

BS EN ISO 19152:2012



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Geographic information — Land Administration Domain Model (LADM)

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**Geographic information - Land Administration Domain Model
(LADM) (ISO 19152:2012)**

Information géographique - Modèle du domaine de
l'administration des terres (LADM) (ISO 19152:2012)

Geoinformation - Land Administration Domain Model
(LADM) (ISO 19152:2012)

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EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN ISO 19152:2012) has been prepared by Technical Committee ISO/TC 211 “Geographic information/Geomatics” in collaboration with Technical Committee CEN/TC 287 “Geographic Information” the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2013, and conflicting national standards shall be withdrawn at the latest by May 2013.

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Introduction

This International Standard defines the Land Administration Domain Model (LADM). The LADM is a conceptual model, and not a data product specification (in the sense of ISO 19131).

The purpose of the LADM is not to replace existing systems, but rather to provide a formal language for describing them, so that their similarities and differences can be better understood. This is a descriptive standard, not a prescriptive standard.

Land administration is a large field; the focus of this International Standard is on that part of land administration that is interested in rights, responsibilities and restrictions affecting land (or water), and the geometrical (geospatial) components thereof. The LADM provides a reference model which will serve two goals:

- to provide an extensible basis for the development and refinement of efficient and effective land administration systems, based on a Model Driven Architecture (MDA), and
- to enable involved parties, both within one country and between different countries, to communicate, based on the shared vocabulary (that is, an ontology), implied by the model.

The second goal is relevant for creating standardized information services in a national or international context, where land administration domain semantics have to be shared between regions, or countries, in order to enable necessary translations. Four considerations during the design of the model were that:

- it will cover the common aspects of land administration all over the world;
- it will be based on the conceptual framework of 'Cadastre 2014' of the International Federation of Surveyors (FIG) ^[14];
- it will be as simple as possible in order to be useful in practice;
- the geospatial aspects follow the ISO/TC 211 conceptual model.

Until now, most countries (or states, or provinces) have developed their own land administration system. One country operates a deeds registration system, another a title registration system. Some systems are centralized, and others decentralized. Some systems are based on a general boundaries approach, others on fixed boundaries. Some systems have a fiscal background, others a legal one. The different implementations (foundations) of the various land administration systems do not make meaningful communication across borders easy. However, looking from a distance, one will observe that the different systems are in principle largely the same: they are all based on the relationships between people and land, linked by (ownership or use) rights, and are in most countries influenced by developments in Information and Communication Technology (ICT). Furthermore, the two main functions of every land administration (including cadastre and/or land registry) are:

- keeping the contents of these relationships up-to-date (based on regulations and related transactions); and
- providing information from the (national) registers.

Land administration is described as the process of determining, recording and disseminating information about the relationship between people and land. If ownership is understood as the mechanism through which rights to land are held, we can also speak about land tenure. A main characteristic of land tenure is that it reflects a social relationship regarding rights to land, which means that in a certain jurisdiction the relationship between people and land is recognised as a legally valid one. These recognised rights are in principle eligible

for registration, with the purpose being to assign a certain legal meaning to the registered right (e.g. a title). Therefore, land administration systems are not just 'handling geographic information', as they represent a lawfully meaningful relationship amongst people, and between people and land.

As land administration activity on the one hand deals with huge amounts of data, which moreover are of a dynamic nature, and on the other hand requires a continuous maintenance process, then the role of ICT is of strategic importance. Without the availability of information systems it will be difficult to guarantee good performance with respect to meeting changing customer demands. Organizations are now increasingly confronted with rapid developments in technology, a technology push (the Internet, geospatial databases, modelling standards, open systems, and GIS), as well with a growing demand for new services, a market pull (e-governance, sustainable development, electronic conveyance, and the integration of public data and systems). Modelling is a basic tool, facilitating appropriate system development and reengineering and, in addition, it forms the basis for meaningful communication between different systems.

Standardization has become a well-known process in the work of land administrations and land registries. In both paper-based systems and computerized systems, standards are required to identify objects, transactions, relationships between objects (e.g. parcels, generally referred to as spatial units) and persons (e.g. citizens, legally referred to as subjects and generally referred to as parties), classification of land use, land value, map representations of objects, and so on. Computerized systems require further standardization when topology and the identification of single boundaries are introduced. In existing land administrations and land registries, standardization is generally limited to the region, or jurisdiction, where the land administration (including cadastre and/or land registry) is in operation. Open markets, globalization, and effective and efficient development and maintenance of flexible (generic) systems, require further standardization.

The scope of this International Standard is provided in Clause 1. Conformance in relation to this International Standard is given in Clause 2, and a conformance test is specified in Annex A. Normative references are presented in Clause 3 and the used terms, definitions and abbreviations in Clause 4. Clause 5 gives a global overview of packages. Clause 6 introduces the classes, attributes and associations in detail. Annex B explains the 2D and 3D representations of spatial units. A comprehensive set of informative examples (using instance level classes) is available in Annex C.

It must be noted that this is a generic domain model. It is expandable and it is likely that additional attributes, operators, associations, and perhaps even additional classes, will be needed for a specific region or country; see the country profiles in Annex D. Specific parts of the LADM are further detailed: the spatial profiles in Annex E and the legal profiles in Annex F. Some examples of using the LADM in a specific context are: the INSPIRE cadastral parcels in Annex G, the integration of the LADM with the agricultural Land Parcel Identification Systems (LPIS) of the European Union in Annex H, and the Social Tenure Domain Model (STDM) in Annex I. It is possible to use only a subset, or profile, of the LADM for a specific implementation.

Annex J gives an overview of code tables as a basis to describe a flexible enumeration.

The construction of external databases with party data, address data, taxation data, land use data, land cover data, valuation data, physical utility network data, and archive data, is outside the scope of the LADM. However, the LADM provides stereotype classes for these data sets (if available), see Annex K. Interface classes are in Annex L. Annex M makes some remarks in relation to process models. History and dynamic aspects are included in Annex N. Annex O explains the link to other ISO international standards.

Geographic information — Land Administration Domain Model (LADM)

1 Scope

This International Standard:

- defines a reference Land Administration Domain Model (LADM) covering basic information-related components of land administration (including those over water and land, and elements above and below the surface of the earth);
- provides an abstract, conceptual model with four packages related to
 - 1) parties (people and organizations);
 - 2) basic administrative units, rights, responsibilities, and restrictions (ownership rights);
 - 3) spatial units (parcels, and the legal space of buildings and utility networks);
 - 4) spatial sources (surveying), and spatial representations (geometry and topology);
- provides terminology for land administration, based on various national and international systems, that is as simple as possible in order to be useful in practice. The terminology allows a shared description of different formal or informal practices and procedures in various jurisdictions;
- provides a basis for national and regional profiles; and
- enables the combining of land administration information from different sources in a coherent manner.

The following is outside the scope of this International Standard:

- interference with (national) land administration laws that may have any legal implications;
- construction of external databases with party data, address data, valuation data, land use data, land cover data, physical utility network data, archive data and taxation data. However, the LADM provides stereotype classes for these data sets to indicate which data set elements the LADM expects from these external sources, if available; and
- modelling of land administration processes.

2 Conformance

The LADM consists of three packages and one subpackage, and for each of them a conformance test is specified in Annex A. Three conformance levels are specified per (sub)package: level 1 (low level), level 2 (medium level), and level 3 (high level). Level 1 tests the basic classes per package and level 2 also includes the more common classes. Level 3 includes all classes. Any LADM claiming conformance to this International Standard shall satisfy the requirements of Annex A.

3 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4217:2008, *Codes for the representation of currencies and funds*

ISO 8601:2004, *Data elements and interchange formats — Information interchange — Representation of dates and times*

ISO/IEC 13240:2001, *Information technology — Document description and processing languages — Interchange Standard for Multimedia Interactive Documents (ISMID)*

ISO 14825:2011, *Intelligent transport systems — Geographic Data Files (GDF) — GDF5.0*

ISO/TS 19103:2005, *Geographic Information — Conceptual schema language*

ISO 19105:2000, *Geographic Information — Conformance and testing*

ISO 19107:2003, *Geographic Information — Spatial schema*

ISO 19108:2002, *Geographic Information — Temporal schema*

ISO 19111:2007, *Geographic Information — Spatial referencing by coordinates*

ISO 19115:2003, *Geographic information — Metadata*

ISO 19125-2:2004, *Geographic information — Simple feature access — Part 2: SQL option*

ISO 19156:2011, *Geographic information — Observations and measurements*

4 Terms, definitions, and abbreviations

4.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1.1

administrative source

source (4.1.21) with the administrative description (where applicable) of the **parties** (4.1.13) involved, the **rights** (4.1.20), **restrictions** (4.1.19) and **responsibilities** (4.1.18) created and the **basic administrative units** (4.1.2) affected

EXAMPLE 1 It is the evidence of a party's right to a basic administrative unit.

EXAMPLE 2 A document describing a transaction (a deed), or a judgement of the register holder.

4.1.2

basic administrative unit

baunit

administrative entity, subject to registration (by law), or recordation [by informal **right** (4.1.20), or customary right, or another social tenure relationship], consisting of zero or more **spatial units** (4.1.23) against which (one or more) unique and homogeneous rights [e.g. ownership right or **land** (4.1.9) use right], **responsibilities** (4.1.18) or **restrictions** (4.1.19) are associated to the whole entity, as included in a **land administration** (4.1.10) system

NOTE 1 'Unique' means that a right, restriction, or responsibility is held by one or more **parties** (4.1.13) (e.g. owners or users) for the whole basic administrative unit. 'Homogeneous' means that a right, restriction or responsibility (e.g. ownership, use, social tenure, lease, or easement) affects the whole basic administrative unit. For a restriction, zero parties are a possibility.

NOTE 2 A basic administrative unit may play the role of party, e.g. when the right holder is a basic administrative unit (and not a person or organization).

NOTE 3 A baunit should get a unique identifier when registered, or recorded.

NOTE 4 A baunit can consist of zero spatial units, when a registry exists, and not a cadastre.

