



VL OpenGIS

Introduction

24S 856.164 | 5 March 2024 | 08:30 – 10:00



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Course materials



- Available via Blackboard including
 - Presentation slides
 - Required reading material
 - complementary reading material

The screenshot shows a web browser window displaying a Blackboard course page. The browser's address bar shows the URL: <https://elearn.sbg.ac.at/webapps/blackboard/content/listContentEditable.jsp?coi>. The page header includes navigation links: Home, Courses, and Notifications. The course title is '175856164: Open GIS: Standards, Architectures and Services Standardgruppe'. A status message indicates '(Course is unavailable to students)'. The left sidebar contains a 'Table of Contents' with links to 'Lecture 1 Introduction' and 'Literature'. The main content area shows a 'Success: Literature edited.' message and a list of course materials. The first material is 'Lecture 1 Introduction' with an attached file '17_OpenGIS_1_Introduction.pdf' (4.111 MB) and a description 'Introductory Slides - Distributed Information Architectures'. The second material is 'Literature' with an attached file 'Standards Guide for UNGGIM.pdf' (1.121 MB) and a description 'A Guide to the Role of Standards in Geospatial Information Management (2015)'. A task is listed: 'Task: Read introduction to standards (page 6 to 12)'.

Lecture Dates & Time

856.164 Open GIS: Standards, Architectures and Services (2SSt VO, SS 2023/24)											
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Examination dates (8.30-10.00 s.t.): 26.06.2024, 25.07.2024? and opt. 25.09.2024?

Open GIS: Standards, Architectures and Services: WHY?

AGI Masters Curriculum – Salzburg:

- 856M16 – Spatial Data Infrastructures (12 ECTS)
 - Design of Geo-Data- Models (3ECTS)
 - OpenGIS: Standards and Architectures & Services (3 ECTS)
 - SDI Services implementations (3ECTS)

OpenGL – What's in your mind?

- Asked about OpenGIS? Which keywords do you have in mind?
- <https://www.menti.com/kip3d27r9e>
- www.menti.com code: **3100 8459**



Open GIS: Standards, Architectures and Services: Goals

- Students will learn
 - how to utilize open,
 - shared GIS resources like INSPIRE and Open-Government data.
 - this will foster the students' understanding and ability to
- This will foster the students' understanding and ability to
 - design and use
 - Open GIS data infrastructures,
 - workflows and processes
 - leveraging open information repositories.

Open GIS: Standards, Architectures and Services: 3 ECTS

- to learn about technical and organizational concepts
 - used to create digital abstractions of the real world
 - for evolving service-oriented (geographic) information infrastructures
 - used to design national and international connected spatial data infrastructures (SDI).
 - used to establish SDIs, organizing and serving geo-information using international established technical standards.
- To harmonize and standardize (geo-)information and its exchange by
 - using standardized service interfaces
 - Using acknowledged harmonized data specifications based on e.g. adjusted legal frameworks.

What is OpenGIS

- the activity pursued by the Open Geospatial Consortium (OGC) to form bases of the interoperability between GIS services such as
 - mapping services,
 - data services and portrayal services.

Operating on different platforms

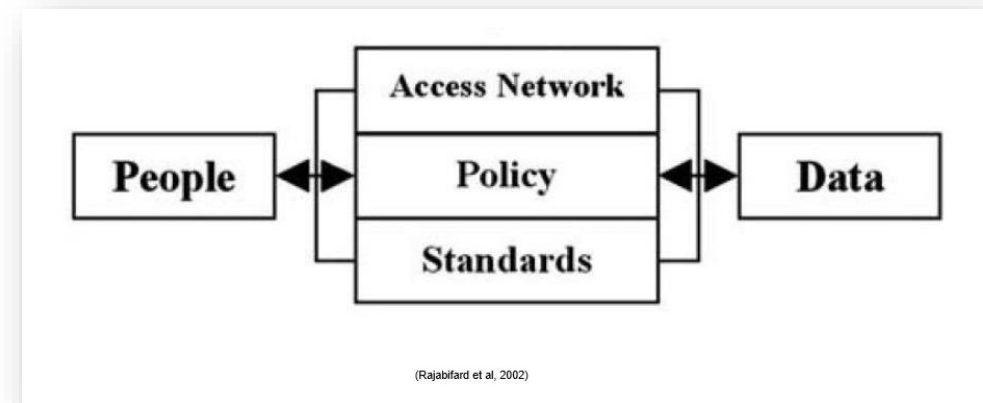
Rich suite of open interfaces

Integrating different information sources

standardized data and information models

Open GIS: Standards, Architectures and Services: What is it about?

- Shifting the GIS paradigm to
 - share,
 - access,
 - analyze and
 - exploit spatial information
 - across communities and
 - technical IT platforms



Open GIS: Standards, Architectures and Services: What is it about?

- Organizational drivers
 - Establishment of harmonization efforts (OGC, OASIS, ISO, APC Foundation etc.)
 - Integrating different information sources (spatial non-spatial) using harmonized feature concept models
 - Development of standardized data and information models (e.g. INSPIRE UML data specifications)

Open GIS: Standards, Architectures and Services: What is it about?

- Technical components,
 - Spatio-temporal enabled database models
 - service-oriented (geographic) information infrastructures for
 - Development of technically standardized IT service interfaces for geo-data/information exchange
 - Distributed geo-processing
- Accompanied by the establishment of
 - legal acts and directives (e.g. INSPIRE, PSI etc.)
 - and institutional arrangements (e.g. GEOSS, OGD etc.)

