

CANoe/CANalyzer

Tools for comprehensive CAN Network Analysis and Test - An Overview

Agenda

► **Overview**

Measurement and Simulation Setup

Working with Databases

Analysis Windows

Data Logging

Offline Mode

Simulation

Testing

Scalability

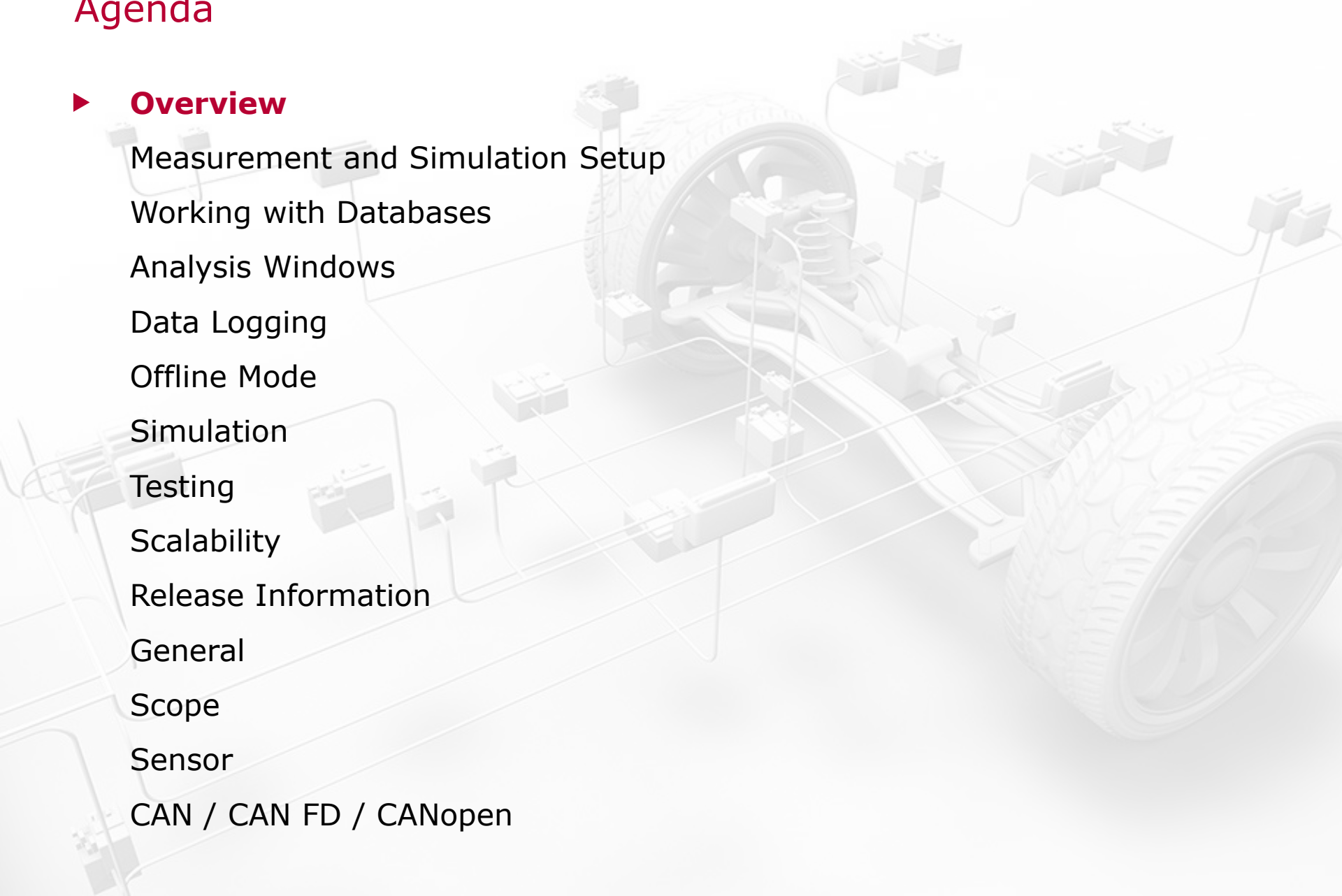
Release Information

General

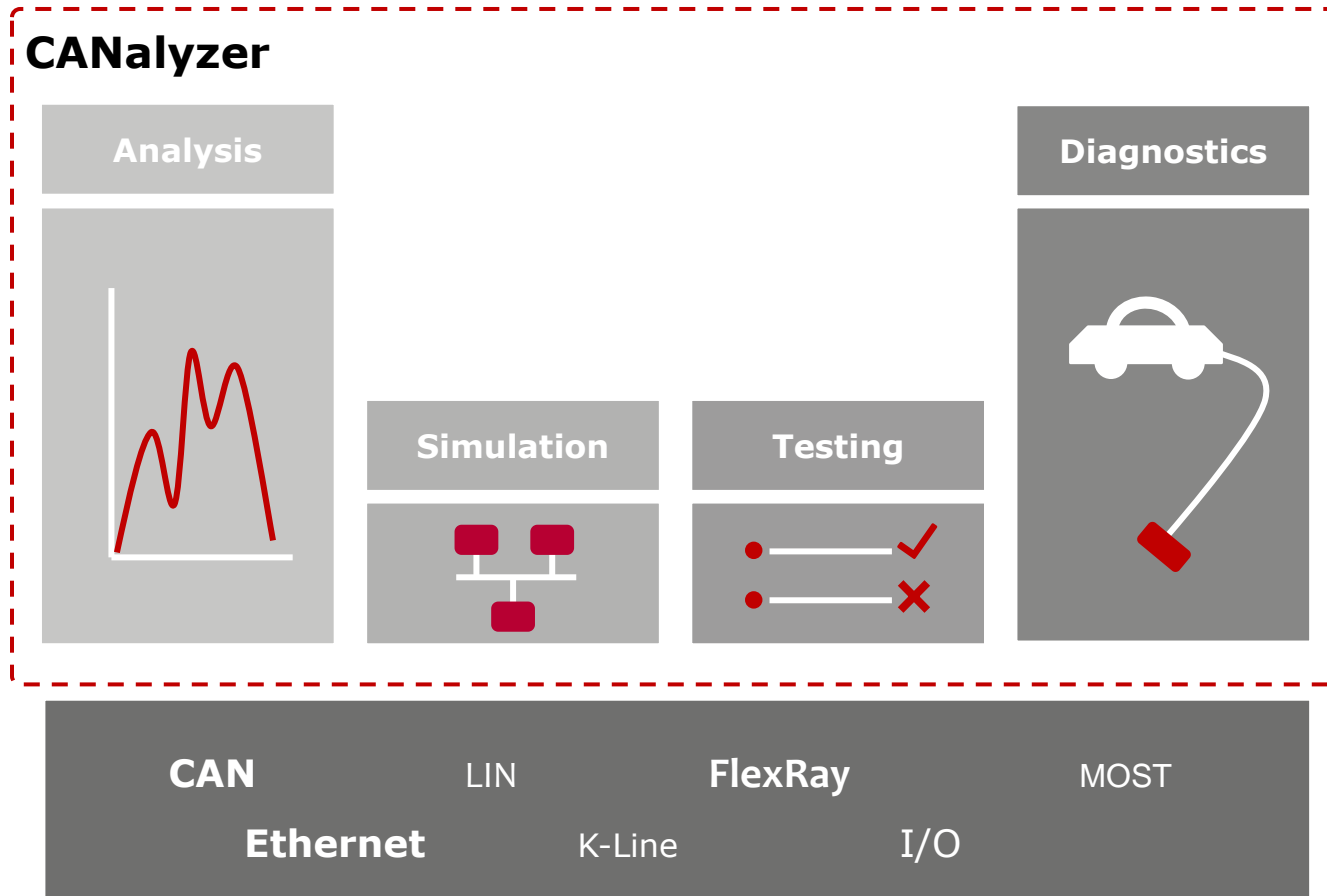
Scope

Sensor

CAN / CAN FD / CANopen

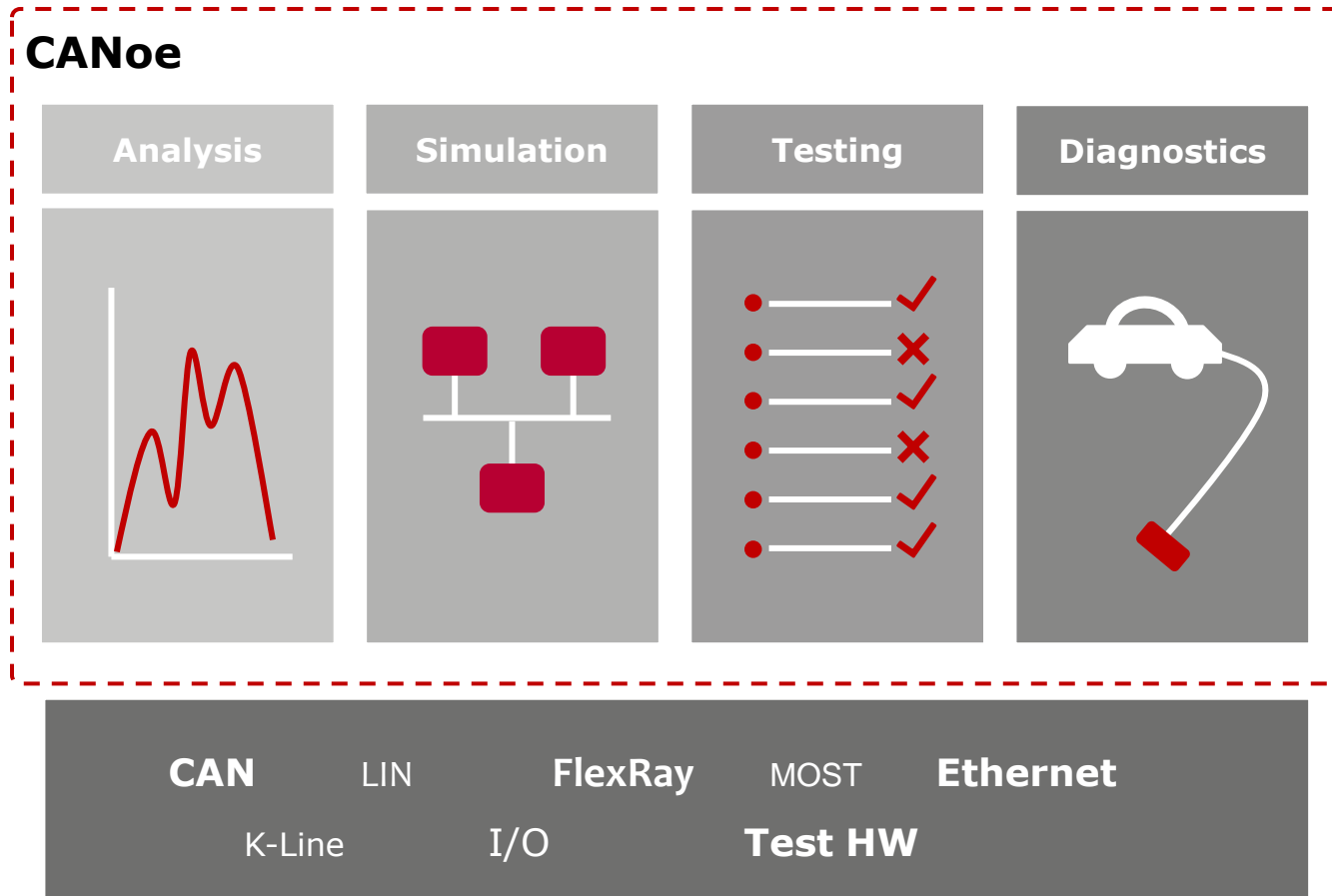


CANalyzer and CANoe: What is the difference?



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 
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*3,3V TI SN65HVD233HD Transceiver available

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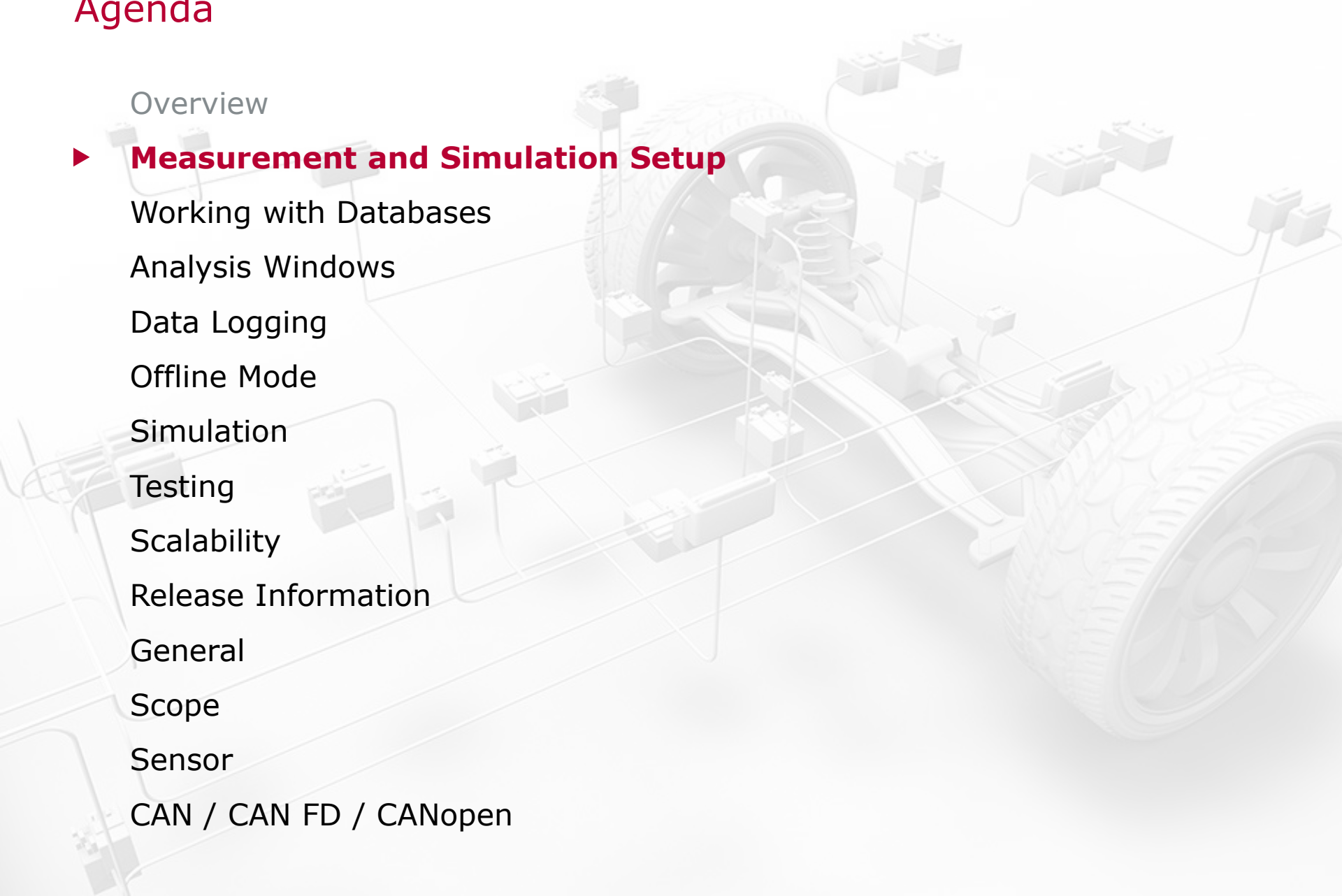
Release Information

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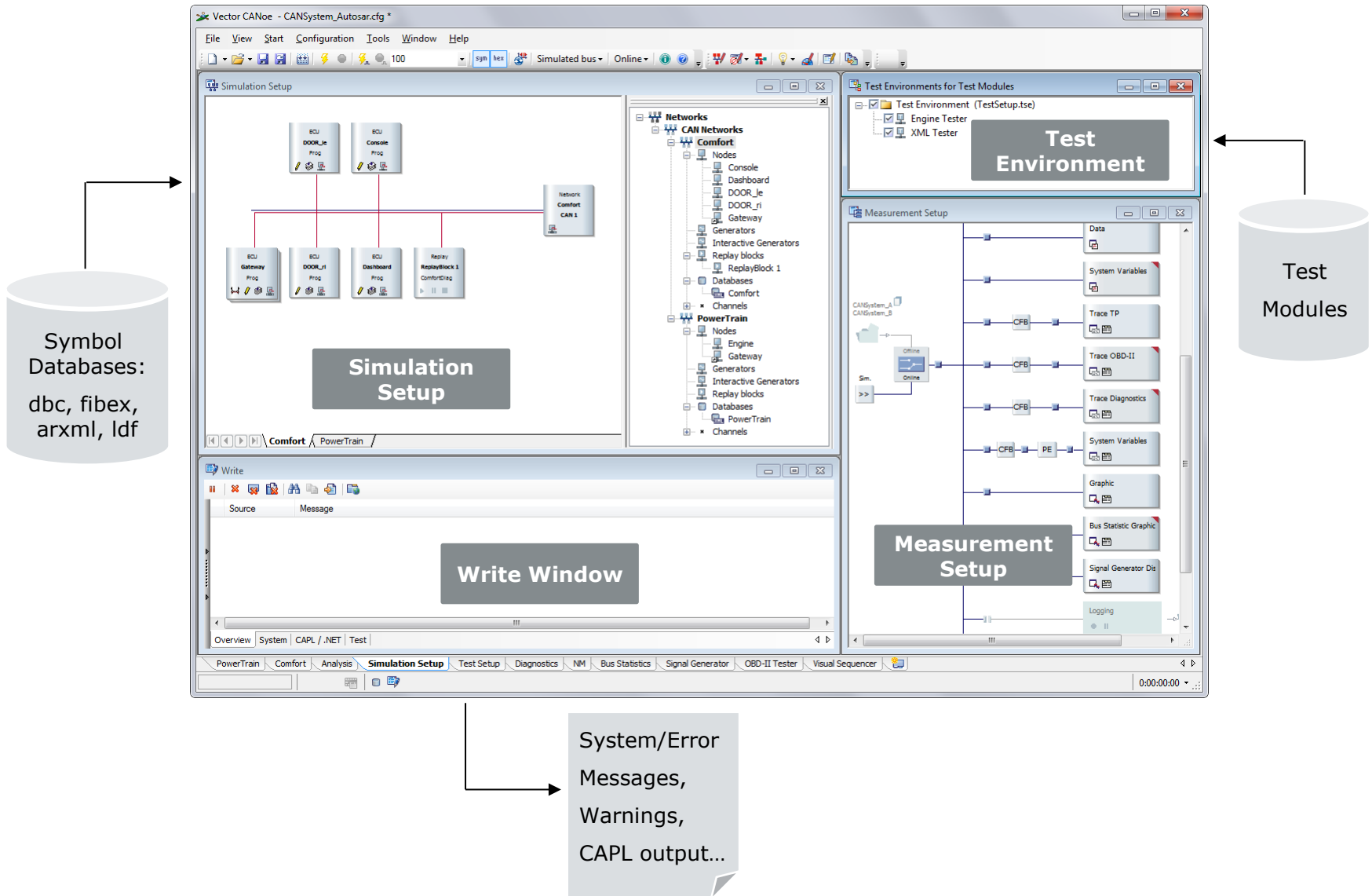
Scope

