Why and what to standardize in Land Administration?

12-5-2015

Peter van Oosterom, based on joint work with Chrit Lemmen
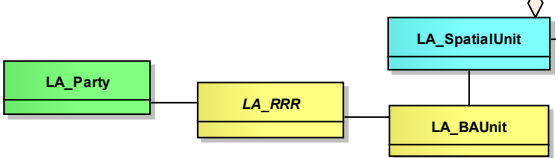
World Cadastre Summit, Congress& Exhibition
İstanbul Haliç Congress Center, 20-24 April 2015

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Challenge the future

Standardize

LA_Party — LA_RRR — LA_BAUnit — LA_SpatialUnit

1. *Why?*
2. What?
3. How?

in the context of ISO 19152:2012 LADM
Land Administration Domain Model

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Some rights and restrictions

(Sweden, Ireland, Germany, the Netherlands & Portugal, by Paasch)

Possibility of reverter   Easement   B.P. right

Beschränkte persönliche Dienstbarkeiten   Freehold covenant

Ownership   Erbbaurecht

Grunddienstbarkeit   Gemensamhetsanläggningar

Servidão de Estilicio   Profit á pendre

Wayleave   Niessbrauch

Servitut   Erfdienstbaarheid

Bearbetningskonsession   Building lease

Right of entry or re-entry   Rentenschuld

Vruchtgebruik   Leasehold   Detaljplan

Emphyteusis   Mortgage   Opstal   Grundschuld

Reallast   Usufruct   Erfpacht   Lien   Right of pre-emption

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Diversity, even with common roots

(Zevenbergen, 6 july'12 at LADM workshop, Rotterdam)

Property rights, including land rights, very diverse, even in Europe

- Of course its language has its own words for 'similar notions', even two jurisdictions with shared language have often different wordings

- EU Lisbon treaty: 'The Treaties shall in no way prejudice the rules in Member States governing the system of property ownership' (art.345)

- Core right, esp. ownership, rather similar, but..
  - more customary rights very diverse (although number of effected parcels might not be that large), even in Europe
  - individual possession of flats extreme diverse (own part of building, co-own whole building, special cooperation, stocks in company, ..)

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Legal Families in Europe

Newman and Thornley (1996)

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Diversity, some common elements

- Land Rights rather limited, even ownership
- Layered rights (leasehold), secondary rights (usufruct)
- Restrictions and responsibilities

- One person's right, is the neighbors burden; e.g. servitude
- Rights that are linked to another right (not to be separated)
- Stake in group rights; e.g. joint facilities, which can not be separated from the main right
- Mortgage (hypotec) on any other strong rights

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Standardization in Land Adminastration?

- Supposition: there are huge differences between cadastral and land registry systems

- However, look at the common area's:
  - Standardized Model (adaptable, extensible)
  - Avoid "re-inventing the wheel"
  - Enable involved parties to communicate

- Lack of a shared set of concepts and terminology in the Land Administration Domain
  - *FIG, Washington 2002: Proposal for Domain Model*
  - ISO/TC211 2007: Core Cadastral Domain Model CCDM → LADM

- Note FIG = International Federation of Surveyors (founded 1878 NGO)

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Motivation LADM
Generic benefits of standards

- Standardization condition for interoperability, use parts together (meaningful exchange of data and building SDI)

- Standardization quality enhancing (based on knowledge and experience of global community)

- Standardization cost effective (components do fit better, industry+open source solutions)

ISO ISO/TC 211
Geographic information/Geomatics

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Background ISO TC211

ISO/TC 211
Geographic information/Geomatics

- Over 60 P/O-member countries (participating + observing), including *Türk Standardlari Enstitüsü* (TSE), O-member

- Liaisons with other organizations; e.g. OGC and FIG

- Over 40 standards, LADM = ISO 19152

- Main phases in standards development process:
  1. Proposal of new work item (NWIP), determination of scope
  2. Development of specifications in Working Drafts (WD) and Committee Draft (CD) in consensus-building processes
  3. Formal approval International Standard (IS), via Draft IS (DIS) and optionally Final Draft IS (FDIS)

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Relationships ISO/TC211 family

- ISO/IS 19103 Conceptual Schema Language
- ISO/IS 19107 Spatial Schema
- ISO/IS 19108 Temporal Schema
- ISO/IS 19111 Referencing by Coordinates
- ISO/IS 19115 Metadata
- ISO/IS 19156 Observations and Measurements (O&M)

- UoM, Area, Volume (19103)
- GM_Point (19107)
- Coordinate Reference System (19111)
- DQ_Element (19115)
- OM_Observation & OM_Process (19156)

