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Agent-Oriented Modelling: A Methodology for Modelling, Prototyping, and Simulation of Sociotechnical Systems

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Tallinn University of Technology
Tallinn, Estonia

Who am I?

- Name: Kuldar Taveter
- Position: Professor in Software Engineering, Head of the Laboratory of Sociotechnical Systems
- 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**
  - **Apr – May 2016: Shanghai University for Science and Technology, China**
- Research areas: Agent-oriented software engineering, engineering of sociotechnical systems, multiagent systems, intelligent systems

Outline

- Overview of Estonia and my university
- Introduction to the AOM methodology
- The case study of aircraft turnaround simulation
- The case study of crisis management
- The case study of designing proactive services of e-government

Basic Facts about Estonia

- North-East Europe
- Capital Tallinn
- Population 1,34 mio

- Area 45 000 km2, comparable to the Netherlands and Denmark
- Parliamentary republic, independence Feb 24 1918
- EU, May 1 2004
- Schengen treaty, Dec 21 2007
- Euro zone, Jan 1 2011

People and society

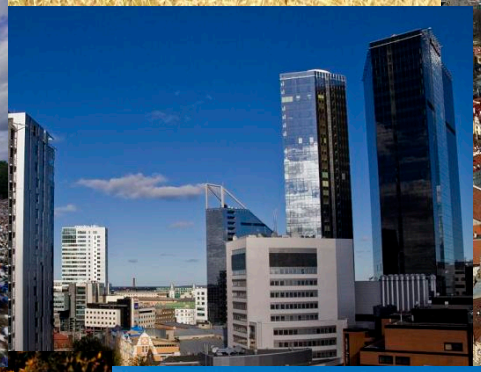
- Nordic mindset
- Peaceful and hard-working people
- Safe and stable society
- 70/30% of population native Estonian/Russian-speakers
- Foreign languages widely spoken: English, Russian, German, Finnish….
- 3 million tourists visit Estonia every year

Nature and country

- 4 seasons
- Well-preserved nature
- 1520 islands
- 1000 lakes…








e-Estonia

- Advanced IT society - free Internet access in many public areas, on coaches, trains, etc.
- ID-card, e-Government, e-Taxation, e-Voting, e-School, e-Signing, e-Parking (no parking meters known!), e-Business Register, e-Land Register, e-Banking (no bank checks known!), etc.
- The development centre of Skype lies in Tallinn
- The headquarters of the EU IT Agency are located in Tallinn

Higher Education in Estonia

smartEstonia.ee

- Higher (tertiary) education is offered at **universities** and **professional higher education institutions**
- Ca 2/3 of the age group study in higher education institutions - there are **ca 68 000 students** in Estonia
- There are **8 universities** in Estonia
- All institutions have introduced a **bachelor-master (3+2) structure** for most study programmes
- Growing number of **English taught programmes** are offered, especially at Master level.

Tallinn University of Technology

- Founded as an engineering college in 1918
- Acquired university status in 1936
- The second largest universityy in Estonia with about 14,200 students, 2,000 employees and with more than 54,000 graduates
- Courses taught in Estonian, English, and Russian
- International students ~7%
- 134 Bachelor's, Master's, and Doctoral degree programs
- The biggest faculty of economics and business administration in Estonia

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1918
2008

Faculty of Information Technology

- The number of students: approximately 2500
- The number of research and teaching staff: approximately 150
- Departments:
  - Thomas Johann Seebeck Department of Electronics
  - Radio and Communication Engineering
  - Computer Engineering
  - Computer Control
  - Computer Science
  - Informatics

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1918
2008

Department of Informatics

- Research and teaching staff 41 people
- Number of students in our study programs: approx. 1500
- Qualifications
  - PhD: 17 members
  - M.Sc.: 24 members, among them 12 PhD students

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1918
2008

Department of Informatics: Research Areas

- e-Government
- Information systems
- Socio-technical systems
- Data mining and big data

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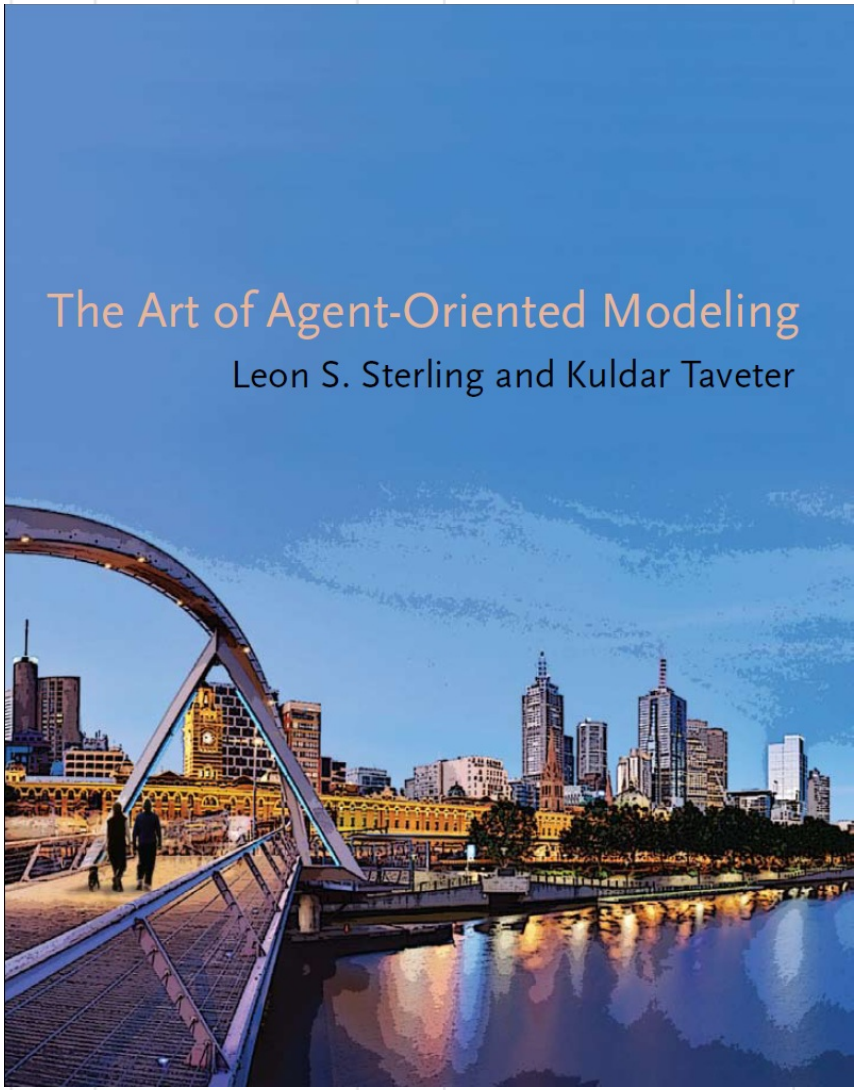
1918
2008

Agent-oriented modelling (AOM)



Other relevant articles

Miller, T.; Lu, B.; Sterling, L.; Beydoun, G.; Taveter, K. (2014). Requirements Elicitation and Specification Using the Agent Paradigm: The Case Study of an Aircraft Turnaround Simulator. IEEE Transactions on Software Engineering, Vol. 40, 1007−1024

Mahunnah, M.; Norta, A.; Ma, L.; Taveter, K. (2014). Heuristics for Designing and Evaluating Socio-Technical Agent-Oriented Behaviour Models with Coloured Petri Nets. In: Proceedings of the IEEE COMPSAC 2014 (438−443). IEEE.

Norta, A.; Mahunnah, M.; Tenso, T.; Taveter, K.; Narendra, N.C. (2014). An Agent-Oriented Method for Designing Large Socio-technical Service-Ecosystems. In: IEEE 10th World Congress on Services (242−249). IEEE.

Why “agent-oriented”?

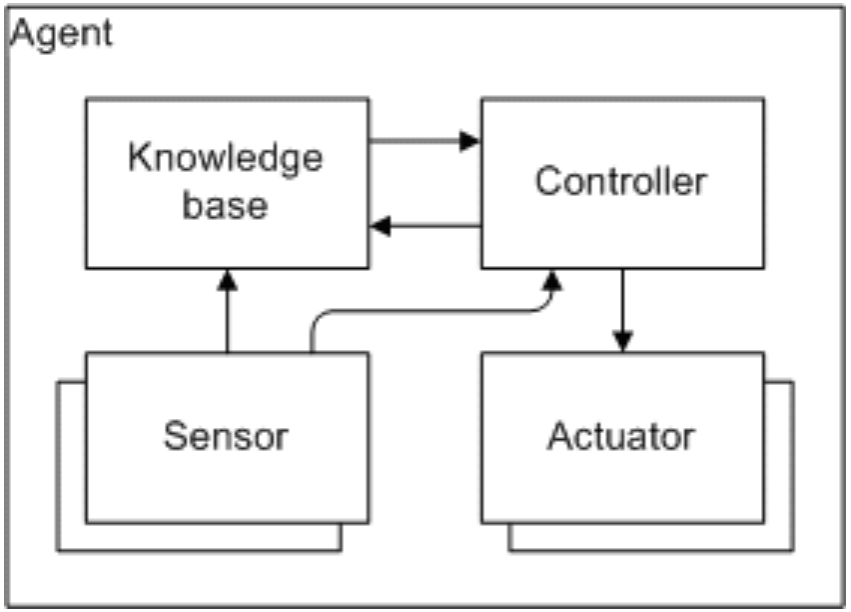
What is agent?

- An active entity as opposed to a passive entity
- An entity that can act in the environment, perceive events, and reason
- An entity that acts on behalf of someone or somebody

Agent

- Agent is an entity that perceives and affects its environment and performs reasoning
- Agent is:
  - reactive;
  - proactive;
  - social.
- Agent interacts in an asynchronous way

The abstract agent architecture



The execution loop of an abstract agent

while *the agent is unfulfilled* ***do***
sense the environment;
update the knowledge base;
reason;
choose actions;
act;
end while

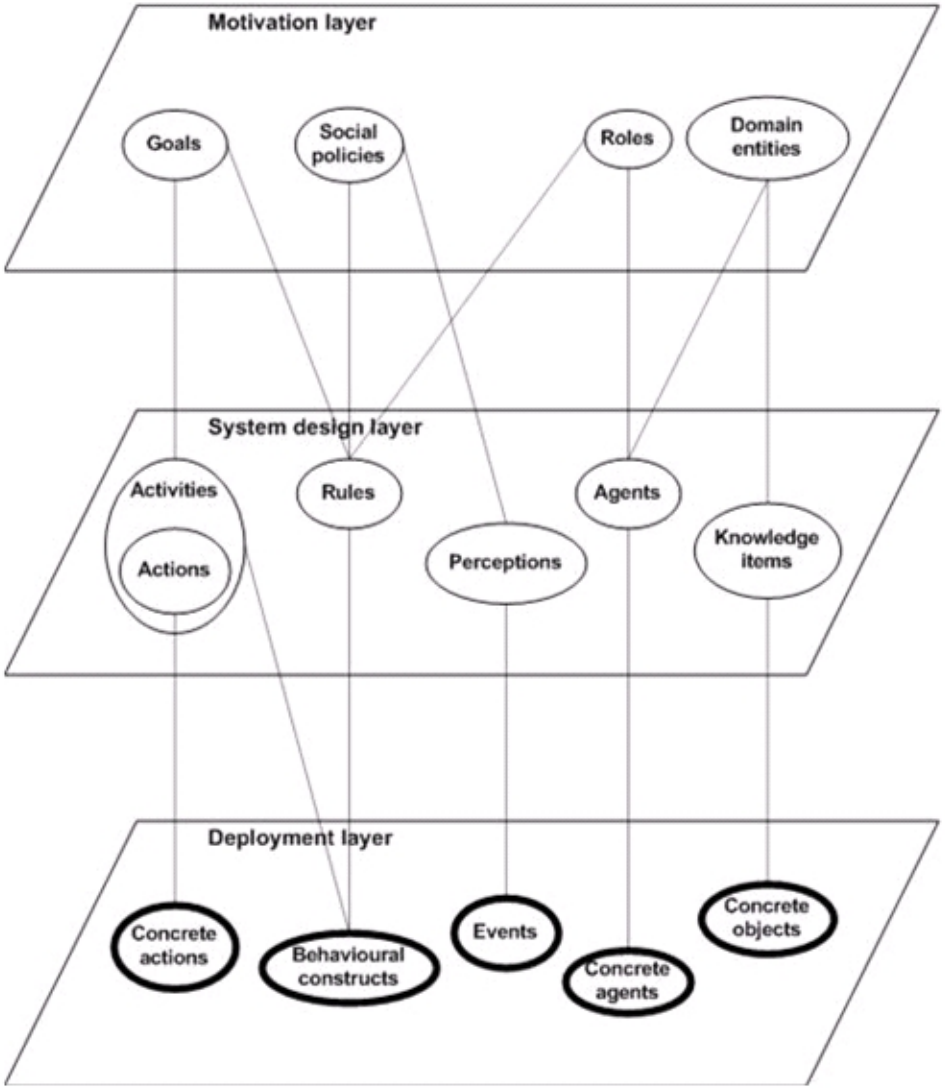
Anthropomorphic qualities

- Beliefs
- Responsibilities
- Expectations
- Capabilities
- Goals
- Desires
- Intentions

Socio-technical system

- A software intensive system that has defined operational processes followed by human operators and which operates within an organization
- A system that contains both a social aspect, which may be a subsystem, and a technical aspect

The conceptual space (metamodel)



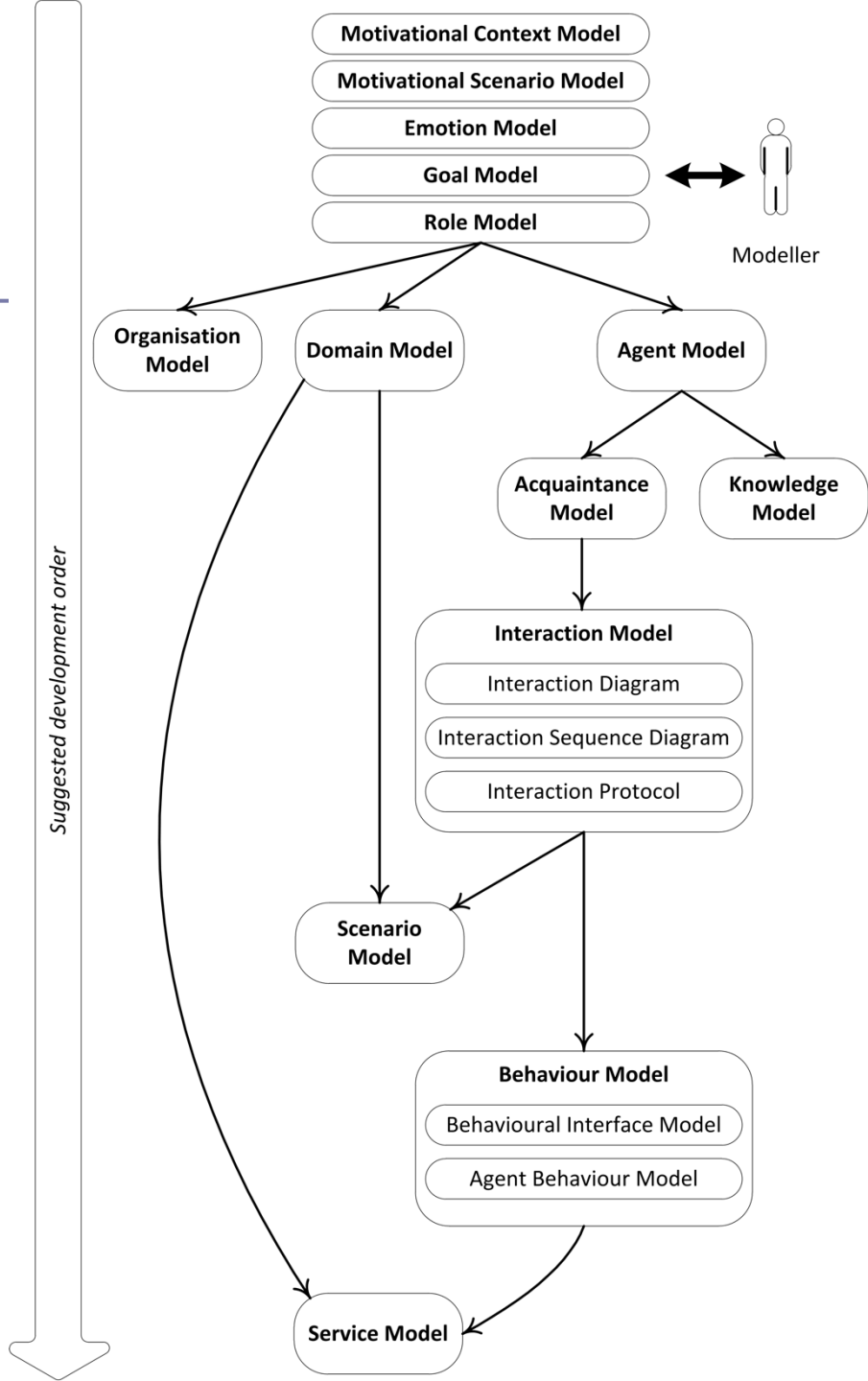
Three vertical perspectives required

- Behaviour
- Interaction
- Knowledge

The Viewpoint Framework

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

Modelling process:



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	Agent knowledge model	Scenarios and agent behavior models
Prototyping	Interaction prototyping	Information prototyping	Behavior prototyping

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

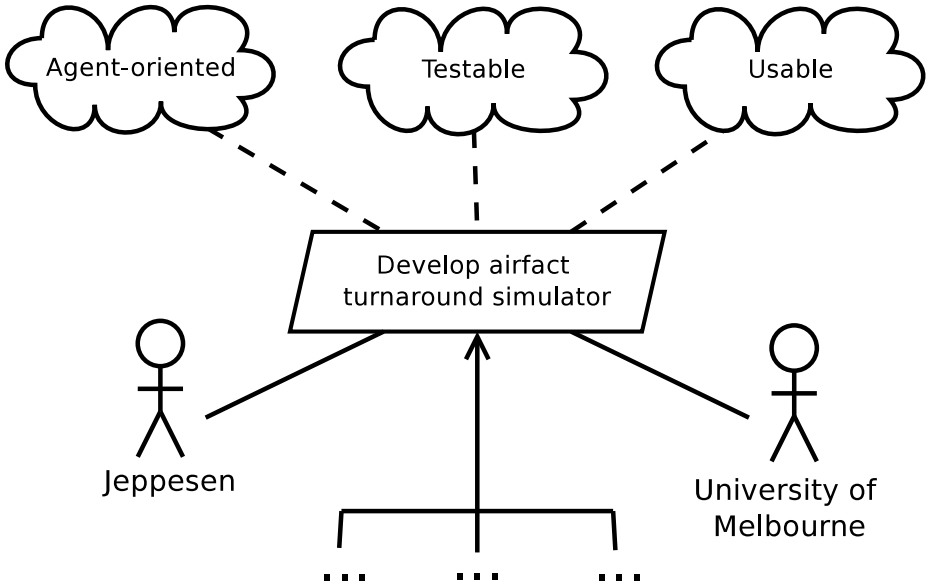
Goal model

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

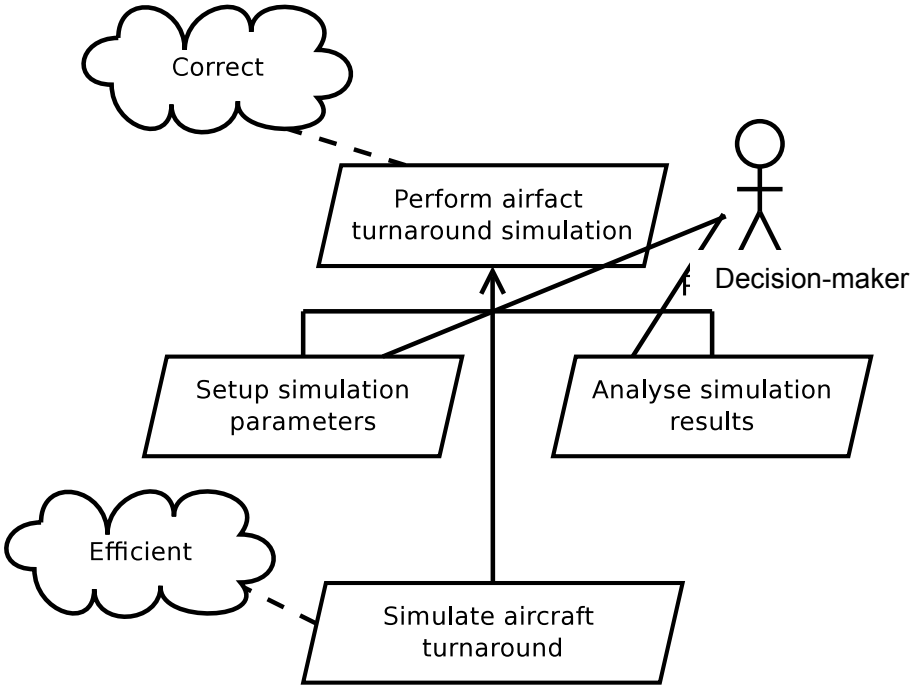
Notation for goal models

Symbol	Meaning
	**(Functional) Goal:** **To-Do goal**
	**Quality Goal:** **To-Be goal**
	**Quality Goal:** **To-Feel goal**
	**Role**
———————	**Relationship between goals**
- - - - - - - - -	**Relationship between goals and quality goals**

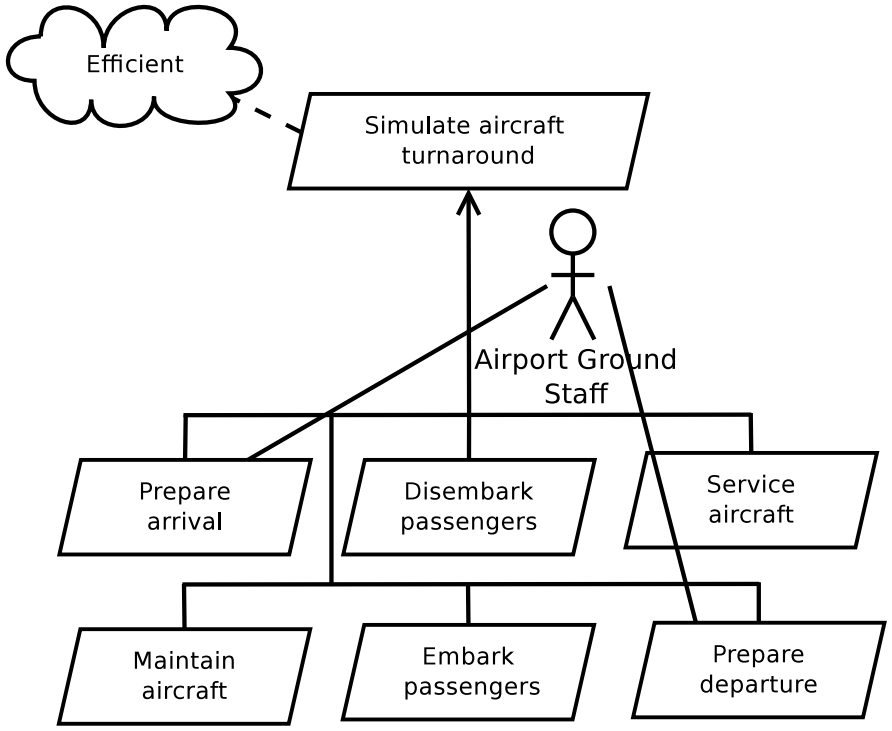
An excerpt of the project motivation model



