MoSSEC
Child of CRESCENDO

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Introduction

- All of this has now been officially released by the ASD Strategic Standardisation Group (ASD SSG).

- Airbus and Eurostep partners in CRESCENDO and in two follow-up projects:
  - CONGA (2 years from Feb 2013)
  - TOICA  (3 years from Sept 2013)

- Both are covered by project agreements including release procedures

- Both are contributing to the MoSSEC standard development which is intended to be an open development
CRESCENDO and MoSSEC

» CRESCENDO was the European Research Project that finished in October 2012.
  - CRESCENDO stands for: “Collaborative and Robust Engineering using Simulation Capability Enabling Next Design Optimisation”
  - The results of CRESCENDO are jointly owned by the partners and are private unless specifically approved for publication

» MoSSEC is pushed under ASD as an emerging standard.
  - MoSSEC stands for: “Modeling and Simulation information in a collaborative Systems Engineering Context”.
  - The MoSSEC project is and will be open
Achievements

- PDT Europe 2012 presentation by Peter Coleman
CRESCEUNDO approach (1)

- Define a model of the data that is used and generated
  - Make use of existing data models such as those from relevant standards (Systems Engineering, PLCS)
- Develop web services that enable creation, updating, search and read of the data
- Implement the web services against a collaboration hub
Rich model designed to enable traceability from customer expectations through to certification.
Philosophy

» The model is intended to capture the whole simulation process
  - Study intent
  - Relationship to requirements
  - Models and values as inputs
  - Models and values as outputs
  - Quality aspects
  - Library of simulation types
  - Process record
    » How long, who, what,…

» It operates at the meta data level
  - Lots of data about data!!!

» It is intended to be process and simulation type independent

» Joined up “big picture” view

Key objects

» Study
» Associative Model Network [AMN] and Collaborative Model Template [CMT]
» Model Instance and Model Type
» Key Value Instance and Key Value Type
» Requirement, should be satisfied by, and verification
» Method and Tool
» Organisation, Type of Organisation, Person and Type of Person
» Methodology Library
» Approval
» Documents (e.g. managed in a PDM system)
Diagram of the main classes in the packages that cover basic collaboration.

Note many relationships are hidden and not all classes are included.
The BDA Object model uses an object-oriented style

Objects are declared as subtypes of base objects
Study

» A (collaborative) study is a package of work that is launched by a Programme to drive the design, modelling, simulation and verification of something. Studies can launch multiple nested (sub)studies allowing complex product/system engineering activities and datasets to be organised and managed.

» Studies can have different purposes, e.g. evolving the design, managing change, performing trade-off analysis, investigating sensitivity of a solution to uncertainty, performing optimisation, developing the detail of the design, developing new methods and tools, combining results from other studies into a single baseline.
Associative Model Network [AMN]

» An Associative Model Network [AMN] is a container that identifies all the elements that together represent the set of activities and results for a study.

» The associativity between these elements firstly represents the evolving plan of what is to be done, and finally represents the audit-trail of what has been done.

» Each element in the AMN has an understanding of its dependencies (what it is derived from), and so together they make up a network of associative models. These allow to plan and record the "who", "what", "where", "when", "how" and "why".

» The dependencies can link to elements outside of the AMN, so enabling proper interconnection to previous results and to systems engineering context.
Requirements

» Requirements are 4 steps into the anticipated process

» Requirements core model is as per AP233/239
Key results: BDA Web Services

- It all starts from the BDA Object Model:
• **Outcome 1**: Now have a validated design approach for information web services based on an object model
  – Efficient and re-usable
  – Accessible to implementers

• **Outcome 2**: Validated that collaboration hub can support modelling and simulation as part of life cycle
  – Approach feasible

• **Outcome 3 (Eurostep)**: Showed that Share-A-space™ can handle M+S data without need to change core model
  – Needed to add viewer
Viewer showing data created by MSC using the BDA web services
Web services

» The following material describes the web services and how they work.

- They are defined using a wsdl plus set of associated XMLSchema files

- As they are defined in XML you can apply stylesheets to the definitions to get a more friendly form

» All available on www.asd-ssg.org/asd_ssg_standards
Key results: Crescendo DEXs

- From the BDA Object Model:
  - BDA Object Templates
  - BDA Data Exchange Specification (DEX)
  - ISO 10303-239
MoSSEC in PLCSlib

- **PLCSlib** is the SysML based environment for defining DEXs (Data Exchange Specifications)
• The approach uses the BDA Business Object Model as its starting point

The strong use of inheritance within the BDA BOM inspired development of corresponding capabilities within PLCSlib
One template is defined for each BDA Business Object

There are 60 templates defined.
Two DEXs built on the templates

- To enable exchanges to specify and update AssociativeModelNetworks and ModellInstances
AssociativeModelNetwork DEX in PLCSlib

A detailed view of the information to be exchanged is provided by the SysML model in Figure 3. This shows all the information that can be exchanged by the DEX.

NOTE The information shown in the SysML Block Definition diagram in Figure 3 is intended to illustrate the type of information that can be represented by the DEX. It does not imply that all exchanges must contain all this information. Each of the blocks shown in the figures is hyperlinked to the definitions which are displayed in the window below.

Figure 3 shows the objects used to represent an AssociativeModelNetwork.
DEX development – lessons learned

• The BDA Business objects map one to one to templates which specify the mapping to PLCS
  – This makes the use of PLCS as an exchange/archive mechanism closely compatible with the BDA Web Services as the means to share

• The BDA Object Model is designed to enable sharing and forces all items to exist within a defined context (such as a Study)
  – The DEX development follows this paradigm
  – Some ability to exchange partial data or data without context may be required

• The process of defining templates corresponding to the BDA’s inheritance led to improvements to PLCSlib as it required and tested additional aspects to cleanly handle the inheritance in SysML
Key results

- The Model-driven approach has worked!
MoSSEC

» The released material includes:
  - The BDA Object Model
  - The web services
  - The DEXs

» Although coming from an Aerospace project it is NOT intended to be aerospace specific

» It builds on AP239 (and AP233)

» The follow-on projects to CRESCENDO (CONGA and TOICA) have agreed to keep all MoSSEC related material open

» Airbus and others are keen to have other parties, e.g. SAVI, involved