Defense System of Systems Gap Analysis

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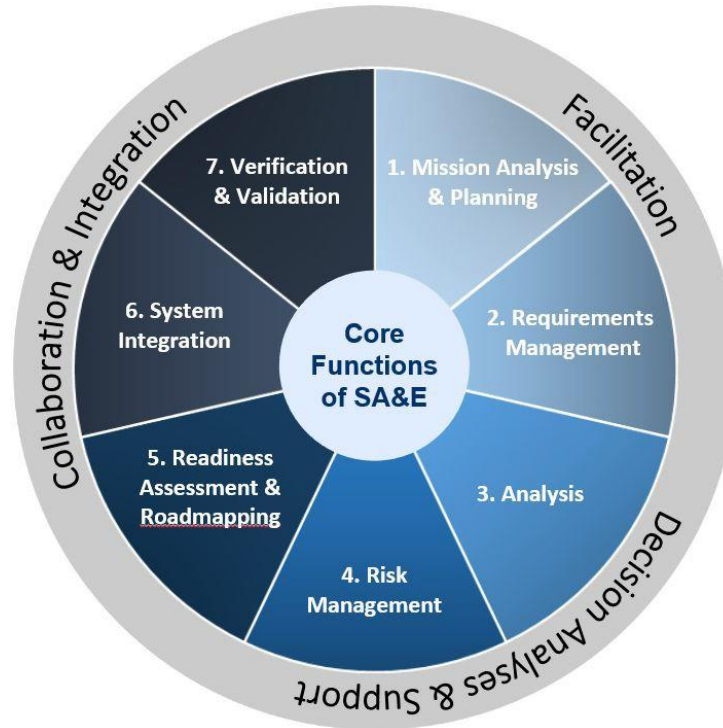john.collins@inl.gov

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INL Systems Analyses &
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Core Functions –
INL Systems Analyses & Engineering

7
- Verification of System Performance and Functionality
- Validation of System Specification and Design Parameters
- Test Planning and Implementation

6
- Program & Project Integration
- Laboratory-wide R&D Integration
- Laboratories/Industries/ Universities Integration
- Integration of System Elements
- Systems of Systems Analyses

5
- Technology Maturity Analysis
- Technology Development Roadmap/Path Forward
- Roadblock Identification & Mitigation
- System Assessments (e.g., Energy Systems)

Central diagram:

Collaboration & Integration — Facilitation — Decision Analyses & Support

7. Verification & Validation
1. Mission Analysis & Planning
6. System Integration
2. Requirements Management
5. Readiness Assessment & Roadmapping
3. Analysis
4. Risk Management

Core Functions of SA&E

1
- Concise Problem Definition
- Understanding Important Customer Needs
- Concise System/Project Boundaries
- Strategic Planning & Baselines
- "Concept" of Operations
- Stakeholder Buy-in
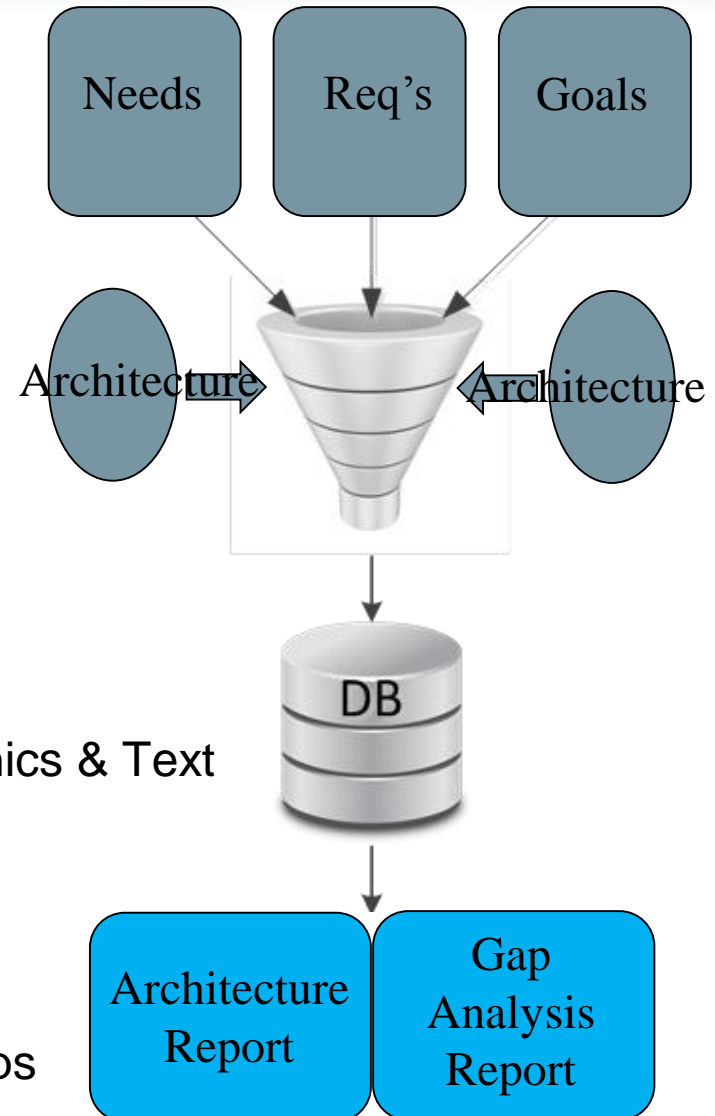- Acquisition Strategy
- White Papers

