Universität Bayreuth
Lehrstuhl für Angewandte Informatik IV
Datenbanken und Informationssysteme

Prof. Dr.-Ing. Jablonski

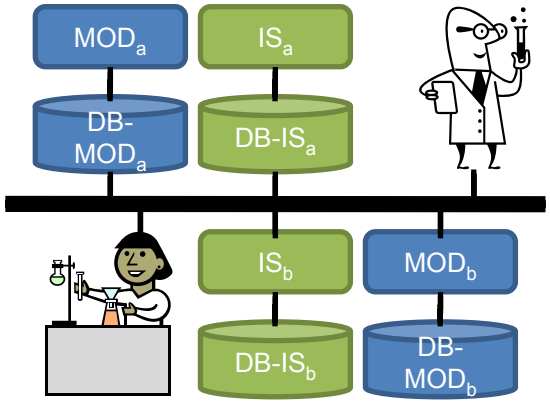
A Modeling Methodology for Scientific Processes

Stefan Jablonski , Bernhard Volz, M. Abdul Rehman

Lehrstuhl für Angewandte Informatik IV
Universität Bayreuth
Fakultät für Mathematik und Physik
D-95440 Bayreuth

Fon +49 921 55-7343
Fax +49 921 55-7339
email Bernhard.Volz@uni-bayreuth.de
www http://ai4.inf.uni-bayreuth.de

Applications in Geology



- Main characteristica
  - Many, heterogeneous systems involved
  - Data of different quality and format must be exchanged
  - Scientists are part of the applications
- Key points: Integration of data and human actors

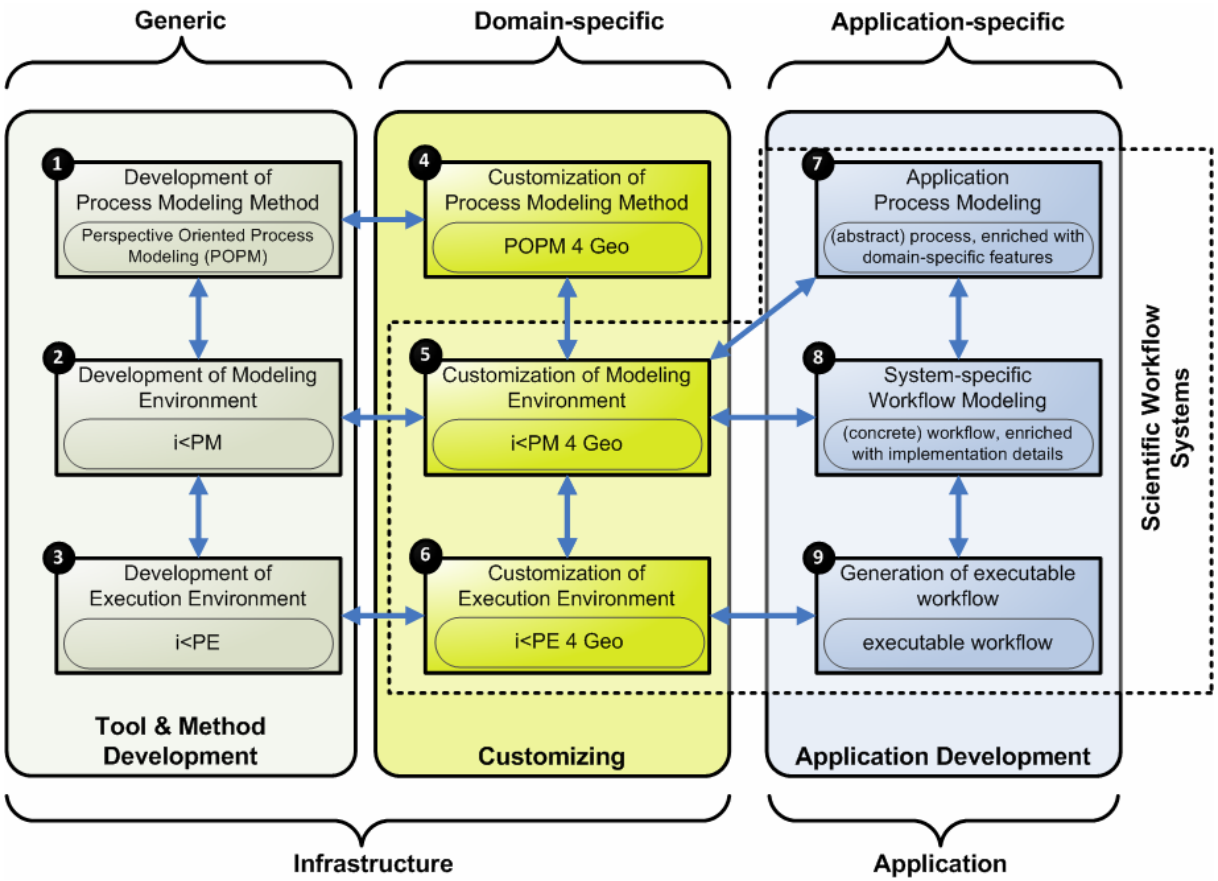
- Aspects in integration
  - Technical: Data extraction and exchange (format, protocols)
  - Semantical: Different terminologies and ontologies of data
  - Organizational: Roles and rights of human agents
- Existing Systems (Kepler, Taverna etc.)
  - Working, but: Too specific, hard to extend
  - Missing: manual tasks, use of external models (e.g. data model)
  - We criticize the method that stands behind the Structural Method or use!

