Sissejuhatus ainesse "Agentorienteeritud modelleerimine ja multiagentsüsteemid" (IDK5151)

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Tallinna Tehnikaülikool

Kohtumise kava

- Kes olen mina?
- Kes olete teie?
- Aine logistika
- Hindamine
- Sissejuhatus agentidesse
- Modelleerimisharjutus

Kes olen mina?

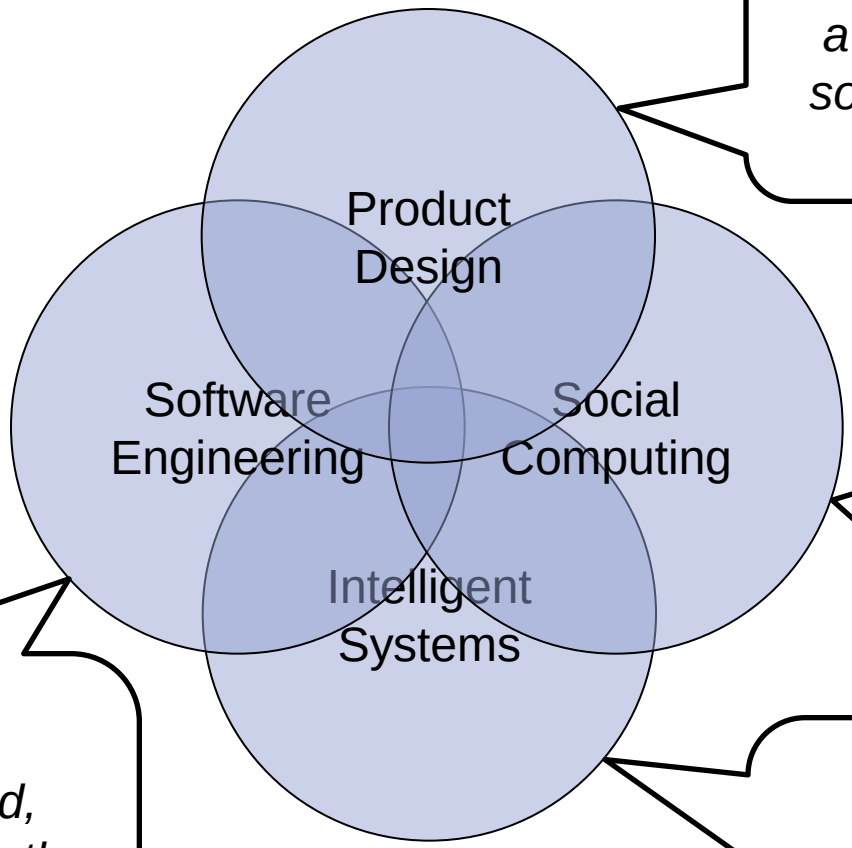
- Name: Kuldar Taveter
- Position: Professor, Chair of Software Engineering
- Education:
  - Dip.Eng., TUT, 1988
  - M.Sc., TUT, 1995
  - Ph.D., TUT, 2004
- Work experience:
  - 1985-1989: Institute of Cybernetics
  - 1989-1993: Private companies
  - 1993-1998: Department of Informatics of TUT
  - 1997-2005: Technical Research Centre of Finland
  - 2005-2008: The University of Melbourne, Australia
  - 2008- : Department of Informatics of TUT
  - Jan-Aug 2011: University of South Carolina, USA
- Research areas: Agent-oriented software engineering, multiagent systems, intelligent systems, ambient intelligence, agent-based mobile systems, agent-based simulation

Kes olete teie?

