CANoe/CANalyzer

Comprehensive CAN Network Analysis and Test - An Overview

Agenda
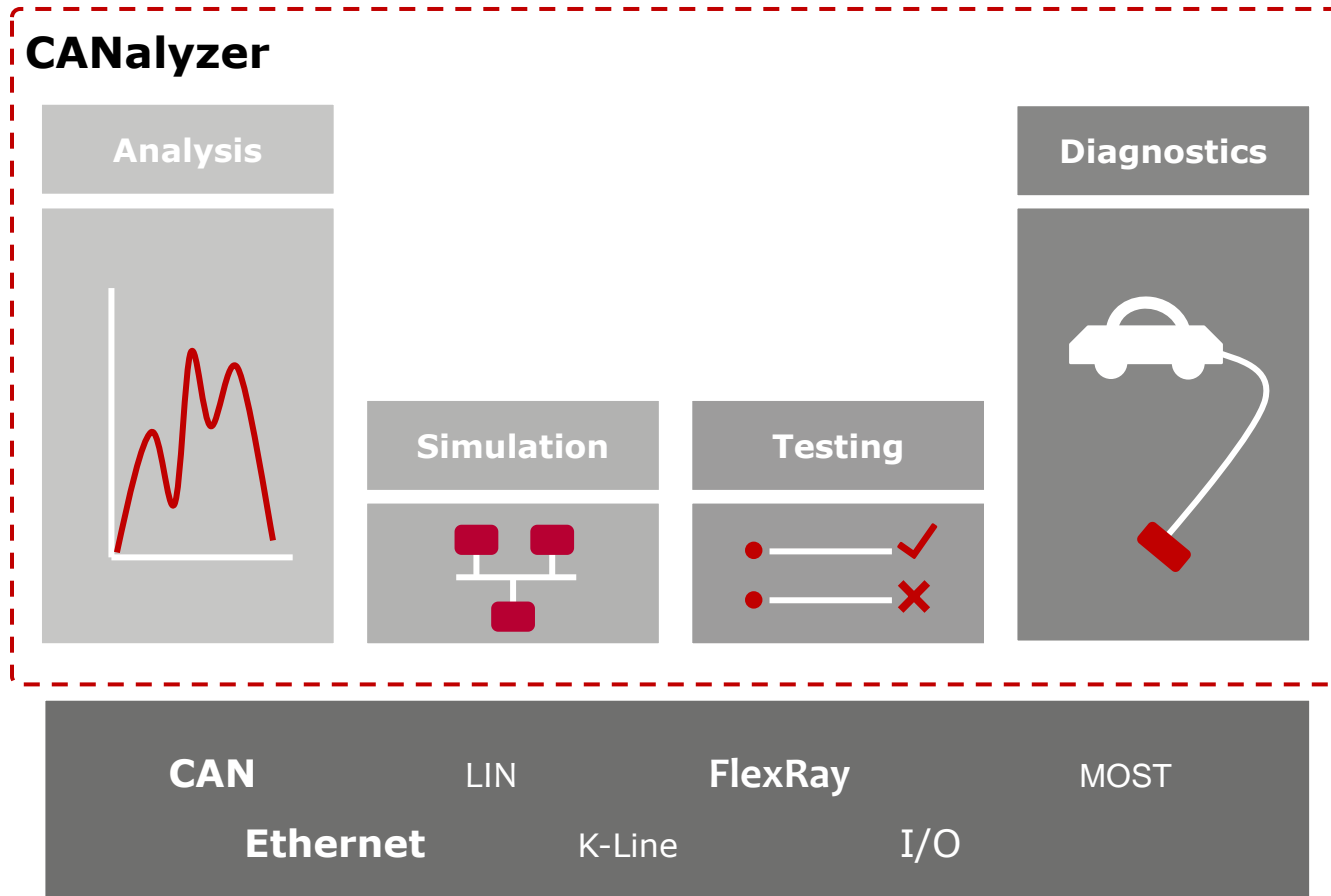
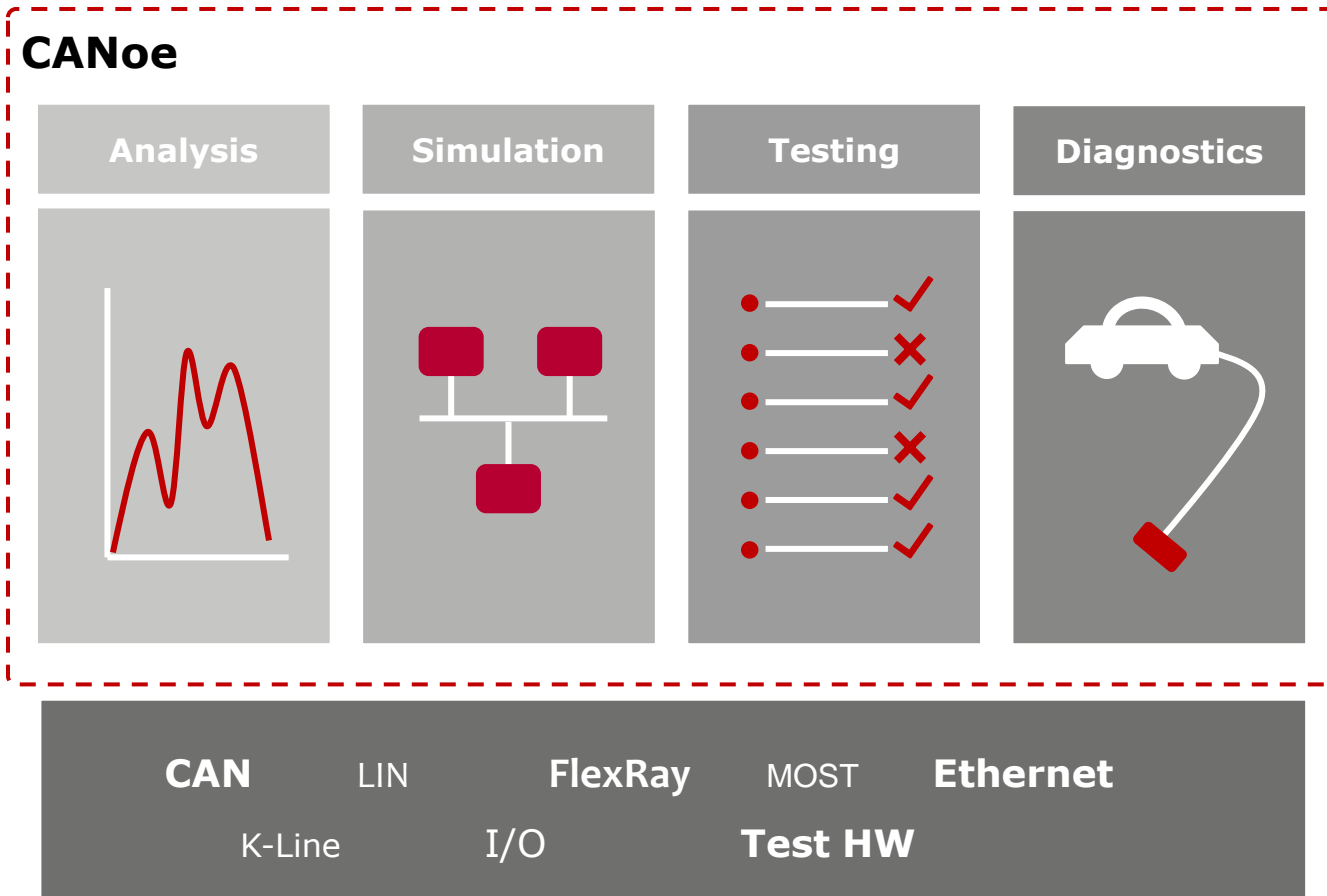# CANalyzer and CANoe: What is the difference?

CANoe and CANalyzer offer powerful functions for analysis, simulation, testing and diagnostics.

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CANalyzer and CANoe: What is the difference?

CANoe

| Analysis | Simulation | Testing | Diagnostics |

CAN   LIN   **FlexRay**   MOST   **Ethernet**
K-Line   I/O   **Test HW**

CANoe and CANalyzer offer powerful functions for analysis, simulation, testing and diagnostics.

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Basic Setup

Input	DBC, ARXML, FIBEX (CAN, CAN FD)	DBC, FIBEX, ARXML (Ethernet)	CDD, ODX, MDX (Diagnostics)
	FIBEX, ARXML (FlexRay)	LDF (LIN)	EDS/DCF/XDD/XDC (CANopen)

CANoe / CANalyzer	Configuration Files Templates

Vector Network Interface	CAN*, CAN FD, LIN Ethernet FlexRay

*3,3V TI SN65HVD233HD Transceiver available

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Main Windows in CANoe

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Data Flow in CANoe (Real Bus Mode)

Hardware Interface

Ethernet
MOST
FlexRay
LIN
CAN

Data Flow in CANoe (Simulated Bus Mode)

