THE MODEL DRIVEN ARCHITECTURE APPROACH FOR ISO 19152:2012 (LADM) IMPLEMENTATION

Fabián Mejia
Germán Carrillo
Sergio Ramirez
Lorenz Jenni
THE MODEL DRIVEN ARCHITECTURE APPROACH FOR ISO 19152:2012 (LADM) IMPLEMENTATION
Model Driven Approach – MDA

- **Model** as the primary source for constructing a system from documenting and analysis to maintenance and enhancement
  - Agile development process
  - Reduces gaps between design and deployment
  - Standardizes viewpoints
- Focuses the discussion on the model not in artifacts
LADM_COL (the core model) – and now?
Why INTERLIS?

• LADM: typically described with a **UML class diagram**

• But: **UML as a semi-formal language** for describing conceptual data models (Naja & Giger, 2006) is not very precise for computer assisted DB implementations; no geometry types; **data exchange is not purpose of UML**

• **INTERLIS as a formal language** (with a strict syntax) for describing **conceptual data models**, includes an **exchange format (XML)** derived from the model; geometry types and constraints can be defined in the model

• Translating LADM UML class diagrams to INTERLIS is straight forward...

• ...and **computer processable data models and data exchange formats** are obtained (software independent)
Why INTERLIS? – this is important

• Object oriented language for formal data model description → allows **computer supported DB implementation**

• Model based XML exchange format → allows **automated and massive data validation** against the underlying model

• Complete tool chain available → jump start for **any LADM implementation**
INTERLIS Model Implementation Workflow

1. **DATA MODELING**
   - **DATA MODELING**
     - **MODEL FILE**
       - *UI
     - **VALIDATE MODEL**
       - INTERLIS Compiler
     - **DB SCHEMA & DATA GENERATION**
       - GENERATE PHYSICAL MODEL
         - DB schema empty tables
       - GENERATE AND EDIT DATA IN LADM
         - QGIS Plugin for LADM model
     - **DATABASE**
       - Data generated
     - **EXTERNAL DATA SOURCE**
       - EXTERNAL DATA
         - Non-valid data
     - **IMPORT DATA**
       - Non-valid data

2. **DATA VALIDATION**
   - **INTERLIS Transfer file**
   - **VALIDATE DATA**
     - *xdl
   - **EXPORT DATA**
     - *xdl
   - **VALIDATE DATA**
     - *xdl

---

**FIG Commission 7 and 9**
Annual Conference and Meeting
4th – 8th December 2017 - Cartagena Colombia

**Universidad de los Andes**
LADM Data Reception – System requirements
LADM Data Reception – Implemented architecture

- **Services**
  - Geoportal
  - Validation Service
    - iValidator

- **Apps**
  - Field Surveying
    - ODK
  - Data Edition
    - Project Generator

- **Storage**
  - File Manager
    - Document + Model repository
  - Spatial-database
    - PostgreSQL + PostGIS

- **Data Model**
  - LADM_COL models in INTERLIS
QGIS Project Generator + LADM-COL Assistant
Web Portal

• A centralized access to main modules and services
• Requires authentication for certain functionalities/content
LIS Viewer – with special features...
LIS Viewer – with special features...
Validation Service

- Web-based, roles + permissions configurable
- Validates data integrity against constraints in the model
- Error reports includes location and tech details
Validation Use Case – On failed

Multiple Output formats

Log + Errors Viewer
Validation Use Case – On succeed

<table>
<thead>
<tr>
<th>Result</th>
<th>File</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔️</td>
<td>datos_exportados_2017_05_22.xtf</td>
<td>No errors during validation</td>
</tr>
</tbody>
</table>

Upload to PostgreSQL
Conclusions

• The use of **INTERLIS and the tools available**, allow to develop an information infrastructure based on **MDA**; → **facilitates LADM implementation**.

• The **Data Validation Service** of the developed web system **increases productivity in the quality control** process, through automagical and massive check of data against a given model and the included validation rules.

• The system stands out with its flexibility, **low requirements in terms of hardware** and the software components entirely based on FOSS (although hybrid solutions are possible too).

• The system, employable by administrations even with limited resources, can be considered as a **generic information infrastructure of Land Administration**.

• **Doing the step from the discussion on the conceptual model to its actual implementation contributed to gain new insights on LADM itself**
Future work (— end of 2019)

• Work on integration of Colombian LAMP Profile (ISO 19115) and LADM (metadata model described in INTERLIS → same tool chain and validation service can be employed in combination with Geonetwork)

• Improving UML/INTERLIS-Editor compatibility with other UML-Editors

• Continuous work on QGIS plugins assisting LADM data edition (mutation management → Versioned Object implementation)

• Test use/benefit of extended (thematic) models in an operational SDI scheme (cadaster-registry, spatial planning, protected areas/natural parks)

• Performance tests with massive data validation

• Develop open online courses in applying the MDA approach for LADM implementation using INTERLIS
Important links

• http://www.proadmin tierra.info
• http://ide.proadmin tierra.info
• https://github.com/AgencialImplementacion
3 Demo sessions during lunch time

- **The LADM-COL model and INTERLIS**: from the UML diagram to an implementable INTERLIS data model → 10 min

- **Generate and validate data in a LADM-INTERLIS model**, using available Open Source tools → 10 min

- **A basic data infrastructure for LADM**: load, query and download LADM model conform data → 10 min
Muchas gracias!