Web and Cloud computing Based Geospatial Services and Applications

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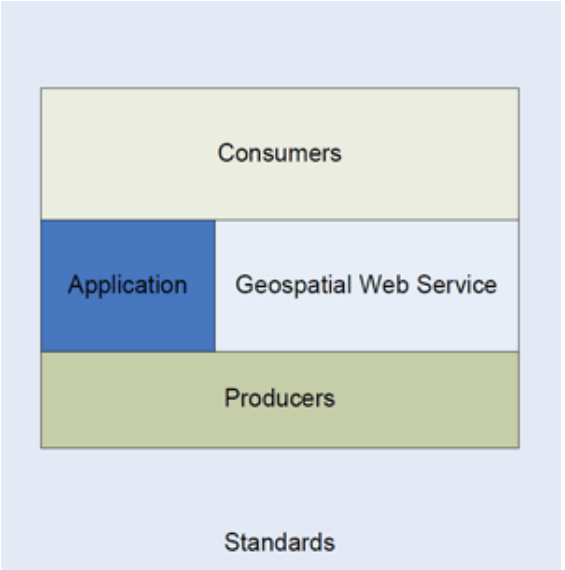
Outline

- Introduction to web geospatial services and applications
- Geospatial web services in details
- Cloud computing and services
- Network services in INSPIRE
- Conclusion

What are the web geospatial services?

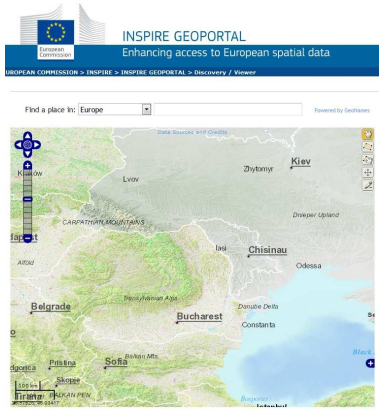
- Geospatial web services – web services that serve and process geospatial information for a wide range of applications
- Allow geospatial data and services to be interoperable
- Component of Spatial Data Infrastructures (SDIs)
- Interoperable pieces used to build modular and distributed GIS applications over Internet



Website vs. Web Services

- Websites
- Provide HTML pages and forms for human users to navigate and perform functions: Searching, Shopping, Interaction
- Front end user interfaces through the browser
- Example: www.google.com

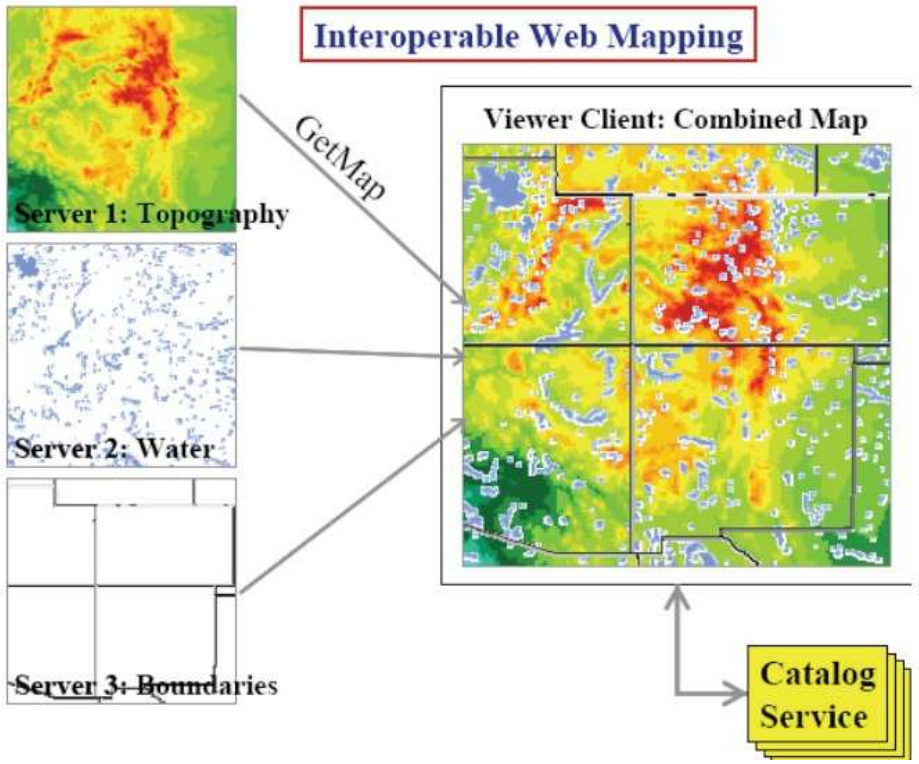
- Web Services (**NOT a website**)
- Operations that can be called to return information
- Invoked automatically through a program
- Publicly available and standardized for use by all programmers (integration)
- Example:



Geospatial web services?

