



Bus Systems

Automotive Bus Systems – TT-CAN

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Learning objectives

- TT-CAN
 - Understand specifics of TT-CAN protocol
 - Understand differences between bit- and frame synchronization
 - Understand how time and event triggered messages are transmitted

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CAN Bus – TTCAN - introduction

- Time triggered variant of CAN bus protocol
- The TTCAN (time-triggered CAN) protocol (standardized in ISO 11898-4) is a higher layer protocol on top of the CAN (Controller Area Network) data link layer as specified in ISO 11898-1.
- Time-triggered communication means that activities are triggered by the elapsing of time segments.
 - In a time-triggered communication system all points of time of message transmission are defined during the development of a system.
 - A time-triggered communication system is ideal for applications in which the data traffic is of a periodic nature.

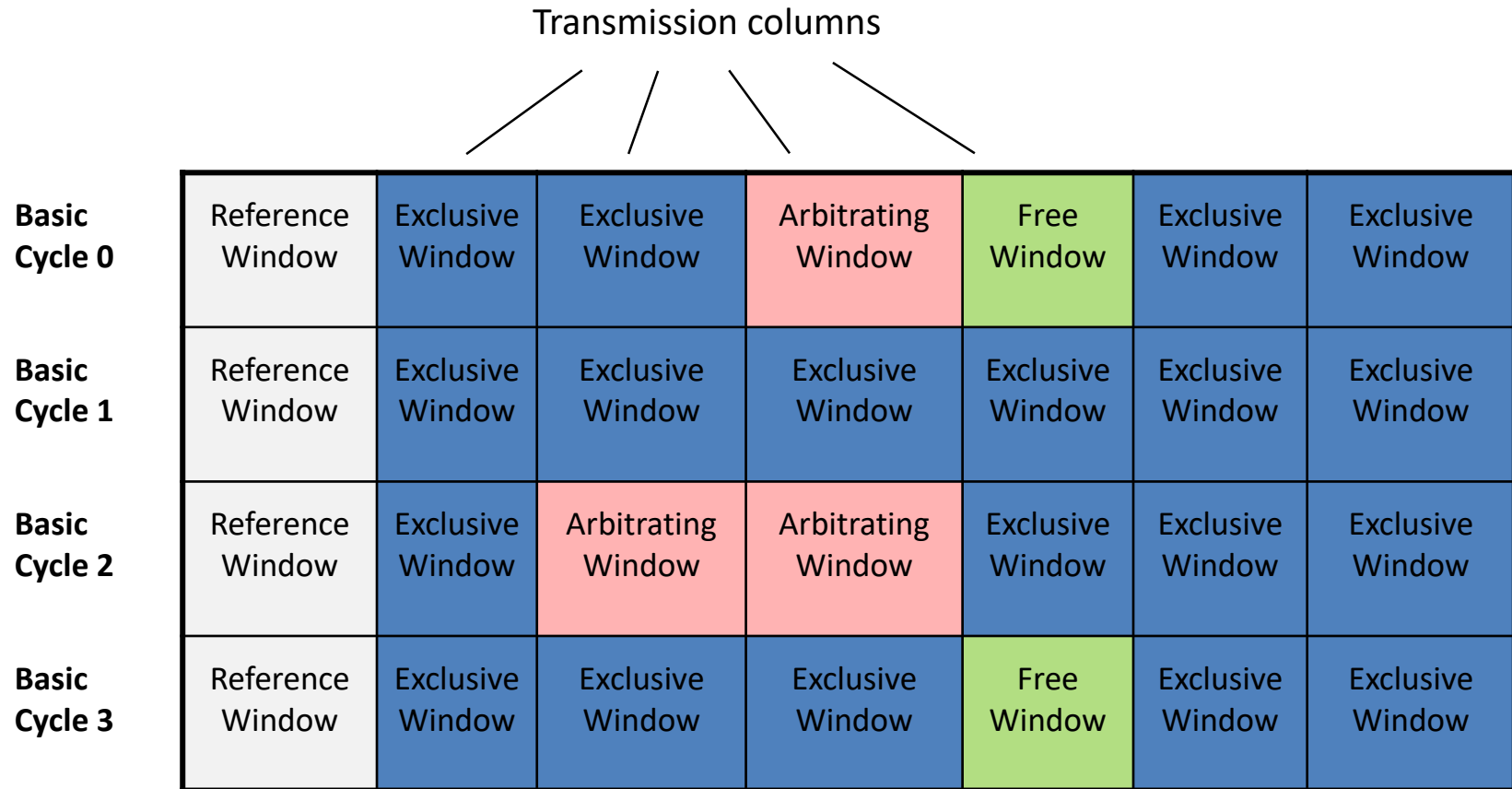
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CAN Bus – TTCAN - synchronization

