

XXVII FIG CONGRESS 11–15 SEPTEMBER 2022 Warsaw, Poland

Volunteering for the future – Geospatial excellence for a better living

LADM in the Classroom

Making the Land Administration Domain Model Accessible

Christiaan Lemmen, Malumbo Chipofya, Andre da Silva Mano, Dennis Ushiña Huera, Abdullah Kara, Peter van Oosterom, Javier Morales, Paula Dijkstra, Jaap Zevenbergen

13 September 2022, 14:30–15:30 hours, TS06F: LADM in the Classroom – Making the Land Administration Domain Model Accessible







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Volunteering for the future – Geospatial excellence for a better living

Introduction

Chrit Lemmen, Abdullah Kara, and Peter van Oosterom (editors LADM edition II, various parts)

13 September 2022, 14:30–15:30 hours, TS06F: LADM in the Classroom – Making the Land Administration Domain Model Accessible









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Brief history

- FIG Congress 2002, Washington, proposal to create core cadastral domain model (CCDM) within FIG to avoid confusion
- FIG Congress 2006, Munich, after several iterations verion 1.0 of CCDM is ready, plans to submit to ISO
- ISO/TC211 2008, CCDM submitted by FIG, but rather soon renamed to Land Adminsitration Domain Model (LADM)
- UN-Habit, GLTN, FIG, ITC work in parallel on a profile for developing countries: Social Tenure Domain Model (STDM)
- ISO/TC211, 2012, LADM accepted as International Standard (IS 19152) with STDM as informnative annex
- Today:
 - Over 40 countries have published a LADM country profile, nearly 10 are in production
 - Support by World Bank, UN-Habitat, and other funding organizations
 - Revison has changed and LADM edition II will be multi-part



ISO 19152:2012

Geographic information -- Land Administ (LADM)

Media and price

| Format | Price | Language | | | |
|--------|------------|----------|--|--|--|
| PDF | CHF 210,00 | English | | | |





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What next?

- The multi-part edition of LADM conisits of (expected publication dates from end 2023 for part 1 to 2025/26 for part 6):
 - Part 1 Generic Conceptual Model
 - Part 2 Land Registration
 - Part 3 Marine Georegulation
 - Part 4 Valuation Information
 - Part 5 Spatial Plan Information
 - Part 6 Implementation

Scope of current LADM edition

- The increasing use of LADM requires education both of regular students, but also of mid-term carreer professionals
- Learning from the ISO standard 19152 has proven to be rather difficult, today a better approach is launched





School for Land Administration Studies

Paula Dijkstra

Kadaster International





Mission

To build land administration capacity in developing and emerging economies

by supporting the creation of enabling institutional environments, networks, and change agents



Capacity Building in Land Administration

- Scientific
 - concepts
 - models
 - methodology
- Operational
 - operations
 - management
 - governance









FIG Congress 2022, Warsaw, September 13th, 2022

LADM in the Classroom

Making the Land Administration Domain Model Accessible

Christiaan Lemmen, Malumbo Chipofya, Andre da Silva Mano, Dennis Ushiña

Huera, Abdullah Kara, Peter van Oosterom, Javier Morales, Paula Dijkstra, Jaap

Zevenbergen









Teaching information modeling for LA



Concerned with understanding common elements of Land Administration Information Systems (LAIS) including their development

Teaching information modeling for LA

• Why do we teach LA Info. modeling? What do we want to teach the students?





 «codeList»
 «codeList»
 «codeList»

 Party::LA_PartyType
 Party::LA_GroupPartyType
 Party::LA_PartyRoleType

LADM in the Classroom

• But teaching LADM itself can be challenging





LADM in the Classroom some guiding principles through examples

- 1. Base all content on a **unified** (exemplary) **case study**
- 2. Use a consistent **presentation structure**
- 3. Incremental and progressive knowledge and skill development
- 4. Demonstrate subtle implications of design choices through **alternative models** for a given scenario
- 5. Complexity beyond the conventional models: **customary tenure** models
- **6. Reinforce learning** through exercises supported by a comprehensive dataset and tool setup

