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Model-driven engineering – solutions for software intensive systems

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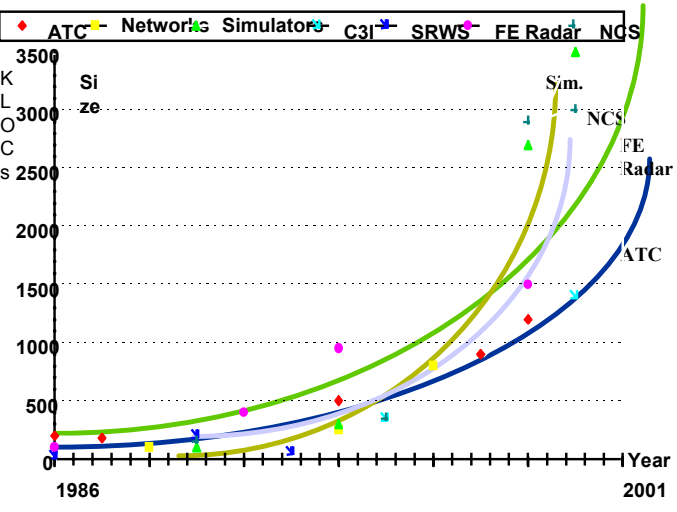
Management of Complexity and Separation of problems

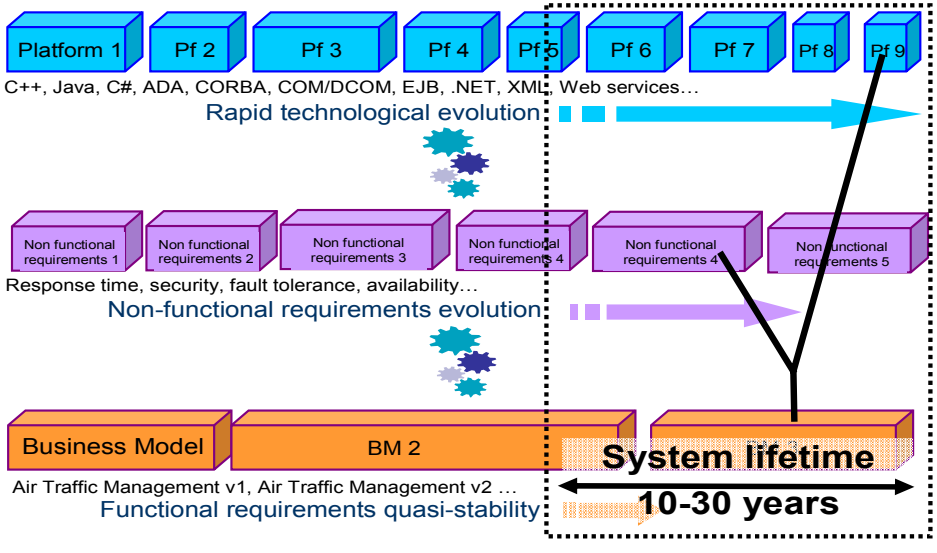


Every 5 years, the size of SW systems is multiplied by 5 to 10.

Functional aspects
Quality of Services
Technological platforms

3 different aspects

3 different life cycles



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Why Model-driven Engineering ?

Strategic objectives

- Safeguard from **future technological evolutions.**
- Capitalise our knowledge (technical or domain)
- **Improve the development and maintenance of our systems (quality and productivity).**
- Facilitate subcontracting / the **collaboration** with our partners during full life cycle development.

MDE : technological answer

- **Separation** of concerns and aspects (functional, quality of services, domain, technological).
- Formalise our knowledge in precisely **defined language**.
- **Automatise** development activities (traceability, impact analysis, model check, test, doc generation, code generation, ….)
- **Build reusable assets** including domain, technical and technological Engineering aspects.

