

ELISE action
Webinar Series

Monitoring and understanding emerging geospatial technologies

Danny VANDENBROUCKE, KU Leuven
Gobe HOBONA, Open Geospatial Consortium
Lorena HERNANDEZ, European Commission JRC
Simon VREČAR, European Commission JRC (consultant)

24/09/2020 14:00 CEST (UTC+2)



European Location Interoperability
Solutions for e-Government

*Enabling Digital Government through
Geospatial and Location Intelligence*



ISA² Programme & ELISE action

European Interoperability Programme

cross-border and cross-sector Interoperability solutions

for public administrations, businesses and citizens

54 different actions tackling **interoperability** from different angles

ELISE action is the **only** action focusing on the **location dimension**



















European Location Interoperability Solutions for e-Government

Enabling Digital Government through Geospatial and Location Intelligence



Welcome to the ELISE webinar series



 <p>ELISE action Webinar Series</p> <p><i>The Role of Geospatial for Digital Government Transformation</i></p> <p>07/05/2019 14:00 CEST (UTC+2)</p>	 <p>ELISE action Webinar Series</p> <p><i>Governance models, ecosystems and benefits of APIs for public sector organisations</i></p> <p>11/06/2019 14:00 CEST (UTC+2)</p>	 <p>ELISE action Webinar Series</p> <p><i>Persistent Identifiers (PIDs) as the glue for linking information infrastructures</i></p> <p>15/07/2019 14:00 CEST (UTC+2)</p>	 <p>ELISE action Webinar Series</p> <p><i>Geospatial Technology and Public Participation</i></p> <p>28/08/2019 14:00 CEST (UTC+2)</p>
<p>ELISE Webinar - The role of Geospatial for Digital Government</p> <p>07/05/2019 event </p>	<p>ELISE Webinar - Governance models, ecosystems and benefits</p> <p>11/06/2019 event </p>	<p>ELISE Webinar - Persistent Identifiers (PIDs) as the glue for</p> <p>15/07/2019 event </p>	<p>ELISE Webinar - Geospatial Technology and Public Participation</p> <p>28/08/2019 event </p>
 <p>ELISE action Webinar Series</p> <p><i>The Role of Spatial Data Infrastructures for Digital Government Transformation</i></p> <p>09/10/2019 11:00 CEST (UTC+2)</p>	 <p>ELISE action Webinar Series</p> <p><i>Using serious games in the geospatial domain to stimulate digital transformation of government</i></p> <p>14/01/2020 14:00 CEST (UTC+2)</p>	 <p>ELISE action Webinar Series</p> <p><i>The role of Organisational Interoperability in the context of Geospatial and Digital Government Transformation</i></p> <p>11/02/2020 14:00 CEST (UTC+2)</p>	 <p>ELISE action Webinar Series</p> <p><i>Location Intelligence and Partnerships to support the Sustainable Development Goals</i></p> <p>30/04/2020 14:00 CEST (UTC+2)</p>
<p>ELISE Webinar - The role of Spatial Data Infrastructures for</p> <p>09/10/2019 event </p>	<p>ELISE Webinar - Using serious games in the geospatial domain to</p> <p>14/01/2020 event </p>	<p>ELISE Webinar - The role of Organisational Interoperability in the</p> <p>11/02/2020 event </p>	<p>ELISE Webinar - Location Intelligence and Partnerships to support</p> <p>30/04/2020 event </p>

ELISE Knowledge Transfer activities

Purpose:

- Engage in an agile way
- with topics of relevance to the Digital Transformation
- by harnessing the use of spatial data and technology.
- Share the results of ELISE activities.

<https://europa.eu/!nP74ph>



“Location Intelligence for regions and cities” event pack

ELISE webinar
03/09 at 14:00h
Preparing the
ground for smart
places of the
future

ELISE webinar
17/09 at 14:00h
Location
Intelligence
Technology trends
and case studies in
digital government

Participatory Lab
14/10 at 11:30h
Location
Intelligence4Cities
and Regions

More info:

<https://joinup.ec.europa.eu/node/703049>

ISA²

18th EUROPEAN WEEK of
REGIONS and **CITIES**

05>09 OCTOBER 2020

12>16 OCTOBER 2020

19>22 OCTOBER 2020



Monitoring and understanding emerging geospatial technologies

TECHNOLOGY
TRENDS



Our speakers

**Danny
VANDENBROUCKE**

Senior
Researcher
KU Leuven

KU LEUVEN

**Gobe
HOBONA**

OGC
Standards
Team

OGC[®]
Making location count.

The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.



What we will cover today

1. Introduction

2. Drivers and trends in the geospatial sector

3. Monitoring and assessing trends: from isolated studies to TTW

4. Major trends and how they fit together: some examples

5. Interoperability efforts and challenges: evolving architectures & standards

6. Key take-away messages and conclusions

7. Q&A (15')

Key messages

- 1 Many technological trends **are emerging**, while others **become 'mature'**; it is often difficult to see the wood for the trees
- 2 In order to monitor and understand **interconnected trends** a comprehensive Technology Trends Watch is needed
- 3 New technological developments requires a **revision** of our 'traditional' SDI **architectures** and also the **standards** evolve with them



Geospatial technology, the data management, handling and processing is changing rapidly due to these trends

1

*Drivers & trends in the
geospatial sector*

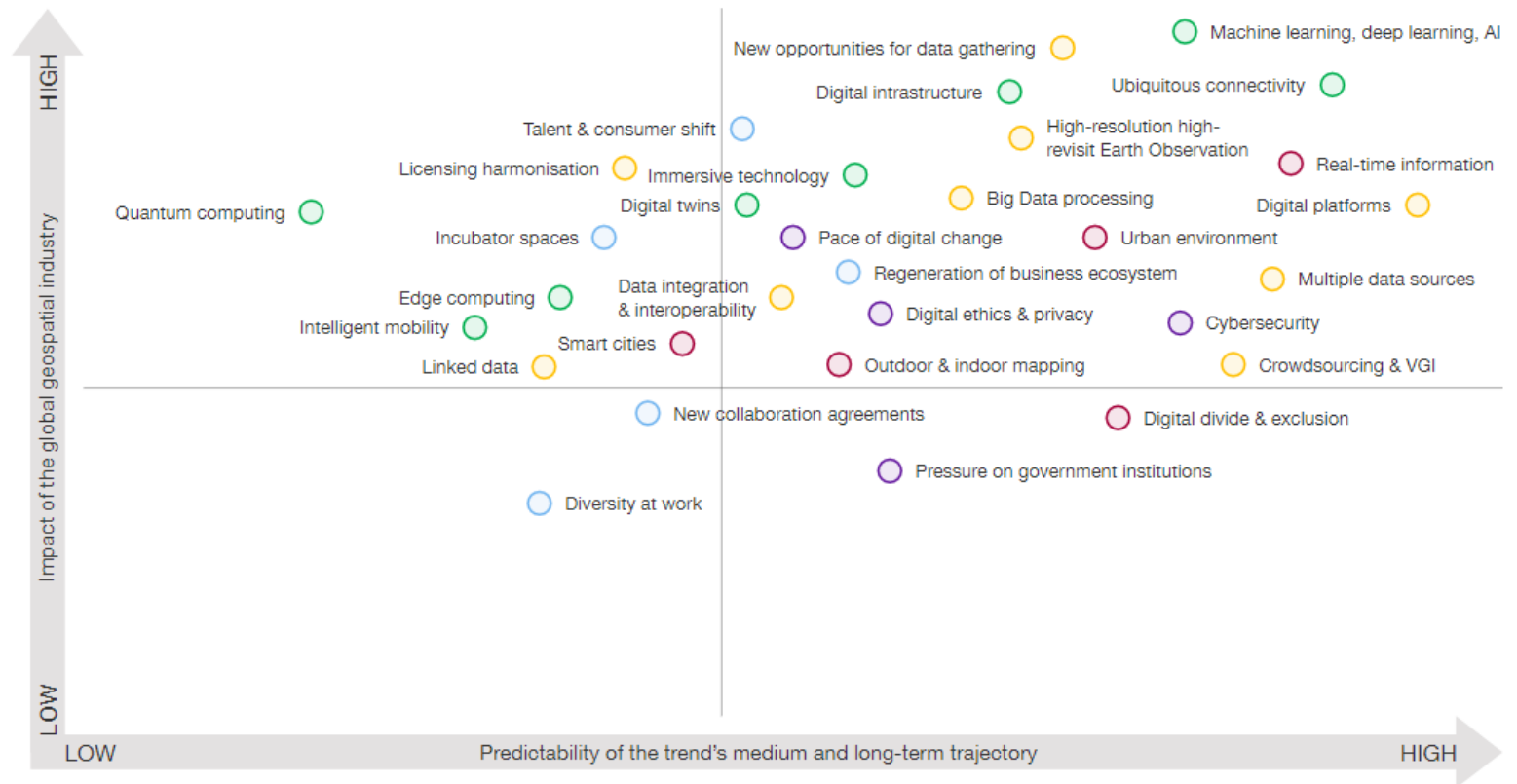
Drivers & trends

UN-GGIM Future Trends (Third Edition, 2020) identifies **5 key drivers** and **31 related trends**

1. **New data sources & analytical methods**
2. **Technological advancements**
3. **Evolution of user requirements**
4. **Industry structural shift**
5. **Legislative environment**

Graphic 1.

