Human Learning as a Side effect of Learning GRID Services

Stefano A. Cerri

Laboratoire d'Informatique de Robotique et de Microélectronique de Montpellier
LIRMM

European Learning Grid Infrastructure

The European Learning Grid Infrastructure based on GRID technologies for supporting ubiquitous, collaborative, experiential-based, contextualised and personalised learning

Human Learning as a side effect of Learning GRID services

Stefano A. Cerri

LIRMM: CNRS & Un. Montpellier II, France
Département Informatique
Social Informatics team

CELDA 2005
December 15th, 2005
9h30

Technology-enhanced learning and access to cultural heritage

Information Society Technologies

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Thanks

European Learning Grid Infrastructure

To Pedro, Toshio, Kinshuk
who invited me !

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The promise

Web:
http://www.iadis.org/celda2005/keyn@ote.asp

Offline:
CELDA 2005- Keynotes.html

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Telescopes and computers

« applicative research does not exist, …

… there are, however,
applications of fundamental research … »

Synergies between Informatics research and the Human Learning context
Tradition started by Alan Kay with Smalltalk and the Dynabook more that 30 years ago - http://www.squeakland.org/community/biography/alanbio.html

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Social Informatics: conjectures

Intelligence is a social phenomenon (eg: Di Castri)
Traditional AI (individualist):
- making machines more « intelligent »
- studying intelligence by simulations

Current AI (social):
- making Societies (human+artificial Agents) more intelligent
- studying societie's intelligence by simulations

Social intelligence depends on Interactions
Interaction is a poorly understood phenomenon

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Social Informatics: conjectures

Interaction is « more powerful » than Algorithms (Wegner)
Interaction « starts » by 3
Interacting Agents may exchange « products » (classic) …
But also « services » (new)
Service : a « new » concept
Learning is crucial for all above
Think! (IBM, 1960)
Do not think, compute! (CDC 1970)

When in doubt, do not think, neither compute: ASK !

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The ELeGI project

http://www.elegi.org/

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The European Learning Grid Infrastructure based on GRID technologies for supporting ubiquitous, collaborative, experiential-based, contextualised and personalised learning

European Grid Technology Days 2005 (EGTD05)

Stefano A. Cerri; Philippe Lemoisson

LIRMM (UM2 & CNRS) - France

Brussels, Spring 2005

cerri@lirmm.fr ; lemoisson@lirmm.fr

Technology-enhanced learning and access to cultural heritage

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European Learning Grid Infrastructure

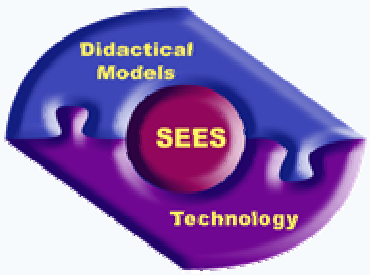
IST / FP6 project

a consortium of 23 partners

4 years : 1 Feb 2004 -> 31 Jan 2008

7,5 millions € EU contribution

LIRMM: UM2+CNRS = ~750 000 €



Aimed at synergically combining new methodologies and advanced technologies in a user and pedagogy driven approach

WP6 : conversational processes, collaboration & enhanced presence

Initial Motivation of our Work Package:

To further the **understanding of the roles of conversational processes and collaboration aspects** through combining the expertise and experience of LIRMM and KMI for the benefit of the ELeGI project;

To **demonstrate** our conceptual framework through prototyping Grid environments for collaboration.

The ELeGI WP6 Team

KMi / OU : Marc Eisenstadt, Jiri Komsak, …

LIRMM / (CNRS & UM2) : Joost Breuker, Stefano A. Cerri, Philippe Lemoisson, Pascal Dugénie, Nik Nailah Binti Abdullah, Clément Jonquet, …

Telindus (THTI) : Simon Kusters, Joost Drieman, …

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Conversational Processes and Enhanced Presence

Snapshot of online multiparty conversations (Flashmeeting, KMI CNM, OU, UK)

Flashmeeting ELeGI Memo 15 01 2005

(Quicktime movie, offline):

QuickTime™ et un
décompresseur Sorenson Video
sont requis pour visionner cette image.

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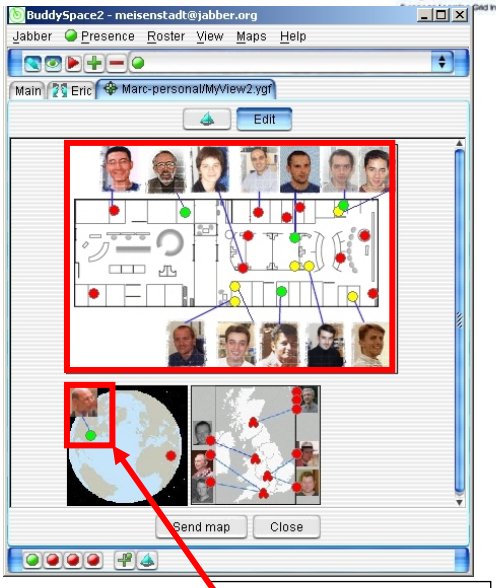
Enhanced Presence 1: BuddySpace

*Goal: "Find me the person who can **really** help me **now**"*



Found an expert!

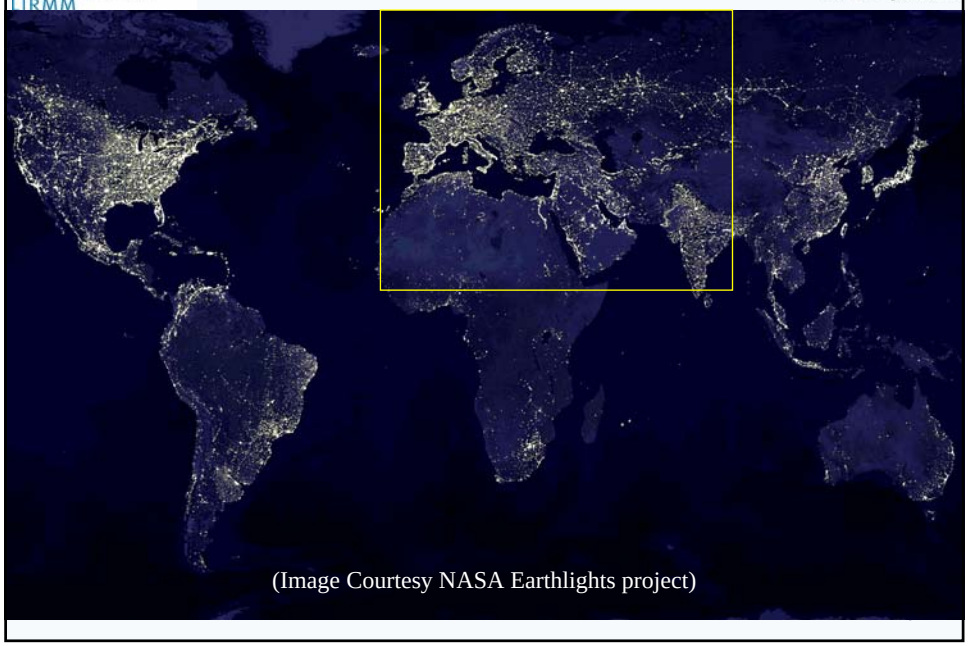
Enhanced Presence 2

Goals:

- *True* multiparty
- zero install
- GRID power

December 2005

"Find me the person who can really help me now."

