Hochschule für Technik Stuttgart

HFT Research

The possibilities of using CityGML for 3D representation of buildings in the cadastre

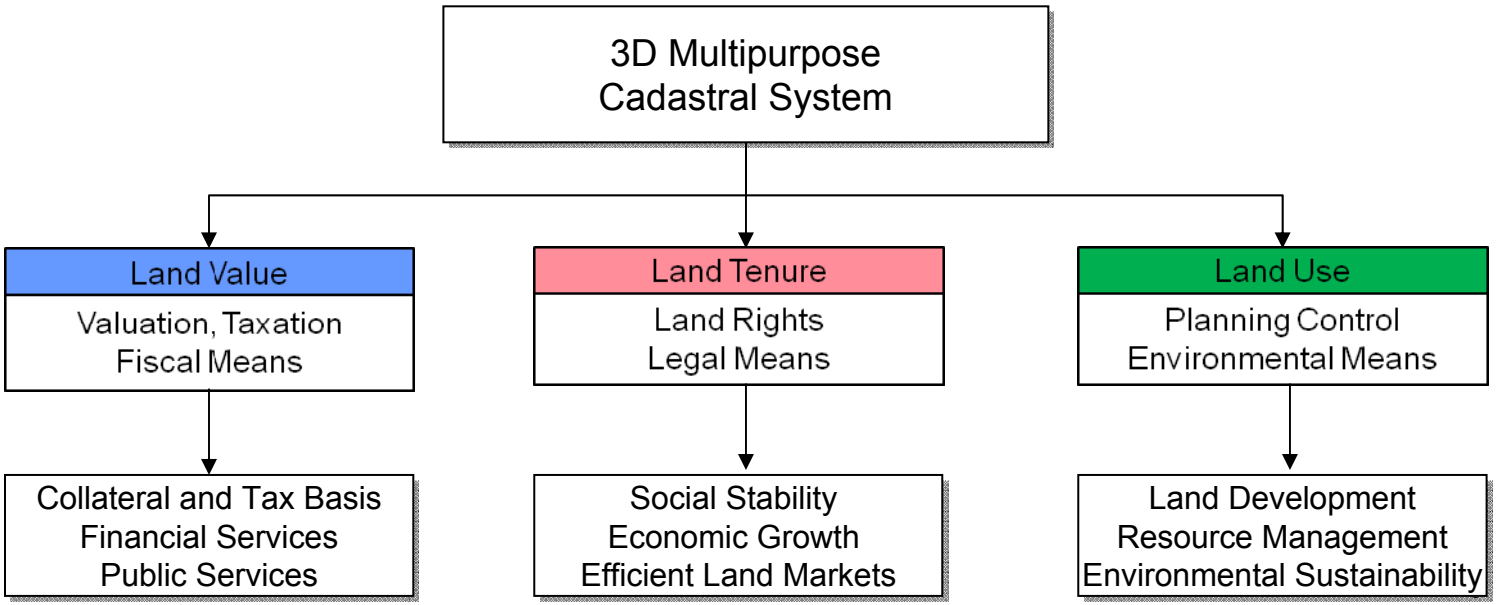
Prof. Dr. Volker Coors
Prof. Dr. Peter van Oosterom
Prof. Dr. Wojciech Pachelski
Katarzyna Góźdź

Content

- Introduction
- Cadastral registration in Poland
- Conceptual integration of the LADM and CityGML
- Case studies
- Conclusion

Motivation

- Development of 3D multipurpose cadastral system, based on International Standards.



(Enemark, 2004)

ISO 19152 Scope

Standardisation
of the legal world content
(real estates with RRR)