Hardware Interface

Ethernet
MOST
FlexRay
LIN
CAN

Main Windows in CANalyzer

CAPL programs

Measurement Setup

Write Window

Database Management

CAN Statistics

Symbol Databases:

dbc, fibex, arxml, ldf

System/Error Messages, Warnings, CAPL output…

Data Flow in CANalyzer

Hardware Interface

Ethernet
MOST
FlexRay
LIN
CAN

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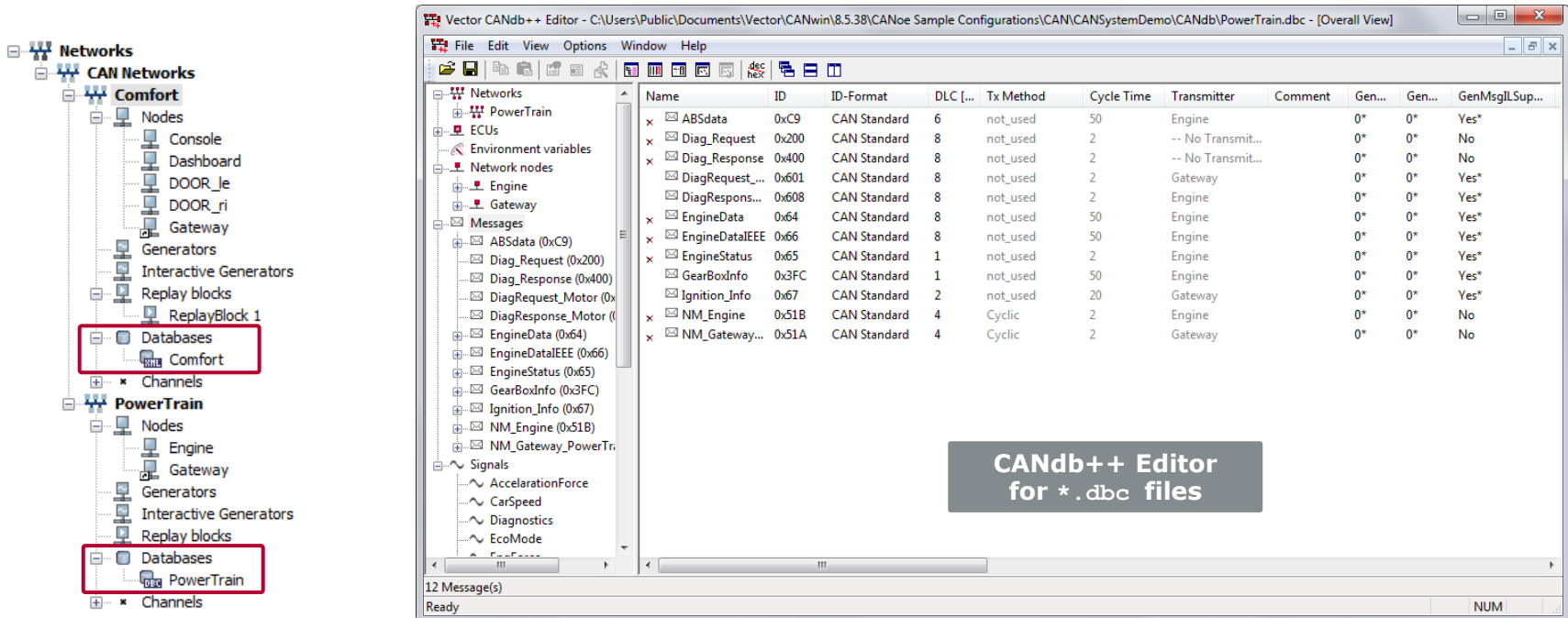
Assigning a Database

In CANoe's Simulation Setup, one or more databases can be added to the defined networks:

▶ CANopen: dbc is generated by the network configuration tool ProCANopen

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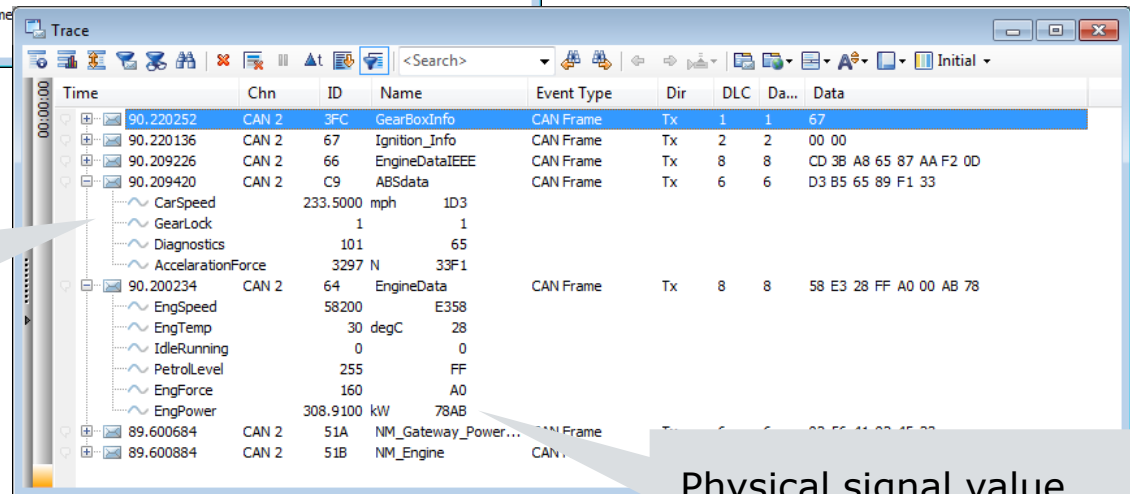# Effect in Analysis

Among other things, databases contain:

▶ Assignment between message identifier and symbolic message name

▶ Signal descriptions

Without database assignment, there is no symbolic interpretation of the data

With database assignment, messages are displayed with their symbolic names and described signals
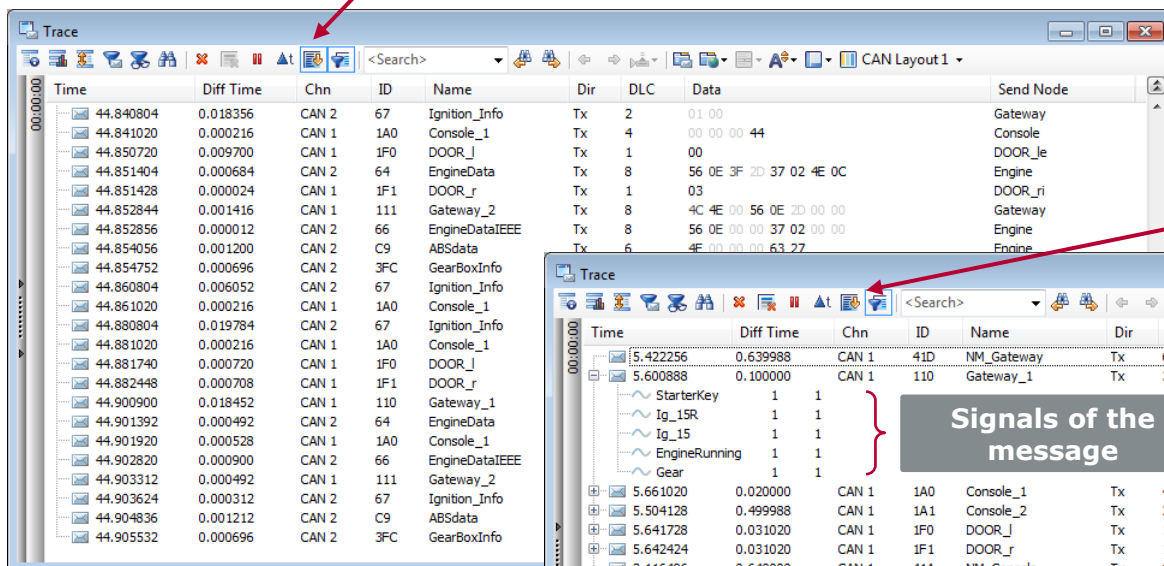
Physical signal value display with units
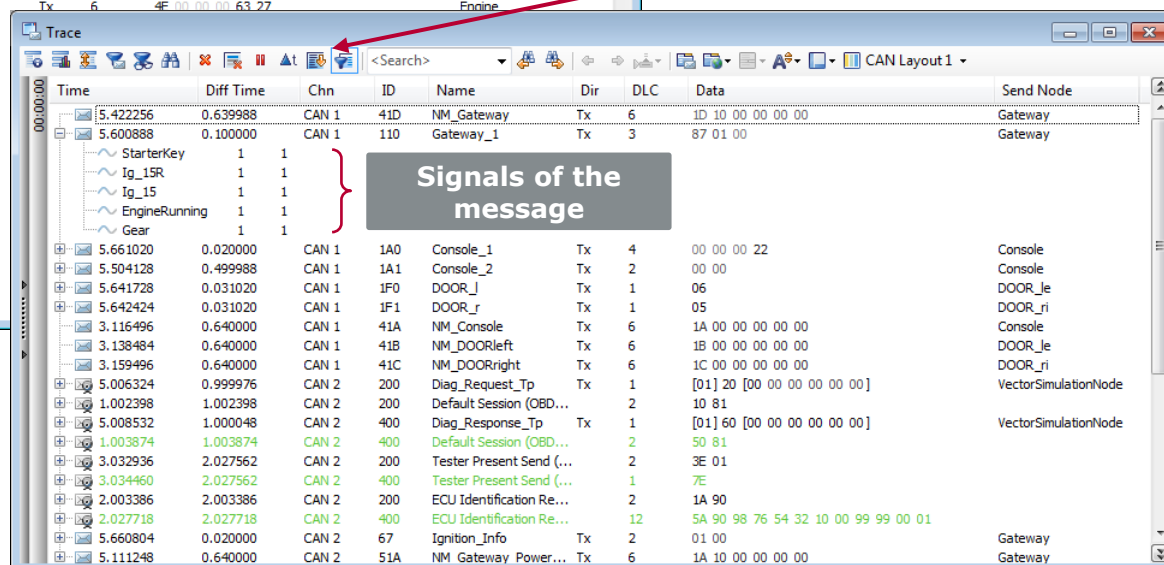
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Trace Window

Messages are displayed as line of text in the Trace Window. When choosing the Fixed Position Display Mode, signals can also be displayed.

