MCAL PACKAGE INTRODUCTION

GETTING STARTED

DATE: 1ST AUG 2025
NAME: PHAN DAI PHAT
RENESAS ELECTRONICS CORPORATION

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AGENDA

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INTRODUCTION

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INTRODUCTION

- This document will summarize and give a general instruction on how to use the MCAL Package for R-CAR SOC
- For the purpose of this document, we will be using MCAL Package for V4H specifically R-Car V4H AUTOSAR R19-11 MCAL

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OVERVIEW OF MCAL SUPPORT FROM RENESAS

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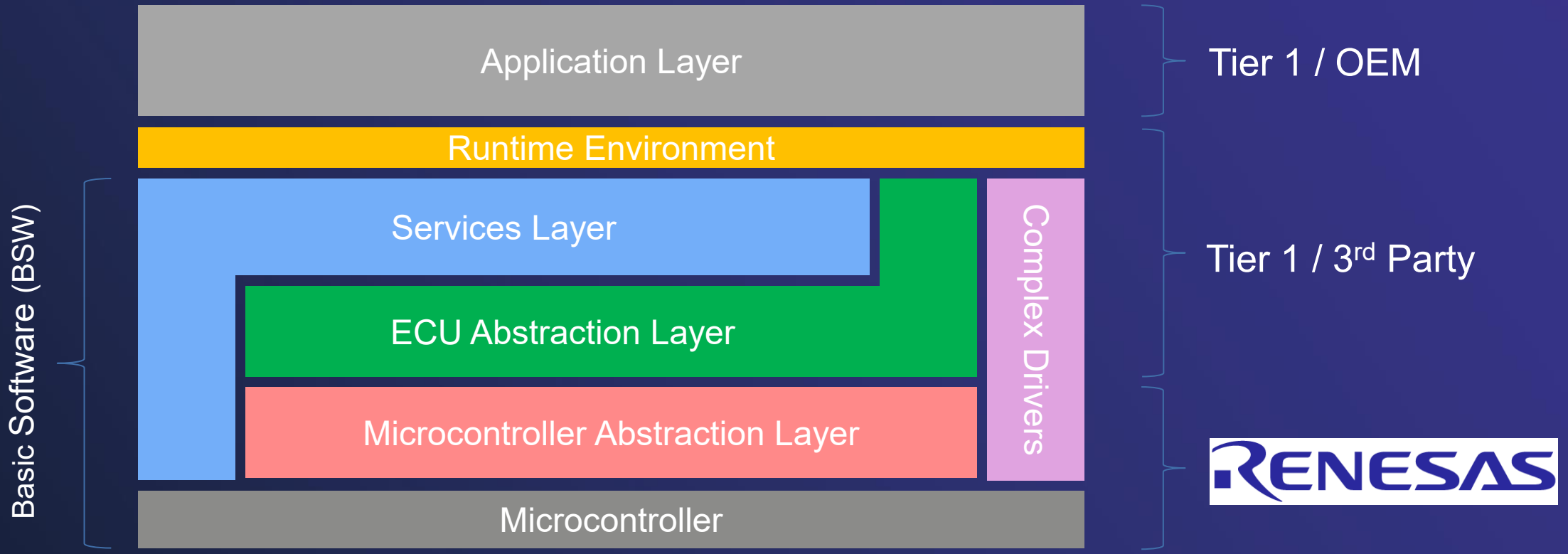
OVERVIEW OF MCAL SUPPORT FROM RENESAS



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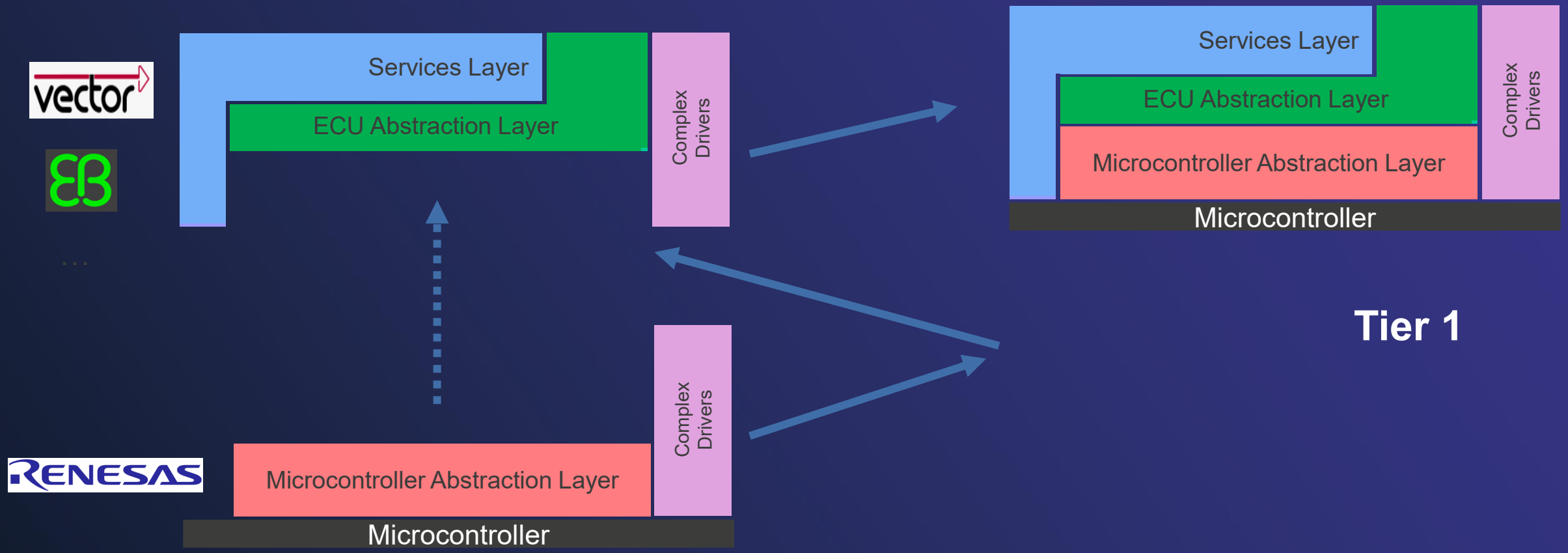
RENESAS

OVERVIEW OF MCAL SUPPORT FROM RENESAS



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MCAL PACKAGE CONTENT

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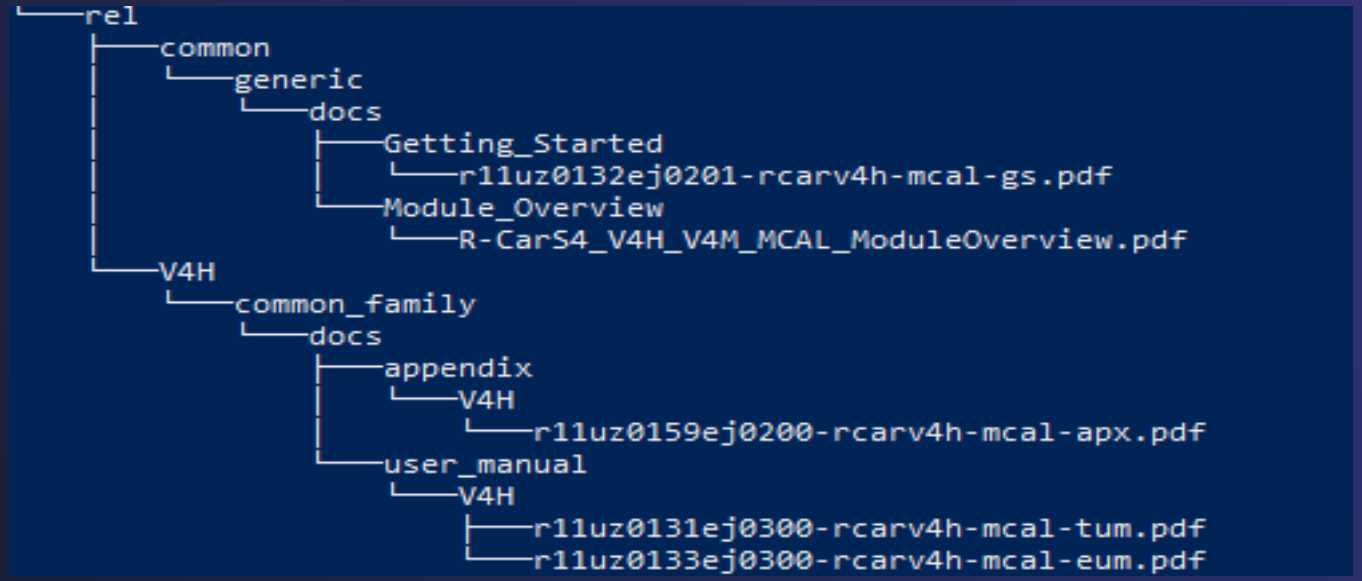
MCAL DOCUMENTS

MCAL Package Tree



For the DaVinci instruction file (**r01an6904ea0100_mcal.pdf**) you can find it through searching the web or on Renesas

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MCAL DOCUMENTS

There are a total of 5 document in the package. They are as followed:

1. r11uz0133ej0300-rcarv4h-mcal-eum.pdf
   - This document is called the Embedded User's Manual
   - The document will go into details the embedded information like the Architecture Details, the APIs, and some general information about the specific module that are present in the package
2. r11uz0131ej0300-rcarv4h-mcal-tum.pdf
   - This document is called the Generation Tool User's Manual
   - The document will go into details the specific of the generation tool related to each module, for example:
     - The module in relation to the Generation tool
     - The input file, and output file
     - Specific error message relating to the module

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MCAL DOCUMENTS

3. r11uz0159ej0200-rcarv4h-mcal-apx.pdf
   - The document present the information relating to the package as a whole, including which module are available in the ticket, the version of AUTOSAR,
4. R-CarS4_V4H_V4M_MCAL_ModuleOverview.pdf
   - The document will give you information relating to the specific module. Information may include:
     - Module overview
     - Module dependency
     - Folder structure
     - Etc.
5. r11uz0132ej0201-rcarv4h-mcal-gs.pdf
   - The document will give you a broad overview of the concept and description of file for you to better understand the overall aspect of the package
6. r01an6904ea0100_mcal.pdf
   - The document will give you information on how to use DaVinci Configurator tool (this document is not included in the package)

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MCAL SAMPLE APPLICATION AND SOURCE CODE

- For each module in the MCAL Package we provide a sample application which include
  - A Sample Configuration File (.arxml)
  - Sample Generated Source code (.c)
  - Sample Generated Binaries of Sample Application (.srec)
  - A build file for cleaning the workspace, generating source code from the configuration, and compiling the source code into a binary file. The file is called **SampleApp.bat**
- Sample application file main intention is to provide the user with a basic configuration as a start, as well as, how each module work on the SOC.
- Beside what is included in the package, in order to use the sample application, the user needs to provide compatible compiler, and DaVinci Configurator.

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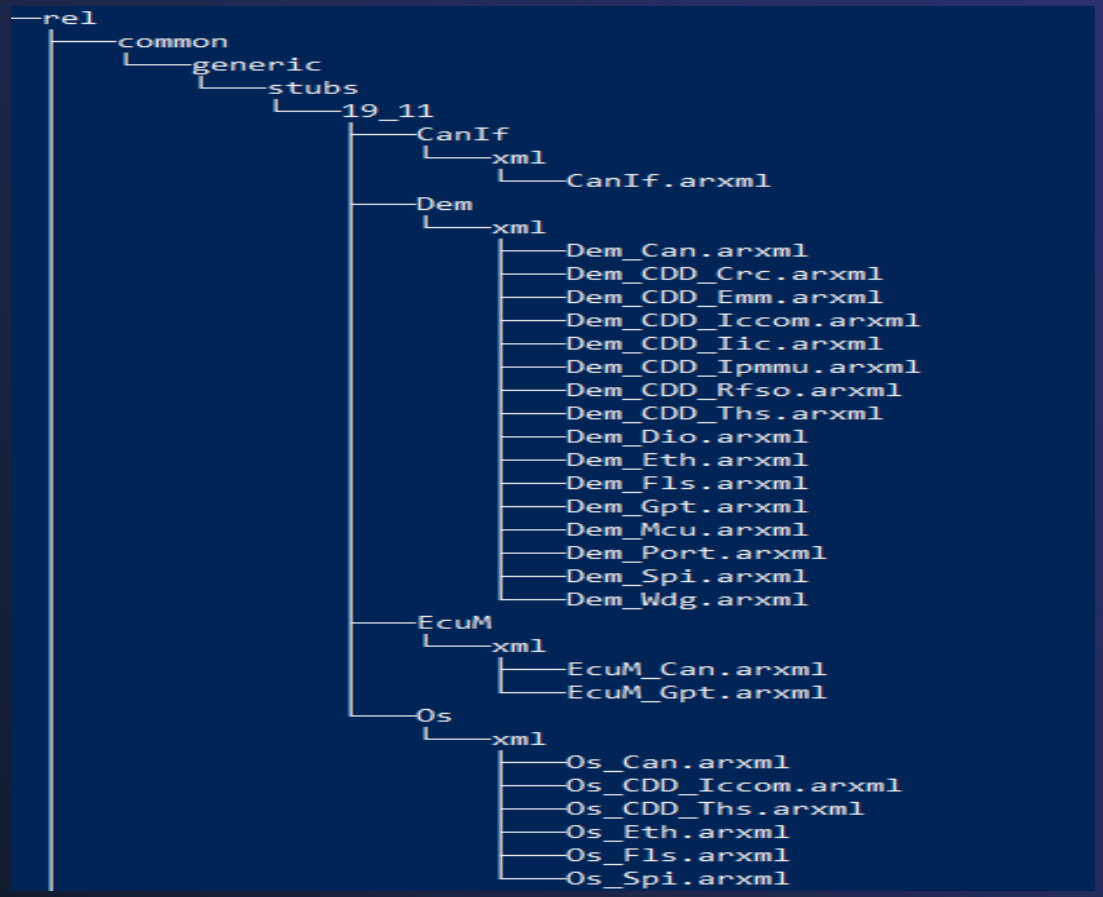
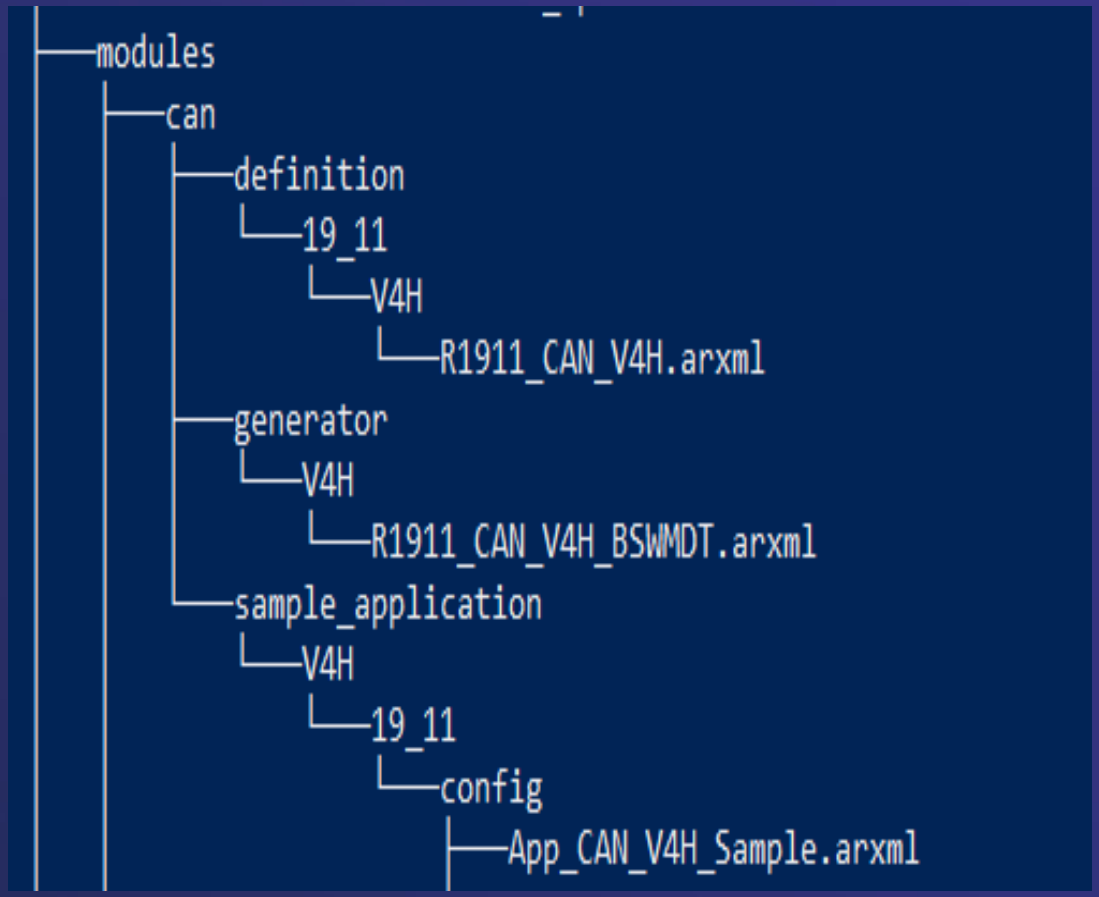
MCAL SAMPLE APPLICATION AND SOURCE CODE

File location for all the relevant .arxml file of the CAN module





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MCAL SAMPLE APPLICATION AND SOURCE CODE

Type of file for generation of example module CAN:

- App_CAN_V4H_Sample.arxml
  - Type: CDF (Configuration Description File)
  - Purpose: Contains sample configuration values for the CAN module.
  - Role: Provides actual parameter values (e.g., controller settings, baud rates) used in generation.
- R1911_CAN_V4H_BSWMDT.arxml
  - Type: PDF (Parameter Definition File)
  - Purpose: Describes the structure and metadata of the CAN module.
  - Role: Tells the generator what parameters exist and how they relate.
- MCU_CAN_V4H.arxml
  - Type: ECUC (ECU Configuration File)
  - Purpose: Contains microcontroller-specific configuration for CAN.
  - Role: Ensures the generated code matches the hardware (e.g., number of CAN controllers, interrupts).