OpenGIS

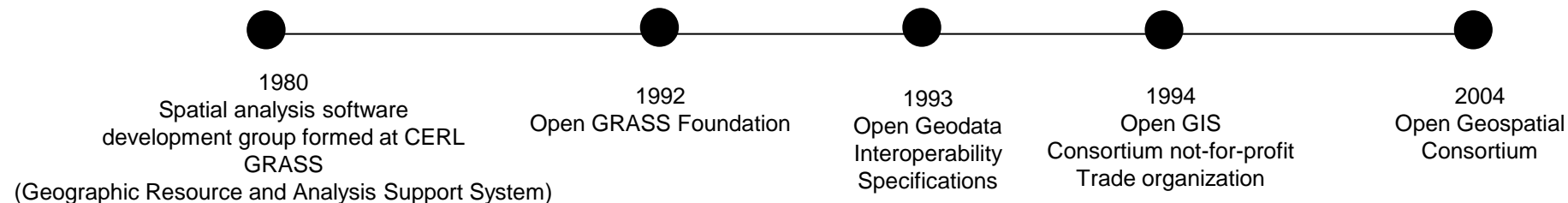
- Supports Spatial data Infrastructures / GI Service Infrastructures
- based on legal Frameworks and/or international/global initiatives like INSPIRE, GEOSS, GMES, etc.
- is based on Interoperability & Standards
 - Spatial Feature Concepts – geo-DBMS
 - XML, GML, KML, geoRSS and geoJSON
 - View & Download Services
 - Discovery & Registry Services
 - Processing Services
 - Workflow & Orchestration Services
 - Security Services

OpenGIS specifications

- enable you to get, mix and match your GIS services from multiple sources over the web
- enable you to integrate resources from different vendors and approved by the OGC
- using Web Services which
 - use service-oriented architecture (SOA)
 - avoid vendor locks
 - allow server-to-server sharing of data and service

OpenGIS – OpenGIS Consortium (OGC)

- OGC was founded 1994 as non-profit organisation:
 - The *Open GIS Consortium (OGC)* is an open industry/science consortium
 - The *OGC Vision* is a world in which everyone benefits from geographic information
 - The *OGC Mission* is to deliver open spatial interface and encoding specifications

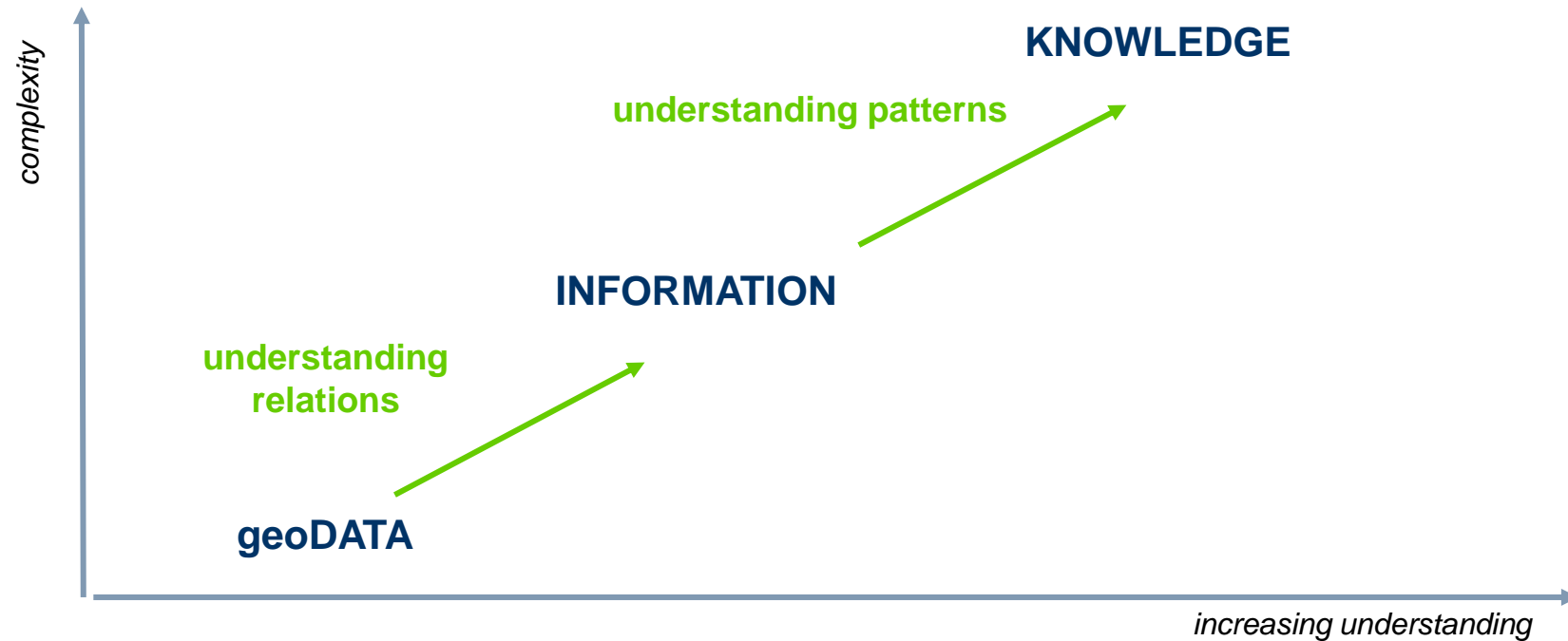


OpenGIS – OpenGIS Consortium

- Open GIS Consortium (OGC)
 - Non-profit, international voluntary consensus standards organization
 - Industry, government, and university members
- Over 400+ members worldwide – 130 countries & 5 continents
 - 91 European members - 19 countries
 - 35 Asia-Pacific members - Japan, Republic of Korea, Australia, China, and Thailand
- OGC collaborates and works closely with:
 - International Organization for Standardization (ISO)
 - World Wide Web Consortium (W3C)
 - OASIS, etc.



