ANEMONE - A Network of Multi-Agent Platforms for Academic Communities

3G. Armano, 2P. Baroni, 3G. Cherchi, 6M. Colombetti, 5A. Gerevini, 1M. Mari, 1A. Poggi, 4C. Santoro, 5E. Tramontana, 6M. Verdicchio

1DII - Università degli Studi di Parma
2DEA - Università degli Studi di Brescia
3DIEE - Università degli Studi di Cagliari
4DIT, 5DMI - Università degli Studi di Catania
6DEI – Politecnico di Milano
Introduction

- ANEMONE: Cofin project started on January 2005 with a duration of 2 years

- Multi-agent platforms network that provides services for the academic community (professors, researchers and students) implemented by using the JADE agent development framework
ANEMONE Services

Platforms and Services Management

System-oriented services

Agent Interaction

Automated Reasoning

Agenda Management

User-oriented services

Documents Search

Software Development

Students Support

ANEMONE – A Network for Multi-Agent Platforms … – WOA 2005 – Camerino, 15 November 2005
System-oriented services have the goal to provide support to the management of agent platforms and services and provide reusable components to realize new types of service:

- Platforms and Services Management
- Agent Interaction
- Automated Reasoning
Platform and service management services are based on the services provided by the JADE framework and a set of services to register and search platforms, agents and services in an open network of agent platforms:

- Connect a new platform to the openNet network
- Make visible the new platform to others
- Deploy own naming directory and monitoring services

A set of monitoring services allows to monitor the platform's status and its ability to communicate with others.
ANEMONE – A Network for Multi-Agent Platforms … – WOA 2005 – Camerino, 15 November 2005

ANEMONE Services

Platforms and Services Management

System-oriented services

Agent Interaction

Automated Reasoning

User-oriented services

Agenda Management

Documents Search

Software Development

Students Support
Agent Interaction

- Instead of analyzing changes in the state of the internal architecture of agents, our approach focuses on the external social state holding among agents.

- Communicative acts: actions performed by agents to change their commitments towards the others.

- We provide a commitment-based communication system in the form of an agent that is called Notary.
  - The Notary is responsible for examining the content of the messages that are exchanged over the system and creating public structured data items reporting the relevant commitments between agents.
ANEMONE Services

Platforms and Services Management

System-oriented services

Agent Interaction

Automated Reasoning

User-oriented services

Agenda Management

Documents Search

Students Support

Software Development

ANEMONE – A Network for Multi-Agent Platforms … – WOA 2005 – Camerino, 15 November 2005
Automated Reasoning

- Domain-independent automated reasoning services are made available to the community by a wrapper agent

- Two reasoning services are currently being integrated into the ANEMONE network:
  - Argumentation system: argumentation theory is a framework for practical and uncertain reasoning, where arguments supporting conclusions are progressively constructed in order to identify the set of conclusions that should be considered justified
  - Planning system: receives requests to solve plan generation problems specified using the recent standard PDDL2.2 language and computes plans solving such problems
Reference Model (Standard FIPA)

Our Choice

- Wrapper Agent
- SOAP
- Web Service
- Application
User-Oriented Services

- ANEMONE provides a set of services to support
  - Academic people in some of their recurrent activities (fix an appointment, organize a meeting, search documents, …)
  - Students in getting information about courses
  - Information technology people (including students) in getting information on documents and people that may help them to solve their programming problems

- The ANEMONE network integrates four services:
  - Agenda management
  - Students support
  - Documents search
  - Software development
ANEMONE Services

Platforms and Services Management

System-oriented services

Agent Interaction

Automated Reasoning

User-oriented services

Agenda Management

Documents Search

Students Support

Software Development

ANEMONE – A Network for Multi-Agent Platforms … – WOA 2005 – Camerino, 15 November 2005
An agenda management system called MAgentA (Multi-Agent Agenda) has been developed:

- manage users’ personal agendas
- support meeting organization

Through a process of automated negotiation agents are able to determine the temporal location of a meeting which best fits the preferences of their owners, while satisfying some constraints specified by the meeting proposer.
MAgentA Use Scenario

- A user interacts with a GUI agent to express her/his preferences about temporal locations of requested meetings. She/He can insert personal scheduled activities.

