VECTOR

Diagnostics via CANoe Gateways

Version 1.3

2017-03-08

Application Note AN-IND-1-004

Author Vector Informatik GmbH

Restrictions Public Document

Abstract Explains the concept of a diagnostics gateway between CAN and any other bus system or transport protocol to make CANoe's diagnostics features available when direct access is not yet possible

Table of Contents

1.0 Overview

CANoe supports a multitude of features for the development of diagnostics in ECUs and vehicles as a whole. While all features are available on the CAN bus system with ISO transport protocol, not all features are available on non-CAN bus systems, and not every proprietary transport protocol is supported.

For most scenarios, a “diagnostics gateway” can make the CAN diagnostics features available to any bus system. This application note explains the basic scenarios, the currently available features, the concept of a diagnostics gateway, and finally some CAPL example implementations.

In the final section, a multi-connection CAN-FlexRay TP-level gateway is described in detail.

Please note, that since the time this application note was written, features may have been made available for additional bus systems. For the latest information and sample implementations, please have a look at the Vector homepage www.vector.com or call the support hotline.

2.0 Diagnostics scenarios

2.1 Isolated ECU

In this scenario only the ECU is real, all other components of the vehicle are simulated by CANoe. For example, on a LIN bus CANoe.LIN acts as the master node, while the ECU is directly attached to the PC’s bus interface as a slave.

2.2 ECU as part of a cluster

The ECU as device under test (DUT) is part of a larger component, e.g. a complete sub-bus. There are other ECUs existing that may interact with the DUT and CANoe, though parts of the remaining bus may be simulated in CANoe.

In the LIN example, it may be possible that CANoe is not the master here, i.e. the master node can be a real ECU.

2.3 ECU integrated into vehicle

In this scenario, the ECU is not accessible physically. Instead it is part of the vehicle, and CANoe cannot be attached to the same bus directly, e.g. the LIN sub-bus in the door of the vehicle.

3.0 Diagnostics features in CANoe

This is an overview of the diagnostics features available in CANoe 9.0, unless stated otherwise. For more details please refer to the application note AN-IND-1-001, “CANoe and CANalyzer as Diagnostic Tools” (available as help document from the start menu, and as “AN-IND-1-001_CANoe_CANalyzer_as_Diagnostic_Tools.pdf” in the “Doc” folder of your CANoe installation directory).

Feature	Availability
Transport protocols	Implementations: > ISO TP on CAN, LIN and FlexRay > AMS and MOST High Protocol on MOST > AUTOSAR TP 2.0 and 3.0 on FlexRay > VW TP 1.6 and 2.0 on CAN (in a separate package) > VW TP 2.0 on MOST (in a separate package) > AUDI AUTOSAR TP 3.2.1.4 on FlexRay (in a separate package) > BMW TP on FlexRay (in a separate package) > K-Line > DoIP/HSFZ
Transport protocol observers	Data transfers can be recognized for: > ISO TP on CAN, LIN and FlexRay > AMS and MOST High Protocol on MOST > AUTOSAR TP2.0 and 3.0 on FlexRay > VW TP 2.0 on CAN (in a separate package) > VW TP 2.0 on MOST (in a separate package) > AUDI AUTOSAR TP 3.2.1.4 on FlexRay (in a separate package) > BMW TP on FlexRay (in a separate package) > DoIP/HSFZ
Interpretation of diagnostics data	Interpretation is available for: > ISO TP on CAN, LIN and FlexRay > AMS and MOST High Protocol on MOST > AUTOSAR TP2.0 and 3.0 on FlexRay > VW TP 2.0 on CAN (in a separate package) > VW TP 2.0 on MOST (in a separate package) > AUDI AUTOSAR TP 3.2.1.4 on FlexRay (in a separate package) > BMW TP on FlexRay (in a separate package) > K-Line > DoIP/HSFZ
Diagnostics Console, Fault Memory and Session Control Window	Available for: > ISO TP on CAN, LIN and FlexRay > AUTOSAR TP 2.0 and 3.0 on FlexRay > VW TP 2.0 on CAN (in a separate package) > AUDI AUTOSAR TP 3.2.1.4 on FlexRay (in a separate package) > BMW TP on FlexRay (in a separate package) > K-Line > DoIP/HSFZ
CAPL program access	Possible from nodes on: > CAN > LIN > FlexRay > K-Line > DoIP/HSFZ
CAPL Callback Interface	Reference implementations available as CAPL include files (*.cin) for: > CAN > LIN

