NLS
NATIONAL
LAND SURVEY
OF FINLAND

New Topographic Data Production System

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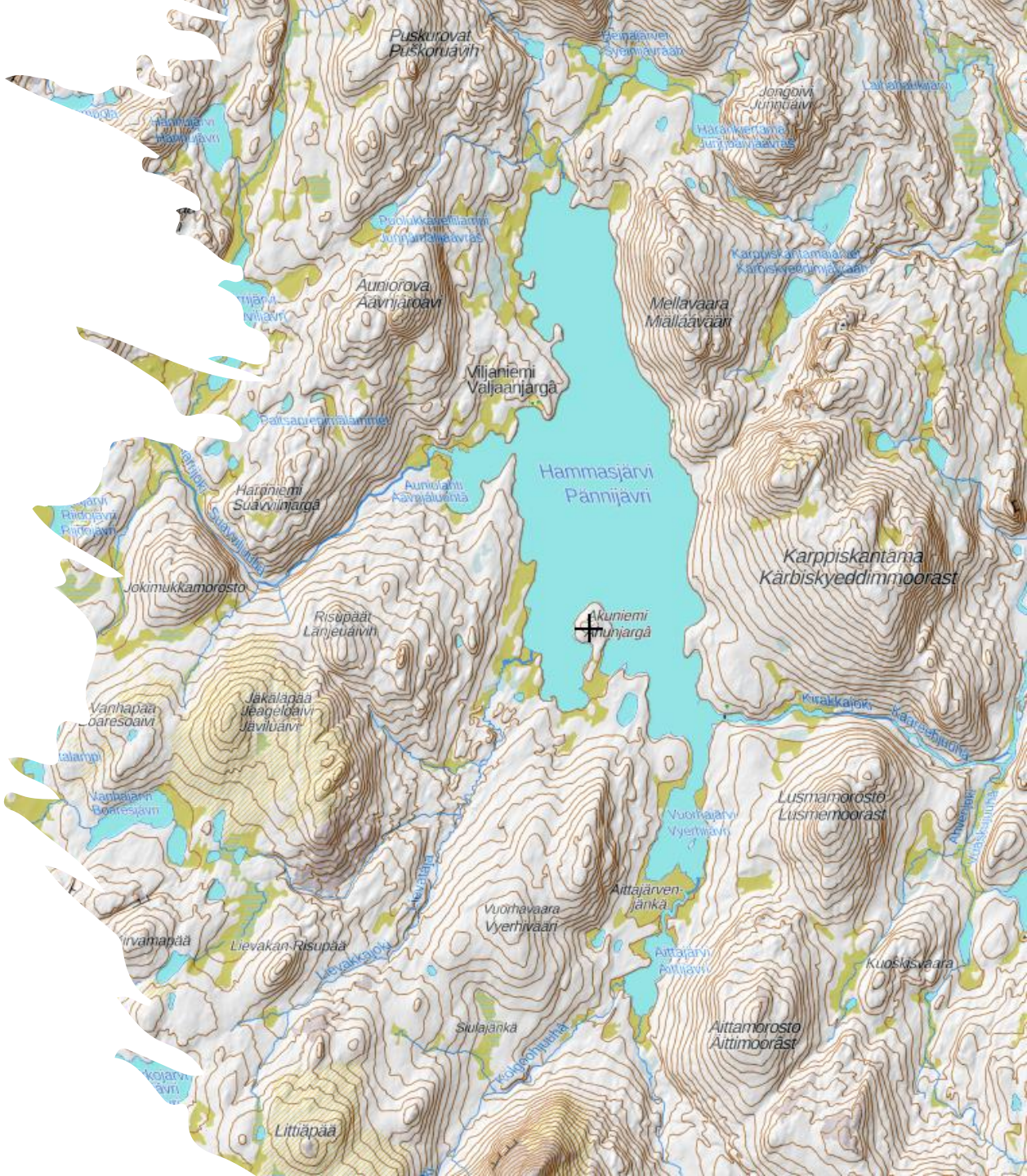
Contents

- Background of the project
- Objectives and schedule
- System architecture
- Quality tools

Background of the project

- NLS collects comprehensive data of the whole of Finland’s topography and publishes almost all the data as open data
- Old legacy system is at the end of the life cycle
- Decision to develop the collecting system based on open-source technologies and especially on QGIS client was made on the fall of 2020
  - User and developer base are strong which provides confidence that the product lifecycle is secured, and programs would receive updates made by other developers as well
  - Open source allows enhanced collaboration with other governmental agencies and OS-community



Data themes in the national topographic database

Buildings & constructions

13 different feature types which display buildings, masts, docks, fences etc.

