



Semantics-based Fusion for CityGML and 3D LandXML

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Motivation

- 3D data are fundamental to support national development and planning, data fusion from varying sources is often unavoidable
- But 3D data are massive and generally diverse in
 - **system** – e.g. *ESRI, Bentley, etc;*
 - **syntax** – e.g. *binary, ASCII;*
 - **schema/structure** – e.g. *CityGML, LandXML;*
CityGML for city modeling, while LandXML operationally used in automated cadastral processing
 - **semantics** – e.g. *“spot level”, “elevation”, “height”*
- Differences in **system, syntax, schema/structure** currently can be resolved by commercial software but not for **semantics**

Objectives



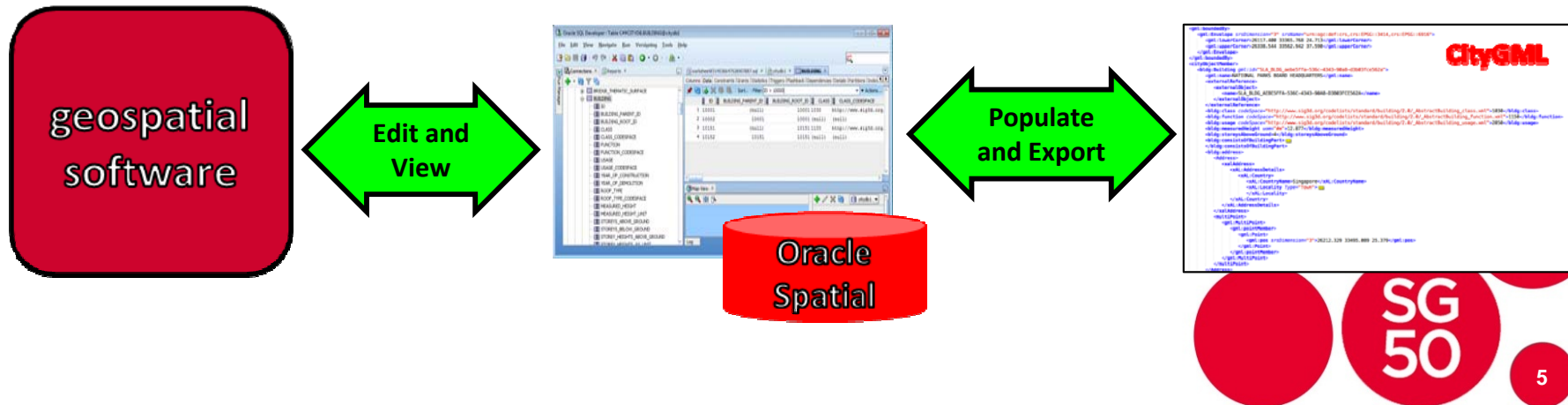
- **To semantically fuse Physical Building Data in CityGML and Building Legal Boundary in 3D LandXML with LADM Ontology in OWL**
- **To provide a useful reference in discussing the future directions and harmonization of the schemas**

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3D National Topographic Mapping project

- airborne imagery and laser scanning for the whole Singapore
- LOD 0 and 1 modeling for Terrain, Water Body, and Building (in CityGML)
- LOD 2 building modeling
- a national 3D topographic database, which is based on CityGML 2.0 schema

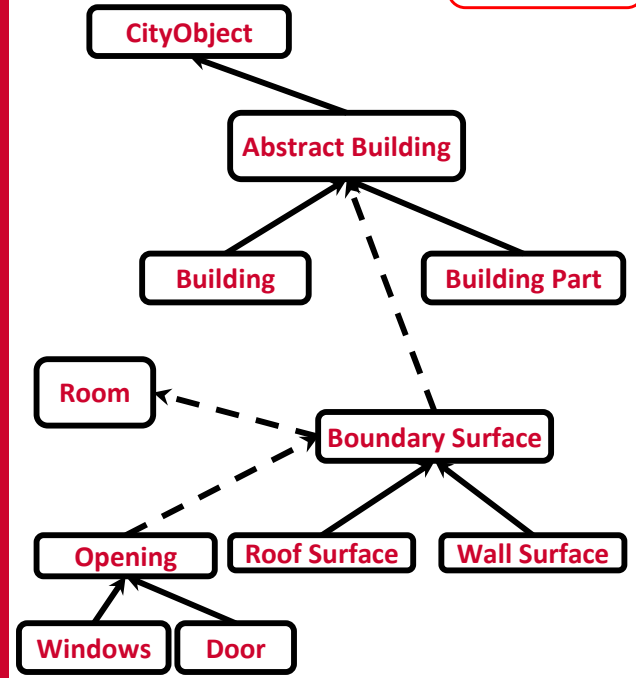
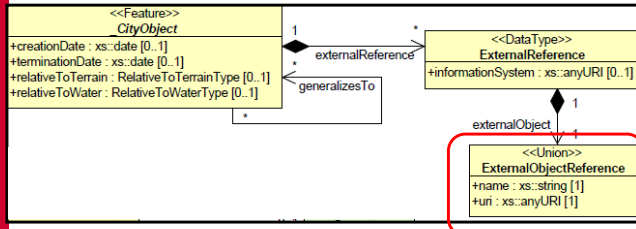


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Building Module (CityGML)