Feature	Availability
	> FlexRay (for AUTOSAR and ISO TP) > K-Line > DoIP/HSFZ
Test module access	Diagnostics targets may be located on: > CAN > LIN > FlexRay > K-Line > DoIP/HSFZ

Table 1: Availability of CANoe diagnostics features on bus systems and for transport protocols

4.0 Diagnostics Gateway

4.1 Basic concept

In order to make all of CANoe’s diagnostics features available to the development of ECUs connected to any *target bus* system or transport protocol, a *diagnostics gateway* can be used:

- The diagnostics description is configured for a CAN bus, which may be “virtual”, i.e. does not require any additional hardware.
- The ECU is connected to a remaining bus simulation as needed for the target bus’ technology, e.g. a “master” node may be necessary.
- The diagnostics gateway is assigned to both busses. It receives requests on the CAN bus context and forwards them to the target bus context. Responses from the ECU travel the reverse way.
- The interpretation of the transferred data is available on the CAN bus, while the low level data transfers are available on the target bus.
- The diagnostics console window and the fault memory window operate normally.
- Diagnostics test modules also work as if the ECU was connected to the CAN bus.

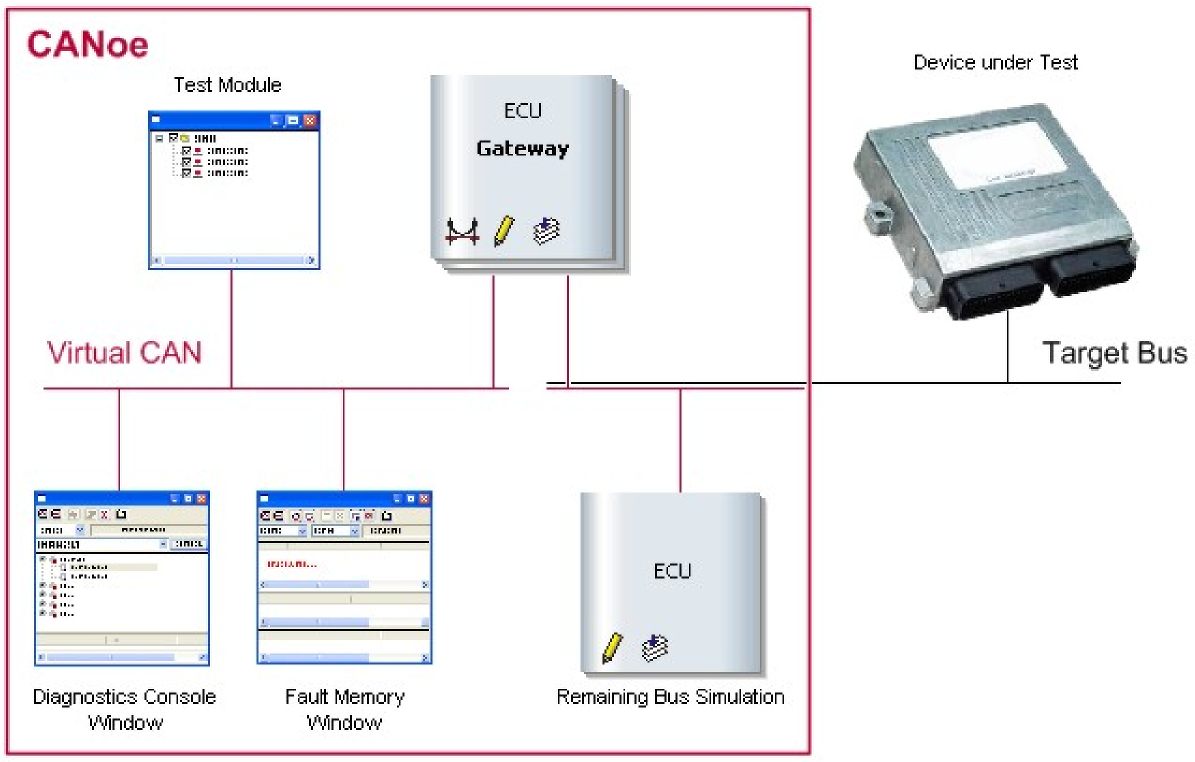


Figure 1: Gateway routing diagnostic information between a bus system which supports diagnostic access natively (e.g. CAN) and the target bus system.

