

# Master topics

# 09-09-2016

... on top of what is published

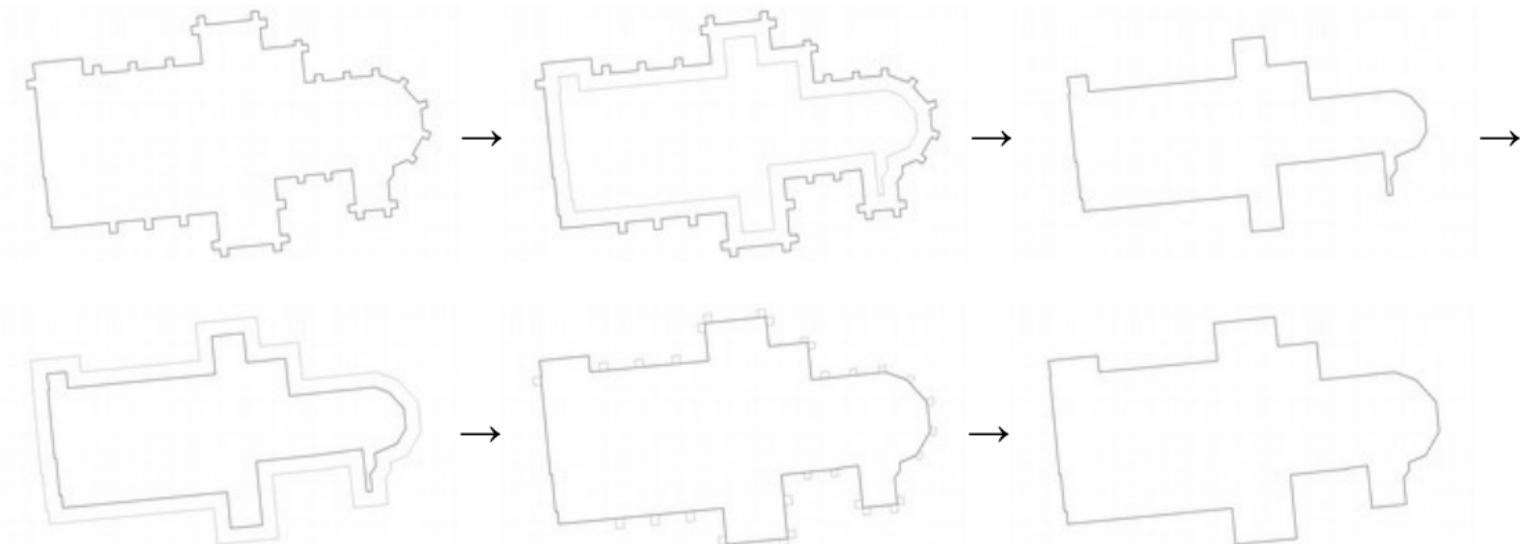
# Master topics

## 3D-GISt

.. some more ideas

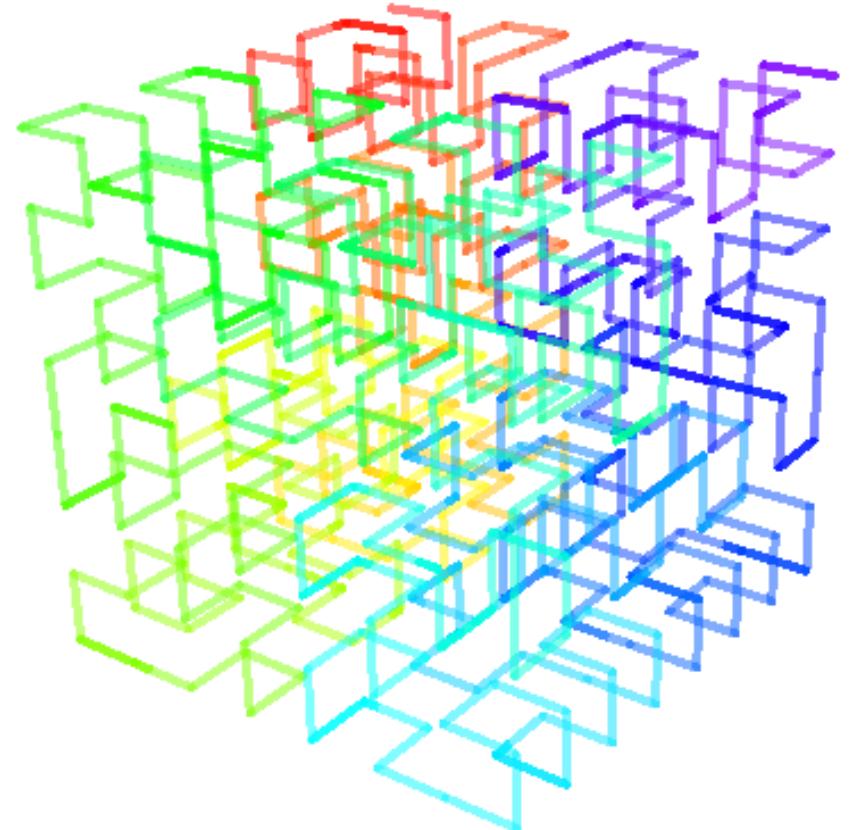
# Straight skeletons for vario-scale maps

- What we can do with the Straight Skeleton as supporting data structure for vario-scale map generalization?



