An Event-Driven Platform for Agility Management of Crisis Response

Anne-Marie Barthe-Delanoë, Ecole des Mines Albi-Carmaux, University of Toulouse, Toulouse, France
Sabine Carbonnel, Ecole des Mines Albi-Carmaux, University of Toulouse, Toulouse, France
Frédérick Bénaben, Ecole des Mines Albi-Carmaux, University of Toulouse, Toulouse, France
Hervé Pingaud, Jean-François Champollion University, Albi, France

ABSTRACT

This article aims at presenting a whole approach of Information System Interoperability management in a crisis management cell: a Mediation Information System (MIS) may be used to help the crisis cell partners to design, run and manage the workflows of the response to a crisis situation. The architecture of the MIS meets the needs of low coupling between the partners’ Information System components and the need of agility for such a platform. It is based on Service Oriented Architecture (SOA) and Event-Driven Architecture (EDA) principles that are combined to the Complex Event Processing (CEP) principles. This should lead on the one hand to an easier orchestration, choreography and real-time monitoring of the workflows’ activities, on the other hand to assume on-the-fly automated agility of the crisis response (considering agility as the ability of the processes to remain consistent with the response to the crisis).

Keywords: Adaptation, Agility, Complex-Event Processing, Detection, Event-Driven Architecture, Event Cloud, Model-Driven Architecture, Service Oriented Architecture

1. INTRODUCTION

As stated by (Devlin, 2006), a crisis situation can be political, military, economical, humanitarian, social, technological, environmental or sanitary. Regardless its nature, a crisis is an abnormal situation, which is the result of an instability impacting a subpart of the world (called ecosystem or system) with unacceptable consequences (Devlin, 2006; Lagadec, 1992). Such a situation implies to deal with the crisis management through a dedicated set of stakeholders in charge of the crisis response. According to (Atlay & Green, 2006; Beamon & Kotleba, 2004) the crisis management life-cycle is classically composed of four main steps starting with (i) mitigation, followed by (ii) preparedness, succeeded by (iii) a response phase and finally (iv) recovery.

DOI: 10.4018/ijiscram.2014040104
The efficiency of the response step is determined by the speed and the accuracy with which information can be managed and exchanged among the partners (i.e., organizations, people and devices involved into the collaboration). Considering the fact that an Information System (IS) is the visible part of an organization, our point is to tackle organizations’ collaboration issue through ISs interoperability. Interoperability is defined by the European Network of excellence InterOp as “the ability of a system or a product to work with other systems or products without special effort from the customer or user” (Konstantas, Bourrières, Léonard & Boudjilida, 2005) (pp. v-vi). It is also defined by Pingaud (2009a) as “the ability of systems, natively independent, to interact in order to build harmonious and intentional collaborative behaviours without deeply modifying their individual structure or behaviour”.

As a crisis situation is an unstable phenomenon (by nature or by effect of the crisis response), it may challenge the relevancy of the collaborative processes run among the ISs of the crisis cell partners.

Mainly, the problem statement is the following: how to ensure the agility of the crisis response and the use of various and heterogeneous data sources to feed the ISs of the collaboration? How to analyse all the gathered data and extract the relevant information for a given crisis situation at time t?

2. MISE APPROACH OVERVIEW

Considering these points, we aim at designing and producing a Mediation Information System (MIS) to support interoperability among partners and to keep the response workflows relevant to the crisis situation, through the Mediation Information System Engineering 2.0 (MISE 2.0) project. This part of this research work is presented in “MISE Design Time” and “MISE Run Time” sections. The first version of the MIS prototype (result of the MISE 1.0 project) was successfully used in the French funded project ISyCri (ISyCri stands for Interoperability of Systems in Crisis situation), whose one objective was to design an IS for several partners who have to solve, or at least to reduce, a crisis into which they are involved.

Another point to deal with during the response phase is the evolutionary character of a crisis situation. Due to this fact, the system shall remain compliant with the possibly changing requirements of the situation. This implies to measure the efficiency of the response, to be able to take into account the changes of the crisis itself or in the crisis cell (i.e., the events happening in the studied ecosystem). In a few words, a continuous response to the crisis is needed.

Several research projects focused on the event-management as a mean to be more accurate about the situation at time t on the field of the crisis, but also to be more efficient to manage the events sent by the crisis’ ecosystem. Some of these projects are the French funded project SocEDA, the European funded projects PLAY (Truptil, Barthe, Bénaben, & Stuehmer, 2012) and PRONTO (Marterer, Matthias, & Koch, 2012). Such platforms integrate an Event-Driven Architecture layer, that provide them the ability to retrieve, manage and even generate complex events in order to help the users to filter the events and detect any anomaly. But such event-management is quite limited by the fact that only known types of events can be managed by static business rules. We believe that the EDA layer is a real benefit that completes the architecture of existing SOA platform (like MISE 1.0 and MISE 2.0) but its implementation is not limited to the use of a single Complex Event Processing engine (which plays the role of event filter, event manager and event generator). While (Yu & Cai, 2012) focus on the modeling of the collaborative activities and their dependencies and on the event impact on the states of the activities to solve this limitation, MISE 2.0 focuses on the detection of divergences between the whole crisis model and the effects of the events on both the crisis situation and the crisis cell (the partners and their activities). Then we propose a tool to adapt the crisis response if needed (via a partial or complete redesign/a partial or complete re-execution of

Predicting Tweet Retweetability during Hurricane Disasters