4.2 Gateway level

A diagnostics gateway can operate on different levels which affect the transfer delays and possibilities to filter requests and responses.

Note
The samples only sketch one of several possible implementations!
Please refer to the CANoe help and manual for details on functions and CAPL keywords.

4.2.1 Network layer, identical transport protocols on both buses

For every CAN frame received by the gateway, a target bus frame is sent. For every target bus frame containing an ISO transport protocol PDU the gateway receives, it sends a frame on CAN. Note that there may be some frame modification taking place in the gateway, e.g. the ids may be changed or the length of the frame by adding or stripping padding bytes.

Example: ISO TP level

Source Bus	CAN ID	DLC	Data	Dir	Target Bus ID	DLC	Data
Request:							
SingleFrame	200	8	02 1A 81 00 00 00 00 00	RX			
				TX	150	24	02 1A 81 00 …
Response:							
FirstFrame				RX	151	24	10 09 5A 81 12 34 56 78 …
	400	8	10 09 5A 81 12 34 56 78	TX			
FlowControl	200	8	30 00 14 00 00 00 00 00	RX			
				TX	150	24	30 00 14 00 …
Consecutive Frame				RX	151	24	21 9A BC DE 00 00 00 00 …
	400	8	21 9A BC DE 00 00 00 00	TX			

Discussion:

- No transport protocol implementations have to be present in the gateway.
- Since the data is not stored, gateways of this type provide the smallest transmission delay.
- The transport protocols used on the buses must be identical to the largest extend. Especially the size and layout of the transferred protocol data must be the same, though additional padding may be used (as indicated in the example).

Sample Implementation:

```
On message 0x200
{
   <target>message 0x150 tgtMsg = { dlc = 24 };
   long i;

   for( i = 0; i < this.dlc; ++i)
      tgtMsg.byte( i) = this.byte( i);
   SetBusContext( targetBus);
   output( tgtMsg);
}
On <target>message 0x150
{
   message 0x400 canMsg = { dlc = 8 };
   long i;
   for( i = 0; i < 8; ++i)
      canMsg.byte( i) = this.byte( i);
   SetBusContext( canBus);
   output( canMsg);
}
```

4.2.2 Transport layer

The gateway waits for the complete reception of a transport protocol data packet from either direction, and forwards the data as a whole to the other bus. For a more elaborate example, see the CAN-LIN gateway implementation in **KWPSim on LIN**.

Example: ISO TP with fixed length frames to ISO TP with variable length frames

Source Bus	CAN ID	DLC	Data	Dir	Target Bus ID	DLC	Data
Request from Tester to Gateway							
	200	8	02 1A 81 00 00 00 00 00	RX			
Forward of request from Gateway to ECU							
				TX	160	3	02 1A 81
Response from ECU to Gateway							
				RX	170	8	10 09 5A 81 12 34 56 78
				TX	160	3	30 00 14
				RX	170	4	21 9A BC DE
Forward of request from Gateway to Tester							
	400	8	10 09 5A 81 12 34 56 78	TX			
	200	8	30 00 14 00 00 00 00 00	RX			
	400	8	21 9A BC DE 00 00 00 00	TX			

Discussion:

> This type of gateway provides the most generic form of forwarding while sticking to KWP/UDS, since it is possible to connect between any type of bus system and transport protocol.
> Note that the buffering of the transported data in the gateway will introduce a significant delay into the communication. It might be possible to change certain protocol parameters (e.g. the separation time in ISO TP) to reduce this delay.
> For both sides of the gateway complete implementations of the transport protocols have to be present, and the protocols have to be configured correctly. But other than that, no in-depth knowledge of the protocol has to be used.

Sample Implementation:

```
CanTp_ReceptionInd( long connHandle, byte rxBuffer[])
{
   SetBusContext( targetBus);

   TargetBusSend( rxBuffer, elcount( rxBuffer));
}

TargetBus_DataInd( BYTE data[])
{
   SetBusContext( canBus);

   CanTpSendData( connHandle, data, elcount( data))

}
```

4.2.3 Diagnostics layer

A gateway operating on this highest level of abstraction can translate from a completely different communication protocol to the standard KWP/UDS, i.e. especially ECUs using proprietary protocols for diagnostics can be made accessible to the CANoe diagnostics features.

