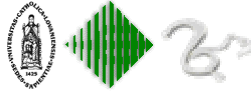


University of Louvain, Information Systems Research Lab



SKwyRL: Social Architectures for Agent Software Engineering

Adrien Coyette, Tung Do, Stéphane Faulkner,
Hang Hoang, Tai Nguyen
Manuel Kolp, Alain Pirotte

Social Architectures for Software Engineering

- **New IT domains:** E-business, knowledge management, peer-to-peer computing, web services, ...
 - Virtual Enterprises / Communities, E-MarketPlaces, TeamWare, ...
- **Multiagent systems:** more appropriate for building concurrent, distributed, and dynamic IT applications.
- ➔ **Requirements Driven Motivation:** Analyzing System in terms of abstractions that better match its **social operational environment** (e.g., an enterprise, a corporate alliance, ...) = **Tropos**
- ➔ **MAS motivation = Society** of agents

Tropos: Requirements-Driven (Agent) Software Engineering

- 1. **Early requirements**: understanding a problem by studying an **organizational setting**; output : organizational model with relevant **actors**, their **goals** and inter-dependencies
- 2. **Late requirements**: system-to-be described within its **operational environment**, with relevant **functions** and **qualities**
- 3. **Architectural design**: global **architecture** defined in terms of interconnected subsystems
- 4. **Detailed design**: behavior of each architectural component defined in **detail**
- 5. **Implementation**: system implementation carried out **consistently** with detailed design

SKwyRL*: Multi-Agent Systems Architectures

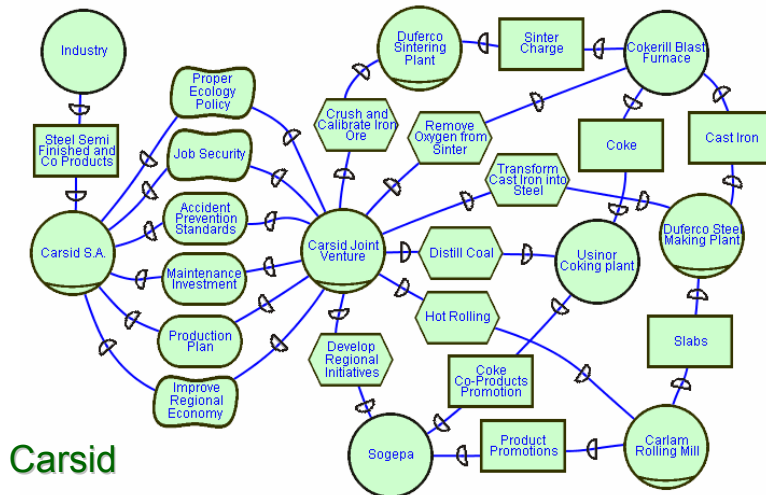
- **Architectural Design: Organizational Styles** (Organizational Th.)
 - Vertical Integration, Pyramid, Joint Venture, Structure in 5, Bidding, Hierarchical Contracting, Takeover, ...
- **Detailed Design: Social Patterns (Agent, Social Th., ...)**
 - Broker, Matchmaker, Contract-Net, Mediator, Monitor, Embassy, ...
- **Atomic : Social and intentional concepts – *i****
 - goals, actors, social dependencies, ...
- **+ Agent Architectural Description Language**

**Social Architectures for Knowledge Systems Requirements Elicitation*

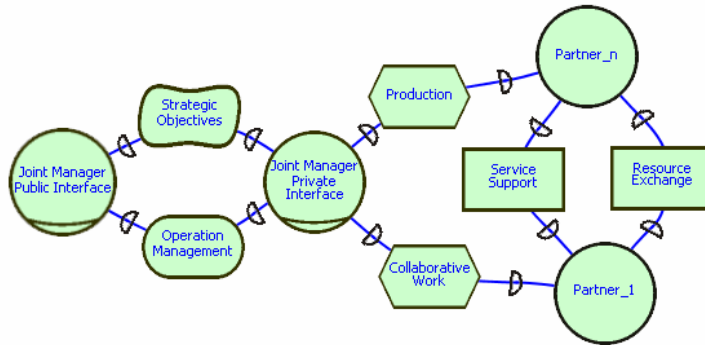
Agent and Multi-Agent System

- An **Agent** is a system entity, **situated** in some environment, that is capable of **flexible, autonomous** action in order to meet its design **objective**
- A **Multi-Agent System** is a **social organization** composed of agents that interact with each other to achieve common or private goals
- **BDI Model : Most mature and used agent model**
 - Roots in philosophy and cognitive science
- Main **BDI** concepts are:
 - **Beliefs** represent the informational state
 - **Desire** are its motivational state
 - **Intention** represents the deliberative state

