



# Canoe and VECTOR CANdb++

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*Basic Introduction and Concepts*

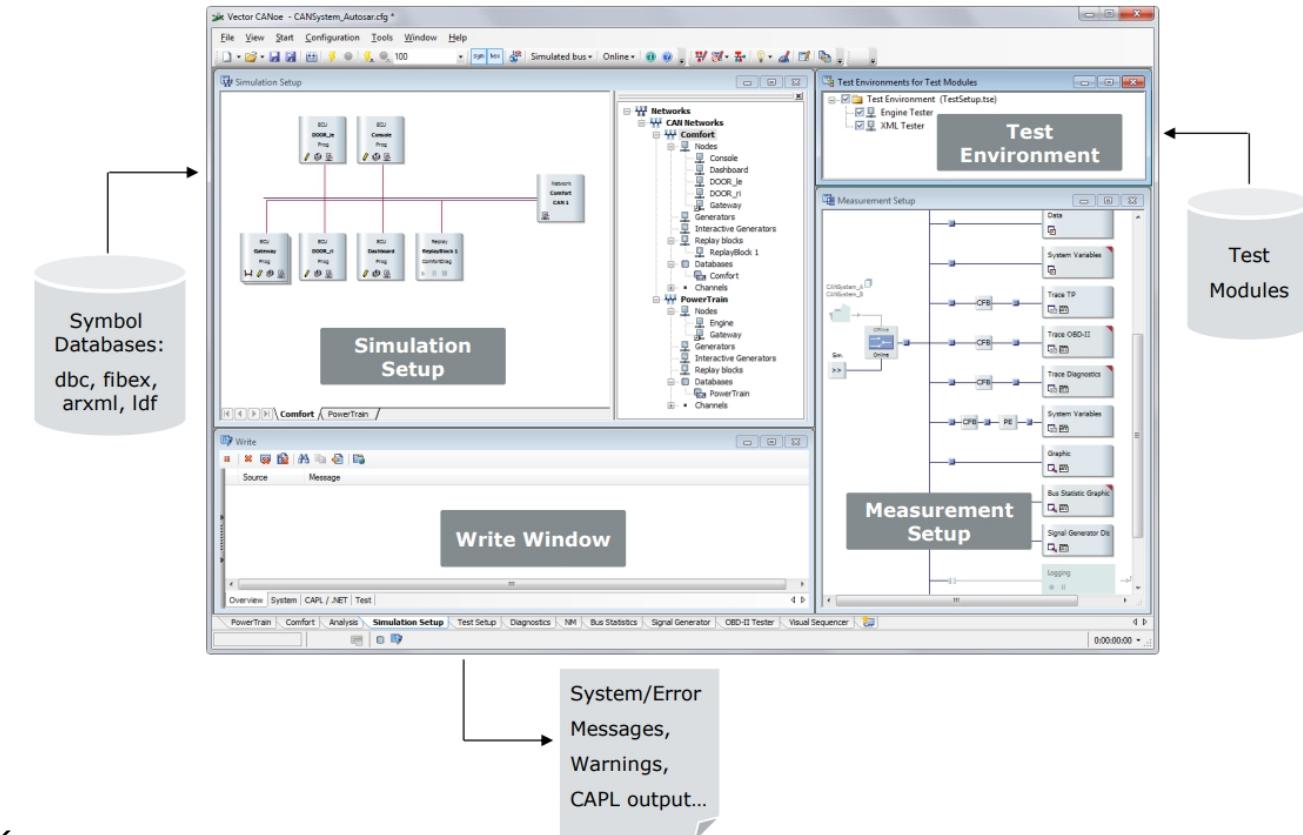


- 1. Overview - What do you know about CANoe ?**
- 2. Testing lab set up .**
- 3. Common Errors**
- 4. VECTOR CANdb++ : CAN messages & signals:  
How to configure the various fields.**
- 5. CAPL programs (T.B.D).**



# 1 - Overview - What do you know about CANoe ?

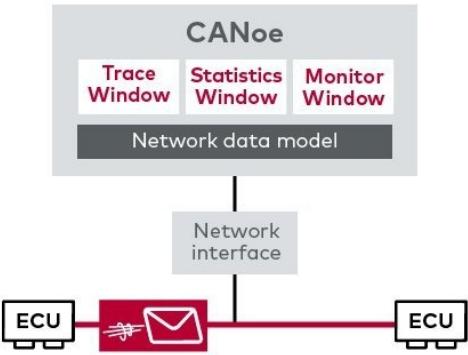
- ◆ A powerful SW tool developed by Vector Informatik GmbH for **development, testing, analysis**.
- ◆ Used widely in the automotive industry for developing and testing ECUs, network and system .
- ◆ Supporting communication protocols : CAN, LIN, FlexRay and Ethernet.



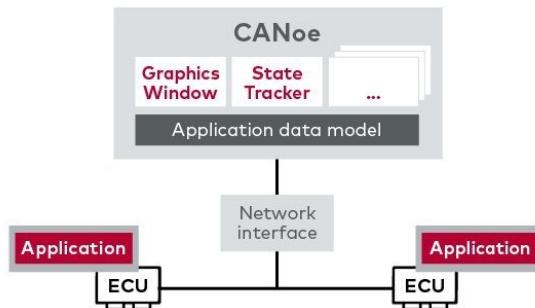
- Use of **databases** that describe the specific network.
- **Simulation** of entire systems and remaining bus simulations
- **Analysis** of the bus communications.
- **Testing** of entire networks and/or individual ECUs.
- User programmability using the **CAPL** programming language to support simulation, analysis and testing.

