

Support for collaborative multidisciplinary research processes: a knowledge base approach

Ayalew Kassahun, Adrie J.M. Beulens & Huub Scholten



Outline

1. Why multidisciplinary research and problems encountered
2. Process support for scientific research projects
3. Requirements for process support
4. Analysis of existing tools
5. Framework and knowledge base approach
6. Top level ontologies
7. Prototype implementation

Reasons for & problems in CMR*

Reasons for:

- Addressing shared problems
 - real world problems don't fall into one discipline or another
 - active participation of all stakeholders
 - collaboration across institutional boundaries
- Encouraged by major research sponsors and policy makers
 - The EU Framework Program (FP)
 - The US National Science Foundation (NSF)
- Promote innovation
 - brings new ideas and approaches to problems
 - enables new ways of using existing techniques
 - researchers share ideas and learn from each other
- Technologies for collaboration support
 - instant messaging, e-mail, groupware's
 - project/workflow management tools

Problems encountered:

- Collaboration problems
 - lack of coordination
 - trust/responsibility/accountability
 - information overload
- Miscommunication & misunderstanding
 - differing norms and values
 - different backgrounds and roles
 - confusing terminology
- Lack of transparency and documentation
 - lack of documentation
 - misuse of research results
- Difficulty accessing relevant and up-to-date information
 - printed documents (paper-based)
 - difficult to search and maintain
 - information overload
- Current project or workflow tools not used
 - not suited to support CMR

*CMR = Collaborative Multidisciplinary Research

Why use a process support system?

- Doing research is a (business) process. A process support system:
 - improves quality of results
 - increases efficiency of work
 - supports project management
- Process-approach to quality management & good practices
 - ISO 9000
 - CMM/CMMi
 - many health care guidelines
 - good practices (GxP)

Types of process support (aware) systems

- Different types process support tools:
 - specific vs. generic
 - application (integration & automation) vs. supporting people
 - individual vs. collaborative
 - repetitive vs. one-of-a-kind
 - routine/simple vs. knowledge intensive
- The degree to which process life cycle is supported
 - design
 - implementation
 - execution
 - reporting
 - diagnosis (evaluation)