Five drivers will advance change in the global geospatial information management landscape over the next 5 to 10 years



Five prevailing drivers and an underlying set of trends

- Technological advancements
- Rise of new data sources & analytical methods
- Industry structural shift
- Evolution of user requirements
- Legislative environment

Drivers & trends

Political realities

Population change

Technological
developments

COVID-19

Economic outlook

Shifting values

Environmental
pressure



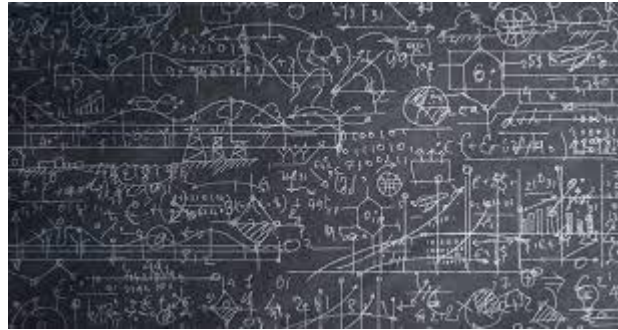
“The view of ‘**everything happens somewhere**’ will drive many of the changes in the global economy as **geospatial** enters the **mainstream**. Developments in location-based applications offered by non-geospatial businesses have transformed the **way** in which **services are consumed**, and the rise of autonomous systems has shaped the increasing need for **near real-time information**. The next five to ten years will see an unprecedented change in the way in which **geospatial** information will **shape** and be shaped by **the global economy**”

(UN-GGIM, 2020)

Drivers & trends

“Technological disruption in the geospatial industry is driven by automation, Artificial Intelligence, sensor technology, and the Internet of Things”

(UN-GGIM, 2020)



Pictures: sentech.nl, nextit.com,
Innovationobserver.com

Technological advancement:
not one but many developments



“It is anticipated that mobile data collection, crowdsourcing, and social media are likely to have the greatest impact over the coming decade”

(UN-GGIM, 2020)

New data sources and analytical methods

Drivers & trends

Industrial shift



“... automation and Artificial Intelligence applications will enable employees to be freed up from monotonous tasks that machines take over enabling the workforce to upskill or reskill to perform higher value tasks”

(UN-GGIM, 2020)



New user requirements

“Demand for near real-time data is driven by the expectation of instant and frictionless access to information on mobile devices”

(UN-GGIM, 2020)

Legal environment

“The Cambridge Analytica and Facebook data scandal in 2018, has led to calls for tighter data privacy regulations and data ethics frameworks”

(UN-GGIM, 2020)



2

*Monitoring and assessing trends:
from isolated studies to TTW*

Monitoring trends: what do we speak about?

What is disruptive or innovative is disputable ... It might also already exist for a long time, but only have a breakthrough recently ...

“Disruptive technology is an innovation that significantly alters the way that consumers, industries, or businesses operate. A disruptive technology sweeps away the systems or habits it replaces because it has attributes that are recognizably superior (...) Recent disruptive technology examples include e-commerce, online news sites, ride-sharing apps, and GPS systems”

Smith and Scott (2020)



AI research was born at [Dartmouth College](#) in 1956



Various terms are used:
Future trends, disruptive technologies, technological innovation ...

Monitoring trends: why do we need it?



Many reasons might be mentioned for monitoring trends:

- 1) To discover **new markets** or business opportunities
- 2) To increase **efficiency** and **effectiveness**
- 3) To improve **performance** of (ICT) systems
- 4) To be able to solve **complex problems**

Human Augmentation

The Empowered Edge

AI Security

Autonomous Things

Democratisation of Expertise

“CIOs and IT leaders must assess which of these disruptive technologies will strategically drive the most value, innovation, and growth for their enterprise through digital transformation”

Gartner (2020)

ISA²



Pictures: thysenkruupp.com

Monitoring trends: Individual Studies

Many studies from major consultancy companies:
Deloitte, PWC, Gartner, ...



Covering many aspects

Descriptive & Context

Case Studies

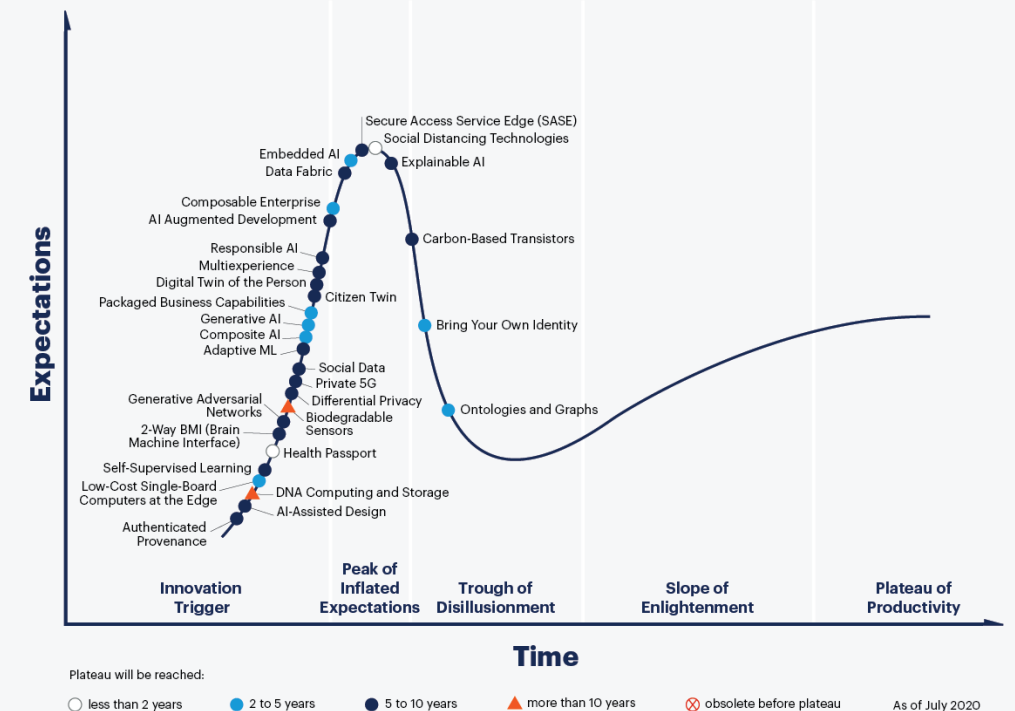
Maturity assessment

Companies, Government

Repeating (annually)

...

Hype Cycle for Emerging Technologies, 2020



gartner.com/SmarterWithGartner

Source: Gartner
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Gartner

Monitoring trends: many existing Initiatives

In the space sector, several large organisations and companies set-up a technology trends watch or studies: examples are Airbus, ESA ...



- To assess the key **Position, Navigation and Timing (PNT)** sectors with a view to identify the main innovation trends on each sector
- The **identification of enabling actions** for the identified technical innovation trends with the aim of future possible injection into NAVISP
- To enhance cooperation between the industry and research institutions on **R&D subjects** within PNT areas of common interest

Monitoring trends: consistent methodology for forecasting

“Something that is emerging can be just coming into existence, or beginning to become evident or obvious after a period of obscurity. While an emerging technology may become disruptive sometime, somewhere, its potential for such disruption may not have been recognized when it was first applied”

Covers different aspects:

- 1) **Need** for persistent long-term forecasting
- 2) Technology Forecasting **methodologies**
- 3) The **nature** of **disruptive technologies**
- 4) Reducing ignorance and **bias**
- 5) **Attributes** of forecasting systems
- 6) Evaluation of existing forecast **systems**



