DoD Software Engineering and System Assurance

Focusing on Top Software Issues

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Elements of a DoD Strategy for Software

- Support Acquisition Success
  - Ensure effective and efficient software solutions across the acquisition spectrum of systems, SoS and capability portfolios
- Improve the State-of-the-Practice of Software Engineering
  - Advocate and lead software initiatives to improve the state-of-the-practices through transition of tools, techniques, etc.
- Leadership, Outreach and Advocacy
  - Implement at Department and National levels, a strategic plan for meeting Defense software requirements
- Foster Software Resources to meet DoD needs
  - Enable the US and global capability to meet Department software needs, in an assured and responsive manner

Promote World-Class Leadership for Defense Software Engineering

Recap of Activities

- Documented software issues, needs
  - Software Industrial Base Study completed
  - NDIA Top Software Issues Workshop Report
  - Defense Software Strategy Summit Report
- Created partnerships
  - Established network of DoD software POCs
  - Chartered the NDIA Software Committee and Expert Panel
  - Bi-weekly software collaboration exchanges with Government, Academia, and Industry
  - Restructured the US-UK-AUS Trilateral Working Group
- Performed gap analysis
  - Identified ongoing software initiatives; mapped them to issue areas
  - Two outcomes:
    1. Identified initiatives that deserve cross-DoD attention
    2. Identified gaps where attention is needed

NDIA Software Committee Tasking

- Provide strategic guidance, analysis, and recommendations to help enable mission success for DoD Large-Scale Software Programs
- Specific example activities include:
  - Help organize and lead workshops and related meetings such as the Software in Acquisition Workshops (October 2007 and April 2008),
  - Contribute to software working groups such as groups focusing on software requirements, risk/estimation, and quality attributes,
  - Provide industry perspectives on DoD software issues
  - Support communication and integration among engineering and management disciplines required to achieve software improvements

Led by Industry Software Experts Panel

*Top Software Issues**

1. The impact of requirements upon software is not consistently quantified and managed in development or sustainment. **"Requirements"**
2. Fundamental system engineering decisions are made without full participation of software engineering. **"SE/SW Integration"**
3. Software life-cycle planning and management by acquirers and suppliers is ineffective. **"SW Sustainment"**
4. The quantity and quality of software engineering expertise is insufficient to meet the demands of government and the defense industry. **"Human Capital"**
5. Traditional software verification techniques are costly and ineffective for dealing with the scale and complexity of modern systems. **"SW Testing"**
6. There is a failure to assure correct, predictable, safe, secure execution of complex software in distributed environments. **"SW Assurance"**
7. Inadequate attention is given to total lifecycle issues for COTS/NDI impacts on lifecycle cost and risk. **"SW COTS/NDI/Reuse"**

***NDIA Top Software Issues Workshop August 2006**

DoD Software Systemic Issues

- Software systemic issues are significant contributors to poor program execution
  - Software requirements not well defined, traceable, testable
  - Immature architectures, COTS integration, interoperability, obsolescence (electronics/hardware refresh)
  - Software development processes not institutionalized, planning documents missing or incomplete, reuse strategies inconsistent
  - Software test/evaluation lacking rigor and breadth
  - Schedule realism (compressed, overlapping)
  - Lessons learned not incorporated into successive builds
  - Software risks/metrics not well defined, managed