- Additional frame level synchronization in addition to CAN bus bit level synchronization is necessary
- The time-triggered control and thus the synchronization of the involved control units within the TTCAN network are done via a reference message.
 - All participants of the TTCAN network identify the reference message by its identifier.
 - As soon as the first bit of the frame (Start of Frame: SOF) is recognized, the local time unit is synchronized.
 - The accuracy of the local time units depend only on the physical signal propagation of the bus line and is thus neglectable for frame level synchronization.
 - All TTCAN participants are configured to know when to send their frames after having received the reference frame.

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CAN Bus – TTCAN - overview



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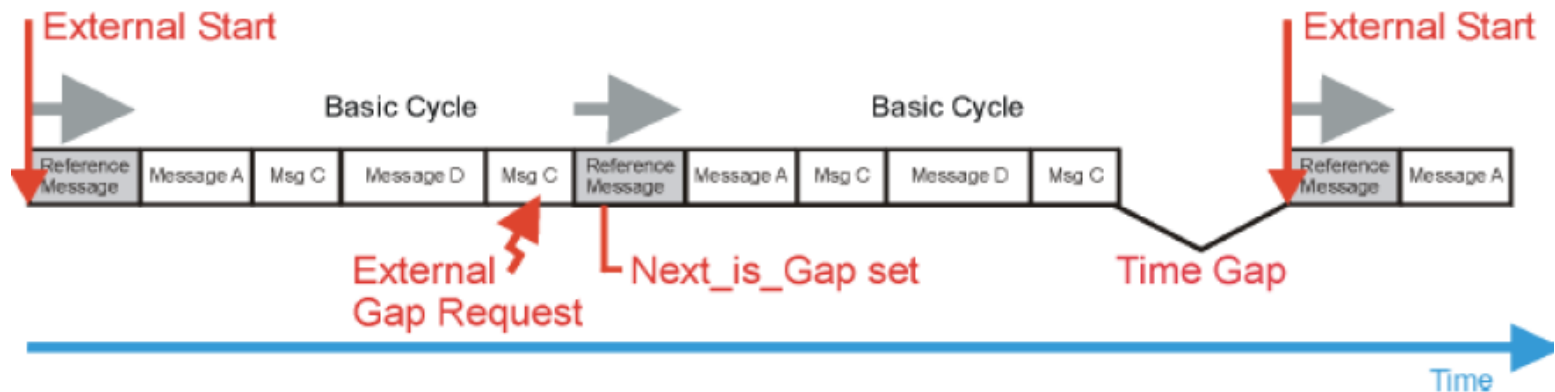
CAN Bus – TTCAN - synchronization

- The time between two reference frames is called the basic cycle.
 - Basic cycles are not always identical in order to be able to transmit messages at different periodic frequencies.
 - The system matrix comprises several basic cycles and is repeated indefinitely until the vehicle is turned off.

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CAN Bus – TTCAN - synchronization

- Event triggered communication in TTCAN
 - For some applications it is necessary that the reference frame is sent corresponding to an event.
 - For these cases a bit is inserted in the basic cycle, which discontinues the periodic transmission of messages until the event has taken place.
 - This is done e.g. to synchronize communication and motor rotation.



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CAN Bus – TTCAN - synchronization

- Within a basic cycle there are exclusive windows, during which only one node may send a frame.
- Apart from that there are free windows and arbitrating windows, for which the nodes compete for bus access just as in the regular CAN communication.
- Several arbitrating windows can be merged (merged windows).
 - The end of an arbitrating window is always predictable.
 - Thus the advantages of event-triggered communication can be combined with those of time-triggered communication.