FIG WORKING WEEK 2023
28 May - 1 June 2023 Orlando Florida USA
Protecting Our World, Conquering New Frontiers

Galileo High Accuracy Services

support through ISO 19152 LADM Edition II

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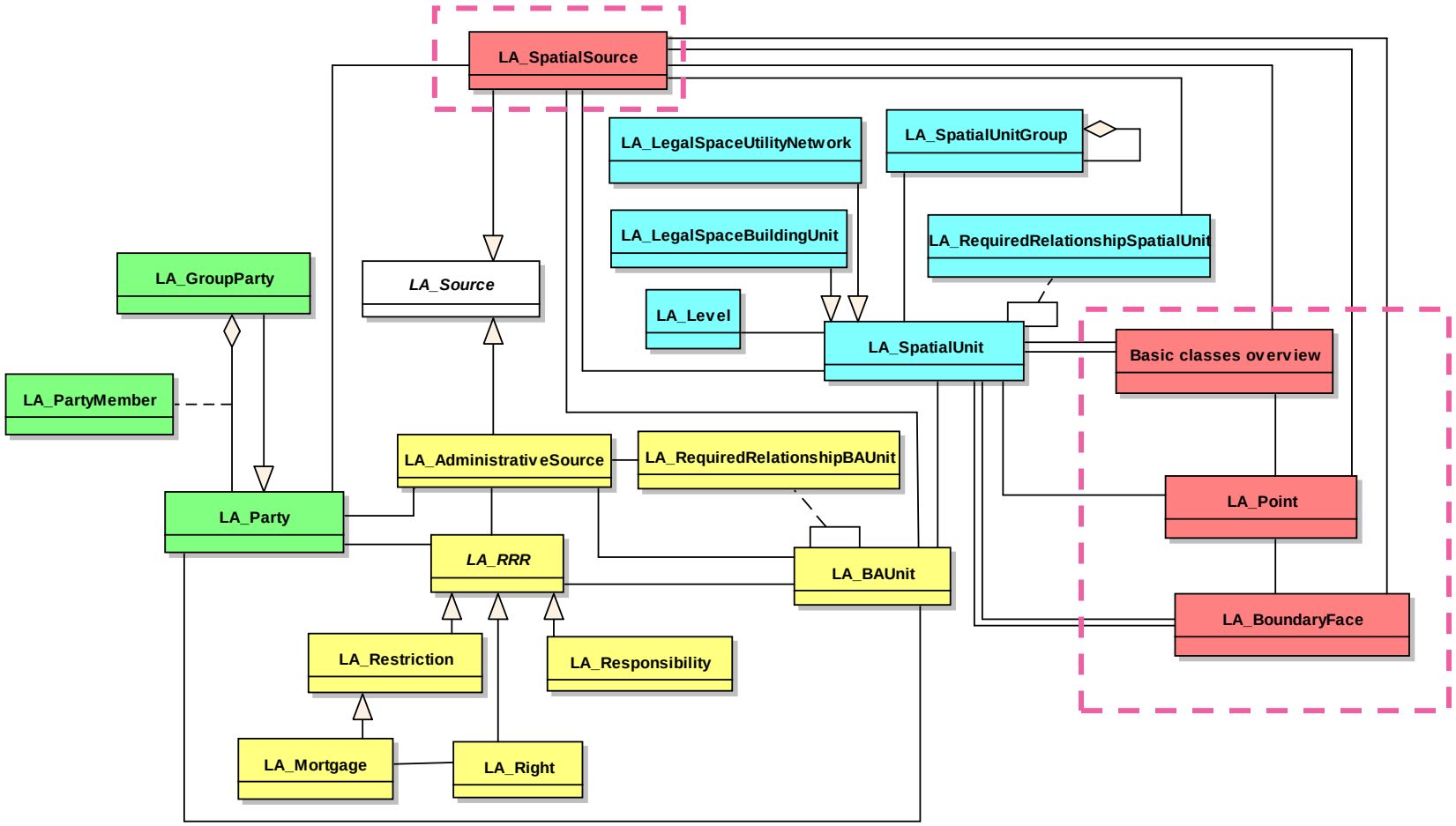
Organized By NSPS FIG INTERNATIONAL FEDERATION OF SURVEYORS
Diamond Sponsors esri THE SCIENCE OF WHERE Trimble

Contents

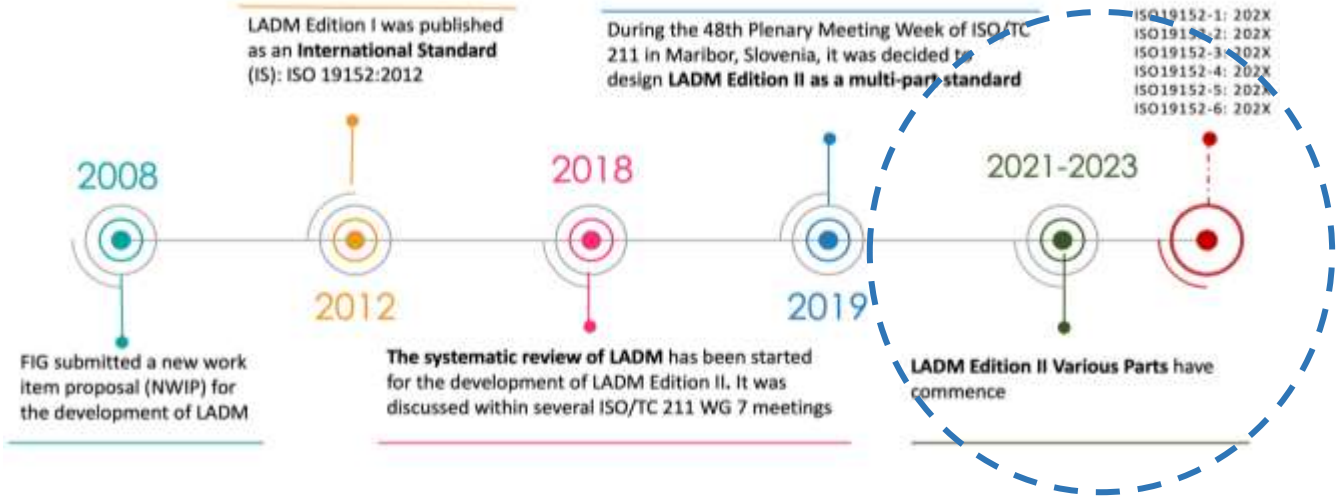
- **Introduction**
- Refined Survey Model LADM
- Evaluation with test cases
- Requirements for cadastral encodings
- Conclusion

