Project Performance International

Systems Engineering

Newsletter (SyEN)

SyEN #011 - September 2, 2009

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Dear Colleague,

SyEN, an independent free newsletter containing informative reading for the technical project professional, with scores of news and other items summarizing developments in the field, including related industry, month by month. This newsletter and a newsletter archive are also available at www.ppi-int.com.

Systems engineering can be thought of as the problem-independent, and solution/technology-independent, principles and methods related to the successful engineering of systems, to meet stakeholder requirements and maximize value delivered to stakeholders in accordance with stakeholder values.

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We hope that you find this newsletter to be informative and useful. Please tell us what you think. Email to: contact@ppi-int.com.

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A Quotation to Open On

In preparing for battle I have always found that plans are useless, but planning is indispensable. - Dwight D. Eisenhower

Feature Article

Lean Enablers for Systems Engineering

Dr. Bohdan W. Oppenheim
Loyola Marymount University

A new product named Lean Enablers for Systems Engineering (LEfSE) is described. It is a collection of 194 practices and recommendations formulated as "dos" and "don'ts" of SE, and containing collective wisdom on how to prepare for, plan, execute, and practice SE and related enterprise management using Lean Thinking. The enablers are focused on mission

assurance and the satisfaction of stakeholders achieved with minimum waste. The product has been developed by experts from the Lean Systems Engineering (LSE)1 Working Group (WG) of the International Council on Systems Engineering (INCOSE). LEfSE are organized into six well-known Lean Principles called Value, Value Stream, Flow, Pull, Perfection, and Respect for People. The LEfSE are not intended to become a mandatory practice. Instead, they should be used as a checklist of good practices.

Systems engineering is regarded as an established sound practice but not always delivered effectively. Sixty-two recent successful space launches indicate that mission assurance can be practiced well. At the same time, recent U.S. Government Accountability Office (GAO) and NASA studies of space systems [1, 2, 3, 4] document notorious major budget and schedule overruns, some exceeding 100 percent. Most programs are burdened with waste, poor coordination, unstable requirements, quality problems, and management frustrations. Recent studies by the MIT-based Lean Advancement Initiative (LAI) researchers [5, 6, 7, 8] have identified a mind-boggling amount of waste in government programs, reaching 70 percent of charged time. This waste represents a vast productivity reserve in programs and major opportunities to improve program efficiency.

The new field of LSE is the application of Lean Thinking to SE and to the related aspects of enterprise management. SE is focused on the flawless performance of complex technical systems. Lean Thinking is the holistic management paradigm credited for the extraordinary rise of Toyota to the most profitable and the largest auto company in the world [9]. Toyota is well known for practicing excellent Product Development and SE (what Toyota refers to as simultaneous engineering). For example, the Prius car design was completed in nine months from the end of styling, a performance level unmatched by any competitor [10]. Lean Thinking has been successfully applied in defense industry and in the U.S. military itself, (e.g., [5], and the Air Force Lean initiative named AFSO-21). It has become an established paradigm in manufacturing, aircraft depots, administration, supply chain management, health, and Product Development, including engineering.

LSE is the area of synergy of Lean and SE with the goal to deliver the best life-cycle value for technically complex systems with minimal waste. LSE does not mean less SE. It means more and better SE with higher responsibility, authority, and accountability (RAA), leading to better and waste-free workflow and mission assurance. Under the LSE philosophy, mission assurance is non-negotiable, and any task which is legitimately required for success must be included, but it should be well-planned and executed with minimal waste.

Fundamentals of Lean Thinking

Three concepts are fundamental to the understanding of Lean Thinking: value, waste, and the process of creating value without waste (also known as Lean Principles).

Value

The value proposition in engineering programs is often a multi-year complex and expensive acquisition process, involving thousands of stakeholders and resulting in hundreds or even thousands of requirements, which, notoriously, are rarely stable (even at the Request for Proposal phase). In Lean SE, Value is defined simply as mission assurance (the delivery of a flawless complex system, with flawless technical performance during the product or mission life cycle), satisfying the customer and all other stakeholders, which implies completion with minimal waste, minimal cost, and the shortest possible schedule.

Waste in Product Development

LAI classifies waste into seven categories: 1) Overproduction; 2) Transportation; 3) Waiting; 4) Over-processing; 5) Inventory; 6) Unnecessary movement; and 7) Defects. These wastes, in the SE context, are elaborated on in [11].

Lean Principles

Womack [9] captured the process of creating value without waste into six Lean Principles2. The Principles are abbreviated as Value, Value Stream, Flow, Pull, Perfection, and People, defined as follows:

1. **The customer (either external or internal) defines value.** The value proposition must be captured with crystal clarity early in the program.

2. **Map the value stream.** Prepare for and plan all end-to-end linked actions and processes necessary to realize value, streamlined, after eliminating waste.

3. **Make value flow continuously.** This should happen without stopping, rework, or backflow (legitimate optimized iterations are okay).

4. **Let (internal or external) customers pull value.** The customer's pull/need defines all tasks and their timing.

5. **Pursue perfection.** Constantly improve, and make all imperfections visible to all, which is motivating to the continuous process of improvement.

6. Respect for people. Create a system of mutually respectful, trusting, honest, cooperating, and synergistic relationships of key stakeholders, motivating staff to exhibit top capabilities.

Lean Enablers for SE

LEfSE is a major product recently released in the field of Lean SE. It is a comprehensive checklist of 194 practices and recommendations formulated as the do's and don'ts of SE, containing tacit knowledge (collective wisdom) on how to prepare for, plan, execute, and practice SE and related enterprise management using Lean Thinking. Each enabler enhances the program value and reduces some waste.

As a set, the enablers are focused on providing more affordable solutions to increasingly complex challenges and improving response time from the identification of need to the release of the system.

The enablers deal with mission assurance and promote practices that optimize workflow and reduce waste.