# Using nD data in a web services setting

- This project tests whether a generic spatial access method for nD data (based on grouping the nD objects into a Hilbert Rtree) can be used in a web service environment.



# Master topics

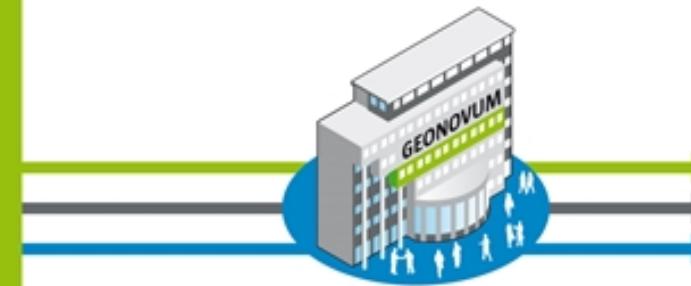
# GISt

In cooperation ..

# Geonovum



Geonovum in vogelvlucht



# Geonovum in one slide



Improving  
Accessibility



Improving  
Usability



Spatial enabled government

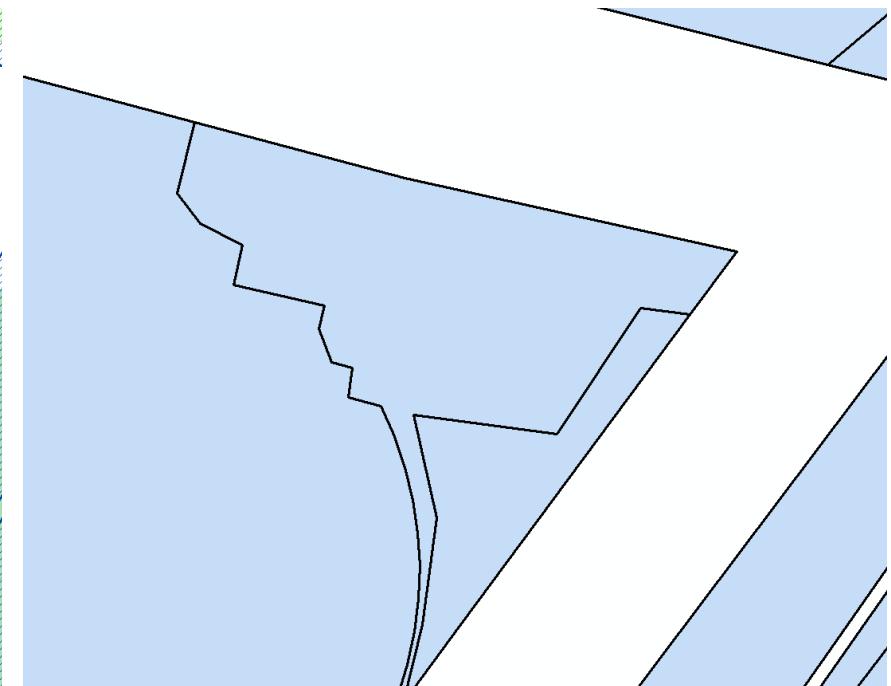
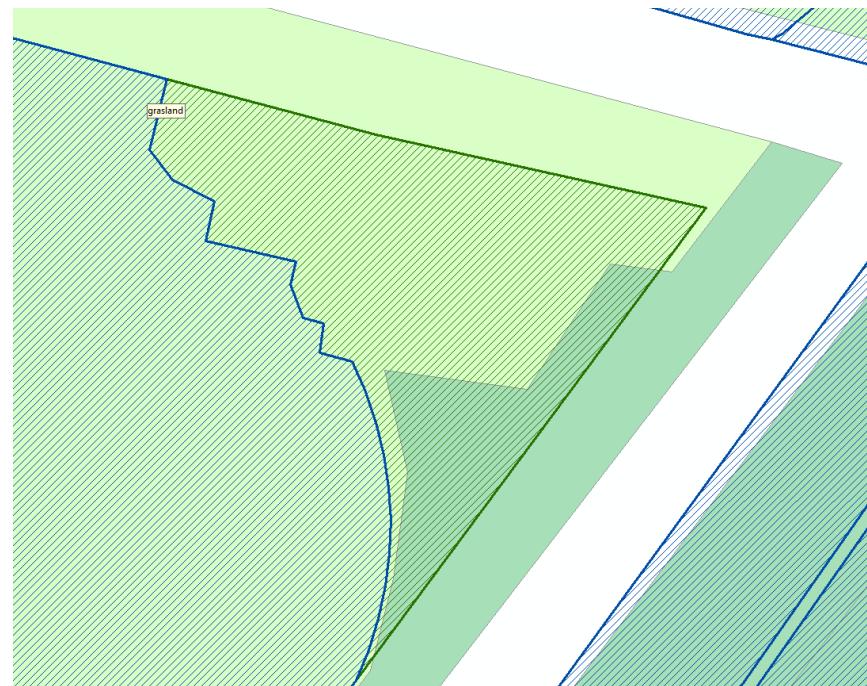
Co-creation as strategy

