Spatial Data Infrastructure and Earth Observation Education and Training for North Africa

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SEED4NA
Virtual Summer School

18-27th May 2021

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Spatial Data Infrastructure and Earth Observation Education and Training for North Africa

SDI curriculum developed by BESTSDI project

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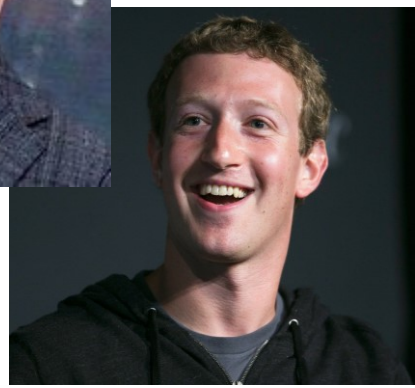
Used BESTSDI presentations delivered by
Danny Vandenbroucke and Dražen Tutić

Introduction

- Spatial information is today attached to any human activity
- Many activities in fact depend on spatial information and its quality
- But spatial information is not always available due to:
  - Legal restrictions
  - Commercial reasons
  - Technical incompatibility of any kind
- And as we heard spatial information is money!



- **Therefore, everybody needs SDI (or SII) in some form**

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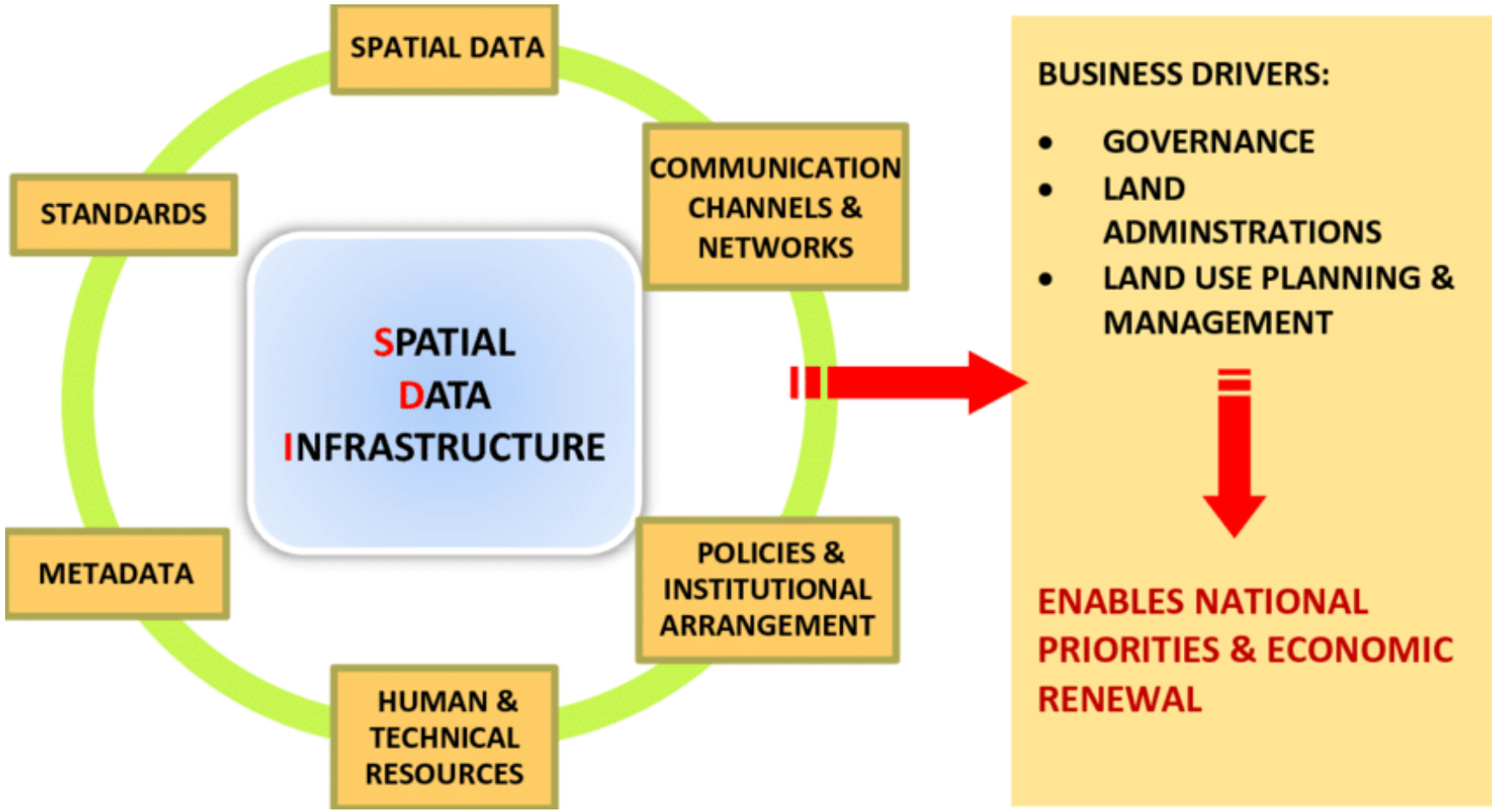
SDI – more than just data & standards