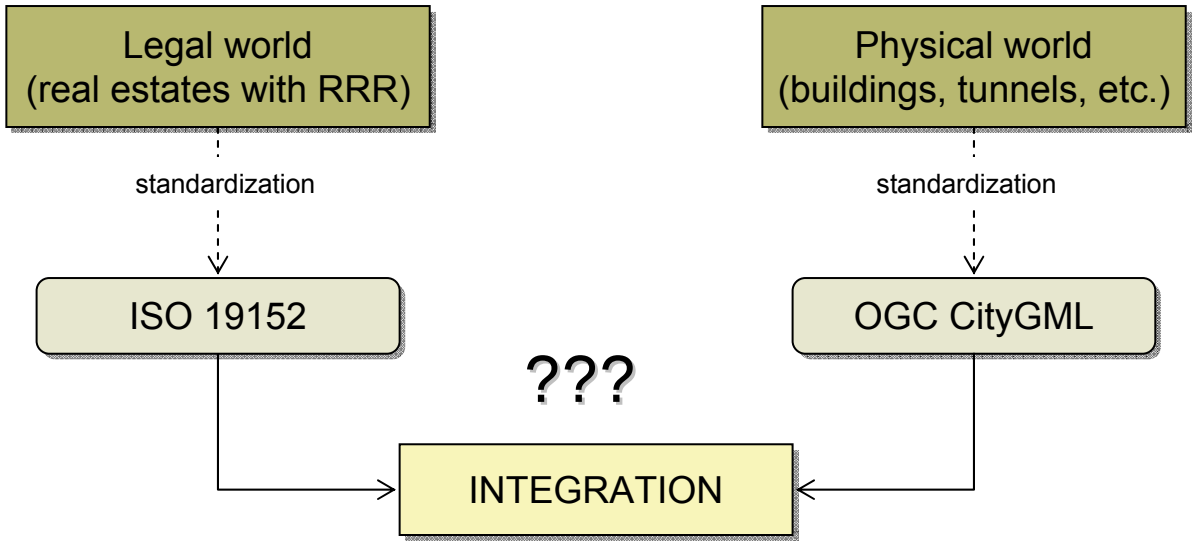
- a reference covering basic information-related components of Land Administration
- abstract, conceptual schema related to: (1) parties, (2) basic administrative units, rights, responsibilities and restrictions, (3) spatial units, (4) spatial sources and spatial representations
- terminology enabling communication
- basis for national, and regional profiles

CityGML Overview

Standardisation
of the physical world content
(buildings, tunnels, bridges, ...)

- gespatial information model for 3D urban landscapes
- data exchange format
- modular structure
- five consecutive Levels of Detail (LOD 0-4)
- based on GML 3.1.1
- extandable Multipurpose Model

Research question



How to provide relations between spatial objects from legal and physical world?

Registration of buildings: the case of Poland

- Three types of real estates:
  1. land real estate
  2. building real estate
  3. apartment real estate

- Two cadastral registration cases for buildings:
  1. building as an element of land parcel (with the same legal status)
  2. building as a separate real estate (legal costruct accessible only for buildings located on lands belonging to governmental entities)

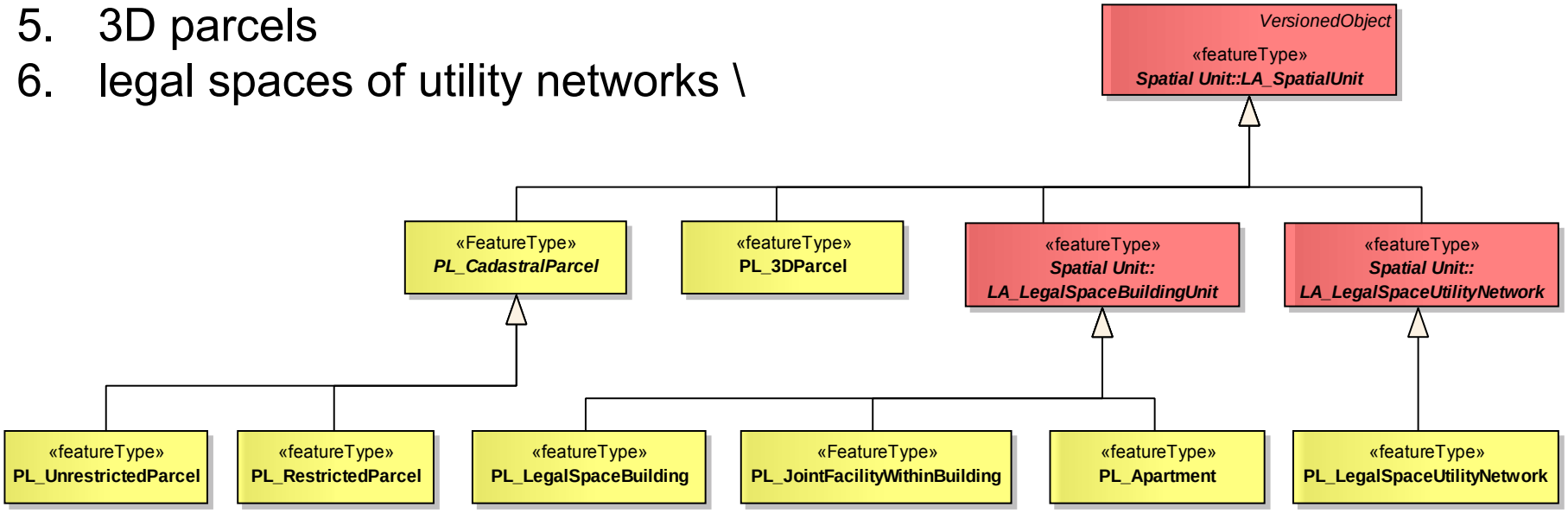
- Other aspects of Polish cadastre:
  - multipurpose (a variety of information about physical features of buildings, detailed geometry = distinction of building parts)
  - 2D (serious complications with providing information about the legal status of properties in case of 3D complex situations)

