

Wiki-based conceptual modeling: an experience with the Public Administration

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Joint work with:

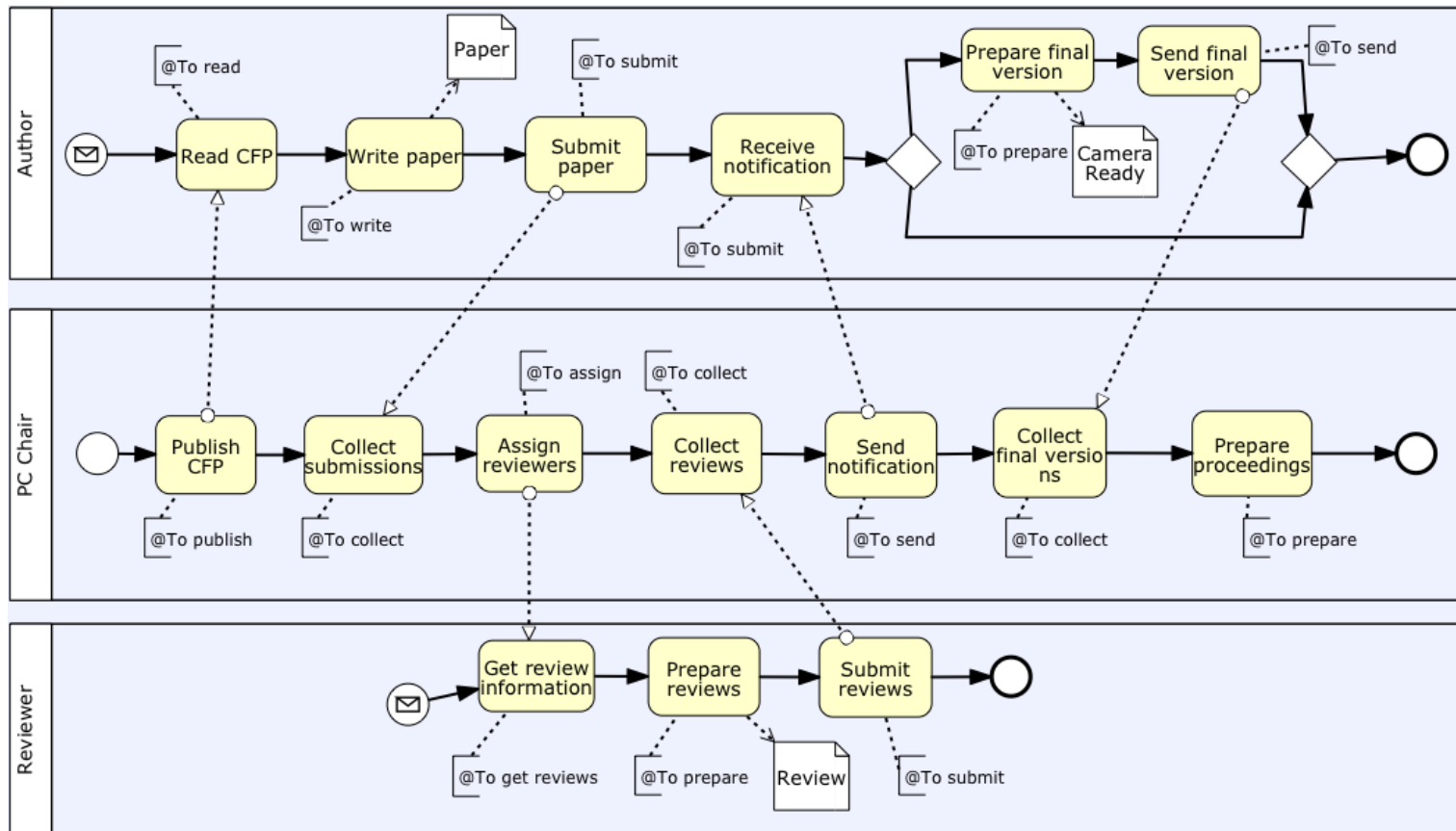


Cristiano Casagni, Chiara Di Francescomarino, Mauro Dragoni, Licia Fiorentini, Luca Franci, Matteo Gerosa, Federica Rizzoli, Marco Rospocher, Anna Rovella, Luciano Serafini, Stefania Sparaco, and Alessandro Tabarroni

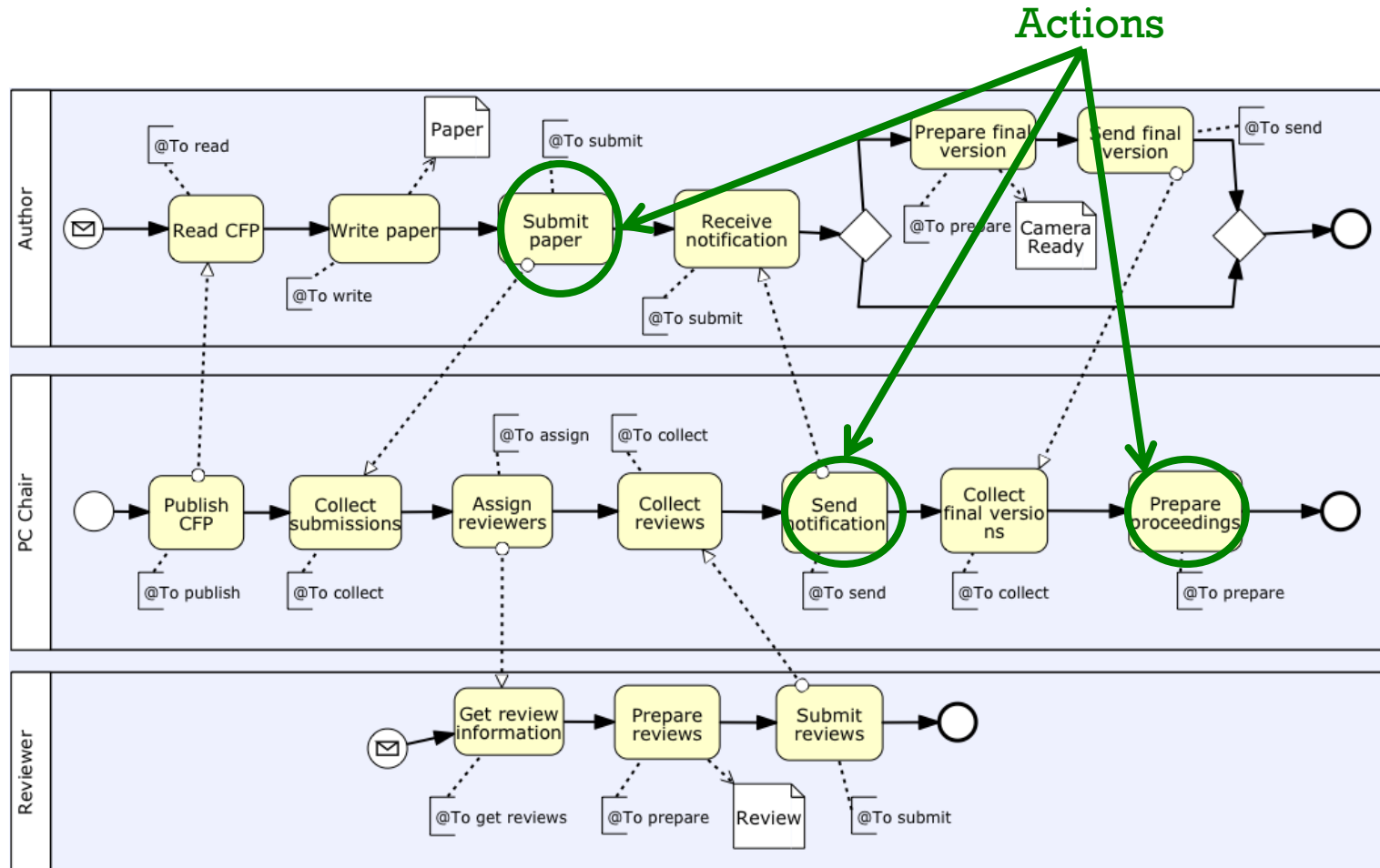
What is this about?

- Development of a theoretical and practical framework that:
 - Supports the **integrated modeling** of Processes and Ontologies and their representation in formal models;
 - Fosters the **collaboration** between domain experts and knowledge engineers;
 - Is **useful** in practical settings (e.g., the Public Administration).

Why integrated modeling of processes and ontologies?

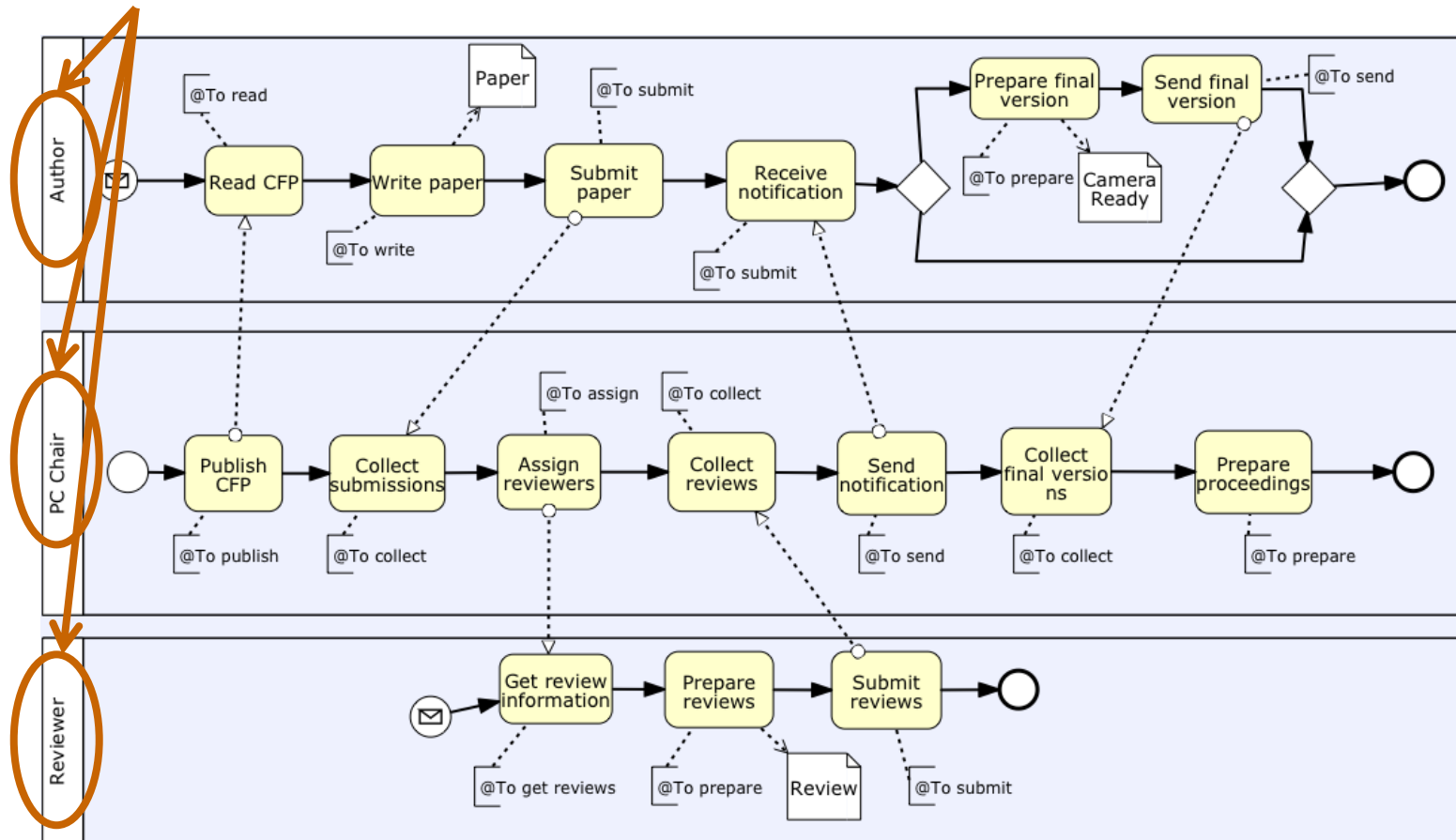


Why integrated modeling of processes and ontologies?