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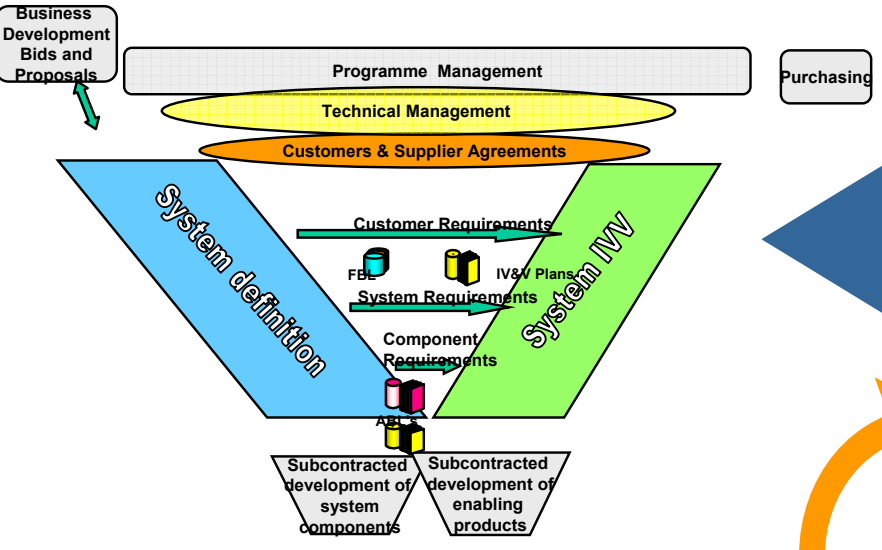
MDSysE: a model-driven solution for software intensive systems

MDSysE

Building a model-driven systems engineering methodology



Model-driven methods

-What model work products?
-Concepts & notation, modelling rules
-Traceability principles and means
-Verification rules and means
-Automation rules
-Configuration mgt
-Tooling

MDSysE

LEVERAGE

INFLUENCE

Standard modelling languages

UML 1.4

UML 2.0

UML for SE Profile

QoS UML 2 Profile
SPT UML 1.4 Profile

Testing Profile

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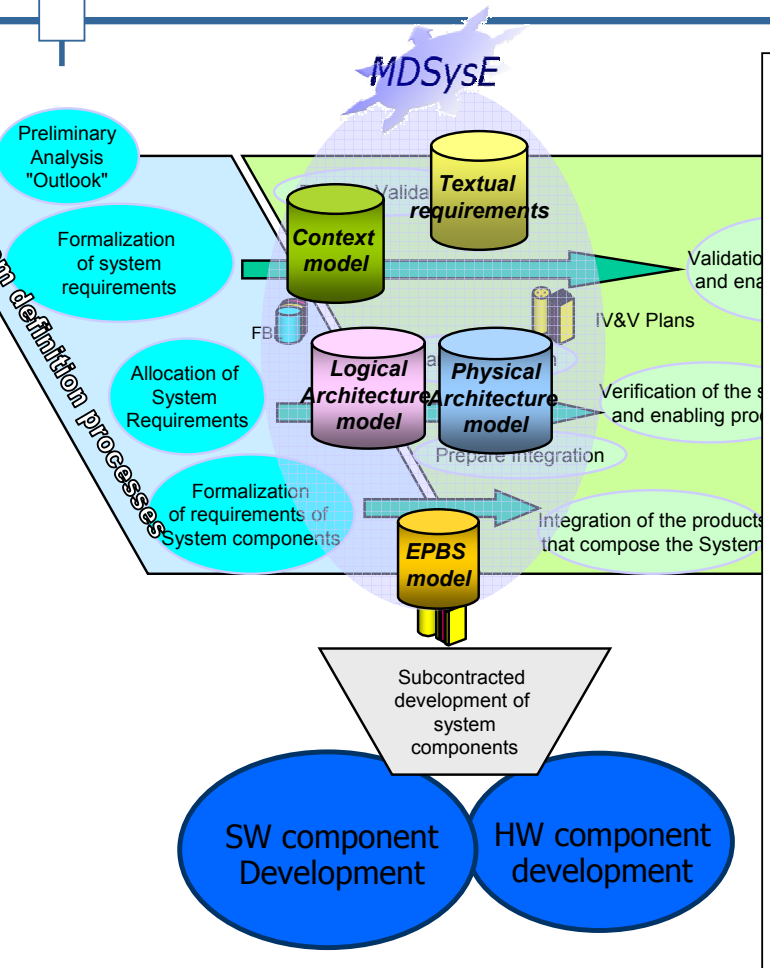
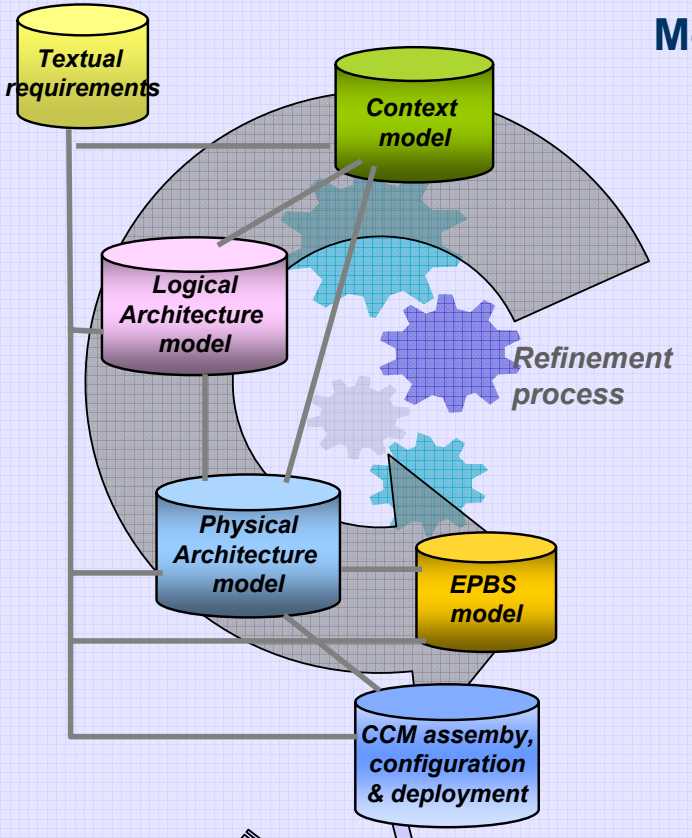
A model-driven solution for software intensive systems