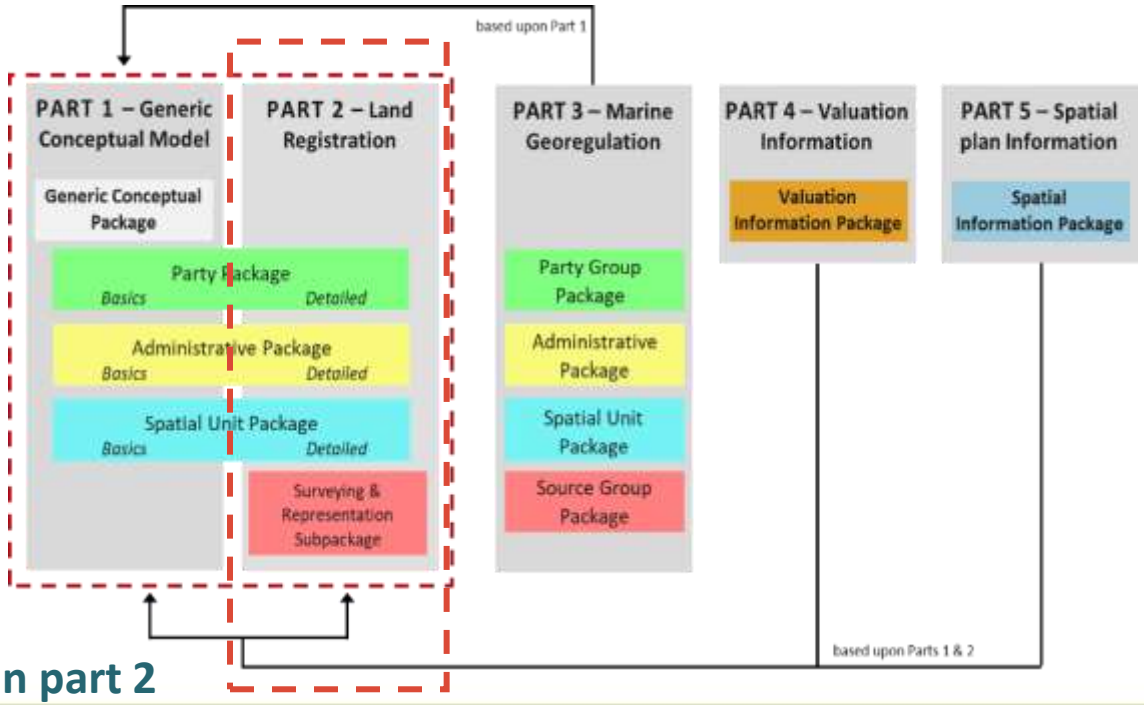
Introduction
ISO 19512:2012
LADM



ISO 19152-2:202x
LADM Edition II

Development timeline of the LADM





Revision LADM, refined survey model in part 2

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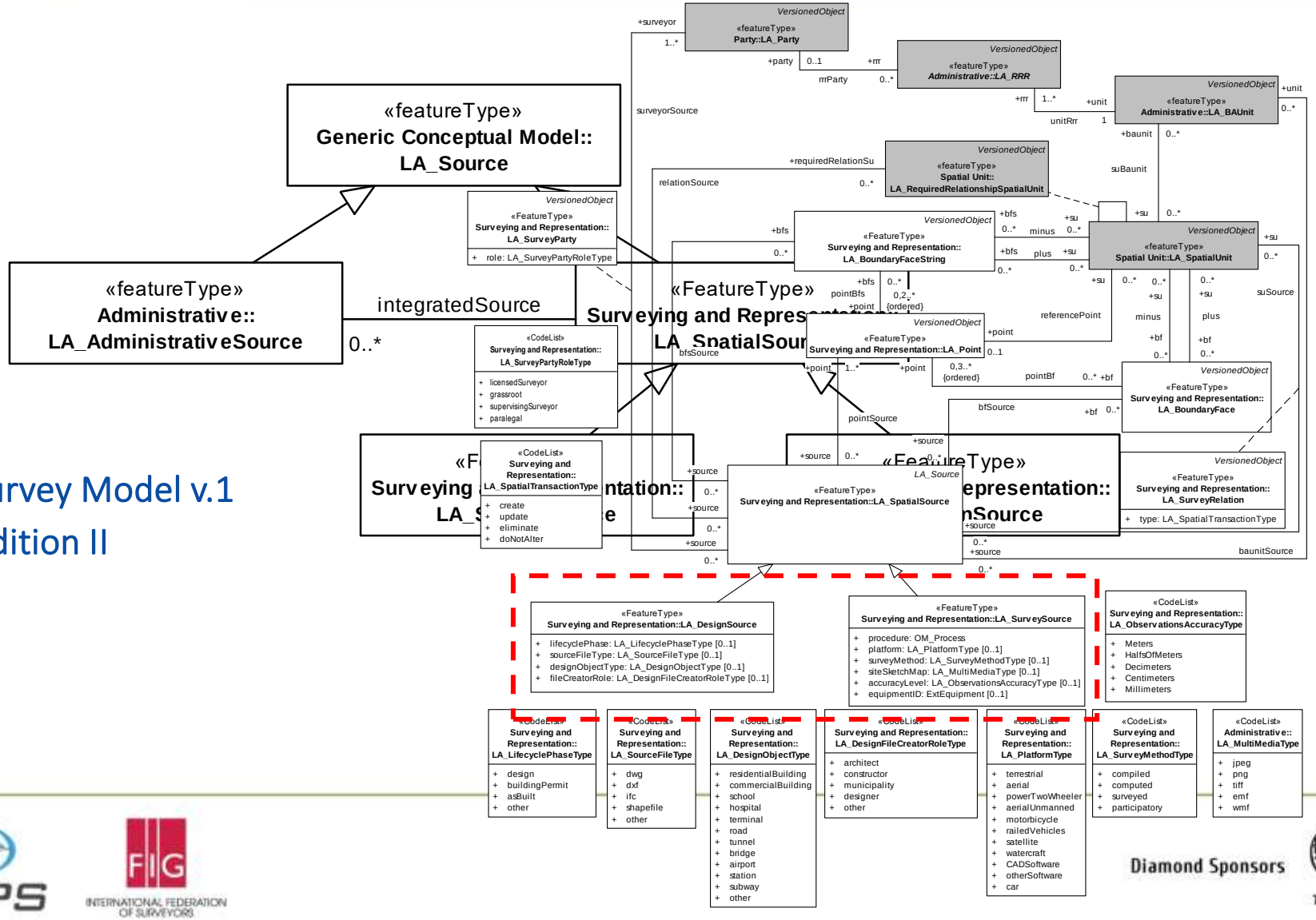
Progressive work towards the development of the model

