3D-BUILDING PRODUCTION IN NLS

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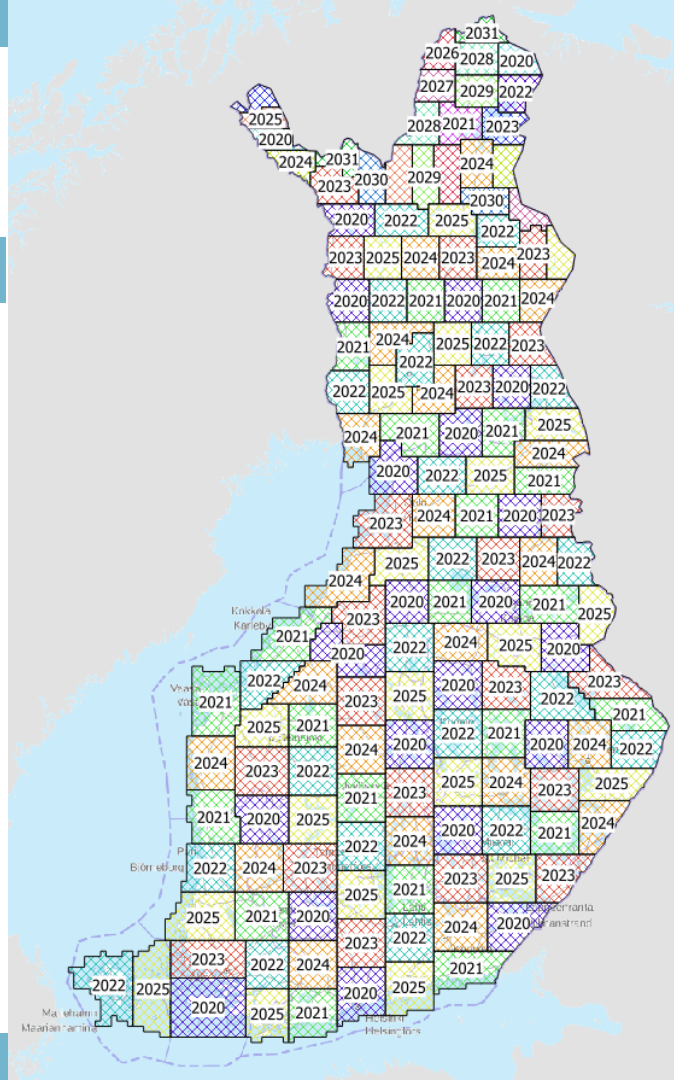
NATIONAL
LAND SURVEY
OF FINLAND

NEW LASER SCANNING PROGRAM

- 6 year cycle, starting 2020
  - ~55 000km²/year
- Northern Lapland
  - 12 year cycle
  - ~3 000km²/year
- Production areas
  - 20-22 areas / year
  - 2916 km² each (54km x 54 km)
  - Areas smaller in the north and east due to more unpredictable weather