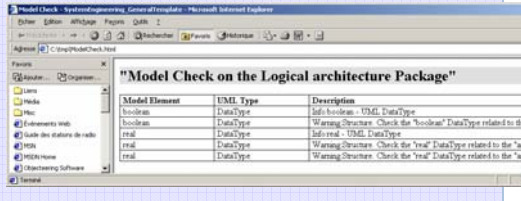


- Efficient, precise capture of systems information in an **integrated, modular** way.
- **Continuous transition to system development processes** (software and hardware development processes), with continuous traceability.
- **Incremental, automated verification** is for a significant part built in the model-driven process.
- **Integration & deployment** support targeting CCM middleware.
- **Automation** of a number of production and verification tasks through the MDSysE Tools.



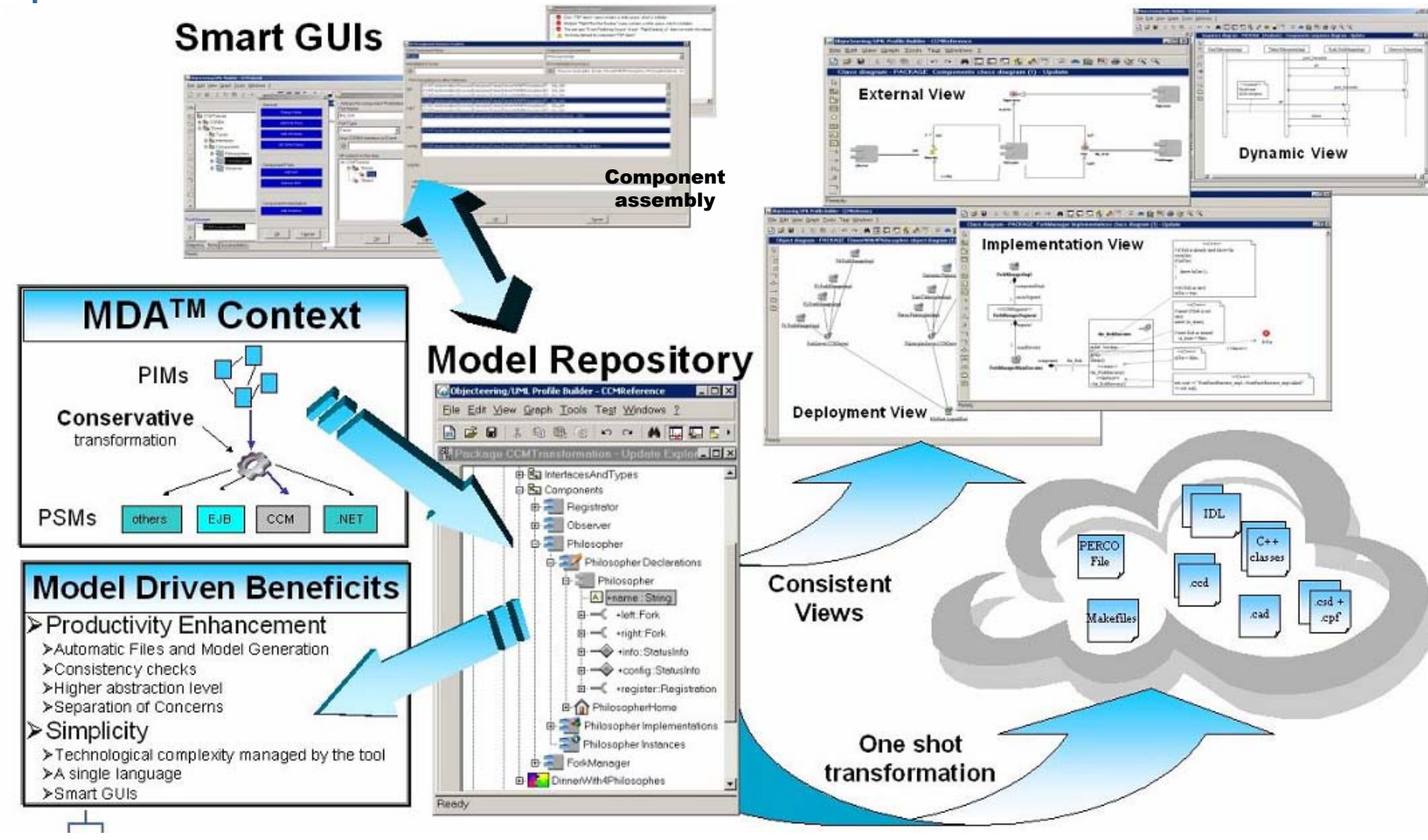
Modelling environment extending Modelling COTS

