Towards Simulation of Organizational Norms

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Outline

Research Goals

Main Goals and sub-goals:

- Model and Simulate organizational norms which constraint the agents behavior in the context of organizational business processes
- Extend the Agent-Object-Relationship (AOR)[1] Simulation Language with Organizational and Normative constructs

- analyze the existing semantics and usage of the normative concepts originating from the social philosophy, organizational theory and AI/MAS fields
- extract/decide on an ontology of normative constructs for human organizations
- express the norm ontology using the UML meta-language
- adapt the norm ontology to the AOR simulation language
- find solutions for the end-implementation languages such as: Java/JavaScript

[1] AOR - http://aor-simulation.org

Research Goals

Challenges:

- defining the concepts of organizational norms by unifying the diverse terminologies under the same semantics
- synthesize the concepts needed for modeling organizational norms and NOT for modeling any manifestation of social norms
- consequently, we do not consider:

- any kind of social norms which targets the informal normative layer (or cultural layer) of an organization e.g., table manners

Norm Definition

Encyclopedia Britannica relates the norm concept to its sociological roots as a rule or a standard of behavior shared by members of a social group.

AI Approaches

The norm concept:

- is a formal specification of a deontic statement that aims at regulating the life of software agents and the interactions among them
- takes the form of an obligation, a permission or a prohibition
- it is represented with some dialect or extension of deontic logic

MAS Approaches

- (Wooldridge, Jennings, and Kinny 1999), (Omicini 2001), (Zambonelli, Jennings, and Wooldridge 2003), (Dignum 2004) - the norm concept is indirectly referred and mixed with the concept of role, usually understood as a set of permissions/prohibitions
- (Wooldridge, Jennings, and Kinny 2000) and (Cabri, Leonardi, and Zambonelli 2003) - add to the role concept the set of duties
- (Wagner 2003) - introduces the deontic logic of the AOR modeling, as the set of duties and rights to perform certain actions
- (Grossi, Aldewereld, and Dignum 2006) - consider duties and permissions, but also emphasize the concept of regimentations (e.g., prohibitions used to avoid serious damages caused by the non-compliance to the specified norms)
- (Figueiredo and da Silva 2011) - introduce sanctions which apply when a norm it is violated (e.g., punishments) and rewards received by the entities when a norm it is fulfilled

Social Philosophy Approaches

Norms are:

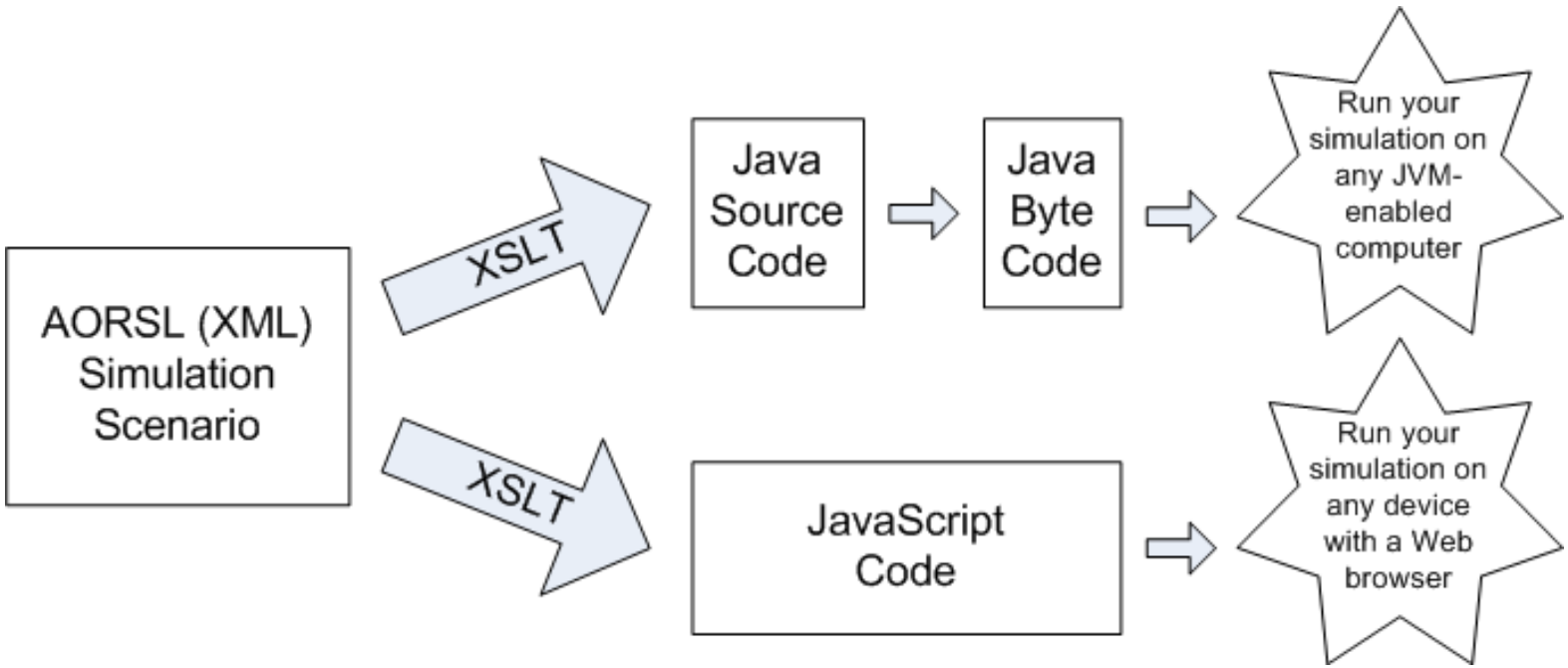
- (Searle 1995) - (1) regulative rules - stipulate correct behavior when certain social actions are performed (e.g., obligations and permission rules); (2) constitutive rules - constraints regulating the creation/modification and deletion of social concepts
- (Tuomela 2002) - (1) rule norms - formal when enforced through institutions (e.g., university laws) and informal (e.g., family rules established by parents for their children); (2)social norms - collective acceptance and mutual expectations (e.g., table manners)
- (Bottazzi and Ferrario 2009) - (1) normative descriptions; and (2) technical norms which describe the correct procedure to perform certain tasks