Chronological Display Mode

Fixed Position Display Mode

Signals of the message

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Trace Window – Filter Options

Different filter options are available in the Trace Window. They can be activated and deactivated during the measurement:
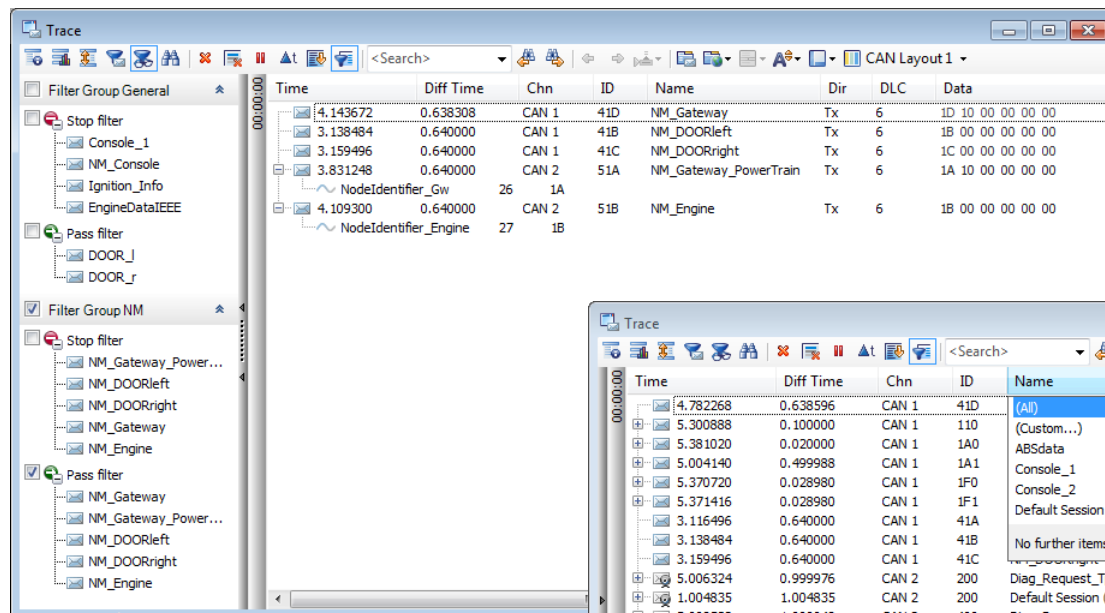
Column Filters can be configured for every column during running measurement
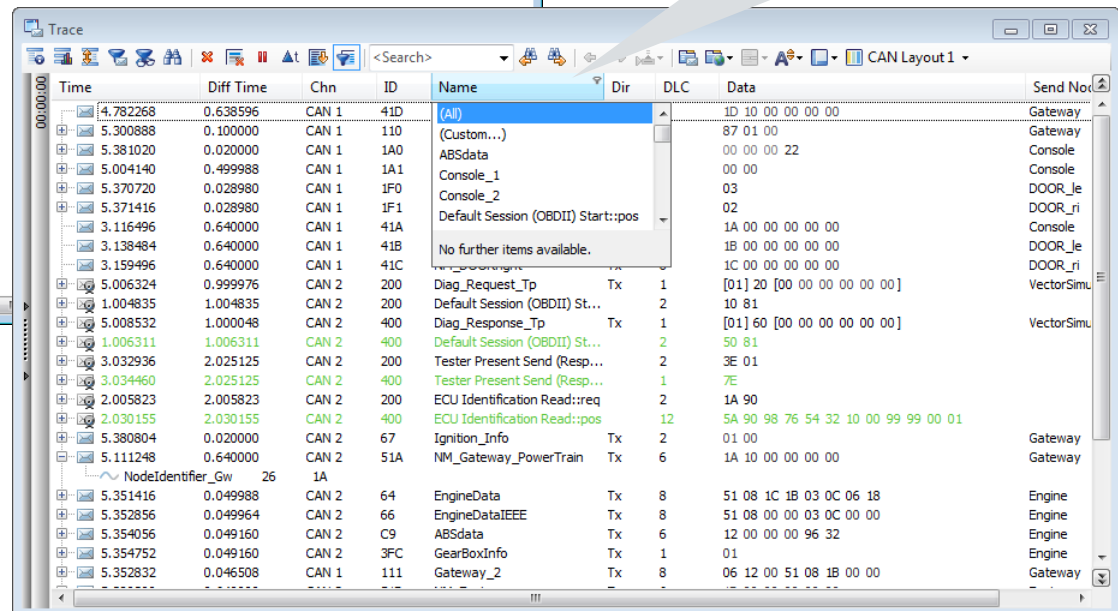
In the analysis filters area, *Stop and Pass Filters* can be configured

Graphics Window

In the Graphics Window symbols are displayed graphically in an XY diagram:

- ▶ Symbols are Signals, Variables and Diagnostic Parameters

- ▶ Symbols can be added to the Graphics Window via context menu or drag &drop

- ▶ Various functions are available for highlighting/hiding curves and their measurement points

- ▶ A Legend can be displayed

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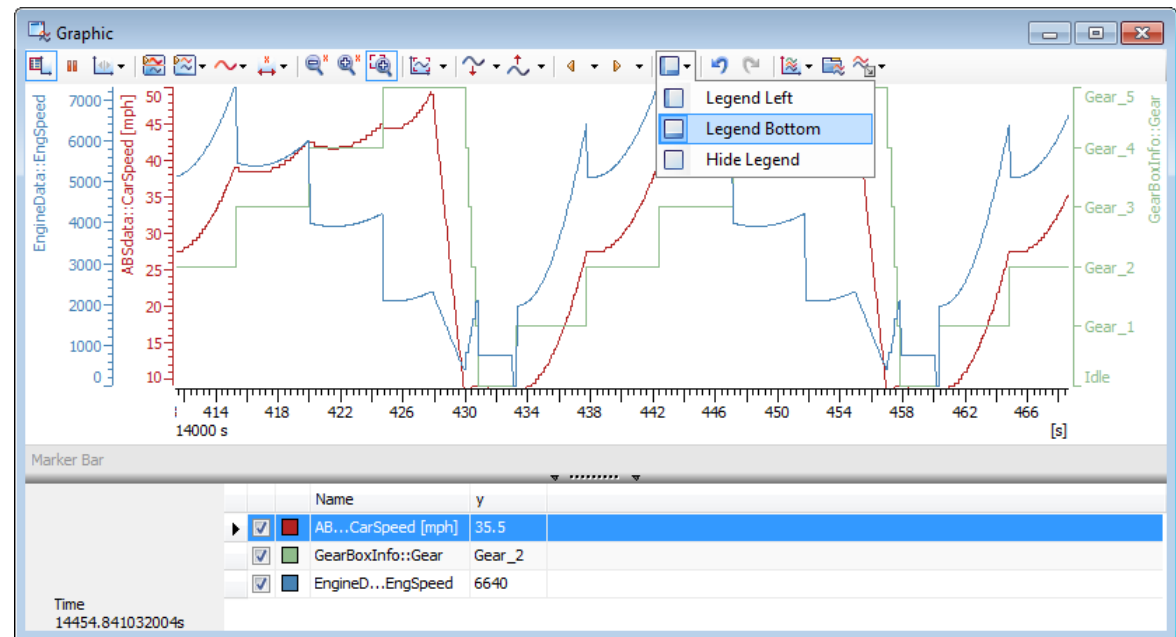
Graphics Window – Measurement and Evaluation

Various functions allow to measure and evaluate the curves:

Measurement Cursor and Difference Cursors for absolute and relative value analysis
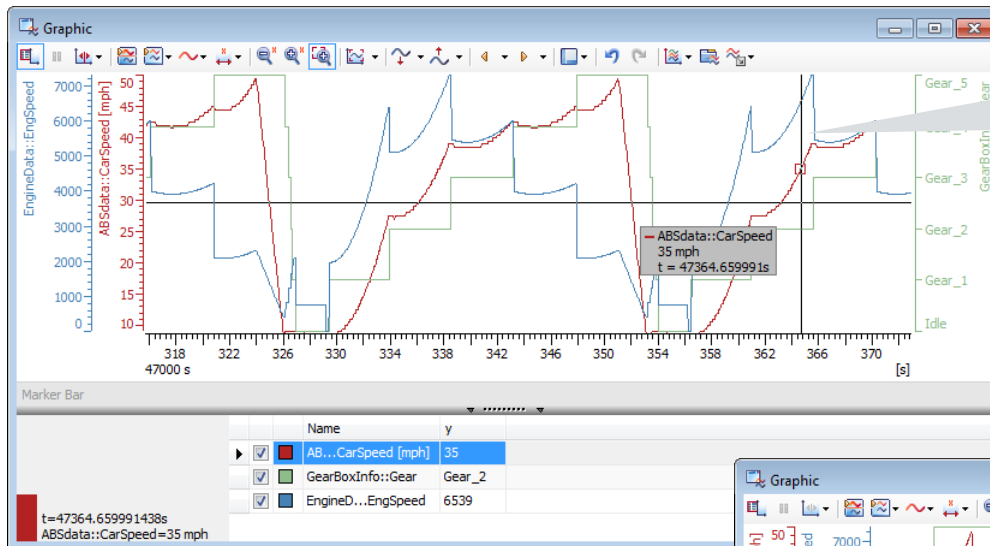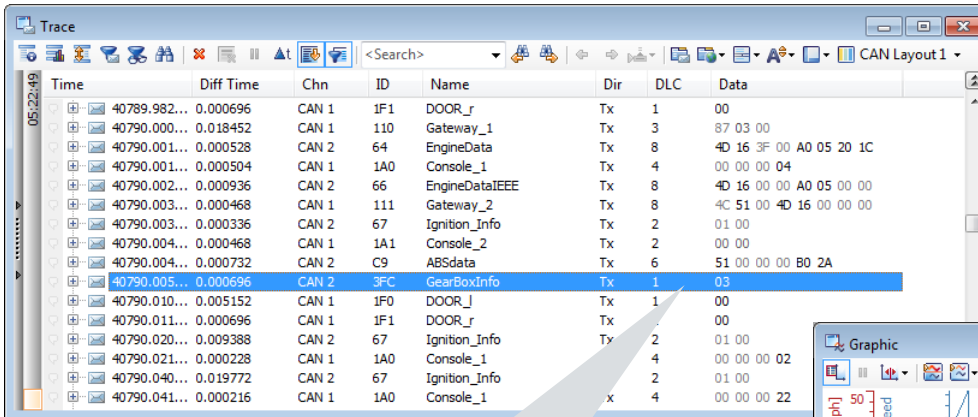
Markers can be set to easily tag and locate different points in time of a measurement