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```

<cityObjectMember>
<bldg:Building gml:id="SLA_BLDG_90d36b63-7f79-486c-ba7d-e07787a2f199">
<gml:name>NATIONAL UNIVERSITY OF SINGAPORE (BUKIT TIMAH CAMPUS)</gml:name>
<externalReference>
<informationSystem>singapore 3D national topographic mapping</informationSystem>
<externalObject>
<name>SLA_BLDG_90D36B63-7F79-486C-BA7D-E07787A2F199</name>
</externalObject>
</externalReference>
<bldg:class codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/_AbstractBuilding_class.xml">1100</bldg:class>
<bldg:function codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/_AbstractBuilding_function.xml">2100</bldg:function>
<bldg:measuredHeight uom="#m">12.436</bldg:measuredHeight>
<bldg:storeysAboveGround>4</bldg:storeysAboveGround>
<bldg:consistsOfBuildingPart>
<bldg:BuildingPart gml:id="PT55A0001_0">
<bldg:roofType codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/_AbstractBuilding_roofType.xml">1000</bldg:roofType>
<bldg:lod2Solid>
</bldg:lod2Solid>
<bldg:boundedBy>
<bldg:RoofSurface gml:id="roof_T55A0001_p0_0">
<bldg:lod2MultiSurface>
<gml:MultiSurface>
<gml:surfaceMember>
<gml:OrientableSurface gml:id="os_T55A0001_p0_0" orientation="+">
<gml:baseSurface>
<gml:Polygon gml:id="poly_T55A0001_p0_0">
<gml:exterior>
<gml:LinearRing gml:id="line_T55A0001_p0_0">
<gml:posList srsDimension="3">26063.730 33082.798 40.988 26074.894 33080.928 40.988 26125.811 33096.957 40.987 26125.119 33099.19
987 26129.645 33100.593 40.986 26126.012 33112.311 40.986 26113.012 33110.719 40.986 26110.144 33119.905 40.986 26116.465 33123.3
.986 26113.045 33135.611 40.985 26107.601 33134.090 40.985 26106.870 33136.703 40.985 26084.418 33130.428 40.986 26084.982 33128.
40.986 26081.101 33127.329 40.986 26079.698 33132.350 40.986 26080.922 33132.692 40.986 26079.037 33139.435 40.986 26071.958 3313
456 40.986 26073.678 33131.304 40.986 26075.617 33131.846 40.986 26077.067 33126.662 40.986 26074.048 33125.818 40.986 26073.535
.652 40.986 26047.135 33118.414 40.987 26050.498 33106.383 40.987 26064.015 33107.011 40.987 26066.333 33099.471 40.987 26053.251
33094.884 40.988 26056.351 33084.884 40.988 26058.631 33085.591 40.988 26068.907 33050.626 40.989 26073.697 33052.055 40.989 2606
730 33082.798 40.988 </gml:posList>
</gml:LinearRing>
</gml:exterior>
</gml:Polygon>
</gml:baseSurface>
</gml:OrientableSurface>
</gml:surfaceMember>
</gml:MultiSurface>
</bldg:lod2MultiSurface>
</bldg:RoofSurface>
</bldg:boundedBy>
<bldg:boundedBy>
<bldg:WallSurface gml:id="wall_T55A0001_p0_1">
<bldg:lod2MultiSurface>
<gml:MultiSurface>
<gml:surfaceMember>
<gml:OrientableSurface gml:id="os_T55A0001_p0_1" orientation="+">

```

Cadastral Survey Management System project

Motivation

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CityGML

LandXML

OWL

LADM OWL

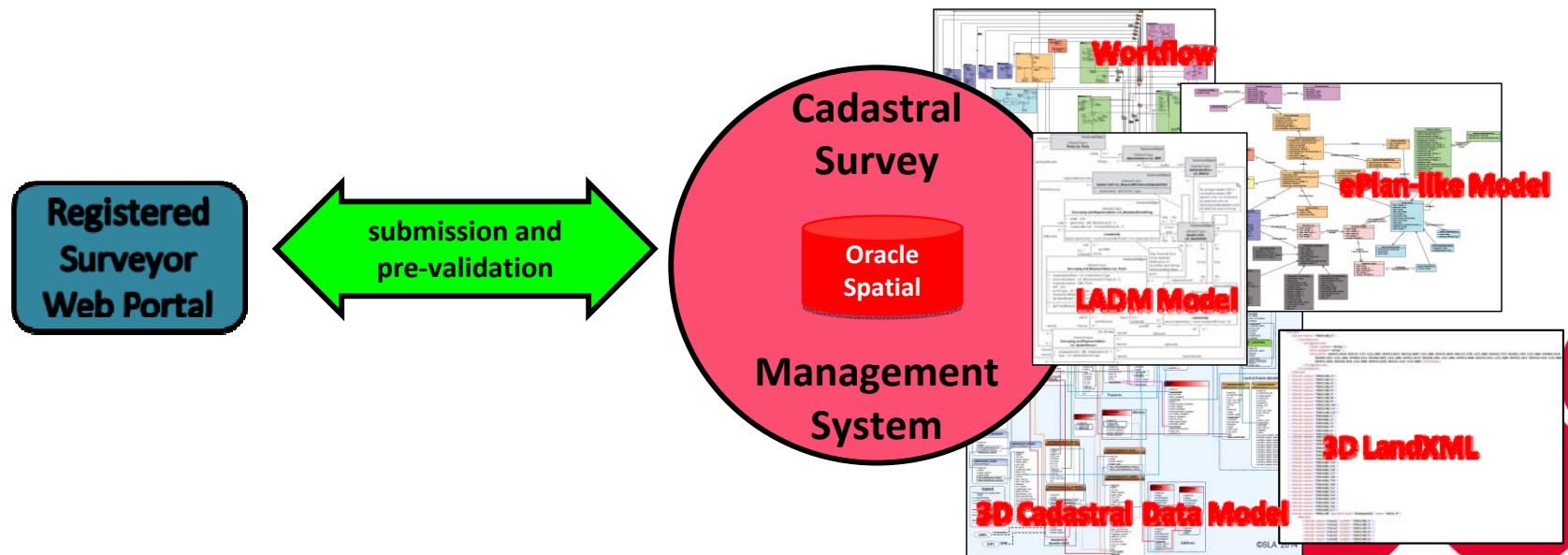
Extend

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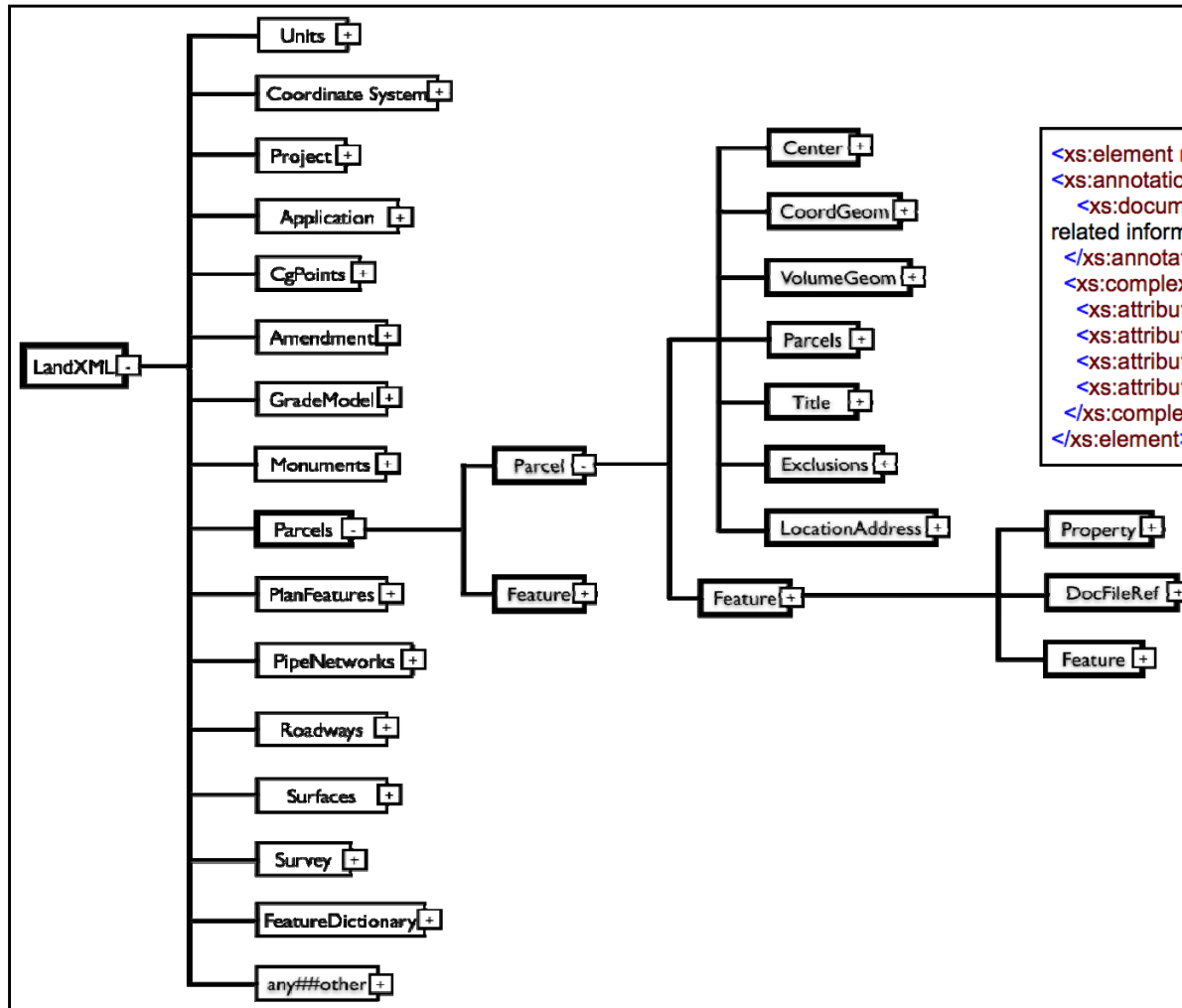
- To support 3D Cadastre and automation for Cadastral Survey in Singapore
- Currently at the requirement study with vendor
- To adopt Land Administration Domain Model (LADM) & ePlan model
- Formulating 3D LandXML as submission format



LandXML 1.2 Schema

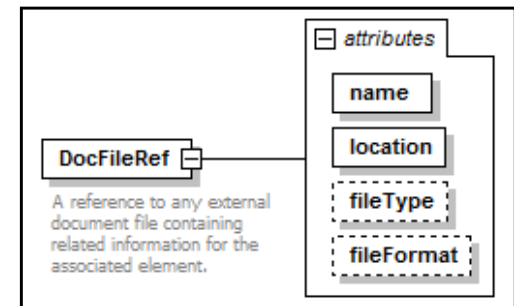


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```

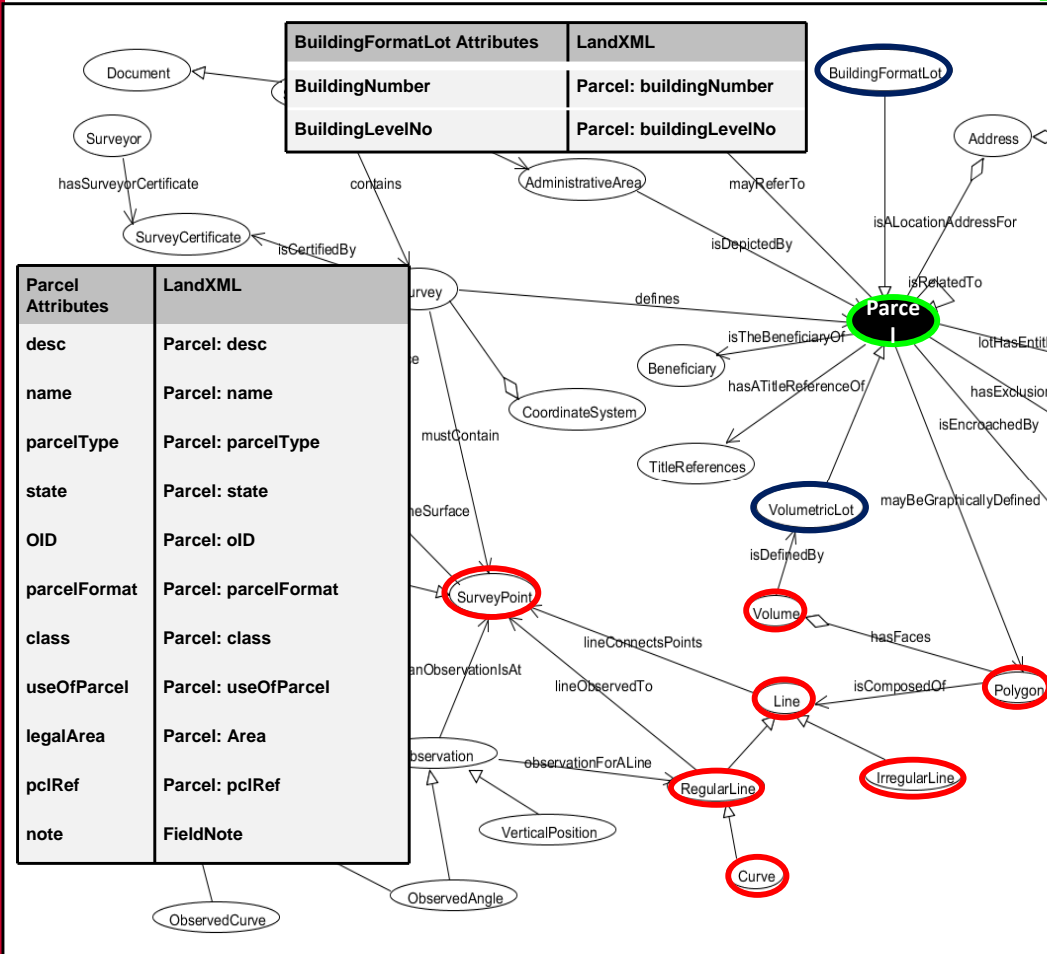
<xs:element name="DocFileRef">
  <xs:annotation>
    <xs:documentation>A reference to any external document file containing
    related information for the associated element.</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:attribute name="name" use="required"/>
    <xs:attribute name="location" type="xs:anyURI" use="required"/>
    <xs:attribute name="fileType" type="xs:string"/>
    <xs:attribute name="fileFormat" type="xs:string"/>
  </xs:complexType>
</xs:element>
  
