Modeling Expert Knowledge in the Mediation Domain: A Middle-out Approach to Design ODR Ontologies

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Abstract. In this paper we describe the steps taken to model expert knowledge within the mediation domain as the basis for the design of the Mediation Core Ontology (MCO), of which we also offer a first outline of its present stage of development. MCO is created from scratch by eliciting practical knowledge from mediation experts to identify the basic working concepts of the domain. MCO offers initial support towards knowledge acquisition and reasoning and, in later steps, will serve as a general basis for the development of different mediation domain and sub-domain ontologies to be used by the ONTOMEDIA mediation platform, currently also under development.

Keywords: Online Dispute Resolution (ODR), Alternative Dispute Resolution (ADR), online mediation, ontologies, knowledge acquisition.

1 Introduction

Online Dispute Resolution (ODR) is an umbrella domain that covers a full range of processes (i.e. negotiation, early neutral evaluation, conciliation, mediation, and arbitration) to handle disputes online. While it was sometimes viewed as the online equivalent of ADR (Alternative Dispute Resolution) processes, there is a growing consensus in specialized literature that considers ODR more than just the delivery of alternative dispute resolution (ADR) services through the Internet, especially since Katsh first suggested to give technology the role of a "four party" [1]. In this line, the emergence of a panoply of both new terminologies and typologies to systematize current ODR practices proves that the domain is becoming a branch of dispute resolution in its own right [2, 3, 4, 5].

For fifteen years now, ODR processes have evolved with the development of the Internet. As an example, ENSs (e-negotiation systems) deployed in the Web use different Internet technologies to actively assist negotiators, facilitators, and mediators [6]. Yet, some experts have warned that ODR service providers may be lagging behind the curve of recent developments in both Web 2.0 and Semantic Web [7, 8, 9]. The ONTOMEDIA project aims at filling this gap by designing an interactive, web-based mediation platform to assist disputing parties and mediators in identifying

different options for the management and resolution of disputes in different domains.[1] One of the objectives of ONTOMEDIA is to model expert knowledge on mediation as a domain independent process that, in turn, may be able to encompass different mediation sub-domains (i.e. commerce, family, health, workplace, environment, etc.). The ONTOMEDIA platform will therefore assist users in considering different options of mediation and guiding them throughout the online mediation process.

In this paper we describe the methodological approach taken for modeling expert knowledge on mediation processes, and outline the design of the Mediation Core Ontology (MCO). MCO thus represents the common structure of mediation processes and provides the platform with conceptual machine-processable knowledge regarding mediation events. This is one of the first attempts to design an ontology that models mediation processes within the dispute resolution field.

2 Mediation as a domain of knowledge

A meta-analysis of the relational justice domain (the justice produced through cooperative behavior, agreement, negotiation, or dialogue among actors in conflict or post-conflict situations) reveals that there are at least thirty disciplinary areas contributing to the development of the domain [10]. It therefore comes as no surprise if the mediation domain is populated with a full range of concepts, operational definitions, and models [11, 12]. To quote a recent example, Alexander identifies up to six models of mediation practice: settlement mediation, facilitative mediation, transformative mediation, expert advisory mediation, wise counsel mediation, and tradition-based mediation [12]. In addition, as far as it provides a new procedural and communicational framework for interaction, decision-making, and emotion expression [13] online mediation may substantially transform any of those models.

2.1 Mediation as a process

While bearing in mind the many possible ways in which mediation might be defined and modeled, therefore, we have opted for an approach that emphasizes the representation of the procedural aspects of mediation over the epistemological and theoretical ones. This is not meant to be an entirely agnostic approach, since the focus on procedures already implies epistemological and theoretical choices. Similarly, the emphasis on procedural knowledge does not entail neglecting conceptual knowledge on mediation. Rather, we intend MCO to be a shareable and reusable ontology so that we needed to restrain these ontological commitments to a minimum [14].

Coherently, we propose to define mediation as a voluntary, non-binding process in which a neutral third party, the mediator, assists the parties in reaching a settlement of the dispute. This definition is consistent with the one proposed by the recent Directive

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[1] ONTOMEDIA: Platform of Web Services for Online Mediation, Spanish Ministry of Industry, Tourism and Commerce (Plan AVANZA I+D, TSI-020501-2008, 2008-2010).

