# Land Administration Standardization with Focus on Evidence from the Field and Processing of Field Observations

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FIG Working Week 2012, Rome, Italy 6–10 May 2012,

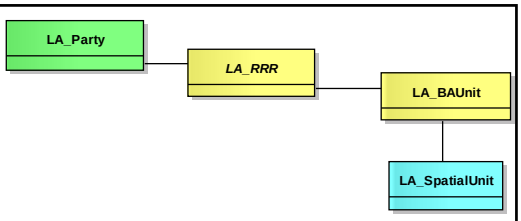
TS04C – Cadastre and Spatial Information, Tuesday, 8 May 09:00–10:30



## 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, ...

# Contents




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

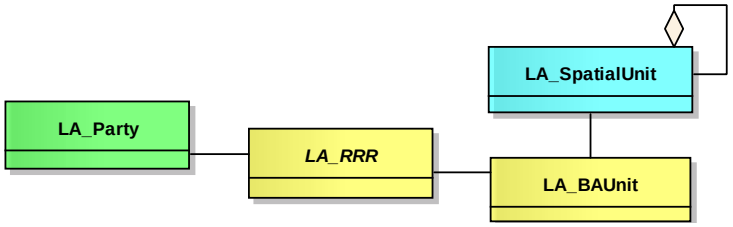


# ISO 19152 (=LADM) Scope

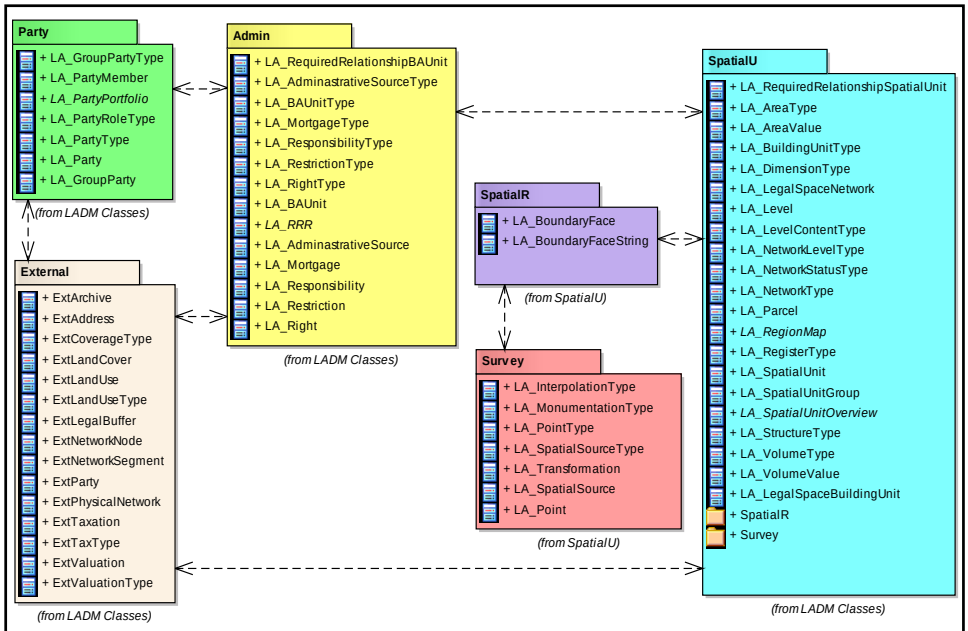
- Reference model (abstract, conceptual schema)
- Land/water, below/above surface
- Basic classes:
  1. parties,
  2. rights, responsibilities, restrictions,
  3. spatial units (incl. spatial sources and spatial representations)
- Terminology enabling communication
- Shared description of formal or informal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

| Voting | NWIP | CD | DIS |
|---|---|---|---|
| Approve | 15 | 22 | 26 |
| Disapprove | 6 | 3 | 2 |
| Abstain | 4 | 4 | 4 |
| Not Voted | 7 | 3 | 0 |

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



## External classes (Domains)

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

→ Related, but outside the scope of LADM

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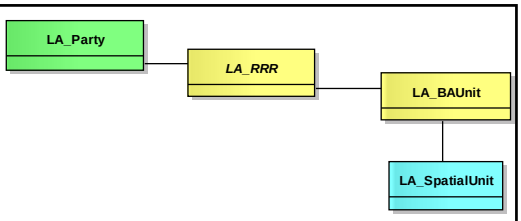


