PROCEEDINGS AND PRESENTATIONS

29 OCTOBER 2021

INTO THE FUTURE – EMERGING APPLICATION AREAS

Keynote: Spatial Knowledge Infrastructure
Dr. Lesley Arnold, CEO, Geospatial Frameworks, Australia

Transforming National Mapping & Cadastre with Deep Learning
Nick Land, Business Development Manager, National Mapping & Cadastre, Esri

Precision Agriculture
Marc Tondriaux, Chairman, European Association of Remote Sensing Companies

High Precision Satellite Imagery
Rene Griesbach, Regional Manager Presales, Planetlabs, Germany

Smart City Platform Enabling Digital Twin: Helsinki 3D+ project
Jarmo Suomisto, City of Helsinki, City Executive Office, Finland

Geospatial for Finance Industry
Christophe Christiaen, Oxford University Sustainable Finance Programme, United Kingdom

KartAI Project
Ivar Oveland, Norwegian Mapping Authority

Hybrid Approaches for Sustainable Base Mapping
Anders Nesse, Norconsult Information Systems, Norway

Setting-up the Scene

Chair: Astrid Hvattum, Head of Business Intelligence and Innovation, Geodata, Norway

Astrid is a dedicated technology optimist, business developer, strategic advisor and technology blogger. She is a Head of Business Intelligence and Innovation at Geodata – a Norwegian company, which by Astrid's words, "lives and breathes four dimensions."

Setting-up the scene, Astrid commenced the day with an inspirational introduction emphasising her firm belief that anything and everything is possible if we put our minds into it and that specifically Spatial Data and Technology are key elements in reaching a sustainable future.

She underlined that we need to
- Have technology, information, applications, and solutions
- Understand local specifics and changes that occur over time
- Connect our efforts to our governments' goals, visions and aspirations
- Show how spatial data can help to understand impacts and to becoming data-driven
- Demonstrate endless possibilities geospatial provides, especially when driven by crises
- Convince that geospatial provides dynamic evidence for data-driven decision-making

New technologies provides us with exiting possibilities of getting "a lot for less":
- Airborne imagery and machine learning combined gives us an up-to-date overview and occurred changes show changes
- Raster analytics and Artificial Intelligence can take you even further
- Lidar-data can show us what the naked eye cannot see
- Drones can document and we can map – live, in detail, and in three dimensions

Astrid pointed out that we would need to reach out to the public to engage, to interact, and to get accurate information on what is happening and where. It is important to use difference sources for collecting and spreading the information – for example, crowd sourcing or social media as a source of information in emergencies.

At the same time, it will be increasingly important to establish and implement national and international standards, to create trust in the data we provide, and to be able to work towards common goals in the international society. We need to create standards that makes it possible to compare apples and apples – even if the data comes from different sources and countries.

We have created and collected data for decades. Now, we need to think about how we can connect the dots and make a digital copy of our surroundings. The most important is not if this digital copy is perfect from day one, but if and how it can grow and show what is already in place with information about quality. How it evolves over time through an always updated, dynamic, and visualized representation of your data.

Astrid concluded stating that her goal was for all participants to be inspired, so after these three day they would get ideas for new possible values and partnerships, new potential buyers and users, new ways of attracting employees, new ways of collecting data and a good plan for the future.

Keynote: Spatial Knowledge Infrastructure

Dr. Lesley Arnold, CEO, Geospatial Frameworks, Australia

Dr Lesley Arnold is Director Geospatial Frameworks Australia. She works with governments to develop strategies, policies and implementation plans for spatial information reform, open data initiatives and spatial innovation globally.

Lesley currently works with the United Nations and World Bank supporting countries to strengthen their geospatial information management capabilities towards implementing the 2030 Agenda for Sustainable Development, and is one of the lead authors of the UN-GGIM Integrated Geospatial Information Framework.

She is currently a Board of Director of AuScope and the Australia Urban Research Innovation Network (AURIN), and is President-elect and Board Member of the Surveying and Spatial Sciences Institute, Australia.

Lesley has worked with several committees to achieve incremental change including the Intergovernmental Committee on Surveying and Mapping (ISCM) Australia to develop Cadastre 2034 strategy and the Elevation and Depth 2030 Strategy.

Lesley continued the inspirational picture drawn by Astrid and talked about a paradigm shift required for spatial data enabling infrastructures to achieve a Spatial Knowledge Infrastructure (SKI) and in particular knowledge on-demand. She noted that this was a paradigm shift from current SDI technologies that are based on Web 2.0 technologies and data delivery; to an enabling environment based on Web 3.0 technologies that enable knowledge inferencing.

Lesley started with a very technology focus. She told about research conducted by the Cooperative Centre for Spatial Information (CRCSI) (now FrontierSI) where they experimented with Sematic Web technologies and integrated data on the Web, under its spatial infrastructure program with over ten PhDs and Post Docs, and industry partners. The Program looked at all aspects of SDI data supply chains and developed a vision for the SKI - a network of data analytics, expertise and policies that assist people, whether individually or in collaboration, to integrate in real-time, spatial knowledge into everyday decision-making and problem solving".

Lesley touched upon what is necessary to achieve this vision of knowledge on-demand for decision-making. She pointed out that this relies on government engagement, higher technical skill levels and some required prerequisite technologies, such as linked data formats, automated workflows and ontologies. She stated that we are now in an SDI/SKI hybrid environment, where access to machine-actionable data is becoming a reality and proof of concepts developed. There is still much to do to achieve the envisaged SKI to move beyond current SDIs.

In conclusion, Lesley provided a fuller picture using the Integrated Geospatial Information Framework (IGIF) as the means for digital transformation. She called upon participants to start creating and exposing data as linked data, as well as linkable metadata so that it can be found by machines. According to Lesley, this will lead to innovation potential, particularly in the open source community. There is free and open source software, such as Protégé, that can be used to develop ontologies and you can build on and adapt the many existing ontologies that already exist. Visit W3C and GitHub to find out more. https://www.w3.org/wiki/Lists_of_ontologies.

The link to the CRCSI research poster is here https://www.crcsi.com.au/assets/Resources/CRCSI-Program-3-overview.pdf and more papers can be found in the CRCSI Library here https://www.crcsi.com.au/library/. The white paper on SKI is located here https://www.crcsi.com.au/assets/Program-3/CRCSI-Towards-Spatial-Knowledge-Whitepaper-web-May2017.pdf.

Spatial Knowledge Infrastructure

Knowledge On-demand

A future enabled by machine actionable data

DR LESLEY ARNOLD

Specialist in Governmental Geospatial Information Policy and Practice

geospatialframeworks.com.au

Image: Robin Higgins - Pixabay

Where do I buy a GIS and which one is the best?

Image: Robin Higgins - Pixabay

Find

Download

Process

Fix errors

Overlay

Analyse

Transform

Curate

Display

Image: Robin Higgins - Pixabay

Count me out!

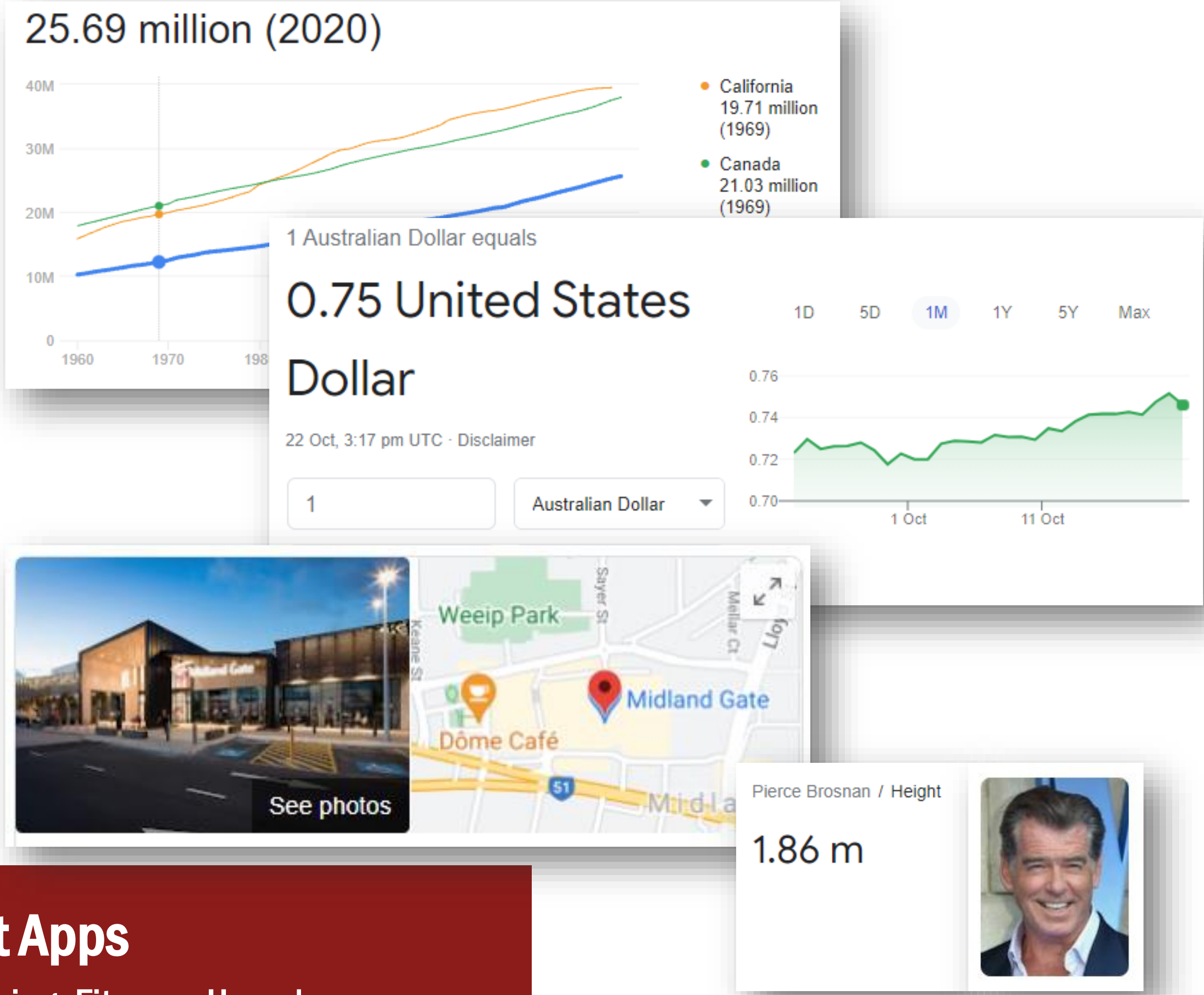
There must be a simpler way?

I’ll just ask Siri or Google!

On-demand Revolution

Consumer experiences happen in seconds

Information and services are pushed out via a digital mesh of applications - layered on top of existing digital infrastructure networks.



Fixed–content Apps

Taxi, Weather, Shopping, Fitness, Homebuyer, Gaming, COVID -19.

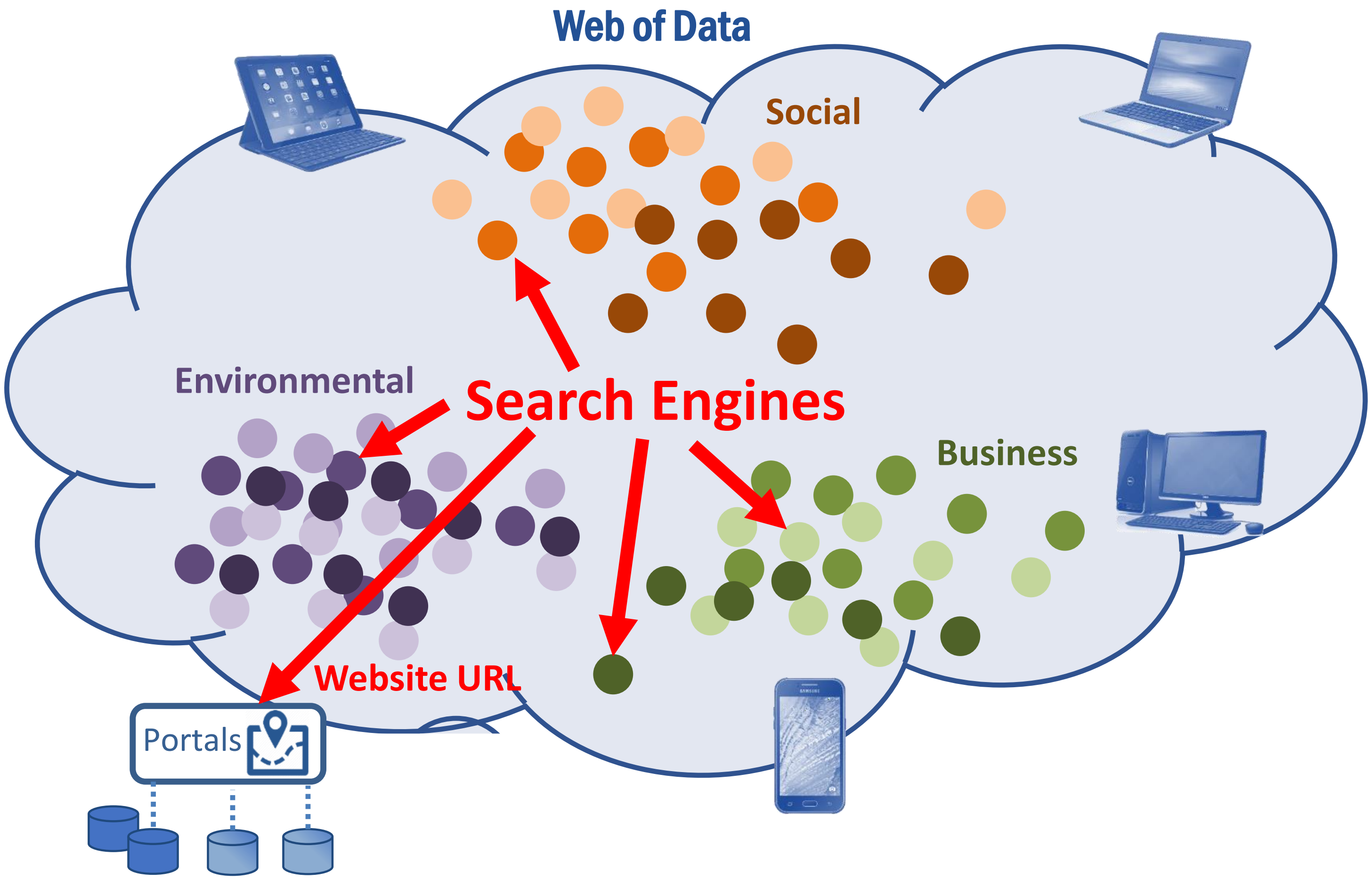
Can't get answers to *ad hoc* complex location-based queries

Open Query Apps

Virtual assistants –
Siri, Cortana, Alexa

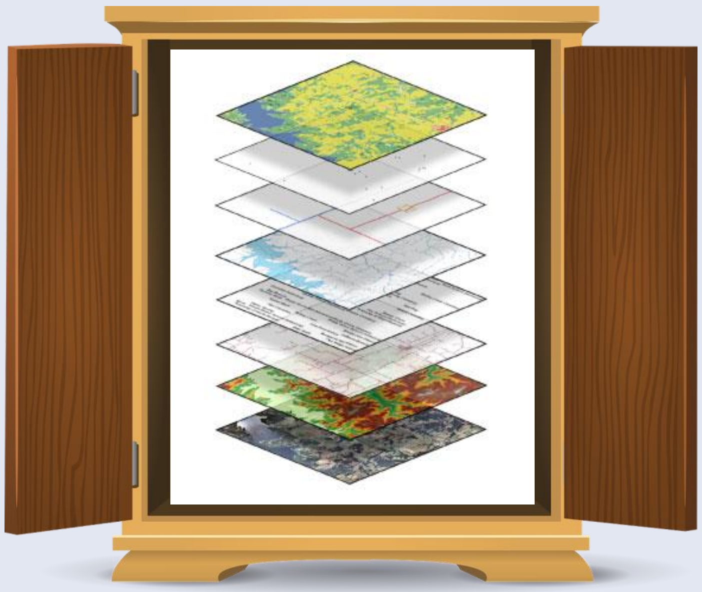
SDI – Not Machine Actionable

SDI Portals -
data catalogues are
human-readable



Search Engines Can't Find Data

SDI – Not Machine Actionable



SDI Portals -
data catalogues are
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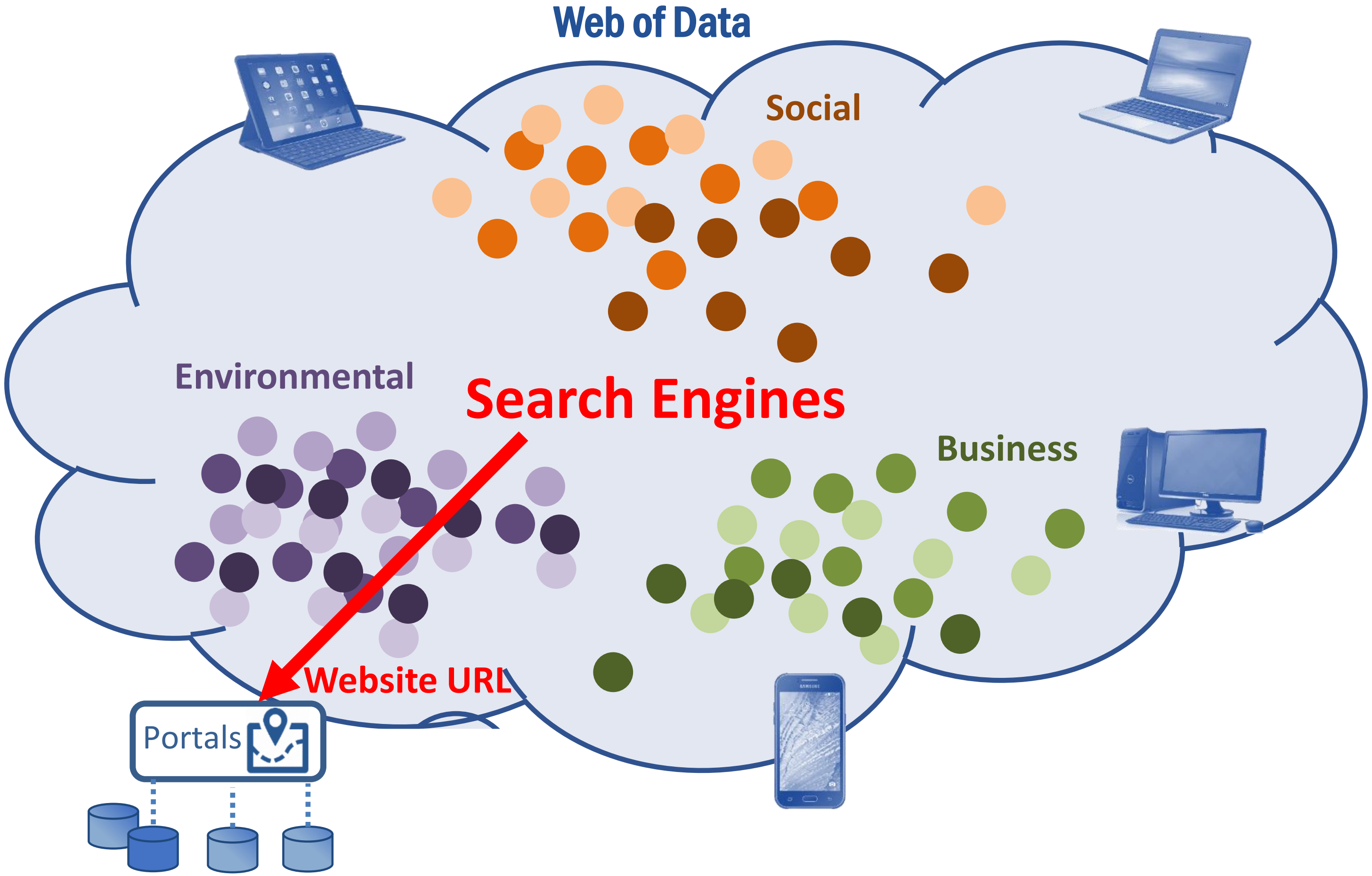
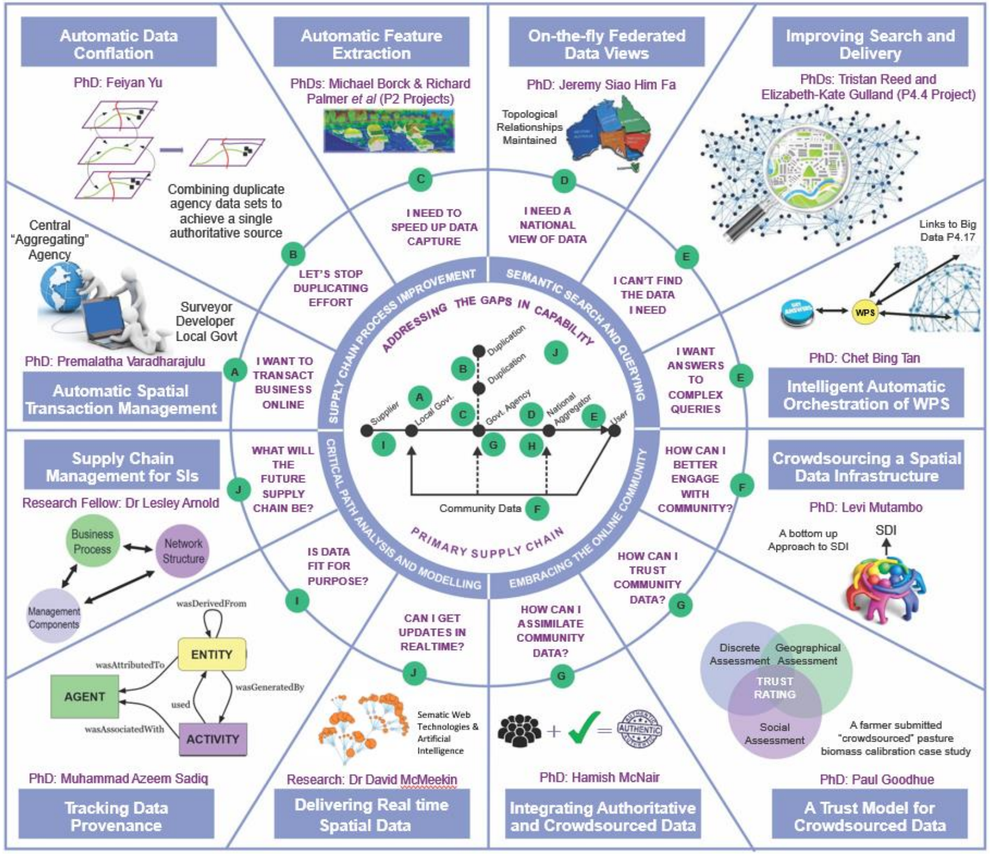


Search Engines Can't Find Data

If you could redesign an SDI what would it look like?

CRCSI (Now FrontierSI)

- Spatial Infrastructure Program
- Move beyond capability of SDIs
- Experimented with Semantic Web Technologies and integrated data on the Web



G. West, L. Arnold, D. McMeekin,
I. Ivanova, K. Armstrong, D. Mottolini,
10+ PhD and PostDocs
Over 15 industry partners

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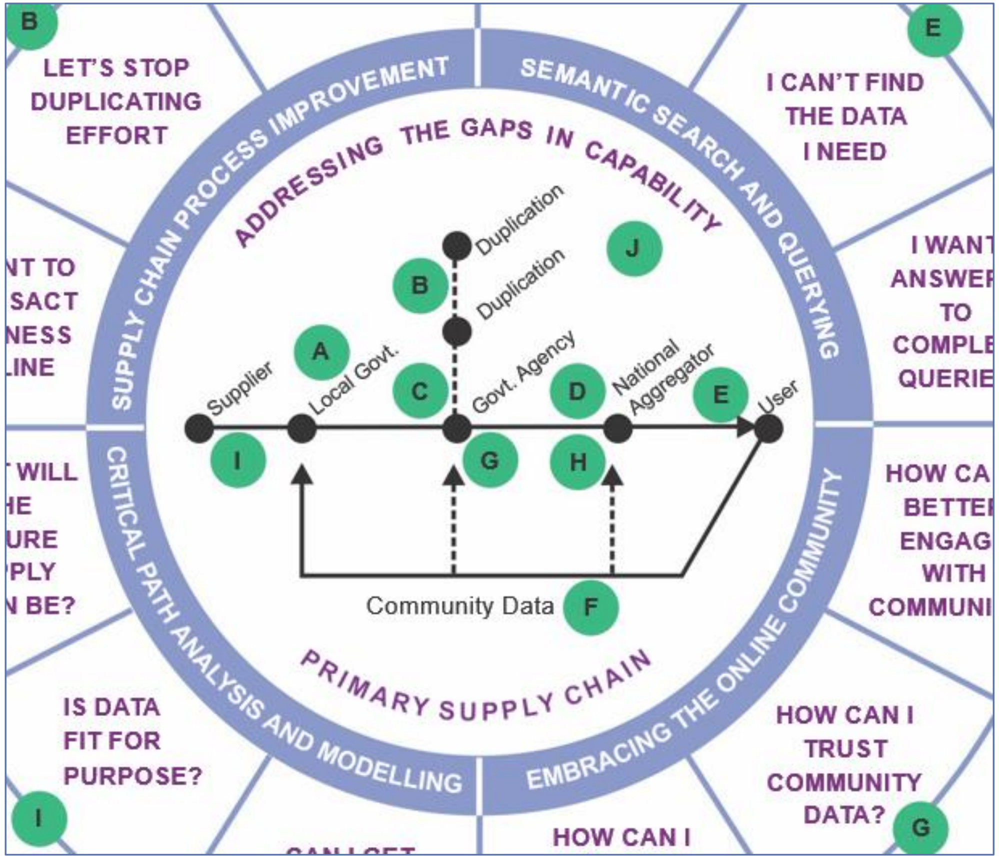


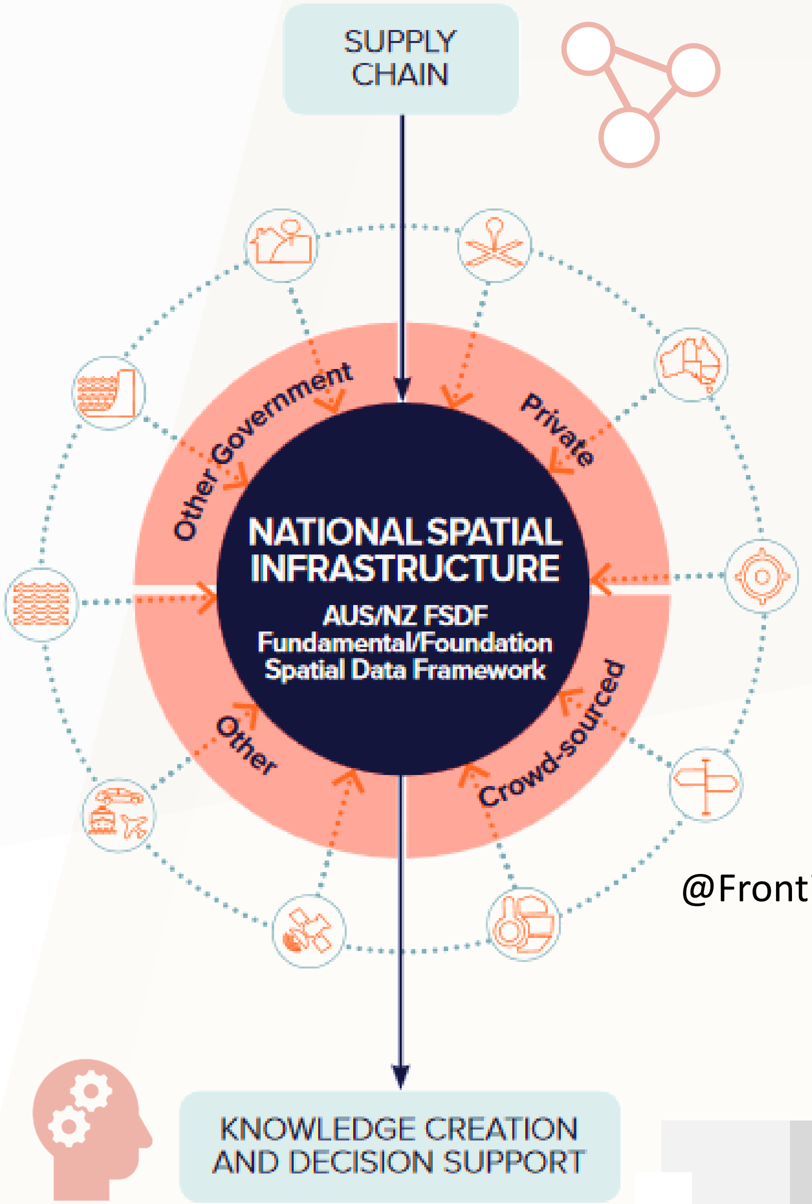
https://www.crcsi.com.au/assets/Resources/CRCSI-Program-3-overview.pdf

https://www.crcsi.com.au/

Spatial Knowledge Infrastructure

Vision Statement

"a network of data analytics, expertise and policies that assist people, whether individually or in collaboration, to integrate in real-time spatial knowledge into everyday decision-making and problem solving"



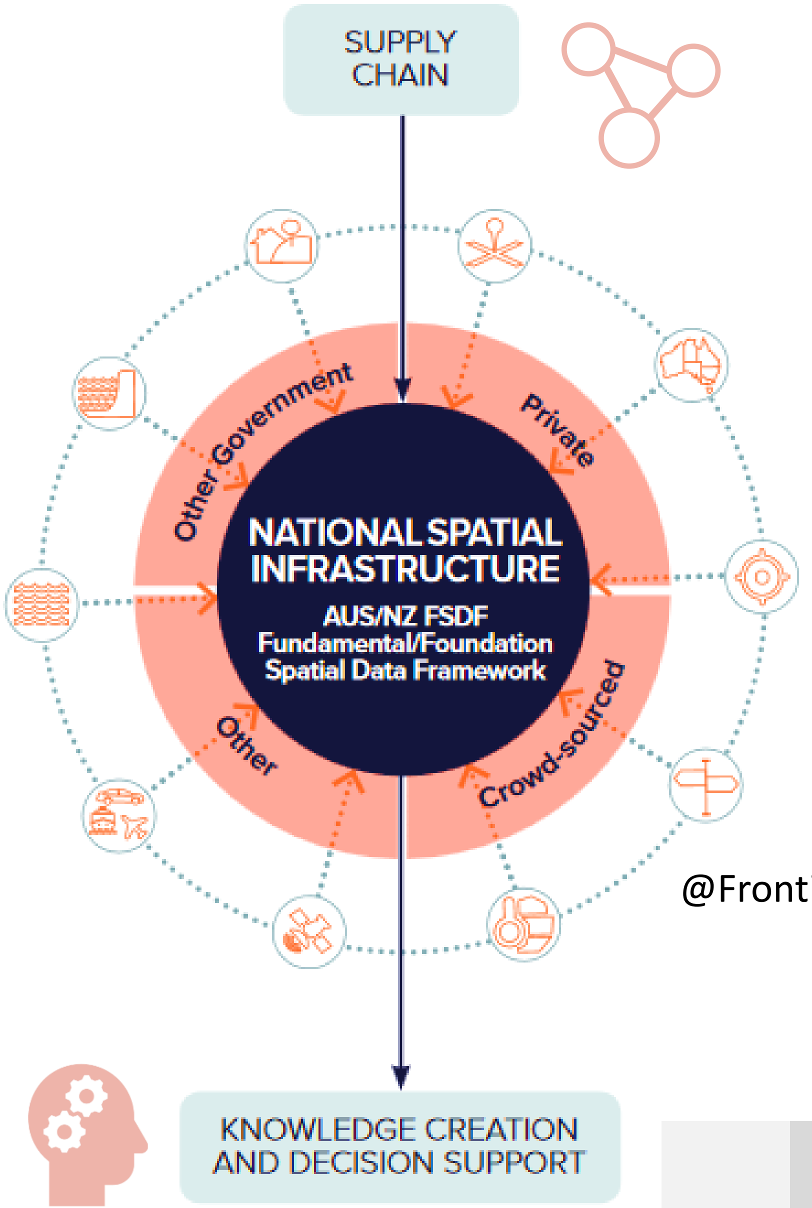
@FrontierSI

Paradigm Shift

Spatial Data Infrastructure	=	Web 2.0

Spatial Knowledge Infrastructure	=	Web 3.0 Semantic Web

SKI is a fundamental change in approach and challenges our underlying assumptions on how we manage, share and use GI.



@FrontierSI

Semantic Web

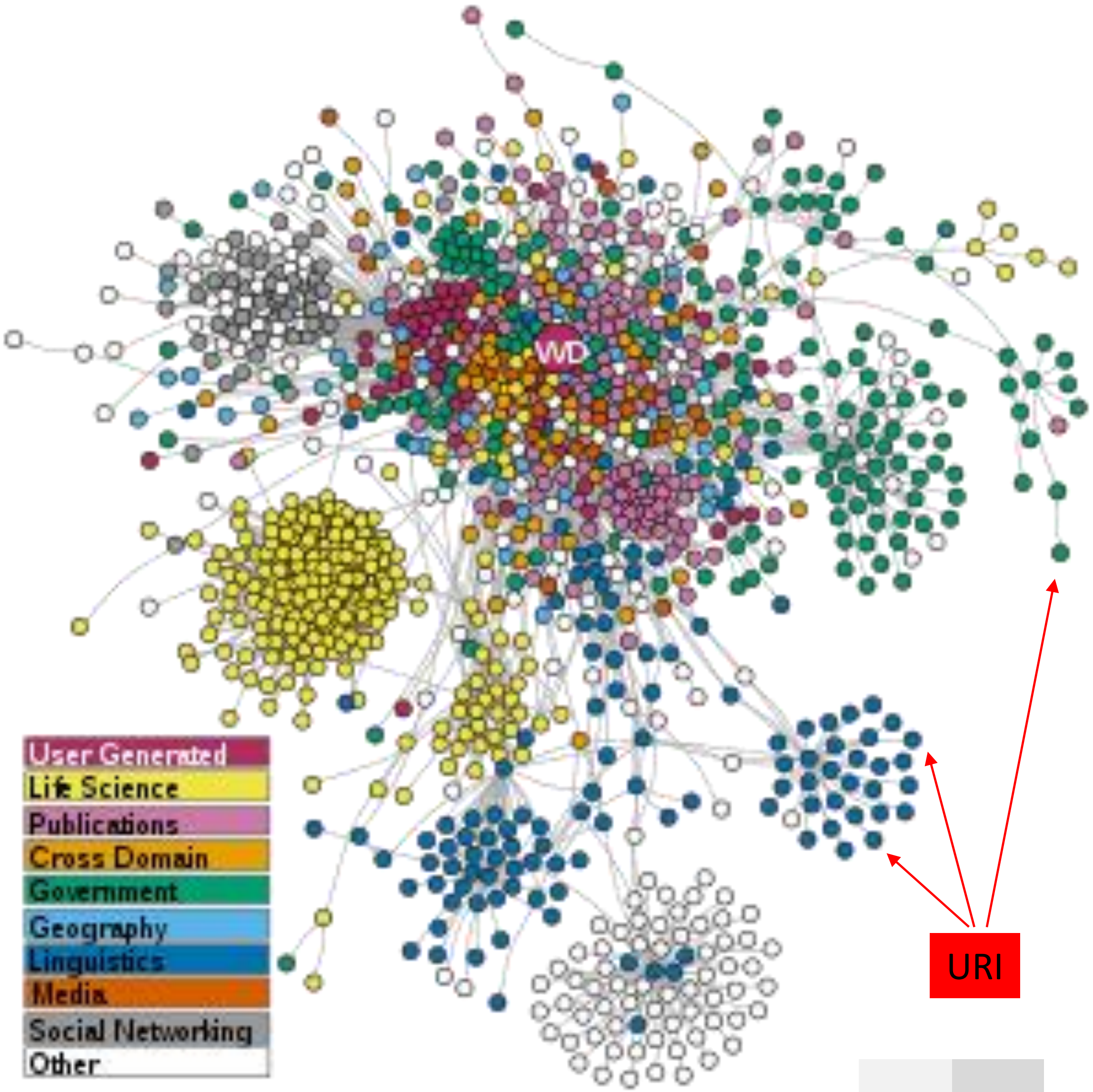
Is a vision of the Web of Data where everything is connected.

Linked Data is the means to achieve this vision.

- Sematic Web is the what!
- Linked Data is the how!

Linked Data has an address called a URI (Unique Resource Identifier).

Countries are now developing Linked Data Registries.

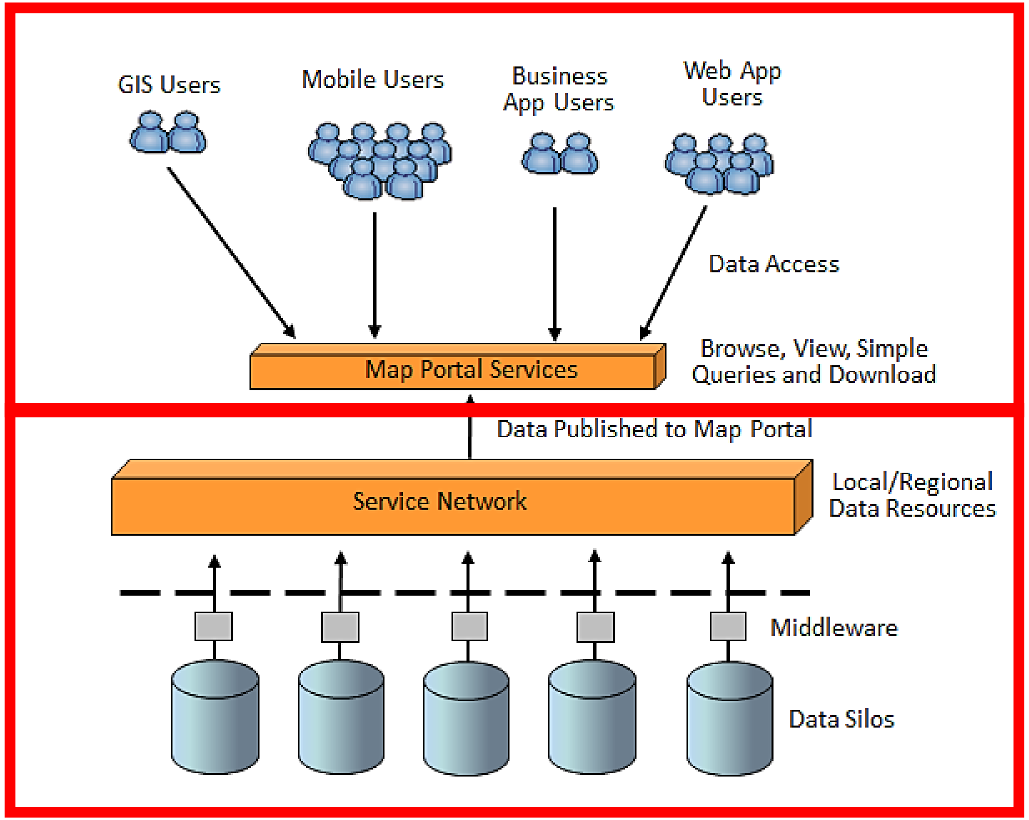


@Wikipedia

SKI builds on current SDIs.

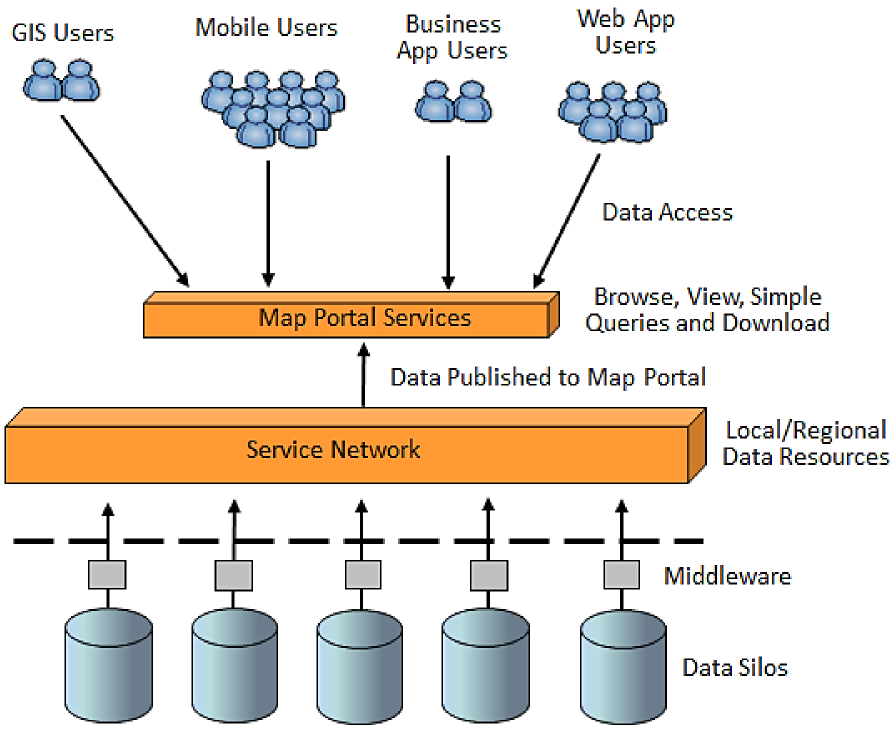
We can transform SDIs to make it easier for machines to connect the dots.

SDI
Enabling infrastructure



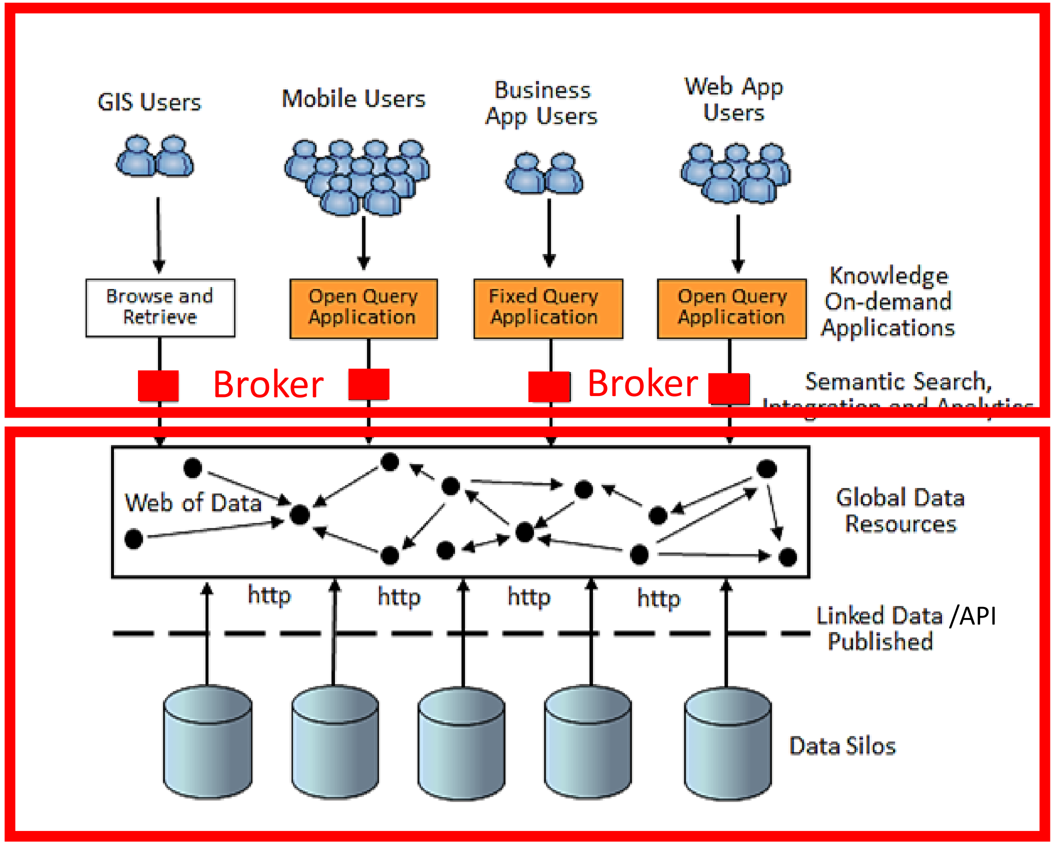
Human-accessible Data

SDI
Enabling infrastructure



Human-accessible Data

SKI
Enabling infrastructure



Machine-accessible Data

Applications Environment

All sorts of **smart** applications – real-time conflation service, federation service, smart search, smart flood models, smart processes.

SKI

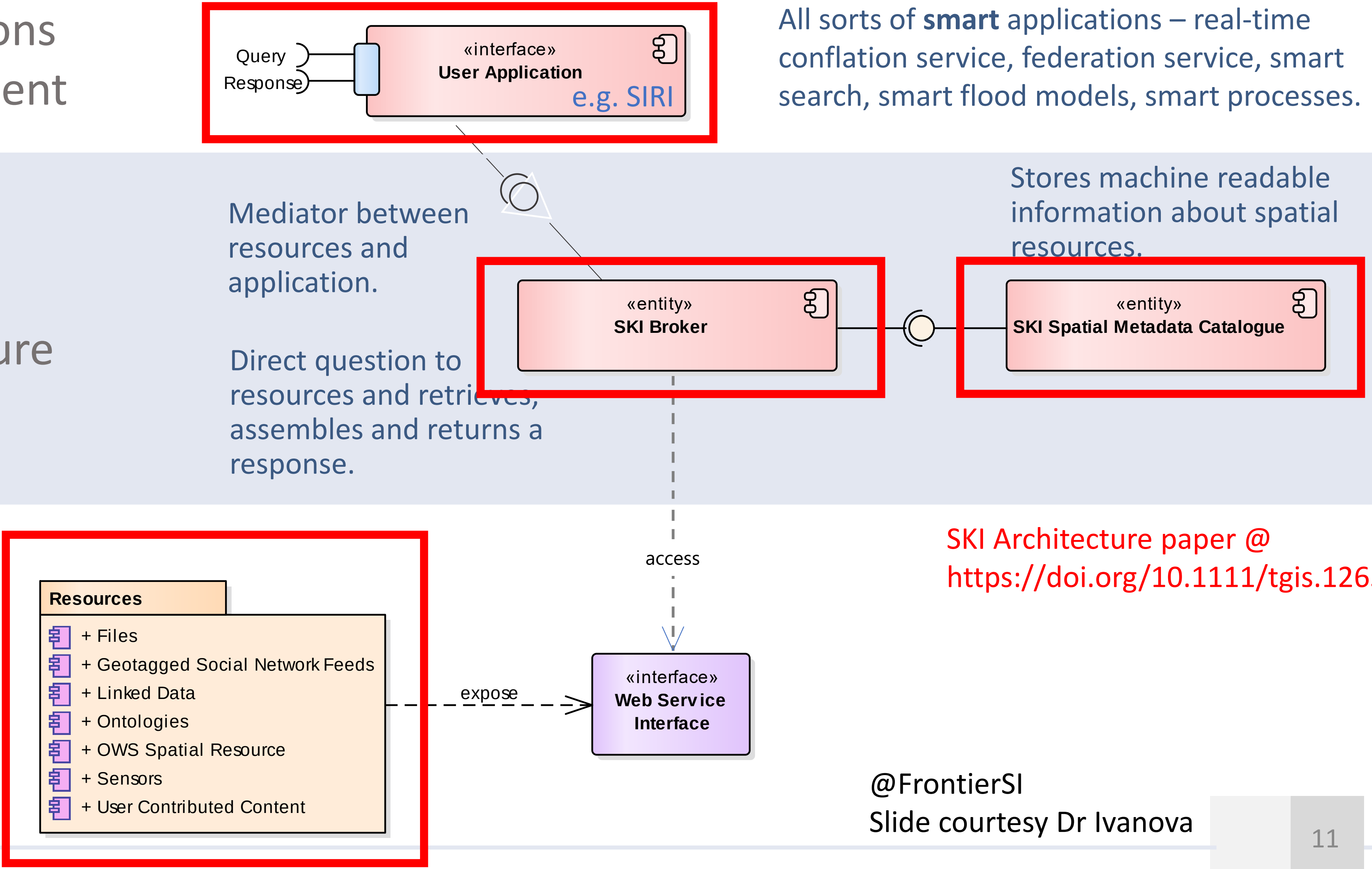
Architecture

Mediator between resources and application.

Direct question to resources and retrieves, assembles and returns a response.

Stores machine readable information about spatial resources.