Sensor

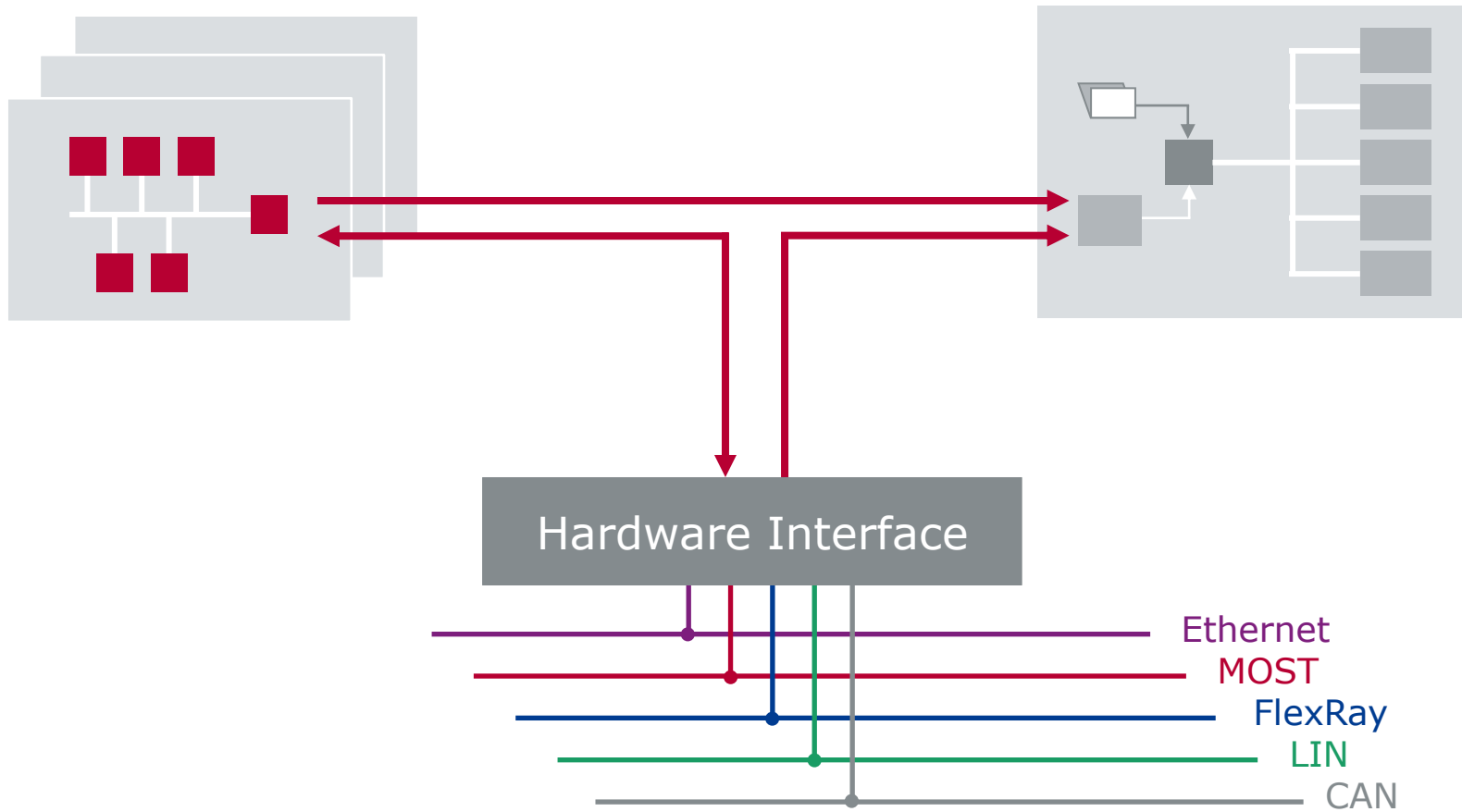
CAN / CAN FD / CANopen



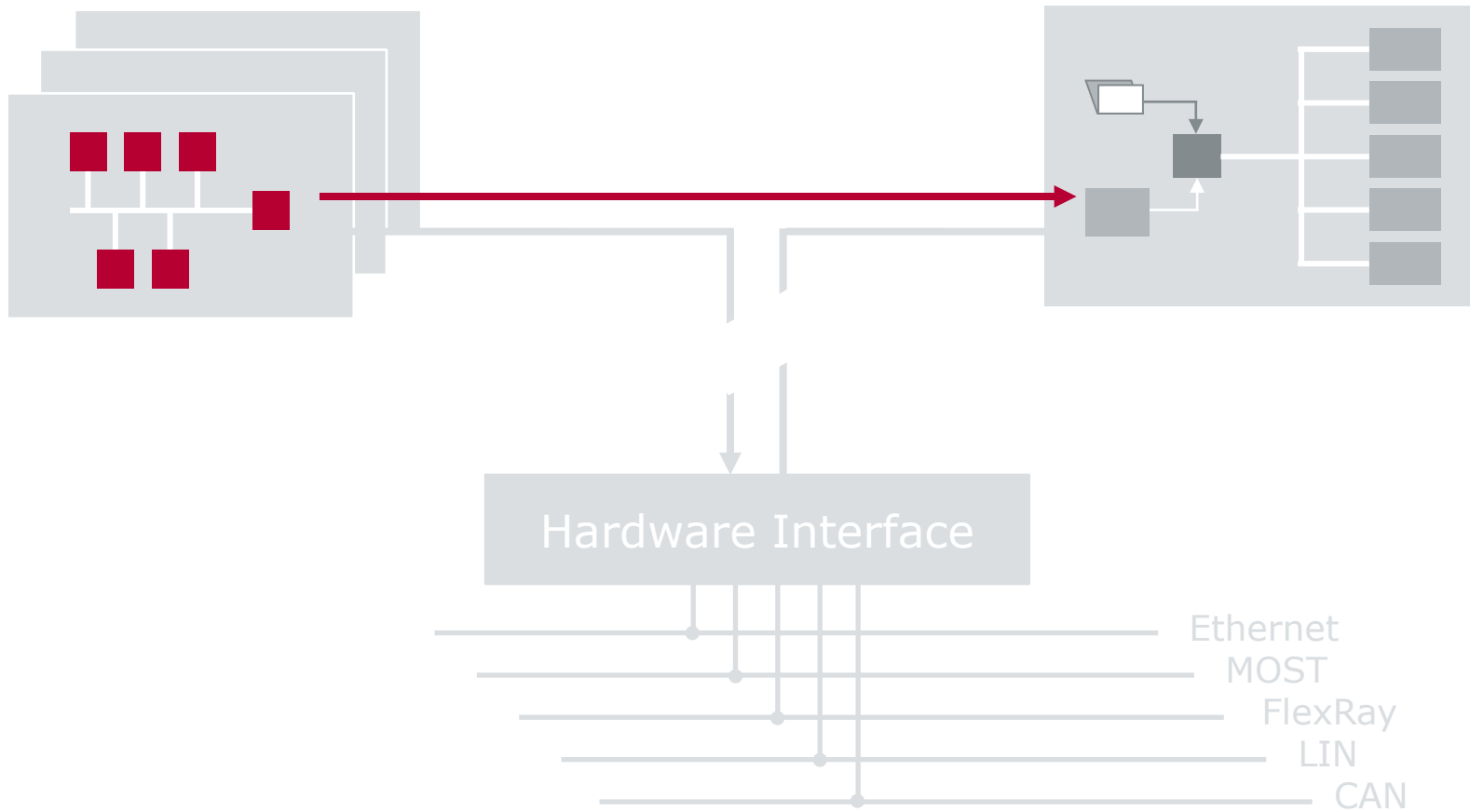
Main Windows in CANoe



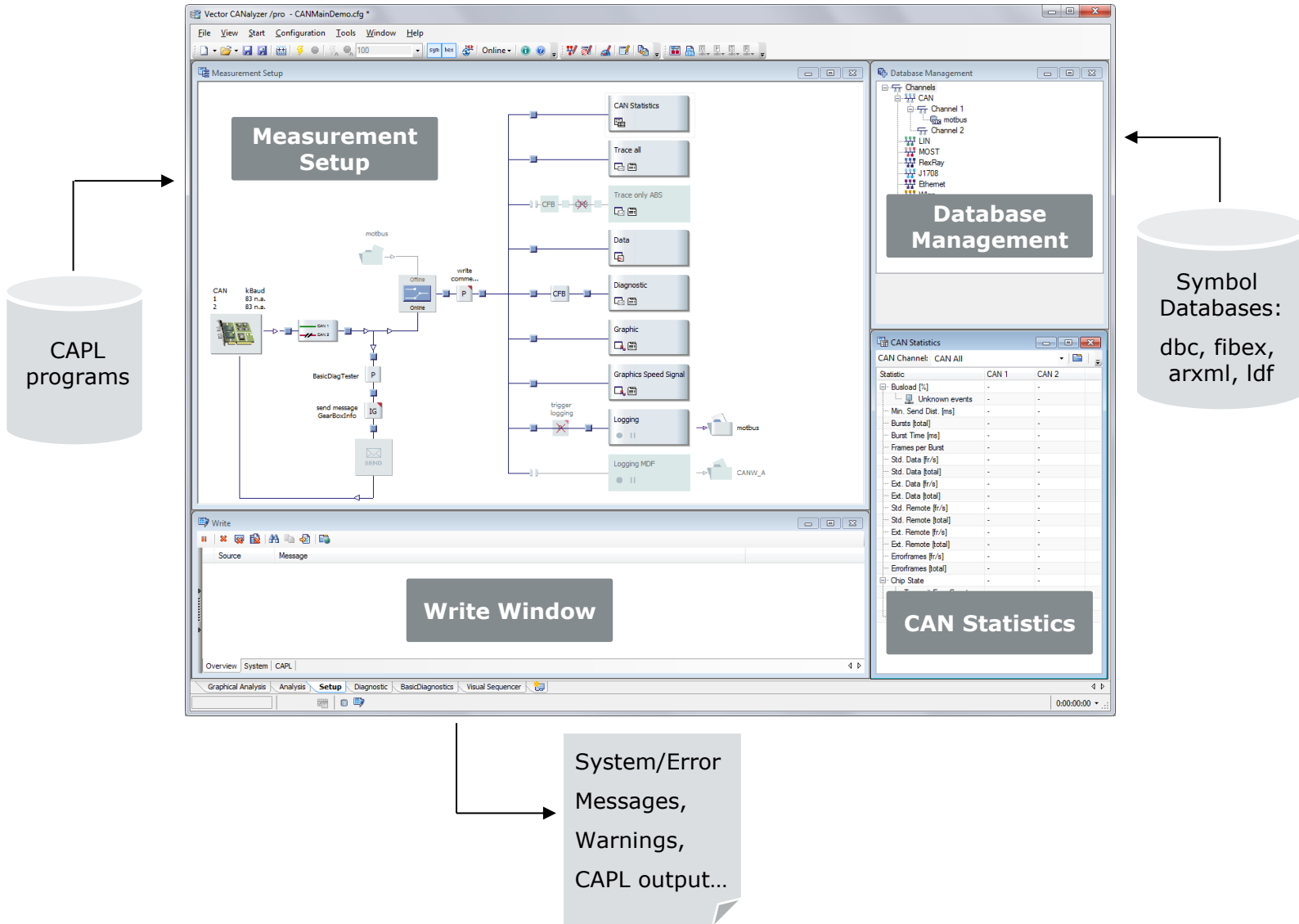
Data Flow in CANoe (Real Bus Mode)



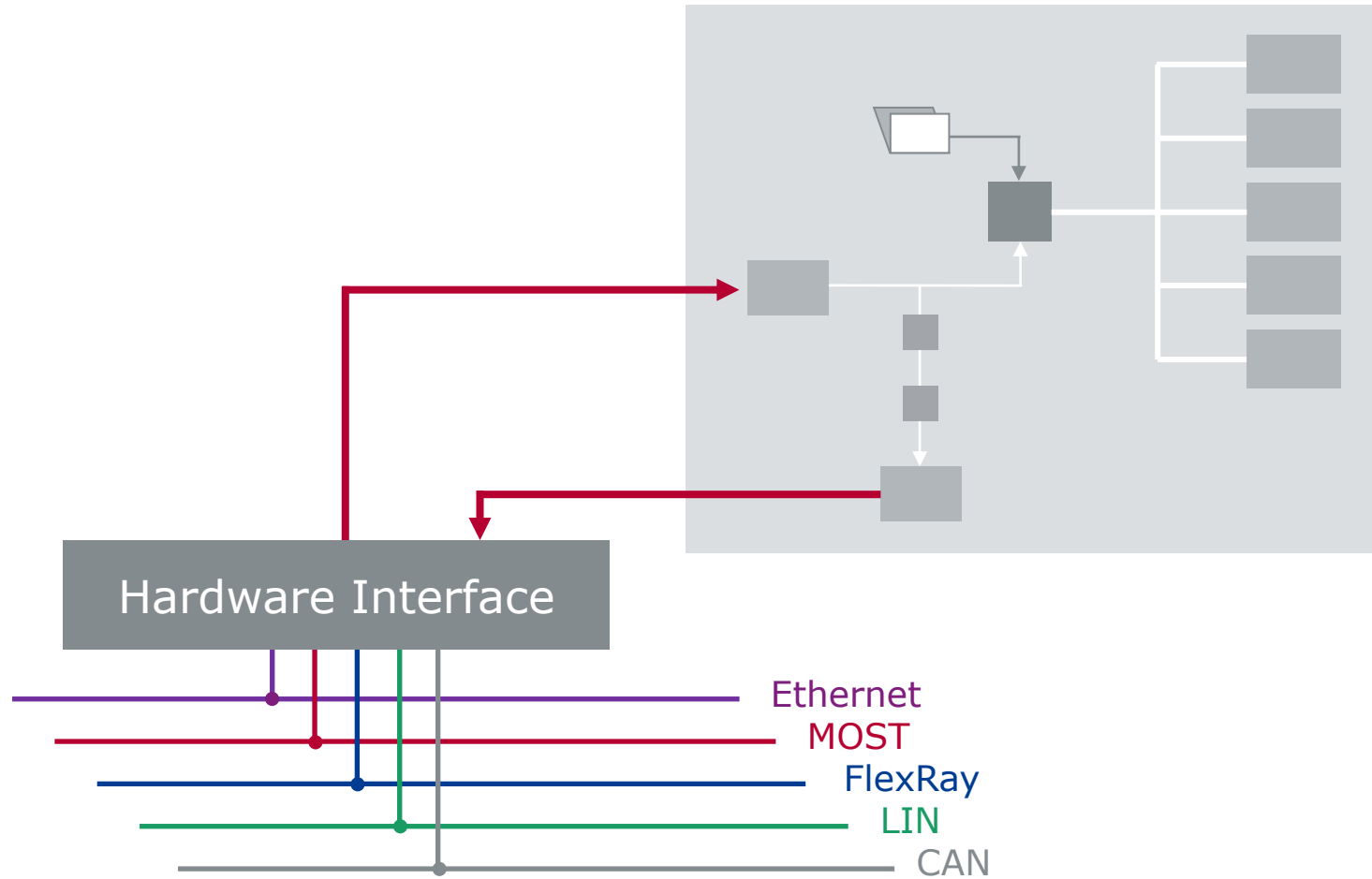
Data Flow in CANoe (Simulated Bus Mode)



Main Windows in CANalyzer



Data Flow in CANalyzer



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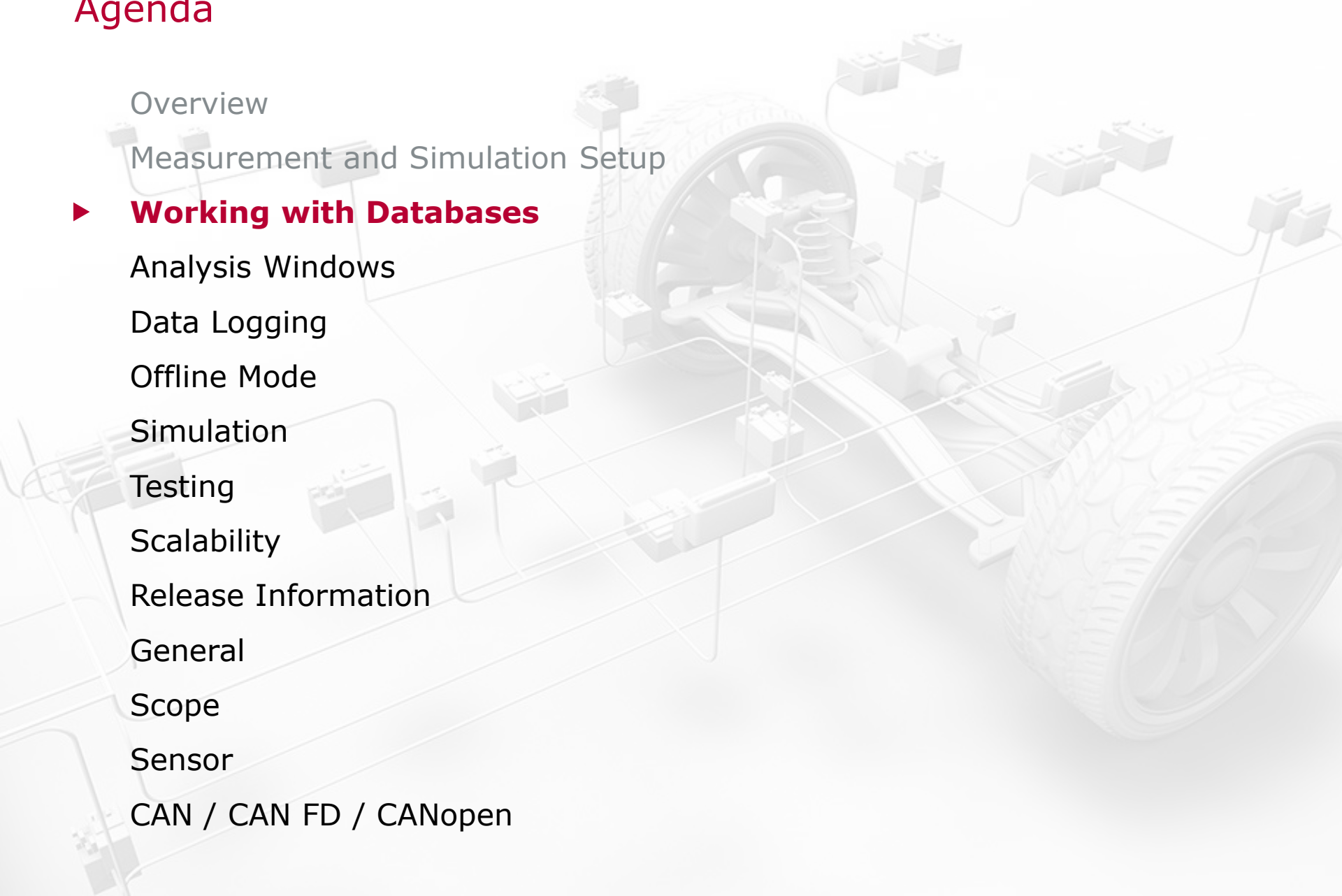
Release Information

General

Scope

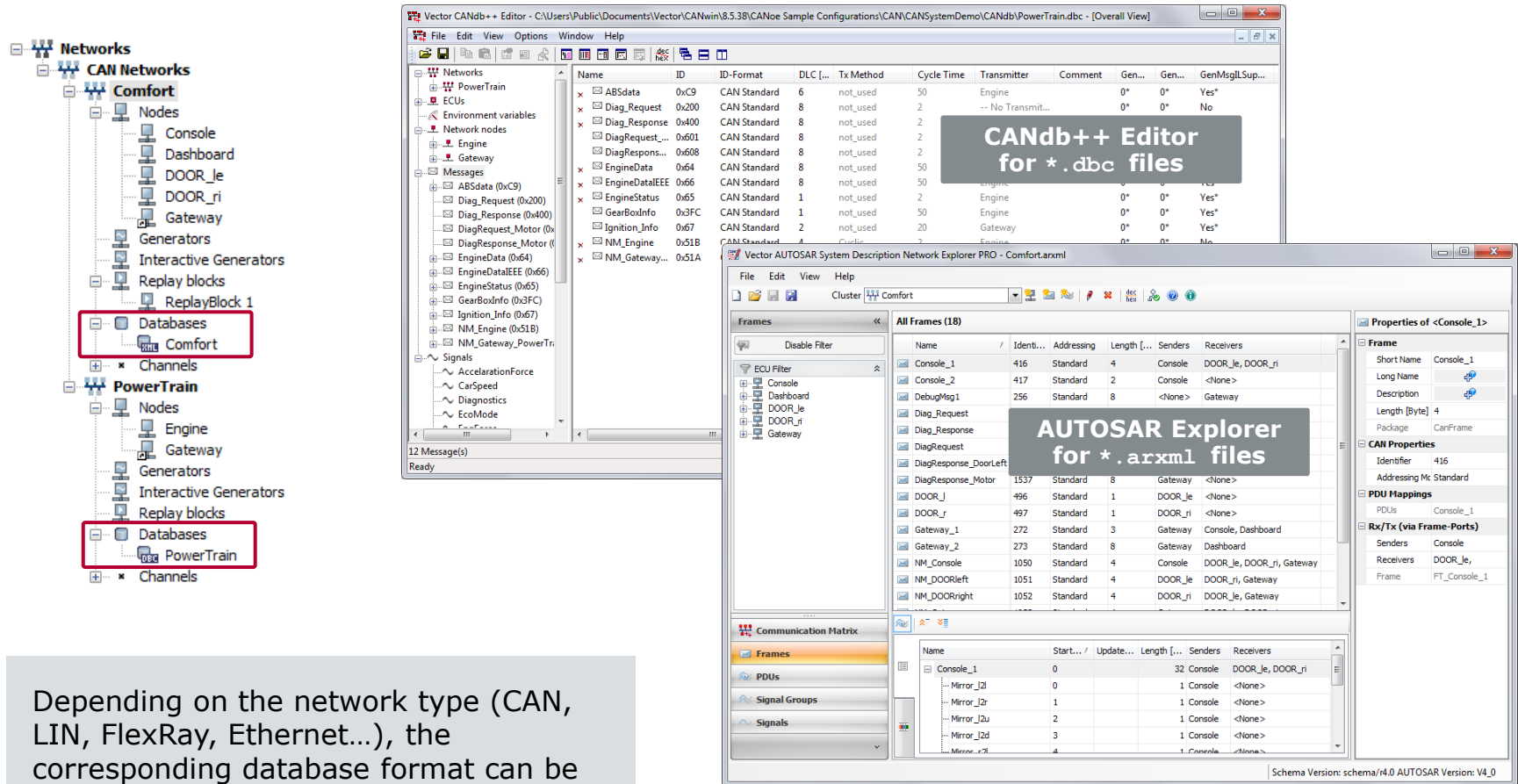
Sensor

CAN / CAN FD / CANopen



Assigning a Database

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



The screenshot displays the CANoe simulation environment. On the left, a tree view shows the network configuration for 'CAN Networks' and 'PowerTrain'. The 'Databases' folder is highlighted in red, showing 'Comfort' and 'PowerTrain' databases assigned to their respective networks.

The main window shows the 'CANdb++ Editor for *.dbc files' interface, displaying a table of CAN messages:

Name	ID	ID-Format	DLC	Tx Method	Cycle Time	Transmitter	Comment	Gen...	Gen...	GenMsgILSup...
ABSdata	0xC9	CAN Standard	6	not_used	50	Engine		0*	0*	Yes*
Diag_Request	0x200	CAN Standard	8	not_used	2	-- No Transmit...		0*	0*	No
Diag_Response	0x400	CAN Standard	8	not_used	2					
DiagRequest...	0x601	CAN Standard	8	not_used	2					
DiagResponse...	0x608	CAN Standard	8	not_used	2					
EngineData	0x64	CAN Standard	8	not_used	50	Engine				
EngineDataEEE	0x66	CAN Standard	8	not_used	50	Engine				
EngineStatus	0x65	CAN Standard	1	not_used	2	Engine		0*	0*	Yes*
GearBoxInfo	0x3FC	CAN Standard	1	not_used	50	Engine		0*	0*	Yes*
Ignition_Info	0x67	CAN Standard	2	not_used	20	Gateway		0*	0*	Yes*
NM_Engine...	0x51B	CAN Standard	4	not_used	2	Engine		0*	0*	No
NM_Gateway...	0x51A	CAN Standard	4	not_used	2	Engine		0*	0*	No

The 'AUTOSAR Explorer for *.arxml files' window shows the 'All Frames (18)' table:

Name	Ident...	Addressing	Length	Senders	Receivers
Console_1	416	Standard	4	Console	DOOR_je, DOOR_ri
Console_2	417	Standard	2	Console	<None>
DebugMsg1	256	Standard	8	<None>	Gateway
Diag_Request					
Diag_Response					
DiagRequest					
DiagResponse_DoorLeft					
DiagResponse_Motor	1537	Standard	8	Gateway	<None>
DOOR_l	496	Standard	1	DOOR_je	<None>
DOOR_r	497	Standard	1	DOOR_ri	<None>
Gateway_1	272	Standard	3	Gateway	Console, Dashboard
Gateway_2	273	Standard	8	Gateway	Dashboard
NM_Console	1050	Standard	4	Console	DOOR_je, DOOR_ri, Gateway
NM_DOORleft	1051	Standard	4	DOOR_je	DOOR_ri, Gateway
NM_DOORright	1052	Standard	4	DOOR_ri	DOOR_je, Gateway

The 'Properties of <Console_1>' window shows details for the selected frame:

- Short Name: Console_1
- Long Name: Console_1
- Description: Console_1
- Length [Byte]: 4
- Package: CarFrame
- CAN Properties: Identifier 416, Addressing Mc Standard
- PDU Mappings: PDUs Console_1
- Rx/Tx (via Frame-Ports): Senders Console, Receivers DOOR_je, Frame FT_Console_1

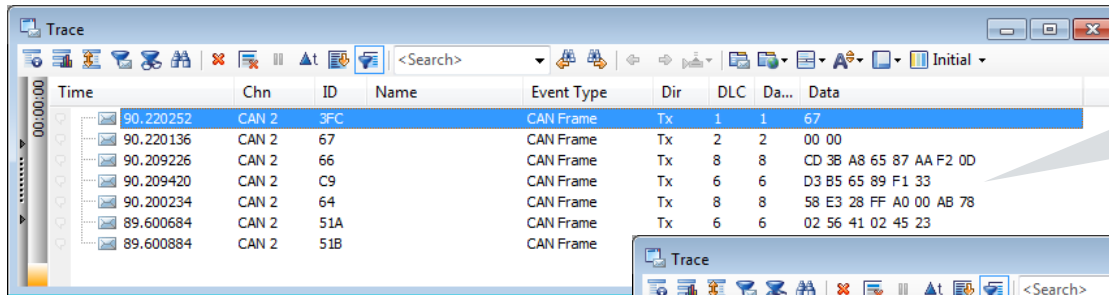
Schema Version: schema/r4.0 AUTOSAR Version: V4_0

Depending on the network type (CAN, LIN, FlexRay, Ethernet...), the corresponding database format can be selected.

