

Semantic-enhanced personalised access to collaboratively constructed digital resources

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*Presentation at ARIES & MADMUC seminar,
University of Saskatchewan, 13th June 2005*



ACKNOWLEDGEMENTS

- ◆ **The SWALE project** (UK-NL Partnership in Science)
 - Lora Aroyo and Ronald Denaux
- ◆ **The Edukalibre project** (European Union)
 - Chris Tebb, Julika Matravers, Drew Withworth (Leeds)
 - Jesus Gonzalez-Barahona (Madrid), Luca Botturi (Lugano)
- ◆ **Colleagues from the Leeds Ontology Group**
 - Pragya Agarwal and Yongjian Huang

Outline of talk

Context and vision: Educational Semantic Web

Personalised resource recommendations

- Cold start
- User Model Dynamics
- Task recommendation
- Seamless integration

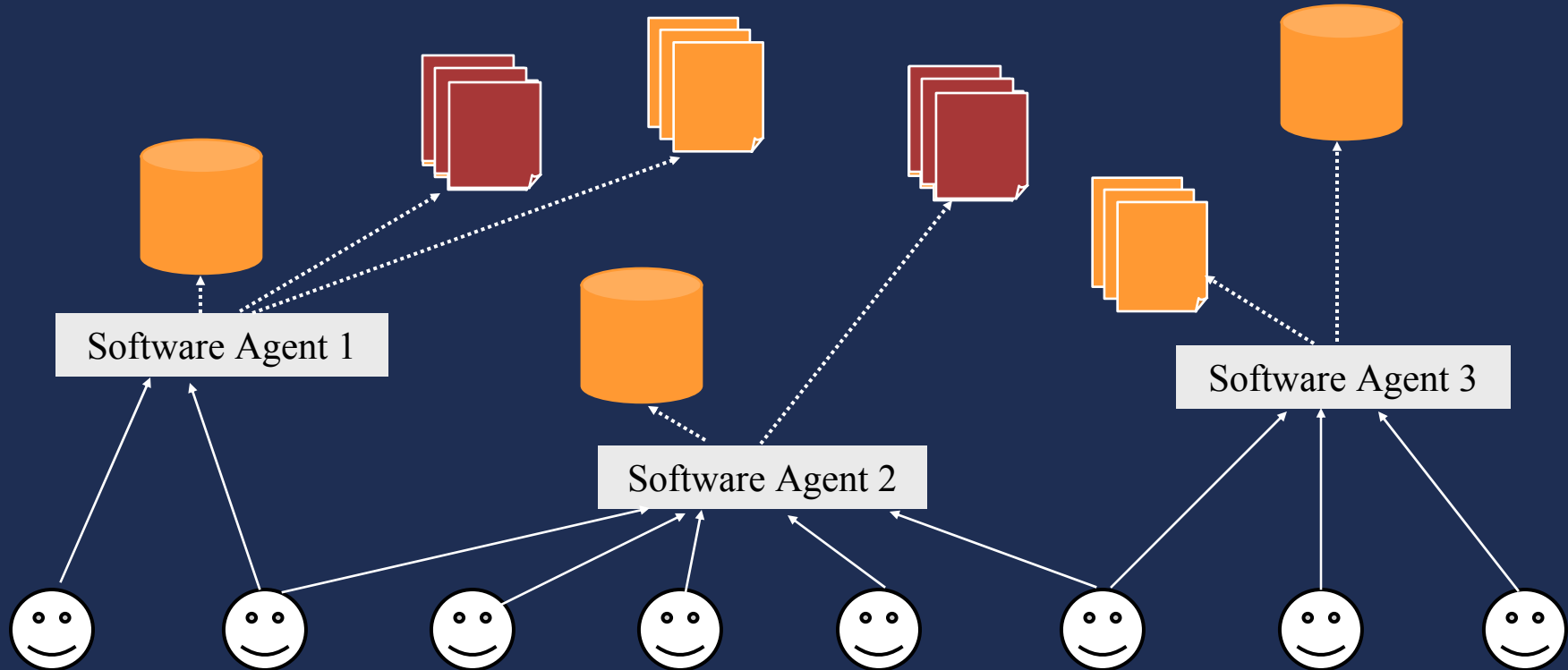
Collaborative creation of learning materials