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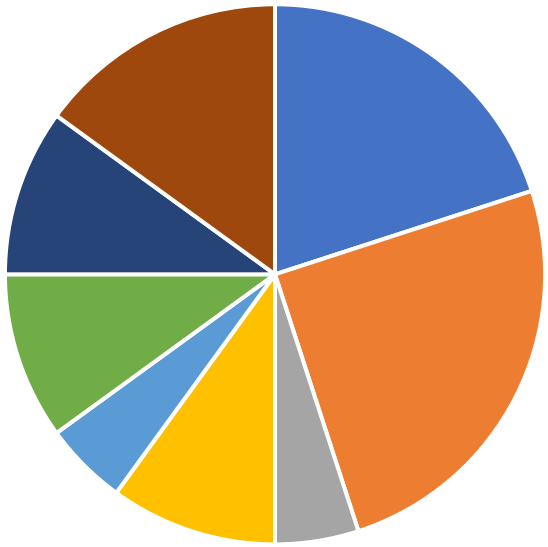
Diversity of study programs on projects

BESTSDI (12 Univ.)

Modernized study programs



- Geodesy & Geoinformatic
- (Civil) Engineering
- Architecture
- Natural sciences/Geography
- Agriculture
- Forestry
- Mine/Geology
- Informatics

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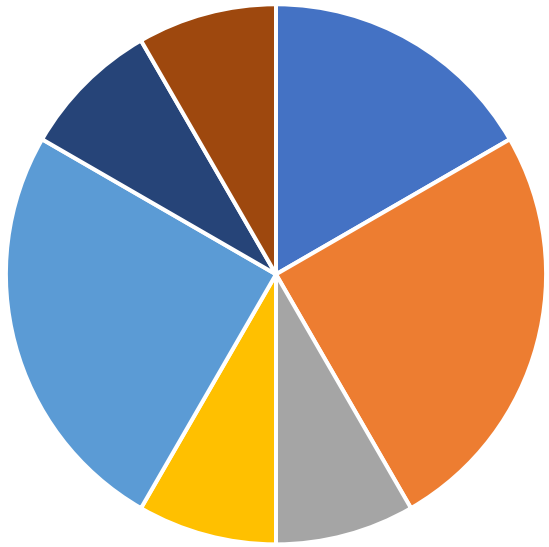
Study programs in modernization



- Geodesy & Geoinformatic
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SDI in academic and professional education

- Indirectly everywhere, directly somewhere
- Volume varies from lecture to courses/modules
- Content varies dependent on study program field and scope
- In broadest sense, it is lectured even when it is not recognized or called so

- **But it is not irrelevant how is lectured!**

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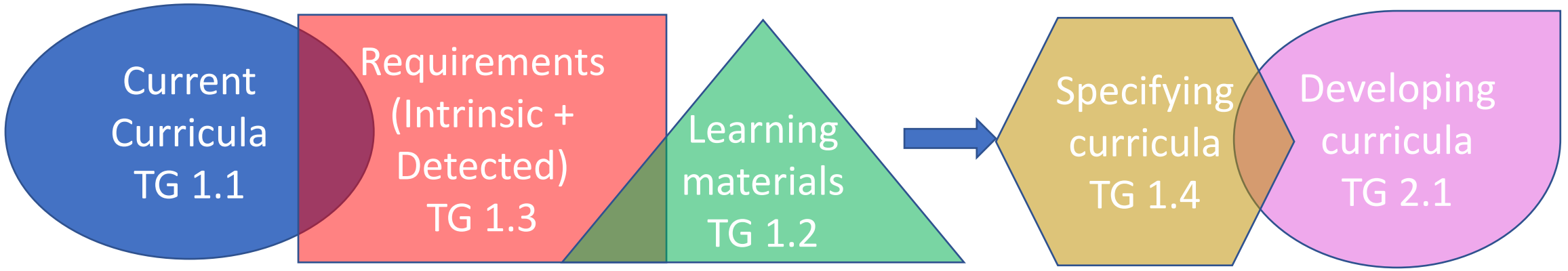
BESTSDI curricula development

