Architecting Command and Control Capability in the Networked Era

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Outline

• Background
  – Previous work on a hybrid C2 architecture development methodology
• Representing C2 architectures
• Integrating components of a hybrid methodology
• A common UML model for mapping component methodologies to DoDAF products
• Implementing a hybrid methodology
• Summary
Background

• Previous work: provided a reasoned, rational and traceable process for assembling a hybrid methodology

• Paper: *On Identifying a Methodology for Land C2 Architecture Development*.

• Adapted Avison and Fitzgerald’s framework to evaluate 13 candidate methodologies across a wide range of criteria
Summary of Development of a Hybrid Methodology

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IE has the highest score of 66.
Possible hybrid options (score 72):
- IE+SSADM - ‘hard’ system focus
- SSM+RUP+SSADM – ‘soft’ systems and object-oriented
Phases and Components of a Hybrid C2 Methodology

SSM – Soft Systems Methodology
RUP – Rational Unified Process
SSADM – Structured Systems Analysis and Design Method
Representing C2 Architectures

• C2 architecture is represented by a collection of design artefacts.
• Need to identify a ‘vehicle’ for C2 architecture representation that can unite elements of a hybrid methodology.
• Solution = DoDAF products.
Architectures, Architecture Frameworks and Tools

- Components
- Functions
- Interfaces
- Constraints
- Relationships
- Design Principles

Collectively form the

C2 Architecture

Support/ implement

Document/ describe

Architecture Tools

Architecture Frameworks

DoDAF

TV-n
SV-n
OV-n

Comprise the

Is one example of many

Is one example of many

System Architect

Implements the
Integrating components of a Hybrid Methodology

• Before a hybrid methodology can be used to populate DoDAF products and thus create a C2 architecture, there is a “missing link”.

• Issue is: not all components of a hybrid generate outputs that immediately fit into DoDAF. Therefore need an interface between Hybrid and DoDAF products.

• Solution = Common UML model.
  – Methodology stage CAN output something in UML compatible form.
An Integrated Hybrid C2 Methodology

Strategy  Feasibility  Analysis  Logical Design  Evaluation

SSM  SSADM  RUP  RUP  RUP

Common UML Architecture Model

C2 Architecture Description - DoDAF Products (TV-n, SV-n, OV-n)

I/P  O/P
A Common UML Model for C2 Architecture Development

• Common UML model provides a language for linking the inputs and outputs of the different components of the hybrid and evolves as the hybrid methodology is executed.

• As UML model evolves, the DoDAF representation of the architecture can grow in parallel, fed by the UML model.

• The input is processed through a methodology selected as most suited to C2 development, the output is that C2 architecture in DoDAF product form.

• We think this addresses the DoDAF issue of “how” to implement DoDAF in practice (not specified in DoDAF).
Evolving a Common UML Model

Common UML Model

C2 Architecture Description - DoDADF Products
(TV-n, SV-n, OV-n)
Implementing a Hybrid Methodology

- RUP to UML mapping is firmly established, but no immediately apparent link between SSM and SSADM components and UML.
- Hybrid phases can be mapped to a generic SE lifecycle model and UML diagrams are derived from the lifecycle, hence mapping between hybrid methodology phases and UML products.
- Specific UML products are created in the process (GRAPPLE).
- Reinforces link between methodology components, UML and then to DoDAF.
Lifecycle Model of C2 Architecture Development

- Use Case
- Sequence
- Collaboration
- Class
- State

- Package
- Class
- Deployment
- Activity
- Use Cases

- Object
- Activity
- Component
- Deployment

GRAPPLE
Populating the Common UML Model

- Activity Diagram
- Class Diagram
- Deployment Diagram
- Package Diagram
- Use Case Diagram
Summary

• Redress the deficiency of a lack of a systematic comparison and evaluation of approaches for architecting C2 systems.

• Key idea: a way to actually create the DoDAF representation of a C2 architecture.

• DoDAF says ‘what’ the products are, but not ‘how’ to generate them (although a few techniques are presented in the Deskbook).

• We try to show ‘how’ to generate them.