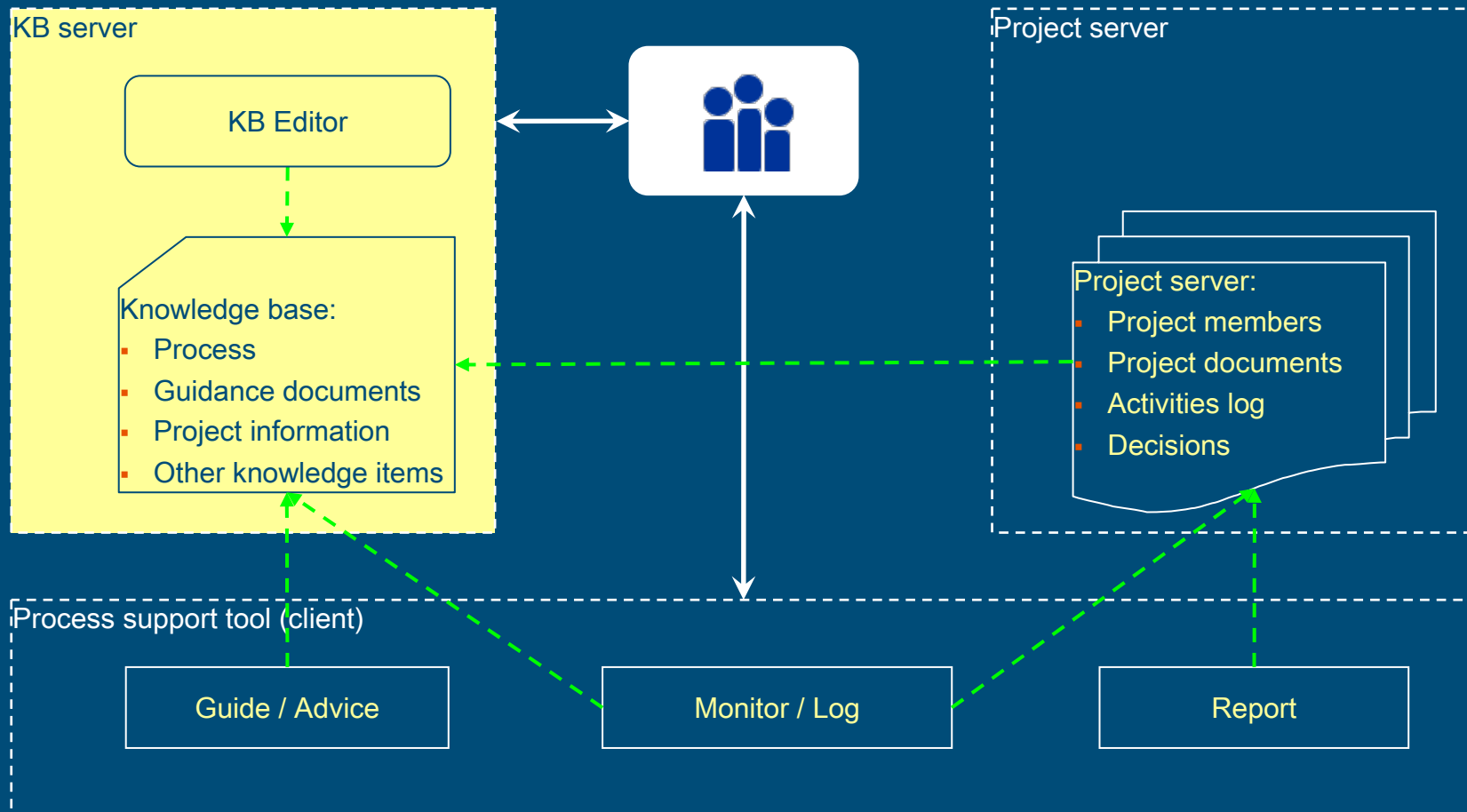
Requirement matrix

	Collaborative	One-of-a-kind (with some repetitive elements)	Knowledge intensive
Design and implementation	<ul style="list-style-type: none"> ■ Who defines the process? <ul style="list-style-type: none"> ● mostly the same people define and execute ● they are no process experts ■ Different viewpoints <ul style="list-style-type: none"> ● capture different viewpoints ● to whom is the activity/ information relevant? ● to which activity is the information relevant? 	<ul style="list-style-type: none"> ■ Structure of process <ul style="list-style-type: none"> ● ad hoc, or ● project management, or ● guidance ● not “production process” ■ Predictability <ul style="list-style-type: none"> ● less predictable ● executed once or only few times, or ● serves as a guide, like in guideline development 	<ul style="list-style-type: none"> ■ The purpose of process definition <ul style="list-style-type: none"> ● To provide guidance ● Compliance to standards and regulations ● Quality assurance ● To provide access to new findings and insights ● To organise existing state-of-the-art knowledge
Execution and diagnosis	<ul style="list-style-type: none"> ■ How is the process used? <ul style="list-style-type: none"> ● Usually as a guide – preferred/normal way of doing things ● collaborate ● tasks manually controlled ■ Different viewpoints <ul style="list-style-type: none"> ● sub-projects per problem domain ● filtering information and authorisation 	<ul style="list-style-type: none"> ■ A process per project <ul style="list-style-type: none"> ● project planning and management ● robust & tolerant to changes 	<ul style="list-style-type: none"> ■ How is the process used? <ul style="list-style-type: none"> ● Guidance ● To implement new findings and insights ● User wants access to relevant information to the activity at hand

Existing tools and standards

	Individual Collaborative	Repetitive ... One-of-a-kind	Routine ... Knowledge intensive
Application	<p><u>Workflow:</u> BPM SOA ...</p> <hr/> <p>COSA, SAP Workflow TIBCO iProcess ...</p>	<p><u>Workflow:</u> BPM SOA ...</p> <hr/> <p>COSA, SAP Workflow TIBCO iProcess ...</p>	<p><u>Workflow:</u> BPM SOA ...</p> <hr/> <p>COSA, SAP Workflow TIBCO iProcess ...</p>
People	<p>Collaborative project management ProjectInsight</p> <p>Project-aware collaboration</p> <p>Collaboration tools: ▪ TeamWare</p> <p>Knowledge-based process support for CMR</p>	<p>Case handling: FLOWer</p> <p>Project management (PM)</p> <p>PM tools: ▪ Prince2 ▪ Microsoft project</p> <p>Knowledge-based process support for CMR</p>	<p>Knowledge-based process support for CMR</p>

