

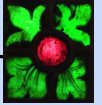


Ontology Engineering for the Comparison of Cadastral Processes

Claudia Hess, Christoph Schlieder

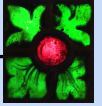
COST Action G9 “Modelling Real Property Transactions”,
Workshop Thessaloniki

June 09-11, 2005



Agenda

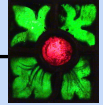
1. Comparing Process Models
2. Ontology-based Comparison of Real Property Transactions
3. A Worked Example
4. Conclusions



Comparing Cadastral Processes

■ Comparative Analysis

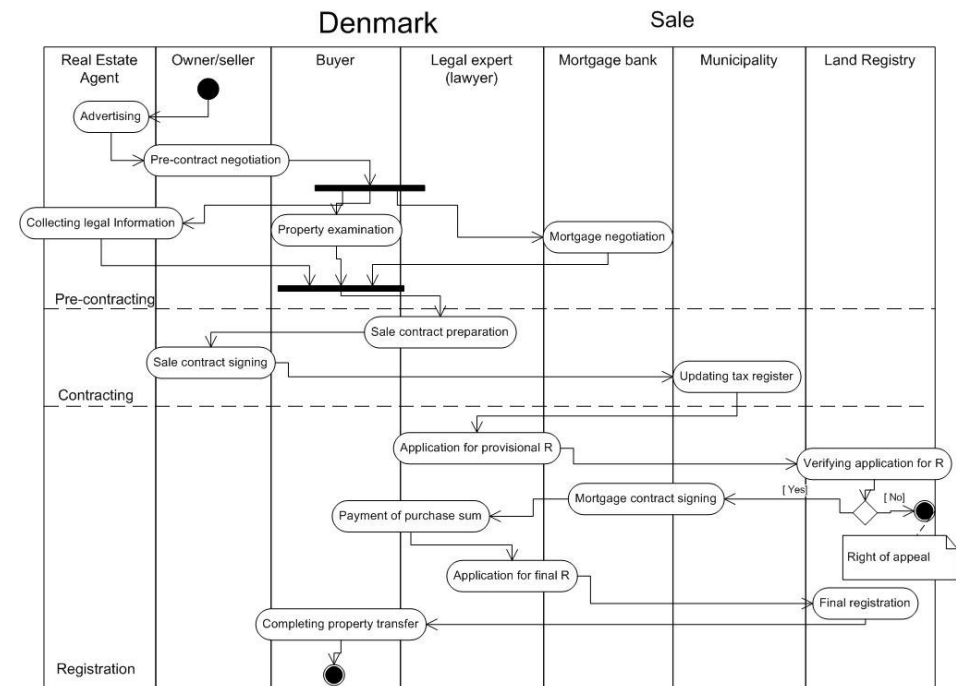
- ▶ Enhanced understanding of the national processes
- ▶ Identification of commonalities and differences
- ▶ Basis for identifying the reasons for a different efficiency and transaction costs
- ▶ Basis for the development of a reference process



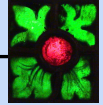
Cadastral Process Models

■ Process Models

- ▶ Textual description and activity diagrams of national cadastral transactions
- ▶ Property transfer, property subdivision
- ▶ E.g., Denmark, England / Wales by Vaskovich (2003)
- ▶ No reference process!