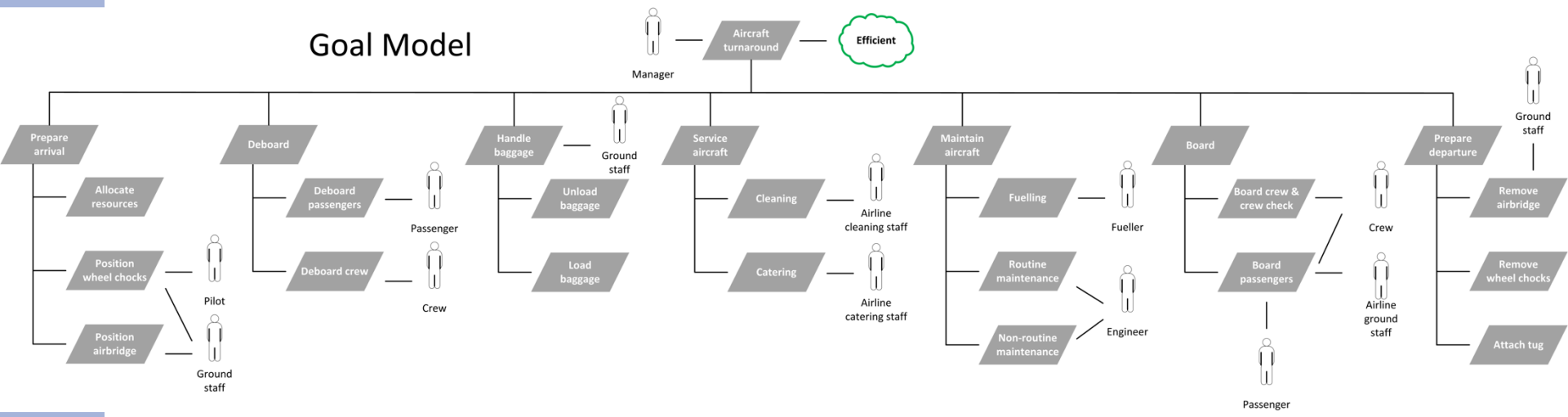
High-level motivation model for the ATS



High-level motivation model for the aircraft turnaround process



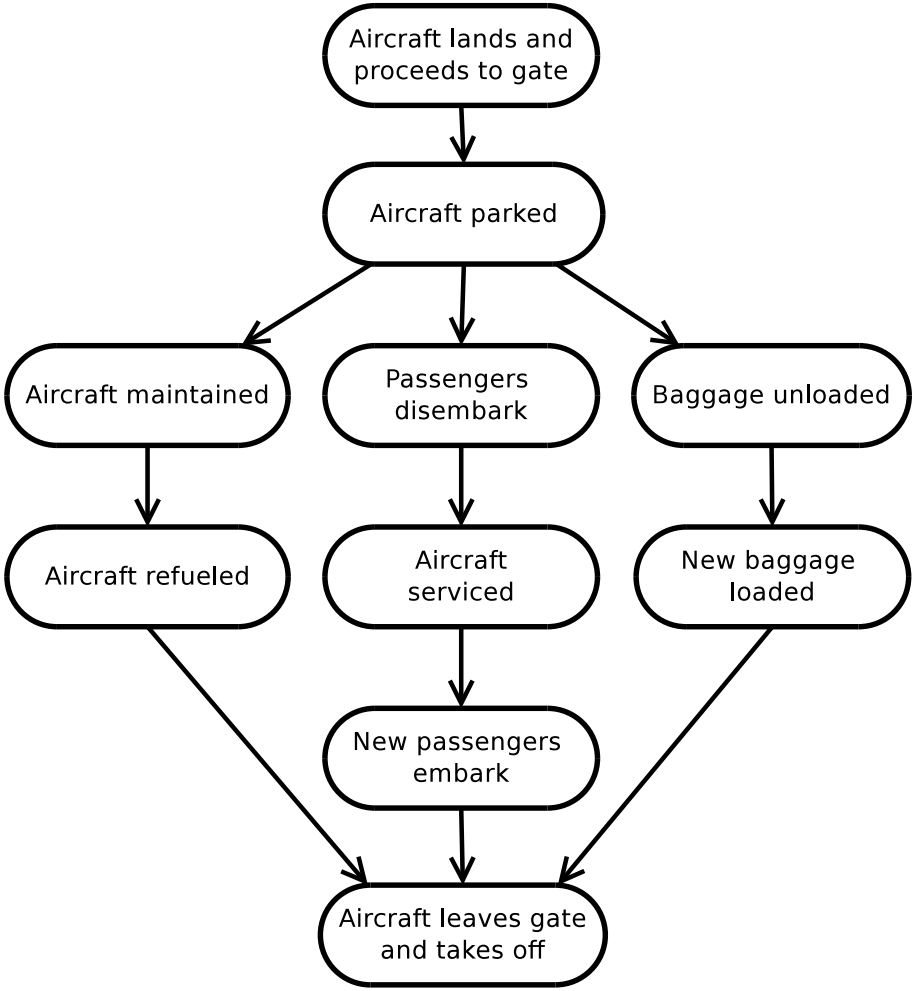
Goal model


Goal Model
Manager
Aircraft turnaround
Efficient
Prepare arrival
Allocate resources
Position wheel chocks
Position airbridge
Pilot
Ground staff
Deboard
Deboard passengers
Deboard crew
Passenger
Crew
Handle baggage
Ground staff
Unload baggage
Load baggage
Service aircraft
Cleaning
Catering
Airline cleaning staff
Airline catering staff
Maintain aircraft
Fuelling
Routine maintenance
Non-routine maintenance
Fueller
Engineer
Board
Board crew & crew check
Board passengers
Crew
Airline ground staff
Passenger
Prepare departure
Ground staff
Remove airbridge
Remove wheel chocks
Attach tug

The Viewpoint Framework

	Viewpoint aspect		
Abstraction layer	Interaction	Information	Behavior
Analysis	Role models and organization model	Domain model	Goal models and **motivational scenarios**
Design	Agent models, acquaintance model, and interaction models	Agent knowledge model	Scenarios and agent behavior models
Prototyping	Interaction prototyping	Information prototyping	Behavior prototyping

High-level motivational scenario



Part IV

ROLE AND ORGANIZATION MODELLING

The Viewpoint Framework

	Viewpoint aspect		
Abstraction layer	Interaction	Information	Behavior
Analysis	**Role models** and organization model	Domain model	Goal models and motivational scenarios
Design	Agent models, acquaintance model, and interaction models	Agent knowledge model	Scenarios and agent behavior models
Prototyping	Interaction prototyping	Information prototyping	Behavior prototyping

Role model

- Role models are orthogonal to goal models
- A role model consists of the following four elements to describe the role:
  - Role name: A name identifying the role
  - Description: A textual description of the role
  - Responsibilities: A list of responsibilities that the agent playing the role must perform in order for a set of goals and their associated quality goals to be achieved
  - Constraints: A list of conditions that the agent playing the role must take into consideration when exercising its responsibilities

Role models: Pilot

Role ID: R1

Name: Pilot

Description: The pilot is a person who operates an aircraft and directs the airline staff, including the crew.

Responsibilities:

1. Operate aircraft
2. Direct airline staff
3. Indicate when aircraft is in position to initiate turnaround

Constraints:

1. N/A

Role models: Crew

Role ID: R2

Name: Crew

Description: The crew directs and provides services to passengers.

Responsibilities:

1. Instruct passengers to embark the aircraft
2. Instruct passengers to disembark the aircraft
3. Check cabin service

Constraints:

1. N/A

Goal Model: Manager

Role ID: R6

Name: Manager

Description: The manager is responsible for allocating resources and coordinating staff.

Responsibilities:

1. Coordinate airport staff
2. Allocate resources

Constraints:

1. N/A

Role model: Ground staff

Name: Ground staff

Description: The ground staff prepares the aircraft for arrival and departure, and loads and unloads the baggage.

Responsibilities:

1. Load baggage
2. Unload baggage
3. Position airbridge
4. Remove airbridge
5. Position wheel chocks
6. Remove wheel chocks
7. Attach tug

Constraints:

1. N/A

Role model: Passenger

Role ID: R10

Name: Passenger

Description: The passenger is a person who embarks and disembarks the aircraft to fly between destinations.

Responsibilities:

1. Board the aircraft
2. Disembark the aircraft

Constraints:

1. Check-in on time
1. Cooperate with the crew and airline ground staff

The Viewpoint Framework

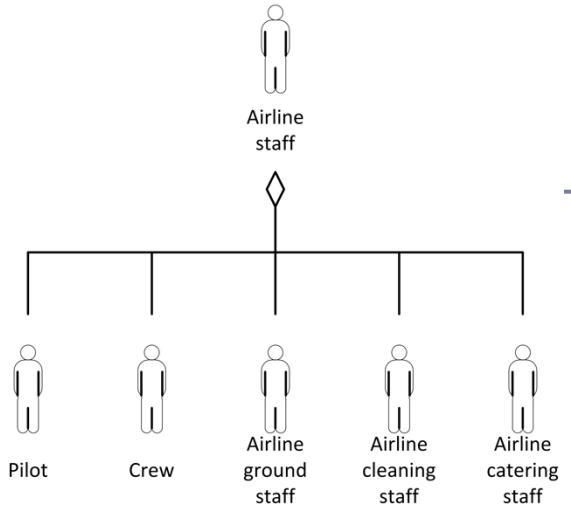
	Viewpoint aspect		
Abstraction layer	Interaction	Information	Behavior
Analysis	Role models and **organization model**	Domain model	Goal models and motivational scenarios
Design	Agent models, acquaintance model, and interaction models	Agent knowledge model	Scenarios and agent behavior models
Prototyping	Interaction prototyping	Information prototyping	Behavior prototyping

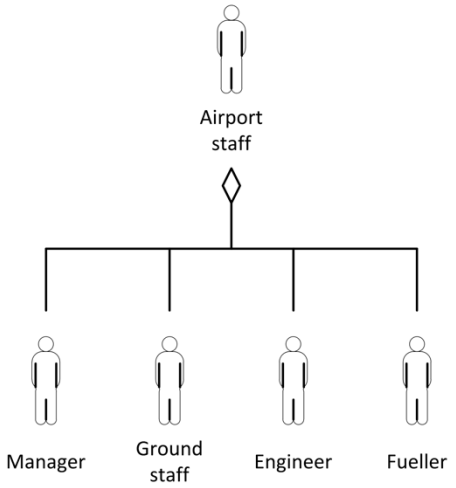
The organization model

- The model that represents relationships between the roles of the socio-technical system
- There can be different types of organizational relationships:
  - Is controlled by
    - Between a „boss“ and his subordinates
  - Is benevolent to
    - Between self interested roles
  - Is peer to
    - Between equal roles
  - Is dependent for resource
  - …

Organisation model: Aggregation

Aggregation relationships

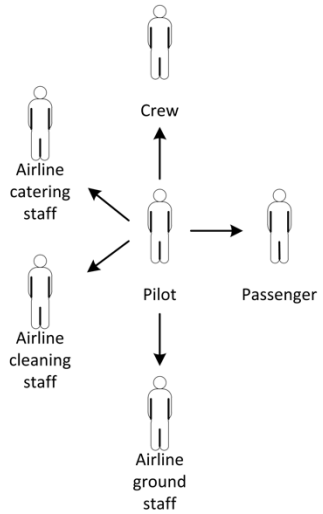


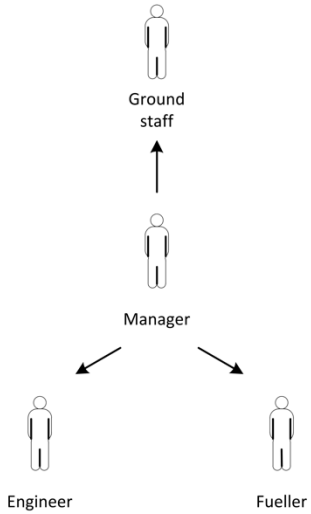


Organisation Model

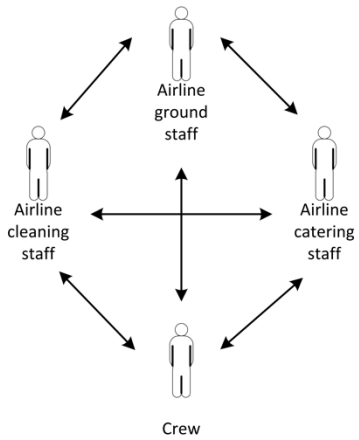
Organi-sation model

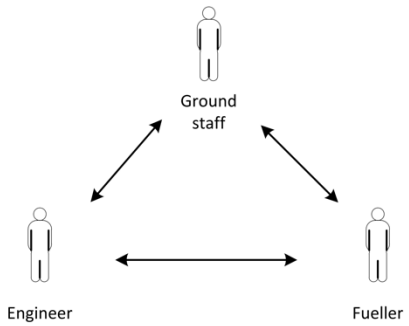
Control relationships





Peer relationships





The Viewpoint Framework

	Viewpoint aspect		
Abstraction layer	Interaction	Information	Behavior
Analysis	Role models and organization model	**Domain model**	Goal models and motivational scenarios
Design	Agent models, acquaintance model, and interaction models	Agent knowledge model	Scenarios and agent behavior models
Prototyping	Interaction prototyping	Information prototyping	Behavior prototyping

Concept for domain models

- Domain entity

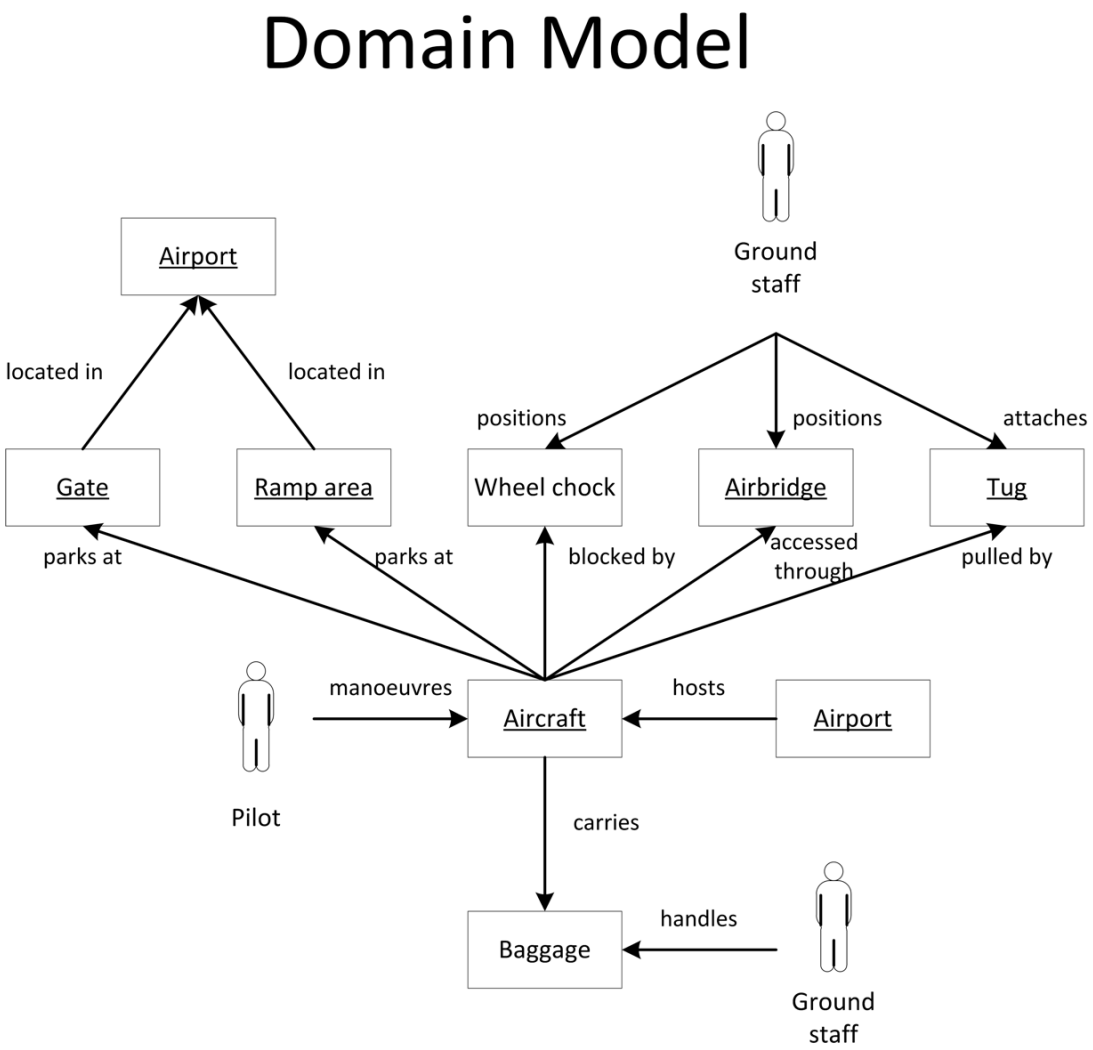
What is domain entity?

- A modular unit of knowledge handled by a sociotechnical system
- Examples

Domain model

- Domain model represents the knowledge within the system that the system is supposed to handle
- A domain model consists of domain entities and relationships between them. A domain entity is ? A domain model relates domain entities to roles

Domain model



Part VI

DECIDING SOFTWARE AGENTS

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	Agent knowledge model	Scenarios and agent behavior models
Prototyping	Interaction prototyping	Information prototyping	Behavior prototyping

Agents

- We now need to decide the types of components – agents – of the sociotechnical system
- Why agents?
  - Proactivity
  - Reactivity
  - Social nature

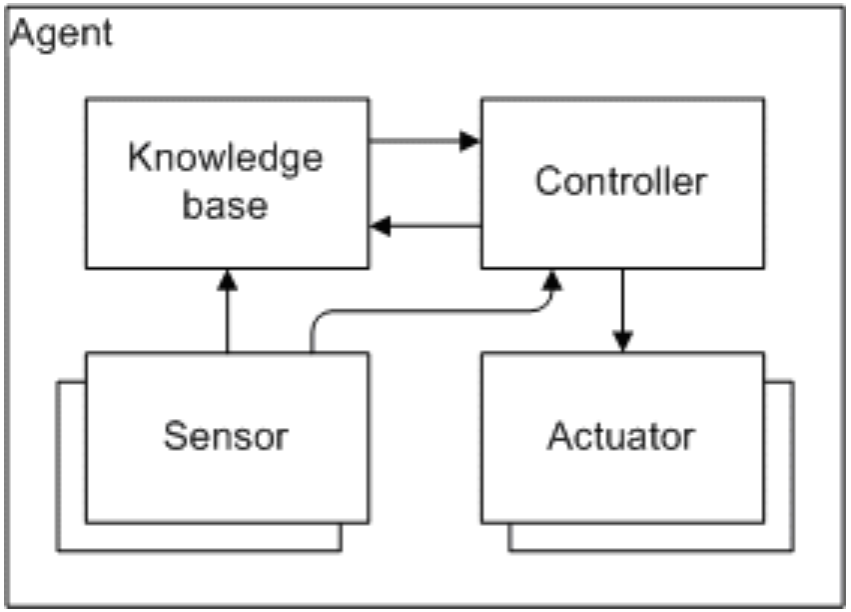
What is agent?

- An active entity as opposed to a passive entity
- An entity that can act in the environment, perceive events, and reason
- An entity that acts on behalf of someone or somebody

Agent

- Agent is an entity that perceives and affects its environment and performs reasoning
- Agent is:
  - reactive;
  - proactive;
  - social.
- Agent interacts in an asynchronous way

The abstract agent architecture



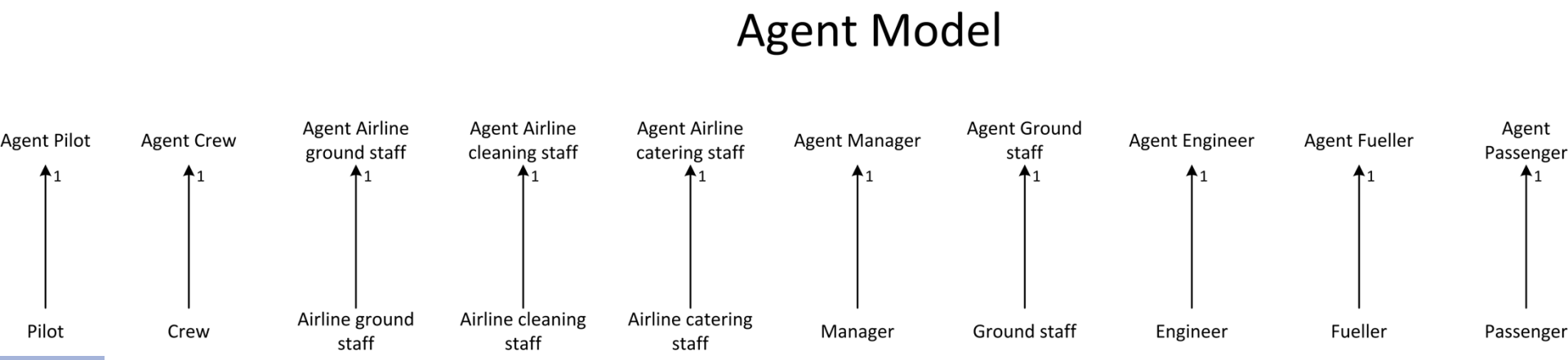
The execution loop of an abstract agent

while *the agent is unfulfilled* ***do***
sense the environment;
update the knowledge base;
reason;
choose actions;
act;
end while

Agent model

- The purpose of an agent model is to map roles to agents of specific types

Agent model


Agent Model
Agent Pilot
1
Pilot
Agent Crew
1
Crew
Agent Airline ground staff
1
Airline ground staff
Agent Airline cleaning staff
1
Airline cleaning staff
Agent Airline catering staff
1
Airline catering staff
Agent Manager
1
Manager
Agent Ground staff
1
Ground staff
Agent Engineer
1
Engineer
Agent Fueller
1
Fueller
Agent Passenger
1
Passenger

Part III

MODELLING „WHO GOES WITH WHOM?“

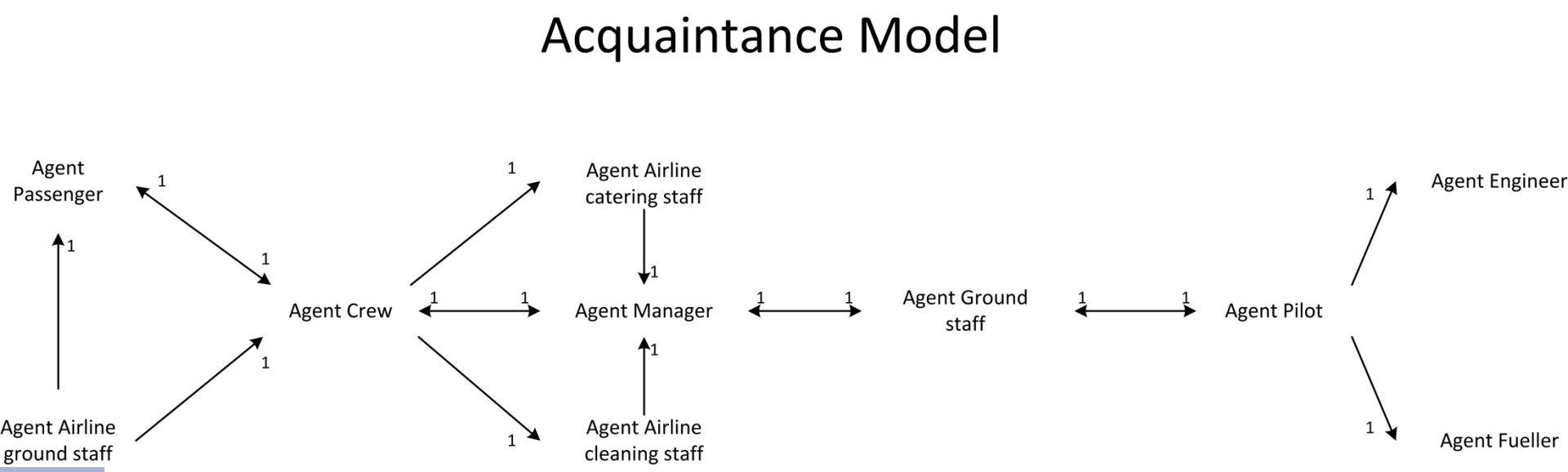
The Viewpoint Framework

	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	Agent knowledge model	Scenarios and agent behavior models
Prototyping	Interaction prototyping	Information prototyping	Behavior prototyping

Acquaintance model

- The acquaintance model complements the agent model by outlining interaction pathways between the agents of the system

Acquaintance model



Part III

MODELLING AGENT INTERACTIONS

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**	Agent knowledge model	Scenarios and agent behavior models
Prototyping	Interaction prototyping	Information prototyping	Behavior prototyping

