                   RObust Header Compression (ROHC):
      Requirements and Assumptions for 0-byte IP/UDP/RTP Compression

Status of this Memo

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Abstract

   This document contains requirements for the 0-byte IP/UDP/RTP
   (Internet Protocol/User Datagram Protocol/Real-Time Transport
   Protocol) header compression scheme to be developed by the Robust
   Header Compression (ROHC) Working Group. It also includes the basic
   assumptions for the typical link layers over which 0-byte compression
   may be implemented, and assumptions about its usage in general.

1. Introduction

   The goal of the Robust Header Compression (ROHC) Working Group is to
   develop header compression schemes that perform well over links with
   high error rates and long link roundtrip 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 roundtrip
   times.

   ROHC RTP has become a very efficient, robust and capable compression
   scheme, able to compress the IP/UDP/RTP headers down to a total size
   of only one octet. This makes ROHC RTP an excellent solution for
   future cellular environments with new air interfaces, such as WCDMA,
   making even speech services possible over IP with an insignificantly
   lower spectrum efficiency compared to existing circuit switched
   solutions.

However, all-IP cellular networks will also be built with already
existing air interfaces such as GSM and IS-95, which are less
flexible using radio bearers optimized for specific frame sizes
matching the speech codecs used. This means that not a single octet
of header can be added without switching to the next higher fixed
packet size supported by the link, something which is obviously very
costly. In the long term, this drawback should of course be
eliminated with new, more flexible air interfaces, but in the short
term it would be desirable if an efficiency comparable to the circuit
switched case could also be achieved for already deployed speech
codecs when used over the existing air interfaces. To achieve that,
it must be possible to completely eliminate the headers for a
majority of the packets during normal operation, and this is the
purpose of 0-byte header compression. All functionality normally
provided by the 1-octet header must then be provided by some other
means, typically by utilizing functionality from the lower layer. It
is important to remember that the purpose of 0-byte header
compression is to provide optimal efficiency for applications
matching the link layer characteristics, not efficiency in general.

As a starting point for these requirements, the well-established
requirements base developed in the ROHC WG has been used. From that,
the requirements have evolved through input from the 3GPP2 community
and from discussions within the WG.

2. Assumptions for the Applicability of 0-byte RTP Header Compression

The purpose of 0-byte header compression is to provide optimal usage
of certain links when the traffic pattern of a packet stream
completely matches the characteristics of that link. There are no
assumptions that only packet streams complying with that pattern will
occur, but optimal efficiency cannot of course be provided when this
is not the case.

To make 0-byte header compression feasible, it is assumed that lower
layers can provide the necessary functionality needed to replace the
1-octet headers and fulfill the requirements defined in section 3.
An example is the synchronized nature of most cellular links, which
can provide sequencing and timing information and make packet loss
detection possible.

3. Requirements on 0-byte RTP Header Compression

Since 0-byte header compression for ROHC IP/UDP/RTP is a variant of
regular ROHC RTP compression [ROHC], these requirements are described
as deltas to those defined in the regular RTP requirements [RTP-REQ].
For simplicity, this section is also separated into the same three
subsections as the requirements in [RTP-REQ], where the first deals

with the impact of header compression on the rest of the Internet
infrastructure, the second concerns the headers to be compressed, and
the third covers efficiency and link technology related issues.

3.1. Impact on Internet Infrastructure

The meaning of header compression is in no way changed by the
introduction of 0-byte header compression. No additional impact on
the Internet infrastructure is thus allowed. The "Transparency" and
"Ubiquity" requirements of [RTP-REQ, section 2.1] therefore also
apply to 0-byte RTP compression without any modifications.

3.2. Supported Headers and Kinds of RTP Streams

The 0-byte RTP compression scheme in general imposes the same
requirements on supported headers and RTP streams as regular ROHC RTP
[RTP-REQ, section 2.2]. However, there are some aspects regarding
the "Genericity" and IPSEC requirements that should be noted.

The "Genericity" requirement of [RTP-REQ] states that compression of
headers of arbitrary RTP streams must be supported, and this is also
true for the 0-byte compression scheme to the extent that it is not
allowed to assume certain RTP behavior. However, as also stated in
[RTP-REQ], this does not preclude optimizations for certain media
types where the traffic pattern is known. For 0-byte RTP, this means
that the scheme must be able to handle arbitrary RTP streams in order
to fulfill the requirements of section 3.1. However, due to the
typical characteristics of 0-byte compression, by requiring a traffic
pattern that suits the link over which it is implemented to be able
to compress down to 0-byte headers, it becomes optimized for
applications with link-suited traffic patterns. For traffic that
does not comply with the link properties, the scheme must
automatically and immediately fall back to non-0-byte RTP compression
and must not have any impact on the packet stream.

Regarding IPSEC, it should be noted that 0-byte compression cannot be
achieved if parts of the original headers are encrypted or carry
randomly changing fields. IPSEC and 0-byte RTP header compression
therefore do not go well together. If IPSEC is used and prevents 0-
byte compression, the scheme must fall back to a less efficient
compression that can handle all present header fields. Of course,
this applies not only to IPSEC but to all cases where headers cannot
be compressed down to 0-byte.

3.3. Performance Issues

   All the performance requirements of [RTP-REQ] also apply to 0-byte
   RTP header compression, with the following additions and exceptions:

   - Performance/Spectral Efficiency: For packet streams with traffic
      patterns that match the characteristics of the link over which 0-
      byte header compression is implemented, the performance should be
      such that 0-byte header packets are generated during normal
      operation, most of the time. 0-byte headers would then replace
      most of the 1-octet headers used by regular ROHC RTP [ROHC].

      Justification: Spectrum efficiency is a primary goal. Studies
      have shown that for certain applications and link technologies,
      even a single octet of header may result in a significant decrease
      in spectrum efficiency, compared to existing circuit switched
      solutions.

   - Header Compression Coexistence: The scheme must fit into the ROHC
      framework together with other ROHC profiles.

      Justification: Implementation simplicity is an important issue and
      the 0-byte RTP compression scheme should therefore have as much as
      possible in common with the regular IP/UDP/RTP profile.

   - Unidirectional links: It is of less importance that the 0-byte
      header compression scheme be able to also work over unidirectional
      links.

      Justification: 0-byte header compression targets links that
      typically are bi-directional.

4. IANA Considerations

   A protocol which meets these requirements, e.g., [LLA], will require
   the IANA to assign various numbers. This document by itself,
   however, does not require any IANA involvement.

5. Security Considerations

   A protocol specified to meet these requirements, e.g., [LLA], may
   have a number of security aspects that need to be considered. This
   document by itself, however, does not add any security risks.

6. References

   [RTP-REQ] Degermark, M., "Requirements for robust IP/UDP/RTP header
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7. Author's Address

   Lars-Erik Jonsson
   Ericsson AB
   Box 920
   SE-971 28 Lulea
   Sweden

   Phone: +46 (920) 20 21 07
   Fax: +46 (920) 20 20 99
   EMail: lars-erik.jonsson@ericsson.com

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