TECHNICAL SPECIFICATION

Technique

- Single photon or Geiger mode techniques not allowed

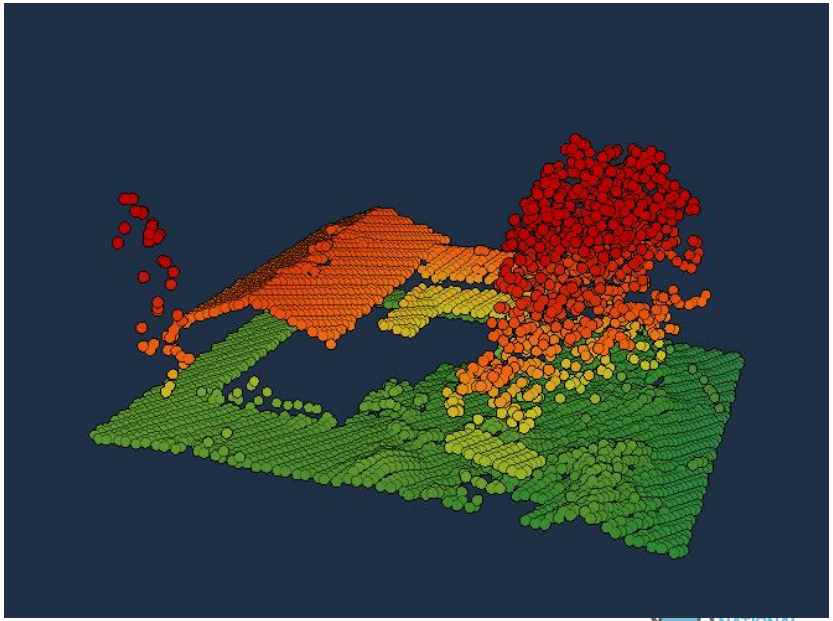
Point density: 5 pts/m²

Height accuracy: 0.10m

Planimetric accuracy: 0.45m

Scanning time windows:

- No leaves (Early spring) or
- Leaves on (Summer)



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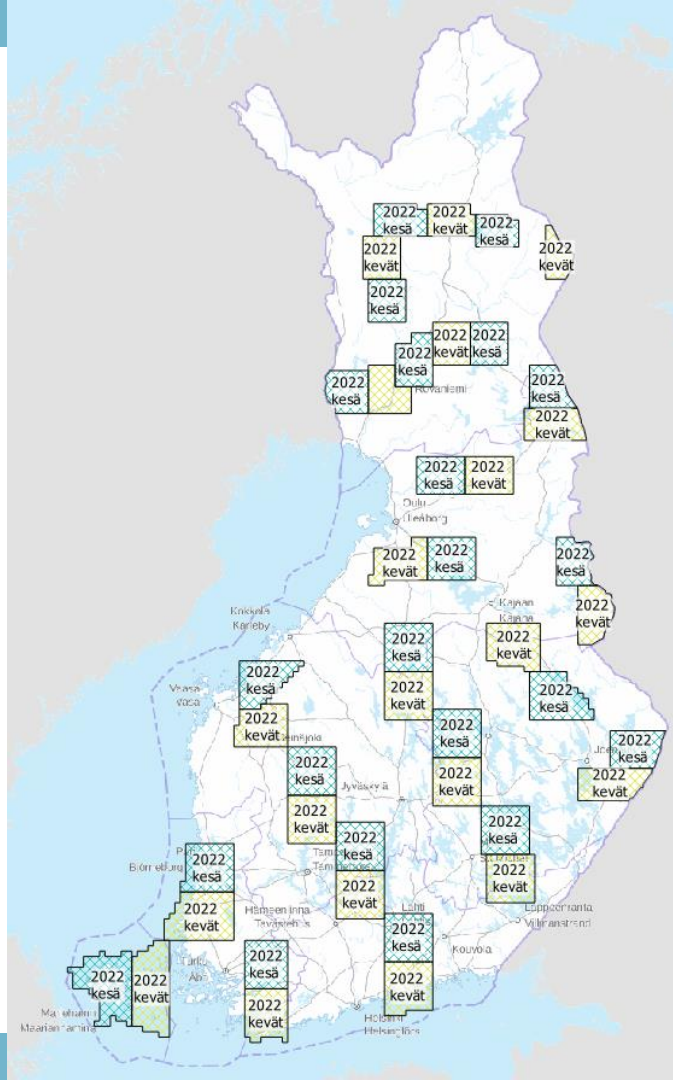
AERIAL IMAGERY PROGRAM

- GSD 40 cm
- Syncronized with laser scanning program
- 3 year cycle
- Northern Lapland 12 year cycle
- 50 % of images taken during spring season
- 50% of images taken during summer season
  - Summer imagery = Scanning during the same year