- Tools to support the open source development model in education
- Sharing of resources

Open issues, link to ARIES and MADMUC research

Distributed Delivery of Content and Services

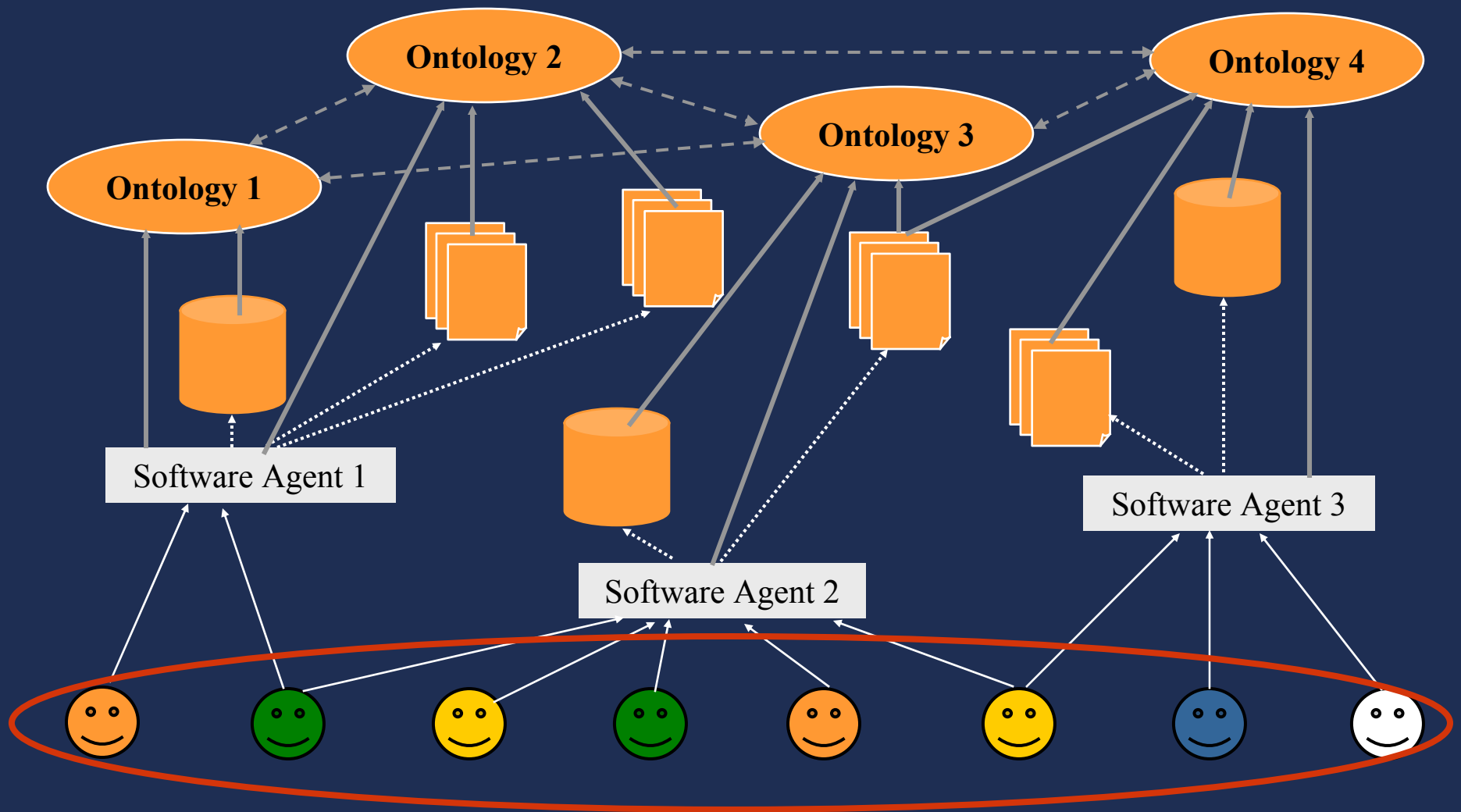
“Automated services will improve in their capacity to assist humans in achieving their goals by **understanding** more of the content on the web, and thus providing more accurate filtering, categorisation, and search of information resources. This process will ultimately lead to an extremely knowledgeable system that features various specialized reasoning services. These services will support us in nearly all aspects in our daily life-making access to information as pervasive, and necessary, as access to electricity is today.” (Ding et al., 2002)



