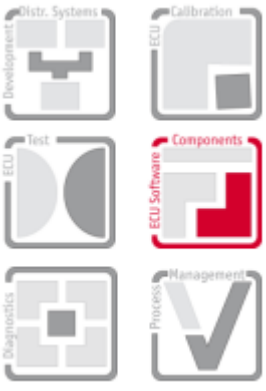

User Manual

Startup with GM SLP2

A Step by Step Introduction

Version 3.0.0 for MICROSAR 4 Release 12
English

vector

Content

1 About This Manual

1.1 History Information

Cross Reference

For detailed information about whats new, whats changes in current version, refer to section Whats New, Whats Changed? on page 212.

1.2 Finding Information Quickly

The user manual provides the following access help:

- In the footer you can see to which version the user manual replies,
- At the end of the user manual you will find an index to find information quickly,
- Also at the end of the user manual you will find a glossary to look up an explanation of the used technical terms

1.3 Conventions

In the following two charts you will find the conventions used in the user manual regarding utilized spellings and symbols.

Style Utilization	Style Utilization
bold	Blocks, surface elements, window- and dialog names of the software. Accentuation of warnings and advices. **[OK]** Push buttons in brackets **File|Save** Notation for menus and menu entries
MICROSAR	Legally protected proper names and side notes.
`Source Code`	File name and source code.
Hyperlink	Hyperlinks and references.
<CTRL>+<S>	Notation for shortcuts.

Symbol Utilization	Symbol Utilization
	Here you can obtain supplemental information.
	This symbol calls your attention to warnings.
	Here you can find additional information.
	Here is an example that has been prepared for you.
	Instructions on editing files are found at these points.
	This symbol warns you not to edit the specified file.

1.4 Certification

Vector Informatik GmbH has ISO 9001:2008 certification. The ISO standard is a globally recognized standard.

1.5 Warranty

We reserve the right to change the contents of the documentation and the software without notice. Vector Informatik GmbH assumes no liability for correct contents or damages which are resulted from the usage of the documentation. We are grateful for references to mistakes or for suggestions for improvement to be able to offer you even more efficient products in the future.

1.6 Support

Germany And all other countries, not listed here.	
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IT Italia	**JP** Japan
☎ +39 2 678171 10 ✉ support@de.vector.com	☎ TOKYO +81 3 5769 6972 ☎ NAGOYA +81 52 238 5014 ✉ support@jp.vector.com
KR South Korea	**Scandinavia** Sweden, Denmark, Finland, Iceland, Norway
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UK United Kingdom & Ireland	**North America** USA, Canada, Mexico
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1.7 Registered Trademarks

1.8 Errata Sheet of Hardware Manufacturers

Caution! Vector only delivers software!

Your hardware manufacturer will provide you with the necessary errata sheets concerning your used hardware. In case of errata dealing with CAN, please provide us with the relevant erratas and we will examine whether this hardware problem is already known to us or whether to get a possible workaround.

Note

Because of many NDAs with different hardware manufacturers or because we are not informed about them, we are not able to provide you with information concerning hardware errata of the hardware manufacturers.

1.9 Example Code

Caution!

All application code in any of the Vector User Manuals is for training purposes only. They are slightly tested and designed only to understand the basic idea of using a certain component or set of components. Vector gives consent that you use it as a basis for developing your own code and modify it (Vector waives its copyright to forbid you the use), however, with regard to the fact that the code is designed for training purposes only and not for the use by you, usability of the code is not warranted and Vector’s liability shall be expressly excluded in cases of normal negligence, to the extent admissible by law or statute. Of course you have to test the software developed on the basis of the code with diligent care before using the software.

2 Introduction

2.1 What Do You Learn from This Manual

Use this document to

- Set up your project in just a few steps
- Learn how to use the Vector tools
- Learn how to work with the AUTOSAR means like software components, runnables, etc.
- Work with the Vector AUTOSAR Solution on a basic level
- Get a feeling of what you have to do when you start working for your actual project

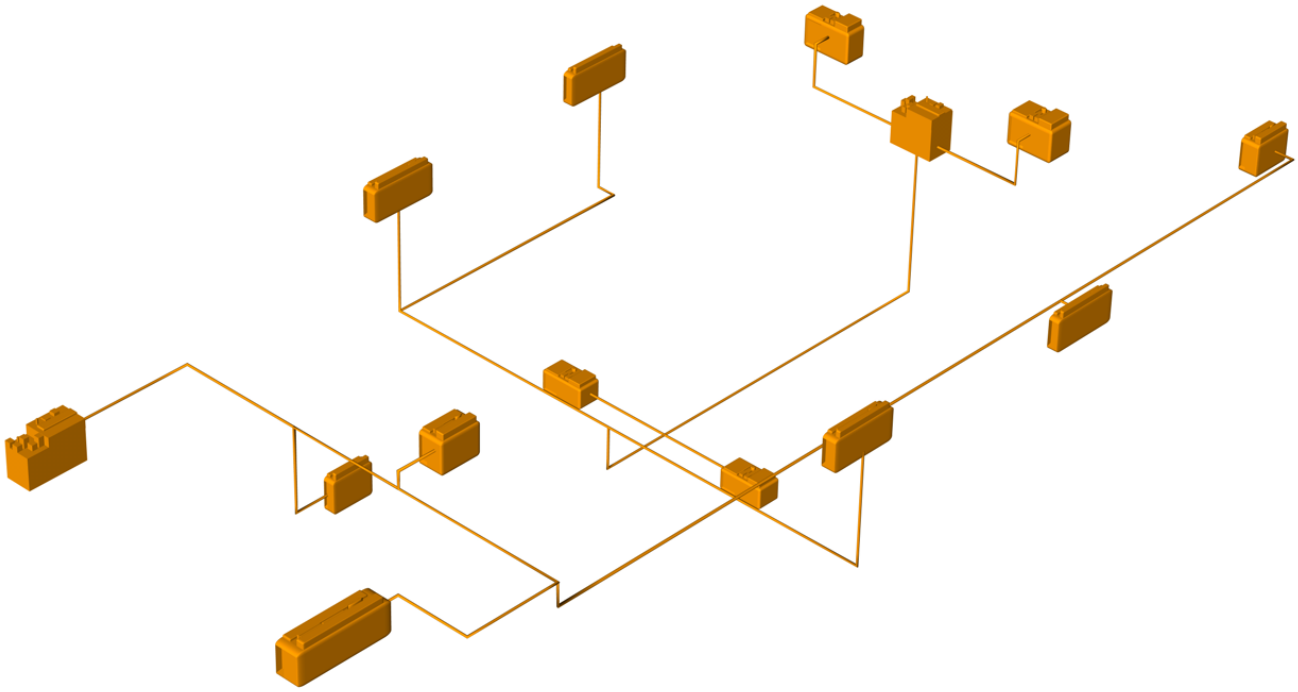
The document is split in two parts, a **STEPbySTEP** description and an **Expert Knowledge** section.

- **STEPbySTEP**
  This section gives you a short overview how to set up your project in just a few steps. Use the step by step description to start up with basic information and get your project basically running.
- **Expert Knowledge**
  This section gives you a detailed information about working with Vector AUTOSAR Solution. It contains expert knowledge based on STEPbySTEP description sections and information about tool use and general AUTOSAR concepts.

2.2 An Overall View

What we are talking about is an ECU, a module to be built-in a vehicle . The ECUs have to communicate with other ECUs and therefore almost every ECU participates in a bus system like e.g. CAN, FlexRay, LIN, MOST or IP. Any ECU within one bus system has to provide an identical interface to this bus system, because all ECUs have to share information via this bus system.

The illustration below shows an example of a CAN network that connects the ECUs of a vehicle.



All ECUs are built-up in a very similar way. There is a software part to perform the main job (application) of the ECU, e.g. to control the engine or a door. The other part handles the network communication and diagnostics.

2.3 MICROSAR - Vector's AUTOSAR Solution

The Vector MICROSAR Solution provides efficient and scalable basic software modules and an RTE for AUTOSAR ECUs.

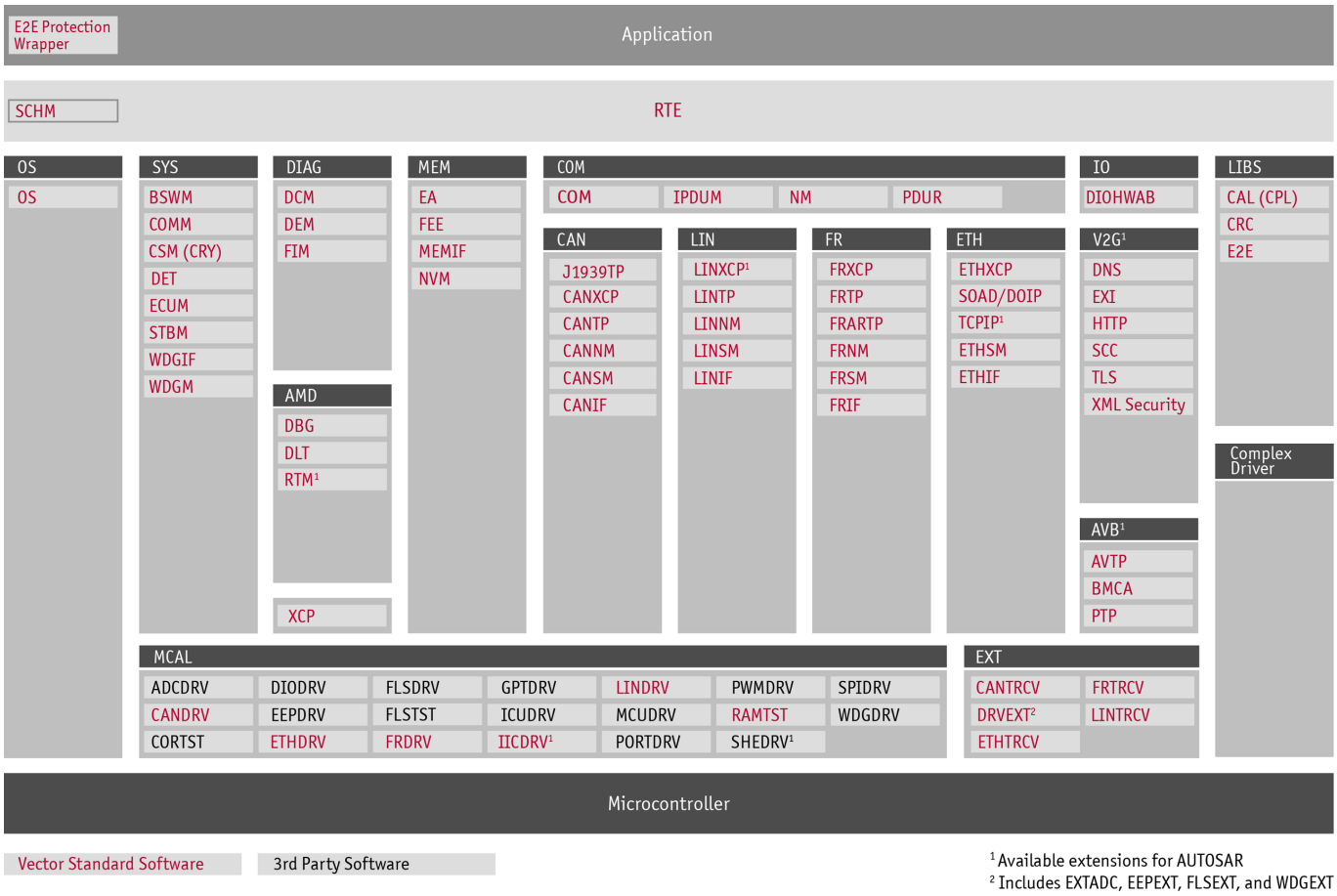
The individual AUTOSAR basic software modules are grouped into MICROSAR products that of related functions. The configuration of the MICROSAR basic software with DaVinci Configurator Pro is simple, user-friendly, and consistent. The included command-line-based generators create optimized code for your ECU based on the configuration.

Cross Reference

To get more information about the MICROSAR concept refer to General Overview on page 69.

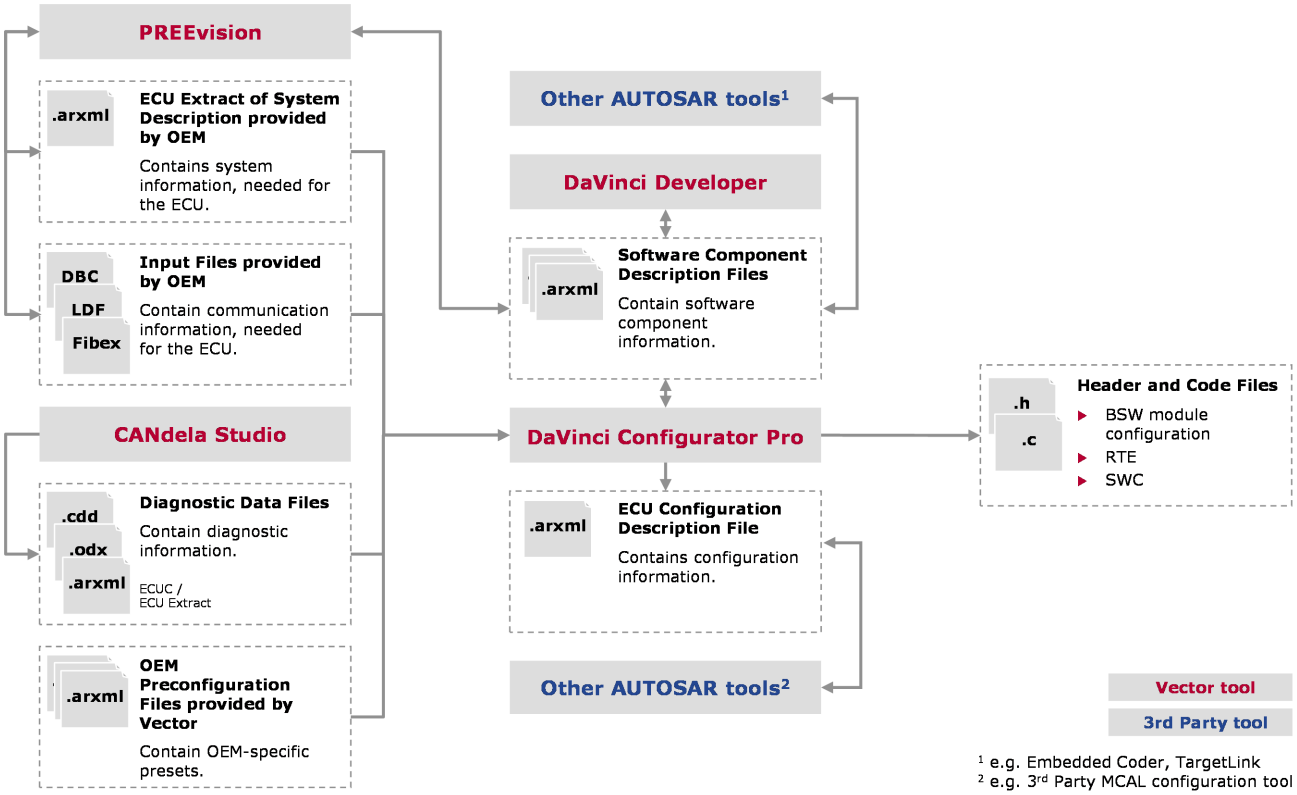
2.4 AUTOSAR Layer Model GM SLP2

The following figure shows the AUTOSAR Layer model for GM SLP2.



2.5 Configuration Workflow GM SLP2

The following figure shows the configuration workflow for GM SLP2.



I STEPbySTEP

This section gives you a short overview about setup your project in just a few steps. Use it to startup with basic information and get your project basically run.

1 STEP1 Setup Your Project

This section includes all information for setting up a new project. It starts with the situation after installation and provides all information about relevant tools.

Expert Knowledge

You need to know more? See section New Project on page 78.

1.1 Situation after Installation Guide

- Before you start your first steps with GM SLP2 Solution check whether you have installed all necessary tools and software.
- Have you read the **Installation Guide**?
- Have you received and installed all the necessary tools mentioned there?
- Have you installed the MICROSAR SIP?

NO? Then please read the installation guide carefully and follow the installation guidelines given there.

Cross Reference

You will find the installation guide document at the Vector Knowledge Base:
https://vector.com/kbp/entry/640/

YES? You are ready to continue and to start with your first steps with the GM SLP2 Solution.

1.2 Setup Project via DaVinci Configurator Pro

Start the DaVinci Configurator Pro to set up your project.

Cross Reference

You use vVIRTUALtarget? Then refer to the **UserManual_vVIRTUALtarget_DualTarget.pdf** located at the \Doc\UserManuals.

Note

The DaVinci Configurator is located in your SIP Folder:
<SIPFolder>\DaVinciConfigurator\Core\DaVinciCFG.exe

1. Open **File|New**.
   A set of four configuration windows will open; **General Settings**, **Target**, **Project Folder Struc-**

ture, and **Tools**

2. Enter the necessary Information for each window and click **[Next>]** to get to the next window.

Note for No-Communication Projects

For projects without communication modules like e.g. DEM only, just confirm the following windows **Target** and **Tools** as the information is not relevant.

Especially the **Target** window will show pull-down menus where **(undefined)** is preset and nothing else can be selected. This is not relevant for your use case and can be confirmed with **[Next]**.

1.2.1 General Settings

The following settings are required for project setup.

- **SIP root path**
  The SIP root path will be defined automatically based on the DaVinci Configurator Pro location and cannot be changed by the user! The DaVinci Configurator Pro is always located within the SIP.
- **Project Name**
  The name of your project (e.g. MyECU). It will be used as name of the generated ECUC files and for the **DaVinci Developer workspace**.
- **Project Folder**
  This is the root path of your project. Select an existing or define a new one.
- **Create entries in the start menu**
  The checkbox **Create entries in the start menu** is set as default. This is a comfortable feature that enables you to open your tools and project folder directly from the Windows start menu.

1.2.2 Target

Check **Target Type**, **Derivative**, **Compiler** and **Pin layout** (automatically set, based on SIP information).

1.2.3 Project Folder Structure

Define your output paths here. You can use the given defaults or change paths to fit your project's needs.

Note

Default paths are based on the location of the defined project folder.

ECUC File Granularity

Additionally, you can specify whether the ECUC should be saved as one file (Single file) or is split into several files (One file per module).

Note

Split to several files is necessary for multi user concept. Refer to Multiple User Concept.

1.2.4 Tools

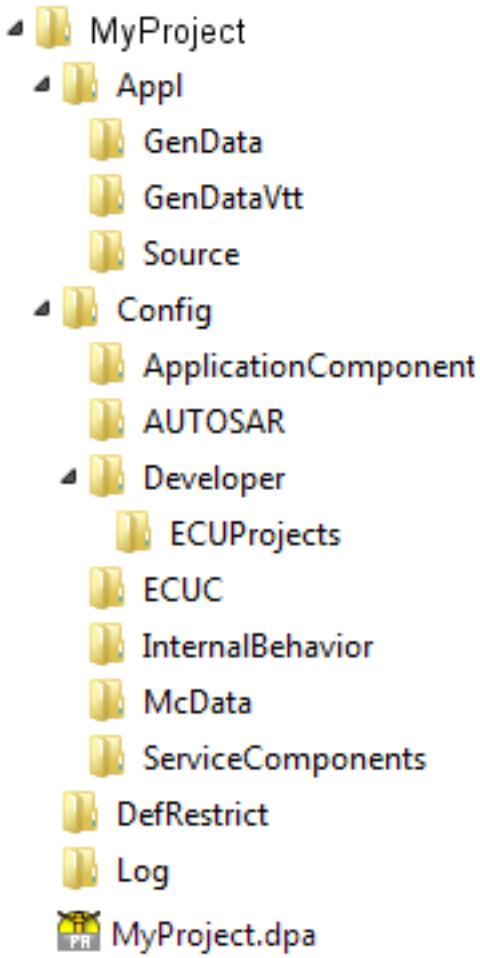
> **DaVinci Developer Workspace**
If you have a RTE and you use the DaVinci Developer select the checkbox **Create DaVinci Developer Workspace** and define the path to the DaVinci Developer executableand the path to the workspace.

> **Automatic update of DaVinci Developer workspace**
Options used for updating the DaVinci Developer workspace during the project update process. Details see DaVinci Developer help.

3. Click the button **[Finish]** to create your project.

1.3 Result Project Folder - result of the project set-up

The DaVinci Configurator Pro automatically creates and stores all relevant files to the project folder. The content of the folder is described below briefly.



1.3.1 Appl folder

The **Appl** folder contains further folders **GenData**, **GenDataVtt** and **Source**. In **GenData** the configuration tools generated their output files, if vVIRTUALtarget is used, the generated output will be

stored in **GenDataVtt**. The **Source** folder is meant to carry your source code files.

1.3.2 Config folder

The **Config** folder contains the following folders:

- **ApplicationComponents**
  This is a folder to put in additional SWC-Ts (Software Component Types). The DaVinci Configurator Pro reads in all *.arxml files of this folder.
- **AUTOSAR**
  The definition file of DataTypes (**PlatformTypes_AR4.arxml**) is stored centrally here.
- **Developer**
  All relevant project data for DaVinci Developer is located in this folder.
- **ECUC**
  This folder contains the created ECUC files. Before you add your input file(s), these files are only placeholders without content.

File Name	Description
<ProjectName>.ecuc.arxml	ECU Configuration Description
<ProjectName>.ecuc.Initial.arxml	Initial ECU Configuration Description for internal tool use only.

- **InternalBehavior**
  This folder contains the bswmd files for all activated modules in the DaVinci Configurator.
- **McData**
  Folder is used for storing measurement and calibration data.
- **ServiceComponents**
  The DaVinci Configurator stores all generated Service Component Prototypes to this folder.

Note

After you have added your Input file(s) and updated the configuration in the DaVinci Configurator, the **System** folder will be added to the **Config** folder.

- **System**
  The input file(s) and an additional created input file extract for communication use are stored to this folder.

Do not edit manually!

These files must not be modified manually!

1.3.3 <ProjectName>.dpa

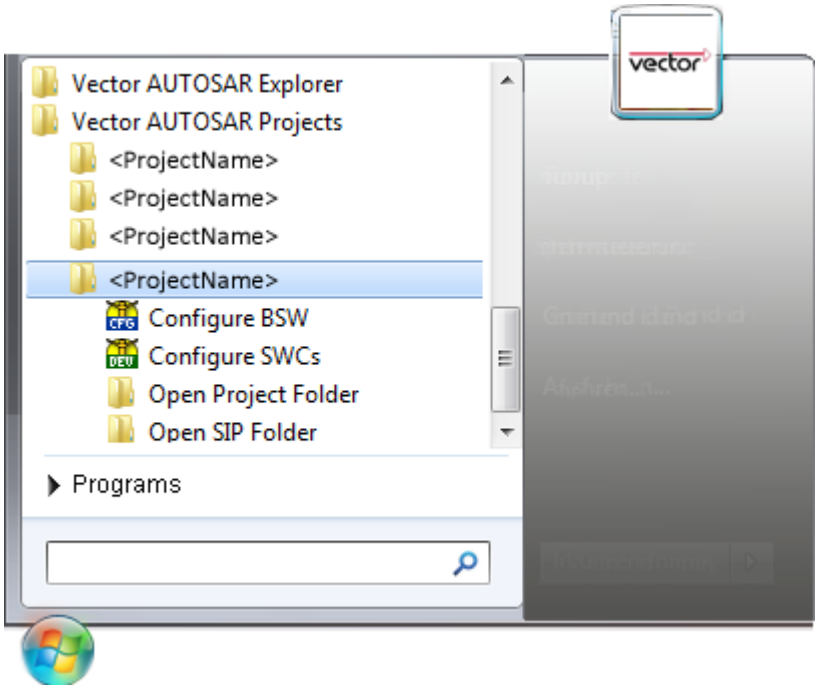
Project File  <ProjectName>.dpa, that includes all relevant project data. Additionally the context menu of this file is the control center to open your tools with already loaded projects.

1.3.4 Log Folder

Folder for the generated log files.

1.4 Start Menu - Result of the Project Set-up

The DaVinci Configurator Pro creates a link to start the tools with already loaded configuration. You will find this link in **Start | Programs | Vector AUTOSAR Projects | <ProjectName>** if **Create entries in the startmenu** was selected while project setup.



Info

You can also use the ***.dpa** file to start your project with already loaded configuration. Therefore right-click on your ***.dpa** file and select **Configure BSW** to open the DaVinci Configurator Pro with already loaded configuration or **Configure SWCs** to open the DaVinci Developer for Software Design and Data Mapping.

1.5 DaVinci Configurator Pro Project

After finishing project set-up, a new empty project is loaded within the DaVinci Configurator Pro.

Note

Editors to configure modules will be available after input file import (see Add Input Files on page 24) or after module activation (see Activate Your BSW Modules on page 32).

2 STEP2 Define Project Settings

Before you start with the configuration it is necessary to define some project-specific data.

The definition of project-specific data comprises the definition of all necessary input file(s) for communication and diagnostic purpose. Additional custom workflow steps, external generation steps and the activation of the necessary Basic Software Modules has to be done in the DaVinci Configurator Pro Project Settings view before.

Expert Knowledge

You need to know more? See section Project Settings on page 83.

Cross Reference

If you would use variant handling within your project, you have to define your variants before adding input files. For detailed information about defining project settings for variant handling refer to Variant Handling on page 159.

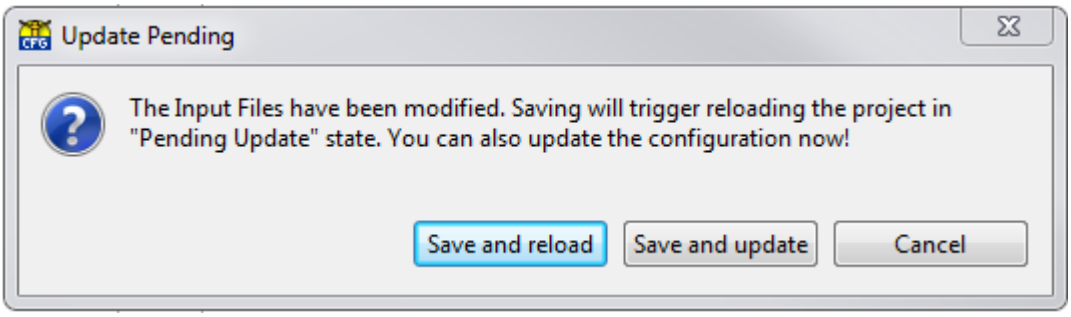
2.1 Add Input Files

Open Input Files editor via **Project | Input Files** or use the **input file button**  of DaVinci Configurator Pro toolbar.

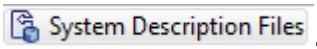
Note

Any change of the input files requires an update of the configuration. Add all relevant files before starting the update process.

If you save your project, and input files are modified, the DaVinci Configurator notice the pending state and shows a window which enables starting update configuration directly via **[Save and update]**.



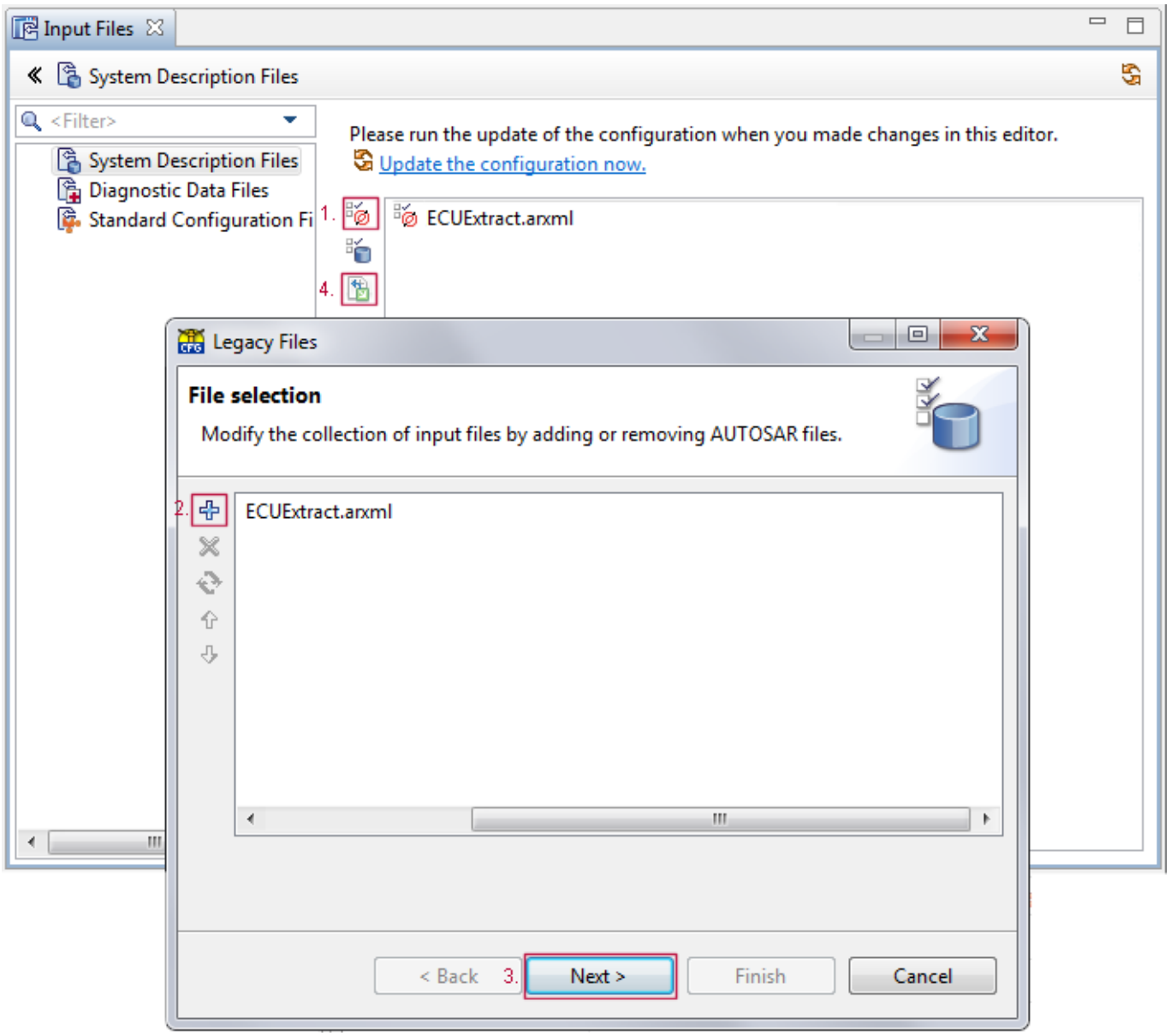
2.1.1 Add System Description Files

Add your System Description File first. Therefore open the **System Description Files view** 

. First you have to decide if you add **AUTOSAR Files (arxml)**  or **Legacy Files (dbc, xml, ldf)**  .

Note

The following section describes the import of AUTOSAR files. If you use legacy file as input, you have to perform nearly the same steps, only for 1. **Legacy Files button**  has to be selected.



1. Use the **AUTOSAR Files button** to open the window where you can add your AUTOSAR files.
2. Add your Input Files via **[+]**

Note - Only necessary if DBC is used as input file

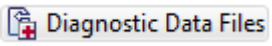
There is a document TechnicalReference_DbcRules_Vector.pdf that describes necessary DBC rules to help you creating your DBC file. You find this document in the TechnicalReference folder of your delivery.

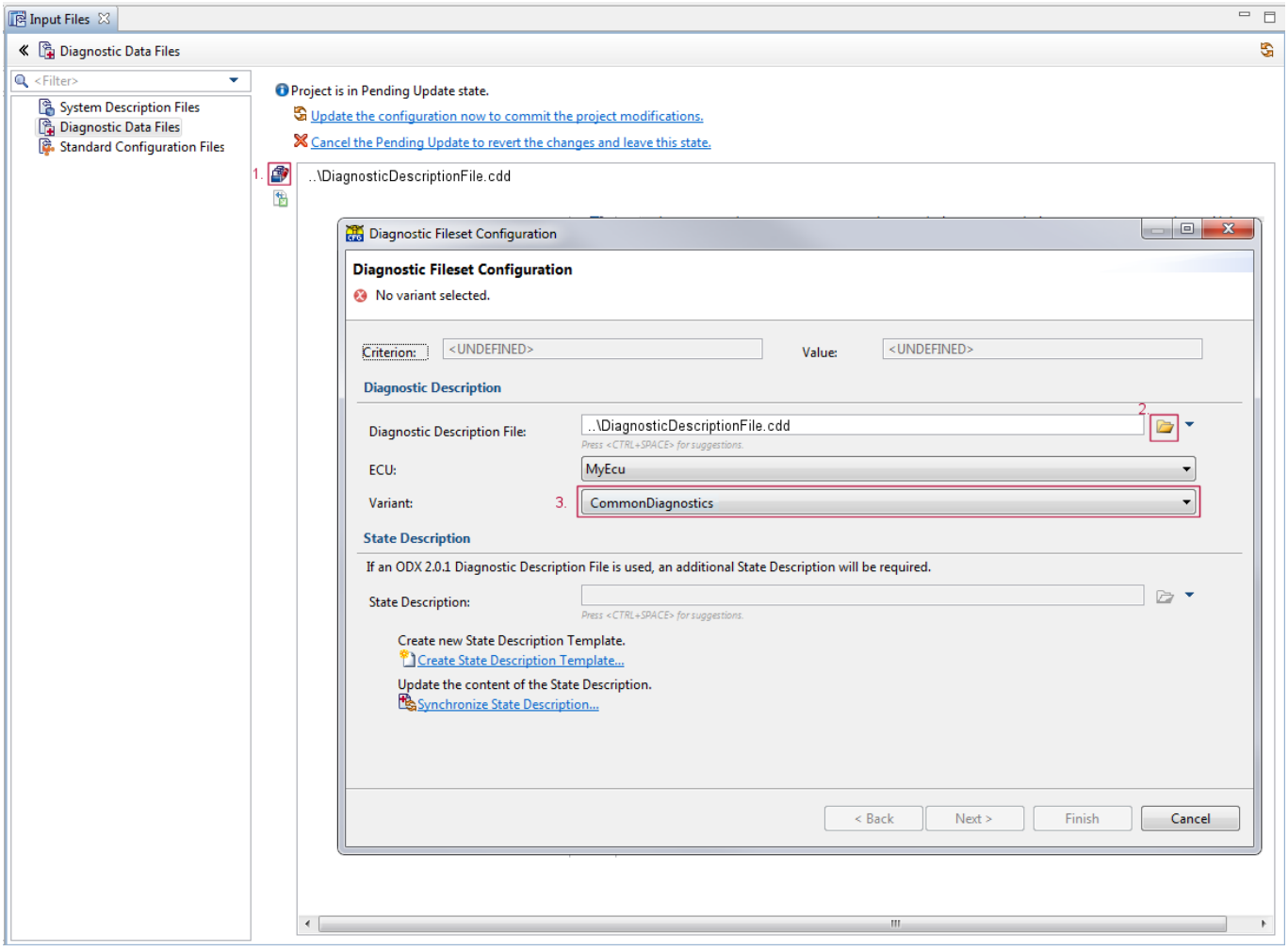
3. Go on with **[Next]** and select the **ECU** instance.
4. Make your input file path relative to your project folder via **Make Path Relative button**

2.1.2 Add Diagnostic Data Files

If diagnostic is used, you have to add a diagnostic data file. If not, you can skip this section. There are different use cases to import diagnostic data, decide if you import your data from a diagnostic data file or from a already existing configuration.

Use Case 1: Import Diagnostic Data from ODX, PDX or CDD File
Open your project in the DaVinci Configurator and go on with the following Steps to import your diagnostic data from a diagnostic data file.

1. Open the Input Files editor via **Project | Input Files** or use the **input file button**  of DaVinci Configurator Pro toolbar
2. Open the **Diagnostic Data Files view**  in the Input File editor and open the Diagnostic Fileset Configuration window via **Add, remove or modify diagnostic data button** 
3. Browse for the **Diagnostic Description File** (*.cdd/*.pdx/*.odx)
4. Select ECU and Variant



Use Case 2: Import Diagnostic Data From a Existing Configuration
Open your project in the DaVinci Configurator and go on with the following Steps to import your diagnostic data from a existing Configuration.

1. Start Import Assistant via File | Import
2. Add **[+]** ECUC File and go on with **[Next]**
3. Select modules which should be imported and close the Modul Configuration Import dialog via **[Finish]**.

Make your input file path relative to your project folder via **Make Path Relative button** 

2.1.3 Add Standard Configuration Files

In some cases a OEM-specific preconfiguration is necessary, therefore add the Standard Configuration File provided by your OEM.

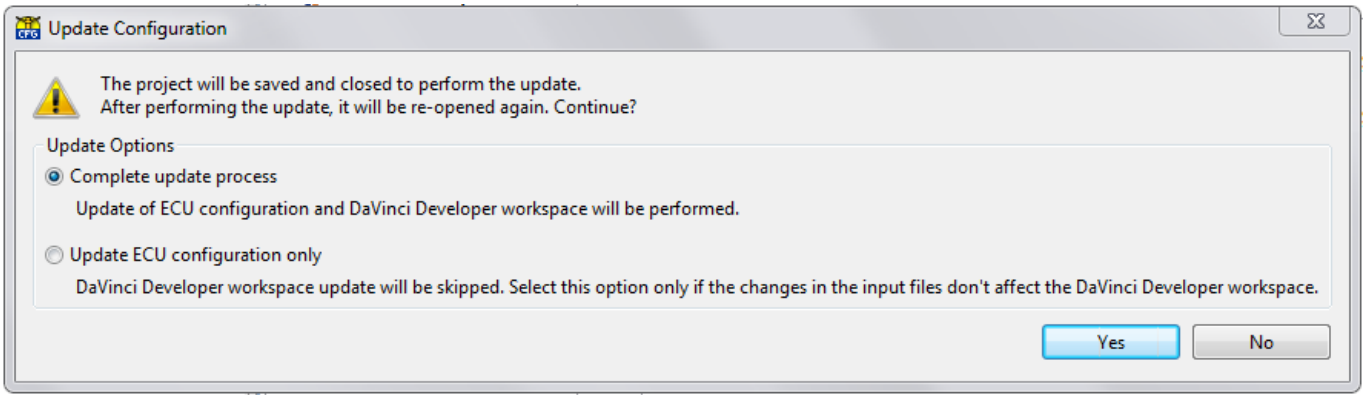
2.1.4 Update Configuration

Any change of the input files lead to Pending Update state of the project, this requires an update of the configuration.

Update the configuration via  .

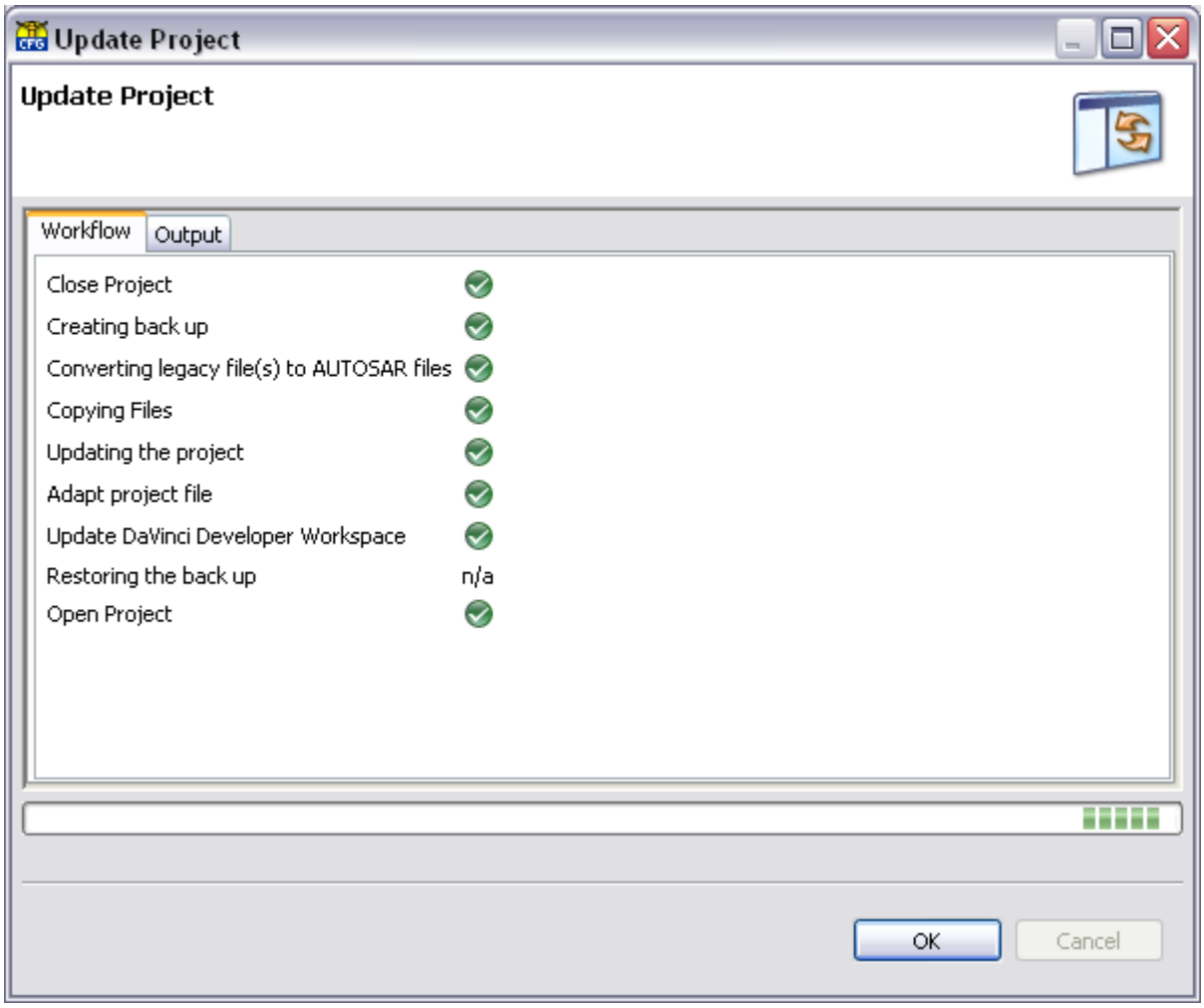
What happens while update configuration process?

Before the update starts the **Update Configuration** message opens, select **Complete update process** and go on with **[Yes]**.



Note

If you do not know if your changes will affect the DaVinci Developer workspace, always select **Complete update process**!



The project file will be updated based on loaded input/diagnostic files. If you selected **Complete update process**, the DaVinci Developer update will be run in background.

The update runs successfully?

Note

After the first update/import of data bases all required modules are automatically enabled. This information is derived from the data base. If further modules are required or some shall be removed please refer to section Activate Your BSW Modules on page 32.

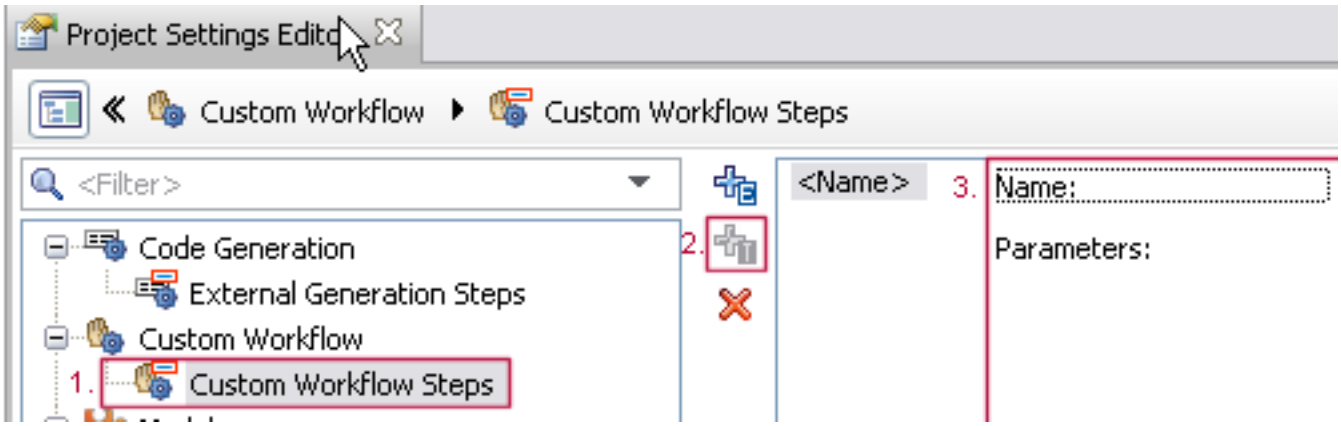
2.2 Define Custom Workflow Steps and External Generation Steps

To define custom workflow steps/external generation steps, open Project Settings Editor via **Project | Project Settings** or use the **project settings icon** ofDaVinci Configurator Pro toolbar.

2.2.1 Custom Workflow Steps

In some cases it is necessary to define custom workflow steps, e.g. to Generate SWC Templates.

Then perform the following steps.



1. Select **Custom Workflow** | **Custom Workflow Steps**
2. Add **[+]** step
   Decide if internal or external step should be created.

Note

Internal Workflow Step
Internal Workflow steps will call the RTE generator for generating e.g. component header files or component implementation templates.
These steps will be created automatically by the DaVinci Developer.

External Workflow Step
Create this step to call any external tool, e.g. for generating description files for application software components.

3. Define **Name** and **Parameters** e.g. to Generate SWC Templates Rte: -g i.

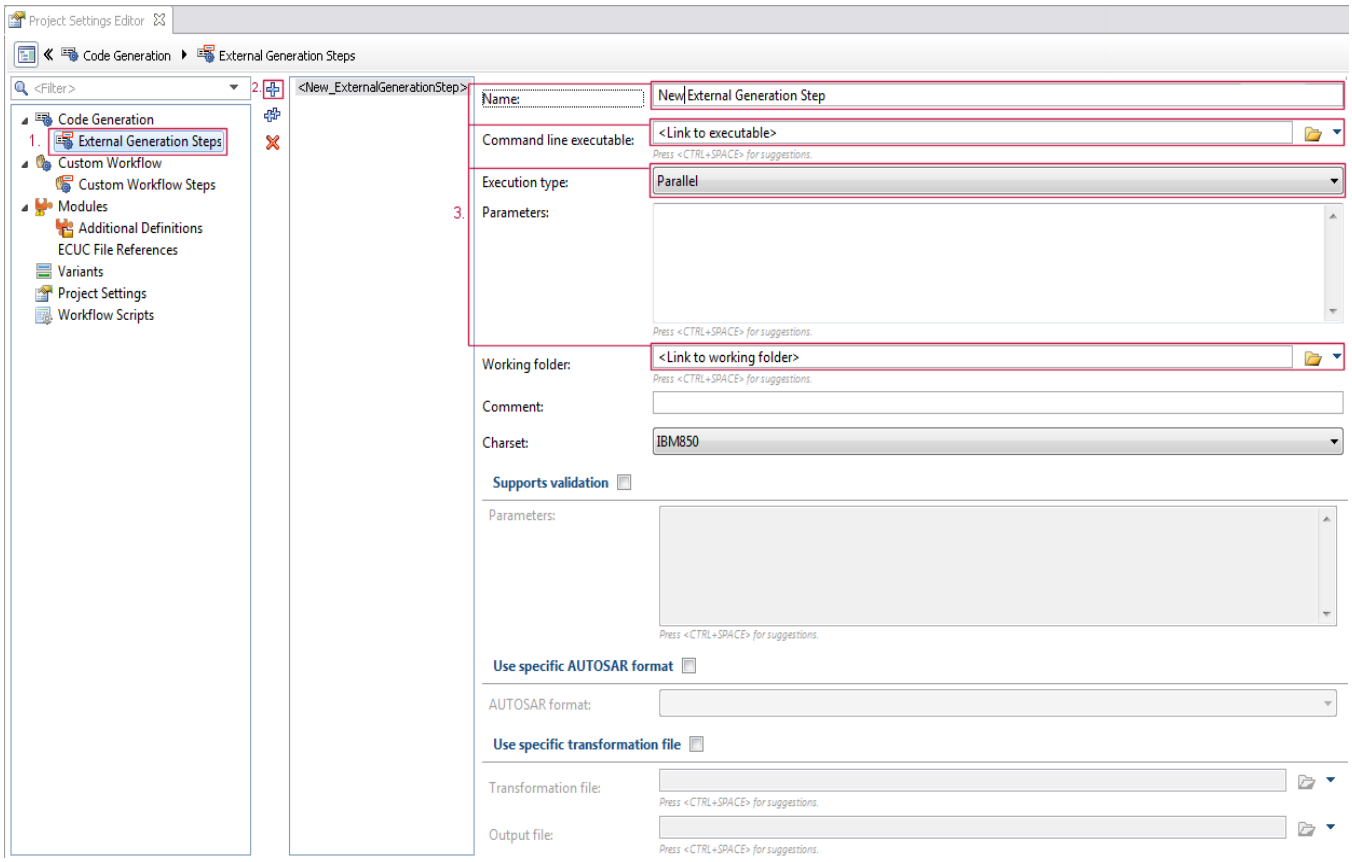
2.2.2 External Generation Steps

You have external software that needs to be started during the code generation of DaVinci Configurator? Or just before? Or afterwards?

Then link your software to the **External Generation Steps** of DaVinci Configurator Pro.

How? Follow these steps.

1. Select **Code Generation** | **External Generation Steps**
2. Add **[+]** step
3. Define **Name**, **Command line executable**, **Execution Type** and **Working folder**.



2.3 Activate Your BSW Modules

Before you start configuring your Basic Software, you have to activate all modules you need for your project. Therefore open Project Settings Editor via **Project** | **Project Settings** or use **project settings icon**  at DaVinci Configurator Pro toolbar.

Select **Modules** to see all modules currently activated for your project.

Info

It depends on your Input File which modules are loaded initially.

You need additional modules?

1. Click **[+]** and select the source of the module definition.
2. Select the module you would like to add to your configuration and confirm with **[OK]**.

Info

Multiple selection is possible for activating or deactivating modules.

Not all modules are needed?

To delete not used modules, select the module and delete it via **[x]**.

Caution!

It is not recommended to delete initially activated modules from project!

You have a completely configured module and would use this for the current configuration?

1. Make sure, that the module you would like to import, is deactivated in your current project.
2. Select **File** | **Import**
3. Add **[+]** ECUC file including the configured module
4. Click **[Next]**
5. Select the module configurations to be imported

Note

It is not allowed to import BSW modules which are currently activated.

6. Click **[Finish]**

2.4 Add ECUC File References

In some cases it is necessary to add a ECUC reference file, to include mechanisms for module configuration from other projects.

1. Select **File** | **Add ECUC File Reference...**
2. Add **[+]** the ECUC file of the module configuration you want to refer
3. Click **[Finish]**
4. Open Project Settings Editor and ECUC File References view, select reference and make path relative via **Make path relative to...**  icon.

3 STEP3 Validation

Start initial validation process to solve the first warnings and errors.

The DaVinci Configurator Pro provides validation routines that run in the background and are called live validation. At the beginning of the configuration, the project has a lot of leaks, errors and information in the system is still missing. Therefore the DaVinci Configurator Pro offers a powerful solving algorithm.

Expert Knowledge

You need to know more? See section Validation on page 86.

3.1 Start Solve All Mechanism

First of all start solving mechanism via the **Solve All button**  at the validation view of the DaVinci Configurator.

Note

Not all errors can be fixed with **Solve All** mechanism.

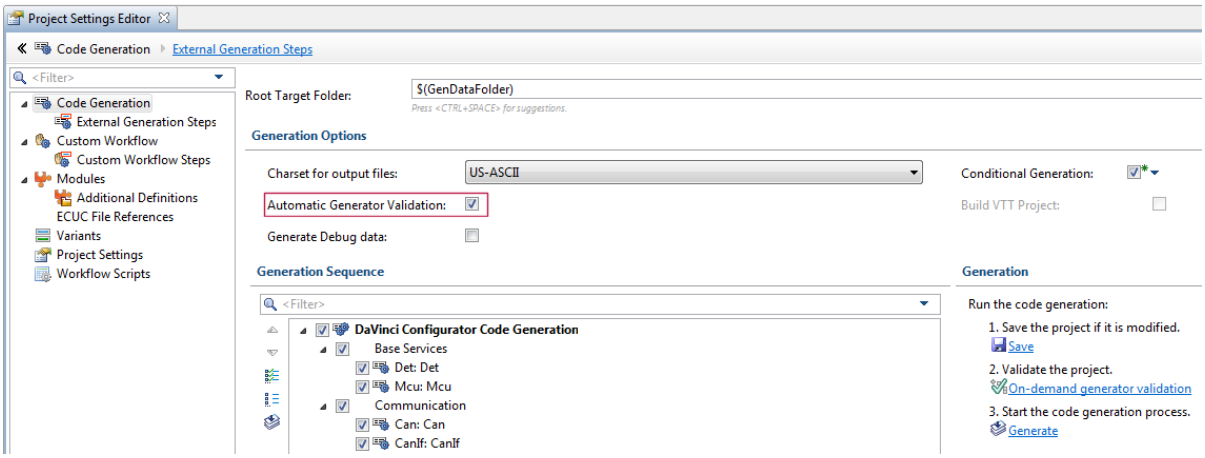
Some errors might have two or more solutions, these errors cannot be fixed automatically by the **Solve All** mechanism.

3.2 Live Validation - Solving Actions

The DaVinci Configurator Pro provides a live validation during project configuration. For some parameter errors the live validation process offers possible solution(s) in the validation view of the DaVinci Configurator Pro. These errors are marked with a bulb.

Note 3rd Party Module Live Validation

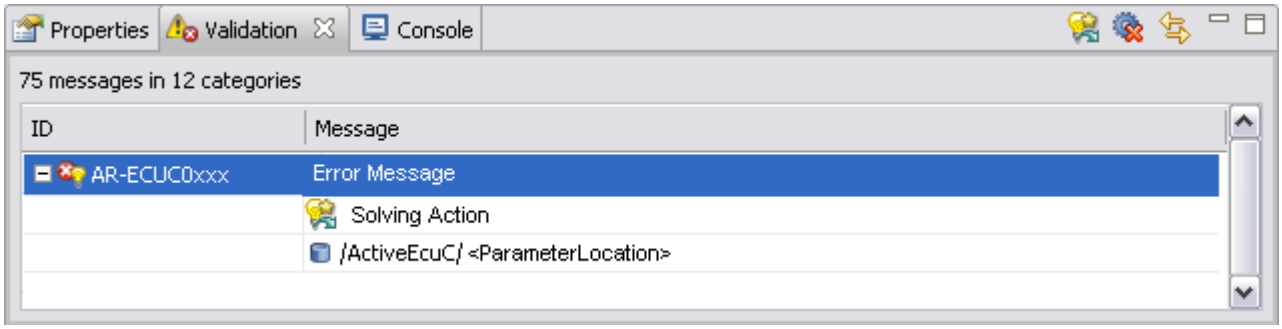
If **Automatic Generation Validation** is activated in **Project Setting Editor**, the configuration of 3rd party modules is also checked while live validation.



Check if the suggested solving action is correct. Double click the error message to open the configuration window of the parameter.

Solving Action is correct?

Start the solving action via double click on the solving action entry in the validation window.



Note

If the solving action is not correct, you can additionally use the link in the solving action to navigate to the parameter and configure the changes manually.

4 STEP4 Start BSW Configuration

Start the configuration of the BSW modules now. The target of this first description is a basically working configuration, using a minimal necessary configuration.

Expert Knowledge

You need to know more? See section Configuration with Configurator Editors on page 87.

Note

Changes in Configurator Editors could lead to errors during live validation!

If these errors include solving actions, check and start solving action in the validation view

Cross Reference

If you use variant handling within your project, you have to refer to Variant Handling on page 159 for special configuration information.

4.1 Start Configuration with Configuration Editors

The configuration editors are use case oriented and optimized for displaying or configuring those parts of the ECU configuration, which are related to the use case.

4.2 Base Services

The Base Services domain contains comfort editors for the configuration of the development error reporting, general purpose timer channels, microcontroller units and RAM test algorithms.

4.2.1 Development Errors

Open **Development Errors** | **Enable or Disable Error Tracing** and select necessary modules or domains to enable the development error tracing.

4.2.2 General Purpose Timer (GPT)

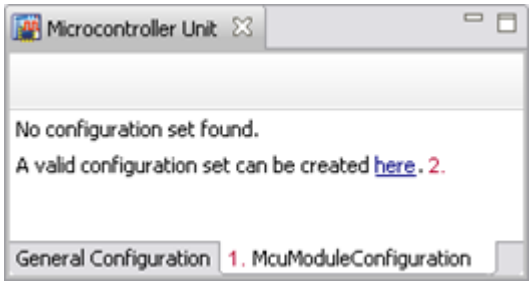
Use default settings.

Note

If the editor is deactivated (greyed out), you can activate the General Purpose Timer (GPT) module via click. The Modules Assistant opens to specify the short name of the module to be added. Click finish to add the module.

4.2.3 Microcontroller Unit

1. Open tab McuModuleConfiguration
2. Create new configuration via **[here]**.



3. Open **Clock Config Sets** | **McuClockSettingConfig** | **McuClockReferencePoint**, add [+] an **McuClockReferencePoint** and define **Clock Reference Point Frequency**

4.2.4 RAM Test

Use default settings.