- Discovery
- View
- Download
- Processing
- Transformation
- …

- Example: View services

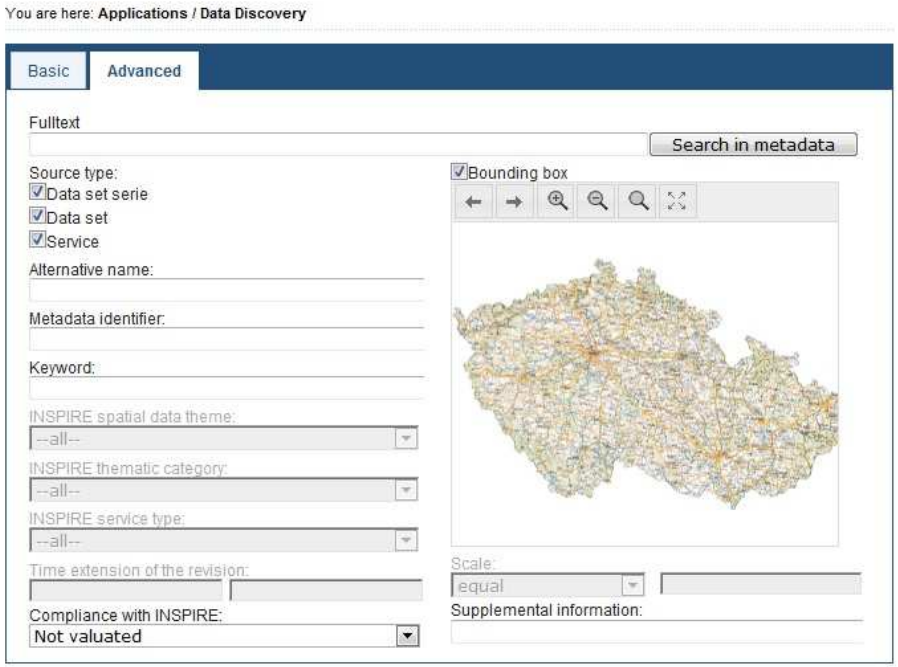


Discovery

- OGC Catalog Service for the Web (CSW)
- Enables searching for information about the geoservices and geospatial data in the SDI based on metadata
- Requests include:
- GetCapabilities - returns the properties of requests that are accepted by the server
- DescribeRecord - returns info about the model of records
- GetDomain (optional) - returns for a given record field, the range of values held by records
- GetRecords - search for records, returning record IDs
- GetRecordsById - returns records, specified by their ID
- Harvest (optional) - create/update metadata by asking the server to 'pull' metadata from somewhere
- Transaction (optional) - create/edit metadata by 'pushing' the metadata to the server