# Various topics

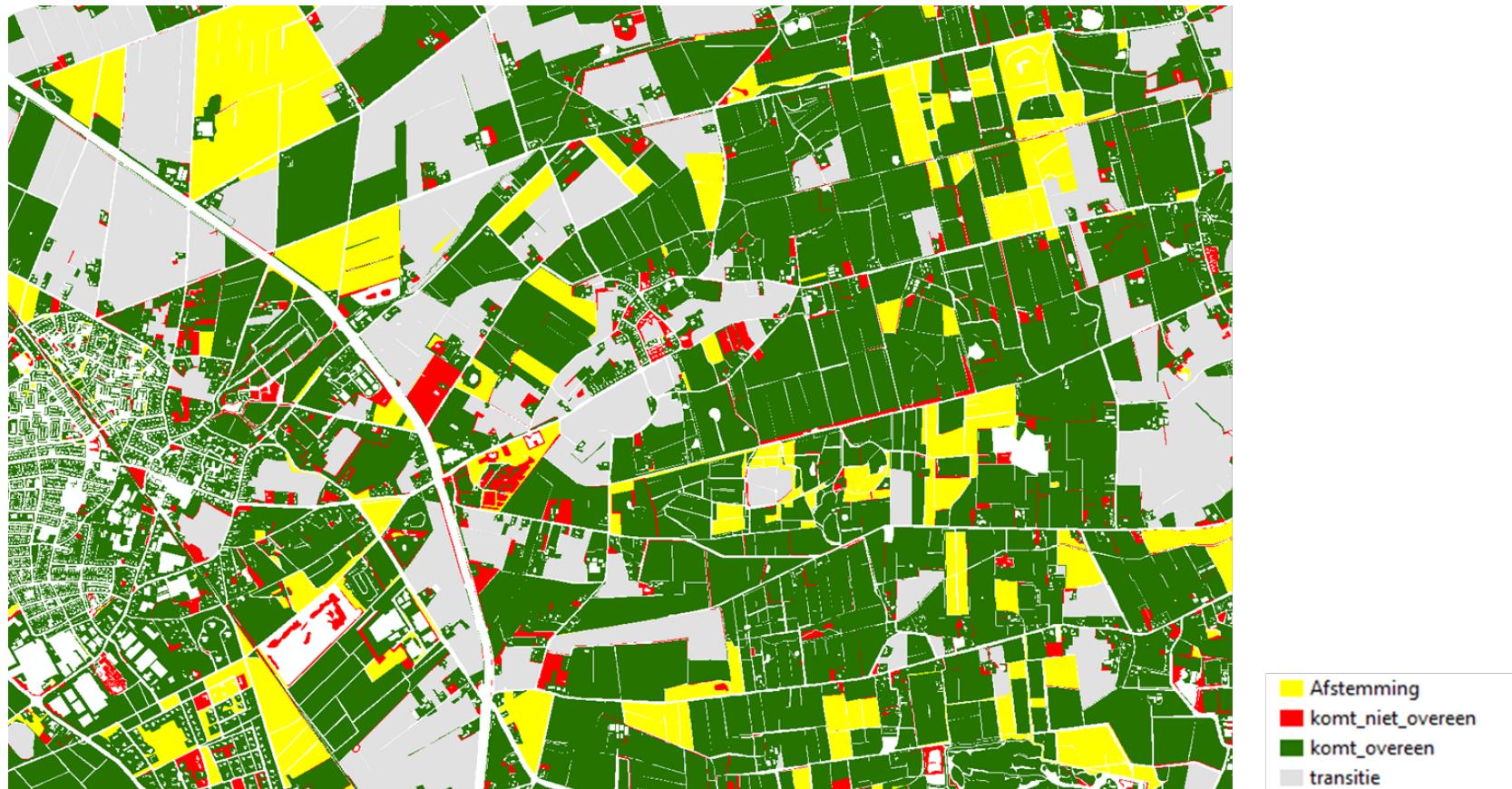
- Semantic repository with all spatial data of NL
  - Create semantic repository of all open spatial data in the NL to:
    - Geocoding: find ‘Palace op de Dam’ regardless of typos or knowing whether it is a street name or other point of interest.
    - Public service: Provide all relevant information of a building to a fireman that is going to save lives.
- Linking Big data and the sensor web
  - Geonovum is participating in the Platform Making Sense for Society.  
Many opportunities here to experiment with
  - New tooling BIG geo-data, sensors networks
- Interactive development of specifications
  - Via Mapbox or Cartodb visualize UML diagrams of datasets.
  - Automatically convert existing data into the new model so that users can validate the model by working with data instead of looking at a UML diagram.



