Systems Modeling with the ARCADIA method and the Capella tool

www.prfc.fr
Introduction

- Pascal Roques: senior consultant, 25 years of experience
  - SADT, OMT, UML, SysML, ARCADIA

- UML2 and SysML Certified by the OMG

- Co-founder of the SysML France association

- Trainer for Thales on ARCADIA / Melody
  - 80+ sessions, 1000+ trainees
  - Part of Clarity project

- Author of the most widely read books in France on UML ... and of the first French book on SysML
Objectives and Prerequisites

- Objectives
  - Know the main principles and objectives of the ARCADIA method
  - Know (a part of) the possibilities of the Capella tool
Agenda

1. ARCADIA principles
2. Capella in action
3. Conclusion
MBSE: 3 pillars

Language

Tool

Method
ARCADIA

- **ARCADIA = ARChitecture Analysis and Design Integrated Approach**

  - “Model-based engineering method for systems, hardware and software architectural design”

- Developed by Thales between 2005 and 2010 through an iterative process involving architects of all business domains

- ARCADIA promotes a viewpoint-driven approach (as described in ISO/IEC 42010) and emphasizes a clear distinction between need and solution
ARCADIA: Global View

What the users of the system need to accomplish

What the system has to accomplish for the users

How the system will work to fulfill expectations

How the system will be developed and built
Capella Big Picture
Case Study
Case Study
Case Study

Operational Analysis
- Define Stakeholder Needs and Environment
  - Capture and consolidate operational needs from stakeholders
  - Define what the users of the system have to accomplish
  - Identify entities, actors, roles, capabilities, activities, concepts

System Analysis
- Formalize System Requirements
  - Identify the boundary of the system, consolidate requirements
  - Define what the system has to accomplish for the users
  - Model functional dataflows and dynamic behaviour

Logical Architecture
- Develop System Logical Architecture
  - See the system as a white box: define how the system will work
  - So as to fulfill expectations
  - Perform a first trade-off analysis

Physical Architecture
- Develop System Physical Architecture
  - How the system will be developed and built
  - Software vs. hardware allocation, specification of interfaces, deployment configurations, trade-off analysis

Formalize Component Requirements
- Manage industrial criteria and integration strategy: what is expected from each designer / sub-contractor
- Specify requirements and interfaces of all configuration items
Case Study

Operational Analysis

Define Operational Entities and Capabilities

- [OEBD] Create a new Operational Entity Breakdown diagram
- [OCBI] Create a new Operational Capabilities diagram

Define Operational Activities and describe Interactions

- [OABD] Create a new Operational Activity Breakdown diagram
- [OAIB] Create a new Operational Activity Interaction diagram
- [OASI] Create a new Operational Activity Scenario

Allocate Operational Activities to Operational Actors, Entities or Roles

- [OABI] Create a new Operational Architecture diagram
Case Study (OAB)

What the users of the future system need to accomplish
Case Study (OEBD)

Breakdown Diagrams are always complete!
Agenda

0. Capella Basics
1. Operational Analysis
2. System Analysis
3. Logical Architecture
4. Physical Architecture

Capella
Case Study (SAB)

What the system has to accomplish for the users
Case Study (SAB + CE)
Case Study (SAB + filters)

Different views of the same diagram!
### Case Study (SA – OA Realization Links)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Get Time</th>
<th>Wake Up</th>
<th>Get News</th>
</tr>
</thead>
<tbody>
<tr>
<td>Get Time</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set Current Time</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set Alarm Time</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Listen To Radio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set Radio</td>
<td></td>
<td>X</td>
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<tr>
<td>Display Time</td>
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<td></td>
<td>X</td>
</tr>
<tr>
<td>Manage Clock</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manage Alarm</td>
<td>X</td>
<td></td>
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<tr>
<td>Broadcast Radio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receive Radio Waves</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Emit Radio Waves</td>
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</tr>
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</table>

**Traceability is key!**

<table>
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<tr>
<th>$\text{OE}$</th>
<th>House</th>
<th>$\text{OE}$</th>
<th>Room</th>
<th>Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>User</td>
<td></td>
<td>$\text{OE}$</td>
<td>Room</td>
<td></td>
</tr>
<tr>
<td>Radio Transmitter</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Case Study (SES)
Case Study (S&M)
Case Study (SES + S&M)
A Function can be allocated only once!
Only leaf Functions are meaningful
Case Study (LDFB)

Only leaf Functions are meaningful
Functional Chains are important
Case Study (Transition + LFCD)
Case Study (LAB + FC)

Traceability for Functional Chains
Case Study (Transition + LES)

 Initialization from SES!
Agenda

0. Capella Basics
1. Operational Analysis
2. System Analysis
3. Logical Architecture
4. Physical Architecture
Capella will provide soon basic demonstration viewpoints
  • Mass, Cost and Latency
Combined with Kitalpha, it also provides an API for viewpoint development
Agenda

1. ARCADIA principles

2. Capella in action

3. Conclusion
MBSE: 3 pillars

- Language
- Tool
- Method

- Capella
- ARCADIA
Links between viewpoints!
Capella Differentiating Features

- Methodological Guidance
- Semantic Color Map
- Semantic Browser
- Computed Links
- Advanced Diagram Management
- Model Checking
- Semantic Delete With Preview
- Replicable Elements And Libraries
- System/Subsystems Transition
- Multi-Viewpoint
- ...

The page number is 40.
To Learn More...

Web Sites:

- www.polarsys.org/capella/index.html
- www.prfc.fr
- pascalroquesformationconseil.blogspot.fr/
- www.incose.org/
- www.afis.fr

- Introduction to ARCADIA with Capella: 1 day
- Capella in action: 4 days
Homework!

Evaluate the sessions at www.eclipsecon.org

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