

An Agent-based Architecture for Multifaceted Online Dispute Resolution Tools

Davide Carneiro, Paulo Novais, José Neves

Department of Informatics, University of Minho, Braga, Portugal
{dcarneiro, pjon, jneves}@di.uminho.pt

Abstract. Online Dispute Resolution (ODR) tools are being seen as a way to settle disputes out of courts, namely under virtual environments. However, the acceptance of these alternative methods is still relatively restricted, once existing tools are relatively undemanding and domain-centered. Indeed, there is the need for conceptual tools whose parts may be arranged for particular use, i.e., to operate in different domains. Following this line of attack, in this paper it will be presented a new agent-based approach to ODR. It comes in an abstract and formal form, in order to be independent of the legal domains, but specific enough to be applied to concrete ones. The main advantage is that functionality reuse is maximized, making architectures simpler to implement and to expand.

Keywords: Multi-agent Systems, Online Dispute Resolution, Intelligent Environments.

1 Introduction

The technological evolution led to unprecedented changes in virtually every aspect of the society. As an example, a significant percentage of contracts in the most different fields is now signed under an electronic or virtual environment, whereas in the past all contracts were signed with the physical presence of all the parties involved. Another difference is that in the past these contracts were paper-based, while now they are completely electronic, without a mandatory paper support. The most evident example of this new reality is visible on the recent e-commerce phenomenon [1], of which web-sites like the ones of Amazon and e-Bay are the best examples. However, similarly to traditional paper-based contracts, disputes can also arise in an electronic setting. In fact, according to Javelin Strategy and Research¹, only 45% of electronic costumers are satisfied with the quality of products sold online. It is nowadays clear that the traditional approach for solving disputes by means of litigation in court is not feasible anymore.

An alternative way of solving disputes arising out of electronic contracting is Online Dispute Resolution (ODR), allowing already traditional alternative dispute resolution methods such as negotiation, mediation or arbitration to be moved “from a physical to a virtual place” [2]. ODR makes available to all the parties an

¹ <https://www.javelinstrategy.com/research>

undemanding way of litigation, and a simple and efficient way to deal with disputes, thus saving time and assets [3].

In devising such systems, we are taking into consideration the Katsch/Rifkin vision of the four parties in an ODR process: the two opposing parties, the third neutral party and the technology that works with the mediator or arbitrator [4]. We clearly assume a gradual tendency to foster the intervention of autonomous software agents, which act either as decision support systems or as real electronic mediators [5]. The consideration of this wider role for software agents is based in the use of Artificial Intelligence based methodologies and techniques either for problem solving or knowledge representation and reasoning, such as Case-Based Reasoning [6].

In this paper we focus on the problematic of developing an architecture for multi-domain dispute resolution, whose objective is to enable a range of services targeted at assisting the disputant parties, independently of the domain of the dispute. This architecture is abstract in the sense that it encompasses perceptions that are common to the several domains addressed. It is also specific in the sense that it provides support for the specificities of each domain, in a transparent manner. Indeed, the objective of this work is to develop an agent-based architecture that can be used in several legal domains. It is being developed in the context of the Portuguese legal system, covering three major fields of The Law: Family Law [13], Consumer Law [12] and Labor Law [11].

2 Identifying Abstract Perceptions and Processes

In a dispute resolution process we can talk of abstract entities that are present regardless the domain of the dispute. As an example, to a certain point, a negotiation process will always be a sequence of rounds in which, in each round, each party states its view about the current proposal on the table, i.e., the process goes on independently of the subject of the proposals. The same happens with certain perceptions. As an example, independently of the domain of the dispute, a party will always be interested in knowing its best and worst possible scenario. Therefore, in the development of an abstract architecture, firstly one has to identify which perceptions and processes are present in the quite a few domains that can be modeled.

2.1 Abstract Perceptions

On determining the abstract picture for a multi-domain ODR tool aimed at assisting the parties, one must pursue by determining which information would actually be useful for the parties and then state the overall perception of the situation. Undeniably, it would be interesting for a party to determine to which extent is it reasonable to engage in a dispute resolution process, i.e., would a better outcome be reached using an alternative dispute resolution process instead of litigation?

The thought that encompasses this is the BATNA - Best Alternative to a Negotiated Agreement, or the possible best outcome “along a particular path if I try to get my interests satisfied in a way that does not require negotiation with the other party” [7]. This conception is abstract as it is useful for any dispute, and it is

constructive for parties once, at least, it contributes to the acknowledgement that an agreement may be disadvantageous [8]. A similar hypothesis is the Worst Alternative To a Negotiated Agreement (WATNA) [9]. A WATNA intends to estimate the worst possible outcome along a litigation path. It can be quite relevant in the calculation of the real risks that parties will face in a judicially determined litigation, imagining the worst possible outcome for the party.