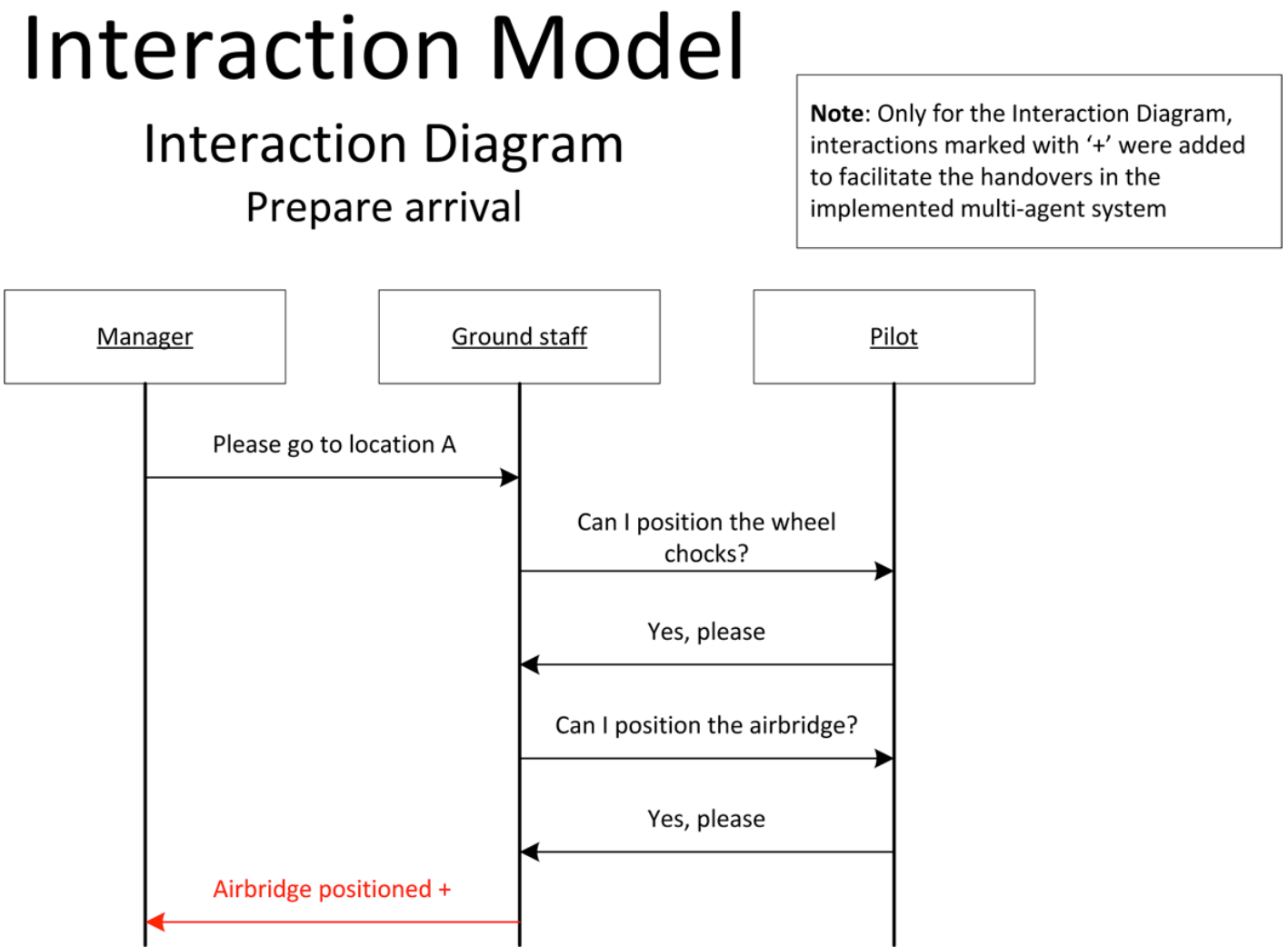
Interaction model

- Represents an interaction pattern between agents
- Is based on responsibilities defined for the corresponding roles