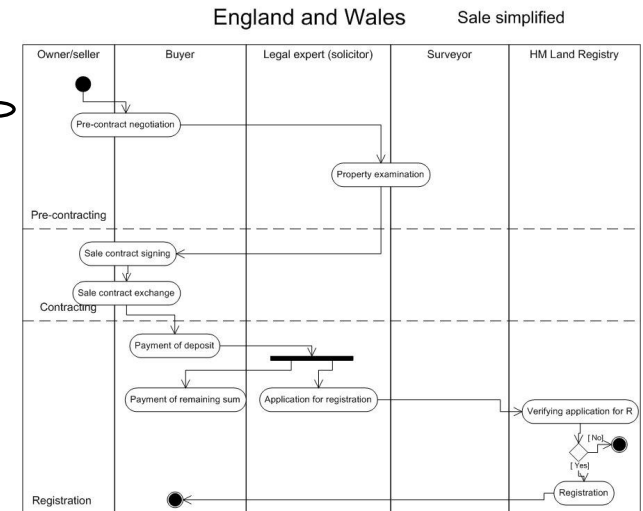
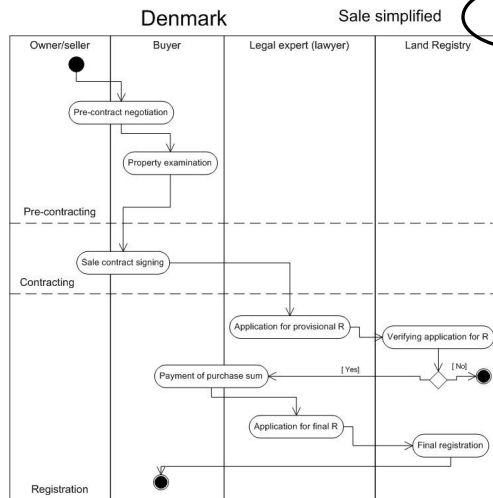
Activity Diagram for Property Transfer
(Vaskovich, 2003)



Comparison of Transaction

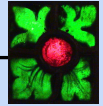
Buying a one-family house in Denmark works like this ...

And in England/Wales, it's like this ...



Formal ontology-based comparison





Initial Comparisons

■ Comparison by Activities

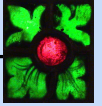
- ▶ Activities performed during the subdivision process are mapped
- ▶ Actors are not considered

■ Comparison by Actors

- ▶ Actors involved in the subdivision process

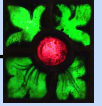
Denmark	England/Wales
Initiation	Initiation
Investigation	Investigation
Check/Measurement	Consultation
Case Preparation	Case Preparation
Case Approval	-
Application for Registration	Application for Registration
Case Check	Case Check
Ownership Registration	Ownership Registration
Information Updating	-

Initial Comparison of Subdivision (Vaskovich, 2004)



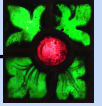
From the Initial to a Formal Comparison

- Why a formal comparison?
 - ▶ Comparison of different countries at the same level of detail
 - ▶ Detailed knowledge on the degree of conformity
 - ▶ Explain why a country *A* is more similar to a country *B* than to a country *C*
- ➔ ontology-based comparison



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A Formal, Ontology-Based Approach

■ Ontologies?

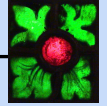
- ▶ “explicit account of a shared understanding“ (Uschold & Grüniger 1996)
- ▶ vocabulary for a domain