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MCAL SAMPLE APPLICATION AND SOURCE CODE

- Sample_Application_V4H.trxml
  - Type: Tool-specific configuration (likely EB tresos or Renesas format)
  - Purpose: Defines tool behavior, templates, or transformation rules.
  - Role: Guides how the generator interprets and transforms ARXML data
- Dem_Can.arxml
  - Type: Stub for DEM (Diagnostic Event Manager)
  - Purpose: Provides placeholder or minimal configuration for DEM integration.
  - Role: Allows CAN module to reference DEM events without needing full DEM setup.
- EcuM_Can.arxml
  - Type: Stub for ECU Manager
  - Purpose: Provides basic ECU startup/shutdown configuration.
  - Role: Ensures CAN module can integrate with ECU lifecycle management.
- Os_Can.arxml
  - Type: Stub for OS (Operating System)
  - Purpose: Defines OS counters, alarms, or tasks used by CAN.
  - Role: Enables CAN module to interact with OS services (e.g., interrupts, timing).

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SAMPLE APPLICATION

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ENVIRONMENT PREPARATION

- The following requirements are needed in order to use the package effectively
  - Compiler: The MCAL Package here uses the Arm Compiler, for each package a different version of Arm Compiler is needed. For package MCAL V4M the compiler version needed is ARM Compiler 6.16.1
    - Information relating to the compiler version can find in the Release Note document
    - The compiler by default needs to be located at root folder C e.g C:\ ARMCompiler6.16.1
    - If you have access to Renesas internal site, you can get the compiler at the following link
      - How to install ARM Compiler on Windows - RCar_xOS_SWDev - Renesas Confluence
  - DaVinci Configurator: This software is needed in order to configure and modify the configuration in order to test different setting of the module

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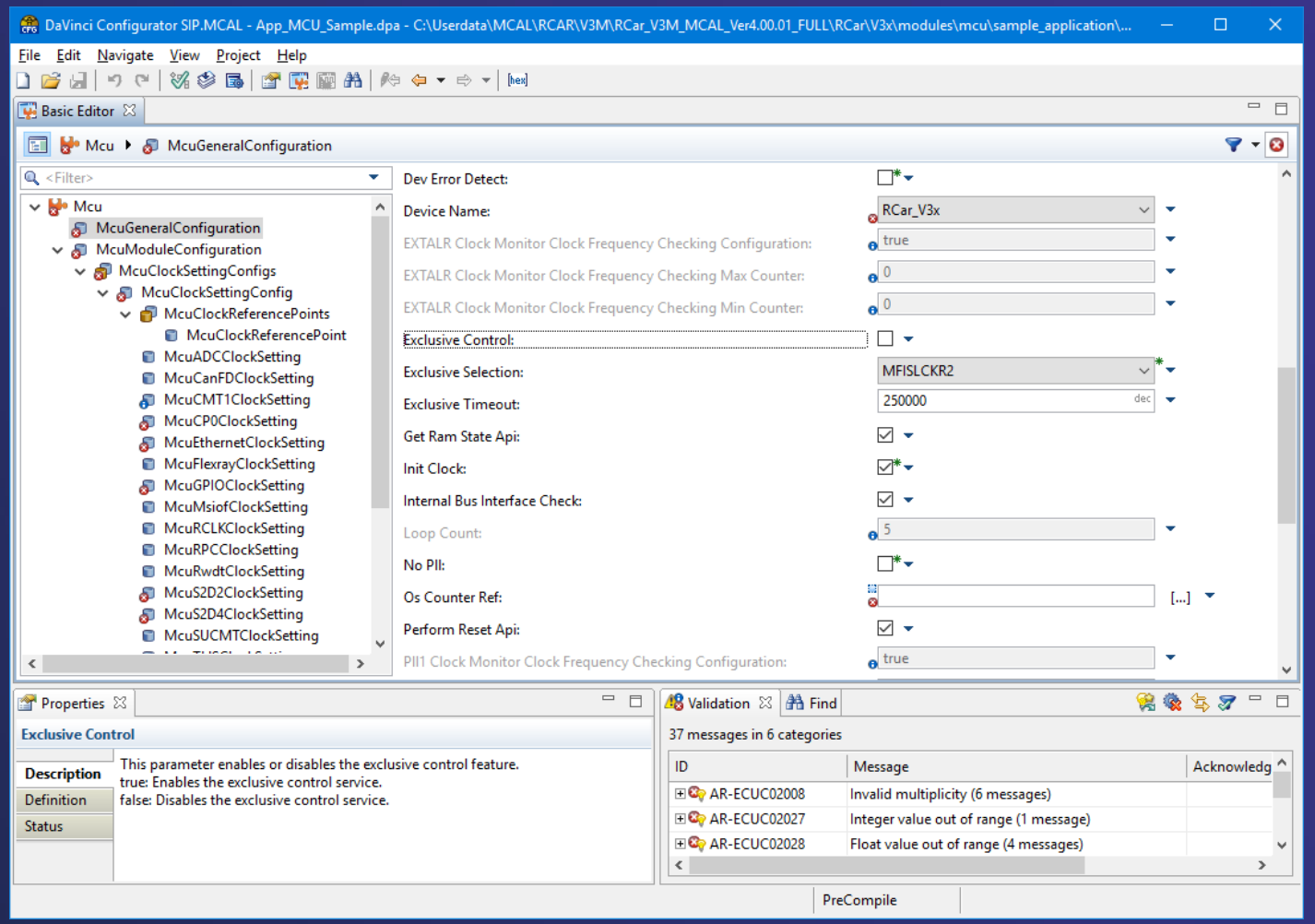
GENERAL WORKFLOW FOR SAMPLE APPLICATION

- Configuration
  e.g. DaVinci Configurator
- Generation
- Building
- Debugging



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GENERAL WORKFLOW FOR SAMPLE APPLICATION

- Configuration
- Generation
- Building
- Debugging

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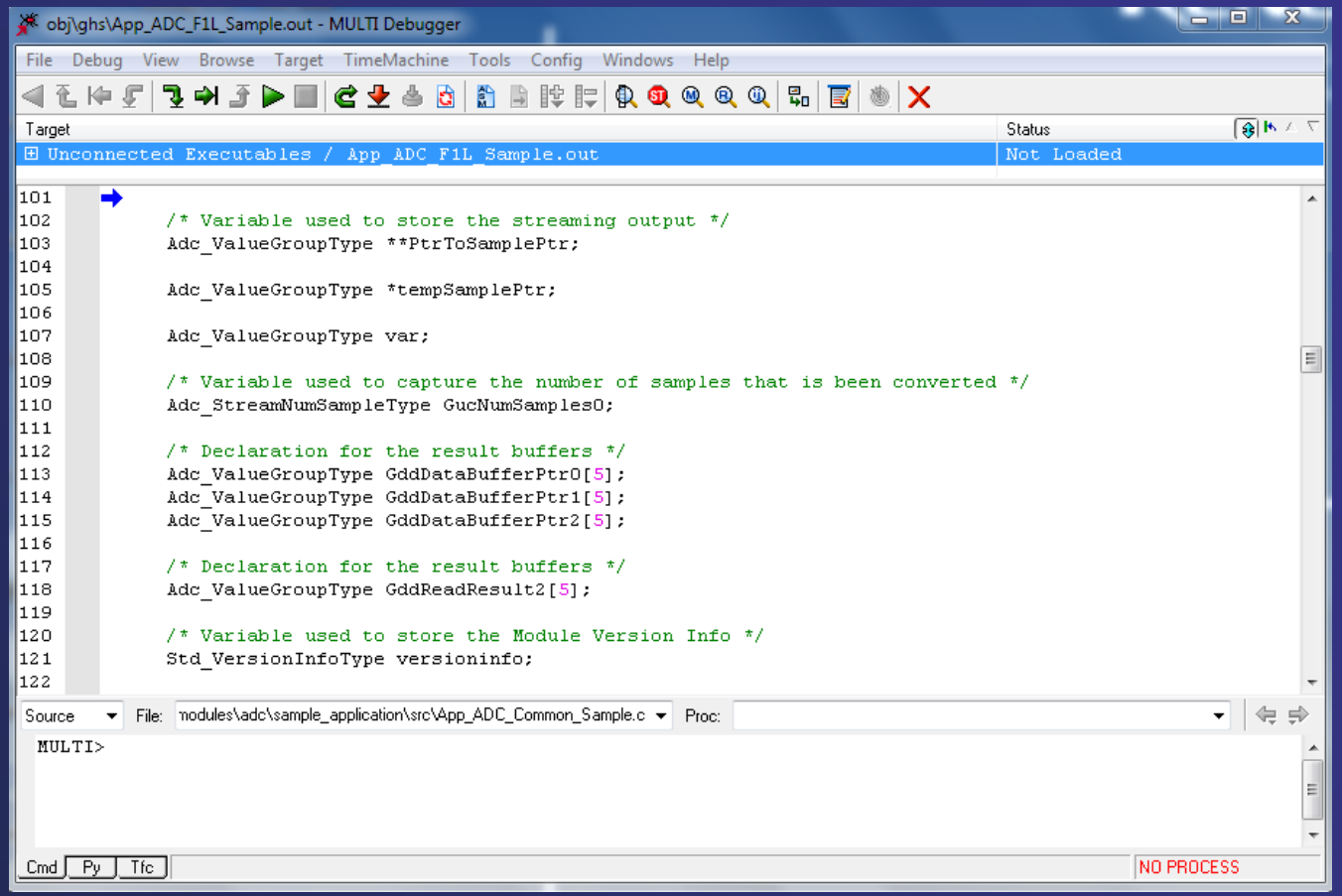
GENERAL WORKFLOW FOR SAMPLE APPLICATION

- Configuration
- Generation
- Building
- Debugging
  - Lauterbach, GHS Multi, etc.