Discovery

- Example: http://geoportal.cuzk.cz/



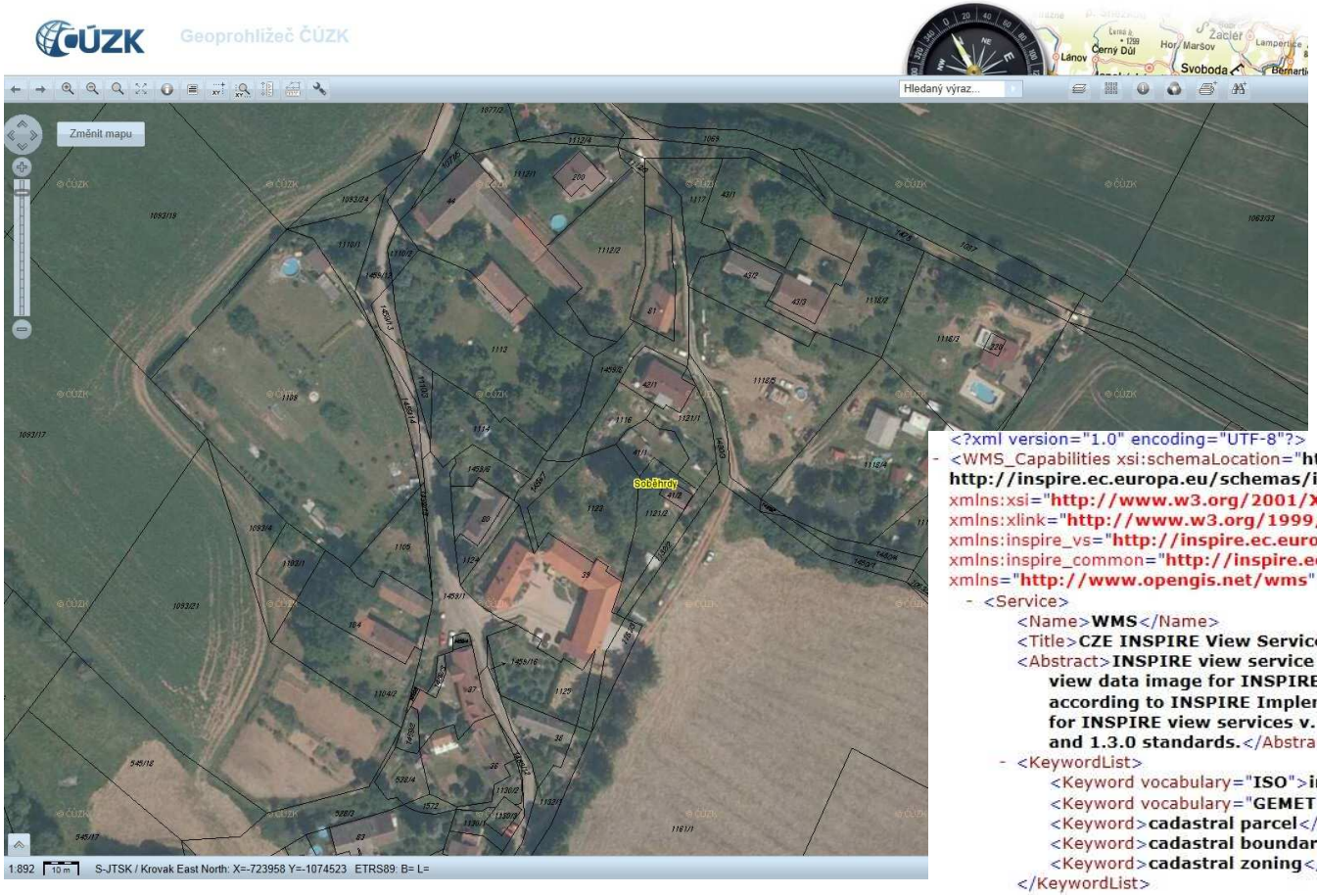

```
<?xml version="1.0" encoding="UTF-8"?>
- <csw:Capabilities xmlns:gml="http://www.opengis.net/gml"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:ows="http://www.opengis.net/ows"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:csw="http://www.opengis.net/cat/csw/2.0.2"
xsi:schemaLocation="http://www.opengis.net/cat/csw/2.0.2
http://geoportal.cuzk.cz/SDIProCSW/Schemas\CSW-publication.xsd" version="2.0.2">
  - <ows:ServiceIdentification>
      <ows:Title>Vyhledávací služba CSW v metadatech datových sad a služeb resortu
        ČÚZK</ows:Title>
      <ows:Abstract> Veřejná katalogová vyhledávací služba pro vyhledání metadat o sériích
        datových sad, datových sadách a službách resortu ČÚZK. Umožňuje uživatelům on-line
        přístup k průběžně aktualizovaným metadatovým záznamům. Služba splňuje požadavky
        pro INSPIRE Discoveryservice 1.0. Zároveň splňuje standard OGC CS-W 2.0.2.
        </ows:Abstract>
    - <ows:Keywords>
        <ows:Keyword>CSW</ows:Keyword>
        <ows:Keyword>OGC</ows:Keyword>
        <ows:Keyword>Catalog Service for Web</ows:Keyword>
      </ows:Keywords>
      <ows:ServiceType>CSW</ows:ServiceType>
      <ows:ServiceTypeVersion>2.0.2</ows:ServiceTypeVersion>
      <ows:Fees>no conditions apply</ows:Fees>
      <ows:AccessConstraints>http://geoportal.cuzk.cz/Dokumenty/Podminky_sluzby_CUZK.pdf</ows:
  </ows:ServiceIdentification>
  - <ows:ServiceProvider>
      <ows:ProviderName>Český úřad zeměměřický a katastrální</ows:ProviderName>
      <ows:ProviderSite xlink:href="www.cuzk.cz"/>
    - <ows:ServiceContact>
      - <ows:ContactInfo>
        - <ows:Address>
            <ows:City>Praha</ows:City>
            <ows:Country>Česká republika</ows:Country>
            <ows:ElectronicMailAddress>podpora.zums@cuzk.cz</ows:ElectronicMailAddress>
          </ows:Address>
        </ows:ContactInfo>
      </ows:ServiceContact>
  </ows:ServiceProvider>
  - <ows:OperationsMetadata>
```

