

# Conceptual Modelling in Wikis

## A Reference Architecture and a Tool

**Marco Rospocher**

Fondazione Bruno Kessler (FBK) - Trento, Italy



**DKM**  
DATA & KNOWLEDGE  
MANAGEMENT

<http://dkm.fbk.eu/rospocher>

[rospocher@fbk.eu](mailto:rospocher@fbk.eu)

Joint work with:

Chiara Ghidini, Luciano Serafini

# Introduction

- Wiki increasingly adopted for **collecting**, **sharing**, and **managing** knowledge;
- Publishing of the unstructured wiki content in a **structured form**:
  - **DBpedia, Semantic MediaWiki, ...**
- Recent works on developing wiki-based tools for collaborative construction and visualization of **conceptual models**:
  - **SMW+, MoKi, OntoWiki, AceWiki, IkeWiki, ...**
- Crafting a wiki for a conceptual modeling language is still a challenging task: **a reference architecture** is needed!

# Introduction

- A wiki-based architecture for conceptual modeling **should address** the following aspects:

**Generality aspects:** *The reference architecture must aim at understanding **how the features of wikis** can be used to **represent the building blocks of a general conceptual modeling language**, before tailoring them to the needs of a particular one;*

**Collaboration aspects:** *The reference architecture must aim at understanding **how the features of wikis** can be used to **support an active and well-balanced collaboration** between domain experts and knowledge engineers in modeling.*

# Our Contribution

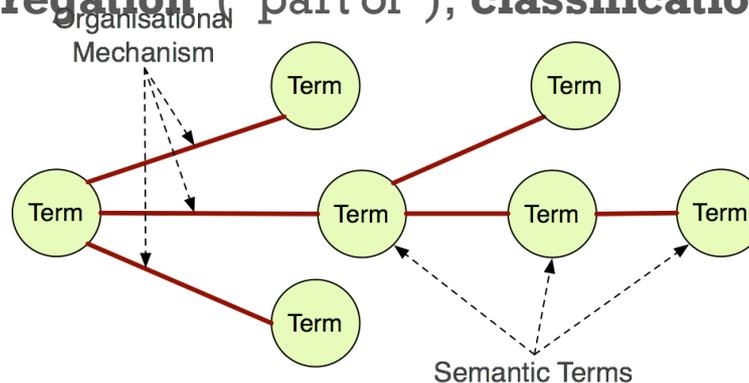
- A **reference architecture** for wiki-based conceptual modeling tools, having the following distinctive characteristics:
  1. the **use of wiki pages** to mimic the basic building blocks of conceptual modeling languages;
  2. the organization of wiki pages in an **unstructured part** (for unstructured content) and a **structured part** (for structured content); and
  3. a **multi-mode access to the pages** to facilitate the usage both by domain experts and knowledge engineers.
  
- An **implementation** of the architecture in **MoKi**, a wiki for modeling ontologies and business processes.

# Outline

- Conceptual Modeling (CM)
- A reference architecture for CM wikis
- MoKi: an implementation of the proposed architecture
- Some real-world usages of MoKi
- MoKi Evaluation Results and Lesson Learned
- Conclusions & Future Work

# Conceptual Modeling Languages

- **Conceptual Model:** A description of knowledge organized in **nodes** that represent concepts, and **associations** that represent relationships between them (e.g. *ontologies*, *business processes*).
- **Conceptual Modeling Language:** a language to build conceptual models (e.g. *OWL*, *BPMN*). Building blocks of the language:
  - **Semantic terms:** these are the concepts built into the conceptual model (e.g. entities, activities, agents, ...);
  - **Organisational mechanisms:** these are primitive mechanisms for structuring the model along different dimensions, e.g. **generalization** (“*isA*”), **aggregation** (“*part of*”), **classification** (“*instanceOf*”), ...



# An architecture for collaborative conceptual modeling in wikis

## 1. **One element** ↔ **One page**

- each element of the model is represented by a page in the wiki;

Concept “Mountain”



### Mountain

A **mountain** is a large [landform](#) that stretches above the surrounding land in a limited area usually in the form of a peak. A mountain is generally steeper than a [hill](#).