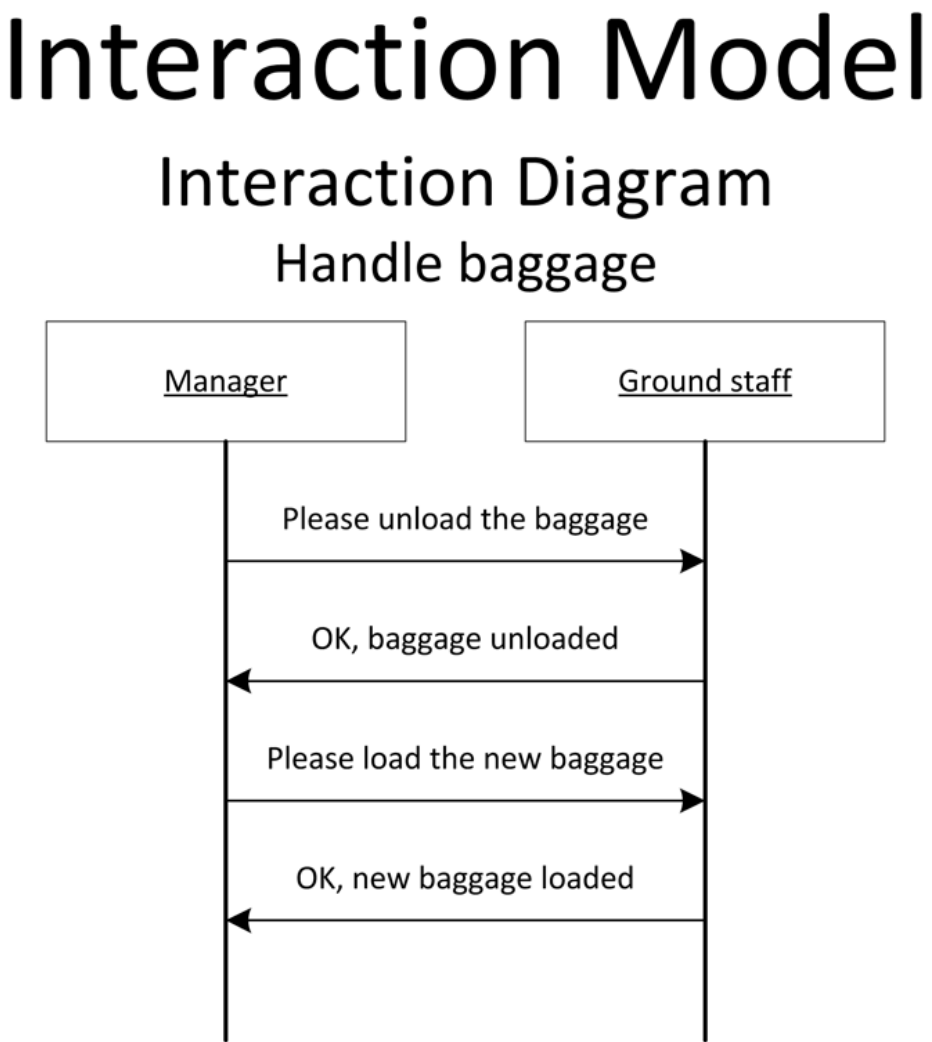
Two kinds of interaction models

- Pure interaction models
- Protocol models

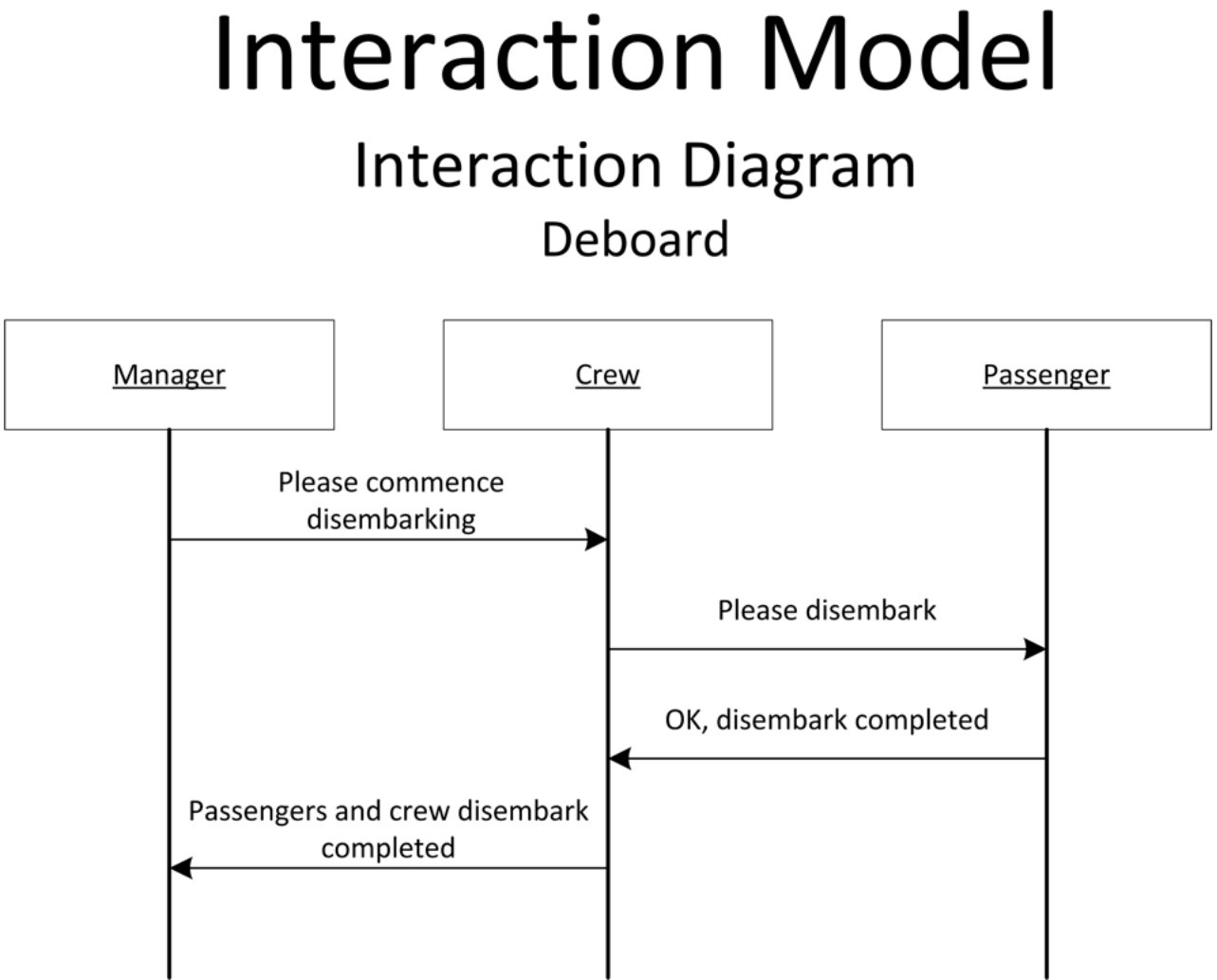
Interaction diagram: Prepare arrival



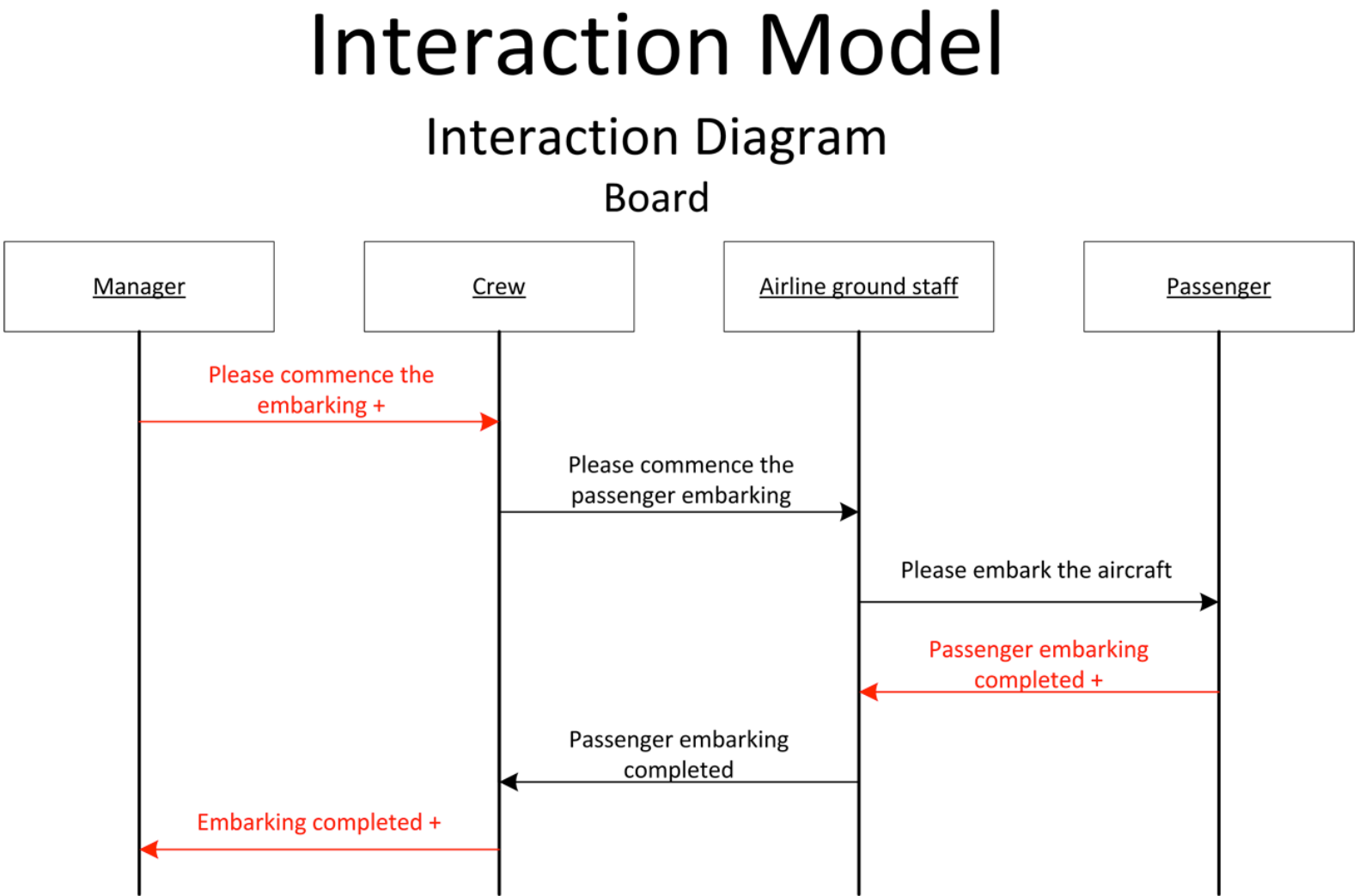
Interaction diagram: Handle baggage



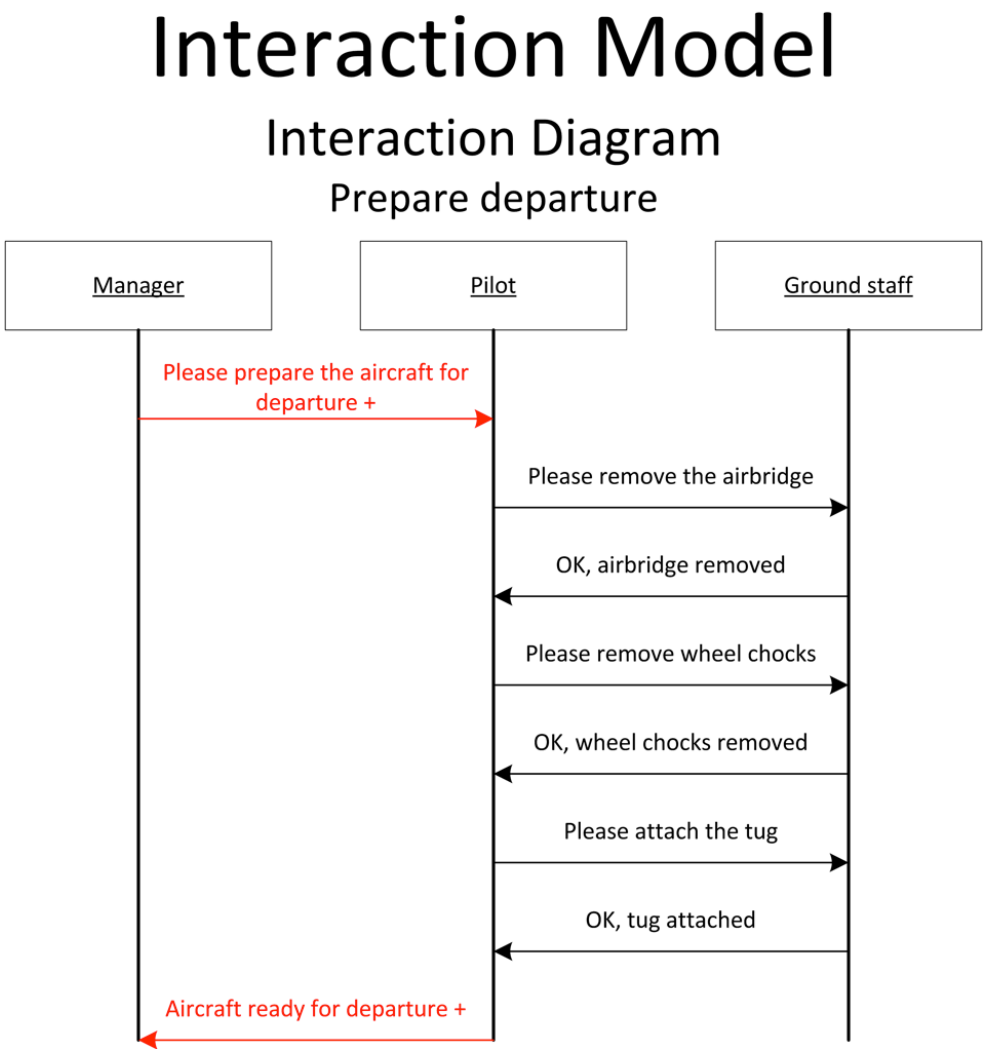
Interaction diagram: Deboard



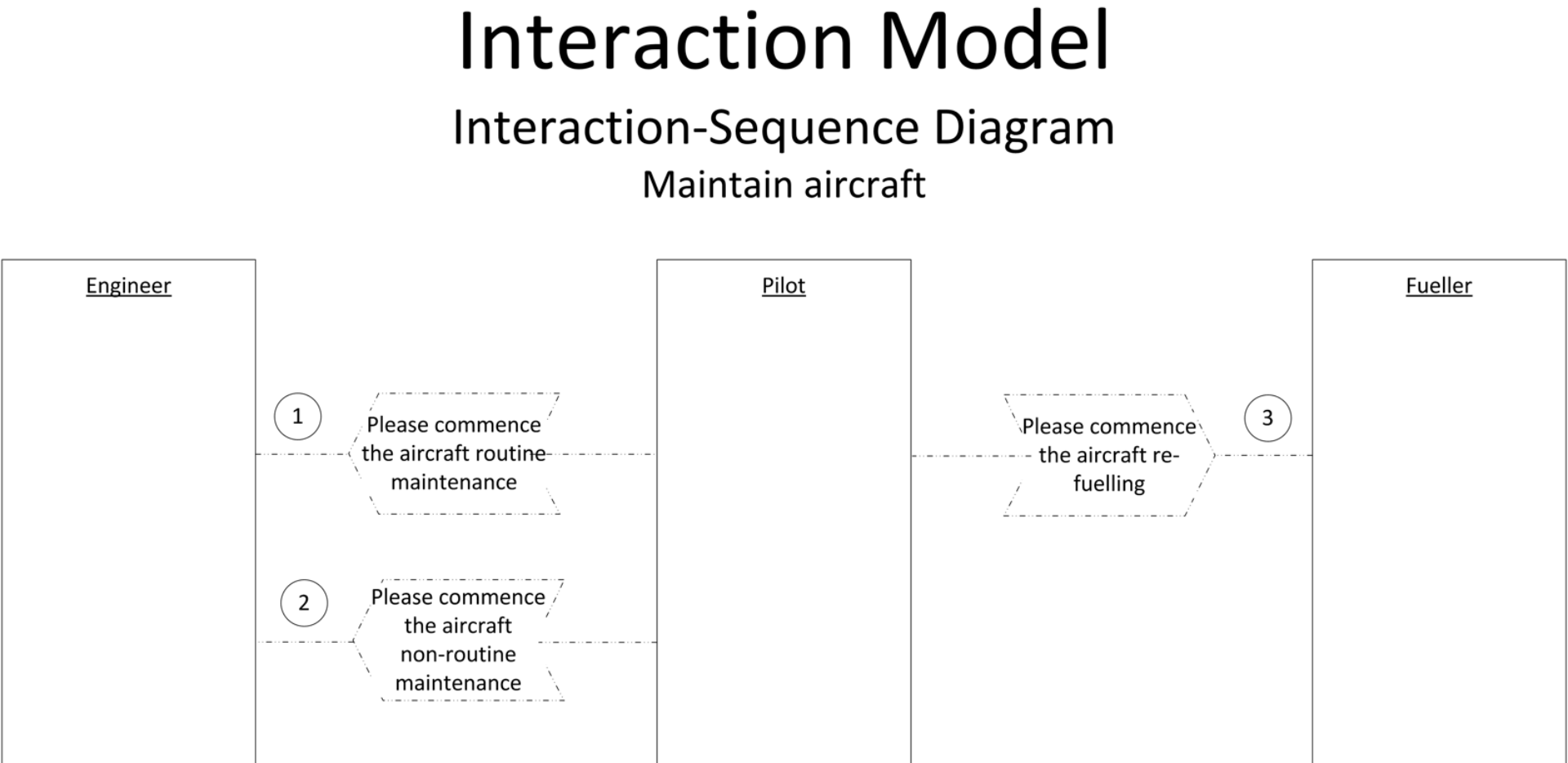
Interaction diagram: Board



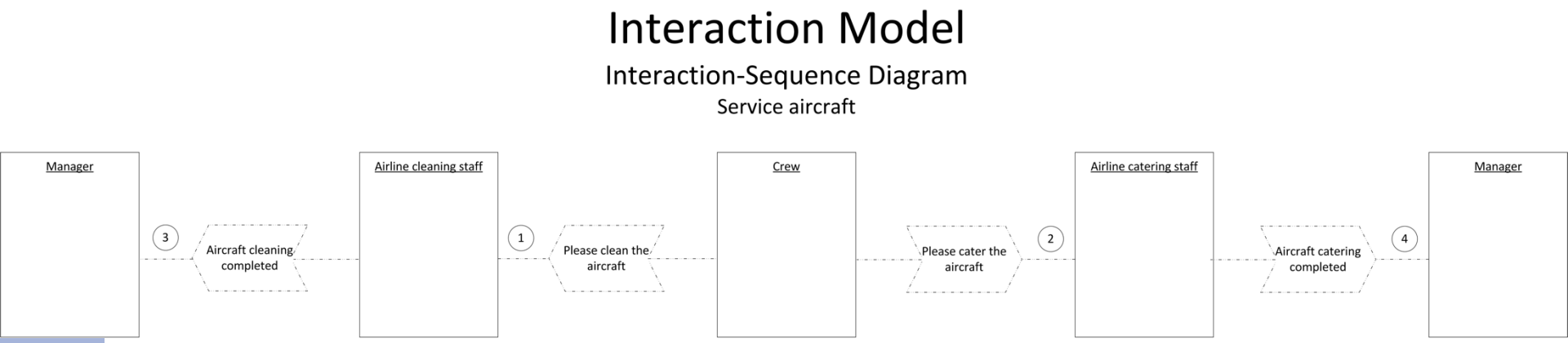
Interaction diagram: Prepare departure



Interaction sequence diagram: Maintain aircraft



Interaction sequence diagram: Service aircraft

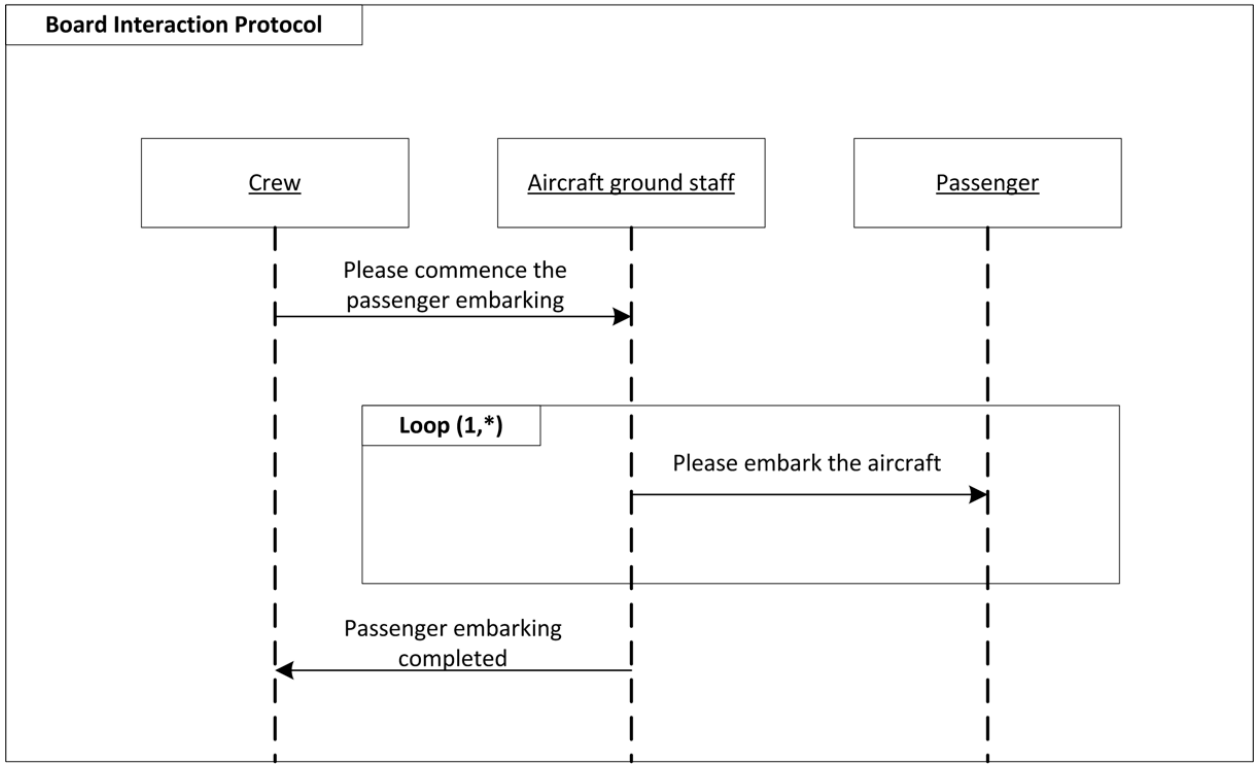


Interaction protocol: Board

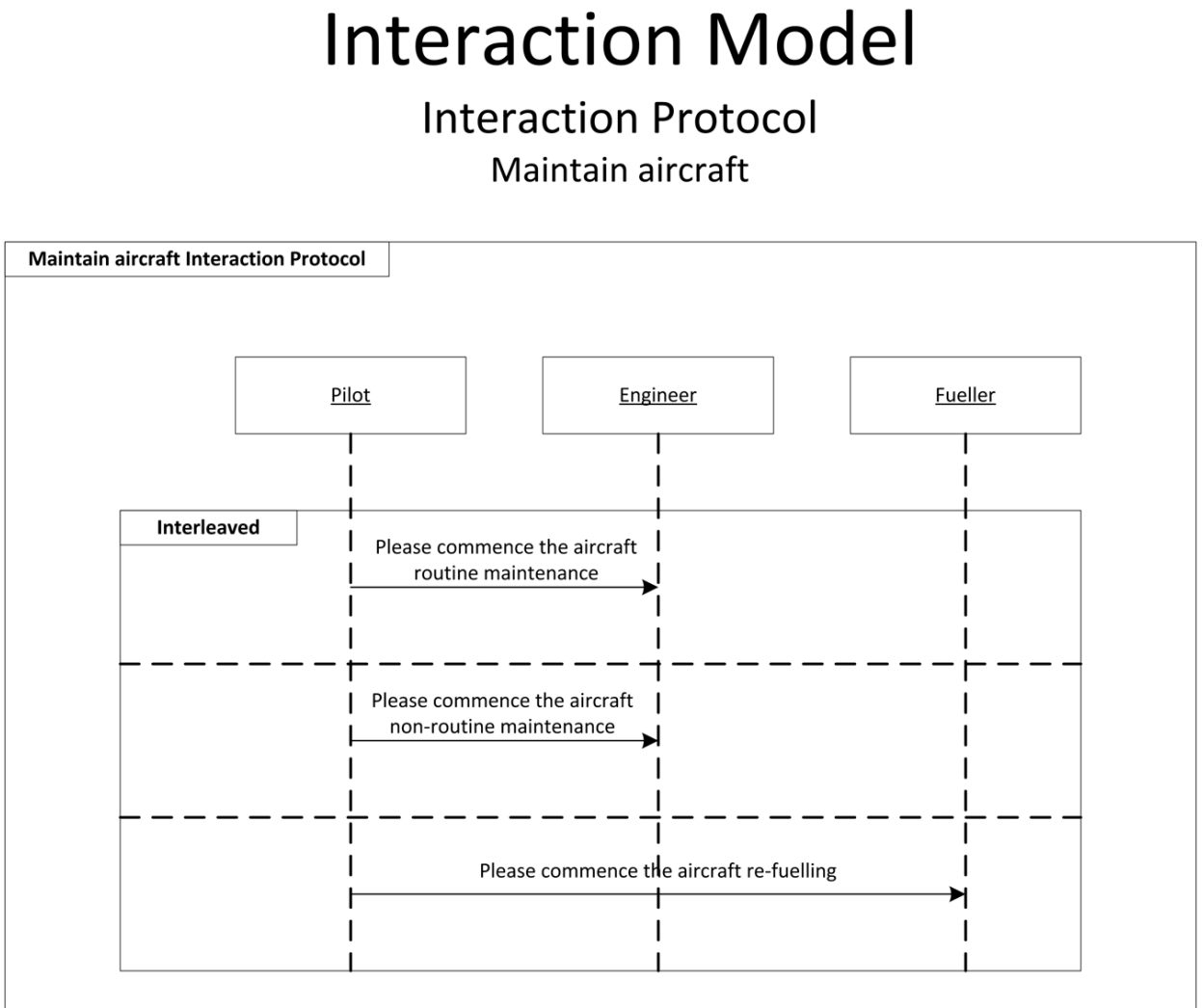
Interaction Model

Interaction Protocol

Board



Interaction protocol: Maintain aircraft



Part III

MODELLING THE KNOWLEDGE BY AGENTS

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	**Agent knowledge model**	Scenarios and agent behavior models
Prototyping	Interaction prototyping	Information prototyping	Behavior prototyping

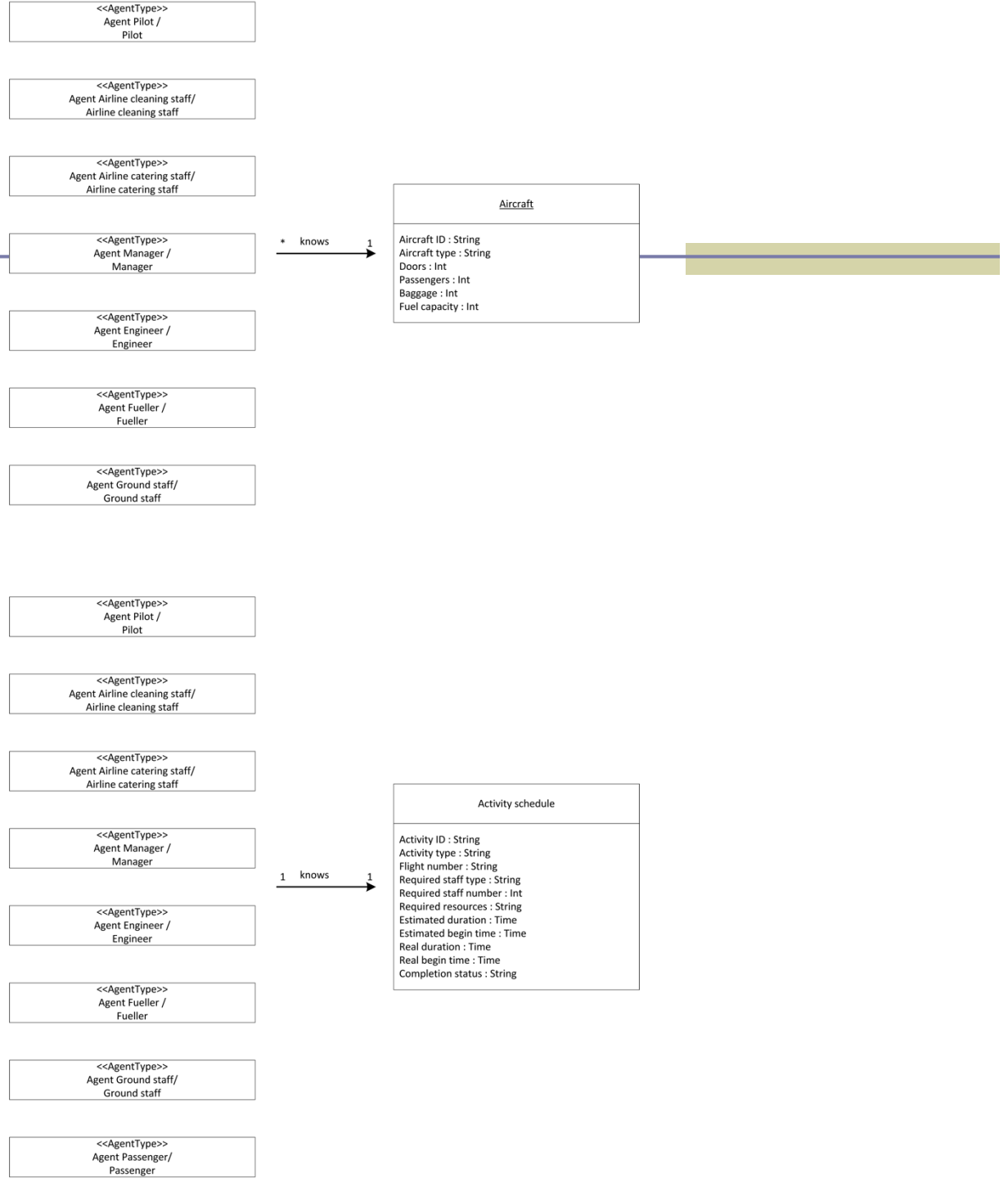
Agent knowledge model

- Elaborates the domain model
- Represents the knowledge that the agents of the system have about their environment and themselves
- Can be viewed as an ontology providing a common framework of knowledge for the agents

Knowledge Model

UML-like notation

Knowledge model 2



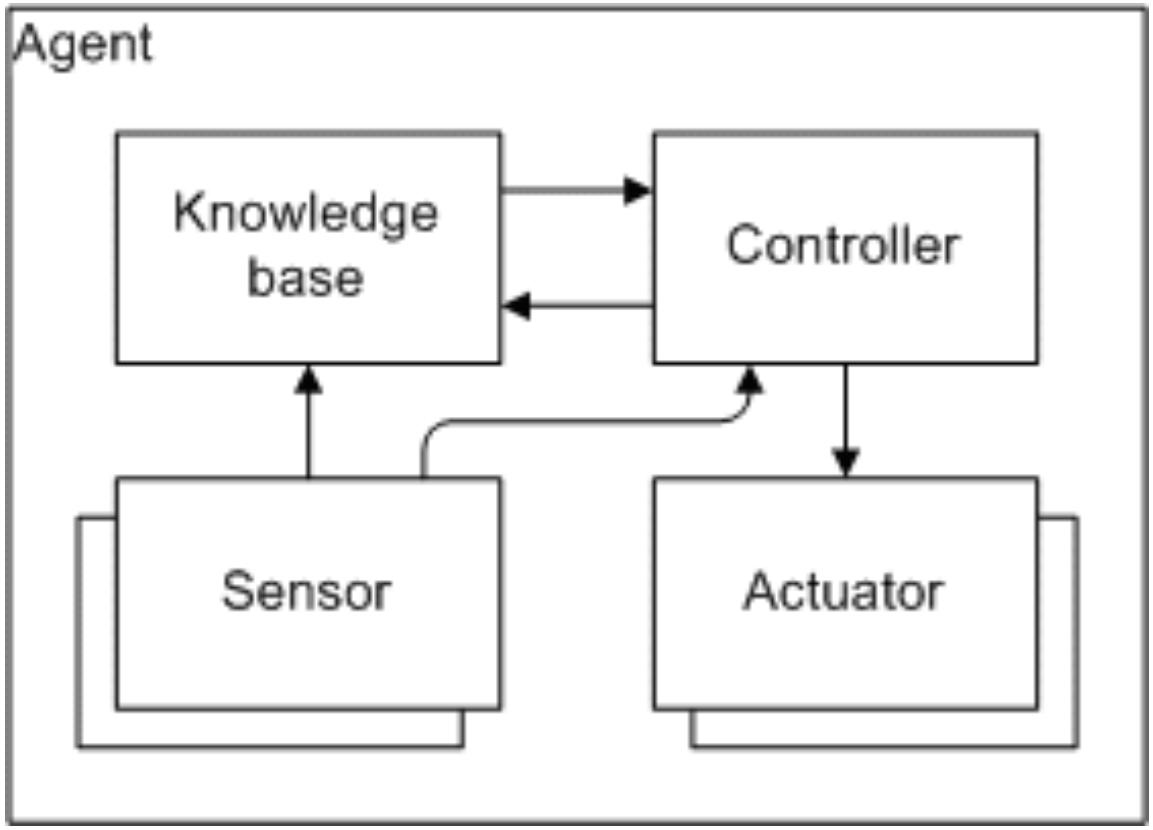
The Viewpoint Framework

	Viewpoint aspect		
Abstraction layer	Interaction	Information	Behavior
Analysis	Role models and organization model	Environment model and domain knowledge model	Goal models
Design	Agent models, acquaintance model, and interaction models	Knowledge model	Scenarios and **agent behavior models**
Prototyping	Interaction prototyping	Information prototyping	Behavior prototyping

Agent behaviour model

- Agent behaviour model addresses what an individual agent does

The abstract agent architecture revisited

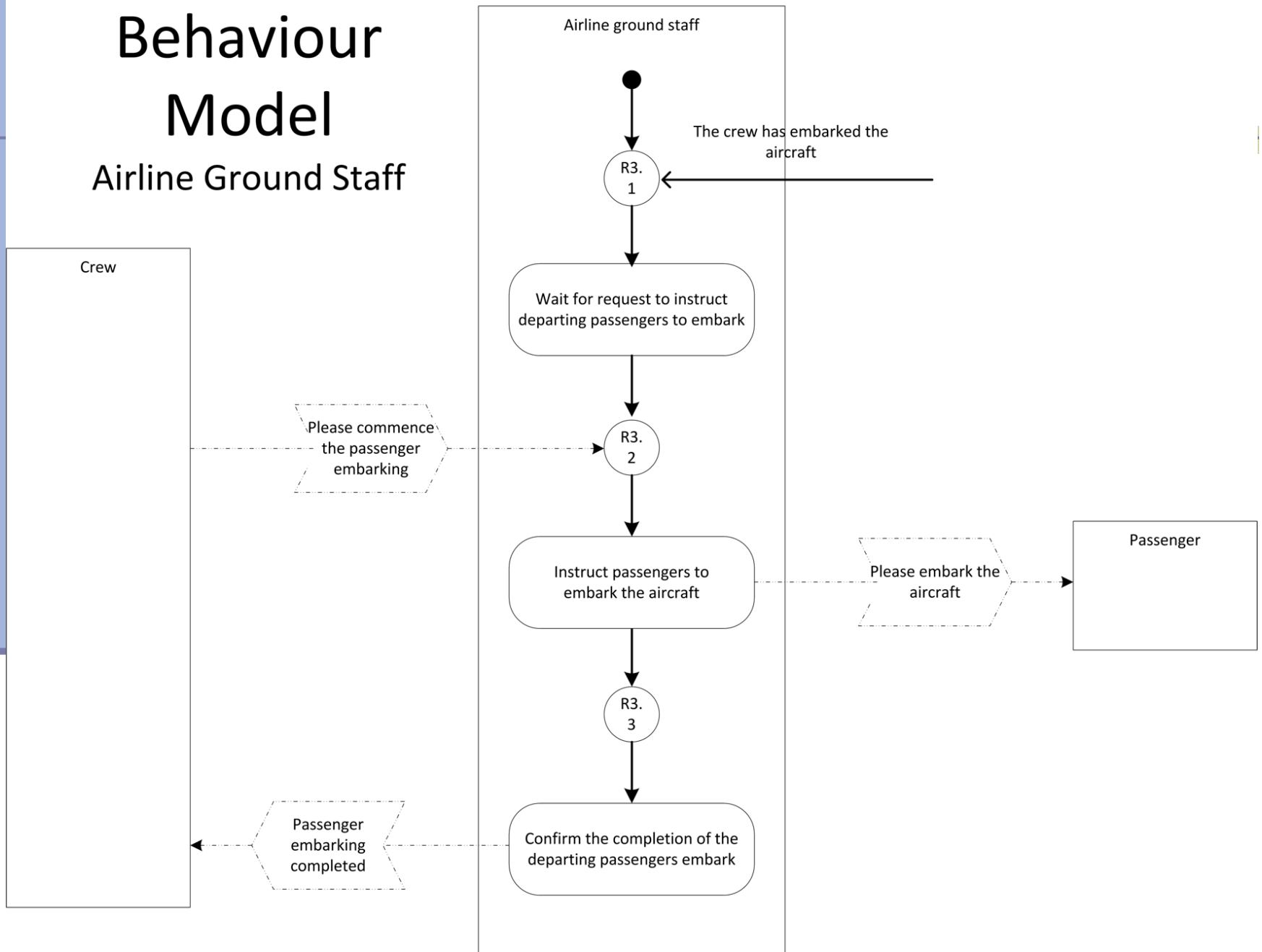


The execution loop of an abstract agent

while *the agent is unfulfilled* ***do***
sense the environment;
update the knowledge base;
reason;
choose actions;
act;
end while