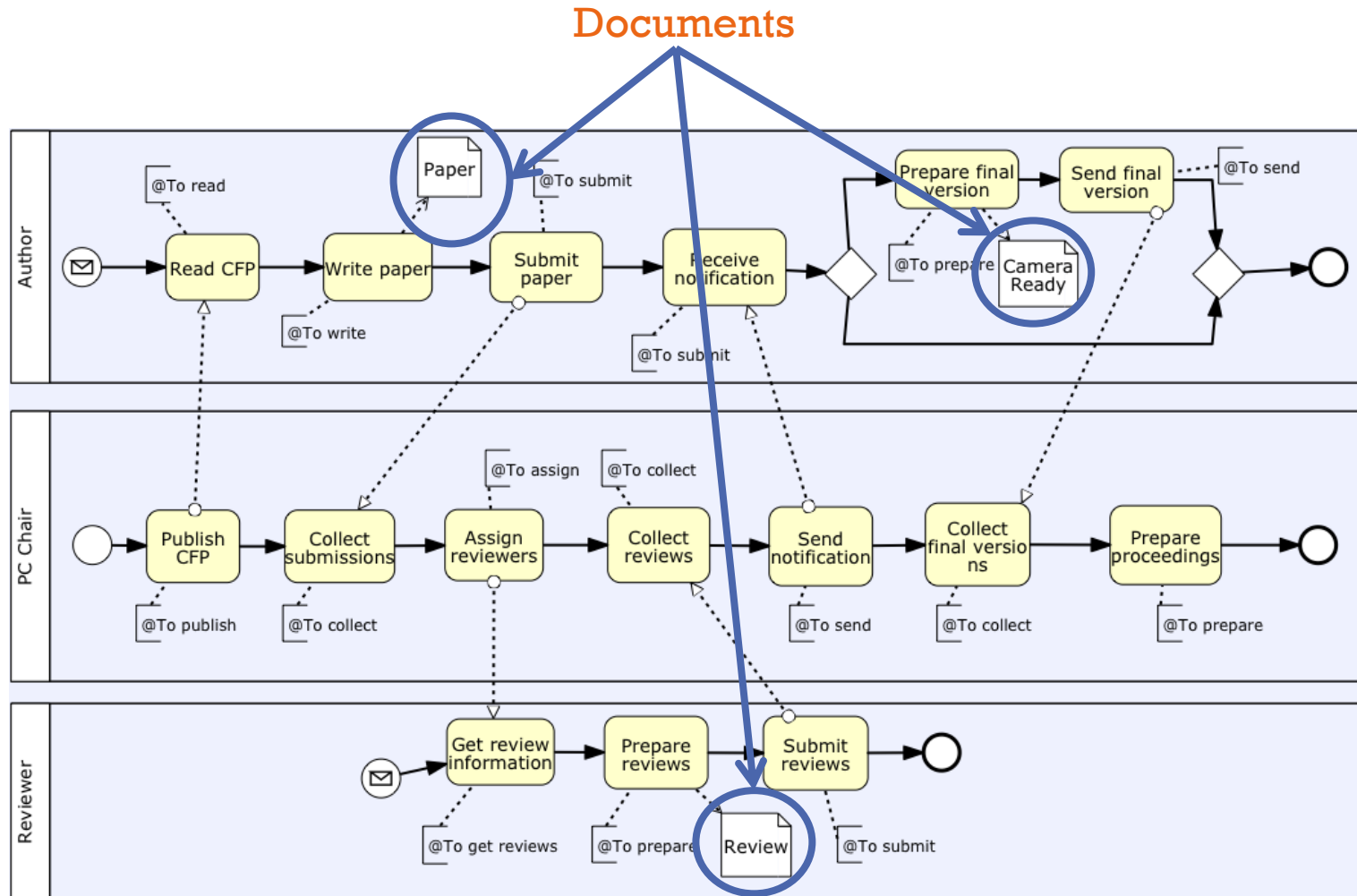


Why integrated modeling of processes and ontologies?

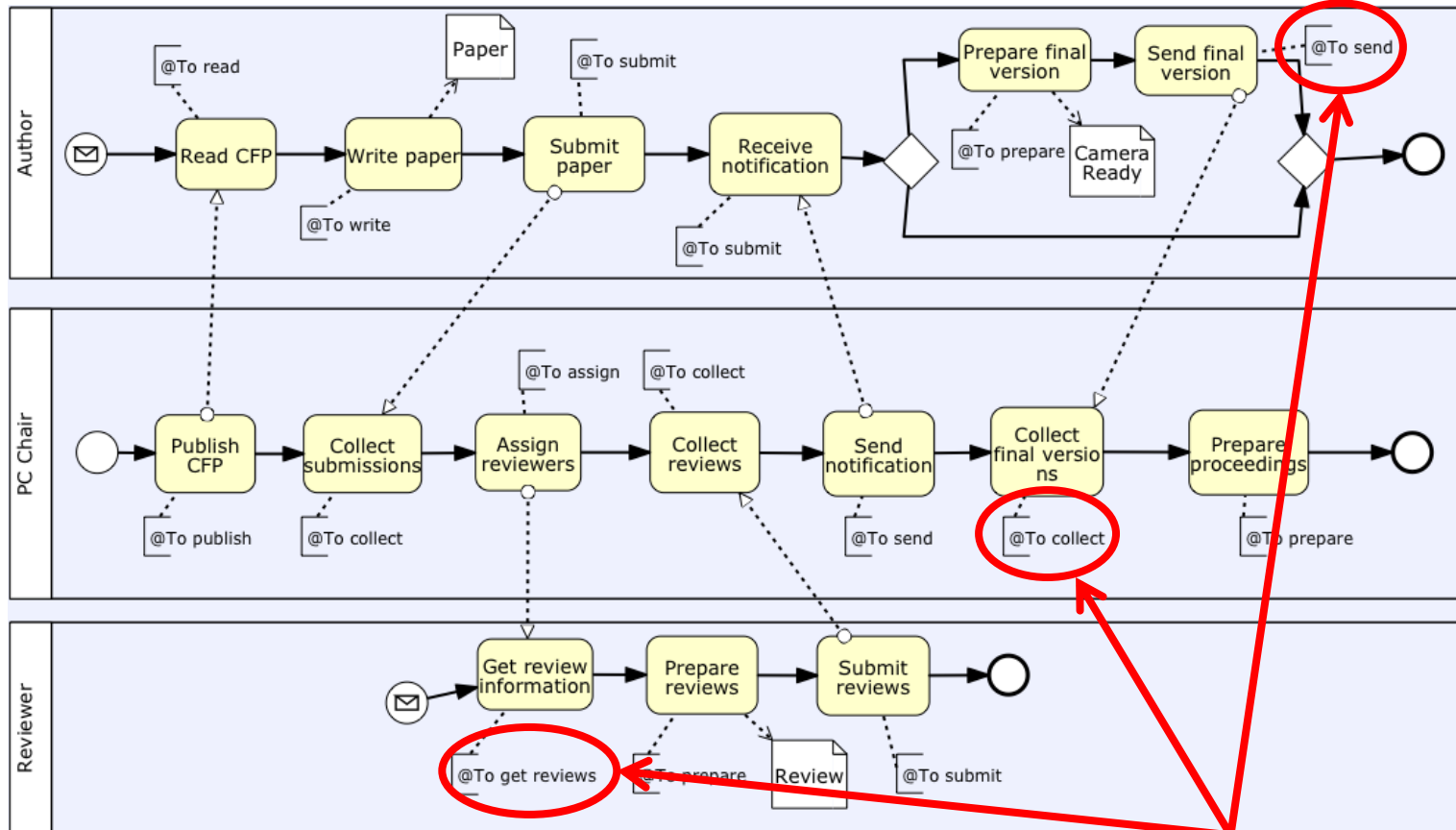
Roles / Organization



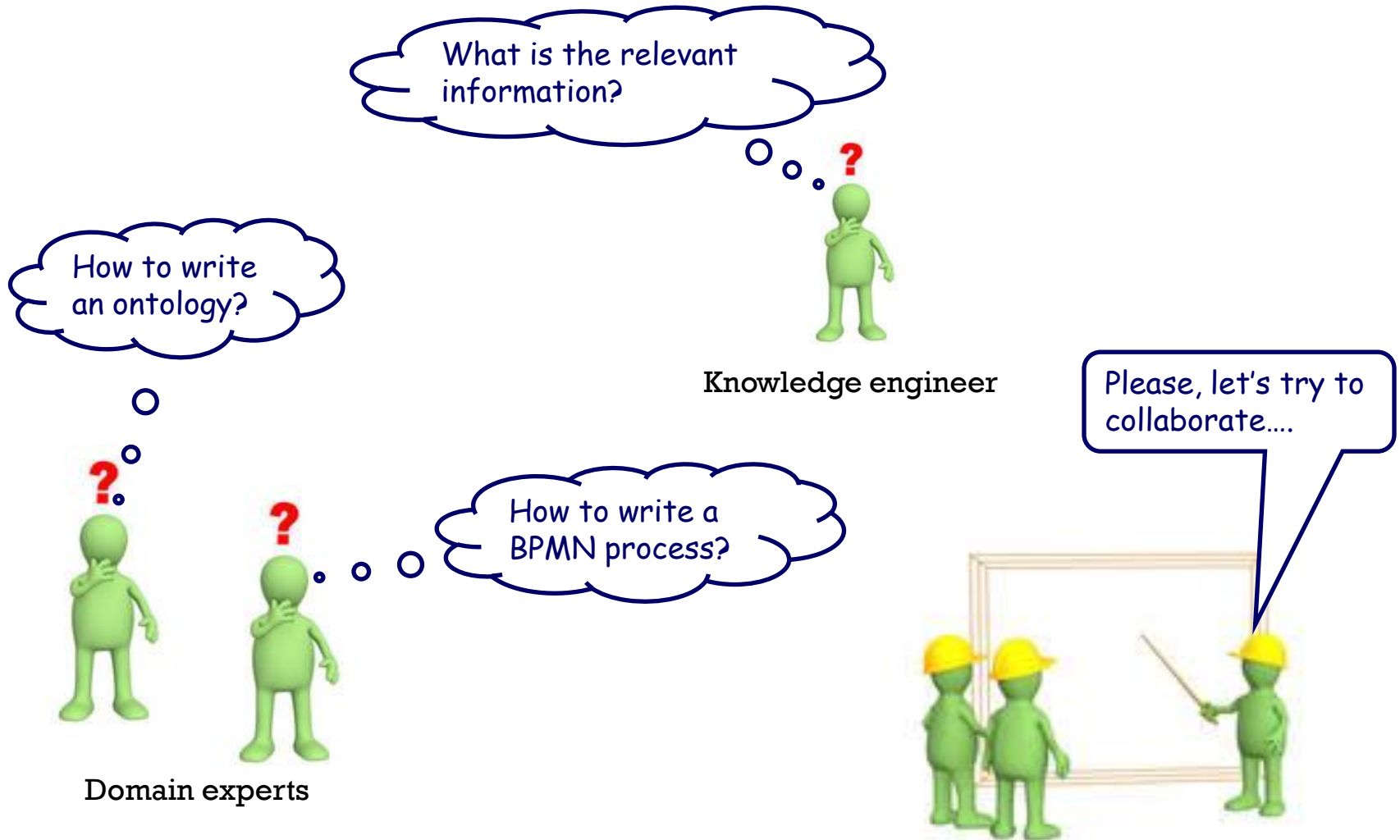
Why integrated modeling of processes and ontologies?



