3D spatial units – considering the ISO 19152 standard (LADM) as a base for 3D Cadastre

Karel JANEČKA, Pavel RAK
University of West Bohemia
Pilsen, Czech Republic
Content

• Motivation for 3D Cadastre
• 3D spatial units according to ISO 19152 (LADM)
• FIG activities on 3D Cadastre
in 2D: Right of Easement

(věcné břemen)
Right of Easement
(current solution in 2D)

(Bumba 1999)
ISO 19152 Land Administration Domain Model

• is a conceptual schema for 3D Cadastre
• is based on four basic classes
  – Class LA_Party
  – Class LA_RRR
  – Class LA_BAUnit
  – Class LA_SpatialUnit

• **Spatial Unit** = single area (or multiple areas) of land and/or water, or a single volume (or multiple volumes) of space
Classes of Spatial Unit Package

(Spatial Unit::
LA_RequiredRelationshipSpatialUnit)

(Spatial Unit::
LA_SpatialUnitGroup)

(Spatial Unit::
LA_SpatialUnit)

(Spatial Unit::(LA_Parcel)
LA_SpatialUnit)

(Spatial Unit::
LA_Level)

(Spatial Unit::
LA_LegalSpaceUtilityNetwork)

(Spatial Unit::
LA_LegalSpaceBuildingUnit)

(ISO 19152)
Utility Network

GaiaFarmCredit : LA_Party
  type = nonNaturalPerson
  role = moneyProvider

Case15 : LA_Mortgage
  ranking = 1
  interestRate = 5.0
  amount = {250000, dollar}
  type = linear

CableTVNet_Gaia : LA_LegalSpaceUtilityNetwork
  label = "CableTVNet_Gaia SubNet"
  suID = 145
  dimension = 3D
  type = telecommunication
  status = inUse
  surfaceRelation = below

CableTVNet : LA_Party
  type = nonNaturalPerson

networkOwnership : LA_Right
  type = ownership
  share = 1/1

CableTVNET_Gaia : LA_BAUnit
  name = gaiaSubnet

(ISO 19152)
Cooperative property

Housing Co-operative x House Unit Owners Association

(Bydłosz 2012)
Apartment building – a point of view of apartment owner

This diagram evolves from the point of view of a given apartment owner, Frank.

Frank : LA_Party
  type = apartment
  share = 1/1

CommonParts : LA_Right
  share = 1/100
  type = apartment

FiveStar_GroundParcel : LA_BAUnit
  buildingUnitID = 104
  type = shared

IndividualUnit : LA_BAUnit

FiveStar_GroundParcel : LA_SpatialUnit

FiveStar_Commons : LA_LegalSpaceBuildingUnit
  type = shared

FiveStar_2A : LA_LegalSpaceBuildingUnit
  buildingUnitID = 110
  type = individual

WholeBuilding : LA_LegalSpaceBuildingUnit
  suID = 100

(ISO 19152)
2D boundary representation - **boundary face string** concept

- GM_MultiCurve (linestring) used for **boundary face strings** storage

(ISO 19152)
Spatial units defined by boundary face strings

(Linestring at local ground level)

(ISO 19152)
3D boundary representations – boundary faces concept

- Used when the implied vertical and unbounded faces of a boundary face string are not sufficient to describe 3D spatial units.
- Close volumes in height (e.g. every apartment floor), or in depth (e.g. an underground parking garage).
- GM_Surface (that may be curved) used for boundary faces storage.
3D (topology based) cadastre

This is the spatial profile of a pure 3D topology structure (so no 2D or liminal representations in this level). There are no overlapping volumes (3D_SpatialUnits). However, volumes may be open at the bottom or at the top, corresponding to non-bounded 3D_SpatialUnits (in this case the size of the volume cannot be computed). The following class should be omitted from any implementations of the 3D_ProfileDefinition: LA_BoundaryFaceString. This is the topological spatial profile for the 3D case. Note that in 3D_Level the attribute structure is fixed to 'topological'. In the 3D_SpatialUnit the attribute dimension is fixed to '3D'; there still is an optional referencePoint, which should be provided via a 3D GM_Point. Finally, there are a set of constraints defining a valid topological structure for a 3D volume partition.

(ISO 19152)
Example of 3D spatial unit – using boundary face concept

ISO 19152
Bounded and unbounded 3D volumes

Side view showing the mixed use of *boundary face strings* and *boundary faces* to define both bounded and unbounded 3D volumes.
Garage as a 3D object

(Bumba 1999)
FIG & 3D Cadastre

• Questionnaire – 3D Cadasters
  – In 2010: 43 countries involved (21 from Europe), Czech Republic didn’t participate
  – In 2014: ??? countries involved, inc. Czech Republic
It is no longer a question if 3D cadastre should be realised, but **when** and **how**.
Thank you for your attention!

This work was supported by the European Regional Development Fund (ERDF), project “NTIS – New Technologies for the Information Society”, European Centre of Excellence, CZ.1.05/1.1.00/02.0090.

kjanecka@kma.zcu.cz
References


• ISO 19152. Land Administration Domain Model.
