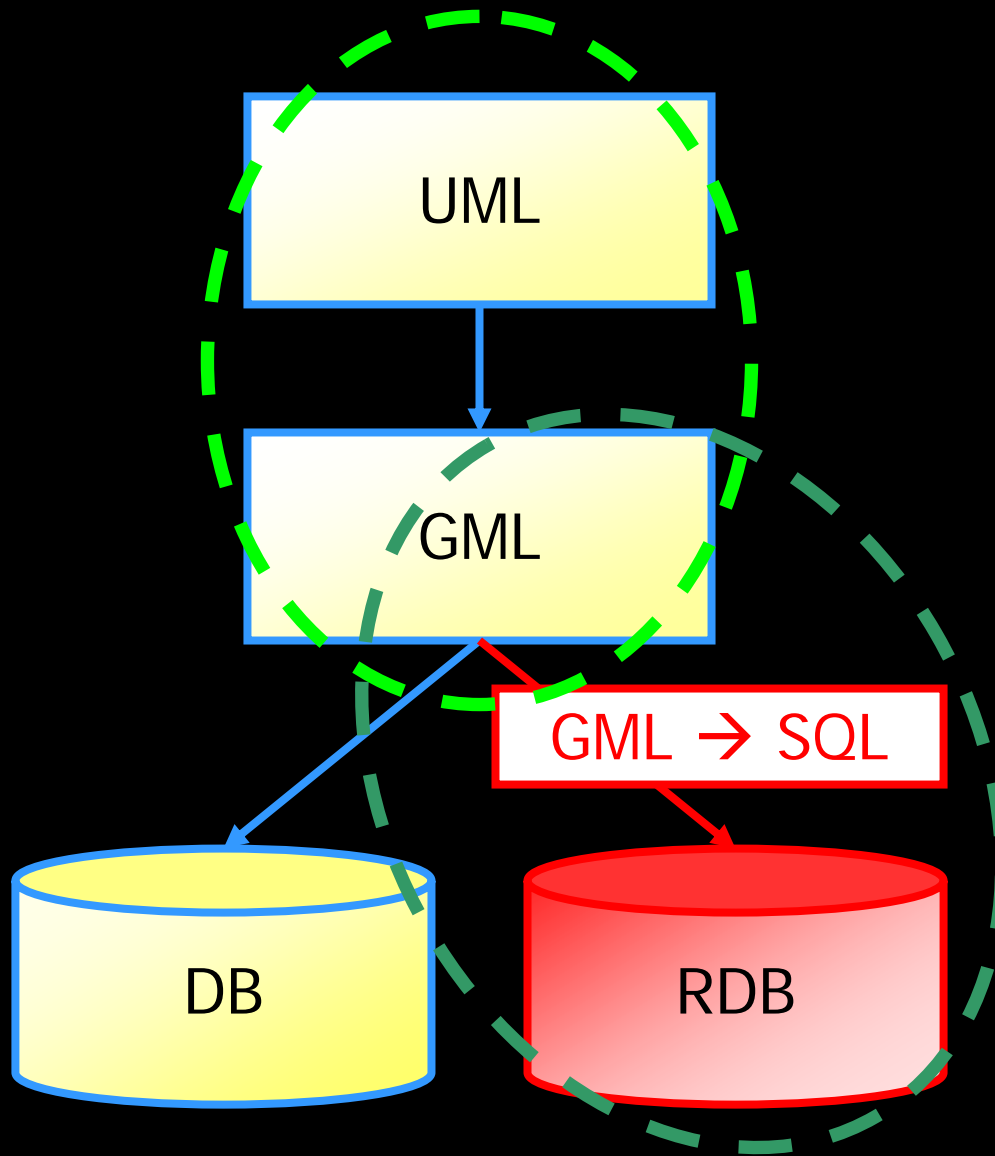


Standards-based approaches to publishing and accessing content in SDIs

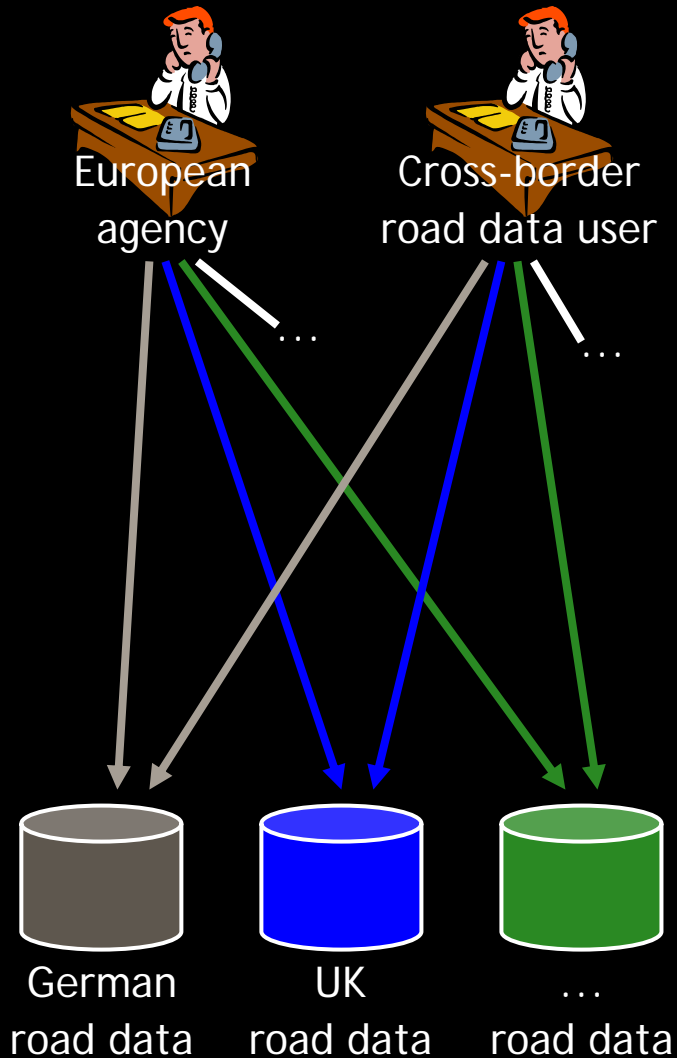
Reinhard Erstling - interactive instruments GmbH