```



ePlan Model (Parcel) with LandXML



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- <xs:element name="Parcel">

```

<xs:annotation base="Spatial" />
<xs:complexType base="Spatial" />
<xs:sequence>
  <xs:choice maxOccurs="unbounded">
    <xs:element ref="Center" minOccurs="0"/>
    <xs:element ref="CoordGeom"/>
    <xs:element maxOccurs="unbounded" ref="VolumeGeom" minOccurs="0"/>
    <xs:element maxOccurs="unbounded" ref="Parcels" minOccurs="0"/>
    <xs:element maxOccurs="unbounded" ref="Title" minOccurs="0"/>
    <xs:element maxOccurs="unbounded" ref="Exclusions" minOccurs="0"/>
    <xs:element maxOccurs="unbounded" ref="LocationAddress" minOccurs="0"/>
  </xs:choice>
  <xs:element maxOccurs="unbounded" ref="Feature" minOccurs="0"/>
</xs:sequence>
  
```

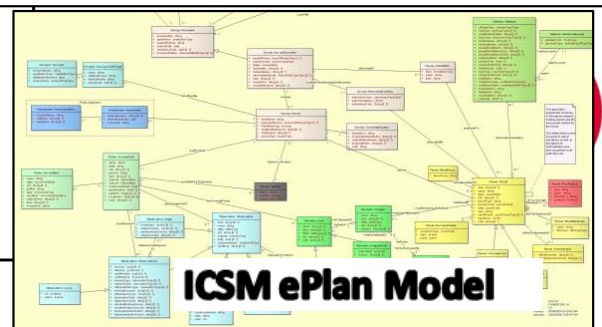
spatial

```

<xs:attribute type="xs:string" name="name" use="required"/>
<xs:attribute type="xs:string" name="oID"/>
<xs:attribute type="xs:double" name="area"/>
<xs:attribute type="xs:string" name="desc"/>
<xs:attribute type="xs:double" name="dirClosure"/>
<xs:attribute type="xs:string" name="owner"/>
<xs:attribute type="xs:double" name="distClosure"/>
<xs:attribute type="xs:string" name="parcelType"/>
<xs:attribute type="xs:double" name="setbackFront"/>
<xs:attribute type="xs:double" name="setbackRear"/>
<xs:attribute type="xs:double" name="setbackSide"/>
<xs:attribute type="xs:string" name="taxID"/>
<xs:attribute type="parcelStateType" name="state"/>
<xs:attribute type="xs:string" name="class"/>
<xs:attribute type="useOfParcelType" name="useOfParcel"/>
<xs:attribute type="parcelFormat" name="parcelFormat"/>
<xs:attribute type="xs:string" name="buildingNo"/>
<xs:attribute type="xs:string" name="buildingLevelNo"/>
<xs:attribute type="xs:string" name="volume"/>
<xs:attribute type="parcelNameRef" name="pclRef"/>
<xs:attribute type="xs:string" name="lotEntitlements"/>
<xs:attribute type="xs:string" name="liabilityApportionment"/>
</xs:complexType>
</xs:element>
  
```

non-spatial

Referencing



Simplified ePlan Model (just Concepts w/o Attributes)

ICSM ePlan Model

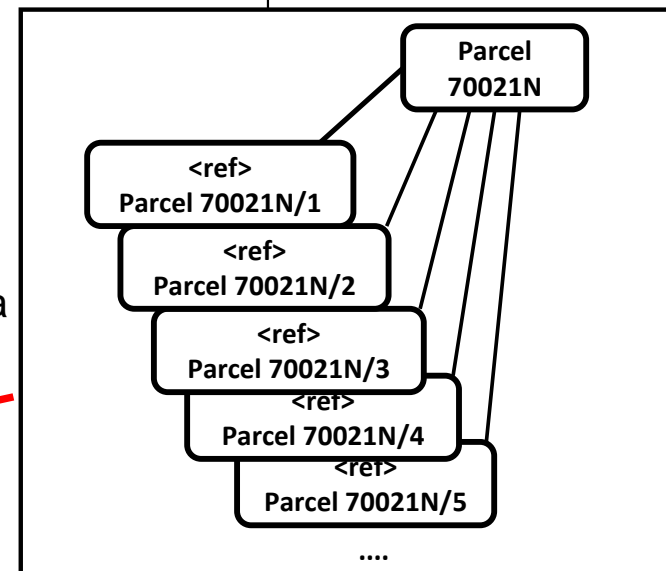
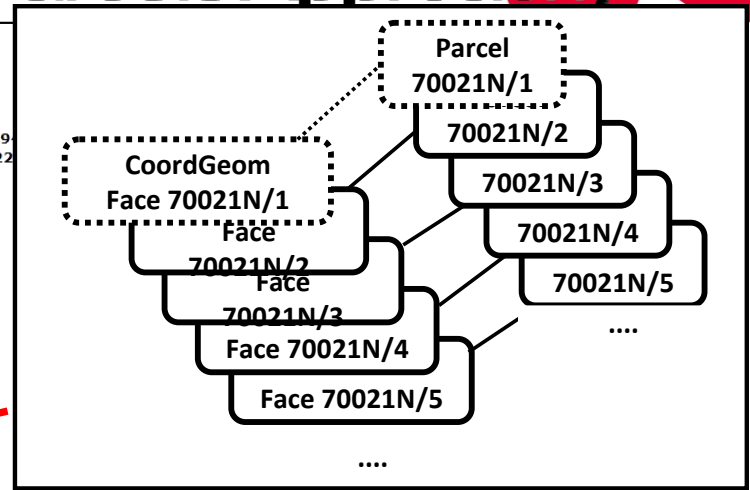
LandXML for 3D (Nested Parcels Approach)

