Interaction Protocols Adaptation Based Coordination for Crisis Management Processes

Wassim Chtourou, MIRACL Laboratory, ISIMS/University of Sfax, Sfax, Tunisia
Lotfi Bouzguenda, MIRACL Laboratory, ISIMS/University of Sfax, Sfax, Tunisia

ABSTRACT

This work deals with Interaction Protocols adaptation for coordination in the context of Crisis Management Processes. One possible way to deal with this coordination is the use of Interaction Protocols (IP). In order to guarantee an efficient use of IP, one needs to adapt them. In this paper, the authors propose the conjointly use of version and context concepts to model the IP versions and their contexts within a coherent conceptual framework, called MDA. Following this practice, they first propose the contextualized versioned IP meta model. Second, they propose an extension of Agent UML sequence diagram meta-model in order to specify graphically the contextualized versioned IP. Third, they provide an Interaction Protocols Adaptation and Management System to support the life cycle of IP from modeling to performing. Finally, they illustrate their solution through a well-known crisis scenario called “Air Crash Management Process”.

Keywords: Adaptation, Agent, Context, Crisis Management Processes, Interaction Protocols, Versioning Technique

INTRODUCTION

Today, the Crisis Management Processes (CMP for short) which refer to the coordination of several tasks running in different organizations (governmental organizations, humanitarian organizations, hospitals, civil protection, etc.) in an open, dynamic and unstable context (C.M. Pearson & J. A. Clair, 1998), take a considerable importance by the communities engaged in crisis response and management due to the proliferation of crises in all fields such as political crises, natural and socio-economic.

However, several problems encountered in the crisis management area cannot be solved and questions are still waiting for an answer. In fact, semantic coordination between partners involved in CMP is still a challenge and current crisis management systems ((B. Bauer, 2010), (M. Hölzle et al., 2010) and (W. Smari et al., 2014) are too rigid to deal with the variety of contexts due to

DOI: 10.4018/IJISCRAM.2015100104
the presence of heterogeneity at different levels: processes, policies, objectives, authorities, local and global commitments and security. Regarding the analysis and synthesis of pre-existing processes how to coordinate them in an efficient way and within a coherent framework?

The use of interaction protocols (namely contract nets, negotiation or vote) is one possible way to deal with coordination to rule and structure the communication between partners (C. Hanachi & C. Sibertin-Blanc, 2004). Indeed, the Interaction Protocols (IP) based coordination is widely recognized as an efficient mechanism to share resources and coordinate the activities of agents (C. Hanachi & C. Sibertin-Blanc, 2004). Several works have been proposed in the literature for instance in ((C. Hanachi & C. Sibertin-Blanc, 2004), (H. Mazouz et al., 2002) and (C. Stephen & P. Martin, 2002)). These research works consider protocols as entities of first class and address the engineering issue such as specification, validation and implementation of protocols for specifying and developing a Multi-Agent System (MAS) in a stable context.

In this paper, we also consider IP as first class entities but to deal with coordination in CMP viewed as open MAS and within an engineering perspective. Thus, the interaction protocols adaptation is needed in order to support the coherent interaction between organizations involved in open, dynamic and unstable context. Roughly speaking, IP adaptation can be investigated in the context of the two following distinctive approaches. The first one concerns the management of problems (called exceptions) which can occur under the execution of protocols while the second approach aims at the re-use and the modification out (i.e., at build time) and in progress of execution of the modeled IP. This approach is based on meta-modeling aspect. In this paper, we concentrate on the IP adaptation according to the second approach. One possible way to deal with this adaptation is the use of versioning technique (W. Chtourou & L. Bouzguenda, 2013) which captures all the predictable changes of the considered interaction protocol. More precisely, the paper tries to answer to the following questions:

- How to model the IP versions and their contexts?
- How to specify graphically the IP version?
- How to select the appropriate IP version among several ones to deal with a given context?
- How to coordinate the activities composing the crisis management process?

In the first part of this work, we defend the idea that versioning technique is an interesting solution to deal with interaction protocols adaptation at build time. Indeed, this technique permits to keep trace of the previous versions of an entity, which supports the re-use of these versions if the same situation arises. Also, it allows the definition for the same entity several versions which can be used in an alternative way. Moreover, the use of the context notion (W. Chtourou & L. Bouzguenda, 2013) is also interesting in order to describe the conditions use of such IP version. In the second part, we specify graphically the contextualized versioned IP.

Obviously, the design of different IP versions can be represented without specific information regarding the version. However, it is more interesting to propose an appropriate notion or language allowing in the design step to represent the IP version concepts to the designer. Various notions, languages and formalisms have been proposed to design the IP. The majority have been focused on the representation of IP behavior such as AUML (B. Bauer et al., 2000), Petri Nets (B. Marzougui & K. Barkaou, 2013), Event-B (L. Ben Ayed & F. Siala, 2008), Commitment (M. Baldoni et al., 2010) and Algebra Process (T. Miller & P. McBurney, 2007).

AUML language is the result of collaboration between the OMG (OMG, 2000) and FIPA (FIPA Website) organization which allows the design of IP behavior. In our work, we use the AUML language for three reasons. First, its ability to represent the behavior of IP using AUML sequence diagram. Second, it is apprehended by user due its graphical interface. Finally, it pro-
Community Hospital Disaster Preparedness in the United States
www.igi-global.com/article/community-hospital-disaster-preparedness-in-the-united-states/221341?camid=4v1a

Towards a Grid for Characterizing and Evaluating Crisis Management Serious Games: A Survey of the Current State of Art
www.igi-global.com/article/towards-a-grid-for-characterizing-and-evaluating-crisis-management-serious-games/207715?camid=4v1a