Reuse and Migration of Legacy Systems to Interoperable Cloud Services

REMICS Consortium

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Project facts

- REMICS is a STREP accepted in the Objective 1.2 of FP7 Call 5 (Internet of Services, Software and virtualization).
- REMICS runs from September 2010 for 3 years. The original budget is 4.5 MEuro.
- Current partners are:
  - SINTEF, DI Systemer **(Norway)**
  - Softeam, Netfective Technology **(SMEs from France)**
  - Fraunhofer FOKUS **(Germany)**
  - ESI (Tecnalia), DOME Consulting and Solutions **(Spain)**

About roles

- SINTEF is the coordinator of the project.
- I work as research scientist in SINTEF and have taken over the coordinator role. I also teach at university (NTNU).
- We perform research on cloud computing, SOA modeling, interoperability, methodology and empirical studies.
- Other partners roles:
  - Netfective: recovery with BluAge tool
  - Softeam: SOA and modeling with Modelio tool
  - Tecnalia (ESI): methodology and integration
  - Fraunhofer FOKUS: model-based testing
  - DOME and DISYS: SMEs with use cases

REMICS Enlarged EU

- In negotiation phase, extended budget is 870 000 Euro.
- Assuming start on September 1, 2011.
- The new partners are:
  - Warsaw University of Technology (**Poland**) – WU. Focus on requirement-based recovery and migration
  - University of Tartu (**Estonia**) – UT. Focus on scientific applications and cloud performance
  - Institute of Information and Communication Technologies – Bulgarian Academy of Sciences (**Bulgaria**) – IICT-BAS. Focus on agile methodologies.

Problem to be addressed

- Legacy systems are most of the times of substantial value for companies:
  - They still function for the users' needs;
  - They capture important business logic;
  - The cost of replacing them with systems designed from scratch is often too high.
- However:
  - Legacy systems are often difficult to reuse due to platform, documentation and architecture obsolescence.
  - Legacy systems are facing critical issues: need to change but do not know how.
  - New technologies arrive such as **Cloud Computing** and **Software as a Service (SaaS)** that promise better performance or cost saving that motivate organizations to modernize their applications.

