Elements of a Service Oriented Architecture (SOA) based on OGC and W3C Standards

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COGIS: Coordination, geoinformation and services

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Outline

• Organisation: COGIS: Coordination, Geoinformation and Services
• What is Service Oriented Architecture (SOA)?
• ZapThink’s SOA Roadmap
• Elements of a SOA (walking along the Roadmap …)
  – Web Service Implementations
  – Identity and Access Management (IAM)
  – Governance Framework
  – Metadata Management
  – MDA, Semantic Integration
• Conclusion
Mission of COGIS: Coordination, geoinformation and services

• movement towards a better promotion of geoinformation, its methods and tools
• agreement on a common strategy for geoinformation and GIS
• coordination of acquisition, diffusion and pricing policies related to geographical data
• the promotion in the use of tools and standards for modelling and geographical data exchange
• the promotion of services for disseminating geoinformation

The federal strategy for geoinformation passed by the federal council in June 2001
main goal: Swiss National Spatial Data Infrastructure
Political economics profit, Impact and the National Spatial Data Infrastructure (NSDI)

→ Hear Jean-Philippe Amstein at Friday, 14:20, on “Implementation of the Swiss National Geodata Infrastructure” (MAX 350)
Federal Spatial Data Infrastructure

- Federal geographical data
- Networked services
- Federal SDI as part of the NSDI
What is Service Oriented Architecture (SOA)?

• perspective of software architecture
• defines the use of loosely coupled software services to support the requirements of the business processes and software users.
• resources on a network are made available as independent services
• services can be accessed without knowledge of their underlying platform implementation
• Definition from OASIS:
  Service Oriented Architecture is a paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains. It provides a uniform means to offer, discover, interact with and use capabilities to produce desired effects consistent with measurable preconditions and expectations.
Elements of a SOA (acc. to Krafzig et al)


The ZapThink Roadmap and the Federal Spatial Data Infrastructure in Switzerland – where are we?

zapthink's Service-Oriented Architecture Roadmap™
Service Implementations

- Service interfaces wrap geodata
- Usage of these services primarily in in-house projects
- “tight coupling” of know how between provider and consumer

Point-to-Point Integration

The first step toward SOA for many organizations is to use Web Services for point-to-point integration, typically with legacy systems.
Networked services spring from exploitable geographical data

The geodata portal: an element of the Federal Spatial Data Infrastructure
The Geodata Portal of swisstopo / KOGIS

Geodata portal with services

Applications
(combination of services)

COGIS
14.09.2006
page 14
Types of services

- Gazetteer service
- Access service
- Metadata service
- Viewing service

COGIS page 15
Chaining of services

gov. address register  
Suchdienst  
Commune, street

ZIP Code  
X, Y  
ZIP, town

pixel map PK25  
Visualisierungsdienst  
Map

Köniz,  
Seftigenstr.  
284

600977,  
197417

3084 Wabern

COGIS  |  14.09.2006  |  page 16
Technologies for geographical web services

- SOAP (Simple Object Access Protocol) for search services (see following slides)
- OGC WMS (Web Map Service) for visualization services:
  - http://some.server.ch/wms?
  - version=1.1.1&
  - request=GetMap&
  - Layers=pk50,vec200_building,vec200_road&
  - format=png&
  - bbox=643000,176500,651000,184500&
  - width=800&height=800
Example: business process of the Federal Office of Communications OFCOM
Management of antenna locations

• request for new antenna: neighbour cantons are involved too

• problem: how to find these cantons

• solution: SOAP-Service (implemented using the open source database PostGIS)
What is SOAP?
(Simple Object Access Protocol)

**Request:** (simplified)

```xml
<getCantonsInCircle>
  <x>629980</x>
  <y>233350</y>
  <radius>2000</radius>
</getCantonsInCircle>
```

**Question:** in which canton lies the point 629980 / 233350? Which cantons are in the neighbourhood?

**Response:** (simplified)

```xml
<getCantonsInCircleResponse>
  <canton>AG</canton>
  <cantonCrossed>
    <item>BE</item>
    <item>SO</item>
    <item>LU</item>
  </cantonCrossed>
</getCantonsInCircleResponse>
```

**Answer:** The point lies in AG with SO, BE, LU in the neighbourhood.
Web Service Implementation on PostGIS basis: few code required

// get the canton below the coords (x,y)
$result = pg_query("SELECT ak FROM bfs.kanton ".
                  "WHERE contains(the_geom, GeometryFromText('POINT($x $y)', -1));");
$cantonBelow = pg_fetch_row($result);
if ($cantonBelow)
  $cantonBelow = $cantonBelow[0];

// get the cantons that are inside (even partially)
// the circle except the previous one.
$result_2 = pg_query("SELECT ak FROM bfs.kanton ".
                     "WHERE ak <> '".$cantonBelow."' AND ".
                     "distance(the_geom, GeometryFromText('POINT($x $y)', -1)) < $radius;");

- PostGIS SQL statement:
  SELECT ak FROM bfs.kanton WHERE contains(the_geom, GeometryFromText('POINT($x $y)', -1));

- (yet another PostGIS case study ... cf. talk of Paul Ramsey)
What is WSDL?
(Web Service Description Language)

- Description of result (simplified):

```xml
- <complexType name="getGeoDataBySn25Response">
  - <all>
    - <element name="msg" type="xsd:string"/>
    - <element name="data" type="types:SNData"/>
  </all>
</complexType>
- <complexType name="SNData">
  - <all>
    - <element name="id" type="xsd:int"/>
    - <element name="name" type="xsd:string"/>
    - <element name="geoname" type="xsd:string"/>
    - <element name="kanton" type="xsd:string"/>
    - <element name="x" type="xsd:double"/>
    - <element name="y" type="xsd:double"/>
  </all>
</complexType>
```