Effect in Analysis

Among other things, databases contain:

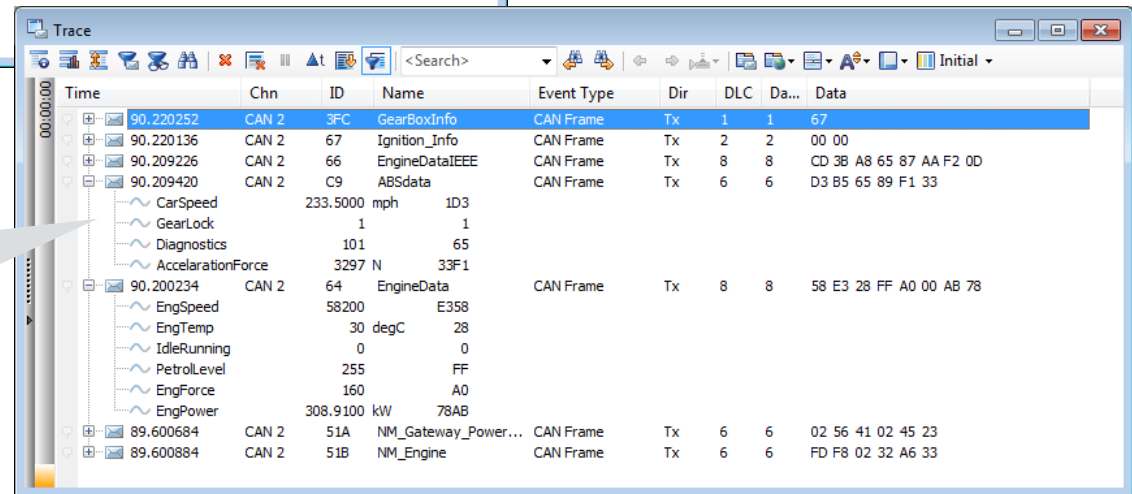
- ▶ Assignment between message identifier and symbolic message name
- ▶ Signal descriptions



Time	Chn	ID	Name	Event Type	Dir	DLC	Da...	Data
90.220252	CAN 2	3FC		CAN Frame	Tx	1	1	67
90.220136	CAN 2	67		CAN Frame	Tx	2	2	00 00
90.209226	CAN 2	66		CAN Frame	Tx	8	8	CD 3B A8 65 87 AA F2 0D
90.209420	CAN 2	C9		CAN Frame	Tx	6	6	D3 B5 65 89 F1 33
90.200234	CAN 2	64		CAN Frame	Tx	8	8	58 E3 28 FF A0 00 AB 78
89.600684	CAN 2	51A		CAN Frame	Tx	6	6	02 56 41 02 45 23
89.600884	CAN 2	51B		CAN Frame	Tx	6	6	FD F8 02 32 A6 33

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

With database assignment, messages are displayed with their symbolic names and described signals



Time	Chn	ID	Name	Event Type	Dir	DLC	Da...	Data
90.220252	CAN 2	3FC	GearBoxInfo	CAN Frame	Tx	1	1	67
90.220136	CAN 2	67	Ignition_Info	CAN Frame	Tx	2	2	00 00
90.209226	CAN 2	66	EngineDataIEEE	CAN Frame	Tx	8	8	CD 3B A8 65 87 AA F2 0D
90.209420	CAN 2	C9	ABSdata	CAN Frame	Tx	6	6	D3 B5 65 89 F1 33
90.200234	CAN 2	64	EngineData	CAN Frame	Tx	8	8	58 E3 28 FF A0 00 AB 78
89.600684	CAN 2	51A	NM_Gateway_Power...	CAN Frame	Tx	6	6	02 56 41 02 45 23
89.600884	CAN 2	51B	NM_Engine	CAN Frame	Tx	6	6	FD F8 02 32 A6 33

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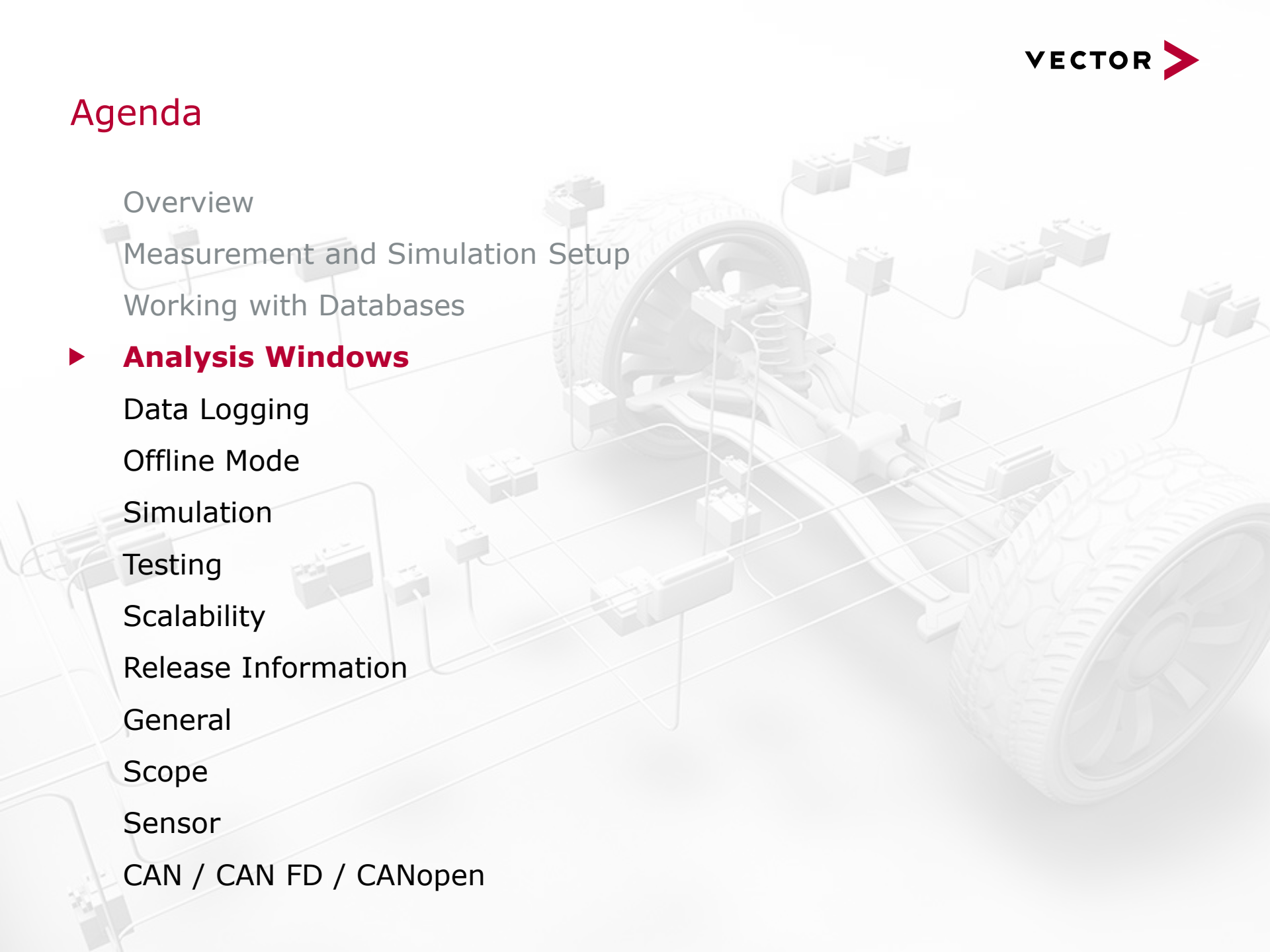
Release Information

General

Scope

Sensor

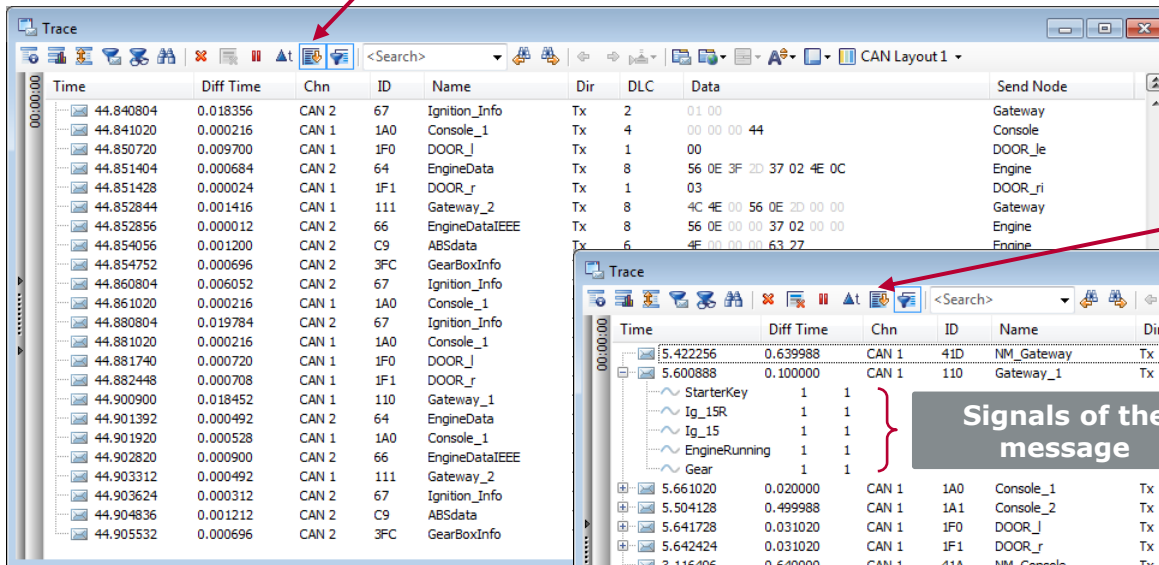
CAN / CAN FD / CANopen



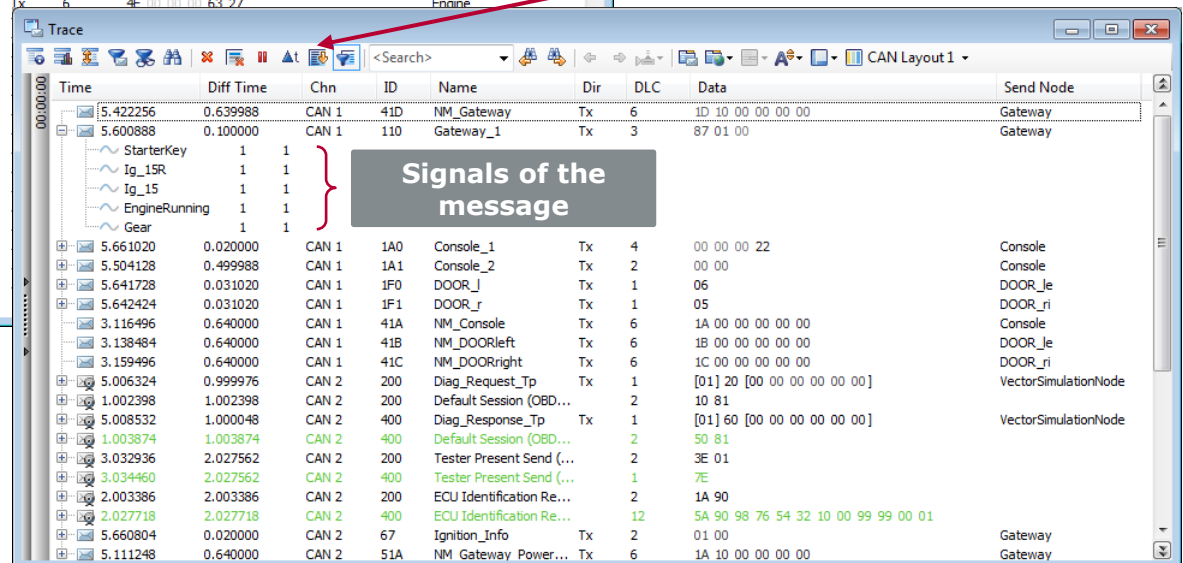
Trace Window

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

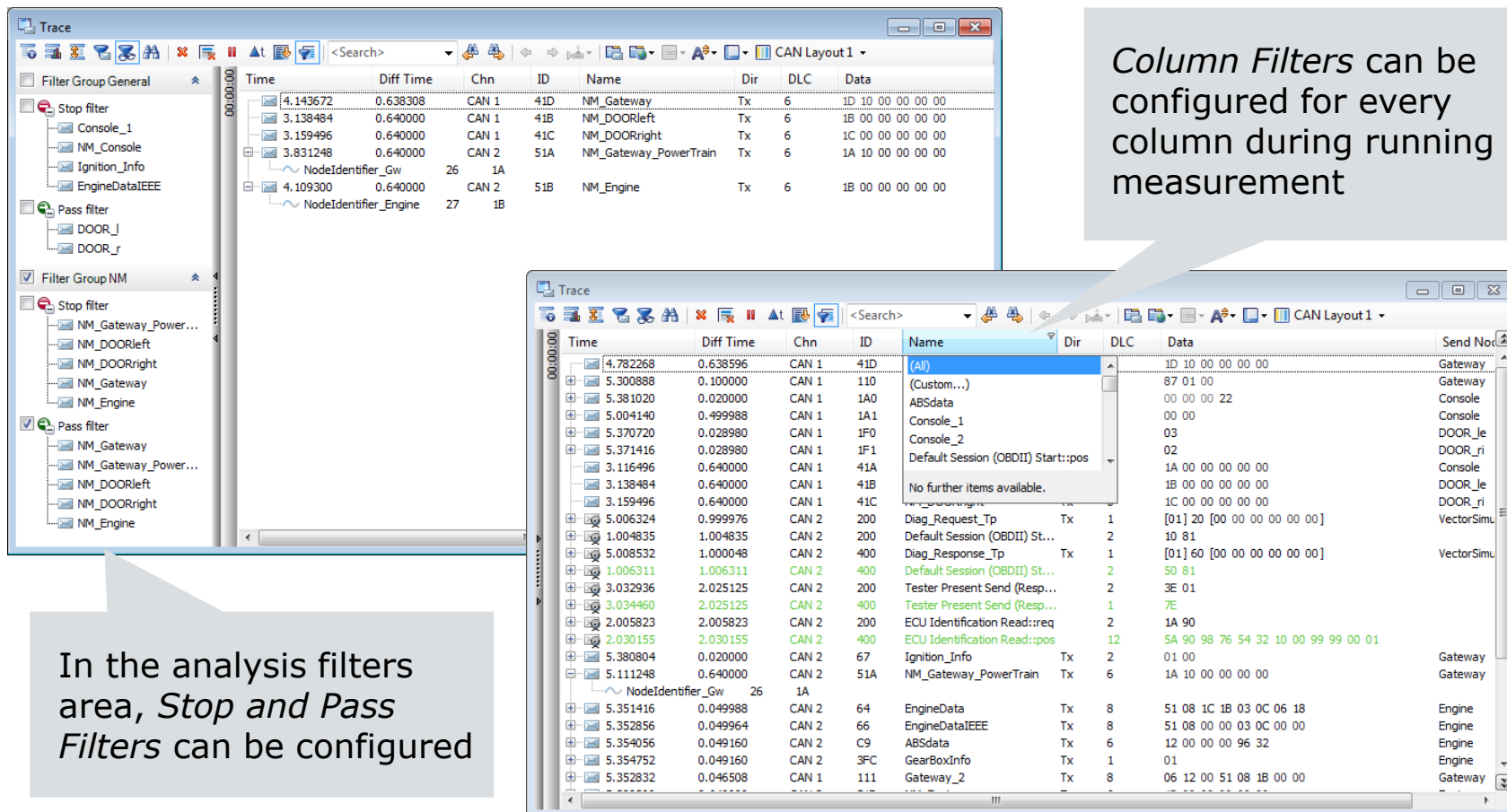


Fixed Position Display Mode



Trace Window – Filter Options

Different filter options are available in the Trace Window. They can be activated and deactivated during the measurement:



The screenshot shows the Trace Window interface with two panels. The left panel displays filter groups: 'Filter Group General' and 'Filter Group NM'. Under 'Filter Group General', there are 'Stop filter' (Console_1, NM_Console, Ignition_Info, EngineDataIEEE) and 'Pass filter' (DOOR_l, DOOR_r). Under 'Filter Group NM', there are 'Stop filter' (NM_Gateway_Power..., NM_DOORleft, NM_DOORright, NM_Gateway, NM_Engine) and 'Pass filter' (NM_Gateway, NM_Gateway_Power..., NM_DOORleft, NM_DOORright, NM_Engine). The right panel shows a table of trace data with columns: Time, Diff Time, Chn, ID, Name, Dir, DLC, Data, and Send No. A context menu is open over the 'Name' column, showing options like '(All)', '(Custom...)', 'ABSdata', 'Console_1', 'Console_2', 'Default Session (OBDII) Start:pos', and 'No further items available.'.

Column Filters can be configured for every column during running measurement

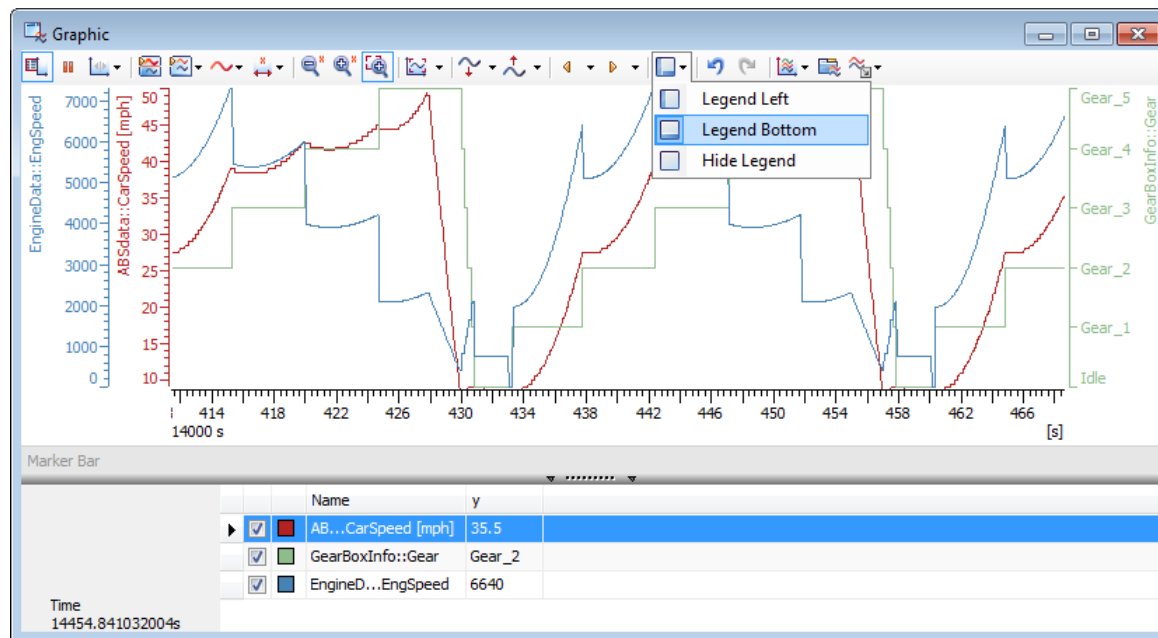
In the analysis filters area, Stop and Pass Filters can be configured

Time	Diff Time	Chn	ID	Name	Dir	DLC	Data	Send No.
4.143672	0.638308	CAN 1	41D	NM_Gateway	Tx	6	1D 10 00 00 00 00	Gateway
3.138484	0.640000	CAN 1	41B	NM_DOORleft	Tx	6	1B 00 00 00 00 00	Gateway
3.159496	0.640000	CAN 1	41C	NM_DOORright	Tx	6	1C 00 00 00 00 00	Console
3.831248	0.640000	CAN 2	51A	NM_Gateway_PowerTrain	Tx	6	1A 10 00 00 00 00	Console
4.109300	0.640000	CAN 2	51B	NM_Engine	Tx	6	1B 00 00 00 00 00	DOOR_le

Graphics Window

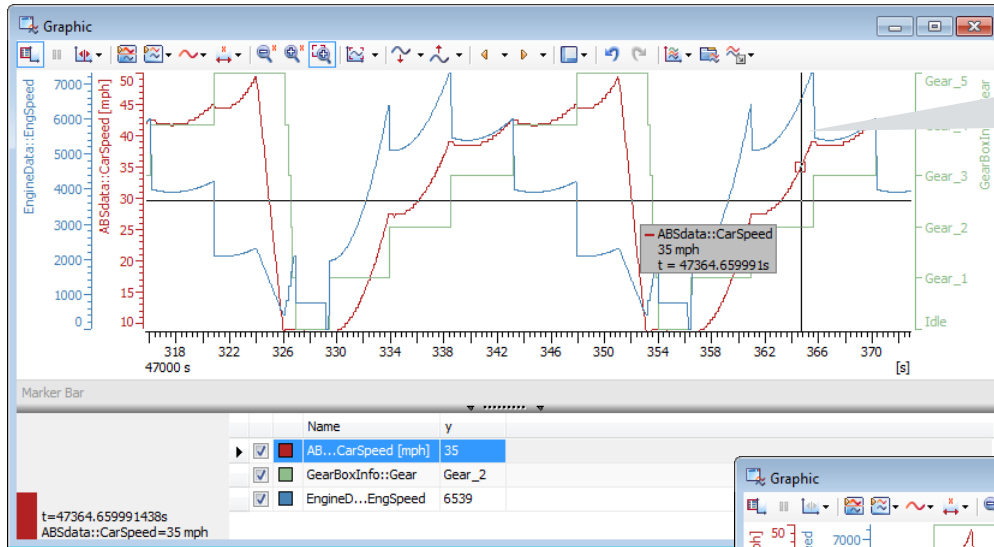
In the Graphics Window symbols are displayed graphically in an XY diagram:

- ▶ 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



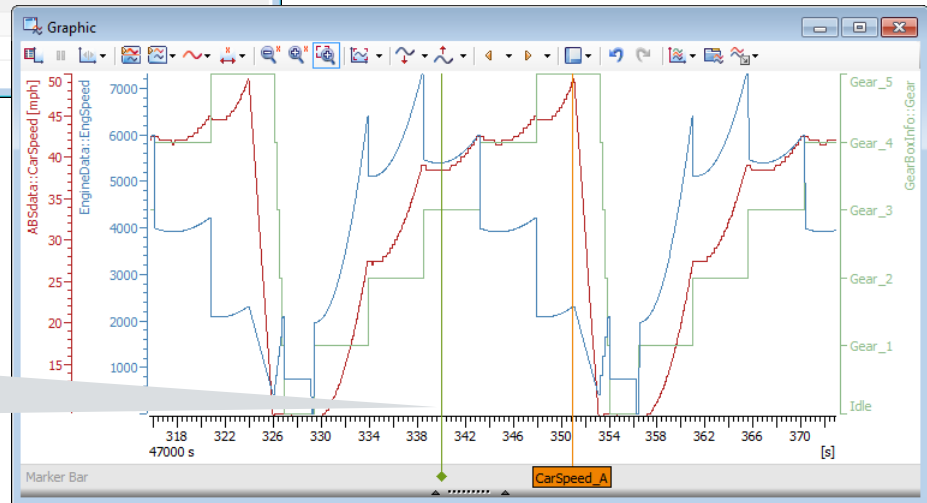
Graphics Window – Measurement and Evaluation

Various functions allow to measure and evaluate the curves:



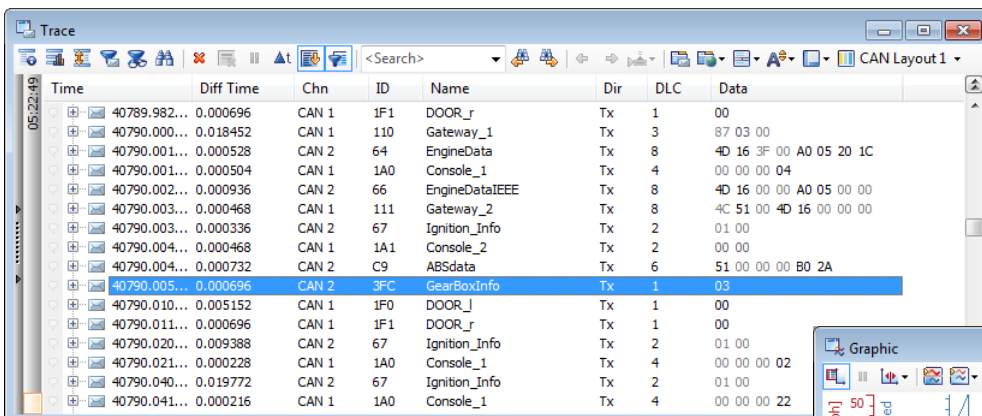
Measurement Cursor and Difference Cursors for absolute and relative value analysis

Markers can be set to easily tag and locate different points in time of a measurement



Synchronize Windows

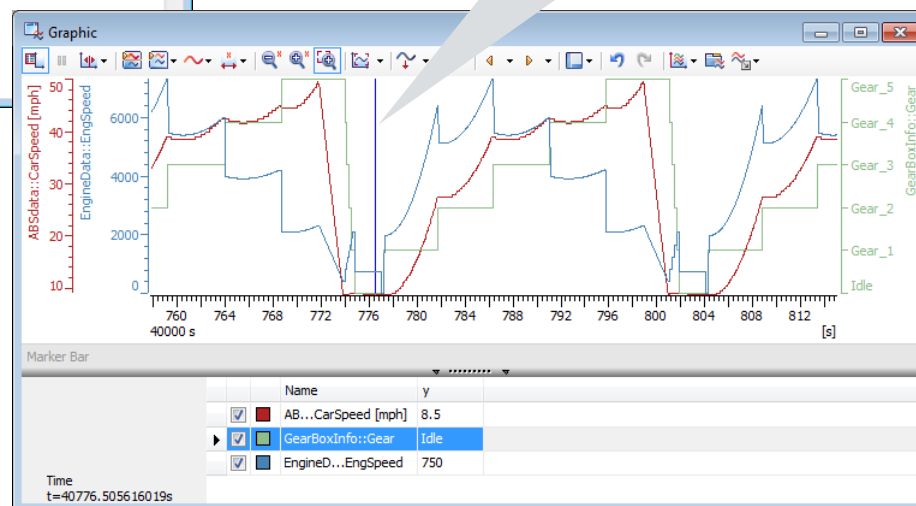
Data can be analyzed synchronously after stop of measurement. Amongst others, synchronization of analysis windows is supported in Trace and Graphics Windows.