The enablers are formulated as a Web-based addendum to the traditional SE manuals—such as "The International Council on Systems Engineering [INCOSE] Handbook," ISO 15288, and similar NASA, DoD, or company manuals— and do not repeat the practices made therein, which are regarded as sound.

The LEfSE practices are organized into the previously mentioned six Lean Principles. The practices cover a large spectrum of SE and other relevant enterprise management practices, with a general focus to improve program value and stakeholder satisfaction, and reduce waste, delays, cost overruns, and frustrations3.

The full text of the LEfSE is too long for the present article, therefore only a brief summary is given herein. The full text is available online4.

- Under the **Value Principle**, the enablers promote a robust process of establishing the value of the end-product or system to the customer with crystal clarity. The process should be customer-focused, involving the customer frequently and aligning the enterprise employees accordingly.
- The enablers under the **Value Stream Principle** emphasize waste-preventing measures, solid preparation of the personnel and processes for subsequent efficient workflow and healthy relationships between stakeholders (customer, contractor, suppliers, and employees); detailed program planning; frontloading; and use of leading indicators and quality metrics.
- The **Flow Principle** lists the enablers which promote the uninterrupted flow of robust quality work and first-time right; steady competence instead of hero behavior in crises; excellent communication and coordination; concurrency; frequent clarification of the requirements; and making program progress visible to all.
- The enablers listed under the **Pull Principle** are a powerful guard against the waste of rework and overproduction. They promote pulling tasks and outputs based on need (and rejecting others as waste) and better coordination between the pairs of employees handling any transaction before their work begins (so that the result can be first-time right).
- The **Perfection Principle** promotes excellence in the SE and enterprise processes; the use of the wealth of lessons learned from previous programs in the current program; the development of perfect collaboration policy across people and processes; and driving out waste through standardization and continuous improvement. A category of these enablers calls for a more important role of systems engineers, with RAA for the overall technical success of the program.
- Finally, the **Respect-for-People Principle** contains enablers that promote the enterprise culture of trust, openness, respect, empowerment, cooperation, teamwork, synergy, good communication and coordination; and enable people for excellence.

LEfSE were developed by 14 experienced practitioners organized into two teams, some recognized leaders in Lean and System Engineering from industry, academia and governments (from the U.S., United Kingdom, and Israel), with cooperation from the 100-member strong international LSE WG of INCOSE [11].

Both SE and Lean represent challenging areas for research as they are grounded in industrial and government practice rather than laboratory work or theory. It is well-known that hard data about SE in large programs is difficult to obtain because:

- The programs are classified and proprietary.
- The companies are not willing to release such data even when it exists.
- In many cases, the data is non-existent, of a poor quality, lacks normalization, suffers from discontinuities over long program schedules, and is convoluted with other enterprise activities.

As a result, it is difficult to collect the data needed to perform hypothesis testing. Therefore, rather than to rely on explicit program data, the enablers were developed from collective tacit knowledge, wisdom, and experience of the LSE WG members. Such an approach has been practiced for ages by numerous institutions, and is being described in [12]. LEfSE have been formulated for industry SE practitioners, but the development benefited from academic depth, breadth, and rigor; the latter emphasis provided by surveys and benchmarking to published data, as follows.

The development of LEfSE included five phases: Conceptual, Alpha, Beta, Prototype, and Version 1.0. It was evaluated by

separate surveys in the Beta and Prototype phases and by comparisons with the recent programmatic recommendations by GAO and NASA [1, 2, 3, 4]. The surveys indicated that LEfSE are regarded as important for program success but are not widely used by industry. The comparisons indicated that LEfSE are consistent with the NASA and GAO recommendations, but are significantly more detailed and comprehensive.

Intended Use

The LEfSE are not intended to become a mandatory tool. Instead, they should be used as a checklist of good holistic practices. Some are intended for top enterprise managers, some for programs, and others for line employees. Some are more actionable than others, and some are easier to implement than others. Some enablers may require changes in company policies and culture. However, employee awareness of even those least actionable and most difficult to implement enablers should improve the thinking at work.

The creators believe that as many systems (and other) engineers, enterprise managers, and customer representatives as possible should be trained in the LEfSE, as it will lead to better programs. At this time, a large effort of offering tutorials and lectures about the LEfSE throughout INCOSE chapters, industry, and academia is ongoing.

The published product includes examples of the programs and companies that practice the given enablers. Also listed is the average value measuring the use of a given enabler in industry, obtained from the surveys.

A formal online process of continuous improvement and periodic new releases of the LEfSE has been set up as new knowledge and experience becomes available. A comprehensive description of the history of LSE, the development process of LEfSE, the full text of the enablers, the surveys, and industrial examples can be found in [11]. _

References

1. GAO. "Defense Acquisitions – Assessments of Selected Weapon Programs." GAO-07-4065SP. Washington, D.C. Mar. 2008 .

2. GAO. "Best Practices – Increased Focus on Requirements and Oversight Needed to Improve DOD's Acquisition Environment and Weapon System Quality." GAO-08-294. Washington, D.C. Feb. 2008 .

3. GAO. "Space Acquisitions – Major Space Programs Still at Risk for Cost and Schedule Increases." GAO-08- 552T. Washington, D.C. 4 Mar. 2008 .

4. "NASA Pilot Benchmarking Initiative: Exploring Design Excellence Leading to Improved Safety and Reliability." Final Report, Oct. 2007.

5. LAI. "Phase I." 1 Jan. 2009 .

6. McManus, Hugh L. "Product Development Value Stream Mapping Manual." LAI Release Beta, MIT, Apr. 2004.

7. Slack, Robert A. "Application of Lean Principles to the Military Aerospace Product Development Process." Master of Science – Engineering and Management Thesis, MIT, Dec. 1998.