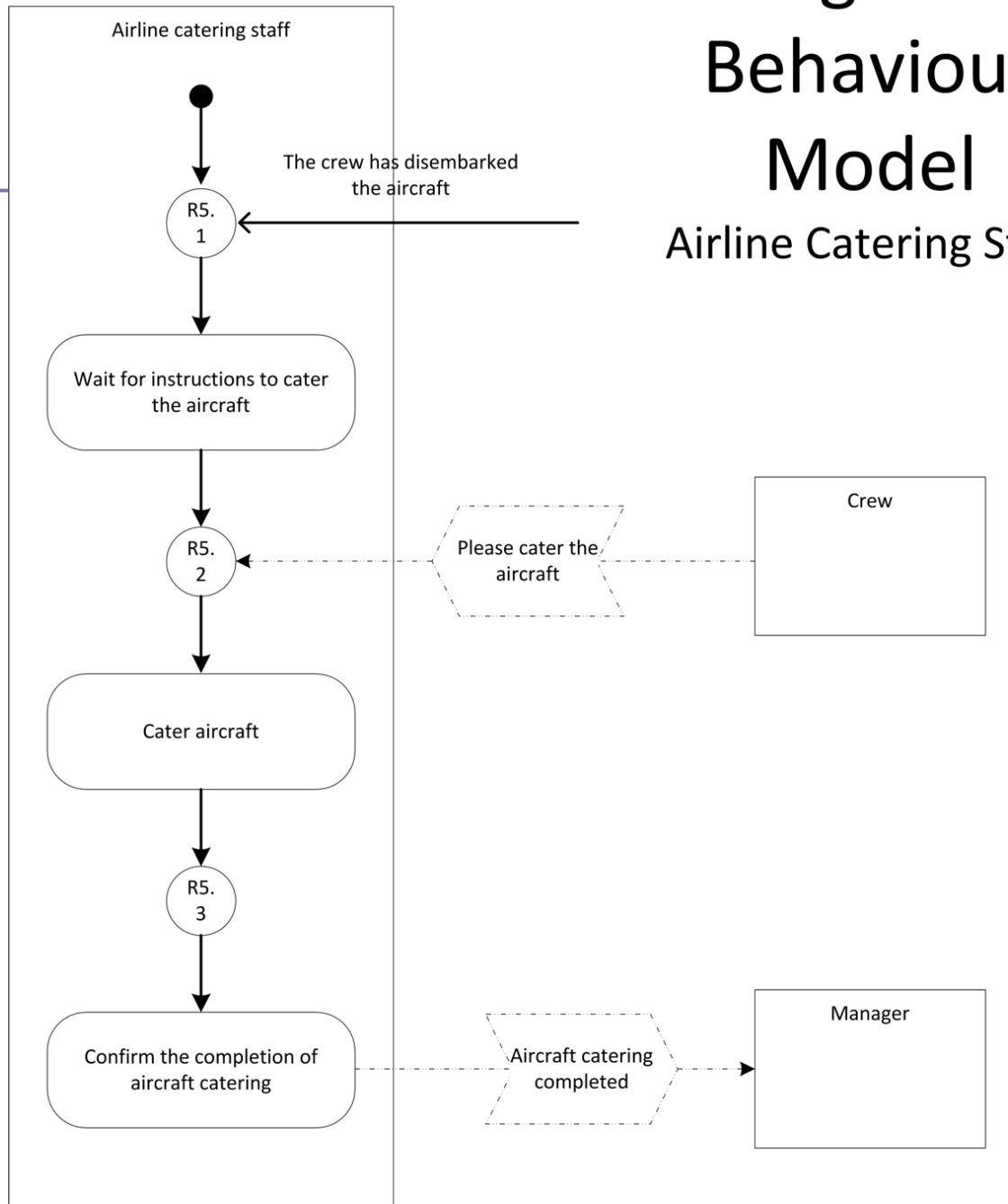
Agent Behaviour Model

Airline Ground Staff



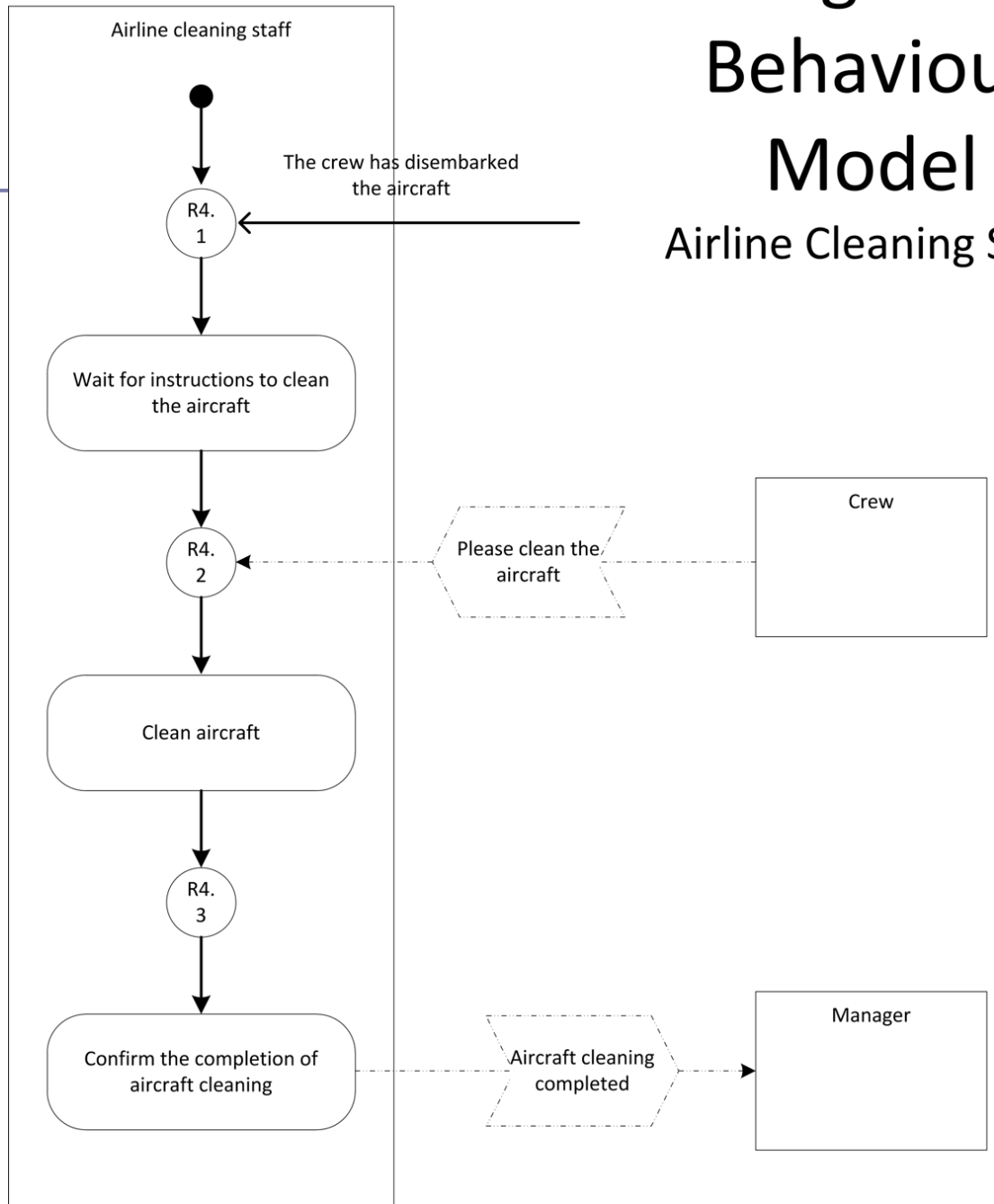
Agent Behaviour Model

Airline Catering Staff



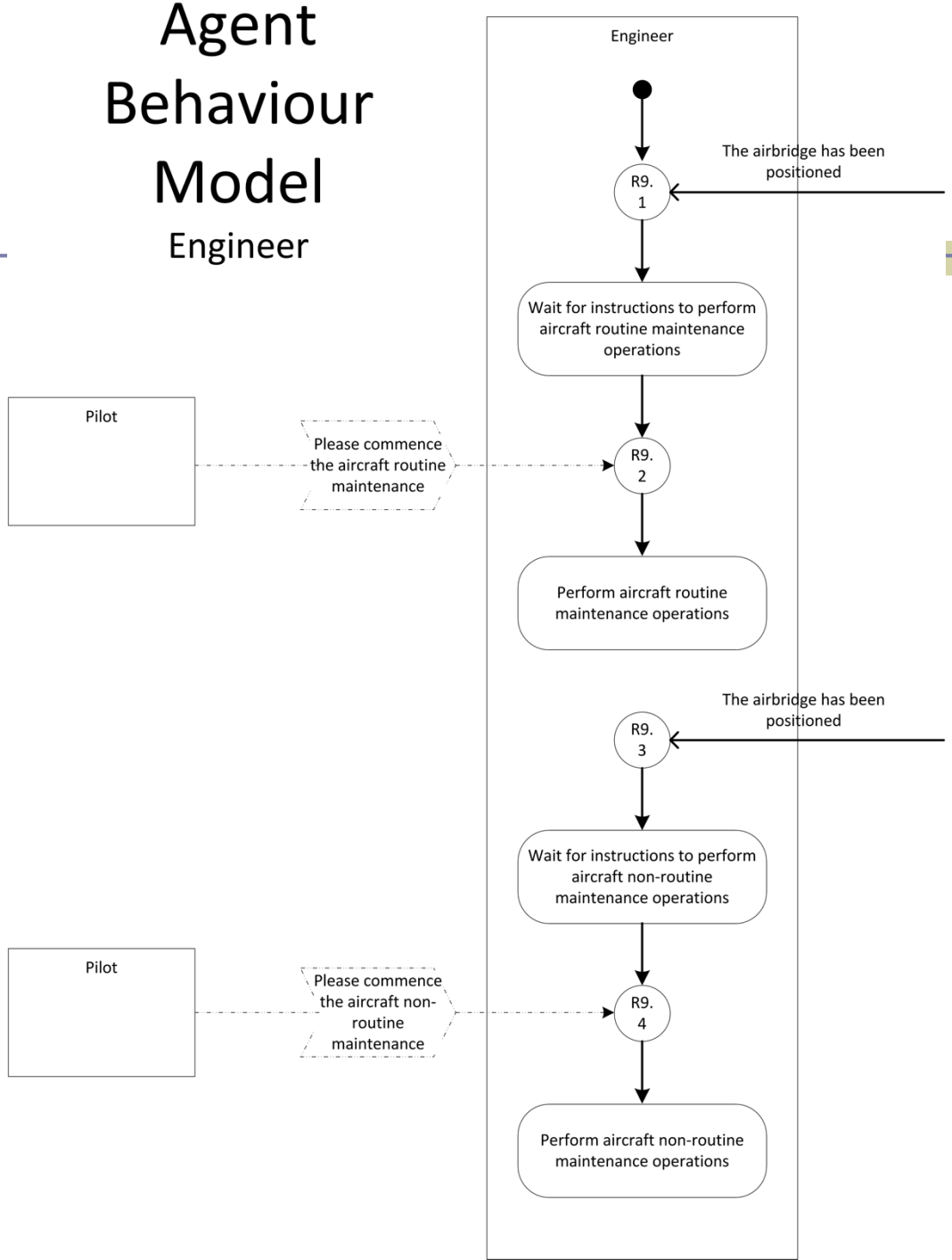
Agent Behaviour Model

Airline Cleaning Staff



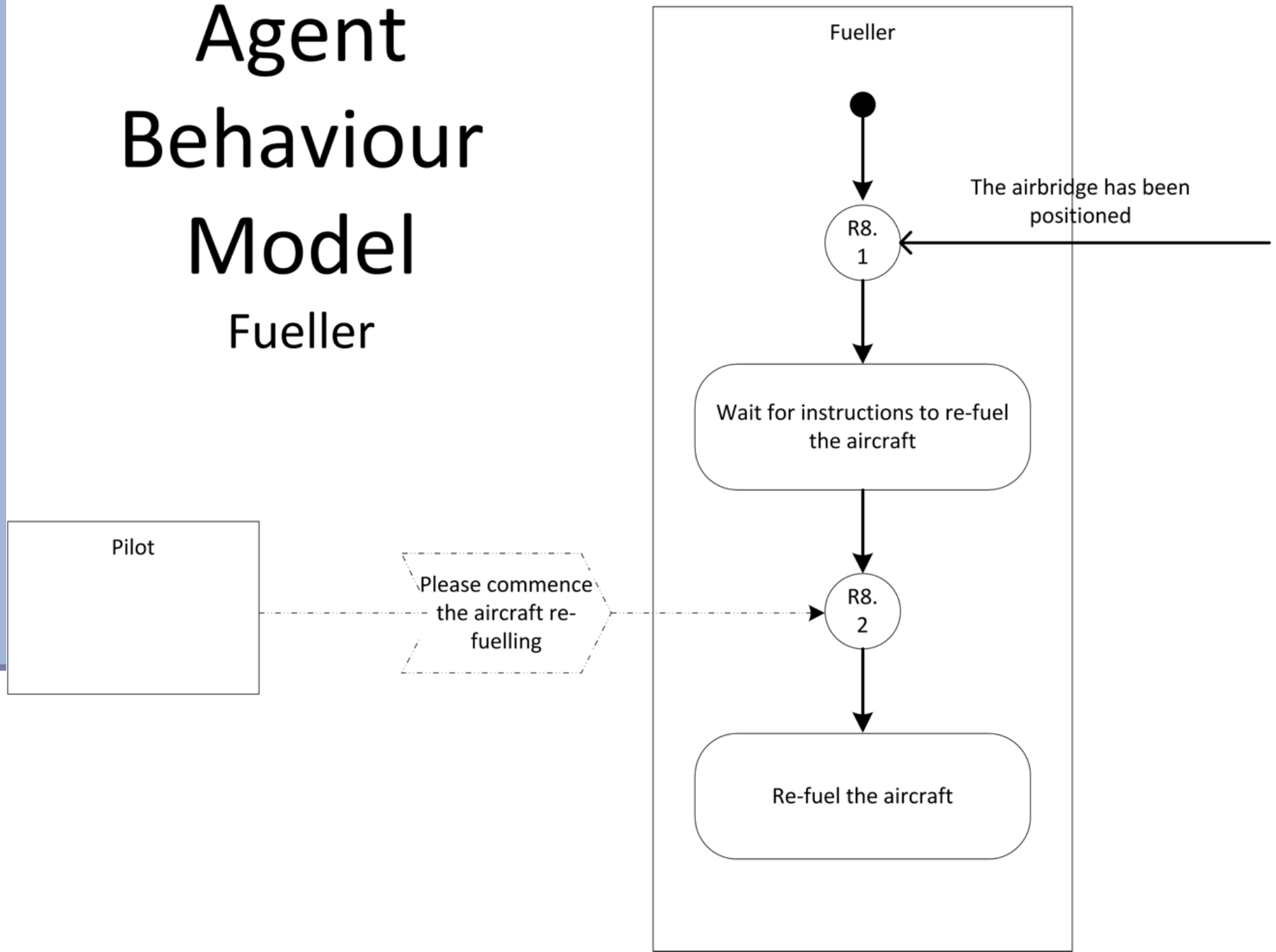
Agent Behaviour Model

Engineer



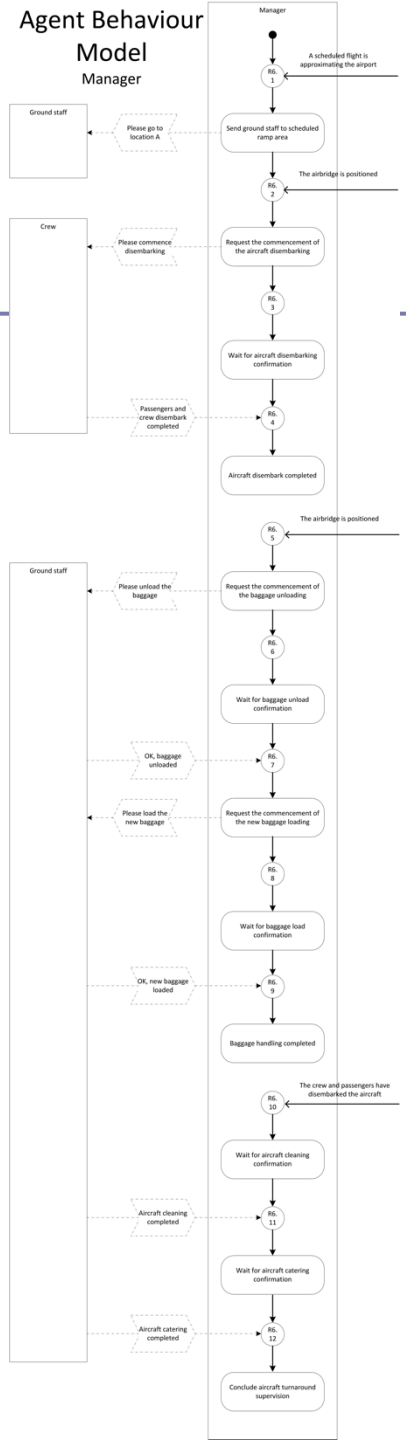
Agent Behaviour Model

Fueller



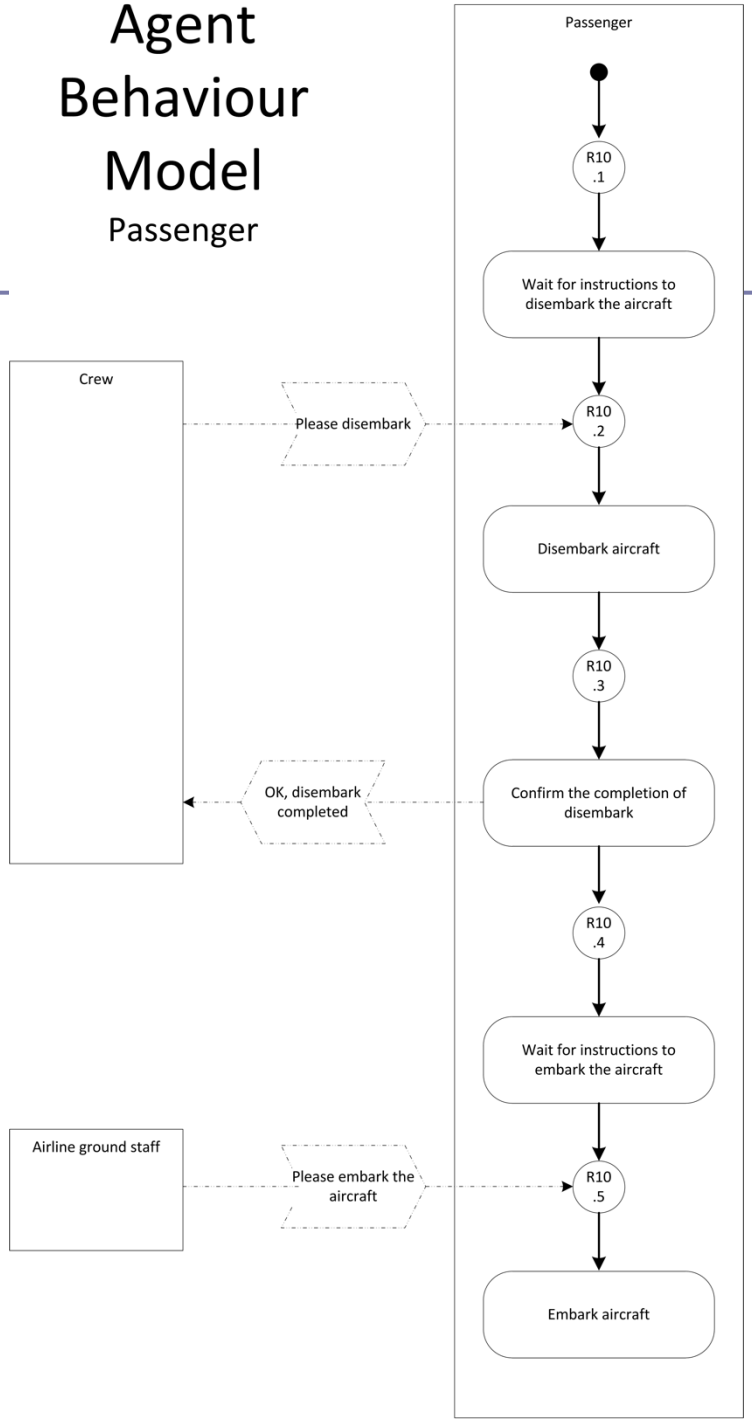
Agent Behaviour Model

Manager



Agent Behaviour Model

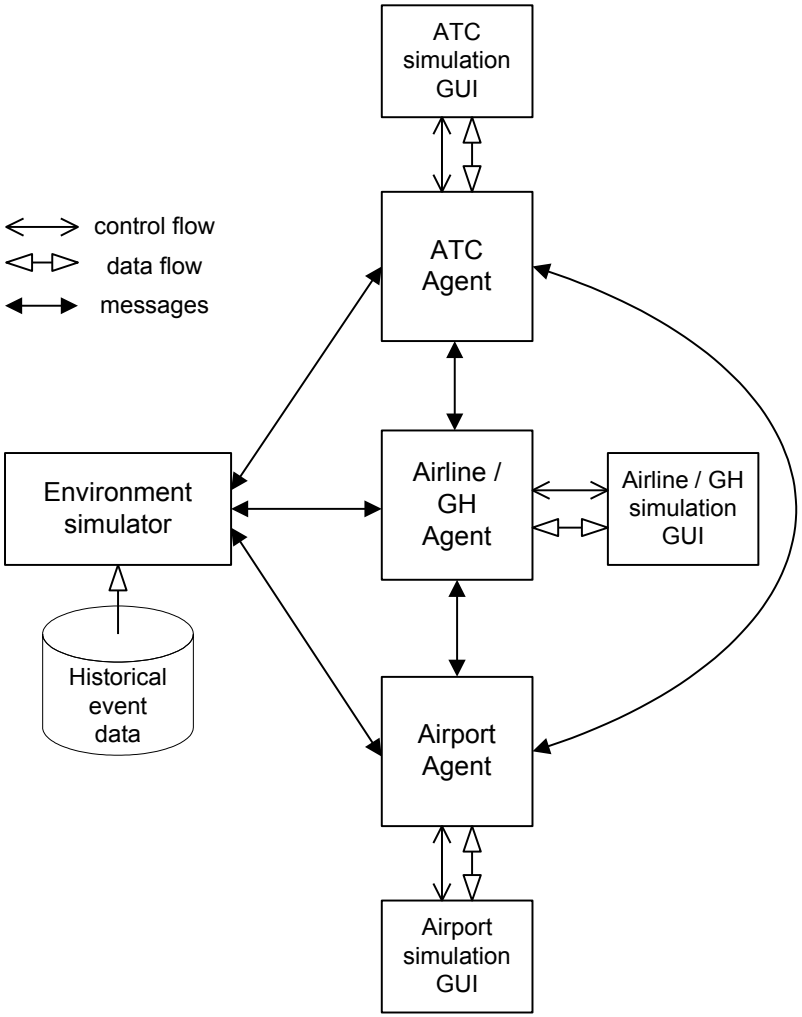
Passenger



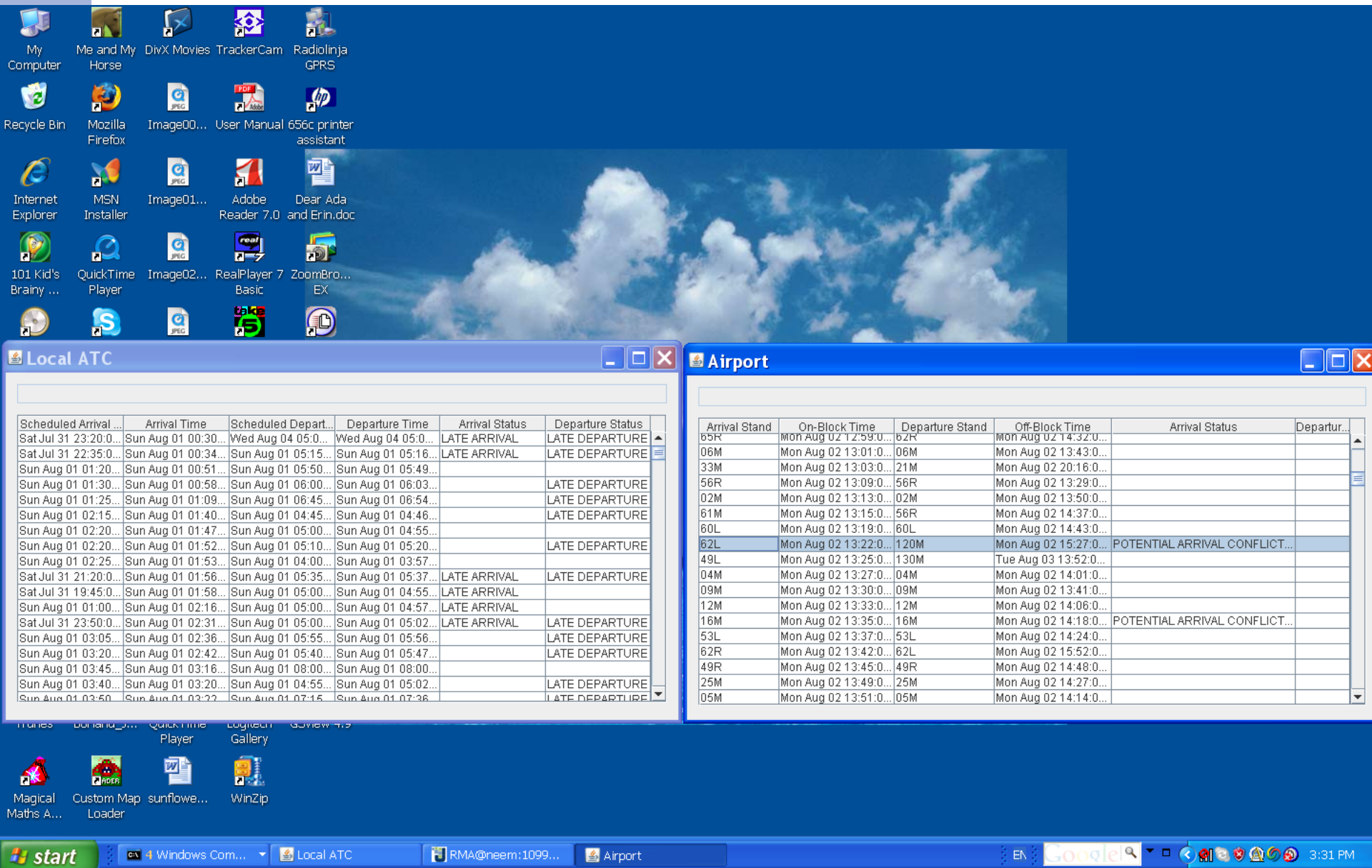
Prototyping

- A prototype by a third-year undergraduate software engineering student at the University of Melbourne, Australia, with no previous experience in agent-oriented software engineering
- A Master's thesis by a M.Sc. student from Tallinn University of Technology, Estonia, who is an air-traffic controller studying software engineering, and had undertaken one subject on agent-oriented modelling
- A visiting scholar to the University of Melbourne, Australia, who is a software engineer with a master's degree and over ten years experience specialising in software for air-traffic control, but with no previous experience with agent-oriented software engineering.