Generalities about ER/AOR Simulation Language

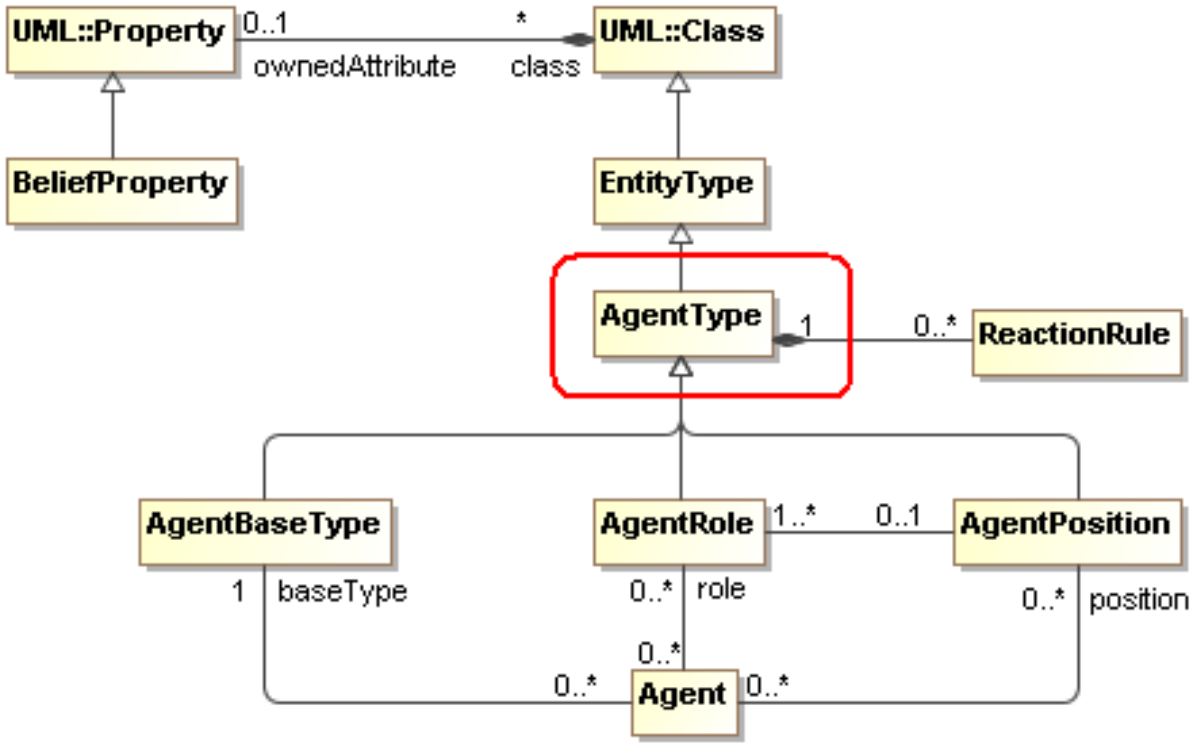
- it supports both basic DES models without agents, also called Entity-Relationship (ER) simulations, and complex agent-based simulation models with agents having (possibly distorted) perceptions and (possibly false) beliefs, called Agent-Object-Relationship (AOR) simulations
- distinctive features of the ER/AOR Simulation framework are: (1) its high-level rule-based simulation language ER/AOR simulation language; and (2) an abstract simulator architecture and execution model
- both the behavior of the environment (its causality laws) and the behavior of agents are modeled with the help of rules, which support high-level declarative simulation modeling

