Dynamic agent architecture for open e-commerce

Nader Troudi
ntroudi@newtrade.com
&
Peter Kropf
kropf@IRO.UMontreal.ca
Plan

• Agents and multi-agent systems
• Agents and e-commerce
• Existents solutions : constraints and complexities
• The P2P model
• Agents and P2P
• The proposed architecture
• Conclusion
Motivation: the hotel domain

- Actors: clients, providers and intermediaries.
- Case: the client wants to book 25 rooms in a specific city.
  - No provider has 25 rooms available.
  - Client has to split his request over many hotels.
  - Many independent requests: prices will vary.
  - Client wants to deal with one hotel only.
  - The hotel needs to contact other hotels (better deal).
Our view of agent and multi-agent systems

- **Agent:**
  « Agents are persistent computations that can perceive, reason, act and communicate. » [Jennings2001]

- **Multi-agent systems (MAS):**
  « consists of a group of agents that combine their specific competencies and cooperate in order to achieve a common goal. Efficient cooperation as well as coordination procedures between agents endow a MAS with a capability higher than the sum of the individual agent’s capabilities. » [O’Hare96]
What are our Agent characteristics?

- The agent needs to be:
  - Personalized
  - Proactive
  - Reactive
  - Autonomous
  - Interactive with other agents

- An agent may be:
  - Intelligent
  - Able to learn
  - Mobile
Why agent oriented methodology in E-commerce problem solving?

- We need to decompose the problem in multiple, interacting, flexible, autonomous components that have goals to achieve (buyer, seller, service provider, etc).
  - Agent decomposition.
- We need a model or an analysis tool to represent these subsystems and their relationship:
  - Agent paradigm is the most suitable.
  - Agent interaction: can be viewed in terms of high-level social interactions.
When you need the agent?

- The environment is highly dynamic, uncertain or complex (e-commerce)
- Agents are a natural metaphor (seller, buyer)
- Distribution
  - data
  - control
  - expertise
- Integration with legacy systems (Hotel industry: PMS, CRS)

*We need agency in E-commerce.*
Agent and MAS applications

- Personal Assistant Agents (Internet agents, Mail agents Scheduling/ secretary). BotBox.com
- Interface agents, (MIT projects : Letizia )
- Manufacturing and resource allocation.
- Traffic Management.
- Entertainment (games and movies).
- Network Management, (Telcordia products).
- Virtual organizations and e-commerce.
E-commerce?

- **Definition**: « *A commerce where market and participants are virtual.* » [Oliveira2001].
  - capabilities of making available and/or searching for product information in electronic format.
  - Electronic negotiation has been added recently.

- **Specificities**:
  - **Virtuality**: participant, place, product, money, etc.
  - **Availability**: 7 days a week, 24 h per day.
  - **Transparency**: more information is now available.
  - **Size**: huge number of user and transactions (7000 M $).
  - **Diversity**: region, culture, language, etc.
  - **Competitiveness**: a solid competition (40 000 properties).
  - **Cost reduction**: marketing, transport.
Examples: the Hotel case.

• Commercial
  • Hotels.com
  • Price line
  • ebay
  • Expedia
  • etc

• Academic
  • Kasbah
  • Magma
  • etc

• most of the currently available systems are inflexible.
Constrains and limitations

• Too much control
  – Enforces conventions that create a stable, predictable environment for trading.
  – Set rules of interaction (how, when, where, policies, price increment).

• Segregation
  – Traders in a particular electronic market cannot see trading partners in other similar markets without first joining those markets.
  – The travel domain: hotels need to register at expedia, hotels.com, travelocity, etc.
Constrains and limitations

• Inflexibility:
  • Different proprietary trading environments available and no way to profit from all of them.
    • Priceline : « Name your own price »
    • Mercata.com et Mobshop.com : aggregated demands to reduce price.
  • many type of request are impossible today
    • « I want to buy a golf package if the chance of rain is less than 30% »

• Weak automation
  • Decisions in many systems are still made by people, not by software agents.
  • the online travel agencies are not able to compare their price to the one provided in GDS for example.
Constrains and limitations

- *Emphasis on price*: we should include
  - Participant awareness
  - Branding
  - Trust
  - Context
What we need?

• E-commerce applications have to be seen as enabling technologies for more advanced inter-agent relationships leading to the effective creation of open virtual environments.

• Open environments are characterized by having components that are autonomous (acting independently), heterogeneous (designed independently), of dynamic membership (joining, changing, and leaving arbitrarily) and of large scale (numerous).

• These properties are compatible with both the agent and the peer-to-peer paradigm.
P2P networks, consisting of nodes that are peers of each other provide a suitable paradigm for implementing dynamic trading.

Replace the traditional centralized structure of client-server interactions.

Applications

- Napster, Kazaa, Gnutella and Freenet.
- Pastry and Chord.

P2P tools are not able to exchange complex data and to deal with heterogeneity, coordination and data management problems.

Agent technology is of interest here because it adds more intelligence over the P2P technological layer.
P2P agent system architecture
Advantages

• Flexibility:
  • Decentralized and open market.
  • Participants are autonomous and have the control.
  • New network and relationship.

• Customization
  • Agents are personalized and context aware.
  • They can involve other criteria than price when trading.
Advantages

• **Collaboration**
  - Agents can rely on each other to execute complex tasks.
  - Agents will need to cooperate and exchange information for protection purpose.

• **Integration**
  - Agent will not replace available solutions, they can wrap them or use them (integration of existing standards).
Agent internal architecture

- Coordination layer
- Collaboration layer
- Business processing layer
  - Management and monitoring
- Presentation
- Communication layer
  - EbXML/OTA
  - JMX
  - HTML
  - WML
  - http/https
  - JXTA
  - FIPA
Advantages

- Modularity.
- Reusability.
- Flexibility.
- Easy of use.
- Personalization.
- Standardisation.
Conclusion

• Software agents can help in E-commerce.
• E-commerce marketplace are not necessarily centralized.
• We presented a distributed marketplace architecture
  • P2P network
  • Agent technology
• futures work
  • Dynamic group creation and self-organization.
  • Security in open environments.