View

- Web Mapping Service (WMS)
- Enables serving of georeferenced map images over the Internet generated by a map server
- Map image – usually bitmap (PNG, JPEG, GIF), in addition vector graphics (SVG or WebCGM)
- Requests include:
- GetCapabilities - returns parameters about the WMS
- GetMap - returns a map image
- GetFeatureInfo (optional)
- DescribeLayer (optional)
- GetLegendGraphic (optional)

View

- Example: http://geoportal.cuzk.cz/




```
<?xml version="1.0" encoding="UTF-8"?>
- <WMS_Capabilities xsi:schemaLocation="http://inspire.ec.europa.eu/schemas/inspire_vs/1.0
http://inspire.ec.europa.eu/schemas/inspire_vs/1.0/inspire_vs.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:inspire_vs="http://inspire.ec.europa.eu/schemas/inspire_vs/1.0"
xmlns:inspire_common="http://inspire.ec.europa.eu/schemas/common/1.0"
xmlns="http://www.opengis.net/wms" version="1.3.0">
  - <Service>
      <Name>WMS</Name>
      <Title>CZE INSPIRE View Service - Cadastral Parcels</Title>
      <Abstract>INSPIRE view service for theme Cadastral Parcels provides a possibility to
        view data image for INSPIRE theme Cadastral Parcels. The data are harmonised
        according to INSPIRE Implementing Rules. The service fulfils technical guidance
        for INSPIRE view services v. 3.11 and simultaneously fulfils the OGC WMS 1.1.1
        and 1.3.0 standards.</Abstract>
    - <KeywordList>
        <Keyword vocabulary="ISO">infoMapAccessService</Keyword>
        <Keyword vocabulary="GEMET">Cadastral parcels</Keyword>
        <Keyword>cadastral parcel</Keyword>
        <Keyword>cadastral boundary</Keyword>
        <Keyword>cadastral zoning</Keyword>
      </KeywordList>
```

Download

- Web Feature Service (WFS)
- Allows requests for geospatial data (objects) across the web encoded in Geography Markup Language (GML) format
- Requests include:
- GetCapabilities - Provides information about what the WFS server can do
- DescribeFeatureType - Returns XML schema for the feature
- GetFeature - Allows retrieval of features according to XML
- schema
- Transation and LockFeature (optional) - For inserting, updating and deleting instances

Download

- Example: http://geoportal.cuzk.cz/

INSPIRE download service for the theme cadastral parcels (CP)

Product information	
Name	INSPIRE download service for the theme cadastral parcels (CP)
Commercial code	Commercial code is not defined.
Export unit	
Unit price	No charges.
Product description	WFS download service for the theme Cadastral Parcels (CP) is a public download service for provision of data from the Information System of the Cadastre of Real Estates (ISKN) that makes possible repetitive download of these data in files by cadastral units and an online access to these data using the WFS 2.0.0. technology. The download service provides harmonised data from the theme Cadastral Parcels (CP) in GML formate according to INSPIRE. The service is available only for cadastral units with a digital map (DKM/KMD) – effective for CP.CadastralParcel and CP.CadastralBoundary layers. The layer CP.CadastralZoning is available for the whole territory of the CR. The service fulfils technical guidance for INSPIRE download services v. 3.0 and simultaneously fulfils the OGC WFS 2.0.0 standard.
Service characteristics (GetCapabilities)	http://services.cuzk.cz/wfs/inspire-cp-wfs.asp?service=WFS&request=GetCapabilities
Service location	http://services.cuzk.cz/wfs/inspire-cp-wfs.asp?
Data set provided by the service	Provided data
Terms of use - charging the service	No charges.


```
<?xml version="1.0" encoding="UTF-8"?>
- <WFS_Capabilities xmlns="http://www.opengis.net/wfs/2.0" version="2.0.0"
xmlns:fes="http://www.opengis.net/fes/2.0"
xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml/3.2"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  - <ows:ServiceIdentification>
      <ows:Title>CZE INSPIRE Download Service - Cadastral Parcels</ows:Title>
      <ows:Abstract>WFS download service for the theme Cadastral Parcels (CP) is a
        public download service for provision of data from the Information System of the
        Cadastre of Real Estates (ISKN) that makes possible repetitive download of
        these data in files by cadastral units and an online access to these data using the
        WFS 2.0.0. technology. The download service provides harmonised data from the
        theme Cadastral Parcels (CP) in GML formate according to INSPIRE. The service
        is available only for cadastral units with a digital map (DKM/KMD) – effective for
        CP.CadastralParcel and CP.CadastralBoundary layers. The layer
        CP.CadastralZoning is available for the whole territory of the Czech Republic.
        The service fulfils technical guidance for INSPIRE download services v. 3.0 and
        simultaneously fulfils the OGC WFS 2.0.0 standard.</ows:Abstract>
      <ows:ServiceType>OGC WFS</ows:ServiceType>
      <ows:ServiceTypeVersion>2.0.0</ows:ServiceTypeVersion>
    </ows:ServiceIdentification>
  - <ows:ServiceProvider>
      <ows:ProviderName>Czech Office for Surveying, Mapping and
        Cadastre</ows:ProviderName>
      <ows:ProviderSite xlink:href="www.cuzk.cz" xlink:type="simple"/>
    - <ows:ServiceContact>
      - <ows:ContactInfo>
        - <ows:Phone>
            <ows:Voice>+420 284 044 455</ows:Voice>
            <ows:Facsimile>+420 284 041 557</ows:Facsimile>
          </ows:Phone>
```