AOR Simulation Language ... a MDA Approach

- the simulation scenario is expressed with the help of the XML-based ER/AOR Simulation Language

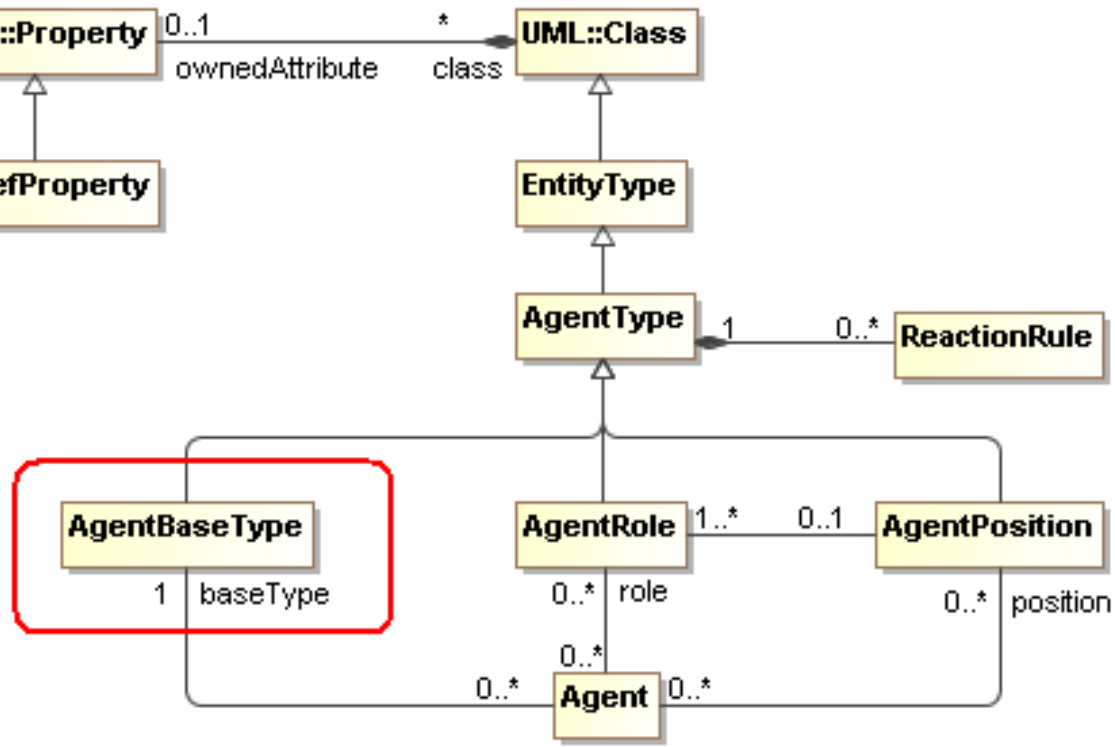


AOR - Agent Types



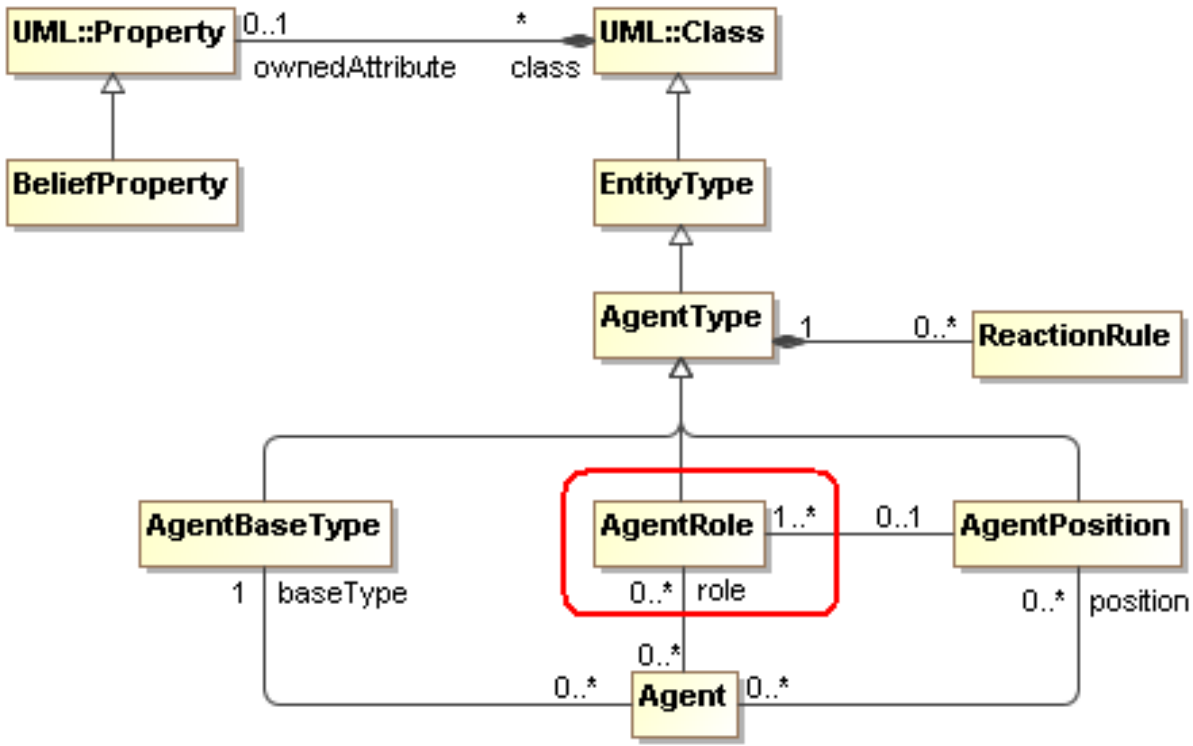
- defines the common set of properties, UML::Property class, and behavior expressed by means of ReactionRule(s) for all agent type's instances