The highest mountain on earth is the [Mount Everest](#)



- special pages for browsing / editing of the overall organization of the conceptual model according to a specific organizational mechanism

# An architecture for collaborative conceptual modeling in wikis

## 2. **Unstructured** and **structured** descriptions

- each page contains both structured and unstructured content;

### Mountain

A **mountain** is a large **landform** that stretches above the surrounding land in a limited area usually in the form of a peak. A mountain is generally steeper than a **hill**.

The highest mountain on earth is the **Mount Everest**



$\sqsubseteq$  *Landform*

---

$\sqsubseteq$   $\neg$ *Hill*  $\sqcap$   $\neg$ *Plain*

---

$\sqsubseteq$   $\forall$ *madeOf*(*Earth*  $\sqcup$  *Rock*)

---

$\sqsubseteq$   $\exists$ *height*.  $\geq$ 2500

---

*Mountain*(*Mt.Everest*)

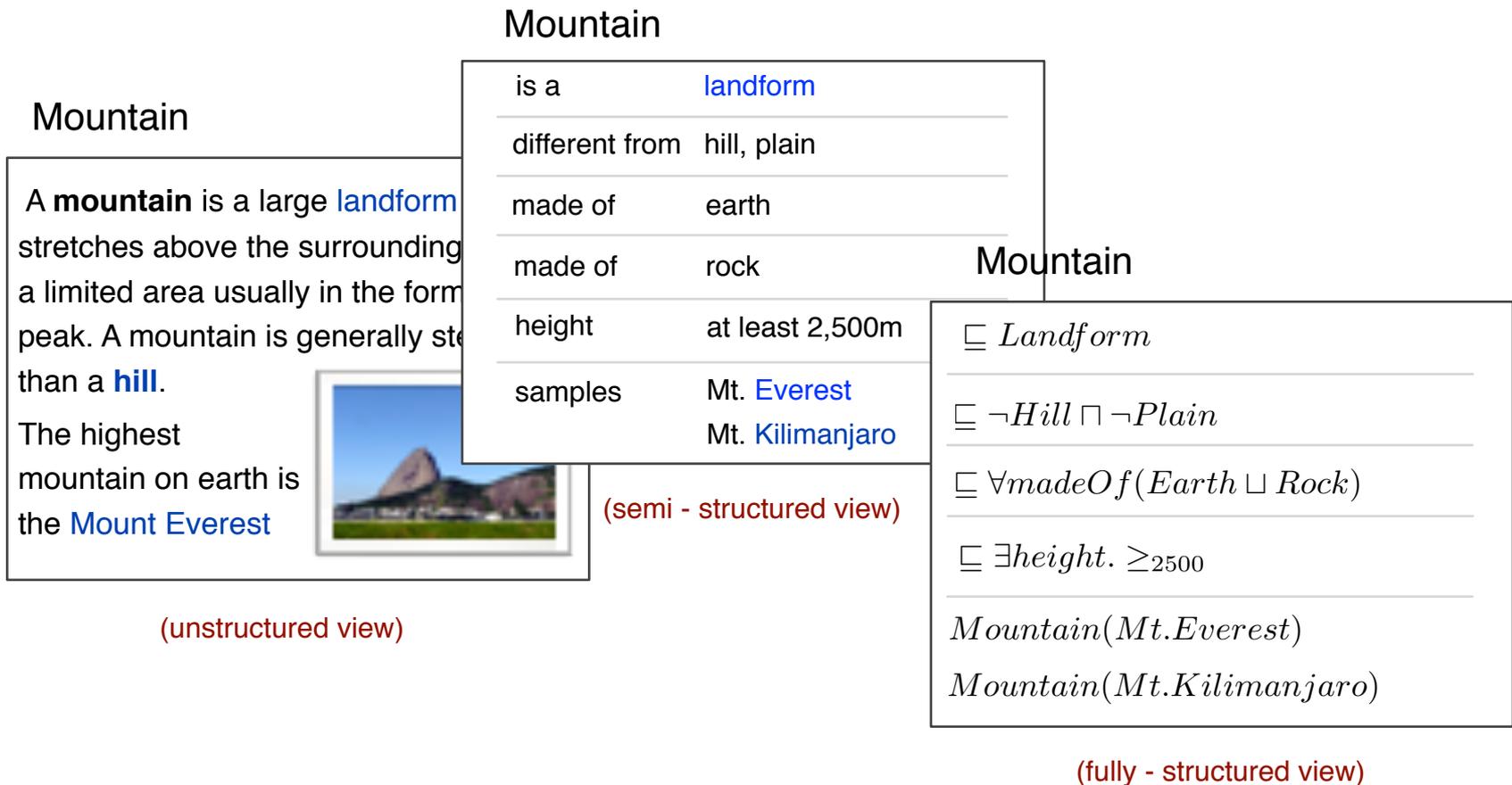
*Mountain*(*Mt.Kilimanjaro*)

