GeoSmartCity Workshop

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The GSC extended data models and the data harmonisation methodology

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Summary

- Objectives
- Data models
  - Scenarios and pilots involved
  - Methodology for the production of the GSC data models
  - INSPIRE DS extension approach
  - An insight into the GSC data models
- Data harmonisation

Objectives

- To design the data model needed to harmonize the overall heterogeneous spatial datasets to be further managed by the hub.
- To harmonize the spatial datasets from the different heterogeneous sources to the common target schemas.

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Scenarios

- Green Energy
  - Buildings (Reggio Emilia - IT, Marousi - GR, Oeiras – PT)
  - Green routing (Girona – ES, Turku – FI)
- Underground (Pamplona – ES, Genova – IT, Oeiras – PT, Flanders – BE, South Moravia – CZ, Ruda Slaska – PL)

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Methodology for the production of the GSC data models

Collect requirements

- Create a template file in order to collect the users' data modelling requirements in a structured way.
- Request each pilot to provide the list of information (attributes, code list ..) needed to run its use cases.

Analyse & Compare

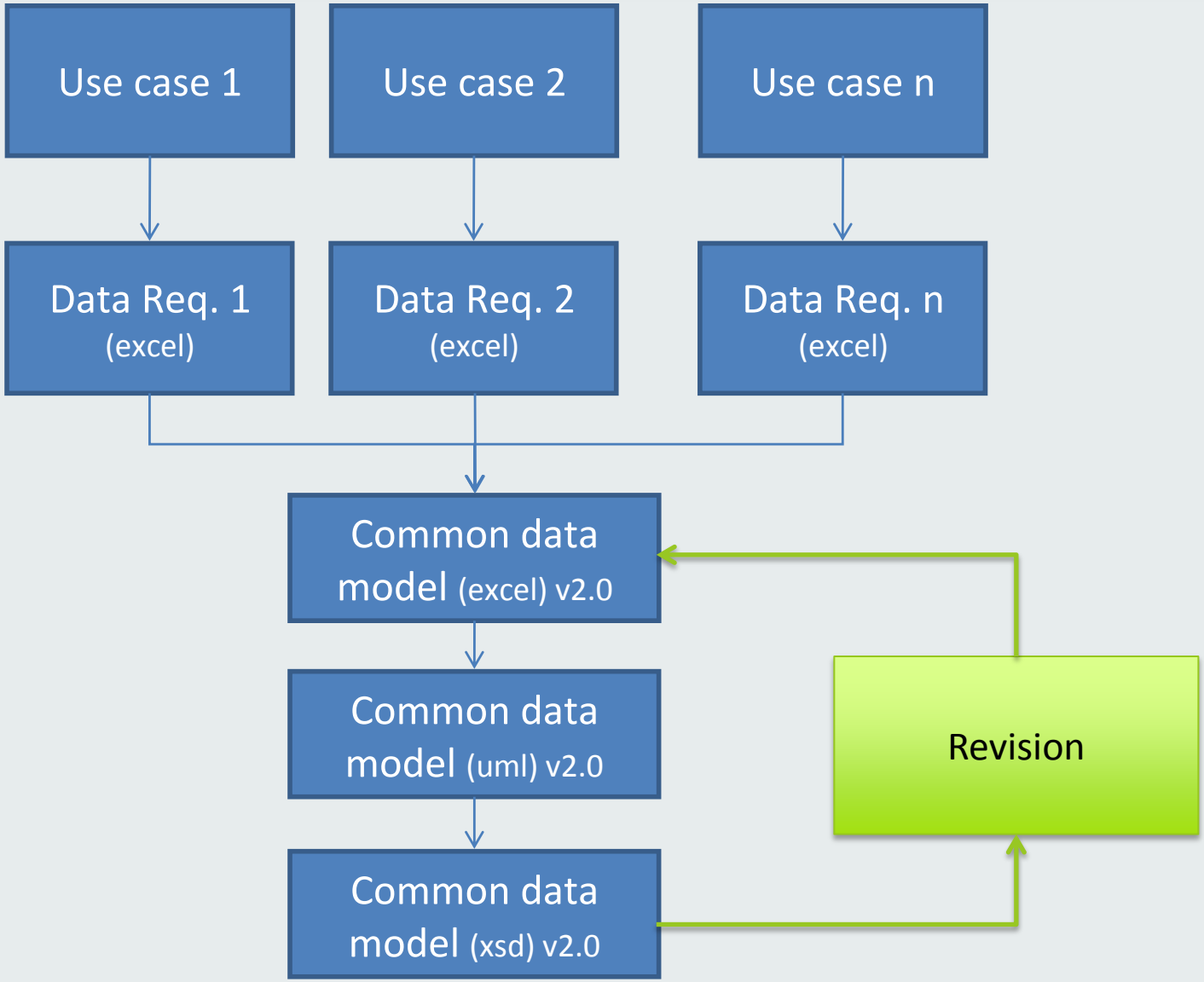
- Align different pilots' data modelling requirements (whereas feasible, group requirements into common classes)
- Compare data requirements so collected to the relevant INSPIRE Data Specifications

Extend data models

- Provide an extension of the INSPIRE data models to take into account requirements not covered by the INSPIRE DS
- Provide detailed instructions for maintenance of the schemas and the revision loop

Validate results

- Successfully validate the produced schemas against encoding requirements using desktop (Oxygen) and online (OGC CITE test Suite) tools.


Use case 1
Use case 2
Use case n
Data Req. 1 (excel)
Data Req. 2 (excel)
Data Req. n (excel)
Common data model (excel) v2.0
Common data model (uml) v2.0
Common data model (xsd) v2.0
Revision

A	B	C	D	E	F	G	
User services N°	DATA LOGIC NAME	DESCRIPTION LOGIC NAME	INPUT_OUTPUT DATA	DATA TYPE	INSPIRE	Extended properties (e.g. from CityGML ADE Energy	EXSISTING TABLE . ATTRI (OR OUTPUT METHOD CA
1	Building.Geometry 2D	footprint of the building	INPUT	Geometry	Building.Geometry 2D		EDIFICI_COMUNALI.SHA
	Building.Name	Name of the building, if known	INPUT	Text	Building.Name		EDIFICI_COMUNALI.DEN
	Building.Nature	Typology of the building	INPUT	Code list	Building.Nature		EDIFICI_COMUNALI.TIPC
	Building.Use(s)	Uses of the building	INPUT	Code list	Building.currentUse		EDIFICI_COMUNALI.TIPC
2	Building.Geometry 2D		INPUT	Geometry	Building.Geometry 2D		EDIFICI_COMUNALI.SHA
	Building.Name		INPUT	Text	Building.Name		EDIFICI_COMUNALI.DEN
	Building.Nature		INPUT	Code list	Building.Nature		EDIFICI_COMUNALI.TIPC
	Building.Use(s)		INPUT	Code list	Building.currentUse		EDIFICI_COMUNALI.TIPC
	Building.Presence of photovoltaic panels	Presence of solar panels used by the	INPUT	Number	(rel) installationValue (solarPanel)		IMPIANTI_RINNOVABILI_
3	Building.Geometry 2D		INPUT	Geometry	Building.Geometry 2D		EDIFICI_COMUNALI.SHA
	Building.Name		INPUT	Text	Building.Name		EDIFICI_COMUNALI.DEN
	Building.Nature		INPUT	Code list	Building.Nature		EDIFICI_COMUNALI.TIPC
	Building.Use(s)		INPUT	Code list	Building.currentUse		EDIFICI_COMUNALI.TIPC
	Building.Heated volumes	Cube meters (volume) of the building	INPUT	Number	n.a.		CENTRALI_TERMICHE_E
	Building.Unit of measure of energy consumption	Unit of measure of energy used (e.g. m3 for gas)	INPUT	Code list	n.a.		CONSUMI_CENTRALI_TE
	Building.Energy fuel	building	INPUT	Number	n.a.		CONSUMI_CENTRALI_TE
	Building.Energy value	fuel	INPUT	Number			CONSUMI_CENTRALI_TE
	Building.Energy consumption (in kWh)	kWh	INPUT	Number			CONSUMI_CENTRALI_TE
	Building.Presence of photovoltaic panels		INPUT	Number	Building.Installation (association)		IMPIANTI_RINNOVABILI_
4	Building.Geometry 2D		INPUT	Geometry	Building.Geometry 2D		EDIFICI_COMUNALI.SHA
	Building.Name		INPUT	Text	Building.Name		EDIFICI_COMUNALI.DEN
	Building.Nature		INPUT	Code list	Building.Nature		EDIFICI_COMUNALI.TIPC
	Building.Use(s)		INPUT	Code list	Building.currentUse		EDIFICI_COMUNALI.TIPC
	Building.Energy consumption (total in kWh)						
	Building.Presence of photovoltaic panels		INPUT	Number			IMPIANTI_RINNOVABILI_
	Building.Geometry 2D		INPUT	Geometry	Building.Geometry 2D		EDIFICI_COMUNALI.SHA
	Building.Name		INPUT	Text	Building.Name		EDIFICI_COMUNALI.DEN
	Building.Nature		INPUT	Code list	Building.Nature		EDIFICI_COMUNALI.TIPC
	Building.Use(s)		INPUT	Code list	Building.currentUse		EDIFICI_COMUNALI.TIPC

A	B	C	D	E	F	G	H	I	J	K
Pilot 01			Pilot 02				Pilot 03			
UC-GSCP01-01	UC-GSCP01-02	DATA LOGIC NAME (PILOT 1)	UC-GSCP02-01	UC-GSCP02-02	UC-GSCP02-03	DATA LOGIC NAME (PILOT 2)	DATA LOGIC NAME (PILOT 3)	DATA LOGIC NAME *	DESCRIPTION LOGIC NAME *	INPUT_OTPUT DATA
X (1, 2, 3, 4, 5, 6, 6bis, 7, 8)	X (1,2,3,4,7)	BuildingTerritory.Geometry 2D; BuildingUE.Geometry 2D	X	X	X	Building.Geometry 2D	Building.Geometry 2D; EconomicActivity.the_geom	**geometry2D**	footprint of the territorial building	INPUT
X (1, 2, 3, 4, 5, 6, 6bis, 7, 8)		BuildingUE.Name	X	X	X	Building.Name		**name**	Name of the building	INPUT
X (1, 2, 3, 4, 5, 6, 6bis, 7, 8)	X (1,2,3,4,7)	BuildingUE.Nature	X	X	X	Building.Nature	Building.Nature (__TEDIF)	**buildingNature**	Typology of the building	INPUT
							Building.gid; UserBulding.gid;	**inspireId**		INPUT
X (1, 2, 3, 4, 5, 6, 6bis, 7, 8)		BuildingUE.Ownership						**ownership**	Ownership of the building	INPUT
X (1, 2, 3, 4, 5, 6, 6bis, 7, 8)	X (1,2,3,4,7)	BuildingUE.Use(s)	X	X	X	Building.Use(s)	Building.currentUse (__TUTIL); EconomicActivity.tser	**currentUse**	Type of uses of the building (use classification based on the energy certification)	INPUT
X (1, 2, 3, 4, 5, 6, 6bis, 7, 8)	X (1,2,3,4,7)	BuildingUE.Address	X	X	X	Building.Postcode; Building.Neighborhood		**address**	Address building (Street, Civic, Civic sub)	INPUT
X (1, 2, 3, 4, 5, 6, 6bis, 7, 8)		BuildingUE.CostructionYear	X	X	X	Building.Construction period - begin; Building.Construction period - end	Building.__EPOCA; Building.UserYear	**dateOfConstruction**	Costruction Year of the building (if available or estimated)	INPUT
			X	X	X	Building.height; Building.height_statu		**heightAboveGround**	Total height of the building, in meters	INPUT