Aine logistika

- Neli kohtumist:
  - 01.02.2013 : 19:30-21:00 IT-213D
  - 12.04.2013 : 19:30-21:00 IT-213D
  - 26.04.2013 : 19:30-21:00 IT-213D
  - 10.05.2013 : 19:30-21:00 IT-213D
- Põhiline on iseseisev õppetöö:
  - Loengute videod ja esitlused (inglise keeles) leheküljel http://maurus.ttu.ee/sts/?page_id=1315
  - Miniprojektid

Kursuse asetus



the process of creating a new product to be sold by a business to its customers

supporting social behavior through computational systems

the application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software

a system that perceives its environment and takes actions that maximize its chances of success

Kursuse eesmärk

- To design by AOM a ***software-intensive intelligent social product*** that delivers the overall solution for the end user through interactions between different nodes and by following the execution loop of an abstract agent

Miniprojektid

- Design and prototyping or simulation of a software-intensive social product
- Range of topics:
  - Crowdsourcing applications
  - Intelligent digital assistants
  - Social applications
- Two Mektory (http://www.ttu.ee/mektory) projects:
  - Healthminer
  - Phoenix
- Vaadake veel eelmise aasta miniprojektide lehekülge http://maurus.ttu.ee/sts/?page_id=875

Millist laadi probleemid?

- Allocation of scarce resources (e.g., electric power, parking spaces, emergency care, transportation)
- Distributed situation assessment (e.g., traffic jams)
- Decentralized decision-making (e.g., finding a grocery store, legal decision-making, taxation, intelligent traffic control)
- Cooperative information exchange (currently no context, no help by other users)

Millist laadi süsteemid?

- Distributed systems that obtain control information *from* the edge of the system to provide desired behaviors *at* the edge of the system
- Examples:
  - Electricity distribution
  - Grocery shopping
  - Healthcare
  - Transportation
  - Traffic control
  - Telecom bandwidth

Hindamine

- Analüüsimudelite kaitsmine: 10%
- Disainimudelite kaitsmine: 10%
- Kirjalik aruanne, umbes 2000 sõna koos lisadega, joonistega, tabelitega ja lähtekoodi näidetega: 20%
- Töö lõpukaitsmine: 10%
- Kahetunnine kirjalik eksam: 50%