Example: ISO TP/KWP to a proprietary protocol

Source Bus	CAN ID	DLC	Data	Dir	Proprietary protocol[1]
Request "Read all identified DTCs":					
SingleFrame	200	8	04 18 02 FF 00 00 00 00	RX	
					Query individual DTCs
				TX	01 01 90 01
				RX	02 01 00
				TX	01 01 90 02
				RX	02 01 13
					…
				TX	01 01 90 27
				RX	02 01 15
Response carrying the identified DTCs:					
FirstFrame	400	8	10 11 58 05 90 02 13 90	TX	
FlowControl	200	8	30 00 14 00 00 00 00 00	RX	
Consecutive Frames	400	8	21 08 13 90 20 15 90 21	TX	
	400	8	22 15 90 27 15 00 00 00	TX	

[1] Non-existing example

Discussion:

> This is the most flexible form of diagnostics gateway, since it can react to the requests on application level.
> A gateway of this type will be very specific typically, i.e. for every ECU (type) another gateway implementation might be necessary.
> Automatic configuration of such a gateway will be very hard to realize.

Sample Implementation:

```
On DiagRequest Door.FaultMemory_ReadAllIdentified
{
  ClearCurrentDTCList();
  gNextDTCToRead = 0x9001;
  ReadNextDTC();
}

ReadNextDTC()
{
  <target> message 01 mQueryOneDTC = { dlc = 4, byte(0) = 1, byte(1) = 1 };
  mQueryOneDTC.byte(2) = gNextDTCToRead / 256;
  mQueryOneDTC.byte(3) = (BYTE) gNextDTCToRead;

  SetBusContext( targetBus);
  output( mQueryOneDTC);

  // There should be timeout handling; omitted here
}

On <target> message 02
{
  if( this.byte(2) != 0)
    AddDTCtoCurrentDTCList( gNextDTCToRead, this.byte(2));

  ++gNextDTCToRead;
  if( gNextDTCToRead > 0x9027)
  {
    // Last DTC queried, so send DiagResponse to tester
    SendCurrentDTCListToTester();
  } else
  {
    ReadNextDTC();
  }
}
```

4.3 Important notes

There are caveats that must be considered before relying on a diagnostics gateway for critical projects:

> Depending on the gateway's implementation, some additional delay time will be introduced into the communication.
> With connection oriented transport protocols like VW TP 2.0 or MOST High Protocol, the gateway has to setup connections to the ECU. This may be done on demand for each diagnostic transfer individually or once during an initialization phase. In the latter case the gateway may have to keep this connection alive during phases where no diagnostic transfers are made.
> If a virtual CAN channel is used, hardware synchronization is only possible with CANoe versions 7.1 and newer and driver versions 6.8 and newer.

5.0 Example: Multi-connection TP-level CAN-FlexRay gateway

5.1 Overview

In this example a complete ISO TP on CAN – AUTOSAR TP on FlexRay gateway is documented that allows a diagnostics tester on a CAN network to simultaneously access several ECUs on a FlexRay network.

The complete source code and setup is available from Vector in the AUTOSAR FlexRay Package; please contact Vector support if you would like to obtain it.

5.2 Setup

The gateway consists of one CANoe simulation node that is attached to a CAN and a FlexRay network. The node is configured to load the modules "AutosarFlexRayTP3.dll" and "osek_tp.dll" on "all buses".

The networks have to be configured to allow communication with real hardware on CAN (if a stand-alone tester should be used) and FlexRay: On CAN, the correct baud rate has to be selected. On FlexRay, the cluster definitions have to be read from a FIBEX database that includes the cycle layout. Please refer to the CANoe manual for more details.

