FIG 2018 ISTANBUL

XXVI FIG CONGRESS

6–11 May 2018, İstanbul

Presented at the FIG Congress 2018
May 6-11, 2018 in Istanbul, Turkey

武漢大学 Wuhan University

Spatial representation of the ownership structure of condominium units

Lin Li，Haihong Zhu, Jindi Wu, Yuan Lei

School of Resource and Environmental Science,
Wuhan University, China

EMBRACING OUR SMART WORLD WHERE THE CONTINENTS CONNECT:
ENHANCING THE GEOSPATIAL MATURITY OF SOCIETIES

Organized by

Main Supporters

Platinum Sponsors

资源与环境科学学院 School of Resource and Environmental Science

Outline

1 *Introduction*

2 *Ownership structure*

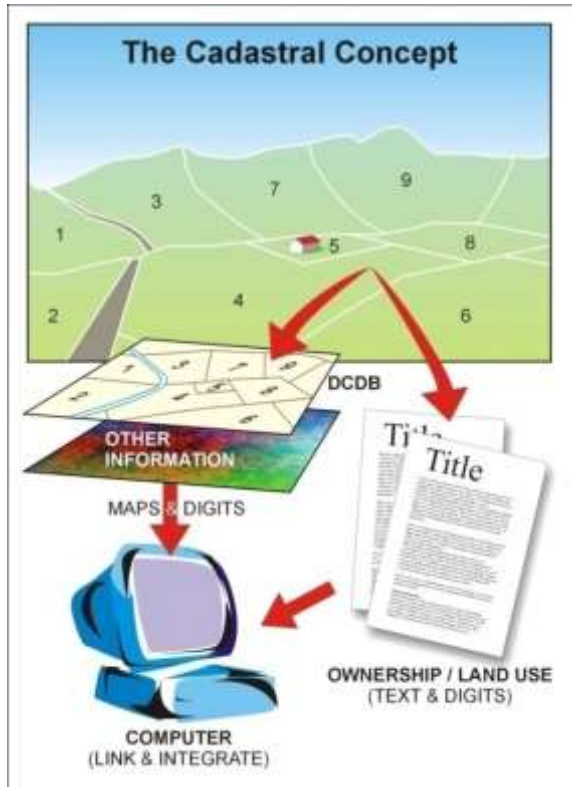
3 *CityGML-based data model*

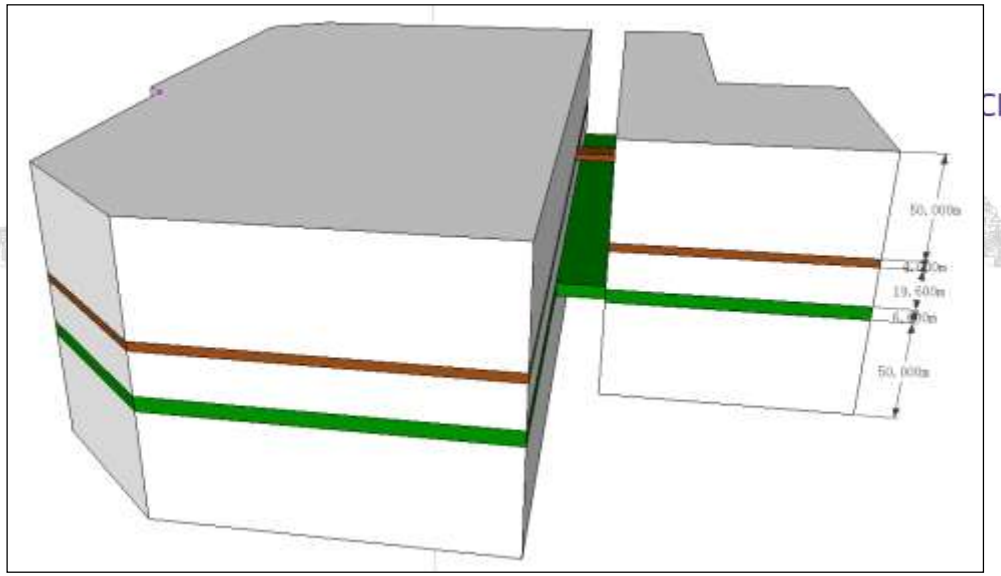
4 *Conclusions*

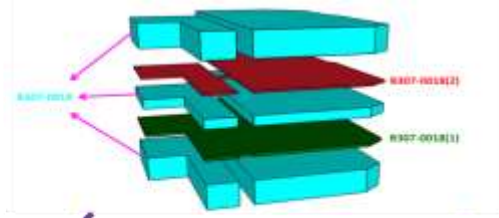
1 Introduction

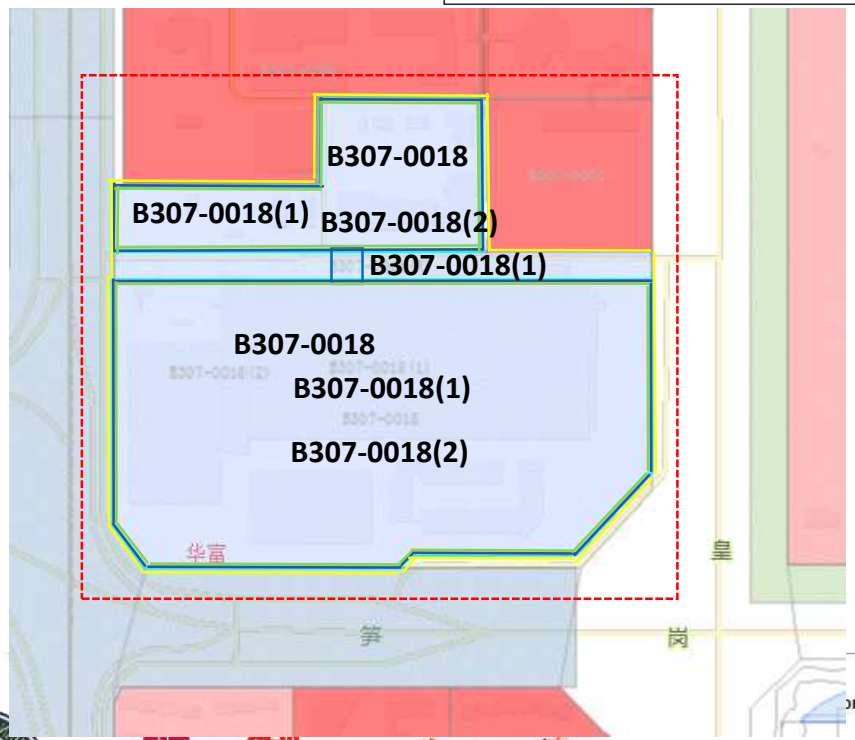
➢ **Urban development –urbanization– high-rise buildings**