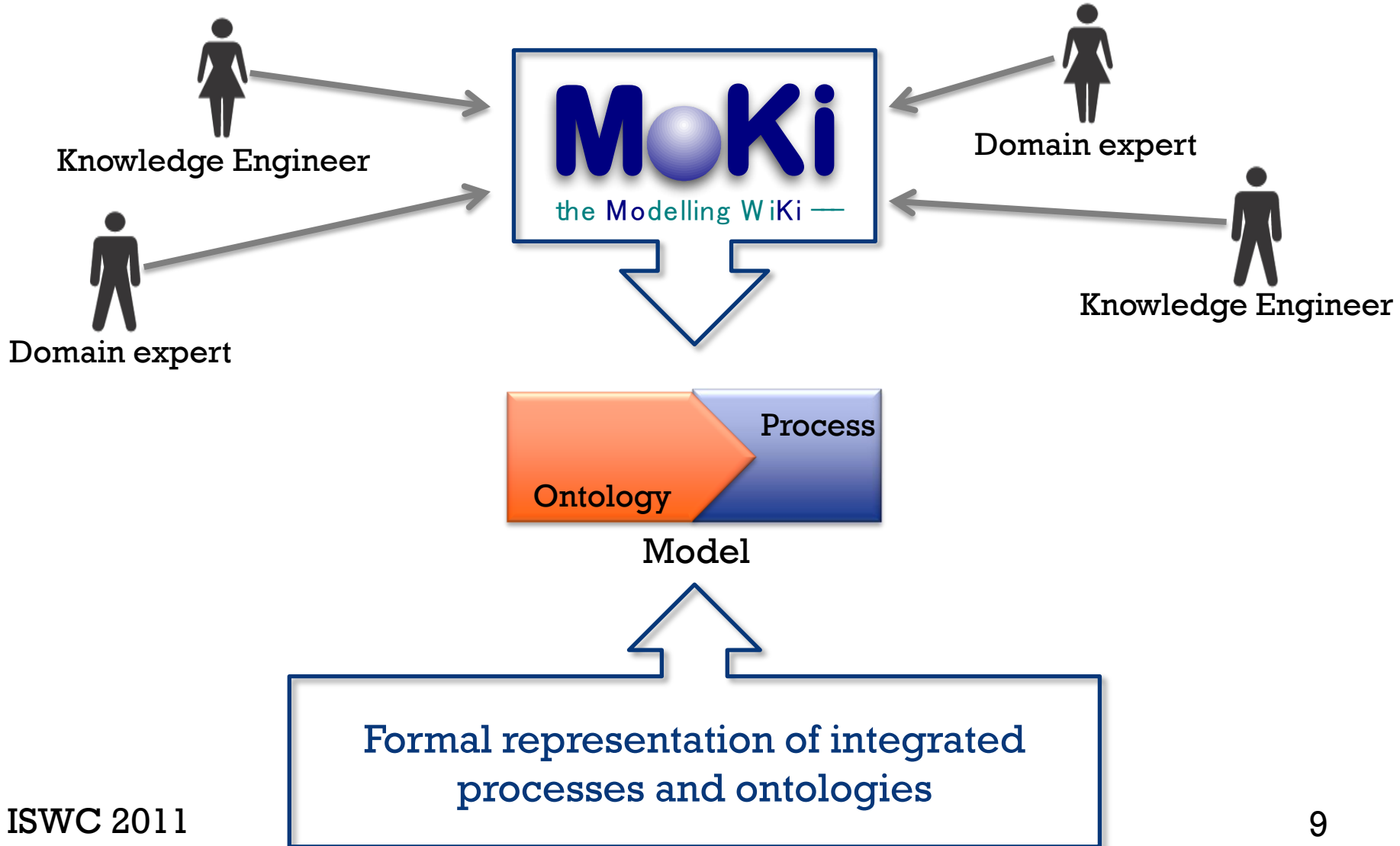
Why integrated modeling of processes and ontologies?



Why a collaborative environment?



The research vision



Today's talk

- MoKi: the modeling wiki tool;
- Working with the Public Administration: the experience of using MoKi within the ProDe project (Progetto Dematerializzazione)

- Integrated representation of processes and ontologies:
 - *Semantics based aspect oriented management of exceptional flows in business processes* – C. Ghidini, C. Di Francescomarino, M. Rospocher, P. Tonella, L. Serafini - IEEE Transactions on Systems, Man and Cybernetics. Part C: applications and reviews, To appear.
 - *Semantically-aided business process modeling* - C. Di Francescomarino, C. Ghidini, M. Rospocher, L. Serafini, P. Tonella - International Semantic Web Conference (ISWC'09)



MOKI: THE MODELING WIKI

Why a wiki-based conceptual modeling tool?

- Wikis support **collaborative** editing;
- Users are quite **familiar** with viewing/editing wiki content (e.g. Wikipedia);
- Only a **web-browser** is required on the client side;
- Wikis provide a **shared knowledge repository** accessible by users spread all over the world;
- Wikis can provide a **uniform tool/interface** for the specification of different model types (e.g. ontologies, processes, ...);

MoKi: the collaborative modeling framework

1. One element \longleftrightarrow One page
 - each element of the model is represented by a page in the wiki;

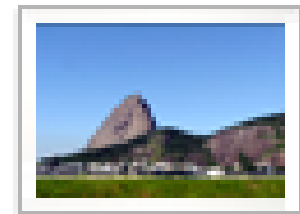
Concept “Mountain”



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](#)



MoKi: the collaborative modeling framework

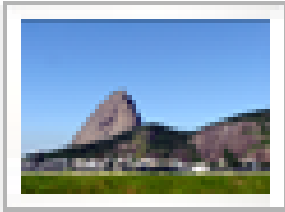
2. Unstructured and structured descriptions

