YYT-C3001 Management environmental data and information

Learning session 1: Introduction and basics

Aalto University
School of Engineering

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Contents of this lecture

Practical matters

- **Learning goals**
- **Schedule**
- **Grading**

Introduction to the course topics

- **Environmental data and geospatial data**
- **Spatial data utilization**
- **Topics for the rest of the course**

Learning goals for this lecture

You know the learning goals of the course

You know the overall schedule and know where to find the detailed schedule

You know in general how the course is graded and know where to find details of the grading

Overview of the YYT-C3001 course

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The goal of the course

On this course you will learn the importance of spatial data sets.

You will learn about existing, important spatial data sets, how to spatial data sets are managed, and how they can be used for solving real-world problems.

You will learn why the use of spatial data in real problems is a non-trivial task that requires time, resources, and expertise.

Learning goals on the course

You are familiar with the most important Finnish and European spatial data providers and know where to try and find data

You understand the basics of the standards, technology and processes used for managing spatial data

You know how to look for spatial data and how to assess the usefulness of datasets found

You know how to find more information about spatial data, GIS, and related matters

Course schedule

- **Weekly schedule**
  - Exercise session: Monday at 14-16 in **Teams**
  - Weekly **exercise deadline** Wednesday at 10am
    - **Next exercise** round published at the same time
  - Learning sessions
    - Wednesday at 10-12
    - Thursday at 14-16

Date	Time	Lecture topic	Exercise deadline
Wed 9.9	10-12	Introduction	
Thu 10.9	14-16	Spatial data modeling and management	
Wed 16.9	10-12	Data sets in Finland 1	Round 1
Thu 17.9	14-16	The INSPIRE directive and data	
Wed 23.9	10-12	Spatial data model technologies	Round 2
Thu 24.9	14-16	Technical standards for spatial data	
Wed 30.9	10-12	*No learning session*	Round 3
Thu 1.10	14-16	Learning diary peer assessment	
Wed 7.10	10-12	Spatial metadata	Round 4
Thu 8.10	14-16	Infrastructures and cloud services	
Wed 14.10	10-12	Data sets in Finland 2	Round 5
Thu 15.10	14-16	Spatial data business (by Juha Saarentaus)	

What is required for passing the course

Do the following

- **Write a learning diary that gets at least grade 1**
- **Participate in learning diary peer assessment**
- **Get at least 15 points from the course weekly exercises**

Course grading

- **Learning diary is graded 0-5**
  - Grades 1-2 represent diaries that are lacking (e.g. personal reflection is missing or short)
  - Grade 3 represents the norm
  - Grades 4-5 represent diaries that are well done (e.g. significant and insightful personal reflection)
- **Maximum points from exercises is 30**
  - 0-14 p: Course not passed
  - 15-19 p: Course passed -1 to course grade (cannot fail the course)
  - 20-24 p: course passed
  - 25+ p: course passed, +1 to course grade
- **The compulsory learning diary peer assessment will be part of exercise round 4.**

Exercises

- **5 rounds of exercises**
- **3 exercises per round**
- **Maximum of 2 points per exercise (6 points per round)**
- **You will have a chance to ask for help on Mondays at 14-16**
  - Via the course Teams
  - There's a queue list for assistant's help

- **Most exercises are answered with essay-type answers**
- **In some exercises you need to use a service**
- **In some exercises you need to find and read documentation**
- **Course assistant Eemeli Saarelainen can help you with problems in the exercises**

Learning diary

- **A learning diary describes your learning on the course from your own point of view**
- **The diary contains**
  - Discussion of course material (topics)
  - How the topics are related to each other and the wider world (context)
  - The author's own point of view on the material (subjective pov)
  - The author's considerations on their own learning (**reflection**)

- **You should start writing the learning diary immediately**
- **The 4th exercise round is learning diary peer assessment**
  - You will read and comment on each other's learning diaries
- **Therefore you need to submit a version of the diary (covering the course to that point) on Wednesday, September 30th**

Learning diary assessment

Dimension	Description	Missing	Lacking	Good	Excellent
Lecture topics	Does the student discuss the topics dealt with in lectures or homework?	None of the content is discussed.	Some topics are mentioned or referred to, but not discussed.	Some topics are discussed, but not really comprehensively or in depth.	Several topics are discussed systematically, comprehensively, and in depth.
Author's own point of view	Does the LD show how the author sees the topic?	Author's own point of view (subjective perspective) is not visible at all. Only descriptive (objective) discussion.	Author's own view can be seen in a few cases. E.g. "I think ..." used occasionally, but not going beyond that.	Author's own point of view is visible in several cases, and it is clear they have been thinking about some topics deeply.	Author's own point of view is extensively described. Considerable effort has been put into expressing deep thinking in many cases.
Applications and the "big picture"	Does the LD consider how the topics are used in practice and set them in a wider context?	Practical use is not discussed, nor is anything put into wider context.	A couple references to applications e.g. how something is used for specific purpose, but only very briefly.	In addition to presenting practical use of the topics, the author also tries to set them in a wider context.	Application areas for topics are described in detail and comprehensively discussed in a wider context, thus placing the topic to a "bigger picture".
Learning process	Does the author discuss their learning process?	Author's learning process is not discussed and it is not visible in the learning diary.	The author discusses what they've learned. However, there is no self-reflection on the learning.	The evolution of author's understanding is discussed, and some strengths and weaknesses in their learning are recognized.	The evolution of author's understanding is clearly described, strengths and weaknesses in learning recognized, and goals are set for how the learning can proceed in the future.

Pre-assignment

Environmental information in daily life

- **Maps**
  - Google Maps
- **Transport networks**
  - Navigation (car/bike/on foot)
  - HSL reittiopas
- **Location**
- **Weather**
- **Climate data**
- **Air pollution and water quality**
- **Traffic**
- **Topographic laser scanning**
  - Not a daily use

Expectations for the course

- **Deeper understanding**
- **Theoretical side of GIS**
- **Technologies**
  - Technical details
- **Data analyzing**
- **To know whether to choose geoinformatics as master's program**
- **Professional vocabulary**
- **Applications to different fields**
  - Ecology
  - Biology
  - Construction

Introduction: spatial data and spatial data sets

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Classroom exercise: Previous GIS experience

What is your previous GIS experience?