8. Oppenheim, Bohdan W. "Lean Product Development Flow." Journal of Systems Engineering. Vol. 7, No. 4, 2004.

9. Womack, James P., and Daniel T. Jones. Lean Thinking. New York: Simon & Schuster, 1996.

10. Morgan, James M. and Jeffrey K. Liker. The Toyota Product Development System – Integrating People, Process And Technology. New York: Productivity Press, 2006.

11. Oppenheim, Bohdan W., Earl M. Murman, and Deborah Secor. "Lean Enablers for Systems Engineering." Submitted to Journal of Systems Engineering. Dec. 2008.

12. .Webb, Luke. "Knowledge Management for Through Life Support." Doctoral Thesis (in progress) via private communication. RMIT University (Australia), 2008.

About the Author

Bohdan W. Oppenheim, Ph.D., is a professor of mechanical and systems engineering at Loyola Marymount University. He is the founder and co-chair of the LSE WG of INCOSE and serves as the local coordinator of the Lean Aerospace Initiative Educational Network. Oppenheim has worked for Northrop, the Aerospace Corporation, and Global Marine, and has served as a

Lean consultant for Boeing and 50 other firms. He has a doctorate in dynamics from the University of Southampton (U.K.), a naval architect's degree from MIT, a master's degree in ocean systems from the Stevens Institute of Technology, and a bachelor's degree in mechanical engineering and aeronautics from Warsaw Technical University. Oppenheim is a member of INCOSE and is a Fellow of the Institution for the Advancement of Engineering.

Loyola Marymount University
Pereira Hall of Engineering
RM 204
Los Angeles, CA 90045
Phone: (310) 338-2825
Fax: (310) 338-6028
E-mail: boppenheim@lmu.edu

Notes

1. The early use of the term LSE is sometimes met with concern that this might be a "re-packaged faster, better, cheaper" initiative, leading to cuts in SE at a time when the profession is struggling to increase the level and quality of SE effort in programs. Our work clearly disproves this concern.

2. The original formulation had five principles; the sixth (the Respect-for-People Principle) was added at a later time.

3. LEfSE practices do not deal, however, with explicit financial steps such as cost estimating or earned value analysis, which are regarded as a separate activity.

4. A PowerPoint presentation is available in PDF format at:

<http://cse.lmu.edu/Assets/Colleges+Schools/CSE/Lean+Enablers+for+SE+Version+1.01.pdf>.

Originally published in Jul/Aug 2009 issue of CrossTalk titled "Process Replication" Republished with permission.

Systems Engineering News

Stevens Institute of Technology and the International Council on Systems Engineers (INCOSE) Partnership

Stevens Institute of Technology and the International Council on Systems Engineers (INCOSE) have signed an agreement that will streamline how Stevens graduate students and alumni can obtain INCOSE's Certified Systems Engineering Professional (CSEP) and Associate Systems Engineering Professional (ASEP) certification. Through the terms of the agreement, Stevens and INCOSE will collaborate to encourage and enable the certification of Stevens' qualified graduate students and alumni who are interested in pursuing certification as part of their academic and professional goals.

More information

OMG Celebrates 20 Years of Setting the Standards at First Latin American Technical Meeting

Members of the OMG(TM) met in San Jose, Costa Rica during the week of June 22-26, 2009. At this meeting, one specification and five final reports finished the adoption process and were approved by the OMG Board of Directors. The Technology Committees approved the issuance of two new requests for proposal.

Specifications expected to go before the OMG Board of Directors for adoption at the next meeting include:

- Business Process Modeling Notation (BPMN) 2 revised submission
- Unified Profile for DoDAF and MODAF (UPDM) RFC FTF
- UML Profile for Modeling Real-time and Embedded (MARTE) FTF report
- Object Constraint Language (OCL) 2.1 RTF report
- Knowledge Discovery Metamodel (KDM) 1.2 RTF report

OMG is an open-membership organization and welcomes any organization, government agency, or university to join and contribute to its specifications. The following were issued in San Jose, Costa Rica and are currently open to participation:

- OMG Systems Modeling Language (SysML) RFI
- Metamodel for Federal Segment Architecture RFP

Non-members of the OMG may download information on any Request process from http://www.omg.org/public_schedule.

More information

Twin Engineering Prizes Awarded

NASA's Exploration System Mission Directorate Space Grant Project announced two first-place winners of this year's Systems Engineering Paper Competition. The two winning teams were Rice University's "Team Taurus," and Virginia Polytechnic Institute and State University's "Hokie Space Team".

More information

WCBF's 4th Annual Global Lean, Six Sigma and Business Improvement Summit & Industry Awards

Following the huge success of last year's event, WCBF's 4th Annual Global Lean, Six Sigma and Business Improvement Summit & Industry Awards, taking place October 13-16 2009 at the Walt Disney World Swan and Dolphin in Orlando, FL, USA is positioned to be the largest gathering for those who are passionate about achieving process and business excellence.

More information

U.S. DoD Releases Reliability, Availability, Maintainability, and Cost Rationale Report Manual

The Office of the United States Secretary of Defense and the Joint Staff collaborated on the Reliability, Availability, Maintainability-Cost (RAM-C) Report Manual to assist combat developers, project managers, and engineers to design RAM into systems early in a program. The manual supports life cycle implementation of the Sustainment metric, for which the Chairman of the Joint Chiefs of Staff (CJCS) issued new guidance in May 2007.

The Sustainment metric consists of an Availability Key Performance Parameter (KPP) and two supporting Key Systems Attributes (KSAs): Reliability and Ownership Cost. The CJCS guidance requires programs under development to create a balance between RAM performance in the field and the related costs of providing that performance - a distinct paradigm shift within the acquisition community that, once fully implemented, should result in improved value for major acquisition programs.