Transformation

- Web Coordinate Transformation Service (AP of WPS)
- Provides a standard way for software to specify and access coordinate transformation services
- Enables overlaying views of geodata (“maps”) from diverse sources in the same CRS
- Requests include:
- GetCapabilities - this operation enables the client to demand and obtain services of metadata.
- Transform - this operation enables the client to demand and obtain the transformation.
- IsTransformable - this operation enables the client to ask the server, whether it is possible to perform the transformation

Transformation

- Example: http://geoportal.cuzk.cz/

Web coordinate transformation service WCTS

Product information	
Name	Web coordinate transformation service WCTS
Commercial code	Not defined.
Export unit	No export unit defined.
Unit price	No charges.
Product description	The CUZK Geoportal provides web coordinate transformation service – that enables transformation of digital geospatial data between S- JTSK, S-JTSK/05 and ETRS89 datums. CUZK incorporated into this service the transformation module ETJTZU 2013 Program containing more accurate global transformations between above mentioned systems. RMSE of transformation between S-JTSK and ETRS89 when using this service reaches mxy = 0.025 m (mp = 0.035 m) at the whole territory of the Czech Republic. Provided operations are quoted in properties of the service (GetCapabilities). The service may be used separately or as a part of other services and applications. The service client - application Coordinate Transformation is available for clients interested in these transformations on the CUZK Geoportal web page. The service fulfils technical guidance for INSPIRE coordinate transformation services v. 2.1 and simultaneously fulfils the OGC WCTS 0.4.0 standard.
Service characteristics (GetCapabilities)	http://geoportal.cuzk.cz/WCTService/WCTService.svc/get?request=GetCapabilities&service=WCTS
Service location	http://geoportal.cuzk.cz/WCTService/WCTService.svc/get?
Terms of use - charging the service	There are no terms.

Software support i.e.

- GeoNetwork
- Geoserver
- MapServer
- ArcGIS Server
- ArcIMS
- GeoMedia
- ERDAS APOLLO
- …

