Arguers and the Argument Web

Mark Snaith, Rolando Medellin, John Lawrence and Chris Reed

School of Computing, University of Dundee, DUNDEE, DD1 4HN, UK
{marksnaith,chris,rmedellin,johnlawrence}@computing.dundee.ac.uk

Abstract. In this paper, we lay some groundwork in understanding the ways in which users of the Argument Web can be represented in the Argument Interchange Format (AIF). In particular, we tackle two specific challenges of (i) how to handle various roles on the Argument Web, based on the level and type of contribution they make; and (ii) how to support mixed initiative argumentation in which software agents may adopt a role defined by the previous activity of human arguers.

1 Introduction

The relationships between arguers and the arguments that they create, navigate and invoke are many and complex. As the number of tools available on the Argument Web continues to increase, as the datasets available there expand, and as the user base grows, these relationships need to be understood and defined so that software can work with them coherently and consistently. Here, we lay some groundwork in understanding the ways in which users need to be represented, particularly in order to tackle two specific challenges: (i) how to handle various roles on the Argument Web, based on the level and type of contribution they make; and (ii) how to support mixed initiative argumentation in which software agents may adopt a role defined by the previous activity of human arguers.

The paper proceeds as follows: in section 2, we provide brief introductions to the Argument Web and the Argument Interchange Format; in section 3, we characterise three different roles on the Argument Web; in section 4 we specify our method for representing users in the AIF; in section 5 we show how representing roles can be deployed in a practical application and in section 6 we conclude the paper.

2 Background

2.1 Argument Web

The Argument Web is a vision for integrated, reusable, semantically rich resources connecting views, opinions, arguments and debates online, wherever they may occur, whether in blogs, in comments or in multimedia resources, whether in educational, political, legal or other domains [6, 7, 1].

Recent work has seen development of Argument Web infrastructure [4] and applications [8, 3], and the platform is expected to grow rapidly in the near future.

2.2 Argument Interchange Format

The Argument Web is underpinned by the Argument Interchange Format (AIF) which is a description, standard and series of implementations of a mechanism for exchanging argument resources between tools [2]. The AIF is specified by a core ontology, which is implemented in various forms. One such form is a MySQL[1] database (AIFdb[2]), the entity-relationship diagram for which can be seen in Figure 1 and illustrates the nature of the ontology.

The main principles of the AIF that are relevant to the present work are **Locutions** and **People**. Locutions are statements (written or oral) that have a property indicating the utterer and are either directly contributed (via an application such as ArguBlogging [8]) or indirectly, through an analysis of what a person has said (via an application such as OVA [9]). Representing locutions in the AIF allows of a degree of attribution, which supports mixed initiative dialogue applications such as Arvina [3]. However, this representation goes no further than to provide a name; what is not account for is exactly who the utterers of the locutions are. While this is entirely reasonable within the core AIF, since it is a format for representing *argument*, there are advantages to allowing a closer connection between locutions and the people who made them. From the application perspective, it allows systems such as Arvina to harvest all

[1] While MySQL has been used for AIFdb, in principle any SQL-based database management system can be used.