Clemens Portele - interactive instruments GmbH

Publishing and accessing content in SDIs

Easy, or is it?

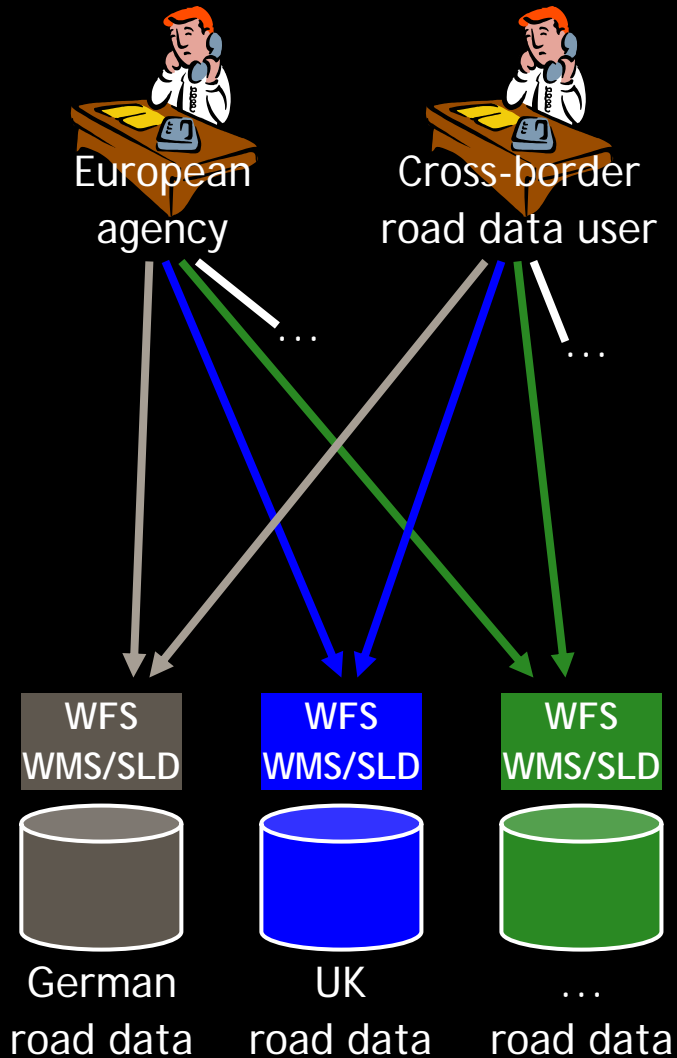


The point of departure ...



