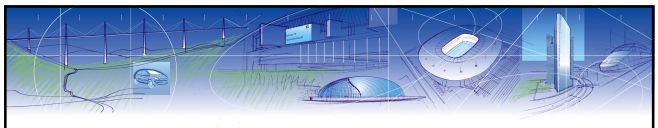


Application of ontologies in the construction sector

Catarina Ferreira Da Silva
Celson Lima

COST Action C21
**** Towntology - Urban Ontologies for an Improved Communication in Urban Civil Engineering Projects****

Lyon, June 14 2005

Centre Scientifique et Technique du Bâtiment

Université Claude Bernard Lyon 1

Laboratoire d'InfoRmatique en Image et Systèmes d'information

About me

- PhD applicant
- Subject: *Interoperability among knowledge models in cooperative environments*
  - at the Information Technologies and Knowledge Dissemination Department – CSTB and
  - at the Cooperative Modelling Team – LIRIS
  - PhD supervisors: Parisa Ghodous, Celson Lima, Lionel Médini
- All the projects presented hereafter are results of a team work: Alain Zarli, Marc Bourdeau, Celson Lima, Bruno Fiès, Chan Le Duc …

Outline

- CSTB
- Construction context
- Ontologies in the construction sector
- CoMMA project
- eConstruct project
- e-COGNOS project
- SPICE project
- FUNSIEC project
- Conclusions and prospect

Centre Scientifique et Technique du Bâtiment

- Four professions at the service of construction
  - Applied research
  - Consultancy at high level and expertise
  - Evaluation, testing and certification
  - Knowledge dissemination
- Six main themes
  - Sustainable development
  - Economics and sociology
  - Safety and risk prevention
  - Construction quality
  - Optimising structures
  - Information technology industry

Construction Context

- Organisational
  - Complex and fragmented processes, involving numerous expert partners in a single project
  - Different organizational methods
  - Ephemeral companies consortiums
- Informational
  - Heterogeneous resources models
  - Voluminous data sources
  - Strong information dependency

Ontologies in the construction sector

- Several distinct domains
- Several disparate Semantic Resources
- Several standards: ISO/PAS 16739 (**I**ndustry **F**oundation **C**lasses), ISO 12006 (Organization of information about construction works)
- Resources publicly/currently available: LexiCon, BARBI, bcBuildingDefinitions, e-COGNOS, SDC

Structure, architecture, construction and facilities management, building controls, heating, ventilating and air conditioning (HVAC), plumbing and fire protection, etc.

Ontologies, standards, taxonomies, thesauri, classification systems, dictionaries etc.

CoMMA project

Corporate **M**emory **M**anagement through **A**gents

(IST-1999-12217)

- Goal: to implement and trial a corporate memory management platform based on ontologies and agent technologies
- Two application scenarios
  - New employee insertion
  - Technology Monitoring
- Software platform based on ontology and on agent technologies
- **O'CoMMA ontology**: 420 concepts, 50 relations, 630 terms to label those primitives and depth of 12 levels
- CORESE: RDF-based semantic search engine - INRIA

eConstruct project

eConstruction: eCommerce and eBusiness in the European Building and Construction Industry: Exploiting the Next Generation Internet

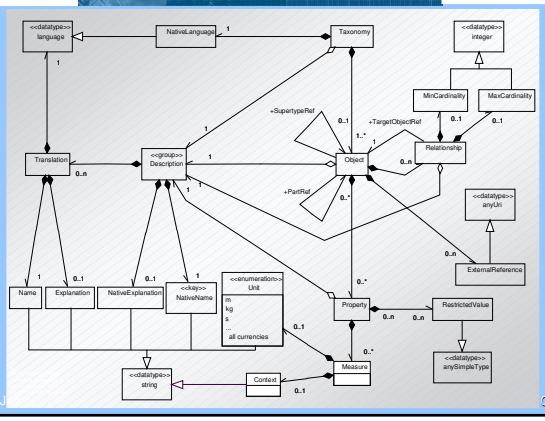
(IST-1999-10303)