- **Assisted edition:**
  - high-level system edition wizards, "correct by construction"
  - automated model initialisation & synchronisation
  - automatic view generation
- **Automated verification:**
  - Traceability mechanism
  - Impact analysis
  - Consistency checking
  - Quality metrics



- **CCM assembly, configuration and deployment support:**
  - PIM-PSM transformation
  - Automatic meta-data/configuration files and code generation

Tooling: CCM assembly, configuration and deployment support



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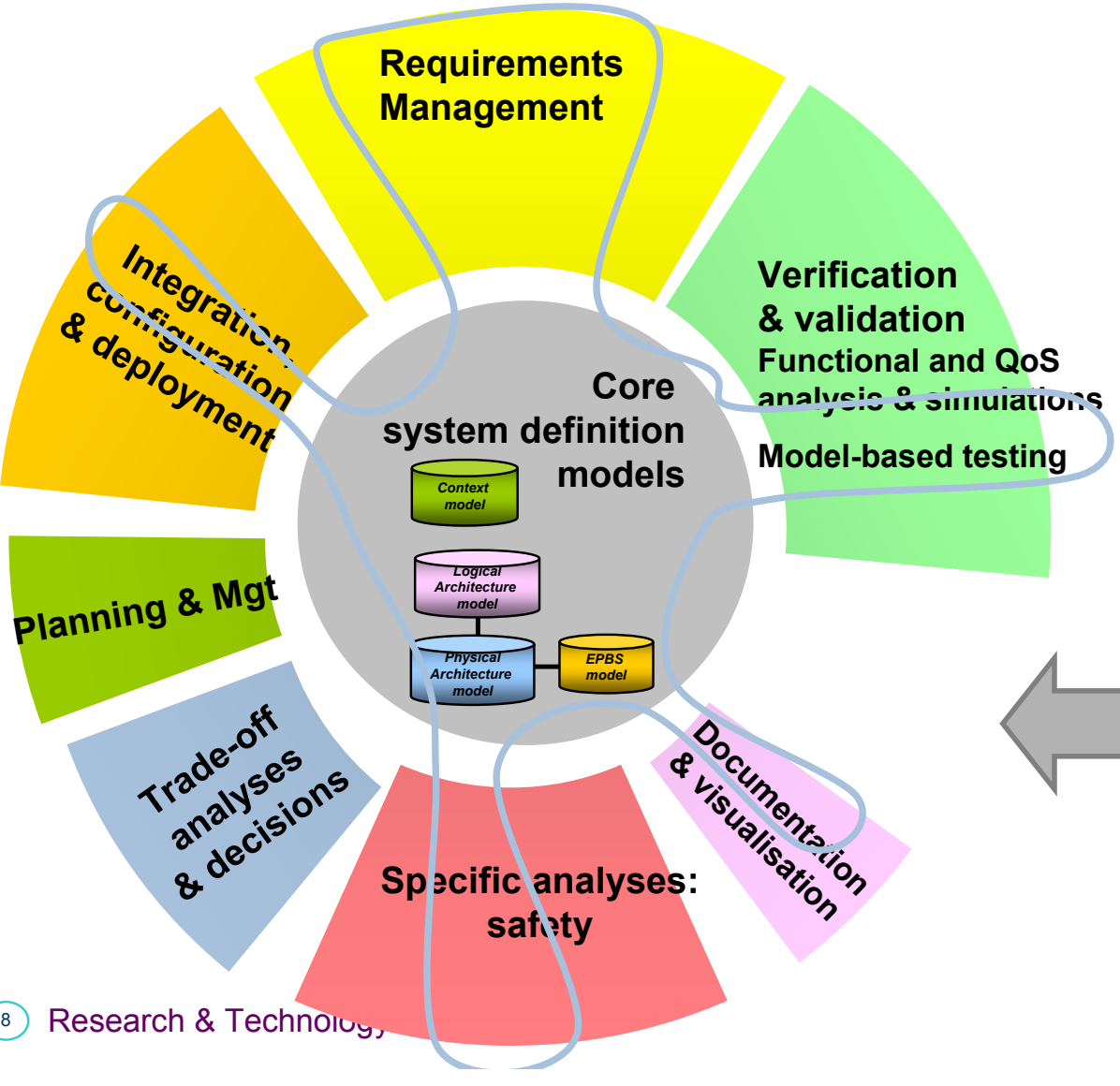
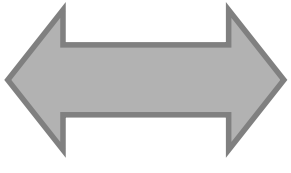
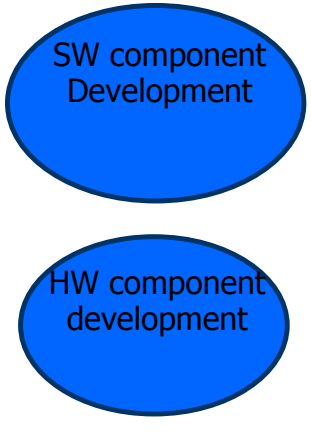
The bigger picture: MDE as the integrating frame