Terrain

32 different feature types which display land use, land cover and specific land features

For example, cultivated lands, parks, cemeteries, marshlands etc.

Hydrography

17 different feature types which display hydrographic objects such as lakes, sea, canals, waterfalls etc.

Traffic

13 different feature types which cover roads, cycling and walking paths, waterways and railways etc.

Also we are currently working on adding another theme covering electric powerlines, protected and other special areas. Furthermore, we are adding, for example contour lines and depth sounding points to the database.
We are continuously looking possibilities to use different data sources to do co-operation and reduce duplication of the work

Some specifications are on our www-site

First phase goals – production starts 2025

150 operators can update Topographic database simultaneously

Work management

Handy tools for operators

Products and services

Stereo mapping

Elevation data for objects

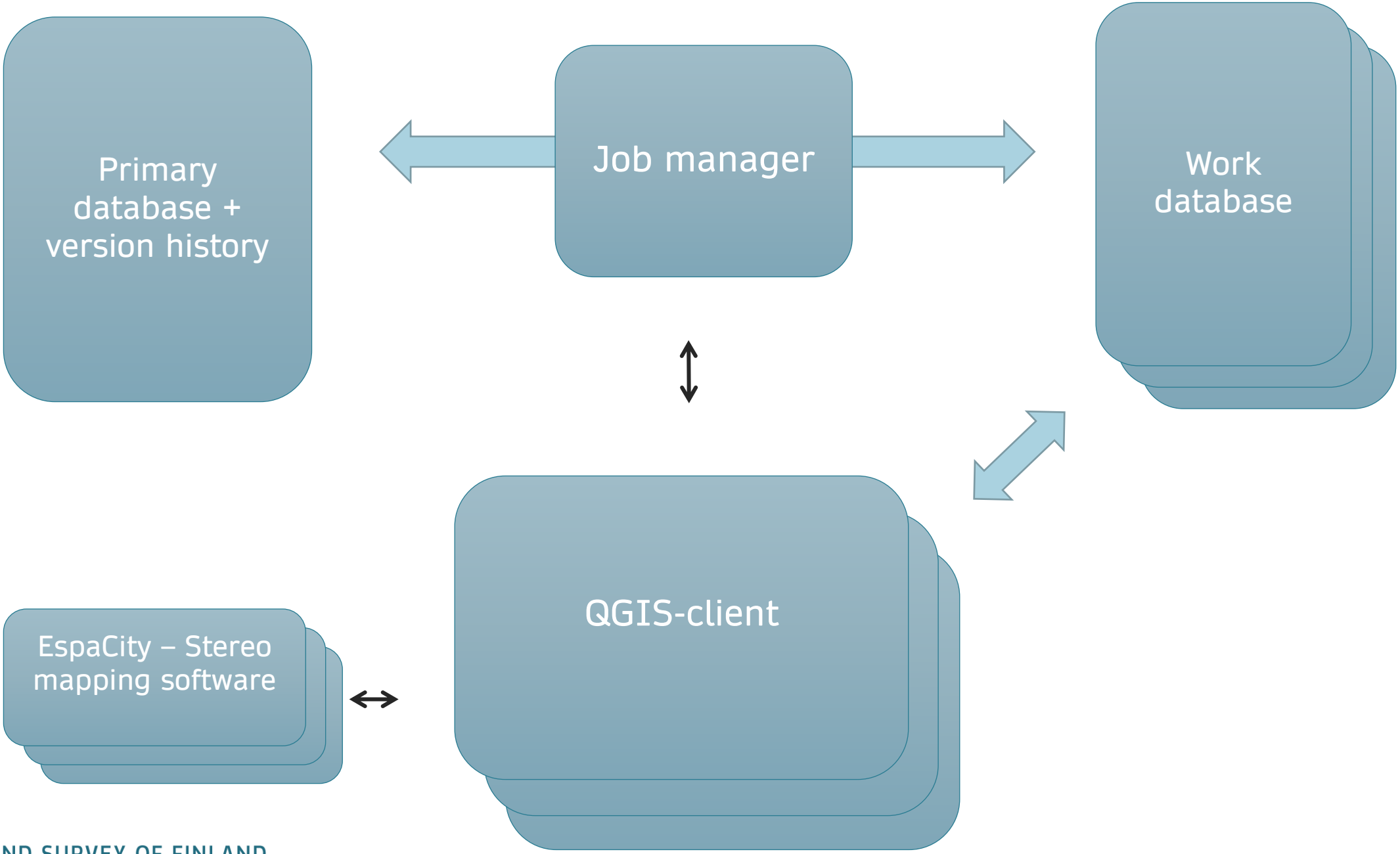
Field mapping

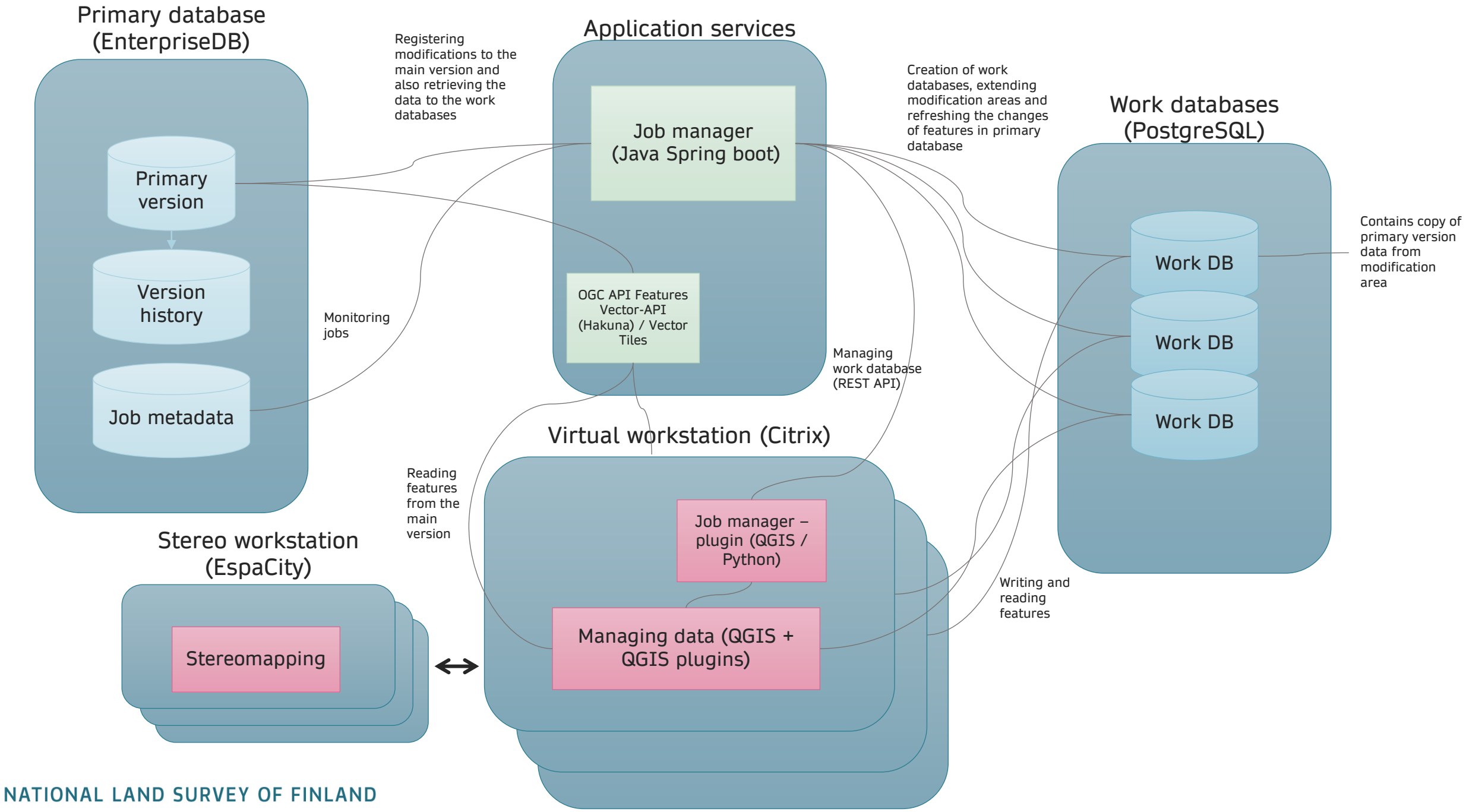
Place and map names

Done

Under development

At definition


Primary database + version history
Job manager
Work database
QGIS-client
EspaCity – Stereo mapping software

