Hands-On Systems Modeling with ARCADIA / Capella
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 / Capella
  - 100+ sessions, 1200+ 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
- Practice (a part of) the possibilities of the Capella tool

**Prerequisites**
- Bring a Laptop with Capella 1.0!
1. ARCADIA principles

2. Capella in action

3. Conclusion
MBSE: 3 pillars

Language

Tool

Method

Capella
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
Agenda

1. ARCADIA principles
2. Capella in action
3. Conclusion
Agenda

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

Capella

« Basic Viewpoints »

Coupled Viewpoints

Decoupled Viewpoints

Upstream Engineering Workbench

Transition bridge

(e.g. NAF)

Operational needs

System

Logical Architecture

Physical Architecture

EPBS

MDE Runtime Environment

Bridge

Perfo. VP

Performance Engineering

MDE Runtime Env.

Safety VP

Safety Engineering

Cost VP

Transition bridge

Downstream Engineering Workbench

(e.g. UML, DSLs, etc.)

Code Generation

International Standard

ISO/IEC 42010

Systems and software engineering — Architecture description — Information on the application of this standard — Glossary of terms

eclipsecon France 2016
Agenda

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

First Steps

Getting started with Capella

- **New Capella Project**
  Run the wizard to create a Capella Project

- **Import Capella Project**
  Run the wizard to import a Capella Project

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

- **Visit the Capella Forum**
  Access the discussion board and post a general question about Capella tooling, Sys-EM / Arcadia methodology, about how to model some specific parts of your system, etc.
Case Study

Workflow of ClockRadio

1. 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

2. 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 behavior

3. 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

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

5. 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
- [OCB] Create a new Operational Capabilities diagram

Define Operational Activities and describe Interactions

- [OABD] Create a new Operational Activity Breakdown diagram
- [OAIR] Create a new Operational Activity Interaction diagram
- [OAS] Create a new Operational Activity Scenario

Allocate Operational Activities to Operational Actors, Entities or Roles

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

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

Breakdown Diagrams are always complete!
Agenda

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Case Study (System Mission)

What the system has to accomplish for the users
Case Study (Mission)

Mission

Editing of the properties of an object Mission

- Name: Wake-Up User On Time
- Summary:
- Involved Actors: <undefined>
- Exploited Capabilities: <undefined>
Case Study (MCB)

Create a new Mission and / or Capability Blank diagram.

Create a System Actors / Operational Entities Traceability Matrix.

Wake-Up User On Time

Control Alarm
Manage Current Time
Emit Sound

ClockRadio - Activity Explorer
[MCB] Clock Radio Capabilities - Mission Capabilities Blank

Palette

Tools

Actor
Mission
Capability
Capability Exploitation
Involved Actor
Extends
Includes
Capability Generalization
Actor Generalization
Actors
Capabilities
Missions
Relationships
{C} Constraint
Case Study (Capabilities)
Case Study (Capabilities)
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 (SES)
Case Study (S&M)
Case Study (SES + S&M)

User

Clock Radio

The previous evening...

alarm on/off

alarm time

OPT

frequency

volume

radio sound

radio

Silent

Ringing

Silent

(C) Alarm Time

alarm timeout
Case Study (Data Modeling)

ClockRadio - Activity Explorer  [SCDB] Time - Class Diagram Blank  

Classes
- Data Package
- Class
- Numeric Type
- Numeric Reference
- Property
- Class Operation
- Parameter
- Association
- Collection Type
- Data Packages
- Types
- Data Values
- Relationships
- {C} Constraint

- current time
- alarm time
- timestamp
- timestamp display

newCT
newAT
newTimestamp
ct

Timestamp

h : Hour
mn : Minute

Minute
[min] = 0
[max] = 59

Hour
[min] = 0
[max] = 23

31
Case Study (CE, FC, EI... )
Case Study (LAB)
Case Study (Transition + LES)

Initialization from SES!
Agenda

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www.prfc.fr
Capella provides 3 basic demonstration viewpoints:
- Mass,
- Price,
- Performance (Latency)

Combined with Kitalpha, it also provides an API for viewpoint development.
PAB with Viewpoints: Basic Price
Agenda

1. ARCADIA principles
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www.prfc.fr
MBSE: 3 pillars

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Capella
Links between viewpoints!
Capella Differentiating Features

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

Web Sites:

- www.polarsys.org/capella/index.html
- www.prfc.fr
  - Introduction to ARCADIA with Capella: 1 day
  - Capella in action: 4 days
- www.clarity-se.org/
- www.incose.org/
- www.afis.fr
Do not forget!

“All models are wrong but some are useful.”

- George Box
Homework!

Evaluate the Sessions

Sign in and vote at eclipsecon.org

-1  0  +1