Requirements and compliance in legal systems: a logic approach

Luigi Logrippo
Université du Québec en Outaouais
Waël Hassan
University of Ottawa
A logic approach?

- Legal systems seen as inference systems
- Axioms $\rightarrow$ Decision
- **Consistency**: only one decision possible
- **Completeness**: decision always possible
Consistency?

- Consistency within a law
- Consistency between different laws and regulations and their implementation
Translating legalese into logic?

- Various levels of logical discourse are used jointly in expressing laws and regulations
- From requirements to implementation
- Some extremes:
  - Hammurabi level = Program or ECA:
    - If any one steals cattle or sheep, or an ass, or a pig or a goat, if it belong to a god or to the court, the thief shall pay thirty fold
  - Moses level = Requirements
    - Thou shalt not steal = Stealing is forbidden
  - And other levels in between
  - Also: Ontology level, conveys definitions and structure
Use of several styles in legalese

In PIPEDA (Canadian Privacy Law):
- ‘An organization is responsible for personal information’
- ‘When an individual expresses a withdrawal of consent, the organization needs to inform the individual of the implications’

How to translate the first statement in logic?

Should the second statement be seen as an ‘implementation’ of the first?

Requirement in SOX:
- ‘Approvals cannot be granted to transactions initiated in other departments’
- Easily derived implementation: ‘if initiator is in different department then deny access to approval action’
Patterns

Several are apparent in privacy law:

- accountability
- responsibility
- separation of concerns
- ...

Ontologies

- Another normative level, orthogonal wrt the two previous ones
- Define the data types and their relations as are used in the law and regulations
  - ‘Bank X consists of the following departments:
    - Banking, Insurance, Investments, Capital Markets, Global Services’
  - ‘Consent can be received through a signature, a check-off box or verbal ack’
- Laws may place constraints on enterprise ontologies:
  - ‘Financial controllers must report to CEOs’
  - ‘The company’s board of directors should include the chief financial officer and internal financial auditor’
  - ‘A chief financial officer should be assigned to the task of selecting an audit firm’
Ensuring consistency:

- In each normative level
- Across levels
Detecting incompleteness

- As much as possible, within each normative level
  - E.g. for some values of a datatype there is no applicable rule
- Between levels
  - is an obligation stated at a high level completely discharged by implementation rules?
- How to resolve?
  - Human intervention seems necessary
Conformance and compliance

- Conformance is a basic concept in software engineering
  - Compliance = conformance?
- Usually, it is the final **result** that must conform to specifications
  - It must have the specified properties
    - See *black-box testing*
- In many laws however, the **process** has to be compliant too
  - ‘Filings’ are
    - *due at the end of fiscal quarter,*
    - *prepared by the finance department,*
    - *reviewed by CFO,*
    - *validated by an Audit-Firm,* and
    - *signed by the CFO & CEO, prior to submission*
  - See *grey-box testing*
A language and a tool

- The problem: check mutual consistency between legal and enterprise req’ts

Analyser uses tool Alloy
Sample result: counterexample found

Law specifies disposal of data after end of loan process

However tool discovers that in a company data can be leaked to a department where data is saved
Research questions

- Does logic provide a good perspective?
  - Application to consistency and completeness

- How to translate legal language into logic
  - Separating several intermixed levels of discourse
    - Imperative, declarative, ontological
Relation to SE?

- We have observed similarity with concepts of SE
- As well as usefulness of the same tools
- Can we use SE conformance theory?
- Can we conclude that SE and legal theory have
  - many concepts to share,
  - Many methods to learn from each other?
    - Surely it seems to be so in the RELAW area
Related events, related research areas

- **JURIX:**
  - International Conference on Legal Knowledge and Information Systems

- **ICAIL:**
  - International Conference on AI and Law

- **DEON:**
  - International Conference on Deontic Logic in Computer Science

- **NorMAS:**
  - International Workshop on Normative Multiagent Systems