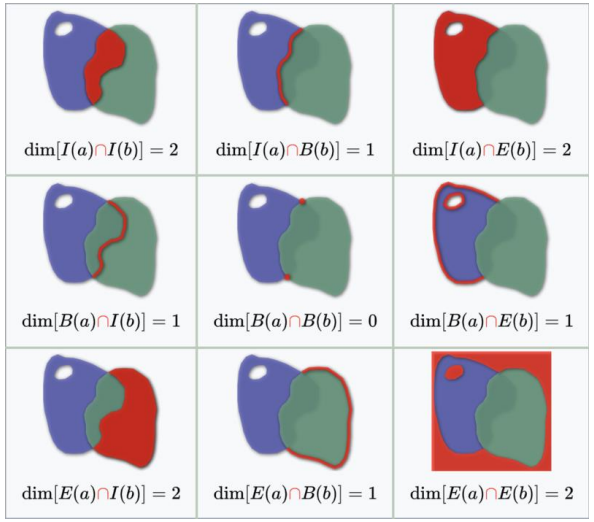

Primary database (EnterpriseDB)
Primary version
Version history
Job metadata
Registering modifications to the main version and also retrieving the data to the work databases
Application services
Job manager (Java Spring boot)
OGC API Features Vector-API (Hakuna) / Vector Tiles
Monitoring jobs
Creation of work databases, extending modification areas and refreshing the changes of features in primary database
Work databases (PostgreSQL)
Work DB
Work DB
Work DB
Contains copy of primary version data from modification area
Managing work database (REST API)
Virtual workstation (Citrix)
Reading features from the main version
Job manager – plugin (QGIS / Python)
Managing data (QGIS + QGIS plugins)
Writing and reading features
Stereo workstation (EspaCity)
Stereomapping

Quality assurance tools

- Focuses on logical consistency
- Other quality elements (coverage, completeness, up to dateness…) are evaluated in separate processes (annually)
- Based on quality rules
  - Geometry, attribute and topological rules
    - (also *continuity of attributes* in networks e.g. roadlinks)
- Productional work is guided with the severity level of the error
  - (currently: info, warning and fatal)
- QGIS provide some tools for quality checking:
  - Custom solution provides comprehensive inspection for the data
  - Easy way to manage the rules
  - Performance (running in the backround)
  - Not client dependent, if other ways to manage data is later added in addition to QGIS