# 1 - Overview - What do you know about CANoe ?

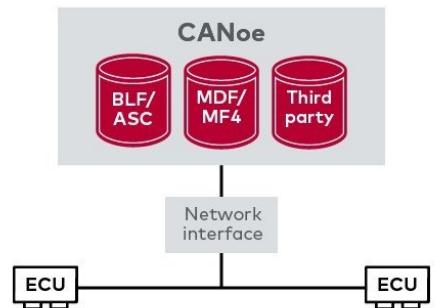
## Analysis



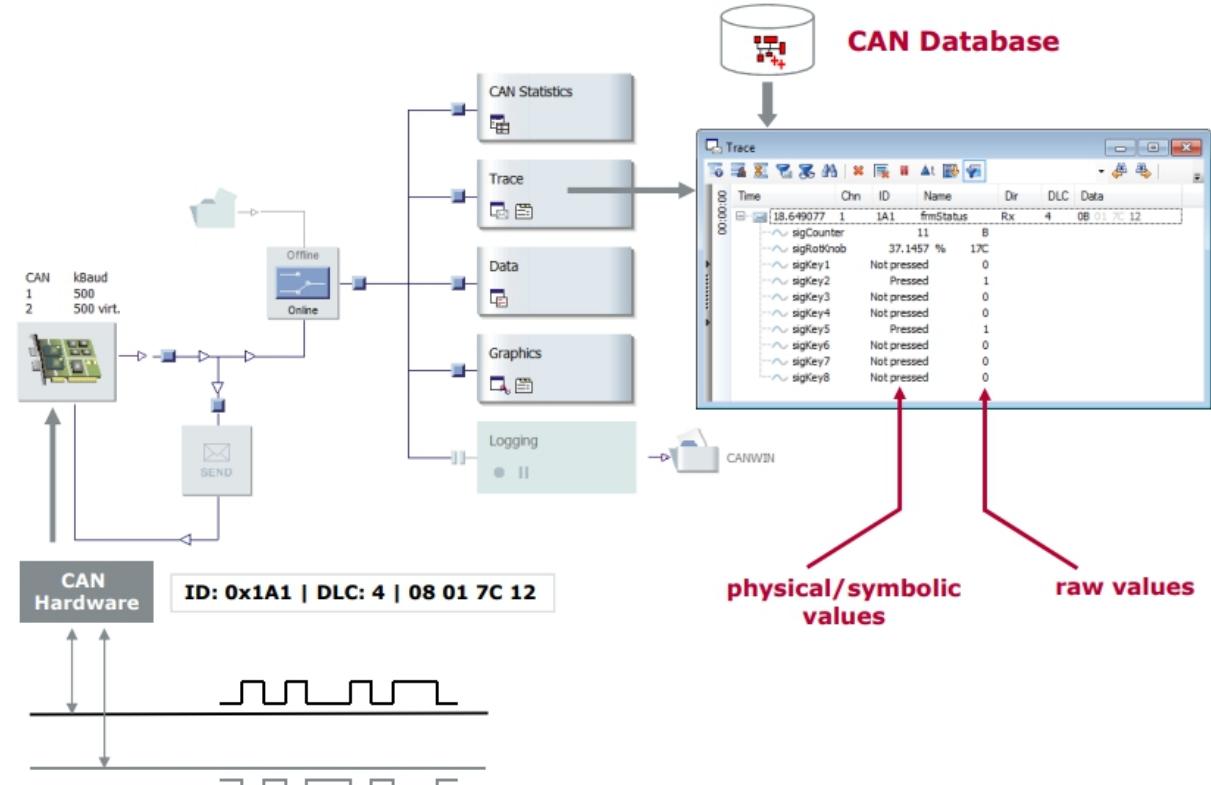
Network Communication Analysis



Application Data



Logging and Offline Analysis



# 1 - Overview - What do you know about CANoe ?

## Trace Window

- Insert filters
- Hide unchanged data
- Color events
- Set markers
- Show statistics
- Log data

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

**Column Filters** can be configured for every column during running measurement

Time	Diff Time	Chn	ID	Name	Dir	DLC	Data
4.143672	0.638308	CAN 1	41D	NM_Gateway	Tx	6	1D 10 00 00 00 00
3.138484	0.640000	CAN 1	41B	NM_DOORleft	Tx	6	1B 00 00 00 00 00
3.159496	0.640000	CAN 1	41C	NM_DOORright	Tx	6	1C 00 00 00 00 00
3.831248	0.640000	CAN 2	51A	NM_Gateway_PowerTrain	Tx	6	1A 10 00 00 00 00
4.109300	0.640000	CAN 2	51B	NM_Engine	Tx	6	1B 00 00 00 00 00

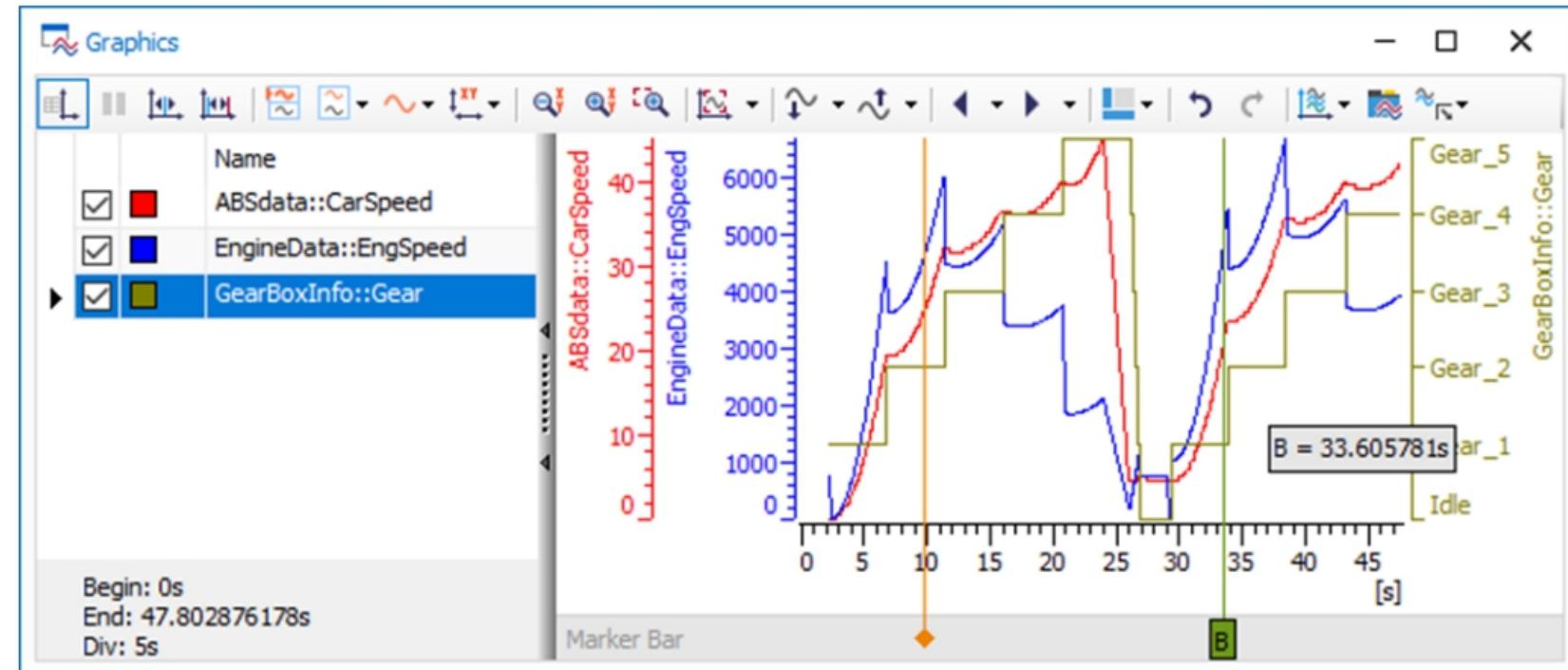
  

Time	Diff Time	Chn	ID	Name	Dir	DLC	Data
4.782268	0.638596	CAN 1	41D	(All)			1D 10 00 00 00 00
5.300888	0.100000	CAN 1	110	(Custom...)			87 01 00
5.381020	0.020000	CAN 1	1A0	ABSdata			00 00 00 22
5.004140	0.499988	CAN 1	1A1				00 00
5.370720	0.028980	CAN 1	1F0	Console_1			03
5.371416	0.028980	CAN 1	1F1	Console_2			02
3.116496	0.640000	CAN 1	41A				1A 00 00 00 00 00
3.138484	0.640000	CAN 1	41B				1B 00 00 00 00 00
3.159496	0.640000	CAN 1	41C				1C 00 00 00 00 00
5.006324	0.999976	CAN 2	200	Diag_Request_Tp	Tx	1	[01] 20 [00 00 00 00 00 00]
1.004835	1.004835	CAN 2	200	Default Session (OBDII) St...			10 81
5.008532	1.000048	CAN 2	400	Diag_Response_Tp	Tx	1	[01] 60 [00 00 00 00 00 00]
1.006311	1.006311	CAN 2	400	Default Session (OBDII) St...			50 81
3.032936	2.025125	CAN 2	200	Tester Present Send (Resp...)			3E 01
3.034460	2.025125	CAN 2	400	Tester Present Send (Resp...)			7E
2.005823	2.005823	CAN 2	200	ECU Identification Read:req			1A 90
2.030155	2.030155	CAN 2	400	ECU Identification Read:pos			12 5A 90 98 76 54 32 10 00 99 99 00 01
5.380804	0.020000	CAN 2	67	Ignition_Info	Tx	2	01 00
5.111248	0.640000	CAN 2	51A	NM_Gateway_PowerTrain	Tx	6	1A 10 00 00 00 00
5.351416	0.049988	CAN 2	64	EngineData	Tx	8	51 08 1C 1B 03 0C 06 18
5.352856	0.049964	CAN 2	66	EngineDataIEEE	Tx	8	51 08 00 00 03 0C 00 00
5.354056	0.049160	CAN 2	C9	ABSdata	Tx	6	12 00 00 00 96 32
5.354752	0.049160	CAN 2	3FC	GearBoxInfo	Tx	1	01
5.352832	0.046508	CAN 1	111	Gateway_2	Tx	8	06 12 00 51 08 1B 00 00