# Kadaster: BGT performance



# Kadaster: BGT performance

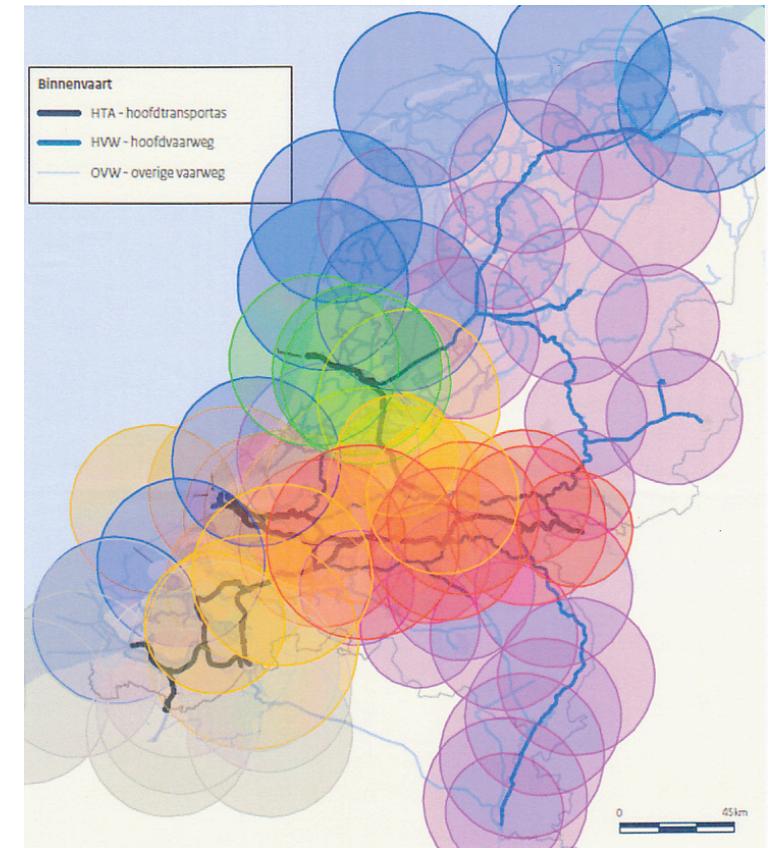


# RWS topic: anonymization of ships locations

- RWS collects locations of all ships in NL for traffic management (Via AIS)
- Privacy issues makes re-use hard.

## Possible questions:

- Can we anonymize the data?
- What are the legal obligations for re-use?



# Point Clouds

- Spatio Temporal
  - It's melting ...



## EXPLORATIVE POINT CLOUDS

Geomatics Synthesis Project Symposium

3 Project Teams

Interesting Guest Speakers

& Drinks in Berlagezaal afterwards





# Geomatics Thesis Subjects at Fugro

Geo-ICT & Data Management

## Dense Matching in industrial environments

Industrial plants require frequent updates of 3D information for asset management and regulatory compliance.

Dense Matching is a technology to retrieve point clouds from images. However, this is hard because of the smooth surfaces in an plant.

However, prior knowledge about shapes is present: pipes are cylindrical, steel beams have a H-shape, etc. This knowledge can be applied in the Dense Matching process.

As part of the thesis, we expect you to visit a plant and collect the required images yourself.



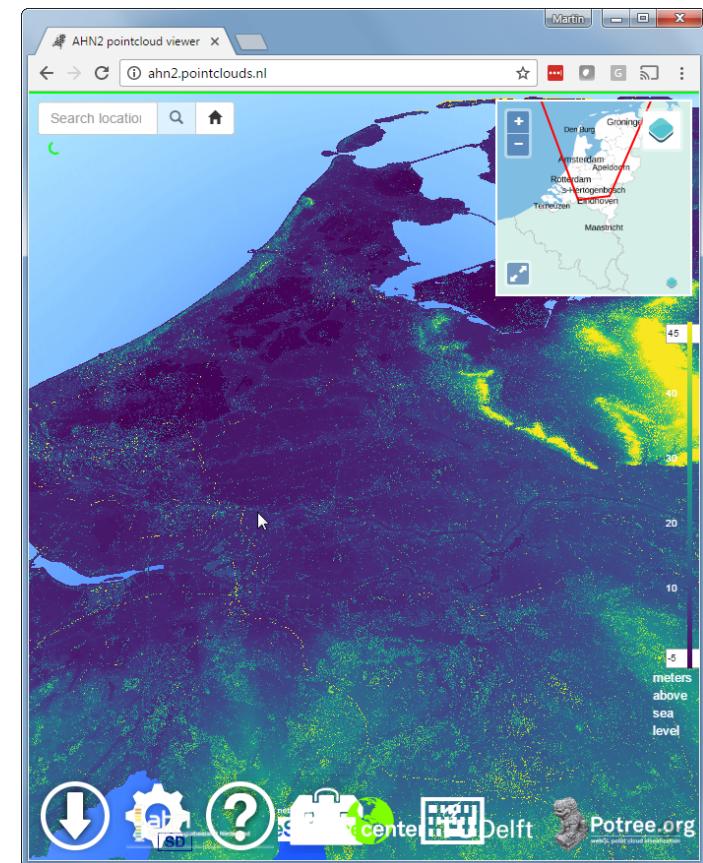
## Open Point Cloud Map

Last year, the website ahn2.pointclouds.nl was developed by TU Delft, eScience Center, Rijkswaterstaat, Oracle and Fugro

The site uses open source tooling to host and visualise the entire AHN2 in the browser

We would like to extent this project to built the Open Point Cloud Map. One environment where all open point cloud data sets from around the world can be hosted.

This poses many challenges, including data management, indexing, coordinate reference systems and 3D visualisation