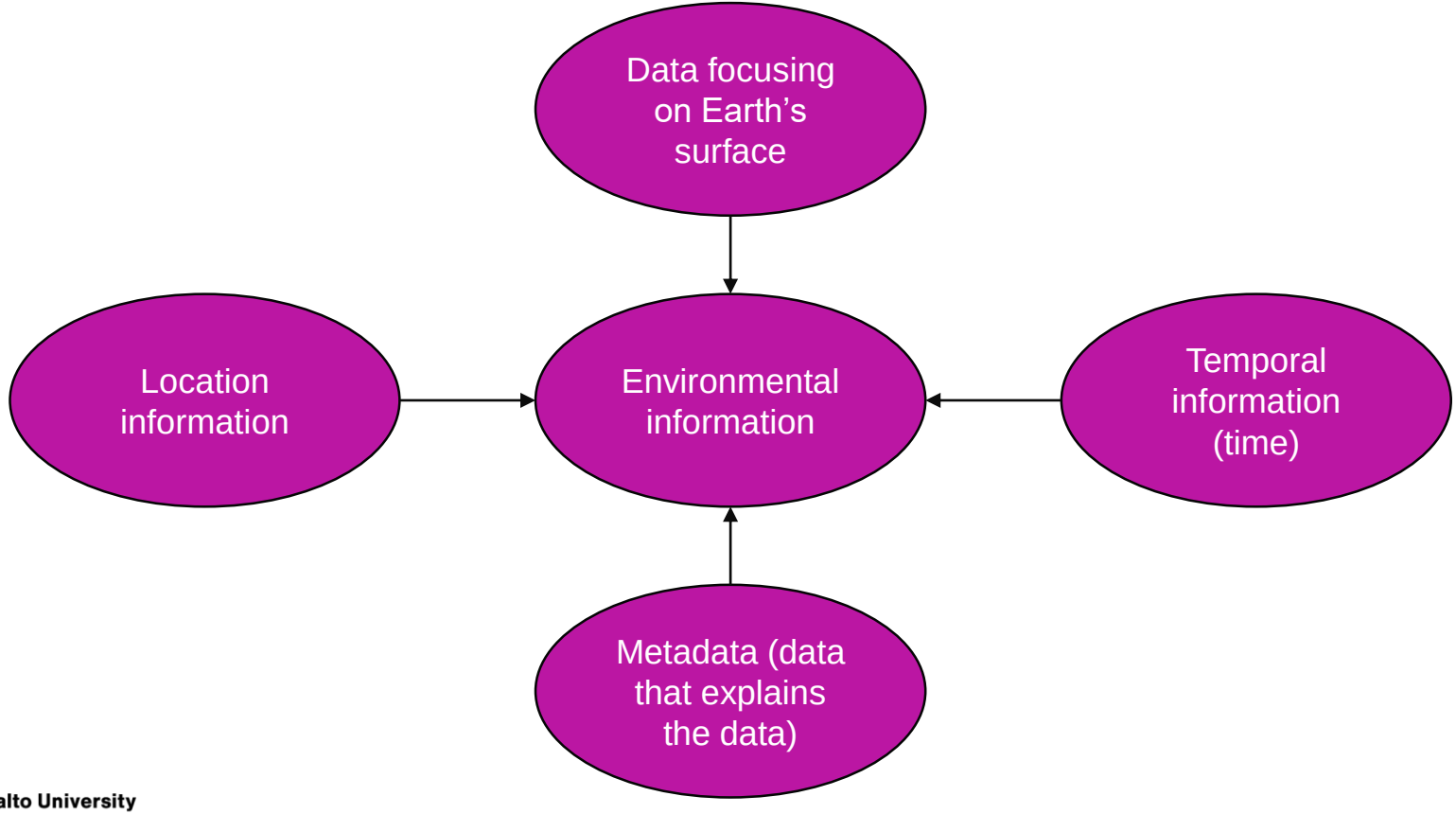
- **Answer in the Presemo session (link in the Zoom comments)**
- **https://presemo.aalto.fi/medi1/**

Environmental information

“By *environmental information*, we mean data about the state of Earth's biosphere (and associated spheres) and those processes affecting it. Environmental information differs from generic information in that its dimensionality always includes space and time, and its correct interpretation requires considerable scientific context (i.e., metadata).”

Frew, J.E. and Dozier, J., 2012. Environmental informatics. *Annual Review of Environment and Resources*, *37*, pp.449-472.

Environmental information



Why do we need environmental information?

