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FlexRay/Ethernet Transport Protocol Concept

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Overview

- Motivation
- Introduction to FlexRay
- Automotive IEEE 1722 Subtype Proposal
- Next steps

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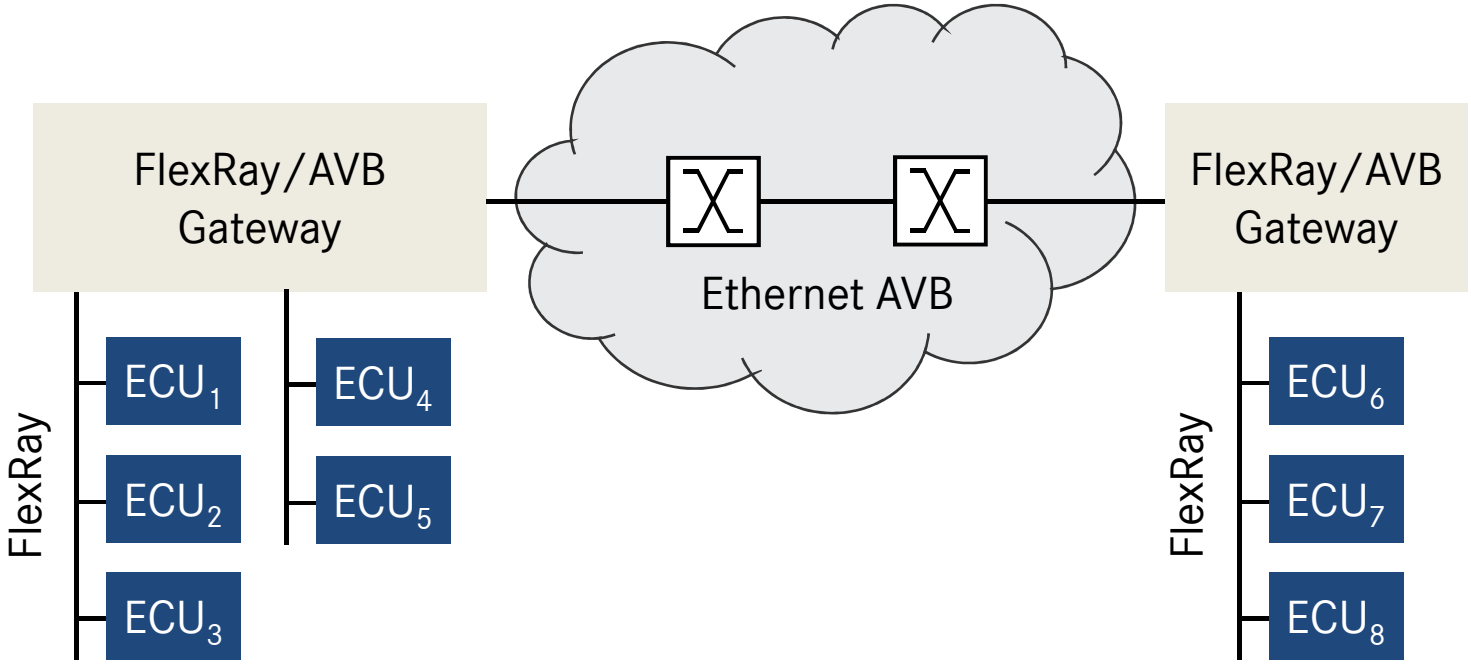
Motivation

FlexRay/Ethernet Transport Protocol

- "FlexRay use cases" with bandwidth demand >> 10 Mbit/s
- Ethernet AVB for transmitting real-time control data
- For migration and interworking purposes: FlexRay/AVB-Gateway and investigation of different transformation strategies from FlexRay to IEEE1722 and vice versa



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Motivation

Typical automotive control data transport via FlexRay

- require hard real-time constraints
- TDMA based transport (inherent time synchronization)
- multiple FlexRay clusters within a car with data rates of 10MBit/s each
- FlexRay cycle times 10µs – 16ms (5ms typically)
- 0-254 byte frame size
- message jitter < 2µs
- redundancy via a second transmit channel is supported
- provides real-time independent from bus load

FlexRay is currently not used as it has been designed

- Chance for Ethernet AVB to address use cases in chassis domain, e.g. driving assistance