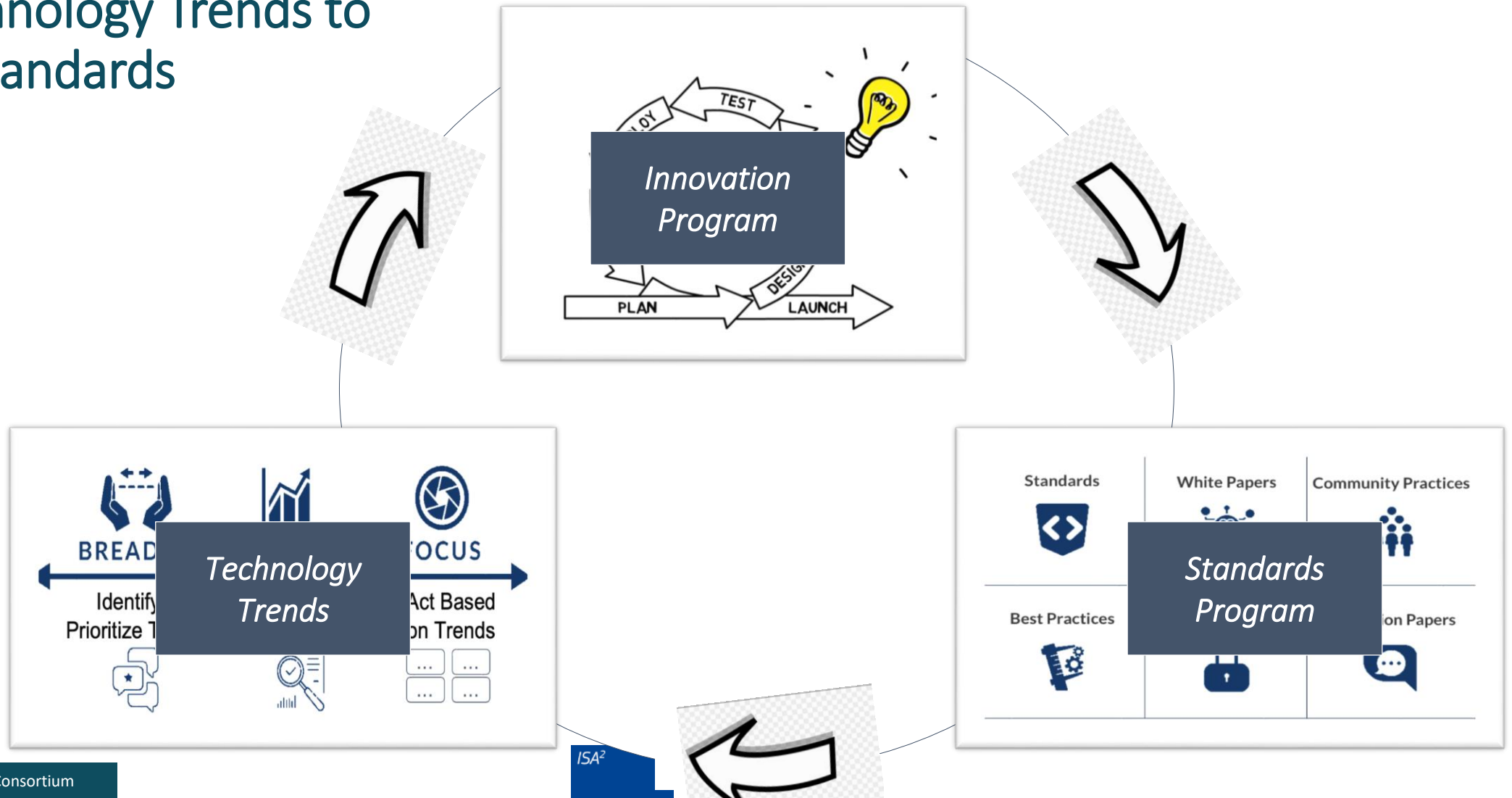
National Research Council (2020)

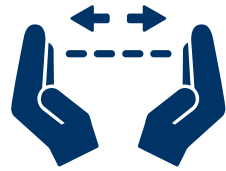


Why OGC tracks Geospatial Technology Trends? (Example 1)

- Direction from the OGC Planning Committee
 - Maintain current standards; while simultaneously addressing evolution of technology and markets with new standards
 - Establish a Technology Trends project to anticipate change
- OGC Tech Trends initiative provides unique technology assessments
 - Peer-reviewed material spanning ICT, science, and technologies
 - Collection, processing, and understanding of geospatial information
- OGC Members use Tech Trends assessments to plan internal R&D

From Technology Trends to Applied Standards





BREADTH



ASSESSMENT



FOCUS



Identify & Prioritize Trends

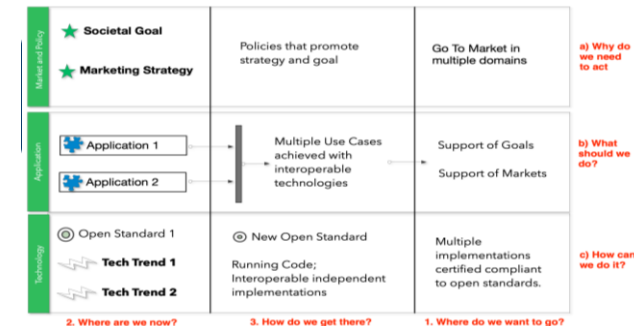
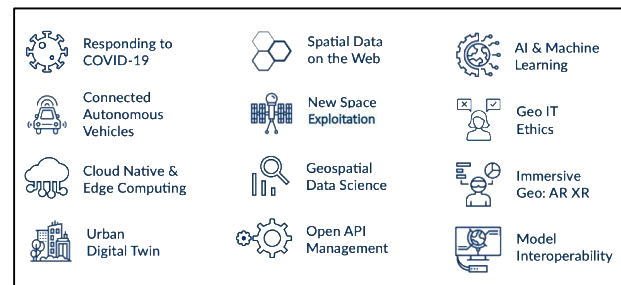
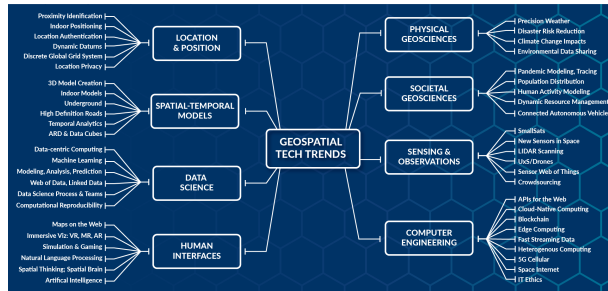
Evaluate Clusters of Trends

Act Based on Trends



Plan OGC Testbeds

Identify Future Standards



2. Where are we now?

3. How do we get there?

1. Where do we want to go?



Sources for Tech Trends

Nov 2019 to May 2020:
446 sources total

Peer-Reviewed Journals,

Magazines, Newsletters

- AAAS
- ACM
- IEEE
- ISPRS
- SPIE
- AGU
- EGU
- National Academies

OGC Member publications

Industry publications

- Geospatial Media, Directions, GIS Café, Coordinates, Between the Poles, etc.
- SpaceNews
- MIT Tech Review and similar
- Web publications: Medium, Vox,

OGC Activities

- Location Powers summits
- Standards Program:
 - Future Direction workshops,
 - Discussion Papers
- Innovation Program
 - Engineering Reports