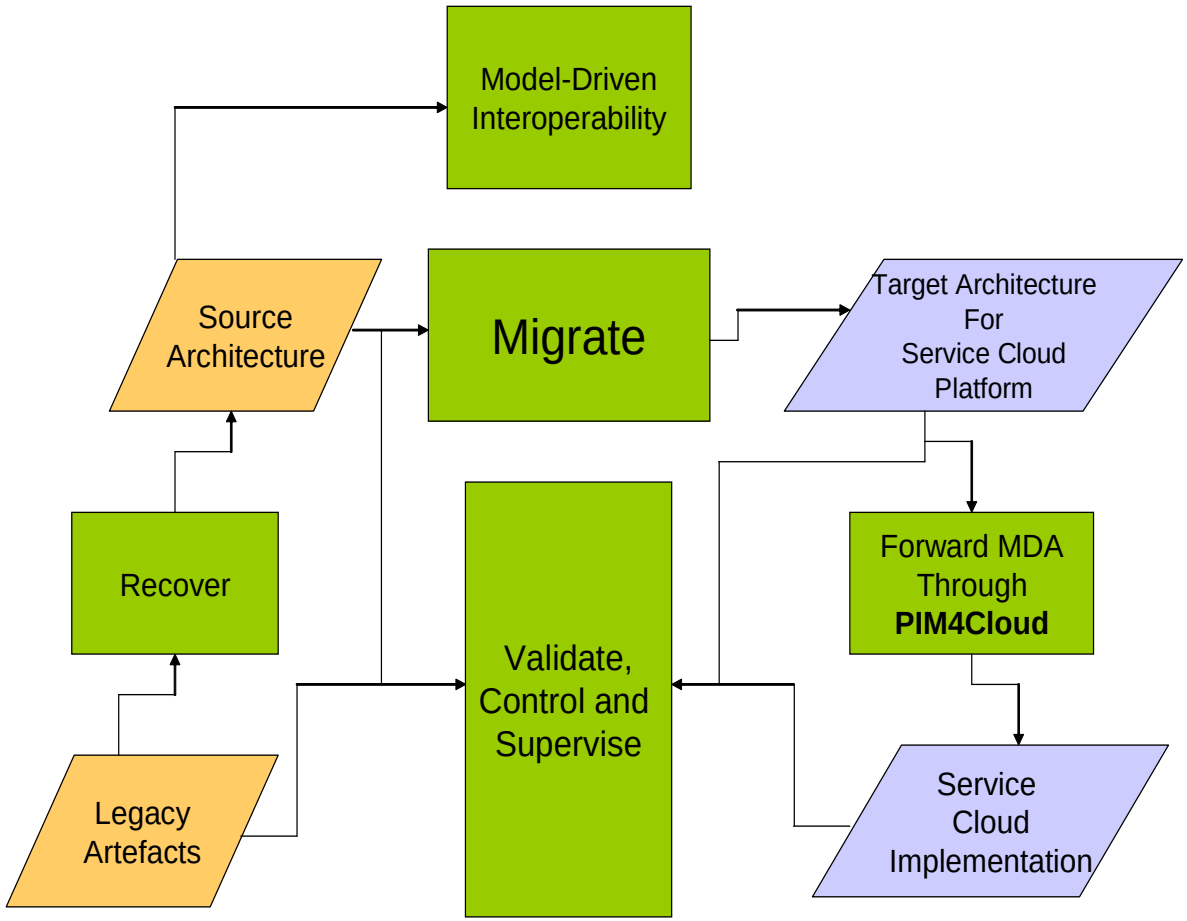
Challenges

- The oldness degree of technologies to be reversed;
  - How to adapt them to the SaaS and cloud paradigms?
  - How to handle interoperability?
- The absence of knowledge;
  - How to extract business value information?
- QoS should be preserved;
  - Performance of heavy loaded and critical applications;
  - How to reuse legacy systems in automated testing of the new SaaS?
- Cost of the migration process;
  - How to plan a progressive migration process?
  - How to train people in new technologies such as MDE, service engineering etc.?

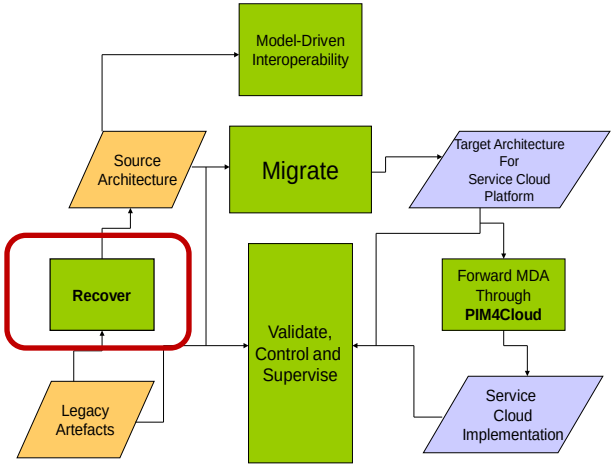
REMICS approach; main points

- Model-driven engineering techniques;
  - Models to capture legacy and transforming them into SOA and cloud deployment;
- Automatic or semi-automatic recovery and migration;
- Service engineering based on SoaML;
- Modernizing by service composition, applying patterns and SaaS concept;
- Standardizing the results
  - Open models and metamodels

Steps in the REMICS approach



Recover



- Input is source code, documentation, execution logs, people's knowledge.