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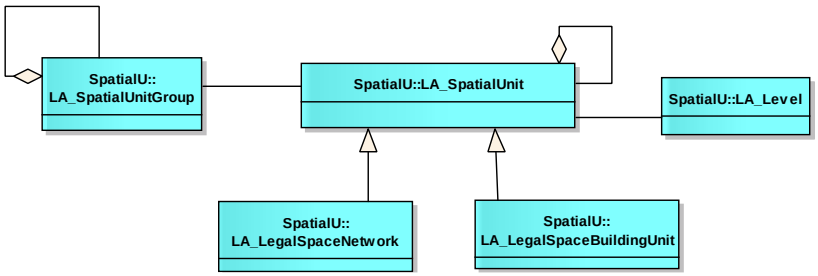
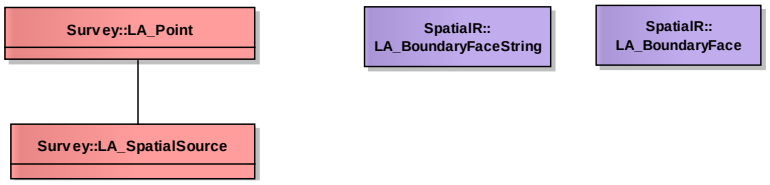
# LA_SpatialUnit (alias LA_Parcel)

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

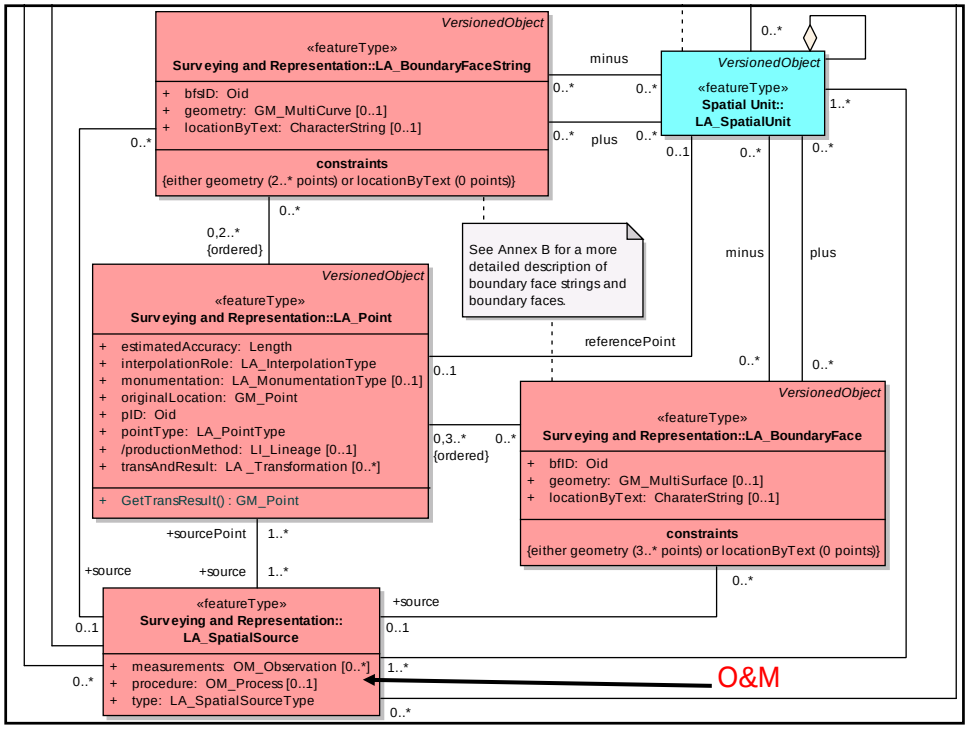


# Spatial Representation and Survey subpackages of SpatialUnit

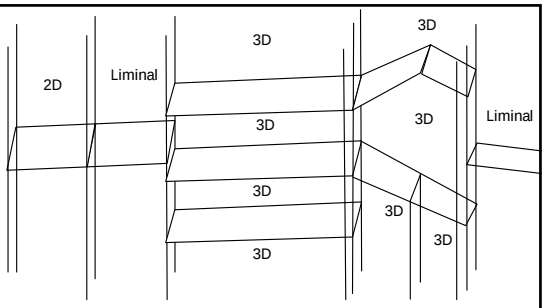
- Geometry, topology of Spatial Units (based ISO 19107)
- Spatial source (based ISO/CD 19156 Observations and Measurements)