Polish LADM profile - Spatial Package ‘extension’

Proposed types of cadastral objects:

1. land parcels (unrestricted and restricted)
2. legal spaces of buildings
3. apartments
4. joint facilities within buildings
5. 3D parcels
6. legal spaces of utility networks \

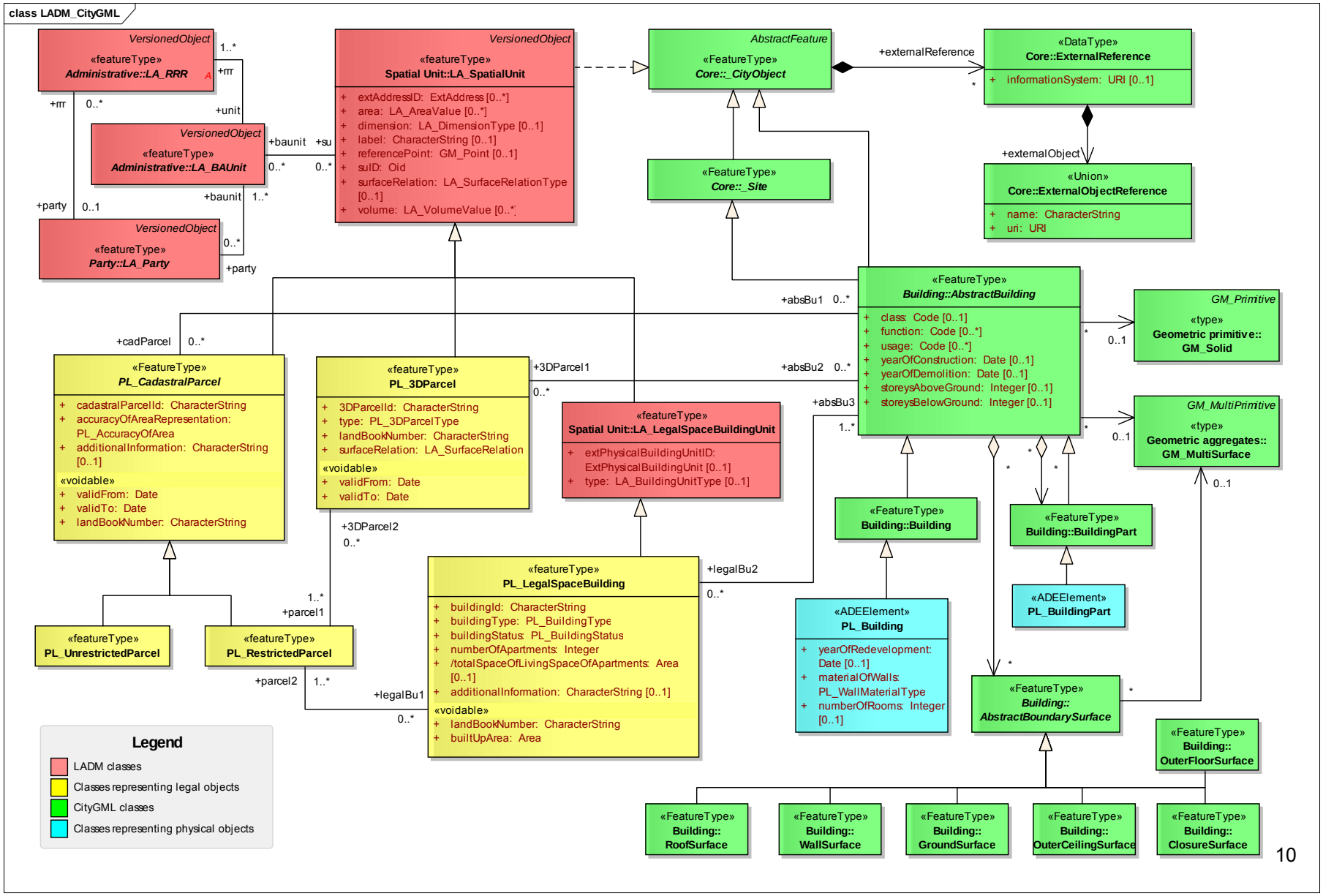
PROPOSAL
(not implemented yet)



CityGML ADE for land administration purposes

- Assumption: Spatial Objects are elements of the City.
- Support of the LA pattern: ‘Object - Right - Subject’
- Concentration on links between legal spaces occupied by buildings and their physical counterparts.
- Distinguishing three types of relationship concerning buildings:
  - PL_Building - PL_LegalSpaceBuilding
  - PL_Building - PL_CadastralParcel
  - PL_BuildingPart - PL_3DParcel