Time	Diff Time	Chn	ID	Name	Dir	DLC	Data
40789.982...	0.000696	CAN 1	1F1	DOOR_r	Tx	1	00
40790.000...	0.018452	CAN 1	110	Gateway_1	Tx	3	87 03 00
40790.001...	0.000528	CAN 2	64	EngineData	Tx	8	4D 16 3F 00 A0 05 20 1C
40790.001...	0.000504	CAN 1	1A0	Console_1	Tx	4	00 00 00 04
40790.002...	0.000936	CAN 2	66	EngineDataIEEE	Tx	8	4D 16 00 00 A0 05 00 00
40790.003...	0.000468	CAN 1	111	Gateway_2	Tx	8	4C 51 00 4D 16 00 00 00
40790.003...	0.000336	CAN 2	67	Ignition_Info	Tx	2	01 00
40790.004...	0.000468	CAN 1	1A1	Console_2	Tx	2	00 00
40790.004...	0.000732	CAN 2	C9	ABSdata	Tx	6	51 00 00 00 80 2A
40790.005...	0.000696	CAN 2	3FC	GearBoxInfo	Tx	1	03
40790.010...	0.005152	CAN 1	1F0	DOOR_l	Tx	1	00
40790.011...	0.000696	CAN 1	1F1	DOOR_r	Tx	1	00
40790.020...	0.009388	CAN 2	67	Ignition_Info	Tx	2	01 00
40790.021...	0.000228	CAN 1	1A0	Console_1	Tx	4	00 00 00 02
40790.040...	0.019772	CAN 2	67	Ignition_Info	Tx	2	01 00
40790.041...	0.000216	CAN 1	1A0	Console_1	Tx	4	00 00 00 22

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

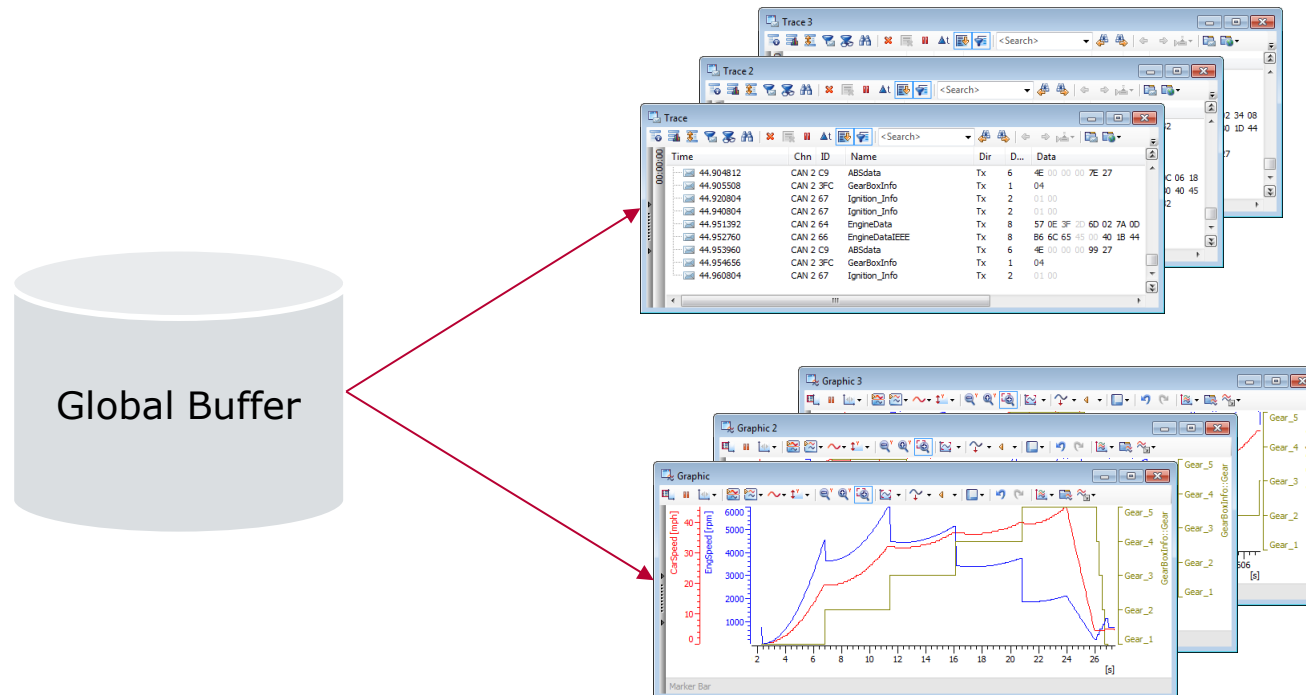
When marking a message in the Trace Window, the corresponding event in the synchronized Graphics Window is marked by a blue measurement cursor



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:

Statistic	Current / Last	Min	Max	Avg
Busload [%]	15.02	11.20	16.91	14.29
Console	5.38	5.26	5.57	5.34
Dashboard	0.00	0.00	0.00	0.00
DOOR_le	2.38	2.38	2.59	2.41
DOOR_ri	2.31	2.26	2.55	2.32
Gateway	4.95	1.05	6.84	4.22
VectorSimulationNode	0.00	0.00	0.00	0.00
Unknown sender	0.00	0.00	0.00	0.00
Unknown events	0.00	0.00	0.00	0.00
Min. Send Dist. [ms]	0.000	n/a	n/a	n/a
Burst Time [ms]	6.960	1.392	7.392	2.454
Bursts [total]	4647	n/a	n/a	n/a
Console	23	n/a	n/a	n/a
Dashboard	-	n/a	n/a	n/a
DOOR_le	-	n/a	n/a	n/a
DOOR_ri	-	n/a	n/a	n/a
Gateway	19	n/a	n/a	n/a
VectorSimulationNode	-	n/a	n/a	n/a
Unknown sender	-	n/a	n/a	n/a
Frames per Burst	7	2	7	3
Std. Data [fr/s]	157	130	171	153
Std. Data [total]	17369	n/a	n/a	n/a
Ext. Data [fr/s]	0	0	0	0
Ext. Data [total]	0	n/a	n/a	n/a
Std. Remote [fr/s]	0	0	0	0
Std. Remote [total]	0	n/a	n/a	n/a
Ext. Remote [fr/s]	0	0	0	0
Ext. Remote [total]	0	n/a	n/a	n/a
Errorframes [fr/s]	0	0	0	0
Errorframes [total]	0	n/a	n/a	n/a
Chip State	Simulated	n/a	n/a	n/a
Transmit Error Count	0	n/a	0	n/a
Receive Error Count	0	n/a	0	n/a
Transceiver Errors	0	n/a	n/a	n/a

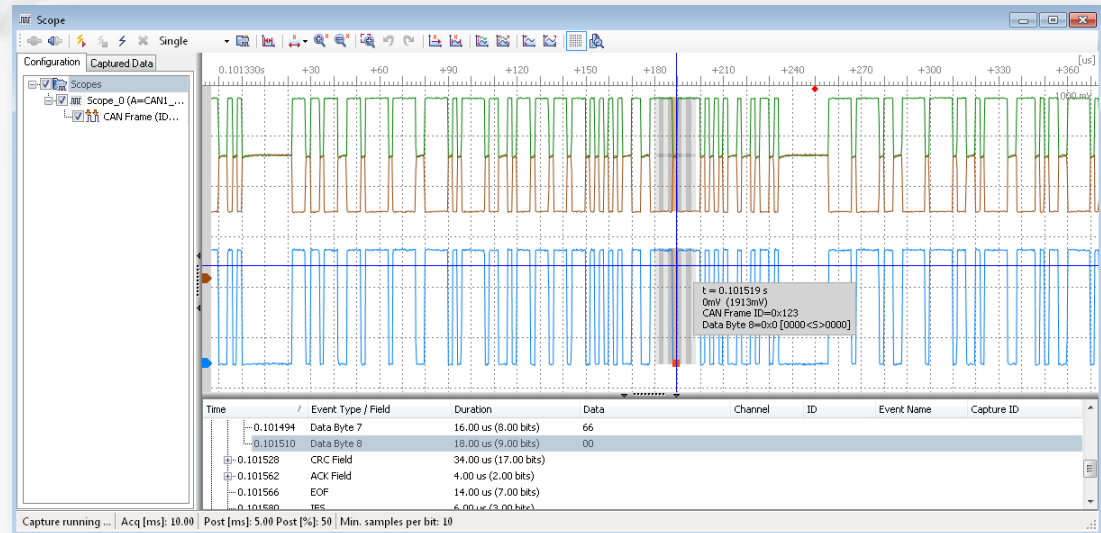
Total number of bursts during the measurement as well as the burst time

Error Statistics (Bus specific)

Statistic	Current / Last	Min	Max	Avg
Errors Bus [total]	24	n/a	n/a	n/a
Errors Resp [total]	0	n/a	n/a	n/a
Errors Resp Detected [total]	0	n/a	n/a	n/a
GWE	n/a	n/a	n/a	n/a
DLF_Left	0	n/a	n/a	n/a
DLF_Right	0	n/a	n/a	n/a
DLR_Left	0	n/a	n/a	n/a
DLR_Right	0	n/a	n/a	n/a
WWS	0	n/a	n/a	n/a
Diag No Resps [total]	9761	n/a	n/a	n/a
Busload [%]	43.16	0.00	43.53	42.50
Frames [fr/s]	0	0	2	0
Frames [total]	11	n/a	n/a	n/a
Frame Cycle Time [ms]	1242.46	600.00	46380.00	15381.51
Baud Rate Master [bit/s]	19202	19198	19203	19202
Baud Rate Dev. Master [%]	0.01	0.00	0.02	0.01
Tolerance Header [%]	18.20	17.62	18.21	18.20
Tolerance Resp [%]	0.02	0.02	0.02	0.02
Duration Header [ms]	2.093	2.083	2.093	2.093
Duration Resp [ms]	1.563	1.563	4.688	1.847
Resp Space [us]	0.3	0.2	0.4	0.3
Sleep Commands [total]	1	n/a	n/a	n/a
Wakeups [total]	0	n/a	n/a	n/a
Wakeups Duration [us]	-	-	-	-
Init Time Master [ms]	-	-	-	-
ETF Resps / Headers [total]	-	n/a	n/a	n/a
ETF Invalid Resps / Head...	-	n/a	n/a	n/a
ETF Collisions / Headers [t...	-	n/a	n/a	n/a
ETF Resolutions / Collisio...	-	n/a	n/a	n/a

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



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

The screenshot displays the Vector Scope Window interface. On the left, the 'Devices and Triggers' panel shows the scope configuration for 'Scope_1 (A=CAN1_H, B=CAN1_L, External=Trigger)' and 'CAN Frame (ID=0x0-0x7F, Channel=CAN1)'. Below it, the 'Eye Diagram' panel is set to 'Filter settings' with 'Frame: CAN Frame', 'Channel: CAN 1', 'ECU: All', and 'Bit fields: Standard'. The main window is divided into three sections: a top-left waveform view showing a CAN signal with a highlighted frame, a top-right eye diagram showing signal transitions, and a bottom table of bus events.

Time	Event / Bit	Duration	Rise Time	Fall Time	Min Voltage	Max Voltage
426.909272	CAN Frame	243.98 us	285.07 +/- 49.49 ns	100.99 +/- 16.86 ns	-70 mV	1650 mV
426.909272	Stuff Bit (0)	2.00 us	-	90.38 ns	-	-
426.909272	PDF (1)	2.00 us	293.24 ns	-	-	-
426.909272	DLC (0)	2.00 us	-	70.81 ns	-	-

Time	Event Type / Field	Duration	Data	Channel	ID	Event Name	Capture ID
426.909272	CAN Frame	244.00 us (122.00 bits)	00 01 02 03 04 05 06 07	CAN1	100		3
426.909034	SOF	2.00 us (1.00 bits)			100		
426.909036	ARB Field	26.00 us (13.00 bits)	100		100		
426.909062	CTRL Field	14.00 us (7.00 bits)			100		
426.909062	IDE	2.00 us (1.00 bits)	0		100		
426.909064	PDF	4.00 us (2.00 bits)	0		100		
426.909068	DLC	8.00 us (4.00 bits)	8		100		
426.909076	DATA Field	146.00 us (73.00 bits)	00 01 02 03 04 05 06 07		100		
426.909222	CRC Field	32.00 us (16.00 bits)			100		
426.909254	ACK Field	4.00 us (2.00 bits)			100		
426.909258	EOF	14.00 us (7.00 bits)	7F		100		
426.909372	TSF	6.00 us (3.00 bits)			100		

Acq [ms]: 10.00 Post [ms]: 5.00 Post [%]: 50 Min. samples per bit: 25

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▶ **Data Logging**

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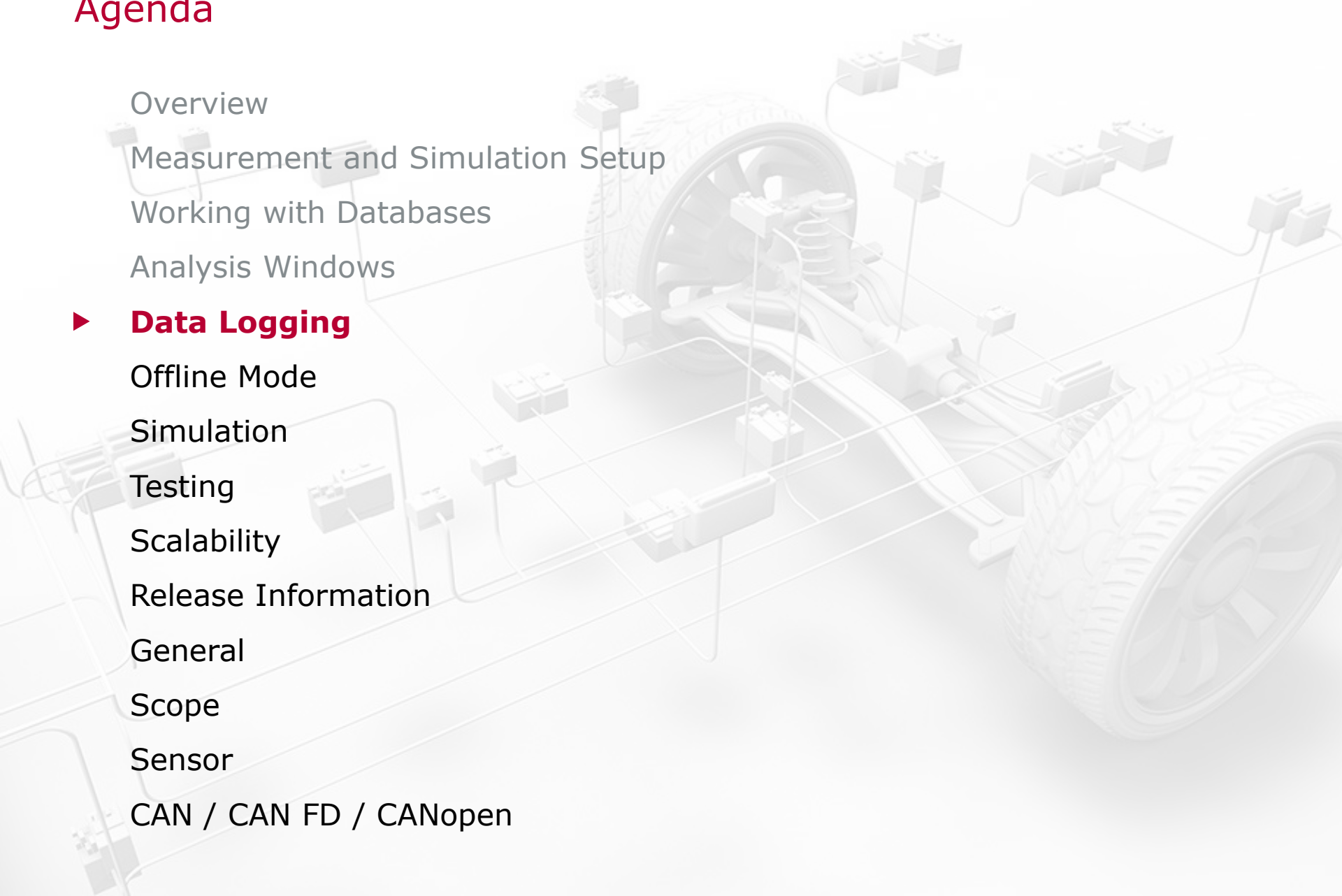
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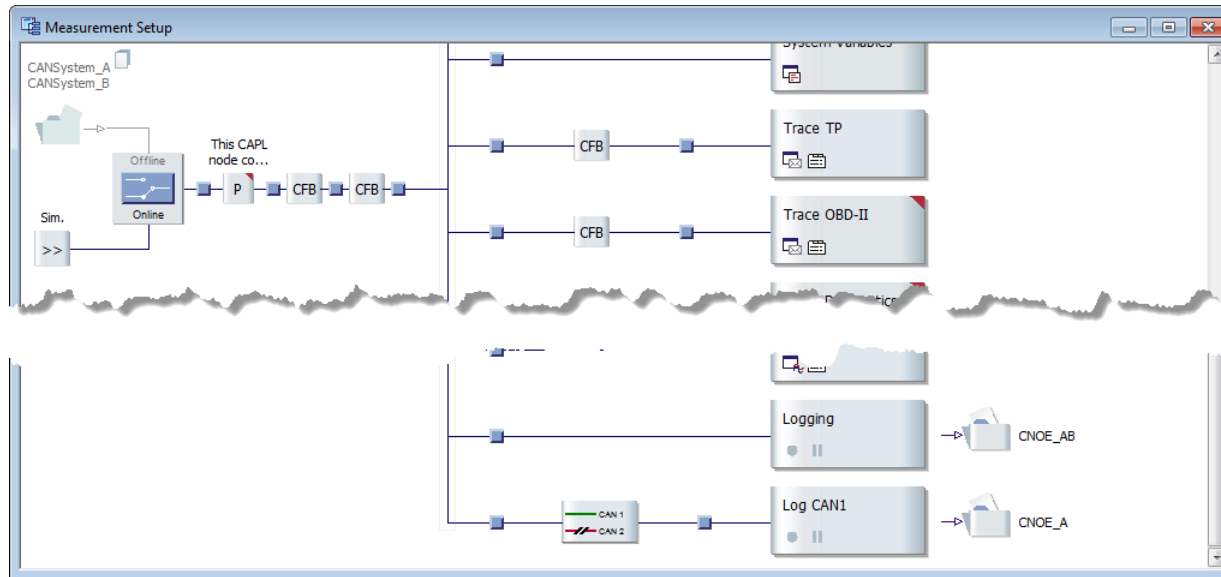
Sensor

CAN / CAN FD / CANopen



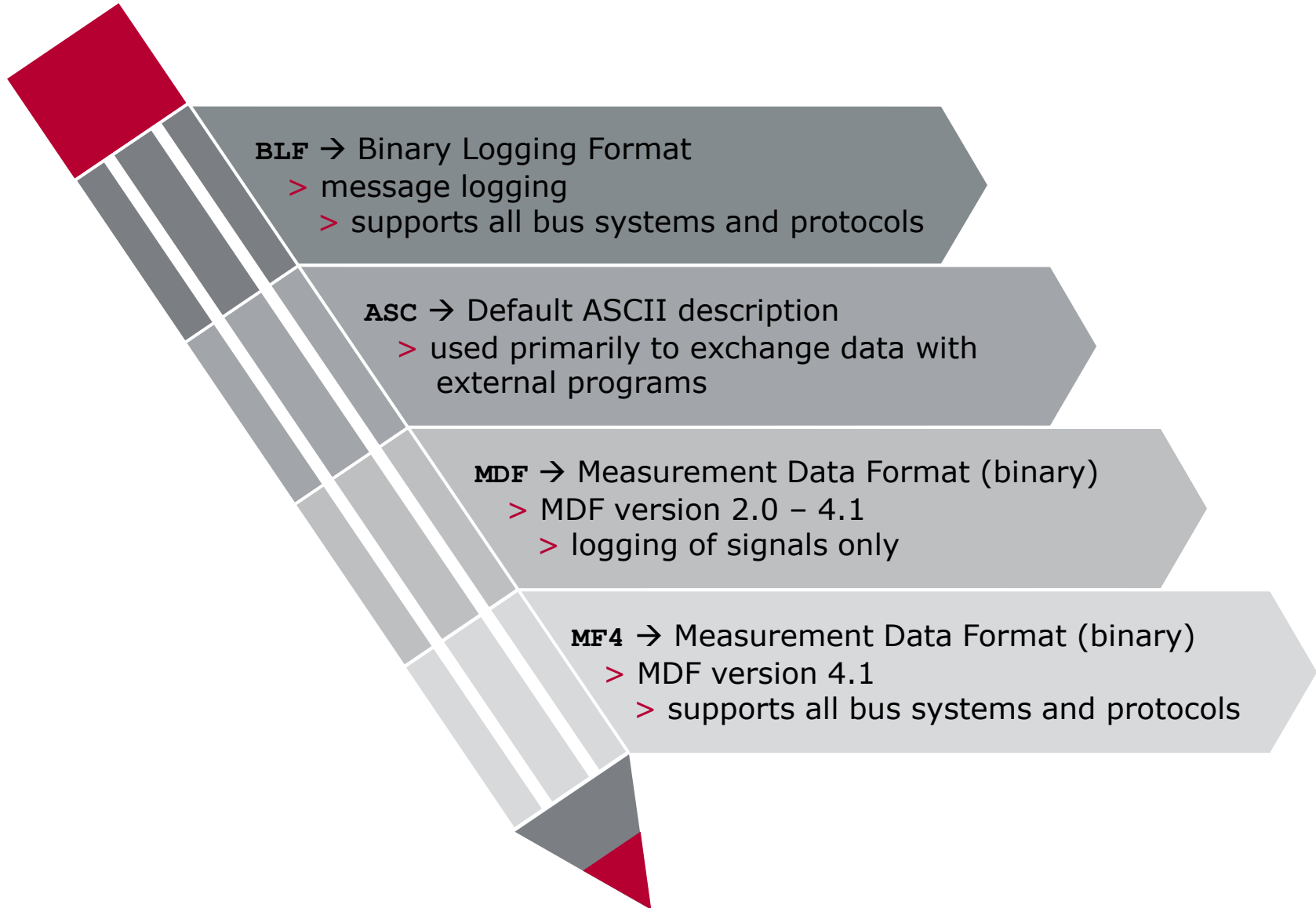
Logging Block

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

Log File Format



Agenda

Overview

Measurement and Simulation Setup

Working with Databases

Analysis Windows

Data Logging

▶ **Offline Mode**

Simulation

Testing

Scalability

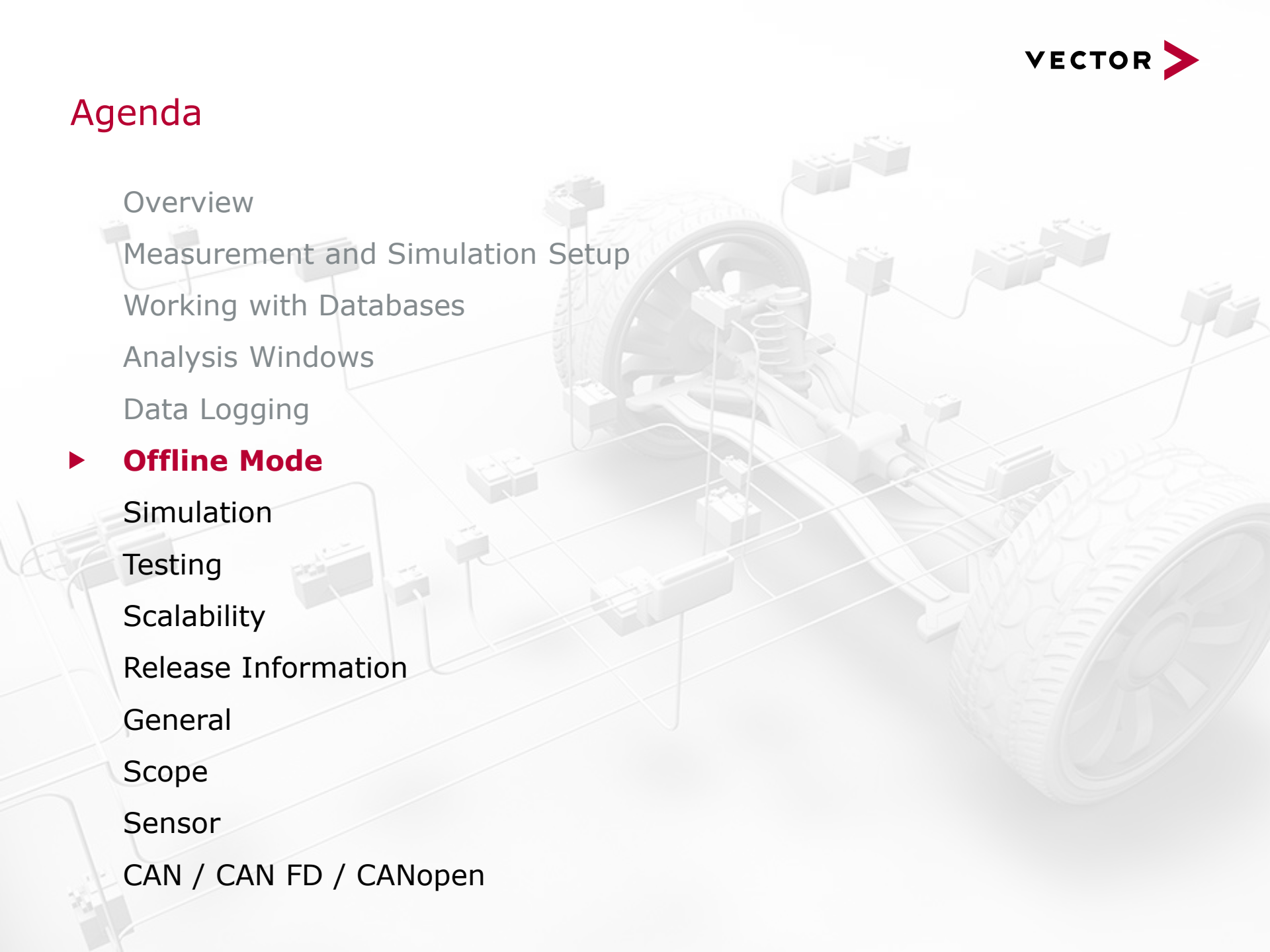
Release Information

General

Scope

Sensor

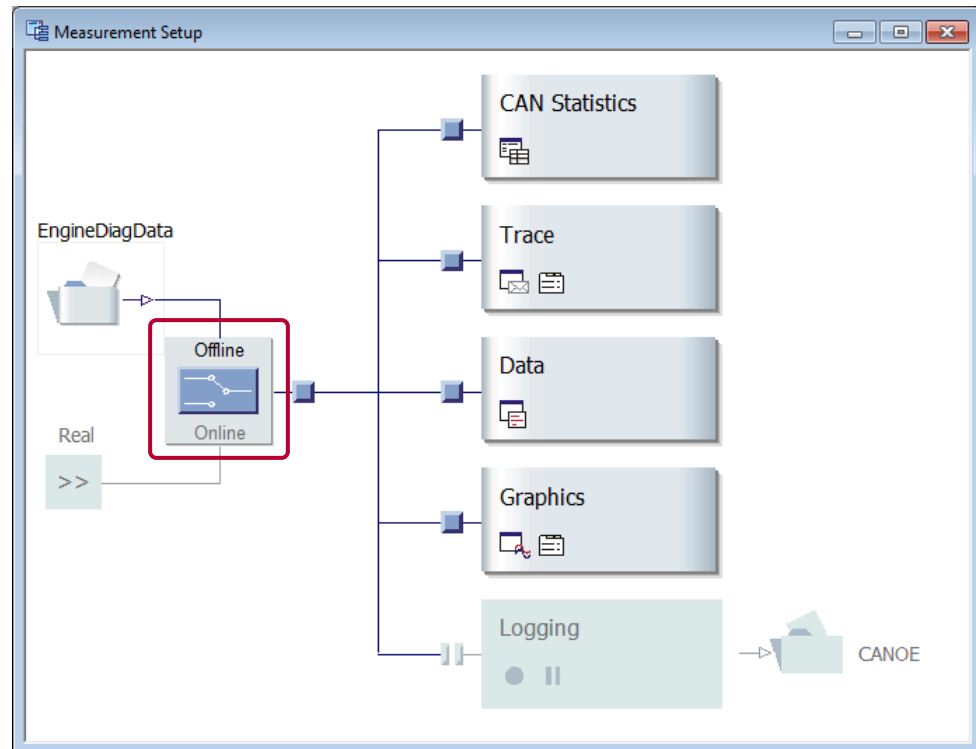
CAN / CAN FD / CANopen



Overview

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

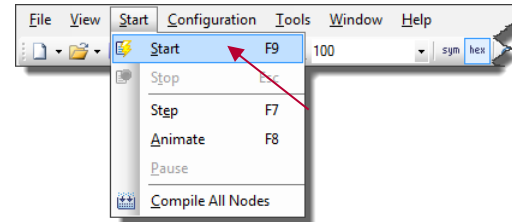
- ▶ All analysis windows can be used just like in Online Mode
- ▶ In CANoe, the Simulation Setup is not active in Offline Mode
- ▶ In CANalyzer, the send branch is not active in Offline Mode