Note

If the editor is deactivated (greyed out), you can activate the RAM Test module via click. The Modules Assistant opens to specify the short name of the module to be added. Click finish to add the module.

4.3 Communication

The Communication domain contains comfort editors for the configuration of general parameters of the communication related modules, ECU Bus Controllers, protocol data units, data signals and the transport protocol.

4.3.1 Communication General

Define central settings of the communication based modules.

CAN

1. Open **CAN** | **Miscellaneous**
2. Set **[...]** parameter **Counter Ref** to **SystemTimer**.
3. Set **Interrupt Category** to **CATEGORY 2**
4. Set **Interrupt Lock** to **DRIVER**

4.3.2 Bus Controller

1. Open the **CAN Controllers** | **<CANController>**
2. Define **[...]** Controller Default Baudrate
3. Define **[...]** CPU Clock Ref

Note

If no CPU Clock Ref available, add a new reference via **[+]** in the Select Reference Target view.

4.3.3 PDUs

Configure the PDUs of the modules (depends on your project)

- CAN/LIN/FR
- CANIF/LINIF/FRIF
- CANTP/LINTP/FRISOTP
- PDUR
- IPDUM
- COM

4.3.4 Signals

Configure the communication signals of the ECU.

4.3.5 Socket Adapter Users

Use default settings.

Note

If the editor is deactivated (greyed out), you can activate the SOAD module via click. The Modules Assistant opens to specify the short name of the module to be added. Click finish to add the module.

4.3.6 Transport Protocol

1. Open **FlexRay** | **Tx Pdu Pools** and **Rx Pdu Pools** to add **[+]** a new **Tx Pdu Pool** and **Rx Pdu Pool**.
2. Open **FlexRay** | **Connections** | **FrTpConnection** and set **[...]**

- Connection Control,
- TxPduPool and
- RxPduPool.

4.4 Diagnostics

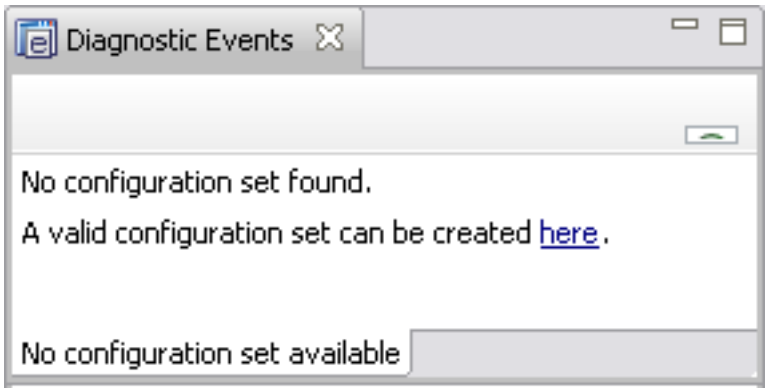
The Diagnostic domain contains comfort editors for the configuration of extended data records and snapshot records, diagnostic events and production error handling of the individual BSW modules and a automatic setup of the NV memory blocks.

4.4.1 Diagnostic Event Data

Use default settings.

4.4.2 Diagnostic Events

If no configuration set is found, use the hyperlink **here** to create a valid configuration set.

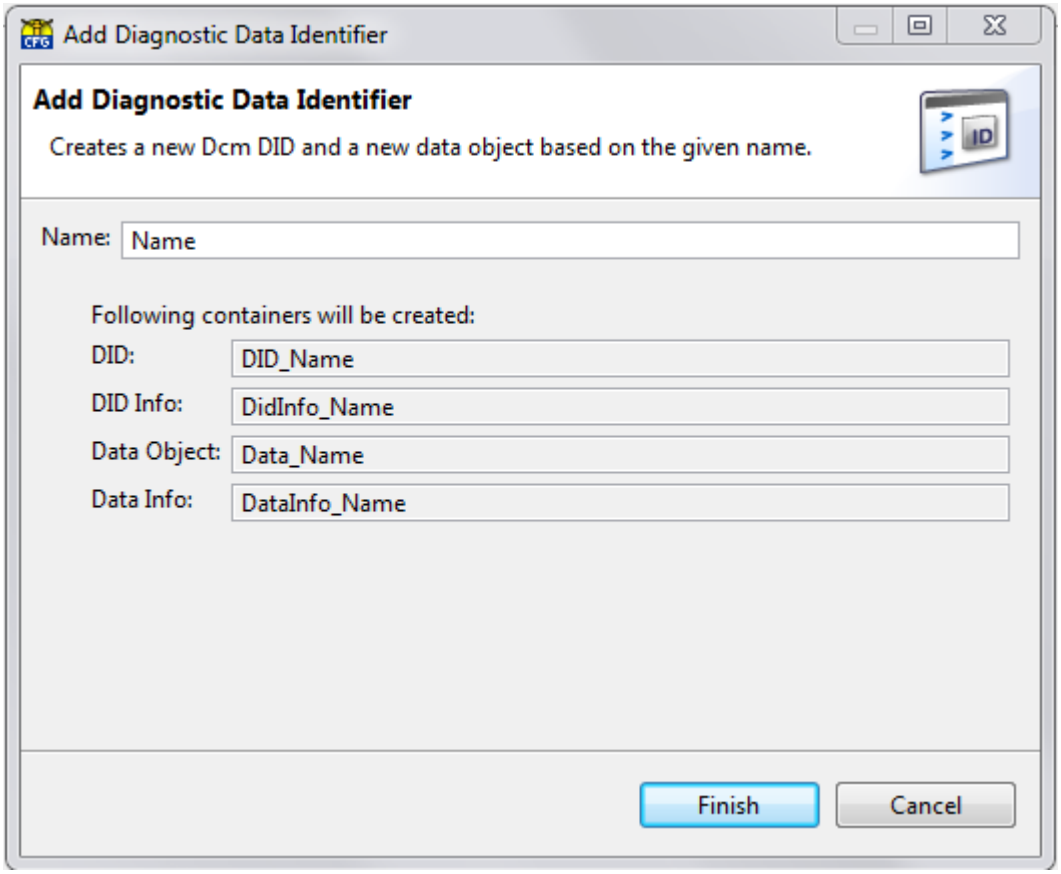


4.4.3 Production Error Handling

Use default settings.

4.4.4 Add Diagnostic Data ID Assistant

Start the assistant, enter a Name and confirm with **[Finish]**. The assistant creates a new DCM DID and a new Data Object based on the given name.



Note

The assistant can not be used within a project with variants.

4.4.5 Automap Diagnostic Data Objects

Maps the data objects of the DCM DIDs to NV memory blocks. Therefore start the assistant, select the data objects, go on with **[Next >]**, select Data object to be mapped and confirm with **[Finish]**.

4.4.6 Setup Event Memory Blocks

The event memory block configuration needs to be updated. Start the Editor and confirm with **[finish]**.

Note

The automatic setup of the NV memory blocks is required for diagnostic purpose.

4.5 I/O

4.5.1 IO Hardware Abstraction

Use default settings.

4.6 Memory

The Memory domain contains comfort editors for the configuration of the general parameters of the memory related modules, the memory block in the non volatile memory blocks.

4.6.1 Memory General

If FEE is used, define

- **BSS Thresholder Reserved**
  BSS - Background Sector Switch
- **FSS Thresholder Reserved**
  FSS - Foreground Sector Switch

4.6.2 Memory Blocks

Open **Memory Partitions** | **PartitionConfiguration** and define

- **Partition Device**
  Add the reference to their device of the partition

Note

If the editor is deactivated (greyed out), you can activate the EA/FEE module via click. The Modules Assistant opens to specify the short name of the module to be added. Click **[finish]** to add the module.

4.6.3 Optimize Fee

If Fee is used, start FEE Optimization The number of chunk instances (parameter FeeNumberOfChunkInstances) of the Fee blocks will be optimized. Please review the new value or select "skip" to leave the parameter.

Note

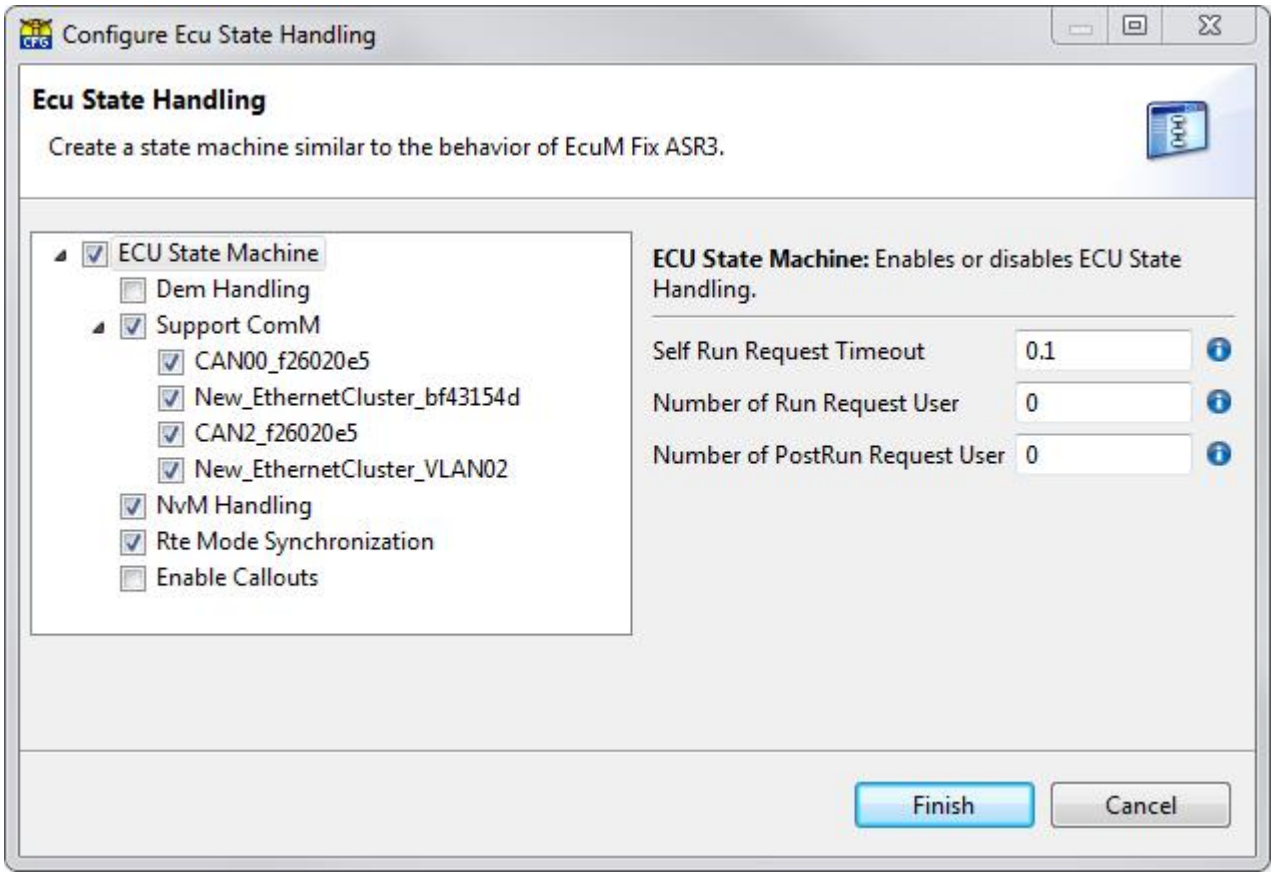
If the editor is deactivated (greyed out), you can activate the FEE module via click. The Modules Assistant opens to specify the short name of the module to be added. Click [finish] to add the module.

4.7 Mode Management Editors

The Mode Management domain contains comfort editors for the configuration of BSW Management, ECU Management, initialization and restart sequences of the BSW modules, sleep modes and wakeup sources, supervised entities and watchdog modes.

4.7.1 BSW Management

Auto Configuration: Ecu State Handling
Open Auto Configuration: Ecu State Handling and configure Ecu State Handling settings via **Configure Ecu State Handling hyperlink**  . The Configure Ecu State Handling dialog opens.



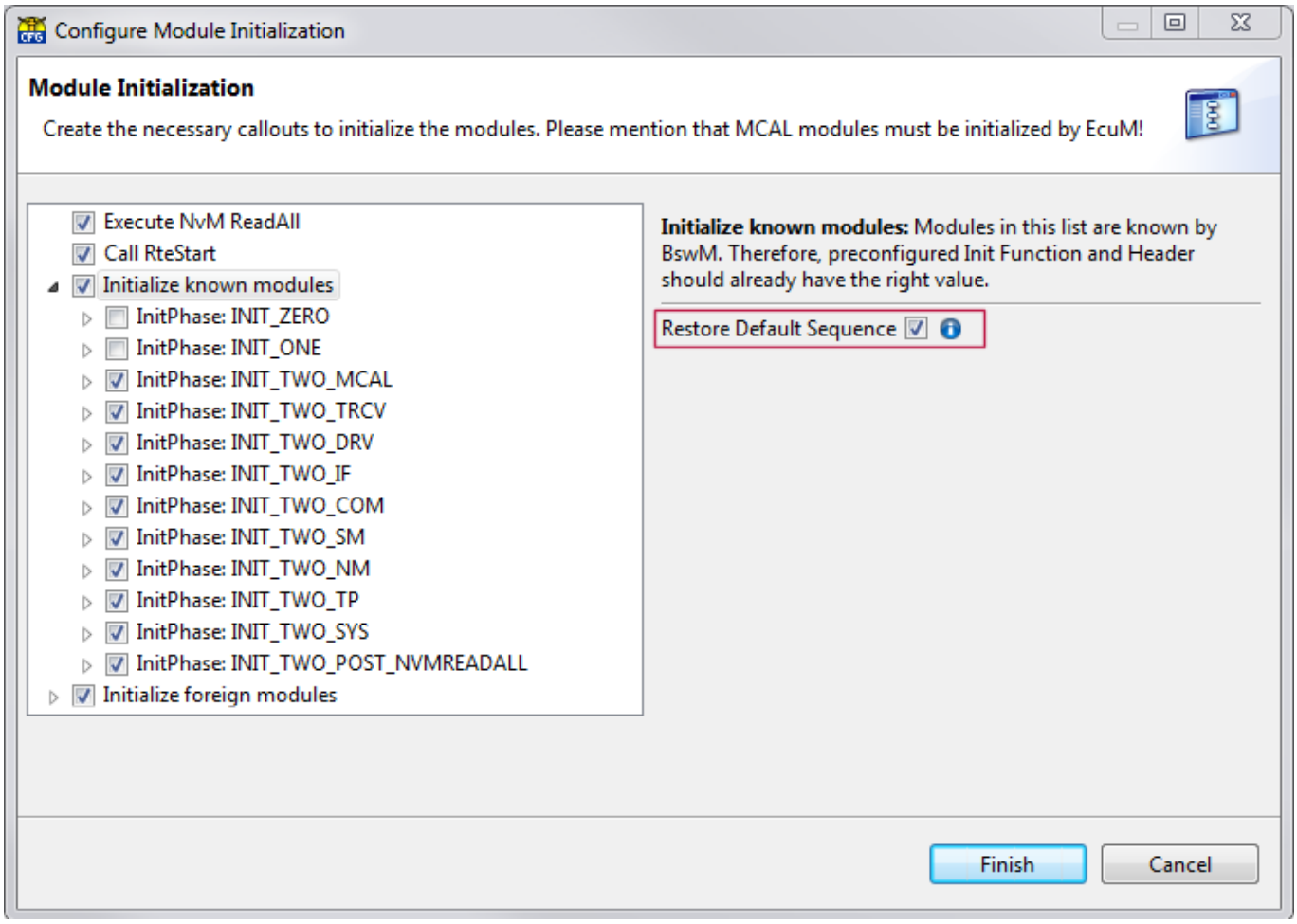
Select the necessary use case definitions to create a state machine similar to the behavior of EcuM Fix in AUTOSAR3.

Note

If you select Ecu State Machine, you have to define the project-specific settings **Self Run Request Timeout** and **Number of Run Request User**.

Auto Configuration: Module Initialization

Open Auto Configuration: Module Initialization and configure Module Initialization via **Configure Module Initialization hyperlink** Configure Module Initialization . The Configure Module Initialization dialog opens.



Select module to create the necessary callouts to initialize the modules.

Note

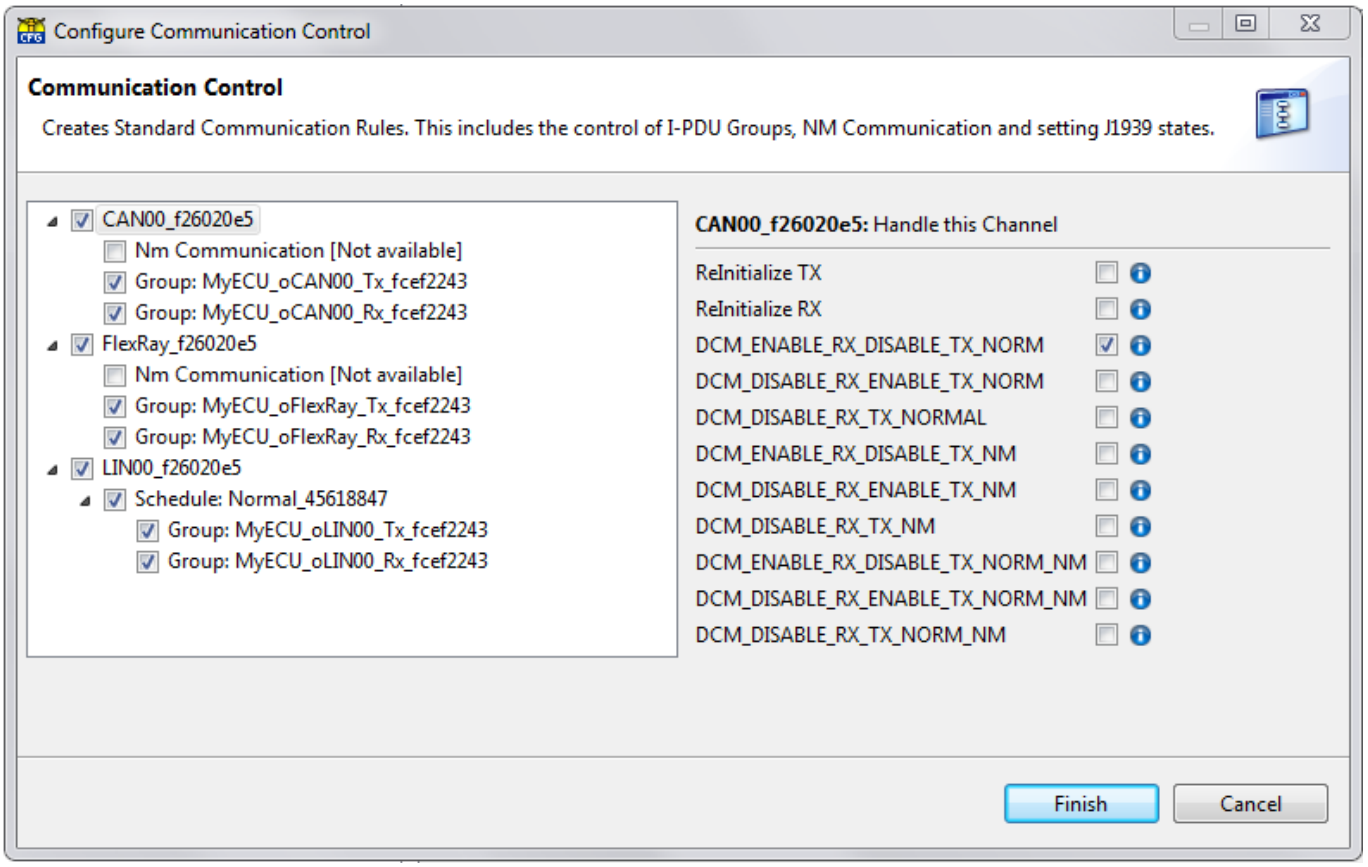
Please notice that MCAL modules must be initialized by EcuM!

Note

If **Restore Default Sequence** is activated, the lists will be sorted automatically, all new entries will be located at the end of the list.

Auto Configuration: Communication Control

Open Auto Configuration: Communication Control and configure Communication Control via **Configure Communication Control hyperlink** Configure Communication Control . The Configure Communication Control dialog opens.



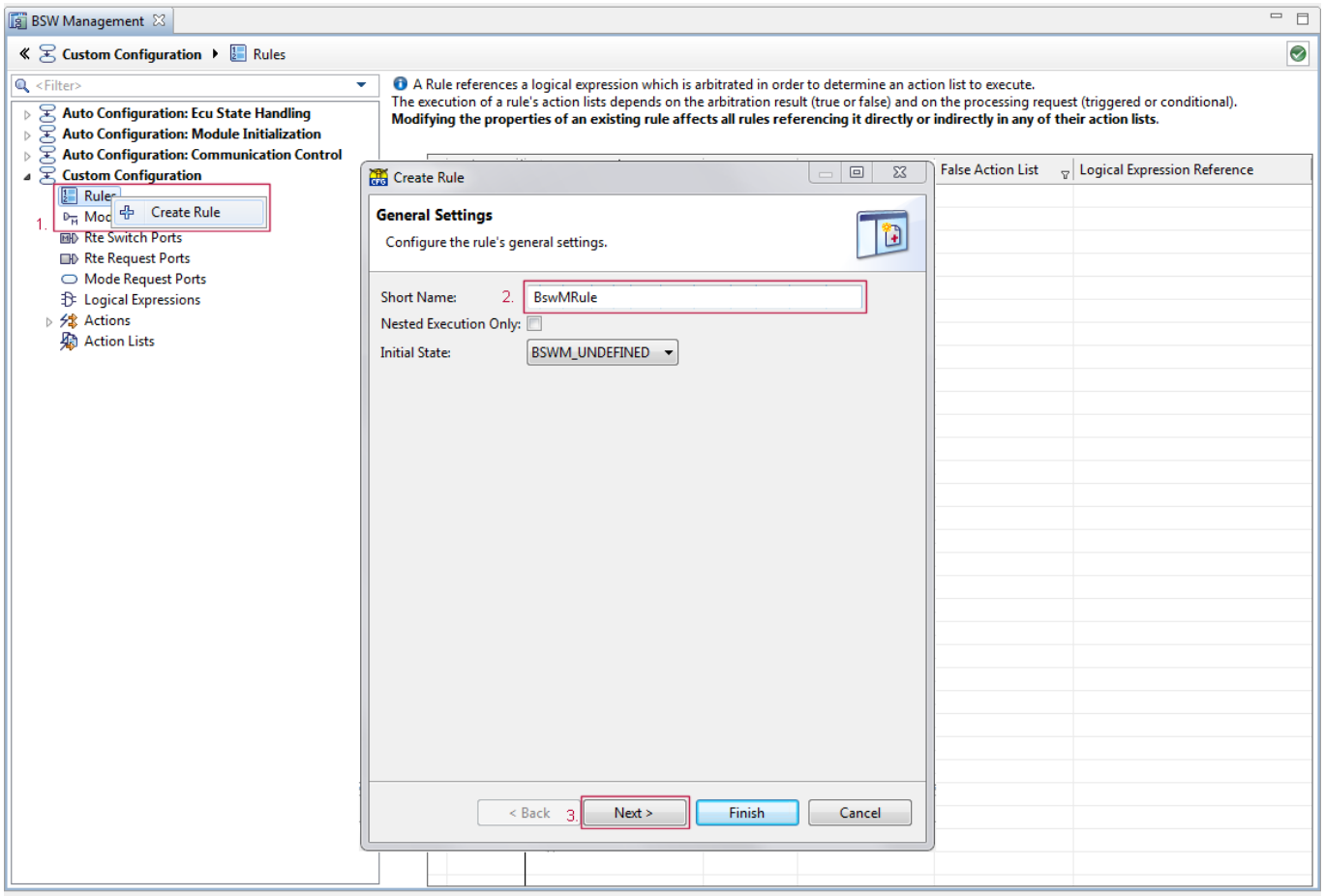
Select the bus systems for which you would like to create standard communication rules.

Custom Configuration
If necessary you can define additional Custom BswM Configuration information.

Note

To create a rule, at least one **logical expression** and one **action list** is necessary. If they are not available, you can additionally configure them via **Create Rule** dialog.

1. Open **Custom Configuration**, right click **Rules** and select **Create Rule**.
2. Define Short Name
3. Go on with **[Next]**



4. Define a non-empty expression for the resulting condition
5. Configure Action List "True", therefore define actions to be executed if the rule's condition evaluates to "true".
6. Configure Action List "False", therefore define actions to be executed if the rule's condition evaluates to "false".

Note

If no actions are configured, no action list will be created.

4.7.2 ECU Management

1. Open **EcuMCommonConfiguration** and define the **OS Resource** which is used to bring the ECU into sleep mode.
2. Open **EcuMCommonConfiguration** | **EcuMSleepModes** and define **Sleep Mode Mcu Mode Ref** and **Wakeup Source Mask**.

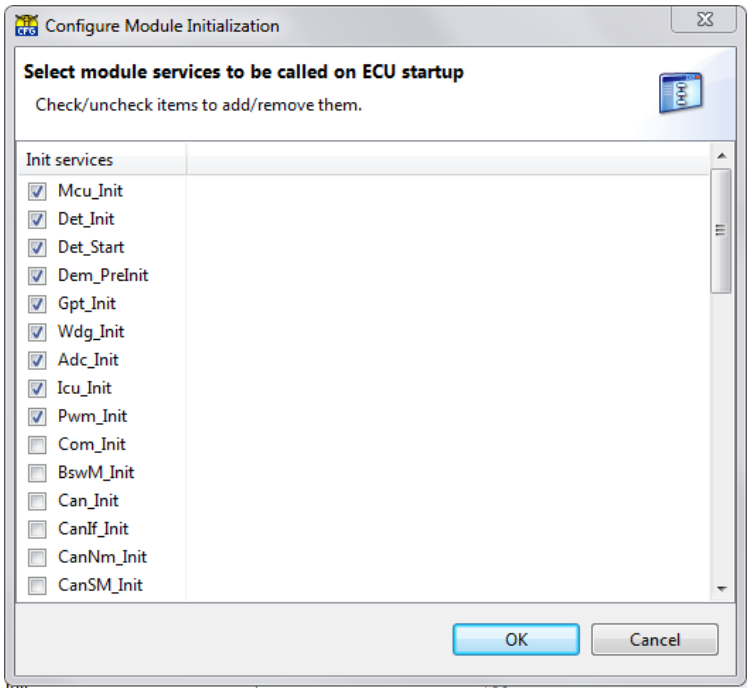
3. Open **EcuMCommonConfiguration** | **EcuMWakeupSources** and add **[+]** wakeup source for each channel.
4. Open **EcuMFlexConfiguration** and define **Mcu Mode Ref** which is being restored after a sleep.

4.7.3 Initialization

Open Initialization editor to configure initialization and restart sequence of the basic software.

Pre-OS Initialization Sequence

Open **Configure Module Initialization** via **Configure Sequence button** .



Select all MCAL modules and the DET to call them on ECU startup. Confirm with **[OK]** and order the elements according to your needs with the **Move up** and **Move Down** buttons.

4.7.4 Watchdogs

Use default settings.

Note

If the Editor is deactivated (greyed out), you can activate the Wdg module via click. The Modules Assistant opens to specify the short name of the module to be added. Click **[finish]** to add the module.

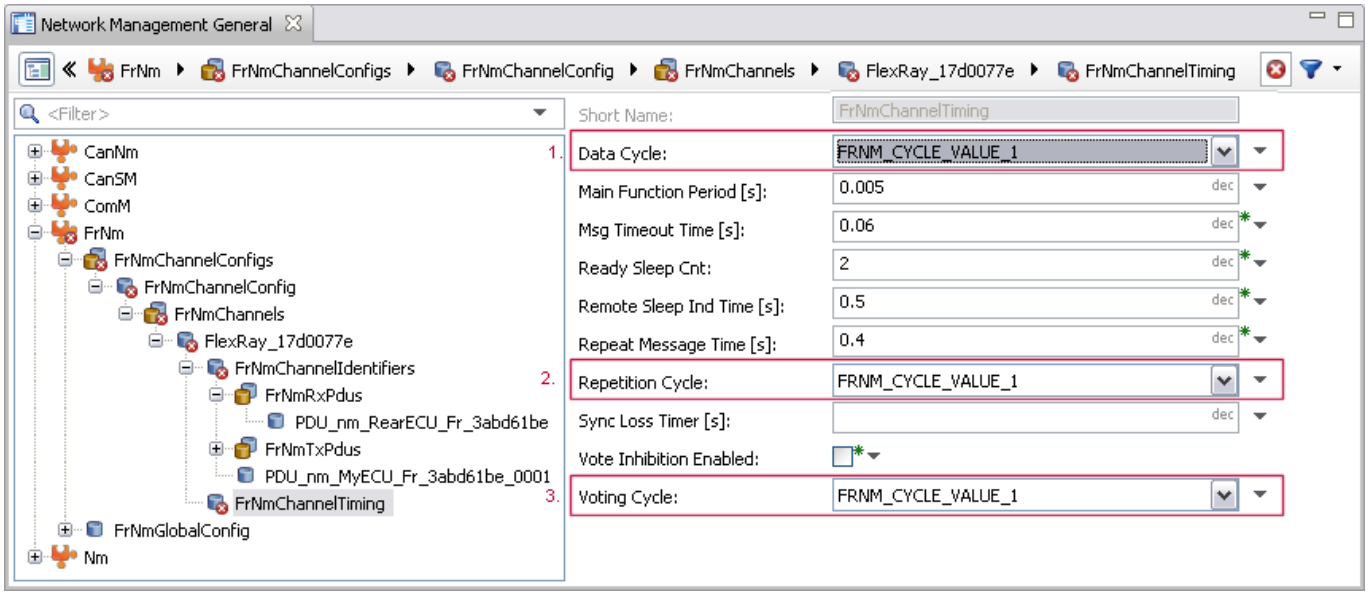
4.8 Network Management

The Network Management domain contains editors for the configuration of the general network management parameters and users which are relevant for the ECU communication management.

4.8.1 Network Management General

Open **FrNm** | **FrNmChannelConfigs** | **FrNmChannels** | **<FRNMChannelIdentifiers>** | **FrNmChannelTiming** and define

1. Data Cycle,
2. Repetition Cycle and
3. Voting Cycle.



Note

For all other NM modules, use default settings.

4.8.2 Communication Users

Use default settings.

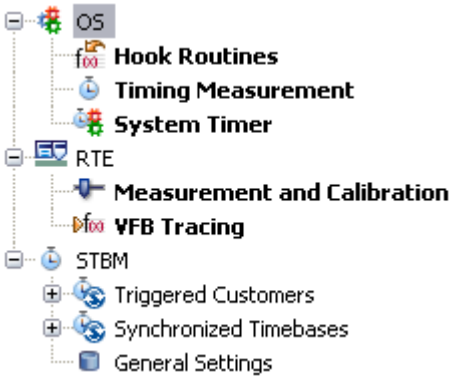
4.8.3 Partial Networking

Use default settings.

4.9 Runtime System

The Runtime System domain contains comfort editor for the configuration of general RTE and OS parameters, operating system and mapping assistants.

4.9.1 Runtime System General



OS

1. Open **Runtime System General** | **OS** and activate/deactivate the following settings if necessary.
   > Stack Monitoring
   > Use GetServiceId
   > Use Parameter Access
2. Define **Scalability Class**, **CC** and **Schedule**.
3. Open **OS** | **Hook Routines** and activate/deactivate the following settings if necessary.
   > Startup Hook
   > Error Hook
   > Shutdown Hook
   > Pre-Task Hook
   > Post-Task Hook
   > Protection Hook

Note

The **Shutdown Hook** is required for shutdown of the ECU to power off.

The **Error Hook** is recommended to inform the application on any error events in the OS.

4.9.2 ECU Software Components

ECU Composition and Application Components

Note

Read only data after STEP5 Design Software Components.

Service Components

Open **ECU Software Components** | **Service Components** and check if all Service Components are added to your project. If not create new component prototypes, based on component types created by the DaVinci Configurator Pro.

Note

The component types are stored in **<ProjectFolder>\Config\ServiceComponents**.

4.9.3 OS Configuration

4.9.4 Create Tasks

Open **OS Configuration** | **Task**. Add the following tasks, define Schedule, Priority and Type.

- Init_Task
- Rte_Task
- Main_Task

Note

All events and alarms which are required are created by the RTE automatically.

Derived from the settings for the runnables and their activation (triggers) some OS events an OS alarms will be created automatically for RTE by the DaVinci Developer. The names start with **Rte_**.

4.10 Go on with Basic Editor

Open the Basic Editor and configure additional settings, currently not supported by specific configuration editors.

Note: Bottom Up Approach - from hardware-dependent to hardware-independent modules

Start configuration with hardware dependent modules and continue with the hardware independent modules.

4.11 Start Solving Actions

Changes in Configurator Editors/Basic Editor could lead to errors during live validation!

If these errors include solving actions, check and start solving action in the validation view.

4.12 Start On-demand Validation

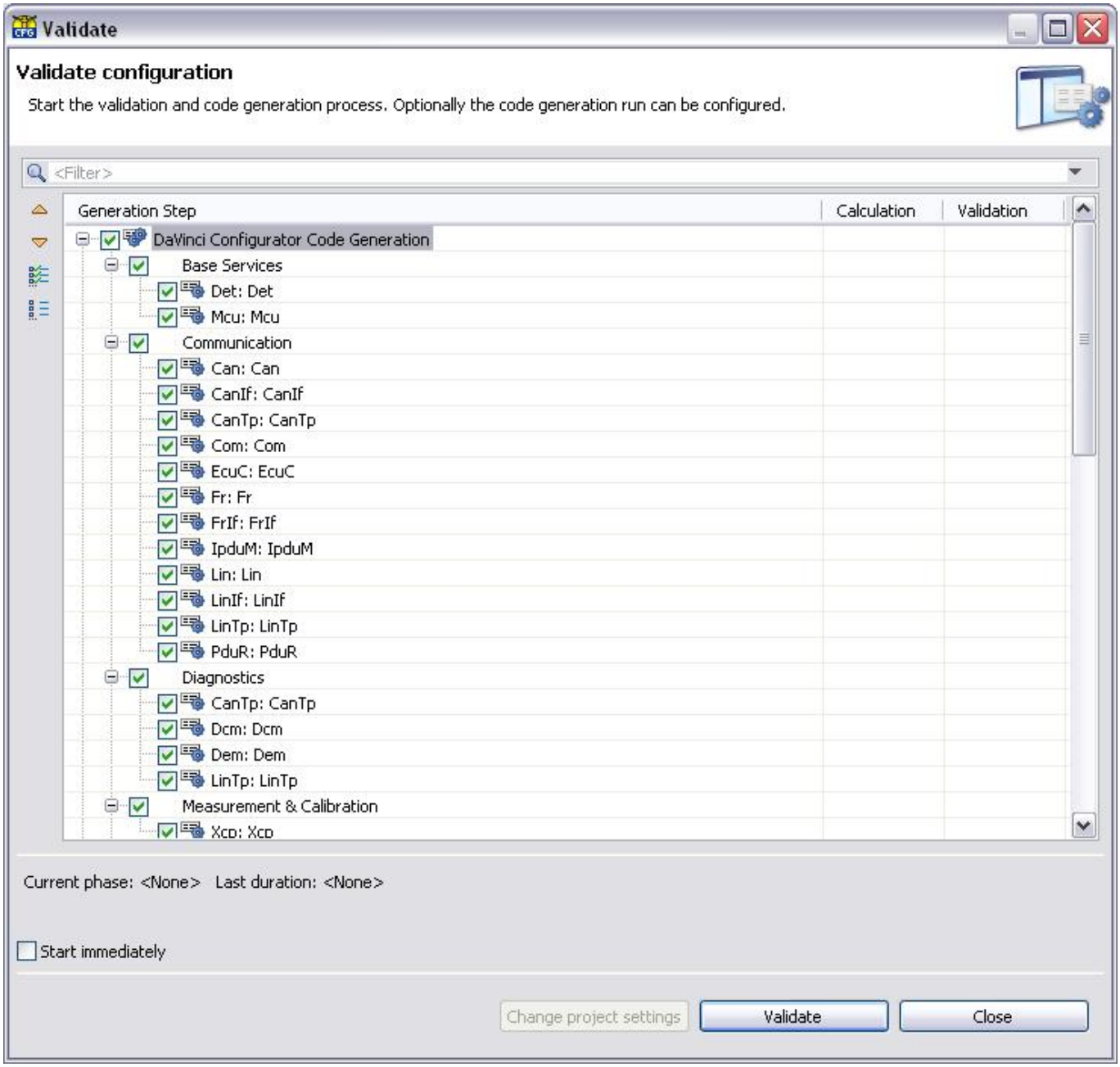
The on-demand validation is performed in addition to the automatic validation before starting the code generation or on explicit user request. The on-demand validation calls the specific validation function of the code generators.

1. Open **On-demand Validation** dialog via **on-demand Validation button** 
2. Deactivate **RTE**

Note

Currently the RTE is not configured completely, this causes errors while validation. The RTE configuration will be finished after SWC Design in the DaVinci Developer.

3. Start the Validation via **[Validate]**

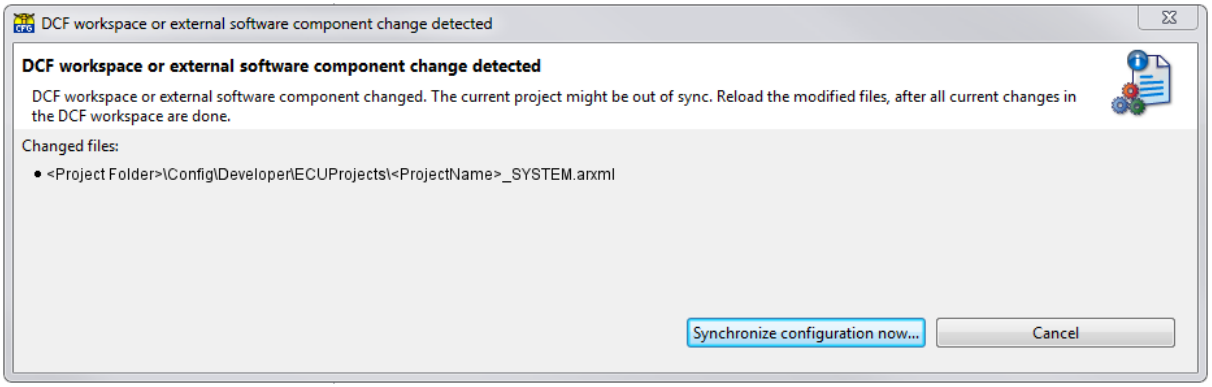


Validation finished successfully?

Save the DaVinci Configurator Pro project and go on with configuring SWCs in the DaVinci Developer.

Note

It is possible to work with both tools parallel. A update message within the DaVinci Configurator will inform you about the DaVinci Developer workspace changes.



Validation finished NOT successfully?

See error message in validation view and fix the configuration.

4.13 BSW Configuration finished

You have finished your BSW Configuration?

Now it depends on your project, how to go on. You have created a Developer workspace while setting up the project? Then you have to go on with the STEP5 Design Software Components on page 52using the DaVinci Developer. If you have no Developer workspace, you can skip the following chapter an go on with STEP6 Mappings on page 53.

5 STEP5 Design Software Components

Switch to the DaVinci Developer to create, configure or modify software components, create or add ports and data elements. Connect software components and define runnables and their activation and interfaces (data access).

Expert Knowledge

You need to know more? See section Software Component Design on page 88.

5.1 Switch to DaVinci Developer

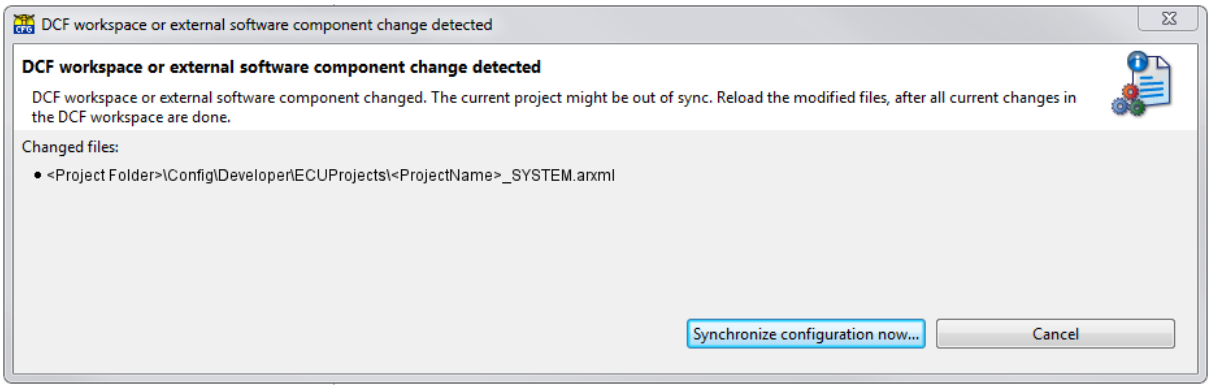
You can start DaVinci Developer with already loaded project in two different ways:

- **Start** | **Programs** | **Vector AUTOSAR Projects** | **<your project name>** | **Configure SWCs** (Only if Create entries in the start menu is selected)
- Right-click on your **<projectname>.dpa** and select **DaVinci Project Assistant** | **Configure SWCs**

Note

For faster resynchronization, the DaVinci Configurator may remain open while working with the DaVinci Developer.

A update message within the DaVinci Configurator will inform you about the DaVinci Developer workspace changes.



5.2 Design Software Components

If the software components are not delivered by the OEM, use the DaVinci Developer to design your software components. How to do this is described more detailed in the expert knowledge part of this manual. Use the link above.

Everything correct? Finally check your settings via .**Check workspace** .

6 STEP6 Mappings

Start project mappings via assistants offered by the DaVinci Configurator Pro. It is also possible to perform data mapping within the DaVinci Developer.

Expert Knowledge

You need to know more? See section Mappings on page 109.

6.1 Perform Data Mapping within DaVinci Developer or DaVinci Configurator?

Via the data mapping, you connect data elements with network signals. Network signals have been loaded via import of ECU Extract of System Description.

Data Mapping can be done in DaVinci Developer or DaVinci Configurator Pro. Decide which tool should be used. In the following step, both variants are described.

Note

Data Mapping in DaVinci Developer has a higher priority than Data Mapping in the DaVinci Configurator Pro.

Data Mapping performed in DaVinci Developer cannot be overwritten in DaVinci Configurator Pro.

Cross Reference

To perform data mapping within the DaVinci Configurator Pro, skip this section and go on with section Switch (back) to DaVinci Configurator on page 56.

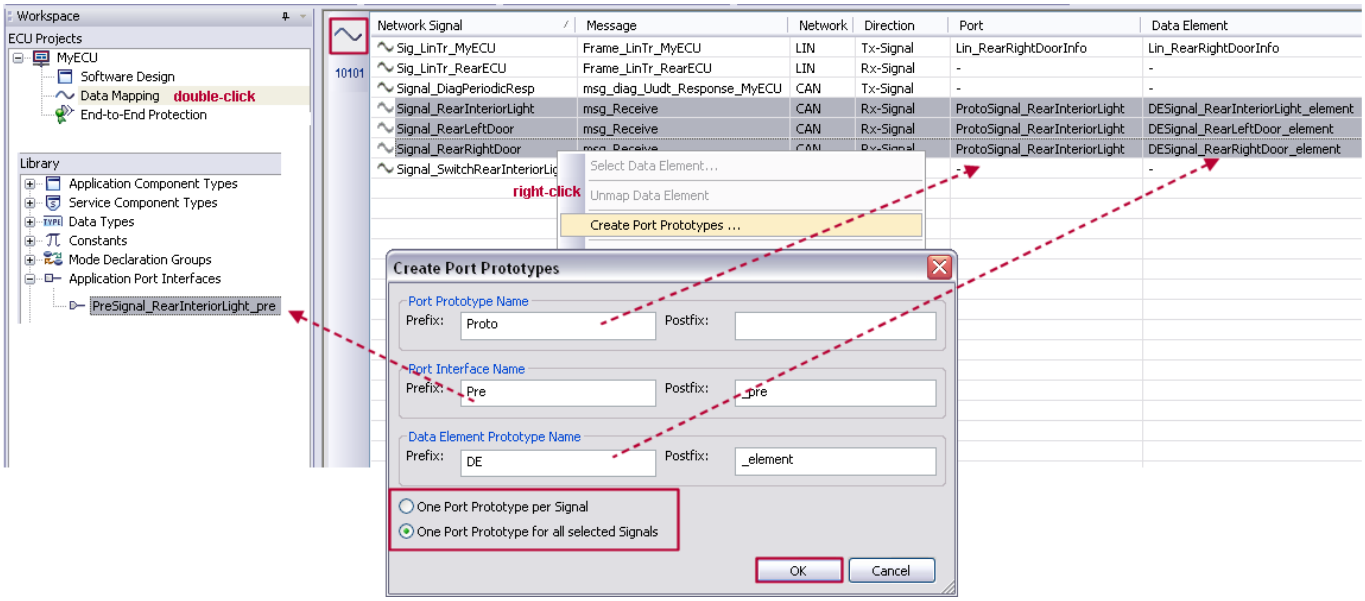
6.2 Data Mapping within the DaVinci Developer

The DaVinci Developer offers two ways of data mapping - **automatically** OR **manually**.

6.2.1 Data Mapping Automatically - DaVinci Developer

Network signal oriented approach
Select bus signals and let DaVinci Developer create all necessary data elements, ports and the mapping of the signals to the data elements.

Finally, you only have to drag'n'drop the port interfaces to your software components and create the connections. Here is how this works.



1. Double-click Data Mapping from the ECU Projects view
2. Select the **Signal view mode** 
3. Select signals to create Data Elements and Port(s)
4. Right-Click selected signals and select Create Port Prototypes … to open the Create Port Prototypes window.
5. Define prefixes and postfixes for the Port Prototype Name, Port Interface Name and Data Element Prototype Name.
6. Select whether you want One Port Prototype per Signal or One Port Prototype for all selected Signals.

Note

If you select One Port Prototype for all selected Signals, of course the signal must be of equal direction, only Tx signals or only Rx signals.

7. Confirm your settings with **[OK]**.
8. You see that one Port Prototype, three Data Elements and one Application Port Interface are generated. The pre- and postfixes help to easily find them in the list.
9. Select the Software Design view and see the delegation port that has been also created.
10. Now drag'n'drop the Application Port Interface form the library to your software component (same direction as the delegation port) and connect them.

6.2.2 Data Mapping Manually - DaVinci Developer

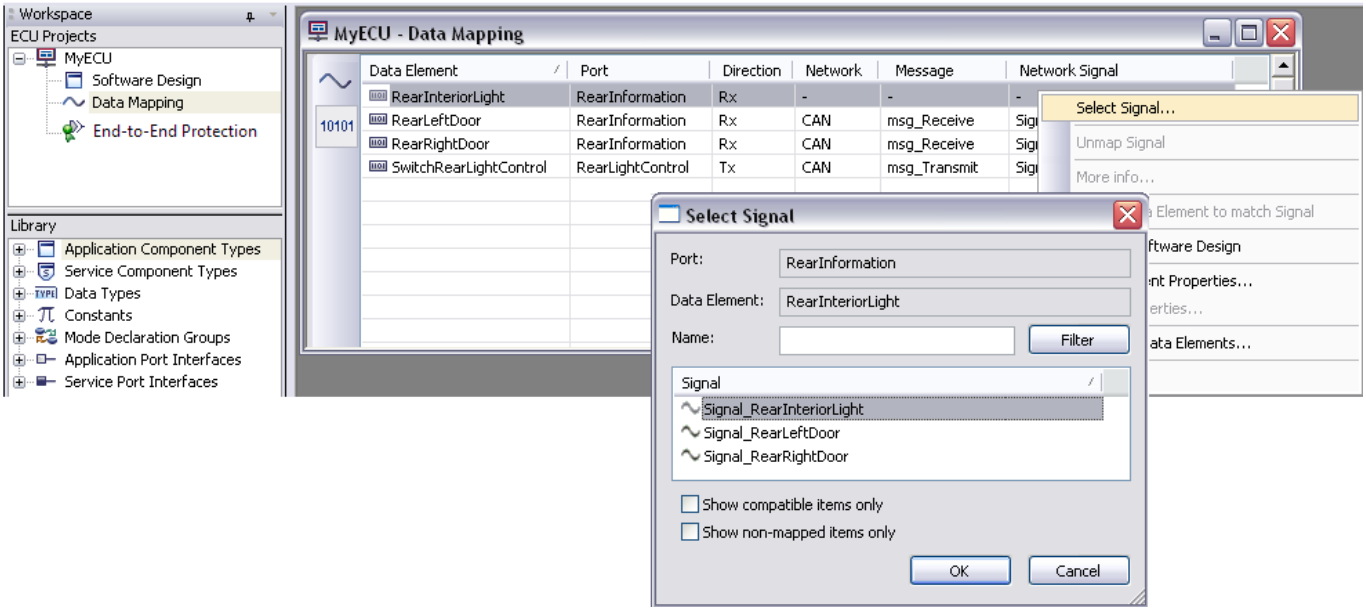
You can also connect the data elements with real bus signals manually.

Note

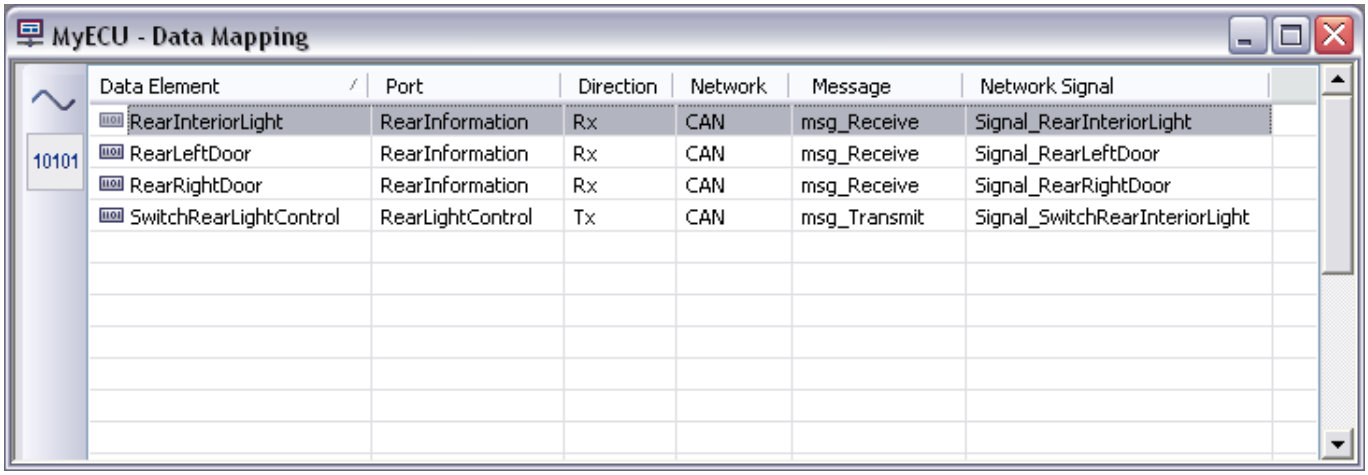
A prerequisite is that you have to create the necessary delegation ports before!

Select Data Mapping in the ECU Projects view and select e.g. the **Data Element View Mode** 10101 and see a list of data elements. The dash (-) on the right side below Network, Messages and Network Signals shows that there is no assignment between data elements and messages/signals from the ECU Extract of System Description.

Right-click the **Data Element column** and click **Select Signal...**. Select the suitable signal in the Select Signal window and confirm with [OK]. Repeat this until every signal is mapped.



The result of the data mapping should look like this.



6.2.3 DaVinci Developer - Save and close

You have imported your Service Components, configured your Software Components and finished Data Mapping?

Check  your workspace. If there are no messages in the **Output** view, save your project and close the DaVinci Developer.

6.3 Switch (back) to DaVinci Configurator

Start the DaVinci Configurator Pro (again) with already loaded configuration using one of the two possibilities.

> **Start** | **Programs** | **Vector AUTOSAR Projects** | **<your project name>** | **Configure BSW**
(Only if Create entries in the start menu is selected)

> Right-click on your **<projectname>.dpa** and select **DaVinci Project Assistant** | **Configure BSW**

6.4 Synchronize System Description

Changes by the DaVinci Developer require a synchronization of the System Description in the DaVinci Configurator Pro.

The necessity of a synchronization is detected by the validation process of DaVinci Configurator Pro and displayed in the **Validation view**. Start System Description synchronization via the validation message **RTE59000** | **Synchronize the System Description**.

6.5 Add Component Connection

Data elements can only be transported from one application component to another if their ports are connected via connectors. Create these connections using the **Component Connection Assistant** 

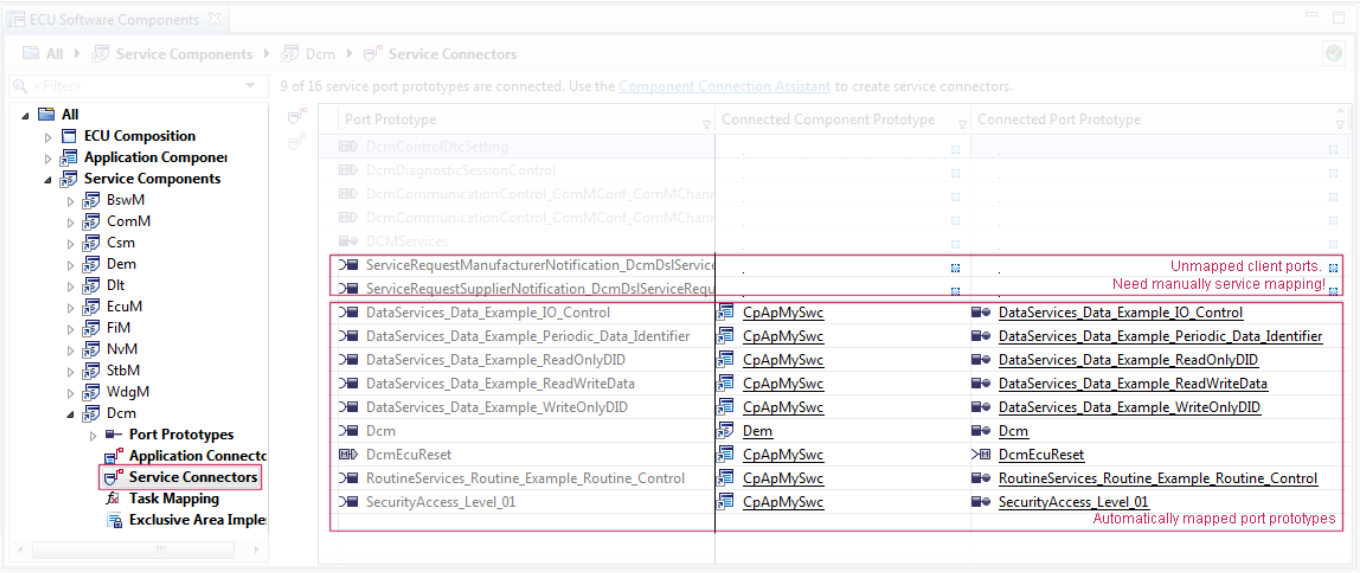
(below **Runtime System**).

1. Start Assistant, select connector type and go on with **[Next]**
Select **Application Connector Prototypes** to connect software components or **Service Connector Prototypes** to connect service components
2. Select a **Component Prototype** and go on with **[Next]**
3. Select **Port Prototypes** and go on with **[Next]**
4. If necessary select additional search option and go on with **[Next]**
Initially the Component Connection Assistant will search matching port prototypes based on the port prototype name automatically
5. Check mapping. All Connector Prototypes are mapped with the right ports? Confirm with **[Finish]**

6.6 Service Mapping

If you have connected your service components via **Add Component Connection** in the previous step, the service mapping is basically done.

To define additional mappings manually you have to configure it in the service component directly. Therefore open **ECU Software Components** | **Service Components** and select the service component you want to map. Open service component and select **Service Connectors**.