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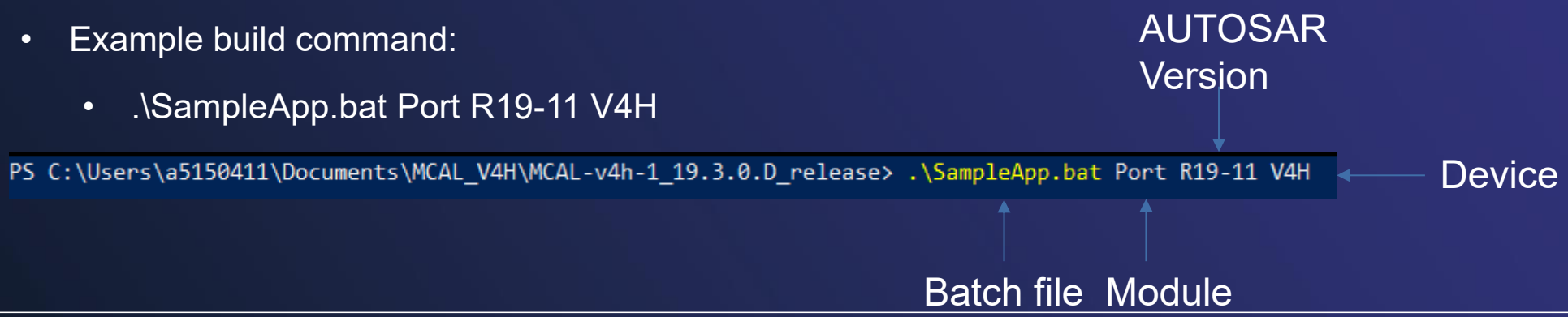
GENERATE, BUILD AND DEPLOY SAMPLE APPLICATION

- To generate and build the sample application we need to follow the following step
  - Open a PowerShell terminal
  - Navigate to the SampleApp.bat file located at “rel\\V4H\common_family\make\arm”
  - Run the SampleApp.bat with the appropriate option, these option include
    - Module: The module you want to generate and build
    - AUTOSAR Version: The AUTOSAR Version use to build
    - Device: The device use to run the application
    - BUILD_OPTION: Leave blank to perform clean; generate; and build at the same time
  - Example build command:
    - .\SampleApp.bat Port R19-11 V4H



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DAVINCI CONFIGURATOR

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BASIC CONCEPT

Validation by Configurator Tool

- The tool validates configuration values based on **Parameter Definition Files (PDF/BSWMD)** provided by Renesas
- The PDF file define the container, parameters, value ranges, and selectable options.
- The tool flags mismatches with warnings and errors.

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BASIC CONCEPT

Generation Tool Usage

- The generation tool is a command-line utility that takes:
  - ECU Configuration Description File (CDF)
  - BSWMDT file
  - Translation XML
  - Configuration XML
- It produces C source and header files based on the module configuration

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BASIC CONCEPT

Information and Warning Messages during Generation

- The generator tool returns:
  - Errors: Stop the generation process; must be fixed before proceeding
  - Warnings: Do not stop generation but may indicate potential issues
  - Information messages: Provide helpful insights
- It is recommended to resolve warnings to ensure robust

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BASIC CONCEPT

- DaVinci Configurator is a tool developed by **Vector** and used in the **AUTOSAR** ecosystem to configure ECU software components. It's commonly used by companies like **Renesas** for configuring **MCAL (Microcontroller Abstraction Layer)** parameters.
- **Parameter Definition File (PDF)**
  - Contains metadata and definitions for configuration parameters
  - Acts as input for the generator tool
  - Used to generate configuration templates
- **Configuration Description File (CDF / BSWMD)**
  - Stores actual configuration values set by the user
  - Created or modified using templates from the PDF
  - Used to generate final output files for integration

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DAVINCI CONFIGURATOR GUI AND INSTRUCTION

- Familiarizing with DaVinci Options
  - **File**: Create/open/close projects, import/export configurations.
  - **View**: Access properties, validation results, unresolved references, etc.
  - **Project**: Add modules, configure settings, and run generation.
  - **Basic Editor**: View and edit module configurations in a tree structure.
  - **Help**: Access documentation and tool info.

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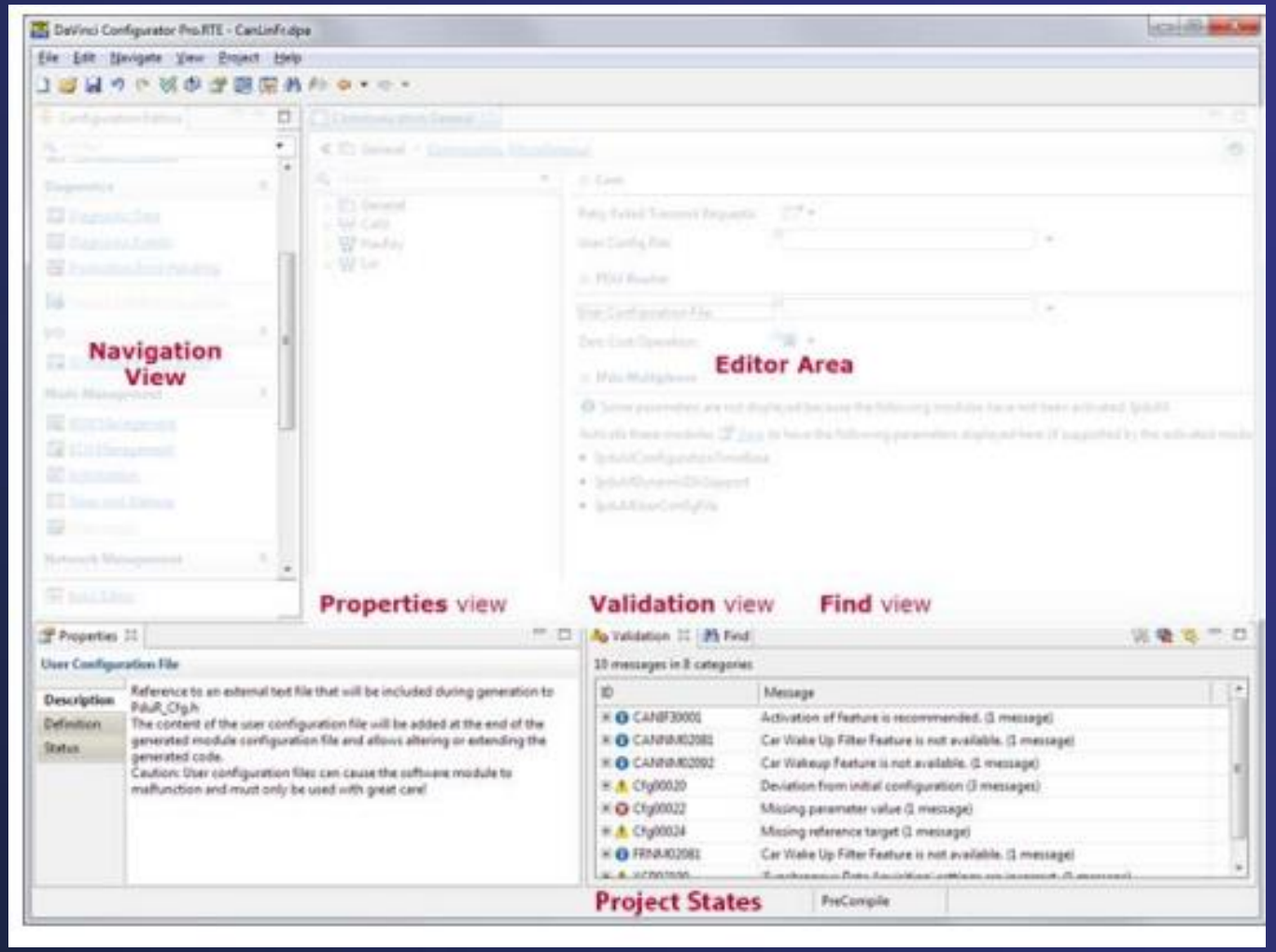
DAVINCI CONFIGURATOR GUI AND INSTRUCTION



