Coordinating Agents Plans in Multi-Agent Systems Using Colored Petri Nets

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Abstract. Applying coordination mechanisms to handle interdependencies that exist between agents in multi-agent systems (MASs), is an important issue. In this paper, two levels MAS modeling scheme and a language to describe a MAS plan based on interdependencies between agents' plans are proposed. Initially a generic study of possible interdependencies between agents in MASs is presented, followed by the formal modeling (using Colored Petri Nets) of coordination mechanisms for those dependencies. These mechanisms control the dependencies between agents to avoid unsafe interactions where individual agents' plans are merged into a global multi-agent plan. This separation, managed by the coordination mechanisms, offers more powerful modularity in MASs modeling.

Keywords: Agent Plan, Colored Petri Nets, Coordination Mechanism, Dependency, Multi-Agent System.

1 Introduction

There are two main streams of research on software agents, namely the multi-agent systems (MAS) and mobile agents (MA). Research on multi-agent systems (MAS) is rooted in distributed artificial intelligence, and dates back to the fifties [3]. In a multi-agent system, agents are autonomous, reactive, proactive and sociable. The idea of agents as autonomous entities, which can interact with each other to solve problems, has led to the development of interests in agent-based design paradigm for software engineering [1].

A multi-agent system can be considered as a loosely coupled network of problem solver entities that work together to find answers to problems that are beyond the individual capabilities or knowledge of each entity [15].
Try to ensure that all members of the system act consistently, is critical in the MAS design [4].

In its general terms, coordination is the art of managing interactions and dependencies among activities, that is, among agents, in the context of MASs [5, 6].