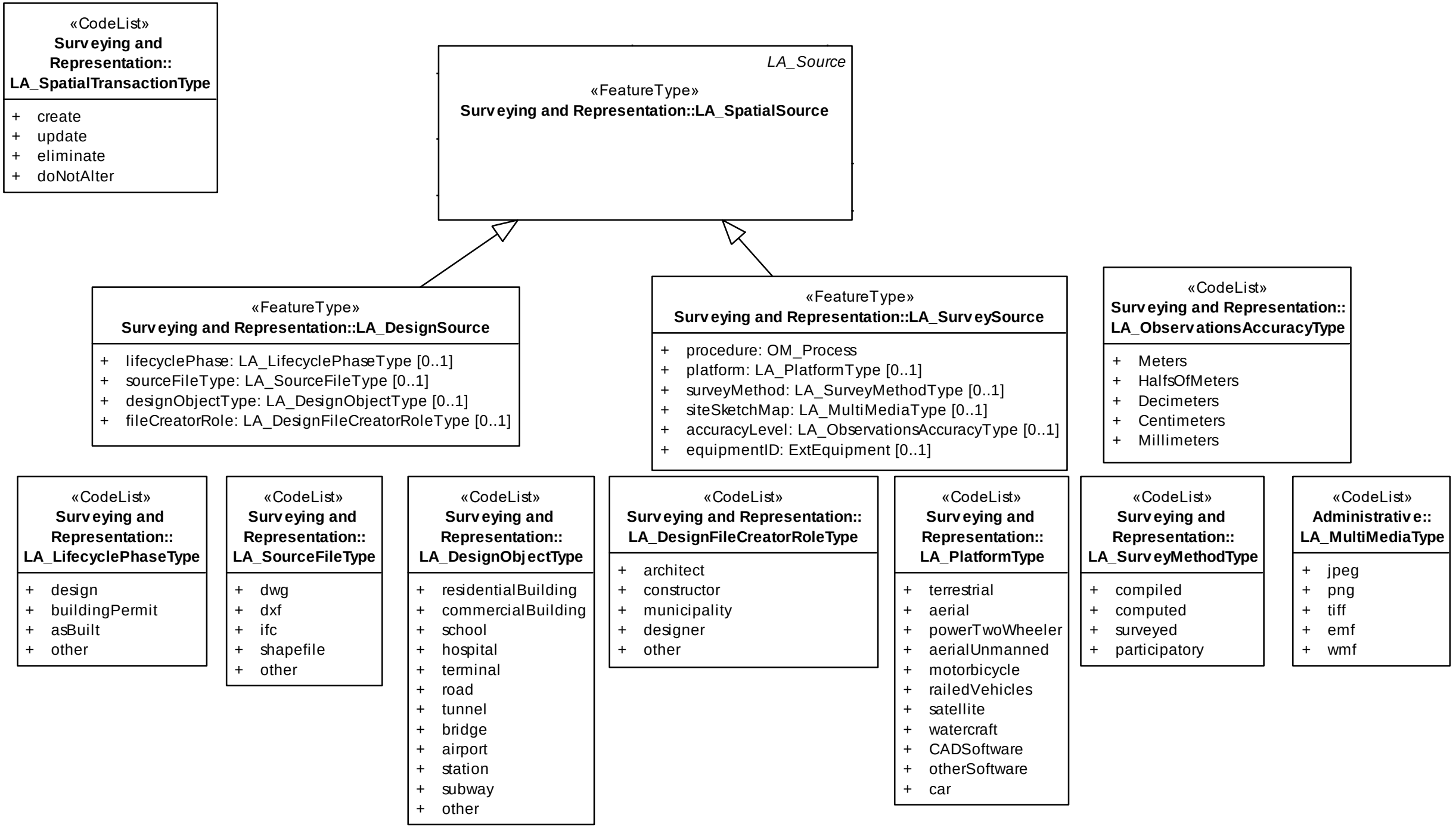
1. **LADM Edition I** – Abstract model based on ISO19156:2011 O&M [2012]
2. Integrated Future Data Model for Survey Data and Cadastral Mapping based on the LADM profile for the Netherlands [MSc thesis TUDelft, Soffers P., 2017]
3. **LADM Edition II - Refined Survey Model v.01** [Shnaidman, A., van Oosterom, P.J.M., Lemmen, C.H.J., 2019]
4. Work on LADM – OGC LandInfra synergy on the survey functionality [2020 – 2022]
5. **LADM Edition II - Refined Survey Model v.02**
   1. **v.02a** [Kalogianni, E., Dimopoulou, E., Gruler, H.C, Stubkjær, E., Lemmen, C.H.J., van Oosterom, P.J.M., 2021] → simple and compact
   2. **v.02b** → more detailed and complex [work together with E. Verbree, R. Capua & M. Schimtz, 2022]
6. **LADM Edition II - Refined Survey Model v.1 → current version submitted in ISO ++ survey-related requirements definition in the context of LADM revision**

