Net Centric Information Environment – Transcending Force Development

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Kristen Baldwin
Deputy Director, Software Engineering & System Assurance
OUSD(AT&L)
Outline

• How Net Centric Information applies to Force Development
  – The problem, and a proposed solution framework

• Building Net Centric Solutions:
  – Complex, integrated, Systems of Systems

• Net Centric Enablers (areas that need attention)
  – Integrated Management Information
  – Systems of Systems
  – Software Engineering
  – System Assurance

DoD Engineering Center of Excellence
The Force Development Problem

- Lack of synchronization of major processes – timing, context, performance management
- Investment decisions currently detached from Defense strategic direction and joint warfighting concepts (bottom up)
- Choice is made without broader context of risk and value
  - Decisions are component centric and lack portfolio context
  - Ad hoc process for determining where to divest
- Resource and investment decision authority rests with the DSD
- Lack of information transparency and integration across the enterprise
Institutional Reform and Governance Roadmap (IR&G)

- IR&G Co-Leads: Mr. Krieg, USD(AT&L); LTG Sharp, D, JS
- DSD Roadmap Direction
  - Create or invigorate empowered horizontal organizations to integrate priority areas
  - Improve Department effectiveness and efficiency to include exploring a portfolio based approach to defense planning, programming and budgeting
  - Move toward common data structures/approaches at enterprise level
  - Implement new acquisition policies, procedures and processes for dramatic improvements by all measures

Source: DSD Memo 5 January 2006
IR&G Framework: Corporate Decision Lanes

Employ the Force: Highly Joint
Operates with what we have available and provides performance feedback to inform future decision making

Now

Manage the Force: Increasingly Joint
Prepares, supports, sustains, and aligns what we have to what we need

1-3 Years

Develop the Force: Learning to be Joint
Builds capability and capacity (DOTMLPF) to fulfill future joint customer needs (fits supply to demand)

3 Years and Beyond

Corporate Support
Department Administration and Support Activities

Establish Strategic Direction

Decision Lanes

Temporal Focus
Near-Term ➔ Far-Term

Definition
IR&G Governance and Management Framework: Three Levels of Choice

**Strategic Choice**
- Establish Priorities and Balance Across Integrated Capability Portfolios
- What are the effects, objectives and context?
- What is the right balance of portfolios to achieve objectives and minimize risk?

**Portfolio Choice**
- Balance Seams, Gaps, Overlaps Between and within Like Capability Portfolios
- What’s the right mix of capabilities and assets within a Portfolio?

**Program/System Choice**
- Balance Time, Performance, Affordability & Risk to determine best program and/or system solution
- What are the right DOTMLPF solutions to achieve the optimal capability mix for the Portfolio?
Portfolios provide Structure for Horizontal & Vertical Integration

A capability portfolio taxonomy is needed to enable this integration.
Acquiring Defense Capabilities
What Have We Learned?

• Capability needs will be satisfied by groupings of legacy systems, new programs, and technology insertion – Systems of Systems (SoS)

• Issues:
  – **Scale**: Size of defense enterprise makes a single integrated architecture infeasible
  – **Ownership/Management**: Individual systems are owned by the military component or agencies
  – **Legacy**: Current systems will be part of the defense inventory for the long-term and need to be factored into any approach to SoS
  – **Changing Operations**: Changing threats and concepts mean that new (ad hoc) SoS configurations will be needed to address changing, unpredictable operational demands
  – **Criticality of Software**: SoS are constructed through cooperative or distributed software across systems
  – **Enterprise Integration**: SoS must integrate with other related capabilities and enterprise architectures
Enabling Choice: Integrated Management Information

• Transparent information enables strategic decision-making
• Common language to serve all Department activities: Operational as well as Force Development
  – Common link - Capabilities

Multiple Data Views:
• Systems vs. Capabilities
• Capabilities vs. Strategic Goals
• System Context
• Highly dependent programs (Joint Enablers)
• S&T vs. future needs
• Portfolio Efficiency
• Portfolio Affordability
  • ……
Profiling Systems of Systems

System Context
- Mission evolves slowly
- Mission very fluid, ad-hoc
- Single function, single enterprise
- Multiple programs, multiple systems
- Similar users
- Many different users

Mission Environment
- Mission evolves slowly
- Mission very fluid, ad-hoc
- Single function
- Single user class
- Single program, single system
- Single enterprise
- Extended enterprise

