Contextualized Institutions in Virtual Organizations

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Outline

- Background
- Our Proposal
- Case Study
- Conclusion
- Future Work

Background

- Multiple institutions involved in a virtual organization,
- Each institution has regulations on actors' behavior,
- Together reflects the objectives of the organization.

Problem?



With actors' behavior being simultaneously regulated by more than one institution, normative conflicts can appear.

Solution?



Detect them and fix them.

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Detect them and fix them.

How to detect?

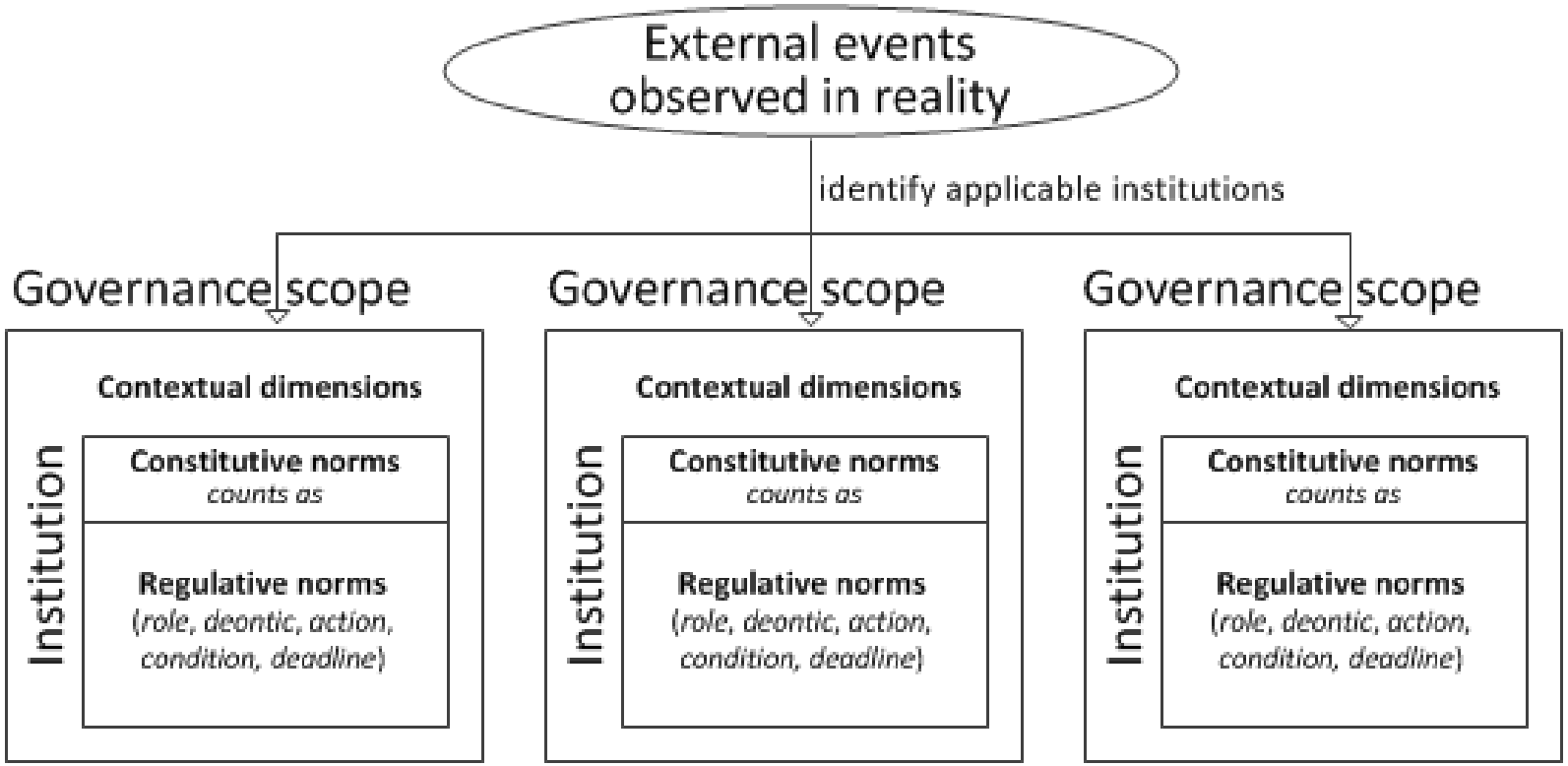
- We need to know the control boundary of each institution, e.g., activity, individuality, time, location, relation etc.
- We need to check whether there are overlapped control boundaries over the actors' behavior among the institutions.
- We need to verify whether the overlapped control boundaries lead to conflicting regulations.