# Spatial Units in 3D




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

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



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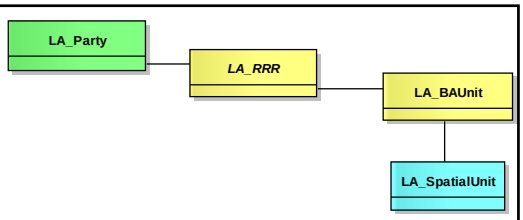


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# Relationships ISO/TC211 family

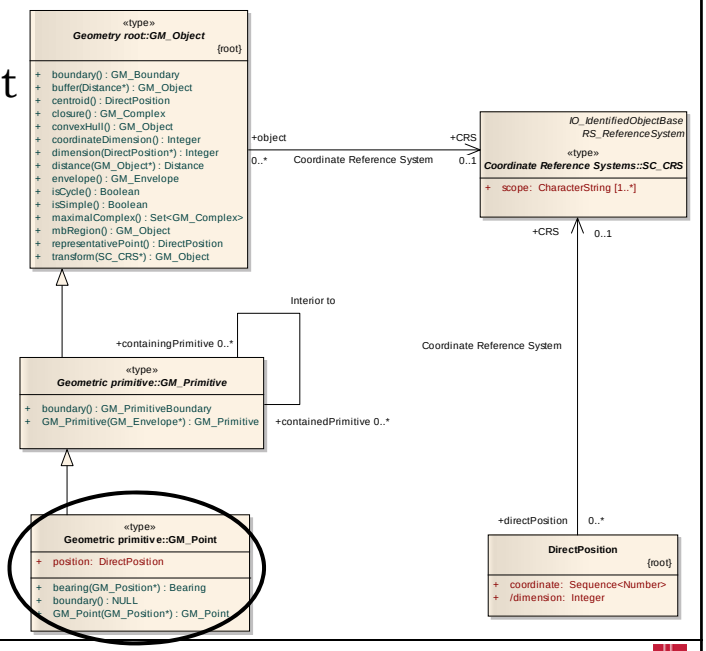
- ISO/IS 19107 Spatial Schema
- ISO/IS 19108 Temporal Schema
- ISO/IS 19111 Referencing by Coordinates
- ISO/IS 19115 Metadata
- ISO/DIS 19156 Observations and Measurements (O&M)

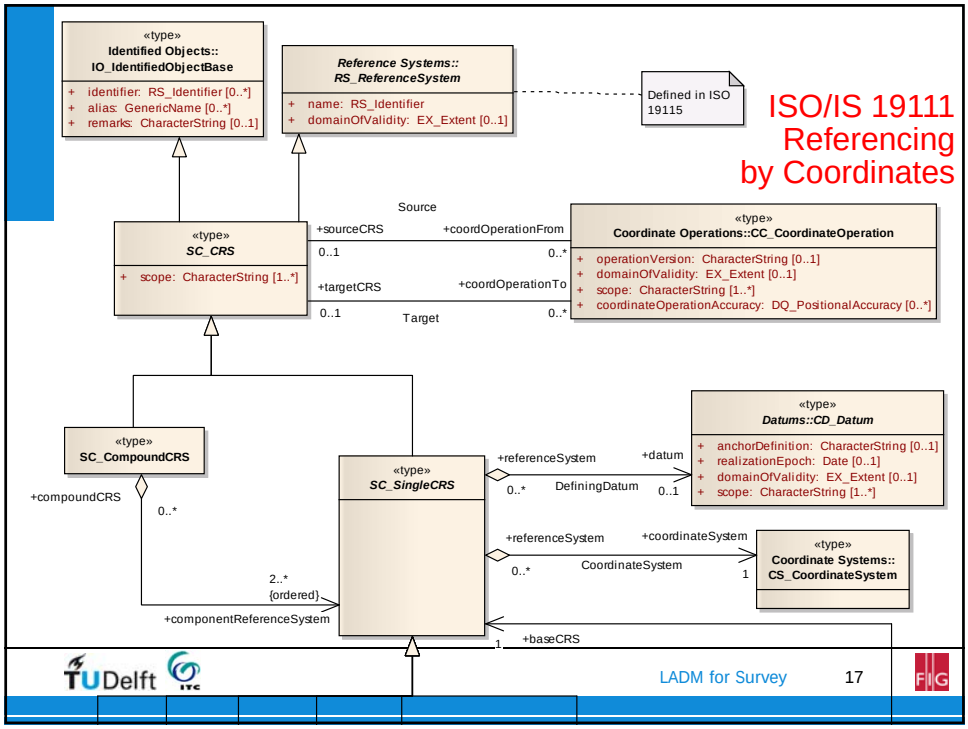
- GM_Point (19107)
- Coordinate Reference System (19111)
- DQ_Element (19115)
- OM_Observation & OM_Provess (19156)