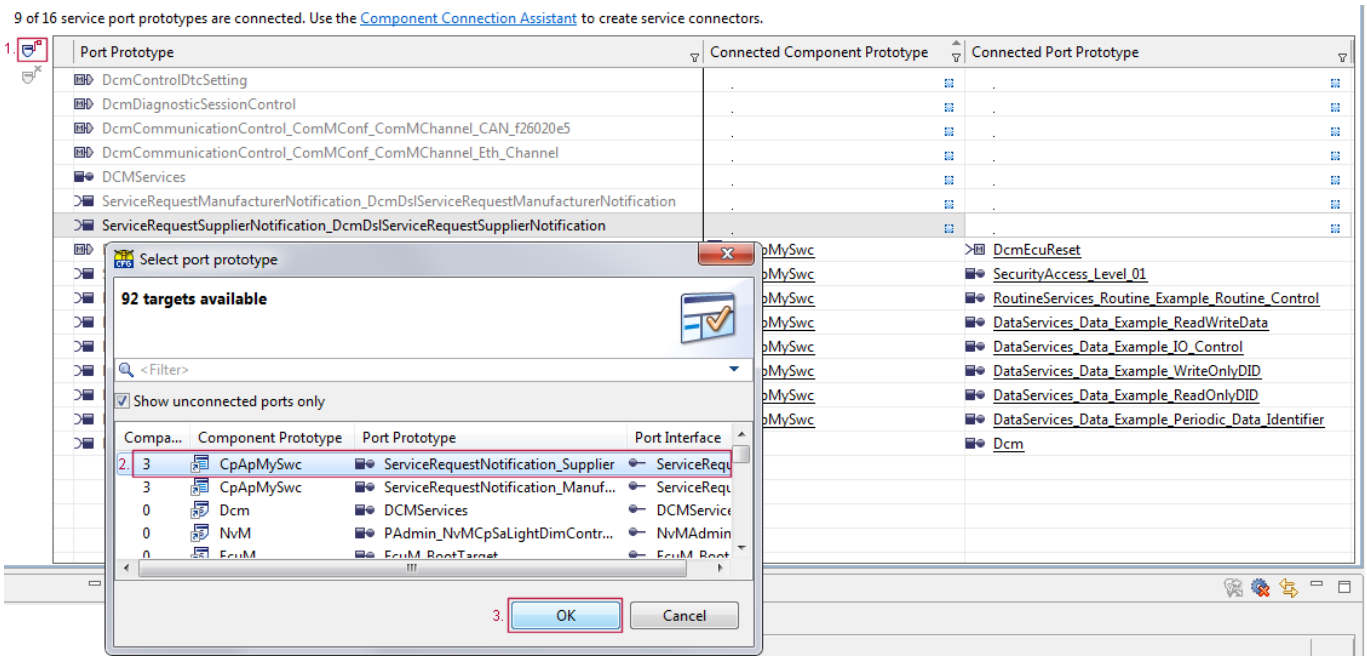


Now you can see all ports, the automatically matched connections and unmapped ports. **Is manually service mapping necessary?**

Note

Each **client port** should be mapped to a **server port**! For all unconnected client ports the RTE will generate a **dummy** function returning RTE_E_UNCONNECTED.

YES? Therefore select the service component port and use the **connect button** to assign the appropriate port prototype to the selected port of the service component.



6.7 Add Data Mapping

You have already performed Data Mapping within the DaVinci Developer?

Yes? Skip this section and go on with Add Memory Mapping on page 60.

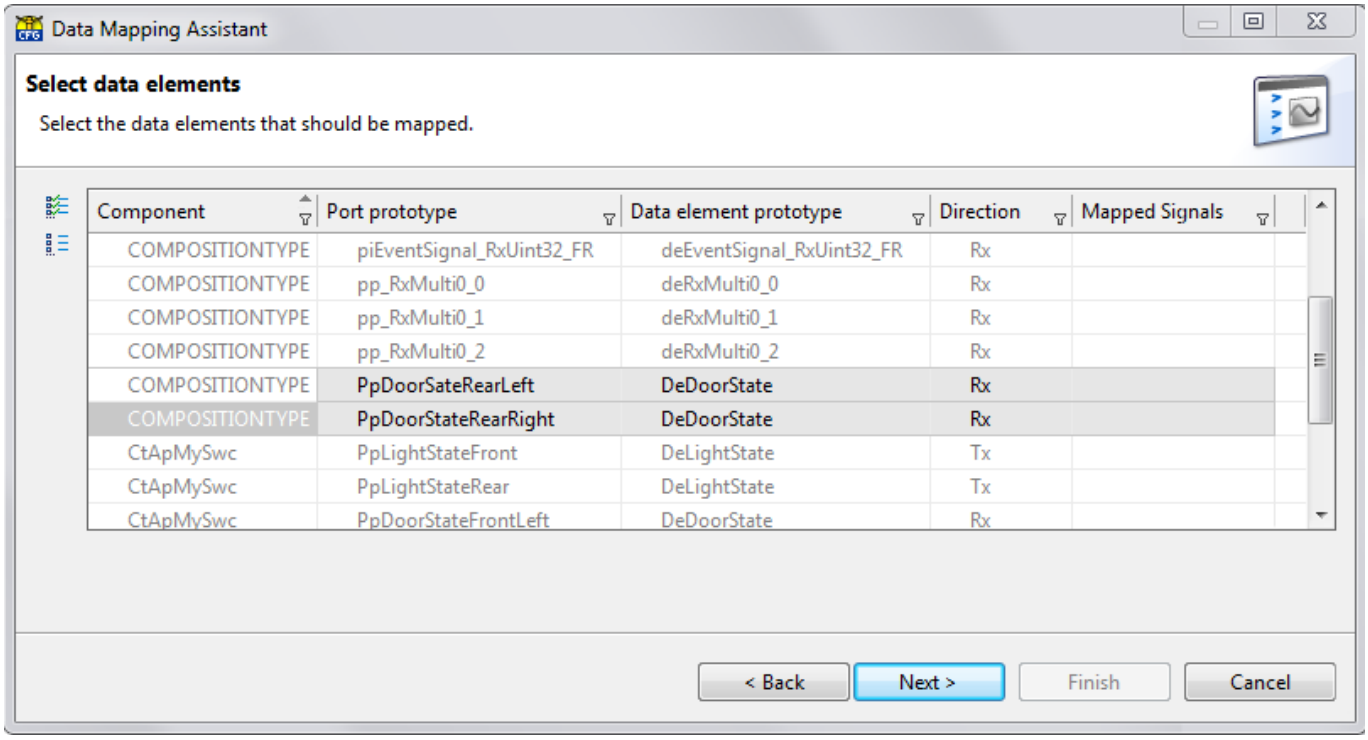
Cross Reference

See section Perform Data Mapping within DaVinci Developer or DaVinci Configurator? on page 53

No? Start Assistant via Add Data Mapping Add Data Mapping and select mapping direction, i.e. choose whether **Signals** or **Data Elements** should be mapped.

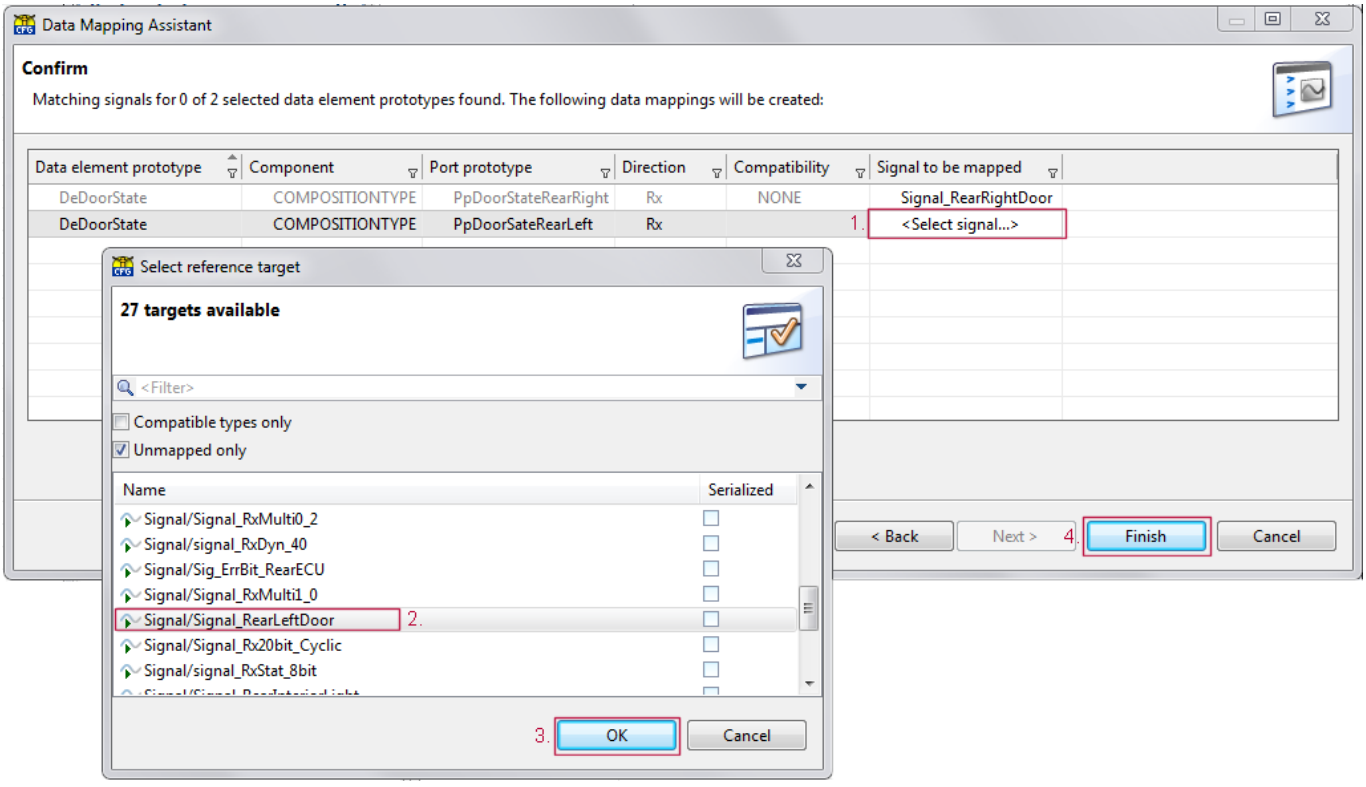
Choose **Find matching signals for the data elements** to assign your signals based on a selected data element and go on with **[Next]**

Now you can see a list of data elements. The empty row **Mapped Signals** shows that there is no assignment between data elements and messages/signals from the ECU Extract of System Description.



Select the Data element prototypes you want to map and go on with **[Next]**.

Now you can see if matched signals are found automatically. If there are no entry in row **Signal to be mapped**, you have to define the signal manually.



1. Click **<Select signal...>** to open the **Select reference target** window.
2. Select the signal you want to map.
3. Confirm with **[OK]**.

Repeat these steps until all data elements you have selected for mapping are mapped to a signal.

4. Close Data Mapping with **[Finish]**.

6.8 Add Memory Mapping

You have to map all per-instance memory objects of the application components to NV memory blocks. Therefore use the **Memory Mapping Assistant**  Add Memory Mapping .

Note

A per-instance memory object is mappable if it is referenced by a service need object. The definition of per-instance memory objects or service needs is part of the component type definition and not yet editable by DaVinci Configurator Pro.

1. Start Assistant, choose **Use Case** and go on with **[Next]**
2. Select component prototype and go on with **[Next]**
3. Select per-instance memory objects
   Choosing Use Case Find existing NV memory blocks?
   Go on with **[Next]**, Check the memory mappings and confirm with [Finish]
   Choosing Use Case Create new NV memory blocks?
   Confirm with **[Finish]**

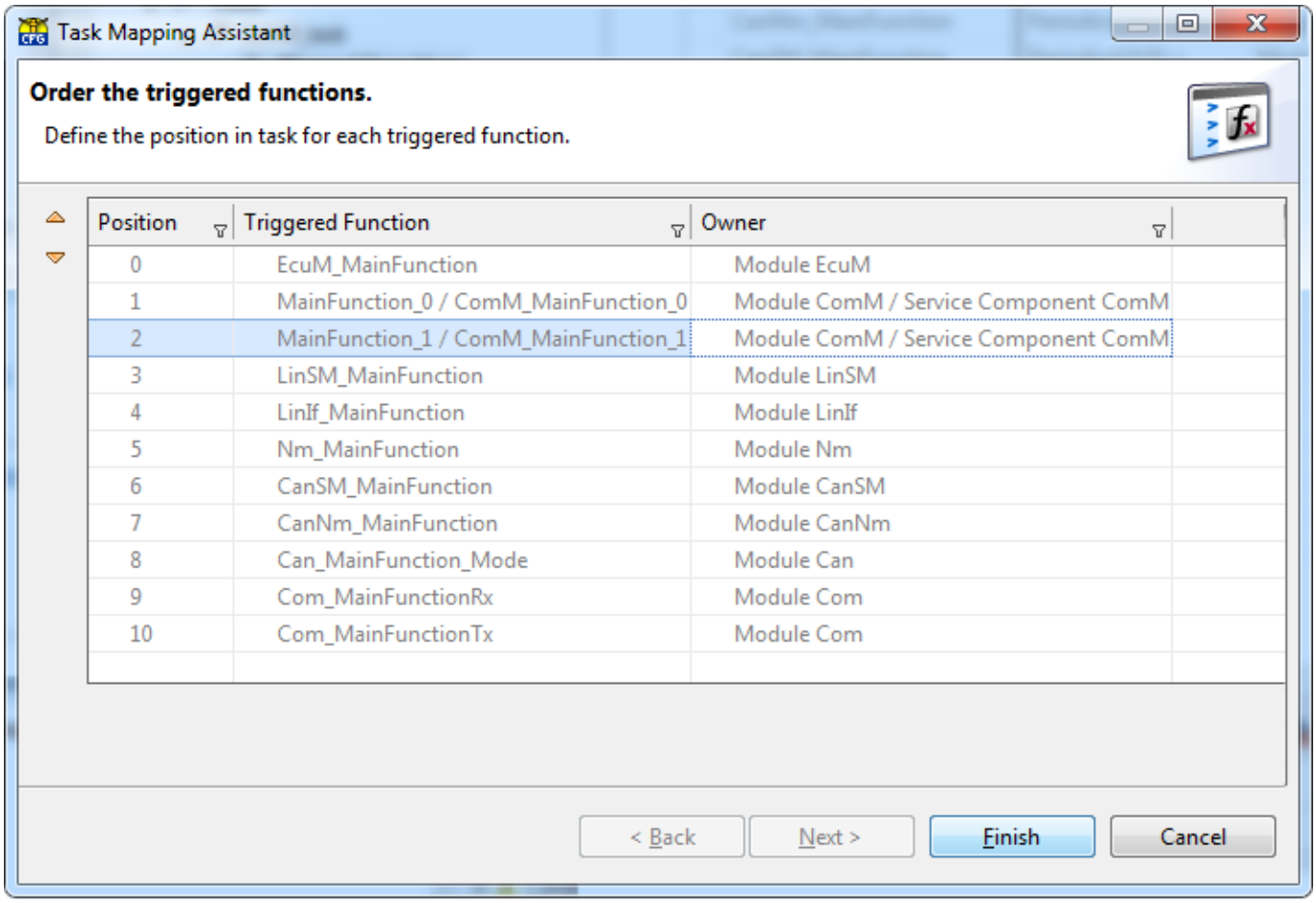
6.9 Add Task Mapping

You have to map all runnable entities and schedulable entities (e.g. Main Functions of the BSW modules) to a task. Therefore use the **Task Mapping Assistant**  Add Task Mapping .

Note

A runnable has to be mapped to a task if it is not re-entrant but could be called re-entrantly during system operation.

1. Start Assistant, select all Triggered Functions with Function Trigger On Init and go on with **[Next]**
2. Select Init_Task and go on with **[Next]**
3. Define the position in task for each triggered function and confirm with **[Finish]**



4. Repeat the steps and select all **Main Functions** of **Service Components** and **Modules** and map them to **Main_Task**.
5. Repeat the steps and select all **Runnables** of your **Application Components** and map them to **Rte_Task**.

Note

Runnables with Function Trigger **On Operation Invocation** are normally not needed to be mapped to a task, as they result in direct function calls.

Mappings finished? Validation successfully? Then go on with project generation!

7 STEP7 Code Generation

Now you can go on with code generation.

Expert Knowledge

You need to know more? See section Generation on page 116.

7.1 Start Custom Workflow Steps

Open Project settings via **Project Setting icon**  from DaVinci Configurator Pro toolbar. Open **Custom Workflow** and check, if a step for creating **SWC Templates** is available.

Available?

Start Custom Workflow Step via **Execute Custom Workflow icon**  .

Not available?
Create a Custom Workflow Step with parameter **RTE: -g i**.

Cross Reference

How to create Custom Workflow Step? See section STEP2 Define Project Settings on page 30.

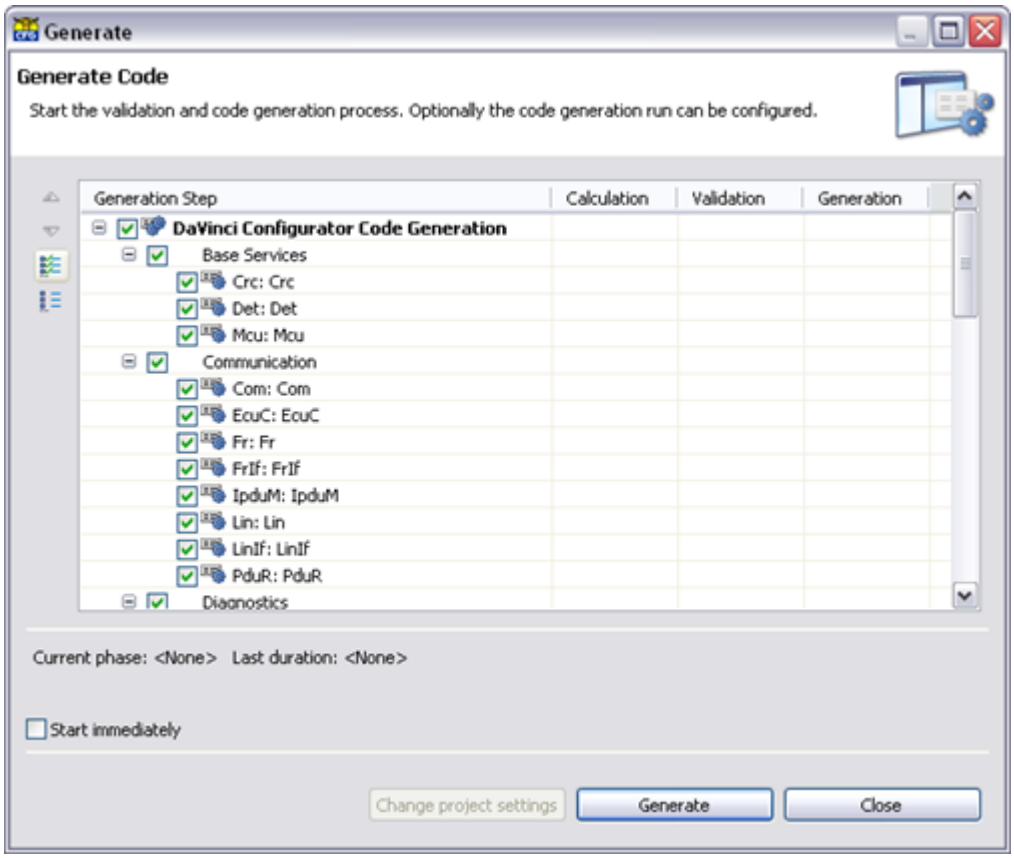
7.2 Start Code Generation

1. Open the Generation dialog via **Generate button** 

Note

The activated generation steps depend on the project settings. If you want to take over your selection to the project settings press **[Change project settings]**.

2. Start Generation Process via **[Generate]**
   If you select **Start immediately** the generation starts immediately after opening this dialog.



Note

Before the **Generation** process starts, **Calculation** and **Validation** has to be finished successfully.
If code generation canceled because of calculation and validation errors, start solving actions at the validation window of the DaVinci Configurator Pro (see section STEP3 Validation on page 34).

7.3 Generation Process finished!

Generation Process finished and all generation steps are marked with Phase finished successfully ?

Note

The DaVinci Configurator Pro strores all generated *.c and *.h file in the modules files folder, given during project setup (the default is **<ProjectFolder>\Appl\GenData**).

Go on with implementation of your code to the runnable skeletons created during the generation process.

8 STEP8 Add Runnable Code

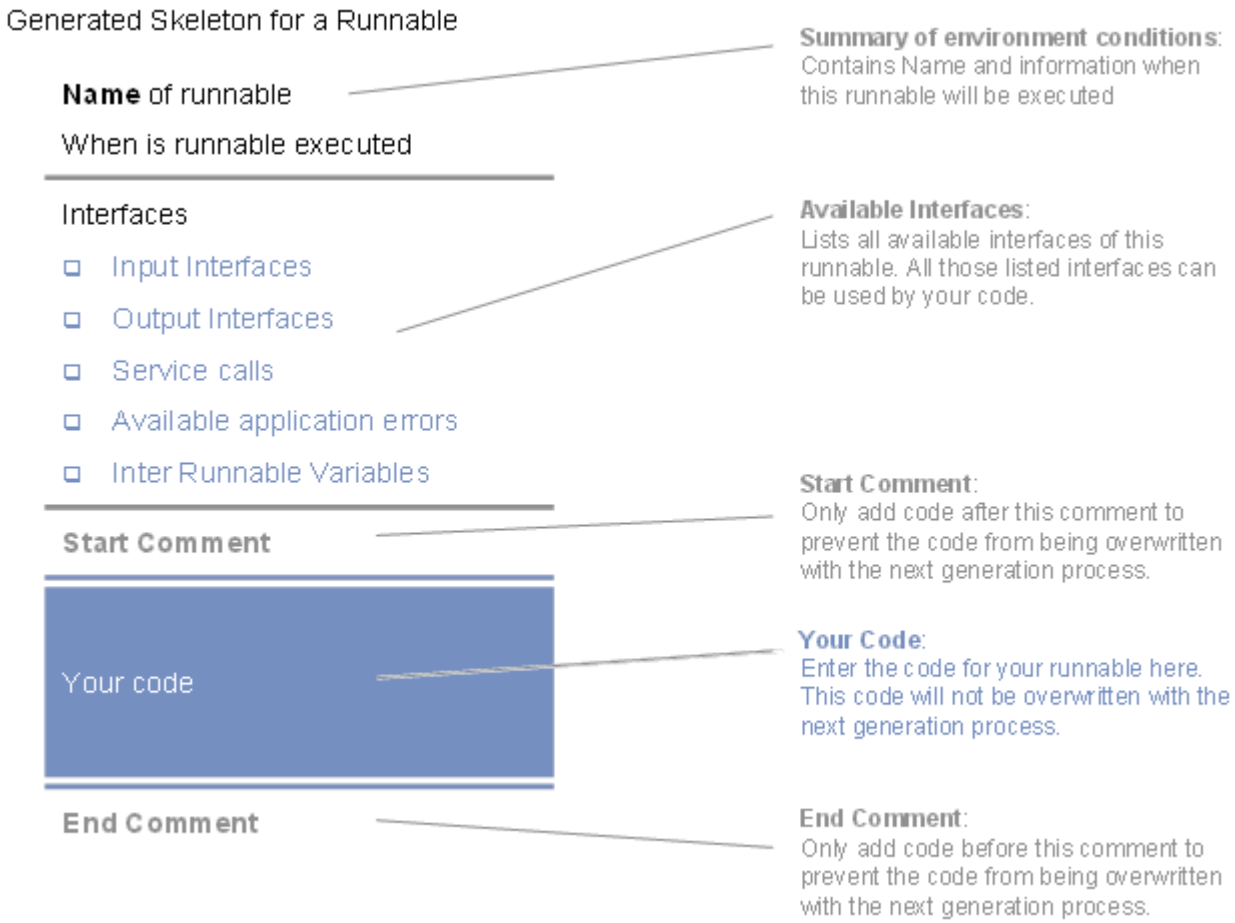
If configured, the DaVinci Configurator Pro code generator generates the skeletons for your runnables into the software component template files. Now you have to implement your code to the runnable skeletons.

Expert Knowledge

You need to know more? See section Runnable Code on page 117

8.1 Component Template

The software component templates contain all runnables of the according software components. The RTE Template Generator generates skeletons for the runnables. The structure of those skeletons looks as shown in the illustration below.



8.2 Implement Code

Implement your code to the runnable skeletons. Make sure to enter your code between the start and end comment. Only this section is protected against modification by a further generation process.

```
FUNC(void, RTE_AP_MYSWC_APPL_CODE) MySCW_Code(void)
{
/**********************************************************************************************************************
 * DO NOT CHANGE THIS COMMENT!          << Start of runnable implementation >>          DO NOT CHANGE THIS COMMENT!
 * Symbol: MySCW_Code
 *********************************************************************************************************************/
Boolean dataLeft, dataRight, dataLeftRear, dataRightRear;

Std_ReturnType value;


Rte_Read_FrontLeftDoorState_OpenClose(&dataLeft);
Rte_Read_FrontRightDoorState_OpenClose(&dataRight);
Rte_Read_RearInformation_RearLeftDoor(&dataLeftRear);
Rte_Read_RearInformation_RearRightDoor(&dataRightRear);


if (dataLeft || dataRight || dataLeftRear || dataRightRear)
{
    Rte_Call_UR_ComMUser_CAN_GetRequestedComMode(&value);
    if (value != COMM_FULL_COMMUNICATION)
    {
        Rte_Call_UR_ComMUser_CAN_RequestComMode(COMM_FULL_COMMUNICATION);
    }

    Rte_Write_FrontLightState_OnOff(TRUE);
    Rte_Write_RearLightControl_SwitchRearInteriorLight(TRUE);
}
else
{
    Rte_Write_FrontLightState_OnOff(FALSE);
    Rte_Write_RearLightControl_SwitchRearInteriorLight(FALSE);

    Rte_Call_UR_ComMUser_CAN_GetRequestedComMode(&value);
    if ((value != COMM_NO_COMMUNICATION) && (lightDimControl == 0))
    {
        Rte_Call_UR_ComMUser_CAN_RequestComMode(COMM_NO_COMMUNICATION);
    }
}
/**********************************************************************************************************************
 * DO NOT CHANGE THIS COMMENT!          << End of runnable implementation >>          DO NOT CHANGE THIS COMMENT!
 *********************************************************************************************************************/
}
```

All other sections like execution information or interfaces can be changed depending on your settings in the DaVinci Developer. If access to e.g. a port interface is missing, go back to the DaVinci Developer and adapt your configuration, regenerate and then you can use this port interface. There is no other way to do it properly.

Info

A backup (*.bak) file will be generated before a component template C file is modified to make sure that your previous version is not deleted in case of any generation problem caused by non-predictable reasons.

And there is a backup section at the end of the template file to rescue the code of runnables that have been deleted by the DaVinci Developer.

9 STEP9 Compile And Link Your Project

Now you can compile and link to get your executable for the download to your hardware.

Expert Knowledge

You need to know more? See section Compile and Link on page 119.

9.1 Finish your project with compiling and linking

This step is highly dependent on your compiler, linker and project settings.

1. Compile, Link your code.
2. Test your code
   A proper Compile and Link process is just the beginning. The final step is to test what you have done until now. This is no detailed test. It is just to make sure that you have bus communication. The ideal tester would be CANoe from Vector Informatik. Connect your hardware to CANoe, start CANoe, set the correct baud rate and have a look at the trace window. You see any bus communication?

No error frames?

9.2 Congratulations, that’s it!

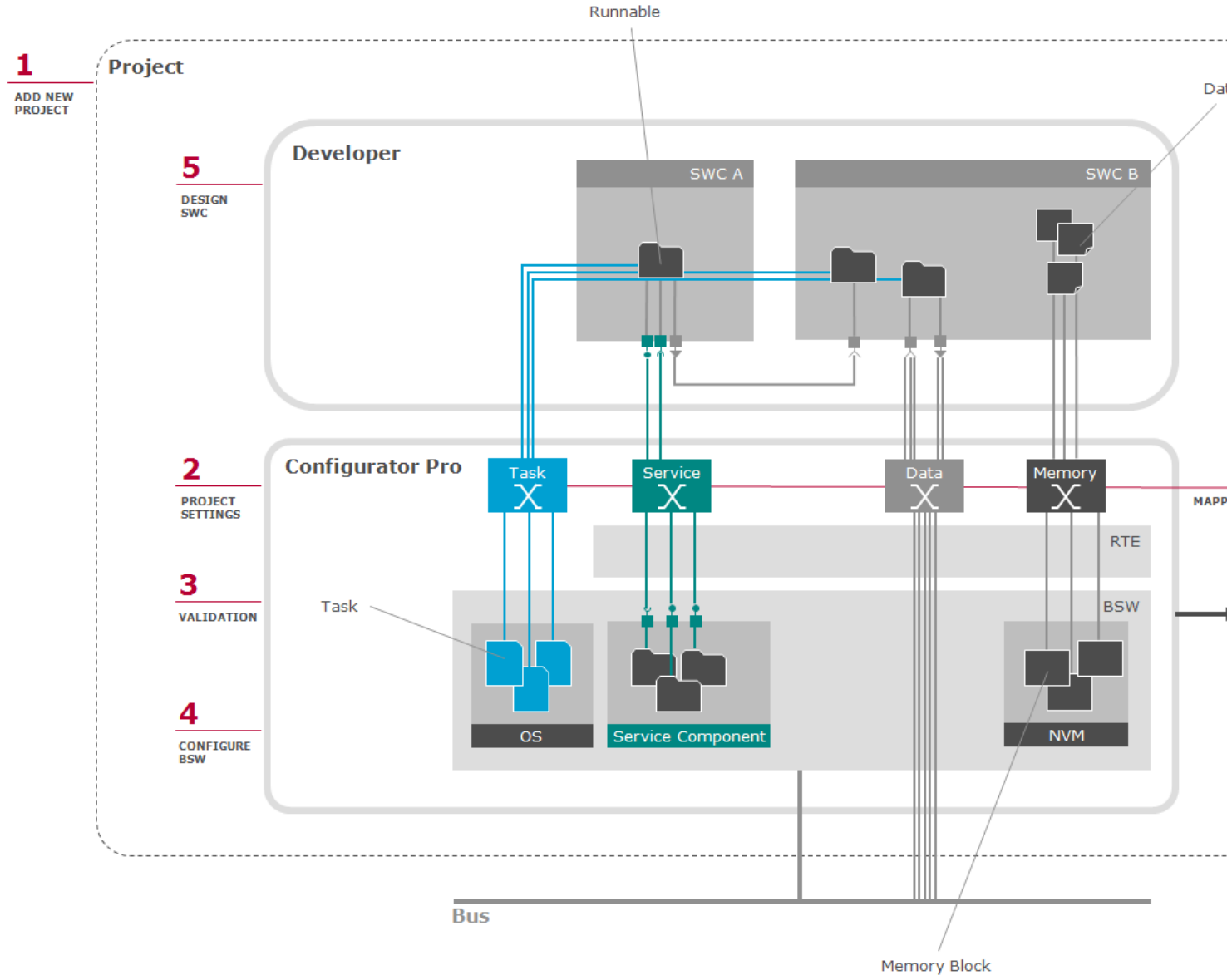
The basic step is done, the GM SLP2 software is basically working together with your application.

That is the base you can start from to optimize your system. Refer to Technical References of the BSW modules for more detailed information.

Cross Reference

You need additional Information? See section Additional Information on page 120.

II Concept


Runnable
1
ADD NEW PROJECT
Project
5
DESIGN SWC
Developer
SWC A
SWC B
2
PROJECT SETTINGS
Configurator Pro
Task
Service
Data
Memory
3
VALIDATION
RTE
Task
BSW
4
CONFIGURE BSW
OS
Service Component
NVM
Bus
Memory Block

1 General Overview

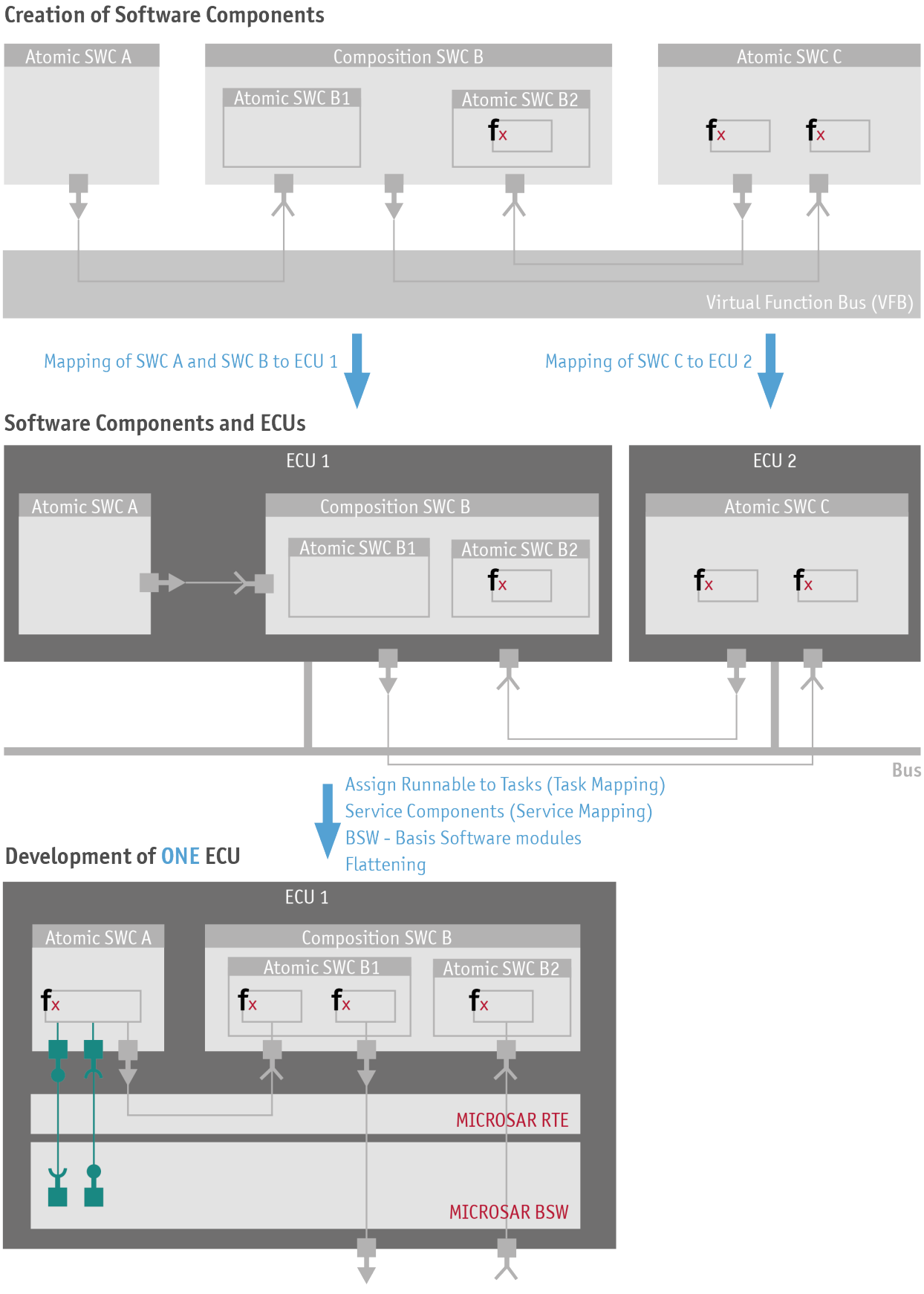
The following illustration shows the basic idea behind AUTOSAR and can be divided up into 3 parts, upper, middle and lower part, named as

- Creation of Software Components
- Software Components and ECUs
- Development of ONE ECU

The upper part deals with software components, runnables, ports and connections. It is the design level of functions and applications.

During the transition to the middle part, the software components are assigned to ECUs. Software components that are assigned to the same ECU can communicate internally, via so-called internal connections. Software components, that have to communicate and that are mapped to different ECUs communicate via so-called external connection, i.e. via the used bus system.

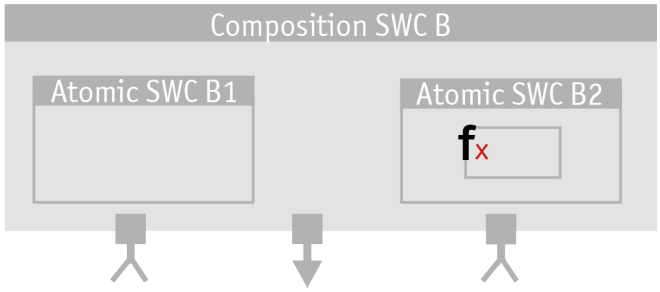
In the last transition towards the ECU sight, the BSW is put in between the software components and the hardware. And this is the starting point for the ECU development.


Creation of Software Components
Atomic SWC A
Composition SWC B
Atomic SWC B1
Atomic SWC B2
Atomic SWC C
Virtual Function Bus (VFB)
Mapping of SWC A and SWC B to ECU 1
Mapping of SWC C to ECU 2
Software Components and ECUs
ECU 1
ECU 2
Bus
Assign Runnable to Tasks (Task Mapping)
Service Components (Service Mapping)
BSW - Basis Software modules
Flattening
Development of ONE ECU
MICROSAR RTE
MICROSAR BSW

The following sub chapters explain all the means that belong to AUTOSAR and that make it work.

1.1 Software Component

Software Components are described by their SWC file - a file in XML format. By definition SWC files are independent from any ECU except for the sensor and actuator software components. Those software components are dependent on the sensors and actuators attached to a specific ECU.



There are several kinds of software components

1.1.1 Atomic components

- Application
- Sensor Actuator
- Calibration
- I/O Hardware Abstraction
- Complex Driver
- Application (End-to-end Protection)
- Non-Volatile Memory Block
- Service components

1.1.2 Compositions

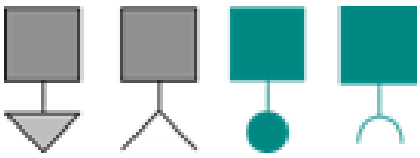
Use compositions to group software components.

1.2 Runnables

A runnable entity, runnable for short, is a C function that carries your code. It depends on the configuration of the runnable when it is called and what data your code is allowed to access within the runnable. Runnables are triggered by the RTE.

1.3 Ports

Via ports, a software component can communicate with its outside world. This outside world can be another software component within the same ECU or a software component within another ECU. There are several kinds of ports:



1.3.1 Application Port Interfaces

To communicate between different SWCs

- Sender port
- Receiver port
- Client port
- Server port
- Calibration port
- Mode port
- Interface to non-volatile data

1.3.2 Service Port Interfaces

To communicate between BSW and SWCs

- Sender port
- Receiver port
- Client port
- Server port
- Calibration port
- Mode port
- Interface to non-volatile data
- NV Data Interface

1.4 Data Element Types

Data elements types determine the kind of data that can pass a port. There are predefined data element types and you can define data elements on your own.

1.5 Connections

To define which software components communicate with each other, their ports have to be connected via so-called connectors. The connectors realize the sender/receiver and client/server communication between the software components. A connector can only be drawn between two ports, if their port interfaces are compatible.

1.6 RTE

The RTE is the interface between the SWCs and the BSW. In essence the RTE

- controls the execution of the Runnables (your code),
- controls access of Runnables to the basic software modules,
- controls the access of Runnables to Services of the BSW,
- knows about external and internal transmission of data and
- provides data consistency

1.7 BSW – Basic Software Modules

The BSW contains configurable modules that offer services to the SWCs dealing with:

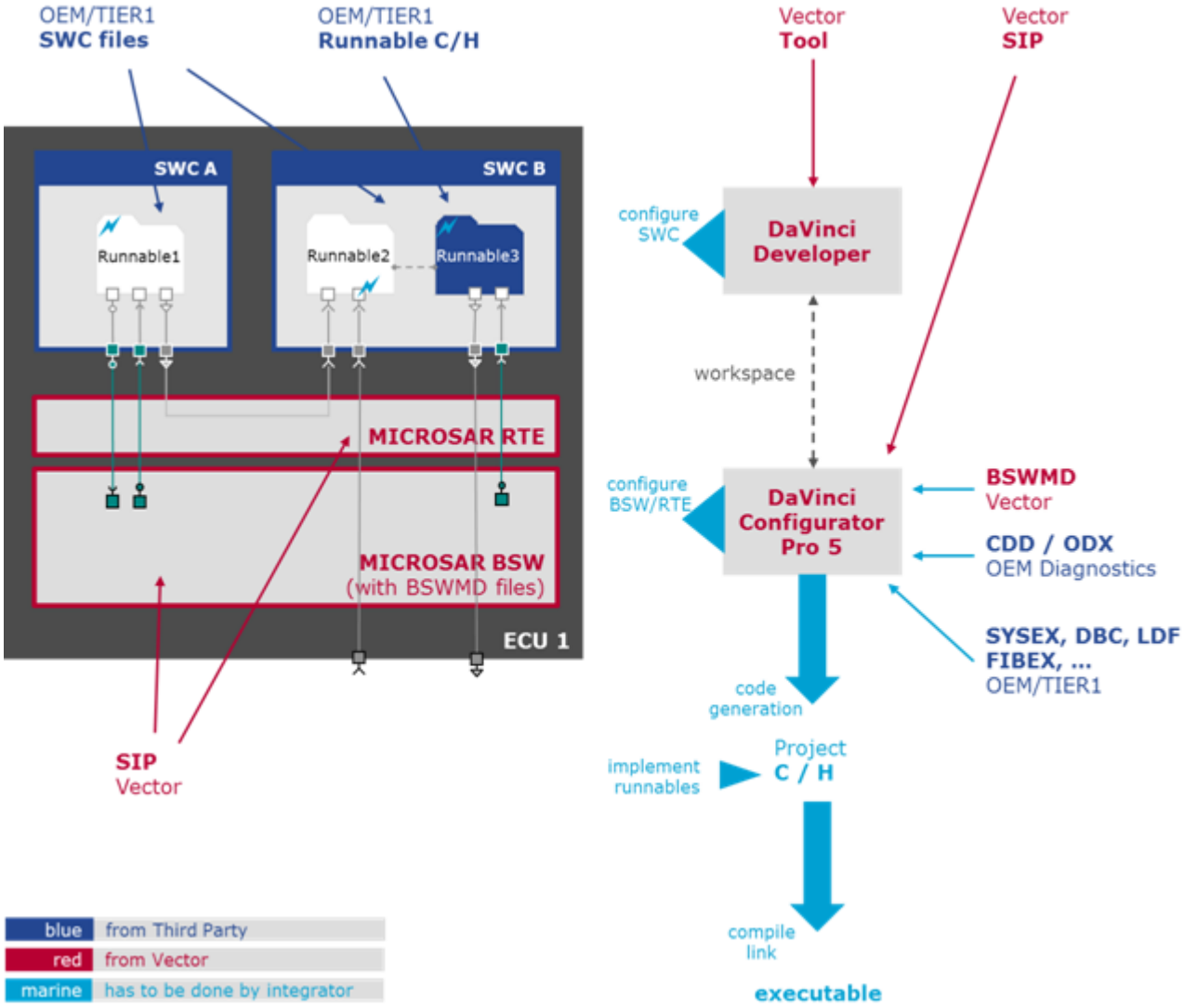
- Communication
- Diagnostics
- Mode management
- Memory management
- Network management

1.8 Software, Tools and Files

When setting up a new project using the DaVinci Configurator Pro, many things that are not necessary to know for your basic work with the tool happen in the background. But sometimes it might be necessary to know more. Then this part of the document is the place to get a deeper insight.

This chapter gives you an overview what kind of files you need to set up a new project, where the files normally come from and how to work with the DaVinci Configurator Pro and, if necessary for software component design, with DaVinci Developer. Get familiar with what is installed where and how to work with it and to know, how to update if necessary.

Starting point is the development of a single ECU. The focus is set on the MICROSAR Solution and where all the necessary software and files do come from.



To build up a project according AUTOSAR with MICROSAR from Vector you need the following tool(s), software and files:

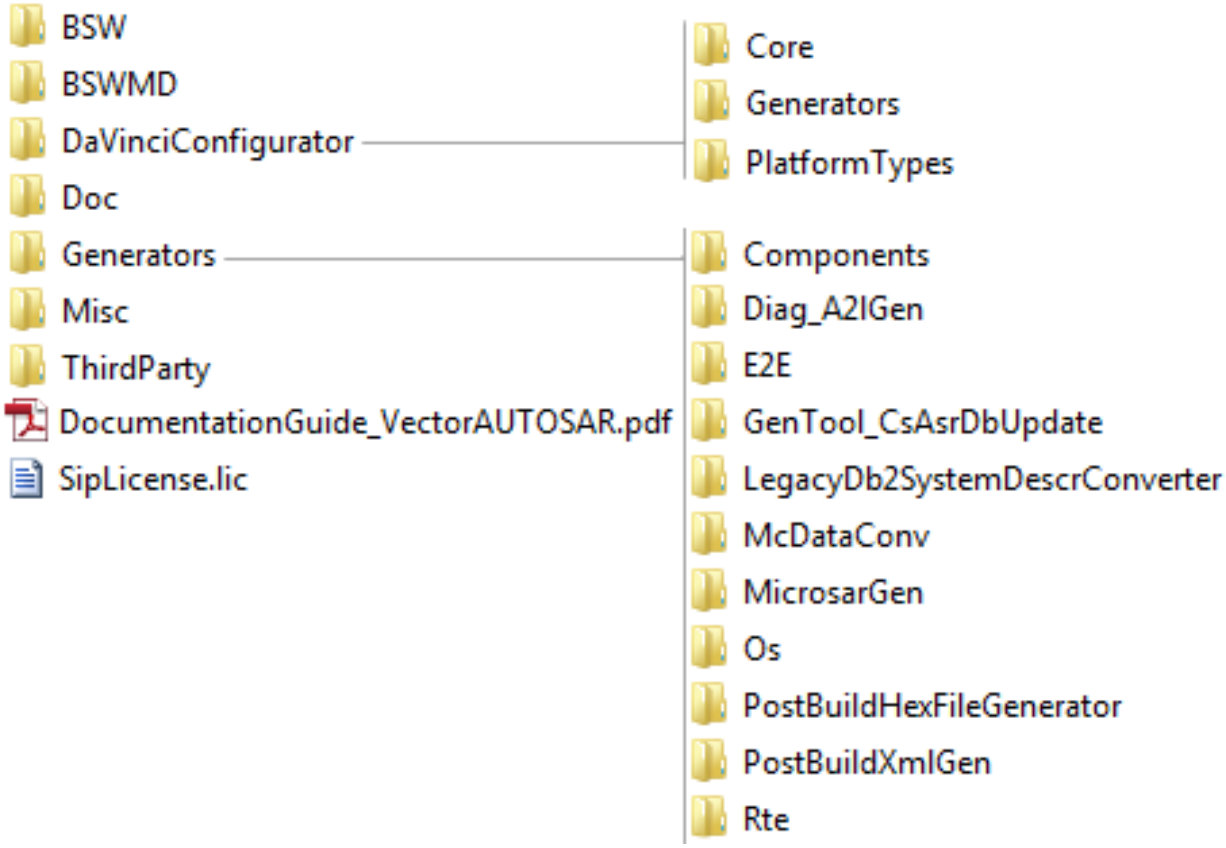
- **Software Components (SWC) and Runnables**
  Software components are created by the OEM or the TIER1. A software component can be an SWC file, where you have to perform the task mapping and decide about runnables and the code they should contain. Or the software component is delivered ready-made, together with C and H files. Then you only have to map it to a task and compile and link the files together with your project.
- **DaVinci Developer (Vector Tool, has to be ordered separately - NOT included within the SIP)**
  The DaVinci Developer is the Vector Tool to create and configure Software Components. Via a graphical view you can draw software components, add ports, draw connections, etc. DaVinci Developer and DaVinci Configurator Pro exchange information via the DaVinci Developer Workspace.

> **BSW and RTE (included in SIP)**
The BSW modules together with their BSWMD files (dependent on your order) and the RTE are part of the Vector delivery that is called SIP. **SIP** stands for **Software Integration Package**. A SIP is a ready-made software from Vector, already tailored and tested for your hardware, derivative, compiler, compiler version (as you filled-out the questionnaire) and can be put to work within a few steps (see step by step description).

> **DaVinci Configurator Pro (included in SIP)**
The DaVinci Configurator Pro is the Vector Tool to configure the BSW and the RTE. It is part of the SIP delivery. It contains a comfort editor to configure the BSW cluster-oriented, a powerful validation concept to check your settings against constraints and it also offers to directly edit AUTOSAR parameters.

1.9 Structure of the SIP Folder

The screenshot below shows the file structure that is created by installation of the SIP.



> **BSW**
Contains the code files (*.C and *.H) files for each Basic Software Module (BSW).

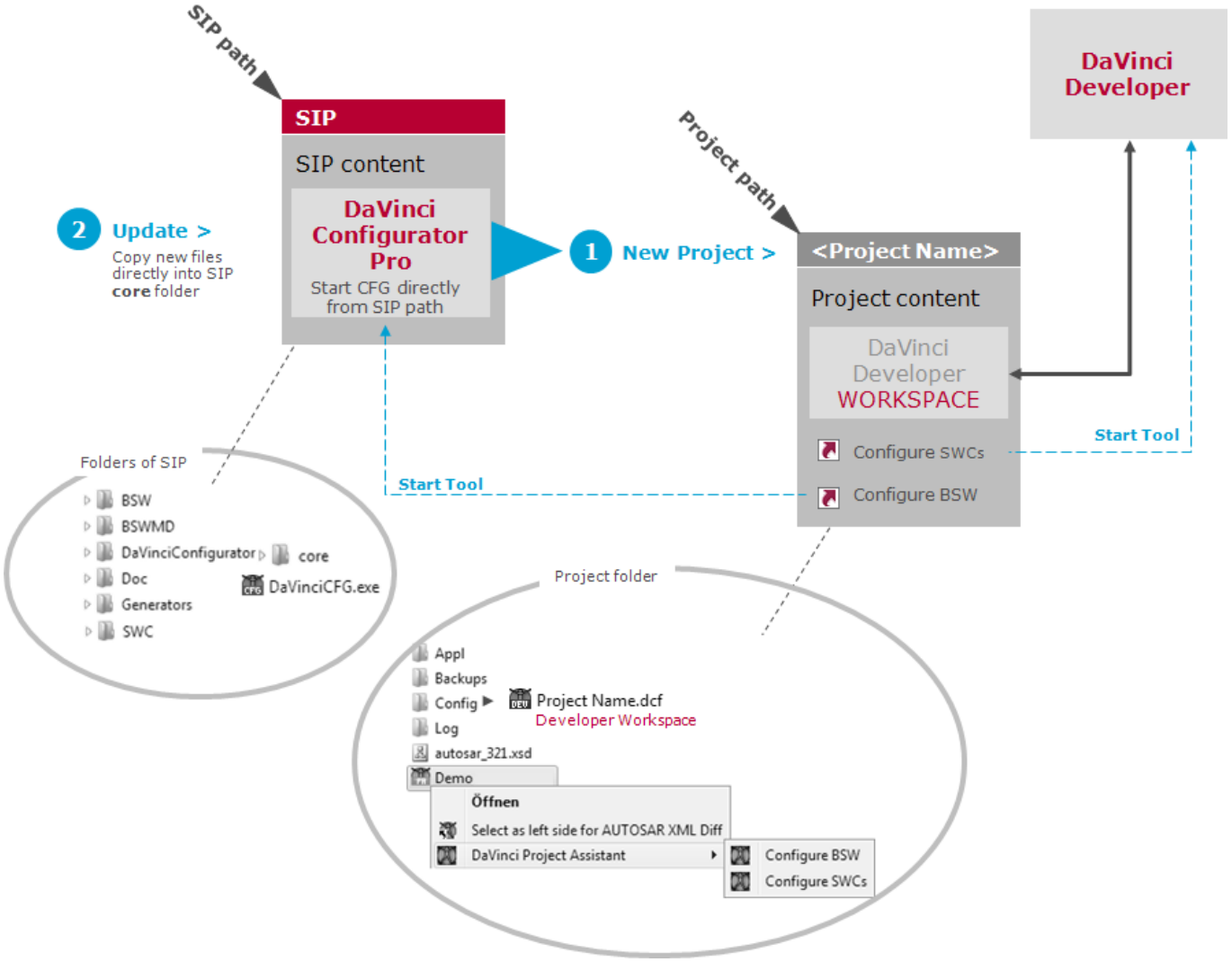
- **BSWMD**
  Contains the BSWMD files for each Basic Software Module, which include necessary information for DaVinci Configurator Pro.
- **DaVinciConfigurator**
  Contains the DaVinci Configurator Pro tool itself. This is also the place where your tool is updated when an update is available.
- **Doc**
  Contains SIP relevant documentation e.g. Technical References, User Manuals, Startups (containing Release Notes) and Application Notes.
- **Generators**
  Contains Generators and additional tools
- **Misc**
  Contains SIP-specific additional data
- **ThirdParty**
  Contains MCAL-specific data

Note

Each MCAL Module is listed within a separate folder (<MCAL Short Name>).

This folder includes:

- **\Supply**
  Location of the 3rd party MCAL delivery in its original structure
- **\VectorIntegration** (optional)
  Location of scripts for the integration into the MICROSAR SIP
- Legal notes (optional)



Vector MICROSAR for AUTOSAR 4 now has one major tool – the DaVinci Configurator Pro. DaVinci Configurator Pro is the starting point, coming with the SIP. To start the tool, use the file **DaVinciCFG.exe** located in the **CORE** folder of the DaVinci Configurator folder.

2 Set-Up New Project

The DaVinci Configurator Pro offers a Project Assistant to set up that helps you setting up a new project file in just a view steps. The assistant guides you through several windows to enter necessary project information.

The DaVinci Configurator Pro creates your new project to the defined folder. The project folder contains:

- **Appl** folder for generated files and source files.
- **Config** folder for software components, BSWMD files, ECUC files, System description and DaVinci Developer workspace
- **Backup** folder to store older DaVinci Developer workspaces
- **Log** folder
- Access to DaVinci Developer and DaVinci Configurator Pro via context menu on the *.**dpa file**.

Your development project consists of a folder structure on your disk, where all the configuration files, template files, etc. are generated to and where you implement your runnables using the empty runnable skeletons. Then you compile and link and get your executable that you can download to your hardware.

The DaVinci project file (DPA) is the central file which references all the related folders and files. It also references the SIP, which is used for the project.

2.1 DaVinci Configurator

As already mentioned the DaVinci Configurator Prois the major tool for Vector MICROSAR for AUTOSAR 4.

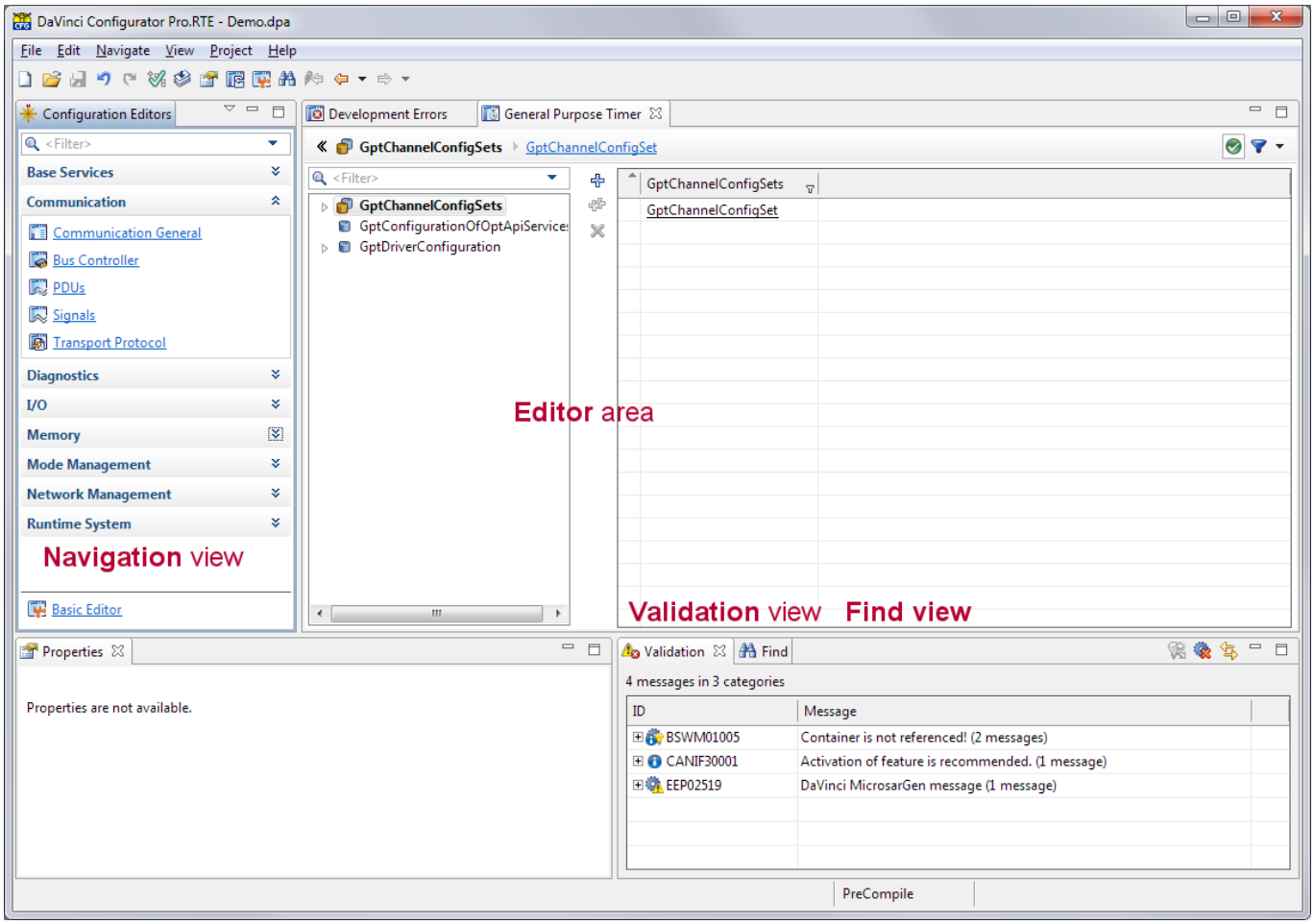
2.1.1 The Main Window of DaVinci Configurator Pro

The illustration below shows the main appearance of the DaVinci Configurator Pro. It consists of 3 main areas or views. The positions of the views can be defined manually and depend on your habits in handling with tools.