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The INSPIRE DS extension approach

INSPIRE
Infrastructure for Spatial Information in Europe

INSPIRE Generic Conceptual Model

Title	D2.5: Generic Conceptual Model, Version 3.4
Status	Version for Annex II/III data specifications v3.0
Creator	Drafting Team "Data Specifications"
Date	2014-04-08
Subject	Generic Conceptual Model of the INSPIRE data specifications
Publisher	Drafting Team "Data Specifications"
Type	Text
Description	Generic Conceptual Model of the INSPIRE data specifications
Contributor	Members of the INSPIRE Drafting Team "Data Specifications", INSPIRE Spatial Data Interest Communities & Legally Mandated Organisations, INSPIRE Consolidation Teams and other Drafting Teams
Format	Portable document format (pdf)
Source	Drafting Team "Data Specifications"
Rights	Public
Identifier	D2.5_v3.4
Language	En
Relation	n/a
Coverage	Project duration

Annex F
(informative)

Example for an extension to an INSPIRE application schema

F.1 Introduction

The agreement on harmonised data specifications addresses the need of users, in particular pan-European users, to combine multiple spatial data sets without repetitive manual intervention and in such a way that the result is coherent. This requires an effort to transform the existing spatial data to the new harmonised data specifications. In the long-term, it is the hope that less and less effort will be required for such transformations and that data providers start to re-use the harmonised data specifications as the basis for their spatial data sets in case they are restructured. Since national spatial data sets will in almost all cases contain information not covered by the INSPIRE data specifications, national SDIs or community SDIs will typically have to extend the INSPIRE data specification for their own purpose.

The Generic Conceptual Model has been designed to support such extensions. This annex provides an example for a simple extension.

F.2 General rules

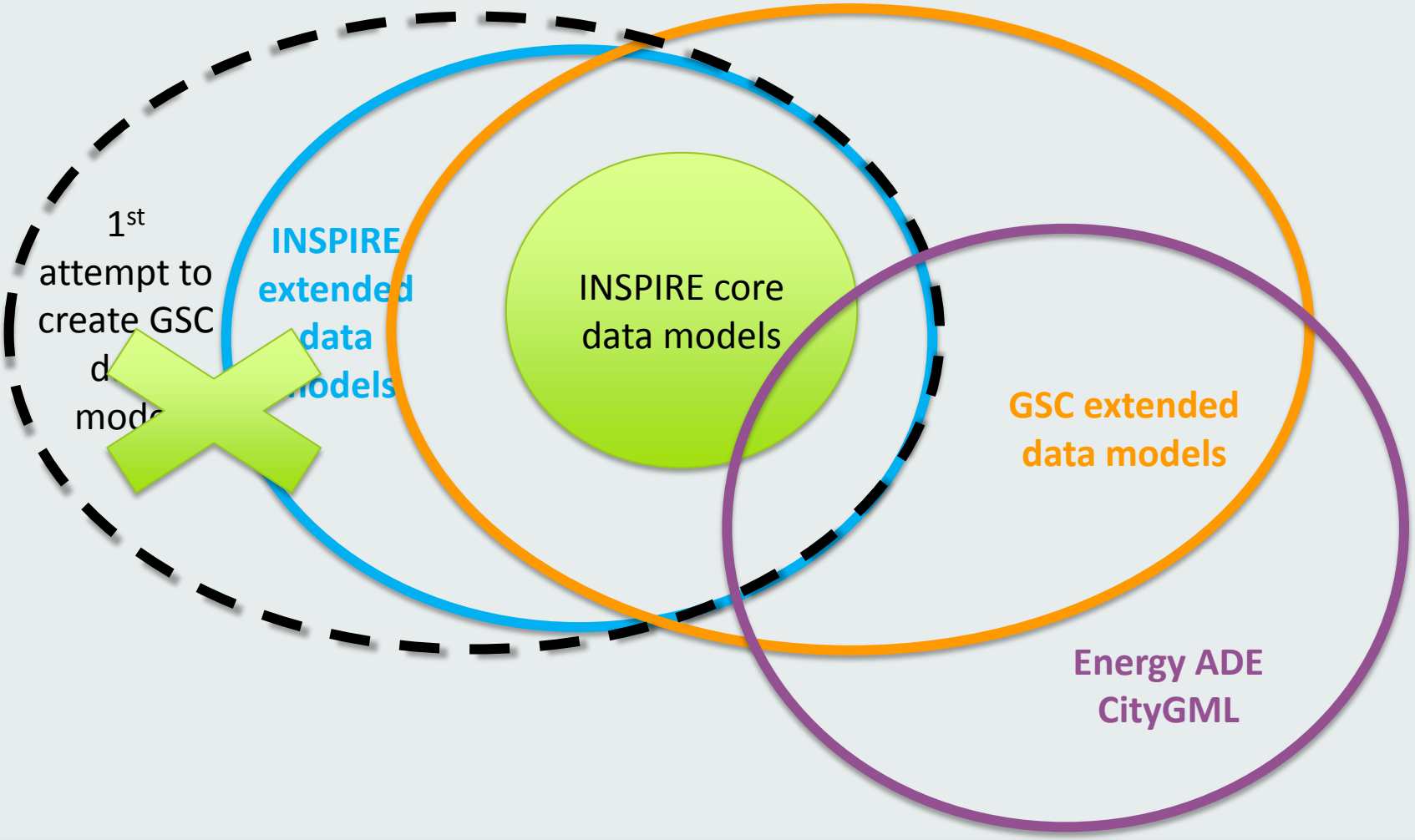
The INSPIRE data specifications have been developed through a process involving the European stakeholders. While the future maintenance of the specifications has not yet been fixed, it is reasonable to assume that this will be the case in the future, too. The INSPIRE

Extending an INSPIRE data specification would imply at a minimum that:
- the extension does not change anything in the INSPIRE data specification but normatively references it with all its requirements
- the extension does not add a requirement that breaks any requirement of the INSPIRE data specification

However, the extension may, for example, do any of the following:
- add new application schemas importing INSPIRE or other schemas as needed
- add new types and new constraints in your own application schemas
- extend INSPIRE code lists as long as the INSPIRE data specification does not identify the code list as a centrally managed, non-extensible code list
- add additional portrayal rules

In addition to these general rules that are mainly implied by the rules of UML, further harmonisation will be achieved, if the extensions conform to all requirements of this document and the document "Guidelines for the encoding of spatial data", too.

The GSC Data Model extension approach



The GSC Data Model extension approach

Starting point: relevant INSPIRE core schemas.

Steps of the development process:

- INSPIRE matching tables were used to identify the corresponding concepts (attributes, associations, code lists) between INSPIRE and GeoSmartCity data models.
- Enterprise Architect software tool was used to create the logical model using UML class diagrams and to transform them into relevant application schemas. To extend the INSPIRE schemas the relevant INSPIRE themes were imported into the GSC data model EA project.

The GSC Data Model extension approach

To comply with GSC requirements for which no matching attributes were found in the INSPIRE schemas:

- additional attributes were added in GSC feature types derived from the INSPIRE feature types via a generalization relationship in the application schemas (when feasible).
- new feature types – i.e. not derived from INSPIRE ones – were added to deal with concepts not present in INSPIRE
- new code lists / code list values were created only if no corresponding INSPIRE value exists. A registry has been created for GSC codelists at http://hub.geosmartcity.eu/registry/

A	B	C	D	E	F	G	H	I	J	K	L
Application Schema 'Building2D-Energy' (version 2.1)								**Pilot Mapping**			
Type	**Documentation**	**Attribute Association role New/updated attribute**	**Attribute / Association role Documentation**	**Values / Enumerations**	**Multiplicity**	**Voidable / Non-Void:**		**Pilot 01**	**Pilot 02**	**Pilot 03**	
Building Supertypes:Building *BuildingAbstractBuildingAbstractConstructionBuildingInfo BuildingAndBuildingUnitInfo*	Building A Building is an enclosed construction above and/or underground, used or intended for the shelter of humans, animals or things or for the production of economic goods. A building refers to any structure permanently constructed or erected on its site.										
		beginLifespanVersion	Begin lifespan version Date and time at which this version of	DateTime	1	voidable					
		conditionOfConstruction	Condition of construction Status of the	ConditionOfConstructionValue	1	voidable					
		dateOfConstruction	Date of construction Date of construction.	DateOfEvent	0..1	voidable		BuildingUE.Costruction	Building.Construction	Building.__EPOCA;	
		dateOfDemolition	Date of demolition Date of demolition	DateOfEvent	0..1	voidable					
		dateOfRenovation	Date of last major renovation Date of last major renovation	DateOfEvent	0..1	voidable					
		elevation	Elevation Vertically-constrained dimensional property	Elevation	0..*	voidable			Building.Elevation_value		
		endLifespanVersion	End lifespan version Date and time at which this version of	DateTime	0..1	voidable					
		externalReference	External reference Reference to an external	ExternalReference	0..*	voidable					
		heightAboveGround	Height above ground Height above ground NOTE:	HeightAboveGround	0..*	voidable			Building.height:		
		inspireId	inspire id External object identifier of the spatial	Identifier	1					Building.gid; UserBuilding	
		name	Name Name of the construction EXAMPLES: Big	GeographicalName	0..*	voidable		BuildingUE.Name	Building.Name		
		buildingNature	Building nature Characteristic of the building that	BuildingNatureValue	0..*	voidable		BuildingUE.Nature	Building.Nature	Building.Nature (__TEDIE)	
		currentUse	Current use Activity hosted within the building. This attribute addresses mainly the	CurrentUse	0..*	voidable		BuildingUE.Use(s)	Building.Use(s)	Building.currentUse (__TUTIL);	
		numberOfDwellings	Number of dwellings Number of dwellings A	Integer	0..1	voidable					
		numberOfBuildingUnits	Number of building units Number of building units in the	Integer	0..1	voidable			Building.Units		
		numberOfFloorsAboveGr	Number of floors above	Integer	0..1	voidable			Building.Num		