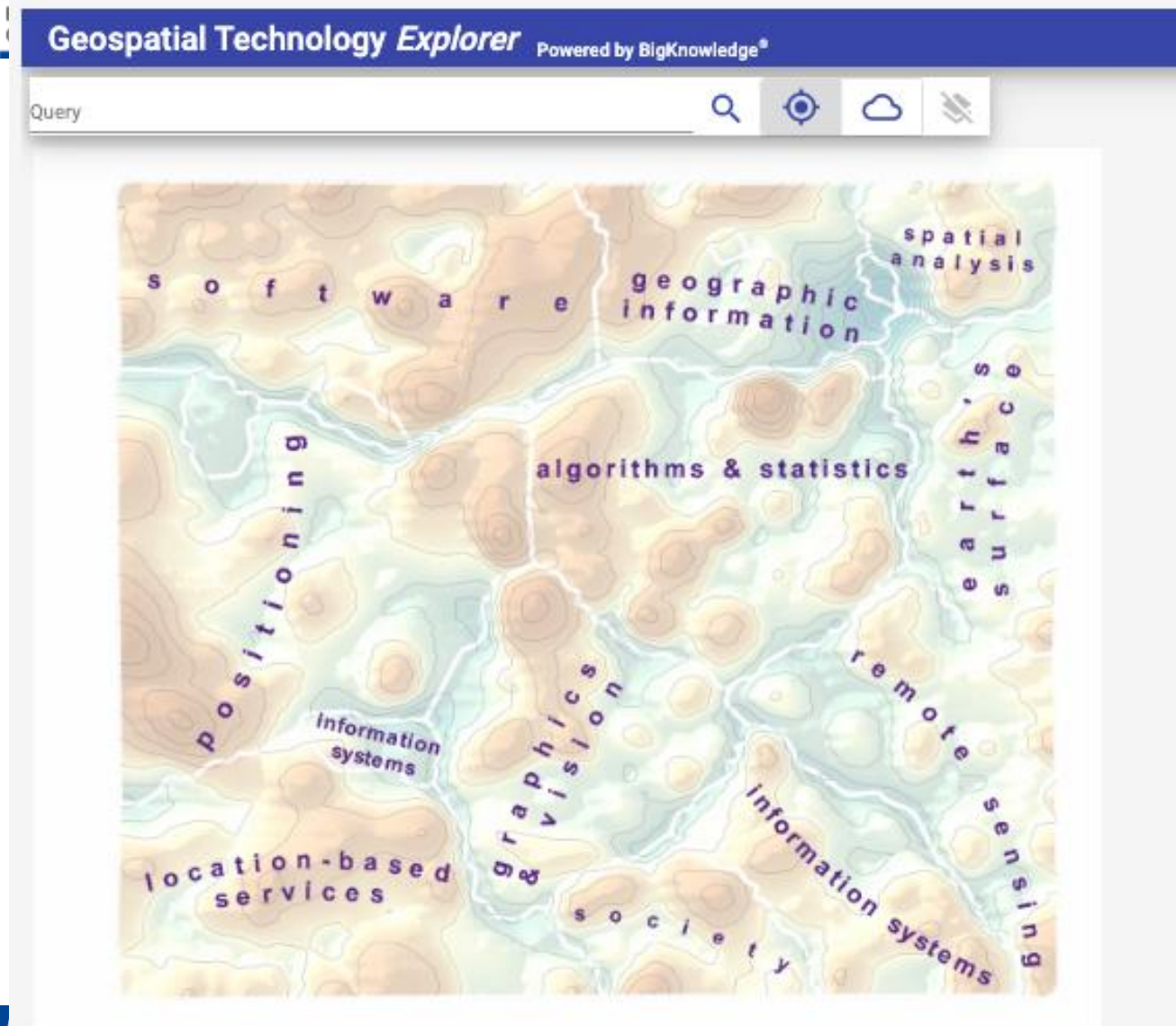
Categories with the most sources:

- Artificial Intelligence - 45 notes
- Autonomous Vehicles - 35 notes
- IT Ethics 28 notes
- Machine Learning - 27 notes

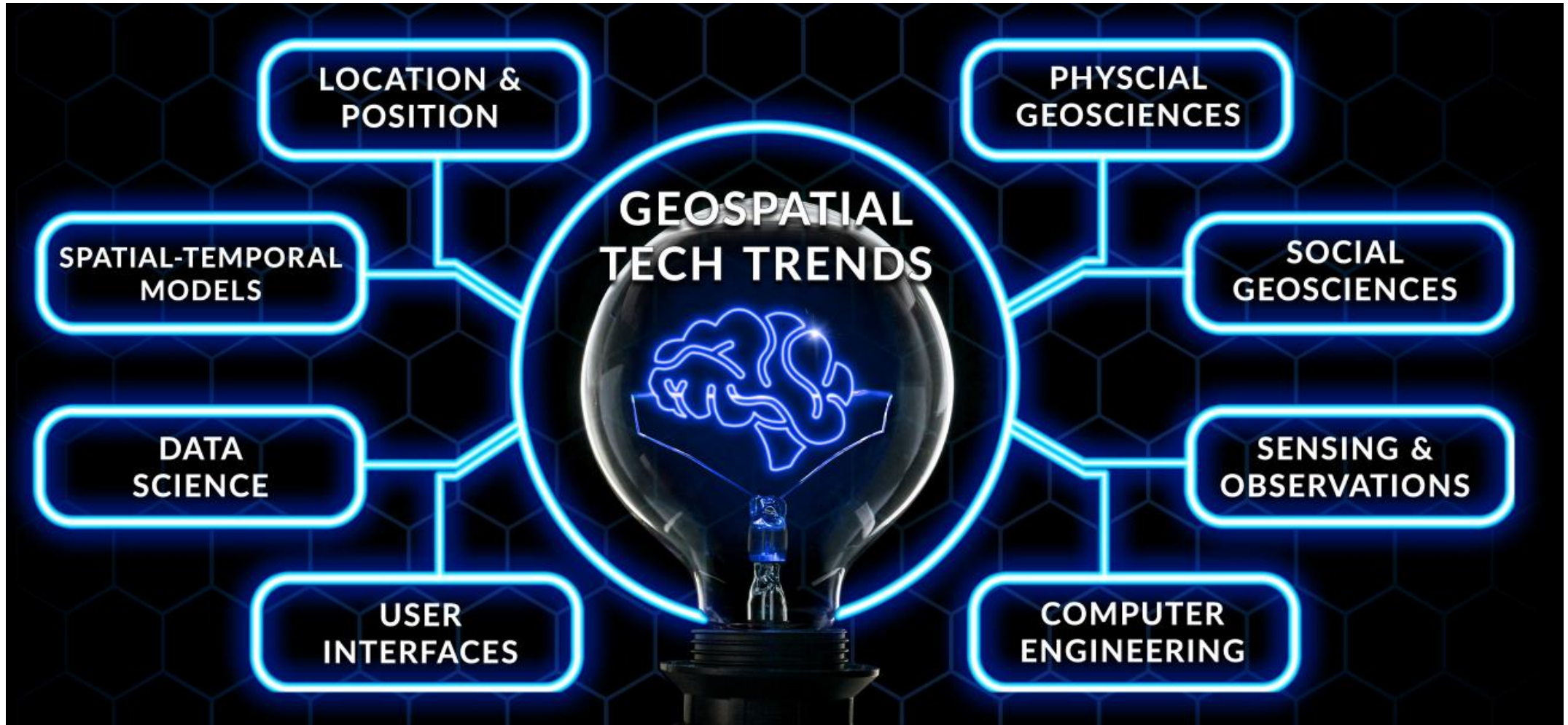
Geospatial Technology Explorer

- Geospatial Tech Explorer
 - Tool to understand geospatial technology landscape
 - Expose complex interrelationships
- Constructed from
 - 100,000+ domain artifacts, e.g., textbooks, standards, BoKs manuscripts, glossaries, etc.
 - 1300-Dimensional concept space identified with AI - NLP
 - Topography metaphor to visualize