Joint Venture Applied to Steel Industry

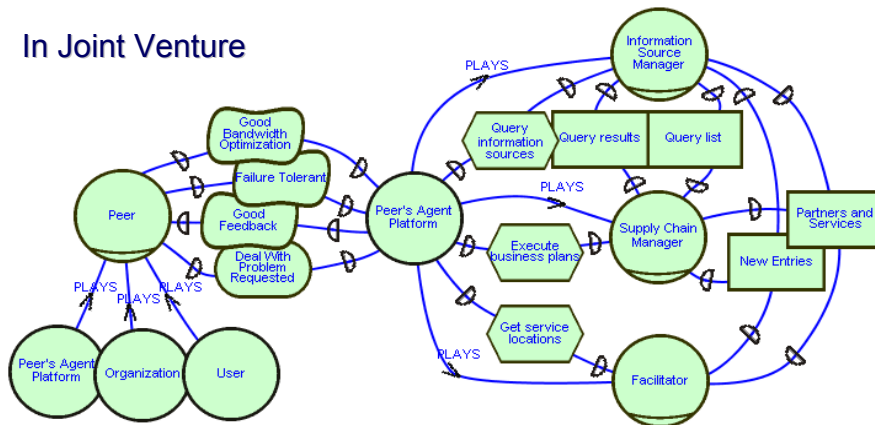


Abstracting the Joint Venture Pattern

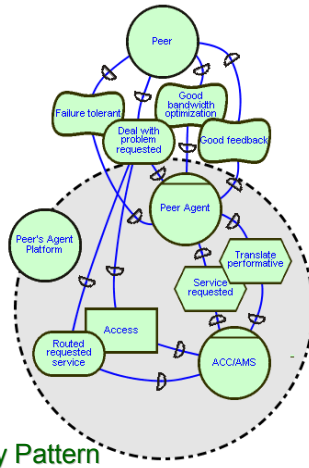


Social Architecture: P2P Supply Chain Manager

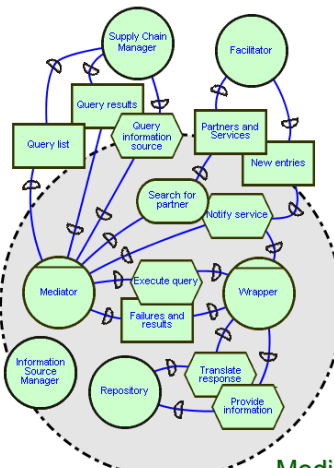
In Joint Venture



Components' Rationale with Social Design Patterns



Embassy Pattern



Mediator Pattern

1) Patterns Generation and Simulation

CodeGenerationInterface

Please choose a pattern, then a domain and finally enter the agent name in the corresponding role fields

Pattern: **Broker** Domain: **NULL**

Client Role: **Customer** Broker Role: **E_Broker** Service Provider Role: **E_MediaShop**

Confirm Pattern

Summary of agent role for generate code:

```

pattern: BB | domain: NULL | role: YellowPage | agent: E_Broker
pattern: GB | domain: NULL | role: ServiceProvider | agent: E_MediaShop
pattern: BD | domain: NULL | role: Client | agent: Customer
pattern: BR | domain: NULL | role: Broker | agent: E_Broker
pattern: BR | domain: NULL | role: Client | agent: Customer
pattern: BR | domain: NULL | role: Broker | agent: E_Broker
pattern: BR | domain: NULL | role: ServiceProvider | agent: E_MediaShop
    
```

Please enter the path to the directory storing your JACK code files:

D:\GeneratedCodeForECommerceApplication\

Generate Code **Exit**

Interface Generation

An E-Business Broker

Broker

Media shops	Item	Quantity	Buy price	Sell price
MediaShop1	Fraser	40	20.9	30.0
MediaShop3	Leagues-Under-The-Sea	130	23.09	25.0
MediaShop4	ToyStory_And_ToyStory2	70	23.4	26.0
	Spirited-Away	40	19.0	21.9
	Lord-of-the-Ring	150	25.5	25.66
	One_Another_Day	209	23.15	25.99
	Harry_Potter	190	44.5	48.07
	Chicago	55	25.01	28.0