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```

- <Parcels>
- <Parcel name="70021N/1">
- <CoordGeom>
- <IrregularLine>
  <Start pntRef="433a"/>
  <End pntRef="433a"/>
  <PntList3D> 29452.018 30232.133 123.280 29452.832 30216.800 123.280 29425.899 30215.278 123.280 29
  30284.567 123.280 29484.221 30260.005 123.280 29451.876 30258.266 123.280 29452.008 30255.922
  29451.056 30250.256 123.280 29452.018 30232.133 123.280 </PntList3D>
</IrregularLine>
</CoordGeom>
</Parcel>
+ <Parcel name="70021N/2">
+ <Parcel name="70021N/3">
+ <Parcel name="70021N/4">
+ <Parcel name="70021N/5">
+ <Parcel name="70021N/6">
+ <Parcel name="70021N/7">
+ <Parcel name="70021N/8">
+ <Parcel name="70021N/9">
+ <Parcel name="70021N/10">
+ <Parcel name="70021N/11">
+ <Parcel name="70020K/1">
+ <Parcel name="70020K/2">
+ <Parcel name="70020K/3">
+ <Parcel name="70020K/4">
+ <Parcel name="70020K/5">
+ <Parcel name="70020K/6">
+ <Parcel name="70020K/7">
+ <Parcel name="70020K/8">
+ <Parcel name="70020K/9">
+ <Parcel name="70020K/10">
+ <Parcel name="70020K/11">
+ <Parcel name="70020K/12">
+ <Parcel name="70020K/13">
+ <Parcel name="70020K/14">
+ <Parcel name="70020K/15">
+ <Parcel name="70020K/16">
+ <Parcel name="70020K/17">
+ <Parcel name="70020K/18">
+ <Parcel name="70020K/19">
+ <Parcel name="70020K/20">
+ <Parcel name="70020K/21">
+ <Parcel name="70020K/22">
+ <Parcel name="70020K/23">
+ <Parcel name="70020K/24">
+ <Parcel name="70020K/25">
+ <Parcel name="70020K/26">
+ <Parcel name="70020K/27">
+ <Parcel name="70021N" parcelFormat="Volumetric" area="2621.4">
- <Parcels>
  <Parcel name="Face1" pclRef="70021N/1"/>
  <Parcel name="Face2" pclRef="70021N/2"/>
  <Parcel name="Face3" pclRef="70021N/3"/>
  <Parcel name="Face4" pclRef="70021N/4"/>
  <Parcel name="Face5" pclRef="70021N/5"/>
  <Parcel name="Face6" pclRef="70021N/6"/>
  <Parcel name="Face7" pclRef="70021N/7"/>
  
```

Every face is defined with coordinates thru PntList3D



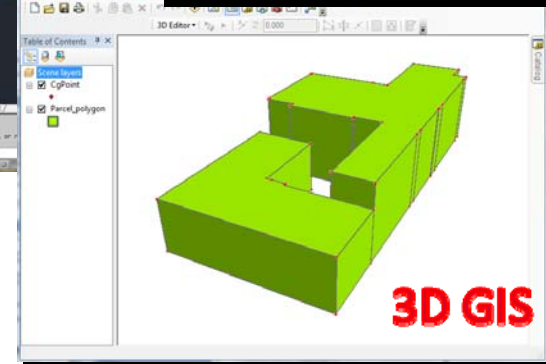
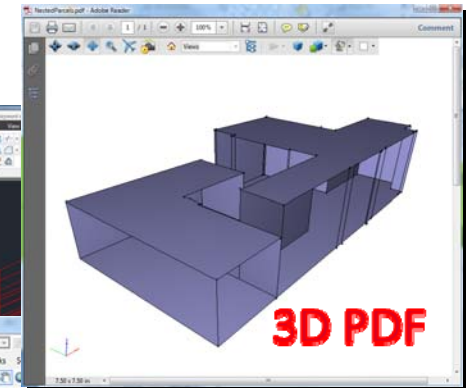
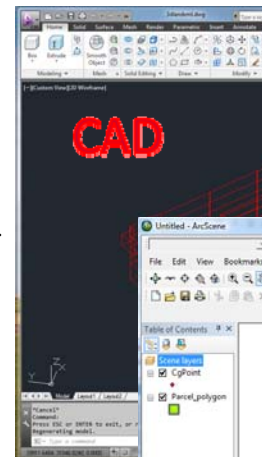
all related faces are referenced to form a Volumetric 3D Parcel

From 3D LandXML to Other Formats

3D LandXML