Ontologies

- ◆ **An ontology is a formal, explicit specification of a shared conceptualization (Gruber, 1993)**
- ◆ **An ontology consists of several levels**
 - Is-a taxonomy of concepts
 - Internal concept structure and relations between concepts, usually specified with some axioms
- ◆ **Examples**
 - CYC, WordNet, Yahoo!Dictionary, UN/SPSC, UMILS
 - Various smaller domain ontologies used in specific contexts
 - Task ontology, activities ontology, etc.

The Semantic Web Vision



Users' conceptualisations differ

◆ The vocabulary problem

- Furnas, Landauer, Gomez & Dumais: The Vocabulary Problem in Human-System Communication. *Com ACM* 30(11): 964-971 (1987)

◆ Even experts' conceptualisations differ

- Hameed, Sleeman & Preece: Detecting mismatches among experts' ontologies acquired through knowledge elicitation. *Knowledge-Based Systems* 15: 265-273 (2002)
- Noy & Musen: The PROMPT suite: interactive tools for ontology merging and mapping. *IJHCS* 59: 983-1024 (2003)

If we could capture user conceptualisations

◆ Enhance search

- Efficiency
- Effectiveness

◆ Provide support

- Clarification, explanation
- Assist learning (note the role of discrepancies here!)
- Facilitate knowledge sharing

◆ Enable interoperability and sharing of resources

- Align different viewpoints
- Facilitate resource sharing

Problem 1: Personalised Access

Can a *user's conceptual model* be captured and used to enable *personalisation and adaptation* of learning environments on the *semantic web*?

Interactive ontology-based user modelling

Maintain a **diagnostic dialogue** between an intelligent agent and a human user to **articulate** and **align** the user's conceptualisation

◆ User modelling challenges to address

- Cold start
- Dynamics of user conceptual models
- User model inaccuracy (combined with other approaches)

Why dialogue?

◆ Studies with creating, merging and aligning ontologies show that dialogue between people is crucial

- stated in all methodologies for creating ontologies (see review in Bruijn, 2003)
- shown in studies with CHIMAERA (McGuinness et al., 2000) and PROMPT (Noy & Musen, 2003)

◆ Dialogue is critical in multi-agent systems for sharing meaning

- do agents know the same concept, do different concepts actually have same meaning (Williams, 2004)
- agents that do not share the same ontology negotiate meaning (Bailin & Truszkowski, 2002)

OWL-OLM (UM2005, WWW2005)

◆ Task: learning Unix concepts

- Dialogue to deal with cold start
- User-adaptive task recommendation

◆ Domain ontology & User model represented in OWL

- Interoperability
- Re-use of OWL reasoning tools (Jena used)