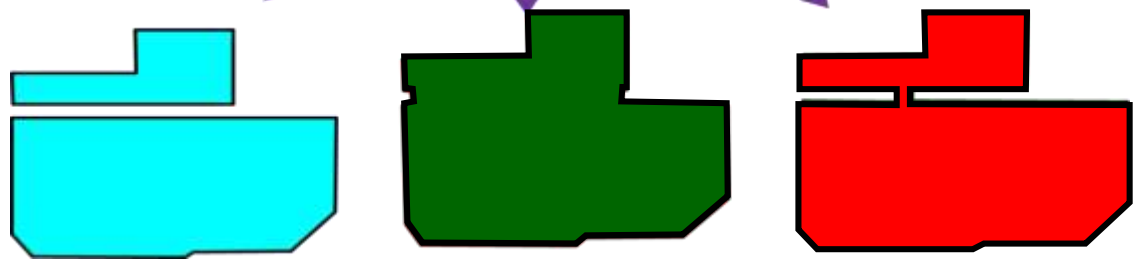
Management of property

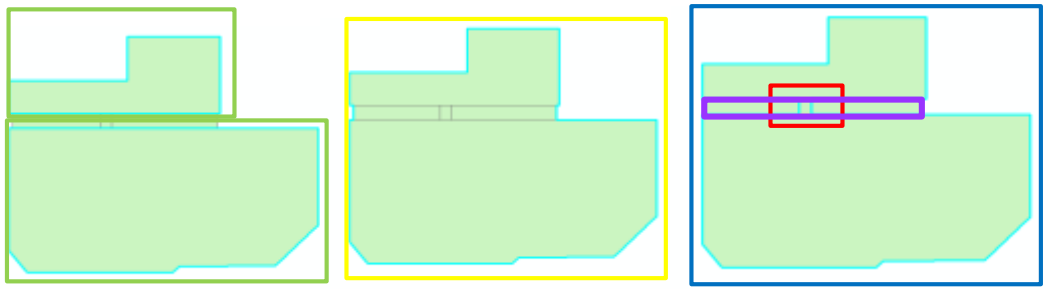




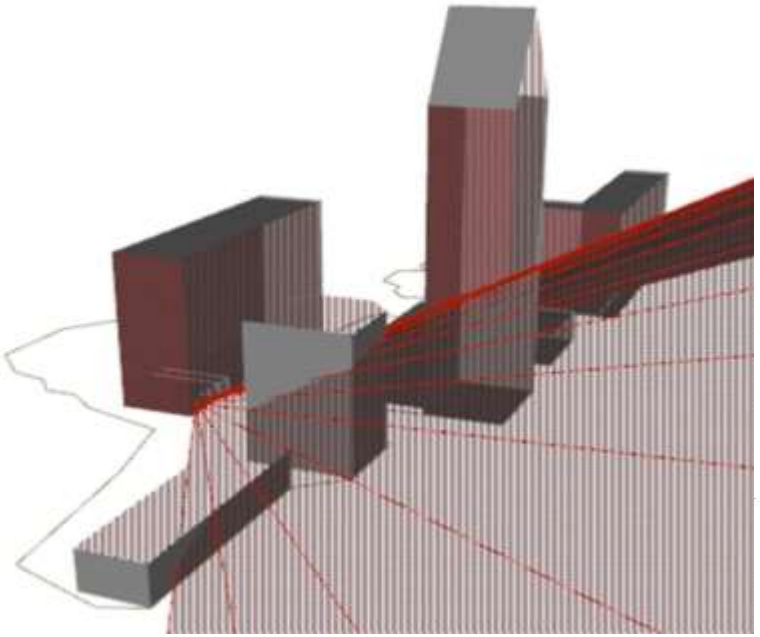






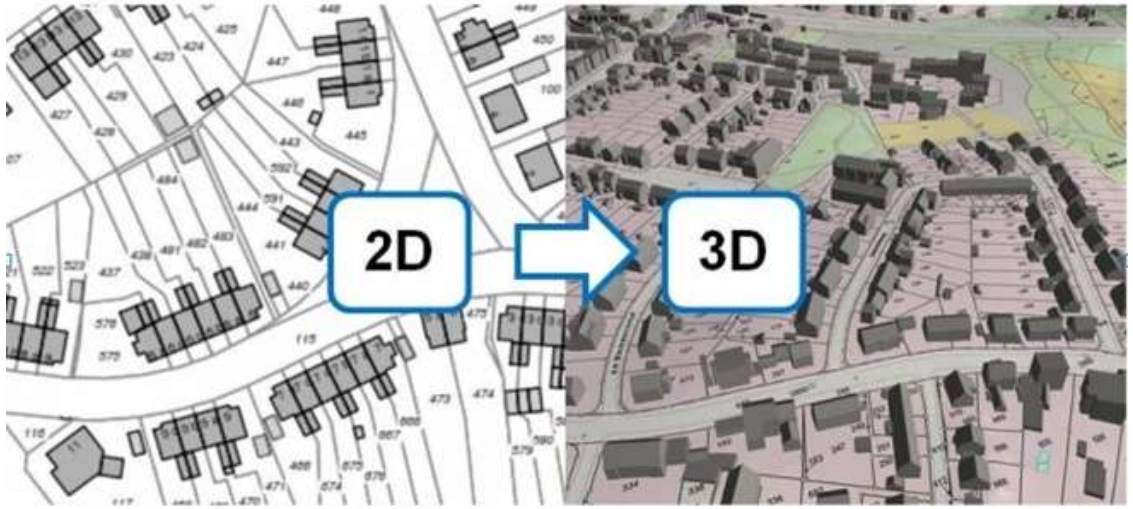


B307-0018 B307-0018(1) B307-0018(2)



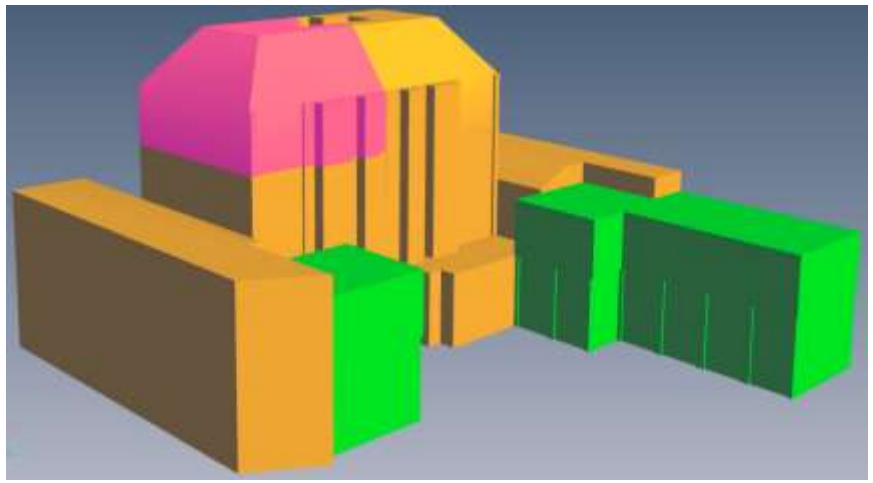
1 Introduction

- **from 2D cadastre to 3D cadastre : from surface to space**



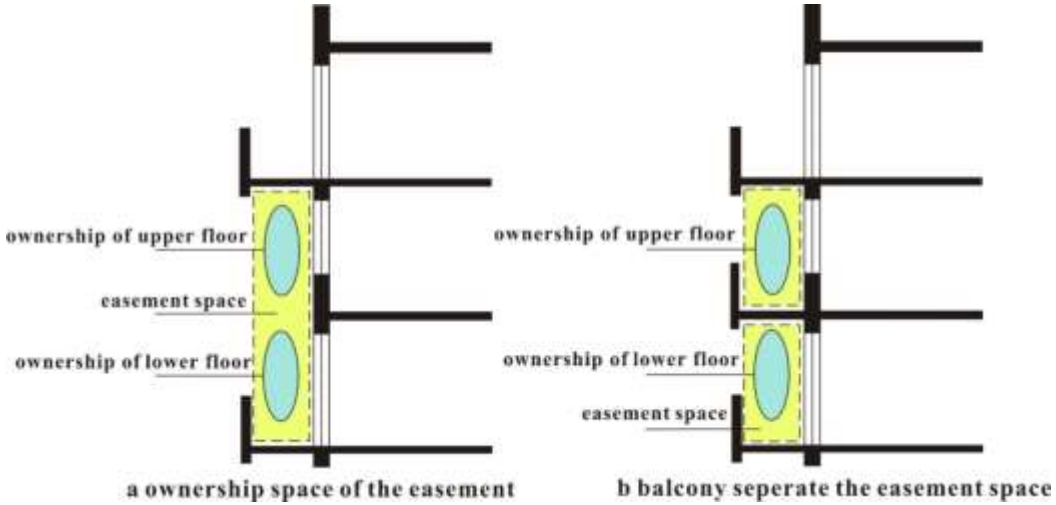
- **Administration of land to management of property—precise management**