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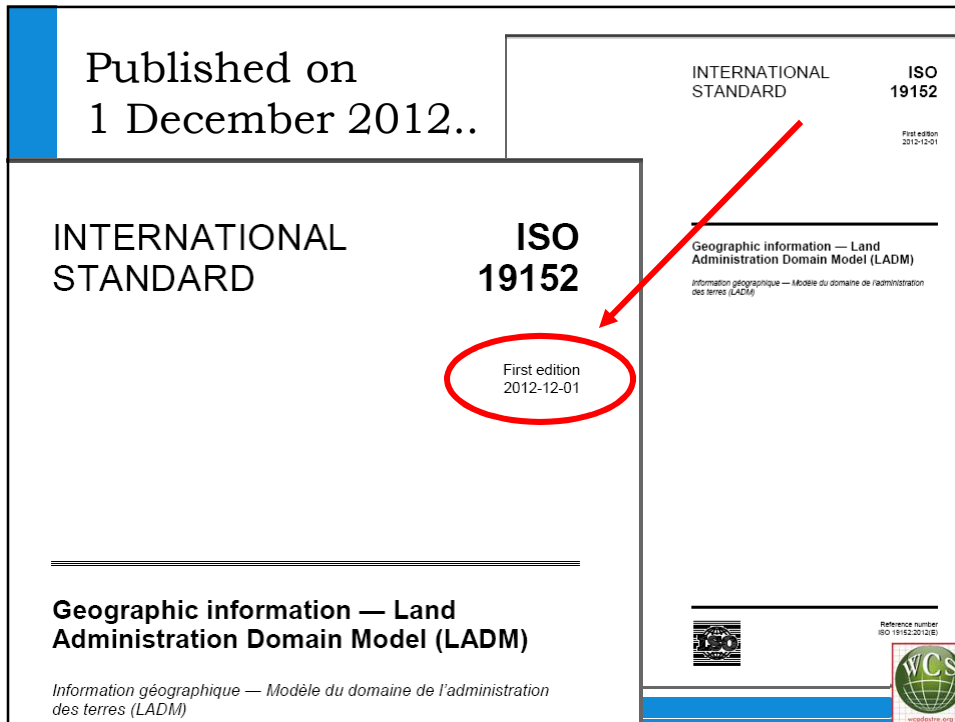
ISO TC211 and CEN TC287

- CEN: European Centre for Standardization

- Close cooperation arranged via resolutions, based on overall Vienna agreement between ISO and CEN (FDIS phase obligatory)

- Goal: equal standards
  - existing ISO standards: unique acceptance procedure (UAP), fast
  - new/ongoing standards: parallel voting

- Project with CEN – French translation needed

→ *parallel voting in ISO TC211 and CEN TC287 (including LADM)*

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ISO 19152 LADM based INSPIRE cadastral parcels

- Infrastructure for Spatial Information in the European Community
- INSPIRE defines 34 data theme's, of which cadastral parcels is one

- From LADM to INSPIRE:
  1. Selection of relevant classes
  2. Based on inheritance
  3. Add attributes
  4. Add constraints (to refine meaning)

- LADM and INSPIRE cadastral parcels are compatible

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INSPIRE
Cadastral Parcels (CP)

class inspire cad parcels based on ladm - pure

LA_LAUnit

«FeatureType»
BasicPropertyUnit

+ inspireId: Identifier
+ nationalCadastralReference: CharacterString
+ areaValue: Area [0..1]
+ validFrom: DateTime
+ validTo: DateTime [0..1]
+ name: CharacterString [0]
+ quality: DQ_Element [0]
+ source: CI_ResponsibleParty [0]
::LA_LAUnit
+ nationalCadastralReference: Oid
+ name: CharacterString [0..1]
::VersionedObject
+ beginLifespanVersion: DateTime
+ endLifespanVersion: DateTime [0..1]
+ quality: DQ_Element [0..*]
+ source: CI_ResponsibleParty [0..*]

Note:
The LADM attributes inherited by INSPIRE can have a more specific data type or cardinality in INSPIRE (compared to LADM). This has been included in the diagram. This implies that an optional LADM attribute [0..1], might not occur at all in INSPIRE as the cardinality can be set to 0; e.g. volume in CadastralParcel. This also implies that an optional LADM attribute [0..1], might be an obligatory attribute in INSPIRE; e.g. label in CadastralZoning.

«CodeList»
CadastralZoningLevel

+ 1st-order
+ 2nd-order
+ 3rd-order

/derived LADM

0..*

0..*

/derived LADM

0..1

/derived
LADM

0..1   0..*

LA_Parcel

«FeatureType»
CadastralParcel

+ geometry: GM_Object
+ inspireId: Identifier
+ label: CharacterString
+ nationalCadastralReference: CharacterString
+ areaValue: Area [0..1]
+ validFrom: DateTime [0..1]
+ validTo: DateTime [0..1]
+ dimension: LA_DimensionType [0]

LA_SpatialUnitSet

«FeatureType»
CadastralZoning

+ geometry: GM_MultiSurface
+ inspireId: Identifier [0..1]
+ label: CharacterString
+ nationalCadastralZoningReference: CharacterString
+ estimatedAccuracy: Length [0..1]
+ level: CadastralZoningLevel

/derived LADM   1..2

0..*

LA_FaceString

«FeatureType»
CadastralBoundary

+ geometry: GM_Curve

Motivation LADM
Geo-information/land admin aspects

• Within ISO geo-information/geomatics is responsibility
of TC211 (Technical Committee)

• Earlier TC211 standards domain neutral: basics for geometry,
topology, temporal aspects, reference systems, metadata, …

• LADM is first domain specific standard within TC211
→ meaningful (inter)national communication between professionals

• Allows efficient design/development of ICT systems

• Note: standardization itself not new in our field, was already applied
in analogue times, both for spatial/survey and admin/legal docu
(However, ICT requires more strict approach and detect errors)

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Motivation LADM
Reasons to apply LADM

- LADM collective experience of experts from many countries (FIG)
- LADM is based on consensus and adopted by ISO (and CEN)
- LADM allows meaningful data exchange: 1. within country, SDI-setting (other types of data), 2. between countries/states (same type)
- LADM covers complete land administration spectrum: survey, cadastral maps, rights, restrictions, responsibilities, mortgages, persons, etc.
- LADM focuses on information, not on process/organization aspect
- LADM is modular (packages) and extensible → country profiles
- LADM allows integrated 2D and 3D representation of spatial units
- LADM supports both formal and informal RRRs
- LADM links essential land information data to source documents, both spatial (survey) and legal (title, deed)

LADM compliance will seldom be main reason for new system in country
  → every system needs upgrades: consider becoming LADM compliant!

