An Agent-Based Architecture for Information Processing Services

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an architecture for information processing services

- overview of the architecture
- example: **DIPE**
  image processing services
- example: **WOPE**
  workflow management
- some ideas
  relevance to TACIT topics

http://sls-www.lcs.mit.edu/~sally/
information processing services

economic sectors

... , services

network infrastructure

multimedia data processing
DNA sequence analysis
meteorology
simulations
workflow
statistics

legacy software
information processing - examples

• simulations (physics, VLSI, etc.)
• statistics
• meteorology
• DNA and protein sequence analysis
• integrated development environments
• 3D reconstruction and virtual reality
• signal processing
• image processing
PLEGMA architecture

- Customers
- Plegma marketplace
- Manager
- Directory
- Analyzer
- Execution agents
- Providers (resources)

organization A
organization B
organization C
information processing in the digital agora

- the network of computational resources is an electronic marketplace

- simple processing service items are grouped in complex predefined sequences and offered as a service package

- delivery of a single service item involves participation of a single computational resource as shown in the figure:
PLEGMA agents

**executor**
- manages the local business unit to the best interest of its owner
- develops the local business plan and pricing policy according to self-evaluation, local policies and current market trends
- manages the supply feed (input data & software module)
- ensures competitiveness of services (software repository)
- arranges product delivery (store-and-forward, proactive signaling)

**analyzer**
- customer representative for a particular service package
- handles the scheduling of a service package
- manages overall execution of individual tasks, handles negotiations, poses required policies & strategies
- delivers final product to destination

**manager**
- like a bank with a network of branches
- performs accounting and monitors overall credibility of customers and workers
- broker of the local agora, participating in a network of brokers to cover the global market place
task allocation and charging

- based on market metaphor and realized through negotiation among analyzers and execution agents

- analyzer initiates an auction for the execution of the service package

- participating execution agents calculate bids based solely on local information and desired policies

- analyzer grants execution to the best bidder according to criteria specified by his client or other policies

- analyzer can choose to grant execution with a direct contract, when the cost for bidding is relatively high compared to the cost for the task

- a simulator is used to test each market model & auction process, thus aiding in formulating the desired policy
processing within an organization
home-office work
virtual organizations
providing services for the public
DIPE - image processing services

✓ distributed execution of image processing algorithms
✓ plug-n-play insertion of third-party image processing software
✓ software development, testing, & evaluation
✓ construction & processing of macros
✓ intelligent mechanisms for computational resource management
✓ integration with other services & systems

- C++, UNIX & Windows 95/NT
- zApp - graphical user interface transparency
- ACE - operating system transparency, network transparency
- CORBA - integration
WOPE - dynamic workflow processing

- dynamic workflow processing for functional integration in regional healthcare service networks

Java - environment transparency

XML - data integration, workflow specification

WfMC standard compliance

CORBA - integration, communication
image processing services

DIPE

manager

execution agent

other application

user application
DIPE - coordination model
DIPE - execution profile

- I/O data size
- processing element memory
- execution time
DIPE - resource management

bid

• performance of local CPU
• current state of local CPU
• network characteristics
• cached data
• algorithm profile
• self-confidence
• agents’ policies

task assignment

• minimum cost
• minimum execution time
• reliability of bidder
6: EvaluateBids

3: RequestBid ( )

8: AbortBid ( )

4: AnswerBid ( )

2: RequestBid ( )

7: GrantExecution ( )

11: ExecuteAlgo

1: RequestExecution ( )

5: AnswerBid ( )

UserApp : Application

10: ExecData ( )

9: RequestData ( )

12: ResExecData ( )

Manager : ManagementAgent

ExAgentN : ExecAgent

ExAgent1 : ExecAgent
- software related characteristics (static)
- execution characteristics (dynamic)
- user goals
- user preferences
DIPE - agents’ policy

on

- accepting execution
- allocating execution
- charging

in terms of

- user priority
- execution priority
- user id and origin
- user preferences
- time and date
- system state
- ...

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