2008/52/EC,[2] and flexible enough to allow any number of disputing parties, roles, and procedural stages of mediation.

2.1   Ontologies, mediation and ODR

To date, there is no working ontology dealing with the fundamental concepts of mediation as a process. Certainly, there is precedent work on ontology design within related domains, namely the e-commerce field [15], task collaboration [16], negotiation [17], and negotiation agents [18]. There are also some ontologies that model different conflict events [19, 20] but in these cases the emphasis is put on terrorism and security issues rather than in conflict management.

Finally, there are a number of ongoing research projects that are currently developing ODR-related ontologies. The BEST project (BATNA Establishment using Semantic Web Technology) aims to provide disputing parties with information about their position in the negotiations before they seek professional assistance, and to assist them in the dispute or get information about the legal possibilities to claim compensations [21]. The ALIS Project (Automated Legal Intelligent System) combines game theory, computational logic, and legal reasoning to analyze the compliance of parties' requests in intellectual property disputes [22]. The CEN Workshop on Standardization of Online Dispute Resolution Tools has elaborated a basic ontology of ODR processes [23]. While BEST and ALIS are producing in fact legal domain ontologies (covering damage disputes and intellectual property respectively), the CEN ontology is domain-independent and, thus, the closest precedent to our work [24].

3   Mediation Core Ontology development

The initial stages of the ONTOMEDIA project have run in parallel with the elaboration of the White Book on Mediation in Catalonia, a project coordinated by the UAB Institute of Law and Technology [25]. The main purpose of the White Book is to provide Catalan lawmakers with in-depth research on the state-of-the-art mediation theories and practices as the basis for future legislation and policies. The White Book project has provided a unique opportunity to gather national and international leading experts and practitioners in a number of work sessions and workshops on concepts, methods, techniques and protocols of mediation.

The expert knowledge and support offered by the participants and the outcomes of the White Book project have been integrated in the methodological process for the

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[2] The Directive 2008/52/EC of the European Parliament and of the Council of 21 May 2008 on certain aspects of mediation in civil and commercial matters defines mediation in article 3(a) as "a structured process, however named or referred to, whereby two or more parties to a dispute attempt by themselves, on a voluntary basis, to reach an agreement on the settlement of their dispute with the assistance of a mediator. This process may be initiated by the parties or suggested or ordered by a court or prescribed by the law of a Member State".

development of MCO. These different methodological steps have followed already established ontology development methodologies, such as METHONTOLOGY [26], On-To-Knowledge (OTK) [27], HCOME [28] or UPON [29], which describe a preparatory step (establishment of requirements), a development step (knowledge acquisition, conceptualization and formalization), an evaluation stage and a (if required) implementation step [30]. In the following sections, we will describe the preparatory and development steps.

3.1   Ontology requirements

MCO will serve as a general basis for the development of the mediation domain ontologies and sub-ontologies that will be used by the ONTOMEDIA platform. Therefore, it is directed at knowledge reuse, although it may also offer initial support towards knowledge acquisition and reasoning.

The knowledge acquisition stage is mainly based on the elicitation of expert knowledge. Nevertheless, existing upper ontologies (and legal core ontologies) are taken into account for design purposes. This knowledge acquisition process is guided by a list of questions establishing which knowledge ought to be included in the ontology and what type of answers ought the ontology to be able to give.