GISCAD-OV Task 6.1

Requirement	Description
Requirement 2-12 SurveyBasedMaps: Cadastral maps should be based on surveys	Cadastral maps shall be based on cadastral surveys including distance, level, image, angular, GNSS, total station, ground penetrated radar, multibeam echo sounding, as well as point cloud observations.
Requirement 2-13 DataAcquisitionMethods: Different data acquisition methods can be used to identify boundaries of spatial unit(s)	Various data acquisition and surveying techniques shall be supported. Cadastral boundary should be included in relation to 'Object' in the Triple (Object-Right-Subject). Surveys may concern the identification of boundaries of spatial units on a photograph, an image, or a topographic map. In all cases the representation of 'legal' reality should be distincted from the 'physical' reality. Depending on the local situation, different registrations or recordings of land rights are possible.
Requirement 2-14 CadastralReferenceSystem: Cadastral surveys should be represented in a reference system	Efficient LASs compatible with this part of LADM shall be capable of producing coordinates, forming an essential component of cadastral systems. Provisions should be made to accommodate future changes in the network that may occur as a result of technical improvements. These may affect all coordinate-based systems. Imagery can be used depending on the user requirements, cost, and timing among other factors. It should be possible to include all documentation on data collected as evidence from the field.
Requirement 2-15 DataQuality: Quality of cadastral data should be specified	The cadastral information shall be as complete as possible, reliable (which means ready when required), and rapidly accessible. Users of cadastral information need clarity, simplicity and speed in the registration process. Consistency between spatial and legal administrative data is important. Topology integrated with geometry and other attributes is relevant. The system must be ready to keep the information up to date. Data quality of spatial data may be improved in a later stage of development of a LAS, this has to be documented. For combined data products from different sources the quality descriptions and meta data related to the original data are relevant in relation to liability and information assurance.
Requirement 1-01 Model simplicity: The data model describing the surveying process should be simple.	The conceptual model that describes the data acquisition for cadastral surveying purposes shall be coherent, complete and simple, in order to be used.
Requirement 1-02 GNSS corrections: GNSS corrections should be supported	The various types of GNSS correction sources, that all provide information that improves GNSS performance and precision, shall be efficiently supported.

