

ROHC IMPLEMENTATION COMPATIBILITY

JONATHAN GRAEFE NETWORKS AND SYSTEMS
ENGINEER

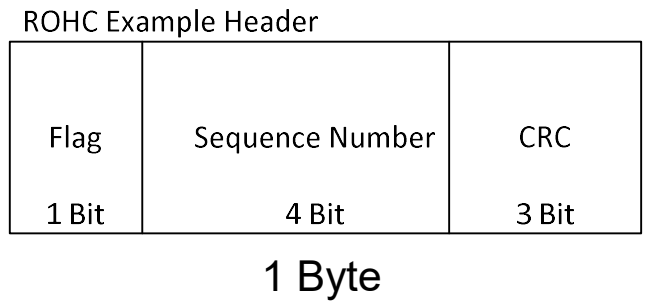
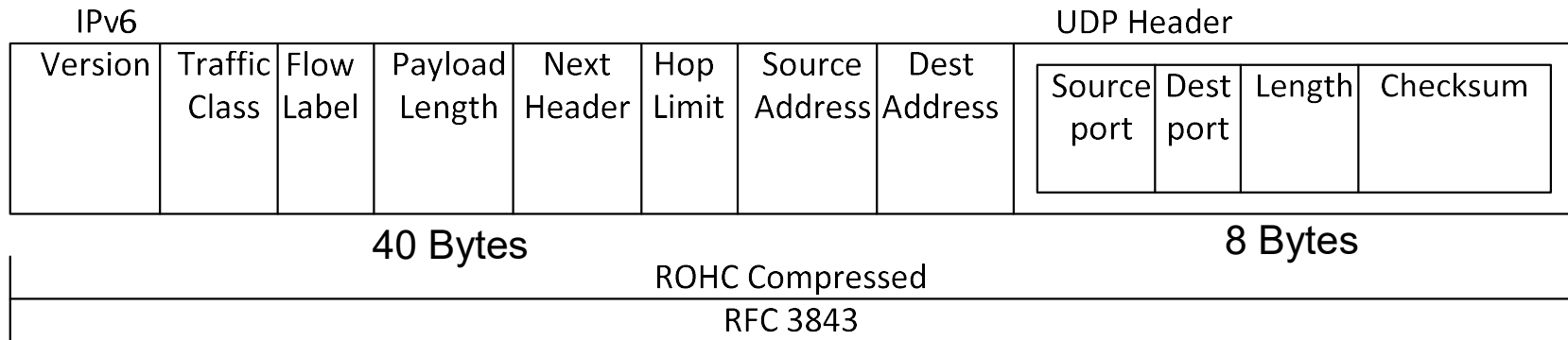


© 2020 Collins Aerospace
This document is not controlled under EASA/Eurocontrol regulations but may contain controlled technical data in other jurisdictions. | Collins Aerospace proprietary.

ROHC

- ROHC – Robust Header Compression (RFC 5795, 5225, 2460, 4995, 3843)
- Concept is most of the IP and UDP headers do not change from one packet to the next, so rather than repeat the redundant information for every packet, simply send a reference ID shared between the compressor and decompressor, allowing the decompressor to replace the static information back into the packet.
- Reduces the overhead signaling for IP/UDP packets over the RF.
- Can be expanded to include TCP/IP, RTP/UDP/IP, UTPLite/IP, etc.
- Currently used by 4G LTE and 5G Cellular Networks
- Can approach 98% effective header compression in ideal situations

ROHC EXAMPLE COMPRESSION



This example is
98% header
compression

THE EXPERIMENT

- Using two different implementations of ROHC, one representing the aircraft the other the ground. Prove that ROHC compression is still possible.
- Selected ROHC-Lib and didier-barvaux rohc.
 - ROHC-Lib was selected because it has a known non-critical bug. ROHC-lib forces K and N values to be the same, effectively forcing an error message for every missed decompression.
 - Didier-barvaux chosen because it is a more robust implementation of ROHC
- We ran the experiment 3 ways:
 - ROHC-lib on ground and aircraft
 - ROHC-lib on ground with aircraft running Didier-barvaux
 - Didier-barvaux on ground with aircraft running ROHC-Lib