Decision-making should be based on accurate information

Accurate information for decision-making can be created by analyzing data

Data can also be used to analyze or simulate phenomena and their effects

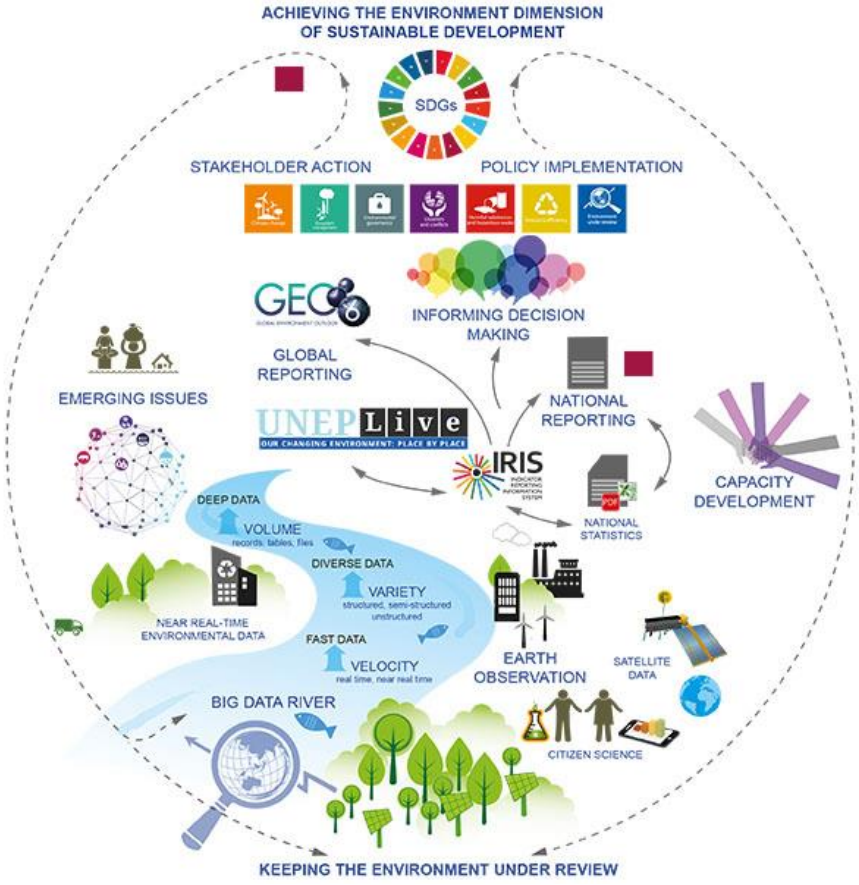
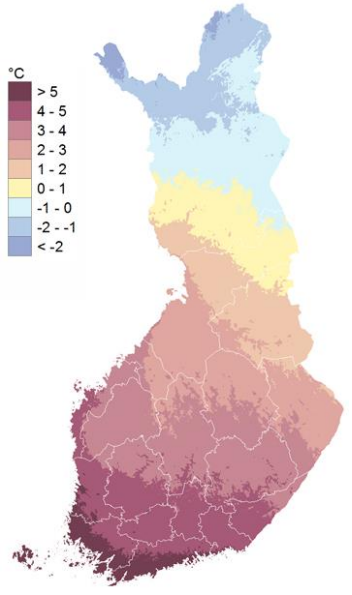


Image source: United Nations Environment Programme

Geospatial information



Environmental information is always georeferenced

- **That is: related to a location on Earth surface and the attributes of a specific phenomenon at that location**

Thus environmental information can be considered a type of spatial information

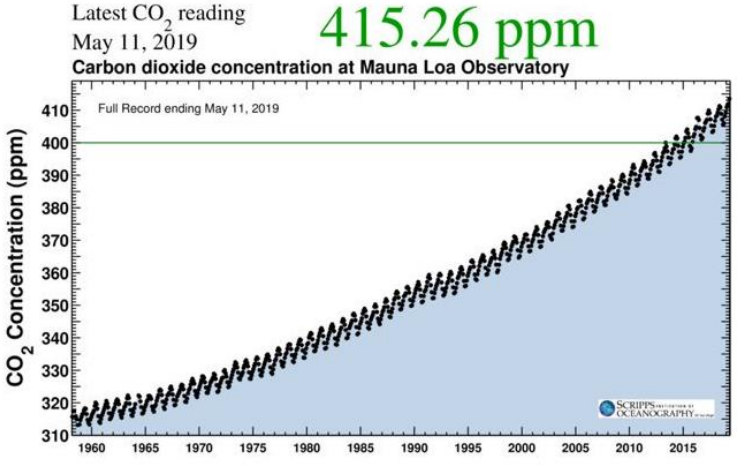
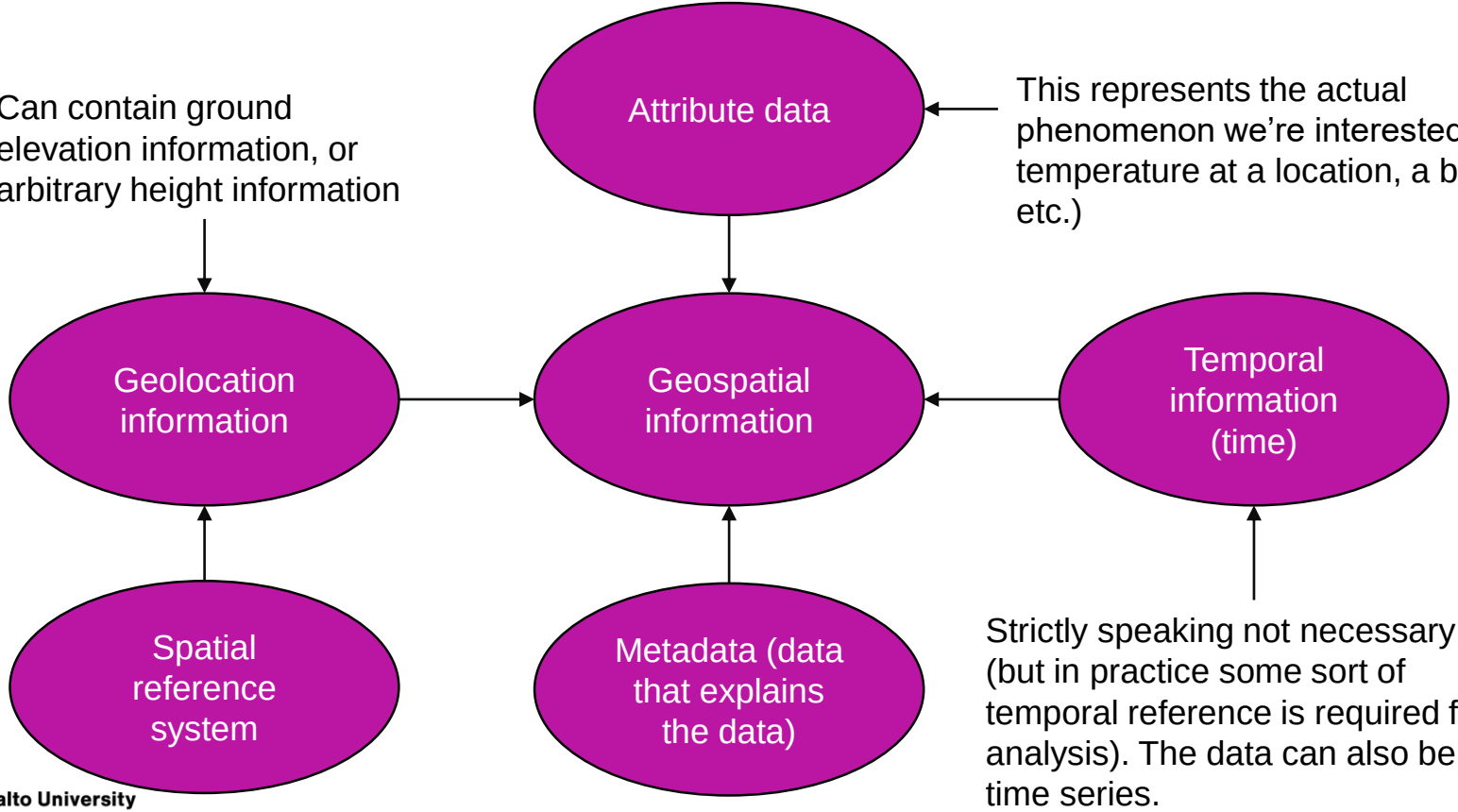