  Ownership : from spatial extent to internal structure



1 Introduction

➢**Condominium:**



a ownership space of the easement

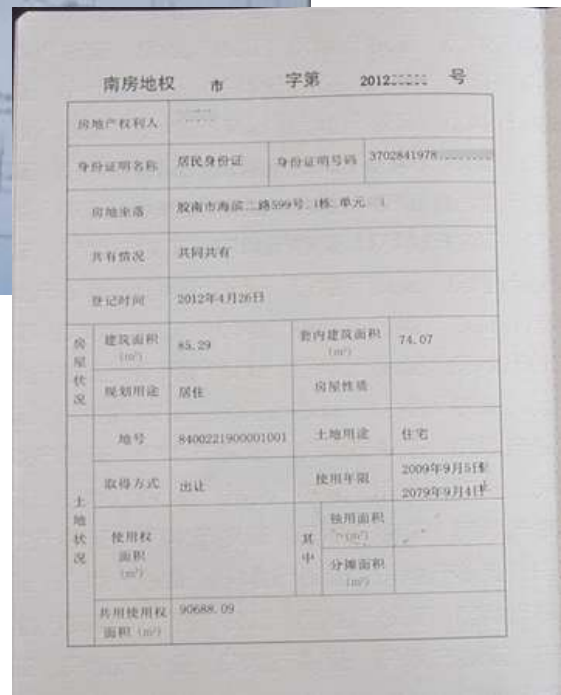
b balcony seperate the easement space

2 Ownership structure

- **Legal context in China**

Land :

- **All land (but rural land) is owned by the stat**
- **Rural land is owned by the collective! (not**
- **Land can be used for private buildings – Ow nd**



Condominium unit: (ownership including:)

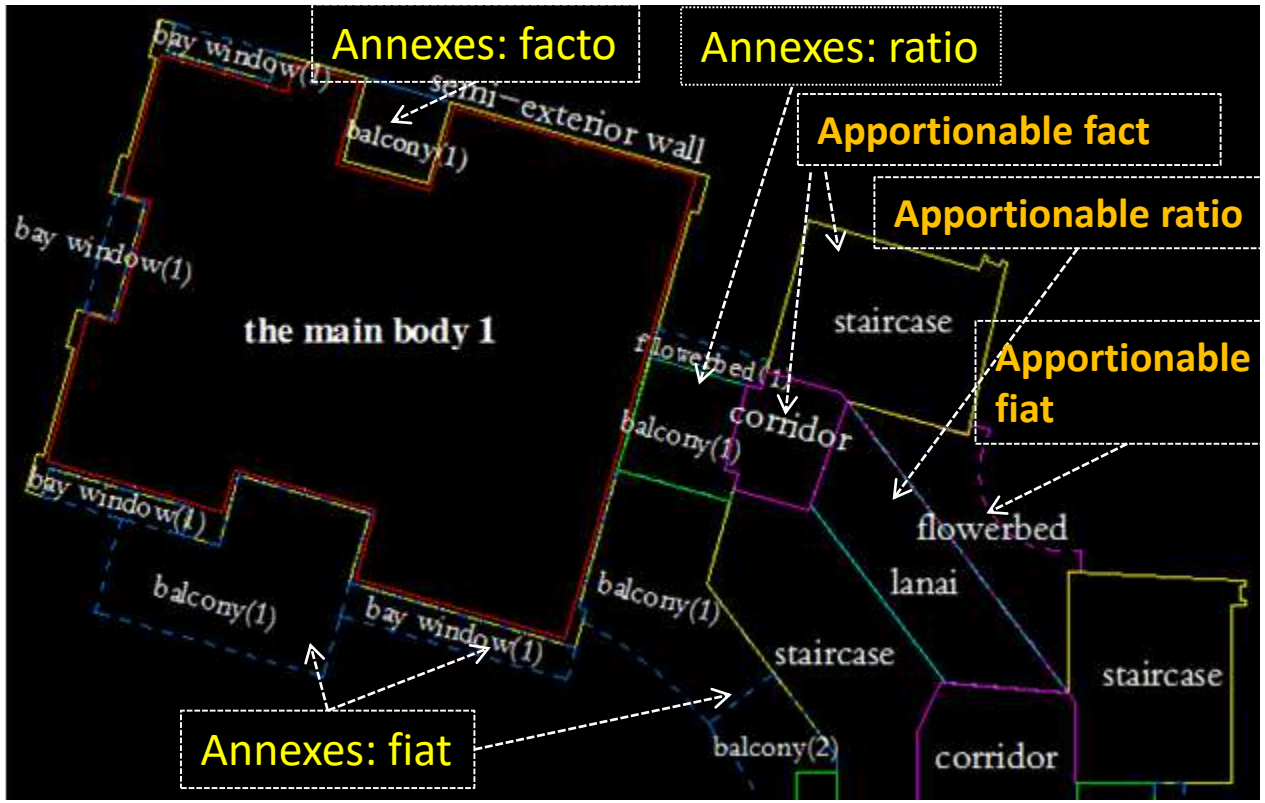
- **Exclusive part**
- **Common part**
- **common management**

2 Ownership structure

➢ **Internal structure of ownership (by physical components)**

- **Exclusive objects**
  - -- Major body
  - -- Annexes
    - --- facto objects
    - --- ratio objects
    - --- fiat objects

- **Shared objects**
  - -- Apportionable (area)
    - --- facto objects
    - --- ratio objects
    - --- fiat objects
  - -- Non-Apportionable



2 Ownership structure

➢ **Ancillary rights of ownership – Solar rights**

Solar rights: to **ensure adequate sunlight**.

-- Solar easements
-- Neighbouring solar rights
--measurement of solar rights: **sunlight duration**

UDC
中华人民共和国国家标准
GB
P
GB 50180-93
城市居住区规划设计规范
Code of urban Residential Areas Planning & Design
(2002 年版)
1993-07-16 发布
1994-02-01 实施
国家技术监督局
中华人民共和国建设部
联合发布

Code of Urban Residential Area Planning and Design

- **The sunlight duration received by homes for elderly people cannot be less than 2 hours**
- **Any new building will not reduce the duration of sunlight received by adjacent residences.**

2 Ownership structure

- **How to calculate the sunlight duration**

  -- when (which day) : with the least sunlight duration.

Climate regions for buildings in China

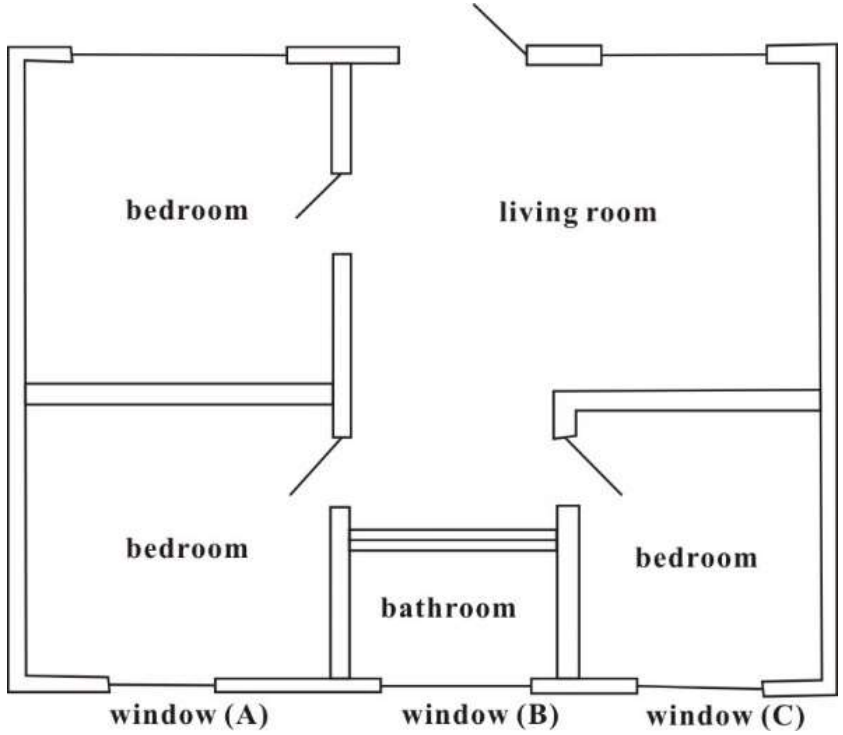
The sunlight standard for residential buildings

Building climate region	I, II, III, and VII		IV		V and VI
	Metro	Small-medium	Metro	Small-medium	
Sunlight reference day	The Great Cold Day			Winter solstice	
Sunlight duration (h)	>=2	>=3		>=1	
Period of effective sunlight (h)	8~16			9~15	
Reference position	**Bottom edge of window**				

2 Ownership structure

- **How to calculate the sunlight duration**

  -- in which way: calculation of sunlight duration?



