ADCSS 2014

SOFTWARE REFERENCE ARCHITECTURE – OSRA SPECIFICATION

CONCEPT, HISTORY OF ACTIVITIES AND LOGIC, STRUCTURE OF DELIVERABLES

2014, October 27th

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- Introduction to the COrDeT-3 study.
- COrDeT-3 deliverables.

OBJECTIVE AND HISTORY OF ACTIVITIES

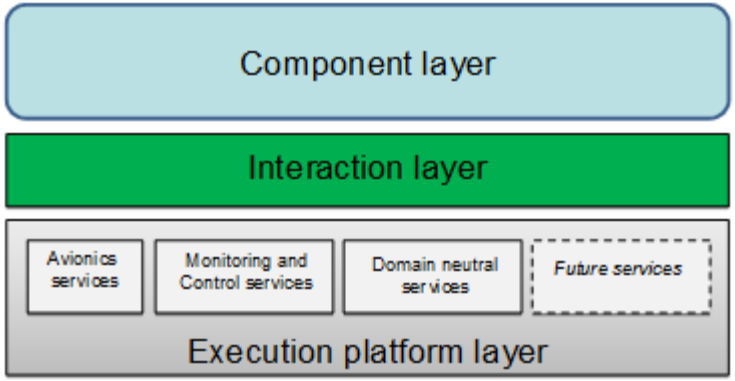
INNOVATING SOLUTIONS

MOTIVATION BEHIND OSRA

- The SW executed on-board of the Spacecraft (OBSW) in different ESA's mission:
  - is increasing in size and complexity,
  - share many capabilities and constraints,
  - is developed over and over again.
- This approach is time consuming, costly, not flexible, etc.
- Potential solution:
  - **Definition of an On-Board Software Reference Architecture (OSRA) designed for the needs of the OBSW domain.**
  - **The software design and evolution shall be guided by fundamental principles: CBDE, MDA, separation of concerns…**

ON-BOARD SOFTWARE REFERENCE ARCHITECTURE (OSRA)

- The OSRA represents the on-board software reference architecture.
- It is sustained by the principles of component- and model-based software engineering.
- Three-layer architecture:



- The OSRA specification will be presented in the "*OSRA Specification and Rationale*" session.