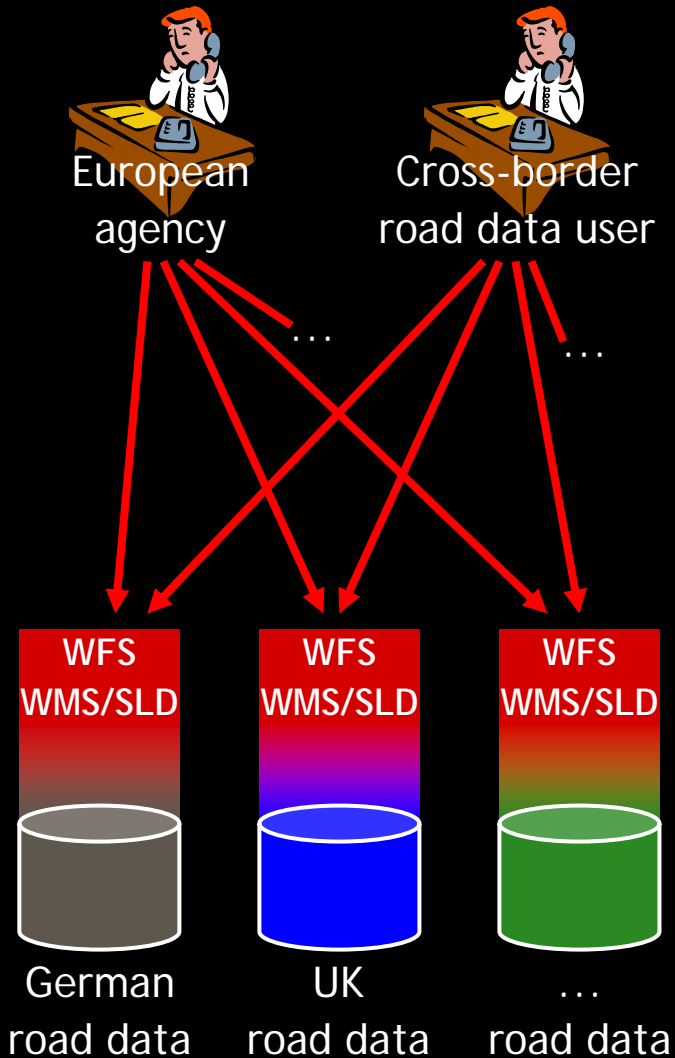
- Access to spatial data typically via digital media
- User has to deal with interpreting heterogeneous data in different formats

What we see more and more ...



- SDIs allow online access to spatial data via standardised web services
- User still has to support a variety of application schemas

What INSPIRE is aiming at ...



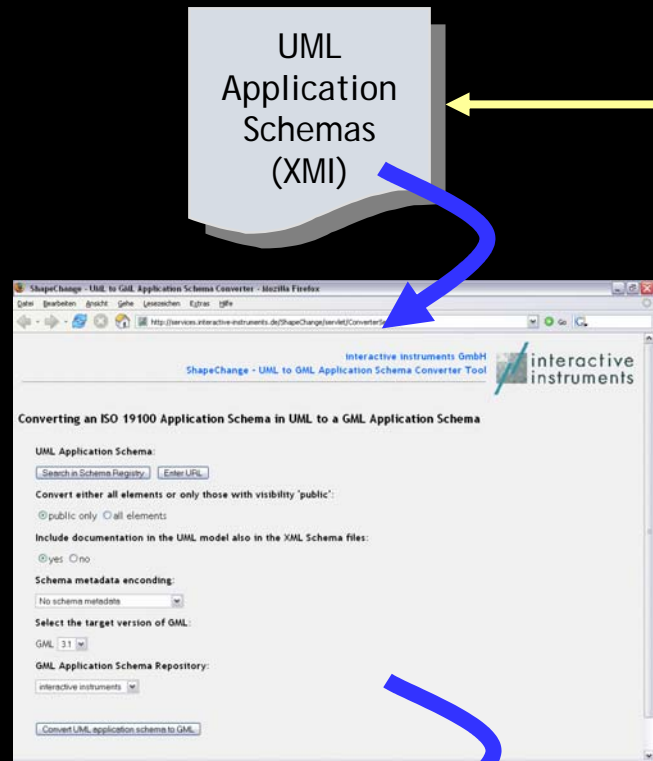
- Efforts ongoing in SDI activities to harmonise data content offerings → harmonised data specifications based on the ISO 19100 series
- Content provider has to translate between the internal data model and the harmonised data specification → the WFS or WMS/SLD needs to support an extremely flexible mapping language to automate the translation

ShapeChange: Mapping tool from UML to GML Application Schemas (Open Source)

