A MAS for Intelligent Monitoring of Airline Operations Control

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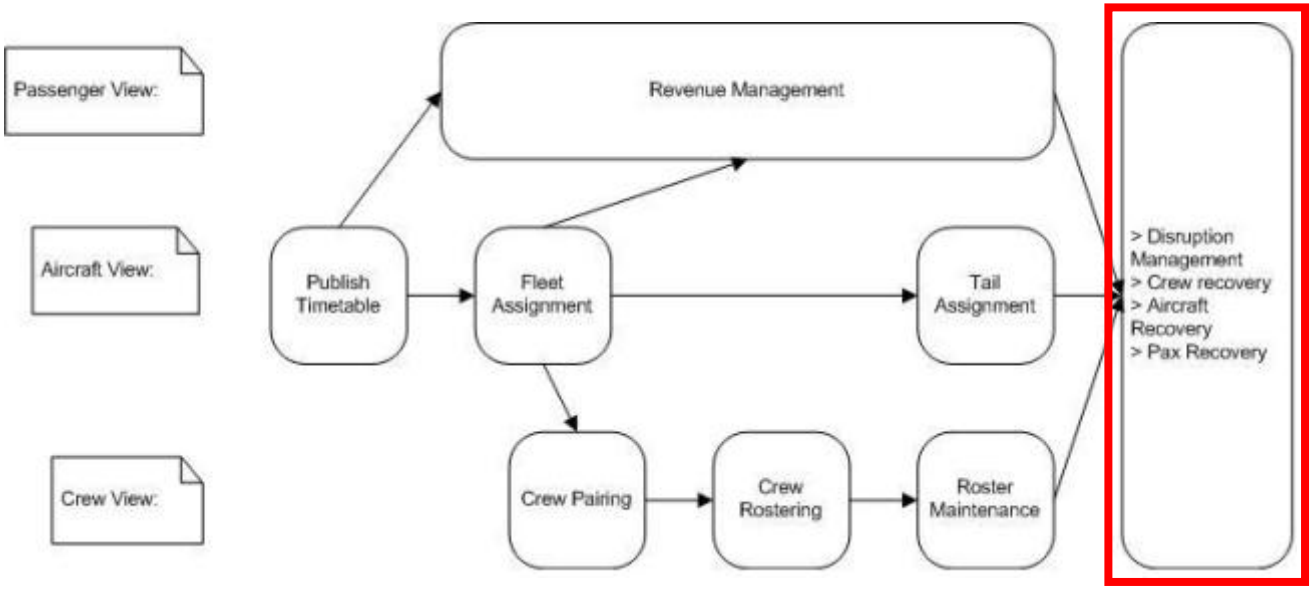
Outline

- The airline scheduling problem
- Methodology and tools
- Vision and scope
- Draft of the architecture
- Our expectations
- Evaluation

The Airline Scheduling Problem



- Traditionally approach with OR techniques
- Focuses on recovering a particular resource
- Small degree of integration between tools

