

A Multi Agent Methodology for Holonic Manufacturing Systems

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ABSTRACT

There is a definitive need to have methodologies for holonic systems (HMS) [4], based on software engineering principles, which assist the system designer in every development steps and provide clear, unambiguous analysis and design guidelines. We believe that methodologies from the Multi Agent Technology (MAS) are good candidates for modeling HMS. Some reasons are: the similarities between the holonic and the agent approaches [2], the wide use of agents as the implementation tool for HMS, and the availability of complete MAS Methodologies. Nevertheless, there are some extensions we have to include to a MAS methodology to be able to model the HMS requirements in a proper way: holons recursive structure [3], systems abstraction levels, HMS specific guidelines and a mixed top-down and bottom-up approach for analysis and design steps. These facts have leaded our research towards the definition of a MAS methodology for HMS analysis and design.

In our approach, the HMS is specified by dividing it in more specific characteristics that form different *views* of the system. These models are agent, organization, interaction, environment and task/goal. The way in which the views are defined is inspired by INGENIAS methodology [5]. The development process of our methodology provides the HMS designer with clear and HMS-specific modeling guidelines. It also provides complete development phases for the HMS life cycle. The phases of our approach are *System Requirements Analysis*, *Holons Identification and Specification*, *Holons Design*, *Holons Implementation*, *SetUp and Configuration*, and *Operation and Maintenance*. The first stage, *System Requirements Analysis* and the second stage *Holons Identification and Specification* define the analysis phase of our approach. The aim of the analysis phase is to produce a high-level HMS specification. We have defined domain specific guidelines for the identification and specification of holons, such as: *HMS UC Guidelines*, to help the designer to identify domains cooperations [1] and the system goals as

use cases, and *PROSA Guidelines* based on PROSA types of holons [6] to identify and specify holons. The analysis adopts a top-down recursive approach. The next step in the development process is the *Holons Design* stage which is a bottom-up process to produce the system architecture. The aim of the *Holons Implementation* stage is to produce an *Executable Code* for the *SetUp and Configuration* stage. Finally maintenances functions are executed in the *Operation and Maintenance* stage. Currently, we are working on the evaluation of our methodology with industrial Case Studies, and we are developing a CASE tool for our methodology.

Categories and Subject Descriptors

D.2.1 [Software Engineering]: Requirements/Specifications—*Methodologies*; I.2.11 [Artificial Intelligence]: Distributed Artificial Intelligence—*Multiagent systems*; I.2.11 [Computer Applications]: Computers in Other Systems—*Industrial Control*

General Terms

Design

Keywords

Multiagent Systems, Holonic Manufacturing Systems

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AAMAS'05, July 25-29, 2005, Utrecht, Netherlands.

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