Rationalization of Simulators (RATIO-SIM)

Activity Goal

Explore the possibility to rationalize the European simulation tools to allow for a smooth model-based process supporting the project life cycle and allow cross-tool building block exchange. The study should select those components or buildings blocks that are beneficial to jointly develop and or maintain. Building blocks or tools shall be made open source and with a license that allows adaptations or extensions.

The type of simulators targeted in this study are the System level Simulator tools not the domain specific ones (thermal, power etc.).

Current status

The ECSS-TM-10-21 System Modelling and Simulation (ETM-10-21) describes the different types of System level Simulator tools. No single tool but a tool chain is required today to support full life-cycle, with associated increase in cost for licensing, maintenance and training. Long term maintenance (>5 years) of such software infrastructure is difficult.

Current Simulation infrastructures (EuroSIm, SimSat, SimTG, K2, Basiles etc.) are more than 10 years old, some technology (CORBA, C++) is not first choice, time to look into future.

Commercial tools (e.g. Mathwork) are often vendor depended (vendor lock-in) or implementation specific which does not always guarantee long term backward compatibility, availability and support (upward version) specifically considering the space domain.

There exists on European level no (conceptual) data model to capture all the simulator configurations definitions and settings to allow data interoperability and exchange. Also there exists (again on European level) no agreed simulator reference architecture for all type of system level tools as mentioned in ETM10-21.

For the different workflow phases, it is the Archiving phase that lacks the most in terms of methods and tools based on standards to enable re-use, exchange and later analysis.

Future outlook

Depending on the targeted scope, a possible solution could be to select one existing implementation and improve it, to select different implementations, merge and improve it or develop a new implementation. Note that existing implementations could either be proprietary or COTS products.

One specific, obvious aspect to be considered is the inclusion of the EGS-CC building block, currently under development, for the monitoring and control functionality.

Benefits

With next generation of simulator(s) new added value features can be introduced based on state-of-the art technology.

By sharing the effort between the stakeholders of maintaining the building blocks the overall costs will be reduced.

Not only for the corrective (fixing errors) and preventive (increasing maintainability or reliability) maintenance but also for adaptive (modifying to cope with changes in environment) and perfective (new functional enhancements) maintenance.

By using the same components or building blocks the interfaces by definition are standardized and allow for extension of third party entities or

vendors. The aim is to improve overall functionality and quality while reducing cost and development time and increase the commercial viability.

Activity Description
This study aims at preparing a Technical Note containing an agreed approach with stakeholders and outlining a development plan and high level requirements.

Context and scope
The type of simulators targeted in this study are the System level Simulator tools as defined in the ETM-10-21.
More specifically the FES (Functional Engineering Simulator), SVF (Software Validation Facility), AIVS (Assembly Integration & Verification Simulator) and TOMS (Training, Operations and Maintenance Simulator). The SCS (System Concept Simulator) and MPS (Mission Performance Simulator) are out of scope for the moment.
Different workflow phases are considered: Preparation, Execution, Post-processing and Archiving. Each phase could have specific tooling.
Models and modelling methods are also not to be considered.
From the ETM-10-21 generic architecture the following first-cut components can be identified:

- Database
- Facility M&C
  - Generic Infrastructure Control
  - Test Procedure Executor
  - OBSW debug
  - Visualisation
- Simulation Infrastructure
  - Simulation Engine executing models
  - OBC Emulator
- Front-Ends Equipment/SCOE
- Mission Control System
- Archive/Information repository

Organization
For this activity all the major stakeholders need to be involved or consulted. This means the Primes (Airbus, Thales and OHB), Agencies (CNES, DLR, ESTEC/ESOC) and some SMEs (EuroSim Consortium).

Implementation plan

- A number of workshops are foreseen with high level management and technical experts.
- Output is a Technical Note

Estimated effort, costs and schedule
For the preparation study 250k€ and 9 month duration is estimated mainly due to the foreseen large number of stakeholders to be involved. The schedule foresees a concluding workshop at SESP March 2017.

Challenges
Simulators are a strategic important technology. The foreseen stakeholders operate in a competitive business environment for which large investments have been made in the past. It will not be easy to achieve technical as well as programmatic consensus. Also the foreseen benefits will be seen on different organizational levels than the Simulator development.

Funding
ESA Investment budget to fund preparation study. Follow-up foreseen on GSTP or other budgets.