OpenGIS – Step back – the value of (spatial) data





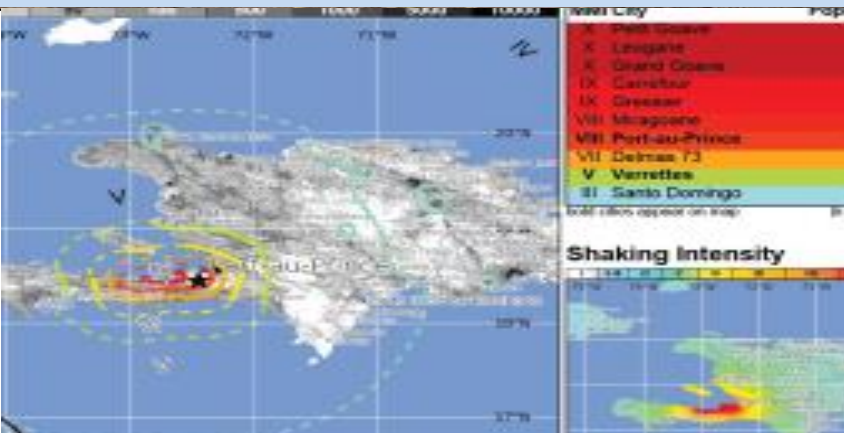
Position Information



Network Infrastructure



Base Layers



Seismic Measurements



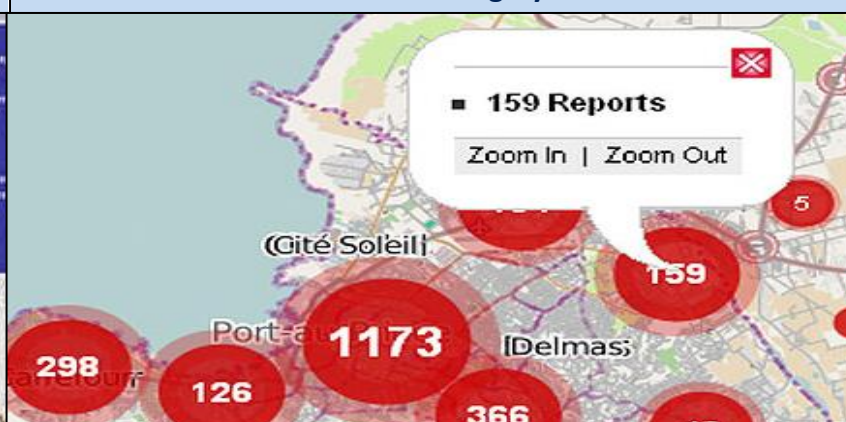
Satellite Imagery



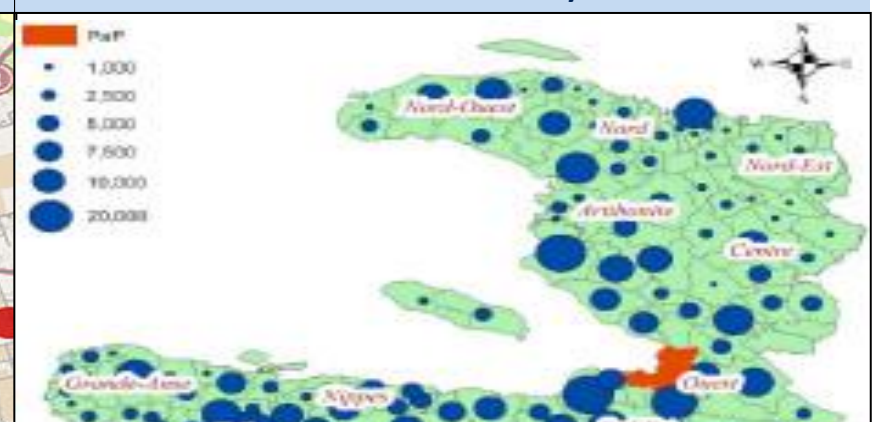
Resource Availability



Volunteered Geography



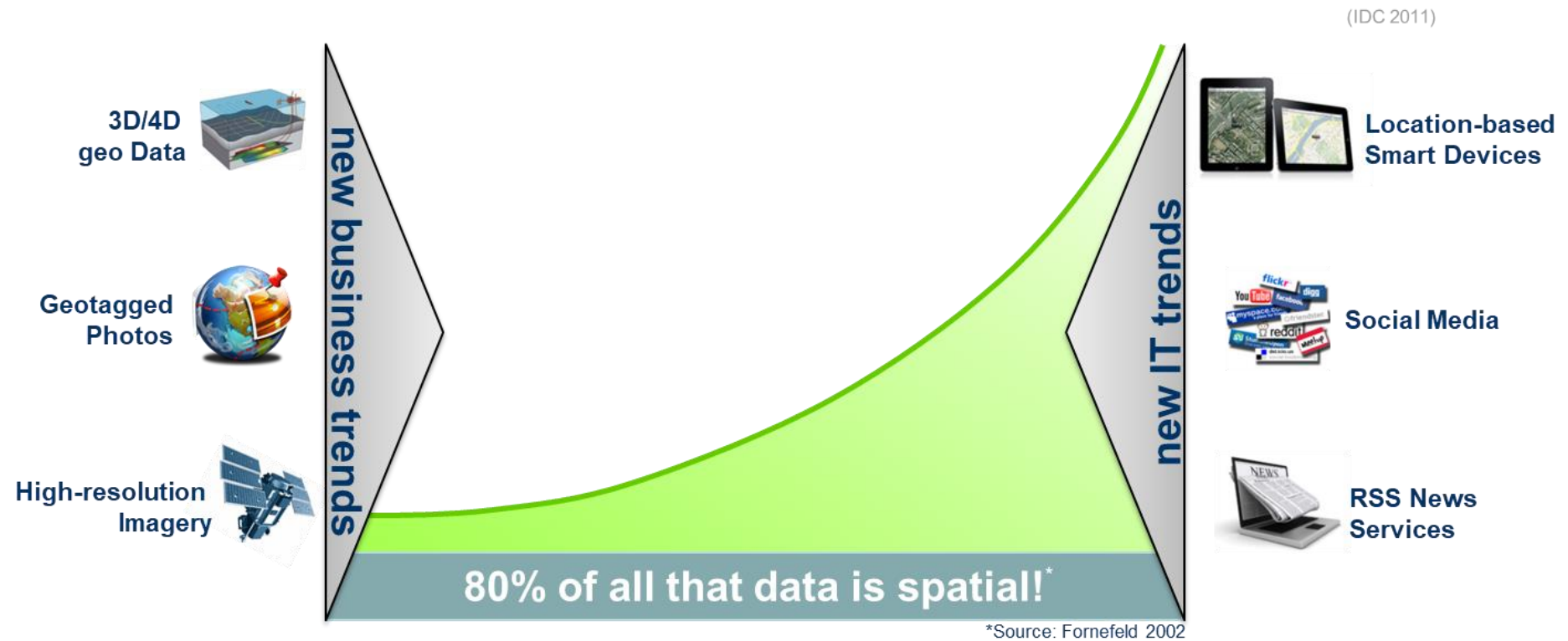
News Feeds & Reports



Demographic Information

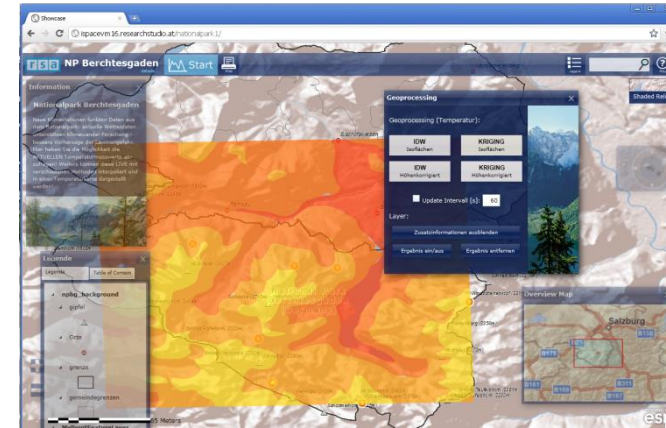


OpenGIS – Increase of data availability

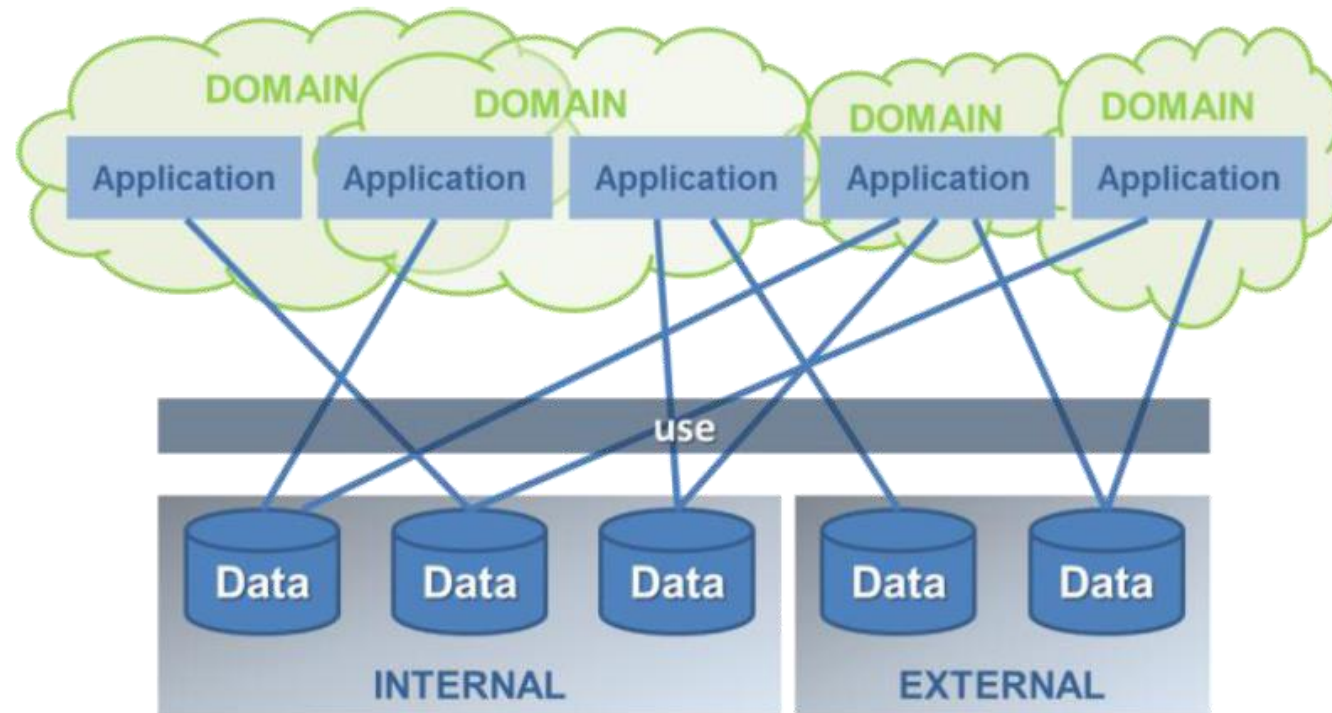


OpenGIS – Information provision challenge

- Information management well performed brings

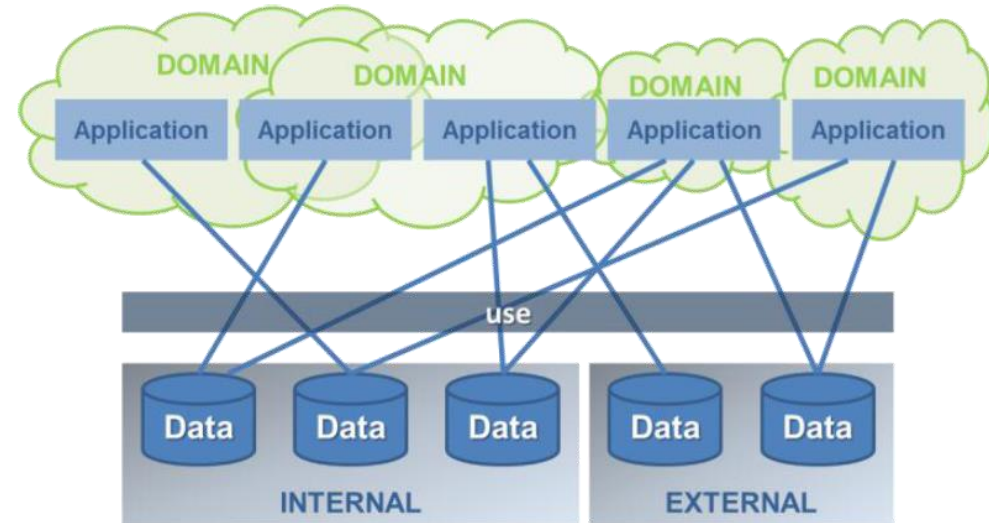


OpenGIS – Heterogeinity Information provision challenge



OpenGIS – Heterogeneity Information provision challenge

- GIS today is characterized by
 - Different actors in data collection & distribution
 - a proliferation of geo-applications, product types, and formats
 - duplication and difficulties in having access to data even within /across departments and organizations
 - Diverse data encodings
 - Different data meaning



OpenGIS – Need for harmonization

- Spatial information is an integral part of day-to-day work and decision making.
- Spatial information has to be accurate, flexible, up-to-date and available on demand.
