Object-Oriented Systems Engineering (OOSE), the Object-Oriented Systems Engineering Method (OOSEM), and the INCOSE OOSEM Working Group (OOSEMWG)

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Briefing Information

• The Briefing Slides are posted in Dropbox (ET16 Folder) at:
  • https://www.dropbox.com/sh/1q7lo8uc78e7594/AADn_XSzsZ5rMo3kyJkmApAva?dl=0

• Other arrangements to get Briefing Information:
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Briefing Goal and Objectives

• **Goal:**
  • Better understanding of ongoing research of Object-Oriented Systems Engineering (OOSE), and the development and refinement of a SysML-based OOSE Method (OOSEM), by the INCOSE OOSEM Working Group.

• **Objectives:**
  • Motivation for OOSE research.
  • History of the development and employment of a SysML-based OOSE Method (OOSEM).
  • Introduction of the INCOSE OOSEM WG, and its continuing work on OOSE research and OOSEM refinement.
Motivation for OOSE Research

- **Object-Oriented Systems Engineering (OOSE)** research by scientists and engineers, including future INCOSE OOSE Method (OOSEM) Working Group members, has evolved from several initiatives conducted between 1996 and 1999 at what was then the Software Productivity Consortium (SPC), as well as at the Lockheed Martin Corporation.

- Understanding well that OO techniques have been used for many years to successfully develop software-intensive system elements, SPC members, and other systems engineers, questioned how such OO techniques might be adapted for use at the full systems level.

- The OOSE research also included how the OO notation language, the Unified Modeling Language (UML), applied at the systems level, might facilitate the elicitation of system requirements, and architecture and design information, in a formalized way that would improve communications between systems and software engineers.
OOA/D is one ‘Language’ of OOSEM (Ex. For SEs collaborating in OO Software-Intensive System Solutions).
History of SysML-Based OOSEM Development

- Systems engineers became interested in using OO tools & techniques, including modeling, to improve the analysis, requirements engineering, architecting, and design of software-intensive systems.

- However, those involved in OOSE research agreed that traditional OO techniques, and strict UML modeling, would need to be adapted in order to be fully useful for engineering at the systems level.

- The initial OOSE Method (OOSEM) incorporated OO concepts and adapted UML v1.3 (Object Management Group, 1999) modeling notation, to enhance the capture of system requirements, and architecture and design information, and facilitate communication between system, software, and other engineering disciplines.

- Future OOSEM research and development plans included refining OOSEM guidelines, continuing adaptation of UML, and integrating the OOSEM with UML-based methods for software engineering.
History of SysML-Based OOSEM Development

• AS OOSE and OOSEM research and development continued in 2000, it became clear that the systems engineering community needed some kind of standardized, domain-independent capability for modeling complex systems, especially the growing number of software-intensive systems.

• This need motivated the International Council on Systems Engineering (INCOSE) and the Object Management Group (OMG) (developers of the UML specification for modeling software) to develop an extension to UML for modeling systems.

• In 2007 OMG released the Systems Modeling Language (SysML) specification, borrowing and extending many of the OO concepts, elements, relationships, and diagrams found in UML.
Object-Oriented Systems Engineering Method (OOSEM)


• “OOSEM is a top-down, scenario-driven process that uses SysML to support the analysis, specification, design, and verification of systems.”

• “The process leverages object-oriented concepts and other modeling techniques to help architect flexible and extensible systems that can accommodate evolving technology and changing requirements.”

• “OOSEM is also intended to ease integration with object-oriented software development, hardware development, and test processes.”
Notional Interrelationships Between MBSE, UML, SysML and OOSEM

MBSE

- SysML (System Modeling Language)/OMG
- OOSEM (Method)

UML (Universal Modeling Language)/OMG

- Fundamental SW Best Practices

OO Concept

- SW Engineering: e.g. ISO 12207, & OOA/D & Agile SW Concepts

Fundamental SE Best Practices

- SE Engineering: e.g. ISO 15288 & Agile SE Concepts

Guides, etc. (e.g. INCOSE SE Handbook, SEBOK, etc.)
OOSE and OOSEM References

- Object Management Group (OMG); “Unified Modeling Language™ (UML®) Version 2.5”
- Object Management Group (OMG); “Systems Modeling Language (SysML) Version 1.4”
- “SysML for Systems Engineering”; Holt, Perry; 2008; IET, London, UK
- “Model-Based Systems Engineering (MBSE) Using the Object-Oriented Systems Engineering Method (OOSEM)”; Wolfrom, Friedenthal; 2011; Tutorial; http://www.jhuapl.edu/ott/Technologies/Copyright/SysML.asp#
Systems Engineers Using OOA/D (UML) and SA/D (SysML) for MBSE

Example: Systems Engineers Working on SA/D
Agile Scrum
System Development Teams

Example: Systems Engineers Working on OOA/D & SA/D
‘Hybrid’ Agile & Waterfall System Development Teams

Systems Engineers Using OOA/D and UML for OO MBSE

Example: Systems Engineers Working on OOA/D
Plan-Driven/Waterfall System Development Teams

OOSEM/OOSEMWG

OOSEM and the INCOSE OOSEMWG
The INCOSE OOSEM Working Group

- Official INCOSE Working Group for more than 16 years.
- Sponsored by the INCOSE Chesapeake Chapter (CC) and the Johns Hopkins University Applied Physics Laboratory (JHU/APL).
- Meets live on the second Saturday of each month; face-to-face and online via INCOSE WebEx18.
  - Live face-to-face meetings at JHU/APL at least once per quarter.
  - Live online attendance at all meetings via WebEx18.
- Membership and participation open to all INCOSE Members interested in learning and advocating the Object-Oriented Systems Engineering Method (OOSEM) in current and modern Model-Based Systems Engineering (MBSE) approaches.
The INCOSE OOSEM Working Group

• Goals of the OOSEM WG include (but not limited to):
  • Improve the practice of Object-Oriented Analysis and Design (OOA/D) applied to SE and MBSE by applying concepts, notations, and methods that:
    • Support the capture, analysis, synthesis, and understanding of complex software-intensive system technologies, specifications, architectures, and designs.
    • Improve integration between engineering disciplines including but not limited to Systems, Human, Software, Hardware, Test, Environment, and Logistics.
    • Facilitate software-intensive System, System of System (SoS), and Family of System (FoS) system, sub-system, element-, and component-level reuse and design evolution.
The INCOSE OOSEM Working Group

- Plans for the OOSEM Working Group include:
  - **EnergyTech 2016 (ET16) (28-30Nov16)**
    - “OOSEM/OOSEM/WG” and “Lean for Agile Planning” Briefs
  - **OOSEM/WG/IEEE, “SAFe Tutorial” at JHU/APL (10Dec16)**
  - **INCOSE International Workshop 2017 (IW17) (28-31Jan17)**
    - OOSEM/WG Outreach Session
  - **INCOSE International Symposium 2017 (IS17) (17-20Jul17)**
    - Proposed 6-Hour Tutorial, “Systems Engineers Using Lean Methods for Initial Planning of Agile Projects”
  - **Define a scaled-down version of the OOSEM (OOSEM-Lite)**
    - Including, “SysML Storybooks”
    - Short, illustrated narrative and diagrams, to help make OOSEM concepts easier to work with in MBSE.
The INCOSE OOSEM Working Group

OOSEM WG POCs:

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Thank You!

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