Contribution: Not just another Information System but also a Structural Method

- Model the application as a process (abstract & concrete)
  - Processes cope with complex application scenarios and can be easily adjusted to changing requirements
  - Processes set up a structural framework that offers possibilities to introduce aspects of data and agent integration
- Automatically derive applications from these models which execute a process
- Leverage from existing techniques and methodologies!

Solution Overview: Process Driven Architecture (PDA)

- PDA is a structural framework for
  - Development and customization of modeling methods
  - Development and customization of tool chain (modeling and execution infrastructure)

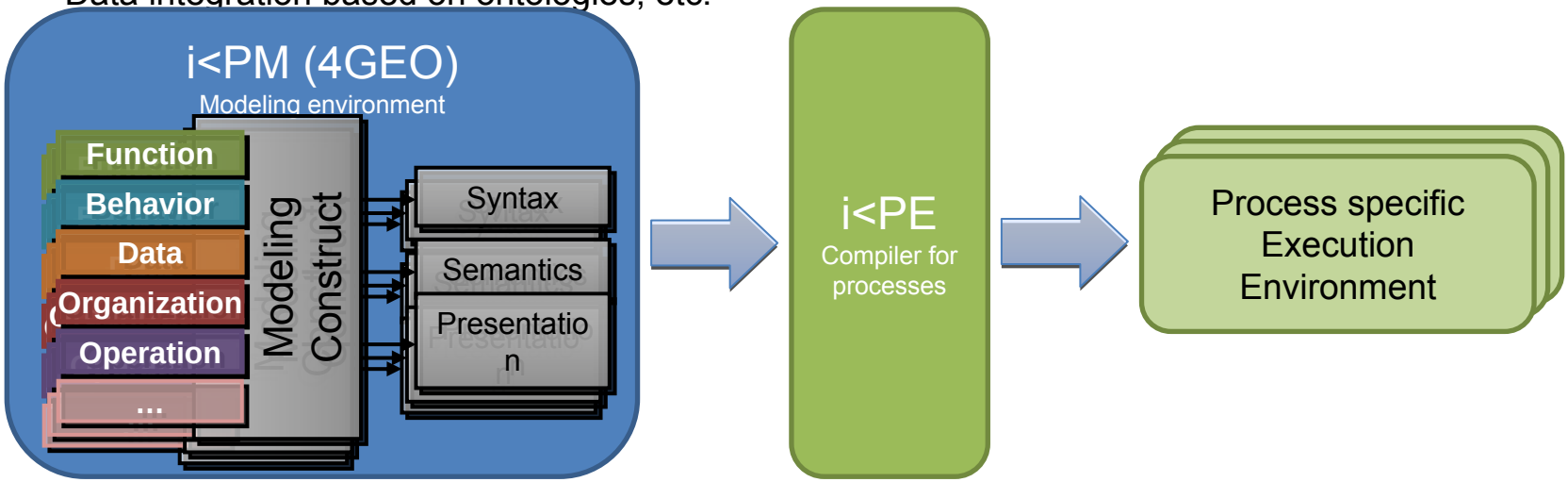


Foundation: Perspective Oriented Process Modeling (POPM)