FUTURE OF BUILDING DATA IN NLS

- Building data in the New National Topographic Database
  - National specifications (The Public Administration Recommendations)
  - Lifecycle management: one object – several versions from it's life cycle
    - Managed through **the persistent identifier**
    - Changes in the attributes or geometries generate a new version of an object
  - One object – several geometries
    - Geometries are attributes of an object
    - Levels of detail (LoD)
    - 2,5D and 3D-geometries
  - One object – one or more sub-objects
    - Building consists of Building Parts

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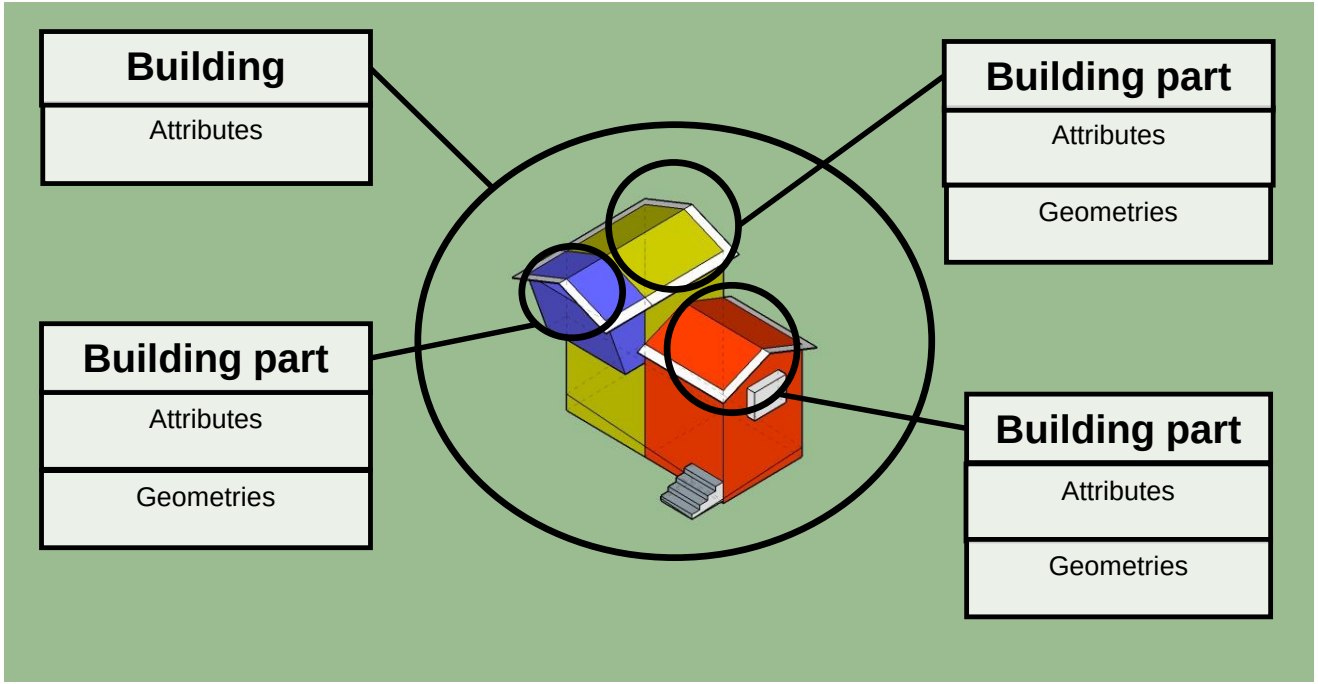
ONE OBJECT –
ONE OR MORE SUB-OBJECTS