- Navigation view
- Editor Area
- Validation, Output and Properties view

Cross Reference

For more information about simple tool handling and icons refer to the help of the DaVinci Configurator Pro.



Navigation view
The Navigation view displays all available editors and assistants sorted by domain. What you select in the Navigation view will be displayed in the Editor view.

Editor area
The Editor area is the place to configure the modules or whatever you have selected in the Navigation view.

Validation view
The Validation view displays the overall list of validation messages. The messages are grouped by their ID. You may expand such a group to display all message of the same ID. By expanding an individual message, the related items are displayed as well as the proposed solutions, the so-called solving actions.

Using according commands in the shortcut menu you can navigate to the editors displaying the related items, or execute one of the proposed solutions for solving the problem.

You can use the Validation view with the following buttons:

> **Solve All** 
Calls the default solving action of all messages that provide a default solving action.

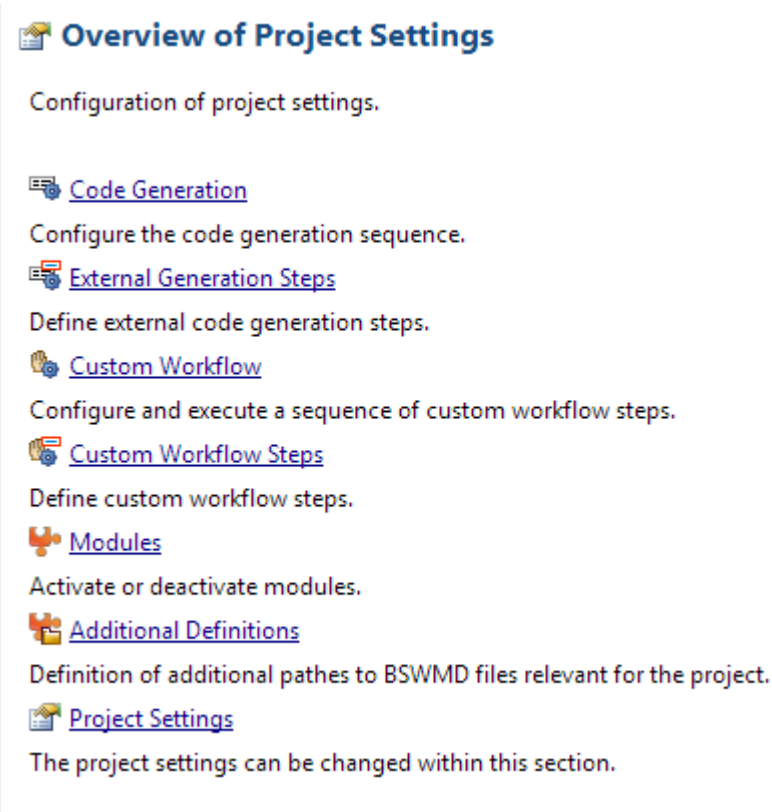
- **Clear On-Demand Validation Messages**
  Deletes all validation messages issued by the external generators during the on-demand validation.
- **Link with Editor**
  Filters the Validation View to display only messages related to the currently focused editor.

Properties view
The Properties view displays details of the object (parameter or container) selected in an editor. The view contains the following tabs:

- **Definition**: Displays the definition of the selected object
- **Status**: Displays information about the parameter state
- **Description**: Displays the description of the parameter definition

2.1.2 Project Settings

This Overview shows all necessary project data and enables the configuration of customer workflow steps, the definition of external configuration steps and the activation of additional BSW modules.



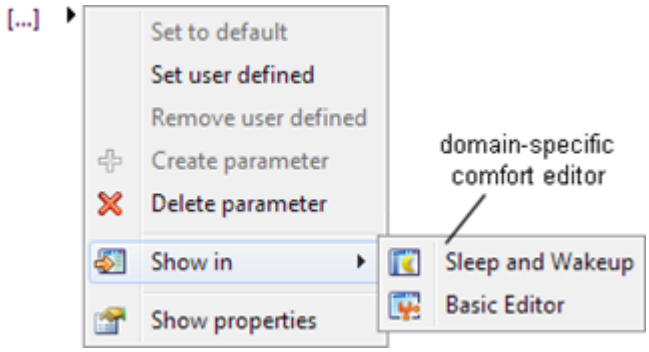
2.1.3 Editors and Assistants

Generally spoken there are two different configuration editor concepts in the DaVinci Configurator Pro.

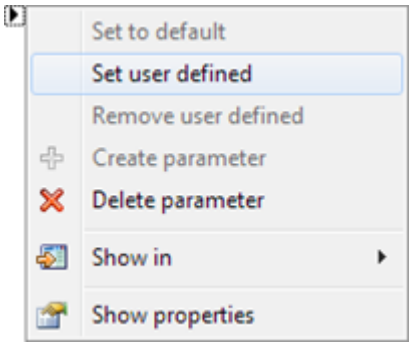
- **Domain-specific** configuration editors, which provide an optimized view on the ECUC
- **Basic** Editor, which provides a native view on the ECUC

Assistants
An assistants guides you through special tasks like connections, data mapping, memory mapping or task mapping.

Switch Between the Two Editors
You can switch from the basic editor to the domain-specific comfort editor and back. Move to a setting or a value and click the little triangle to open the context menu. If there is a pendant in the other configuration editor, you can switch from one to the other via **Show in**.



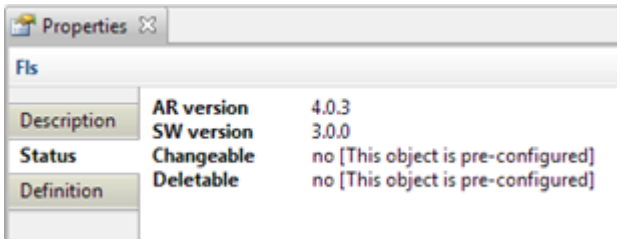
Set User Defined
It is very important to understand that you are responsible for these modifications! With **Set user defined** you can change values even when they are grayed because their values are derived from the input files or locked by a configuration dependency.



When you use **Set user defined**, the parameter will be marked with a little pin on the left side. The upper check box in the example below is marked as user defined, the lower one is not.

Note

Set user defined will not work for pre-configured parameters. The setting in the context menu is grayed and cannot be used. The information about predefined or not can be seen in the **Properties** view. Select **Status** and look at **Changeable** or **Deletable**.



Remove user defined

To set back the user defined status, use the context menu and select **Remove user defined.**

Note

Every parameter set to user defined will provoke a warning during validation with the information, that this parameter was set to be user defined.

Caution!

The feature **set user defined** enables settings that are terribly wrong. As soon as you use this feature, you have to be sure that you know what you do and you have the complete responsibility.

3 Define Project Settings

Your first steps after the new project is set up, are:

- Define Input files
- Define your specific workflow steps and external generation steps (if needed)
- Activate all necessary BSWs

3.1 Input files

The DaVinci Configurator Pro needs information about your system, the bus communication, etc. This information is stored in the SYSEX or when using legacy file formats dependent on the bus system, in the **DBC**,**LDF**or **FIBEX** files. One or more (e.g. for systems with multiple channels) of these files must be given to the DaVinci Configurator as input files.

The necessary diagnostic information is stored in **CDD** or **ODX** files and is also needed by the DaVinci Configurator Pro.

3.1.1 System Description Files

You need one of the following description files:

3.1.2 SYSEX

ECU-specific extract of the System Description. This file is typically provided to the TIER1 by the OEM. It contains

- ECU composition
- Atomic SWCs
- Compositions
- Communication
- Data mapping
- typically NO service SWCs

3.1.3 ECUEX

Base for the ECU development is the ECU Extract of System Description, ECUEX for short. It is created from the SYSEX by flattening the SWC architecture. This means that SWC compositions have been removed, only the atomic SWCs are left. And they now communicate directly with each other. Additionally to the SYSEX, the ECUEX contains:

- Service SWCs
- Service mapping, i.e. service connections between the ports of the SWCS and the ports of the service SWCs.

3.1.4 Legacy Data Base files (DBC, LDF, FIBEX, ...)

The legacy data base files are normally not in ARXML format. They also contain information about ECUCs, messages, signals, attributes, etc. Good AUTOSAR tools can read them and convert their information into AUTOSAR-conform notation. The missing information when using legacy file formats

must be given to the configuration tool by the software developer.

3.1.5 Diagnostic Data Files

Your Project uses Diagnostic? Therefore you need one of the following diagnostic description files:

3.1.6 CDD / ODX

These files contain the diagnostic description for the ECU.

- ***.CDD**
  The CANdelaStudio Document (*.cdd) format is specified by Vector for describing the diagnostic feature set of an ECU.
- ***.ODX/*.PDX**
  ODX (Open Diagnostic Data Exchange) is an ASAM standard which defines a unique, open XML exchange format for diagnostic data. A packaged ODX file (*.PDX) comprises all files of an ODX project.

3.1.7 State Description

Diagnostic session and security level management is modeled as a state machine which describes the transitions between sessions and states triggered by the execution of diagnostic services.

If a CANdela Document (*.CDD) is used as diagnostic description file, all diagnostic session and security level related information will be imported from the input file.

If a Packaged ODX file (*.PDX) is used as diagnostic description file, it will depend on the used ODX version if an additional state description is required.

- **ODX 2.2.0**
  For ODX 2.2.0, the state machines are defined within the ODX file, using the data model intended for this purpose.
- **ODX 2.0.1**
  As ODX 2.0.1 does not provide means to explicitly model diagnostic sessions, security levels and their corresponding transitions, dedicated SDGs (special data groups) are used to annotate the ODX data with supplemental information about the diagnostic session behavior. This information is not sufficient in all cases and an additional state description will be mandatory to augment the ODX data with the required information during the import of the diagnostic description.

A state description is a *.CSV (comma separated values) file which defines the transition matrices of the diagnostic session and security level state machines.

3.1.8 Standard Configuration Files

In some cases a OEM-specific preconfiguration is necessary, therefore additional Standard Configuration Files provided by your OEM are necessary. Add fragments of ECUC modules which will be used as project specific mandatory configuration.

3.2 Custom Workflow Steps / External Generation Steps

In STEP7 Code Generation on page 62, after the configuration, DaVinci Configurator Pro generates code. You can additionally let DaVinci Configurator Pro call any external tool during this step in a free configurable order. If something is to be done before code generation, if you use some command line

tools or whatever, add these tools to the list and define the call order. With STEP7 Code Generation on page 62, all your mentioned tools will be also called.

3.3 Activate BSW

Which modules are activated and which are not depends on the information in the input files. Activate or deactivate the modules.

4 Validation

Nothing done but imported some files and already many mistakes in the configuration? Why is that?

The DaVinci Configurator Pro provides powerful validation routines that run in the background named **Live Validation**. At start-up of your project, there is only the information from the input files of STEP2 Define Project Settings on page 24. The content of these input files normally has leaks, sometimes errors or the information of the system is still missing and has to be accomplished during configuration. This all leads to a number of errors detected by the validator of DaVinci Configurator Pro. But with the powerful solving algorithms and assistants, it is very easy to solve off the first warnings and errors.

4.1 Validation Concept

The validation concept comprises:

- Detailed validation of the ECU configuration
- Comprehensive set of domain-specific validation rules
- Navigation from validation message to the editors
- Tool makes proposal for solving an error (solving actions)
- Automatic consistency (auto-solving action) after changing the configuration via Comfort Editors or via the Basic Editor

Live Validation 

The Live Validation is performed in the background after loading a project or after changing the configuration. The Live Validation directly gives feedback after entering wrong values.

On-Demand Validation 

This validation is performed when you start a generation process. You can start the validation via **Project | on-demand validation**. The on demand validation will also launch external generators or execute more complex validation tasks that cannot be executed live.

Note

The result of a validation is displayed in the **Validation View**.

5 BSW Configuration With Configuration Editors

5.1 DaVinci Configurator Pro Editors

To configure the BSW modules you can use the **Basic Editor** or the more comfortable and cluster-specific **Configuration Editors**.

Basic Editor 

The Basic Editor is a generic configuration editor (GCE) and includes the native view of the ECU configuration. It is based on the basic software module description (BSWMD) format and displays all modules of the ECU configuration.

Configuration Editors 

The Configuration Editors offer a use-case oriented view of the ECU configuration. They are optimized for displaying or configuring those parts of the ECU configuration, which are related to the use case.

Use the Configuration Editor first. To get the necessary settings for your fist step in dependency of your OEM and its use cases refer to Start Configuration with Configuration Editors of the step by step description.

6 Software Component (SWC) Design

6.1 Data Exchange between DaVinci Developer and DaVinci Configurator Pro

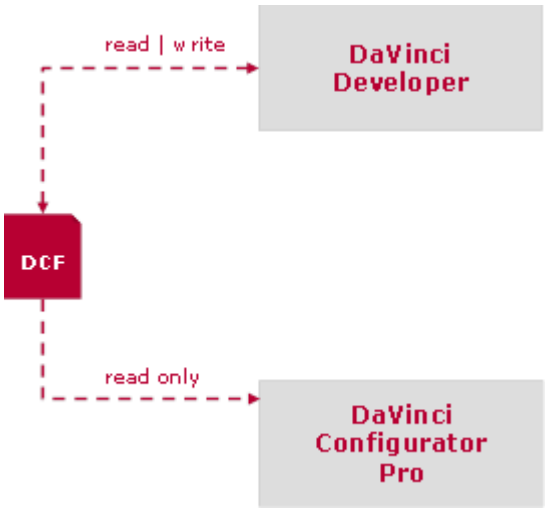
The data exchange between DaVinci Developer and DaVinci Configurator Pro is done via the DaVinci Developer workspace, file with **DCF** format.

DaVinci Developer uses this file to store the complete project information. It can read and write this file.

DaVinci Configurator Pro only reads this file and only at tool start-up.

Note

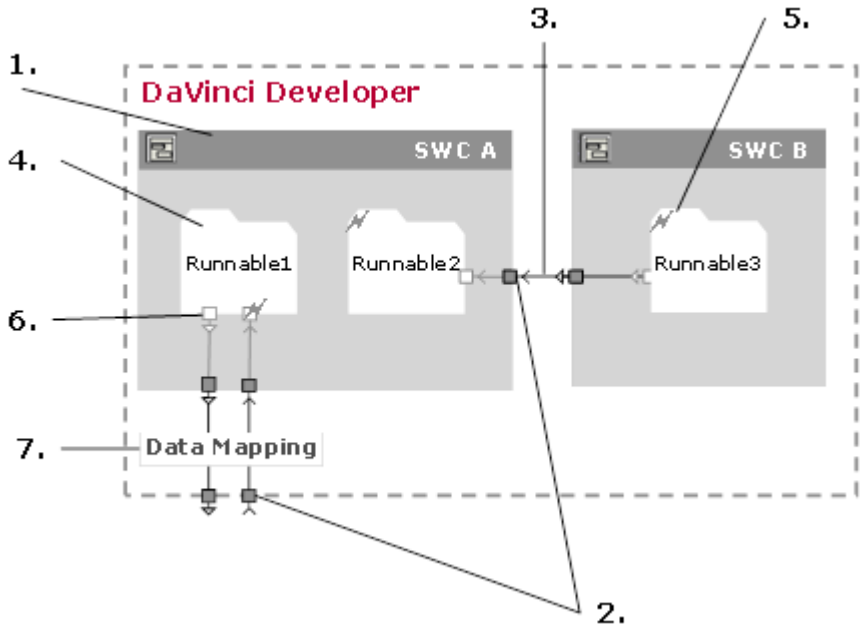
Please re-open the DaVinci Configurator Pro if you have changed the DCF file via the DaVinci Developer to get the current data from the DCF file.



Keep in mind that the DaVinci Configurator Pro is not able to write to DCF file.

6.2 About Application Components, Ports, Connections, Runnables and More...

Learn all about application components, ports, connection and runnables, how they work and how to exchange information between application components.



1. Application Components
2. Ports, Port Init Values and Data Elements
3. Connections
4. Runnables
5. Triggers
6. Port Access
7. Data Mapping

Cross Reference

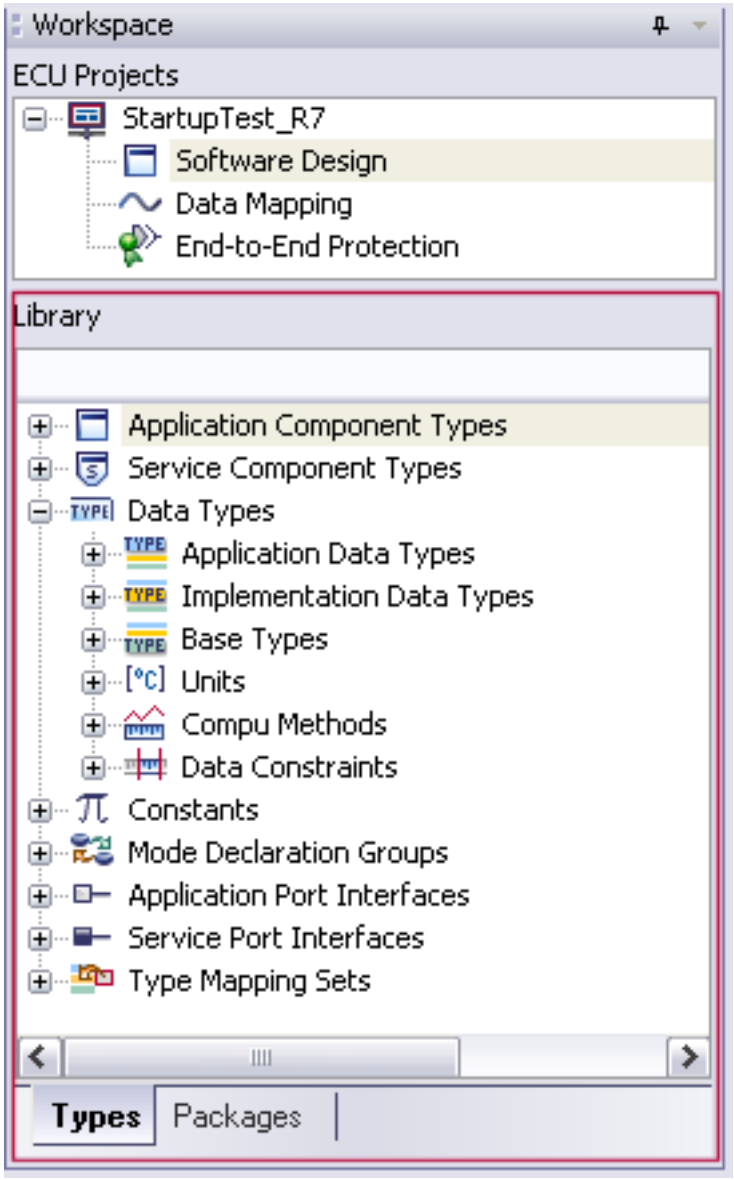
To get basic tool handling information, refer to the online help of the DaVinci Developer.

6.3 Application Components

To create application components use the DaVinci Developer.

6.3.1 The Library – Type and Package

You find the Library of the DaVinci Developer (in standard configuration) below the ECU Projects.



Types or Package?

The Library you use in the following steps can basically be used in two ways.

> Type-oriented
> Package-oriented

The type-oriented workflow is shown in the following steps. But you can also choose the package-oriented one. This concept will now be described briefly.

Packages

With Packages you can pack elements together like:

> Application Component Types
> Service Component Types

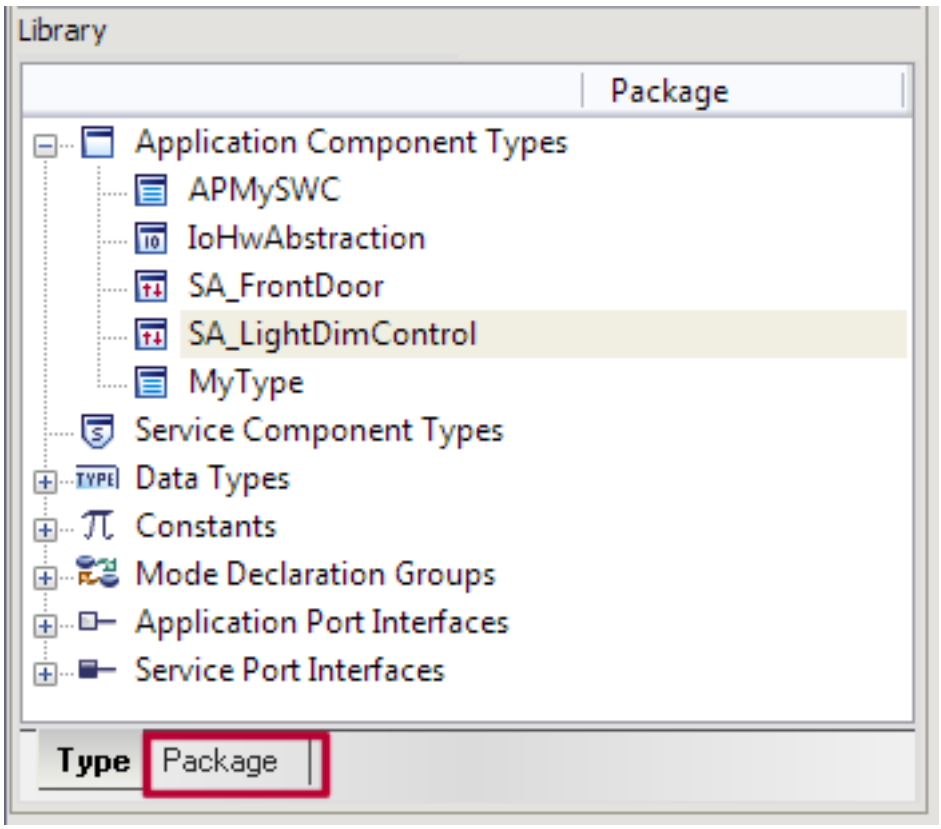
- Data Types
- Constants
- Mode Declaration Groups
- Application Port Interfaces
- Service Port Interfaces

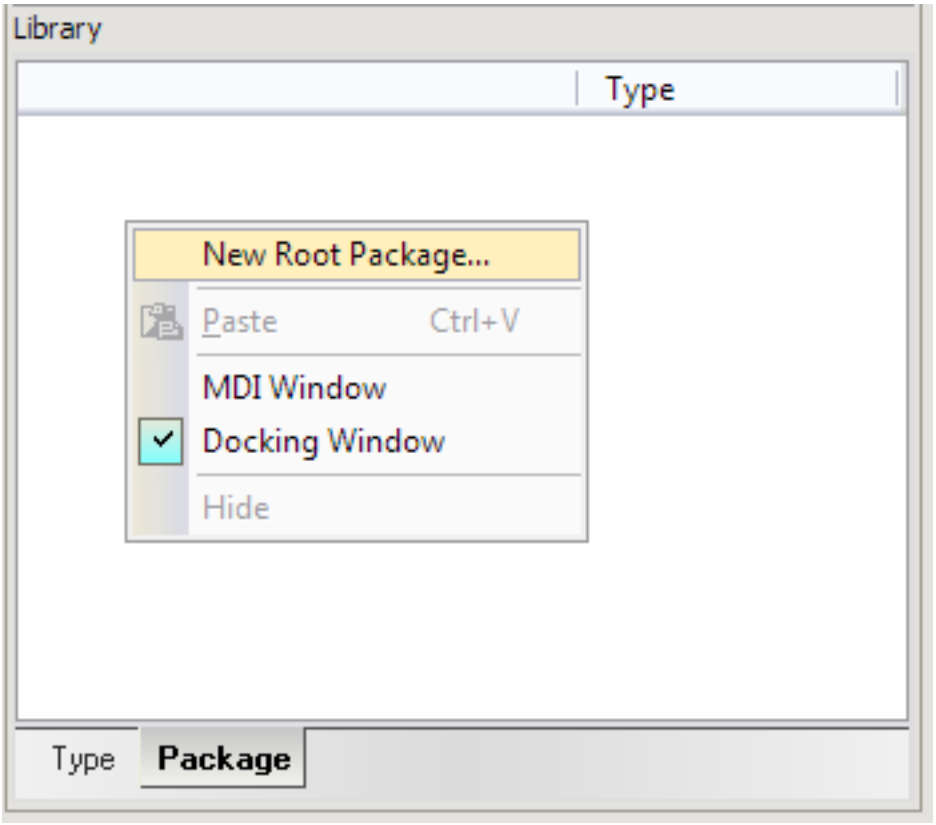
It is like a kind of grouping with its own name space. A name of an object has to be unique within a package but can be used more than once within the project.

These packages can be exported and imported for round-tripping with other tools also supporting the packages.

Switch to package view

At the bottom of the Library you can select Type view or Package view. Select the Package.
You need a Root Package first. Create it via right-click in the empty Package view.

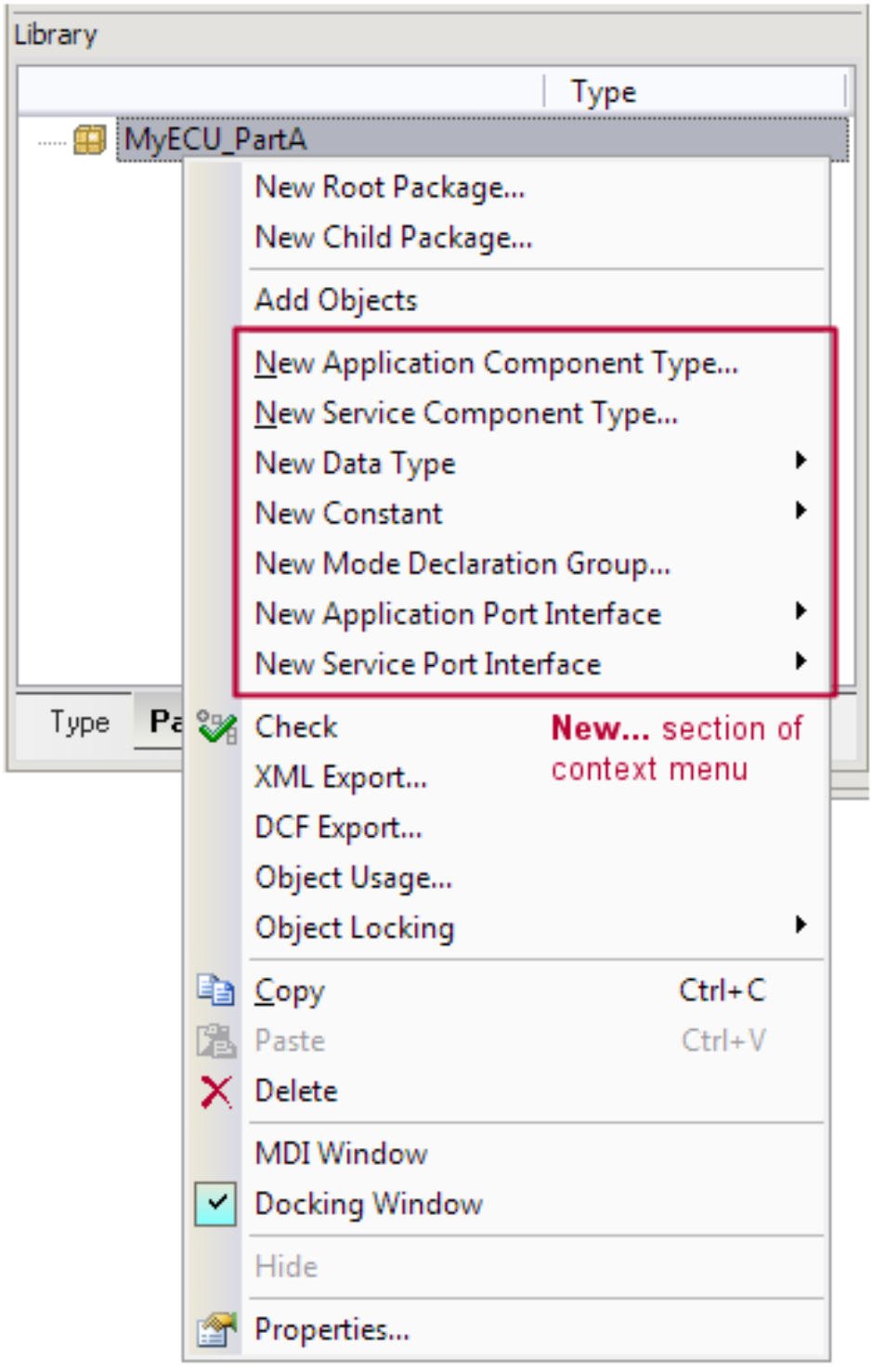




New Child Package...

Then right-click the root (e.g. MyECU_PartA) and you will get to the context menu. Use New Child Package to nest the packages or you put the objects plain below the root package.

The context menu for the packages



Add Objects

Via Add Objects you open a window to select and add already existing object to your package.

New ...

The section New… of the context menu comprises all available objects which you can also create via the Type view of the Library (explained in the following chapter).

XML Export..., DCF Export...

Export your package as XML file or as DCF file.

Object Usage...

Shows dependencies between used objects in a tree-view.

Object Locking APMySWC

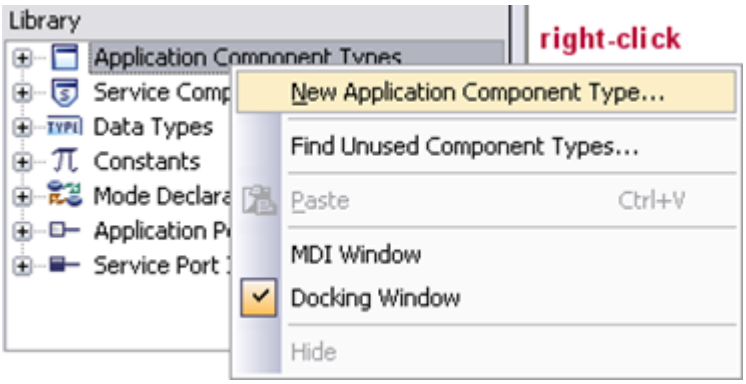
Objects can be locked and unlocked. A locked object is displayed with a little lock. Locked objects cannot be deleted without being unlocked before.

Define new Component Types in the Library

Right-click on Application Component Types in the Library and select New Application Component Type.

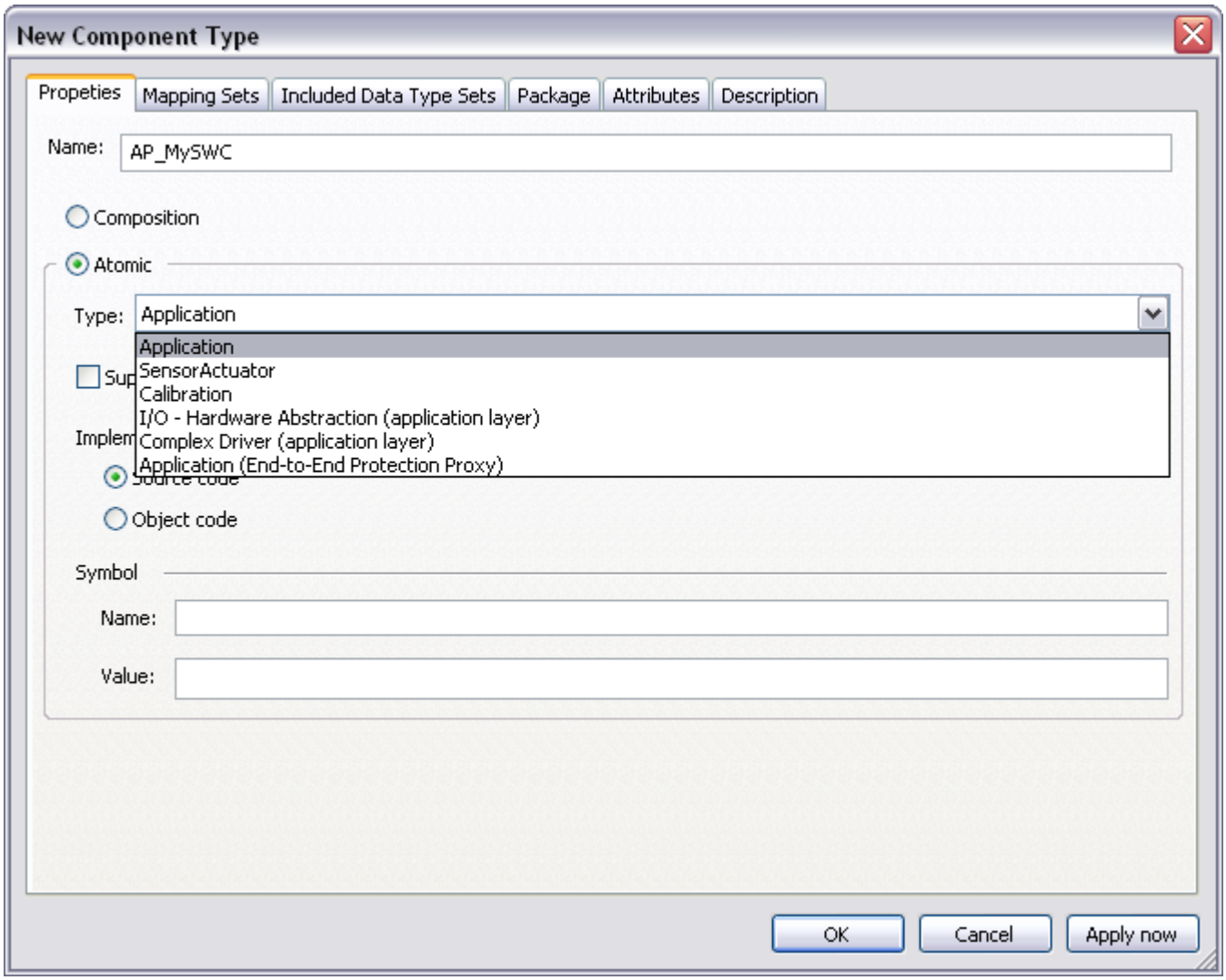
6.3.2 New Application Components

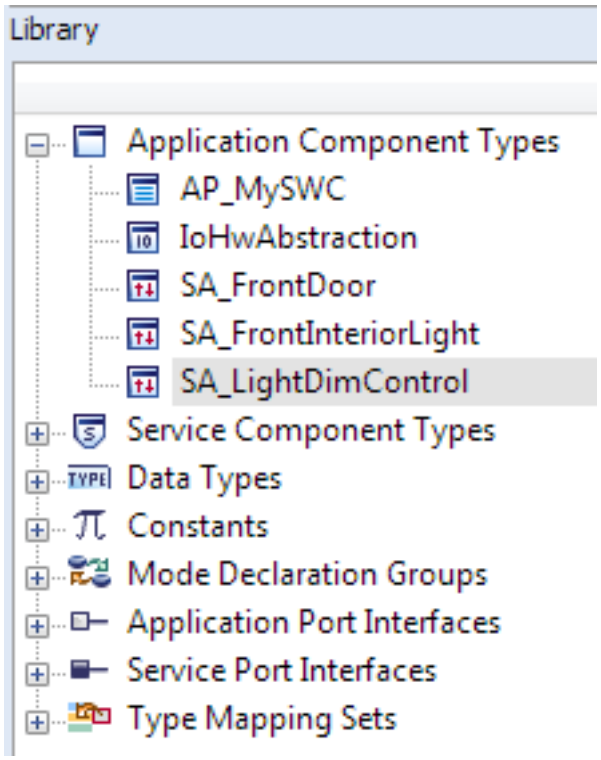
Right-click on Application Component Types in the Library and select New Application Component Type.



It is good to give a speaking name to see what kind of component it is. e.g. AP – Application, SA – Sensor / Actuator

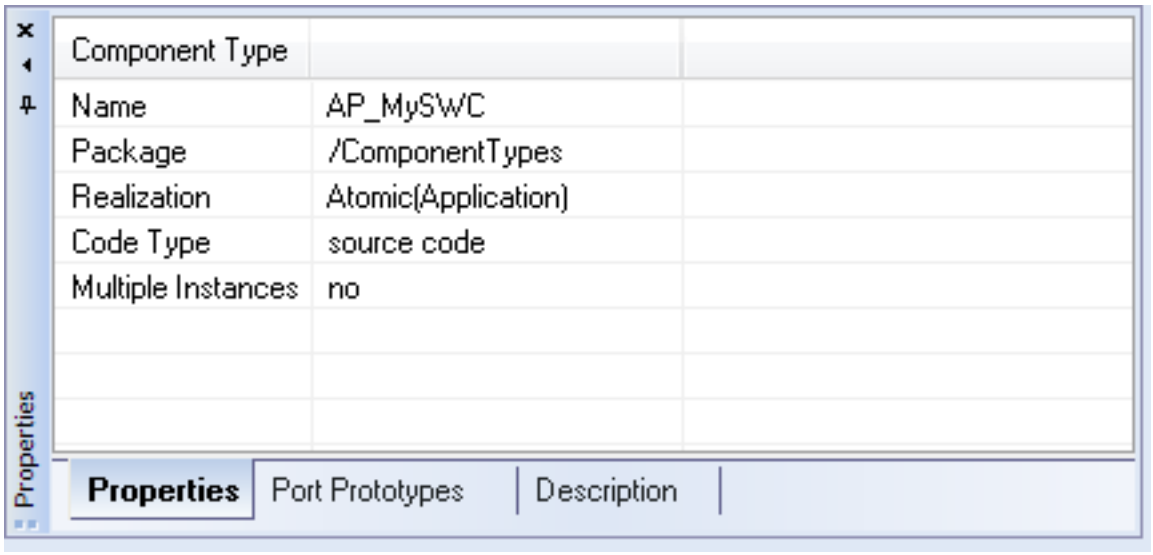
Enter a Name for the Application Component Type. Select Composition if the SWC should contain other SWC or select Atomic. Select its Type and confirm with [OK]. All application software component types are displayed in the library.


New Component Type
Propeties
Mapping Sets
Included Data Type Sets
Package
Attributes
Description
Name:
AP_MySWC
Composition
Atomic
Type:
Application
Application
SensorActuator
Calibration
I/O - Hardware Abstraction (application layer)
Complex Driver (application layer)
Application (End-to-End Protection Proxy)
Object code
Symbol
Name:
Value:
OK
Cancel
Apply now


Library
Application Component Types
AP_MySWC
IoHwAbstraction
SA_FrontDoor
SA_FrontInteriorLight
SA_LightDimControl
Service Component Types
Data Types
Constants
Mode Declaration Groups
Application Port Interfaces
Service Port Interfaces
Type Mapping Sets

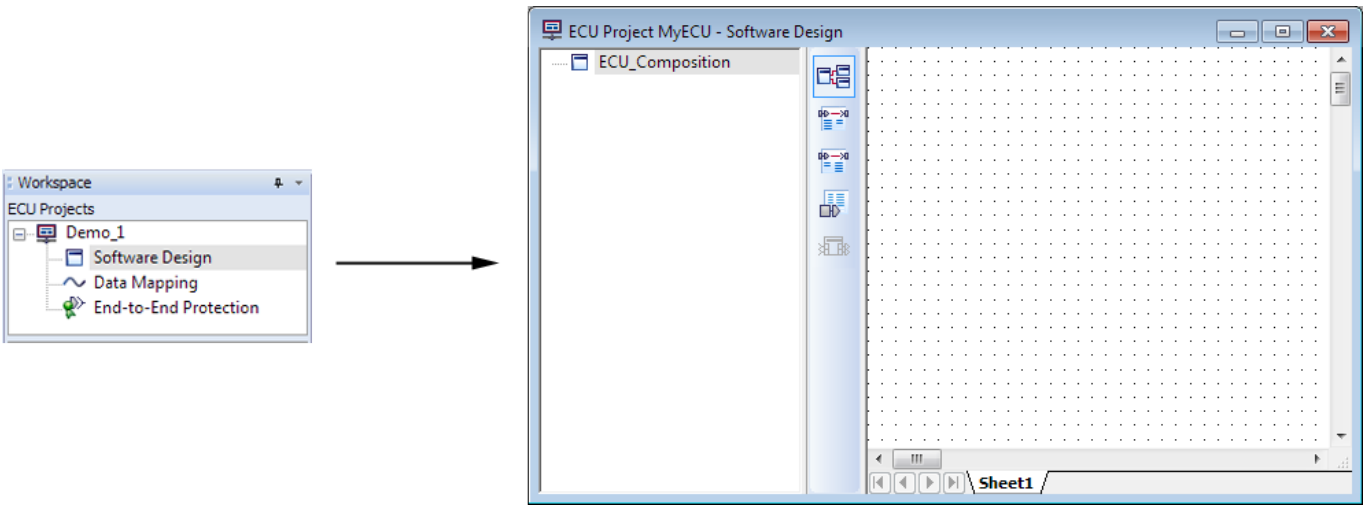
Note

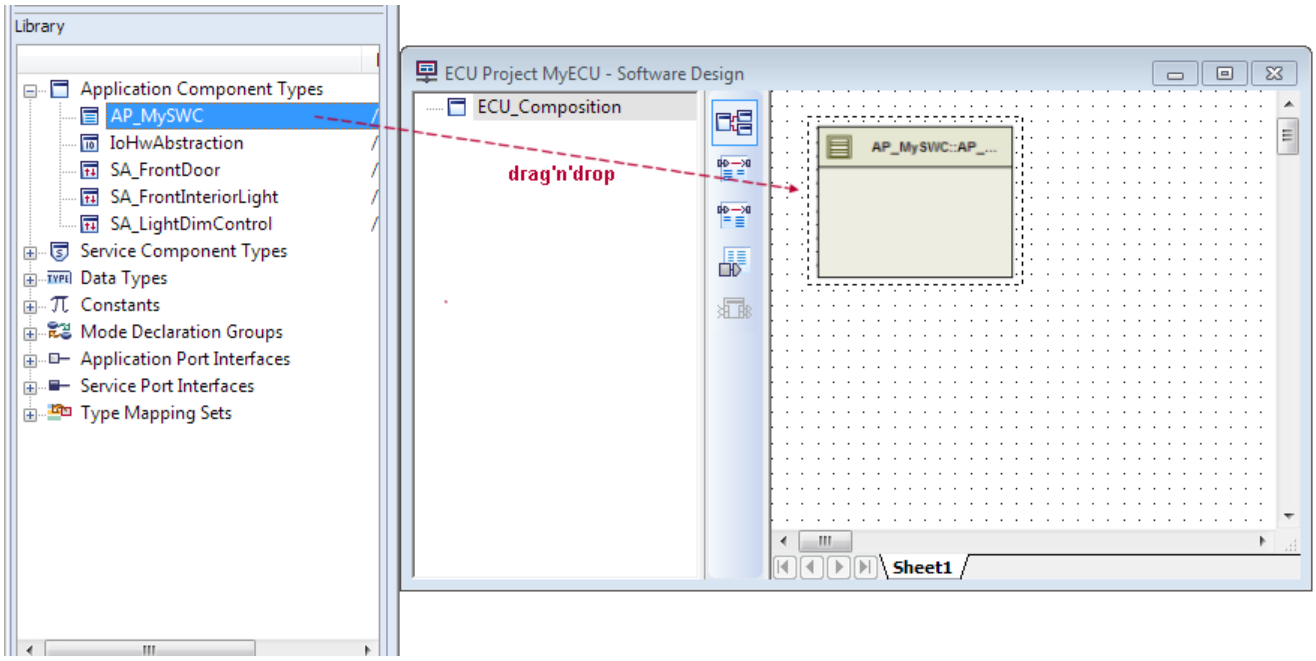
To get fast information about any element in the library just select one and see its Properties, Port Prototypes (if available) and Description in the Properties view (bottom left).



Component types become component prototypes by being used.

Double-click Software Design in the ECU Projects view to open the Software Design view for your ECU project (e.g. MyECU).





Note

In the graphical representation of an application component prototype you can change its size using the little squares shown at the angles and in the middle of the sides.

An application component type becomes an application component prototype when it is used. It also needs a name. Using drag'n'drop, both names are the same. Open the properties window from the context menu for a component prototype to change the prototype name.

Define and use as many application software components as you need for your ECU.

Note

The notation of the software component starts with the software component prototype followed by the software component type.

6.3.3 Understand Types, Prototypes and Interfaces

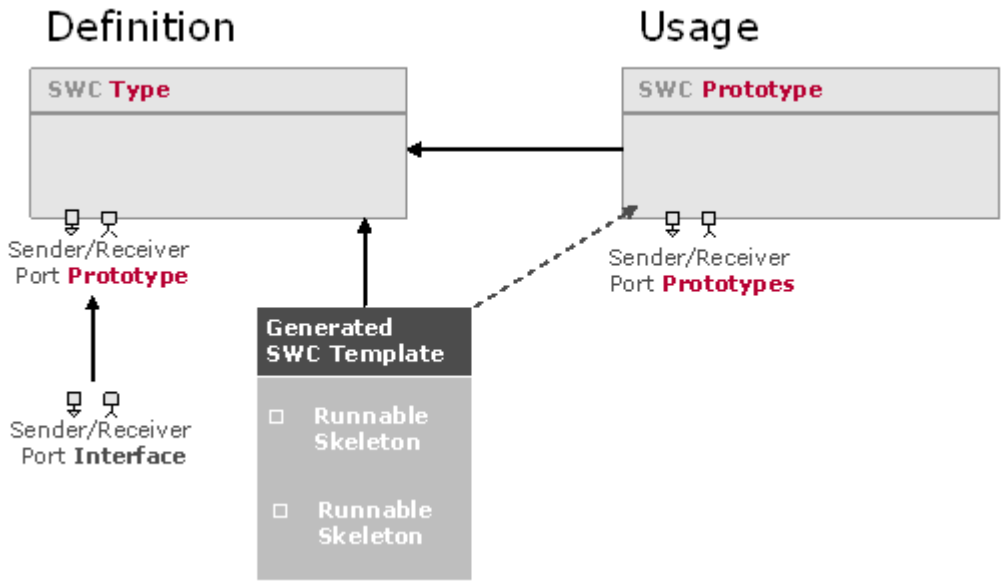
This illustration will help you to understand working with the DaVinci Developer. You have to deal with

- Prototype
- Type
- Interface

When is a software component a software component type, when a software component prototype? When is a port a port interface, when a port prototype?

In the library, the software components are types, the ports are interfaces. As soon as you use them, they become prototypes.

- Port Interface used by a component type ➔ Port Prototype
- Component Type in library used in software design view ➔Component Prototype



Runnables are always connected to the component type.

6.4 Ports, Port Init Values and Data Elements

To communicate and to exchange information the components need so-called ports (S/R ports).

For communication between software component ports have to be defined.

There are different kinds of application/service ports,

- **Sender Ports** to provide information
- **Receiver Ports** to receive information
- **Sender/Receiver Ports** to provide and receive information within one port
- **Server Ports** to provide services (operations)
- **Client Ports** to use services (operations)

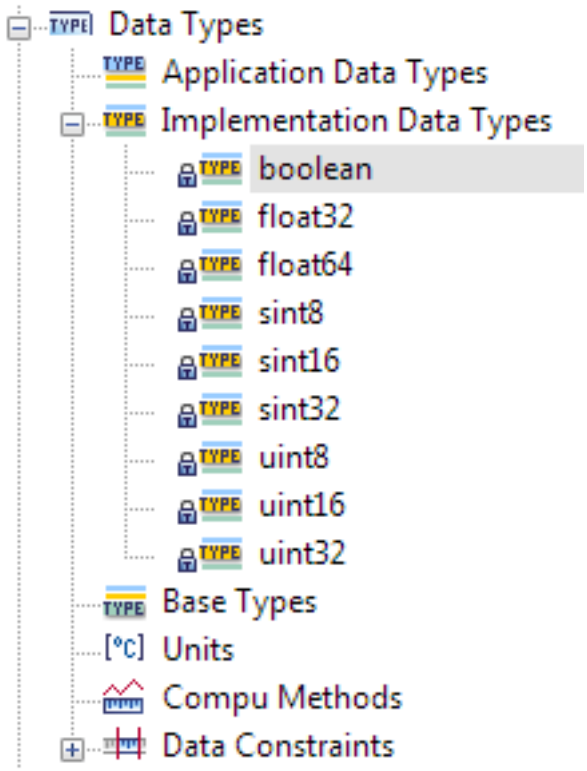
The following ports are listed here for completeness.

- Calibration Ports to hand over calibration parameters
- Mode Ports to e.g. trigger or not trigger runnables within certain modes

Before you can use application ports you have to define application port interfaces. To completely define the port interfaces you have to define data types first, if you don't want to use the predefined ones.

Predefined data types in library

Just right-click and select from the list.

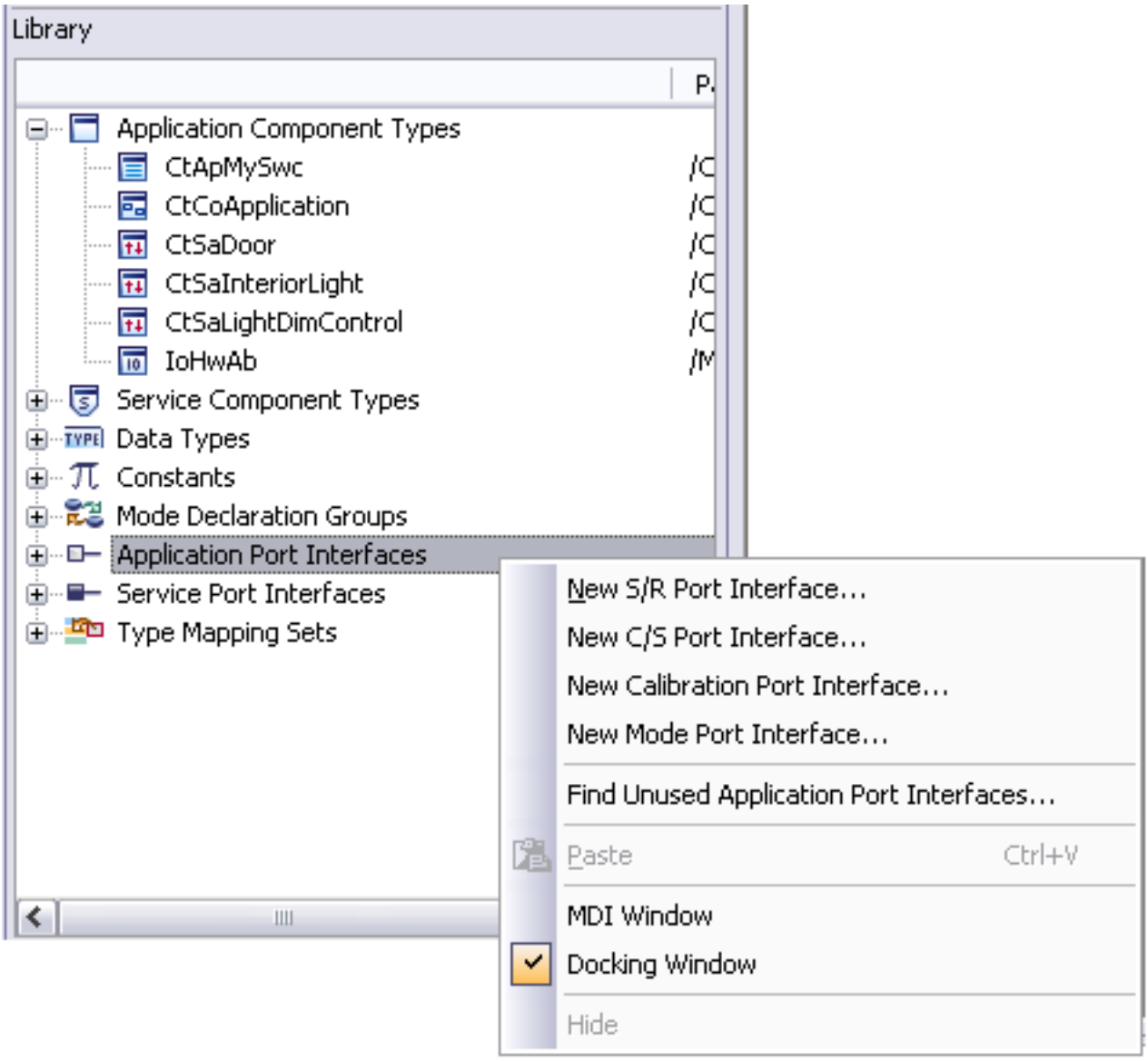


Caution!

You can handle application port interfaces like application component types. Define the application port interfaces in the library and then use them as application port prototypes for each application component. The same applies for data types and data elements.

Create Port Interface

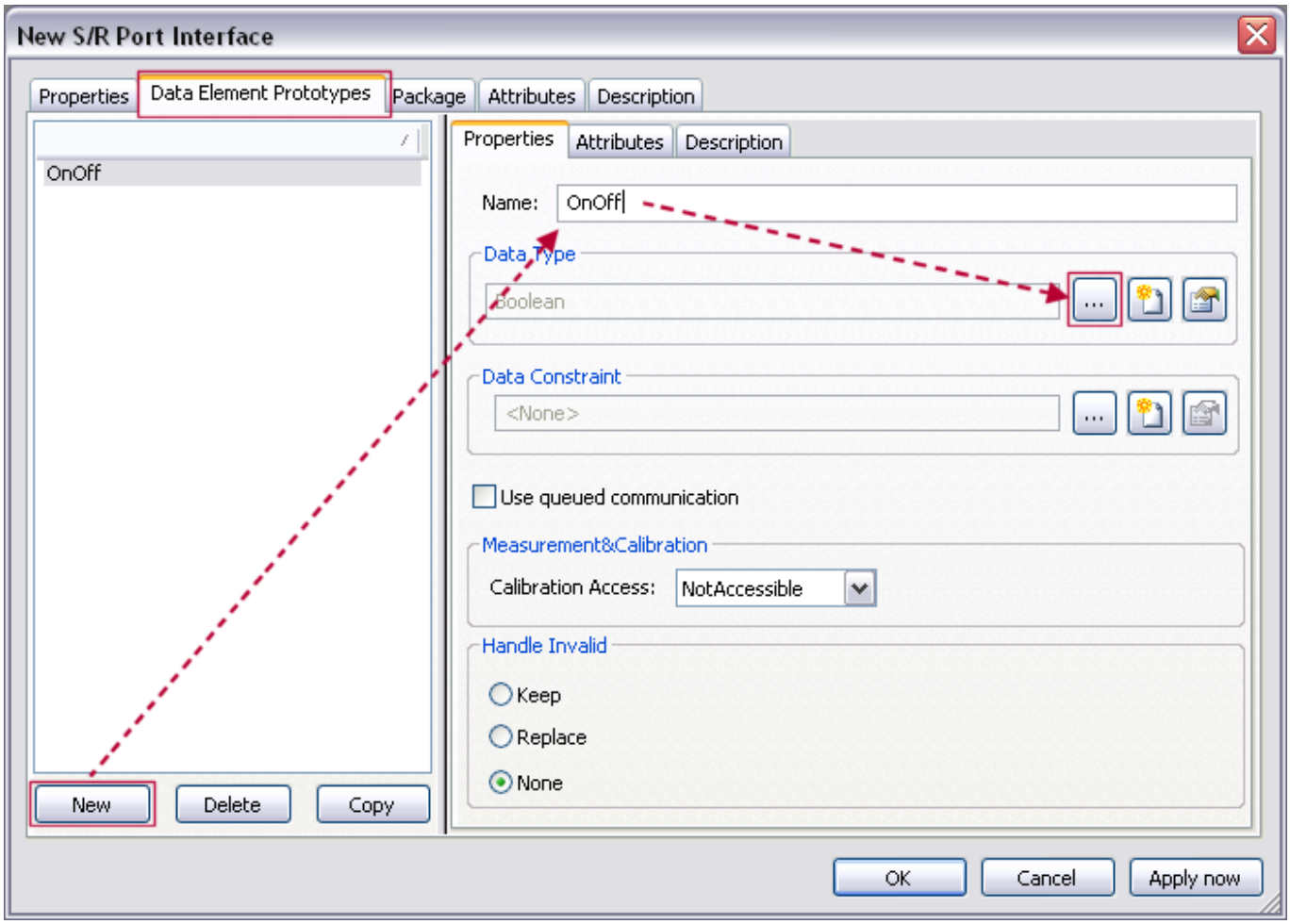
To define a new application port interface, right-click the Application Port Interface in the library and select New S/R Port Interface….



Then the window for the S/R Port Interface opens. Enter a name, select the tab **Data Element Prototypes** and define the content of the port. In this case it is just one data element called OnOff with the Data Type Boolean, use the button [...] to select Data Type.

Note

Data elements are the contents of ports.



Note

A port interface can carry many data elements of different data types.