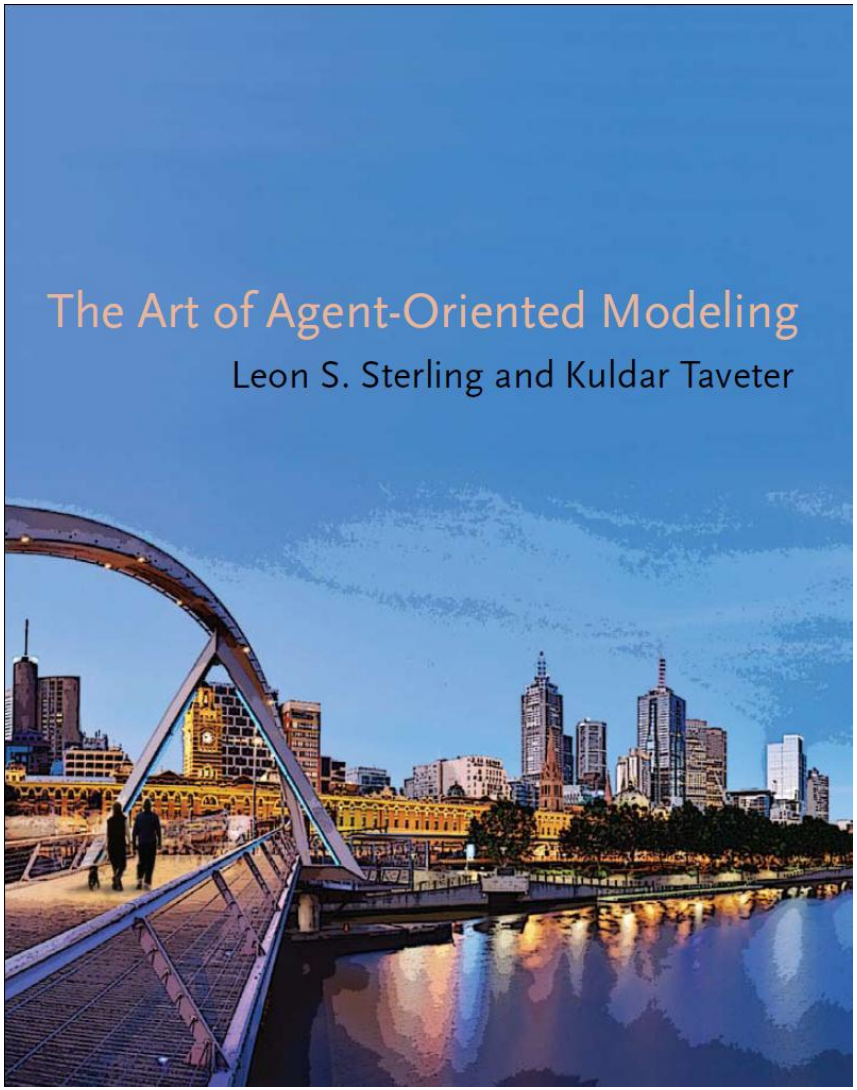
Ajakava

- Esimene kohtumine 01.02.2013: Sissejuhatus
- **15.02.2013: Tähtaeg tiimide moodustamiseks ja teemade valikuks**
- Teine kohtumine 12.04.2013: Analüüsimudelite kaitsmine (7,5 %)
- Kolmas kohtumine 26.04.2013: Disainimudelite kaitsmine (7,5 %)
- **08.05.2013: Tähtaeg miniprojekti esitamiseks**
- Neljas kohtumine 10.05.2010: miniprojekti lõpukaitsmine

Kirjandus

- **Sterling, L. & Taveter, K. (2009). *The art of agent-oriented modeling*. MIT Press.**
- Wooldridge, M. (2009). *Introduction to multi-agent systems, 2nd Edition*. Addison-Wesley.
- d'Inverno, M. & Luck, M. (2001). *Understanding agent systems*. Springer-Verlag.
- Padgham, L. & Winikoff, M. (2004). *Developing intelligent agent systems: A practical guide*. John Wiley and Sons.
- Bellifemine, F., Caire, G, & Greenwood, D. (2005). *Developing multi-agent systems with JADE*. John Wiley & Sons.
- Bordini, R. H., Hübner, J. F., & Wooldridge, M. (2007). *Programming multi-agent systems in AgentSpeak using Jason*. John Wiley & Sons.

Põhiõpik


The Art of Agent-Oriented Modeling
Leon S. Sterling and Kuldar Taveter

The book's mission

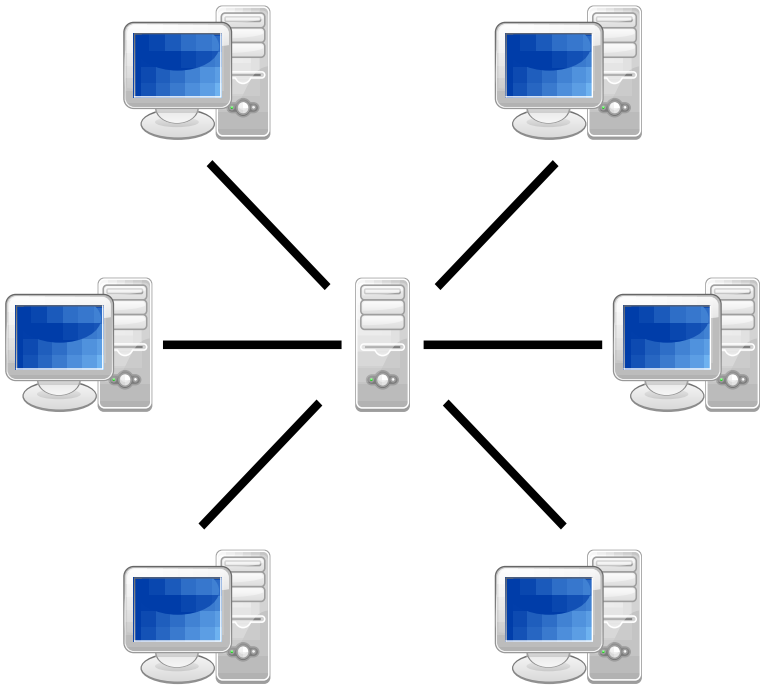
- To address how computing can support individuals and social organizations in the environment where the computing is:
  - Pervasive;
  - Deployed over a range of devices;
  - With multiplicity of users
- Approach for engineering software systems that are:
  - Open;
  - Intelligent;
  - Adaptive