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GSC - Underground Scenario

INSPIRE Utilities and Governmental Services (US) - *"Utility networks"* Profile:

- is based on a node-arc-node structure and network concept
- information is detailed in:
  - one "Common Utility Networks Elements" application schema, that contains all the common elements shared among the different utility network type
  - six network - specific application schemas
    - Electricity network
    - Oil, Gas & Chemicals network
    - Sewer network
    - Telecommunications network (only proposed in the technical guidance, out of legislation)
    - Thermal network
    - Water network

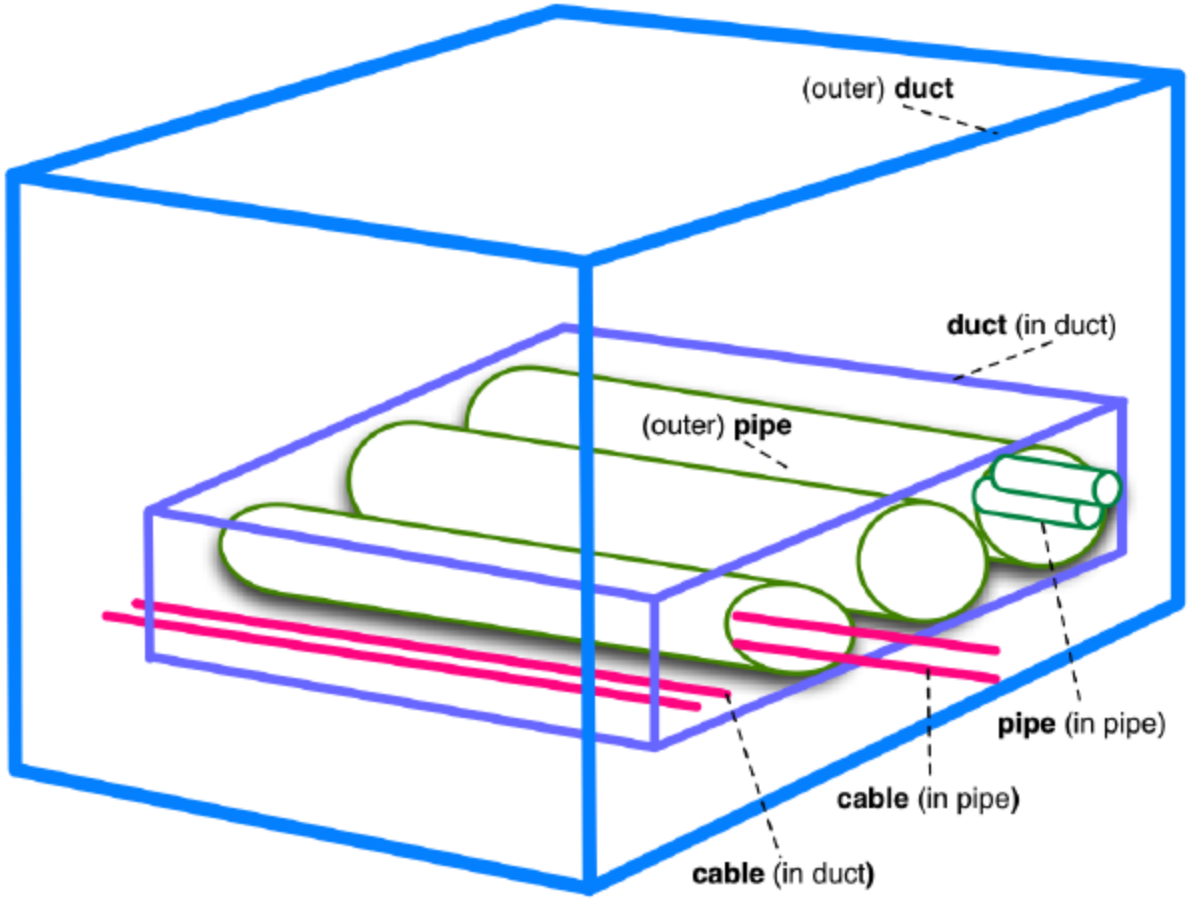
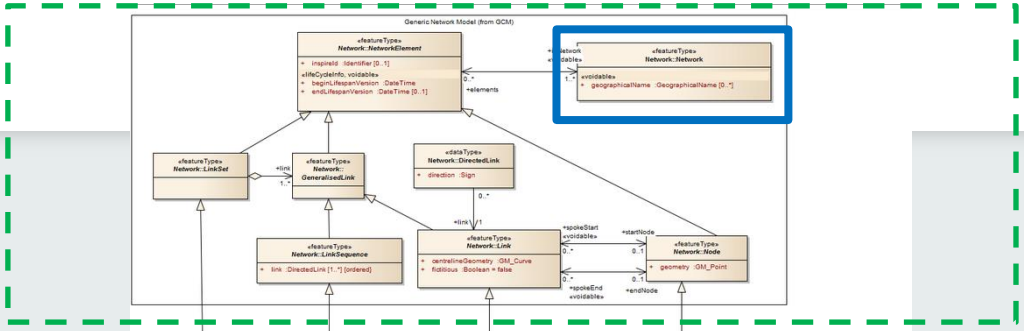
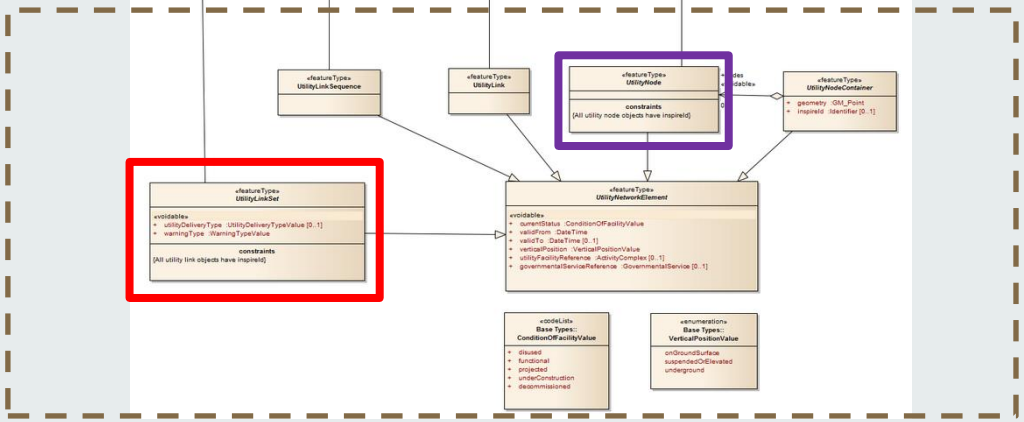


Figure 9 – Physical relations between cables, pipes and ducts

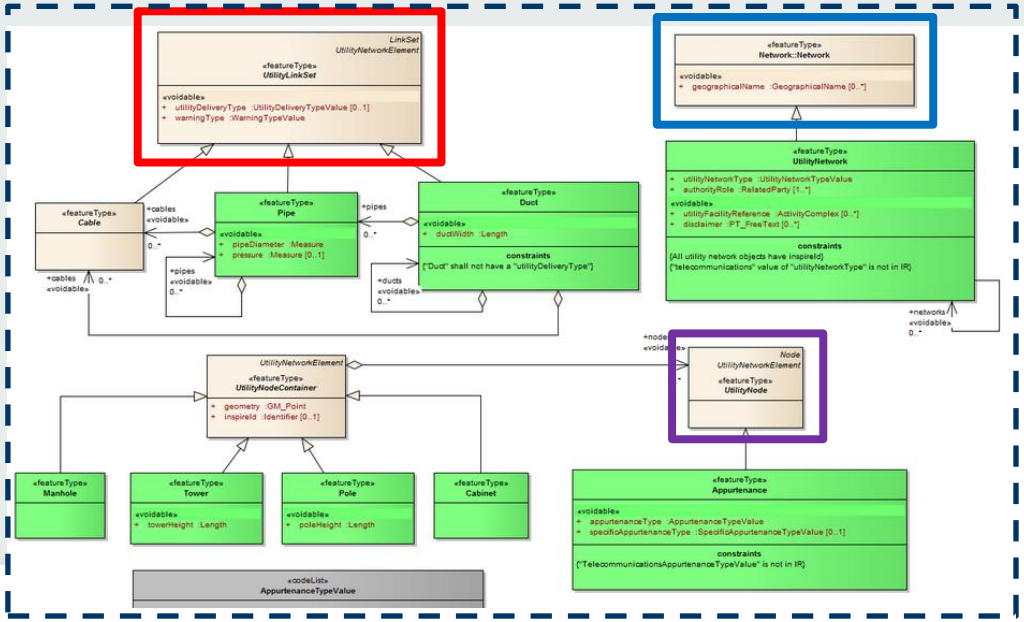
Generic Network Model (from GCM)