- It is important to present spatial information in a fast, intuitive, easy to use and easy to perceive way.
 - Therefore lean web-based map viewers are widely spread all across departments and user types.
- There is an increasing demand for mobile use of spatial applications.

OpenGIS – Need for harmonization

- The majority of users assume that provided information is of satisfying quality without questioning origins or accuracy.
 - Necessity to assure information quality in a predefined process for information provision. Information quality assurance must not be yielded to the end user.
- There is significant potential for more extensive cross-divisional spatial information sharing in order to optimize data exploitation and investments in future data acquisitions.
- There are still challenges for searching, accessing and ordering high-quality spatial information.
- **Need for harmonization on an operational level
=> technical, contextual & organizational**

OpenGIS – Interoperability definition

- IEEE definition:
 - *“the ability of two or more systems or components to exchange information and to use the information that has been exchanged”*
- for being able to
 - find what you need;
 - access it;
 - understand and employ it;
 - have goods and services responsive to the needs of consumers (TC 211)

OpenGIS – GIS Interoperability definition

- The ability of GIS information systems to:
 - “freely exchange all kinds of spatial information about the Earth and about the objects and phenomena on, above, and below the Earth’s surface; and
 - Cooperatively (over networks) run software capable of manipulating such information” (ISO 19101:2001)

OpenGIS – Interoperability

- Technical
 - (machine to machine, software module interaction, API, format...)
- Semantic
 - (understandiing concepts,, terms...)
 - Inter-disciplinary (special vocabularies)
- Political/Human
 - government (policy,training...)
 - Legal (ownership, responsibility...)

OpenGIS – Standards definition (ISO)

- Standards, as defined by the International Organization for Standardization (ISO), are
 - documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics,
 - to ensure that materials, products, procedures, and services are fit for their purpose."

OpenGIS – GIS Standards

- Standards facilitate data sharing and increase interoperability among geographic information systems (GIS).
 - “a document established by **a consensus** and approved by **a recognized body**, that provides, for common and repeated use, **rules, guidelines or characteristics** for activities or their results, aimed at the achievement of the optimum degree of order in a given context” (ISO 19101).