■ Ontological Modeling

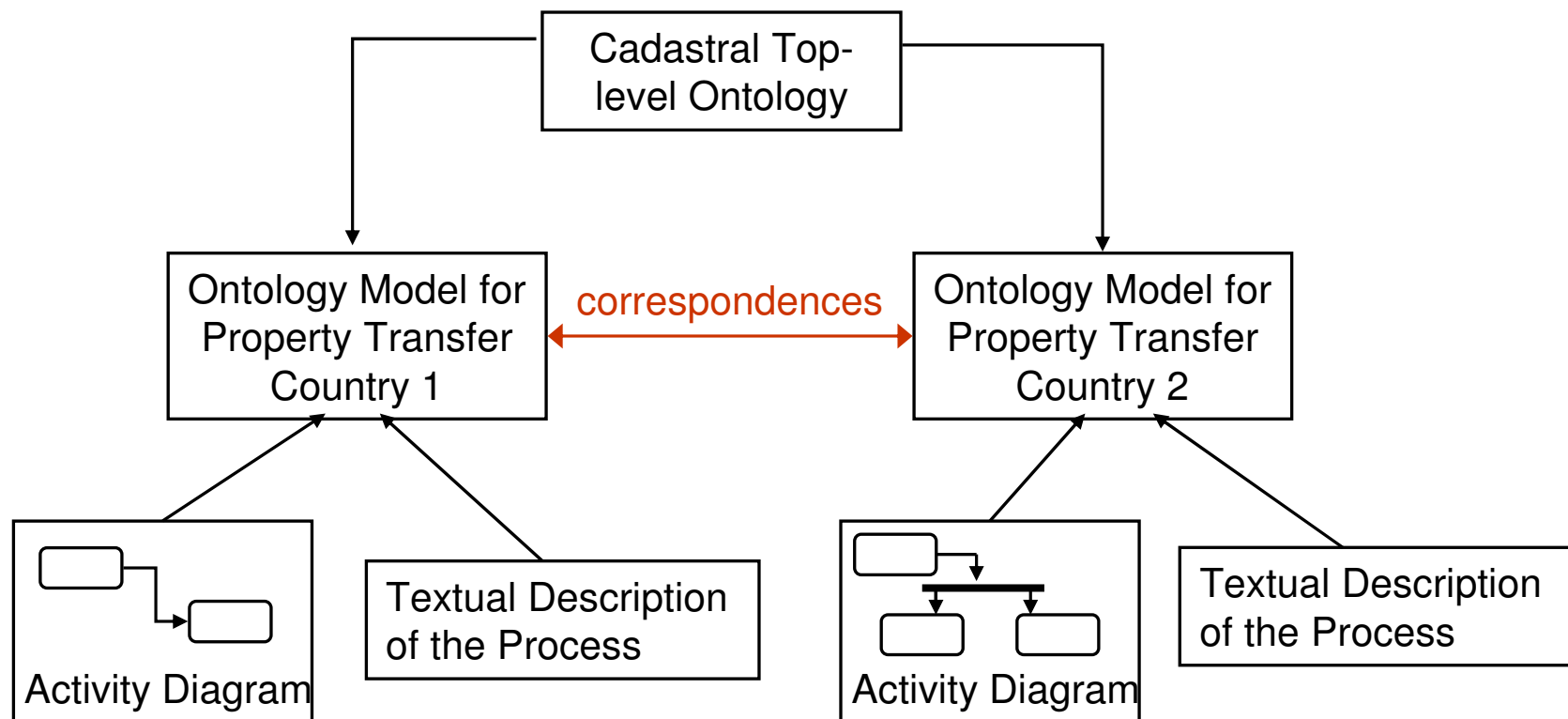
- ▶ Formal way of representing conceptual models
- ▶ in an ontology language
- ▶ Higher expressiveness than other approaches to conceptual modeling: restrictions, quantors, constraints, ...

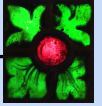
■ Ontological Reasoning

- ▶ Consistency check
- ▶ Subsumption, Equivalence
- ▶ Computation of correspondences between the national models



Ontology-based Comparison





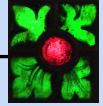
Cadastral Top-Level Ontology

■ Why using a top-level ontology?

- ▶ Concepts and properties used for the description of processes
- ▶ Ensures that all process models use the same terminology
- ▶ And the same criteria for comparison

■ The cadastral top-level ontology

- ▶ Uses terms defined in the Workflow Management Coalition's (WfMC) glossary
- ▶ **Extended with terms for the description of processes in the cadastral domain!**