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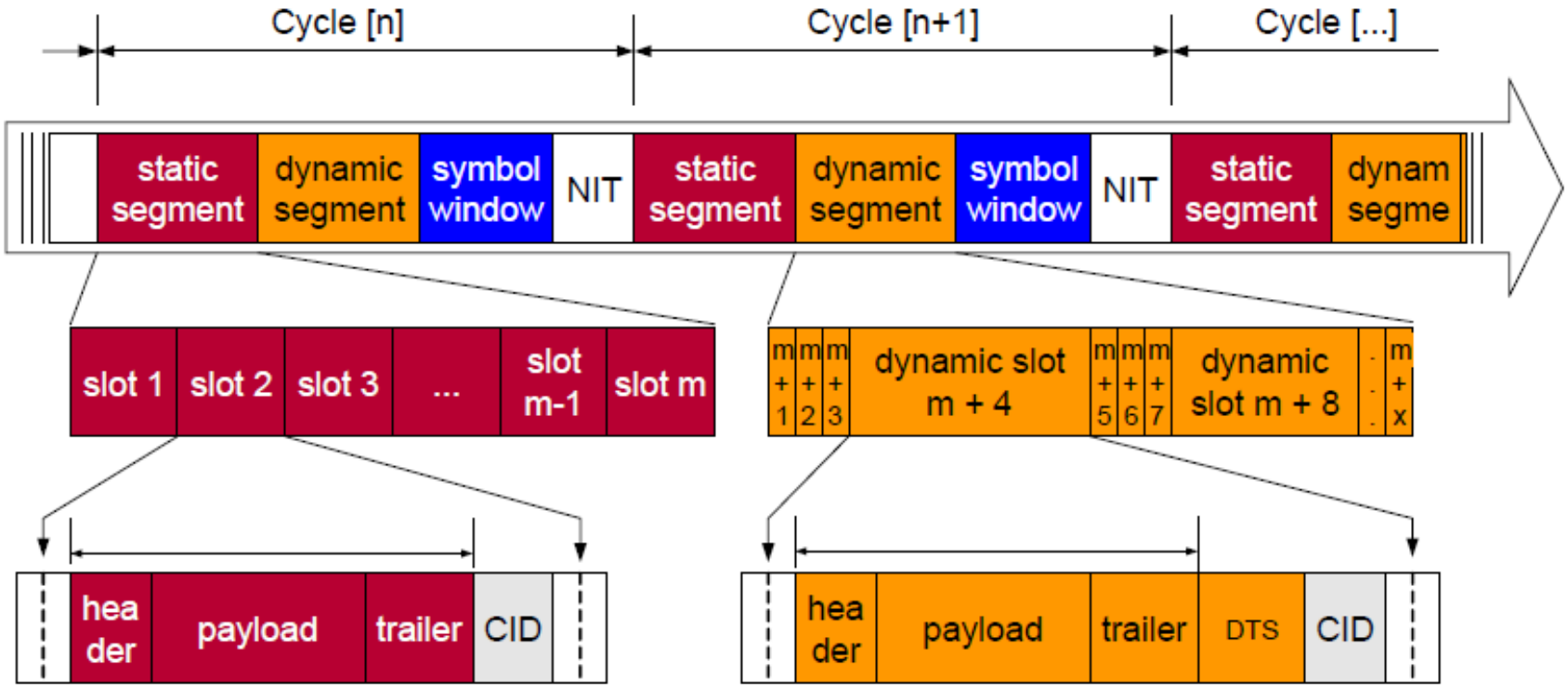
Frame Format