NOTE 5 Restrictions and responsibilities can be associated with their own baunits, each with their own type of spatial unit.

EXAMPLE A condominium unit comprising two spatial units (e.g. an apartment and a garage), a farm lot comprising one spatial unit (e.g. parcel of land), a servitude comprising one spatial unit (e.g. the road representing the right-of-way), a land consolidation area, or a right-of-use unit with several right holders and restricted objects.

4.1.3

boundary

set that represents the limit of an entity

[ISO 19107:2003, 4.4]

NOTE Boundary is most commonly used in the context of geometry, where the set is a collection of points or a collection of objects that represent those points. In other arenas, the term is used metaphorically to describe the transition between an entity and the rest of its domain of discourse.

4.1.4

boundary face

face (4.1.7) that is used in the 3-dimensional representation of a **boundary** (4.1.3) of a **spatial unit** (4.1.23)

NOTE Boundary faces are used when the implied vertical and unbounded faces of a **boundary face string** (4.1.5) are not sufficient to describe 3D spatial units. Boundary faces close volumes in height (e.g. every apartment floor), or in depth (e.g. an underground parking garage), or in all other directions to form a bounded volume. The volumes represent legal space (in contrast with physical space).

4.1.5

boundary face string

boundary (4.1.3) forming part of the outside of a **spatial unit** (4.1.23)

NOTE Boundary face strings are used to represent the boundaries of spatial units by means of line strings in 2D. This 2D representation is a 2D boundary in a 2D **land administration** (4.1.10) system. In a 3D land administration system it represents a series of vertical **boundary faces** (4.1.4) where an unbounded volume is assumed, surrounded by boundary faces which intersect the Earth's surface (such as traditionally depicted in the cadastral map).

4.1.6

building unit

component of building (the legal, recorded or informal space of the physical entity)

NOTE A building unit may be used for different purposes (e.g. living or commercial) or it can be under construction.

EXAMPLE An apartment, a flight of stairs, a threshold, a garage, a parking space or a laundry space.

4.1.7

face

2-dimensional topological primitive

[ISO 19107:2003, 4.38]

NOTE The geometric realization of a face is a surface. The boundary of a face is the set of directed edges within the same topological complex that are associated to the face via the boundary relations. These can be organized as rings.

4.1.8

group party

any number of **parties** (4.1.13), together forming a distinct entity, with each party registered

NOTE A group party may be a **party member** (4.1.14) of another group party.

EXAMPLE A partnership (with each partner registered as a party), or two tribes (with each tribe registered as a party).

4.1.9

land

the surface of the Earth, the materials beneath, the air above and all things fixed to the soil

[UN/ECE, 2004]

4.1.10

land administration

process of determining, recording and disseminating information about the relationship between people and **land** (4.1.9)

NOTE In many countries, land administration information is determined, recorded and disseminated under the umbrella of cadastre and land registry. Both institutions can be unified in a single (state) organization.

4.1.11

level

set of **spatial units** (4.1.23), with a geometric, and/or topological, and/or thematic coherence

EXAMPLE 1 One level of spatial units for an urban cadastre and another for spatial units for a rural cadastre.

EXAMPLE 2 One level of spatial units to define **basic administrative units** (4.1.2) associated with **rights** (4.1.20) and another level of spatial units to define basic administrative units associated with **restrictions** (4.1.19).

EXAMPLE 3 One level of spatial units to define basic administrative units associated with formal rights, a second level for spatial units to define basic administrative units associated with informal rights and a third level for spatial units to define basic administrative units associated with customary rights.

EXAMPLE 4 One level with **point** (4.1.15) based spatial units, a second level with line based spatial units, and a third level with polygon based spatial units.

4.1.12

liminal spatial unit

spatial unit (4.1.23) on the threshold between 2D and 3D representations

4.1.13

party

person or organization that plays a role in a **rights** (4.1.20) transaction

NOTE 1 In order to be registered as a party, not all members need to be identified and registered individually.

NOTE 2 A **basic administrative unit** (4.1.2) may be a party because it may hold a right of e.g. easement.

EXAMPLE An organization may be: a company, a municipality, the state, a tribe, a farmer cooperation, or a church community (with each organization represented by a delegate: a director, chief, CEO, etc.).

4.1.14

party member

party (4.1.13) registered and identified as a constituent of a **group party** (4.1.8)

4.1.15

point

0-dimensional geometric primitive, representing a position

[ISO 19107:2003, 4.61]

NOTE 1 A point may be used to define one or more **boundary faces** (4.1.4) or **boundary face strings** (4.1.5).

NOTE 2 Points can be observed by, e.g. terrestrial surveying, but also by photo interpretation, image interpretation, or identification on an existing map.

4.1.16 profile

set of one or more base standards or subsets of base standards, and, where applicable, the identification of chosen clauses, classes, options and parameters of those base standards, that are necessary for accomplishing a particular function

[ISO 19106:2004, 4.5]

NOTE 1 A profile valid for a whole country is named a country profile (see Annex D).

NOTE 2 A profile is derived from base standards so that by definition, conformance to a profile is conformance to the base standards from which it is derived (see Annex A).

4.1.17 required relationship

explicit association between either **spatial units** (4.1.23), or between **basic administrative units** (4.1.2)

NOTE 1 Due to legal aspects, history of data, inaccurate geometries or missing geometries, geospatial overlay techniques may generate invalid, or no relationships between spatial units, which can be introduced by required relationships.

NOTE 2 Relationships for spatial units may be defined with ISO 19125-2 types.

4.1.18 responsibility

formal or informal obligation to do something

EXAMPLE The responsibility to clean a ditch, to keep a snow-free pavement or to remove icicles from the roof during winter, or to maintain a monument.

4.1.19 restriction

formal or informal obligation to refrain from doing something

EXAMPLE 1 It is not allowed to build within 200 metres of a fuel station; or, a servitude or mortgage as a restriction to the ownership **right** (4.1.20).

EXAMPLE 2 Sequestration can be registered for baunit as a restriction.

4.1.20 right

action, activity or class of actions that a system participant may perform on or using an associated resource

[ISO 19132:2007, 4.38]

NOTE 1 A right may provide a formal or informal entitlement to own or do something.

NOTE 2 This International Standard deals with real rights and personal rights. Real rights are rights over or in respect of **spatial units** (4.1.23) (e.g. ownership, or usufruct). Personal rights are rights that **parties** (4.1.13) have (e.g. fishing rights, grazing rights, or use rights).

NOTE 3 Rights may be overlapping, or may be in disagreement.

EXAMPLE Ownership right, apartment right, tenancy right, possessions, customary right, Islamic right (e.g. miri or milk), indigenous right, or informal right.

4.1.21

source

document providing legal and/or administrative facts on which the land administration (LA) object [**right** (4.1.20), **restriction** (4.1.19), **responsibility** (4.1.18), **basic administrative unit** (4.1.2), **party** (4.1.13), or **spatial unit** (4.1.23)] is based

NOTE Any kind of document may be added as a source according to ISO 19115:2003, B.3.2.

4.1.22

spatial source

source (4.1.21) with the spatial representation of one (part of) or more **spatial units** (4.1.23)

EXAMPLE A field survey sketch, an orthophoto or a satellite image with evidence of the location of boundaries (collected from the field).

4.1.23

spatial unit

single area (or multiple areas) of **land** (4.1.9) and/or water, or a single volume (or multiple volumes) of space

NOTE 1 A single area is the norm and multiple areas are the exception.

NOTE 2 Spatial units are structured in a way to support the creation and management of **basic administrative units** (4.1.2).

NOTE 3 This International Standard supports either 2-dimensional (2D), 3-dimensional (3D), or mixed (2D and 3D) representations of spatial units, which may be described in text ("from this tree to that river"), or based on a single **point** (4.1.15), or represented as a set of unstructured lines, or as a surface, or as a 3D volume.

NOTE 4 In addition to spatial units represented by a single point, text, or a set of unstructured lines, a spatial unit may have an area equal to zero for administrative reasons.

4.1.24

spatial unit group

any number of **spatial units** (4.1.23), considered as an entity

NOTE The spatial units in a spatial unit group are not necessarily continuous.

EXAMPLE Spatial units together forming an administrative zone such as a section, a canton, a municipality, a department, a province, or a country. Spatial units within a planning area.

4.1.25

utility network

network describing the legal space of the topology of a utility

NOTE 1 A utility network may be attributed with information about its legal, recorded or informal space.

NOTE 2 A utility network can also be modelled as a **basic administrative unit** (4.1.2).

EXAMPLE The legal space needed to access and to keep in repair a cable or pipeline utility network.

4.2 Abbreviations

baunit	basic administrative unit
FIG	International Federation of Surveyors
GIS	Geographical Information System
GNSS	Global Navigation Satellite System
INSPIRE	Infrastructure for Spatial Information in Europe

LA	Land Administration
LADM	Land Administration Domain Model
RRR	Right, Restriction, Responsibility
STDM	Social Tenure Domain Model
UML	Unified Modelling Language

5 Overview of the LADM

5.1 Packages and subpackages of the LADM

The LADM, as a product, is a conceptual schema. The LADM is organized into three packages, and one subpackage. A (sub)package is a group of classes, with a certain degree of cohesion. Each (sub)package has its own namespace. (Sub)packages facilitate the maintenance of different data sets by different organizations. The complete model may therefore be implemented through a distributed set of (geo-) information systems, each supporting data maintenance activities and the provision of elements of the model. The model may also be implemented by one or more maintenance organizations, operating at national, regional or local level. This underlines the relevance of the model: different organizations have their own responsibilities in data maintenance and supply, but may communicate on the basis of standardized administrative and technical update processes.

An overview of the (sub)packages (with their respective classes) is presented in Figure 1. The three packages are: (1) Party Package (see 5.3), (2) Administrative Package (see 5.4), and (3) Spatial Unit Package (see 5.5). The Surveying and Representation Subpackage (see 5.6) is a subpackage of the Spatial Unit Package.

All figures are UML 2.1 diagrams. The LADM classes are prefixed by LA_ to differentiate them from other classes in the ISO geographic information series of standards.