- Based on preparatory analysis and surveys → towards curricula content



- Variety of study programs critical factor
- Therefore, core curriculum / not designed as standalone curriculum but as a repository

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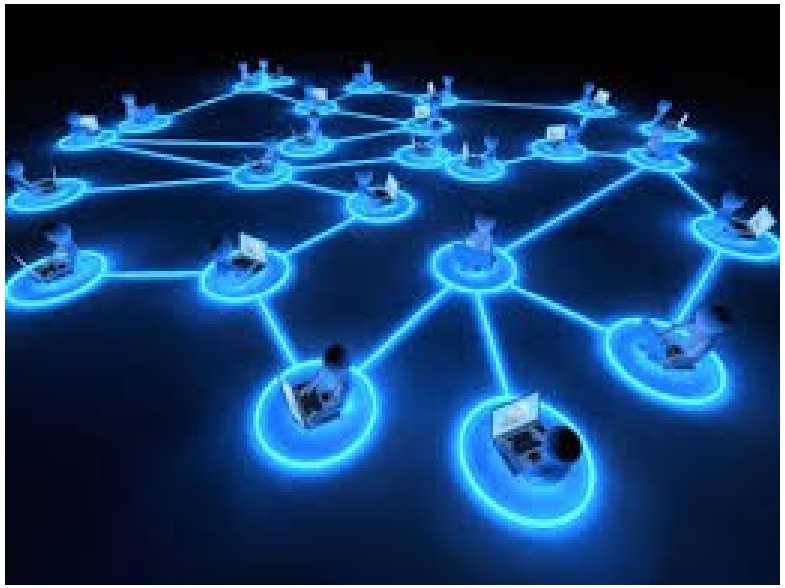
What did we learn from preparatory phase?

- Initial analysis of the survey
  - Many competence (knowledge) areas identified with relevant topics
    - Conceptual foundations
    - Cartography and visualisation
    - Design aspects
    - Data modelling
    - Data manipulation
  - Key areas
    - Infrastructure & platforms
    - Institutional aspects
    - Societal aspects



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What did we learn from preparatory phase?

- The most needed single competences highlighted:
  - Working with land administration systems (KA geospatial data)
  - Know about legal aspects (KA society)
  - Being aware of relevant (national) legislations/regulations (KA society)
  - Understand basic elements (KA conceptual foundation)
  - Measure basic geometric properties (KA analytical methods)
  - Assess data quality (KA geospatial data)

☞To be considered and put in perspective
  - Some will be rather pre-requisites (?)
  - What will be the extent of the societal topics within the project curriculum (?)

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Main structure: initial / basic

1,5 – 6 h

Concept(s) of SDI
SDI Components
Goals of SDI
History of SDI
SDI Standards
Examples of SDI

1,5 – 6 h

SDI at work
How to use SDI
Publish-search-bind
Portals
Using SDI components in GIS
Standards for metadata

6 – 32 h

Data modelling and data specifications
Data harmonisation
Conceptual modelling languages
Standards for data modelling

Accessing data through the web
How the web works
Standards for web services
Types of web services

6 – 32 h

3 – 12 h

Assessing SDI
Quality issues in SDI
Metadata
Data
QoSE
Conformity & Compliancy
Testing & Validation

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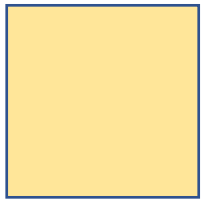
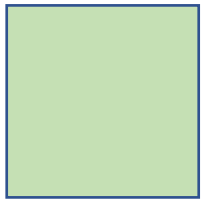
Blue, yellow, green

- ‘required’



- ‘optional’ (also requires blue)



- ‘nice-to-have’ (also requires blue and some yellow)

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SDI concepts and SDI @ work

SDI concepts (B-1)

- SDI objectives
  - Sharing, access, use/re-use
  - Collaboration, distributed
- SDI components
  - Metadata, data, services
  - Users, coordination structures …
  - Institutional aspects, law
- SDI approaches
  - Hierarchy, network
- Overview SDI standards
  - Technical and semantic standards
  - Metadata, data, services