Refined Survey Model v.1 – LADM Edition II

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LA_Source
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+ CADSoftware
+ otherSoftware
+ car
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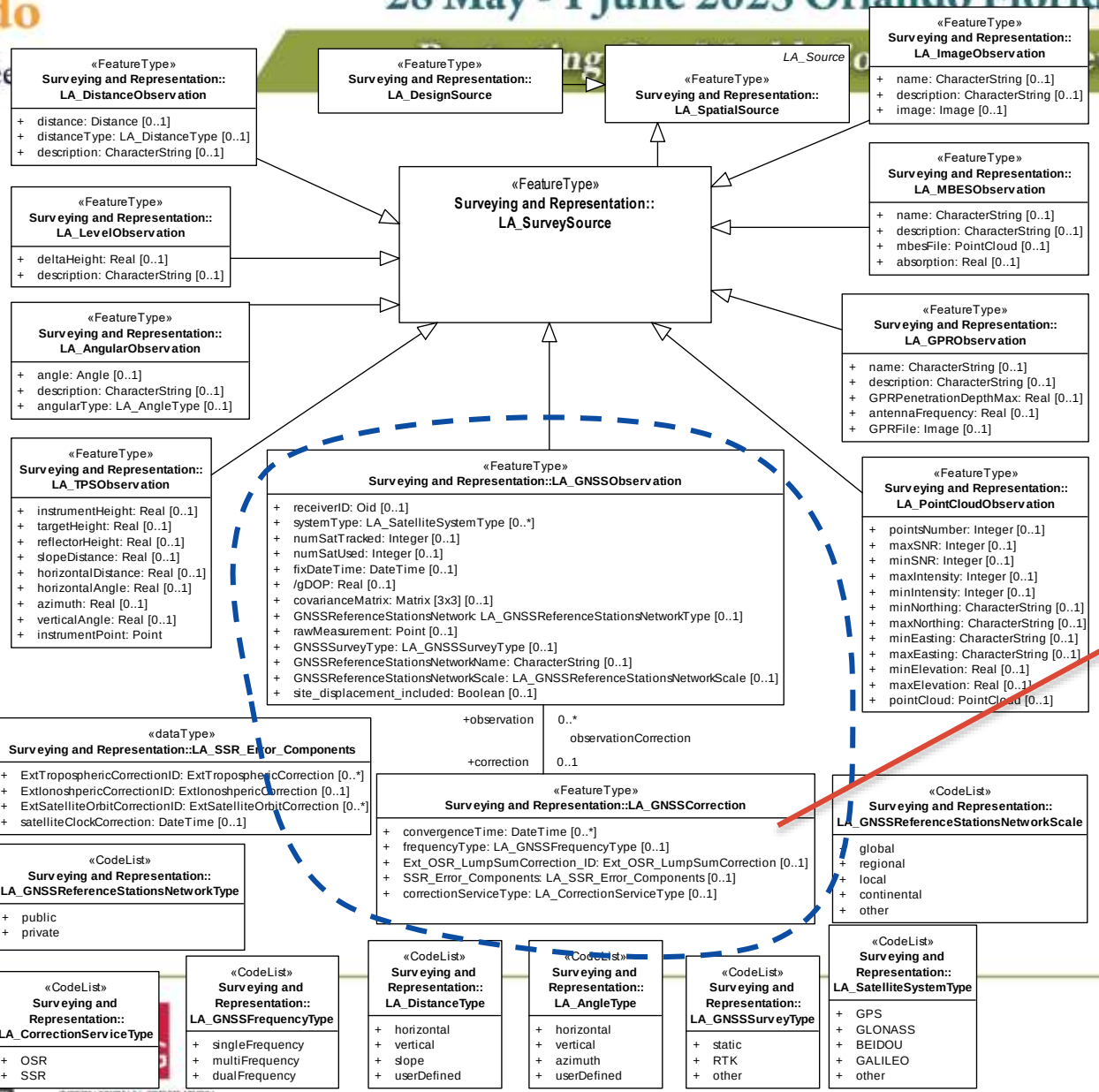
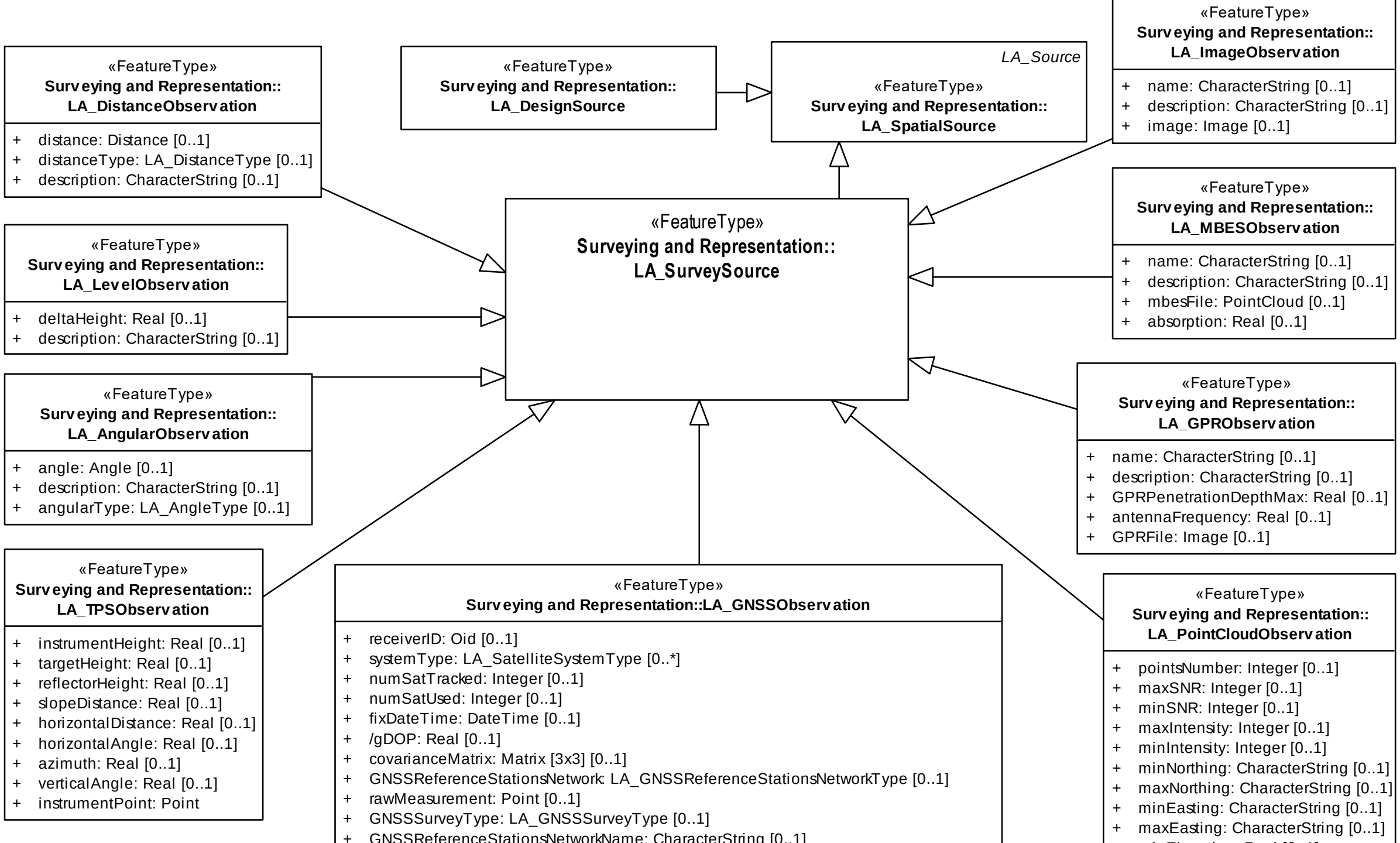