Cloud computing and services

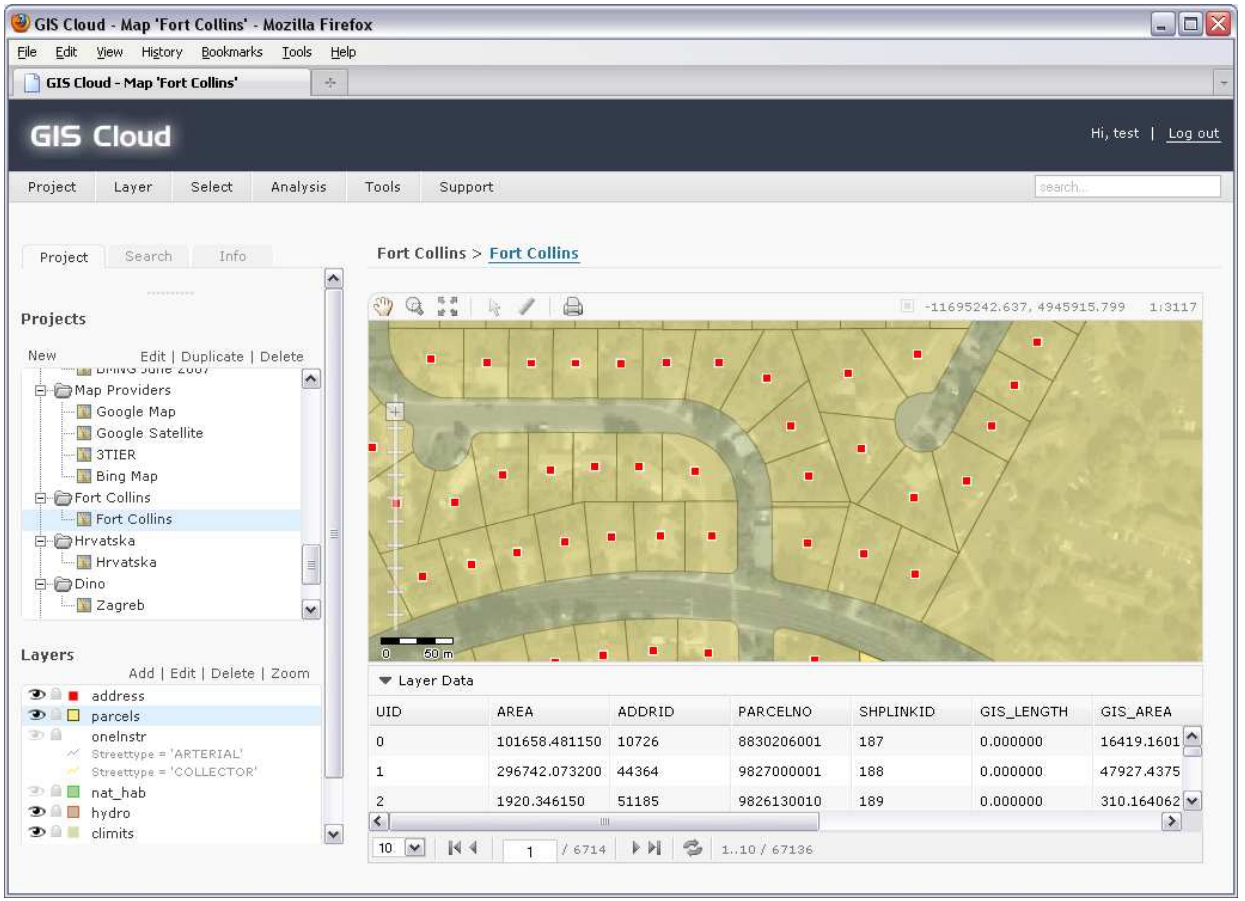
- Cloud Computing is a general term used to describe a new class of network based computing that takes place over the Internet
- Distributed computing over a network, means the ability to run a program on many connected computers at the same time
- Collection/group of integrated and networked hardware, software and Internet infrastructure (platform)
- Network-based services served up by virtual hardware simulated by software on one or more real machines

Cloud computing and services

	Services	Description
Application focused	Services	Complete business services (PayPal, Google Maps, …)
	Application	Cloud based software that eliminates the need for local installation (Google Apps, GIS Cloud, …)
	Development	Software development platforms used to build custom cloud based applications (SAAS, …)
Infrastructure focused	Platform	Cloud based platforms (Amazon EC2, …)
	Storage	Data storage or cloud based NAS (CTERA, iDisk, …)
	Hosting	Hosting – Physical data centers (IBM, HP, NaviSite, …)

GIS Cloud

- Example: http://www.giscloud.com/



Cloud computing

- advantages
- The no-need-to-know possibility to be infrastructure-less
- Flexibility and elasticity
- Pay as much as used and needed.
- Always on, anywhere and any place
- disadvantages
- constant Internet connection
- limited features
- storage and security of data

INSPIRE Network Services

Discovery services

- Through metadata and catalogues, publish and find
  - INSPIRE Data sets
  - INSPIRE Data set series
  - INSPIRE Network services