- Building blocks of a process: Perspectives - Modularization modeling constructs and model
  - Functional perspective - structural composition of a process
  - Behavioral perspective - flow of control in between process steps
  - Data & data flow perspective - data within the process
  - Organizational perspective - responsibilities and roles in the process
  - Operational perspective - tools and applications

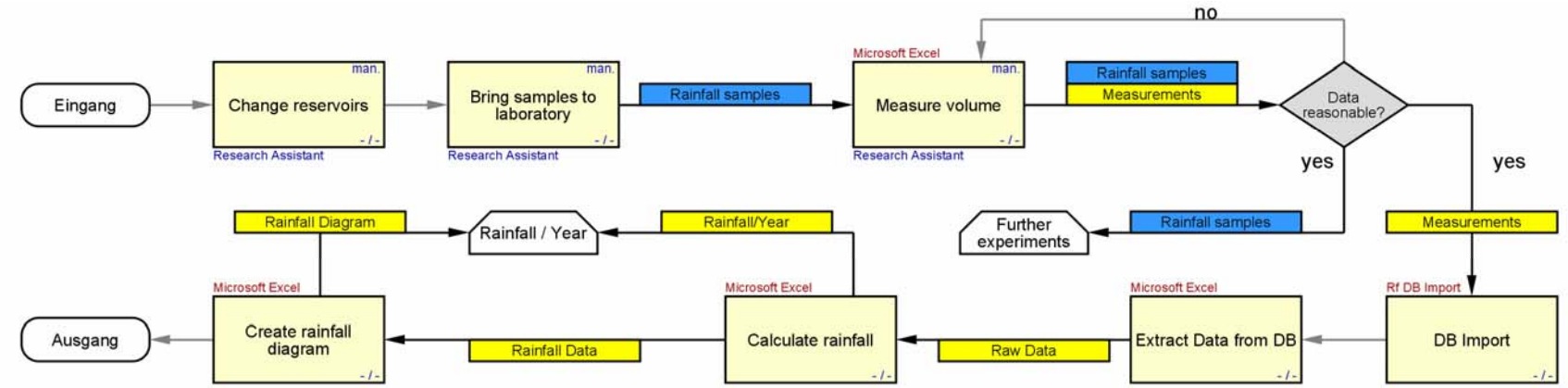
This list is far from being complete/fixed; it can be extended or restricted depending on the individual needs of an application!

- Our modeling tool i<PM implements the POPM approach; advantages
  - New modeling elements can be integrated easily; highly customizable
  - Integration of external models (data, organizational, operational) and manual process steps
  - Data integration based on ontologies, etc.