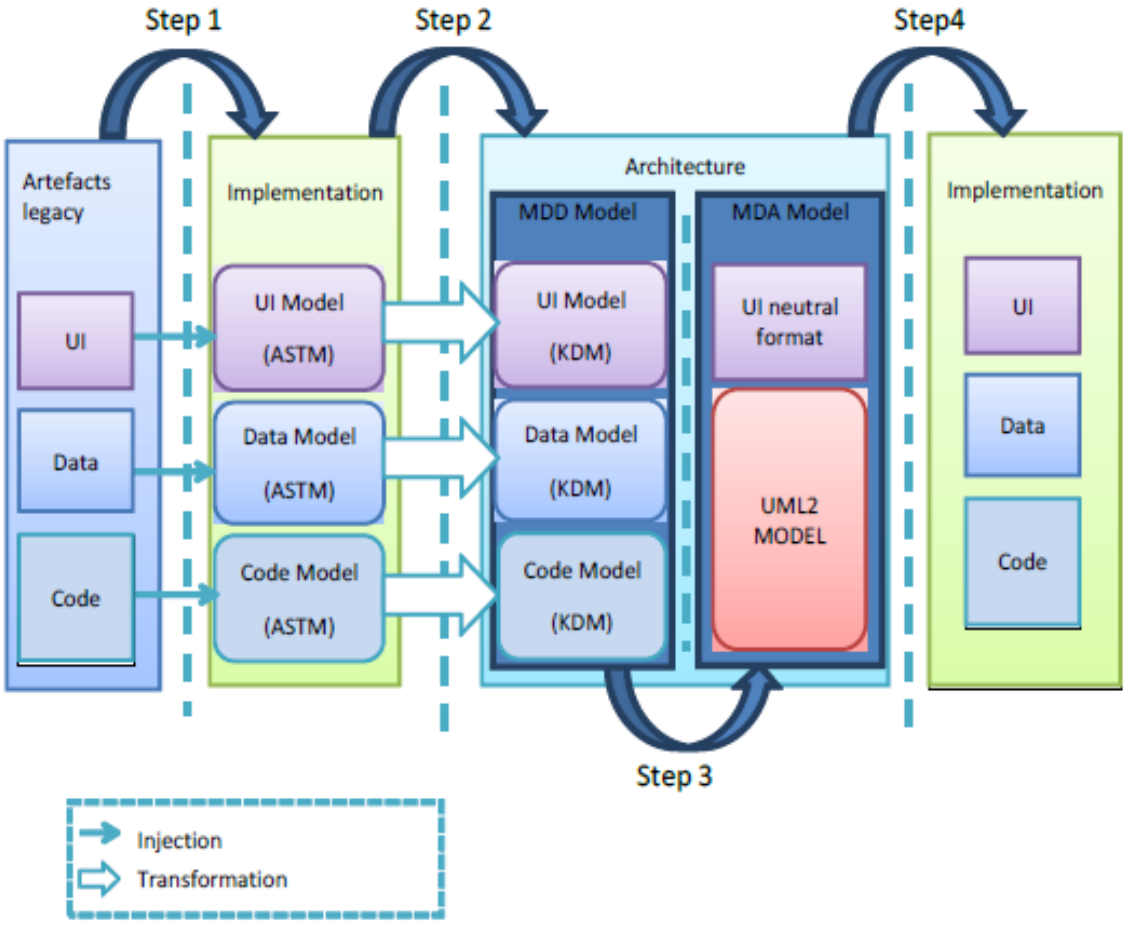
  Output is models: requirements, architecture, business processes and rules, implementation and deployment models, etc

- Analyse feasibility of the modernization strategies and select one or multiple:
  - Automatic extraction
  - Computer assisted extraction
  - Annotation driven extraction
  - Refactoring at the PIM level
  - Paradigm change: from Delphi t for Java for example
  - Usually code is migrated to XML type of data vs algorithmic

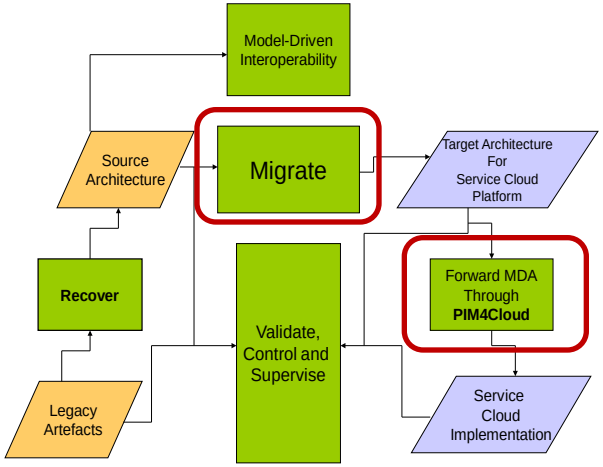
Recover - Continue

- Recover business value information:
  - Requirements, processes, rules, non-functional properties etc.
  - Separation of concern:
    - Business code vs technical code
    - UI/service/Batch/Report/data
- We use the OMG KDM standard and extend it when necessary.
- BluAge tool from Netfective is the recovery tool.
- WUT will focus on recovery of requirements in RSL (CIM level) and using these in migration and testing.

The four step recovery process



Migrate



- The purpose is to start from the legacy models and modernize them to build the new a new SOA by applying methods such as decomposition, component wrapping and replacements.
- Migrated models will be in SoaML with link to business models. Modelio tool from SOFTEAM is used for modeling.
- Some components or services may be replaced by newly discovered ones.
- SOA and cloud computing patterns are to be applied.

