Can Beacons be Compressed to Reduce the Channel Load in Vehicular Networks?

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- CAM structure and format
- Evaluation
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Introduction

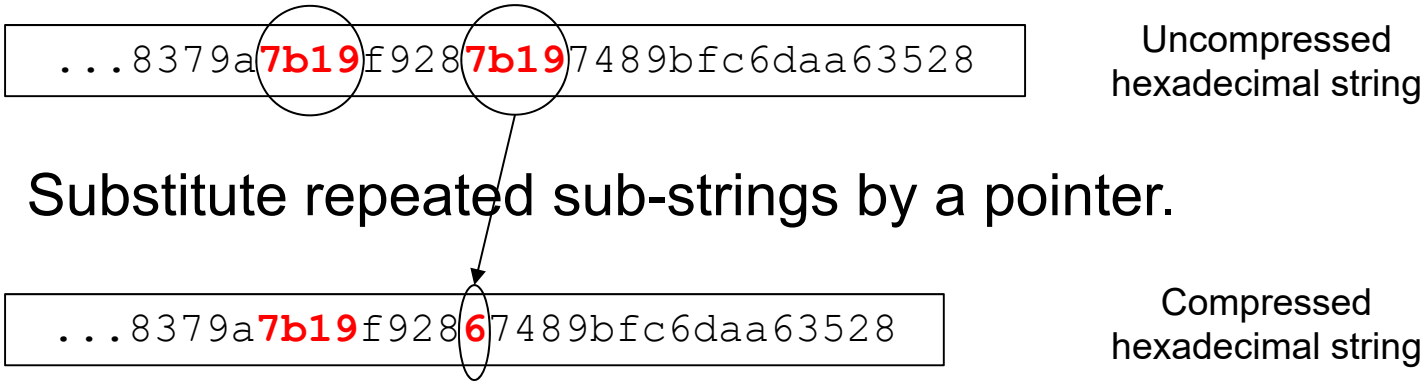
- Significant efforts to design congestion control algorithms.
  - Adapt communication parameters (e.g. power, rate…).
- Data compression: alternative approach to reduce the load.
  - Used in e.g. HTTP to improve bandwidth utilization.
- Proposal: compress/decompress V2X messages.
  - Objective: reduce the load without affecting tx range.
  - Integration in ETSI/WAVE architectures at Facilities.

Introduction

- Compression gain depends on data size and type.
  - Text files can be significantly compressed.
  - V2X messages have a small size (hundreds of bytes).
- V2X devices have limited processing power.
  - Strict latency requirements to compress/decompress.
- Study compression gain and time to compress/decompress.
  - CAM (Cooperative Awareness Message).

Data compression

- Gzip and Compress.
  - Universal lossless data compression tools.
  - Open-source solutions widely used.
- Both are based on the Lempel-Ziv algorithm.
  - Look for repeated sub-strings in the data.



  - Substitute repeated sub-strings by a pointer.
- Need to consider real data to analyze compression gain.