More information

U.S. DDR&E/SE Releases System Security Tool to Assist Acquirers

The Systems Engineering Directorate within the United States DoD Office of the Director, Defense Research and Engineering, has published an Acquisition Security Related Policies and Issuances Tool that brings together the complex universe of acquisition security policies. The tool, published in three formats for ease of use, is intended to provide acquisition Program Managers and Offices of Primary Responsibility a perspective on the number of policies that may be applicable to a program. The web version provides hyperlinks to their full text to facilitate awareness and compliance. Large-scale wall chart and text-friendly versions are also available. The SE team has plans for periodic updates to the tool to keep the policy information current and expand the scope to include other federal laws and issuances.

All three versions can be accessed here in the System Assurance and Cyber Security Section: http://www.acq.osd.mil/sse/pg/guidance.html

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Survey of Architecture Frameworks

An Architecture Framework (AF) may be defined as conventions and common practices for description of architecture established within a domain or stakeholder community.

Examples of AFs include: Zachman, RM-ODP, DODAF, MODAF, GERAM, TOGAF.

Mr. Rich. Hilliard, a leader in this field, is collecting a list of current architecture frameworks in relation to his work with IEEE 1471, ISO/IEC 42010. An initial list is posted at: http://www.iso-architecture.org/ieee-1471/afs/frameworks-table.html

Mr. Hilliard would welcome any additions to this list. Additions may be submitted to Mr. Hilliard at: rh at wn.net

Pointed out by Francis Sota, the concept of view was described in BS (British Standard) 308 of the BSI (British Standards Institute) sometime after its formation in 1901. BS 308 governed the way in which artifacts could be represented on a 2-dimensional paper. The standard views are top view (e.g. floor layout plan), front view (i.e. front of a building), and side view (i.e. sideway of a building, usually with cross-section). To show an object in a 3-dimensional way on a 2-dimensional paper, one can use isometric view or perspective view. BS 308 standard was adopted by building architecture as well as engineering professions for the preparation of building design and construction drawings. So, a view, in essence, is a way in looking at an object from a chosen position within a coordinate system.

A viewpoint is an extended view based on a profession (e.g. mechanical engineer) or a trade (e.g. carpenter). Each stakeholder provides details of an extended view based on his/her professional/trade practices.

Isometric views are often used to show the construction or final assembly of a product (e.g. Ikea's assembly instructions of a closet from different pieces in a package).

Architecture description languages are basically equivalent to the rules articulated in BS 308 on how to create views and viewpoints. Francis Sota points out that engineering borrowed these terms and created different semantics. He points out that one thing is not quite clear in the ISO 42010 standard is that whether one view corresponds exactly to only one viewpoint or not.

Mr. Sota states that an architecture framework provides the rules for classifying views and viewpoints and the ways of creating architectural products for a specific purpose. For instance, DoDAF covers adequately the views of a set of military capabilities, but not the enterprise. TOGAF is suitable for describing an implementation architecture, but not an enterprise. In addition, a good architecture framework must provide semantics on inter-relating views and viewpoints of all architectural products to form a coherent set of architecture descriptions.

NASA Systems Engineering Framework

Have you ever wondered what NASA is doing to stay on the leading edge of systems engineering? Did you know that NASA has a Systems Engineering Excellence Initiative to stimulate and enable the development and advancement of a sound systems engineering capability across the Agency? As part of that initiative, the NASA Office of the Chief Engineer is taking a proactive approach to deploying the 3-axis NASA Systems Engineering Framework that was defined in the NASA Procedural Requirements for systems engineering - NPR 7123.1A NASA Systems Engineering Processes and Requirements. The NASA Systems Engineering Framework consists of three elements that make up the NASA systems engineering capability: 1) common technical processes, 2) tools and methods, and 3) workforce, knowledge and skills. The integrated implementation of these three elements is intended to improve the overall capability required for the efficient and effective engineering of NASA systems.

Since NASA management did not want the Systems Engineering Framework to become "shelfware," they committed the resources to ensure that it was actively deployed into the NASA systems engineering community, and that it actually impacted the way that systems engineering is implemented across the Agency.

More information and download: http://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPR&c=7123&s=1A

Featured Societies - Applied Systems Thinking (ASysT) Institute

The Applied Systems Thinking (ASysT) Institute is a collaborative endeavor of Analytic Services Inc., a not-for-profit public service institute. The stated mission of ASysT is to advance the application of systems thinking principles in the fields of United States national security, homeland security, intelligence, energy, environment, education, and healthcare.

As a research, development, and educational endeavor, the ASysT Institute seeks both to advance the understanding of the field of systems thinking, and translate this understanding into pragmatic applications that enhance the security of the United States.

Stevens Institute of Technology School of Systems and Enterprises joined with Analytic Services in 2007 as the Founding Collaborator for the Applied Systems Thinking Insitute. Utilizing an Open Academic Model, the School of Systems and Enterprises emphasizes global partnerships in Systems and Enterprises related research and education with industry and government. SSE brings together faculty who are industry experts and practitioners, researchers, and academics, with students who are committed to learning, in a dynamic, diverse and engaged community.

More information: http://asysti.org/

INCOSE Technical Operations

Architecture Working Group

Charter

Determine processes, methods, and enabling technologies to develop architecture as part of a systems engineering process.

Leadership

Co-Chair Dr. Charles Dickerson, Engineering Technical Fellow, BAE Systems

Co-Chair Dr. Dimitri Mavris, Director, Aerospace Systems Design Laboratory, Georgia Institute of Technology

Contact Architecture Working Group for additional information or to join this group.

Purpose

The purpose of the AWG is to expand the practice of architecture and the body of knowledge (BOK) in Systems Engineering. Specifically, the purpose of the AWG is to:

- Promote the use and practice of architecture principles in systems engineering
- Share best practices for the use of architecture in systems engineering projects
- Promote the principles of architecture in systems engineering within the member's home organizations

Objectives

Below are the main objectives of the Architecture Working Group:

- Capture and evolve the architecture body of knowledge
- Increase AWG membership knowledge of architecture in the practice of systems engineering
- Expand effort in Architecture related standards
- Provide quality technical products to the INCOSE members, following the guidelines of the Technical Leadership Team

Accomplishments/Products

Much of the work of the Architecture Working Group has been presented to the membership during the International Symposiums. Access to past symposium papers requires INCOSE membership.