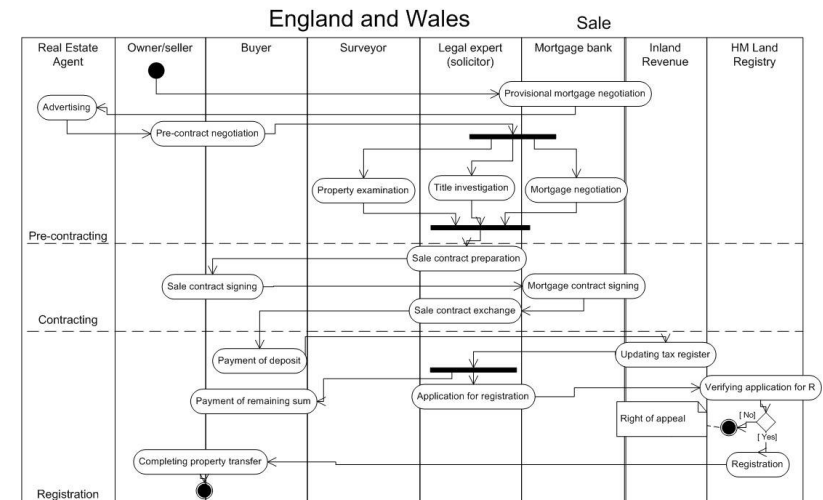
Processes and Activities

■ Process

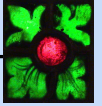
- ▶ Formalized view of a business process, represented as a coordinated set of process activities (WfMC)
- ▶ E.g., Property Transfer, Property Subdivision

■ Activity

- ▶ Description of a piece of work that forms one logical step within a process (WfMC)
- ▶ E.g., sale contract signing



Activity Diagram for Property Transfer in England/Wales (Vaskovich, 2003)



Concepts for Describing an Activity

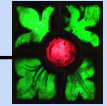
■ Function / Purpose

- ▶ The purpose of an activity

■ Result

- ▶ Signed document, e.g., sale contract
- ▶ Oral agreement between the participants of an activity, e.g. sale agreement
- ▶ Decision, e.g., decision on title registration

Signing the sale contract (DK)	
Function	Official transfer of the rights on the property
Result	Signed, legally binding sale contract

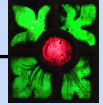


Ontology Models

- Formalization of the Ontology Models
 - ▶ Literate UML models are represented in the ontology modeling language OWL
 - ▶ Use of the concepts defined by the cadastral top-level ontology
 - ▶ Example: DK_SaleContractSigning

The screenshot shows the CLASS EDITOR for the class DK_SaleContractSigning. The interface includes the following sections:

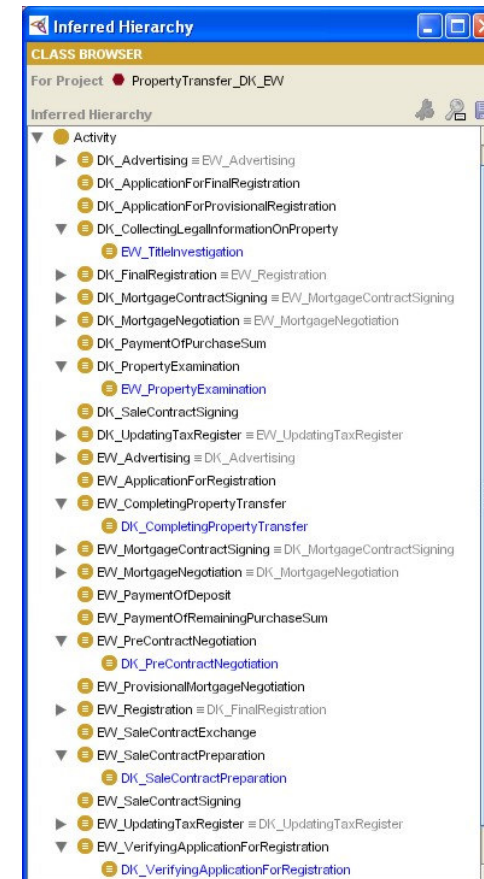
- Name:** DK_SaleContractSigning
- Annotations:** A table with columns Property, Value, and Lang.
- Asserted Conditions:** A list of conditions including:
 - NECESSARY & SUFFICIENT: \exists hasFunction OfficialTransferOfRightsOnProperty
 - NECESSARY: \exists resultsIn SignedLegallyBindingSaleContract
 - Activity
- Disjoints:** A list of classes including DK_Advertising, DK_ApplicationForFinalRegistration, DK_ApplicationForProvisionalRegist..., DK_CollectingLegalInformationOnPr..., DK_CompletingPropertyTransfer, and DK_FinalRegistration.

