CityGML EnergyADE Working groups

Group Building Occupants (G3)

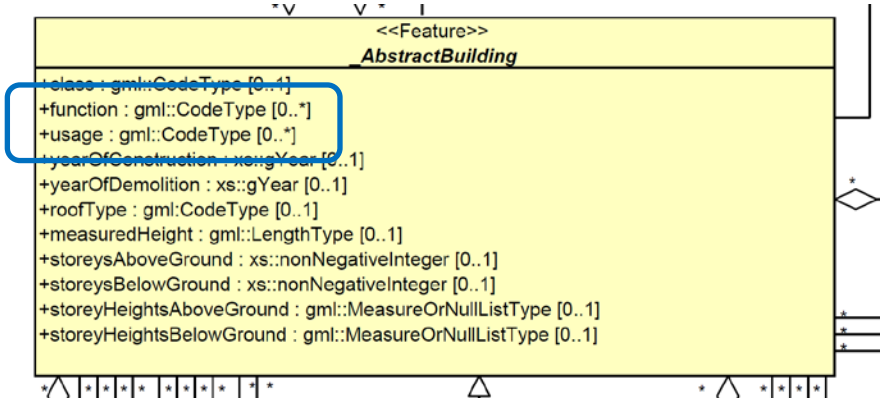
Context

- Development of a common CityGML ADE Energy for building energy calculation

- **Occupant behavior is a key issue** for building design optimization, energy diagnosis, performance evaluation, and building energy simulation by contributing significantly to the building energy consumption

CityGML existing structure

- Current Usage aspects in CityGML:
  - Building Function (dwelling, office building, ...)
  - Building Usage



- These aspects are not enough regarding usage for energy calculation
  - Not „energy-usage-oriented“
  - Building level → energy calculation needs more details (attributes & objects) regarding the usage zone level

Objectives

- Detail the building function in the perspective of building energy calculation

- Anticipate further needs regarding socio-demographic modelling

Methodology

Collaborative development:

1. Definition of the objectives
2. List of required attributes & objects
3. Review & comparison of existing approaches
4. Proposition of an UML structure
5. Iterative improvement by testing different case studies

Existing approachs

- **INSPIRE**

  →Data Specification on buildings – Technical Guidelines

- **IEA EBC Annex 66**

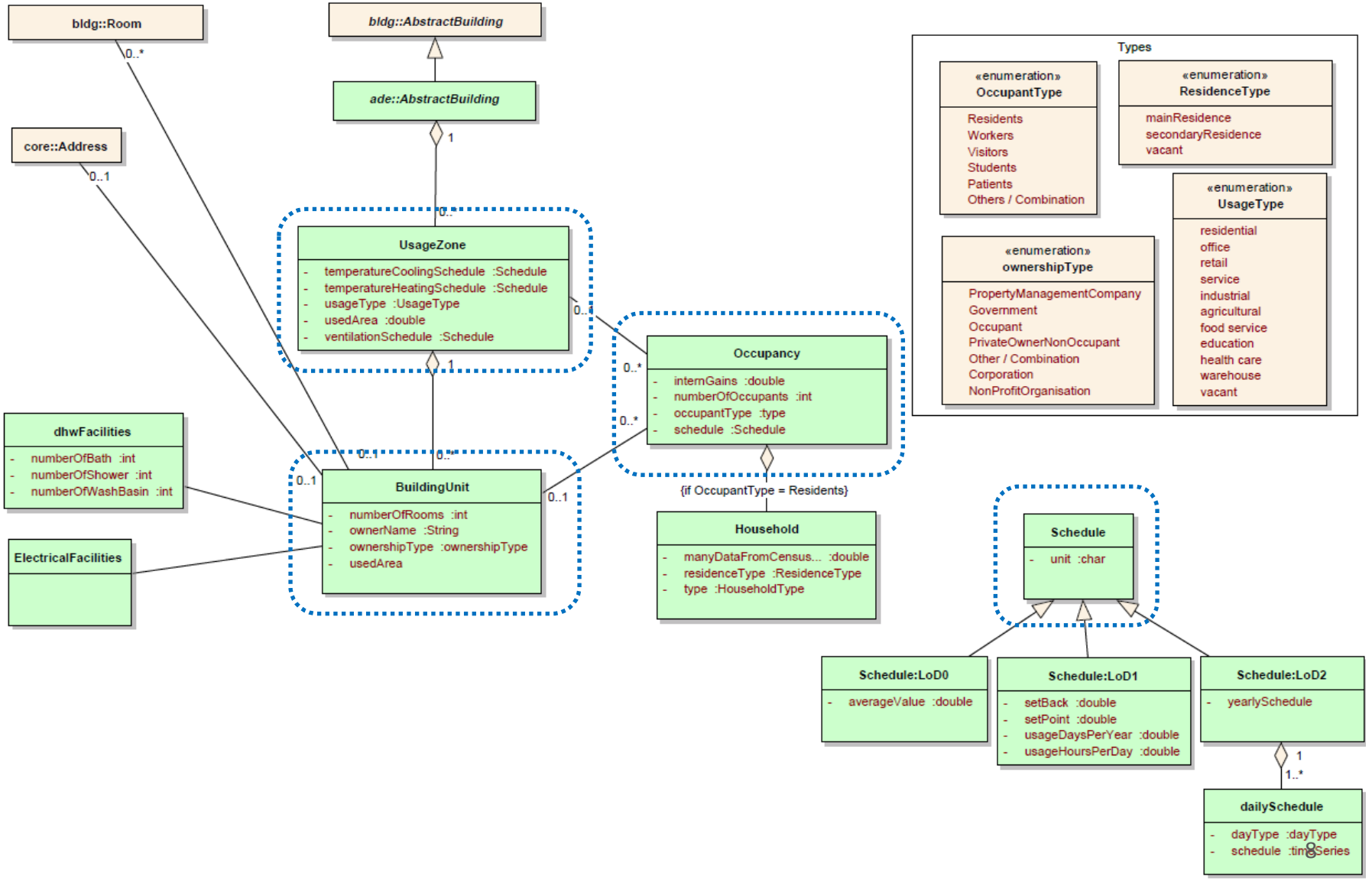
- **Norms**
  - DIN V 18599-10
  - ISO 13790

