

RObust Checksum-based header COmpression (ROCCO)

Lars-Erik Jonsson

Ericsson Research, Sweden

lars-erik.jonsson@ericsson.com

RobHC BOF

1999-11-09

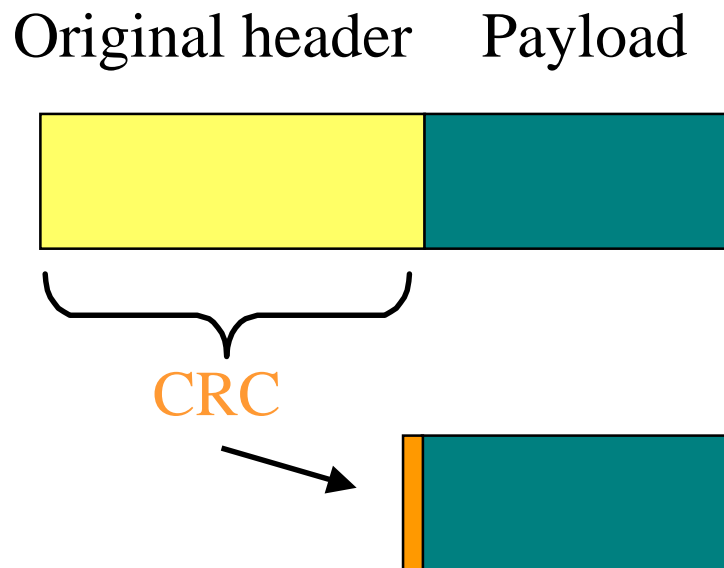
A new robust header compression scheme - Requirements

- **At least the same compression efficiency as CRTP (compressing the headers down to 2 octets)**
- **A high degree of robustness against packet loss over the compressed hop (the scheme must tolerate some lost header information without the context being invalidated)**
- **Large round-trip times must NOT significantly affect the performance of the scheme**

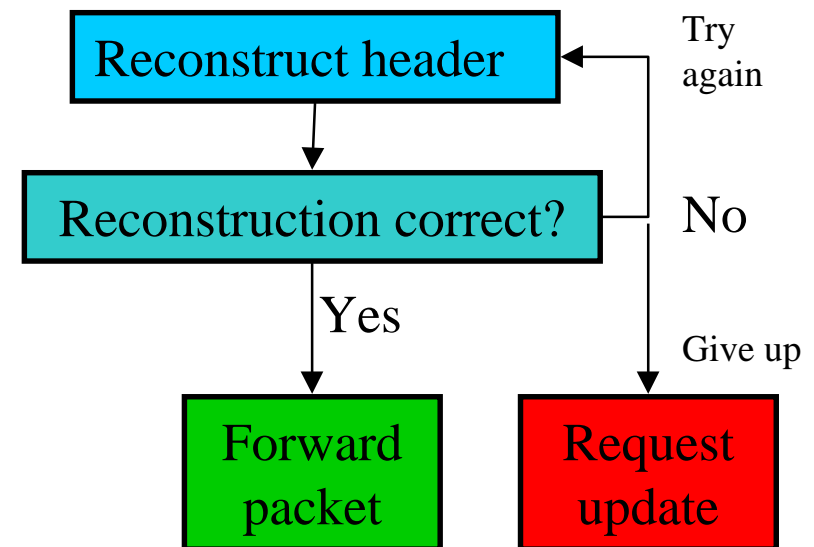
ROCCO - General principles

- Heavily geared towards local de-compressor context repairs
- Based on header reconstruction attempts and verification of reconstructed headers at the de-compressor side
- Reconstruction verification made with a HC internal CRC covering the original packet header.