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DAVINCI CONFIGURATOR GUI AND INSTRUCTION

- Usage of PDF in DaVinci
  - Copy the PDF and BSWMDT file to the BSWMD folder present in the DaVinci installation folder.
    - Installation folder should be at C:\Vector
  - Always ensure that PDF file corresponding to the device variant is selected correctly
  - If user wants to configure a device 702300EABA, then always make sure that the PDF file corresponding to 702300EABA itself is copied to the BSWMD folder
  - Always ensure that only a single PDF file corresponding to a module is present in the BSWMD folder, or else, the DaVinci configurator will throw an error for multiple PDF files for a single module

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DAVINCI CONFIGURATOR GUI AND INSTRUCTION

- Creating a new project
  - Go to File -> New ECU Project
  - Enter a valid project name and folder path
  - Follow the wizard to complete project setup
  - A .dpa file is created and can be reopened later

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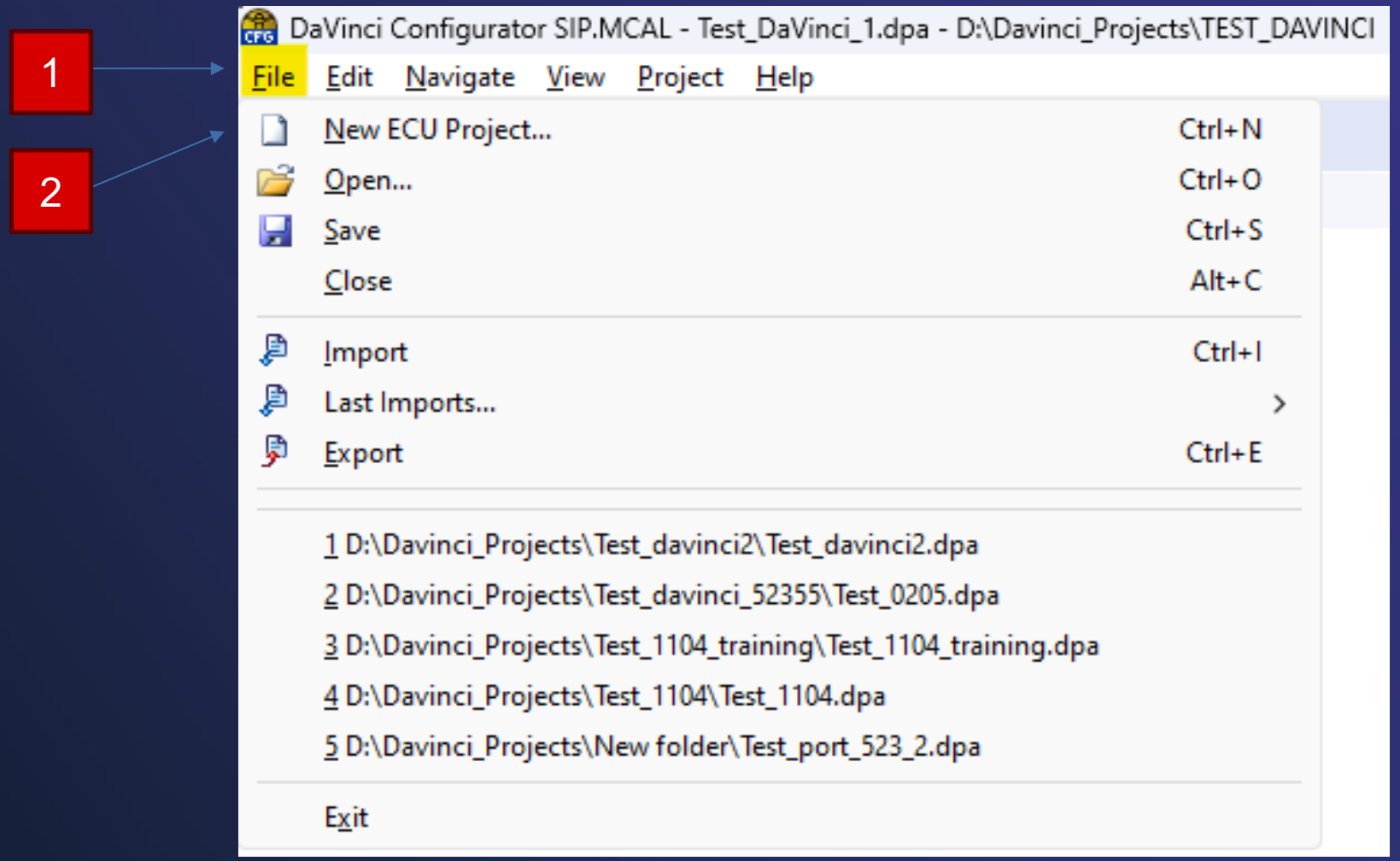
DAVINCI CONFIGURATOR GUI AND INSTRUCTION



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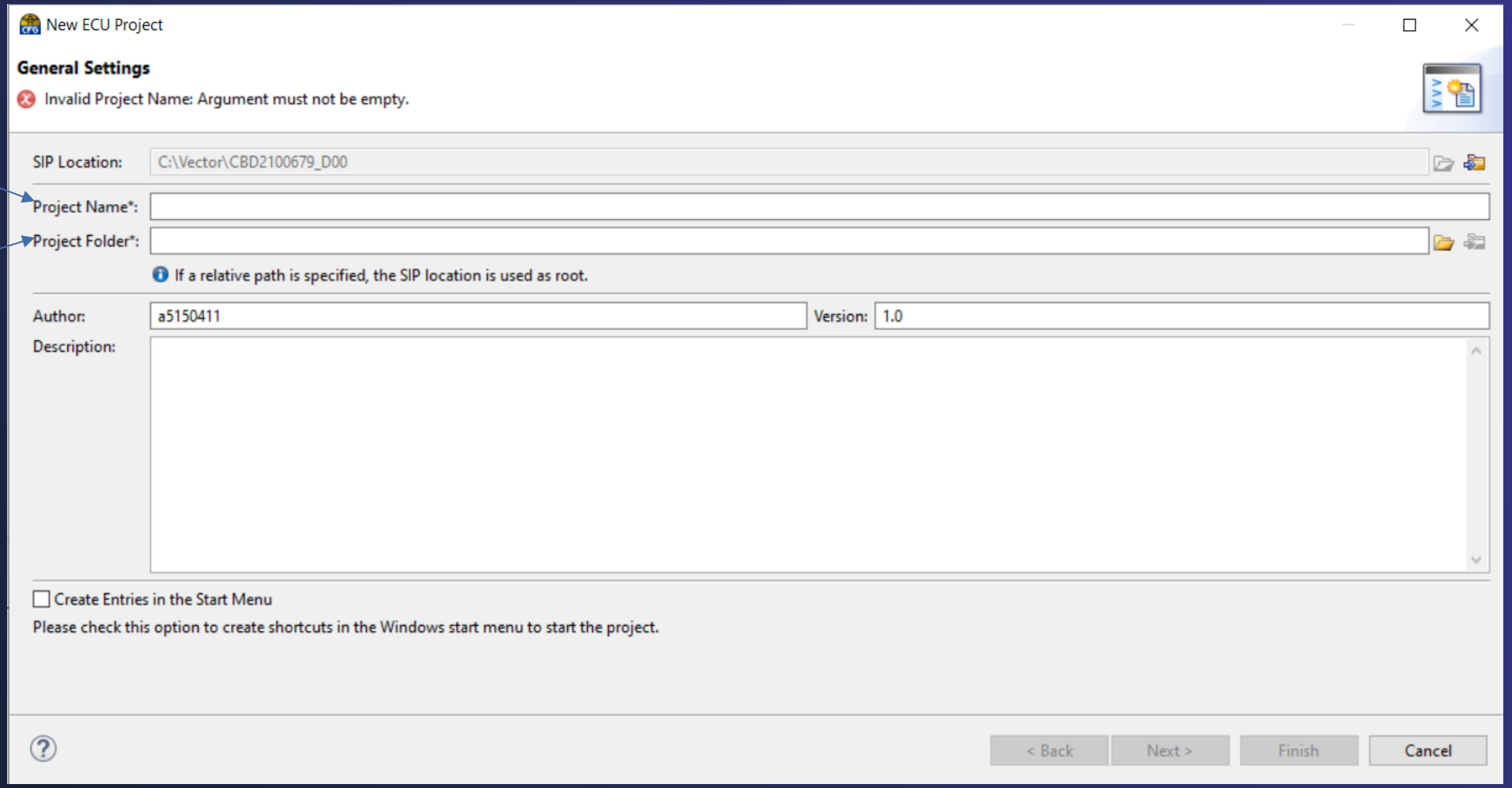
DAVINCI CONFIGURATOR GUI AND INSTRUCTION