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Motivation LADM
Expressed at 5th FIG LADM workshop

- Some quotes from Kalantari (et al, 2013):
    1. International compliance
    2. Cross jurisdictional data exchange
    3. Upgrading or new versions for existing systems
    4. Existing institutions ('do fit in well')
    5. Semantic Compliance (definition of key concepts)
    6. Structural Compliance (agreed model patterns)
    7. Feedback and improvements (during standard development, and after)
    8. Capacity building (LADM included in various curriculums).

- Thompson (2013) added: LADM provides excellent growth path from text, sketch and point parcels to full topology and 3D (and same range of options available in administrative side of model)

- LADM workshop slides (and papers) available at http://isoladm.org

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Some Turkish LADM influence!

- In 2007 two PhD students from Karadeniz Technical University, visiting TU Delft, *Fatih Döner and Halil İbrahim İnan*, converted the first CCDM document in the ISO template (not as trivial as it sounds)
- Current LPIS annex Annex H 'The LADM and LPIS' (for agricultural parcels) was based on joint work with Halil İbrahim İnan and EC/JRC Ispra, Italy

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Data model for the collaboration between land administration systems and agricultural land parcel identification systems

Halil Ibrahim Inan [a,*], Valentina Sagris [b], Wim Devos [b], Pavel Milenov [b], Peter van Oosterom [c], Jaap Zevenbergen [c]

[a] *Karadeniz Technical University, Faculty of Engineering, Department of Geomatics Engineering, GISLab, 61080, Trabzon, Turkey*
[b] *European Commission, Joint Research Centre, Institute for the Protection and Security of the Citizen, Agriculture Unit, Ispra, Italy*
[c] *Delft University of Technology, OTB Research Institute for Housing, Urban and Mobility Studies, Jaffalaan 9, 2628 BX, Delft, The Netherlands*

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ABSTRACT

The Common Agricultural Policy (CAP) of the European Union (EU) has dramatically chang...
and from then on the CAP focused on the management of direct income subsidies instead o...
based subsidies. For this focus, Member States (MS) are expected to establish Integrated A...
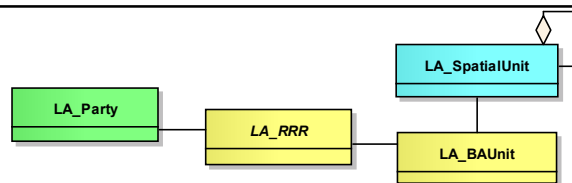
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Standardize

LA_Party — LA_RRR — LA_BAUnit — LA_SpatialUnit

1. Why?
2. *What?*
3. How?

In the context of ISO 19152:2012 LADM
Land Administration Domain Model

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Land Administration Domain Model ISO 19152 (LADM)

- Model includes:
  - Spatial part (geometry, topology)
  - Extensible frame for legal/administrative part

- Object-orientation → expressions in UML

- Model Driven Architecture (MDA)

- FIG proposed LADM to ISO/TC211, January 2008

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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)

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Requirements, support for:

1. Continuum of land rights
2. Continuum of parties
3. Continuum of spatial units
4. Basic Administrative Units (or Basic Property Unit)
5. A range of data acquisition methods
6. A range of authentic source documents
7. Transparency
8. History
9. Different organisations
10. Keep data to the source (within SDI)
11. Existing standards
12. Reference system
13. Identifiers
14. Marine Cadastres, 3D Cadastres
15. Quality

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ISO 19152 *core* in action
Land Administration Domain Model

- *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

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Full version management → inherit from VersionedObject

«featureType»
LA_RRR

«featureType»
LA_Mortgage

«featureType»
LA_BAUnit

«featureType»
LA_RequiredRelationshipBAUnit

«featureType»
VersionedObject

+ beginLifespanVersion: DateTime
+ endLifespanVersion: DateTime [0..1]
+ quality: DQ_Element [0..*]
+ source: CI_ResponsibleParty [0..*]

constraints
{endLifespanVersion (n-1) = startLifespanVersion (n)}

«featureType»
LA_GroupParty

«featureType»
LA_PartyMember

«feature...
LA_Party

«featureT...
LA_Point

«featureType»
LA_BoundaryFaceString

«featureType»
LA_BoundaryFace

«featureType»
LA_RequiredRelationshipSpatialUnit

«featureType»
LA_SpatialUnit

«featureType»
LA_SpatialUnitGroup

«featureType»
LA_Level

«datatype»
Oid

+ localId: CharacterString
+ namespace: CharacterString

«datatype»
Rational

+ denominator: int
+ numerator: int

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LADM Diagram

LA_Spatial Source

LA_LegalSpace Network

LA_Legal Space BuildingUnit

LA_SpatialUnitGroup

LA_Source

LA_GroupParty

LA_PartyMember

LA_Party

LA_AdministrativeSource

LA_SpatialUnit

LA_BoundaryFaceString

LA_Level

LA_Point

LA_RRR

LA_BAUnit

LA_Restriction

LA_Responsibility

LA_BoundaryFace

LA_Mortgage

LA_Right

• Parties
  → green
• RRRs
  → yellow
• Spatial Units
  → blue
• Surveying
  → pink
• Mapping
  → violet

*RRR supports
all land rights*

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LADM and external classes

- Determine scope LA
- Apply SDI thinking
- Link to external registrations:
  - Address
  - Party (person)
  - Valuation
  - Taxation
  - LandCover
  - LandUse
  - PhysicalNetwork (utility)
  - …
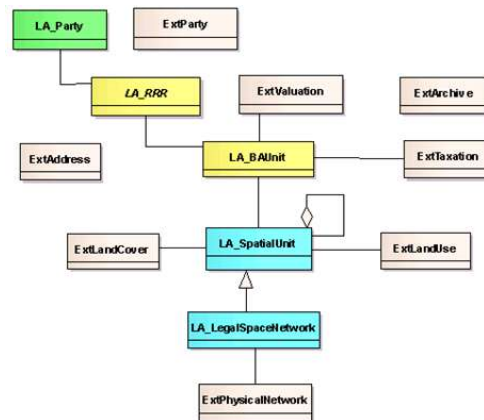
→ *Related, but outside the scope of LADM*