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"Find me the person who can really help me now."
ELeGI
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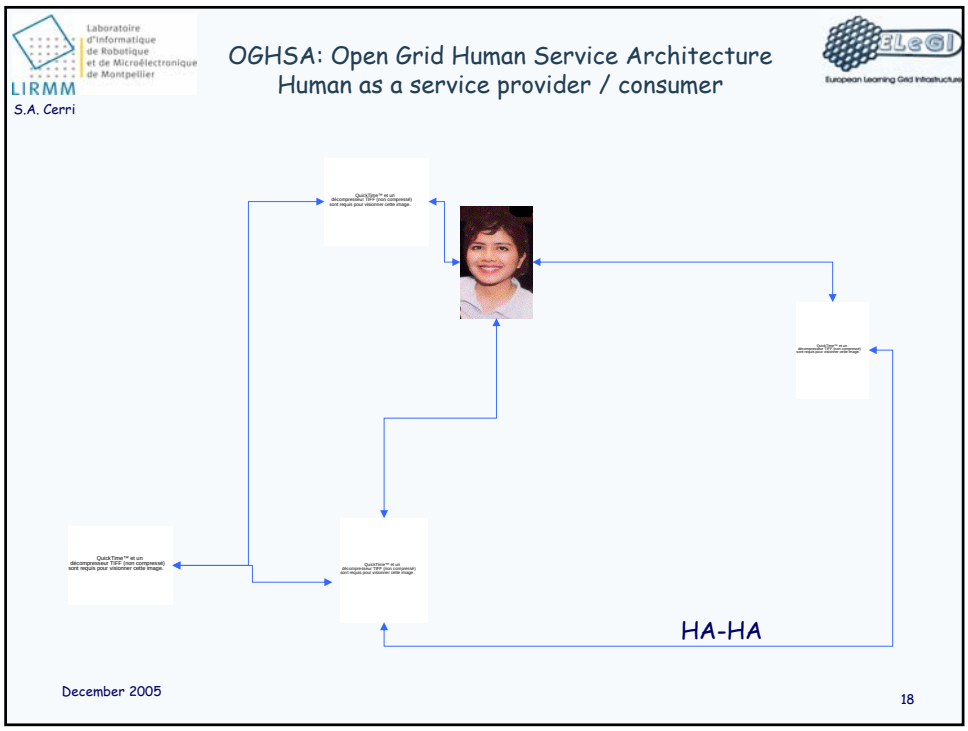
Cluster:
jsmith@jcp.com,
cdoyle@jcp.com
• Who else is facing a *similar* problem?
• Where can I find *complementary* approaches?
• Has anyone solved a related problem?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OGHSA: Open Grid Human Service Architecture
Human as a service provider / consumer
ELeGI
European Learning Grid Infrastructure
HA-HA
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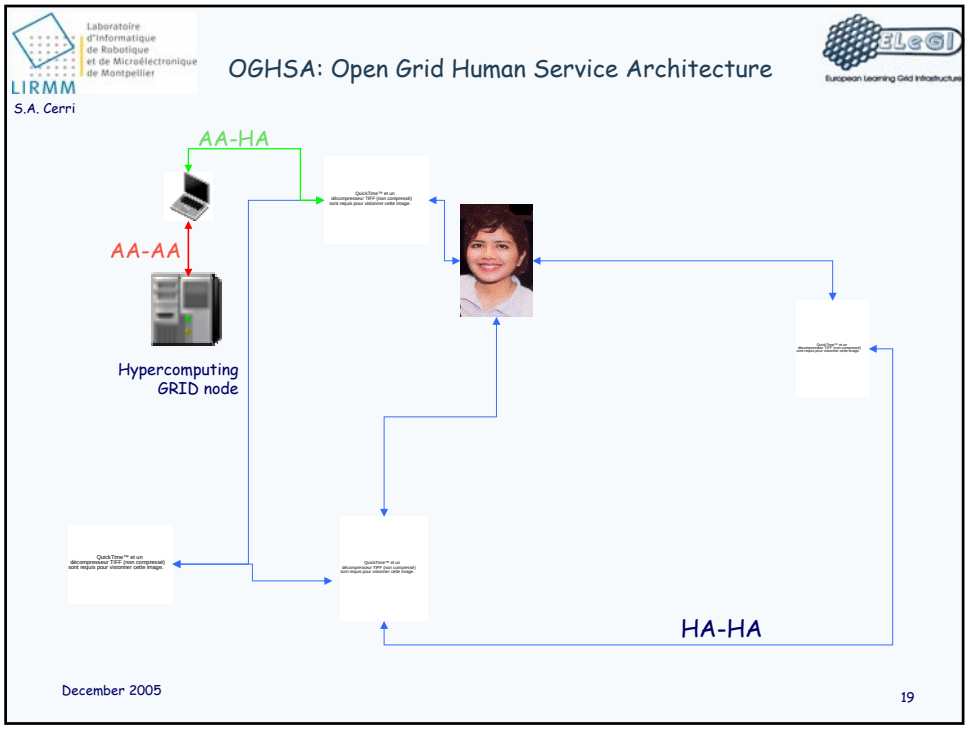
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OGHSA: Open Grid Human Service Architecture
AA-HA
AA-AA
Hypercomputing
GRID node
HA-HA
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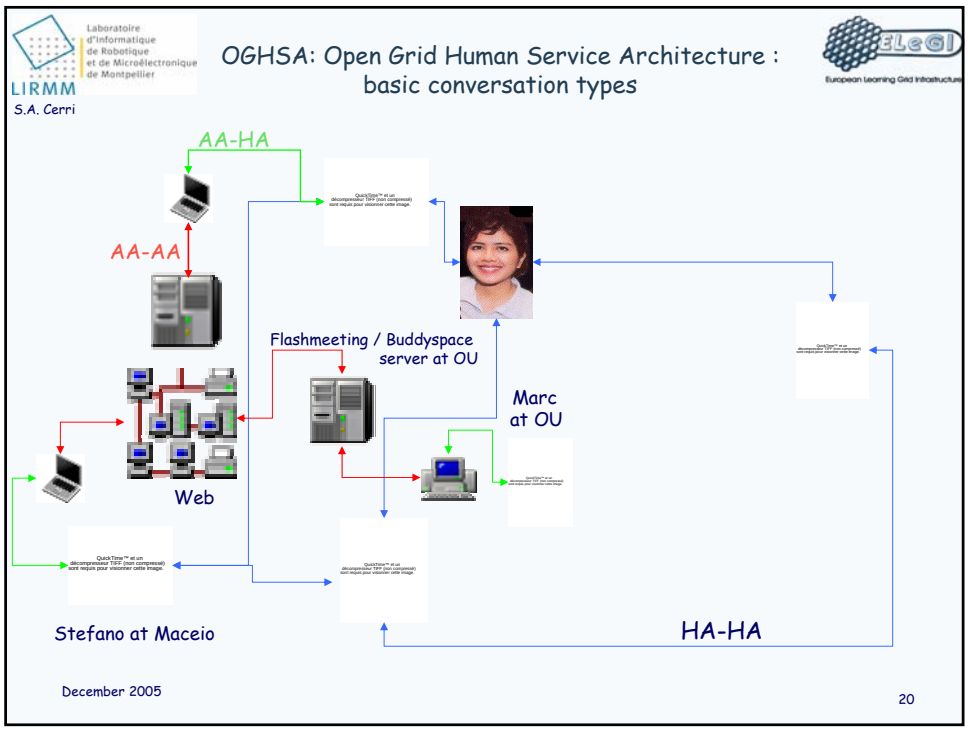
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OGHSA: Open Grid Human Service Architecture :
basic conversation types
AA-HA
AA-AA
Flashmeeting / Buddyspace
server at OU
Marc
at OU
Web
Stefano at Maceio
HA-HA
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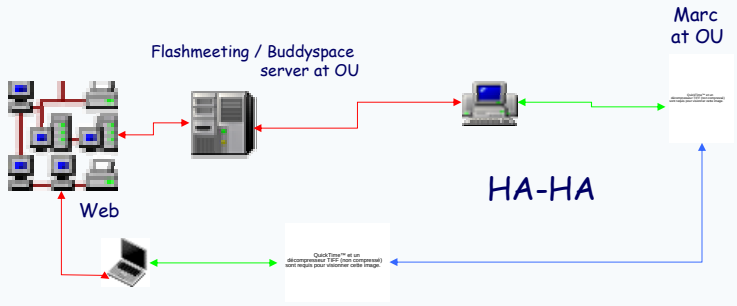
OGHSA: Open Grid Human Service Architecture: combinations of conversations

Enhanced Presence

Conversational Processes

HA-AA + AA-AA + AA-HA



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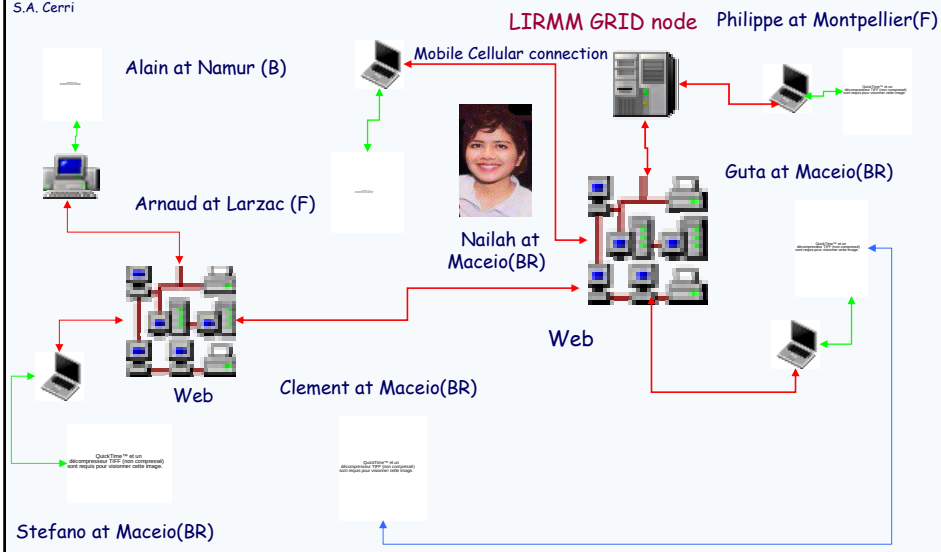
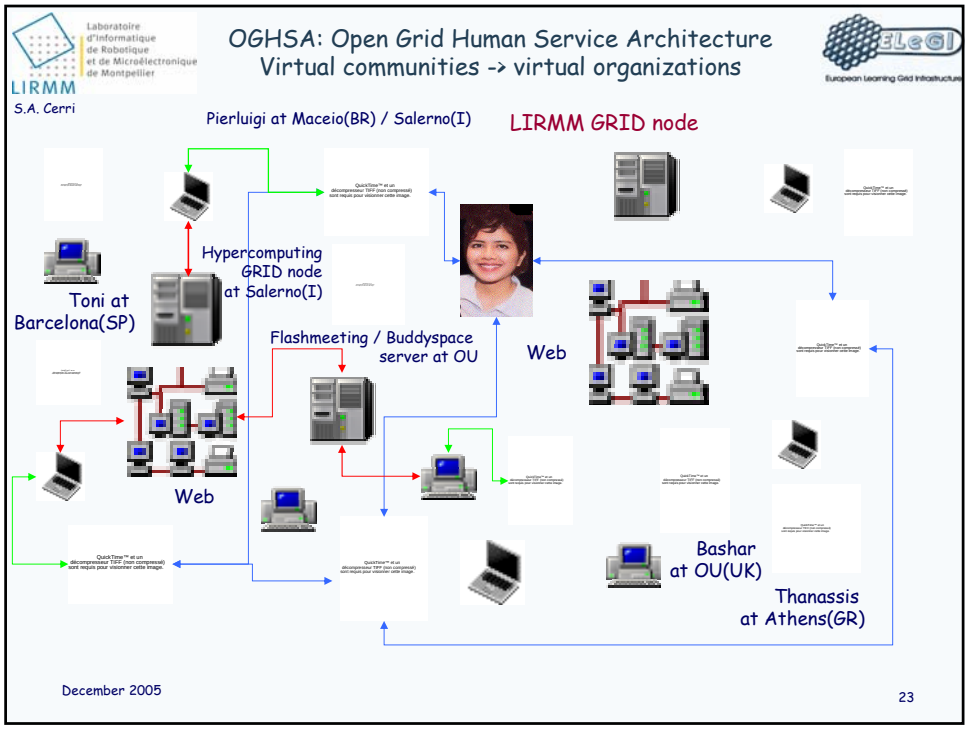
OGHSA: Open Grid Human Service Architecture: human & technical scenarios