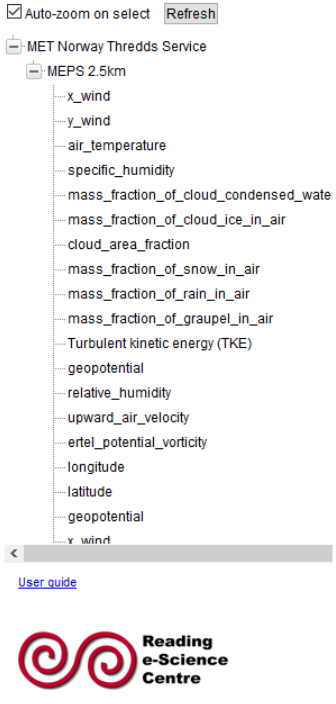
Image sources: FMI and Sciencealert

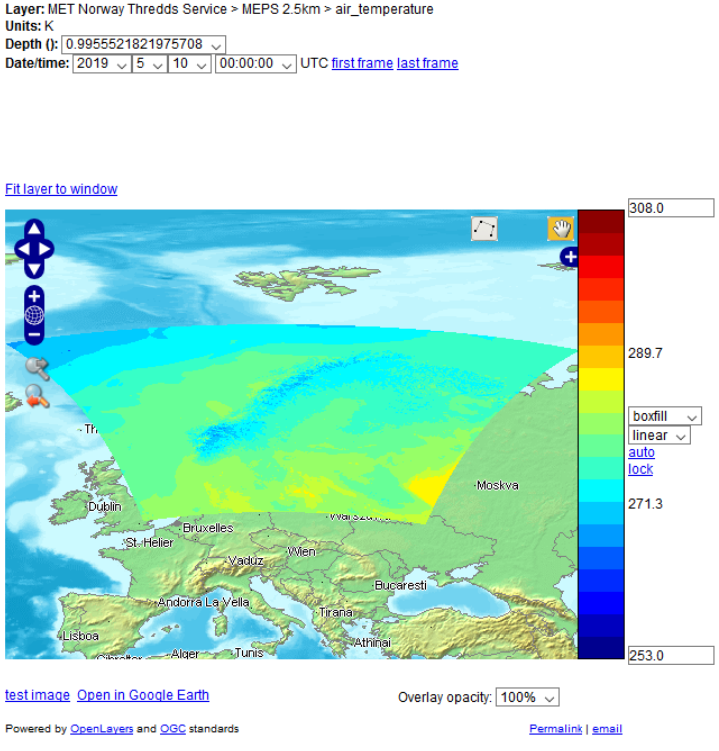
Structure of geospatial information



Spatial data sets and infrastructures

- Spatial data is provided to users as spatial data sets
- A data set consists of one or more spatial data layers
- Each layer represents one or more spatially varying phenomena
- The layers may be explicitly connected to each other (e.g. database relationships)
- Or the layers may have no explicit connections but create a thematic set





Data: thredds.met.no weather data; air temperature layer visualized

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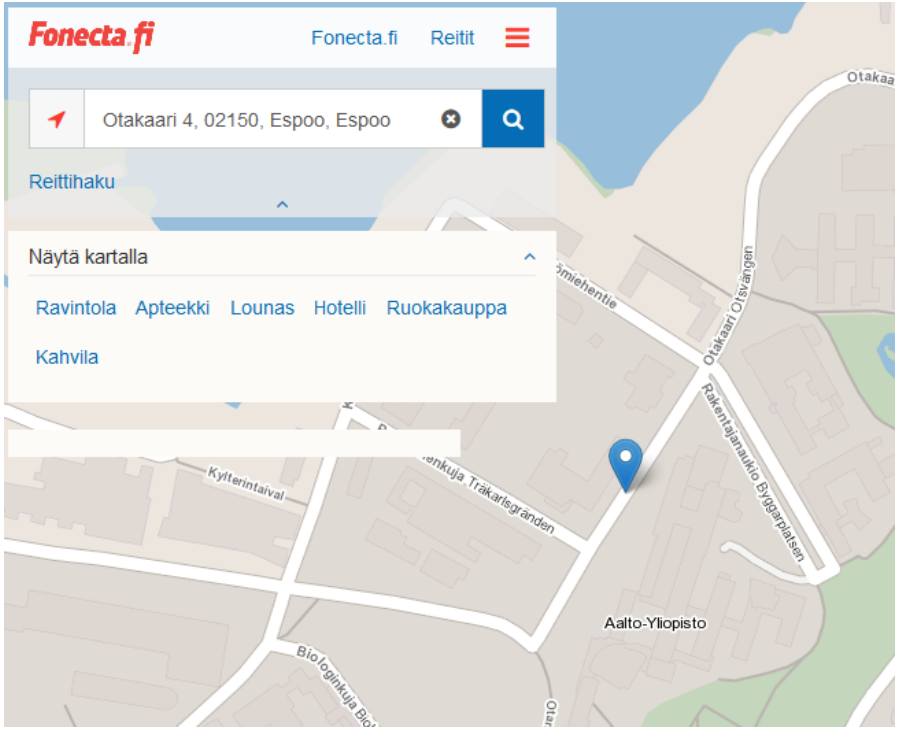
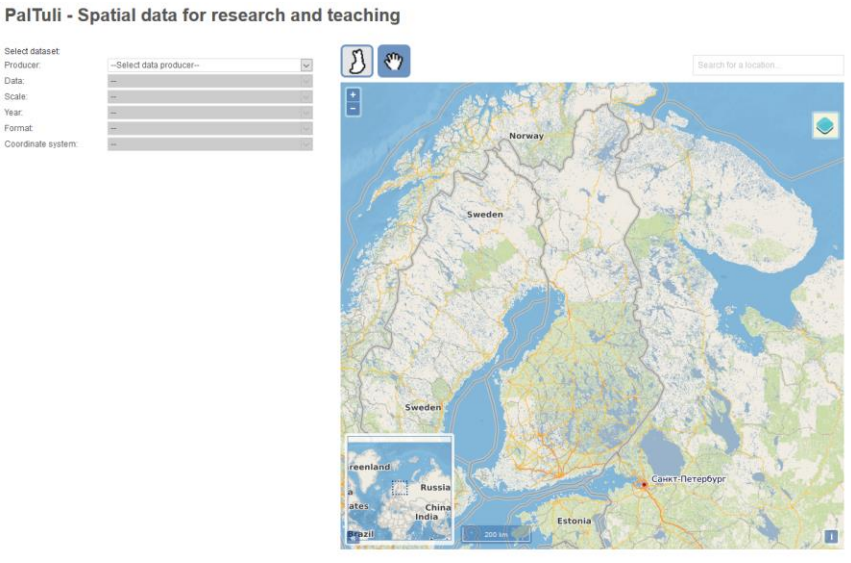
Spatial data services for consumers

