# Declarative Goals in Motivated Agent Architectures

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# Outline

- **What and why**
  - Declarative Goals
  - Meta-reasoning and Motivations
- **Prototypes**
  - AgentSpeak-PL and AgentSpeak-MPL
- **Results**
- **Future Work and Work Plan**

# What and Why

- Existing agent languages and architectures
    - Mostly deal with actions and plans
- Multi-agent techniques
    - Ad-Hoc
- Gap between language expressivity and available techniques
    - Solution: extend existing languages

# BDI Agents

- Based on a philosophical model by Bratman
- Describes agents in terms of:
  - Beliefs: information about the world
  - Desires: preferred world-states
  - Intentions: commitments to achieve desires
- Large body of research on BDI agent architectures

# AgentSpeak(L)

- Agent language that describes procedural plans
- Based on a series of previous BDI architectures and languages
  - Based on a simplification of the BDI model
  - Main goal was get a responsive system
  - Ties plan execution with goal achievement

# Declarative Goals

- World states which an agent intends to hold

- Decouple plan execution from goal achievement

  - Not vulnerable to a poor plan selection strategy
  - More runtime flexibility

# AgentSpeak-PL

- AgentSpeak(L) interpreter extended with planning capabilities

- State-space planning is always towards declarative goals

- AgentSpeak-PL supports declarative goals

# AgentSpeak-PL (detail)

- Planner encapsulated within an action
- Planning allows the creation of high-level plans
- New plans are added to the plan library improving the agent over time
- Allows for shorter, declarative goal descriptions

# Meta-reasoning

- Reasoning about the reasoning process
- Guides the selection of goals and actions
  - Important in declarative agent architectures
- Few current efforts
  - All rely on some static strategy
  - Need a specification language

# Motivations

- Root cause of future-directed behaviour
  - Orientation towards certain classes of goals
  - Varying degrees of intensity
- Interesting abstraction for meta-reasoning

# AgentSpeak-MPL

- AgentSpeak(L) interpreter extended with a motivations-based meta-level controller

- Includes a motivation specification language
  - Intuitive way of describing meta-reasoning
  - Extensive research on the subject

# AgentSpeak-MPL (detail)

- Can be applied to both procedural and declarative agents (e.g. AgentSpeak-PL)
  - Separation of action-directed plans from internal *management* code (procedural)
  - Enforcement of rationality constraints on goal and plan selection (declarative)

# Results

- Journal paper in *Scalable Computing: Practice and Experience*

- Workshop paper in *Declarative Agent Languages and Technologies*

- Written and submitted paper for the *Central and Eastern European Conference on Multi-Agent Systems*

# Future Work

- Multiagent AgentSpeak
  - Selection of partners and actions
  - Norms, contracts and commitments
- Apply meta-level reasoning in MA-AgentSpeak
  - How to cooperate
  - When to do so

# Future Work (cont)

- Explore possibilities of
  - Joint plans
  - Plan sharing

# Work Plan

- 2007
  - April – October
    - Meta-reasoning in multi-agents
  - October – December
    - Planning in multi-agents
- 2008
  - Thesis write up

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