[2] http://aifdb.org

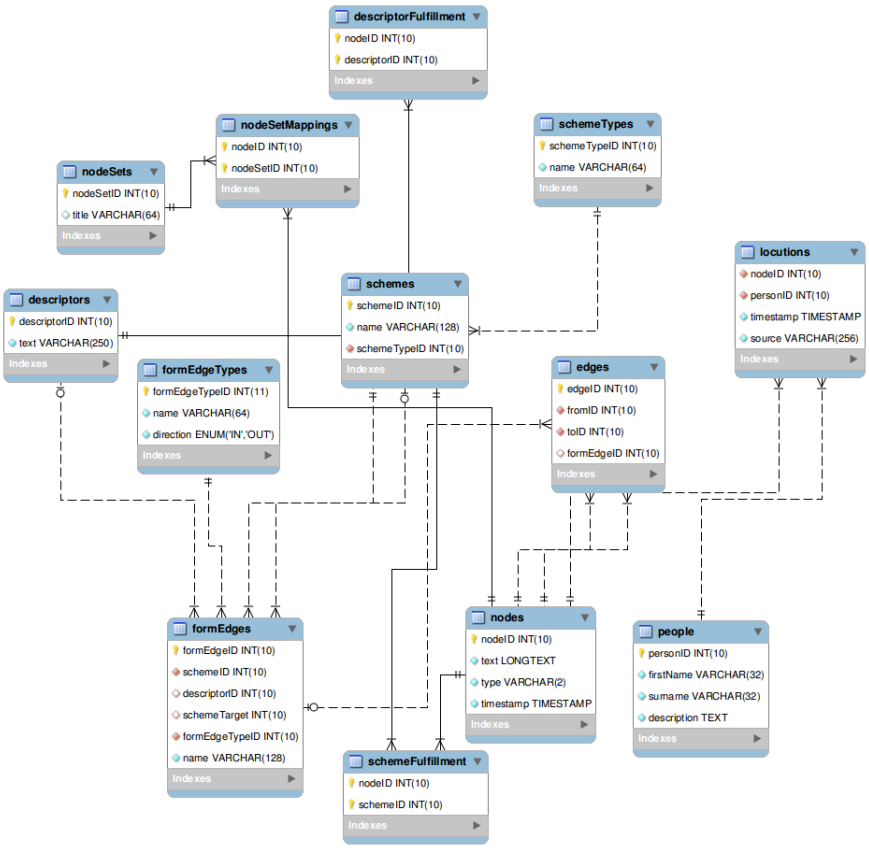

Fig. 1. AIF core ontology

of a user's opinions as opposed to just those available based on the current dialogue; from the user perspective, maintaining a close connection to what they have contributed is behaviour that is already established on the conventional Web, and so would be expected of the Argument Web as well. These will be further elaborated in section 4.

2.3 Mixed initiative argumentation

Mixed initiative argumentation allows both real and virtual (software) agents to participate in a dialogue, with the discussion being driven by any participant.

Arvina is an application that employs mixed initiative argumentation to allow for ease of navigation through complex debates [3]. The system spawns virtual participants representing the views of people whose arguments are already available on the Argument Web. Human users direct the discussion, asking questions of other participants (whether real or virtual) and can at any stage offer their own opinions on the current topic.

3 Roles on the Argument Web

3.1 Speakers

A *speaker* is the person from which the content of a locution was obtained. A speaker is not necessarily a registered user of the Argument Web (see section 3.2), but can instead be an agent (see section 3.3) or the source of a piece of analysed text. When a connection is made between a speaker and a locution, applications such as Arvina [3] are able to spawn virtual agents to represent speakers in a new dialogue (see "Agents" below).

Where a speaker is a registered Argument Web user, there are obvious advantages to maintaining a connection between the user and the locutions they have made. If the speaker (user) were to have an agent spawned from them via Arvina, that virtual representation can link back to their user profile, and subsequently their other contributions to the Argument Web. This in turn allows the spawned agent to access other contributions from that user outside of the nodeset being used to initiate the dialogue.

3.2 Users

A *user* is a person or group that has registered with the Argument Web and contributes through the use of applications. Registration can either be direct, or via a social networking platform such as Facebook or Twitter. A key feature of users is that their contributions can be traced back to them.

Certain applications deployed on the Argument Web already permit user registration, such as ArguBlogging [8], however this is done simply to allow for easy connection to blog and social networking

sites and does not maintain a close connection between the users and the AIF resources they create. The only connection is that the user is represented as the speaker of the locution created by contributing to the Argument Web, however this is little more than a text-based property of an AIF L-Node (see section 3.1) and as such there is no distinction between a contribution from, for instance, John Smith in Dundee and John Smith in London.

3.3 Agents

A "Dialogue-Agent" is a representation of *users* and *speakers* in mixed initiative dialogues.