SDI @ work (B.2)

- Geo- and other portals
  - Portals as GUI
  - Functionalities
- Publish-Search/Find-Bind paradigm
  - Search mechanisms
  - Metadata elements, evaluate data
  - Use service components
- Metadata standards
  - ISO 19115 / 19119 / 19139
- Best Practice for geoportals
  - Examples

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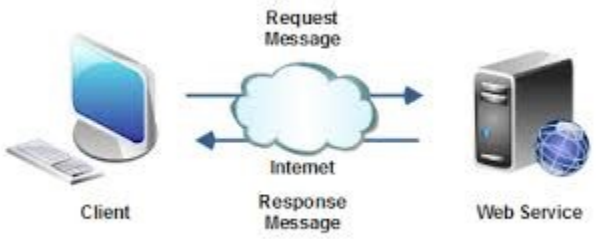
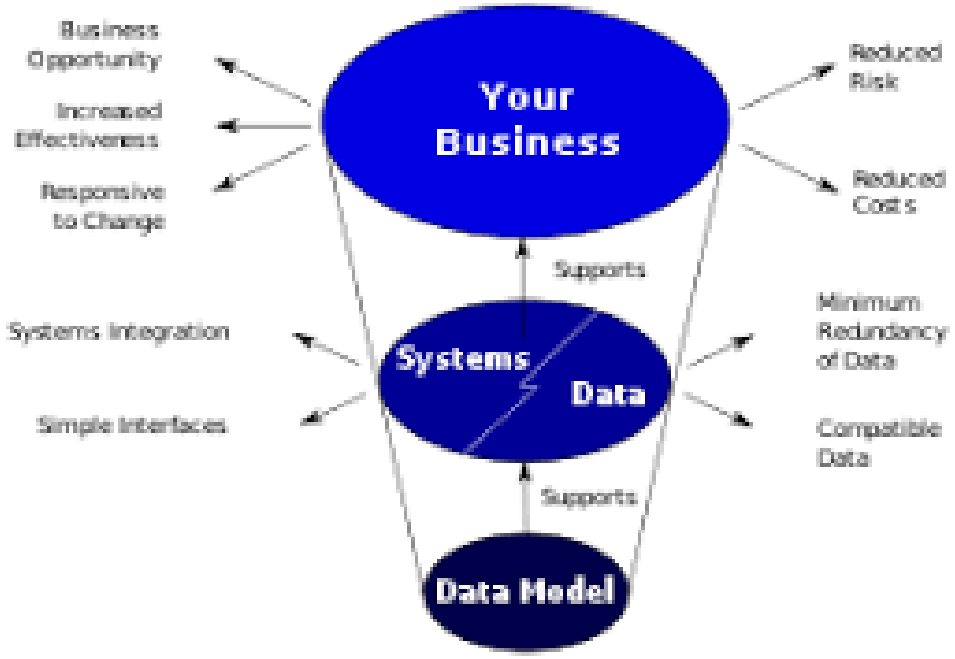
SDI data and SDI services



Data modelling (B.3)



Accessing data (B.4)

- Basics of the web
  - The stack of web protocols
  - Client-server and SOA architecture
  - HTML, GET and POST
- Types of web services
  - Visualisation, data processing, access, …
  - Geospatial web services and others
- Underpinning standards
  - CSW
  - WMS, WMTS, WCS … WFS
- Invoking services and service chaining

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Main structure: advanced

1,5 – 12 h

- Non-technological developments
- SDI and e-Government
- Institutional & Governance
- …
- Legal aspects

1,5 – 24 h

- Technological trends
- Semantic web Linked Data
- Sensor web enablement
- …
- Augmented reality 3D-4D mapping

3 – 24 h

- **SDI for agricultural applications**
- **SDI for Forestry and nature conservation**
- …
- **SDI for geology & mining**

3 – 24 h

6 – 24 h

SDI application development

API's

Programming (methods)

Coding in Java, Python, …

Web app design

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SDI tech and non-tech trends

Non-tech trends (A.1)

- SDI and e-Government
  - SDI supporting e-Gov work processes
  - Integration of governance data & GI
  - Open data versus authentic data
- SDI and multi-Directives
  - INSPIRE and PSI Directive
  - GDPR Directive and regulation
  - Access Directive
- SDI and secure access
  - Reasons for protection
  - Standards and technologies to protect spatial data

...