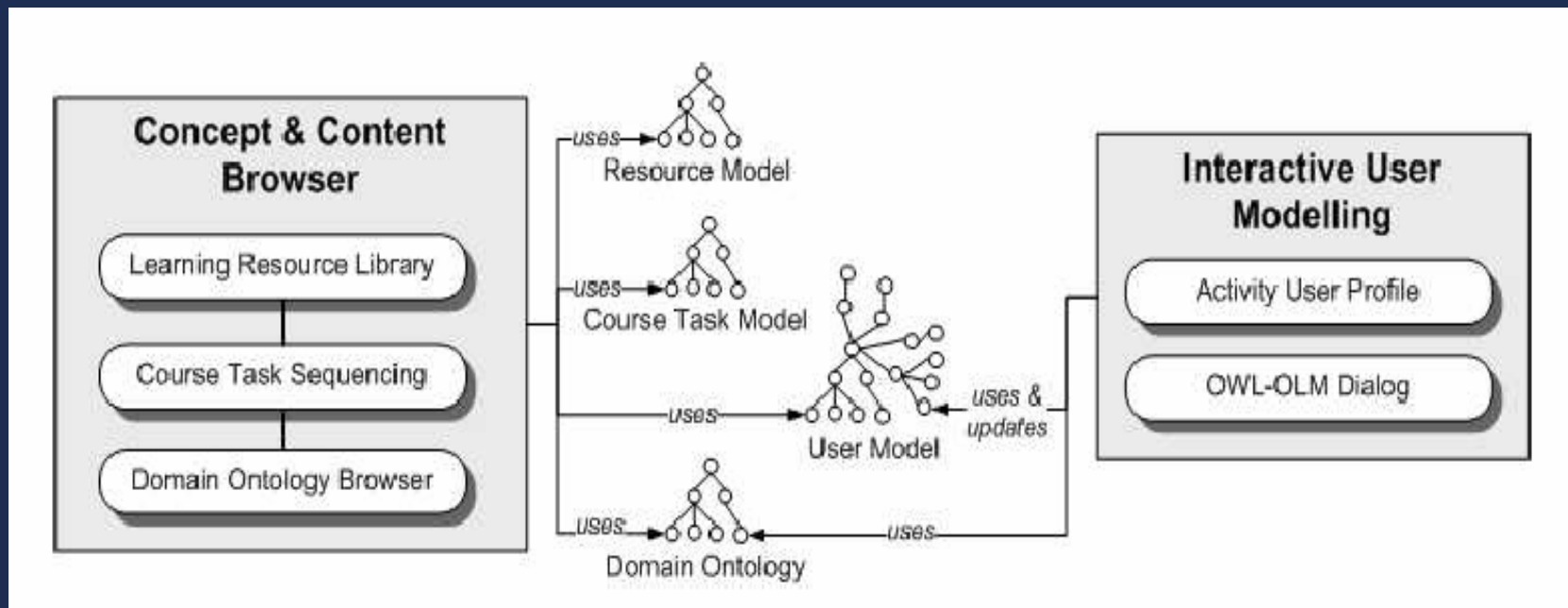
◆ Interface based on graphical rendering of OWL statements

- Initial design based on visualisation approaches

◆ Integrated in OntoAIMS

- Two studies with users
- www.swale.comp.leeds.ac.uk:8080/staims/
(user name: visitor password: visitor)

OntoAIMS architecture



SWALE Dialog User Interface

Dialog history

ronald : Yes, a read file operation has a program as its program performing operation.

At this point DialogGameAgent said.
DialogGameAgent: We are done rapidly probing your knowledge about read file operations.
DialogGameAgent: Let's now begin rapidly probing your knowledge about files.
DialogGameAgent : Do you think a file has executable permissions as its owner executable rights?
ronald : Yes, a file has executable permissions as its owner executable rights.
DialogGameAgent : Do you think a file has a unix user as its owner?

Sentence editor

Move & Edit Connect Create Delete

```
graph TD; file[file] -.->|owner is a| unix_user[unix user];
```

Sentence starters

Give Answer
Give Opinion
Inform Ignorance
Agree
Disagree
Ask
Suggest Topic
Skip
End Dialogue

Sentence to send

ronald : Yes, a file has a unix user as its owner.

Send Sentence

SWALE Dialog User Interface

Dialog history

readable right?
User : Yes, a file has a readable permission as its world readable right.
DialogGameAgent : Do you think a file has a filename?
User : Yes, a file has a filename.

At this point DialogGameAgent said.
DialogGameAgent: We are done rapidly probing your knowledge about files.
DialogGameAgent: Let's now begin rapidly probing your knowledge about move file operations.
DialogGameAgent: Do you know what a move file operation is?

Confirm

Are you sure that moving a file is a command?

