



Results of the evaluation of AADL for the space domain

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Introduction

- This presentation deals with the results of a study of AADL and its interest for the space domain.
- Such a study may be interesting for the AADL committee, because of its inputs for the improvement of the standard.
 - Presentation of the study;
 - Main results.



Presentation of the study



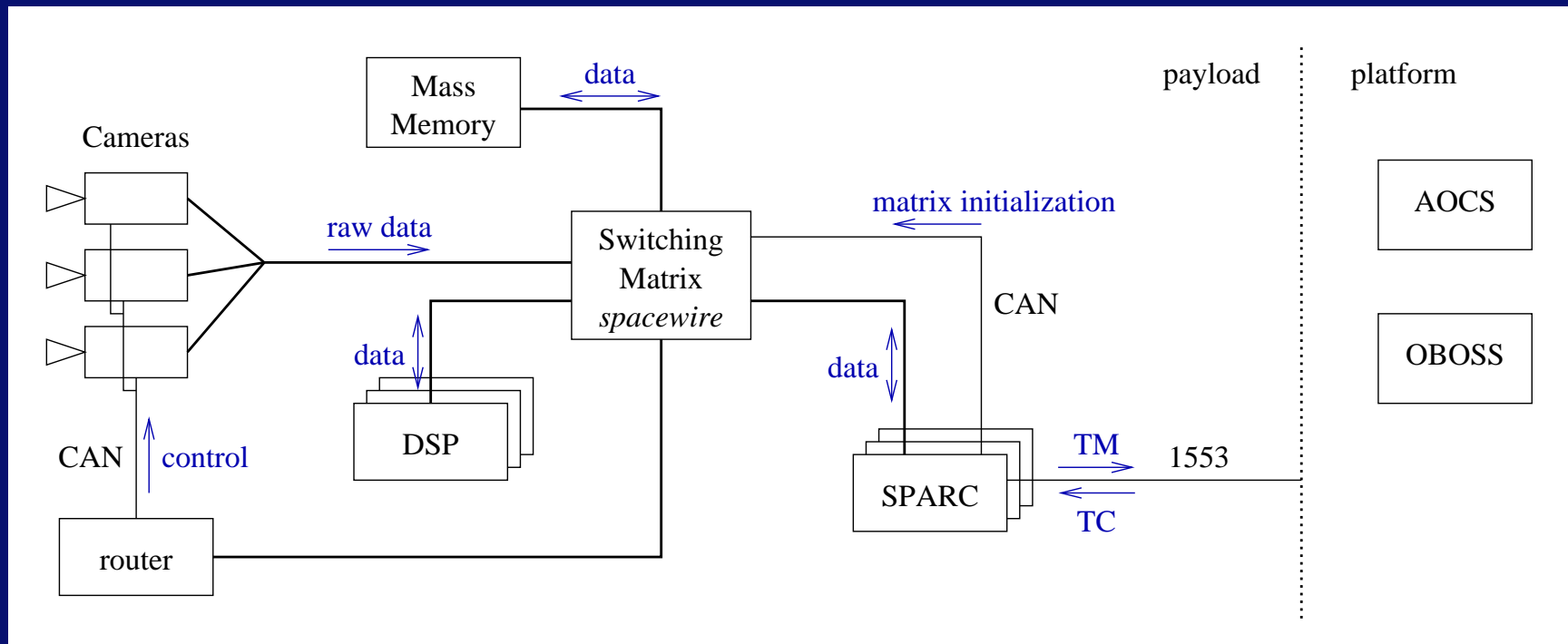
Objective of the study

- Axlog has led for ESA (Éric CONQUET) a one-year study to evaluate the interest of AADL for the space domain:
 - Is it possible to use AADL for this purpose?
 - What are the lacks and weak points?
 - How to improve AADL or adapt it for space?
- To evaluate AADL, we have used a large example, which could be representative of the needs of ESA.
- We have also developed a prototype tool which supports AADL. This tool, called ADeS, aims to simulate the behaviour of an architecture described in AADL.



Space example

The chosen space example is a satellite. Its aim is to be representative of the space domain.





ADeS (1/2)

ADeS is a prototype tool to simulate the behaviour of an AADL architecture.

The screenshot shows the ADeS application window with a menu bar (File, Simulation, Help) and a toolbar. The main area is divided into two panes:

- Left Pane:** A hierarchical tree view of the satellite architecture. The root node is 'satellite', which contains 'platform', 'comm', 'aocs', 'sensor', 'actuator', 'command', 'control' (highlighted in blue), 'telecommand', 'attitude', 'can', 'fp_input_from_sat', 'fp_output_to_sat', 'fp_input_from_pay', 'fp_output_to_pay', 'payload', 'spacewire', 'fp_input', and 'fp_output'.
- Right Pane:** A 'Process' monitoring table. The 'control' process is selected. The table lists various metrics and the current state.

Process	Name	State
control	control	running
	Compute time	
	Priority	
	Elapsed	
	Event queue	
	Event queue size	
	Period	
	Deadline	
	Last dispatch	
	Computed	
	State	running preempted blocked stopped

current step 0

/export/trinidad/people/aadl/aadl/doc/exploitation/satelliteexample/full_satellite.aadl



ADeS (2/2)

ADeS characteristics:

- parsing of the AADL description (about the version 0.7);
- display of the architecture;
- instantiation of the subcomponents;
- simulation of their behaviour (based on an existing generic simulation kernel);
- call of external behavioural models (C, Scilab, SDL).



Main results of the study



Interest of AADL for space

The space domain is not very different from the aeronautics. So the interest is about the same as for the other domains.

Main good points of AADL:

Genericity a single language may be used for many purposes during the system engineering process;

Extensibility it is possible to plug specific parts described with other means;

Standardisation necessary to have various tools supporting this language.



Extensions of AADL

Several means has been used to extend the AADL capabilities. Some of them are completely conform with the AADL standard, others are not.

new parameters For example the *MaxMass* parameter is used to define the maximal mass a subcomponent may have.

association of behaviour models To represent the behaviour of subcomponents when the *behavior* mechanism is not enough, we associate external code by using the *Source_Text*, *Source_Name*... standard properties. We have enabled them for other categories.

new languages The *Source_Language* has been used to support SDL and Scilab.



Weak points

The current draft of AADL has several lacks or insufficiencies.

- The most important one is perhaps the description of the behaviour. The *behavior* only uses mode transitions, which is not enough. So we have not used them.
- Some choices done by the AADL standard come directly from MetaH, and are in fact the particular solutions of problems. Such cases reduce the capabilities of AADL.
 - management of the emissions to the ports by the processes and threads.
 - modes
- expression of the requirements.
- description of the hardware.



Conclusion

- AADL has still lacks and weak points but we think it has a good base and will be improved in the future;
- We have shown that AADL may be used for a large scale of actions in the space system engineering;
- ESA is very interested by this approach, other European industries too.
- This study is very interesting for the AADL standard, it brings a lot of information. It could be interesting to lead similar studies on the other domains (aeronautics...).



AADL in Europe: the ASSERT project



ASSERT is a project for the 6th framework program for research and development of the European Commission.

- ASSERT = Aeronautics & Space System Engineering for Real-Time applications;
- objective: improvement of all the activities of the development cycle;
- leader: ESA/ESTEC (with Éric CONQUET);
- 45 partners;
- 3-5 years;
- 20 millions €;

For this project, ESA and Axlog recommend the use of AADL as a basis for the whole life cycle.