Compressor



De-compressor

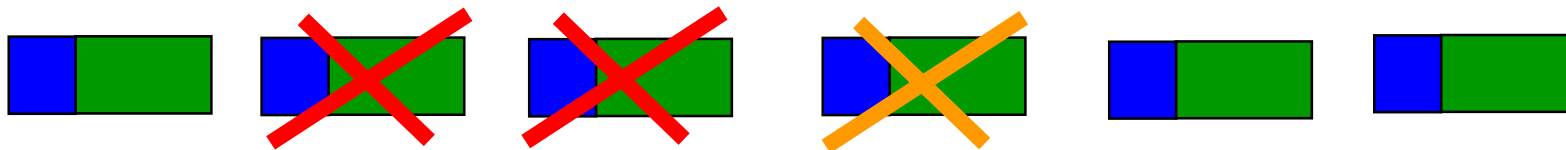


ROCCO - Compression profiles

- **Makes ROCCO flexible and possible to optimize to the characteristics of the:**
 - Link it is used over
 - Packet stream(s) it compresses
 - ◆ Requires mechanisms for Separation, Identification and Classification of different packet streams.
- **Parameters for profile design:**
 - The rate and pattern of losses over the link
 - Support from link layer; number of packet streams per channel and identification of packet types
 - The rate and pattern of losses before the compression point
 - What kind of packet streams to compress (IPv4, IPv6, RTP, etc)
 - The pattern of change for the various changing header fields

ROCCO - Profiles for IP-Telephony packet streams 1(2)

- Robust encoding of sequence numbers ensures that the context state is kept consistent even after 2 (or 3) consecutive packet losses



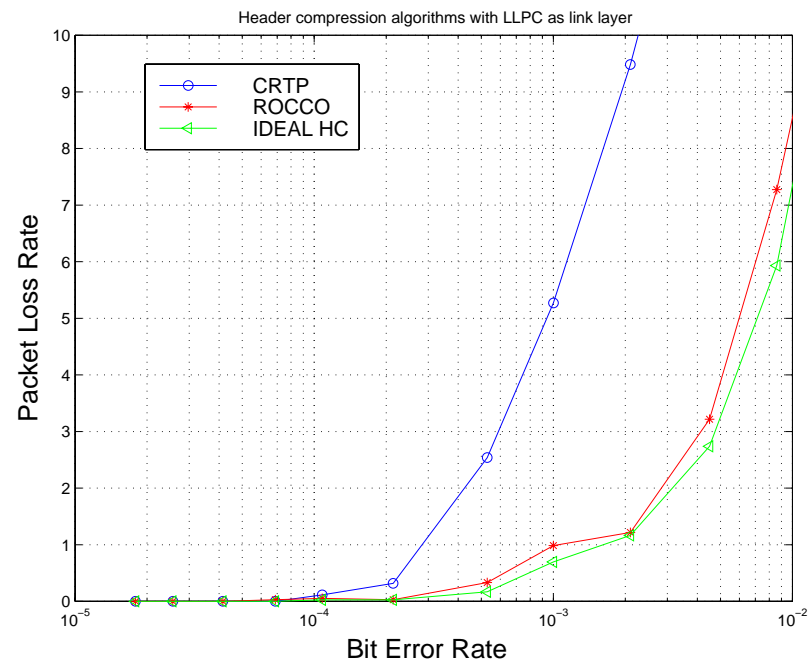
- What if more than 2 (or 3) consecutive packets are lost then?
 - Very rare case!
 - Use similar error recovery mechanism as CRTP, i.e. request for a context state update

ROCCO - Profiles for IP-Telephony packet streams 2(2)

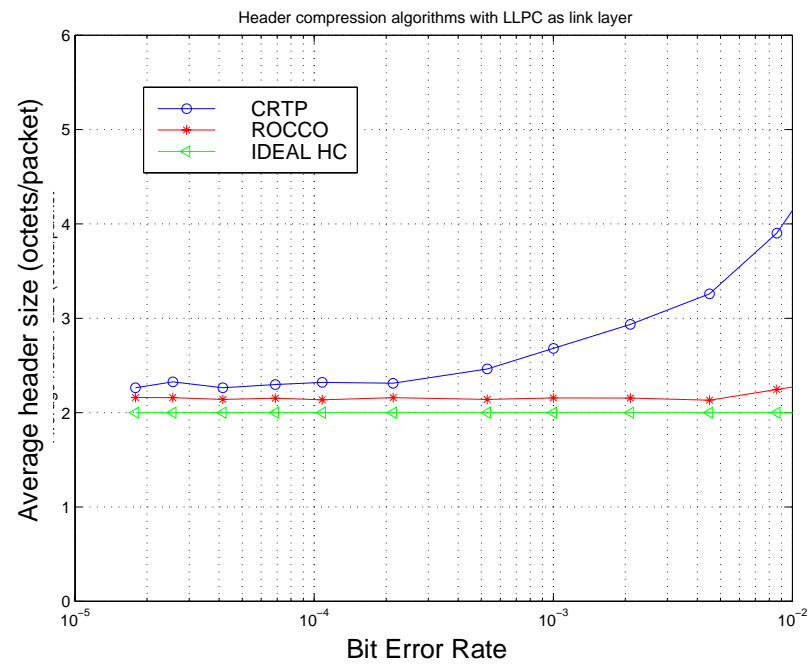
- **Capabilities of current ROCCO profiles for IP-Telephony**
 - Support for IP version 4 and 6
 - Compression of 1, 28 or 256 concurrent packet streams
 - Various mechanisms to efficiently handle different behaviors of the IPv4 Identification field
 - Can handle streams with UDP checksum disabled or enabled