Used and tested in a large number of projects around the world with a number of UML tools

Interoperability of XMI in UML tools is limited and support of XMI is not errorfree

Version supporting GML 3.2 = ISO 19136 in testing stage



UML Modeling Guidelines (→ GML Annex E)

UML Application Schemas (XMI)

Encoding Rules (→ GML Annex E)

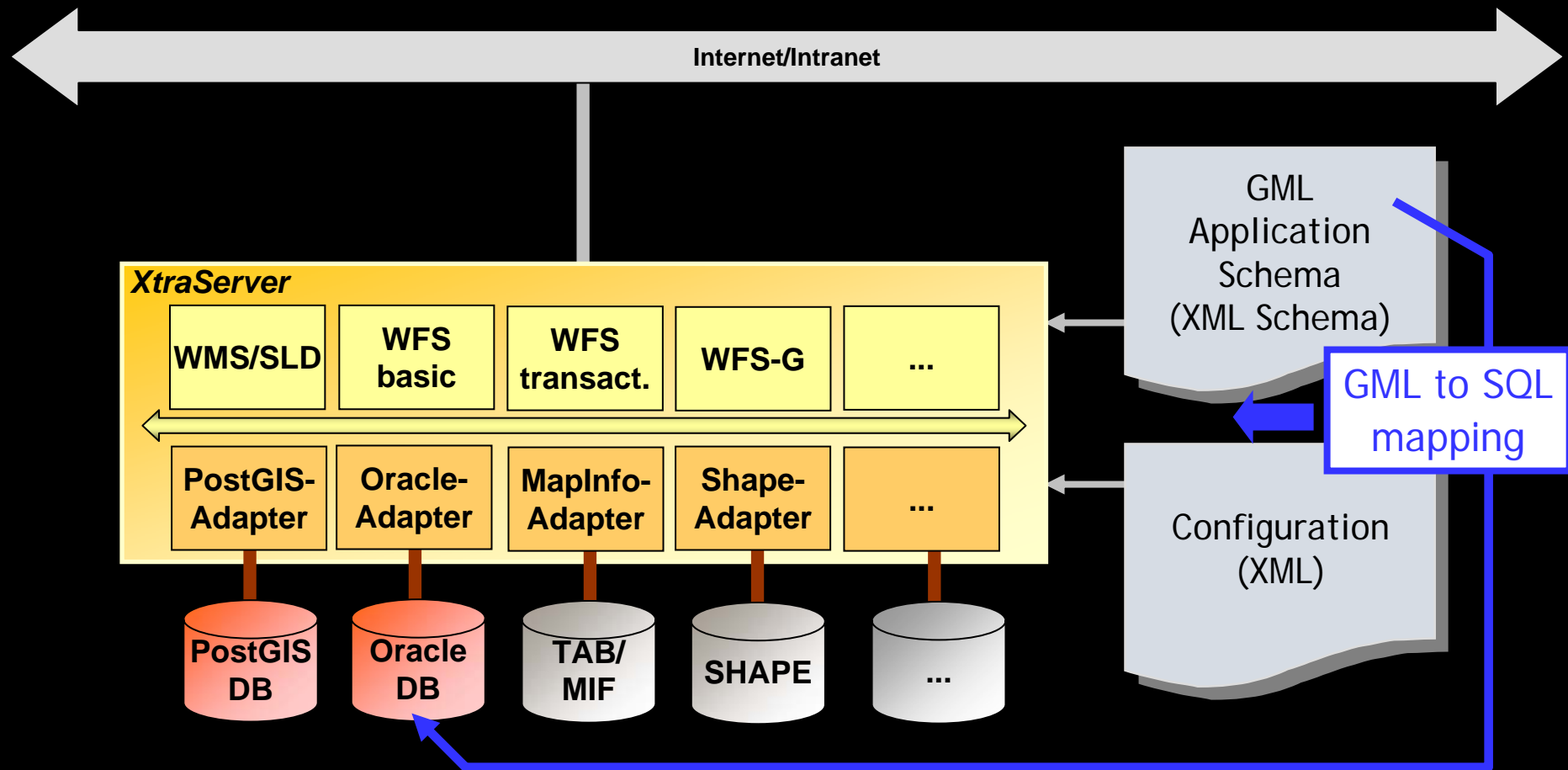
Configuration (XML)

GML Application Schemas (XML Schema)

Posted to schema repository and published in catalogue(s)

<http://www.interactive-instruments.de/ShapeChange/>

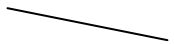
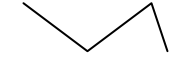
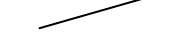
XtraServer: Mapping from GML Appl. Schemas to SQL DBs with SF extension



Schema mapping GML to SQL

Simple cases: What is it basically?

