



# Ontology-based Analysis of Cadastral Processes

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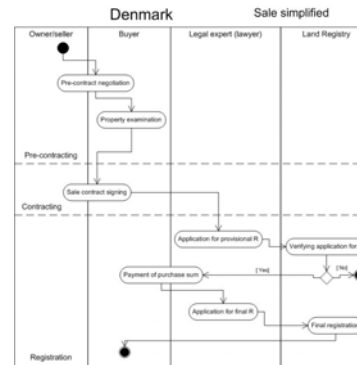
# Agenda

1. Reference Processes for Cadastral Transactions?
2. Computational Assistance for the Inductive Development of Reference Processes
3. Example and Conclusions



# Reference Processes?

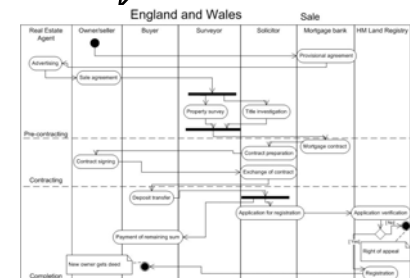
- For the cadastral domain?
- Aren't the countries to different?



We are doing it like that ...

But our legislation is completely different!

We have a different model for the same country!





# ... in Business Software

## ■ SAP R/3 Reference Model

- ▶ Reference models for various business processes
- ▶ Best practices
- ▶ Reflect the functionality of the R/3 system

## ■ Who is using the reference processes?

- ▶ Organizations installing R/3
- ▶ Worldwide
- ▶ In various industries

## ■ How are they used?

- ▶ Select business processes relevant for the specific needs
- ▶ Adapt to reference process vs. extend reference process

## ■ How does they match the different requirements?

- ▶ De-facto standard: due to so many installations worldwide: adapt your processes ...
- ▶ Finetuning by customization



# Cadastral Domain

## ■ Recent approaches

- ▶ Core Cadastral Domain Model
- ▶ Comparisons of Cadastral Processes within the COST Action G8
- ▶ Normative or descriptive?

## ■ Computational answer

- ▶ Not a single process everyone must adhere to but collections of customizable processes
- ▶ Best practices to rely on when building new cadastral systems or modernization



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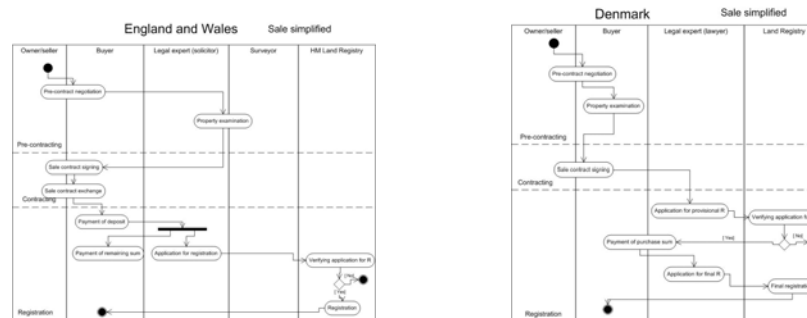