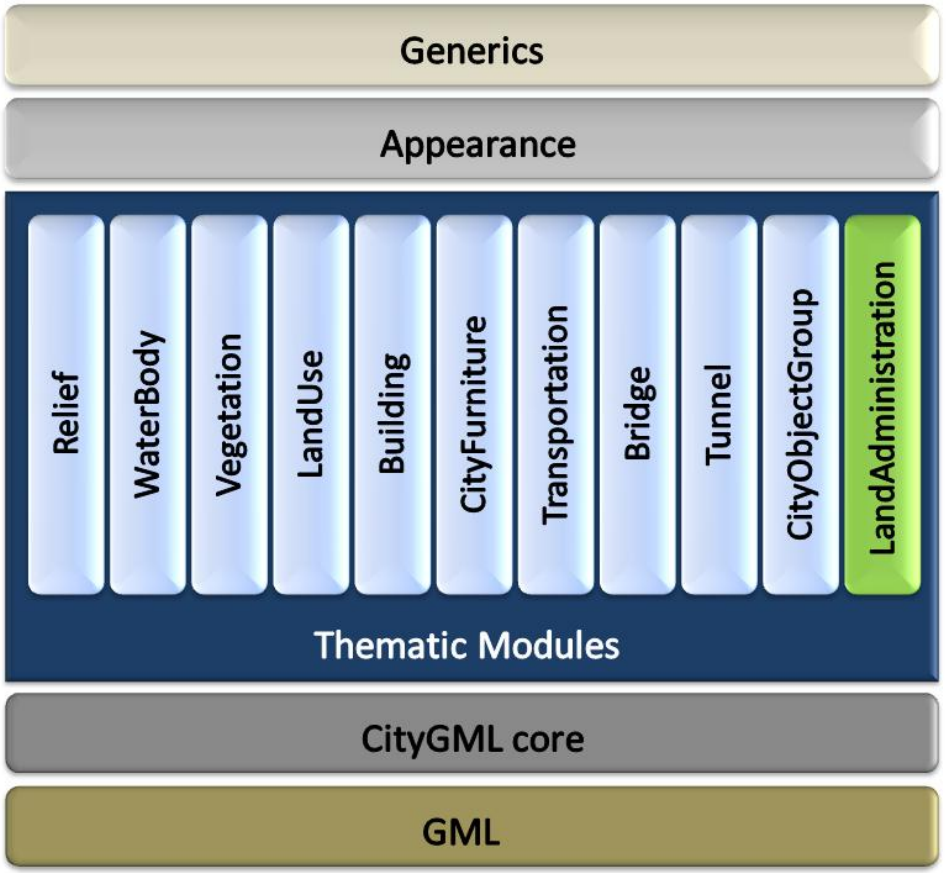
Conceptual integration of the LADM and CityGML



Conceptual integration of the LADM and CityGML

First remarks:

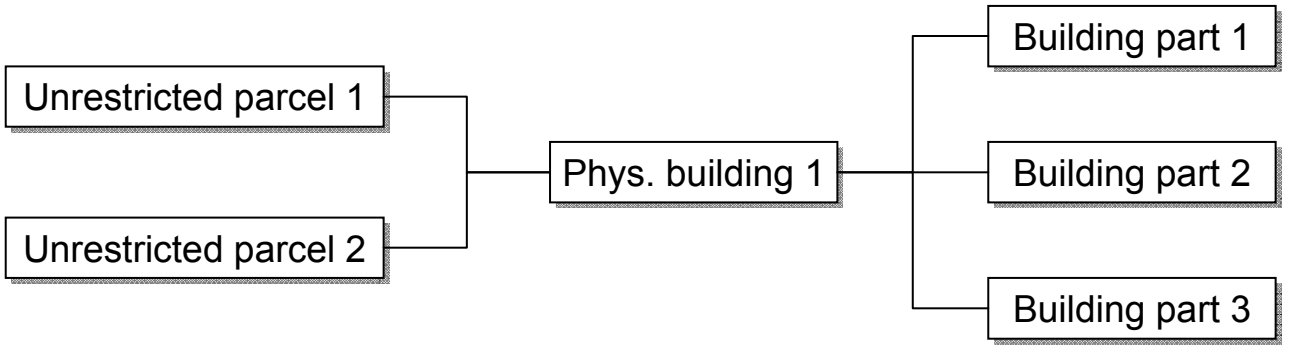
- CityGML does not include information about entities and rights.
- The semantic representation for land administration within CityGML is advisable.