More specifically, "Dialogue-Agents" are entities that represent what *speakers* (from the AIFdb) and *users* (from the Social Layer) said in the context of a debate in the AIFdb. For a given debate or analysis in the AIFdb, we extract the ID's of the speakers that issued locutions and for each speaker, we create a separate entity (the agent) that contains the related assertions and the context in which they were issued. In this way, we can differentiate the actual user or speaker from the agent that represents him in mixed initiative dialogue environments.

In more detail, each agent represents a unique speaker (personID) or user (userID) in a debate or analysis (a nodeset) identified by all its related locution nodes (L-nodes).

We also use the term "Dialogue-Agents" referring to *autonomous agents* in multiagent systems, where an agent is defined as a software entity able to react autonomously employing a representation of its beliefs. The "representation of beliefs" in our case is given only by what speakers or users *said* in the context of a debate or analysis. And the agent "reactions" are extracted from the assertions related to the speaker. In this way, if the agent is questioned, the response can be taken from the assertions related to the user or speaker in the AIFdb node structure (the mechanism to select a particular locution is out of the scope of this paper).

With this mechanism, "Dialogue-Agents" can represent speakers and users from the "Social Layer" in mixed initiative dialogue platforms keeping separate the original analysis in the AIFdb from the new dialogues generated by the agents in other platforms.

Take the example:

- Melanie Philips (MP) says: P is the case
- Michael Buerk (MB) says: Why P?
- MP says: P because of Q
- MB says: Q is not the case therefore P is not the case.
- Claire Fox (CF) says: The evidence of Q is S, so P and q are the case.
- MB says: I accept that.
- MP says: I don't!

From this dialogue we can extract three agents (represented as speakers in the the AIFdb structure): one agent representing Melanie Philips (MP_agent), another agent representing Michael Buerk (MB_agent) and an agent representing Claire Fox (CF_agent). These agents then can be deployed with the information they believe based on their assertions.

MP_agent believes P and Q, MB_agent believes S and Q and CF_agent believes S. If the Melanie Philips agent is asked in Arvina: Do you agree with Q? The agent can confirm this is the case because there exist a direct assertion in the dialogue but the agent cannot agree with S. Furthermore if the CF_agent is challenged with: not Q, he can answer with S.

3.4 Arguers

Arguers are the participants in a dialogue that is being executed in an application such as Arvina [3]. An arguer is either a (human) user of the Argument Web, or a (virtual) dialogue-agent that can respond to human or other agents' locutions. The dialogue execution platform sees all arguers as equal insofar as they all, whether real or virtual, can initiate the dialogue, advance locutions and respond to other participants. This process, called mixed initiative argumentation [9], allows real users to debate with dialogue-agents representing real speakers.

4 Representing users in the AIF

Representations of Argument Web roles in the AIF is currently limited to a property of locutions that indicate the utterer and to ex-

plicitly account for the other roles in the core ontology would be perihperal to the AIF's purpose of representing argument. Nevertheless, representing roles, and users in particular, provides certain advantages. First, it maintains a formal link between AIF resources and a profile representing the person that created them, providing for greater integration between the social World Wide Web and the Argument Web; second, it allows user information to be transmitted as part of the AIF that is used for communication between the Argument Web's applications and underlying infrastructure.

While modifications to the core AIF ontology are undesirable, it remains possible to extend the AIF through the use of adjunct ontologies (AOs). An AO is a specification of application-specific concepts and features that does not change the core AIF, but instead references it. Applications that are aware of the AO call the AO, which then indexes core AIF structures. The main advantage of an AO is that the core AIF does not have any knowledge of the extensions it provides, and as such tools and infrastructure that are capable of processing only core AIF can continue to process AIF extended by the AO, and simply ignore the extensions. We therefore propose an AO for representing roles in the AIF.

In the remainder of this section, we first specify our AO for representing users on the Argument Web, before describing ways of detecting users that have been identified as the speaker of a locution, but did not contribute themselves.