Window-based calculation

Calculate the sunlight duration time of all the window, and take the maximum hours as the referenced sunlight duration of that housing unit.

$$h_{SD} = Max(Num(SD_A), \cdots, Num(SD_N))$$

Room-based calculation

For a habitable space (eg: bedroom and living room) with more than one windows, the union set of the sunshine period is considered as the sunlight duration of the habitable space. The maximum sunlight hours in all habitable spaces is considered as the sunlight hours of the housing unit.

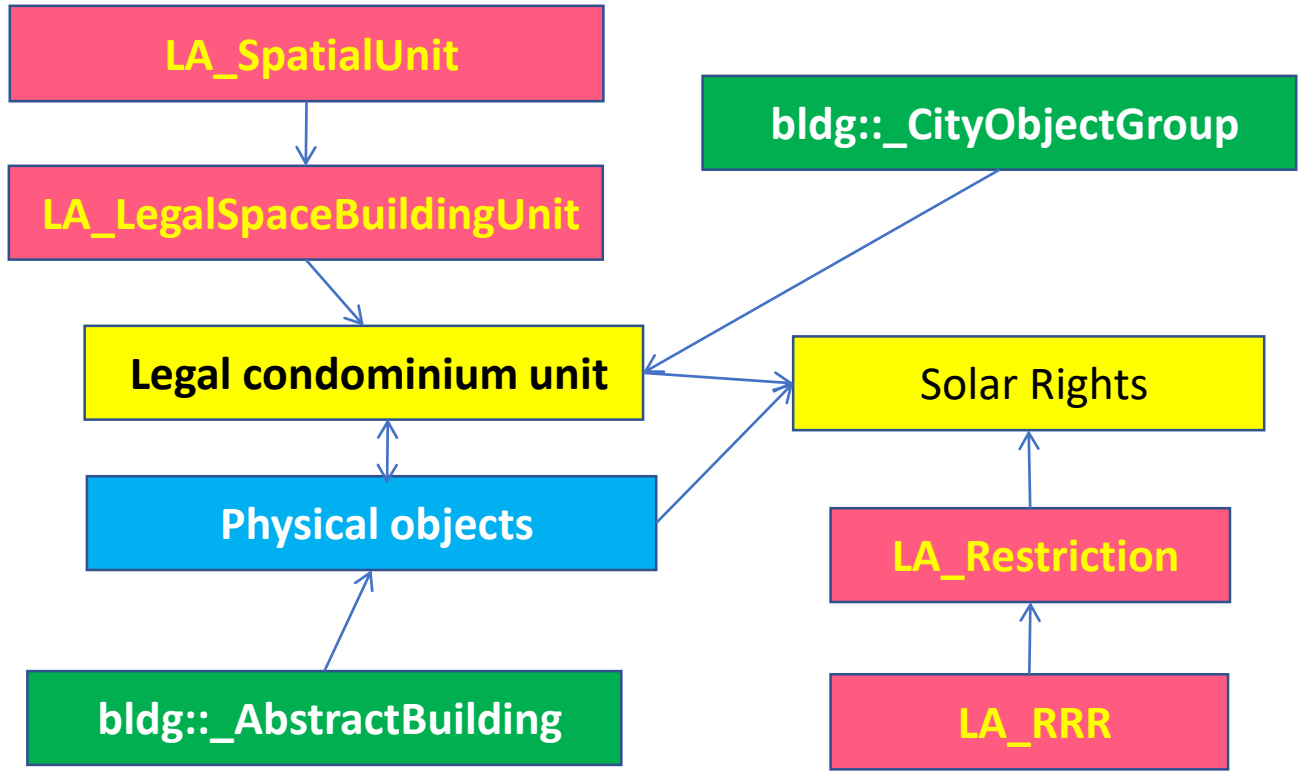
$$h_{SD} = Max(Num(SD_A \cup SD_D), Num(SD_C))$$

3 CityGML-based data model

➢ Data model framework:

-- LADM (ISO 19152) : LA_RRR, LA_SpatialUnit

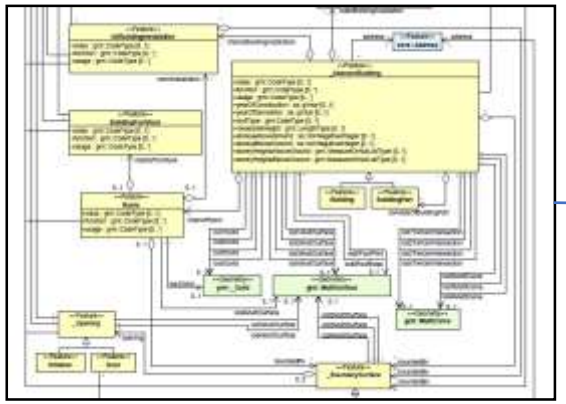
- LA_RRR:
  - -- LA_Right
  - -- LA_Restriction
  - -- LA_Responsibility
  - …
- LA_SpatialUnit:
  - -- LA_Right
  - -- LA_BoundaryFace
  - -- LA_LegalSpaceBuildingUnit
  - …

