

Agent Applications

Boi Faltings

Value Propositions

- Autonomous agents: reactivity
 - Personal agents, ambient intelligence
- Agent-oriented software: structure
 - Simulation, control; shop-floor, etc.
- Self-interested agents: mediation
 - e-commerce, decision-making, etc.

Autonomous agents

- Agents that work for their users
- Reactive/deliberative architecture
- Act/react in environment

Teamed Autonomous UAVs



Human team leader

Human team leader:
"Report Intention"
RF Emitter response:
*"Goal Is jam SAM radar,
RWR on, currently taking
avoiding action"*



RF emitter



TV camera



Designator

Autonomous UAV
"wing men"
team members



SAM radar



Games and Entertainment

- Computer Games:
 - Ex: Creatures from GameWare:
Simulated environments with synthetic agents that a user can interact with in real-time.

www.gamewaredevelopment.co.uk



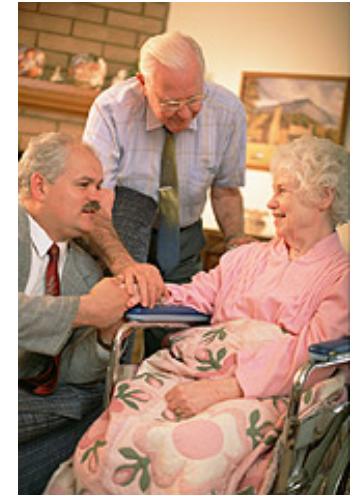
- Entertainment:
 - Ex: Battle Scenes of the Lord of the Rings use the Massive Agent System
 - Each character has its own independent behavior.

www.massivesoftware.com



Health Control at Home

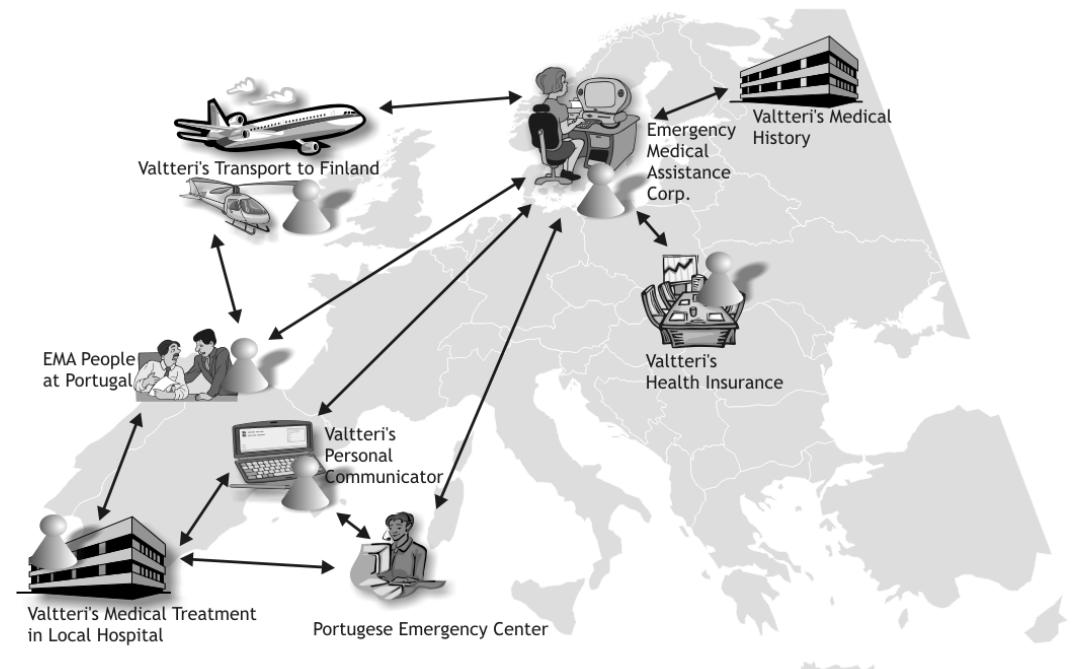
- Chronic ailments are very common
 - Cardiovascular diseases
 - Diabetes
- How to cope with all these (common) diseases, especially in an out-of-hospital environment?
- Health monitoring: regularly monitors George's
 - Blood pressure & glucose values from body sensors
- E-Inclusion: monitoring non-health related parameters
 - Complete universe of data gathered from home sensors
 - Activity monitoring:
 - Where in the apartment is George currently located? Has he suddenly fallen down?
 - Context monitoring:
 - What does George currently do? If he's leaving the house, has he forgotten to switch off the oven?