4.1 Social AIF

To represent users in the AIF, we extend the core specification using an adjunct ontology. We describe AIF extended in this way as "Social AIF" or S-AIF, which consists of four concepts:

- **Users**: A user, as described in section 3.2. Firstname and surname are mandatory properties of users, however other information (e.g. date of birth) may be application-specific. As such, we place no constraints on what information can be stored and delegate responsibility for representing this to UserInfo.
- **UserInfo**: Information about the user, such as date of birth, address, occupation etc. Each instance of UserInfo stores one piece

of information. Representing user details in this way places no assumptions or constraints on the level of user information an application may require.

– **Applications**: Applications used by users to create locutions. A user is connected to locutions via an application.
– **Locution mapping**: A mapping of users in the AO to locutions in one or many AIFdb instances, with a record of the application used to create the locutions. A locution ID is a URI pointer to the relevant L-Node in an AIFdb instance.

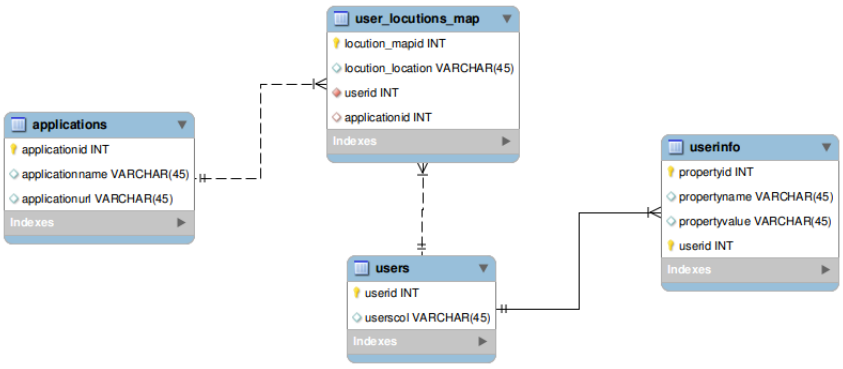

Fig. 2. S-AIF adjunct ontology

Similar to the core AIF ontology, the S-AIF AO can be implemented as a MySQL database, whose entity-relationship diagram is shown in Figure 2.

A rendering of a S-AIF diagram, showing how users and applications connect to locutions, is provided in Figure 3.

5 Practical application - Arvina

In this section, we examine a practical application of S-AIF in an extended version of Arvina, a software tool for mixed initiative argumentation that provides a dialogical interface to complex debates [3]. Arvina uses dialogue protocols to structure the discussion between participants, who may either be real users or virtual agents

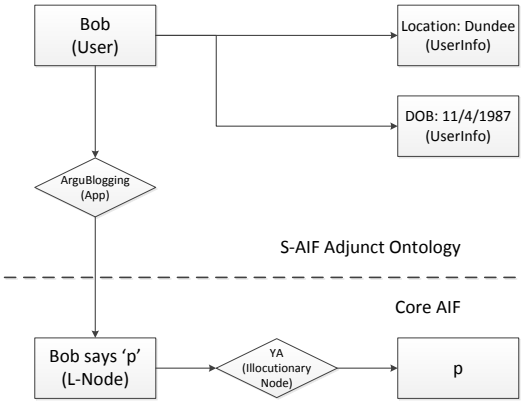

Fig. 3. S-AIF connections to core AIF

representing the arguments of specific authors who have previously added their opinions to the Argument Web.

An Arvina session is initiated by a user selecting a topic, which represents an I-Node in the Argument Web. Arvina then interacts with AIFdb instances to retrieve an AIF structure containing arguments for and against the selected topic. Using the locutions in this structure, Arvina spawns software agents based on the speakers attached to those locutions. The architecture for this is shown in Figure 4.

This architecture has limitations from both the software and user perspectives; the Arvina software is provided with only the name of the speaker of each locution, and is therefore the only information available when spawning agents. For users, there is no way to dig deeper into someone's argument web contributions, because there is no link between what their agent believes in the current dialogue and their other contributions to the Argument Web.