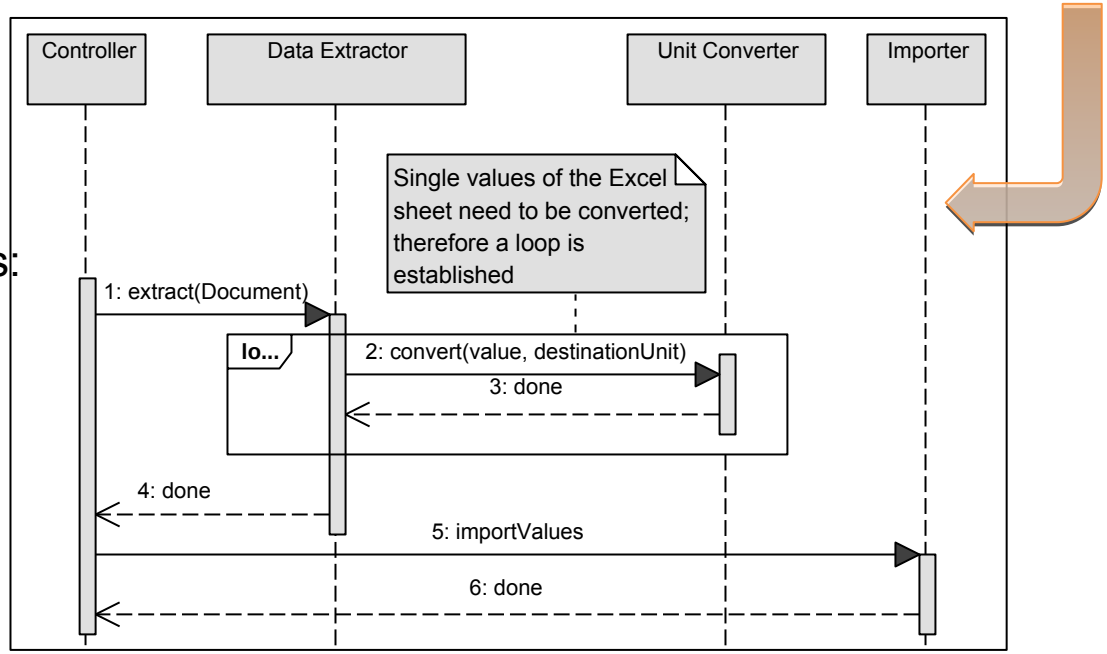
Example

- Simple process involving human actors

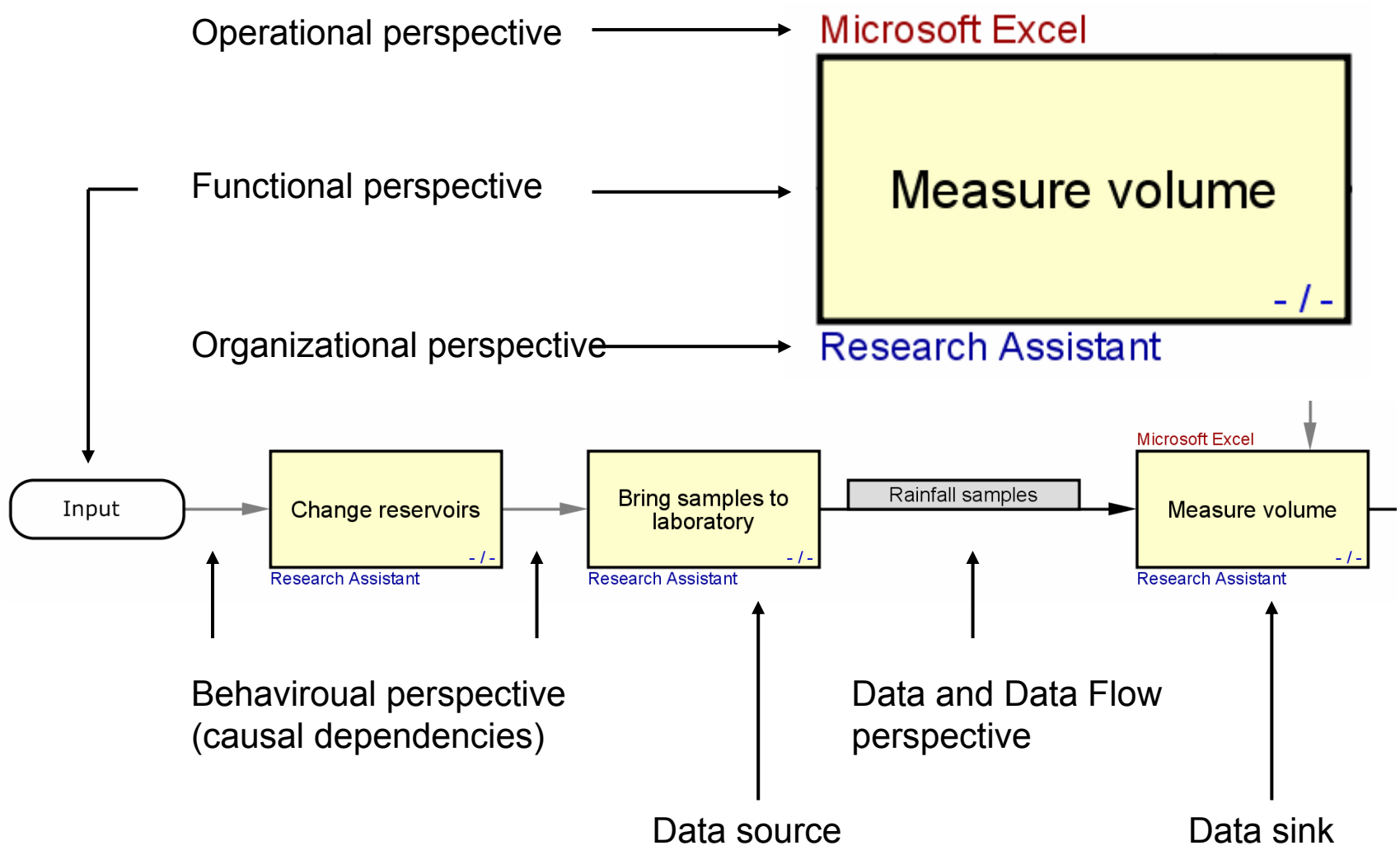


Color can have a meaning:
- Type / kind of data,
- Special tasks etc.