Yes No

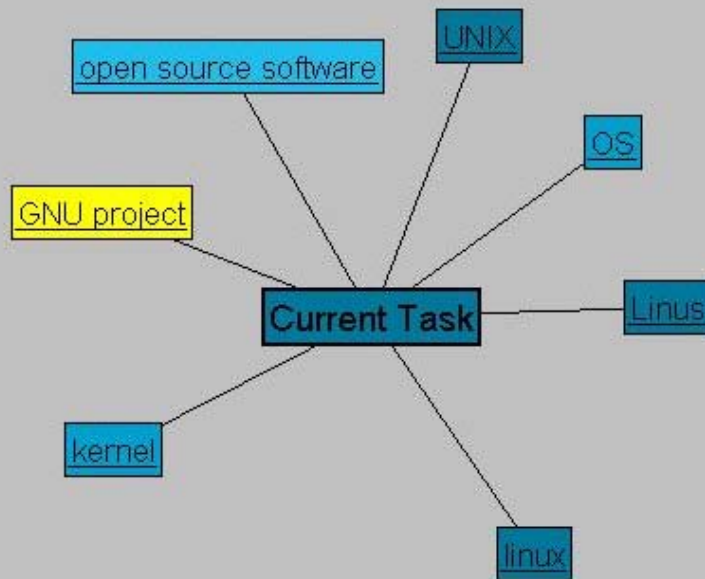
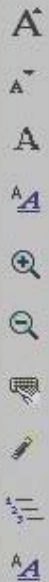
Inform Ignorance
Agree
Disagree
Ask
Suggest Topic
Skip
End Dialogue

Sentence to send
User: I think that moving a file is a command.

Send Sentence

```
graph LR; A[moving a file] -- is a --> B[command]
```

Current Task open source software program free software



5 result documents

GNU project

- Basic Linux Commands
- Manipulating Directories and Files
- Moving around in the Linux file system
- How to view text files in Linux
- Introduction to the Linux Operating System - Lecture

Search: GNU project

Concept: 'GNU project'

Group of people who wrote and still are writing free software according to the GNU license.

AIMS Viewer Interface
 Course View Go Help
Topic: Operating systems
 Task: History of Linux

Current Task open source software program fre

5 result documents
 GNU project
 Basic Linux Commands
 Manipulating Directories and Files
 Moving around in the Linux file system
 How to view text files in Linux
 Introduction to the Linux Operating System - Lecture slides 2

```

  graph TD
    CurrentTask[Current Task] --- OSS[open source software]
    CurrentTask --- GNU[GNU project]
    CurrentTask --- kernel[kernel]
    CurrentTask --- UNIX[UNIX]
    CurrentTask --- OS[OS]
    CurrentTask --- Linux[Linux]
  
```

Search: GNU project

Moving around in the Linux file system
 Author(s): , year: NGene2002
Description: Learn how to move from one directory to another, find out what directory you are in with `pwd` and `ls`, and how to list the contents of a directory with `ls`. You'll also learn what do absolute and relative pathnames mean.
 Location: <http://www.tuxfiles.org/linuxhelp/linuxfiles.html>

Moving around in the Linux file system - Microsoft Internet Explorer
 File Edit View Favorites Tools Help
 Address <http://www.tuxfiles.org/linuxhelp/linuxfiles.html>

tuxfiles
[home](#) [Linux help](#) [ANTI help](#) [directory](#) [who?](#) [contact](#) [search](#)

contents

- > About the Linux file system
- > Finding out where you are
- > Listing the contents of a directory
- > Absolute pathnames
- > Moving around in directories
- > Relative pathnames

back to

- > Command line
- > Linux help
- > tuxfiles home

< Moving around in the Linux file system - 2.0 >

The very basics for operating at the Linux command line begins here. Learn how to move from directory to another with `cd`, how to find out what directory you're in with `pwd`, and how to list the contents of a directory with `ls`. You'll also learn what do absolute and relative path names mean.

Author: NGene <nhlang at gmail dot com >
 tuXfile created: 20 December 2001
 Last modified: 22 October 2002

< About the Linux file system >

Like in Winblows, the files on a Linux system are arranged in a *hierarchical directory structure*. This means that the files are organized the same way as in Winblows: in a tree-like pattern of directories (or folders in winblowspeak), and those directories may contain files or