(unstructured content)
(structured content)

# An architecture for collaborative conceptual modeling in wikis

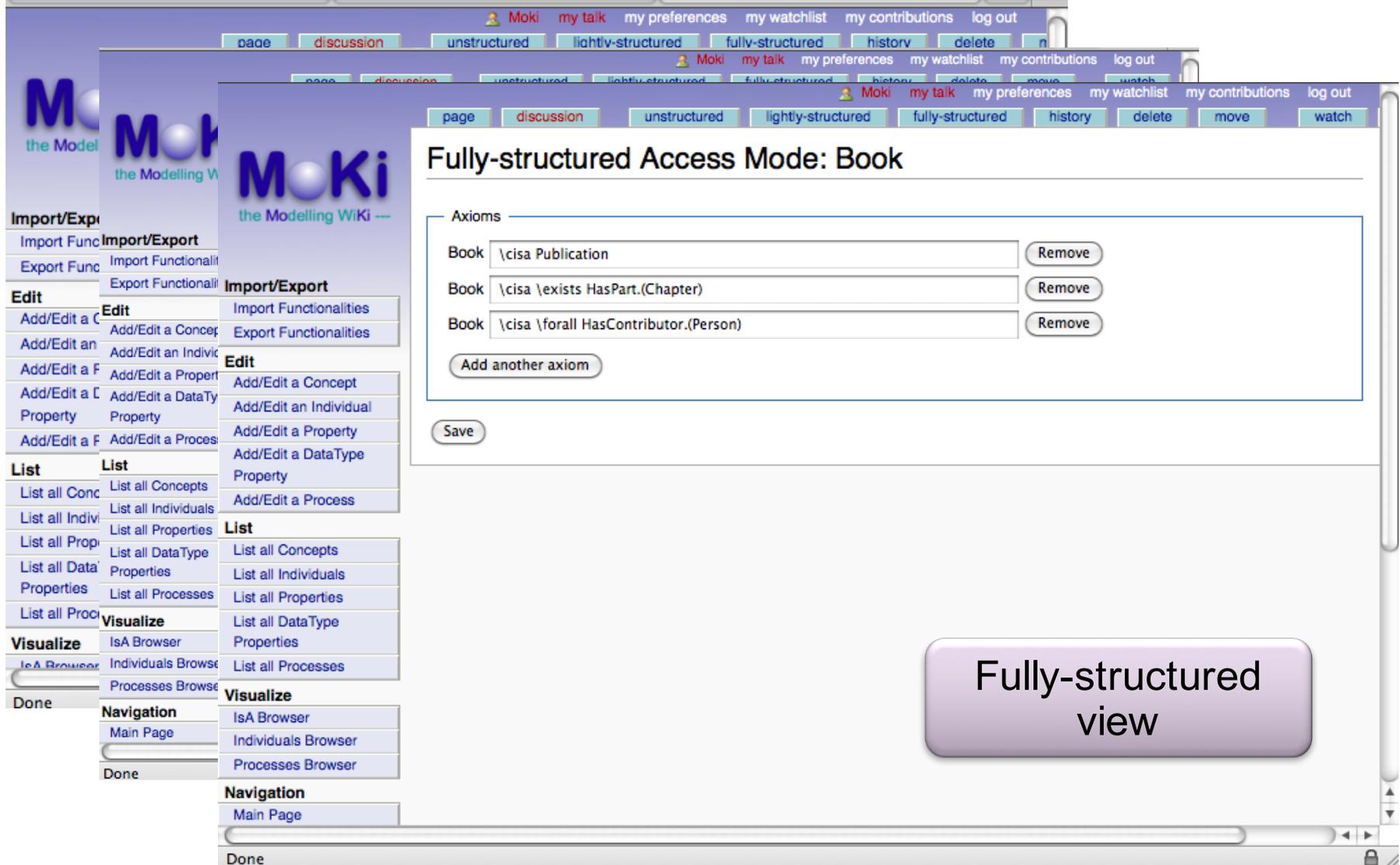
## 3. **Different views** to access the model:

- different views to support different modeling actors;



- Is a **conceptual modeling wiki**;
- Supports the **integrated modeling** of BPMN Processes and OWL Ontologies;
- Provides modeling support both for domain experts and knowledge engineers, fostering the **collaboration** between them;
- Based on the MediaWiki framework (Wikipedia);
- Released **Open Source** in July 2010 (version 1.2 – GPL2);
- **MoKi WebSite:** <http://moki.fbk.eu>
  - On-line demos, code download, documentation, news, support...

# Different views for different roles



The screenshot displays the Moki web application interface. At the top, there is a navigation bar with user links: Moki, my talk, my preferences, my watchlist, my contributions, and log out. Below this, there are tabs for different views: page, discussion, unstructured, lightly-structured, fully-structured, history, delete, move, and watch. The main content area is titled "Fully-structured Access Mode: Book". It contains a section for "Axioms" with three entries:

- Book \cisa Publication (Remove)
- Book \cisa \exists HasPart.(Chapter) (Remove)
- Book \cisa \forall HasContributor.(Person) (Remove)

There is an "Add another axiom" button and a "Save" button at the bottom of the axioms section. The left sidebar contains several menu categories:

- Import/Export**: Import Functionalities, Export Functionalities
- Edit**: Add/Edit a Concept, Add/Edit an Individual, Add/Edit a Property, Add/Edit a Data Type, Add/Edit a Process
- List**: List all Concepts, List all Individuals, List all Properties, List all Data Type Properties, List all Processes
- Visualize**: IsA Browser, Individuals Browser, Processes Browser
- Navigation**: Main Page