Methodology and Tools - I

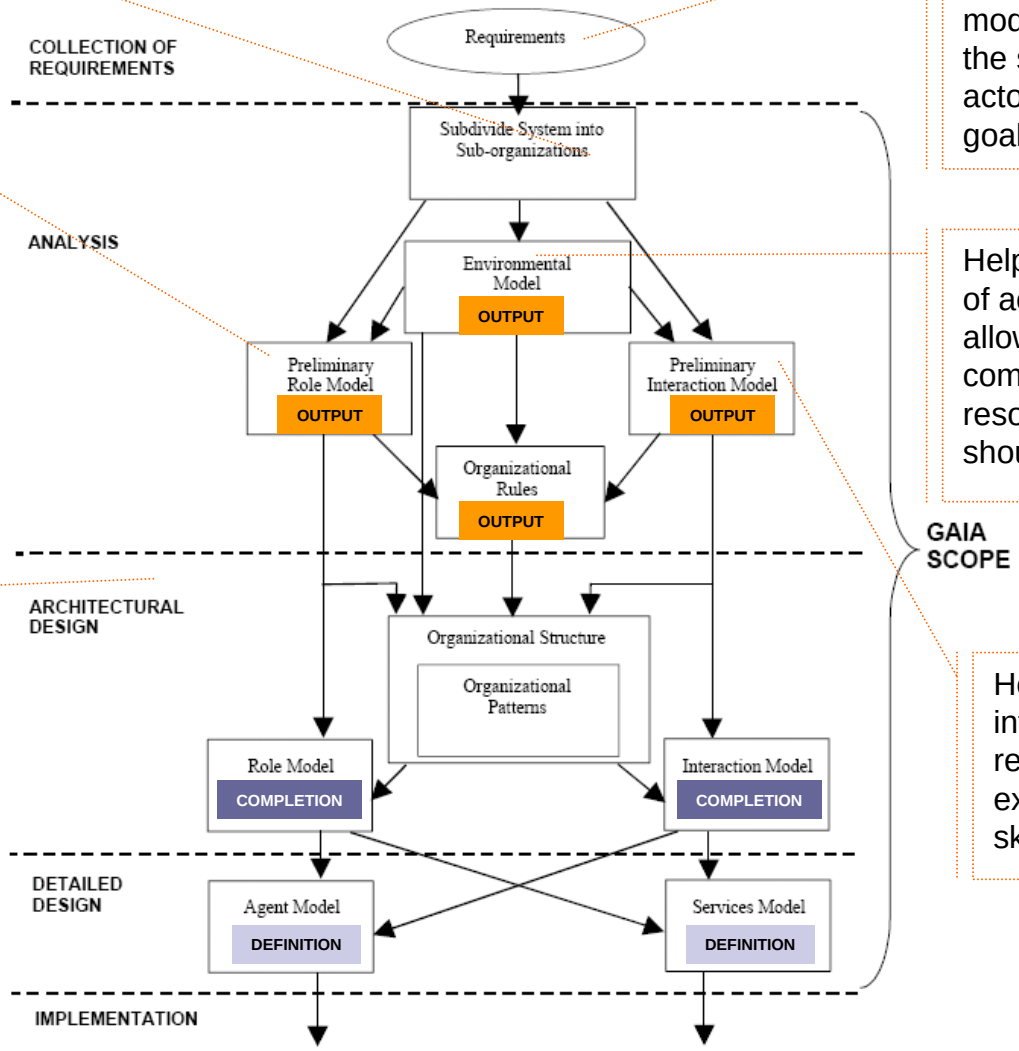
- Early requirements analysis using TROPOS
- GAIA for analysis and design
- AUML as the notation
- IBM Rational Software Architect
- JADE
- Why GAIA instead a complete methodology?
  - From a strict business perspective it would be better to use a more complete methodology. However, we also have an academic interest in seeing how we can complement GAIA and use it to develop a real MAS.

The influence of a goal-oriented requirements analysis in GAIA

Helps the identification of sub-organizations oriented to the achievement of a given sub-goal.

Helps to identify the basic skills (preliminary roles) required by the organization to achieve its goals.

Finally, the effects of using a goal-oriented early requirements analysis in doing the GAIA analysis are reflected through the GAIA design.



A goal-oriented early requirements analysis models the specification of the systems in terms of actors, their roles and their goals.

Helps to identify the roles of active components, allowing to identify active components that are only resources from others that should be agentified.

Helps to identify the basic interactions that are required for the exploitation of the basic skills.