The answer contains the fields id, name etc. and the fields x, y of type double for the coordinates.
Portals and tools for portal development

Open Source Web-GIS framework: [www.cartoweb.org](http://www.cartoweb.org)
Federal Office of Communications OFCOM

cataster of existing antennas (www.funksender.ch)
Swiss Federal Roads Authority (FEDRO)
Consolidation of slow motion traffic routes
Identity and Access Management

- Protection of services:
  see next slides or camptocamp presentation: “Secure WMS Implementation“
- User management:
  - today: simply databases, not coordinated
  - tomorrow: LDAP, Single Sign On

Companies who are already implementing Single Sign-On (SSO) can “kill two birds with one stone“ by leveraging those efforts for SOA.
Secure WMS Implementation: Architecture

- Simple access restrictions per role / user (layer, BBOX)
Secure WMS Implementation: Summary

• Baseline:
  – No OGC standard for security yet
  – Must keep interoperability with existing clients

• Conclusion
  – Market needs are faster than OGC
  – This architecture provides a simple transitional solution

• Source of these slides and more info:
  ➔ talk of Sylvain Pasche, camptocamp SA:
  “Secure WMS Implementation”
metadata management for geographical data and services

• operational since Q1/2005: www.geocat.ch
  swiss metadata catalogue
• basis: swiss profile of ISO 19115
• currently under investigation: extension for service metadata
  (with ISO 19119 under consideration, among others)
The geocat.ch project set up a metadata catalogue for GI search for metadata on the Internet add, edit, manage metadata framework of distributed metadata and applications in a federated and heterogeneous infrastructure.
The metadata application

geocat.ch

Central Metadatabase

Metadatabase Partner B

Metadatabase Partner C

Discovery Service

Gateway Catalog Protocole

Import

Management Application

Partner A

Partner B

Partner C

User

swisstopo
Eurogeographics: [www.euromapfinder.net](http://www.euromapfinder.net) → find geographical data in Europe
Governance allows management to plan an orderly SOA by communicating policies to employees, providing tools for enforcing those policies, increasing visibility into policy compliance, and mitigating any problems that result.

Service contracts are the critical metadata that underlie the Services abstraction.

Create a Governance Framework

Manage Services

Contract-First Development

Contract-first development is a key best practice for...
two parts of a governance framework

• organisational framework and pricing for a service network
  – price models for pixel data services defined
  – service contracts: to be defined, first discussions

  – [Link](http://www.swisstopo.ch/pub/down/about/publi/studieVerrechnungsmodelleOeffentlich_en.pdf) (german)
  – [Link](http://www.swisstopo.ch/pub/down/about/publi/studieVerrechnungsmodelleOeffentlich_fr.pdf) (french)
  – [Link](http://www.swisstopo.ch/pub/down/about/publi/studieVerrechnungsmodelleOeffentlich_de.pdf) (english)

• swiss application profile for geoservices – see next slides
standards for web-based geographical services ➞ need for profiles

- **general goal:** facilitate interoperability within the National Spatial Data Infrastructure (NSDI)
- OpenGIS Consortium (OGC), ISO and W3C standards / specifications provide an important foundation (but ... see talk “How good does open source talk OpenGIS?” by Tom Kralidis etc al)
- **Geographical services application profile project:** guarantee that each service on offer can be used within the framework of the NSDI and can in turn make use of other web services of the NSDI
- prepared in 2005 in collaboration with universities, cantons, organisations and the private sector
- currently: commentaries after public review are processed in working group
goal levels for connecting services

1. **Visualisation** (using services) of data from different providers – symbolisation as chosen by the service provider

2. **Visualisation** of data from different providers – *uniform symbolisation* (maybe chosen by the service consumer, e.g. using SLD)

3. **Info requests** (query features) – format and attributes as chosen by the service provider

4. **Info requests**, *results in uniform format according to a harmonized data model*

5. **Data delivery** – *according to a common, harmonized data model*
„quick and dirty“ solution – goal level 1

Canton A
- Attribute 1
- Attribute 2
- Attribute 3
- Attribute A1
- Attribute A2

Canton B
- Attribute 1
- Attribute 2
- Attribute 3
- Attribute B1
- Attribute B2

Canton C
- Attribute 1
- Attribute 2
- Attribute C1
- Attribute C2
- Attribute C3

Source: KKgeo, Lucien Imhof (VD), Patrick Belser (LU)
final solution – levels 2, 3, 4

Source: KKGEO, Lucien Imhof (VD), Patrick Belser (LU)
„the food chain“ of geoinformation

- typical problems: fish eat mercury, people eat fish … → problems are propagated – awareness needed
- actions for publication stage:
  - application profile for geowebservices
  - establish catalogue of services
- actions for other stages:
  - harmonisation of data and presentation models
  - ensure the modelling of basic geodata of national interest (and their presentation …)
steps towards semantic integration (goal levels 2 – 5)

• MDA: model driven architecture: use a neutral language for defining data and presentation models
• Usage of UML (graphical) and INTERLIS (textual) languages
• [www.interlis.ch](http://www.interlis.ch)
• various open source tools available (Compiler, UML Editor, semantic checker, support in OGR/GDAL, FME plugin …)
Conclusion

• The SOA Roadmap and the realization of the Federal Spatial Data Infrastructure ... where are we?
  – some pieces already realized
  – others planned

• SOA?
  – Service Orientation ... yes
  – Architecture ... ? much work remains to be done

• ... we are on the way
questions and discussion,
further informations

www.e-geo.ch
www.kogis.ch
www.swisstopo.ch

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