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**Host Identity Protocol Signaling Message Transport Modes
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Abstract

This document specifies two transport modes for Host Identity Protocol signaling messages that allow conveying them over encrypted connections initiated with the Host Identity Protocol.

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Table of Contents

| | | |
|------------------------|--------------------------------------------------------------|-------------------|
| 1. | Introduction | 3 |
| 2. | Terminology | 3 |
| 3. | Protocol Extensions | 3 |
| 3.1. | Mode Negotiation in HIP Base Exchange | 3 |
| 3.2. | Mode Negotiation After HIP Base Exchange | 4 |
| 3.3. | HIP Messages on Encrypted Connections | 5 |
| 3.3.1. | ESP mode | 5 |
| 3.3.2. | ESP-TCP mode | 5 |
| 3.4. | Recovering from Failed Encrypted Connections | 6 |
| 3.5. | Simultaneous Host Mobility | 6 |
| 4. | Notify Packet Types | 6 |
| 5. | Security Considerations | 7 |
| 6. | Acknowledgements | 7 |
| 7. | IANA Considerations | 7 |
| 8. | References | 7 |
| 8.1. | Normative References | 7 |
| 8.2. | Informational References | 8 |
| | Author's Address | 8 |

1. Introduction

Host Identity Protocol (HIP) [[RFC5201](#)] signaling messages can be exchanged over plain IP using the protocol number reserved for this purpose, or over UDP using the UDP port reserved for HIP NAT traversal [[I-D.ietf-hip-nat-traversal](#)]. When two hosts perform a HIP base exchange, they set up an encrypted connection between them for data traffic, but continue to use plain IP or UDP for HIP signaling messages.

This document defines how the encrypted connection can be used also for HIP signaling messages. Two different modes are defined: HIP over Encapsulating Security Payload (ESP) and HIP over TCP. The benefit of sending HIP messages over ESP is that all signaling traffic (including HIP headers) will be encrypted. If HIP messages are sent over TCP (which in turn is transported over ESP), TCP can handle also message fragmentation where needed.

2. Terminology

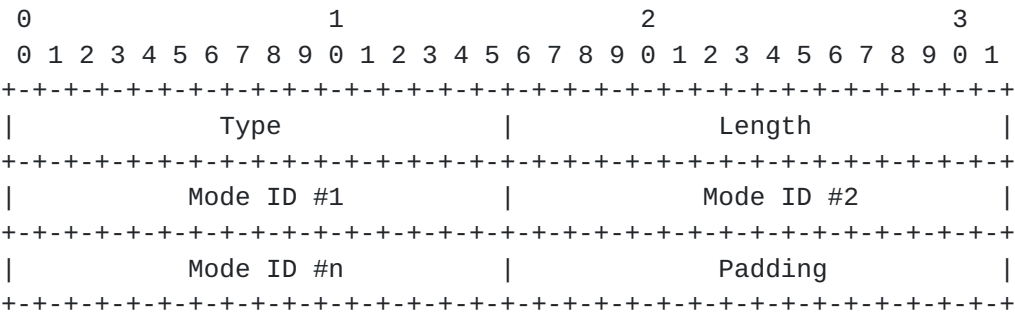
The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [[RFC2119](#)].

3. Protocol Extensions

This section defines how support for different HIP signaling message transport modes is negotiated and the normative behavior required by the extension.

3.1. Mode Negotiation in HIP Base Exchange

A HIP host implementing this specification SHOULD indicate the modes it supports, and is willing to use, in the base exchange. The HIP signaling message transport mode negotiation is similar to HIP NAT traversal mode negotiation: first the Responder lists the supported modes in a HIP_TRANSPORT_MODE parameter (see Figure 1) in the R1 packet. If the Initiator supports, and is willing to use, any of the modes proposed by the Responder, it selects one of the modes by adding a HIP_TRANSPORT_MODE parameter containing the selected mode to the I2 packet. Finally, if the Initiator selected one of the modes and the base exchange succeeds, hosts use the selected mode for the following HIP signaling messages sent between them.



Type [TBD by IANA; 990]
Length length in octets, excluding Type, Length, and padding
Mode ID defines the proposed or selected transport mode(s)

The following mode IDs are defined:

| ID name | Value |
|----------|-------|
| RESERVED | 0 |
| DEFAULT | 1 |
| ESP | 2 |
| ESP-TCP | 3 |

Figure 1: Format of the HIP_TRANSPORT_MODE parameter

The mode DEFAULT indicates that the same transport mode (e.g., plain IP or UDP) that was used for the base exchange should be used for subsequent HIP signaling messages. In the ESP mode the messages are sent as such on the encrypted ESP connection and in the ESP-TCP mode TCP is used within the ESP tunnel.

3.2. Mode Negotiation After HIP Base Exchange

If a HIP hosts wants to change to a different transport mode (or start using a transport mode) some time after the base exchange, it sends a HIP UPDATE packet with a HIP_TRANSPORT_MODE parameter containing the mode(s) it would prefer to use. The host receiving the UPDATE MUST respond with an UPDATE packet containing the mode that is selected as in the negotiation during the base exchange. If the receiving host does not support, or is not willing to use, any of the listed modes, it MUST respond with a NO_VALID_HIP_TRANSPORT_MODE NOTIFY packet (see [Section 4](#)) and continue using the same transport mode.