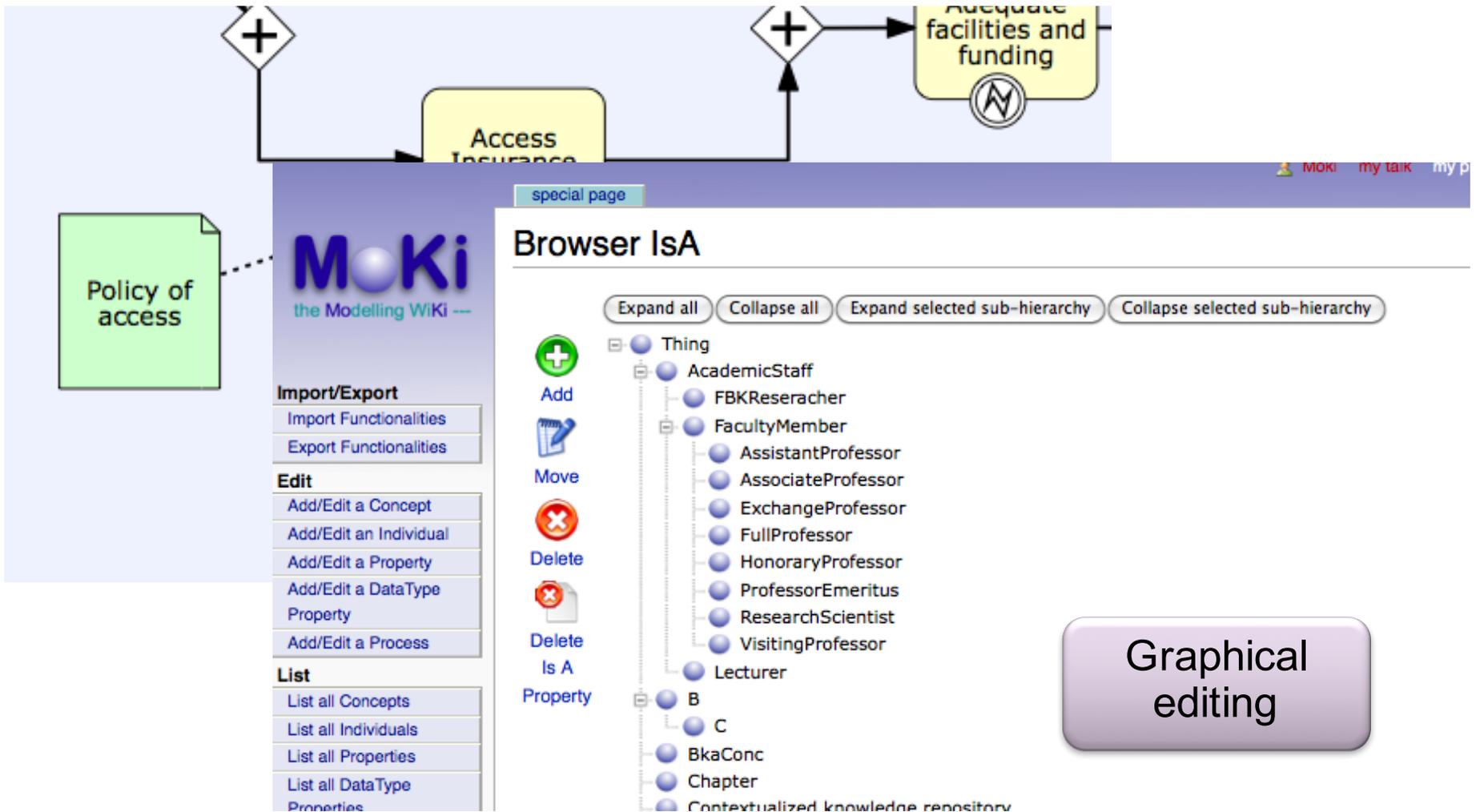
A callout box in the bottom right corner of the screenshot contains the text "Fully-structured view".

# Different views for different roles

The screenshot displays the Moki web application interface, showing three overlapping views of a process diagram for 'Hospital Administration'. The top view is 'Lightly-structured Access Mode', the middle view is 'Lightly-structured Access Mode: Hospital Administration', and the bottom view is 'Fully-structured Access Mode: Hospital Administration'. The 'Fully-structured' view shows a detailed process flow with nodes like 'Patient request admission to hospital', 'Access Medical History database', 'Adequate facilities and funding', 'Refer to other hospitals', 'Reserve Room for Patient', 'Check in Patient', 'Alert consulting Doctor', and 'Update Hospital Admission Records'. A 'Policy of access' document is also visible in the diagram.

The interface includes a navigation menu on the left with sections: Import/Export, Edit, List, Visualize, and Navigation. The top navigation bar shows user information (Moki) and various actions (page, discussion, unstructured, lightly-structured, fully-structured, history, delete, move, unwatch).

# Further features



The screenshot displays the MOKi web interface. At the top, a diagram shows a hierarchy of concepts: a diamond with a plus sign points to a yellow box labeled "Access Insurance", which in turn points to another diamond with a plus sign, which points to a yellow box labeled "Adequate facilities and funding".

Below the diagram is a navigation bar with "special page" and user links "MOKi", "my talk", and "my p".