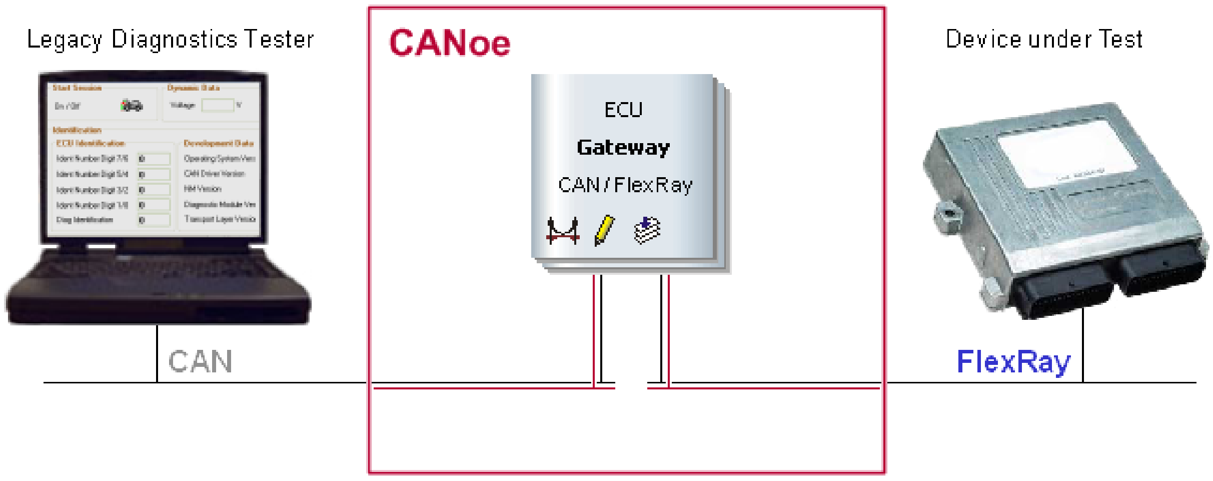


Figure 2: Schematics of a CAN/FlexRay gateway for routing diagnostic frames.

5.3 Basic idea

The basic idea for this multi-connection CAN-FlexRay TP-level gateway is a list of pairs of connection identifiers, pairing one connection on CAN with one on FlexRay. Whenever data arrives on a connection, the corresponding connection on the other bus is searched, and the data received in the gateway is sent on this connection.

Note
Please note the changed timing behavior of such a TP-level gateway (cf. 4.2.2)!

5.4 CAPL code

5.4.1 Variable declaration and initalization

In the section of global variables, the basic configuration information is kept.

```
variables
{
  DWORD gContextCAN;
  DWORD gContextFR;

  // This map is used to find the corresponding connection
  // This will be initialized with 0 on start, i.e. invalid
  long gConnectionMap[10][2];  // [0] for CAN, [1] for FlexRay
}
```

During the pre-start phase, the gateway's bus contexts have to be retrieved in order to access the correct network later.

The network names have to be replaced with those used in the actual configuration!

```
on preStart
{
  gContextCAN = GetBusNameContext( "CAN");   // Replace with actual
  gContextFR  = GetBusNameContext( "FlexRay");  // names!
```

On FlexRay, it might be necessary to register slots for sending during the pre-start phase. This depends on the way FlexRay slots are defined; please refer to the respective manuals.

```
  // Register frames used on FlexRay for TP
  SetBusContext( gContextFR);
  FrTP_ReserveSendSlots(120 , 1);  // Replace with actual values!
}
```

5.4.2 Configuration of TP-connections

The TP connections are created on their respective buses and configured explicitly.

Note: The CanTp CAPL API of the Osek_TP.dll is used here (available with CANoe 7.0); please refer to its manual for details: <CANoe installation directory>\Doc\CanTP_Manual.PDF

```
on start
{
  long conn;        // handle for the connections
  // First pair
  SetBusContext( gContextCAN);   // access the CAN network side
  conn = CanTpCreateConnection(0);   // normal mode
  CanTpSetRxIdentifier( conn, 0x200);  // replace with tester's CAN id
  CanTpSetTxIdentifier( conn, 0x400);  // replace with ECU's CAN id
  CanTpSetBlockSize( conn, 0);   // additional configuration
  CanTpSetSTmin( conn, 5);
  gConnectionMap[0][0] = conn;   // Set CAN side connection handle

  SetBusContext( gContextFR);    // access FlexRay network side
  conn = FrTP_CreateConnUnicast(120,121); // replace with ECU's send/receive slots
  FrTP_SetAddresses( conn, 2, 4444,1234); // replace with ECU's send/receive addr.
                                          // Routing here:
                                          // CAN     0x200 >> FlexRay  4444
                                          // FlexRay  1234 >> CAN     0x400
                                          // Note that the API of this function
                                          // depends on the used TP protocol on
                                          // FlexRay!

  FrTP_SetMaxPDULength( conn, 32);   // additional configuration
  gConnectionMap[0][1] = conn;   // Set FlexRay side connection handle
  // Second pair ...
}
```