- 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**



- *Landform*

- $\neg Hill \sqcap \neg Plain$

- $\forall madeOf (Earth \sqcup Rock)$

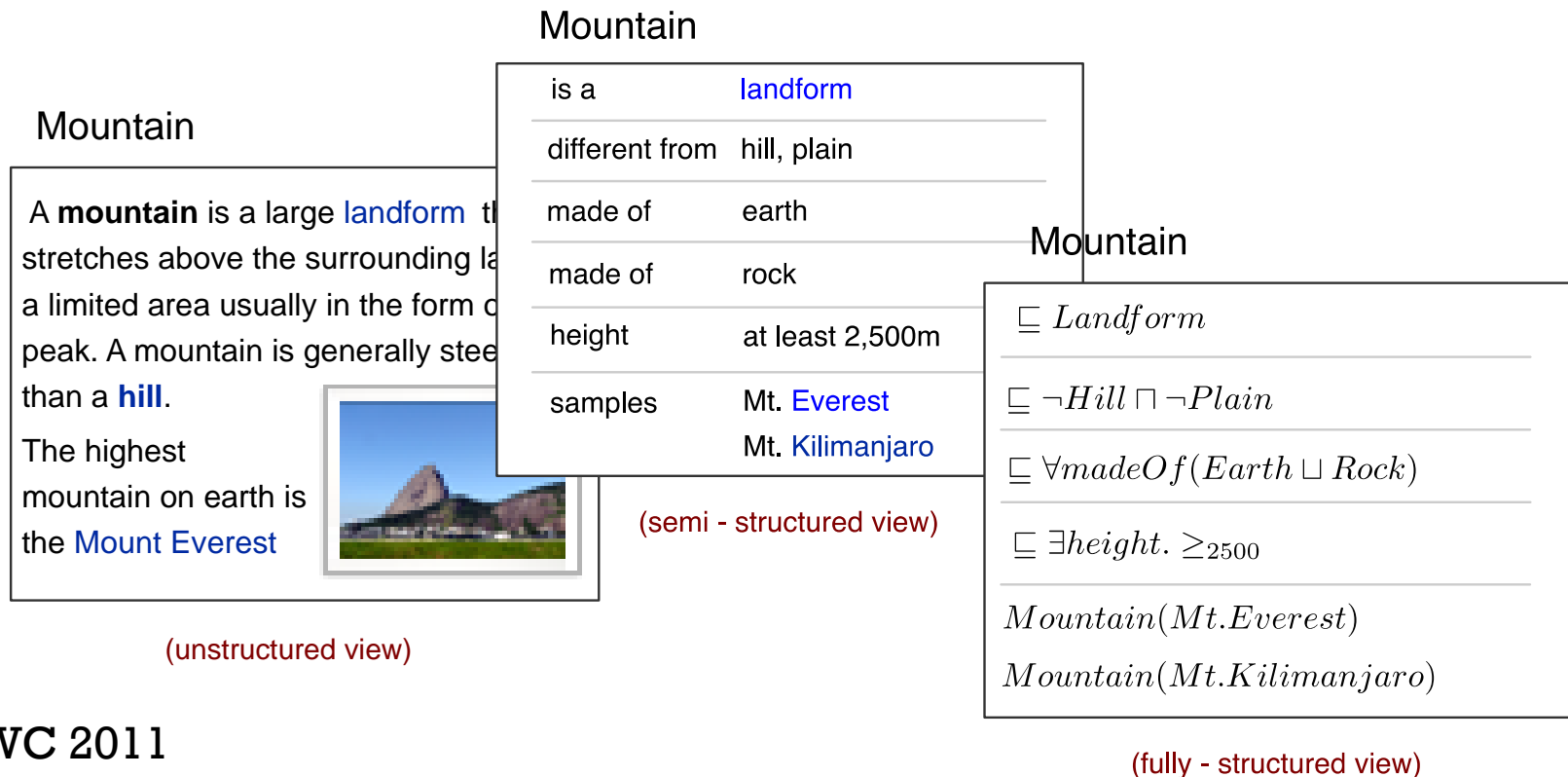
- $\exists height. \geq 2500$

- Mountain(Mt.Everest)*
- Mountain(Mt.Kilimanjaro)*

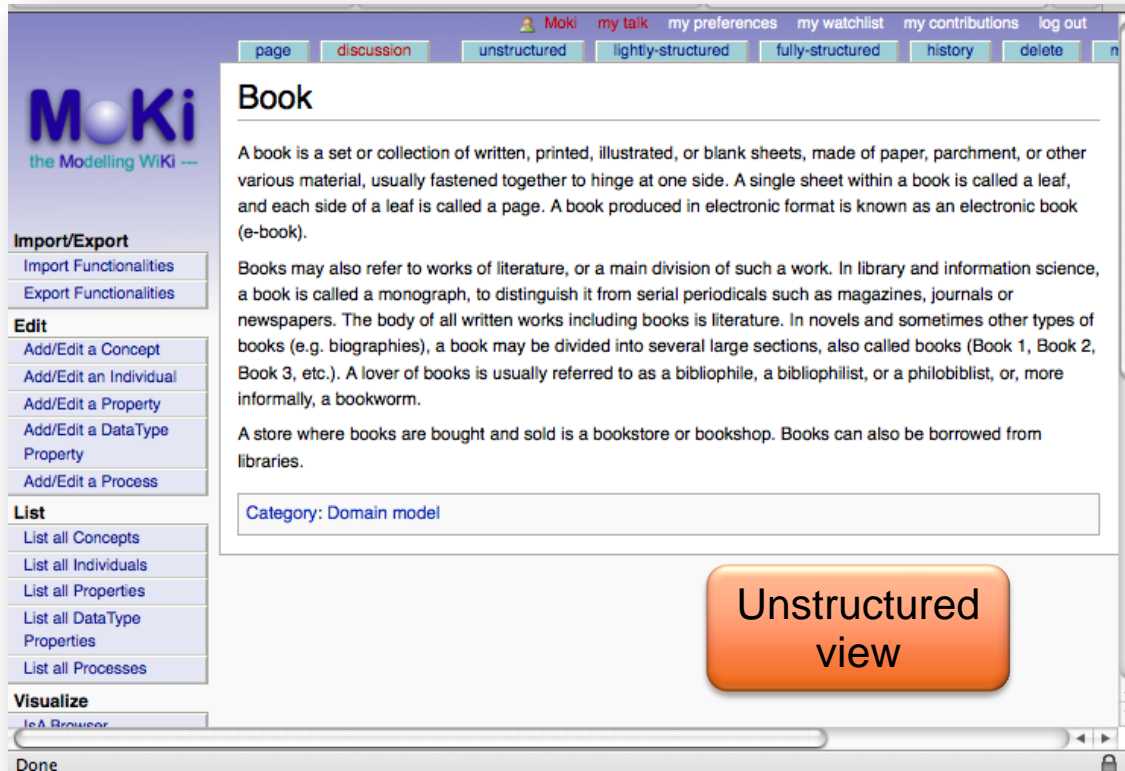
(unstructured content)
(structured content)

MoKi: the collaborative modeling framework

3. Different views to access the model:
- different views to support different modeling actors;



Different views for different roles



The screenshot shows the Moki web application interface. At the top, there is a navigation bar with the user name 'Moki' and links for 'my talk', 'my preferences', 'my watchlist', 'my contributions', and 'log out'. Below this is a secondary navigation bar with tabs for 'page', 'discussion', 'unstructured', 'lightly-structured', 'fully-structured', 'history', and 'delete'. The main content area is titled 'Book' and contains three paragraphs of text defining a book. A category field below the text is labeled 'Category: Domain model'. On the left side, there is a sidebar with sections for 'Import/Export', 'Edit', 'List', and 'Visualize', each containing several sub-links. An orange button with the text 'Unstructured view' is overlaid on the bottom right of the main content area.

Moki
the Modelling Wiki ---

Import/Export
Import Functionalities
Export Functionalities

Edit
Add/Edit a Concept
Add/Edit an Individual
Add/Edit a Property
Add/Edit a DataType
Property
Add/Edit a Process

List
List all Concepts
List all Individuals
List all Properties
List all DataType
Properties
List all Processes

Visualize
In A Browser

Done

page discussion unstructured **lightly-structured** fully-structured history delete n

Book

A book is a set or collection of written, printed, illustrated, or blank sheets, made of paper, parchment, or other various material, usually fastened together to hinge at one side. A single sheet within a book is called a leaf, and each side of a leaf is called a page. A book produced in electronic format is known as an electronic book (e-book).

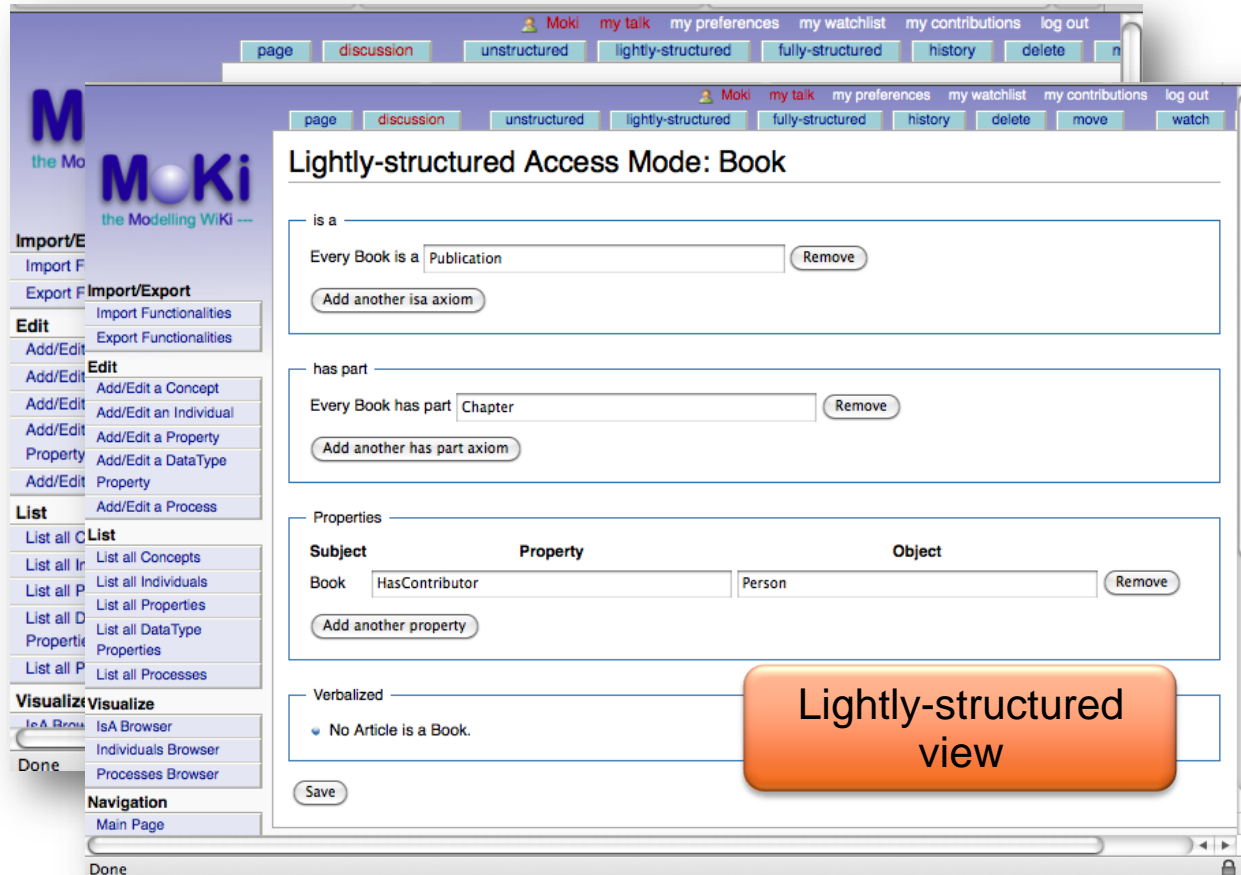
Books may also refer to works of literature, or a main division of such a work. In library and information science, a book is called a monograph, to distinguish it from serial periodicals such as magazines, journals or newspapers. The body of all written works including books is literature. In novels and sometimes other types of books (e.g. biographies), a book may be divided into several large sections, also called books (Book 1, Book 2, Book 3, etc.). A lover of books is usually referred to as a bibliophile, a bibliophilist, or a philiblist, or, more informally, a bookworm.

A store where books are bought and sold is a bookstore or bookshop. Books can also be borrowed from libraries.

Category: Domain model

Unstructured view

Different views for different roles

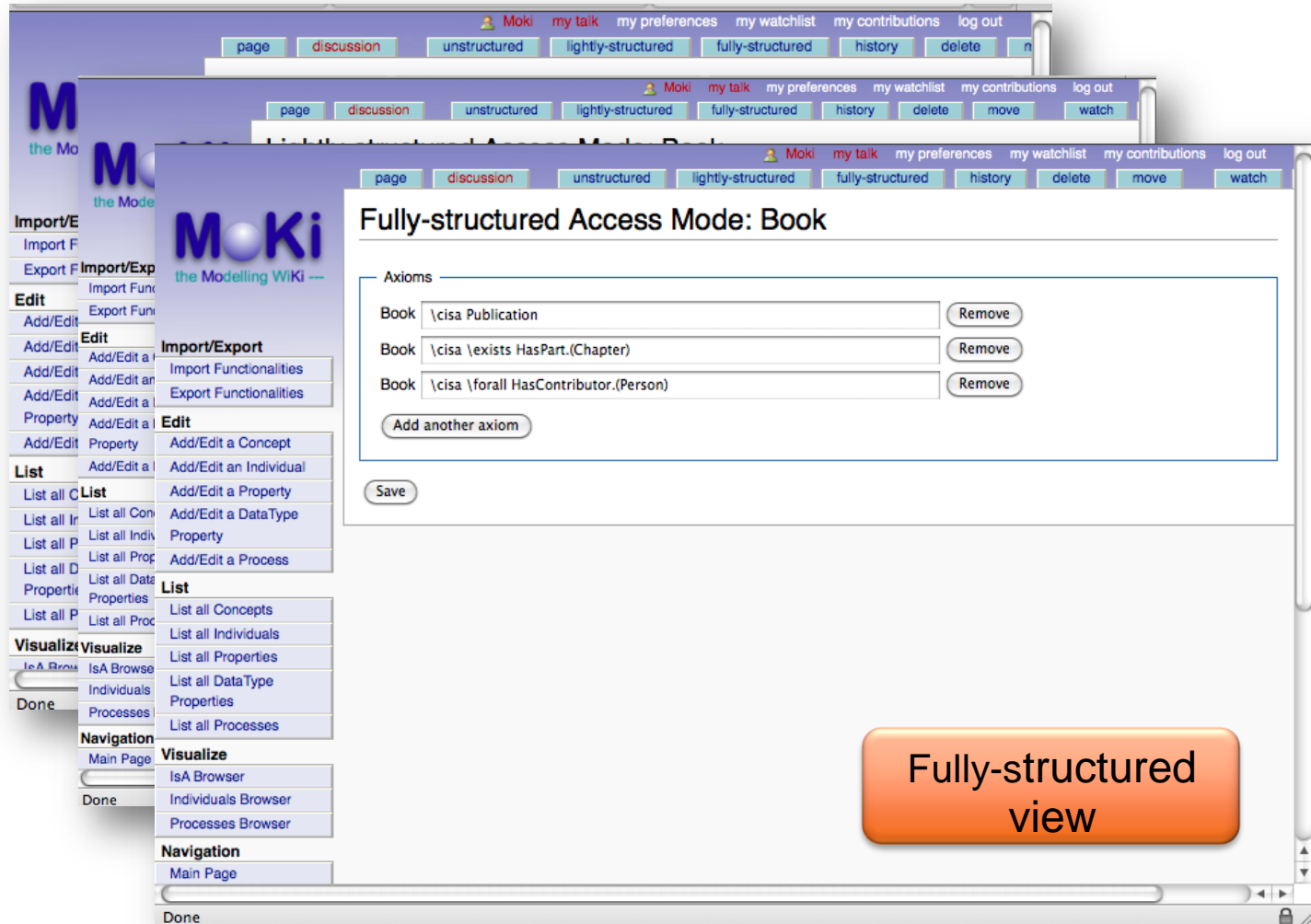


The screenshot displays the Moki web interface for configuring a 'Lightly-structured Access Mode: Book'. The interface includes a navigation menu on the left with sections like 'Import/Export', 'Edit', 'List', 'Visualize', and 'Navigation'. The top toolbar shows user options such as 'Moki', 'my talk', 'my preferences', 'my watchlist', 'my contributions', and 'log out'. The main content area contains several form sections:

- is a:** A form with 'Every Book is a Publication' and a 'Remove' button. Below it is an 'Add another isa axiom' button.
- has part:** A form with 'Every Book has part Chapter' and a 'Remove' button. Below it is an 'Add another has part axiom' button.
- Properties:** A table with columns 'Subject', 'Property', and 'Object'. It contains one entry: 'Book' (Subject), 'HasContributor' (Property), and 'Person' (Object). There is a 'Remove' button and an 'Add another property' button below the table.
- Verbalized:** A section with a radio button selected for 'No Article is a Book.' and a 'Save' button below it.