2
- Technical, Functional, and Operational Analysis
- Requirements Elicitation, Clarification, Derivation, and Tracking
- Traceability, Change Control, and Impact Analysis
- Requirements Verification and Validation Planning

3
- Analysis of Alternatives
- Decision Metrics
- Organization Analysis & Visualization of Complex and Big Data
- Uncertainty Analysis & Probabilistic Risk Assessment
- Risk-informed Decision-making
- Integration of Viable Solutions
- Chemical Process Engineering & Analysis
- Chemical Process Control
- Computational Fluid Dynamics

4
- Risk Identification and Tracking
- Justification for Funding Contingency
- Risk Handling Strategy
- Risk Reduction Plan
- Risk-informed Path Forward

INL Gap Analysis Data Gathering

- Gather Needs and Goals (Capabilities)
  - Review & Filter Documents
  - Interviews
- Analysis
  - Architecture Artifacts
  - Filter by Relevant Architecture
  - Map Capabilities to Needs & Goals
- Reporting
  - Architecture Report
    - Documents Architectural Artifacts
    - Provides Common Baseline in Graphics & Text
    - Supports Further Analysis
  - Gap Analysis Report
    - Needs & Goals, Potential Coverage
    - Implementation Gaps
    - Enterprise Capabilities, Potential Gaps