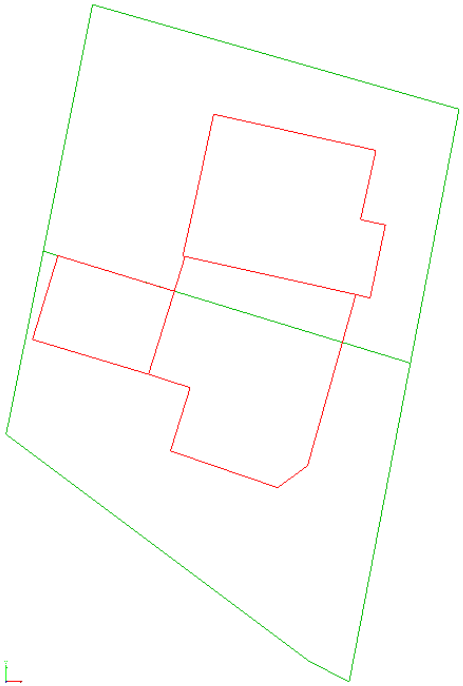
CityGML 3.0 work package – Land Administration

Case study 1: Detached house on land parcel

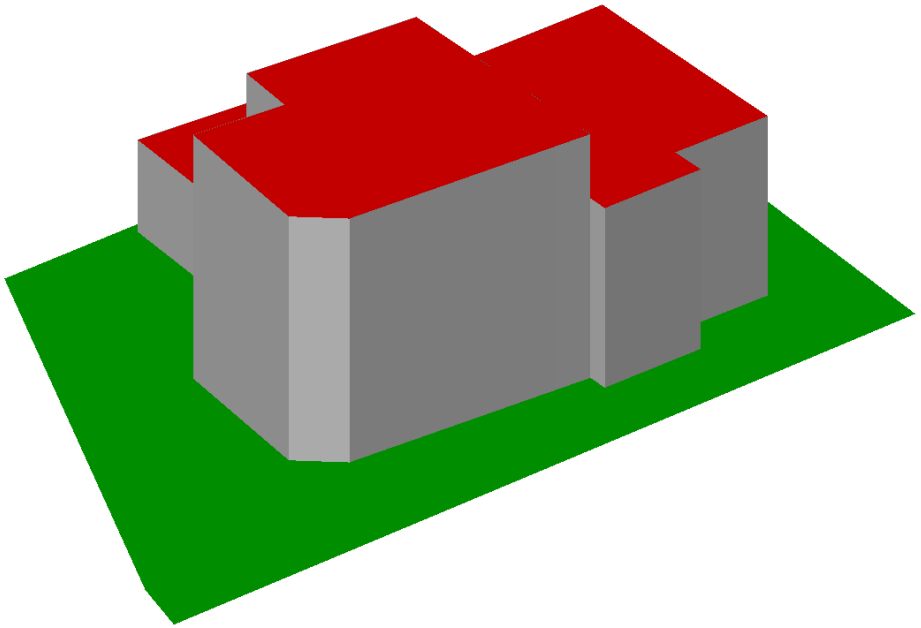
- The same owner both a building and two parcels on which it is located.
- Building is only the element of the legal space of a parcel.
- 3D cadastral representation supports spatial planning, taxation, national statistics, etc. (not legal issues).