Data Resources

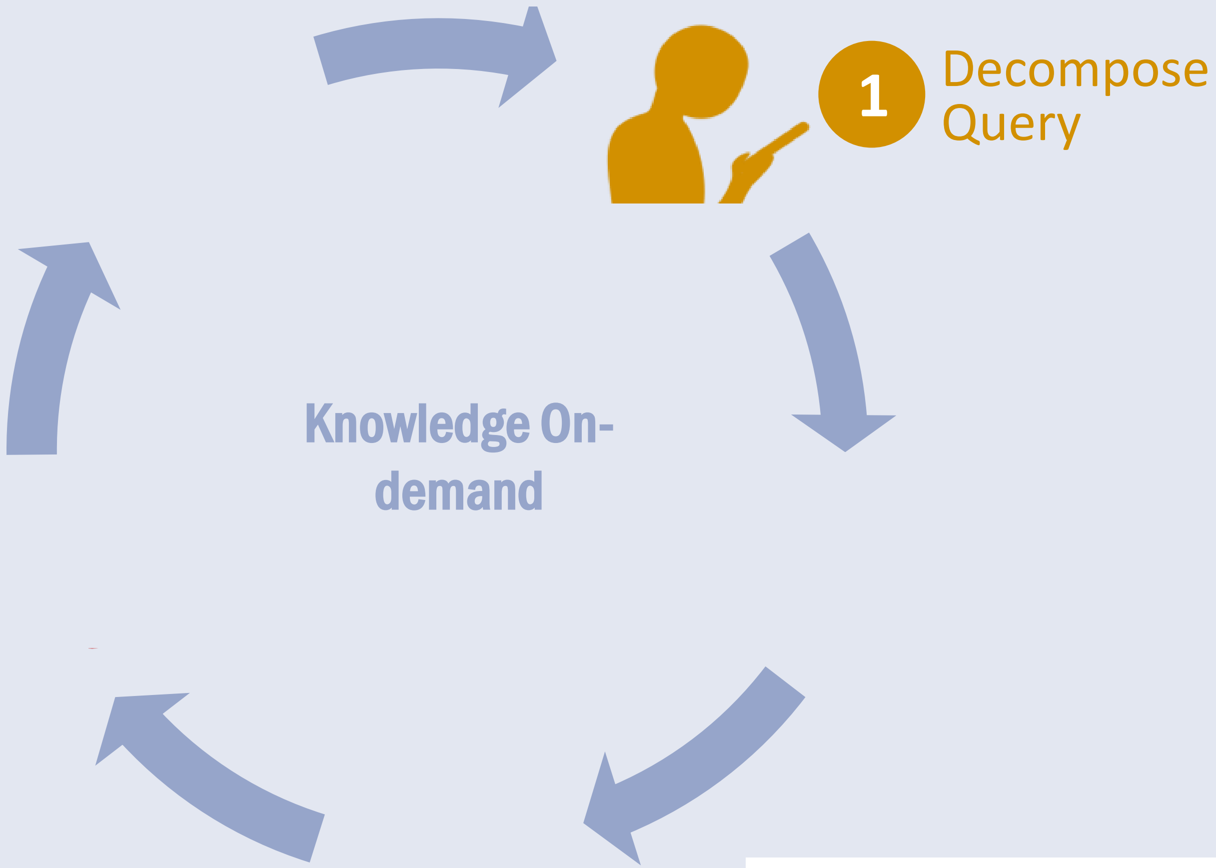


SKI Architecture paper @ https://doi.org/10.1111/tgis.12656

@FrontierSI
Slide courtesy Dr Ivanova

The ultimate aim is Knowledge On-demand?

"Can I use this land for a market garden?"



"Can I use this land for a market garden?"

Natural Language Processing

Which...?

Where is...?

Difference between...?

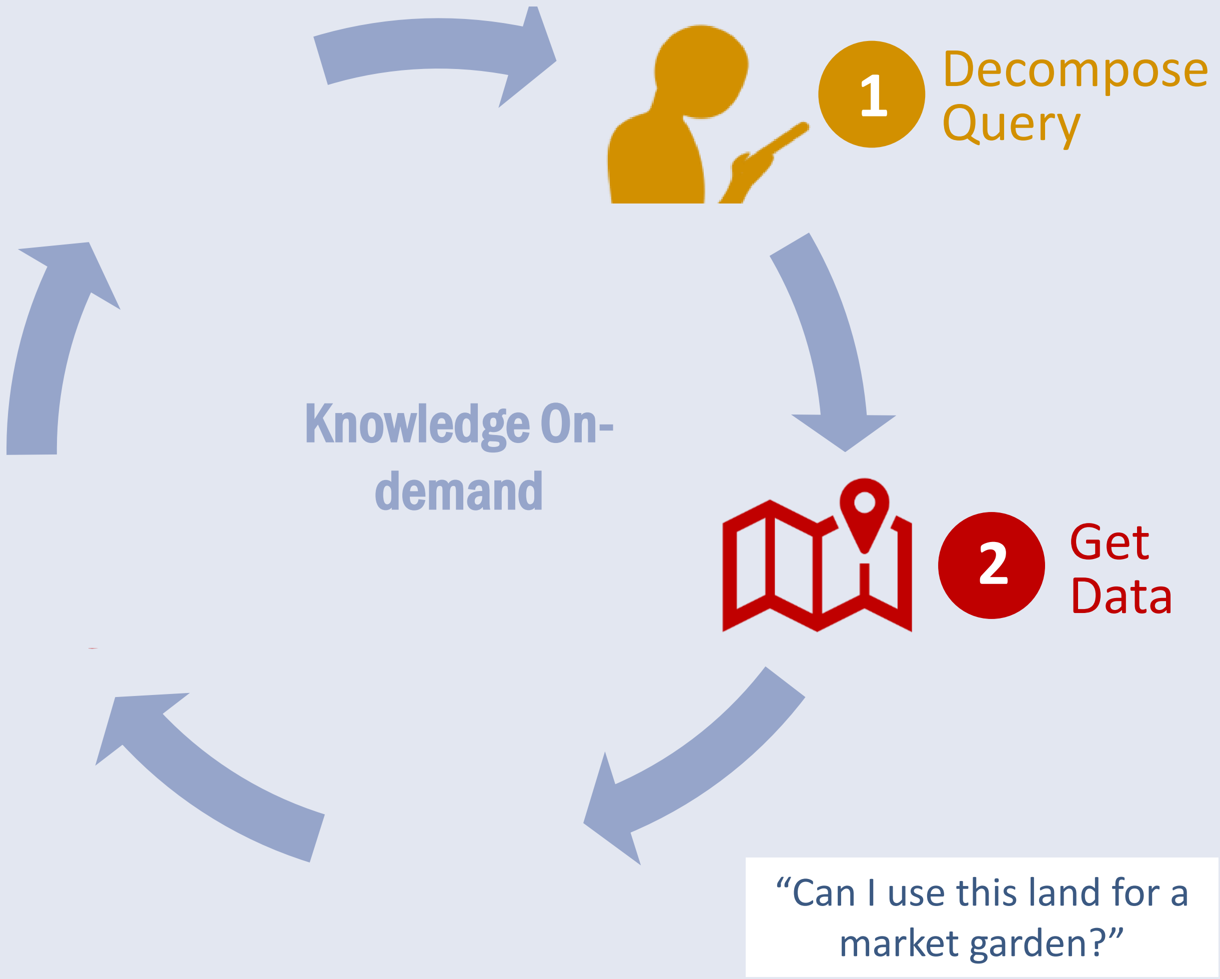
How far.....?

Best location...?

Land use for....?

Risk of flood here....?

How much....?



Semantic Search and Spatial Filtering

Search for subject

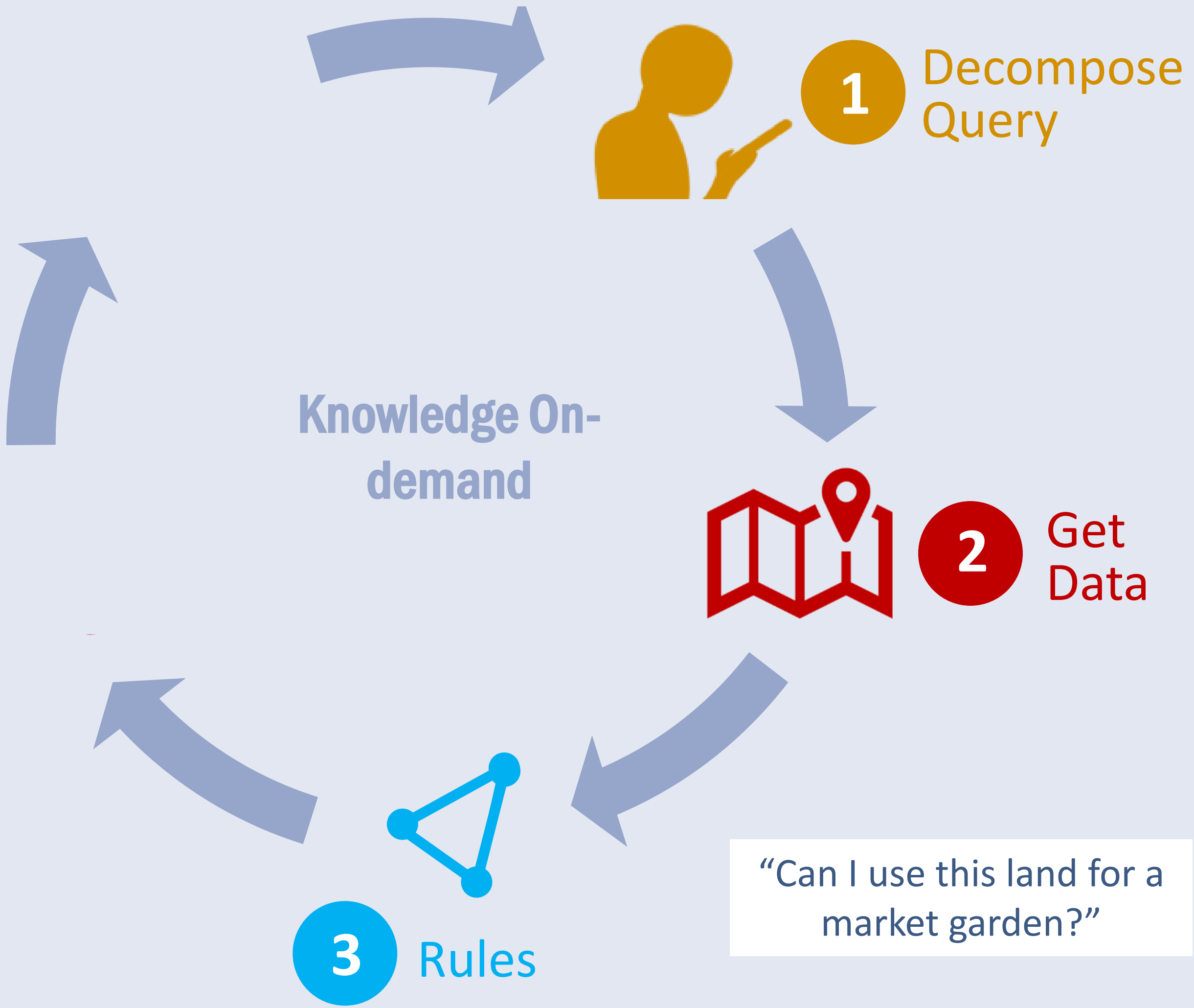
Flood, crop yield, soil, address, water restrictions etc

Rights, Restrictions and Responsibilities on (RRR) on Land.

Filter for Location

Where I am…
Where I am going to…
Where they are…
Somewhere else…

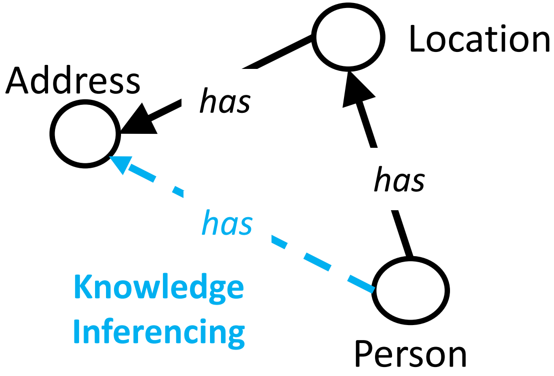
Get the URI address for the data



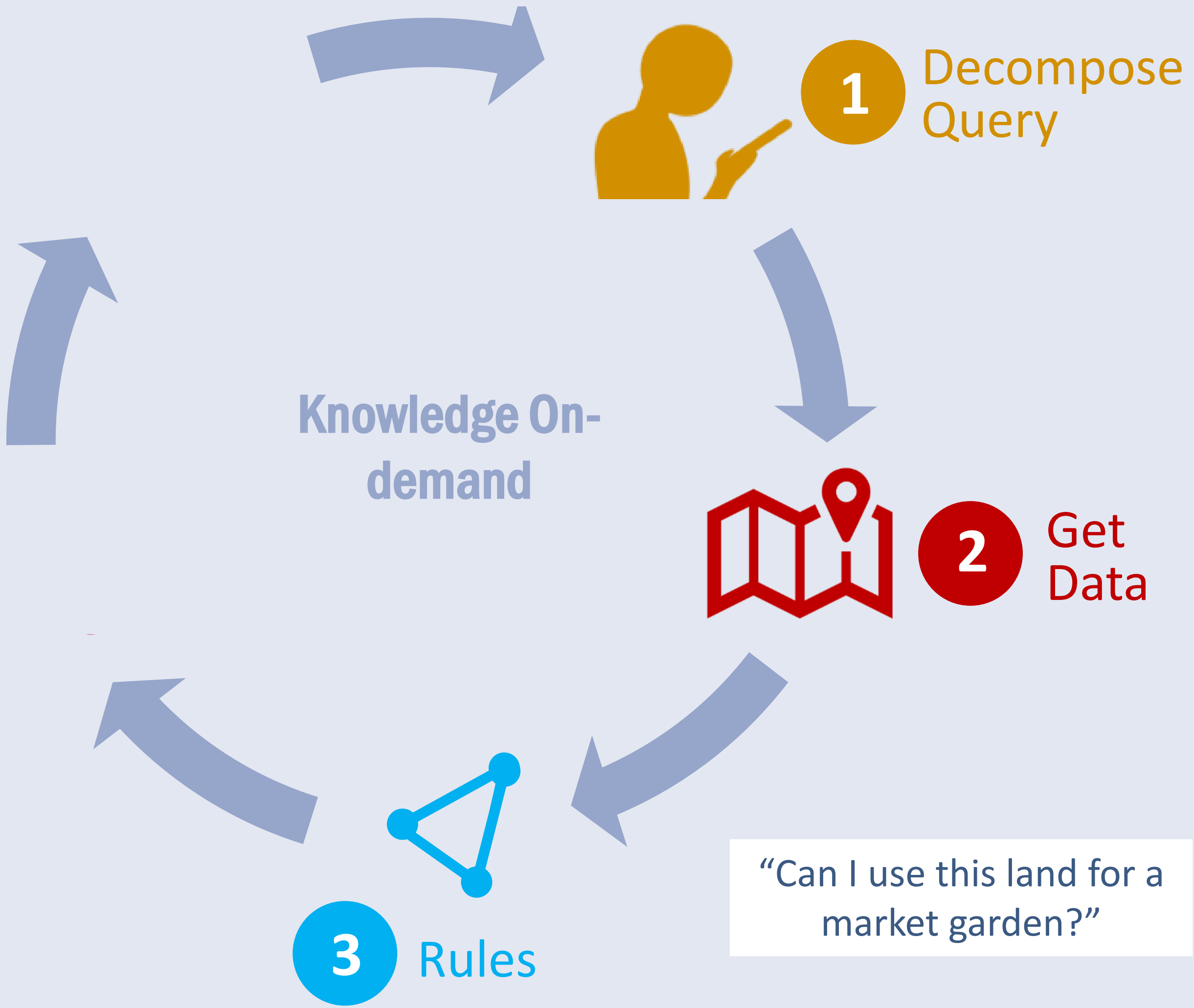
Domain Ontology and knowledge Graphs

<u>Data Model</u> that explains how each element in the knowledge domain relates.

It sits outside a database as opposed to within.



Domain Ontology and knowledge Graphs



Model + Data = Knowledge Graph

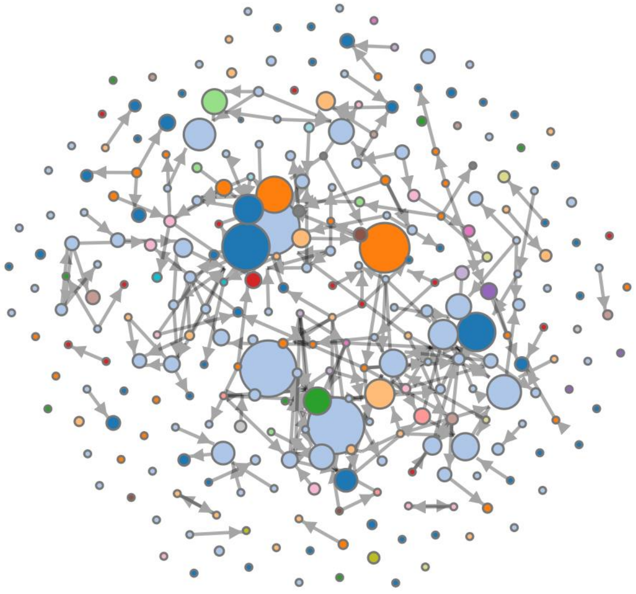
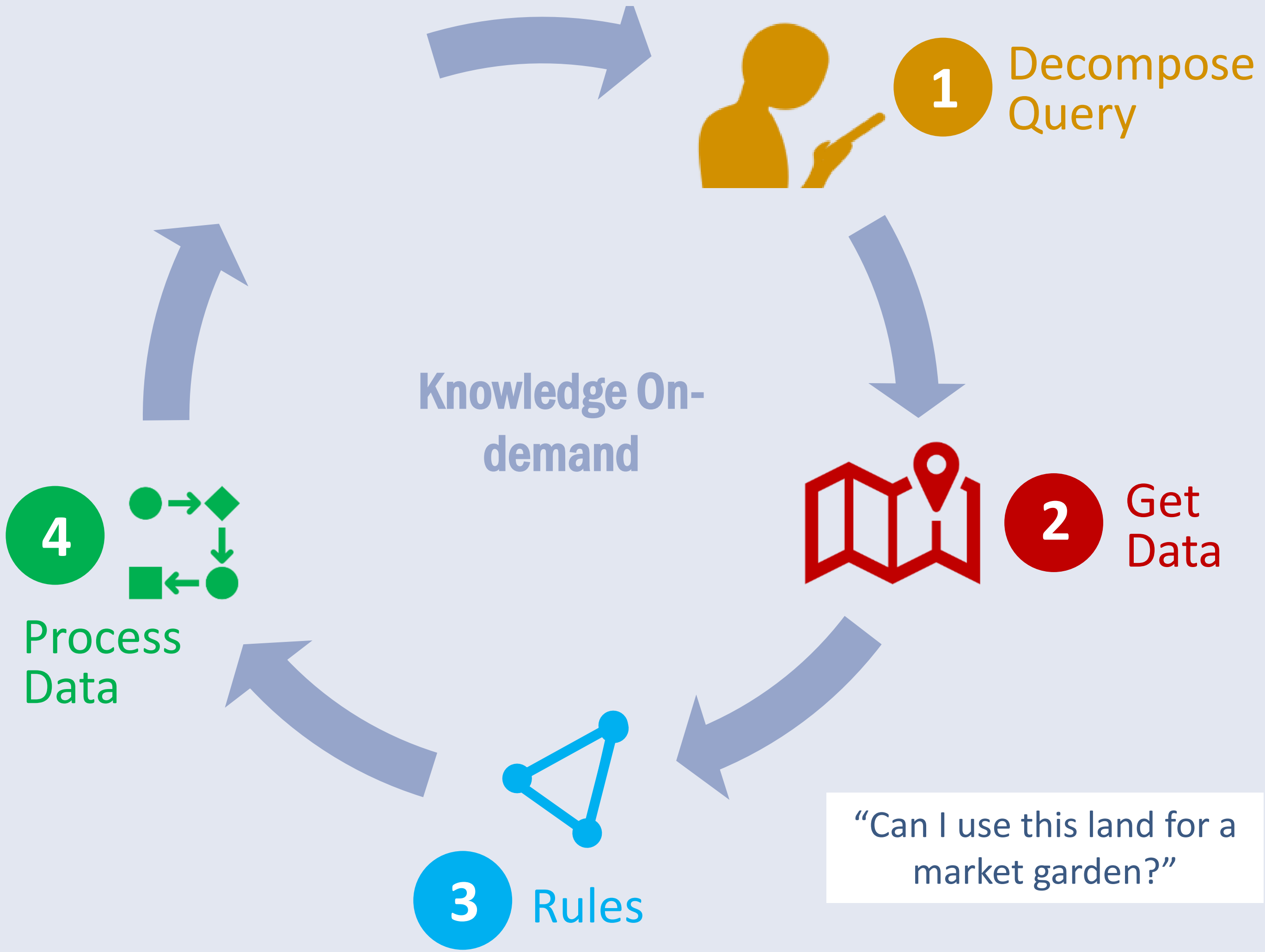
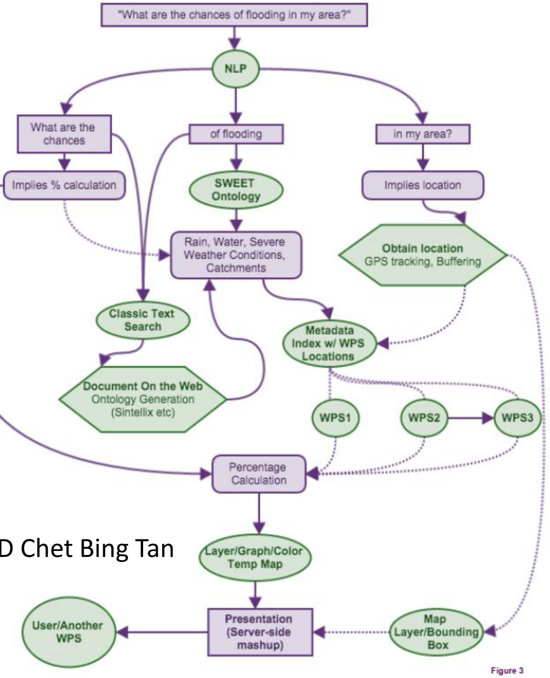


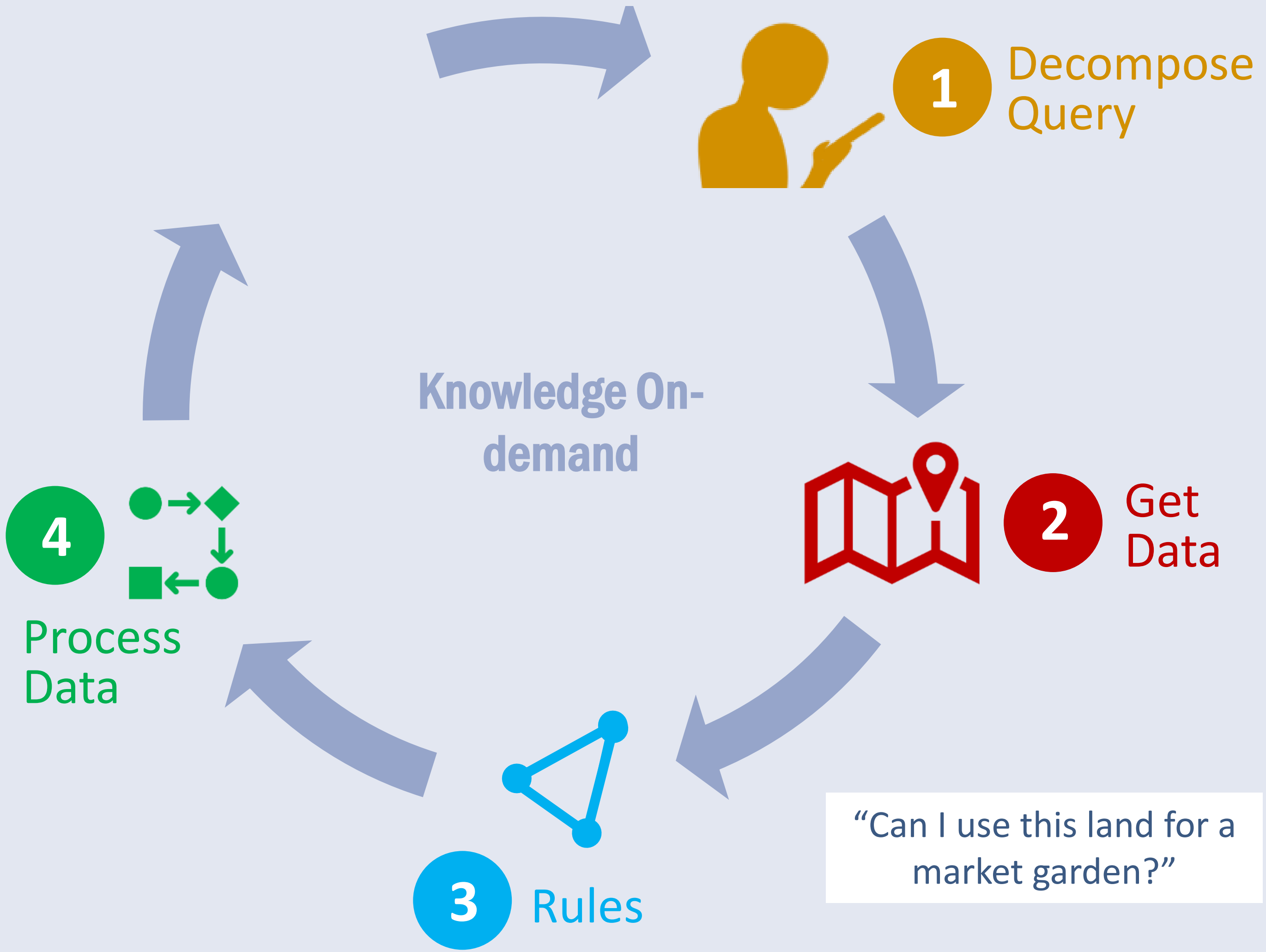
Image: www.copyrightevidence.org



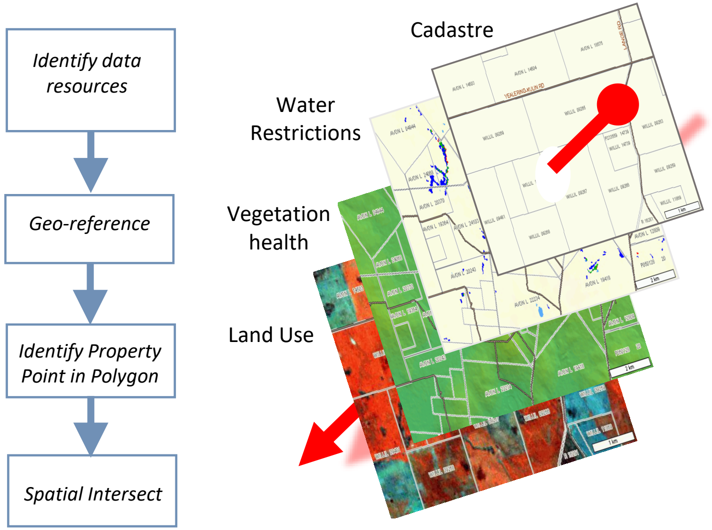
Repeatable Spatial Analytics Workflow -
Key to monitoring SDGs

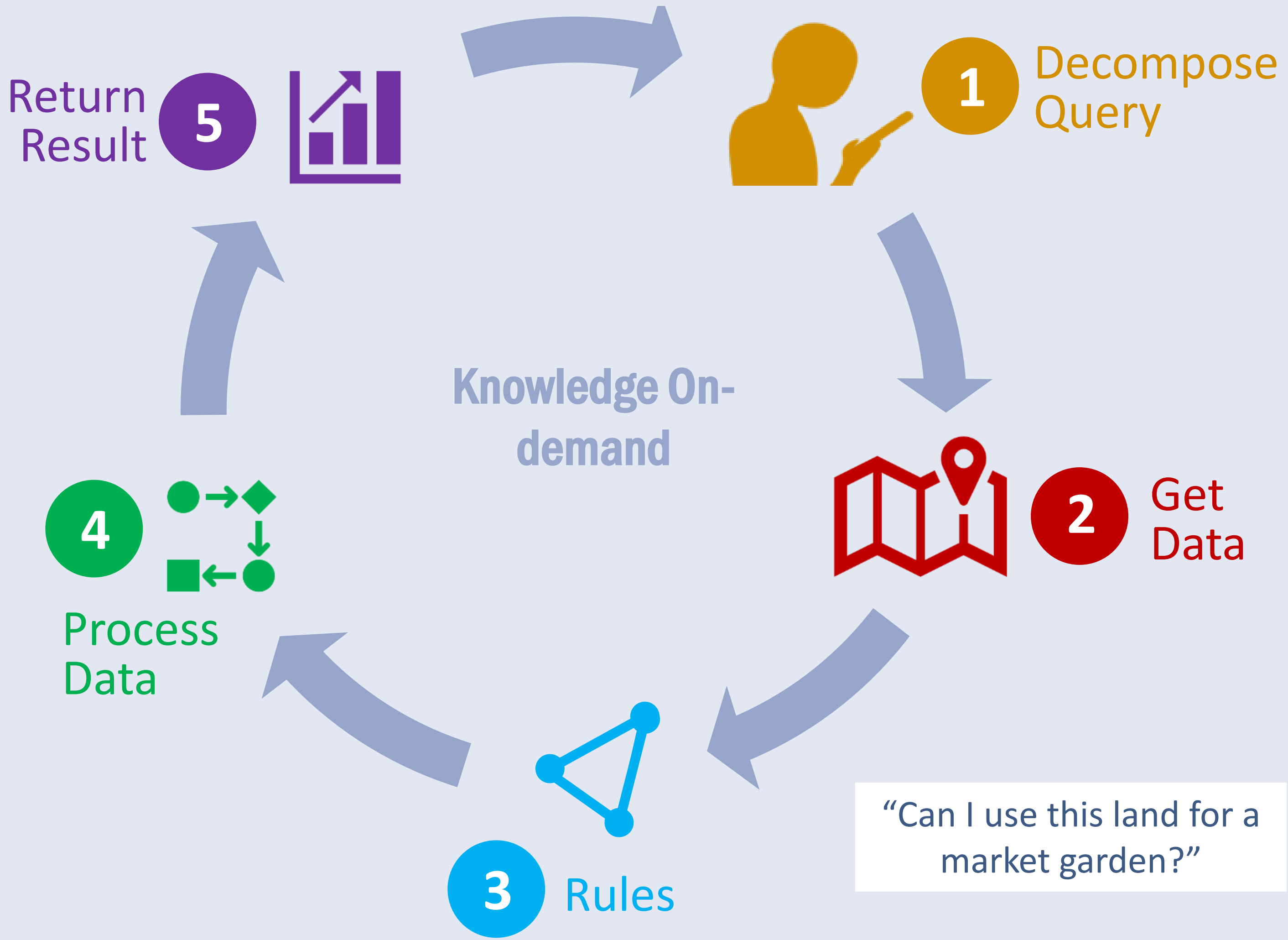


PhD Chet Bing Tan



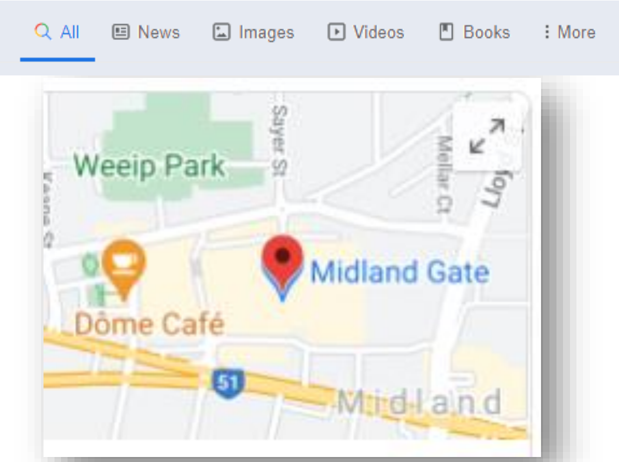
Repeatable Spatial Analytics Workflow

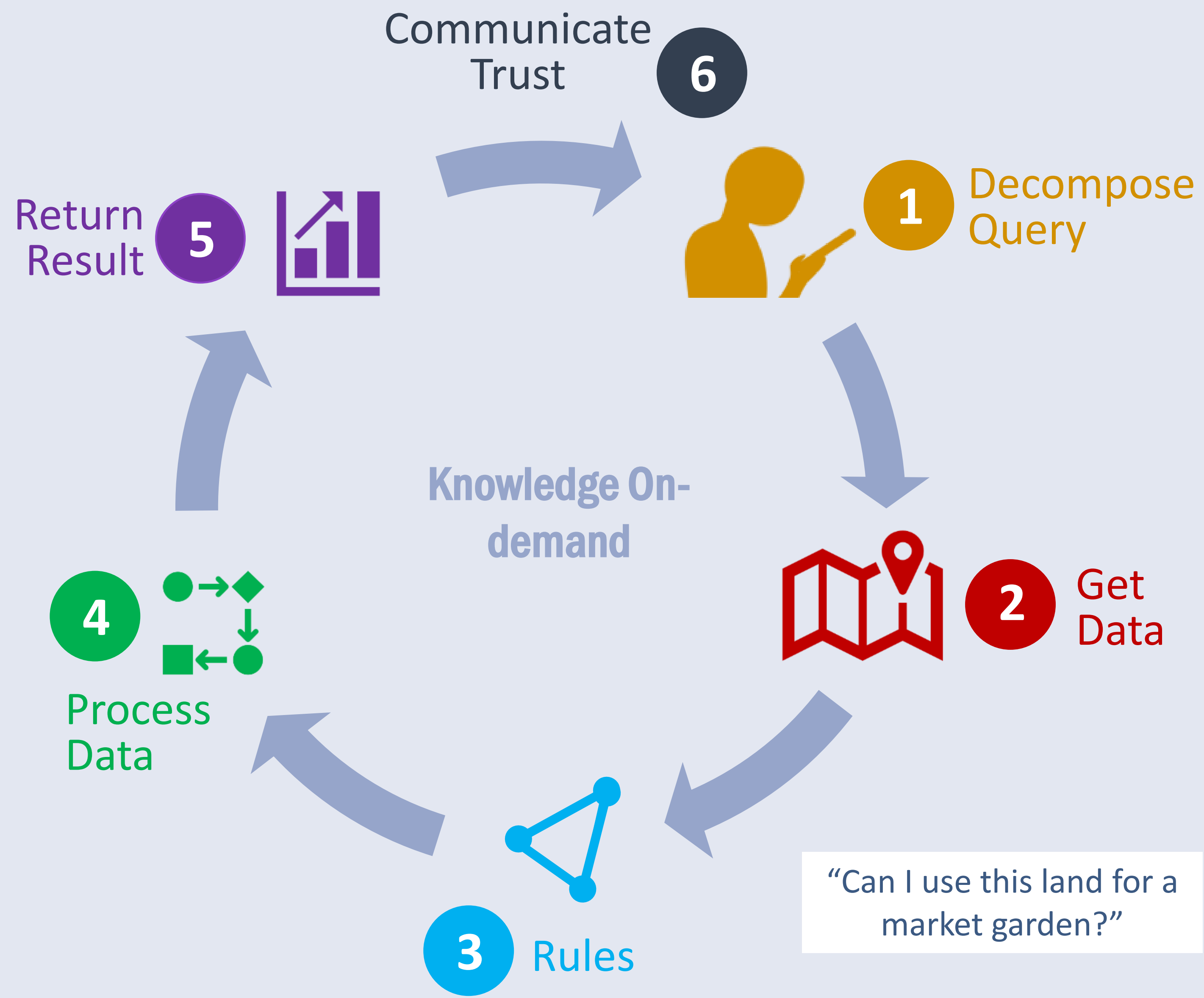




Return Results

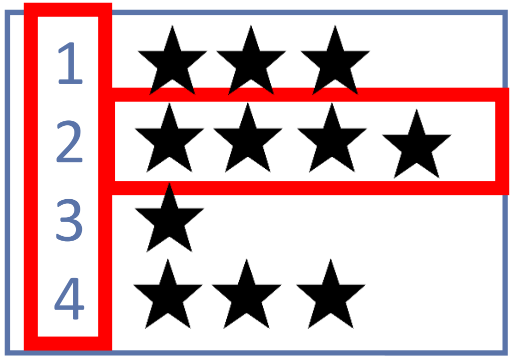
Text, map, graph, drawing, image, number/value, speech.





Rank and Rate Answer

Provenance Metadata



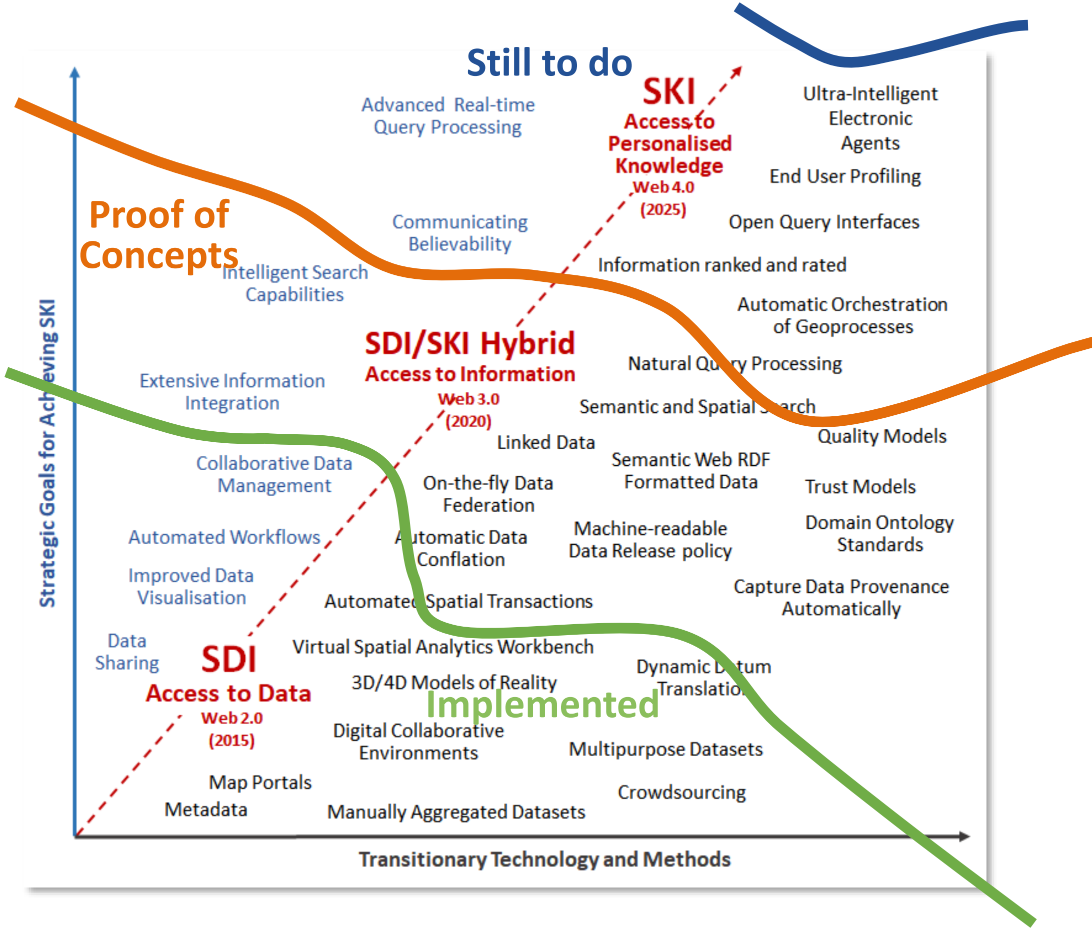
Rank = relevance
Rate = quality

How close are we to Knowledge On-demand?

The Web

3 Stages of Evolution

- **Web 1.0** — One-way interaction
- **Web 2.0** — Two-way participation
- **Web 3.0** — Linked Data (Semantic Web)

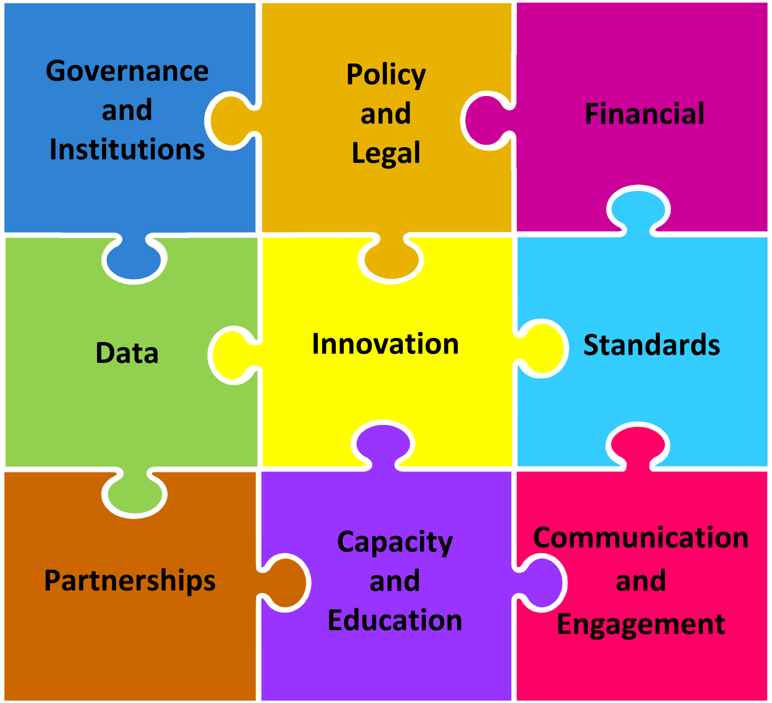


The focus to-date has been on technology only.

Integrated Geospatial Information Framework

- Expose – Linked Open Data, Ontologies, Vocabularies, Linkable Metadata
- Value proposition and socio-economic benefits
- Global governance and partnerships
- Machine-actionable Standards - W3C, ISO
- Encourage start-up innovations
- Teach Semantic Web Technologies
- Data ethics - policies

IGIF = strengthen integrated geospatial information management and deliver knowledge on-demand

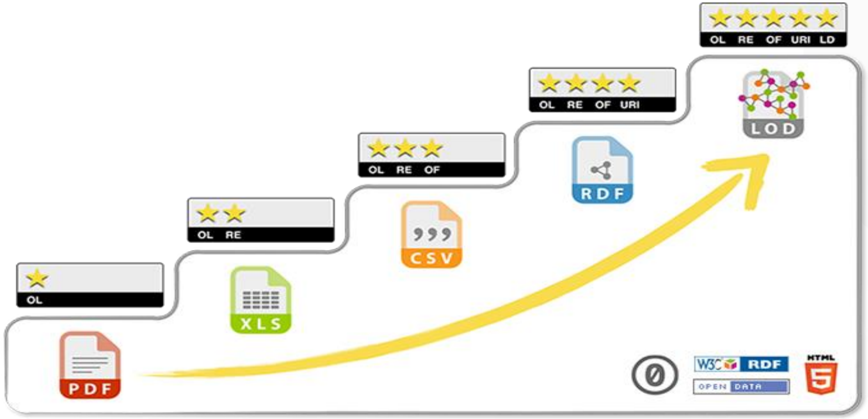


What can you do now?

Data

Exposing data as Linked Data and linkable metadata.

Create innovation opportunities

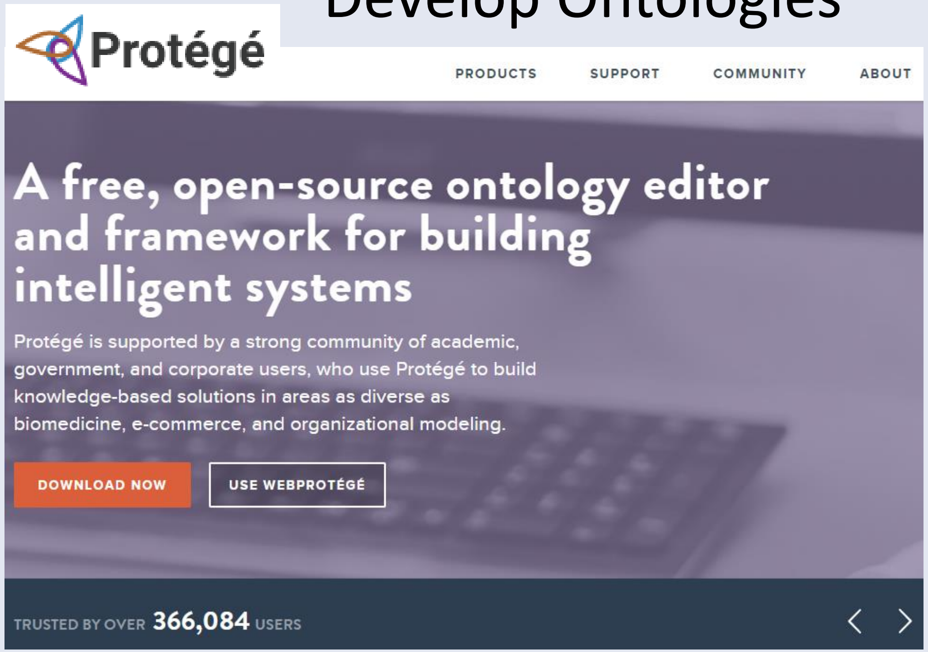


5-star Linked Open Data

ttps://5stardata.info/en/

Standards

Develop Ontologies



https://protege.stanford.edu

Existing Ontologies

https://www.w3.org/wiki/Lists_of_ontologies

GitHub

Lets move beyond SDIs
Our future depends on the decisions we make today!

Thank you

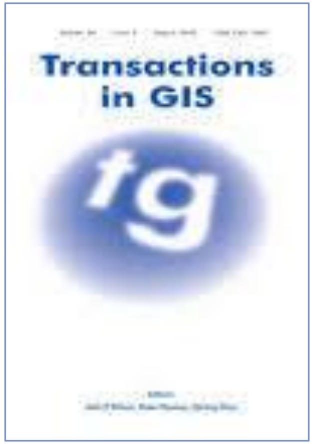
DR LESLEY ARNOLD
Specialist in Governmental Geospatial Information Policy and Practice

geospatialframeworks.com.au

MORE INFORMATION

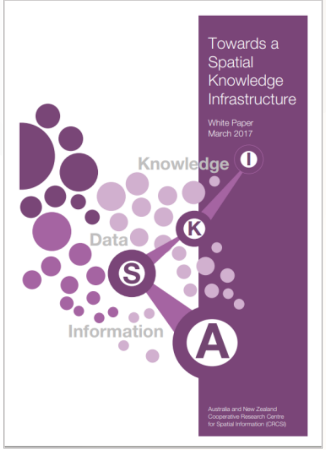
Knowledge on-demand: a function of the future spatial knowledge infrastructure

Lesley Arnold, David McMeekin, Ivana Ivánová and Kylie Armstrong



From spatial data to spatial knowledge infrastructure: A proposed architecture

Ivana Ivánová, Jeremy Siao Him Fa, David A. McMeekin, Lesley Arnold, Rob Deakin, Mathew Wilson



White Paper: Towards a Spatial Knowledge Infrastructure

Matt Duckham, Lesley Arnold, David McMeekin, Kylie Armstrong, Darren Mottolini.

Transforming National Mapping & Cadastre with Deep Learning

Nick Land, Business Development Manager, National Mapping & Cadastre, Esri

Nick is a senior manager at Esri with over 20-year experience working in the field of survey, mapping, cadastre, land registration, GIS, LIS, and SDIs. Before joining Esri, Nick was Executive Director of EuroGeographics – the European Association representing National Mapping, Cadastre and Land Registry Authorities. Prior to this, he was a Director at Ordnance Survey – Great Britain's national mapping agency.

In his current role at Esri, Nick's focus is on maximising the value of GIS in support of national mapping, cadastre and SDIs, including INSPIRE implementation.

In his presentation, Nick talked about artificial intelligence and how it can be applied to the work of the National Mapping and Cadastre Agencies - NMCAs, and in particular how it can be used to modernise map production. In the world of technology, we see many incremental changes and developments and then we see some bigger changes. The topic of Artificial Intelligence is one of those potential game changes for NMCAs.

Nick went through the challenges facing NMCA – from budget constraints and growing users' demands to increasing competition from alternative data providers and outdated architecture. These challenges are forcing NMCAs to think about their mission and their vision. Nick suggested that this mission is evolving. Still, they have a core mission is Delivering High Quality Authoritative Data. The challenge is to make this data as actual and as correct as possible. Many NMCAs are appointed geospatial data coordinators, underpinning National Geospatial Infrastructure, becoming centres of Geospatial Information Excellence, and showing where and how geospatial data play its important part.

Further, Nick demonstrated how AI could improve the map production, especially in the commencing stage of the mapping workflow – collection of data and identification of changes to various data features. Nick touched upon difference aspects of Deep Learning related to AI applications for mapping updates. He presented examples from Ordnance Survey Ireland, Cyprus, the Netherlands, Great Britain, and Kuwait. These use cases showed that use of AI/DLS allows NMCA to be more responsive, to improve data quality, to save time and money, to expand internal capacity and maximize return on investment.

In conclusion, Nick stated that

- Deep Learning and the use of Artificial Intelligence is delivering a real benefit now. It is going to be better and better, but it is clearly a very useful tool when it comes to change-detection and feature extraction.
- It is an iterative and incremental approach for gradual quality improvement and you have to be focused on your specific use case.
- Training data is an absolute key in the process, but we must see deep learning is one of the tools in the overall GIS toolbox.