# 1 - Overview - What do you know about CANoe ?

## Graphics Window

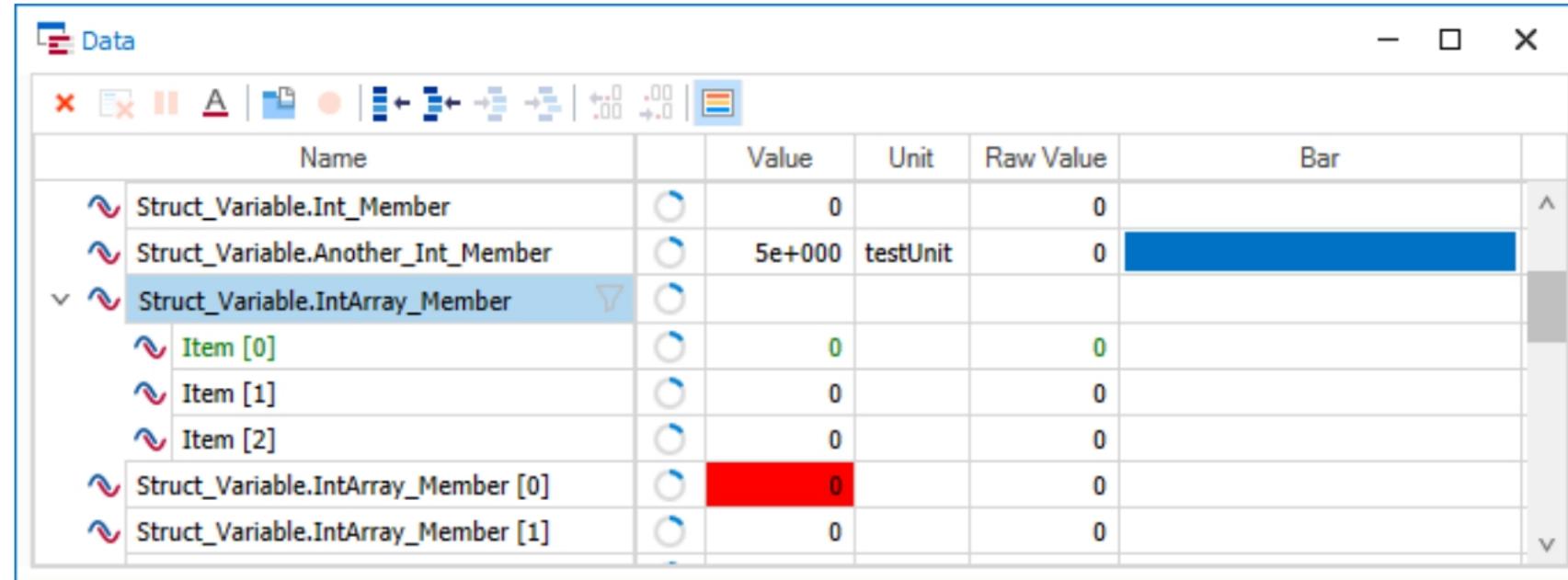
- Show measurement markers/difference markers
- Set markers
- Show measurement columns
- Show statistics
- X/Y mode
- Log data



# 1 - Overview - What do you know about CANoe ?

## Data Window

- Show values
- Log data
- Conditional Formatting
- Filter
- User-defined Groups



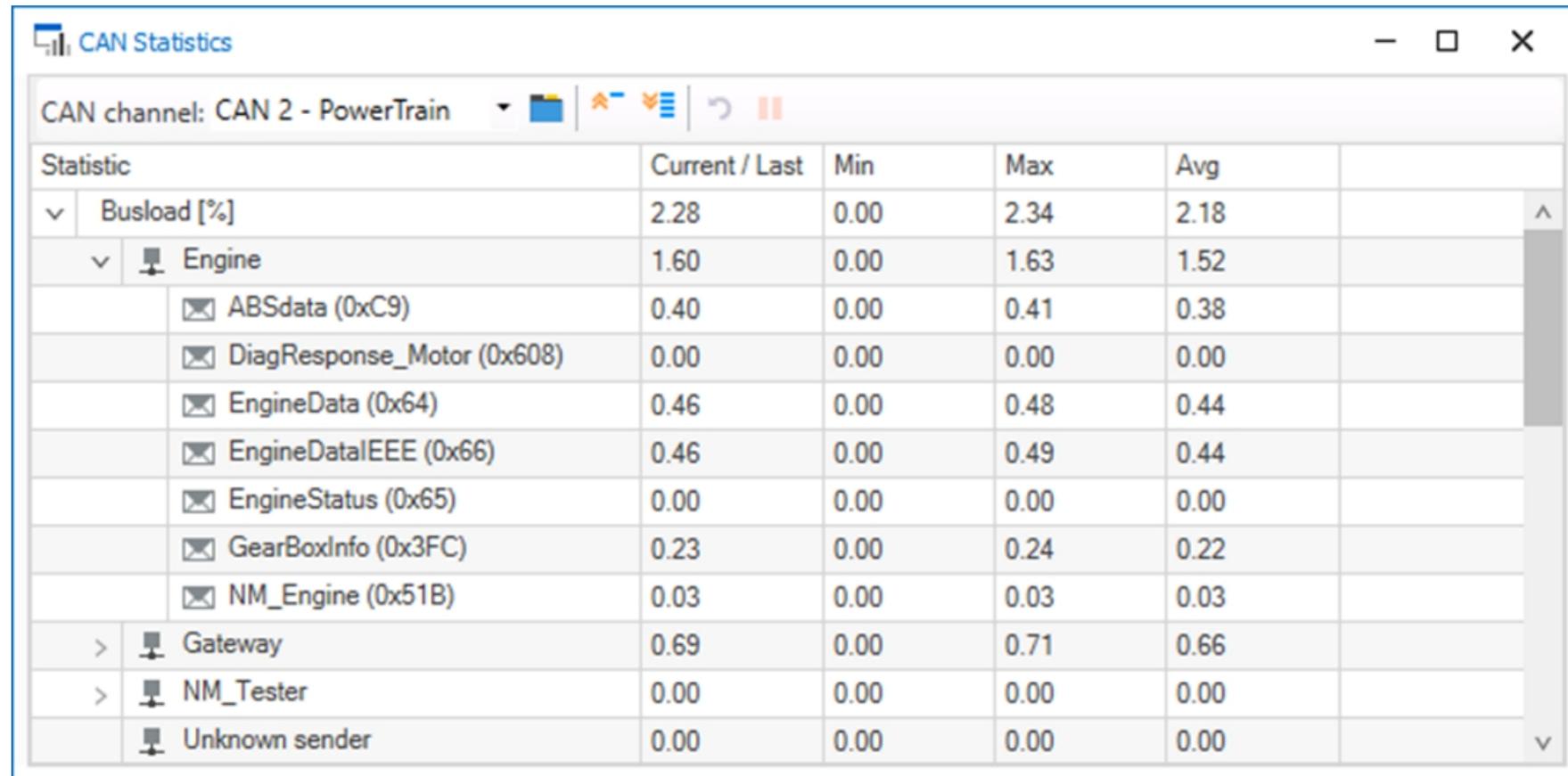
The screenshot shows the CANoe Data window interface. At the top, there's a toolbar with various icons for data management. Below the toolbar is a header row with columns labeled: Name, Value, Unit, Raw Value, and Bar. The main data area is a table with rows representing different variable structures:

Name	Value	Unit	Raw Value	Bar
Struct_Variable.Int_Member	0		0	
Struct_Variable.Another_Int_Member	5e+000	testUnit	0	<div style="width: 100%; background-color: blue;"></div>
Struct_Variable.IntArray_Member				
Item [0]	0		0	
Item [1]	0		0	
Item [2]	0		0	
Struct_VariableIntArray_Member [0]	0		0	<div style="width: 100%; background-color: red;"></div>
Struct_VariableIntArray_Member [1]	0		0	