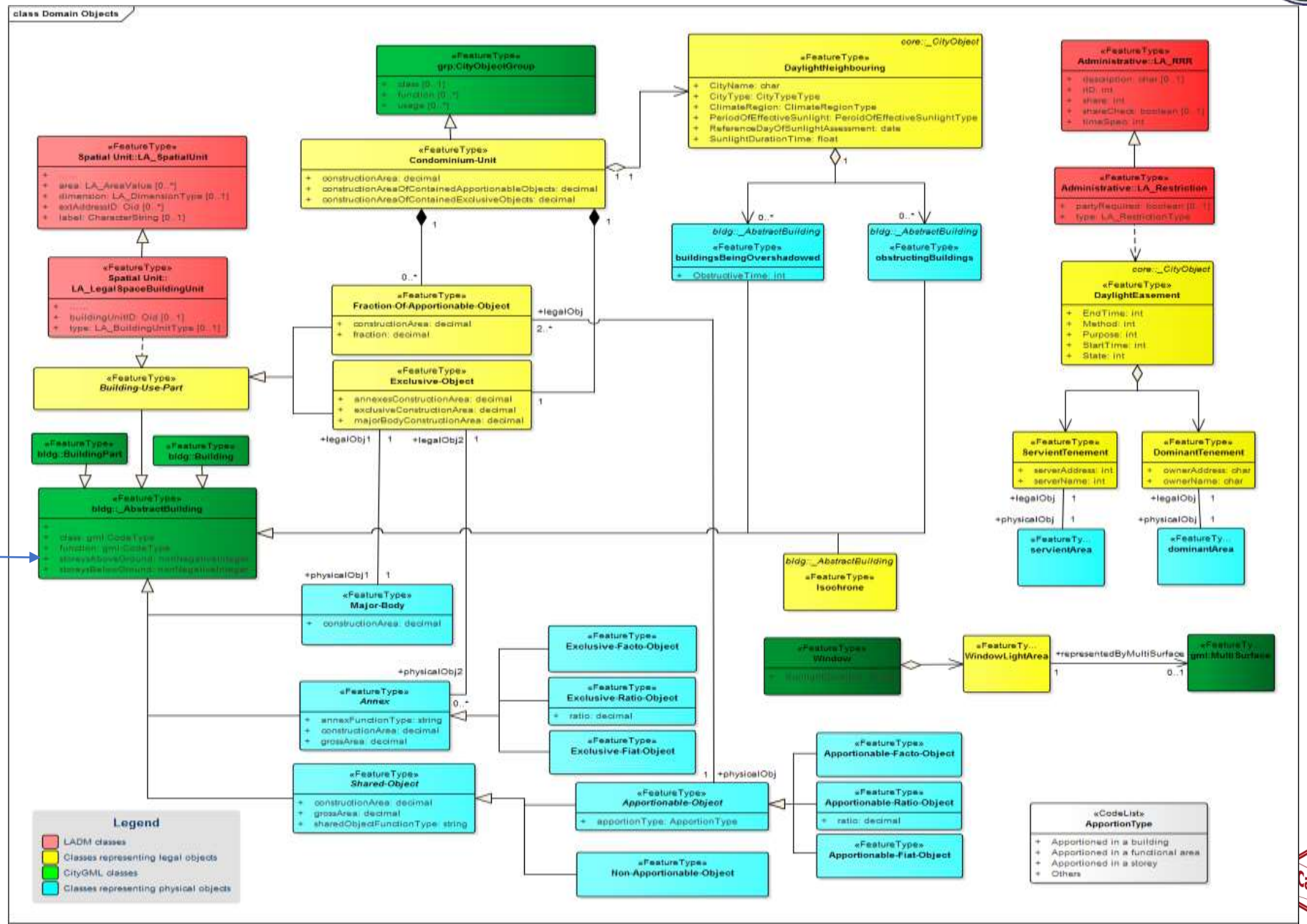


3 CityGML-based data model

➢ Data model

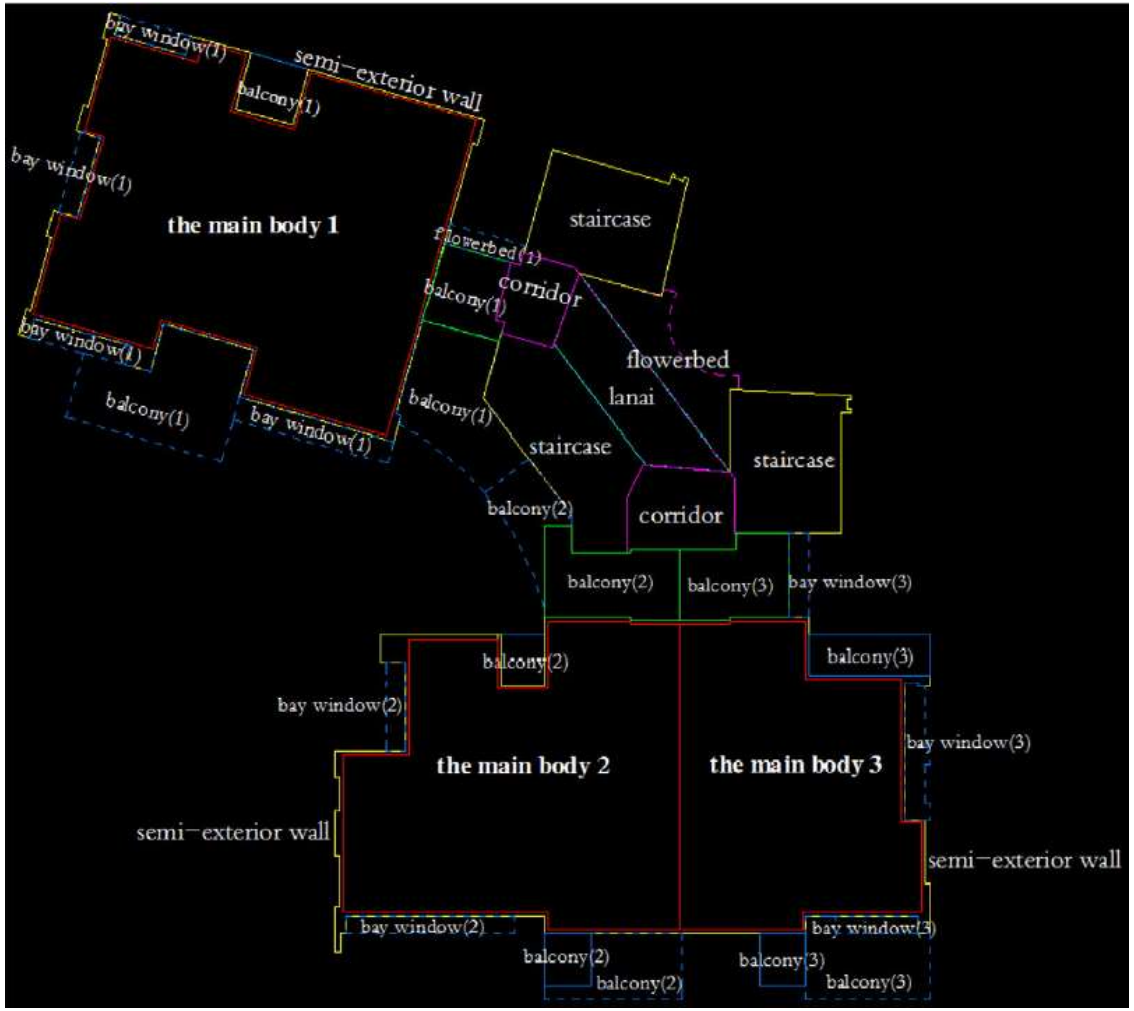
CityGML:Geometry