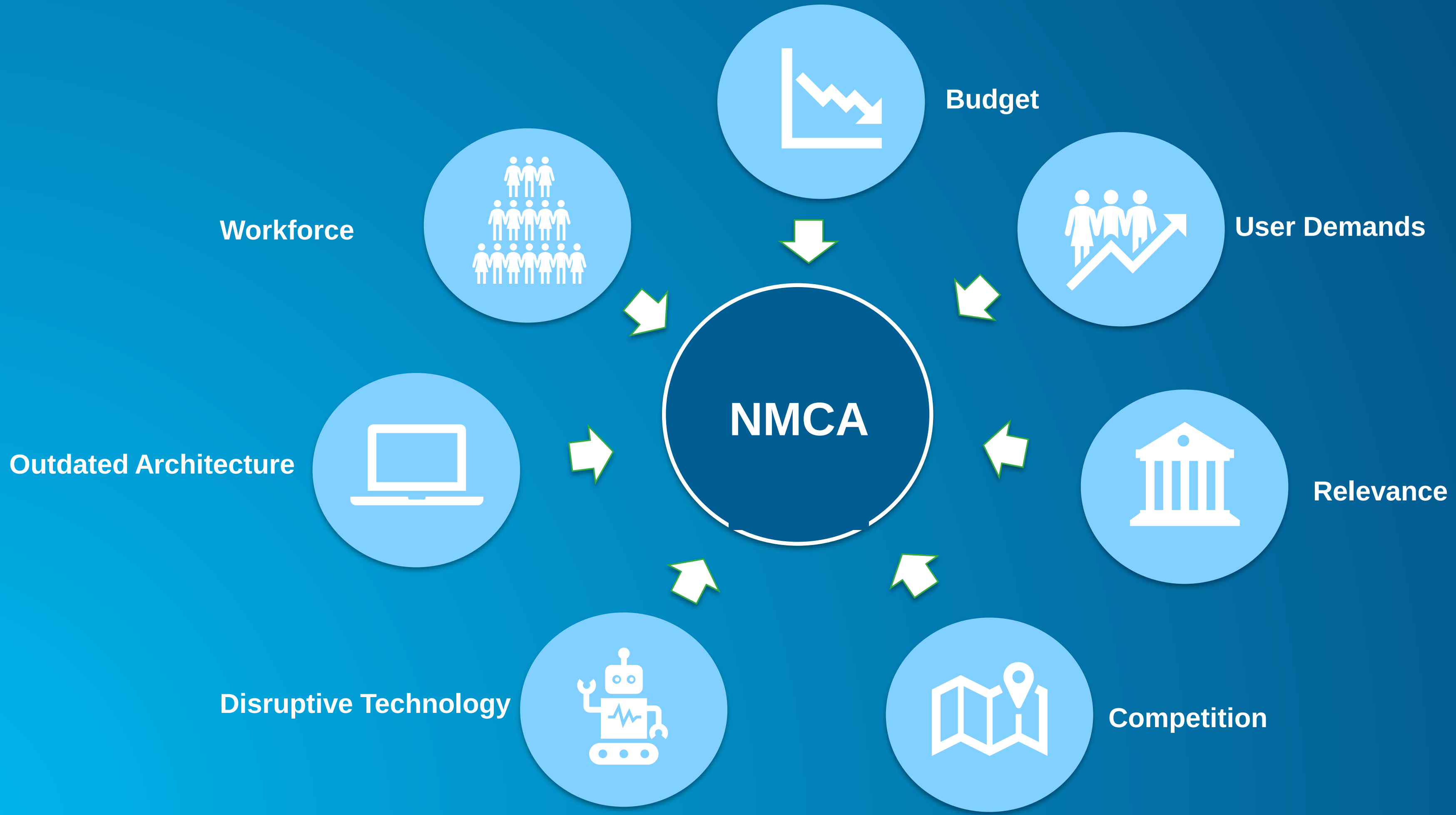
Transforming National Mapping & Cadastre with Deep Learning

Nick Land

Esri Inc

29th October 2021

Challenges Facing National Mapping & Cadastre Agencies (NMCAs)



National Mapping & Cadastre Agencies

Vision & Mission

Delivering High Quality Authoritative Data

- Real World; Near Real Time
- Easy to Find, Access & Use
- From ‘Data’ to ‘Geospatial Services’

Underpinning National Geospatial Infrastructure

- National Security
- Crisis Management
- Economic Growth
- Environmental Protection
- Climate Change
- Sustainable Development

A Centre of GI Excellence

- Customer & Partner focused
- Providing ‘answers to questions’
- Innovative & Collaborative

Underpinning Sustainable Development with Geospatial Information …

Map Production End to End Workflow

GIS Capabilities

Collect → **Manage** → **Produce** → **Share**

Collect
- Imagery & Remote Sensing
- 3D
- GeoAI
- Editing

Manage
- QA & QC
- Workflow Management

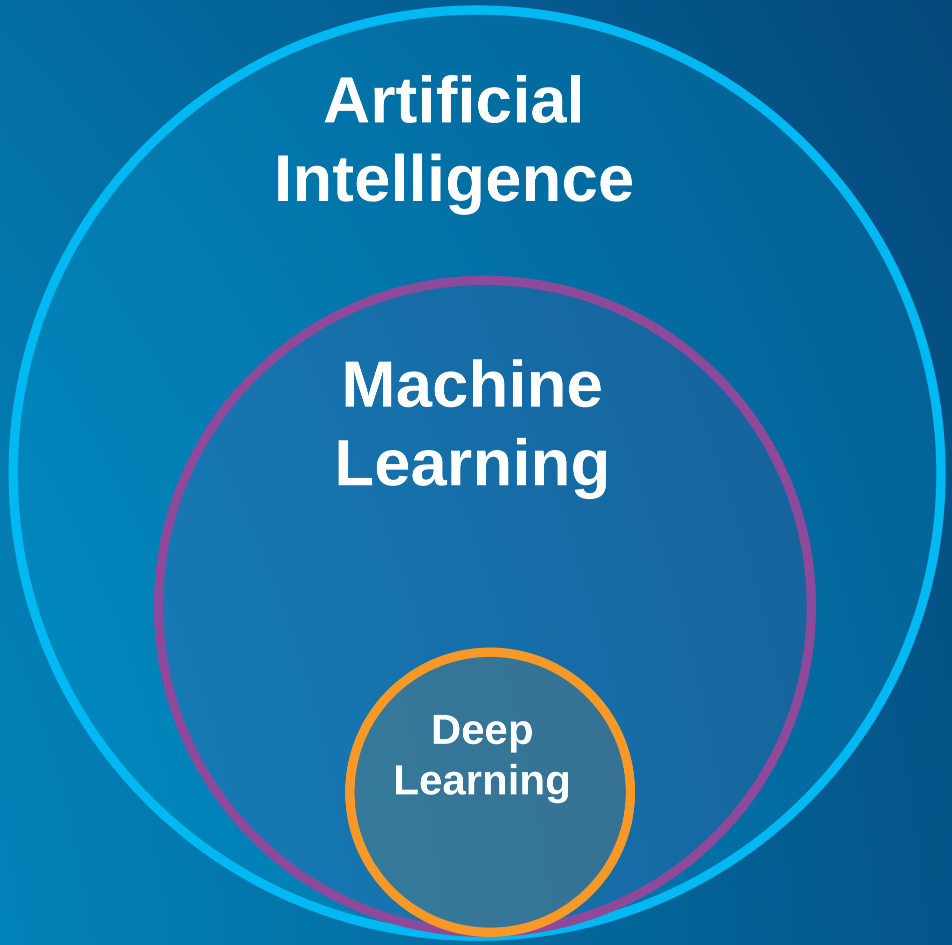
Produce
- Generalisation
- Cartography
- Spatial Analysis
- Data Science

Share
- Series Mapping
- Web Apps & Services
- Portals
- SDI

Transforming with Automation …

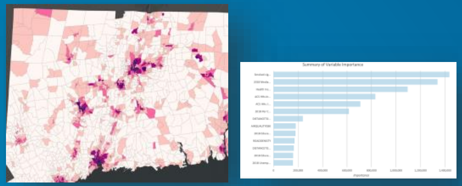
Why is AI State of the Art?

- Advances in AI
- Compute power (cloud)
- Availability of (big labelled) data
- Accessible
- Automation of workflows

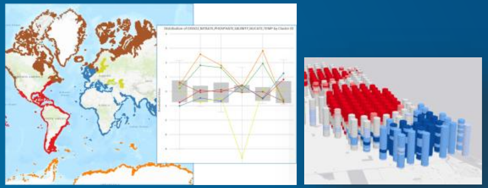


What Can Machine Learning Do?

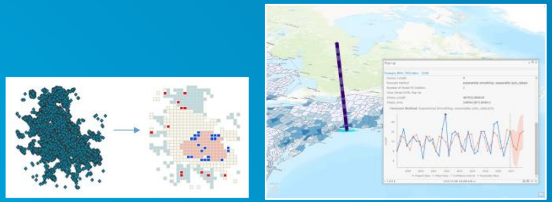
Extract features from
Imagery & LiDAR



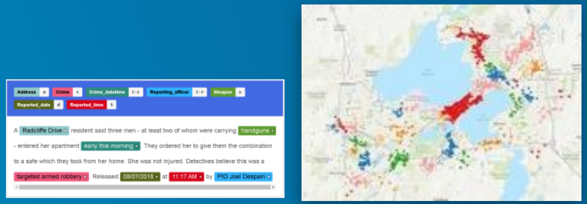
Make predictions



Find patterns & clusters



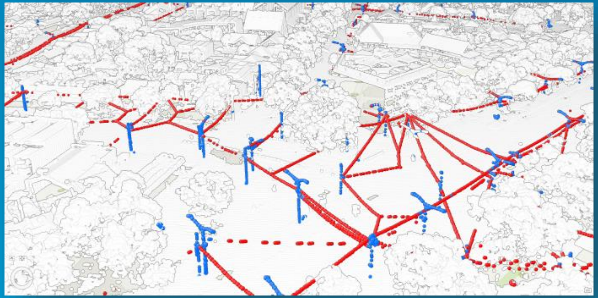
Detect anomalies



Extract insights from
unstructured text

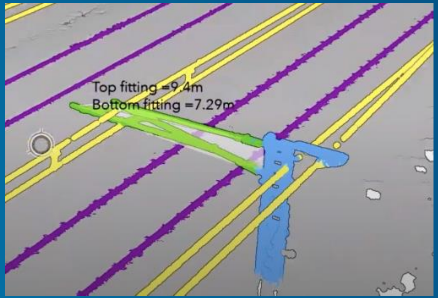
Feature Extraction from LiDAR

Utility poles and lines

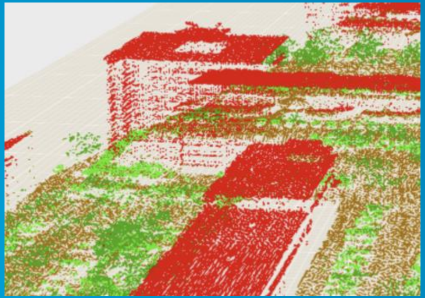


Streetlights

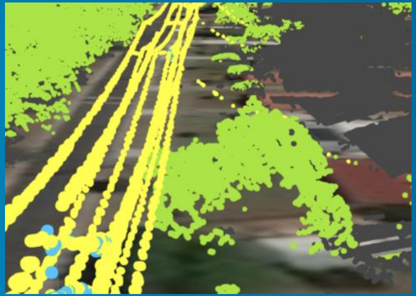
Rail assets



Buildings



Encroachments and trees



Object Detection, Pixel Classification, Object Classification from Imagery

Building footprints

Roads

Land cover

Parcel boundaries

Palm trees

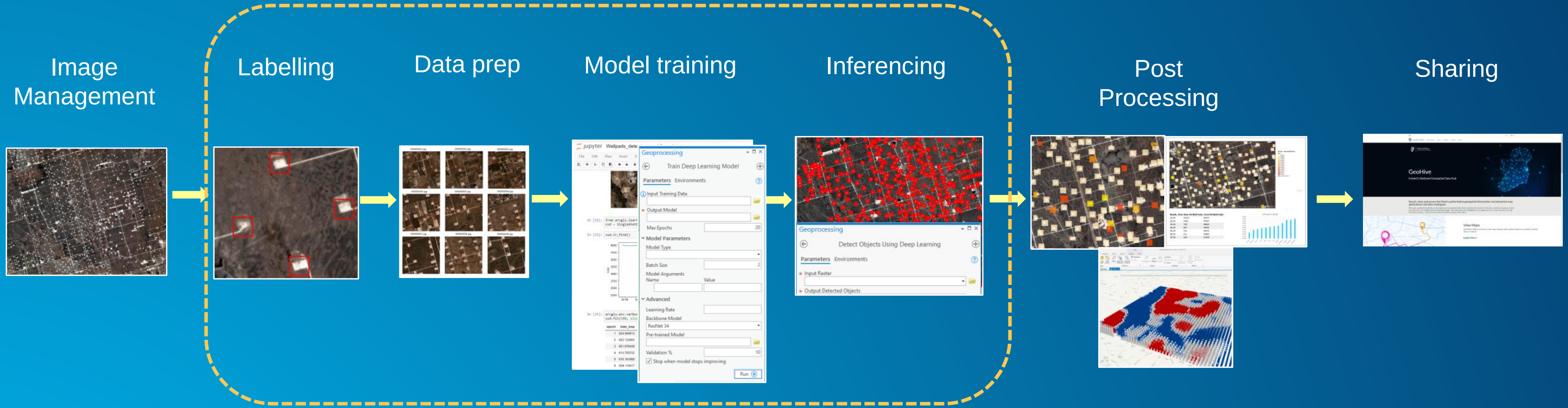
Oil pads

Swimming pools

Damaged structures

DL will detect what you can see in the imagery ……

Deep Learning Workflow



For Wide Range of Data Types

- Aerial
- Satellite
- Radar
- Lidar
- Motion imagery
- Bathymetry
- Point cloud
- Drone

Implementing Many Tasks

- Object classification
- Object detection
- Pixel classification
- Image translation
- Object tracking
- Scanned maps

Deep Learning Workflow

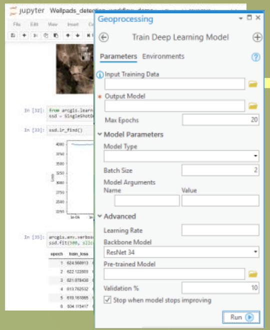
Pre-trained Models

Image Management

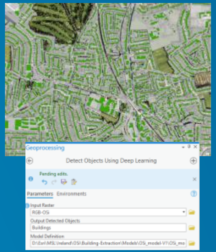
Labelling

Data Prep

Model Training

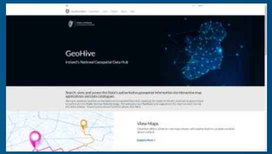


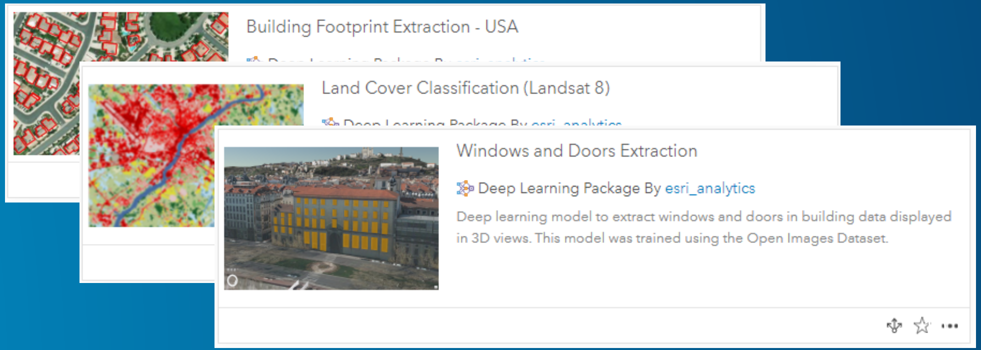
Inferencing



Post Processing

Sharing





Eliminates:

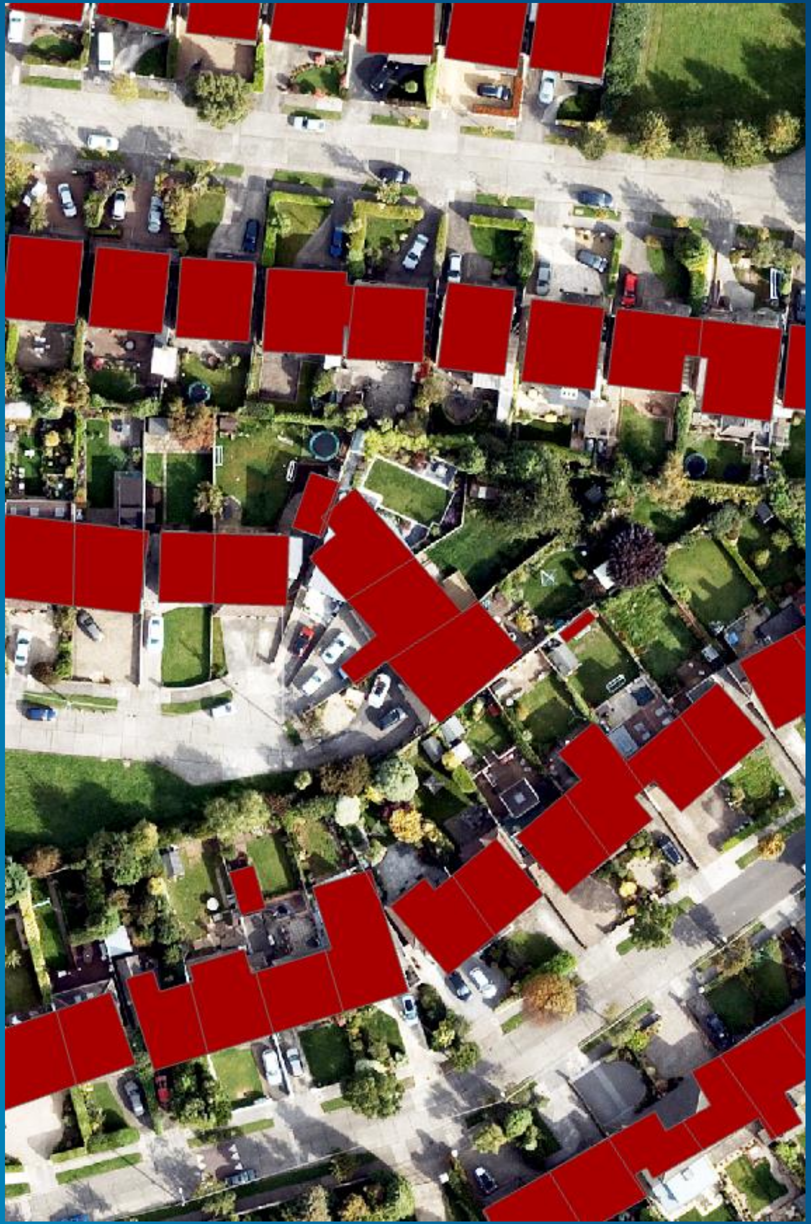
- Imagery requirements for model training
- Labelling requirements
- Training AI models
- Massive compute requirements

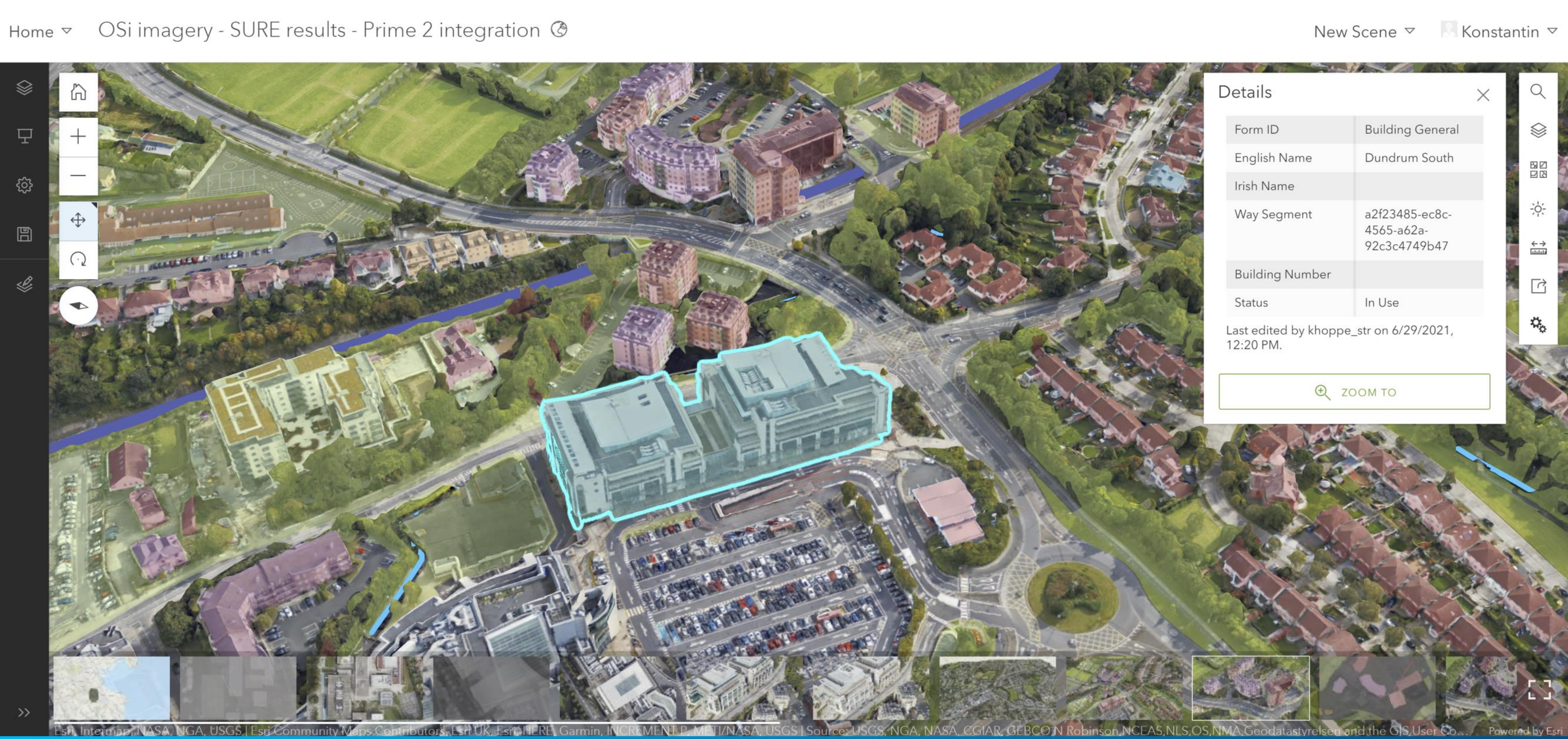
Applying DL

Ordnance Survey Ireland

Ordnance Survey Ireland (OSi)

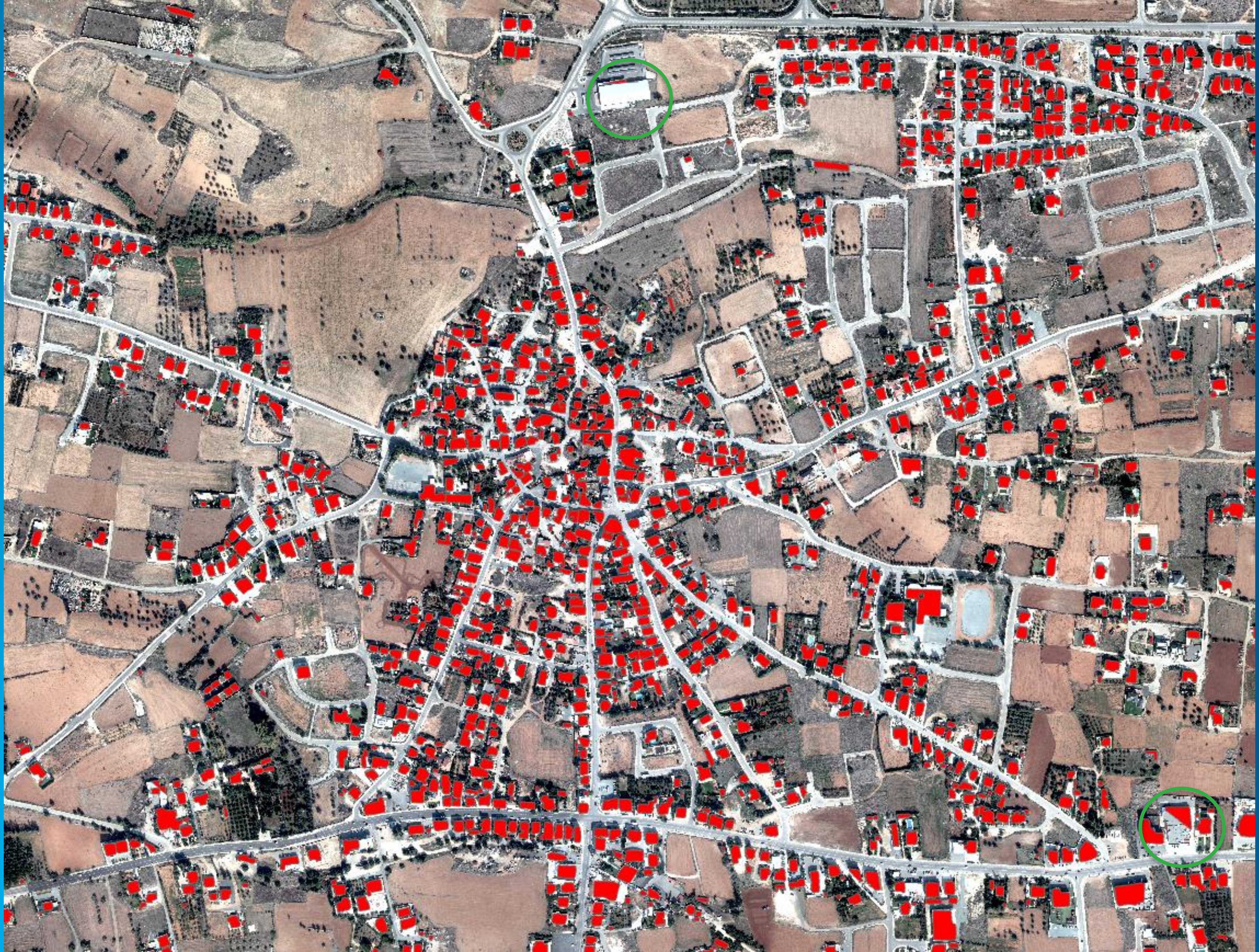
- Update & Quality Improvement of Prime2
- PoC with “Out of the box” capabilities
- New Imagery Strategy

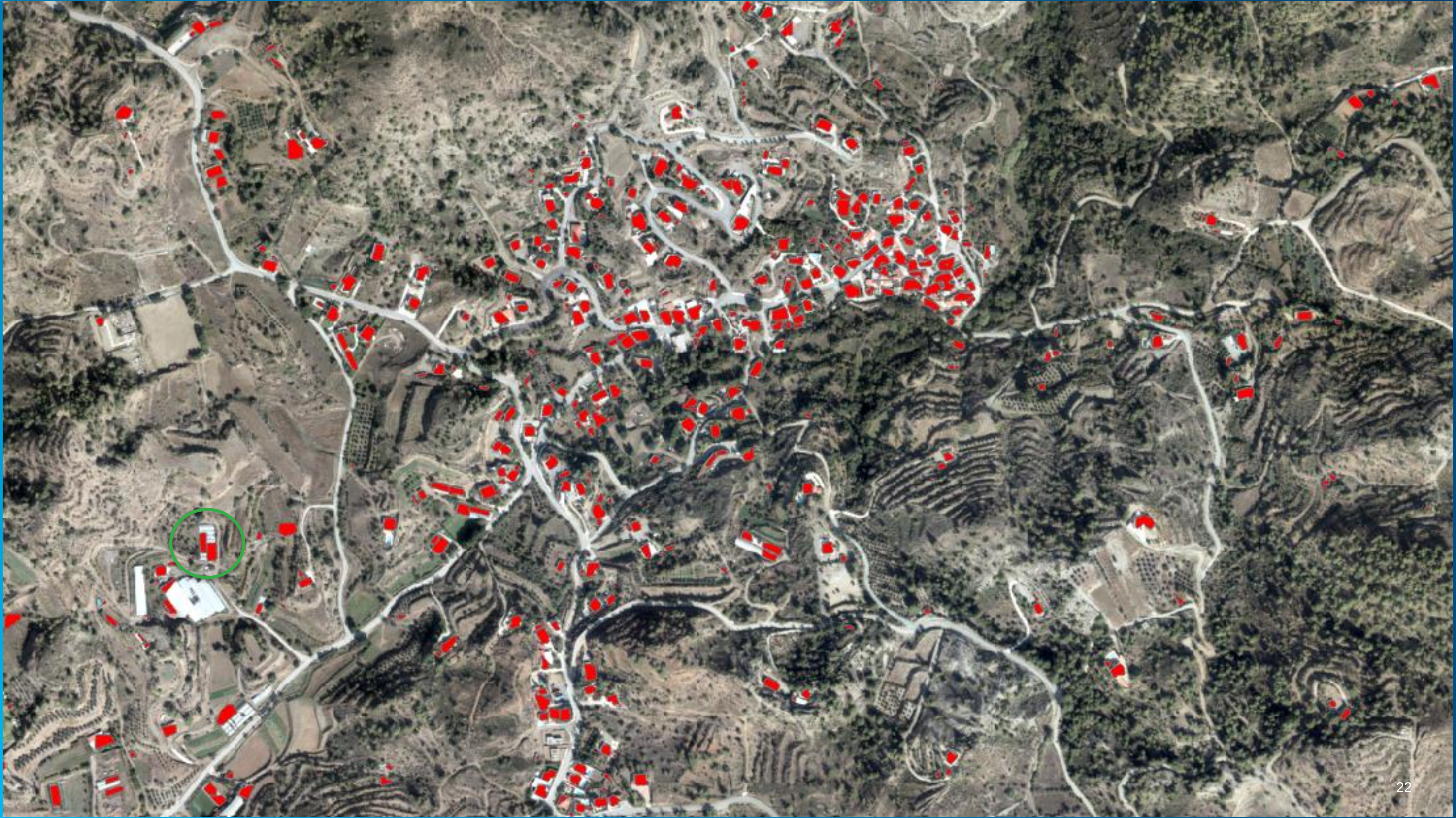


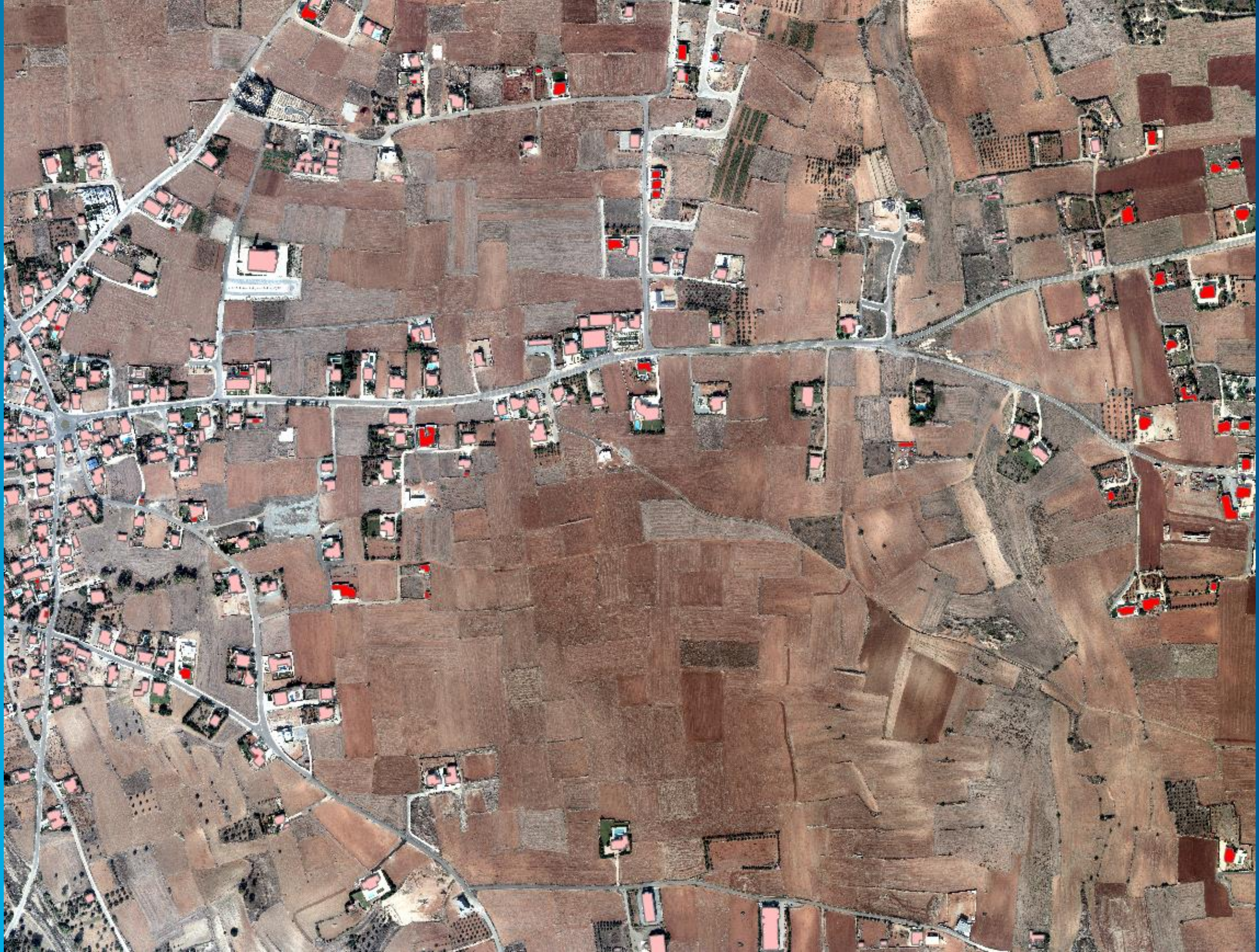

Home
OSi imagery - SURE results - Prime 2 integration
New Scene
Konstantin
Details
Form ID
Building General
English Name
Dundrum South
Irish Name
Way Segment
a2f23485-ec8c-4565-a62a-92c3c4749b47
Building Number
Status
In Use
Last edited by khoppe_str on 6/29/2021, 12:20 PM.
ZOOM TO
Powered by Esri

Applying DL

DLS Cyprus





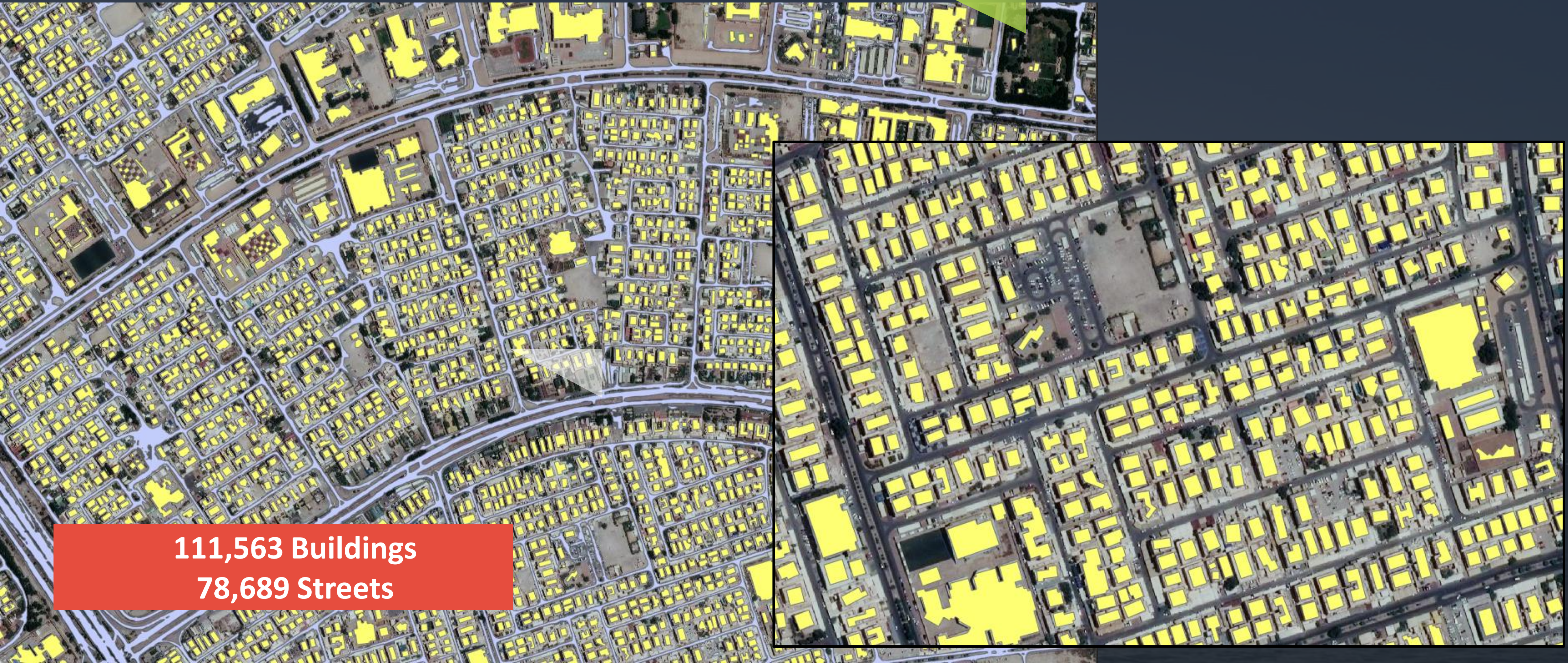


Applying DL

PACI Kuwait

Output

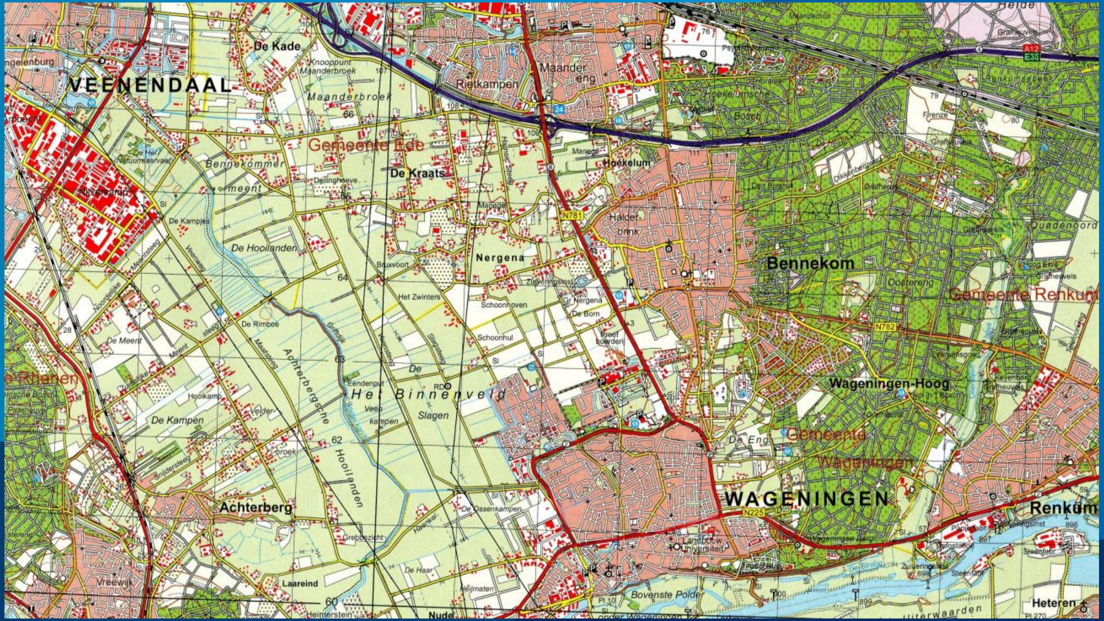
From 120 days > 1.5 hours processing; 5 Days QC
97% Accuracy



111,563 Buildings
78,689 Streets

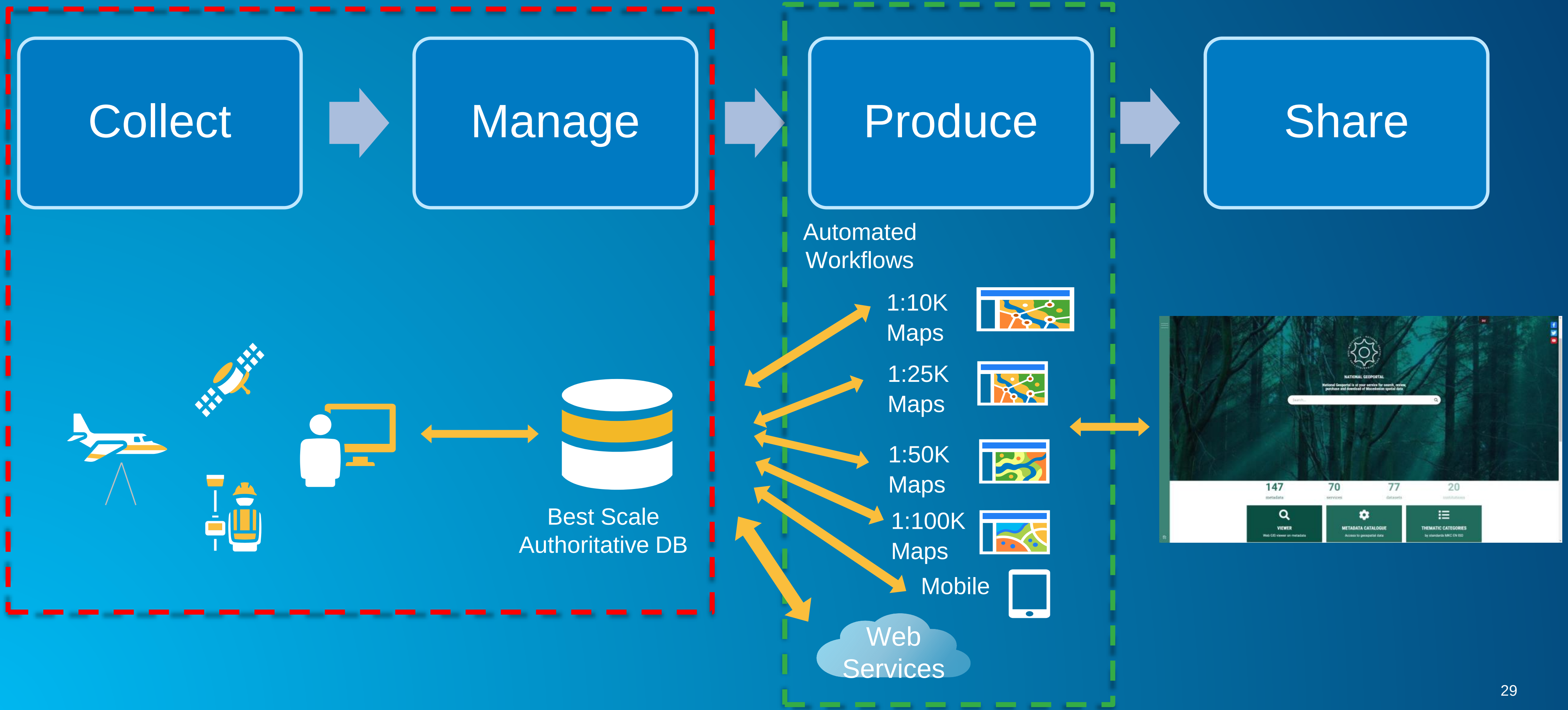
PACI Kuwait and GeoAI

- More Responsive
- Improved Quality
- Savings in Time and Money
- Expanded Internal Capacity
- Maximized Return on Investment



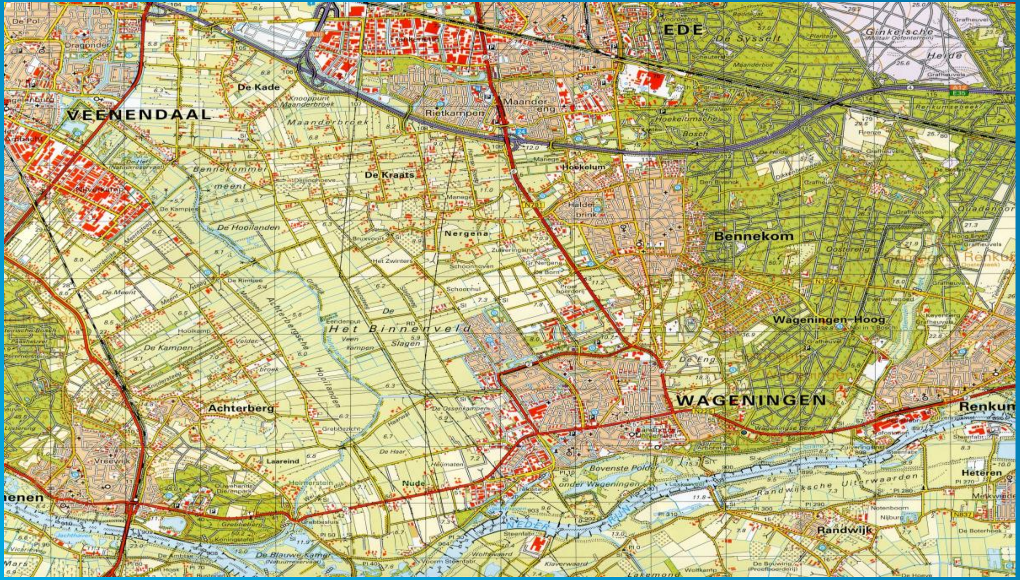
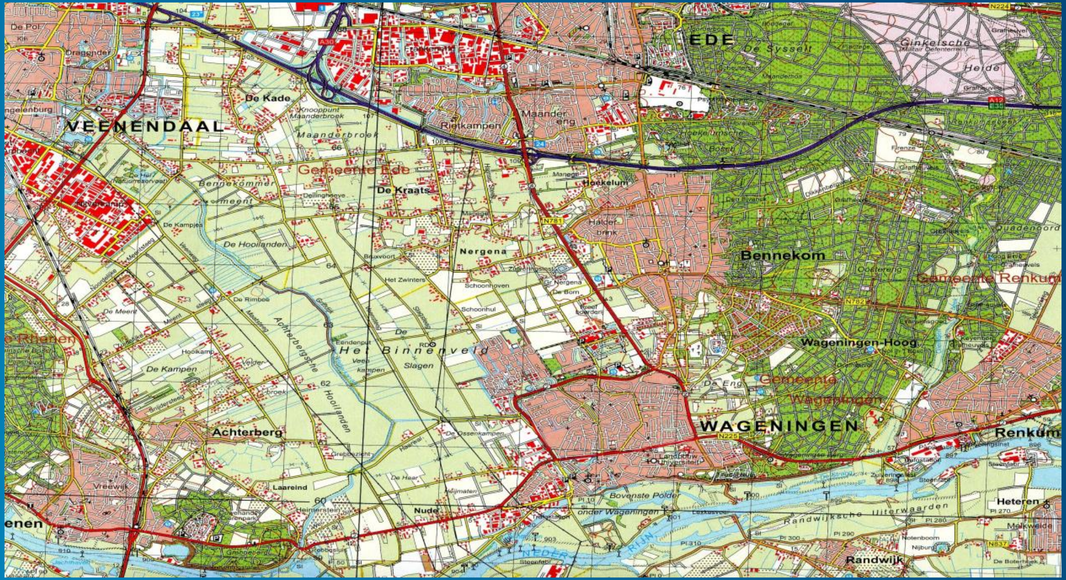
From Data to Product

Map Production End to End Workflow



Automated Map Production

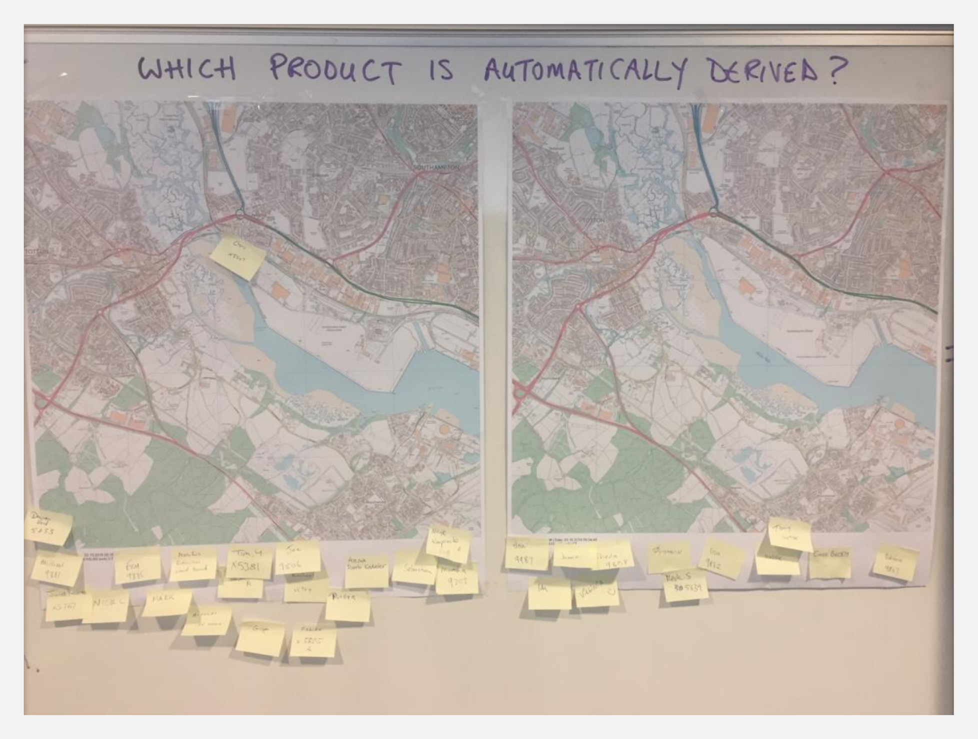
Dutch Kadaster: 1:10k > 1:50k, 1:100k, Multi-scale Web Mapping

Original map	New map
	
25 man/years effort	3 weeks production time
6 year update cycle	1 year update cycle
0% automation	100% automated
	75% cost reduction

Automated Map Production

Ordnance Survey GB: 1:1,250 > 1:10,000

- 100% Automation of Derived Products
- Improved product currency
  - from 3 years to 3 months
- 20 staff cartographers redeployed
- "Good enough"



"These are not insignificant financial savings but actually the real benefits come though to the customer through enhanced product quality and currency"

- Neil Ackroyd, Chief Executive Officer (Acting), Ordnance Survey Great Britain

In Summary ….