- **Compression efficiency**
 - Compresses down to 2 octets when the UDP checksum is disabled, even with multiple concurrent packet streams
 - Saves 1 octet on the link-layer when packet-type identification is performed at header compression level

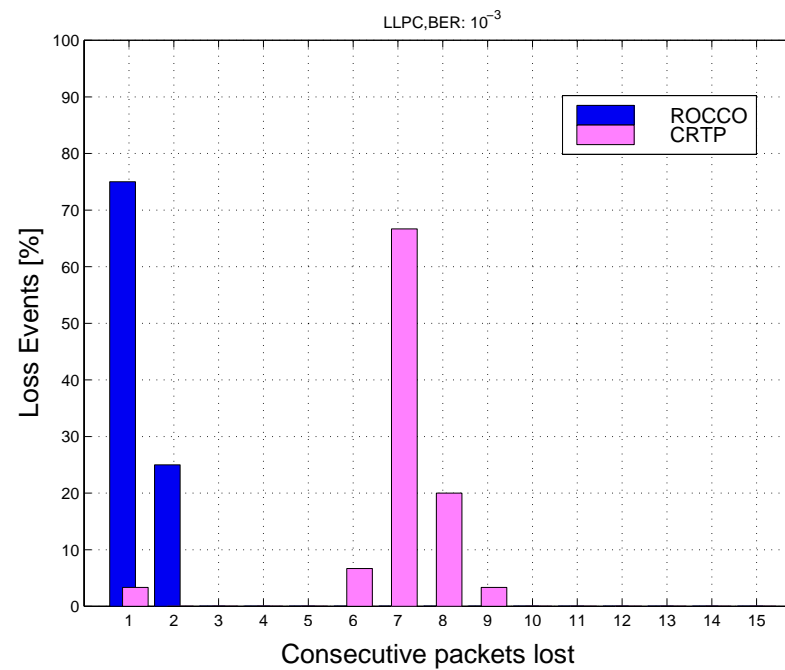
Performance results of ROCCO: Packet loss rate



Performance results of ROCCO: Header sizes

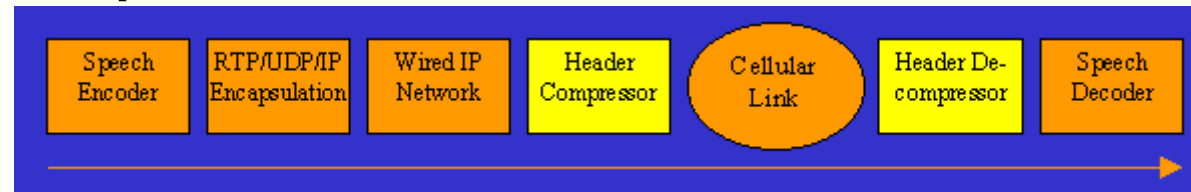


Performance results of ROCCO: Loss distribution



Implementation & Demonstration

- 4 audio snapshots from a Testbed environment



- CRTP and ROCCO
- The cellular link
 - WCDMA channel
 - No Link-Layer ARQ (Automatic Retransmission Request)
 - BER (Bit Error Rate) after channel coding : $1e-3$
 - RTT (Round-Trip Time) : 100 ms
- Speech encoder/decoder
 - GSM-EFR (Enhanced Full-Rate)
 - Bit-rate : 12.2 kb/s
 - Packet interval : 20 ms