Our proposal

A conceptual model
- to capture the control boundaries of institutions,
- to specify the regulations of the institutions.

An operational model
- to formalize the model of institutions,
- to realize the detection of conflicts among the institutions

Conceptual model (framework)



Conceptual model (Key concepts)

- Contextualized institution $I=<\Sigma_0, \mathcal{F}, gs, CN, RN>$
  - Governance scope: delineate the control boundary of institutions based on context model (Giunchiglia and Bouquet, 1996),

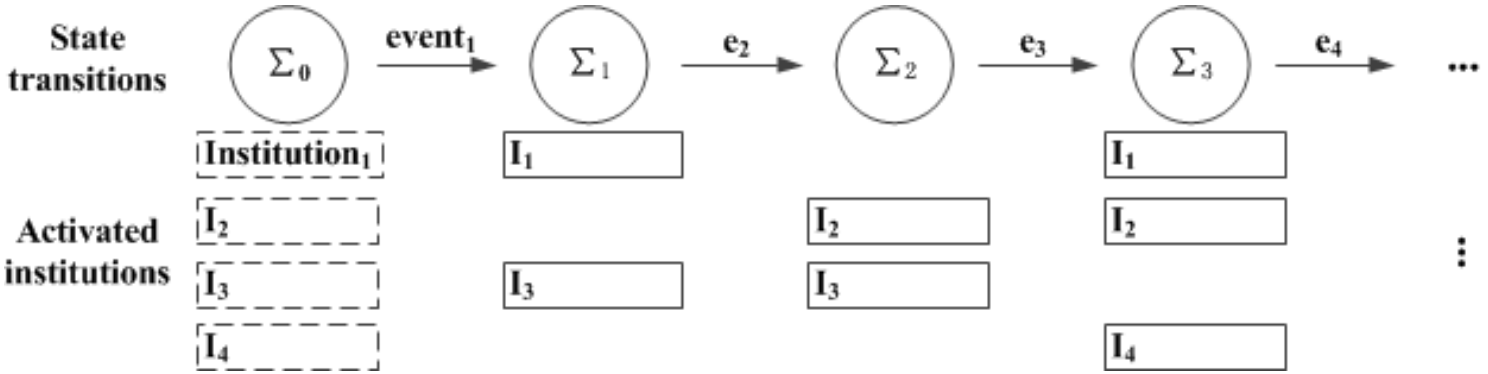
    $gs=<Action, C>$
  - Constitutive norm: translate external events into institutional events and derive institutional states from institutional events,

    $n_c=<\mathcal{E}_{ex}, \mathcal{E}_{inst}>|<\mathcal{E}_{inst}, \Sigma_i, \Sigma_{i+1}>$
  - Regulative norm: specify the (un)desired behavior for actors.

