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# Challenges and opportunities for spatial data infrastructures in the emerging and evolving geospatial ecosystem

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# Data infrastructures

*Metaphor for a physical infrastructure*

- Emerged in the 1980s/1990s
  - As a result of the move from paper to digital data
  - Started with centralized control, evolved to be more distributed bottom-up infrastructures
- Spatial data infrastructure
  - technology, policies, standards, and human resources
  - to acquire, process store, distribute, and improve utilization of geospatial data

# Data ecosystems

*Metaphor for a natural ecosystem*

- Emerged in the 2010s
  - As a result of proliferation and commodification of data
- Geospatial [data] ecosystem
  - a community of actors [**data providers and users**]
  - [**in conjunction with**] the geospatial information and technologies in their environment
  - interact [**as a system**]

# Data ecosystems

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The geospatial [data] ecosystem is part of the larger [data] digital ecosystem

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'living' actors

'non-living' information and technologies

# Data ecosystems – characteristics

- Dynamic
- Self-organize
- Actors
  - Actors collaborate
  - Keystone actors
- Shaped by actors
- Provides goods and services
- Consumption does not deplete the data!

# Data ecosystems are dynamic

*Balance may be disturbed anytime*

*Forever recovering from a disturbance in the past*

- Be aware of disturbances
  - INSPIRE, dataspace
  - Artificial intelligence (GeoAI), digital twins, metaverse
  - Geopolitical tensions, international crises
  - National and global economy
  - New data sources, many more satellites
- Be alert and prepared
  - See UK's crisis plan in the event current Position, Navigation and Timing (PNT) services are unavailable
- Adapt if and when necessary
  - Small and frequent adjustments

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30-year plan?!  
Agility, flexibility



# Data ecosystems **self-organize**

*Through both competition and collaboration*

- Competition
  - If the SDI cannot provide (good enough) products, other actors will provide them
- Standards remain important
  - de facto rather than de jure
  - Facilitate the self-organization



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e.g., competition from the private sector providing or adding value to the data

- If the SDI cannot provide (good enough) products, other actors will provide them

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- de facto rather than de jure
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# Data ecosystem actors collaborate

*For their own benefit and for a specific purpose*

*Short term or longer*

*Without diversity, they 'kill' each other through competition and collaboration not needed*

- Some actors may be intelligent bots
- Opportunities in the larger digital ecosystem
  - as provider and user, much wider range of actors
    - Provide geospatial data for other industries, e.g., insurance
    - Location-based sensors in the IoT, e.g., windows open or close depending on the air quality outside
- What is unique about my SDI (products)?
  - Which niche does the SDI fill?

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e.g., legal mandates

# Data ecosystem have keystone actors

*Impact the ecosystem disproportionately to their numbers*

- SDI can be a keystone actor
- Competition from large tech companies
- Intelligent bots can become keystone actors
- What if they are not benevolent?
  - We all have a responsibility for openness, integrity, balance

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Constant power struggle

# Data ecosystems are shaped by actors

*Abundance and nature of communities of actors*  
*Adaptive and dynamic networks between actors*

- Open communities

VS

- Geospatial-only communities
  - “Only we can do this”

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Professional bodies can be a barrier to open communities

# Data ecosystems **provide goods and services**

*Tangible, e.g., specific dataset from chain of geoprocessing events*

*Intangible, e.g., location-based services (generally)*

*Goods are not depleted*

- If we allow the SDI to be part of the ecosystem, more goods and services can be provided
- *Just use it!*
  - Easy to find and use data, no cumbersome searches anymore



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Location-based data is increasingly integrated in business processes

# Conclusion

- In the beginning,  
it was necessary to build data infrastructures
- Now, data ecosystems are emerging  
Infrastructures must adapt to ecosystems
  - that are dynamic, self-organize
  - where actors collaborate, some as keystone actors
  - that are shaped by actors
  - that can provide a variety of data and services
- Consumption does not deplete the data!

Thank you