The main content area is split into two panels:

- Left Panel:** Features the MOKi logo "the Modelling Wiki" and a "Policy of access" document icon. Below are sections for "Import/Export" (Import/Export Functionalities), "Edit" (Add/Edit a Concept, Add/Edit an Individual, Add/Edit a Property, Add/Edit a DataType Property, Add/Edit a Process), and "List" (List all Concepts, List all Individuals, List all Properties, List all DataType Properties).
- Right Panel:** Titled "Browser IsA", it shows a hierarchical tree of concepts. The root is "Thing", which branches into "AcademicStaff" and "FacultyMember". "AcademicStaff" includes "FBKReseracher". "FacultyMember" includes "AssistantProfessor", "AssociateProfessor", "ExchangeProfessor", "FullProfessor", "HonoraryProfessor", "ProfessorEmeritus", "ResearchScientist", and "VisitingProfessor". Below "FacultyMember" is "Lecturer". The tree continues with "B", "C", "BkaConc", "Chapter", and "Contextualized knowledge repository".

At the bottom right, a purple rounded rectangle contains the text "Graphical editing".

# Further features: key concepts extraction

| Extr     | Concepts extracted (Ordered by Relevance)                                                             | Relevance | 100% matching | Substring of a Concept | Exists a Concept substring of this Term | Synonym 100% matching | Synonym Substring of a Concept | Exists a Concept substring of this Synonym |
|----------|-------------------------------------------------------------------------------------------------------|-----------|---------------|------------------------|-----------------------------------------|-----------------------|--------------------------------|--------------------------------------------|
| (Power   | ▼ activity                                                                                            | 1.00000   | X             |                        |                                         |                       | (2)                            | (4)                                        |
| Files    | ▶ Kx Corpus Synonyms                                                                                  |           |               |                        |                                         |                       |                                |                                            |
|          | ▼ Wordnet                                                                                             |           |               |                        |                                         |                       |                                |                                            |
| Uplo     | ▼ Synset_Num:n#00261466                                                                               |           |               |                        |                                         |                       |                                |                                            |
|          | Wordnet Semfield: <b>Factotum</b>                                                                     |           |               |                        |                                         |                       |                                |                                            |
| ⊕ Sho    | Sumo Entry:<br><b>IntentionalProcess</b>                                                              |           |               |                        |                                         |                       |                                |                                            |
| Remov    | Wordnet Definition: <b>any specific activity or pursuit; "they avoided all recreational activity"</b> |           |               |                        |                                         |                       |                                |                                            |
| Conf     | Is a: <b>act, human action, human activity</b>                                                        |           |               |                        |                                         |                       |                                |                                            |
| Re-loc   | ▶ Synset_Num:n#10090167                                                                               |           |               |                        |                                         |                       |                                |                                            |
|          | ▶ Synset_Num:n#09713396                                                                               |           |               |                        |                                         |                       |                                |                                            |
| Language | ▶ Synset_Num:n#10421664                                                                               |           |               |                        |                                         |                       |                                |                                            |
|          | ▶ Synset_Num:n#09670326                                                                               |           |               |                        |                                         |                       |                                |                                            |
| Take m   | ▶ Synset_Num:n#07828926                                                                               |           |               |                        |                                         |                       |                                |                                            |
|          | ▶ Synset_Num:n#03655835                                                                               |           |               |                        |                                         |                       |                                |                                            |
| • eith   | ▶ attribute                                                                                           | 0.88020   |               |                        |                                         | (1)                   | (1)                            |                                            |
| • or     | sequence flow                                                                                         | 0.71714   | X             |                        |                                         |                       |                                |                                            |
| Maximu   | ▶ business process modeling notation                                                                  | 0.70216   |               |                        | X                                       |                       | (1)                            | (1)                                        |
|          | ▶ task                                                                                                | 0.49418   | X             |                        |                                         |                       |                                |                                            |
| Prefer   | ▶ mapping                                                                                             | 0.48253   |               |                        |                                         |                       |                                |                                            |
|          | ▶ flow                                                                                                | 0.47920   |               | X                      |                                         |                       |                                |                                            |
| Prefer : | ▶ message                                                                                             | 0.43927   | X             |                        |                                         |                       |                                |                                            |
|          | ▶ sub process                                                                                         | 0.41265   | X             |                        |                                         |                       |                                | (3)                                        |
|          | ▶ gateway                                                                                             | 0.39268   | X             |                        |                                         |                       |                                |                                            |
| Extrac   | ▶ pool                                                                                                | 0.30116   | X             |                        |                                         |                       |                                |                                            |