# GM_Point

- Part of large model: ISO 19107
- Many (inherited) methods
- One attribute DirectPosition
- Note SC_CRS (ISO 19111)

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Defined in ISO 19115
ISO/IS 19111
Referencing
by Coordinates
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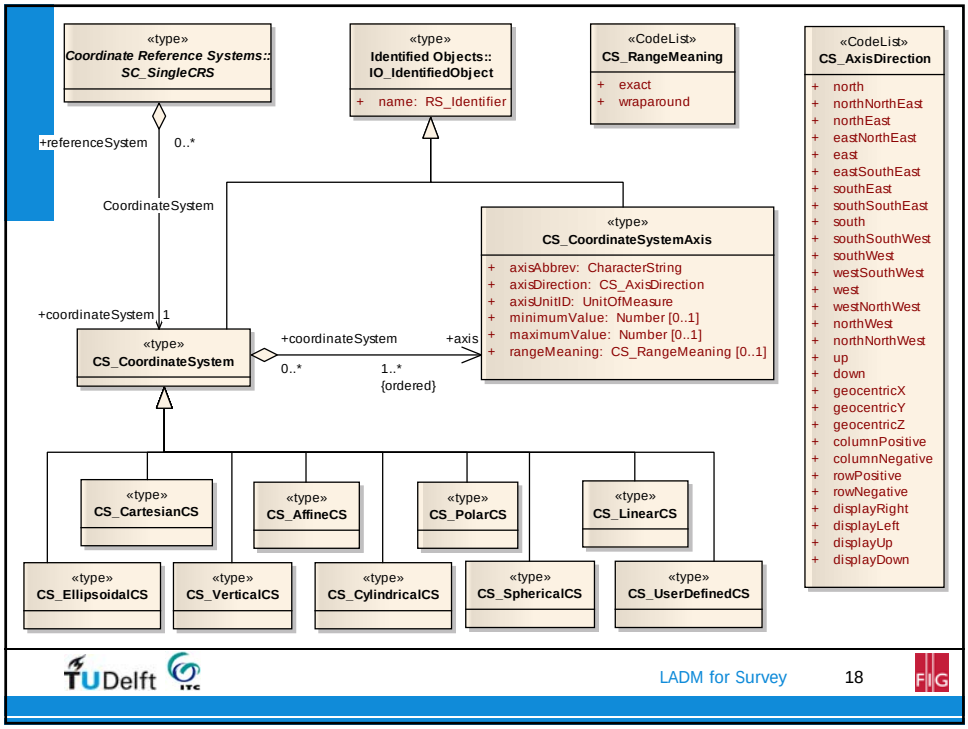
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+ wraparound
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+ axisDirection: CS_AxisDirection
+ axisUnitID: UnitOfMeasure