An orange callout box with the text 'Lightly-structured view' points to the 'Verbalized' section.

Different views for different roles




The screenshot displays the Moki web application interface. At the top, there is a navigation bar with user options: 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" and contains a list of axioms:

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

Below the list, there is an "Add another axiom" button and a "Save" button. On the left side, there is a navigation menu with categories: Import/E, Edit, List, Visualize, and Navigation. An orange button labeled "Fully-structured view" is overlaid on the bottom right of the screenshot.

Different views for different roles



The screenshot shows a web browser window displaying the Moki Modelling Wiki page for 'Hospital Administration'. The page has a purple header with the Moki logo and navigation links. The main content area includes a title, a paragraph describing the role of a hospital administrator, a photograph of a hospital sign, and a sub-section titled 'Run Business Operations' with a descriptive paragraph. A left sidebar contains various utility links.

Moki
the Modelling Wiki

page discussion unstructured lightly-structured fully-structured history delete move unwatch

Hospital Administration

A hospital administrator is the head of business operations or CEO of a hospital or a medical center belonging to a large hospital chain. He interacts with the resident doctors, physicians and medical staff and ensures that resident patients seeking medical care and treatment are taken care of properly. The administrator is entrusted with the responsibilities of running every operation, business process and activity related to the hospital efficiently and productively. Depending on outlined roles, a hospital administrator can be a specialist or generalist.



Run Business Operations

A hospital is run like a small or medium-sized business operation and follows conventional business practices. A hospital administrator as the head of business operations has to ensure smooth running of the hospital. Vital business aspects encompass human resources recruitment and selection, allocation of finance and budgets, establishing procedures and practices, managing computer databases and systems and allied organizational activities. She interacts and co-ordinates with staff members, personnel and other

Import/Export
Import Functionalities
Export Functionalities

Edit
Add/Edit a Concept
Add/Edit an Individual
Add/Edit a Property
Add/Edit a DataType Property
Add/Edit a Process

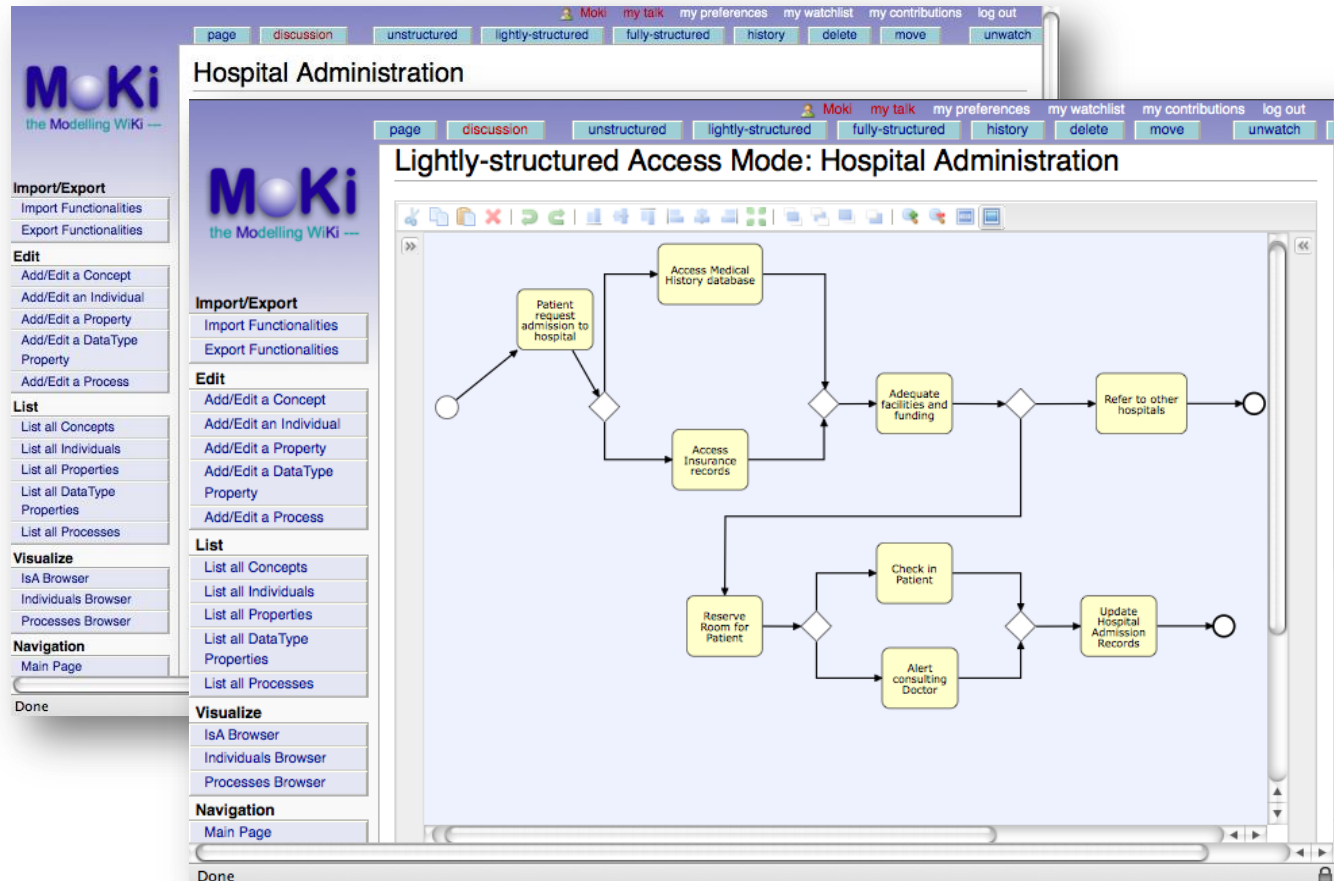
List
List all Concepts
List all Individuals
List all Properties
List all DataType Properties
List all Processes