# Inductive Development

Modeling a reference process  
on the basis of existing  
national processes

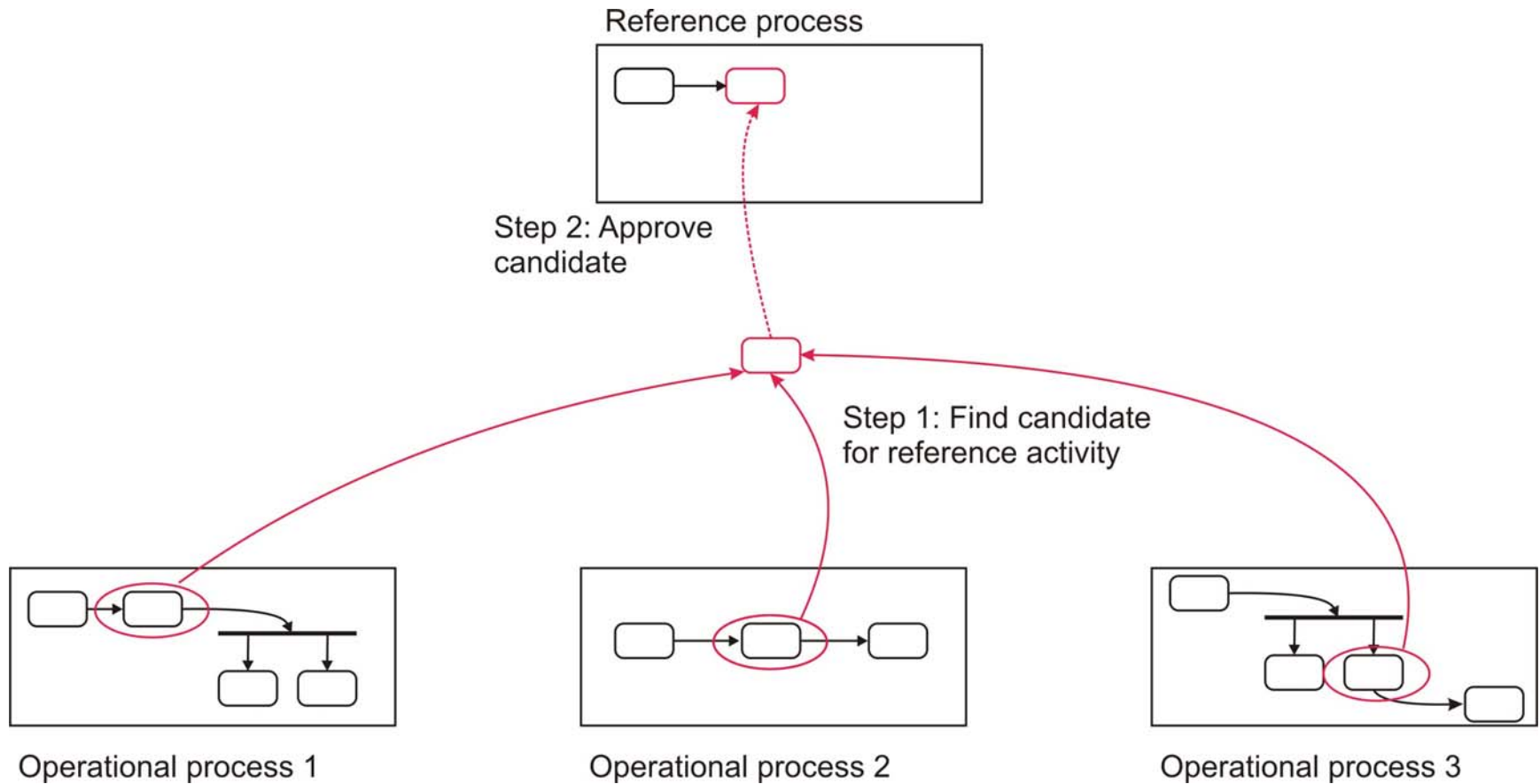
?

generalization





# The Idea

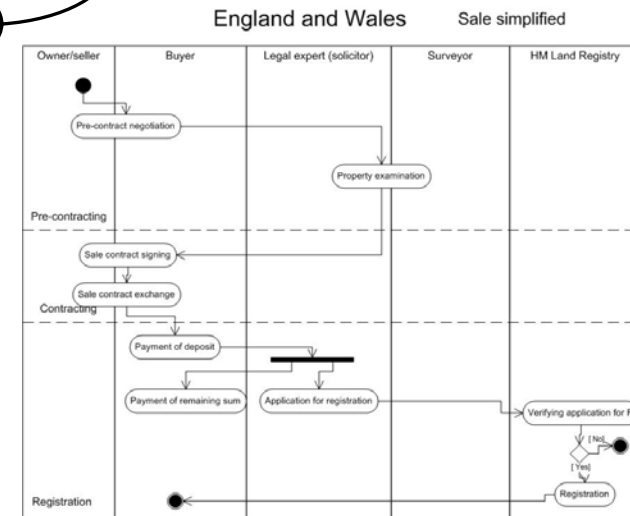
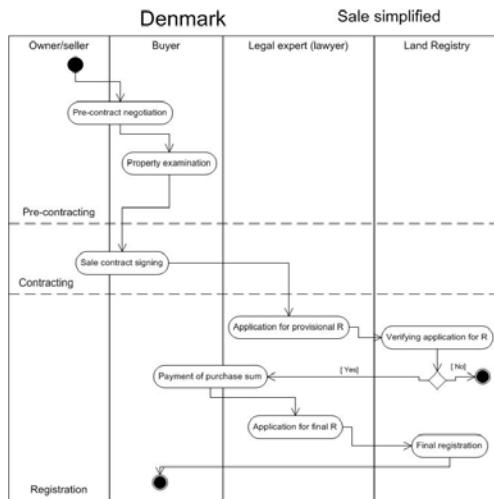