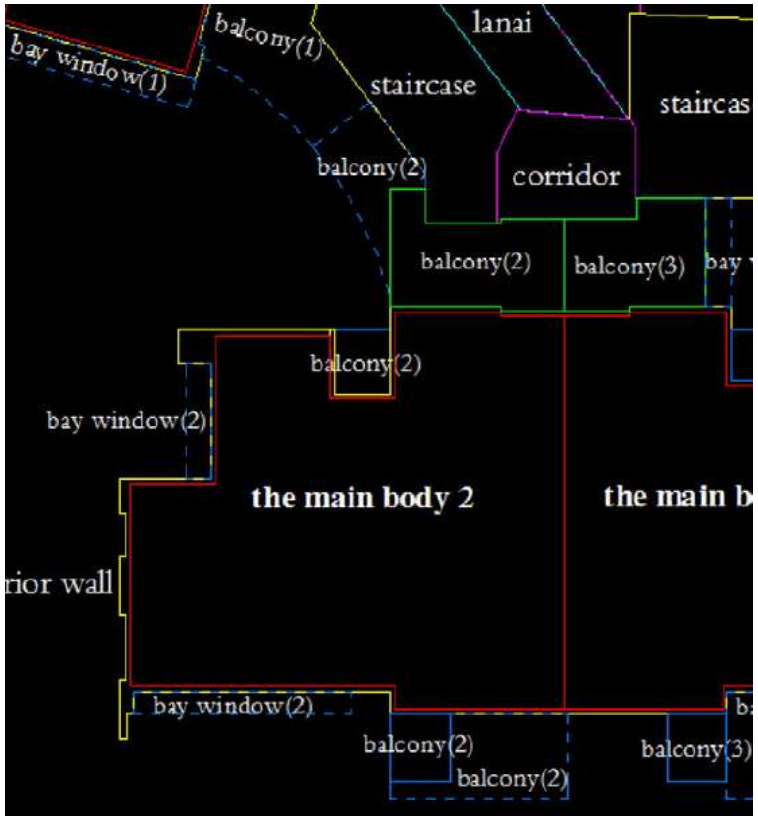
3 CityGML-based data model

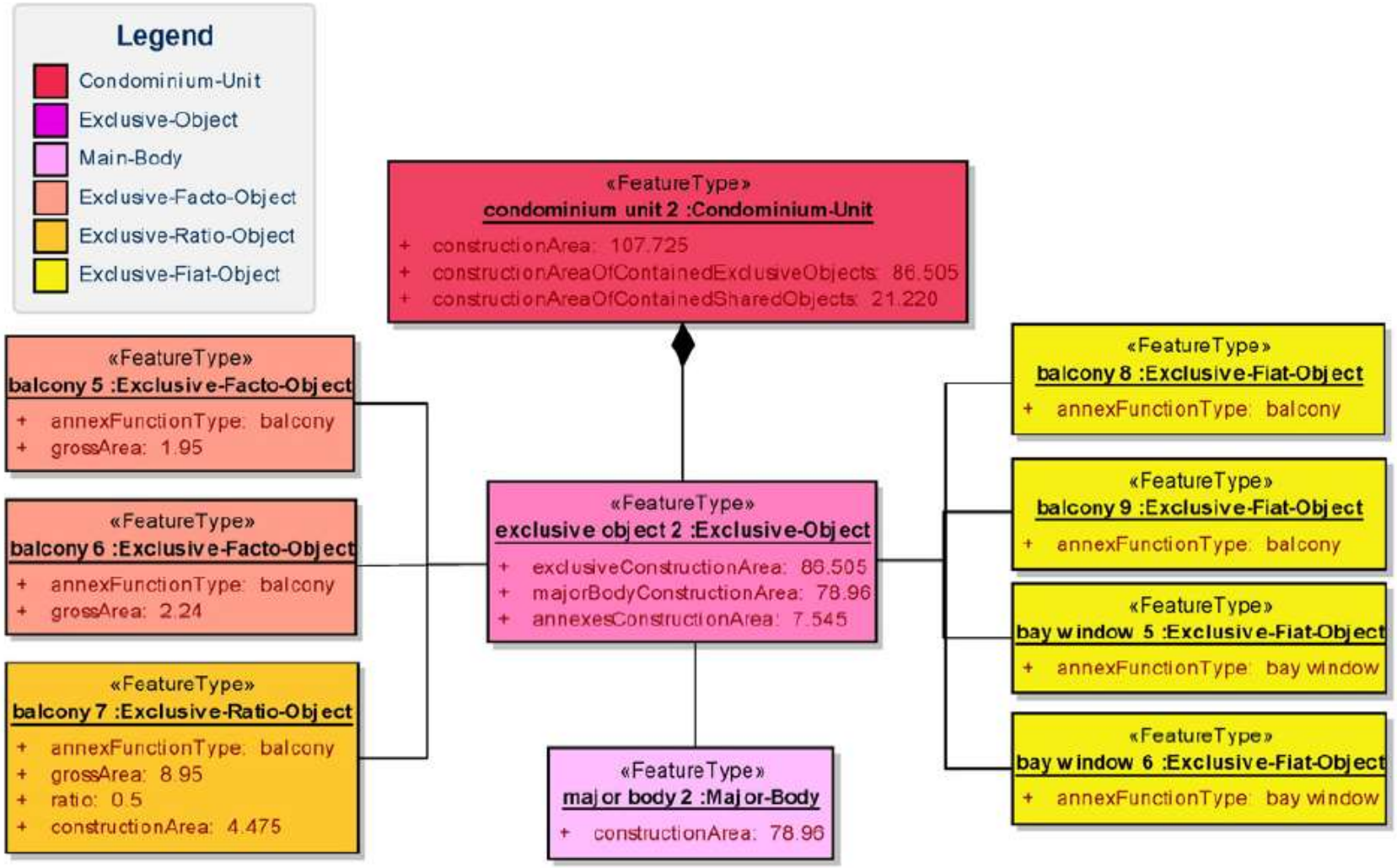
- **Example: representation of internal structure of ownership**