Scenario: George, an Alzheimer patient, 87 years old, also suffering from hypertension and diabetes, is living alone in his apartment.

Healthcare Emergency Application

- A mobile user with a sudden disease may ask his healthcare personal agent (PA) for help
- The PA automatically arranges contacts with a local hospital and the Emergency Medical Assistance Corporation of the origin country
- System agents coordinate information exchange by taking care to transmit medical records between the origin country and the treating physician
- System Agents organize transport locally and back to the origin country: travel means, reservations, medical assistants, etc.



Agent-oriented software

- Software that models many interacting processes becomes very complex
- Agents simplify structure:
 - Reduce cost
 - Easier to maintain

The Old Equation...

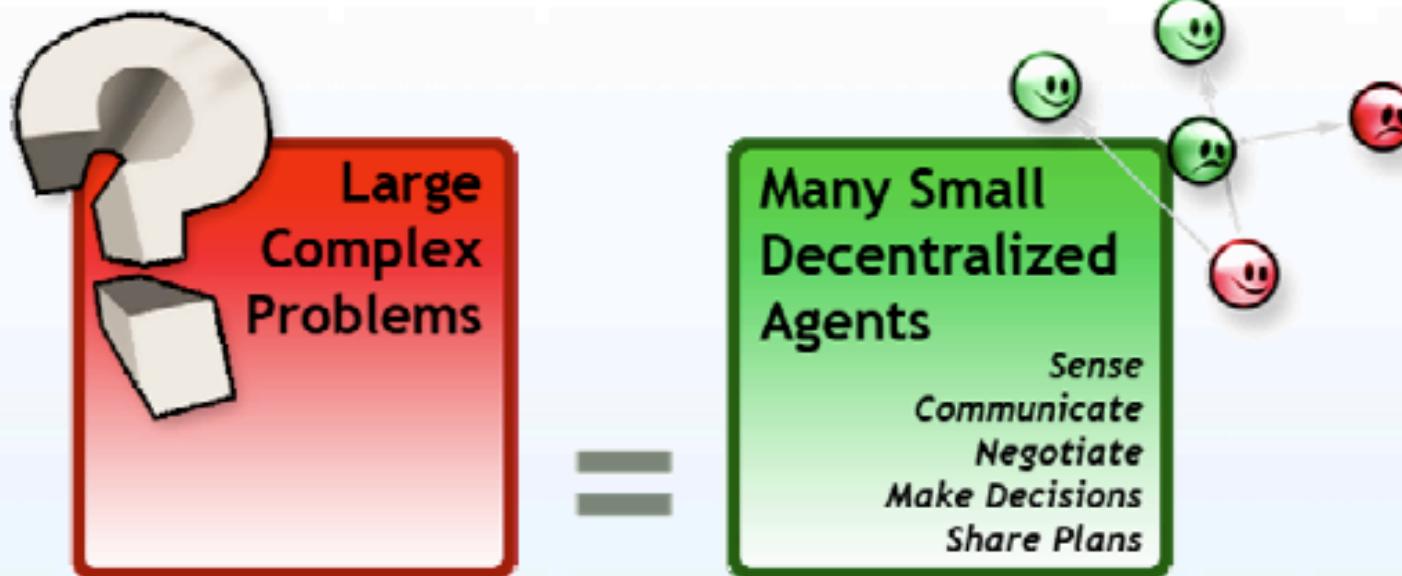


Large
Complex
Problems

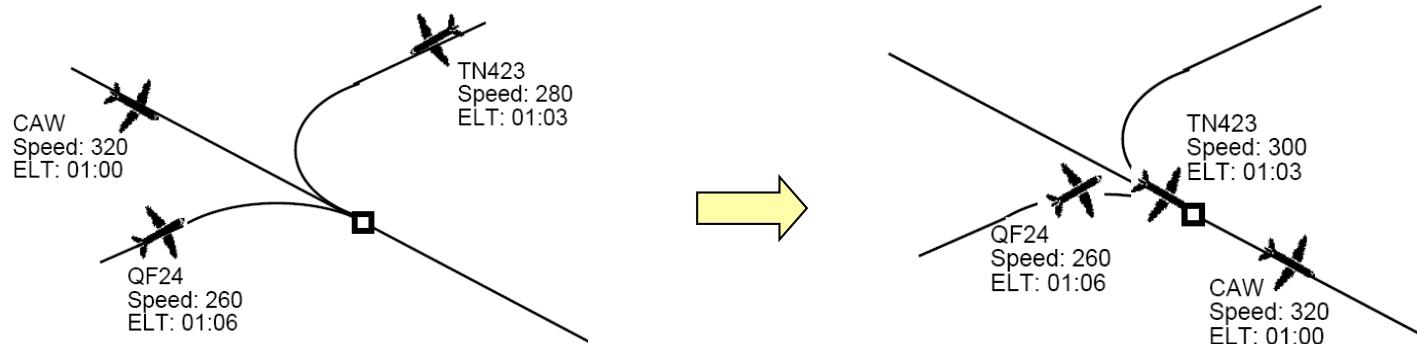


Big Hardware
Big Software

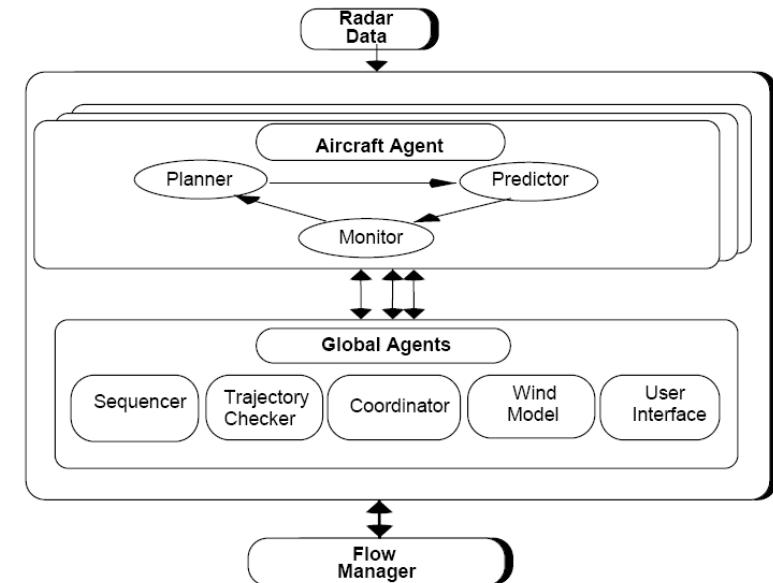
The New Equation...