Provide software components with ports

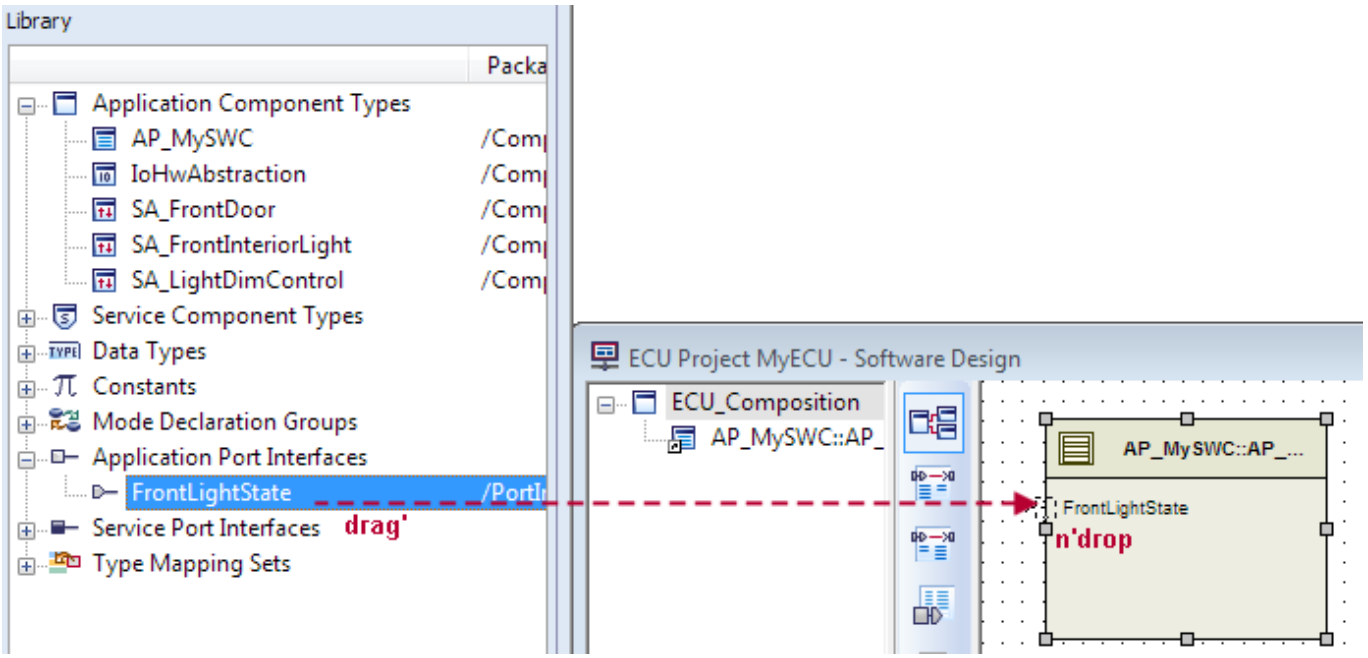
> You have created your application software components.

> You have created necessary application ports interfaces and their content (data element prototypes).

Now you have to define which application component needs which application ports.

Add ports to the application components via drag'n'drop

Select an application port interface from the library and place it onto the application component via drag'n'drop. This transfers a port interface into a port prototype.



Note

Press <Ctrl> while drag'n'drop to change between sender or receiver port.

Interfaces

The ports are added to the components as graphical element together with the name of the port.

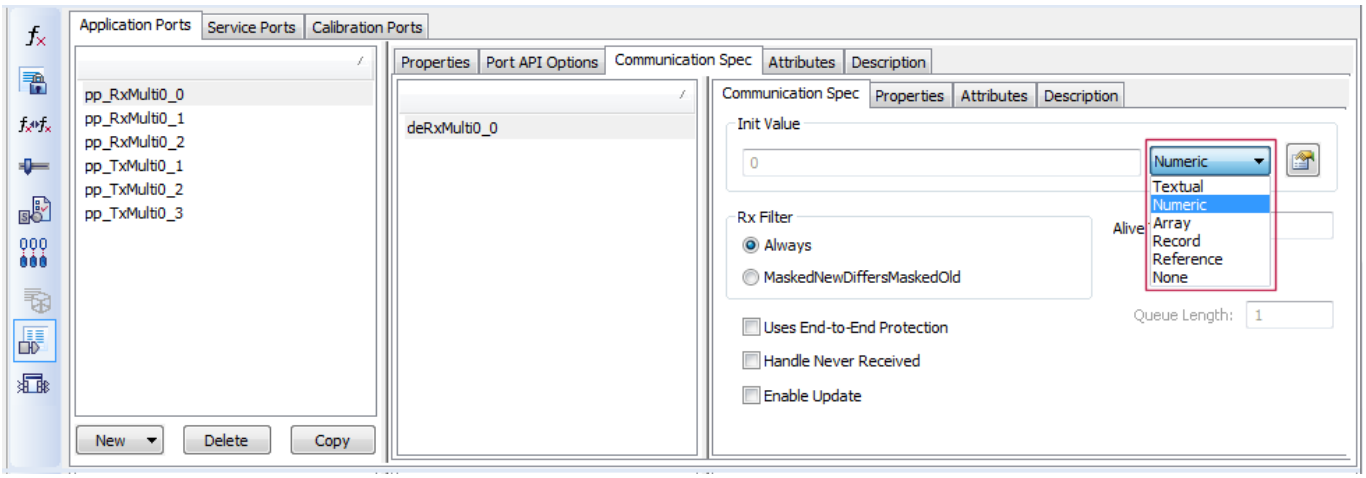
- **Sender port**
- **Receiver port**

Note

Ports need Init Values.

Port Init Values

You have to assign an initial value to every used application port.



6.5 Configure Service Ports within your Application Components

Your Service Components will be loaded automatically to the DaVinci Developer workspace .

Note

The DaVinci Configurator stores the service components within the folder **<Project Folder>\Config\ServiceComponents**.

The content of the service components are not part of the DaVinci Developer workspace.

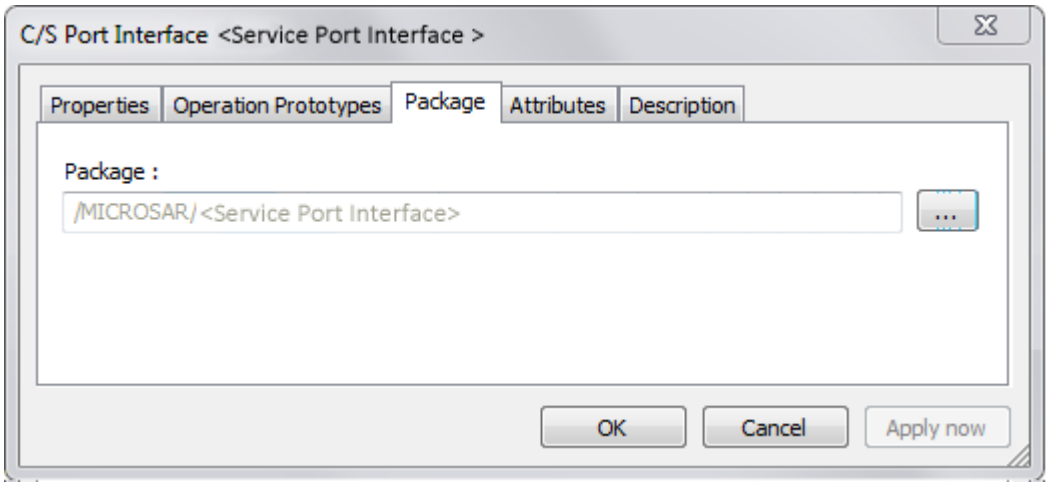
If you want to connect one of your Application Component to a Service Component, you have to define a Service Port Prototype based on a Service Port Interface.

Service Port Interface name and content depend on the BSW configuration and version of the service component within the DaVinci Configurator, so it is not stable. An Application Component shall always define its own or a general Service Port Interface definition.

The Service Port Interface definition from the loaded Service Component is always in read-only status. These Service Port Interfaces are marked with a **read-only icon** within the library.

You have currently not defined your Service Port Interfaces?

Then copy and paste the definition from the Service Component. Assign the definition to an own package, so it is possible to use the same name as before. Therefore open the Service Port Interface, select **Package** tab and choose a package via **[...]**.



Assign your copied Service Port Interface to your Application Component. Therefore open your Application Component Prototype, select **Port Prototype List**  , open **Service Ports** tab and add your Service Port via **[New]** | **From Port Interface**. Now the Service Port used by your Application Component is independent from the Service Component description.

Note

If incompatible changes apply these will be reported by RTE checks.

6.6 Define your Runnables

Now configure runnables that will carry your code.

There are four important topics for a runnable:

- **SYMBOL** and **NAME** – what the runnable skeleton is called in the template file
- **TRIGGER** – when is the runnable executed
- **PORT ACCESS** – what data can the runnable access
- **MAPPING** – in which task context does the runnables work?

Caution!

Runnables can only be defined for atomic application components types.

Note

The runnable skeletons are generated by the DaVinci Configurator Pro/the RTE and can then be accomplished with your code. Find more details follow in the next chapters.

Check also later hints to template generation

1. Open a software component via the library or the software design view.
2. Click on the runnable icon [fx].
3. Click [New] and select Runnable.
4. Enter Name and Symbol for the new runnable on the Properties tab.

If you leave the Symbol field empty, the runnables (functions) will be named according to the entry in the **Name** field.

Minimum Start Interval
Define the minimum time interval between the successive triggering of this runnable.

Can Be Invoked Concurrently

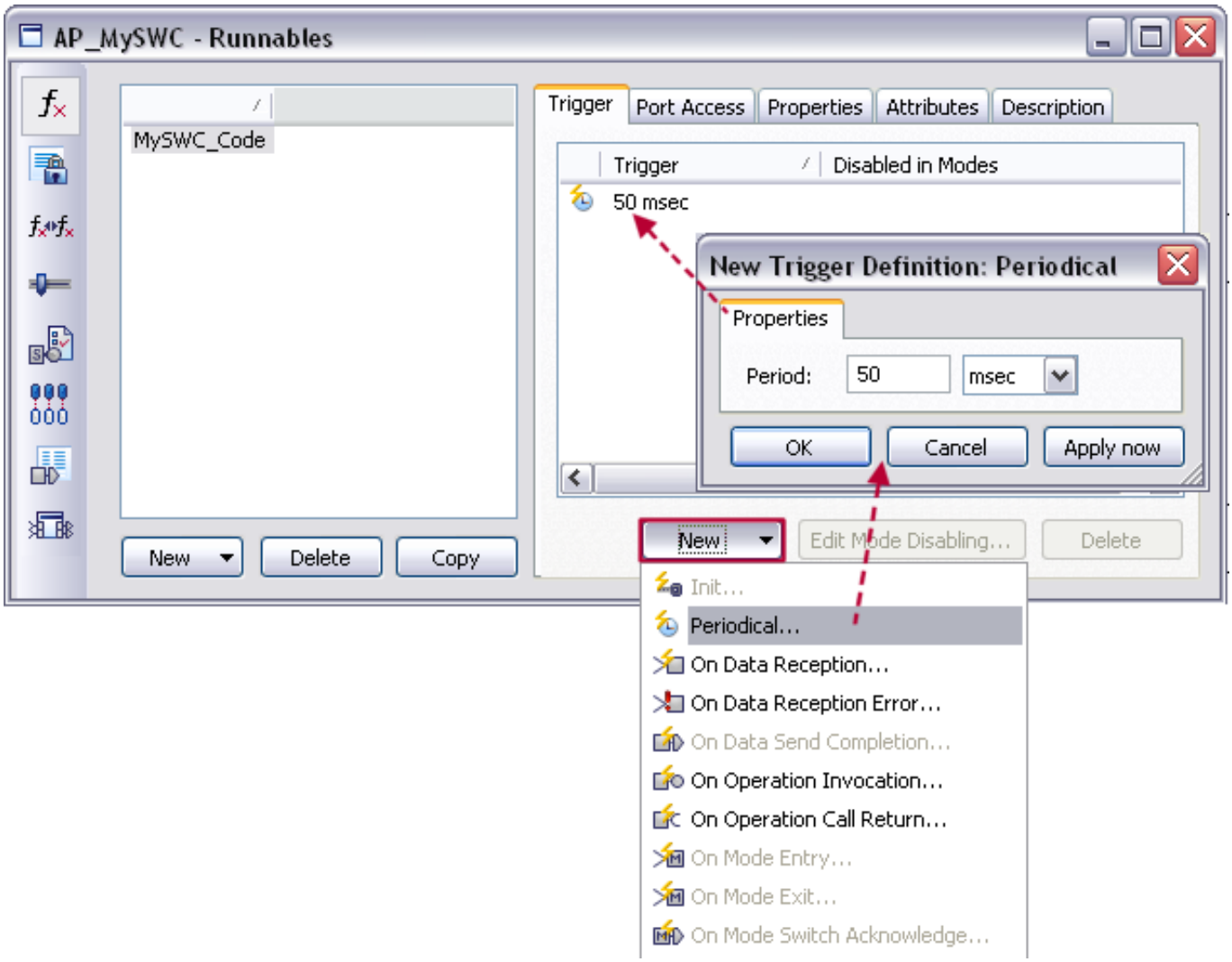
A runnable can be marked as **Can be invoked concurrently** if it can be executed while it is already running. In other words it can be safely executed concurrently (re-entrant). There are a few criteria for your implementation code:

- No static (or global) non-constant data
- No return of address to static (or global) non-constant data
- Only work on data provided by caller
- No modification of own code at runtime
- No call of non-re-entrant runnables

6.7 Triggers for the Runnables

The trigger decides when a runnable is executed.

Select the tab Trigger. On this tab you select when your runnable should be executed.



Note

A runnable can be triggered periodically or via an event.

Periodical: Select the checkbox and enter the cycle time.

On Data Reception: As soon as data is received at the appropriate port the runnable is activated. (Indication)

The trigger **On Operation Invocation** belongs to service ports and will be explained later.

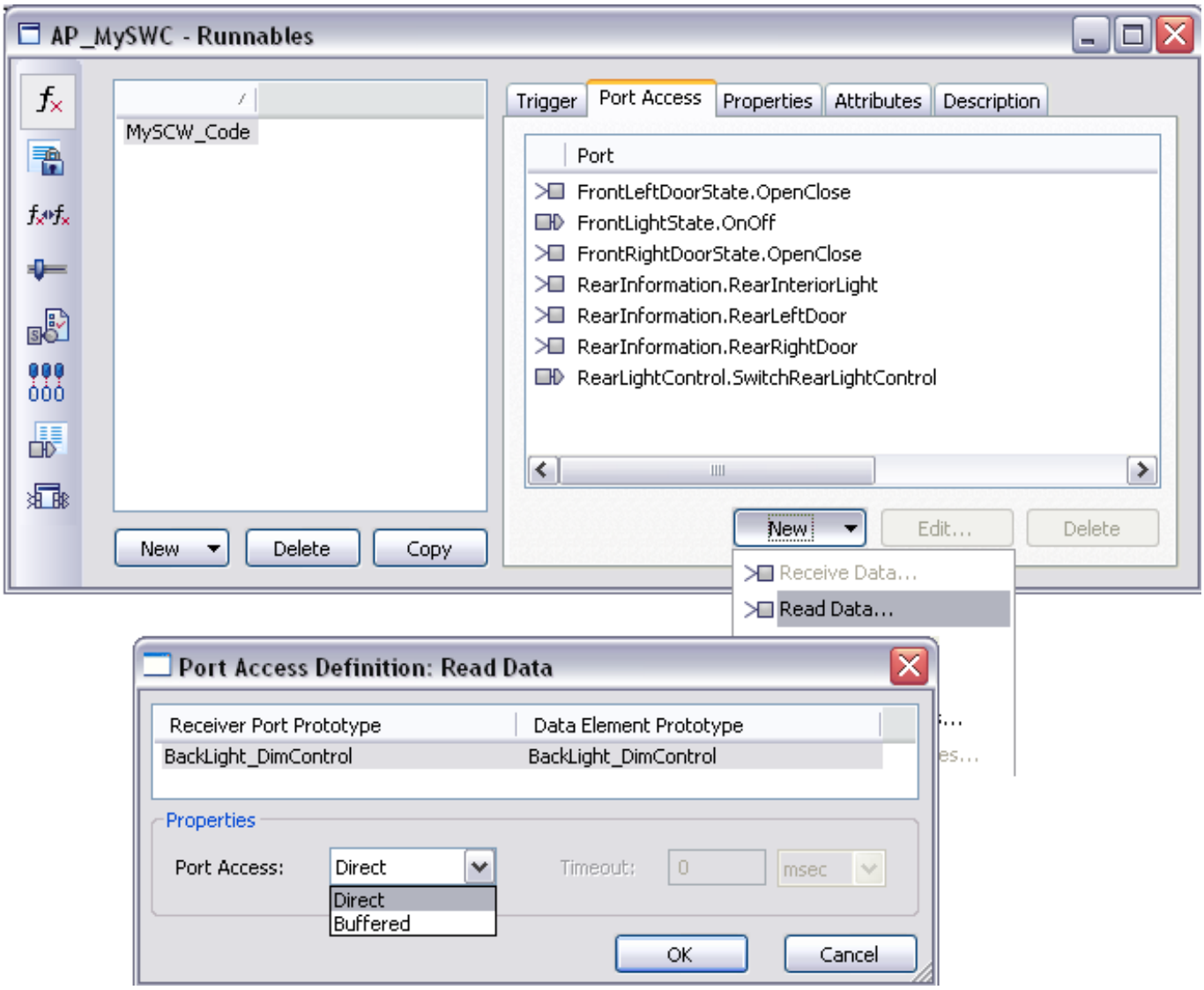
The runnable of the demo application only needs to be called when the state of the doors is changed. This can be realized via a cyclic polling or directly by a trigger from the doors. In the demo, **Periodical**... is chosen.

Note

When experimenting with the demo, replace the cyclic trigger with two triggers On Data Reception…, one for the left and one for the right front door.

6.8 Port Access of the Runnables

Define which port information each runnable should be able to read or write. Select the tab Port Access. You only get displayed accessible ports.



You can define access to

- Read Data… and
- Write Data…
- and later when using client server port also to operations (Invoke Operations).

Click e.g. **Read Data**... and the Port Access Definition:Read Data window will open.

Caution! Direct – Buffered

Direct Write: as soon as you write the information to the data, it is changed immediately.

Buffered Write: the data information is changed at the end of the runnable runtime just before leaving it.

Direct Read: if you access to the data multiple time, it could be changed in the meantime. You always read the current information.

Buffered Read: with the start of the runnable, the data is copied to a buffer. Every time you access the data, it has the same value until the runnable is left.

Note

In the header of the runnable's skeleton that will be generated by the DaVinci Developer, you will find a list with all available API functions for this runnable. If any access is missing, go back to the DaVinci Developer and check whether the Port Access is set correctly.

Summary

Summary of the settings for your runnable MySWC_Code:

- The runnable is called MySWC_Code
- Its functional representation is called: MySWC_Code.
- It is triggered periodically
- The runnable has access to the state of the left and right door and to the data of the front interior light. It also has access to the LightDimControl.

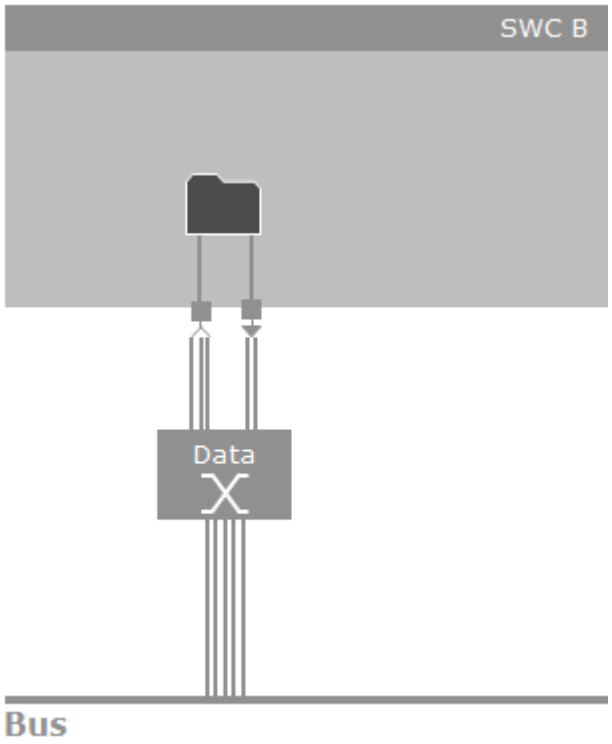
7 Mappings

Generally spoken Mapping stands for assignment of one object to another. There are different mappings in the context of AUTOSAR. What is meant here is:

- Data Mapping
- Task Mapping
- Service Mapping
- Memory Mapping

7.1 Data Mapping

Your ECU has to communicate with other ECUs, the external communication. Signals have to be sent and received via the connected bus system. The signals and the types of data transported via the signals is defined in the data base like DBC, LDF, FIBEX, and also in the SYSEX.



From the view of software components, communication information is exchanged via ports that carry so-called data elements. The definition of a port contains the assignment of data elements that can pass the port. Via the Data Mapping you define, which data element belongs to which signal. For short, you assign data element to bus signals. That’s called Data Mapping.

Note

Data Mapping can also be done in DaVinci Configurator Pro!

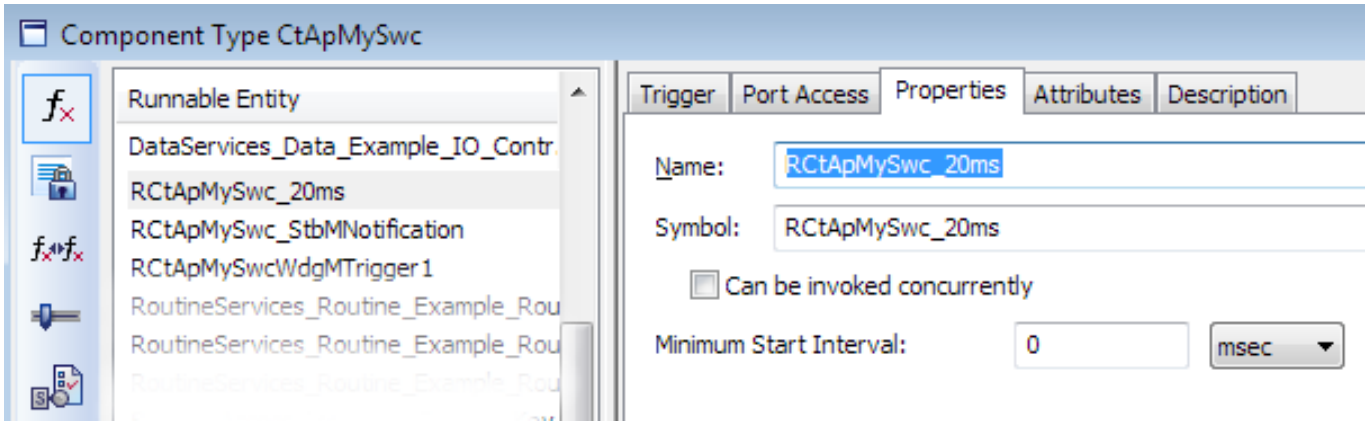
Data Mapping in DaVinci Developer has a higher priority than Data Mapping in the DaVinci Configurator Pro.

Data Mappings done via DaVinci Developer cannot be overwritten by the ones doen via DaVinci Configurator Pro.

7.2 Task Mapping

Tasks are means of the operating system. You can define as many tasks as you like and need. You define the name of the tasks, its priority and its type like **Auto**, **Basic** or **Extended**. You can also define the task as non- or full preemptive.

With Task Mapping, you have to map all runnables to tasks, expect **On operation invocation** triggered runnables. Those are normally called only from one task and have no problem with reentrance.



A runnable has to be mapped to a task if it is not re-entrant but could be called re-entrantly during system operation.

What happens if you do not map a runnable that should be mapped?

The Vector AUTOSAR Solution provides an intelligent RTE generator. The RTE generator checks necessary conditions and will warn you if there are unmapped runnables that have to be mapped.

What happens if you map a runnable that does not have to be mapped?

Nothing will happen. It will still work. But the code efficiency and RAM consumption could be less good.

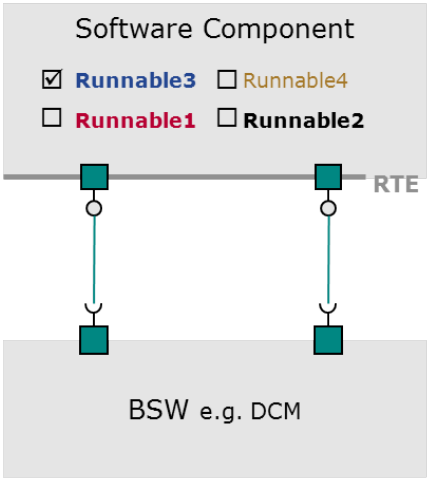
Is there a disadvantage of the RTE generator automatism?

It could be less comfortable to figure out the call context of the runnables and the stack consumption could increase.

7.2.1 Information about Interaction between Runnable, Re-entrance and Task Mapping

Your goal is a configuration of the system that results in a highly centime-optimized and memory consumption-optimizes code. Here is a little information to estimate what the RTE generator does.

Software Design



Task Mapping

Task A	Task B
Runnable1	Runnable2
Runnable5	Dcm_MainFunction
Runnable9	Runnable11
	Dem_MainFunction

	In context of Task A	In context of Task B
RTE	tmp = **A** SetEvent **R1** ...	Rte_Call **Runnable3** Rte_Call **Runnable4**

```
TASK
{
  tmp = A
  waitEvent
  if Event = R1
  Runnable1(A)
  ...
}
```

This illustration shows a software component with four runnables. Only runnable 3 is set to **Can be invoked concurrently**. On the right-hand side you see which runnable is mapped to which task and the result of this mapping for the generated code. Here is the details.

Can be invoked concurrently is set and the runnable is not mapped to a task

Example: Runnable 3

Runnable 3 is called directly in the context of the calling BSW (DCM in this example – DCM_MainFunction, TASK B).

Caution

Make sure that your runnable is really re-entrant (see section **Can Be Invoked Concurrently**). If not, errors can occur that are difficult to debug.

Can be invoked concurrently is NOT set and the runnable is not mapped to a task

Example Runnable 4

If the RTE generator finds out that the runnable is not called multiple times in parallel, Runnable 4 is called directly in the context of the caller BSW (DCM). Otherwise an error message will be shown.

Can be invoked concurrently is NOT set and the runnable is mapped to a task different from the task where the main function of the caller (e.g. Dcm_MainFunction) is mapped.

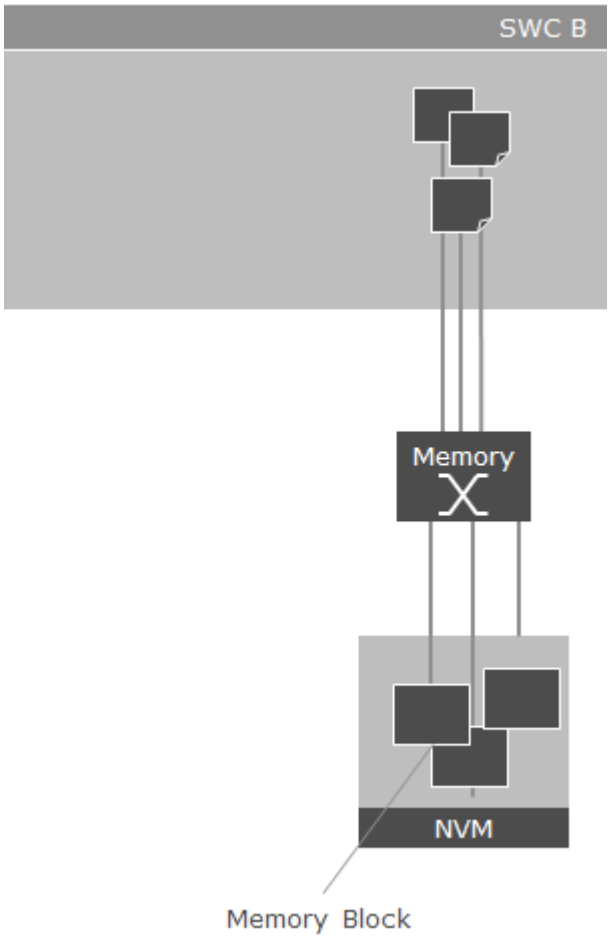
Example: Runnable 1

When the caller BSW now wants to activate the runnable via the RTE call, an event is set and the temporary variables of the runnables are stored to RAM (context of calling BSW, e.g. Task B). When the point in time has come, the WaitEvent in Task A is triggered by the event and starts the Runnable1(A) and hands over the parameters previously stored to RAM.

As you see, runtime is longer than using direct call and the RAM consumption is higher. E.g. for diagnostics: DCM runnables always have array types that are completely stored to RAM. For e.g. 100 DIDs à 4 bytes you need 400 bytes!

7.3 Memory Mapping

Within ECUs there is data that has to be persistent during power-off. Therefore this data cannot be stored simply to RAM, it must be stored to EEPROM or Flash, i.e. to non-volatile memory. As an example for this data, think of the DEM information.



There are two possible ways how this non-volatile data will be used. Either your application always accesses a RAM copy of the NV data where the data is copied at start-up. Or data can be read/written directly from/to NV memory on request.

The Memory Mapping assigns your defined PIM, per instance memory to the memory blocks of the NVM.

A per-instance memory object is mappable if it is referenced by a service need object. The definition of per-instance memory objects or service needs is part of the component type definition and is not yet editable by DaVinci Configurator Pro.

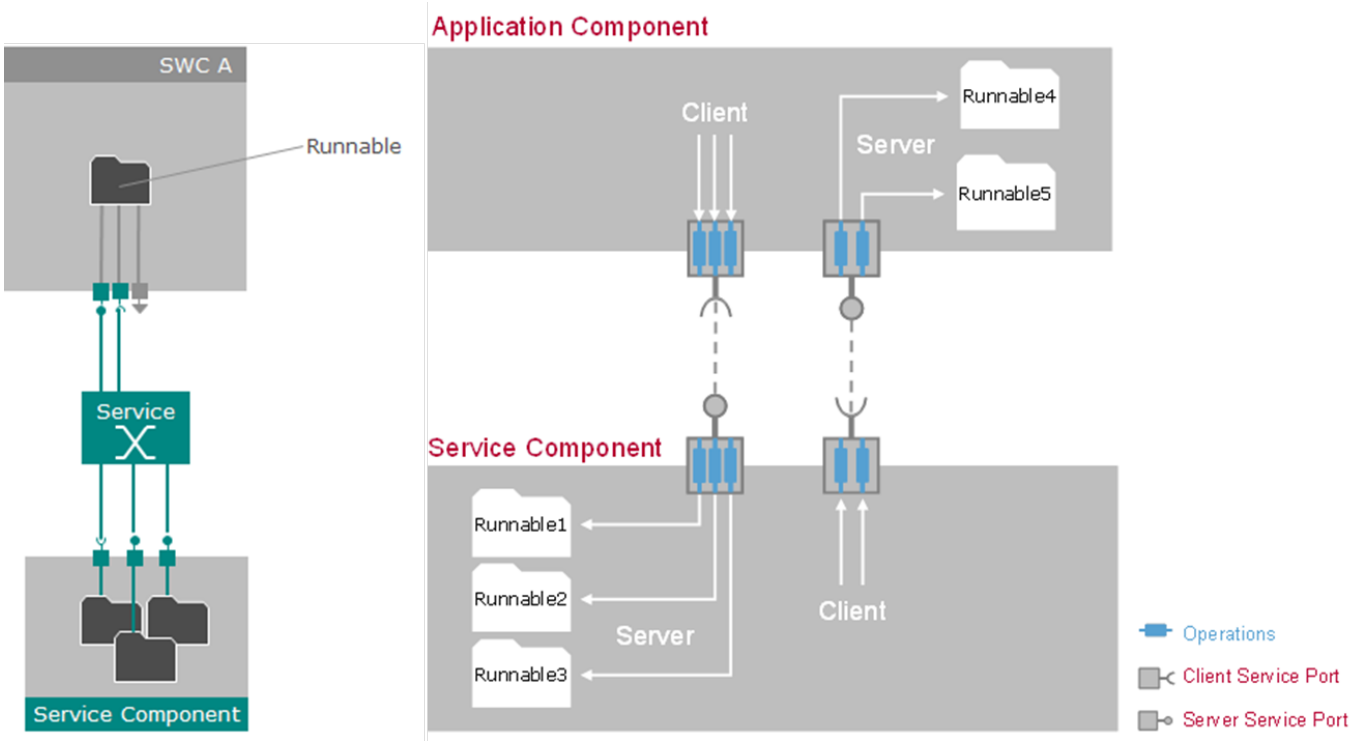
7.4 Service Mapping

The base for the service mapping is the theory about clients and servers. The client uses a service of the server. The server itself provides the operation to the client. The client server communication between your application software component and a service component is done via service ports – client ports and server ports. A server port provides services (one or more operations) and a client port uses these services.

A service component can have server ports and client ports.

- **Service port of the service component is a server port**
  The service is provided by the service component and your application software component just uses the operations (services, functions)
- **Service port of the service component is a client port**
  Your application software component must be server and has to provide the operation (service, function). In this case, you have to program code, i.e. a runnable. This runnable must be created by you and it is triggered by the request of the service.

Besides the sender and receiver ports, there are also client and server ports. Sender and receiver ports carry data elements, via client ports, you can access so-called operations (or functions) of the servers.



Within one service port there could be n operations. Every single operation has to be assigned to a runnable.

The servers provide the runnables that contain the code. Here Runnable1, Runnable 2, Runnable 3 of the service component and Runnable 4 and Runnable 5 of application component.

When performing the service mapping, it is almost the same as the data mapping – but now you deal with services instead. To be able to access the services of a service component, you have to add this service component to your software component.

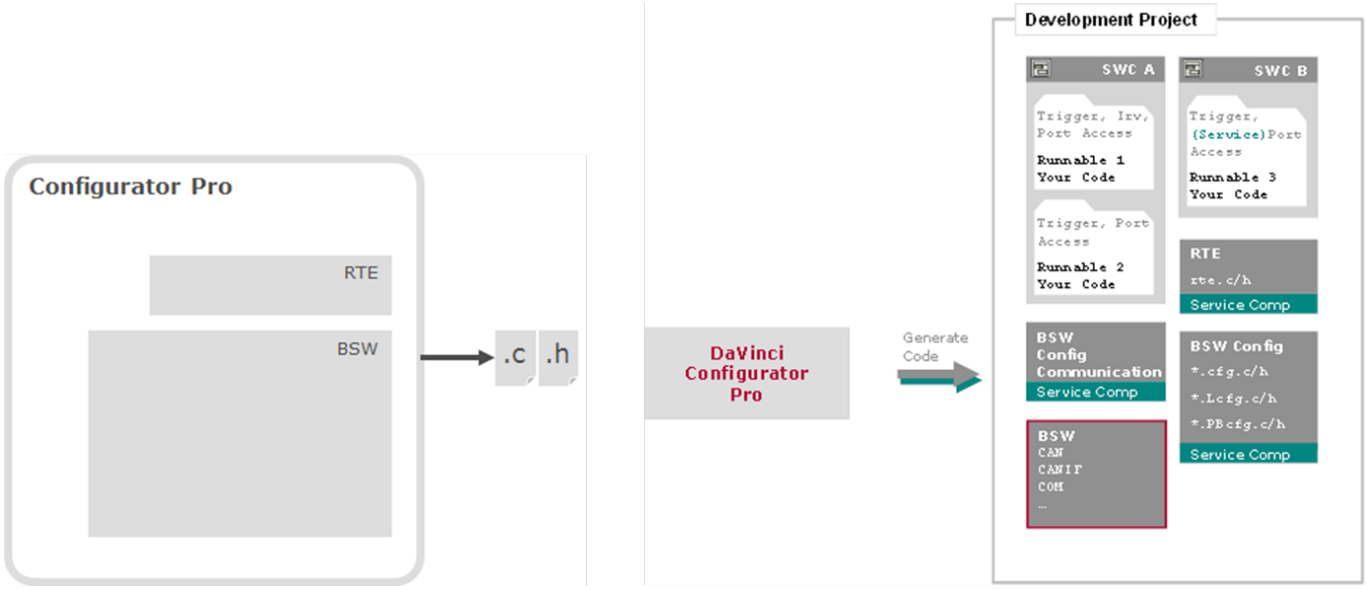
Then you can use all services that are provided by the service component. In this case your application is the client and the service component is the server.

But using a service component not only brings benefit – it also costs. Almost every service component does not only provide services – there can also be client ports on the service component side. And if you add this service component to your software component, you have to provide all the services where the software component provides a client port interface.

8 Generation

With the generation step DaVinci Configurator Pro generates the code for your project and also concerns your settings in STEP2 Define Project Settings on page 24. DaVinci Configurator Pro clings to your settings and works off the “to be generated” list.

The DaVinci Configurator Pro provides an automation interface for remote-controlled validation and code generation.



8.1 MICROSAR Rte Gen

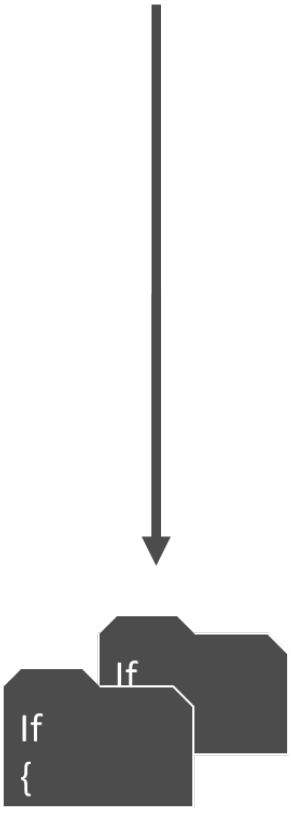
The RTE is generated by the **MICROSAR Rte Gen**. Its generation depends on many settings in the configuration tools and how runnables are mapped to tasks. The files start with **Rte_** or **SchM_**.

9 Runnable Code

Until now you don’t have written one line of C code. And that’s typical for the AUTOSAR concept of software development. There is much more configuring work with tools than programming or implementing as you are normally used to from previous ECU software projects with e.g. CANbedded.

Example

This is an example showing the runnable called MySWC_Code with the function name (Symbol) MySWC_Code




```
/*****************************************************************************************************************
 *
 * Runnable Entity Name: SwitchFrontLight
 *
 *----------------------------------------------------------------------------------------------------------------
 *
 * Executed if at least one of the following trigger conditions occurred:
 *   - triggered on DataReceivedEvent for DataElementPrototype <OnOff> of PortPrototype <FrontLightState>
 *
 *****************************************************************************************************************
 *
 * Input Interfaces:
 * =================
 *   Explicit S/R API:
 *   -----------------
 *   Std_ReturnType Rte_Read_FrontLightState_OnOff(Boolean *data)
 *
 * Client/Server Interfaces:
 * =========================
 *   Server Invocation:
 *   ------------------
 *   Std_ReturnType Rte_Call_FrontInteriorLight_DEFECT_OP_GET(IoHwAb_BoolType *signal)
 *     Synchronous Server Invocation. Timeout: None
 *     Returned Application Errors: RTE_E_env_FrontInteriorLight_DEFECT_E_NOT_OK
 *
 * Service Calls:
 * ==============
 *   Service Invocation:
 *   -------------------
 *   Std_ReturnType Rte_Call_Event_DTC_0x000002_SetEventStatus(Dem_EventStatusType EventStatus)
 *     Synchronous Service Invocation. Timeout: None
 *     Returned Application Errors: RTE_E_DiagnosticMonitor_DEM_E_QUEUE_OVERFLOW, RTE_E_DiagnosticMonitor_E_NOT_OK
 *
 *****************************************************************************************************************/

FUNC(void, RTE_SA_FRONTINTERIORLIGHT_APPL_CODE) SwitchFrontLight(void)
{
/*****************************************************************************************************************
 * DO NOT CHANGE THIS COMMENT!           << Start of runnable implementation >>            DO NOT CHANGE THIS COMMENT!
 * Symbol: SwitchFrontLight
 *****************************************************************************************************************/

IoHwAb_BoolType lightDefect;


Rte_Call_FrontInteriorLight_DEFECT_OP_GET(&lightDefect);

if (lightDefect)
{
  /*Light is detected to be defect. So any light information from MySWC_Code is turned to light off.*/
  Rte_Call_Event_DTC_0x000002_SetEventStatus(DEM_EVENT_STATUS_FAILED);  /*set event*/
}
else
{
  /*Light is working well. No special treatment necessary*/
  Rte_Call_Event_DTC_0x000002_SetEventStatus(DEM_EVENT_STATUS_PASSED);  /*set event*/
}
```

This is the header of a runnable showing all necessary information about the runnable like:

- When it is triggered
- Input and output interfaces
- Service interfaces

Note

If some access is missing, go back to the DaVinci Developer, add the necessary port access for your runnable, go back to DaVinci Configurator Pro, synchronize the system description and generate the component templates again.

Then the missing interface should be there and can be used.

10 Compile And Link

10.0.1 Using your "real" hardware

This step is highly dependent on your compiler / linker / project settings. Compile and link everything together and create a file that can downloaded to your hardware.

III Additional Information

This section includes additional information dealing with special topics like e.g. multiple user concept or support request package.

1 Update Input Files

Open Input Files editor via **Project** | **Input Files** or **Input Files icon**  at DaVinci Configurator Pro toolbar.

Note

Any change of the input files requires an update of the configuration. Update configuration updates all input files, whether they are changed or not.

1.1 System Description Files

If necessary, replace your File at Input Files | System Description File.

Select the Input File, click **Replace button**  and choose the new **Input File**.

Note

Any change of the input files requires an update of the configuration. Update the configuration via **Update Configuration icon**  .

1.2 Diagnostic Data Files

If necessary, update your Diagnostic Description file and select ECU and Variant.

In case of **ODX 2.0.1** as Diagnostic Description file, it is necessary to update the state description. Therefore click **[Synchronize State Description...]**.

Note

Any change of the input files requires an update of the configuration. Update the configuration via **Update Configuration icon** 

2 Update Project Settings

Open Project Settings Editor via **Project** | **Settings** or **Project Setting icon**  at DaVinci Configurator Pro toolbar. Select **Project Settings** to open the view.

3 Support Request Via DaVinci Configurator Pro

If you request support for Vector products, you have to provide project and environment information. Therefore, use the **Support Request Package** function of the DaVinci Configurator Pro.

The **Support Request Package** compiles the necessary project and environment information in a ZIP-file. Send this file to the Vector Support via E-mail. Just follow the description below.

Note

The DaVinci Configurator Pro does not send any data automatically!

1. Open the Support Request Editor via **Help** | **Create Support Request Package...**

Note

The entry **Create Support Request Package**... is only enabled if a project is loaded.

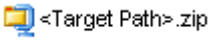
2. Add your First Name, Last Name and E-Mail address.
3. Click **[Next >]**
4. Select project information which has to be added to the support request ZIP-file.

Note

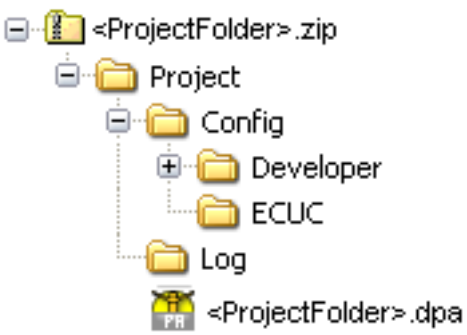
PC Info, Tool Version Info and SIP Info are default and can not be deselected.

5. Click **[Next >]**
6. Enter the path where the created ZIP-file has to be stored.
7. Click **[Finish]**

3.1 Result

In addition to the **Zip-File** 

, the Project Assistant creates the following folders and files.

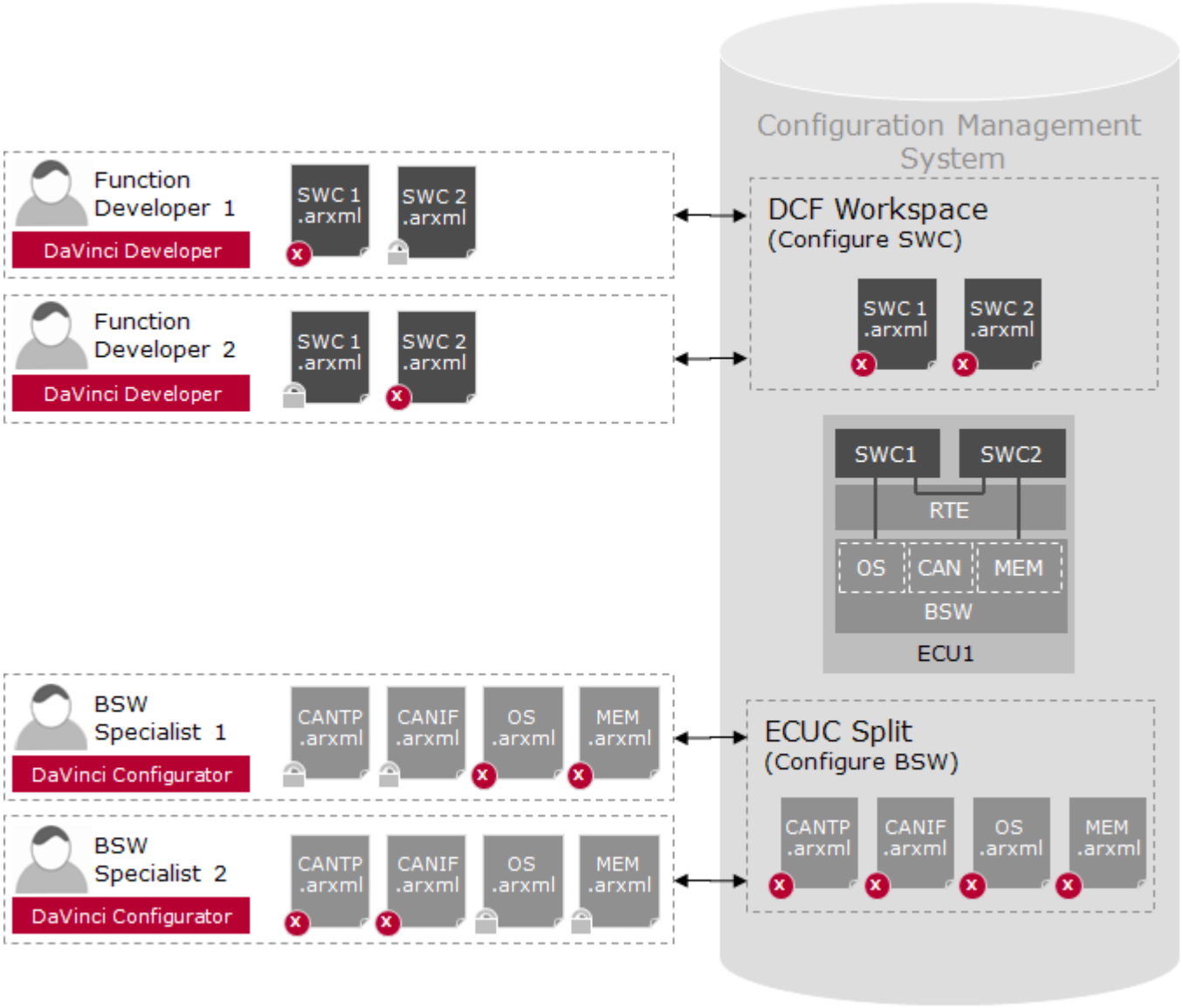
Folder/File	Description
	The Project folder includes all defined project files

Folder/File	Description
 SupportRequest.html	The file includes all necessary project and system information (e.g. version of tools)
 SupportRequest.xml	The file includes all necessary project and system information (e.g. version of tools)

Send **<Target Path>.zip** via e-mail to the Vector Support Address embeddedSupport@de.vector.com.

4 Multiple User Concept

This concept helps you to realize the configuration management of the design and configuration data on a fine-grained level in combination with a configuration management (CM) system. It is available for software components as well as for BSW configurations. Split files also help you in multi-user projects: you can control the read/write access on fine-grained level. This helps you to prevent the users from making unwanted changes and therefore reduce the necessary diffs and merges.



4.1 General

The decision whether to use a single configuration file or split configuration files is done in the Project Assistant settings. The resulting split files are ideally managed through a central CM system. Each user needs the full set of split files to work with the project.

The user has to obtain a rateable working copy to his local file system.

The user has to obtain a read-only working copy to his local file system.

Caution!

After a SIP update, all configuration files may have to be updated. This requires all files to be rateable while loading the configuration with a new SIP for the first time.

It is necessary to lock all files which will be edited during the configuration session. The DaVinci tools load all working copy files. The locked files are rateable; all other files are write-protected.

Note

If you prevent parallel editing e.g. by according settings in the CM system you can ensure that only one user can obtain a writable copy at a time. If you allow parallel editing in the CM system, several users can get a rateable copy. When both users make changes, you can use the Project Merge function to merge the modifications.

After finishing configuration, the locked files have to be checked in (commited) to the CM system.

4.2 Split Files for Software Component and ECU Project Configuration

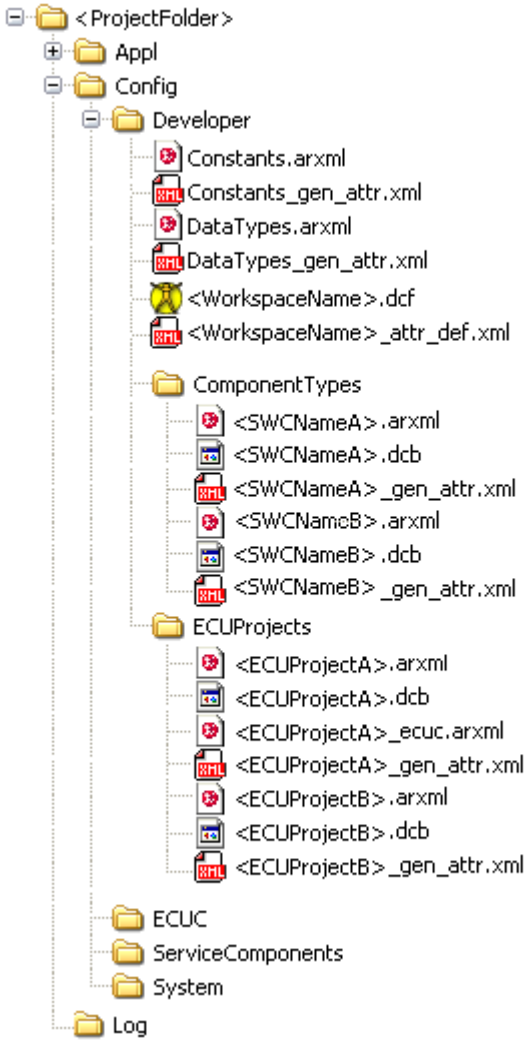
The split of the **DaVinci Developer workspace** is necessary to enable working in parallel for software component configuration.

Note

Workspace splitting is only supported by the DCF workspace format.

Result

Additionally to the workflow file the Project Assistant creates multiple files for each Software Component Type and ECU Project in the Developer folder.



File	Description
<WorkspaceName>.dcf	This file includes references to all single software component and ECU Project files.
<SWCNameA>.arxml	General software component file
<SWCNameA>.dcb	This file includes the binary part of the software component.
<SWCNameA>_gen_attr.xml	This file includes the generic attributes of the software component.
<ECUProjectA>.arxml	General ECU project file
<ECUProjectA>.dcb	This file includes the binary part of the ECU Project.
<ECUProjectA>_ecuc.arxml	Project-specific ECUC file
<ECUProjectA>_gen_attr.xml	This file includes the generic attributes of the ECU Project.

4.3 Configure Software Component Prototype

To configure a software component prototype it is necessary to lock all files, specific for this software component. (**<SWCNameA>.arxml**, **<SWCNameA>.dcb** and **<SWCNameA>_gen_attr.xml**).

4.4 Configure ECU project

To configure an ECU project it is necessary to lock all files, specific for this ECU project. (**<ECUProjectA>.arxml**, **< ECUProjectA >.dcb**, **<ECUProjectA>_ecuc.arxml** and **<ECUProjectA>_gen_attr.xml**).

4.5 Split Files in DaVinci Developer

Note

Parameters of write-protected files are greyed out in the DaVinci Developer.

If Parameters of write-protected modules are changed because of module dependencies, the DaVinci Developer informs about the write-protection during the synchronization process.

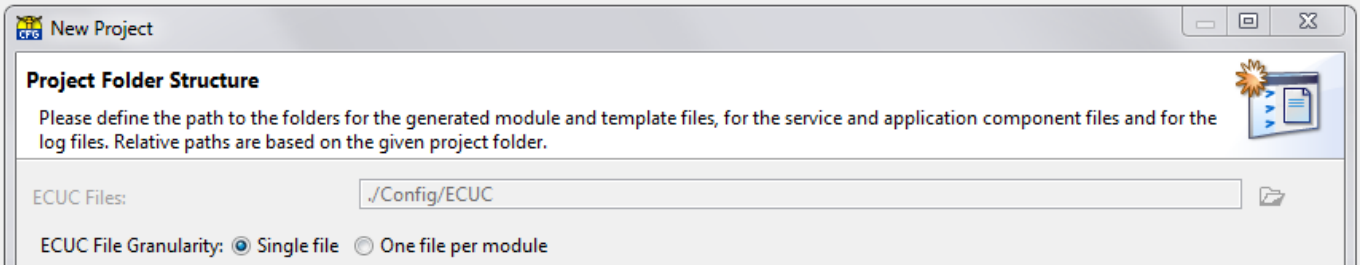
You have the possibility to make the file rateable and repeat the synchronization process.

4.6 Split Files for BSW Configuration

The split of the ECUC is necessary to enable working in parallel for BSW configuration (one file per module).

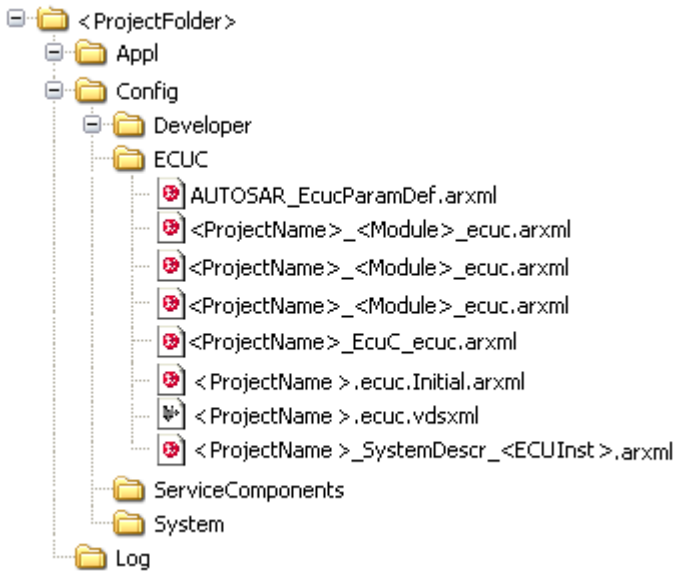
Note

Please note that further .arxml files are created when activating further modules.



Result

Additionally to the standard ECUC files and the AUTOSAR parameter definition file, the Project Assistant creates multiple ECUC files **<ProjectName>_<Module>_ecuc.arxml** to the ECUC folder.



Note

Additionally to the module ECUC files the Project Assistant creates a **<ProjectName>_ EcuC.ecuc.arxml** file, containing references to all module ECUC files. This file is used as project file for the DaVinci Developer and the DaVinci Configurator Pro.

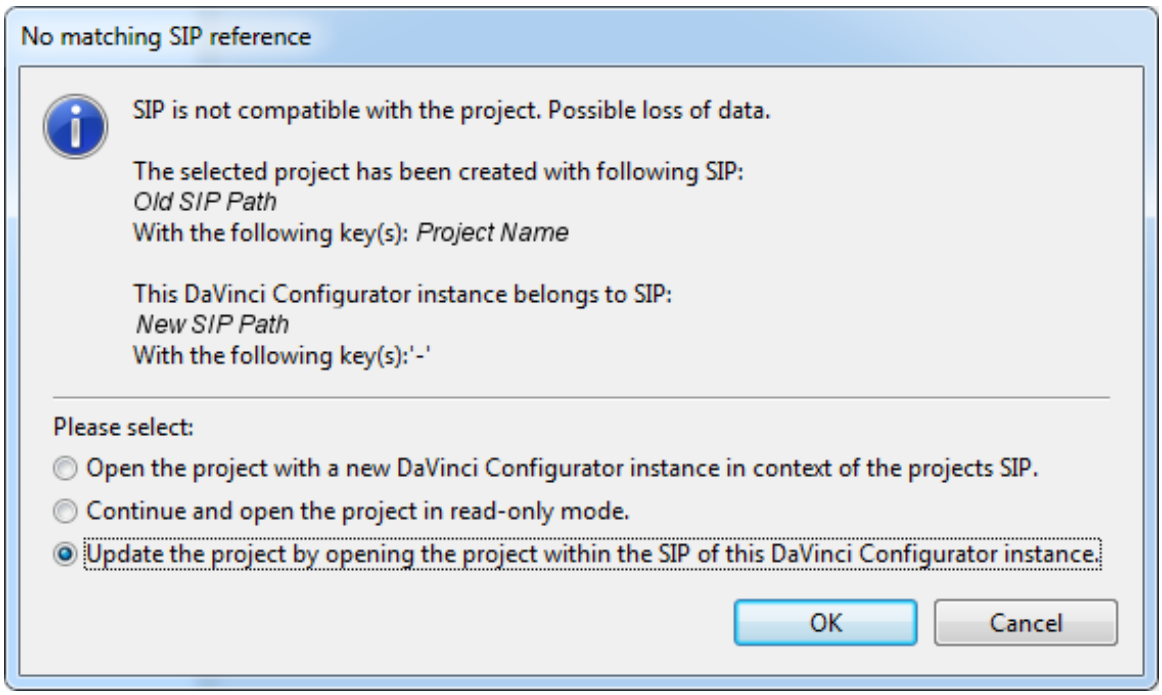
5 Configuration Update

If you get a new delivery with Vector BSW Release x, it is necessary to update some parameter values of your configuration to the new release. There are some steps, that are necessary for most of the updates and there are special steps, that are only necessary for a certain update.