Control Offline Mode

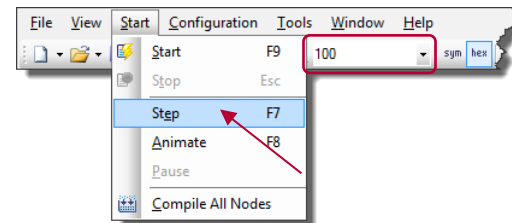
Start and Stop

- > Entire file is played back



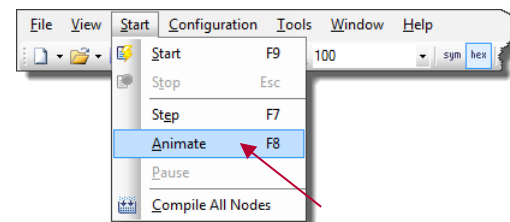
With configurable step width

- > Automatic pause at the end of the step



Animated flow

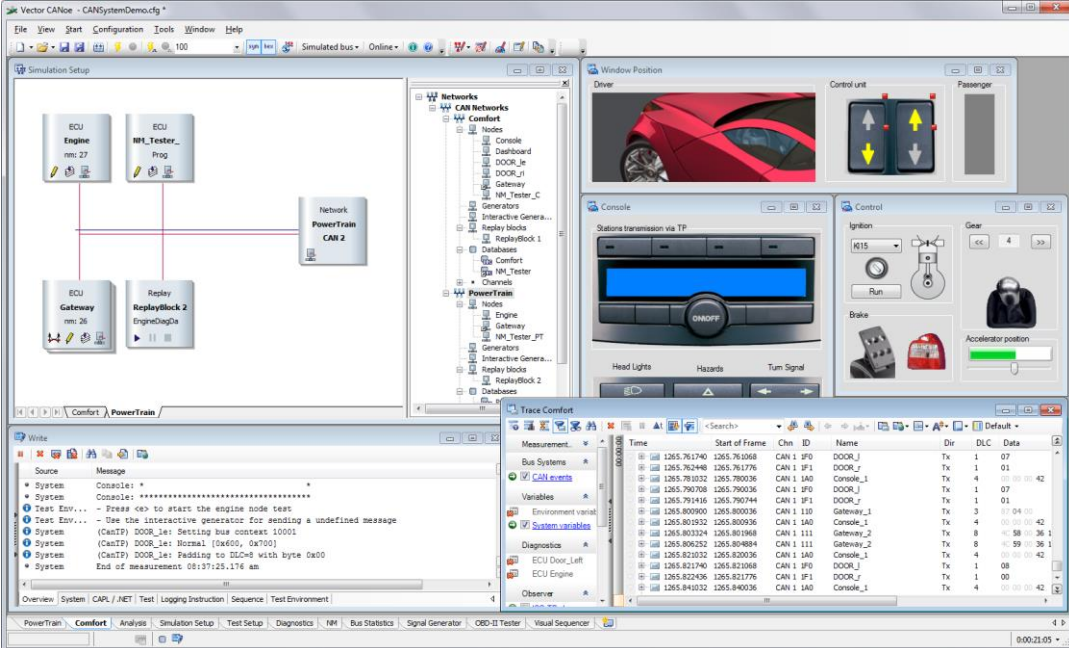
- > Slow-motion display of events



Simulation of Entire Networks or Remaining Bus

CANoe is the comprehensive software tool for development, test and analysis. Using CANoe, you can create simulations of Entire Networks or the Remaining Bus:

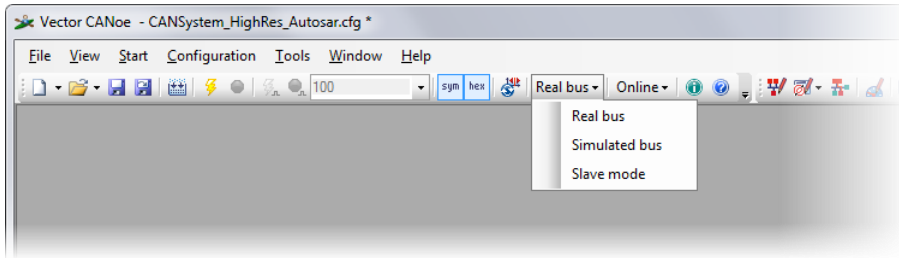
- ▶ Usage of a single CANoe model in all phases of development
- ▶ Function development and regression testing is supported
- ▶ Gateway simulation for different bus systems is possible



The screenshot displays the Vector CANoe software interface. The main window shows a simulation setup for a car network. The network diagram includes components like ECU Engine, ECU NH_Tester_Prog, ECU Gateway, and Replay ReplayBlock 2. The console window shows system messages, including a test environment setup and a CAN message: (CanTP) DOOR_Le: Normal [0x600, 0x700]. The trace window shows a list of CAN messages with columns for Time, Start of Frame, Chn ID, Name, Dir, DLC, and Data. The interface also features a control panel with various vehicle controls like Ignition, Gear, Brake, and Accelerator position.

Time	Start of Frame	Chn ID	Name	Dir	DLC	Data
1265.761740	1265.761068	CAN 1 IFO	DOOR_L	Tx	1	07
1265.762448	1265.761776	CAN 1 IF1	DOOR_L	Tx	1	01
1265.763032	1265.760036	CAN 1 IAO	Console_1	Tx	4	00 00 00 42
1265.760768	1265.760036	CAN 1 IFO	DOOR_L	Tx	1	07
1265.791416	1265.790744	CAN 1 IF1	DOOR_L	Tx	1	01
1265.800960	1265.800036	CAN 1 I10	Gateway_1	Tx	3	07 04 00
1265.801632	1265.800936	CAN 1 IAO	Console_1	Tx	4	00 00 00 42
1265.803324	1265.801968	CAN 1 I11	Gateway_2	Tx	8	58 00 36 1
1265.806252	1265.804884	CAN 1 I11	Gateway_2	Tx	8	59 00 36 1
1265.813032	1265.810036	CAN 1 IAO	Console_1	Tx	4	00 00 00 42
1265.821740	1265.821068	CAN 1 IFO	DOOR_L	Tx	1	08
1265.824736	1265.821776	CAN 1 IF1	DOOR_L	Tx	1	00
1265.843032	1265.840036	CAN 1 IAO	Console_1	Tx	4	00 00 00 42

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

Agenda

Overview

Measurement and Simulation Setup

Working with Databases

Analysis Windows

Data Logging

Offline Mode

Simulation

▶ **Testing**

Scalability

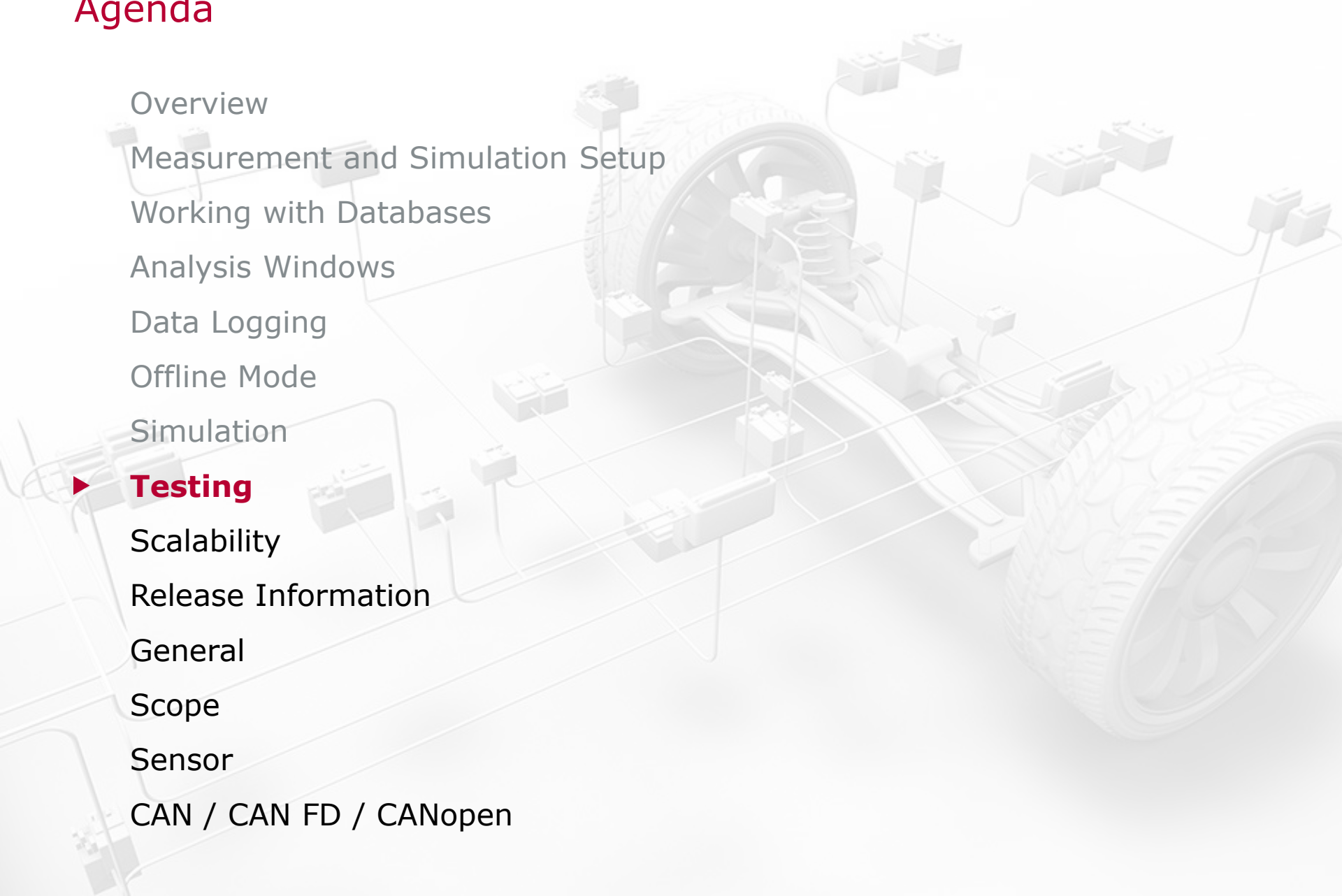
Release Information

General

Scope

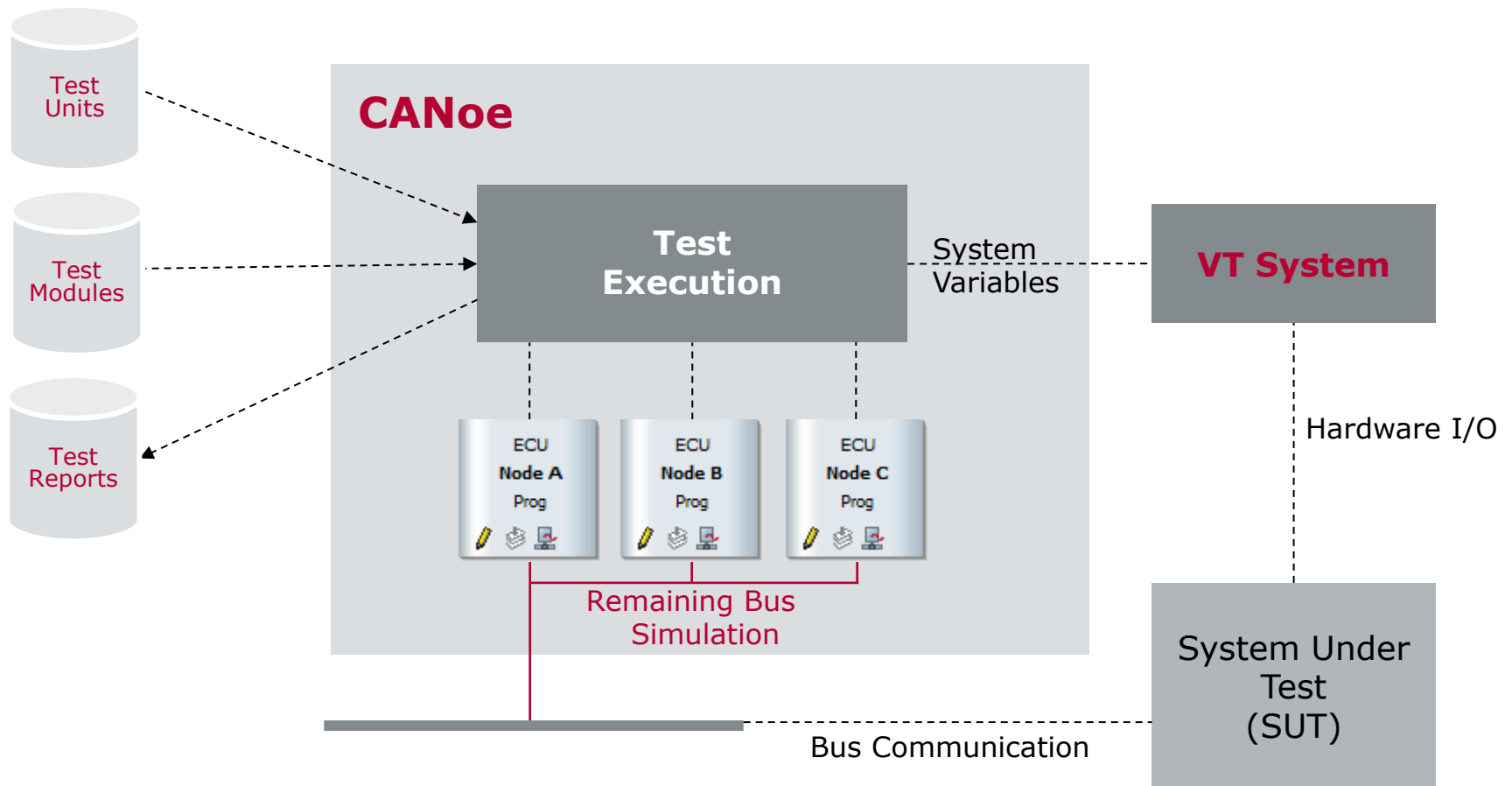
Sensor

CAN / CAN FD / CANopen



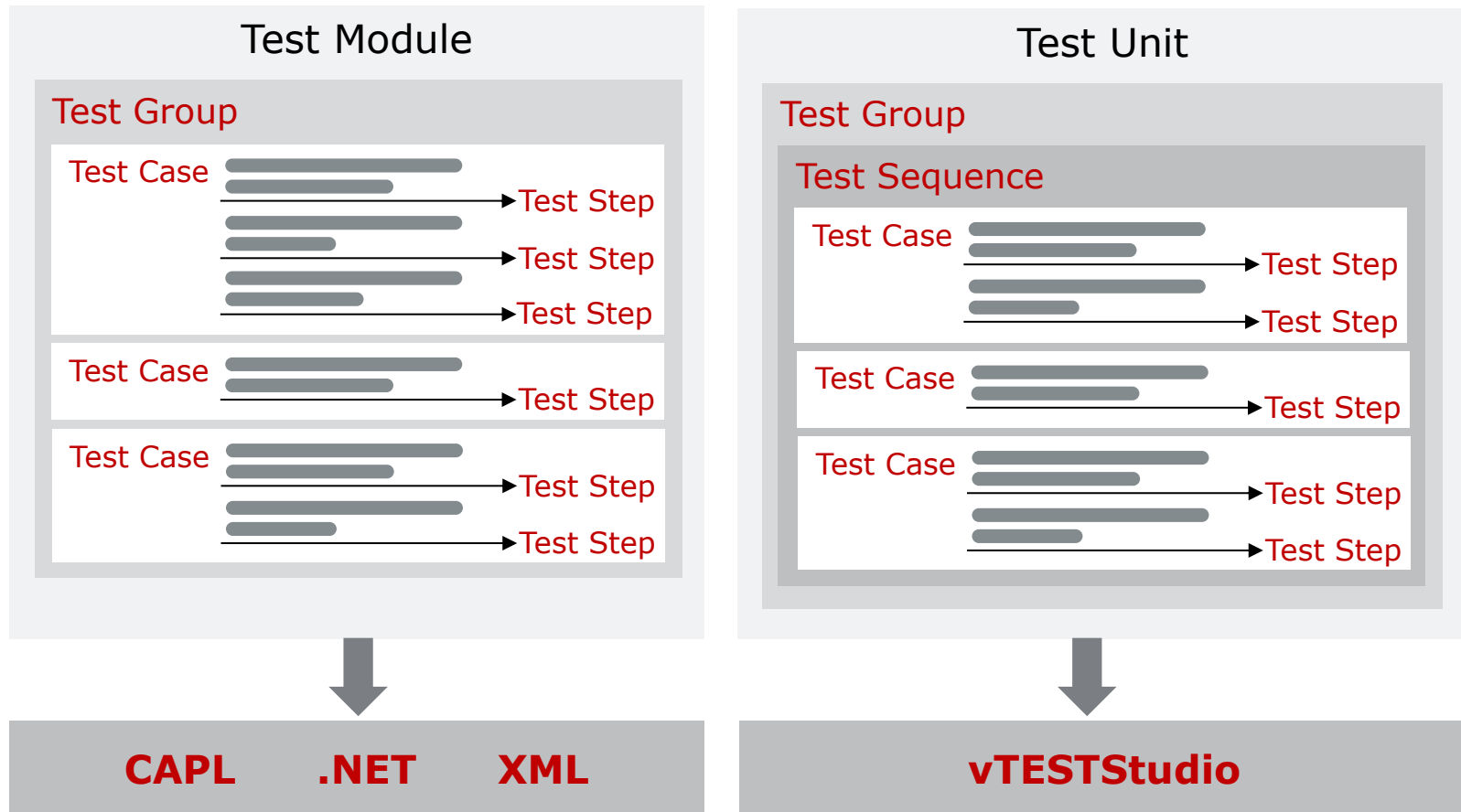
CANoe Test Environment

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:



Screenshot mit laufendem Test

Agenda

Overview

Measurement and Simulation Setup

Working with Databases

Analysis Windows

Data Logging

Offline Mode

Simulation

Testing

▶ **Scalability**

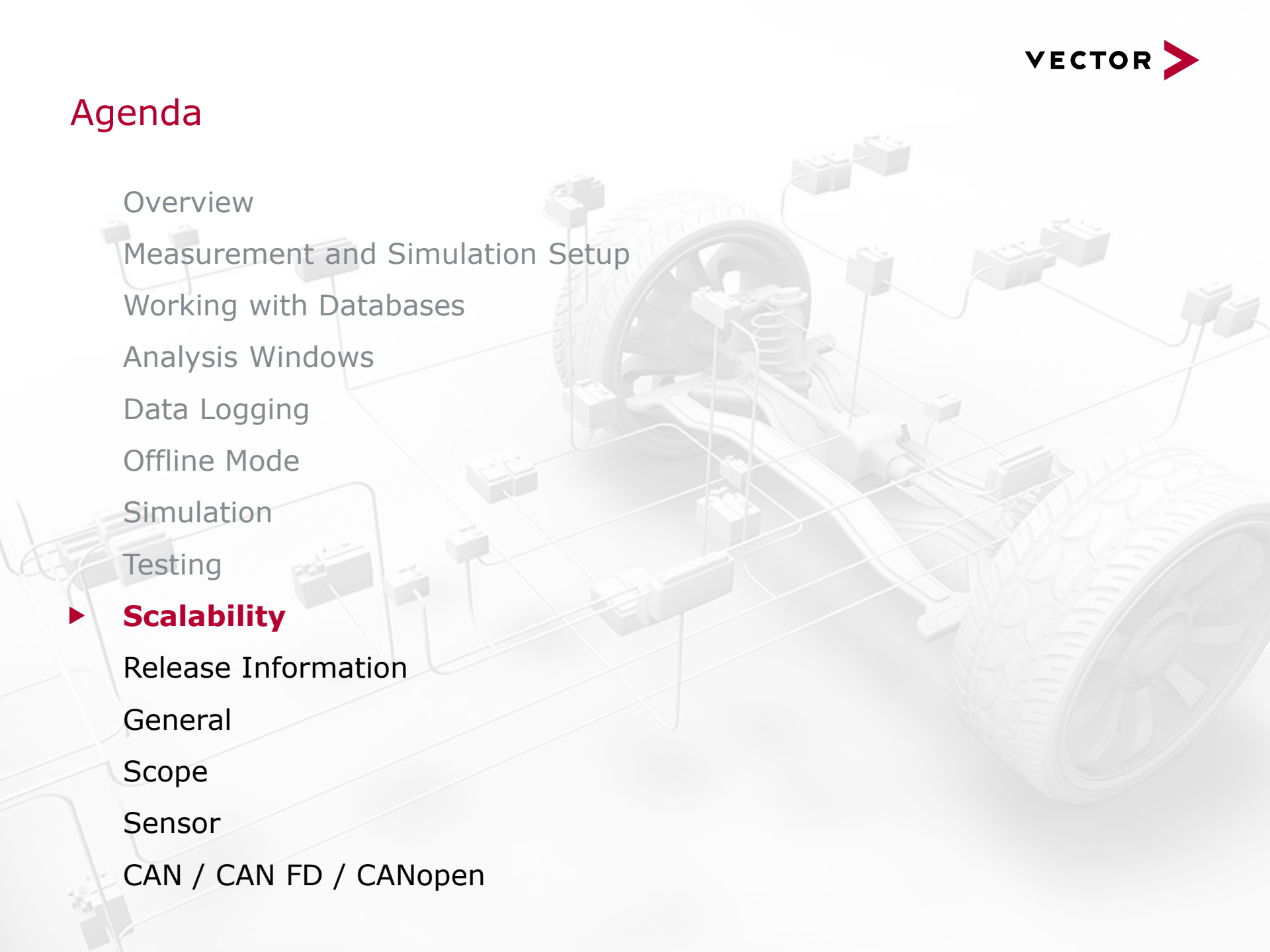
Release Information

General

Scope

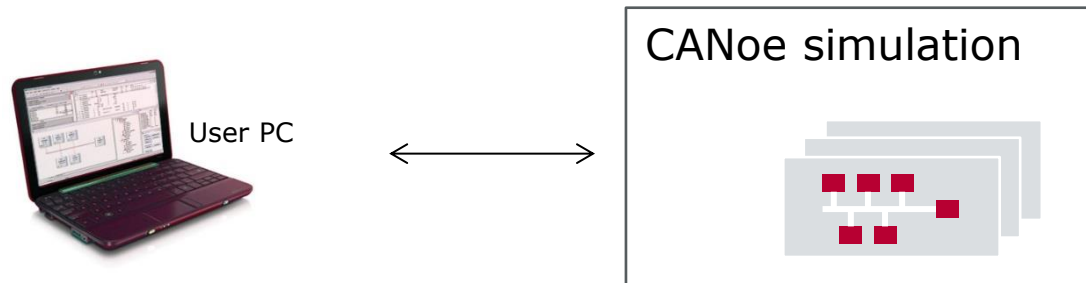
Sensor

CAN / CAN FD / CANopen



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



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



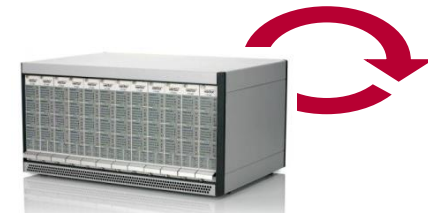
CANoe RT Rack

Special application: Simulation without user interaction:

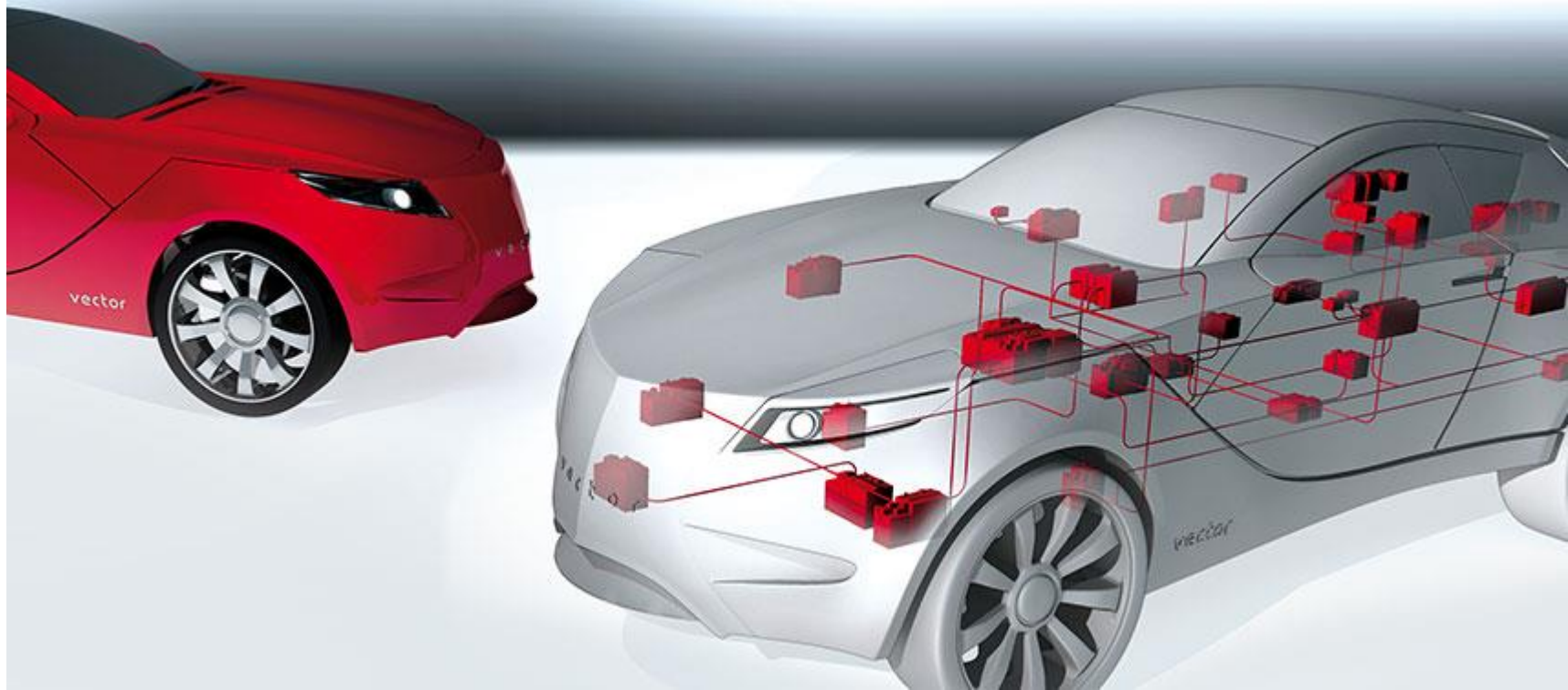
VN8900 standalone



VT System standalone



VT System



CANoe/CANalyzer New Features

Version 10.0

Agenda

Overview

Measurement and Simulation Setup

Working with Databases

Analysis Windows

Data Logging

Offline Mode

Simulation

Testing

Scalability

► **Release Information**

General

Scope

Sensor

CAN / CAN FD / CANopen

Skip topic

Overview

- ▶ Release date 10.0
 - ▶ 2017-05-17
- ▶ Supported bus systems
 - ▶ CAN & CAN FD, LIN, FlexRay, MOST, J1708, Ethernet, WLAN
- ▶ Options
 - ▶ XCP, AMD (AUTOSAR monitoring and debugging) – CANoe
 - ▶ Car2x
 - ▶ Scope for CAN & CAN FD, LIN, FlexRay
 - ▶ J1939, ISO11783, CANopen, J1587
 - ▶ Aerospace options: AFDX[®], A429, CANaero
 - ▶ Sensor: PSI5, SENT, SPI

Agenda

Overview

Measurement and Simulation Setup

Working with Databases

Analysis Windows

Data Logging

Offline Mode

Simulation

Testing

Scalability

Release Information

▶ **General**

Scope

Sensor

CAN / CAN FD / CANopen

Skip topic

Main Benefits

- ▶ Test Report Viewer
- ▶ Improved offline mode configuration and enhanced video/picture display
- ▶ New stress device VH6501 for CAN and CAN FD
- ▶ Simplified diagnostic simulation support
- ▶ Support of SPI with option .Sensor
- ▶ Improved usability with ribbon in Panel Designer

Modern GUI Layout with Windows 10 Style

EthernetSystemDemo.cfg * [Graphic] [Simulated Bus] - Vector CANoe

File Home Analysis Simulation Test Diagnostics & XCP Environment Hardware Tools Window

Measurement Setup Offline Mode Filter Logging Trace Graphics Data State Tracker Statistics GPS Video Scope

Configuration

View

- Trace Eth 1
- Trace Eth 2
- All...
- New Trace Window with:
 - ISO11783 Settings
 - Ethernet Settings
 - Ethernet IP/UDP/TCP Settings
 - Variables Settings
 - Standard Settings
- Show in Favorites
- Copy Screenshot
- Show on all Desktops

ConceptCar Instrument Cluster C2XM Map

Data

Name	Value	Unit
CoolantTempera...	90.00	°C
EngineSpeed	3200	rpm
Gear	5	
TotalDistance	2.05	km
TripDistance	2.04	km
VehicleSpeed	79.98	km/h
Distance	6.00	m
TimeUntilGreen	20	s
TimeUntilRed	5	s

Light Warning Speed

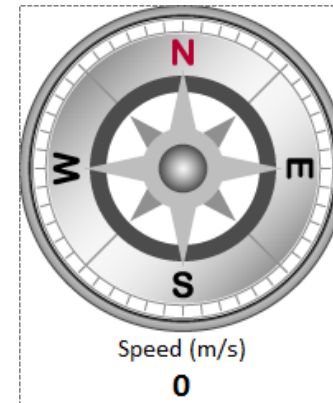
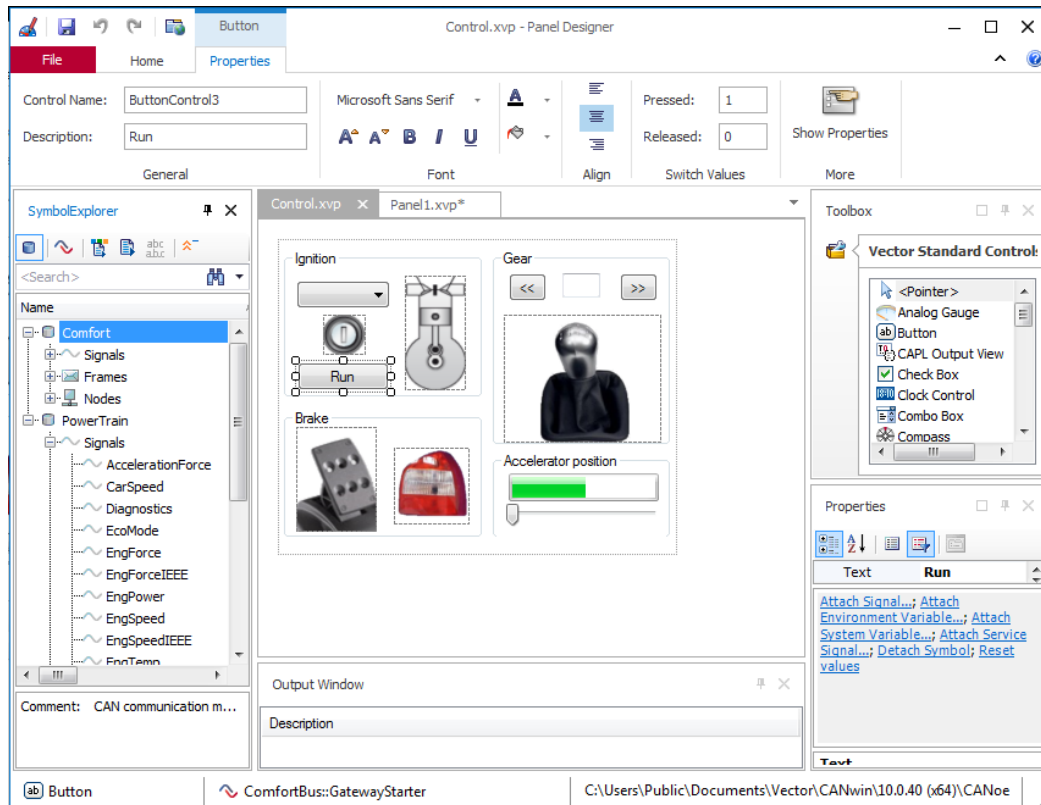
Time 99.74s

Desktop Graphic and Data

Information Usage of the desktop Tip

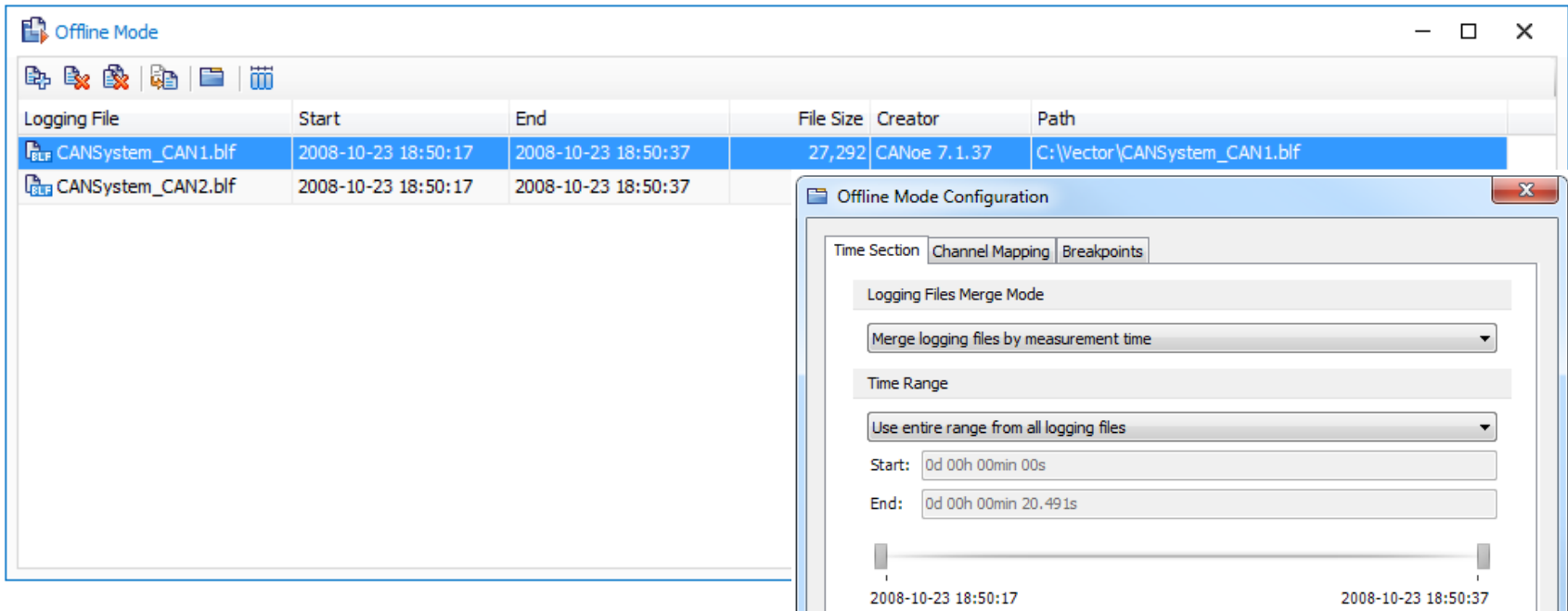
Panel Designer

- ▶ New GUI layout with ribbon
- ▶ Simple to use overlay ribbon for all major control properties
- ▶ New Compass control for direction and speed
- ▶ Panel loading performance improved



Offline Mode

- ▶ New window replaces several dialogs
- ▶ Display meta data of configured logging files
- ▶ Easily drag and drop logging files from Windows Explorer
- ▶ Two merge modes for offline analysis
 - ▶ By date/time and time stamp
 - ▶ By time stamp only



Logging File	Start	End	File Size	Creator	Path
C:\Vector\CANSystem_CAN1.blf	2008-10-23 18:50:17	2008-10-23 18:50:37	27,292	CANoe 7.1.37	C:\Vector\CANSystem_CAN1.blf
C:\Vector\CANSystem_CAN2.blf	2008-10-23 18:50:17	2008-10-23 18:50:37			

Offline Mode Configuration

Time Section | Channel Mapping | Breakpoints

Logging Files Merge Mode

Merge logging files by measurement time

Time Range

Use entire range from all logging files

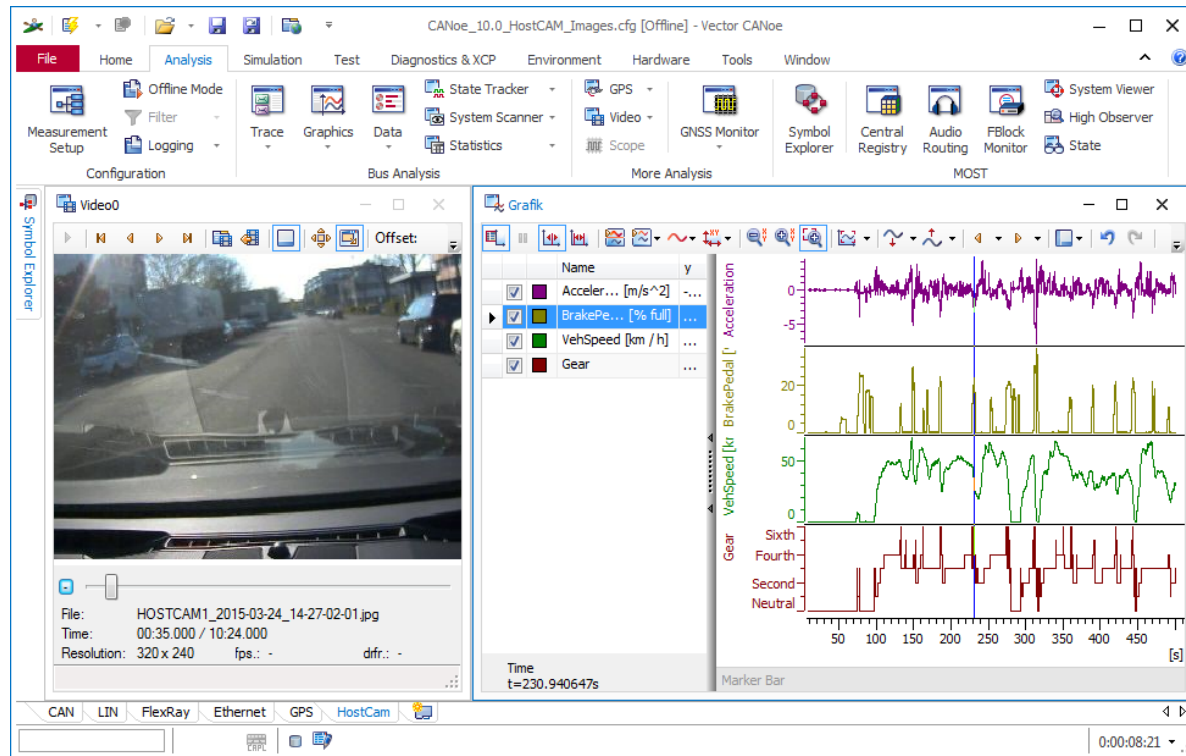
Start: 0d 00h 00min 00s

End: 0d 00h 00min 20.491s

2008-10-23 18:50:17 | 2008-10-23 18:50:37

Video Window

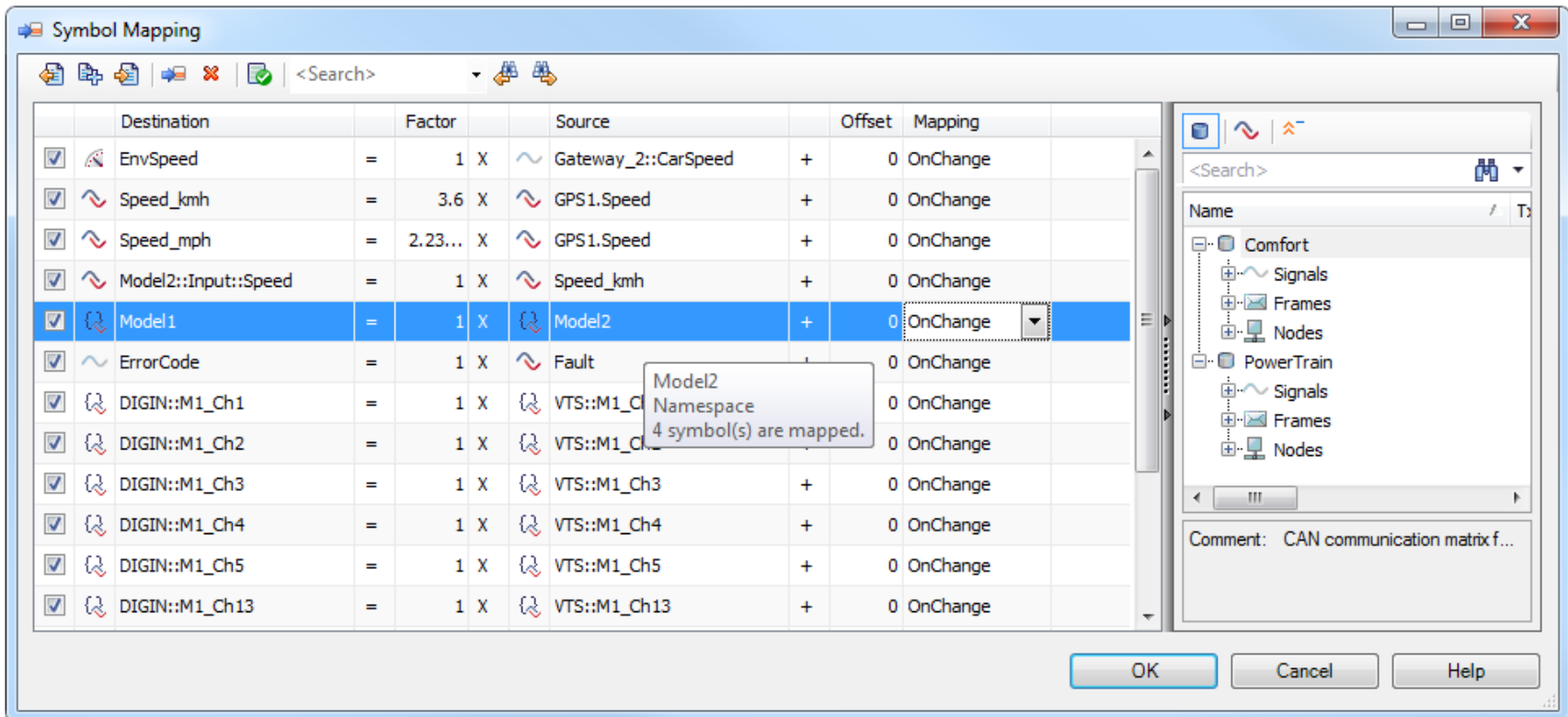
- ▶ Improved offline mode
 - ▶ Display of images delivered by GL Logger synchronized to the logged bus messages



- ▶ Display of video frames during offline mode

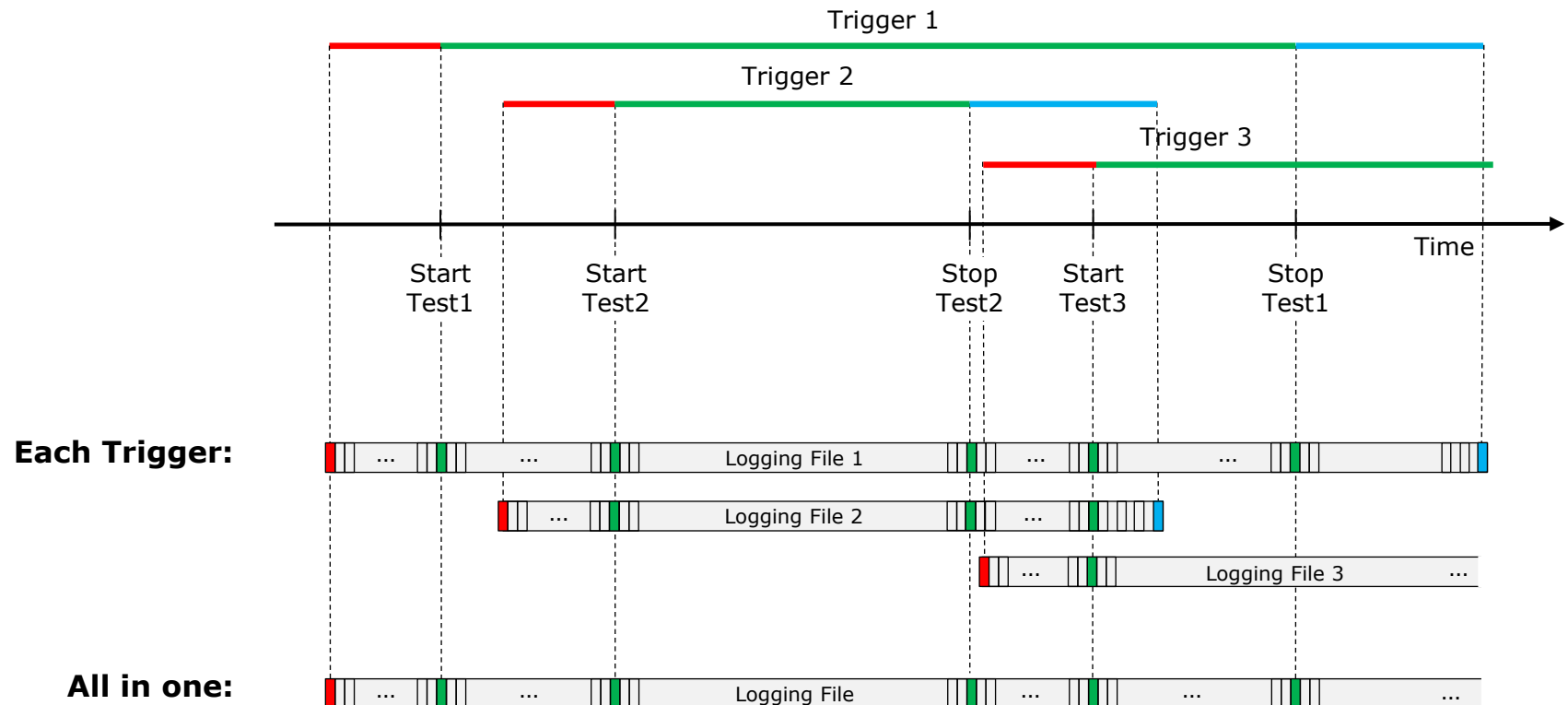
Symbol Mapping Dialog

- ▶ Rework of the Symbol Mapping Dialog
- ▶ Assign from right to left
- ▶ Mapping of complete namespaces



Logging

- ▶ Coupled start and stop condition with toggle trigger
- ▶ Retriggering is always allowed, overlapping can occur at any time
- ▶ Use fieldcode {IncTrigger} to split files by trigger
- ▶ Test Cases / Test Units / ... can now be used as trigger conditions



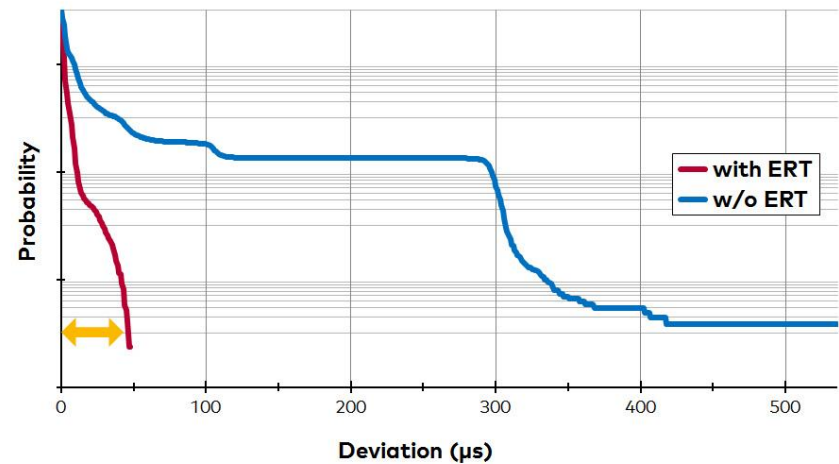
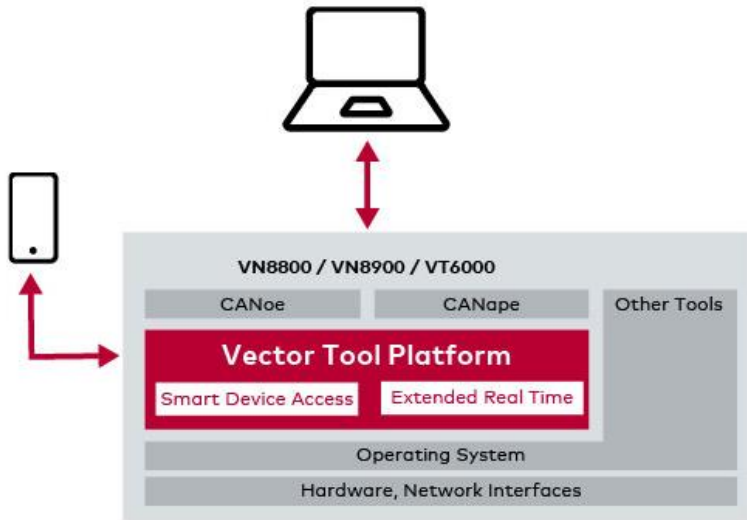
VN8914

- ▶ New Network Interface VN8914, successor of VN8912A
 - ▶ Intel Core-i7 6822EQ: 4 CPU cores, 6th Generation, 8GB RAM
 - ▶ External Power Up/Down control
 - ▶ SD card slot with direct access on the back side
 - ▶ USB Device connector secured by locking screws (conform to USB 3.0 Vision standard, cable is optional accessory)
 - ▶ Planned for Q3/2017



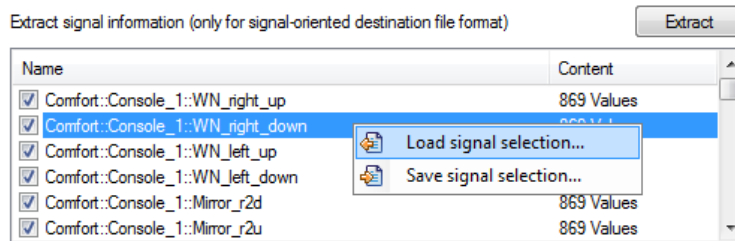
VTP - Extended Real Time

- ▶ Extended Real Time (ERT) is a part of the Vector Tool Platform
- ▶ ERT improves the latency and determinism of CANoe with the VT System
- ▶ Higher sampling rates of 200 μs and 500 μs can be achieved
 - > VT6051A, VT1004, VT7001 and VT2816



Further Improvements

- ▶ Start Value Window: Automation with CAPL & COM Interface
 - > Use Case: Freshness Counter
- ▶ Logging Export Dialog: Signal list can be saved and reloaded



- ▶ Support the Windows Task Bar extension
 - ▶ Start and stop measurement
 - ▶ Show progress of long lasting actions (compile, convert, ...)

