Commitments and Interaction Norms in Organisations

(JAAMAS Extended Abstract)

Mehdi Dastani
Utrecht University
The Netherlands
m.m.dastani@uu.nl

Leendert van der Torre
University of Luxembourg
Luxembourg
leon.vandertorre@uni.lu

Neil Yorke-Smith
American University of Beirut
Lebanon
nysmith@aub.edu.lb

ABSTRACT

In an organisational setting such as an online marketplace, an entity called the 'organisation' or 'institution' defines interaction protocols, monitors agent interaction, and may intervene to enforce the interaction protocols. This extended abstract summarises our JAAMAS article [10]. In the article we generalise over application-specific protocols and consider commitment lifecycles as generic interaction protocols. We model interaction protocols by explicitly-represented norms, operationalise the enforcement of protocols by means of norm enforcement, and analyse the protocols by a logical analysis of the norms. We adopt insights and methods from commitment-based approaches to agent interaction as well as from norm-based approaches to agent behaviour governance. First, we show how to use explicitly-represented norms to model commitment dynamics (lifecycles). Second, we introduce an operational semantics to operationalise norm enforcement. Third, we show how to logically analyse interaction protocols by means of commitment dynamics and norm enforcement. The model, operational semantics, and logical analysis are illustrated by a running example from a vehicle insurance domain.

1. BACKGROUND AND MOTIVATION

A sizeable body of literature has developed theories about organisations, interaction protocols, commitments, and norms. For example, an organisational setting is manifest in the finance and accounting literature, where regulatory bodies monitor or audit firms, and may fine violations of regulations or statues and failures in corporate governance [6].

Andrighetto et al. [1] provide a survey of work in the multi-agent systems literature. This work studies decision making and agent organisations, as modelled by norms, interaction protocols and commitments. A central challenge in this literature is to investigate the relationships between *commitment-based approaches* and *norm-based approaches*. The JAAMAS article [10] contributes to this challenge by modelling dynamics of commitments (often explained as variety in commitment lifecycle) using an explicit representation of norms.

The fact that a commitment lifecycle and a norm set can both be seen as constituting an interaction protocol sug-

gests a fundamental relation between commitment lifecycle and norms. This relation, which forms the main focus of our article, can be explained by viewing a commitment cycle from a normative stance and by viewing it as a set of norms that governs the dynamics of commitments which in turn can be used to regulate the agents' interaction. Following this relation, we propose a formal framework where a commitment lifecycle is modelled as a set of explicitly represented interaction norms. This framework allows us to operationalise commitment lifecycles, and to logically analyse and compare them.

2. CONTRIBUTIONS

Multi-agent systems in an organisational setting typically possess an entity defining interaction protocols, monitoring agent interaction, and enforcing interaction norms by means of regulation policies. We call this entity the 'organisation' or 'institution'. For our purposes, an organisation consists of two main processes: the *monitoring process* checks for conformance of agents' behaviour to protocols or norms, while the *enforcement process* ensures the coordination by means of enforcing the regulation policies.

In the article, we propose to model the interaction protocols of the organisation by explicitly-represented interaction norms. This norm representation has two advantages. The first advantage is that we can operationalise the enforcement of protocols by means of norm enforcement, and the second advantage is that we can analyse the protocol by a logical analysis of the norms. To make this idea more precise, we adopt insights and methods from commitment-based approaches as well as from norm-based approaches.

First, we show how to use explicitly represented norms to model variety in the commitment lifecycle. From the organisation's viewpoint, agent interactions affect the state of the institutional facts, in particular the commitments, while regulation policy is responsible for updating the organisation state as a consequence of detected violations. By modelling the interaction protocols of the organisation as a set of explicitly represented norms, to which the agents' interaction should adhere, we are able to generalise interaction protocols to represent, for example, which agents can detach or satisfy commitments, whether commitments can be satisfied before they are detached or not, and temporal conditions such as whether a commitment which is fulfilled exactly at the moment of the deadline, counts as violated or not.

Second, we introduce an operational semantics to operationalise protocol enforcement. In this way, we show how to operationalise the enforcement of protocols by means of

norm enforcement. An organisational state consists of a set of brute facts, a set of institutional facts, a set of contexts, a set of norms and a set of regulation policies. Given a way to define the set of applicable rules in a context, two transition rules define how the brute and institutional facts should be updated. In the same way, we could add rules for changing the contexts, norms and policies.

Third, we show how to analyse interaction protocol of the organisation and thus commitment cycles by logically analysing the norms and norm enforcement. Since the norms are represented explicitly, and the system dynamics depends on the norms, we can use techniques and insights from deontic logic [12]. Temporal properties show that we can formally check that the operational semantics corresponds to the commitment lifecycle. Moreover, we can analyse interference between distinct commitments, which is often seen as a source of problems in protocol analysis. Finally, redundancy of norms tells us whether the protocol behaves as expected. For example, if an agent makes an offer, it is redundant for it to make the same offer again, or to make an offer which is strictly worse for the other party.

Hence, the contribution of the article is the systematic methodology to formally model and analyse commitment lifecycles in terms of norms and regulation policies that govern the creation and dynamics of commitments emerged during agents' interaction. Our proposed framework is based on a generic operational semantics that operationalise the enforcement of norms and regulation policies, and thereby operationalise the dynamics of commitments. The proposed framework is generic in that it allows formal instantiation and comparison of different approaches to commitment dynamics and commitment lifecycles.

The scope of the article is on monitoring agents' interaction in an organisational setting. Other organisation attributes and processes, such as environmental interaction, or roles, entities, and the relationships between them, are orthogonal to our purpose. We also do not consider other issues discussed in the literature, such as explicit temporal references in the commitments [13], roles of the agents [2, 3], teams and groups, organisational dynamics, procedural norms [4] and culture.

3. METHODOLOGICAL INNOVATION

Throughout the article, we emphasise the methodological innovation of our approach. We address the usual questions regarding agent communication, coordination and monitoring, and we adopt the usual formal methods like constitutive norms [14, 11, 5, 7, 1]. However, the way we establish our formal framework is different from all prior work, as we do not constrain ourselves to one particular commitment lifecycle. Of course, this does not mean that any set of norms and policies defined in our framework will behave well. It is part of our methodology that the behaviour of the organisation is left to the system designer, who defines the norms and policies. The properties we establish show that the commitment cycle we use in the main part of our discussion is well behaved. Whether other norms or policies are as well behaved has to be checked independently.

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