Utility Network Profile – Abstract Types



Utility Network Profile – CommonTypes



GeoSmartCity - Underground Scenario Data Model

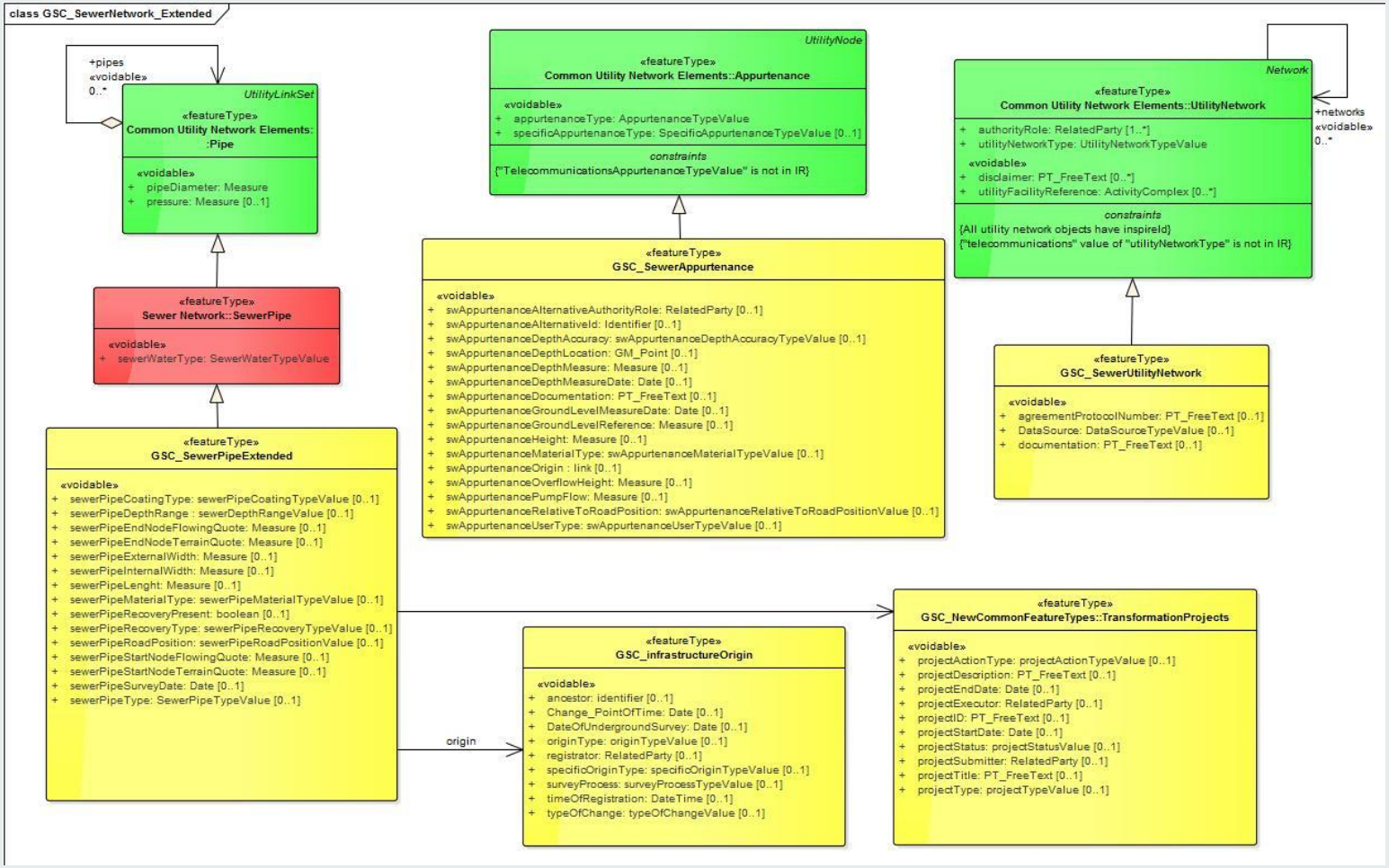
The GeoSmartCity Utilities and Governmental Services data model inherits the core **INSPIRE** data model for **Utilities and Governmental Services** and extends it by means of:

- **1 "New Common Types" application schema**, which contains definitions for feature types and data types which are not present in the INSPIRE core and that are common to all GSC- extended US schemas
- **6 *network-specific extended* application schemas** ,which extend INSPIRE core US feature types adding new attributes and relevant code clist / codelist values:
    - Electricity network
    - Oil, Gas & Chemicals network
    - Sewer network
    - Telecommunications network
    - Thermal network
    - Water network
- **1 *theme-specific extension*** of the Base Model "Activity Complex" application schema according to what stated by D2.10 "The types defined in the Base Model *Activity Complex* are supposed to be extended in the related thematic data specifications

In detail, in the new application schemas, there are:

- **7 INSPIRE feature types extended** adding new attributes to the relevant INSPIRE US core feature types
    - UtilityNetwork
    - ActivityComplex
    - SewerPipe
    - WaterPipe
    - OilGasChemicals Pipe
    - TelecommunicationsCable
    - ElectricityCable
- **9 feature types created from scratch** (no corresponding feature type in the INSPIRE US core model exists)
    - SewerAppurtenance
    - WaterAppurtenance
    - OilGasChemicalsAppurtenance
    - SoilDigs
    - Intervention
    - TransformationProjects
    - InfrastructureOrigin
    - MunicipalIntervention
    - CrowdSourcing

GeoSmartCity extension of the “Sewer Network”



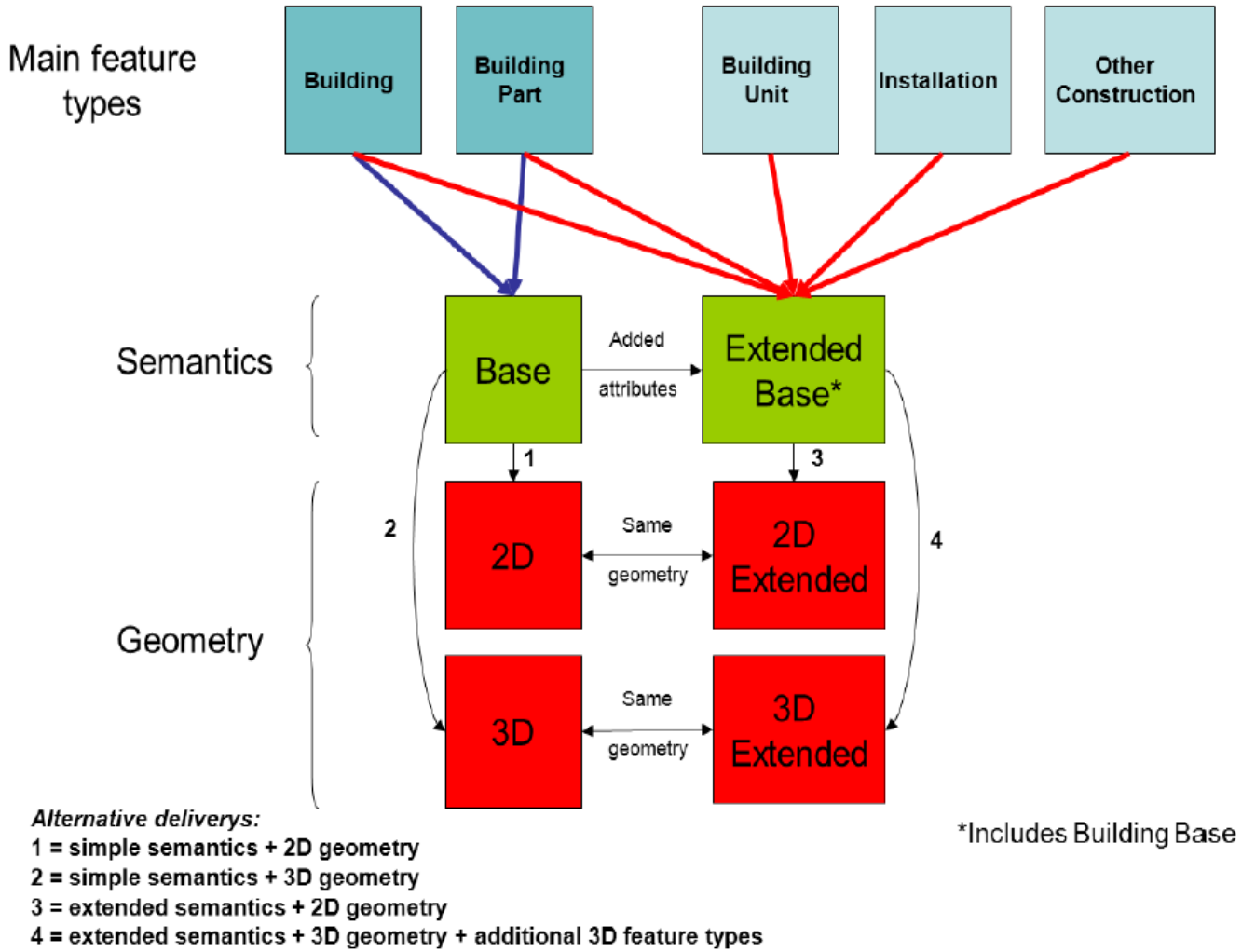


Figure 3: Content and structure of application schemas for theme Buildings

Feature types are represented in blue. Abstract application schemas are represented in green. Instanciable application schemas are represented in red.

NOTE: **Data producers may also extend INSPIRE profiles by other information not included in this specification, under the condition they respect the rules provided in the Generic Conceptual Model.**

