Research Themes

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Research Themes and Activities

Agent-Oriented Computing - Agents and Multi-Agent Systems as a General-purpose Computer Programming Paradigm

Currently my main research interest concerns agent-oriented computing, which is about the definition of general-purpose high-level programming models and languages based on agent-oriented abstractions for the design and development of concurrent / multi-core / distributed programs and systems. The notion of "agent" here is explicitly inspired to existing work in AI/DAI (agents and MAS, agent-oriented programming) and specifically forged and shaped so as to be effective as a first-class abstraction in concurrent programming.

The objective is to explore agent-oriented computing as a suitable novel mainstream paradigm for the so-called Concurrency Revolution (see for instance here), which refers to the fundamental turn towards concurrency in mainstream programming models and languages to exploit current and next generation multi-core & Internet-based computing systems.

Specific contributions about this:

• Agent-Oriented Programming as a Programming Paradigm
• A&A (Agents and Artifacts) programming model
• JaCa (Jason+CArtAgO) programming model and platform
• JaCaMo (Jason+CArtAgO+Moise) programming model and platform
• simpAL agent-oriented programming language and platform
• simpA Java-based agent programming framework

Most recent (ongoing) work:

• ALOO - a Concurrent OOP language with agents as first-class abstraction

Programming Autonomous Systems

This research line - which is strongly related to the previous one - aims at exploring programming models, languages and technologies for developing autonomous (software) systems, i.e. reactive software systems that are capable to fulfill tasks in some environment autonomously, without the human intervention, so deciding what actions to do and how to manage environment inputs. These autonomous systems can be individual software agents or teams of interacting agents.

The reference case studies that we are taking for exploring this line are:

• Home robotics, so the design and programming of software controllers of robots
• artificial players (BOT) in video games

The programming model / platform we are using for such explorations include:

• JaCa (Jason+CArtAgO) programming model and platform
• JaCaMo (Jason+CArtAgO+Moise) programming model and platform

Artifact-Based Computational Models and Infrastructures for Multi-Agent Systems

This research line starts from the idea that the notion of environment can be used as a first-class abstraction for designing and programming Multi-agent Systems, being the suitable designable/programmable place where to encapsulate functionalities to be used exploited by agents.

To this end, we introduced a conceptual model called A&A, where the environment can be conceived in terms of basic modules called artifacts, which are programmed by the MAS designers and that are the basic bricks that agents can instantiate, share, use, and compose at runtime. CArtAgO is a concrete framework and infrastructure for programming and running artifact-based environments.

Related research activities:

• A Theory of Artifacts for Cognitive MAS
  ° A&A and a theory of use for Cognitive MAS
  ° Activity Theory for Cognitive MAS
  ° Cognitive Stigmergy in MAS