```
- <Parcels>
+ <Parcel name="70021N/1">
+ <Parcel name="70021N/2" area="2621.4">
+ <Parcel name="70021N/3">
+ <Parcel name="70021N/4">
+ <Parcel name="70021N/5">
+ <Parcel name="70021N/6">
+ <Parcel name="70021N/7">
+ <Parcel name="70021N/8">
+ <Parcel name="70021N/9">
+ <Parcel name="70021N/10">
+ <Parcel name="70021N/11">
+ <Parcel name="70021N/12">
+ <Parcel name="70020K/1">
+ <Parcel name="70020K/2" area="4735.5">
+ <Parcel name="70020K/3">
+ <Parcel name="70020K/4">
+ <Parcel name="70020K/5">
+ <Parcel name="70020K/6">
+ <Parcel name="70020K/7">
+ <Parcel name="70020K/8">
+ <Parcel name="70020K/9">
+ <Parcel name="70020K/10">
+ <Parcel name="70020K/11">
+ <Parcel name="70020K/12">
+ <Parcel name="70020K/13">
+ <Parcel name="70020K/14">
+ <Parcel name="70020K/15">
+ <Parcel name="70020K/16">
+ <Parcel name="70020K/17">
+ <Parcel name="70020K/18">
+ <Parcel name="70020K/19">
+ <Parcel name="70020K/20">
+ <Parcel name="70020K/21">
+ <Parcel name="70020K/22">
+ <Parcel name="70020K/23">
+ <Parcel name="70020K/24">
+ <Parcel name="70020K/25">
+ <Parcel name="70020K/26">
+ <Parcel name="70020K/27">
- <Parcel name="70021N" parcelFormat="Volumetric">
- <Parcels>
  <Parcel name="Face1" pclRef="70021N/1"/>
  <Parcel name="Face2" pclRef="70021N/2"/>
  <Parcel name="Face3" pclRef="70021N/3"/>
  <Parcel name="Face4" pclRef="70021N/4"/>
  <Parcel name="Face5" pclRef="70021N/5"/>
  <Parcel name="Face6" pclRef="70021N/6"/>
  <Parcel name="Face7" pclRef="70021N/7"/>
  <Parcel name="Face8" pclRef="70021N/8"/>
  <Parcel name="Face9" pclRef="70021N/9"/>
  <Parcel name="Face10" pclRef="70021N/10"/>
  <Parcel name="Face11" pclRef="70021N/11"/>
  <Parcel name="Face12" pclRef="70021N/12"/>
</Parcels>
</Parcel>
+ <Parcel name="70020K" parcelFormat="Volumetric">
</Parcels>
```

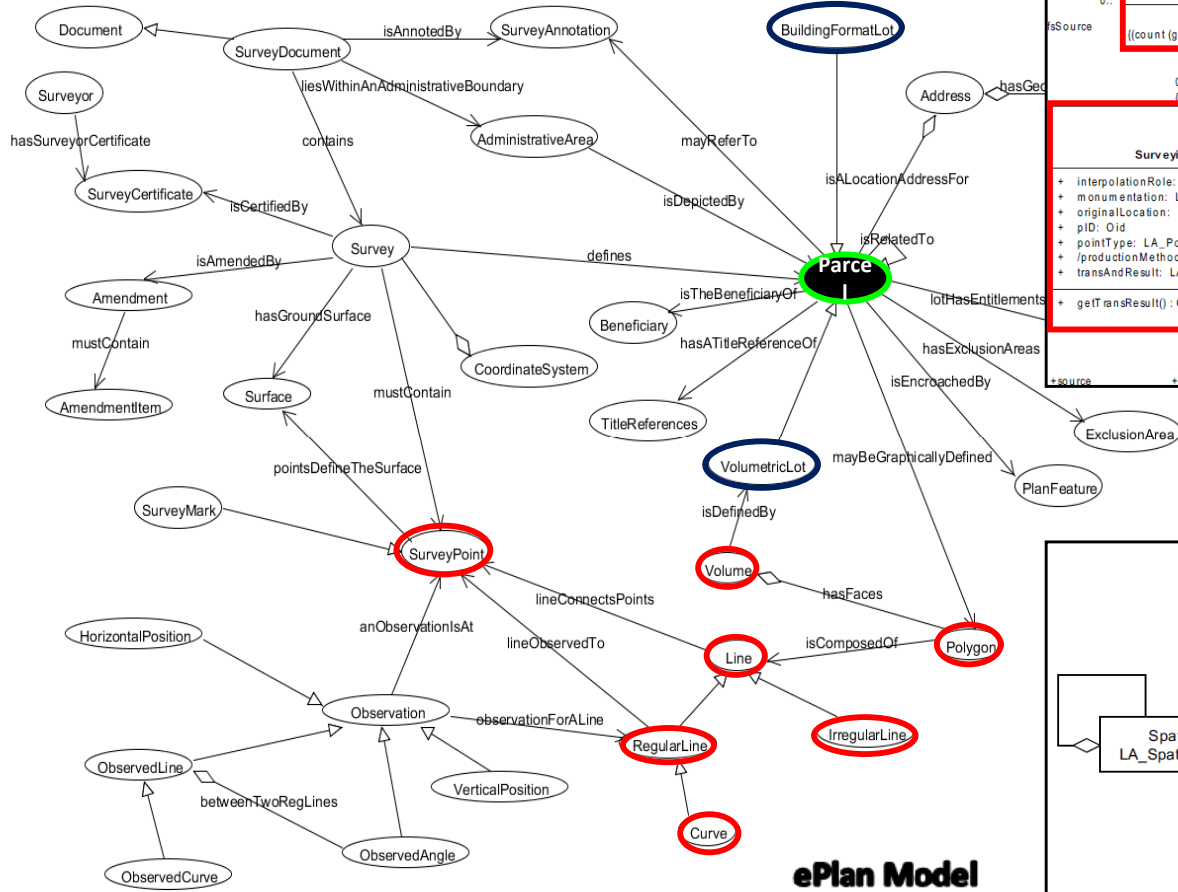
Conversion
using FME



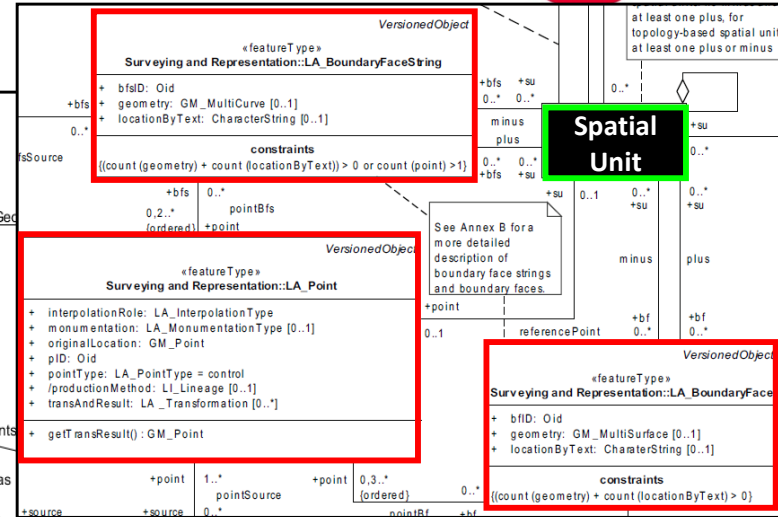
SG
50

ePlan Model (Parcel) – LADM (Spatial Unit)

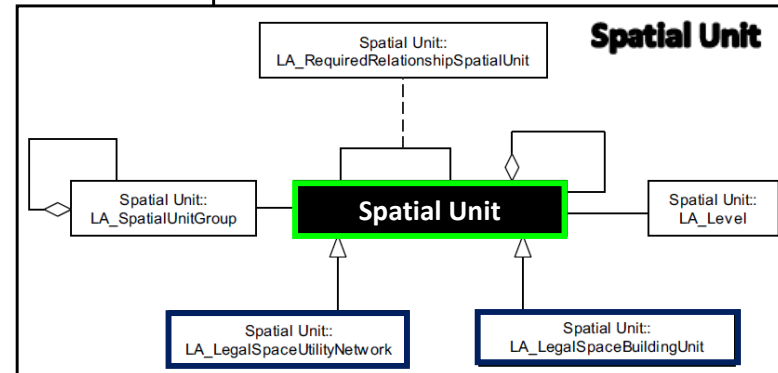
Spatial Unit (LADM) and Parcel (ePlan) both connect spatial and non-spatial attributes of property unit



ePlan Model



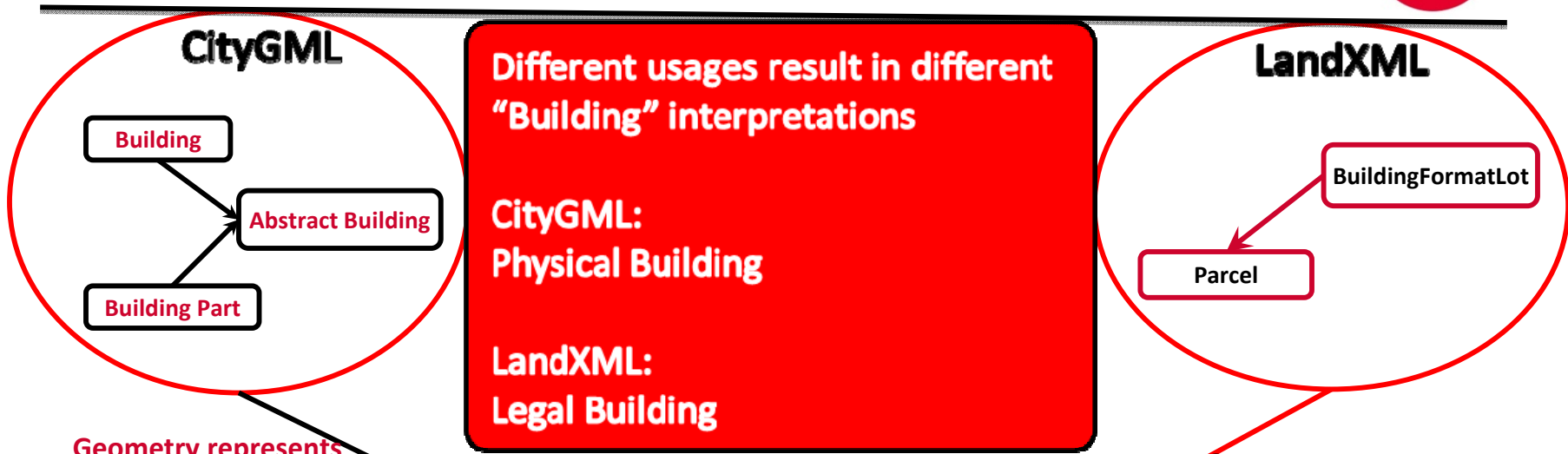
Associations of Spatial Unit with Surveying and Representation



Spatial Unit

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CityGML vs. LandXML



Geometry represents Physical Construct

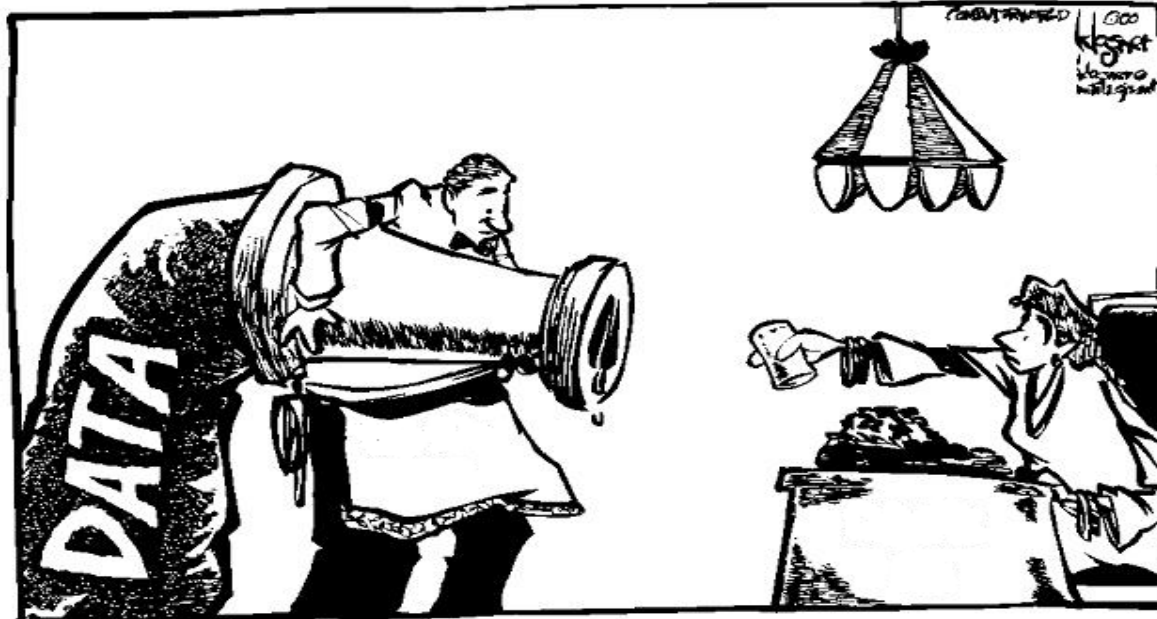
Geometry represents Legal Space



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Why Semantics

- **Semantics is the Study of Meaning**
- **Meaning is implicit and context-dependent**
- **Precise meaning of exchanged information should be well-understood by all parties, otherwise resulting in low recall and precision**



Semantic Ambiguity

- The same term can mean different things

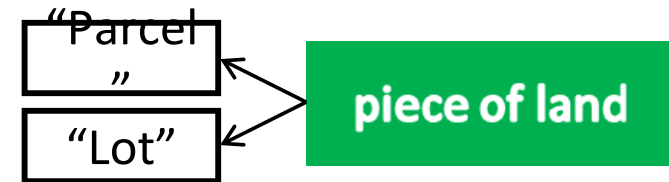
Outlet:

- electronic device points
- retail store
- channel

Parcel:

- package
- land boundary

- Different terms can mean the same thing



A classic example: BoatHouse vs. HouseBoat



Formal Ontology



- **Need an explicit knowledge structure, which should consist of common definitions and semantic relationships for pieces of data used in the domain;**
- **The structure should be represented in a formal language, where computer systems are able to process and understand the meaning;**
- **The structure is called Ontology, which enables computer systems to do reasoning and make inference**

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OWL (Web Ontology Language)



- **OWL is a formal language to describe ontology**
- **different from CityGML and LandXML, it supports formal semantics and rules**