- DL is delivering benefits now
  - Change detection & feature extraction
- Iterative, incremental, approach for each Use Case
- Training data is key
- DL is one tool in the GIS tool box

Collect → Manage → Produce → Share

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nland@esri.com

Precision Agriculture

Marc Tondriaux, Chairman, European Association of Remote Sensing Companies

Marc Tondriaux has been working in the Space sector for more than 35 years after 7 years spent as a telecom engineer at the French Telecom Research Centre. He joined Matra Espace in 1985 for the validation of the SPOT 1 control centre and has continued working for this company, which became Matra Marconi Space, and then EADS Astrium and Airbus. He has been given different responsibilities, including Director of the Ground Systems Division and then of the EO Services Directorate during 11 years, gathering and managing Spot Image and the various Infoterra subsidiaries created in 6 European countries, launching and managing the development of the Spot6/7 investment program. He left Airbus in 2014, just before his retirement, for co-creating the TerraNIS company, specialised in EO services for Agriculture, Viticulture and Environment, which gathers now 20 employees, and where he is still President.

Marc Tondriaux joined the EARSC Board of Directors in 2017, where he took the responsibility of coordinating the working groups dealing with Small Companies Support, and with Applications for Local and Regional Institutions, in line with the actions he had started with the creation of the Eugenius SME's association of EO services providers. During the Annual General Meeting of EARSC in June 2021, members voted the composition of the new Board of Directors who nominated Marc Tondriaux as Chairman.

Marc presented European Association of Remote Sensing EARSC, which is an association founded in 1989 and dedicated to helping European companies in the Earth Observation downstream sector. Nowadays, EARSC has 133 members from 24 countries.

Marc stated that agriculture in the second important sector in Europe for use if Earth Observation applying Precision Agriculture. He explained the objectives of using Precision Agriculture are firstly, to achieve efficient yielding results in changing environmental and climate conditions, and secondly, to develop sustainable practices, with preservation of the natural resources, biodiversity, and the environment. These objectives can be achieved by extracting valuable information from a variety of imagery data captured by satellites, drones and airplanes. In conclusion, Marc provided several examples of Earth Observation application to the agriculture sector.

Precision Agriculture and Earth Observation

Presentation to Kartverlet conference

29th of October 2021

Marc Tondriaux, EARSC Chairman

EARSC

European Association of Remote Sensing Companies

EARSC

Trade (non-profit) association
founded in 1989,
dedicated to helping
European companies
in the
EO downstream sector

133 members from
24 countries in Europe

EARSC
European Association of Remote Sensing Companies

EO European Industry at a glance

- 6th survey on the state & health of the EO services industry, prepared by EARSC with the support of ESA
- 2nd survey in new series of annual updates
- Direct research on over 600 companies; survey sample of 150 companies

713 Companies
up from
572 (+24%*)

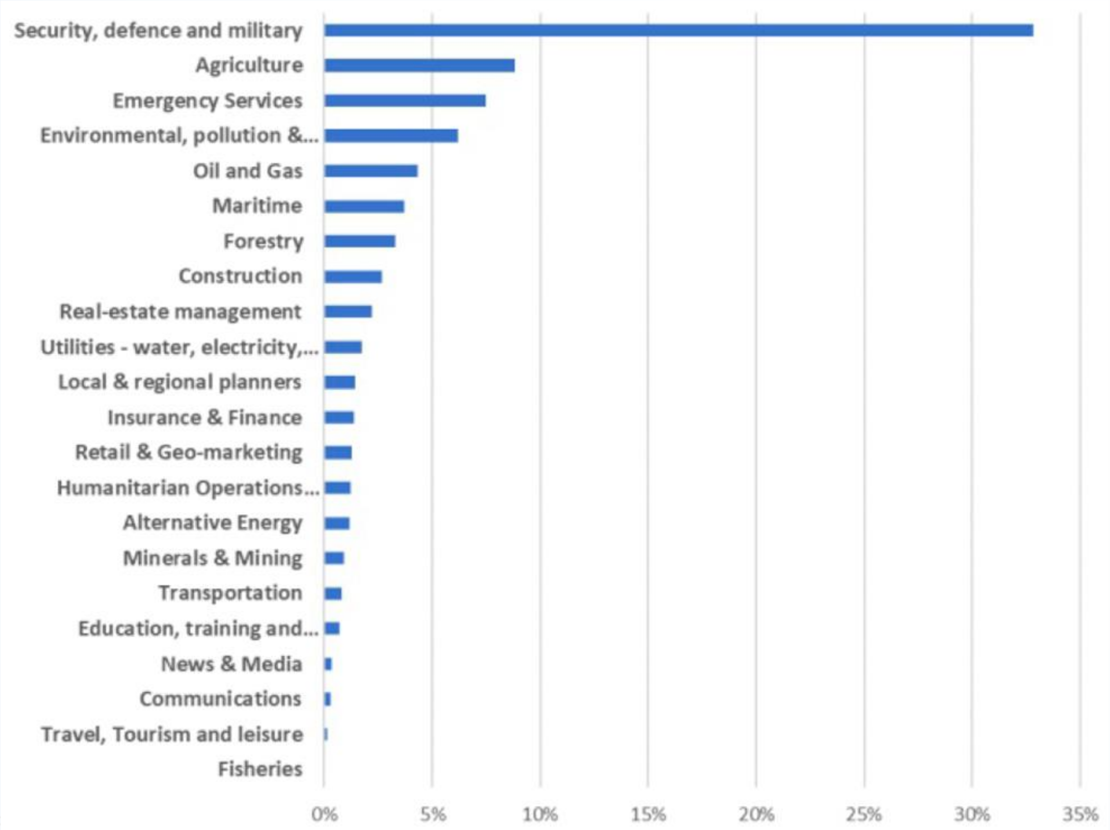
11,600 Employees
up from
9800 (+17%*)

€1.71b Revenues
up from
€1.38b (24%*)

>10% CAGR**
Sustained

* Year On year. ** CAGR over 5 years

EO European Industry at a glance



Agriculture is the 2nd EO applications sector for in Europe (with about 140 M€ pa).

That includes CAP monitorng and Precison Agriculture, with very different market penetration levels, pending on the countries (from less than 1 to more than 10%)

EARSC
European Association of Remote Sensing Companies

Precision Agriculture: what and why?

What?

Precision Agriculture (PA) consists in the application of the "right treatment in the right place at the right time" (*)

That applies to various "intrants" used in the fields (fertilizers, pesticides, water, …) but also to the various practices (sowing, cleaning, pruning, harvesting,…)

Why?

Precision Agriculture provides recognized means to support the farmers in:

- Achieving efficient yielding results even in case of degradation of weather conditions due to climate changes effects (droughts, flooding,..).
- Developing sustainable practices, with preservation of the natural resources and biodiversity, and of the environment.

(*)Gebbers and Adamchuk, Precision Agriculture, 2010

EARSC
European Association of Remote Sensing Companies

Precision Agriculture: how?

PA involves several means and tools, more or less sophisticated, pending on the targeted application:

- Observation sensors: Satellites (30cm to 10 m), Drones or Airplanes, often supported by fields scouting.
- Image processing tools: to extract valuable information from the images. They can be :
    - simple reflectance indices combining different spectral bands values (NDVI for vegetation monitoring, NDWI for water, …),
    - or more sophisticated algorithms for biophysical parameters extraction (f Cover, LAI, Chlorophylls contents, …).
- Agronomic models, specific to the type of monitored crops, which allow to compare the observed parameters values with “optimal values” at the crop development time, and to identify and quantify the missing elements (nitrogen, water, pesticides, …).
- Localization means (GPS/ Galileo receivers, connected to the tractors or the machines), allowing to “modulate” the application of the products inside the observed parcels.
- And, when available, soils sensors and meteo stations.

Precision Agriculture: types of applications and of commercial prices (with satellites sensors)

Operational and commercial services available now :

- Crop growth monitoring: periodic observations (1 image per day or per week) to identify heterogeneities or growth anomalies. *Some euros / hectares.*

- Assessment of the fertilization (mainly Nitrogen) or pesticides needs with intra-parcels modulation. *From 3 to 12 euros /has, pending on the accuracy of the models and pixels.*

- Assessment of the water needs (Hydric stress detection, support to irrigation). *Some euros/ has*

- Yielding prediction thanks to historical backgrounds.

Benefits for the farmers:

Early identification of problems at sowing, of pests infections or soils deficiencies

Fertilizers savings (up to 30% with Variable Rate Application technics)

Saving in irrigation costs (up to 20%)

Support to stocks and commercialization

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Precision Agriculture: future applications

Under development or validation phases:

- Estimation of the fertilization brought by intermediate crop cover practices
- Evaluation and quantification of the overall carbon budget linked to a farm exploitation
- Identification and evaluation of the "biodiversity" performances of a farm exploitation

Benefits:

Minimize additional chemical products

To prepare a "carbon market" for farming economy

Could become a support to the future CAP declarations.

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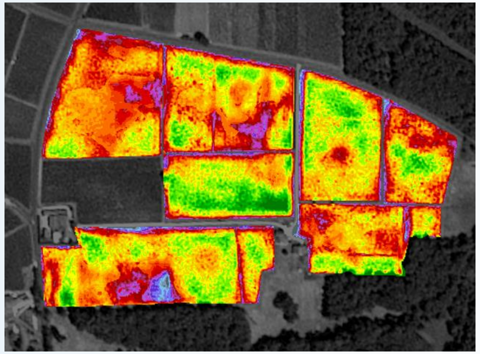
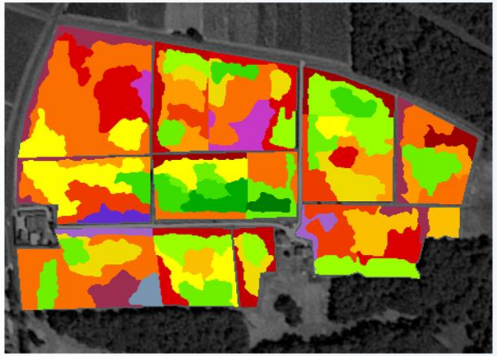
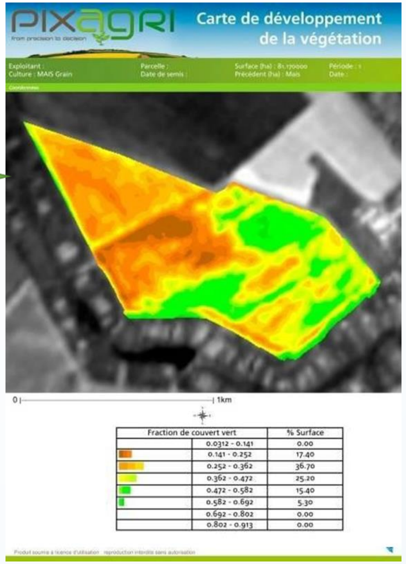
Examples of products



Vines vigor values in a vineyard (f Cover based)

The same parcels with identification of 6 zones for fertilization





Fraction de couvert vert		% Surface
	0.0312 - 0.141	0.00
	0.141 - 0.252	17.40
	0.252 - 0.362	36.70
	0.362 - 0.472	25.20
	0.472 - 0.582	15.40
	0.582 - 0.692	5.30
	0.692 - 0.802	0.00
	0.802 - 0.913	0.00

Detection of growth anomalies within a parcel of maise

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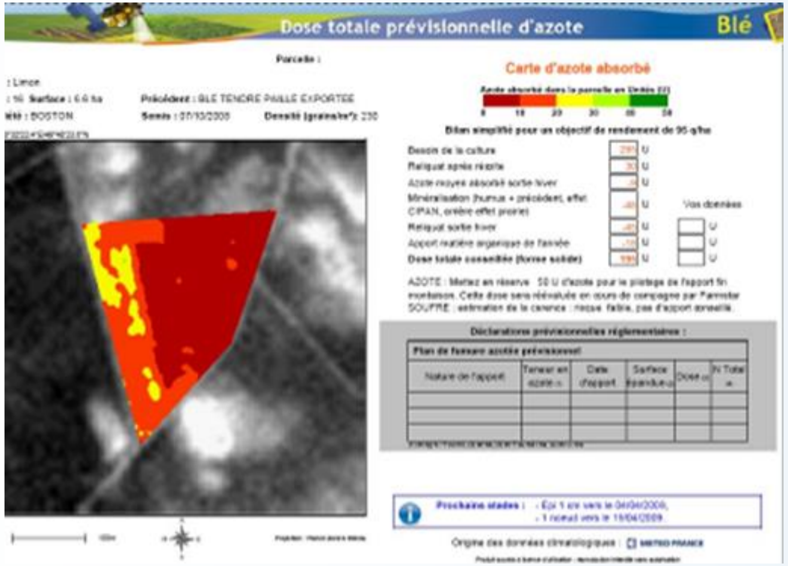
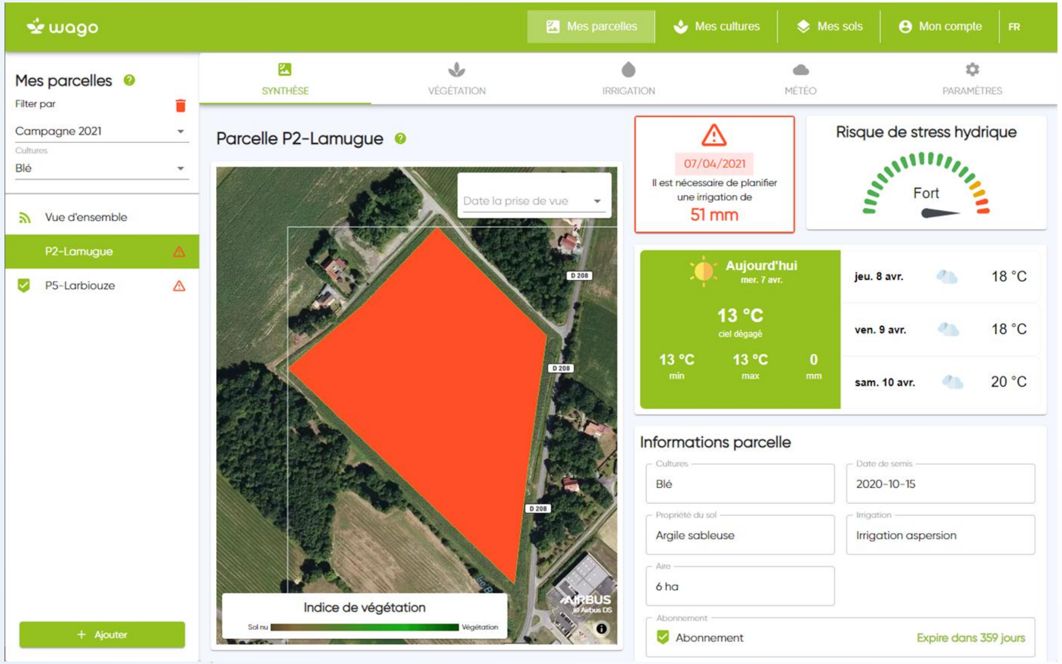
Examples of products

Geo referenced map for modulating the nitrogen application inside a field





Recommandation for water irrigation in a parcel with estimation of hydric stress

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Other examples of EO application to the Agriculture sector

1. For the monitoring of the Common Agriculture Policy: support to the National Payment Agencies for declarations verifications.
2. For the Agri-Insurance actors: risks assessment for “index” insurance or post crisis damages estimation for “classical” insurance (over cultivated fields, grasslands or forestry)
3. For the different institutions, trading actors, NGOs…: overall assessment of agriculture areas and yielding capacities at regional, national, or continental levels.
4. ….

EARSC
European Association of Remote Sensing Companies

Thank You

More information:

info@earsc.org

or

marc.tondriaux@terranis.fr

EARSC
European Association
of Remote Sensing
Companies

High Precision Satellite Imagery

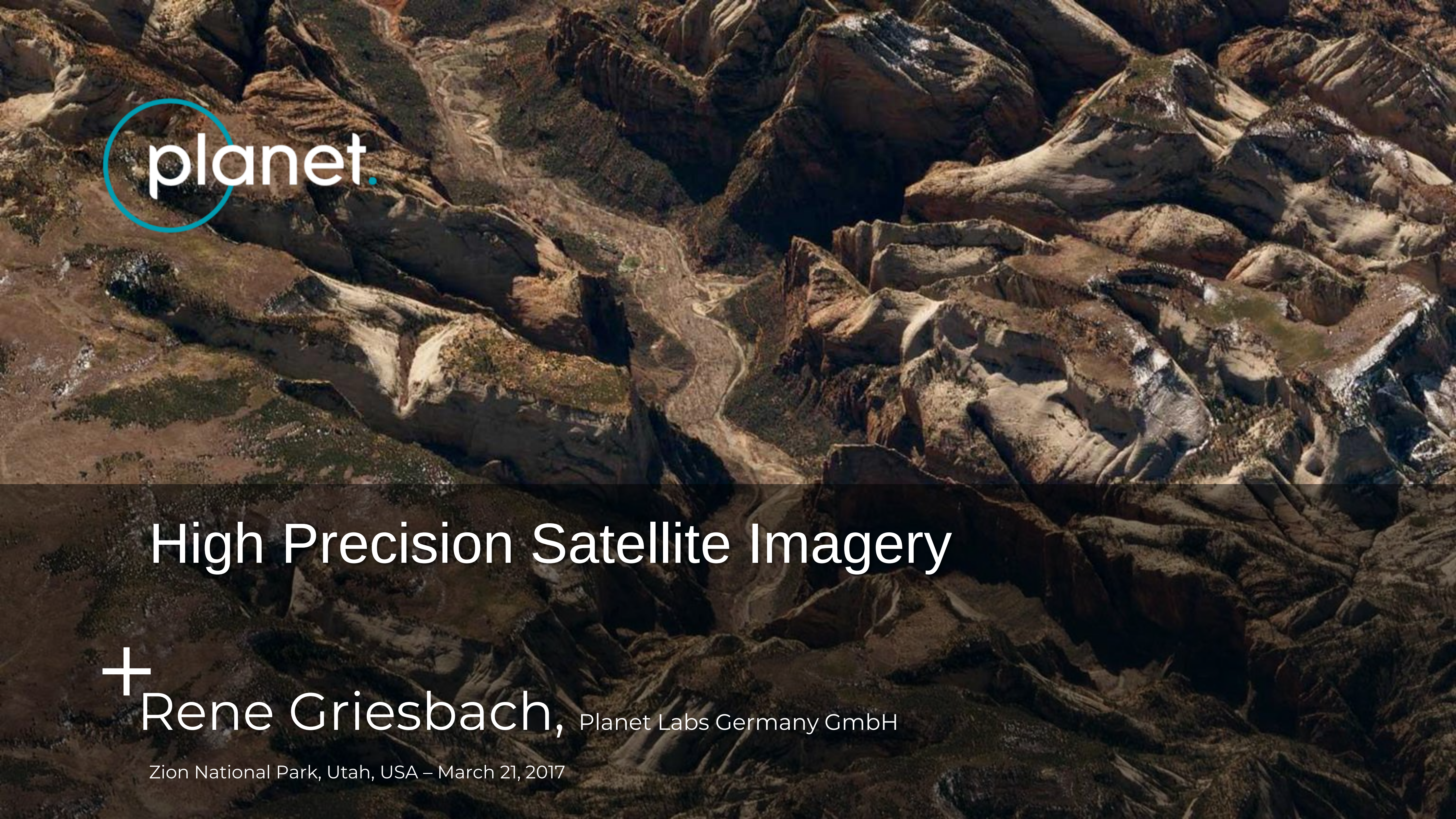
Rene Griesbach, Regional Manager Presales, Planetlabs, Germany

Rene Griesbach is the Regional Director Pre-Sales for Europe, Middle East and Africa at Planet Labs Germany GmbH in Berlin. He studied "Aerial Photogrammetry" and "Remote Sensing" and holds a Ph.D. in Aerospace Imaging from the Siberian State Academy for Geodesy. In his career, he lead aerial and marine survey projects in Germany, Nigeria and the Emirate of Sharjah (UAE), before he joined RapidEye AG to develop satellite data applications in 2007. In this role, Rene worked in and managed a number of application research projects under the EU FP7/Horizon2020 and Interreg programs, funded by German Space Agency DLR, German Development Aid Agency GIZ, by ESA and others. Later, RapidEye AG was acquired by BlackBridge AG and then by Planet Inc.

Today, he and his team of engineers consults Planet customers worldwide in the most effective use of satellite imagery for agriculture, forestry, hydrography, energy, infrastructure, business intelligence and other domains.

Rene was delighted to share his insights on new technology and use of satellite imagery, and what it could bring to different users.

He started with an introduction of his company's mission "to image the whole world every day, making change visible, accessible and actionable." Rene stated that precision imagery is satellite imagery suitable to create a model of the Earth, which is precise in time, location and information content provided. He went through various products offered by Planetlabs. They have recently developed a new sensor SuperDove to be more compatible with public data from Sentilnel-2. They are also pioneering advanced techniques to harmonize, clean, inter-calibrate, and fuse data streams from multiple sensors to produce consistent, comprehensive, and sensor-agnostic data, applying an adapted version of the Cubesat-Enabled Spatio-Temporal Enhancement Method (CESTEM). The offered technology is applicable in many areas – Defence and Intelligence, Energy and Infrastructure, Civil Government, Finance and Business Intelligence, Agriculture, Mapping, Emergency Management, Forestry, Insurance, etc. Data provided by Planetlabs has a fully API based data access. It supports OGS standards like WMS/WMTS/XYZ and it provides integration directly into ArcGIS Pro and QGIS.



High Precision Satellite Imagery

Rene Griesbach, Planet Labs Germany GmbH

Zion National Park, Utah, USA – March 21, 2017

Planet Mission

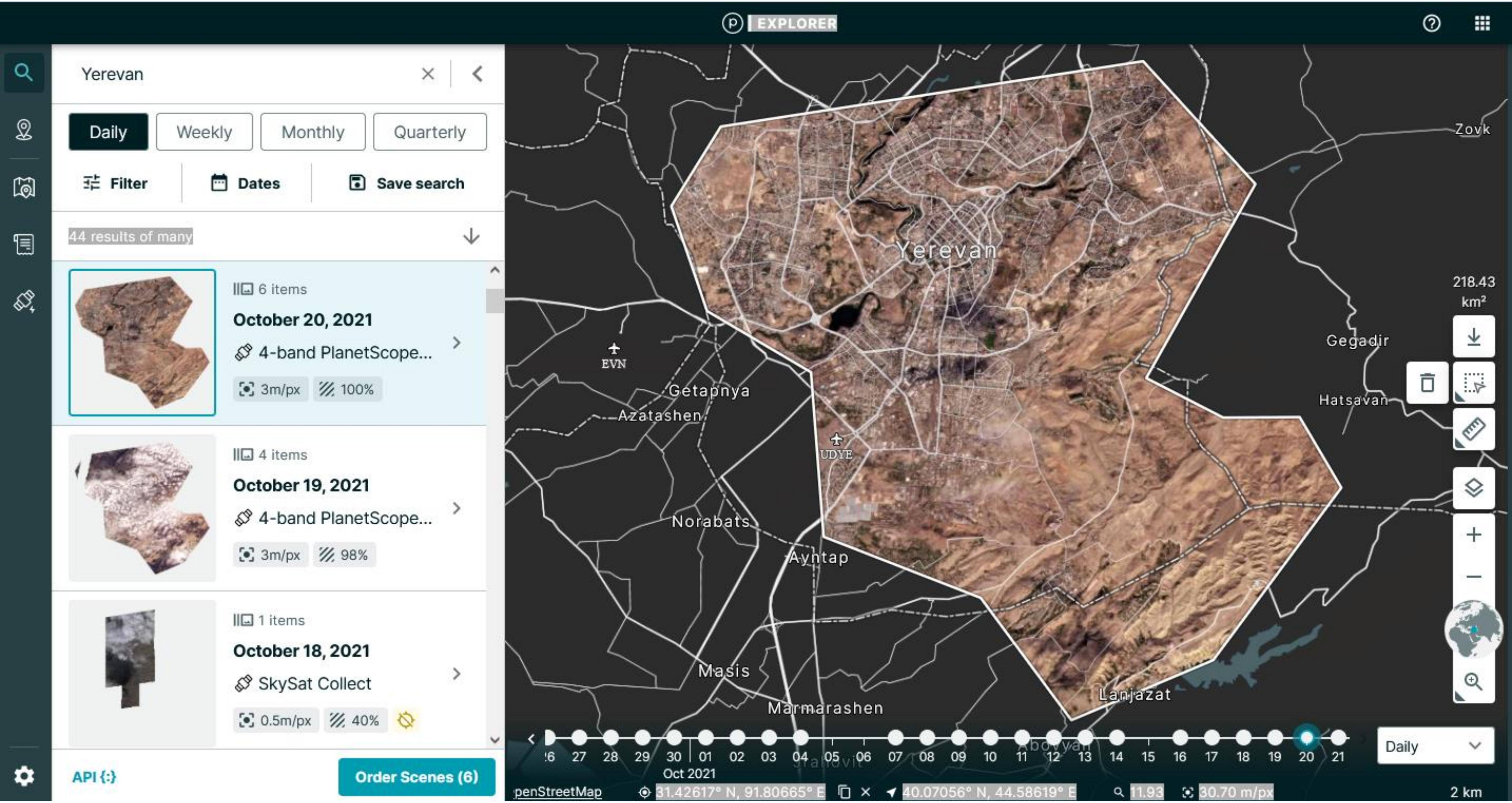
To image the whole world every day, making change visible, accessible and actionable.

What means high precision imagery?

Satellite imagery suitable to create a model of the Earth, which is precise in time, location and information content provided.

... precise in time ......

PlanetScope provides an almost full image of the Earth´s landmasses every 24h, available 6-16h after sensing in your internet browser


EXPLORER
Yerevan
Daily
Weekly
Monthly
Quarterly
Filter
Dates
Save search
44 results of many
6 items
October 20, 2021
4-band PlanetScope...
3m/px
100%
4 items
October 19, 2021
4-band PlanetScope...
3m/px
98%
1 items
October 18, 2021
SkySat Collect
0.5m/px
40%
API {:}
Order Scenes (6)
Yerevan
Zovk
218.43 km²
Gegadir
Hatsavan
EVN
Getapnya
Azatashen
UDYE
Norabats
Ayntap
Masis
Marmarashen
Lanjazat
26 27 28 29 30 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21
Oct 2021
Daily
penStreetMap
31.42617° N, 91.80665° E
40.07056° N, 44.58619° E
11.93
30.70 m/px
2 km

... precise in location ......

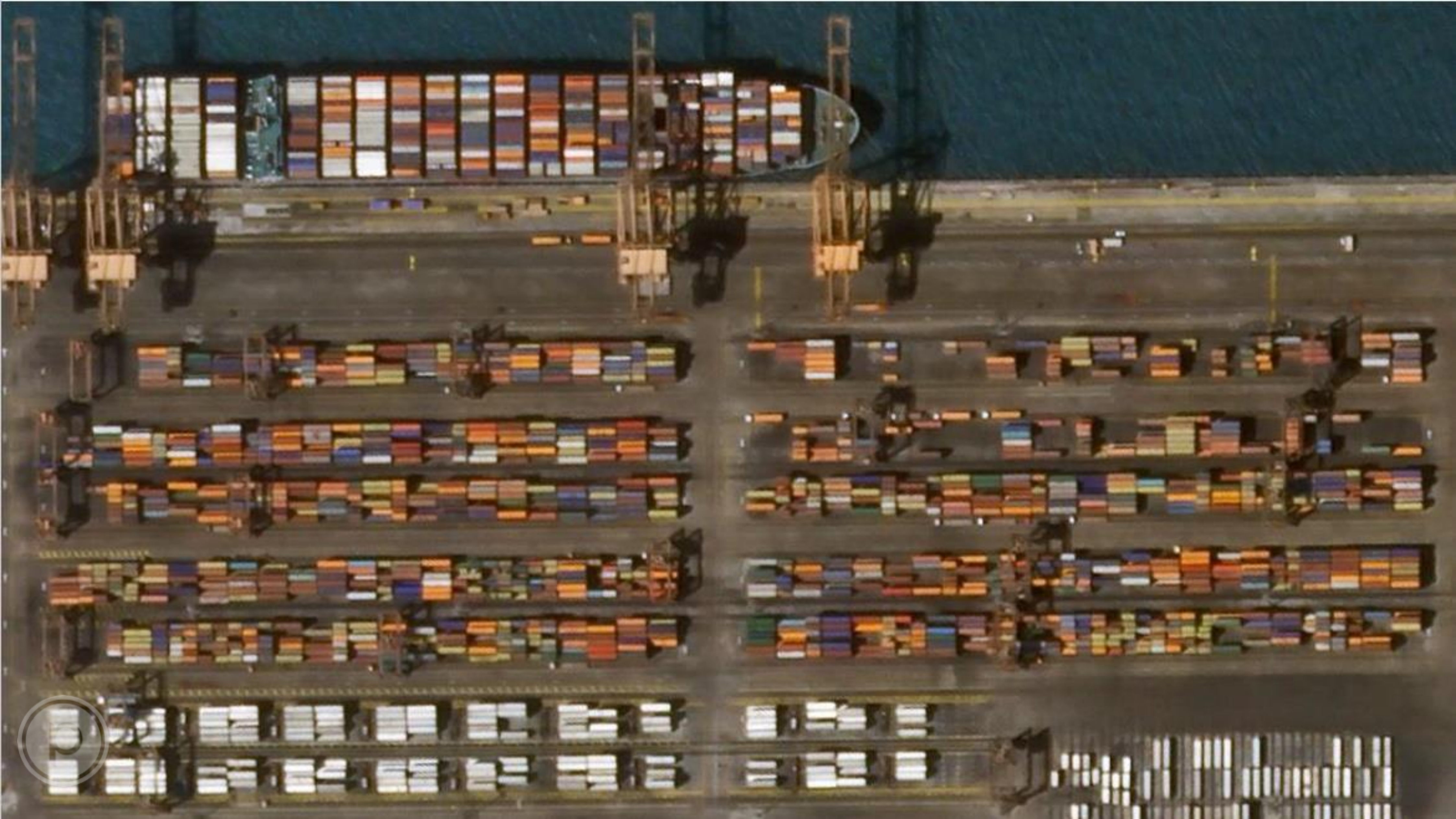
All Planet imagery is aligned to a worldwide network of Ground control Points and a precise DEM, allowing for object recognition with better than 10m (RMSE) accuracy everywhere in the world

… precise in information content

……

- 8 spectral bands
- Harmonization to Sentinel-2
- Removal of atmosphere disturbances
- Up to 0.50 m resolution

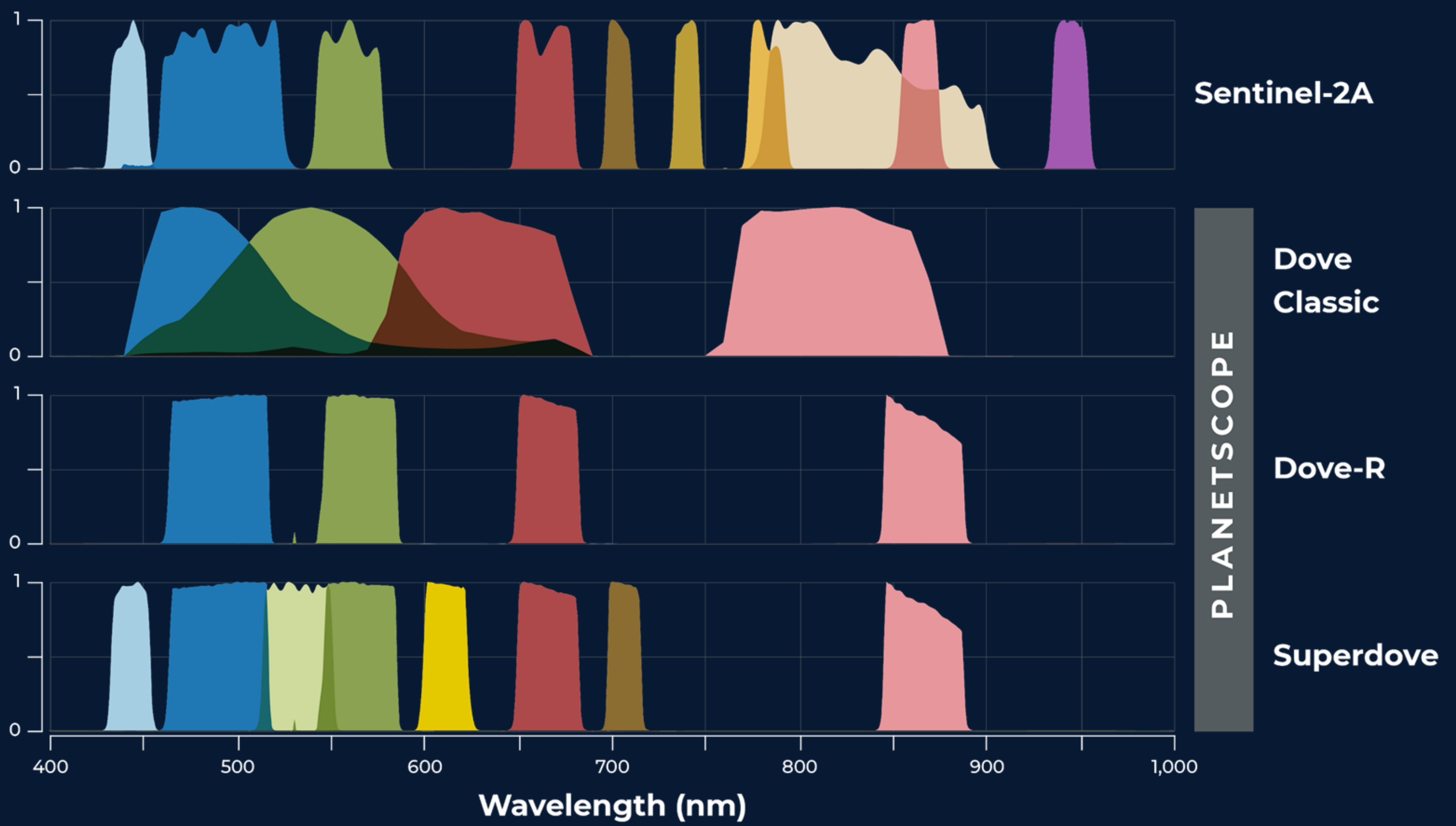
Terms
Myronivka
Georgia Pacific ...
Global Monthly
Hydro Engineeri...
Jul
Aug
Sep
Oct
Nov
Dec
2018
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2019
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2020
Jan
Quarterly Base...
Monthly Basemap
Weekly Basemap
NDVI
49.84° N, 30.58° E
12
2 km



20200104_190525_ssc9_u0001_5_4_50cm

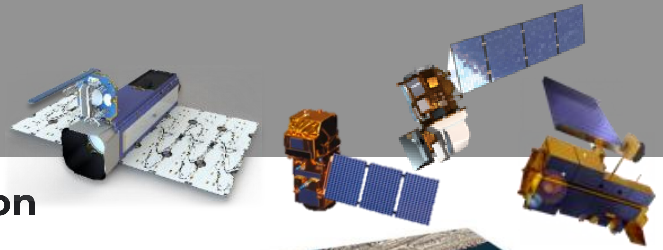
66 cm GSD, 50 cm ortho

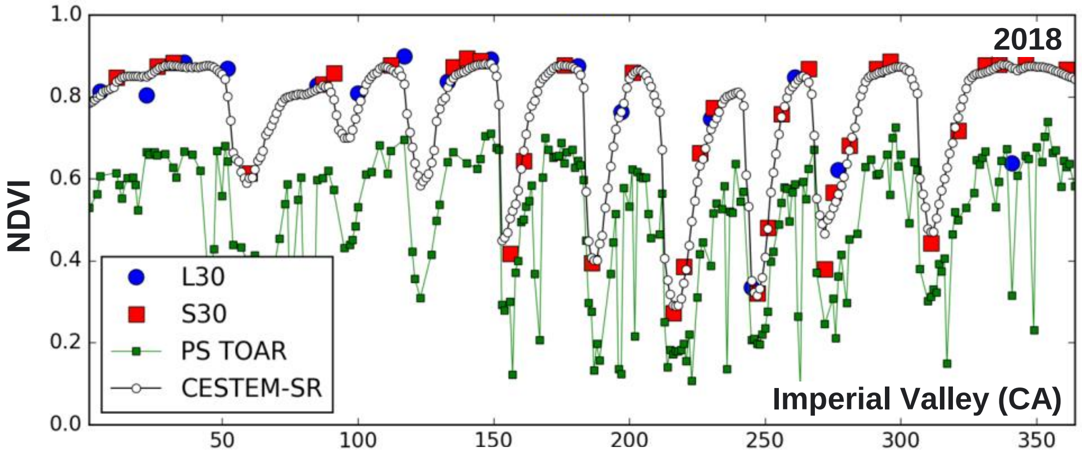
ENHANCED SPECTRAL COMPATIBILITY WITH PUBLIC DATA



Planet Fusion: the future of time-series data

CESTEM: CubeSat-Enabled Spatio-Temporal Enhancement Method





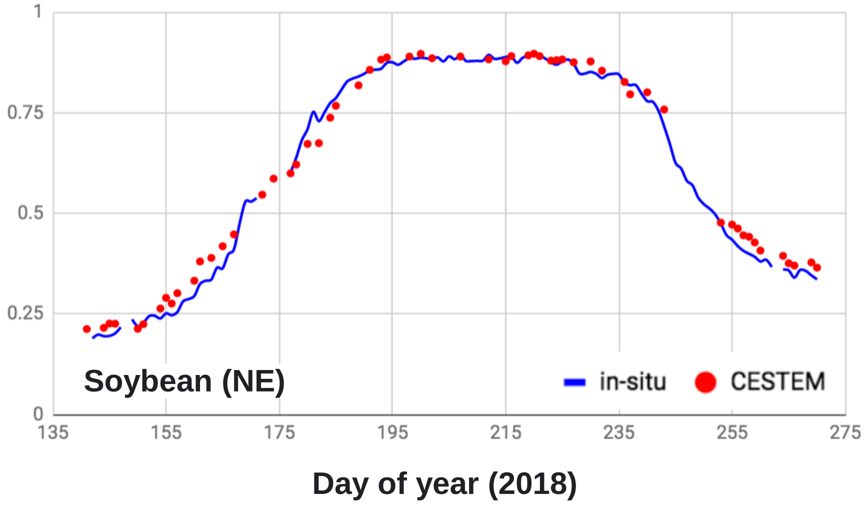
Sensor data fusion

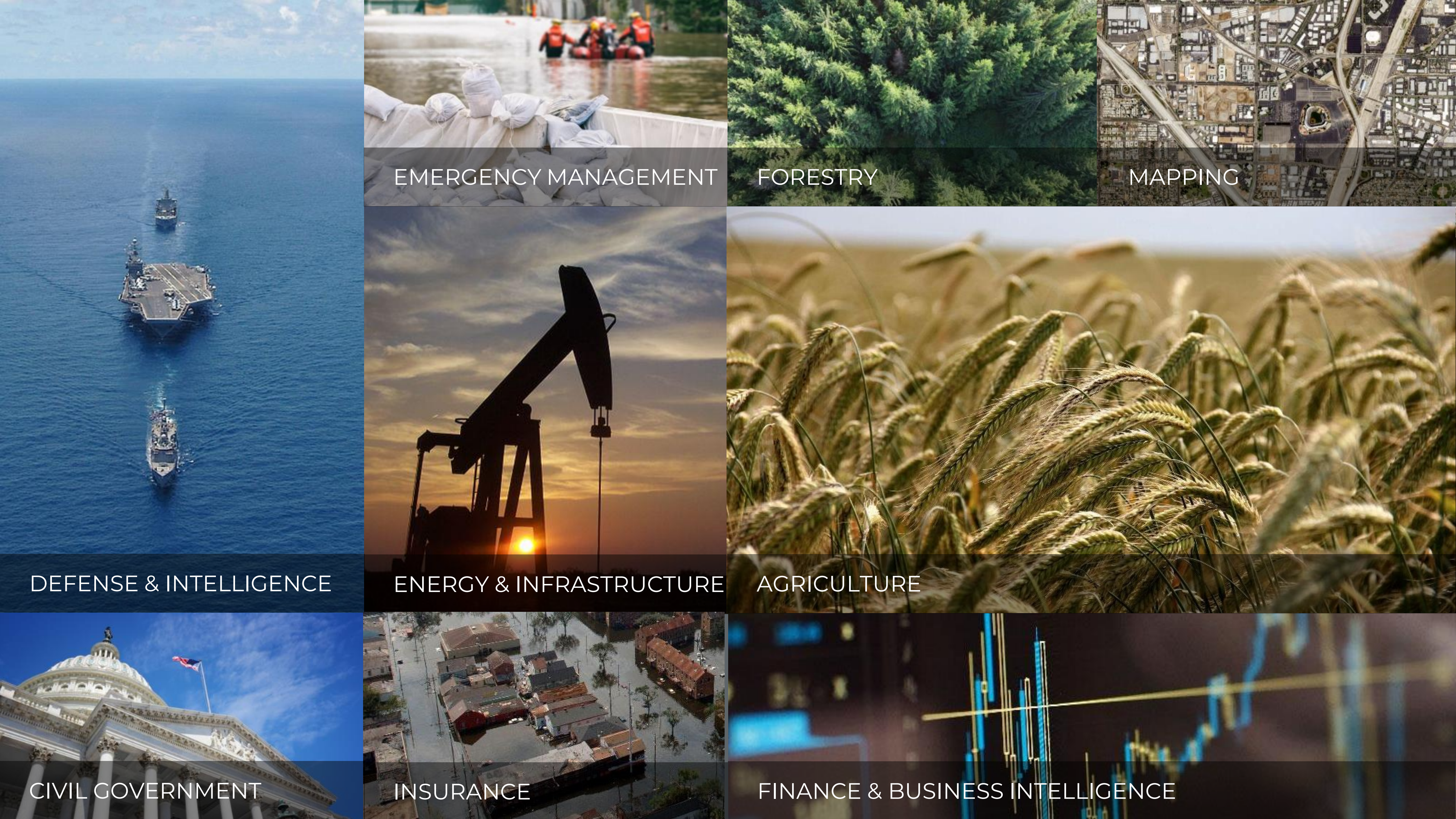
PlanetScope
LANDSAT-8
Sentinel-2
Sentinel-1
MODIS
Sentinel-3
VIIRS

Harmonized stacks that are more than the sum of the parts

Daily (gapfree) tracking of vegetation dynamics

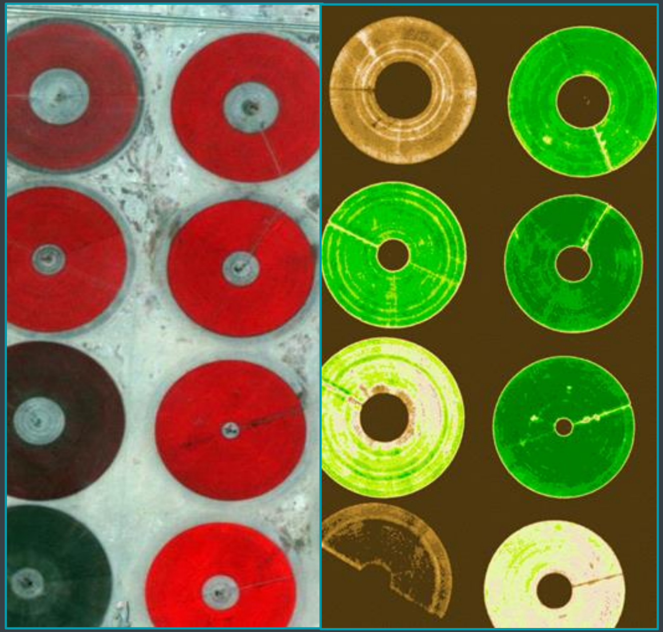
NDVI phenology validation




EMERGENCY MANAGEMENT
FORESTRY
MAPPING
DEFENSE & INTELLIGENCE
ENERGY & INFRASTRUCTURE
AGRICULTURE
CIVIL GOVERNMENT
INSURANCE
FINANCE & BUSINESS INTELLIGENCE

Digital Agriculture

Increase productivity by enabling access to …

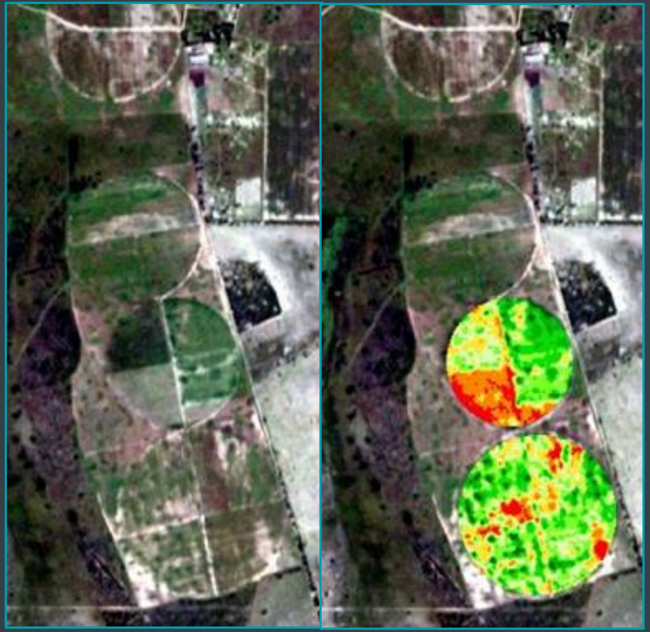


KNOWLEDGE

Planet's high-cadence multi-spectral data reveals sprinkler issue patterns timely and provide immediate actionable insights

TECHNOLOGY

Accurate and timely spatial insights into crop growth dynamics on field level is key for using precision farming technology effectively.



FINANCE

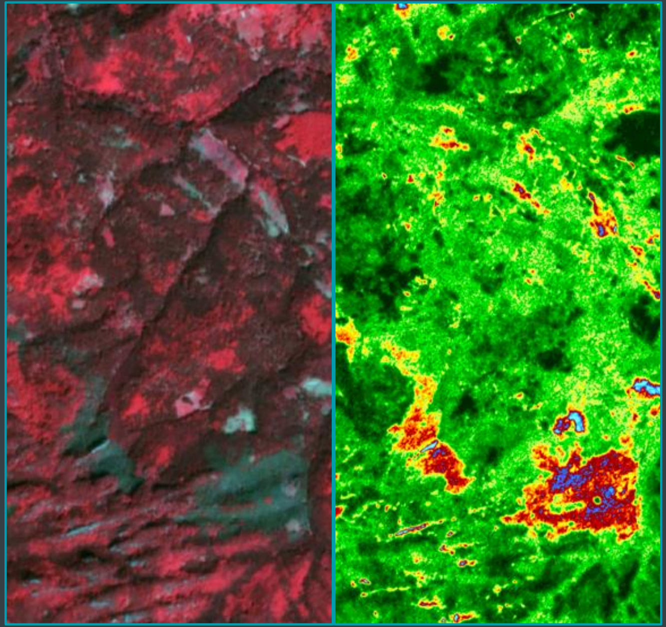
Up-to-date insights into crop performance enables financial institutions to better understand risk and helps to put remote farmers on the financial map.

Environment and Natural Resource Management

Precise, Timely and Reliable Insights

WATER BODY MONITORING

Understand how land is being used and how it changes over time



FOREST HEALTH

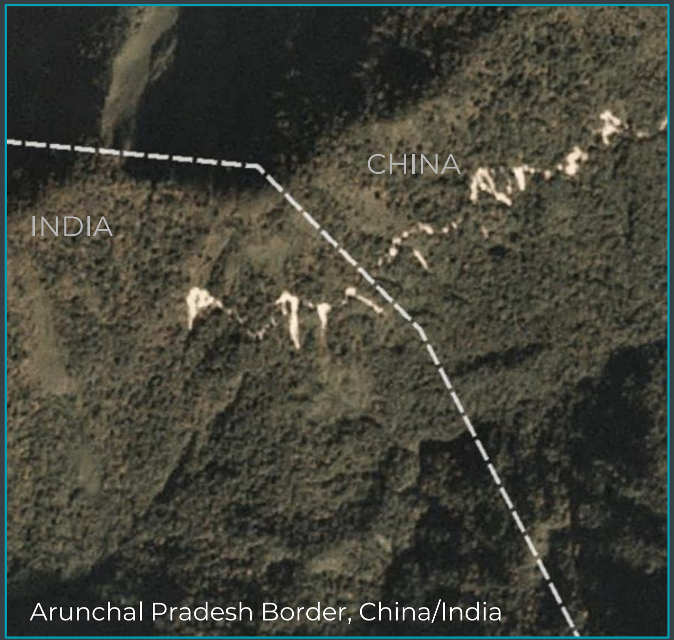
Detect anomalies and understand spatio-temporal dynamics of infestations

WATER MONITORING

Detect oil spills and map their extend on a daily or sub-daily basis

Defence & Intelligence

Gain Situational Awareness of Daily, Global Change



SITUATIONAL AWARENESS

High-cadence coverage and rapid data delivery provide transparency into situational events as change occurs.