Migrate - Continue

- Forward engineering for adding new functionality;
- Deployment in Cloud:
  - **PIM4Cloud or CloudML** planned as an abstraction of cloud computing platforms and a language for modeling deployment in cloud.
  - Initial focus is on IaaS aspects, but we are also interested in PaaS.
- Model transformation from these models to cloud platforms.
- Standardising **RSL** within the OMG as a language for semantically precise requirements.

What is SoaML?

- Service oriented architecture Modeling Language (SoaML)
- Defines language constructs and extensions to UML2 to support service concepts (metamodel and UML profile)
- Focuses on basic service modelling concepts and structure.
- A foundation for further extensions and integration with BPMN, BMM and other metamodels.

- Key language constructs
  - Consumer
  - MessageType
  - Participant
  - Provider
  - ServiceContract
  - ServiceInterface
  - ServicesArchitecture

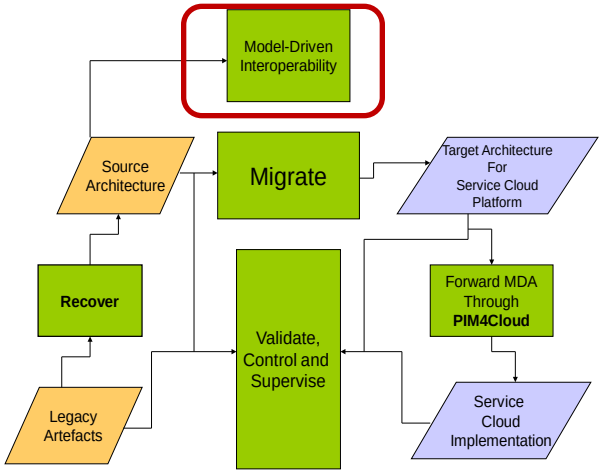
Cloud models and languages

- We are currently looking at some interesting models and languages:
  - Amazon Cloudformation
    - a textual description language for cloud resources
    - http://aws.amazon.com/cloudformation/
  - CA 3Tera AppLogic
    - a graphical language for Cloud configuration
    - http://www.ca.com/us/cloud-management-console.aspx
  - Elastra – with DSLs for Cloud configuration
    - Elastra Cloud Modeling Language (ECML) is used to describe an application (software, requirements, and policies)
    - Elastra Deyployment Modeling Language (EDML) is used to describe the resources (virtual machines, storage, and network) available in a data center.
    - www.elastra.com

Analysis of PaaS and IaaS solutions

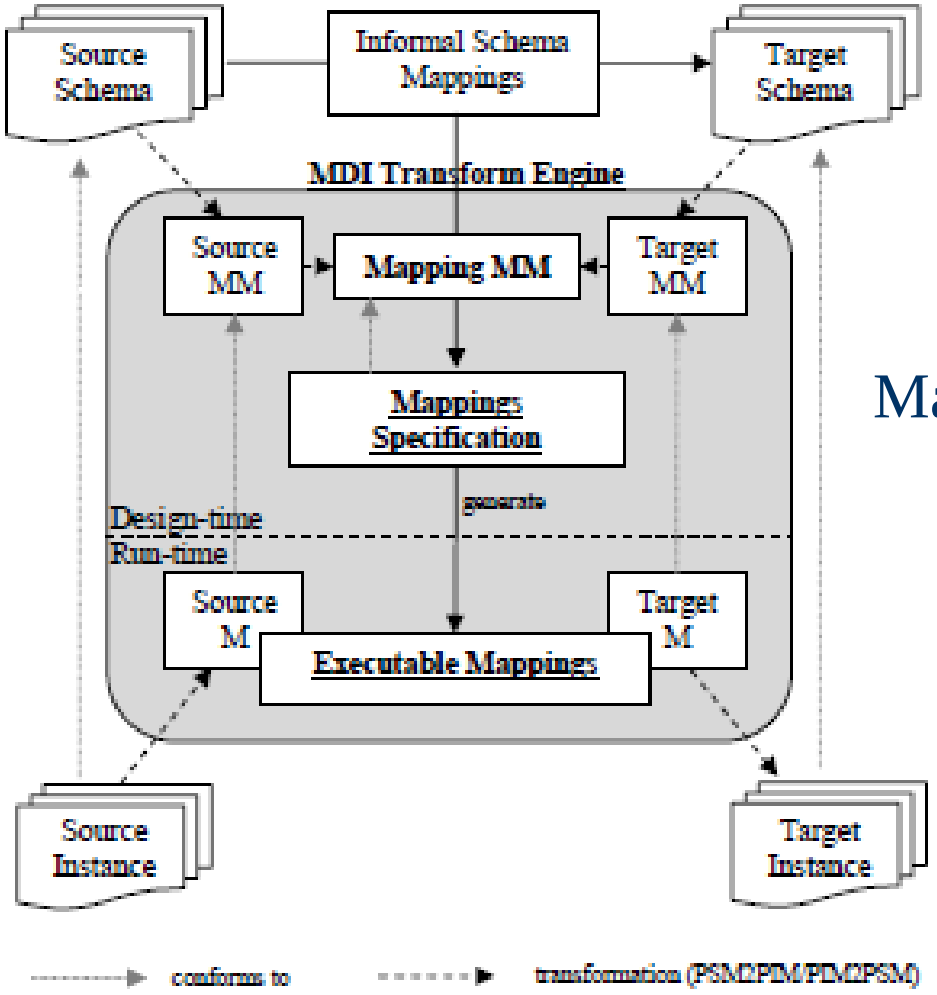
- We have identified parameters for this evaluation:
  - Services they provide:
    - service level, delivery model, license type, business model etc.
  - Architectural issues:
    - security, load balancing, storage, fault tolerance etc.
  - User interface:
    - API, programming framework
- We have compared some cloud computing technologies based on the above parameters.