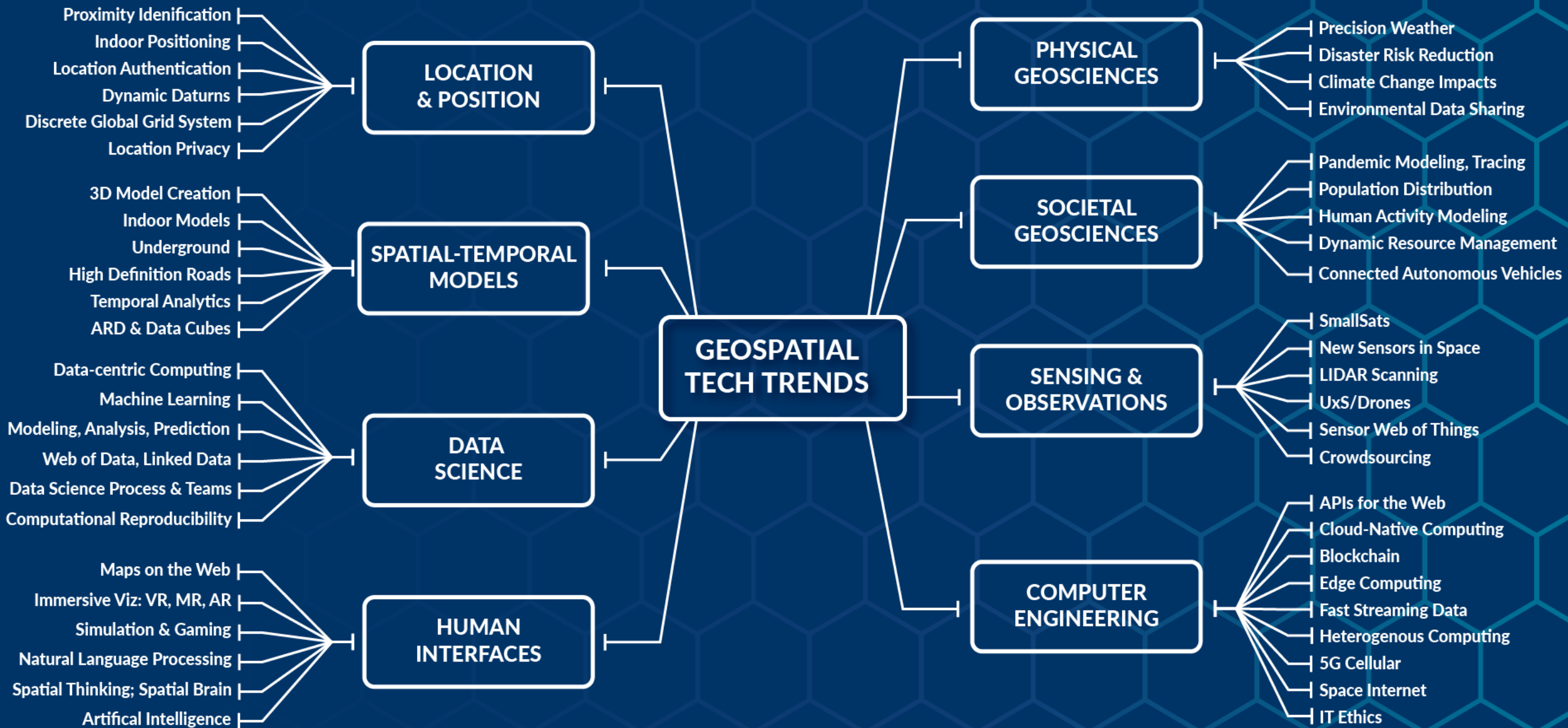
www.opengeospatial.org/OGCtechExplorer



Tech Trends - Top Level Categories



OGC Tech Trends - 2020Q3





Emergent Trend Clusters – June 2020



Responding to
COVID-19



Spatial Data
on the Web



AI & Machine
Learning



Connected
Autonomous
Vehicles



New Space
Exploitation



Geo IT
Ethics



Cloud Native &
Edge Computing



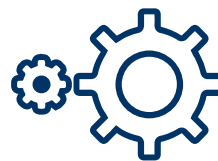
Geospatial
Data Science



Immersive
Geo: AR XR



Urban
Digital Twin



Open API
Management



Model
Interoperability



EO4GEO – Sector Skills Alliance (Example 2)

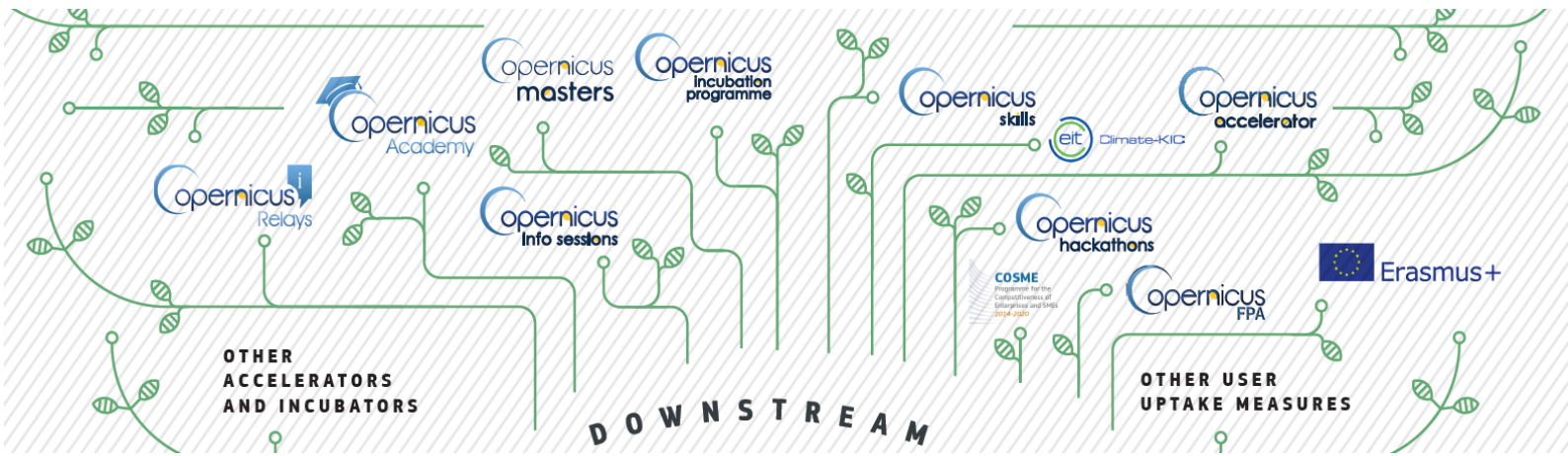
Approach to fill the gap between supply & demand for skills in the space/geospatial sector for improved user-uptake of Copernicus



News.itu.int

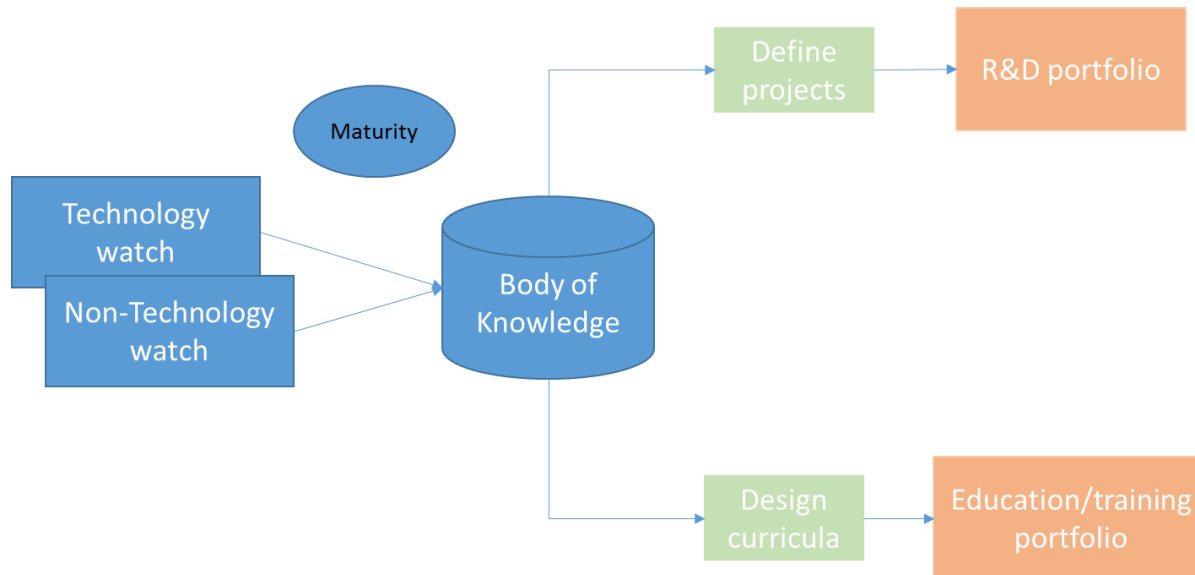
“Skills Intelligence”: “a comprehensive and user friendly information, data, facts, analysis and interpretation about the past, present or future skill needs in occupations and sectors”

Skills Intelligence
Analysis of supply
Analysis of demand
Technological and non-technological trends
Assessing gaps, strategy
Feeding a Body of Knowledge