- Q: why cognitive agents ? R: because the norm is a social concept embodied in ones actions, beliefs or feelings

AOR - Agent Types



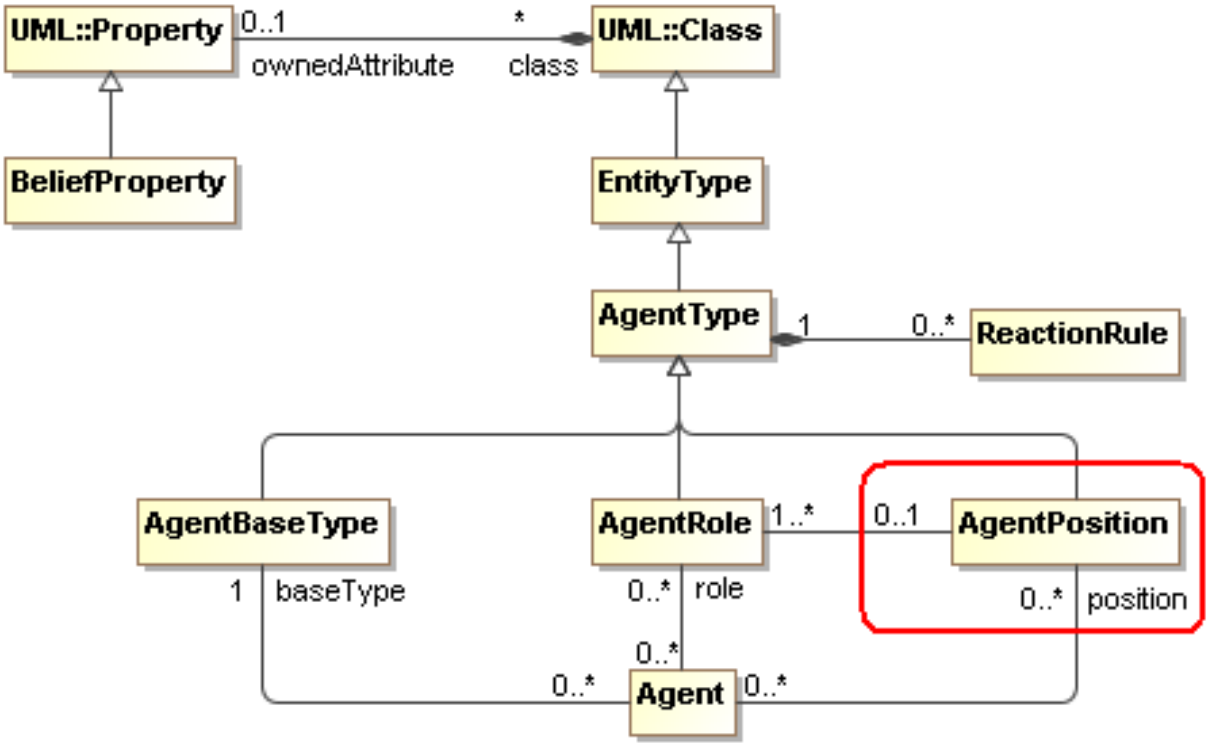
- defines the fundamental characteristics of the agents
- provides the identity criterion for its instances, therefore it is mandatory