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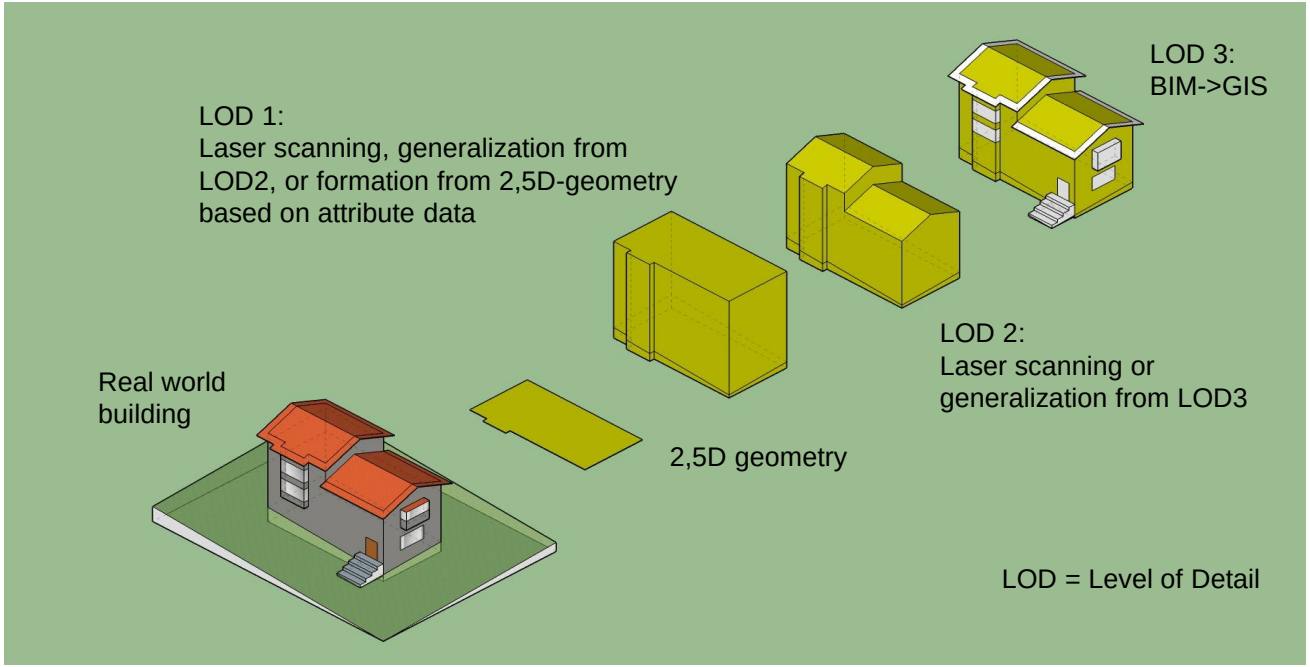
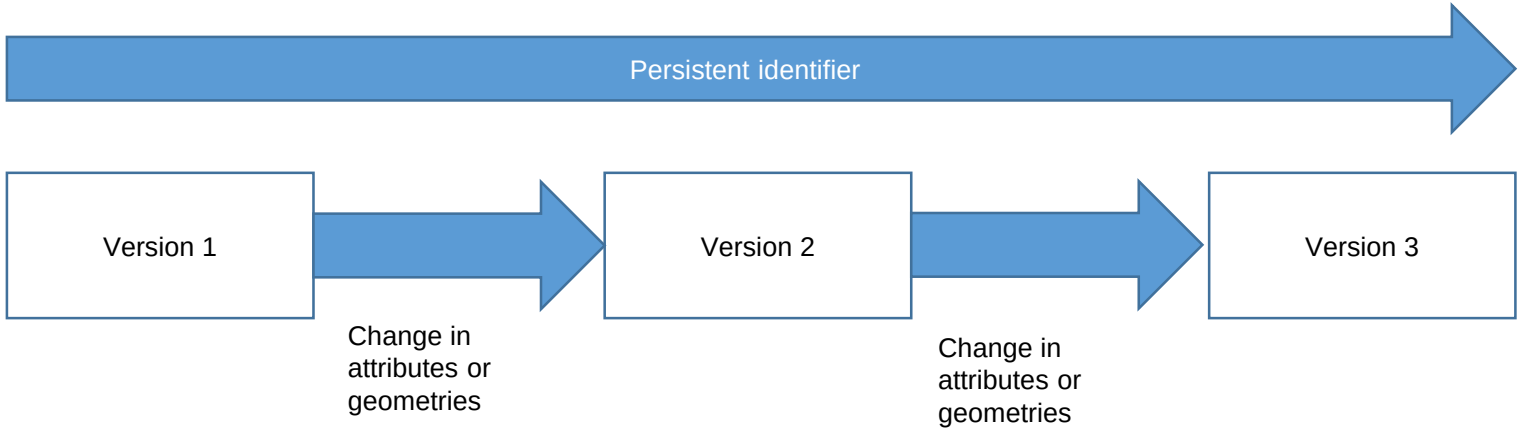
ONE OBJECT – SEVERAL GEOMETRIES