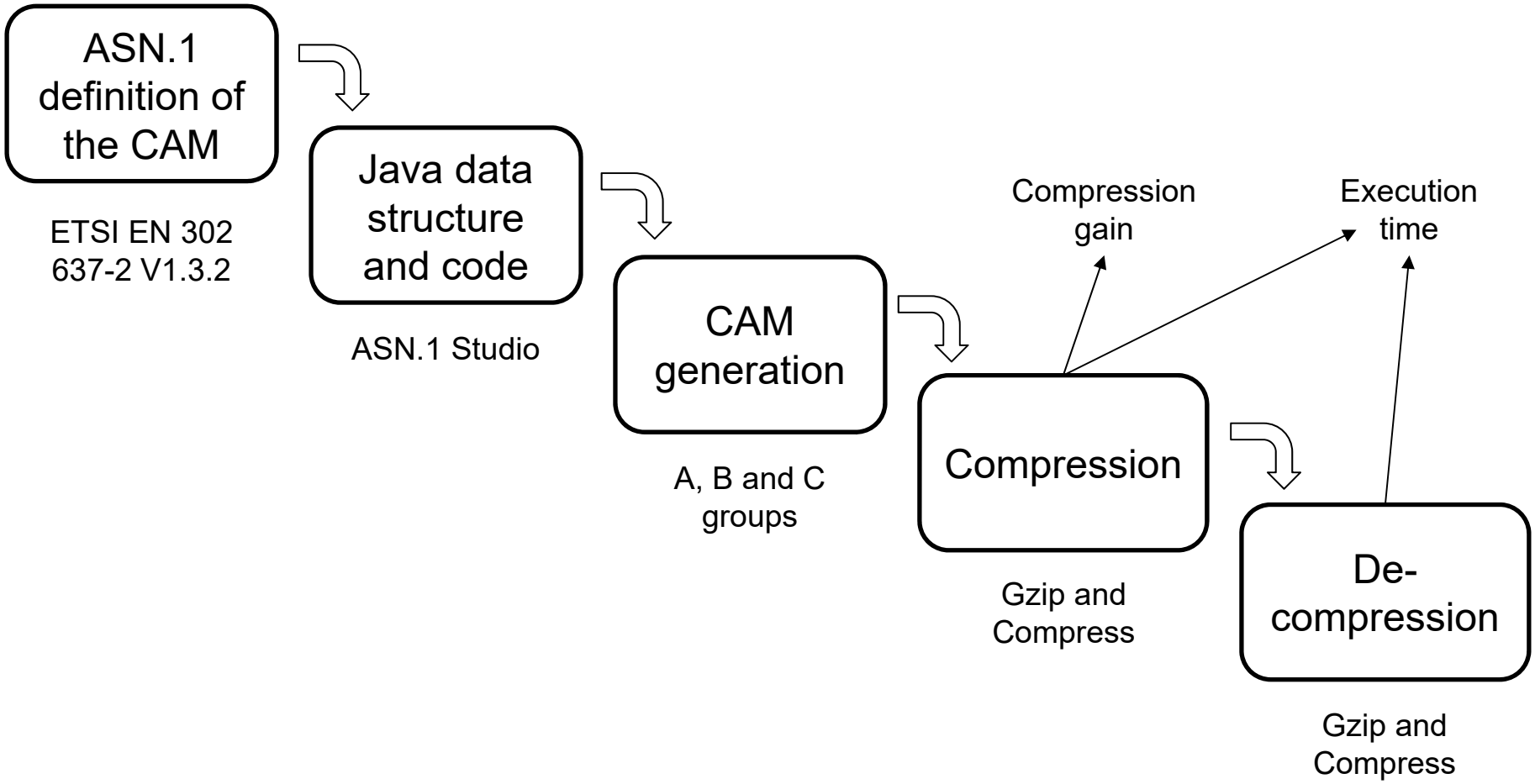
CAM structure and format

- CAMs composed by common header and multiple containers.
  - ITS PDU Header and Basic/High/Low/Special containers.
  - Header and Basic are mandatory and the rest are optional.

- Generation and classification of CAMs in 3 groups:
  - Group A: Basic/High frequency containers (~136 Bytes).
  - Group B: Basic/High/Low frequency container (~195 Bytes).
  - Group C: Basic/High/Low/Special container (~268 Bytes).