- Architecture Related Definitions (requires INCOSE membership to access)
- 2007 INCOSE International Workshop

Architecture Working Group members met during the 2007 INCOSE International Workshop in Albuquerque to discuss AWG status and achievements, and plan activities proposed for the upcoming year

- IEEE SoSE Conference

News and Notes from the 2nd Annual IEEE International Conference on System of Systems Engineering held 3 May, 2007

- Legacy Papers (requires INCOSE membership to access)
  - Systems Architecture Working Group: Progress and Aspirations
  - A System-of-Systems Approach for Application to Large-Scale Transportation Problems
  - Development of an Object-Oriented Multi-Leg Route Choice Model on Transportation Network Simulation
  - Systems Architecture: A View Based on Multiple Impacts
  - Application of Patterns to Systems Engineering and Architecting
  - Proposing a Tool to Support the Process of System Architecting
  - Toward a Comprehensive System Architecture Representation Model

Current Projects

Below are the major projects the Architecture Working Group is involved with currently:

- AWG Review of UPDM Submission

A review of the Proposed UML Profile for the U.S Department of Defense Architectural Framework and UK Ministry of Defence Architectural Framework (UPDM)

- OUSD SoS SE Guide

The United States Office of the Undersecretary of Defense System of Systems Systems Engineering Guide, Considerations of Systems

Engineering in a System of Systems Environment

Recently Released Architecture Documents

Below are links to or copies of useful Architecture-related documents and references. They are presented with the permission of their copyright owners. INCOSE does not own or publish them, so please use them for reference only:

- DoD Architecture Framework, Version 1.5, 23 April 2007
    - Volume I: Definitions and Guidelines
    - Volume II: Product Descriptions
    - Volume III: Architecture Data Description

The AWG will meet to discuss current and future projects during the 2010 INCOSE International Symposium in Chicago.

2008 International Workshop Architecture WG Summary Presentation - Size: 200k

Systems Engineering Software Tools News

OMG Seeks Model Interchange Unity

By Jeff Feinman

The Object Management Group has created a working group to facilitate interoperability among software models and model standards.

The new Model Interchange Working Group (MIWG), announced in July, will focus on model interchange among the DoDAF (Department of Defense Architecture Framework), MODAF (UK Ministry of Defense Architecture Framework), SysML and UML formats.

More information

Systems Engineering Books, Reports, Articles and Paper

Model Based Systems Engineering- White Paper

Gavin Arthurs, IBM

Featured in the IBM Monthly Newsletter, Automate, November 2008, this paper describes the essential elements that comprise an MBSE environment and their importance, as well as how they relate to, and influence, each other. Anyone interested in successfully implementing an MBSE environment could consider these elements together and understand the tradeoffs made around each.

More information

## Systems Thinking Provides a Boost to Quality Professionals

By Mark Alpert

The recently published Conference Board Research Report, "A Leadership Prescription for the Future of Quality", noted that the quality function and the role of the quality professional are at a crossroads..

Of particular interest in the report is the highlighting of systems thinking as one of the key methodologies needed to address these new challenges.

More information

Behavioral Modeling for Embedded Systems and Technologies: Applications for Design and Implementation
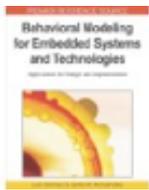
by Luís Gomes (Author, Editor), João M. Fernandes (Author, Editor)
Publisher: Information Science Reference (July 16, 2009)
ISBN-10: 1605667501
ISBN-13: 978-1605667508

Book overview

The development of embedded systems offers a higher degree of abstraction, crucial to tackling the growing complexity and usage of model-driven approaches. Behavioral Modeling for Embedded Systems and Technologies: Applications for Design and Implementation provides an overview on innovative behavior models currently used for developing embedded systems, accentuating on graphical and visual notations. This dynamic compilation presents an authoritative reference collection to the most significant models of computation currently in use for embedded systems design.

More information

Conferences and Meetings

17th IEEE International Requirements Engineering Conference (RE'09)

31 August - 4 September 2009, Atlanta, Georgia, USA
More information

Workshop on Collaboration and Intercultural Issues on Requirements: Communication, Understanding and Softskills (CIRCUS)

In Conjunction with 17th IEEE International Requirements Engineering Conference (RE'09).
31 August, 2009. Atlanta, Georgia, USA
More information

Doctoral Symposium at RE'09

1 September, 2009. Atlanta, Georgia, USA.
More information

4th International Workshop on Requirements Engineering Vizualisation (REV'09)

31 August, 2009. Atlanta, Georgia, USA.
More information

4th International Workshop on Requirements Engineering Education and Training

31 August, 2009. Atlanta, Georgia, USA.
More information

2nd International Workshop on Managing Requirements Knowledge (MaRK '09)

In conjunction with the 17th IEEE Requirements Engineering Conference
1 September, 2009. Atlanta, Georgia, USA
More information

2nd International Workshop on Requirements Engineering and Law

In conjunction with the 17th IEEE Requirements Engineering Conference
1 September, 2009. Atlanta, Georgia, USA
More information

1st Workshop on Service-Oriented Business Networks and Ecosystems (SOBNE '09)

1 September, 2009. Auckland, New Zealand.
More information

The First Workshop on Service oriented Enterprise Architecture for Enterprise Engineering NEW