Strategic Context
- Mission evolves slowly
- Mission very fluid, ad-hoc
- Single function
- Single user class
- Single program, single system
- Single enterprise

Stakeholder Context
- Stakeholders concur
- Agreement in principle; Some not involved
- New relationships
- Relationship stable
- Known system behavior
- System behavior fairly predictable
- System behavior will evolve

Implementation Context
- Single program, single system
- Single program, multiple systems
- Multiple programs, multiple systems
- Similar users
- Many different users
- Multiple equities; distrust
- Resistance to changing relationships
- Sustained outcomes
- Build fundamentally new capability
- Change existing capability
- Improve existing capability

Typical program domain
- Chief Engineer inside the program; reports to program manager
- Traditional systems engineering

Transitional domain
- Systems engineering across boundaries
- Work across system/program boundaries
- Influence vs authority

Messy frontier
- Political engineering (power, control...)
- High risk, potentially high reward
- Foster cooperative behavior

Source: Renee Stevens

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Characterizing the System of Systems Environment

- **Community Involvement: Stakeholders, Governance**
  - **System**: stakeholders generally committed only to the one system
  - **SoS**: stakeholders more diverse; stakeholders from each system involved will have some interest in the other systems comprising the SoS

- **Employment Environment: Mission environment, Operational focus**
  - **System**: mission environment is relatively stable, pre-defined, and generally well-known; operational focus is clear
  - **SoS**: emphasis on multiple missions, integration across missions, need to ad hoc operational capabilities to support rapidly evolving mission objectives

- **Implementation: Acquisition/Test and Validation, Engineering**
  - **System**: aligned to ACAT Milestones, specified requirements, a single DoD PM, SE with a Systems Engineering Plan (SEP), test and validating the system is possible
  - **SoS**: multiple system lifecycles across acquisition programs, involving legacy systems, developmental systems, and technology insertion with multiple DoD PEOs, PMs and operational and support communities; testing is more difficult and test and validation can be distributed and federated.
The System Assurance Problem

• Growing system complexity makes vulnerabilities (*malicious, exploitable logic*) within SoS much more difficult to discover and mitigate.

• Commercial components are highly desirable from standpoint of program cost, schedule and performance, *but*:
  – Risks inherent due to globalization of production.

• High Assurance Components are difficult and expensive to make, and deliver limited functionality.

• *How do we acquire SoS with mission-worthy system-level assurance properties?*

System Assurance Definition

*Level of confidence* that system functions as intended and is free of exploitable vulnerabilities
Whether intentionally or unintentionally introduced, designed, or otherwise inserted.
System Assurance: What does success look like?

- The requirement for assurance is allocated among the right systems and their critical components.
- DoD understands its supply chain risks.
- DoD systems are designed and sustained at a known level of assurance.
- Commercial sector shares ownership and builds assured products.
- Technology investment transforms the ability to detect and mitigate system vulnerabilities.
Establishing a DoD Engineering Center of Excellence

- Support Acquisition Success
- Improve State-of-the-Practice of Software Engineering
- Leadership, Outreach and Advocacy
- Foster Software Resources to Meet DoD Needs
Why Focus on Software: Software Growth in DoD Systems

- Software Requirements Growth (% of functionality provided by software)
  - 1960s: 8%
  - 1980s: 40%
  - 1990s: 60%
  - 2000s: 80%

- Software Size Growth
  - From < 2M estimated source lines of code in 1980s to > 10M lines of code in 1990s
  - Now approaching 20M ESLOC

- Software Overruns
  - 1994: 16.2% of SW projects completed on-time, on-budget

1 CSIS/DSB/PM Magazine
2 CSIS Analysis
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DoD Software Engineering & System Assurance
Getting Started – What are we Doing?

• Identifying issues, needs
  – Software Industrial Base Study
  – NDIA Top Software Issues Workshop; Defense Software Summit

• Creating opportunities, partnerships
  – Established network of Government software POCs
  – Chartered the NDIA Software Committee, and System Assurance Committee
  – Information exchanges with Government, Academia, and Industry, and International partners

• Executing focused initiatives
  – Handbook on Engineering for System Assurance
  – SoS Systems Engineering Guide
  – Transparent Data for Force Development

*We must field assured, reliable, SoS solutions to support Net Centric Operations*
Contact Us

Office of the Under Secretary of Defense
 Acquisition, Technology and Logistics
 Directorate for Software Engineering and System Assurance
 3090 Defense Pentagon
 Washington, DC 20301-3090
 703-602-0851