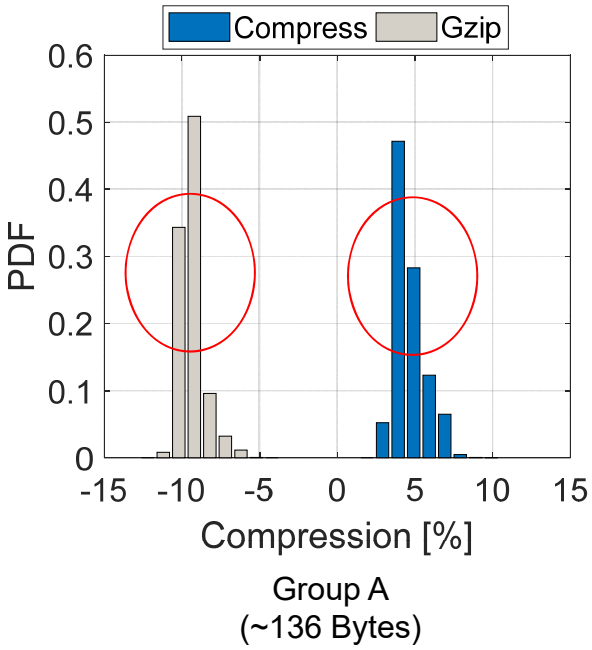
Evaluation

- Methodology

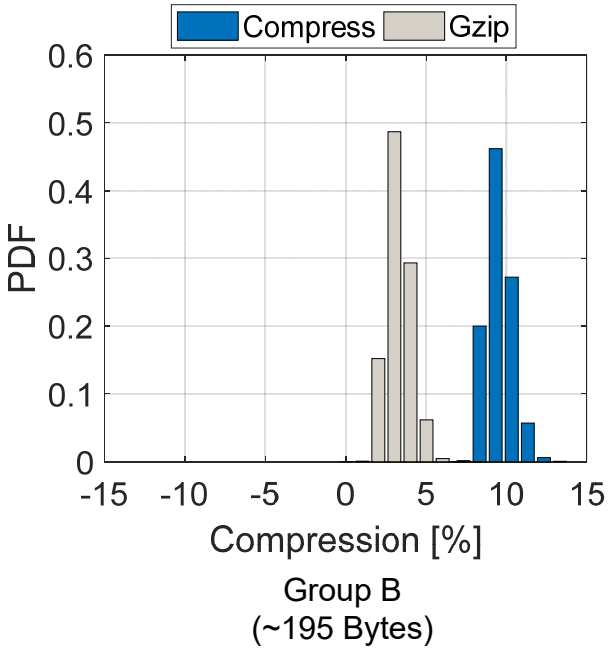


Evaluation

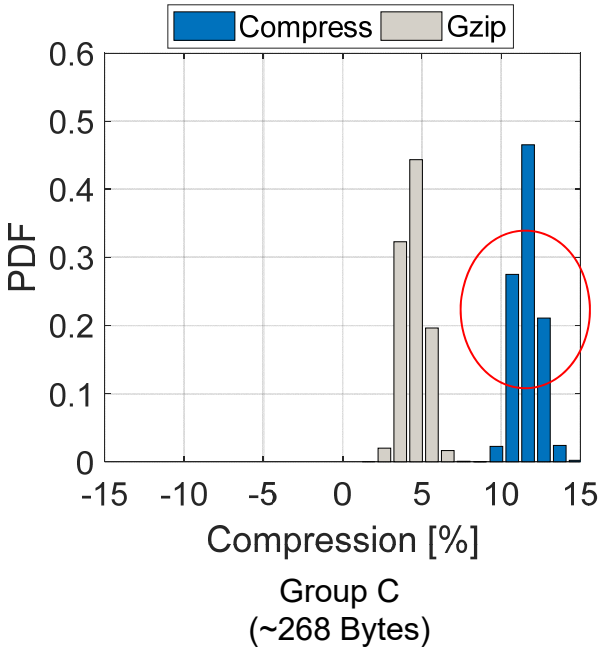
- Compression gain
  - Small CAMs result in low or no compression gain.
  - Compression gain depends on size and content.
  - Compression gain up to 14% with Compress.



Group A
(~136 Bytes)



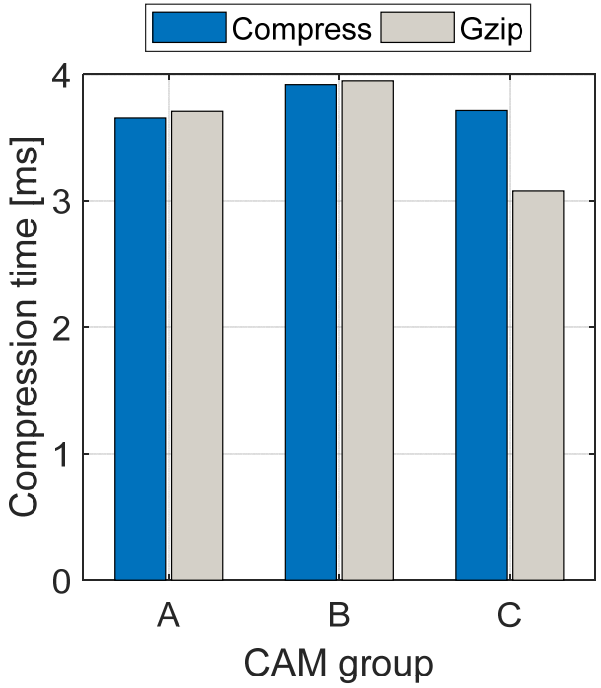
Group B
(~195 Bytes)

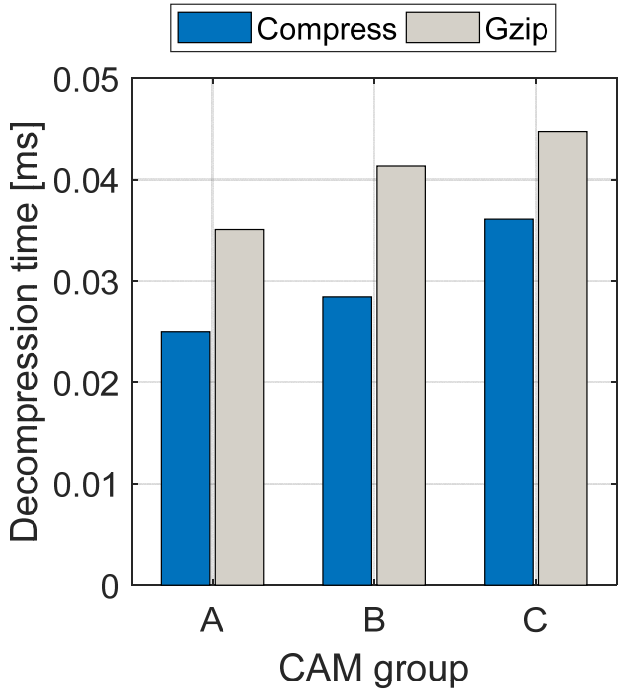


Group C
(~268 Bytes)

Evaluation

- Compression and decompression times
  - Compression is fast compared to CAM generation period.
  - Decompression of 2200-4000 CAMs per second.
    - Around 1200 CAMs/sec. needed for a channel load of 60%.





Conclusions

- Compression of V2X messages.
  - Potential reduction of the load without affecting tx range.
- Exploratory study considering CAMs.
  - Compression gain up to 14%.
  - Compression/decompression are sufficiently fast.
- Future work
  - Optimize configuration and remove unnecessary headers.
  - Study other compression algorithms and messages.
  - Evaluate channel load reduction in network simulator.

Thank you for your attention

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