NEAR-DAILY MONITORING

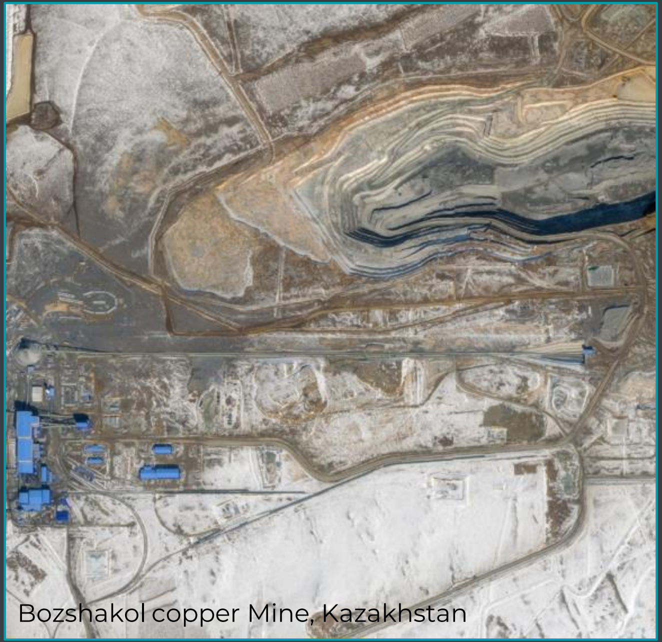
Rapid revisit allows you to see change over time, and increases the likelihood of securing imagery of strategically important assets.

BORDER SECURITY AND TERRITORIAL INTEGRITY

High temporal cadence coupled with global coverage helps allow consistent, monitoring of borders, promoting security and territorial integrity

Energy Infrastructure, Mining and Commodities

Monitor in near real-time



MINING

Monitor mining activities and their impacts on the environment. Detect illegal activities.

ENERGY INFRASTRUCTURE

Manage commodities through infrastructure monitoring, such as wind farms

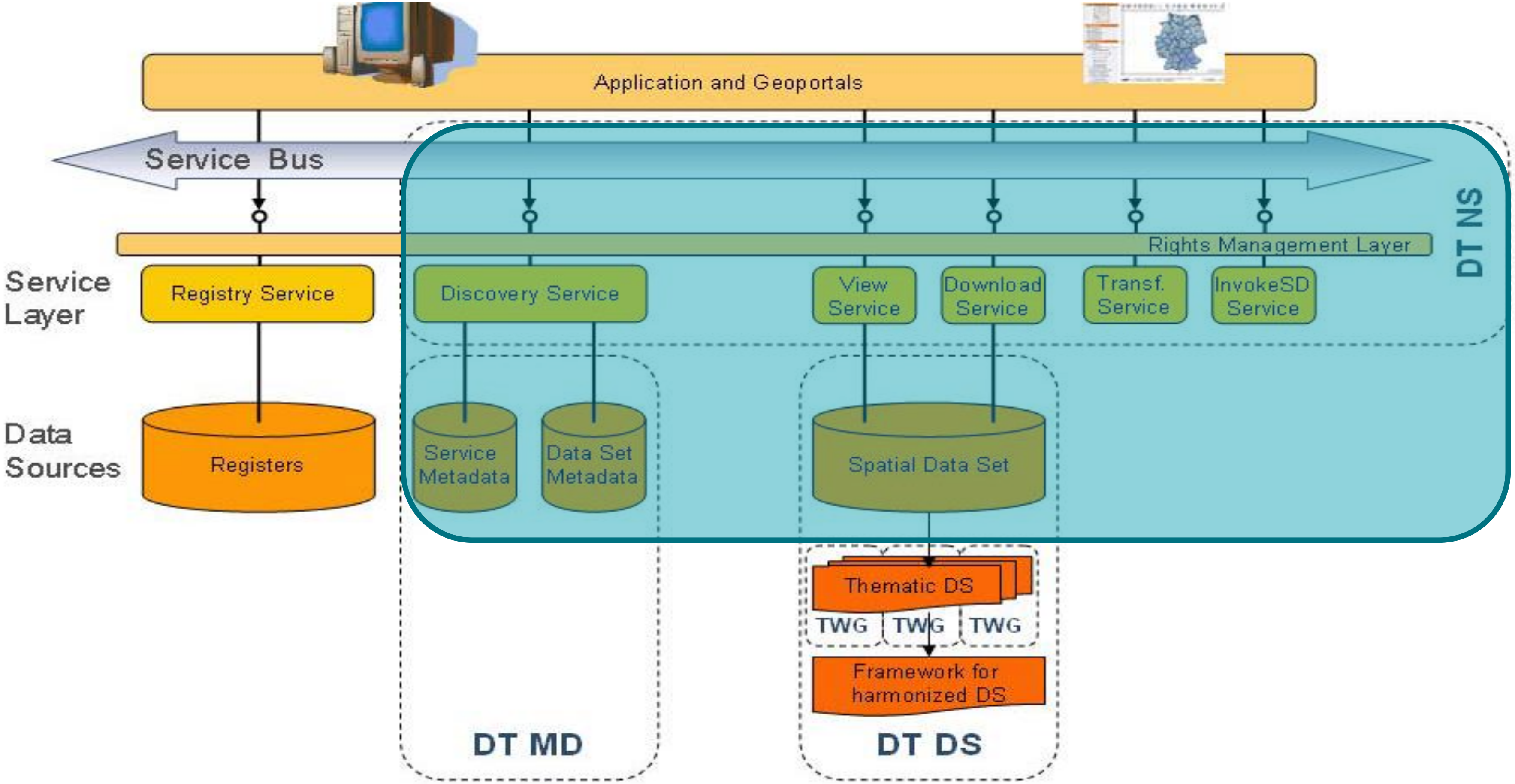
COMMODITIES

Assist in resource management and environmental protection activities.

Planet Data and National Spatial Data Infrastructure

- Fully API based data access
- Worldwide daily data availability
- Support of OGS standards (WMS/WMTS/XYZ)
- Integration in ArcGIS Pro and QGIS

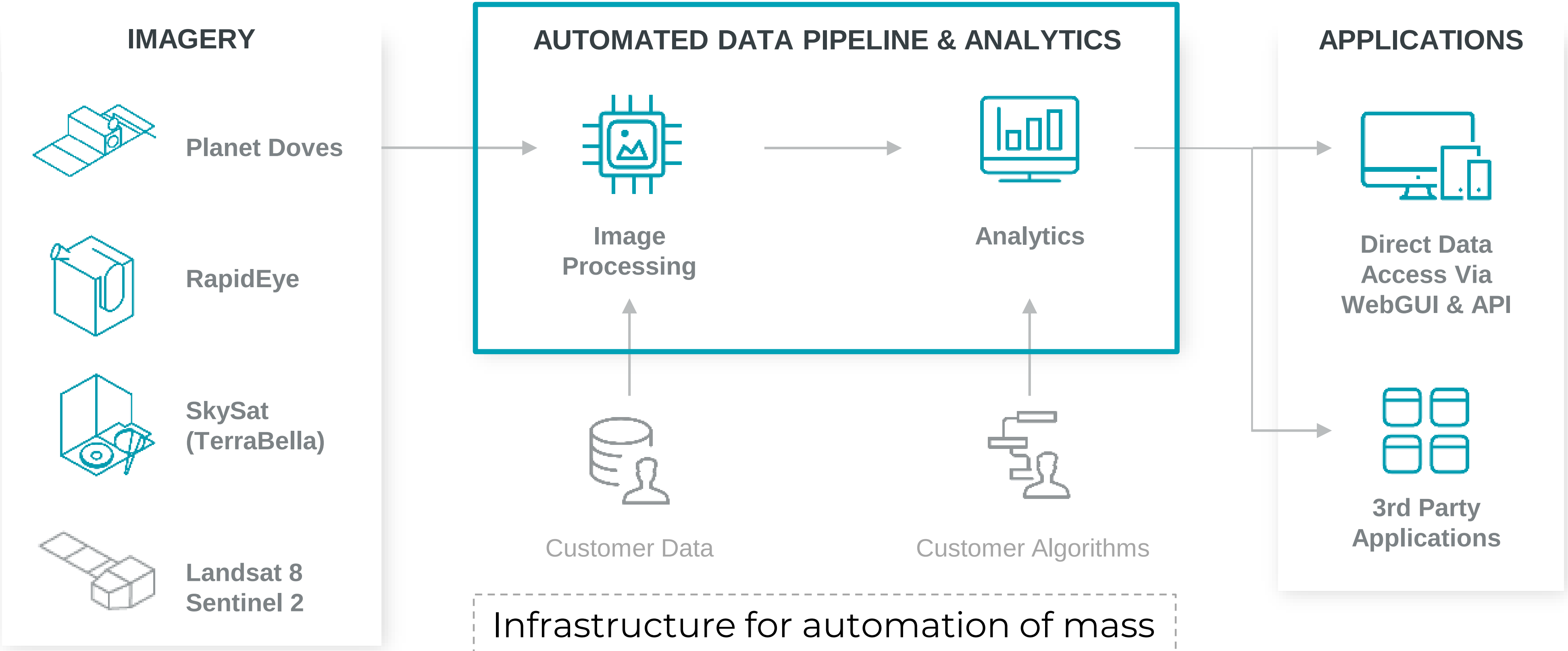
Service Oriented Architecture - SOA



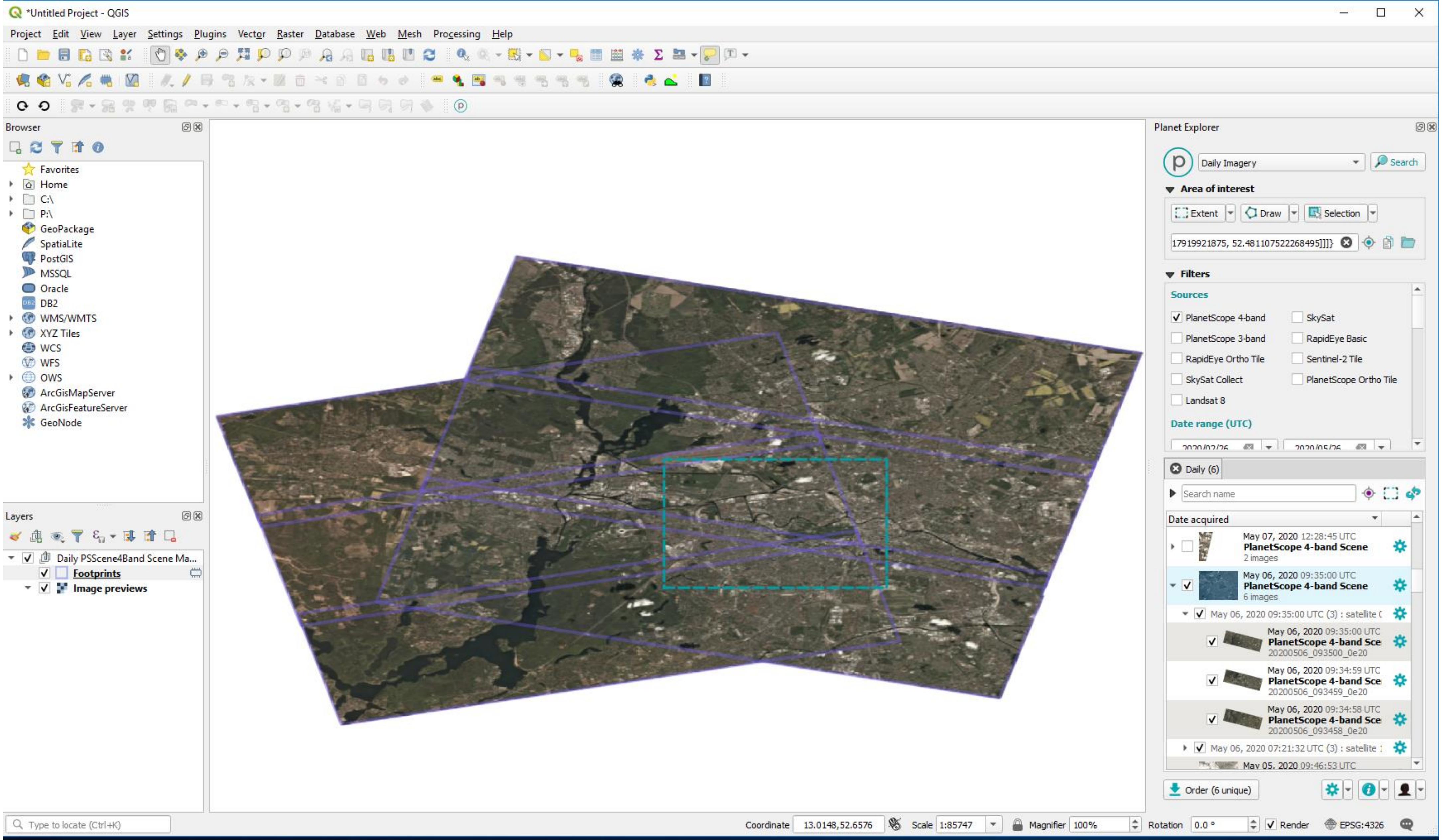
taken from 'INSPIRE Network Services Architecture '

PLANET'S PLATFORM

Faster access to data & analytics



Infrastructure for automation of mass data handling, in the fields of image processing and image based analytics.


*Untitled Project - QGIS
Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help
Browser
Favorites
Home
C:\
P:\
GeoPackage
SpatiaLite
PostGIS
MSSQL
Oracle
DB2
WMS/WMTS
XYZ Tiles
WCS
WFS
OWS
ArcGisMapServer
ArcGisFeatureServer
GeoNode
Layers
Daily PSScene4Band Scene Ma...
Footprints
Image previews
Planet Explorer
Daily Imagery
Search
Area of interest
Extent
Draw
Selection
17919921875, 52.481107522268495]]]}
Filters
Sources
PlanetScope 4-band
SkySat
PlanetScope 3-band
RapidEye Basic
RapidEye Ortho Tile
Sentinel-2 Tile
SkySat Collect
PlanetScope Ortho Tile
Landsat 8
Date range (UTC)
Daily (6)
Search name
Date acquired
May 07, 2020 12:28:45 UTC
PlanetScope 4-band Scene
2 images
May 06, 2020 09:35:00 UTC
PlanetScope 4-band Scene
6 images
May 06, 2020 09:35:00 UTC (3) : satellite (
May 06, 2020 09:35:00 UTC
PlanetScope 4-band Sce
20200506_093500_0e20
May 06, 2020 09:34:59 UTC
PlanetScope 4-band Sce
20200506_093459_0e20
May 06, 2020 09:34:58 UTC
PlanetScope 4-band Sce
20200506_093458_0e20
May 06, 2020 07:21:32 UTC (3) : satellite :
May 05, 2020 09:46:53 UTC
Order (6 unique)
Type to locate (Ctrl+K)
Coordinate 13.0148,52.6576
Scale 1:85747
Magnifier 100%
Rotation 0.0 °
Render
EPSG:4326

Planet Vision for NSDI

- Democratic access to daily updated satellite data for educated decision making
- You cannot manage what you don´t see
- Way forward is Government wide Flat-Rate access

Base Principles for Government Flat-Rates to Planet Data

- Unlimited view Access to daily 3m data via webbrowser from every workplace
- Large download volumes for experienced users in all departments
- Large budget for flexible tasking 0.5m SkySat data via tasking interface
- Access right management by government organization

Base Principles for Government Flat-Rates to Planet Data

Optional inclusion of education sector or start-up scene

License for internal non-commercial use

Lump sum payment upfront per year

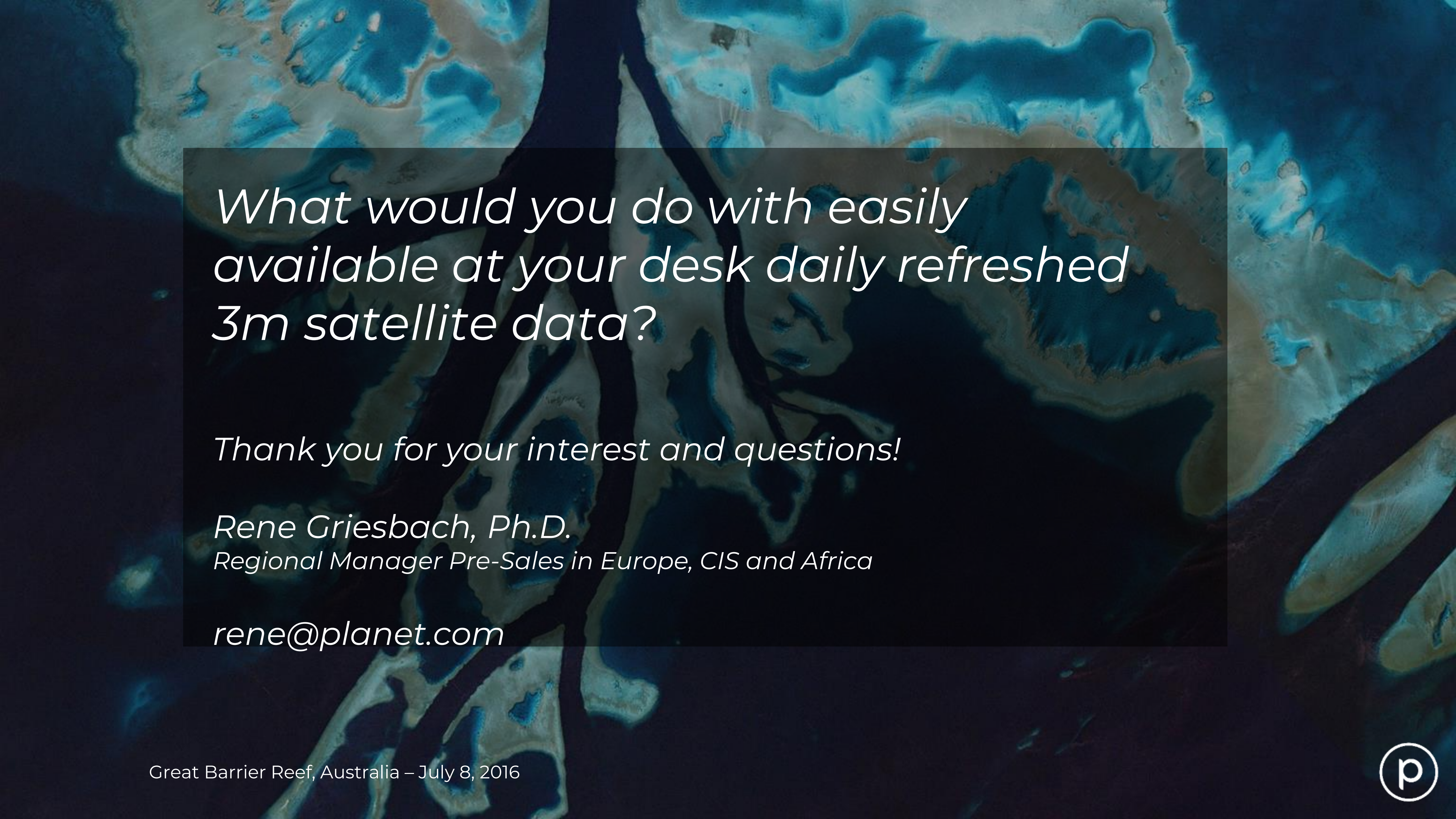
Flat-Rate supply implemented for Afghanistan (currently on hold) and in discussion with Kazakhstan, Germany (tendered), EU and other

What would you do with easily available at your desk daily refreshed 3m satellite data?

Thank you for your interest and questions!

Rene Griesbach, Ph.D.
Regional Manager Pre-Sales in Europe, CIS and Africa

rene@planet.com



Great Barrier Reef, Australia – July 8, 2016

Smart City Platform Enabling Digital Twin: Helsinki 3D+ project

Jarmo Suomisto, City of Helsinki, City Executive Office, Finland

Jarmo Suomisto is a manager of Helsinki 3D+ and responsible of creating, maintaining and delivering virtual models over the whole city. Jarmo has been working for over 25 years with 3D and GIS in building design and city planning. He has practical understanding of the great potential of 3D.

Jarmo is an architect by education possessing a Master of Science degree in Civil Engineering from Helsinki University of Technology. https://www.linkedin.com/in/jarmo-suomisto-08231aa6@Helsinki3D

Helsinki 3D+ project integrates new technology and workflows for processes and city services. The project is a 2020 and 2016 "Year in Infrastructure Award" winner and 2019 "London Tech Fest" Main Award winner. www.hel.fi/3D

Jarmo started with presenting the 3D+project team and a history of Helsinki 3D project, which has started 36 years ago.

Call for urban digital twin was based on the strategic goal to efficiently manage city resources using 3D as a tool to create better life through better services:

Better understanding – Better decision – Better city – Quality of Life.

Helsinki Smart Digital Twin 2021has two production lines City GML Semantic Model and Reality Model. Combined both models, it forms an open innovation platform which is open for downloading and further use.

Jarmo underlined that integrating the twin platform into city processes has many benefits – economic, environmental and societal. City of Helsinki uses moto "Digitally first" to all city processes and programmes, such as "Safe City", "Carbon Neutrality" and other.

Jarmo told about Helsinki strategic plan called "The most functional city in the world", which has one of the goals to become a carbon-neutral city by 2035. Heating was identified as a major factor of greenhouse gas emissions (56%). https://www.hel.fi/static/liitteet/kaupunkiymparisto/julkaisut/esitteet/HNH2035_en_summary_14022019.pdf

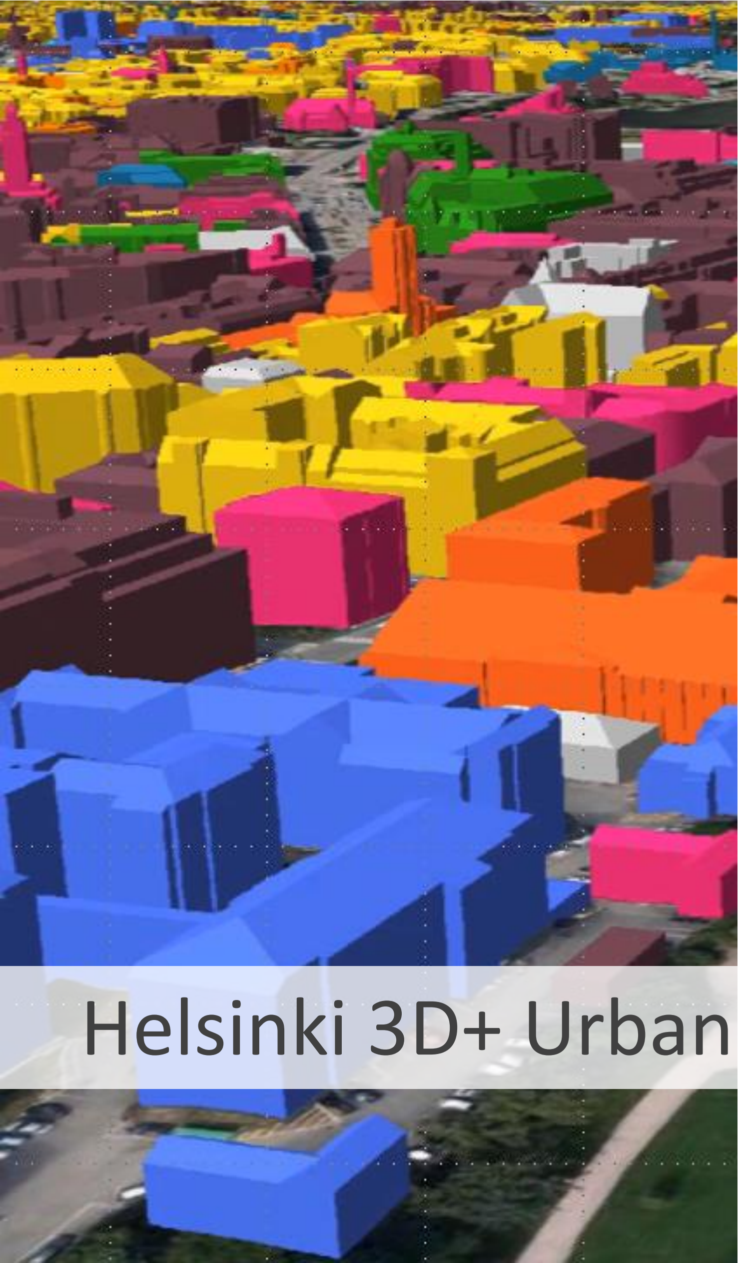
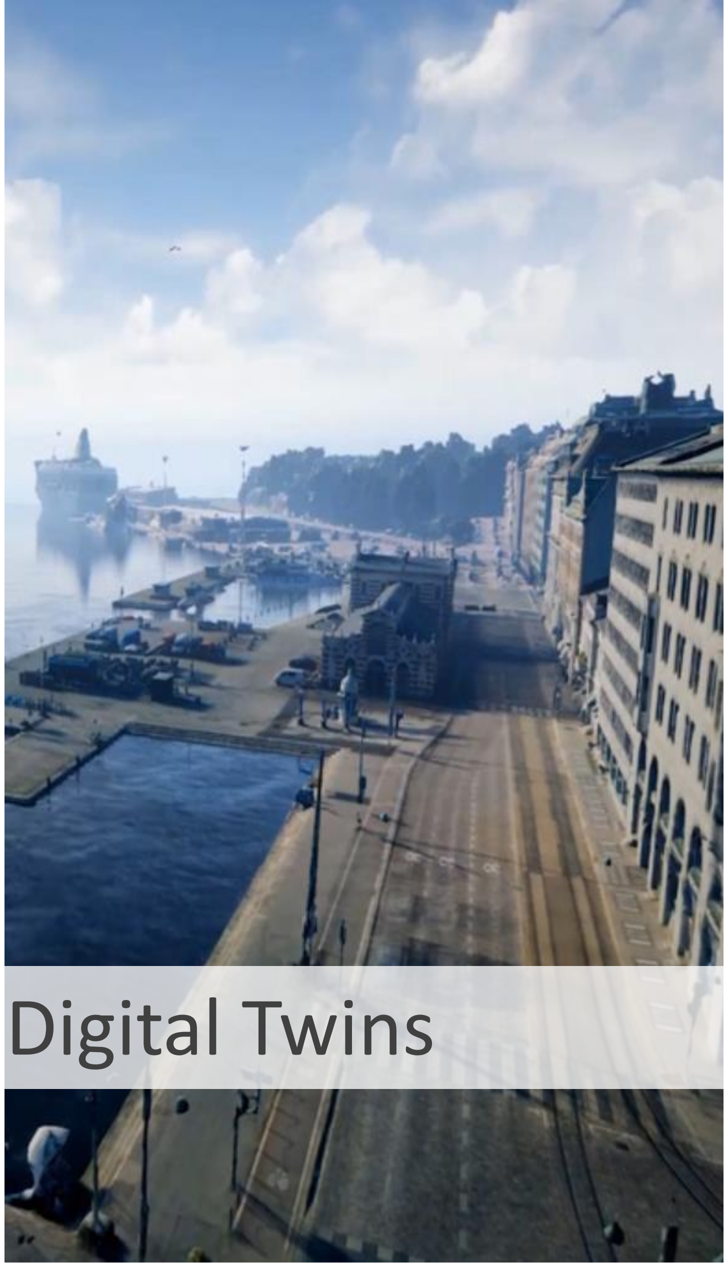
They created Energy and Climate Atlas using 3D+ platform, to monitor heating surfaces, structure and other attribute data of over 80000 buildings – over 1 million surfaces, to calculate and predict heating effects and plan renovation programs.

Another application created with Helsinki Smart Digital Twin 2021 is GeoEnergy potential, which provides information for depth down to 300 meters.

Elaborating on the meaning of technology, Jarmo argued that technology determine only 25%, but 75% is other things – new way of thinking and innovative behavioral changes.

In response to the question on what cost and benefits are, Jarmo said that social return is more important. The achieved results do have real value to people. On cost-side, the investment was about 1-3 million euro during last six years. If you want to start a similar project, you should think analyze your resources – human and financial; what kind and type of model would suit your use case; and apply step – by – step approach.

Helsinki 3D+ website www.hel.fi/3D
Helsinki Energy and Climate Atlas https://kartta.hel.fi/3d/atlas
Open Energy Atlas data in Helsinki Region Infoshare https://hri.fi/fi/dataset/helsingin-3d-kaupunkimalli
Energy and Climate atlas video clip (no audio) https://youtu.be/Cr-M1bla7K0
Heat Demand Prediction of Buildings Using a 3D City Model Presentation by Enni Airaksinen https://youtu.be/J6r-cCL25O0
3D City Models and Minecraft Helsinki as open data in Helsinki Region Infoshare https://hri.fi/data/en_GB/dataset/helsingin-3d-kaupunkimalli
Helsinki 3D+Youtube channel https://www.youtube.com/channel/UCC5zVtGUdLXRI354lghLLqg/videos

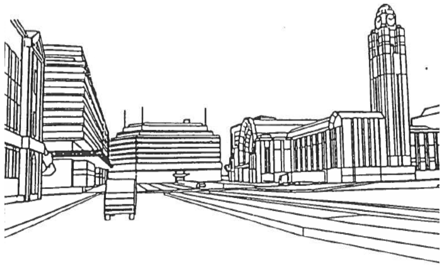

Helsinki 3D+ Urban Digital Twins

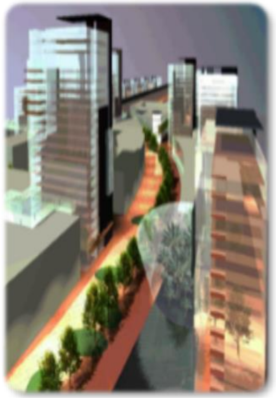
Jarmo Suomisto

Helsinki


Project Manager/ MSc (Civ.Eng)
Kari Kaisla
3D Specialist/ MSc (Civ.Eng)
Enni Airaksinen
Project Manager/ Architect/MSc (Civ.Eng)
Jarmo Suomisto
Helsinki 3D+ Mayors office / Strategies / Data and Analytics Team
Helsinki

36 Years of 3D Helsinki

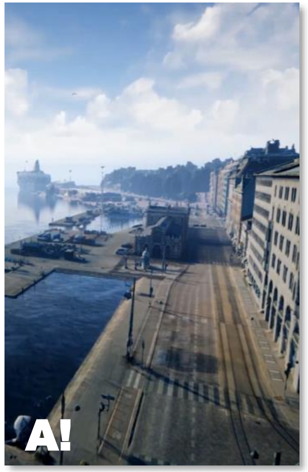


OGC
Making location count.

CityGML

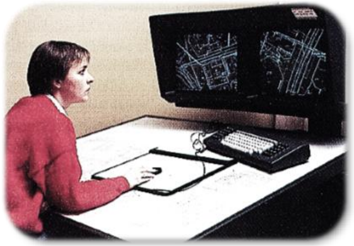
Reality Mesh



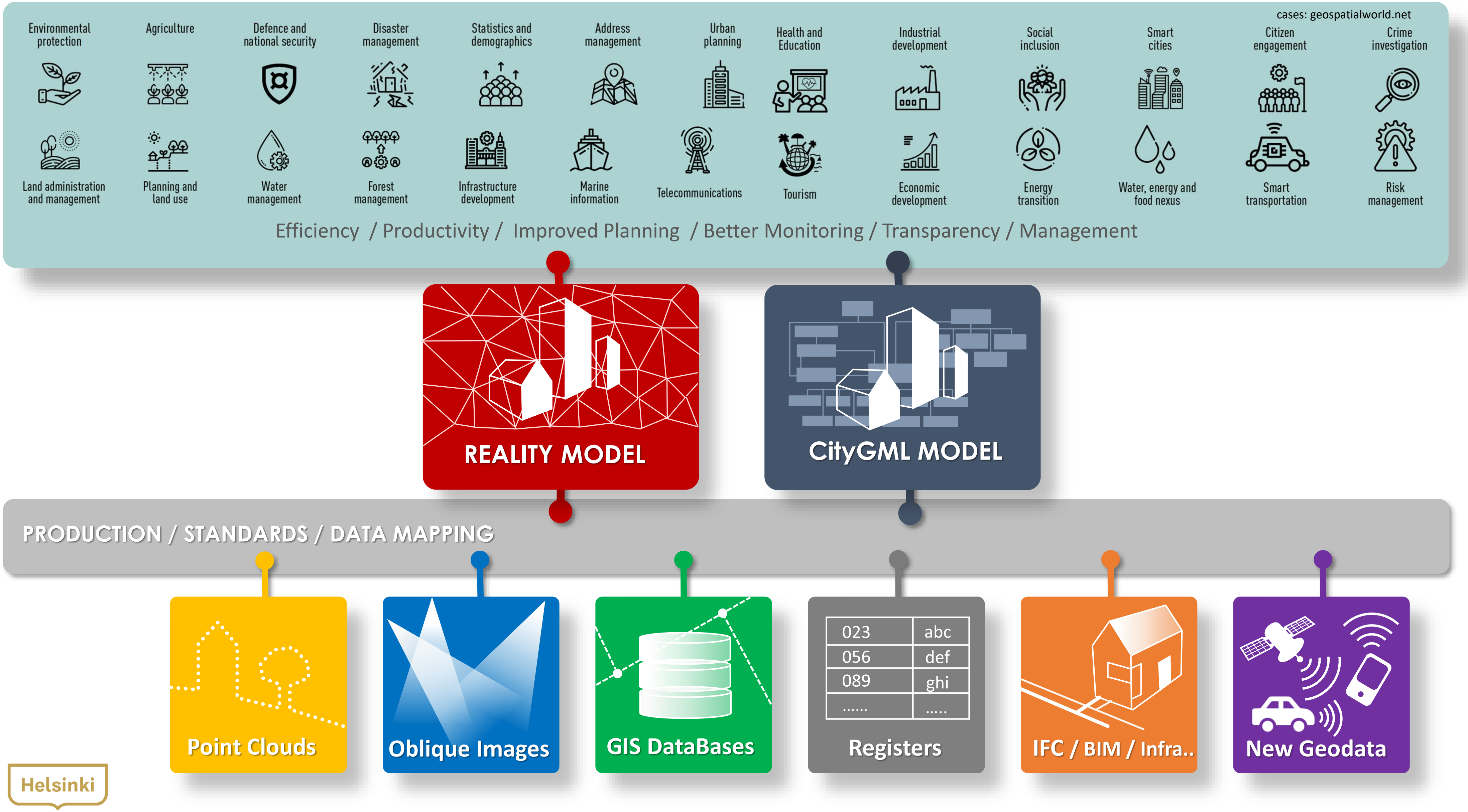
City Model try-outs | Urban Development Models | Entire City 3D CAD | Urban simulators | New Models | Co-innovation

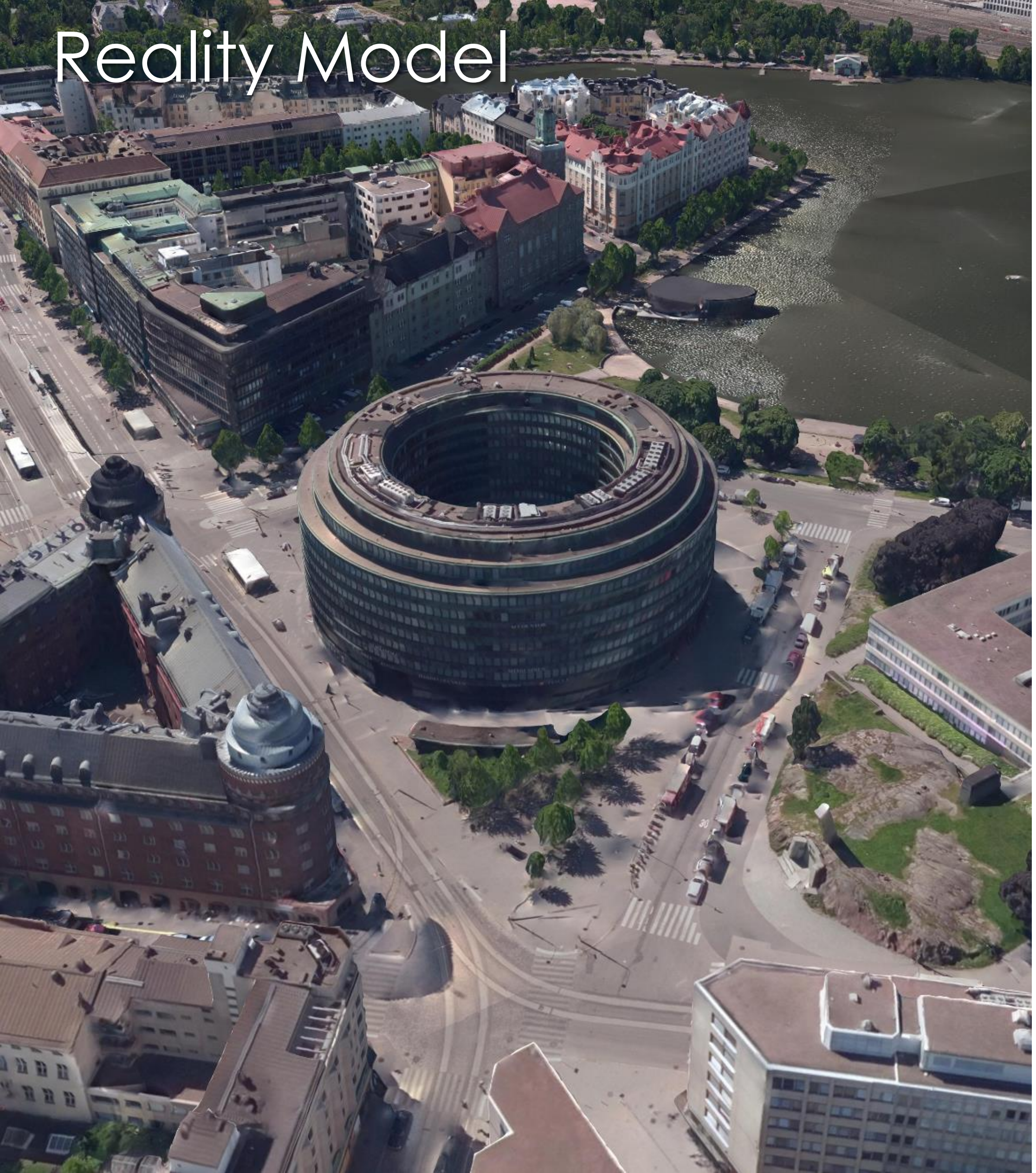
1980 | 1990 | 2000 | 2010 | 2020

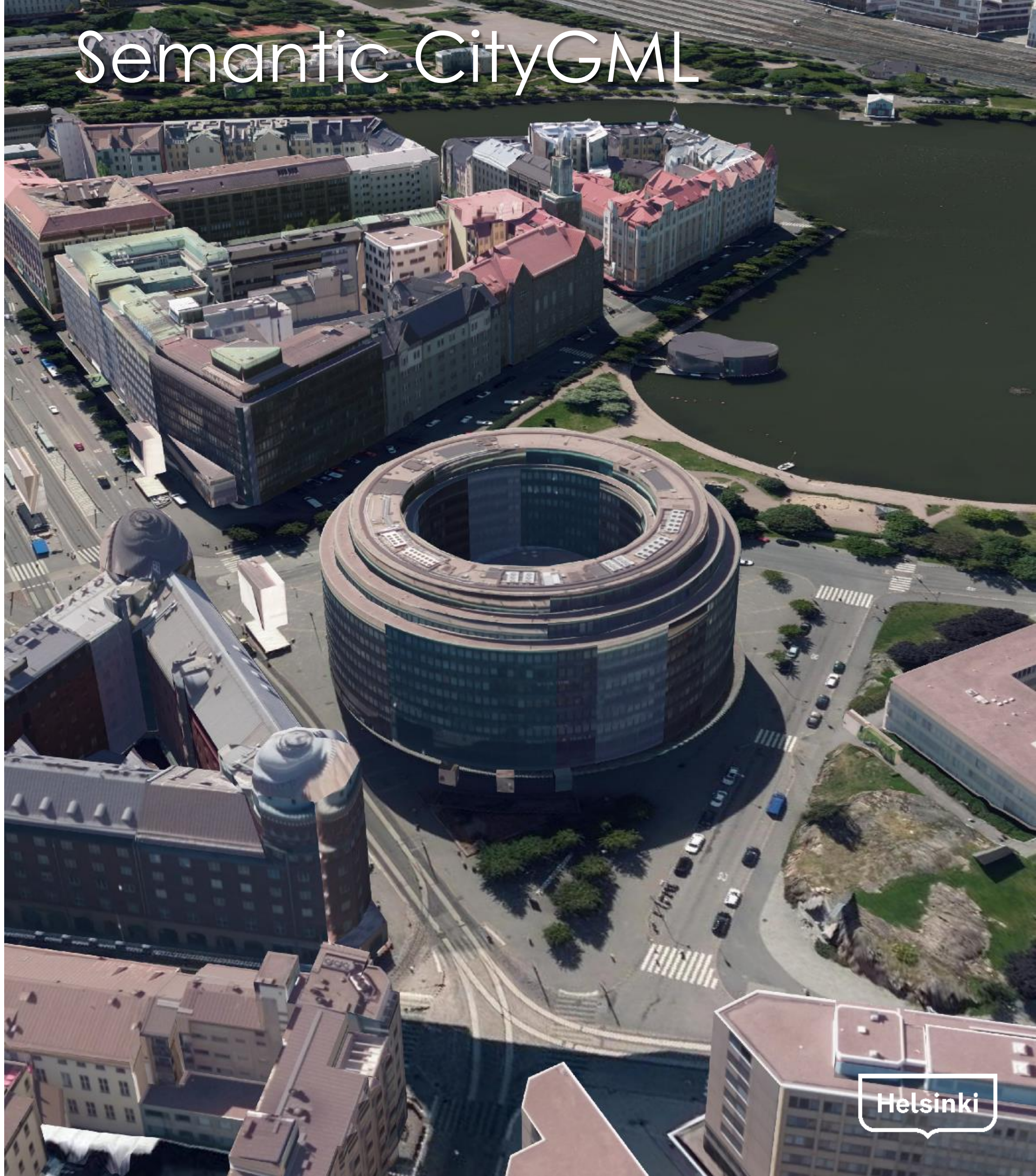
3D workstations | Architectural competitions | Real Time simulator | Helsinki 3D+ | Energy Atlas | Digital Twin

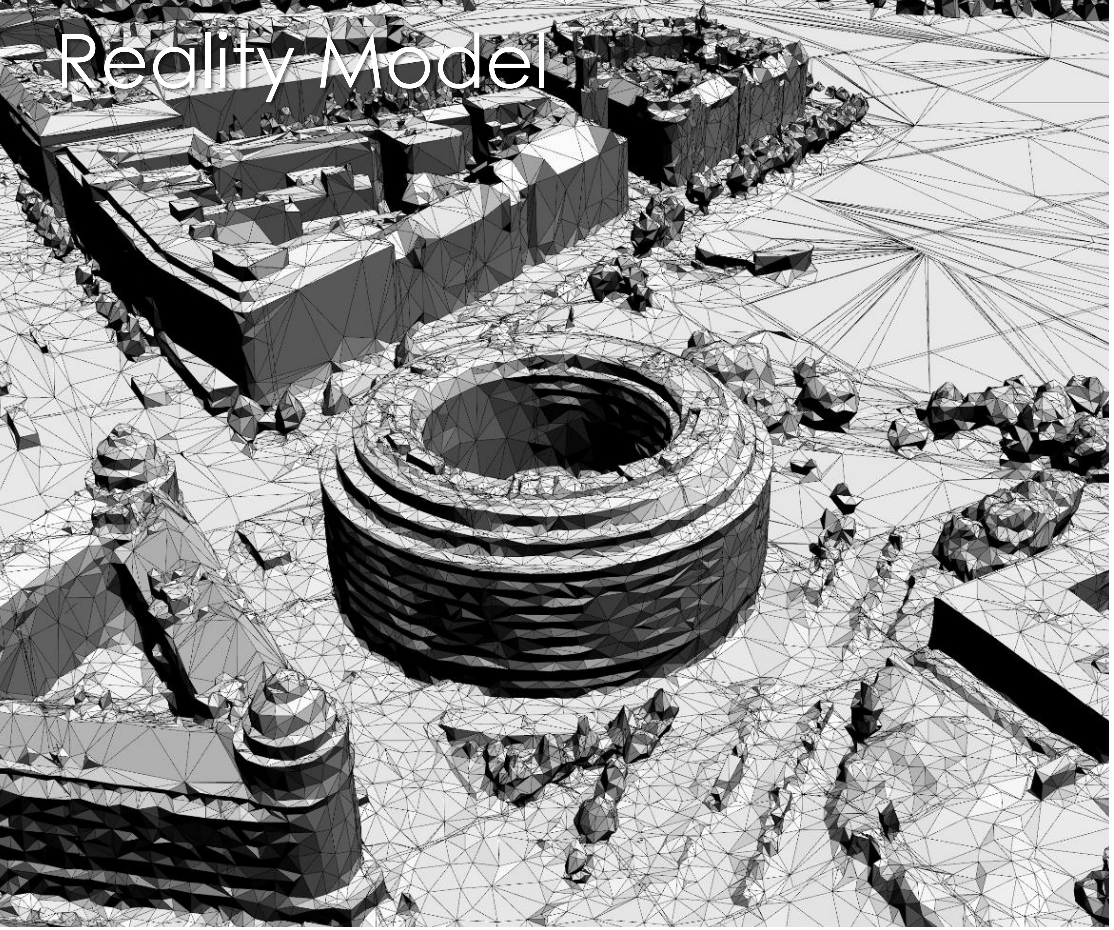



Helsinki

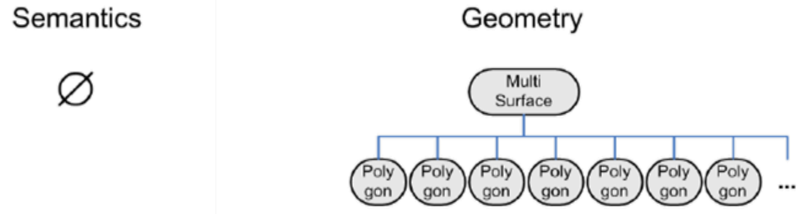

cases: geospatialworld.net
Environmental protection
Agriculture
Defence and national security
Disaster management
Statistics and demographics
Address management
Urban planning
Health and Education
Industrial development
Social inclusion
Smart cities
Citizen engagement
Crime investigation
Land administration and management
Planning and land use
Water management
Forest management
Infrastructure development
Marine information
Telecommunications
Tourism
Economic development
Energy transition
Water, energy and food nexus
Smart transportation
Risk management
Efficiency / Productivity / Improved Planning / Better Monitoring / Transparency / Management
REALITY MODEL
CityGML MODEL
PRODUCTION / STANDARDS / DATA MAPPING
Point Clouds
Oblique Images
GIS DataBases
023 abc
056 def
089 ghi
…… …..
Registers
IFC / BIM / Infra..
New Geodata
Helsinki

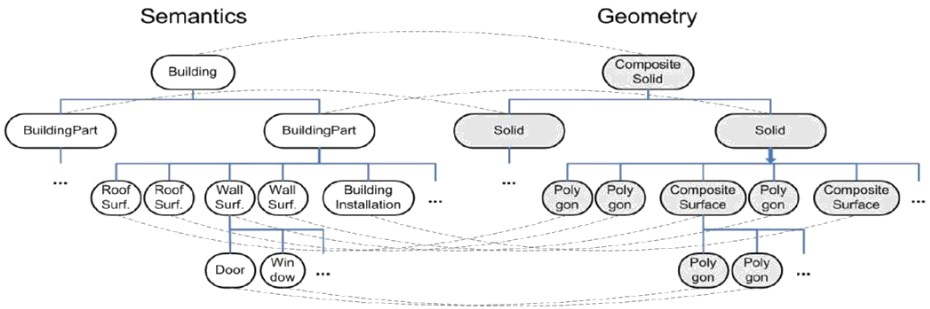

Reality Model


Semantic CityGML
Helsinki


Reality Model


Semantic CityGML
Helsinki


Semantics
∅
Geometry
Multi Surface
Poly gon
Poly gon
Poly gon
Poly gon
Poly gon
Poly gon
Poly gon
...


Semantics
Geometry
Building
BuildingPart
BuildingPart
...
Roof Surf.
Roof Surf.
Wall Surf.
Wall Surf.
Building Installation
...
Door
Win dow
...
Composite Solid
Solid
Solid
...
Poly gon
Poly gon
Composite Surface
Poly gon
Composite Surface
...
Poly gon
Poly gon
...

Reality Model + CityGML

Helsinki

Reality Model + CityGML

Digitally first

Helsinki

The Urban digital twin: an entity of co-operating datasets and systems.
Awareness of data sources allows the combination and further processing.