3 CityGML-based data model

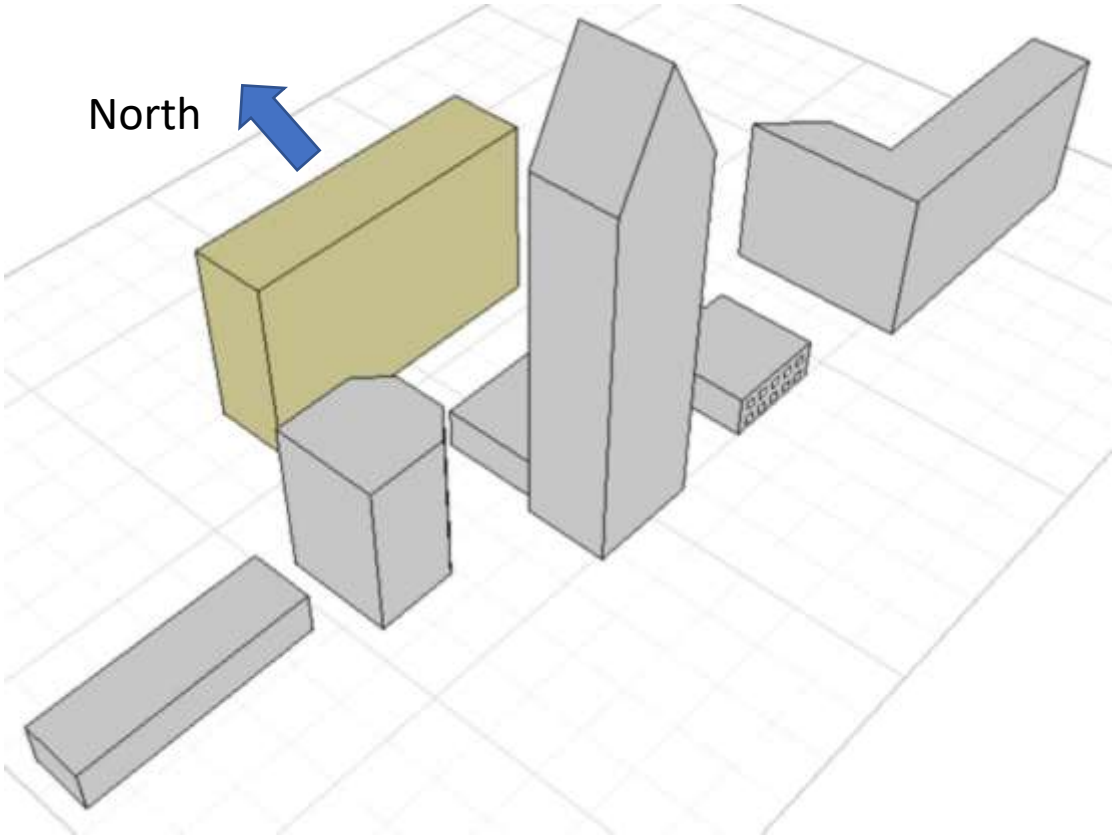
--Unit 2

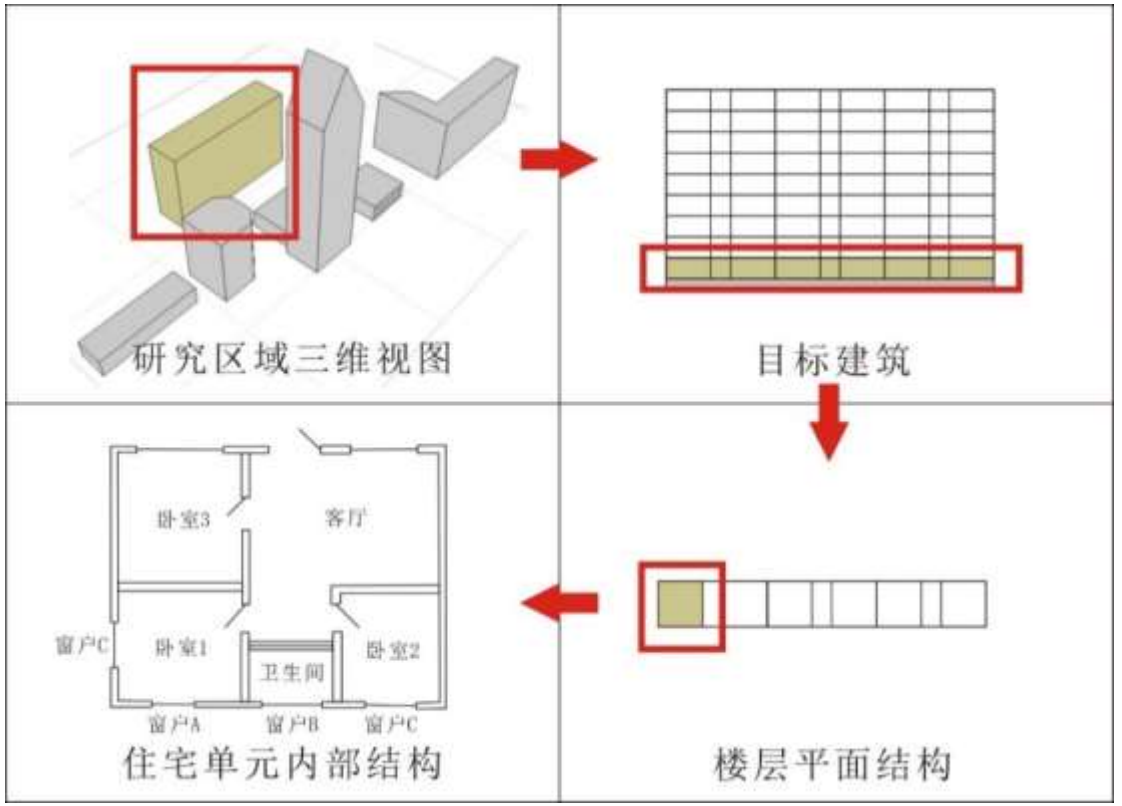




3 CityGML-based data model

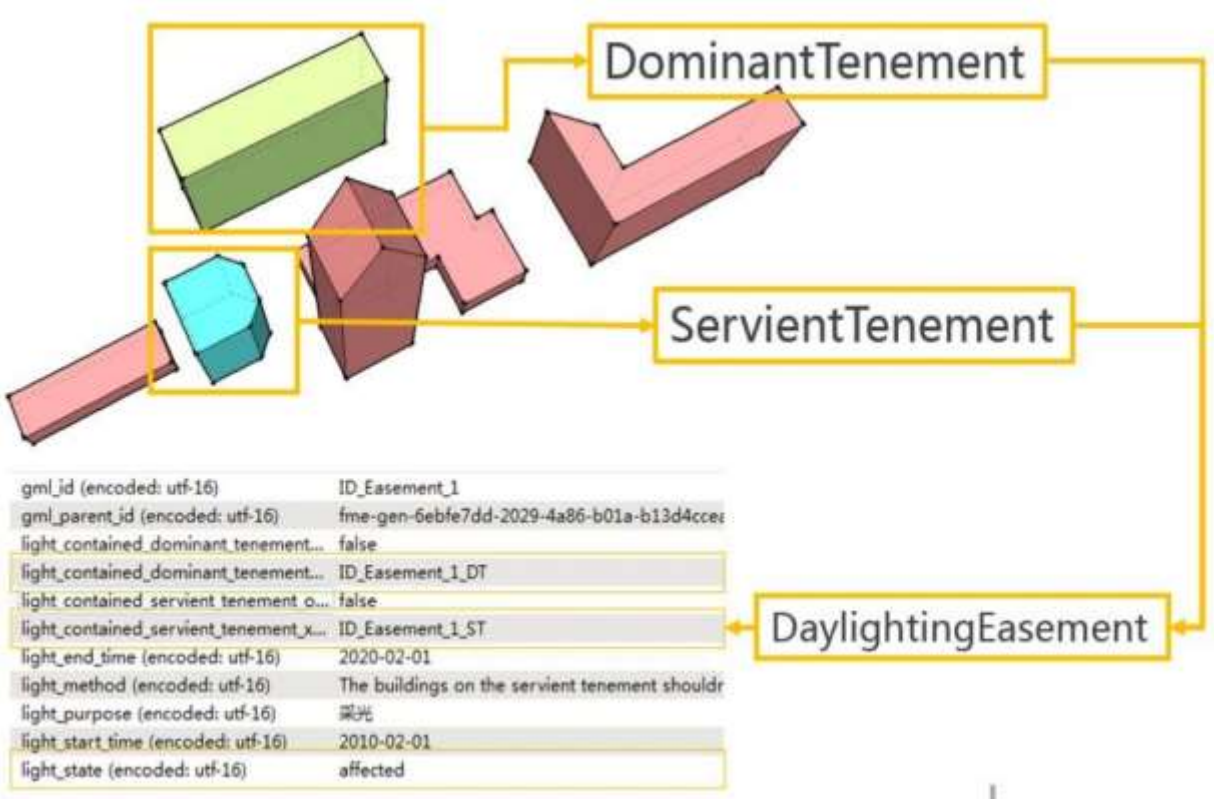
- **Example: representation of solar rights**



