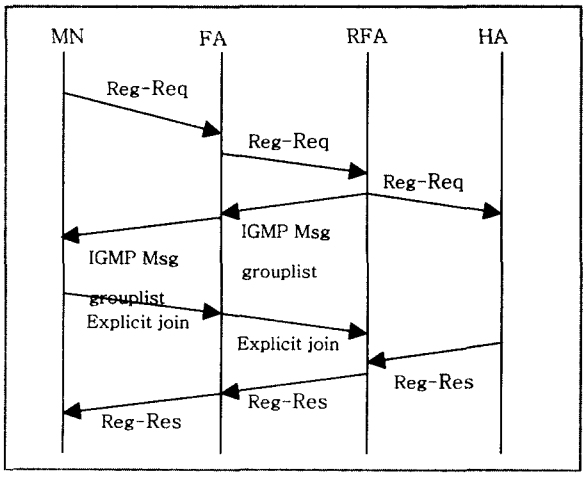
3.3.2 Additional IGMP message

In the Existing IGMPv2[7], when Mobile node moves to the other network, it must wait for IGMP query's cycles to receive a multicast service and send a report message. In this paper, the delay resulted from the existing mechanism like this can be solved by an additional IGMP message. On RFA's receiving a registration request message, it transmits an IGMP message which includes

Type	Max Resp Time	Checksum
Group address (1)		
Group address (2)		
Group address (3)		

[Figure 2] an additional IGMP message

multicast group list serving now to mobile node. the [figure 2] shows a format of IGMP message. In case of not exist a multicast group list which wants to be served, the mobile node can request a RFA to join the coincident multicast group by explicit join message. In case of existing, the mobile node can be served a multicast service without an additional message. If RFA joins to the multicast group, All the mobile node in the domain can be served a multicast service by RFA without an additional join. So After some time, there will be a few possibilities that mobile node will join a new multicast group.
The [figure 3] shows the flowchart from registration request of mobile node to registration response.



[figure 3] Flowchart of message

3.4 Considerations for implementation

According to a number of FA administered by RFA or the number of mobile node served by FA, RFA must have a cache of differentiated size. The cache size maintained by RFA is same with the number of packets which can be stored and retransmitted by RFA. Therefore, It is important that we assign the appropriate cache size according to a number of FA and mobile node. And Because the cycle of modified IGMP has a decisive power about time when mobile node receives a multicast packet. It must be selected prudently. If the cycle is too short in case of wireless environment, the IGMP message is considered as an overhead If the cycle is too long, the mobile node will have much delay time.

4. Conclusion and future work

The proposed scheme solves a problem of TCP layer resulted from mobility and provides a reliable and efficient transmission of multicast packet. The foreign agents are constituted hierarchically and Representative FA is responsible for not only a transmission of multicast packet in authoritative domain but a retransmission of multicast packet and duplicate ACK message. Also, we proposed a modified IGMP message that reduce join delay to a multicast group after handoff.
In this paper, the cache plays an important role. We plan to continue to studying about the most proper size of cache. We also plan to bring about a real outcome by embodying an algorithm of this paper through the real implementation.

Reference

[1] Charles E. Perkins, *IP Mobility Support*, RFC 2002, October 1996
[2] Ajay Bakre and B.R. Badrinath, *I-TCP: Indirect TCP for mobile hosts*, Tech. Report DCS-TR-314, Computer Science Department, Rutgers Univ., Piscataway, N.J., 1994
[3] Ramon Caceres and Venkata N. Padmanabhan, Fast and Scalable Handoffs for wireless internetworks, ACM Mobicom '96, November 1996
[4] Hari Balakrishnan, Srinivasan Seshan and Randy H. Katz, Improving Reliable Transport and Handoff performance in celluar wireless networks, Mobicom '95. November. 1995
[5] Tim G. Harrison, Carey L. Williamson, Wayne L. Mackrell, Richard B. Bunt, Mobile Multicast(MoM) Protocol: Multicast Support for Mobile Hosts, Mobicom '97, 1997
[6] Eva Gustafsson, Annika Jonsson, Charles E. perkins, Mobile IP Regional Registration, Internet draft, march 2001
[7] W. Fenner, *Internet Group Management Protocol, Version2*, November 1997
[8] Cheng Lin Tan, Stephen Pink, and Kin Mun Lye, A Fast Handoff Scheme for wireless networks, WoW-MoM '99, 1999