Collaborative Software Development and Topic Maps

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Overview

- Motivation and Objective
- Development Phases and Modelling
- Development Process Guidance
- Tool Support

Motivation and Objective

Problems in Software Development:

- Consistent semantics transfer of requirements between development phases
  - e.g., requirement analysis, design, implementation
- “Loss-free“ communication between heterogeneous groups of participants
  - e.g., stakeholders, designers, programmers
- Tool-supported collaboration
  - e.g., version management and logging

State of the Art:

- Modelling Languages [Harel]
  - characterises the meaning of “semantics“
- Round-Trip-Engineering [Sendall/Küster]
  - identifies requirements, problems and risks
- Ontology-based Software Development [Oberle et al.]
  - targets application server based development using semantic web techniques

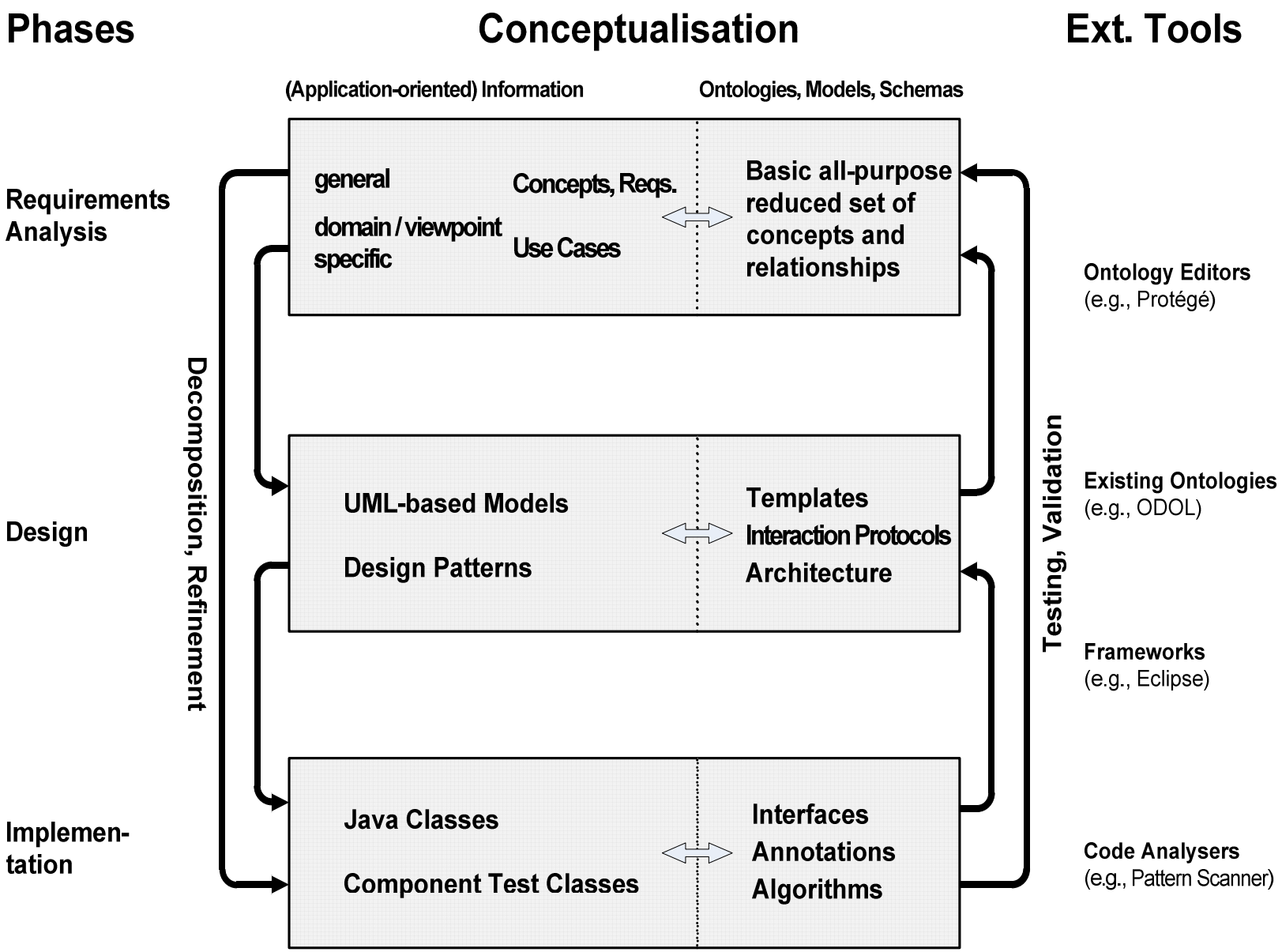
Our Approach

- **Development Phases (Modelling):**
  - Phase-dependent base ontologies, models, schemas
  - Application-oriented information management
- **Development Process Guidance:**
  - Generic Process Model
  - Visualisation