ONE OBJECT – SEVERAL LIFE CYCLE VERSIONS



3D-BUILDING RECONSTRUCTION

Source materials

- Point cloud according to the new laser scanning program
  - Based to the laser scanning program, 3D-models will gradually be available from 2020 onwards
- 2D(2,5D)-footprints of buildings from current topographic database
- (Aerial imagery)

3D-buildings modelled according to the Public Administration Recommendation

- Exports from the reconstruction system in CityGML (might depend on the system)

Conformity validation against product specifications (quality rules)

- FME-based tool QualityGuard (Laatuvahti)

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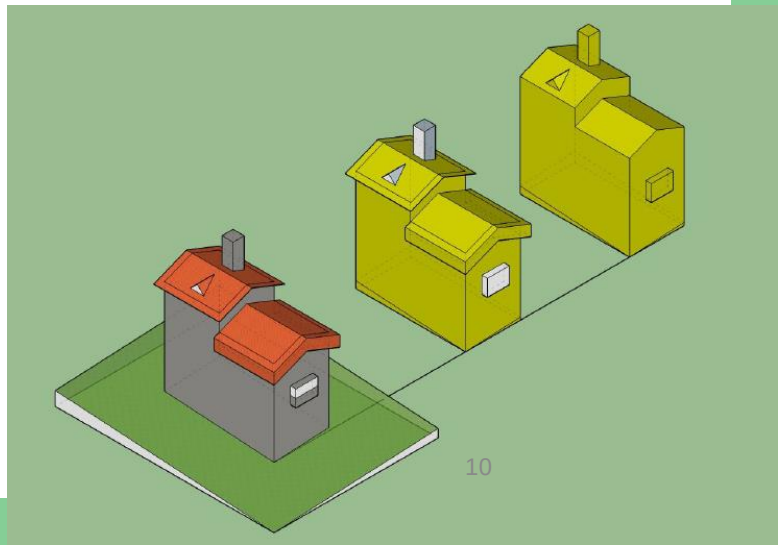
3D-BUILDING RECONSTRUCTION

Data collection for the NTDB is performed by different organizations

- Bigger cities produce their own 3D-models from the whole municipality or the central areas
- NLS will be responsible to produce 3D-models from rest of the country
  - Produced models will correspond to LoD2

Goal is to have the reconstruction process work as automatically as possible

The NLS production areas will mainly contain detached houses with various roof shapes