Galileo High Accuracy Services (HAS) support

Refined Survey Model v.1 – LADM Edition II

Attributes of LA_GNSSCorrections

Attribute name	Type	Cardinality	Description
correctionServiceType	LA_CorrectionService Type	0..1	The category of the corrections' concept used
convergenceTime	DateTime	0..*	The convergence time of GNSS observation
frequencyType	LA_GNSSFrequencyTy pe	0..1	The frequency range of GNSS correction
Ext_OSR_LumpSumCorre ction_ID	Ext_OSR_LumpSumCo rrection	0..1	The lump sum of the errors corrections of OSR
SSR_Error_Components	LA_SSR_Error_Compo nents	0..1	The components of corrections of SSR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LA_ImageObservation
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LA_LevelObservation
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Surveying and Representation::
LA_SurveySource
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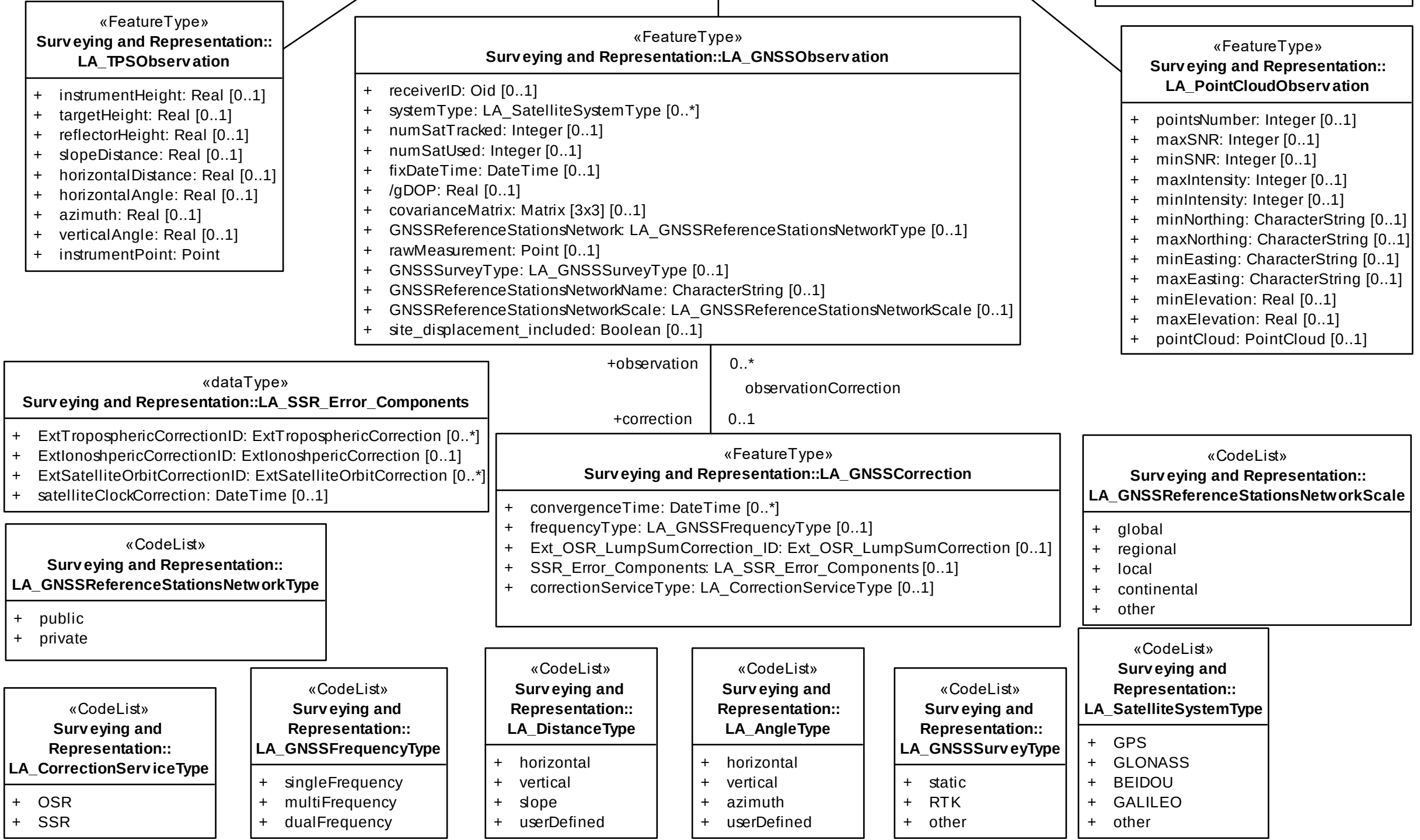
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+ RTK
+ other
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LA_SatelliteSystemType
+ GPS
+ GLONASS
+ BEIDOU
+ GALILEO
+ other

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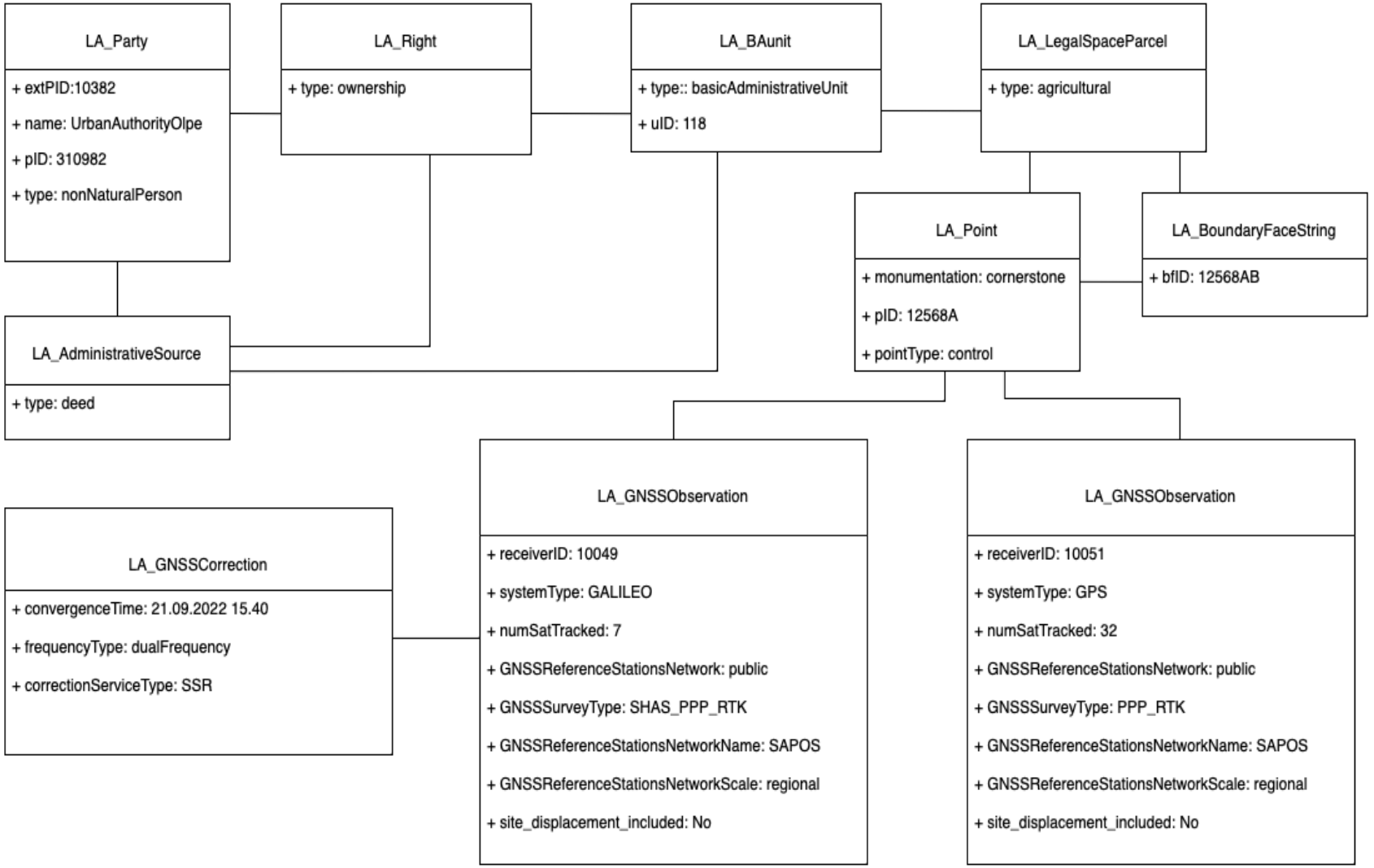
Participation in the pilot campaign in Germany [September 2022] with MSc Geomatics students:

a. 3D building model for Olpe (CityGML)
b. The Height model/ DTM from Olpe
c. Reference points

