Contextualized Institutions in Virtual Organizations [1]

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1 Introduction

Virtual organizations (VOs) [2] can employ various institutions to regulate the behaviour of the participating actors in order to achieve the VO's goals. The norms that make up an institution inherently serve to restrict its applicability, but the variables, in terms of which those norms are expressed, are also typically intended to be restricted to specific, meaningful ranges within the domain being modelled. That is to say, some combinations of event and metadata are meaningful and others are not. We use the term *governance scope* to describe this set of concrete observable events and associated values (event metadata) that can affect the state of an institution and hence characterize the situations (being particular combinations of contextual information such as time, location, weather, relations, system states) in which a given institution has competence.

When an event occurs, several institutions might respond to regulate the behaviour. The activation of multiple institutions can cause problems, in that a single event might be interpreted differently and could result in conflicting consequences. For example, when a Dutch citizen applies for a visa to the US, several institutions might be triggered, e.g., US embassy, Dutch government, and a conflict could exist between information requirements from the US embassy and privacy policies from the Dutch government. We contend that in VOs governed by multiple institutions, the existence of normative conflicts cannot be avoided just by defining mutually exclusive deontic expressions, since that would preclude any institutionally common event. Consequently, we regard the process of designing an institution as not only the definition of a set of norms but also the characterization of its governance scope, i.e., what kinds of situations are under control of the institution, since this is what gives the institution its 'footprint'. That is, the same set of norms with different governance scopes results in different *contextualized institutions*.

This paper introduces an approach that: (i) formalizes the governance scope of an institution through context models and hence captures the relations between institutions, and (ii) provides a mechanism to analyze institutional governance scope, as a precursor to detecting norm conflicts. We operationalize our approach by adapting the institutional action language $InstAL$ [1] which is implemented by Answer Set programming.

2 The Proposal

Figure 1 shows the framework of our proposal which involves three parts: (i) *external events* observed in the real world, each of which has associated contextual information (ii) *institutions* comprising sets of norms,

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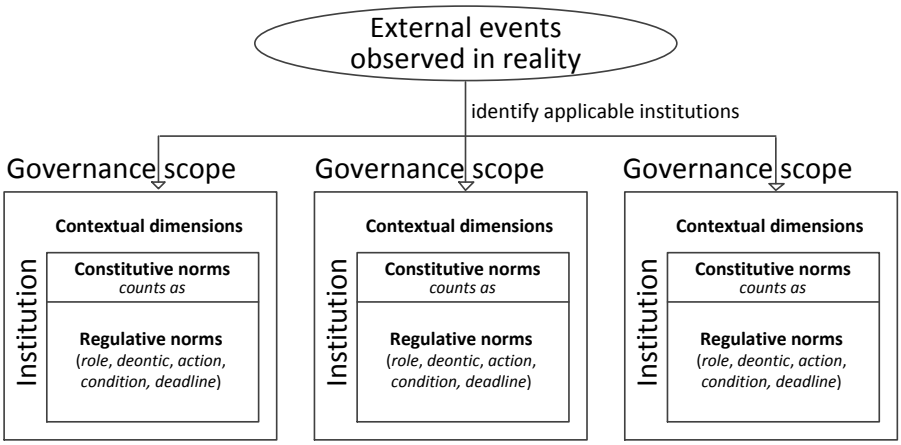


Figure 1: Contextualized institutions in virtual organization.

in which *constitutive norms* translate external events into institutional events which are further mapped to institutional states, and *regulative norms* (deontic expressions: permissions, obligations, prohibitions) react to the occurrence of institutional events and states, and (iii) *governance scopes* that delineate the control boundary of institutions through a set of contextual dimensions [3]. With governance scopes, contextualized institutions are built, which facilitates the identification of applicable institutions for a given event. For each individual institution, the modeling process defines an explicit governance scope and formalizes the norms (both constitutive and regulative) for each institution. Subsequent translation into a computational model allows users to verify the resulting institutional states against a sequence of external events.

When the occurrence of an external event simultaneously activates multiple institutions with overlapping governance scopes, these institutions, which we call a *collective institution set*, should be consistent with each other. However, since the individual institutions are designed originally for their own use, there might be conflicting norms between them. The focus of this paper is on the conflicts between regulative norms that are simultaneously applied to the same agent possibly enacting different roles in different institutions, but associated with inconsistent deontic modalities. Specifically, we differentiate two kinds of norm conflicts, i.e., weak conflicts and strong conflicts. A weak conflict is defined between a permission and a prohibition, which *might* lead to violation. That is, if the action specified in both of the norms is performed, the prohibition is violated, while if not, there will not be any violation. A strong conflict is defined between an obligation and a prohibition, which *must* lead to violation no matter the action specified in both of the norms is performed or not. That is, if the specified action is performed, the prohibition is violated, while if not, the obligation is violated. To operationalize the detection of such conflicts, we follow three steps in our setting (1) modeling contextualized institutions including governance scopes, constitutive norms and regulative norms, (2) identifying collective institution sets in terms of governance overlaps, and (3) detecting conflicting norms within the collective institution sets.

References

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