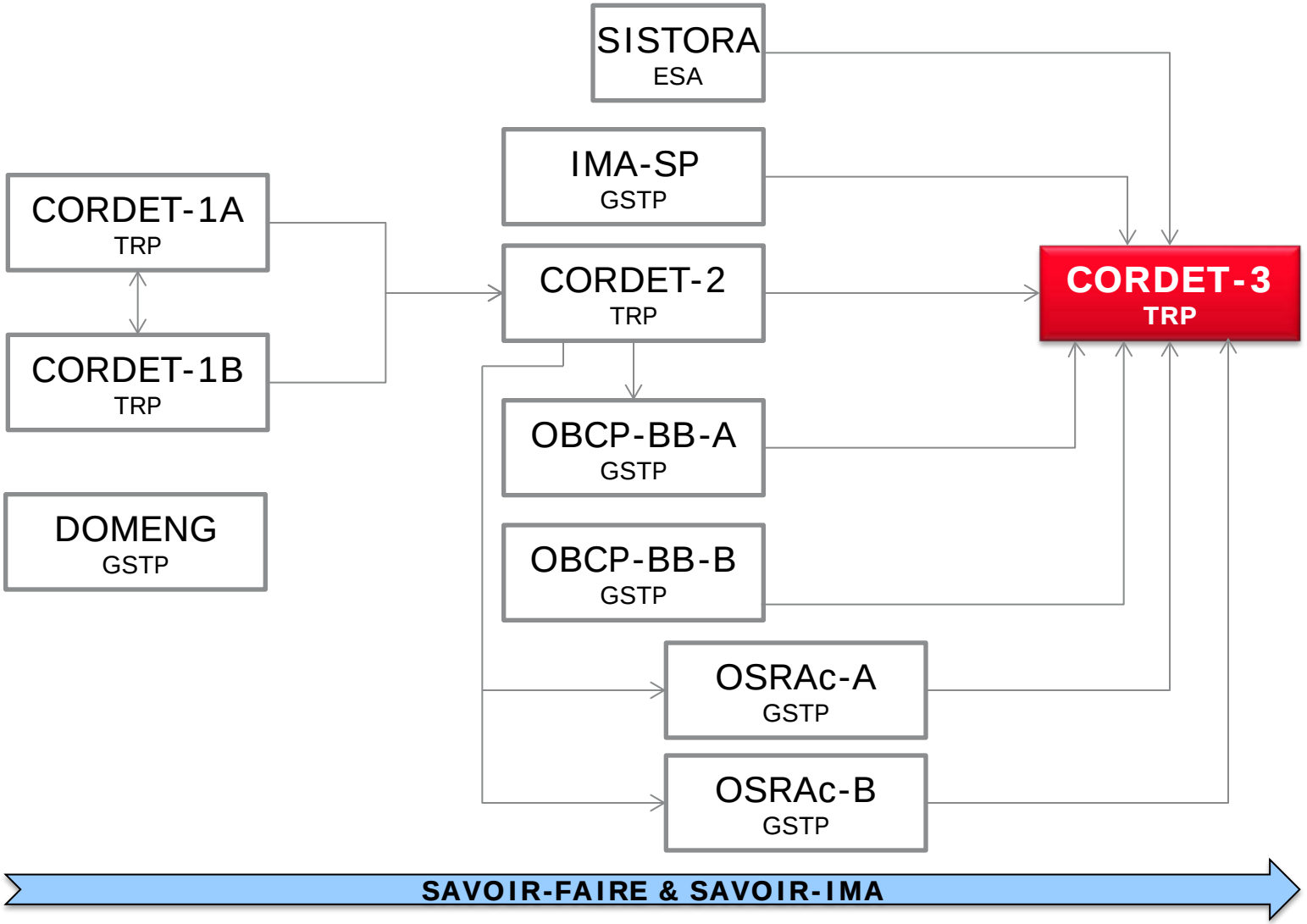
OSRA AND SAVOIR WORKING GROUPS

- The SAVOIR Advisory Group (SAG) created the following SAVOIR sub-groups:
  - ***SAVOIR-FAIRE: Fair Architecture and Interface Reference Elaboration.***

    This working group is intended to elaborate the definition of the On-board Software Reference Architecture (OSRA).
  - ***SAVOIR-IMA: Integrated Modular Avionics.***

    Specific sub-group to elaborate the avionics architecture to support Time and Space Partitioning (TSP) at avionics level.
- Both initiatives are supported by different ***ESA Research and Development (R&D) activities***.
  - The results of these initiatives were evaluated and assessed in COrDeT-3 activity to produce the OSRA.
  - This OSRA shall be agreed with SAVOIR-FAIRE and SAVOIR-IMA working groups.

ESA R&D ACTIVITIES



INTRODUCTION TO THE CORDET-3 STUDY

INNOVATING SOLUTIONS

OVERVIEW

- **COrDeT-3** is intended to provide a consolidated and consistent On-board Software Reference Architecture (OSRA).

OSRA Version	Objective	COrDeT-3
V1	This version ensures the implementation of the OBSW.	OSRA V1 will be produced as a result of COrDeT-3 activity.
V2	It includes additional features (e.g., context management, filed-based operations, etc.). They represent extensions and not modifications to the meta-model or OSRA V1 specification.	COrDeT-3 will identify the features to be implemented by OSRA V2.

- **Consortium**:
  - GMV Aerospace and Defence.
  - Thales Alenia Space.
  - Airbus Defence & Space.
  - SCISYS.
  - OHB System AG.
  - Bright Ascension.

STATUS

- **On-going** activity:
  - Kick-off Meeting: October 2013.
  - Final Review: November 2014.
- **Periodical working group meetings** were held at ESTEC:
  - 5 Working Groups (WG).
  - Each Working Group focused on specific architectural issues of the OSRA.
  - 17 topics were evaluated.

1. Attributes in the component model.
2. Events/interrupts.
3. Component documentation and technical budgets.
4. Avionics and HW devices/IO.
5. PUS/M&C related issues.
6. TSP/IMA-SP.
7. Initialization of components.
8. Execution platform services (reset/context management).
9. Schedulability analysis & connector generation.
10. Sequencing/ordering of operation execution.
11. Meta-model inconsistences.
12. OBCP.
13. Process and roles of OSRA including TSP.
14. Non-functional attributes of pseudo-components.
15. Redundancy management.
16. FDIR.
17. Other features.

WORKING GROUPS - WORKFLOW

Identification of Open Issues

- COrDeT-2 Open Points.
- COrDeT-2 Future Work.
- Recommendations and conclusions extracted from ESA R&D activities (e.g., SISTORA, IMA-SP, etc.).

Evaluation of each Open Issue

- During the Working Groups, each open issue is analysed, evaluated and agreed.
  - Investigation and presentation of technical solutions.
  - Feedback provided by Satellite Primes.

Agreements & Results

- OSRA specification.
- Component Model.
- Prototype Toolset.