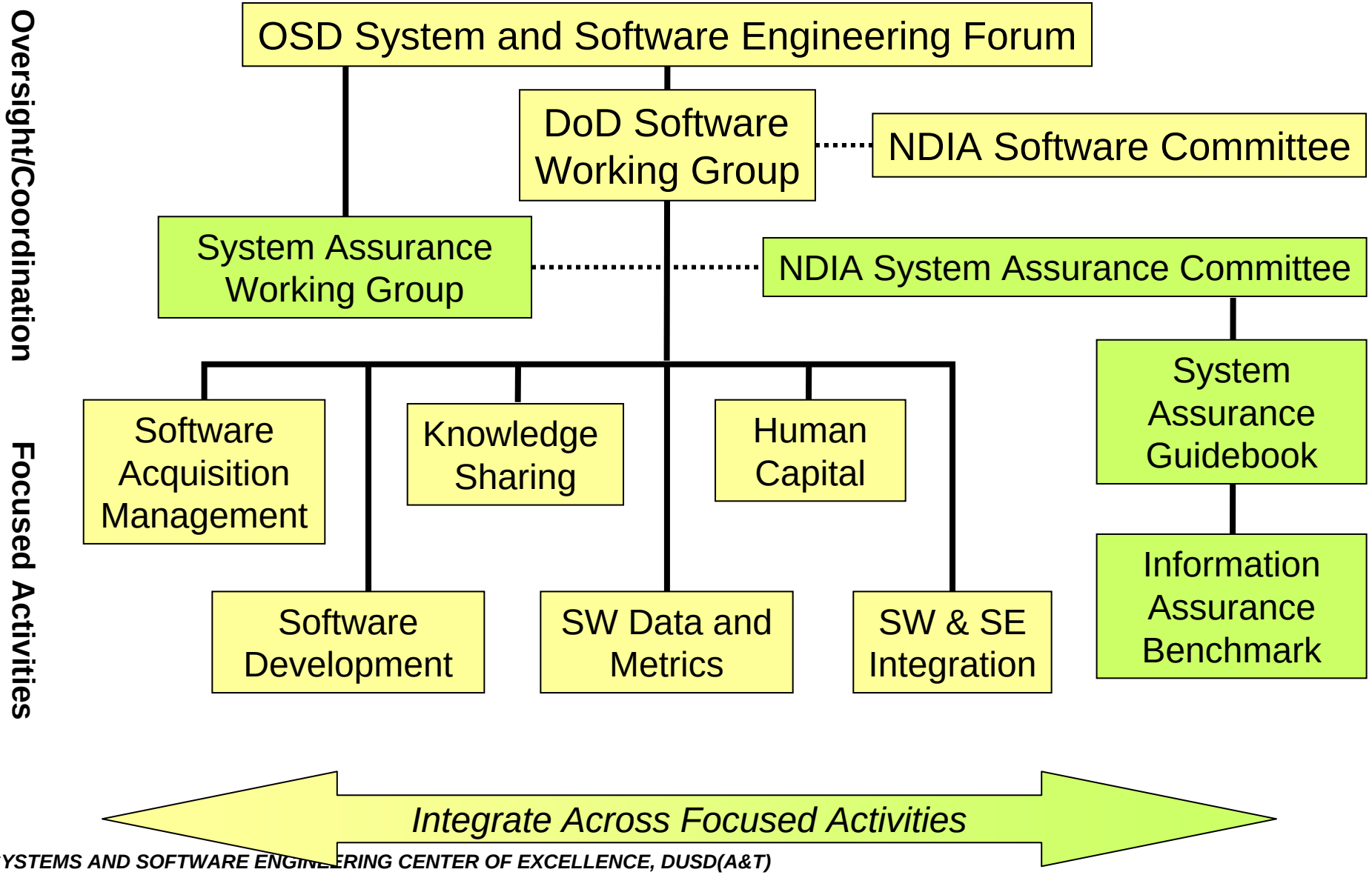
*Based on ~65 program reviews to date

Identified Software Gap Areas

- Estimation
- Risk Identification
- Sustainment
- Interoperability
- Test
- Requirements
- Quality Attributes
- Qualifications for Software Support (SETA)
- Human Capital Strategy

<u>Needed step:</u>
Develop plans to define, and begin to address, these gaps

Activity Oversight/Coordination



Active Projects and Outcome

Software Acquisition Management

- Software Requirements
- SW Acquisition Guidance
- SW COTS/Reuse*

Software Development

- SW Sustainment*
- SW Test*
- SW Interoperability*
- Open Source SW

SW & SE Integration

- SE/SW Process Integration
- SW in SEP/SETR
- SW Quality Attributes

Knowledge Sharing

- SW Knowledge Portal
- SW Collaborator Telecons
- Program Support

Data and Metrics

- SW Metrics
- SW Estimation
- SW WBS
- SW EVM
- Guide on using metrics

Human Capital

- SW Human Capital Strategy
- SW Univ Curriculum
- DAWIA SW Education
- In-House Training

DoD Outcome: Updated policy, guidance, and acquisition support tools
Examples: RFP language, MIL-STD, MDA exit criteria