OpenGIS – Standards & Specifications

- Standard types/categories
 - De jure standards(= Normen)
 - standard adopted by an official standard development organization (national or international)
 - de facto standards
 - a standard that has not received the sanction of any official body, but has imposed itself by eliciting a consensus among users, a group of firms or consortium
- usually, special organizations develop and establish standards ...

aspect	standards
level of coverage	international, multinational, regional, national, local
level of prescriptiveness	recommended practice (<i>advisory document</i>), information (<i>informative document</i>) report , standard (<i>normative document</i>)
function	design (e.g. zip codes and metadata), interface (e.g. communication protocols), framework (e.g.: data dictionaries, coordinates reference systems,...), performance (e.g. braking distance, pavement service life), testing methods (e.g. ISO 9000), terminology
development process	de-facto (arise from market forces), regulatory (e.g. for public health and environment), consensus (<i>napr. ISO</i>)
type	formal (e.g. CEN, ISO, IEEE, ITU, STN, ČSN, DIN, NEN,...), industry (UML, XML, GML), application (e.g. ACM)
technology	for e.g.: hardware, software, communication and device management, API's, data format and transfer,...

OpenGIS – Open Standards

- ‘Open standards’ are
 - Publicly available;
 - Unencumbered by patents and other intellectual property;
 - Anyone can download and use the standard (non-discriminatory);
 - No license fees;
 - Vendor neutral;
 - Data neutral;
 - Agreed to in a consensus decision making process;
 - No single entity controls the standard

OpenGIS – Open Standards

- ‘Open Standards’ have
 - Open data formats:
 - fully documented data formats
 - no royalties to use them and no legal restrictions on creating them
 - Example: shapefile, Keyhole Markup Language (KML), Geographic JavaScript Object Notation (GeoJSON)
 - Open specifications for geospatial web services:
 - Agreed documentation for client-server interaction
 - Example: Open Geospatial Consortium (OGC) standards for web services, GeoServices Representational State Transfer (REST) Specifications
- a goal of open standards is to ensure that "interoperability" (the ability to integrate datasets and related services of different types and sources

OpenGIS – Standards development

- Key types of geospatial standards
 - *information (or content) standards* “Geospatial information standards providing digital coding to locate and describe features on, above or below the Earth’s surface and
 - *technology (interface, API) standards* that allow different systems and services to work together through standard interfaces

OpenGIS – Standards development

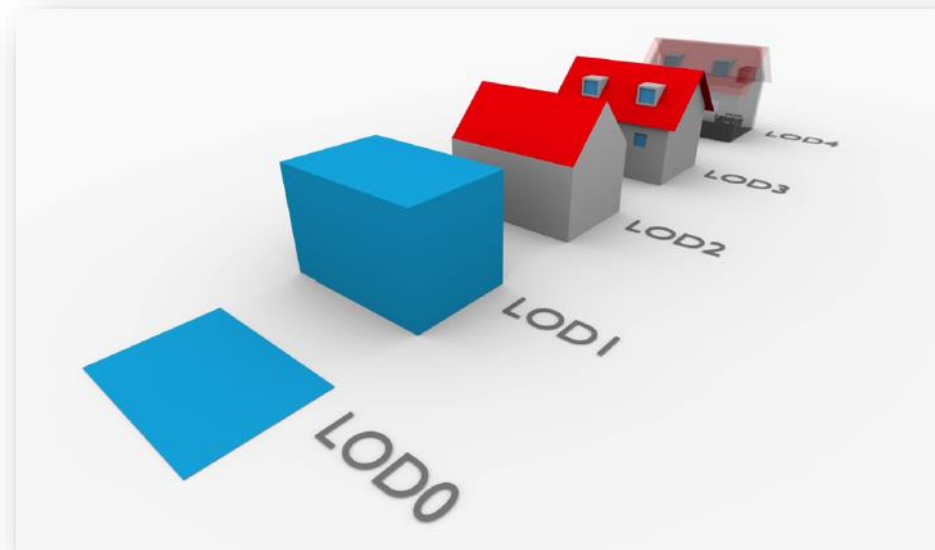
- How are standards developed?
 - The majority of international standards are developed in Standards Development Organizations (SDOs) that use a consensus process guided by documented, repeatable and well proven policies and procedures

OpenGIS – Standards development organisations

- Standardisation organisations important for geospatial resources:
 - International Standardization Organization (ISO)
 - Comité Européen de Normalisation (european level) (CEN)
 - National standardization organizations Normungsgremien (ÖNORM, DIN, ...)
- OpenGIS Consortium (industry consortium)

OpenGIS – What is an OGC Standard

- A document, established by consensus and approved by the OGC Membership, that provides rules and guidelines, aimed at the optimum degree of interoperability in a given context.
- Standards are based on
 - Community requirements
 - Member requirements
 - Market trends
 - Technology trends



OpenGIS – OpenGIS Consortium Howto

- Every member may introduce new specification ideas
- Within OGC such specifications are published as Discussion Papers and Candidate Specifications as first stage on the way to a specification
- The members decide on a specification guided by the OGC Planning Committee.