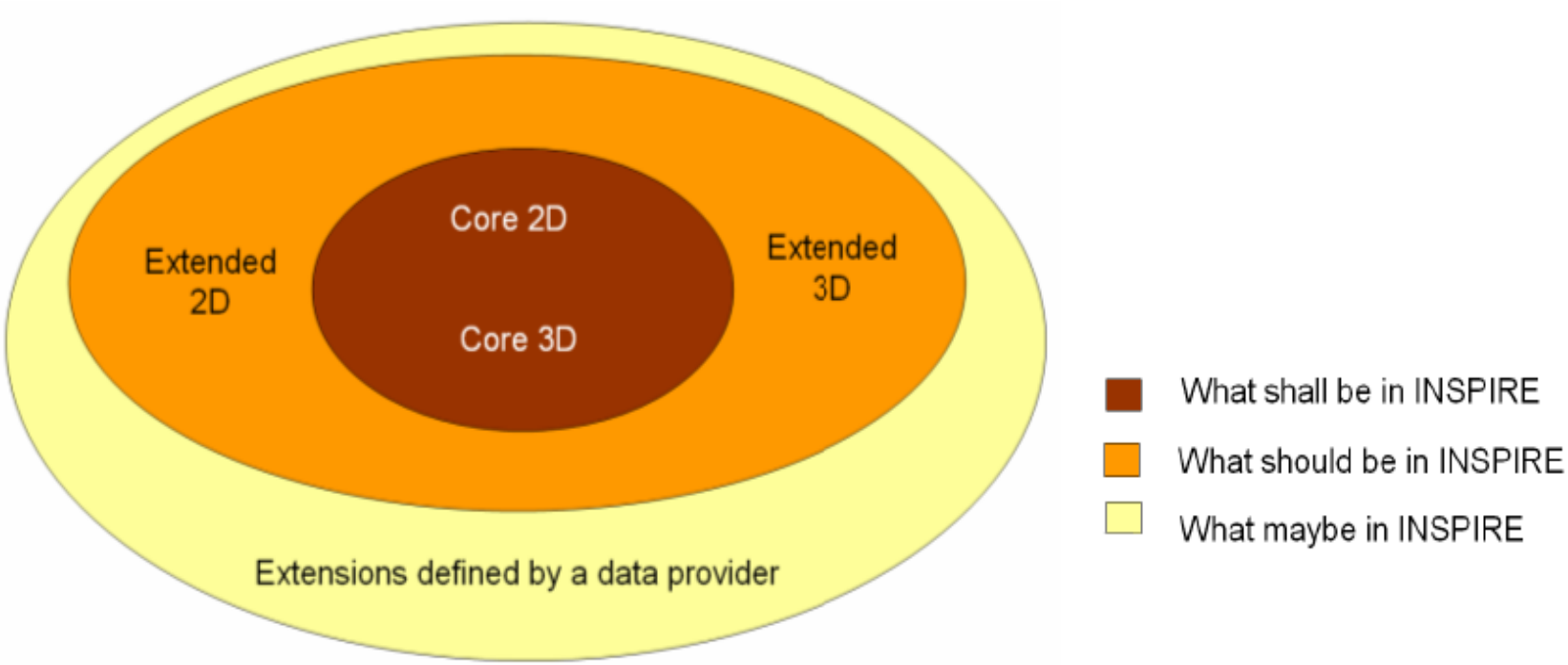
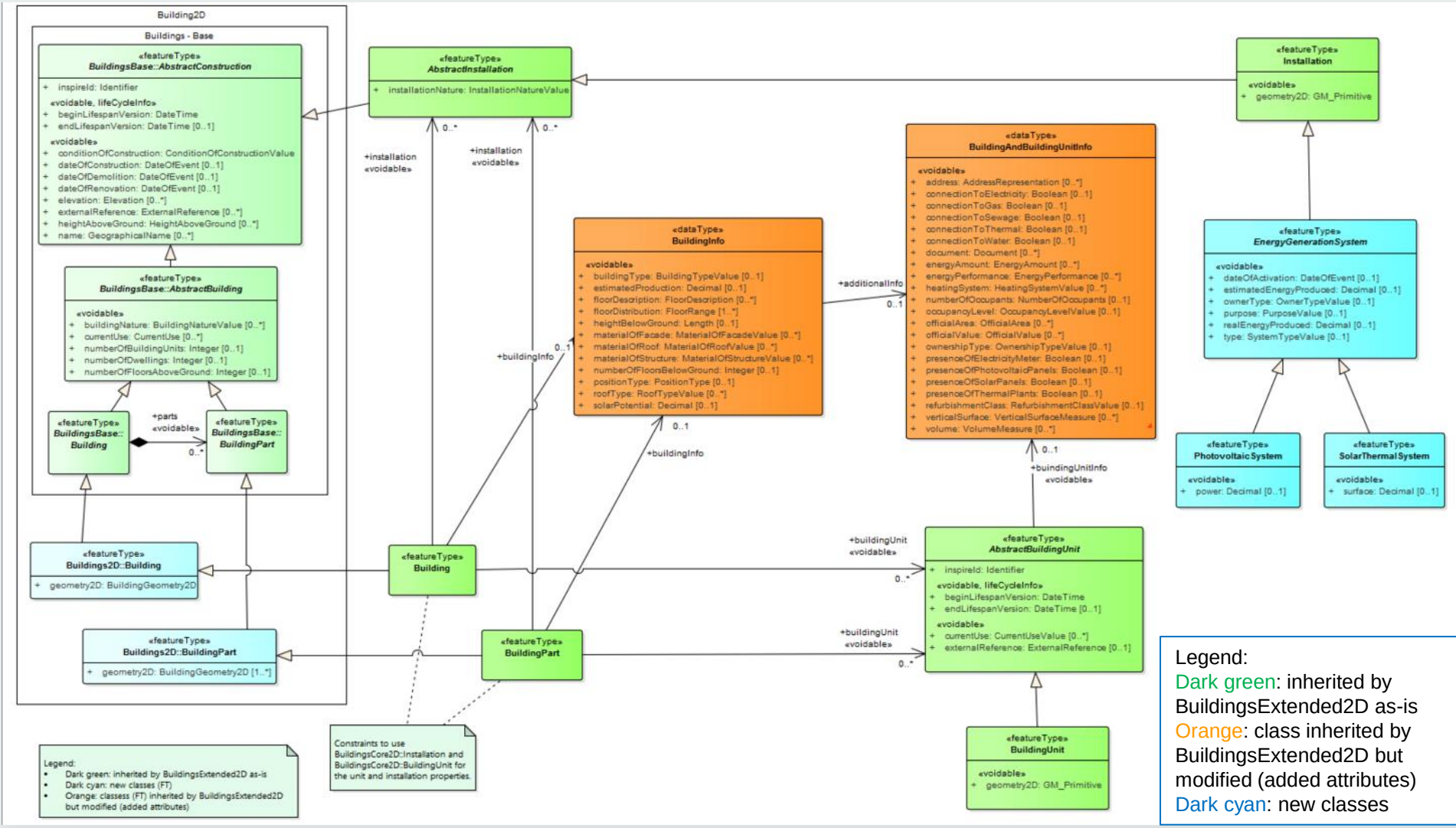
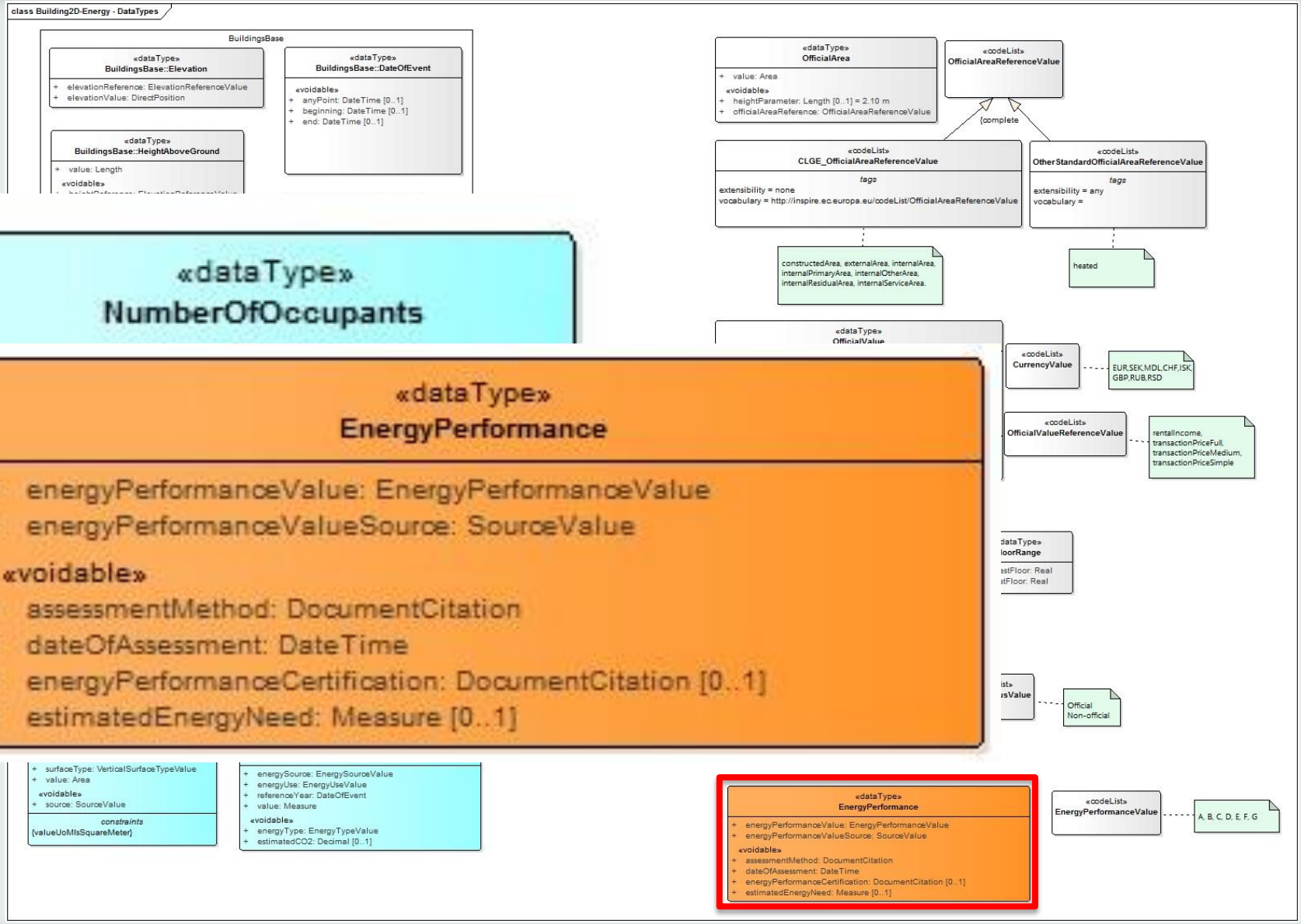


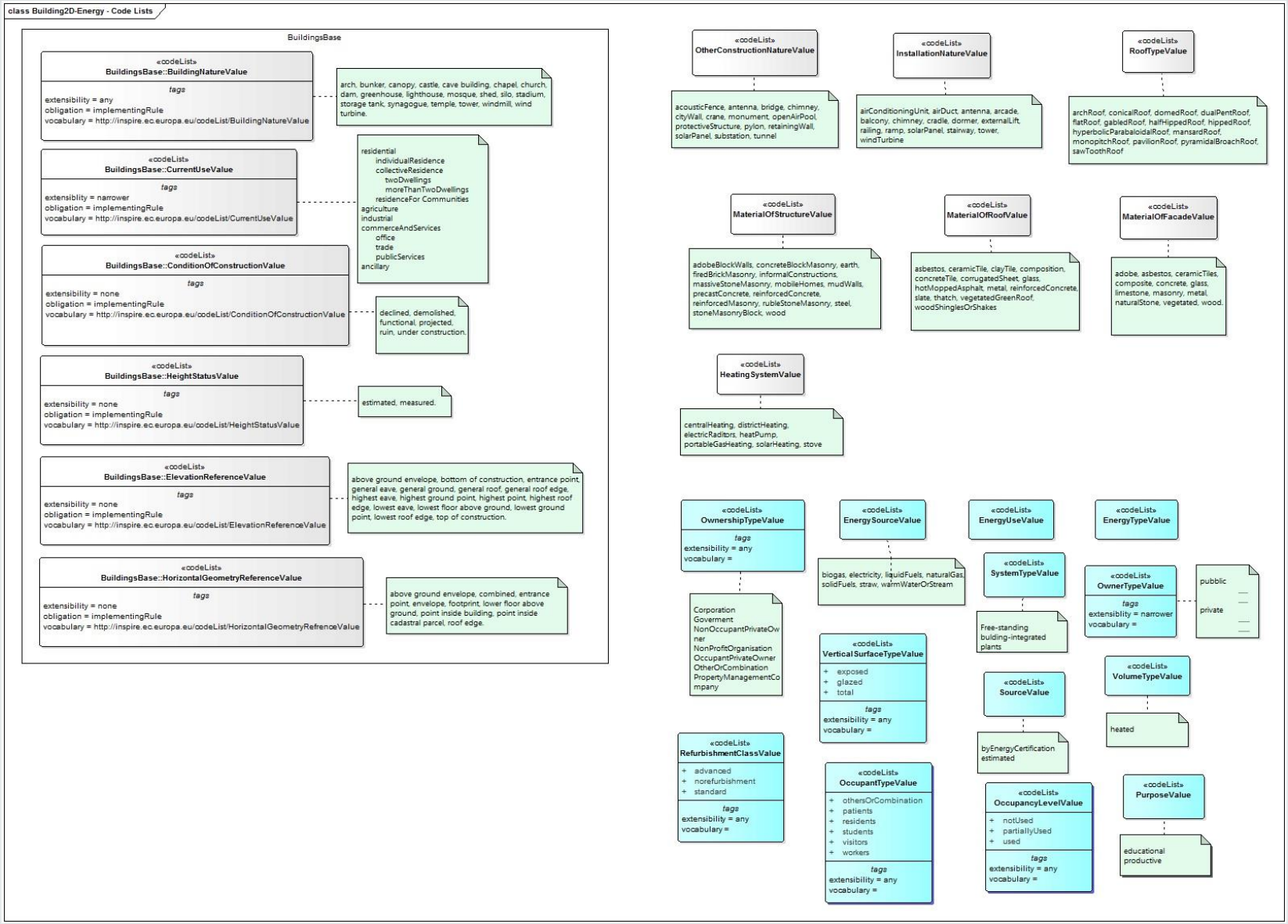
Figure 4: Modular approach for modelling Buildings theme

