Re-Engineering the Swiss Cadastre to Facilitate eGovernment Services

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Re-Engineering Cadastre to Facilitate eGovernment
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1. Switzerland and its cadastre
Switzerland: federated country with 26 cantons ...

Cantons maintain political and administrative bodies on their own
... and some 2900 municipalities

Cantons are further divided into municipalities
Office heads at all levels: have to hold the federal license for cadastral land surveyor.
Basic principles for cadastral system

- no ownership without registration
- no registration without surveying
- no surveying without boundary definition

- title registration system
- title guaranteed by the government
New reference system (CH03 \( \rightarrow \) LV95)
2. Digital reform in 1993
Standardized data modelling

<table>
<thead>
<tr>
<th>OwnershipMaintenance</th>
<th>OwnershipPosition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifier</td>
<td>Description</td>
</tr>
<tr>
<td>Perimeter</td>
<td>Validity</td>
</tr>
<tr>
<td>Date1</td>
<td>Date2</td>
</tr>
<tr>
<td>Date3</td>
<td></td>
</tr>
</tbody>
</table>

PROJOwnership

Object -> Geometry

Ownership

OSKey -> Number

OwnershipType = (parcel, distinct_right, construction_right, water_source_right);

TABLE LimitPoint =

| OKey: OPTIONAL -> OwnershipMaintenance; |
| Identifier: OPTIONAL TEXT*12; |
| Geometry: LKoord; |
| PositionPrecision: Precision; |
| PositionReliability: Reliability; |
| Origin: OPTIONAL TEXT*30; |
| SymbolOrientation: OPTIONAL LetterOrientation; |
| !! Default: 0.0 |
| IDENT Geometry; |
| END LimitPoint; |
| END Ownership; |
| END Basic_Data_Set. |

TRANSFER Data_Catalogue;
MODEL Basic_Data_Set

DOMAIN
LKoord = COORD2 480000.000 70000.000
HKoord = COORD3 840000.000 300000.000
Height = DIM1 0.000 5000.000
Precision = [0 .. 300];
Reliability = (yes, no);
LetterOrientation = GRADS 0.0 400.0;
Status = (planned, valid);

TOPIC Control_Points =

END Control_Points;

TOPIC Land_Cover =

END Land_Cover;

END Ownership.

END Basic_Data_Set.

Information Layers
(Possibility to realise the layers separately)

Data Model per layer
( Entity-Relationship-Diagram )

Data Description Language
XML / INTERLIS
(system independent)
### Possible structure for LIS

<table>
<thead>
<tr>
<th>Legal topic</th>
<th>Spatial data</th>
<th>Textual data</th>
<th>Stakeholders (data owners)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water protection</td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
<td>Local government</td>
</tr>
<tr>
<td>Noise protection</td>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
<td>Local government</td>
</tr>
<tr>
<td>Environmental protection</td>
<td><img src="image5" alt="Diagram" /></td>
<td><img src="image6" alt="Diagram" /></td>
<td>Environmental department</td>
</tr>
<tr>
<td>Land use planning</td>
<td><img src="image7" alt="Diagram" /></td>
<td><img src="image8" alt="Diagram" /></td>
<td>Planning department</td>
</tr>
<tr>
<td>Indigenous land rights</td>
<td><img src="image9" alt="Diagram" /></td>
<td><img src="image10" alt="Diagram" /></td>
<td>Tribe, clan</td>
</tr>
<tr>
<td>Collective land rights</td>
<td><img src="image11" alt="Diagram" /></td>
<td><img src="image12" alt="Diagram" /></td>
<td>Corporations</td>
</tr>
<tr>
<td>Land ownership, cadastre</td>
<td><img src="image13" alt="Diagram" /></td>
<td><img src="image14" alt="Diagram" /></td>
<td>National government, State government, Local government</td>
</tr>
</tbody>
</table>

**Two preconditions:**
- common geodetic reference framework
- common data modelling concept

**only connection between layers is geographic location !!!**
Drilling the topics from different stakeholders

Property parcel #: 1234
Building #: A445
Building permit: lease
Easement: parcel 1235
Land-use zone: residential 2-floors

Property parcel #: 1234
Building #: A445
Building permit: lease
Easement: parcel 1235
Land-use zone: residential 2-floors
Two definitions from Cadastre 2014 (1/2)

A) Principle of "Legal Independence"

<table>
<thead>
<tr>
<th>Legal Topics</th>
<th>Land Object Boundaries</th>
<th>Rightful Claimants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Exploitation</td>
<td></td>
<td>Chartered company</td>
</tr>
<tr>
<td>Collective Land Rights</td>
<td></td>
<td>Corporation</td>
</tr>
<tr>
<td>Water Protection</td>
<td></td>
<td>Society</td>
</tr>
<tr>
<td>Indigenous Land Rights</td>
<td></td>
<td>Tribe, Clan</td>
</tr>
<tr>
<td>Environment Protection</td>
<td></td>
<td>Society</td>
</tr>
<tr>
<td>Land Use Planning</td>
<td></td>
<td>Society</td>
</tr>
<tr>
<td>Land Property</td>
<td></td>
<td>Private Land Owners</td>
</tr>
<tr>
<td>Shelter and Housing</td>
<td></td>
<td>House owners</td>
</tr>
<tr>
<td>Natural Resources</td>
<td></td>
<td>Society</td>
</tr>
<tr>
<td>Natural Land Objects</td>
<td></td>
<td>Society</td>
</tr>
<tr>
<td></td>
<td>Common reference system</td>
<td></td>
</tr>
</tbody>
</table>
**Two definitions from Cadastre 2014 (2/2)**