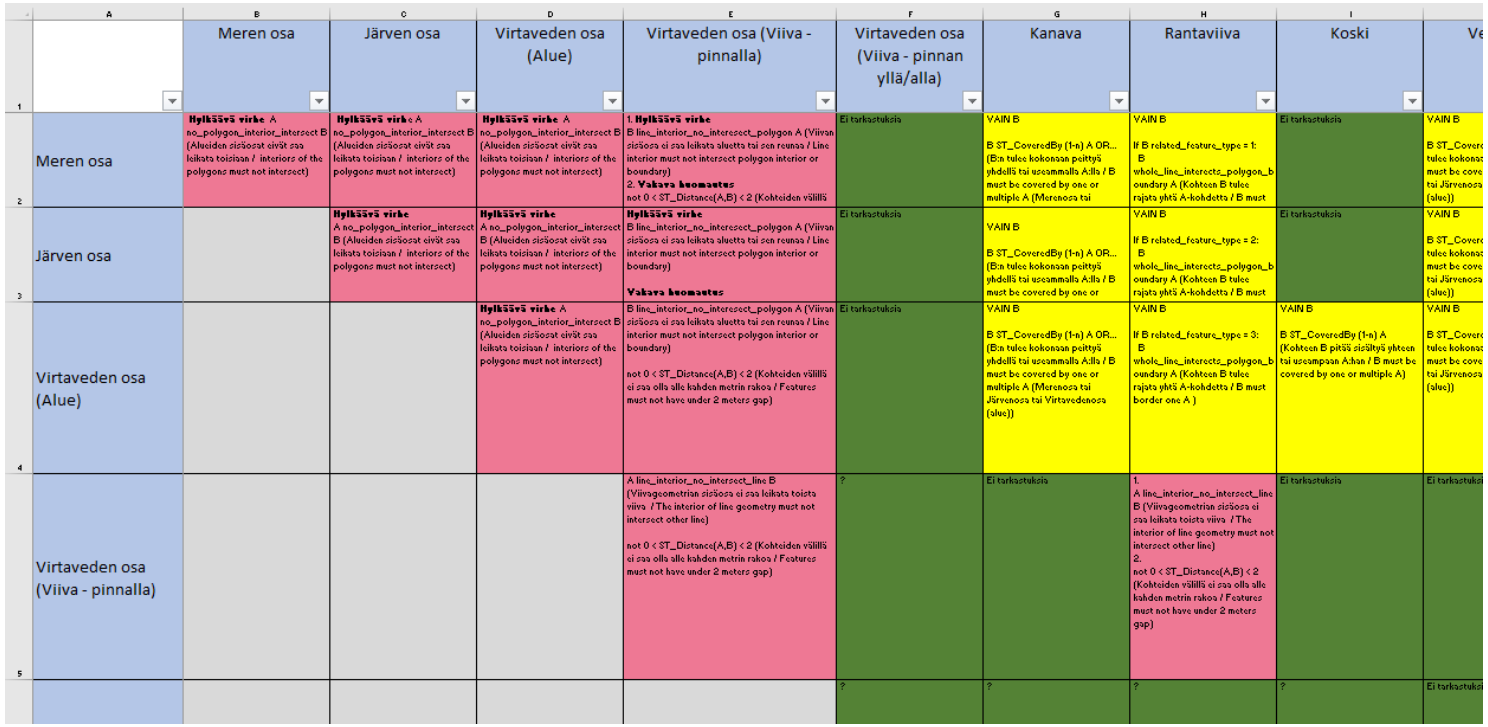
Topological rules based on PostGIS

- ST_disjoint, ST_coveredBy and custom rules
- Custom rule set is implemented by using ST_relate funcion which is based on Dimensionally Extended 9-Intersection Model (DE-9IM).
- Currently seven custom rules e.g.
  - “Line interior must not intersect polygon interior or boundary”
    - Controlling how ditches (line geometry) topologically connects to lake features
  - “Feature A must border feature B (whole line intersects polygon boundary)”
    - Controlling the topological consistency of lake and shoreline features