AOR - Agent Types



- defines common characteristics of the agent roles (is a concept type)
- represents the functions that are performed by human agents, members of the organization, on behalf of the organization
- is a constitutive element of any organization, but it is temporal
- there may exist some dependencies relationships: (1) among roles - disjunctive/conjunctive roles; and (2) between a role and a base type

AOR - Agent Types



- defines the common characteristics of the agent positions (is a concept type)
- human agents may assume certain positions within the hierarchy of the organization they belong to
- one position aggregates at least one agent role

How do we define an Organization ?

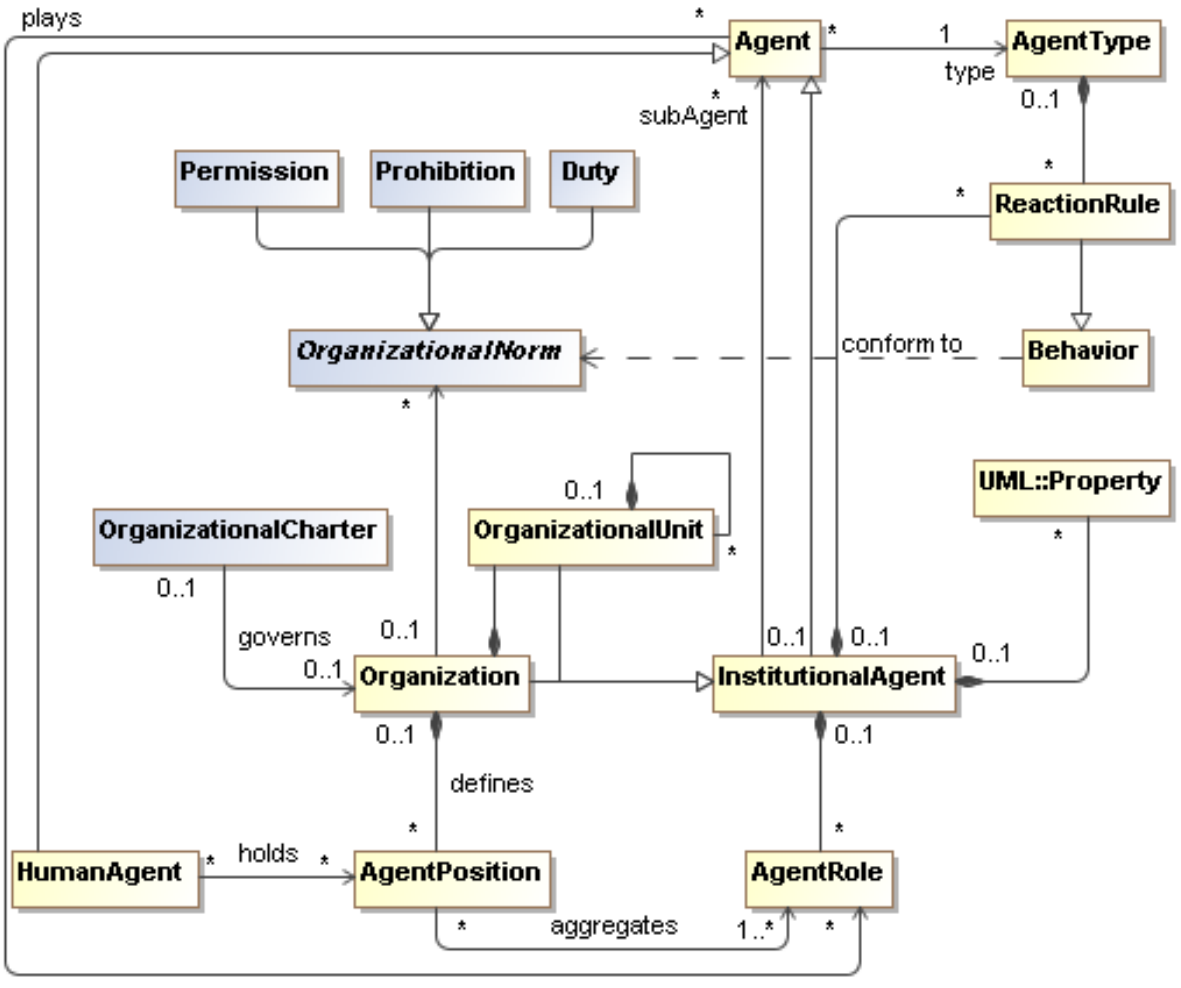
An organization is:

- an institutional agent with organizational units and human actors as subagents that participate in business processes involving other agents, which are possibly affiliated with other organizations.

We distinguish between:

- institutions represented by the *InstitutionalAgent* concept, e.g., family
- organizations represented by the *Organization* concept and their sub-unities, e.g., university and its organizational units: senat, faculties, presidential body and so on

How do we define an Organization ?



Organizational Charter

- defines a set of commonly agreed conventions or descriptive norms which are responsible for creating the entire structure of one organization
- governs the Organization together with its positions and corresponding roles sets
- may include ad-hoc norms which are used to prescribe certain behavior to accomplish certain tasks
- the norms it contains are not susceptible to violations, and therefore they do not attract punishments or rewards

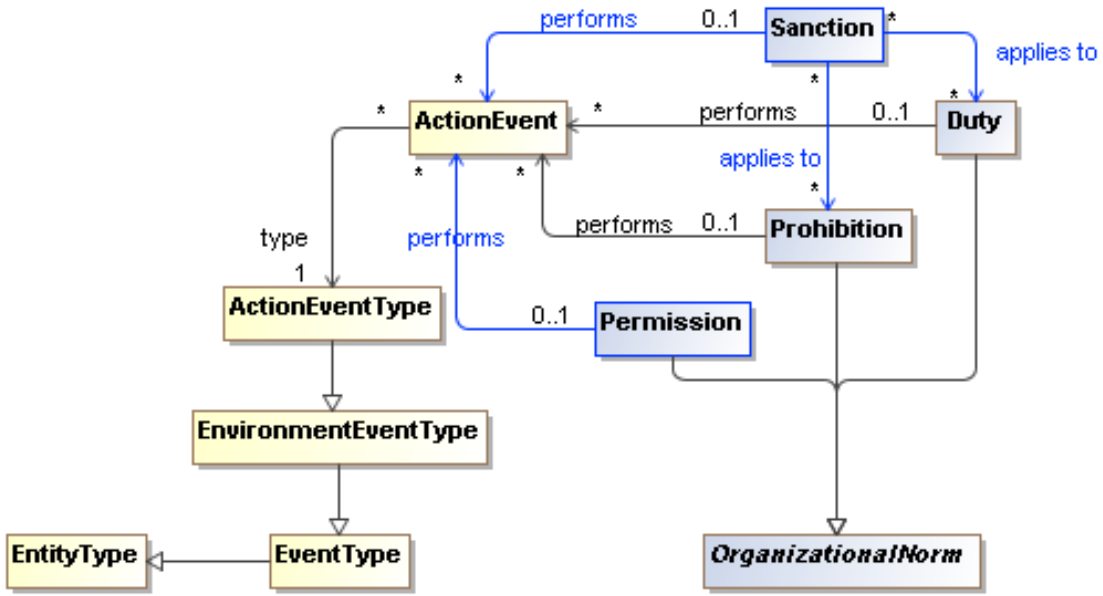
Example

One could not:

- name a new staff member of the Chair
- dismiss one staff member of the Chair

if the rules of structuring a Faculty's Chair into roles and positions did not exist.

Organizational Norms (1)



