Ontology-based Methodology for Collaborative Process Definition of Enterprise Networks

V. Rajsiri, JP. Lorré
EBM WebSourcing, Ramonville St-Agne, 31520, France

F. Bénaben, H. Pingaud
Ecole des Mines d’Albi-Carmaux, Centre de Génie Industriel, Albi, 81000, France

IFAC World Congress - Seoul – Korea – July 10, 2008
Outline

• Scope of the study

• Collaborative Ontology

• Collaborative Process Ontology

• Design rules for the collaborative process generation

• Conclusions and perspectives
Scope of our presentation in the MISE project

- Business layer (requirements)
  - Knowledge about collaboration networks
  - Specific network collaboration model
  - BPMN model of a collaborative process (CP)

- Logical layer
  - UML mediation information system model (MIS model)
  - Configuration model for the MIS layout using an ESB solution

- Physical Layout
  - MIS

Rajsiri PhD (2006-2009)

Touzi PhD (2004-2007)

The expected result
Collaborative Network Ontology (CNO)

- « *Ontology is a formal explicit specification of a shared conceptualization for a domain of interest. It contains a set of concepts relevant in a given domain, their definitions and relationships* » (Gruber, 1993)

- **Concepts**
  - Features of collaborative network
  - Features of collaborative process

- **Deduction rules**

Outline

- Scope of the presentation
- Collaborative Ontology
- Collaborative Process Ontology
- Design rules for the collaborative process generation
- Conclusions and perspectives
Collaboration Ontology (1)

Litterature references on Enterprise Collaboration

- **Relationship** of collaboration (Fombrun and al., 1982)
  - Vertical (supply-chain), horizontal (concurrence), group of interest

- **Components** of network (Poulin and al., 1984)
  - Network, node (participant), link, relationship, flow

- Network **topologies** (Katzy & Löh, 2003)
  - Star, Peer-to-peer, Chain

- **Configuration factors** of network (Zaidat, 2005)
  - Objective, duration, relationship, partner, role, connectivity, organizational structure, ...

  - Enterprise modelling for networked organisations
Participant can be an individual or an enterprise.

Collaborative network is a set of participants who would like to work together in respond to one or multiple common goals and a set of relationships between the participants.

Role defines the responsibility of participant in the network.

Common goal describes the reason why the network does exist.

Abstract service is a high level service that explains the competencies or the know-how of the participant.

Relationship defines the existing of interaction between two participants.

Topology describes the relationships between partners at high level.

Power describes the behavior and the orientation of decision-making in the network.

Duration describes the frequency of interactions occurred during the collaboration in the network.
Collaboration Ontology (3)

Collaboration ontology

Collaboration Ontology (3)

- Deduction Rules:
  - Role ↔ Abstract service
  - Power & Duration → Topology Type

Purchase materials & supplies
Acquire resources…
Outline

• Scope of the presentation
• Collaborative Ontology
  • Collaborative Process Ontology
• Design rules for the collaborative process generation
• Conclusions and perspectives
Collaborative Process Ontology (1)

Some references on collaborative process

- Modelling of collaborative or cross organisational processes (Touzi, 2007)
  
  **Target Model**
  - definition and components of collaborative process oriented

- MIT Process Handbook
  - developed over 10 years at the MIT
  - includes over 5,000 entries:
    - MIT business activity model (buy, make, sell...)
    - Coordination processes (manage by market with bidding...)
    - Case examples (supply chain, e-business...)
    - Activity categories (produce, deploy, provide, modify...)
    - Dependencies (flow of information...)
    - Resources (human agent, software agent, location...)
  - [http://ccs.mit.edu/ph](http://ccs.mit.edu/ph)

- OWL MIT Process Handbook
  - developed at the University of Zurich to test their Semantic Web applications
  - an OWLized version of the MIT Process Handbook containing:
    - an ontology schema file (ProcessHandbook.owl)
    - approximately 8000 business processes which are stored in their own files.
  - [http://www.ifi.unizh.ch/ddis/ph-owl.html](http://www.ifi.unizh.ch/ddis/ph-owl.html)
Collaborative Process Ontology (2)

Rule: Abstract → Business services

- Examples of business processes listed by function
  - Procurement
    - General procurement processes
      - Buy
        - Buy using EDI
  - Specific procurement examples
    - Supply Chain Management
    - Marketing
    - Sales
    - Information Systems
    - Human Resources
    - Strategic Planning
    - Finance/Accounting
    - Manufacturing/Logistics
    - Engineering

Buy
- Related Processes
- Generate new ideas
- Print this process
- Find more information
- View with Compass Explorer (advanced)

Description of Buy
Buying occurs when a "buyer" provides money in exchange for something of value (e.g., a product or service).