Internet

User studies with OntoAIMS

◆ User modelling integrated in learning environments

- Knowledge articulation
- Seamless integration in the overall learning process

◆ Dialogue fairly coherent

- Focus maintenance
- User initiative

◆ Dialogue cumbersome at times

- Probing too long
- Moves rather monotonous

◆ Users often unsure

- Some ask questions, other make claims

Challenges & Future work

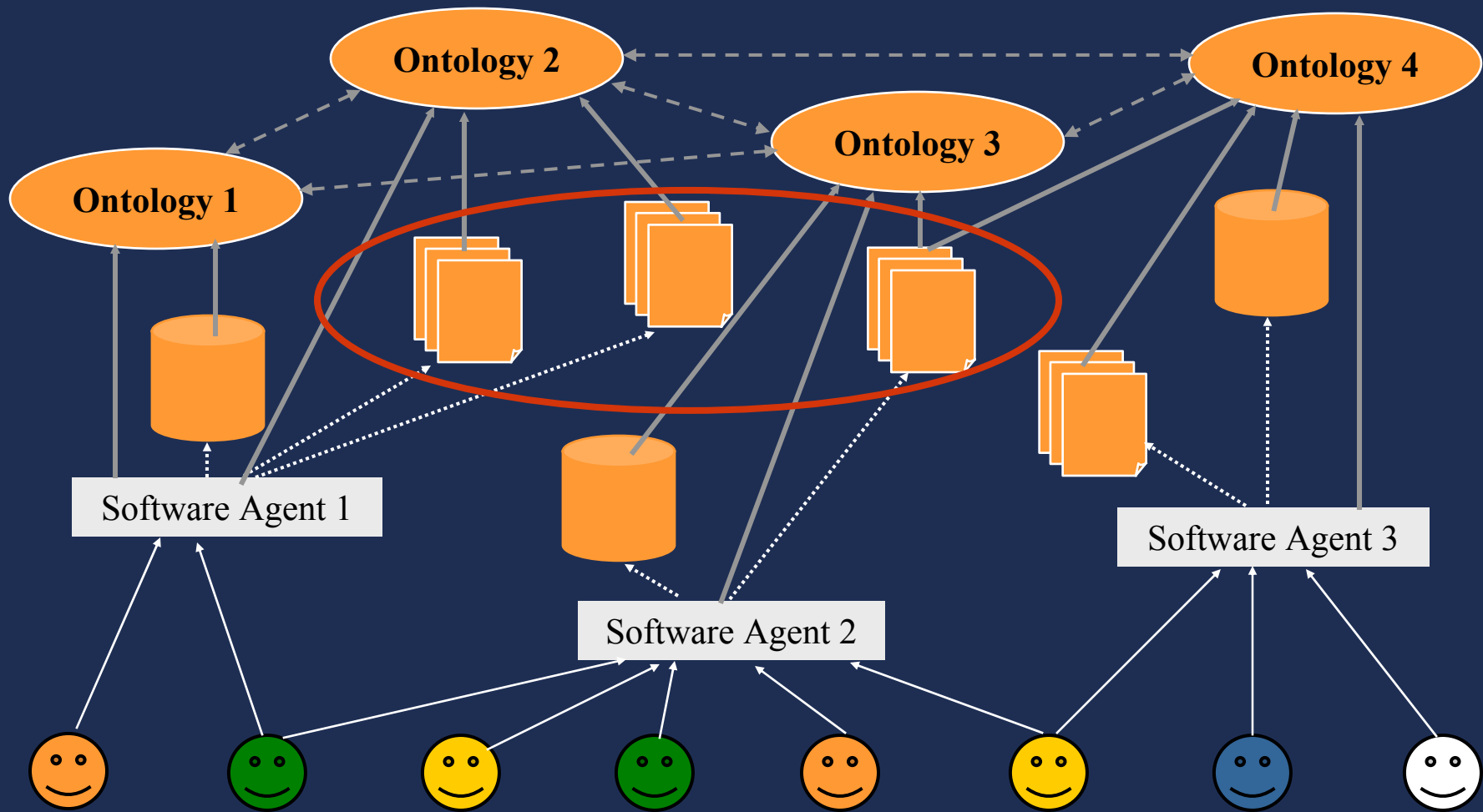
◆ Formalise discrepancy patterns

- Based on description logic
- Initial framework developed (Persweb@UM05)
- Applied in several domains
- User studies with a NASA space ontology from SWEET

◆ Dealing with open world

- Take into account different perspectives
- Approximate rather than overlay
- Employ ontology reasoning combined with dialogue for clarification

Back to the Semantic Web Vision



Problem 2: Collaborative creation of resources

Can the *open source development model* be applied to the construction of *open educational resources* and what *tools* are needed to support the users?