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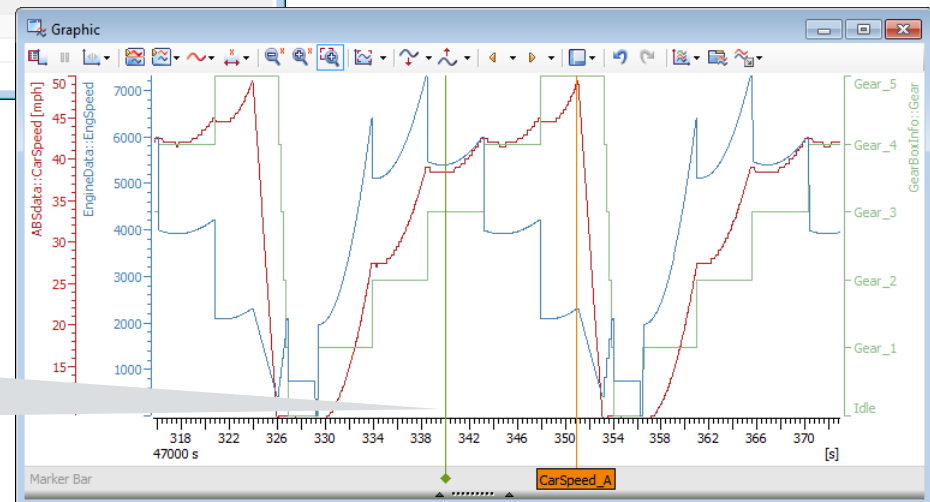
Synchronize Windows

Data can be analyzed synchronously after stop of measurement. Amongst others, synchronization of analysis windows is supported in Trace and Graphics Windows.

When moving the measurement curser in Graphics Window, the corresponding message in Trace Window is marked

When marking a message in the Trace Window, the corresponding event in the synchronized Graphics Window is marked by a blue measurement curser
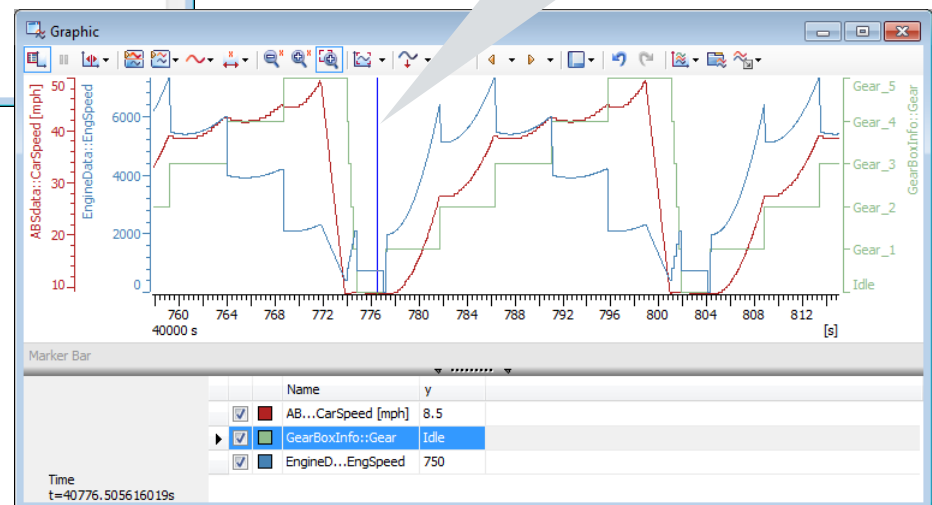
Data History

CANoe saves measured data from Trace and Graphics Window in a Global Buffer. The size of the buffer, hence the length of the data history, is influenced by the hard disk space used:

- ▶ Maximum data history: up to 200GB swap file
- ▶ Short data history: no swap file, smallest system stress
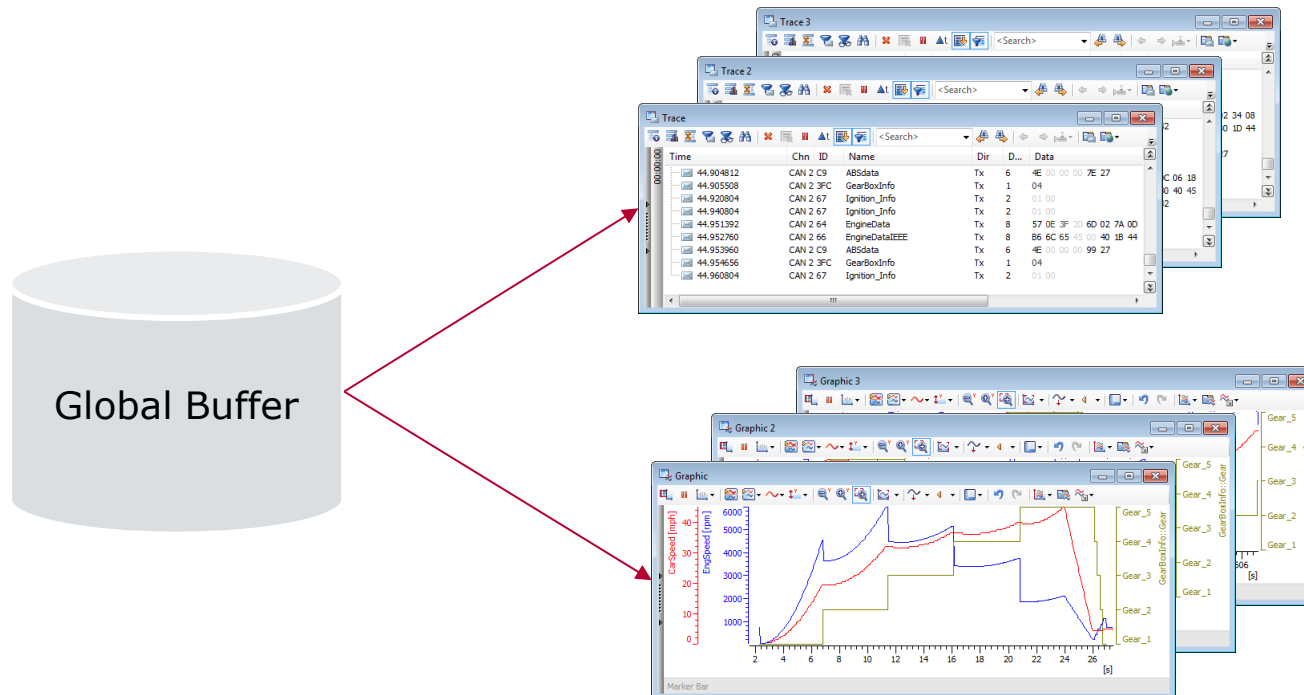
Statistics Window

The Statistics Window displays statistics of bus activities during measurement:

Total number of bursts during the measurement as well as the burst time

Error Statistics (Bus specific)

Option Scope

▶ Integrated oscilloscope solution for CANoe and CANalyzer

▶ Powerful combination of USB scope and development/analysis tool

▶ Scope triggered via sync line of Vector bus interfaces

  ▶ e.g. VN1630/40, VN7600, VN8970, CANcardXLe, XL-Family

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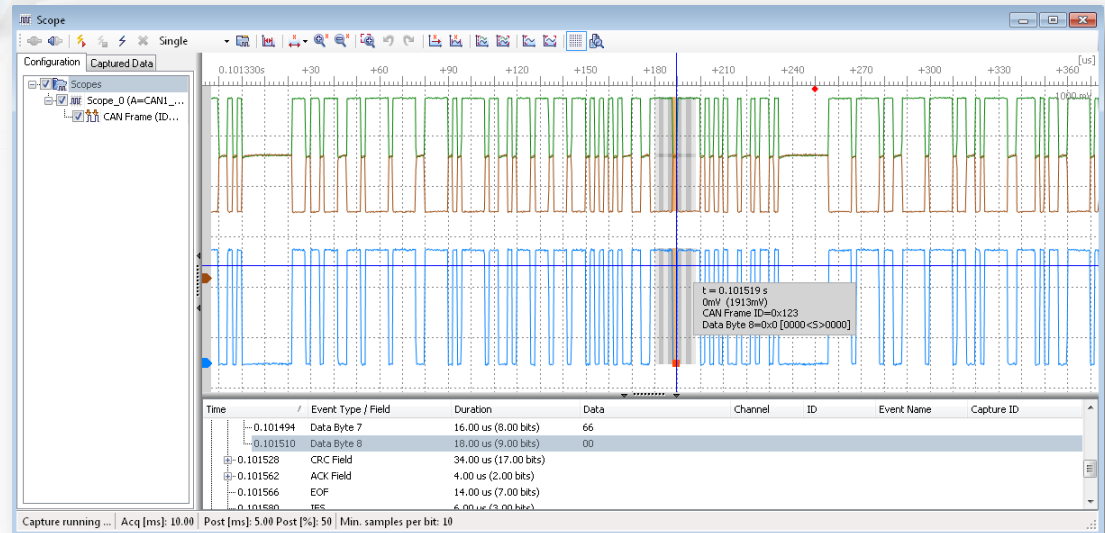
Scope Hardware