View services

- Maps

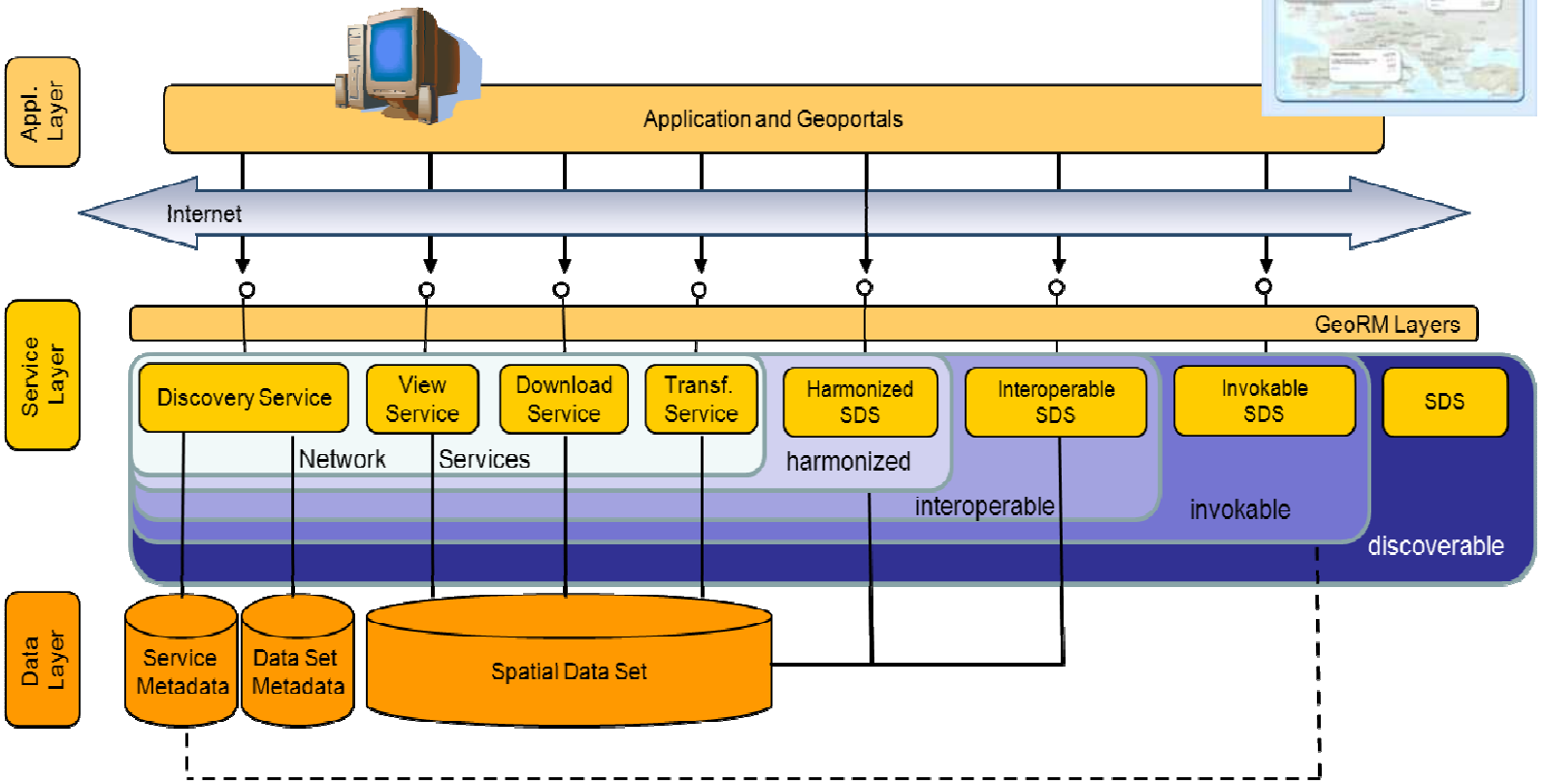
Download and Transformation services

- Download predefined data sets or data objects
- Transform coordinates or data models

