EMBEDDED SOFTWARE

Ansys SCADE Avionics Package 2021 R1

The Ansys SCADE Avionics Package extends Ansys SCADE capabilities for the aerospace and defense industries. Combined with SCADE design capabilities, the Avionics Package offers system engineers a unique solution to tackle the multiple challenges of embedded avionics system design: a growing number of software components, a large volume of data exchanged between components and numerous communication protocols.

The package consists of several solutions targeting these objectives:

The Future Airborne Capability Environment (FACE) Technical Standard is the open avionics standard for making military computing operations more robust, interoperable, portable and secure. With the FACE configuration included in the SCADE Avionics Package, compliance to the FACE Technical standard both at the model and at the generated code levels is ensured.

The Architecture & Analysis Description Language (AADL) is dedicated to real-time embedded systems, modeling both the software and hardware resources. It is extensible through annexes, both standard and custom, bringing detailed specifications especially for verification of non-functional system requirements, such as performance. With the AADL configuration included in the SCADE Avionics Package, SCADE Architect becomes a user friendly, full-fledged AADL modeler.

The Avionics Interface solution provided in the SCADE Avionics Package includes all means to specify consistent avionics messages in a model for protocols such as ARINC 429, ARINC 664 (AFDX), or CAN, in an integrated modular avionics architecture. It supports configuration file generation for ARINC 653 properties, resource usage checks, and a comprehensive aircraft braking system example. SCADE Architect Configurator is a prerequisite for using the SCADE Avionics Package.

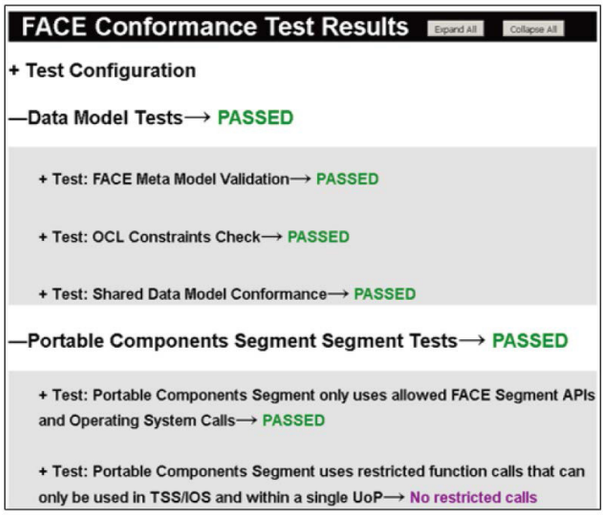
/ Solution for the FACE Technical Standard

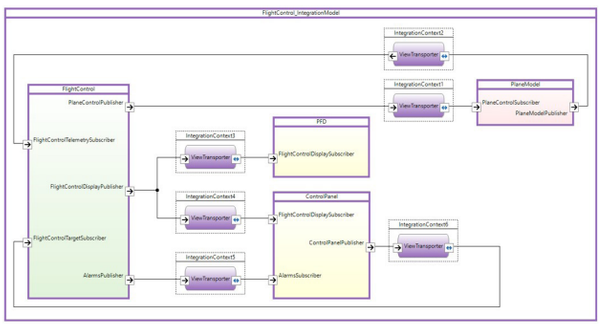
The Future Airborne Capability Environment (FACE)™ is a standard that promotes innovation and rapid integration of portable capabilities. It defines a powerful software interface modeling methodology and a runtime software architecture. For designers to efficiently develop FACE UoP Supplied Data Models (USM) for their Units of Portability (UoPs) and produce the code for the corresponding Units of Conformance (UoCs), robust tooling and processes are recommended.

The SCADE Avionics Package provides a complete set of features for efficient implementation of applications in the Future Airborne Capability Environment (FACE) environment:

- SCADE Architect is tailored with a specific FACE configuration. It enables users to perform FACE Data Modeling. Both FACE 2.1 and FACE 3.0 versions are fully supported. Roundtrip import/export functionality is provided for any FACE file, including the Shared Data Model. The exported FACE file passes the Data Model testing with FACE Conformance Test Suite (CTS) 2.1.30 or 3.0.
- The SCADE Architect modeler offers an intuitive FACE data modeling with tree view, graphical diagrams and tables. For FACE 3.0, it provides graphical view of the FACE integration model, as well as syntactic textual editor for the FACE 3.0 Query and Template languages, with automated on-the-line preview of the IDL types outcome.
- The solution features an automated FACE 2.1 to FACE 3.0 model transformation. It even supports model synchronization allowing to maintain both models up-to-date with incremental modifications: any change in the FACE 2.1 model is automatically reported in the FACE 3.0 model.
- SCADE Architect and SCADE Suite designs are synchronized (incremental import), ensuring consistent definition of the Unit Of Portability (UoP) in both the “system view” and the “software view.”