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CS_CylindricalCS
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CS_SphericalCS
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CS_UserDefinedCS
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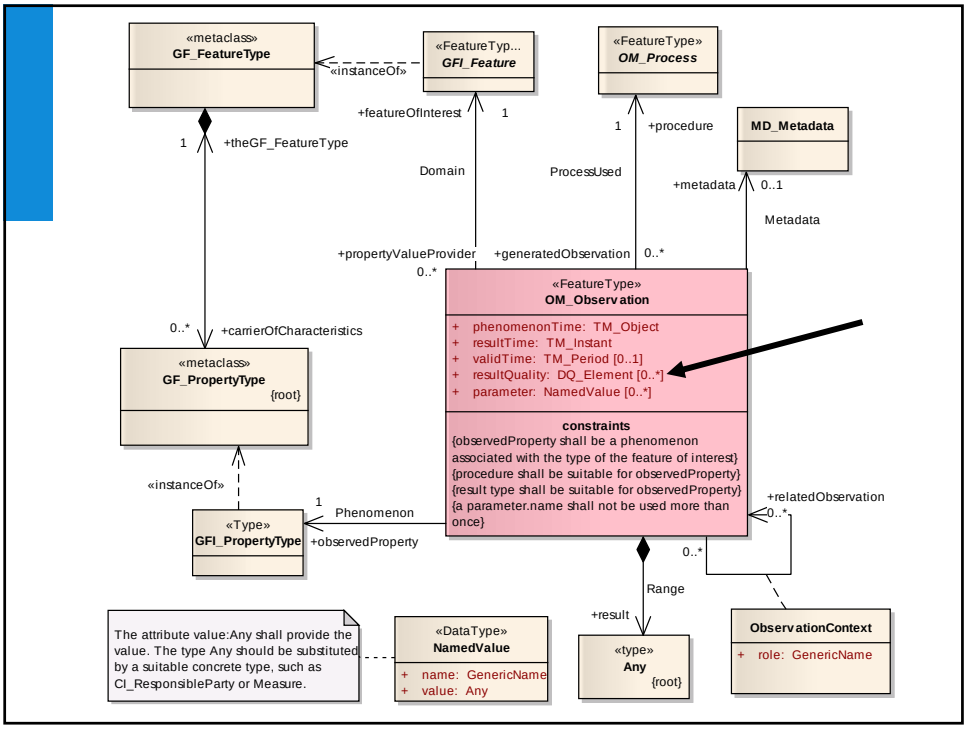
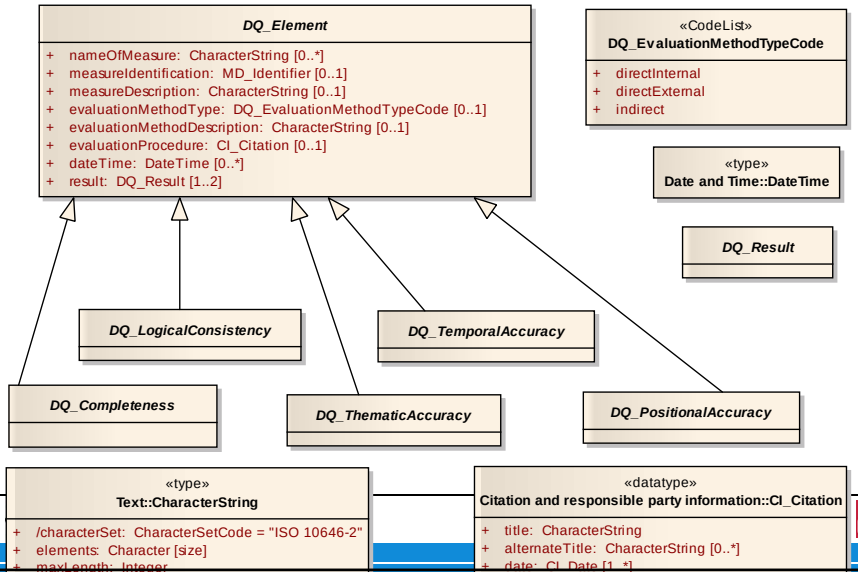
# Observations and Measurements

- 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





# DQ_Element (ISO 19115)

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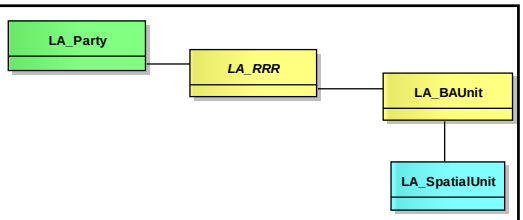


