GCDC16 Communication Architecture

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Contents

Version: 1.0

1 Introduction

This document will provide an overview of the communication stack that will be used for GCDC16. It will also provide an introduction to the message sets used, and to how the sensor fusion system and the scenario-specific Simulink models will communicate with other vehicles. This document will be updated during the project.

2 Message Sets

This section breifly explains the message sets used for GCDC. Another document will be released to cover the messages in more detail.

2.1 CAM

Cooperative awareness messages (CAM) is the "hello" message. It is broadcasted at a rate of up to 10Hz and contains detailed information about the vehicle broadcasting it. There are methods for preventing traffic congestion by, for example, lowering the message rate when the vehicle is moving slowly. However, GCDC16 may require a non-standard CAM transmission interval and may or may not use the methods for preventing traffic congestion. A CAM message consists of a header and up to four containers.

- The basic container includes basic information related to the originating ITS station (ITS-S).
- The high frequency container contains highly dynamic information about the originating ITS-S, such as heading and speed.
- The low frequency container contains static and not highly dynamic information of the originating ITS-S.
- The special vehicle container contains information specific to the vehicle role of the originating ITS-S. This container is not needed within i-GAME.

Source: Deliverable 3.2

2.2 DENM

Decentralized environmental notification message (DENM) is the message used for event-based communication. It is sent to communicate with or to

notify other vehicles about some event and is sent to a all vehicles withing a specific geographical area. A DENM message consists of a header and up to four containers.

- The management container contains information related to the DENM management and the DENM protocol.
- The situation container contains information related to the type of detected event. For example road work.
- The location container contains information about the event location.
- The à la carte container contains information specific to the event. This container is used for cases where specific information not included in the other containers needs to be transmitted.

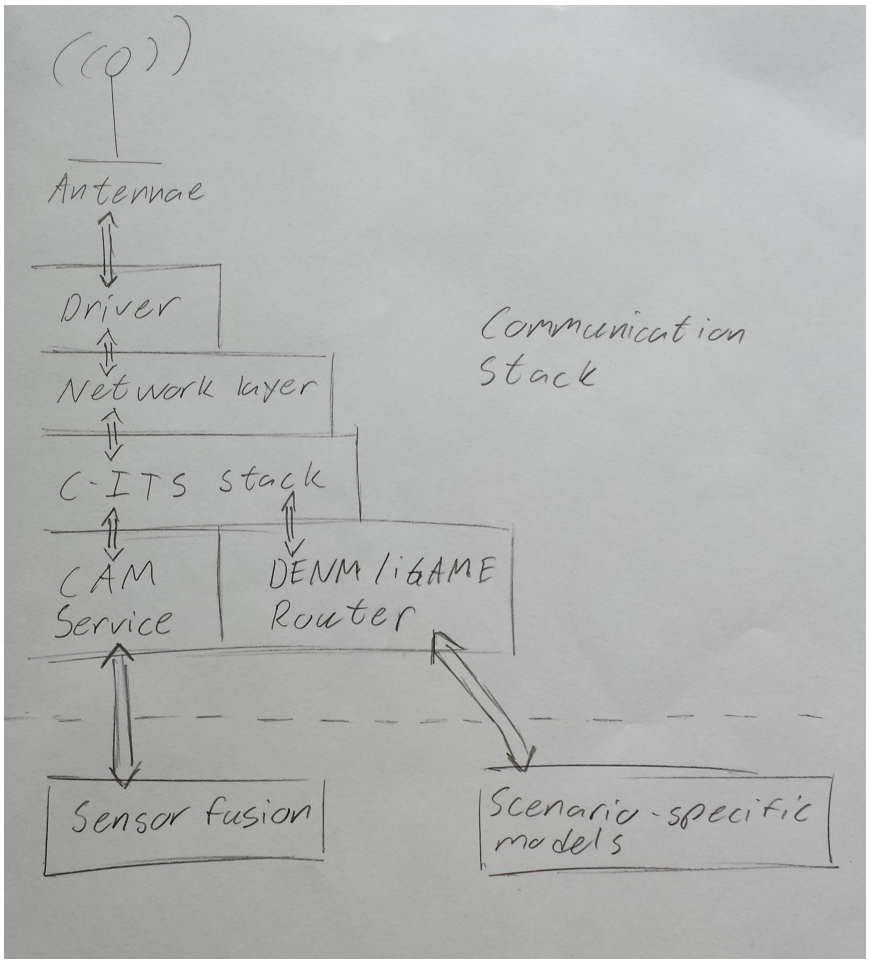
Source: Deliverable 3.2

2.3 iGAME

The CAM and DENM message sets are developed primarily with platooning in mind. To enable the complex automated driving required for GCDC, the CEM and DENM message sets will be extended with a message set specific for iGAME. This set is not yet defined, but it will include messages for coordinating lane changes and such.

Source: Deliverable 3.2

3 Architecture



3.1 Antennae (OSI 1)

Not decided as of writing this, but must follow the ITS-G5 spec for wireless transmission.

3.2 Driver (OSI 2)

The network driver used. Not decided as of writing this.

3.3 Network layer (OSI 3)

Will be part of the C-ITS stack or will run as a separate program. Note that C-ITS in general does very little tunelling. Messages are sent as datagrams that doesn't guarantee arrival and message order. Instead the ITS stack is made to be resilient against message loss.

3.4 C-ITS Stack

Cooperative intelligent transportation system software stack handles creation of CAM and DENM messages. It will add header information and package the data to follow specification.

3.5 CAM service

The CAM service handles sending CAM messages at proper intervals. The CAM service will listen for UDP message from the sensor fusion system and will forward them to the C-ITS stack, which will transmit them. If methods for preventing traffic congestion are used, the CAM service will make a decision on whether or not to forward every time a message is received.

The CAM service will expect UDP messages from the sensor fusion system containing all information required for CAM messages at whatever rate that is decided on. Currently, the highest rate of any message is 25Hz.

3.6 DENM/iGAME Router

The DENM/iGAME router listens for messages coming to and from the Simulink models controlling the car and is completely stateless as it only forwards messages.

The router will expect UDP packets from the Simulink models controlling the car, containing the message ID as defined in deliverable 3.2 and additional information required to create the specified DENM/iGAME message. Incoming messages will be forwarded to the Simulink models that use that message.

4 Internal communication

Communication between systems in the car will be performed using UDP packets sent on the local LAN.

4.1 Sensor Fusion

The CAM service will expect UDP messages from the sensor fusion system containing all information required to create any CAM message. This packet will be sent to the CAM service at the rate of the most frequent CAM message. Currently, the highest rate of any message is 25Hz.

4.2 Scenario-specific models

The scenario-specific models will communicate with the DENM router to send and receive DENM/iGAME messages required for the scenario. For example, pairing with other vehicles during the platoon merge scenario.

The messages will include the message ID as specified in deliverable 3.2 and an alacarte container that is defined on a per-message basis. For example, sending a message to pair with another vehicle during the platoon marging scenario requires sending a UDP packet containing the message ID for the pairing message and the vehicle ID of the vehicle to pair with.