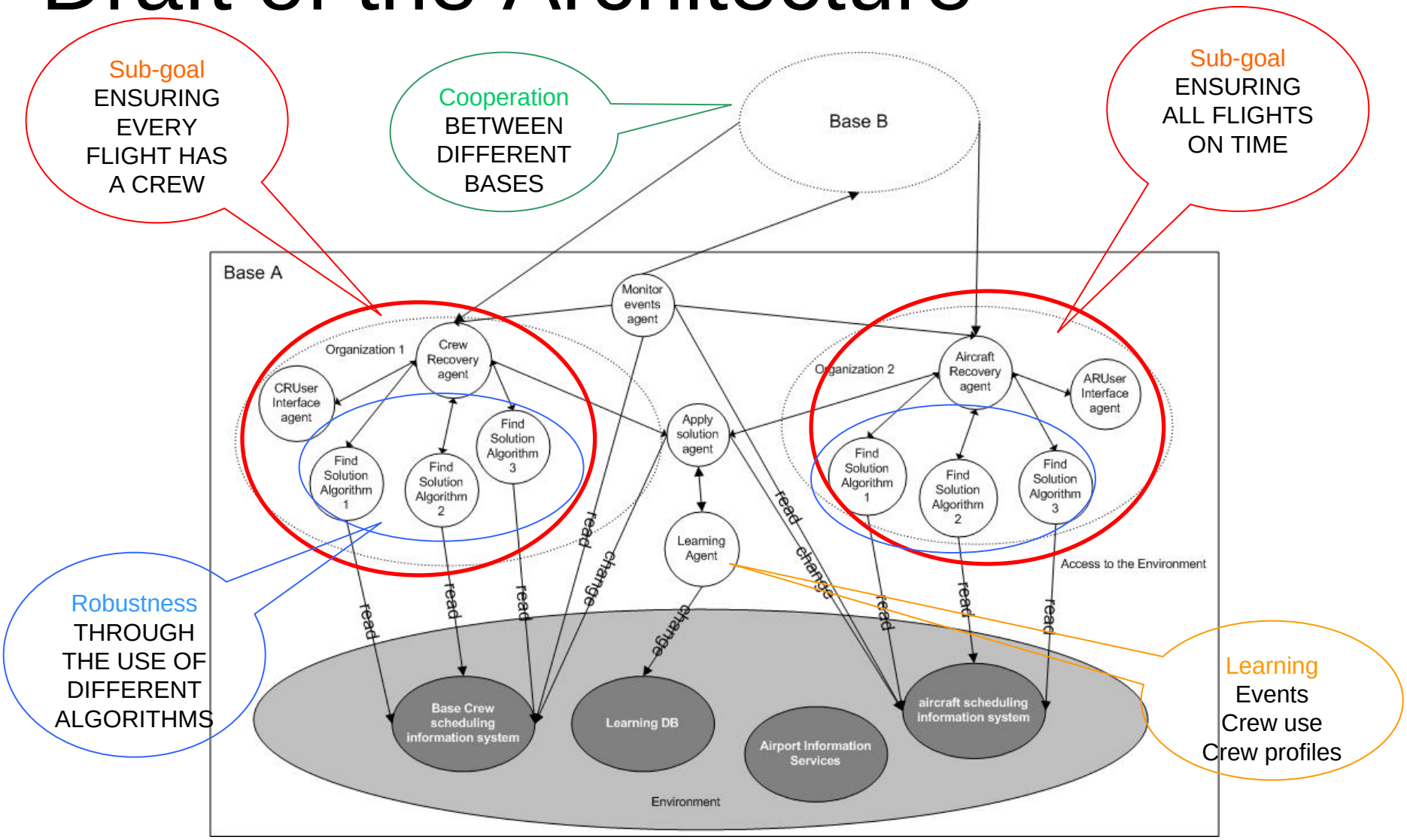
Vision and Scope - I

- Why a MAS?
  - More autonomy
  - Wider scope
  - Reliability (more Fault-tolerant and robust)
  - Modularity and scalability
  - Users as managers instead of controllers
  - Geographic distribution of resources
  - Cooperation between different bases
  - Different algorithms cooperate to find the best solution

Vision and Scope - II

- Monitoring events and learn with users
- Automate the resolution of the most trivial problems
- Solve problems for each base and share resources between them.
- Open to solutions from other companies
- Learn preferences and profiles
- Robustness through redundancy

Draft of the Architecture



Architecture: Summary

- Organization topology: hierarchical (multi-level)
- Control regime: work specialization
- Negotiation:
  - Basic CONTRACT-NET (Internally)
  - English auction or First-price sealed-bid auctions (Externally for the EM)
- Communication: FIPA-ACL
- Learning:
  - Event-based Decision: case-based reasoning
  - Crew utilization: statistical method
  - Crew profile and preferences: unsupervised (APRIORI or COBWEB)

Our Expectations

1. Have a useful and fully functional MAS to be implemented in the airline company
2. Learn from the use of a methodology in developing a MAS applied to a real domain
3. Learn from the use of existing tools
4. Measure the performance of our MAS
5. Collect data related with our hypothesis and predictions
6. Cooperation between different airlines through an electronic market

Evaluation

- Compare the performance of using a centralized versus decentralized approach to the problem
- Compare the use of only one algorithm to find the solution versus the use of several and different algorithms
- Compare the generation of a monthly roster with and without the knowledge gathered from and used by our MAS (related with crew use and crew profiles/preferences)

THANKS FOR YOUR ATTENTION!

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