

Improvement based study related with handover latency of mobile IP

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Abstract

Mobility is the ability to move freely. And this free movement of any node can only be done by an Internet Engineering Task Force (IETF) Standard Communication Protocol i.e. Mobile IP. A mobile node always passes through many of the processes of handovers as it is changing its networks again and again. And these handovers increases latency. This paper evolved with a survey on handover latencies with many of the extensions of Mobile IP by discussing and comparing them and their related problems with latency and also proposes the best scheme for it.

Keywords: MIPv4, MIPv6, DAD, HMIPv6, Multicast Technology, FMIPv6, FHMIPv6

1. Introduction

Mobile IP has a significant role for handling mobility. It enables a node to move from one network to another while maintaining the continuity of the service. It can be done by providing two addresses simultaneously i.e. Permanent address and Temporary address to a node when it is at Home network and foreign network respectively while maintaining its Permanent address. Although many of the issues have already solved by Mobile IP in terms of their latencies. But some of them are still taken into account to further improve the latencies.

2. Material and method

The very first protocol came to solve the mobility issues were Mobile IPv4 (MIPv4) [1]. This were also dealt with many of the problems which gives rise to Mobile IPv6 (MIPv6).

2.1 mobile ipv4

Mobile IPv4 is the protocol which deals with many of the

entities. These entities are having their respective functionalities:-

2.1.1 Entities

Each Mobile node (MN) assigned with a permanent address at their Home network. Within the Home Network, there is a Home Agent (HA) which maintains the track of the addresses of Mobile node that where it moves. This can be done by MN which always registers itself to HA with its new CoA (Care Of Address) when it changes its network and moves to foreign network, where it gets a temporary address which is called as Care-Of-Address.

2.1.2 Functionality

Refer Fig 1, for the discovery of the agents i.e. Home Agent or Foreign agent, they advertise themselves periodically by Agent

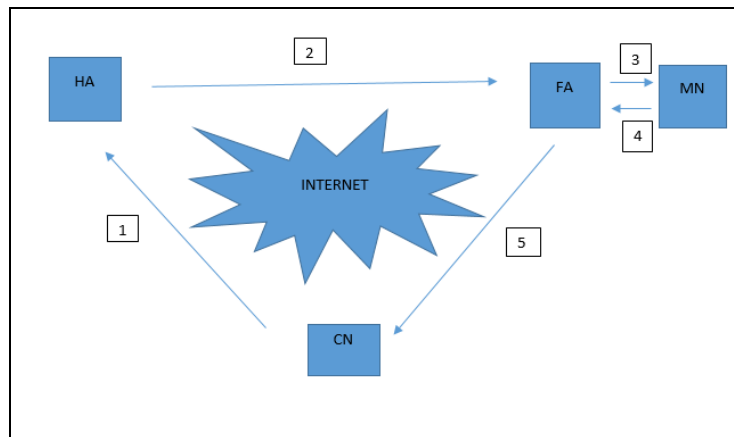


Fig 1: Mobile IPv4

Advertisement message. MN can also send a request message which in return gives the advertisement of the agent. This is called as Agent Solicitation. After discovering agent, when MN moves to foreign network, then it first registers its new CoA with HA. This is called as Registration Process. Every time when Corresponding Node (CN) which is assumed as a fix node

communicates with MN by sending a packet, then this packet first goes to HA, then HA provides tunnelling and Encapsulation(wrapping the IP datagram into IP for sending it to new address through tunnel) to the Packet and then sends this packet to the foreign network. This is shown in Fig 1.

2.1.3 Issues

Triangular Routing Problem:- In MIPv4, every time Packet first goes to HA, then after tunnelling and encapsulation, it goes to MN. So this suffers a long handover delay.

2.1.4 Solution

The Triangular Routing Problem was solved by using Binding Cache. Messages passes directly to MN from CN but not through HA. Binding cache uses four messages, these are:- Binding Request, Binding Update, Binding Acknowledgement, Binding Warning. This helps in direct communication of CN and MN which reduces the handover latency.

2.2 Mobile ipv6

It is the protocol which solved many of the issues in MIPv4. It supports Route Optimization in which Binding Update is the major part which provides direct communication between MN and CN without going via HA. It also removed FA by providing Address Auto Configuration feature. So MIPv6 gives better results in terms of handover latency.

2.2.1 Handover Procedure

In Mobile IPv6, handover follows with the further Steps [2] Refer Fig. 2, MN somehow detects its movement. And then Router Discovery is done by sending Router Solicitation and gets the revert with Router Advertisement. Then auto address configuration is done onto which Duplicate Address Detection is performed. During DAD, MN sends neighbour Solicitation message to confirm the uniqueness of the address. If it is in use, then node reverts with Neighbour advertisement message to help against it. Then After authentication and authorization, new COA is registered. This process is finally completed with Binding Update.