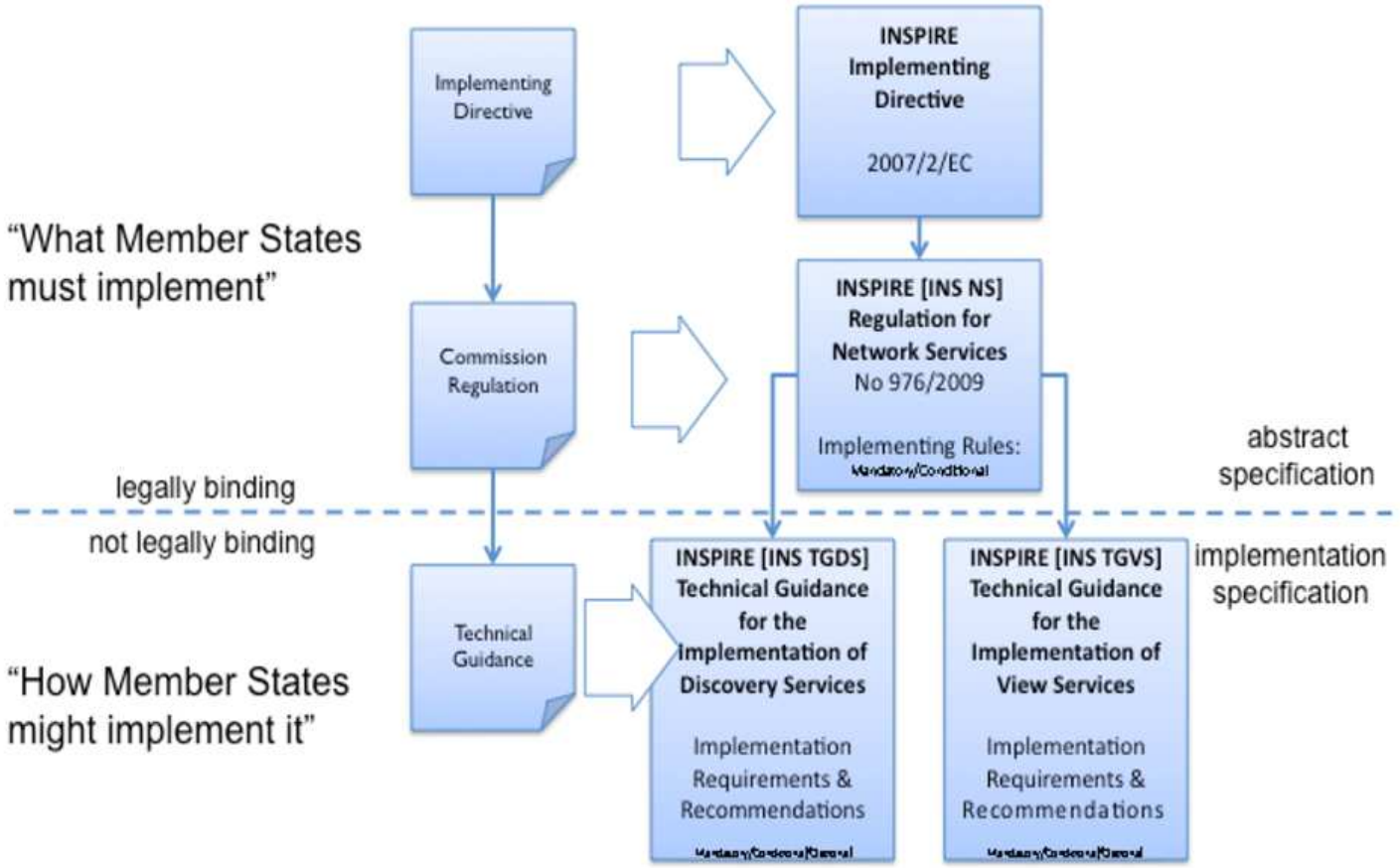
Invoke and Spatial Data Services

- More generic services

INSPIRE Network Services

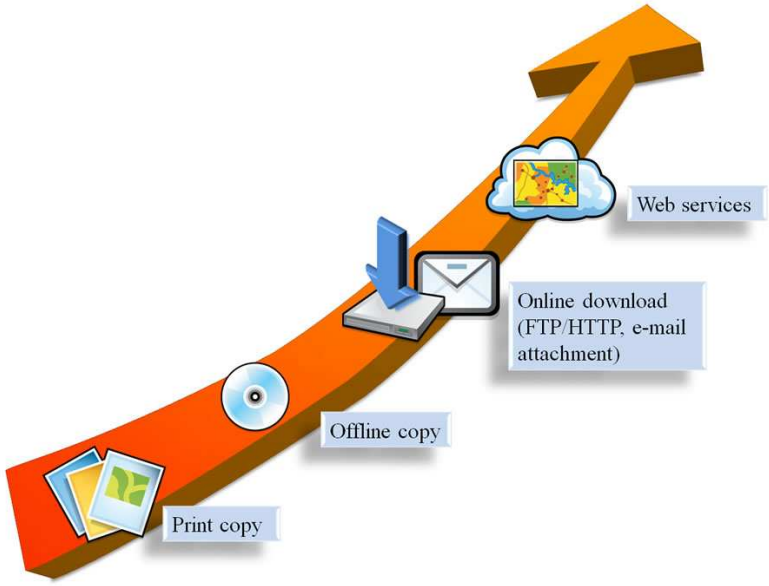


INSPIRE Network Services



Conclusion

- Network (web) services are key component of SDI to enable data discovery, data sharing, data and service utilization, etc.
- Standard based implementation (OGC, ISO, INSPIRE, …) to enable interoperability
- New services and applications (GeoWeb)
- Increasing use of Cloud (big volumes of data, user demands, cloud-enabled SDI)



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Thank you for your attention!