Topological rule set matrix

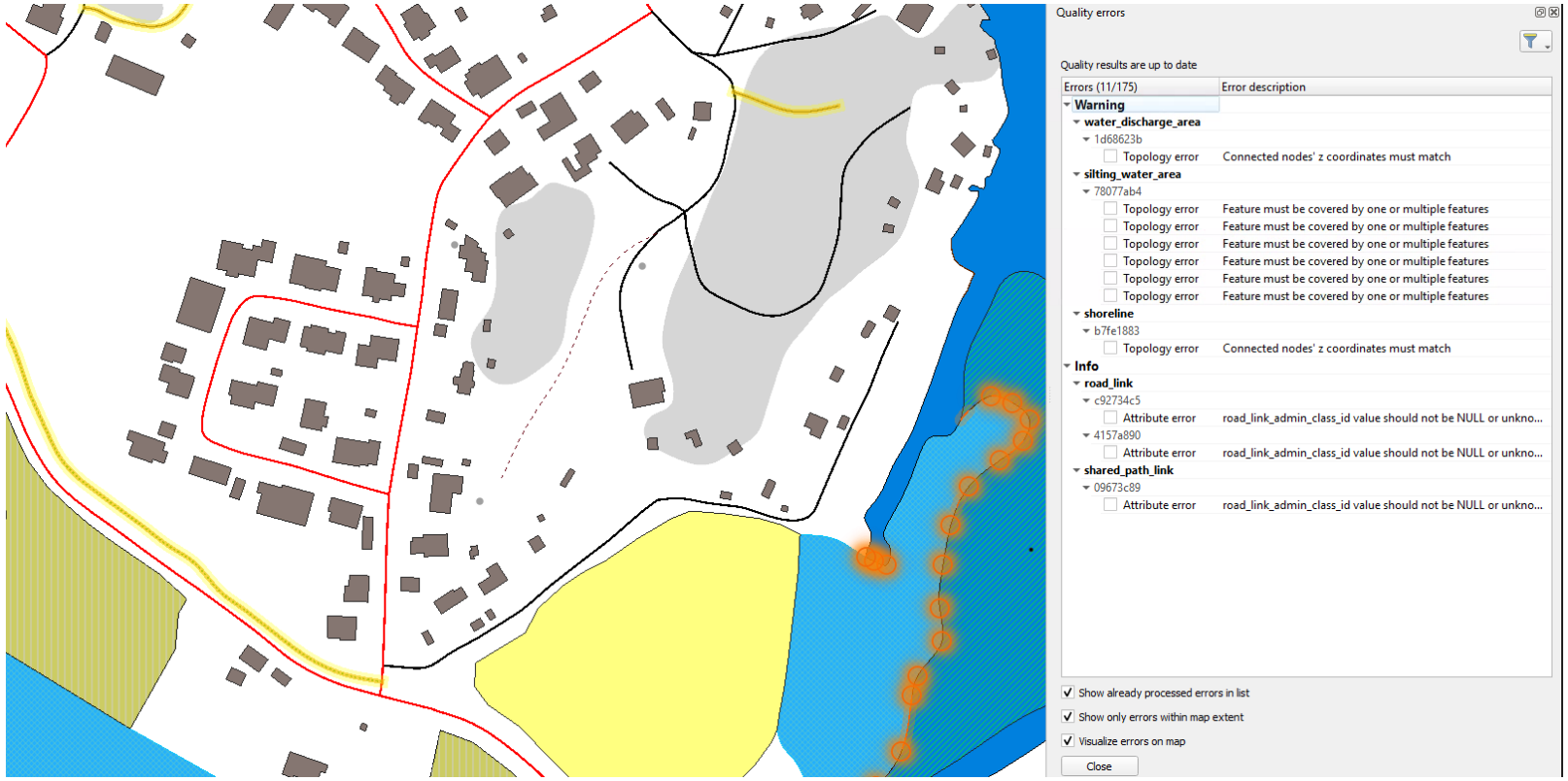
- Defined in collaboration by the data theme specialists and the development team
- The goal is to define the relationships of every object class to each other object class
- Major challenge is to balance between ”just in case” checks and useful checks
- Still a work in progress