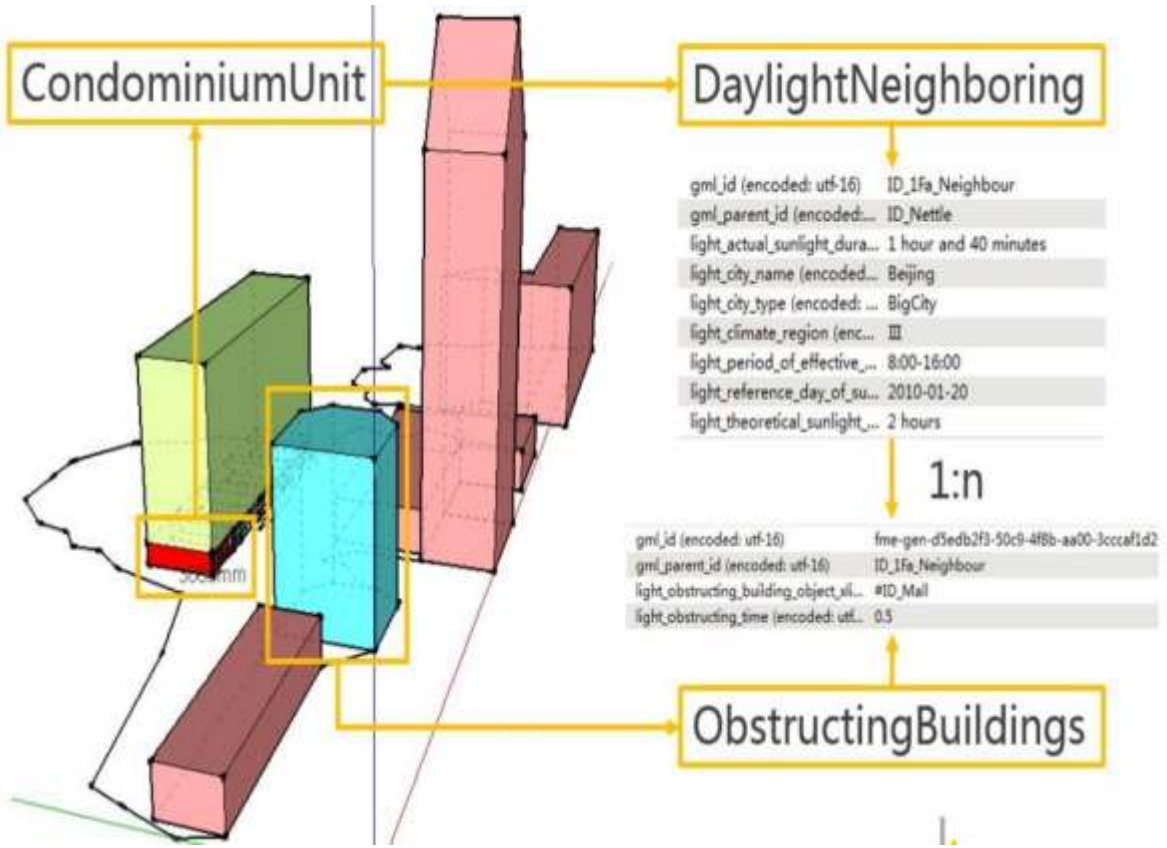


3 CityGML-based data model

-- Representation of solar rights



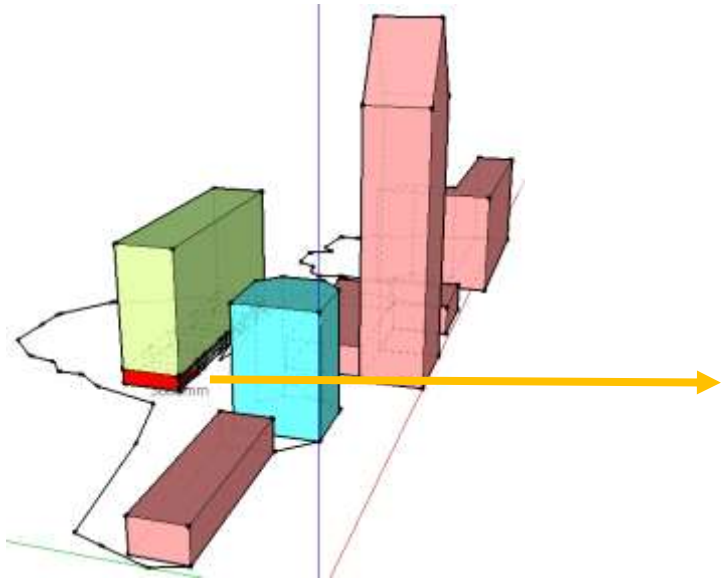
Solar easements

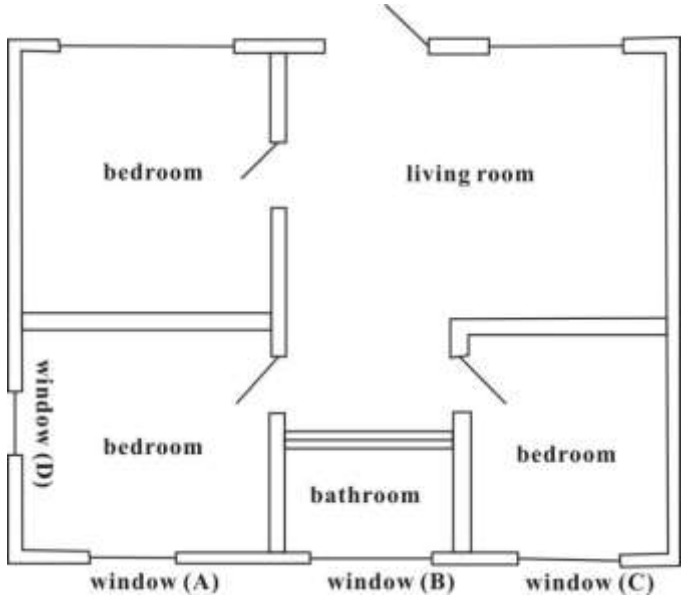


Neighboring solar rights

3 CityGML-based data model

-- Discussion





Window-based calculation：

Step 1: Get the sunlight duration time of all the window objects in habitable space.

Step 2: Take the maximum sunlight hours of the window as the referenced sunlight duration time of that housing unit.

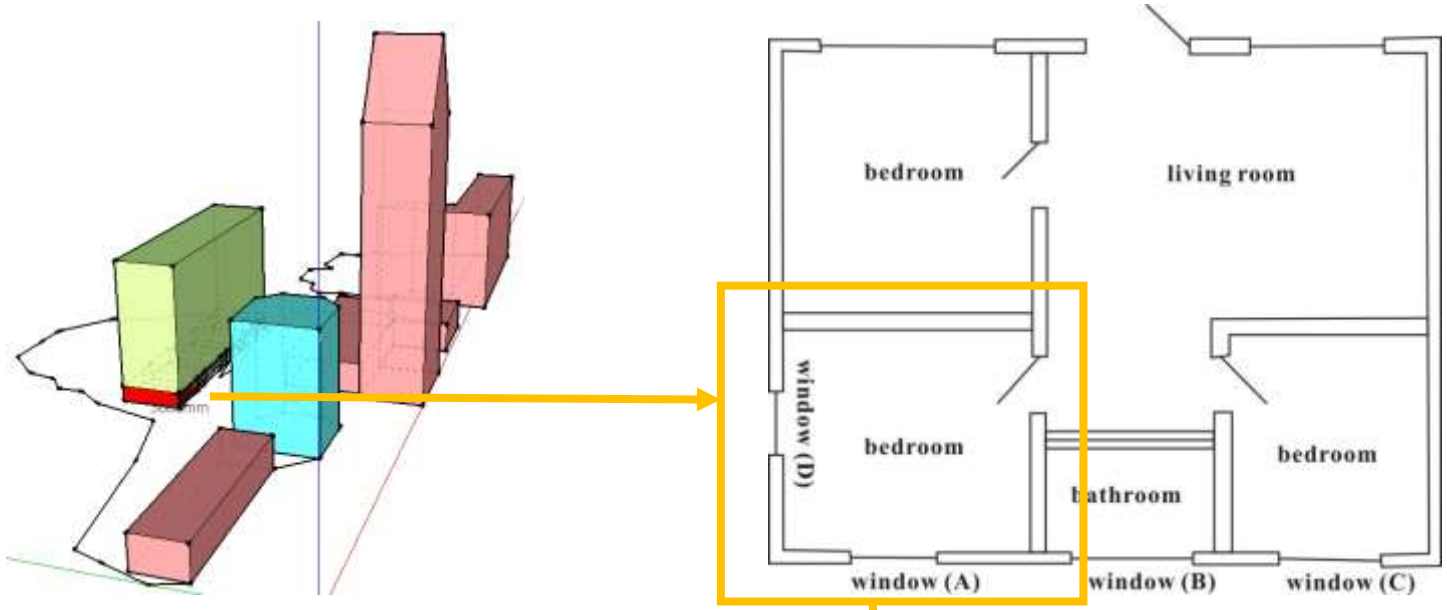
Housing unit	Room	Window	Windowsill	Sunlight duration
1FA	1	A	0.9m	1:30 (8:50-9:30 11:25-11:50 15:30-16:00)
		D	0.9m	1:00 (15:00-16:00)
	2	B	0.9m	1:25 (8:55-9:35 11:40-12:25)
	3	C	0.9m	1:45 (9:00-9:50 11:55-12:50)

1.75 hours in total

- ✓ 9:00-9:50
- ✓ 11:55-12:50

3 CityGML-based data model

-- Discussion



Room-based calculation：

Step 1: Get the union of sunlight period of window A and window D, and calculate the total number of sunlight duration.

Step 2: Get the maximum sunlight hours in all habitable area as the sunlight duration time of this housing unit.

Housing unit	Room	Window	Windowsill	Sunlight duration
1FA	1	A	0.9m	1:35 (8:50-9:30 11:25-11:50 15:30-16:00)
		D	0.9m	1:00 (15:00-16:00)
	2	B	0.9m	1:25 (8:55-9:35 11:40-12:25)
	3	C	0.9m	1:45 (9:00-9:50 11:55-12:50)

2.5 hours in total

- ✓ 8:50-9:30
- ✓ 11:25-11:50
- ✓ 15:00-16:00

4 Conclusions

1. Internal structure of ownership exists and can be semantically modeled and the current registration needs to be upgraded
2. Extending CityGML with the LADM is an available means for modeling the ownership structure of condominium units
3. Solar rights can be represented by spatial/temporal attributes in terms of sunlight duration, but calculation is multiple
4. 3D/4D spatial modeling can provide a great help for clarifying legal conflicts of ownerships--technical support/not solution

Thanks !