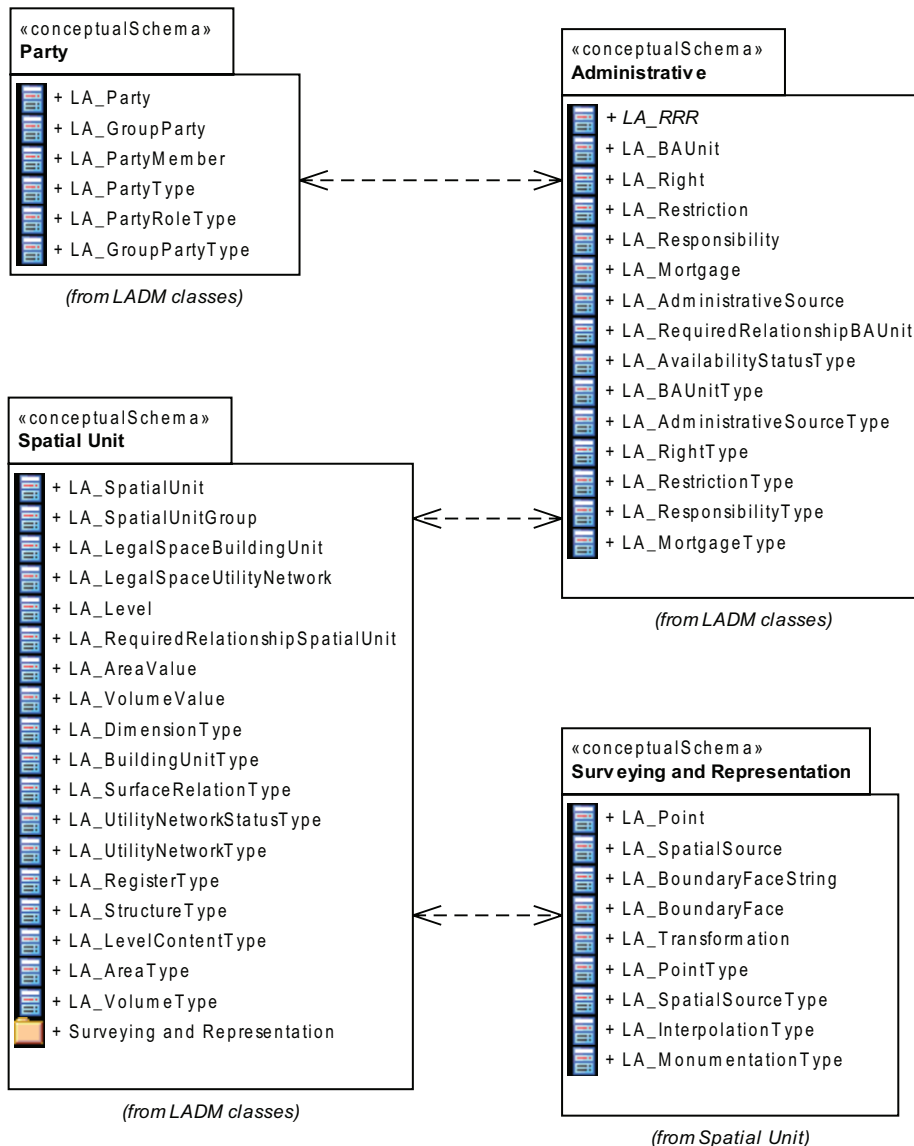


Figure 1 — The LADM overview of (sub)packages (with their respective classes)

5.2 Basic classes of the LADM

The core LADM is based on four basic classes:

- 1) Class LA_Party. Instances of this class are parties.
- 2) Class LA_RRR. Instances of subclasses of LA_RRR are rights, restrictions or responsibilities.
- 3) Class LA_BAUnit. Instances of this class are basic administrative units.
- 4) Class LA_SpatialUnit. Instances of this class are spatial units.

Figure 2 shows the basic classes of the LADM. The details of these four basic classes, and all other LADM classes, are presented in Clause 6.

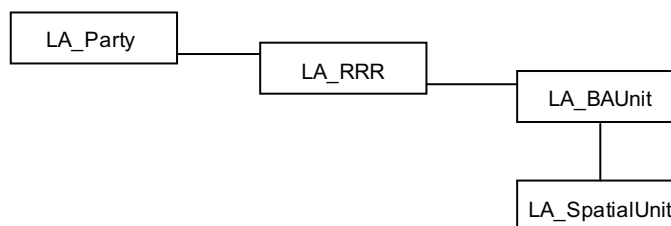


Figure 2 — Basic classes of the LADM

5.3 Party Package

The main class of the Party Package is the basic class LA_Party (with party as an instance). LA_Party has a specialization: LA_GroupParty (with group party as an instance). Between LA_Party and LA_GroupParty there is an optional association class: LA_PartyMember (with party member as an instance). See Figure 3.

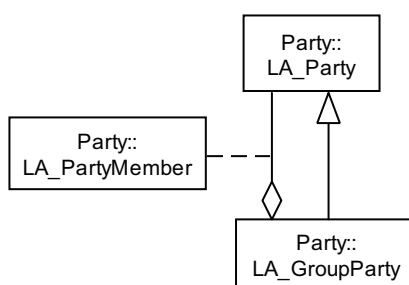


Figure 3 — Classes of Party Package

A group party, being a specialization of party, is also a party. This means that the aggregation relationship between LA_Party and LA_GroupParty in Figure 3 creates group parties with (registered) parties as constituents. Every party, being a constituent of a group party, may then be registered as a party member of class LA_PartyMember.

5.4 Administrative Package

The main classes of the Administrative Package are basic classes LA_RRR and LA_BAUnit. See Figure 4.

LA_RRR is an abstract class with three specialization classes:

- 1) LA_Right, with rights as instances. Rights are primarily in the domain of private or customary law. Ownership rights are generally based on (national) legislation, and code lists in the LADM are in support of this, see Annex J.
- 2) LA_Restriction, with restrictions as instances. Restrictions usually "run with the land", meaning that they remain valid, even when the right to the land is transferred after the right was created (and registered). A *mortgage*, an instance of class LA_Mortgage, is a special restriction of the ownership right. It concerns the conveyance of a property by a debtor to a creditor, as a security for a financial loan, with the condition that the property is returned, when the loan is paid off.
- 3) LA_Responsibility, with responsibilities as instances.

Instances of class LA_BAUnit are basic administrative units (abbreviated as baunits). Baunits are needed, among other things, to register 'basic property units', which consist of several spatial units, belonging to a party, under the same right (a right shall be 'homogeneous' over the whole baunit). RRR shall be unique for each baunit in order to establish a unique combination between an instance of LA_Party, an instance of a subclass of LA_RRR, and an instance of LA_BAUnit.

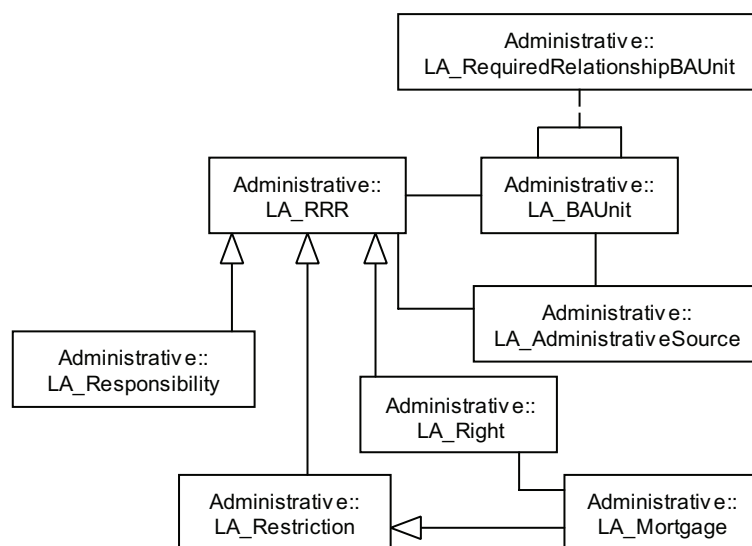


Figure 4 — Classes of Administrative Package

In principle, all rights, restrictions and responsibilities are based on an administrative source, as instances from class LA_AdministrativeSource.

Class LA_RequiredRelationshipBAUnit allows for creating instances of relationships between baunits. Relationships can be legal, temporal, or of a spatial nature.

5.5 Spatial Unit Package

5.5.1 The main class of the Spatial Unit Package is the basic class LA_SpatialUnit, with spatial units as instances. LA_Parcel is an alias for LA_SpatialUnit, see Figure 5.

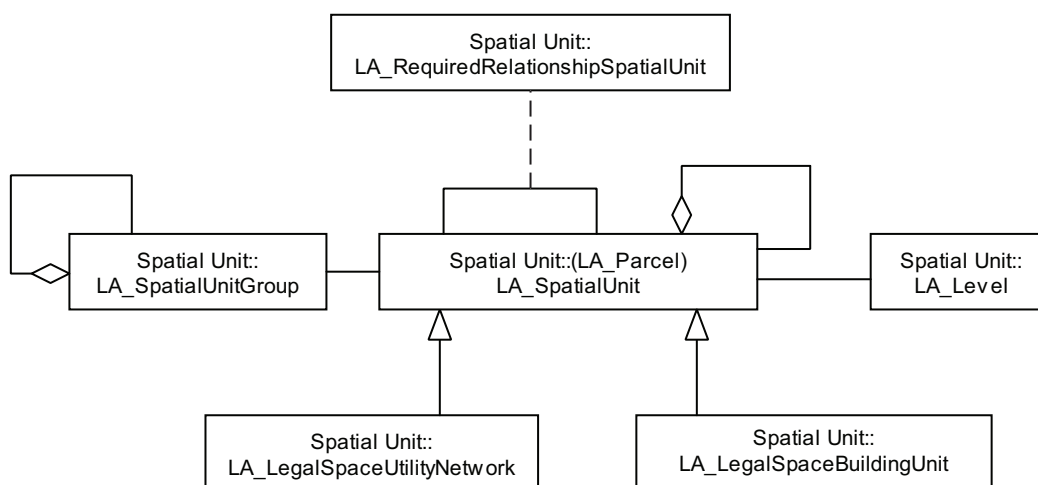


Figure 5 — Classes of Spatial Unit Package

5.5.2 Spatial units may be grouped into two forms:

- 1) as spatial unit groups, as instances of class `LA_SpatialUnitGroup`. Spatial unit groups can be further grouped into larger spatial unit groups. This is realised by an aggregation relationship of `LA_SpatialUnitGroup` onto itself, see Figure 5. An example of a spatial unit group is a municipality. A spatial unit group may be a grouping of other spatial unit groups. In the implementations of the LADM, this is to enable the inclusion of spatial unit identifiers in hierarchical zones.
- 2) as sub spatial units, or subparcels, that is a grouping of a spatial unit into its parts. This is realized by an aggregation relationship of `LA_SpatialUnit` onto itself, see Figure 5. Parts, in their turn, may be grouped into subparts (sub subparcels), and so on.