# Step 1: Find Candidates

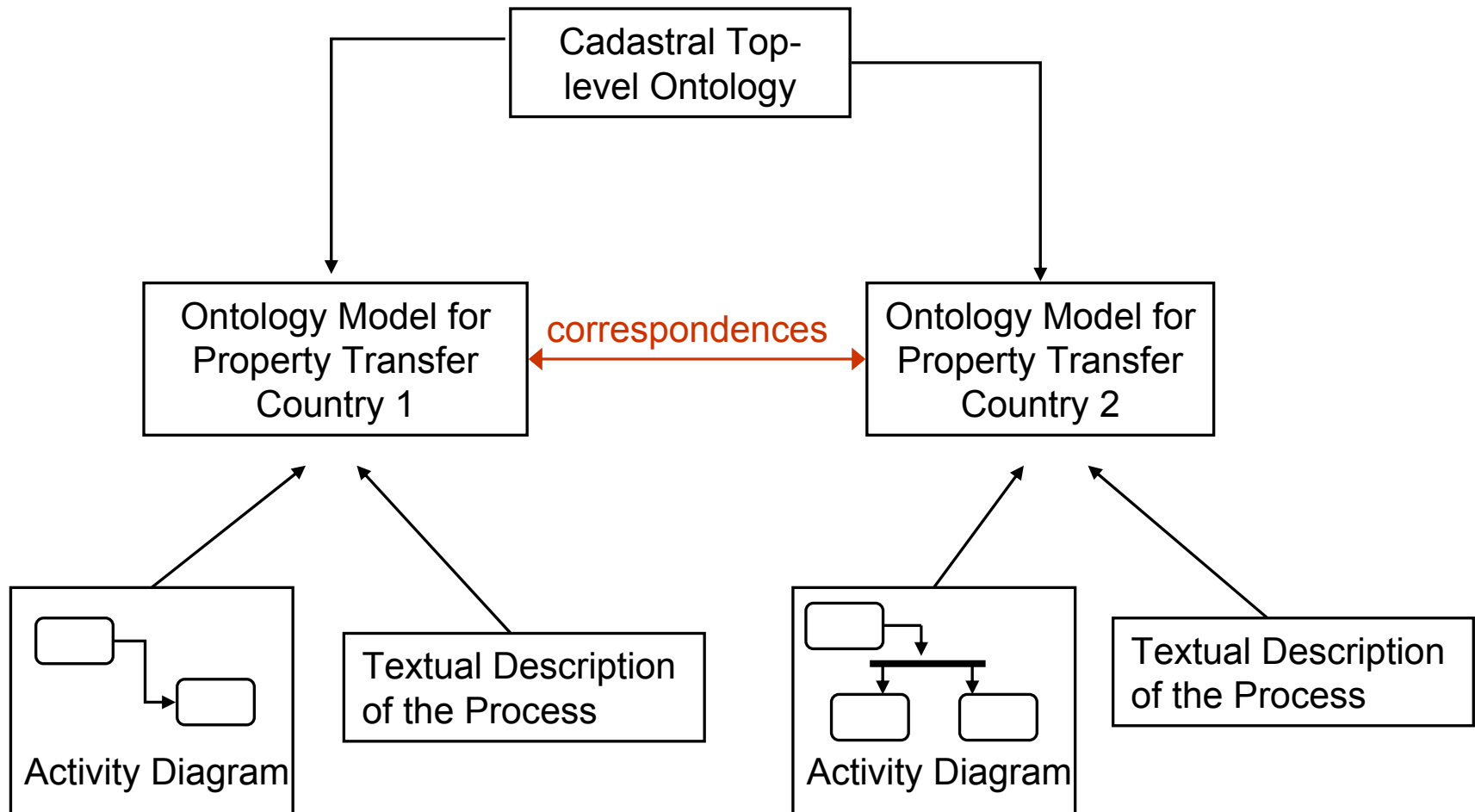
Which activities can I find across all national sale processes?