# 1 - Overview - What do you know about CANoe ?

## Statistics Window

- Show statistical data of individual channels
- Set updating interval
- Pause statistics

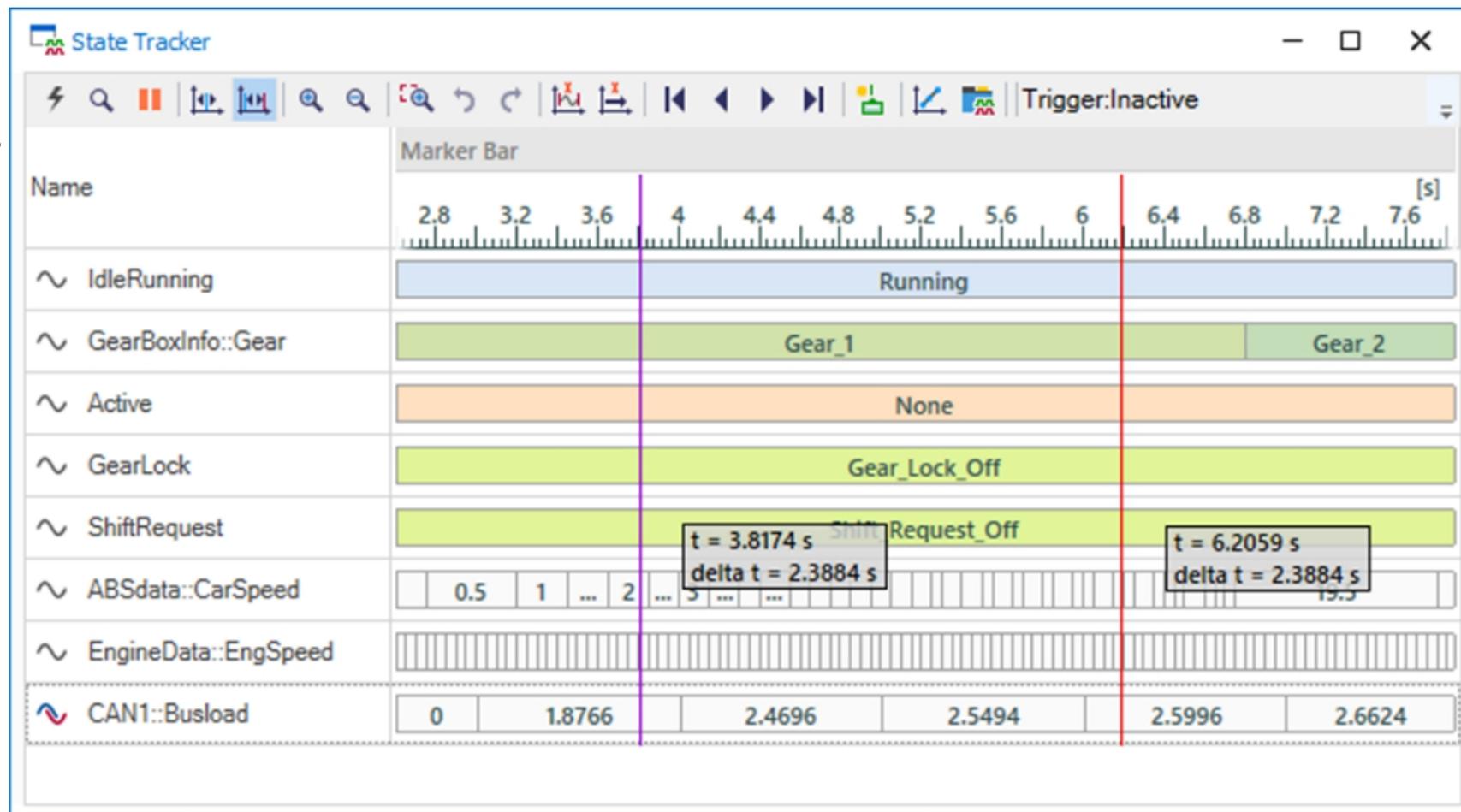


Statistic	Current / Last	Min	Max	Avg	
Busload [%]	2.28	0.00	2.34	2.18	
Engine	1.60	0.00	1.63	1.52	
ABSdata (0xC9)	0.40	0.00	0.41	0.38	
DiagResponse_Motor (0x608)	0.00	0.00	0.00	0.00	
EngineData (0x64)	0.46	0.00	0.48	0.44	
EngineDataIEEE (0x66)	0.46	0.00	0.49	0.44	
EngineStatus (0x65)	0.00	0.00	0.00	0.00	
GearBoxInfo (0x3FC)	0.23	0.00	0.24	0.22	
NM_Engine (0x51B)	0.03	0.00	0.03	0.03	
Gateway	0.69	0.00	0.71	0.66	
NM_Tester	0.00	0.00	0.00	0.00	
Unknown sender	0.00	0.00	0.00	0.00	

# 1 - Overview - What do you know about CANoe ?

## State Tracker

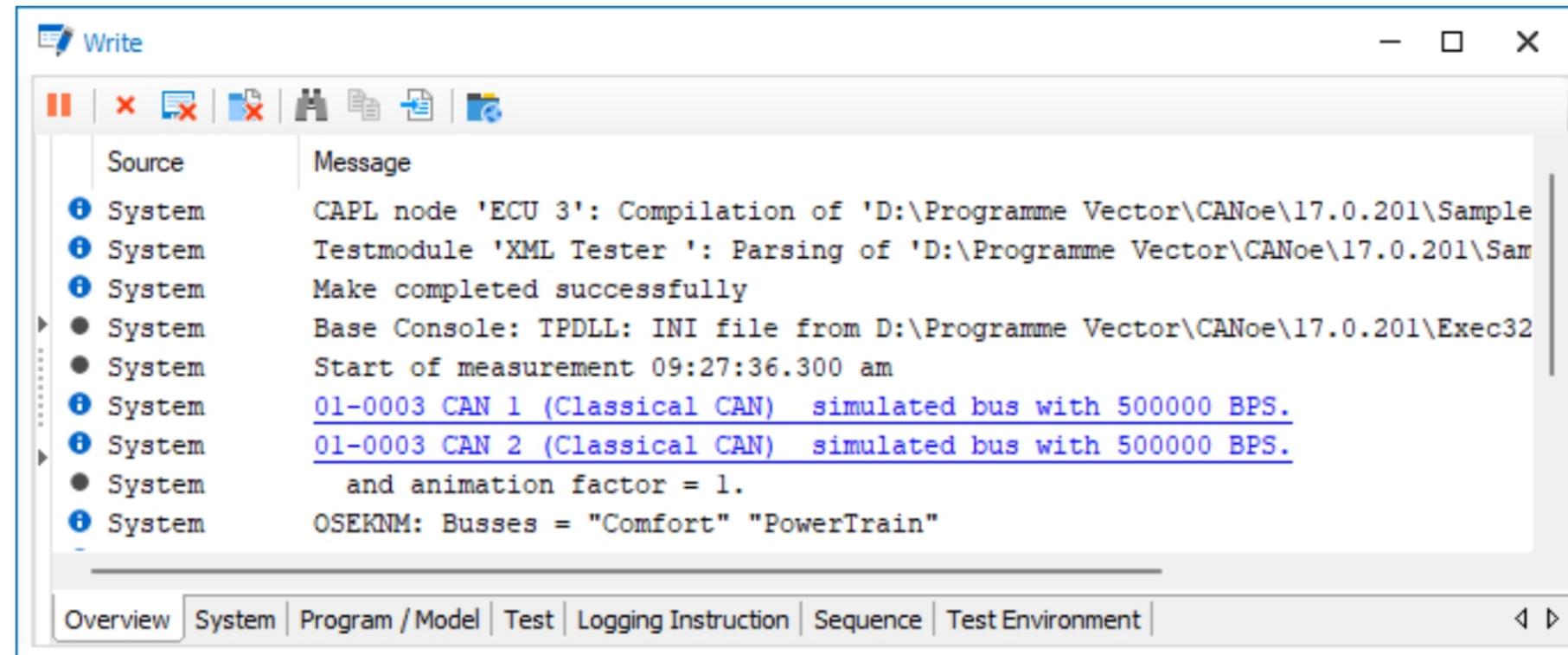
- Search for errors
- Analyze information
- Monitor AUTOSAR runnables
- Set triggers
- Set markers