Main asumptions

- Model occupants as aggregated occupant groups, rather than single occupants.

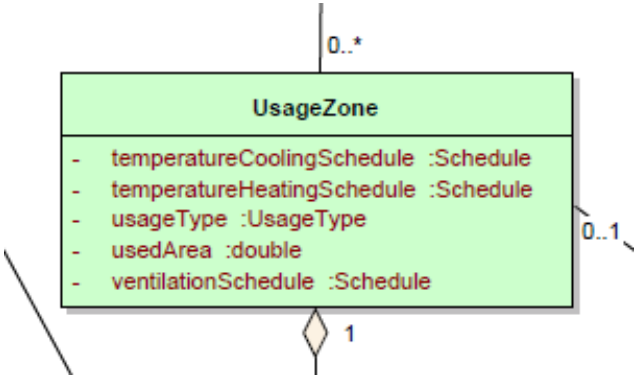
- Usage zone → single usage

Proposal: UML class diagram



Definition : Usage Zone

- **UsageZone** represents a zone with homogeneous usage/activity type (residential, office, retail etc...), related to the class **AbstractBuilding** of CityGML.

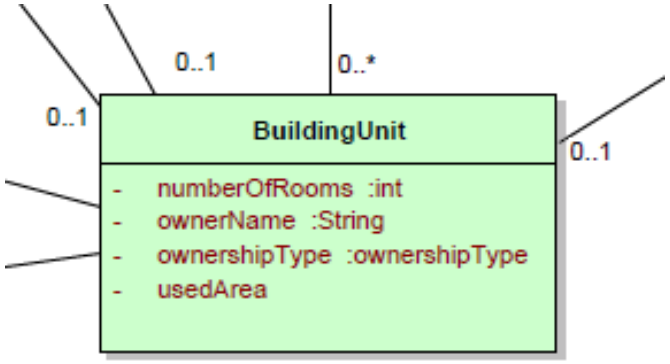


- Non-geometrical object (Geometrical information: UsageArea)

- It includes the indoor climate set-points

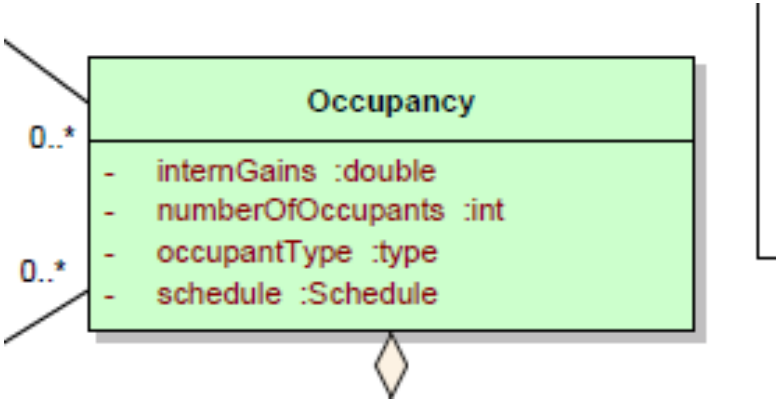
Definition: BuildingUnit

- **BuildingUnit** is a spatial unit of ownership (dwelling, workplace), part of **UsageZone**.