Visualize
IsA Browser
Individuals Browser
Processes Browser

Navigation
Main Page

Done

Different views for different roles

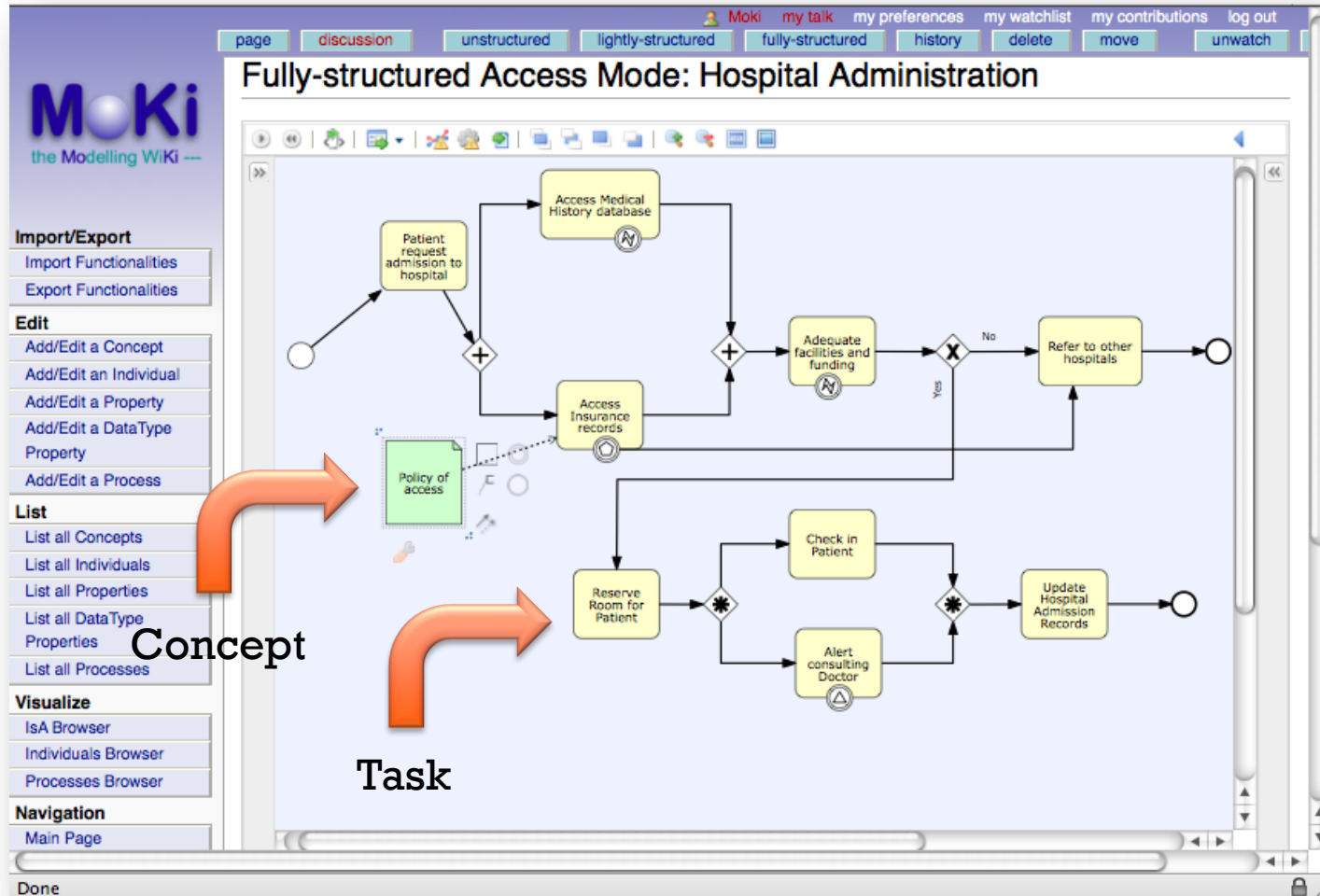


Different views for different roles

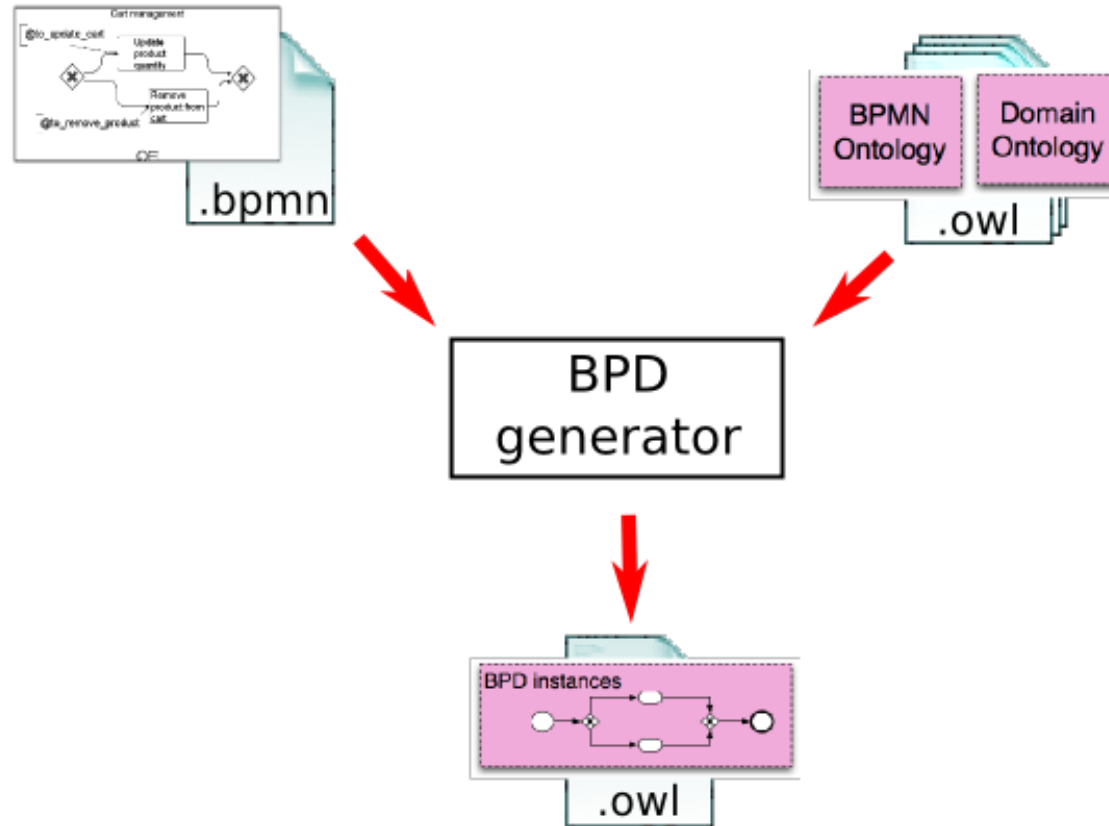
The screenshot displays three overlapping browser windows from the Moki web application, illustrating different access modes for the 'Hospital Administration' page. Each window has a navigation bar with tabs for 'page', 'discussion', 'unstructured', 'lightly-structured', 'fully-structured', 'history', 'delete', 'move', and 'unwatch'. The user is logged in as 'Moki'.

- Top Window (Hospital Administration):** Shows the main page with a sidebar containing navigation and editing options. The sidebar includes sections for 'Import/Export', 'Edit', 'List', 'Visualize', and 'Navigation'.
- Middle Window (Lightly-structured Access Mode: Hospital Administration):** Shows a simplified view of the page content, focusing on the main text area.
- Bottom Window (Fully-structured Access Mode: Hospital Administration):** Displays a detailed Business Process Model (BPMN) diagram. The process starts with 'Patient request admission to hospital', leading to 'Access Medical History database' and 'Access Insurance records'. It includes decision points for 'Adequate facilities and funding' (Yes/No) and 'Reserve Room for Patient' (AND-split). The 'No' path leads to 'Refer to other hospitals', while the 'Yes' path leads to 'Check in Patient' and 'Alert consulting Doctor', both of which lead to 'Update Hospital Admission Records'.

Integrated modeling of Processes and Ontologies



Integrated modeling of Processes and Ontologies



Further features

MOKi
the Modelling Wiki

Import/Export
Import Functionalities
Export Functionalities

Edit
Add/Edit a Concept
Add/Edit an Individual
Add/Edit a Property
Add/Edit a DataType Property
Add/Edit a Process

List
List all Concepts
List all Individuals
List all Properties
List all DataType Properties
List all Processes

Visualize
IsA Browser
Individuals Browser
Processes Browser

Navigation
Main Page
Recent changes
search

Extract new concepts from textual resources

(Powered by Kx - a Keyphrase eXtraction system)

Files

Upload a new file:

The files repository is currently **empty**

Configure and Run

Language: Domain:

Percentage of relevant concepts to return:

Take multiword expressions that occur at least:

- times in a document
- times in the corpus

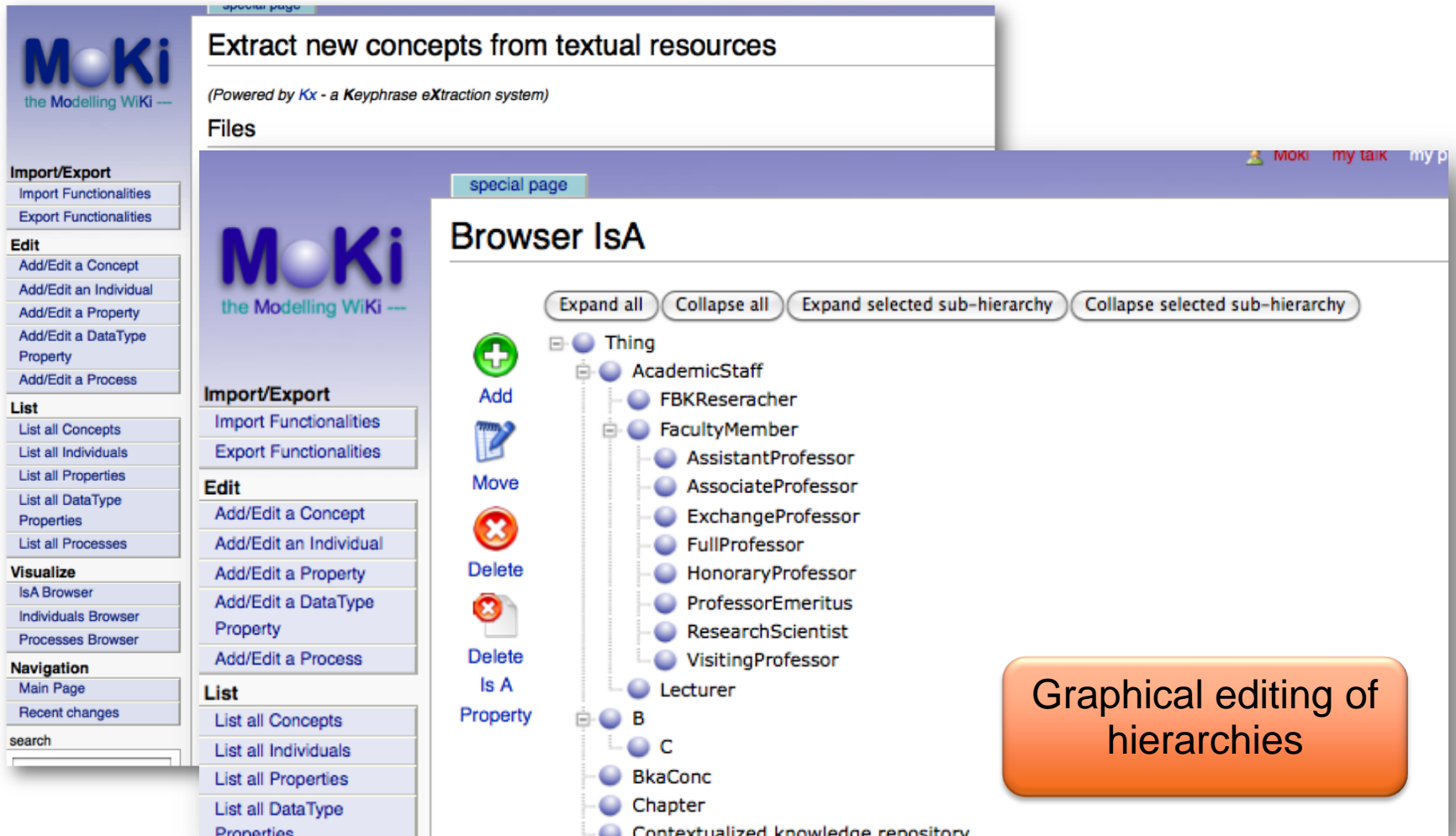
Maximum length of multiword expressions:

Prefer key-concepts occurring early in the text:

Prefer specific key-phrases:

Key concept extraction

Further features



Extract new concepts from textual resources
(Powered by Kx - a Keyphrase eXtraction system)

Files

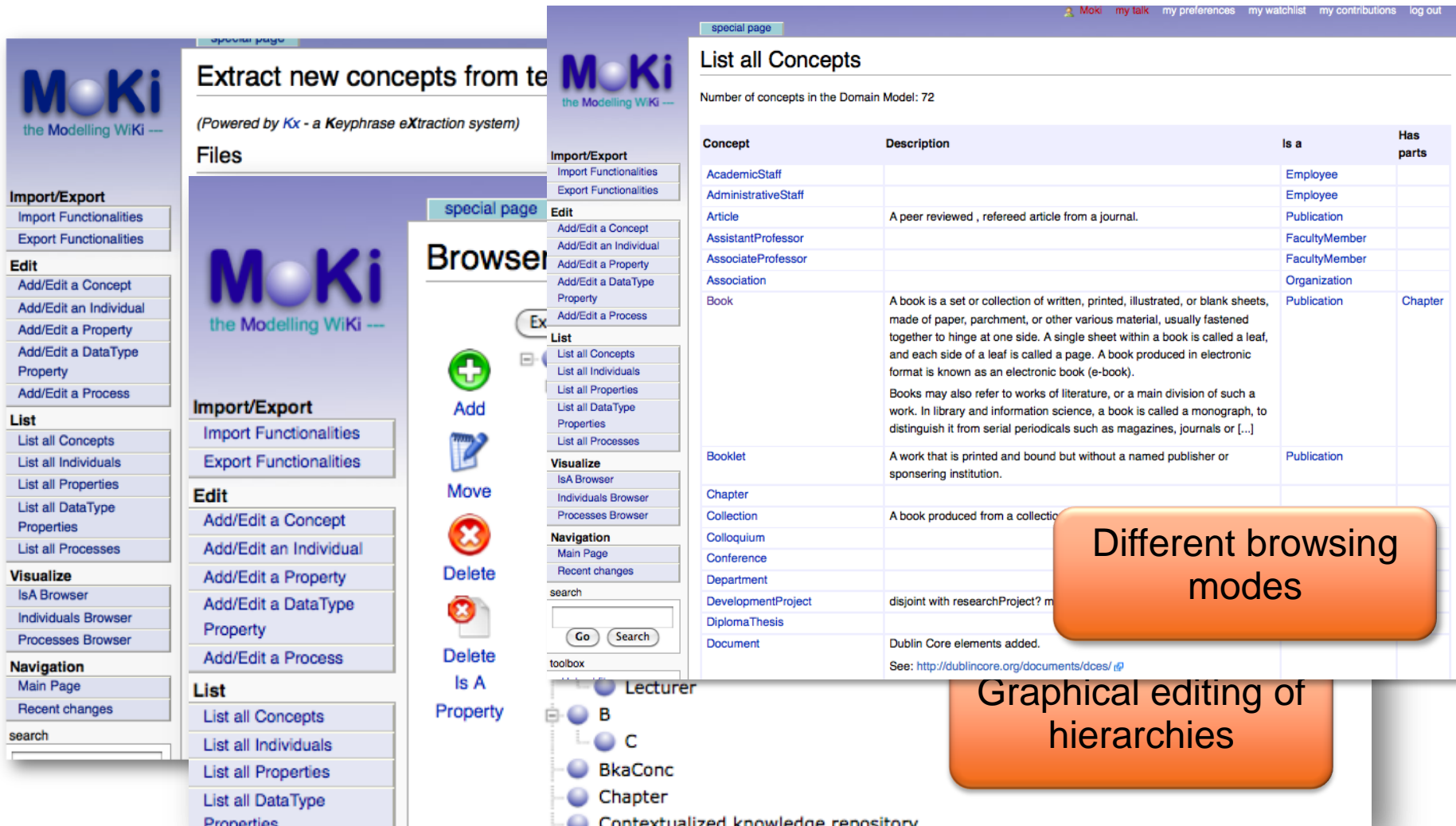
Browser ISA

Expand all Collapse all Expand selected sub-hierarchy Collapse selected sub-hierarchy