Unified Case Study: Waterriver

Welcome to the Municipality Waterriver



The Cadastral Map



Structure of the content

Tornas, Elisabeth and Monique's situations can be depicted with the LADM. In the LADM the administrative/legal data, the 'registry', and the spatial data, the 'cadastre', are represented in one integrated model. A good way to introduce the structure of this model is to start with concrete depictions of how the records relate. Taking the case of Monique, Figure 6 presents a reader friendly schematic showing which objects are involved and how they relate to each other. This directly translates to the more UMLlike instance diagram in Figure 10.

Implementing the dataset in an actual database allows us to create exercises to form part of the learning material. Exercises can be developed objectively at several levels of the Bloom taxonomy of learning (Anderson et al., 2001). As a proof of concept, we present three levels of complexity of exercises developed using the implementation setup and dataset. The first two levels are illustrated with simple examples.

The most basic exercise addresses the base (knowledge) and second (comprehension) tiers of the Bloom cognitive model. The student is asked to draw the UML instance diagrams for a given scenario and to identify the UML class of each object in the diagram. For example:

This exercise assesses how the student has assimilated the core LADM closses and the idea that a class represents a group of objects of the same kind such as a party. It also shows that the student can use the core LADM closses to describe a specific scenario. The solution to problem La, would look exactly like the bottom row of boxes in Figure 18 (a) or (b), except the class of each object would be included in the diagram or as a separate descriptive text. It should be noted that from this initial problem, questions exluted with other knowledge areas such as model representations in relational database tables, basic SQL query syntax or and spatial representations may be derived.

A student who answers all basic problems such as problem 1 correctly would be ready to tackle more challenging problems involving the application of the knowledge to several different scenarios not directly presented in the examples. This is where the concept of country profile becomes a useful teaching tool as it provides real-world land administration models. Consider the problem presented below:

- Given the initial scenario shown in Figure 17, where Morique owns an apartment, laundry room, and parking space in an apartment complex (as depicted in Figure 4).
 - a. redraw the instance diagram where a single entity, Galaxy Properties, buys out the entire property. In the new scenario - Galaxy Properties now owns both the land and all the structures on the residential complex.
 - b. Write the SQL queries required to update the data to reflect the new scenario.





| | p_id | name | | r_id | type | share | | bau_id | | su_id | area | geom | *** |
|----|------|--------|----|---------|-----------|--|----|--------|----|-------|------|------|-----|
| 1 | PO1 | Carlos | 1 | Right01 | Ownership | - | 1 | BAU01 | 1 | WR01 | | | |
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| 4 | | | 4 | | | | 4 | | 4 | | | | |
| 5 | | | 5 | | | 1 | 5 | | 5 | | | | |
| 6 | | | 6 | | 1 | | 6 | | 6 | | | 1 | |
| 7 | | | 7 | | | | 7 | | 7 | | | | |
| 8 | | | 8 | | | | 8 | | 8 | | | | |
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| 10 | | | 10 | 6 | | | 10 | | 10 | | | | |
| 11 | | | 11 | | | | 11 | | 11 | | | | |
| 12 | | | 12 | | | | 12 | | 12 | | | | |
| 13 | | | 13 | 1 | | | 13 | | 13 | | | | |
| 14 | | | 14 | | | | 14 | | 14 | | 1 | | |
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Toware, Ultradieth and Minergae's situations can be depicted with the LADM. In the LADMS the colorization being data the registry, and the qualitation, the 'walcole', are represented in our singularithmetical's grant way for information the situation of this number is in start with some electrophytheses of here the eccentration Taking the means? Minerican, Figure 1 generation or maker if itself y situations in data singular the situation of Minerican. Figure 11 generation or maker if itself y situations is described and here they define a start. This situation is a figure 12.5.1. Here they are diagonal they relate to each other. This discussion is the second DML. the trademost diagonal to Figure 13.

implementing the detect to an actual chains a closer as in create memory, in these part of the forwards material. Therefore, can be developed algorithmly of extend freedoallithe blance increasing of forwards (finderward et al., 2020), the provided memory, we present these forces of complexity of memory discributed and the implementation stagement dataset. The first increasing of instructed with simple resemptive.