**B) Definition of term "Land Object"

<table>
<thead>
<tr>
<th>Basic unit of traditional cadastre:</th>
<th>Basic unit of future cadastre:</th>
</tr>
</thead>
<tbody>
<tr>
<td>→ Land Parcel</td>
<td>→ Land Object</td>
</tr>
</tbody>
</table>

A land parcel is a piece of land with defined boundaries, on which a property right of an individual or legal person applies.

A land object is a piece of land in which homogenious conditions exist within its boundaries. A legal land object is described by the legal content of a right or restriction and the boundaries which demarcate where the right or restriction applies.
Example for land object: PARCELS
Example for land object: BUILDINGS
Example for land object: EASEMENTS
Example for land object: PLANNING ZONES
Reasons for data modelling

- high value of data vs. short life span of HW/SW
- data need to be transferred from older to newer systems
- devolution and networking (flexible and easy data sharing without information loss)

- product definition for introduction of tendering process (method and system independent) → model-based approach
- separation of data model and description language (data models always evolve, concept can be used for any other data model)

- quality checking and assurance
- long-time archiving
1st update of data model

1994: introduction of data model "AV93"
Shortcomings in AV93 data model:
- one data model with cantonal options (for political reasons)
  → heterogeneous development
  → too many cantonal options
  → no easy solution to consolidate data on federal level

2004: revised data model "DM.01"
Main changes are:
- one clearly defined federal data model
- hierarchy of data models (Cantons can add options to federal model, but have to provide data in federal model)
- checking of data becomes much easier → introduction of check service on Internet
- technical possibility of incremental updating (requires OID and INTERLIS2)
1st update of data model: federal DM as core for other administrative levels
3. SDI developments
Landinformationssystem Nidwalden
MUNICIPALITY
Cadastral map
CANTONAL
regional planning
MUNICIPALITY

land use
MUNICIPALITY

facilities
natural hazards
MUNICIPALITY

Grundlagedaten

- Orthophotos (OPP)
- Digitales Höhenmodell (DHM)

OPP 50cm

MFH Parzelle 1441, Beckenried

OPP 10cm
3D visualisation
Example of web portals:

Portal of cantons for geoinformation
Example of web portals:

Portal of cantons for geoinformation
Example of web portals:

Portal of cantons for geoinformation
Example of web portals:

Portal of cantons for geoinformation
Example of web portals:

**Cantonal portal for cadastral data**
Example of web portals:

Cantonal portal for cadastral data
Example of web portals:
Cantonal portal for cadastral data
Example of web portals:

Cantonal portal for cadastral data
Example of web portals: Cadastral data for Federal administration
Example of web portals:

Cadastral data for Federal administration
Example of web portals:

Cadastral data for Federal administration
Example of web portals:

Topographic mapping data for outdoor activities

http://map.schweizmobil.ch/
Example of web portals:

Topographic mapping data for outdoor activities

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Example of web portals:

Topographic mapping data for outdoor activities

http://map.schweizmobil.ch/
4. New law on geoinformation
**Why**

**Context of geoinformation**

The aim of the new law is:

- to provide easy access to geoinformation for public and private sectors;
- to enable and support broad use of geoinformation;
- to provide access to geoinformation in sustainable ways, in the right quality and with appropriate fees and costs.
Why

**Importance of geoinformation**

Geoinformation is a growing market

- The US Department of Labor considers geo-technology together with bio- and nano-technology to be among the three most important economic growth areas.

- The annual growth in Switzerland is estimated to be approx. 10%. 

![Bar chart showing growth in geoinformation market](image-url)
Why

Geoinformation is considered to be an infrastructure

<table>
<thead>
<tr>
<th></th>
<th>CHF</th>
<th>EUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of data recovery</td>
<td>5 billion</td>
<td>3.1 billion</td>
</tr>
<tr>
<td>Mortgages secured by land and real estates</td>
<td>650 billion</td>
<td>406 billion</td>
</tr>
<tr>
<td>Annual investment in geodata by Federal and cantonal levels</td>
<td>230 million</td>
<td>144 million</td>
</tr>
<tr>
<td>Turnover in private geodata market (growing tendency)</td>
<td>200 million</td>
<td>125 million</td>
</tr>
<tr>
<td>Annual value-added tax income</td>
<td>3-6 million</td>
<td>2-4 million</td>
</tr>
</tbody>
</table>
How

New legal basis: art. 75a, Swiss constitution

Art. 75a Surveying
1 National Surveying is in the responsibility of the Confederation.
2 The Confederation establishes ordinances about cadastral surveying.
3 The Confederation can establish ordinances about the harmonisation of official land information.