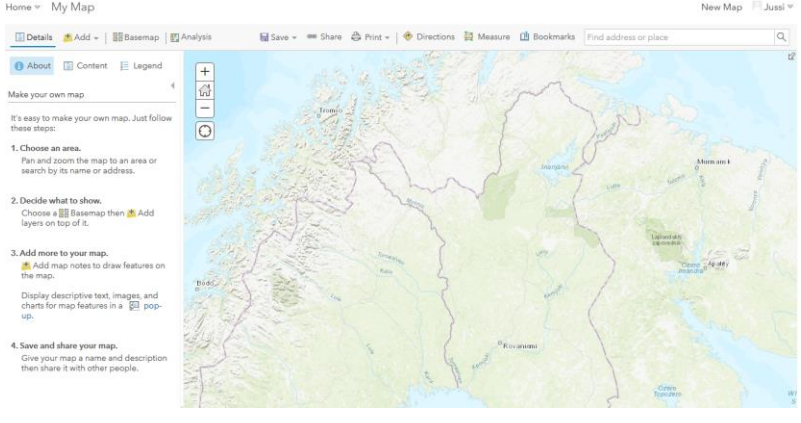
- There are plenty of spatial data services aimed at consumers. There are many different types
- Many provide limited set of easily-used services (e.g. route finding)
- Some provide more complex services that can be employed (e.g. google maps)
- Some attach spatial information to a service where location is not the primary focus (e.g. tripadvisor, Instagram, twitter, etc.)



Spatial data sets for GIS experts

- **Experts typically want data they can work with, using whatever tools they happen to like**
  - QGIS, ArcGIS, R, python scripting, etc.
- **Thus, majority of GIS services for experts provide them data**
  - To download
  - Through an API
  - Cloud services can also contain both data and tools





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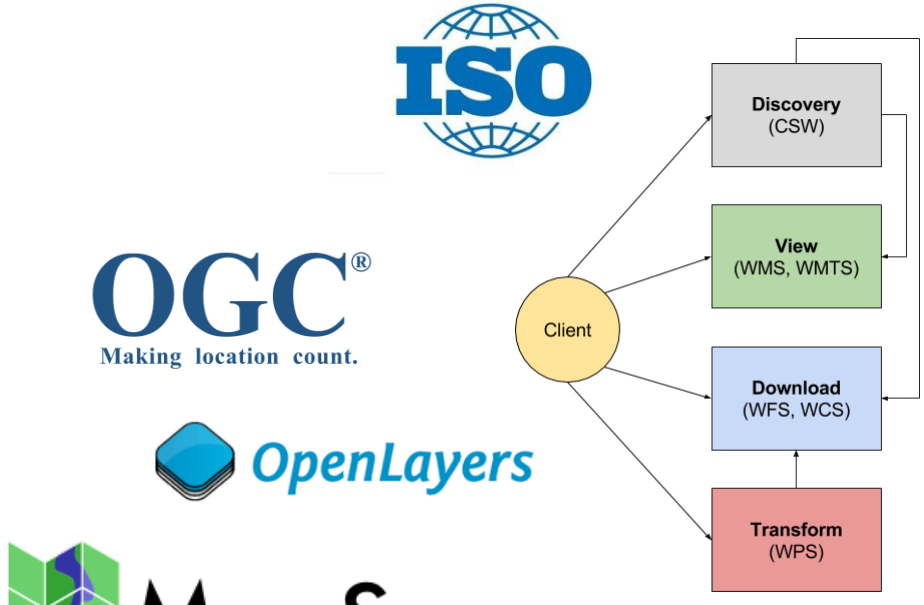
The underlying technologies and practices

- **Standards**
  - Data storage
  - Data delivery
  - Metadata
- **GIS frameworks and libraries**
  - Software development
  - Server-side software
- **Desktop GIS**
- **Cloud services**



