

# Semantic model transformation within the context of INSPIRE

unter der Anleitung von

**Dipl.-Ing. Eva-Maria Unger**

Federal Office of Surveying and Metrology of Austria

**Priv.-Doz. Dipl.-Ing. Dr. techn. Gerhard Navratil**

Vienna Technical University

**Dipl.-Ing. Stefan Klotz**

Federal Office of Surveying and Metrology of Austria

FIG Working Week Rome 2012

## Content

**1 Motivation**

**2 Data Model Basics**

**3 Source model for CP (Austria)**

**4 Target model for CP (INSPIRE)**

**5 Humboldt Alignment Editor**

**6 Limits of Implementation**

**7 Conclusion**

## Motivation

**EU** → In May 2007 INSPIRE (Infrastructure for Spatial Information in the European Community) entered into force  
Aims to ensure **compatibility** and **usability** in a community and cross-boundary context

**BEV** → Geodata infrastructure law GeoDIG establishing a Geodata infrastructure in Austria

Eva-Maria Unger, FIG Working Week Rome 2012

Folie 3 von 17

## Motivation

INSPIRE offers the users to

- » **find**
- » **browse**
- » **share**
- » **and download**

spatial data

**Problem:** every state or federal offices

- » **create**
- » **manage and**
- » **provide**

in different systems, models and data formats

**Solution:** Harmonization of data models with the implementation of transformation services for geodata.



Eva-Maria Unger, FIG Working Week Rome 2012

Folie 4 von 17

## Data Model Basics

### Model transformation of geodata

- » Syntactical transformation

Syntax of geodata is converted -> insufficient for the purpose of use

- » Semantic transformation

Data is restructured, supplemented and/or reduced to fit

the target model

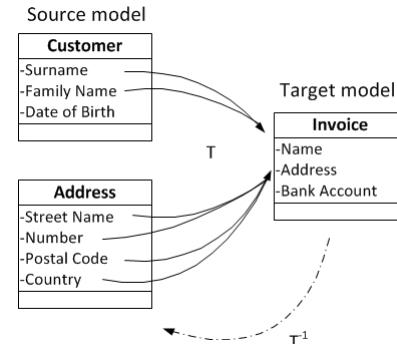
enables exchange of heterogeneous data

## Data Model Basics

### Semantic Transformation

Problems:

1. Lossless mapping of the semantics between different data models is not possible
2. The bijectivity of mapping rules from source- to target model is not guaranteed



## Source model for CP (Austria)

Based on 2 pillars

- » cadastre (its technical implementation: digital cadastral map DKM)
- » land register

**Source model**

```

classDiagram
    class DKM {
        <<Digital cadastral map>>
        Cadastral zoning
    }
    class GDB {
        <<Parcel database>>
        Basic property unit
    }
    class Cadastral parcel
    Cadastral zoning "1" --> "n" Cadastral parcel
    Cadastral parcel "n" --> "1" Basic property unit
    
```

The diagram illustrates the Source model architecture. It features two main components: 'DKM' (Digital cadastral map) and 'GDB' (Parcel database). The 'DKM' component contains a 'Cadastral zoning' feature. The 'GDB' component contains a 'Basic property unit'. A 'Cadastral parcel' entity connects the two, with multiplicity '1' at the 'DKM' side and 'n' at the 'GDB' side. Additionally, there is a relationship between 'Cadastral parcel' and 'Basic property unit' with multiplicity 'n' at the 'Cadastral parcel' side and '1' at the 'Basic property unit' side.

Eva-Maria Unger, FIG Working Week Rome 2012

Folie 7 von 17

## Source model for CP (Austria)

**Source model consist of:**

- » Grundstueck = parcel
- » Grundstueck\_EZ =
- parcel\_basic property unit
- » KG = cadastral zoning