Needs   Req's   Goals

Architecture   Architecture

DB

Architecture Report   Gap Analysis Report

INL Gap Analysis Approach

Many to Many relationship
Capabilities to Tasks

Many to Many relationship
Products to Task Standards and Metrics

Many to Many relationship
Tasks to Gaps

Task

Required Capability

Task Standard

Metric

Required Capability

Task

Required Capability

Task Standard

Metric

Product

Product

Product

Product

Gap

Gap

Gap

Gap
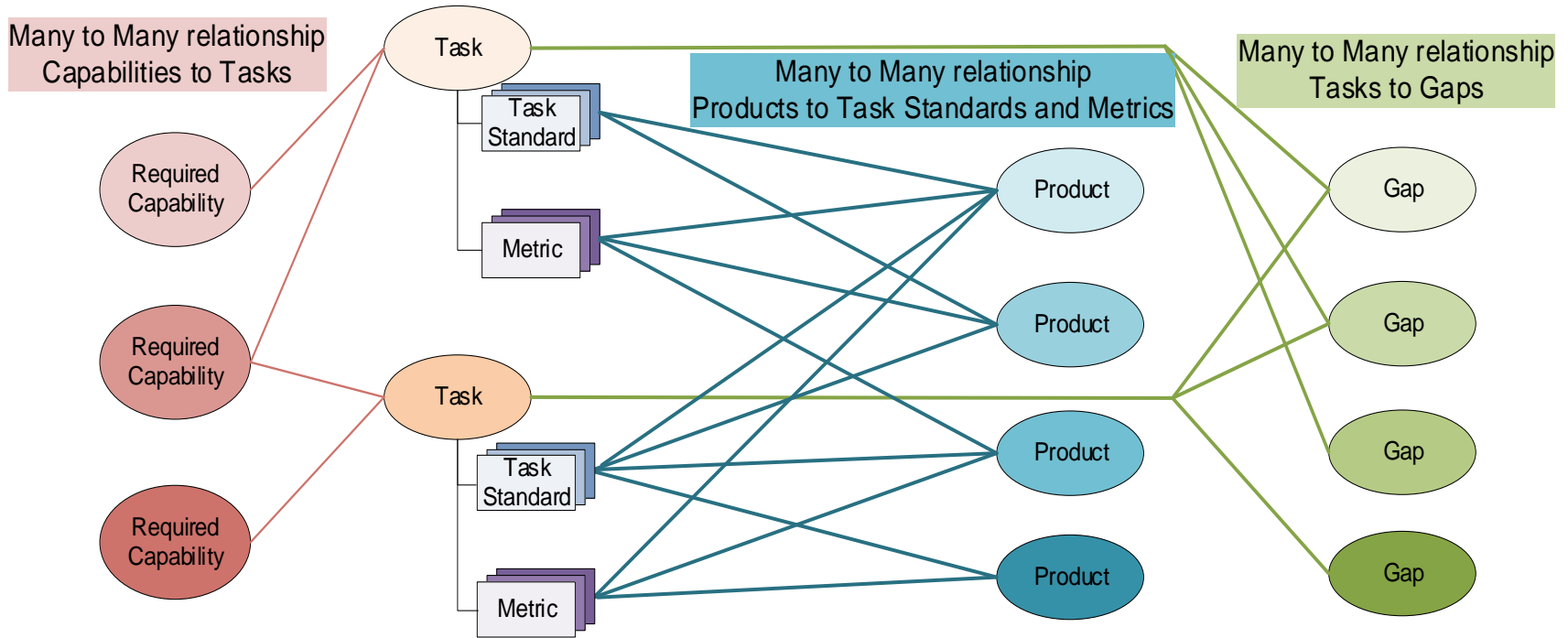
- Capabilities are linked to Tasks
- Tasks are linked to Task Standards & Metrics
- Many Task Standards are shared among Tasks
- Many Metrics are shared among Tasks

- Task Standards & Metrics evaluated as Met / Not Met by Products
- Task Standard & Metric evaluations roll up to Tasks
- Task evaluations roll up to Gap Closure Percentages

Shared Task Standards & Metrics Shrink Problem Space

Gap Analysis Results

Numerical Sum of Gap Closure is larger than combined Gap Closure because of Capability Overlap

7.1%
92.9%

1.3%
98.7%

4.9%
95.1%

6.6%
93.4%

1.5%
98.5%

2.0%
98.0%

6.4%
93.6%
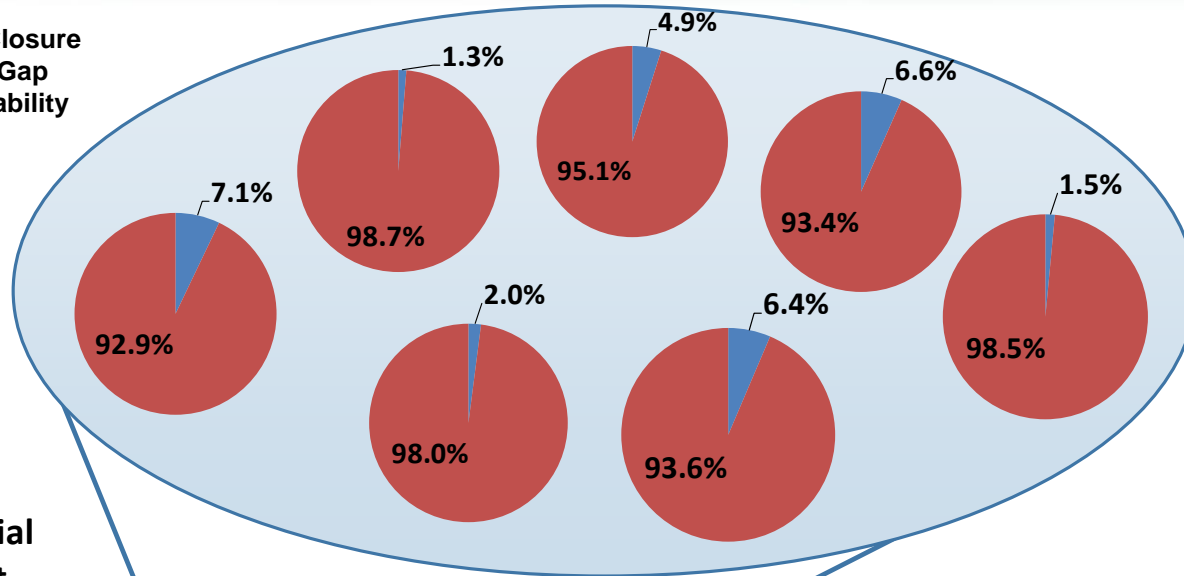
Combined Potential Gap Assessment

