Integrated Architecture-Based Portfolio Investment Strategies

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Agenda

- Present DoD Governance, Policies, and Directives
- Discuss gap in integrated architecture-based investment decisions
- Present our approach to fill this gap
  - Start with integrated architectures
  - Transition to executable architectures
- Present Portfolio Investment Analysis
  - PALMA™ – an investment analysis tool
- Present linking integrated and executable architecture analysis with investment portfolio selection
  - 6 step process
- Summary
Information Technology Portfolio Management: ITPM

Establishes DoD policy for managing Information Technology (IT) investments as portfolios to improve business and warfighting outcomes and capabilities.

“IT [Information Technology] investment policies are a cornerstone to enable change throughout the Department. …It is DoD policy that IT investments shall be managed as portfolios…using integrated strategic planning, integrated architectures, measures of performance, risk management techniques, transition plans, and portfolio investment strategies…Portfolio management processes shall be comprised of core activities: Analysis, Selection, Control, Evaluation and leverage principal Decision Support Systems (JCIDS, PPBE, and DAS)”
Three DoD Decision Support Systems

The Defense Acquisition System (DAS) - DoDD 5000.1 & DODI 5000.2
“Exists to manage the nation's investments in technologies, programs, and product support necessary to achieve the National Security Strategy and support the United States Armed Forces”….Assigns roles and responsibilities for “developing joint integrated architectures for capability areas as agreed to by the Joint Staff”

The Joint Capabilities Integration and Development System (JCIDS) - CJCSI&M 3170
“JCIDS implements a capabilities-based approach .... to identify improvements to existing capabilities and to develop new warfighting capabilities.... requires a collaborative process that utilizes joint concepts and integrated architectures to identify prioritized capability gaps and integrated DOTMLPF solutions .. to resolve those gaps.”

Planning, Programming, Budgeting, and Execution (PPBE) – MID 913
The DoD Resource Allocation System to “provide warfighter with best mix of forces, equipment and support attainable under fiscal constraints….new emphasis on using performance metrics to focus on output, return on investment”*
Portfolio Management Process

**Analysis**
Links objectives to vision, goals, priorities and capabilities, develop performance measures, identify gaps and risks

**Evaluation**
Measures actual contributions of portfolio towards improved capability and supports adjustments to the investment mix

**Selection**
Identifies and selects best mix of investments to achieve capability goals and objectives across portfolio

**Control**
Ensure investments within portfolios are managed and monitored to determine whether to continue, modify or terminate

Ref: OSD 03246-04
Currently, architecture-based investment decisions are not prevalent in DoD
We Seek To Fill This Gap

- By linking integrated architecture modeling and performance analyses with analytical methods and models used to identify optimal portfolios of investments
  - Will enable a robust analytical foundation for capability and architecture-based investment decisions
  - Will fully support critical DoD transformation goals, policies, and directives
Developing Integrated Architectures (IA)

- Start with fully integrated, unambiguous, and consistent DoDAF views using **Activity-Based Methodology (ABM)**

- **ABM** is a new paradigm for developing Integrated Architectures
  - Enables both “As-Is” (now) and “To-Be” (future) architecture development, gap-analysis, and assessment
  - Uses **data centric** architecture elements and product renderings and cross-product relationships based on core set of symmetrically aligned architecture elements
  - Incorporates built-in automation that
    - Ensures data consistency leading to quality architecture data and products
    - Results in more accurate and valuable architecture analysis not subject to misinterpretation

- **ABM** captures sufficient representations of “**static**” architectures to transition to “**dynamic**” executable process models

* Activity-Based Methodology is a concept developed by The MITRE Corporation and Lockheed-Martin, Copyright © 2003
Foundation of an Integrated Architecture

ABM Triple 3-Way Associations Between Core Elements

Role • Activity
Op Node

Op Node • Role
Op Activity

Sys Node • System
Sys Function

System • Function
Sys Node

Role • System
Org Unit

Org Unit • Role • System

Op Node

Info

Data

Function • Sys Node • System

Activity • Op Node • Role

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Integrated Architecture Represented as Conceptual Architecture Specification Model – “ASM”
ABM Workflow Steps to IA - Operational

Art of Architecture

Manual 3-way Associations

Op Nodes

Role

Data Entry

Activity

Info

Op Node

Role

Auto form 3-way associations

Activity

Info

NodeA

"Act1~RoleX"

NodeA

"Act1~RoleX"

RoleX

"NodeA~Act1"

Info Exchange

Render Information Exchanges

OV-2

Complete OV-2

Generate OV-3

Automation

Need Line

OV-2

Complete OV-2

Generate OV-3
What Are Executable Architectures?