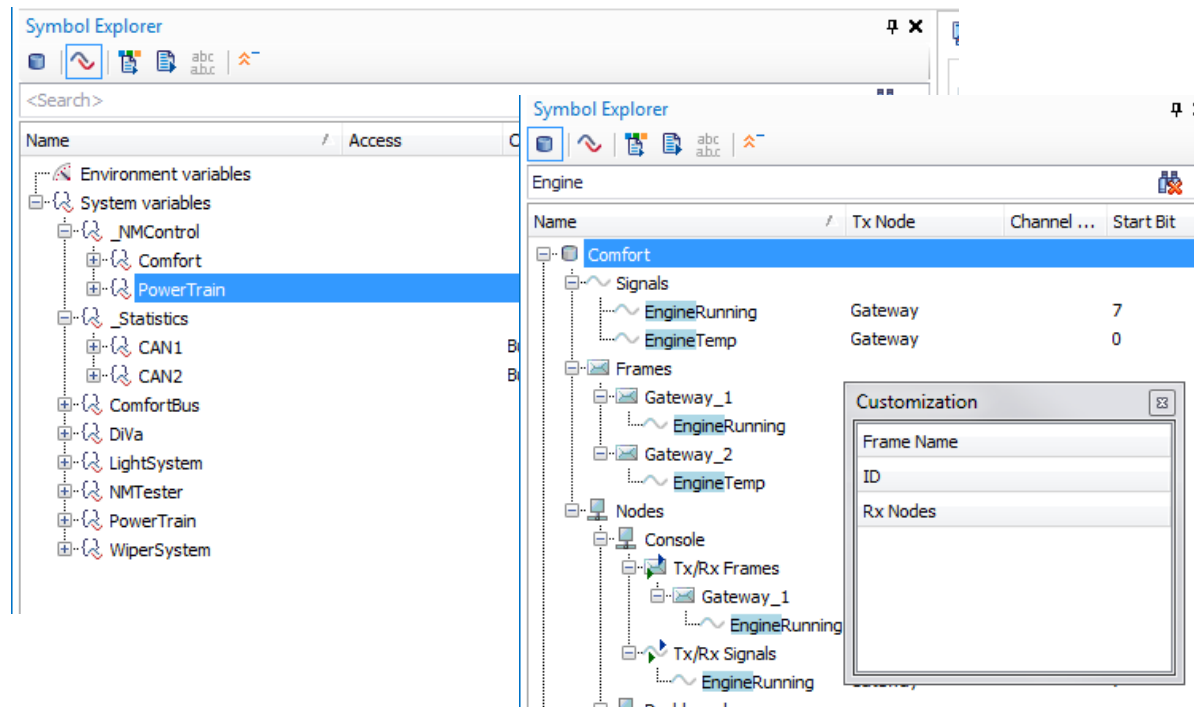


Further improvements

- ▶ GPS Window
 - ▶ Support for GNSS receiver other than GPS. E.g. Galileo, Glonass, Baidou and QZSS
 - ▶ Improved selection of COM port
- ▶ Support Assistant
 - ▶ Installation as common component (only one instance per Computer)
 - ▶ Reports from all tools can be opened easily
 - ▶ Integration of online crash tutorial
- ▶ With 9.0 SP
 - ▶ Redesign of Vector I/O configuration Dialog
 - ▶ CAPL Browser can save source files encrypted
 - ▶ Support of VN8810

Further improvements II

- ▶ New Symbol Explorer and Symbol Selection Dialog (with 9.0 SP)
 - ▶ Columns with field chooser
 - ▶ Filtered Search through entire tree
 - ▶ Easy switch between item types



Agenda

Overview

Measurement and Simulation Setup

Working with Databases

Analysis Windows

Data Logging

Offline Mode

Simulation

Testing

Scalability

Release Information

General

► **Scope**

Sensor

CAN / CAN FD / CANopen

Skip topic

Features

- ▶ **CANoe/CANalyzer version 9.0 SP2**
 - ▶ Eye diagram and serial bit mask analysis for CAN, CAN FD

- ▶ **CANoe/CANalyzer version 9.0 SP3**
 - ▶ Eye diagram and serial bit mask analysis for FlexRay (CAPL)
 - ▶ Support of Option Sensor for SENT and PSI5

- ▶ **CANoe/CANalyzer version 9.0 SP4**
 - ▶ Eye diagram and automated transition time measurement for LIN
 - ▶ Import/export of eye diagram masks

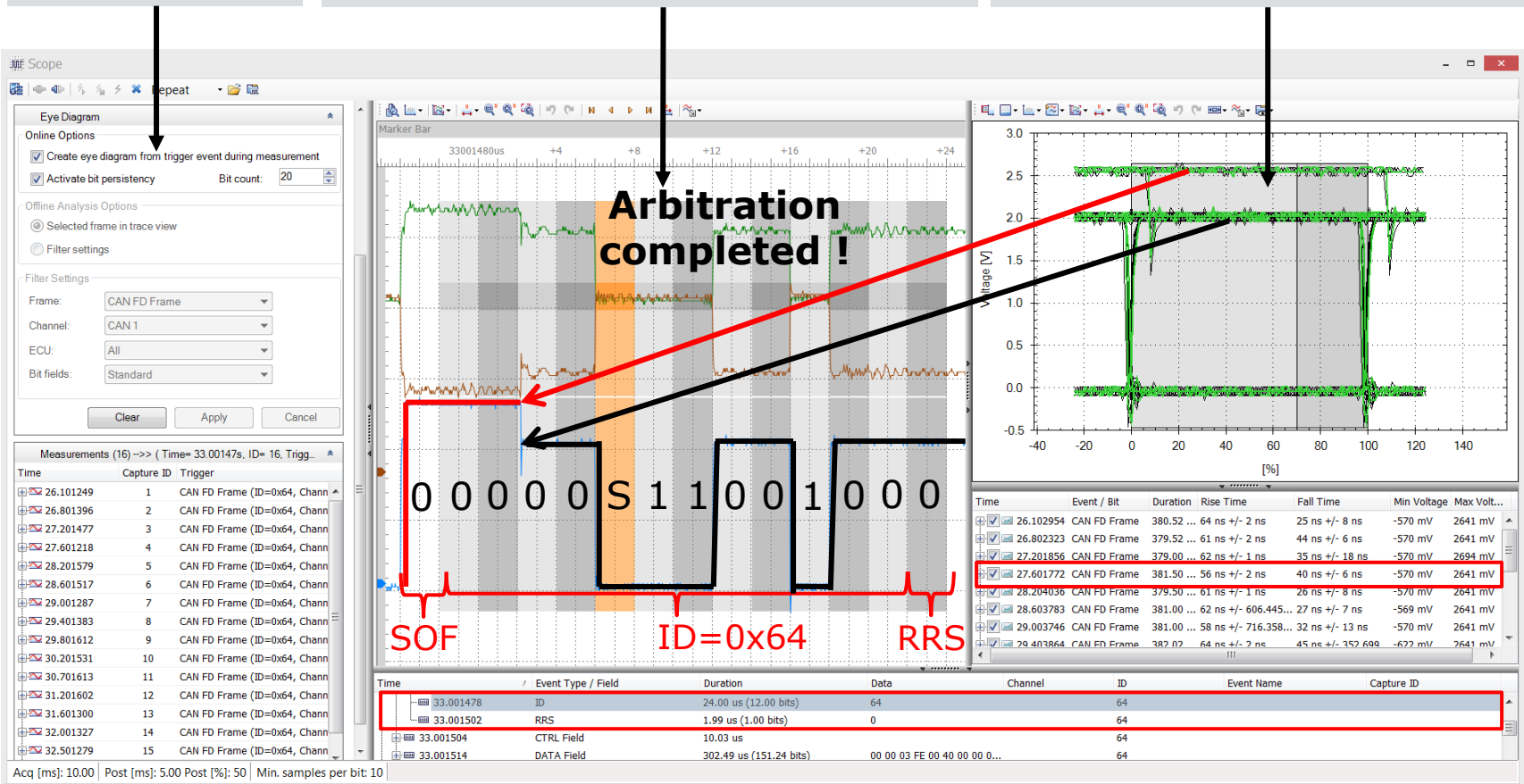
- ▶ **CANoe/CANalyzer version 10.0**
 - ▶ Fast automated scaling according to trigger condition e.g. BRS bit by CAN FD
 - ▶ Continuous online eye diagram analysis with persistency mode
 - ▶ Improved comparison of signals via Compare Mode
 - ▶ New native binary export format CSFX (approx. 5 times smaller than CSF)
 - ▶ New measurement cursor concept
 - ▶ Support of signal symmetric testing via CAPL (planned for 10.0 SP3)

Eye Diagram – From Frame to Bit Analysis

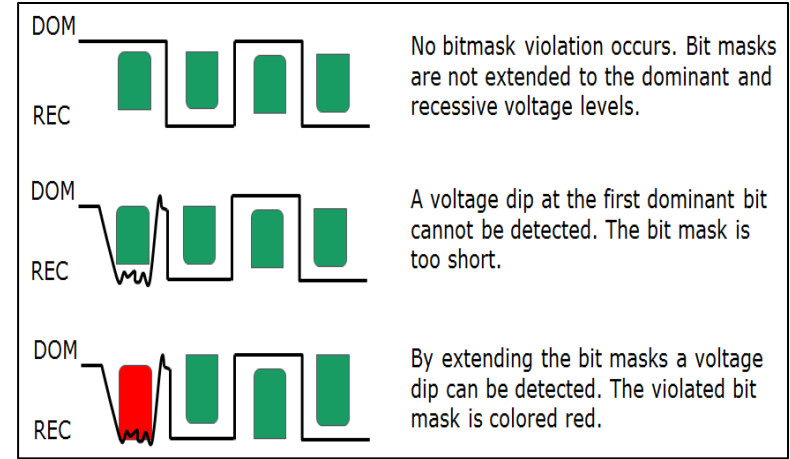
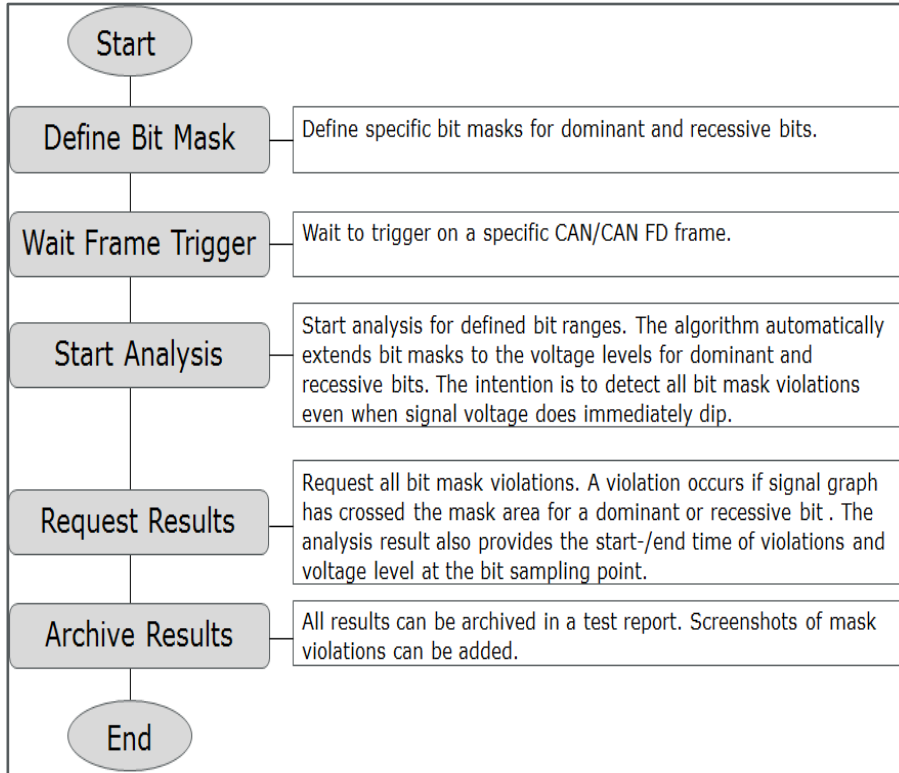
**Configuration
Data History**

Graph View: Highlighted bits in measurement graphs reflect the eye diagram analysis

Eye Diagram: Analyzed bit range from ID field to RRS-Bit



Bit Mask Analysis – Program Flow



Agenda

Overview

Measurement and Simulation Setup

Working with Databases

Analysis Windows

Data Logging

Offline Mode

Simulation

Testing

Scalability

Release Information

General

Scope

▶ **Sensor**

CAN / CAN FD / CANopen

Skip topic

General

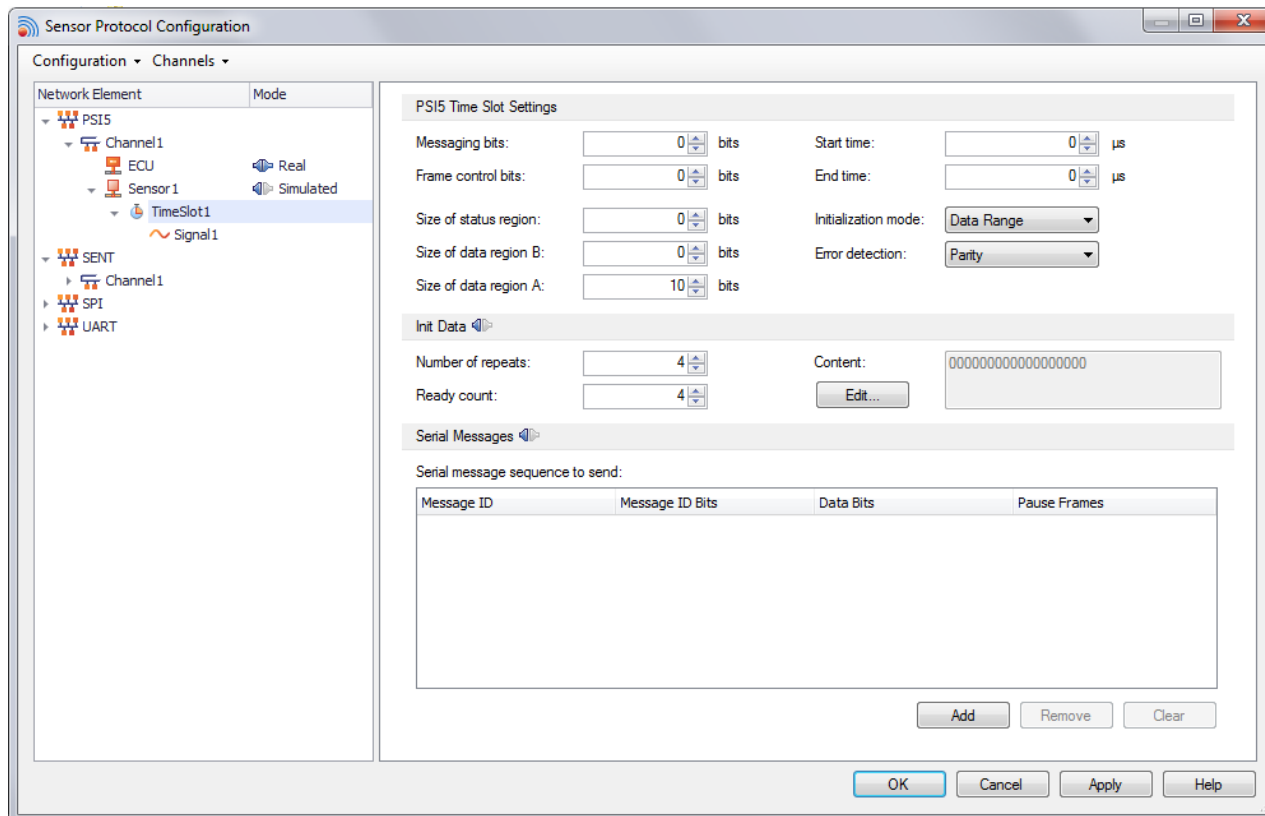
- ▶ Option Sensor available since **CANoe 9.0 SP3**
- ▶ The Option Sensor is CANoe only
- ▶ The Option Sensor requires VT2710 as network interface

- ▶ Coverage of the Option Sensor with CANoe 9.0 SP3
 - ▶ Protocols requiring a license
 - > PSI5
 - > SENT

- ▶ Protocols supported with the CANoe core feature set (following in subsequent CANoe versions)
 - > SPI (CANoe 10.0)
 - > UART
 - > I2C
 - > LVDS

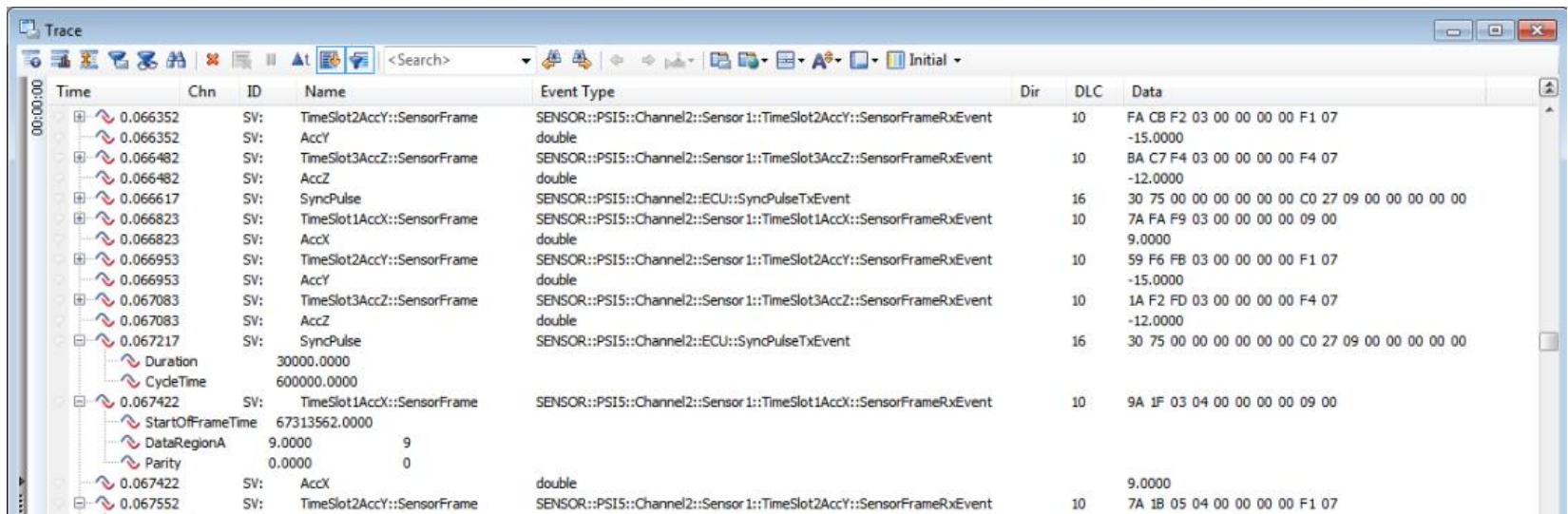
Configuration

- ▶ Intuitive GUI to configure Sensor channels
- ▶ Sensor configurations can be exported and used in other CANoe configurations



Simulation and Analysis

- ▶ Sensor protocol events modeled generically based on System Variables
- ▶ Support of CANoe's Analysis Features
 - ▶ Analysis Windows
 - ▶ Panels
 - ▶ Logging

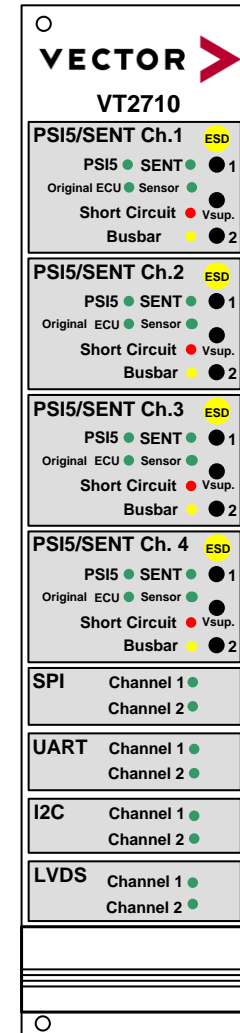


Time	Chn	ID	Name	Event Type	Dir	DLC	Data
0.066352	SV:	TimeSlot2AccY::SensorFrame		SENSOR::PSI5::Channel2::Sensor 1::TimeSlot2AccY::SensorFrameRxEvent		10	FA CB F2 03 00 00 00 F1 07
0.066352	SV:	AccY		double			-15.0000
0.066482	SV:	TimeSlot3AccZ::SensorFrame		SENSOR::PSI5::Channel2::Sensor 1::TimeSlot3AccZ::SensorFrameRxEvent		10	BA C7 F4 03 00 00 00 F4 07
0.066482	SV:	AccZ		double			-12.0000
0.066617	SV:	SyncPulse		SENSOR::PSI5::Channel2::ECU::SyncPulseTxEvent		16	30 75 00 00 00 00 00 C0 27 09 00 00 00 00
0.066823	SV:	TimeSlot1AccX::SensorFrame		SENSOR::PSI5::Channel2::Sensor 1::TimeSlot1AccX::SensorFrameRxEvent		10	7A FA F9 03 00 00 00 09 00
0.066823	SV:	AccX		double			9.0000
0.066953	SV:	TimeSlot2AccY::SensorFrame		SENSOR::PSI5::Channel2::Sensor 1::TimeSlot2AccY::SensorFrameRxEvent		10	59 F6 FB 03 00 00 00 F1 07
0.066953	SV:	AccY		double			-15.0000
0.067083	SV:	TimeSlot3AccZ::SensorFrame		SENSOR::PSI5::Channel2::Sensor 1::TimeSlot3AccZ::SensorFrameRxEvent		10	1A F2 FD 03 00 00 00 F4 07
0.067083	SV:	AccZ		double			-12.0000
0.067217	SV:	SyncPulse		SENSOR::PSI5::Channel2::ECU::SyncPulseTxEvent		16	30 75 00 00 00 00 00 C0 27 09 00 00 00 00
		Duration	30000.0000				
		CycleTime	600000.0000				
0.067422	SV:	TimeSlot1AccX::SensorFrame		SENSOR::PSI5::Channel2::Sensor 1::TimeSlot1AccX::SensorFrameRxEvent		10	9A 1F 03 04 00 00 00 09 00
		StartOfFrameTime	67313562.0000				
		DataRegionA	9.0000	9			
		Parity	0.0000	0			
0.067422	SV:	AccX		double			9.0000
0.067552	SV:	TimeSlot2AccY::SensorFrame		SENSOR::PSI5::Channel2::Sensor 1::TimeSlot2AccY::SensorFrameRxEvent		10	7A 1B 05 04 00 00 00 F1 07