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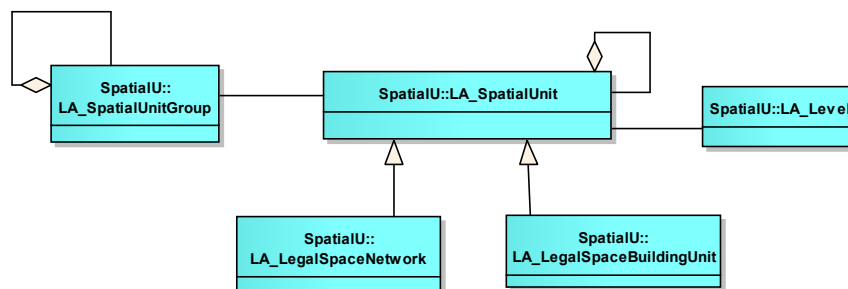

Spatial Information Infrastructure

- Standards needed as users are at unknown distance
  → ISO LADM (and CEN)
- Network of related information sources, blueprints for
  → Address, Building, Party, Network, LandUse, …
- Remote users might need/refer to historic version
  → All object classes need to be versioned objects

- Maintain consistency: subscription on update warnings
- Legal counterparts of physical objects
- Information assurance (contracts)

- In LADM, external classes as *<<blueprint>>* and expected to be defined in more detail elsewhere (other standard)

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External classes as <<blueprints>>

Figure K1. External LADM classes
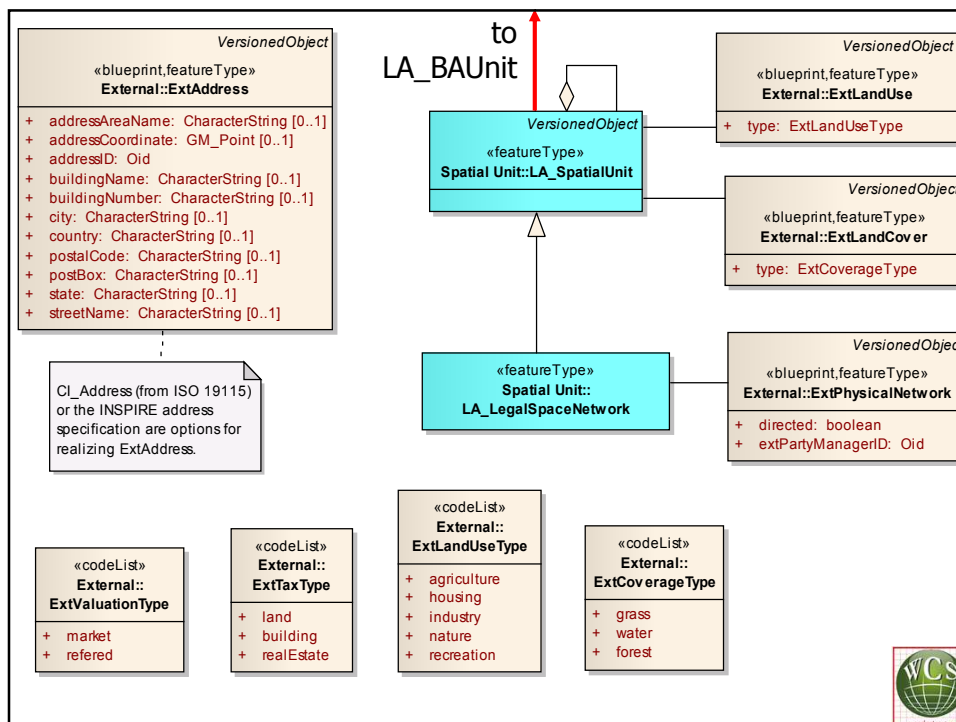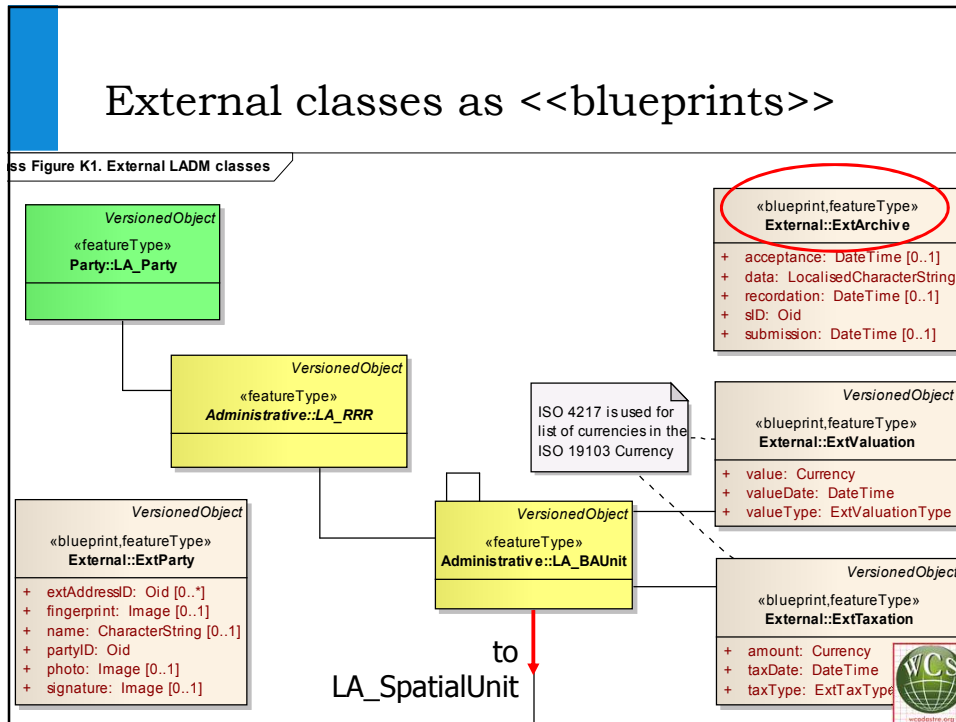
LA_SpatialUnit (alias LA_Parcel)