Formal ontology-based comparison



# Ontology-based Comparison (1/2)

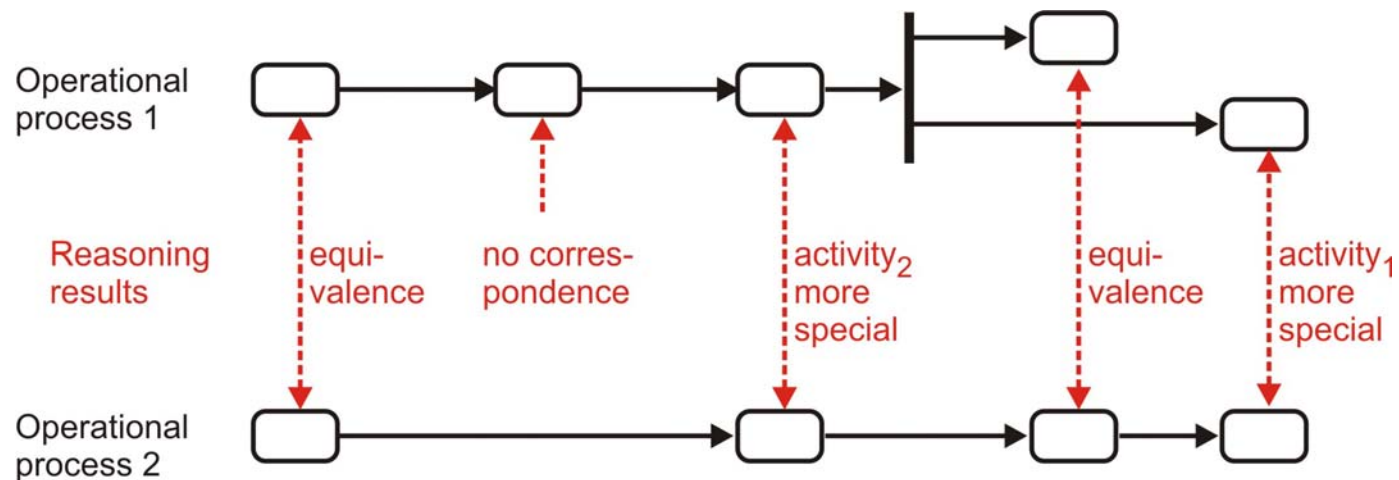




# Ontology-based Comparison (2/2)

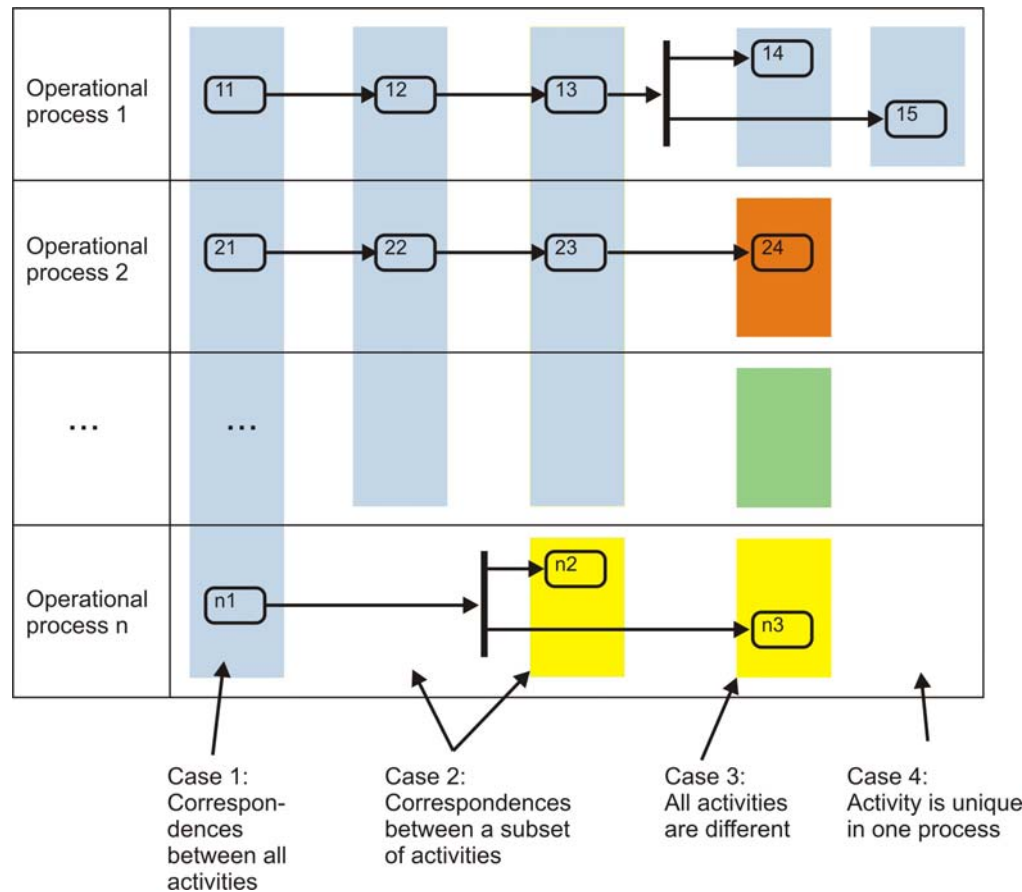
## ■ Correspondences

- ▶ Between the national processes
- ▶ computed by a reasoner
- ▶ Suggest those activities as reference activities that are similar in all / most national processes





# Possible Relationships





# Case 1: All Activities Correspond

Process 1		Process 2		Process 3	Suggested reference activity
activity 1	$\equiv$	activity 2	$\equiv$	activity 3	activity 1 (or 2 or 3, equivalence!)
activity 1	$\subseteq$	activity 2	$\equiv/\subseteq$	activity 3	activity 3 (the most general one)
activity 1	$\cap$	activity 2	$\cap$	activity 3	Least common subsumer

Possible combinations of correspondences



## Case 2 – 4

### ■ Case 2: subset of activities corresponds

- ▶ Does the majority of the concepts correspond?
- ▶ Yes: Suggest candidate as in case 1
- ▶ No: Manual analysis  
→ Further support by inference services?

### ■ Case 3: Only differing activities

- ▶ Manual analysis  
→ Further support by inference services?

### ■ Case 4: Unique activity

- ▶ Activity is not suggested as candidate because it is too specific for a country



## Step 2: Approve Candidate

- From candidates to reference activities
  - ▶ Cadastral domain experts can:
  - ▶ Approve candidates as suggested
  - ▶ Reject them
  - ▶ Modify them
  - ▶ Insert reference activities manually

→ It is not prescribed how the reference process should look like but assistance



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# Examples (1/2)

## ■ Case 1: All activities correspond

- ▶ Activities related to the payment of the purchase sum,
- ▶ E.g. EW\_PaymentOf-RemainingPurchaseSum, DK\_PaymentOfDeposit, ...
- ▶ Functions are similar, results can be structured hierarchically
- ▶ Candidate: PaymentOfPurchaseSum

## ■ Case 2: Subset of activities corresponds

- ▶ Activities related to the sale contract signing