City model
Geospatial data
Registers

\+

Sensor data, simulations & plans

Digitally first:
Plan the full life cycle before building
Simulated impacts before changes are made

Better understanding → Better decisions→ Better city→ Quality of life

Levels of operation

Helsinki

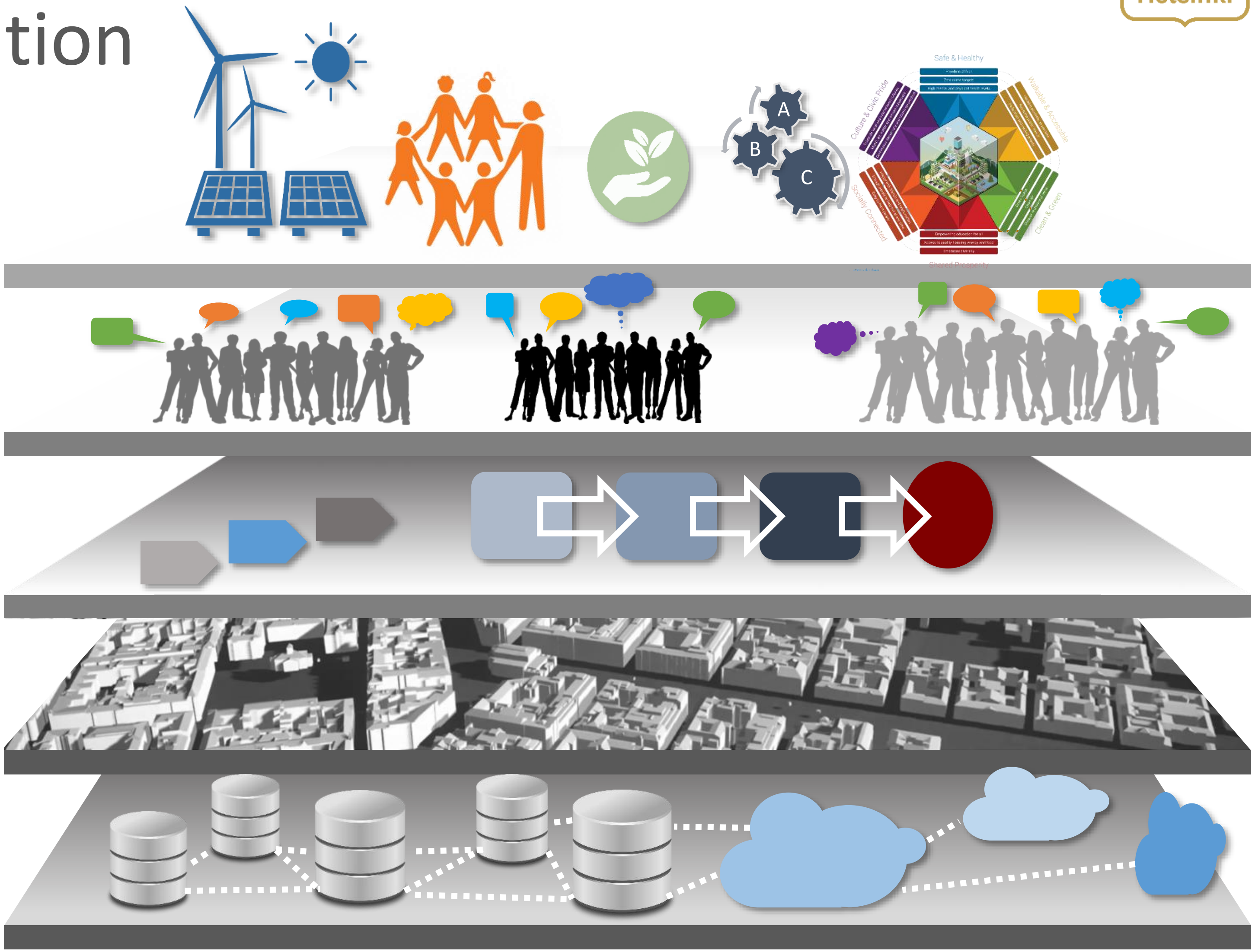
STRATEGIC GOALS

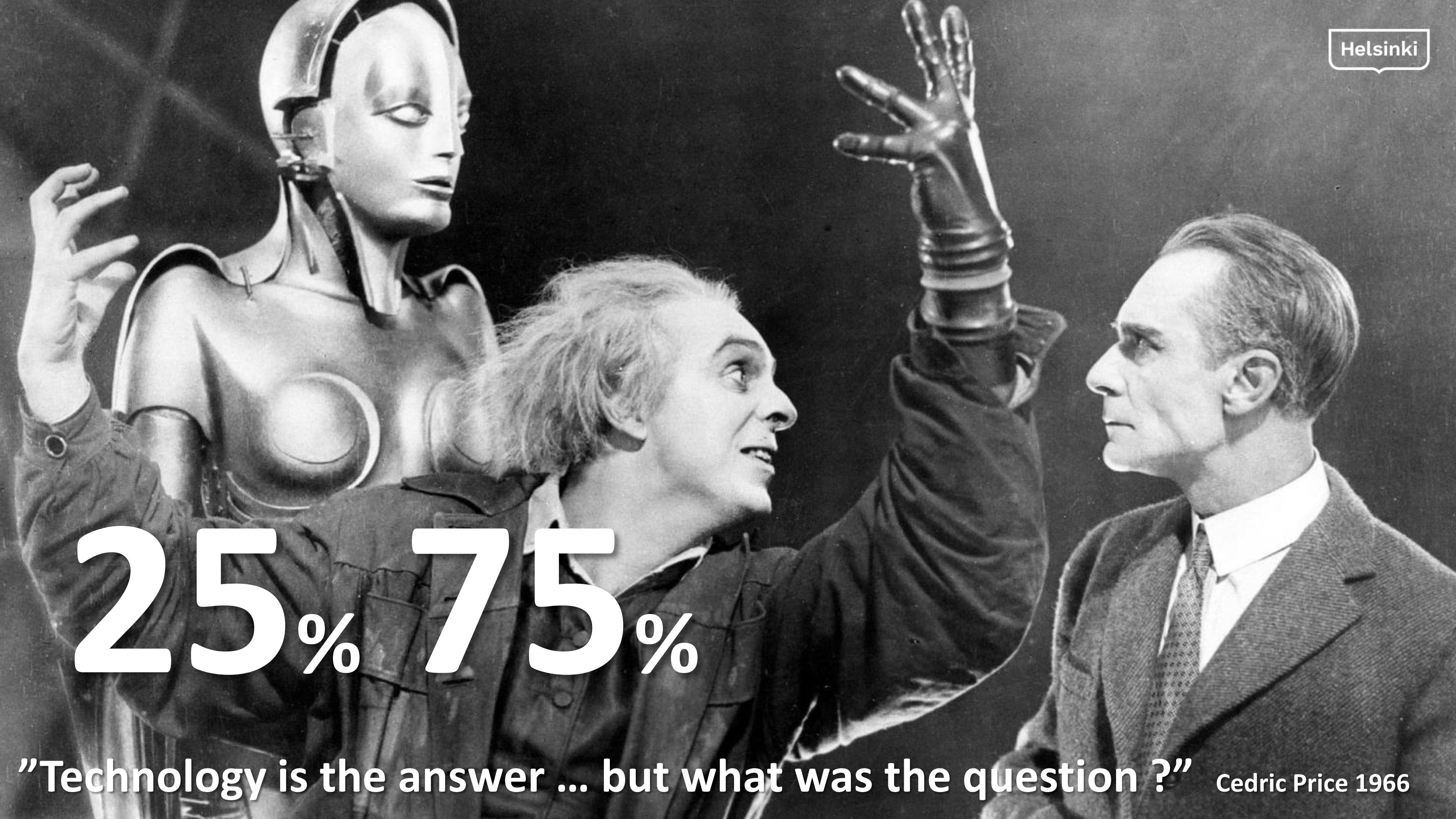
OPEN DATA

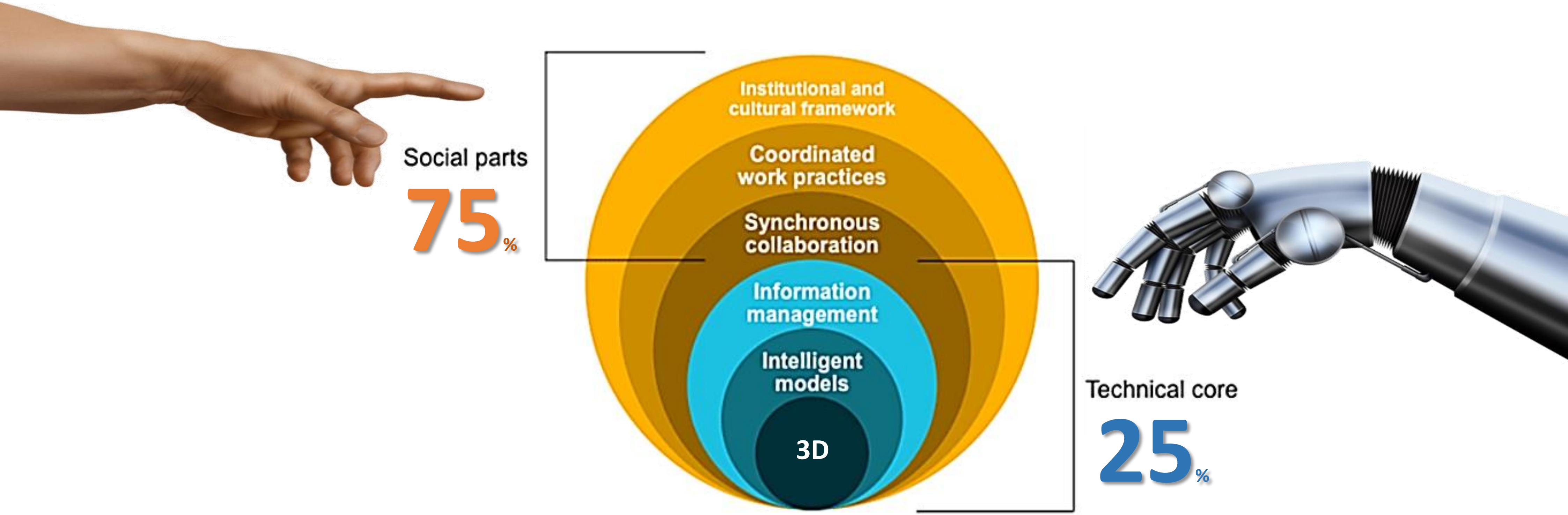
PROCESSES & SERVICES

3D MODELS

DATA




Helsinki
25% 75%
”Technology is the answer … but what was the question ?” Cedric Price 1966


Social parts
75%
Institutional and cultural framework
Coordinated work practices
Synchronous collaboration
Information management
Intelligent models
3D
Technical core
25%

The Most Functional City in the World
Helsinki City Strategy 2017–2021
Helsinki

Hallitulla rytminmuutoksella nopeampaan ja ketterämpään toimintakulttuuriin
4
Maailman toimivin kaupunki
Helsingin kaupunkistrategia 2017–2021

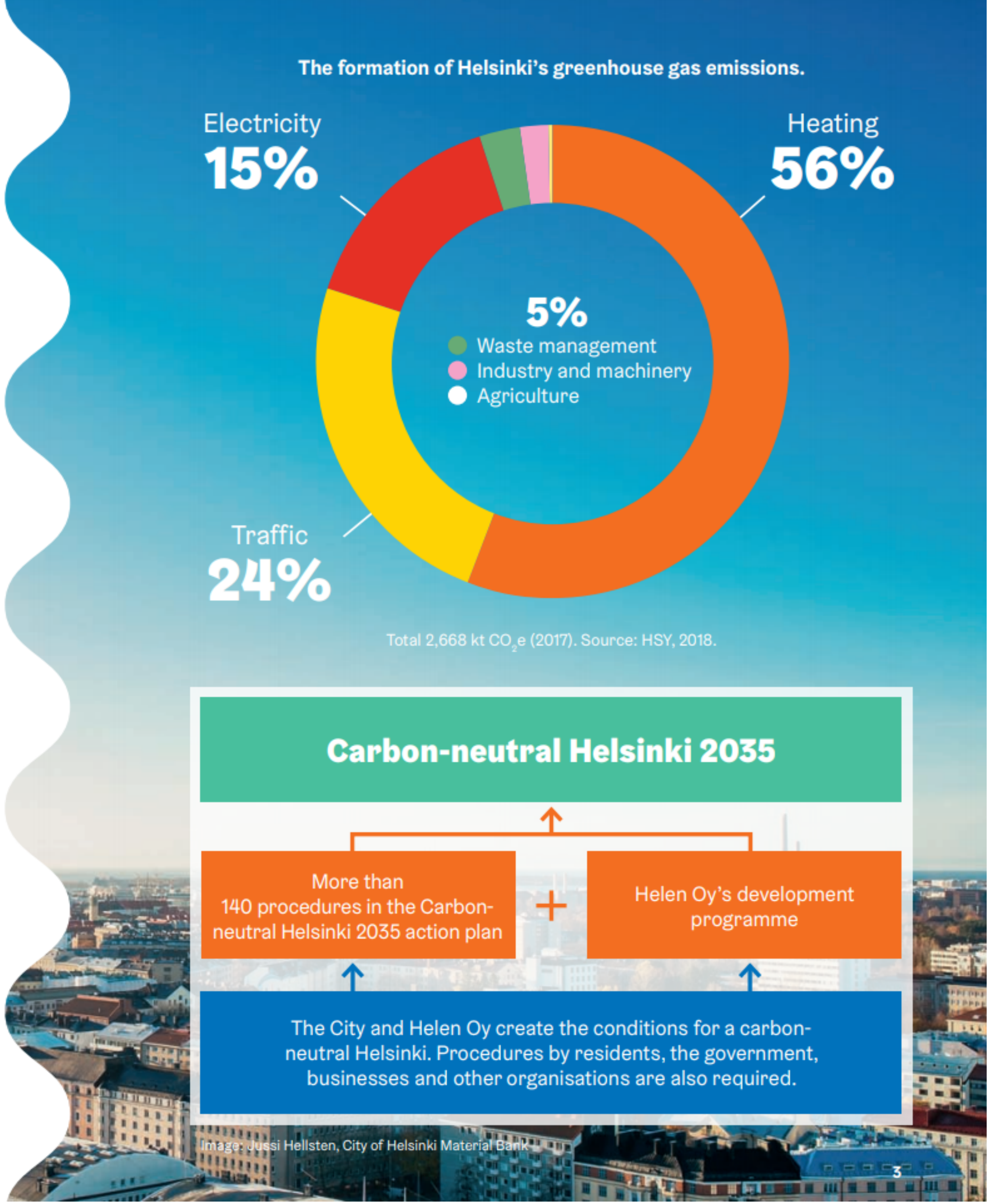
129

Making Helsinki carbon-neutral

The goal of Helsinki City Strategy 2017–2021 is to create a carbon-neutral Helsinki by 2035. When this goal is reached, operations taking place in Helsinki will no longer warm up the climate. The Carbon-neutral Helsinki 2035 action plan describes how Helsinki can get on the right track in terms of reducing emissions.

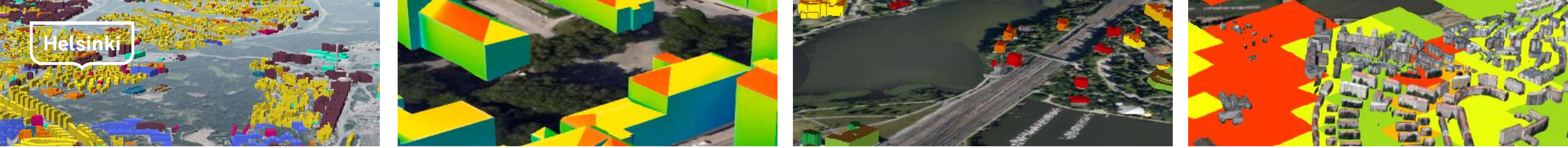
Becoming carbon-neutral requires that greenhouse gas emissions are reduced by at least **80%** from the levels of 1990. The remaining **20%** will be compensated for by Helsinki taking care of implementing emission reductions outside the city or, for example, increasing the number of carbon sinks. The City's emission calculations take emissions generated inside the city limits into account. The calculations do not include emissions generated outside Helsinki, such as those from air travel, food produced elsewhere or goods and services purchased outside the city.

Significant progress has already been made with continuous climate work. In 2017, Helsinki's emissions were **24%** smaller than those in 1990, even though the number of residents had increased by 150,000. Per resident, the emissions were calculated to be approximately **42%** smaller. However, in order to make Helsinki carbon-neutral, the emissions have to be reduced even more and faster than before. A carbon-neutral Helsinki is being created in collaboration between the residents, the City, businesses and organisations.



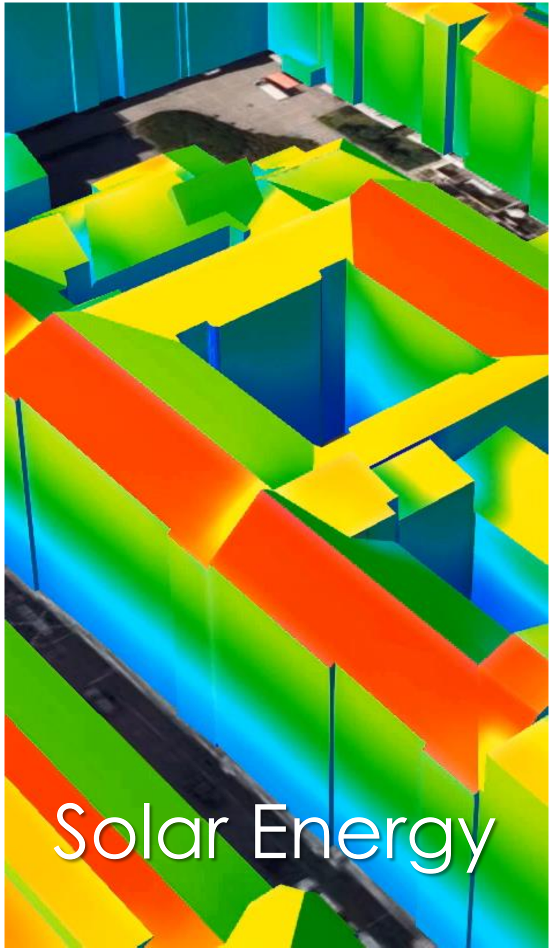
Helsinki

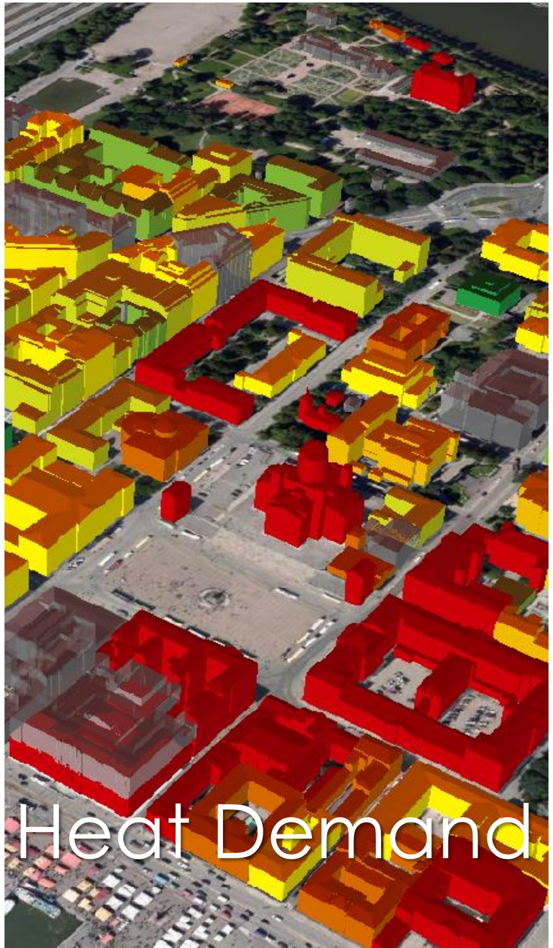
https://www.hel.fi/static/liitteet/kaupunkiymparisto/julkaisut/esitteet/HNH2035_en_summary_14022019.pdf

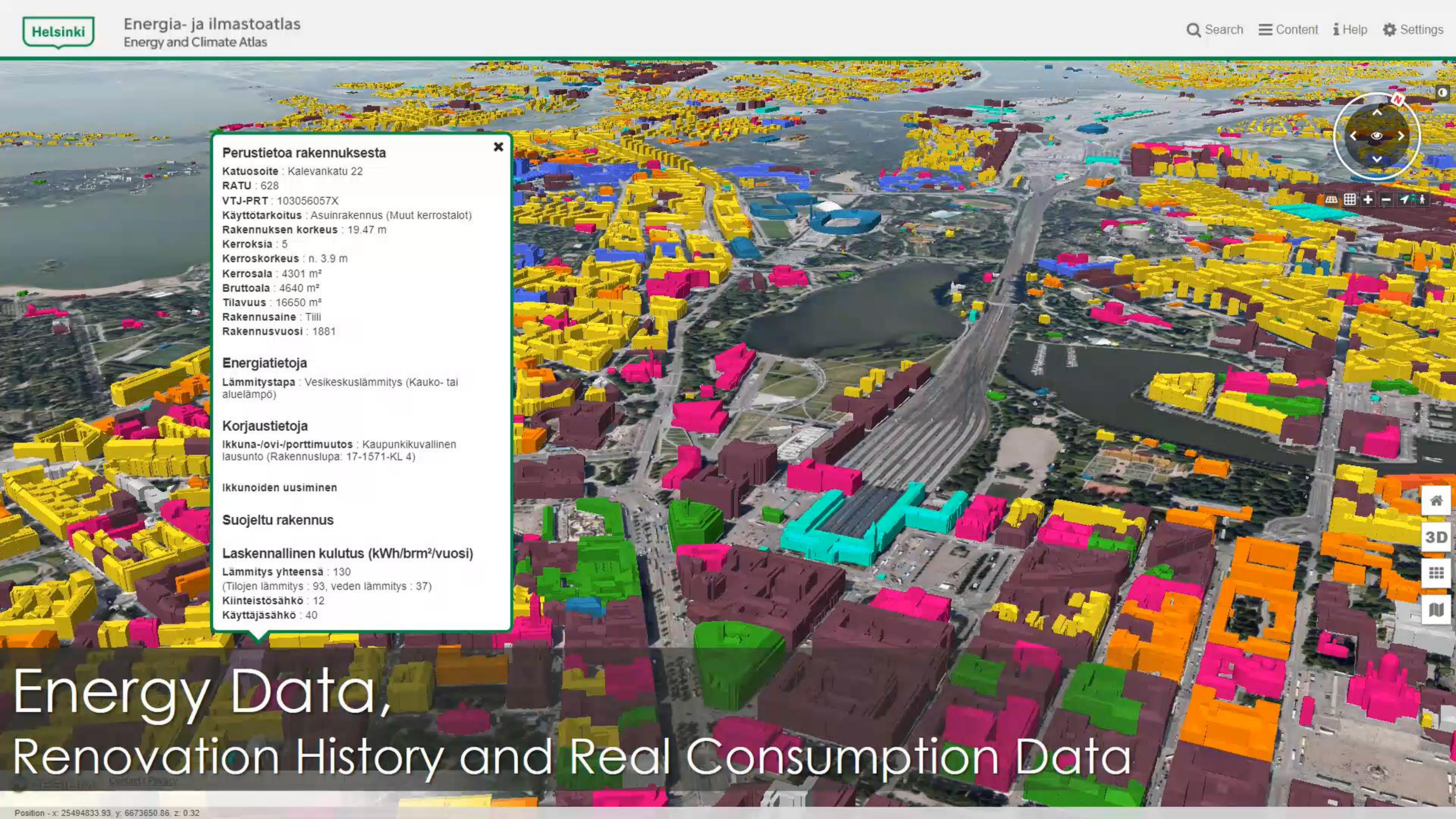


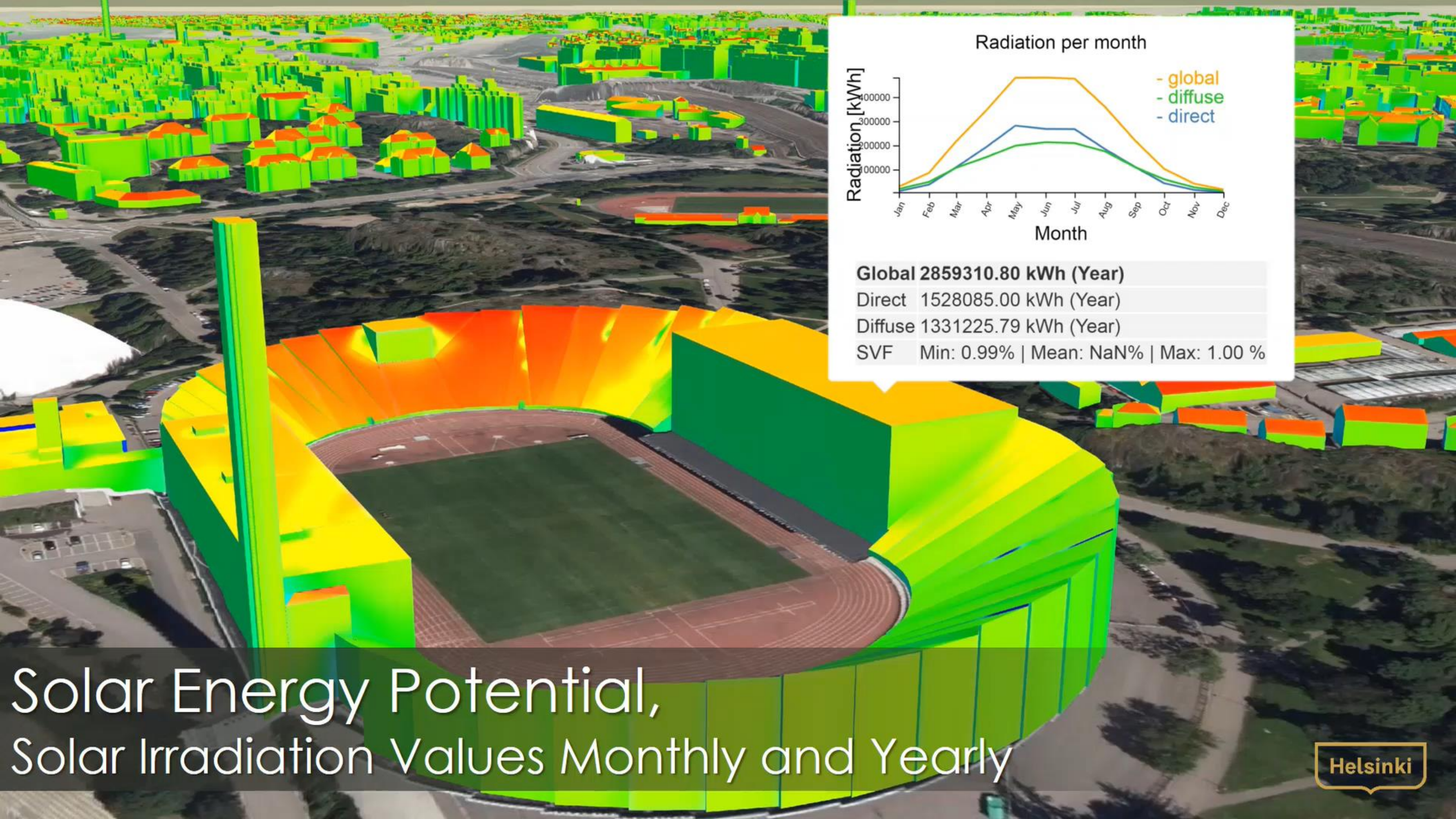
Helsinki Energy and Climate Atlas

hel.fi/3D

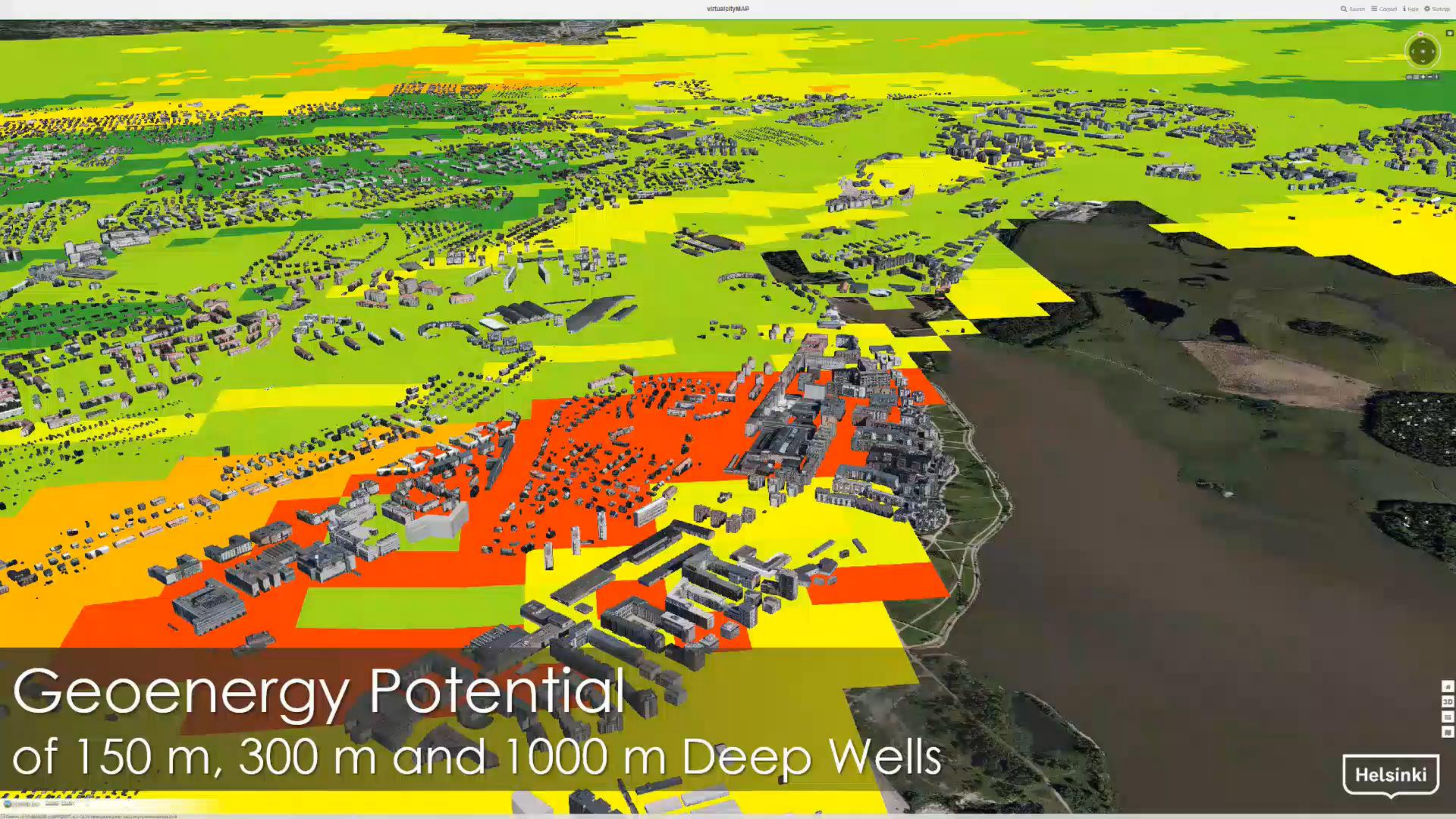





Helsinki
Energia- ja ilmastoatlas
Energy and Climate Atlas
Search
Content
Help
Settings
Perustietoa rakennuksesta
Katuosoite : Kalevankatu 22
RATU : 628
VTJ-PRT : 103056057X
Käyttötarkoitus : Asuinrakennus (Muut kerrostalot)
Rakennuksen korkeus : 19.47 m
Kerroksia : 5
Kerroskorkeus : n. 3.9 m
Kerrosala : 4301 m²
Bruttoala : 4640 m²
Tilavuus : 16650 m³
Rakennusaine : Tiili
Rakennusvuosi : 1881
Energiatietoja
Lämmitystapa : Vesikeskuslämmitys (Kauko- tai aluelämpö)
Korjaustietoja
Ikkuna-/ovi-/porttimuutos : Kaupunkikuvallinen lausunto (Rakennuslupa: 17-1571-KL 4)
Ikkunoiden uusiminen
Suojeltu rakennus
Laskennallinen kulutus (kWh/brm²/vuosi)
Lämmitys yhteensä : 130
(Tilojen lämmitys : 93, veden lämmitys : 37)
Kiinteistösähkö : 12
Käyttäjäsähkö : 40
3D
Energy Data,
Renovation History and Real Consumption Data
Position - x: 25494833.93, y: 6673650.86, z: 0.32


Radiation per month
Radiation [kWh]
400000
300000
200000
100000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
- global
- diffuse
- direct
Global 2859310.80 kWh (Year)
Direct 1528085.00 kWh (Year)
Diffuse 1331225.79 kWh (Year)
SVF Min: 0.99% | Mean: NaN% | Max: 1.00 %
Solar Energy Potential,
Solar Irradiation Values Monthly and Yearly
Helsinki


Styling Options
Heating demand
Heating saving potential
CO2 emissions
Climate change
Refurbishments
Heating demand in a changing climate [MWh]
Mar
2020: 452 MWh
2035: 425 MWh
2050: 404 MWh
600
500
400
300
200
100
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2020
2035
2050
BID_49877441-38b6-45b3-8cba-2af05b3c8051
VTJ_PRT 1031519121
RATU 2078
Adress Siltasaarenkatu 18
Function Toimistorakennukset
Year of construction 1968
Storeys above ground 10
Total floor area 39351 m²
Volume 129212 m³
Space heating demand: 108 (kWh/m²a)
Space heating [kWh/(m².a)]
A B C D E F G
0 75 100 130 160 190 240
Helsinki
Heat Demand,
Heat Savings and also CO2 Emissions
CESIUM
Data attribution


virtualcityMAP
Geoenergy Potential
of 150 m, 300 m and 1000 m Deep Wells
Helsinki

The Kalasatama Digital Twins Project

The final report of the KIRA-digi pilot project

https://www.hel.fi/static/liitteet-2019/Kaupunginkanslia/Helsinki3D_Kalasatama_Digital_Twins.pdf

KIRA-digi

Ympäristöministeriö
Miljöministeriet
Ministry of the Environment

Helsinki

2.5.2019


MINECRAFT
Helsinki

3D+

Thank You

jarmo.suomisto@hel.fi

www.hel.fi/3D

Youtube Helsinki3D+

Links

- Helsinki 3D+ website www.hel.fi/3D
- Helsinki Energy and Climate Atlas   https://kartta.hel.fi/3d/atlas
- Open Energy Atlas data in Helsinki Region Infoshare https://hri.fi/fi/dataset/helsingin-3d-kaupunkimalli
- Energy and Climateatlas videoclip (no audio) https://youtu.be/Cr-M1bla7K0
- Heat Demand Prediction of Buildings Using a 3D City Model
  Presentation by Enni Airaksinen https://youtu.be/J6r-cCL25O0
- 3D City Models and Minecraft Helsinki as open data in Helsinki Region Infoshare
  https://hri.fi/data/en_GB/dataset/helsingin-3d-kaupunkimalli
- Helsinki 3D+ Youtube channel   https://www.youtube.com/channel/UCC5zVtGUdLXRI354lghLLqg/videos

Helsinki

Geospatial for Finance Industry

Christophe Christiaen, Oxford University Sustainable Finance Programme, United Kingdom

Christophe is the Data, Innovation and Impact Lead within the Oxford Sustainable Finance Programme, developing innovation strategy and partnerships for the UK Centre for Greening Finance and Investment as well as the Spatial Finance Initiative, which he co-founded.

He also created and runs the Satellite Applications Catapult's Sustainable Finance value stream, stimulating geospatial technology innovations for the financial services market. At the Catapult, he has worked across numerous national and international technology innovation projects in strategy advisory capacities and supported multiple technology start-ups and SMEs with the commercialisation of their products.

Previously Christophe held roles at the European Space Agency, working as a business analyst and at Henkel, working across credit management and sales controlling. Christophe holds an MSc in Business Engineering from the University of Antwerp, specialising in finance, accountancy, and environmental economics.

Christophe is the data and innovation lead at the UK centre for Green Finance and Investment and co-founder of the spatial finance initiative. He set out a convincing case for a huge opportunity for geospatial in the finance sector. Green finance is a hot topic, with investors increasingly wanting to channel funds to sustainable projects. This is not only because of environmental concerns, but also growing evidence that such projects financial outperform those made in projects likely to be adversely affected by climate change. Further, many governments are setting up mechanisms to force financial institutions to report on climate related risks in regulating their fitness to operate. This type of reporting relies on good, granular data and existing sources, based on self- disclosure, are often very general, historical, and non-standard, making objective comparison difficult. Geospatial data, particularly from earth observation, answers this need – it reflects the real world, is detailed enough to identify individual assets, offers global coverage and rapid refresh.

Christophe highlighted many use cases, including monitoring global supply chains, underpinning the carbon credit market and measuring greenhouse gas emissions of individual power plants. He also explained that often the outputs of analysis are spreadsheets that can be easily fed into existing financial analytics, rather than as geographical visualizations. In summing up and subsequent discussion, he explained that financial services sector spends and estimated USD33 billion per annum on data and the proportion spent to support ESG (Environmental, Social and Governance) decisions was increasing rapidly. A wide range of future applications is still emerging, which geospatial and EO professionals were well placed to exploit by working together.

GEOSPATIAL FOR FINANCE INDUSTRY

Spatial Finance: Next Generation Climate and Environmental Analytics for Resilient Finance

Christophe Christiaen
29th October 2021

IS PART OF

UK Centre for Greening Finance & Investment

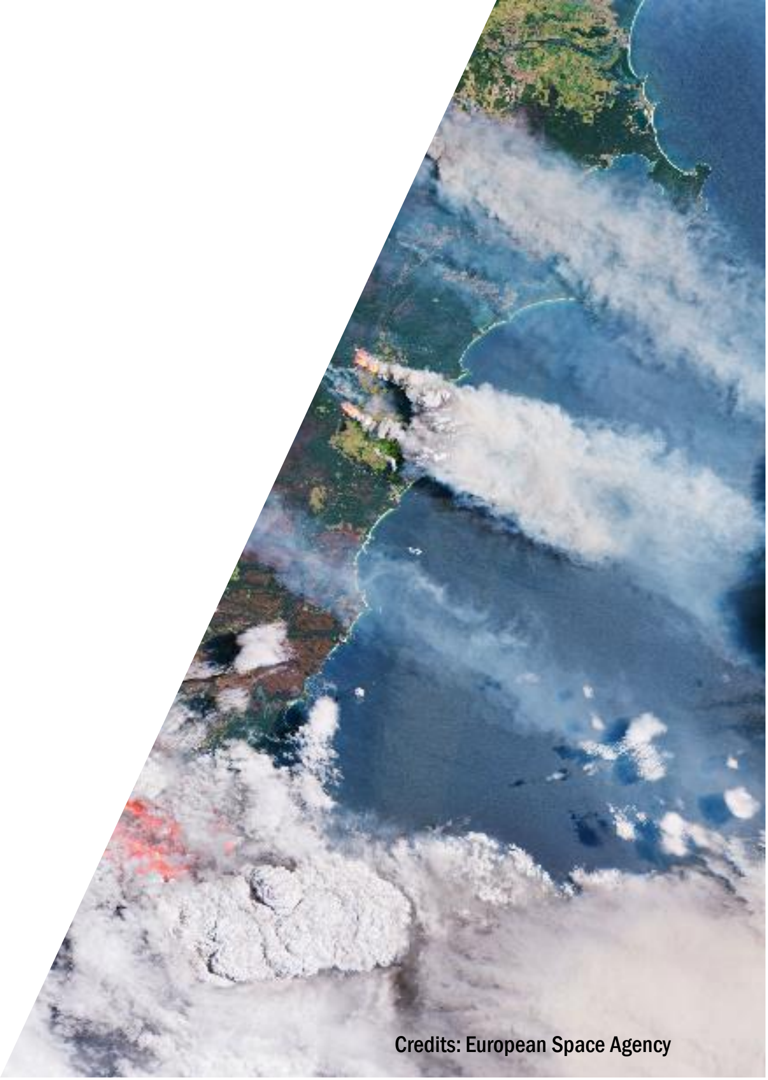
MARKET DEVELOPMENTS

Green/Sustainable Finance is about:

- Aligning the financial system with global sustainability = Greening Finance
- Financing the transition to global sustainability = Financing Green

Interest in green finance is growing rapidly, driven by:

- **Financial considerations**
- **Regulation and policy**
- **Customer and consumer preferences**



Credits: European Space Agency

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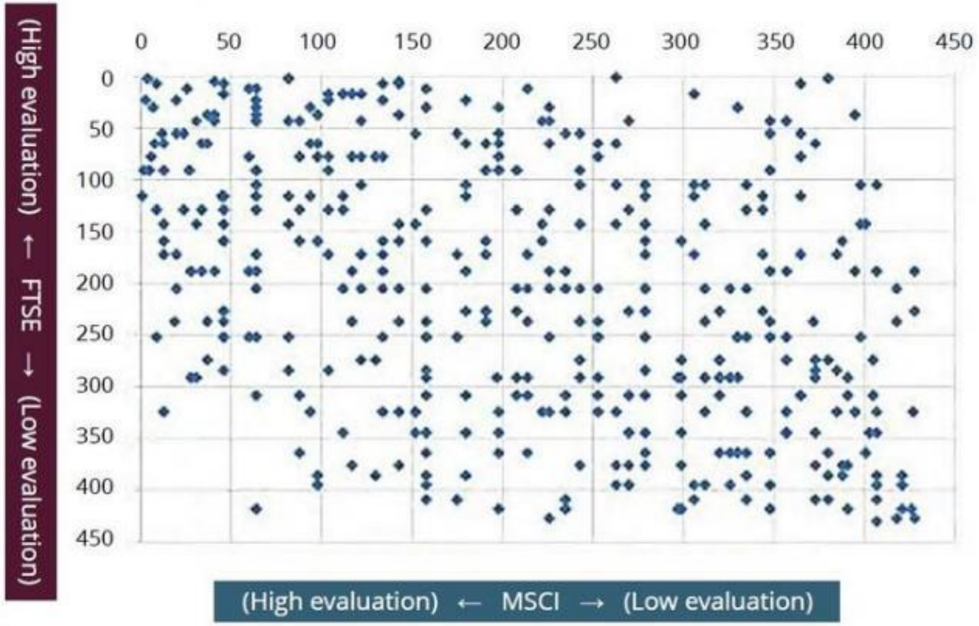
DATA CHALLENGE

Main source of data on a company's sustainability performance is its voluntarily reported information or 'disclosures'.

This comes with various challenges:

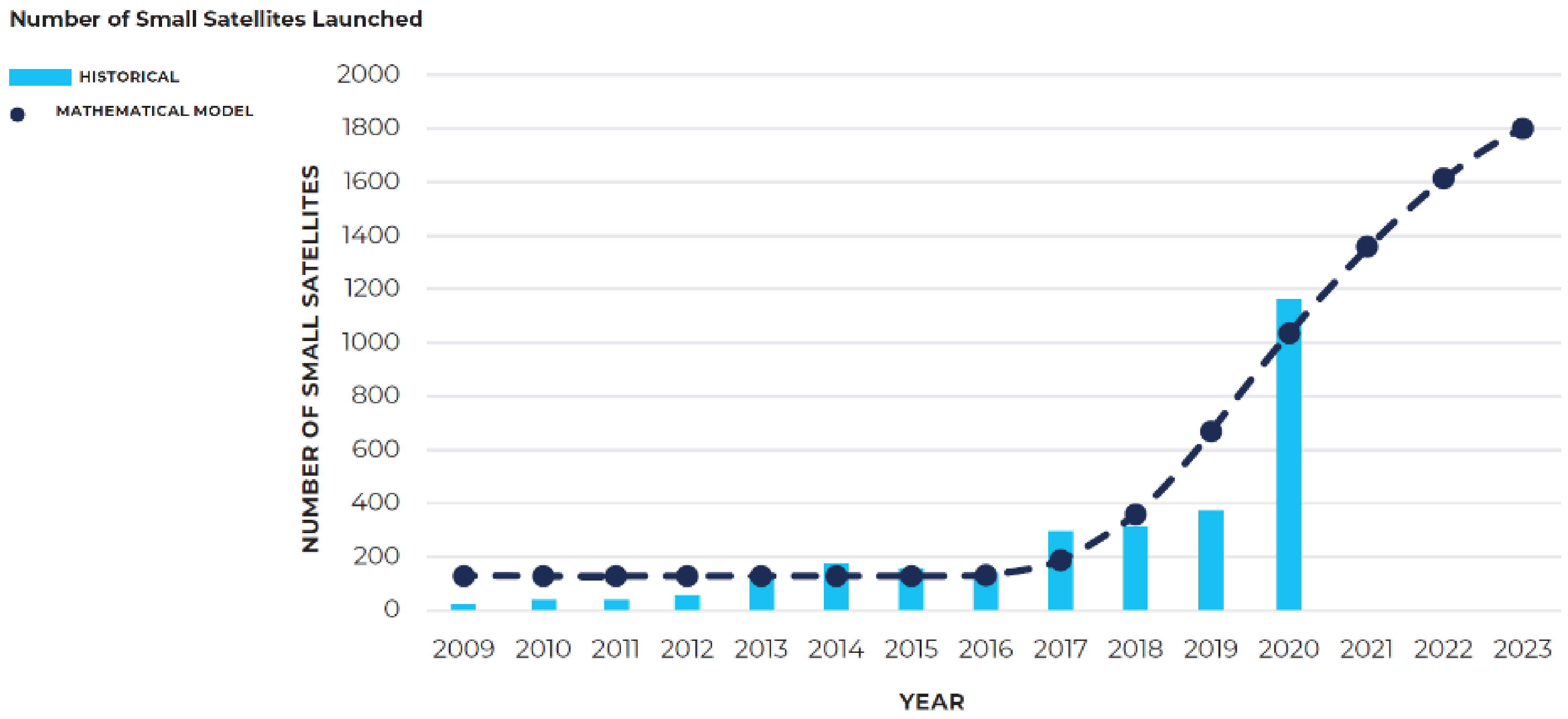
- Information is **self-disclosed** and typically compiled top-down
- ESG reporting is not mandatory, which means **not all companies report**
- ESG reporting not standardised, which means **data is not comparable**
- Annual reporting means ESG **data is outdated** once released