Supporting research processes: KB approach



Process representation using ontologies

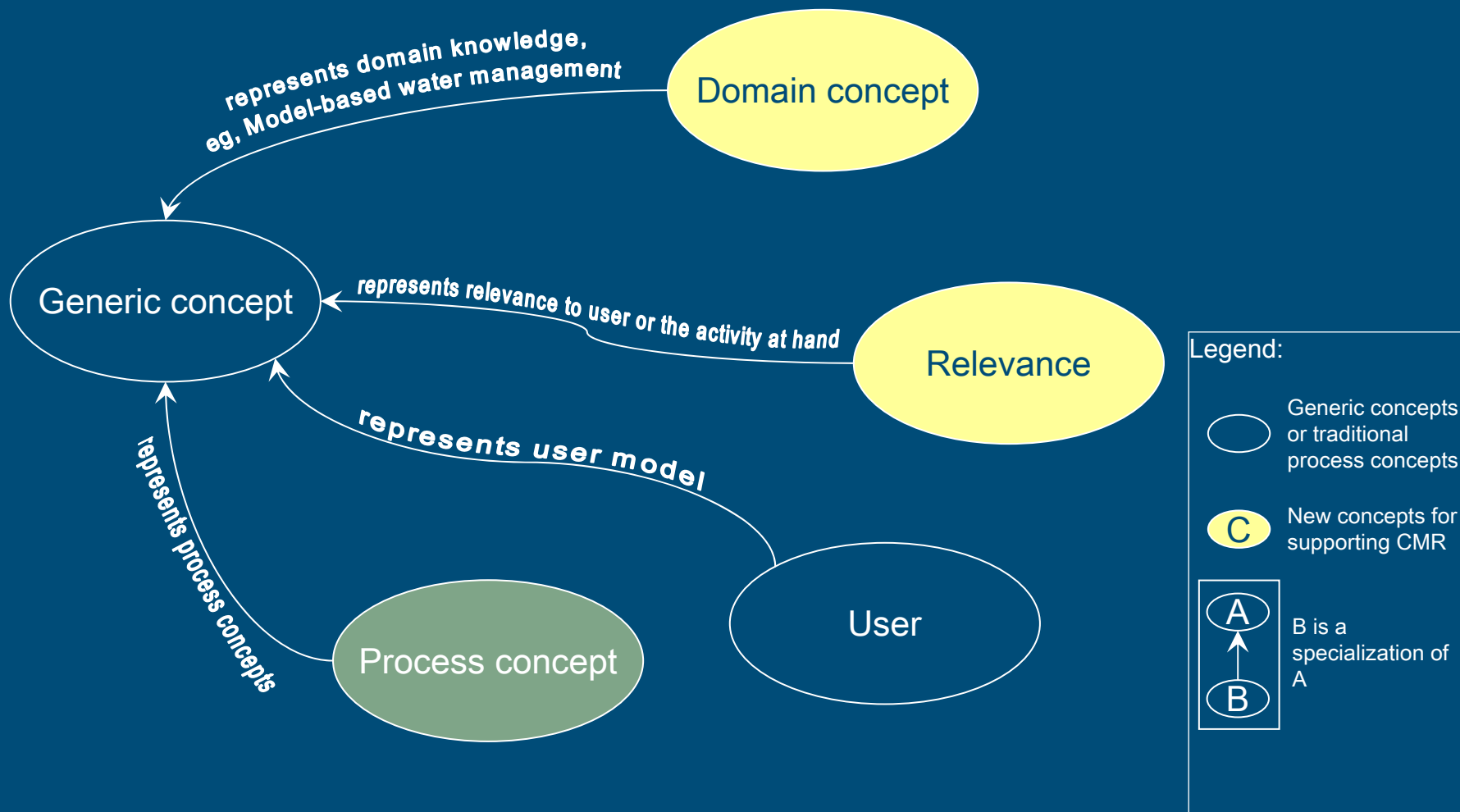
Ontology is “an explicit representation of a conceptualization”, or in simple words ...

