

Agents: Nomads, Migrants or Globetrotters?

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Examples of agents

- Human agents
 - police agents
 - real estate agents
 - insurance agents
 - secret service agents
 - Robots
 - Software agents:
 - personal digital agents
 - trading agents at auctions
 - information agents
- Individuals ?
Representatives?
Intermediaries?
Organisations?

In the field of law

- Knowledge retrieval is essential (if you could have known something)
- Knowledge management can not be ignored
- Legal ontologies are available (categorisation)
- Profiles of groups, companies, and individuals can be built on the basis of retrieval, analysis and synthesis
- Document management (e.g. version control) can be automated
- Planning, scheduling and monitoring support can improve efficiency

Examples of tasks agents can perform

- Search the internet and intranets for information
- Process the information
- Combine different types of knowledge: e.g. build profiles
- Manage distributed knowledge: e.g. version control
- Plan, schedule and monitor (distributed) processes
- Plan, schedule and monitor (distributed) projects
- Perform (n-party) transactions

Agent characteristics

- are autonomous and pro-active
 - are often intelligent
 - can learn
 - have knowledge, can be experts in a domain
 - can reason
 - manage their own resources: planning, scheduling,
 - communicate with other agents
 - interact with the “world”
- and
- may be **mobile**

Agent concepts

- autonomous and pro-active
 - reasoning & learning
 - protocols & negotiation
 - co-operation
- in a physical environment/network

Reasoning and learning

- reliability of
 - information,
 - informants,
 - information sources,
 - network
- incompleteness and uncertainty of information
- experience: e.g. to be able to build profiles
- strategic knowledge
- importance of deviations from norms

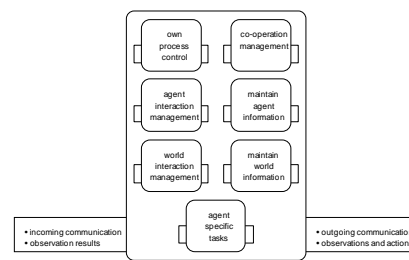
Protocols & Negotiation

- norms and values, beliefs, trust
- contracts, agreed procedures, law,
- language
- reliability, trusted third parties
- delegation
- security
- privacy

Co-operation

- delegation of control
 - traceability
 - anonymity
 - accountability
- negotiation / competition
- strategies
- common “language”
- common goals

Generic model of a co-operative agent*



* (Brazier, Cornelissen, Jonker, Treur, 2000)

Agent Mobility

There are three main reasons for agent mobility in a distributed environments:

- resource management: bandwidth, co-ordination
- security: data access
- nature of the devices involved

Categorisation

- **Migrants:** prefer to live elsewhere for one reason or another on a semi-permanent basis
- **Nomads:** perform different tasks at different locations depending on the availability of resources
- **Globetrotters:** hop around the world acquiring new knowledge and adapting on the way

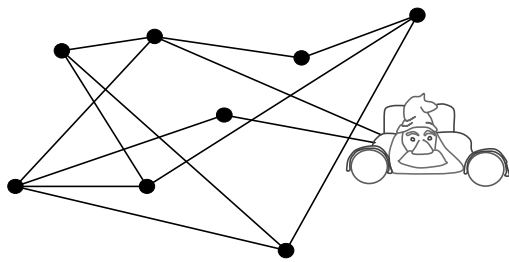
Examples of mobile agents

- **Human agents**
 - police agents nomads
 - real estate agents nomads
 - insurance agents nomads
 - secret service agents globetrotters
- **Robots** nomads
- **Software agents:**
 - personal digital agents globetrotters
 - trading agents at auctions migrants
 - information agents nomads and/or globetrotters

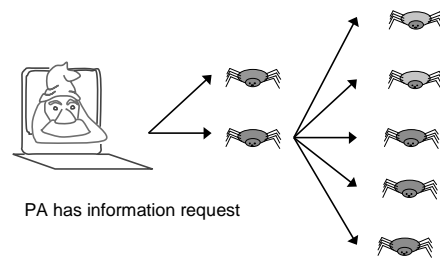
Implication

Globetrotters are the most demanding
 increasing the need for scalable technology.

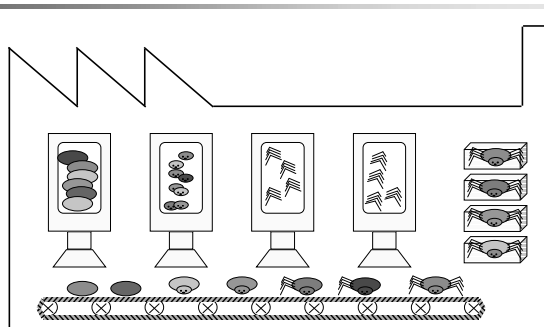
An example of a globetrotter: a mobile embedded system



Dynamic creation of mobile information agents

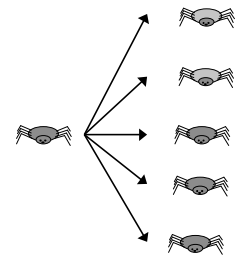


Agent factory



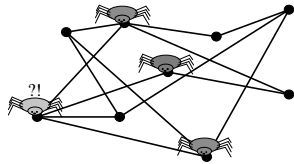
Dynamic agent creation may be problematic

- can be recursive ...
- identity & ownership
 - creation
 - deletion
- who is legally responsible
 - audit trails
 - mutation
 - contractual obligations
- security & anonymity & privacy

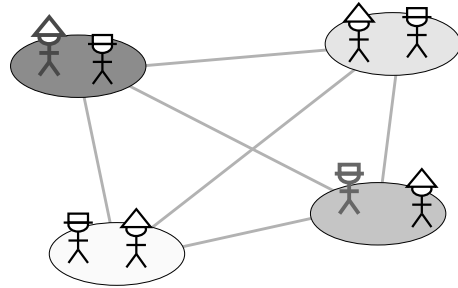


Scalable directory services - "yellow" pages

- by location → location server
- by name → name server
- by property → attribute server
- by type → directory server



Another option: replication of auction halls



New technology required

Agentscape* is a framework for

- scalable,
- interactive,
- secure,
- robust,
- distributed agent systems.

* Currently being designed and implemented by the IIDS Group together with (Tanenbaum and van Steen (both Computer Systems Group), VUA

Agentscape Framework

Includes:

- a distributed agent operating system (AOS)
- services
 - agent management
 - matchmaking
 - directory services
 - agent modification (e.g. agent factory, cloning),

designed to support large scale distributed agent applications.

New legal frame of reference required

- Are migrants, nomads and globetrotters full-fledged citizens of today's society?
- What rights do they have?
- Obligations?
- What is their legal status?
- Are all transactions in which they are involved legal? Valid?

Discussion

Thank you for your attention

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