Two kinds of systems

- Predominantly client-server systems
- Increasingly more *peer-to-peer* systems
- *Peer-to-peer* subsumes *file sharing*

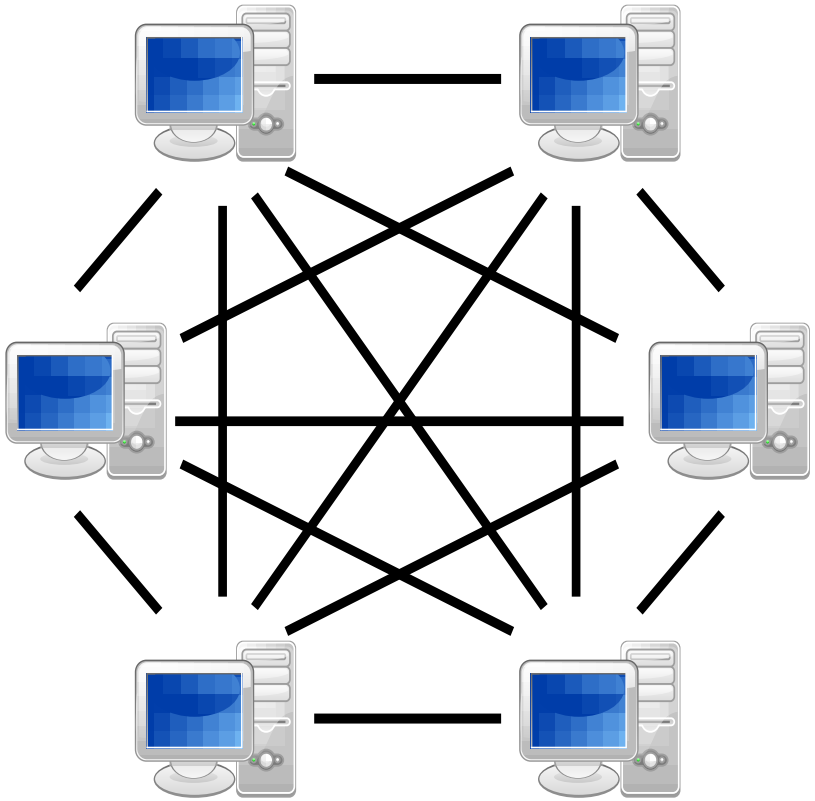
Client-server systems

- Client:
  - queries;
  - waits;
  - receives;
- Server:
  - waits;
  - serves;
  - does not query.



Peer-to-peer systems

- All nodes are equal
- Each node can work as a client or as a server
- Each node can offer (computing, memory, bandwidth, *information*) resources



Client-server vs. *peer-to-peer*

- *Peer-to-peer* resources are distributed
- *Peer-to-peer* is more robust
- *Peer-to-peer* is more secure
- *Peer-to-peer* is trickier to test
- *Peer-to-peer* is trickier to manage
- Hybrid network: *peer-to-peer* network + client-server directory

The Viewpoint Framework

	Viewpoint aspect		
Abstraction layer	Interaction	Information	Behavior
Analysis	Role models and organization model	Domain model	Goal models
Design	Agent models, acquaintance model, and interaction models	Knowledge model	Agent behavior models
Prototyping	Interaction prototyping	Information prototyping	Behavior prototyping

What is model?