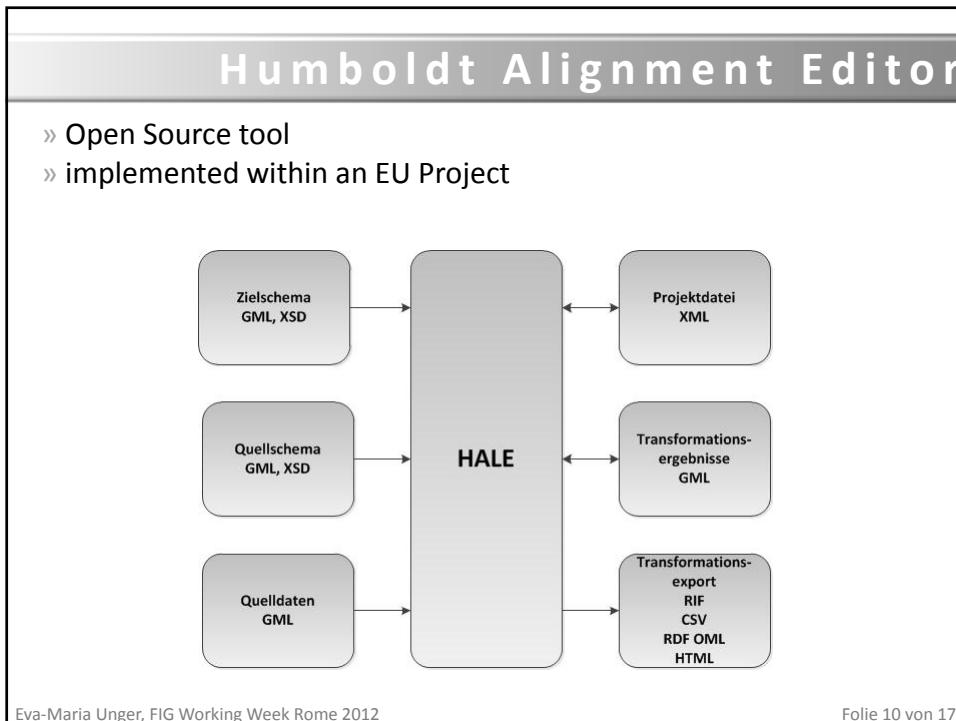
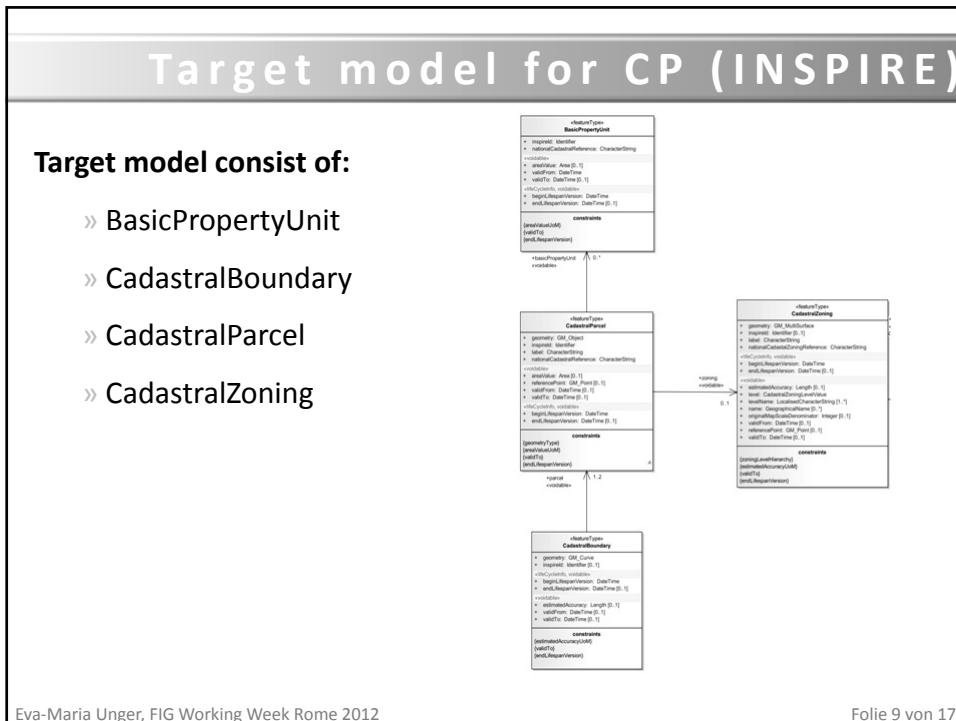
```

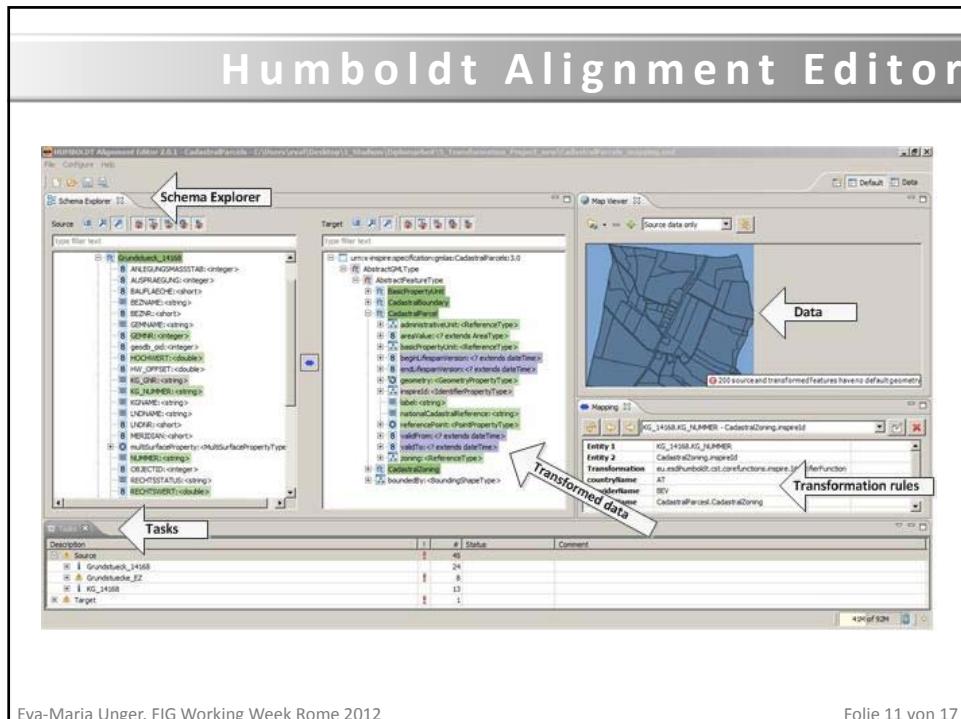
classDiagram
    class Grundstueck_EZ {
        <<gml:AbstractFeatureType>>
        <<xSDComplexType>>
        Grundstueck_EZ
        +OBJECTID: Object ID
        +Nummer: string
        +Flaeche_Gzt: double
        +Geodetic_Coordinate
        +Erlage: string
        +KG_NR: string
        +KG_NUMMER: long integer
        +GB_EZ: string
    }
    class Grundstueck {
        <<gml:AbstractFeatureType>>
        <<xSDComplexType>>
        Grundstueck
        +OBJECTID: Object ID
        +Shape: geometry
        +KG_NUMMER: string
        +MERIDIAN: short integer
        +KG_GNR: string
        +NAME: string
        +BAUFLAECHE: short integer
        +STAMMNUMMER: long integer
        +UNTERTEILNUMMER: long integer
        +AUFTRAGNUMMER: long integer
        +AUFTRAGLUNG: long integer
        +RECHTSSTATUS: string
        +ANLEGENGSTAB: long integer
        +DIREKTER: double
        +HOCHWERT: double
        +ROTATION: double
        +DZ: double
        +HW_OFFSET: double
        +ROTATION_ARROW: double
        +LNB: short integer
        +BEZNR: short integer
        +LNDNR: short integer
        +UNDE: short integer
        +KGNAME: string
        +GEMNAME: string
        +ENDNAME: string
        +LNDNAME: string
        +VANNAME: string
        +SHAPE_X: double
        +Shape_Length: double
        +Shape_Area: double
        +GB_EZ: string
    }
    class KG {
        <<gml:AbstractFeatureType>>
        <<xSDComplexType>>
        KG
        +OBJECTID: Object ID
        +Shape: geometry
        +KG_NUMMER: string
        +MERIDIAN: short integer
        +GEMNR: long integer
        +BZNR: short integer
        +LNDNR: short integer
        +VANR: string
        +KGNAME: string
        +BEZNACHE: string
        +LNDNAME: string
        +UNDE: string
        +Shape_Area: double
        +Shape_Length: double
    }
    class KG_NUMMER {
        <<xs:Element>>
        +KG_NUMMER: string
    }
    
```

