The Ethernet VN Device Family from Firmware Version 11.1
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Application Note AN-IND-1-023_Ethernet_VN_Family_From_Firmware_Version_11.1

Author Vector Informatik GmbH
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Abstract Introduction of the functionality of the new device firmware from version 11.1 for Vector Ethernet Network Interfaces.

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1 Overview

This document provides an introduction into the scope of functions of the new device firmware from version 11.1 which is available for all Vector Ethernet network interfaces. The device firmware from version 11.1 meets the requirement resulting from the analysis, test, and simulation of the Ethernet-based systems. This document describes fundamental innovations, such as

- network and port definition,
- free device segmentation,
- flexible scaling,
- Ethernet host connection (data uplink to the PC), and
- hardware filters.

This document also contains information on how to work with Vector applications (e.g. CANoe or CANape). In addition, useful information which makes it easier for you to get started with the new functions is provided.

Note

This document assumes that the user is familiar with the use and operation of the Vector Ethernet network interfaces. Apart from the commissioning and use of interfaces, this also includes fundamental topics relating to device configuration (segmentation, standard configuration). Further information on these topics can be found in AN-IND-1-020_Getting_Started_with_VN5640.

The user should also be familiar with the basic functions of CANoe or CANape.

2 Definitions of Terms

2.1 Port

A port is an access point for an application like CANoe, CANape or a real device like an ECU. A distinction is made between a physical port and a virtual port. Each port has a unique name and is assigned to exactly one segment.
2.1.1 Port (Physical)

Each Vector Ethernet network interface provides a defined number of physical connections. Exactly one physical port is assigned to each physical connection at one point in time. An application can configure physical layer properties by means of the physical port. An application has only read access to a physical port, apart from stress sending.

Note

Assigning a physical port to a segment enables the usage of a physical connection. Unassigned physical ports will disable the physical connection and no communication can take place.

2.1.2 Port (Virtual)

A virtual port does not represent any physical connection. Therefore, no physical layer properties can be configured. Several applications can have read access to a virtual port. Only one (1) application can have write access to a virtual port.

Note

Simulation nodes (e.g. CAPL program or interactive generator block) are connected to the Ethernet network by means of virtual ports. The number of virtual ports that can be created is limited by the hardware (e.g. a VN5640 supports up to 32 virtual ports). In most cases, the virtual ports are automatically created by the application and no user interaction is necessary.

2.2 Segment

A segment acts as a coupling element between ports. At least one segment must be created and connected to a physical port. Each segment has a unique name and is assigned to exactly one network. Two types of segments are available: switch and link.
2.2.1 Switch Segment
A switch segment provides the basic functions of a layer-2 switch. Any number of ports can be assigned to a switch segment.

2.2.2 Link Segment
A link segment always connects exactly two ports transparently to each other. The link segment is used to transparently forward Ethernet packets and the states of the physical layer (e.g. link up/down, OPEN Alliance TC10 wake/sleep).

Note
Segments can be set up on the interface via a graphic interface (Ethernet Device Configuration) (see Figure 6).

Note
A link segment is used when the message traffic between two ports is to be considered.

2.2.2.1 TAP (Test Access Point)
Connection of two physical ports with very low and constant latency (≤ 6 µs). A TAP is functionally similar to the MAC bypass offered in firmware before version 11.1.

2.2.2.2 Direct Connection
Connection of one physical port to one virtual port.

2.3 Network
A network groups one or more segments. As a minimum one network must be defined per interface. One interface can support multiple different networks. A network has a unique name. A network can span over multiple interfaces.

Note
The network name is also used to connect applications to the interfaces. For example, in CANoe the network name can be specified in the System View in the Simulation Setup.

2.4 Uplink
An uplink connects the interface to a host. Filters can be configured to reduce the data transfer on an uplink.
2.4.1 Host: Vector Application

From device firmware version 11.1, a USB and/or Ethernet can be used as uplink to the Vector application.

2.4.2 Host: Mirroring

Ethernet packets can be mirrored via a mirror uplink. For example, a data logger can be connected to a mirror port.