OUTPUTS

- The COrDeT-3 study will produce three main outputs:

1. Consolidated and consistent **OSRA specification**:
   - Resolving the Open Issues identified in COrDeT-2.
   - Harmonizing the architecture with the IMA approach defined in the IMA-SP activity (following the recommendations of SISTORA).
   - Identification of the **processes** applicable to and the **roles** of each stakeholder of the OSRA.
2. The **Component Model**:
   - Definition of a complete and consistent meta-model.
   - Complete semantic description.
3. A **Prototype Tool** (as a proof-of-concept), implementing the Component Model.

CORDET-3 DELIVERABLES

INNOVATING SOLUTIONS

DELIVERABLES

- The following deliverables will be produced in the scope of the COrDeT-3 activity.
  - ***D02 – On-Board Software Reference Architecture Specification.***
  - ***D03 – Specification of the metamodel for the OSRA component model.***
  - ***D04 – Software user manual and installation guide of the prototype tool.***

OSRA SPECIFICATION (1/2)

- ***D02 – On-Board Software Reference Architecture Specification***.
- Main contents:
  - Development process and roles.
  - Description of the OSRA component model.
  - A full description of OSRA, detailing its three layers:
    1) Component Layer.
    2) Interaction Layer.
    3) Execution Platform.

OSRA SPECIFICATION (2/2)

- D02 is split into two documents:
  - **D02-Specification** → Normative part of the OSRA.
  - **D02-Rationale** → Informative part of the OSRA.

  The D02-Rationale compiles:

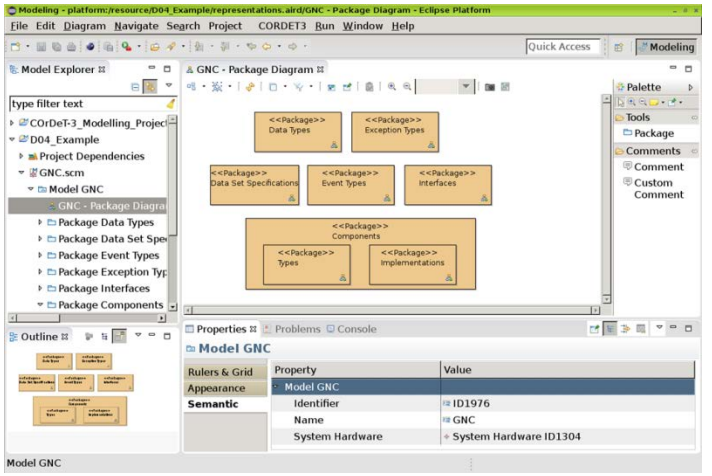
  - ✓ Justification of the decisions taken in COrDeT-3 (not those justifications taken in earlier studies).
  - ✓ Improvements required.
  - ✓ Main conclusions reached in each open point.
  - ✓ Envisaged future work for OSRA V2.

- The D02 documents will be presented in the "*OSRA Specification and Rationale*" session.

OSRA META-MODEL

- ***D03 – Specification of the metamodel for the OSRA component model***.
- Normative specification of the component model.
- It describes the general organization of the metamodel and focuses on each single meta-class for a detailed description of its semantics.
  - Similar to the UML superstructure specification.
- Clarification:
  - The OSRA component model is described in D02.
  - D03 comprises the specification of the reference implementation of the metamodel for the OSRA component model.
- The document D03 will be accompanied by the normative meta-model:
  - Space Component Model (SCM).
  - SCM consists of a Domain Specific Language (DSL) realised as an *ecore* model.
- Further details in the "*Component Model/Meta-model reference implementation*" session.

PROTOTYPE TOOLSET



- ***D04 – Software user manual and installation guide of the prototype tool.***
- It includes:
  - Installation guide.
  - User manual of the COrDeT-3 toolset.
  - Validation rules.
  - An example to design a user model from scratch using the graphical editor.
- Prototype tool is implemented as a proof of concept to evaluate:
  - Feasibility of the agreements reached regarding the OSRA.
  - Meta-model.
- The toolset will be presented in the "*The component model editor prototype (from COrDeT-3) – A complete tool chain from components to binary (from COrDeT-2)*" session.

DELIVERABLES: STATUS

- **Draft versions are already available**.
  - Mature versions.
  - The documents include normative/informative sections.
    - The contents of D02-Rationale and D04 are fully informative.
    - D02-Normative and D03 documents highlight which parts are normative (i.e., to be standardised) and which ones are informative.
  - These versions will be reviewed by the SAVOIR-FAIRE and SAVOIR-IMA members.

    The specification of the OSRA shall be agreed and shall become (after having provided and discussed the feedback) the baseline of the SAVOIR Software Reference Architecture.
- **Final versions**.
  - Available after the Final Review (i.e., December 2014).
  - The final versions will include the comments received from SAVOIR WG members.

Thank you!

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