Table 1: Mediation Core Ontology (MCO) Requirements Specification Document

Purpose		Explicit expert knowledge in the mediation domain for knowledge reuse and for providing support towards knowledge acquisition and reasoning.
Methodological approach		An expert-based methodology based on the main steps provided by several current ontology methodologies (METHONTOLOGY, OTK, HCOME or UPON): 1) preparatory step, 2) development step, and 3) evaluation step. The knowledge acquisition process is mainly based on knowledge elicitation from experts, although is supported by knowledge acquisition from texts and guidance from theoretical approaches to the analysis of the mediation domain.
Sources of knowledge	**Competency questions**	What types of mediation exist? What characterizes them? Are there separate acts or situations within a mediation process? Which documents or other information sources are produced or used during a mediation process or stage? Which participants can take part in a specific type of mediation process? Which restrictions on the mediation process are caused by the topic of the mediation? What are the limitations on agents regarding the roles they might take in a mediation process?
	Other sources	Expert elicitation (White Book project). Relevant regulations and legislation (e.g. Directive 2008/52/EC, EC Recommendation 98/257 & 2001/310).
Tool support		Statistic text analysis tools (JRef, Yoshikoder, AntConc, etc.)
Ontology editor		Protégé v. 3.4.
Reuse		Conceptual knowledge contained in upper ontologies such as PROTON [31], LKIF-Core [32], CLO (DOLCE) [33], has been taken into account as design support.

3.2   Knowledge acquisition

From the knowledge acquisition perspective, the White Book outputs (early drafts, workshop papers, literature reviews, etc.) are a first-hand input for ontology design in ONTOMEDIA. We have analyzed these materials in consensus building sessions to identify a common conceptual framework broader enough to support different models and sub-domains of mediation. As a result, we elicited an initial taxonomy of concepts and relations, guided by the established competency questions (ORSD).
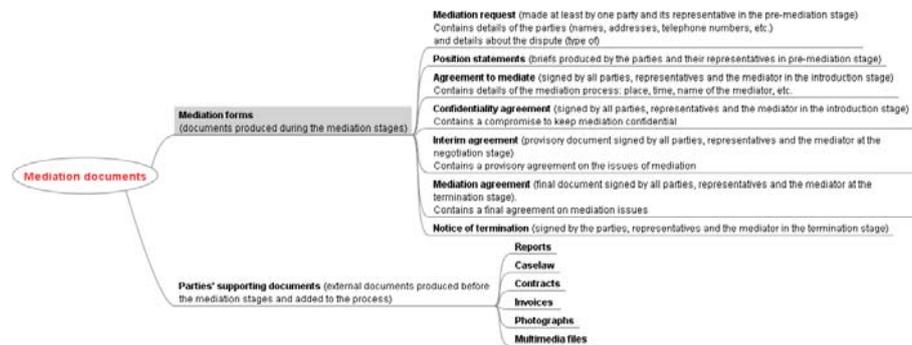

Figure 1: Expert schema regarding mediation documents

A second source of acquisition of knowledge has been drawn from ethnographic fieldwork, since one member of the team has been participating in a multiparty mediation process involving five mediators (this is work in progress). Participant observation has produced informal interviews with mediators conducted either individually or in group to elicit procedural knowledge used by domain experts in their practice. The translation of ethnographic findings into manageable knowledge leading to the design of ontologies relies on experience from related research projects [34, 35]. In this case, ethnographic research also loosely follows the guidelines of the EthnoModel, which are defined as a set of generic heuristics that "may be used both by investigators to conduct ethnographic studies of work and by designers interested in system design" (i.e. plans, procedures, and coordination) [36].

We have complemented these previous inputs with an analysis of mediation procedures as deployed by major mediation services (both online and off line service providers). Again, we have benefitted here from synergies from the White Book project, where we have developed a template to analyze which mediation stages and related mediation forms are most usual among major service providers (up to 23 so far), regardless of the mediation sub-domain involved [37].

Finally, relevant existing regulations within the European Union (*e.g.* Directive 2008/52/EC of the European Parliament and of the Council of 21 May 2008 on certain aspects of mediation in civil and commercial matters) have been taken into account as regards concept definitions and linguistic use of terms. For example, extracted relevant terms in the mediation domain from European regulations are:

mediation, *parties*, *dispute*, *agreement*, *process*, *mediator*, *information*, *resolution*, *provider*, etc.
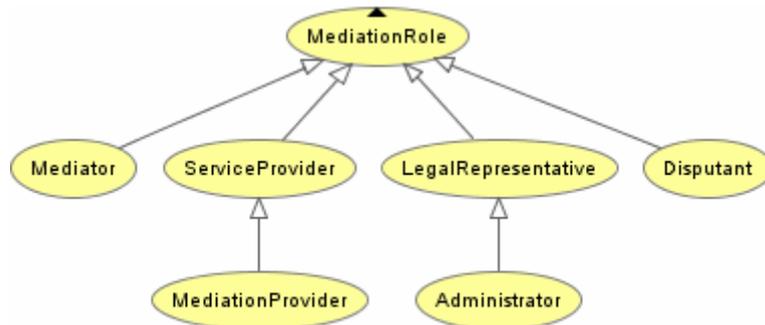