“Ontology is a formal and declarative representation – vocabulary (or names) – for referring to the terms in a subject area, and the logical statements that describe what the terms are, ...”

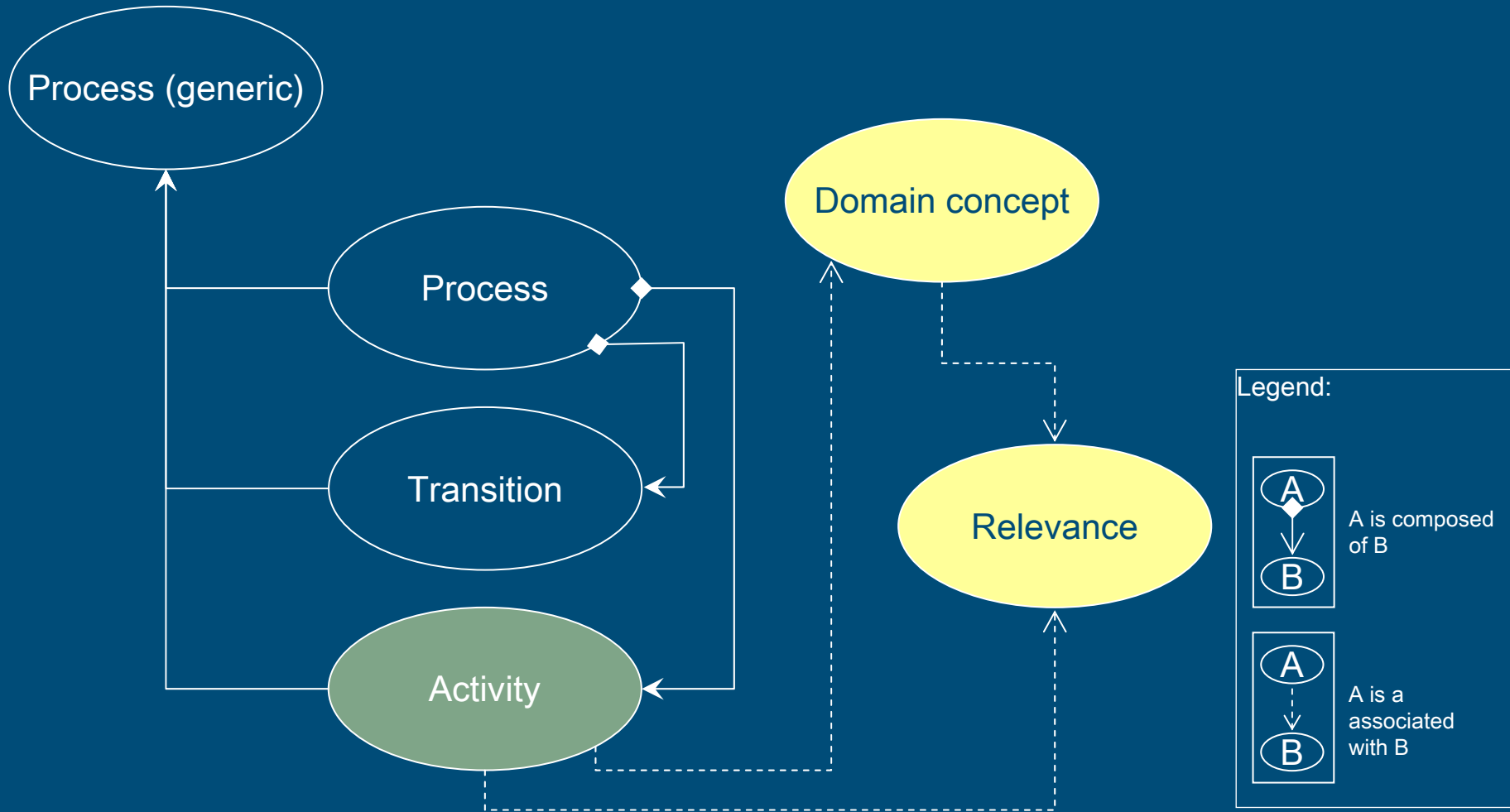
Motivation:

- Structuring & organizing existing state-of-the-art knowledge:
 - How can we organize our existing information? – Structure existing knowledge.
 - Where is a piece of information required? For a given activity, which relevant guidance's, documents, etc are there?
 - To whom is it relevant for? There is too much information; which ones are relevant for me and for the activity I am working on?
- Represent semantics:
 - automated knowledge exchange
 - a rich collection of other ontologies available

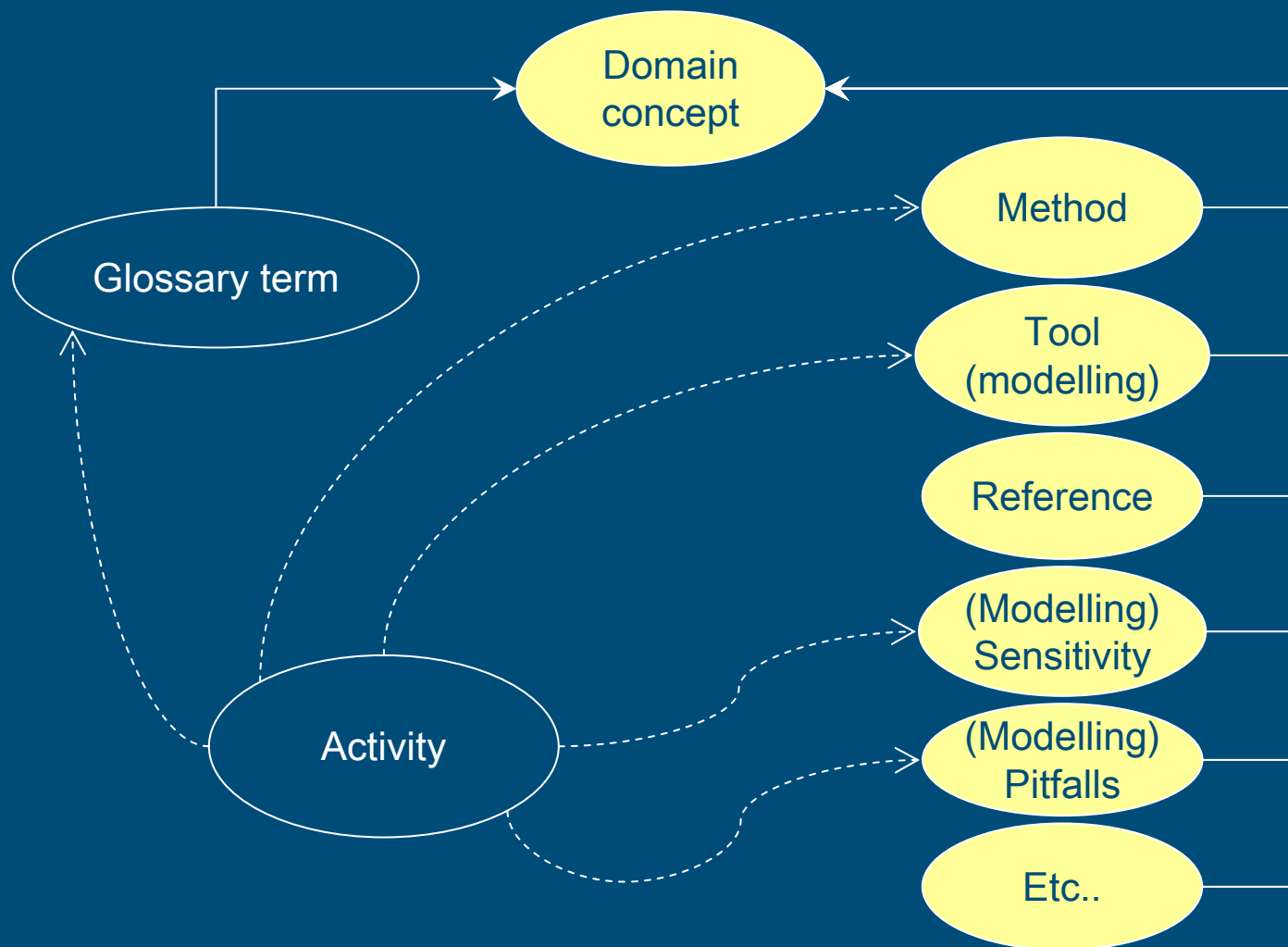
Ontologies for supporting CMR projects



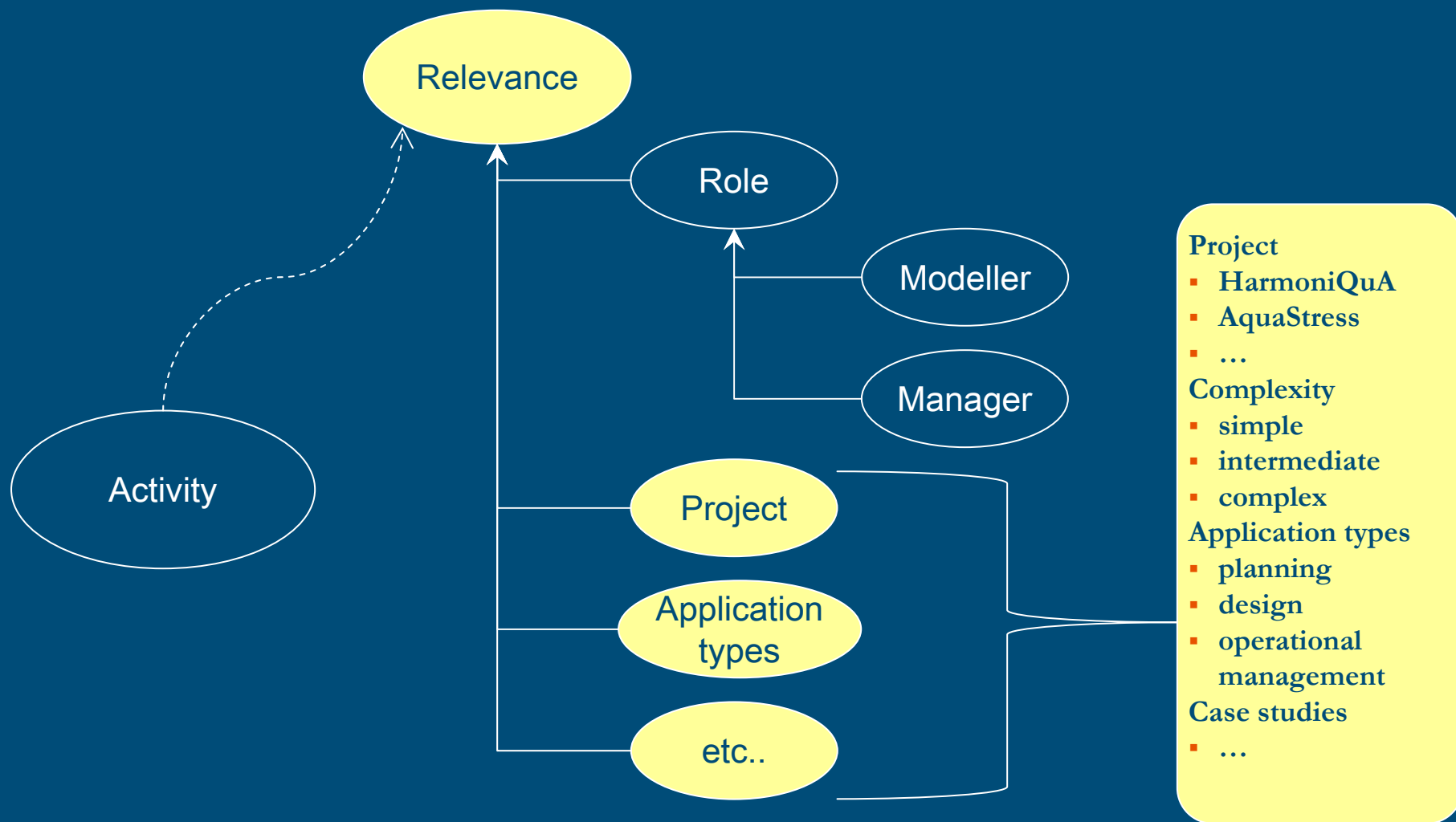
Process ontology



Domain ontology (e.g. from project HarmoniQuA)



Ontologies to describe relevance (e.g.)