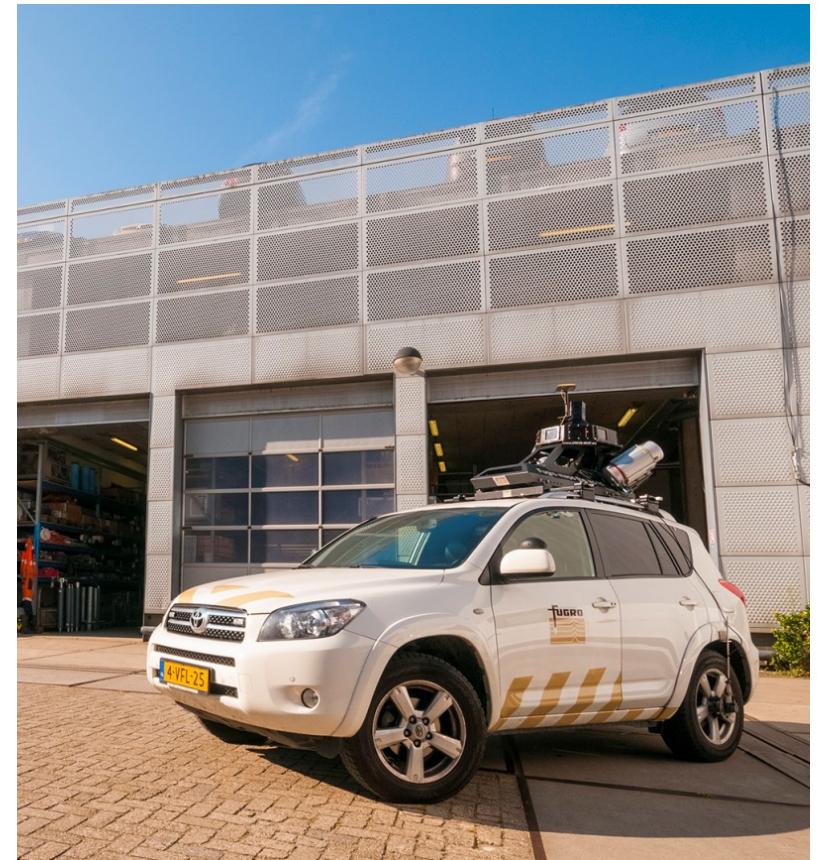
## Automatic Point Cloud Matching

Mobile Mapping is a very common and popular way to collect 3D data

The position accuracy of these data sets is typically in the order of a few cm. This is too big for most practical applications. Hence matching of point clouds is applied.

Various methods for point cloud matching exist, but applying them on massive data sets requires parallelization and high performance computation clusters.

In this research you will work with our HPC cluster to develop a method to automatically match massive point clouds.



# MSc. Thesis at Fugro

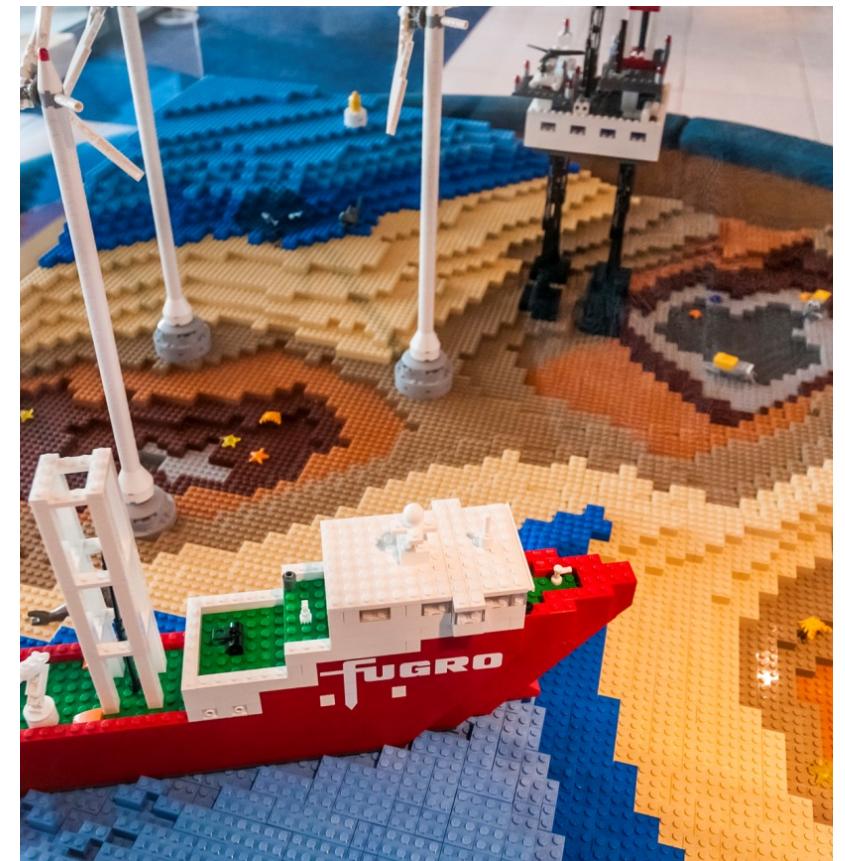


Fugro is the world's largest integrator of survey and geotechnical services.

From our main office in Leidschendam, you will work in a large team of Geomatics Engineers, many of them being alumni from Delft University.

We provide an internship position at Fugro during your research and lots of supervision from our technical experts.

You will learn a lot about employing Geomatics innovations in the real world. And above all, you will have a lot of fun in our young and motivated team.





Thank you for your attention

For more information:

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# Master topics

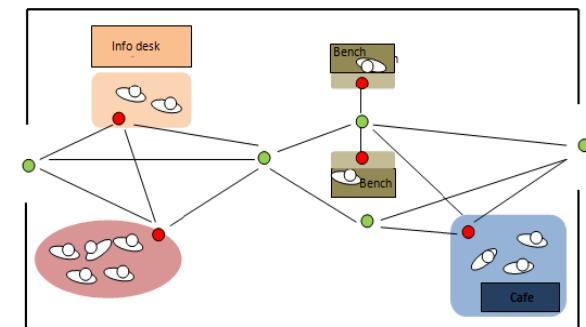
# 3D Indoor Lab

The best of two worlds

# Shape grammar to subdivide spaces

Indoor environment in public buildings consist of very large spaces and usually **it is difficult to give instructions how to get to a specific part of the such space.** Therefore for indoor localisation and navigation, spaces are **subdivided into functional areas.** There several approaches to subdivide spaces.