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Challenges & strategy

From MDA to MDE

- A landscape of multiple heterogeneous models for a system, in distinct technological spaces (UML, DB, XML, formal languages, etc.).
- Need for semantic bridging across languages and tools.

Durability / capitalisation of our methodological & domain developments (DSLs, verification rules, transformations, patterns, domain models, etc.)

- We need model repositories and tool builders to:
  - Facilitate **sharing** of models
  - Enable in-house **methodology** development, modular, reusable and adaptable according to programs context
  - **Minimize tool-vendor lock-in**
- Standardisation (QVT, SysML, QoS, MARTE, UPDM, etc.)
- Toward tool-independent assets based on metamodeling techniques and standards.

Building sound and cost effective MDE methodologies

- Defining the “right” modelling frameworks for a domain
  - Adequate metamodels & syntaxes: relevant abstractions, granularity, with validation mechanisms that match the target system types and complexity, and the specific engineering concerns.
  - Example: modelling systems of systems

- Mastering production and exploitation costs of MDE
  - Scalability for design & analysis of complex systems
  - Legacy management
  - Adoption: decision model, MDD capability levels, TCM

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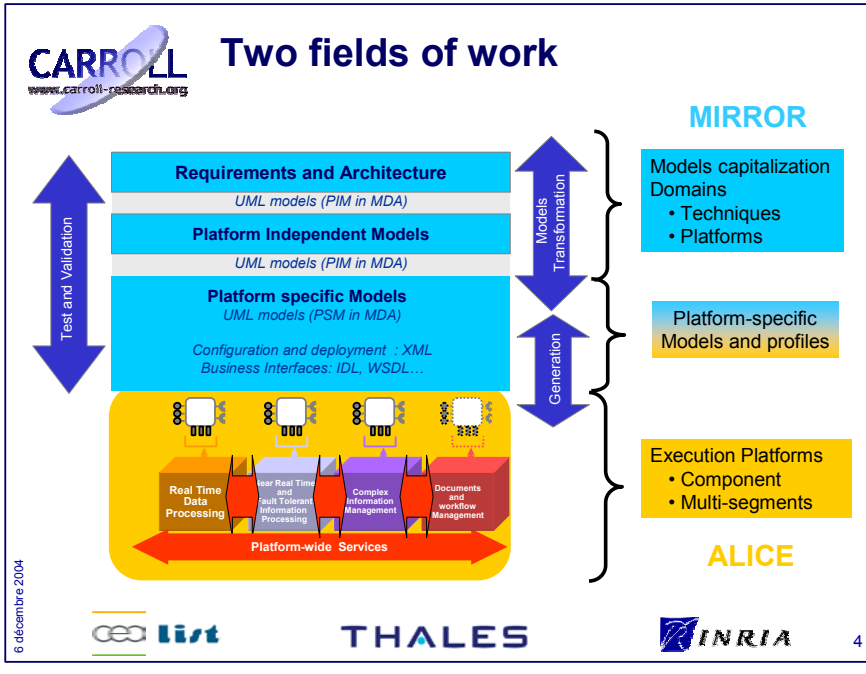
Partners