Prototype: Knowledge acquisition tool (KB Editor)

Home Log in Register About

[Process List](#) » [Iskar process](#) » [Preparations](#)

- AquaStress KB
 - [-] ○ Process list
 - + ○ Iskar - Kremikovzki pollution reduction (old)
 - [-] ○ Iskar process
 - [-] **ST** Preparations
 - + **TA** Establishment of LPSF
 - + **TA** Identification of the focal problems and goals
 - + **TA** Identify (water stress mitigation) strategy
 - + **RE** Approval
 - + **ST** Test Options
 - + **ST** Evaluation and Dissemination
 - + ○ Iskar process (old)
 - + ○ Vecht process
 - + ○ Concepts

Step (Preparations)

Name: Preparations

Type: Step

Synonym(s):

Description:

Weight: 0

Task(s): [Establishment of LPSF](#)
[Identification of the focal problems and goals](#)
[Identify \(water stress mitigation\) strategy](#)
[Approval](#)

Flowchart: Note:
currently there is no flowchart viewer.

Attachment(s):

Questions:

User comment(s):

[Processes](#) | [Sites](#) | [Case studies](#) | [Indicator definitions](#) | [Option definitions](#) ||| [or Browse the KB](#)

For more information contact Ayalew Kassahun by email: ayalew.kassahun@wur.nl

Prototype: ProST guideline support component

The screenshot displays the ProST - Test v1.0 (Local - not saved yet) - Guideline v application window. The interface includes a menu bar (File, Guideline, Project, Options, Favorites, Help) and a toolbar with icons for opening projects, filtering, printing, finding text, expanding/collapsing views, navigating between views, and zooming. Below the toolbar are tabs for Guideline, Project, and Reporting.

The main workspace is divided into two panes. The left pane shows a hierarchical tree structure of the guideline:

- GU
- ST 1. Model Study Plan
 - TA 1.1. Describe Problem and Context
 - TA 1.2. Define Objectives
 - TA 1.3. Identify Data Availability
 - TA 1.4. Determine Requirements
 - TA 1.5. Prepare Terms of Reference
 - TA 1.6. Proposal and Tendering
 - RE 1.7. Agree on Model Study Plan and Budget
- ST 2. Data and Conceptualisation
- ST 3. Model Set-up
- ST 4. Calibration and Validation
- ST 5. Simulation and Evaluation

The right pane displays a detailed view of the selected task, "1.1. Describe Problem and Context". It features a list of tasks (1.1 to 1.6) and a detailed description for the selected task:

Describe Problem and Context
(User Type: MA; Domains: FF, GE, GW, HD, PR, WQ, SE, BI)

Definition

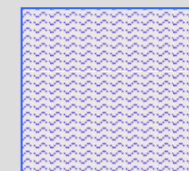
A specification of the known problem and the context of the study.

A problem has been detected. It has been decided that a modelling study could provide useful contributions towards the management decisions needed to address the problem. The first [task](#) is to analyse the problem and decide how such a modelling study might be framed. This is the responsibility

At the bottom of the window, the user type and domain type are listed: User type: MD, MA, AU, SH, PU - Domain type: MD, BI, FF, GW, HD, PR, SE, WQ, GE.

Prototype: ProST monitoring component

Project server



Concluding remarks:

- CMR needs to be supported and managed like most (business) processes. The knowledge base approach described in this presentation provides support by providing the means for:
 - gathering & structure existing state-of-the-art knowledge required
 - structuring state-of-the-art knowledge using ontologies
 - Ontologies are fundamental to domain knowledge modeling and integrating different systems. As an integration mechanism ontologies allow us to link knowledge and process management systems
 - linking project activities to knowledge items
 - capturing the different view points and perspectives
 - providing timely and personalized guidance
 - facilitating collaboration
 - allow users to share information and exchange ideas
 - indicate where and to whom a knowledge item is relevant for, thereby allowing filtering of information and overcoming information overload
- Prototype implementations are available:
 - www.harmoniqua.org
 - www.harmoniqua.org/aquastress

Questions?

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