- ▶ USB precision oscilloscope with up to 4 channels and 200 MHz bandwidth
  - ▶ USB-powered for 2 channels (1 CAN/FR or 2 LIN/IO)
  - ▶ External power supply needed for 4 channels (2 CAN/FR or 4 LIN/IO)
- ▶ 500 MS/s sampling rate with up to 512 MS buffer
- ▶ Bus connection via Scope Bus Probe with DSUB bus connector
- ▶ External triggering via sync line of bus interface
  - ▶ Connection via Scope Trigger Y-Cable for Vector interfaces
- ▶ Only available from Vector

Scope Window

▶ Synchronized views for scope signal and bus events

▶ Analysis of CAN signals

▶ Eye diagram to determine wiring quality and optimal sampling point
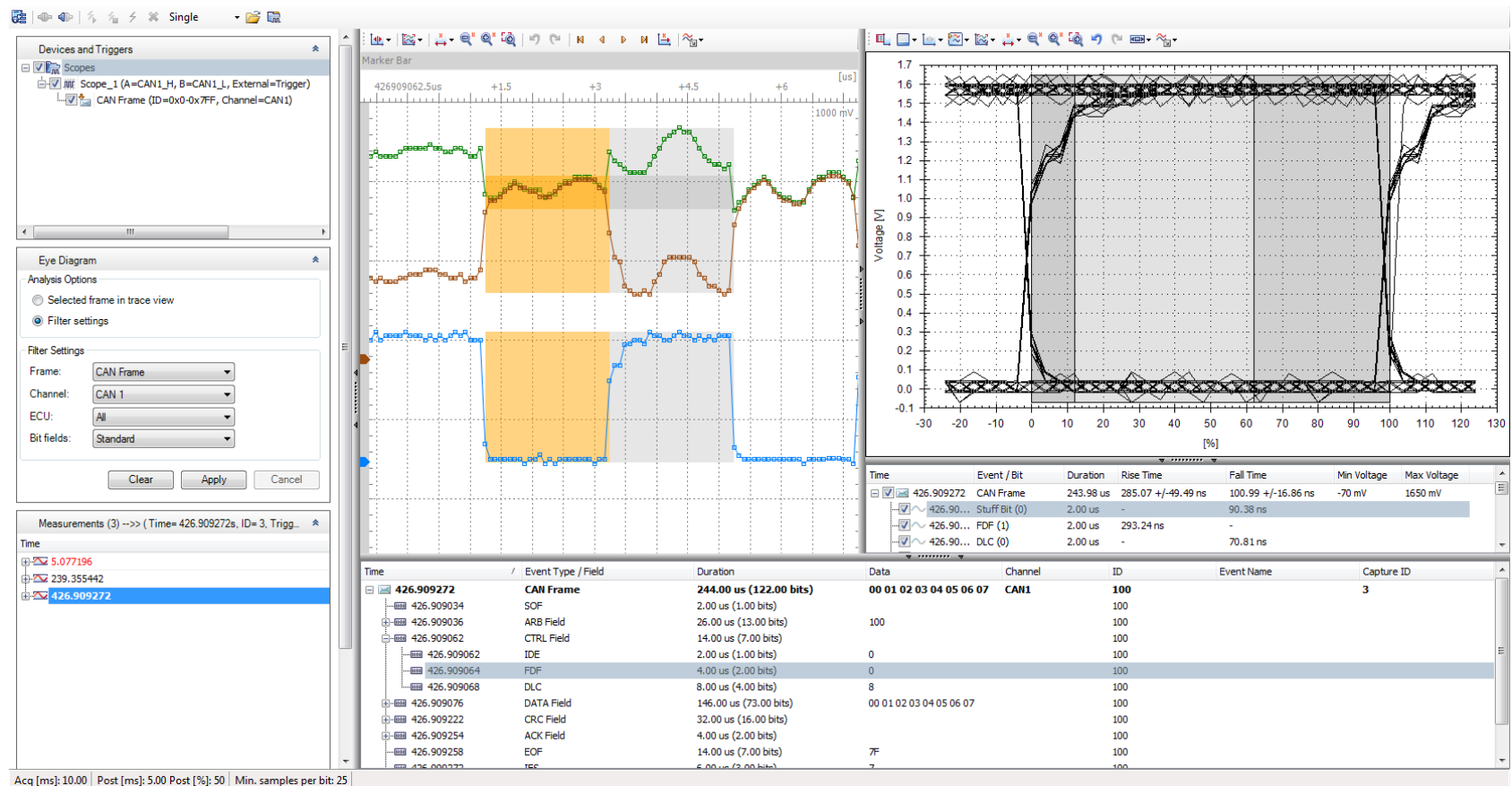
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Logging Block

Data can be recorded during measurement for offline analysis or to be replayed on the bus:
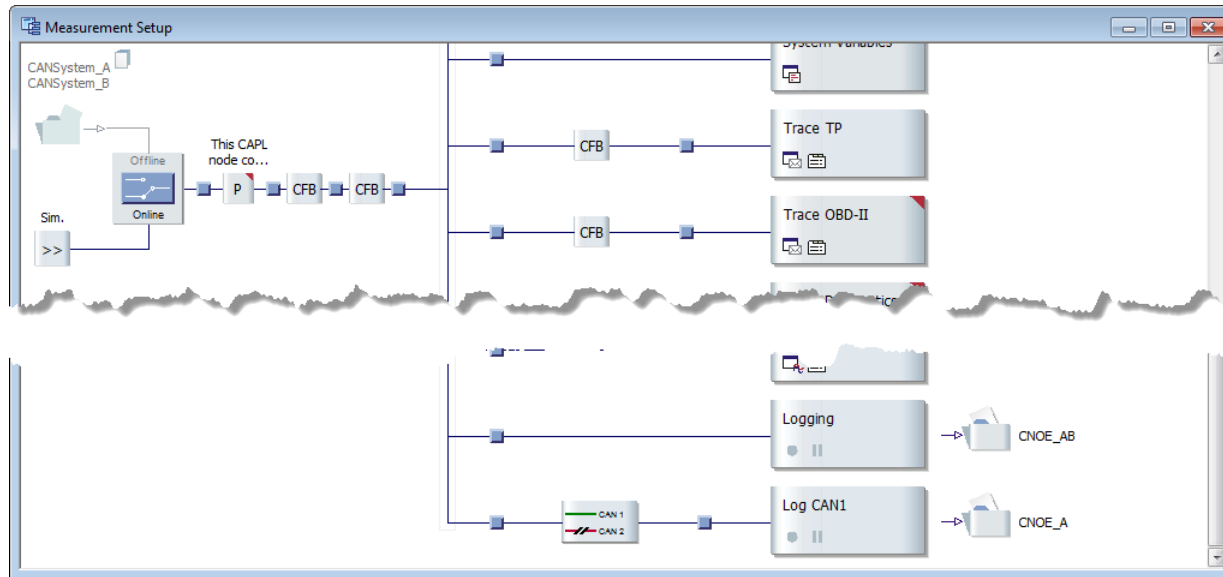
- ▶ Logging is configured in the Measurement Setup
- ▶ Multiple logging branches are possible
- ▶ Triggers are used to start/stop the logging
- ▶ Filters can be used to reduce the amount of data in the log file
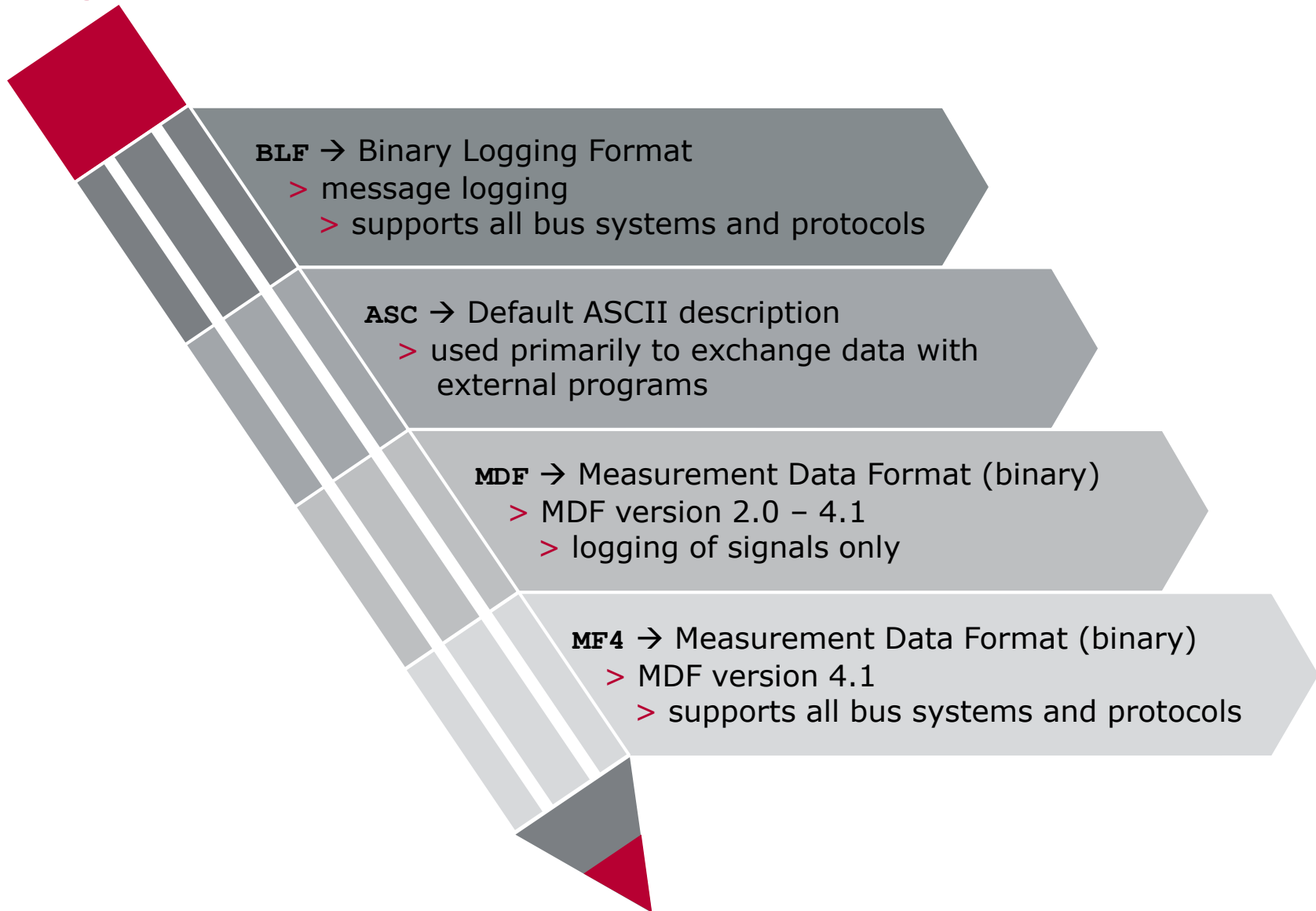
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Log File Format