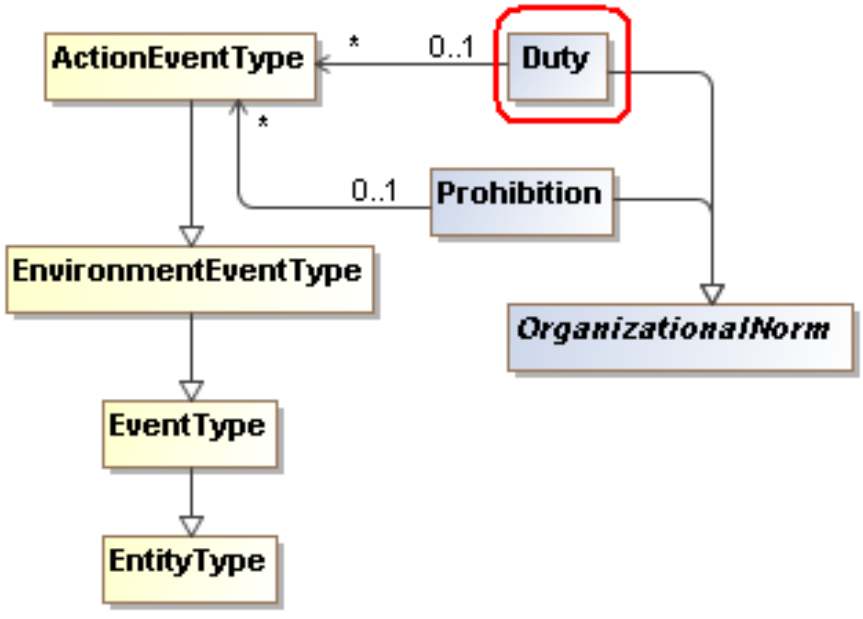
- stipulate constraints on the agents behavior by means of reaction rules
- are valid during a particular time interval, threfore their validity is influenced by their association with some specified "due time"
- the agents react to all the events triggering a specified reaction rule from the behavior set and they perform all the actions scheduled by the reaction rule
- the reactive behavior of the agents enforces the execution of all specified norms, so norm violations do not exist

Organizational Norms (2)

Formalization of AOR Norms

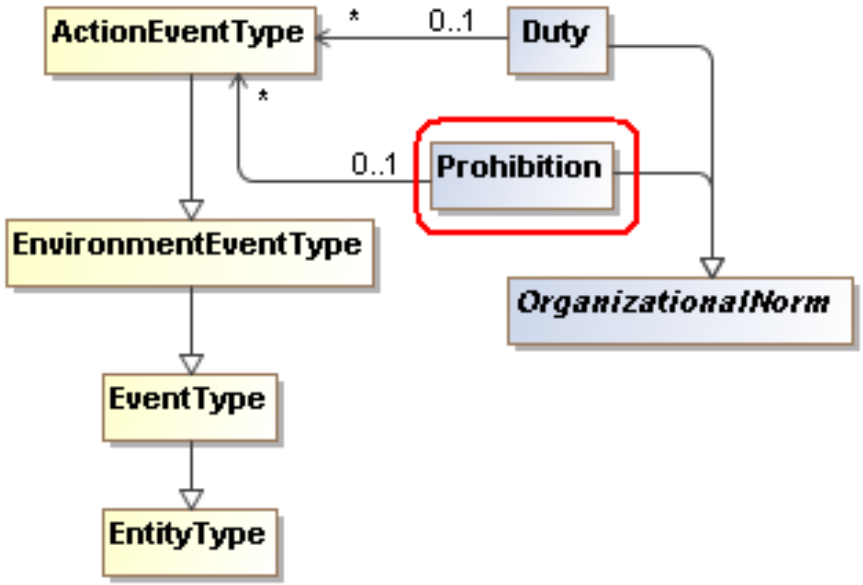
- $p \rightarrow q$, where p and q represent state structures, e.g., properties, conditions and event occurrences
- read: whenever p, then after some time q
- under AOR semantics: the reaction to a triggered event, by performing some actions after some time
- after some time - the actions implied by the organizational norm may be scheduled for execution as a result of a reaction rule chain

