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1. Approaches to combining distributed spatial data
2. Motivation for using OGC Web Services
3. Potential of the OGC Web Services approach
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5. Conclusions and recommendations
6. Topics for future research

Comparison of the approaches

Data Integration
File transfer
- Graphics/images e.g. TIFF, SVG
- Features e.g. Shape, SQD
- Model driven approach e.g. INTERLIS (CH)

Service Oriented Architecture
WWW as Distributed Computing Platform
- Graphics/images e.g. OGC WMS
- Features e.g. OGC WFS
- Model driven approach does not exist yet

Motivation for using OGC Web Services

"The lower the user effort, the higher the number of users!"
Benefits of the OGC Web Services Approach exemplified by a Multi-Vendor SDI for Local Governments

OGC Specifications

- OGC WMS (Web Map Service)
- OGC WFS (Web Feature Service)
- OGC WCTS (Web Coordinate Transformation Service)

Aggregate Services (implement several OGC interfaces)

GIS Vendors (Products)
- Autodesk (MapGuide 6.5)
- GE Energy
- C-Plan
- Intergraph (Smallworld SIAS 2.1)
- ESRI (ESRI ArcIM S 9.0, WMS & WFS Connector)
- Terradata
- M.O.S .S . (WEGA-MARS 4.2)
- UMN (open source software, Map Server 4.3)

GIS Service Providers
- Geo-IT
- RI WA
- PLEdoc
- TU München
- UniBW München

Applications

1) Multi-vendor SDI for the Real Estate domain (cross-vendor test of OGC WMS, 2001)
2) Multi-Vendor SDI for Local Governments based on OGC Web Services (cross-vendor test of OGC WFS, 2004)

Test Areas
Cities and Counties of the German states Baden-Württemberg, Bavaria and Brandenburg

Donaubauer: A Multi-Vendor SDI for Local Governments based on OGC Web Services

Selecting a postal address

Address input

Geocoding and requesting a map from a WMS

address geocoding (WFS) and map request (WMS)

Highlighting the area of interest

User-defined polygon

Requesting information from the utilities companies' GI systems (WFS interface)
Consolidated answers to a user’s request

Benefits and requirements to a multi-vendor SDI

Benefits:
- Minimized effort for using and combining spatial data on the users’ side
- Reduced effort, lower costs and more efficiency on the service providers’ side
- Increased information liability because of updatenness
- Reusability of services

Requirements:
- Full coverage of spatial data in the area of interest
- GIS - and IT standards must be fulfilled
- Data providers must allow standardized access to their systems

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Potential of OGC Web Services

Combining distributed, heterogeneous GIS systems is simple
User effort is low
No outdated information because of direct access to the original data source
Re-use of geographic information resources

New users for existing geographic information resources (non-experts)

Current limitations of the OGC Web Services approach

Practicability:
- Service chaining
- Consistency: OGC specifications, general IT standards
- Limitations of distribution and modularity

Functionality:
- (simple) read-only web applications
- Lack of analysis functionality
- Semantic interoperability
- Model driven data transfer

Acceptance (supply and demand):
- Reached for WMS, not yet for WFS
- Absence of security and access control in the current OGC specifications

Conclusions: When to use OGC Web Services?

<table>
<thead>
<tr>
<th>OGC Web Services</th>
<th>Data Integration</th>
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<tbody>
<tr>
<td>Quick and simple read-only access</td>
<td>+</td>
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<tr>
<td>Data updatenness is critical</td>
<td>+</td>
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<tr>
<td>Combination of a wide range of data sources</td>
<td>+</td>
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<tr>
<td>Ad hoc data combination</td>
<td>+</td>
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<tr>
<td>Complex GIS analysis</td>
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<td>Paper Map production</td>
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<tr>
<td>Write access</td>
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<tr>
<td>Model driven data transfer</td>
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Future research topics...

Integration of OGC web services and model driven approach
Dynamic service chaining and semantic interoperability
Business models for service oriented SDIs
Security and access control
Web Spatial Analysis and Geoprocessing Services
Thank you very much!

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