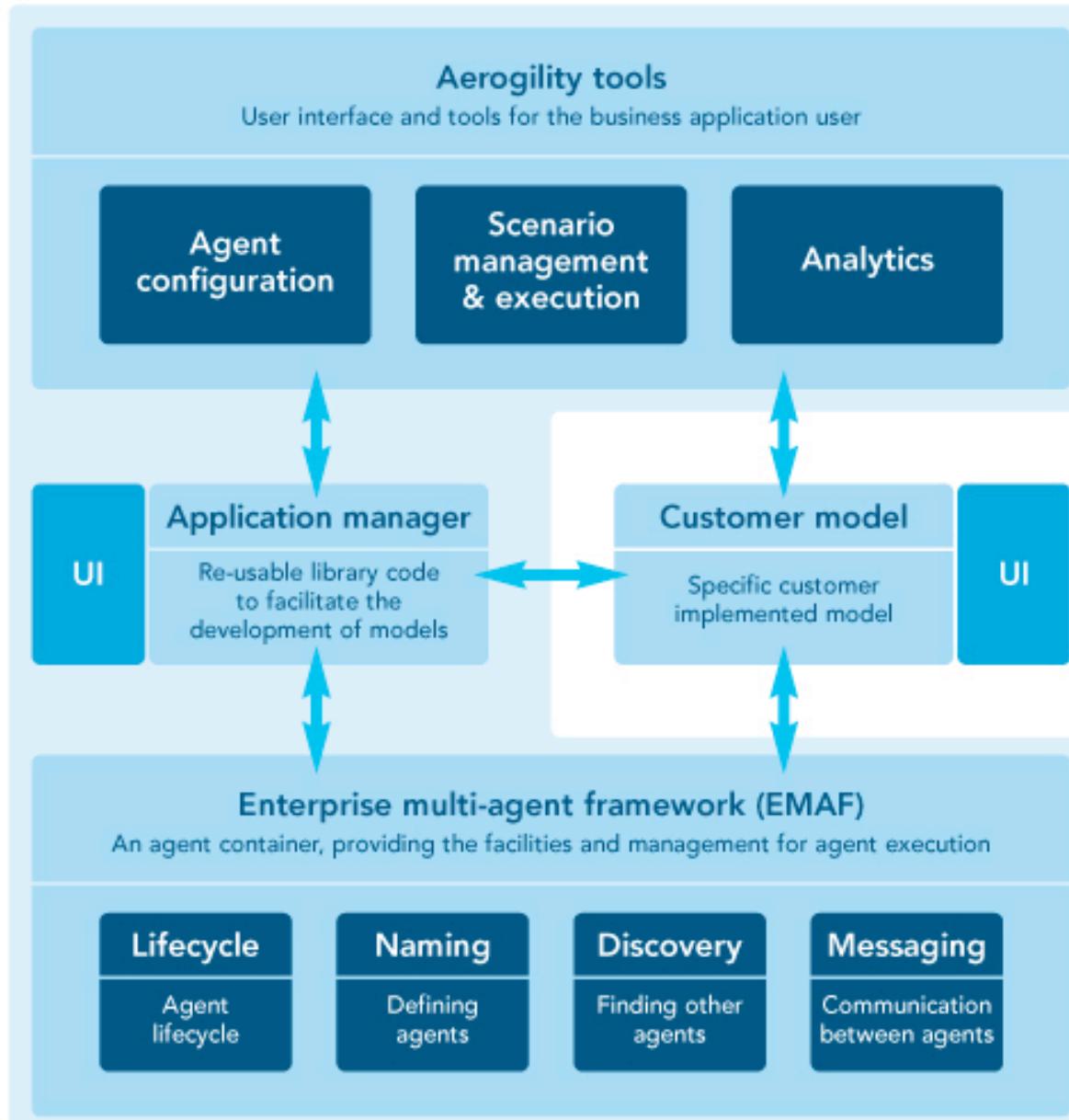


Air Traffic Management



- Optimal Aircraft Sequencing using Intelligent Scheduling (OASIS)
- Assigns landing times 20 to 45 min. before arrival time.
- Continuous monitors aircrafts until they land at an airport
- Based on BDI-agents
- Used at Sydney airport