BLF → Binary Logging Format
> message logging
> supports all bus systems and protocols

ASC → Default ASCII description
> used primarily to exchange data with external programs

MDF → Measurement Data Format (binary)
> MDF version 2.0 – 4.1
> logging of signals only

MF4 → Measurement Data Format (binary)
> MDF version 4.1
> supports all bus systems and protocols

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![Vector logo]
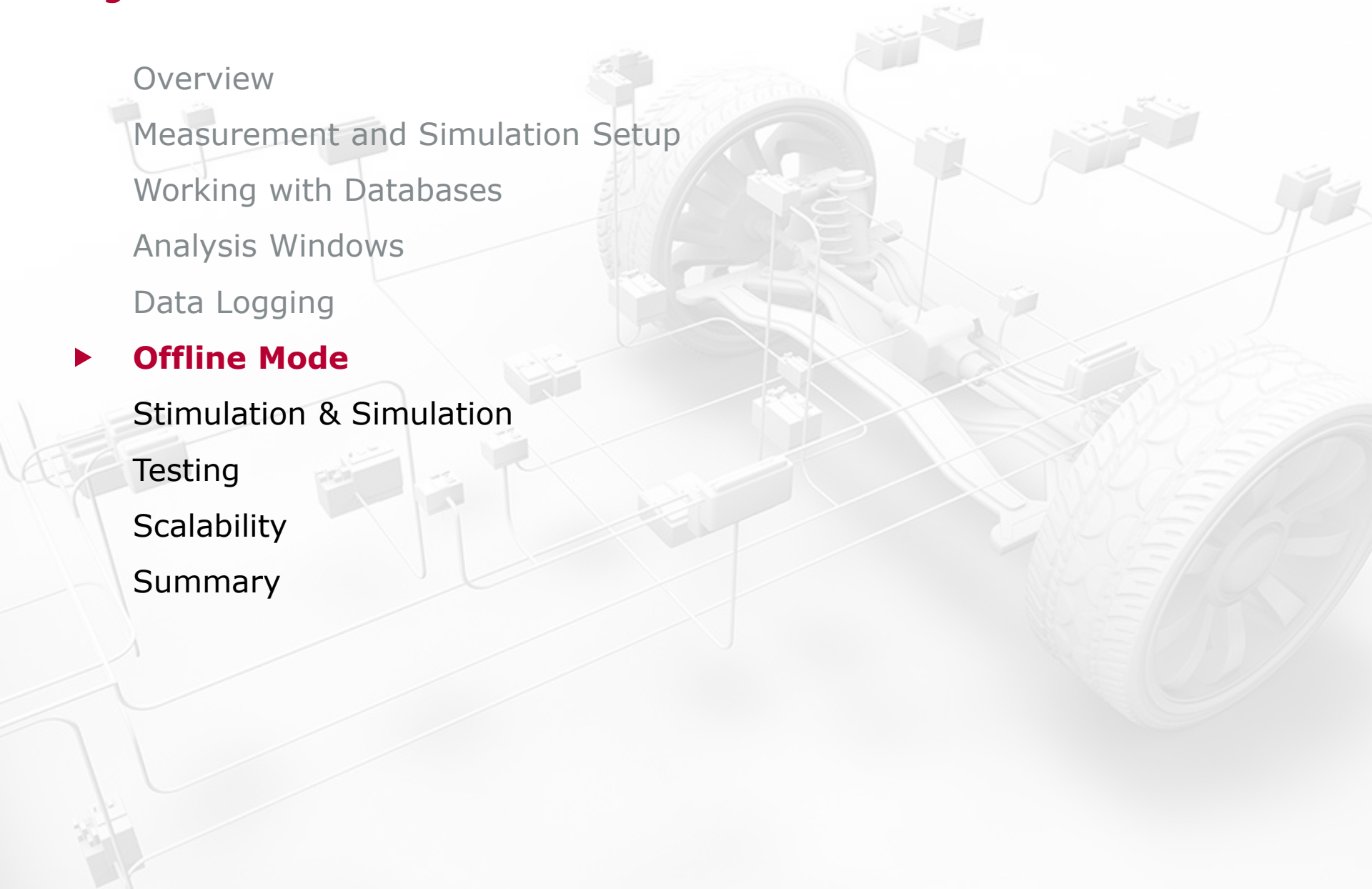
Overview

In Offline Mode, recorded measurement values from a log file are used as Data Source:

- ▶ All analysis windows can be used just like in Online Mode
- ▶ In CANoe, the Simulation Setup is not active in Offline Mode
- ▶ In CANalyzer, the send branch is not active in Offline Mode

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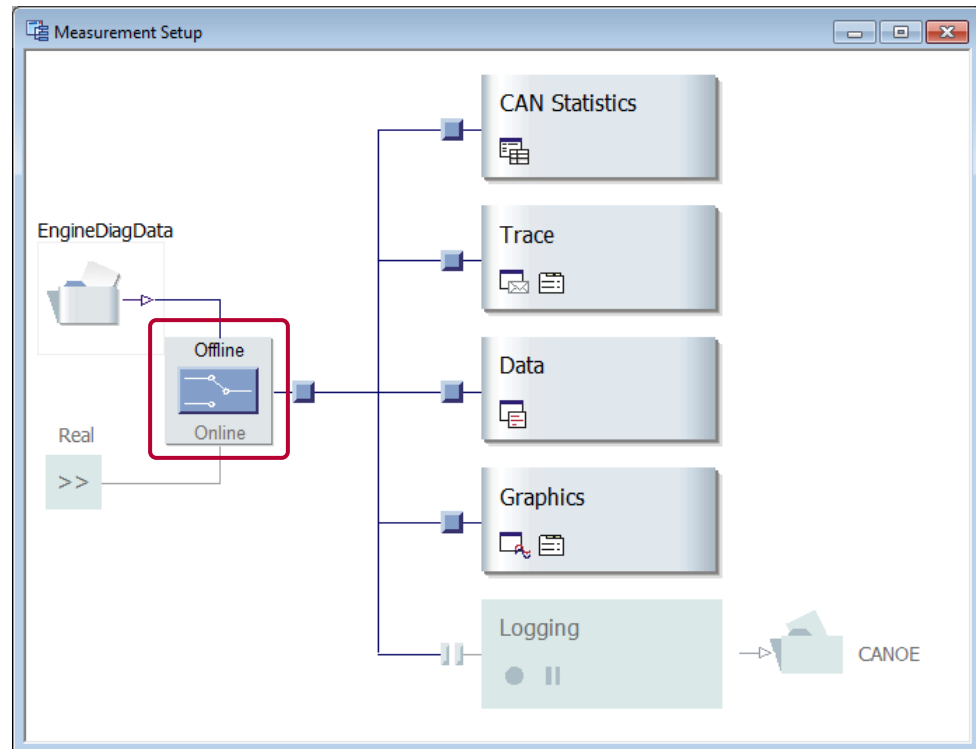
Control Offline Mode

Start and Stop
> Entire file is played back
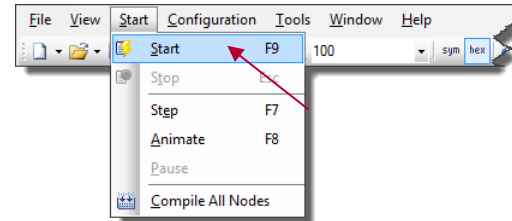
With configurable step width
> Automatic pause at the end of the step
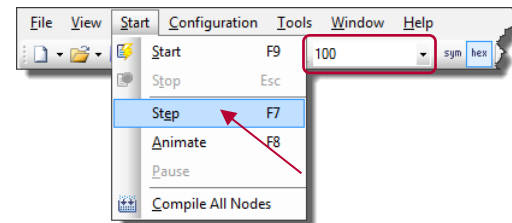
Animated flow
> Slow-motion display of events

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Stimulation with CANalyzer and CANoe