Simulation environment



Simulation


My Computer
Me and My Horse
DivX Movies
TrackerCam
Radiolinja GPRS
Recycle Bin
Mozilla Firefox
Image00...
User Manual
656c printer assistant
Internet Explorer
MSN Installer
Image01...
Adobe Reader 7.0
Dear Ada and Erin.doc
101 Kid's Brainy ...
QuickTime Player
Image02...
RealPlayer 7 Basic
ZoomBro... EX
Local ATC
Scheduled Arrival ... | Arrival Time | Scheduled Depart... | Departure Time | Arrival Status | Departure Status
Sat Jul 31 23:20:0... | Sun Aug 01 00:30... | Wed Aug 04 05:0... | Wed Aug 04 05:0... | LATE ARRIVAL | LATE DEPARTURE
Sat Jul 31 22:35:0... | Sun Aug 01 00:34... | Sun Aug 01 05:15... | Sun Aug 01 05:16... | LATE ARRIVAL | LATE DEPARTURE
Sun Aug 01 01:20... | Sun Aug 01 00:51... | Sun Aug 01 05:50... | Sun Aug 01 05:49...
Sun Aug 01 01:30... | Sun Aug 01 00:58... | Sun Aug 01 06:00... | Sun Aug 01 06:03... | LATE DEPARTURE
Sun Aug 01 01:25... | Sun Aug 01 01:09... | Sun Aug 01 06:45... | Sun Aug 01 06:54... | LATE DEPARTURE
Sun Aug 01 02:15... | Sun Aug 01 01:40... | Sun Aug 01 04:45... | Sun Aug 01 04:46... | LATE DEPARTURE
Sun Aug 01 02:20... | Sun Aug 01 01:47... | Sun Aug 01 05:00... | Sun Aug 01 04:55...
Sun Aug 01 02:20... | Sun Aug 01 01:52... | Sun Aug 01 05:10... | Sun Aug 01 05:20... | LATE DEPARTURE
Sun Aug 01 02:25... | Sun Aug 01 01:53... | Sun Aug 01 04:00... | Sun Aug 01 03:57...
Sat Jul 31 21:20:0... | Sun Aug 01 01:56... | Sun Aug 01 05:35... | Sun Aug 01 05:37... | LATE ARRIVAL | LATE DEPARTURE
Sat Jul 31 19:45:0... | Sun Aug 01 01:58... | Sun Aug 01 05:00... | Sun Aug 01 04:55... | LATE ARRIVAL
Sun Aug 01 01:00... | Sun Aug 01 02:16... | Sun Aug 01 05:00... | Sun Aug 01 04:57... | LATE ARRIVAL
Sat Jul 31 23:50:0... | Sun Aug 01 02:31... | Sun Aug 01 05:00... | Sun Aug 01 05:02... | LATE ARRIVAL | LATE DEPARTURE
Sun Aug 01 03:05... | Sun Aug 01 02:36... | Sun Aug 01 05:55... | Sun Aug 01 05:56... | LATE DEPARTURE
Sun Aug 01 03:20... | Sun Aug 01 02:42... | Sun Aug 01 05:40... | Sun Aug 01 05:47... | LATE DEPARTURE
Sun Aug 01 03:45... | Sun Aug 01 03:16... | Sun Aug 01 08:00... | Sun Aug 01 08:00...
Sun Aug 01 03:40... | Sun Aug 01 03:20... | Sun Aug 01 04:55... | Sun Aug 01 05:02... | LATE DEPARTURE
Airport
Arrival Stand | On-Block Time | Departure Stand | Off-Block Time | Arrival Status | Departur...
06M | Mon Aug 02 13:01:0... | 06M | Mon Aug 02 13:43:0...
33M | Mon Aug 02 13:03:0... | 21M | Mon Aug 02 20:16:0...
56R | Mon Aug 02 13:09:0... | 56R | Mon Aug 02 13:29:0...
02M | Mon Aug 02 13:13:0... | 02M | Mon Aug 02 13:50:0...
61M | Mon Aug 02 13:15:0... | 56R | Mon Aug 02 14:37:0...
60L | Mon Aug 02 13:19:0... | 60L | Mon Aug 02 14:43:0...
62L | Mon Aug 02 13:22:0... | 120M | Mon Aug 02 15:27:0... | POTENTIAL ARRIVAL CONFLICT...
49L | Mon Aug 02 13:25:0... | 130M | Tue Aug 03 13:52:0...
04M | Mon Aug 02 13:27:0... | 04M | Mon Aug 02 14:01:0...
09M | Mon Aug 02 13:30:0... | 09M | Mon Aug 02 13:41:0...
12M | Mon Aug 02 13:33:0... | 12M | Mon Aug 02 14:06:0...
16M | Mon Aug 02 13:35:0... | 16M | Mon Aug 02 14:18:0... | POTENTIAL ARRIVAL CONFLICT...
53L | Mon Aug 02 13:37:0... | 53L | Mon Aug 02 14:24:0...
62R | Mon Aug 02 13:42:0... | 62L | Mon Aug 02 15:52:0...
49R | Mon Aug 02 13:45:0... | 49R | Mon Aug 02 14:48:0...
25M | Mon Aug 02 13:49:0... | 25M | Mon Aug 02 14:27:0...
05M | Mon Aug 02 13:51:0... | 05M | Mon Aug 02 14:14:0...
Quick Time Player
Logitech Gallery
Magical Maths A...
Custom Map Loader
sunflowe...
WinZip
start
4 Windows Com...
Local ATC
RMA@neem:1099...
Airport
3:31 PM

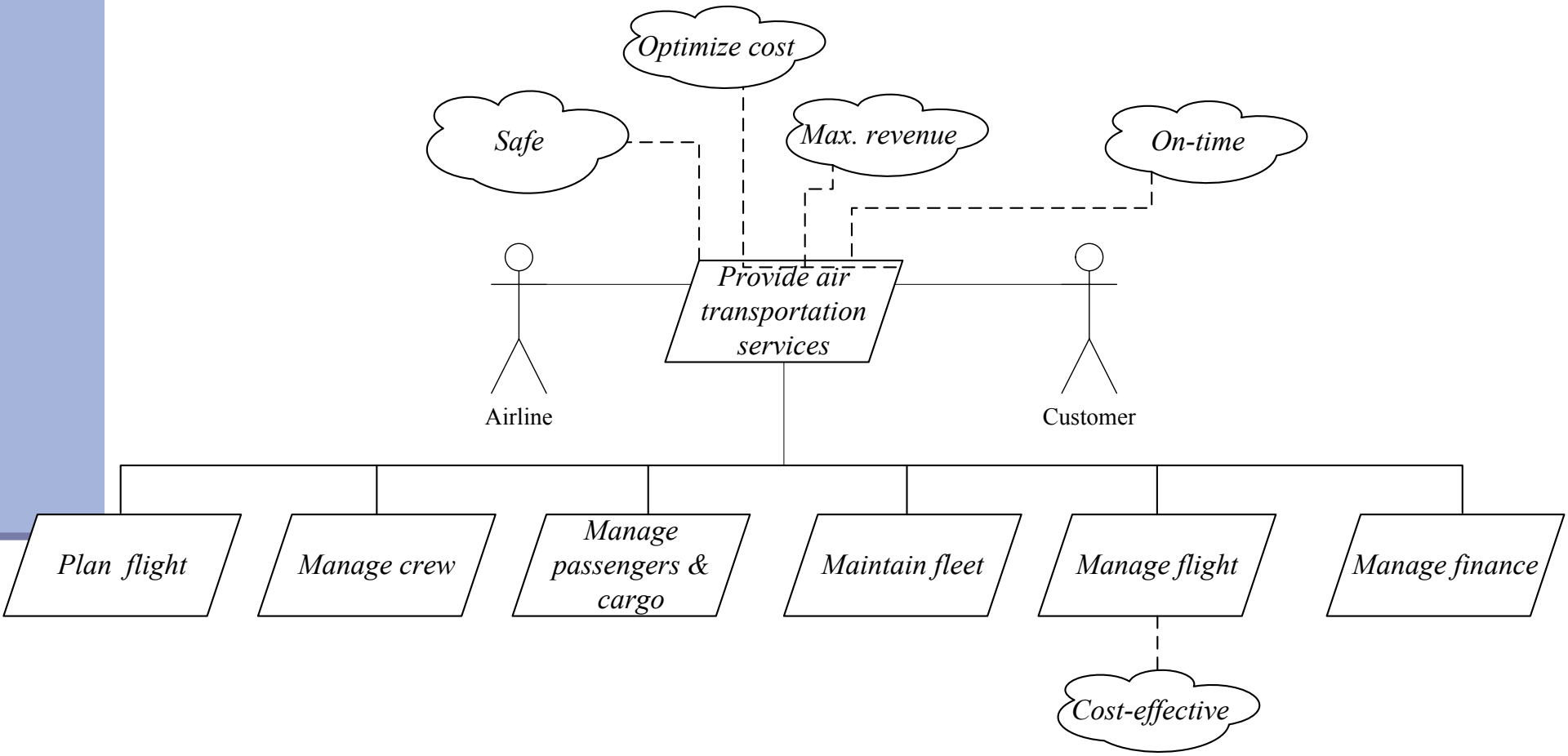
Results

- Systematic method for agent-oriented requirements elicitation and modelling
- Three implementations proving the usability of the method: two in Australia and one by a M.Sc. student in Estonia

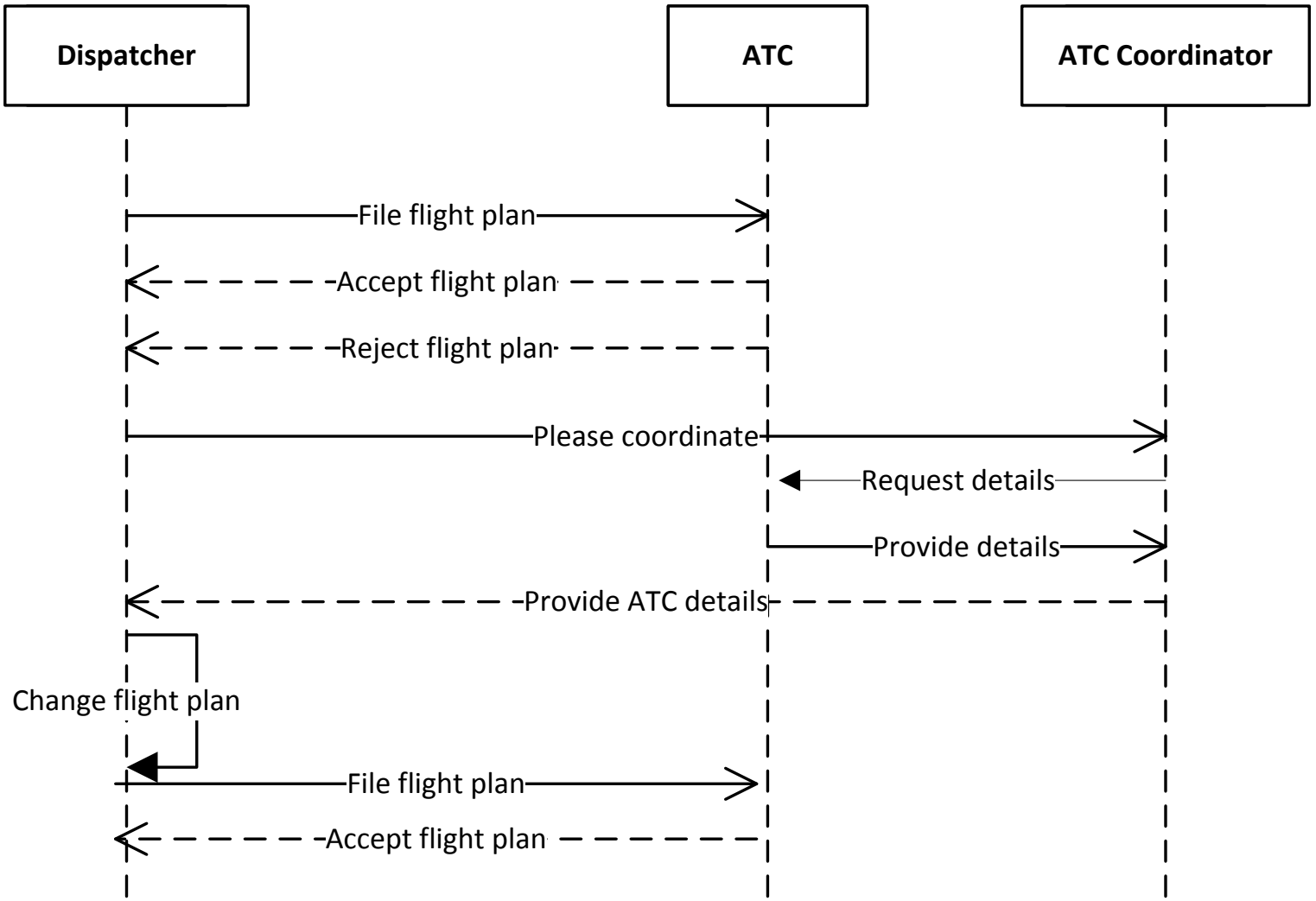
Two M.Sc. projects with Jeppesen (subsidiary of Boeing)

- Agent-oriented modelling and simulation of airlines:
  - Model an airline
  - Simulate an airline
  - Demonstrate bottlenecks and possible savings by simulation
- Business processes management of airlines
  - Model business processes of an airline
  - Simulate business processes of an airline
  - Demonstrate bottlenecks and possible savings by simulation

Project 1: Overall goal model for an airline



Project 1: Interaction model of filing a flight plan

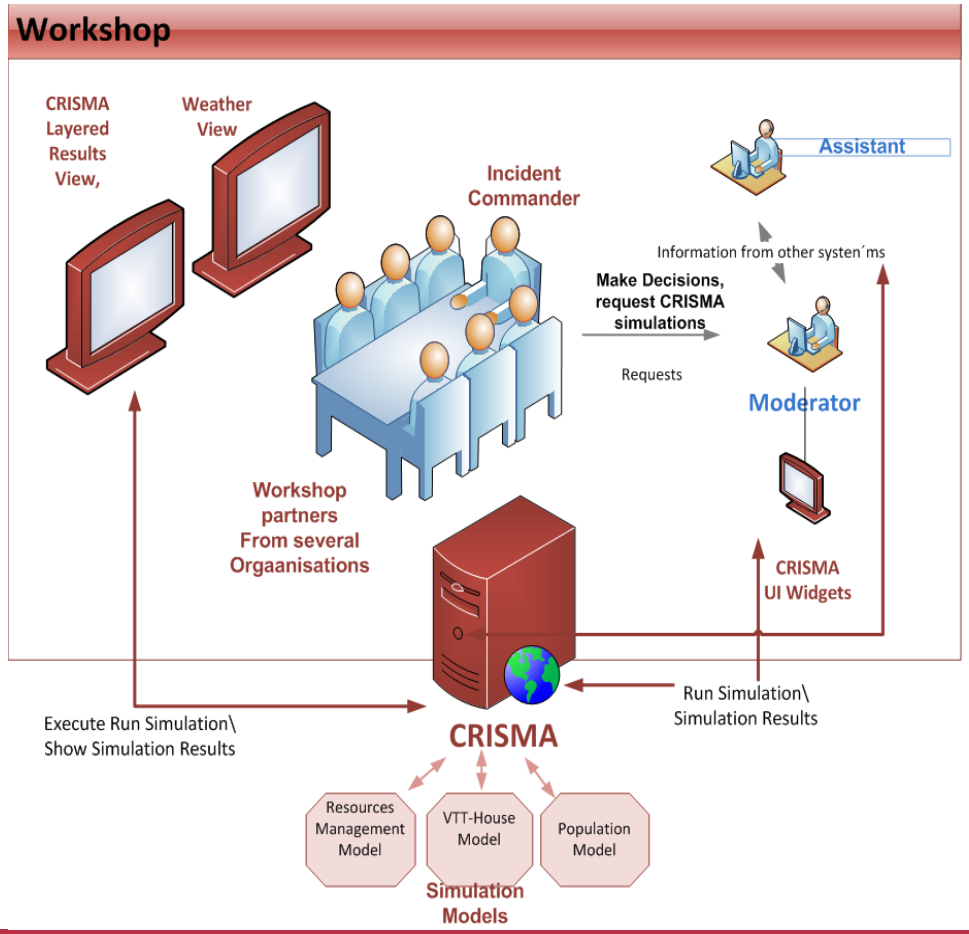


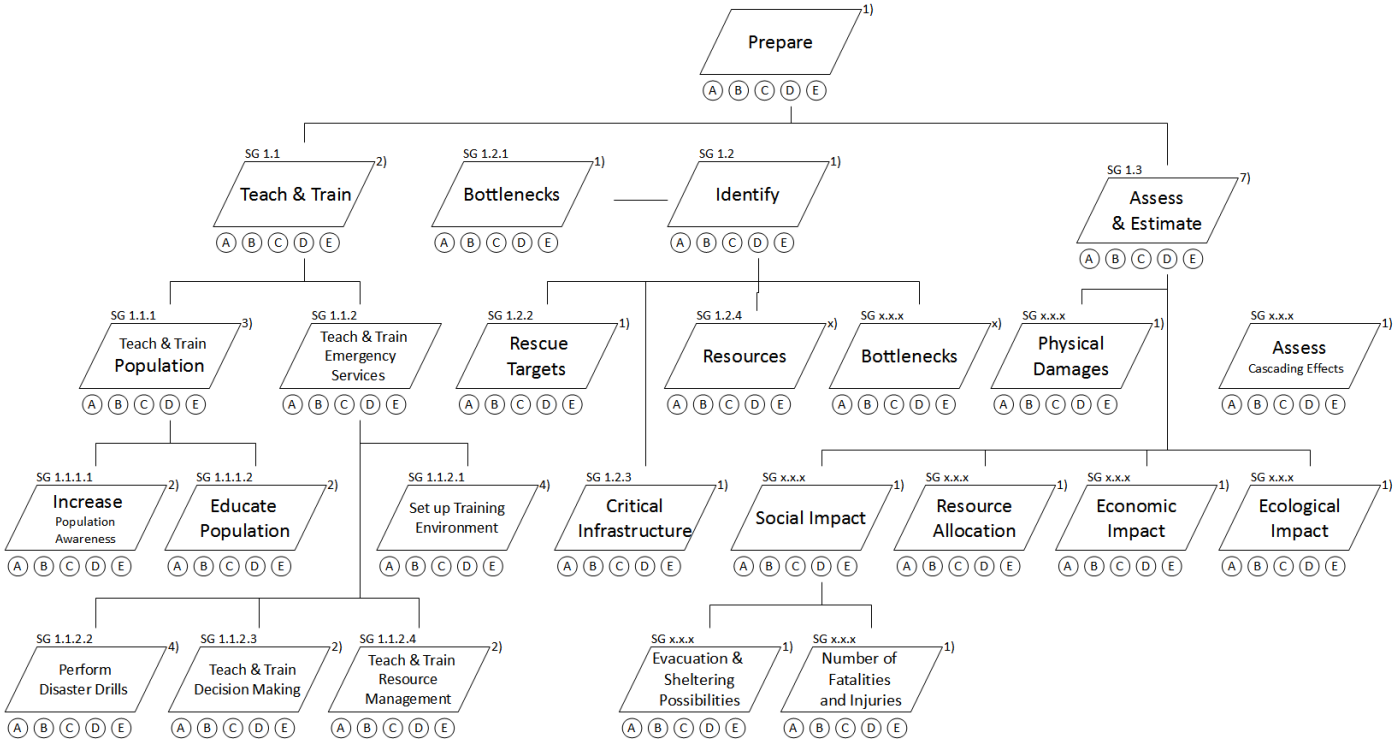
EU project "Modelling crisis management for improved action and preparedness" (CRISMA)

EU-FP7 Theme 10: Security Call	FP7- SEC-2011.4.1-1 Crisis management modelling tool Type of funding scheme: Collaborative Project Type of project: Integration Project Work programme topics addressed: SEC-2011.4.1-1
Duration	42 months Start date: 1st March 2012, End date: 30th August 2015
Effort	1097,85 person months
Cost/EU-Funding	appr. 14.4 m Euro / appr. 10.1 m Euro
WWW	www.crismaproject.eu
Contacts	Anna-Mari Heikkilä, VTT Crisma.Coordinator@vtt.fi

CRISMA Participants

Purpose of CRISMA: Enhancing tabletop exercises by computer-based simulations





[1] ...

[2] for reasons of simplicity teach and train are addressed under the same subgoals

[3] e.g. educate on survival skills

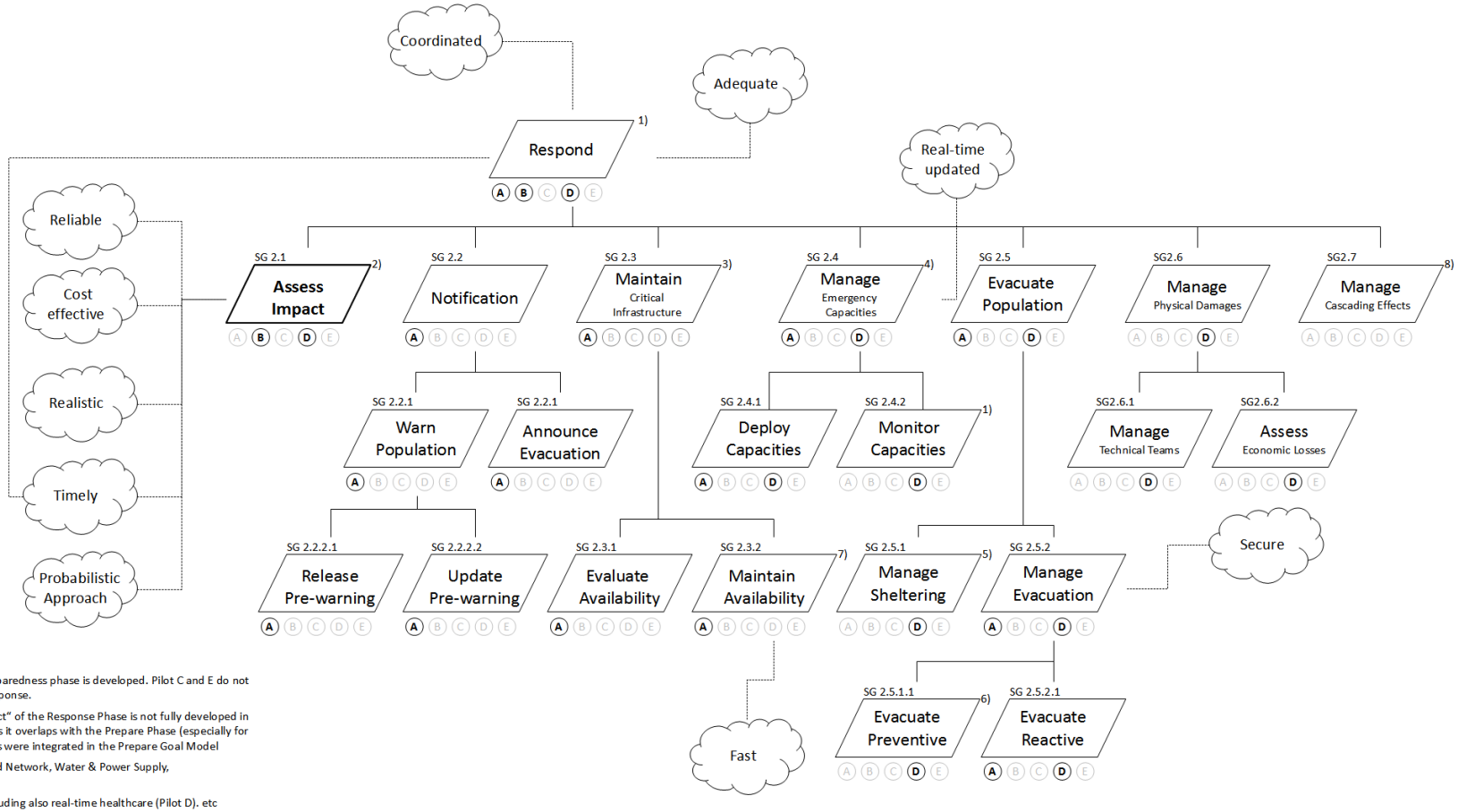
[3] "set up ... " subgoals should also be elaborated in the HOW goal model. Encompasses also the TEACH GENERALIZING subgoal of Pilot C.

[4] "physical training", includes e.g. evacuation exercises, traffic accident recovery trainings, routine emergency trainings, etc.

[5] communication infrastructure, road network, electricity ...

[6] Terms "Assess", "Identify" and "Evaluate" inconsistently used among pilots.

[7] includes also what if scenarios



[1] In the pilot B, only the preparedness phase is developed. Pilot C and E do not define a Goal Model for Response.

[2] The Subgoal "Assess Impact" of the Response Phase is not fully developed in this Response Goal Model as it overlaps with the Prepare Phase (especially for Pilot B). Instead, its contents were integrated in the Prepare Goal Model

[3] Critical infrastructure: Road Network, Water & Power Supply, Communication, ...