→ To be used to validate the UML model of the LADM Survey Model

Instance level diagram

Two GNNS observations:
- Galileo, SHAS_PPP_RTK
- GPS, PPP_RTK
  for reference



Participation in the pilot campaign in Estonia [December 2022] 3D coordinates of a building + IFC file

a. Parcel boundaries

b. Reference points

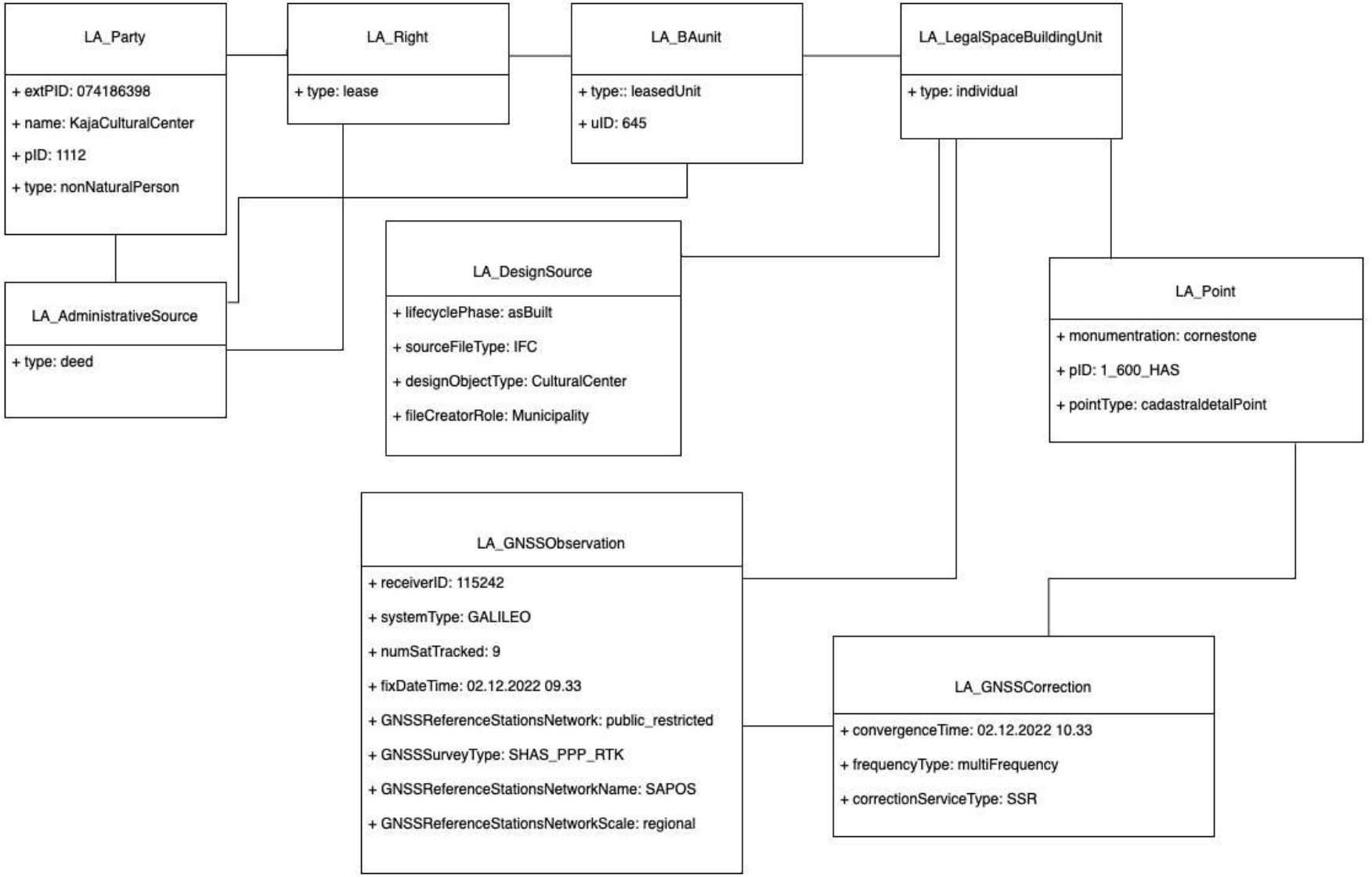
→ To be used to validate the UML model of the LADM Survey Model