3 Concept Changes from Firmware Version 11.1

3.1 Networks

The following example illustrates the network concept:

![Network Diagram](image)

The example contains two complex network nodes (N3 and N4), each of which has an integrated switch. These two network nodes are to be simulated together with the network nodes N1 and N6. Network nodes N2 and N5 are real ECUs.

Figure 5 shows both approaches to the implementation of the example scenario. The left side of the figure represents device firmware before version 11.1 and the right side shows device firmware from version 11.1.

The device firmware before version 11.1 allows a maximum of one (1) switch segment per Ethernet interface. Therefore, two Ethernet interfaces are required. The Ethernet interfaces are connected to CANoe via two application channels (ETH1 and ETH2). This results in two Ethernet networks in the simulation setup of CANoe.

![Simulation Setup Diagram](image)
The device firmware from version 11.1 allows free segmentation. Therefore, two switch segments with the associated ports can be defined with this version. Both segments are assigned to the same network **Network1**. In CANoe, in this setup only one (1) Ethernet network is required in the Simulation setup (network name = **Network1**).

### 3.2 Receive and Send Directions of Ethernet Packets

![Receive and send directions of a packet from the interface perspective](image)

Ethernet packets received by an interface are always marked with the Rx direction. In this case, it is irrelevant whether the packets were generated by the application (e.g. CANoe simulation) or came from the real network. Packets which are sent from the interface to the real network or the simulation/application (e.g. due to a forwarding rule in a switch segment) are marked as Tx packets.

**Note**

In CANoe/CANalyzer, the Trace window column **Sim** (Simulation) can be used to display which packets were sent by CANoe/CANalyzer.
4 Configuring the Ethernet Hardware

All relevant properties of an Ethernet interface are configured using the Ethernet Device Configuration dialog. This dialog is opened from the Vector Hardware Config application.

Upon completion, the configuration can be written to the Ethernet interface or saved to a file.

Figure 5: Opening the Ethernet Device Configuration dialog from the Vector Hardware Config application.

Figure 6: Example of an Ethernet Device Configuration dialog for the example described in section 3.1: with network (Network1), segments (Switch_N3, Switch_N4), physical ports (N2, SWN3, N5, SWN4). The virtual ports (N1, N3, N4, N6) will be dynamically created by the application and do not need to be configured in the Ethernet Device Configuration.
5 Additional Resources
VECTOR APPLICATION NOTE
AN-IND-1-020 Getting Started with VN5640

6 Contacts
For a full list with all Vector locations and addresses worldwide, please visit http://vector.com/contact/.
7 Appendix: Compatibility of Various Applications and Device Firmware Versions

With VN5610(A), VN5640 and VT6306 interfaces, all device firmware versions, including version 11.1 can be used. Newer interfaces (e.g. VN5430, VN5620, ...) will only support device firmware versions $\geq$ 11.1. The device firmware version depends on the installed driver version.

CANoe Option .Ethernet supports the firmware version 11.1 from CANoe version 12.0.

CANape supports the firmware version 11.2 from CANape version 18.0.

The following table shows compatibility of application software and interface firmware version.

<table>
<thead>
<tr>
<th>Interface with the device firmware version</th>
<th>Application with support of the device firmware version $&lt; 11.1$</th>
<th>Application with support of the device firmware version $\geq 11.1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface with the device firmware version $&lt; 11.1$</td>
<td>Operation is possible, without port-based network access. Consider update of device firmware.</td>
<td>Operation is possible, without port-based network access. Consider update of device firmware.</td>
</tr>
<tr>
<td>Interface with the device firmware version $\geq 11.1$</td>
<td>Operation is possible, without port-based network access. Consider update of application software.</td>
<td>Operation with port-based network access.</td>
</tr>
</tbody>
</table>

Table 1: Compatibility of tool version versus device firmware version
8 Appendix: Impact of Port-based Network Access on CANoe/CANalyzer Option.Ethernet

8.1 Activation
Port-based network access can be activated via the CANoe Options dialog (Select radio-button Bus Systems/Protocols | Ethernet | Network Access | Port-based Network Access).