29.8%
70.2%

■ Potential Coverage   ■ Remaining Potential Gap
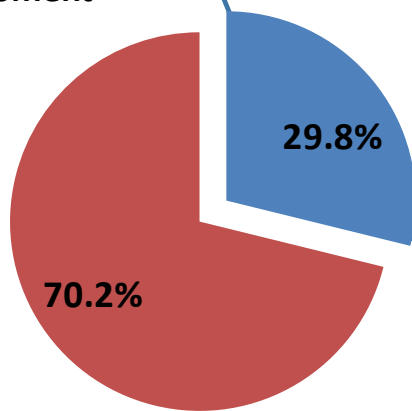
Gap Assessment Considering Overlaps
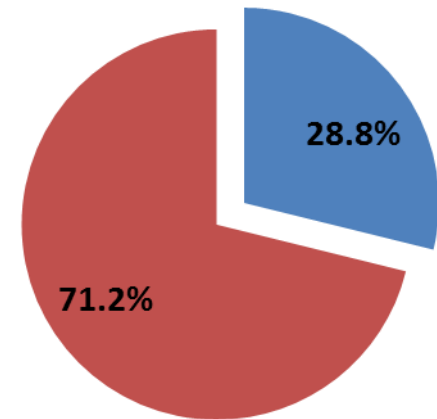
28.8%
71.2%

■ Potential Coverage   ■ Remaining Potential Gap

Capability Use by Location Field View

Contrast this Field View with the Acquisition HQ View on following slide

Legend:

Permission Level

Color	Level
Blue	Admin
Cyan	User
White	Unknown

Current Usage

Color	Status
Green	Using, no issues
Orange	Using, with configuration (HW/SW) issues
Yellow	Deployed, not using
Red	Not Deployed
White	Unkown

	Location	Planned / Assessed	Tool / Capability 1		Tool / Capability 2		Tool / Capability 3		Tool / Capability 4		Tool / Capability 5		Tool / Capability 6		Tool / Capability 7	
			Permission Level	Current Usage	Permission Level	Current Usage	Permission Level	Current Usage	Permission Level	Current Usage	Permission Level	Current Usage	Permission Level	Current Usage	Permission Level	Current Usage
CONUS	Location1	Planned														
	Location2	Planned														
	Location3	Planned														
	Location4	Planned														
	Location5	Assessed	User	Orange	User	Green	User	Orange	User	Orange	User	Orange		Red	User	Orange
	Location6	Planned														
	Location7	Assessed	User	Orange	User		User	Orange	User	Orange	User			Red	User	Orange
	Location8	Planned														
	Location9	Planned														
	Location10	Planned														
	Location11	Planned														
	Location12	Planned														
OCONUS 1	Location13	Planned														
	Location14	Planned														
	Location15	Planned														
	Location16	Planned														
	Location17	Assessed	Admin	Green	Admin	Green	Admin	Yellow	Admin	Orange	Admin	Orange	Admin	Green	Admin	Green
OCONUS 2	Location18	Assessed									User	Orange				
	Location19	Assessed									User	Orange				
	Location20	Planned														
	Location21	Planned														
OCONUS 3	Location22	Assessed	User	Green	User	Orange	User	Orange	User	Orange	User	Green		Red	User	Orange
	Location23	Assessed		Red	User	Orange	User	Orange	User	Orange	User	Orange		Red	User	Orange
	Location24	Planned														
	Location25	Assessed	User	Green	User	Orange	User	Orange	User	Orange	User	Green		Red	User	Orange
	Location26	Assessed	User	Red	User	Orange	User	Orange	User	Orange	User			Red	User	Orange
	Location27	Assessed	User	Green	User	Orange	User	Orange	User	Orange	User	Green		Red	User	Orange
OCONUS 4	Location28	Assessed	User	Green		Red	User	Green		Red		Orange		Red		Red
	Location29	Assessed	Admin	Orange	Admin	Green	Admin	Orange	Admin	Orange	Admin	Orange	Admin	Green	Admin	Orange