2.2.2 Issues

- Most of the latency is affected by DAD process.
- It has an issue in its reachability and the connections between MN and CN.

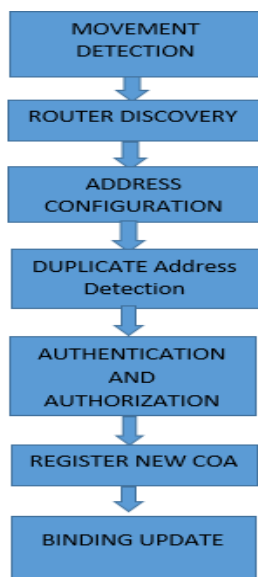


Fig 2: Handover Procedure

2.2.3 Solution

There are many improvements defined in the DAD Process. They reduces the delay time to get the unique address. These are:-

2.2.3.1 Optimistic Dad

It is done on the basis of probability of DAD process which is considered as small.

2.2.3.2 Proactive Dad

DAD process is performed over a new IP address before MN moves to new access router.

2.2.3.3 Advanced Dad

It stores a pool of unique addresses at every Access Router. Each router creates random addresses as a background process and then DAD is performed over it. The unique addresses are only stored in the pool. If it listens to the address onto which already another router is performing DAD. It silently discard that address from that pool. This further decrease the latency.

2.2.3.4 Enhanced Advanced Dad

It creates the pool of addresses by AR and distributes those addresses to its neighbours. It further helps in decreasing latency.

2.3 Extensions in Mipv6

There are many of the extensional schemes which works differently in their own ways and solved many of the issues of MIPV6 and further decreases their handover latency.

2.3.1 Hierarchical Mobile Ipv6

Refer Fig 3, HMIPV6 [3] solved the problem of reachability by maintaining the complete internet into many of the domains, each of which is handled by their respective administrative.

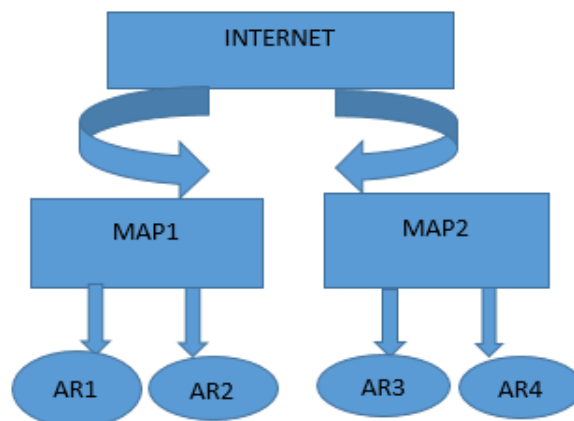


Fig 3: Hierarchical MIPV6

It introduces Mobility Anchor Point (MAP) which is treated as HA for each domain. This provides inter and intra domain movement. But intra domain was performing well by using HMIPV6 but not inter domain. So, for providing fast handover in inter domain movement also, Multicast Technology Concept [6] is adopted. This Concept has modified the HMIPV6 which provides fast handover.

2.3.1.1 Multicast Technology Concept

After reaching onto the edge of the boundary of any domain, MN sends the multicast message to the MAP of that domain. Then in return, MAP generates a control message for that previous access router as well as the new access router. With this concept, the new access router will get the copy of those on going packets, when the MN is still in the old MAP domain. And while having registration process with the new access router, new AR forwards those packets to the MN. So, it gives the improved and fast handover in terms of latency.

2.3.1.2 Issues

Within a MAP domain, each AR use different IPV6 prefix. When MN moves from one access router to another within the same domain, it has to generate new LCOA for every router and then detects its uniqueness with DAD process. It increases a lot of latency.

2.3.1.3 Solution

The Optimized HMIPv6 (O-HMIPv6) [4] guarantees the uniqueness of Network Id and MN’s interface id within each MAP domain. As we know, for each MAP domain, MN configures RCOA and LCOA and then DAD occurs on each LCOA for every router. But O-HMIPv6 solves the problem to apply DAD on every router’s LCOA in the same MAP domain. This can be done by advertising the same NID for all the routers within the domain.

2.3.2 Fast Mobile Ipv6

FMIPv6 allows the MN to first establish the connection with the new access router and then disconnect with the previous one. This provides the tunnelling between Previous Access Router and New Access Router but not with the MAP. This has further decreased the latency.