5.5.3 Spatial units are refined into two specializations:

- 1) building units, as instances of class `LA_LegalSpaceBuildingUnit`. A building unit concerns legal space, which does not necessarily coincide with the physical space of a building.
- 2) utility networks, as instances of class `LA_LegalSpaceUtilityNetwork`. A utility network concerns legal space, which does not necessarily coincide with the physical space of a utility network.

5.5.4 An instance of `LA_Level` is a level.

5.5.5 Required relationships are explicit spatial relationships between spatial units, and instances of class `LA_RequiredRelationshipSpatialUnit`. Sometimes there is a need for these explicit spatial relationships, when the geometry of the spatial units is not accurate enough to give reliable results, when applying geospatial overlaying techniques (e.g. a building, in reality inside a parcel, is reported to fall outside the parcel; the same applies to the geometry of a right, e.g. an easement). Required relationships override implicit relationships, established through geospatial overlaying techniques.

5.6 Surveying and Representation Subpackage

The four classes of the Surveying and Representation Subpackage are (1) `LA_Point`, (2) `LA_SpatialSource`, (3) `LA_BoundaryFaceString`, and (4) `LA_BoundaryFace`, see Figure 6.

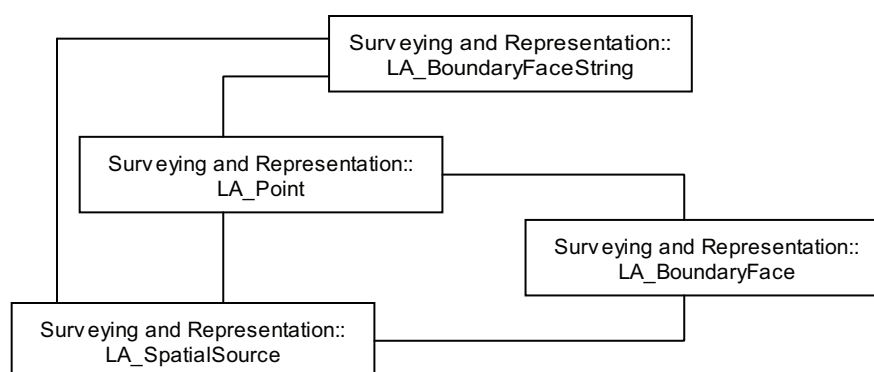


Figure 6 — Classes of Surveying and Representation Subpackage

Points, as instances of `LA_Point`, lines and surfaces can be acquired in the field (with classical surveys, or with GNSS), in an office, or compiled from various sources, for example using forms, field sketches, ortho-images or orthophotos. The acquisition of points, lines or surfaces (a survey) may concern the identification of spatial units on a photograph, on an image, or on a topographic map; cycloramas or pictometry methods (multiple images from different angles) may also be used for that purpose.

A survey is documented with spatial sources, instances from class `LA_SpatialSource`. This may be the final (sometimes formal) documents, or all documents related to a survey. Sometimes, several documents are the result of a single survey. A spatial source may be official, or not (i.e. a registered survey plan, or an aerial photograph). Paper based documents (which may be scanned) can be considered as an integral part of the land administration system.

The individual points are instances of class `LA_Point`, which is associated to `LA_SpatialSource`. While it is not required that the complete spatial unit is represented, a spatial source may be associated to several points. Geodetic control points, including multiple sets of coordinates for points, and with multiple reference systems, are all supported in the LADM.

2D and 3D representations of spatial units use boundary face strings as instances of class `LA_BoundaryFaceString`, and boundary faces as instances of class `LA_BoundaryFace`.

Coordinates themselves either come from points, or are captured as linear geometry.

The LADM supports the increasing use of 3D representations of spatial units, without putting an additional burden on the existing 2D representations. Another feature of the spatial representation within the LADM is that there is no mismatch between spatial units that are represented in 2D and spatial units that are represented in 3D. See Annex B for more details. The LADM is based on accepted and available spatial schemata, such as that published in ISO 19107:2003.

6 Content of classes of the LADM and their associations

6.1 Introduction

All LADM classes adhere to ISO/TS 19103 stereotype class `featureType` (a feature type is a class of features, i.e. abstractions of real world phenomena, having common properties). Many LADM classes are subclasses of class `VersionedObject` (see 6.2.1).

The LADM presupposes stereotype classes, with a minimal number of attributes, to address the situation where an LADM class refers to external sources for parties, addresses, taxations, land uses, land covers, valuations, building units, utility networks, or archives. See Annex K.

The LADM allows user-defined elements to be added. It is likely that additional attributes, operators, associations, or perhaps new classes, will be needed for a specific region or country. It is possible that parts of the LADM are not used. Therefore, country profiles can be used for customizing the LADM, to meet specific needs. See Annex D.

6.2 Special classes

6.2.1 VersionedObject

Class `VersionedObject` is introduced in the LADM to manage and maintain historical data in the database. History requires, that inserted and superseded data, are given a time-stamp. In this way, the contents of the database can be reconstructed, as they were at any historical moment. For more on history and dynamic aspects of LA systems, see Annex N.

Classes `LA_Party`, `LA_PartyMember`, `LA_RRR`, `LA_BAUnit`, `LA_SpatialUnit`, `LA_SpatialUnitGroup`, `LA_RequiredRelationshipSpatialUnit`, `LA_RequiredRelationshipBAUnit`, `LA_Level`, `LA_BoundaryFaceString`, `LA_BoundaryFace`, and `LA_Point` are all subclasses of class `VersionedObject`, see Figure 7.

Classes `LA_GroupParty`, `LA_Right`, `LA_Restriction`, `LA_Responsibility`, `LA_Mortgage` (via `LA_Restriction`), `LA_LegalSpaceUtilityNetwork` and `LA_LegalSpaceBuildingUnit` inherit `VersionedObject` through the above classes.

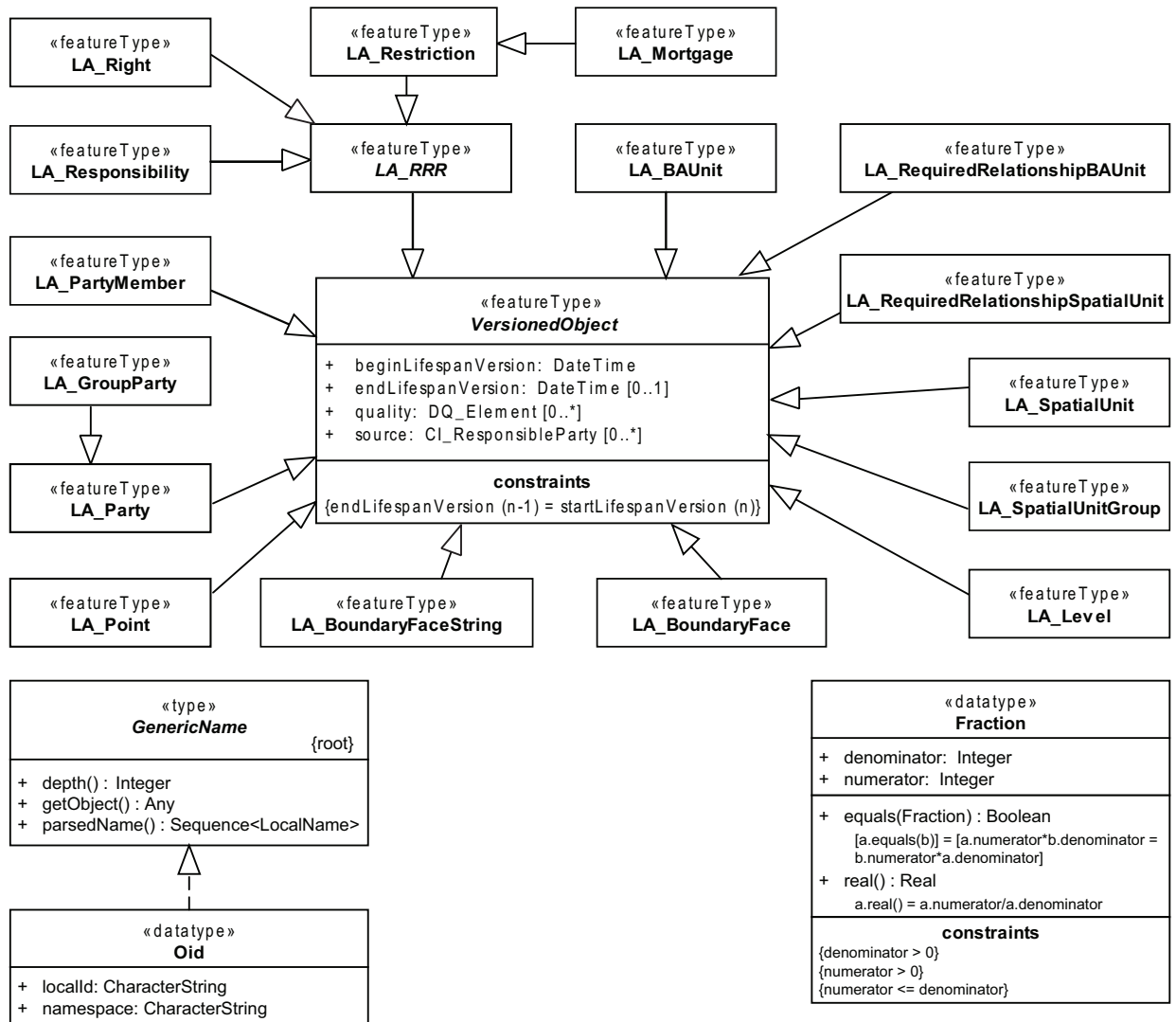


Figure 7 — Classes VersionedObject (with subclasses) Fraction and Oid

The attributes of VersionedObject are:

- | | |
|-------------------------|--|
| — beginLifespanVersion: | Start time of a specific instance version; |
| Value type: | DateTime, based on ISO 19108 |
| Multiplicity: | 1 |
| — endLifespanVersion: | End time of a specific instance version; |
| Value type: | DateTime, based on ISO 19103 |
| Multiplicity: | 0..1 |
| — quality: | Quality of a specific instance version; |
| Value type: | DQ_Element (type from ISO 19115) |
| Multiplicity: | 0..* |

— source:	Responsible organization of a specific instance version;
Value type:	CI_ResponsibleParty (type from ISO 19115)
Multiplicity:	0..*

6.2.2 Fraction

Generic data type Fraction is introduced in the LADM to provide support for fractions, e.g. $\frac{1}{2}$ or $\frac{3}{4}$. A fraction is written as a pair of numbers, the top number called the numerator and the bottom number called the denominator. A line usually separates the numerator and denominator, see Figure 7.

The attributes of Fraction are:

— denominator:	The bottom number in the notation of a fraction;
Value type:	int
Multiplicity:	1
— numerator:	The top number in the notation of a fraction;
Value type:	int
Multiplicity:	1

Value type of denominator shall be a positive integer value ≥ 0 .

Value type of numerator shall be a positive integer value ≥ 0 , and shall be lower than the denominator value.

6.2.3 Oid

Generic data type Oid is introduced in the LADM to provide support for object identifiers, see Figure 7.

The attributes of Oid are:

— localId:	Local identifier, assigned by the data provider;
Value type:	CharacterString
Multiplicity:	1
— namespace:	Identifier for the data source of the spatial object;
Value type:	CharacterString
Multiplicity:	1

The local identifier should be unique within the namespace, i.e. no other spatial object should carry the same identifier.

NOTE Country profiles can limit the set of characters to ensure compliancy with local standards (e.g. {"A".."Z", "a".."z", "0".."9", "_", ".", ",", "-"}, i.e. only letters from the Latin alphabet, digits, underscores, periods, commas, and dashes are allowed).

6.2.4 LA_Source

In the LADM, administrative sources and spatial sources are modelled, starting with an abstract class LA_Source. LA_Source has two subclasses: (1) LA_AdministrativeSource (see 6.4.7), and (2) LA_SpatialSource (see 6.6.2), see Figure 8.

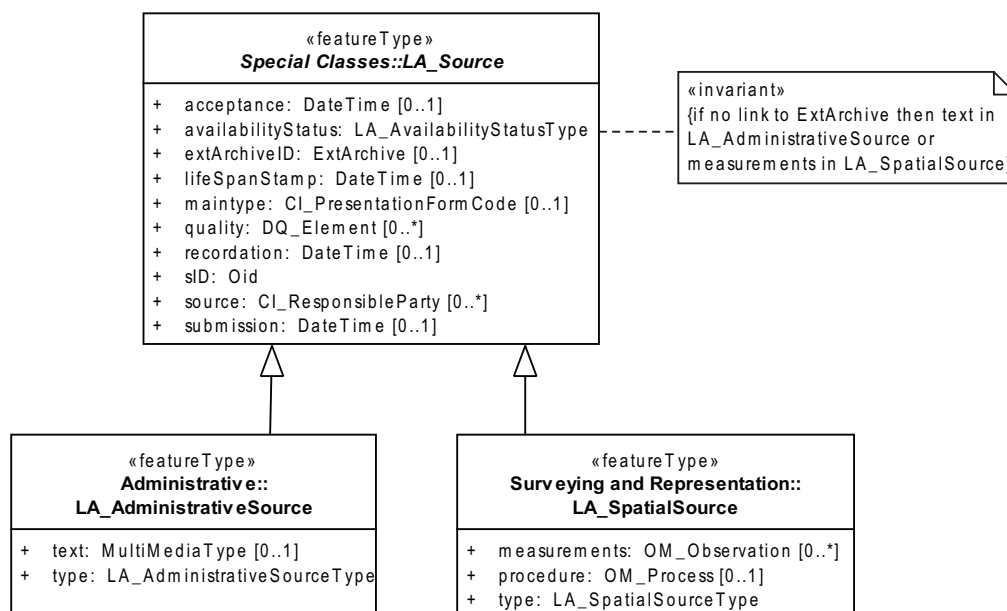


Figure 8 — Class LA_Source (with subclasses)

The attributes of LA_Source are:

- acceptance: The date of force of law of the source by an authority;
Value type: DateTime, based on ISO 19108
Multiplicity: 0..1
- availabilityStatus: The availability status of the source;
Value type: LA_AvailabilityStatusType
Multiplicity: 1
- extArchiveID: The identifier of a source in an external registration;
Value type: ExtArchive
Multiplicity: 0..1
- lifeSpanStamp: The moment that the event, represented by the instance of LA_Source, is further processed in the LA system (this is the moment of endLifespanVersion of old instances, and the moment of beginLifespanVersion of new instances);
Value type: DateTime, based on ISO 19108
Multiplicity: 0..1

— maintype:	The type of document;
Value type:	CI_PresentationFormCode
Multiplicity:	0..1
— quality:	The quality of the source;
Value type:	DQ_Element from ISO 19115
Multiplicity:	0..*
— recordation:	The date of registration (recordation) of the source by the registering authority;
Value type:	DateTime, based on ISO 19108
Multiplicity:	0..1
— sID:	The identifier of the source;
Value type:	Oid
Multiplicity:	1
— source:	The responsible party of the source;
Value type:	CI_ResponsibleParty
Multiplicity:	0..*
— submission:	The date of submission of the source by a party;
Value type:	DateTime, based on ISO 19108
Multiplicity:	0..1

NOTE 1 The fact that all different (public or private law) rights find their base in some kind of transacting document is represented by the association between LA_RRR and LA_AdministrativeSource. The party responsible for drafting the document is connected to the latter as 'conveyancer', 'notary', or 'writer' (see Figure 10).

NOTE 2 In some land administration systems, sources are required to perform the transactions but these are not archived afterwards. The registration itself then serves as such evidence.

6.3 Classes of Party Package

6.3.1 LA_Party

An instance of class LA_Party is a party. A party is associated to zero or more [0..*] instances of a subclass of LA_RRR. LA_Party is also associated to LA_BAUnit, to cater for the fact that a basic administrative unit can be a party (e.g. a basic administrative unit holding an easement on another basic administrative unit). A party may be associated to zero or more [0..*] administrative sources (i.e. the author of a transfer document is defined as a party playing the role of conveyancer in a source). A party may be associated to zero or more [0..*] spatial sources (i.e. the author of a survey document is defined as a party playing the role of surveyor in a source); see Figure 9.

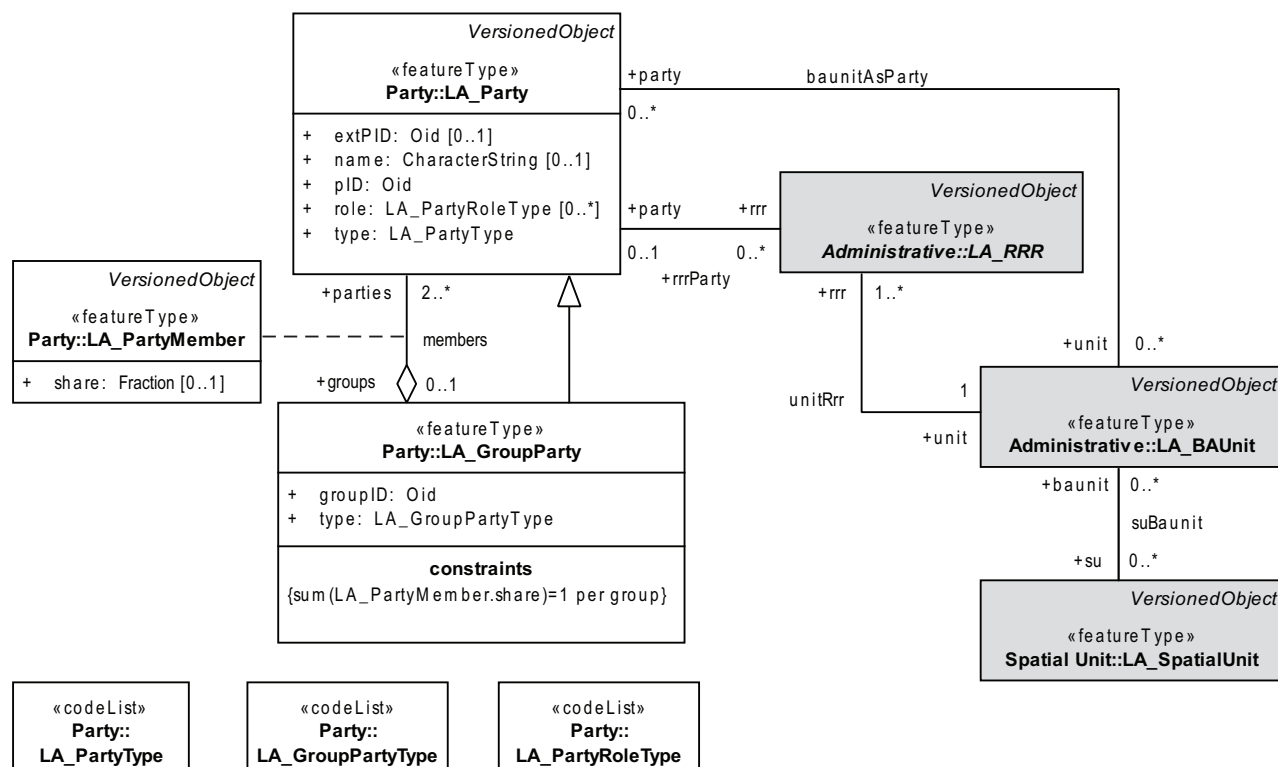


Figure 9 — Content of Party Package and associations to other basic classes

The attributes of LA_Party are:

- extPID: The identifier of the party in an external registration;
Value type: Oid
Multiplicity: 0..1
- name: The name of the party;
Value type: CharacterString
Multiplicity: 0..1
- pID: The identifier of the party;
Value type: Oid
Multiplicity: 1
- role: The role of the party in the data update and maintenance process;
Value type: LA_PartyRoleType
Multiplicity: 0..*

— type:	The type of the party;
Value type:	LA_PartyType
Multiplicity:	1

NOTE If 'role' has a specific value (e.g. conveyancer) then it is possible that no subclasses of LA_RRR are associated to the party, hence [0..*] multiplicity, 0 indicating that, e.g. this conveyancer is not involved in any subclass of LA_RRR.