    $n_r=<role, deontic, action, condition, deadline>$

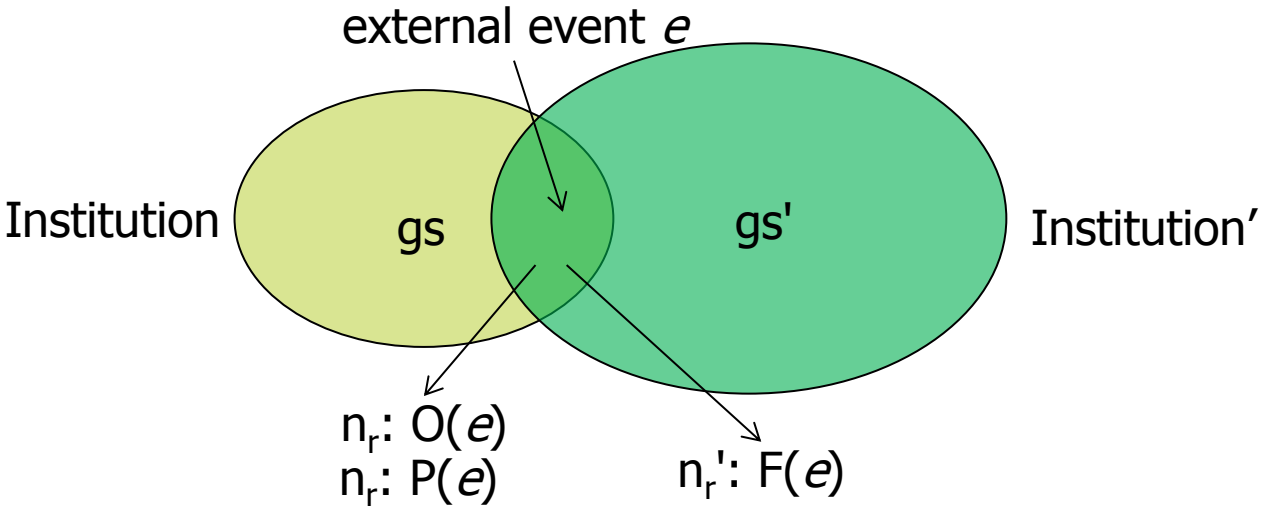
Conceptual model (Key concepts)

- Collective institutions
  - Collective institution set: activated institutions $\{I_i\}$
  - Governance overlap: $\Omega(gs, gs') \neq \emptyset$



Conceptual model (Key concepts)

- Norm conflicts
  - Strong conflicts: between obligations and prohibitions
  - Weak conflicts: between permissions and prohibitions



Operational model (related work)