Introduction to FlexRay



Source: http://www.vector-informatik.de/

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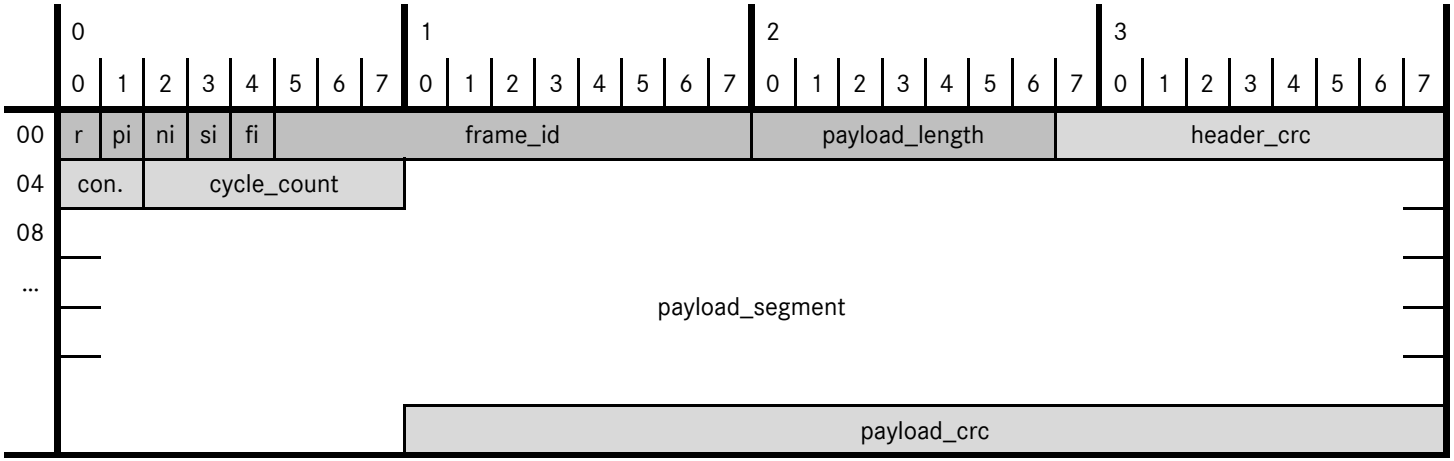
Frame Format

Introduction to FlexRay



- **r (reserved):** Reserved for future use. (set to 0_2)
- **pi (payload preamble indicator):** Indicates an optional vector contained within the *payload_segment*. (0 – not contain / 1 – contain)
- **ni (null frame indicator):** Indicates a null frame which doesn't contain usable data in the *payload_segment*.
- **si (sync frame indicator):** Indicates a sync frame.
- **fi (startup frame indicator):** Indicates a startup frame. Only cold start nodes are allowed to send startup frames.
- **frame_id:** Defines the slot in which the frame should be transmitted.
- **payload_length:** Determines the size of the payload_segment. The size is encoded to the number of *payload_segment* data bytes divided by two.
- **header_crc:** Contains a cyclic redundancy check code over the fields *si*, *fi*, *frame_id*, and *payload_length*.
- **cycle_count:** Indicates the transmitting node's view of the value of the cycle counter at the time of frame transmission.
- **payload_crc:** Contains a cyclic redundancy check code over the *payload_segment* field.

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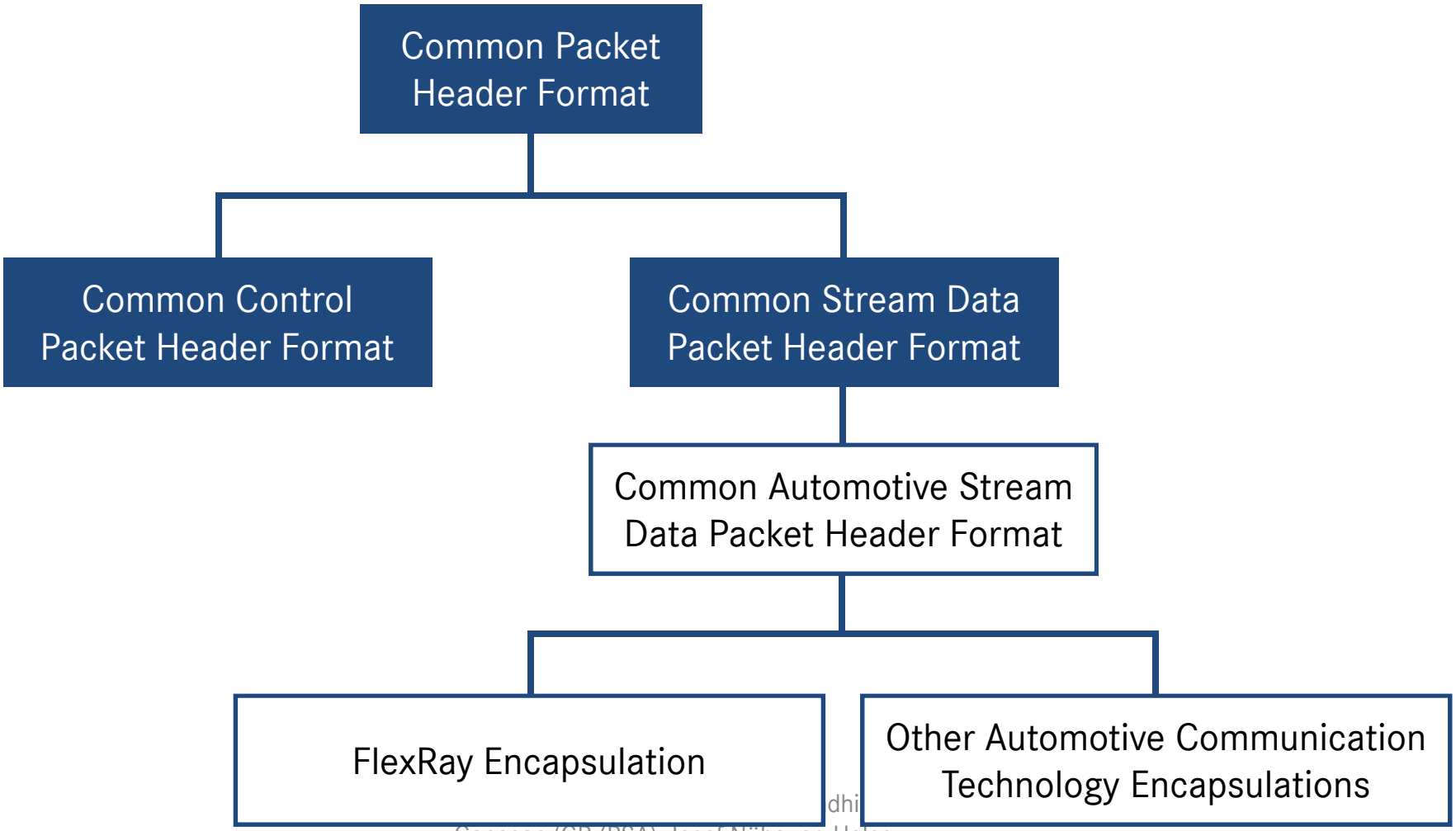
General Idea