Definition Occupancy

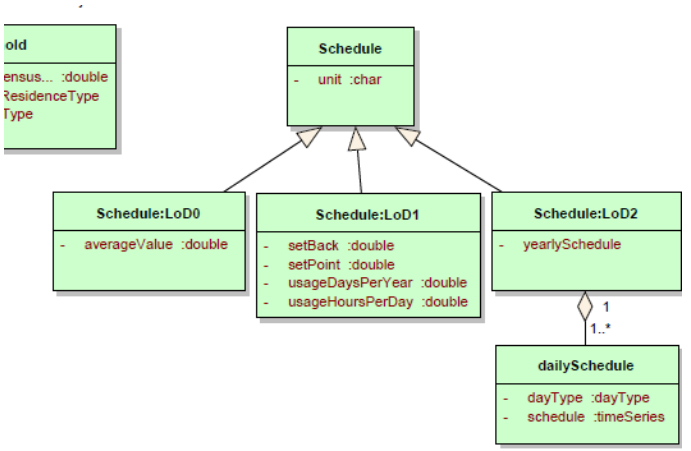
- **Occupancy** represents the "human content" of a UsageZone or a BuildingUnit, defined as an aggregated group of occupants which can be residents, workers, visitors etc.



- **Occupancy** may be detailed in **Household**

Definition Schedule

- **Schedule** details time-depending variables (indoor climate set-points, occupancy)



- It should be defined with **different Level of Details:**
  - LOD0: yearly average value
  - LOD1: setPoint, setBack, UsageHoursPerDay, UsageDaysPerYear
  - LOD2: timeSeries (hourly resolution)

Working group

- Participants
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Annex – List of attributes

Attribute Name	Description	Unit/Type	Reference Object	Application Field
OccupantNumber	number of occupants when dwelling occupied	int	Dwelling	
heatingSetPointTemperature		°C	zoneUsage	space heating
coolingSetPointTemperature		°C	zoneUsage	space cooling
waterConsumption		Liter / year	ZoneUsage	water
dhwDemand	domestic hot water demand	kWh/yr	zoneUsage / Dwelling	heat
airChangeRateRequirement		AC/H	zoneUsage	space heating
usageDaysPerYear		int	zoneUsage	
usageHoursPerDay		int	zoneUsage	
zoneArea		m²	zoneUsage	
dwellingNumber	number of dwelling	int	zoneUsage / Building	
householdType	profile of household	student, worker, family with young children, worker couple without children, retired	household / Dwelling	
ownerStructure	ownership	Housing company, private owner-resident,…	zoneUsage	
residencyType	type of residency	main residence (permanent), holiday home, week-end home, unoccupied	Dwelling / Dwelling	space heating,
employeeNumber	maximal number of employee	int	workplace	heat, water…
organizationName	name of the firm/establishment/organisation	String	workplace	
working capital turnover	turnover of the firm/organisation, made in the workplace	€	workplace	
internalGains	anthropogenic heat gains (people + devices)	W/m2	zoneUsage	space heating

Annex - Existing approachs

- **IEA Annex 66**

Objective:

- set up a standard occupant behavior definition platform,
- establish a quantitative simulation methodology to model occupant behavior in buildings,
- understand the influence of occupant behavior on building energy use and the indoor environment.

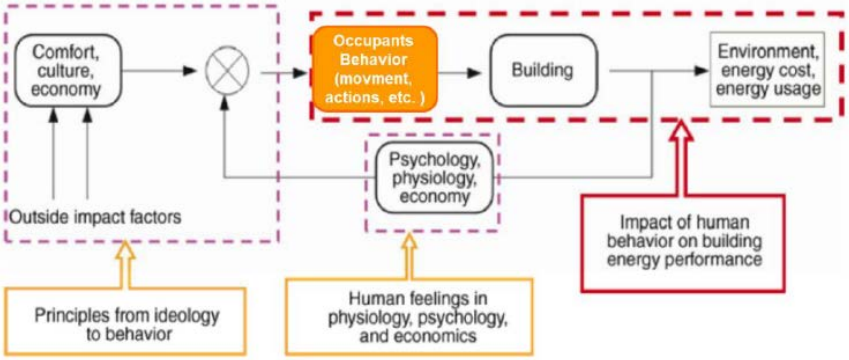

Figure 7 Relationship between occupants and buildings

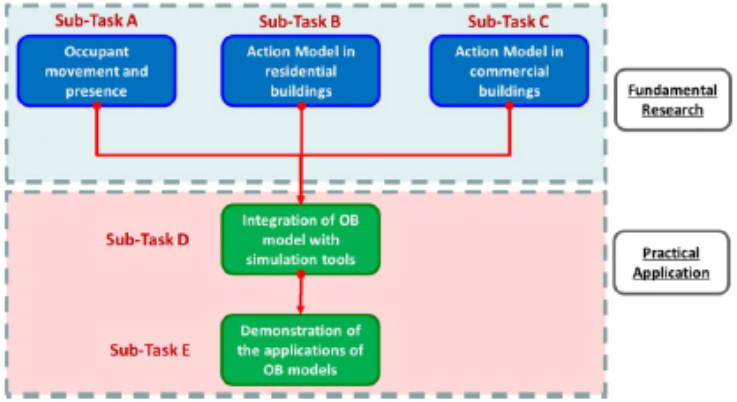

Figure 8 Subtasks structure of Annex 66