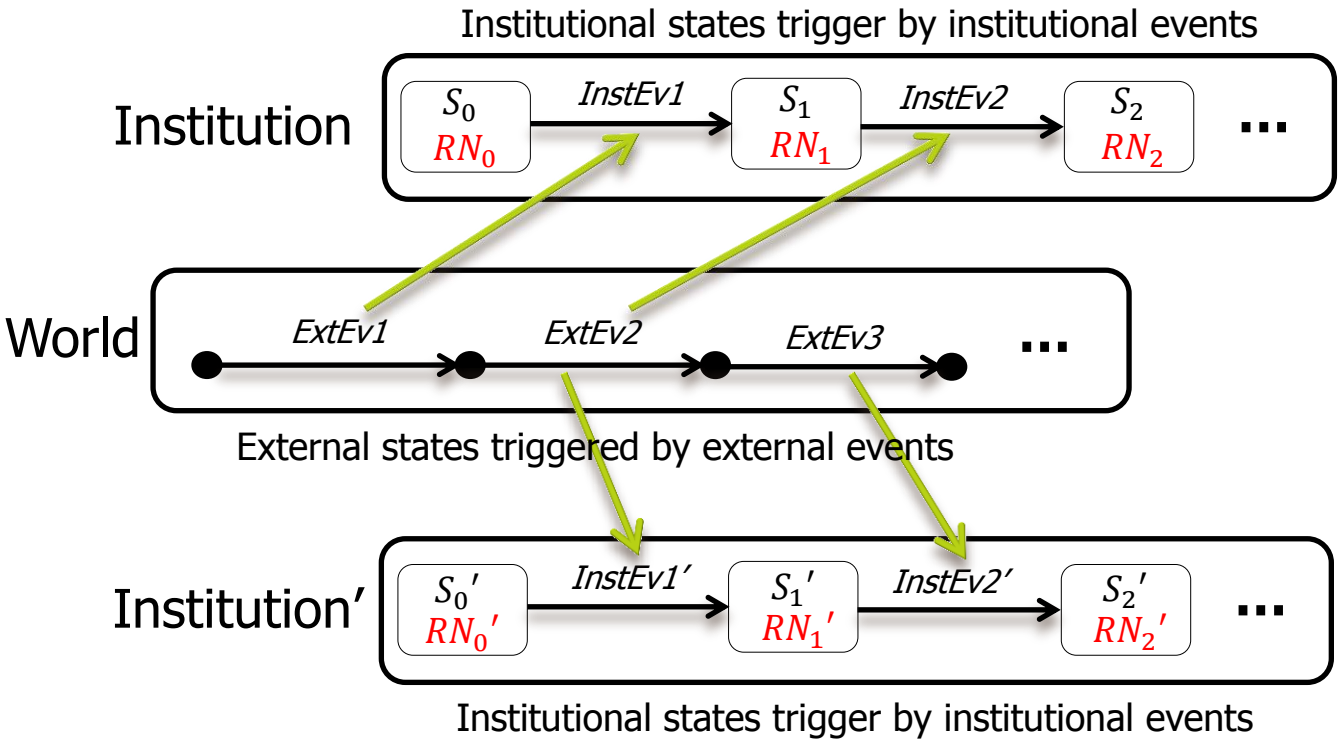
InstAL (Owen Cliffe, 2007)

- Formalize contextualized instituions.

Answer set programming

- Translate into computational models,
- Verify institutional states against event traces,
- Checking conflicts among collective institutions.

Operational model (key concepts)



Conflict Detection Mechanism

- Identification of Collective Institution Set
  - Varies with time and observed external events
  - Depends on the ***gs*** of each institution

- Example: to check if **`InstX`** is in the set at time **`T`**

```
collectiveInstSet(InstX,T):- obs(ev(action, v1,…, vn), T),
                             governedX(action, v1,…,vn).
```

Conflict Detection Mechanism

- A weak conflict is detected between the permission on action ***AX*** of ***InstX*** and the prohibition on ***AY*** of ***InstY*** at time ***T***.

%% weak conflict

```
weakConflict(perm(AX,RX,InstX), forb(AY,RY,InstY), T) :-
        norm(perm(AX,RX,InstX),T), norm(forb(AY,RY,InstY),T),
```

Conflict Detection Mechanism

- A weak conflict is detected between the permission on action ***AX*** of ***InstX*** and the prohibition on ***AY*** of ***InstY*** at time ***T***.
- ***AX*** and ***AY*** are both derived from the same external action ***A*** in terms of the ***countAs*** relations.

%% weak conflict

```
weakConflict(perm(AX,RX,InstX), forb(AY,RY,InstY), T) :-
        norm(perm(AX,RX,InstX),T), norm(forb(AY,RY,InstY),T),
        countAs(ev(A,V1,…,Vn), ev(AX,IV1,…,IVn), InstX),
        countAs(ev(A,V1,…,Vn), ev(AY,IV1,…,IVn), InstY),
```

Conflict Detection Mechanism

- A weak conflict is detected between the permission on action ***AX*** of ***InstX*** and the prohibition on ***AY*** of ***InstY*** at time ***T***.
- ***AX*** and ***AY*** are both derived from the same external action ***A*** in terms of the ***countAs*** relations.
- Both institutions are within the collective set at time ***T***, i.e., action ***A*** is covered by the governance scopes of them.