Demonstration

CRTTP

Demonstration

ROCCO

Current ROCCO work

- **The current, improved ROCCO version (02) must be implemented in the Testbed**
- **IP-Telephony profiles compressing the headers down to 1 octet are being developed**

Documentation and contacts

- **ROCCO Homepage**

 - ◆ <http://www.ludd.luth.se/users/larsman/rocco>

- **Internet-Draft**

 - ◆ [draft-jonsson-robust-hc-02.txt/ps](#)

- **Authors**

 - ◆ **Lars-Erik Jonsson** lars-erik.jonsson@ericsson.com
 - ◆ **Mikael Degermark** micke@sm.luth.se
 - ◆ **Hans Hannu** hans.hannu@ericsson.com
 - ◆ **Krister Svanbro** krister.svanbro@ericsson.com

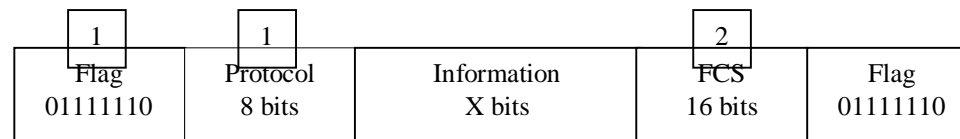
Extra slide 1 - An ideal header compression scheme

- **Introduced and defined for comparison purposes.**
- **Performs like CRTP would do if used over error-free links to compress input data without irregular changes in its header fields.**
- **Characteristics of the scheme are:**
 - ◆ **The compressed header is always two octets.**
 - ◆ **No packets are lost due to context damage.**
 - ◆ **De-compressor context do not need to be initialized.**

Extra slide 2 - Used link layers

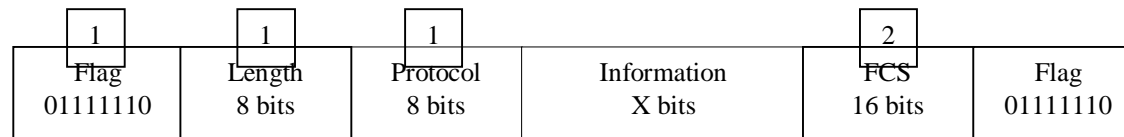
● PPP in HDLC-like framing (HDLC)

- ◆ FCS (checksum) covers protocol and the entire information field
- ◆ Any errors anywhere in the frame will cause the FCS to fail and the frame will be discarded

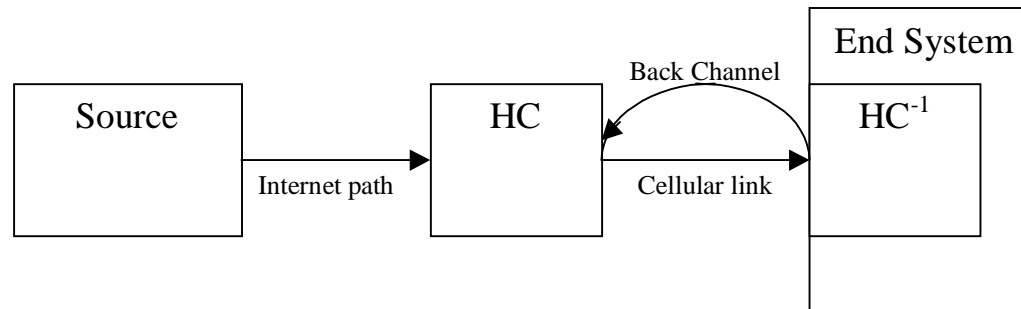


● Link layer with partial checksum (LLPC)

- ◆ FCS (checksum) covers an optional part of the Information field, indicated by the length field.
- ◆ Errors in the remaining part of the Information field will not cause the frame to be discarded



Extra slide 3 - Simulated scenario



- **Source**
 - ◆ Generates RTP packets containing speech data.
- **Speech Source**
 - ◆ Payload: 16 octets, 20 ms of sound data.
 - ◆ Exponentially distributed talk spurts and silence intervals with expected lengths of 1 second.
- **Cellular Link**
 - ◆ WCDMA channel.
- **Back channel**
 - ◆ Gives an RTT of approximately 120 ms.
- **Resulting frame-error-rate = Packet loss rate due to link-layer loss and header de-compressor loss.**