**This research will concentrate on space subdivision using shape grammar.** A shape grammar consists of number of shape rules and a generation process that selects and processes rules. In general, shape rule specifies the transformations on existing (part of a) shape. This research is part of [www.sims3d.net](http://www.sims3d.net) project.

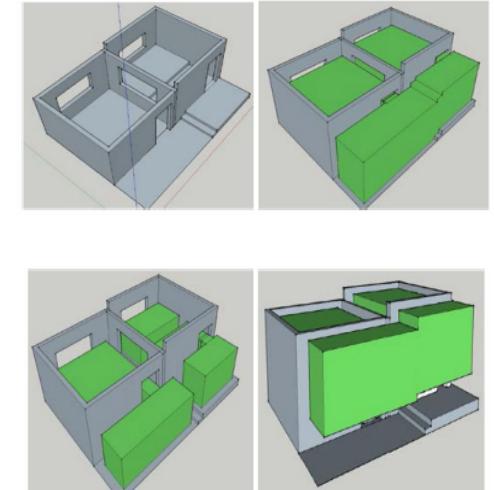


# Navigation for user profiles

Current commercial navigation **applications distinguish only between few navigations modes** and does not take into account the profile of the user. To be able to provide personalised navigation, **two types of information is needed: about the user and about the environment** in which a user will be navigated.

This research is going therefore to investigate the following issues:

- Which **characteristics (age, gender, availability, ...)** can be taken into a user profile?
- What **kind of Indoor spaces** are of interest per profile?
- What **kind of paths** can be computed considering the profile?

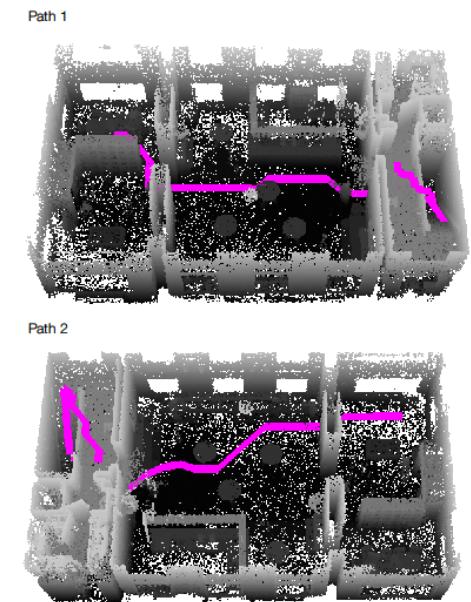


Khan, A. A., & Kolbe, T. H. (2012, November). Constraints and their role in subspaceing for the locomotion types in indoor navigation. In *Indoor Positioning and Indoor Navigation (IPIN), 2012 International Conference on* (pp. 1-12). IEEE.

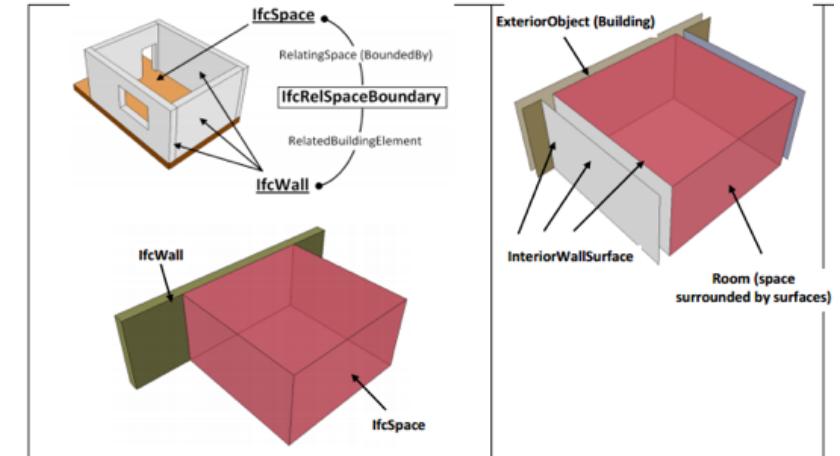
# Octree – Indoor/Outdoor navigation

**3D raster representation** is increasingly gaining the interest of the researchers. They are simple structures but usually **result in large data sets**. Therefore in previous research we have investigated **Octree data structure** and its use for **indoor path computation**.

This research topic will continue and extend previous work by considering rasterization of outdoor space. The goal is to investigate what kind of Octree would be needed for **seamless indoor/outdoor navigation**.



# Facilitat



Most **building managers have little to no information** about the indoor status of their buildings: the number of buildings, their structure, rooms, size of windows, doors, area of room floors, etc. Many maintenance daily and yearly tasks such as cleaning, renovation, painting, refurbishing, safety are performed in an ad-hoc manner, which **cost extra effort and money**.

This research will evaluate the suitability of 2 semantic 3D model standards (IFC and CityGML) for facility management purpose. It will also study the integration of both, in order to take benefit from each side.