	Meren osa	Järven osa	Virtaveden osa (Alue)	Virtaveden osa (Viiva - pinnalla)	Virtaveden osa (Viiva - pinnan yllä/alla)	Kanava	Rantaviiva	Koski	Ve
Meren osa	**Hylkäysvirhe** A no_polygon_interior_intersect B (Alueiden sisäosat eivät saa leikata toisiaan / Interiors of the polygons must not intersect)	**Hylkäysvirhe** A no_polygon_interior_intersect B (Alueiden sisäosat eivät saa leikata toisiaan / Interiors of the polygons must not intersect)	**Hylkäysvirhe** A no_polygon_interior_intersect B (Alueiden sisäosat eivät saa leikata toisiaan / Interiors of the polygons must not intersect)	1. **Hylkäysvirhe** B line_interior_no_intersect_polygon A (Viivan sisäosa ei saa leikata aluetta tai sen reunaa / Line interior must not intersect polygon interior or boundary) 2. **Vakava huomautus** not 0 < ST_Distance(A,B) < 2 (Kohteiden välillä	Ei tarkastukcia	VAIN B B ST_CoveredBy (1-n) A OR... (B:n tulee kokonaan peittyä yhdellä tai useammalla A:lla / B must be covered by one or multiple A (Merenosa tai	VAIN B If B related_feature_type = 1: B whole_line_intersects_polygon_boundary A (Kohteen B tulee rajata yhtä A-kohdetta / B must	Ei tarkastukcia	VAIN B B ST_Covered tulee kokonaa must be covered tai Järvenosa (alue))
Järven osa		**Hylkäysvirhe** A no_polygon_interior_intersect B (Alueiden sisäosat eivät saa leikata toisiaan / Interiors of the polygons must not intersect)	**Hylkäysvirhe** A no_polygon_interior_intersect B (Alueiden sisäosat eivät saa leikata toisiaan / Interiors of the polygons must not intersect)	**Hylkäysvirhe** B line_interior_no_intersect_polygon A (Viivan sisäosa ei saa leikata aluetta tai sen reunaa / Line interior must not intersect polygon interior or boundary) **Vakava huomautus**	Ei tarkastukcia	VAIN B B ST_CoveredBy (1-n) A OR... (B:n tulee kokonaan peittyä yhdellä tai useammalla A:lla / B must be covered by one or	VAIN B If B related_feature_type = 2: B whole_line_intersects_polygon_boundary A (Kohteen B tulee rajata yhtä A-kohdetta / B must	Ei tarkastukcia	VAIN B B ST_Covered tulee kokonaa must be covered tai Järvenosa (alue))
Virtaveden osa (Alue)			**Hylkäysvirhe** A no_polygon_interior_intersect B (Alueiden sisäosat eivät saa leikata toisiaan / Interiors of the polygons must not intersect)	B line_interior_no_intersect_polygon A (Viivan sisäosa ei saa leikata aluetta tai sen reunaa / Line interior must not intersect polygon interior or boundary) not 0 < ST_Distance(A,B) < 2 (Kohteiden välillä ei saa olla alle kahden metrin rakoa / Features must not have under 2 meters gap)	Ei tarkastukcia	VAIN B B ST_CoveredBy (1-n) A OR... (B:n tulee kokonaan peittyä yhdellä tai useammalla A:lla / B must be covered by one or multiple A (Merenosa tai Järvenosa tai Virtavedenosa (alue))	VAIN B If B related_feature_type = 3: B whole_line_intersects_polygon_boundary A (Kohteen B tulee rajata yhtä A-kohdetta / B must border one A)	VAIN B B ST_CoveredBy (1-n) A (Kohteen B pitää sisältyä yhteen tai useampaan A:han / B must be covered by one or multiple A)	VAIN B B ST_Covered tulee kokonaa must be covered tai Järvenosa (alue))
Virtaveden osa (Viiva - pinnalla)				A line_interior_no_intersect_line B (Viivageometrian sisäosa ei saa leikata toista viiva / The interior of line geometry must not intersect other line) not 0 < ST_Distance(A,B) < 2 (Kohteiden välillä ei saa olla alle kahden metrin rakoa / Features must not have under 2 meters gap)	?	Ei tarkastukcia	1. A line_interior_no_intersect_line B (Viivageometrian sisäosa ei saa leikata toista viiva / The interior of line geometry must not intersect other line) 2. not 0 < ST_Distance(A,B) < 2 (Kohteiden välillä ei saa olla alle kahden metrin rakoa / Features must not have under 2 meters gap)	Ei tarkastukcia	Ei tarkastuk
					?	?	?	?	Ei tarkastuk

Developed quality tool

- Operator can access quality results at any time during the workflow
- The results are refreshed each time the operator saves the modifications
- Operator can filter quality results



