

Chapter 8

Agents, Availability Awareness, and Decision Making

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ABSTRACT

Despite the importance of resource availability, the inclusion of availability awareness in current agent-based systems is limited, particularly in decision support settings. This article discusses issues related to availability awareness in agent-based systems and proposes that knowledge of resources' online status and readiness in these systems can improve decision outcomes. A conceptual model for incorporating availability and presence awareness in an agent-based system is presented, and an implementation framework operationalizing the conceptual model using JADE is proposed. Finally, the framework is developed as an agent-based decision support system (DSS) and evaluated in a decision making simulation.

INTRODUCTION

Context aware computing has gotten a great deal of attention in recent years as mobile computing and pervasive computing technologies have advanced. The scope of context aware computing is broad and covers a variety of subject areas including location awareness, environment awareness, preference awareness, and usability. In computing, context refers to the physical and social situation

where a computing device is being used. Context aware computing strives to acquire and utilize information about the context of devices and their users in order to provide computational services that are appropriate for the user, place, time, and environment. This concept of context extends to intelligent agent-based systems (Moran et al. 2001). Agent interactions take place in a rich context of previous actions, individual beliefs, invisible states and different perspectives about which agents must reason in order to interpret the

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settings in which they find themselves (Benerecetti et al. 2001).

As with most modern computer systems, intelligent agent-based systems are increasingly being utilized to support human decisions making processes. Today, nearly every type of information system supports some aspect of Simon's (1960) decision making phases. The intensifying dependency on systems to support all types of decisions, from critical medical decisions, to business decisions, to commonplace personal decisions, has made context awareness increasingly crucial. In support of this fact, several management and behavioral studies have indicated that the context and environment in which decisions are made affect decision outcomes (Beach et al. 2005; Goll et al. 1997; Simon 1959).

Intelligent agent systems inherently operate in and interact with decision makers' environment. Subsequently, intelligent agent research has invested a great deal of attention in approaches that enable or utilize context awareness. As a result, many agent systems employ some form of context awareness (Payton et al. 2004; Plaza et al. 2001). However, few of these systems deliver this context information directly to the user. More specifically, context information is commonly used by agents to tailor decision makers' system experiences without users' direct knowledge of the details. The reason for this may be explained by the fact that much of context awareness research tends to concentrate on environmental conditions such as location and lighting, user characteristics such as preference and interests, or computing device characteristics such as screen size or mobile orientation. All of these things describe context about which the system user is consciously or subconsciously aware.

This raises the question, what about the context information of which a decision maker is unaware? As noted above, context can affect decision outcomes, which by extension implies that context can affect the support provided by agent-based decision support systems (DSS). Moreover, in

many cases agents within a system fulfill the role of a decision maker, making decisions as a proxy for users (Ajenstat 2004). In a decision support scenario, context-related information that is not directly known may be valuable when provided to the decision maker. Particularly in agent systems where the resources necessary to provide support are distributed around a network, extending contextual information about the system may improve decision outcomes. The availability of distributed elements of the system, which is contextual information, may have direct impacts on the support provided by the system and therefore, the decision outcomes.

Consider the implications if the data needed by a data-driven DSS was not available within sufficient time to make the system useful for the decision maker or if the data was not available at the time of the initial request, but would be should the decision maker wait a few moments. How would this change the decision maker's behavior? How would having information about when the data would be available affect the decision outcome? In this example, the data can be considered a resource and the concept of resource could be generalized to any distributed element of the system. Knowledge of resource availability information could have a dramatic impact on the performance of the system and the outcomes of decisions they support. From a systems perspective, this same availability information could be equally vital for agents' resources and agent-to-agent interactions. Despite the potential benefits of making availability information obtainable to decision makers, little attention has been given to examining the effects of agent, data, and system availability on decision outcomes and agent-based DSS.

The objective of this article is twofold. The first objective is to propose an agent framework that can provide online status (presence awareness) and readiness (availability awareness) information to system users regarding agents and their data sources. The second is to answer the general

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