Integrated Framework For Executable Architectures Development

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Outline

– Problem Description
– Motivation
– Framework Description
  • Techniques and Tools
  • Related Work
– Framework Automation
– Conclusions
Problem Description

SoS integration

New capability

Existing capabilities

Force elements

Force structure
Problem Description / Motivation

Characteristics of System/Problem
- large
- ill-defined
- concurrent
- distributed
- probabilistic
- event-driven
- timed
- SoS integration

Static Models

Equivalent

Executable Models

DoDAF, DAF, MODAF, IDEF0, Business Process Modelling, TOGAF, IAF, Workflow models, UML, rich pictures, informal drawings

Techniques/Methods

CPN, Influence Nets, Bayesian Networks, State machines, Stochastic, Discrete-Event Systems

Implementation/Tools

C-MAP  CORE  PowerPoint  System Architect  DOORS  Visio  MindGenius  ExtendSim  OpNet  CPN Tools  CORESim  MATLAB  STK  Yeeper  COAST
Framework Description

1. Architecture design
   - Problem definition
   - Functional decomposition of the problem
   - IDEF0 diagram construction
   - Specification of rules and sequences
   - Specification of other architecture products as required

2. Architecture products
   - CORE tool architecture model implementation
   - Refinement of CORE schema

3. Synthesis of executable model
   - XML output
   - XQuery script and translation technology
   - CPN model construction (automatic and manual)
   - Construction of other executable models as required

4. Analysis of data produced by the executable model
Framework Description

**Problem Description**

**DoDAF**

**Domain Knowledge**

**Analysis**

**Change Schema**

**Results**

**Recommendations**

<table>
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<th>Option</th>
<th>Cost (mln $)</th>
<th>Readiness</th>
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</tr>
<tr>
<td>B</td>
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**CORE to CPN Tool**

(XQuery and Java)

**Input/Interpretation**
Framework Description

- DoDAF (US)
- Communication device
- Evolution
- Shared Repository
- Views are built from underlying data elements
- Visual and some textual representation of data
- Other similar Architecture Frameworks include
  - MoDAF (UK)
  - DAF (AU)
Framework Description Tools: CORE

- CORE and CORESim
- Integrated Systems Engineering tool
- Used during the requirements and analysis stages of building a systems architecture
- DoDAF 1.5 (current version)
- Graphical representation of functional and data requirements
- Collaborative
- Traceability
Framework Description Tools: Petri Nets

- Technique suited to the specification and development of concurrent and distributed systems
- Clear and intuitive graphical representation
- Mathematical foundations – sound methods for analysis
Framework Description Tools: Petri Nets

- Bipartite directed graph
  - Set of places
  - Set of transitions
  - Set of arcs
  - Associated annotation and initial marking

- Typically places represent resources and transitions represent events

- Analysis
  - Reachability
  - Invariant
  - Reduction
Framework Description: Related Work

- Raytheon Company
- MITRE Corporation
- Lockheed-Martin
- Defense Information Systems Agency (Arlington)
- George Mason University
- University of Arizona
Framework Automation

- Activities
- Nodes
- Information
- Triggers

Schema
- Data_Type
- Value

Rules (OV-6a)
- Initial Marking
Colour Petri Net (CPN) Model Construction

- Transition and Places
- Colour Sets and declarations
- CPN Layout
Conclusions

• Integrated framework for executable architectures
• Framework automation
• Applications
• Measures
Integrated Framework For Executable Architectures Development

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