4   Mediation Core Ontology (MCO)

The knowledge acquired in the previous phase (list of terms and conceptual schemas regarding knowledge required for the competency questions) from the experts has been further formalized in OWL-DL.[3] The current version of the Mediation Core Ontology has 62 concepts. The main objective of the formalization stage was to model formally the main acquired concepts related to the mediation domain and to try to establish the most important relations between them.

Our approach has resulted in an initial taxonomic structure formed by the following concepts:

- `MediationAgent`: Includes all possible agents (actors) in the mediation domain.
- `MediationInformationSource`: All possible information sources, including the forms that are created within the mediation process or `MediationForm` (such as, `AgreementToMediate`, or `NoticeOfTermination`), and other sources of information that can support the claims of the disputants.
- `MediationTopic`: all topics that configure the different types of `MediationProcess`, for example, mediation regarding family issues, consumer related complaints, environmental issues, school or labour problems, etc. The mediation process, its agents and other related concepts may require different properties according to the topic or the particular problem underlying the process.
- `MediationProcess`: includes the different processes according to their topic. Thus, it includes as subclasses: `ConsumerMediation`, `SchoolMediation`, `LabourMediation`, etc.
- `MediationProcessStage`: identifiable stages of a mediation process.
- `MediationSession`: identifiable situations taking part during the mediation process involving the different roles.
- `MediationRole`: all the possible roles that participants may assume in a mediation process (`Disputant`, `Mediator`, `ServiceProvider`, `LegalRepresentative` are some of its subclasses).

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[3] Protégé versión 3.4.

Figure 2: `MediationRole` in Mediation Core Ontology

Once this main hierarchy of concepts could be established, these concepts were specified and the main relations existing between them, elicited from experts, were also formalized. At the moment, 10 `owl:objectProperty` and 3 `owl:dataTypeProperties` have been included in the ontology.

More complex relations and concept definitions have also been specified to allow reasoning on the mediation domain, and facilitate its reuse by the OntoMedia platform. For example, the ontology includes the specification of the idea that a mediation process requires at least two disputants and one mediator.

5   Conclusions and future work

In this paper we have described the knowledge acquisition process and conceptualization stages leading to the design of the Mediation Core Ontology (MCO), of which we also offer a first outline. We intend MCO to represent a basic and flexible conceptual structure of mediation processes with minimal ontological commitments.

Currently, the Mediation Core Ontology includes only the concepts related to the core mediation domain, and may be of use towards knowledge acquisition and reasoning tasks. Future work will include its modular extension to the different mediation subdomains (i.e. labour mediation, family mediation, etc.) and will be adapted for the use of the ONTOMEDIA platform.

Moreover, the Mediation Core Ontology is currently under submission for evaluation to an expert panel from the White Book project, and will be further tested (and refined if necessary) with the instantiation of several currently available mediation services.

Once the ontology has undergone the evaluation and refinement processes it will be made publicly available.