- LA_SpatialUnit specializations: utility network, building unit
- organized in LA_Level based on structure or content
- 5 types: *point, text (unstructured) line, polygon, and topology*
- 2D and 3D integrated without complicating 2D

class Figure 4. Spatial Unit Package

SpatialU::
LA_SpatialUnitGroup

SpatialU::LA_SpatialUnit

SpatialU::LA_Level

SpatialU::
LA_LegalSpaceNetwork

SpatialU::
LA_LegalSpaceBuildingUnit

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Text-Based Spatial Unit

"beginning with a corner at the intersection of two stone walls near an apple tree on the north side of Muddy Creek road one mile above the junction of Muddy and Indian Creeks, north for 150 rods to the end of the stone wall bordering the road, then northwest along a line to a large standing rock on the corner of John Smith's place, thence west 150 rods to the corner of a barn near a large oak tree, thence south to Muddy Creek road, thence down the side of the creek road to the starting point."

(quoted from: http://en.wikipedia.org/wiki/Metes_and_bounds).

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Point-Based Spatial Unit

"*a single coordinate of the centre of the dwelling unit could positively identify that unit, and this may be sufficient for basic recording purposes where the limits of the land holding are for the time being unimportant".*

- An early stage in a system of progressive title improvement, ending in a standard freehold system.
- Identifies a spatial unit, but does not delineate it.
- Provides an address reference point.
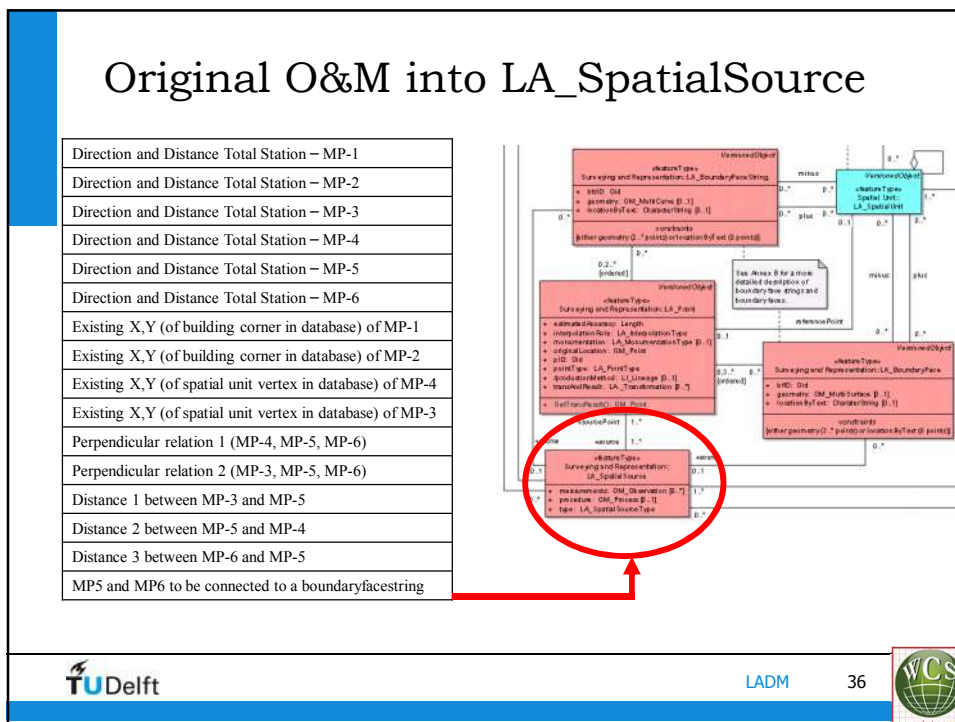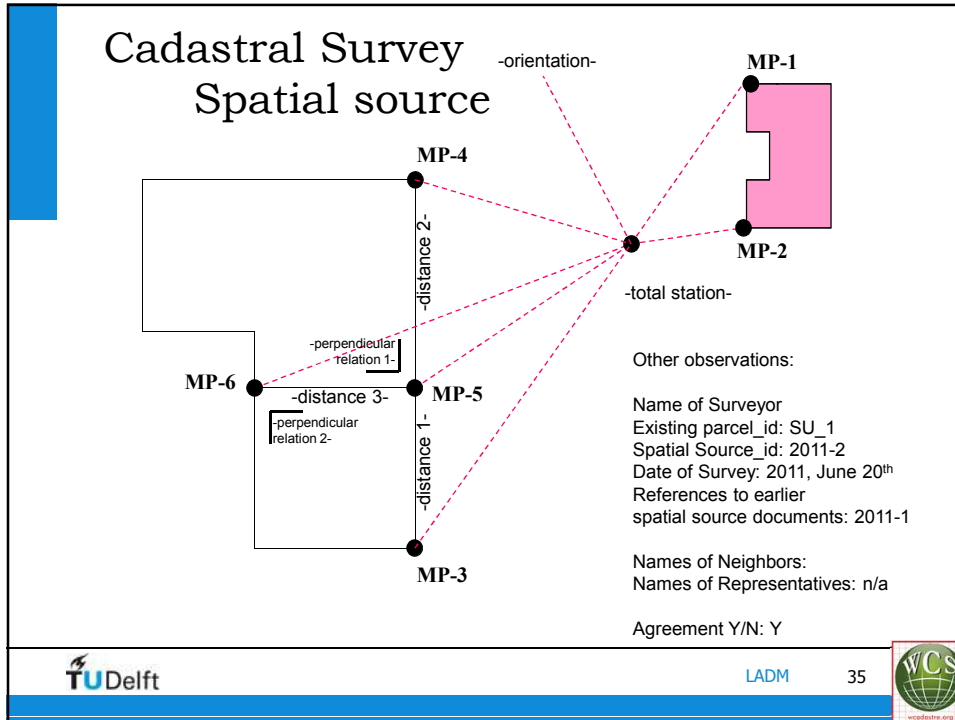
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2D and 3D Integration