Automotive IEEE 1722 Subtype Proposal



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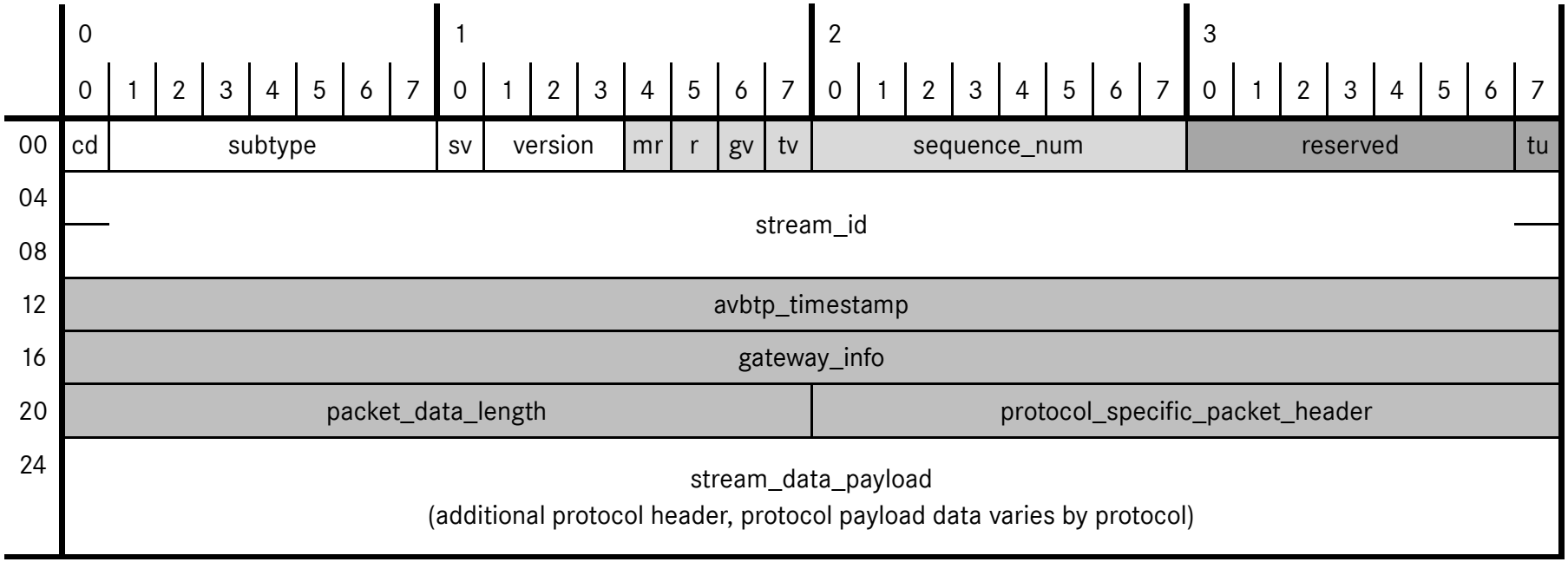
Common Stream Data Packet Header Format