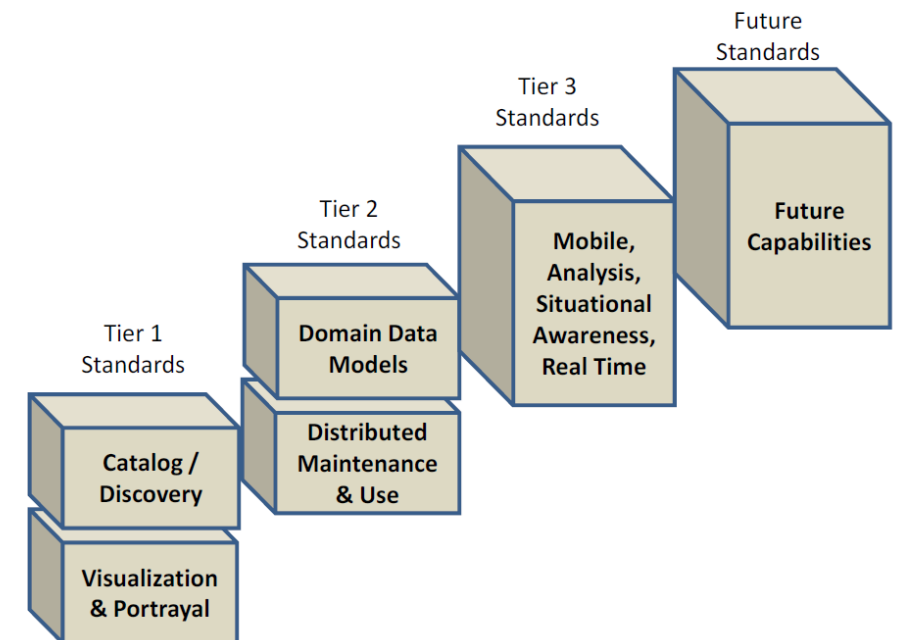
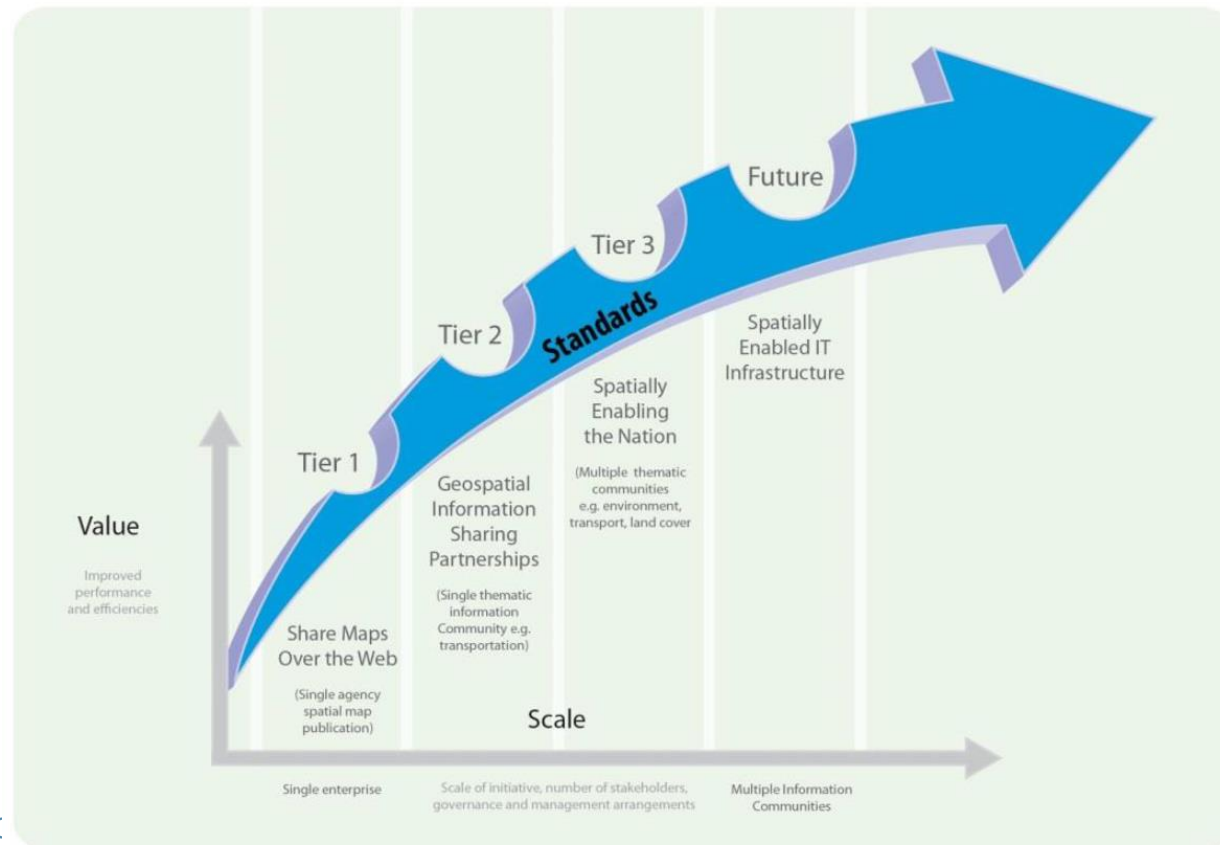
OpenGIS – OGC Standard Development

- Standard development
 1. Identify requirement
 2. Form a Standards Working Group (SWG)
 3. Create the Standard
 4. Submit Standard for internal review and public comment
 5. OGC members vote to approve Standard
- Technical Committee (TC)
 - Where the formal standards development consensus discussion and approval process occurs.
 - Comprised of a number of Domain Working Groups (DWGs) and Standards Working Groups (SWGs).
 - Work is guided by the Technical Committee Policies and Procedures

