

ROUTE OPTIMIZATION BASED ON DYNAMIC MOBILE NODE SELECTION

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Abstract— Proxy Mobile IPv6 (PMIPv6) is a network-based mobility management protocol that supports network mobility and it allow the mobile by keeping same IP address within PMIPv6 domain. Route Optimization (RO) is a technique to minimize packet transmission delay between communicating routers. Basic PMIPv6 does not support the RO. Thus RO is supported by many schemes. The out-of-sequence problem occurs when the packet not arrives at order, which may happen between the existing path (i.e) basic PMIPv6 path and the newly established RO path. The out-of-sequence problem is solved by using the packet sequence number and the time when the packet occur and it reduce the packet transmission delay. In proposed scheme, the mobile node is selected dynamically based on the shortest path and it is link stability. The MAG_{MN} dynamically select the nearest Mobile Node based the position calculation. This feature is used to reduce the packet loss and transmission delay. It allows a mobile node (MN) to move around within the same PMIPv6 domain by keeping the same IP address.

Keywords— Proxy Mobile IPv6, Route Optimization, Out-of-sequence.

1. INTRODUCTION

Mobility based management protocol enables particular feature resource optimization in their networks and reduces energy consumption of an MN. A Mobile Access Gateway (MAG) and a Local Mobility Anchor (LMA) are in charge of the mobility of an MN in the PMIPv6 domain. However, basic PMIPv6 does not support Route Optimization (RO). If so, all packets are always transmitted via an LMA, and this increases the load of an LMA and increases packet transmission delay. Many schemes are proposed to support the RO to resolve this problem in PMIPv6. When the RO occurs in PMIPv6, the MN communicates with the Correspondent Node (CN) via the RO path between MAGs.

Proxy Mobile IPv6, a network-based localized mobility protocol that allows a mobile node (MN) to move around within the same PMIPv6 domain by keeping the same IP address. However, PMIPv6 does not support the global handover since it supports only an intra-domain handover. To support the global handover, MNs need to load the protocol stack for the global mobility.

The RO path is defined as a new path, and the basic PMIPv6 path as an old path. When the new path is established, the out-of-sequence problem occurs due to the difference the transmission time between the old path and the new path. This problem causes packet loss in User Datagram Protocol (UDP) and packet retransmission request messages in Transmission Control Protocol (TCP). The Out-of-sequence Time Period (OTP) scheme is proposed to resolve the problem. The OTP scheme is the solution to restrain the tunnel establishment when the new path is established. However, the scheme cannot provide reliable service to an MN, because it is hard to predict the restraint time of the tunnel establishment in the OTP scheme.

2. PREVIOUS WORK

The RO schemes for PMIPv6 have been proposed. The packets generated between an MN and a CN are transmitted via an LMA before the new path is created. After the RO, a tunnel is established between the MAGs that the MN and the CN are connected. However, tunnels exist in the old path and the new path. Some packets are transmitted using the old path and some packets are transmitted using the new path. Therefore, the out-of-sequence problem occurs. The OTP scheme was proposed to prevent this problem.

The OTP scheme prevents the problem by the tunnel restraint during the RO in PMIPv6, but it stores the packets at both MAG and LMA. In addition, it does not forward the packet during the RO. Therefore, the packet reception delay is longer than the PMIPv6 supported by RO. It predicts the tunnel restraint time to resolve the problem, but the approach to the prediction does not guarantee prevention of out-of-sequence packets precisely.

To provide reliable service for MN more accurately to prevents the out-of-sequence problem. By using the sequence number resolves the problem effectively, using the packet sequence number, and reducing the forwarding delay time using the value of Time To Live (TTL).

3. METHODOLOGY

3.1 Basic assumption

The basic PMIPv6 path established after the Mobile Node (MN) registered in binding cache entry of the Mobile Node

LMA. The PMIPv6 path exists between the MAG and LMA of the Mobile Node (MN) and this path is considered as old path. During RO occurs in PMIPv6, the MN communicates with Correspondent Node (CN) via the RO path between MAG's.

They use IP header's information to prevent the problem more effectively. The identification field, which is the number assigned from a router of the IP header, is a unique number used by devising or recombining a packet following the Maximum Transfer Unit (MTU). Accordingly, it is possible to know the packet sequence using the identification number in the communication between routers. MAGs and LMAs know the packet sequence via the identification number in the IP header.

Therefore, this determines the out-of-sequence packets that arrive at the MAG by the identification number in the IP header. TTL value in the IP header is used to calculate the transmission time of the old path and the new path. This scheme counts the number of routers through the old path and the new path from the TTL value. The TTL value in the tunnel header decreases when the packet passes through the tunnel, since the packet is encapsulated. The packet is decapsulated after passing through the tunnel. Then, the TTL value in IP header decreases just one.

It is impossible to count the accurate number of routers in each path due to this situation. This scheme uses the minimal encapsulation to resolve the problem. Minimal encapsulation is proposed to reduce the header's overhead. The TTL value usually decreases after a packet passes through the tunnel, because the minimum information is kept at the inner IP header, and the remaining information moves to the tunnel header.

