A Multi-Agent Design of a Peer-Help Environment

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Adaptation in a Distributed Environment
Finding an **Appropriate** Resource

**Key Problems:**
- location of resources (human or electronic)
- matching resources to need
- motivation to participate
I-Help: a Peer Help Environment in University Class

Why?

• Peer help is inexpensive
• Encourages sense of community
• The helper also learns
Multi-Agent Approach to User Modeling
User Model: a Resource Repository for the Personal Agent

**User Resources**

- Knowledge
- Social Capabilities
- Relationships
- Time
- Currency
Intra-Agent Processes

- Monitor the environment
- Calculate goal importance
- Calculate and maximize utility
- Retrieve plans for goal achievement / plan
- Execute plans
- Delegate goals / Negotiate with other agents

Agents are *autonomous* and *rational*
Agent Implementation

- Agents - Java objects
  - each agent - several threads (tasks)
  - JDK 1.2 - CORBA to link together
  - distributed - runs on NT, SUN
  - trial with DCOM with Visual Studio (Basic, C)
Inter-Agent Processes

- Agents can communicate with each other
- Agents can not achieve their goals alone --> need to collaborate: delegate goals, share resources, and to compete
- Agents offer excess resources or services (adopt goals) in exchange for money
- Agents negotiate to resolve conflicts
- Agents make models of other agents
The Issue of Motivation

• Why would busy people offer help?
  – to build relationships / obligations
  – if it’s part of organizational culture
  – if there is a reward
    • class participation points ...
    • performance review
• Adding extrinsic motivation
  – currency in exchange for help???
• Money reflects real social costs and benefits
Implementation
Agent Negotiation (what)

• Agents negotiate on behalf of their users depending on
  – the importance of a request
  – the importance of own goals
  – the importance of saving or earning money
  – the importance and sign of the relationship

--> determine a “fair market value” for the help
Agent Negotiation (how)

• Each agent computes a utility function
  – one for the utility of getting help
  – one for the utility of providing help
  – price affects utility; quality affects price
  – agents have limited knowledge about each other

• Decision theoretic approach

• Negotiation protocol
A Global View: Agent Economy

Questions:

• What economy type: barter or market?
• What real world equivalent for virtual currency?
• Zero sum game or cumulative w.r.t. some resource?
• Social control and protection mechanisms?
Simulating Agent Economies

• The SWARM simulation environment
• To test suitability of a market as a regulating mechanism:
  – stability, predictability, conditions, economic measures of control
• How to cope with crooks and malicious agents?
  – Centralized and distributed measures
• few results to report yet
An experiment (fall 99)

• Student peer help for sale!!
  – 65 students in 3rd year Comp.Sci. UNIX class
  – the I-Help architecture engineered for this class
  – students use I-Help throughout the class
  – helpers get paid, helpees pay
  – rate of pay negotiable (by agents)
User-Agent Relationship

• What to do if the user doesn’t keep the contracts made by her agent?
  – Agent *negotiates* or *persuades* user to adopt some goal
  – User has to pay a penalty
  – Agent “punishes” user
Human-Agent Interaction

Anthropomorphic Agents:

– How much autonomy?
– What type of relationship?
– Agent “Persona”?
– Modeling emotion
SE challenge: how to design an adaptive distributed learning environment?

• Personal and Application Agents
  – Intelligent location of distributed help resources (electronic+human) based on user / application modeling
  – Dynamic, heterogeneous environment
  – Robust and easily extendible in depth and breadth
UM challenge: what models in such an environment?

– User models AND Application models
– Agents modelling other agents in negotiation
– User model as a repository of user resources:
  • knowledge
  • social competence
  • time, money and relationships with other users
– Distributed, domain/task specific diagnostic applications
Motivation Challenge!

• **Help Economy**
  – motivating resourceful agents to offer their resources and services
  – protecting such agents from overuse by means of price

• **Human in the Loop**
  – as a helper;
  – as a diagnoser;
  – as an author of electronic resources (applications).