```
<SubClassOf>
  <Class IRI="#BAUnit"/>
  ▼<ObjectHasSelf>
    <ObjectProperty IRI="#hasRequiredRelationshipBAUnit"/>
  </ObjectHasSelf>
</SubClassOf>
```

```
<DLSafeRule>
  ▼<Body>
    ▼<ClassAtom>
      <Class IRI="#Father"/>
      <Variable IRI="urn:swrl#x"/>
    </ClassAtom>
  </Body>
  ▼<Head>
    ▼<ClassAtom>
      <Class IRI="#Husband"/>
      <Variable IRI="urn:swrl#x"/>
    </ClassAtom>
  </Head>
</DLSafeRule>
```

Rule

Other OWL semantic relationships include:

```
owl:TransitiveProperty, SymmetricProperty, FunctionalProperty,
InverseFunctionalProperty, inverseOf
owl:sameAs, differentFrom
owl:disjointWith, complementOf,
owl:hasValue, allValuesFrom, someValuesFrom
owl:equivalentClass, equivalentProperty
```



OWL as ISO 19150



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Fransais | Русский Member area

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ISO/DIS 19150-2

Geographic information -- Ontology -- Part 2: Rules for developing ontologies in the Web Ontology Language (OWL)

General information Revisions Corrigenda / Amendments

Edition: 1 (Monolingual)	ICS: 35.240.70
Status: Under development	Stage: 40.99 (2014-06-05)
TC/SC: ISO/TC 211	Number of Pages: 103

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ISO/TS 19150-1:2012

Geographic information -- Ontology -- Part 1: Framework

Abstract [Preview ISO/TS 19150-1:2012](#)

ISO/TS 19150-1:2012 defines the framework for semantic interoperability of geographic information. This framework defines a high level model of the components required to handle semantics in the ISO geographic information standards with the use of ontologies.

General information Revisions Corrigenda / Amendments

Edition: 1 (Monolingual)	ICS: 35.240.70
Status: Published	Stage: 60.60 (2012-11-13)
TC/SC: ISO/TC 211	Number of Pages: 30

OWL (Web Ontology Language)



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- Classes and Instances
- Class Hierarchies
- Class Disjointness
- Object Properties
- Property Hierarchies
- Domain and Range Restrictions
- Equality and Inequality of Individuals
- Datatypes
- Complex Classes
- Property Restrictions
- Property Cardinality Restrictions
- Enumeration of Individuals
- Property Characteristics, Property Chains

e.g. **LandLot ::= ¬ StrataLot**

```
<DisjointClasses>
  <Class IRI="LandLot"/>
  <Class IRI="StrataLot"/>
</DisjointClasses>
```

e.g. **Father ::= Parent ∩ Man**

```
<EquivalentClasses>
  <Class IRI="Father"/>
  <ObjectIntersectionOf>
    <Class IRI="Man"/>
    <Class IRI="Parent"/>
  </ObjectIntersectionOf>
</EquivalentClasses>
```

e.g. **locatedIn as transitive**

```
<TransitiveObjectProperty>
  <ObjectProperty IRI="locatedIn"/>
</TransitiveObjectProperty>
```

reference: <http://www.w3.org/TR/owl2-primer/>

• **Every class, instance, property (relationship) has a unique URI (Uniform Resource Identifier), e.g.**