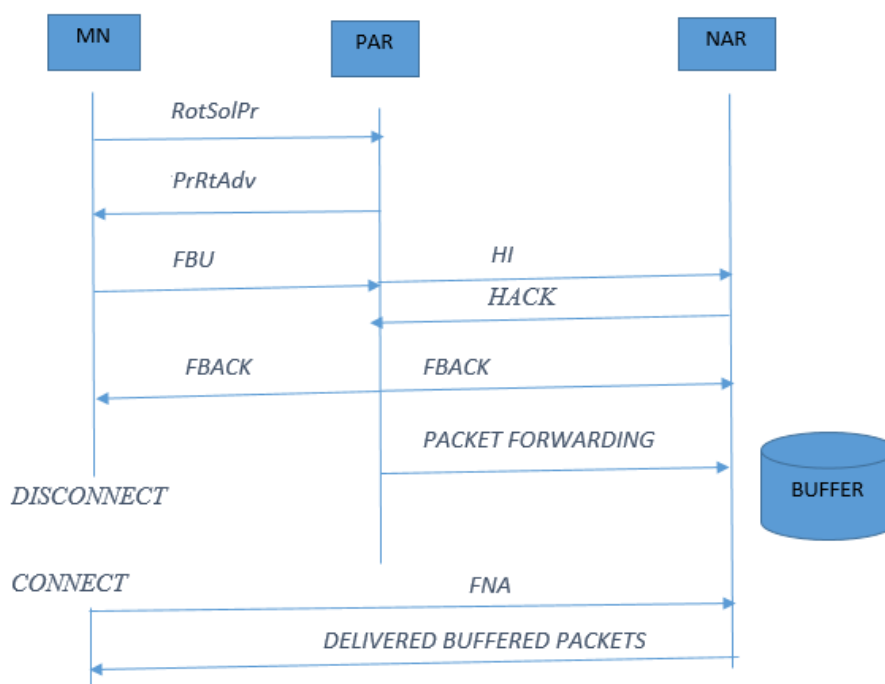


Fig 4: Fast Mobile IPV6

Refer fig.4, MN first sends the Router Solicitation Proxy message (Rot Sol Pr) to Previous access router (PAR), then it gets the revert with Proxy router Advertisement from PAR. Then, MN sends the Fast Binding Update to PAR. After this, handover Initiation gets started between Previous and New Access Router. NAR acknowledge PAR by sending Handover Acknowledgement. When PAR sends the Fast Binding Acknowledgement to both MN and NAR, then MN gets disconnected with PAR and connects with NAR and all the packets now forward to new Access router which were stored in a buffer. This packet buffering helps in decreasing latency. It sends all the buffered packets when it gets connected to NAR.

2.3.2.1 Issues

It provides the tunnelling only within PAR and NAR but not

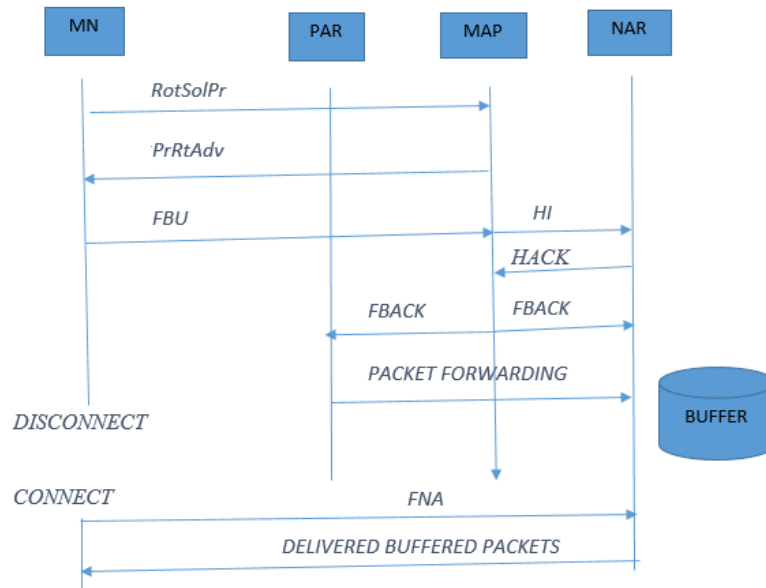
with MAP.

2.3.2.2 Solution

It provides the combination of two different schemes which further decreases latency. These schemes are HMIPv6 and FMIPv6. This combination is explained in the section below.

2.4. Fast Hierarchical Mobile Ipv6

FHMIPv6 [5] is the combination of two different protocols i.e. FMIPv6 and HMIPv6. FMIPv6 provides the tunnelling between PAR and NAR, but not with MN. And HMIPv6 Provides tunnelling from MAP to mobile nodes. So this is the concept of retunneling and further decreases latency.



3. Conclusion

By using these protocols, much of the handover latency is decreased. Further, we need to decrease the latency by proposing many other new techniques.

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