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Minimal Encapsulation within IP
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Abstract

This document specifies a method by which an IP datagram may be encapsulated (carried as payload) within an IP datagram, without incurring all the overhead of using a standard IP header. Encapsulation is suggested as a means to effect "re-addressing" datagrams (i.e, delivering them to an intermediate destination other than that specified in the IP destination field) for any of a variety of reasons, but particularly those useful for adherence to the mobile-IP specification.

1. Introduction

This document specifies a method by which an IP datagram may be encapsulated (carried as payload) within an IP datagram, without incurring all the overhead of using a standard IP header, as specified in [5], Encapsulation is suggested as a means to effect "re-addressing" datagrams -- that is, delivering them to an intermediate destination other than that specified in the IP destination field. The process of encapsulation and decapsulation a datagram is frequently referred to as "tunneling" the datagram, and the encapsulator and decapsulator are then considered to be the the "endpoints" of the tunnel.

2. Motivation

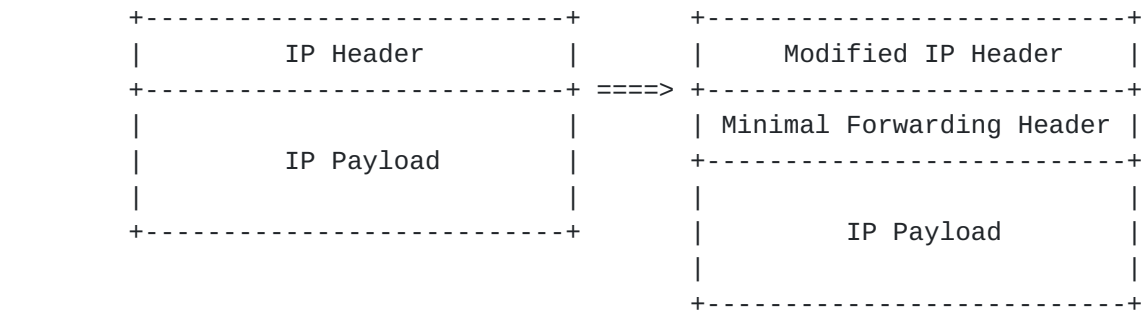
The mobile-IP working group has specified the use of encapsulation as a way to deliver packets from a mobile host's "home network" to an agent which can deliver packets to the mobile host by conventional means [1]. The use of encapsulation may also be desirable whenever the source (or an intermediate router) of an IP datagram must influence the route by which a datagram is to be delivered to its ultimate destination. Other possible applications include preferential billing, choice of routes with selected security attributes, and general policy routing.

See [5] for a discussion concerning the advantages of encapsulation versus source routing. Since using IP headers to encapsulate IP datagrams requires the unwarranted duplication of several fields within the inner IP header, it is possible to save some additional space by specifying a new encapsulation mechanism that eliminates the duplication. The scheme outlined in this protocol specification comes from the mobile-IP working group (in earlier Internet Drafts), and is similar to that which had been outlined in [3].

3. Minimal Encapsulation

A minimal forwarding header is defined for datagrams which are not fragmented prior to encapsulating. Use of this encapsulating method is optional. Minimal encapsulation must not be used when an original datagram is already fragmented, since there is no room in the inner header to store fragmentation information.

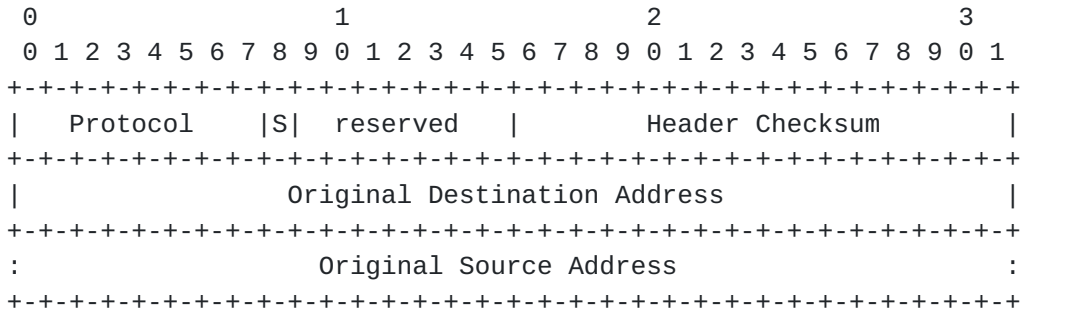
The minimal encapsulation process produces a datagram structured as shown below; the IP header of the original datagram is modified, then followed by the minimal forwarding header, followed by the unmodified IP payload of the original datagram.



Encapsulation is performed as follows. The protocol field in the IP header is replaced by protocol number 55 for the minimal encapsulation protocol. The destination field in the IP header is replaced by the care-of address of the mobile node. If the encapsulating agent is not the original source of the datagram, the source field in the IP header is replaced by the IP address of the encapsulating agent.

When decapsulating a datagram, the fields in the forwarding header are restored to the IP header, and the forwarding header is removed from the datagram.

The format of the minimal forwarding header is as follows:



Protocol

Copied from the protocol field in the original IP header.

S

Source field present bit, which indicates whether the Original Source Address field is present.

0 not present.
1 present.

reserved

Sent as zero; ignored on reception.

Header Checksum

The 16-bit one's complement of the one's complement sum of the encapsulation header. For computing the checksum, the checksum field is set to 0.

Original Destination Address

Copied from the destination field in the original IP header.

Original Source Address

Copied from the source field in the original IP header. Present only if the S-bit is set.

The encapsulating agent is free to use existing IP mechanisms appropriate for delivery of the encapsulated payload to the tunnel endpoint. In particular, this means that use of IP options and fragmentation are allowed, unless the "Don't Fragment" bit is set in the inner IP header. This is required so that hosts employing Path MTU discovery [4] can obtain the information they seek.

4. ICMP messages from within the tunnel

ICMP messages are to be handled as specified in [5], including the maintenance of soft state.

5. Security Considerations

Security considerations are not addressed in this document, but are generally thought to be similar to those outlined in [5].

6. Acknowledgements

The text for most of section 3 was taken from the mobile-IP draft [2].

References

[1] IETF Mobile-IP Working Group. IPv4 Mobility Support. ietf-draft-mobileip-protocol-12.txt - work in progress, September 1995.

[2] IETF Mobile-IP Working Group. IPv4 Mobility Support. ietf-draft-mobileip-protocol-10.txt -- outdated draft, May 1995.

[3] David B. Johnson. Scalable and Robust Internetwork Routing for Mobile Hosts. In Proceedings of the 14th International Conference on Distributed Computing Systems, pages 2--11, June 1994.

[4] J. Mogul and S. Deering. Path MTU Discovery. RFC 1191, November 1990.

[5] C. Perkins. IP Encapsulation within IP. Internet Draft -- work in progress, October 1995.

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