→ Combination of surveying + design sources

IFC model

Instance level diagram

Two spatial sources:
- LA_DesignSource, IFC
- LA_GNSSObservation



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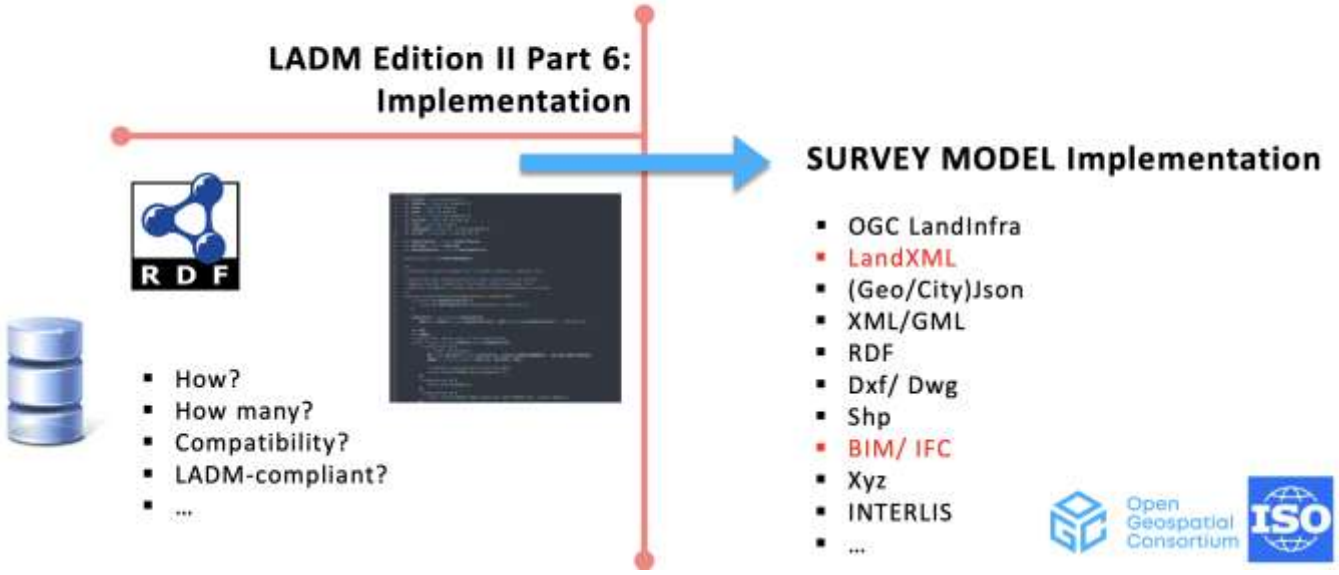
PART 2 – Conceptual Model → **PART 6 –** Implementation Solutions

LADM EDITION II PART 6 & RELATED STANDARDS



Define a set of requirements

bringing together experts from the surveying, AECOO and GIS **industry**, **Cadastral Authorities** and **surveyors**

Requirements for cadastral encodings

1. industry support for both the survey and GIS vendors/ software providers through the whole lifecycle of the encoding;
2. user groups' experience and familiarity with the encoding;
3. support by various ETL tools or other systems that facilitate the interoperability with other encodings/ formats/ schemas/ web services;
4. support georeferenced, units of measurements and storage of coordinate reference systems;
5. "web friendly" - ability to transport efficiently using web services, efficient parsing.
6. based on technical specifications from national regulations for submissions to Cadastral Authorities;
7. support automatic and effective translation from the conceptual survey model;
8. vendor neutral/ platform independent;
9. open format;
10. scalable format;
11. support topology;
12. support geometry in 2D and 3D;
13. support rasters;
14. simple and compact;
15. human readable (preferable ASCII formats) and not binary;
16. be the foundation for collaboration between different instances (field/ office/ registration) as collaboration of vital importance and a standardised encoding can improve quality and productivity;

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- Evaluation with test cases
- Generic cadastral survey workflow
- **Conclusion**

Conclusion

- The refined survey model of the ISO19152-2, with support to GNSS corrections (including Galileo HAS) has been developed in the context of EU H2020 project GISCAD-OV
- The conceptual model has been validated with GISCAD-OV pilots in Germany & Estonia
- From the validation it occurs that the developed survey model meets the needs of the practice
- The requirements for the technical implementation of the survey model has been set

11th International Workshop on Land Administration Domain Model and 3D Land Administration

FIG

University of Gävle
in corporation with Lantmäteriet

11-13 October 2023
Gävle, Sweden

The Workshop addresses developments in the following areas:

- 3D Land Administration System operational experiences (analysis, LADM based, learn from each other, discover gaps)
- 3D LAS cost effective workflow for new / updated 3D parcels = 4D (part of whole spatial development lifecycle: from planning / design / permit in 3D, to registration / use in 3D)
- 3D LAS web-based dissemination (usability, man-machine interfaces, including mobile/AR)
- Remote sensing/LiDAR and artificial intelligence (AI) for efficient 3D cadastral boundary extraction
- Legal aspects for 3D LAS, best legal practices in various legislation systems

- Focus on large cities, including developing countries
- 3D in the revision of ISO 19152, the Land Administration Domain Model
- Proposals for (and evaluations of) LA (remote) sensing information models (CD 19152-2) and data processing workflows (CD 19152-6), in the context of the revision of LADM

Working sessions

- Urban development / plan information LADM part 5 (Chair: Karel Janecka, Czech Republic, Peter van Oosterom, The Netherlands)
- 3D legal building models/BIM (Chair: Vučić Nikola, Croatia, Abdullah Alattas, Saudi-Arabia)
- Legal aspects of 3D LA (Chair: Jenny Paulsson, Jesper M. Paasch, Sweden)
- Valuation Information / LADM part 4 (Chair: Jaap Zevenbergen, The Netherlands, Abdullah Kara, Turkey)

More information

Deadlines:

11 June 2023	Extended abstract (500-1000 words)
15 July 2023	Reviewing
19 September 2023	Final version of full paper
11-13 October 2023	Workshop

Website: http://www.gdmc.nl/3dcadastres/workshop2023/
Conference fee: 2300 SEK (approx. 195 Euro)
Co-chairs: Jesper Paasch (local) / Peter van Oosterom (programme)

UNIVERSITY OF GÄVLE

LANTMÄTERIET

TU Delft 3D Land Administration

OGC meeting, DWG Land Administration on 6 June 2023, 8:00am-9:30am (CDT), Huntsville AL, USA / online

1. Opening Christiaan Lemmen
2. Progress LADM Edition II, Peter van Oosterom
3. Developments in the Social Tenure Domain Model (STDM), Eva-Maria Unger & John Gitau
4. Standardisation of Cadastral Processes, Josip Križanović, University of Zagreb
5. OGC LADM Standards Working Group, Scott Simmons, OGC
6. Dicussion

Thanks for listening!

Any questions?