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OGHSA: Open Grid Human Service Architecture
Virtual communities -> virtual organizations
Pierluigi at Maceio(BR) / Salerno(I)
LIRMM GRID node
Hypercomputing GRID node at Salerno(I)
Toni at Barcelona(SP)
Flashmeeting / Buddyspace server at OU
Web
Web
Bashar at OU(UK)
Thanassis at Athens(GR)
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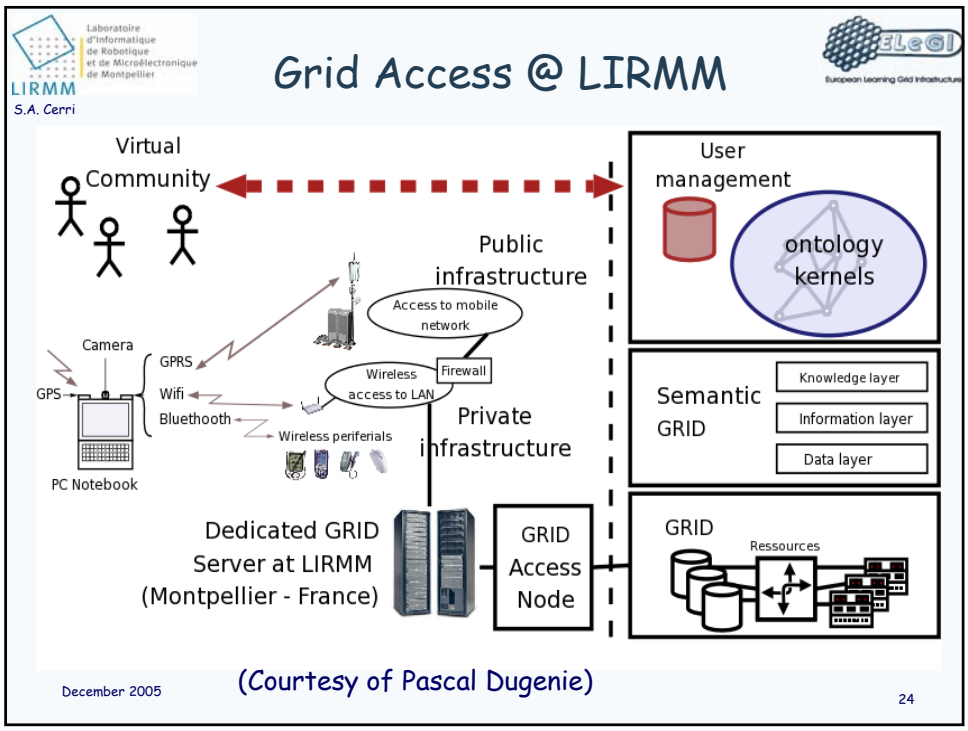
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Grid Access @ LIRMM
Virtual Community
User management
ontology kernels
Public infrastructure
Access to mobile network
Camera
GPS
GPRS
Wifi
Bluethooth
Wireless periferials
PC Notebook
Wireless access to LAN
Firewall
Private infrastructure
Semantic GRID
Knowledge layer
Information layer
Data layer
Dedicated GRID Server at LIRMM (Montpellier - France)
GRID Access Node
GRID
Ressources
(Courtesy of Pascal Dugenie)
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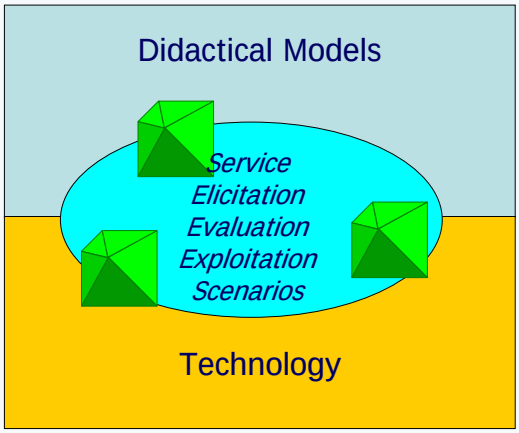
What and Why

SEES: informal (1,2,3)
formal (4,5)

- 1. VIAD
- 2. ENCORE
- ==> Principles of Theory Formation

SEES



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Informal SEES

VIAD: Virtual Institute on Alphabetization for Development (A. Martin)
(empowerment => development)
Pays Cœur d'Hérault, Larzac (Tourism? Other? To be decided by THEM)
Chili (Easter Island)
Brazil (Maceio + Rondonia)

ENCORE: Encyclopedie de Chimie Organique Electronique (A. Krief)
Researchers learning how to construct ENCORE
Students learning how to use ENCORE
Both learning Organic Chemistry (check: Da Nobrega's thesis)

=> Unified view: elements of Theory Formation

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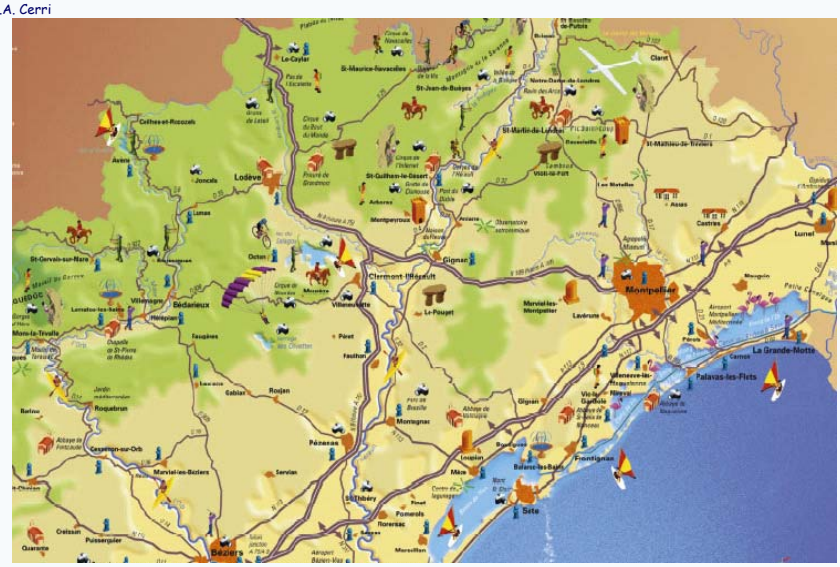
VIAD: Pays Coeur d'Herault



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SEES n°1 in brief

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Context: Sustainable development in the remote, rural and culturally rich context of Larzac Coeur d'Herault (LCH)
- EU regional policy …
  … reinterpreted for informal virtual communities

Goal: to define, experiment and demonstrate :
- instant collaboration inside a group
- written knowledge capitalization

Approach: Constructivist learning in dynamic virtual communities

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UNESCO Cultural Heritage
Saint Guilhem-le-désert

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Local Empowerment:
a New paradigm for the development

until the 70's : Technical rationality (national policies)

starting in the 80's : Decentralization, then…

90's: …New paradigm (from Francesco Di Castri):

1. emergence of local actors' entrepreneurial capacity,
2. connectivity among all concerned stakeholders, from local populations to potential service users and providers,
3. diversification of activities

Needs for knowledge sharing experiences,
learning from each other, etc.