Integrated “Static” Architectures

- Only shows that Activities “must be capable of” producing and consuming Information
- No Details on...
  - Event sequencing and ordering
  - How or what conditions information is produced and consumed
  - Producers/ consumers or other resources used

Executable “Dynamic” Architectures

- Goes beyond “must be capable of” producing and consuming Information
- Defines precise...
  - Sequential/ concurrent event flows, ordering & timing
  - Rules and conditions on which Information is produced and consumed
  - Details on producers and consumers – their numbers, process ordering, and when [not] available

**Defn**: Dynamic model of Activities and their event sequencing performed at Operational Nodes by Roles (within Organizations) using Resources (Systems) to produce and consume Information
Transforming DoDAF Views to “Dynamic” Views

Rules/Constraints

Process View

Resource Views

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Roadmap to Actionable Portfolio Investment Strategies

- Activities
- Roles
- Systems
- Nodes

System Architect™

DoDAF + Architecture Tools

Integrated Architectures

OV3 SV5 SV6

M&S Tools + Mission Scenarios

Bonapart™

Executable Architectures

Analytical Tools + Analysis Methods

PALMA™

Actionable Architectures

Portfolio Analysis Tools

Actionable Portfolio Investment Strategy
So What is A Portfolio Investment Analysis?

**Investment**
- Something on which I can expend funds

**Portfolio**
- DOTMLPF investments in the form of **materiel resources** (person, facility, equipment, platform, ...) or **non-materiel resources** (training, education, etc) required to accomplish a mission or outcome

**Portfolio Investment Analysis**
- Process for assessing pros and cons of different combinations of investments based on specific mission goals

*Defn*: Methods or processes to help decision makers select the “best” combination of investments from a set of potential investment options that will achieve mission-level performance objectives and outcomes in an efficient manner
PALMA™*

A Portfolio Investment Analysis Tool

- Decision support tool developed by MITRE that facilitates **Capability-Based** investment analysis
- Brings together
  - Investment options
    - Costs and what they do for you (detailed impacts)
    - How each fits into your overall goals (hierarchical decomposition of mission needs)
- Develops “**Efficient Frontier**”
  - Identifies unique portfolios options (and elements in each) providing most benefit at a specific budget or funding level
- **Strengths**
  - Sophisticated search algorithms derive optimal benefit/cost portfolio
  - Investment options planned over multiple years and separated by “colors” of money
  - Can conduct variety of “what-if” scenarios
  - Ability to identify critical paths so that for any model, one can determine where to direct a new investment to create the greatest marginal benefit

* **Portfolio Analysis Machine**
Building the PALMA “Strategy-to-Task” Tree

- Mission goal decomposed into its constituent activities, creating hierarchical decomposition or “strategy-to-task” tree

- “As-is” conduct of activities is related to “baseline” (or current) value they provide to the mission through a “scoring” process
  - Assessed as the lowest level of the tree

- Each activity is measured on a value scale of 0-100 based on how well it meets some criteria (i.e. requirements, success, risk, …)
  - Color representations for different score regions
    - 76-100 – exceeds criteria
    - 51-75 – meets criteria
    - 26-50 – partially meets criteria
    - 0-25 – does not meeting criteria

- “Roll-up rules” assessed to determine overall mission score based on individual activity scores
  - Roll up rules identify mathematical relationship between the “parent task” and its “children” in the “strategy-to-task” tree
Example PALMA “Strategy-to-Task” Tree

Roll-Up Rule: Weighted Average Mission = (0.6 x Activity 1) + (0.4 x Activity 2)
Generate the “Efficient Frontier”

For each investment
- Understand both cost and increase in value that would occur for each activity the investment impacts (e.g., if investment 1 is funded, the value of activity 1.1 will change from 30 to 60)

PALMA optimization algorithms generate the “Efficient Frontier”
- Portfolios that provide the greatest overall benefit (y axis) for a specific budget or funding level (x-axis)

Portfolio contains investments “N2” and “M5”
At a cost of $200, and a value/benefit of 58
Workflow Steps to an IA-Based Portfolio Investment Strategy

1. **Integrated Architectures**
2. **Warfighter Value**
3. **Executable Architectures**
4. **Portfolio Analysis Model (PALMA)**
5. **SME Value Assessment Functions**
6. $\beta = \text{Related to how well activity meets criteria (Value) vs how long it takes (Performance)}$
Summary

- Wide applicability within DoD and other Government Agencies

- Demonstrates way-ahead and shows value for an architecture-based investment decision-making process directly linked to mission objectives and their outcomes

- Provides a robust analytical foundation for capability and architecture-based portfolio investment decisions
  - Relate impact of any set of investment options to achievements of high level “strategic” objectives

- Architecture-based portfolio measurements and assessment of outcomes can help identify
  - Critical mission capabilities (keep)
  - Unnecessary duplication of mission elements (eliminate)
  - Gaps, overlaps, and deficiencies (recommend alternates [new?])

- Fully supports DoD transformation goals, guidelines, and policies
  - Showed how to transform and evolve organizations, processes and modes of operation to adapt to new roles, relationships, technologies, and capabilities