In the following:

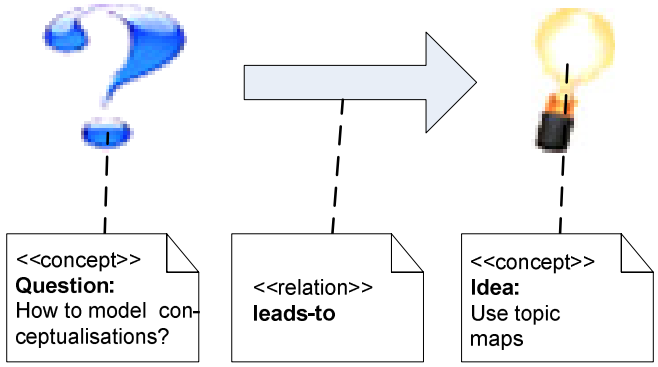
How to adapt our methodology, why are Topic Maps particularly suited?

Development Phases **(Simplified View)**



Conceptualisation: **Technical Realisation**

Concepts and Relationships




```
[question: concept = "Question" @...]
[idea: concept = "Idea" @...]
...
relationship(leads-to: relation, question, idea)
...
{question, comment, [[How to model conceptualisations?]]}
{idea, comment, [[Use topic maps]]}
...
```

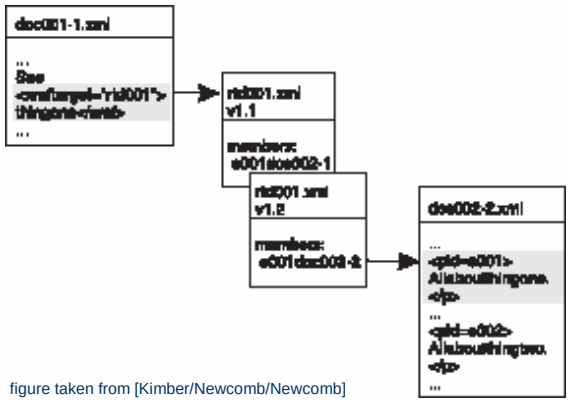


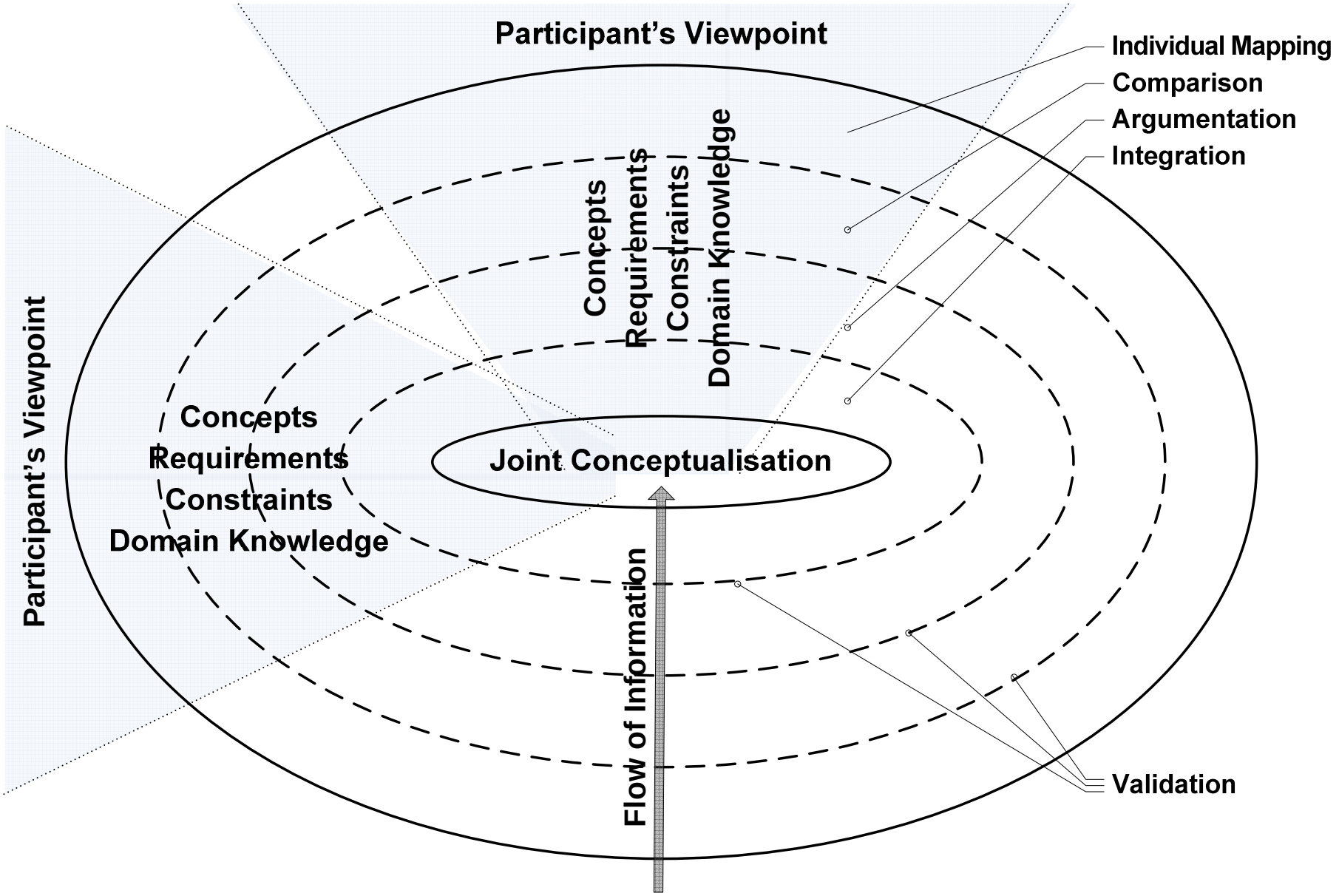
figure taken from [Kimber/Newcomb/Newcomb]

Version Control

```
relationship(references: relation, source, destination1)
    ~ internal-id1
{internal-id1, human-readable-version, [[1.0]]}
...
relationship(references: relation, source, destination2)
    ~ internal-id2
{internal-id2, human-readable-version, [[1.1]]}
superseded-by(internal-id1: outdated, internal-id2: current)
...
```

But how to make sure that changes get detected?