Simulation Applications

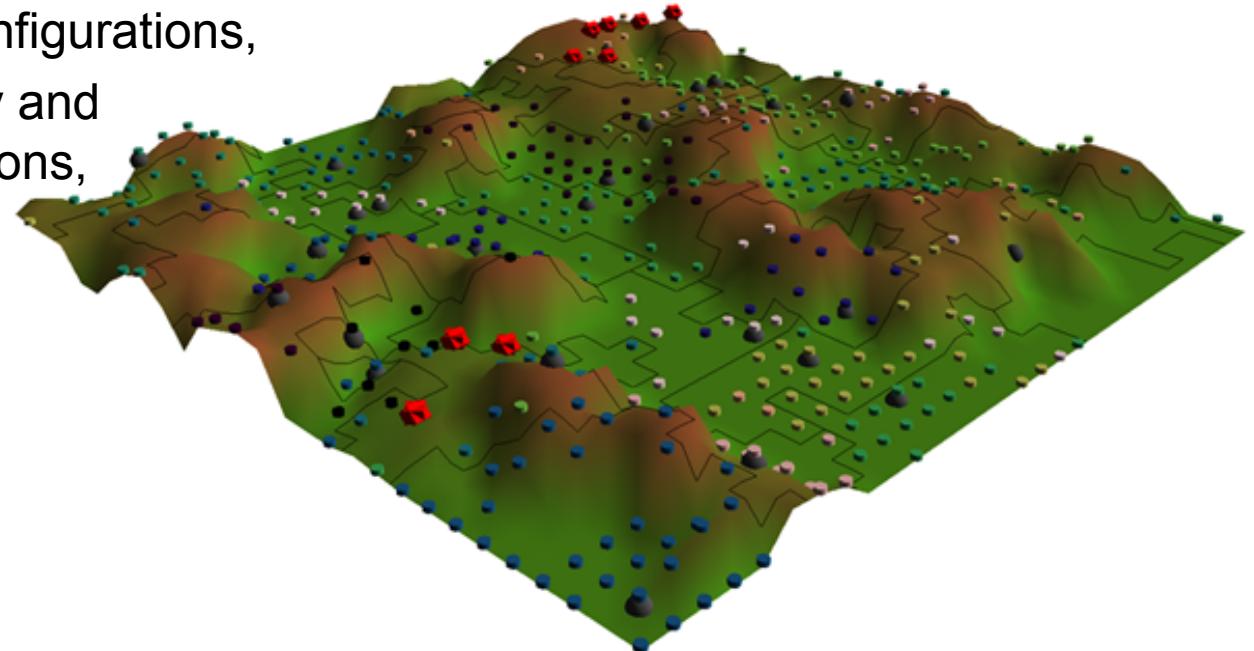
- Multiagent simulations offer strong models for representing real-world environments
- Differ from traditional kinds of simulation (e.g. with differential equations) in that the simulated entities are modeled in terms of agents with strategies
- Allows mixing software with human agents
- Three broad application areas:
 - Social structures and institutions:
 - *Ex: marketplace simulation where agents represent consumers of products*
 - Physical systems:
 - *Ex: Traffic systems (Tunnel of Glion), biological populations*
 - Software systems:
 - *Ex: Traffics in telecommunication networks*

Agent-Based Simulation

- GeoSim, an agent-based simulation framework of geopolitical processes

Prof. Cederman, International Conflict Research, ETHZ – www.icr.ethz.ch

- Explores complex issues in world politics:
 - influence of polarity configurations,
 - evolution of democracy and nationalist transformations,
 - reconstruction of war-size and state-size distributions.



Holonic Manufacturing Systems (HMS)

"Holonics"

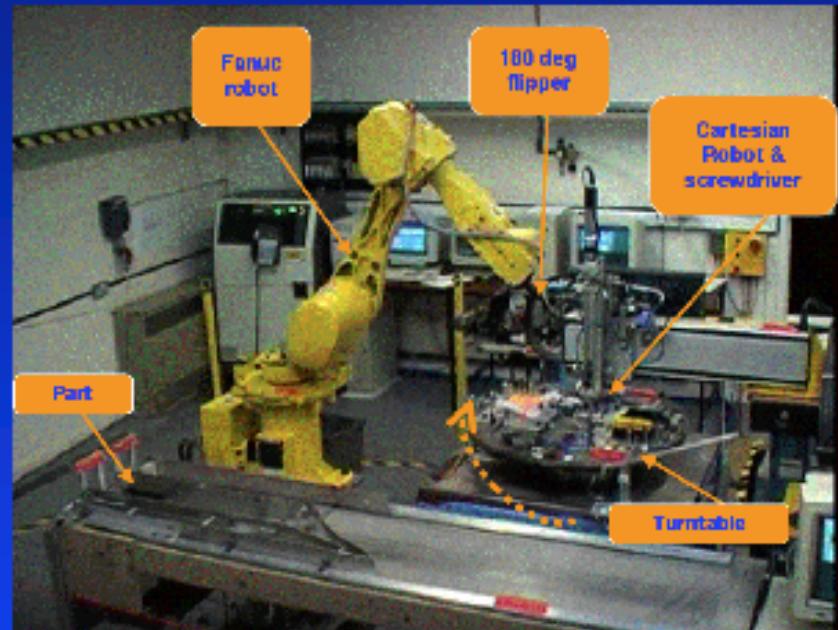
- A **Holon** is the combination of a physical process and an intelligent agent
- Holonic manufacturing systems are autonomous and co-operative