# 1 - Overview - What do you know about CANoe ?

## Write Window

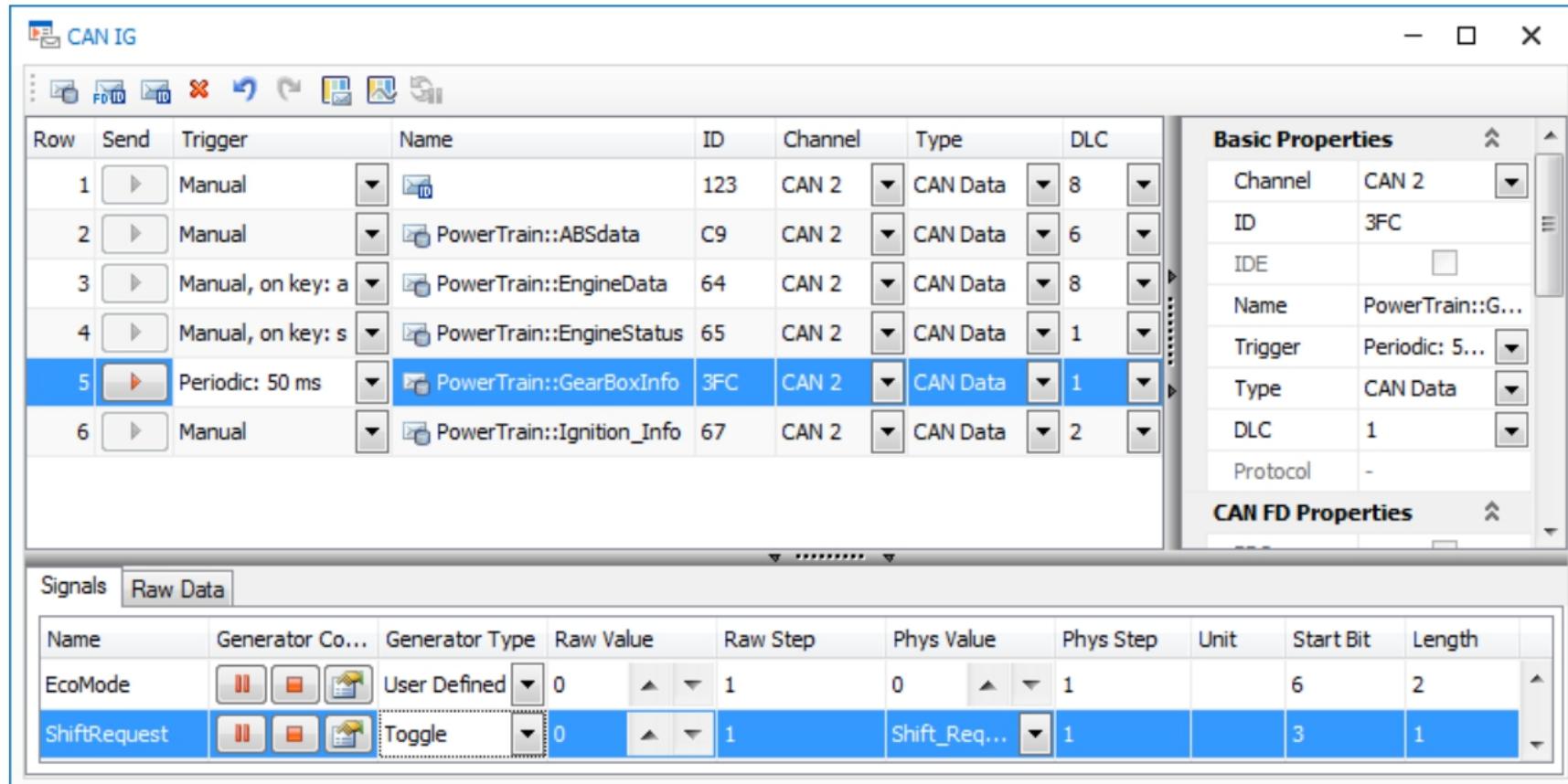
- Configure output
- Log output
- Status display



# 1 - Overview - What do you know about CANoe ?

## Interactive Generator (IG)

- Define messages
- Send messages
- Change signal values



The screenshot shows the CANoe Interactive Generator (IG) interface. The main window displays a table of CAN messages with columns for Row, Send, Trigger, Name, ID, Channel, Type, and DLC. Message 5 is selected, showing a periodic trigger of 50 ms. The right side of the interface contains two property panes: 'Basic Properties' and 'CAN FD Properties'. The 'Basic Properties' pane shows settings like Channel (CAN 2), ID (3FC), and Type (CAN Data). The 'CAN FD Properties' pane is currently collapsed. Below the main table is a 'Signals' tab, which lists two signals: 'EcoMode' and 'ShiftRequest'. The 'ShiftRequest' signal is currently selected, showing its generator type as 'Toggle'.

Row	Send	Trigger	Name	ID	Channel	Type	DLC
1	▶	Manual	✉	123	CAN 2	CAN Data	8
2	▶	Manual	✉	C9	CAN 2	CAN Data	6
3	▶	Manual, on key: a	✉	PowerTrain::EngineData	64	CAN 2	8
4	▶	Manual, on key: s	✉	PowerTrain::EngineStatus	65	CAN 2	1
5	▶	Periodic: 50 ms	✉	PowerTrain::GearBoxInfo	3FC	CAN 2	1
6	▶	Manual	✉	PowerTrain::Ignition_Info	67	CAN 2	2

Name	Generator Co...	Generator Type	Raw Value	Raw Step	Phys Value	Phys Step	Unit	Start Bit	Length	
EcoMode	⏸️ ⏸ 📈	User Defined	0	▲ ▼	1	0	▲ ▼	1	6	2
ShiftRequest	⏸️ ⏸ 📈	Toggle	0	▲ ▼	1	Shift_Req...	▼	1	3	1