The detailed diagram shows the structure of the components. 'Grundstueck\_EZ' is a complex type derived from 'gml:AbstractFeatureType'. It includes attributes for OBJECTID, Nummer, Flaeche\_Gzt, Geodetic\_Coordinate, Erlage, KG\_NR, GB\_EZ, and a reference to 'KG\_GNR' (multiplicity 1..\*). 'Grundstueck' is another complex type derived from 'gml:AbstractFeatureType'. It includes attributes for Shape, KG\_NUMMER, MERIDIAN, KG\_GNR, NAME, BAUFLAECHE, STAMMNUMMER, UNTERTEILNUMMER, AUFTRAGNUMMER, AUFTRAGLUNG, RECHTSSTATUS, ANLEGENGSTAB, DIREKTER, HOCHWERT, ROTATION, DZ, HW\_OFFSET, ROTATION\_ARROW, LNB, BEZNR, LNDNR, UNDE, KGNAME, GEMNAME, ENDNAME, LNDNAME, VANNAME, SHAPE\_X, Shape\_Length, Shape\_Area, and GB\_EZ. There is also a reference to 'KG\_NUMMER' (multiplicity 1..\*). 'KG' is a complex type derived from 'gml:AbstractFeatureType'. It includes attributes for OBJECTID, Shape, KG\_NUMMER, MERIDIAN, GEMNR, BZNR, LNDNR, VANR, KGNAME, BEZNACHE, LNDNAME, UNDE, Shape\_Area, and Shape\_Length. Finally, 'KG\_NUMMER' is defined as an element type with a single attribute KG\_NUMMER.