Why do we think it should work?

◆ Open source development model led to radical changes in software production

- operating systems (Debian, FreeBSD, Fedora)
- desktop environments (GNOME, KDE)
- web browsers (Mozilla, Firefox)
- web servers (Apache)
- office suites (OpenOffice.org)

◆ There are emerging open source educational materials

- Open Learning Support (Utah), MIT OpenCourseware, Open Learning Initiative (CMU)
- Connexions, CASCADE, WIKI

Characteristics

- ◆ **Frequent release**

- Sometimes without validation

- ◆ **Quality checked by many individuals**

- Peer-review, different viewpoints and criteria

- ◆ **Geographically distributed development**

- Few or none face-to-face meetings

- ◆ **Asynchronous development**

- Software tools to coordinate

Edukalibre (www.edukalibre.org)

◆ Tools used in open source are not suitable

- Not intuitive
- Require good technical skills
- **Develop a truly open system**

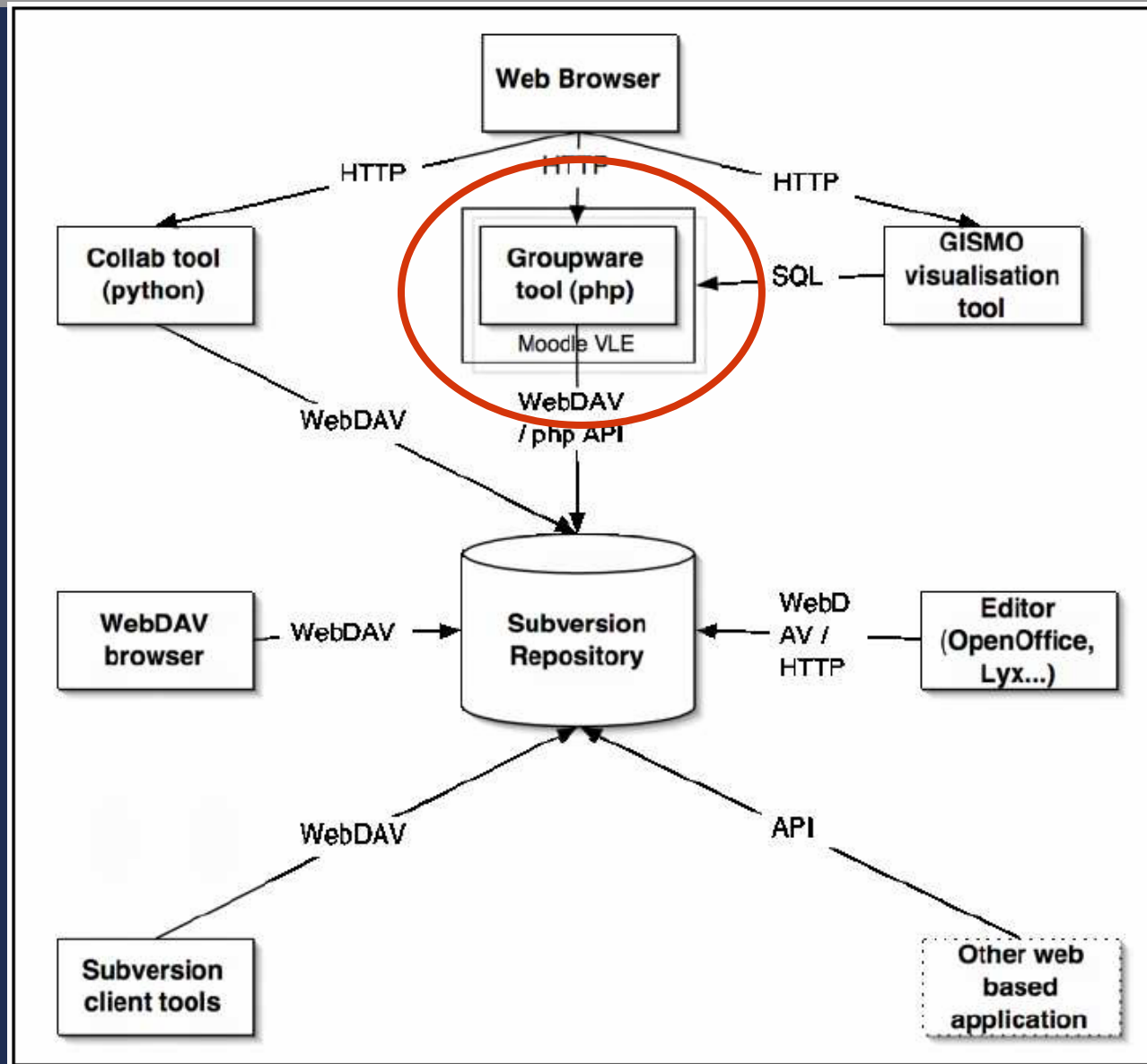
◆ Can we involve teachers to collaboratively construct educational resources

