Special Theme Section: Semantic Web Technologies for Technology Enhanced Learning

Ontologies, rules and linked data to support Crisis Managers Training

Introduction

In a catastrophic event, human behaviour determines the efficacy of crisis management. Timeliness of reactions and exactness of decisions are the most relevant factors. In this context, training plays an important role to prepare Crisis Managers.

Technology-enhanced Learning (TEL) bridges the gap between *table-top exercises* – low-cost preparation testing the theoretical responsiveness to a situation – and *real-world simulations* – very effective and expensive exercises to gain valuable skills. TEL provides a near-real training environment at affordable costs. The PANDORA project (http://www.pandoraproject.eu/) is creating a training environment to coach Crisis Managers.

Modelling a Crisis Knowledge Base

To re-create crisis scenarios, PANDORA employs a Crisis Planner based on Timeline-based Planning and Scheduling technologies [4]. This Planner creates training storyboards of "events" for the trainees (e.g. news videos, phone calls or e-mails) and "reacts" to trainees' strategic decisions, triggering consequent events to continue the training session.

To simulate such scenario, a great effort is required to understand the problem specificity and to model the relevant aspects [3]. Within the PANDORA project, we are building the Crisis Knowledge Base (CKB) collecting and maintaining the "knowledge" about crisis scenarios and training sessions. The CKB illustrated in Figure 1:

- models the trainer knowledge about scenarios and training path alternative options;
- provides the Crisis Planner with "events" to be triggered during the training sessions;
- supplies other PANDORA components with information about the training session;
- records each session's events and decisions, to create individual trainee reports at the end of the training.

To fulfil those requirements, the CKB should model the crisis scenarios, the training events, the trainees' behaviour, etc. This is an opportunity to exploit Semantic Web Technologies (SWT) for TEL.

The Crisis Knowledge Base Ontologies

SWT call for the adoption of *ontologies* [11] to explicitly formalise shared knowledge conceptualizations. Moreover, developing *modular ontologies* [10] allows for an improved reuse of such modelling.

We designed two modular OWL [12] ontologies to model the CKB knowledge:

- A *Timeline-based Planning Ontology* (http://swa.cefriel.it/ontologies/tplanning), reflecting the basic conceptualization of Planning Applications based on Timeline Representations; and
- A *PANDORA Ontology* (http://swa.cefriel.it/ontologies/pandora), specifying the Crisis Management Training entities (training events, trainees, crisis situations, etc.).

- The Timeline-based Planning Ontology models the knowledge handled by a Timeline-based Planner; this ontology represents a valuable foundation for a systematic use of SWT in Planning research. The PANDORA Ontology represents the domain-specific modelling of crisis scenarios. Finally, our ontologies refer to pre-existing models, like the Time Ontology (http://www.w3.org/TR/owl-time/) or the WGS84 Geo-Positioning vocabulary (http://www.w3.org/2003/01/geo/), thus linking the CKB to other datasets.
- Still SWT offer further opportunities: we are extending our CKB by modelling the logical "consequences" between the crisis events in rule languages like RIF [2] or the SPARQL 1.1 Entailment Regimes [5]; we are exploring existing implementations using SPARQL [9] for inference, like SPIN [6].

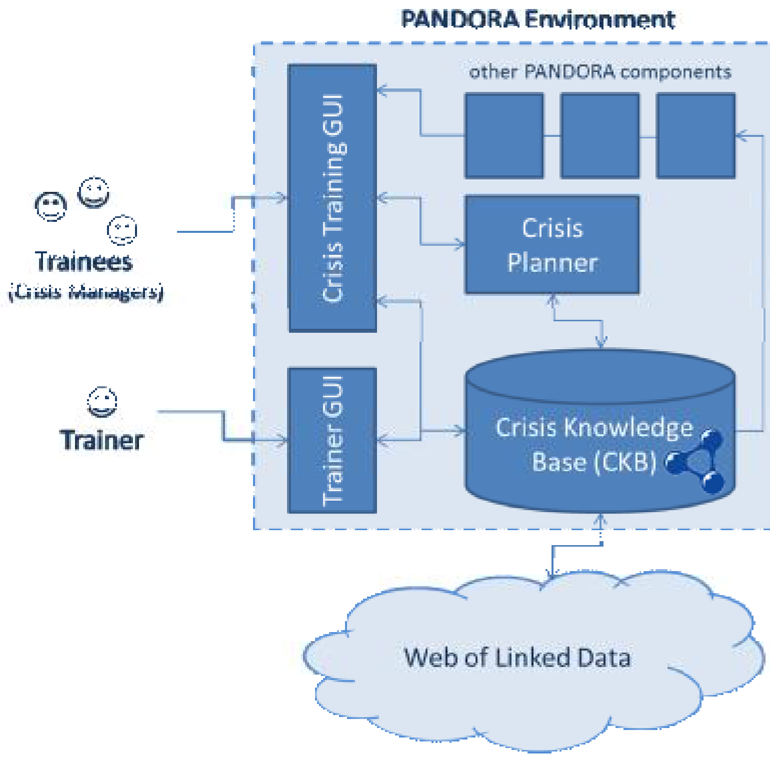

Figure 1 - The Crisis Knowledge Base.

Populating the Crisis Knowledge Base

The CKB stores the crisis data as RDF triples [8] described in the aforementioned ontologies. While the basic data are provided by the trainers, who hold the experience to model such knowledge, they cannot insert all the potentially useful information to describe a crisis scenario (e.g. a town topology); still, such elements can be crucial to make the training realistic.

We adopted Linked Data principles [1] to connect our CKB to the Web of Data. Linking to GeoNames, for example, lets our CKB to directly benefit from a geographical database containing over 10 million geographical names. Similarly, the CKB is linked to other general-purpose datasets like Freebase (http://freebase.com/) or DBpedia [7] (http://dbpedia.org/).

We will also publish our CKB as Linked Data. This brings two advantages: we provide our contribution to the Web of Data, enabling other researchers to re-use our knowledge base; and we open the CKB to the community contribution, which can extend our knowledge base.

Conclusions and future works

In this paper we presented our work towards a comprehensive Crisis Knowledge for the Crisis Managers Training. We explained how we employ SWT to enhance this TEL environment. Our future activities include the CKB deployment as Linked Data and the development of a read/write REST API to let external components interact with the CKB. Our approach will be tested and validated in the PANDORA environment.

Acknowledgments

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