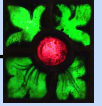


Ontological Reasoning

■ Ontological Reasoning

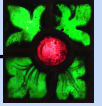
- ▶ Computes the type of the identified mapping: equivalence, specialization
- ▶ Reasoner, e.g., RACER
- ▶ Interpretation of the results by knowledge engineers and domain experts
- ▶ Example: Property Examination: $EW \subseteq DK$





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Comparing Property Transfer

■ Compared Transactions

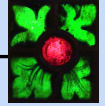
- ▶ Denmark and England / Wales

■ Approach

- ▶ Ontological modeling and computation of correspondences in several iterations
- ▶ Differences with the domain experts' intuition on correspondences?
- ▶ Explanation and refinement of the models

■ Example Activities

- ▶ Property examination
- ▶ Signing of the sale contract



Property Examination

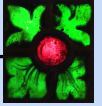
■ Equivalence?

Specialization?

- ▶ Correspondence of the type specialization
- ▶ The examination of the physical state of the property is more formal in E/W than in DK

- ▶ Results are organized in a hierarchy according to increasing “professionalism” and level of detail.

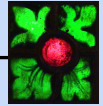




Sale Contract Signing

■ Equivalence?

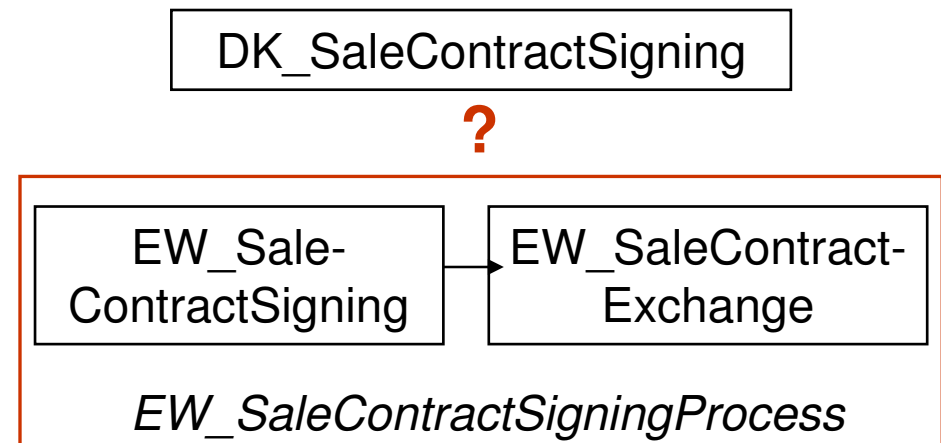
- ▶ Between DK_SaleContract-Signing and EW_Sale-ContractSigning?
- ▶ False!
- ▶ DK: Sale contract is signed and immediately legally binding.
- ▶ E/W: Sale contract is signed independently by both parties and is only legally binding after exchange.
- ▶ Sale contract exchange must be considered!

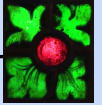


Sale Contract Signing 2

■ Aggregation

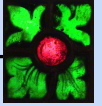
- ▶ To a new activity
- ▶ *hasPart* EW_SaleContractSigning and EW_SaleContractExchange
- ▶ Result is the result of the last subactivity
- ▶ New function corresponding to the function of the activity DK_SaleContractSigning
- ▶ Reasoner: EW_SaleContractSigningProcess \subseteq DK_SaleContractSigning





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Approach and Results

■ Top Level Ontology

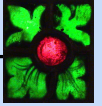
- ▶ Function and result: new focus on the activities which has not yet been analyzed
- ▶ Extensible

■ Level of Detail

- ▶ Detailed enough → not everything is equivalent
- ▶ Not too detailed → correspondences could be identified

■ Results of the Comparison

- ▶ Verification of the intuitions
- ▶ Results conforming with the intuitions
- ▶ More detailed knowledge about commonalities and differences
- ▶ All relationships can be explained



Conclusion

■ Approach

- ▶ is applicable to the comparison of cadastral process models
- ▶ Sensible results
- ▶ Useable to the comparison of > 2 process models
- ▶ without modifying the approach and
- ▶ without a pair wise comparison

■ Not restricted to the cadastral domain

- ▶ Definition of a different top level ontology

■ Future Work

- ▶ Basis for the development of a reference process