Requirements for RoHC IP/SCTP Robust Header Compression
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Abstract

This document contains requirements for the IP/SCTP header compression scheme (profile) to be developed by the ROHC WG. The structure of this document is inherited from the document defining IP/TCP requirements for ROHC.
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1. Introduction

The goal of the ROHC WG is to develop header compression schemes that perform well over links with high error rates and long link round trip times. The schemes must perform well for cellular links, using technologies such as WCDMA, EDGE, and CDMA-2000. However, the schemes should also be applicable to other future link technologies with high loss and long round trip times.

The main objective for ROHC has been robust compression of IP/UDP/RTP. Next step was IP/TCP compression.

SCTP is the new reliable transport protocol from the IETF. It offers a number of features not available in other reliable transport protocols such as TCP, including multi-streaming, multi-homing and resistance to flooding and masquerade attacks. SCTP is designed to transport PSTN signaling messages over IP networks but its rich feature set makes it capable of many broader applications. Additionally, SCTP is required for reliable server pooling (transport between name servers and between pool elements and name servers) and recommended for SIP signaling. The selection of SCTP for this purpose will improve the quality of these services.

One of the most important innovations of SCTP is the multi-streaming function. This feature allows data to be partitioned into multiple streams where each stream is delivered independently, so in-sequence delivery can be guaranteed for data sent within a single stream. The advantage of this technique is that when a packet is lost, only certain streams are affected.

From the header compression point of view the multi-streaming function raises a number of new issues to solve. Most importantly a SCTP packet consists of a common header followed by a sequence of chunks. User payload is transported in DATA chunks which contain stream specific information. All other chunks do not contain stream specific information. To obtain maximum compression efficiency it is important to maintain a separate context for the stream-specific fields from each stream, but to use a shared context for all general fields.

The remaining requirements will be similar to IP / TCP compression [5].
2. Header compression requirements

The following requirements have, more or less arbitrarily, been divided into five groups.

The first group deals with requirements concerning the impact of a header compression scheme on the rest of the Internet infrastructure. The second group defines what kind of headers that must be compressed efficiently. The third group defines SCTP specific requirements, while the forth and fifth groups concern performance requirements and capability requirements from the properties of the anticipated link technologies.

2.1 Impact on Internet infrastructure

Transparency:

When a header is compressed and then decompressed, the resulting header must be semantically identical to the original header. If this cannot be achieved, the packet containing the erroneous header must be discarded.

Justification: The header compression process must not produce headers that might cause problems for any current or future part of the Internet infrastructure.

Note: The ROHC WG has not found a case where "semantically identical" is not the same as "bitwise identical".

Ubiquity:

Must not require modifications to existing IP (v4 or v6) or SCTP implementations.

Justification: Ease of deployment.

2.2 Supported headers

IPv4 and IPv6:

Must support both IPv4 and IPv6. This means that all possible changes in the IP header fields must be handled by the compression scheme and commonly changing fields should be compressed efficiently.

Justification: IPv4 and IPv6 will both be around during the foreseeable future.
Mobile IP:

The kinds of headers used by Mobile IP(v4,v6) must be supported and should be compressed efficiently. For IPv4 these include headers of tunneled packets. For IPv6 these include headers containing the Routing Header, the Binding Update Destination Option, and the Home Address option.

Justification: It is very likely that Mobile IP will be used by cellular devices.

IPSEC:

The scheme should be able to compress headers containing IPSEC sub-headers.

Justification: IPSEC is expected to be used to provide necessary end-to-end security.

Note: It is of course not possible to compress the encrypted part of an ESP header, nor the cryptographic data in an AH header.

2.3 SCTP specific requirements

Generality:

Must support efficient compression of the SCTP information in a SCTP packet. This means that the scheme must be able to work with the protocol structure of the SCTP protocol (SCTP common header, chunk-1 header, chunk-1 body, chunk-2 header, chunk-2 body...) in a proper way.

Justification: There must be a generic scheme which reflects the structure of SCTP packets.

Streams:

Multi-streaming function of SCTP has to be kept in most of the cases.

Justification: The independent transport of multiple streams is a big advantage of SCTP. In case of a packet loss at the compressed link, two cases have to be differentiated:

Case 1: The verification of the decompression via CRC compression checksum went well. In this case, uncompressed SCTP packets will be forwarded and the SCTP endpoints will take care about
multi-streaming functionality.

Case 2: The verification of the decompression via CRC compression checksum fails. In this case, the release of the related SCTP packet could influence unrelated streams as well. The only way to avoid this would be the generation of a new SCTP packet by the decompressor (without the data chunks from the involved stream) - in violation to the transparency transport requirement.

The compression stream must support the multiple streams feature in a way that head of line blocking is introduced by RoHC only in very rare cases. Context update should be restricted to a minimum.

Extensions:

SCTP extensions as described in ADDIP [2] and PRSCTP [3] should be compressed efficiently.

Justification: SCTP extensions will be a normal part of the protocol. To reach good efficiency for SCTP, these extension have to be handled in an appropriate way.

Extendibility:

Generic extendibility describes the handling of yet not defined chunks, the compression scheme must be able to handle this chunks.

Justification: The compression scheme must support full SCTP functionality.

2.4 Performance issues

Performance/Spectral Efficiency:

Must provide low relative overhead under expected operating conditions.

Justification: Spectrum efficiency is the primary goal here.

Error propagation:

For SCTP traffic, link layer retransmissions should be applied to make use of the bandwidth in the most efficient way. Lost or damaged headers should thus not occur and therefore it is not a primary goal to have mechanisms for error propagation avoidance in
case of such events.

Justification: To provide robustness against loss or damage introduced by the link, efficiency must be sacrificed. Since loss or damage is not expected for SCTP traffic, efficiency should instead be prioritized. This does not mean that some robustness should not be provided, if efficiency can still be optimized.

Note: In general, error propagation due to header compression should be kept at an absolute minimum. Error propagation is defined as the loss or damage of headers subsequent to headers lost or damaged by the link, even if those subsequent headers are not lost or damaged.

Note: There are at least two kinds of error propagation; loss propagation, where a lost header causes subsequent headers to be lost or damaged, and damage propagation, where a damaged header causes subsequent headers to be lost or damaged.

Moderate Packet Reordering:

The scheme should efficiently handle moderate reordering (2-3 packets) in the packet stream reaching the compressor.

Justification: This kind of reordering is common.

Packet Reordering:

The scheme should be able to compress when there are reordered packets in the packet stream reaching the compressor.

Justification: Reordering happens regularly in the Internet. However, since the Internet is engineered to run SCTP reasonably well, excessive reordering will not be common and need not be handled with optimum efficiency.

Processing delay:

The scheme must not contribute significantly to system delay budget.

2.5 Capability requirements related to link layer characteristics

Unidirectional links:

Must be possible to implement (possibly with less efficiency) without explicit feedback messages from decompressor to
compressor.

Justification: There are links that do not provide a feedback channel or feedback is not desirable for other reasons.

Link delay:

Must operate under all expected link delay conditions.

Header compression coexistence:

The scheme must fit into the ROHC framework together with other ROHC profiles.
3. IANA Considerations

A protocol which meets these requirements will require the IANA to assign various numbers. This document by itself, however, does not require any IANA involvement.
4. Security Considerations

A protocol specified to meet these requirements must be able to compress packets containing IPSEC headers according to the IPSEC requirement, 2.2.4. The efficiency of the compression may be influenced by encrypted protocol header elements. This document by itself, however, does not add any security risks.
References


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