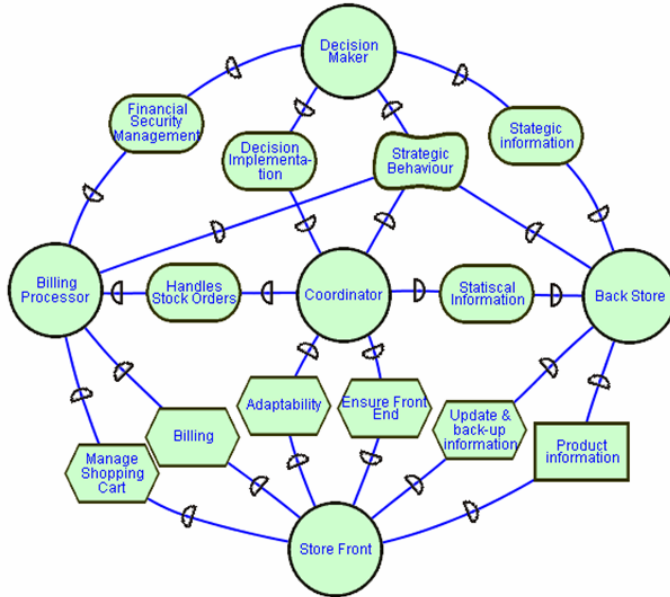
Customer DVDs: Fraser, Leagues-Under-The-Sea, Cheers, ToyStory_And_ToyStory2, Spirited-Away, Lord-of-the-Ring, Die_Another_Day, Harry_Potter, Gangs_of_NewYork, Chicago, Die_And_The_City_Season4, Catch me if you can

Quantity: 20 Deadline(s): 9

Details: MediaShop2 is sleeping: 5.506(s), MediaShop2 proposes: 25.5: waiting, MediaShop3 proposes: 22.5: rejected, MediaShop4 proposes: 24.99: waiting, MediaShop1 proposes: 23.5: waiting, price has been decreased from 26 to 23, Broker is choosing, MediaShop2 proposes: 25.5: optimal, Broker has chosen MediaShop2

Code Skeleton Generation

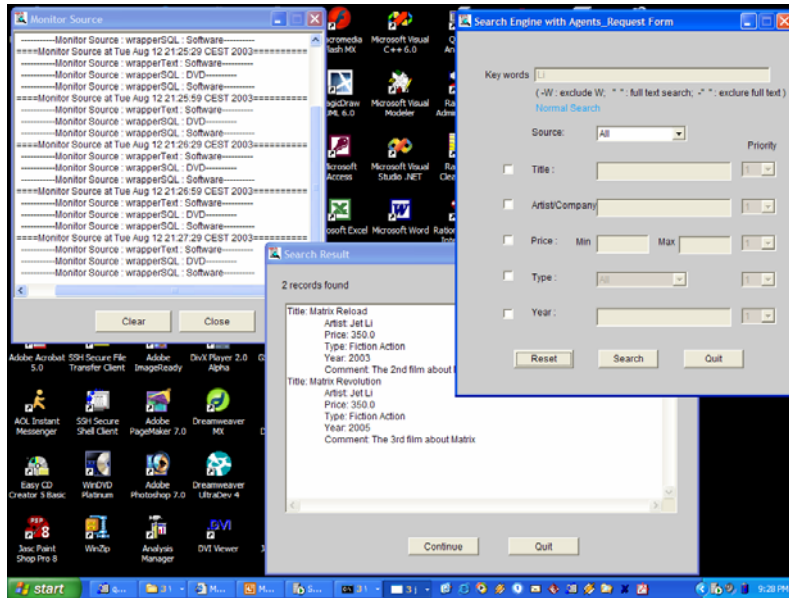
2) E-media as a structure-in-5



Jack Development Environment & E-Media

The screenshot displays the JACK Development Environment (JACK IDE) interface. The main window shows the project structure for 'emedia'. The Project Explorer on the left lists the project name, design views, and agent model components. The central workspace shows the 'Back_Store' agent type, which extends the 'Agent' class. It includes documentation, a constructor, belief data, capabilities, external events, and plans. The Search browser on the right shows a list of search results for the 'purchase' class, including fields like 'String Id_Card', 'key String Id_Prod', 'int Quantity', and 'double Amount'. The interface also shows a list of agent types and a search browser for the 'purchase' class.

3) E-Search



Conclusion

- New IT domains for the Enterprise (open, dynamic, distributed)
 - Virtual Enterprises / Communities, E-MarketPlaces, TeamWare
 - → Social Environments
- Architectures in terms of requirements and social modeling concepts
 - → Social Structures, Conceptual Framework, ADL
 - MAS Architectures as Social Styles
 - Details in terms of social design patterns
- Narrows the gap requirements / design