Manage Interoperability



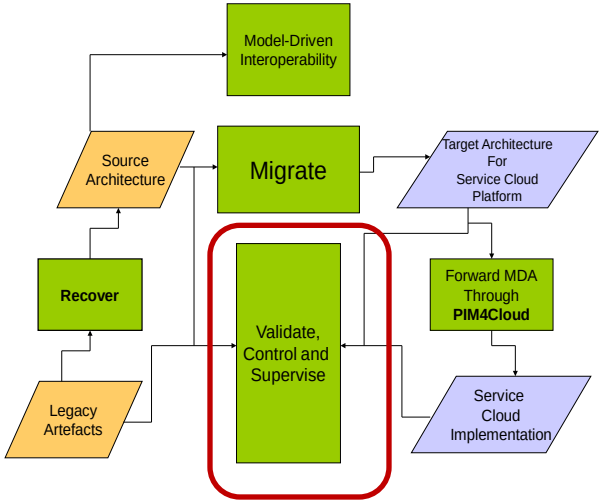
- The legacy system may be enhanced by adding new services or services may be composed in new ways.
- Model-driven interoperability helps in adapting services using **mediators**.
- Mediators or mediation services take input data in one format and provide it in another format.
- We plan to extend SoaML (SOA modeling language) with data format models and behavioral model for mediation.
  - **PIM4ServiceInteroperability**

The first release: B2B data mapping



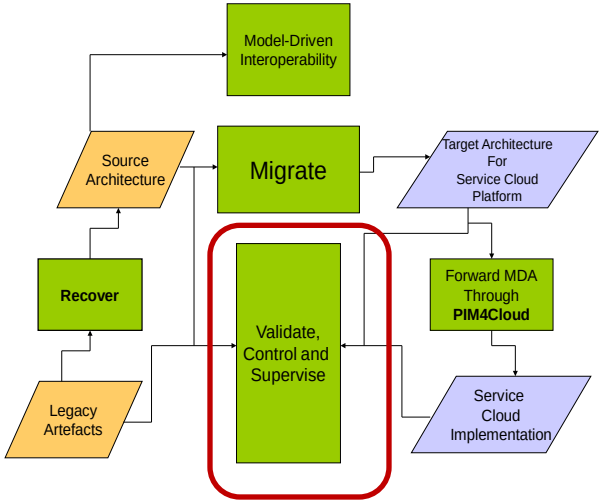
Mapping metamodel

Validate



- The recovered architecture should correspond to the legacy system;
- And provide the same or better QoS, business goals, coverage, etc.
- Recovered models should be used in the validation process based on model-based testing techniques.
- The original system can act as a test oracle since requirements may not be well captured.
- Static model analysis and MBT will involve OCL (Object Constraint Language) and U2TP (UML2 Testing Profile)