EXAMPLE Parties are demonstrated in instance diagrams, see Annex C, Figures C.3, C.4, C.13 and C.31.

6.3.2 LA_GroupParty

An instance of class LA_GroupParty is a group party. Class LA_GroupParty is a subclass of LA_Party, thus allowing instances of class LA_GroupParty to have an association with instances of class LA_RRR (and thereby also to class LA_BAUnit). A group party consists of two or more [2..*] parties, but also of other group parties (that is to say, a group party of group parties). Conversely, a party is a member of zero or more [0..*] group parties, see Figure 9.

The attributes of LA_GroupParty are:

— groupID:	The identifier of a group party;
Value type:	Oid
Multiplicity:	1
— type:	The type of a group party;
Value type:	LA_GroupPartyType
Multiplicity:	1

LA_GroupParty has a constraint requiring that the sum of the shares of the group party members shall equal 1. This constraint is only enforced if a class LA_PartyMember exists (see 6.3.3).

EXAMPLE Group parties are demonstrated in instance diagrams, see Annex C, Figures C.3, C.4, C.5 and C.26.

6.3.3 LA_PartyMember

An instance of class LA_PartyMember is a party member. Class LA_PartyMember is an optional association class between LA_Party and LA_GroupParty, see Figure 9.

The attribute of LA_PartyMember is:

— share:	The fraction of the whole;
Value type:	Fraction
Multiplicity:	0..1

6.3.4 Code lists for Party Package

Party Package has three code lists (see Figure 9). See Annex J for examples of the values.

- LA_PartyRoleType: the LA_PartyRoleType code list includes all the various roles, such as surveyor or notary, parties may play in updating and/or maintaining the land administration in a specific land

administration profile implementation. The LA_PartyRoleType code list is required only if the attribute role in LA_Party class is implemented. The code list shall provide a complete list of all codes with a name and description.

- LA_GroupPartyType: the LA_GroupPartyType code list includes all the various types of group parties, such as association or family, recognized/allowed in a specific land administration profile implementation. The LA_GroupPartyType code list is required to implement the LA_GroupParty class. The code list shall provide a complete list of all codes with a name and description.
- LA_PartyType: the LA_PartyType code list includes all the various types of parties, such as natural or non natural persons, recognized/allowed in a specific land administration profile implementation. The LA_PartyType code list is required to implement the LA_Party class. The code list shall provide a complete list of all codes with a name and description.

6.4 Classes of Administrative Package

6.4.1 LA_BAUnit

An instance of class LA_BAUnit is a basic administrative unit. LA_BAUnit is associated to class LA_Party (a party may be a basic administrative unit). A basic administrative unit is associated to zero or more [0..*] spatial units. A basic administrative unit shall be associated to one or more [1..*] instances of right, restriction or responsibility (i.e. a basic administrative unit cannot exist if there is not at least one right, restriction or responsibility associated to it). A basic administrative unit can be spatially related, through a required relationship, to zero or more [0..*] other basic administrative units (i.e. create an explicit spatial relationship between two basic administrative units when the geometry is missing or inaccurate to provide reliable implicit results). Basic administrative units do not need to be related explicitly. However, if an explicit required relationship is specified, a basic administrative unit shall be associated to one or more [1..*] other basic administrative units. A basic administrative unit can be associated to zero or more [0..*] administrative sources (i.e. the basic administrative unit is usually described as the object affected by the right, restriction or responsibility in the administrative source). A basic administrative unit can be associated to zero or more [0..*] spatial sources (i.e. the extent – part of – of a basic administrative unit can be described on a spatial source). See Figure 10.

The attributes of LA_BAUnit are:

- name: The name of the basic administrative unit;
Value type: CharacterString
Multiplicity: 0..1
- type: The type of the basic administrative unit;
Value type: LA_BAUnitType
Multiplicity: 1
- uID: The identifier of the basic administrative unit;
Value type: Oid
Multiplicity: 1

LA_BAUnit has a constraint requiring that the sum of all the shares for one basic administrative unit shall equal 1 for the same subclass of class LA_RRR, unless 'share' is meaningless with regard to the type of right, restriction or responsibility. The constraint should be applied only to instances valid at the same moment in time (life span).

LA_BAUnit has a constraint requiring that no overlap be allowed between timeSpecs for the same RRR type and the same basic administrative unit.

NOTE 1 LA_BAUnit allows the association of one right to a combination of spatial units (e.g. an apartment and a parking place).

NOTE 2 It is possible that no spatial unit exists for a basic administrative unit, thus allowing for the support of special administrative situations (e.g. deeds registration without mapping).

NOTE 3 With class LA_BAUnit it is possible to register spatial units from different levels as one unit. If (parts of) spatial units are included, or eliminated from the baunit, the uID stays the same, with a different version. In this approach, a mortgage can only be established on the complete baunit, not on one or more of the registered spatial units.

NOTE 4 A (group of) baunits may be a party.

EXAMPLE Basic administrative units (baunits) are demonstrated in instance diagrams, see Annex C, Figures C.1, C.17, C.24, C.25, C.26, C.28, C.30, C.31, C.33, C.34 and C.35.

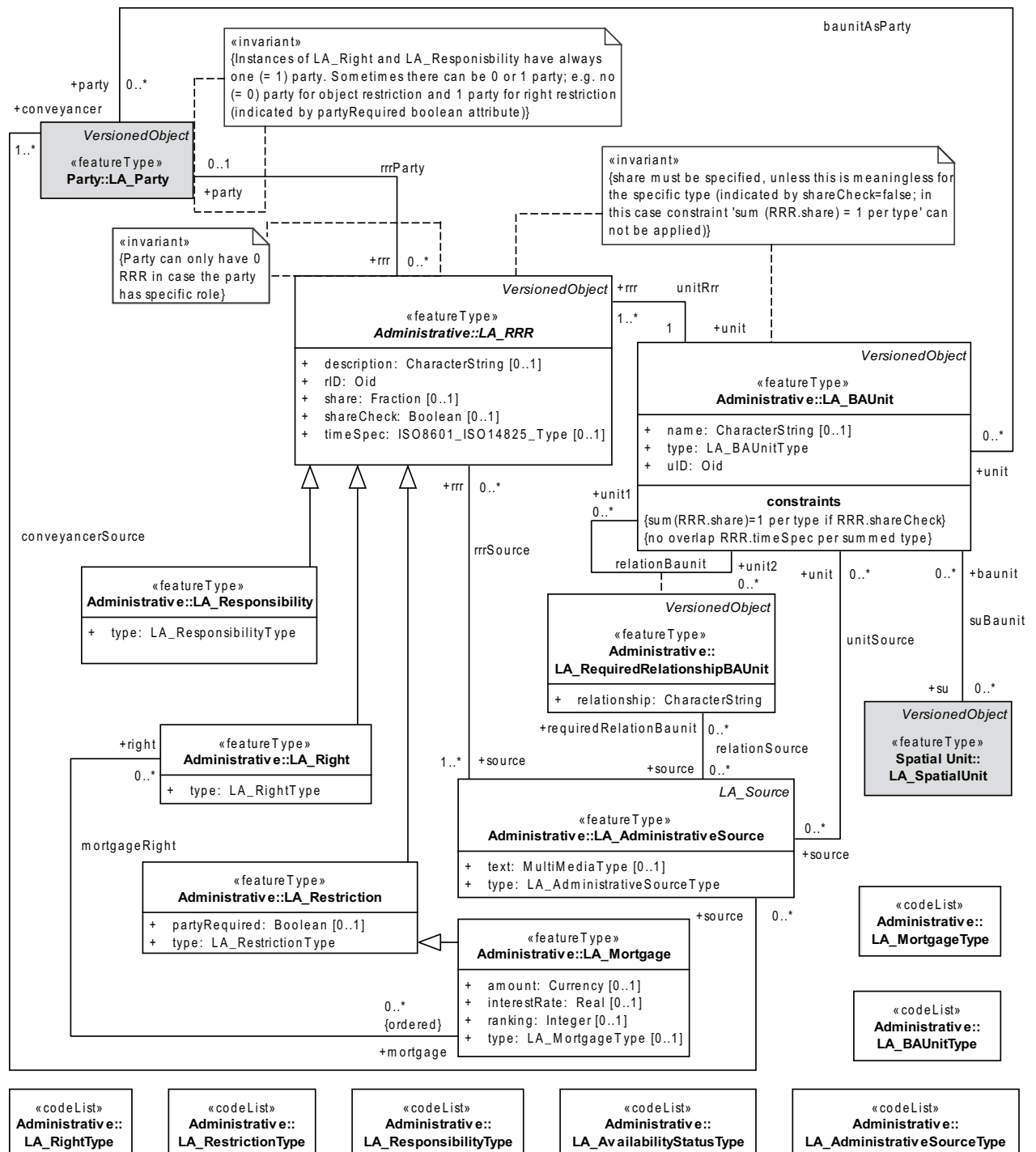


Figure 10 — Content of Administrative Package with associations to other basic classes

6.4.2 LA_RRR

Class LA_RRR is an abstract class. An instance of a subclass of LA_RRR is a right (or social tenure relationship), a restriction, or a responsibility. If it is a right or responsibility, then it is associated to exactly one [1] party, and exactly one [1] basic administrative unit. If it is a restriction, then it is associated to zero or one [0..1] parties, and exactly one [1] basic administrative unit. The latter allows for the registration of restrictions (e.g. right-of-way, right-to-harvest-fruit), with, or without an association to LA_Party. An instance of a subclass of LA_RRR shall be associated to one or more [1..*] administrative sources (i.e. the right, restriction or

responsibility affecting a basic administrative unit shall be supported by at least one administrative source). See Figure 10.