- A hypothetical, simplified description of a complex entity or process
- “A model should be as complex as it needs, but not more complex”, David Lorge Parnas
- What features...
  - are important?
  - can be ignored?

Examples of models

- A model of the solar system
- The model of a gold mine
- The model of a chemical plant
- Air traffic simulator:

Concepts for goal models

- Goal
  - Functional goal
  - Quality goal
- Role

What is goal?

- Dream with a deadline ☺
- A particular state of affairs intended by one or more agents

Two kinds of goals

- Functional goal: a goal that captures one or more desired scenarios. Example: attend the lecture
- Quality goal: quality requirement of the achievement of the functional goal. Example: attend the lecture *attentively*

What is role?

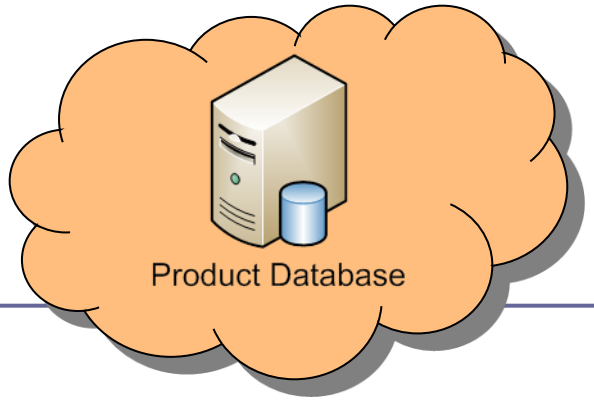
- Some capacity or position that the system requires in order to achieve its goals
- Examples

Goal model

- Hierarchy of goals
- Roles associated with goals
- Quality goals attached to goals

Fair grocery shopping

- Customers post the prices they paid for their groceries and QoS information
- A prospective shopper enters a grocery list and obtains a pointer to the store(s) with the lowest total price (and best service)
- Each customer has an app representing his/her interests and interacting with the agents of the other customers
- Results from initial experiments by Prof. Michael Huhns and Hongying Du: savings up to 21% can be obtained!



Product information

Product information

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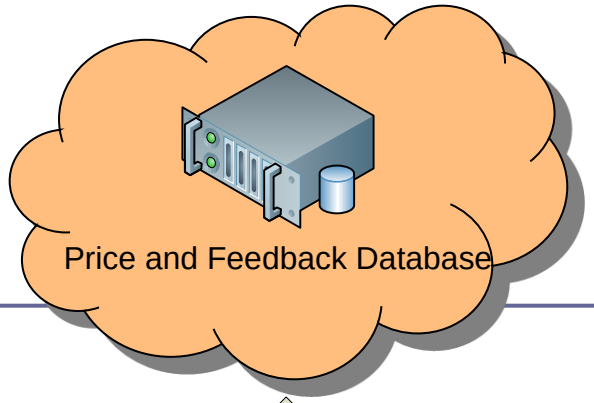
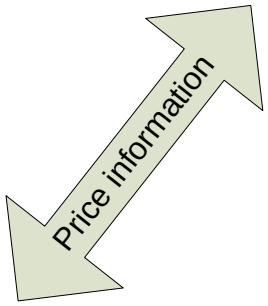
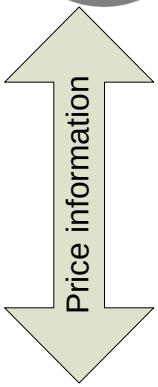