Control and supervise

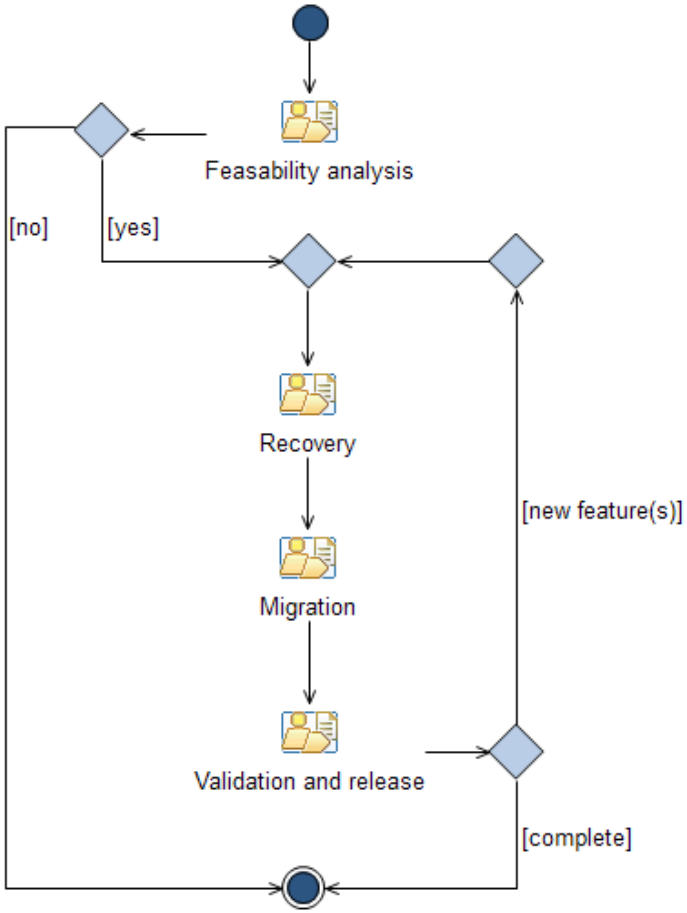


- The goal is managing applications by observing them and performing corrective actions.
- Models@runtime for self-managability is one possible technique to use.
- UT will work on performance prediction and monitoring with different configurations on cloud infrastructure.

REMICS methodology

- The purpose of methodology is to guide the users on how to apply REMICS methods and tools during recovery and migration.
- This includes:
  - feasibility analysis,
  - Understanding business logic and business rules
  - Architecture recovery
  - Identifying services
  - Modernizing the architecture
  - Validation
- Based on agile principles (IICT-BAS will contribute to this).