3.2 Description about Model

The MAG's buffer the packets and it is received from the RO path, until all the packets pass from the old path. Enabling the sequence number to understand the order of all the packets passing though the old and new path resolves the problem more precisely than other schemes do. In addition, the packets transfers via the shortest path due to performing the buffering in MAGCN, Thus, the problem is resolved, and the packet reception delay is reduced.

3.3 Basic Operation

The packets between an MN and a CN pass through the old path before the new path is established. If the new path is established, the packets pass through the new path. MAGCN receiving the packets via the new path, buffers the packets to prevent the problem. From the beginning of the buffering in MAGCN, MAGCN compares the sequence number of the first packet in the buffer and the sequence number of the packet that passed via the old path. MAGCN

performs the buffering until the last packet from the old path arrives at MAGCN. When the last packet from the old path arrives at MAGCN, MAGCN forwards the packet and then forwards the all packets in its buffer.

The out-of-sequence problem is prevented by storing the **packets from the new path in the MAG's buffer, until all the** packets pass from the old path. Enabling the sequence number to understand the order of all the packets passing though the old and new path resolves the problem more precisely than other schemes do. In addition, this scheme transfers via the shortest path due to performing the buffering in MAGCN, Thus, the problem is resolved, and the packet reception delay is reduced. MAGCN forwards the packets in the buffer to CN after the last packet from the old path passes through MAGCN. However, if the last packet from the old path is lost, MAGCN performs the buffering infinitely.

The maximum forwarding delay time (*Twait*) is calculated to prevent infinite buffering in this scheme. If the last packet from the old path does not arrive at MAGCN within the *Twait*, the packets in the buffer are forwarded to CN. The problem is prevented using the maximum forwarding delay time, even though the packets from the old path are lost.

$$T_{wait} = TOP - TNP \quad \dots(1)$$

$$TOP = (TTL_{Max} - TTL_{OP}) \cdot T_{One-Hop} \quad \dots(2)$$

$$TNP = (TTL_{Max} - TTL_{NP}) \cdot T_{One-Hop} \quad \dots(3)$$

Twait is calculated by the time difference between the times that the packets coming from the old path and the new path arrive at MAG_{CN}. *Twait* is calculated by equation (1). TOP and TNP define the time that the packet passes via the old path and the new path, respectively. From equation (1), they calculate the different arrival times between TOP and TNP. Equation (2) and (3) are the formulas to calculate TOP and TNP. TTL_{Max} is the maximum value of TTL. TTL_{OP} and TTL_{NP} are the TTL values of the packets from the old path and the new path, respectively.

4. EXISTING SYSTEM

4.1 Data Communication between Mobile and Correspondent Node

The mobile node is selected by the MAG based on the shortest path and its link stability. The selected mobile node establish basic PMIPv6 path between the MAG and LMA. Then the RO trigger message exit between the LMA1 and LMA2 and the RO path is established between the MAG's.

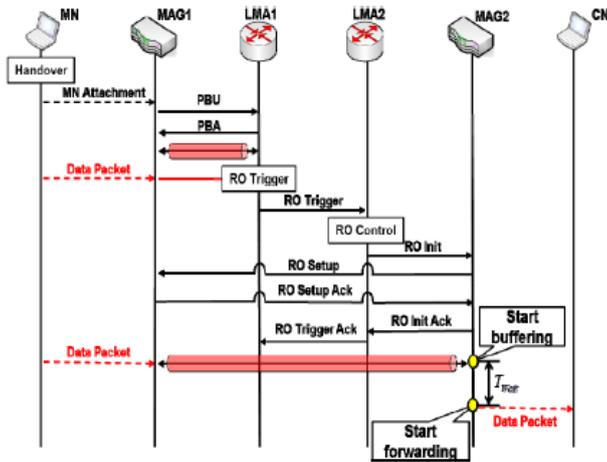


Fig-1: Data communication between Mobile and Correspondent Node

When the RO is completed, MAG2 starts to store the packets from the new path and checks the packet sequence number from the old path. If the last packet from the old path arrives at MAG2, MAG2 forwards the packet to CN. Next, MAG2 forwards all the buffered packets in MAG2 to CN. However, if the last packet from the old path does not arrive at MAG2 during *Twait*, MAG2 determines the last packet from the old path is lost. Therefore, MAG2 forwards all buffered packets in its buffer to CN.

This scheme provides reliable service to resolve the out-of-sequence problem more precisely than the OTP scheme. The problem is prevented using *Twait*, even though the packets from the old path are lost. In addition, the scheme minimizes the packet reception delay, using the old path during the establishment of the new path. Moreover, this scheme reduces the buffering cost, because the buffering is performed only by MAGCN.

4.2 Result Analysis

They run the simulator implemented in C++ to measure the number of the out-of-sequence packets. They conduct their experiment in the UDP environment to determine the packet loss and out-of-sequence packets. The experiment uses the CBR traffic generator, and data packets are generated in 0.02 seconds interval. If the traffic is generated by CBR, they verify the incidence of packet reception delay and the number of out-of-sequence packets accurately. Packet size is fixed at 500 bytes.