- ▶ Support of CANoe's test and simulation capabilities:
 - ▶ Powerful CAPL API
 - ▶ Usage of test modules and test units for automated testing

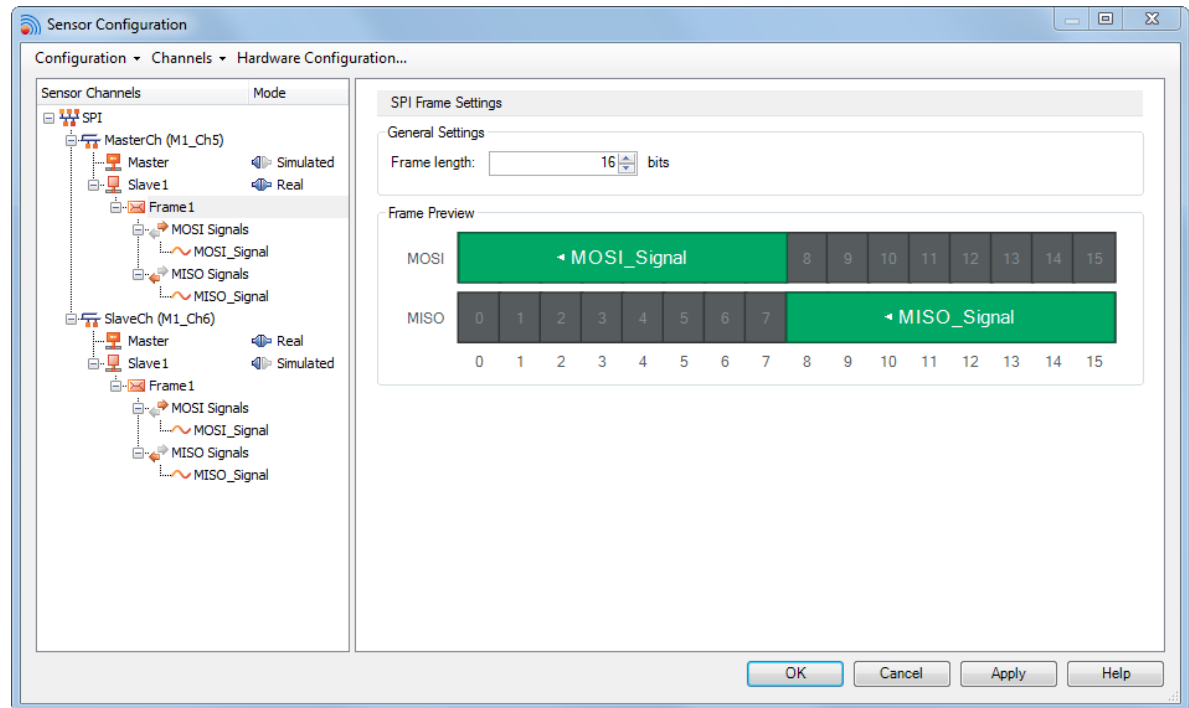
VT 2710 Main Features

- ▶ Modular concept
 - ▶ Basic Module: 2 SPI/UART + 2 I2C + 2 LVDS channels
 - > channels available with CANoe > 10.0
 - ▶ Up to 4 PSI5/SENT channels can be equipped
 - > 1 piggy board per channel
 - ▶ PSI5/SENT channels are galvanically isolated
- ▶ Operation modes
 - ▶ Sensor simulation
 - ▶ ECU simulation
 - ▶ Monitoring
 - ▶ „Active probes“ via LVDS
 - > Proprietary interface incl. power supply
 - > channels available with CANoe > 10.0
- ▶ Self Test capability for PSI5 / SENT
- ▶ On-Board reference voltage for automatic self calibration



SPI Support (new with CANoe 10.0)

- ▶ Analyzing SPI communication
- ▶ Simulating an SPI master / SPI slave
- ▶ 5 CS lines available
- ▶ Bit rate up to 10MBit/s for master simulation and monitoring
- ▶ Bit rate up to 6MBit/s for slave simulation

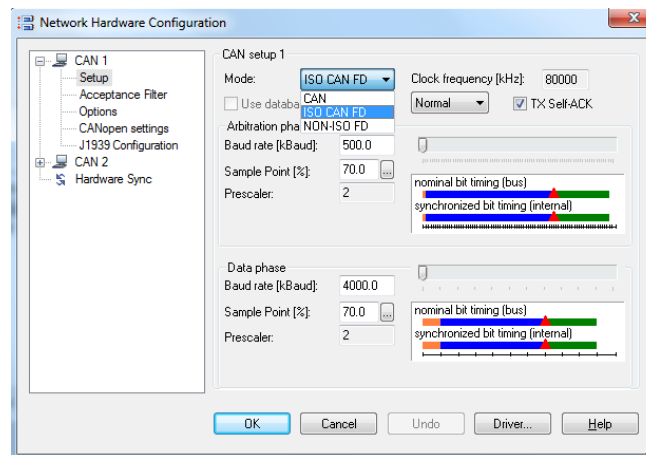


CAN FD: Selection of ISO / non-ISO

- ▶ Current Approach:
 - ▶ Two Driver Setups
 - > Setup 9.2.1: non-ISO drivers
 - > Setup 9.9.7: ISO drivers

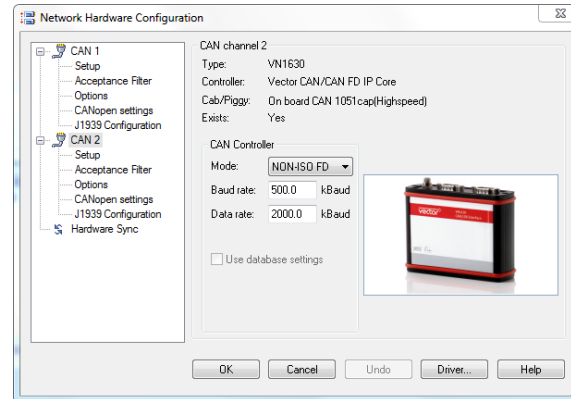
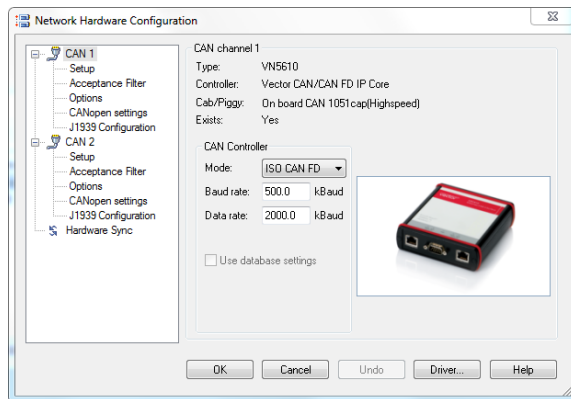
- ▶ Future Approach:
 - ▶ Drivers that allow to switch between non-ISO and ISO CAN FD
 - ▶ First switchable drivers available in Q3 2017

- ▶ CANoe and CANalyzer now allow to configure the FD mode in the Network Hardware Configuration

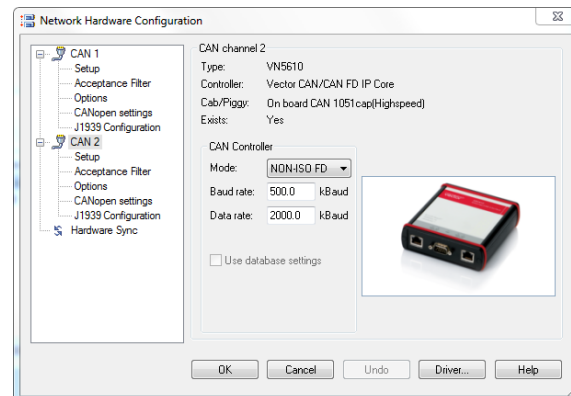
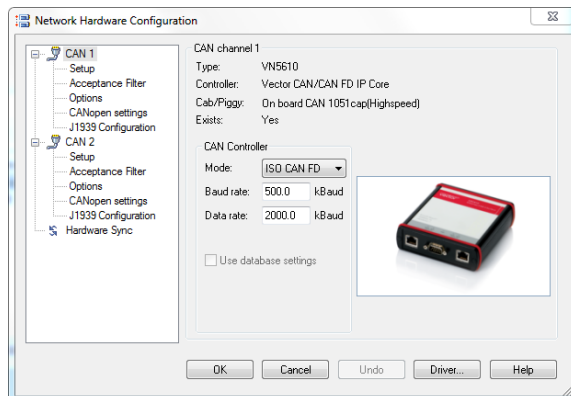


CAN FD: Selection of ISO / non-ISO

- ▶ Using non-ISO and ISO FD in one configuration:
 - ▶ Currently use two different types of network interfaces
 - > E.g. VN5610 with ISO driver and VN1600 with non-ISO driver



- ▶ In future network interfaces will allow to select the FD mode channel wise



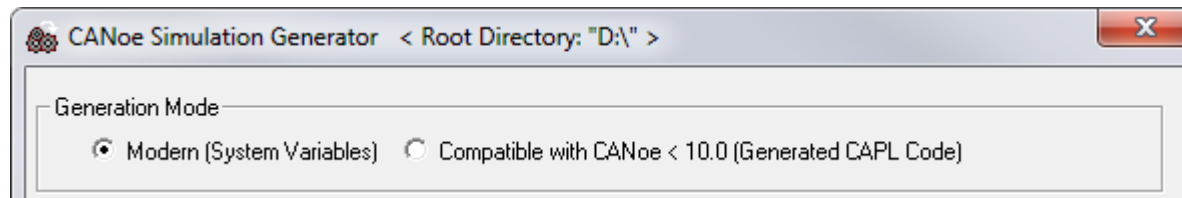
CAN FD: Extended Configuration via DBC

- ▶ For CAN FD, the following attributes can be used for configuration via a DBC file*:
 - ▶ Baudrate, BaudrateCANFD
 - ▶ TimeQuantaMin, TimeQuantaMax, TimeQuantaCANFDMin, TimeQuantaCANFDMax
 - ▶ SamplePointMin, SamplePointMax, SamplePointCANFDMin, SamplePointCANFDMax
 - ▶ SyncJumpWidthMin, SyncJumpWidthMax, SyncJumpWidthCANFDMin, SyncJumpWidthCANFDMax
 - ▶ SSPOffsetCANFDMin, SSPOffsetCANFDMax

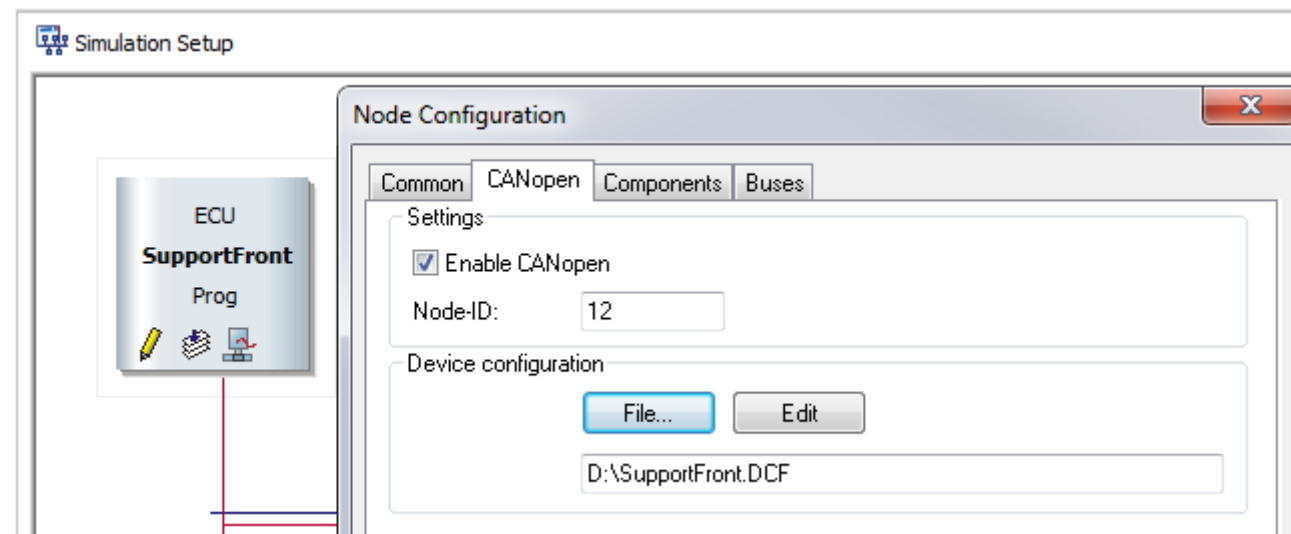
*Note: To use the attributes it is required to set **Use database settings** in the **Network Hardware Configuration** dialog.

New CANopen Simulation Concept (CANoe only)

- ▶ New option in the ProCANopen CANoe Simulation Generator

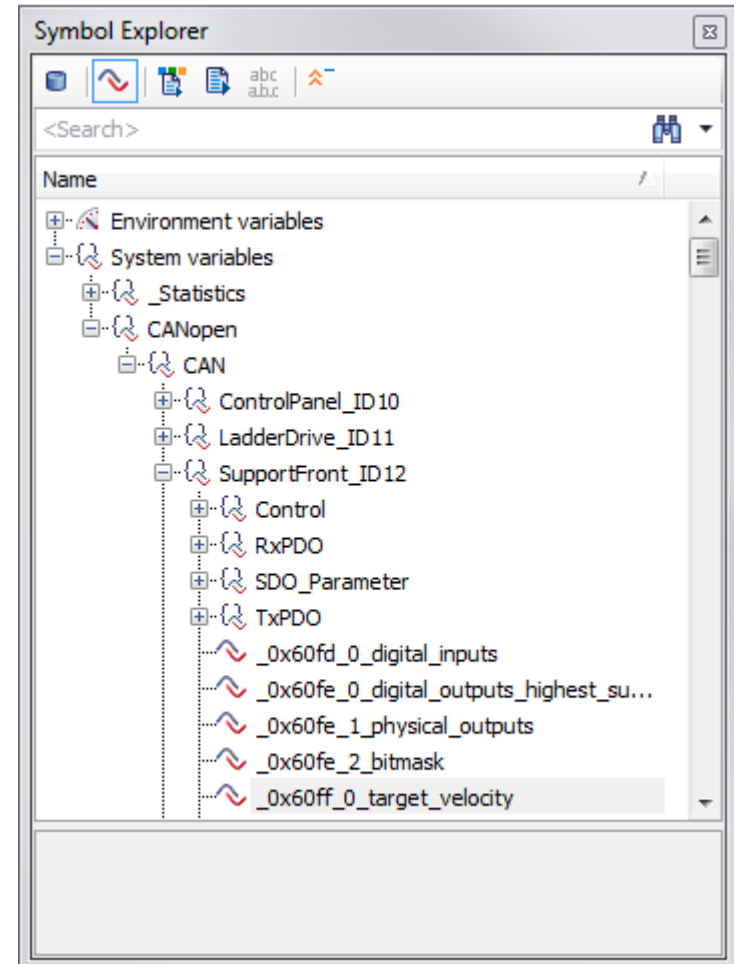


- ▶ CANopen support is now integrated in the node configuration directly:
 - ▶ Node ID
 - ▶ Device Configuration file (*.dcf *.xdc)



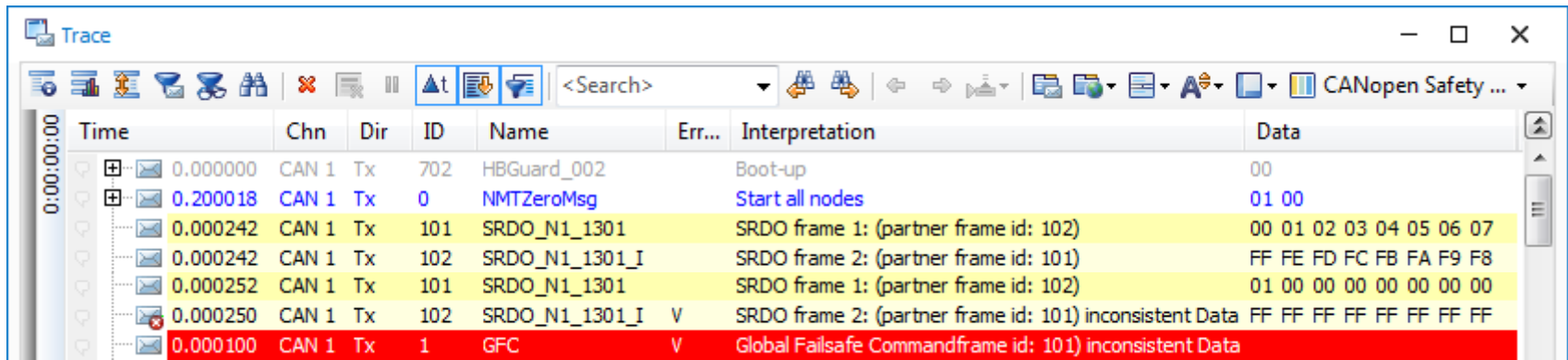
CANopen System Variables (CANoe only)

- ▶ System variables represent the Object Dictionary of each simulated CANopen device
 - ▶ Namespace: `NodeName_ID`
 - ▶ Variables: `_Index_SubIndex_Name`
- ▶ Benefits
 - ▶ Less and easier to read code
“What was 0x60FF Sub 0 again?”
 - ▶ PDO mapping completely transparent to the (CAPL) application
 - ▶ System variables can be controlled from test units and test modules, panels, Signal Generators, etc.



CANopen Safety (CANoe only)

- ▶ New simulation concept supports CANopen Safety (CiA 304, EN 50325-5)
- ▶ Features
 - ▶ Safety PDOs (SRDO) are sent redundant (one is bit-inverted)
 - ▶ SRDO configuration validated with CRC checksum
 - ▶ Global fail-safe command (GFC) is sent on data consistency errors or timing violations



Time	Chn	Dir	ID	Name	Err...	Interpretation	Data
0.000000	CAN 1	Tx	702	HBGuard_002		Boot-up	00
0.200018	CAN 1	Tx	0	NMTZeroMsg		Start all nodes	01 00
0.000242	CAN 1	Tx	101	SRDO_N1_1301		SRDO frame 1: (partner frame id: 102)	00 01 02 03 04 05 06 07
0.000242	CAN 1	Tx	102	SRDO_N1_1301_I		SRDO frame 2: (partner frame id: 101)	FF FE FD FC FB FA F9 F8
0.000252	CAN 1	Tx	101	SRDO_N1_1301		SRDO frame 1: (partner frame id: 102)	01 00 00 00 00 00 00 00
0.000250	CAN 1	Tx	102	SRDO_N1_1301_I	V	SRDO frame 2: (partner frame id: 101) inconsistent Data	FF FF FF FF FF FF FF FF
0.000100	CAN 1	Tx	1	GFC	V	Global Failsafe Commandframe id: 101) inconsistent Data	

Agenda

Overview

Measurement and Simulation Setup

Working with Databases

Analysis Windows

Data Logging

Offline Mode

Simulation

Testing

Scalability

Release Information

General

Scope

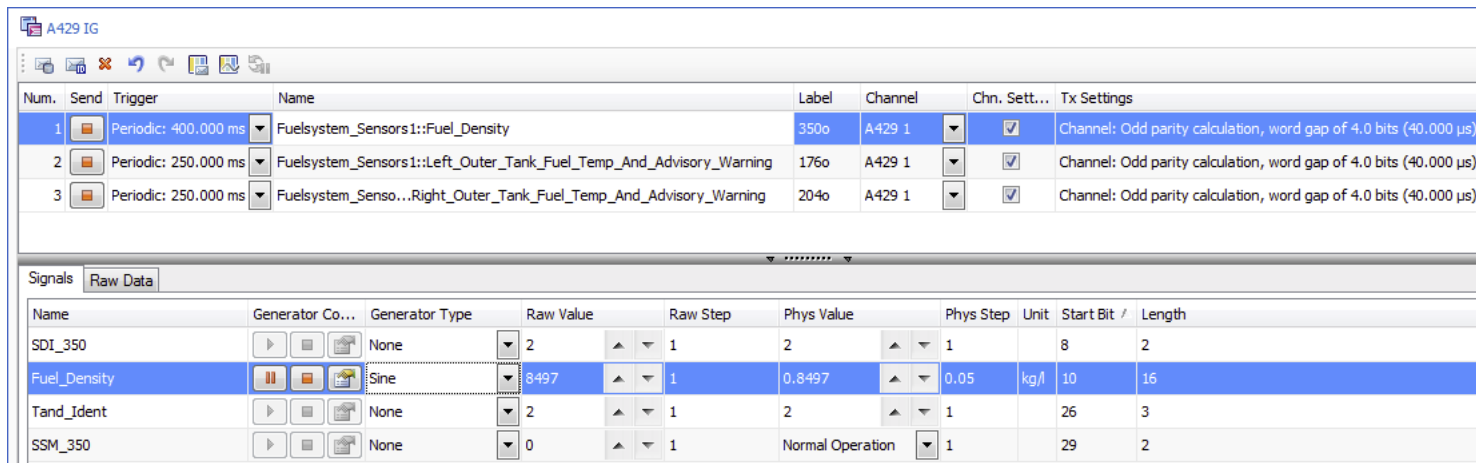
Sensor

CAN / CAN FD / CANopen

Skip topic

Options AFDX, A429, CANaero

- ▶ Option AFDX
 - ▶ Extended support for ICMP (internet control message protocol)
 - > Configuration via DBC, Decoding and highlighting in Trace Window, Additional support functions in CAPL
- ▶ Option A429
 - ▶ New ARINC-429 Interactive Generator



Num.	Send	Trigger	Name	Label	Channel	Chn. Sett...	Tx Settings
1		Periodic: 400.000 ms	Fuelsystem_Sensors1::Fuel_Density	350o	A429 1	<input checked="" type="checkbox"/>	Channel: Odd parity calculation, word gap of 4.0 bits (40.000 µs)
2		Periodic: 250.000 ms	Fuelsystem_Sensors1::Left_Outer_Tank_Fuel_Temp_And_Advisory_Warning	176o	A429 1	<input checked="" type="checkbox"/>	Channel: Odd parity calculation, word gap of 4.0 bits (40.000 µs)
3		Periodic: 250.000 ms	Fuelsystem_Senso...Right_Outer_Tank_Fuel_Temp_And_Advisory_Warning	204o	A429 1	<input checked="" type="checkbox"/>	Channel: Odd parity calculation, word gap of 4.0 bits (40.000 µs)

Name	Generator Co...	Generator Type	Raw Value	Raw Step	Phys Value	Phys Step	Unit	Start Bit /	Length
SDI_350		None	2	1	2	1		8	2
Fuel_Density		Sine	0.8497	1	0.8497	0.05	kg/l	10	16
Tand_Ident		None	2	1	2	1		26	3
SSM_350		None	0	1	Normal Operation	1		29	2

- ▶ Option CANaero
 - ▶ Enhanced message decoding in Trace Window
 - > Decode node services, high integrity messages and software data loading

Vector Aerospace Message Editor (AME)

- ▶ Manage message descriptions for the options^(*) AFDX, A429 and CANaero
 - ▶ Import, create, modify

- ▶ Supported input formats
 - ▶ Airbus ICD files (AFDX, ARINC-429, CAN)
 - ▶ XML profile descriptions according to ARINC 825-3
 - ▶ Vector XML format (label descriptions for ARINC-429)

- ▶ Supported output format
 - ▶ DBC files (options AFDX, A429 and CANaero)

*The tool is shipped with every option AFDX, A429 and CANaero.

For more information about Vector
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www.vector.com

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