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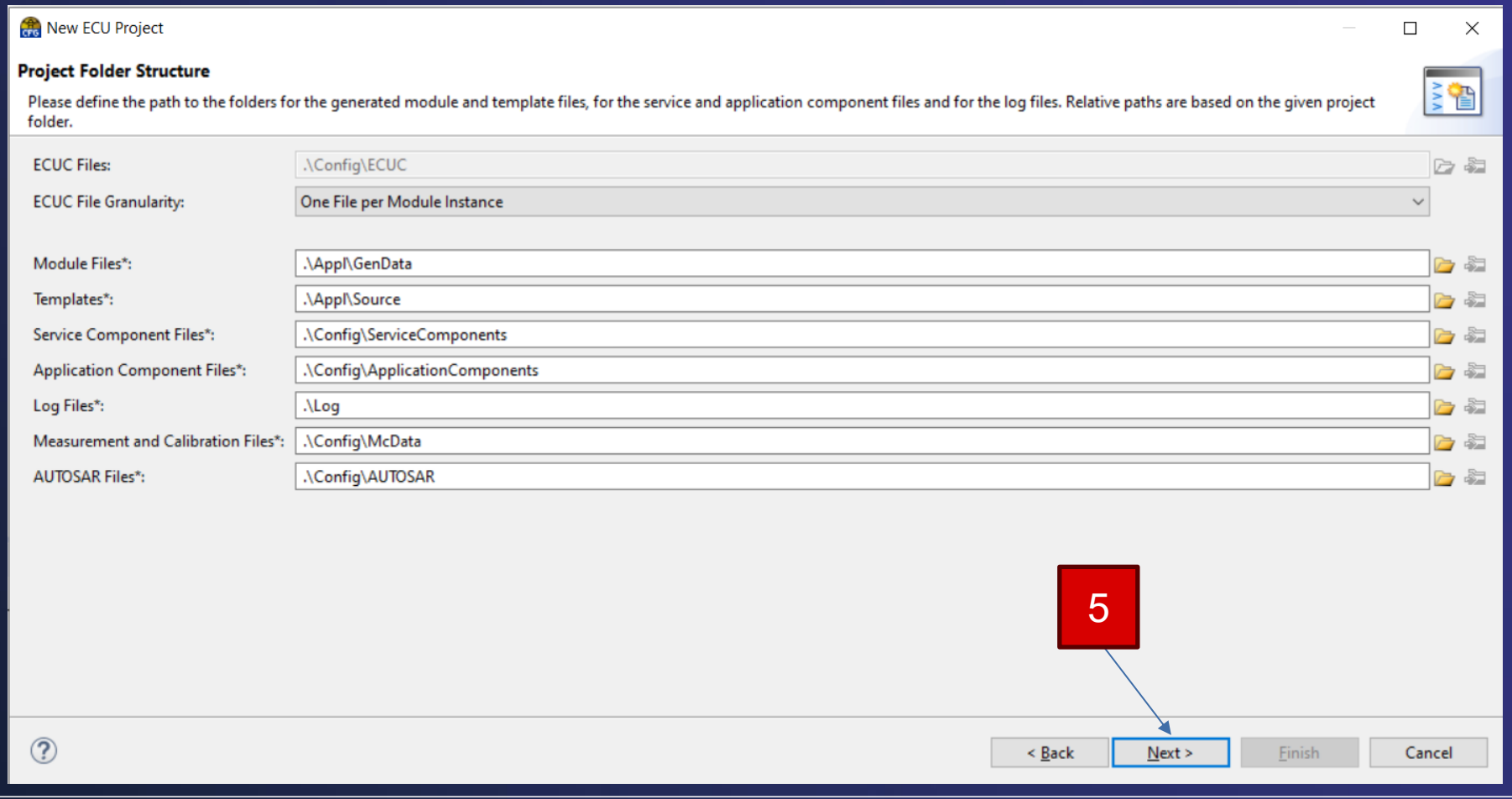
DAVINCI CONFIGURATOR GUI AND INSTRUCTION

Leave the setting here as default



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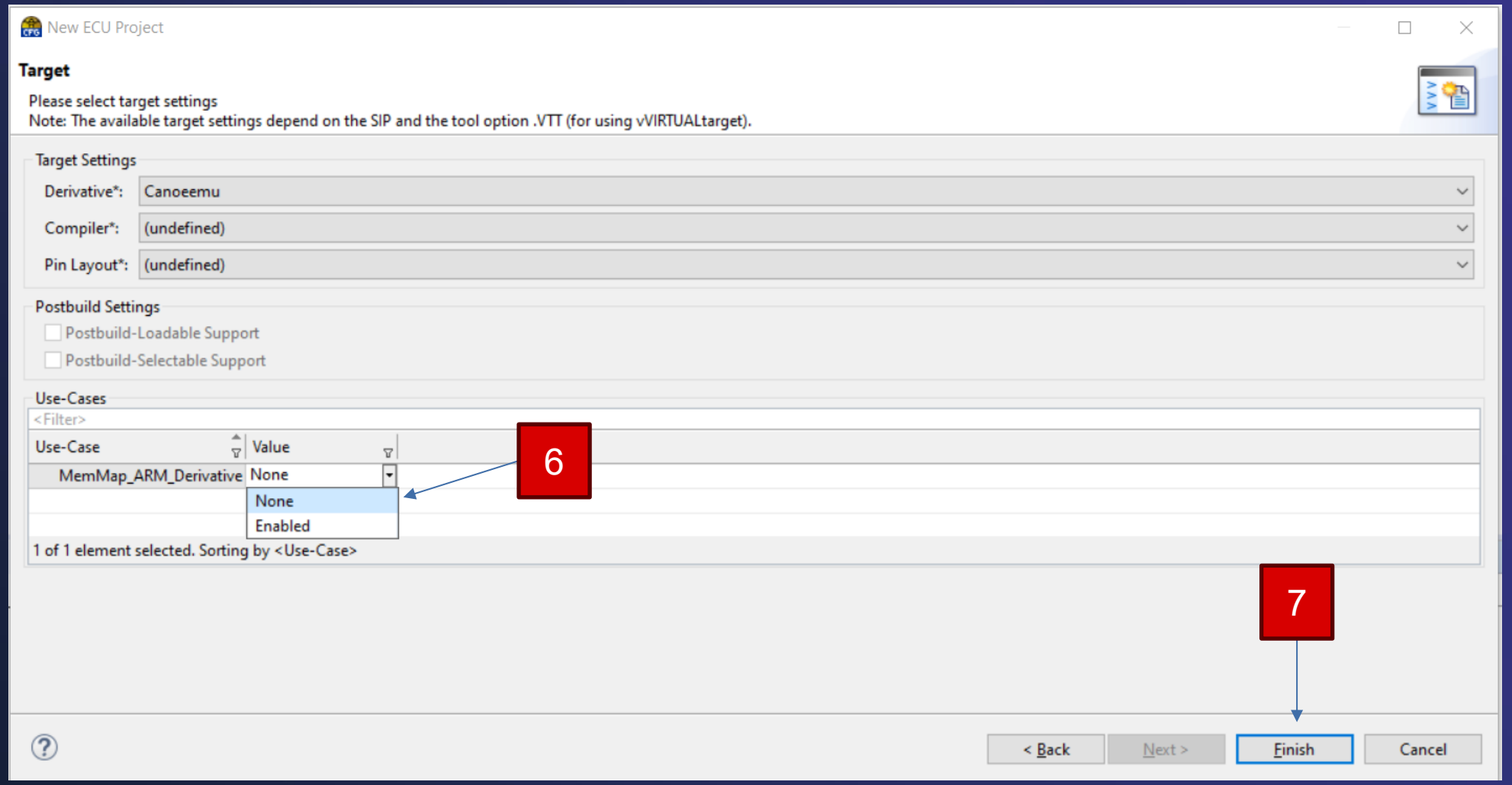
DAVINCI CONFIGURATOR GUI AND INSTRUCTION



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DAVINCI CONFIGURATOR GUI AND INSTRUCTION

- Creating a new configuration using PDF
  - Add modules via **Project** → **Project Settings** → **Modules**.
  - Select modules from the **Software Integration Package (SIP)**.
  - Use the **Basic Editor** to configure parameters.
  - Export the configuration when done.