1 September 2009, at the IEEE EDOC 2009 conference in Auckland, New Zealand
More information

Business Analyst World

1 - 2 September, 2009, Wellington, New Zealand. More information
7 - 8 September, 2009, Auckland, New Zealand. More information
16 - 17 September, 2009, Perth, Australia. More information
21 - 22 September, 2009, Canberra, Australia. More information
5 - 6 October, 2009, Denver, USA. More information
5 - 6 October, 2009, Edmonton, Canada. More information
5 - 7 October, 2009, Brisbane, Australia. More information
19 - 22 October, 2009, Boston, USA. More information
26 - 29 October, 2009, Vancouver, Canada. More information
16 - 19 November, 2009, Chicago, USA. More information
30 November - 1 December, 2009, Ottawa, Canada. More information

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European Systems & Software Process Improvement and Innovation (EuroSPI2)

2 - 4 September, 2009. University of Alcala, Spain
More information

3rd International Workshop on Enterprise Modeling and Information Systems Architectures

10 - 11 September, 2009. Ulm University, Germany
More information

AIAA Space 2009 - Joint Space Systems Engineering and Economics Track

Within the conference is a joint Space Systems Engineering and Economics Track that has room for slots for four space systems engineering papers. 14 - 17 September, 2009. Pasadena, CA, USA

Download Call for Papers

Additional Conference Information

Third IEEE International Conference on Self-Adaptive and Self-organising Systems (SASO'09)

(IEEE approval pending)

14 - 18 September, 2009. San Francisco, USA

More information

Workshop on the Design of Dependable Critical Systems NEW

In the framework of The 28th International Conference on Computer Safety, Reliability and Security, 15-18 September 2009, Hamburg, Germany

More information

SEPG Asia-Pacific 2009

16 - 18 September, 2009. Osaka, Japan.

More information

Training Software/Systems Engineers for Embedded Systems NEW

19th September 2009, Thessaloniki, Greece

More information

ICAPS 2009 Workshop on Verification and Validation of Planning and Scheduling Systems (VV&PS 2009)

19 - 20 September, 2009. Thessaloniki, Greece.

More information

14th System Design Languages Forum

22 - 24 September, 2009. Ruhr-University of Bochum, Germany
More information

ReConf® SChweiz 2009 Requirements Engineering Tagung NEW

22 - 24 September 2009, Renaissance Zürich Hotel, Zürich
More information

ICISE 2009 - International Conference on Industrial and Systems Engineering

23 September, 2009, Toronto, Canada.
More information

Ninth International Workshop on Automated Verification of Critical Systems (AVoCS 2009)

Swansea University Computer Science, 23 - 25 September, 2009.
More information

28th International Symposium on Reliable Distributed Systems

27 - 30 September, 2009, Niagra Falls, USA.
More information

Workshop "Games, Business Processes and Models of Interactions"

28 September, 2009, University of Lubeck, Germany.
More information

Systems Thinking in Schools: Level 1 Workshop

29 September - 2 October, 2009. Cavendish Road State High School, Holland Park, QLD, Australia.
More information

12th Australian Workshop on Requirements Engineering (AWRE'09)

1 -2 October, 2009. University of Technology, Sydney, Australia.
More information

Workshop "Integration Engineering" held at the annual meeting 2009 of the Gesellschaft fuer Informatik e.V. (GI)

2 October, 2009, University of Lubeck, Germany.
More information

ACM/IEEE 12th International Conference on Model Driven Engineering Languages and Systems (formerly the UML series of conferences)

4 - 9 October, 2009, Denver, Colorado, USA.
More information

Educators' Symposium at MODELS 2009

4 - 9 October, 2009, Denver, Colorado, USA.
More information

2nd International Workshop on Model Based Architecting and Construction of Embedded Systems (in conjunction with MODELS 2009)

6 October, 2009. Denver, Colorado, USA.
More information

Track Systems Engineering 2009

7 - 8 October, 2009, Munich, Germany.
More information

2009 SEER by Galorath North American User Conference: Best Practices in Project Estimation, Planning & Control

8 - 9 October, 2009. Porofino Hotel, California, USA.
More information

International Conference on Man-Machine Systems (ICoMMS)

11 - 13 October, 2009, University of Malaysia Perlis.
More information

7th International Symposium on Automated Technology for Verification and Analysis

13 - 16 October, 2009, Macao SAR, China.
More information

INCOSE Cleveland-Northern Ohio – (Region IV Autumn '09) NEW

25-26 October, 2009, OHIO Aerospace Institute, 22800 Cedar Point Road, Cleveland, OH 44142
More information

Symposium on Automotive/Avionics Systems Engineering SAASE 2009

14 - 17 October, 2009, San Diego, CA, USA.

12th Annual Systems Engineering Conference

26 - 29 October, 2009, San Diego, CA, USA.

Formal Methods for Industrial Critical Systems (FMICS) 2009

2 - 3 November, 2009, Eindhoven, The Netherlands.

16th International Symposium on Formal Methods (FM2009)

2 - 6 November, 2009, Eindhoven, The Netherlands.

FM 2009 Doctoral Symposium

6 November, 2009, Eindhoven, The Netherlands.

28th International Conference on Conceptual Modeling

9 - 12 November, 2009, Gramado, RS, Brazil.

Workshop on Requirements, Intentions and Goals in Conceptual Modeling

9 - 12 November, 2009, Gramado, RS, Brazil.

Tag des Systems Engineering (Day of Systems Engineering) NEW

Friedrichshafen am Bodensee
12 - 13 November, 2009

1st Annual Global Conference on Systems and Enterprises (GCSE)

2 - 4 December, 2009. Singapore.

4th South-East European Workshop on Formal Methods (SEEFM 2009) NEW

4-5 December 2009, Thessaloniki, Greece

INCOSE 2010 International Workshop

7 - 10 February, 2010. Phoenix Marriott Mesa, Mesa, Arizona.

1st Workshop on Semantically-Enabled Systems Engineering (SENSE-2010)

15 - 18 February, 2010. Andrzej Frycz Modrzewsk Cracow College, Krakow, Poland.