- Goals:
  - Develop, implement and disseminate a construction-oriented language tailored to create taxonomies: Building and Construction eXtensible Mark-up Language (**bcXML**)
  - Develop associated software tools to enable explicit searching/finding precisely a given product/component when using marketplaces/portals devoted to the construction domain

eConstruct project

- The **bcXML** supports the eBusiness communication between
  - clients (architects and engineers),
  - suppliers and contractors
- The **bcXML** taxonomy (bcBuildingDefinitions):
  - Contains terms/expressions in 6 European languages related to construction products
  - Based on a generic meta-schema "eXtensible Taxonomy Definition (XTD)"

bcXML meta-schema



e-COGNOS project

Methodology, tools and architectures for Electronic COnsistent knowledGe maNagement across prOjects and between enterpriSes in the construction domain

(IST-2000-28671)

- Goals:
  - Analysis of the specificity of KM activities of European construction companies
  - Understanding of the semantics within and across heterogeneous construction documents
  - development of an ontology (**e-COGNOS ontology**) and model-based adaptive mechanisms in order to organise documents according to their contents and interdependencies
  - Specify a web-based infrastructure (**e-CKMI**) including services allowing to create, capture, index, retrieve, disseminate knowledge
  - Implement, deploy and evaluate the proposed infrastructure
- Additional software application: e-COGNOS ontology server (**e-COSer**)

e-Cognos ontology

- eCognosConcepts
  - Actor
  - Process
  - Resource
  - Technical topic
  - Related domain
    - Community domain
    - Standard domain
    - Engineering domain
    - Trades and unions domain
    - Political domain
    - Urban planning domain
    - Management domain
    - Architecture domain
    - Basic concepts domain
    - Computers domain
    - Legal domain
    - Economic domain
  - Product
    - Construction aid
    - Management product
    - Construction complex product
    - Basic product and part
    - Material
  - project
  - bs6100 glossary

- 17 000 concepts and relations
- Four European languages
- OWL format
- Based on IFC model, bcXML, BS6100, Uniclass, Talo 90

- eCognosRelations
  - Attributes
  - Is Part Of
  - Is Involved In
  - Is Composed Of
  - Is Assigned To
  - Involves
  - Is Associated To
  - Produces

SPICE project

- **SPICE**: **SP**ecifications for **I**ntegrated **C**onstruction **E**-standards
- eEurope Pilot Project to Support the CEN/ISSS **eConstruction** Workshop
- Create an European platform for
  - harmonisation of ***eConstruction***,
  - information integration in the construction life-cycle and business supply-chain
- Establish the basis for an European consensus on *specifications for Construction e-standards*:
  - CEN Workshop Agreements on eConstruction

SPICE project

- CWA1: **European eConstruction Framework**
  - Context and Scope for "eConstruction"
- CWA2: **European eConstruction Architecture**
  - Functional/logical ICT-oriented view
- CWA3: **European eConstruction Meta Schema**
  - Recommendations regarding
    - technical and business schemas
    - representation languages
    - development of cross translators to map schemas among themselves

SPICE project

- CWA4: **European eConstruction Ontology**
  - Guidance about the adoption/development of European Ontologies tailored to the Construction sector (how to jump into the "ontology world")
  - Convergence to the Semantic Web recommendations
- CWA5: **European eConstruction Software implementation toolset**
  - Description of the most relevant functionalities of:
    - ontology design tools
    - ontology exploitation tools
    - high level infrastructures

FUNSIEC project

funsiec (eContent)