- Thing
 - AcademicStaff
 - FBKReseracher
 - FacultyMember
 - AssistantProfessor
 - AssociateProfessor
 - ExchangeProfessor
 - FullProfessor
 - HonoraryProfessor
 - ProfessorEmeritus
 - ResearchScientist
 - VisitingProfessor
 - Lecturer
 - B
 - C
 - BkaConc
 - Chapter
 - Contextualized knowledge repository

Graphical editing of hierarchies

Further features



The screenshot displays the Moki web interface, which is a modelling wiki. The main content area shows a table titled "List all Concepts" with 72 concepts in the domain model. The table has columns for Concept, Description, Is a, and Has parts. The concepts listed include AcademicStaff, AdministrativeStaff, Article, AssistantProfessor, AssociateProfessor, Association, Book, Booklet, Chapter, Collection, Colloquium, Conference, Department, DevelopmentProject, DiplomaThesis, and Document. The Book concept has a detailed description: "A book is a set or collection of written, printed, illustrated, or blank sheets, made of paper, parchment, or other various material, usually fastened together to hinge at one side. A single sheet within a book is called a leaf, and each side of a leaf is called a page. A book produced in electronic format is known as an electronic book (e-book). Books may also refer to works of literature, or a main division of such a work. In library and information science, a book is called a monograph, to distinguish it from serial periodicals such as magazines, journals or [...]"

Two callout boxes highlight specific features:

- Different browsing modes:** This box points to the "Browser" sidebar, which offers various ways to view the data, such as "List all Concepts", "List all Individuals", "List all Properties", "List all DataType Properties", and "List all Processes".
- Graphical editing of hierarchies:** This box points to a hierarchical tree view showing a structure of concepts like "Lecturer", "B", "C", "BkaConc", "Chapter", and "Contextualized knowledge repository".

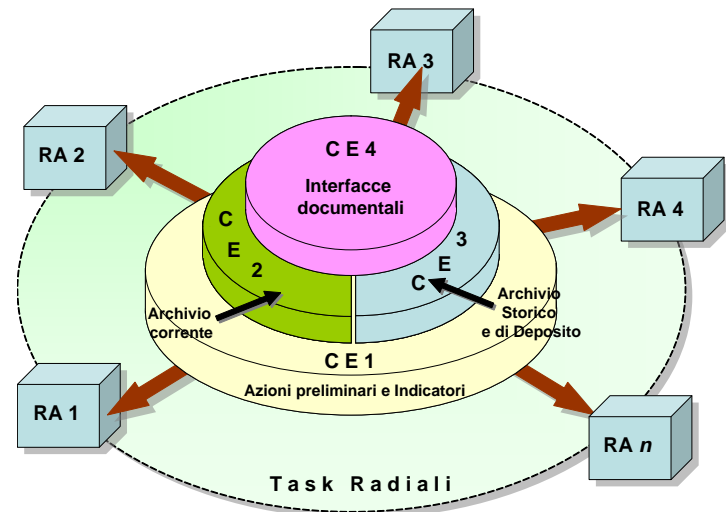
The interface also includes a top navigation bar with user options (Moki, my talk, my preferences, my watchlist, my contributions, log out), a left sidebar with "Import/Export", "Edit", "List", "Visualize", and "Navigation" sections, and a central "special page" area with "Extract new concepts from text" and "Files" sections.



USAGES OF MOKI: THE PRODE PROJECT

The ProDe Project

- **ProDe** (Progetto Interregionale Dematerializzazione) is an Italian inter-regional project whose aim is to define a reference model for the gradual introduction of electronic documentation (de-materialization of documents) in the Public Administration .
- The project started in May 2010 and has a duration of 30 months until October 2012.
- More at <http://www.progettoprode.it>



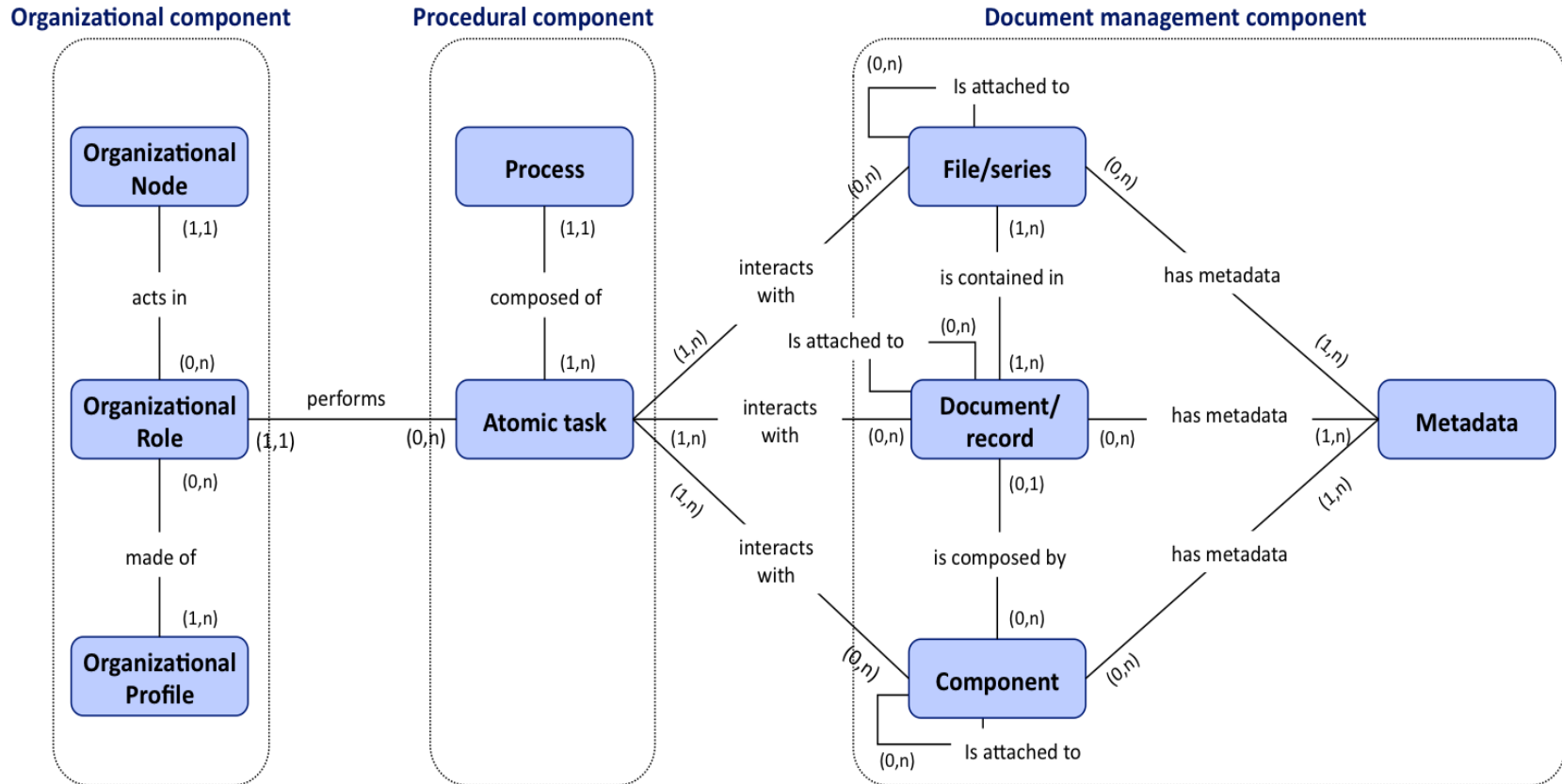
The MoKi tool in ProDe

- The analysis of the administrative procedures and of the related documental flows requires modeling.

As is → To be

- This modeling involves:
 - Dynamic aspects (processes);
 - Static aspects (documents / roles → ontologies)
 - Collaborative and distributed aspects
- MoKi was proposed as a tool for the modeling of documental flows.
- **How to customize MoKi to support that?**

Step 1: Define a reference conceptual schema



- Work done in collaboration with experts in archival science

Step 1: Define a reference conceptual schema

- Each entity was described by means of:
 - Relations with other entities;
 - Attributes / meta-data;
 - (Possibly) related to different phases of its life-cycle.
- Example: document
 - **Create** (how the document is created);
 - **Capture** (how the document is acquired in the document management system);
 - **Manage** (how the document is managed inside the document management system);
 - **Store/preserve** (how the document is stored in the document management system and preserved in the long run); and
 - **Deliver** (how the document is distributed and made available by the system).