The attributes of LA_RRR are:

- description: Description regarding the right, restriction or responsibility;
Value type: CharacterString
Multiplicity: 0..1
- rID: The RRR identifier;
Value type: Oid
Multiplicity: 1
- share: A share in an instance of a subclass of LA_RRR;
Value type: Fraction
Multiplicity: 0..1
- shareCheck: Indicates whether the constraint in class LA_BAUnit is applicable;
Value type: Boolean
Multiplicity: 0..1
- timeSpec: Operational use of a right in time sharing;
Value type: ISO 8601 type or ISO 14825 type
Multiplicity: 0..1

NOTE Attribute timeSpec is capable of handling other temporal descriptions, such as recurring patterns (every week-end, every summer, etc.). This means, for example, that a party can hold a right to use an apartment each year in March, or that a group of pastoralists has the right to cross a field each summer (for fuzzy time range specifications see ISO 14825:2011, Annex D; ISO 14825:2011, Annex D may be used instead of ISO 8601:2004).

6.4.3 LA_Right

An instance of class LA_Right is a right. LA_Right is a subclass of class LA_RRR. A right may be associated to zero or more [0..*] mortgages (i.e. a mortgage is associated to the affected basic administrative unit but it may also be specifically associated to the right which is the object of the mortgage); see Figure 10.

The attribute of LA_Right is:

- type: The type of the right;
Value type: LA_RightType
Multiplicity: 1

EXAMPLE Rights are demonstrated in instance diagrams, see Annex C, Figures C.1, C.8, C.11, C.30 and C.31.

6.4.4 LA_Restriction

An instance of class `LA_Restriction` is a restriction. `LA_Restriction` is a subclass of class `LA_RRR`. `LA_Mortgage` is a specialization of `LA_Restriction` (6.4.6); see Figure 10.

The attributes of `LA_Restriction` are:

- `partyRequired`: Indicates whether a party is required for the registration of the restriction in the association to `LA_Party`;
 Value type: Boolean
 Multiplicity: 0..1
- `type`: The type of the restriction;
 Value type: `LA_RestrictionType`
 Multiplicity: 1

NOTE Attribute `partyRequired` is set to `TRUE` (by default), if for the registration of the restriction a party is required, and to `FALSE`, if the restriction is considered as a spatial unit restriction. The spatial unit restriction is always via a baunit.

EXAMPLE Restrictions are demonstrated in instance diagrams. See Annex C, Figures C.9, C.16, C.19, C.21, C.22 and C.23.

6.4.5 LA_Responsibility

An instance of class `LA_Responsibility` is a responsibility. `LA_Responsibility` is a subclass of class `LA_RRR`. See Figure 10.

The attribute of `LA_Responsibility` is:

- `type`: The type of the responsibility;
 Value type: `LA_ResponsibilityType`
 Multiplicity: 1

EXAMPLE Responsibilities are demonstrated in instance diagrams. See Annex C, Figure C.20.

6.4.6 LA_Mortgage

An instance of class `LA_Mortgage` is a mortgage. `LA_Mortgage` is a subclass of `LA_Restriction`. `LA_Mortgage` is associated to class `LA_Right` (the right that is the basis for the mortgage). A mortgage can be associated to zero or more `[0..*]` rights (i.e. a mortgage can be associated specifically to the right which is the object of the mortgage). In all cases, the mortgage is associated, through `LA_Restriction` and `LA_RRR`, to the basic administrative unit which is affected by the mortgage; see Figure 10.

The attributes of `LA_Mortgage` are:

- `amount`: The amount of money of the mortgage;
 Value type: Currency, based on ISO 4217
 Multiplicity: 0..1

- **interestRate:** Interest rate of the mortgage (percentage);
Value type: Float
Multiplicity: 0..1
- **ranking:** The ranking order, if more than one mortgage applies to a right (or rights);
Value type: Integer
Multiplicity: 0..1
- **type:** The type of the mortgage;
Value type: LA_MortgageType
Multiplicity: 0..1

NOTE ISO 4217 should be used for the list of currencies in the ISO/TS 19103 measure.

EXAMPLE Mortgages are demonstrated in instance diagrams. See Annex C, Figures C.10, C.11 and C.15.

6.4.7 LA_AdministrativeSource

An instance of class LA_AdministrativeSource is an administrative source. LA_AdministrativeSource is a subclass of class LA_Source. An administrative source shall be associated to one or more [1..*] parties (i.e. as a minimum the party playing the role of conveyancer must be specified). An administrative source may be associated to zero or more [0..*] basic administrative units (i.e. the administrative source may describe the objects of the right, restriction or responsibility). An administrative source may be associated to zero or more [0..*] instances of specializations (right, restriction/mortgage, and responsibility) of LA_RRR (i.e. the administrative source may describe the rights, restrictions or responsibilities hold by a party and affecting a basic administrative unit); see Figures 8 and 10.

The attributes of LA_AdministrativeSource are:

- **text:** The content of the document;
Value type: MultiMediaType based on ISO/IEC 13240
Multiplicity: 0..1
- **type:** The type of document;
Value type: LA_AdministrativeSourceType
Multiplicity: 1

NOTE 1 An availability status for an administrative source is required, because it may be lost, e.g. by a disaster.

NOTE 2 ISO/IEC 13240 may be used for the content of the document.

NOTE 3 Archives can be internal or external to the LA organization. If internal then text attribute can be used; if external then extArchiveID of administrative source.

6.4.8 LA_RequiredRelationshipBAUnit

An instance of association class LA_RequiredRelationshipBAUnit is a required relationship between basic administrative units, see Figure 10. A required relationship between spatial units can be associated to zero or more [0..*] spatial sources to provide supporting documentation for the explicit relationship.

The attribute of LA_RequiredRelationshipBAUnit is:

— relationship:	The description of the required relationship;
Value type:	CharacterString
Multiplicity:	1

NOTE 1 Instances of LA_RequiredRelationshipBAUnit override implicit relationships, established through geospatial overlaying techniques.

NOTE 2 Even if the geometry of spatial units is accurate, there may be legal reasons to establish required relationships between baunits.

NOTE 3 LA_RequiredRelationshipBAUnit is a versioned object class. Different life cycle attributes than the versioned object ones, can be added using the attribute 'relationship'.

EXAMPLE Two historic versions of baunits should be connected in time when related to the same change, e.g. when a part of a spatial unit is sold.

6.4.9 Code lists for Administrative Package

Administrative Package has seven code lists for classes. See Annex J for examples of the values.

- LA_AdministrativeSourceType: the LA_AdministrativeSourceType code list includes all the various administrative source types, such as deed or title, used as supporting documents in a specific land administration profile implementation. The LA_AdministrativeSourceType code list is required to implement the LA_AdministrativeSource class. Code list shall provide a complete list of all codes with a name and description.
- LA_MortgageType: the LA_MortgageType code list includes all the various mortgage types, such as linear or micro-credit, used in a specific land administration profile implementation. The LA_MortgageType code list is required only if the attribute type in LA_Mortgage class is implemented. Code list shall provide a complete list of all codes with a name and description.
- LA_RightType: the LA_RightType code list includes all the various right types, such as ownership, customary or lease, used in a specific land administration profile implementation. The LA_RightType code list is required to implement the LA_Right class. Code list shall provide a complete list of all codes with a name and description.
- LA_RestrictionType: the LA_RestrictionType code list includes all the various restriction types, such as servitudes, used in a specific land administration profile implementation. The LA_RestrictionType code list is required to implement the LA_Restriction class. Code list shall provide a complete list of all codes with a name and description.
- LA_ResponsibilityType: the LA_ResponsibilityType code list includes all the various responsibility types, such as waterway maintenance, used in a specific land administration profile implementation. The LA_ResponsibilityType code list is required to implement the LA_Responsibility class. Code list shall provide a complete list of all codes with a name and description.
- LA_AvailabilityStatusType: the LA_AvailabilityStatusType code list includes all the various availability status types, such as original, destroyed or incomplete, used in a specific land administration profile implementation. The LA_AvailabilityStatusType code list is required to implement the LA_AdministrativeSource class. Code list shall provide a complete list of all codes with a name and description.
- LA_BAUnitType: the LA_BAUnitType code list includes all the various basic administrative unit types, such as basic property unit or right unit, used in a specific land administration profile implementation. The LA_BAUnitType code list is required to implement the LA_BAUnit class. Code list shall provide a complete list of all codes with a name and description.

6.5 Classes of Spatial Unit Package

6.5.1 LA_SpatialUnit

An instance of class LA_SpatialUnit is a spatial unit. A spatial unit may be associated to zero or more [0..*] basic administrative units (i.e. the spatial unit may be used to describe the extent – part of – a basic administrative unit). A spatial unit may be associated to zero or one [0..1] levels (i.e. a spatial unit can be associated to a property level). A spatial unit cannot be associated to more than one level. A spatial unit may be associated to zero or more [0..*] spatial unit groups (i.e. a spatial unit can be associated to a subdivision and also to school district). A spatial unit can be spatially related, through a required relationship, to zero or more [0..*] other spatial units (i.e. creates an explicit spatial relationship between two spatial units when the geometry is missing or inaccurate to provide reliable implicit results). Spatial units do not need to be related explicitly. A spatial unit can be associated to zero or more [0..*] spatial sources. A spatial unit can form part of 0..1 other spatial unit. A spatial unit can include 0..* other spatial units. Spatial units can be further specialized into building units (6.5.3) or utility networks (6.5.4); see Figure 11.