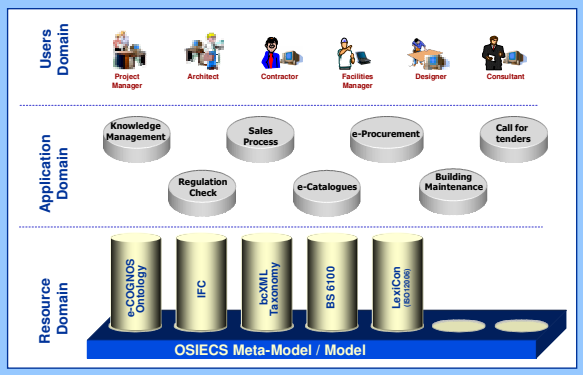
Feasibility study for an **UN**ified **S**emantic **I**nfrastructure in the **E**uropean **C**onstruction sector (*eContent*)

Study the feasibility of building an **O**pen **S**emantic **I**nfrastructure for **E**uropean **C**onstruction **S**ector (**OSIECS**) to support the development of **e-services**

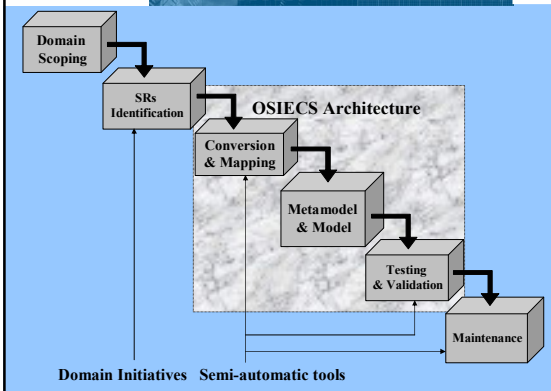
OSIECS

- Semantic and linguistic e-resources devoted to the construction sector
- Exploit public results produced by international initiatives and European projects (**e.g. IFC, bcXML, e-COGNOS Ontology, Barbi, ISO DIS 12006-3, …**)

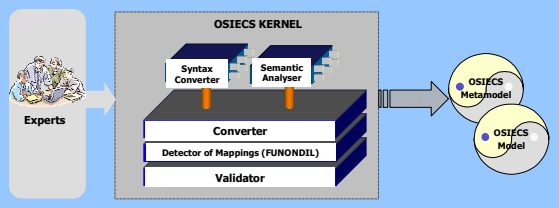
FUNSIEC framework



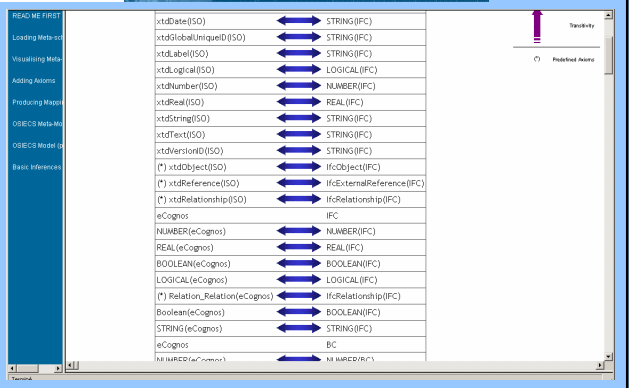
FUNSIEC methodology for OSIECS construction