EPF implementation



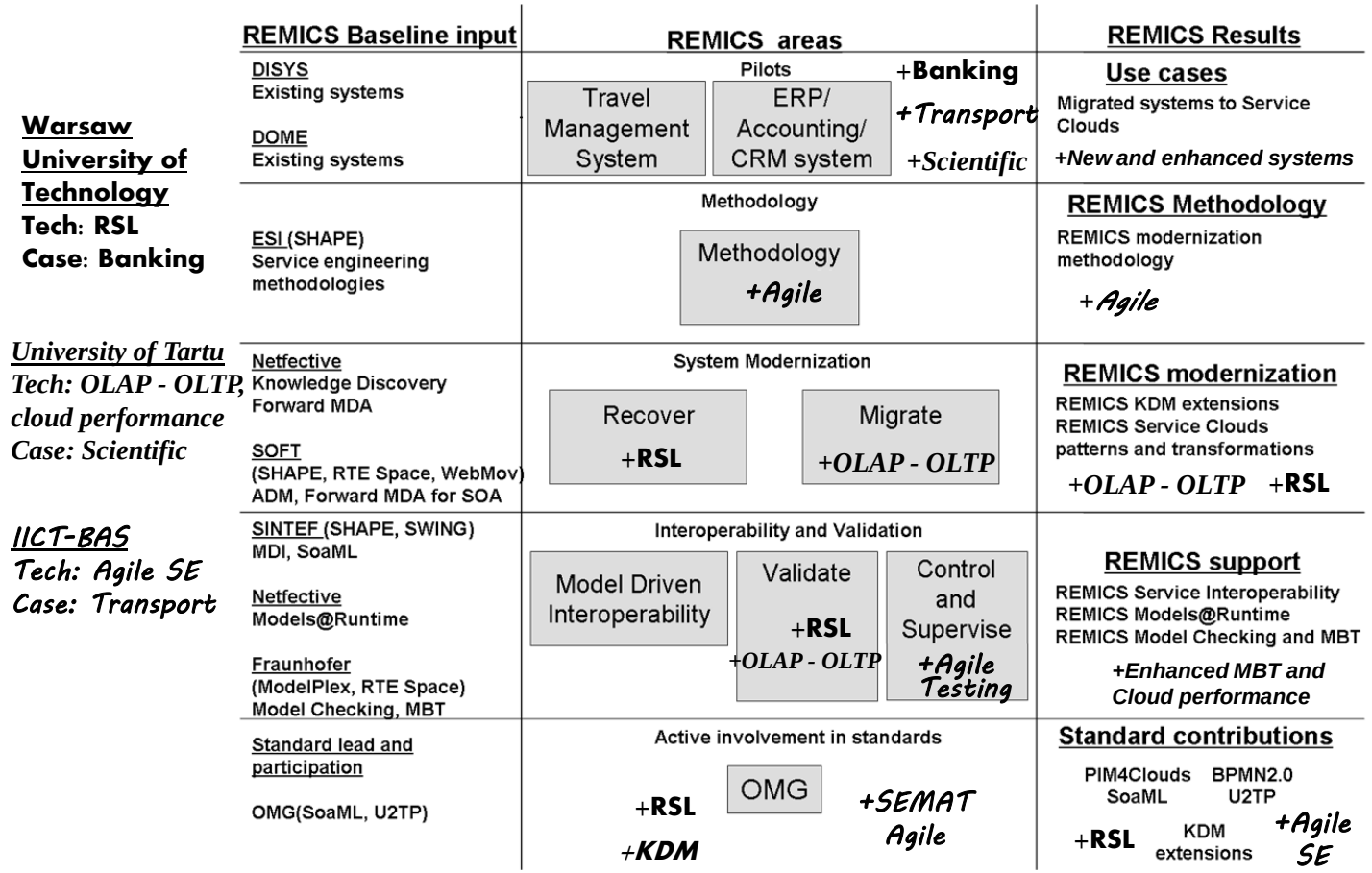
Software engineering challenges during migration

- Feasibility stage
  - Set of questions to answer
  - Identifying SOA and cloud benefits for the context
- Modernizing the architecture
  - Separating business logic from APIs;
  - Separating business logic from data;
  - Changing the synchronous behavior of legacy systems to the asynchronous behavior of services;
  - Componentization of architecture to improve scalability
- Defining quality characteristics in the cloud: max load, accessibility, etc.

ESSENSE initiative

- SINTEF is together with the SEMAT initiative following up work on defining a RFP regarding developing a DSL for software engineering.
- This will include support for developing methods based on practices defined in Kernel and any other ones.
- IICT-BAS will join SINTEF in this work.