Figure 1 – Comparison of ESG scores from FTSE

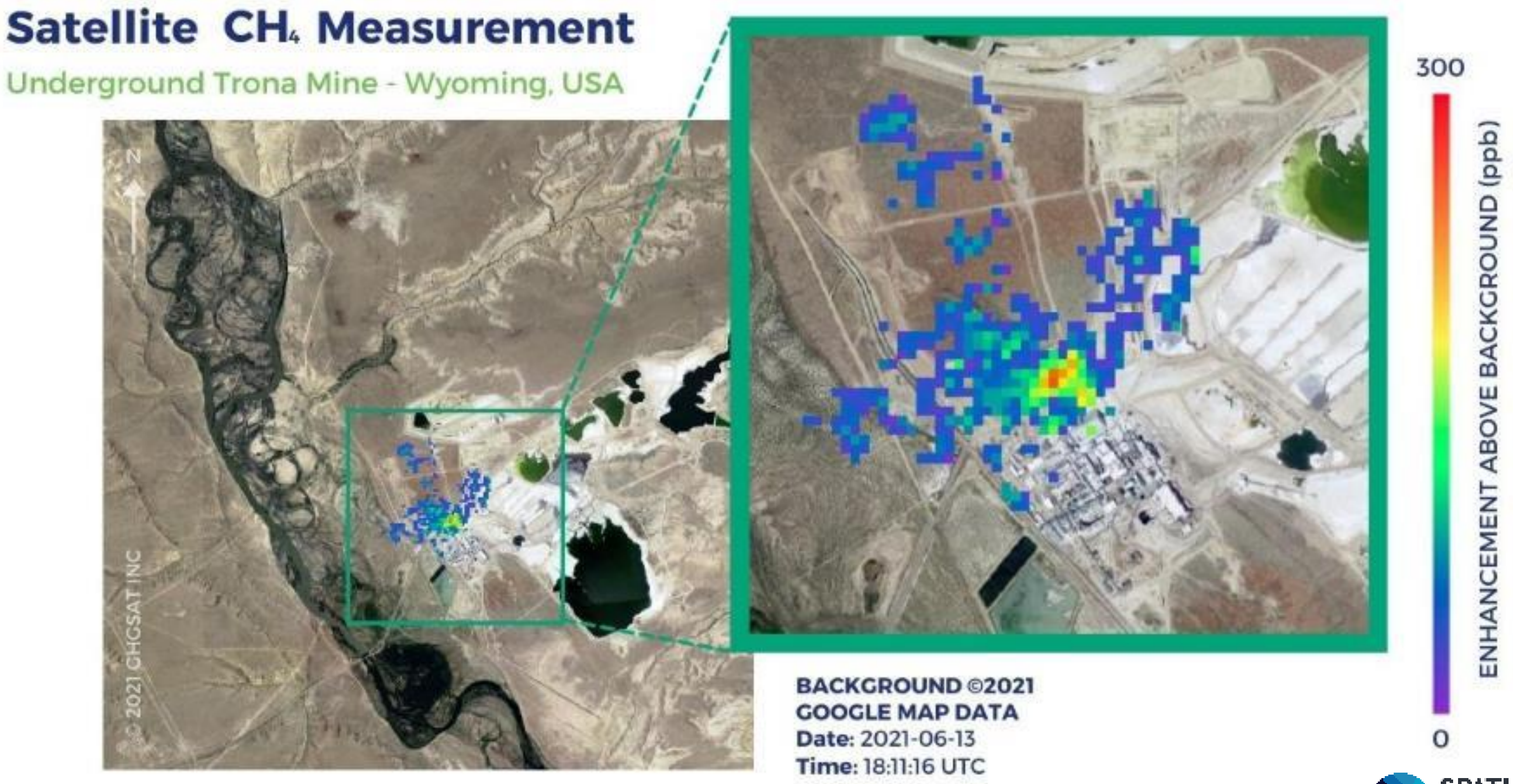


Source: CLSA, GPIF

TECHNOLOGY ADVANCEMENTS

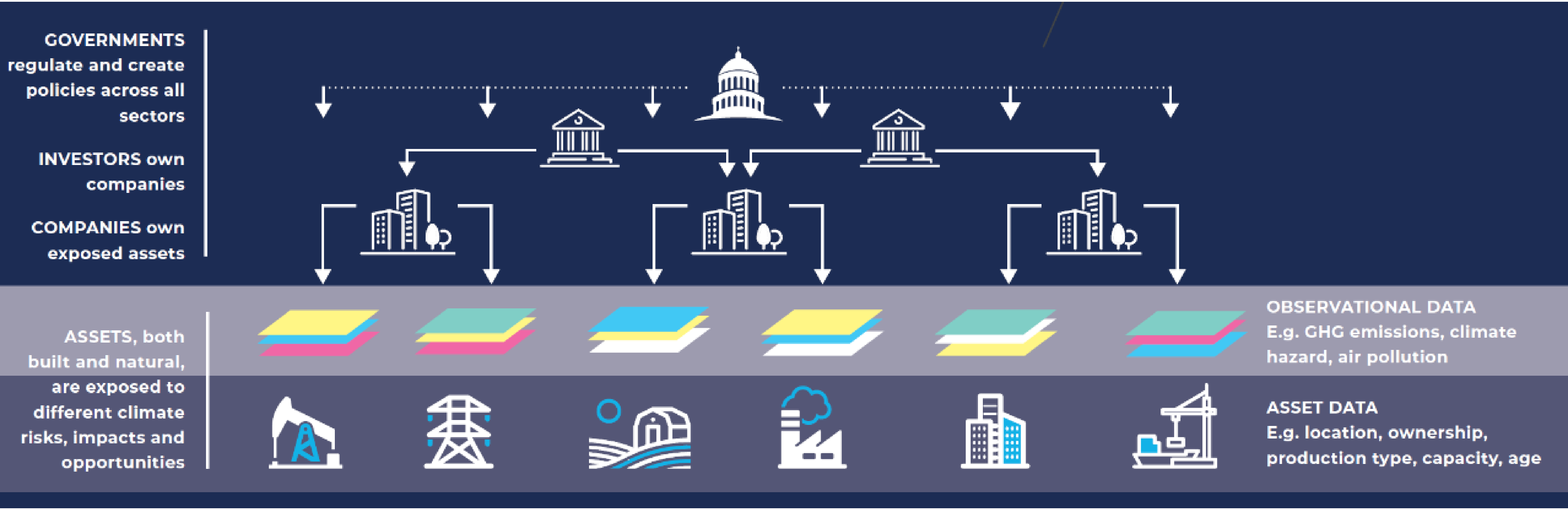


TECHNOLOGY ADVANCEMENTS



Credits: GHGSat

SPATIAL FINANCE AND ASSET-LEVEL DATA



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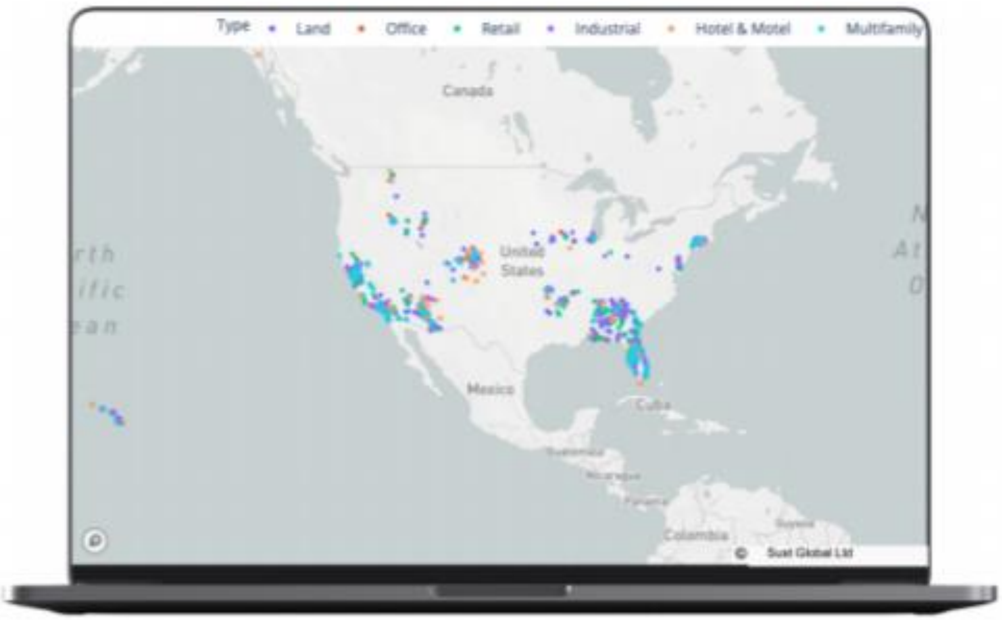
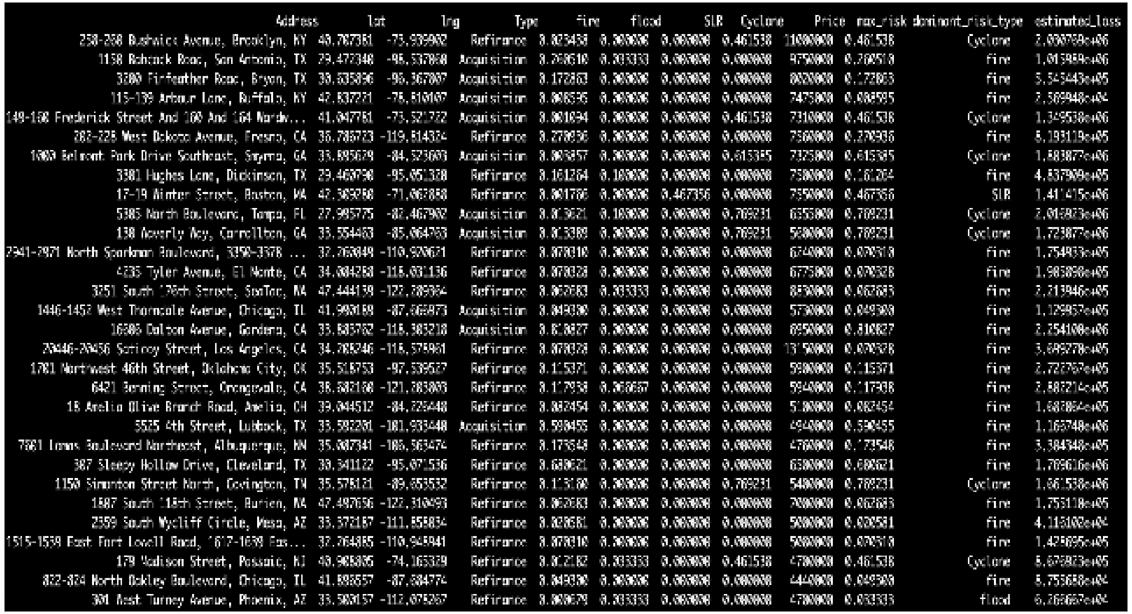
SPATIAL FINANCE APPLICATIONS

SPATIAL FINANCE APPLICATIONS
PHYSICAL CLIMATE RISK

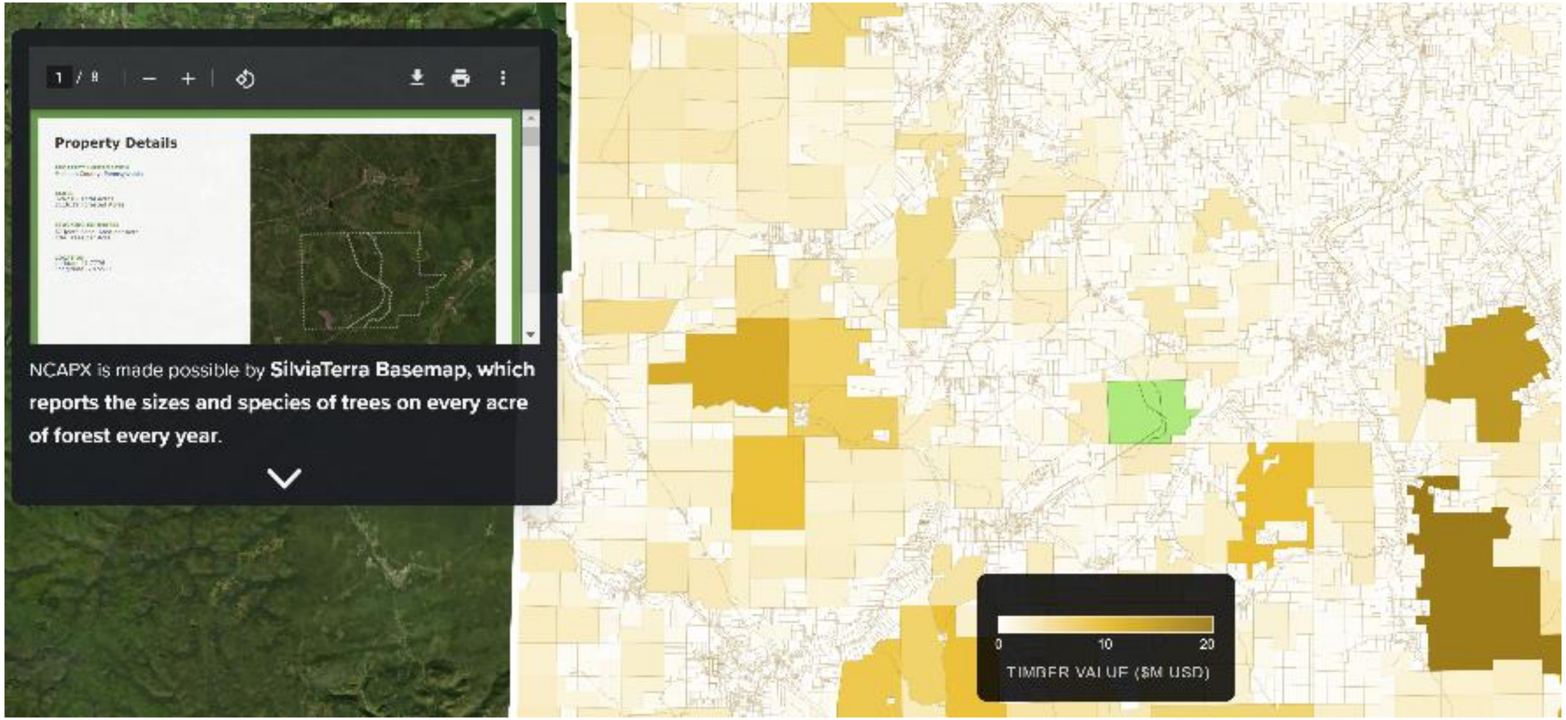




Address	lat	lng	Type	fire	flood	SLR	Cyclone	Price	max_risk	dominant_risk_type	estimated_loss
258-268 Bushwick Avenue, Brooklyn, NY	40.707381	-73.939902	Refinance	0.023438	0.000000	0.000000	0.461538	11000000	0.461538	Cyclone	2.030769e+06
1138 Babcock Road, San Antonio, TX	29.477348	-98.537868	Acquisition	0.260610	0.333333	0.000000	0.000000	9750000	0.260610	fire	1.013959e+06
3200 Firfeather Road, Bryan, TX	30.635896	-96.367007	Acquisition	0.172863	0.000000	0.000000	0.000000	8020000	0.172863	fire	5.545443e+05
113-139 Arbour Lane, Buffalo, NY	42.837221	-78.810007	Acquisition	0.008595	0.000000	0.000000	0.000000	7475000	0.008595	fire	2.569948e+04
149-158 Frederick Street And 160 And 164 Nordw...	41.047781	-73.521722	Acquisition	0.001094	0.000000	0.000000	0.461538	7310000	0.461538	Cyclone	1.349538e+06
202-228 West Dakota Avenue, Fresno, CA	36.786723	-119.814324	Refinance	0.270936	0.000000	0.000000	0.000000	7360000	0.270936	fire	6.193119e+05
1000 Belmont Park Drive Southeast, Smyrna, GA	33.895629	-84.523603	Acquisition	0.003457	0.000000	0.000000	0.615385	7325000	0.615385	Cyclone	1.803077e+06
3381 Hughes Lane, Dickinson, TX	29.460790	-95.051328	Refinance	0.161264	0.100000	0.000000	0.000000	7300000	0.161264	fire	4.637909e+05
17-19 Winter Street, Boston, MA	42.389268	-71.067858	Refinance	0.001786	0.000000	0.467356	0.000000	7350000	0.467356	SLR	1.411415e+06
5303 North Boulevard, Tampa, FL	27.985775	-82.467902	Acquisition	0.013621	0.100000	0.000000	0.769231	6355000	0.769231	Cyclone	2.016923e+06
138 Beverly Way, Carrollton, GA	33.554463	-85.064763	Acquisition	0.013389	0.000000	0.000000	0.769231	5600000	0.769231	Cyclone	1.723077e+06
2941-2971 North Sparkman Boulevard, 3350-3378 ...	32.263049	-110.920621	Refinance	0.070310	0.000000	0.000000	0.000000	6240000	0.070310	fire	1.754933e+05
4235 Tyler Avenue, El Monte, CA	34.084268	-118.031136	Refinance	0.070328	0.000000	0.000000	0.000000	6775000	0.070328	fire	1.903890e+05
3251 South 176th Street, SeaTac, WA	47.444139	-122.289064	Refinance	0.062683	0.333333	0.000000	0.000000	8830000	0.062683	fire	2.213946e+05
1446-1452 West Thorndale Avenue, Chicago, IL	41.990189	-87.666873	Acquisition	0.049300	0.000000	0.000000	0.000000	5730000	0.049300	fire	1.129957e+05
16306 Dalton Avenue, Gardena, CA	33.885762	-118.303218	Acquisition	0.810827	0.000000	0.000000	0.000000	6950000	0.810827	fire	2.254100e+06
20446-20456 Saticoy Street, Los Angeles, CA	34.205246	-118.575961	Refinance	0.070328	0.000000	0.000000	0.000000	13150000	0.070328	fire	3.699278e+05
1701 Northwest 46th Street, Oklahoma City, OK	35.518753	-97.539527	Refinance	0.115371	0.000000	0.000000	0.000000	5900000	0.115371	fire	2.722767e+05
6421 Benning Street, Orangevale, CA	38.682160	-121.203003	Refinance	0.117938	0.066667	0.000000	0.000000	5940000	0.117938	fire	2.802214e+05
16 Amelia Olive Branch Road, Amelia, OH	39.044512	-84.226448	Refinance	0.082454	0.000000	0.000000	0.000000	5100000	0.082454	fire	1.682064e+05
5525 4th Street, Lubbock, TX	33.582201	-101.933448	Acquisition	0.590455	0.000000	0.000000	0.000000	4940000	0.590455	fire	1.166748e+06
7601 Lomas Boulevard Northeast, Albuquerque, NM	35.087341	-106.563474	Refinance	0.173548	0.000000	0.000000	0.000000	4760000	0.173548	fire	3.304348e+05
387 Sleepy Hollow Drive, Cleveland, TX	30.341122	-95.071536	Refinance	0.680621	0.000000	0.000000	0.000000	6300000	0.680621	fire	1.709616e+06
1150 Simonton Street North, Covington, TN	35.575121	-89.653532	Refinance	0.113160	0.000000	0.000000	0.769231	5400000	0.769231	Cyclone	1.661538e+06
1887 South 118th Street, Burien, WA	47.497636	-122.310493	Refinance	0.062683	0.000000	0.000000	0.000000	7000000	0.062683	fire	1.753118e+05
2359 South Wycliff Circle, Mesa, AZ	33.372167	-111.855834	Refinance	0.020581	0.000000	0.000000	0.000000	5000000	0.020581	fire	4.116102e+04
1515-1539 East Fort Lowell Road, 1617-1639 Eas...	32.264365	-110.945941	Refinance	0.070310	0.000000	0.000000	0.000000	5000000	0.070310	fire	1.425695e+05
179 Madison Street, Passaic, NJ	40.905005	-74.165329	Refinance	0.012182	0.333333	0.000000	0.461538	4700000	0.461538	Cyclone	6.676923e+05
822-824 North Oakley Boulevard, Chicago, IL	41.895557	-87.684774	Refinance	0.049300	0.000000	0.000000	0.000000	4440000	0.049300	fire	6.753688e+04
301 West Turney Avenue, Phoenix, AZ	33.500157	-112.075267	Refinance	0.000679	0.333333	0.000000	0.000000	4700000	0.033333	flood	6.266667e+04

Credits: Sust Global

SPATIAL FINANCE APPLICATIONS
ENVIRONMENTAL MARKETS



Credits: SilviaTerra

SPATIAL FINANCE INITIATIVE

SPATIAL FINANCE APPLICATIONS
EMISSIONS MODELLING

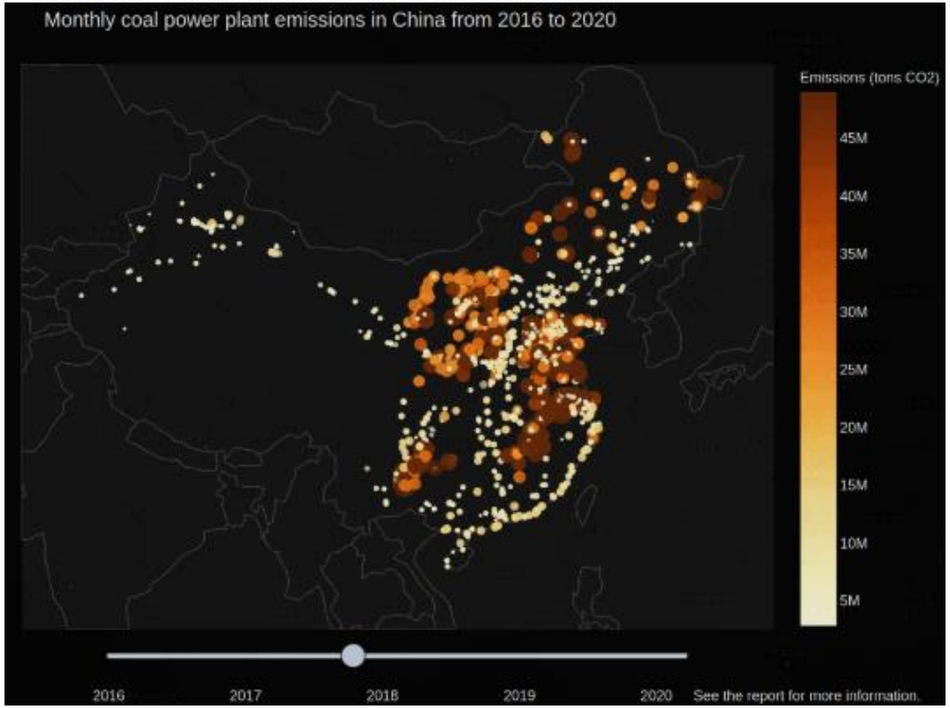
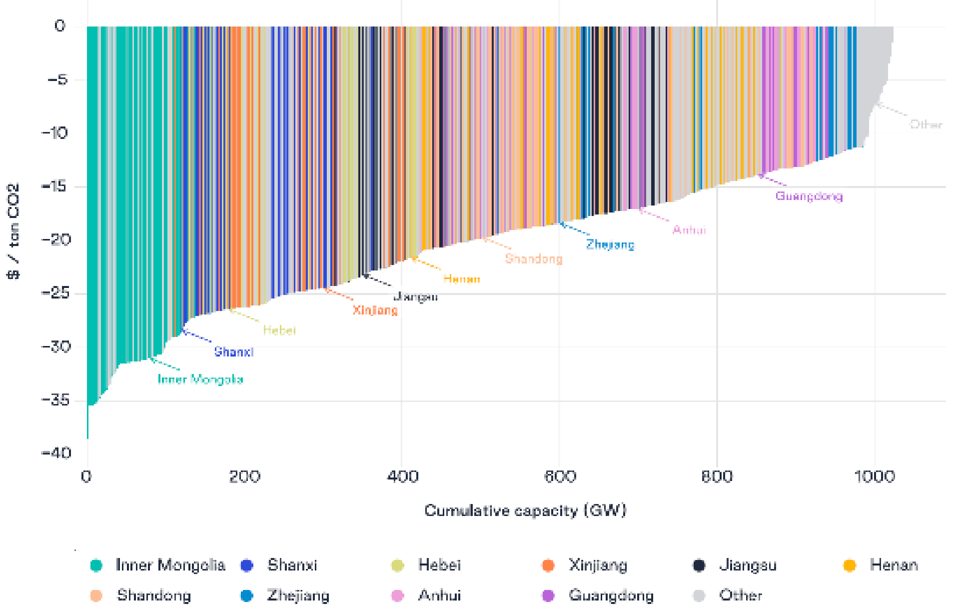


Figure 8. Unit level marginal abatement cost to replace existing coal by province



Source: TransitionZero analysis

Credits: TransitionZero

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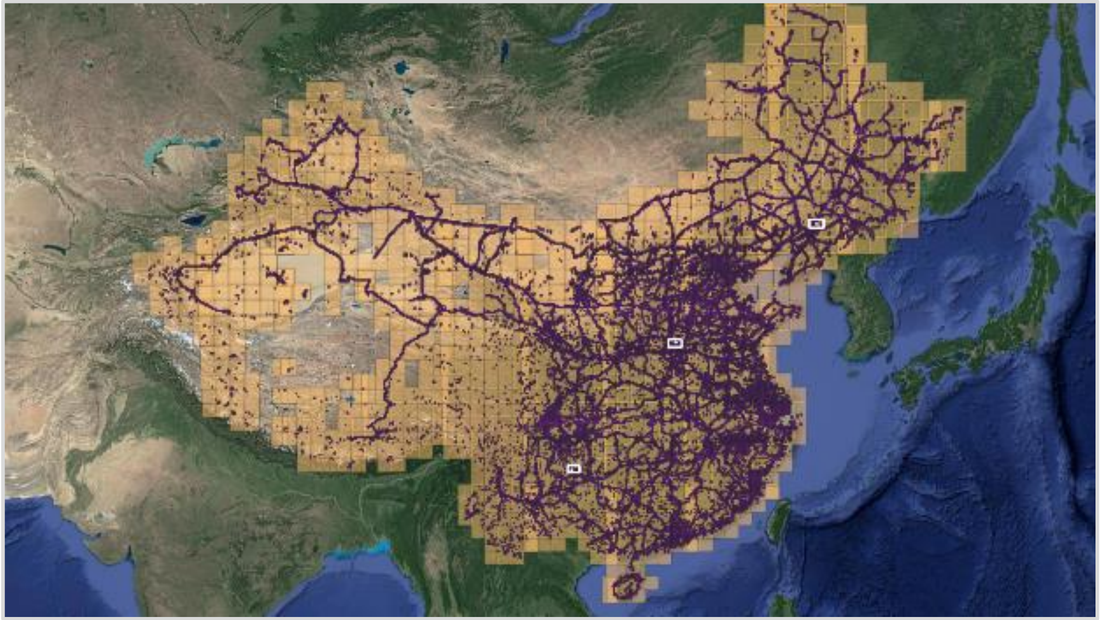
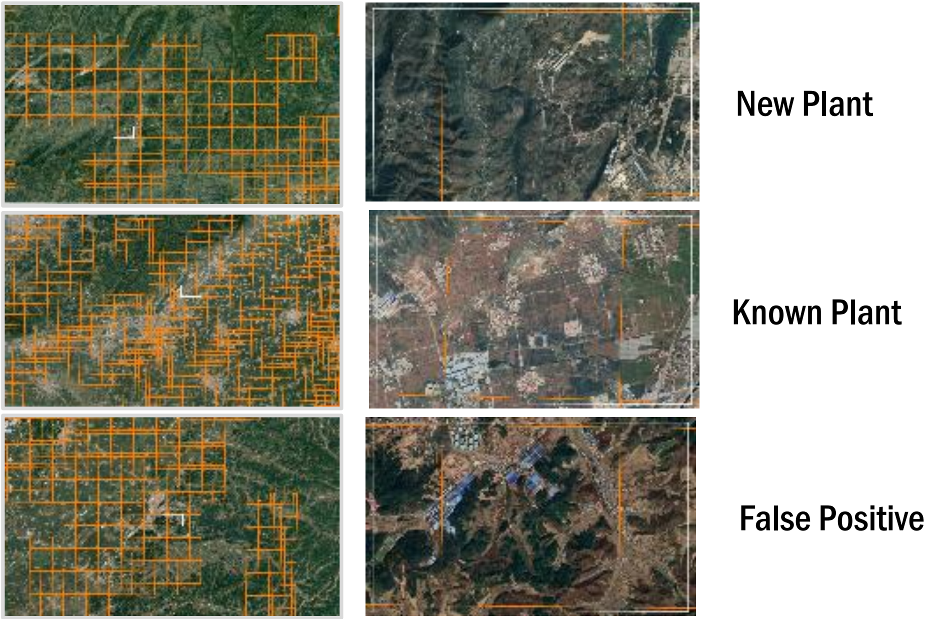
DIGITAL FOOTPRINT OF GLOBAL ECONOMY





Credits: Spatial Finance Initiative, Astraea Inc

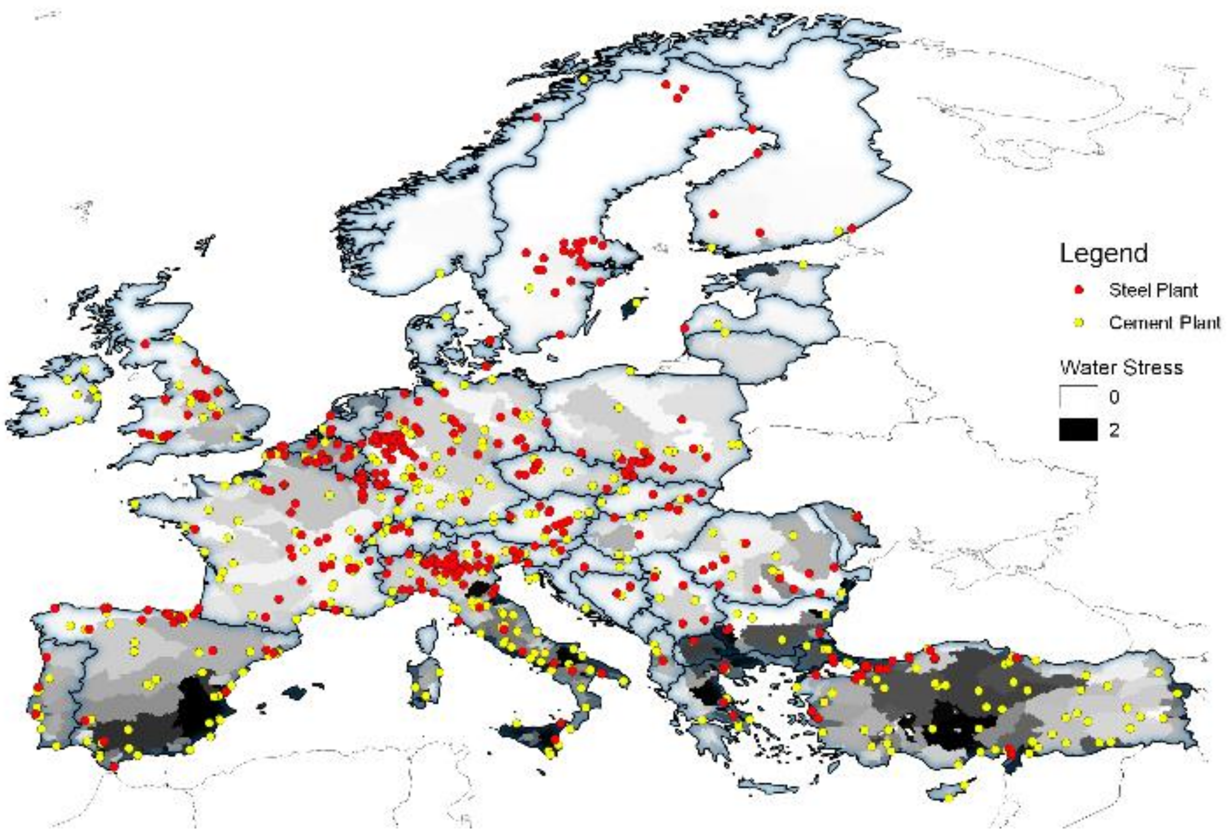
DIGITAL FOOTPRINT OF GLOBAL ECONOMY

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
1	uid	city	state	country	iso3	country_code	region	sub_region	latitude	longitude	accuracy	status	plant_type	production_type	capacity	capacity_source	year	owner_permid	owner_name	c
2	GACTAFG0001	Pol-e Khomri	Baghlan	Afghanistan	AFG	4	Asia	Southern Asia	35.9658	68.686338	Exact	Operating	Integrated	Wet	0.36	https://prd-wret.s3				
3	GACTAFG0002	Injil	Herat	Afghanistan	AFG	4	Asia	Southern Asia	34.322144	61.953503	Exact	Under Construction								
4	GACTAGO0001	Luanda	Luanda	Angola	AGO	24	Africa	Sub-Saharan Africa	-8.766173	13.316051	Exact	Operating	Integrated		1.2	https://prd-wret.s3		4296811479	Nova Cimangola	h
5	GACTAGO0002	Cacuaco	Luanda	Angola	AGO	24	Africa	Sub-Saharan Africa	-8.796392	13.42678	Exact	Operating	Integrated	Dry	1.83	Estimated	2017	4296811479	Nova Cimangola	h
6	GACTAGO0003	Lobito	Benguela	Angola	AGO	24	Africa	Sub-Saharan Africa	-12.342644	13.581766	Exact	Operating	Grinding		0.35	https://prd-wret.s3		5035943898	Secil Angola SARL	h
7	GACTAGO0004	Sumbe	Kwanza-Sul	Angola	AGO	24	Africa	Sub-Saharan Africa	-11.185243	14.030804	Exact	Operating	Integrated	Dry	1.4	https://prd-wret.s3				
8	GACTAGO0005	Ícolo e Bengo	Bengo	Angola	AGO	24	Africa	Sub-Saharan Africa	-9.101295	13.567408	Exact	Operating	Integrated	Dry	4	https://prd-wret.s3				
9	GACTAGO0006	Benguela	Benguela	Angola	AGO	24	Africa	Sub-Saharan Africa	-12.537825	13.496729	Exact	Operating	Grinding		0.7	https://prd-wret.s3				
10	GACTALB0001	Rrethi i Lezhës	Qarku i Lezhës	Albania	ALB	8	Europe	Southern Europe	41.83677	19.63345	Exact	Operating	Grinding		0.5	https://prd-wret.s3	2010		Colacem Albania Shpk	h
11	GACTALB0002	Rrethi i Krujës	Qarku i Durrësit	Albania	ALB	8	Europe	Southern Europe	41.503079	19.743606	Exact	Operating	Integrated	Dry	1.33	https://prd-wret.s3		4296766190	Kushe Kruje Cement Factc	h
12	GACTALB0003	Rrethi i Krujës	Qarku i Durrësit	Albania	ALB	8	Europe	Southern Europe	41.549091	19.725338	Exact	Operating	Integrated	Dry	1.4	https://prd-wret.s3	2010	5036173163	Antea Cement ShA	h
13	GACTALB0004	Rrethi i Elbasanit	Qarku i Elbasanit	Albania	ALB	8	Europe	Southern Europe	41.120103	20.045136	Exact	Operating	Integrated		0.3	https://prd-wret.s3				
14	GACTARE0001	Eastern Region	Abu Dhabi	United Arab Emirates	ARE	784	Asia	Western Asia	24.003398	55.438602	Exact	Operating	Integrated	Dry	3.6	https://www.emira		5074852997	Al Ain Cement Factory	h
15	GACTARE0002	Al Ain	Abu Dhabi	United Arab Emirates	ARE	784	Asia	Western Asia	24.137441	55.733956	Exact	Operating	Integrated	Dry	1.14	Estimated	1994	5035440316	Emirates Cement Factory	h
16	GACTARE0003	Dubai	Dubai	United Arab Emirates	ARE	784	Asia	Western Asia	24.998572	55.134171	Exact	Operating	Grinding					5035580861	CEMEX Falcon LLC	h
17	GACTARE0004	Ghalilah	Ras al Khaimah	United Arab Emirates	ARE	784	Asia	Western Asia	25.972745	56.070834	Exact	Operating	Integrated	Dry	3.8	https://gulfcement	1982	4295893472	Gulf Cement Co PSC	h
18	GACTARE0005	Dubai	Dubai	United Arab Emirates	ARE	784	Asia	Western Asia	25.00427	55.12941	Exact	Operating	Grinding		0.84	https://www.jacen	1978	5041755029	Jebel Ali Cement Factory I	h
19	GACTARE0006	Ras Al-Khaimah	Ras al Khaimah	United Arab Emirates	ARE	784	Asia	Western Asia	25.548753	55.986541	Exact	Operating	Integrated	Dry	1	https://www.jkcen	2014	5036198541	JK Cement Works Fujairah	h
20	GACTARE0007	Dibba Al Fujairah	Fujairah	United Arab Emirates	ARE	784	Asia	Western Asia	25.552944	56.226827	Exact	Operating	Integrated	Dry	3.2	https://www.lafarg	1996	4296646466	Lafarge Emirates Cement	h
21	GACTARE0008	Ras Al-Khaimah	Ras al Khaimah	United Arab Emirates	ARE	784	Asia	Western Asia	25.558872	55.985251	Exact	Operating	Integrated	Dry				4296646466	Lafarge Emirates Cement	h
22	GACTARE0009	Abu Dhabi	Abu Dhabi	United Arab Emirates	ARE	784	Asia	Western Asia	24.315716	54.495748	Exact	Operating	Grinding					4295893487	National Cement Co PSC	h
23	GACTARE0010	Eastern Region	Abu Dhabi	United Arab Emirates	ARE	784	Asia	Western Asia	24.040157	55.593386	Exact	Operating	Grinding					5050910802	Nael Cement Products Fac	h
24	GACTARE0011	Dubai	Dubai	United Arab Emirates	ARE	784	Asia	Western Asia	25.157152	55.242025	Exact	Operating	Integrated	Dry	1.5	http://www.nation		4295893487	National Cement Co PSC	h
25	GACTARE0012	Adhen Village	Ras al Khaimah	United Arab Emirates	ARE	784	Asia	Western Asia	25.386639	55.968218	Exact	Operating	Integrated	Dry	1.2	https://pioneercen	2006	5001427098	Pioneer Cement Industrie:	h
26	GACTARE0013	Ghalilah	Ras al Khaimah	United Arab Emirates	ARE	784	Asia	Western Asia	25.975192	56.068896	Exact	Operating	Integrated	Dry	1	http://rakcc.ae/en		4298061671	Ras Al Khaimah Cement C	h
27	GACTARE0014	Ghalilah	Ras al Khaimah	United Arab Emirates	ARE	784	Asia	Western Asia	25.964045	56.069847	Exact	Operating	Integrated	Dry	0.9	http://www.rakwh	1978	5000050939	Ras Al Khaimah for White	h

Credits: Spatial Finance Initiative, Astraea Inc

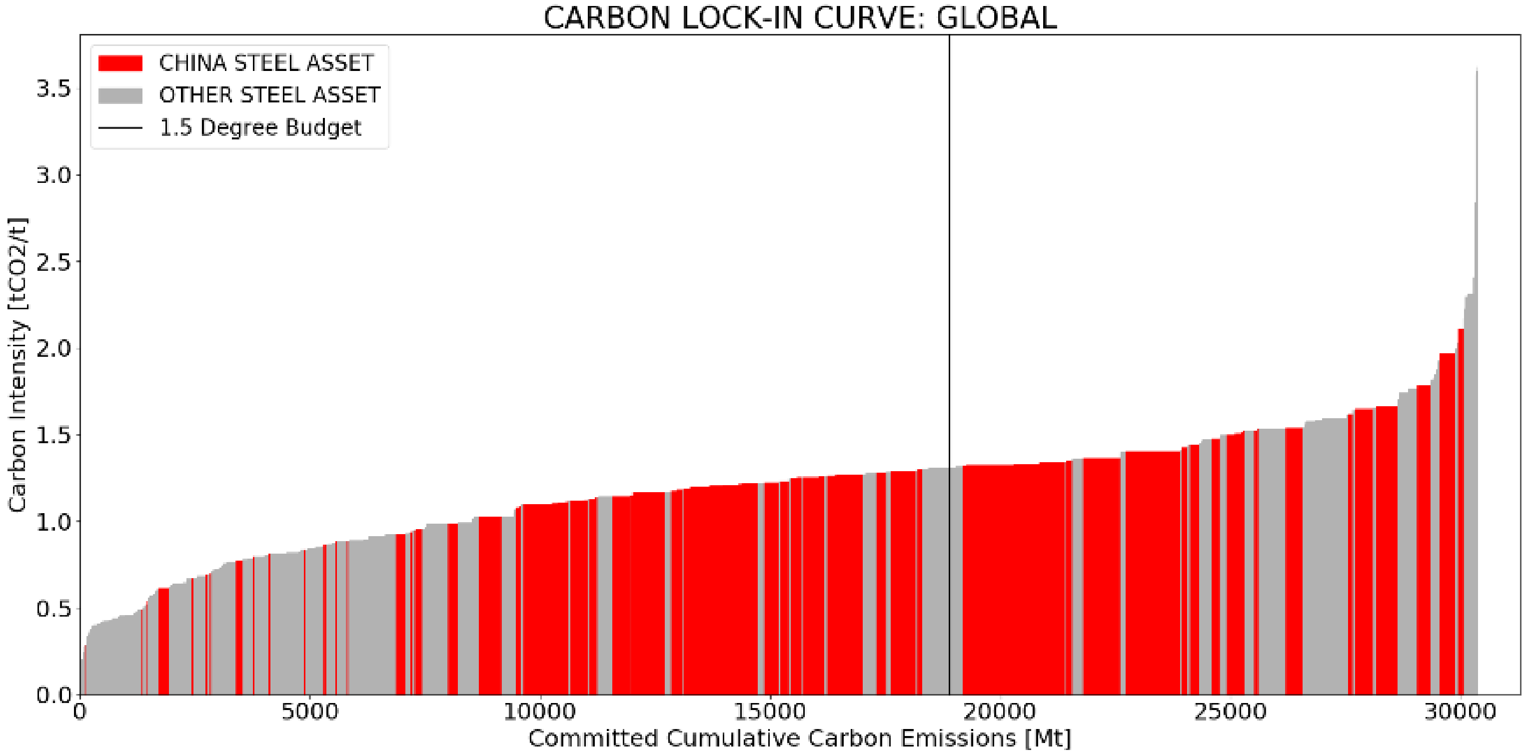
IS PART OF

PHYSICAL CLIMATE RISK



IS PART OF

TRANSITION CLIMATE RISK – CARBON LOCK-IN CURVE



34.6% of CHINA crude steel producing assets incompatible SR 1.5ºC
29.7% of CHINA crude steel capacity incompatible SR 1.5ºC

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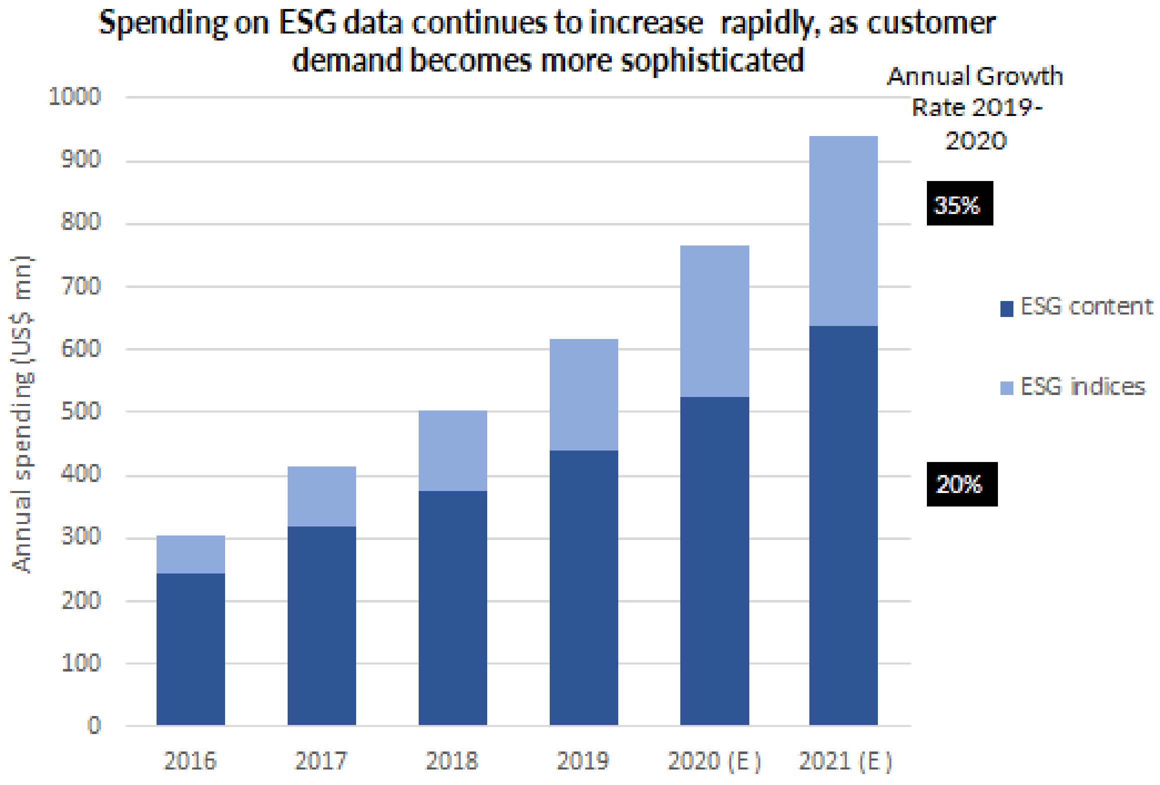
MARKET OPPORTUNITY



Source: Opimas

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FUTURE OF SPATIAL FINANCE

FUTURE USE CASES

Liability Risk Assessment

Disclosure Verification

Mission-Aligned Investing

Policy Implementation Monitoring

FUTURE DATASETS

Mobility and Transport Data

IoT Sensor Data

National Statistics

Unknown Unknowns

FUTURE APPLICATIONS

Geospatially Enabled Smart Contracts

Near-real Time ESG Risk and Impact Dashboards

Predictive Analytics

SPATIAL FINANCE INITIATIVE

THANK YOU

Christophe.Christiaen@smithschool.ox.ac.uk

KartAI Project

Ivar Oveland, Norwegian Mapping Authority

Ivar Oveland holds a PhD from the Norwegian University of Life Sciences where his major subject was in the borderland between robotics, geomatics and building information models.

He worked 13 years in the private airborne LIDAR industry. Today, he works at the Norwegian Mapping Authority with projects related to research and development.

Ivar is the lead researcher on this project, a joint initiative involving public and private sector partners and funded by the Norwegian regional growth fund. It aims to improve the quality of the cadastre through crowd sourcing. The problem for municipal government is that although the volume of building applications is decreasing, the costs of processing them is increasing. Further, there are known issues with the quality of the cadastre, which is acute in the north and west of Norway.

The potential solution is to better integrate data sources (aerial imagery, topographic basemaps and LiDAR); develop automated machine learning to identify buildings that are missing or wrongly classified and through an active dialogue with landowners to verify results from applying machine learning. The project will run from 2021 to 2023 and offers a very high cost-benefit return.

KartAI

Digital, Democratic and Automatic quality enhancement of the cadaster

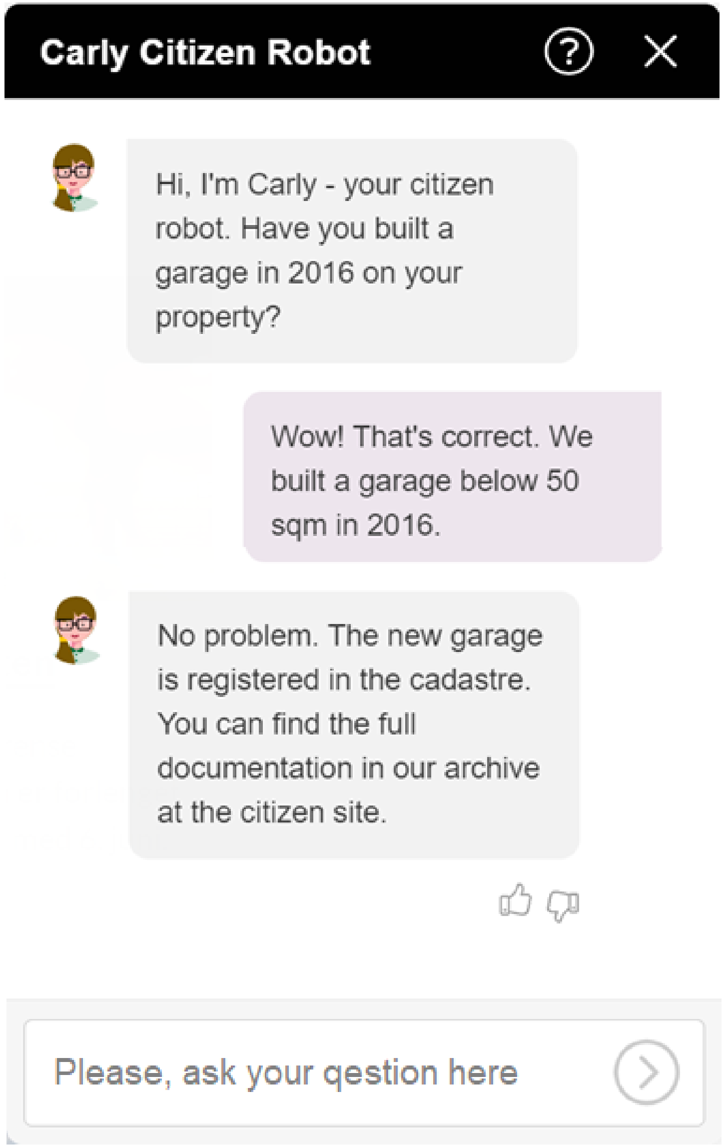
Kartverket

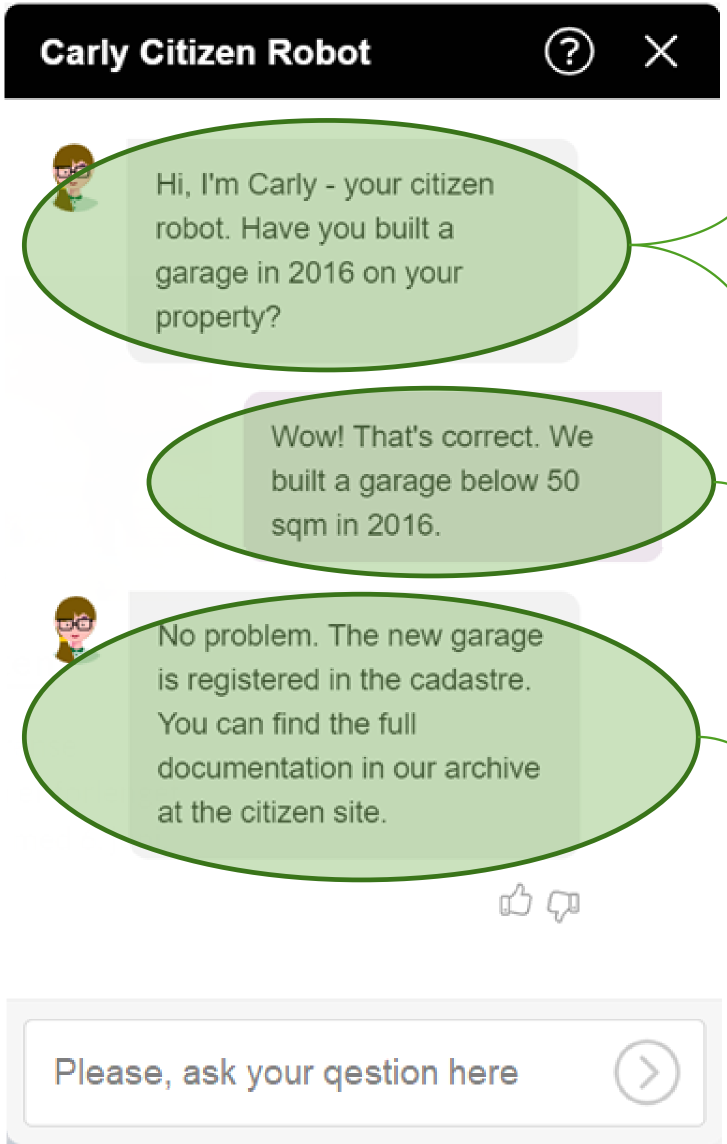
NORKART KUNNSKAP

Kristiansand kommune

UiA Universitetet i Agder

Citizen involvement creates better data and a better data democracy


Carly Citizen Robot
Hi, I'm Carly - your citizen robot. Have you built a garage in 2016 on your property?
Wow! That's correct. We built a garage below 50 sqm in 2016.
No problem. The new garage is registered in the cadastre. You can find the full documentation in our archive at the citizen site.
Please, ask your qestion here



- How to store data from different sources?
- What is the best database/storage architecture for artificial intelligence (AI).
- How do we reuse training data and AI models?

- how do we find building objects from the different data sources?
- How do we establish/estimate the reliability for each building objects?

- How do we create a proactive, fully digital citizen dialogue?
- What motivates residents to participate?

- Should the cadaster be updated automatically?
- How do we ensure the quality of data from uncertain sources?

MOTIVATION

The number of building application is declining(-11%)

Municipal operating expenses are increasing(+15%)

SSB (https://www.ssb.no/natur-og-miljo/statistikker/fysplan)

Data sources are processed individually and not combined

Increase cost benefit ratio for mapping projects

Raising the quality of the cadaster provide great potential

The digitization process requires an accurate cadaster and national map database

KARTAI

MAIN GOAL :

The main goal is to streamline the building application processing performed by the municipalities.