The attributes of LA_SpatialUnit are:

- area: The area of the 2D spatial unit;
Value type: LA_AreaValue
Multiplicity: 0..*
- dimension: The dimension of the spatial unit;
Value type: LA_DimensionType
Multiplicity: 0..1
- extAddressID: The link to external address(es) of the spatial unit;
Value type: Oid
Multiplicity: 0..*
- label: Short textual description of the spatial unit;
Value type: CharacterString
Multiplicity: 0..1
- referencePoint: The coordinates of a point inside the spatial unit;
Value type: GM_Point (type from ISO 19107)
Multiplicity: 0..1
- suID: The spatial unit identifier;
Value type: Oid
Multiplicity: 1

- **surfaceRelation:** Indicates whether a spatial unit is above or below the surface;
Value type: LA_SurfaceRelationType
Multiplicity: 0..1
- **volume:** The volume of the 3D spatial unit;
Value type: LA_VolumeValue
Multiplicity: 0..*

NOTE The method 'createArea()' constructs geometric primitive of type GM_MultiSurface based on associated spatial representation (2D). The method 'areaClosed()' checks if associated spatial representation is closed (2D). The method 'computeArea()' computes area of associated spatial representation (2D). The method 'computeVolume()' computes volume of associated spatial representation (3D). The method 'createVolume()' constructs geometric primitive of type GM_MultiSolid based on associated spatial representation (3D). The method 'volumeClosed()' checks if associated spatial representation is closed (3D). These methods define meaning of class at conceptual level, and are not inherited from other classes, nor defined in other ISO standards. Not all methods are meaningful in all situations, e.g. computeVolume() in case of 2D.

EXAMPLE Spatial units are demonstrated in instance diagrams, see Annex C, Figures C.6, C.7, C.16, C.17, C.22, C.29 and C.33.

6.5.2 LA_SpatialUnitGroup

An instance of class LA_SpatialUnitGroup is a spatial unit group. A spatial unit group is made of one or more [1..*] parts/elements (which can be spatial units, or spatial unit groups, or a combination of spatial units and spatial unit groups). A spatial unit group is part of zero or one [0..1] larger spatial unit group, which again can even be part of zero or one [0..1] larger spatial unit group, and so on. See Figure 11.

The attributes of LA_SpatialUnitGroup are:

- **hierarchyLevel:** The level in the hierarchy of an administrative or zoning subdivision;
Value type: Integer
Multiplicity: 1
- **label:** Short textual description of the spatial unit group;
Value type: CharacterString
Multiplicity: 0..1
- **name:** The name of the spatial unit group;
Value type: CharacterString
Multiplicity: 0..1
- **referencePoint:** The coordinates of a point within the spatial unit group;
Value type: GM_Point (type from ISO 19107)
Multiplicity: 0..1

— sugID:	The identifier of the spatial unit group;
Value type:	Oid
Multiplicity:	1

NOTE The highest level in the hierarchy of a subdivision (country) is 1; lower levels are incremented by 1.

6.5.3 LA_LegalSpaceBuildingUnit

An instance of class LA_LegalSpaceBuildingUnit is a building unit. LA_LegalSpaceBuildingUnit is a subclass of class LA_SpatialUnit, see Figure 11.

The attributes of LA_LegalSpaceBuildingUnit are:

— extPhysicalBuildingUnitID:	The identifier of the building unit;
Value type:	extPhysicalBuildingUnit
Multiplicity:	0..1
— type:	The type of the building unit;
Value type:	LA_BuildingUnitType
Multiplicity:	0..1

NOTE The extBuildingUnitID is optional, as in most cases, the sulD inherited from LA_SpatialUnit is sufficient to uniquely identify instances of LA_LegalSpaceBuildingUnit.

EXAMPLE Building units are demonstrated in instance diagrams, see Annex C, Figures C.6, C.23, C.25, C.28, C.29, C.34 and C.35.

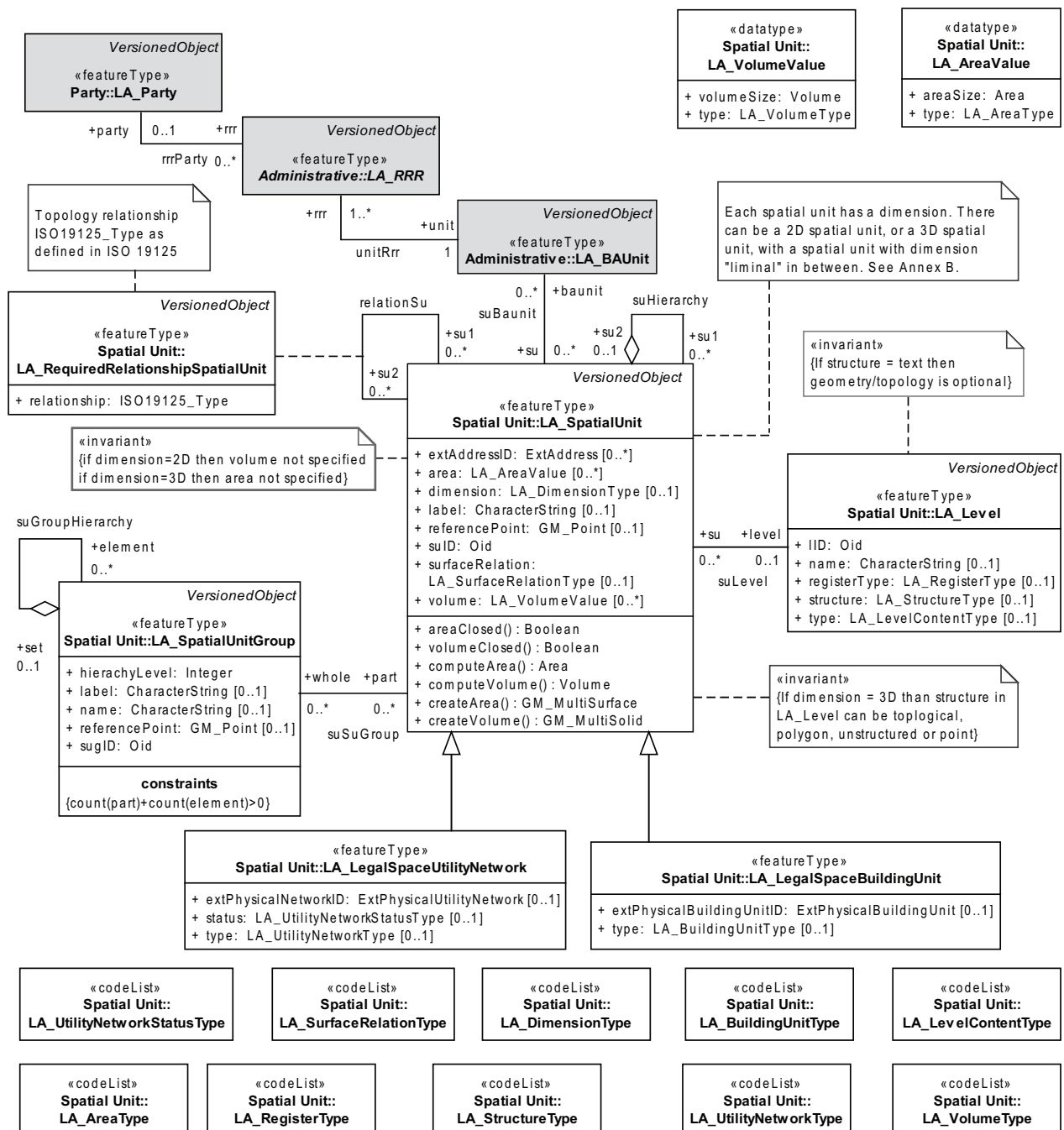


Figure 11 — Content of Spatial Unit Package with associations to other basic classes

6.5.4 LA_LegalSpaceUtilityNetwork

An instance of `LA_LegalSpaceUtilityNetwork` is a utility network. `LA_LegalSpaceUtilityNetwork` is a subclass of class `LA_SpatialUnit`, see Figure 11.

The attributes of `LA_LegalSpaceUtilityNetwork` are:

- `extPhysicalUtilityNetworkID`: A reference to the physical (technical) description of the utility network;
Value type: `Oid`
Multiplicity: `0..1`

- status: The status of the utility network;
Value type: LA_UtilityNetworkStatusType
Multiplicity: 0..1
- type: The type of the utility network;
Value type: LA_UtilityNetworkType
Multiplicity: 0..1

EXAMPLE Utility networks are demonstrated in instance diagrams, see Annex C, Figure C.15.

6.5.5 LA_Level

An instance of class LA_Level is a level. LA_Level is associated to class LA_SpatialUnit, see Figure 11.

The attributes of LA_Level are:

- IID: The identifier of the level;
Value type: Oid
Multiplicity: 1
- name: The name of the level;
Value type: CharacterString
Multiplicity: 0..1
- registerType: The register type of the content of the level;
Value type: LA_RegisterType
Multiplicity: 0..1
- structure: The structure of the level geometry;
Value type: LA_StructureType
Multiplicity: 0..1
- type: The type of the content of the level;
Value type: LA_LevelContentType
Multiplicity: 0..1

EXAMPLE Levels are demonstrated in instance diagrams, see Annex C, Figures C.2, C.14, C.16, C.21, C.23, C.24, C.25 and C.32.

6.5.6 LA_RequiredRelationshipSpatialUnit

An instance of association class LA_RequiredRelationshipSpatialUnit is a required relationship between spatial units, see Figures 11 and 12. A required relationship between spatial units can be associated to zero or more [0..*] spatial sources to provide supporting documentation for the explicit relationship.