GeoSmartCity – Green Energy Scenario Data Model



Legend:
Dark green: inherited by BuildingsExtended2D as-is
Orange: class inherited by BuildingsExtended2D but modified (added attributes)
Dark cyan: new classes


class Building2D-Energy - DataTypes
BuildingsBase
«dataType»
BuildingsBase::Elevation
+ elevationReference: ElevationReferenceValue
+ elevationValue: DirectPosition
«dataType»
BuildingsBase::DateOfEvent
«voidable»
+ anyPoint: DateTime [0..1]
+ beginning: DateTime [0..1]
+ end: DateTime [0..1]
«dataType»
BuildingsBase::HeightAboveGround
+ value: Length
«voidable»
«dataType»
OfficialArea
+ value: Area
«voidable»
+ heightParameter: Length [0..1] = 2.10 m
+ officialAreaReference: OfficialAreaReferenceValue
«codeList»
OfficialAreaReferenceValue
{complete
«codeList»
CLGE_OfficialAreaReferenceValue
tags
extensibility = none
vocabulary = http://inspire.ec.europa.eu/codeList/OfficialAreaReferenceValue
«codeList»
OtherStandardOfficialAreaReferenceValue
tags
extensibility = any
vocabulary =
constructedArea, externalArea, internalArea, internalPrimaryArea, internalOtherArea, internalResidualArea, internalServiceArea.
heated
«dataType»
NumberOfOccupants
«dataType»
EnergyPerformance
+ energyPerformanceValue: EnergyPerformanceValue
+ energyPerformanceValueSource: SourceValue
«voidable»
+ assessmentMethod: DocumentCitation
+ dateOfAssessment: DateTime
+ energyPerformanceCertification: DocumentCitation [0..1]
+ estimatedEnergyNeed: Measure [0..1]
«codeList»
CurrencyValue
EUR,SEK,MDL,CHF,ISK, GBP,RUB,RSD
«codeList»
OfficialValueReferenceValue
rentalIncome, transactionPriceFull, transactionPriceMedium, transactionPriceSimple
Official
Non-official
+ surfaceType: VerticalSurfaceTypeValue
+ value: Area
«voidable»
+ source: SourceValue
constraints
{valueUoMIsSquareMeter}
+ energySource: EnergySourceValue
+ energyUse: EnergyUseValue
+ referenceYear: DateOfEvent
+ value: Measure
«voidable»
+ energyType: EnergyTypeValue
+ estimatedCO2: Decimal [0..1]
«dataType»
EnergyPerformance
+ energyPerformanceValue: EnergyPerformanceValue
+ energyPerformanceValueSource: SourceValue
«voidable»
+ assessmentMethod: DocumentCitation
+ dateOfAssessment: DateTime
+ energyPerformanceCertification: DocumentCitation [0..1]
+ estimatedEnergyNeed: Measure [0..1]
«codeList»
EnergyPerformanceValue
A, B, C, D, E, F, G


class Building2D-Energy - Code Lists
BuildingsBase
«codeList» BuildingsBase::BuildingNatureValue
tags
extensibility = any
obligation = implementingRule
vocabulary = http://inspire.ec.europa.eu/codeList/BuildingNatureValue
arch, bunker, canopy, castle, cave building, chapel, church, dam, greenhouse, lighthouse, mosque, shed, silo, stadium, storage tank, synagogue, temple, tower, windmill, wind turbine.
«codeList» BuildingsBase::CurrentUseValue
tags
extensiblity = narrower
obligation = implementingRule
vocabulary = http://inspire.ec.europa.eu/codeList/CurrentUseValue
residential
individualResidence
collectiveResidence
twoDwellings
moreThanTwoDwellings
residenceFor Communities
agriculture
industrial
commerceAndServices
office
trade
publicServices
ancillary
«codeList» BuildingsBase::ConditionOfConstructionValue
tags
extensibility = none
obligation = implementingRule
vocabulary = http://inspire.ec.europa.eu/codeList/ConditionOfConstructionValue
declined, demolished, functional, projected, ruin, under construction.
«codeList» BuildingsBase::HeightStatusValue
tags
extensibility = none
obligation = implementingRule
vocabulary = http://inspire.ec.europa.eu/codeList/HeightStatusValue
estimated, measured.
«codeList» BuildingsBase::ElevationReferenceValue
tags
extensibility = none
obligation = implementingRule
vocabulary = http://inspire.ec.europa.eu/codeList/ElevationReferenceValue
above ground envelope, bottom of construction, entrance point, general eave, general ground, general roof, general roof edge, highest eave, highest ground point, highest point, highest roof edge, lowest eave, lowest floor above ground, lowest ground point, lowest roof edge, top of construction.
«codeList» BuildingsBase::HorizontalGeometryReferenceValue
tags
extensibility = none
obligation = implementingRule
vocabulary = http://inspire.ec.europa.eu/codeList/HorizontalGeometryRefrenceValue
above ground envelope, combined, entrance point, envelope, footprint, lower floor above ground, point inside building, point inside cadastral parcel, roof edge.
«codeList» OtherConstructionNatureValue
acousticFence, antenna, bridge, chimney, cityWall, crane, monument, openAirPool, protectiveStructure, pylon, retainingWall, solarPanel, substation, tunnel
«codeList» InstallationNatureValue
airConditioningUnit, airDuct, antenna, arcade, balcony, chimney, cradle, dormer, externalLift, railing, ramp, solarPanel, stairway, tower, windTurbine
«codeList» RoofTypeValue
archRoof, conicalRoof, domedRoof, dualPentRoof, flatRoof, gabledRoof, halfHippedRoof, hippedRoof, hyperbolicParabaloidalRoof, mansardRoof, monopitchRoof, pavilionRoof, pyramidalBroachRoof, sawToothRoof
«codeList» MaterialOfStructureValue
adobeBlockWalls, concreteBlockMasonry, earth, firedBrickMasonry, informalConstructions, massiveStoneMasonry, mobileHomes, mudWalls, precastConcrete, reinforcedConcrete, reinforcedMasonry, rubleStoneMasonry, steel, stoneMasonryBlock, wood
«codeList» MaterialOfRoofValue
asbestos, ceramicTile, clayTile, composition, concreteTile, corrugatedSheet, glass, hotMoppedAsphalt, metal, reinforcedConcrete, slate, thatch, vegetatedGreenRoof, woodShinglesOrShakes
«codeList» MaterialOfFacadeValue
adobe, asbestos, ceramicTiles, composite, concrete, glass, limestone, masonry, metal, naturalStone, vegetated, wood.
«codeList» HeatingSystemValue
centralHeating, districtHeating, electricRadiators, heatPump, portableGasHeating, solarHeating, stove
«codeList» OwnershipTypeValue
tags
extensibility = any
vocabulary =
Corporation
Goverment
NonOccupantPrivateOwner
NonProfitOrganisation
OccupantPrivateOwner
OtherOrCombination
PropertyManagementCompany
«codeList» EnergySourceValue
biogas, electricity, liquidFuels, naturalGas, solidFuels, straw, warmWaterOrStream
«codeList» EnergyUseValue
«codeList» EnergyTypeValue
«codeList» SystemTypeValue
Free-standing
buliding-integrated
plants
«codeList» OwnerTypeValue
tags
extensiblity = narrower
vocabulary =
pubblic
private
«codeList» VerticalSurfaceTypeValue
+ exposed
+ glazed
+ total
tags
extensibility = any
vocabulary =
«codeList» SourceValue
byEnergyCertification
estimated
«codeList» VolumeTypeValue
heated
«codeList» RefurbishmentClassValue
+ advanced
+ norefurbishment
+ standard
tags
extensibility = any
vocabulary =
«codeList» OccupantTypeValue
+ othersOrCombination
+ patients
+ residents
+ students
+ visitors
+ workers
tags
extensibility = any
vocabulary =
«codeList» OccupancyLevelValue
+ notUsed
+ partiallyUsed
+ used
tags
extensibility = any
vocabulary =
«codeList» PurposeValue
educational
productive

GeoSmartCity data model for green routing

Regarding data requirements for Green Routing scenario, the reference target data model are INSPIRE Transport Networks (http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_TN_v3.2.pdf) for the road data and the data model GTFS (https://developers.google.com/transit/gtfs/) for the transportation schedules.

The adoption of a separate data model for transportation schedules was due by the fact that the INSPIRE Data Specifications for TN explicitly state that the data model is not conceived for such kind of information.

The selection of GTFS data model was based on the fact that it is globally used and after a first cross-check with the pilots concerned it seems well fitting for purpose with their use cases.

GeoSmartCity data model for green routing

- Initial selection of the INSPIRE TN theme as target data model for the two pilots involved.
- Evaluated the possibility of using existing routing algorithms and provide the data to a wider community
- Use of OSM as data model for geometry/topology and part of the attributes
- Use of GTFS as data model for public transport schedules

Summary

- Objectives
- Data models
  - Scenarios and pilots involved
  - Methodology for the production of the GSC data models
  - INSPIRE DS extension approach
  - An insight into the GSC data model
- **Data harmonisation**

Data harmonisation

According to the definition provided by INSPIRE, “Data harmonisation” is intended as:

“Providing access to spatial data through network services in a representation that allows for combining it with other harmonised data in a coherent way by using a common set of data product specifications“.