Holons can be in teams

- A team of holons can be a group of machines, each with a role

Orders are pro-active - Order Holons

- Negotiate with resources to "make themselves"
- Novel view, inverts conventional concept of a static "order"



Institute of Manufacturing, Cambridge University

- assembly cell control using a JACK Team implementation
- combine holons with radio-based part identification - the future of manufacturing...

Manufacturing applications

- See DaimlerChrysler presentation...

Logistics applications

- see Whitestein presentation...

Self-interested agents

- Distributed multi-agent systems
- Purpose: mediate interests
- Non-manipulable
- Individually rational
- Efficient (optimization)

Key Technology Features: Demand and Resource Matching

Virtual Market Engine



Agents representing individual elements of both demand and supply enter the Virtual Market and trade to meet their objectives. Once a demand agent matches with a supply agent a match contract is created. This contract describes the terms of the agreement. As changes effect demand and supply (such as cancelled orders or unavailable equipment) or as new demand and supply enter the Virtual Market, these contracts can be re-evaluated and broken or kept as is required to meet the level of response needed in the overall network.

Other interesting applications: iBundler ■

iSOCO Services

| RFQ | Quantity | Contract | | Numprovider | | Weight |
|-----------------|----------|----------|------|-------------|-----|--------|
| | | Min | Max | Min | Max | |
| Req FONTE HUB | 400.0 | 0.25 | 0.75 | 20 | 2.0 | 0.2 |
| Req STRUT | 800.0 | 10 | 100 | 20 | 2.0 | 0.2 |
| Req L.C.A.B. | 600.0 | 0.0 | 1.0 | 00 | 0.0 | 0.2 |
| Req STAB. BAR | 700.0 | 10 | 100 | 30 | 2.0 | 0.2 |
| Req COIL SPRING | 400.0 | 0.25 | 1.0 | 10 | 2.0 | 0.2 |

Delegating tasks
in e-procurement

Buyer RFQ form

| RFQ | Quantity |
|-----------------|----------|
| Req FONTE HUB | 20 |
| Req STRUT | 100 |
| Req L.C.A.B. | 000 |
| Req STAB. BAR | 200 |
| Req COIL SPRING | 100 |

Provider's Capabilities

| RFQ Item | Supplier provider 1 | Supplier provider 2 | Supplier provider 3 | Supplier provider 4 | Supplier provider 5 |
|-------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| HUB | Y | Y | Y | Y | Y |
| STRUT | Y | Y | Y | Y | Y |
| L.C.A.B. | Y | Y | Y | Y | Y |
| STAB. BAR | Y | Y | Y | Y | Y |
| COIL SPRING | Y | Y | Y | Y | Y |

Provider's Single Bids

| Offer | Supplier 1 | | | Supplier 2 | | | Supplier 3 | | | Supplier 4 | | |
|-------------|------------|-------|------|------------|-------|------|------------|-------|------|------------|-------|------|
| | Initial | Offer | Last |
| HUB | 20 | 200 | 200 | 20 | 200 | 200 | 20 | 200 | 200 | 20 | 200 | 200 |
| STRUT | 10 | 100 | 100 | 10 | 100 | 100 | 10 | 100 | 100 | 10 | 100 | 100 |
| L.C.A.B. | 0 | 00 | 00 | 0 | 00 | 00 | 0 | 00 | 00 | 0 | 00 | 00 |
| STAB. BAR | 0 | 00 | 00 | 0 | 00 | 00 | 0 | 00 | 00 | 0 | 00 | 00 |
| COIL SPRING | 0 | 00 | 00 | 0 | 00 | 00 | 0 | 00 | 00 | 0 | 00 | 00 |

Other interesting applications: Mortgage negotiation ■