Process Guidance: Generic Process Model



Process Model, Roles: **Technical Realisation**

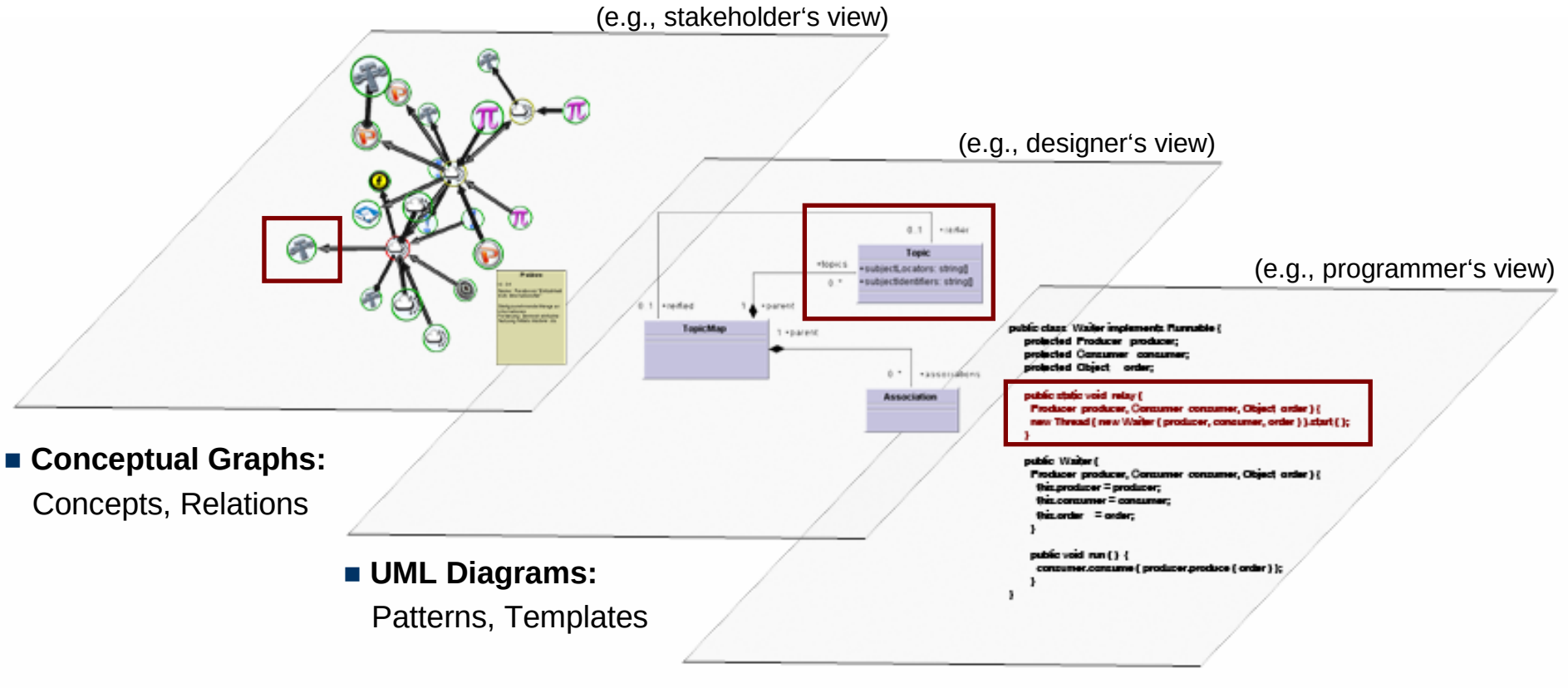
- Anything can and should be modelled using topic maps

```
[developer: role = "Developer" @...]      /* cf. stakeholder, programmer, tester, … */
[individual-mapping: subprocess = "‘Individual mapping‘ phase" @...]
…
[mue: person = "Markus Ueberall"]
[task-id1: task = "Task name"]
…
has-role(… :person, …: role, … :subprocess, … :task)
…
```

- How to associate the needed (application-specific) business logic?

```
associated-business-logic(…: java-class, …: subprocess)
associated-business-logic(…: java-class, …: task)
associated-business-logic(…: java-class, …: role)
…
[my-java-class: java-class = "check whether references changed" %"http://…/my-java.class"]
    /* better use a proxy resource here… */
```

Visualisation: Semantic Zooming, Filtering

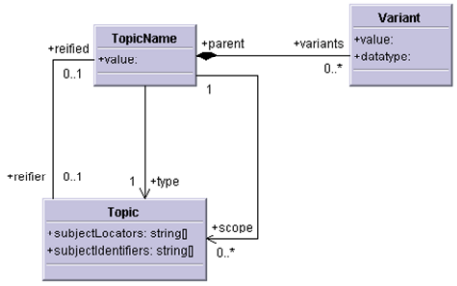


- **Conceptual Graphs:**
  Concepts, Relations
- **UML Diagrams:**
  Patterns, Templates
- **Java Code:**
  Classes, Methods, Java-specific Annotations