However, it could also be interesting to consider the room already settled between the BATNA and WATNA, as a useful element to be taken into account for making (or accepting) a proposal. Of course, excluding the space between BATNA and WATNA, less dangerous is for the party not to accept the agreement (unless, of course, its BATNA is really unfavorable). A wider room between BATNA and WATNA would usually mean that it becomes rather dangerous for the party not to accept the ODR agreement (except in situations when the WATNA is really not inconvenient at all for the party). This idea is evidently related to the Zone of Possible Agreement (ZOPA) proposed by Raiffa (1982) [10].

Moreover, it would be interesting for a party to understand the region of such a space in which a result is more likely to come about, i.e., if the parties are going to solve the dispute through litigation, which is the most likely outcome? In fact, sticking only with the BATNA and WATNA may not be realistic. Thus, an informed party should also consider concept of MLATNA – Most Likely Alternative to a Negotiated Agreement. Using the same arguments, it may bring to a close that the existence of metrics that assess the probability of each possible outcome could also be extremely useful for a party. Thus, it will be possible to consider the view of plausible case: a possible outcome with an associated value of likeliness.

2.2 Abstract Processes

Likewise, there are processes that implement key functionalities, which are intangible enough to be reused in a number of legal domains. Concretely, two abstract processes were applied: case retrieval and negotiation. The former caters for a selection of a set of past known cases that can be relevant, considering the current dispute. Parties can then analyze these cases, and obtain valuable information about past similar disputes. The remaining one is concerning with negotiation, making available a common negotiation process in which two or more parties state their opinions in sequential rounds about the subject being negotiated. This process allows the parties to reach a consensus about the outcome of a dispute.

3 An Architecture for a Multifaceted ODR Platform

Let us now depict the architecture that implements the ideas described so far. There are two main issues: the actual abstract architecture and an ontology that allows for the agents to perform specific tasks according to the domain of discourse.

3.1 The Architecture

The architecture builds on a set of software agents, autonomous and proactive, that cooperate in order to achieve their goals. On the other hand, a development strategy was devised that organizes the agents in two categories, namely: high-level agents and low-level ones. High-level agents perform tasks that do not need explicit domain-dependant information. Low-level ones are closer to the legal domain, in need of methodologies for problem solving and/or methods for knowledge representing and reasoning, in particular to think up the legal procedures. In general, high-level agents monitor and set the behaviour of the low level ones. Low-level agents act on the object-level data and knowledge, that make the extensions of the functions that describe the universe of discourse.

Let us take as example a negotiation process: high-level agents guide the process and determine when a new round should start, or finish; low-level ones have the autonomy to choose the actions to be performed, according to the state of the domain of discourse. That is, depending on the domain, low level agents will compute a valid output in each round. All the agents and their roles are depicted in [11]. These agents were defined according to the specific requirements of the project, following an iterative cut-down practice of increasing specification.

3.2 The Ontology

Having specified the high level architecture, let us now show how it can be used to implement specific services. This will be done through the use of ontologies. The method consists in defining a specific ontology for each legal domain. Each ontology encodes a domain theory, actions, constraints and rules, revealing to the agent what action is to be executed and how to achieve it, i.e., according to the legal domain being attended to. The main advantage of this approach is that a single agent can be used to perform a similar task in a wide range of domains in opposition to a traditional one in which an agent would be used for each different domain. As an example, let us consider the action of searching for similar cases. Instead of having three different agents, one for each of the legal domains under equation (i.e., Commercial, Family and Labour), we have one single agent and three different ontologies. This line of attack significantly increases functionality reuse and allows for a single architecture supporting services in a wide range of domains. It also simplifies the task of extending the architecture for addressing new legal domains by developing an ontology for everyone, with all the actions, rules, constraints and specific theories. This will tell the low-level agents how to act in a new domain.

Each ontology comprises four components: the vocabulary, the actions, the features and a theory. The vocabulary contains all the words that can be used to describe the entities that belong to the domain. Actions define how each action should be executed according to the domain of the ontology. The theory will define all the elements that make up the perceptions about the universe of discourse (e.g., type, number). Finally, features allow for add up of invariants to the perceptions and actions that make up the ontology.

As an example, let us consider the computation of the BATNA and WATNA in two different legal domains, namely: Commercial Law and Labour Law. These two

abstract conceptions denote, as it was described above, the best and worst possible scenario in a litigation process, i.e., it has a meaning that can be of use independently of the domain of the dispute. Nevertheless, depending on that domain, it is computed in different ways. In Labour Law we will have to consider views in terms of worker antiquity, monthly salary, seniority, a joust cause for dismissal, just to name a few. On the other hand, in Commercial Law key views would be the date in which the product was bought, the type of the product, the type of the warranty, the state of the product, among others. Thus, two different ontologies (i.e., Labour and Commercial) define the act of computing the BATNA and WATNA, in different ways:

A simplification of the rules that allow the computation of the BATNA and WATNA for the Portuguese Labour Law, as it is given in Decree of Law (DL) 7/2009 (Portuguese laws)..

```
Def Rule 396
if RULE_394 then
  WATNA := 3 * (M_SALARY + SENIORITY)
  if TEMPORARY_CONTRACT then
    if WATNA < M_REMAINING * (M_SALARY + SENIORITY) then
      WATNA := M_REMAINING * (M_SALARY + SENIORITY)
  if WATNA < 15 * (D_SALARY + SENIORITY) then
    WATNA := 15 * (D_SALARY + SENIORITY)
  BATNA := 45 * (D_SALARY + SENIORITY)
  if BATNA < DAMAGE then
    BATNA := +DAMAGE
```

A simplification of the rules that allow the computation of the BATNA for the Commercial Law, as it is given in DL 67/2003. In this example rule it will be considered only numbers 1 to 4 of Article 5th.

```
Def Rule 5
if IS_MOBILE then
  if DEFECT_COMPLAINT_DELAY < 60 then
    if WARRANTY_DELAY < 730 then
      BATNA := {"product repair in 30 days";
               "product replacement"}
    else BATNA := {"no indemnity due"}
  else BATNA := {"no indemnity due"}
else
  if DEFECT_COMPLAINT_DELAY < 365 then
    if WARRANTY_DELAY < 1810 then
      BATNA := {"product repair in reasonable time";
```

4 Conclusion

One of the major challenges that Online Dispute Resolution faces is the lack of tools that can address more than one legal field. In fact, most of existing tools focus only on small and very limited domains. Following the approach presented in this paper, three prototypes focusing on different legal domains are being developed. These prototypes are based on a single agent-based architecture targeted at providing services for dispute resolution. The services implemented are abstract enough to be useful in

several legal domains and contain the specific rules needed to be used in each specific domain. Using ontologies to specialize a single agent in several legal domains makes the architecture simple and makes it easy to expand it to other legal domains, by adding new ontologies. This, we believe, will foster the development of multi-domain Online Dispute Resolution Platforms.

Acknowledgments. The work described in this paper was developed under the TIARAC - Telematics and Artificial Intelligence in Alternative Conflict Resolution Project (PTDC/JUR/71354/2006), a research project supported by FCT (Science & Technology Foundation), Portugal.

5 References

1. Goel, R.: E-Commerce. New Age International. (2007)
2. Bellucci, E., Lodder, A., Zeleznikow, J.: Integrating artificial intelligence, argumentation and game theory to develop an online dispute resolution environment, ICTAI-2004 – 16th IEEE International Conference on Tools with Artificial Intelligence, pp. 749-754. (2004)
3. Klaming, L., Van Veenen, J., Leenes, R.: I want the opposite of what you want: summary of a study on the reduction of fixed-pie perceptions in online negotiations. In: Expanding the horizons of ODR, Proceedings of the 5th International Workshop on Online Dispute Resolution (ODR Workshop'08) Firenze, Italy, pp. 84-94. (2008)
4. Katsch, E., Rifkin, J.: Online Dispute Resolution – resolving conflicts in cyberspace. Jossey-Bass Wiley Company, San Francisco. (2001)
5. Peruginelli, G., Chiti, G.: Artificial Intelligence in Online Dispute Resolution. Proceedings of the Workshop on the law of electronic agents – LEA. (2002)
6. Kolodner, J. L.: Case-based Reasoning. Morgan Kaufmann Publishers. (1993)
7. Notini, J.: Effective Alternatives Analysis In Mediation: “BATNA/WATNA” Analysis Demystified, (<http://www.mediate.com/articles/notini1.cfm>), 2005.
8. Klaming, L., Van Veenen, J., Leenes, R.: I want the opposite of what you want: summary of a study on the reduction of fixed-pie perceptions in online negotiations. In: Expanding the horizons of ODR, Proceedings of the 5th International Workshop on Online Dispute Resolution (ODR Workshop'08), Firenze, Italy pp. 84--94. (2004)
9. Steenberg, W.: Rationalizing Dispute Resolution: From best alternative to the most likely one, in Proceedings 3rd ODR workshop, Brussels. (2005)
10. Raiffa, H.: The art and science of negotiation: how to resolve conflicts and get the best out of bargaining, Cambridge, The Belknap Press of Harvard University Press. (1982)
11. Carneiro D., Novais P., Andrade F., Zeleznikow J., Neves J.: The Legal Precedent in Online Dispute Resolution. In: Legal Knowledge and Information Systems, ed. Guido Governatori. Proceedings of the Jurix 2009 - the 22nd International Conference on Legal Knowledge and Information Systems, Rotterdam, The Netherlands, IOS press, pp. 47--52 (2009)
12. Costa, N., Carneiro, D., Novais, P., Andrade, F.: An Agent-based Approach to Consumer's Law Dispute Resolution. Proceedings of the 12th International Conference on Enterprise Information Systems - ICEIS 2010. (2010)
13. Café, A., Carneiro, D., Novais, P., Andrade, F.: Online Dispute Resolution tool for Property Division - Conjugal and Hereditary. INFORUM 2010. (2010) (*in portuguese*)