Organizational Norms: Duties



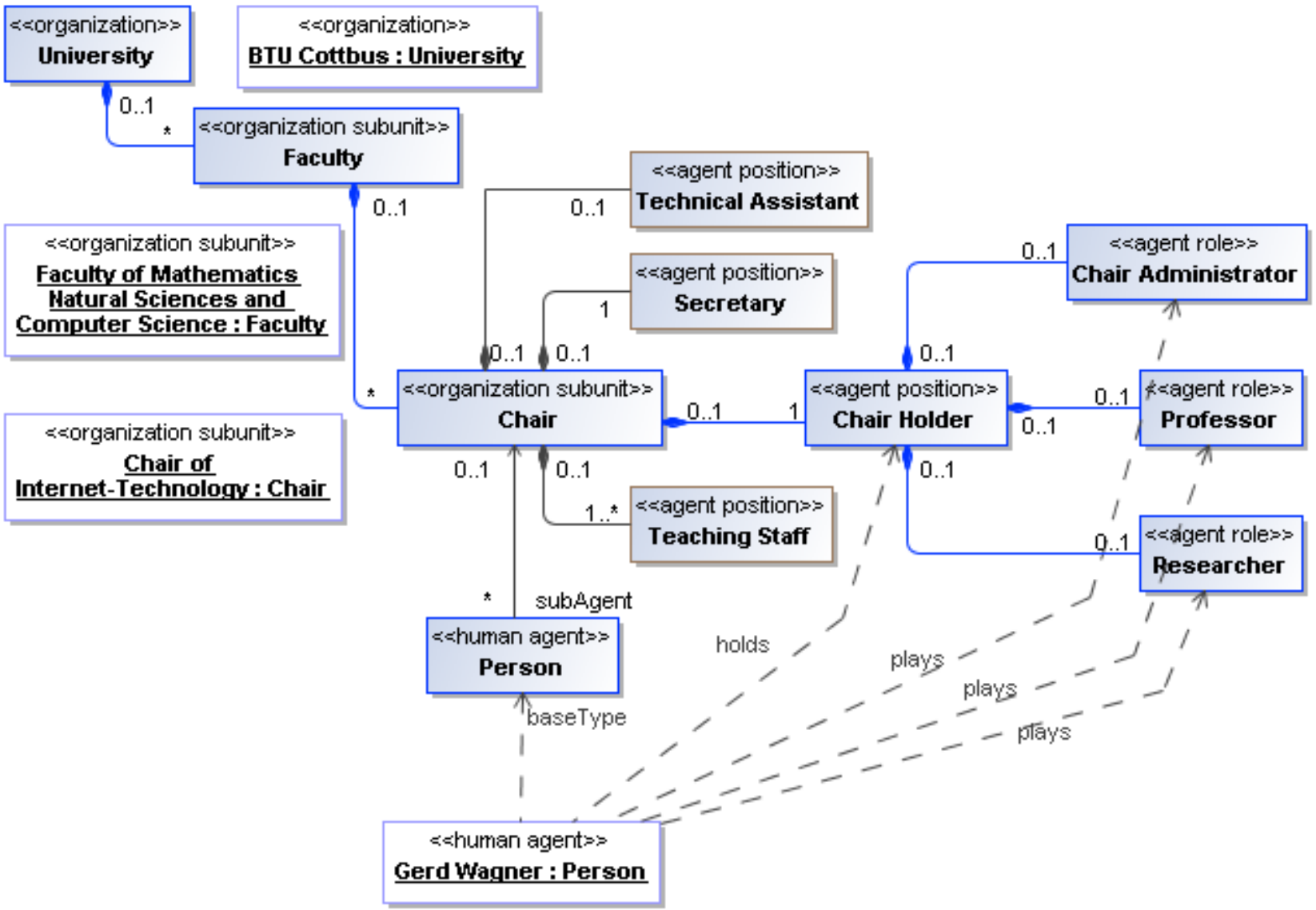
- duties are expressed in terms of reaction rules and specified at the level of human agent types, organizations, roles, or positions
- under AOR semantics: the duty to react to certain events - for each defined duty, there must be at least one reactive rule which handles each type

Organizational Norms: Prohibitions



- prohibitions are disjunctive with respect to the permissions - everything that is not forbidden it is allowed
- we model prohibitions and only indirectly refer to permissions
- prohibitions can be seen as alarm signals pointing out the negative consequences caused by their hypothetical violation

University - a Normative Organization Case Study



University - a Normative Organization Case Study

Organizational Charter

- defines the entire structure of the University in terms of organizational units, positions and roles

Examples of Organizational Norms

- duty: Each Chair Holder has the duty to organize study courses and examinations.
- duty: Each Chair Holder has the duty to coordinate the research within the Chair.
- prohibition: It is forbidden for every BTU PhD student to not finish his/her doctorate thesis within six years.
- prohibition: It is forbidden for every BTU employee to refuse to accomplish his/her work duties without a professional justification.

Conclusions and Future Works

- we described a proposal for enhancing the AOR simulation language with a normative layer for the organizational structure
- the presented approach is limited to some default normative behavior exposed at the level of agent/position/role types: (1) the duty/prohibition to react to some triggering events; and (2) the duty/prohibition to perform some actions

Future Works:

- formalize the AOR organizational norms
- investigate the AOR organizational norms under the proactive behavior of the agents (agents are not enforced to react to events/agents may choose to perform actions which are prohibited)
- adapt the envisioned norm ontology to our AOR simulation language

QUESTIONS ?

Towards Simulation of Organizational Norms

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Thank you for your attention!

Simurena Web-portal http://portal.simulario.de

AOR-JavaSim http://code.google.com/aor-javasim/