- **mr (media clock restart):** Indicates a change in the source of the media clock. For example, when an audio/video input is changed from one source to another and the media clock is supplied by the talker. Uses a toggle mechanism to point out a media clock restart.
- **r (reserved):** Reserved for future use (set to 0_2)
- **gv (gateway_info valid):** Indicates the validity of the *gateway_info* field. A gateway is a device which transports streams between an Ethernet network and another type of network like a IEEE1394 network. (0_2 – invalid / 1_2 – valid)
- **tv (timestamp valid):** Indicates the validity of the *avbtp_timestamp* field (0_2 – invalid / 1_2 – valid)
- **sequence_num:** Indicates the sequence of AVBTP packets in a stream by a talker.

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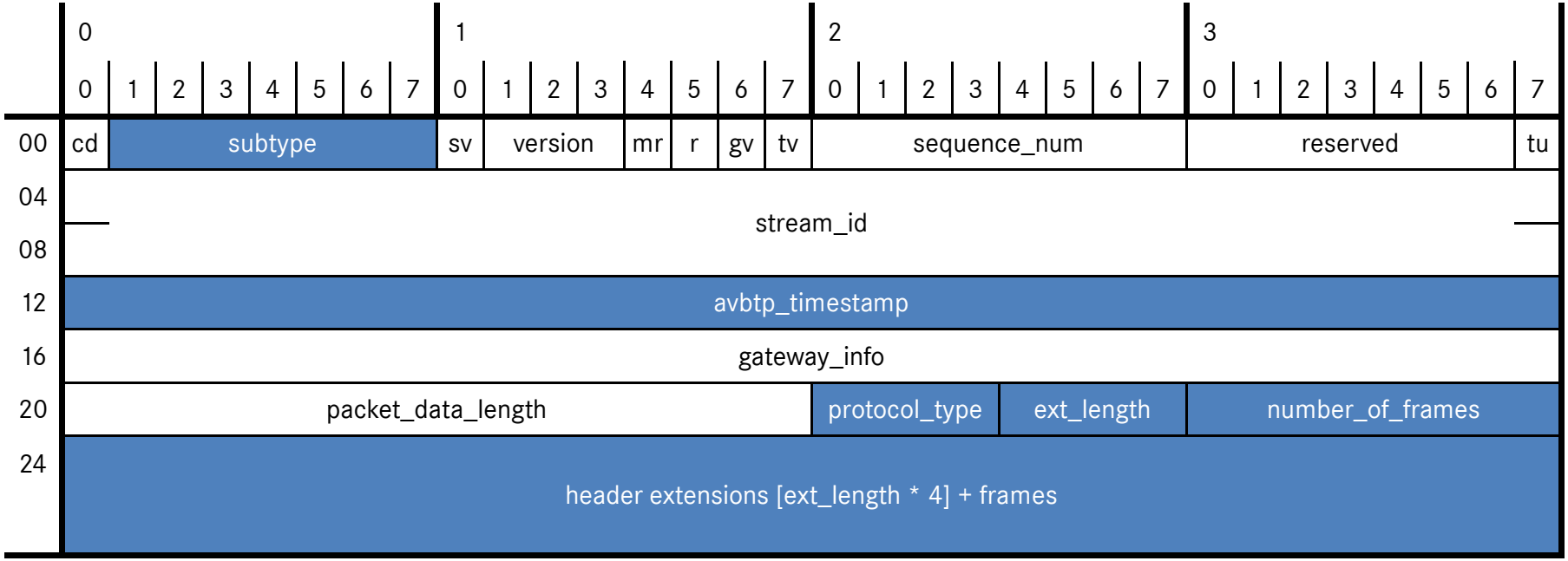
Common Automotive Subtype Header Format

Automotive IEEE 1722 Subtype Proposal



- **subtype:** Set to the Automotive subtype with identifier $??_{16}$.
- **avbtp_timestamp:** The exact definition depends on the *protocol_type*.
- **protocol_type:** Specifies the protocol type of the frames contained in the *stream_data_payload* field. For example CAN or FlexRay.
- **ext_length:** Determines the offset of the first frame in the payload field relative to the beginning of the *stream_data_payload* in bytes divided by four. Enables individual *protocol_type*-based header extensions of the common Automotive subtype header.
- **number_of_frames:** Determines the number of frames contained within the *stream_data_payload*.