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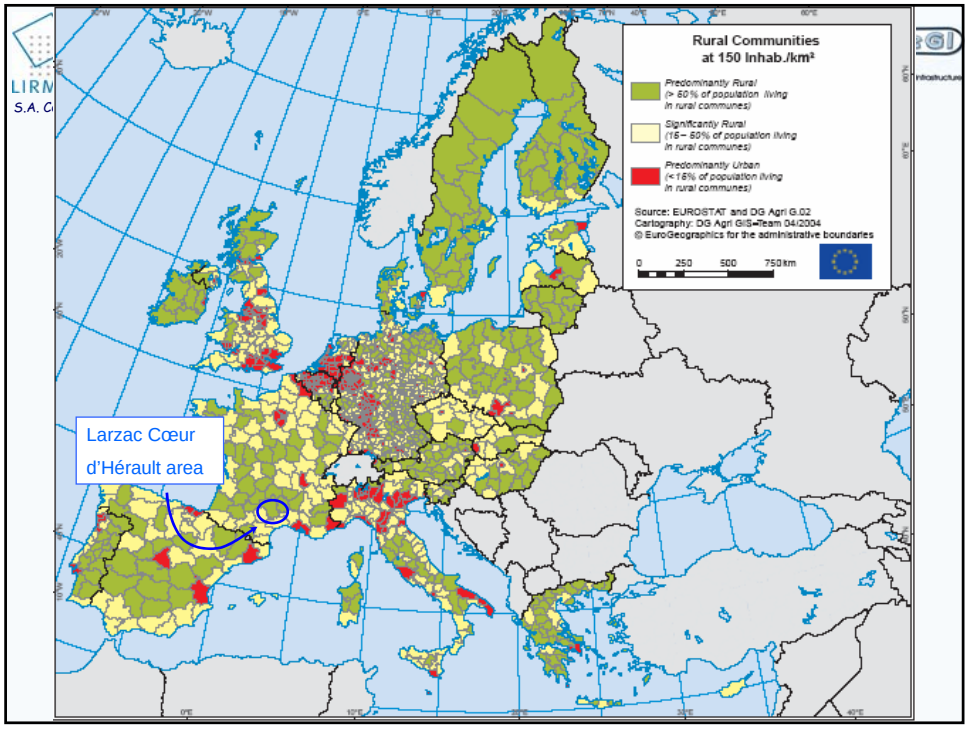


User Perspective

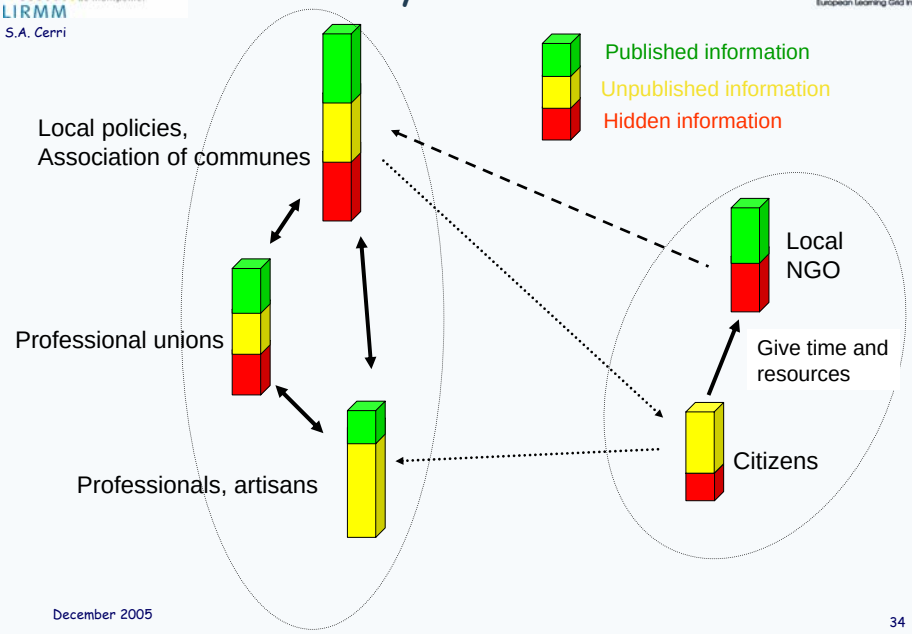
Users:
local stakeholders, local officers
anybody concerned with rural development

Main needs in Larzac-Coeur d'Hérault:

1. to identify and access the skills (including information, available databases, etc…)
2. to enable instant (distant) collaboration (especially for those who live in the mountains)
3. to build and share collaborative knowledge

UNESCO Student' s report

VIAD: Pays Coeur d'Herault



Keys phases in VC life

VC Childhood

VC creation

- name + common project
- definition of rules for membership (VC administration)
- definition of roles inside the community
- definition of media + protocols for interaction (communication services/tools)

VC certification

- official existence among VCs
- visibility

Maturity

- mastering of collaboration protocols
- self management of services and tools

VC 1 / Childhood

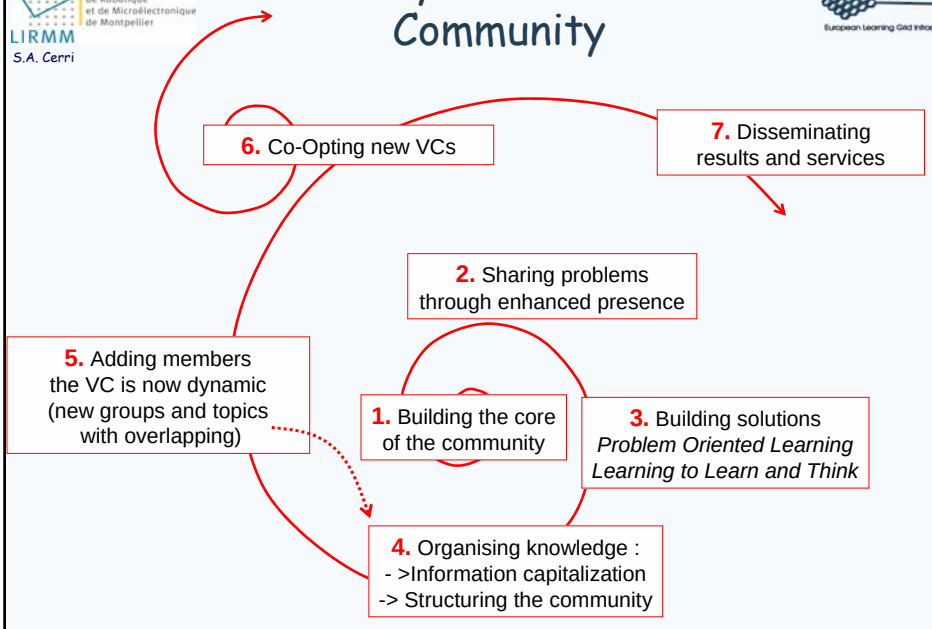
VC 1 / Maturity ->

VC 2 / Childhood

- VC 1 administrates VC 2 services

VC 2 / Maturity ->

Life cycle of Virtual Community



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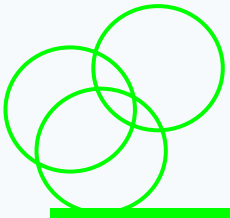
Basic Services Needed

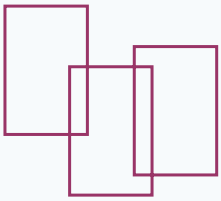
- Ubiquitous Accessibility (anytime/anywhere)
- Group communication
- Organization and capitalization of knowledge
- Integration of services through transparent technology

Instant interaction through enhanced presence	Knowledge organisation and capitalisation



let us co-write a synthesis of our recorded chats !

may I talk with the author ?



1 circle = 1 virtual community	1 rectangle = 1 shared document

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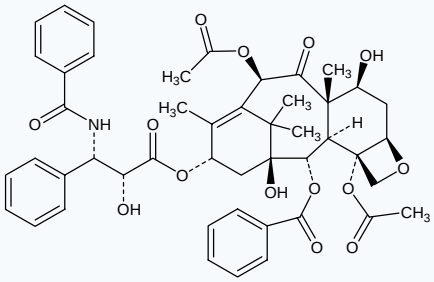
SEES #2 ENCORE

Context: need for organic synthesis

Taxol

Anticancer drug isolated from the bark of the Pacific yew tree



Problem: the treatment of each patient would require the sacrifice of three 100-year old trees per year

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Context

How do chemists solve organic synthetic problems?