More information

IESS 1.0: First International Conference on Exploring Services Sciences

17 - 19 February, 2010. Geneva, Switzerland.
More information

CSER 2010 8th Annual Conference on Systems Engineering Research ᴧᴧ NEW

17-19 March, Honoken, NJ, USA
More information

Track on REAL-TIME SYSTEMS at ACM SAC 2010

21 - 26 March, 2010. Sierre, Switzerland.
More information

The Third Edition of the Requirements Engineering Track (RE-Track'10)

22 - 26 March, 2010. Sierre, Switzerland.
More information

Agent-Directed Simulation Symposium (ADS 2010)

12 - 15 April, 2010, Orlando, Florida, USA.
More information

COFES: Congress on the Future of Engineering Software (COFES) 2010

15 - 18 April, 2010, Scottsdale, Arizona, USA.
More information

22nd Annual Systems & Software Technology Conference (SSTC 2010) ᴧᴧ NEW

26-29 April 2010, Salt Palace Convention Center, Salt Lake City, Utah
More information

Systems Engineering and Test & Evaluation (SETE) 2010

3 - 6 May, 2010, Stamford Grand, Adelaide.
More information

EuSEC 2010: Systems Engineering and Innovation

23 - 26 May, 2010, Stockholm, Sweden.
More information

20th Annual INCOSE International Symposium

11 - 15 July, 2010, Rosemont, IL, USA.
More information

The 22nd International Conference on Advanced Information Systems Engineering (CAiSE'10)
ᴧᴧ NEW

07-11 June 2010, Hammamet, Tunisia

PETRI NETS 2010 NEW

21-25 June, 2010, Braga, Portugal

Fourth Asia-Pacific Conference on Systems Engineering (APCOSE 2010)

11 - 13 September, 2010. Keelung, Taiwan.

Education & Academia

New eCornell Certificate Program Teaches the 'Right Way' to Develop Products and Services

Ithaca, NY, July 20, 2009 - eCornell has announced the launch of a new online Professional development certificate program in Systems Design – A Systems Approach to Product and Service Design.

Postdoc position at CEA LIST, Paris area

The Model Driven Engineering for Embedded Systems Laboratory, part of the CEA LIST institute (450 researchers in the field of software-intensive systems) has an open position for a postdoc in the area of model-driven engineering for distributed real-time and embedded systems.

Delft University of Technology - Lecturer in Space Systems Engineering

The Space Systems Engineering (SSE) group of the Faculty of Aerospace Engineering seeks a lecturer for space-related subjects at undergraduate and graduate level.

Postdoc Position on Model-based Development for Robotics Systems

The laboratory LISE (Model Driven Engineering Laboratory for embedded and real-time systems), part of the CEA LIST (450 researchers in the field of software-intensive systems, see http://www-list.cea.fr/) has an open position for a research assistant in the domain of model-based development for robotics systems.

Postdoc Position in Multi-core Model Checking, Eindhoven, Netherlands

The Eindhoven University of Technology (TU/e) has the following vacancy:
One postdoc position on the project "Efficient Multi-Core Model Checking"

Some Systems Engineering-Relevant Websites

http://www.architectureframework.com/
This website contains information related to the leading frameworks for specifying enterprise architectures, including:

- DoDAF (Department of Defense Architecture Framework - USA)
- MODAF (Ministry of Defence Architecture Framework - UK)
- Unified Profile for DoDAF and MODAF (UPDM)
- TOGAF (The Open Group Architecture Framework)
- Zachman Framework.

The information includes examples for these frameworks using UML and SysML, the leading architecture description languages for software engineering and systems engineering, respectively.

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http://www.systemengineering-lanomethodologies.com/cart/

This is the website of Robert J. Lano, the inventor of the famous N Squared Chart. The site provides access to three books by Mr. Lano: Operational Concept Formulation (CONOPS/OCD), Requirements Analysis and Specification, and the N2 Chart (interface analysis and definition), with a purpose of improving the system engineering processes associated with the front end system design activities of any program.

Standards and Guides

ISO/IEC TR 24748-1 Guide to life cycle management

TR 24748-1, Guide to life cycle management, is in the process of publication by ISO/IEC (full report circulated: DIS approved for registration as FDIS).

ISO/IEC TR 24748-2 Application guide for ISO/IEC 15288 (System life cycle processes)

TR 24748-2, Application guide for ISO/IEC 15288, System life cycle processes, is at the Preliminary Draft Technical Report 24748-2 stage. The draft is presently being commented upon by ISO member bodies and Liaisons.

International Standards ISO/IEC 12207:1998 (Systems and software engineering—Software life cycle processes) and ISO/IEC 15288:2002 (Systems and software engineering—System life cycle processes) have application guides (ISO/IEC TR 15271:1998 and ISO/IEC 19760:2003, respectively) for the use of each standard individually. However, both International Standards were re-published in 2008 after significant revisions. As a consequence, the two published application guides no longer relate to the current versions of their respective.

ISO/IEC Technical Report 24748-1 (Systems and software engineering—Guide to life cycle management) is being published in 2008 to facilitate the joint usage of the process content of ISO/IEC 15288:2008 and ISO/IEC 12207:2008 by providing unified and consolidated guidance on life cycle management of systems and software.

ISO/IEC Technical Report, TR 24748-2 (Guide to the application of ISO/IEC 15288) supports use of ISO/IEC 15288:2008 and replaces TR 19760. This Technical Report and its companion, TR 24748-3 (Guide to the application of ISO/IEC 12207) - which replaces TR 15271 - continue and make use of the alignment effort inherent in the two revised International Standards.

The concept and structure of the TR 24748 series is also intended to allow more general application within engineering, regardless of specific technologies, according to ISO/IEC JTC1 SC7.