```
<owl:Class rdf:about="http://wiki.tudelft.nl/pub/Research/ISO19152/ImplementationMaterial/LADMontology.owl#BoundaryFace">
```



ISO 19152 – Land Administration Domain Model

Motivation

Objectives

Background

CityGML

LandXML

OWL

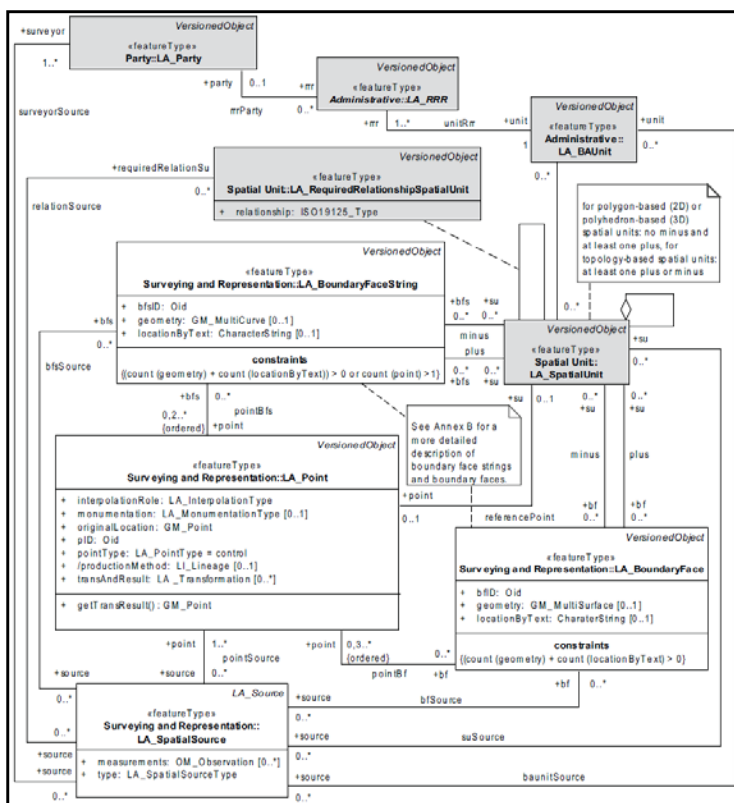
LADM OWL

Extend

LADM OWL

Fusion

Conclusions



- “enables the combining of land administration information from different sources in a coherent manner.” (ISO 19152)
- Currently in UML models, the formalization of LADM in OWL is developed (Soon, 2013)

LADM OWL Ontology in Protege



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 - LandXML
 - OWL
 - LADM OWL
- Extend LADM OWL
- Fusion
- Conclusions

Launcher File Edit View Reasoner Tools Refactor Window Help

LADMOntology (http://wiki.tudelft.nl/pub/Research/ISO19152/ImplementationMaterial/LADMOntology.owl) : [/Users/keanhuatsoon/ontologies/LADMOntology/LADMOntology.owl]

LADMOntology (http://wiki.tudelft.nl/pub/Research/ISO19152/ImplementationMaterial/LADMOntology.owl) Search for entity

Active Ontology Entities Classes Object Properties Data Properties Individuals OWLViz DL Query OntoGraf

Class hierarchy: Thing

- Notary
- StateAdministrator
- Surveyor
- Writer
- PartyMember
- Point
- Role
 - Party
- RolePlayer
 - BAUnit
 - Group
 - NaturalPerson
 - NonNaturalPerson
- RRR
 - Responsibility
 - Restriction
 - Right
- Source
 - AdminSource
 - SpatialSource
- SpatialUnit
 - LegalSpaceBuildingUnit
 - LegalSpaceUtilityNetwork
 - SpatialUnitGroup

Object property hierarchy:

- topObjectProperty
 - containsOtherGroupParties
 - dependsOn
 - describesBFace
 - describesBFaceString
 - describesPoint
 - describesSpatialExtent
 - hasAdminSourceBAUnit
 - hasAdminSourceParty
 - hasAdminSourceRRR
 - hasBASpatialUnit
 - hasRAUnitAdminSource

OWL Viz: Thing

Asserted model Inferred model

To use the reasoner click Reasoner -> Start reasoner Show Inferences

LADM OWL Ontology @ LADM Wiki



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You are here: [TU Delft Wiki](#) > [Research/ISO19152 Web](#) > [ImplementationMaterial](#) (31 May 2014, [PeterVanOosterom](#))

[Edit](#) [Edit wiki text](#) [Attach](#) [PDF](#)

LADM implementation material

Note: also (open source) implementation material could be added (software) here.

Implementation Activities

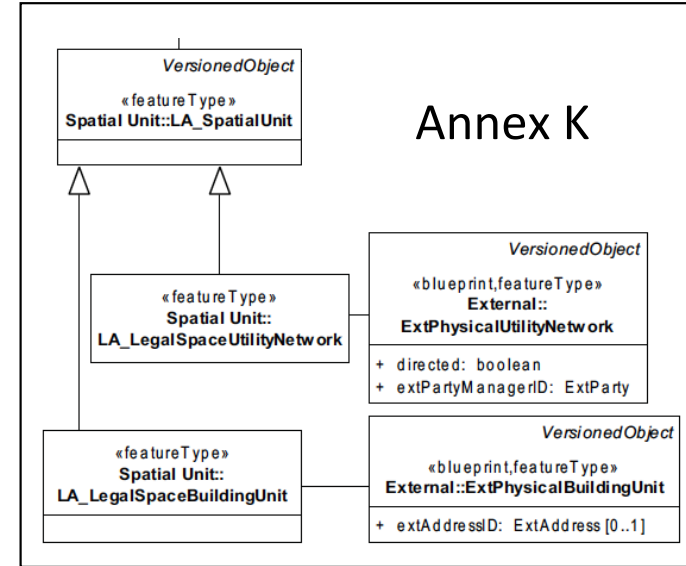
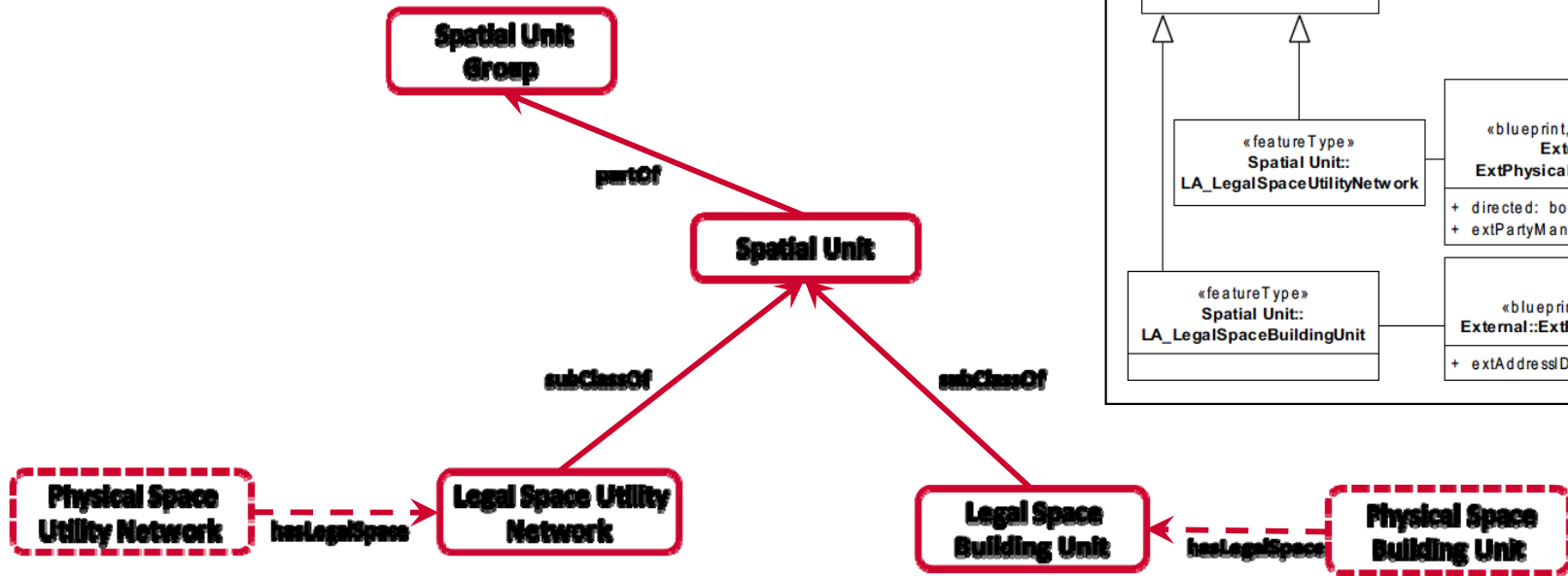
- [LADMOntology.owl](#): Representing Roles in Formalizing Domain Ontology for Land Administration (presented by Kean Huat Soon at the International FIG workshop on the Land Administration Domain Model 24-25 September 2013, Kuala Lumpur, Malaysia).
- UN Habitat Social Tenure Domain Model (STDM) , a pro-poor land rights recording system. STDM source codes released in Github (at FIG Congress 2014 in Kuala Lumpur Malaysia, June 2014). Links for mailing lists subscriptions: users (<http://lists.osgeo.org/cgi-bin/mailman/listinfo/stdm-user>), developer (<http://lists.osgeo.org/cgi-bin/mailman/listinfo/stdm-dev>) and announcements (<http://lists.osgeo.org/cgi-bin/mailman/listinfo/stdm-announce>).
- UN FAO Open Source Software Project - FLOSS Solutions for Open Land Administration (SOLA). LADM is the starting point for this software. Enterprise Architect file within the documents on <http://www.flossola.org>.
- [Example Implementation LADM.pdf](#): IT System Specification. Example Implementation LADM (Jan van Bennekom-Minnema, COWI A/S, Department: Surveying and Land Administration), draft 25 March, 2011.
- Addis Ababa: The Road Map to Progress through Securing Property Rights with Real Property Registration System by Tarek Zein (Hansa Luftbild) and Zerihun Amdemarian Berisso (City Administration of Addis Ababa), World Bank conference, April 2012, http://www.landandpoverty.com/agenda/pdfs/paper/zein_full_paper.pdf

<http://wiki.tudelft.nl/bin/view/Research/ISO19152/ImplementationMaterial>

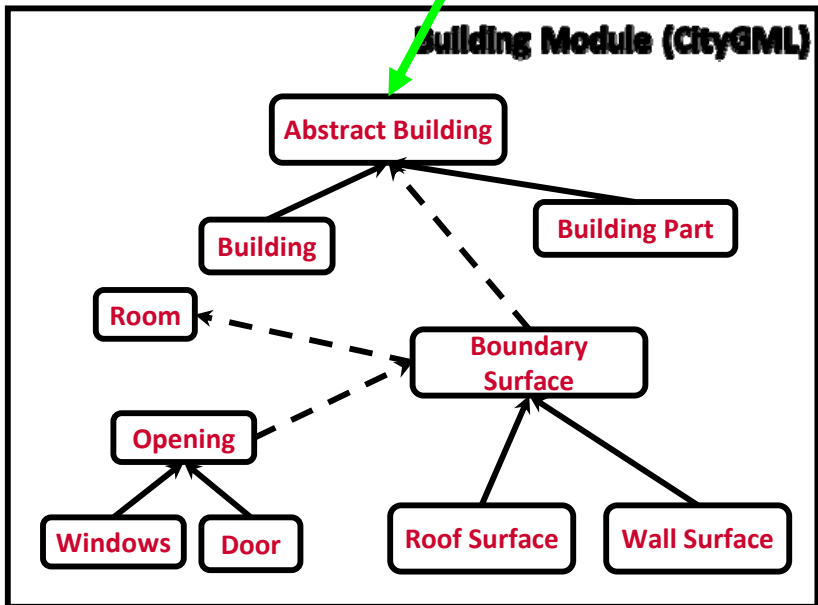
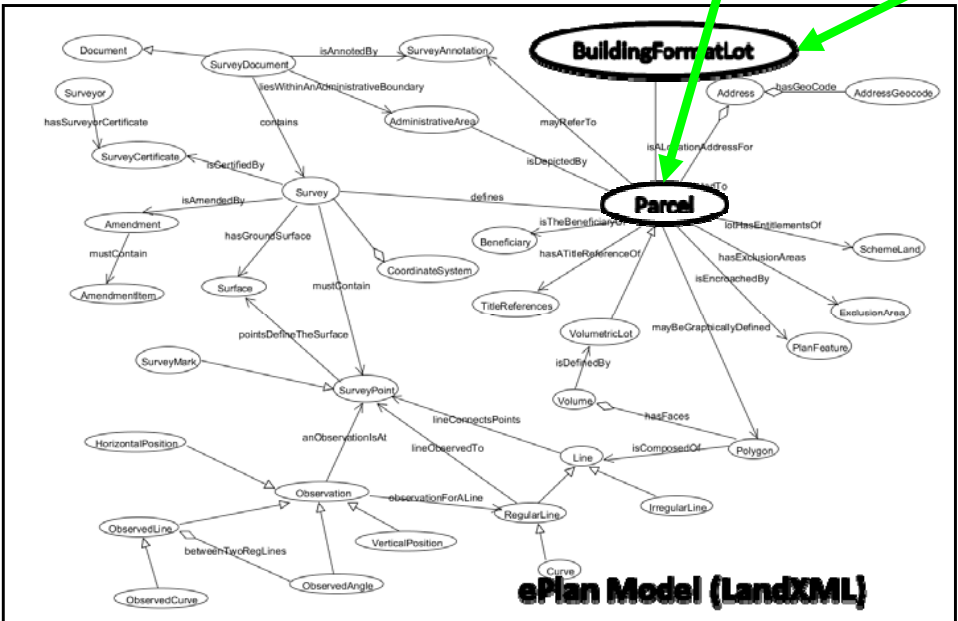
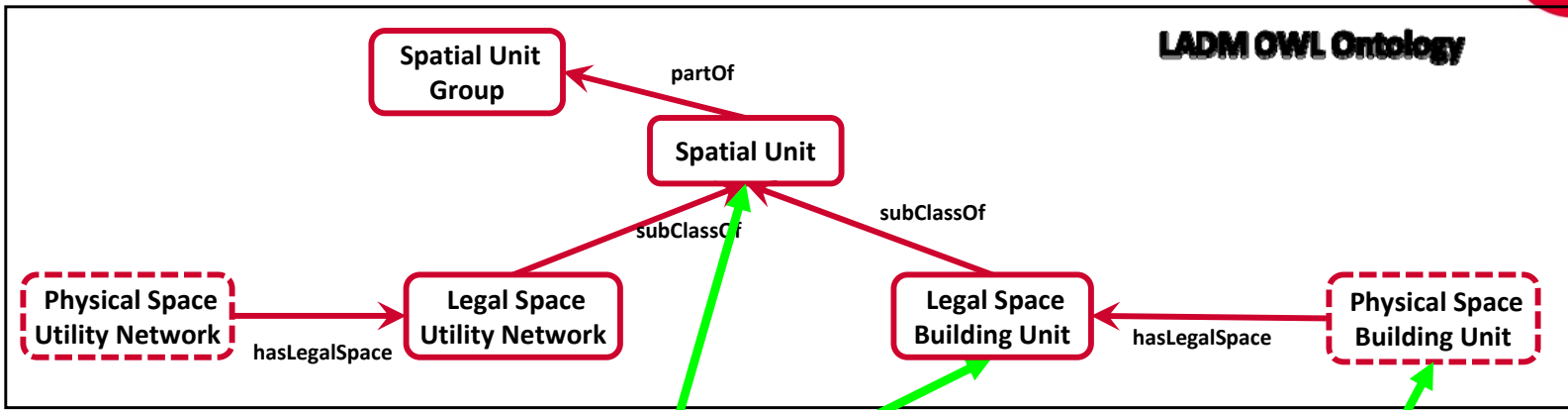
Extending the LADM OWL Ontology



- Motivation
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- LADM OWL
- Extend LADM OWL**
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Mapping



- Motivation
- Objectives
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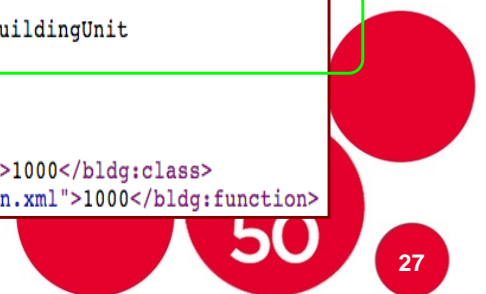
Syntactic Links

LandXML and LADM OWL Ontology