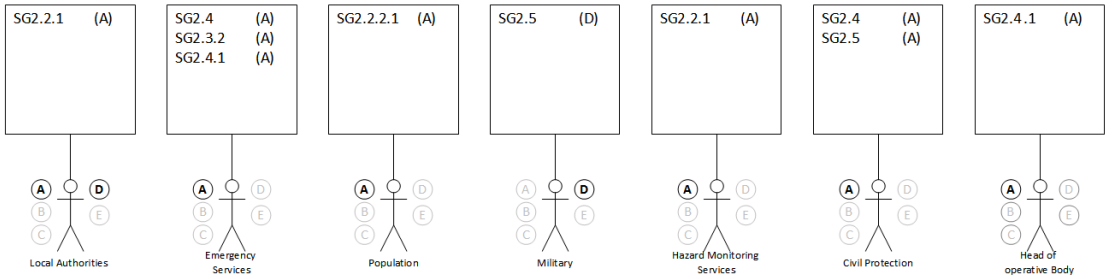
[4] Emergency Capacities: including also real-time healthcare (Pilot D). etc

[5] Manage Sheltering: may include also the management of homeless (Pilot D)

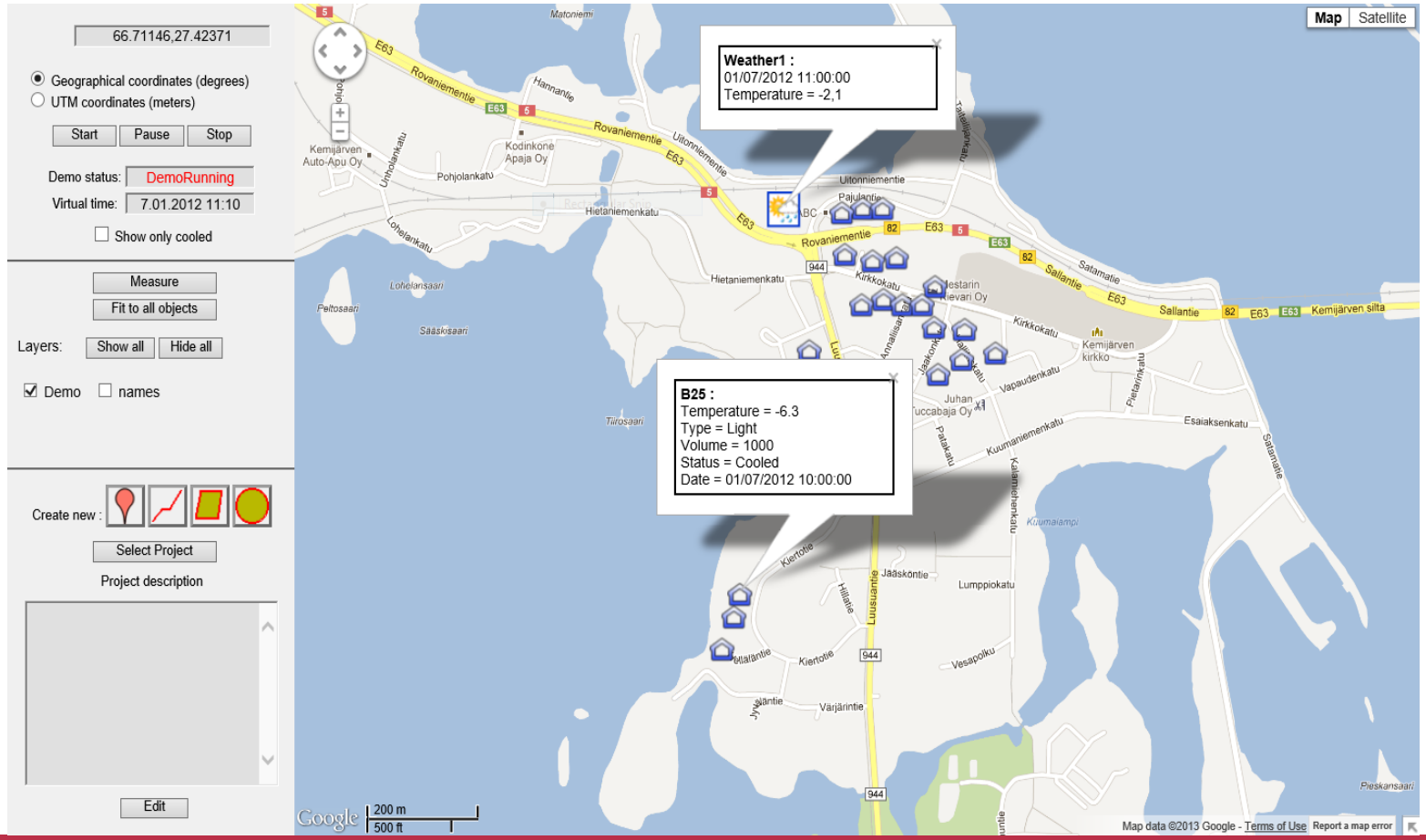
[6] Decision for preventive evacuation is a sub goal of impact assessment (Pilot D) → considered Preparedness Phase

[7] Manage availability of critical infrastructure: e.g. secure power transmission, deploy road maintenance, respond to traffic jams (Pilot A), ...

[8] Cascading not explicitly considered in Pilot Goal Models



Modelling crisis management for improved action and preparedness (CRISMA, EU FP7 project): Cooling of houses 1

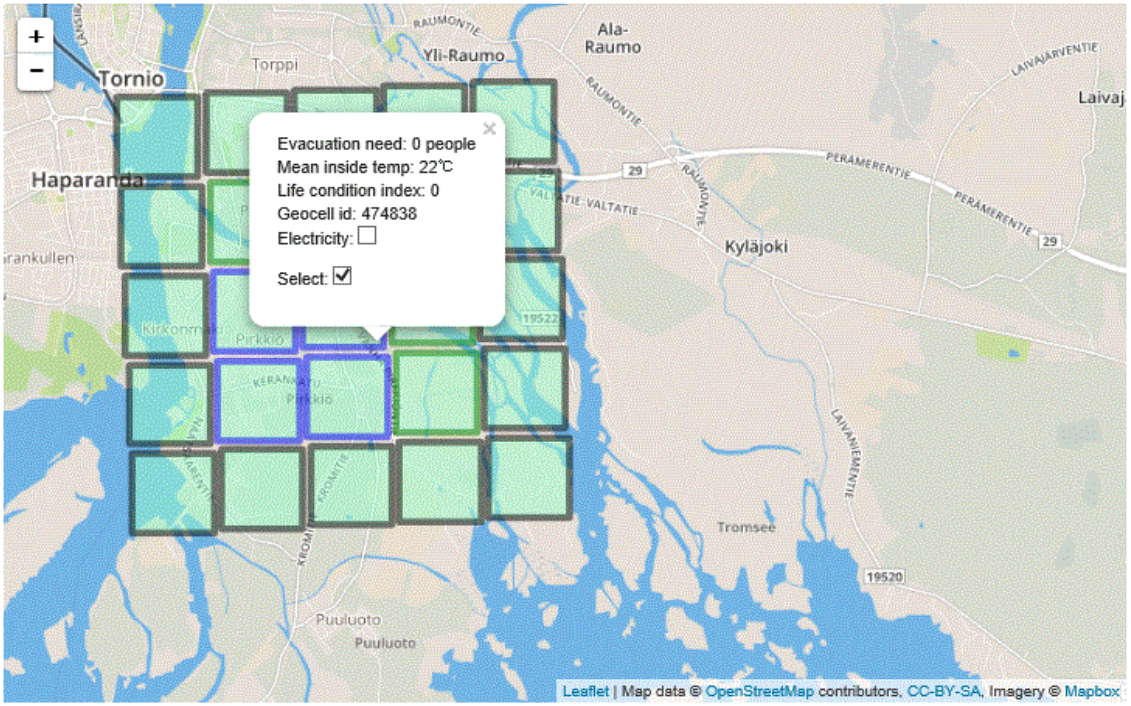


Modelling crisis management for improved action and preparedness (CRISMA, EU FP7 project): Cooling of houses 2

CRISMA Pilot A simulation system: configure power

main.php

Init parameters & simulation



Actions

- Life Condition
- Building Condition
- Emergency Level
- Evacuation Needed

Preparedness Planner

Economic Impacts

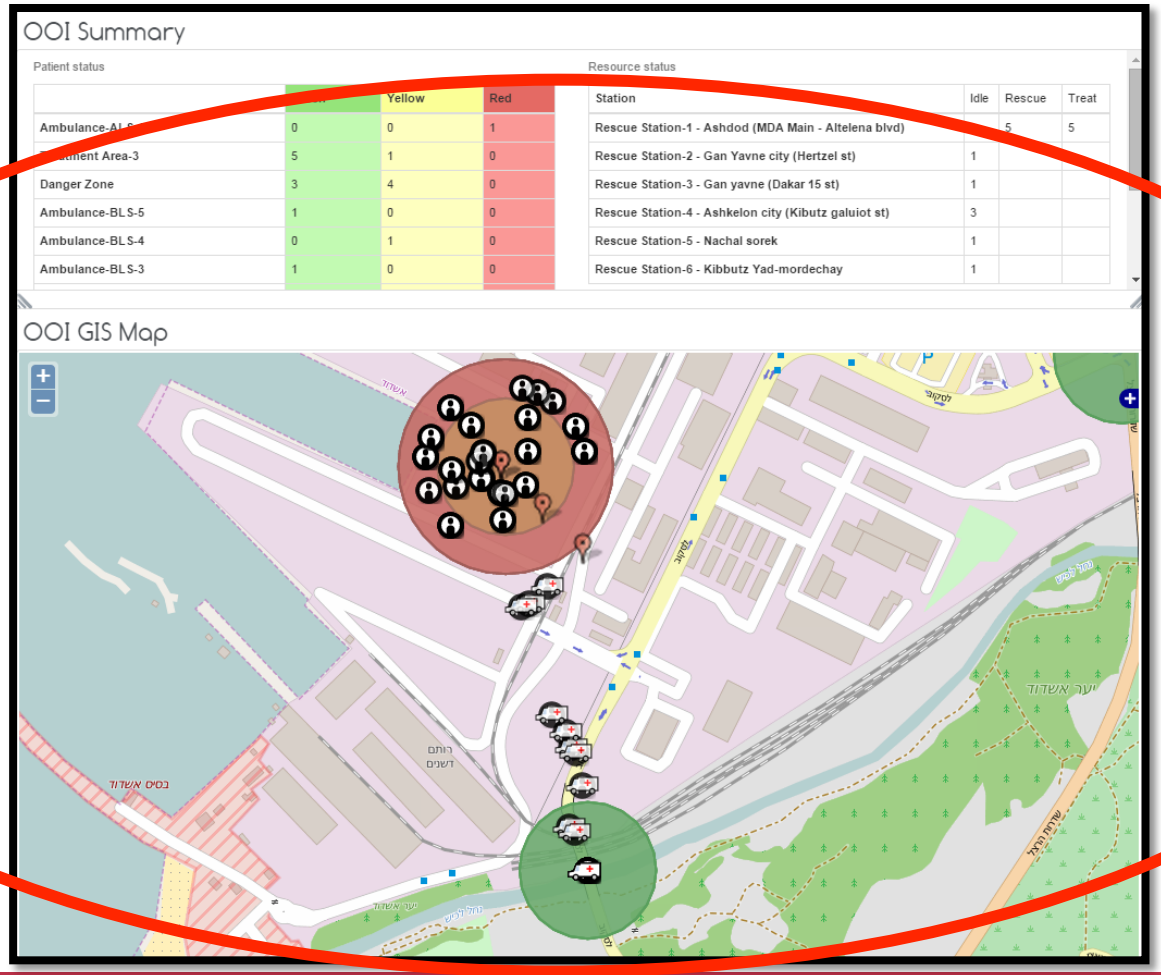
Make new branch

Start simulation

Evacuate people

Compare

Modelling crisis management for improved action and preparedness (CRISMA, EU FP7 project): Resource management



DESIGN OF PUBLIC SERVICES

Public services in Estonia

- Around 2500 public services available
- e-Banking, e-Tax Board, e-Police, e-Voting, e-School, e-Health, e-Road Administration, e-Social Insurance Board, e-Prescription, e-Business Registry, e-Land Registry, e-Building Registry.... e-Residency
- For example, it takes only 15 minutes to establish a company online

Levels of e-government services

1. Information (website)
2. One-way interaction (application form can be downloaded)
3. Two-way interaction (application form can be submitted)
4. Transaction (pre-filled forms can be completed and submitted, payments can be made, status can be followed)
5. Proactive and integrated (service is proactive and as much as possible automated, e.g. submitting tax file declarations in Estonia)

Proactiveness in e-governance

- Flipping the service delivery from “pull” to “push”
- Seamless delivery of timely information and services
- Rooted in needs, preferences, circumstances, life events, and location
- Personalised, adaptive, discreet, unobtrusive

E-government service or public service as a sociotechnical (human activity) system

- A software intensive system that has defined operational processes followed by human operators and which operates within an organization
- A system that contains both a social aspect, which may be a subsystem, and a technical aspect

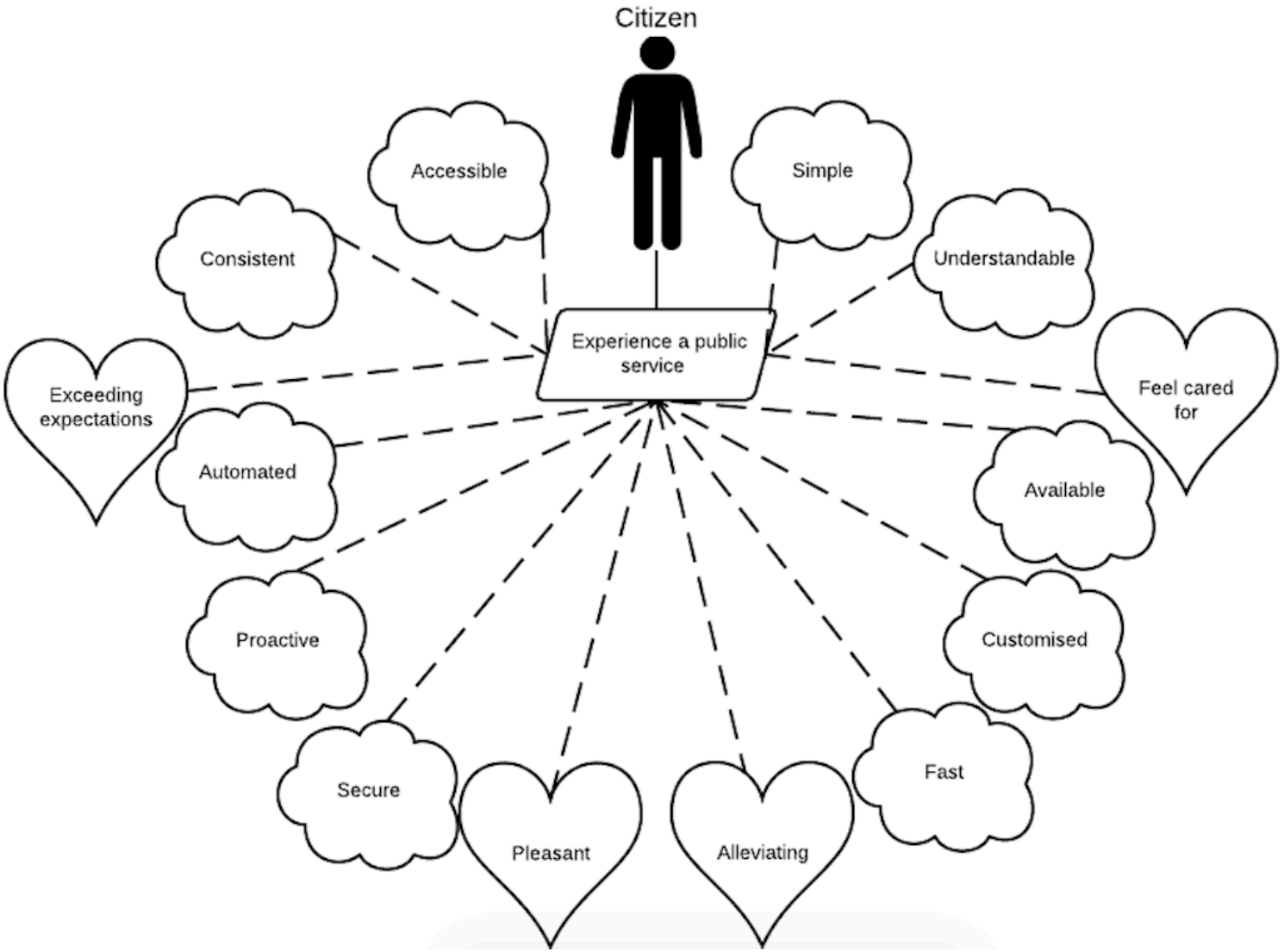
Service design

- Creates ecosystems of connected services
- Considers all the links in the customer-provider chain across:
  - Channels;
  - Organizational silos;
  - Information Systems.
- Requires holistic thinking about *customer experience*

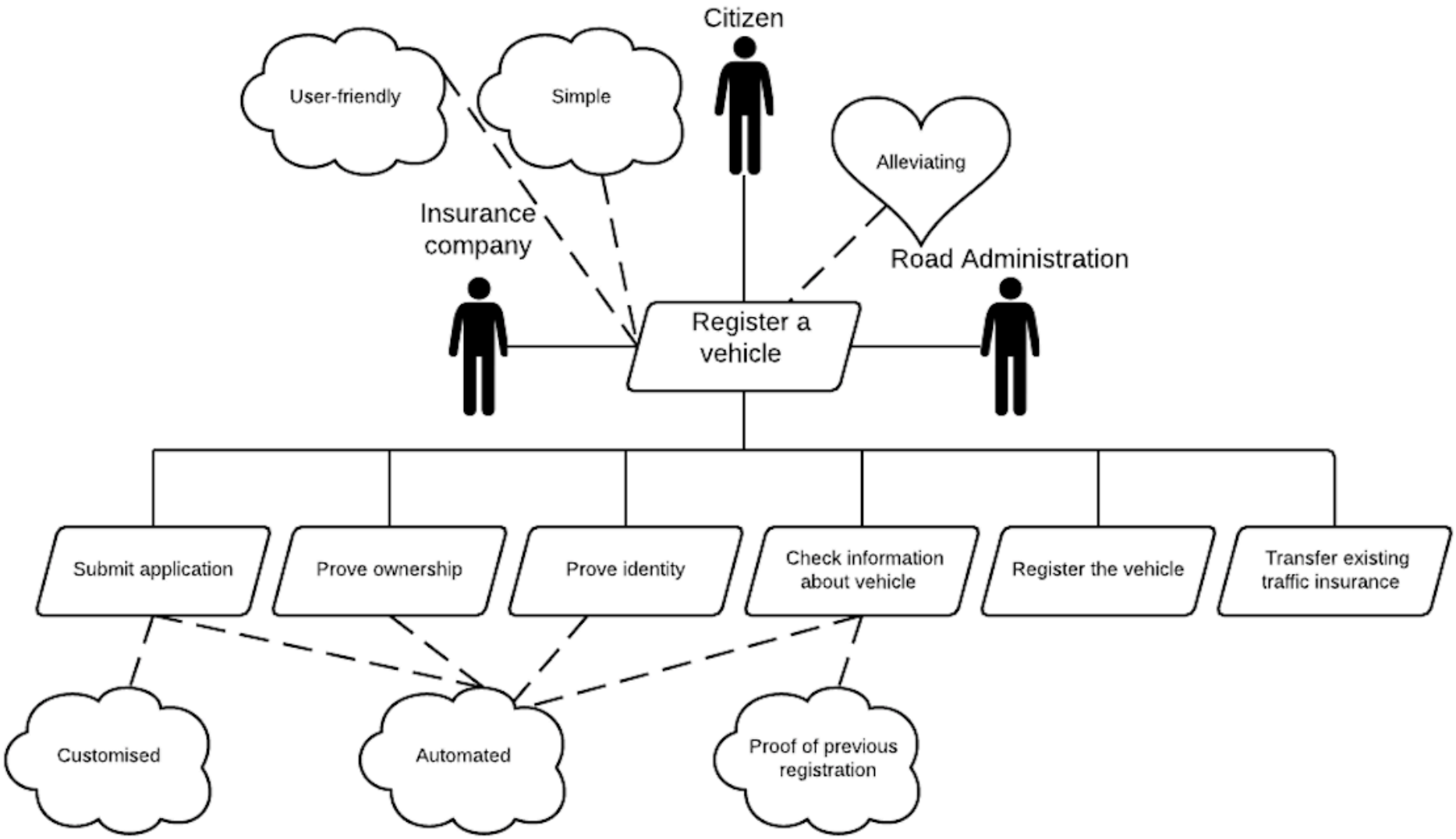
Notation for goal models

Symbol	Meaning
	**(Functional) Goal:** **To-Do goal**
	**Quality Goal:** **To-Be goal**
	**Quality Goal:** **To-Feel goal**
	**Role**
	Relationship between goals
	Relationship between goals and quality goals