Step 2: Create customized semi-structured views for each entity

Attributes

Name

Direction of the Document Workflow

Administrative Act Type

Document Type

Organizational Nodes

Sender

Recipient

File/series

Document Life-Cycle

Creation Acquisition Management Preservation Distribution

Atomic tasks

Organizational nodes

Tools

Note

Specific Metadata

Domain Metadata

Relations

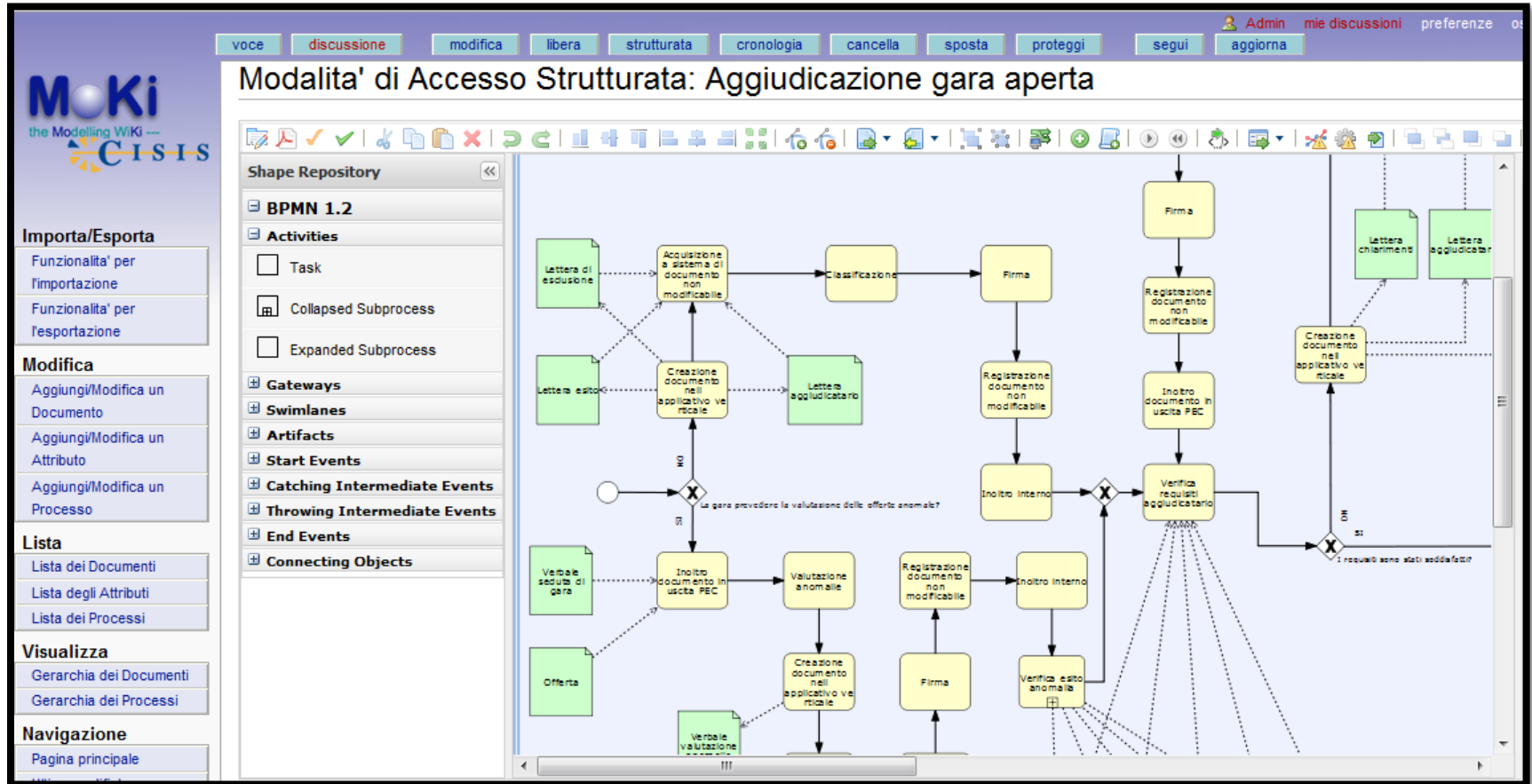
'Is a' relations

'Is attached to' relations

'Has metadata' relations

'Is composed by' relations

Step 3: Integrate BPMN diagrams and “documents”



How long did it take?

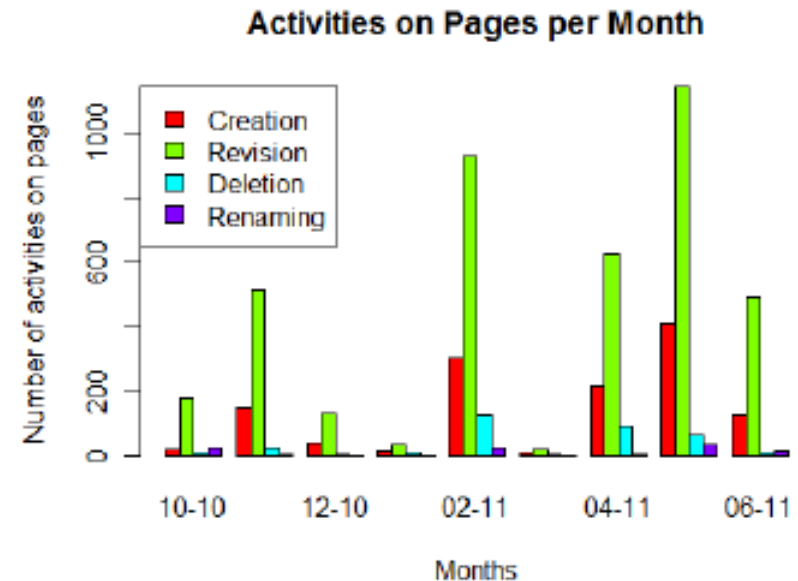
- 1 person-week for the definition of the conceptual model
- 3 person-weeks for the implementation and testing of MoKi.

Does MoKi help domain experts?

- RQ1. Is MoKi **easy to use** for domain experts?
- RQ2. Is MoKi **useful** for collaboratively modeling domain knowledge?
- RQ3. Is there a “**best**” functionality to:
 - Get the model overview
 - Navigate the model
 - Create new model entities.
- Answer provided with:
 - Quantitative evaluation
 - Qualitative evaluation

Quantitative Evaluation

- Analysis of data about the usage of MoKi in the first phase of the ProDe project (October-June 2011)*
- 432 documents and 506 tasks. Besides providing insights about the tool usage, the huge amount of data collected **strengthens the validity of the subjective answers in the qualitative evaluation.**



* Data taken from the MoKi database + server logs

Qualitative Evaluation

- On-line questionnaire with 31 (mostly closed) questions
- Answers from 14 Public Admin employees
- Questions asking for subjective perception about:
 - MoKi specific functionalities
 - overall ease of use and usefulness.
- Answers to the closed questions according to:
 - a Likert scale: 1= very difficult to use, ..., 5=intuitive to use
 - preference over 2 options: 1= I prefer A, 2=I prefer B, 3=I equally evaluate A and B

RQ1. MoKi Ease of Use

- Overall MoKi easiness to use
 - on average 3.36 (more than easy to use)
 - result statistically relevant ($p\text{-value} < 0.05$).
- Ease of use of specific functionalities has also been positively judged by users.

	Avg.	Std. dev.
Entity Creation	4	0.89
Entity Revision	3.45	0.69
Entity Deletion	3.55	0.69
Entity Renaming	3.27	0.65

RQ1. MoKi Ease of Use

- Overall MoKi easiness to use
 - on average 3.36 (more than easy to use)
 - result statistically relevant ($p\text{-value} < 0.05$).
- Ease of use of specific functionalities has also been positively judged by users.
- Most of the users spent < 2 days in learning how to use MoKi and most of them learnt it autonomously.
- We can positively answer RQ1.

RQ2. MoKi usefulness for collaboration

- Overall MoKi usefulness for collaboration
 - on average 3.36 (more than easy to use)
 - result statistically relevant ($p\text{-value} < 0.05$).
- Judged more useful by persons working in larger teams (3.8 for teams with more than 2 persons vs. 2.8 for teams with less than 3).
- We can positively answer RQ2.

RQ3. MoKI functionalities

- Model Overview
- Model Navigation
- Entity Creation

Model Overview
Hierarchy
List

Use Frequency

List	1042
Hierarchy	865

Model Navigation

Hierarchy

Diagram

Textual Search

List

Entity Creation

Documents

Processes/Tasks

Sidebar

Sidebar

Hierarchy

Diagram

Diagram

-

- All the functionalities are useful in MoKi.

Overall Considerations

- Users satisfied with
 - model overview and navigation
 - process modelling
 - collaboration support
 - broad accessibility
- Suggestions for improvement mainly about document modelling

Current and future work

- Develop libraries of ad-hoc templates to guide users in modeling activities
 - describing an artifact is different than describing a role
- Support usage of ontology patterns
 - to speed up modeling activities, and limit modeling errors
- Extend key concepts extraction functionalities
 - Support extraction / identification of semantic relation (e.g. “isA”) between concepts
- Exploit logs to analyze the process of collaborative model construction.

Thank You!

Questions?

- MoKi WebSite: <http://moki.fbk.eu>
 - On-line demos, code download, documentation, news, support...

A first evaluation

- Quantitative and qualitative evaluation on
 - the easiness of use,
 - the collaborative features, and
 - Different functionalities to edit content

- Here we report some main general results.

Background of experts and learning time

- All the participants use the pc almost everyday,
 - writing and reading documents. for job (using office suites)

- navig

- **Frequen**

- half o
pages

- 93% of t
adminis

- 21% hac

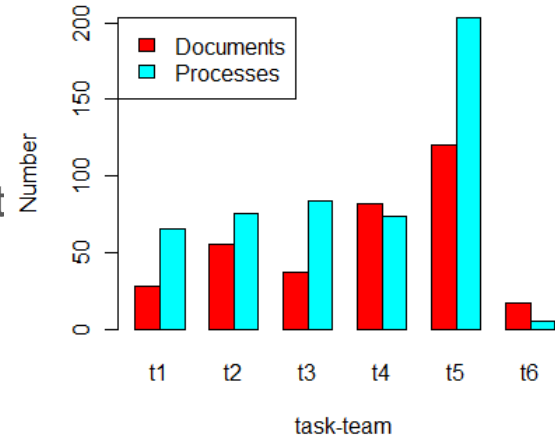
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Property	Value	%	Property	Value	%
Pc use frequency	never	0	Pc use purpose	document reading and editing	27.66
	rarely	0		office suites	27.66
	sometimes	0		Internet browsing	25.53
	often	0		programming	17.02
	always	100		testing and customer care	2.13
Wiki page consultation frequency	never	0	Wiki page editing frequency	never	50
	rarely	21.43		rarely	42.86
	sometimes	28.57		sometimes	7.14
	often	14.29		often	0
	always	35.71		always	0
Experience in domain analysis and documentation	none	7.14	Type of experience	domain analysis and textual documentation drafting	21.43
	bad	0		procedure analysis and diagram creation	21.43
	medium	35.71		document analysis and documentation production	0
	good	42.86		domain analysis as well as documentation and diagram production	57.14
	very good	14.29		autonomous training	72.73
Time spent for learning	< 1 day	36.36	Learning approach	learning session	9.09
	< 2 days	36.36		tutorial	0
	1 week	27.27		talking with and asking colleagues	18.18
	10 days	0			
	> 10 days	0			

Shape of models

- Size of models:
 - Medium size models;
 - More processed than document

Documents and Processes per Task-team



- Integration of process and ontologies.
 - Average number of documents used in processes' diagram: 4.217
 - Average number of processes in which a document is used: 1.32.

Most frequent activities:

- Page **revision** activity,
- Page creation
- Page deletion.

task-team	Page Creations	Page Revisions	Page Deletions	Page Renaming
r1	171	542	71	0
r2	171	799	37	54
r3	135	534	13	33
r4	217	548	55	2
r5	384	1065	58	7
r6	103	316	16	0

Ease of use and usefulness

- The usefulness of MoKi is perceived more strongly by employees working in teams having more than two persons (on average 3.8 for teams with more than two persons versus 2.8 for those with less than three).
- Graphical interfaces considered more useful, but textual interfaces are strongly used.
- The immediate sharing of models and web access considered useful.

	Avg.	Std. dev.
Entity Creation	4	0.89
Entity Revision	3.45	0.69
Entity Deletion	3.55	0.69
Entity Renaming	3.27	0.65