This will be done by increasing the quality of the cadaster and national map databases based on automated processes that include proactive dialogue with residents / landowners.

Kartverket

NORKART KUNNSKAP

Kristiansand kommune

UiA Universitetet i Agder

KartAi

SUB-GOALS:

1. Identify buildings from multiple data sources such as laser data, aerial images, ortophoto and crowd-sourcing. Focus on buildings below 50 square meters.

2. Support the building application process by providing more accurate information.

This gives:

* Efficient case processing
* Better decisions

Kartverket · Norkart Kunnskap · Kristiansand kommune · UiA Universitetet i Agder

A collaboration :

Financially supported by Regional Research Fund Agder, Norway.

The project runs from 2021 to 2023

The intension: open source

PROJECT GROUP

Kartverket

BLOM NORWAY

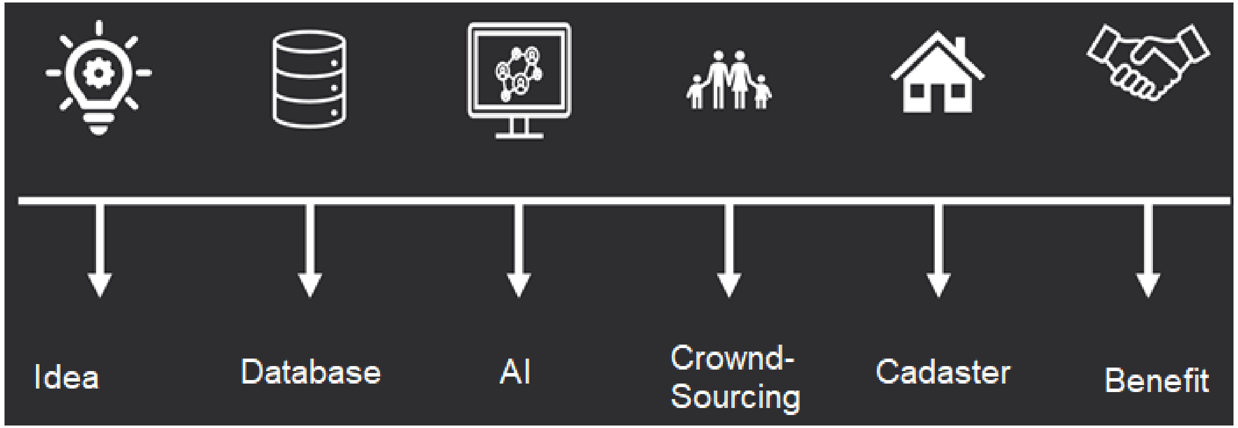
Kristiansand kommune

NORKART KUNNSKAP 1961

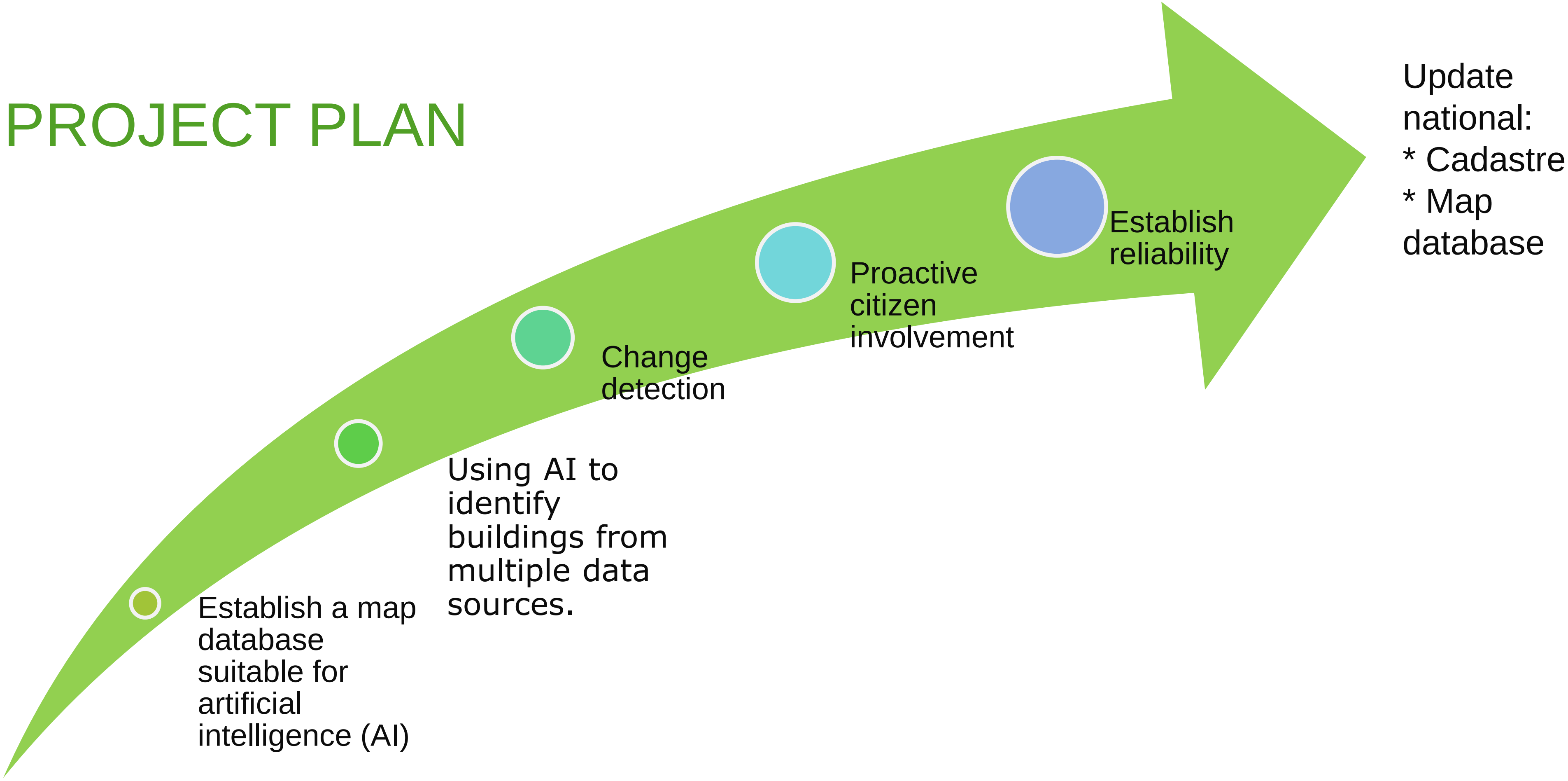
UiA Universitetet i Agder

bitmesh

Egde



PROJECT PLAN



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KartAi senario:

Existing building	Extension	New building	Demolished building
			

KartAi senario:

Existing building

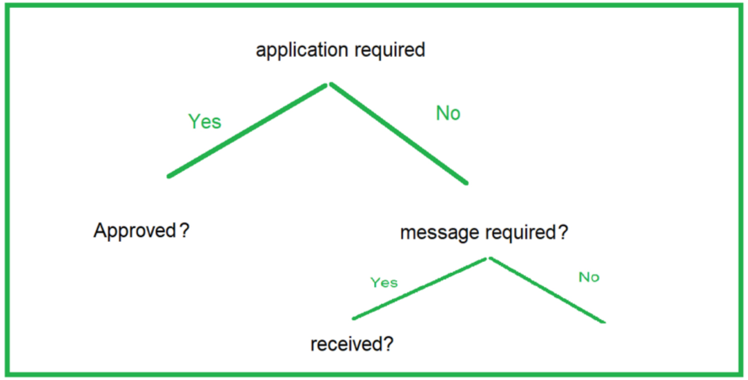
Extension

New building

Demolished building

Why:

The amount of buildings (m^2) on the property may influence the building application.



IDENTIFY BUILDINGS FROM MULTIPLE DATA SOURCES

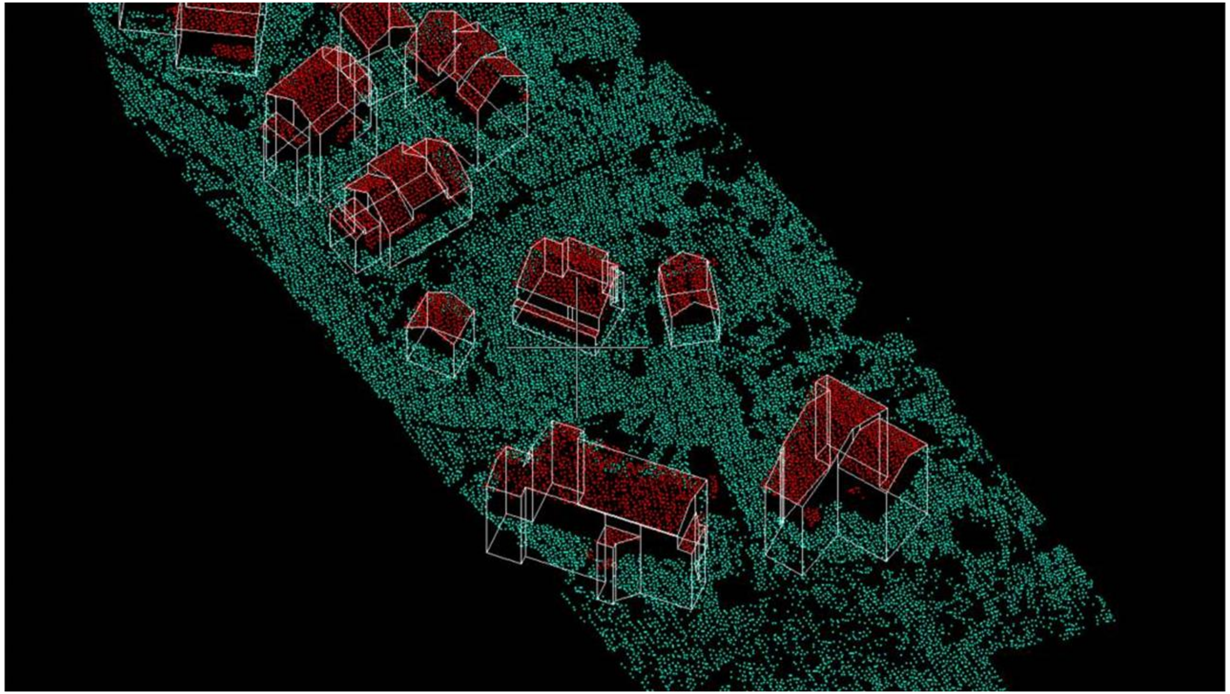
Different data sources establish whether the building exists

Cadaster	National Map Database	Arial Images	Ortophoto	Lidar	Public respond
Yes/no	2016: yes/no	2016: yes/no	2016: yes/no	2020: yes/no	yes/no
date	2017: yes/no	2017: yes/no	2017: yes/no		
areal	2018: yes/no	2018: yes/no	2018: yes/no		
	2019: yes/no	2019: yes/no	2019: yes/no		
	2020: yes/no				

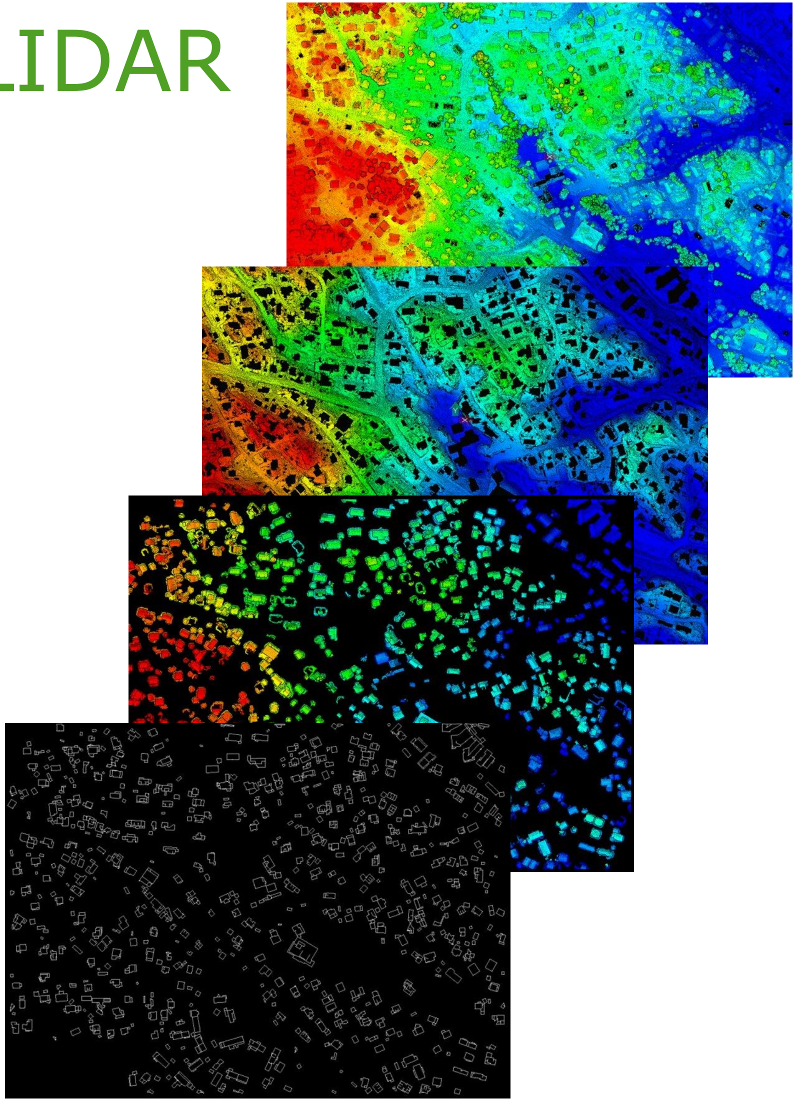
Independent observations are used to estimate reliability

IDENTIFY BUILDINGS USING LIDAR

Software: Tscan, Terrasolid



3D building objects from Lidar (5 point/m^2)



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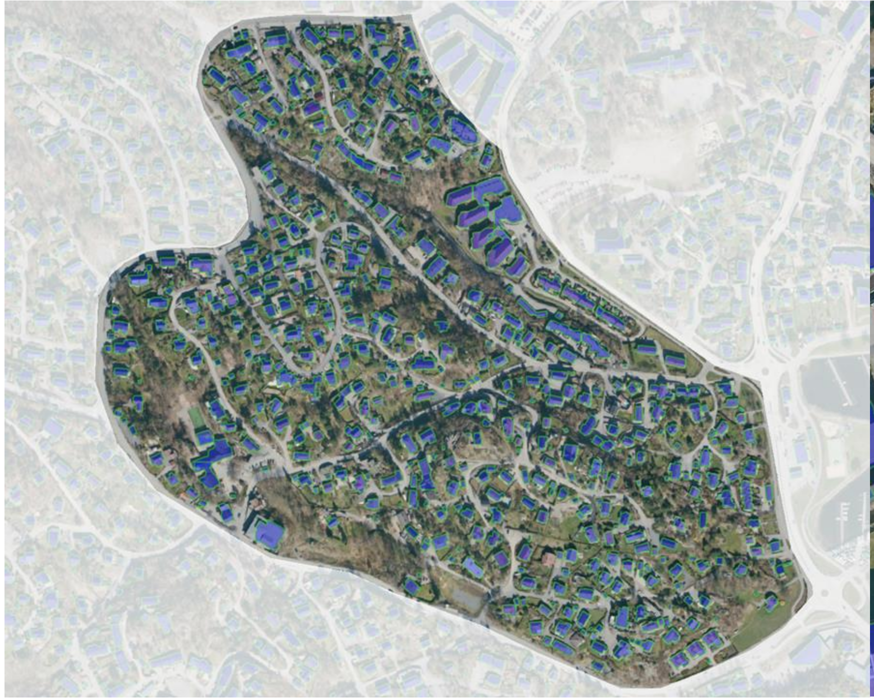
IDENTIFY BUILDINGS USING IMAGES

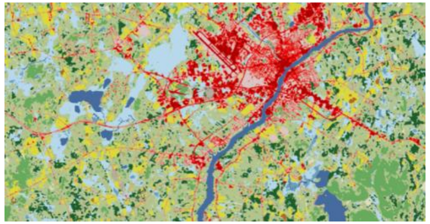
Software: Argis Pro, Image analyst, Esri



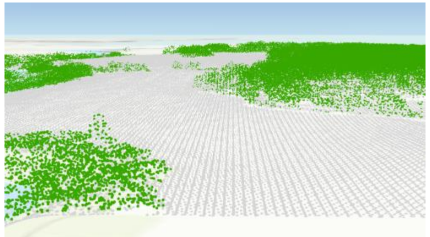
Project area :580 buildings. 90 missing, 2 false

ESRI - AI models:

Building Footprint Extraction model



Landcover Classification model



Tree Point Classification model

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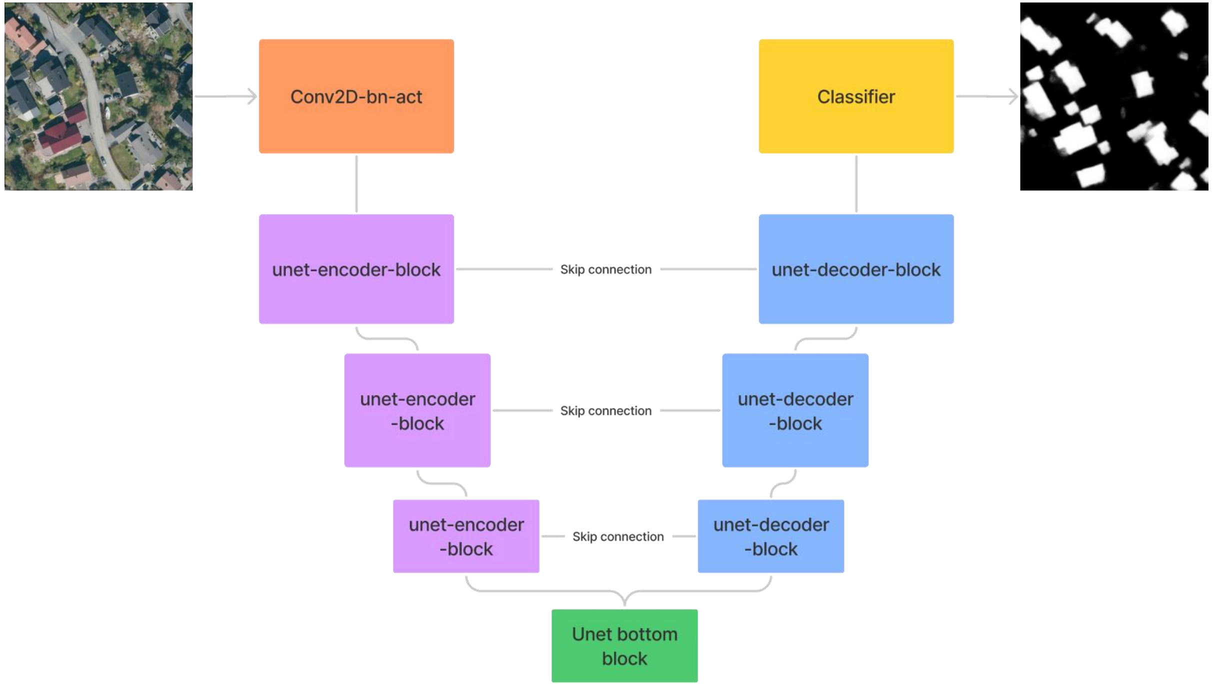
IDENTIFY BUILDINGS USING IMAGES

Develop our own training and AI model:



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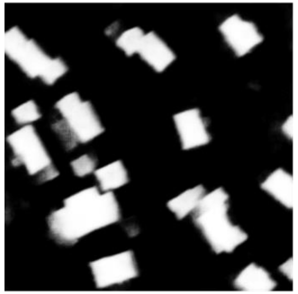
IDENTIFY BUILDINGS USING IMAGES

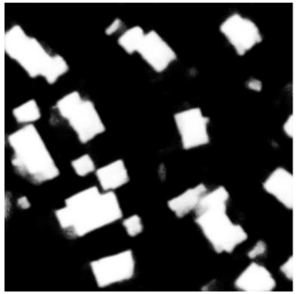
Ortophoto

National map database

AI result using the map database directly



AI result using the adjusted map database



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IDENTIFY BUILDINGS USING IMAGES

Training

Validate

Evaluate

IDENTIFY BUILDINGS USING IMAGES

How we extent our training dataset:

Black spot tile:
More than 40%
of the pixel with
a building
prediction
between 0.3 -0.7

Include areas with poor prediction into the training dataset, continues until the overall prediction converges.

IDENTIFY BUILDINGS USING IMAGES

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IDENTIFY BUILDINGS USING IMAGES AND LIDAR

Ortophoto

Ortophoto + Lidar

Difference

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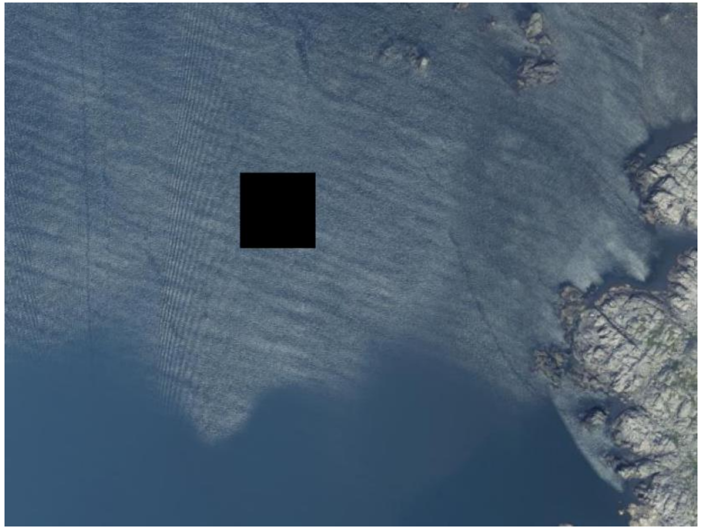
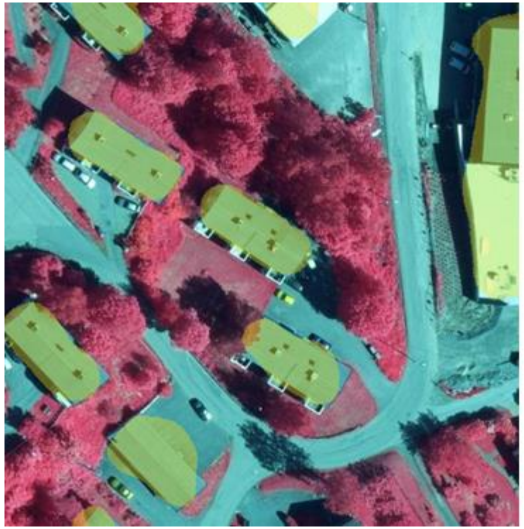
DIFFICULTIES

No buildings





multiple cadastre units in the same building

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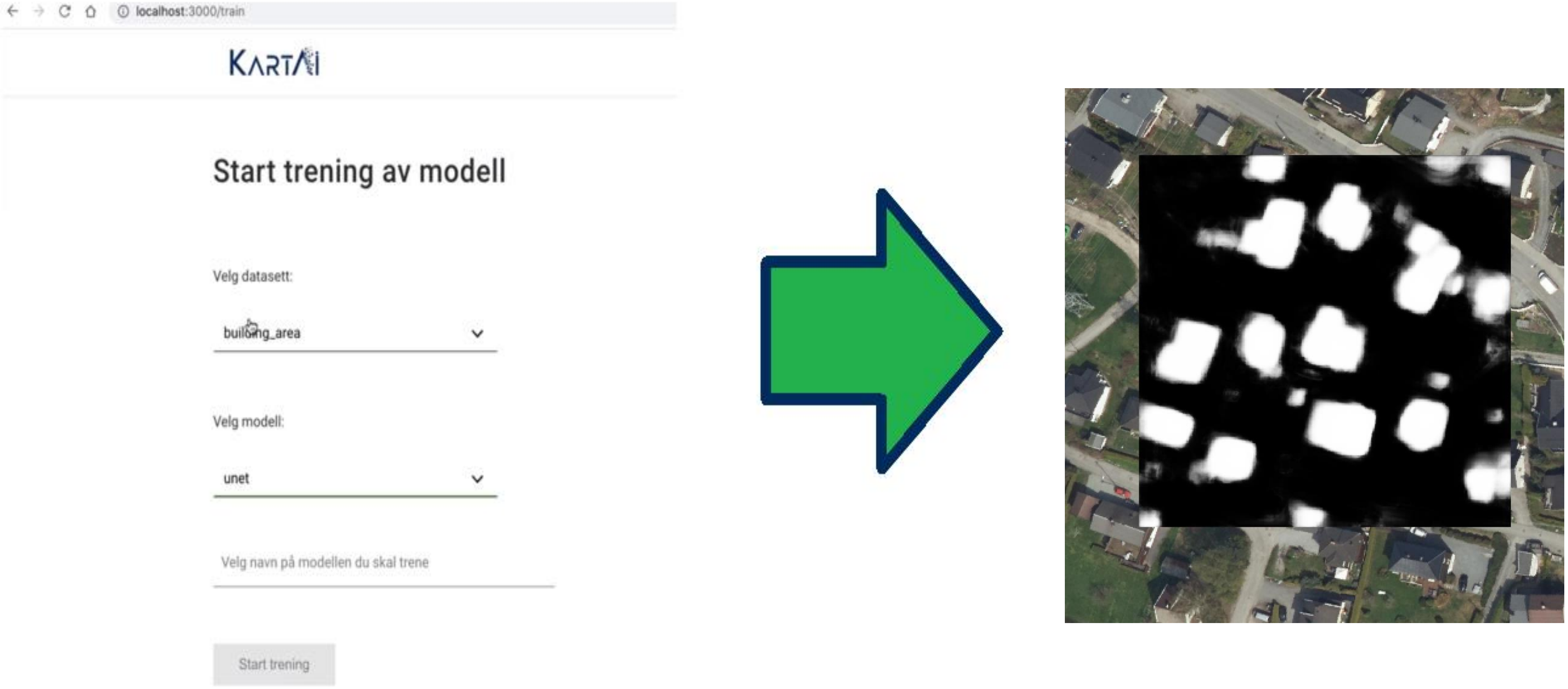


*Online service: the public can evaluate whether the artificial intelligence finds the buildings on the property (**EU:general data protection regulation**).*

Change detection

Building Object

- ID
- Building observations ID
- Geometry
- Reliability
- Status
  - Scenario
  - Cadastre
  - Map

Event sourcing

Building observations

2015

2017

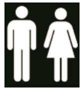
2018

Map database

·

Cadastre

LiDAR



Crowd sourcing

KartAI

Summary

A research project for raising the quality of the property register (cadaster) and the National Map Database using artificial intelligence (AI).

Combining multiple data sources into a common architecture:
Cadaster, map database, laser, aerial images, ortophoto, laser and crowd sourcing.

The goal is to help, automate and streamline building application processing in the municipalities and support the national digitalization process.

Kartverket NORKART KUNNSKAP Kristiansand kommune UiA Universitetet i Agder

KARTAI

Questions?

Ivar.oveland@kartverket.no

www.kartai.no

Kartverket

NORKART KUNNSKAP

Kristiansand kommune

UiA Universitetet i Agder

Hybrid Approaches for Sustainable Base Mapping

Anders Nesse, Norconsult Information Systems, Norway

Anders Nesse is a Geomatics expert and advisor at Norconsult AS, a Norwegian based engineering company with more than 5 000 employees.

Anders graduated in 1990 with his Master of Science degree in Photogrammetry and Surveying. He has more than 30 year of experience in photogrammetric mapping from public and private sector. He has worked in projects on implementation of modern mapping techniques in the Nordic countries, Europe, Asia, Africa, and former Soviet states as Georgia, Kyrgyzstan and Moldova.

Anders has been an expert advisor on many mapping projects on developing countries, so he knows a lot about the practicalities of base mapping. He described the hybrid approach as using the best of many different acquisition techniques now available to minimise cost and maximize value. Aerial capture using fixed wing aircraft, he views as still giving the best value for creating the base, with 20cm accuracy as sufficient for most purposes, with photogrammetry as the key technique for integrating data from different platforms.

His shopping list was:

- Satellite images for vegetation, change detection, climate change
- Drone data for update individual buildings and infrastructure
- Multi-head aerial cameras for 3D city modelling (oblique and vertical)
- LiDAR for elevation, forestry, calculation of biomass
- Handheld tools (smartphones) for micro area change.

His top tip was to keep the data model simple and to look carefully at comparative acquisition costs, he quoted the recent example from Kyrgyzstan, where in one day using a conventional aircraft, they had acquired data for a strip of country 125Km wide.

Norconsult
Informasjonssystemer

Hybrid Approaches for Sustainable Base Mapping

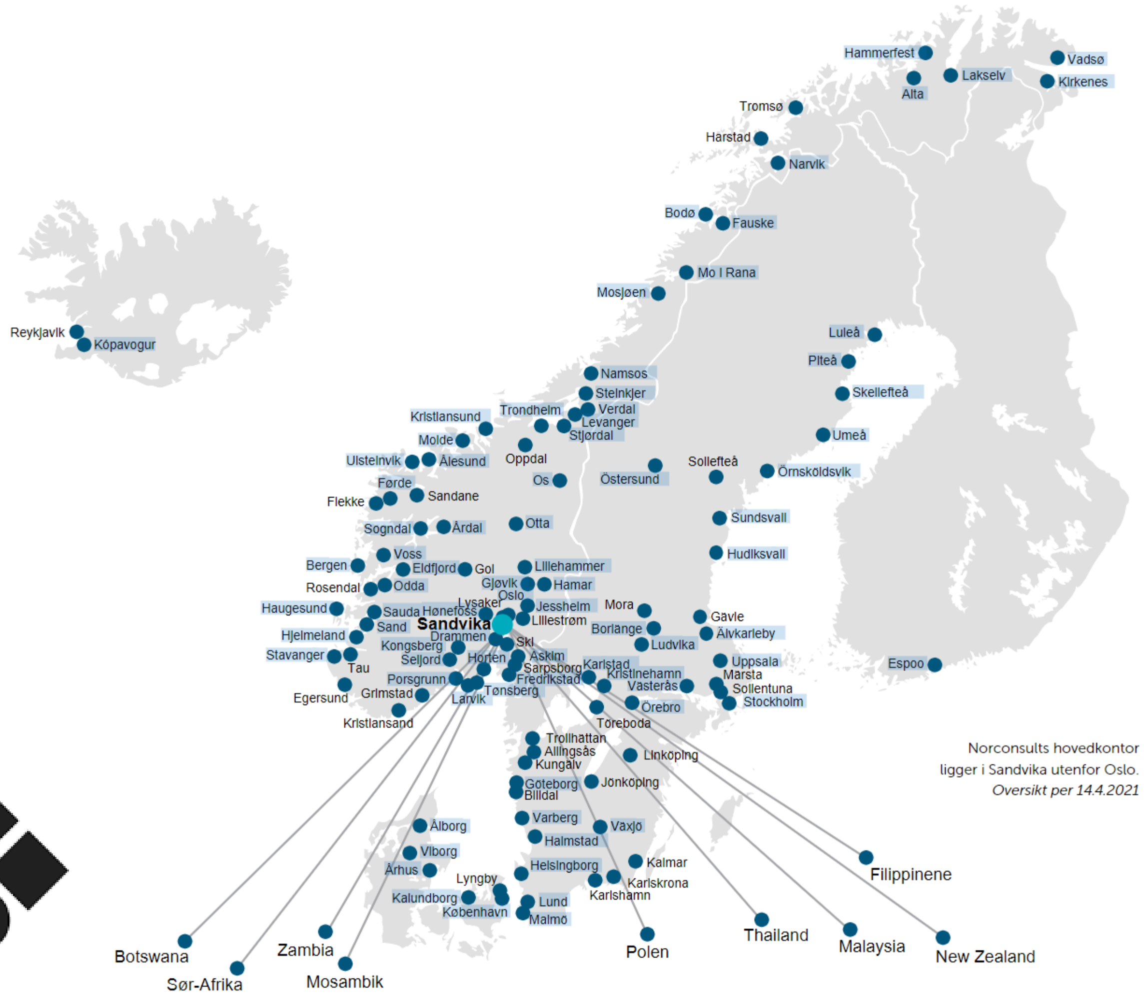
Anders Nesse

92 offices
five continents

- Norway 53
- Sweden 22
- Denmark 4
- Iceland 1
- Outside nordic 12

5.100 employees per august2021

Norconsult



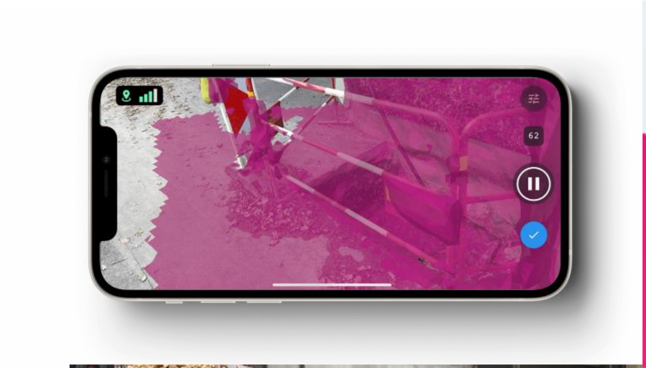
.1.2017

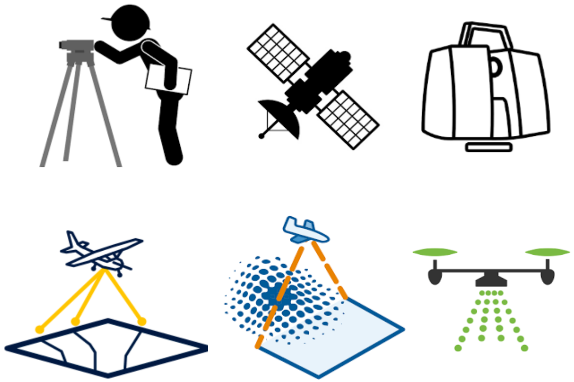
The Terms *Hybrid* Approaches for *Sustainable Base Mapping*

- **Hybrid**
  - *of mixed character; composed of different elements*
- **Sustainable**
  - *able to be maintained at a certain rate or level* and *able to be upheld or defended*
- **Base Mapping**
  - Scale/resolution,
  - Levels, themes, quality

Hybrid - Mixed character, composed of different elements

Hybrid - Mixed character, composed of different elements



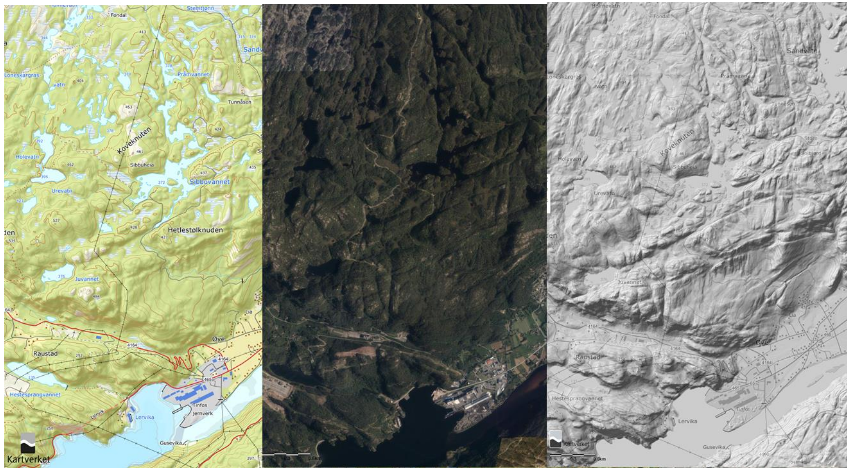


Sustainable – Maintained and upheld, certain rate/level

Good coordination need good and updated coordinates

Base Map

- What is a base map? Typical layers for a basemap:
  - roads,
  - buildings,
  - Water and rivers,
  - Infrastructure, powerlines
  - parcels, cadastre,
  - boundaries (country, county, city boundaries),
  - digital elevation model,
  - aerial or satellite imagery, orthophotos.
  - …..



Aerial Images

- The main source for base maps.
- Information, accuracy, stereo and mono data collection

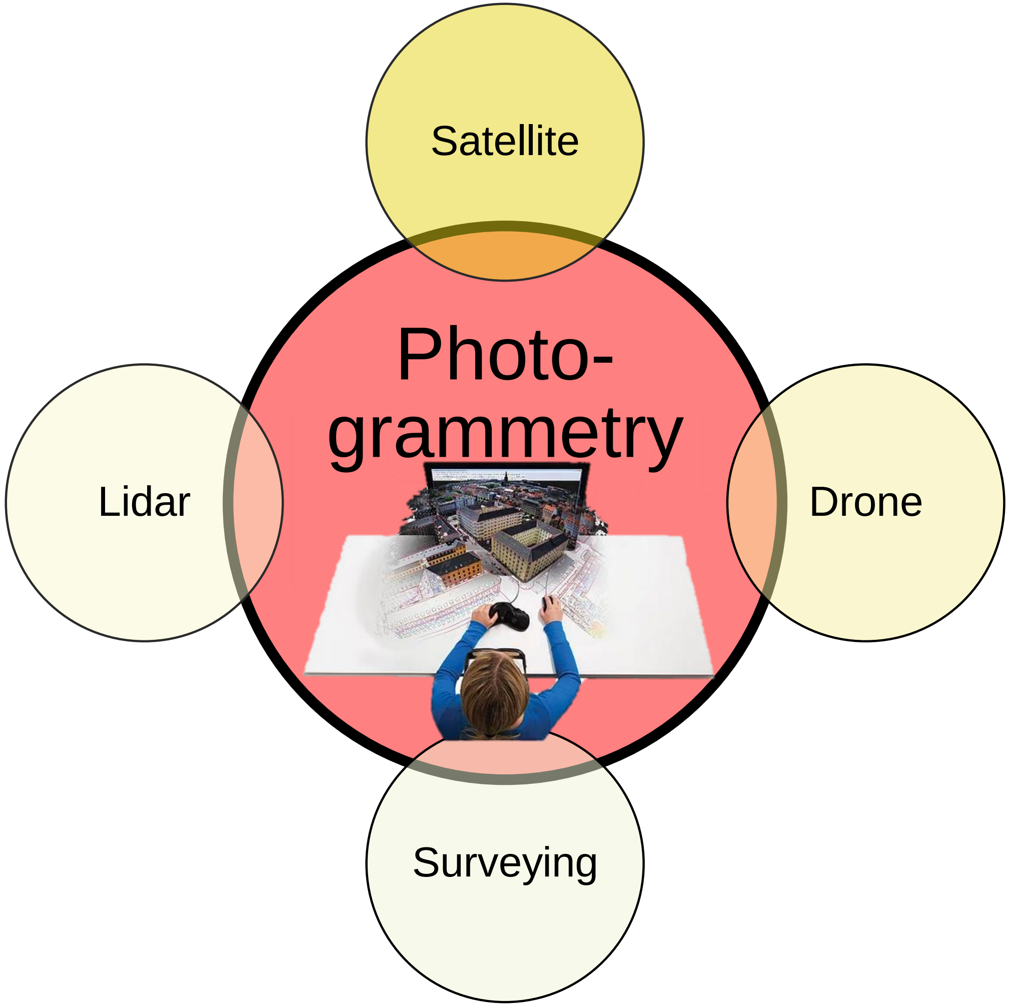
Kartverket MENY

FERSKE OG HISTORISKE: Norge i bilder gjør det mulig å sammenligne gamle og nye bilder fra hele Norge. Skjermdump: Norgeibilder.no, Drammen 1939 og Drammen 2014.

Base Map

- “Bang for the bucks”
- Methods
  - How to produce the data needed to the accuracy and details we require to a reasonable price
  - Automatically VS manual mapping
- Sustainable
  - Update methods and frequency

Base Mapping

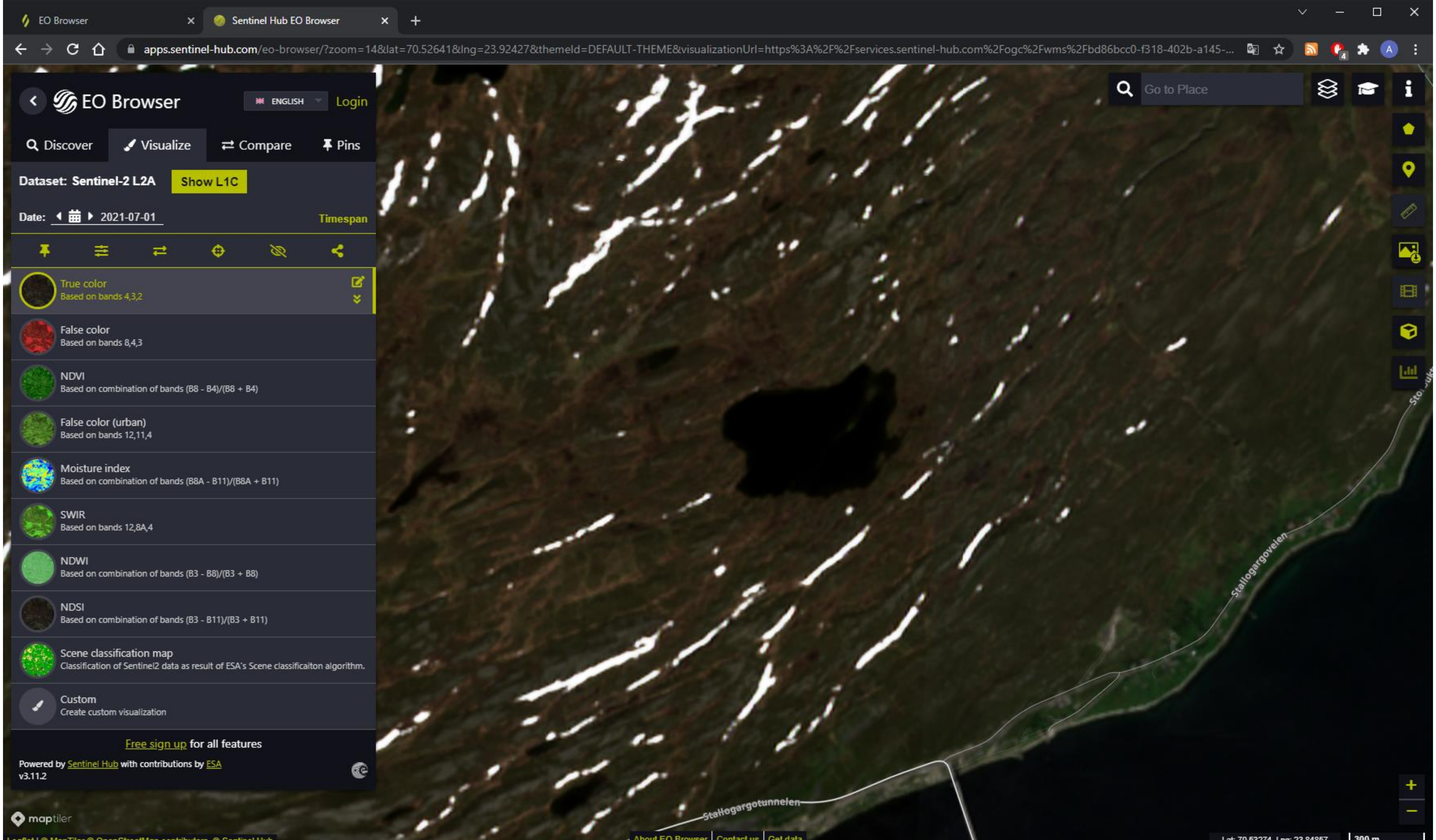


Base Map from Aerial Images, the backbone of all maps

- Traditional line mapping from photogrammetry is the **basic method** for production of maps.
- Difficult to produce automatically
- Feature collection in Stereo and Mono
- Expensive to maintain
- How to maintain the basemap cost effective?
  - Satellite images for vegetation, change detection, climate changes…
  - Drone data for update buildings, infrastructure…
  - Multihead aerial cameras for city modeling
  - Lidar data for elevation data, forestry, calculation of bio mass…
  - Handheld tools for smaller changes

Base Map

- **LOD**, level of details.
- complexity



EO Browser
Sentinel Hub EO Browser
apps.sentinel-hub.com/eo-browser/?zoom=14&lat=70.52641&lng=23.92427&themeId=DEFAULT-THEME&visualizationUrl=https%3A%2F%2Fservices.sentinel-hub.com%2Fogc%2Fwms%2Fbd86bcc0-f318-402b-a145-...
EO Browser
ENGLISH
Login
Discover
Visualize
Compare
Pins
Dataset: Sentinel-2 L2A
Show L1C
Date: 2021-07-01
Timespan
True color
Based on bands 4,3,2
False color
Based on bands 8,4,3
NDVI
Based on combination of bands (B8 - B4)/(B8 + B4)
False color (urban)
Based on bands 12,11,4
Moisture index
Based on combination of bands (B8A - B11)/(B8A + B11)
SWIR
Based on bands 12,8A,4
NDWI
Based on combination of bands (B3 - B8)/(B3 + B8)
NDSI
Based on combination of bands (B3 - B11)/(B3 + B11)
Scene classification map
Classification of Sentinel2 data as result of ESA's Scene classificaiton algorithm.
Custom
Create custom visualization
Free sign up for all features
Powered by Sentinel Hub with contributions by ESA
v3.11.2
Go to Place
Stallogargoveien
Stallogargotunnelen
maptiler

Base Map

- What do we need?
- to what LOD, what accuracy, time?
  - A «rich» datamodel?
  - A reduced datamodel?
- To what cost?
- How to get it.

Base Map

	Layer	BUILDING	Geometry type	Medium	Href	A-std	B-std	C-std	Accuracy class XY	Accuracy class Z	Definitions	Minimum size
56	5000	RoofArea	A			M	M	M	N/A	N/A	RoofArea for graphical visualization. Legal objecttypes for establishment of RoofArea: RoofOutline-A, RoofOutline-B, RoofOutline-C, FictitousOutlineBuilding	
57	5002	RoofOutline	L			M	M	M	2	3	The external delimitation of the roof surface of the building.	Object larger than 10 m2
58	5004	BuildingWithoutWalls	L			M	M	M	2	3	Building with few or no walls (e.g roof in petrolstation, busshelter etc) Freestanding or connected to 5002, if connected to 5002 compile as closed polygon.	A-std > 5 m2 B/C-std > 10 m2
59	5005	FoundationWallOutline	L			M	M	M	1	2	The external delimitation of the building along its foundation wall (building under construction)	
60	5006	Ruin	L			M	M	M	1	2	Delimitation of demolished, or partly demolished building	Larger than 10 m2
61	5051	StaircaseBuilding	L		B	M	M	N/A	3	3	Stairs which constitute the access to buildings and staircases up against buildings. Connects to 5002/5004. Height referernce on step-level, not railing. Compile as closed polygon	Stair longer than 1 m from roofedge in A- and 3m in B-std.
62	5061	Veranda	L		T	M	M	N/A	3	3	Building appendage which includes veranda, balcony and loading-ramp. Height refrence: Top of railing. Compile as closed polygon (identical to 5002/5004 where connected to these outlines)	Area > 2 m² shall be compiled in A (calculated from roof edge).Area > 6 m² shall be compiled in B (calculated from roof edge).
63	5062	Terrace	L		B	M	M	N/A	3	3	Platform on ground-level for recreational use not connected to building-Height reference floor of terrace. Compile as closed polygon.	Area > 10 m² shall be compiled
64	5066	BuildingBridge	L		B	M	M	N/A	3	3	Bridge connected to a building used as access to buildings and bridges between buildings. Used for buildings which is not farming works buildings. In the latter case BarnBridge must be used. Compile as closed polygon (identical to 5002/5004 where connected to these outlines)	
65	5067	BarnBridge	L		B	M	M	N/A	3	3	Access platform to a farming building. Height reference on walkable/drivable level, not on railing if present. Compile as closed polygon (identical to 5002/5004 where connected to these outlines)	
66	5082	RidgeLine	L			M	M	N/A	2	3	Ridgeline on buildings. 5002/5004/5083/5084 is connected in 3D to Ridgeline	RoofRidge must be collected for all buildings, dormers, building extensions and buildings without walls.
67	5083	BuildingLine	L			M	M	N/A	2	3	Buildingline describing breaklines on roof-surface. Must be connected in 3D to 5002/5004 and 5082/5084 if present	
68	5084	RoofLeapTop	L			M	M	N/A	2	3	Roofleap describing highest level if leap is present on main roof-surface. Must be connected in 3D to 5002/5004 and 5082/5083if present.	If height-difference is > 1m in A-std and >2m in B-std
69	5089	RoofLeapBottom	L			O	O	N/A	2	3	Roofleap representing bottom-level in height on main roof-surface. Must be connected in 3D to 5002/5004 and 5082/5083if present on same level, and in 2D to objects on higher level. Identical in xy to 5084. Used to build 3D-models.	
70	5086	BuildingLine2	L			M	O	N/A	2	3	Buildingline describing outline of free-standing protruding objects inside roof-edge, also describing breaklines inside the object if present. Connected in 3D to 5085/5087 if present.	Compile if volume of protruding object is >5m3
71	5085	RidgeLine2	L			M	O	N/A	2	3	Ridgeline on free-standing protruding objects inside RoofOutline. In A-std 5086/5087 is connected in 3D to Ridgeline	
72	5087	RoofLeapTop2	L			M	O	N/A	2	3	Roof leap representing highest level if present on free-standing protruding objects inside roof-edge. Connected in 3D to 5085/5086 if present.	If height-difference is > 1m
											Roofleap representing bottom-level in height on freestanding protruding objects.	

Sheet1 Sheet2 Sheet3

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