- **THALES**
- **CEA** (French Atomic Energy Agency)
- **INRIA** (National Institute for Research in Computer Science and Control)

Common research programme

- Program started in march 2003
- Initial duration = 3 years



Objective

- Integration Research program on Model Driven and Middleware technologies

www.modelware-ist.org

- **IST Integrated Project**
- **2 years duration; 1500 person/months**
- **Total Cost : 21 M€; total Funding : 11 M€**
- **Co-ordination : THALES Research & technology**
- **19 Partners :**
  - **End-users**
    - THALES, IBM, France Telecom, Enabler, AS Aprote
  - **Tool Vendors**
    - Softeam, Adaptive, SINTEF, Imbus
  - **Research labs and academia**
    - INRIA, ESI, Univ Pierre et Marie Curie, UPM, Univ of York, IBM HRL, Fraunhofer
  - **Dissemination**
    - SIGS-DATACOM
- **3 Objectives :**
  - **Objective A** : Develop a solution to enable a significant increase of software systems development productivity thanks to Model Driven Development (MDD);
  - **Objective B** : Lead its industrialisation;
  - **Objective C** : Ensure its successful adoption by the industry

Eclipse MDDi project

MDDi: Model-Driven Development Integration

A MODELWARE and CARROLL Research initiative

- Project goal: Extend Eclipse and develop an Open Source platform dedicated to the integration of MDD tools
- Organization around three themes:
  - Modeling tool interoperability
  - Semantics interchange via a description of modeling languages
  - Support for development processes and methodologies

- The project proposal to be official shortly (creation review today).
- Actors: Stephen Mellor (Mentor Graphics) - leader
  - Current committers: Adaptive, CEA-List, France Telecom, INRIA Nantes,LIP6, SINTEF, THALES, UPM
  - Official supporters: Airbus France, CS, Philips Medical Systems, LIFL, Policnico di Milano, Financial Toolsmiths, inStream, MetaMatrix, Versata, Xactium

Answering these challenges

- A set of integrated research programmes
  - with Academic partners
  - with other industrial partners,
  - at national and international levels
- Proactive participation to standardisation bodies
- Tooling:
  - Open Source strategy
  - Close collaborations with tool vendors (IBM/Rational, Softeam)

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ModelWare and other European projects

OMG OBJECT MANAGEMENT GROUP

Rational software

SOFTEAM Think Object

eclipse

Based on existing solutions,
toward critical mass,
integrated Research and Technology structures
adressing the shared challenges