Classroom exercise: your interests

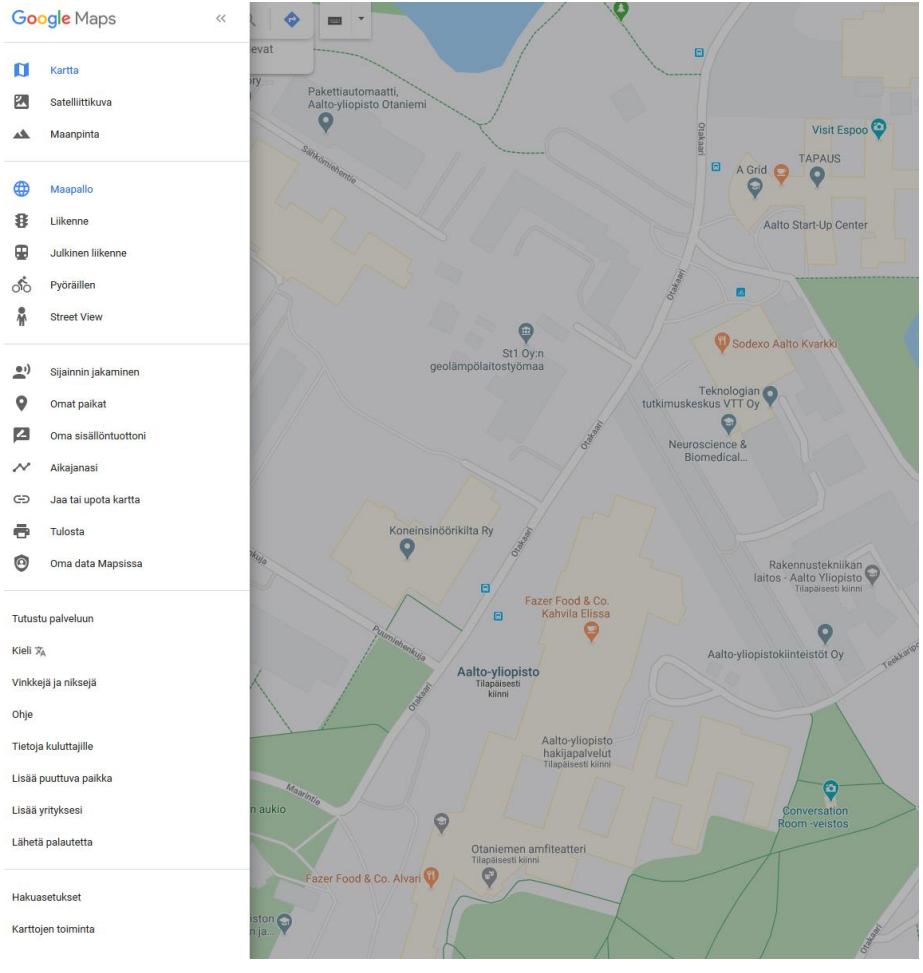
Answer in the Presemo session (link in the Zoom comments)

- **https://presemo.aalto.fi/medi1/**

Utilization of spatial data

Spatial data and non-experts

- **Consumers often use spatial data in their everyday lives**
  - Locations, routes, weather, etc.
- **There are also many services for professionals**
  - Agriculture, tourism, real estate etc.
- **Many of these services are provided by private actors**
  - And especially consumer services are often without a cost
- **What is the benefit for the service provider?**



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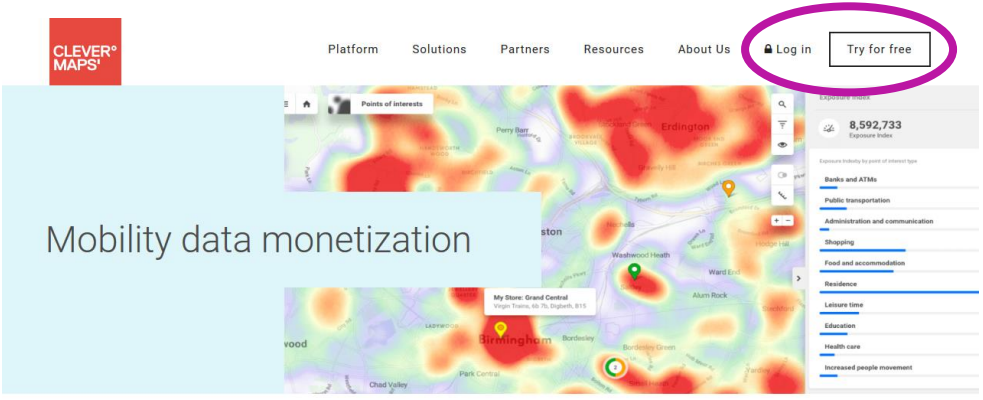
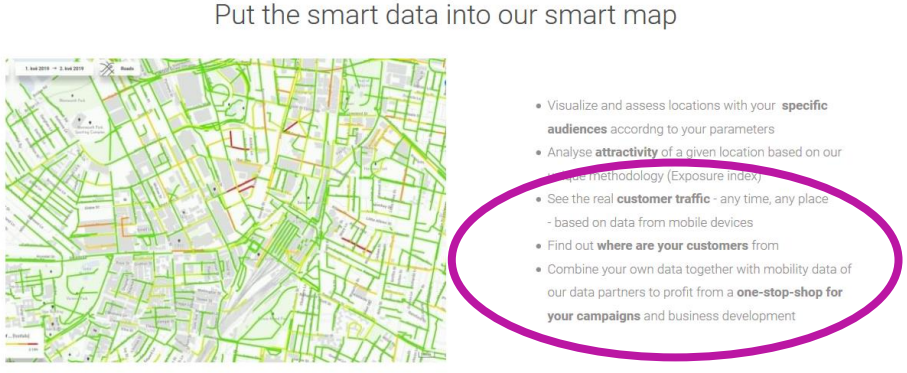
Value of spatial data

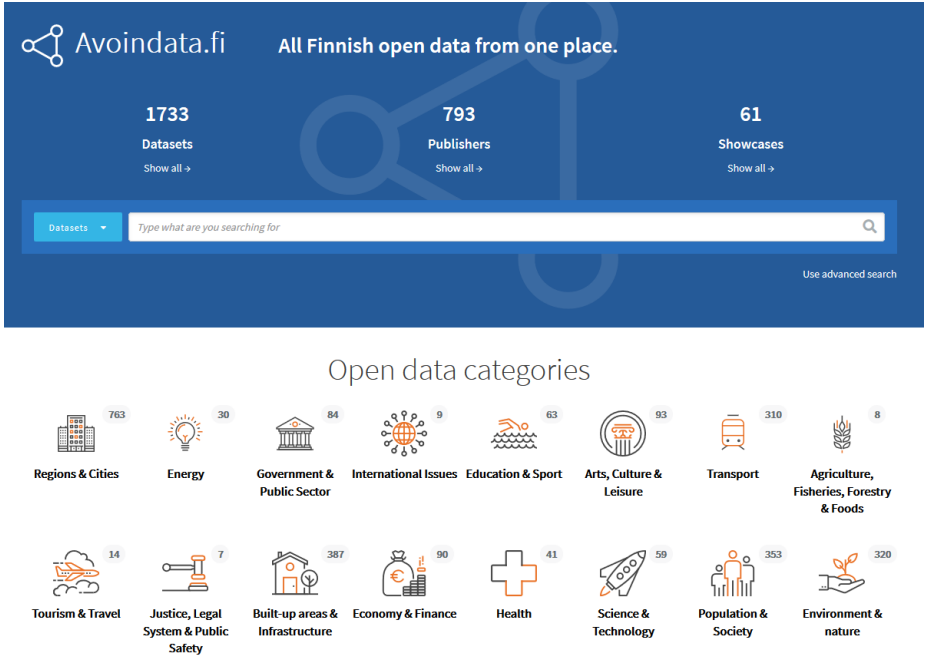
- **How is a private service monetized?**
- **Is the data gathered from the use of the service valuable?**
- **Is the free service a sneak peek for a paid service?**
- **Does somebody else pay for the service?**
- **Remember: there ain't no such thing as a free lunch. Somebody, somewhere, pays for it**
- **There are also non-profit providers**