5.4.3 Find corresponding connection

The following utility functions will retrieve the corresponding connection on the other bus, or return 0 if no such connection is found.

```
// Return CAN connection handle for a FlexRay connection handle
long GetCanConn( long frConn)
{
  dword i;
  for( i = 0; i < elcount(gConnectionMap); ++i)
  {
    if( gConnectionMap[i][1] == frConn)
      return gConnectionMap[i][0];
  }
  return 0;
}

// Return FlexRay connection handle for a CAN connection handle
long GetFrConn( long canConn)
{
  dword i;
  for( i = 0; i < elcount(gConnectionMap); ++i)
  {
    if( gConnectionMap[i][0] == canConn)
      return gConnectionMap[i][1];
  }
  return 0;
}
```

5.4.4 CAN-side callback implementation

The TP implementation in the Osek_TP.dll will indicate the arrival of data, the completion of a data transfer, and errors by calling special CAPL callback functions. These functions have to be implemented in the gateway.

Note that data received on a CAN connection is sent immediately on the corresponding connection on the FlexRay network.

```
CanTp_ReceptionInd( long handle, BYTE data[])
{
  long frConn, status;

  // Find the corresponding FlexRay connection
  frConn = GetFrConn( handle);
  if( !frConn)
  {
    return;  // no corresponding FlexRay connection found!
  }

  // Forward data to other bus
  SetBusContext( gContextFR);   // access FlexRay network side
  status = FrTP_DataRequest( frConn, data, elcount(data));
  SetBusContext( gContextCAN); // reset to CAN network side

  if( status != 0)
    FrTP_ErrorInd( frConn, status);   // forward error to our handler
}

CanTp_SendCon( long handle, DWORD txCount)
{
  // Sending of data succeeded
}
```

```
CanTp_ErrorInd( long handle, long error)
{
  char cErrorText[13][30] = {
    "(no error)"
  , "Timeout while waiting for CF" // 1
  , "Timeout while waiting for FC" // 2
  , "Wrong Sequence Number"        // 3
  , "TP_DLL busy"                  // 4
  , "Unexpected PDU"               // 5
  , "Timeout waiting for Tx-Ack"   // 6
  , "WFT Overrun"                  // 7
  , "Buffer overflow"              // 8
  , "Wrong parameter"              // 9
  , "Invalid FlowStatus received"  // 10
  , "Transfer abort requested"     // 11
  // Sentinel
  , "unknown error!"
  };

  long i;
  if( error < 0 || error >= elcount(cErrorText))
    i = elcount(cErrorText) - 1;
  else
    i = error;

  write( "CanTp_ErrorInd(%d): %s", error, cErrorText[i]);
}
```

5.4.5 FlexRay-side callback implementation

The TP implementation in the AutosarFlexRay.dll will indicate the arrival of data, the completion of a data transfer, and errors by calling special CAPL callback functions. These functions have to be implemented in the gateway.

Note that data received on a FlexRay connection is sent immediately on the corresponding connection on the CAN network.

```
FrTP_ReceptionInd(long handle, BYTE data[])
{
  long canConn, status;
  // Find the corresponding CAN connection
  canConn = GetCanConn( handle);
  if( !canConn)
  {
    return;  // No corresponding CAN connection found!
  }

  // Forward data to other bus
  SetBusContext( gContextCAN);  // access CAN network side
  status = CanTpSendData( canConn, data, elcount(data));
  SetBusContext( gContextFR);   // reset to FlexRay network side

  if( status != 0)
    CanTp_ErrorInd( canConn, status); // forward error to our handler
}
```

```
FrTP_TxConfirmationInd( long handle)
{
  // Sending of data succeeded!
}
```