# Indoor modelling with the Google Tango

The **Google Tango tablet** is a very intuitive, interactive and **interesting tool for indoor scanning**. The device contains **suitable sensors to rapidly produce 3D models**. But the few apps available for this task are **very limited**, and only provides either an already processed mesh or point cloud samples.

The goal of this research is to evaluate to which extent the tablet can be used for indoor modelling. It is about fully exploiting the skills of the tablet to extract proper point clouds and perform semantically rich surface reconstruction, by relying on other information such as the scanning trajectories, the coloured pictures of the environment, etc.

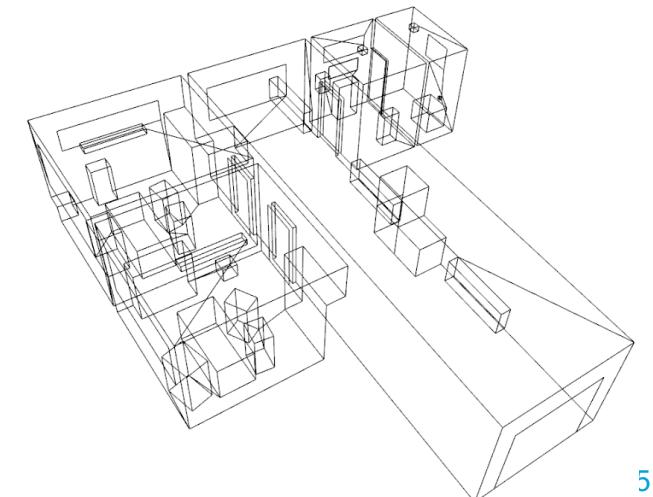
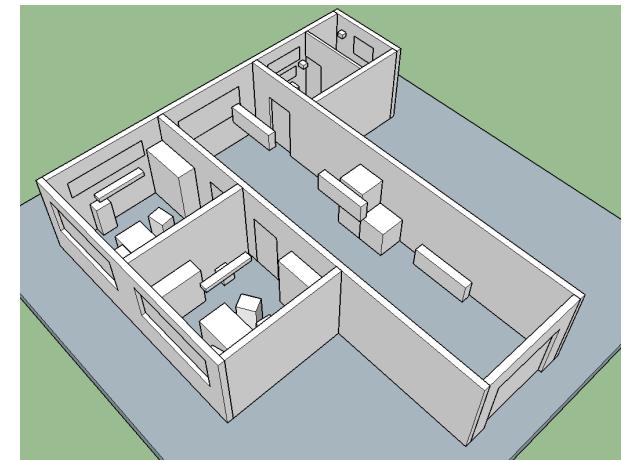


# Dynamic changes of the 3D indoor space

In order to perform **fine-grained indoor navigation**, one needs to consider the entire **3D free and non-free space**. The non-free space is often characterized by **furniture elements and people** activities (crowd, queue, etc). The free space that is **available for navigation** cannot be evaluated without considering the obstacles. This problem is even more complex because the **obstacles can move** in the indoor space.

**The goal of this research is to investigate the best way to consider the moving objects in an indoor environment to optimally evaluate the real free space available for navigation.**

This research is part of [www.sims3d.net](http://www.sims3d.net) project.



# Master topics in cooperation with Thomas H. Kolbe

The best of two Technical Universities  
Delft + München

# In cooperation with Thomas H. Kolbe (TUM)

## Development of a CityGML Point Cloud ADE

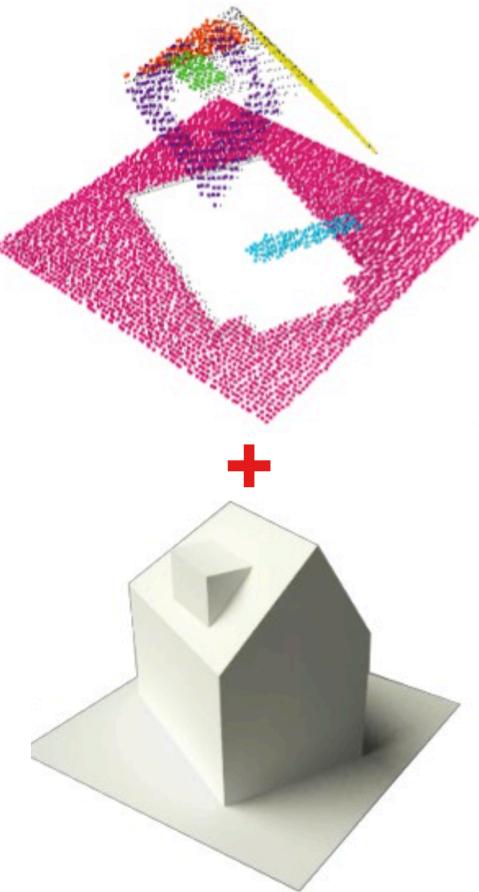
In CityGML the geometry of 3D objects are represented by vectors or boundary representations. This research shall work on **extending CityGML to also allow for point clouds** to represent the geometry of the different CityGML feature types.

Besides the development of a formal data model using UML, also a way has to be found to **segment and classify point clouds into CityGML feature types** using vector geometry from given CityGML datasets in LOD1/2. By this method, the given CityGML datasets shall be enriched by the point cloud data.

Finally, a **deviation measure between the point cloud representation and the vector representation** shall be developed.