*in concept stage only – GAP exists

Software In Acquisition Workshop

Tuesday, October 16, 2007		Wednesday, October 17, 2007	
0800-0815	Welcome: Dr Finley - DUSD(A&T)	0800-1500	Workshops - continued
0815-0900	Keynote: Carl Siel – Navy Chief SE	1515-1600	Keynote: Dr Myers, DoD Deputy CIO
0900-1015	Industry Presentation – NDIA Software Experts Panel	1600-1645	Workshop Outbriefs (3)
1025-1445	Presentation Tracks (12 Presentations)	1645-1700	Closing Remarks
1500-1700	Focused Workshops		

Attendance:
- 100+ attendees
- Services, Agencies, Industry, Academia, FFRDC, NASA

Workshop Topics:
- Software Requirements
- Software Estimation / Software Risk
- Software Quality Attributes

Major Events/Progress

- Oct 07: Software in Acquisition Workshop
- Dec 07: Govt/Industry Co-Chair meeting
  - Review workshop results, set 6-12-18 month plans
- Feb 08: NDIA SW Committee Meeting
  - Update on all Govt/Industry collaborator activities
- Apr 08: "Industry Insights on Software in Acquisition"
  - Requirements paper (SEI/Raytheon)
  - Cost/Risk paper (SRA/Lockheed Martin)
  - Architectural Quality Attributes paper (Boeing/CSC)
- Oct 08: Software in Acquisition Workshop
  - Full day workshop aligned with NDIA Annual SE Conference
  - Workshop reports
  - Update on all Govt/Industry Collaborator activities

Way Ahead

- Tracking progress
  - Bi-weekly collaborator telecons
  - 6-12-18 month workshops on issues
  - Track software systemic issues
    - Updated Database query – December 07
    - Confirms top 2 software issue areas are SW/SE Integration and SW Requirements
- Additional Areas that need attention – focus for FY08
  - Software Sustainment
  - Software Test
  - Software COTS/Reuse

Goal: Establish strategy and activity to address top SW Issues

Backup Slides

Software Requirements Workshop

Requirements Workshop Recommendations

1. Define an effective “software portfolio” management framework
   - Protect the continuity of systems/software and requirement engineering throughout the software life cycle
2. Implement the techniques we know will work and identify any shortcomings
3. Find ways to leverage the malleability of software
   - Software has the ability to adapt to changing requirements
4. Change our view/perspective of “sustainment” to “continuous evolution”
5. Establish a research program

Software Risk/Cost Estimation Workshop

Software Estimation/Risk Recommendations

- Establish Work Breakdown Structure guidance to better highlight Software Engineering activity
- Developing and evolving an integrated software data repository and related tools
- Conduct Root Cause analysis studies to understand the problems in software estimation and the use of estimates in the acquisition process
- Develop and implement an incremental acquisition approach (as well as the overall acquisition framework) that accommodates the uncertainty associated with early software estimates and allows for adjustment and refinement over time
- Establish policy, related guidance, and recommended implementation approaches for software data collection and analysis across all DoD acquisition programs

Software Quality Attributes Workshop

Software Quality Attribute Priority Recommendations

1. **Develop engineering guidance on quantitatively identifying, predicting, evaluating, verifying, and validating Quality Attributes**
   1.1. Address tie-in to KPPs and TPMs
   1.2. Identify methods for predicting quality attribute outcomes for the delivered system, throughout the life cycle
2. **Improving OSD/Service-level acquisition policy regarding Quality Attributes**
   2.1. Identify benefits of addressing software quality attributes as part of an acquisition risk reduction strategy
   2.2. Address gaps in SEP, TEMP, JCIDS, DAG, RFP language
   2.3. Define expectations for Quality Attribute review during Acquisition Milestone Reviews (e.g. PDR)
3. **Develop taxonomy of software quality attributes and how they are related**
4. **Develop Program Manager guidance on Introduction to Software Architectural Evaluation of Quality Attributes**
5. **Develop Collaboration site for collecting data, sharing work products, facilitating on-going discussion**

OUSD(AT&L)/SSA FOCUSED INITIATIVES

System Assurance Guidebook Project Description

Issue: Systems are vulnerable to malicious tampering

- Project Description:
  - Provide *practical guidance* on augmenting systems engineering practice for system assurance
  - Synthesize existing knowledge from organizations, standards and best practices
  - Recap concepts from standards
- Opportunity for:
  - Practitioners, academe who implement systems engineering, assurance, safety, security, program protection, etc. into processes and programs
- The project addresses
  - Integration of assurance guidance and practices into systems engineering
- Product:
  - Guidebook on Engineering for System Assurance
- Outcome Goal:
  - Intent is to yield assured program / system with demonstrable evidence of assurance