By using and sharing

- chemical data, information and knowledge
- intelligence
  (logical and analogical reasoning, strategies and tactics …)

Not by quantum mechanical calculation

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Involved actors & institutions

EnCOrE organisation

Scientific commitee
A. Krief (F. Namur), B. Castro (Sanofi – Aventis)
I. Fleming (U. Cambridge), J.A. Gladysz (U.Erlangen)

Automatic text analysis
C. Fairon (U. Louvain)

Chemical graph processing
C.Laurenço/ Ph. Vismara
(CNRS/ENSCM/U. Montpellier 2)

Organic synthesis modelling
C. Colaux-Castillo (F. Namur)

Service architecture
Ph. Lemoisson/ P. Dugénie
(CNRS/U. Montpellier 2)

Ontologies

Knowledge extraction
Reaction facts and their interpretation
C. Laurenço (CNRS/ ENSC Montpellier + F. Namur)

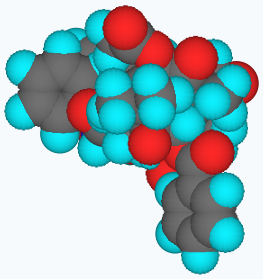
Databases

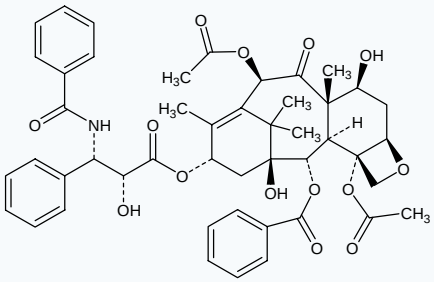
Dictionary of Organic Chemistry

User Perspective

Chemistry is a multi-language domain

Taxol





CAS Registry Number: 33069-62-4

Systematic name: [2aR-[2aa,4b,4ab,6b,9a(aR*,bS*),11a,12a,12aa,12ba]]-b-(Benzoylamino)-a-hydroxybenzenepropanoic acid 6,12b-bis(acetyloxy)-12-(benzoyloxy)-2a,3,4,4a,5,6,9,10,11,12,12a,12b-dodecahydro-4,11-dihydroxy-4a,8,13,13-tetramethyl-5-oxo-7,11-methano-1H-cyclodeca[3,4]benz[1,2-b]oxet-9-yl ester

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User Perspective

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reaction path
1. A synonym for *mechanism.*
2. A trajectory on the *potential-energy surface.*
3. A sequence of synthetic steps.

See also *minimum-energy reaction path*.
1994, *66,* 1159

IUPAC Compendium of Chemical Terminology 2nd Edition (1997)
IUPAC = International Union of Pure and Applied Chemistry

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User Perspective

Objectives:

- to give definitions for words, with clearly identified meanings and contexts of validity of them
- to establish significant relationships between terms
- to get a shared vocabulary
  - to develop his own understanding of organic synthesis
  - to transmit and share his knowledge
  - to prepare the building of EnCOrE

Needs:

- to discuss and collaborate with other chemists
- to negotiate consensual definitions with them
- to keep trace of dialogues
- to share reference sources

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Organic Chemistry experiments and representation of data

(borrowed from: Catherine Colaux-Castillo and Alain Krief)

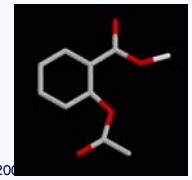
Matter is part of our day life ….

Aspirin

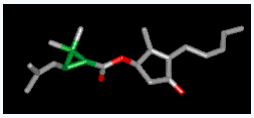
Pyrethrin I

Organic Chemistry experiments and representation of data

Aspirin

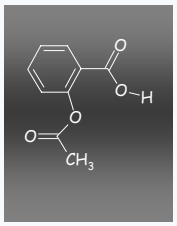


Pyrethrin I

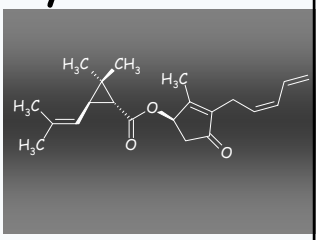


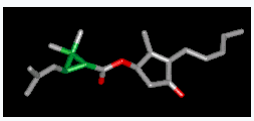
Organic Chemistry experiments and representation of data

Aspirin



Pyrethrin I





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Organic Chemistry experiments and representation of data

Aspirin

How to name those molecules?

Pyrethrin I

Aspirin

AcetylSalicylic Acid

2-Acetoxy-benzoïc acid

Pyrethrin I

2,2-Dimethyl-3-(2-methyl-propenyl)-Cyclopropanecarboxylic acid 2-methyl-4-oxo-3-penta-2,4-dienyl-cyclopent-2-enyl ester

With the IUPAC rules
Or/and with "commercial" name

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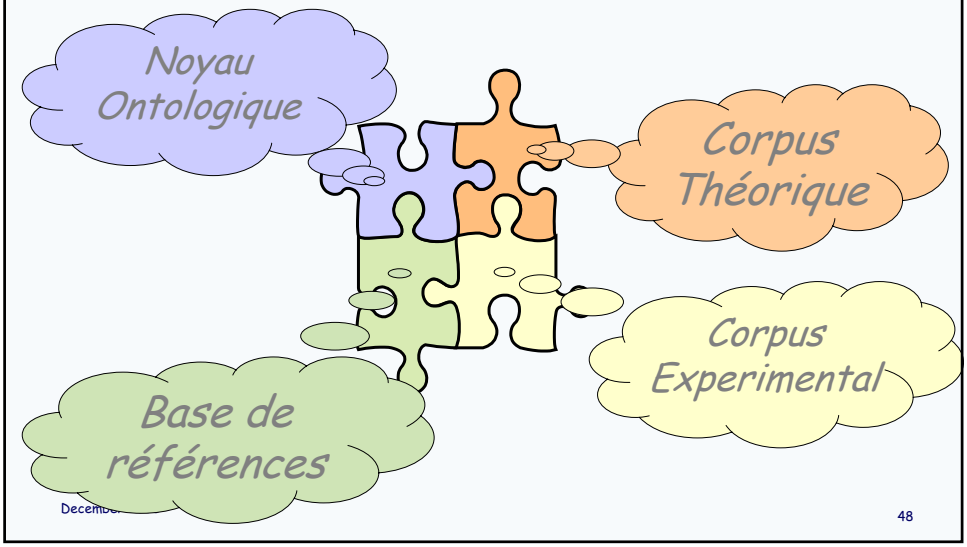
EnCOrE

(Encyclopédie de Chimie Organique Électronique)



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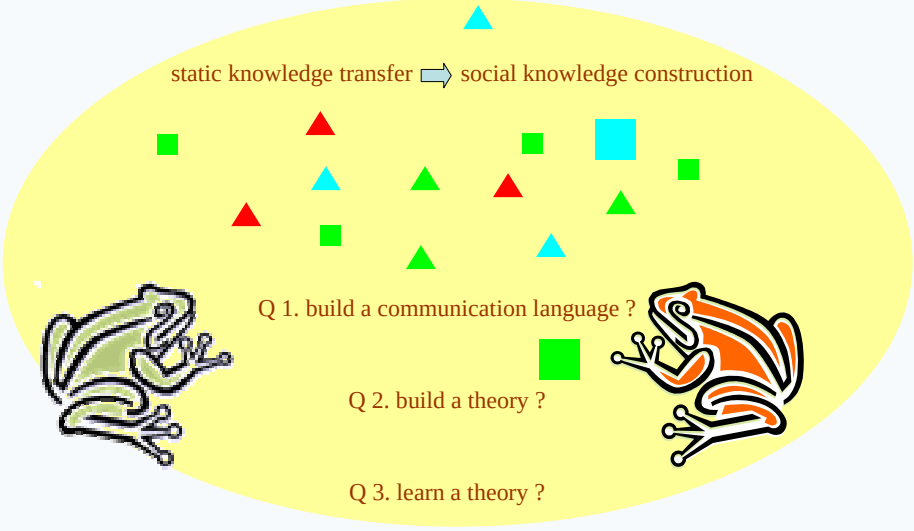
You and Me in the World

(borrowed from: Interactive Knowledge Construction; Lemoisson & Cerri, 2005)