## Logging/Replay

- Replay
- Logging
  - In the BLF and ASCII formats

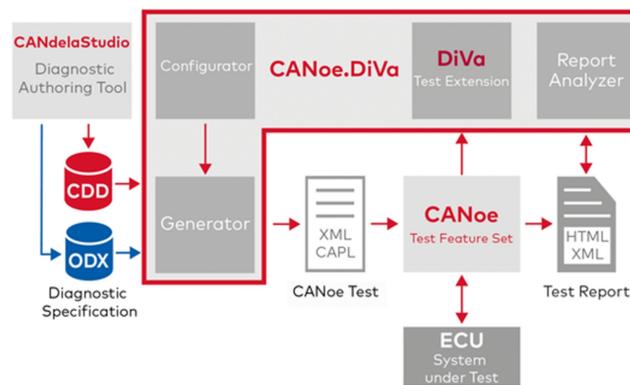
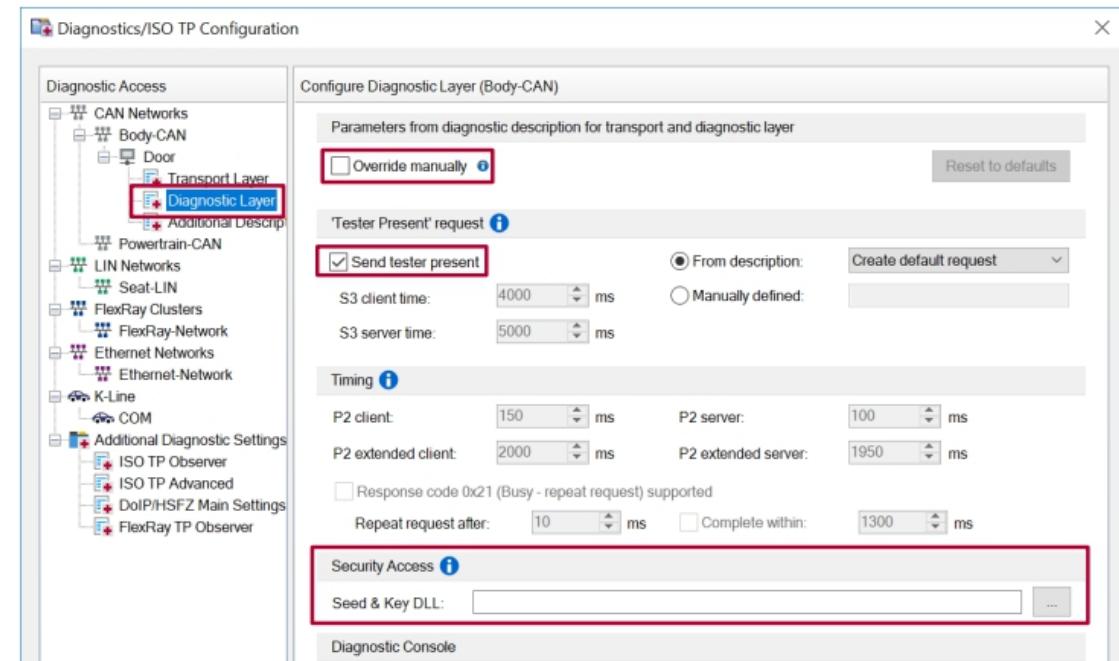
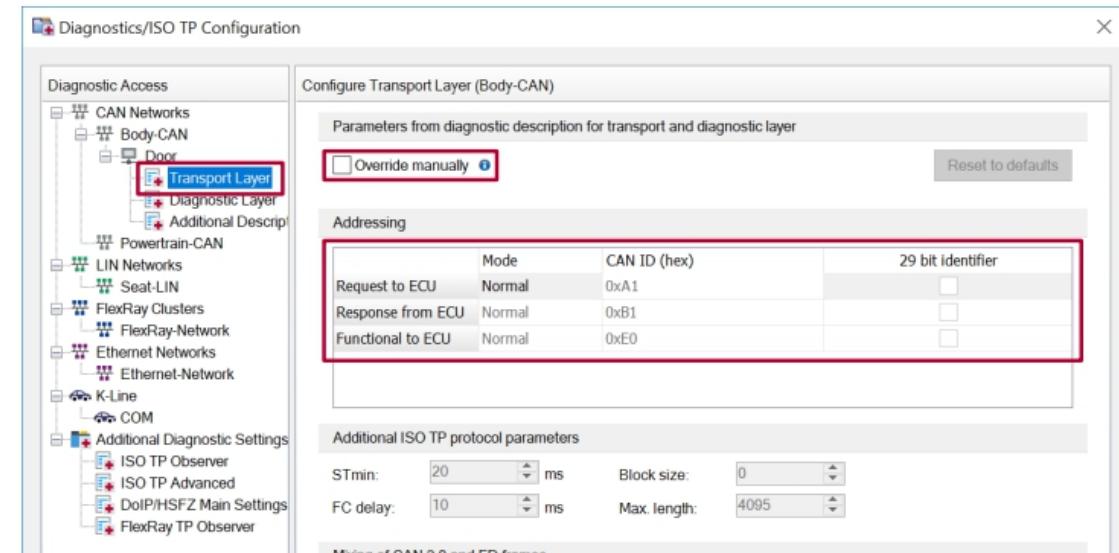
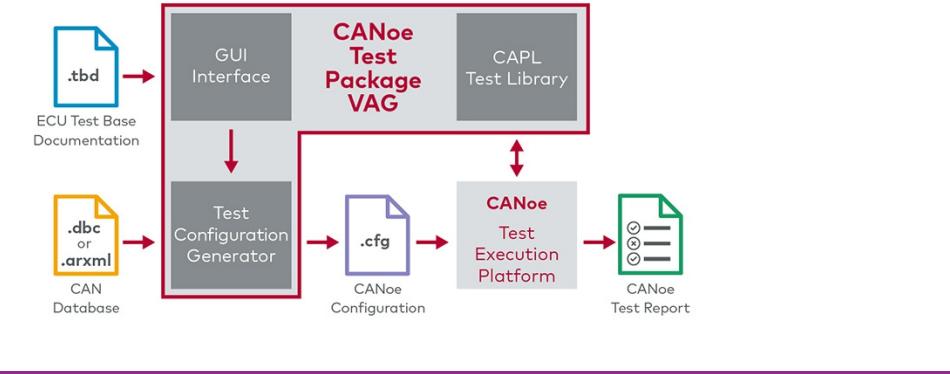
## Triggers and Filters

- Filter in the hardware
  - The CAN controllers use acceptance filtering to control which received messages are passed to CANoe
- Filters in the Trace Window
- Filters in the Measurement Setup
  - To define which data should be passed to the specific analysis windows and/or which data should be explicitly blocked.
- Triggers in the Measurement Setup

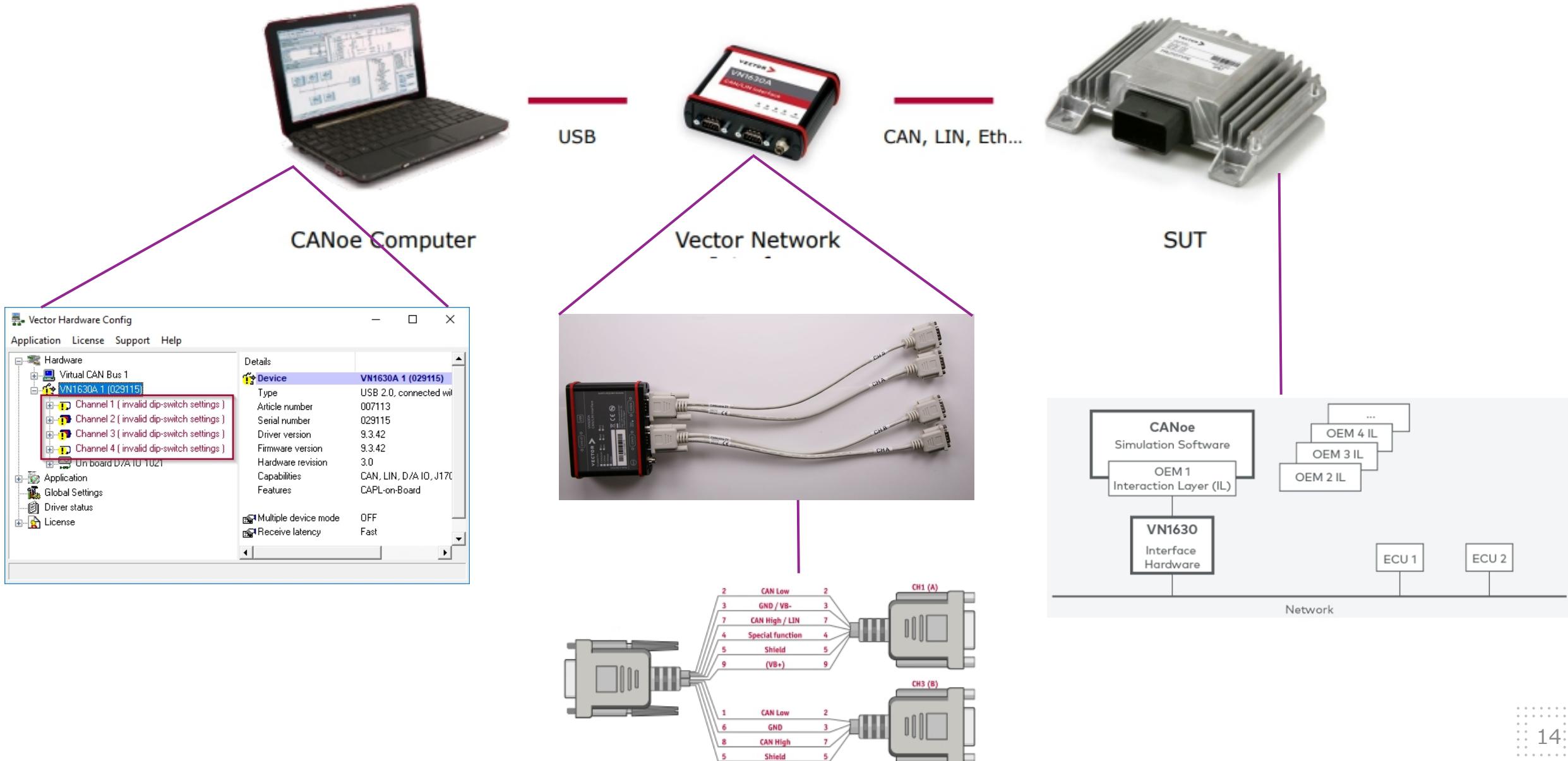
# 1 - Overview - What do you know about CANoe ?