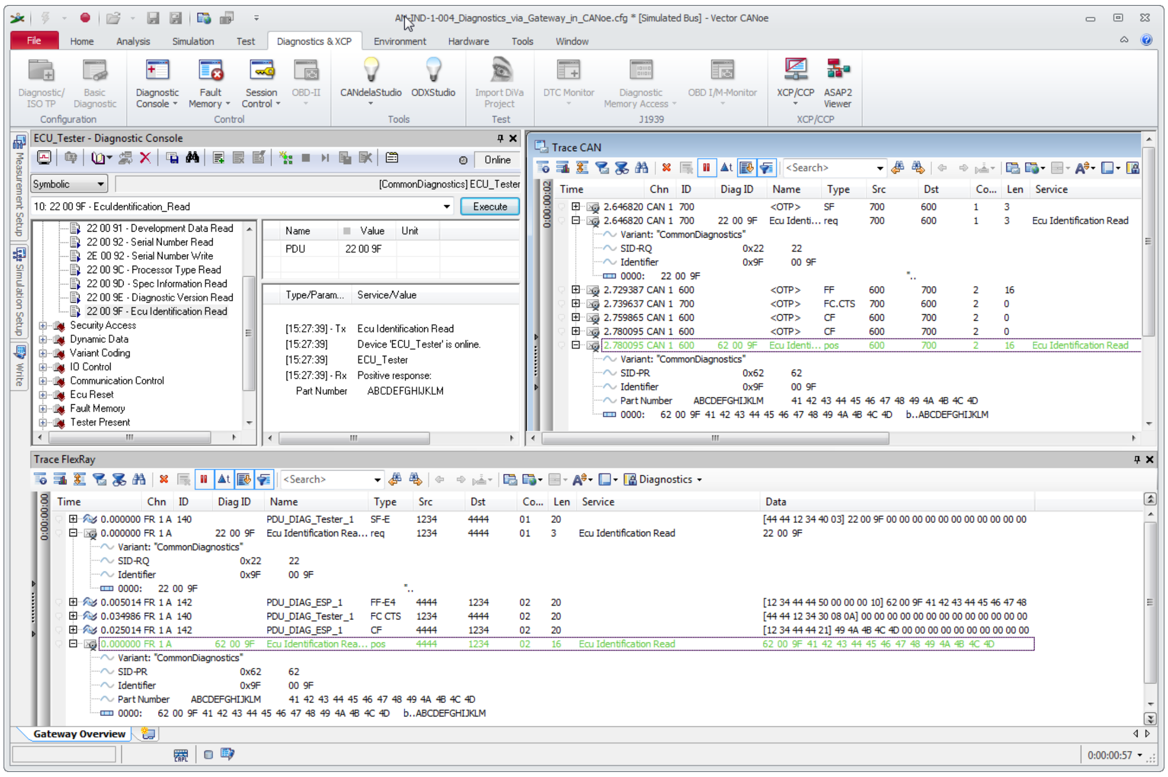
```
FrTP_ErrorInd(long connectionHdl, DWORD error)
{
  char cErrorText[14][60] = {
    "(no error)"
  , "Some mandatory settings are missing, e.g. the addresses"
  , "The value given contradicts another setting made earlier"
  , "The send request was rejected due to another transmission"
  , "A reception was active when FF or SF was received"
  , "A negative ACK was received for acknowledged connections"
  , "The bus did not confirm transmission of a frame in time"
  , "The transmitter did not receive a FC (or AF) in time"
  , "The receiver did not receive the next CF in time"
  , "(unknown)"
  , "(unknown)"
  , "The peer rejected the data since it is too long"
  , "Peer sent an undefined Ack"
  // Sentinel
  , "unknown error!"
  };

  long i;
  if( error < 0 || error >= elcount(cErrorText))
    i = elcount(cErrorText) - 1;
  else
    i = error;

  write( "FrTP_ErrorInd(%d): %s", error, cErrorText[i]);
}
```

5.5 Sample data transfers

In this example a diagnostics request is sent using the diagnostics console window on CAN to the gateway, forwarded on FlexRay, and responded by a simulated ECU. The response is sent back via the gateway to the diagnostics console. The console can display the response as if the ECU was attached to CAN.