Accepted by electorate in Nov. 2003, enacted 1 Jan. 2008.
## Structure

### Structure of new law

<table>
<thead>
<tr>
<th>Constitution</th>
<th>Article 75a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil code</td>
<td>Articles on land registration (Grundbuch) with integrated maps</td>
</tr>
</tbody>
</table>

**Law on Geo-information**

- **Aim, definitions, applicability, generalities**
- Cadastre on public-law rights and responsibilities
- Articles on national surveying
- Articles on cadastral surveying
- Articles on national geology

**Ordinances**

- GeoIV
- LVV
- VAV
- LGeoIV
- GeoIV-s.top
- LVV-VBS
- TVAV
- EGKV
- GeoNV
- GebV-s.top
- GeomV
- ÖREBV
Swiss Cadastre

New cadastre for public-law R&R

Extended purpose of cadastral data

Increasing use and benefit of cadastral system

1. Introduction cadastral surveying
2. Digital Standard AV93
3. Art. 75a in constitution
4. Complete coverage
5. Public-law R&R
6. Geoinformation purpose
7. Private law (land registration)

1912
1993
2002
2008
20xx

Swiss Cadastre
## Prioritized objects for Cadastre of public-law R&R

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Forest demarcations</td>
</tr>
<tr>
<td>2</td>
<td>Basic land use (for land-use planning)</td>
</tr>
<tr>
<td>3</td>
<td>Protection zones</td>
</tr>
<tr>
<td>4</td>
<td>Noise areas</td>
</tr>
<tr>
<td>5</td>
<td>Hazardous waste locations</td>
</tr>
<tr>
<td>6</td>
<td>Ground water areas</td>
</tr>
<tr>
<td>7</td>
<td>(ev.) natural danger areas, flooding areas</td>
</tr>
<tr>
<td>8</td>
<td>(ev.) construction lines / planning zones for national highways</td>
</tr>
<tr>
<td>9</td>
<td>(ev.) construction lines / planning zones for railway projects</td>
</tr>
<tr>
<td>10</td>
<td>(ev.) agricultural production areas</td>
</tr>
</tbody>
</table>
An example from canton of Zurich

<table>
<thead>
<tr>
<th>Parzelle</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Kat. Nr.</td>
<td>3150</td>
</tr>
<tr>
<td>Plan Nr.</td>
<td>10</td>
</tr>
<tr>
<td>Fläche (m²)</td>
<td>1600</td>
</tr>
</tbody>
</table>

Die Parzelle enthält folgende ÖREBs gemäss § GIG:

<table>
<thead>
<tr>
<th>Nutzungszenen</th>
<th>Weißer Wald / 1297 m²</th>
<th>Weißer Wald / 262 m²</th>
</tr>
</thead>
</table>

Lärmpendlizitätstufen DIII

<table>
<thead>
<tr>
<th>Rautlinie</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Behörde</td>
<td>Gemeinde</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weibachstandl.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Behörde</td>
<td>Gemeinde</td>
</tr>
</tbody>
</table>

Beispiel Ausschnitt:

Der Ausschnitt besteht aus einer geschützten analog oder digitalen Planendarstellung der Geobasisdaten und einer mit dieser verbundenen textlichen Darstellung der Rechtsdaten.
Kataster der öffentlich rechtlichen Eigentumsbeschränkungen

1. Raumplanung (Kontakt: Planungsamt der Stadt Thun)

Einträge im Zonenplan vom Juni 2002
- Wohnen W3, seit Juni 2002
- Überbauungsordnung ZPP I Zenger-Gut, seit 27.10.2005

Reglement zum Zonenplan
| BR: Thun, vom 06.2002 |

Sondernutzungsplanungen
Die Überbauungsordnung beinhaltet:
- Überbauungsplan 1:500 vom 27.10.2005
- Überbauungsvorschriften vom 27.10.2005

Übergeordnetes Recht

| BauG BE 721.0 | Baugesetz |
| BauV BE 721.1 | Bauverordnung |
| BewD 725.1 | Baubewilligungsdekret |
| D NBauR 723.13 | Normalbaureglementdekret |
| KWaG BE 921.11 | Waldgesetz |
| KWaV BE 921.111 | Waldverordnung |
| BPG 215.124.1 | Bäuerliches Boden- und Pachtrecht |
| RPG SR 700 | Raumplanungsgesetz |
| RPV SR 700.1 | Raumplanungsverordnung |
| BGBB SR 211.412.11 | Bäuerliches Bodenrecht |
| VBB SR 211.412.110 | Bäuerliches Bodenrecht Verordnung |

An example from city of Thun
Concluding

In order for the cadastre to play the key role in a geoinformation infrastructure, the following elements are essential:

– co-ordinated cadastre based on a unified geodetic foundation and an operational positioning infrastructure
– standardized data modelling which allows layering
– completeness in coverage and content
– top-down approach for standards, bottom-up approach for data acquisition