A Design Framework for Generating BDI Agents from Goal Models
Loris Penserini, Anna Perini, Angelo Susi, Mirko Morandini and John Mylopoulos

Goal Model design in Tropos
Knowledge Level and Capability Level

Two different abstraction levels characterize the agent design, the knowledge level and the capability level.

The knowledge level refers to the goal AND/OR decomposition part of the GM that contributes to the description of the behaviors the specific agent can play. In the example, find in Internet and find in encyclopedia are two alternative subgoals of the goal find word description, which the agent can choose to achieve.

A capability is a sub-graph rooted in a leaf goal, containing the set of plans in means-end relation to a goal, with their inter-dependency relationships towards other goals.

Why implement the knowledge level?
- The agent itself will have knowledge on ‘why’ it has to perform some actions.
- Modeled alternatives are implemented together with knowledge about when to use them.
- The results is a software with evolvability and adaptivity properties, i.e. agents recognize and adapt to a variety of user categories.

From Tropos knowledge level to Jadex: The Mapping

Concepts and structures modeled at knowledge level in Tropos are mapped to the Jadex framework. The process is automated by the Tropos2Jadex tool in Taom4e, generating an agent definition.

Tropos goals are mapped directly to Jadex goals; root-level plans are mapped to Jadex plans, which execute the associated capabilities, defined accordingly to [3].

In Jadex, goals can only select and execute (“trigger”) plans. Therefore, to model Tropos goal hierarchies, intermediate service plans are needed. AND-decomposed goals are mapped to a structure with a single plan, which dispatches the sub-goals as stored in the agent's belief base. OR-decompositions (and similarly means-end relations) are mapped defining a triggerable plan for every subgoal.

To choose the appropriate plan, Jadex starts meta-reasoning, which was adapted to prefer goals with positive softgoal contributions.

To resolve a goal-dependency to another agent, a special plan is implemented, which tries to request satisfaction of that goal, communicating via a FIPA-Request protocol.

Additional details are given in [1] and [2].

Run-time behavior

Generated agents are ready to be executed with a default behavior. They try to satisfy user requests for goal achievement.

Alternatives are selected at run-time, trying to maximize positive contribution to softgoals, mapped to the Jadex belief base [4]. Importance of one softgoal over another can be specified by the stakeholders and changed dynamically. Failures of subgoals are compensated by exploiting alternatives.

The figure shows the correspondence between the goal model and the run-time evolution of goals and plans visualized in Jadex.

Collocation in the Tropos Process

The software development steps presented here fit into later design and implementation stages of the Tropos development Process (see also picture at the right).

The focus is given to the system's sub-actor goal models. Design (in UML) and JADE implementation of the capability level are described in [3].

http://www.troposproject.org
For further information
http://sra.itc.it/tools/taom4e/

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