Open-Sourcing the Model-Based Systems Engineering Solution Capella

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Reminder
Capella, a Workbench for System Architectural Design
Objective of the talk

- Not a talk about Capella features!
  - Methodological browser
  - Semantic browser
  - Computed links
  - Advanced diagram mgt.
  - Validation & quick fixes
  - Semantic delete
  - Replicable elements
  - Patterns
  - HTML generation
  - Transition to sub-systems
  - Multi-viewpoint mgt.

- Available at http://www.polarsys.org/capella/
- Not a talk about Capella open-source project!
  - Project architecture
  - Development infrastructure
  - Development process
  - Change management
  - Release engineering
  - Quality assessment
  - Planning
  - Governance
  - Community
  - Committers

- Available at https://polarsys.org/wiki/Capella/Technical_Information
A talk about the open-sourcing of an originally in-house (Thales) MBSE solution!

Focus
- Motivations
- Challenges
- Some elements on the implementation
Context
R&T flow at Thales: coming of age of the Capella MBSE tool (2001-2010)
Schedule of the open sourcing

- **2014-07-30**: Submission of the proposal.
- **2014-09-10**: Project proposal has been approved and the Capella project has been created.
- **2014-10-06**: Initial CQ contribution of Capella for Intellectual Property review.
- **2014-10-12**: Capella dissemination means (Support Forum and Wiki) are born.
- **2014-11-20**: Capella technical infrastructure (Hudson, Code repository) is setup.
- **2014-12-08**: Capella "pre-release" build 0.8RC is available.
- **2015-01-30**: Capella IP review has been approved.
- **2015-02-13**: Capella 0.8.1 Release Review has been submitted.
- **2015-03-20**: Capella 0.8.1 IP Log has been submitted.
- **2015-04-02**: Capella 0.8.1 Release Review has been approved.
- **2015-04-06**: Capella 0.8.1 is available for download.
- **2015-06-05**: Capella 0.8.2 Release Review has been submitted.
- **2015-06-04**: Infrastructure has been enhanced with the use of SonarQube and PolarSys Maturity Assessment.
- **2015-06-30**: Capella 0.8.2 has been released.
Outline

1. Context
2. Motivations
3. Challenges and Implementation
4. Conclusion
Collective intelligence for a safer world

Whenever critical decisions need to be made, Thales has a role to play. In all its markets — aerospace, space, ground transportation, defence and security — Thales solutions help customers to make the right decisions at the right time and act accordingly.

World-class technology, the combined expertise of 65,000 employees and operations in 56 countries have made Thales a key player in keeping the public safe and secure, guarding vital infrastructure and protecting the national security interests of countries around the globe.

A balanced revenue structure

<table>
<thead>
<tr>
<th>Defence</th>
<th>Civil</th>
</tr>
</thead>
<tbody>
<tr>
<td>55%</td>
<td>45%</td>
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Revenues in 2012

€14.2 billion euros

Shareholders
(at 31 May 2013)

- French State 27%
- Dassault Aviation 26%
- Float 47% of which employees 3%
Motivation
Thales: Markets we serve

Dual markets
Military & Civil

TRUSTED PARTNER FOR A SAFER WORLD
Motivation
Thales: Global leadership

No. 1 worldwide
- Payloads for telecom satellites
- Air Traffic Management
- Sonars
- Security for interbank transactions

No. 2 worldwide
- Rail signalling systems
- In-flight entertainment and connectivity
- Military tactical radiocommunications

No. 3 worldwide
- Avionics
- Civil satellites
- Surface radars

€14 billion in revenues
Motivation
Needs for an Engineering Transformation

Facts

- Model Driven Engineering, BUT...
  - ... Slow & painful modeling deployment
  - ... COTS are not well adapted to industrial needs
  - ... Tool vendor dependencies are too constraining

Define a method & provide dedicated tooling

- Specified, designed & developed from operational needs
- With the following capabilities
  - Better quality of the systems
  - Better productivity of engineering activities
  - Ease of Use
  - Early validation
  - Integration, seamlessness, coherency, traceability
  - Best practice & know-how capitalization
  - Performance & scalability
  - Configuration management
  - Collaborative engineering
Motivation
Capella Operational Deployment within Thales

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
# Motivation

Why Open Sourcing? : Rationale

<table>
<thead>
<tr>
<th>Engineering Env. sharing</th>
<th>- Increasing need for sub/co-contracting</th>
</tr>
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</table>
| Investment preserving    | - Engineering proprietary solutions future at stake  
                           | - Sustainability through (de facto) standardisation |
| Costs & risks sharing    | - A critical mass is needed  
                           | - Sharing maintenance & evolution costs  
                           | - Enhancement opportunities from the community |
| Focusing on competitive advantages | - Focus now on in-house know-how capitalisation  
                                      | - Further productivity & quality improvement solutions |
| ... And it is the right time | - Industrial needs are shared  
                               | - MBSE trend is established  
                               | - The Open Source environment is ready (PolarSys) |
Motivation
Toward Open innovation in the large