Overall view of REMICS research



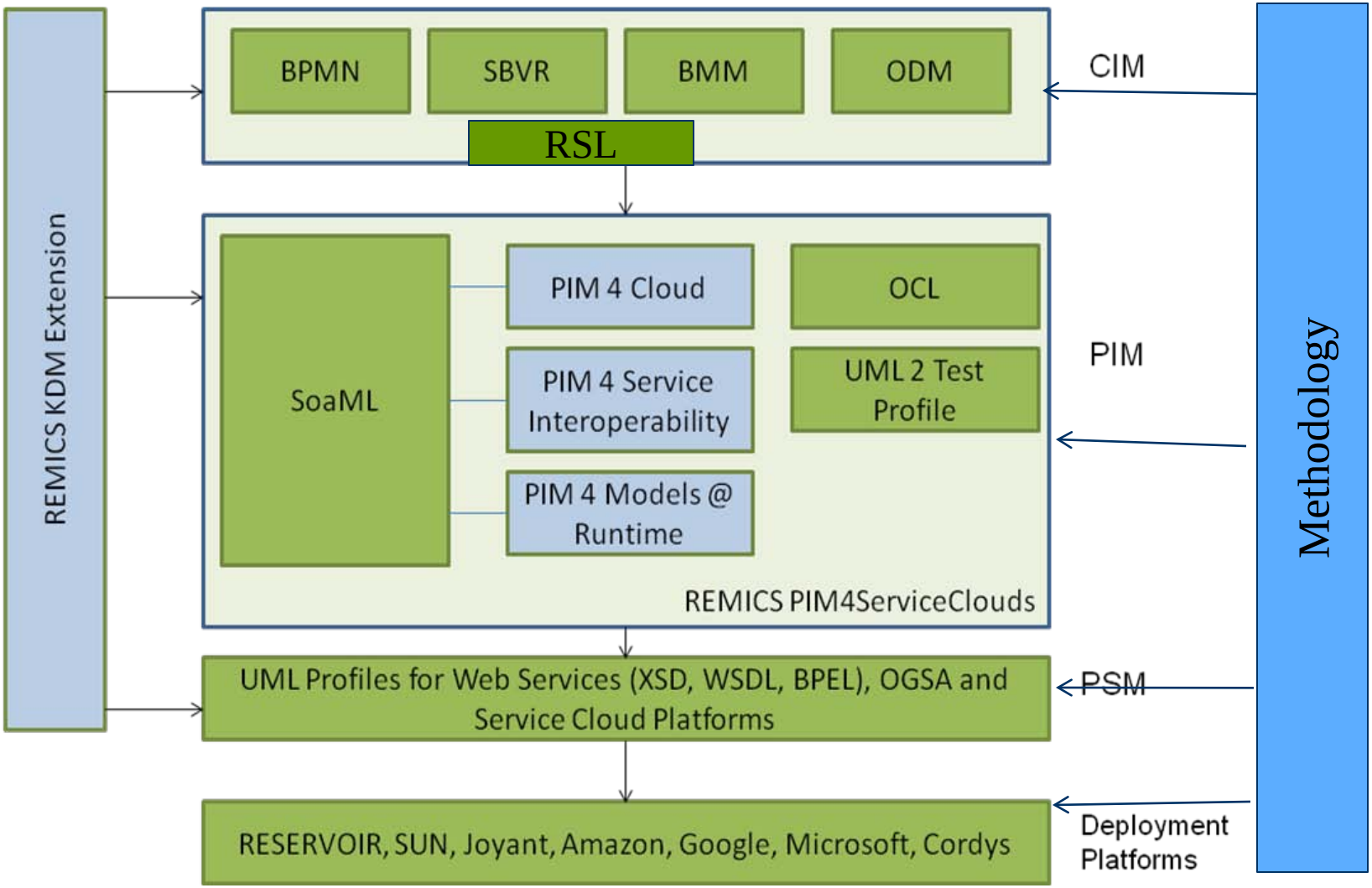
Pilot cases in REMICS

- Two pilot cases in existing project:
  - DI systems from Norway with ERP/acounting
  - DOME consulting from Spain within the tourism section
- Three new pilot cases in the enlarged project:
  - Bank and finance (WUT)
  - Scientific applications (UT)
  - Transport (IICT-BAS)

Expected impact

- REMICS will preserve and capitalize on the business value engraved in legacy systems to gain:
  - flexibility brought by Service Clouds,
  - lower the cost of service provision,
  - shorten the time-to-market.
- REMICS research will provide innovations in advanced model driven methodologies, methods and tools in Software as a Service engineering.
- REMICS will provide standards-based foundation service engineering and will provide a suite of open ready-to-use metamodels that lowers barriers for service providers.

REMICS and Standards



About us

- SINTEF is a research organization in Norway with over 2000 employees in Oslo and Trondheim.
- Networked Systems and Software is part of ICT with 260 people and has three groups around model-based development, security and HCI.
- Our expertise in:
  - modeling, metamodeling (SoaML, CVL), transformations, traceability, quality in modeling
  - Services and Things
  - Adaptive systems
  - Architecture, interoperability and semantic technologies etc.
- Projects:
  - ATHENA
  - INTEROP
  - IRMOS
  - MoSiS
  - MODELWARE
  - MODELPLEX
  - DiVa
  - COIN
  - EMPOWER
  - SESAR
  - REMICS
  - NEFFICS
  - And national projects
- Several standards and open source tools

Future research in Call 8; interests

- Internet of Things and Internet of Services
  - Adaptive systems at all levels
  - Optimization, testing, run-time management
- Cloud computing
  - Following research in developing solutions to manage the challenges
    - Interoperability
    - Abstraction and modeling
    - Migration strategies and business models
    - Services and platforms
    - Software engineering for the cloud

Thank you and

Questions?

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