ISO/IEC TR 24748-3 Guide to the application of ISO/IEC 12207 (Software life cycle processes)

ISO/IEC TR 24748-3, Systems and software engineering -- Life cycle management -- Part 3: Guide to the application of ISO/IEC 12207 (Software life cycle processes) was in Working Draft stage as at 10 August 2009.

People

USA DoD OSD Director for Systems Engineering Appointed

Mr. Stephen Welby has been appointed as the new Director, Systems Engineering, of the United States Department of Defense, Office of Director of Defense Research and Engineering. Mr. Welby will commence in mid-September. Mr. Terry J. Jaggers has been appointed as the Principal Deputy Director.

Mr. Welby has over 20 years of experience in advanced technology and development. He is presently Deputy for Advanced Missiles and Unmanned Systems at Raytheon Missile Systems, Tucson, Arizona, USA.

Some Definitions to Close On - Scenario, Use Case, Mission Profile

Scenario

A sequence of events especially when imagined; especially : an account or synopsis of a possible course of action or events (Merriam-Webster's online dictionary)

Comment from Robert:
Operational scenarios play a major role in the successful engineering of systems. An operational scenario is a dynamic view of the system in operation, typically looking forward, with emphasis on the users' point of view. An operational scenario may be expressed in words and/or graphics as a sequence of actions performed outside of the system (including on the system), and by the system. A set of operational scenarios provides a reference for fitness for intended use.

The role of operational scenarios is well described in ANSI/AIAA G-043-1992, Guide for the Preparation of Operational Concept Descriptions.

Use Case

A use case is a description of a system's behaviour as it responds to a request that originates from outside of that system. In other words, a use case describes "who" can do "what" with the system of interest. (Wikipedia)

Comment from Robert:
Use cases describe the interaction between a primary actor (the initiator of the interaction) and the system itself, represented as a sequence of simple steps. Actors are something or someone which exists outside the system of interest, and that take part in a sequence of activities in a dialogue with the system for some purpose. Actors may be human end users, human operators, or other systems. Use cases may define pre-conditions, triggers and post-conditions. Each use case aims to be a complete series of actions at appropriate level of detail, described from the point of view of the primary actor.

Thus, a Use Case is a form of expression of a scenario.

A "Mission Profile"

Is also a form of expression of a scenario. In practice, Mission Profiles tend to incorporate detail on timing and other key aspects of performance, together with the key external conditions under which actions are expected to take place. Thus a mission profile, in practice, tends to be more detailed than a use case. The concept of a 'mission profile" is especially popular in the space and defence sectors.

A common issue in expressing scenarios, regardless of what they are called, is the expressiveness of the language used. Fully expressive languages provide for: sequence, potential concurrency, exclusive "or", looping – exit loop under defined condition(s), iteration (defined number of iterations), and replication (defined number of potentially concurrent instances of the same action), together with inputs, outputs, commencement condition(s), completion condition(s), and measures and values of performance for each action (function).

Project Performance International News

PPI's Course "Software Engineering – a Systems Approach" Accredited in South Africa

ECSA South Africa has accredited PPI's in depth course on software engineering: Validation number: INCOSE 09/006/10 (Software Engineering - A Systems Approach (5 days)). The course now attracts 40 hours of CPD credits in South Africa.

PPI has just completed its first delivery of this course in South Africa, with excellent reviews from course participants. The course was delivered in Pretoria to delegates from a variety of sectors.

PPI's Systems Engineering Course at Ipanema, in Rio de Janeiro, Brazil, over 26-30 October 2009 now Confirmed

PPI's first public course in Rio de Janeiro, Brazil, has just achieved the status of "confirmed", with still two months to go. Whilst the course is strictly business, could there be a better location in the world? We hope that you or your colleagues will add to the cadre of quality delegates already registered. And enjoy amazing Rio.

PPI to Deliver its First Systems Engineering Course in Poland

September 2009 will mark a new milestone for PPI, with the delivery of its 5-day systems engineering course in Warsaw, to a European government agency.

Project Performance International Events

Systems Engineering 5-Day Courses

Upcoming locations include:

- Rio de Janeiro, Brazil
- Cape Town, South Africa
- Las Vegas, USA
- Singapore
- Amsterdam, The Netherlands
- London, UK

View 2009 Systems Engineering Course Schedule

Requirements Analysis and Specification Writing 5-Day Courses

Upcoming locations include:

- Cape Town, South Africa
- Amsterdam, The Netherlands
- Adelaide, Australia
- Las Vegas, USA

View 2009 RA&SW Course Schedule

OCD/CONOPS 5-Day Courses

Upcoming locations include:

- Adelaide, Australia
- Las Vegas, USA
- Pretoria, South Africa

View 2009 OCD/CONOPS Course Schedule

Software Engineering 5-Day Courses

Upcoming locations include:

- Adelaide, Australia
- Amsterdam, The Netherlands

Cognitive Systems Engineering 5-Day Courses

Upcoming locations include:

- Adelaide, Australia
- London, UK

- Las Vegas, USA

PPI Upcoming Participation in Professional Conferences

- 30 September - 2 October, 2009 - **XI SIGE** - São José dos Campos, Brazil (Silver Sponsor)
- 26 - 29 October, 2009 - **12th Annual Systems Engineering Conference** - San Diego, CA, USA (Exhibiting)

Kind regards from the SyEN team:
Robert Halligan, Managing Editor, email: rhalligan@ppi-int.com
Alwyn Smit, Editor, email: asmit@ppi-int.com
Julie May, Production, email: jmay@ppi-int.com
Michael Halligan, Production, email: halliganm@ppi-int.com

Project Performance International
PO Box 2385, Ringwood, Vic 3134 Australia
Tel: +61 3 9876 7345
Fax: +61 3 9876 2664
Web: www.ppi-int.com
Email: contact@ppi-int.com

Tell us what you think of SyEN: email to contact@ppi-int.com

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