Phase 1:
Close partnership
Get Open Source competence

Phase 2:
Sharing the technical platform

Phase 3:
Open innovation in the large

« Hosted by »
Kitalpha

« Built upon »
Capella

Other logos: MBAT, AGeSys, MERge, CRYSTAL, Clarity, PolarSys, eclipse
Motivation
Open Innovation at Work

COMMUNITIES
- Sharing
- Standardisation
- Communities

SERVICE PROVIDERS
- Consulting
- Training
- Deployment

END-USER ORGANIZATIONS
- Evaluation
- Consolidation
- Collaborations

TOOLS & TECHNO PROVIDERS
- Technologies
- Tools
- Commercialisation

RESEARCH & ACADEMIA
- Academic training
- Engineers
- Research

Capella
Motivation
Open innovation at work – to community dynamics
Motivation
Open innovation at work – to community dynamics
Implementation
Preliminary Activities

- Define the most appropriate business model
  - MBSE market specificities
- Convince the top management
- Create the framework allowing to implement an open innovation strategy for MBSE
  - Eclipse was not the proper host anymore
  - Polarsys genesis
- Open sourcing Capella and the components it uses
  - Sirius, Kitalpha, EGF…
  - Business models impacts
- Create the appropriate environment
  - Clarity collaborative project
  - Industrial partners, technology providers and services companies
Implementation
Capella: The big picture

« Basic Viewpoints »

Coupled Viewpoints

Decoupled Viewpoints

Upstream Engineering Workbench

(e.g. NAF)

Transition bridge

Capella

Operational needs

System

Logical Architecture

Physical Architecture

EPBS

Downstream Engineering Workbench

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

MDE Runtime Environment

Performance Engineering

MDE Runtime Env.

Safety Engineering

Bridge

Bridge

Bridge

Cost VP

Safety VP

Perfo. VP

Code Generation
Vision: Capella as a Backbone of the Engineering Activities

- Requirements Management
- Transition from Architecture Frameworks
- Transition to Sub-Systems
- Product Line Management
- Monitoring & Metrics
- Configuration Management
- Versioning
- Operational Need Analysis
- System Need Analysis
- Logical Architecture
- Physical Architecture
- End Product Structure Breakdown
- IV&V Management
- Safety Analysis
- Simulation
- Transition to Software Design & Code generation
- Extensibility through Viewpoints (Specialty Engineering, e.g. cost, performance, human factors, etc.)
Implementation
Sharing: What to Give and What to Keep?

Value

Focus on one’s value
- Keep as competitive Advantage

Share
- Co-develop
- Contribute
- Use

Expertise, Know-how, Core business

Domain end-user solutions

Domain platform

Technical platform
Implementation
Sharing: What to Give and What to Keep?

Viewpoints:
• Specialty Eng.
• Architecture styles
• Etc.

Advanced MDE:
• Teamworking
• Smart tools
• Etc.

Capella
Kitalpha
Sirius
emf
diff/merge
Eclipse
EGF
Eclipse Generation Factories
eclipse

Focus on one’s value
- Keep as competitive Advantage

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Implementation

Preliminary Activities: splitting a huge component into several ones

- **Keeping some parts internal**
  - For business related reasons,
  - For technical reasons,
  - For licensing reasons,
  - ...

- **Define what will be open sourced**
  - Before: one internal component
  - After: open source components and proprietary components
• **Understand what open sourcing Melody Advance means**
  - Clarifications to reach a mutual understanding (Obeo and Thales)

• **Size and refactoring**
  - Melody Advance: 100 p.y effort and more than 1 million of lines of code ➔ Huge refactoring effort
  - Obeo used its open sourcing experience to estimate
  - Specific parameters: IP, dependencies, used components open sourcing (e.g. Sirius & Kitalpha)

• **Overall effort for open sourcing: 2 p.y**
Implementation

Technical challenges

- **Artifacts renaming**
  - Melody Advance → Capella.
  - Impact on tools using Melody/Capella inside Thales.
  - APIs changes.

- **Infrastructure**
  - From a proprietary infrastructure to an open source one

- **Intellectual Property**
  - Open sourcing a component, especially an Eclipse component, means a huge IP verification effort.
■ **Window of opportunity**
  - Very small.
  - One uncontrollable item: Eclipse IP team contribution $\rightarrow$ risk regarding the timing.
  - Large amount of work made before those activities to lower the associated risk probability.
  - Ongoing developments during all those activities.

■ **Transparency**
  - Going open source is also becoming transparent:
    - Communications, web site, forums…
    - Processes changes.
    - Work philosophy.
Today: in Clarity

Before: a first organization
- Eclipse Foundation and Polarsys
- Definition of Capella leaders & commiters
- Definition of a Polarsys solution
- Community Management

Community management is a priority
Conclusion

Thank you! Questions?

- **Capella website:**
  http://www.polarsys.org/capella/

- **LinkedIn**
  http://www.linkedin.com/company/capella-modelling-workbench

- **Twitter**
  https://twitter.com/capella_arcadia

- **Arcadia forum**
  https://polarsys.org/forums/index.php/f/12/

- **Capella forum**
  https://polarsys.org/forums/index.php/f/13/

- **IFE model & doc.**
  http://www.polarsys.org/capella/start.html