## Diagnostics

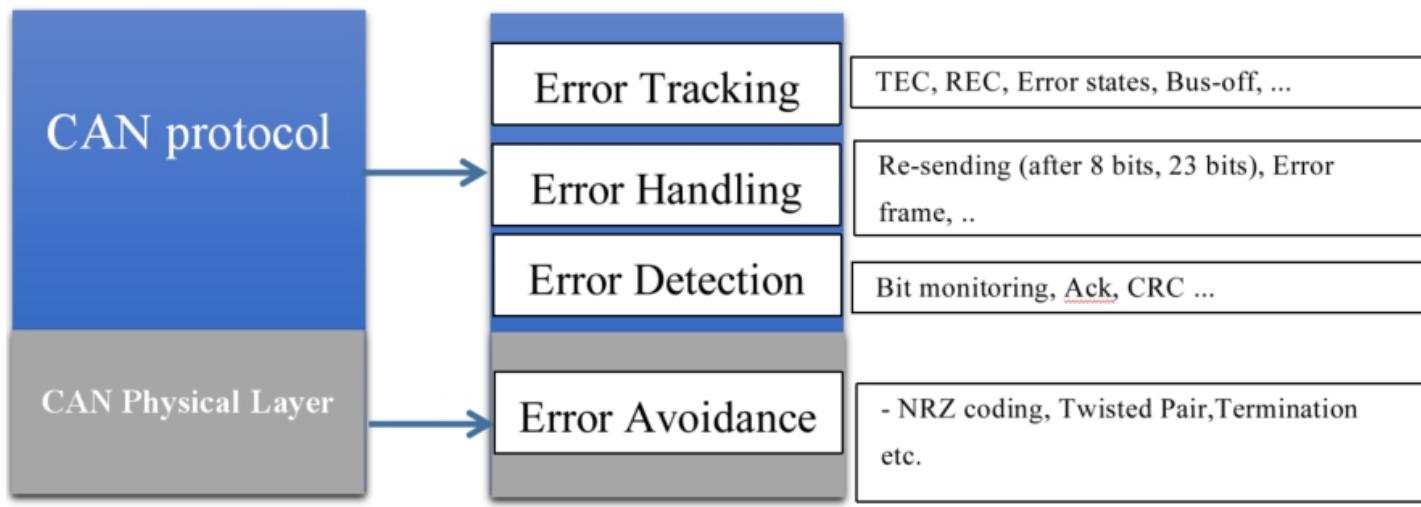
- KWP2000 and UDS (ISO 14229)
- Basic Diagnostic Editor
- Interactive diagnostic tester with Diagnostic Console, Fault Memory Window and Diagnostic Session Control with configurable security-DLL.
- So on



# 2 - Testing lab setting up



# 3 - Common Errors



## Error Types:

1. Other / Unknown error
2. Bit Error e.g. violation of CAN frame format,
3. Bit stuffing Error
4. CRC Error
5. Ack

Time	Chn	ID	Name	Event Type	Dir	DLC	Data
18,331969	CAN 1			CAN Error	TxErr		ECC: 11000000xxxx, Bit Error, Bit Position = 65
		ECC	: 11000000xxxx				
		Code	: Bit Error				
		Position	: 65				
		ID	: 0000000110110b (36)				
		DLC	: 8				
		Data 00-07:	FF FF 00 00 00 00 00 00				
18,333960	CAN 1 36	HU_DATC_E_03		CAN Frame	Tx	8	FF FF 00 00 00 00 00 00
18,337985	CAN 1 1D4			CAN Frame	Rx	8	00 00 04 00 00 00 00 00
18,339234	CAN 1 1D5			CAN Frame	Rx	8	01 FF FF FF FF FF FF FF
18,340443	CAN 1 44D	NM_CLU		CAN Frame	Rx	8	4D 01 00 00 00 00 FF FF
18,346403	CAN 1 454	NM_HUD		CAN Frame	Rx	8	54 01 00 00 00 00 FF FF
18,361047	CAN 1 455	NM_CGW		CAN Frame	Rx	8	55 01 00 00 00 00 FF FF
18,378815	CAN 1 440	NM_H_U		CAN Frame	Rx	8	40 01 00 00 00 00 FF FF
18,397364	CAN 1 448	NM_AMP		CAN Frame	Rx	8	48 01 00 00 00 00 FF FF
18,426129	CAN 1 50F	HUD_HU_P_00		CAN Frame	Rx	8	00 00 00 00 00 00 00 00
18,437896	CAN 1 44D	NM_CLU		CAN Frame	Rx	8	54 02 00 00 00 00 FF FF

# 3 - Common Errors

## What Causes CAN Bus Errors?:

### Physical Layer Issues:

Faulty wiring, poor connections, or damaged cables can interfere with the CAN Bus signals. Physical disruptions like these are common sources of errors, as they can corrupt data being transmitted across the network.

- The correct Termination of the CAN Bus.
- The correct Grounding of the CAN Bus
- Short Circuit in CAN Wiring
- The correct Voltage Levels on CAN\_H and CAN\_L

### Electrical Interferences:

- CAN Bus systems are designed to be resilient against noise. However, excessive electromagnetic interference (EMI) from external sources or other electronic systems within the vehicle can lead to signal degradation and errors.

### Protocol Violations:

- The CAN Bus operates under a strict set of rules defined by its protocol. Any device that does not adhere to these rules can introduce errors. This includes incorrect message formatting, timing violations, or the transmission of erroneous data.

### Overloaded Network:

- When too many messages are sent simultaneously, or a device monopolizes the bus, it can cause network congestion. This overload can result in delayed message transmission or, in severe cases, loss of data.