References

1. Katsh, E., Rifkin, J.: Online Dispute Resolution: Resolving Conflicts in Cyberspace. Jossey-Bass Inc., San Francisco (2001)
2. Mann, B. L.: Smoothing Some Wrinkles in Online Dispute Resolution. International Journal of Law and Information Technology 17(1), 83--112 (2008)
3. Thiessen, E., Zeleznikow, J: "Technical Aspects of Online Dispute Resolution -Challenges and Opportunities" in Conley Tyler, M., Katsh, E., Choi, D. (eds.): Proceedings of the Third Annual Forum on Online Dispute Resolution, Melbourne, Australia, 5-6 July 2004, http://www.odr.info/unforum2004/thiessen_zeleznikow.htm
4. Lodder, A., Thiessen, E. "Artificial Intelligence and ODR", in Katsh, E., Choi, E.: Proceedings of the United Nations Forum on Online Dispute Resolution (ODR): Technology as the "Fourth Party", Palais des Nations, Geneva, June 30 - July 1, 2003, http://www.odr.info/unece2003/
5. Gordon, T.F., Märker, O.: "Mediation Systems", in Märker, O., Trénel, M. (eds.): Neue Medien in Der Konfliktvermittlung - Mit Beispielen Aus Politik Und Wirtschaft. Berlin: Edition Sigma, 2002. 61-84.
6. Kersten, G., Lai, H.: Negotiation Support and E-negotiation Systems: An Overview. Group Decision and Negotiation 16: 553--586 (2007)
7. Rule, C.: Making Peace on eBay: Resolving Disputes in the World's Largest Marketplace. ACResolution, Fall 2008: 8--11 (2008)
8. Hattotuwa, S.: The Future of Online Dispute Resolution (ODR): Technologies to Keep an Eye On. In 2008 Online Dispute Resolution Forum, June 22, 2008, http://ict4peace.wordpress.com/2008/06/
9. Poblet, M.: Bringing a New Vision to Online Dispute Resolution. In: Poblet, M. (ed.) Expanding the Horizons of ODR: Proceedings of the 5th International Workshop on Online Dispute Resolution (ODR Workshop'08). CEUR-Workshop Proceeding Series, vol. 430, pp. 1--7 (2008), http://ftp.informatik.rwth-aachen.de/Publications/CEUR-WS/Vol-430/
10. Casanovas, P., Poblet, M.: Concepts and Fields of Relational Justice. In P. Casanovas, G. Sartor, N. Casellas, R. Rubino (eds.) Computable Models of the Law: Languages, Dialogue, Games, Ontologies. LNAI, vol. 4884, pp. 323-339. Springer, Heidelberg (2008)
11. Herrman, M.S., Hollett, N., Gale, J. Mediation from Beginning to End: A Testable Model. In M.S. Herrman (ed.) The Blackwell Handbook of Mediation: Bridging Theory, Research, and Practice, pp. 19--78. Blackwell Publishing, Malden, MA (2006)
12. Alexander, N.: The Mediation Metamodel: Understanding Practice. Conflict Resolution Quarterly 26 (1): 97--125 (2008)
13. Poblet, M., Casanovas, P.: Emotions in ODR. International Review of Law, Computers & Technology 21 (2), 145--156 (2007)
14. Gruber, T.: Toward Principles for the Design of Ontologies Used for Knowledge Sharing. International Journal Human-Computer Studies 43 (5-6), 907--928 (1995)
15. Walton, D., Godden, D.M.: Persuasion Dialogue in Online Dispute Resolution. AI and Law 13, 273–295 (2005)
16. Tamma, V., Phelps, S., Dickinson, I., Wooldridge, M.: Ontologies for Supporting Negotiation in e-Commerce. Engineering Applications of Artificial Intelligence 18, 223–236 (2005)

17. Ermolayev, V., Keberle, N., Tolok, V.: OIL Ontologies for Collaborative Task Performance in Coalitions of Self-Interested Actors. In: Arisawa, H., Kambayashi, Y., Kumar, V., Mayr, H.C., Hunt, I. (eds.) ER Workshops 2001. LNCS, vol. 2465, pp. 390–402. Springer, Heidelberg (2002)

18. Anumba, C.J., Ren, Z., Thorpe, A., Ugwu, O.O., Newnham, L.: Negotiation within a Multiagent System for the Collaborative Design of Light Industrial Buildings. Advances in Engineering Software 34, 389–401 (2003)

19. Tanev, H., Wennerberg, P.: Learning to Populate an Ontology of Politically Motivated Violent Events. In: F. Fogelman-Soulié *et al*. (eds.) Mining Massive Data Sets for Security, pp. 311—322. Ios Press, Amsterdam (2008)

20. Smart, P.R., Russell, A., Shadbolt, N.R., Schaefel, M.C., Carr, L.: A Technical Demonstrator System For Enhanced Situation Awareness. The Computer Journal 50 (6), 703—716 (2007)