Table: ROAD_SECTION

ID	LENGTH	...	AXIS
28736	981		
28740	2350		
28741	6778		

```
<gml:FeatureCollection>
  <gml:featureMember>
    <RoadSegment gml:id="RoadSegment. [redacted]" >
      <hasCenterLine>
        <gml:LineString srsName="urn:...">
          [redacted]
        </gml:LineString>
      </hasCenterLine>
      <length uom="km"> [redacted] </length>
    </RoadSegment>
  </gml:featureMember>
  ...
</gml:FeatureCollection>
```

Schema translation GML→SQL

Complex mapping cases

- Simple mapping requirements +
- Cardinality of elements or grouping particles
 - Cardinality $\neq 1$ expressed by table joins or multiple columns
 - Omission of content by NULL or table joins
- Specialisation and choice selection
 - Specialisation/generalisation expressed by joined tables or dummy columns
 - Choice and substitution determination by predicates
- Embedding and referencing
 - Grouping of values in features, properties, data types
 - Features mapped to tables filtered by predicates or union of tables
 - xlink:href reference generation vs. object embedding
 - Global elements can be differently mapped according to usage context
- Sorting

Schema mapping GML to SQL

A complex case: Substitution determination

Table: ROAD_SECTION

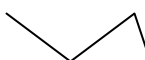

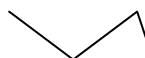
ID	LENGTH	NOCW	AXIS
28740	2350	2	
28741	6778	1	

Table: ROAD_SECT_2CWY

IDREF	DIST	AXISR
28736		
28740	25	

```
< [redacted] >
  gml:id="[redacted]"
  <length uom="km"> [redacted] /length>
  <hasAxis>
    <gml:LineString srsName="urn:...">
      [redacted]
    </gml:LineString>
  </hasAxis>
</ [redacted] >
< [redacted] >
  gml:id="[redacted]"
  <length uom="km"> [redacted] </length>
  <hasAxis>
    <gml:LineString srsName="urn:...">
      [redacted]
    </gml:LineString>
  </hasAxis>
  <hasReverseAxis>
    <gml:LineString srsName="urn:...">
      [redacted]
    </gml:LineString>
  </hasReverseAxis>
  <axisDistance uom="m"> [redacted] </axisDistance>
</ [redacted] >
...

```

Schema mapping GML to SQL

Another complex case: Union of tables

Table: ROAD_SECTION




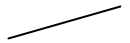





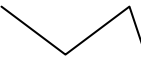
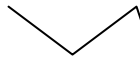



ID	LENGTH	AXIS
		
28741	6778	






Table: ROAD_SECT_2CWY

ID	LENGTH	DIST	AXIS1	AXIS2
				
28740	2350	25		

```

<RoadSegment gml:id="RoadSegment.  >
  <length uom="km">/length>
  <hasAxis>
    <gml:LineString srsName="urn:...">
      
    </gml:LineString>
  </hasAxis>
</RoadSegment>

...

<RoadSegment gml:id="RoadSegment.  >
  <length uom="km">/length>
  <hasAxis>
    <gml:LineString srsName="urn:...">
      
    </gml:LineString>
    <ReverseAxis>
      <gml:LineString srsName="urn:...">
        
      </gml:LineString>
    </ReverseAxis>
    <axisDistance uom="m">/axisDistance>
  </RoadSegment>

...

```

Schema translation GML→SQL

Query translation

- The “expression part” of filter expressions is generally easy to translate,
 - because FE and SQL are quite similar!
- Property access ...
 - ... is easy if only translating into columns of the feature table,
 - ... is quite demanding, e.g. if feature association is involved, because multiple tables are connected,
 - ... needs a good deal of optimisation efforts.

Complex schema translation GML→SQL

Examples

- Generating conformant OKSTRA[®]-XML from an internal database of a road information system
 - The internal database is on Oracle spatial and not based on OKSTRA
 - OKSTRA data is generated by a WFS 1.1 mapping on that database
 - Note: this could as well be EuroRoadS data
- Generating selected ATKIS data according to the new AAA-schema (NAS)
 - The database is a close representation of the EDBS data model on Oracle spatial
 - Output is by WFS 1.1 and WMS/SLD mapping on that database

Thank you for your attention !

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Germany



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