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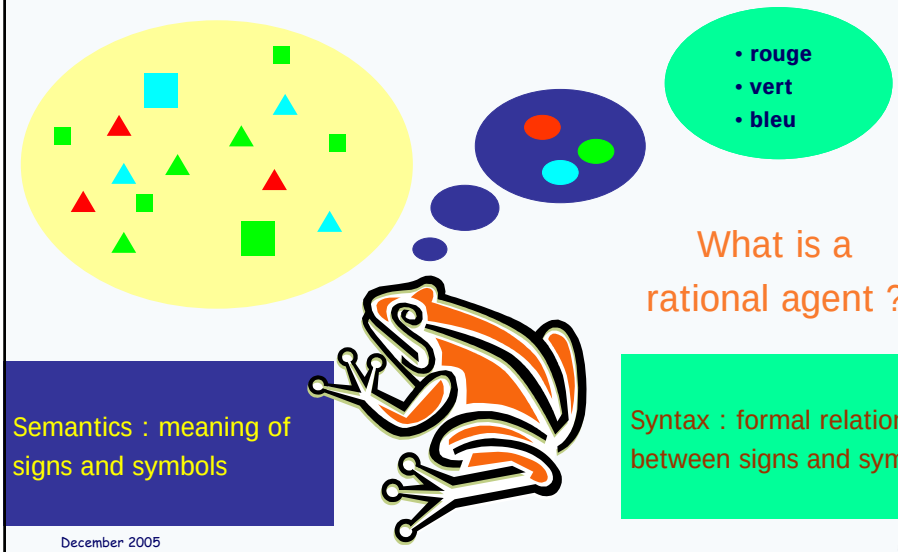
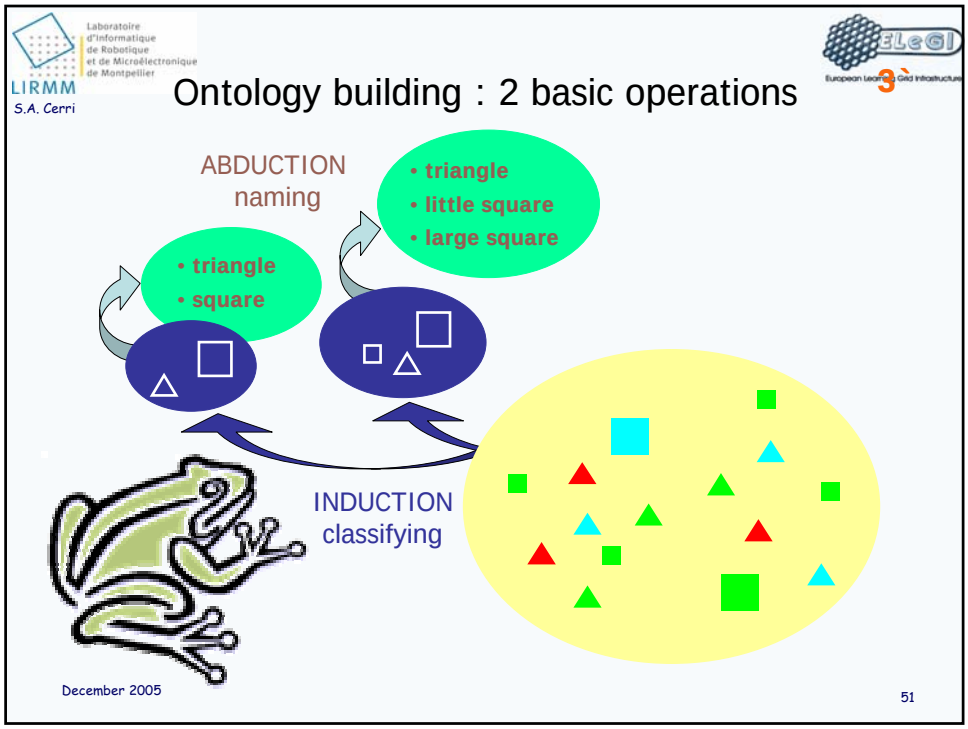
Reality, Mind and Speech



What is a rational agent ?

Semantics : meaning of signs and symbols

Syntax : formal relations between signs and symbols


LIRMM
S.A. Cerri
Ontology building : 2 basic operations
ABDUCTION
naming
• triangle
• square
• triangle
• little square
• large square
INDUCTION
classifying
December 2005
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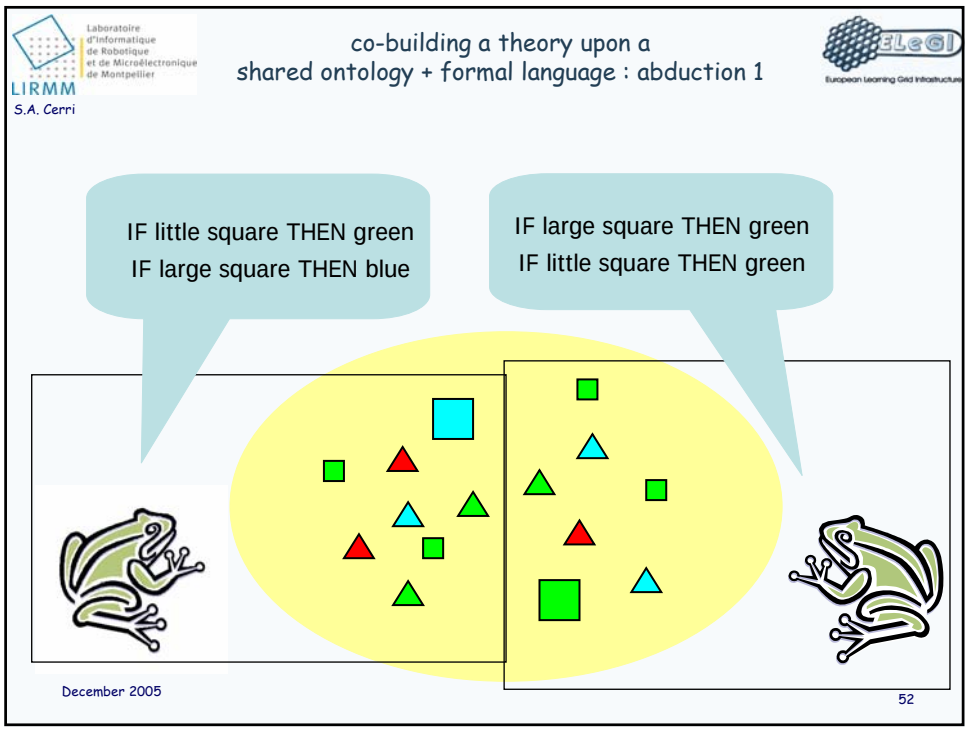
LIRMM
S.A. Cerri
co-building a theory upon a
shared ontology + formal language : abduction 1
IF little square THEN green
IF large square THEN blue
IF large square THEN green
IF little square THEN green
December 2005
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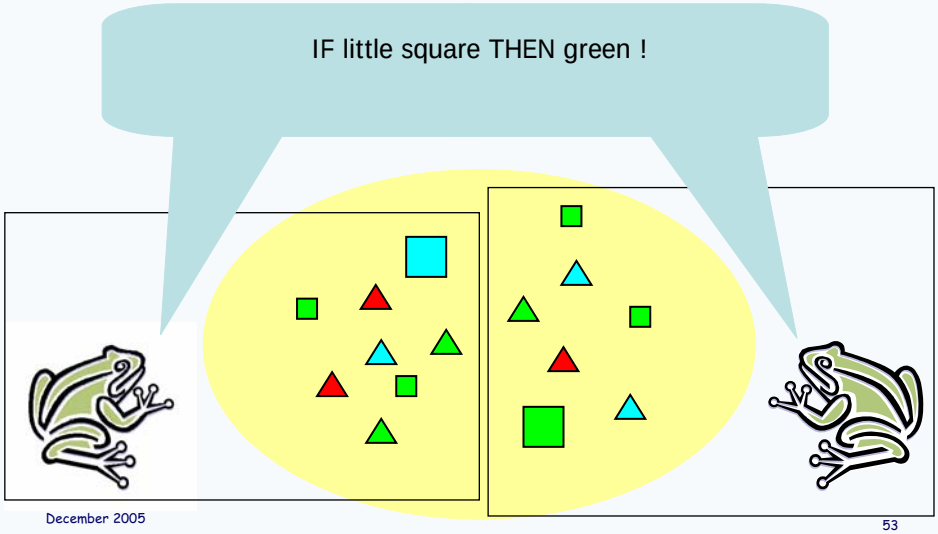
S.A. Cerri

co-building a theory upon a shared ontology + formal language : abduction 2



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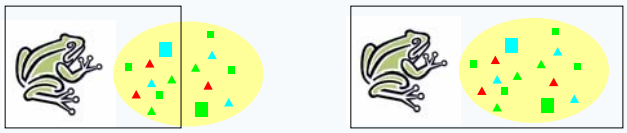
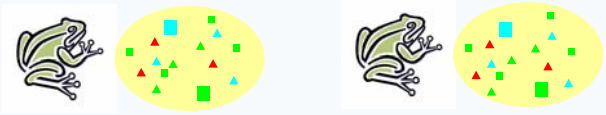
Which PROTOCOLS for constructive interactions ?

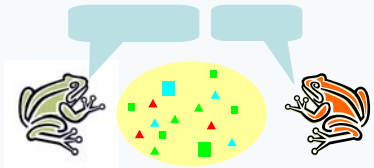
Which horizon ?



Which dynamicity ?



Which initially shared syntax ?
which conventions ?
which standards ?