Integration of external models:
- Definition of data (e.g. ER),
- Definition of invocation semantics,
- Organizational mapping etc.

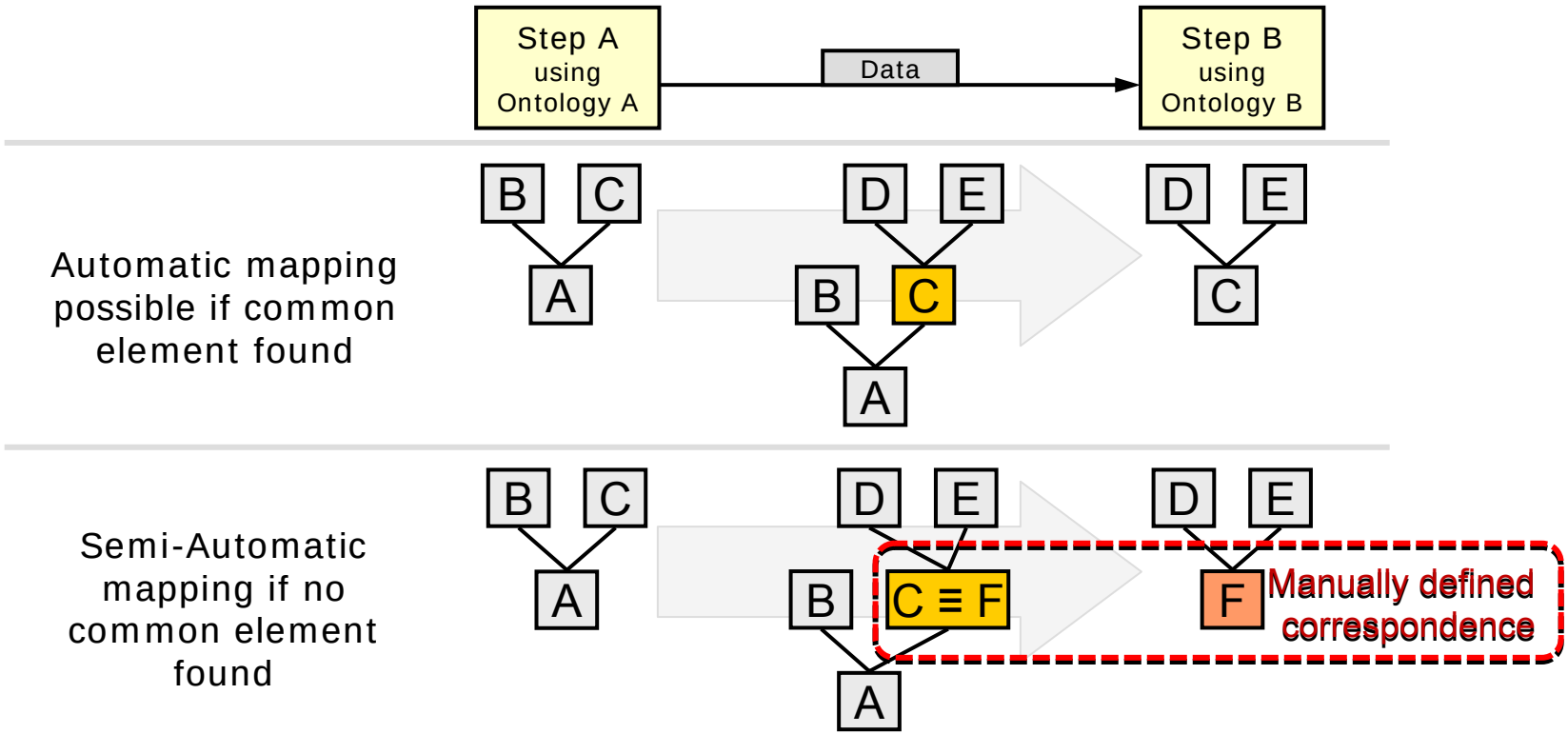


Perspectives in the process model (Overview)