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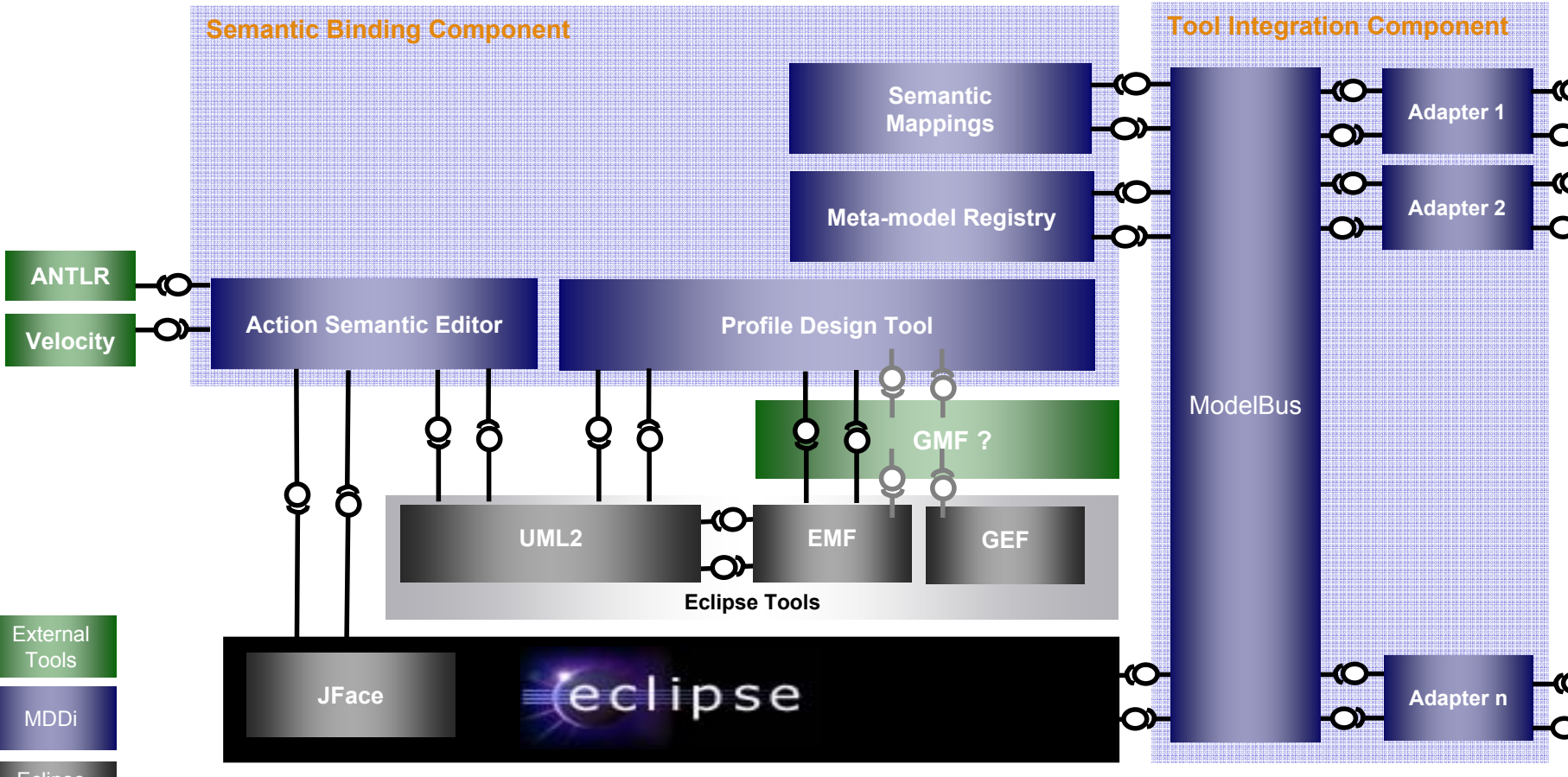
Back-up

MDDi Platform outline



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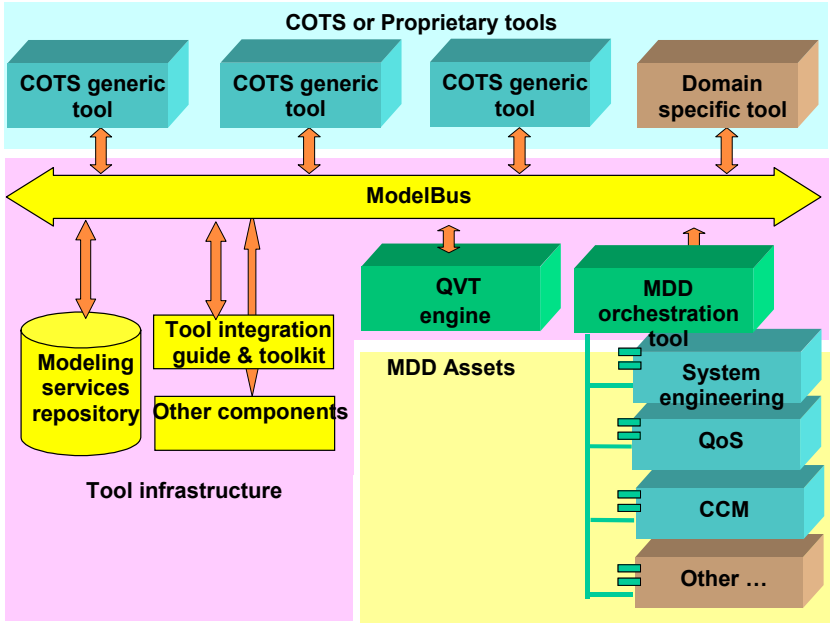
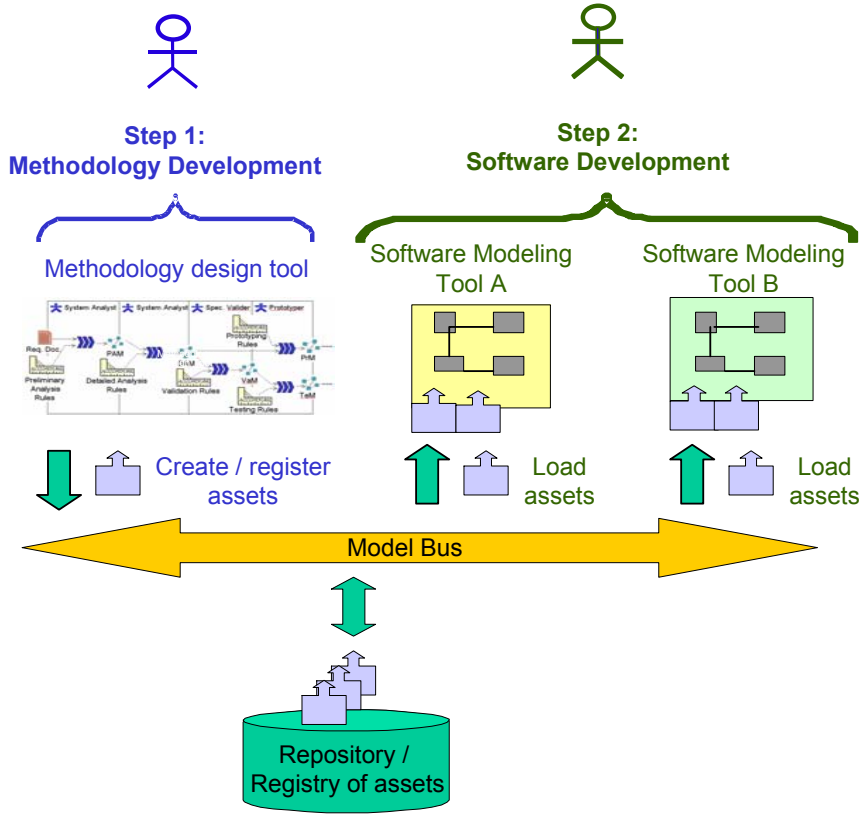
What is MODELWARE? Open Source Platform