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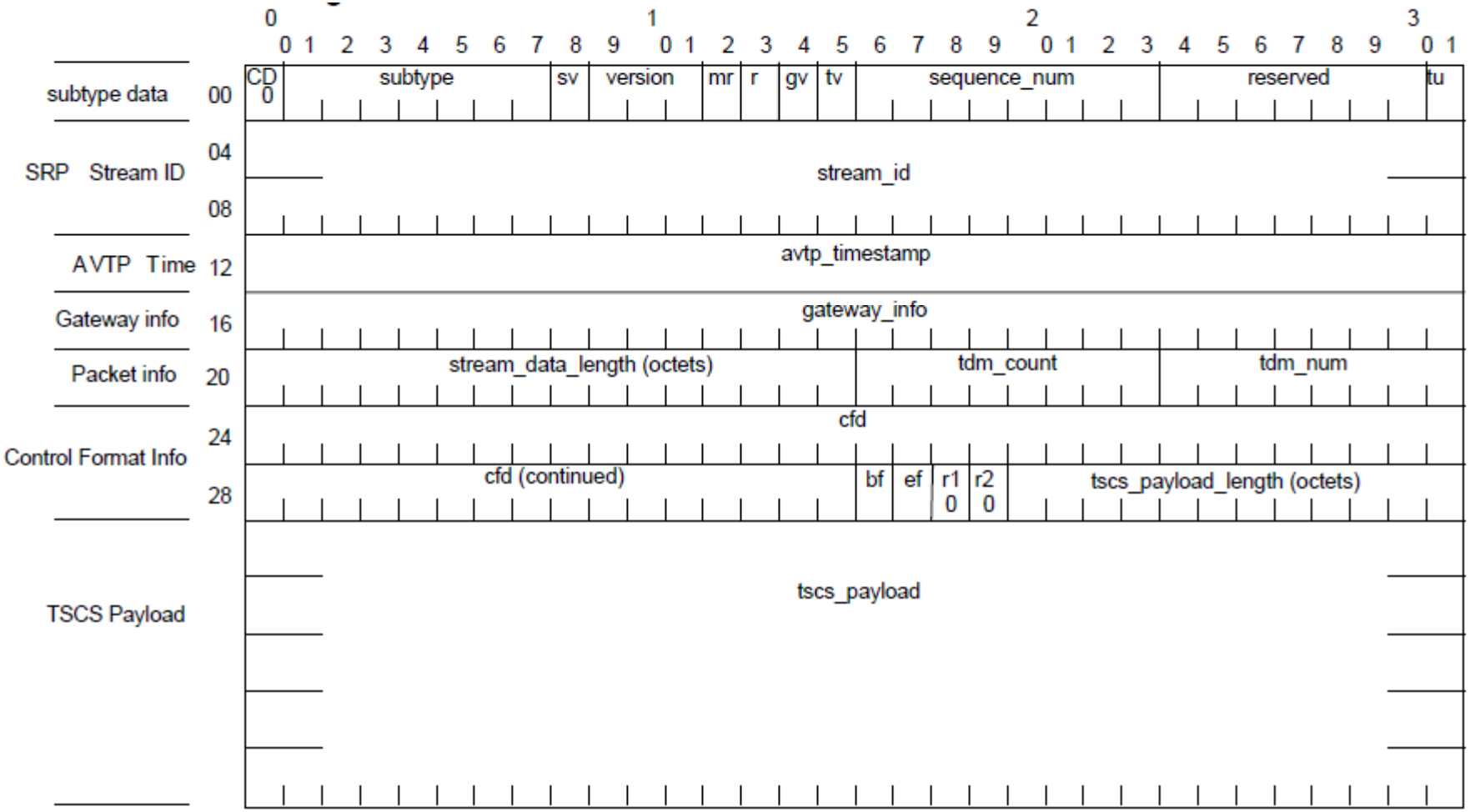
IEEE P1722A proposal

TSCS IEEE 1722 Subtype Proposal



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Status and Open points

Next steps

Current Status

- Demonstrator system with FlexRay cluster synchronized to the IEEE 802.1AS timing (AVB cloud)
- Implementation of automotive IEEE 1722 subtype proposal implemented

Open points

- Timestamp interpretation
- P1722A proposal for TSCS was not considered
- Transport protocol header (format, subtype, size)
- Payload header
- End to End latency needs to be improved (AVB Gen2)