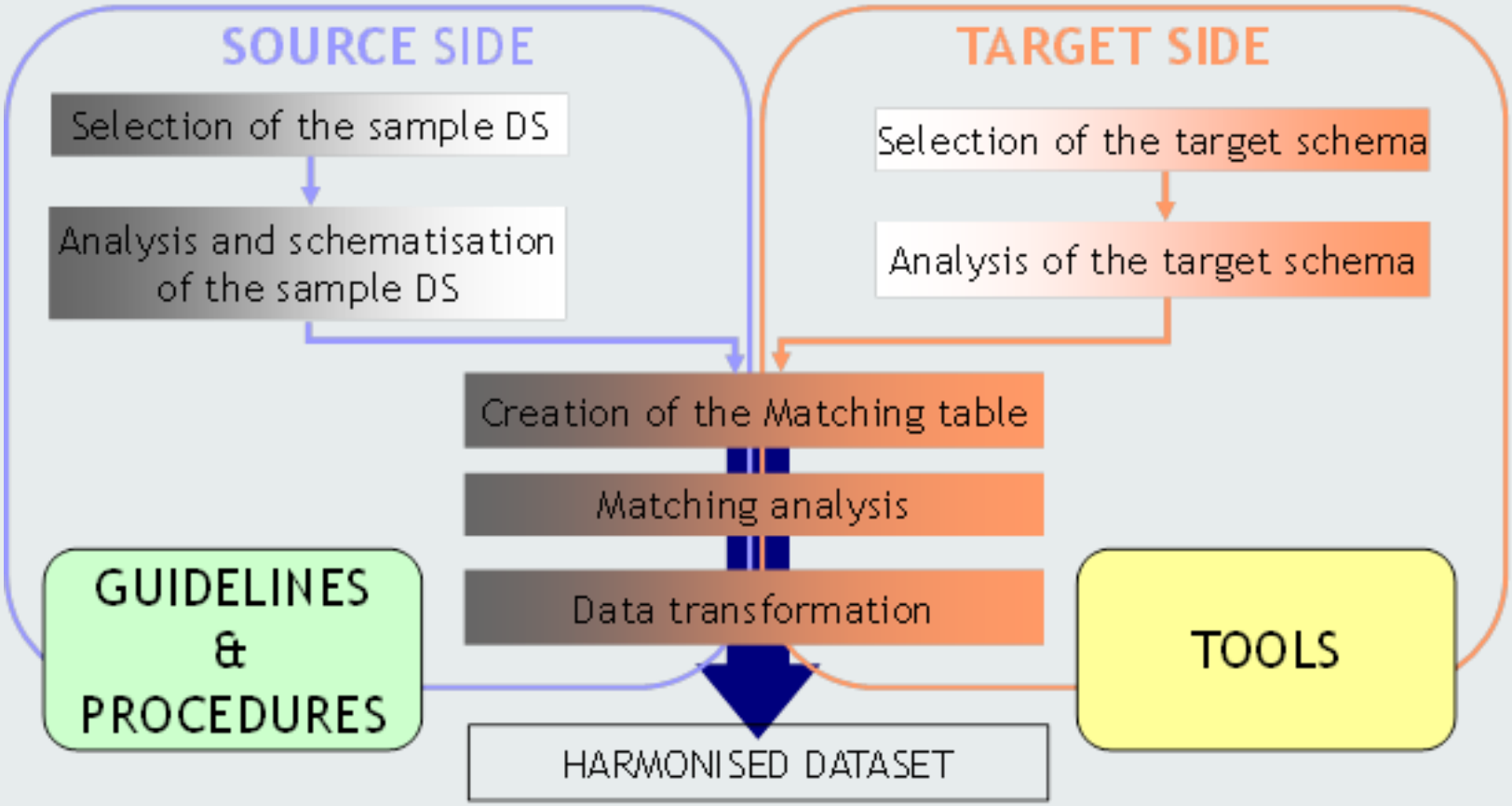
Data harmonization can be seen as a process in which the input is a source dataset and the output is a dataset conformant to a specific target schema and published as a network service.

Data harmonisation

The process consists of several steps summarised as:

- **Evaluation**: Source, target schemas and actual data should be closely examined before design begins.
- **Matching**: this step often involves extraction of data from available sources, often with some combination of queries and translation. Sometimes data assembly is required.
- **Transformation**: a process which reshapes source schema and geometry to match the required target schema.
- **Validation**: conformance assessment process i.e. process for assessing the conformance of an implementation to standards.
- **Publication**: transformed datasets have to be made available through OGC network services.

Steps of the data harmonization process

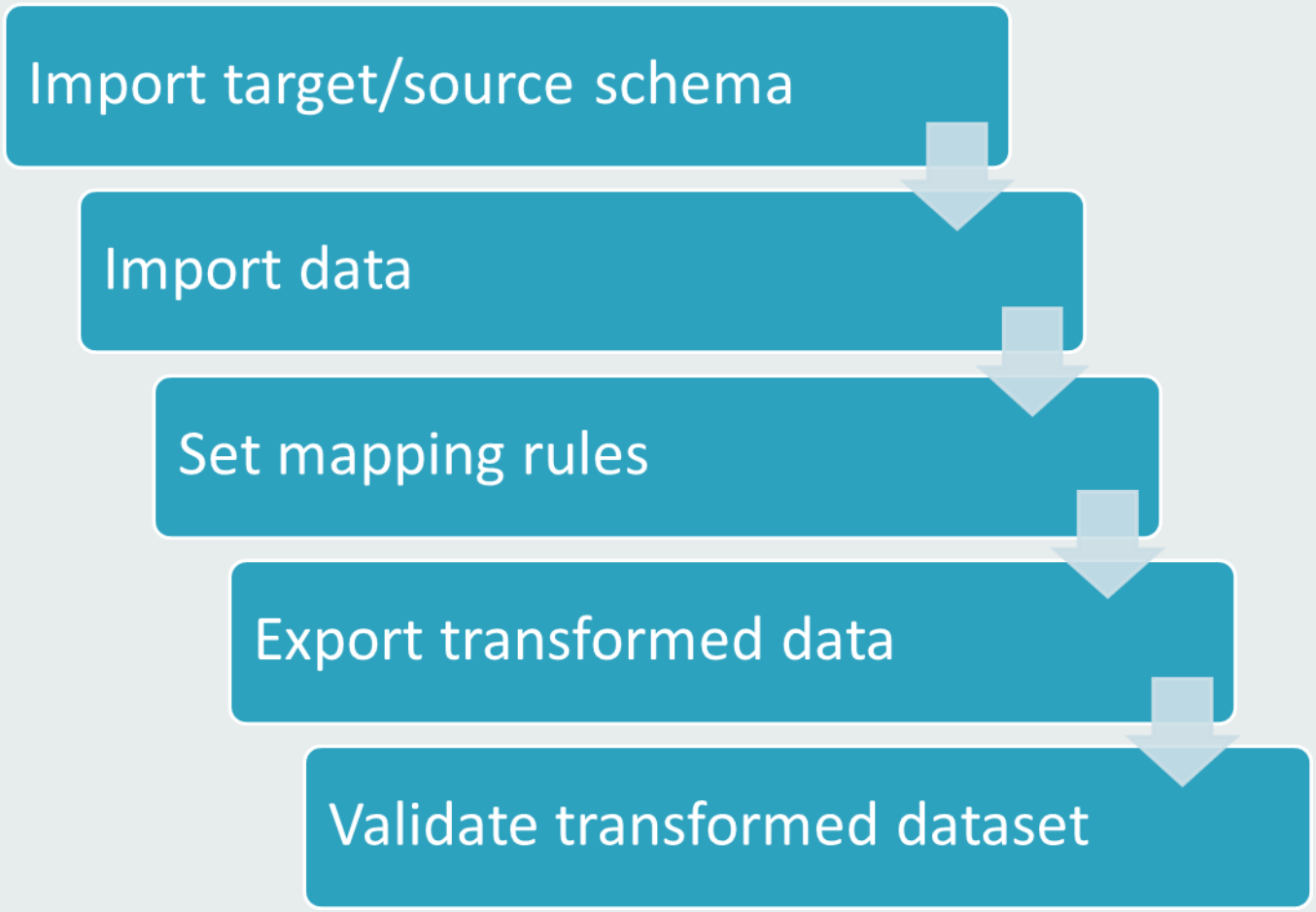


Steps of the data harmonization process

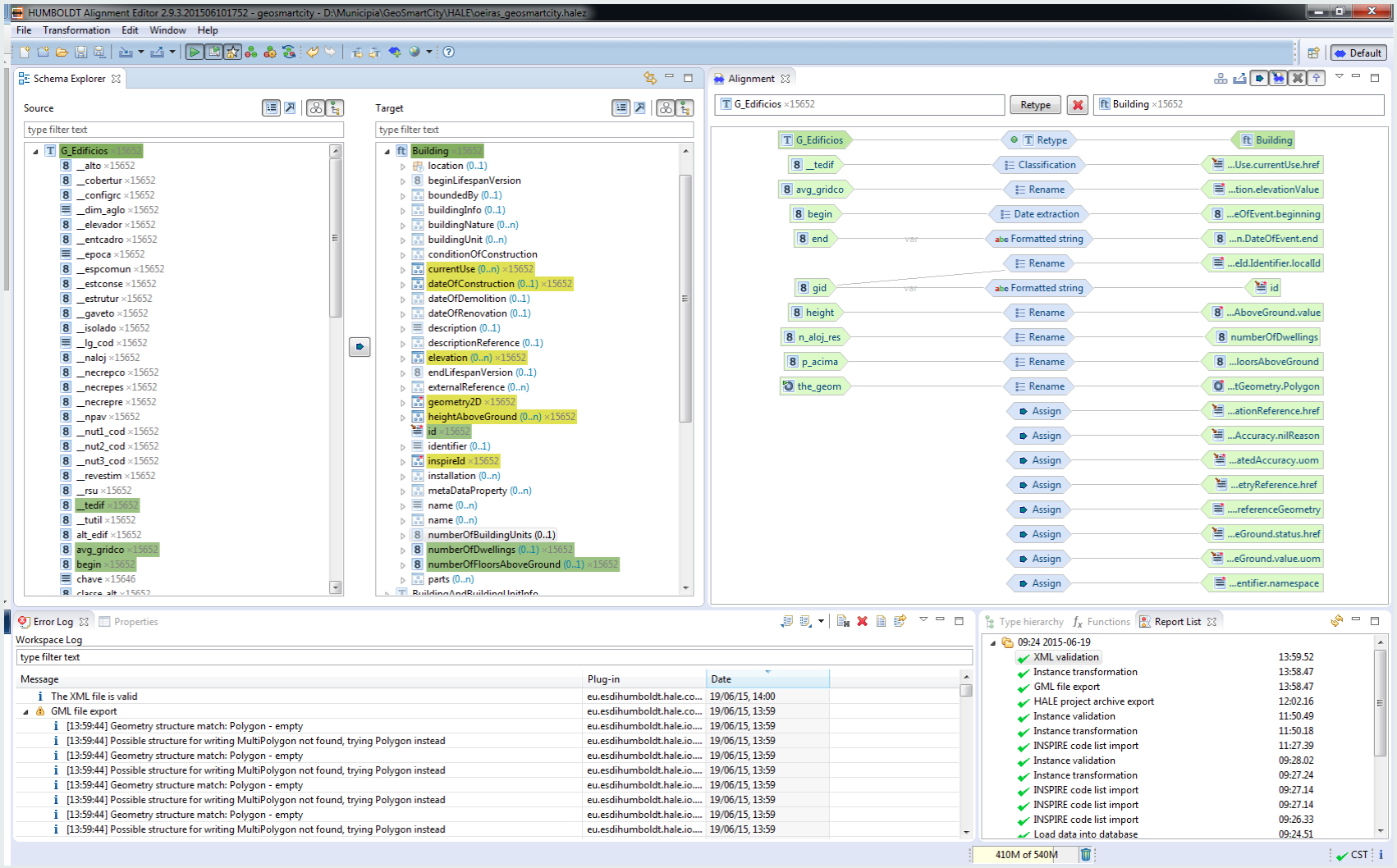
1. Analysis of the source dataset and its associated data model
2. Selection of the target schema best fitting for purpose with the source dataset and with the objective of the transformation and analysis of the relevant data model
3. Filling-in of the mapping table.
   - It's the most crucial harmonization step!
   - Performing very carefully this exercise, analysing and solving the eventual mapping problems, strongly facilitates the transformation.
5. Transformation of the source dataset by means of software transformation tools.
6. Validation of the transformed dataset against relevant application schema
7. Publication of the validated transformed dataset by means of network services