First there are described the necessary steps for any update followed by the special update steps dependent on the release version.

5.1 Release x-1 to Release x (necessary steps for any update)

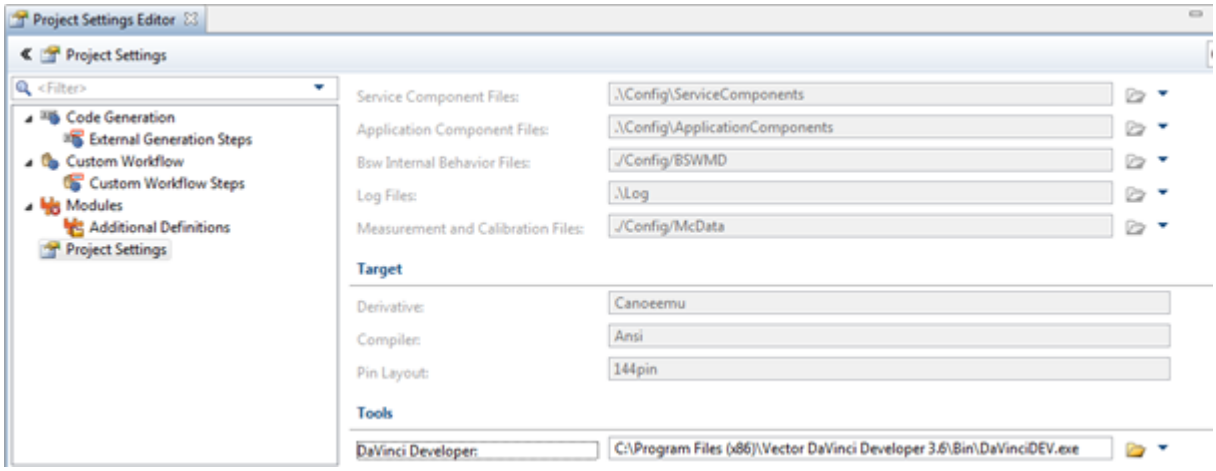
1. Install the latest DaVinci Developer
2. Open your configuration with the DaVinci Configurator of the new SIP .\DaVinciConfigurator\Core\DaVinciCFG.exe and select the following option:



Note

The path within the *.DPA file will be updated to the new SIP.

3. Change the path to the new DaVinci Developer if it was installed to a different location than the former DaVinci Developer version.



Note

C:\Program Files (x86)\Vector DaVinci Developer **<version>**\Bin\DaVinciDEV.exe

4. Click **Solve All** button
5. Handle remaining errors and warning. The following might occur for any update

Errors Invalide/Incorrect Definitions	
> AR-ECUC02008 Invalid multiplicity > AR-ECUC03019 Incorrect definition of configuration element	
Solution	Delete parameter in ECUC file not existing in BSWMD file any more.
Example	Some parameters has been replaced. E.g. **/MICROSAR/Dem/DemGeneral/DemEventStorageTrigger** has been replaced by /**MICROSAR/Dem/DemGeneral/DemEventMemoryEntryStorageTrigger**

Errors Inconsistent Connector Prototypes	
> RTE51027 Connector prototype inconsistent. (1 message) > RTE51031 Connector prototype inconsistent. (1 message)	
Solution	Due to changes within the Service Components the ports can be become incompatible Application Software Components. Adapt your Application Software Components with the DaVinci Developer to match the new port definitions. The changes are normally resulting from > Correction (the old definition was wrong) > Changed implementation based on AUTOSAR Bugzilla entries / RfC > Changed implementation due to support of newer AUTOSAR Version (e.g. AUTOSAR 4.0.3 to AUTOSAR 4.1.2)

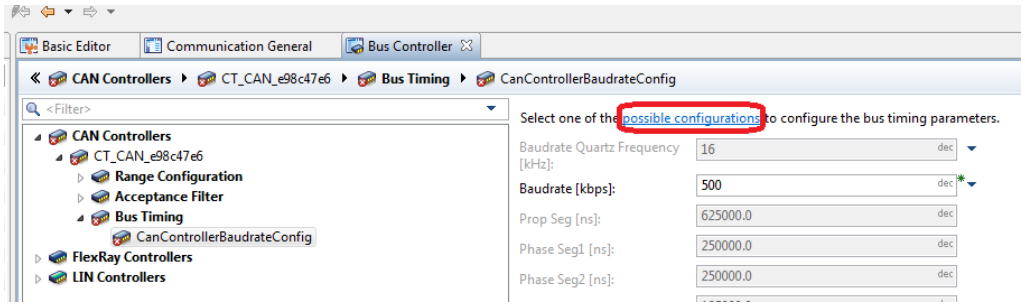
6. Process all further Errors and Warnings given within the Validation View of the DaVinci Configurator
7. Check for updating of the input data base files.
   Even though they might not have changed, the deriving of parameters might have improved. Thus an update now would reduce the changes when receiving changed input data base files.

Cross Reference

Additional information about necessary configuration update steps are described within the Release Notes (**Category: Change**).

The following describes what to do when updating especially from one release to another.

5.2 Release 8 to Release 9

Errors Invalid Baud Rate	
> CAN02012 An invalid baud rate value is configured > CAN02012 invalid baudrate settings: [MANUAL ACTION]: change clock or baudrate. /ActiveEcuC/Can/CanConfigSet/CT_CAN_e98c47e6/CanControllerBaudrateConfig	
Solution	The tool now checks the values of the baud rate configuration, they might have been wrong before. Check valid settings of McuClockReferencePointFrequency referenced by **/MICROSAR/Can_Canoeemu Canoe/Can/CanConfigSet/CanController/CanCpuClockRef** Then select one of the offered baud rate configurations by clicking on 'possible configurations'. 

5.3 Release 7 to Release 8

If you get a new delivery with Vector BSW Release 8, it is necessary to update some parameter values of your configuration to the new release.

After you have updated your project with the new SIP the following steps are necessary:

1. Select ECUC parameter which is not defined by a BSWMD Parameter definition.
   (Error number AR-ECUC03019)
2. Check whether additional parameters exist.
   (Parameters without value definition or with default value)
3. Define value of the new parameter with value from the existing parameter
4. Delete existing parameter

Use the same steps for container updates.

Note

Select all **VectorCommonData** containers, which are marked with an error, use multi-selection in the DaVinci Configurator Basic Editor and delete them via **Delete Container**.

All **Use RTE** switches and **Production Error Detection** switches can be deleted without check.

6 Update DaVinci Tools

Cross Reference

The DaVinci service packs are located at the **Vector Download Center**.
https://vector.com/vi_downloadcenter_en.html

The Update of the DaVinci Tools is described within the installation guide.

Cross Reference

You will find the installation guide document at the Vector Knowledge Base:
https://vector.com/kbp/entry/640/

6.1 DaVinci Configurator Pro

If necessary , update DaVinci Configurator Pro service packs, therefore you have to download them from the Vector Download Center and install them via DaVinci Configuration Service Pack Installer. Select the installed SIPs which should be updated.

6.2 DaVinci Developer

Service Packs of DaVinci Developer are also available in the Vector Download Center. The service packs include an installer to update your DaVinci Developer installation.

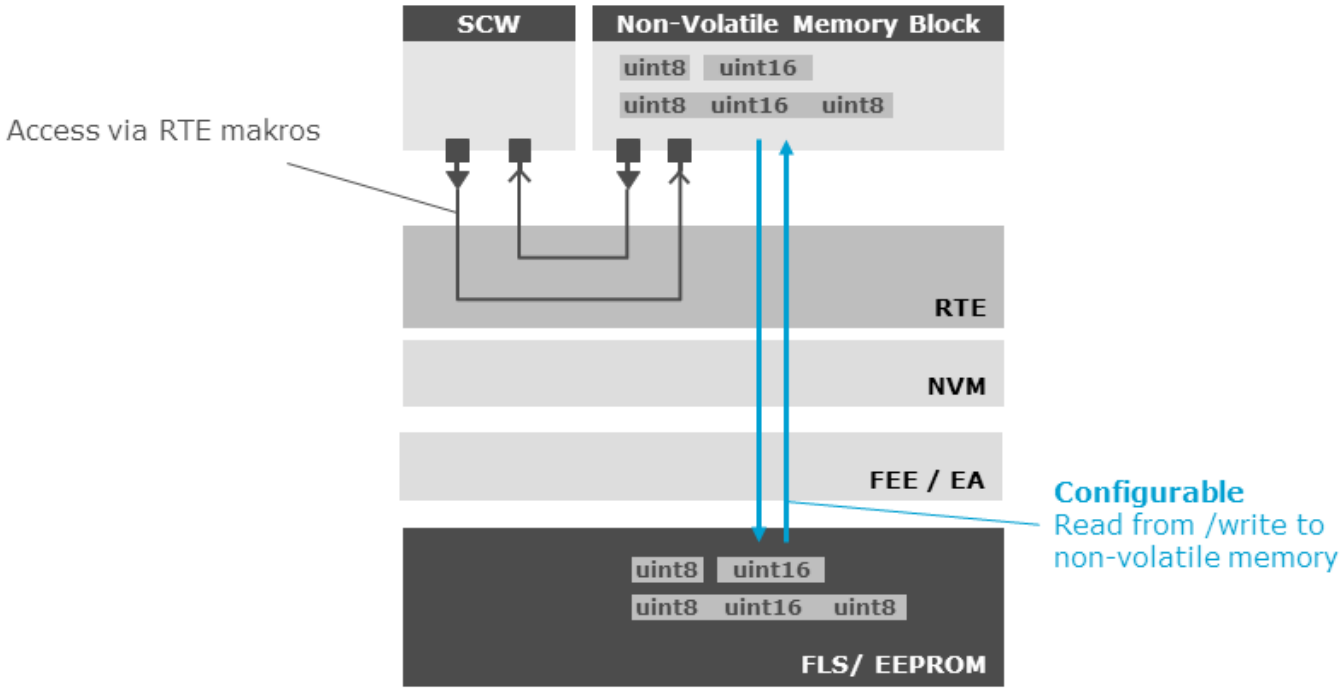
Note

Please note that compatibility is only granted for service packs provided for the same major and minor version.

7 Non-Volatile Memory Block

This is a description how to handle data that has to be stored to non-volatile memory like FLASH or EEPROM.

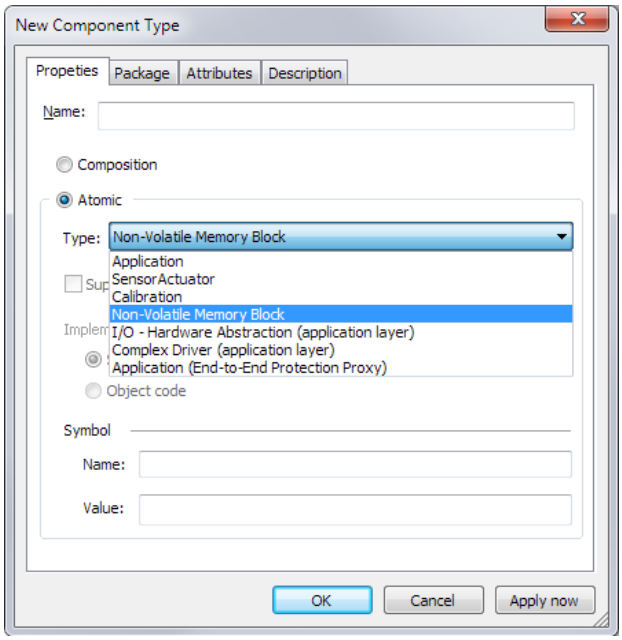
The illustration below shows briefly the concept behind. Data is defined in a Non-Volatile Memory Block. The application SWC has access to this data via the RTE. The data is stored and addressed in RAM. At configuration time you can define which data in which format you need and when and how this data is written to and read from the non-volatile memory. You can also trigger the immediate writing of this data to the FLS or EEPROM.



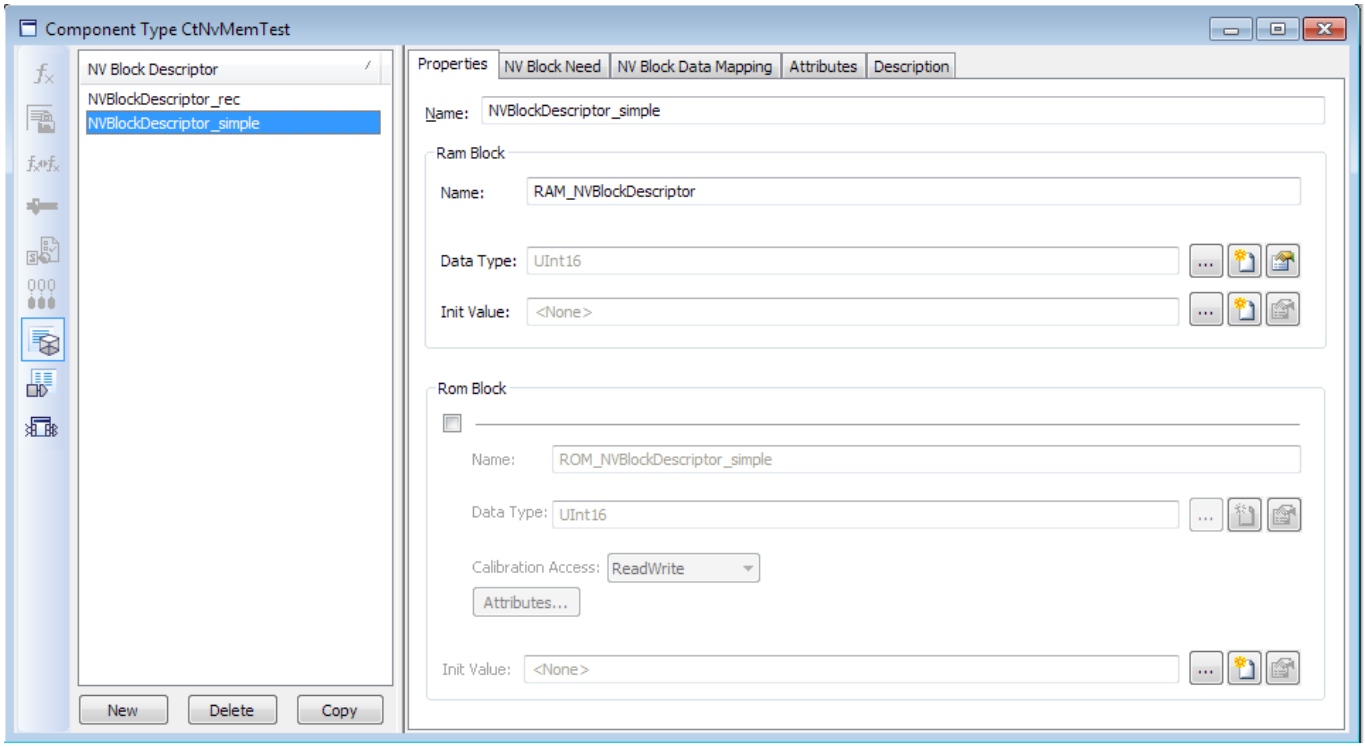
7.1 Configure and use Non-Volatile Memory Block

The following description shows, how the Non-Volatile Memory Block is configured and used.

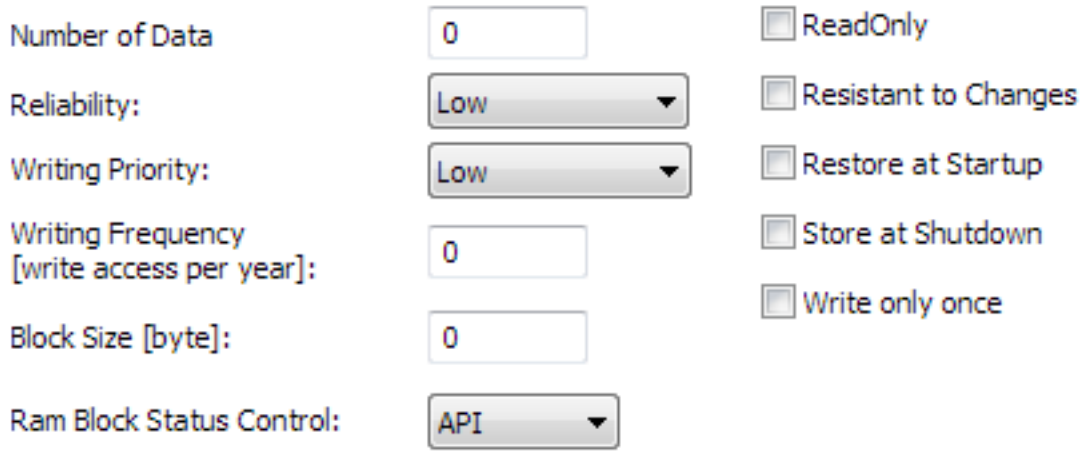
In the Library of DaVinci Developer, add a **New Application Component Type**, select **Non-Volatile Memory Block** as type and give a **Name** to this new component type. Double-click the new **Non-Volative Memory Block** in the **Library** and select **NV Block Descriptors** 



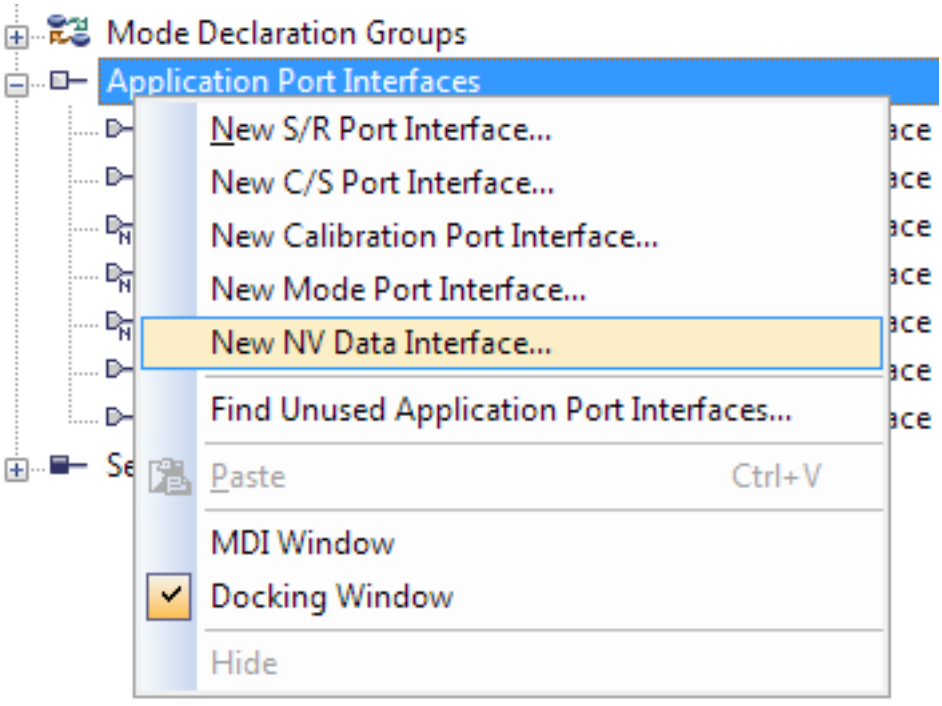
Use **[New]** to define a new NV Block Descriptor. On the Properties tab define the data you want to store to non-volatile memory and its type. This can be a single variable like integer or boolean. Also complex data types like records or arrays can be defined.



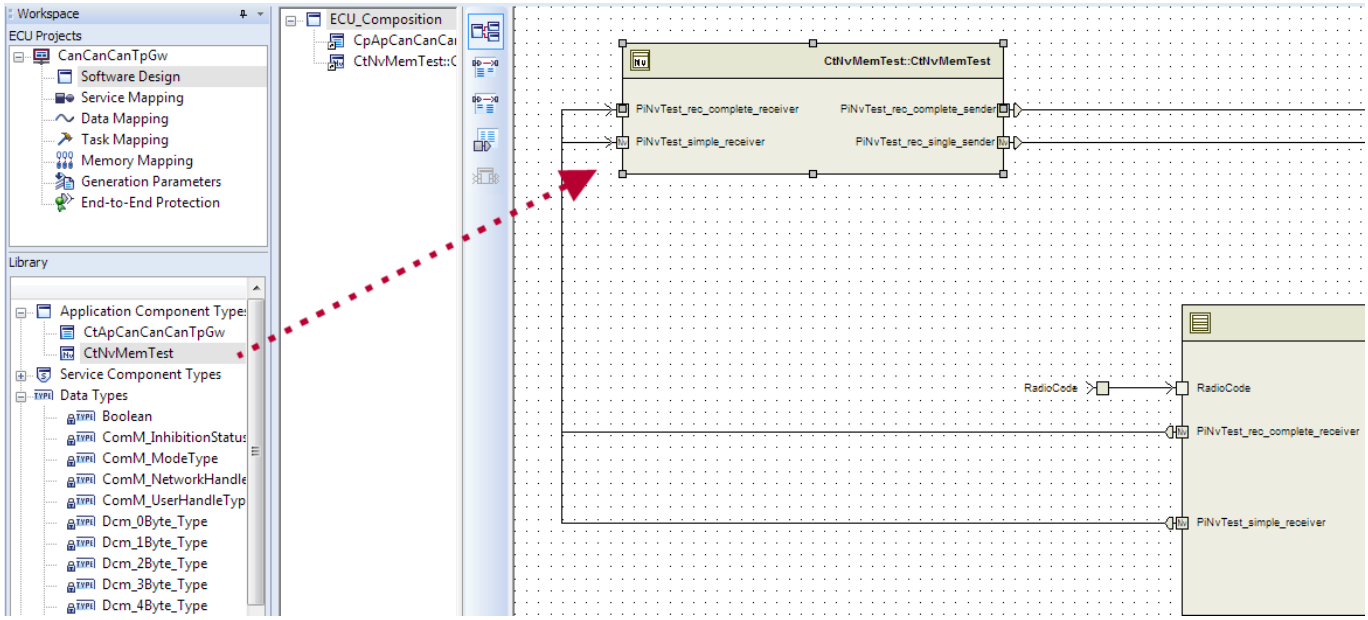
Select the tab NV Block Need and define, when and how your data should be finally written to NV memory (FLS or EEPROM).



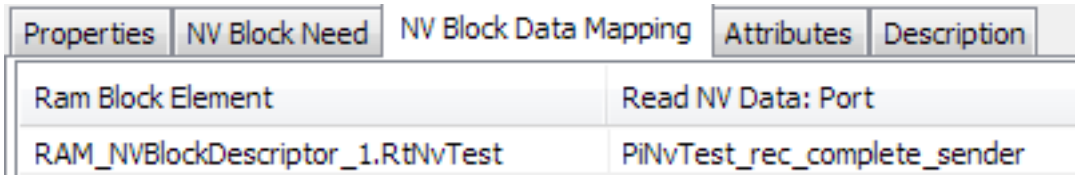
Now add New NV Data Interface… to define a port to access the data defined before. Select suitable Data Element Prototypes.



Add the NV component type to your Software Design (drag’n’drop from Library), assign the NV Data Interface to the NV component prototype and another NV Data Interface to your application SWC. Draw the necessary connectors by hand. Define the Init Values of all ports.



Double-click NV component prototype and perform the internal mapping on the NV Block Data Mapping tab (right-click to open context menu).



7.2 Port Access of your Runnables

What is left now – the access of your application runnable to the **NV Data Interface**(s). Open your application software component, select a runnable and then the tab **Port Access**. Use the **[New]** button to add a read or write data access to the **Non-Volatile Memory Block**.

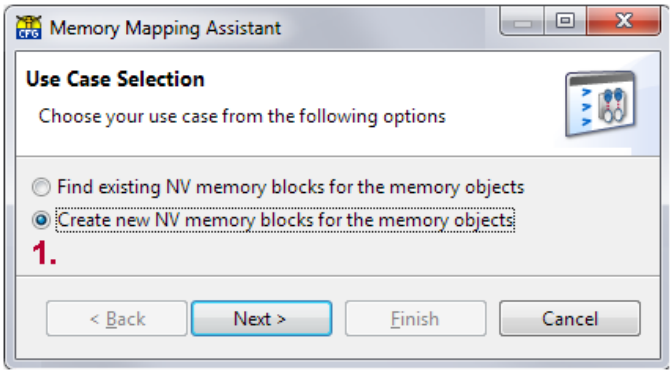
Save your project and switch to DaVinci Configurator Pro.

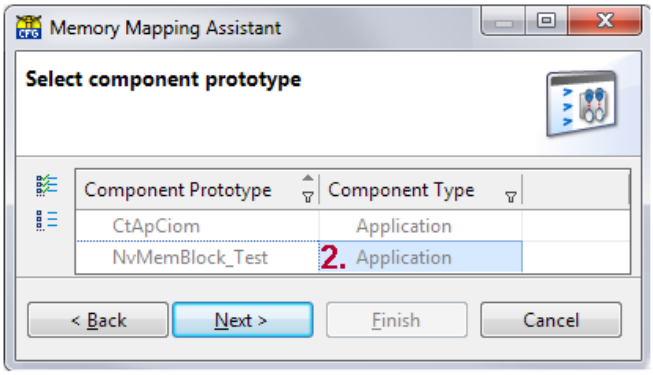
7.3 Memory Mapping in DaVinci Configurator Pro

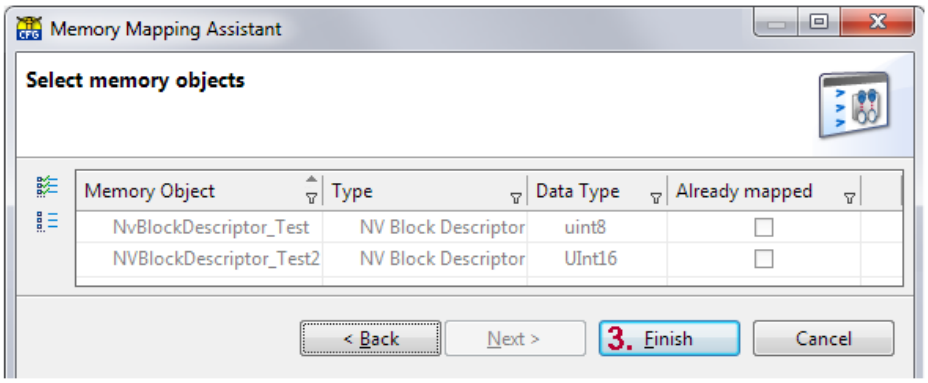
Synchronize the system using the synchronization message in the **Validation** area.

Open **Runtime System**. Click **Add Memory Mapping**.

1. Select **Create new NV memory blocks for the memory objects**.
2. Select the block created before in the DaVinci Developer
3. Get information about unmapped blocks and click **[Finish]**.

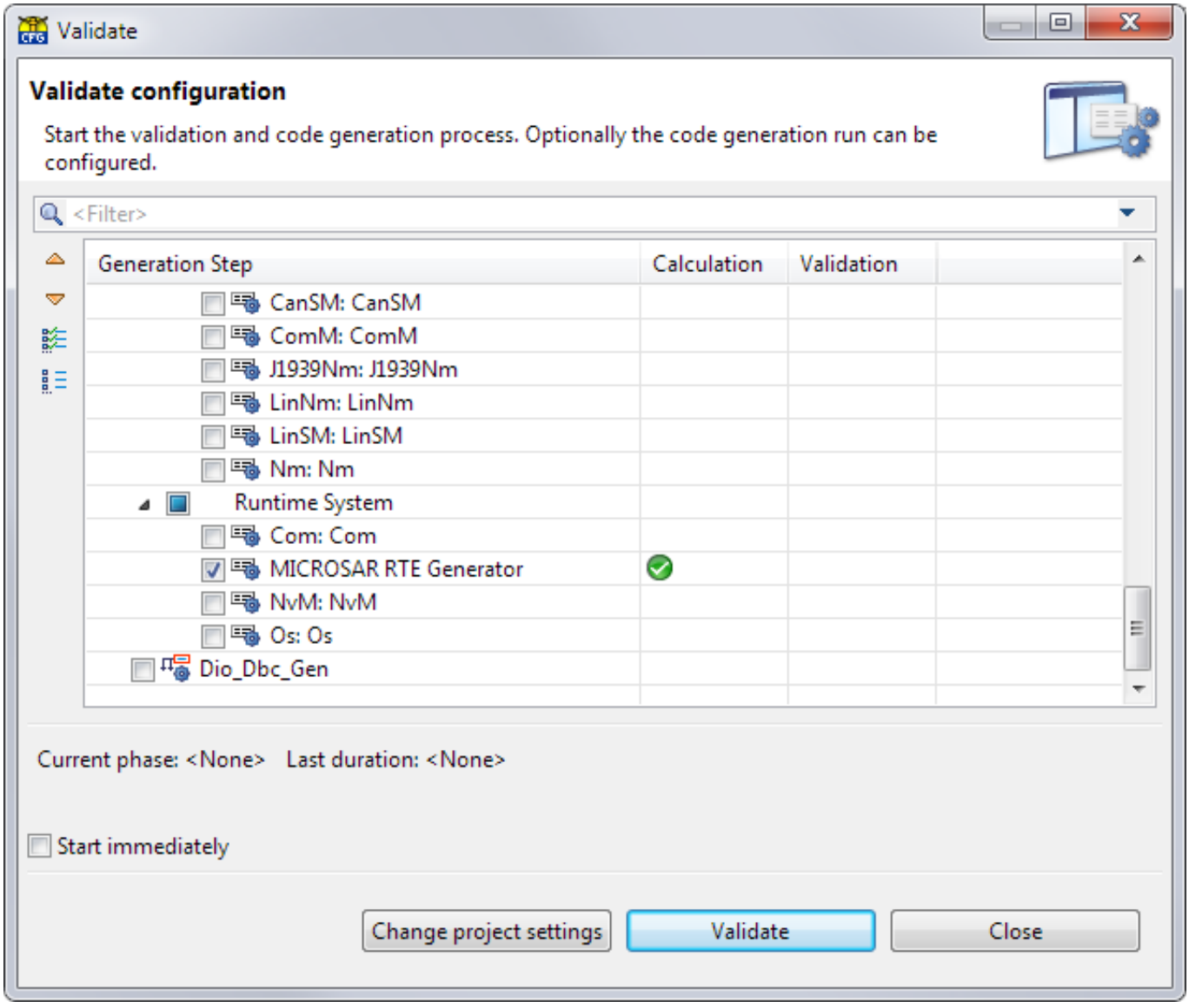

Memory Mapping Assistant
Use Case Selection
Choose your use case from the following options
Find existing NV memory blocks for the memory objects
Create new NV memory blocks for the memory objects
1.
< Back
Next >
Finish
Cancel


Memory Mapping Assistant
Select component prototype
Component Prototype
Component Type
CtApCiom
Application
NvMemBlock_Test
2.
Application
< Back
Next >
Finish
Cancel


Memory Mapping Assistant
Select memory objects
Memory Object
Type
Data Type
Already mapped
NvBlockDescriptor_Test
NV Block Descriptor
uint8
NVBlockDescriptor_Test2
NV Block Descriptor
UInt16
< Back
Next >
3.
Finish
Cancel

7.4 Validate the RTE

1. Open the validation window via 
2. Deactivate all boxes via 
3. Select RTE and click **[Validate]**.



When implementing you runnable code, you can now access the defined variables by using RTE read and write macros.

8 CANoe OsCAN Library

8.1 Emulate your project with CANoe

You can use CANoe and the CANoe osCAN Library to simulate your project without any hardware but your PC.

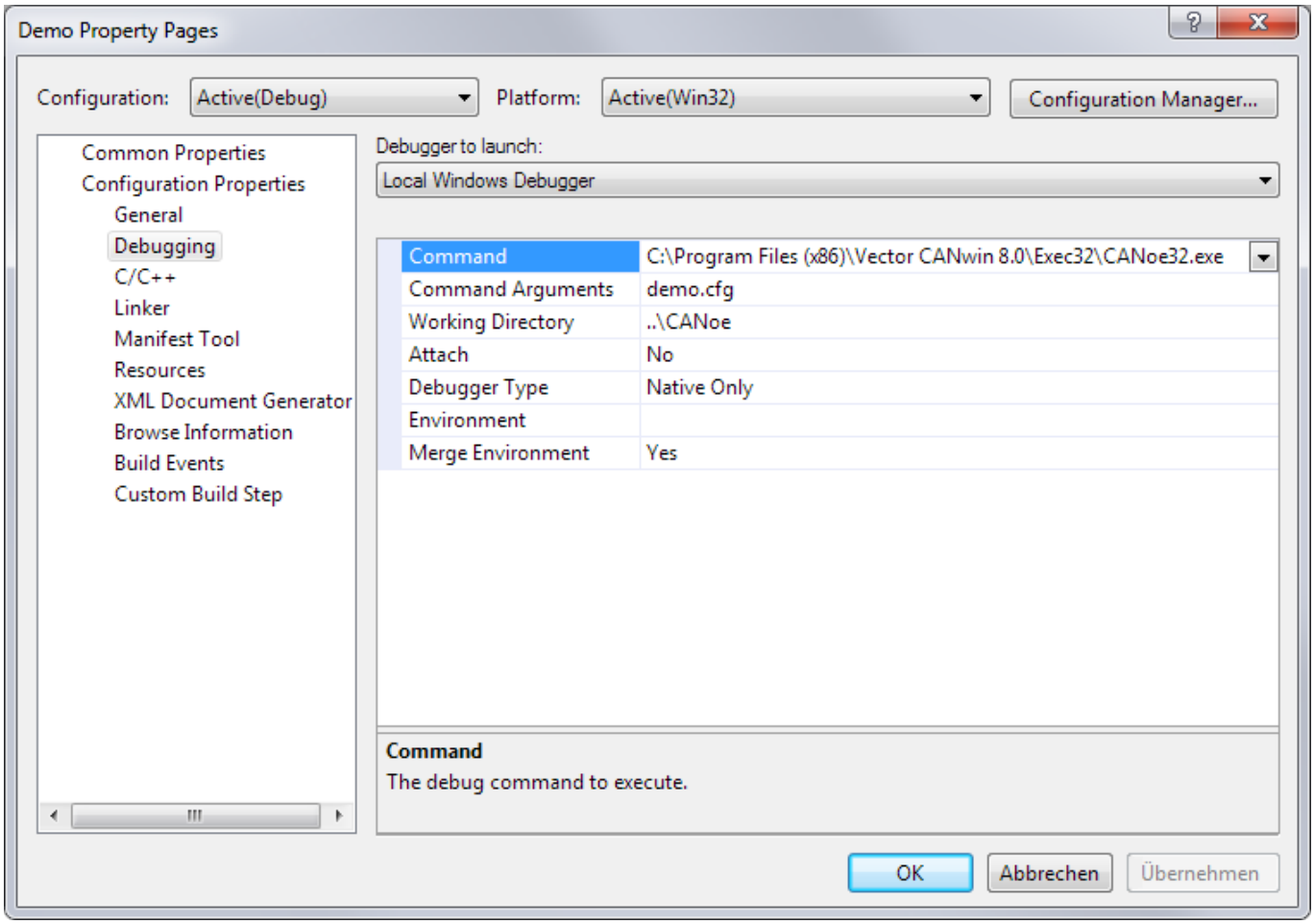
Make sure your project includes all files from:

- the BSW delivery (CAN, CANIF, CANNM, OS…)
- The configuration files of GENy
- The configuration files of DaVinci Configurator Pro
- The generated RTE (RTE_DEV)
- And the folder sources with the component templates filled with your code.

All generated code has to be compiled and linked

Right click your project and select Properties. Then click Debugging and fill in the following information:

- Give the path to your CANoe in the Command line
- Select the CANoe project, here demo.cfg as Command Argument
- Set the Working Directory to ..\CANoe (i.e. to the path, where your demo.cfg is located)
- Set the Debugger Type to Native Only



Now you can start the simulation via <F5>.

You can run your ECU together with other ECUs, programmed like this one and represented as DLL or as remaining bus simulation. You can debug the system using breakpoints in Microsoft Visual Studio™.

9 Basic Software Modules

This chapter deals with BSW modules, Basic Software Modules. First they are introduced theoretically then configured with the DaVinci Configurator Pro.

9.1 Generic BSW Modules

Before you start to configure the BSW module with DaVinci Configurator Pro you have to know something about BSW modules.

This chapter introduces to you a generic BSW module and wants you to get a basic understanding of it:

- How it looks like
- Of what it is formed
- How it is configured
- How it works
- What is fix
- What is generated and

some special topics like

- Memory sections and
- Exclusive areas

Cross Reference

Find the detailed description of the BSW module in the folder **Doc|TechnicalReferences** of your delivery.

9.2 What is a BSW Module?

A Basis Software Module (BSW module) consists of:

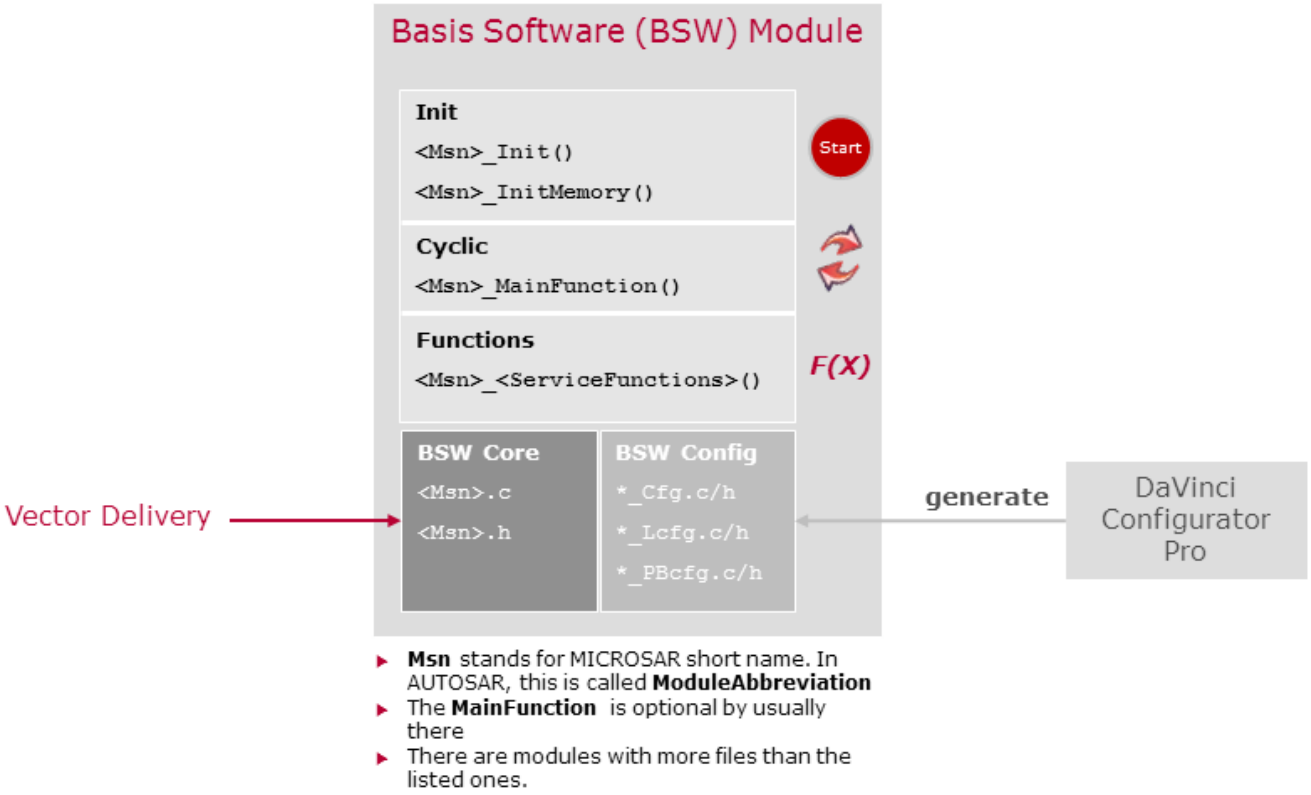
- Static BSW files (algorithms and functions)
- Generated files (data and sometime algorithms and functions)

To get it to work it has to be

- Included
- Initialized
- Its main function has to be called cyclically (in most of the cases)

The mapping of its code and variables can be configured as well as their exclusive areas, to protect the module's internal data.

- Memory Mapping
- Exclusive Areas



Example

Examples for the short names: DEM, DCM, ECUM, etc.

9.3 What Forms a BSW Module?

A BSW module is specified via its implementation files (`<Msn>.c`, `<Msn>.h`). They define the basic functionality of the BSW module.

9.4 BSW Module Configuration

The amount and properties of configurable parameters is defined within the <Msn>.bswmd file. BSWMD stands for Basic Software Module Description file. This file is read by the BSW configuration tool (DaVinci Configurator Pro) and used to create the Basic Editor. The Basic Editor is the tool expression of all configurable parameters of the BSW module, displayed in a generic way.

Note

In addition to the Basic Editor, the Vector BSW configuration tool DaVinci Configurator Pro provides comfortable views that make configuration of BSW modules very comfortable.

The DaVinci Configurator Pro generates the configuration files for every used BSW module. These are files like

- <Msn>_cfg.c/h,
- <Msn>_Lcfg.c/h,
- <Msn>_PBcfg.c/h

9.5 BSW Initialization

9.5.1 <Msn>_InitMemory()

Most BSW module needs variables that have to be initialized before the call of `<Msn>_Init()`. This can be global or static variables. According AUTSOAR concept, all necessary variables will be initialized by the start-up code. Where this is not done or not possible the function `<MSN>_InitMemory` has to be called as an alternative.

9.5.2 <Msn>_Init()

Every BSW module has to be initialized at start-up. This is done with the start-up of the ECUM. The function to initialize a BSW module is called: `<Msn>_Init()`

Note

Our modules and functions are protected against multiple initializations.

9.6 BSW Module Version (xxx_GetVersionInfo)

Each BSW module provides an API **<MSN>_GetVersionInfo**.This API returns the BSW published information

- BSW version
- Module ID
- Vendor ID

The BSW versions are BCD-coded. The availability of this API can be individually configured for each module.

9.7 Cyclic Calls

9.7.1 <Msn>_MainFunction()

To run and to work, most of the BSW modules (except for those, that are triggered by interrupt), have to be called cyclically with a configured call cycle. The module derives its time base from those cyclic calls. This cyclically called function is called main function and its name is formed like: `<MSN>_MainFunction()`

Note

In most of the cases it is mapped to a cyclic task that is called cyclically triggered by an Alarm of the Operating System.

9.8 Service Functions

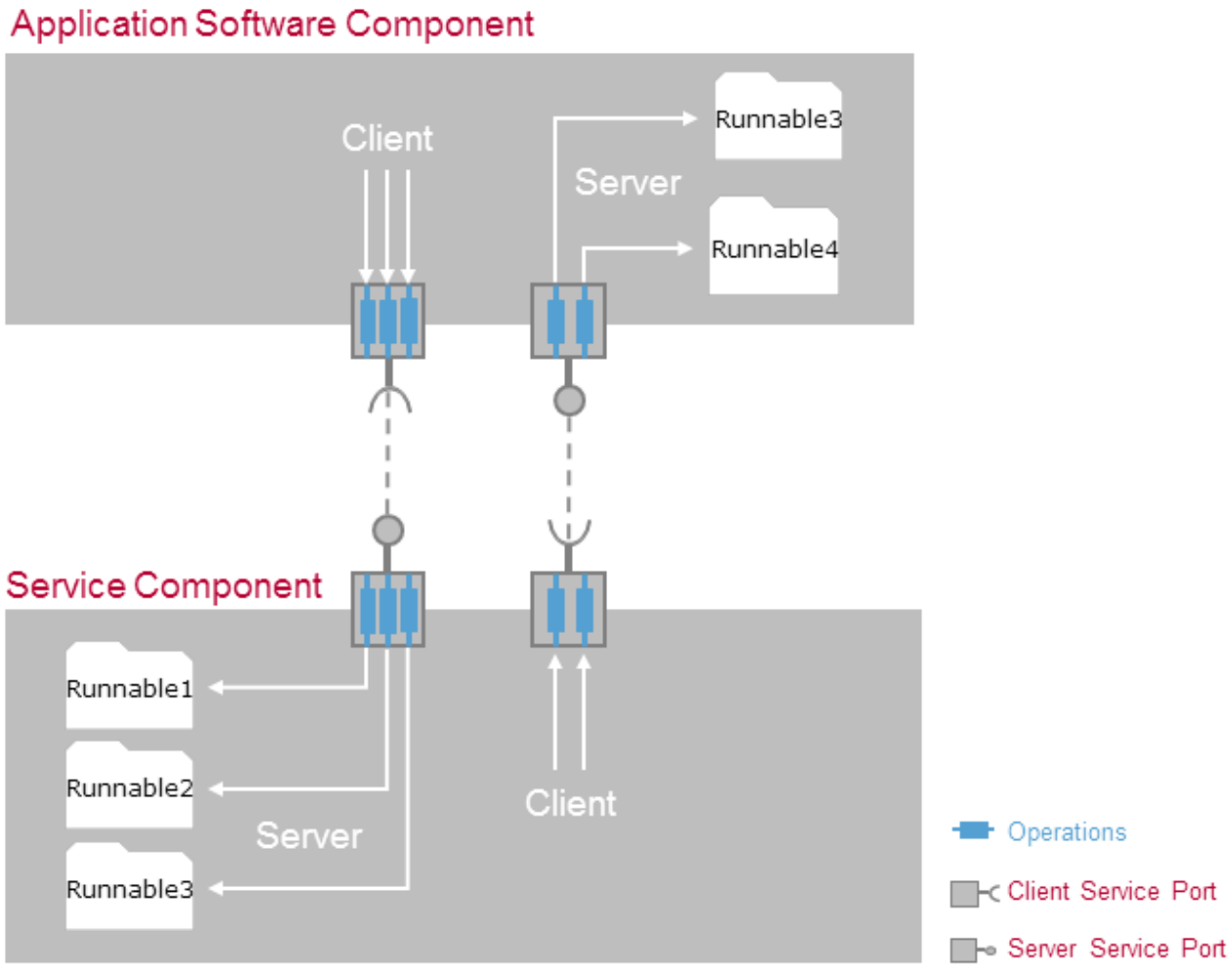
9.8.1 Client Server Theory

Besides the sender and receiver ports, there are also client and server ports. Sender and receiver ports carry data elements, via client ports, you can access so-called operations (or functions) of the servers.

The client uses a service of the server. The server itself provides the operation.

The client server communication between your application software component and a service component is done via service ports – client ports and server ports. A server port provides services (one or more operations) and a client port uses these services. A service component can have server ports and client ports.

- **Service port of the service component is a server port**
  The service is provided by the service component and your application software component just uses the operations (services, functions)
- **Service port of the service component is a client port**
  Your application software component must be server and has to provide the operation (service, function). In this case, you have to program code, i.e. a runnable. This runnable must be created by you and it is triggered by the request of the service.



Within one service port there could be n operations. Every single operation has to be assigned to a runnable.

The servers provide the runnables that contain the code. That is Runnable1, Runnable 2, Runnable 3 of service component and Runnable 4 and Runnable 5 of application component.

9.9 Critical Sections - Exclusive Areas

BSW modules use so-called exclusive areas to protect their resources (module internal data) from concurrency. Each module defines its own exclusive areas, up to 5 can be defined per AUTOSAR definition.

Whether a critical section needs to be handled or not depends on the possibility of a concurrent access onto a given resource of the BSW. It therefore depends on e.g. OS or hardware configuration constraints. If a critical section needs to be handled, different measurements are possible, ranging from a global interrupt lock to the usage of OS semaphores.

Example

As an example, a definition of an exclusive area could look like:

```
SchM_Enter_Com_COM_EXCLUSIVE_AREA_2();
com_TxModeHdlr_DelayTimeCnt[i]--; /* Protected object */
SchM_Exit_Com_COM_EXCLUSIVE_AREA_2();
```

There are different locks available i.e. different interrupt sources could be locked. Global interrupt, peripheral interrupt like CAN or no lock at all.

Cross Reference

Refer to the technical reference document of the BSW module to get information how exclusive areas are defined and used.

9.9.1 Memory Section

Every generated code and variable of the <MSN> modules is enclosed by #defines. Via the template file `compiler_memMap.h` you can define the mapping of each single section of a <MSN> module.

Cross Reference

See more about the memory mapping via `memMap.h` in the technical references of each <MSN> module.

9.9.2 Switch <MSN> Modules Off

Most of the modules can be switched off via: `<Msn>_Shutdown`

10 Command Line Parameters Of The DaVinci Configurator

10.1 Common parameters

Option	Arguments	Mandatory	Description
-h, --help	-	no	Shows command line usage information (use cases and available options).
--verbose	n <ERROR> <WARN> <INFO>	no	Enables the verbose output of logging messages. Possible arguments: ERROR, WARN, INFO Optional Argument: The Log-Level for the verbose output. Default: ERROR
-l, --logfile	1	yes	Set the file to log the Console output into.

Mandatory parameters missing. Please choose a use case. E.g. specify a Project and **--generate** to generate the Project.

10.2 Command Line Interface Use Cases

The DaVinci Configurator command line interface has different use cases:

10.3 Usecase With GUI (only DaVinciCFG.exe)

Opening the GUI is the default use case.

Option	Arguments	Mandatory	Description
-p, --project	1 <DPA-FILE>	no	Specifies the absolute path to the DPA project file to be opened in the GUI immediately

10.4 Use Case DaVinci Configurator CodeGenerator

The identifying option for this use case is -g.

The DaVinci Configurator generates the BSW modules for a given ECU project.

Usage Example

DVCfgCmd --project Project.dpa --generate

DVCfgCmd --project Project.ecuc.arxml --generate --modulesToGenerate "/MICROSAR/Det

Option	Arguments	Mandatory	Description
-p, --project	1 <DPA-FILE>	yes	Specifies the absolute path to the DPA project file or the ECUC
-g, --generate or -v	-	yes if-v is not used	Generate the given project specified in <DPA_FILE>. The -g option also executes --validate At least one of the options -g or -v must be specified.
-v, --validate or -g	-	yes if-g is not used	Validate the given project specified in <DPA_FILE>. At least one of the options -g or -v must be specified.
-m, --modulesToGenerate	1	no	Specifies the module definition references, which should be generated by the -g switch. Separate multiple the modules by a ','. Syntax: --modulesToGenerate "<identifier>,<identifier> ..." The identifier of a module is the AUTOSAR Definition path. E.g. /MICROSAR/Nm, /MICROSAR/CanIf --modulesToGenerate "/MICROSAR/Nm,/MICROSAR/CanIf". You could also pass the shortname of the module, like "Rte", but be aware, if multiple modules have the same shortname, all modules will be generated!
-x, --modulesToExclude	1	no	Specifies the module definition references, which should not be generated by the -g switch. Separate multiple the modules by a ','.

Option	Arguments	Mandatory	Description
			Syntax: --modulesToExclude "<identifier>,<identifier> ..." The identifier of a module is the AUTOSAR Definition path. E.g. /MICROSAR/Nm, /MICROSAR/CanIf --modulesToExclude "/MICROSAR/Nm,/MICROSAR/CanIf" You could also pass the shortname of the module, like "Rte", but be aware, if multiple modules have the same shortname, all modules will be excluded!
--extGenStepsToGenerate	1 <GEN_STEPS>	no	Specifies the External Generation Steps, which should be generated by the -g switch. If empty (""), then no External Generation Steps is executed. Syntax: --extGenStepsToGenerate "<identifier>,<identifier> ..." The identifier of a step is the step name. Separate multiple steps by a ','. E.g. MyStep,DioExtStep,SwcGenStep --extGenStepsToGenerate "DioExtStep,SwcGenStep"
--genArg	n <GEN_ARGS>	no	Passes arguments to the specified code generators. Syntax --genArg <DEFINTION>:<Argument> or --genArg="<DEFINTION>:<Argument>" The Definition is the AUTOSAR Definition path of the module to generate. E.g. /MICROSAR/Nm, /MICROSAR/CanIf You could also pass the shortname of the module, like "Rte", but be aware, if multiple modules have the same shortname, all modules will get the argument! You can pass multiple --genArg parameters. E.g. --genArg /MICROSAR/Nm:DoSomethingSpecial=true --genArg="Rte:DoAnotherThing=true" Multiple arguments for one definition can be passed in one --genArg argument or in

Option	Arguments	Mandatory	Description
			several. If several --genArgs are used for the same definition, the values are concatenated with a blank as separator. E.g. --genArg /MICROSAR/Nm:Arg1=true Arg2=false or --genArg /MICROSAR/Nm:Arg1=true --genArg /MICROSAR/Nm:Arg2=false
--saveProject	-	no	Saves the project after validation or generation. Generators may modify the project in the calculation phase before the actual generation has started. This option will persist these modifications.
--synSystemDescription	-	no	Performs the synchronization of the System Description after loading the project. This might modify the project, so please consider also the usage of the --saveProject option.
--genType	1 <GEN_TYPE>	no	Specifies the generation process type (""NORMAL"" => Real Target or ""VTT"" => vVIRTUALtarget) Syntax: --genType <GEN_TYPE> E.g. NORMAL If no --genType is set, the default depends on the <TargetType>-setting from dpa file.

The options **--generate** and **--validate** are mutual exclusive but one of them has to be specified.

10.5 Use Case DaVinci Configurator Execute Converter

The identifying option for this use case is -g.

The DaVinci Configurator converts the ECU configuration.

Usage Example

DVCfgCmd --project Project.dpa --convert

DVCfgCmd --project Project.ecuc.arxml --convert

Option	Arguments	Mandatory	Description
-p, --project	1 <DPA-FILE>	yes	Specifies the absolute path to the DPA project file or the ECUC file.
-c, --convert	-	yes	Convert the given project specified in <DPA-

Option	Arguments	Mandatory	Description
			FILE>.
--convertArg	n <CONVERT_ ARGS>	no	Passes arguments to the specified converter. Syntax: --con- vertArg=""<NAMESPACE>:<Argument>"". The Namespace is the namespace defined by the converter

10.6 Use Case BaseEcucGenerator (create initial empty project, without GUI)

The identifying option for this use case is -d.

Usage Example

DVCfgCmd -d D:\TEMP\MyProj -n MyProject --derivative Canoeemu

Option	Arguments	Mandatory	Description
-d, --projectDir	1 <DIR>	yes	The directory, the new pro- ject shall be stored in
-n, --projectName	1 <NAME>	yes	The project name and name of generated EcuC files
--derivative	1 <DERIVATIVE>	yes	The derivative name
--splitProject	-	no	Generates a project using one file per module con- figuration
--ecucGenArg	n <ECUC_ARGS>	no	Passes additional arguments to the BaseEcucGenerator. Syntax: --ecucGenArgs "<EcucOption>=<Value>" or --genArg="<Ecuc You can pass multiple -- ecucGenArgs parameters.

10.7 Use Case EcucUpdater (without GUI)

The identifying option for this use case is -u.

Usage Example

DVCfgCmd -u D:\TEMP\MyProj\MyProject.dpa -e D:\SysExtract.arxml

Option	Arguments	Mandatory	Description
-u, --updateProject	1 <DPA-FILE>	yes	The DPA file of the project which shall be updated
-e, --extract	1 <FILE>	no	The system extract file
--odx	4 <ODX-FILE> <ECU> <VARIANT> <CSV-FILE>	no	Path to ODX file, ODX ECU, ODX VARIANT, CSV file path
--cdd	2 <CDD-FILE> <VARIANT>	no	Path to CDD file, CDD VARIANT
--onlyEcuc	-	no	If no argument is passed, the complete update is performed (including DaVinci Developer workspace). If --onlyEcuc is set, only ECUC is updated, without the DaVinci Developer workspace.
--ecucGenArg	n <ECUC_ARGS>	no	Passes additional arguments to the BaseEcucGenerator. See BaseEcucGenerator usecase for additional information.

The options **--cdd** and **--odx** are mutual exclusive.

At least one of **--cdd**, **--odx** and **--extract** must be specified.

10.8 Use Case DaVinci Configurator Exporter (without GUI)

The identifying option for this use case is --exportDir.

The DaVinci Configurator exports different types of AUTOSAR arxml files. For example files per variant in a variant project.

Usage Example

DVCfgCmd --project Project.dpa --exportDir ./exportDir --exportPostbuildVariants

Option	Arguments	Mandatory	Description
-p, --project	1 <DPA-File>	yes	Specifies the absolute path to the DPA project file
--exportDir	1 <DIR>	yes	Specifies the directory to export the data into.
--exportPostbuildVariants	-	yes	Export the Post-build variants into. This will export the Active-Ecuc and miscellaneous data - Active Ecuc export into one file (even for split DPA-projects) per variant <project-name>.<variant-name>.ecuc.arxml - Miscellaneous data into one file per variant. The files contain all data of the project except: * ModuleConfigurations, ModuleDefinitions * BswImplementations, EcuConfigurations * Variant information like EvaluatedVariantSet <project-name>.<variant-name>.misc.arxml
--listAvailableExporterIds	-	no	
--exportWithExporterId	1	no	Exports the loaded project

Option	Arguments	Mandatory	Description
	<EXPORTER_ID>		with the selected exporter. This will create a file named Exported_ <EXPORTER_ID>.arxml in the folder specified by --exportDir. An <EXPORTER_ID> could be retrieved with the --listAvailableExporterIds argument.