**Faulty ECUs:** Electronic control units that malfunction due to hardware failures or software bugs can **send incorrect data** or fail to communicate altogether, leading to errors within the CAN Bus system. The same frame IDs are transmitted by more than one nodes

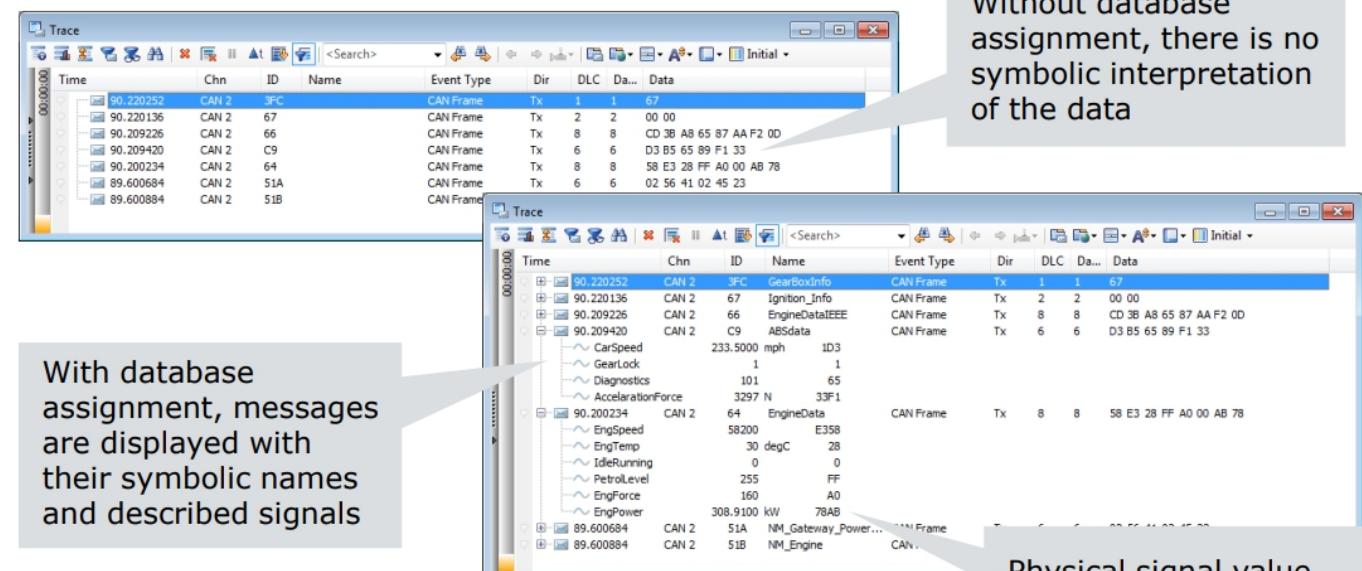
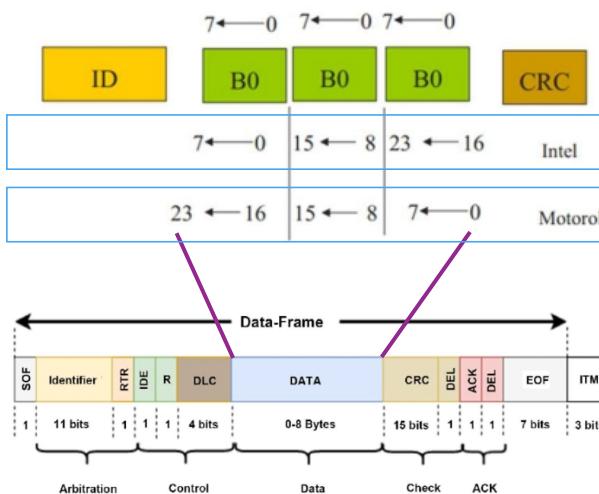
# 3 - VECTOR CANdb++

## **VECTOR CANdb++ is important ...**

- A DBC file contains critical information about nodes, messages, and signals required for proper functioning of the network.
- Understanding the **structure and importance of DBC files** is crucial for engineers and developers working with communication systems in vehicles.

## **DBC file used for:**

- Sending Messages defined in DBC file (manual or by CAPL script)
- Monitoring Signals: You can visualize real-time data, plot graphs, and set triggers based on signal conditions. Helps you analyze and debug your network's performance.
- Simulating Nodes



## 3 - VECTOR CANdb++

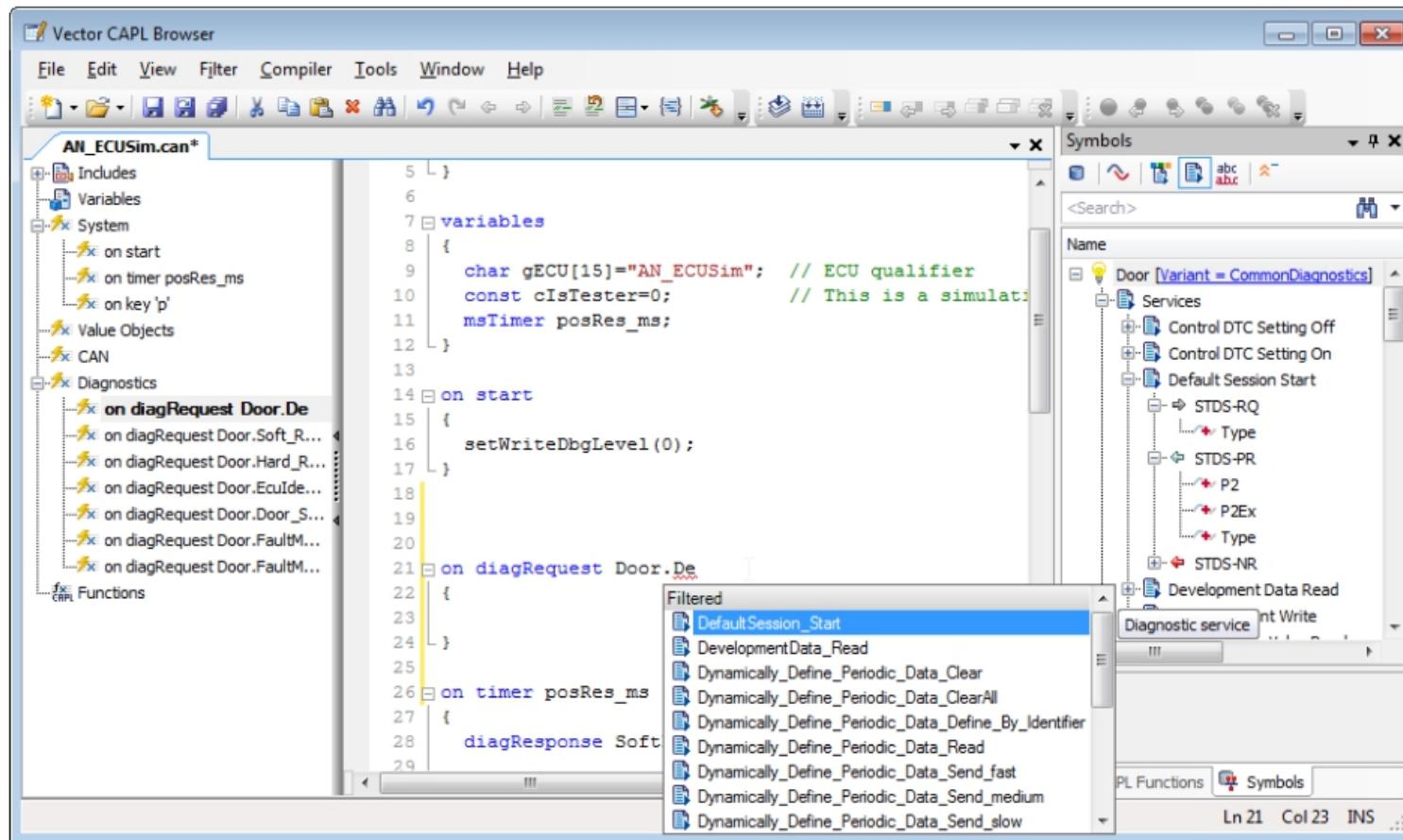
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DEMO

# 4 - CAPL programs (T.B.D)

- ◆ CAPL is a procedural programming language similar to C, which was developed by Vector Informatik.
- ◆ CAPL programs are developed and compiled in a dedicated browser.
- ◆ This makes it possible to access all of the objects contained in the database (messages, signals, environment variables) as well as system variables. In addition, CAPL provides many predefined functions to support users.





**THANK  
YOU**