Steps of the data transformation process

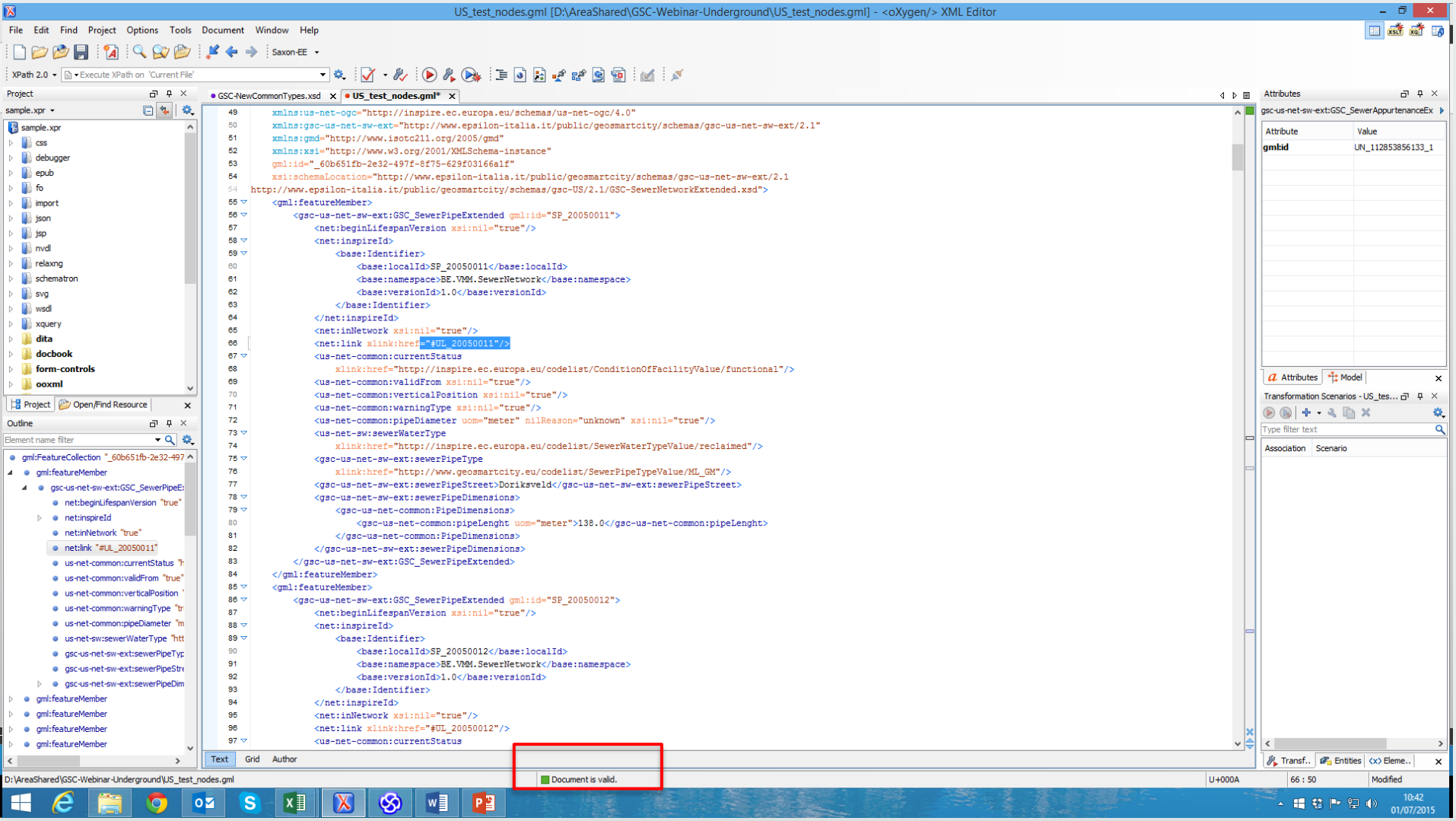
Generic workflow to transform datasets according to selected target schema

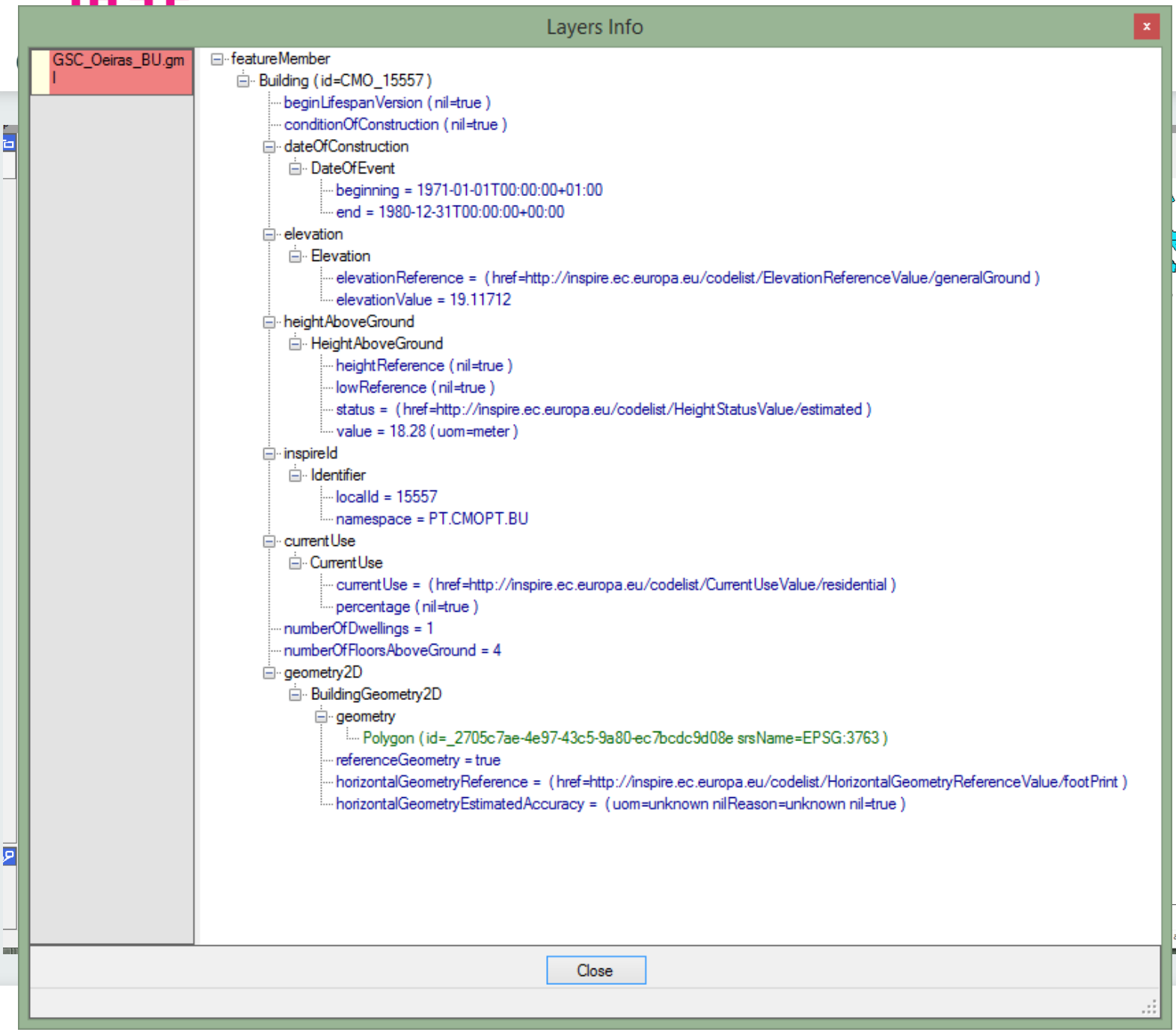


Hale studio: transformation of source data



Transformed data




Layers Info
GSC_Oeiras_BU.gml
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beginLifespanVersion (nil=true)
conditionOfConstruction (nil=true)
dateOfConstruction
DateOfEvent
beginning = 1971-01-01T00:00:00+01:00
end = 1980-12-31T00:00:00+00:00
elevation
Elevation
elevationReference = (href=http://inspire.ec.europa.eu/codelist/ElevationReferenceValue/generalGround)
elevationValue = 19.11712
heightAboveGround
HeightAboveGround
heightReference (nil=true)
lowReference (nil=true)
status = (href=http://inspire.ec.europa.eu/codelist/HeightStatusValue/estimated)
value = 18.28 (uom=meter)
inspireId
Identifier
localId = 15557
namespace = PT.CMOPT.BU
currentUse
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currentUse = (href=http://inspire.ec.europa.eu/codelist/CurrentUseValue/residential)
percentage (nil=true)
numberOfDwellings = 1
numberOfFloorsAboveGround = 4
geometry2D
BuildingGeometry2D
geometry
Polygon (id=_2705c7ae-4e97-43c5-9a80-ec7bcdc9d08e srsName=EPSG:3763)
referenceGeometry = true
horizontalGeometryReference = (href=http://inspire.ec.europa.eu/codelist/HorizontalGeometryReferenceValue/footPrint)
horizontalGeometryEstimatedAccuracy = (uom=unknown nilReason=unknown nil=true)
Close

THANK YOU!

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