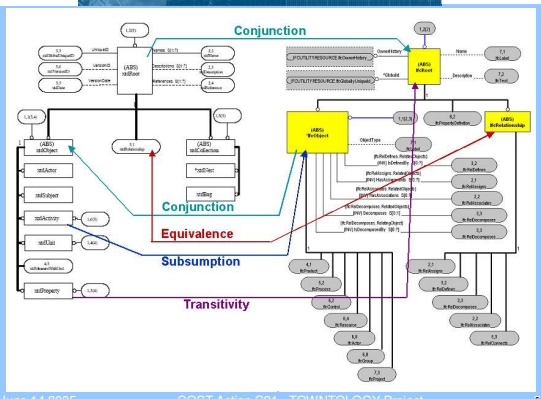
OSIECS Kernel



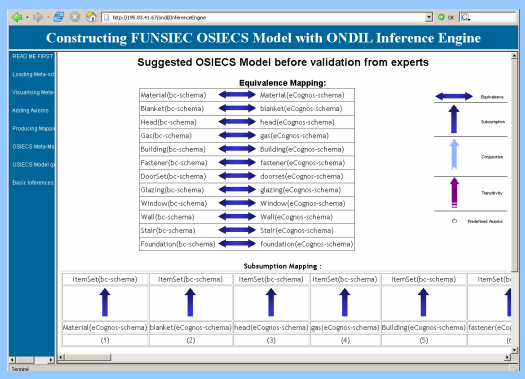
Part of the OSIECS Metamodel



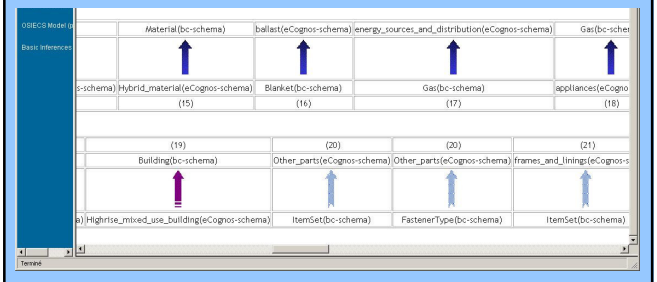
Part of the OSIECS Metamodel: Mapping examples



Part of the OSIECS Model (1/2)



Part of the OSIECS Model (2/2)



Conclusions and prospect (1/2)

- Users viewpoint
  - Users prefer their very specific (& relevant) and concise taxonomies
  - The ordinary user does not want to hear about ontology itself; s/he is mainly concerned with the results provided by the tool/service that use an ontology
- Development and promotion viewpoint
  - Big ontologies are not necessarily the best option; some projects have turned them down in favour of small and very precise ontologies
  - Standards play a more than vital role: IFC, ISO 12006
  - International effort based on ISO 12006: International Framework for Dictionaries (IFD)
  - Adopt common references (methodologies, schemas, etc) and develop shared guidelines to populate the ontologies
  - Standardization of reference ontologies
    - Content: somehow difficult to be standardised, etc
    - Focus on languages, methodologies, processes/tools, etc

Conclusions and prospect (2/2)

- Putting in place ontologies of reference: **how**?
  - There is no way to **force** people
  - Ontologies of reference are used if
    - Appropriate tools: hide complexities, facilitate use
    - Prove their added-value for the business
  - Slow process
  - Mandatory: promotion/dissemination
  - Collaborative work
- The reference ontologies have also
  - To cope with multiple European languages
  - To be open and flexible in order to accommodate the regional (in theory, smaller) taxonomies/ontologies

References

- **CSTB** http://www.cstb.fr
- **Roadcon project** http://cic.vtt.fi/projects/roadcon
- **IFC** http://www.iai-international.org
- **ISO 12006** http://www.icis.org/index.php?page=tc/index.php
- **Corese engine** http://www-sop.inria.fr/acacia/soft/corese
- **eConstruct project** http://www.econstruct.org
- **bcXML browser** http://195.83.41.68:8080/bcXB/index.html
- **e-Cognos project** http://www.e-cognos.org
- **eCOSer ontology server** http://195.83.41.67/eCOSer/Loginad.jsp
- **e-CKMI** http://195.83.41.67/eCognosPortal/servlet/ECognosServlet
- **CEN/ISSS eConstruction Workshop** http://www.nen.nl/wseconstruction
- **IFD** http://bwds06.bwk.tue.nl/ifd-international/tiki-index.php?page=IfdHomePage
- **Funsiec project** http://funsiec.org
- **FSEC** http://195.83.41.67/SemanticExperienceCentre/index.html
- **Funondil** (prototype) http://195.83.41.67/ondil/InferenceEngine

Thank you for your attention