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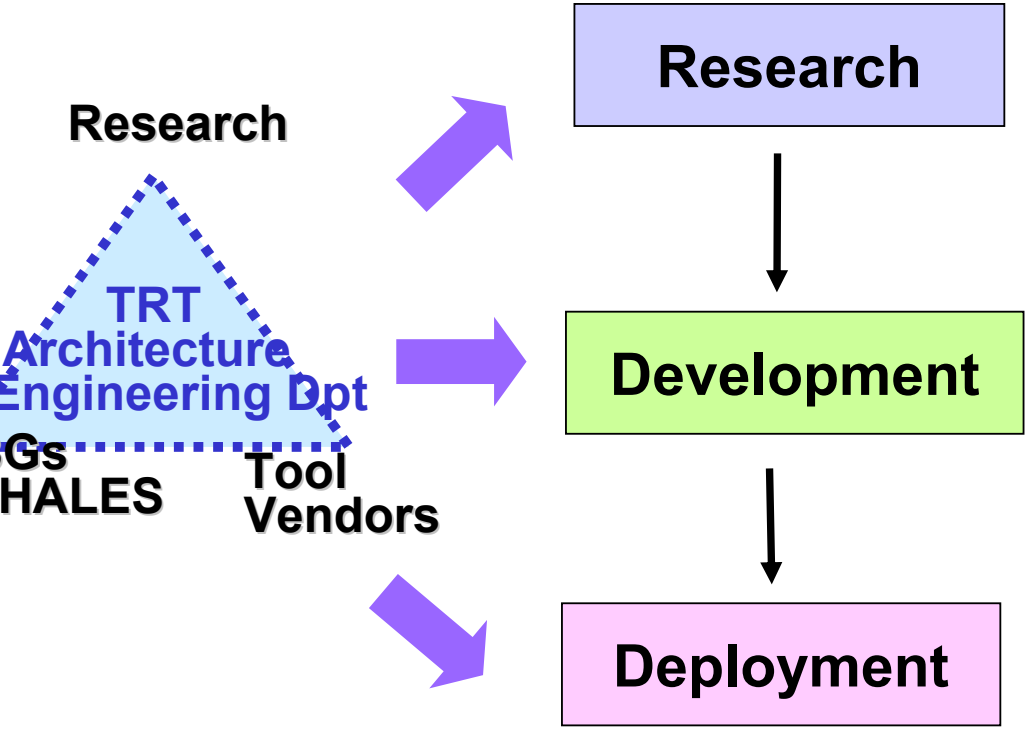
Our mission: improve the Group competitiveness in Software Intensive Systems development



- Standardisation (OMG)
- Speed-up transfert of academic results
- Applied research in collaborative frame

- MDD solutions (tools + method)
- Tool Vendors collaboration (Rational, ILogix, Softeam)

- Dissemination to BGs (support, coaching, training)
- High level experts on MDE
- Technical Change Management for BGs (TCM)

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