▶ Interactive Generator for interactive sending, includes signal value generation
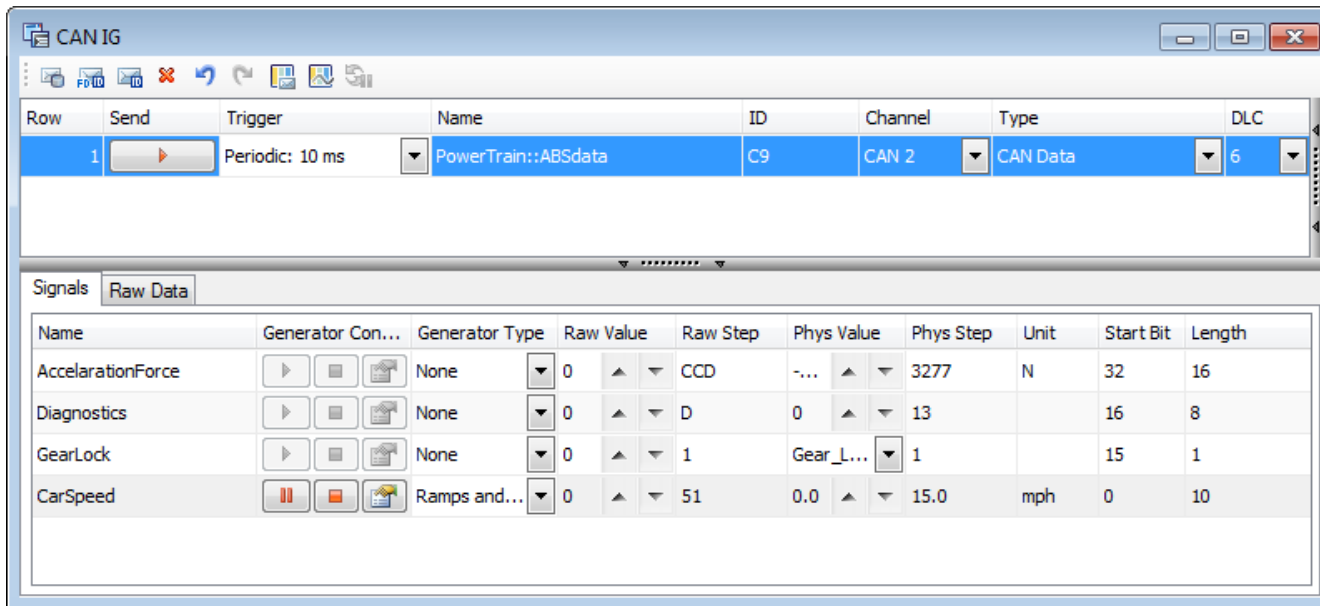
▶ Replay Block for replaying logged CAN data

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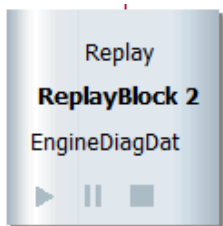
Simulation of Entire Networks or Remaining Bus

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CANoe is the comprehensive software tool for development, test and analysis. Using CANoe, you can create simulations of Entire Networks or the Remaining Bus solely based on the database:
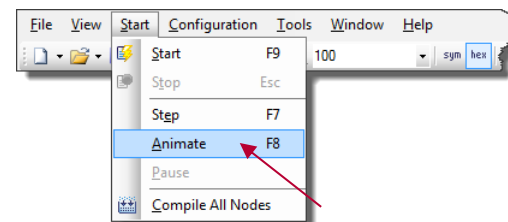
▶ Nodes automatically send their messages according to the database file

▶ Usage of a single CANoe model in all phases of development

▶ Function development and regression testing is supported

▶ Gateway simulation for different bus systems is possible
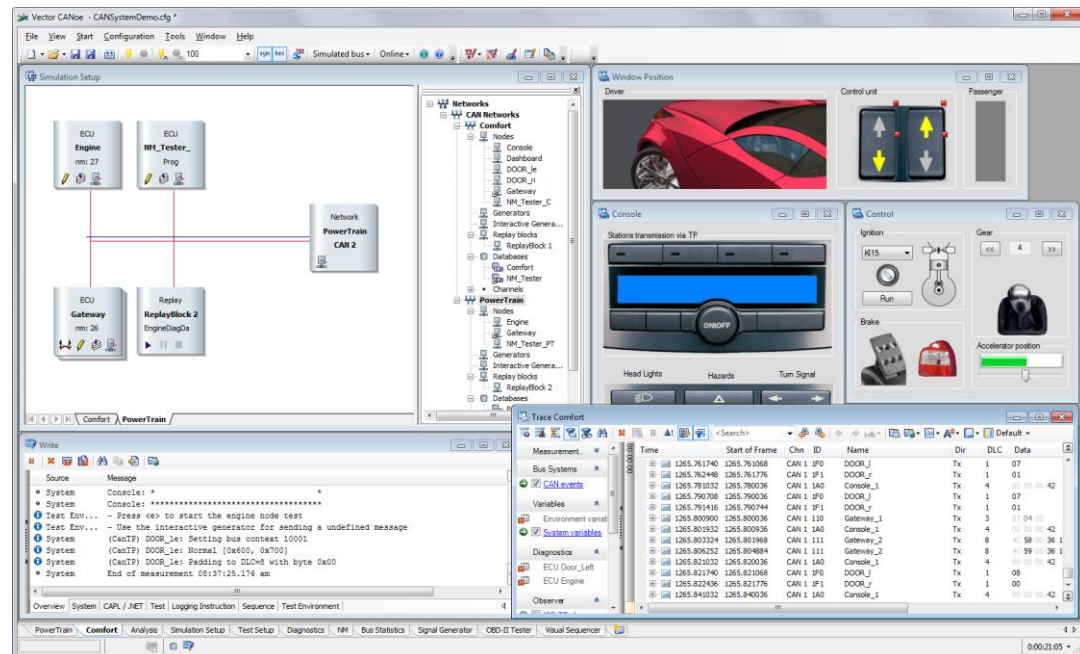
Execution Mode
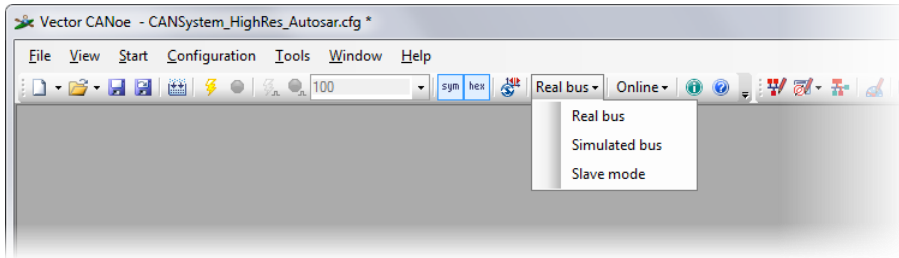
Real bus

- ▶ With a remaining bus simulation, the real bus mode has to be selected
- ▶ Real time is derived from connected network interface HW

Simulated bus

- ▶ Communication network is simulated
- ▶ An **animation factor** can be specified: the simulated measurement then appears slowed-down resp. accelerated by this factor

Slave mode

- ▶ Time basis is controlled from external application, e.g. COM client

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CANoe Test Environment

CANoe is the ideal tool for efficient automated ECU and system testing:
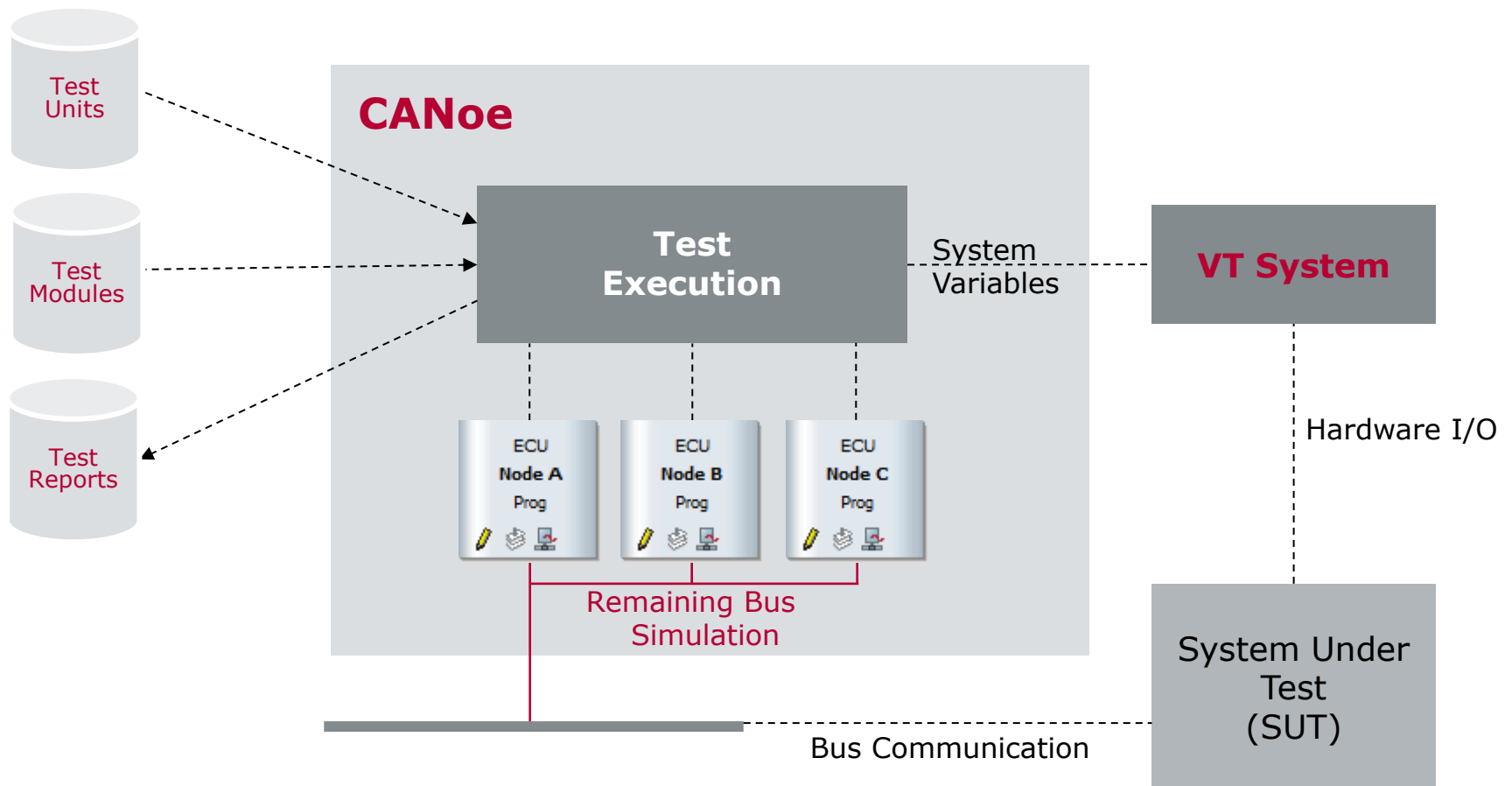
Test Specification