8.2 Creating a New Configuration
To create a new configuration based on port access, one of the following templates can be selected from the File | New tab:

- ASR4_Ethernet Port Based
- Ethernet Port Based
- SOME-IP Port Based

8.3 Adjusting an Existing Configuration

8.3.1 Automatic migration
With CANoe/CANalyzer 12.0 SP4 an automatic migration to port-based network access is provided. The migration wizard guides you step by step to convert both the CANoe/CANalyzer configuration as well as the hardware configuration.

Automatic migration works best when:

- You have a channel-based CANoe/CANalyzer configuration and attached hardware complete with a correct application channel assignment
- or a channel-based CANoe/CANalyzer configuration and vaset-files containing the hardware configuration settings and application channel assignment.

After the migration has finished, your configuration will be in port-based network access mode and will reference (a) hardware configuration file(s). Applying the hardware configuration(s) will switch the hardware to port-based network access mode and writes the hardware configuration(s) to the Ethernet interface(s).

8.3.2 Manual migration
First, port-based network access must be activated as described in section 8.1. After port-based network access activation, simulation ports are created for each node in the simulation setup.

Please use the Ethernet Hardware Configuration to create a fitting hardware configuration.

As a last step, the two columns Port(s) and Sim can be added in the Trace Window.

Note
Please refer to the port-based network access help pages in CANoe/CANalyzer for further details, hints and tips.
8.4 Ports in CANoe

Ports define where the stimulation is connected, or which data is measured in the network.

![Port Configuration dialog](image)

Figure 7: Simulation Ports and Measurement Ports lists in the Port Configuration dialog

8.5 Simulation/Stimulation

Once a node has been added to the simulation setup, a Simulation Port is automatically added in the Port Configuration dialog. When the measurement is started, CANoe assigns this port to a segment available in the network (with the same name) on the connected interface(s). The following rules apply:

- **Port (virtual) has the same name**
  
  CANoe uses this port (virtual).

- **Number of segments in the network = 1**:  
  
  A port (virtual) is created in the interface and assigned to this segment.

- **Number of segments in the network > 1**:  
  
  CANoe cannot start a measurement, since it is not defined at which segment the port must be created. Therefore, before a measurement is started, you must select or define the name of the segment to which the port is to be connected (Port Settings | Segment in the Port Configuration dialog).

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**Outlook**

If the network contains several segments, in the future, upon the start of a measurement CANoe will query at which segment an unassigned port must be created. If the interface configuration remains the same, this query will be carried out once.
8.6 Measuring

Ports are also used to define where information is measured in the network. The ports relevant for measurement must be added in the **Measurement Ports** list in the **Port Configuration** dialog.

8.7 Trace Window

The following columns have been added to the Trace Window:

- **Port(s)**: Displays the port name at which the Ethernet packet was measured.
- **Sim (Simulation)**: Indicates whether the Ethernet packet was sent from CANoe.

![Figure 8: Trace Window with new columns Port(s) and Sim](image)
9 Appendix: Impacts for CANape

9.1 Activation

The assignment mode of the Ethernet device can be changed via the CANape Options dialog (Select radio-button Miscellaneous | Device driver | Network name).

The assignment of the Ethernet network is done within the device configuration. The Ethernet network configuration can now be assigned to the corresponding network name within the Ethernet hardware.

9.2 Measuring with CANape

For measuring or bus monitoring by means of CANape, all ports of the selected network or those of the network assigned to the bus monitor are used by default.

The Trace Window has been extended by a port column that indicates one or several ports at which the packet has been received or sent. A simulation column as with CANoe is not relevant for CANape and, thus, not available.

9.3 Calibration/Communication with CANape

CANape sends and receives data within the network transparently for the user so that it is not necessary to specify a segment.

CANape always uses for communication the segment with the most configured physical ports, segments of type TAP are ignored. If several segments with the same number of ports are assigned to the network, the assignment among them is not defined.

According to the network definition (see chapter 2.3), in case of several segments, CANape expects that they are connected externally. Thus, the selection of a segment by CANape should not have any influence on whether the communication with the remote station is generally possible.