- between 2D and 3D spatial unit transition via *liminal* spatial units
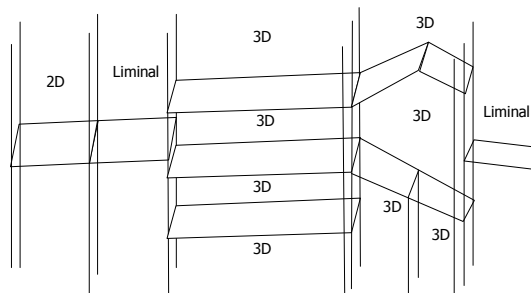
- Liminal spatial units are 2D parcels, but are stored as 3D parcels

- Liminal spatial units are delimited by a combination of LA_BoundaryFace and LA_BoundaryFaceString objects

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Cadastral Survey Spatial source

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

Standardize

LA_Party — LA_RRR — LA_BAUnit — LA_SpatialUnit

1. Why?
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In the context of ISO 19152:2012 LADM
Land Administration Domain Model

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How to realize LA standardization

1. Involve all stakeholders and learn from other countries
2. Determine scope/ambition level, besides ownership, also:
   leases, mortgages, restrictions, spatial planning, urban, rural, infrastructure (road, rail, utilities), public/private spaces, forest, marine, archaeology, mining rights, groundwater, responsibilities, ..
3. Develop conceptual model (in packages)
4. Derive technical model
5. Test/assess model with prototype(s), data conversion/collection
6. Apply SDI thinking
   - between LA-parts/packages, also
   - to External classes
7. Realize operational production LA system

8. Use and maintain
9. Participate in (international) standardization: ISO, FIG, INSPIRE

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Develop LADM country profile (conceptual model)

- Design, develop and test a complete LADM country profile for (2D and 3D) cadastral registration system in country

- Partly based on the country's existing LA system and new developments inspired by the LADM standard

- Attempt to cover all LA related information in the model
  → *even if data maintained by different organizations*

- Often (several) novel aspects for country LA may be introduced: 3D, integrated history, link to sources, link spatial-legal, BAUnit concept, topology, quality ISO 19115, unique id's all data, …

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Example: Malaysian LA organizations

- Dept of Survey and Mapping Malaysia (DSMM) or JUPEM in Malay
- Land Offices (for administrative/legal data) or PTG in Malay
- Malaysian Centre for Geospatial Data Infrastructure (MaCGDI)

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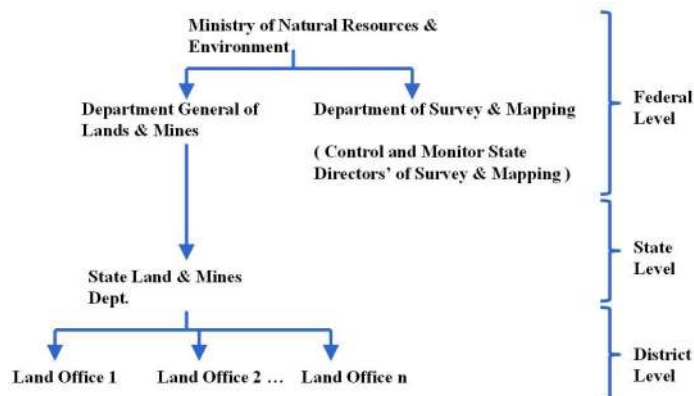
Example: Israel SDI approach

- Establish national SDI enabling meaningful exchange of information between different organizations within Israel):
  1. Survey of Israel (SOI) +
     Licensed Surveyors (LSs, creating new 2D/3D representations)
  2. Land Registry (LR, register apartments, condominiums in 3D),
  3. Israel Land Authority (ILA, 93% of Israel in public domain),
  4. Others: Interior Min (plans), Construction, Tax/bank, Municipalities,..

Illustration:
Yaron Felus/Shimon Barazani

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Checklist of FIG 3D Cadastre WG

- What are the types of 3D cadastral objects?
  → *E.g. a. related to (future) constructions (buildings, pipelines, tunnels, etc.), and b. any part of 3D space (airspace, subsurface)*

- 3D Parcels also for simple apartments/ condominium buildings?
  → *Yer or No, shorter or longer term option*

- 3D Parcels for infrastructure objects, such as long tunnels, pipelines, cables: divided by surface parcels or single object?
  → *Try avoiding too much splitting (perhaps cadastral section)*

- For representation of 3D parcel, has legal space own geometry or specified by referencing to existing topographic objects
  → *Coordinate cadastre or general boundaries based*

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LADM Country Profile
(source documents)

- All information in the system should originate from source documents

- In case of spatial source documents; i.e. subdivision/mutation plans there are links with spatial unit and point tables

- In case of administrative source documents (i.e titles) there are associations with RRRs (incl. mortgage) and BAUnit