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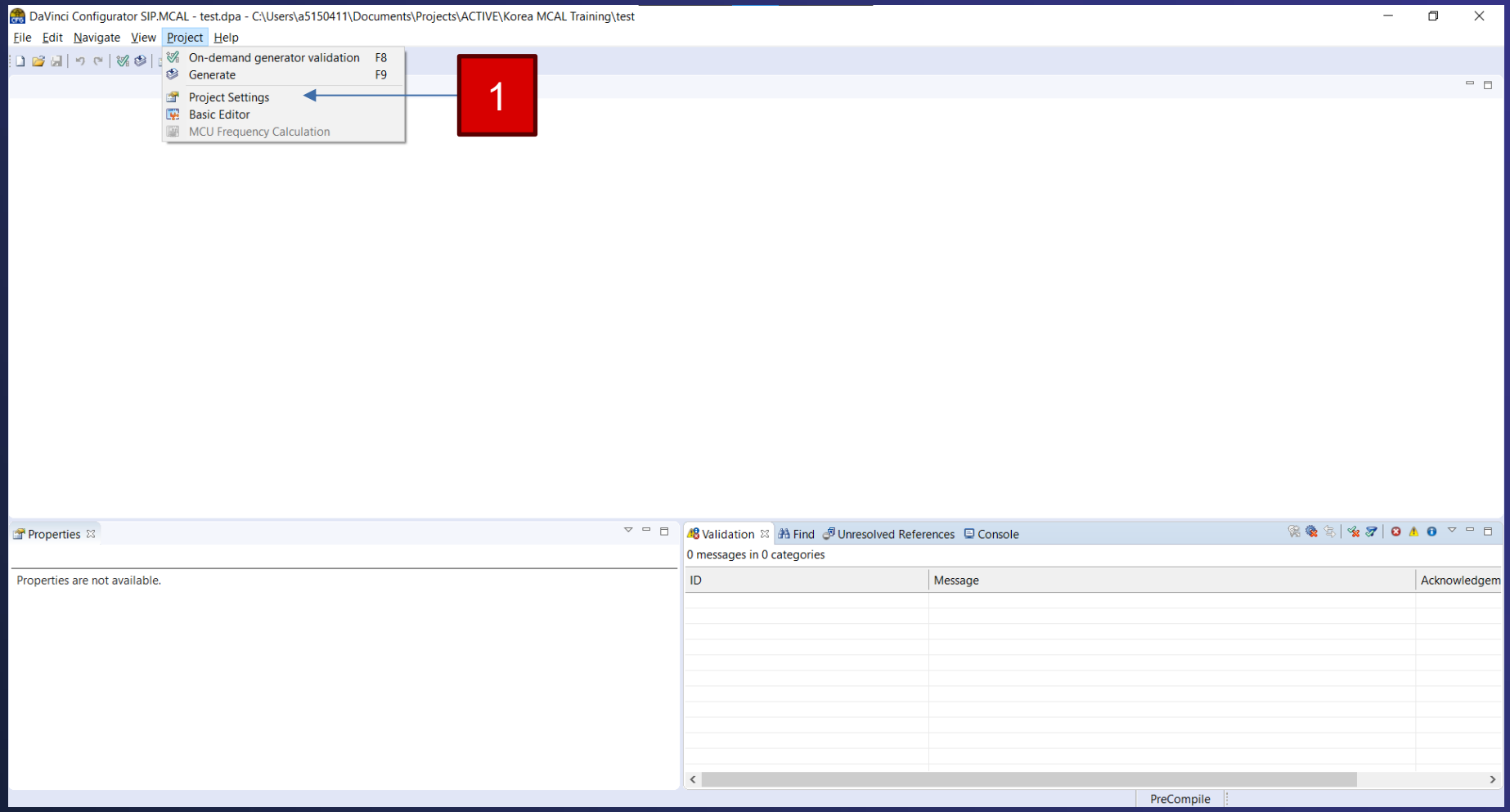
DAVINCI CONFIGURATOR GUI AND INSTRUCTION



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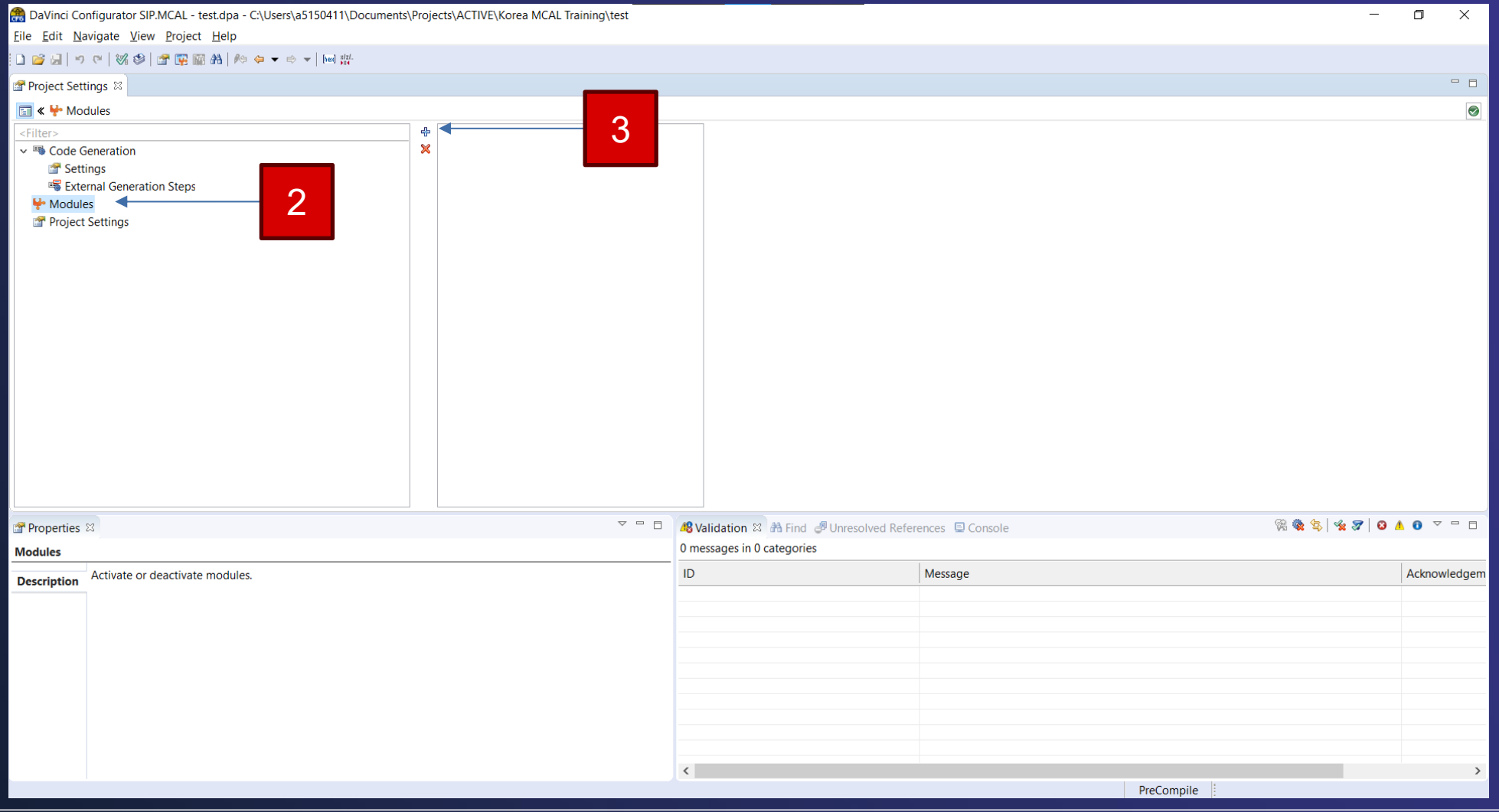
DAVINCI CONFIGURATOR GUI AND INSTRUCTION



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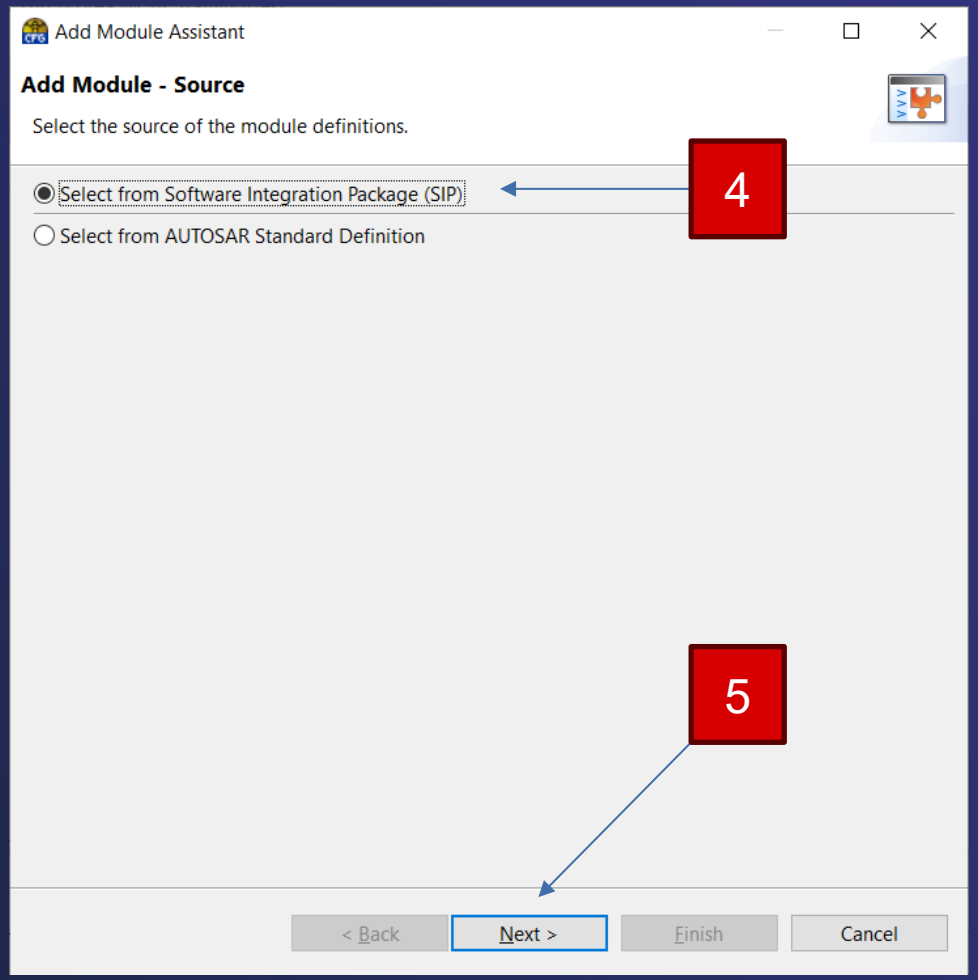
DAVINCI CONFIGURATOR GUI AND INSTRUCTION