All options starting with --export (except --exportDir) are mutual exclusive.

At least one --export option or --listAvailableExporterIds must be specified.

10.9 Use Case DaVinci Configurator Sign Script

The DaVinci Configurator creates a signature for workflow scripts.

Usage Example

DVCfgCmd --sign MyScript.py

Option	Arguments	Mandatory	Description
--sign	1 <SCRIPT_FILE>	yes	Specifies the script file so sign.

10.10 Return Codes

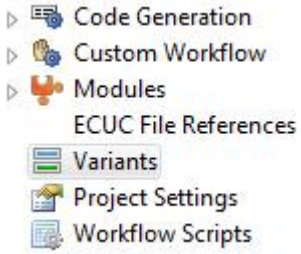
Name	Integer-Value	Description
EXIT_OK	0	ALL_OK in BaseEcuC, Updater and Gen: Configuration loaded without errors, generated without errors.
EXIT_NOT_OK	1	Exit object indicating abnormal termination
EXIT_NO_WORKSPACE_PATH	2	Indicating no workspace path
EXIT_NO_ACTION	3	Indicating no action specified
EXIT_INVALID_SIP	4	Configuration could not be opened.
EXIT_NO_PARAMETERS	5	Indicating missing parameters
EXIT_INVALID_COMMANDLINE_ARGS	6	Invalid generation paths.
EXIT_UNHANDLED_EXCEPTION	7	Unexpected error occured.
EXIT_BASE_ECUC_GENEARTOR_ ERROR	10	
EXIT_UPDATER_ERROR	11	

11 Variant Handling

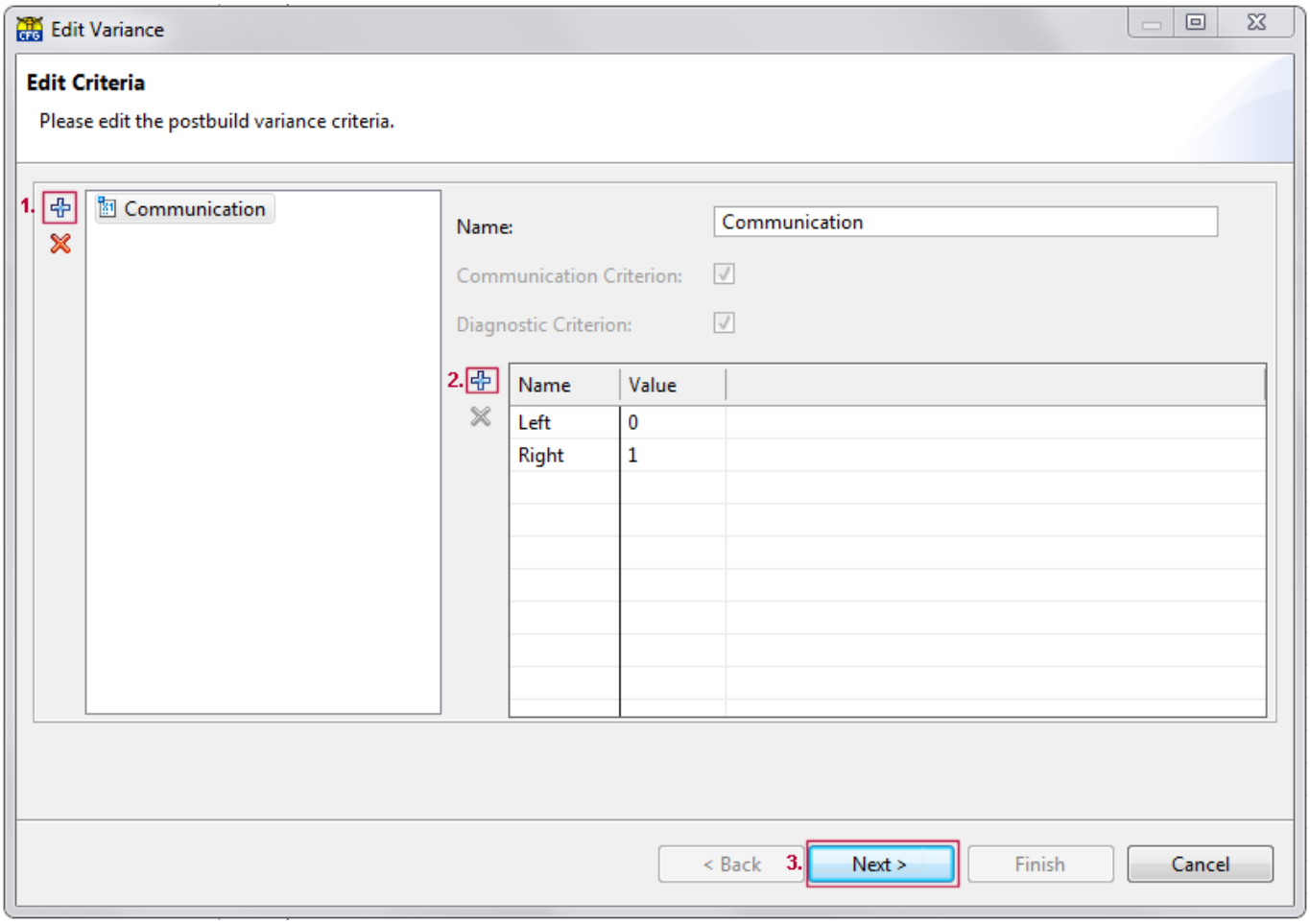
11.1 Define Criterion and Variants

If you use variant handling within your project you have to define your variants first.

After you setup your project, open the **Project Settings Editor** via **settings icon**  and select **Variants**.



Select the **Edit Variance icon**  to add criterion, define criterion values and map criterion values to variants.

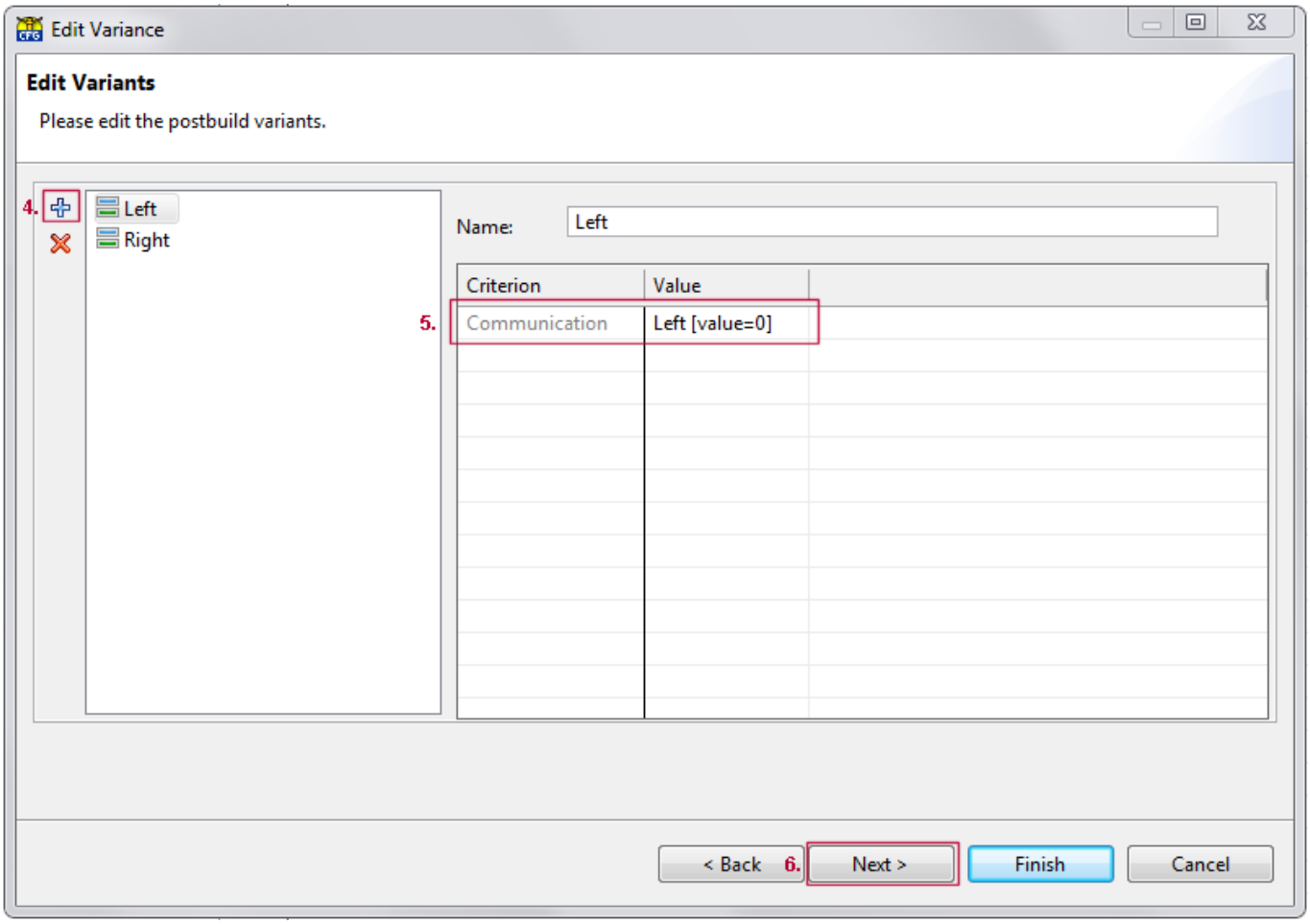


1. Add **[+]** new Criterion.

Note

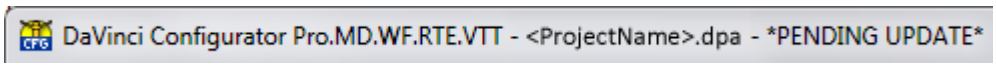
The DaVinci Configurator Pro is currently limited to a single criterion. This criterion can be used for **diagnostic** and **communication** variance.

2. Add **[+]** one criterion value for each variant.
3. Go on with **[Next >]**



4. Add **[+]** your Variants
5. Define Criteria Value for your Variants
6. Go on with **[Next>]** to see a summary of your definitions or **[Finish]** to come back to Variants view.

After finishing variant definition, the tool enters to **PENDING UPDATE** project state.



Note

The DaVinci Configurator Pro is currently limited to a single criterion. This criterion can be used for **diagnostic** and **communication** variance.

11.2 Add and Assign Input Files to Variants

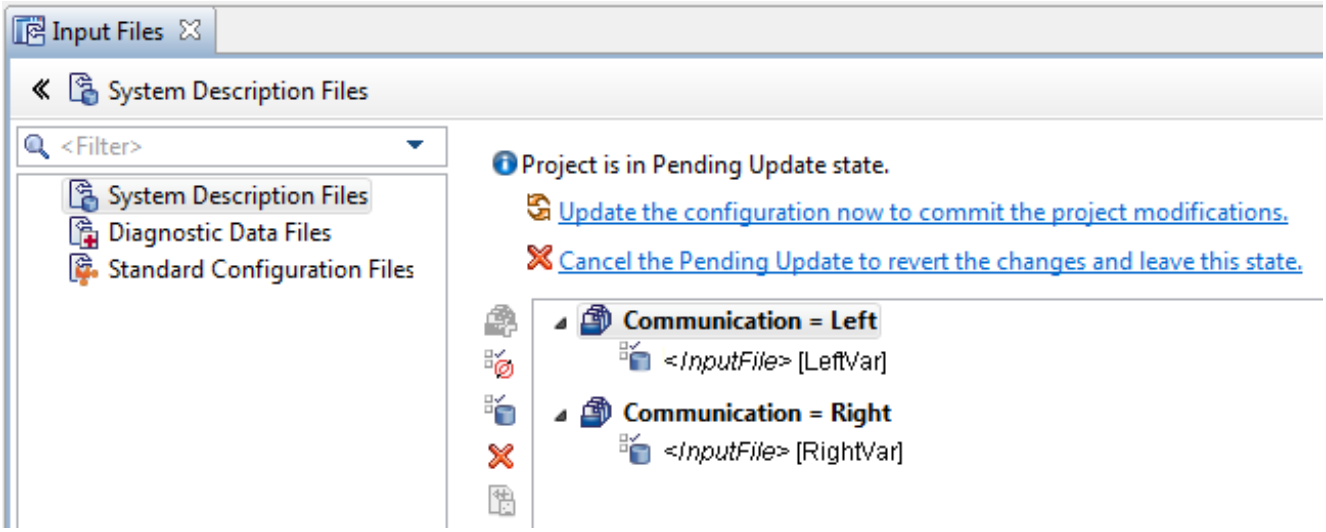
Open Input Files editor via **Project | Input Files** or use the **input file button**  of DaVinci Configurator Pro toolbar.

Select **System Description Files** and add your Input Files via **Add File Sets icon** . The Add File Set Assistant opens.

Note

The following step is necessary for each variant.

Select the **Post-Build Criterion Value** (Variant) your input file will be valid and go on with **[Next >]**. Add **[+]** your input file(s), select your ECU Instance and confirm with **[Finish]**.



After adding and assigning your input files our project is still in PENDING UPDATE state.

Select **Update the configuration now to commit the project modifications** to start update process.

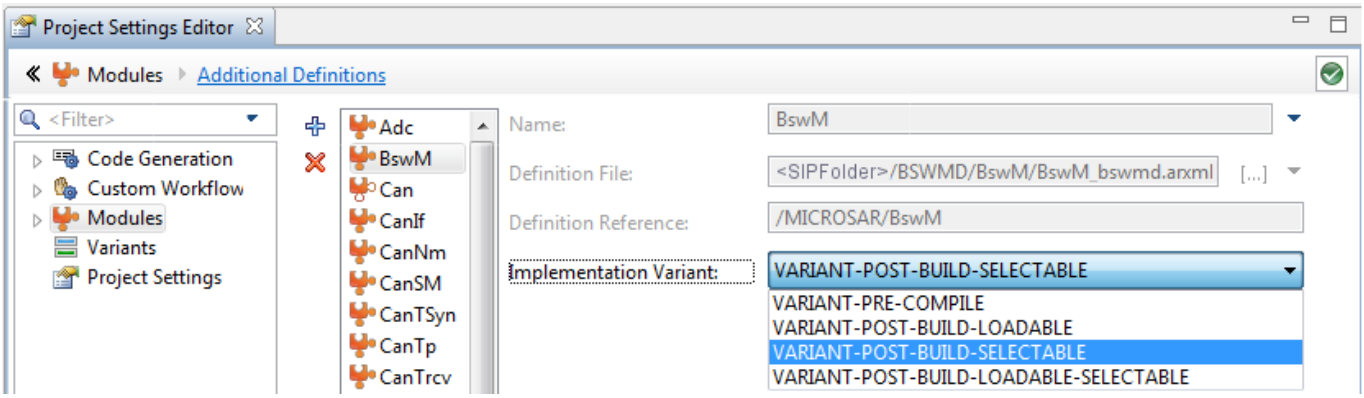
Cross Reference

What happens while Update Process? See section STEP2 Define Project Settings on page 28.

11.3 Define Variance for BSW Modules

Open Project Settings Editor via **Project** | **Project Settings** or use **project settings icon** at DaVinci Configurator Pro toolbar.

Select **Modules** to see all modules currently activated for your project.



For each BSW module define if it supports variance or not. Therefore choose **Implementation Variant**.

- **VARIANT-POST-BUILD-SELECTABLE**
  No post-build loadable update of the configuration at post-build time. All variants are configured at pre-compile time.
- **VARIANT-POST-BUILD-LOADABLE-SELECTABLE**
  post-build loadable update of the configuration data is supported using MICROSAR Post-Build Loadable. This feature required dedicated licensing.

Note

Multi selection is possible within module view of the DaVinci Configurator Pro, this enables you to set variance for several BSW modules at the same time.

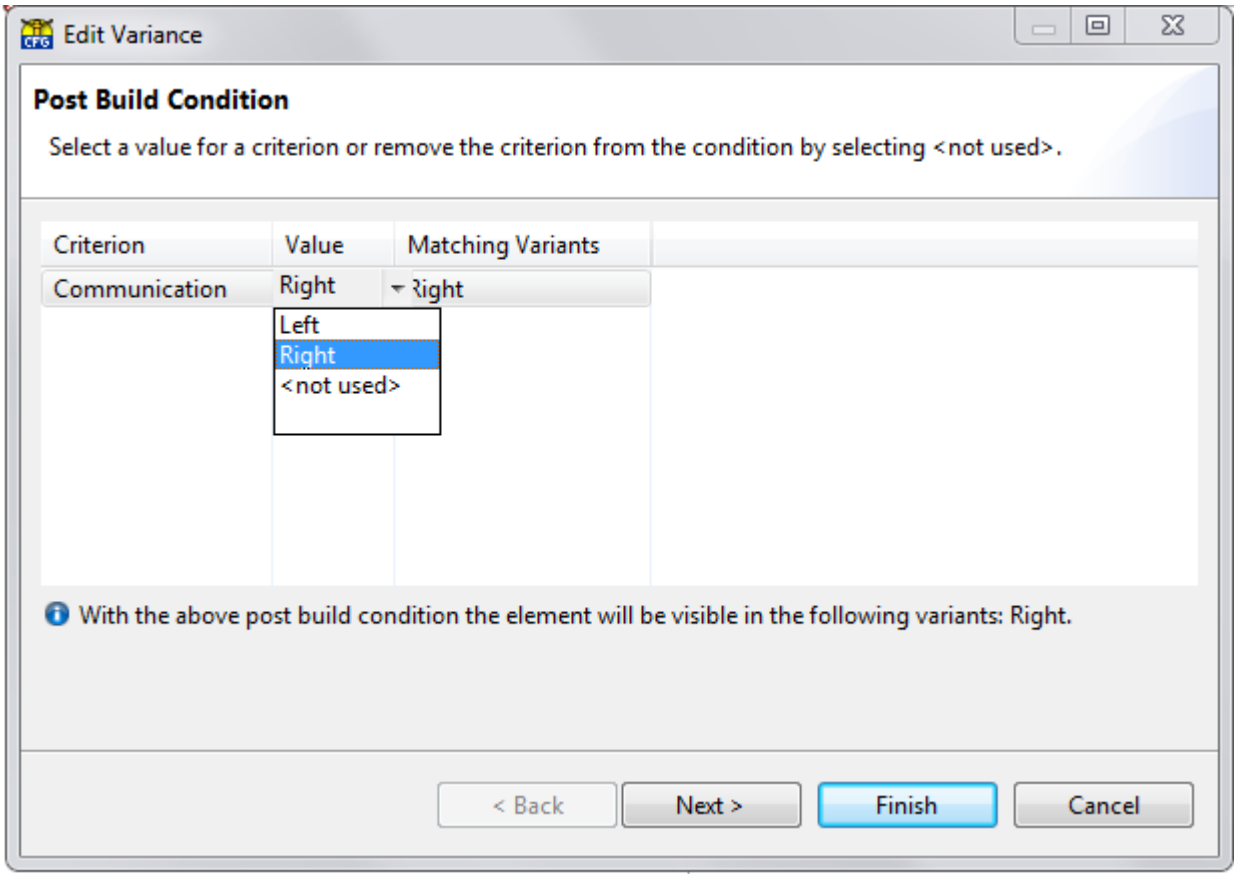
11.4 Configure and Validate BSW

The DaVinci Configurator Pro highlights variant parameter and container using a brown [V]. When changing the configuration it has to be considered whether the change shall be applied to all variants or if the change shall be done only for one variant.

Note

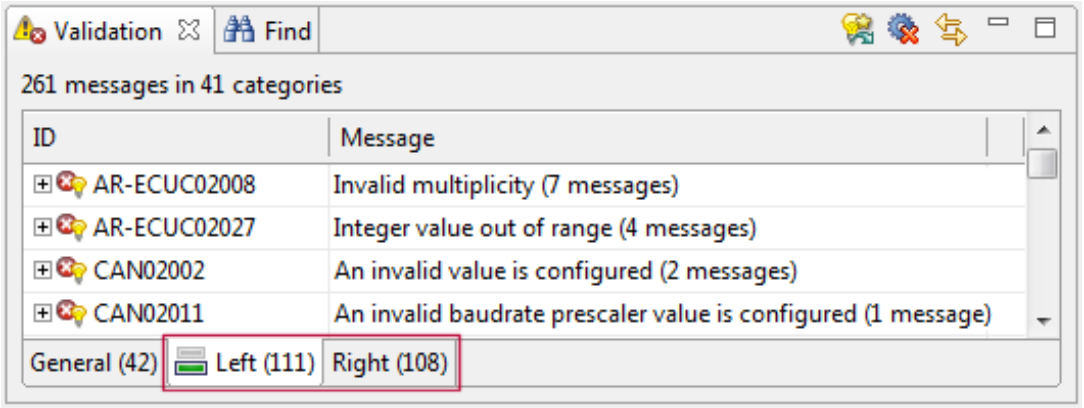
You can select your **Active Variant** at the DaVinci Configurator toolbar.

To define a value for a single variant only, right-click on parameter, select **Edit variance** and define variant (**Value**).



Note

The validation view includes views for each variant.

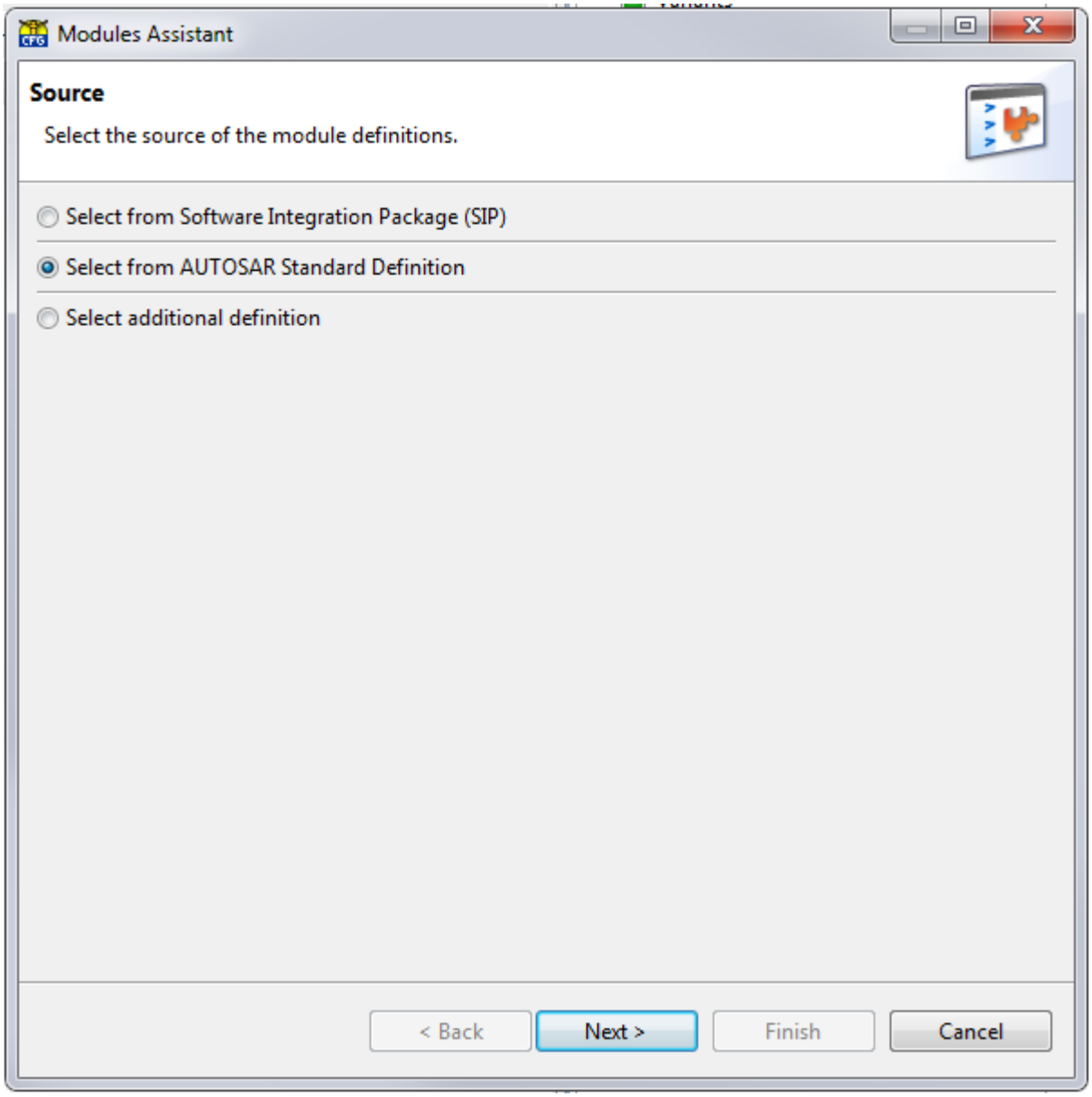


12 Add Module Stubs From AUTOSAR Definition

In some cases it is necessary to add a module, which is not delivered within your SIP, e.g. a delivered module (DCM) needs references and interfaces to a not delivered module (NVM), otherwise the validation fails.

To avoid validation and generation errors you have to add the required module according to AUTOSAR standard definition. Therefore open **Project Settings Editor**, select **Modules** and open Modules Assistant via add **[+]**.

Choose **Select from AUTOSAR Standard Definition** and go on with **[Next]**, select the required module and confirm with **[Finish]**.



Now the module is available at the **Basic Editor**. The module based on AUTOSAR Standard definition needs to be configured basically with all necessary definitions required by the MICROSAR modules within your project.

13 TCP/IP Stack Migration Of Projects Based On MICROSAR R11 And Earlier (due To FEAT-261)

The API between SOAD and TCPIP is now realized according to AUTOSAR 4.2.1.

13.1 SD – Service Discovery

The Service Discovery module delivered with MSR4-R12 is conforming to the AUTOSAR Release 4.2.1. Due to changes of the configuration containers introduced with this AUTOSAR release, a legacy SD configuration has to be adapted.

Main changes

- Removed possibility to configure a SdEventHandler with the "Auto Available" feature. The corresponding parameter can be removed without any impact to the configuration.
- Additional references SdMulticastEventSoConRef and SdConsumedEventGoupMulticastGroupRef. These references simplify the validation and improve the traceability of the configuration.
- Each SdServerService and SdClientService contains additional references to SoAdSocketConnectionGroups (SdClientServiceXxxRef and SdServerServiceXxxRef). These references specify the UDP and TCP SoAdSocketConnections which shall be used for the communication of the corresponding service. This implies, that in case of a SdServerService, the entire communication of the service uses a single SoAdSocketConnectionGroup per communication protocol. The previously required additional SoAdSocketConnectionGroup to support provided methods can be removed.
- The legacy SdClientServiceXxxRef and SdServerServiceXxxRef within the SdConsumedMethods and SdProvidedMethods can be removed.
- Changed multiplicity of the SdEventHandlerXxx container. Due to additional APIs and configuration possibilities within the SoAd module, the configuration of the SdEventHandler is simplified. In contrast to the legacy configuration, each SdEventHandler requires exactly one SoAdRoutingGroup per communication protocol in order to enable and disable the transmission-paths of the corresponding SomeIp messages. The configuration of independent SoAdRoutingGroups per used SoAdSocketConnection is not required anymore.

13.2 TCPIP - Transmission Control Protocol / Internet Protocol

The API of the module TCPIP has been adapted to be conform to AUTOSAR release 4.2.1. Also the configuration interface between TCPIP and its upper layer (e.g. SOAD) has been adapted.

Main changes

- Sockets are not preconfigured to be used for a specific user or port / network-address combination anymore. The sockets now have to be requested and bound during runtime, and rx and tx buffers have to be requested (via TcpIp_ChangeParameter) before they can be used.
- TCPIP now implements the socket users according to AUTOSAR 4.2.1. In earlier AUTOSAR version the only user of TCPIP has been the SOAD, while the Vector implementation of TCPIP always sup-

ported a multi user concept. Socket users are now called socket owners (renamed according to AUTOSAR)

- TCP server sockets now use a more BSD-like (Berkeley Software Distribution) behavior than before. To accept multiple connections on one listen socket the maximum number of accepted connections is now configured during runtime when calling TcpIp_TcpListen.

Configuration changes

- Most elements from TcpIpSockUser are transferred to TcpIpSocketOwnerConfig
  - All existing TcpIpSockUser containers will be removed during the SIP update
  - The new TcpIpSocketOwnerConfig container for the SOAD will be created automatically
  - For each additional socket owner a TcpIpSocketOwnerConfig container has to be created manually
- TcpIpSockConfig is removed, so all old references to socket configurations have to be deleted
- The container TcpIpTcpSocketBuffer is added, here the required tx and rx buffers have to be configured
- The number of listen sockets (server sockets) a socket owner wants to use has to be configured using the parameter TcpIpSocketOwnerTcpListenSocketMax

13.3 SOAD - Socket Adapter

The API to the lower layer module TCPIP has been adapted to be conform to AUTOSAR release 4.2.1.

Now all sockets and their resources are assigned dynamically at runtime.

Configuration changes

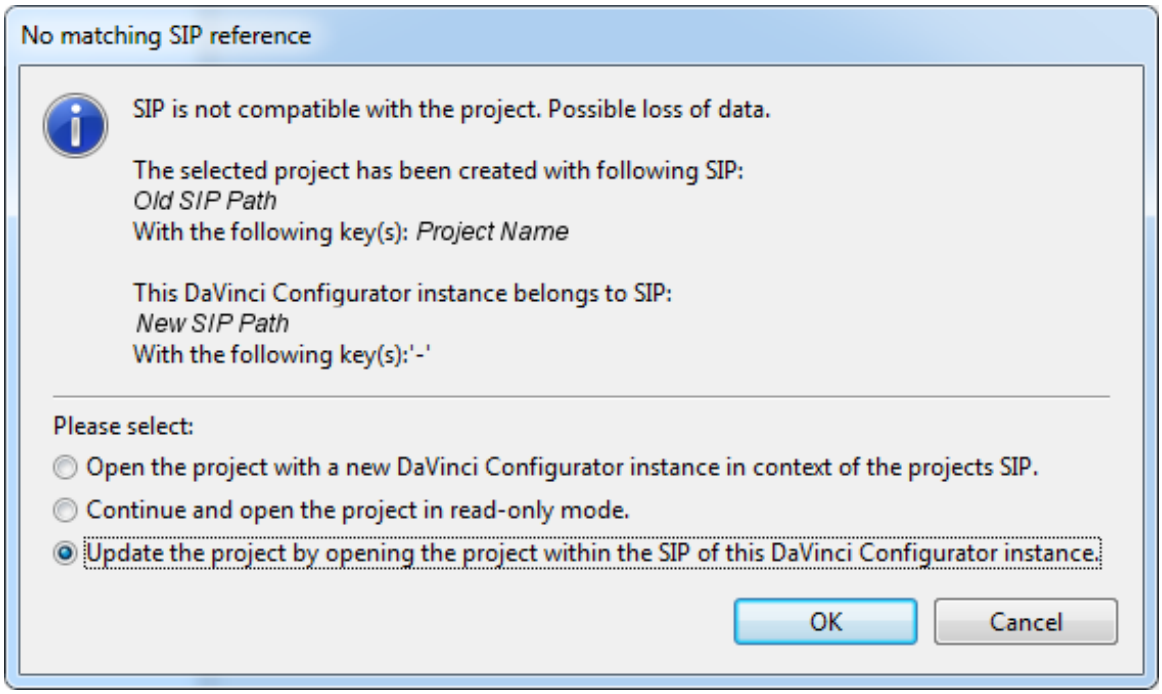
- Container TcpIpSockConfig does not exist anymore. Tx and Rx buffer configuration for a TCP socket is now located in SoAd. For UDP no adaptions are needed.
  - TcpIp/TcpIpConfigSet/TcpIpSockConfig/TcpIpSockTxBufSize →SoAd/SoAdConfig/SoAdSocketConnectionGroup/SoAdSocketProtocol/SoAdSocketTcp/SoAdSocketTcpTxBufferMin
  - TcpIp/TcpIpConfigSet/TcpIpSockConfig/TcpIpSockRxBufSize → SoAd/SoAdConfig/SoAdSocketConnectionGroup/SoAdSocketTpRxBufferMin
- Ressources for Tx and Rx buffer for TCP sockets are still located in the TcpIp module (container TcpIpTcpSocketBuffer). It must be ensured that enough buffers with corresponding sizes are configured for all sockets which are active at the same time at runtime. It must exist an exact value match of the following parameter set:
  - TcpIp/TcpIpConfigSet/TcpIpTcpSocketBuffer/TcpIpTcpSocketTxBufferSize ↔ SoAd/SoAdConfig/SoAdSocketConnectionGroup/SoAdSocketProtocol/SoAdSocketTcp/SoAdSocketTcpTxBufferMin
  - TcpIp/TcpIpConfigSet/TcpIpTcpSocketBuffer/TcpIpTcpSocketRxBufferSize ↔ SoAd/SoAdConfig/SoAdSocketConnectionGroup/SoAdSocketTpRxBufferMin

All other changes and adaptions are done by the configuration tool automatically or additional solving actions are provided to adapt the configuration manually.

14 SIP Update

You received a newer version of your SIP. This requires a update of your current project. Therefore open the project with the new version of the DaVinci Configurator Pro. The **DaVinciCFG.exe** is located within the folder *<UpdateSIP>\DaVinciConfigurator\Core*.

The DaVinci Configurator Pro identifies that the project was created with an older SIP and displays the following message. Select **Update the project by opening the project within the SIP of this DaVinci Configurator instance** and click **OK**.



The update will performed. Wait until the DaVinci Developer project opens. Click **[Accept]** when the warning message appears. Click **[Import]** in the next dialog.

The Signal Import Mode dialog opens, select **Use import mode for all remaining objects** and click **[OK]**. The dialog proposing to **Save and close now** opens, confirm with **[Yes]**.

The DaVinci Developer project is closed and the update of the DaVinci Configurator Pro project continues. Once the update finishes click **[Ok]**.

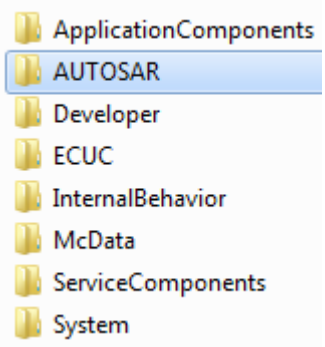
The project is now migrated to the new SIP.

15 Platform Types

DaVinci Configurator and DaVinci Developer use from Release 12 on a common definition of Platform Types as defined by AUTOSAR. These types are defined in the package defined by AUTOSAR: */AUTOSAR_Platform/*.

15.1 Location of the common definition

The **/Config** folder of the project contains a new folder named **/AUTOSAR**



This folder contains the file **PlatformTypes_AR4.arxml**, which defines the AUTOSAR Platform Types. This file is shared between DaVinci Configurator project and DaVinci Developer project. This file shall not be modified manually.

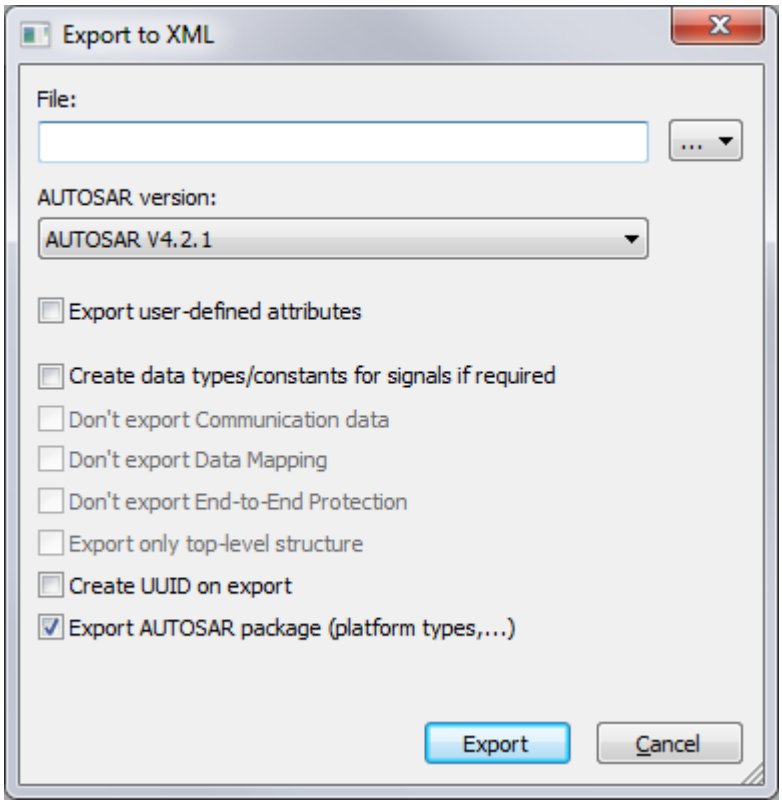
15.2 Import/Export behavior

DaVinci Configurator and DaVinci Developer provide the definition of the Platform Types as seen above. That means, the SWCs or Service Components do not have to provide this definition again, but shall only reference the types via the package defined by AUTOSAR (*/AUTOSAR_Platform/*).

When a file is imported in the project, the references to the provided Platform Types (via */AUTOSAR_Platform/* package) are automatically solved by DaVinci Configurator and DaVinci Developer.

In case an imported file contains the definition of a Platform Type already provided by DaVinci Configurator and DaVinci Developer, this definition is not imported, and the one provided by DaVinci Configurator and DaVinci Developer is used.

The **Export Editor** provides a new option **Export AUTOSAR package (platform types, ...)**



When this option is selected, the objects from the */AUTOSAR_Platform/* package are exported from the target file.

When this option is not selected, the objects from the */AUTOSAR_Platform/* package are not exported, only the references are exported.

15.3 Service components use the new Platform Types

In the SWC description of the service components generated by DaVinci Configurator, the new Platform Types are used instead of the ones generated in the previous SIP. The old types

15.3.1 Old types

UInt8	/MICROSAR/Dem_swc/DataTypes
UInt8	/MICROSAR/Csm_swc/DataTypes
UInt8	/MICROSAR/Dcm_swc/DataTypes
UInt8	/MICROSAR/Det_swc/DataTypes

15.3.2 New types

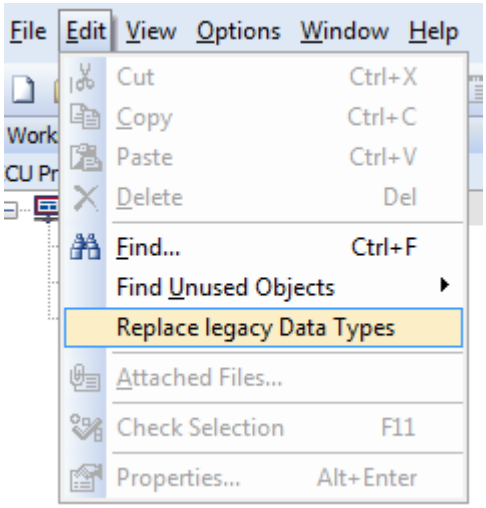
uint8	/AUTOSAR_Platform/ImplementationDataTypes

15.4 Replacement of old developer standard types (Replace legacy Data Types)

Standard Types were provided in previous versions of DaVinci Developer projects under the */DataTypes/PlatformTypes/* package. These standard types are not provided anymore by DaVinci Developer, but they may remain in the project after migration to the new SIP.

An option is available in DaVinci Developer to replace references to these old types by references to the new provided Platform Types.

This option is available at **Edit | Replace legacy Data Types**



By clicking **Replace legacy Data Types**, the references are replaced.

This option is currently unavailable if the library is selected.

Note

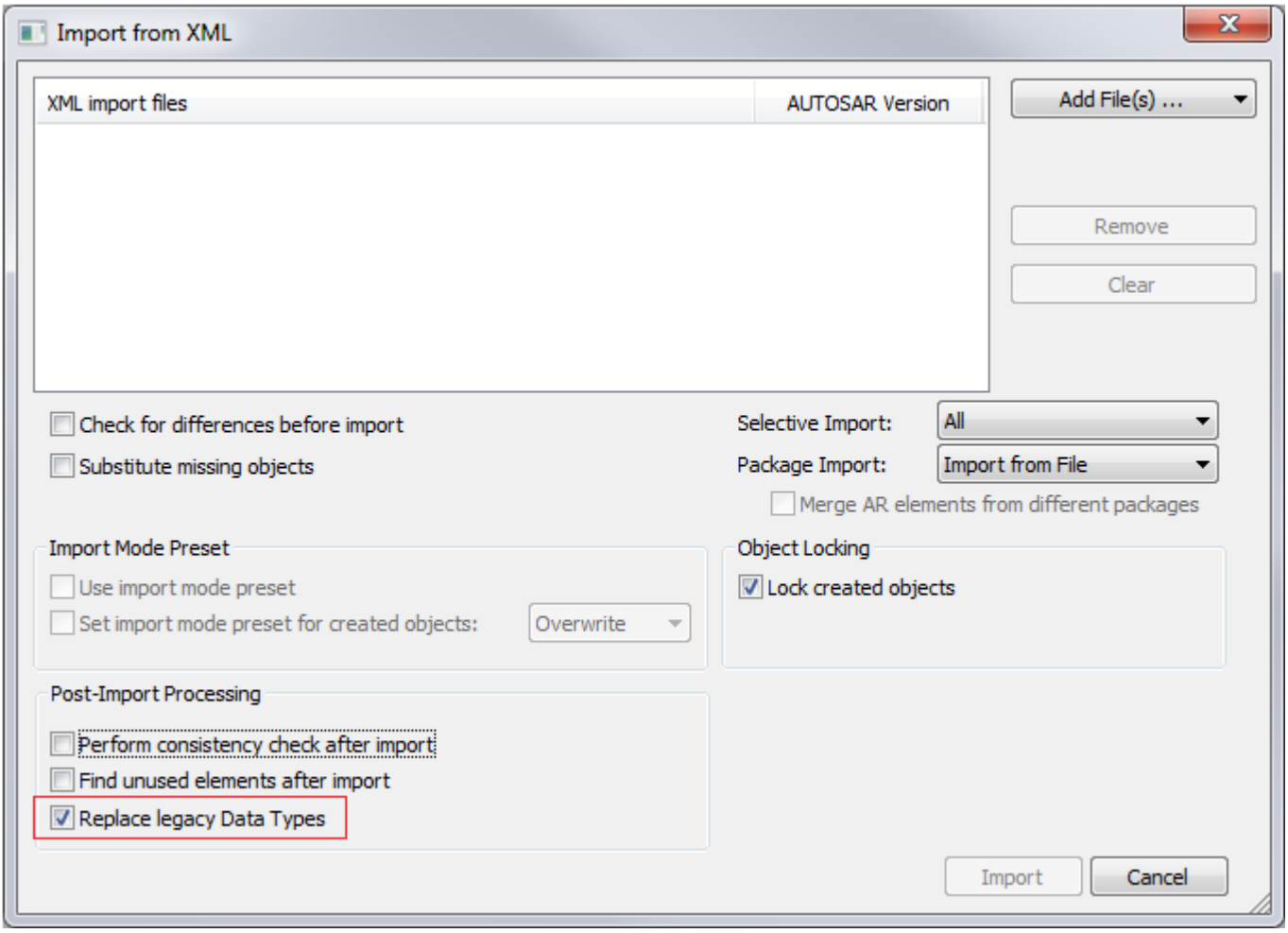
The Data Types within the package /DataTypes/PlatformTypes/ are not removed from the library. This action can be performed manually.

Example with uint8

> References to */DataTypes/PlatformTypes/uint8* are replaced by */AUTOSAR_Platform/ImplementationDataTypes/uint8*

> */DataTypes/PlatformTypes/uint8* is kept in the project.

The same option is available when a file is imported in the project. The **Import from XML** editor provides the option **Replace legacy Data Types**"



When the box is checked, all references to the DataTypes within the */DataTypes/PlatformTypes/* package are replaced by the corresponding Platform Type from */AUTOSAR_Platform/* package.

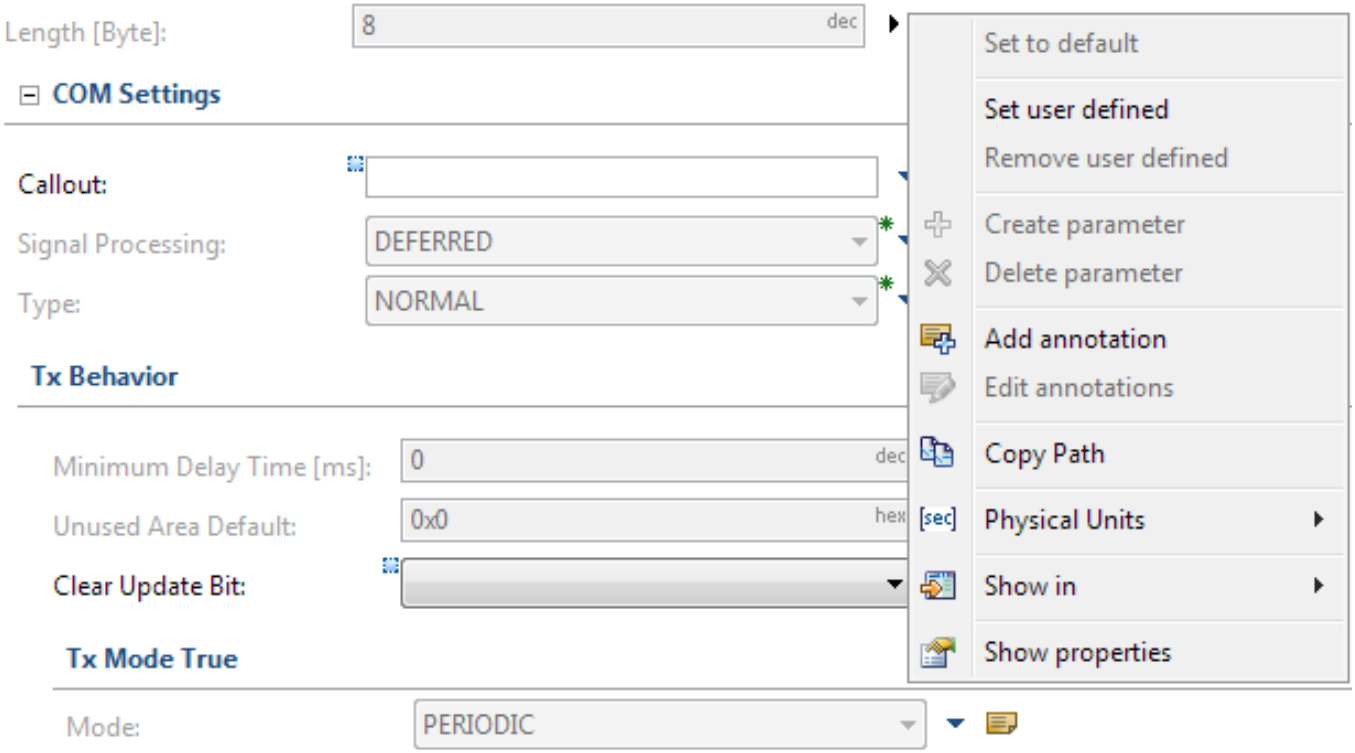
16 Frequently Asked Questions

You have a certain question? You just want to know how to do e.g. a certain setting without reading the whole document again? Then go on reading the following list and use the links to get at the place in the document where your question will be answered. This chapter will be extended continuously.

16.1 Annotations for any parameter

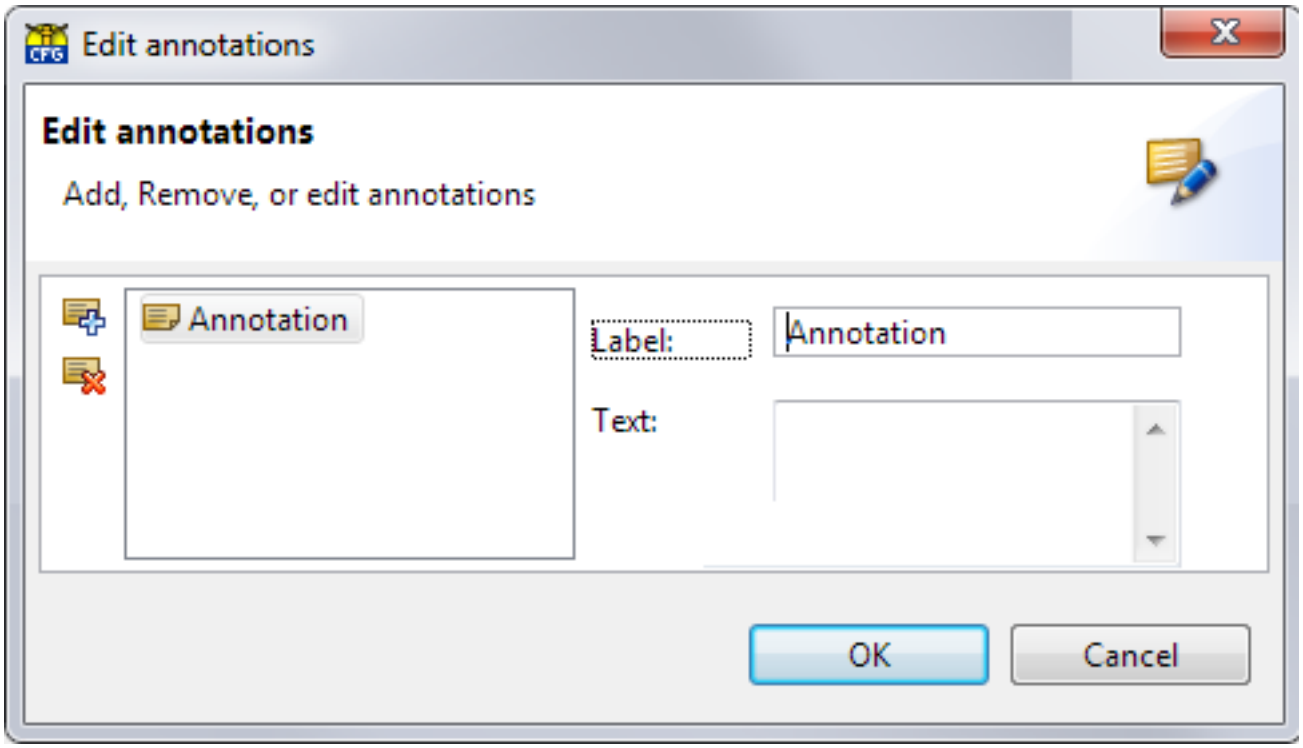
How to append an annotation to a parameter

For almost any parameter you can add individual annotations regardless whether you are in the Basic Editor or in the Configuration Editor. Open the context menu of a parameter by clicking the little right-pointing arrow and click **Add annotation**.

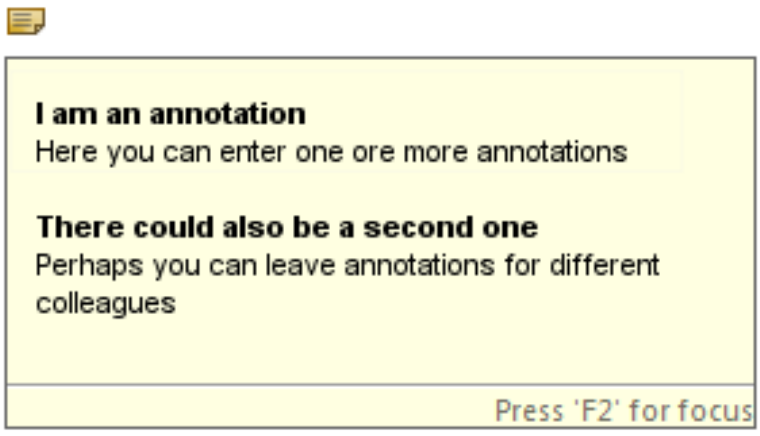


The annotation editor will open. You can enter one or more annotations each with a headline and floating text.

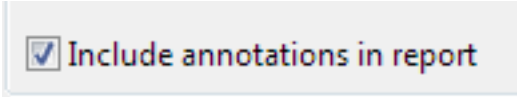
Via **Edit annotations** you can open and edit an already written annotation.



To read you annotations you can either open it via the editor or just by touching the little letter icon with the mouse, its content will be displayed like shown below as an example.



Via a report (**Project|Report...**) it is possible to see all your annotations. Make sure to activate the checkbox **Include annotations in report**



16.2 Find Reference Container

16.2.1 How to find references using the [Find] dialog

Open the **Find** dialog, type in **value==""** and give a container name between the apostrophes.

17 Release Notes

This section gives an overview of the changes which have been made on the MICROSAR Basic Software Modules (BSW) within the last releases.

Listed changes are new features or the extension of existing functionality. Please note that this document does not provide a list of fixed issues. Open issues are documented in the issue report document IssueReport_<CBD-Number>.pdf, which is part of the deliveries documentation.

This section refers to Vector internal tracking numbers (ESCAN, EVAL tickets and Feature List numbers) which uniquely identify the changes.

Please refer also to the Technical References for more information on the changes, modifications or extensions.

Changes to DaVinci Configurator Pro and DaVinci Developer are documented in Release Notes provided along with the tools.

17.1 Release 12

17.1.1 Breaking Changes

Modification of existing functionality or APIs that can have an impact on existing applications (such as SWCs, CDDs …).

Change ID	Affected Modules	Description
FEAT-254	DaVinci Configurator Pro 5 MCAL	The location of the VTT (formerly VIP) modules has changed in the SIP. They are now located in BSW\Vtt_<ShortName>. **Impact on existing projects:** The VTT environment that includes the VTT source and header files will have to be recreated or adapted in order to match the new naming convention. Old: BSW\Vip_<ShortName> New: BSW\Vtt_<ShortName> **Beta Implementation. This feature shall not be used for production.**
FEAT-261	Base EcuC Converter SOAD TCPIP	The API between SOAD and TCPIP is now realized according to AUTOSAR 4.2.1. **Impact on existing projects:** Please follow the instructions given in the fol-

Change ID	Affected Modules	Description
		lowing chapter TCP/IP stack migration of projects based on MICROSAR R11 and earlier (due to FEAT-261).

17.1.2 Extension

New APIs have been introduced or functionality has been added. There is no influence on existing implementations.

Change ID	Affected Modules	Description
FEAT-1063	IP v6	Store a DHCP-assigned IPv6 address in NvM. Defined by AUTOSAR concept CONC_600_ SwitchConfiguration.
FEAT-1210	DaVinci Configurator Pro 5 DaVinci Developer FEE RTE	The RTE now supports Background Trigger (OS background task) of SWC runnables and BSW main functions. Selected BSW modules can now be configured to make use of the background task scheduling.
FEAT-1268	TSYNC ETH	Support Timestamps from OS, GPT and application callbacks.
FEAT-1280	DaVinci Developer RTE SOMEIPXF	The data type UTF16 is now supported. **Beta Implementation. This feature shall not be used for production.**
FEAT-1286	CRY CSM	Support signature verification and RSA decryption in CSM and CRY.
FEAT-1348	IP v4 IP v6 SOAD TCPIP	TcpIp_ChangeParameter() API can be used to update/set the frame priority (VLAN-tag) and the TTL/HopLimit.
FEAT-229	IPDUM	IPDUM now supports a selector field with a length up to 16bits. **Beta Implementation. This feature shall not be used for production.**
FEAT-349	DaVinci Configurator Pro 5 DaVinci Developer RTE SOMEIPXF	DaVinci DEV and RTE now supports union data types for intra ECU communication.

Change ID	Affected Modules	Description
	Transformer	
FEAT-515	Base EcuC Converter ECUC J1939NM J1939RM Legacy DB Converter TechnicalReference_ DBCRules (Vector)	Implementation of further J1939 features: > J1939Nm performs now true random delay calculations to avoid BusOff. > J1939Rm features now a ServicePort interface. > Supported DBC attributes include now the ProtocolType ISO11783 and the GenMsgRequestable flag. **Beta Implementation. This feature shall not be used for production.**
FEAT-516	CANIF J1939NM J1939RM	MICROSAR J1939 was extended to support ISOBUS applications: > J1939Nm provides full access to dynamic network management related information. > Address translation is now handled separately for each CAN channel. > The timing of the initial AddressClaiming sequence and the layout of the acknowledgement message have been adapted to conform to ISO 11783. **Beta Implementation. This feature shall not be used for production.**
FEAT-528	DaVinci Developer E2E Protection Lib RTE SOMEIPXF Transformers_E2eXfTtTechSub	The E2E profiles 5 and 6 are now supported and can be used in combination with the MICROSAR E2EXF. The library CRC Routines is provided up to ASIL D. **Beta Implementation. This feature shall not be used for production.**
FEAT-531	IP v6	Support local IPv6 multicast and broadcast addresses which can be assigned to sockets separately. Reception of SD multicast packets on separate socket.
FEAT-63	Base EcuC Converter CAN CAN	CAN-FD Mode 2 for communication and diagnostics is now supported. **Beta Implementation. This feature shall**

Change ID	Affected Modules	Description
	CANIF CANTP DaVinci Configurator Pro 5 PDUR SOMEIPXF	**not be used for production.**
FEAT-690	BSWM LINIF LINSM	At the end of each schedule table execution the LINIF can now trigger a so called schedule end notification. This gives the application a better control over the LIN communication (e.g. by being able to change the schedule table after a fixed number of cycles).
FEAT-705	ETHIF ETHTRCV	Ethernet wakeup based on Activation Line as defined by AUTOSAR 4.2.1. **Beta Implementation. This feature shall not be used for production.**
FEAT-717	DaVinci Developer RTE SOMEIPXF Transformers_E2eXfTt-techSub	The E2E profiles 4, 5 and 6 can now be used for inter ECU C/S communication. **Beta Implementation. This feature shall not be used for production.**
FEAT-728	DaVinci Configurator Pro 5 DaVinci Developer RTE	Data prototype mapping is now supported. This allows e.g. a bitfield text table mapping.
FEAT-947	DaVinci Configurator Pro 5 DCM DEM	The DEM allows > additional configuration data to be changeable at post-build time (MICROSAR PBL license required) > some data to be variant using post-build selectable (e.g. variant snapshot data) . This feature requires licensing of MICROSAR IDM

17.1.3 Information

The internal behavior of the BSW has been improved without any change in the API. Only for information purpose.