A FACE Transport Services adaptor wraps the code generated by SCADE Suite KCG on top of the Transport Services API. The automatically generated C code, makefiles and object files pass Portable Component Segment testing with FACE Conformance Test Suite 2.1.3 or 3.0, C or C++ programming languages, ARINC 653 or POSIX OS environments.





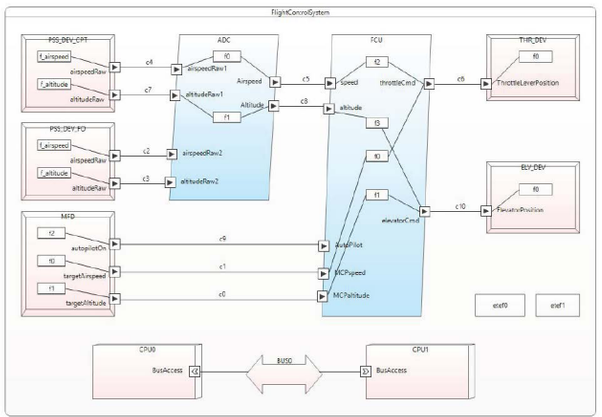
/ Solution for AADL

AADL is a recognized SAE standard within the systems modeling community and is widely used for defense applications. AADL is dedicated to real-time embedded systems, modeling both software and hardware resources, and providing detailed specifications for verification of non-functional systems requirements, such as performance, safety, costs, etc.

The SCADE solution for AADL provides a graphical AADL modeler tool compliant with the AADL standard. The SCADE AADL tool imports and exports standard AADL files, including property sets definitions.

The easy-to-use graphical user interface allows for the modeling and understanding of AADL models through straightforward, direct and complete definition of the components as single objects.

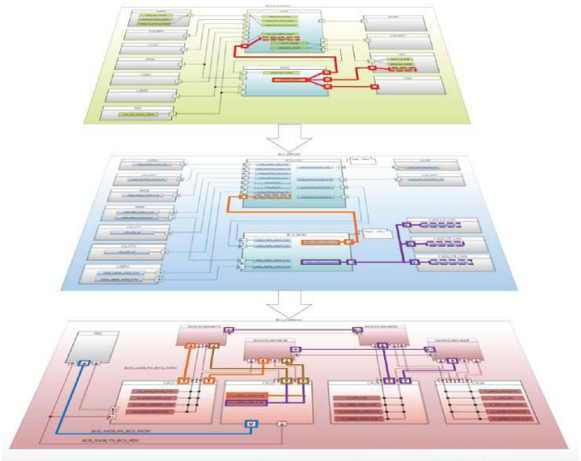
SCADE AADL also provides a seamless path to the Ansys SCADE Suite for the development of software components. You can streamline your development activities and benefit from the qualified tool chain, code generation and tests. The SCADE for AADL software completes the SCADE product family, which offers solutions from specification and analysis of real-time, performance-critical systems early in the system design cycle through certified code generation.



The AADL support in the SCADE avionics package offers:

- Full compatibility with AADL v2.2 standard.
  - Allows for legacy model import.
  - Allows for export to third-party analyzers.
- Ease of use.
  - AADL expressiveness simplified down to concrete components.
  - Intuitive graphical interface and diagrams.
- SCADE tools ecosystem.
  - Bi-directional synchronization with SCADE Suite for software component development, verification and certification.
  - Traceability through SCADE ALM gateway.
  - Same IDE as for SysML and FACE modeling (mixed design supported).

/ Solution for Avionics Interfaces



The Avionics Interfaces solution enables one to configure the SCADE Architect Advanced Modeler user interface for a methodology relying on independent functional, software and platform layers. This configuration enables defined Modular Avionics or any other avionics architecture. The configurations are provided as models for reuse and customization to support company-specific methods.