EXPERIMENT PARAMETERS

- IP address of Aircraft and ground randomized for every run
- Packets exchanged per simulation
 - 1 million to represent convergence values.
 - 100 packets to represent a more realistic scenario.
- Simulations ran several times to verify similar results
- The Layer 2 transmission media is imperfect and fails to catch some bit errors.
- Layer 3 BER of 1×10^{-4} after compression or one out of every 10,000 packets has at least one bit flipped.
 - Realistically this consistent error rate, would cause suspicion that an offending signal is interfering with safety of flight transmissions.
- Assume both Aircraft and Ground seek to reach ROHC optimistic mode as quickly as possible.

RESULTS

- Two different ROHC implementations can communicate with each other
- Compression ratio stayed the same, regardless of implementation
- Bit errors did cause some degradation in average packet compression gain, this was due to retransmissions, however this only caused a 4% decrease from theoretical in header compression gain.
- Header Compression:
 - Header compression reached 94% in all million packet examples
 - Header compression reached 92% in all 100 packet examples
- In general, the first packet had no compression (Initial state), the second and third had 79% compression (Reliable mode) and all remaining packets approached 94% compression (Optimistic mode)
- Total packet compression (Data + Header): 12-13%
- Average Data size 533 Bytes (Packet length generated randomly)

CONCLUSIONS

- Header compression was possible using mixed implementations of ROHC RFCs
- Given slightly worse than expected normal conditions:
 - 93 - 94% header compression was possible with all implementations
 - 12-13% total packet compression was possible given unusually large average packet size.
- Total Packet compression will be higher with smaller packets.
- Total header compression should go higher with less noise at Layer 3.
- 10X-4 BER at layer 3 is higher than expected if the Layer 2 CRC and integrity checks worked as expected.
- ROHC is possible in the aviation environment with different implementations and will yield 90%+ header compression in less-than-ideal conditions.

RESULTS ROHC-LIB ONLY

BOTH GROUND AND AIR USE ROHC-LIB

- Total Packet Count 1,000,000
 - Packet Failed count 2250
 - Total Bytes transmitted 526,735,474
 - Total Bytes Failed 1,154,286
 - Compressed Data loss rate: 2.19×10^{-3}
 - Average Header Compression Gain: 94%
 - Average Packet Compression Gain: 12%
- Total Packet Count 100
 - Packet Failed count: 0
 - Total Bytes transmitted: 50587
 - Total Bytes Failed: 0
 - Compressed Data loss rate: 0
 - Average Header Compression Gain: 92%
 - Average Packet Compression Gain: 13%

ROHC-LIB AND DIDI

AIR USES ROHC-LIB AND GROUND USES DIDI

- Total Packet Count 1,000,000
 - Packet Failed count 2282
 - Total Bytes transmitted 526,528,741
 - Total Bytes Failed 1,193,598
 - Compressed Data loss rate: 2.27×10^{-3}
 - Average Header Compression Gain: 94%
 - Average Packet Compression Gain: 12%
- Total Packet Count 100
 - Packet Failed count: 0
 - Total Bytes transmitted: 52855
 - Total Bytes Failed: 0
 - Compressed Data loss rate: 0
 - Average Header Compression Gain: 92%
 - Average Packet Compression Gain: 13%

DIDI AND ROHC-LIB

AIR USES DIDI AND GROUND USES ROHC-LIB

- Total Packet Count 1,000,000
 - Packet Failed count 2287
 - Total Bytes transmitted 526,720,699
 - Total Bytes Failed 1,200,287
 - Compressed Data loss rate: 2.28×10^{-3}
 - Average Header Compression Gain: 94%
 - Average Packet Compression Gain: 12%
- Total Packet Count 100
 - Packet Failed count: 0
 - Total Bytes transmitted: 51729
 - Total Bytes Failed: 0
 - Compressed Data loss rate: 0
 - Average Header Compression Gain: 92%
 - Average Packet Compression Gain: 13 %