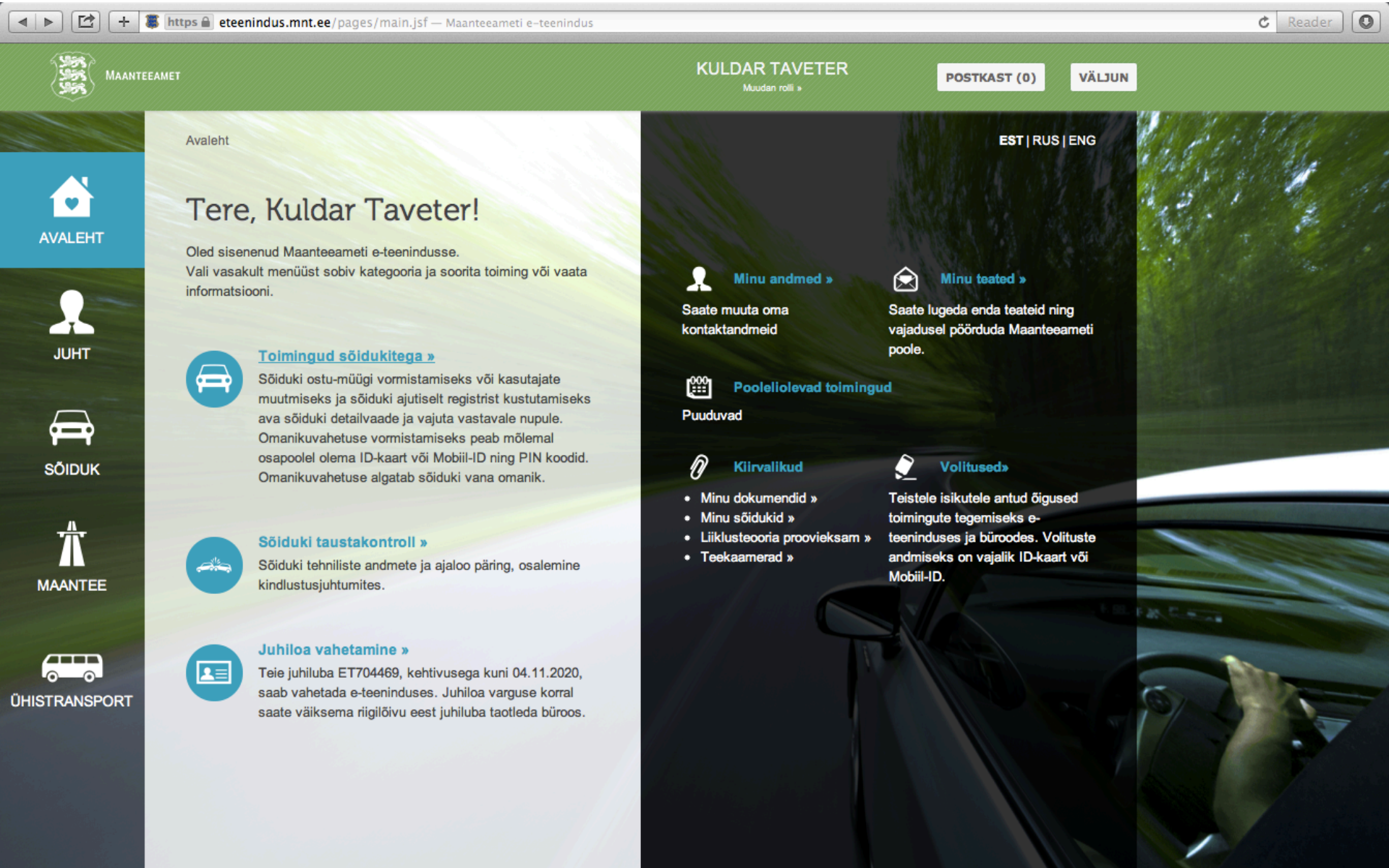
Good public service



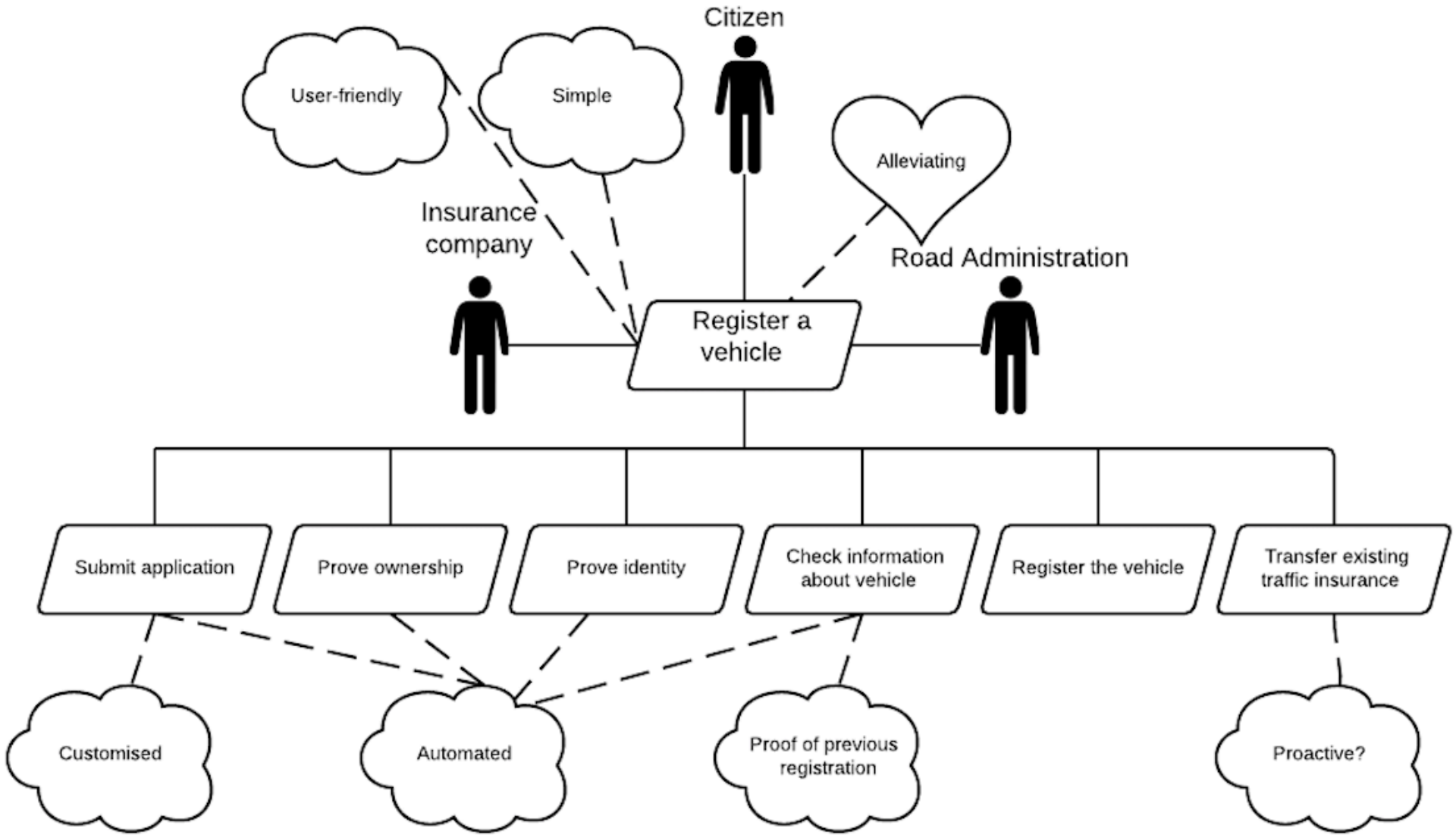
Registering a vehicle



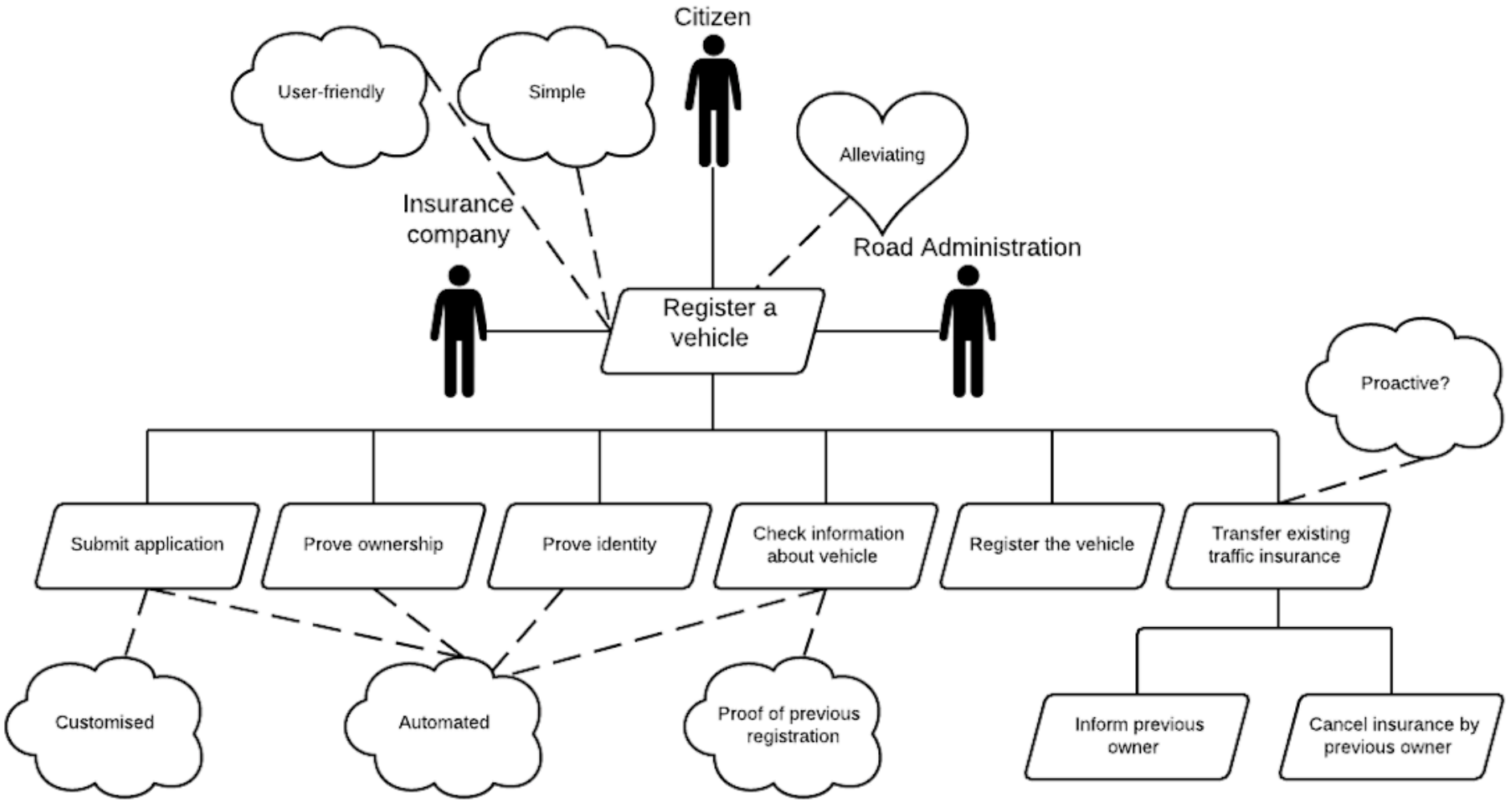
Public service for registering a vehicle



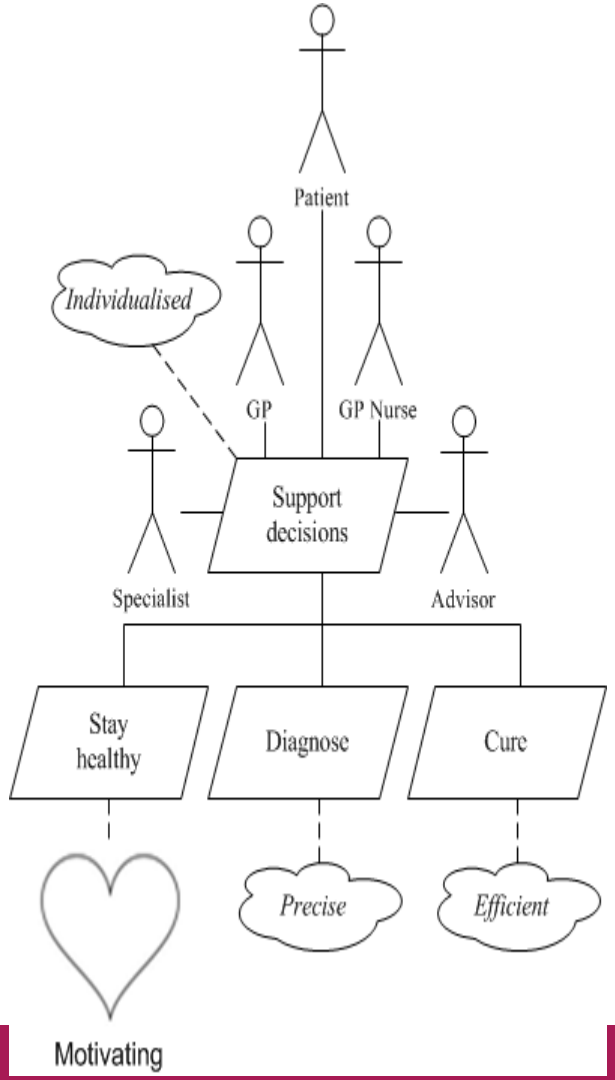
Room for improvement?



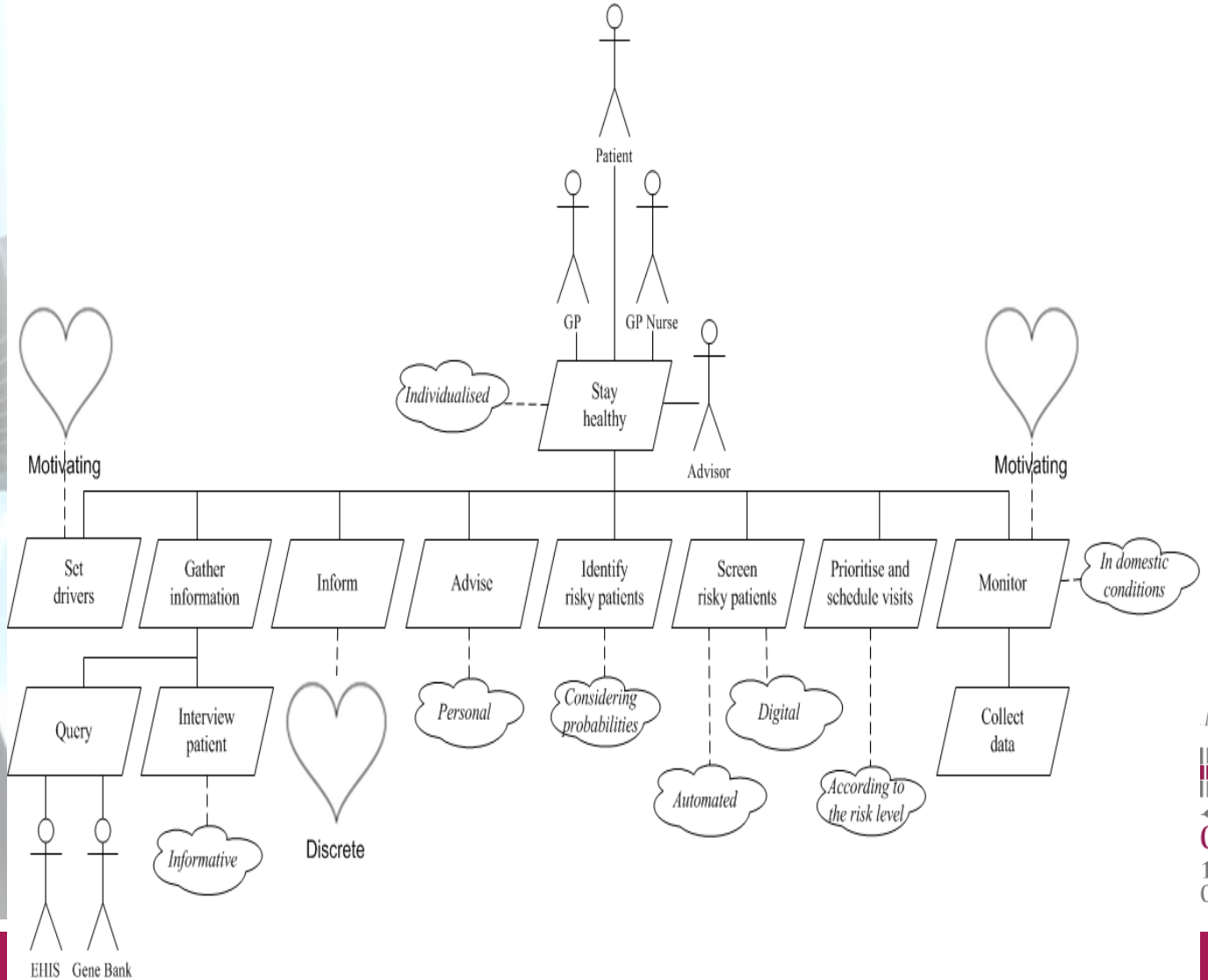
Proactiveness introduced

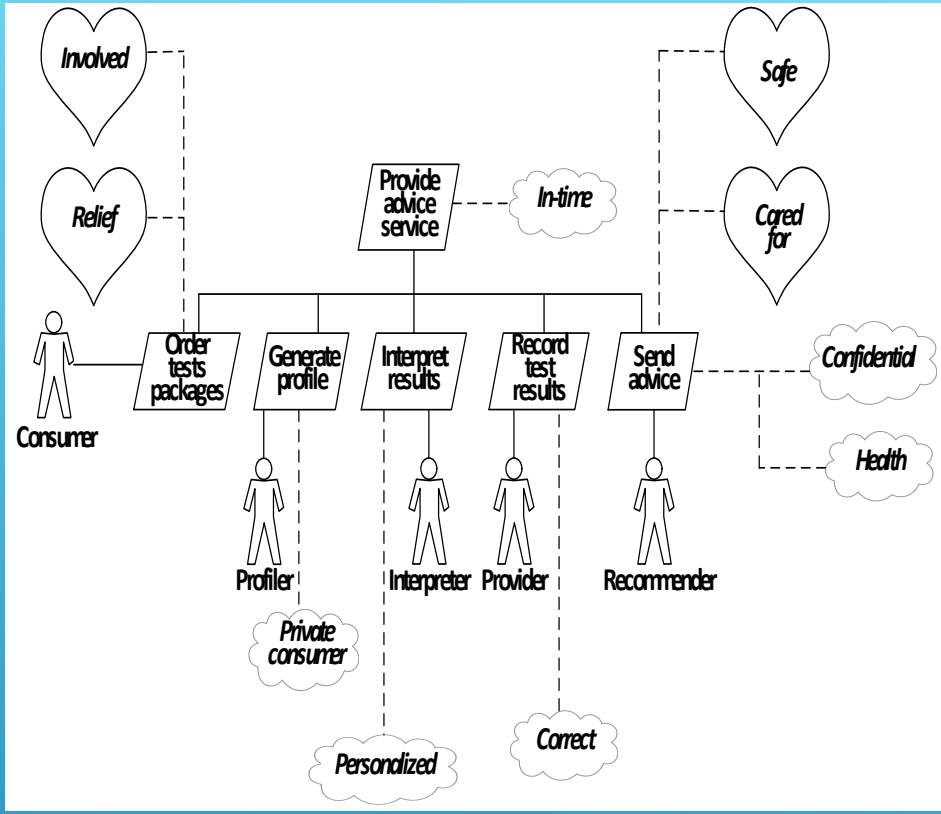


Goal model “Support decisions”



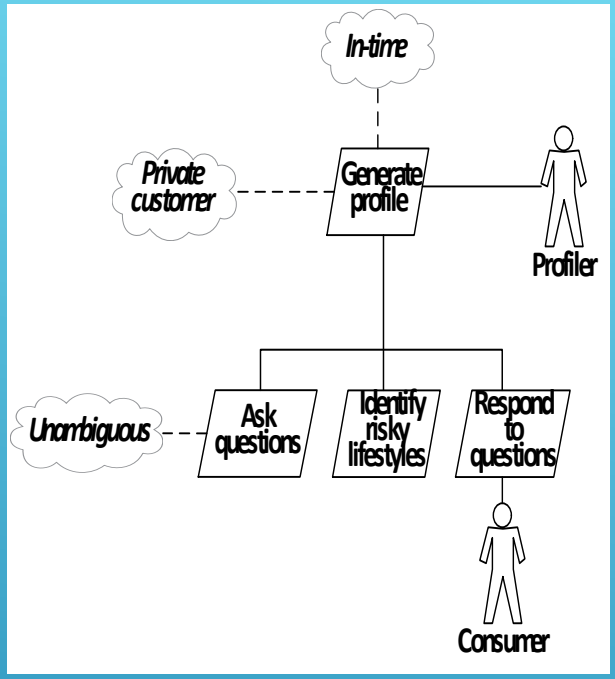
Goal model “Stay healthy”



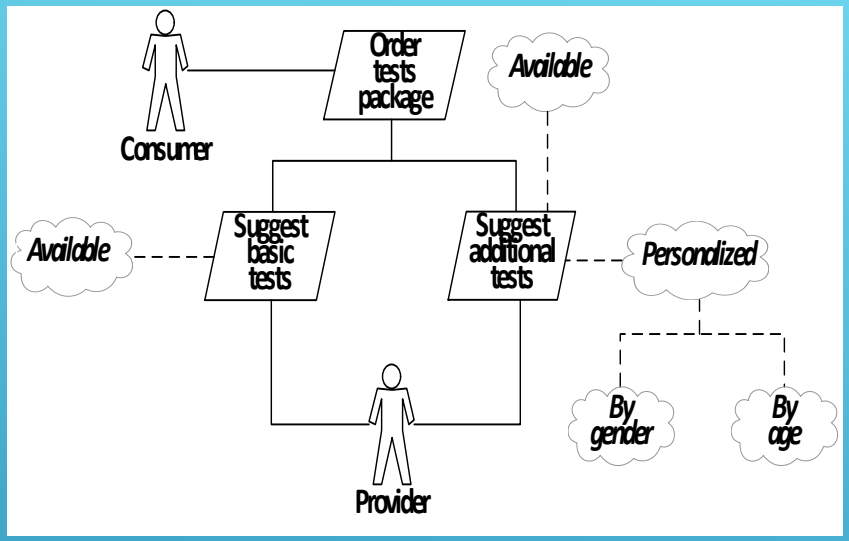


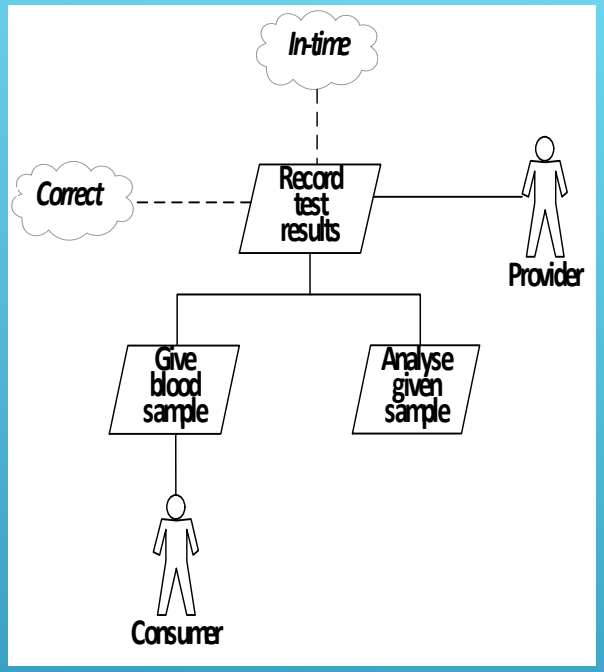
GOAL MODEL FOR ADVISING ON MEDICAL TESTS

GOAL MODEL FOR GENERATING PROFILE

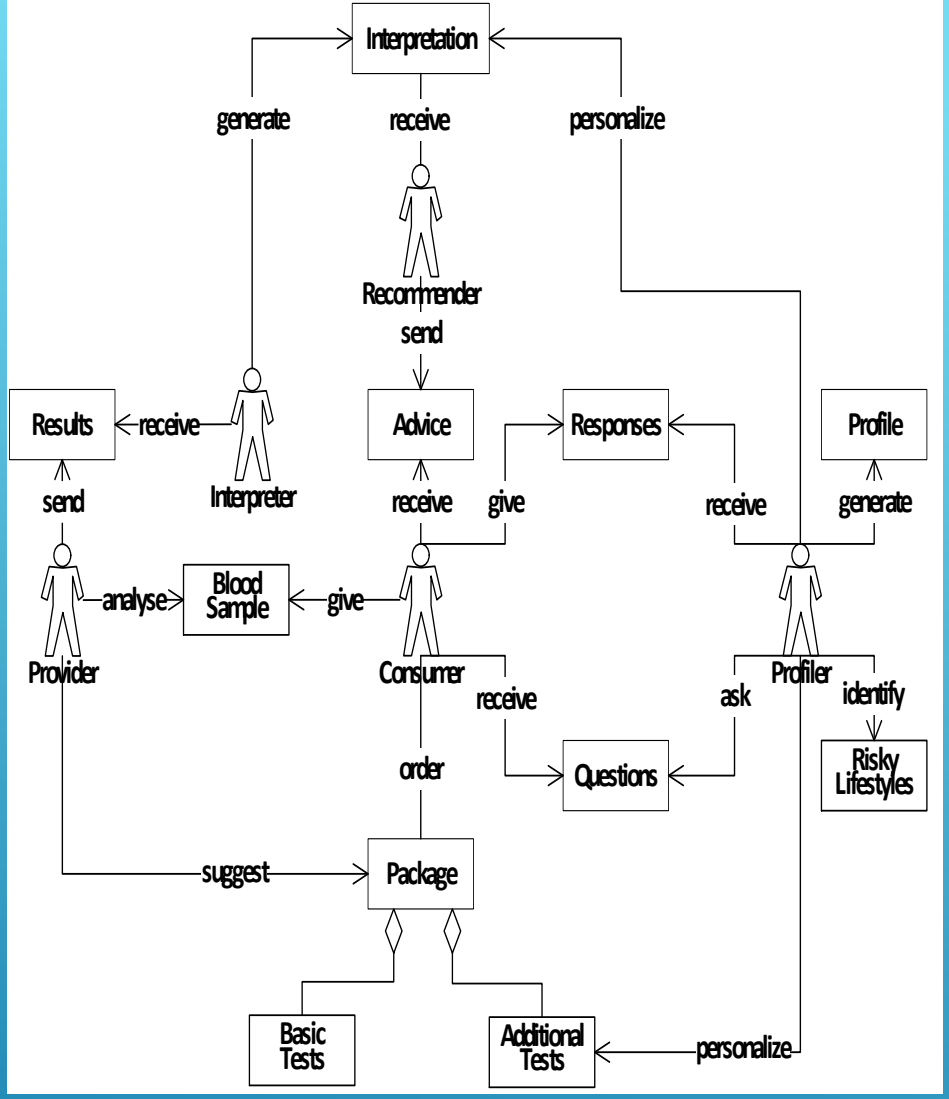


GOAL MODEL FOR ORDERING TEST PACKAGES

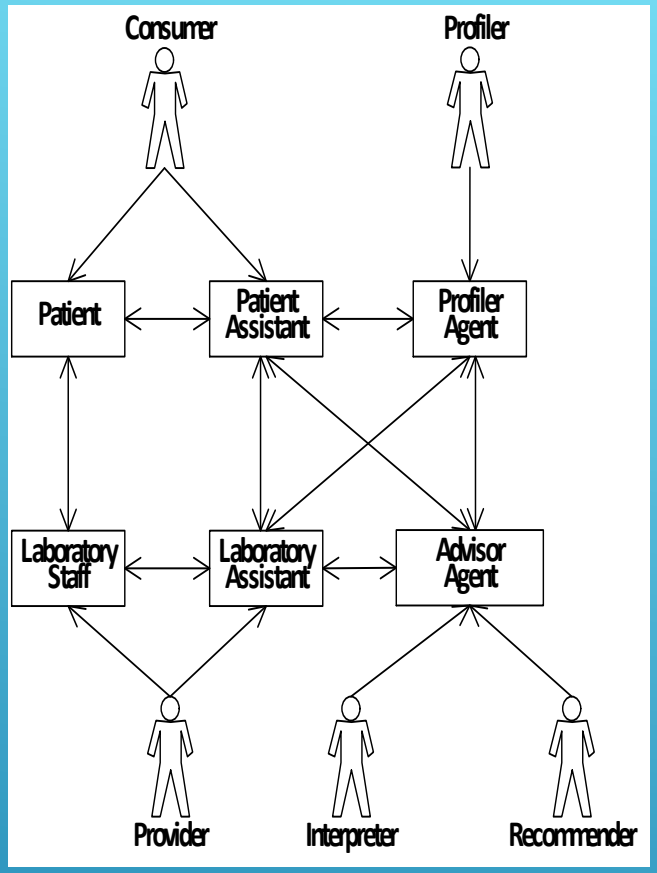




GOAL MODEL FOR RECORDING TEST RESULTS



DOMAIN MODEL



MAPPING ROLES TO AGENTS

Thank you! ☺ Any questions?