3D-BUILDING RECONSTRUCTION

Automatic reconstruction rarely produces optimal results

Production areas are large and contain heterogenous buildings

➢The 3D-building production workflow will produce erroneous 3D-models

Manual validation and editing needed

QualityGuard cannot detect all of the problems

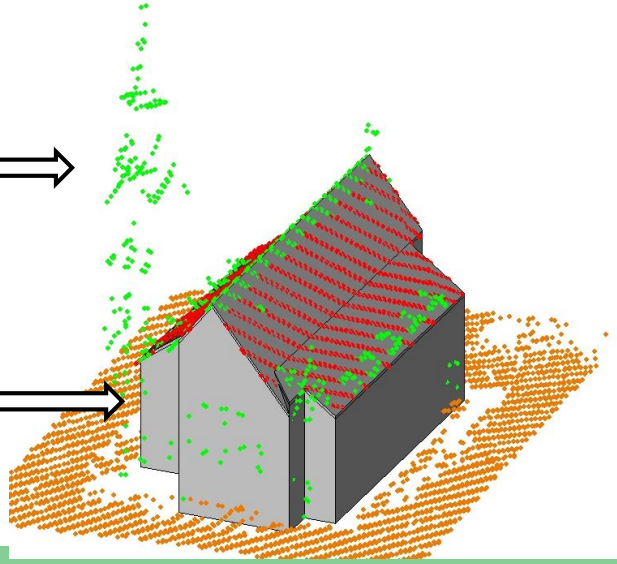
Produced models should pass both automatic and manual checks

Missing church tower

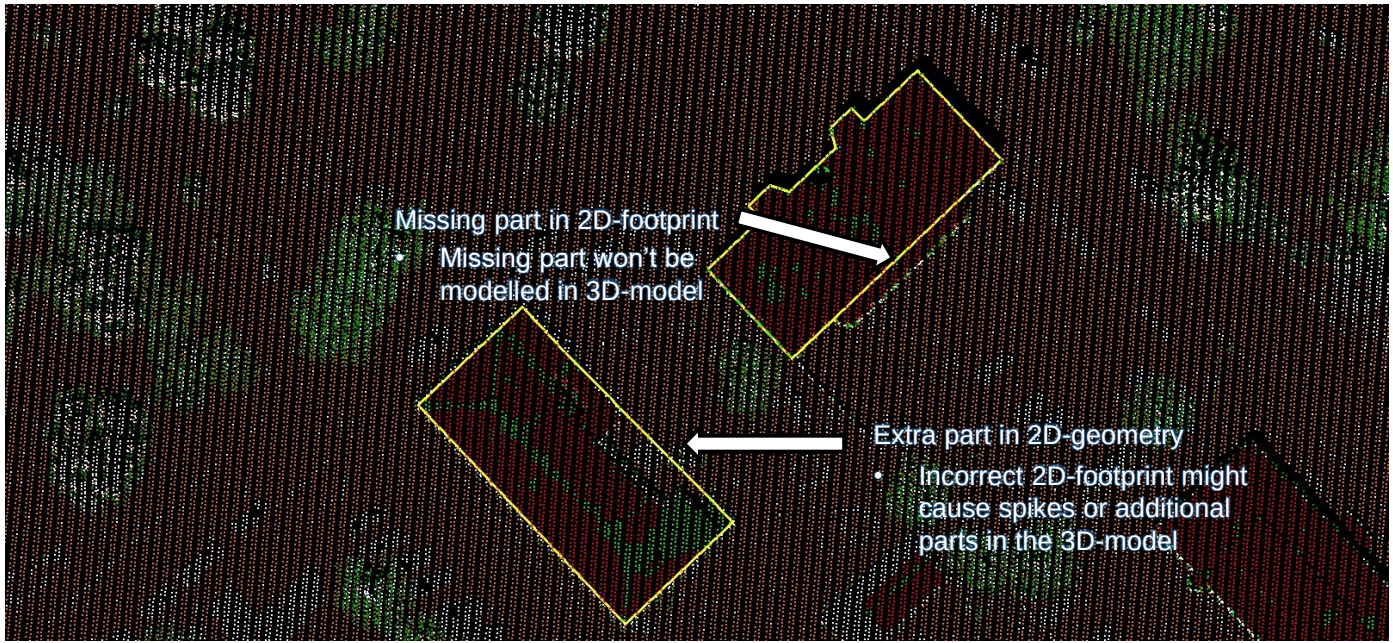
- Does the building pass manual checks?
- What kind of tools are needed to fix the model?

Automatically generated 3D-building

- Does the geometry (and semantics) pass the QualityGuard's checks?