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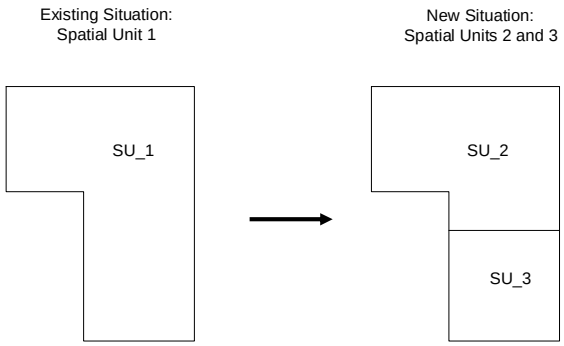
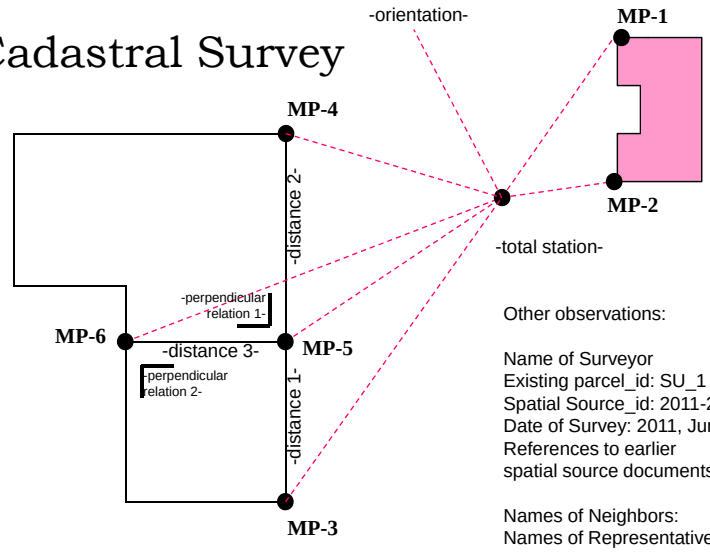
# Survey approach

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






# Cadastral Survey




Other observations:

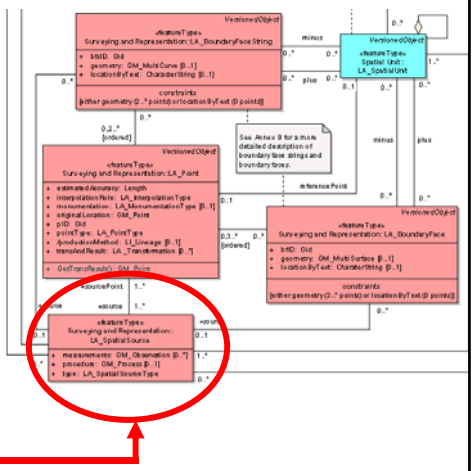
Name of Surveyor
Existing parcel_id: SU_1
Spatial Source_id: 2011-2
Date of Survey: 2011, June 20th
References to earlier
spatial source documents: 2011-1