- A user may initiate the organization of a meeting by specifying:
  - temporal constraints
  - minimum and maximum duration
  - a list of participants, partitioned into necessary and optional

- The system searches for solutions where all participants are available and it proposes them to the initiator user, ordered on the basis of participants’ preferences.
If the system doesn’t find solutions with all participants available, it searches for solutions where at least the necessary participants are available.

In case of failure, a final search for (possibly less-satisficing) solutions is carried out.

The list of the solutions found or a message of failure is provided to the initiator user, that can select and confirm one of them.
PACMAS (Personalized, Adaptive and Cooperative MultiAgent System) is a multi-agent system designed to support the development of application aimed at:

- Retrieving heterogeneous data spread among different Internet sources
- Filtering and organizing information according to personal interests explicitly stated by each user
- Providing adaptation techniques to improve and refine throughout time the profile of each selected user

The generic architecture encompasses four main levels:

- Information ➔ information extraction
- Filter ➔ information retrieval and filtering
- Task ➔ information processing
- Interface ➔ result presentation
Students Support: PACMAS (2)

- Each level is populated by a society of agents, which are autonomous and flexible, and can be personalized, adaptive and cooperative depending on the role they assume in the implemented application
  - Information agents: access information sources, and are able to collect and manipulate such information
  - Filter agents, able to process information according to user preferences
  - Task agents: help users to perform tasks by solving problems and exchanging information with other agents
  - Interface agents, devised to facilitate the interaction between the user and other agents
  + Middle agents: in charge of establishing communication among requesters and providers
ANEMONE Services

Platforms and Services Management

System-oriented services

Agent Interaction

Automated Reasoning

Agenda Management

User-oriented services

Documents Search

Software Development

Students Support
SHARK is a multi-agent P2P document sharing system aiming to provide users with a more effective tool to find documents and promote collaborations among them.

SHARK is composed by several agents:

- Cruncher analyses shared documents and extracts from each a set of keywords, removing HTML, LaTeX, RTF and PDF tags.
- Categoriser, on the basis of extracted keywords, associates categories to documents.
- UserProfiler detects the activities that a user operating with a Web browser performs, and analyses the shared documents in order to continually update his/her profile.
- Searcher runs on an AgentCities host and holds the list of categories for the local shared documents, for each category the list of documents and the user providing each document.
Shark agents (continued):

- Correspondent handles document download requests originating from other users
- Advertiser periodically checks user profiles in order to find a partial match. Whenever the matching degree is above a given threshold, the users with common interests are notified with an email message

Users interact with SHARK by means of a Web interface:

- The searching results are sorted so that the more relevant document is that exhibiting the highest frequency. If more than one keyword is given, the total relevance is computed as the average of each single keyword relevance
- Collaboration: the system provides a list of users who have, in their profile, the keyword(s) queried
ANEMONE Services

Platforms and Services Management

System-oriented services

Agent Interaction

Automated Reasoning

User-oriented services

Agenda Management

Documents Search

Students Support

Software Development

ANEMONE – A Network for Multi-Agent Platforms … – WOA 2005 – Camerino, 15 November 2005
RAP (Remote Assistant for Programmers), is a Web and multi-agent based system to support remote students and programmers during common projects or activities based on the use of the Java programming language.

- RAP integrates information and expert searching facilities, supporting users by recommending:
  - Documents (tutorials, javadocs, code fragments, …) extracted from document repositories
  - Answers extracted from answer repositories
  - Expert users whom to ask about a specific topic
The profiles are represented by vectors of weighted terms whose values are related to the frequency of the term in the document or in the user’s Java code, using the TF-IDF algorithm.
RAP: Open and Distributed Communities

- The retrieving of experts and information can take a great advantage if the community beneath the system has the capability to grow and include new users or new communities.

- RAP represents a distributed and open system.
  - The whole system can consist of a dynamic group of local communities: each community can exist and operate isolated, but can also decide to join a group of communities, sharing experts and document repositories.
  - New users can register and access the system and a registered user can acquire new skills or write new code and therefore update his profile.
ANEMONE - A Network of Multi-Agent Platforms for Academic Communities

3G. Armano, 2P. Baroni, 3G. Cerchi, 6M. Colombetti, 5A. Gerevini, 1M. Mari, 1A. Poggi,
4C. Santoro, 5E. Tramontana, 6M. Verdicchio

1DII - Università degli Studi di Parma
2DEA - Università degli Studi di Brescia
3DIEE - Università degli Studi di Cagliari
4DIT, 5DMI - Università degli Studi di Catania
6DEI – Politecnico di Milano