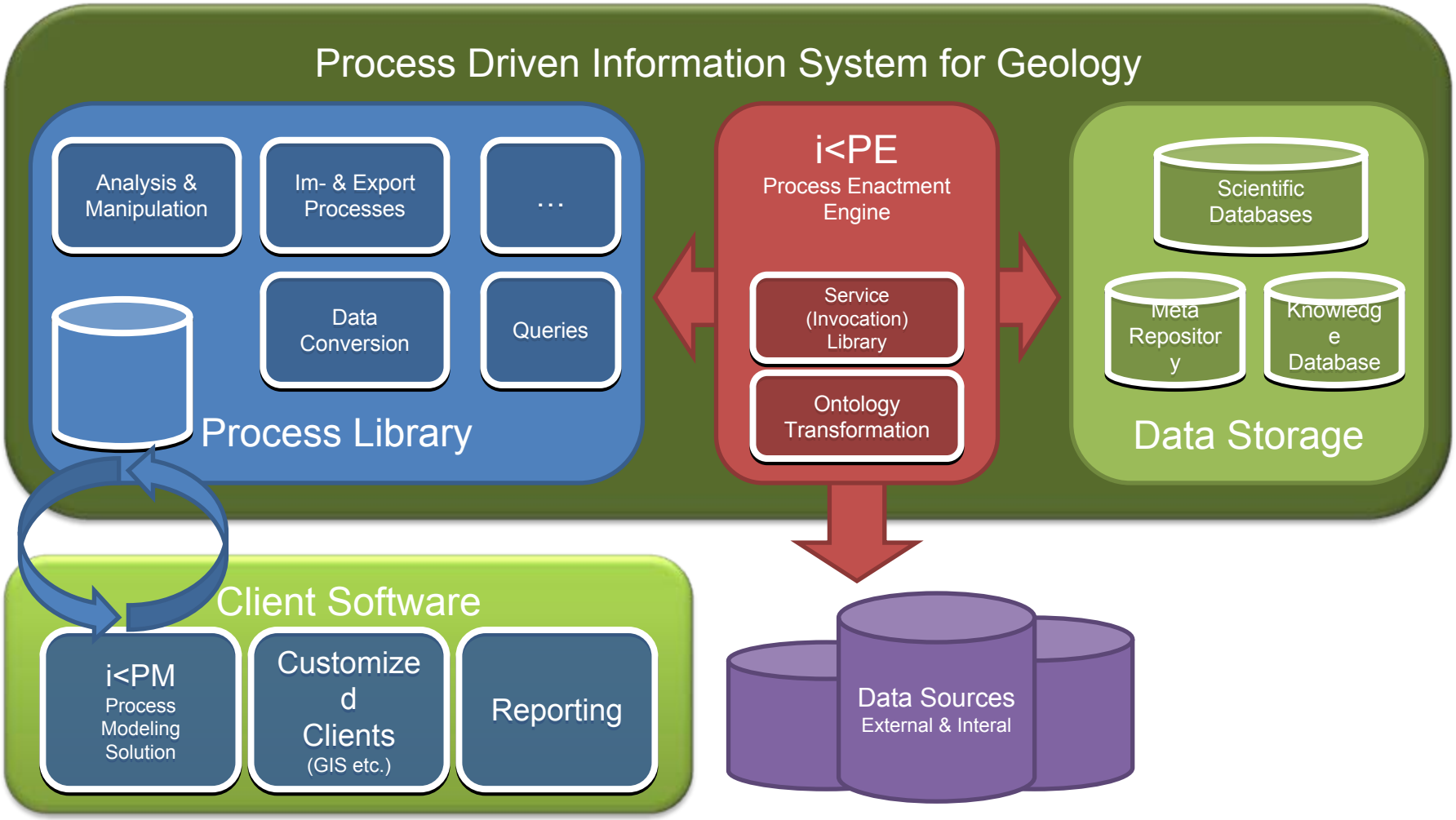


Data Integration: How does it work?

- Two different "modes": automatic and semi-automatic mapping
  - Depending on the ontologies used
  - Format conversions (not shown)



Global Scenario: Process Driven Information System for Geology



Summary

- Existing scientific workflow systems provide capabilities to integrate data, but they are too specific
  - Often bound to an application domain
  - Hard to adapt/extend: Special functionality which is often needed cannot be integrated cleanly

- PDA together with POPM provides this flexibility and extensibility
  - Small amount of actual coding needs to be done, mostly "configuration"
  - Ability to extend the methodology, modeling language and the software tools is part of the method (PDA) and not a feature of one special (sub-)system

  - Example: Modeling construct for classifying data items