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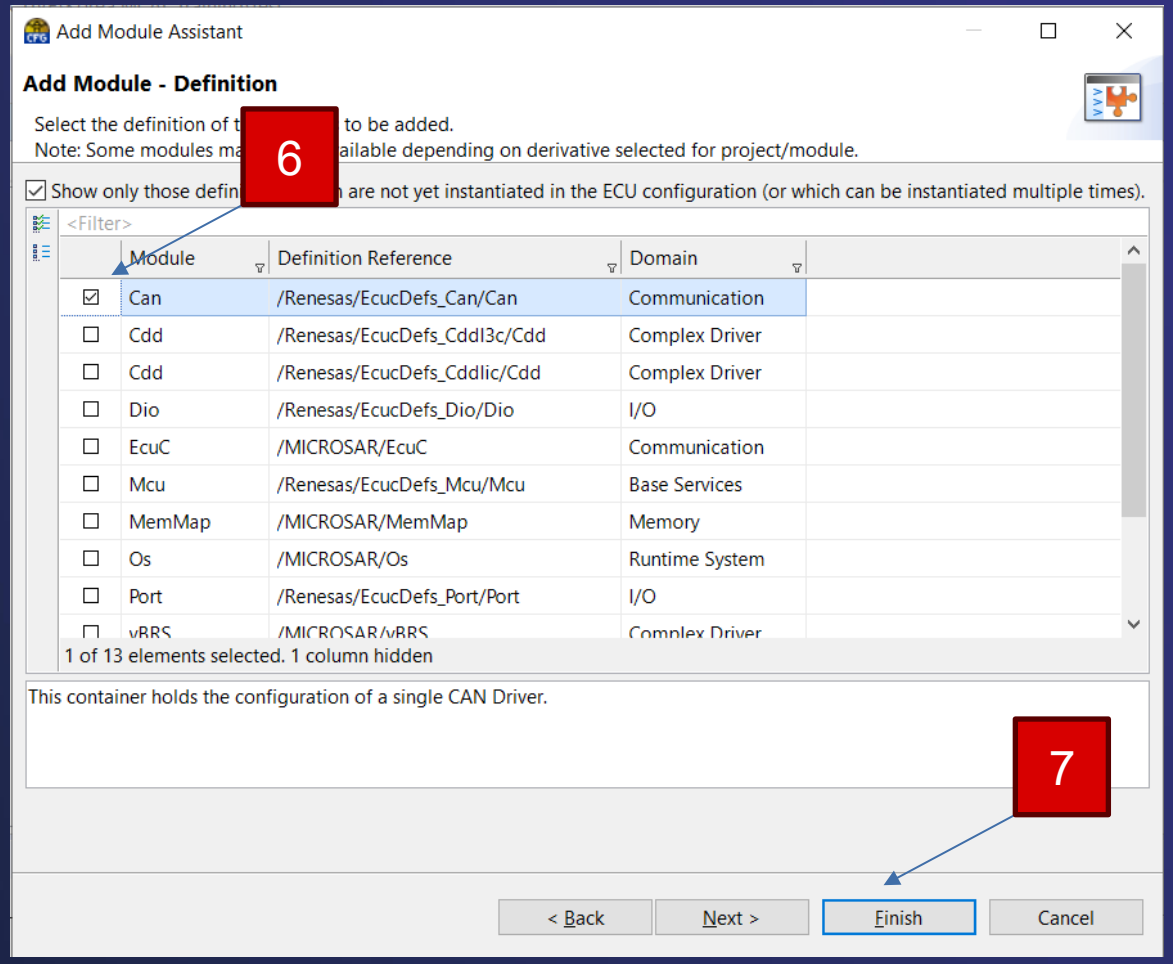
DAVINCI CONFIGURATOR GUI AND INSTRUCTION



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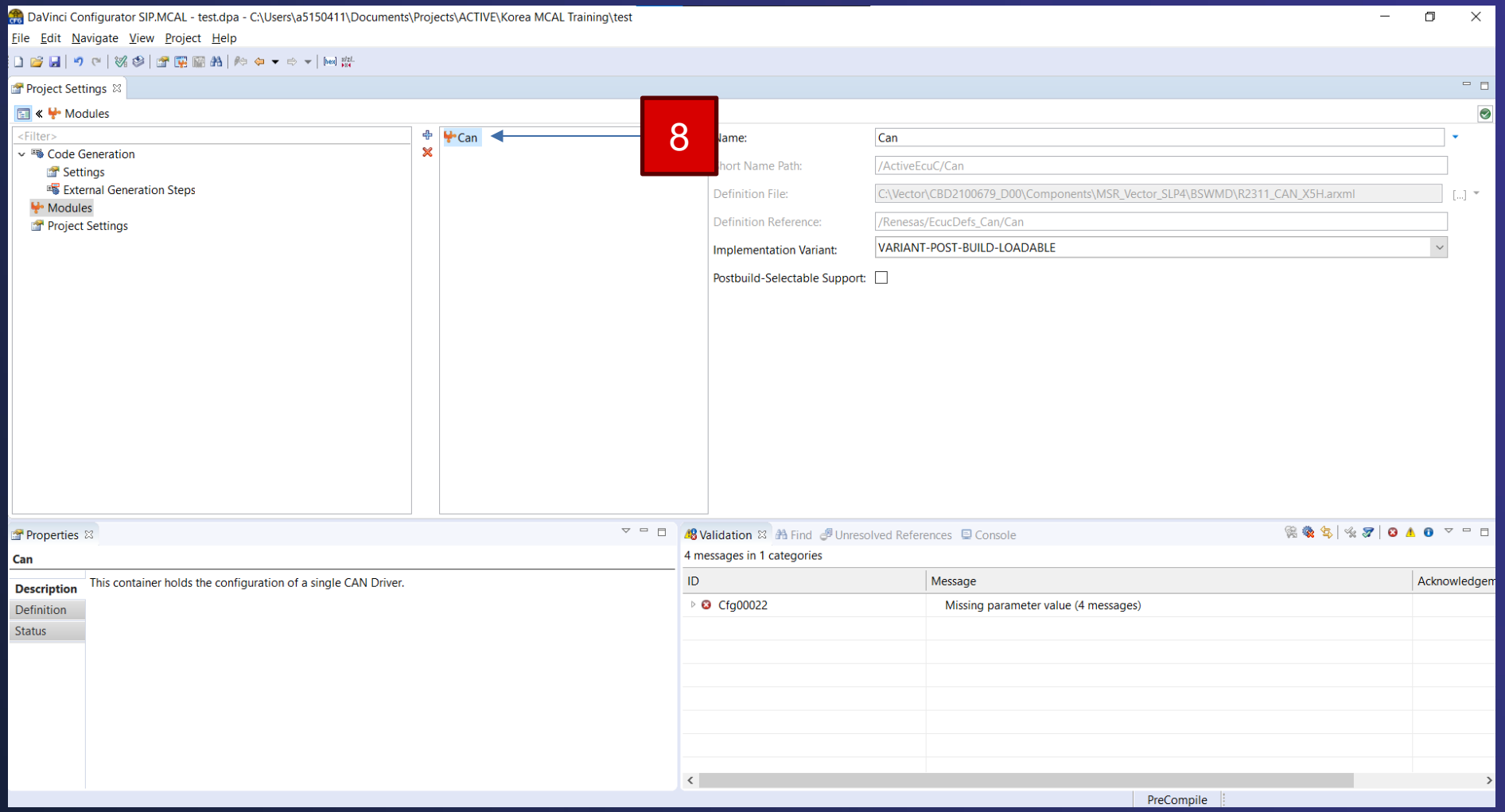
DAVINCI CONFIGURATOR GUI AND INSTRUCTION



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IMPORTING, EXPORTING, AND MODIFYING MODULE AND CONFIGURATION

- Importing and export functionality
  - Import: Load existing configurations.
  - Export: Save configurations to .arxml or other formats.
  - There are several case of importing and exporting that can be performed with DaVinci Configurator
    1. **Import multiple configs → Export to single file**
    2. **Import multiple configs → Export to multiple files**
    3. **Import single config with multiple modules → Export to single file**
    4. **Import single config with multiple modules → Export to multiple files**

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IMPORTING, EXPORTING, AND MODIFYING MODULE AND CONFIGURATION

- Modifying existing configuration
  - Use the **Basic Editor** to navigate and edit containers and parameters.
  - Use the **Properties window** to view and change:
    - **Description** (functionality and options)
    - **Definition** (type, multiplicity, origin)
    - **Status** (current and default values)

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