Since the HIP_TRANSPORT_MODE parameter's type is not critical (as defined in [Section 5.2.1 of \[RFC5201\]](#)), a host not supporting this extension would simply acknowledge the UPDATE without responding with an UPDATE containing a HIP_TRANSPORT_MODE parameter.

3.3. HIP Messages on Encrypted Connections

This specification defines two different transport modes for sending HIP packets over encrypted ESP connections. These modes require that the ESP transport format [[RFC5202](#)] is negotiated to be used between the hosts. If the ESP transport format is not used, these modes MUST NOT be offered in the HIP_TRANSPORT_MODE parameter.

The ESP mode provides simple protection for all the signaling traffic and can be used as a generic replacement for the DEFAULT mode in cases where all signaling traffic should be encrypted. If the HIP messages may become so large that they would need to be fragmented, e.g., because of HIP certificates [[I-D.ietf-hip-cert](#)] or DATA messages [[I-D.ietf-hip-hiccups](#)], it is RECOMMENDED to use the ESP-TCP mode which can handle message fragmentation at TCP level instead of relying on IP level fragmentation.

3.3.1. ESP mode

If the ESP mode is selected in the base exchange, both hosts MUST listen for incoming HIP signaling messages and send outgoing messages on the encrypted connection. The ESP header's next header value for such messages MUST be set to HIP (139).

3.3.2. ESP-TCP mode

If the ESP-TCP mode is selected, the host with the larger HIT (calculated as defined in [Section 6.5 of \[RFC5201\]](#)) MUST start to listen for an incoming TCP connection on the port 10500 on the encrypted connection and the other host MUST create a TCP connection to that port. The host with the lower HIT SHOULD use port 10500 as the source port for the TCP connection. Once the TCP connection is established, both hosts MUST listen for incoming HIP signaling messages and send the outgoing messages using the TCP connection. The ESP next header value for messages sent using the ESP-TCP mode connections MUST be set to TCP (6).

If the hosts are unable to create the TCP connection, the host that initiated the mode negotiation MUST restart the negotiation with UPDATE message and SHOULD NOT propose the ESP-TCP mode. If local policy does not allow using any other mode than ESP-TCP, the HIP association MUST be closed. The UPDATE or CLOSE message MUST be sent using the same transport mode that was used for negotiating the use of the ESP-TCP mode.

Since TCP provides reliable transport, the HIP messages sent over TCP MUST NOT be retransmitted for the purpose of achieving reliable transmission. Instead, a host simply waits for the same time that

would be taken by the maximum amount of retransmissions with unreliable transmission before concluding that there is no response.

3.4. Recovering from Failed Encrypted Connections

If the encrypted connection fails for some reason, it can no longer be used for HIP signaling and the hosts SHOULD re-establish the connection using HIP messages that are sent outside of the encrypted connection. Hence, while listening for incoming HIP messages on the encrypted connection, hosts MUST still accept incoming HIP messages using the same transport method (e.g., UDP or plain IP) that was used for the base exchange. When responding to a HIP message sent outside of encrypted connection, the response MUST be sent using the same transport method as the original message used.

The UPDATE messages used for re-establishing the encrypted connection MUST contain a HIP_TRANSPORT_MODE parameter and the negotiation proceeds as described in [Section 3.2](#).

3.5. Simultaneous Host Mobility

If two hosts having a HIP association change addresses simultaneously, they may not be able to send UPDATE messages to the right address using the encrypted connection. This results in a similar situation as if the encrypted connection had failed and the hosts need to re-negotiate the new addresses using un-encrypted UPDATE messages and possibly rendezvous [[RFC5204](#)] or HIP relay [[I-D.ietf-hip-nat-traversal](#)] servers. Also these UPDATE messages MUST contain the HIP_TRANSPORT_MODE parameter and perform the transport mode negotiation.

4. Notify Packet Types

The new Notify Packet Types [[RFC5201](#)] defined in this document are shown below. The Notification Data field for the error notifications SHOULD contain the HIP header of the rejected packet.

| NOTIFICATION PARAMETER - ERROR TYPES | Value |
|--------------------------------------|-------|
| ----- | ----- |
| NO_VALID_HIP_TRANSPORT_MODE | 70 |

If a host sends UPDATE message that does not have any transport mode the receiving host is willing to use, it sends back a NOTIFY error packet with this type.

5. Security Considerations

By exchanging the HIP messages over ESP connection, all HIP signaling data (after the base exchange) will be encrypted, but only if NULL encryption is not used. Thus, host requiring confidentiality for the HIP signaling messages must check that encryption is negotiated to be used on the ESP connection.

6. Acknowledgements

Thanks to Gonzalo Camarillo, Kristian Slavov, Tom Henderson, and Miika Komu for comments on the draft.

7. IANA Considerations

This section is to be interpreted according to [[RFC5226](#)].

This document updates the IANA Registry for HIP Parameter Types [[RFC5201](#)] by assigning new HIP Parameter Type value for the HIP_TRANSPORT_MODE parameter (defined in [Section 3.1](#)).

The HIP_TRANSPORT_MODE parameter has 16-bit unsigned integer fields for different modes, for which IANA is to create and maintain a new sub-registry entitled "HIP Transport Modes" under the "Host Identity Protocol (HIP) Parameters" registry. Initial values for the transport mode registry are given in [Section 3.1](#); future assignments are to be made through IETF Review [[RFC5226](#)]. Assignments consist of a transport mode identifier name and its associated value.

8. References

8.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
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8.2. Informational References

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