- Different format (e.g. Word, Latex, OpenOffice)
- Resistant to change their working environment
- Would not use systems that are not intuitive and easy to use

◆ Can we involve students to collaboratively construct educational resources

- Linked with learning objectives
- Seamlessly integrated in their learning activities
- Motivational factors

The Edukalibre system (OSS2005, ED-MEDIA2005)



ConDOR (edukalibre.comp.leeds.ac.uk)

- Holistic design
- Intuitive interface
- Version control (OpenOffice & Latex)
- Used in 4 courses
- Feedback positive

The screenshot shows a web browser window displaying the ConDOR interface. The browser title is "GW101: groupware demo - Mozilla Firefox". The address bar shows the URL: <http://edukalibre.comp.leeds.ac.uk/groupware/mod/groupware/view.php?id=3&method=resource&page=browser&location=/res>. The page has navigation tabs for Home, Messages, Discussions, and Resources. Below the tabs, there are links for "My Resources", "Repository browser", "Upload a new file here", and "Create a new folder here". The main content area shows "Resources for 'groupware demo'" and "You are in folder : Home -> resources ->". A table lists the resources with columns for Name, Author, View history, Add to My Resources, Upload a new version, List source files, and Delete.

Name	Author	View history	Add to My Resources	Upload a new version	List source files	Delete
adagio2.egg	chr:py	View history	N/A	Upload	N/A	Delete
apple.jpg	chr:py	View history	N/A	Upload	N/A	Delete
Azmar_gana.jpg	chr:py	View history	N/A	Upload	N/A	Delete
Boo-stop.gif	chr:py	View history	N/A	Upload	N/A	Delete
edukahowto.sxw (OpenOffice)	chr:py	View history	Add to My Resources	Upload	List source files	Delete
file.txt	chr:py	View history	N/A	Upload	N/A	Delete
lear2003.tex (Latex)	chr:py	View history	Add to My Resources	Upload	List source files	Delete
Sample.jpg	chr:py	View history	N/A	Upload	N/A	Delete
Sony_Cybershot.zip	chr:py	View history	N/A	Upload	N/A	Delete
testdocbook1-5.sxw (OpenOffice)	chr:py	View history	Add to My Resources	Upload	List source files	Delete
view.php	chr:py	View history	N/A	Upload	N/A	Delete

The history of /resources/edukahowto_sxw

Revision number: 439
Author: invitado
Date: 2004-10-07T12:32:17.810036Z
Description: added some stuff

Revision number: 372
Author: invitado
Date: 2004-09-23T07:55:45.328551Z

Challenges & Future work

◆ Issues from user studies

- Improvement of the interface
- Required personalised features (mainly customisation)
- Confusion with the construction of large repositories
- Lack of motivation to share and collaborate

◆ Semantic web issues

- Dealing with inconsistent terminology in the created document (different vocabularies and viewpoints)
- Enable interoperability (some meta-data required, e.g. topic, author, key words, links with similar resources)
- Combine document sharing and construction, enable peer review

Summary

◆ OntoAIMS

- Interoperability
- Use of several ontologies
- Dealing with cold start
- Using OWL and ontology reasoning tools

- Combining open learner models with tracking data
- Dealing with different usage goals and context

LORNET

◆ ConDOR

- Dynamic construction and sharing of resources
- Holistic environment
- Embedded in a course management system

- Dealing with different vocabularies, add semantics
- Motivational factors
- Flexible construction and sharing of resources, peer review

COMTELLA

References

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