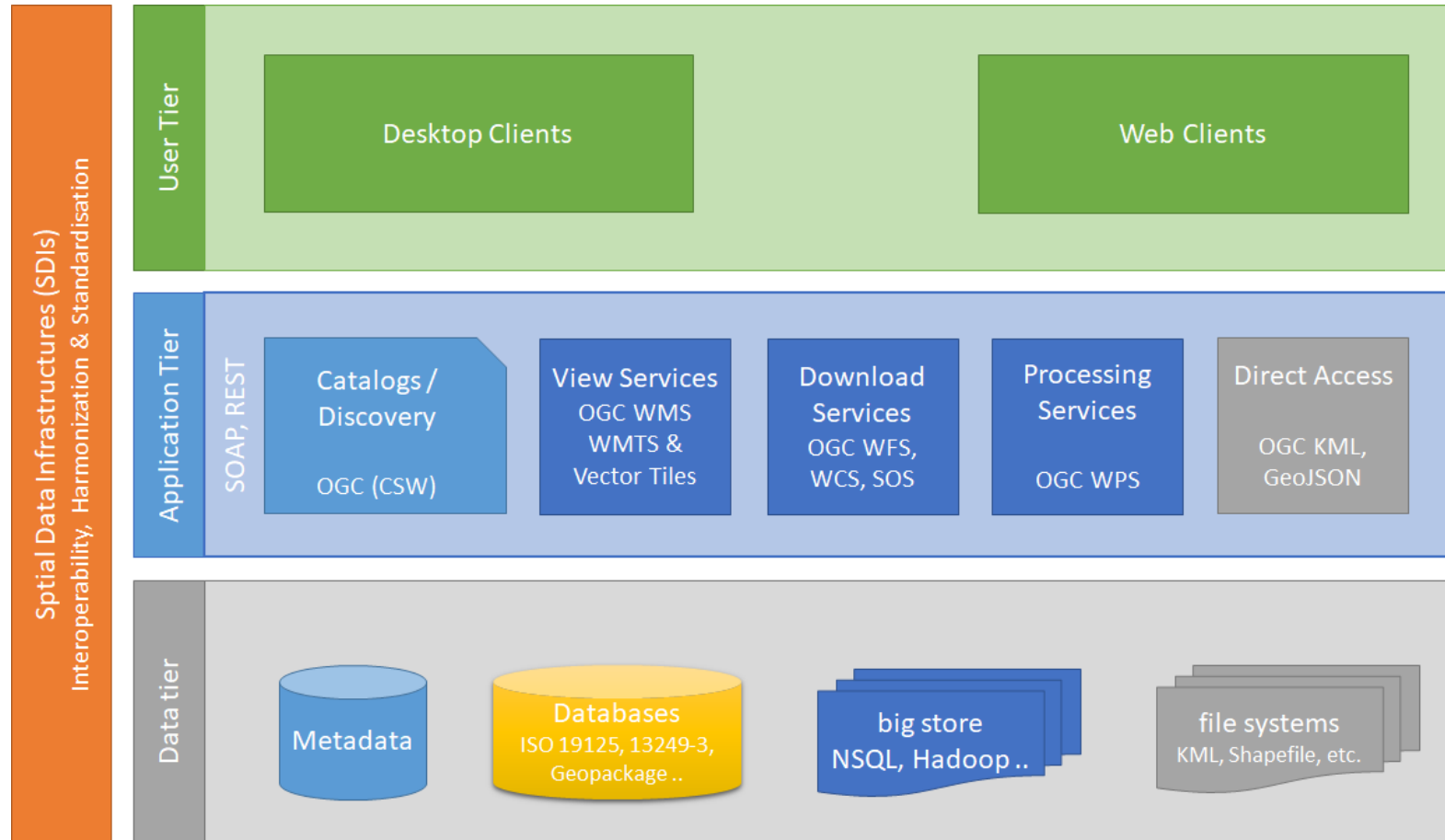


Standardization Maturity Model

- E.g. for and bridging between Spatial Data Infrastructures and a broader ecosystem of information systems.



OGC Geospatial service standards (excerpt)



OpenGIS – OGC standards list

- Cat: ebRIM App Profile: Earth Observation
- Products
- Catalogue Service
- CityGML
- Coordinate Transformation
- Filter Encoding
- GML in JPEG 2000
- GeoAPI
- GeoSparql
- Geographic Objects
- Geography Markup Language
- Geospatial eXtensible Access Control Markup
- Language (GeoXACML)
- KML
- Location Services (OpenLS)
- NetCDF
- Observations and Measurements
- Open GeoSMS
- Ordering Services Framework for Earth
- Observation Products
- SWE Common Data Model
- SWE Service Model
- Sensor Model Language
- Sensor Observation Service
- Sensor Planning Service
- Simple Features
- Simple Features CORBA
- Simple Features OLE/COM
- Simple Features SQL
- Styled Layer Descriptor
- Symbology Encoding
- Table Joining Service
- Web Coverage Processing Service
- Web Coverage Service
- Web Feature Service
- Web Map Context
- Web Map Service
- Web Map Tile Service
- Web Processing Service
- Web Service Common



Further reading

- UN-GGIM (2015): A Guide to the Role of Standards in Geospatial Information Management
 - Chapter 1 Introduction



A Guide to the Role of Standards in
Geospatial Information Management