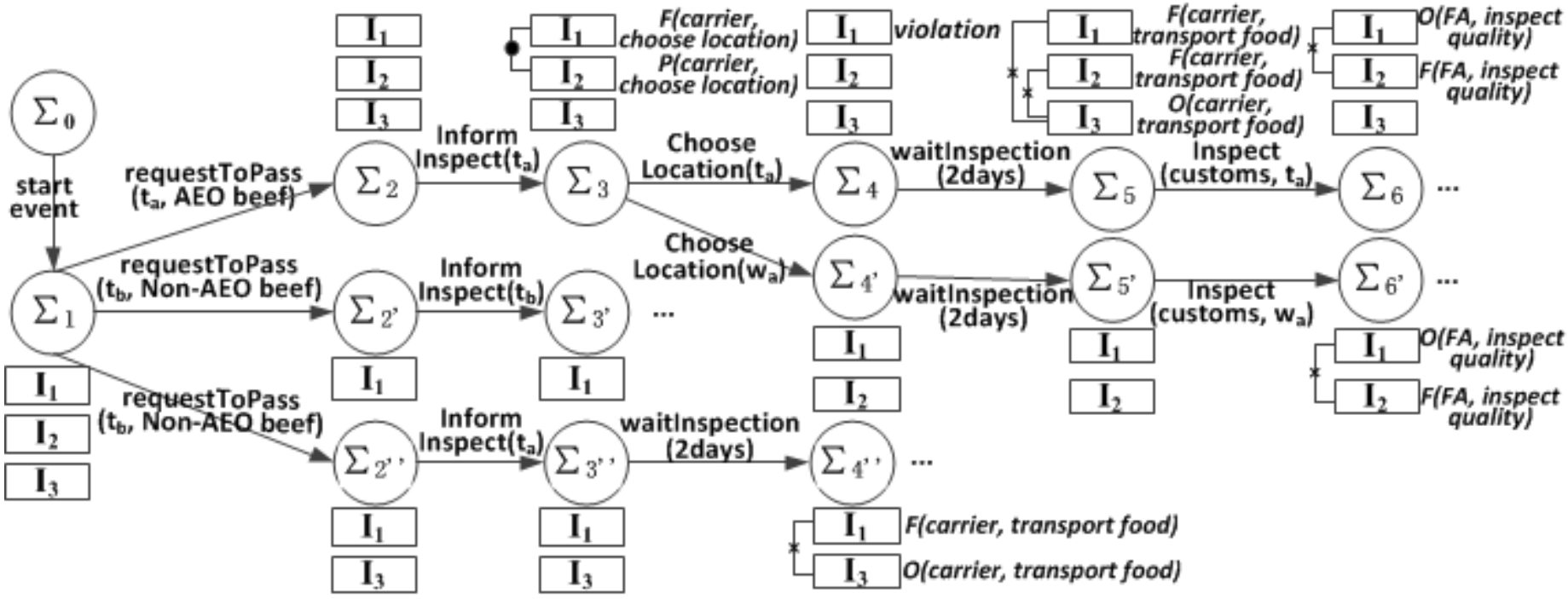
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        countAs(ev(A,V1,…,Vn), ev(AX,IV1,…,IVn), InstX),
        countAs(ev(A,V1,…,Vn), ev(AY,IV1,…,IVn), InstY),
        collectiveInstSet(InstX; InstY, T).
```

Case study (introduction)

- Authorized Economic Operator (AEO)
- Food importation to EU countries
- Multiple institutions
  - EU commission
  - Dutch customs
  - Container terminals

Case study (analysis and results)



Conclusion

This paper

- characterizes the control boundaries of the institution using the concept of governance scope.
- presents a full illustration of what an institution consists of and how it evolves to the changes of reality.
- defines norm conflicts .
- provides a computational model for detecting strong and weak conflicts.

Future work

We are trying to

- extend the institution model to multiple levels through hierarchical context models,
- consider the possible relations between norms and study their impact on norm conflicts,
- enrich the definition of norm conflicts and the detection mechanism.

Questions ?