Case study 1: Proposed solution



2D footprints from cadastral map



3D representation of building

Case study 1: Proposed solution

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                              <bldg:RoofSurface gml:id="UUID_8f6c502c-e334-4145c38aab46">
                                       <bldg:lod2MultiSurface>
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                                                          <gml:surfaceMember>
                                                      <gml:Polygon>
                                       (…)
```

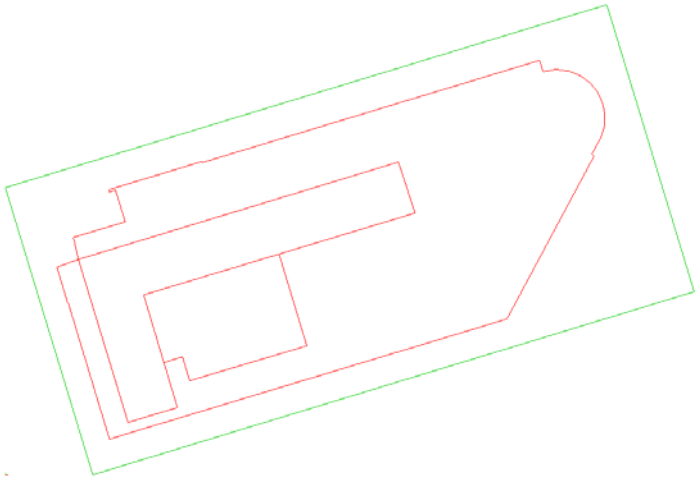
Case study 2: Building situated above another construction

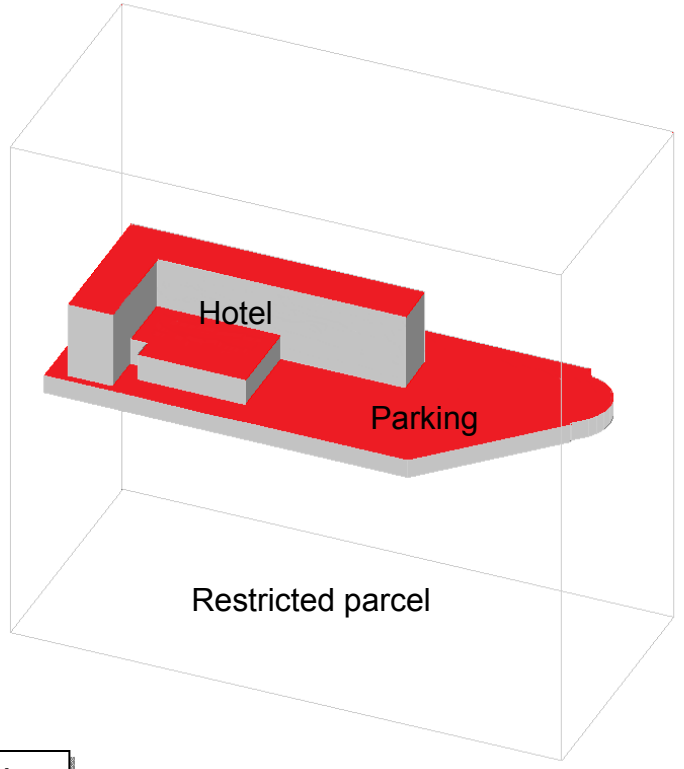
Courtyard Mariott Warsaw Hotel:
- located at the Chopin International Warsaw Airport
- erected in 2003 at the top of the building of a parking
- the owner: Port-Hotel Company

