A Multi-Agent System to Support Remote Software Development

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Overview

- The RAP system
  - Architecture
  - Case Study
  - Documents and profiles management
  - Implementation

- Related and future works
Finding relevant information is a longstanding problem

- Conventional approaches partially address the problem
- Often the most valuable information is not widely available
  - finding the “expert”
  - avoiding
    - “banal” questions
    - asking different times the same questions
A multi-agent system that integrates **information** and **expert searching** facilities

- First prototype: specialized for communities of remote students and researchers working on related projects, using the Java programming language

Supports users by recommending:

- Documents (javadocs, tutorials, code fragments)
- Expert answers
- On-line or off-line experts
The system is based on seven different kinds of agents:

- Personal Agents
- Code Documentation Managers
- Answer Managers
- User Profile Managers
- Email Managers
- Starter Agents
- Directory Facilitators
Architecture

On-line users

Web Server

Off-line users

Mail Server

Personal Agents

Starter Agent

User Profiles Managers

Mail Manager

Directory Facilitator

Code Documentation Managers

Answer Managers

Managers

M. Mari - RAP - WOA 2004
Submitting a Query

◆ The user submits a query through a web interface

◆ The query is composed of two parts:
  ▪ **Annotation**: list of
    • Keywords from the system glossary
    • Package and/or class names from Java/JADE API
  ▪ **Content**: textual description

◆ The user can select the types of answers she/he would like to receive
Scenario:

A user asks information to hers/his own PA in order to solve a problem.
The PA finds one (or more) “pieces of information” that may help her/him.

Related issues:
- Submit a query
- Find answers
- Rate answers
Finding Answers

- **Documentation/answer repositories**
  - PA asks DF for all the code documentation/answer managers
  - PA forwards the query to all the manager agents
    - They send back code fragments/answers related to the query, with an assigned score

- **Users with the appropriate expertise**
  - Find experts
  - Receive expert rating
  - Select experts
  - Receive answers
Finally the PA asks the user to rate the list of the answers received

The PA forwards each rating to the corresponding agent (PA, Answer Manager, User Profile Manager)

- Automating profiling
  - Reduce the possibility of inaccuracy
  - Profiles are dynamic
  - But agents might be wrong in their assessments
    - Users can alter their profiles
Terms used in the profiles are not extracted from a training set of documents, but correspond to:

- Terms included in the system glossary
  - SUN “glossary of Java related terms”
- Package and class names of Java/JADE software libraries

Both documents and user profiles are represented by vectors of weighted terms. Weights correspond to:

- Documents: TF-IDF weight
- Users:
  - The real frequency in the source code
  - History of help interactions - rating assigned to the answers
    - “decaying expertise”
Profile Management Process

1. Add Terms to System Glossary
2. Add Terms to System Terms Set
3. Create/Update Document Profile Repository
4. Create/Update User Software
5. Add/Update Answer Repository
6. Update Answer
RAP has similarities with WBT, I-MINDS and, in particular, with the Expert Finder system

- All these systems provide agents that recommend possible “helpers”

**But …**

- None of them provides integration of different sources of information (experts, answers archive and code documentation)
- None of them builds the users’ profile by using both
  - Their own Java source code files
  - The answers provided by the users themselves
Future Work

- RAP implementation by using JADE
- We plan to test RAP in practical courses on JADE shared among students and researchers involved in two projects:
  - @lis Technology Net
  - ANEMONE
- We plan to extend RAP to be used in other software development areas:
  - Maintenance
  - Design
  - …
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Questions?

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