Model-based System Engineering Multilevel Method

The SCADE Avionics Interface solution allows for the clean separation of concerns into functional, software and platform levels.

Functional Architecture Design

At the functional architecture level, SCADE Architect enables:

- Representing data exchanges between functions.
- Propagating data flow in functional architecture.
- Importing/exporting data with MS Excel or CSV files, allowing for integration in existing workflows.

Software Architecture Design

At the software architecture level, SCADE Architect enables:

- Assembling functions on software components and representing message exchanges between components.
- Defining ARINC 429, ARINC 664-P7/AFDX or CAN message exchanges between software components.
- Propagating messages in logical architecture.
- Allocating functions to software components.
- Allocating functional data onto ARINC 429, ARINC 664 or CAN messages.

		A	B	C	D	E
		LabelID	Encoding	Coding_type	Position	Size
171	A429_BCS_LGRDC1_L15					
173	L15	15	BNR = 1			
175	I_AS_PB_2			BCD = 0	0	30
176	A429_BCS_LGRDC1_L16					
178	L16	16	BNR = 1			
180	PT_FILTERED_1			BCD = 0	0	30
181	A429_BCS_LGRDC1_L17					
183	L17	17	BNR = 1			
185	PT_FILTERED_2			BCD = 0	0	30
186	A429_BCS_LGRDC1_L27					
188	L27	27	Discrete = 2			
190	B_I_AS_CONDITION_SV_1				0	1
191	B_I_AS_CONDITION_SV_2				1	1
192	B_AS_PASSIVE_1				2	1
193	B_AS_PASSIVE_2				3	1
194	B_PCL_ACTIVE_1				4	1
195	B_PCL_ACTIVE_2				5	1

Platform Architecture Design

At the platform architecture level, SCADE Architect enables:

- Representing computation of units, buses and switches.
- Mapping software components to the hardware platform components.
- Defining ARINC 664 frames and virtual links.

Model-based ICD Management

SCADE Avionics Package allows for the comprehensive generation of consistent Interface Control Documents (ICD) across architecture design levels.

The package allows for the automated production of:

- Tables of ARINC 429 message definitions.
- Tables of ARINC 664-P7/AFDX messages and virtual links.
- Tables of CAN messages.

Verification and Generation

SCADE Avionics Package automates platform-specific verification checks and configuration table generation.

Resource Usage Checks

- Checking AFDX communication bandwidth to verify every platform port has enough bandwidth to transmit all allocated messages.

Generation of VxWorks ARINC 653 configuration files

- Generating one VxWorks 653 software partition configuration file per ARINC 653 hardware module.

Customization Capabilities

SCADE Avionics Package supports user-specific and company-oriented customization:

- Extending configurations provided as models for SCADE Architect Configurator with new properties, new object categories, etc.
- Creating new configurations from existing configurations used as a library to refine them and adding new configurations to existing models at any time.

- Adding support for new communication protocols using copy/paste/edit from one of the existing communication protocol configurations.
- Developing one's own rules for automated verification based on SCADE Architect API, which includes all domain specific information generated automatically from the configurations.
- Customizing IDE menus to launch the generation of specific codes or tables using Java or TCL scripts and access the model API.
- Customizing powerful tables in SCADE Architect for unique messages and ICDs tables, and export/import with MS Excel and CSV files.

Application Lifecycle Management

The life cycle management of systems designed with SCADE Avionics Package can be supported by SCADE LifeCycle® by:

- Connecting Application Lifecycle Management (ALM) tools and setting requirements traceability from models.
- Generating documentation automatically from models.

For information on the SCADE LifeCycle product line, see the Ansys SCADE LifeCycle technical data sheet.

SCADE Avionics Package Product Line

Solution for the FACE 2.1 and 3.0 Technical Standards:

- Configuration and modeler for the FACE Technical Standard.
- Import and export FACE data model files.
- Dedicated synchronization with SCADE Suite and code wrapper for FACE UoP.

Solution for AADL:

- AADL configuration.
- Import and export textual AADL files.
- Dedicated synchronization with SCADE Suite.

Solution for Avionics Interface:

- Avionics configuration source models and plug-ins for ARINC 429, AFDX, CAN, ARINC 653.
- Dedicated tables customization (ICD).
- Dedicated checker rules.
- ARINC 653 tables generation.

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