Capabilities Purchased and Deployed

Capability	Purchased Capabilities	Deployed Capabilities	Capability	Purchased Capabilities	Deployed Capabilities	Capability	Purchased Capabilities	Deployed Capabilities
Tool / Capability 1			*Tool / Capability 3*			*Tool / Capability 6*		
Tool Module / Sub-Capability 1	X	X	Tool Module / Sub-Capability 1	X	X	Tool Module / Sub-Capability 1	X	X
Tool Module / Sub-Capability 2	X	X	Tool Module / Sub-Capability 2	X	X	Tool Module / Sub-Capability 2	X	X
Tool Module / Sub-Capability 3	X	X	Tool Module / Sub-Capability 3	X	X	Tool Module / Sub-Capability 3	X	X
Tool Module / Sub-Capability 4		X	Tool Module / Sub-Capability 4	X	X	Tool Module / Sub-Capability 4	X	X
Tool Module / Sub-Capability 5	X	X	Tool Module / Sub-Capability 5	X	X	Tool Module / Sub-Capability 5	X	X
Tool Module / Sub-Capability 6	X	X	Tool Module / Sub-Capability 6	X	X	Tool Module / Sub-Capability 6	X	X
Tool Module / Sub-Capability 7	X	X	Tool Module / Sub-Capability 7	X	X	Tool Module / Sub-Capability 7	X	X
Tool Module / Sub-Capability 8	X	X	Tool Module / Sub-Capability 8	X	X	Tool Module / Sub-Capability 8	X	X
Tool Module / Sub-Capability 9	X	X	Tool Module / Sub-Capability 9	X	X	Tool Module / Sub-Capability 9	X	X
Tool Module / Sub-Capability 10	X	X	Tool Module / Sub-Capability 10	X	X	Tool Module / Sub-Capability 10	X	X
Tool Module / Sub-Capability 11	X	X	Tool Module / Sub-Capability 11	X	X	*Tool / Capability 7*		
Tool Module / Sub-Capability 12	X	X	*Tool / Capability 4*			Tool Module / Sub-Capability 1	X	X
Tool Module / Sub-Capability 13	X	X	Tool Module / Sub-Capability 1	X	X	Tool Module / Sub-Capability 2	X	X
Tool Module / Sub-Capability 14	X	X	Tool Module / Sub-Capability 2	X	X	Tool Module / Sub-Capability 3	X	X
Tool Module / Sub-Capability 15	X	X	Tool Module / Sub-Capability 3	X	X	Tool Module / Sub-Capability 4	X	X
Tool Module / Sub-Capability 16	X	X	Tool Module / Sub-Capability 4	X	X	Tool Module / Sub-Capability 5	X	X
Tool Module / Sub-Capability 17	X	X	Tool Module / Sub-Capability 5	X	X	Tool Module / Sub-Capability 6	X	X
Tool / Capability 2			*Tool / Capability 5*			Tool Module / Sub-Capability 7	X	X
Tool Module / Sub-Capability 1	X	X	Tool Module / Sub-Capability 1	X	X	Tool Module / Sub-Capability 8	X	X
Tool Module / Sub-Capability 2	X	X						
Tool Module / Sub-Capability 3	X	X						

Contrast this View with the Field View on prior slide

Acquisition HQ View

8

Operational Impacts

- Capabilities are stove-piped vs. integrated
  - ❖ Reduced interoperability, duplication of capability, and tool proliferation
  - ➢ Implement a System Engineer / Architect to integrate systems / investments

- Training not tailored, timely, or recurring
  - ❖ Covered ancillary features and provided too early (>1 year ahead of tool)
  - ➢ Provide persistently available, feature and location specific training

- Capabilities deployed without direction or expectations for use
  - ❖ Multiple local adaptations and assumptions about Acquisition HQ intent
  - ➢ Deploy standardized tools with approved CONOPS, roles & responsibilities

- Capabilities only partially deployed or partially implemented at sites
  - ❖ Insufficient/EOL hardware, licensing, limited permissions limit capabilities
  - ➢ Synch HW investments with SW and socialize roles & responsibilities

- Requirements are not allocated to the Capabilities
  - ❖ Capabilities are added without verification or validation
  - ➢ Derive and validate requirements and verify Capabilities meet requirements

Questions?

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