21. BEST Project, http://www.best-project.nl/index.shtml

22. Cevenini, C., Fioriglio, G. ICT-Supported Dispute Resolution. In: In P. Casanovas, G. Sartor, N. Casellas, R. Rubino (eds.) Computable Models of the Law: Languages, Dialogue, Games, Ontologies. LNAI, vol. 4884, pp. 312-322. Springer, Heidelberg (2008)

23. CEN Workshop on Standardization of Online Dispute Resolution Tools, http://www.cen.eu/cenorm/businessdomains/businessdomains/isss/activity/ws_odr.asp

24. CEN [Draft] Workshop Agreement on Standardisation of Online Dispute Resolution Tools (open to comments, final version to be published on June 2009), 2009-02-16, http://www.cen.eu/cenorm/businessdomains/businessdomains/isss/activity/draftcwaodrstand v31.pdf

25. White Book on Mediation in Catalonia, http:// http://idt.uab.es/llibreblanc/index.php?lang=english

26. Gómez-Pérez, A., Fernández-López, M., and Corcho, O. *Ontological Engineering. With examples from the areas of Knowledge Management, e-Commerce and the Semantic Web. Advanced Information and Knowledge Processing*. Springer-Verlag, London. (2003).

27. Sure, Y. and Studer, R. A methodology for ontology-based knowledge management. In Davies, J., Fensel, D., and van Harmelen, F., editors, Towards the Semantic Web. Ontology-driven Knowledge Management, pages 33–46. John Wiley & Sons, LTD, Chichester, England (2003).

28. Kotis, K. and Vouros, A. Human-centered ontology engineering: The HCOME methodology. Knowledge and Information Systems, 10(1):109–131 (2006).

29. Nicola, A. D., Missikoff, M., and Navigli, R. A proposal for a unified process for ontology building: UPON. In Andersen, K. V., Debenham, J. K., and Wagner, R., editors, Database and Expert Systems Applications (DEXA), volume 3588 of Lecture Notes in Computer Science, pages 655–664. Springer (2005).

30. Casellas, N. Modelling Legal Knowledge Through Ontologies. OPJK: the Ontology of Professional Judicial Knowledge. PhD thesis, Faculty of Law, Universitat Autònoma de Barcelona, Barcelona (2008).

31. Terziev, I., Kiryakov, A., and Manov, D. (2005). D1.8.1 base upper-level ontology (bulo) guidance. SEKT IST-2003-506826 Deliverable 1.8.1, SEKT, EU-IST Project IST-2003-506826, Ontotext Lab, Sirma Group (Bulgaria).

32. Breuker, J., Hoekstra, R., Boer, A., van den Berg, K., Rubino, R., Sartor, G., Palmirani, M., Wyner, A., and Bench-Capon, T. (2007). Owl ontology of basic legal concepts (lkif-core). Deliverable 1.4 D.1.4, ESTRELLA project (IST-2004-027655).

33. Gangemi, A., Sagri, M.-T., and Tiscornia, D. (2005). A constructive framework for legal ontologies. In Benjamins et al. (2005b), pages 97–124.

34. Casanovas, P., Casellas, N., Vallbé, J.J. "An ontology-based decision support system for judges". A P. Casanovas, J. Breuker, M. Klein i E. Francesconi (eds.), *Channelling the legal information flood. Legal ontologies and the Semantic Web*, Volume 188, Frontiers in

Artificial Intelligence and Applications, IOS Press: Amsterdam, (2009) pp. 165-176 (ISBN 978-1-58603-942-4).

35. Poblet, M., Vallbé, J.J., Casellas, N., Casanovas, P.: Judges as IT Users: The Iuriservice Example. In A. Cerrillo and P. Fabra (eds.) E-justice: Using Information Communication Technologies in the Court System, pp. 38 – 56. IGI-Global, USA (2008)

36. Iqbal, R., Gatward, R.A., James, A.E.: A General Approach to Ethnographic Analysis for Systems Design. In: Proceedings of SIGDOC 2005, pp. 34--40. ACM, Coventry, UK (2005)

37. Poblet, M.: Mediació i Tecnologia: Estat de l'Art. Deliverable ET.11.1 of the White Book on Mediation in Catalonia (2008)