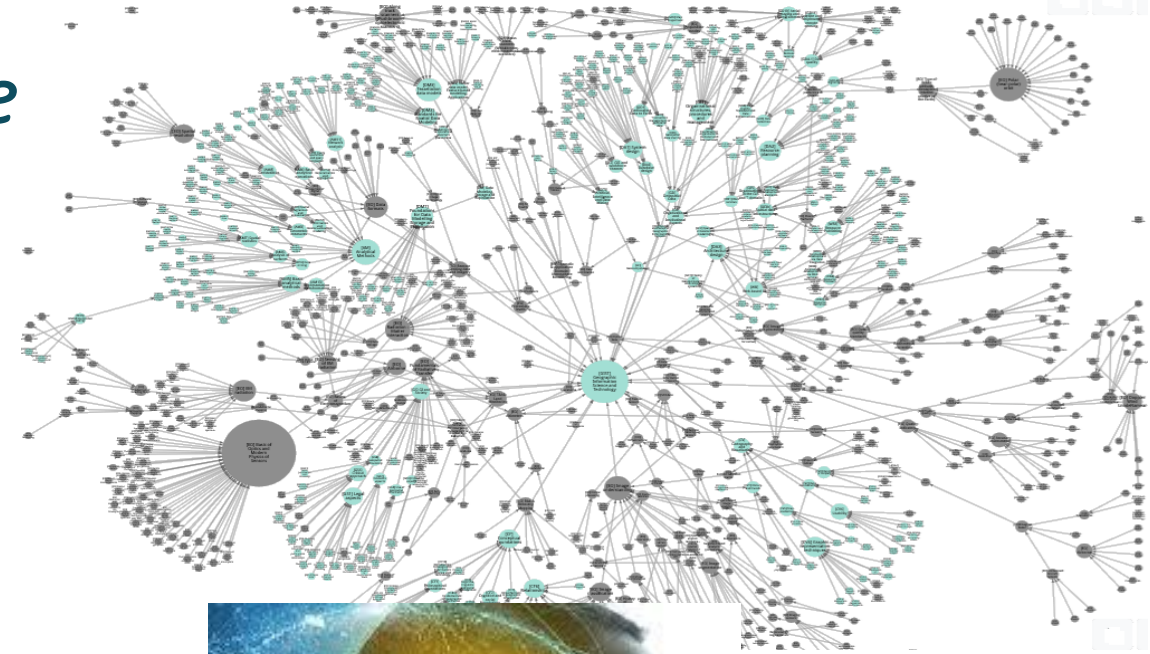
An ontology-based *Body of Knowledge*

A formal description of a professional domain

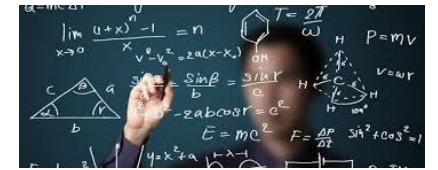
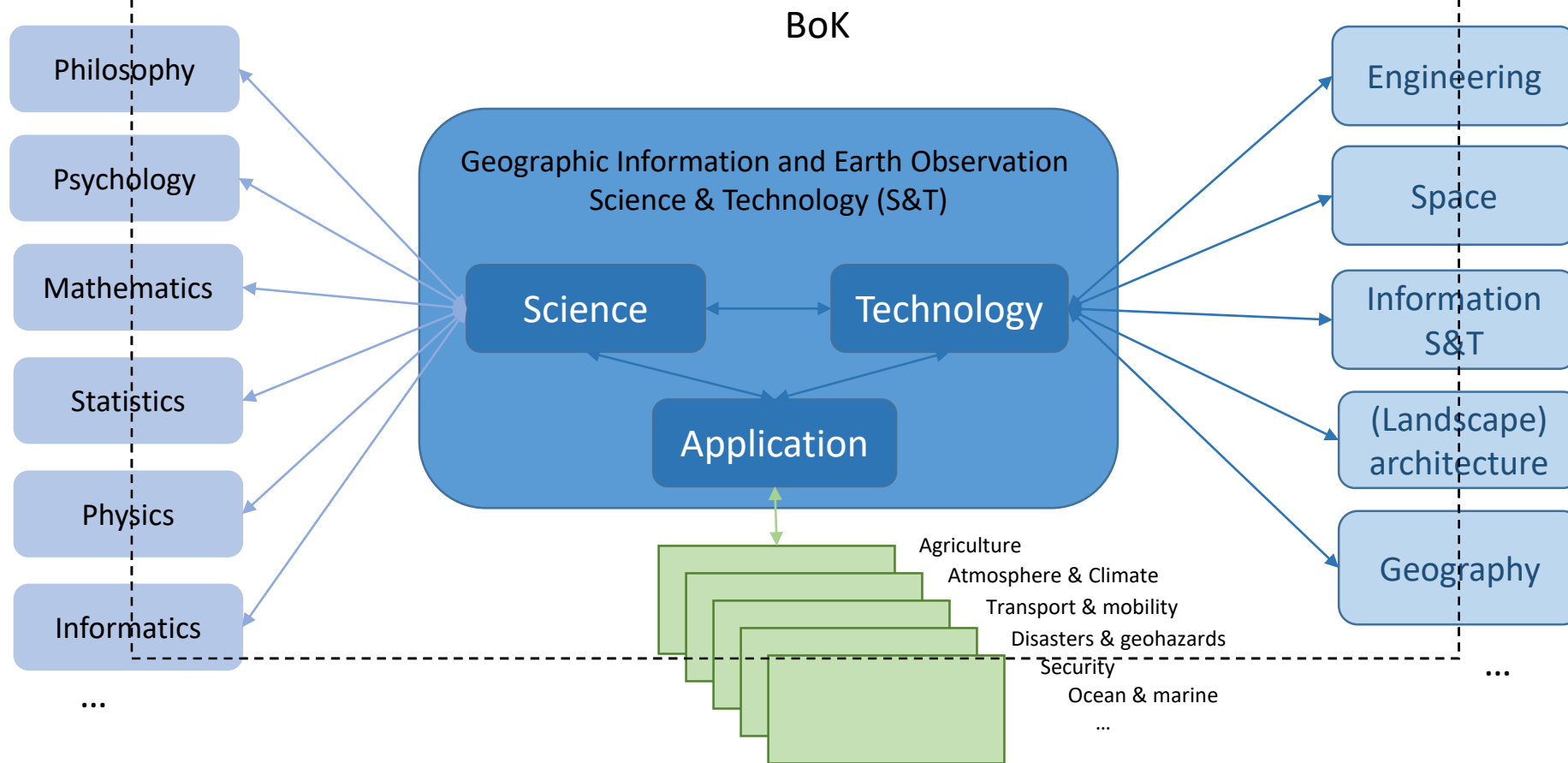


Technology Trends Watch should feed the BoK

BoK is used for designing academic and vocational training



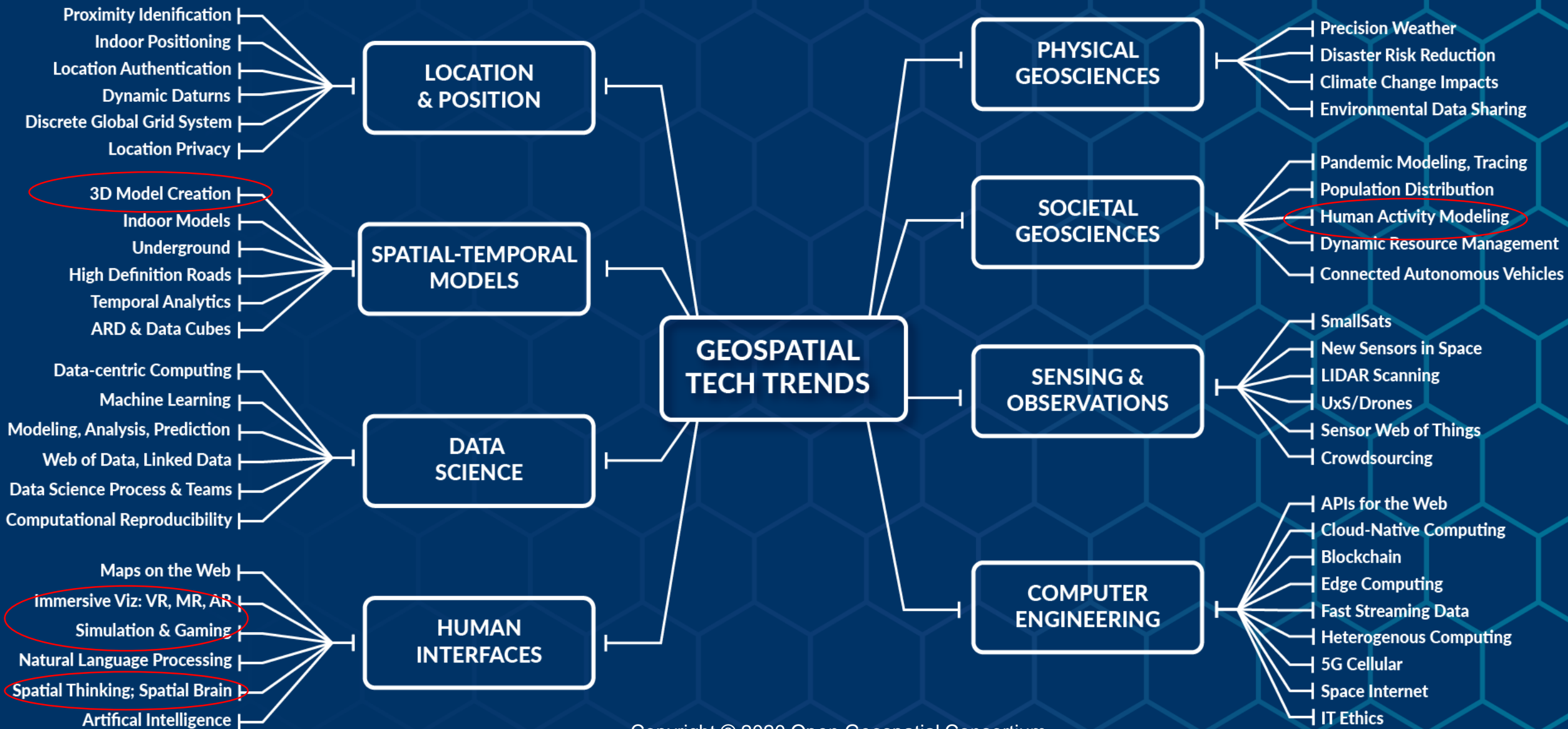
What is this professional domain?