System of Systems Project Description

Issue: No common definition, or guidance for SoS

- Project Description:
  - Effort led by the Office of the Secretary of Defense
  - Collaborative Approach with DoD, Industry, Academia
- Purpose
  - 6 month effort addressing areas of agreement across the community
  - Focus on technical aspects of SE applicable across SoS management constructs
  - Vehicle to capture and debate current SoS experience
- Audience
  - Program Managers and Lead/Chief Engineers
- The project addresses
  - Considerations for engineering above a system level
- Product:
  - SoS Engineering Guide, v1.0, Fall 2007
- Outcome Goal:
  - Program managers/chief engineers have requisite knowledge to manage SoS

SW Engineering Graduate Curriculum Project Description

Issue: There is no commonly accepted structure or content for graduate software engineering education

- Project Description:
  - Develop a core curriculum and core competencies for software engineering
- Opportunity:
  - Industrial and government workforce customers of SWE graduate education
  - Academics who provide SWE and SE graduate education
  - Professional societies with a vested interest in SWE and SE graduate education
- The project addresses
  - Inconsistencies in software graduate degrees
  - Poor definition of labor categories and software expertise
  - The divide between systems and software engineers in industry, government, and academia
  - The project will integrate SE principles and practices into a SWE curriculum.
- Product:
  - An approved curric that can be adopted by the community (industry, academia, associations)
- Outcome Goal(s):
  - Software engineers have a more consistent training base

DoD Acquisition Workforce Software Education Project Description

Issue: DAWIA Curriculum does not address software acquisition issues

- Project Description:
  - Compare identified software competencies with current curriculum
  - Update DAU software acquisition management courseware and other career field training to meet competency needs
  - Develop continuous learning modules as part of the DAU Core Plus construct
  - Initial focus on PM and SPRDE career fields
- Opportunity for:
  - Software and career field process owners and practitioners
- The project addresses
  - Methodology for determining software competencies
  - Methodology for developing tailored solutions for each career field
- Product:
  - Updated DAWIA software competencies reflecting latest policies and guidance
- Outcome Goal:
  - Acquisition professionals have requisite software knowledge

SE/SW Process Integration Project Description

Issue: SE and SW have not been well integrated on projects

- Project Description:
  - Study SE and SW processes, capture ongoing harmonization efforts
  - Assess current guidance
  - Identify opportunities for better integration
- Opportunity for:
  - SE and SW process owners or practitioners
  - Academe who teach/study SE and SW
- The project addresses
  - Integration of SW with requirements, risk management and other SE technical and management processes
- Product:
  - Report and recommendations for SW policy, guidance, and tools to better integrate with SE and Acquisition
- Outcome Goal:
  - Software is a major factor in engineering design and acquisition management decisions

CMMI-Acquisition Project Description

Issue: Acquirers lack an appraisable model for acquisition PI

- Project Description:
  - Using GM CMMI for Outsourcing; pilot and generate CMMI-ACQ
  - Involve broad set of acquisition stakeholders to ensure wide application
- Opportunity for:
  - Process improvement stakeholders
  - Acquiring organizations
- The project addresses
  - Identification of key acquirer activities and products
  - Amplification of CMMI core practices to capture acquirer considerations
- Product:
  - CMMI model for Acquisition (built on CMMI foundation for consistency with CMMI-DEV)
- Outcome Goal:
  - Acquisition organizations implement best practices, and institute organizational process improvement

Our Challenge

- Given the shortage of software resources and critical software reliance
  - We cannot afford to be stovepiped
  - We must integrate across cross-functional perspectives to improve our software capability
- We must focus on long standing software issues
  - Leverage ongoing activities to make a difference
  - Invest in collaborative efforts where there are gaps
- Now...
  - Work together to address software issues
  - Join the DoD SIA Collaborators – participate in bi-weekly collaboration telecons
  - Contribute to workshop action items, and/or ongoing initiatives
  - Contact us at ATL-SSA@osd.mil

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