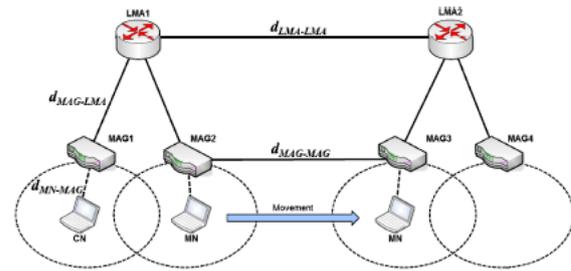


Fig-2: Network topology of simulation.

They configure $d_{LMA-LMA}$ as 15hops, $d_{MAG-LMA}$ and $d_{MAG-MAG}$ as 7hops, d_{MN-MAG} as 1hop. In this experiment, the number of the out-of-sequence packets and the packet reception delay are verified during the RO setup in the inter-domain handover.

4.3 SIMULATION RESULTS

Fig. 3 shows the simulation results of PMIPv6 supported by RO with dynamic mobile node selection. Fig. 4 is the simulation results based on packet drop calculation. Fig.5 is the stimulation result based on transmission delay calculation.

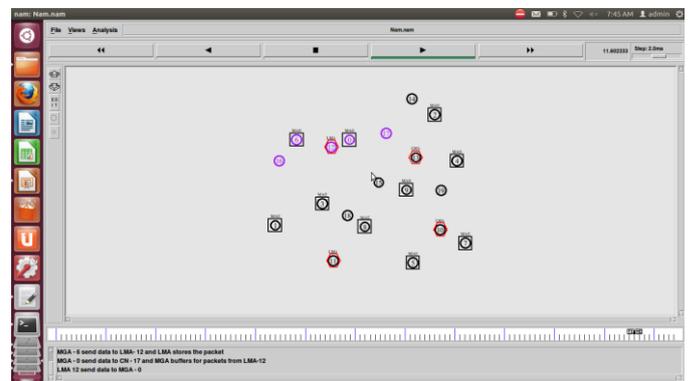


Fig-3: RO based on dynamic mobile node selection

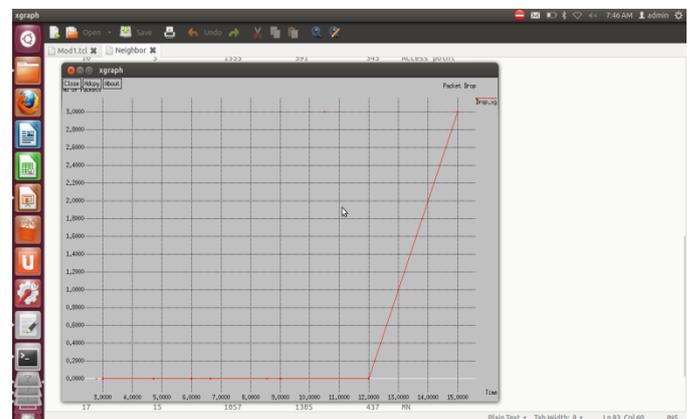


Fig-4: Stimulation Result about on Packet Drop

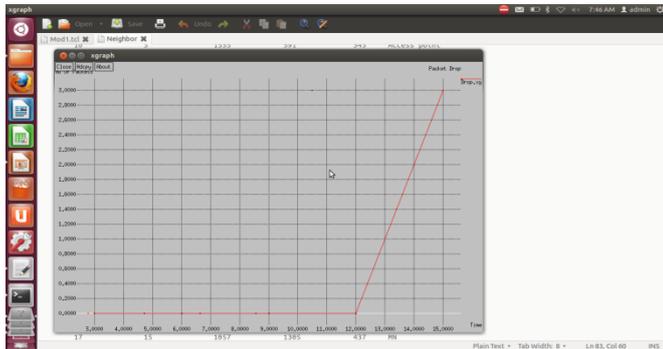


Fig-5: Stimulation Result about on Transmission Delay

5. CONCLUSION

Route Optimization (RO) is a function to minimize packet transmission delay through the optimal path between routers communicating with each other. The difference of the transmission delay between the old path and the new path generates the out-of-sequence problem in PMIPv6. This scheme provides reliable service for MN more accurately to prevent the problem occurring from the RO. The scheme resolves the problem effectively, using the packet sequence number, and reduces the forwarding delay time using Twait.

In this scheme, the mobile nodes are selected dynamically by the MAG based on its link stability and its shortest path. These particular features enable reliable packet transmission between the mobile node and correspondent node through the Route Optimization. It reduce the packet transmission delay and packet drop using route optimization technique.

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BIOGRAPHIE



Porkodi R is a PG scholar in the field of Information Technology at Sona College Of Technology [autonomous] India. Holding a bachelors degree in IT from the K S Rangasamy College of technology [autonomous], Coimbatore, affiliated to Anna University Chennai, in the year 2013. My current research is undertaken on Route Optimization based on dynamic mobile node selection.