- SDI and GIS *(at the begining)*
  - Links and relations
  - How does SDI contributes to efficient GIS development
- SDI and modern geo-concepts *(at the end)*
  - Recent development of modern geo-concepts (IOT, smart cities, precise farming, sustainable environment, inteligent transport)
  - Role of SDI in deveopment of modern geo-concepts

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SDI tech and non-tech trends

- SDI and e-Government
  - SDI supporting e-Gov work processes
  - Integration of governance data & GI
  - Open data versus authentic data

Tech trends (A.2)

- SDI and the semantic web
  - Semantics and Ontologies
  - Linked (Open) Data
  - (Geo)DCAT-AP
- Sensor Web Enablement
  - Types of sensors and their application
  - Human sensors (mobile technology)
  - SOS, SPS … and related standards

…

- Multi-dimensional GI
  - 3D (+BIM), 4D and 5D
  - Augmented reality

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SDI application in different domains

SDI Application <domain> (A.3.1 .. A.3.n)

- Specific use(r) cases
  - Using specific thematic portals
- Specific spatial data models
  - E.g. LPIS, IACS … (agriculture); GBIF (nature conservation) …
  - Non-spatial community data – how to integrate them
- Specific other standards or formats
  - E.g. NetCDF for array-oriented scientific data (and metadata for gridded data)
  - E.g. WaterML, GeoScML (Geology), …
  - E.g. CityGML (spatial and urban planning)
- Examples of applications
  - Making use of SDI web services
  - Existing API's to use for developments
- Specific non-technical arrangements
  - Structures, organisations, legislation …

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SDI concepts and SDI @ work

Assessing SDI (A.5)

- Quality issues in SDI
  - Metadata
  - Data
  - Quality and Experience of a Service
- Conformity and compliancy
  - Testing and validation
- SDI assessment and evaluation
  - Techniques for assessing
  - Benchmarking
  - Performance measurement

SDI application development (B.4)

- Application Programming Interfaces (API)
  - What are API's and how can you built on them
  - Web application design
- Programming methods
  - Scrum as AGILE method
  - Rules for good program coding
  - Testing and documenting code
  - Use of Github and other platforms

Result - 9 learning building blocks, 72 topics

INITIAL	SPECIALIZED
1. SDI Concepts and Principles 2. SDI at Work	6. Non-technical Developments 7. Technological Trends
3. SDI Data Modelling and Data Harmonization 4. SDI Access Mechanisms	8. SDI for Thematic Applications
5. SDI Assessment and Quality Issues	9. SDI Application Development

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LBB1. SDI concepts and principles

Outcoms:

- Understand and being able to identify the objectives of SDI's, the different components of an SDI and the different types of SDI in place;
- Gaining insight in the geospatial standardisation process, the most important standardisation bodies and the different types of geospatial standards;
- Being able to identify existing Best Practice SDI implementations in the world.

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Topics in LBB1.

The usage of spatial data in different application domains: examples of spatial data (sets) and applications;
Existing barriers to access and use spatial data: non-harmonisation, licensing and pricing, restricted use, …;
SDI's as answer to resolve those barriers: facilitating access, stimulating sharing and optimizing use;
Different components of SDI: data, metadata, access mechanisms, standards, people and organisations, institutional and legal aspects …;
Different types of SDI and different models: hierarchical or network based, connecting distributed resources;
Main geospatial standards, the standardisation process and relevant standardisation bodies;
Examples of existing SDI's, their evolvement over time and comparison worldwide.

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LBB7. Technological trends

Outcoms:

- Being able to identify the major technological trends;
- Being able to analyse a 3D geospatial data model and recognise ways of exploiting 3D in the context of a GIS;
- Understand and gain basic knowledge and skills on the semantic web and how Linked Data technology is used to publish, link and use spatial data on the web.

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Topics in LBB7.

Overview of the major developments and trends as defined by UN-GGIM and OGC (with focus on technological trends);
New ways of data acquisition and new data sources: UAV's; Image-based Mobile Mapping, Laser scanning, Crowd Sourcing and VGI; etc.
Major programmes to support better and more data, more accessible and easier to use: Copernicus and GNSS, Galileo, …
The influence of huge amounts of data on the way we work (big data): cloud computing; workflow and provenance; big data analytics; big data coming from social networks/media; etc.
3D/4D geospatial data: space and time including the provision of examples on: moving objects in space (eye-tracking), agent-based modelling (indoor/outdoor); augmented reality (looking to the past and into the future); etc.
New ways to publish and use geospatial data on the web by making use of semantic web technology such as linked data: examples and small exercises on usage and implementation;
SDI to improve sharing and exchanging data, but taking into account sensitive information by using secure access mechanisms and protection of (spatial) features.