Names of Neighbors:
Names of Representatives: n/a

Agreement Y/N: Y

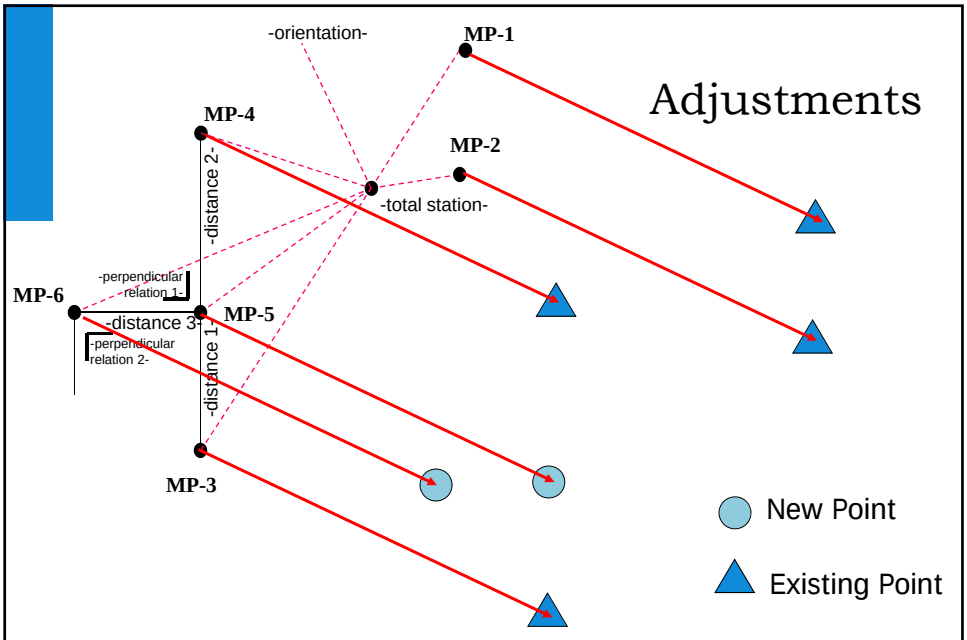
# Original O&M into LA_SpatialSource

| |
|---|
| 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 |

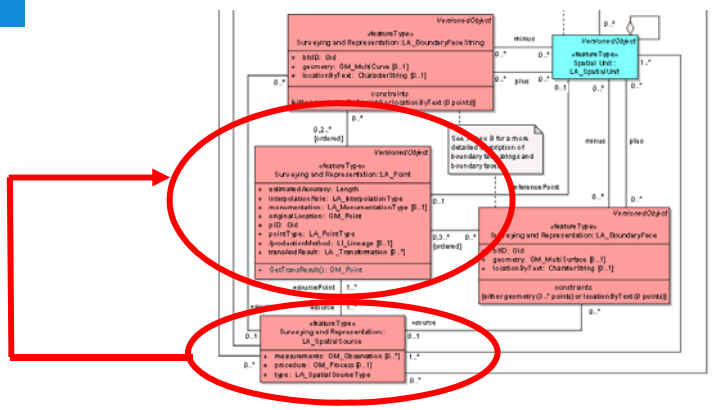




# Adjustments



# Adjustment: Original O&M adjusted to Geo DB using existing Points



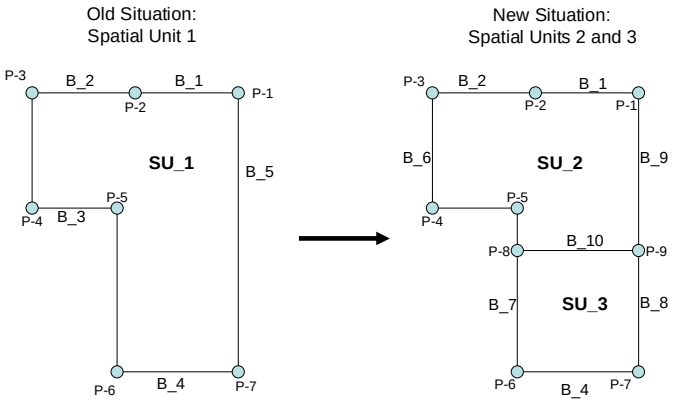
Accuracy Labels can de included now



# 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..*)

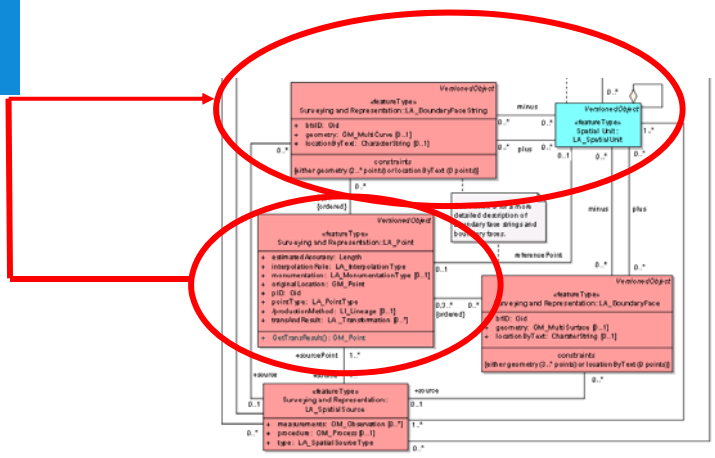
# New Spatial Units created



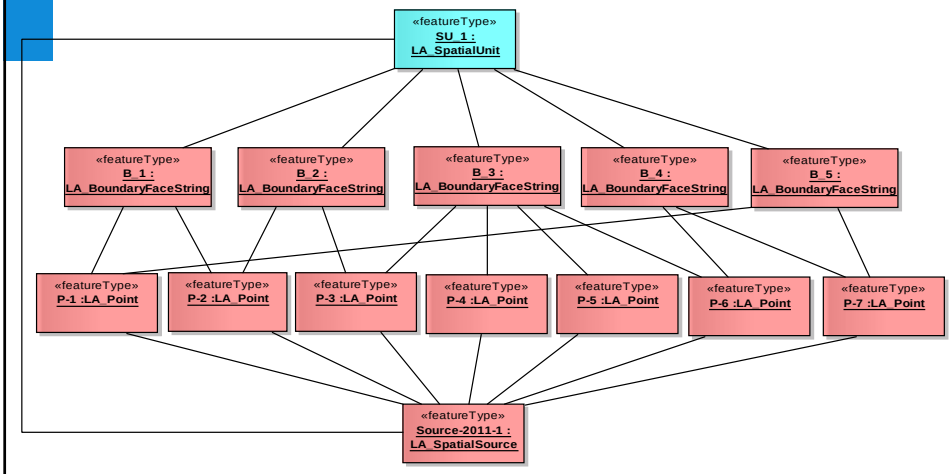

