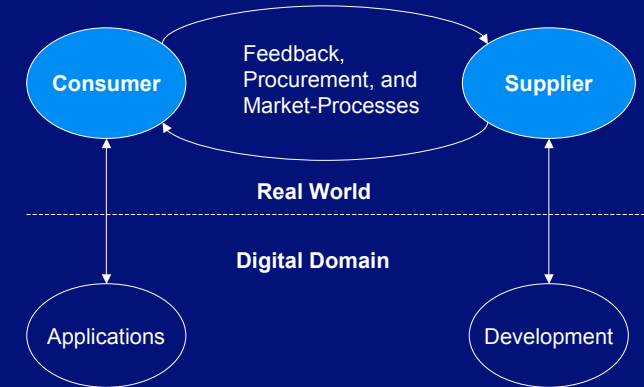# Machine-driven Markets

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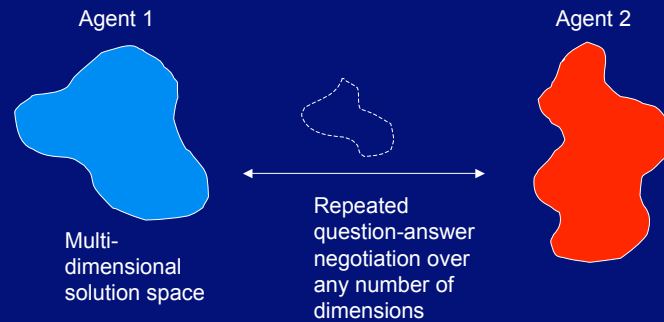# The Present Software Market

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Machine-driven Software Market

- ☐ Shift the procurement and feedback process into the digital domain
- ☐ Integration of market competition at all stages of the software engineering process
- ☐ Enable competitive, market-based allocation of all resources required to run a software system

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Auctions

- ☐ Mechanism of price-determination in a competitive environment
- ☐ Example: The Dutch auction— determination over a single dimension
- ☐ However, we are trading software services/resources:
  - ■ Multi-dimensional problem, many constraints, some hard, some soft
  - ■ Time and execution constraints of auction
  - ■ Perfect and imperfect information visibility

Direct negotiation

Agent 1

Agent 2

Multi-dimensional solution space

Repeated question-answer negotiation over any number of dimensions
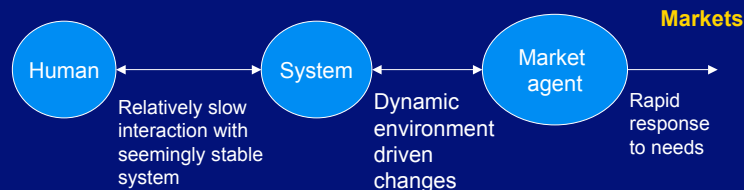
Agent behaviours

- Agents must perform many roles in order to automate the markets:
  - Supply
  - Procurement
  - Brokering
  - Trading
- Strategies used to achieve this depend on the rules — the auction rules
- Agent negotiates on behalf of a human— so preferences must be represented

Why Agents not People?

- Dynamics of a system as it reacts to its environment operating at machine speed
- Agents capable of high enough level of decision making take humans out of this loop

Markets

Human

System

Market agent

Relatively slow interaction with seemingly stable system

Dynamic environment driven changes

Rapid response to needs

The ACCESS Market

User requirements specification

Goals in the marketplace

ACCESS Trading Agent

Negotiation in auction according to goals

Maintenance of contracts with other agents
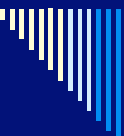
Monitoring of marketplace supporting strategic behaviour

Benefits of the ACCESS Market

- Benefits including the idea of futures and identification of unmet demand, focussing future software development
- Not particular to any technology, but rather encourages the most competitive solutions
- User requirements directly reflected in a fast changing, efficient market system
- Unmet demand and flow of profits direct engineering of future systems
- Not just applicable to software engineering….

Requirements for a machine software market

- Machine-operable auction systems
- Autonomous agents discerning economic strategy
- Agents with representation of human goals
- Flexible, Grid-like operating environment, allowing economic allocation to be reflected
- Licensing, trust, and identification – prerequisites for successful market operation
- Marked-up tradable software products
- Measurement of real product performance

Markets enabling Autonomic Systems

- Market not just operated autonomously, it in itself enables autonomic systems
- Gives room for self-driven change (machine-operable procurement), in a way that gives added benefits:
  - Efficiency in the software market
  - Greatly reduced transaction costs
  - Greatly reduced software costs
  - Need-driven development

Research question

To what extent might humans be willing to delegate strategic, and important, market decisions to autonomous agents, and how might any reluctance to do this be overcome?