The neural involvements an attenues the inner (inner integr) and excerning (comprehension) trees of the Harmon magnitude could. The standard is added to these the TSE, tendence diagrams for a given scenario and in identity the TSE, show of each algorithm the diagram. For manying

This measures have shown in a stational into accirculated iterator v1.5 DM characteristic in the state that a characterpresents a group of highest of the same limit such as a payely. It show denote that the statement can mee the same 1.6 DM characteristic a specific terminate the solution is problem. I.e. eventh backcaracteristic term in the statement of Piperse III [42] or [54], enough the characteristic termination in the statement of the staeogenetic tilt scattering terms of much object around the translated in the stangeness or to a supersist interactive text. To characteristic terminate this institut problems, questions relation of vide other have being generate and an excellent representations in relationed details we listles, back (32), query specific at and quark to presentations may be derived.

A circlest size measures of iterate problems southers problem 11 commity would be reachy to challe some challenging problems, incurving the application of the homebright in second different constants and density presented in the manyles. This is achieve the commpt of southy product to become consellat tracking leads of products and a world land soluciestation methods. Elements the problem presented interva-

- Chowella statistication in Space 17, sales Minniger examples operations, loansky recent, and particing space in an apartment complex (ps. depicted on Figure 4).
 - entron the instance diagram where a single-mitig, Calory Properties, logis and the mitine property. In the new scientistic Talaxy Properties, new science holds the band and all the single-new on the residential complex.
 - Write the KQL quester, required to applied the state in other time area consume.





| | p_id | name | | r_id | type | share | | bau_id | | su_id | area | geom | *** |
|----|------|------------------|----|---------|-----------|-------|-----------|--------|----|-------|------|------|-----|
| 1 | POI | Carlos | 1 | Right01 | Ownership | - | 1 | BAU01 | 1 | WR01 | | | |
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| | | - t ₁ | | | ÷ | | · · · · · | | 17 | | | | |

Progressive knowledge and skill development





Carlos: Party Every land rights holder is called a party in LADM

Record of "Ownership Right01"

The spatial referent or target of the record of land rights is called a Spatial Unit

WR01







| | p_id | name | | r_id | type | share | | bau_id | | su_id | area | geom | *** |
|----|------|--------|----|---------|-----------|-------|----|--------|----|-------|------|------|-----|
| 1 | PO1 | Carlos | 1 | Right01 | Ownership | | 1 | BAU01 | 1 | WR01 | | | |
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| 4 | | | 4 | | | | 4 | | 4 | | | | |
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| 11 | | | 11 | | | | 11 | | 11 | | | | |
| 12 | | | 12 | 1 | | | 12 | | 12 | | | | |
| 13 | | | 13 | 13 | | | 13 | | 13 | | | | |
| 14 | | | 14 | 1 | | | 14 | 6 | 14 | | | | |
| 15 | | | 13 | 1 | | | 15 | | 15 | | | | |
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| | p_id | name | | r_id | type | share | | bau_id | 1 | su_id | area | geom | *** |
|----|------|--------|----|---------|-----------|-------|----|--------|----|-------|------|------|-----|
| 1 | POI | Carlos | 1 | Right01 | Ownership | - | 1 | BAU01 | 1 | WR01 | | | |
| 2 | | | 2 | | | | 2 | | 2 | | | | |
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| | | | | | | | | | 18 | | | | |
| | | | | | | | | | 19 | | | | |









