



Semantic After Action Analysis of Crisis Responding

DIADEM creates an ICT system for collaborative situation assessment and decision making during chemical crisis in industrial areas. The system logs the different actions of the crisis responders. DIADEM provides user interface for analyzing these logs later on - achieving effective after action analysis.

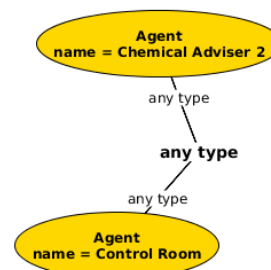
A distributed multi-agent system is used to support collaborative situation assessment and decision making for effective management of chemical hazards crisis in industrial areas. Each crisis responder is using an agent allowing him to communicate with other responders and be part of the overall workflow. In addition some agents represent automatic modules (such as gas detectors, or decision support modules). The disseminated information and the system states are logged. In order to enable the end users to learn from these logs, they are converted to semantic structures. The user can graphically query these structures to get meaningful graphical representations of the events.

Crisis Responding Scenario

The events: At a refinery, a chemical starts leaking and forms a toxic plume spreading over a populated area. The **Control Room** operator is notified by the **Gas Detection** system about the possible presence of a chemical incident caused by the leak of a dangerous gas. The **Control Room** staff apply local knowledge of the industrial environment to determine the source of the leak/cause of the incident and requests a report of the situation from the factory via the **Factory Representative**. The **Factory Representative** replies with a report that confirms the incident and provides information about the type of escaping gas. The **Control Room** directs a field inspector **Chemical Adviser 1** to the location of the incident. **Chemical Adviser 1** has appropriate expertise to estimate the quantity of the escaping gas and to propose mitigation measures at the refinery. The **Control Room** dispatches a chemical expert, **Chemical Adviser 2**, who has expertise in estimating the gas concentration in the affected area. **Chemical Adviser 2** requires information about the meteorological conditions, the source of the pollution, and the quantity and type of escaping fumes in order to estimate the zones in which the concentration of toxic gases has exceeded critical levels and to identify areas which are likely to be critical after a certain period of time. **Chemical Adviser 2** gets the weather information from the **Control Room** and the information about the source, from **Chemical Adviser 1**. **Chemical Adviser 2** guides fire fighter **Measurement Teams** which can measure gas concentrations at specific locations in order to provide a more accurate estimation of the critical area. This interaction between **Chemical Adviser 2** and the **Measurement Teams** involves negotiation to determine which team can best provide the needed measurements. A map showing the critical area is supplied by the **Chemical Adviser 2** to a **Health Expert**. He uses additional information on populated areas obtained from the municipality to estimate the impact of the toxic fumes on the human population in case of exposure.

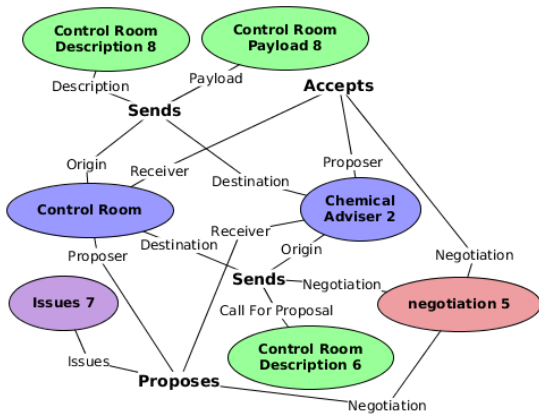
Supporting After Action Analysis

How to improve the response to crises? One of the main needs is to better understand what should be improved. That is, to obtain a clear picture of what actually happened during exercises and training sessions and real incidents. For that, detailed after action review sessions and lessons-learned reports are authored. In our context, because the communication between the different crisis responders is done using the DIADEM distributed multi-agent system, all communication is logged. These log files contain the needed information. However, they are complex to understand and distributed across the different platforms running the agents. Federation of these logs and presentation of the meaningful part of the information in a user friendly manner is needed. This is done by automatically converting the logs to semantic structures using Topic Maps (ISO/IEC 13250:2003) and by providing a graphical user interface, for querying and browsing the relevant data. The user can create a simple query such as:



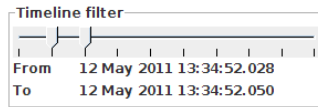
Query: relationship between two agents

That is, the user asks to see the communication between the two crisis responders - one using the Control Room agent and the other using the Chemical Adviser 2 agent. As a result all the relationships between these two specific agents are presented to the user as shown below:



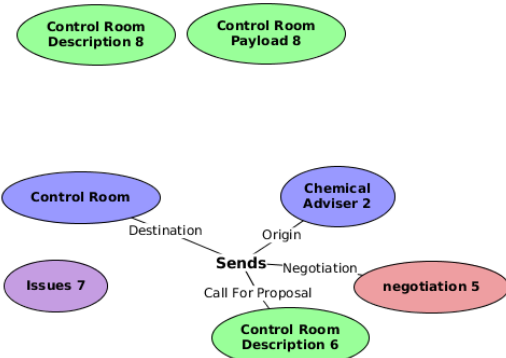
Communication between two specific agents

This resulted graph presents the negotiation messages and the actual data provided later on. However the timing of the events is not clear. Since in after action analysis, timing is crucial for understanding the events, and for identifying opportunities for improvements, the different events are presented with their timing, and a timeline filter is provided.



Timeline filter

This way, the user can filter the above picture to see, for example, the first event only - the call for proposal - as shown below.



Filtering out all events apart from one

References

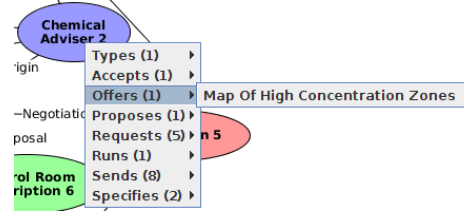
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This supports the user in finding delays and bottlenecks during the crisis response.

Apart from providing graphical querying over the logged data, the user can also browse further from the query results: right click over a node provides a drop down selection of all related nodes as shown below.



Drop down selection for browsing

That is, instead of analyzing complex distributed logs, the user is provided with natural and intuitive analysis tool allowing full understanding of the complete picture.

DIADEM Project

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