ARCADIA: Model-Based Collaboration for System, Software and Hardware Engineering

An architecture-centric, tool-supported method

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1. Essentials of the Arcadia method
2. Arcadia-dedicated modeling workbench
3. Return on experiment
Requirements for a Scalable and Adaptable Method

Early validation in short decision loop

Multi-viewpoint trade-off analysis

How flexible and enduring?

ARCADIA
Architecture Analysis & Design Integrated Approach

Tooled-up ecosystem-wide collaboration

Multi-level impact analysis

How to improve agility and flexibility of overall engineering?
One Need Definition for all

Specialities know-how confronted to architecture

Need & Architecture driving IVVQ

One global method, adaptable/adapted to each domain

Specialty engineering: safety, perf, security, …

Efficiently support and secure the engineering collaboration
Early Validation: Specialties Know-How Confronted to Architecture

- Safety
- Performance
- Human Factors
- Security
- IVVQ, Product Line, Cost...

Multi-viewpoint trade-off analysis (see ISO 42010 standard)
Mastering Complexity through Multiple Abstraction Levels

System Engineering

Sub-Systems Engineering

Software/Hardware Engineering

Maintaining consistency across engineering phases
Using ARCADIA Engineering Models to Drive IVVQ

Define IVV Strategy

Focus on Functional Content and Architecture

Master Development Ups and Downs

Control Maturity of Deliveries

Optimize IVVQ Globally (incl. Enabling Systems / Test Means)

Operational Need, Functional Contents

System Components

Test Benches

Mission System
Radar
Receiver
Software/HW
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### Manage Information Complexity
- Automatic synthesis, simplification on diagrams, modelling aids
- Modularity (viewpoints and transitions)
- Separation of concerns through viewpoints and diagram layers

### Ease Capitalization
- Concepts
- Engineering rules
- Architectural assets
- Centralize information managed by specialized tools

### Manage a Common Reference Model
- Configuration management
- Collaboration between stakeholders (multi-user access on a shared model)
- Coupling with change management, test environments, documentation generation, etc.

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Arcadia-supporting tools are crucial for the best benefit of the method
Rationale for an Arcadia-Dedicated Workbench

Several Alternatives

- Arcadia method is tool-agnostic
- Tooling can be minimal… or sophisticated
- Profiling UML/SysML would be a natural option

Thales previous experiences with UML Profiling

- Poor adoption by system engineers
- Meta-models constrained by UML concepts
- Representations constrained by existing UML diagrams

Development of a dedicated workbench (DSL)

- Freedom both in language and representation
- Close to UML/SysML, interoperable with MODAF-like Architecture Frameworks
- Extensible in many ways for domain-specific purposes (Sirius / Eclipse EMF foundations)
Focus on Two Keys of the Arcadia Modeling Workbench

Hiding complexity: Model ≠ Representations

Actual Model Content

Graphical Representations

Layered / filtered diagrams for viewpoint visualization

System Architecture
Safety Viewpoint
Resource Viewpoint
Overview of the Modeling Workbench Main Features

Edition Tools
Layered diagrams, Tables, Editors
Overview of the Modeling Workbench Main Features

**Main Features**
- Embedded Methodological Guide
- Edition Tools
  - Layered diagrams, Tables, Editors

**System Analysis**
- Operational Analysis
- System Analysis
  - Formalize System Requirements
- Logical Architecture

**Edition Tools**
- Layered diagrams
- Tables
- Editors

**System Analysis**
- Transition From Operational Activities
- Define Actors, Missions and Capabilities
- Refined System Functions, describe Functional Exchanges

**Edition Tools**
- Common
  - Class Diagram Blank
  - Function Scenario
- Functional Chain Description
- Function Scenario
- Modes and States
- System Analysis
  - Contextual Mission
  - Contextual System Actors
  - Missions Blank
  - Missions Capabilities Blank
  - System Actors - Operational Actors
  - System Architecture Blank
  - System Data Flow Blank
  - System Function Breakdown
  - System Functions - Operational Activity
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Embedded Methodological Guide

Model Analysis
Semantic browser, Model check, Etc.
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**Iterative Transition Tools**
Traceability, Generation

**Logical Architecture**

**Physical Architecture**

[Diagram of Logical and Physical Architecture with various elements and connectors, indicating the iterative transition tools and model analysis features.]
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Librairies, Patterns, Etc.

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Model Monitoring
Progress, metrics

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Librairies, Patterns, Etc.

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**Extensibility**
New diagrams, new layers, M2 extensions, Etc.

**Model Monitoring**
Progress, metrics

**Modularity & Reuse**
Libraries, Patterns, Etc.

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**Quick demonstration!**

_THALES_
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Return on experiment

Proven Benefits

- A strong lever for engineering transformation
- Field-proven in real industrial situations
- Leading to a better mastering of products, costs and cycles
- Improving architecture quality and sharing as well as IVV mastering

Deployed or under adoption in various Thales divisions, including industrial partnerships
Critical Information Systems
- Ground Exploitation Systems
- Command & Control (air, sea, railways…)
- Large secured Communication Networks…
- Satellite Control Networked Ground Stations

Embedded Systems
- Combat Systems (Radar, Self Protection, Optronics…)
- Mission Systems (Air, Sea, Ground)
- Satellite Constellations
- Avionics Suites
- Computing Systems
- Electrical Power Systems
- Thermal Cooling Systems
- Railways signalling Systems

### Engineers trained per year 500+
### Daily users 1000+
### Projects 50+
### Diagrams / Models 1,5M+
### Nodes / Diagrams 1,5M+
### Model elements (« EObjects »)
Thank you for your attention!

Any Questions?