Eva-Maria Unger, FIG Working Week Rome 2012

Folie 8 von 17





Eva-Maria Unger, FIG Working Week Rome 2012

Folie 11 von 17

### Humboldt Alignment Editor

**Using an overview table**

INSPIRE Elemente	DKM Element	M/V	Bestand	HALE Transformationsfunktion
CadastralParcel	Grundstueck_14168_UTM33			Retype Feature
administrativeUnit	GEMNR		✓	Attribute Rename Function auf Untertyp title
areaValue	Flaeche_GST	M	✓	Attribute Rename Function
basicPropertyUnit	GB_EZ	V	✓	Attribute Rename Function auf Untertyp title
beginLifespanVersion	*	V	*	NilReason Function
endLifespanVersion	*	V	*	NilReason Function
geometry	SurfaceProperty	M	✓	Attribute Rename Function
inspireID	KG_GNR	M	✓	INSPIRE Identifier Function

Eva-Maria Unger, FIG Working Week Rome 2012

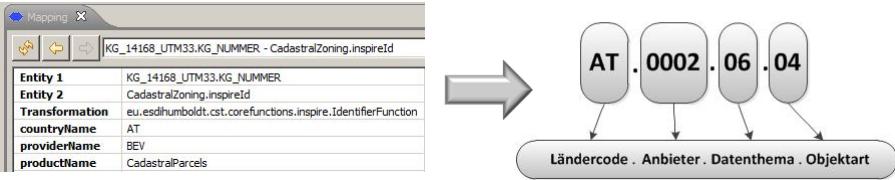
Folie 12 von 17

## Limits of Implementation

- » Not all voidable attributes could be filled
 

INSPIRE Nil Reason

*beginLifespanVersion, endLifespanVersion*

*validFrom, validTo*
  
- » INSPIRE ID couldn't be generated
 

INSPIRE ID

AT.0002.06.04

Ländercode . Anbieter . Datenthema . Objektart

Eva-Maria Unger, Wien, 4. Juli 2011

Folie 13 von 17

## Limits of Implementation

- » Estimated Accuracy maximum positional error
 

Default value 20m within the Alps
  
- » Reference Point couldn't be generated
 

CadastralParcels: Coordinates

CadastralZoning: CentroidFunction



Positives (links) und negatives (rechts) Ergebnis einer Centroid-Funktion

Eva-Maria Unger, FIG Working Week Rome 2012

Folie 14 von 17

## Conclusion

### Most relevant results:

- » Finding and investigating current transformation tools and their transformation language
- » Analyzing the source model
- » Analyzing the target model
- » Establishing, executing and validating a prototype transformation

Eva-Maria Unger, FIG Working Week Rome 2012

Folie 15 von 17

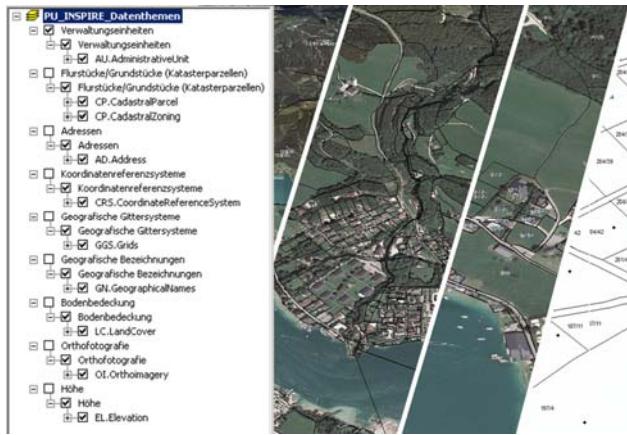
## Conclusion

- » In principle, semantic model transformation is **possible**
- » Austrian data model **fulfills** the INSPIRE target model
- » The tool shown is still **under-development**, essential functions are missing  
So keep an eye on development
- » Data model in Austria will be **changed**
- » Current implementation at BEV: Download and  
Transformation services

Eva-Maria Unger, FIG Working Week Rome 2012

Folie 16 von 17

**Thanks a lot for your attention!!!**



Datathemes of INSPIRE WMS in BEV, in different scales