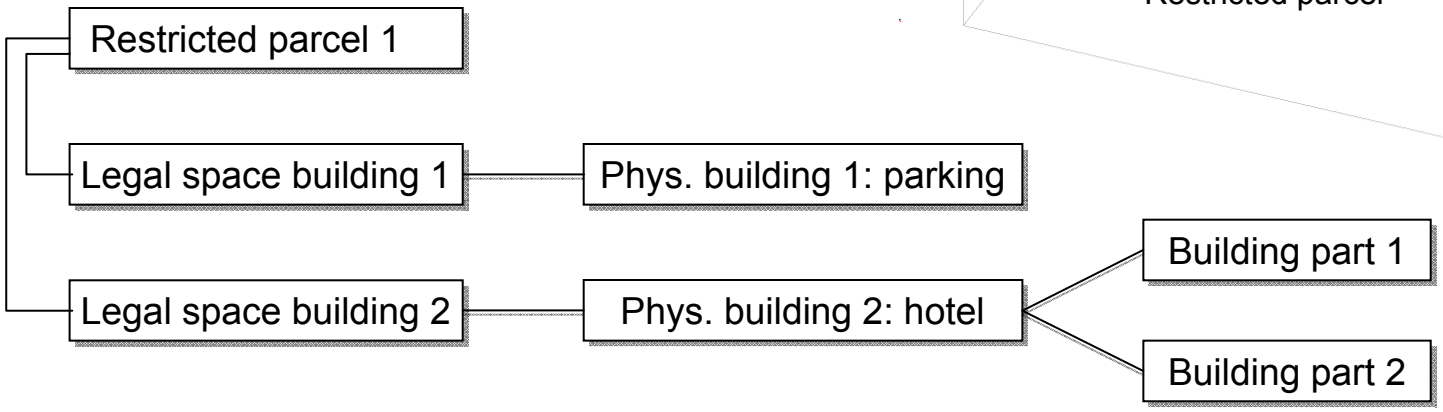
Multi-storey parking:
- erected in 1992
- the owner: Polish Airports' State Enterprise

Buildings are revealed as apartments because of the lack possibility of vertical subdivision of the space.

Case study 2: Proposed solution





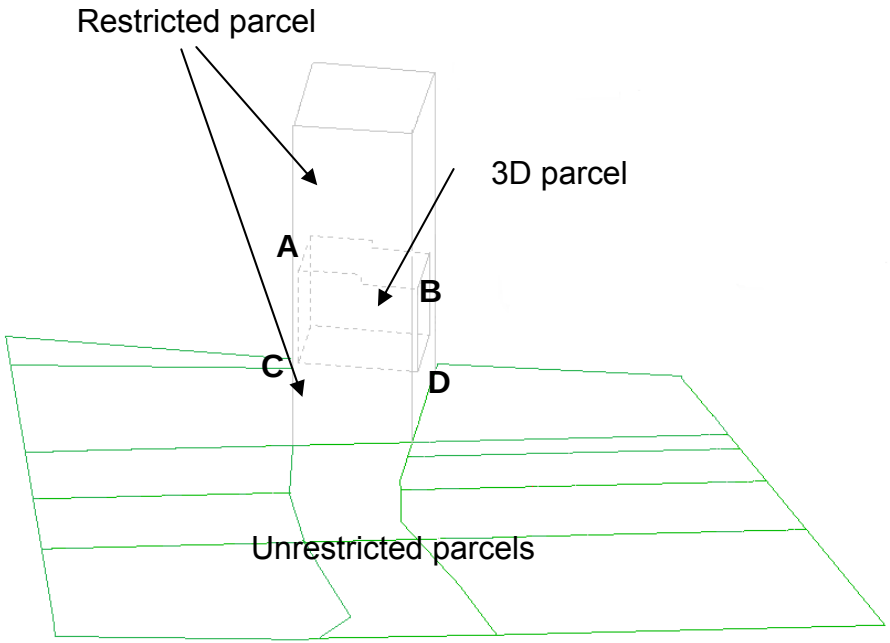


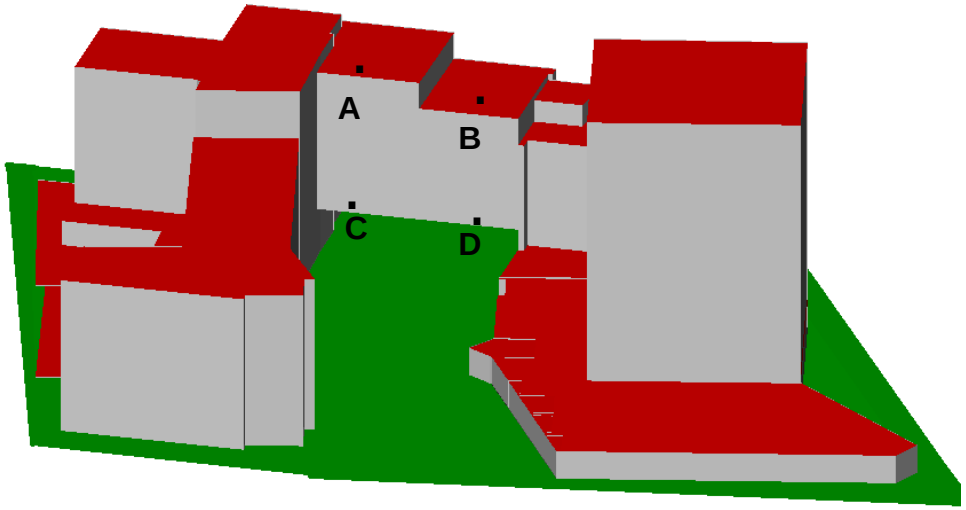
Case study 3: Residential building partially above the public road

- Residential complex of 4 buildings with apartment units.
- One of the buildings partially hanging over the public road.
- Several building parts distinguished on account of different number of floors.

The owner of a parcel with a public road:
the City of Warsaw.
The owner of remaining parcels:
the Housing Cooperative.

Case study 3: Proposed solution

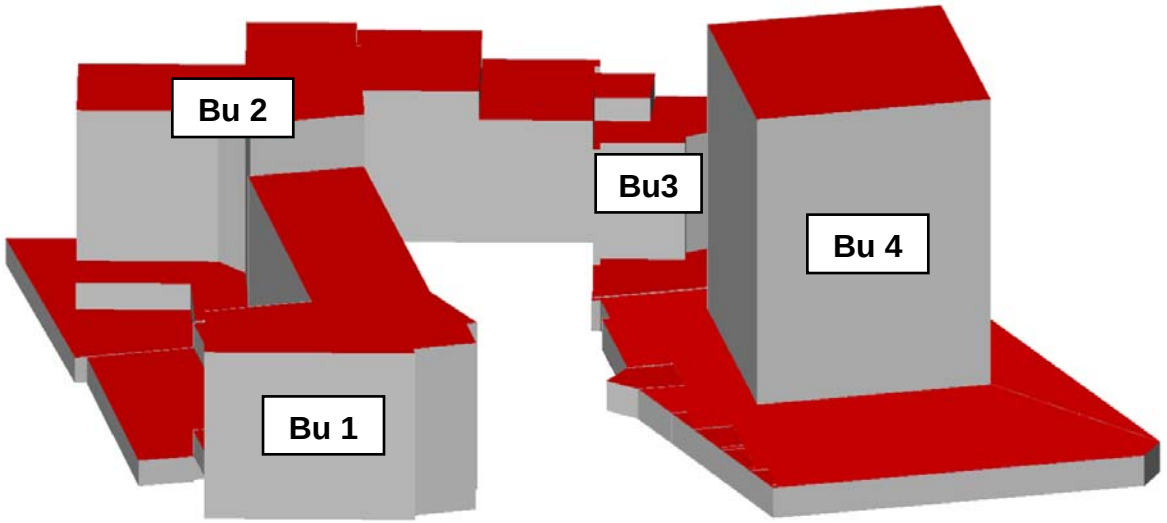


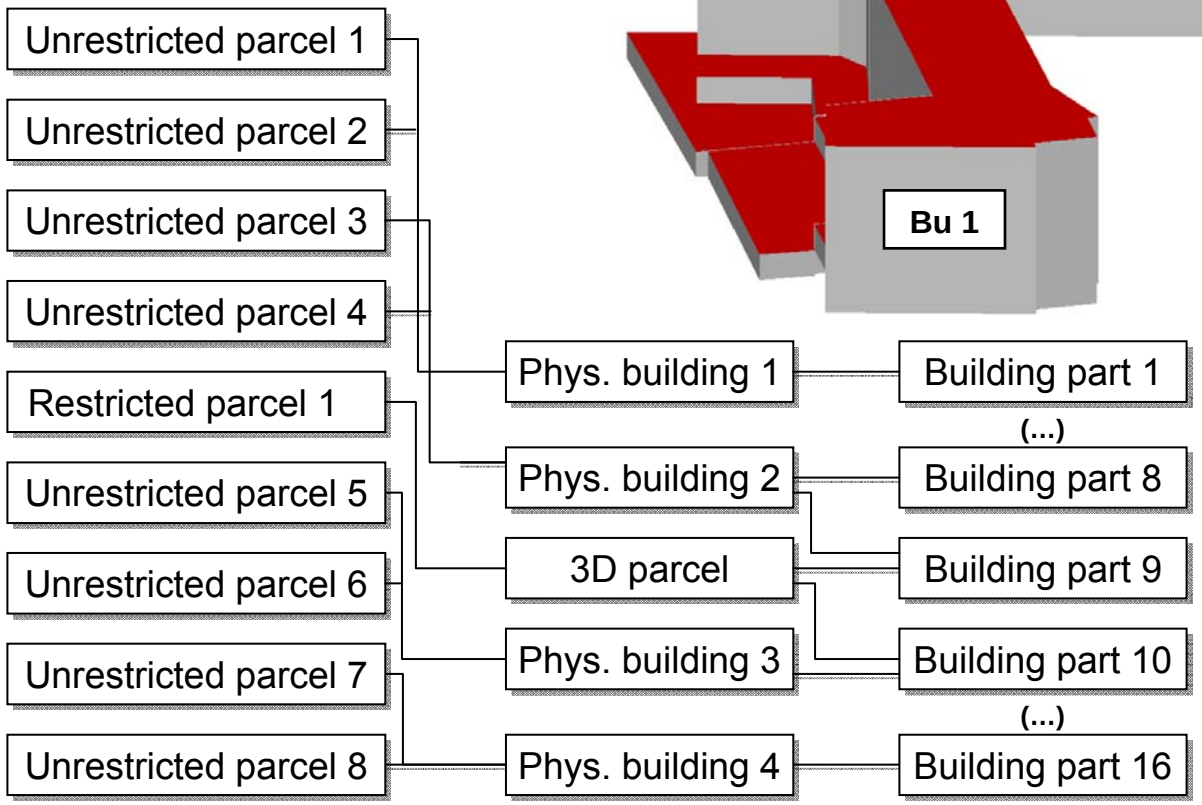


Hybrid (2D/3D) solution for legal spaces

3D representation of physical objects

Case study 3: Proposed solution





Conclusion

CityGML:

- a flexible, multiresolution model (geometry)
- version 2.0 – may support spatial concepts for LA, but is not sufficient for representation of the Land Administration domain entirely
- beneficial for understanding the location and size of the legal spaces
- relevant in the context of developing the multipurpose cadastral systems
- Appartment / Room exists in LoD4 only ☹

Possibilities of using CityGML for cadastral purposes:

- add the semantic representation for Land Administration within CityGML (current work)
- embed the selected CityGML fragments into (broader) LADM framework (future work)
- introducing a link between both domain models (in SDI setting) using references between object instances

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Kontakt
Prof. Dr. Volker Coors
volker.coors@hft-stuttgart.de
http://www.coors-online.de