Group affiliation: GISt

Co-Supervisor @ TU Delft: Edward Verbree



# In cooperation with Thomas H. Kolbe (TUM)

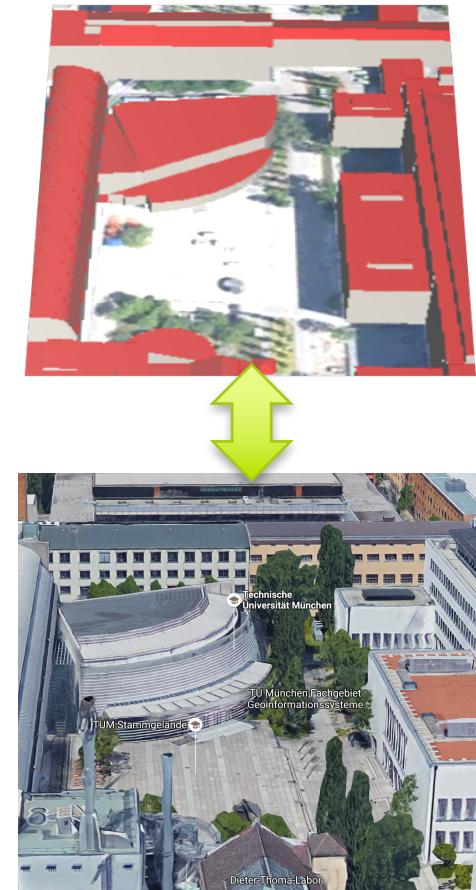
## Relate CityGML and popular mesh-representations / views

The aim of this research is to **integrate object-based 3D city models with high-resolution textured mesh representations** like the ones used in Google Maps 3D or Apple Maps today. The purpose is to enrich CityGML data by high-resolution 3D mesh geometries on the one hand and to enrich high-resolution 3D meshes by semantic information on the other hand.

Possible **applications** which should also be investigated are **change detection or validation** of CityGML datasets; **solar potential analysis** including vegetation and other obstacles like installations on the roofs; or the **creation of LOD3 based on existing LOD1/2 models** plus the meshes. An existing software module of TUM can be used to perform solar potential analysis.

Group affiliation: 3DGeoInfo

Co-Supervisor @ TU Delft: Hugo Ledoux or Abdoulaye Diakité



# In cooperation with Thomas H. Kolbe (TUM)

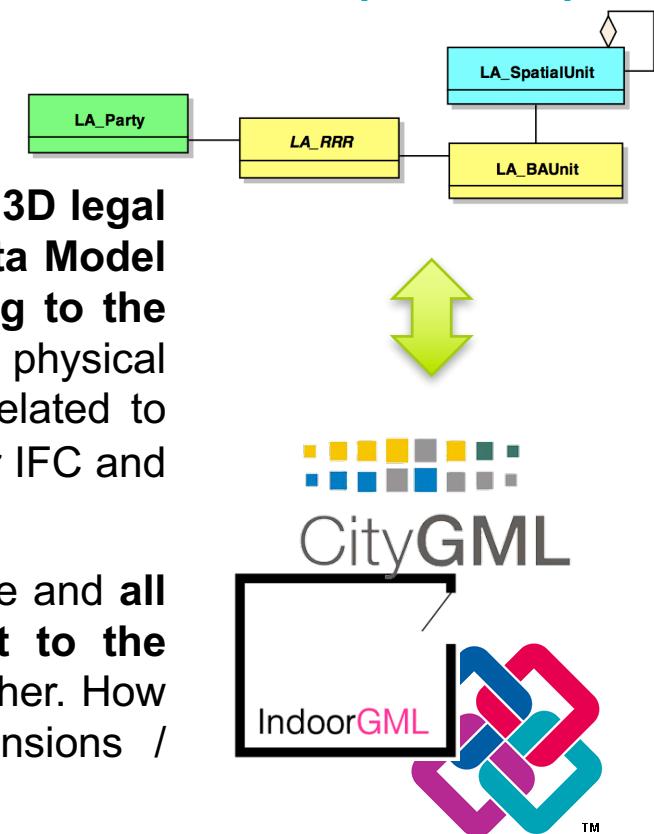
## For LADM 2.0 revision (ISO 19152) develop model

This thesis project shall investigate the **relationships of 3D legal spaces as described by the Land Administration Data Model (LADM) with 3D building models specified according to the CityGML / IndoorGML / IFC standards** representing the physical objects. To which extent can the LADM concepts be related to existing real-world data given in CityGML, IndoorGML, or IFC and where are possible problems?

**A catalog of aspects on the matching** should be made and **all three standards should be evaluated with respect to the integrability with LADM** and compared against each other. How could the matchings be improved by possible extensions / changes to LADM (**in direction forward to LADM 2.0**)?

Group affiliation: GIS

Co-Supervisor @ TU Delft: Peter van Oosterom



# In cooperation with Thomas H. Kolbe (TUM)

## Indoor Localisation using Google Tango and a 3D Building Model

In this research it should be examined to which extent the **Google Tango tablet** can be used for **automatic localisation and orientation in indoor spaces** based on the 3D scans matched with a 3D BIM model. Methods to be investigated come from the field of **mobile robotics**. Localisation likely will require tracking of movement.

As soon as the position of the user is determined, a **3D view of the building model shall be shown aligned with the orientation of the device** (possibly as an overlay to the current scan). It should be investigated, if a 3D object in the view can be clicked and highlighted on the screen.

Group affiliation: 3DGeoInfo

Co-Supervisor @ TU Delft: Abdoulaye Diakité