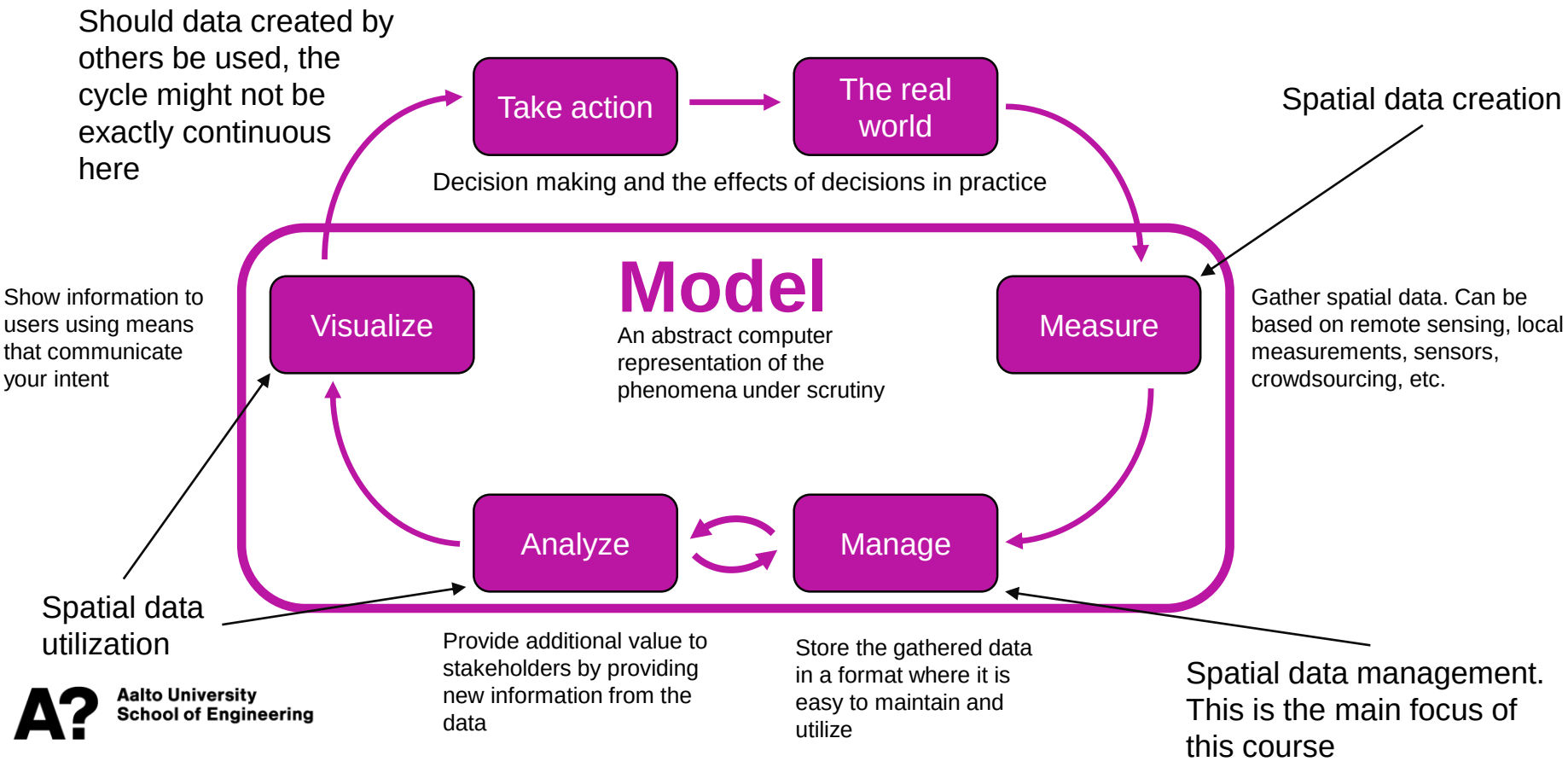


Spatial data for expert users

- **Expert users are typically interested in data**
- **There's a lot of private, closed data**
- **Public sector also creates a lot of data**
  - Public sector data is increasingly available as open data
  - We have all paid for that data with our taxes



