Data flow transparency

Rapid developments continue to challenge electronic control units in the automotive industry. This fact must be taken into account by Hardware-in-the-Loop systems.

To solve this challenge for Hardware-in-the-Loop (HiL) systems, Micronova has designed the software feature Bus Tracing for its Novasim simulators. With the help of this feature, all communication buses connected with the system can be monitored and recorded.

Less and less frequently, modern ECUs send or receive required information via dedicated analog or digital lines. Instead, the sensor itself or another ECU puts the information on one or several buses, from where the data can be picked up accordingly. Therefore, the precise knowledge of the data on the buses is essential as this data determines the operating status of the ECU. Depending on the test case, the ECU of the simulator needs to be set to the proper mode of operation at the start of each test. In most cases this is achieved by an appropriate calibration of the bus signals. Only after the testing engineer has set the targeted output mode at the ECU can the errors be entered and the system checked for its error response.

The Bus Tracing feature provides the architecture required to monitor bus data. Based on the existing hardware, data can be collected from different networks, transmitted to the control computer, processed there, and displayed on the user interface. The structure is illustrated in Figure 1.

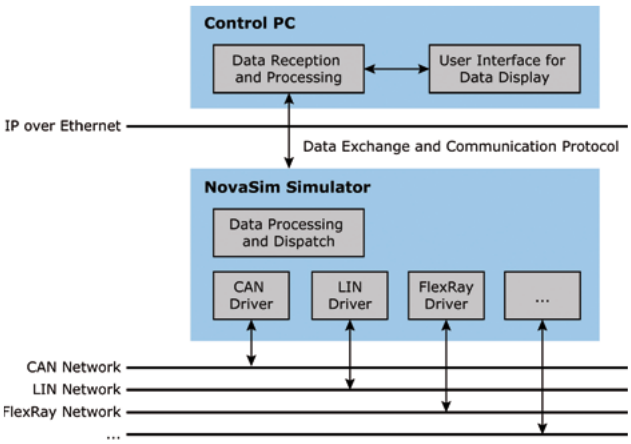

Figure 1: Structure of the Bus Tracing architecture

Data acquisition

The testing engineer can monitor and record the data of each network used by Novasim on the user interface (see Figure 2). Currently, the solution supports the networks CAN, LIN, and Flexray. The HiL simulator provides the recorded data with a time stamp that is accurate to the millisecond for ▷

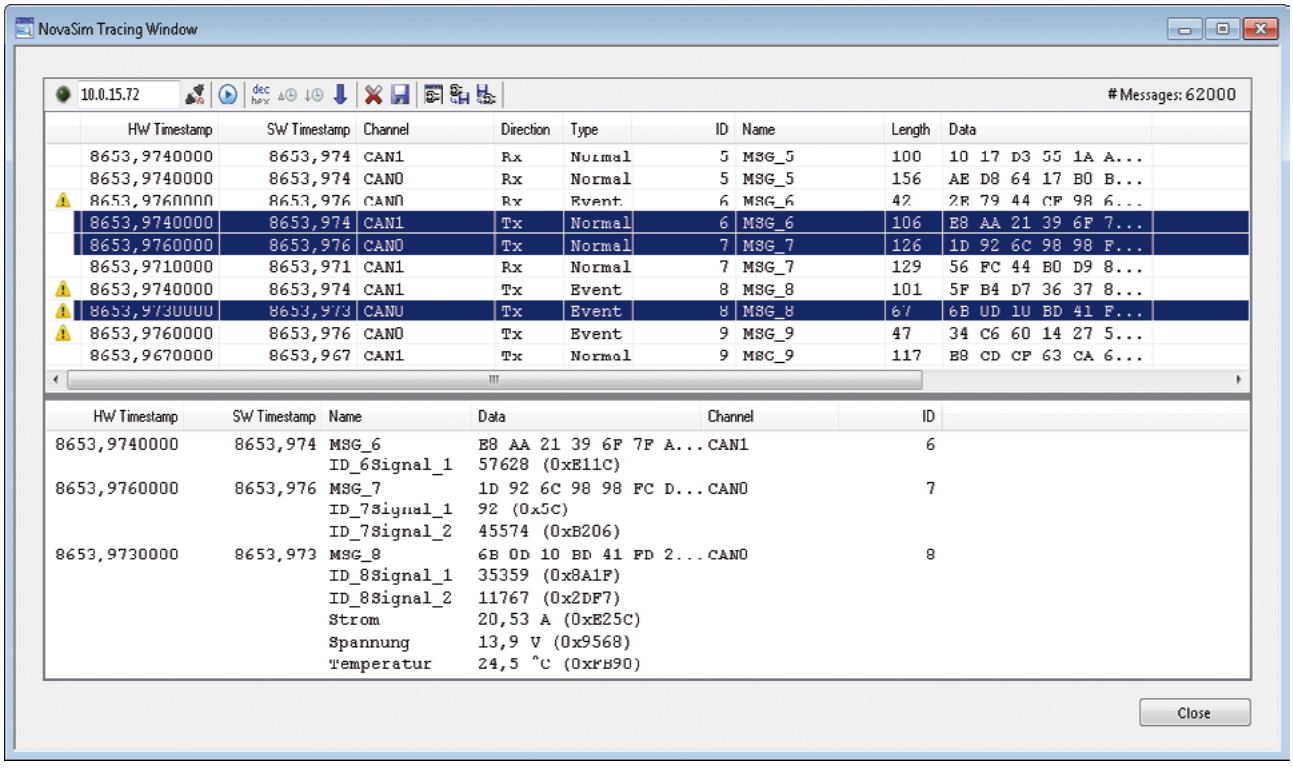

Figure 2: User interface of the Novasim Bus Tracing

Fibex: XML-based file format

The “Fieldbus Exchange Format” (Fibex) is an ASAM-defined and XML-based file format. It contains the information necessary for the description of the communication process on message-oriented communication buses. The information includes the topology, configuration parameters, schedules, frames, and signals as well as their coding on the bit level. It is used for the description of CAN and Flexray communication.

the purpose of a time-related tracing among the records. For some hardware devices, the hardware generates even more accurate time stamps. Each simulator supports up to fifty data channels. The implemented protocol for the communication with the simulator also allows to query the number and type of bus connections installed in the simulator and to display them on the user interface.

Display and analysis

The traced data is displayed on the user interface along with the identifier, time stamp (software time stamp and hardware time stamp, if any), channel, direction (the Novasim simulator may be sender or receiver), and raw value. In addition, it is possible to display the interpreted data, i.e. the corresponding physical and logical variables. The rule of interpretation is stored in bus description files for each data channel. The format used for the description files of CAN and Flexray is Fibex 3.X, and that of LIN are Intermediate Data Files (IDF).

In order not to lose track in case of high data traffic a filtering system based on messages (ID) and/or buses is included. For the filtering process based on message IDs there are numerous options available including range filters. Furthermore, the user has the advantage of sorting the displayed messages by channel, message ID, and time stamp. The configurations (IP and channel configuration, filter configuration) can be stored and do not need to be re-created in later applications. In order to analyze the recorded communication at a later date, there is an additional option to save the trace in a file (Vector ASCII Logfile format).

Through its compatibility with the HiL simulator, the Bus Tracing feature provides a convenient way to monitor the data traffic on the existing bus systems. By using the existing bus connection no additional hardware is necessary and costs are saved.

Authors

Hermann Naredi-Rainer, Michael Schaffarczyk
Micronova AG
www.micronova.de