Change ID	Affected Modules	Description
FEAT-1001	Base EcuC Converter	Enhanced configuration of service-oriented com-

Change ID	Affected Modules	Description
	SD SOAD	munication according to AUTOSAR 4.2.1 SystemTemplate.
FEAT-1311	DLT	Diagnostic Log and Trace (DLT) module available according to AUTOSAR: > Support of the AUTOSAR communication protocol via Ethernet (TCP/UDP) > verbose and non- verbose communication > VfB Tracing APIs using RTE hooks > Context registration The AUTOSAR DLT is an option that needs to be licensed explicitly. **Beta Implementation. This feature shall not be used for production.**
FEAT-34	J1939TP	Improved validation rules during configuration.

17.1.4 Required AUTOSAR Tools

This MICROSAR release requires the usage of the following tools:

Tool	Version
DaVinci Developer	**3.10.x** Please use the latest service pack available from the Vector download center
DaVinci Configurator Pro	The latest service pack version is delivered as part of the SIP. Upcoming service packs can be retrieved from the Vector download center

17.2 Release 11.1

17.2.1 Breaking Changes

Modification of existing functionality or APIs that can have an impact on existing applications (such as SWCs, CDDs …).

Change ID	Affected Modules	Description
FEAT-1317	General MCAL Feature	The location of 3rd party MCALs within the MICROSAR SIP has changed. This change is applicable for MCALs previously located in the ".\Supply" folder of the SIP. The new structure is defined as follows:

Change ID	Affected Modules	Description
		> .\ThirdParty\<MCAL Name>\Supply <-- 3rd party MCAL delivery in its original structure (similar to the content of the former .\Supply folder. > .\ThirdParty\<MCAL Name>\Vect-orIntegration <-- Optional folder that may contain scripts and tools for the integration of the MCAL the MICROSAR SIP Impact to existing projects: As the location of the "Supply" folder has changed, make files referring 3rd party MCAL components may have to be adapted.

17.2.2 Extension

New APIs have been introduced or functionality has been added. There is no influence on existing implementations.

Change ID	Affected Modules	Description
FEAT-1129	DaVinci Configurator Pro 5 DCM DEM	It is now possible to configure the diagnostic stack based on ECUC files received e.g. by the vehicle manufacturer. Use the DaVinci Configurator Pro feature "Standard Configuration Files" in the Input File editor to configure and update such ECUC files. **Beta Implementation. This feature shall not be used for production.**
FEAT-1285	DaVinci Configurator Pro 5 DaVinci Developer RTE	The non-volatile data interface of the RTE now also supports PR ports. **Beta Implementation. This feature shall not be used for production.**
FEAT-1313	RTE	The RTE now supports an optimized way to copy large data blocks in a runtime efficient manner on 32bit CPUs.
FEAT-24	SD	Support Service Discovery extensions specified in AUTOSAR 4.2.1: > New Entry Format Type 2 (Counter field added) > New IPv4/IPv6 SD Endpoint Option > New development and production errors

Change ID	Affected Modules	Description
FEAT-264	DaVinci Configurator Pro 5 DaVinci Developer RTE	The RTE now supports CompuMethods for bit-field data types (category BITFIELD_TEXTTABLE). **Beta Implementation. This feature shall not be used for production.**
FEAT-394	DaVinci Developer E2E Protection Lib	The End-to-End Communication Protection profile 1c is now supported.
FEAT-520	DCM	The DCM now supports the ModeDeclarationGroup DcmResponseOnEvent_<RoeEventID>. **Beta Implementation. This feature shall not be used for production.**
FEAT-627	DaVinci Configurator Pro 5 DCM	DCM allows to forward ranges of DIDs to the application. **Beta Implementation. This feature shall not be used for production.**
FEAT-742	CAL CPL	The RSA-2048 (asymmetric algorithms)and SHA256 (basic package) is now supported. This allows SBA ticket validation in the application
FEAT-823	DaVinci Configurator Pro 5 DaVinci Developer RTE	PR port now also allow mode switch functionality. **Beta Implementation. This feature shall not be used for production.**
FEAT-971	FRIF STBM TSYNC CAN TSYNC ETH TSYNC FR	Completion of the realization of AUTOSAR concept CONC_605_GlobalTimeSynchronization. **Beta Implementation. This feature shall not be used for production.**

17.2.3 Information

The internal behavior of the BSW has been improved without any change in the API. Only for information purpose.

Change ID	Affected Modules	Description
FEAT-108	AN-ISC-8-1169_How_to_add_XCP_PDUs_in_DaVinciConfiguratorPro	New application note that describes how CAN XCP messages can be added to an existing con-

Change ID	Affected Modules	Description
		figuration. This can be relevant if the vehicle manufacturer does not describe XCP PDUs in his databases (ARXML, DBC...).
FEAT-1282	AN-ISC-8-1166_BRE_ without_AUTOSAR_OS	There is a new application note available that describes how BRE might be used without an AUTOSAR OS.
FEAT-220	MSR_TechRef_DbcRules_ Vector	CAN-FD networks can be described using DBC files. This includes the definition of 64byte messages and TP relations. **Beta Implementation. This feature shall not be used for production.**

17.2.4 Required AUTOSAR Tools

This MICROSAR release requires the usage of the following tools:

Tool	Version
DaVinci Developer	**3.9.x** Please use the latest service pack available from the Vector download center
DaVinci Configurator Pro	The latest service pack version is delivered as part of the SIP. Upcoming service packs can be retrieved from the Vector download center

17.2.5 Required AUTOSAR Tools

This MICROSAR release requires the usage of the following tools:

Tool	Version
DaVinci Developer	**3.8.x** Please use the latest service pack available from the Vector download center
DaVinci Configurator Pro	The latest service pack version is delivered as part of the SIP. Upcoming service packs can be retrieved from the Vector download center

17.3 Release 8

17.3.1 Modifications

Change ID	Affected Modules	Description	Category
AR4-477 AR4-478	EthIf SOME/IP	Ethernet Stack according to AUTOSAR 4.1.1 (BSWMD Schema 4.0.3). Support Nm User Data	Change

Change ID	Affected Modules	Description	Category
AR4-490	NmIf	for UdpNm.	
AR4-516	UdpNm		
AR4-486	ComM		
AR4-492	EthSM		
AR4-495	PduR		
AR4-496	SoAd		
AR4-502	DoIP		
ESCAN00069048	Communication Interface		
ESCAN00069041	Complex Driver		
ESCAN00069042			
ESCAN00069043			
ESCAN00067480			
ESCAN00067481			
ESCAN00068226			
ESCAN00067480			
ESCAN00067842			
ESCAN00067481			
ESCAN00067816			
ESCAN00067479			
ESCAN00067843			
ESCAN00067836			

Change ID	Affected Modules	Description	Category
ESCAN00068227 ESCAN00068230 ESCAN00068231 ESCAN00068229			
AR4-346 ESCAN00068579 ESCAN00068580 ESCAN00068581 ESCAN00068582 ESCAN00068583 ESCAN00068584 ESCAN00068585 ESCAN00068586 ESCAN00068587 ESCAN00068588 ESCAN00068589 ESCAN00068590 ESCAN00068591	All BSW Modules DaVinci Configurator 5	Remove vendor specific parameter VectorCommonData/BswmdVersion as this information is no longer required. Change has no effect on application or tool usage. **Impact on existing projects** Removed container and parameter may have to be deleted manually. Change has no effect on application.	Change

Change ID	Affected Modules	Description	Category
ESCAN00068592			
ESCAN00068593			
ESCAN00068594			
ESCAN00068595			
ESCAN00068596			
ESCAN00068597			
ESCAN00068598			
ESCAN00068599			
ESCAN00068600			
ESCAN00068601			
ESCAN00068602			
ESCAN00068603			
ESCAN00068604			
ESCAN00068605			
ESCAN00068606			
ESCAN00068607			
ESCAN00068608			
ESCAN00068609			

Change ID	Affected Modules	Description	Category
ESCAN00068610			
ESCAN00068611			
ESCAN00068612			
ESCAN00068613			
ESCAN00068614			
ESCAN00068615			
ESCAN00068616			
ESCAN00068617			
ESCAN00068618			
ESCAN00068619			
ESCAN00068620			
ESCAN00068621			
ESCAN00068622			
ESCAN00068623			
ESCAN00068624			
ESCAN00068625			
ESCAN00068626			
ESCAN00068627			
ESCAN00068628			
ESCAN00068629			
ESCAN00068630			

Change ID	Affected Modules	Description	Category
ESCAN00068631 ESCAN00068632 ESCAN00068633 ESCAN00068634 ESCAN00068636 ESCAN00068640 ESCAN00068641 ESCAN00068642 ESCAN00068643 ESCAN00068644 ESCAN00068645			
AR4-260 ESCAN00068296 ESCAN00068297 ESCAN00068298 ESCAN00068299 ESCAN00068300 ESCAN00068301 ESCAN00068302 ESCAN00068303 ESCAN00068304 ESCAN00068306	All BSW Modules	Remove vendor specific configuration switch “ProdErrorDetection”. The switch is no longer required as AUTOSAR provides the same feature using references to the DEM event container.	Change

Change ID	Affected Modules	Description	Category
ESCAN00068307			
ESCAN00068308			
ESCAN00068310			
ESCAN00068311			
ESCAN00068313			
ESCAN00068314			
ESCAN00068315			
ESCAN00068316			
ESCAN00068317			
ESCAN00068318			
ESCAN00068319			
ESCAN00068320			
ESCAN00068322			
ESCAN00068324			
ESCAN00068325			
ESCAN00068326			
ESCAN00068328			
ESCAN00068329			
ESCAN00068330			

Change ID	Affected Modules	Description	Category
AR4-549 ESCAN00069555	Documentation	The generic and OEM specific startup manuals have been merged to one CHM based documentation.	Change
AR4-292 ESCAN00068275 ESCAN00068274 ESCAN00068395 ESCAN00068394	Dlt Dem Det	Implementation of the module DLT based on XCP communication as part of MICROSAR AMD. Reporting of DET and DEM errors. Custom notifications and free text notifications.	Extension
AR4-379 ESCAN00067782 ESCAN00067785 ESCAN00067786	WdgM BswM ComM	Provide Debug Data (DBG) for MICROSAR AMD.	Extension
AR4-355 ESCAN00068481 ESCAN00068482 ESCAN00068483 ESCAN00068484 ESCAN00068485 ESCAN00068486 ESCAN00068487 ESCAN00068488 ESCAN00068489 ESCAN00068490 ESCAN00068491 ESCAN00068492 ESCAN00068493 ESCAN00068494 ESCAN00068495 ESCAN00068496	CANoe MCAL Modules	Dual target support: Generate CANoe MCAL code directly from the hardware specific BSW configuration. Enables parallel execution of a project on the hardware and the PC.	Extension

Change ID	Affected Modules	Description	Category
ESCAN00068497			
AR4-406 EVAL00107854 ESCAN00068433	Rte DaVinci Configurator 5	Support use-case without RTE by generating contract phase headers for Service-SWCs.	Extension
AR4-385 ESCAN00068222 ESCAN00068223 ESCAN00068224	SoAd DoIp EthIf TcpIp IpV4 IpV6	VLAN support (multi home) Dual IP stack (IPv4 und IPv6) Support of multiple IPv4 IP address; e.g. one static and one dynamic address	Extension
AR4-497 ESCAN00068233	SoAd	Support of PDU header option	Extension
AR4-501 ESCAN00068236 ESCAN00068237	IpV4 IpV6	IP address storage in NvM	Extension
AR4-514 ESCAN00069007 ESCAN00069008 ESCAN00069009 ESCAN00069010 EVAL00108066	EcuM	Alarm clock handling (Cyclic wakeup based on timer events)	Extension
AR4-397 EVAL00107922 ESCAN00069107 ESCAN00069108 ESCAN00069109 ESCAN00069145	Can CanIf CanSm DaVinci Configurator 5 Base EcuC Converter	CANFD mode 1 (8 byte payload)	Extension
AR4-200 ESCAN00061790	IpduM	Improved configuration support using validation rules.	Extension

Change ID	Affected Modules	Description	Category
AR4-205 ESCAN00064077	Com	Support Tx timeout in Com	Extension
AR4-520 ESCAN00067585	Com	Support dynamic DLC	Extension
AR4-89 ESCAN00067863 ESCAN00067862 ESCAN00067861 ESCAN00067860 ESCAN00067859 ESCAN00067858 ESCAN00067857 ESCAN00067856	PduR All Com Stack Modules	Tx confirmation functions are now configurable for not buffered I-PDUs	Extension
AR4-231 ESCAN00068551	Dcm	Support diagnostic service ResponseOnEvent (86h)	Extension
AR4-420 ESCAN00068416 ESCAN00068205 ESCAN00068146 ESCAN00068414 ESCAN00068415	Dem DaVinci Configurator 5 Post-Build XML Generator EcuM EcuC	Allow post-build time update of selected fault memory configuration data for legislative OBD use-cases.	Extension
AR4-81 ESCAN00068082 ESCAN00068083	Dcm DaVinci Configurator 5	OBDII support	Extension
AR4-307 EVAL00107700 EVAL00107759 EVAL00108857 ESCAN00067978	DaVinci Configurator 5 Base EcuC Converter Legacy Db Converter	Support for J1939 according to AUTOSAR 4.1.1 (BSWMD Schema 4.0.3).	Extension

Change ID	Affected Modules	Description	Category
ESCAN00067979 ESCAN00067980 ESCAN00067981 ESCAN00067982 ESCAN00068467 ESCAN00068650 ESCAN00068673 ESCAN00068766 ESCAN00068767 ESCAN00068768 ESCAN00068792 ESCAN00068793 ESCAN00068794 ESCAN00068795 ESCAN00068796 ESCAN00068797 ESCAN00068803	DaVinci Developer Com Rte CanIf NmIf CanSm J1939Tp J1939Nm J1939Rm PduR		
AR4-438 ESCAN00068788 ESCAN00068789 ESCAN00068790	CanIf J1939Nm	Support ISO-Bus (fully dynamic CAN addresses).	Extension
AR4-389 ESCAN00067901	LinIf LinTp	It is now possible to configure multiple LinTp connections (TxNSdu and RxNSdu pairs) with the same NAD. This feature allows accessing a LIN slave from the internal diagnostics (of the master node) and from an external tester tool.	Extension
AR4-316 ESCAN00059347 ESCAN00070195 EVAL00102792	Rte DaVinci Configurator 5 DaVinci Developer	Support standardized API for NVM access according to AUTOSAR 4.	Extension

Change ID	Affected Modules	Description	Category
EVAL00107657			
AR4-318 ESCAN00068448 ESCAN00053114 ESCAN00070290 ESCAN00070291 ESCAN00070292	Rte Os EcuM DaVinci Configurator 5 DaVinci Developer	SWC Multicore support for OS with SC1	Extension
AR4-332 AR4-381 ESCAN00064988 EVAL00108055 ESCAN0006904	BswM DaVinci Configurator 5	Provision of standard rules that can simplify the BSWM configuration process for BSW initialization and ECU state handling using a tool assistant.	Extension
AR4-428 ESCAN00069021 ESCAN00069022 ESCAN00069023 ESCAN00069024 EVAL00107734	BswM DaVinci Configurator 5	Add support timer handling as BSWM event trigger.	Extension
AR4-429 EVAL00108064 ESCAN00069025 ESCAN00069026 ESCAN0006902 ESCAN00069028	BswM DaVinci Configurator 5	Advance handling of Generic Mode Requests (add support of symbolic Values). Support bottom up configuration approach of SWC configuration items	Extension
AR4-432 ESCAN00069030 ESCAN00069031 EVAL00108516	BswM DaVinci Configurator 5	Support of rule condition operators “XOR” and “NAND”	Extension

Change ID	Affected Modules	Description	Category
AR4-433 EVAL00107733 ESCAN00069033 ESCAN00069034	BswM DaVinci Configurator 5	Support of User Conditions	Extension
AR4-322 ESCAN00068263 ESCAN00068264 ESCAN00068265	Xcp	Allow XCP Events to be forwarded to the Vx1000 Hardware to simplify switching between XCP based and Vx1000 based measurement.	Extension
AR4-328 EVAL00107660 ESCAN00069020 ESCAN00067711 ESCAN00067708 ESCAN00068809 ESCAN0006999	Rtm Can Lin Fr DaVinci Configurator 5	Predefined runtime measurement points for Rtm (MICROSAR AMD).	Extension
AR4-562 ESCAN00070287	Fr	Support FlexRay Cycle Multiplexing. This feature allows reducing the number of required FlexRay controller buffers.	Extension
AR4-363 ESCAN00068522	Crypto	Production release of crypto	Information
AR4-384 EVAL00107894 ESCAN00067951 ESCAN00068367 ESCAN00069075 ESCAN00069076 ESCAN00069084	DaVinci Configurator 5 Rte	Rework of SipLicense.lic file schema.	Information

Change ID	Affected Modules	Description	Category
ESCAN00069078 ESCAN00069079 ESCAN00069080 ESCAN00069081 ESCAN00069082 ESCAN00069083 ESCAN00069077			
AR4-267 EVAL00102611 ESCAN00064848	Fee	Complete graphical representation of Flash/Fee Load in DaVinci Configurator memory domain.	Information
AR4-459 ESCAN00053014	Rte Os	Runtime optimized handling of interrupt locks when using MICROSAR OS and MICROSAR RTE. This extension is only activated if both modules support that feature.	Information
AR4-312 EVAL00108032 ESCAN00068276 ESCAN00068277 ESCAN00068278 ESCAN00068280 ESCAN00068281 ESCAN00068282 ESCAN00068283 ESCAN00068284 ESCAN00068285 ESCAN00068286	DaVinci Configurator 5 All BSW	All BSW validation rules become part of the generator plugin and are now part of the active issue tracking process (ESCAN).	Information

Change ID	Affected Modules	Description	Category
AR4-450 ESCAN00069125 ESCAN00069126 ESCAN00069193 ESCAN00069194 ESCAN00069205 ESCAN00069206 ESCAN00069207 ESCAN00069387 ESCAN00069571 ESCAN00069570 ESCAN00069569 ESCAN00069568 ESCAN00069566 ESCAN00069565 ESCAN00069564 ESCAN00069563 ESCAN00069562 ESCAN00069561 ESCAN00069559 ESCAN00069558 ESCAN00069546 ESCAN00069545 ESCAN00069544 ESCAN00069541 ESCAN00069540 ESCAN00069539 ESCAN00069538 ESCAN00069537	All BSW	From now on the memory section SEC_PBCFG is used only for post-build loadable projects. Data will be mapped through other SWC_CONST_* sections if post-build loadable is not used.	Modification

Change ID	Affected Modules	Description	Category
ESCAN00069536			
ESCAN00069535			
ESCAN00069534			
ESCAN00069533			
ESCAN00069532			
ESCAN00069531			
ESCAN00069530			
ESCAN00069529			
ESCAN00069528			
ESCAN00069527			
ESCAN00069526			
ESCAN00069525			
ESCAN00069524			
ESCAN00069523			
ESCAN00069522			
ESCAN00069521			
ESCAN00069520			
ESCAN00069519			
ESCAN00069518			
ESCAN00069517			
ESCAN00069516			
ESCAN00069515			
ESCAN00069514			
ESCAN00069510			
ESCAN00069509			
ESCAN00069508			
ESCAN00069693			
ESCAN00069692			

17.3.2 Required AUTOSAR Tools

This MICROSAR release requires the usage of the following tools:

Tool	Version
DaVinci Developer	**3.6.x** Please use the latest service pack available from the Vector download center
DaVinci Configurator Pro	The latest service pack version is delivered as part of the SIP. Upcoming service packs can be retrieved from the Vector download center

17.4 Release 7.1

17.4.1 Modifications

Change ID	Affected Modules	Description	Category
AR4-421 EVAL00107372 ESCAN00067665	Rte DaVinci Configurator DaVinci Developer	Support of Inter- Runnable Variables for Complex Data Types	Extension
AR4-527 ESCAN00067753	Rte	Multi Core for OS SC1 supporting Sender/Receiver Communication using the master core that runs the BSW.	Extension
AR4-532 ESCAN00068036 ESCAN00068037 ESCAN00068038 ESCAN00068039 ESCAN00068040 ESCAN00068041	CanSm	ECUs can be set to (CAN) passive mode by the application. The required API extension of AUTOSAR used to be available in MICROSAR3. New APIs: CanSM_ SetEcuPassive CanSM_PreventBusSleepAtStartUp	Extension
AR4-539	Legacy Converter	Support of Fibex 2.0.1 files as exported by Network Designer.	Extension

Change ID	Affected Modules	Description	Category
ESCAN00068074			

17.4.2 Required AUTOSAR Tools

This MICROSAR release requires the usage of the following tools:

Tool	Version
DaVinci Developer	**3.5.x** Please use the latest service pack available from the Vector download center
DaVinci Configurator Pro	The latest service pack version is delivered as part of the SIP. Upcoming service packs can be retrieved from the Vector download center

17.5 Release 7

17.5.1 Modifications

Change ID	Affected Modules	Description	Category
AR4-279 ESCAN00062129 ESCAN00062130 ESCAN00062131	BswM DaVinci Configurator 5	Mode Request Ports with sender receiver interface	Extension
AR4-240	Rte StbM	Production release	Information
AR4-211 ESCAN00064081 ESCAN00064080 ESCAN00064079 ESCAN00064078 EVAL00095877	Com Base EcuC Converter	Support Signal Gateway	Extension
AR4-247	Dcm	Production release	Information

Change ID	Affected Modules	Description	Category
	Dem Fim CanTp		
AR4-246 ESCAN00064219	SoAd EthIf EthSm Eth EthTrcv	Production release	Information
AR4-241 ESCAN00064988	ComM EcuM BswM CanSm FrSm LinSm FrNm CanNm NmIf	Production release	Information
AR4-255	E2ELib E2EPW SafeWdg SafeWdgIf SafeWdgM	Production release	Information
AR4-242 ESCAN00064511 ESCAN00060322 ESCAN00060324 ESCAN00060323 ESCAN00060320	Com PduR IpduM Communication Interface Complex Driver Com Stack Lib	Production release	Information

Change ID	Affected Modules	Description	Category
ESCAN00056674 ESCAN00056673 ESCAN00060470 ESCAN00060467 ESCAN00060328 ESCAN00060327 ESCAN00060326 ESCAN00060325			
AR4-243	CanIf CanTrcv Can	Production release	Information
AR4-244 ESCAN00060250 ESCAN00060334 ESCAN00060243	LinIf LinTp Generic LinTrcv DrvTrans_ Tle7259LindioAsr Lin	Production release	Information
AR4-245 ESCAN00064879 ESCAN00064880 ESCAN00064881 ESCAN00064882 ESCAN00064883	FrIf Fr Tja1080 Dio FrTrcv Iso10681 FrTp	Production release	Information
AR4-248	NvM MemIf Fee Ea Eep XAt25128E Basic Ea	Production release	Information

Change ID	Affected Modules	Description	Category
AR4-249	IoHwAb	Production release	Information
AR4-251 ESCAN00066036	Cal	Production release	Information
AR4-252 EVAL00103830 EVAL00103831	DaVinci Configurator 5 Legacy Db Converter DaVinci Developer	Production release	Information
AR4-256	WdgM WdgIf Crc	Production release	Information
AR4-267 ESCAN00064884 ESCAN00064885 ESCAN00064886	Xcp XcpOnCan XcpOnFr	Production release	Information
AR4-358	Det	Production release	Information
AR4-315 ESCAN00064128 ESCAN00064126 ESCAN00064127 ESCAN00064125	Dcm Dem All TP Layer Modules All IF Layer Modules PduR Communication Interface Complex Driver	Support of the following AUTOSAR APIs: CancelTransmit, TP CancelReceive, ChangeParameter	Extension
AR4-58 ESCAN00063102 ESCAN00064098 ESCAN00064099	DaVinci Configurator 5 CanIf PduR	CFG5 Feature Licensing for (COM and PDUR Gateway, High-End CAN Driver Features and RTE Memory Protection Handling)	Change

Change ID	Affected Modules	Description	Category
ESCAN00064379 ESCAN00064517	Com Rte		
AR4-291 ESCAN00064408 ESCAN00064444	Rtm DaVinci Configurator 5	Implement Runtime Measurement as part of MICROSAR AMD. Communication via XCP using CANoe Test Feature Set	Extension
AR4-319 AR4-373 ESCAN00064635 ESCAN00063013 ESCAN00063014 ESCAN00064868 ESCAN00063401	Rte	The calibration methods "Initialized RAM" and "Single Pointered" have been optimized for the calibration tool CANape. > New a2l fragment (Rte_MemSeg.a2l) defines the relationship between RAM and Flash segments > Memory Segment definitions provided by Rte have been optimized to simplify the integration of calibration tools > Calibration SWCs are now exported explicitly to the a2l file. Before the calibration ports of SWC had been the only means to access the calibration data.	Change
AR4-282 ESCAN00064486 ESCAN00064488 ESCAN00064489 ESCAN00064492 ESCAN00064491 ESCAN00064495 ESCAN00064497 ESCAN00064498 ESCAN00064499 ESCAN00064494 ESCAN00064500 ESCAN00064490 ESCAN00064501 ESCAN00064502	Dbg Can CanIf CanTp CanSm ComM FrNm CanNm LinIf LinSm Lin EcuM Fr FrIf FrSm	BSW Debugging based on XCP as part of MICROSAR AMD. Provision of a AMD User Manual: UserManual_AMD.pdf	Extension

Change ID	Affected Modules	Description	Category
ESCAN00064493 ESCAN00064503 ESCAN00064486 ESCAN00064490 ESCAN00064496 ESCAN00064485 ESCAN00064504 ESCAN00064484 ESCAN00065856 ESCAN00064646 ESCAN00064647 EVAL00103941 EVAL00103685 EVAL00103009	IpduM Iso10681 FrTp NmIf PduR Xcp Com DaVinci Configurator 5		
AR4-300 ESCAN00062626 ESCAN00062625 ESCAN00064846	Xcp DaVinci Configurator 5 XcpOn<Bus>	MICROSAR XCP Improvements: > Support of up to 65k Events (used to be 256) > XCP Events configured in GENy are allowed to have gaps in order to keep the IDs constant as required by CANape > Parallel usage of internal and externally defined XCP Events > Provision of a master a2l file template in .\Misc\McData_Master.a2l > New user manual for XCP based calibration (UserManual_AUTOSAR_Calibration.pdf)	Extension
AR4-313 ESCAN00064016 ESCAN00064021 ESCAN00062189	DaVinci Configurator 5 Rte	Evaluation and Prototype Bundles now evaluate the SIP Expiry Date.	Extension
AR4-362 ESCAN00064223	TcpIp IP v4	IETF RFCs Enhancements implemented: TcpIp Extensions: Congestion Control, SlowStart, SelectiveAck, MulticastListenerDiscoveryV2	Extensions

Change ID	Affected Modules	Description	Category
	IP v6		
AR4-351 ESCAN00064008 ESCAN00064009	OEM Vector Dbc Rules TechRef Legacy Db Converter	Rework of legacy database rules to comply with MICROSAR 4.	Extensions
AR4-375 ESCAN00065209	Dem	Add Support of "Suppress DTC" functionality	Extensions
AR4-284 ESCAN00064277 ESCAN00063356 ESCAN00060163	Iso10681 FrTp PduR	High-level TP-Routing using ring buffer now supported	Extensions
AR4-352 ESCAN00065159 EVAL00092784 EVAL00102893 ESCAN00066283 ESCAN00065289 ESCAN00065274 ESCAN00066249 ESCAN00066285 ESCAN00065159	ComM BswM CanNm NmIf CanTrcv CanIf Legacy Db Converter DaVinci Configurator 5 Base EcuC Converter	Support partial networking on CAN for the use case with legacy formats (dbc and Fibex).	Extensions
AR4-327	Can	Support node status transition diagram (figure 16) of ISO11898-1 for selected CAN drivers (e.g. in case the hardware supports this). Please refer to the technical reference of the CAN driver.	Change
AR4-296 ESCAN00064768 EVAL00102893	Xcp XcpOnCan XcpOnFr XcpOnTcpIp	Support ASAM XCP specification version 1.1 as specified in AUTOSAR 4.0.3 SWS XCP	Extension

17.5.2 Required AUTOSAR Tools

This MICROSAR release requires the usage of the following tools:

Tool	Version
DaVinci Developer	**3.5.x** Please use the latest service pack available from the Vector download center
DaVinci Configurator Pro	The latest service pack version is delivered as part of the SIP. Upcoming service packs can be retrieved from the Vector download center

17.6 Release 6

17.6.1 Modifications

Change ID	Affected Modules	Description	Category
AR4-131 AR4-166 ESCAN00061819 ESCAN00061820	CSM CAL	CSM and CAL module added to MICROSAR 4	Extension
AR4-80 EVAL00097772 ESCAN00062100 ESCAN00063443	RTE, NVM	Pointer Data Type DATA_REFERENCE now supported. As a consequence the file NvM_VoidPtr.arxml is no longer delivered with the SIP.	Change
AR4-153 ESCAN00061822 ESCAN00061821 ESCAN00061422	FR	FlexRay buffer reconfiguration supported	Extension
AR4-154 ESCAN00061824	FR	Runtime optimization: FlexRay driver is able to filter IsoFrTp messages based on the TP addressing information.	Extension
AR4-169 AR4-168	OS	General OS implementation supporting the OS features SC3, SC4 and MultiCore. Please check for uC specific availability.	Extension
AR4-165	OS, STBM	STBM module added to MICROSAR 4	Extension
AR4-148	FIM	FIM added to MICROSAR 4	Extension

Change ID	Affected Modules	Description	Category
ESCAN00061742			
AR4-91 ESCAN00061826 ESCAN00061825	FlexRay Stack (Tp, Interface, Driver)	CancelTransmit API now supported	Extension
AR4-192	MCAL, WDGM, IOHWAB, NVM, MEMIF, OS, RTE, CFG5, ECUC, BOARD	General parameters are now configured in the ECUC module and no longer in the MICROSAR BOARD module. The BOARD module has been removed as a consequence.	Change
AR4-98 ESCAN00062284 ESCAN00062430	BSWM, NVM	Improved BSWM and NVM interaction. Now supporting NVM-Job and NVM-Block mode notifications.	Extension
AR4-197 ESCAN00061788 ESCAN00061787 ESCAN00061786 ESCAN00061785	IPDUM	Support BIG_ENDIAN Copy Segments	Extension
AR4-199 ESCAN00061798 ESCAN00061797 ESCAN00061796 ESCAN00061795 ESCAN00061794 ESCAN00061792	COM, Tooling	Signal Data Invalidation for Rx and Tx COM signals	Extension
AR4-204 ESCAN00061796 ESCAN00061801 ESCAN00061800 ESCAN00061803 ESCAN00061802 ESCAN00061799	COM, Tooling	Update Bits for COM signals now supported	Extension

Change ID	Affected Modules	Description	Category
AR4-212 ESCAN00061807 ESCAN00061800 ESCAN00061805 ESCAN00061806	COM	Filtering of signal receive events supported	Extension
AR4-225 ESCAN00061808 ESCAN00061809 ESCAN00061711 ESCAN00061810	PDUR	High-level TP Gateway added: > Ethernet <-> FlexRay > Ethernet <-> CAN > CAN <-> CAN	Extension
AR4-228 ESCAN00062048 ESCAN00062050 ESCAN00062053	COM, CANSM, ECUM	Realization of pending AUTOSAR RfCs: > Clarification of the return value and implementation of Com_TriggerTransmit API > Introduction of the API CanSM_CheckBorLevel to check the CAN bus-off recovery > Avoid CAN Controller being online while Tranceiver is in standby by changed CANIF No-Communication State sequence	Change
AR4-77 AR4-78 EVAL00088196 ESCAN00057911 EVAL00088201 ESCAN00057912	RTE, CFG5	Support of Component and Data Type symbol names to avoid name clashes. If the symbol name is not available, the component type short name is used as symbol name.	Extension
AR4-257 EVAL00097773 ESCAN00062102	RTE, tooling	Support Trigger On Transition	Extension
AR4-278 ESCAN00062059	COMM	ComM_CurrentChannelRequest available as port interface	Extension
AR4-279 ESCAN00062129	BSWM	Mode Request Port API with S/R interface	Extension

Change ID	Affected Modules	Description	Category
ESCAN00062130 ESCAN00062131			
AR4-285 ESCAN00061831 ESCAN00062178 ESCAN00061832 ESCAN00062178	PDUR	Routing Path Groups supported	Extension
AR4-288 ESCAN00062720	DCM	The "opStatus" function parameter of the C/S API is either used for all operations or for none depending on the DcmDspDataUsePort configuration (#54767)	Extension

17.6.2 Required AUTOSAR Tools

This MICROSAR release requires the usage of the following tools:

Tool	Version
DaVinci Developer	**3.4.x** Please use the latest service pack available from the Vector download center
DaVinci Configurator Pro	The latest service pack version is delivered as part of the SIP. Upcoming service packs can be retrieved from the Vector download center

IV What's New, What's Changed

What's new and what's changed?

This section explains the changes within this document form the previous version to the one mentioned in the headline.

Version 1.x.x

Author	Date
Manuela Huber	2013-11-05

What's new?

> First Version of Startup document

What's changed?

> There has nothing changed

Version 2.x.x

Author	Date
Manuela Huber	2015-01-26

What's new?

> Remove vVIRTUALtarget information from Startup. There is a separate User Manual available (<Installed SIP Folder>\Doc\UserManuals\UserManual_vVIRTUALtarget_DualTarget.pdf).

What's changed?

> Add necessary information for MICROSAR 4 release 11.x.
> Update section setup project. Name of DaVinci Configurator executable has changed.
> Update add input files section (System Description Files).
> Update service mapping description.
> Add new additional information section describing the command line parameters of the DaVinci Configurator.
> Add Variant Handling description (Additional Information).
> Add new description about configuring service ports within application components (see Mappings on page 109).

- New structure for release notes (see Release Notes on page 177).
- Update Command Line Parameter section (see).

Version 3.x.x

Author	Date
Manuela Huber	2015-03-25

What's new?

- New additional information section, describing the API between SoAd and TcpIp according to AR 4.2.1
- New additional information section, describing SIP Update
- New additional information section, describing new platform types according AUTOSAR
- New section Add ECUC File References
- Add release notes for MICROSAR Release 12

What's changed?

- Update system description file view
- Update diagnostic data file view
- Change the update configuration process description
- Update tool synchronization description

V Glossary

Adc
(Analog Digital Converter Driver) The ADC driver abstracts hardware access to the analog-digital converter. For every input, the conversion parameters are configured (e.g. resolution, trigger source and trigger conditions).

AVTP
(Audio/Video Transport Protocol) The Audio/Video Transport Protocol is specified in IEEE 1722/1722a. In AVB networks it is responsible for the transport of audio/video data, including the Presentation Time.

Bfx
(Bitfield functions for fixed point) Library for bit handling in fixed point arithmetic functions

BMCA
(Best Master Clock Algorithm) The Best Master Clock Algorithm is specified in IEEE 802.1AS and is used to detect the device with the most precise time unit in an AVB network. After finding the device with the most precise time unit, it is used as the time base for the entire system.

BswM
(BSW Mode Manager) The BswM module contains vehicle mode management and application mode management. It processes mode requests from SWCs or other BSW modules, and it performs actions based on the arbitration, such as control of deadline monitoring, switching schedule tables, and handling of IPDU groups. In conjunction with the EcuM, the BswM module is responsible for starting up and shutting down the ECU. The BswM also coordinates the multicore partitions.

Cal (Cpl)
(Crypto Abstraction Library) The Cal library offers SWCs and other BSW modules access to basic cryptographic functions. The individual cryptographic functions are implemented in software via the Cpl module.

Can
(CAN Driver) The CAN Driver abstracts access to the CAN hardware for sending and receiving messages and for switching between controller states (sleep, stop, etc.)

CanIf
(CAN Interface) The CAN Interface offers abstracted (PDU-based) access to the CAN Driver. It controls the CAN Driver ((Can) as well as the transceiver driver ((CanTrcv).

CanNm
(CAN Network Management) Within a CAN network, CAN Network Management is responsible for coordinated transitions between the wake up and sleep state.

CanSM
(CAN State Manager) The CAN State Manager is responsible for the bus-specific error handling.

CanTp
(CAN Transport Layer) The CanTp module conforms to ISO standard 15765-2. As the transport protocol for CAN, it is responsible for segmenting the data in the Tx direction, collecting data in the Rx direction and monitoring the data stream.

CanTrcv
(CAN Transceiver Driver) This driver is responsible for controlling the operating states of an external CAN transceiver. It contains control of wake up and sleep functions.

CanTSyn
(Time Sync Over CAN) This module realizes the CAN specific time synchronization protocol. An access to the synchronized time base by the SWCs requires the Synchronized Time-Base Manager ((StbM).

CanXcp / XCPonCan
(CAN XCP-Module) The CanXcp module contains CAN-specific contents of the XCP module ((Xcp).

CDD
(Complex Drivers) The Complex Drivers are software modules that are not standardized by AUTOSAR. They have access to other BSW modules, the RTE and direct hardware access. For example, these modules are not standardized communication drivers for SPI or legacy software.

Com
(Communication) The Com module provides a signal-based data interface for the RTE. It places signals in messages and sends them according to the defined send type. The module contains various notification mechanisms for receiving signals. It also manages initial values, update bits and timeouts on the signal level. In multi-channel ECUs, the integrated signal gateway offers the ability to route signals between the communication buses.

ComM
(Communication Manager) The ComM module coordinates the communication channels and Partial Network Cluster with the communication requirements of the application.

ComXf
(COM Based Transformer) The COM based transformer optimizes for signal groups the interaction between RTE and the COM module, because you can avoid the shadow buffer in the COM module. It de-/serializes the data identical to the COM module.

CorTst
(Core Test Driver) The CorTst module contains configuration and control of the test capabilities included in the microcontroller core. In addition, it offers a framework for extending these test capabilities. Specifically for safety-related software, the CorTst module tests critical units such as the ALU and the registers.

Crc
(CRC Routines) The Cyclic Redundancy Check library calculates CRC checksums.

Csm (Cry)
(Crypto Service Manager) The Csm module offers SWCs access to basic cryptographic functions. The individual cryptographic functions are implemented by the Cry module in software or hardware (access via (She).

Dbg
(Debugging) The debugging module enables external access to internal information of the basic software. It is also possible to modify memory data.

Dcm
(Diagnostic Communication Manager) The Dcm module implements diagnostic communication according to ISO 14229-1:2006 (UDS). Some diagnostic requests are processed directly in the Dcm (management of diagnostic sessions, reading of error codes, EcuReset, etc.) and some are routed to the SWCs via port interfaces (reading, writing and controlling of data elements within a data identifier, execution of routines, etc.). Legal requirements of OBDII / SAE J1979 are also supported.

Dem
(Diagnostic Event Manager) The Dem module implements a fault memory. The standardized interface for "DiagnosticMonitors" enables uniform development of manufacturer-independent SWCs. The Dem module is responsible for administering the DiagnosticTroubleCode states, environmental data, and for storing the data in NVRAM. The legal requirements of OBDII / SAE J1979 are also supported.

Det
(Development Error Tracer) The Det module supports error debugging during software development. It provides an interface for error notification, which is called by the individual BSW modules in case of error.

Dio
(Digital Input Output Driver) The Digital Input Output Driver provides read and write services for the DIO channels (pins), DIO ports and DIO channel groups.

Dlt
(Diagnostic Log and Trace) The Dlt module provides generic “Logging and Tracing” functionality for SWCs and for the BSW modules (Rte, (Det and (Dem.

DNS
(Domain Name System) The DNS module contains a DNS resolver. It is responsible for resolving a domain, e.g. vector.com, into a valid IP address.

DoIP
(Diagnostics over IP) Since AR 4.1.1 the DoIP module contains diagnostic functionality according to ISO 13400-2 like vehicle discovery. Up to and including AR 4.0.3, this functionality is part of the Socket Adaptor ((SoAd).

DrvExt
(External Driver) Upon request, you can obtain the implementation of drivers for externally connected components. They are already available for plenty of external devices, e.g. for driv-

ing certain EEPROMs (EEPEXT), flash chips (FLSEXT), watchdogs (WDGEXT), analog-digital converters (ADCEXT) and communication controllers (CANEXT, LINEXT, ETHSWTEXT).

E2E
(End-to-End Communication Protection Library) Library for secure data exchange according to ISO 26262 for safety-related ECUs. It is responsible for calculating the checksum and providing the message counter.

E2EPW
(End-to-End Protection Wrapper) The E2E Protection Wrapper extends the RTE by adding verification of safety-related signals.

E2EXf
(E2E Transformer) With the E2E Transformer, you integrate the protection of safety-relevant signals according to ISO 26262 in the RTE interface. In contrast to the E2E protection wrapper, the standard interfaces of the RTE are used.

Ea
(EEPROM Abstraction) The Ea module offers a hardware-independent interface for accessing EEPROM data and uses an EEPROM driver ((Eep) for this. In addition to reading, writing and clearing data, the Ea module also distributes write accesses to different areas of the EEPROM, so that all EEPROM cells are uniformly stressed, which increases their life-time.

EcuM
(ECU State Manager) The ECU State Manager is responsible for starting up and shutting down the ECU as well as waking it up. It is available in two variants: flexible and fixed. The EcuM Fix manages a number of defined, fixed operating states. Using the EcuM Flex, the user defines all operating states flexibly in the (BswM module. This lets you implement special energy-saving states and various types of startup. In a multi-core system, the EcuM coordinates the various cores.

Eep
(EEPROM Driver) The EEPROM driver enables hardware-independent access to EEPROM memory. It provides services for reading, writing and comparing data.

Efx
(Extended Fixed Point Routines) Library with extended mathematical functions for fixed-point values

Eth
(Ethernet Driver) The Ethernet Driver abstracts access to the Ethernet hardware for sending and receiving data and for switching between controller states.

EthIf
(Ethernet Interface) The Ethernet Interface enables bus-independent control of the Ethernet driver ((Eth) and Ethernet transceiver driver ((EthTrcv). Since AR 4.1, this module is also responsible for VLAN handling.

EthSM
(Ethernet State Manager) The Ethernet State Manager provides the Communication Manager ((ComM) with an abstract interface for starting up or shutting down communications in Ethernet clusters. EthSM accesses the Ethernet hardware via (EthIf.

EthSwt
(Ethernet Switch Driver) The module EthSwt provides a uniform and hardware independent interface for controlling and configuring Ethernet switches. It also coordinates the MAC learning when using multiple identical ECUs like cameras for the surround view.

EthTrcv
(Ethernet Transceiver Driver) EthTrcv offers a uniform and hardware-independent interface for driving multiple transceivers of the same kind. Configuration of EthTrcv is transceiver-specific and considers the properties of the physical network that is used.

EthTSyn
(Time Sync Over Ethernet) This module realizes the Ethernet specific time synchronization protocol and references to IEEE Standard 802.1AS ((PTP). An access to the synchronized time base by the SWCs requires the Synchronized Time-Base Manager ((StbM).

EthXcp/ XCPonEth
(Ethernet XCP-Module) The EthXcp module contains Ethernet-specific contents of the XCP module ((Xcp).

EXI
(Efficient XML Interchange) The EXI module is used to interpret XML document and to convert them to a binary format. This makes it more efficient to process the files and to transmit them, in order to economize on communication bandwidth. It is used in the Vehicle2Grid environment.

Fee
(Flash EEPROM Emulation) The Fee module offers a hardware-independent interface for accessing flash data and uses a flash driver ((Fls) for this. In addition to reading, writing and clearing data, the Fee module also distributes write accesses to different areas of flash memory, so that all flash cells are uniformly stressed, which increases their life-time.

FiM
(Function Inhibition Manager) Based on the active errors managed by the (Dem module, the FiM offers the ability to prevent execution of functionalities in SWCs.

Fls
(Flash Driver) The flash driver enables hardware-independent and uniform access to flash memory. It provides services for reading, writing and comparing data, and for deleting blocks (sectors).

FlsTst
(Flash Test) The Flash Test module offers algorithms for testing nonvolatile memory such as data or program flash, SRAM and protected cache.

Fr
(FlexRay Driver) The FlexRay Driver abstracts access to the FlexRay hardware for sending and receiving data and for switching between controller states.

FrArTp
(FlexRay AUTOSAR Transport Layer) FrArTp is a FlexRay transport protocol. Based on ISO 15765-2 ((CanTp), it contains a frame compatibility with the CAN bus.

FrIf
(FlexRay Interface) The FlexRay Interface offers abstracted (PDU-based) access to the FlexRay hardware. In addition, it offers support for synchronization with the global FlexRay time.

FrNm
(FlexRay Network Management) This module is responsible for network management in FlexRay. It synchronizes the transition to the bus sleep state.

FrSM
(FlexRay State Manager) The FlexRay State Manager controls and monitors the wake up and startup of nodes in the FlexRay cluster.

FrTp
(FlexRay ISO Transport Layer) FrTp is a FlexRay transport protocol and is based on the ISO 10681-2 standard.

FrTrcv
(FlexRay Transceiver Driver) The driver for an external FlexRay transceiver is responsible for switching the transceiver on and off.

FrTSyn
(Time Sync Over FlexRay) This module realizes the FlexRay specific time synchronization protocol. An access to the synchronized time base by the SWCs requires the Synchronized Time-Base Manager ((StbM).

FrXcp/ XCPonFr
(FlexRay XCP-Module) The FrXcp module contains FlexRay-specific contents of the XCP module ((Xcp).

Gpt
(General Purpose Timer Driver) The General Purpose Timer Driver provides an interface for accessing internal timers of the microcontroller. It is used for controlling periodic and singular events, for example.

HTTP
(Hypertext Transfer Protocol) The Hypertext Transfer Protocol, for instance, routes browser requests to a server. The module contains a HTTP client. It is used in the Vehicle2Grid environment.

Icu
(Input Capture Unit Driver) The Icu driver provides services for edge detection, measurement of periodic signals, assignment of edge time stamps and control of wake up interrupts.

Ifl
(Interpolation Floating Point) Library with interpolation functions for floating point values

Ifx
(Interpolation Fixed Point) Library with interpolation functions for fixed point values

IicDrv
(I²C Driver) The I²C Driver provides services for communication with external I2C chips.

IoHwAb
(I/O Hardware Abstraction) The I/O Hardware Abstraction represents the connection between the RTE and the ECU's I/O channels. It encapsulates access to the I/O drivers such as (Adc, (Dio or (Pwm and thereby makes the I/O signals of the ECU available to the SWCs.

IpduM
(I-PDU Multiplexer) This module is responsible for multiple use of fixed PDUs with different data contents.

J1939Dcm
(SAE J1939 Diagnostic Communication Manager) The module implements Diagnostic Messages of the SAE J1939-73 protocol, e.g. for reading out the fault memory.

J1939Nm
(SAE J1939 Network Management) J1939 supports adding ECUs to networks on-the-fly. The J1939Nm module is responsible for negotiating a unique ECU address ("AddressClaim") and unlike other NM modules for handling the wake-up or going to sleep of the bus.

J1939Rm
(SAE J1939 Request Manager) The J1939Rm module implements requesting of data via Request Handling that is defined in the SAE J1939 protocol.

J1939Tp
(SAE J1939 Transport Layer) The J1939TP module contains the transport protocols BAM (Broadcast Announce Message) and CMDT (Connection Mode Data Transfer) of the SAE J1939 standard.

LdCom
(Large Data COM) The LdCom module is optimized for routing large signals. Thereby it avoids an unnecessary copying of data. The LdCom is typically used together with (SomeIpXf as a serialization transformer.

Lin
(LIN Driver) The LIN Driver provides services for initiating frame transmission (header, response, sleep-mode and wake up), and for receiving responses, checking the current state and validating wake up events.

LinIf
(LIN Interface) The LIN Interface offers abstracted (PDU-based) access to the LIN hardware. It also handles schedule table processing and contains the LIN transport protocol ((LinTp).

LinNm
(LIN Network Management) The LinNm module contains a hardware-independent protocol, which coordinates the transition between normal operation and the bus sleep mode of the LIN network.

LinSM
(LIN State Manager) The LIN State Manager switches between schedule tables and PDU groups in the (Com module and services the LIN interface with regard to sleep and wake up.

LinTp
(LIN Transport Layer) The LIN transport protocol is responsible for segmenting data in the Tx direction, collecting data in the Rx direction and monitoring the data stream. According to the AUTOSAR specification, LinTp is part of (LinIf.

LinTrcv
(LIN Transceiver Driver) The module for an external LIN transceiver is responsible for monitoring and driving the wake up and sleep functions.

LinXcp
(LIN XCP-Module) The LinXcp module contains LIN-specific contents of the XCP module ((Xcp).

Mcu
(Micro Controller Unit Driver) The MCU driver provides the services for: - A microcontroller reset triggered by software - Selecting microcontroller states (STOP, SLEEP, HALT, etc.) - Configuring wake up behavior - Managing the internal PLL clock unit - Initializing RAM areas with predefined values.

MemIf
(Memory Abstraction Interface) This module provides uniform access to the services of (Ea and (Fee. This lets you use multiple instances of these modules.

Mfl
(Mathematical Floating Point) Library with arithmetic functions for floating point values

Mfx
(Mathematical Fixed Point) Library with arithmetic functions for fixed point values

Nm
(Generic Network Management Interface) The Nm module offers a general and network-independent interface for accessing the bus-dependent network management modules ((CanNm, (LinNm, (UdpNm and (FrNm). In addition, the module handles synchronous, inter-network shutdown of the communication system in coordination with the other ECUs.

NvM
(Non Volatile RAM Manager) The NvM module manages, reads and writes data to a nonvolatile memory ((Ea or (Fee). At system start and at shutdown, it synchronizes the data in the RAM

areas of the application. The module provides services such as saving of redundant blocks for a higher level of data protection. Since AR 4.0.3, the (RTE also provides a simpler and more flexible interface to Nv data (NvDataInterfaces).

Ocu

(Output Compare Unit Driver) The OCU driver standardizes initialization and access to the Output Compare Unit.

Os

(Operating System) This module is the operating system of an AUTOSAR ECU. It is actually an extended OSEK operating system. Extensions are divided into so-called Scalability Classes (SC1-SC4). They cover the following functionalities: - SC1: schedule tables - SC2: timing protection + schedule tables - SC3: memory protection + schedule tables - SC4: memory protection + timing protection + schedule tables In safety-related ECUs, the OS is one of the safety-related modules. The operating system also supports multi-core microcontrollers.

PduR

(PDU Router) The PDU Router handles distribution of the communication packets (PDUs) between the bus systems and the various BSW modules. In addition it offers gateway mechanisms for routing PDUs (FIFO) and TP-PDUs (on-the-fly) between the bus systems.

Port

(Port Driver) This module is responsible for initialization of the entire port structure of the microcontroller.

PTP

(Precision Time Protocol) The PTP module is used to distribute a precise system time to all devices participating in an AVB network. It is implemented according to IEEE 802.1AS. The implementation consists of microprocessor-dependent and independent parts.

Pwm

(Pulse Width Modulation Driver) The Pwm driver provides services for initialization and control of the PWM (pulse-width modulation) channels of the microcontroller.

RamTst

(Ram Test) This module tests internal microcontroller RAM cells. A complete test is triggered during startup and shutdown of the ECU or by a diagnostic command. During normal operation, a periodic test is performed (block-by-block or cell-by-cell).

Rte

(Runtime Environment) The RTE implements the Virtual Functional Bus and the execution of the SWCs. It also ensures consistent data exchange between the SWCs themselves and between the SWCs and the basic software. The execution of the basic software is realized by the integrated (SchM. The RTE also supports communication beyond partition boundaries (multi-core/trusted/untrusted). In addition, it offers simplified access to NVRAM data and calibration data. In safety-related ECUs, the RTE is one of the safety-related modules.

Rtm
(Runtime Measurement) You use the Rtm module to determine the runtime and CPU load of BSW modules and of application code. The module is typically used during development.

SCC
(Smart Charge Communication) This module is responsible for smart charge communication according to ISO 15118 or DIN 70121 and contains the V2GTP transport protocol that is used for this protocol. It supports DC and AC charging and the associated profiles Plug-and-Charge (PnC) and External Identification Means (EIM).

SchM
(BSW Scheduler) The SchM module is integrated in the (RTE, calls the periodic "main" function of the individual BSW modules, and provides functions for critical sections. For the distribution of the BSW (master satellite concept) via partitions and core boundaries, the SchM provides nearly identical communication interfaces like the (RTE.

Sd
(Service Discovery) Service Discovery was first specified in AR 4.1.1. An ECU communicates the availability of its services to communication partners via the publish-subscribe protocol implemented in this module. In addition, ECUs can register to receive automatic notifications, e.g. on a signal update.

SecOC
(Secure Onboard Communication) The SecOC is used to send or receive authenticated messages. Unauthorized, repeated or manipulated messages are detected. The SecOC is part of the AUTOSAR security solution.

She
(Secure Hardware Extension) The She driver implements the cryptographic hardware functions of a Hardware Security Module (HSM). This functionality is used by the (Csm module, for instance.

SoAd
(Socket Adaptor) The socket adaptor converts the communication via PDUs as it is defined in AUTOSAR into a socket-based communication. In AR 4.0, the SoAd also contains the diagnostic functionality defined in ISO 13400-2 ((DoIP). Since AR 4.1, this plug-in is removed and specified as a stand-alone module ((DoIP).

SomeIpXf
(SOME/IP Transformer) The module SOME/IP Transformer is an RPC and serialization protocol. It is used to call methods on other ECUs, which for example were made known in the system beforehand via Service Discovery ((Sd).

Spi
(SPI Handler/ Driver) The SPI Driver handles data exchange over the SPI interface. It is primarily used in conjunction with external hardware such as EEPROM, Watchdog, etc.

StbM
(Synchronized Time-Base Manager) The Synchronized Time-Base Manager enables time synchronization. Since AR 4.2 a time base prescribed by the Time Master can be synchronized

with other ECUs via bus systems.

TcpIp
(TCP/IP Stack) This module contains all protocols for UDP and TCP-based communication. It supports the versions IPv4 and IPv6 as well as parallel operation of IPv4 and IPv6 in one ECU. It contains the following protocols: - IPv4, ICMPv4 and ARP - IPv6, ICMPv6 and NDP - UDP, TCP, DHCPv4 (client) and DHCPv6 (client)

TLS
(Transport Layer Security) This module contains a Transport Layer Security client. The TCP-based communication is encrypted with TLS. The encryption algorithm used can be selected.

Tm
(Time Services) The Tm module is used for such tasks as measuring execution times and functions and implementing active waiting. It offers a resolution from 1µs to 4.9 days.

Ttcan
(TTCAN Driver) The TTCAN Driver offers the same functionality for a TTCAN controller (ISO 11898-4) as the CAN Driver ((Can) does for a CAN controller.

TtcanIf
(TTCAN Interface) The TTCAN Interface offers the same functionality for a TTCAN controller (ISO 11898-4) as the CAN Interface ((CanIf) does for a CAN controller.

UdpNm
(UDP Network Management) You use network management over UDP to implement synchronous transition to sleep mode for Ethernet ECUs.

Wdg
(Watchdog Driver) This module provides services for controlling and triggering the watchdog hardware. The trigger routine is called by the Watchdog Manager ((WdgM). For safety-related ECUs, the Wdg module must be developed according to ISO 26262.

WdgIf
(Watchdog Interface) This module enables uniform access to services of the Watchdog Driver ((Wdg), such as mode switching and triggering. For safety-related ECUs, the WdgIf module must be developed according to ISO 26262.

WdgM
(Watchdog Manager) The Watchdog Manager monitors the reliability and functional safety of the applications in an ECU. This includes monitoring for correct execution of SWCs and BSW modules and triggering of the watchdogs at the required time intervals. The WdgM module reacts to potential faulty behavior with multiple escalation stages. An important fact for safety-related functions according to ISO 26262 is the monitoring of correct flow sequences of critical tasks (logical supervision). For safety-related ECUs, the WdgM must be developed according to ISO 26262.

Xcp
(Universal Measurement and Calibration Protocol) XCP is a protocol for communication between a master (PC tool) and a slave (ECU). It is standardized by ASAM and is used

primarily for measuring, calibrating, flashing and testing ECUs. XCP supports the bus systems CAN ((CanXcp), FlexRay ((FrXcp), Ethernet ((EthXcp) and LIN ((LinXcp).

XML Security

(XML Security) You use this module to generate and validate XML signatures to EXI-encoded data based on the W3C XML security standard. It is used in the Vehicle2Grid environment.

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