- Unique identifier for all objects in model (not only parcels) →crucial for SDI (links)

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LADM Country Profile
(even more model considerations)

- There may be cases (in the future) where one BAUnit (with same RRRs attached) has multiple Spatial Units

- To make the model comprehensive and future proof, a range of spatial units is supported: 2D and 3D

- Various types of spatial units may be organized in levels, e.g.:
  1. Base layer with parcels
  2. Apartment right
  3. Utilities, tunnels, pipelines, etc.
  4. Other 3D subparcels (joined)

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LADM Country Profile (code lists)

- Standard code lists for allowed attribute values

- Codes should cover the spatial part and non-spatial part

- In most cases, values are proposed for the LADM code lists

- In future there may be a global (ISO/ FIG/ OGC) organization, maintaining code list and their values

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LADM's current code lists for Administrative Package (annex J.2)

«codeList» Administrative:: LA_RightType
+ agriActivity
+ commonOwnership
+ customaryType
+ fireWood
+ fishing
+ grazing
+ informalOccupation
+ lease
+ occupation
+ ownership
+ ownershipAssumed
+ superficies
+ usufruct
+ waterrights
+ tenancy

«codeList» Administrative:: LA_MortgageType
+ linear
+ levelPayment
+ microcredit

«codeList» Administrative:: LA_AvailabilityStatusType
+ archiveConverted
+ archiveDestroyed
+ archiveIncomplete
+ archiveUnknown
+ docAvailable

«codeList» Administrative:: LA_AdministrativeSourceType
+ agriLease
+ agriNotaryStatement
+ deed
+ mortgage
+ title
+ agriConsent

«codeList» Administrative:: LA_BAUnitType
+ basicPropertyUnit
+ leasedUnit
+ rightOfUseUnit

«codeList» Administrative:: LA_ResponsibilityType
+ monumentMaintenance
+ waterwayMaintenance

«codeList» Administrative:: LA_RestrictionType
+ adminPublicServitude
+ monument
+ monumentPartly
+ mortgage
+ noBuilding
+ servitude
+ servitudePartly

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Conceptual to technical model

- Conversion takes technical design decisions for:
  - ID, PK, FK and versioning
  - Relationships between objects
  - Constraints
  - Derived attributes/ relationships
  - Multiplicity of attributes
  - Indexing and clustering
  - 2D/3D geometry/topology structure

- Resulting database schema will consist of:
  - Normal table
  - Relationship table
  - View on table (with derived attributes added)
  - Code list table

- Also possible to derive exchange format (XML schema)

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Constraints

- Very important as they specify what is valid data

- There are many types of constraints: e.g.
  - primary key must be unique,
  - endDateTime > beginDateTime,
  - boundary of parcel must be closed,
  - boundaries may not intersect (topology constraints),
  - sum of ownership right shares must be 1,
  - and so on

- It would also be possible to use GIS or database built-in functionality; for example, Esri's or Oracle's versioning

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Multiplicity of attributes

- In LADM country profile, it is possible to have attribute with multiple values; e.g. multiple types of area/volume attributes (surveyed, official and calculated)

- There are at least 3 different ways to implement this:
  1. additional table for this multiple attribute,
  2. use varray to represent all values or
  3. have a fixed number of area/volume attribute (e.g. 3 or 4 and indicate in name of attribute which area/volume type is intended)

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2D/3D geometry/topology structure

- For all spatial types in model decide what data type to use in database: string, blob, Esri geometry, Oracle geometry, standard SQL/SFS, etc.

- With or without topology structure: both options possible (but given the importance of boundary, as basis of cadastre, and avoiding storing same point several times → topology preference)
  - The end points of an edge (node), play an important role in the topology of the model and therefore it is good to be able to differentiate them from intermediate points
  - The topology implementation can be based on own structure
  - The alternative would be to use the SDO_TOPO package from Oracle (available version 11 and higher)

- Note: no 3D topology standard available in Esri or Oracle

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Resulting technical database model: SQL DDL and DML

```
CREATE TABLE  MY_POINT (
pid varchar2(10) primary key,
sid varchar2(25) REFERENCES my_spatialsource(sid),
survey_point mdsys.sdo_geometry,
transformation varchar2(250),                          SQL DDL
map_point mdsys.sdo_geometry,
type varchar2(5) REFERENCES la_pointtype(cid),
begin_date_time timestamp,
end_date_time timestamp);

----------------------------------------------------------------

INSERT INTO MY_POINT VALUES (
'N1',
'04-42351',
MDSYS.SDO_GEOMETRY (2001,24571,MDSYS.SDO_POINT_TYPE (23664.166398,12426.942536,NULL),NULL,NULL),
'NULL',
MDSYS.SDO_GEOMETRY (2001,24571,MDSYS.SDO_POINT_TYPE (23764.739732,12526.967747,NULL),NULL,NULL),
'PN01',
'01-JAN-14 08:10:04.20',                               SQL DML
'');
```

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Conformance testing at model level (of e.g. country profile)

1. Any system claiming to be ISO19152 conformant, has to pass the Abstract Test Suite (ATS, Annex A)

2. Conformance can be tested per
   - Package: Party, Admin, Spatial Unit, (subpackage) Survey
   - Level: 1=basic, 2=medium, 3=full

3. Three outcomes: conformant, notConformant, notEvaluated

4. Proof of conformance (executing the test)
   - Analyse inheritance between LADM and derived model or
   - Create mapping table between LADM and derived model