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How

Products -> Services -> Agents
Dynamic Learning Agents
(STROBE)
Agents as GRID services
Bidirectional access to Information
(Grid Shared Desktop)

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Products

Goal predefined
Associated to a predefined (potential) need
Designed once, produced many times
Evolve slowly
Human « trust » depends on simple demos

Services

Goal to be defined
Anticipate specific needs within a global complex needs
Redesigned every time, custom for the client
Evolve quickly
Human « trust » depends on the history of previous successful services delivered (reputation)

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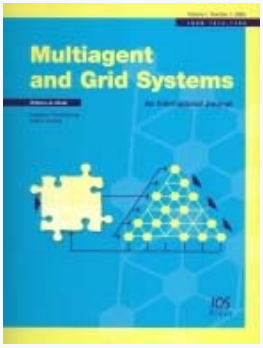
Deux faits importants

AAMAS'04: Article de Foster, Jennings, Kesselman, *Brain meets Brawn: Why Grid and Agents need each other*
- Convergence of interest

2005: Nouvelle revue IOS Press: Multiagents and Grid Systems
- Vol 1 à paraître avant fin 2005



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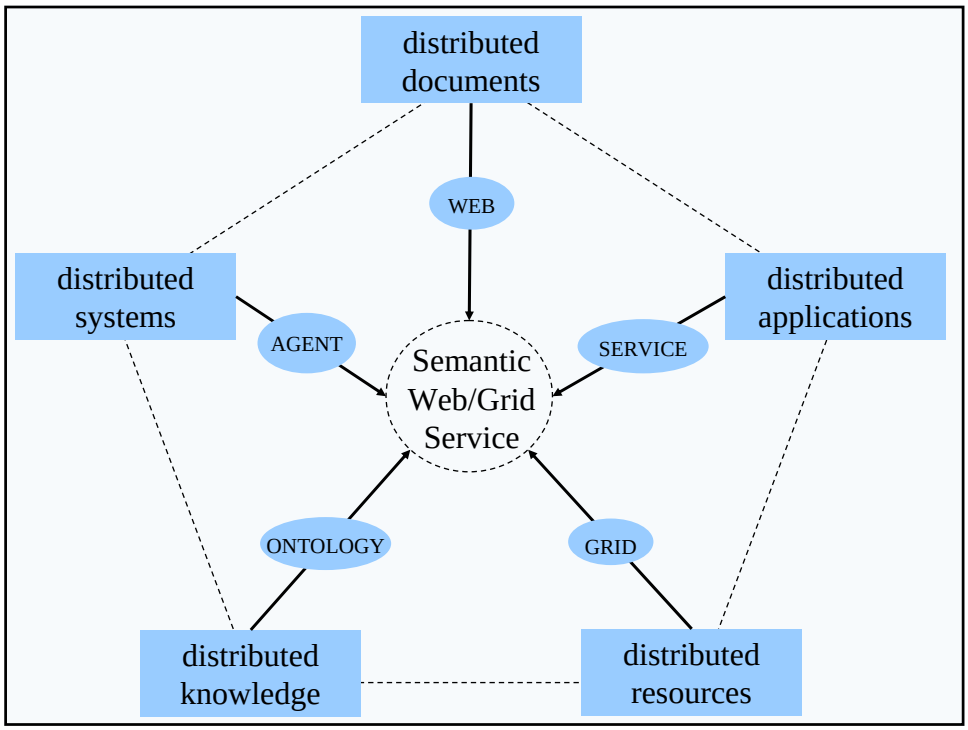
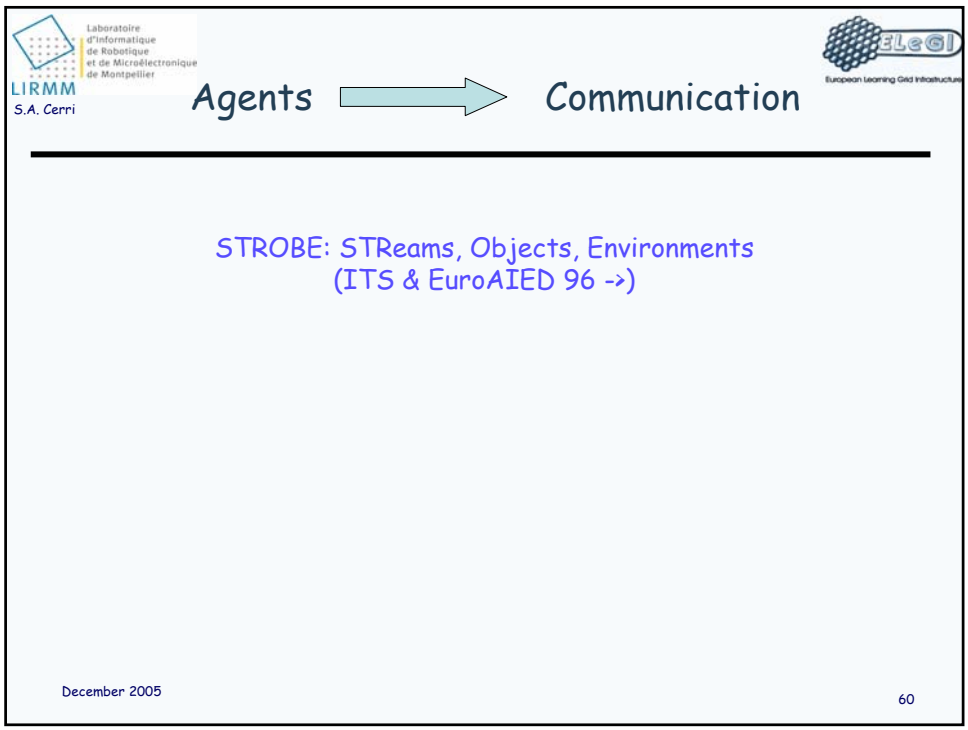
Dynamic Learning Agents

European **Learning GRID** Infrastructure

Learning by being told
(Jonquet et al)
Learning by abstracting and generalizing
Constructive interactions in ENCORE
(Lemoisson, et al)
Induction of interaction protocols
(Binti Abdullah et al)
Contradiction in discovery learning
(Da Nobrega et al, 2003 SBIE award)
Learning as a side effect of a rich learning environment
enhanced presence (Eisenstadt et al.)
serendipitous (Serendip: Sri Lanka)
emotions (motivation, trust, ...): cf SEES !


distributed documents
WEB
distributed systems
AGENT
Semantic Web/Grid Service
SERVICE
distributed applications
ONTOLOGY
GRID
distributed knowledge
distributed resources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Agents
Communication
STROBE: STReams, Objects, Environments
(ITS & EuroAIED 96 ->)
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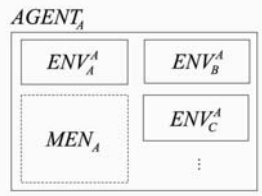
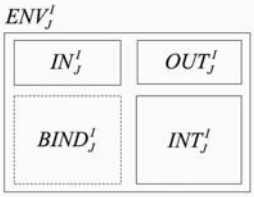
STROBE Agent architecture (2/2)



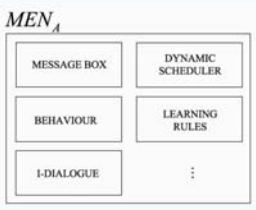


$BIND_J^I$

$\{(\text{var}, val)^*\}$

INT_J^I

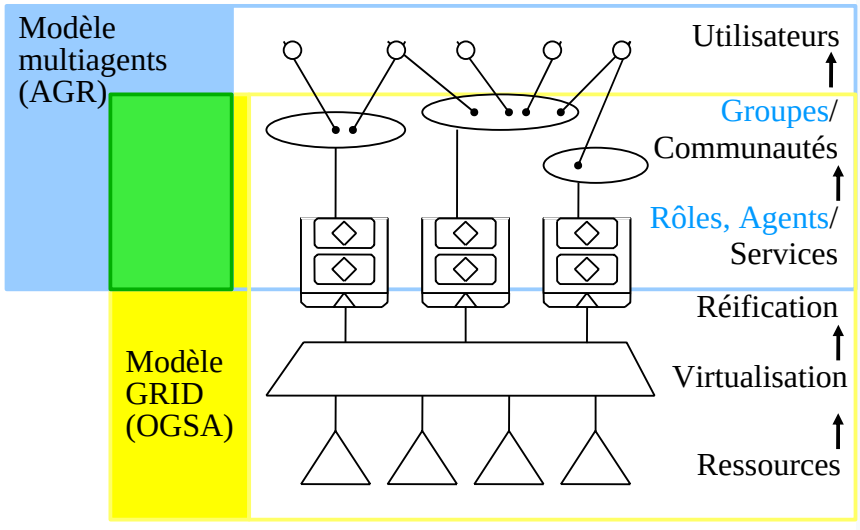
$\lambda : EXP \rightarrow evaluate_J^I(EXP, ENV_J^I)$

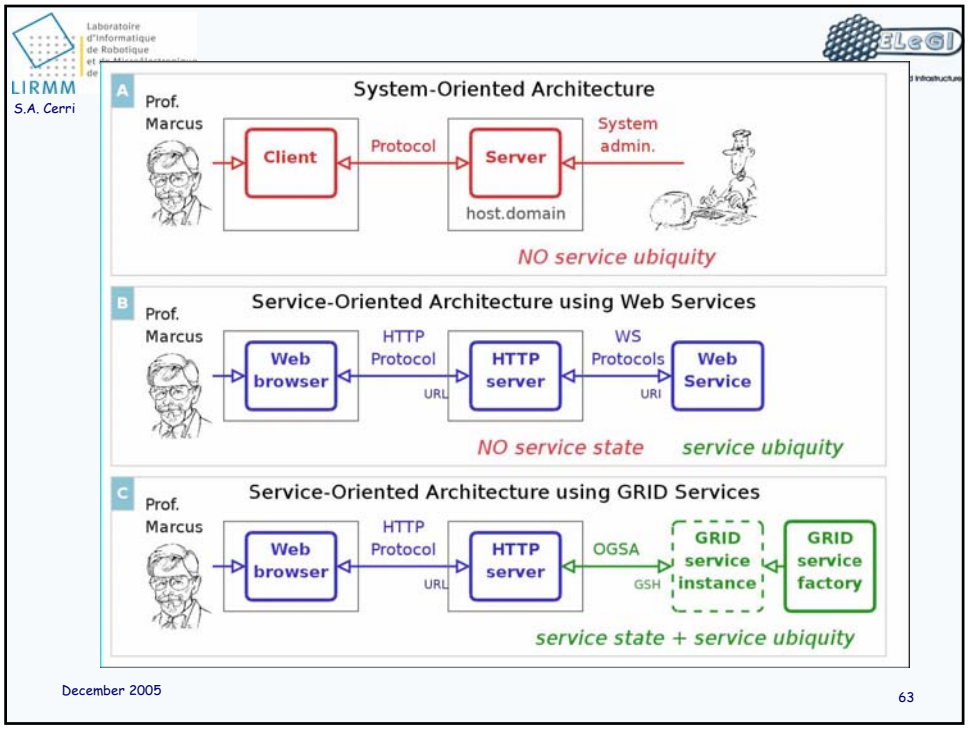


Mental states = agent own objectives, tendencies, behaviour, reasoning rules etc.