3

*Major trends and how they
fit together*

OGC Tech Trends - 2020Q3



Example 1: agent-based spatial modelling

Analysing the **behavior of children in traffic**. How do they experience their environment, e.g. when going to school using the bike? What do they see, what not ... what do they focus on? Maybe there different types of kids (typology). Insights can be used **as input to urban planning**: re-engineer crossings; use of signals; re-positioning of trees ... **Teaching programmes at school**



Pictures: magnetpress.net, earth.com,
eandt.theiet.org, 123rf.com



Technology Trends

Spatial thinking, spatial brain

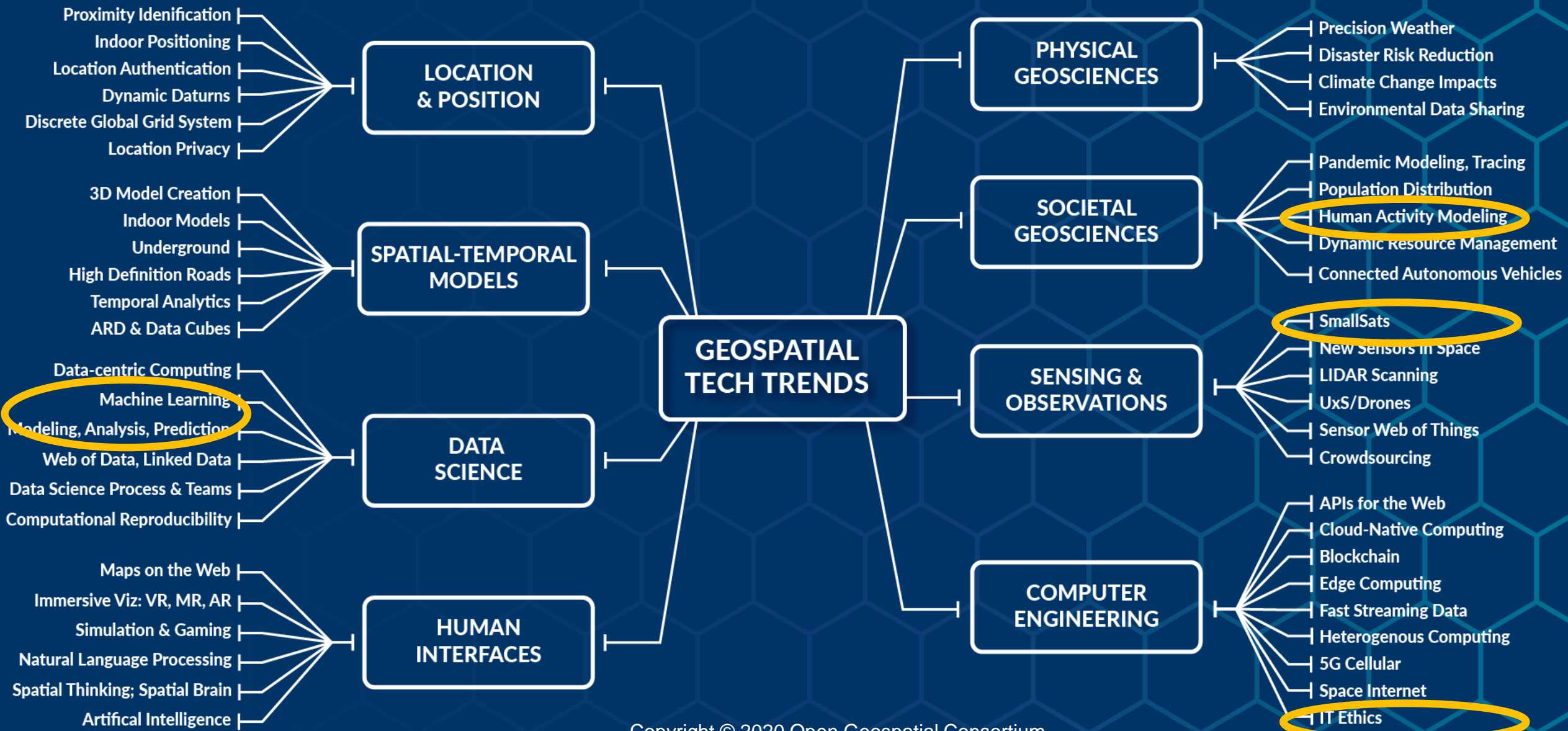
Human activity, agent-based
modelling

Digital Twins, 3D city models

Emersive geo: AR, VR ...,
gaming

Eye-tracking, eyewear

OGC Tech Trends - 2020Q3



Example 2: automatic object detection

Monitoring borders to **identify refugee flows**. Automatic discovery of vehicles and boats using huge amounts of images that needs to be continuously 'refreshed' (**Big Data** streams). Finding the needle in the haystack by using **Machine Learning** and Deep Learning. Results can be used to discover flow patterns and behavior of (groups of) people. Might serve as **input for security policy**.



Technology Trends

Big data, data analytics

Small satellites

AI, Machine Learning

Human activity modelling

HPC and Quantum
computing

IT-ethics

4

*Interoperability efforts and
challenges*

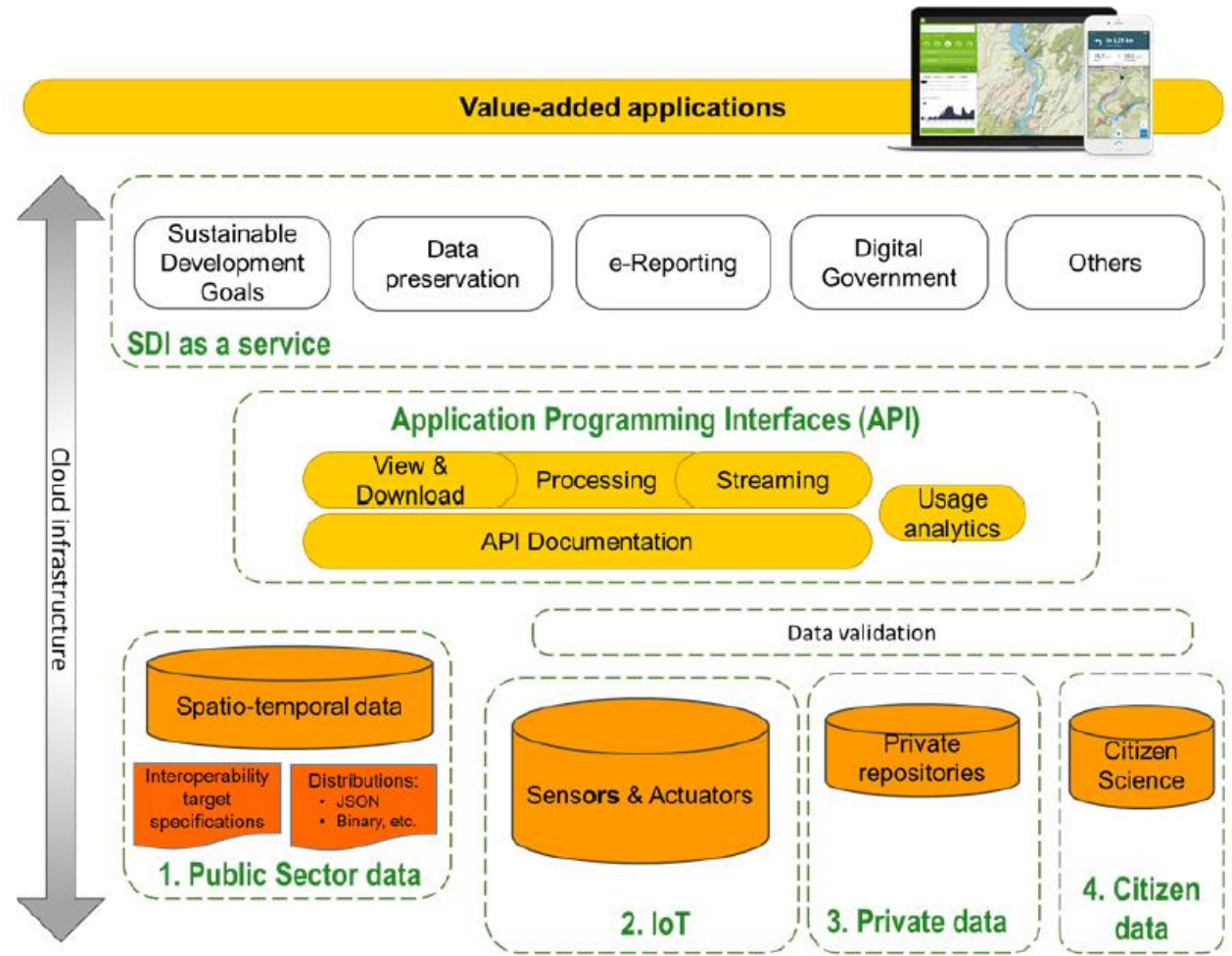
Flexible architectures ...