In CANoe, sequential tests are implemented in test modules or test units:

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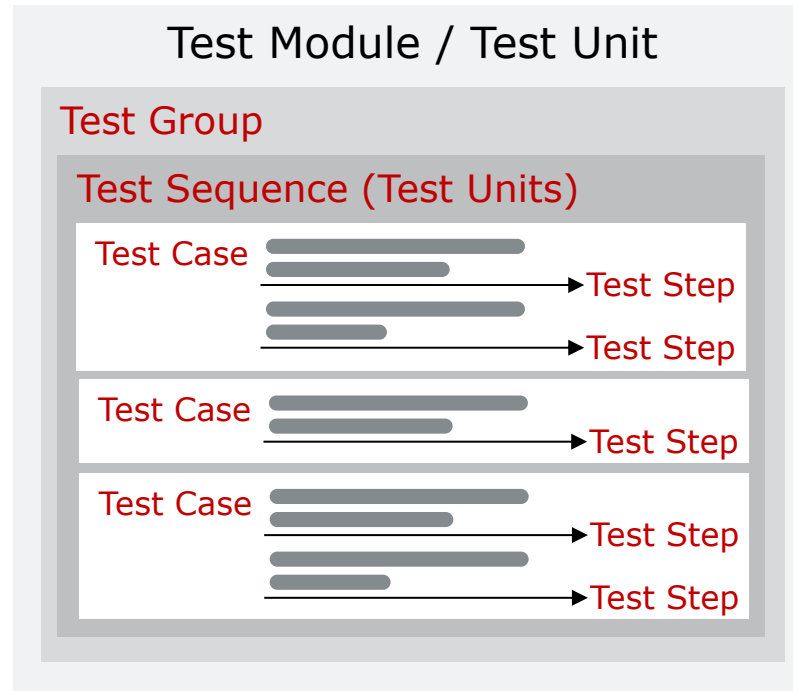
Test Execution

- ▶ Completely automated test execution
- ▶ XML test report converted into HTML or any other format

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Overview

▶ CANoe allows decoupling of user interface and simulation part (CANoe RT)

  ▶ The simulation can be run on a dedicated device or PC

  ▶ Typical operating system: Windows Embedded 7

  ▶ No negative effects of other PC tasks (e.g. compiling, virus scan, Outlook, etc.) to the simulation

  ▶ Higher accuracy, lower jitter, lower simulation latency

  ▶ The same CANoe configuration can be used for CANoe RT and normal CANoe operation

User PC

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CANoe simulation

CANoe RT Applications

VN89xx: Network interface and simulation platform

USB

VN89xx

VT60xx: VT board as simulation platform

Ethernet

VT System

CANoe RT Rack: IPC as simulation platform

Ethernet

CANoe RT Rack

Special application: Simulation without user interaction:

VN8900 standalone

VT System standalone

VT System

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Overview

Measurement and Simulation Setup

Working with Databases

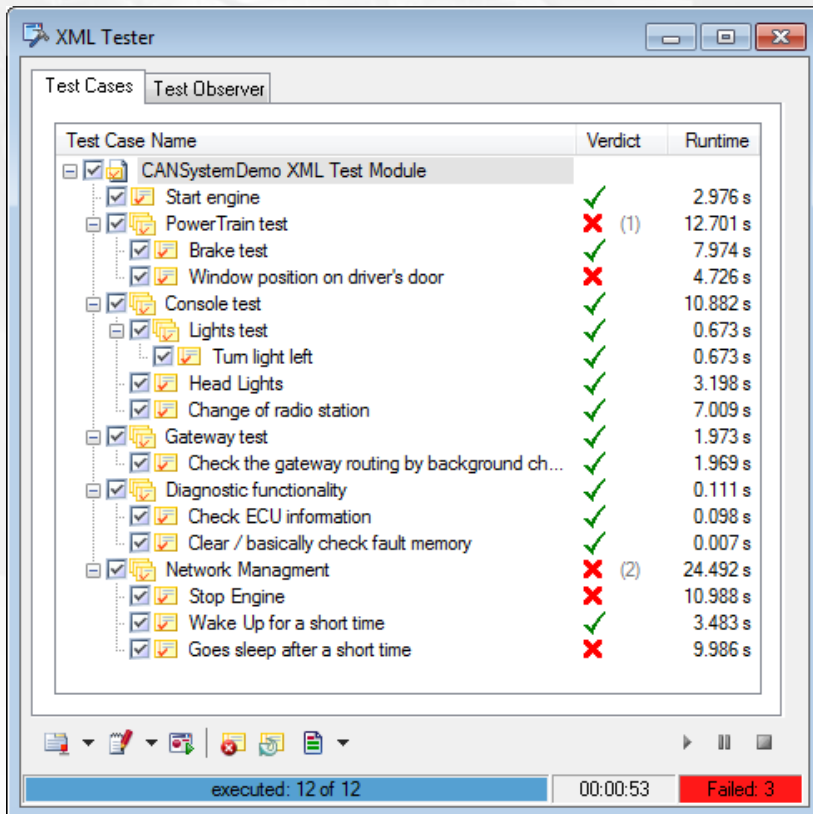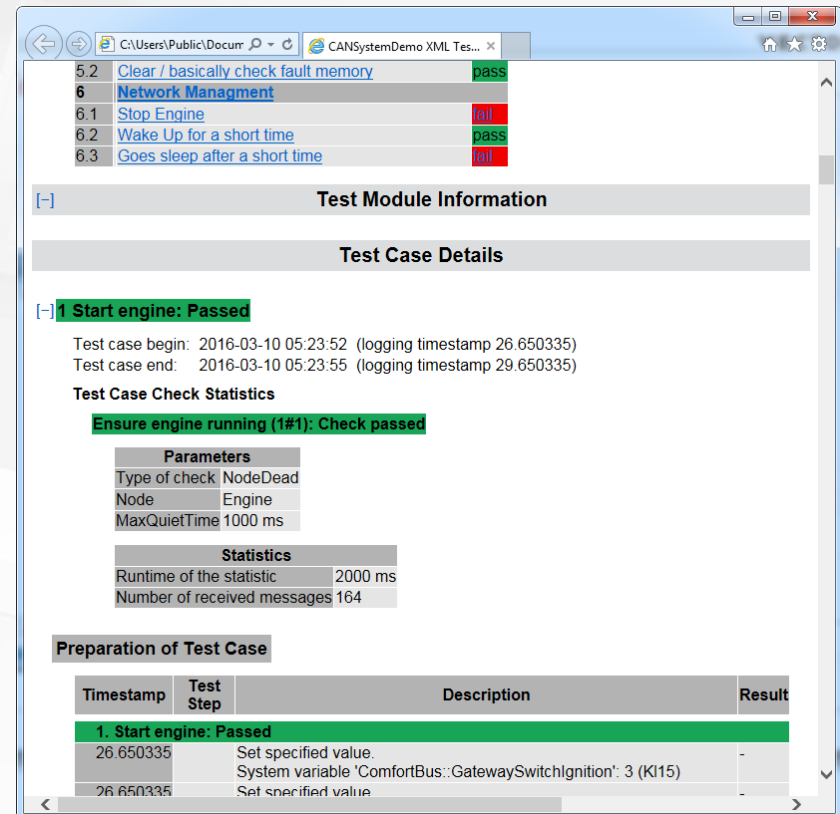Analysis Windows

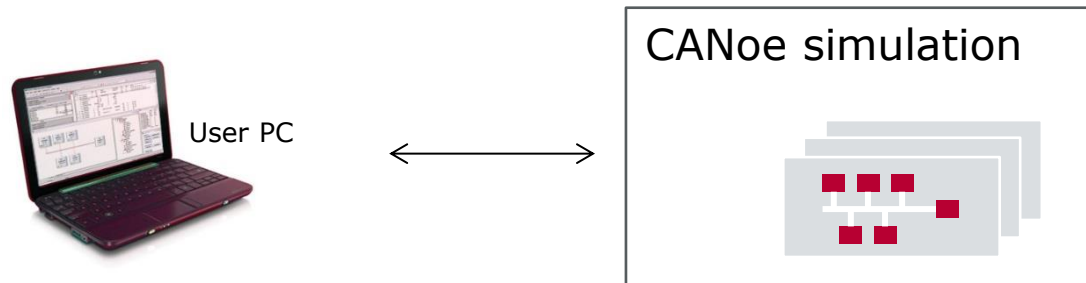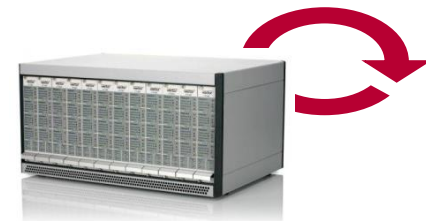Data Logging

Offline Mode

Stimulation & Simulation

Testing

Scalability

▶ **Summary**

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CANoe / CANalyzer in a nutshell

▶ Comprehensive Analysis of CAN networks with CANalyzer and CANoe
  ▶ Decoding of message data using database descriptions
  ▶ Powerful analysis features like Trace and Graphics Window
  ▶ Busstatistic Window with errorframe and burst statistics
  ▶ Logging of bus data
  ▶ Option Scope for physical layer analysis
  ▶ Stimulation features like Replay Block and Interactive Generator

▶ Powerful simulation and test features with CANoe
  ▶ Simulation of complete networks
  ▶ Automated test with reporting

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www.vector.com

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