|                                                                                                                                             |                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p><b>aposdle</b><br/>learn @ work</p>                     | <ul style="list-style-type: none"> <li>• IP FP6 EU Project [03/2006 – 02/2010]</li> <li>• <b>Modeling of tasks/processes in an enterprise and of the topics related to that task (competencies)</b></li> <li>• Used by: 4 SMEs, 3 Universities, ...</li> </ul>          |
|  <p><b>PESCa</b><br/>IIIIIIIIII DO</p>                     | <ul style="list-style-type: none"> <li>• STREP FP7 EU project [01/2010 – 12/2012]</li> <li>• <b>Build/revise an environmental ontology</b></li> </ul>                                                                                                                   |
|  <p>Organic.Edunet</p>                                      | <ul style="list-style-type: none"> <li>• eContentplus EU Project [09/2007 – 08/2010]</li> <li>• <b>Build an ontology of organic agriculture and agroecology</b></li> <li>• Used to foster collaboration between domain experts (FAO) and knowledge engineers</li> </ul> |
|  <p><b>PRO DE</b><br/>PROGETTO<br/>DEMATERIALIZAZIONE</p> | <ul style="list-style-type: none"> <li>• Italian national project [01/2010 – 12/2012]</li> <li>• <b>Modeling of documental flows for analysis/revision and dematerialization</b></li> <li>• Used by employees in 7 Italian regions</li> </ul>                           |
| <p><b>OncoCure</b></p>                                                                                                                      | <ul style="list-style-type: none"> <li>• Fondazione Caritro, Trento [2007 – 2008]</li> <li>• <b>Modeling breast cancer clinical protocols encoded in Asbru.</b></li> </ul>                                                                                              |
| <p><b>eOnco</b></p>                                                                                                                         | <ul style="list-style-type: none"> <li>• FBK Joint Research Project [2009 - 2013]</li> <li>• <b>Modeling of nurse activities in an oncology ward.</b></li> </ul>                                                                                                        |

# Evaluation & Lessons learned

- Evaluation (involving PA employees)
  - Application log analysis + user questionnaires;
- Evaluation Results (excerpt):
  - The users perceived the tool as **more than easy to use**;
  - The users **positively perceived the overall usefulness** of the tool for the collaborative modeling of documents and processes.
- Lessons Learned:
  - Wikis can be a powerful way to **lower the entrance barrier** for inexperienced users to modeling tools and sharing of knowledge;
  - Collaboration **happens** and is **helpful**;
  - Need to **guide domain experts** by providing schemata of representations; e.g., what characterizes a document?

# Conclusions. What you have seen...

- What you have seen...
  - A **reference architecture** for conceptual modeling wikis;
  - **MoKi**: a wiki-based conceptual modeling tool fully implementing the reference architecture;
  - An excerpt of some of the **real-world** usages of MoKi;
  - **Positive** end-user evaluation results.
- ... and what we are working on:
  - Extraction of relations and DL axioms from a text corpus;
  - Handling of multilingual ontologies (w. Organic.Lingua EU project);
  - Dynamic generation of the forms to be used by Domain Experts;
  - Handling of namespaces / modular ontologies;
  - ...

Thank You!

Questions?



**Marco Rospoche**

<http://dkm.fbk.eu/rospoche>  
[rospoche@fbk.eu](mailto:rospoche@fbk.eu)



**MoKi**

<http://moki.fbk.eu>  
[moki-info@fbk.eu](mailto:moki-info@fbk.eu)