Price and Feedback Database


Price information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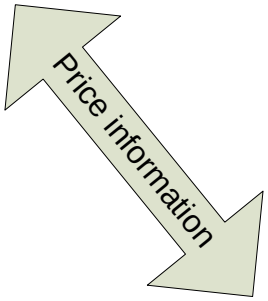
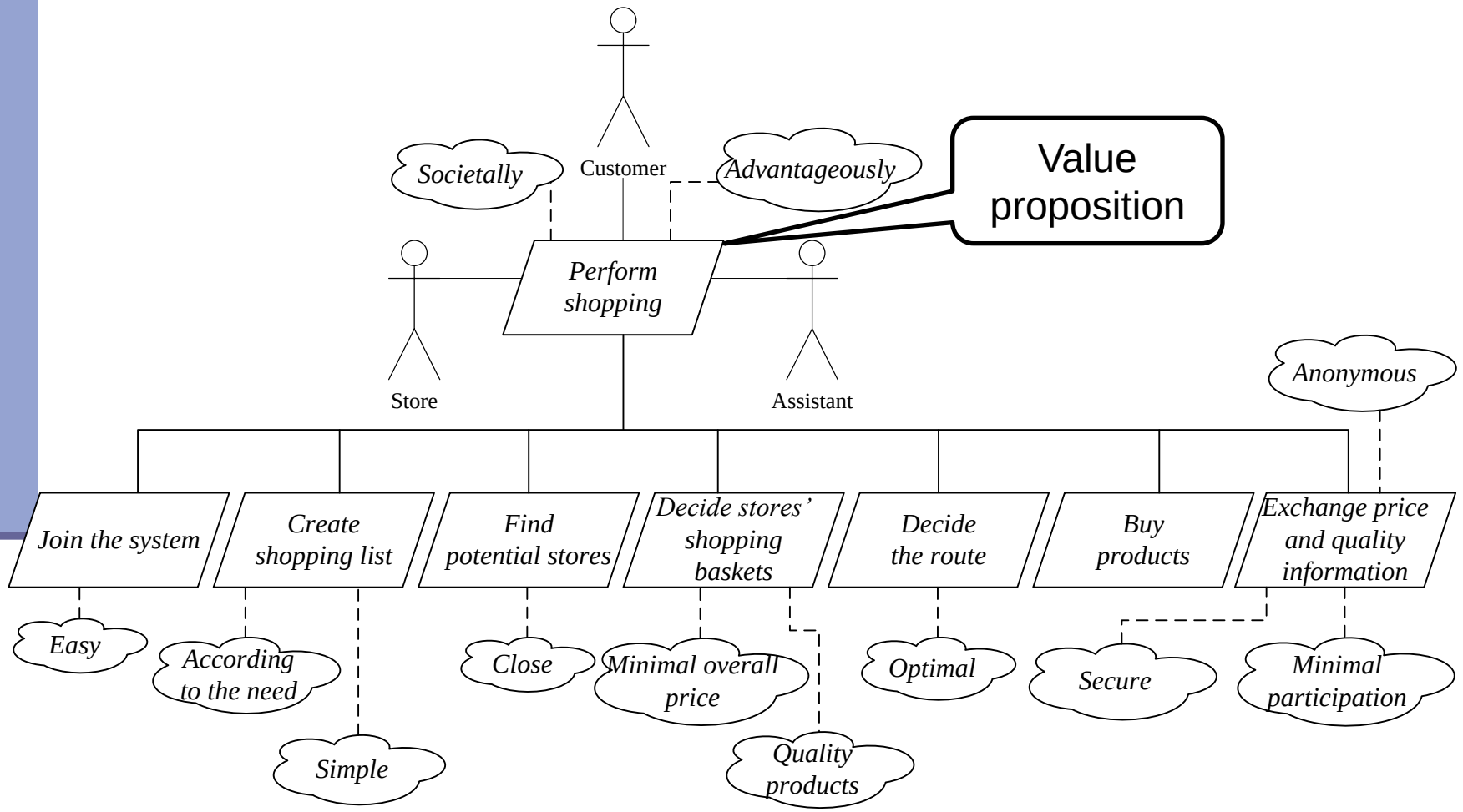
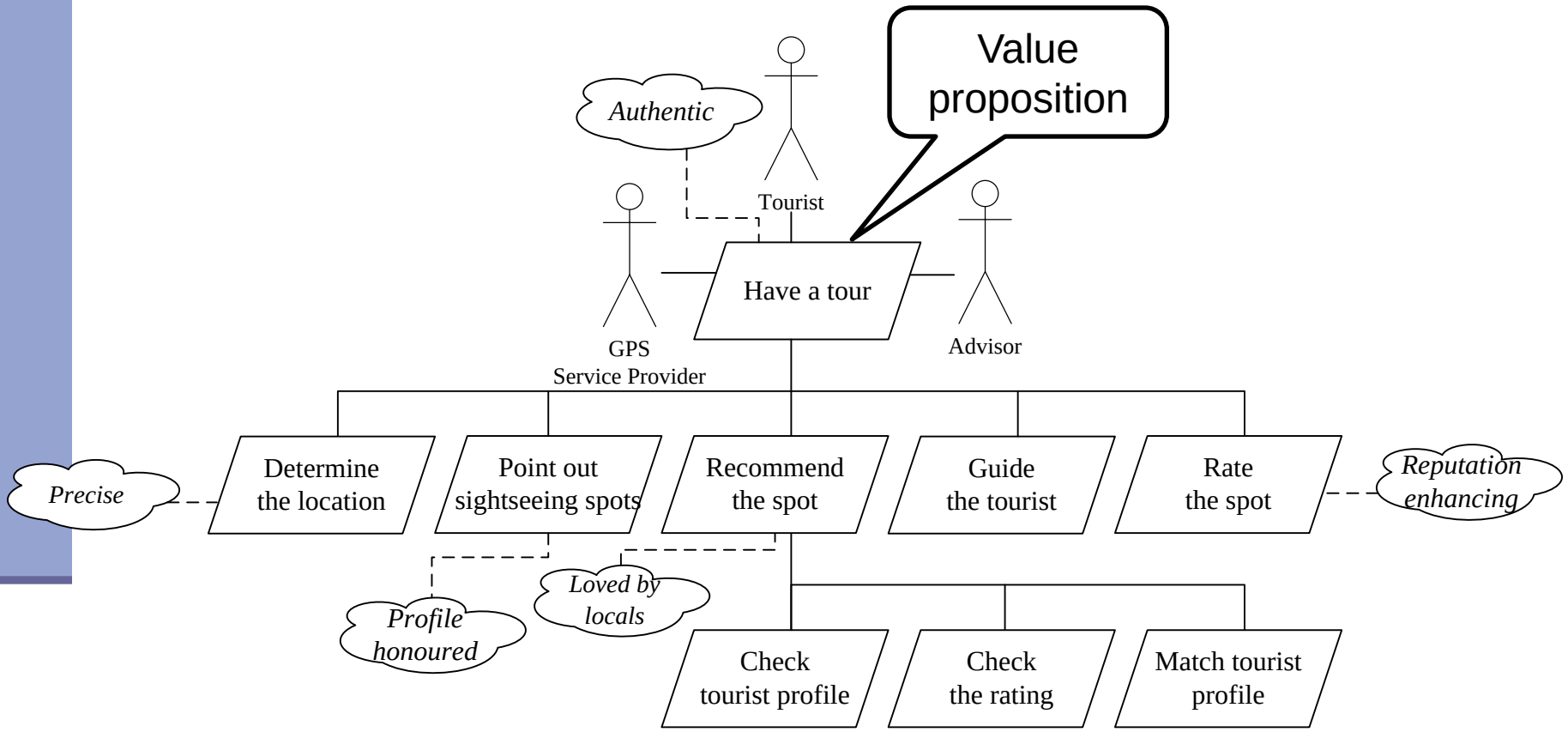

Price information

Goal model for fair grocery shopping



Tourist advisor

Goal model for tourist advisor



Smart parking

Harjutus

- Koostage eesmärgimudel Smart Parking süsteemi kohta