What has been inside BESTSDI created?

Phase 1

- 9 modules
- 72 topics (41 created, ~60 %)

- 4 priority modules
- 32 topics (25 created, ~80 %)

Phase 2 – additional 10 topics created

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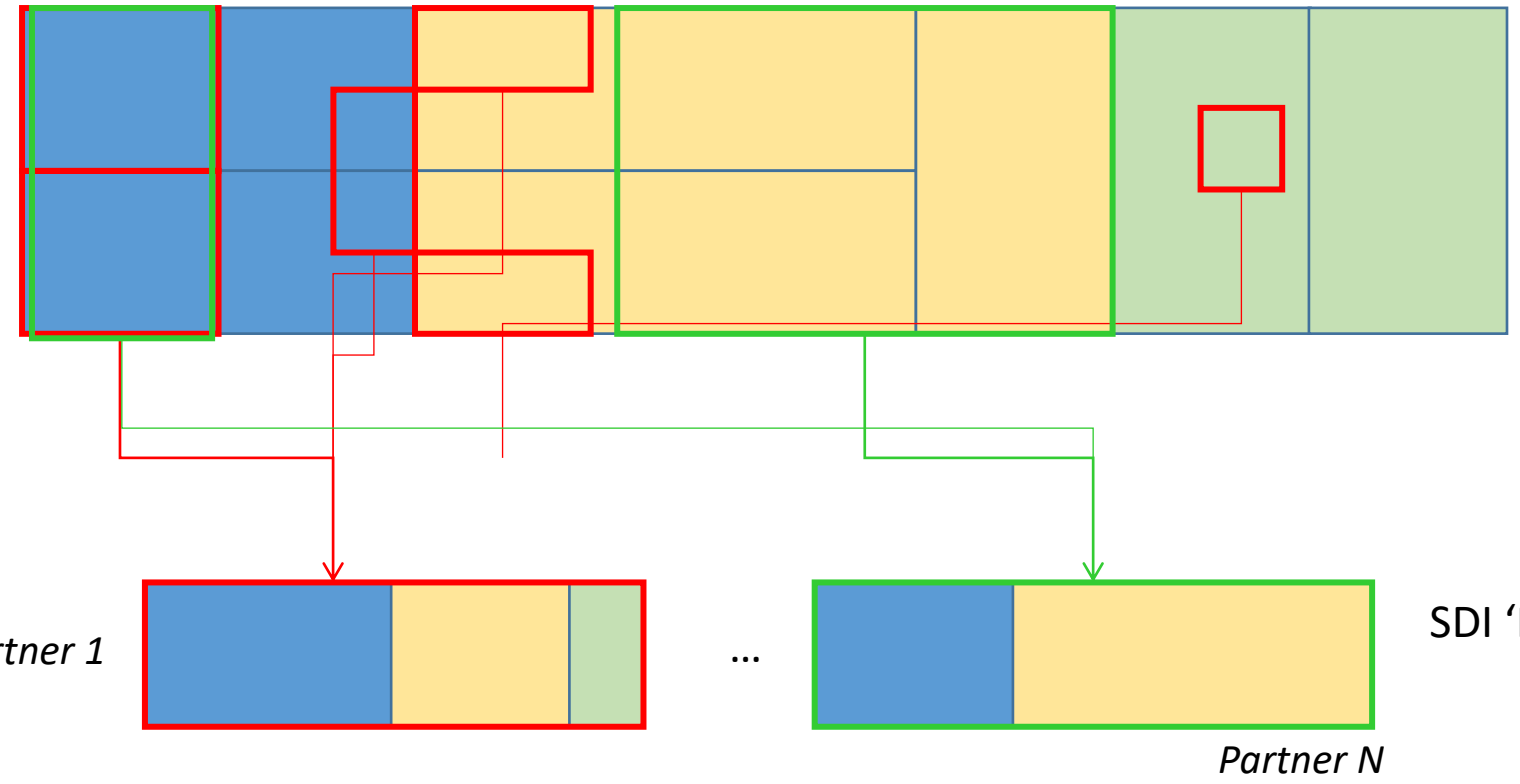
From project curriculum to local curricula



'SDI Cookbook'

SDI 'Menu's'

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Thank you for your attention!

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