- ▶ DK\_SaleContractSigning and corresponding activities in other countries vs.
- ▶ EW\_SaleContractSigning
- ▶ EW: specific case that differs from the “normal” way of signing the sale contract.
- ▶ Candidate: Derived from the majority



## Examples (2/2)

### ■ Case 3: All activities differ

- ▶ Activities related to the securing of the process
- ▶ EW: Payment of deposit
- ▶ DK: Provisional registration
- ▶ Further possibilities?
- ▶ However they belong to the same process step: Define very general activity in the reference process „SecureProcess“

### ■ Case 4: Unique activity

- ▶ EW\_ProvisionalMortgage-Negotiation
- ▶ Cannot be found in DK, ...



# Future Work

## ■ Evaluation

- ▶ Applying the methodology to several national models
- ▶ Requires preparing national process models as ontology models following the cadastral ontology
- ▶ Evaluate whether the criteria for suggesting reference concepts are appropriate
- ▶ Develop tool support, e.g. plug-in for Protégé



# Ontologies within COST G9 (1/2)

- **Ontology-based Conformity Verification**
  - ▶ Does a national data model conform with a reference model
  - ▶ such as the core cadastral domain model?
  - ▶ (Hess and Schlieder, Proceedings Joint FIG and COST G9 Workshop on Standardization in the Cadastral Domain, 2005)

- **Ontology-based Comparison of Process Models**
  - ▶ Comparing process models represented as ontology models
  - ▶ Ontological reasoning to determine correspondences
  - ▶ (STSM to Stockholm, to be published in the new book of the COST G9: Hess and Vaskovich)



# Ontologies within COST G9 (2/2)

## ■ Ontology-based Methodology for the Development of Reference Processes

- ▶ Use of ontological reasoning to determine candidates for a reference process
- ▶ (to be published in the final book of the COST G9: Hess and Schlieder)

## ■ Summing up

- ▶ Approaches for data and process models
- ▶ Assistance systems: support cadastral domain experts in their analysis and comparisons
- ▶ Joint work by cadastral domain experts and knowledge engineers