By placing a *social layer* that interprets S-AIF between Arvina and AIFdb, we can use S-AIF to query a users database to establish if there exist links between users and the locutions in the nodeset being used to initiate the dialogue. Instead of passing a nodeset ID directly to AIFdb, it is passed to the social layer, which then passes it to AIFdb. The social layer uses locutions in the returned AIF to query the users database and return S-AIF containing, where

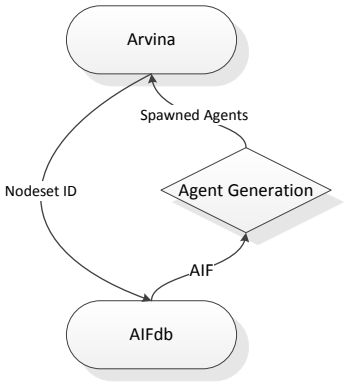

Fig. 4. Current Arvina architecture

applicable, details of any users represented in the nodeset. The S-AIF is passed to the agent generator, which uses the user information to generate the agents, including personal information — for instance, attaching avatars and locations.

The proposed new architecture is shown in Figure 5.

Providing Arvina with the ability to gather extensive information about the users represented by agents allows for more sophisticated time-shifted dialogues. From an application perspective, Arvina can use the information to harvest all of a user's arguments on the argument web, which in turn expands the knowledge base of the agent representing them. For users of Arvina, they too benefit from the agents possessing a larger knowledge base, but also gain a better insight into the "person" (agent) with whom they are arguing.

6 Conclusions and Future Work

In this paper, we identified and described three different roles on the argument web — *speakers*, *users* and *agents* — and specified an AIF adjunct ontology (AO) that allows them to be represented on the argument web and connected to the resources they create.

The work in this paper presents only the first steps towards representing roles on the argument web. Future work will focus both on

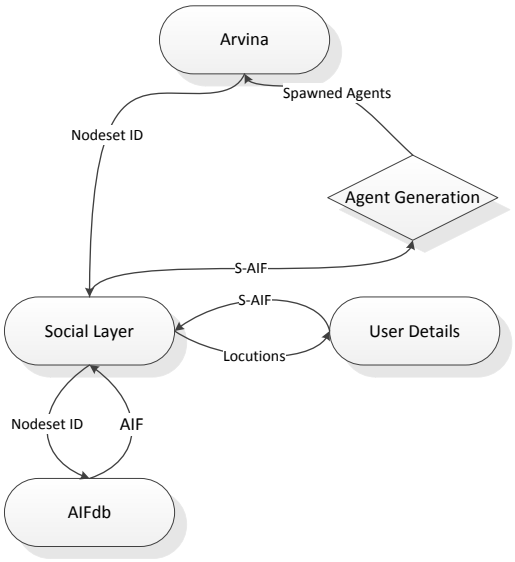

Fig. 5. Proposed Arvina architecture using S-AIF

theoretical extensions to the present work, and its practical deployment.

From a theoretical standpoint, we need to consider how users can be connected to argument web resources to which they attributed, but did not contribute — consider, for instance, a user publishing a blog post that is subsequently analysed using an argument mapping tool. While the analyst can identify the user as a speaker, there is no explicit connection between the user and their argument. In addressing this, it is our intention to explore connections to Named Entity Recognition (NER) [5] and Friend-Of-A-Friend (FOAF)[3].

Before the work presented can be deployed on the Argument Web, privacy and data protection issues must be considered. Specifically, users must be given the means to control third-party access to their argument web content, where third parties can include other users, general users of the web and software systems. We also intend to explore connections between the social world wide web and the

[3] http://www.foaf-project.org/

social argument web, and how sites such as *Facebook* and *Twitter* can be used as platforms to support ubiquitous debate.

Handling identities in the Argument Web is surprisingly challenging – we need to distinguish users from the speakers associated with locutions (because those locutions may have been created in domains not mediated by the Argument Web), and also from the agents that may subsequently represent them in online dialogues. Our goal here has been to sketch why the problem is important and how a coherent solution can be formed. This is a vital step as the Argument Web starts to come out of the lab and find application in the real world.

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