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Mobility management for Dual stack mobile nodes
A Problem Statement
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Status of this memo

This document is a submission of the IETF MIP6 WG. Comments should be directed to the IPv6 WG mailing list, mip6@ietf.org.

Abstract

This draft discusses the issues associated with mobility management for dual stack mobile nodes. Currently, two mobility management protocols are defined for IPv4 and IPv6. Deploying both in a dual stack mobile node introduces a number of inefficiencies. Deployment and operational issues motivate the use of a single mobility management protocol. This draft discusses such motivations. The draft also hints on how current MIPv4 and MIPv6 could be extended so that they can support mobility management for a dual stack node.

1.0 Introduction and motivation

A mobile IPv4 only node can today use Mobile IPv4 [MIPv4] to maintain connectivity while moving between IPv4 subnets. Similarly, a mobile IPv6 only node can today use Mobile IPv6 [MIPv6] to maintain connectivity while moving between IPv6 subnets.

One of the ways of migrating to IPv6 is to deploy dual stack node running both IPv4 and IPv6. Such a node will be able to get both IPv4 and IPv6 addresses and thus can communicate with the current IPv4 Internet as well as any IPv6 nodes and networks as they become available.

A dual stack node can use Mobile IPv4 for its IPv4 stack and Mobile IPv6 for its IPv6 stack so that it can move between IPv4 and IPv6 subnets. While this is possible, it is also clearly inefficient since it requires:

- Mobile nodes to support two sets of mobility management protocols
- Mobile nodes to send two sets of signaling messages on every handoff
- Network Administrators to run and maintain two sets of mobility management systems on the same network. Each of these systems requiring their own sets of optimizations that may include any of the following mechanisms, FMIPv6, HMIPv6, FMIPv4, and many others.

This draft discusses the potential inefficiencies and operational issues raised by running both mobility management protocols simultaneously. It also proposes a work area to be taken up by the IETF on the subject and hints on a possible direction for appropriate solutions.

2.0 Problem description

Mobile IP (v4 and v6) uses a signaling protocol (Registration requests in MIPv4 and BUs in MIPv6) to set up tunnels between two end points. At the moment MIP "signaling" is tightly coupled with the "address family (i.e. IPv4 or IPv6)" used in the connections that it attempts to manipulate. There are no fundamental technical reasons for such coupling. If Mobile IP were viewed as a tunnel setup protocol, it should be able to setup IP in IP tunnels, independently of the IP version used in the outer and inner headers. Other protocols, for example SIP, are able to use either IPv4 or IPv6 based signaling plane to manipulate IPv4 andIPv6 bearers.

A mobile node using both Mobile IPv4 and Mobile IPv6 to roam within the Internet will require the following:

- Both implementations available in the mobile node
- The network operator needs to ensure that the home agent supports both protocols or that it has two separate Home Agents supporting the two protocols, each requiring its own management.
- Double the amount of configuration in the mobile node and the home agent (e.g. security associations).
- Local network optimizations for handovers will also need to be duplicated.

We argue that all of the above will hinder the deployment of Mobile IPv6 as well as any dual stack solution in a mobile environment. We will discuss some of the issues with the current approach separately in the following sections.

2.1. Implementation burdens

As mentioned above, a dual stack mobile node would require both mobility protocols implemented to roam seamlessly within the Internet. Clearly this will add implementation efforts, which we argue are not necessary.

In addition to the implementation efforts, some vendors may not support both protocols in either mobile nodes or home agents. This is more of a commercial issue; however, it does affect the large scale deployment of mobile devices on the Internet.

2.2. Operational burdens

As mentioned earlier, deploying both protocols will require managing both protocols in the mobile node and the home agent. This adds significant operational issues for the network operator. It would certainly require the network operator to have deep knowledge in both protocols. This might add a significant cost for deployment that an operator cannot justify due to the lack of substantial gains.

2.3. Mobility management inefficiencies

This is perhaps the most significant issue to consider. Suppose that a mobile node is moving within a dual stack access network. Every time the mobile node moves it needs to send two mobile IP messages to its home agent to allow its IPv4 and IPv6 connections to survive. There is no reason for doing this. If local mobility optimizations are deployed (e.g. HMIPv6, Fast handovers or local MIPv4 HA), the mobile node will need to update the local agents running each protocol. Ironically, one local agent might be running both HMIPv6 and local MIPv4 home agent. Clearly, there is no need in this case to send two messages.

Hence, such parallel operation of Mobile IPv4 and Mobile IPv6 will

complicate mobility management within the Internet and increase the

amount of bandwidth needed at the critical handover time for no apparent gain.

2.4. The impossibility of maintaining connectivity

A final point to consider is that even if both mobility protocols are supported by a mobile node seamless connectivity would not in fact be guarantied since that also depends on the IPv4/IPv6 capabilities of the networks the mobile is visiting i.e.: a dual stack node attempting to connect via a IPv4 only network would not be able to maintain connectivity of its IPv6 applications and vice versa.

3. Conclusion and recommendations

The points above highlight the tight coupling in both Mobile IPv4 and Mobile IPv6 between signaling and the IP addresses used by upper layers. Given that Mobile IPv4 is currently deployed and Mobile IPv6 is expected to be deployed, there is a need for gradual transition from IPv4 mobility management to IPv6. Running both protocols simultaneously is inefficient and has the problems described above. In order to allow for a gradual transition based on current standards and deployment, the following work areas seem to be reasonable:

- it should be possible to create IPv4 extensions to Mobile IPv6 so that a dual stack mobile node can register its IPv4 and IPv6 HoAs to a dual stack Home Agent using MIPv6 signaling only.
- it should be possible to create IPv6 extensions to MIPv4 so that a dual stack mobile node can register its IPv4 and IPv6 HoAs to a dual stack Home Agent using MIPv4 signaling only.
- it should also be possible to extend MIPv4 and MIPv6 so that a mobile can register a single CoA (IPv4 or IPv6) to which IPv4 and/or IPv6 packets can be diverted to.

Further work in this area, possibly independent of Mobile IP, may also be of interest to some parties in which case it should be dealt with separately from the incremental Mobile IP based changes.

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4. References

[KEYWORDS] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

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