ECU_Tester - Diagnostic Console

Symbolic — [CommonDiagnostics] ECU_Tester

10: 22 00 9F - EcuIdentification_Read

```
22 00 91 - Development Data Read
22 00 92 - Serial Number Read
2E 00 92 - Serial Number Write
22 00 9C - Processor Type Read
22 00 9D - Spec Information Read
22 00 9E - Diagnostic Version Read
22 00 9F - Ecu Identification Read
Security Access
Dynamic Data
Variant Coding
IO Control
Communication Control
Ecu Reset
Fault Memory
Tester Present
```

Name	Value	Unit
PDU	22 00 9F	

```
Type/Param...   Service/Value

[15:27:39] - Tx   Ecu Identification Read
[15:27:39]        Device 'ECU_Tester' is online.
[15:27:39]        ECU_Tester
[15:27:39] - Rx   Positive response:
  Part Number     ABCDEFGHIJKLM
```

Trace CAN

```
Time            Chn  ID   Diag ID    Name          Type    Src  Dst  Co...  Len  Service
2.646820 CAN 1  700                  <OTP>         SF      700  600  1      3
2.646820 CAN 1  700       22 00 9F   Ecu Identi... req     700  600  1      3    Ecu Identification Read
   Variant: "CommonDiagnostics"
   SID-RQ                 0x22       22
   Identifier             0x9F       00 9F
   0000:   22 00 9F                                   "..
2.729387 CAN 1  600                  <OTP>         FF      600  700  2      16
2.739637 CAN 1  700                  <OTP>         FC.CTS  700  600  2      0
2.759865 CAN 1  600                  <OTP>         CF      600  700  2      0
2.780095 CAN 1  600                  <OTP>         CF      600  700  2      0
2.780095 CAN 1  600       62 00 9F   Ecu Identi... pos     600  700  2      16   Ecu Identification Read
   Variant: "CommonDiagnostics"
   SID-PR                 0x62       62
   Identifier             0x9F       00 9F
   Part Number   ABCDEFGHIJKLM       41 42 43 44 45 46 47 48 49 4A 4B 4C 4D
   0000:   62 00 9F 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D    b..ABCDEFGHIJKLM
```

Trace FlexRay

```
Time                 ID   Diag ID    Name                    Type    Src   Dst   Co...  Len  Service                  Data
0.000000 FR 1 A      140             PDU_DIAG_Tester_1       SF-E    1234  4444  01     20                            [44 44 12 34 40 03] 22 00 9F 00 00 00 00 00 00 00 00 00 00 00
0.000000 FR 1 A           22 00 9F   Ecu Identification Rea... req   1234  4444  01     3    Ecu Identification Read  22 00 9F
   Variant: "CommonDiagnostics"
   SID-RQ                 0x22       22
   Identifier             0x9F       00 9F
   0000:   22 00 9F                                   "..
0.005014 FR 1 A      142             PDU_DIAG_ESP_1          FF-E4   4444  1234  02     20                            [12 34 44 44 50 00 00 00 10] 62 00 9F 41 42 43 44 45 46 47 48
0.034986 FR 1 A      140             PDU_DIAG_Tester_1       FC CTS  1234  4444  02     20                            [44 44 12 34 30 08 0A] 00 00 00 00 00 00 00 00 00 00 00 00 00
0.025014 FR 1 A      142             PDU_DIAG_ESP_1          CF      4444  1234  02     20                            [12 34 44 44 21] 49 4A 4B 4C 4D 00 00 00 00 00 00 00 00 00 00
0.000000 FR 1 A           62 00 9F   Ecu Identification Rea... pos   4444  1234  02     16   Ecu Identification Read  62 00 9F 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D
   Variant: "CommonDiagnostics"
   SID-PR                 0x62       62
   Identifier             0x9F       00 9F
   Part Number   ABCDEFGHIJKLM       41 42 43 44 45 46 47 48 49 4A 4B 4C 4D
   0000:   62 00 9F 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D    b..ABCDEFGHIJKLM
```

Figure 3: With the gateway in place, the diagnostic features of CANoe (e.g. Diagnostic Console) can be used to access the target ECU.

6.0 Additional Resources

VECTOR APPLICATION NOTE

AN-IND-1-001 “CANoe and CANalyzer as Diagnostic Tools”

EXAMPLE CONFIGURATIONS

KWPSim on LIN Demo, file location: <CANoe.LIN>\Demo_LIN_CN\KWPSim_Lin

MOST Diagnostic Gateway Demo, file location:
<CANoe.MOST>\Demo_MOST_CN\MOSTDiagnostics

CANOE/DENOE DOCUMENTATION

AUTOSAR FlexRay TP Manual, file location: <CANoe>\Doc\ AutosarFlexRayTP3_Manual.pdf

7.0 Contacts

For a full list with all Vector locations and addresses worldwide, please visit http://vector.com/contact/.