Visualisation: **Technical Realisation**

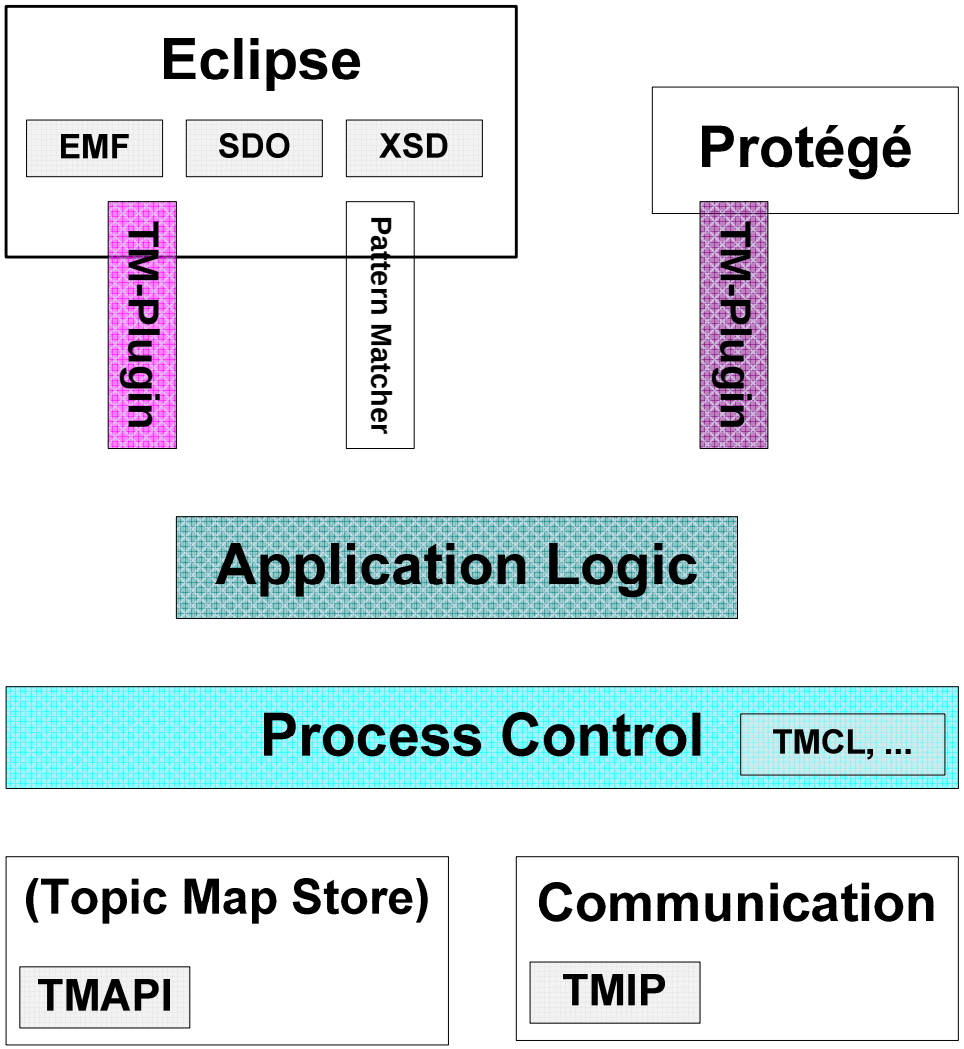
- How to connect / map concepts?

```
{view, description, "roughly corresponds to a layer in the preceding figure"}
{layouter, description, "determines how to arrange objects within a view"}
…
{template, description, "describes how to render a (set of) topic(s)"}
{editor, description, "how to edit (a set of) concept(s)"}
…
contained-in(…: concept, …: template)
applicable-to(…: template, …: view)
editable-by(…: template, …: editor)
…
relationship(references: relation, …: concept, …: template)
…
associated-business-logic(…: java-class, …)
…
```



Tool Support

- Both generic process model and visualisation support have to be evaluated
- Objective / Requirement: Integration of existing tools for ontology maintenance and round-trip engineering support
- Currently: Designing / implementing an Eclipse 3.1 Plugin



Thank you!

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Development Phases: Example

- Business Case: *Timekeeping System*
  - Employee hours are tracked by a time-clock system
- Requirements Specification
  - System must document the hours employees start/stop working and take breaks
  - Supervisors must be able to review the hours of subordinates
  - Timekeeping system must transmit employee hours to the payroll system
- Development of High-Level Essential Use Cases
  - Employee uses timekeeping terminal
- Object-Oriented Analysis
  - Conceptual modelling (think ER diagrams)
- Object-Oriented Design
  - Conceptual modelling results are translated into class diagrams
- Implementation
  - Ideally: identify, use and document well-known patterns
- Validation
  - Check whether initial requirements are met

Process Guidance: Example

- Stakeholders come up with the forementioned business case, emphasising their own point of view
  - Using the base ontologies, activities can be both expressed and linked
  - Requirements and use-cases can be drafted
- Designers start with their object-oriented analysis and design
  - During each revision of the resulting conceptual models, available constraints (i.e., the forementioned requirements) must not be violated
- Reviewers check whether the mapping between the stakeholders‘ points of view and the designers‘ models is sound
  - Without this step, no further model revisions can be commited
- Programmers work with the resulting interfaces (“class/method signatures“)
  - Any signature change will be reported and enforces another review step
- Testers check whether the initial functional and non-functional requirements are met
  - Again, deficincies will be reported „upstream“

User Interface **(old CLE prototype)**