MBSE with ARCADIA / Capella
Clock Radio Example
Introduction: Pascal Roques

- Senior Consultant, 30 years of experience
  - SADT, OMT, UML, SysML, Arcadia/Capella

- UML2 and SysML Certified by OMG
- ASEP Certified by INCOSE

- Arcadia/Capella Trainer for Thales since 2008
  - 150+ sessions, 1500+ trainees

- Member of Capella

- Author of UML/SysML best-sellers in France
- … and of the first Capella book!

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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
The Alarm Clock sample model is shown on a set of slides illustrating how to use Capella 1.3.0 in an iterative and incremental way to build a simple but representative model.

At this stage it describes:
- Operational Need Analysis,
- System Need Analysis,

Next steps:
- Logical Architecture,
- Physical Architecture.

We also illustrate the use of Requirements and Property Values.
Case Study

1. Operational Analysis
2. System Analysis
3. Logical Architecture
4. Physical Architecture
Complements

www.prfc.fr
Case Study: Capella Launched
Case Study: Welcome Page

First Steps
Getting started with Capella

New Capella Project
Run the wizard to create a new Capella Project

Import Existing Project
Run the wizard to import an existing Capella Project

Help Contents
Access to Help Contents about Capella and dedicated Viewpoints

Visit Capella Website
Read Case-Studies, attend to Upcoming Events, access to Training and Coaching, etc.

Visit Capella Wiki
Watch “how-to” and demonstration screencasts, learn more about the next evolutions and roadmaps, access to development resources, etc.

Visit Capella Forum
Access the discussion board and post a general question about Capella tooling, Arcadia methodology, about how to model some specific parts of your system, etc.
Case Study: Model Created

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, activities, concepts

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
- See the system as a white box; define how the system will work so as to fulfill expectations
- Perform a first trade-off analysis

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

Physical Architecture
- Formulate Component Requirements
- Manage industrial criteria and integration strategy
- What is expected from each designer/sub-contractor
- Specify requirements and interfaces of all configuration items

EPBS
Case Study: Activity Explorer

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
- [OABI] Create a new Operational Activity Interaction diagram
- [OAS] Create a new Operational Activity Scenario

Allocate Operational Activities to Operational Actors, Entities or Roles

- [OABI] Create a new Operational Architecture diagram
Case Study: OCB

What the users of the future system need to accomplish
Case Study

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Case Study: System Mission Transition

What the system has to accomplish for the users

Selection Dialog

Selection Wizard

- System Capability
- System Mission

Select a name to find
?= any character, * = any string

- ClockRadio
  - Operational Analysis
  - Operational Capabilities
    - Wake-up on time
Case Study: Mission

System Analysis

Operational Analysis

System Analysis
Formalize System Requirements

Logical Architecture

Mission

Editing of the properties of an object Mission

Capella | Description | Extensions | Management
---|---|---|---
Wake-up user on time

Involved Actors: <undefined>

Exploited Capabilities: <undefined>
Case Study: SMCB first version
Case Study: SMCB with Actors
Case Study: Partial SAB per Capability
Case Study: Partial SAB per Capability
Case Study: Partial SAB per Capability
Case Study: Global SAB first version

What the system has to accomplish for the users
Case Study: SAB + Component Exchanges
Case Study: SAB + Filters
Case Study: SAB + other Filters

Different views of the same diagram!
Case Study: SAB + Functional Chains
Case Study: Semantic Browser
Case Study: Data Modeling (start)
Case Study: Links between CE, FC, EI...
Case Study: SES Example

On previous evening

- alarm on/off
- alarm display
- new alarm time

OPT
- new frequency
- new volume

radio sound

(c) WHEN current time = alarm time
Case Study: SES Example with Functions
Case Study: SES Example with 2 Actors
Case Study: Modes

[Diagram showing a state transition model for modes of a clock radio, with states including Radio OFF, Radio ON, do/Broadcast Radio, Radio AUTO, Silent, and Alarm. Transitions are labeled with conditions such as (WHEN) current time = alarm time and (AFTER) Alarm Timeout.]
Case Study: Data Modeling (Enhanced)
Case Study: SES + Modes
## Case Study: Semantic Browser (more)

![Diagram of Semantic Browser](image)

### [System Function] Manage Alarm

<table>
<thead>
<tr>
<th>Referencing Elements</th>
<th>Current Element</th>
<th>Referenced Elements</th>
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</thead>
<tbody>
<tr>
<td>Allocating System</td>
<td>Manage Alarm</td>
<td>Active In Modes</td>
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<tr>
<td>Clock Radio</td>
<td></td>
<td>Radio AUTO</td>
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<tr>
<td>Functional Chains</td>
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<td>Radio OFF</td>
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<tr>
<td>Alarm Mgt FC</td>
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<td>Radio ON</td>
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<td>Radio Mgt FC</td>
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<td>Incoming Functional Exchanges</td>
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<td>Out Flow Ports</td>
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<td>alarm on/off</td>
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<td>Set Alarm</td>
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<td>current timestamp</td>
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<tr>
<td>Manage Time</td>
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<td>new alarm time</td>
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<td>Manage Alarm</td>
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<td>Root System Function</td>
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<td>All Related Diagrams</td>
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<td>[SAB] Clock Radio</td>
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<td>[SAB] Clock Radio External View</td>
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<td>[SAB] Clock Radio Functional View</td>
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<td>[SAB] Clock Radio with CEs</td>
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<td>[SAB] Clock Radio with FCs</td>
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<td>[SAB] Emit Sound</td>
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<td>[SAB] Manage Alarm</td>
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<td>[SES] Alarm Scenario with 2 Actors</td>
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<td>[SES] Nominal Alarm Scenario</td>
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</tbody>
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Case Study

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Work In Progress...
Case Study

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Work In Progress…
To Learn More...

Web Sites:

- www.polarsys.org/capella/index.html
- www.prfc.fr
- www.clarity-se.org/
- www.incose.org/
- www.afis.fr