The spatial data analysis cycle



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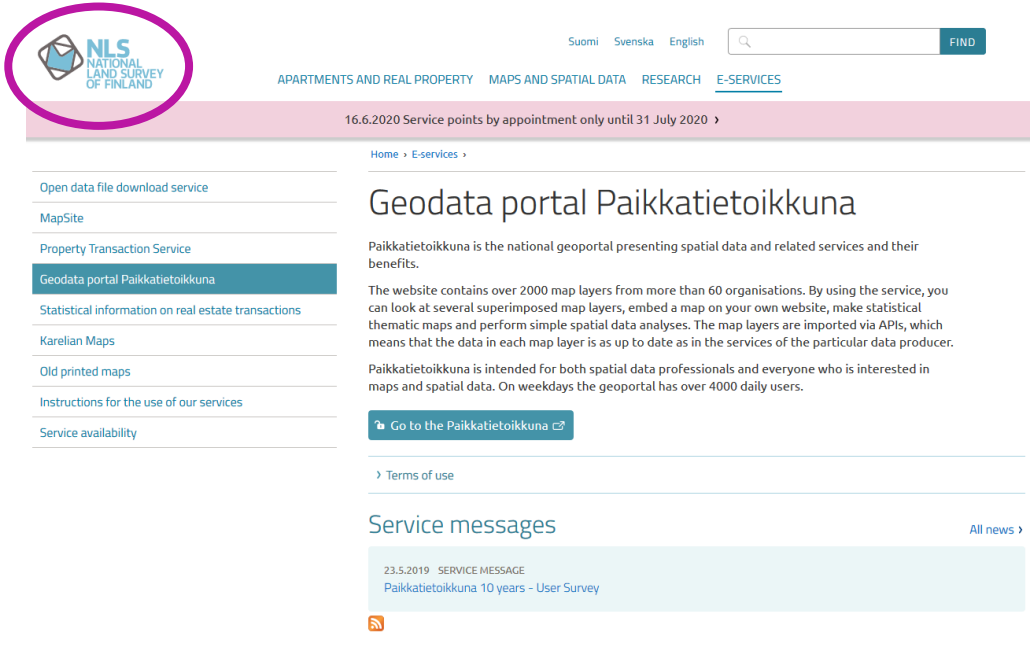
Spatial data utilization in organizations

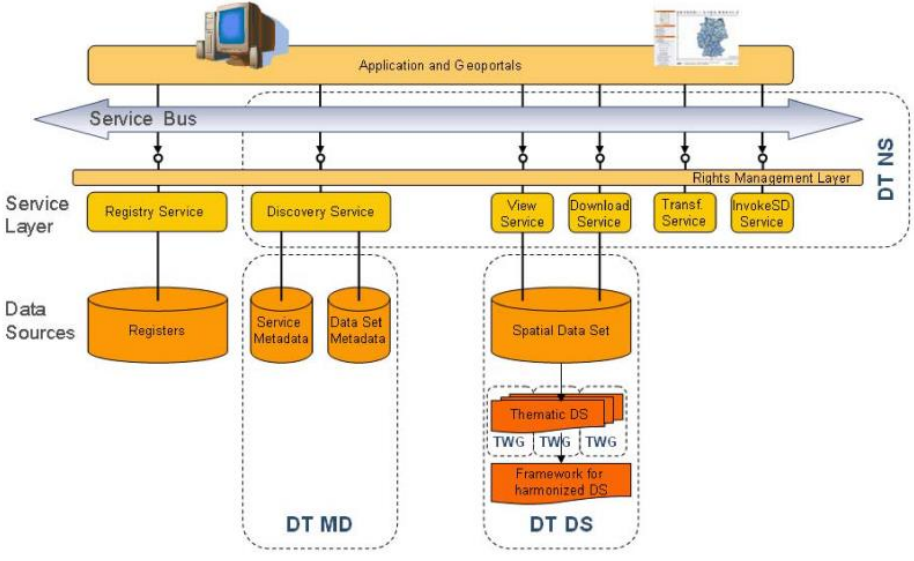
- **Beyond individual experts utilizing spatial data, organizations use it to improve their activities**
- **Organization utilizing spatial data requires a process for data utilization, and a guarantee for the continuity of that process**
  - For example, the process cannot depend on one person
- **They need to be sure the data or service offered by a provider will be available in the future**

One objective of NLS is to manage and provide for use spatial data sets. Thus a service managed by NLS is likely to be available also in the future



Spatial data infrastructures

- On country level, governments want to their spatial data to be utilized for the benefit of the country
- A way to facilitate this is to create a Spatial Data Infrastructure that allows all interested actors to access the data they require
- SDIs require significant investment to work and provide most benefits indirectly, and thus are typically done by governments



The rest of the course

Week 1

- **Introduction**
  - You are here
- **Also, exercise round 1 published**
- **No weekly exercise sessions**

- **Spatial data modeling and management**
  - How is spatial data modeled on computers?
  - How can spatial data be managed and delivered to clients

Week 2

- **Data sets in Finland 1**
  - What sorts of spatial data is available in Finland?
  - National Land Survey
  - Other public sector data providers
  - Commercial GIS
- **Exercise round 2 published**

- **The INSPIRE directive and data**
  - Overview of what is INSPIRE
  - The INSPIRE SDI
  - INSPIRE Data specifications

Week 3

- **Spatial data modeling technologies**
  - What is needed in a spatial datasets
  - Data types
  - Spatial reference
  - Data standards for data modeling
- **Exercise round 3 published**

- **Technical standards for spatial data**
  - Standards for transferring spatial data
  - Standards for representing spatial data
  - Data storage methods

Week 4

- **No learning session**
  - The teacher is unavailable
- **Deadline for submitting learning diary for peer assessment**
- **Exercise round 4 (peer assessment) published**
- **Learning diary peer assessment**
  - Instructions for peer assessment

Week 5

- **Spatial metadata**
  - What is metadata and why is it important
  - Metadata standards
  - Spatial data quality
- **Exercise round 5 published**

- **Infrastructures and cloud services**
  - Data and system interoperability
  - Cloud services
  - Data and information management

Week 6

- **Data sets in Finland 2**
  - Syke
  - Capital region and Helsinki
  - Other Finnish public sector data providers
- **Exercise round 5 deadline**
  - You’ve done all the exercises
- **Spatial data business by Juha Saarentaus**
  - Doing business with spatial data

Assessment week

- **Finalize and submit your learning diary for assessment**

Classroom exercise

What topic are you most looking towards to?

- **Answer in the Presemo session (link in the Zoom comments)**
- **https://presemo.aalto.fi/medi1/**

Learning about spatial data beyond this course…

In case you have not yet studied the ENY-C2005 Geoinformation in environmental modeling course, it is mandatory in the ENY bachelor, and a prerequisite for this course

There is also elective course YYT-C2001 Surveying and observing the environment in the ENY bachelor studies

For those who are really interested, we offer Master's Programme in Geoinformatics

Beyond Aalto, GIS and geoinformatics are taught in a number of institutions. The private sector also provides a lot of courses in GIS.

For the next time…

If you have not submitted the pre-assignment, do it as soon as you're able

Join the course Teams

The first exercise round has been published. Go take a look.

Start writing the learning diary

You can also take a look at what are Web Feature Service and Web Map Service, if you want