Notice that each of the parts in this "Buy" activity corresponds to a complementary part of the "Sell" activity. For example, "Identify potential customers" in the "Sell" activity corresponds to "Identify potential sources" in the "Buy" activity.

Parts of Buy
- Identify potential sources
- Identify own needs
- Select supplier
- Place order
- Receive
- Pay
- Manage suppliers
Collaborative Process Ontology (3)

- Business service explains task at a functional level. An abstract service is composed of some business services.

- Coordination service is in charge of coordinate the dependency by managing its resource.

- MIS service is considered as a coordination service.

- Resource can be machine, software, tool or material used or produced by business service.

- Dependency between business services (message flow) is a flow from a business service to another when they have a resource in common. The two business services linked by this kind of flow do belong to different participants.

- Dependency between CIS services (sequence flow) is a flow from a MIS service to another when they have a resource in common. It is like the movement of resource between MIS services.
Collaborative Process Ontology (4)

Collaborative process ontology

• Deduction Rules:
  • Abstract service ↔ Business service
  • Resource (P1.B.input = P2.B.output) → Dependency
  • Dependency → Coordination service → MIS service
Outline

• Scope of the presentation
• Collaborative Ontology
• Collaborative Process Ontology
• Design rules for the collaborative process generation
• Conclusions and perspectives
Design rules for CP generation (1)

- 5 groups of rules:

  - role and abstract service (Petersen, 2005)(Fox et al., ???)
    
    Participant(?x) ^ playRole(?x, ?y) ^ performAService(?y, ?z) →
    provideAService(?x, ?z)
    
    • links between role and abstract service

  - abstract and business service (Process Handbook online)
    
    Participant(?x) ^ provideAService(?x, ?y) ^ hasBusinessService(?y, ?a) →
    provideBusinessService(?x, ?a)
    
    • Links between abstract and business service

  - dependency, coordination service and CIS service (Malone et al., Chapter 3: A Taxonomy of Organizational Dependencies and Coordination Mechanisms)
    
    CNetwork(?a) ^ hasRelationship(?a, ?z) ^ P1(?z, ?y) ^
    provideBusinessService(?y, ?c) ^ hasOutput(?c, ?d) ^ P2(?z, ?x) ^
    provideBusinessService(?x, ?b) ^ hasInput(?b, ?d) ^
    CoordinationService(?f) ^ manageResource(?f, ?d) ^ Dependency (?e) →
    fromBusinessService(?e, ?c) ^ toBusinessService(?e, ?b) ^
    containResource(?e, ?d) ^ isCoordinatedBy(?e, ?f) ^ hasCISservice(?a, ?f) ^
    CISservice(?f)
    
    • links between input of a business service and output of another business service belonging to the different participants
    • links between resource managed by a coordination service and the common resource
Design rules for CP generation (2)

- **5 groups of rules (cont.):**
  - common goal (not implemented)
    
    
    CommonGoal(?x) ^ description(?x, ?a) ^ swrlb:substringBefore(?y, ?a, " ") ^ AbstractService(?b) ^ name(?b, ?c) ^ swrlb:containsIgnoreCase(?c, ?y) → composedAService(?x, ?b)
    
    - links between the description of goal and the name of abstract service.
  - topology
    
    Topology(?x) ^ hasPower(?x, central) ^ hasDuration(?x, continuous) → hasType(?x, star)
    
    - Deduction of the type of topology from the characteristics of decision-making power and duration of collaboration
An open source based prototype (1)
An open source based prototype (2)
An open source based prototype (3)
Outline

• Scope of the presentation
• Collaborative Ontology
• Collaborative Process Ontology
• Design rules for the collaborative process generation
• Conclusions and perspectives
A multifold view of Model Driven Interoperability

Model driven engineering of MIS