```
▼<Parcel name="70021N" area="2621.4" parcelFormat="Volumetric">
  ▼<Feature>
    <DocFileRef name="Parcel"
      location="http://wiki.tudelft.nl/pub/Research/ISO19152/ImplementationMaterial/LADMontology.owl#SpatialUnit"/>
  </Feature>
  ▼<Parcels>
    <Parcel name="Face1" pclRef="70021N/1" />
    <Parcel name="Face2" pclRef="70021N/2" />
    <Parcel name="Face3" pclRef="70021N/3" />
    <Parcel name="Face4" pclRef="70021N/4" />
  </Parcels>
</Parcel>
```

CityGML and LADM OWL Ontology

```
▼<bldg:Building gml:id="GML_7b1a5a6f-ddad-4c3d-a507-3eb9ee0a8e68">
  ▼<externalReference>
    ▼<externalObject>
      ▼<uri>
        http://wiki.tudelft.nl/pub/Research/ISO19152/ImplementationMaterial/LADMontology.owl#PhysicalSpaceBuildingUnit
      </uri>
    </externalObject>
  </externalReference>
  <gml:name>HDB</gml:name>
  <bldg:class codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/_AbstractBuilding_class.xml">1000</bldg:class>
  <bldg:function codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/_AbstractBuilding_function.xml">1000</bldg:function>
</bldg:Building>
```



- Motivation
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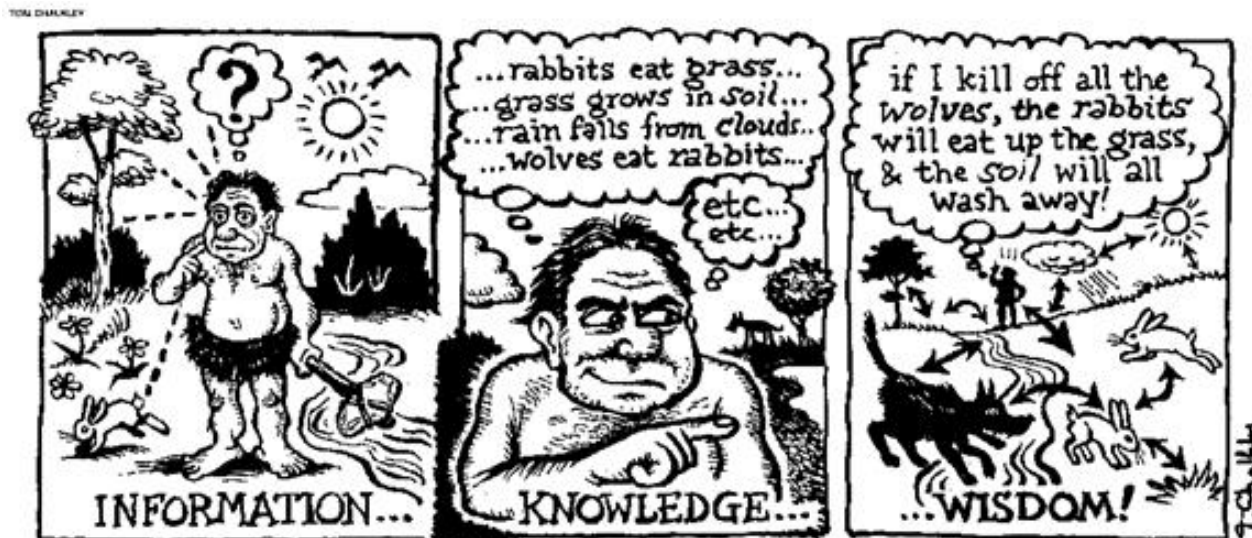
Conclusions

- **fusion of varying spatial datasets is often required in any spatial developments**
- **proposed augmenting LADM OWL Ontology with Physical Space Building Unit concept to fuse Building module (CityGML) and Parcel in the ePlan model (LandXML)**
- **linkages are realized via elements ExternalReference and DocFileRef**
- **linked the schemas, while allowed reasoning and inference in LADM OWL Ontology**



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thank you!



[soon kean huat@sla.gov.sg](mailto:soon_kean_huat@sla.gov.sg) or keanhuat.soon@gmail.com

SG
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13th South East Asian Survey Congress

28 – 31 July 2015, Marina Bay Sands, Singapore



13th South East Asian Survey Congress
 Expanding the Geospatial Future
 28 - 31 July 2015
 Marina Bay Sands, Singapore

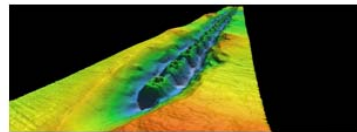
<http://www.seasc2015.org.sg/>

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Abstract Submission: March 1, 2015



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Programme

The South East Asian Survey Congress is for Surveyors in all fields to gain knowledge, and new frontier in the applications of advanced technology in Survey. The Congress is also an excellent place and opportunity to network and exchange ideas.



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Workshop on
Life Cycle of Spatial Developments in 3D
 Tuesday, 28 July 2015 @ Marina Bay Sands, Singapore

In Conjunction with 13th South East Asia Survey Congress, 28 – 31 July 2015
 (<http://www.seasc2015.org.sg/>)

Organizers
 Kean Huat Soon (SLA, Singapore), Alias Abdul Rahman (UTM, Malaysia), and Rod Thompson (Queensland Government, Australia)

Summary
 The workshop aims to serve as a platform to present, discuss, and exchange ideas on issues and possible solutions encountered in the life cycle of spatial developments in 3D. The focus of the workshop is on, but not limited to, topics concerning: 3D data management, 3D modelling and 3D data integration. These are three intrinsic aspects in the life cycle of spatial developments in 3D. Efficient 3D data management ensures 3D data are well managed and organized during the life cycle be it in the phase of data collection, processing, presentation or dissemination. 3D modeling concerns the structure of the data as represented; while 3D data integration addresses open standards and conceptual modeling including, for example the ISO 19152 - Land Administration Domain Model (LADM). The workshop will look into LADM and open standards such as 3D LandXML and CityGML. For better integration in the life cycle, the workshop will also discuss issues resulting from differences in syntax, system, schema and semantics between varying datasets, and will study possible solutions to improve the integration.