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Conformance testing packages, levels (1/2)

package	LADM class		Dependencies
-	*VersionedObject*	1	
	LA_Source	1	Oid, (as a minimum one of the specializations must be implemented [LA_AdministrativeSource or LA_SpatialSource]), LA_AvailabilityStatusType
Spatial Unit			
	LA_SpatialUnit	1	VersionedObject, Oid,
	LA_SpatialUnitGroup	2	VersionedObject, Oid, LA_SpatialUnit
	LA_LegalSpaceBuildingUnit	3	LA_SpatialUnit
	LA_LegalSpaceUtilityNetwork	3	LA_SpatialUnit
	LA_Level	2	VersionedObject, Oid
	LA_RequiredRelationshipSpatial Unit	3	VersionededObject, LA_SpatialUnit
Surveying			
	LA_Point	2	VersionededObject, Oid, LA_SpatialSource, LA_PointType, LA_InterpolationType
	LA_SpatialSource	2	LA_Source, LA_Point, LA_Party, LA_SpatialSourceType
	LA_BoundaryFaceString	2	VersionedObject, Oid, LA_Point (if using geometry)
	LA_BoundaryFace	3	VersionedObject, Oid, LA_Point (if using geometry)

Conformance testing packages, levels (2/2)

package	LADM class		Dependencies
Party			Exist only if Administrative Package is implemented
	LA_Party	1	VersionedObject, Oid, LA_PartyType
	LA_GroupParty	2	Oid, LA_Party, LA_GroupPartyType
	LA_PartyMember	2	VersionedObject, LA_Party, LA_GroupParty
Admin			Exist only if Party Package is implemented
	LA_RRR	1	VersionedObject, Oid, LA_Party, LA_BAUnit, LA_Right (as a minimum, this specialization shall be implemented), LA_AdministrativeSource
	LA_Right	1	LA_RRR, LA_RightType
	LA_Restriction	2	LA_RRR, LA_RestrictionType
	LA_Responsibility	3	LA_RRR, LA_ResponsibilityType
	LA_BAUnit	1	VersionedObject, Oid, LA_RRR, LA_BAUnitType
	LA_Mortgage	2	LA_Restriction
	LA_AdministrativeSource	1	LA_Source, LA_Party, LA_AdministrativeSourceType, LA_AvailabilityStatusType
	LA_RequiredRelationshipBAUnit	3	VersionedObject, LA_BAUnit
	LA_BoundaryFace	3	VersionedObject, Oid, LA_Point (if using geometry)

Example ATS
A.2.4 Test case identifier: Administrative::LA_Right

a) Test Purpose: if LA_Right is implemented, to ensure that the implementation package under test contains at least one class conformant with the definition of one of the specializations of class LA_Right and has all mandatory attributes and association roles of LA_Right.
b) Test Method: examine the application schema of the implementation under test, including class, attribute(s) and association definitions.
c) Reference: level 1 requirement, see 6.4.2 and 6.4.3.
d) Test Type: Basic.

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Standard maintenance

- As the LADM standard is now being used (and read by further eyes) it is inevitable that further issue will arrive

- These can range from:
  1. detecting and correcting simple text error
  2. via omissions
  3. to further extensions of the standard

- E.g. extension of the legal model conform the proposal of Paasch or informative code lists need further structuring and formalization

- Use ISO LADM Wiki for communication http://isoladm.org

- ISO has standardized standard maintenance procedure

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http://isoladm.org

FIG LADM Governance Group

- Conclusion from 5th LADM Workshop (Kuala Lumpur, sept'13): Governance structure is needed.
- Proposal: LADM Governance within FIG to be led by the OICRF - the International Office of Cadastre and Land Records
- Members: ISO 19152 editors, Worldbank, UN Habitat, FAO, FIG comm 3+7, FIG Young surveyors, …

- Activities of LADM governance group:
  1. maintenance of LADM in accordance to ISO requirements
  2. registry for various code lists (and web services for use)
  3. collect and disseminate best practices
  4. plan LADM related events (stand-alone or combined)
  5. check if system (model) is LADM conformant

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Standardize

LA_Party — LA_RRR — LA_BAUnit — LA_SpatialUnit

1. Why?
2. What?
3. How?

Conclusion

In the context of ISO 19152:2012 LADM
Land Administration Domain Model

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Conclusion (1/2)

- LADM standardizes both administrative (legal) and spatial aspects
- LADM in parallel by ISO and CEN
- Consensus process → acceptance by wide community
- Conformance testing
- Many country profiles developed in Annex D: *Portugal, Queensland (Australia), Indonesia, Japan, Hungary, The Netherlands, Russian Federation, and Republic of Korea* (and also: *Canada, Croatia, Cyprus, Israel Honduras, Poland, Portugal, Malaysia* and others)

- From conceptual model to technical model
- Explicit relationship with other domain models *<<blueprint>>*
- Based on other ISO standards ISO 19107, 19111, 19115, 19156
- Land Administration *cornerstone* of the SII (Geoweb)

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Conclusion (2/2)

- Support complete *development life cycle* of rural+urban areas:
  - develop and register zoning plans,
  - design new spatial units/objects;
  - acquire appropriate land/space (after financing);
  - request and provide (after check) permits;
  - construct and build; and
  - use, manage and maintain, etc.

all related to cadastral registration and more and more 3D.
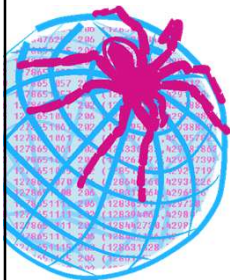
- Standardization is a condition for realizing the GII
- Domain models (themes) contain knowledge
- (G)II or SDI is mega-construction
- ISO (TC211) is often the foundation
- ISO 19152 / LADM and INSPIRE cadastral parcel have different scope, but are consistent in their overlap

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- Clarissa Augustinus and Jaap Zevenbergen with STDM
- Many, many others contributed by developing country profiles, performing reviews, participation in discussions and so on

→ *Thank you very much!!!!!*

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