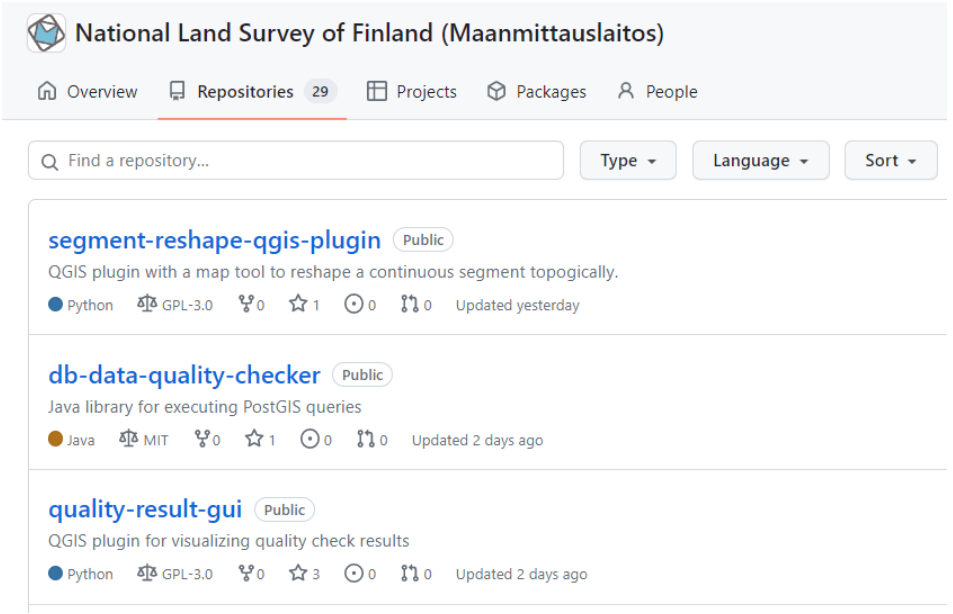
Published open-source tools

All these can be found on the NLS github: https://github.com/nlsfi

- Front end of the quality tool quality-results-gui and the Java library for executing PostGIS queries in the quality tool
- Segment reshape tool to reshape a continuous segments topogically.
- Qgis-plugin-dev-tools for plugin development and packaging, it makes managing runtime third party dependencies easier,
- We have also made contributions for picklayer plugin (used for smoother selecting of layers)

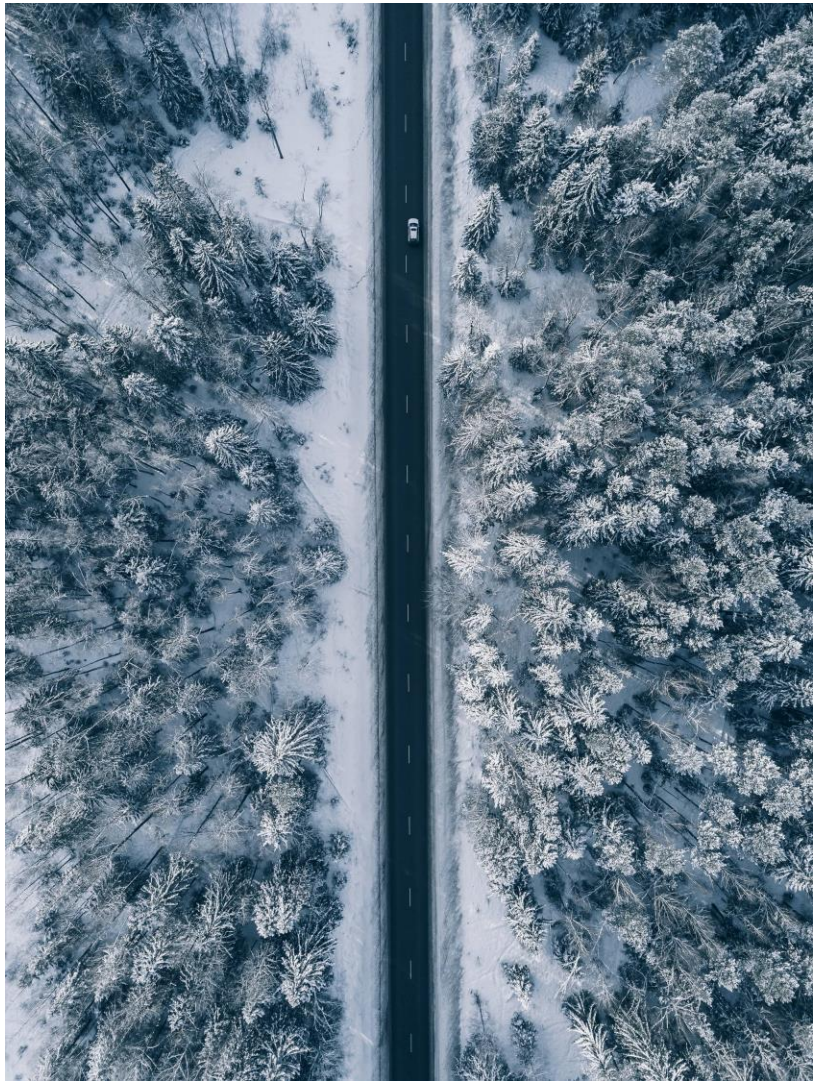
We have also contributed to Pytest-qgis which makes it easier to test plugins

Several other bug fixes and feature requests added to the QGIS core



Next steps

- Elevation of the features
- Field mapping solution
- Managing geographic names
- Integration to the systems that produce geographic products



Advancing together

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