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INCOSE Working Group Addresses System and Software Interfaces

Agenda

- Why Software in INCOSE?
  - Literature Review
- System and Software Interfaces
- Examples
- INCOSE and external WG interfaces
- Plan

Why Software in INCOSE?

Raise your hand if:

- Your education was technical (including systems engineering) but was not software oriented

- Your education was software oriented

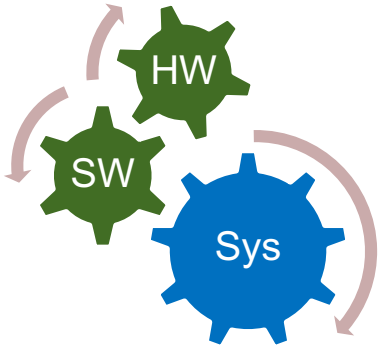
- You are working on (or your last system was) a system that has substantial software content

When INCOSE and other organizations do both SysE and SWE well:

SysEs know which aspects of other subsystems will cause software issues and risks (and vice versa)

SysE

SysEs and SWEs do trade studies including all needed disciplines…



SWE

SWEs know what information to ask for, from SysEs, and when

- SaSIWG (2017+)

Needs

- SWEs need to “systems engineer” their software and their software systems
- SysEs need to understand why software is special, not just another subsystem
  - Software provides most of today’s new capabilities
  - Software controls systems; it determines most of safety and security

  More Critical
  - Software will change and grow during life of system
  - Software has very long-range interfaces

  More Difficult

Literature 1990-2017

Systems and software:

- Affect each other
- Must evolve
- Early: compare/contrast. Recently: how to reconcile
- Must decide how to work together
- Must learn enough about each other
- Interface

Interface Issues and Gaps

Disciplines
Processes
Standards
Organizational Roles
Component specifications
Management
Data
Tools

These are the initial (brainstormed) categories of SysE/SWE or Sys/SW interfaces

SaSIWG has started to address these

Disciplines

- Degree programs and curricula in both
- SWEs generally must be able to write code; SysEs may be able to analyze in Excel or commercial SysE tools
- SysE: External interfaces/Requirements and life cycle focus; SWE: Information and logic focus

Processes -1

- SysEs: Tend toward Vee (external, WBS, use cases) and Agile (internal, story points)
- SWE: Tend toward Agile, DevOps
- Functional vs. OO
- Requirements -> Functions vs. Requirements -> Features?

Processes - 2

- Sometimes separate cost estimation, often separate modeling and development environments
- Terminology (SysE: Prototypes, production; SWE: Minimum viable product)

Where Processes Must Interface

- Information management
- Architecture
- Safety and security, including cybersecurity
- Autonomous system creation
- Use of data analytics
- Risk identification and analysis
- Alternative processes such as COTS/GOTS/NDI/ FOSS, reuse

Standards

- Great efforts to “harmonize” systems and software standards
- SWEs generally still use SW Standards and see systems engineering standards as meant for someone else, despite needing to SysE their software
- Lower priority for SaSIWG to address

Organizational Roles

- Boundaries: What is each group's scope?
- How to collaborate for functioning organizational processes?
- Define interfacing processes: roles, architecting, communication, products, leadership
- Who decides what, in reducing uncertainty from system need to system product?
- How does this all work for Systems of Systems?

Component Specs

- How to coordinate writing of specifications from many different domains points of view? (SysE, SWE, mechanical, electrical, networking, data…)
- How best to employ component-based development tools and techniques?
- Interface specifications: What is still needed? What is newly needed?

Management - 1

- Compatible governance needed
- Policies such as security
- Planning: breadth and detail
- Aligning internal deliverables contents and timing
- Agile vs Vee/contracts/customer expectations

Management - 2

- How best use top-down and bottom-up in design?
- Risk management: combining risks
- Data provenance: what's the history?
- Human-software interface
- User and operator contacts

Data

- From level of smallest interfaces to largest big-data-mining: with which specific interfaces do SysEs need to be fluent?
  - Protocols, interaction modes, bi-directionality, data analysis including “big data”
  - About system, elements, and software
  - Software: includes firmware, computer hardware?
  - Within developed system to far ends of networks

Tools

- Have been addressed by other INCOSE groups for some time
- Not in SaSIWG scope at this time

Potential WG interfaces

- Agile Sys and SysE
- Architecture
- Competency
- Decision Analysis
- Enterprise Systems
- Lifecycle Management
- MBSE
- NAEFMS-INCOSE
- OOSEM
- Patterns
- PM-SE Integration
- Process Improvement
- Requirements
- Risk Management
- Sys Security Eng
- Tools Integration and Model Lifecycle Mgt
- Training
- IEEE
- ACM
- DoD (DAU)
- ?

WG products in work - 1

- “Pain Points” survey of good and bad Sys-SW Interface practices for members and separately for CAB representatives: Please sign up!
- Prioritized areas for improvement
- Knowledge areas that SWEs should understand about SysE and SysEs should understand about SWE

WG products in work - 2

- Newsletter for Chapters (Completed, Stu Bergstrom)
- Interfaces with IEEE (In work: Edmund Kienast, Dick Fairley, Mike Pafford) and possibly other organizations
- Possible work on patterns in systems and software interfaces

Work coordinated via monthly telecons

  - Difficult: U.S., France, Australia

Summary

- Systems and Software Interface Working Group:
  - Is new, global
  - Is beginning to address needs
  - Seeks your contribution
  - Coordinates monthly by telecon

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