THE QUALITY OF 2D-DATA AFFECTS THE QUALITY OF 3D-DATA



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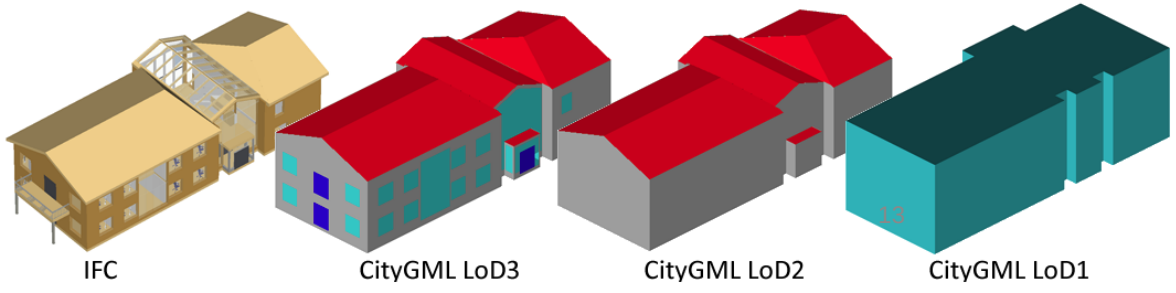
ADDITIONAL SOURCES OF 3D-DATA

BIM-models are used more often in different phases of building permit process

Plans to update the 3D-data repository from BIM (IFC) models

- A BIM-model submitted to the building permit process would be converted to CityGML
  - After validation the CityGML model would be taken as a part of the NTDB
- All of the possible phases of BIM submitted to the building permit process can be used (from initial plan to as-built)
  - And tracked through persistent ID in the NTDB



IMPLEMENTATION OF 3D-BUILDING PRODUCTION

New project 3DRAK set to kick-start the 3D-production in NLS

Goals include:

- Scope out available solutions and determine the necessary functionalities
- Implement the solution for 3D-production
- Determine and create the process of quality control on 3D-buildings

The 3D-models produced with the implemented system should be in line with the Public Administration Recommendation and the models should comply with the QualityGuard's quality rules

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IMPLEMENTATION OF 3D-BUILDING PRODUCTION

Notes:

- Implementation based on the mass production phase
  - The updating process (2026 onwards) will be determined later
- The 3D-production will be based on the existing building footprints
  - In later stages the solution is planned to be used to locate missing buildings
    - Or flag potential candidates to operator for manual checking
- Implementation will be based on off-the-shelf solutions rather than custom-made solutions
  - No NLS specific functionalities will be developed (in the project)
    - However the solution has to be able to handle the basic functionalities (e.g. topological consistency of produced 3D-models)

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IMPLEMENTATION OF 3D-BUILDING PRODUCTION

Schedule:

- 2019 Q4: Proof of Concept realizations of 2-4 different solutions for 3D-production
  - Based on point cloud data from 2019 (5 pts/m²) from an area of ~3000 km²
- 2020 Q1: Tender out the implementation
- 2020 Q2: Implementation ready
- 2020 Q3: Testing, documentation, training of staff
- 2020 Q4: 3D-production in NLS in progress
  - Based on point cloud data from 2020
  - 3D-buildings available nation-wide in 2026-27 (based on the schedule of the new laser scanning program

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SPECIFIC ISSUES

What has been the driving forces behind 3D national mapping efforts?

- National topographic data should depict reality
- Reality is at least three dimensional
- National operational forest inventory

What are the main use cases and benefits?

- 3D data is required in plenty of applications (forestry, taxation, smart cities etc)

How has the funding been solved?

- LIDAR data collection is funded by NLS, Finnish Forest Centre, Metsähallitus (State Forests) and Finnish Environmental Institute
- Vectorization of 3D buildings will be covered by NLS

Are data free and accessible for everyone?

- LIDAR data 5 pts/m^2 is not open data
- 3D building data at current detail level (LOD2) is open data
- Most of the forest data is open to the public

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SHOWING THE WAY

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