Objectives of this presentation

- Land Administration standard (LADM, ISO/DIS 19152) for the Geoweb
- Relationships with other ISO/TC211 standards, specifically ISO/DIS 19156 Observations and Measurements (O&M)
- Spatial source documents (survey) for adjudication, land transactions, physical planning, mortgage, ...
ISO 19152 (=LADM) Scope

- Reference model (abstract, conceptual schema)
- Land/water, below/above surface
- Basic classes:
  1. parties,
  2. rights, responsibilities, restrictions,
  3. spatial units (incl. spatial sources and spatial representations)
- Terminology enabling communication
- Shared description of formal or informal practices
- Basis for national & regional profiles (application schema)
LADM core

- **LA_Party** Peter has **LA_RRR** ownership on **LA_BAUnit** Peter’s estate consisting of 2 **LA_SpatialUnit** parcels (with same **LA_RRR**)

- **LA_BAUnit** stands for Basic Administrative Unit
**Where are we now?**

**NWIP – WD - CD – DIS - FDIS - IS**

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Growing support is clear!

- Many comments on NWIP, WD, CD, DIS versions received and processed
- FDIS to be voted on July/August 2012
- IS publication date second half of 2012

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**External classes (Domains)**

- Archives
- Taxation
- Valuation
- Parties
- Addresses
- Land cover
- Land use
- Utility networks

→ Related, but outside the scope of LADM
### Contents

1. Introduction
2. Spatial Units
3. Imports from other ISO standards
4. Cadastral surveying
5. Conclusions

### LA_SpatialUnit (alias LA_Parcel)

- LA_SpatialUnit specializations: network, building unit
- organized in LA_Layer based on structure or content
- 5 types: point, text (unstructured) line, polygon, and topology
Spatial Representation and Survey

subpackages of SpatialUnit

- Geometry, topology of Spatial Units (based ISO 19107)
- Spatial source (based ISO/CD 19156 Observations and Measurements)

See Annex B for a more detailed description of boundary face strings and boundary faces.
Spatial Units in 3D

- Extend the equivalent concept from 2D to 3D
  \rightarrow 3D parcels are in areas of highest land values

- Challenges:
  1. Majority of parcels is in 2D and should not be lost
     \rightarrow integrate 2D/3D
  2. 3D parcels can be unbounded (up/down) according to National law
     \rightarrow does not fit in ISO 19107, so alternative needed

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Relationships ISO/TC211 family

- ISO/IS 19107 Spatial Schema
- ISO/IS 19108 Temporal Schema
- ISO/IS 19111 Referencing by Coordinates
- ISO/IS 19115 Metadata
- ISO/DIS 19156 Observations and Measurements (O&M)

- GM_Point (19107)
- Coordinate Reference System (19111)
- DQ_Element (19115)
- OM_Observation & OM_Provess (19156)

GM_Point

- Part of large model: ISO 19107
- Many (inherited) methods
- One attribute DirectPosition

Note SC_CRS (ISO 19111)
Observations and Measurements

- In LA_SpatialSource attribute “measurements” is of type OM_Observation (as defined in ISO 19156) and contains the actual source survey data.

- In LA_SpatialSource attribute “procedure” is of type OM_Process and documents the actual survey procedure.
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Survey approach

1. Survey measurements
2. Adjust measurements and fit in existing map
3. Create objects

Existing Situation:
Spatial Unit 1

New Situation:
Spatial Units 2 and 3

Cadastral Survey

Other observations:
Name of Surveyor
Existing parcel_id: SU_1
Spatial Source_id: 2011-2
Date of Survey: 2011, June 20th
References to earlier spatial source documents: 2011-1

Names of Neighbors:
Names of Representatives: n/a
Agreement Y/N: Y
Original O&M into LA_SpatialSource

| Direction and Distance Total Station | MP-1 |
| Direction and Distance Total Station | MP-2 |
| Direction and Distance Total Station | MP-3 |
| Direction and Distance Total Station | MP-4 |
| Direction and Distance Total Station | MP-5 |
| Direction and Distance Total Station | MP-6 |
| Existing X,Y (of building corner in database) of MP-1 |
| Existing X,Y (of building corner in database) of MP-2 |
| Existing X,Y (of spatial unit vertex in database) of MP-4 |
| Existing X,Y (of spatial unit vertex in database) of MP-3 |
| Perpendicular relation 1 (MP-4, MP-5, MP-6) |
| Perpendicular relation 2 (MP-3, MP-5, MP-6) |
| Distance 1 between MP-3 and MP-5 |
| Distance 2 between MP-5 and MP-4 |
| Distance 3 between MP-6 and MP-5 |
| MP5 and MP6 to be connected to a boundaryfacestring |

Adjustments

- New Point
- Existing Point
Adjustment: Original O&M adjusted to Geo DB using existing Points

Storing the observations

- Stored in LA_SpatialSource: raw data and quality info
- Next calculations: transformations, geodetic adjustments, observations are often redundant (and have small errors); e.g. least squares adjustment computes optimal solution
- Result stored in LA_Point attribute “transAndResult” of type LA_Transformation (which has two parts: 1. transformation of type CC_OperationMethod and 2. transformedLocation of type GM_Point)
- Adjustments can be reiterated (cardinality of attribute “transAndResult” is 0..*)
New Spatial Units created

- New LA_Points used to create new LA_BoundaryFaceStrings and these are used to create new LA_SpatialUnits
- All linked in LADM: chain from LA_SpatialSource to LA_SpatialUnit → instance level diagrams before and after split

Object Creation
Instance level diagram, before split

After

LA_DelicatnessRelsationship

parent-child

LA_RequiredRelationship

parent-child

SU_1 : LA_SpatialUnit
beginLifespanVersion = 1-jan-2010
dendLifespanVersion = 24-jun-2011

SU_2 : LA_SpatialUnit
beginLifespanVersion = 24-jun-2011

dendLifespanVersion = 24-jun-2011

SU_3 : LA_SpatialUnit
beginLifespanVersion = 24-jun-2011

dendLifespanVersion = 24-jun-2011

B_1 : LA_BoundaryFaceString

B_2 : LA_BoundaryFaceString

B_3 : LA_BoundaryFaceString

B_4 : LA_BoundaryFaceString

B_5 : LA_BoundaryFaceString

B_6 : LA_BoundaryFaceString

B_7 : LA_BoundaryFaceString

B_8 : LA_BoundaryFaceString

B_9 : LA_BoundaryFaceString

P-1 : LA_Point

P-2 : LA_Point

P-3 : LA_Point

P-4 : LA_Point

P-5 : LA_Point

P-6 : LA_Point

P-7 : LA_Point

P-8 : LA_Point

P-9 : LA_Point
Conclusion

- Spatial Units are the “glue” joining the spatial description of land to the RRR aspects

- Spatial Units are universal in their land administration application (ownership, easement, utilities, building...)

- Range of representations: text → 3D topology

- Based on other ISO standards ISO 19107, 19111, 19115, 19156

- Spatial Units based on Source Documents and LA_Points

→ More info on the ISO 19152 LADM Wiki
http://wiki.tudelft.nl/bin/view/Research/ISO19152/WebHome