- New LA_Points used to create new LA_BoundaryFaceStrings and these are used to create new LA_SpatialUnits
- All linked in LADM: chain from LA_SpatialSource to LA_SpatialUnit
  → instance level diagrams before and after split



# Object Creation

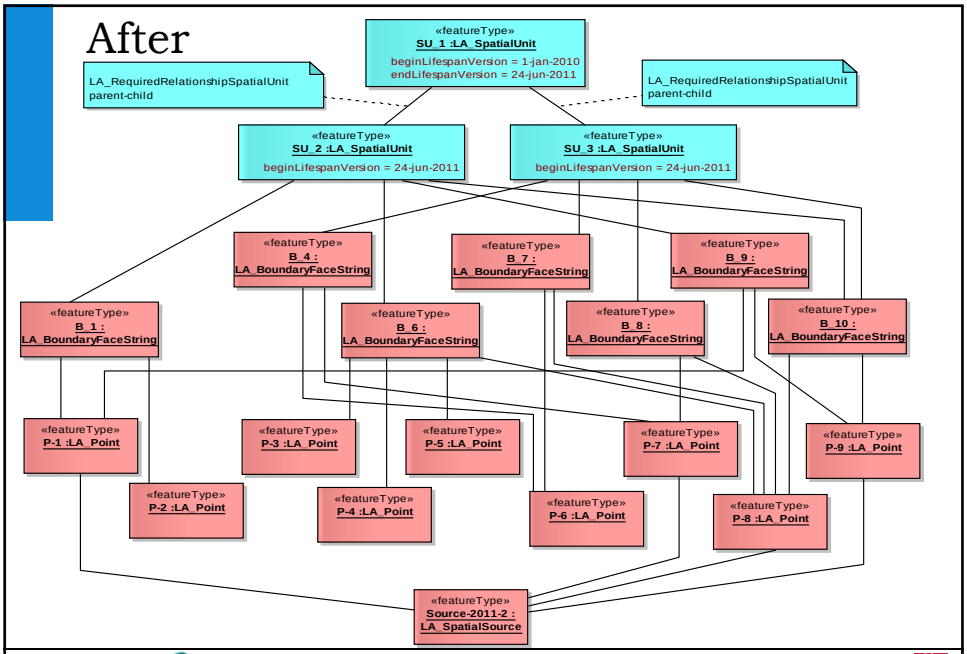


# Instance level diagram, before split






# After



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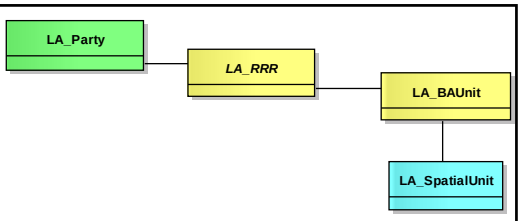


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# Conclusion

- 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