Organisational interoperability

- Internet of Things - sensors
- Scientific and citizens science data
- Private sector data
- Public Sector data
- Earth Observation platforms

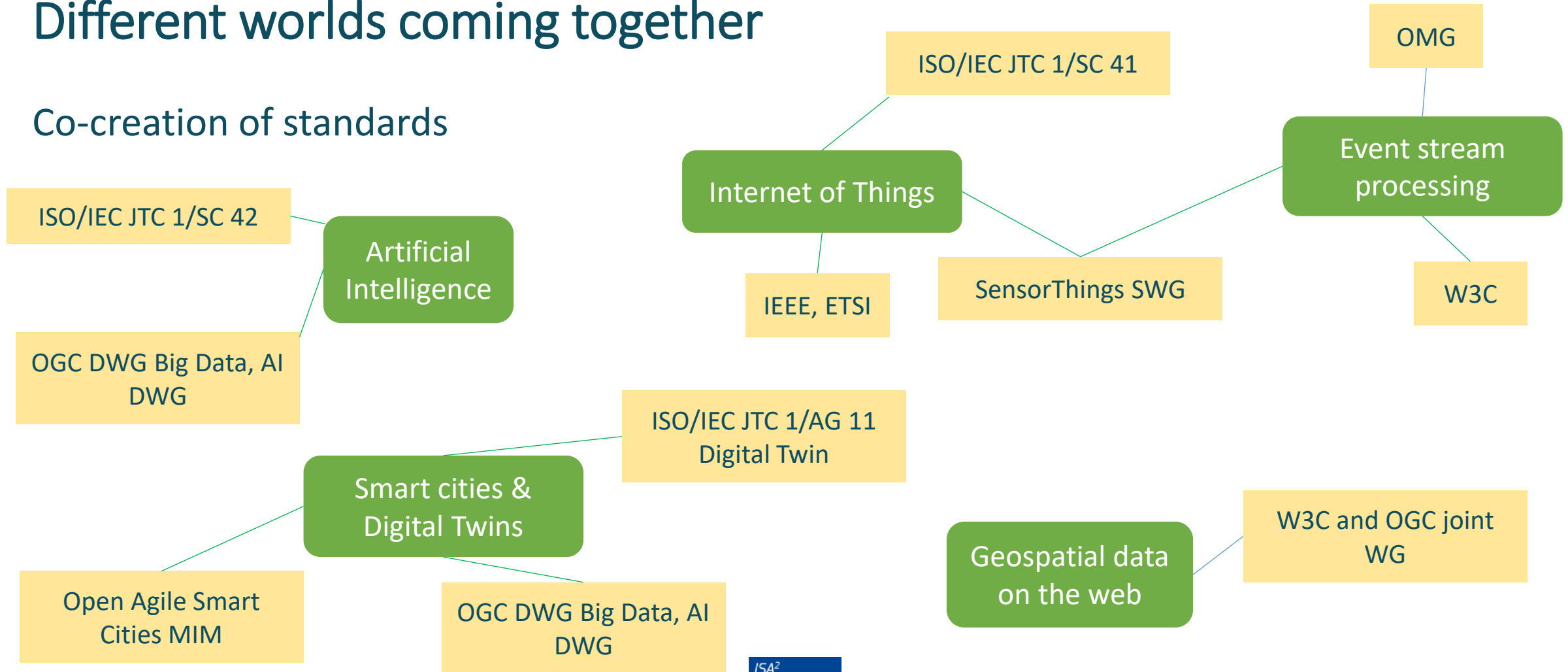
“... actors should become first-class citizens who participate in the co-design and co-creation of technological solutions.”

Kotsev et al. (2020)



Different worlds coming together

Co-creation of standards



OGC - Embracing different worlds

... beyond web services

Indoor
 Smart cities, 3D
 Sensor Web
 Moving features
 Secure access
 Semantic web
 API's



Features

OGC API - Features: Part 1 - Core is already publicly available. Part 2 - Coordinate Reference Systems by Reference will soon be released for public review.

[More Info](#)

[GitHub repo](#)



Common

OGC API - Common provides those elements shared by most or all of the OGC API standards to ensure consistency across the family. The candidate standard will soon be released for public review.

[More Info](#)

[GitHub repo](#)



Q3 2020 OGC API Sprints

The Open Geospatial Consortium (OGC) invites interested developers to the Q3 2020 OGC API Sprints, to be held through remote participation/web-conferencing.

[More Info](#)

[GitHub repo](#)

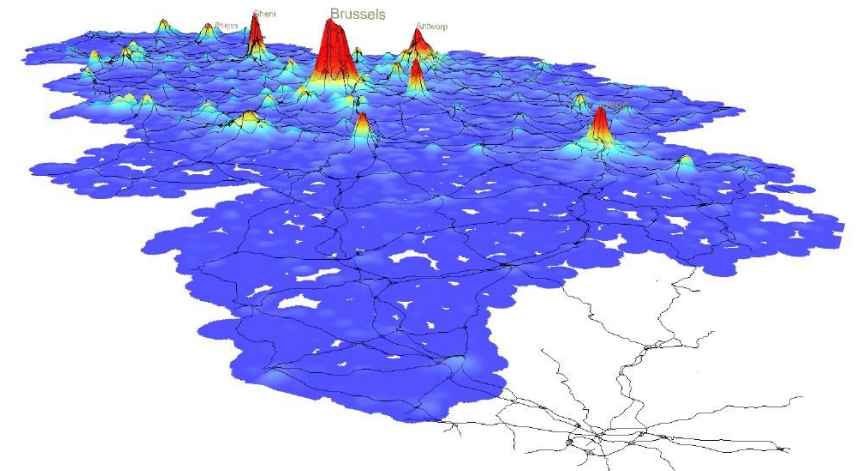
Semantic data models

Traditional data models and more ...

“Despite new technological developments, the need for the use of structured data with clearly defined semantics across multiple domains still remains (...) But data structures based on Spatial Features as a basic building block provides many advantages as OSM and Darwin Core Archive already do to a certain extent (...) Also an encoding-agnostic approach using different representations would be beneficial”

Kotsev (2020)

Eurogeographics.org

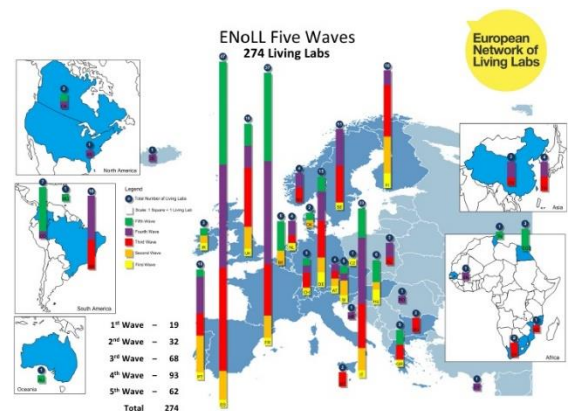


Collaborative experimenting

New developments and new technologies are not being implemented overnight. Organisations need (interconnected) **test environments**. Not only academia, but companies, public sector actors at all levels. Such environments can take **many forms and sizes**. It can contain (new) data, algorithms, software code, services, well documented workflows, insights ... They can be kept open for a long or short period ...



Persistent testbeds
Sandboxing
Living labs
Collaborative platforms




5

*Key take-away messages
& conclusions*



Concluding remarks

Geospatial technology trends are **influenced by different factors**, including economical, legal and political drivers

There is a need for a consistent **technology trends monitoring system** that allows analysis of emerging technologies, how they are interconnected and might be applied in different contexts

Technology trends and the fact that **they change rapidly** should not make us wait to look into them and to apply them. We can **experiment** with new technologies in different kind of test environments



Challenges & priorities

Different stakeholders of the geospatial community should **work together** for having a strong technology trends watch (TTW) system

A TTW should be used to systematically assess **new skills and competencies** requirements

The full **impact of the major technology trends** on geospatial technology and interoperability is not entirely clear yet, and requires further investigation

6

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Q&A



Participatory Lab
14/10 at 11:30h
Location
Intelligence4Cities and
Regions

- **Location Intelligence**
- **Innovation**
- **Energy Efficiency**
- **Data Ecosystems**
- **Cities and Regind**

18th EUROPEAN WEEK of
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05>09 OCTOBER 2020	12>16 OCTOBER 2020	19>22 OCTOBER 2020
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