Alternative modeling choices

Implications of design choices

Demonstrate other advanced concepts: e.g. Transactions



| | r_id | la_right_type | begin_lifespan | end lifespan |
|---|---------|---------------|-----------------|-----------------|
| 1 | Right01 | Ownership | 20150403, 08:29 | 20210826, 14:04 |
| 2 | Right18 | Ownership | 20210826, 14:04 | 99999999, 23:59 |
| 3 | | | | |



| | r_id | la_right_type | begin_lifespan | end_lifespan |
|---|---------|---------------|-----------------|-----------------|
| 1 | Right01 | Ownership | 20150403, 08:29 | 20210826, 14:04 |
| 2 | Right01 | Ownership | 20210826, 14:04 | 99999999, 23:59 |
| 3 | | | | |

| | p_id | name | | r_id | type | share | t_min | t_max | | bau_id | t_min | t_max | | su_id | |
|----|------|-----------------------|----|---------|-----------|-------|--------------------|---------------------|----|--------|--------------------|---------------------|----|--------|--|
| 1 | P01 | Carlos | 1 | Right01 | Ownership | | 20150403, 08:29 | 999999999, 23:59 | 1 | BAU01 | 20150403, 08:29 | 999999999, 23:59 | 1 | WR01 | |
| 2 | P02 | Thomas | 2 | Right02 | Ownership | 1/2 | ••• | | 2 | BAU02 | | | 2 | WR02 | |
| 3 | P03 | Elisabeth | 3 | Right02 | Ownership | 1/2 | | | 3 | BAU03 | | | 3 | WR03 | |
| | | | | | | | | | | •• | | | | | |
| | | | | | | | | | | | | | | | |
| 13 | P13 | Association of Owners | 17 | Right14 | Ownership | | | | 12 | BAU12 | 20140730, | 999999999, | | | |
| 14 | P14 | Monique | 18 | Right15 | Ownership | | | | 1 | | 10:15 | 23:59 | 22 | WR18-4 | |
| | | | 19 | Right16 | Ownership | | 20140730, | 999999999, | 13 | BAU13 | | | 23 | WR18-5 | |
| 15 | P15 | Eco Investment | | Ū | | | 10:15 | 23:59 | 14 | BAU14 | | | 24 | WR18-6 | |



| | p_id | name |
|----|------|-----------------------|
| 1 | P01 | Carlos |
| 2 | P02 | Thomas |
| 3 | P03 | Elisabeth |
| | | |
| | | |
| 13 | P13 | Association of Owners |
| 14 | P14 | Monique |
| 15 | P15 | Eco Investment |

| | r_id | type | share | t_min | t_max |
|----|---------|-----------|-------|--------------------|---------------------|
| 1 | Right01 | Ownership | | 20150403, 08:29 | 20210826, 14:04 |
| 2 | Right02 | Ownership | 1/2 | | ••• |
| 3 | Right02 | Ownership | 1/2 | | |
| | | ••• | •• | | |
| 19 | Right16 | Ownership | | 20140730, 10:15 | 999999999, 23:59 |
| 20 | Right17 | Ownership | | | |
| | ••• | ••• | | | |
| 24 | Digh+19 | Ownership | | 20210826 | ووووووو |

| | bau_id | t_min | t_max |
|----|--------|--------------------|---------------------|
| 1 | BAU01 | 20150403, 08:29 | 20210826, 14:04 |
| 2 | BAU02 | | |
| 3 | BAU03 | | |
| | •• | | |
| | | | |
| 11 | BAU12 | 20140730, 10:15 | 999999999, 23:59 |
| 12 | BAU13 | | |
| 13 | BAU14 | 20210826, 14:04 | 999999999, 23:59 |



Customary tenure relations

A drive on the outskirts of Waterriver

Show how to model more complex land tenure domains





| | r_id | la_right_type | begin_lifespan | end_lifespan |
|---|------------|---------------|-------------------------|-----------------------|
| 1 | Right-R15 | Usufructuary | 2022-09-01 | _ |
| 2 | Right-R16A | Rental | 2022-rainy-season-start | 2022-rainy-season-end |
| 3 | Right-R16B | Usufructuary | _ | _ |

| primaryRight(FK) | dependentRight (FK) |
|------------------|---------------------|
| Right-R15 | Right-R16A |
| Right-R16A | Right-R16B |



Reinforcing learning

Exercises supported by a comprehensive dataset with a QGIS setup