With, $ITEM_Y^X = \begin{cases} \text{X local item dedicated to Y} & \text{if } X \neq Y \\ \text{X global item} & \text{if } X = Y \end{cases}$

Agents et Grille: Vue d'ensemble

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A
System-Oriented Architecture
Prof. Marcus
Client
Protocol
Server
host.domain
System admin.
NO service ubiquity
B
Service-Oriented Architecture using Web Services
Prof. Marcus
Web browser
HTTP Protocol
URL
HTTP server
WS Protocols
URI
Web Service
NO service state
service ubiquity
C
Service-Oriented Architecture using GRID Services
Prof. Marcus
Web browser
HTTP Protocol
URL
HTTP server
OGSA
GSH
GRID service instance
GRID service factory
service state + service ubiquity
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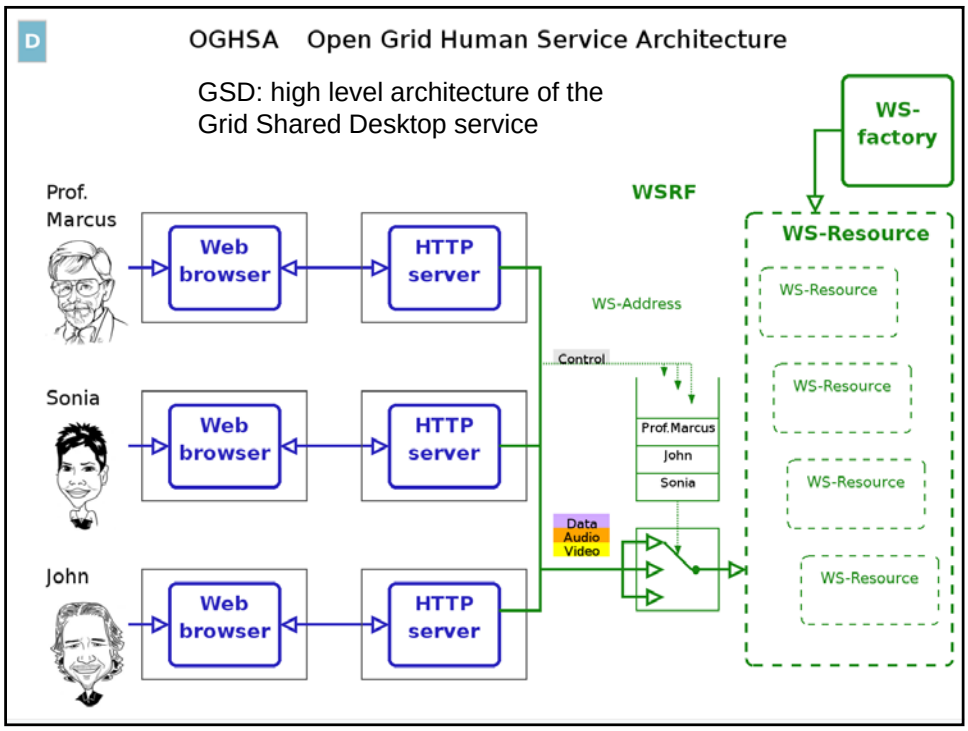
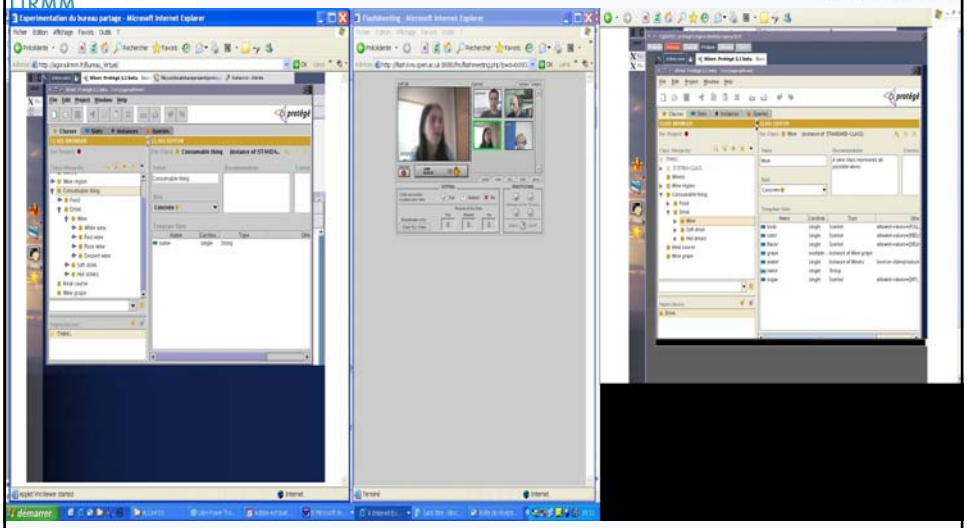

D
OGHSA Open Grid Human Service Architecture
GSD: high level architecture of the Grid Shared Desktop service
WS-factory
WSRF
Prof. Marcus
Sonia
John
Web browser
HTTP server
WS-Address
Control
Prof.Marcus
John
Sonia
Data
Audio
Video
WS-Resource
WS-Resource
WS-Resource
WS-Resource
WS-Resource

Conversational Processes and Enhanced Presence



Dugenie, P. and Lemoisson, P., *A Bootstrapping Scenario for Elicitating CSCL Services Within a GRID Virtual Community.* In: First International ELeGI Conference on Advanced Technology for Enhanced Learning, Naples , Italy, 2005. BCS eWiC

Selected References

S.A. Cerri

Clement Jonquet and Stefano A. Cerri
The Strobe Model: Dynamic Service Generation on the Grid.
Applied Artificial Intelligence, Vol. 19, Number 9-10, pp. 967-1013, 2005.

Clement Jonquet and Stefano A. Cerri
I-Dialogue: Modelling Agent Conversation by Streams and Lazy Evaluation.
International Lisp Conference, ILC'05, Stanford University, CA, USA, June 2005

Philippe Lemoisson and Stefano A. Cerri
Interactive Knowledge Construction in the Collaborative Building of an Encyclopedia.
Applied Artificial Intelligence, Vol. 19, Number 9-10, pp. 933-966, 2005.

Nik Nailah Binti Abdullah and Stefano A. Cerri
Analysis and Synthesis of Learning Agent's Communicative Behavior.
Applied Artificial Intelligence, Vol. 19, Number 9-10, pp. 1015-1041, 2005.

Colin Allison, Stefano A. Cerri, Pierluigi Ritrovato, Angelo Gaeta and Matteo Gaeta
Services, Semantics, and Standards: Elements of a Learning Grid Infrastructure
Applied Artificial Intelligence, Vol. 19, Number 9-10, pp. 861-879, 2005.

Marc Eisenstadt, Jiri Komzak and Stefano A. Cerri
Peer Conversations for e-Learning in the Grid.
First International ELeGI Conference on Advanced Technology for Enhanced Learning.
British Computer Society eWiC

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Main sources for References

Pierluigi Ritrovato, Colin Allison, Stefano A. Cerri, Theo Dimitrakos, Angelo Gaeta, Matteo Gaeta, and Saverio Salerno (eds.)
Towards the Learning GRID: advances in Human Learning Services.
offline: flyer_IOS Book.pdf
Frontiers in Artificial Intelligence and Applications Series, IOS Press, 2005; XVII - 237 pp)

Stefano A. Cerri, Guy Gouardères and Roger Nkambou (eds.)
Learning GRID Services.
offline: Taylor & Francis Gr - 179DB3.html
Taylor & Francis Gr - 179DAD.html
Applied Artificial Intelligence Journal, Vol. 19, N. 9-10;2005; pp. 811-1073.

First ELEGI Conference
offline : eWiC- 1st Internati - 179E19.html
eWiC- E-Learning- P - 179E22.html
eWiC- Grid Technolo - 179E26.html

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Thanks

To my current direct collaborators @ LIRMM:
most but not all cited
To my current indirect collaborators outside LIRMM:
most but not all cited

To the EU IST Programme, partially sponsoring our work

To the audience @ CELDA 2005 (you!)
for the attention and patience