

Open Geospatial Consortium

(OGC)

Open Standards

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There are many dimensions to “Open”

- Open source software.
- Open data.
- **Open specifications/standards.**
- Open publishing.
- Open education resources.
- Open government.
- Open innovation.



FOSS/FOSS4G

Open
Standards



<http://www.sutor.com/c/essays/osvsos/>
<http://oss-watch.ac.uk/resources/openstandardsopensource>

Why “Open”?

Open Data Handbook: Why Open Data?

<http://opendatahandbook.org/guide/en/why-open-data/>

Why FOSS?

http://www.dwheeler.com/oss_fs_why.html

Why open access?

<http://www.sparc.arl.org/resources/open-access/why-oa>

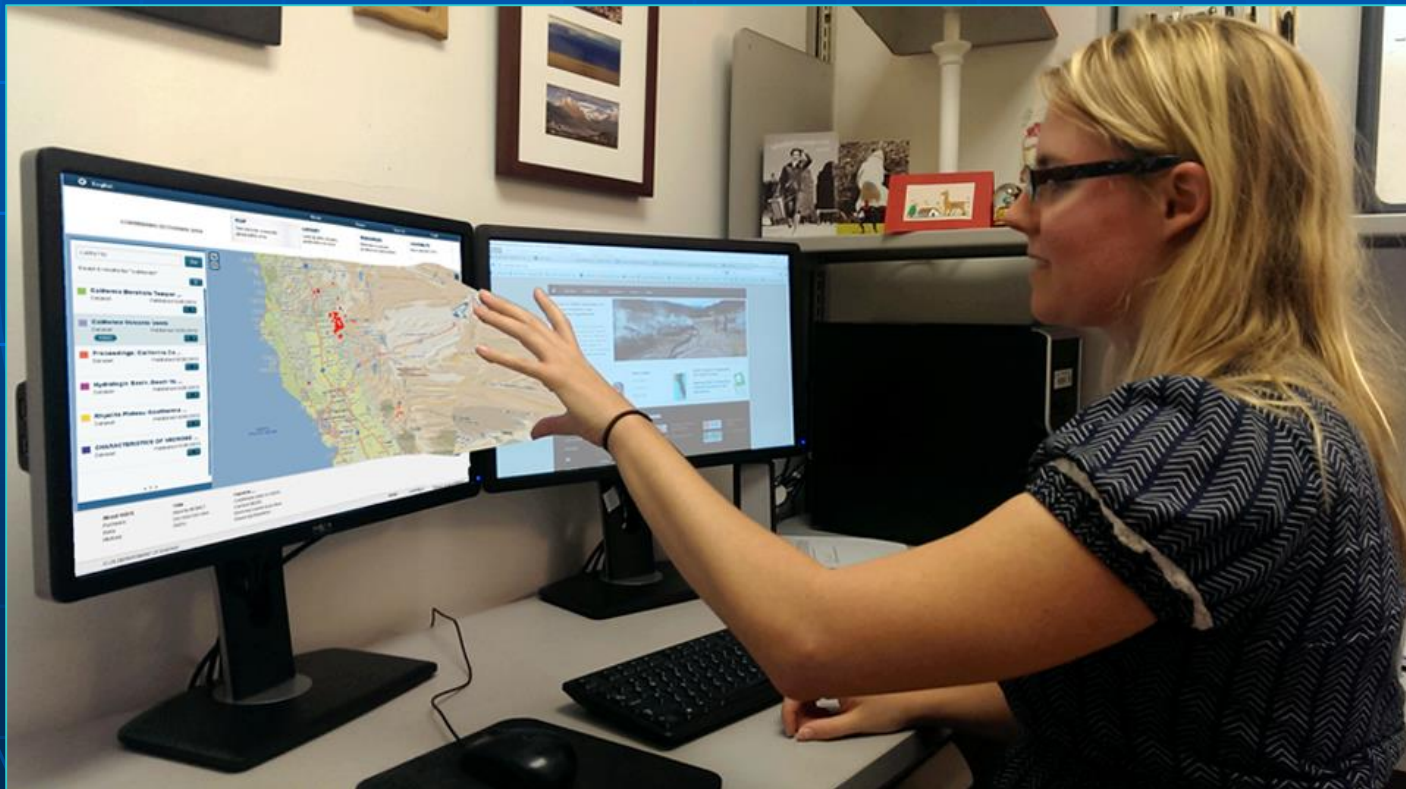
Why open education matters

<http://whyopenedmatters.org/>

Why open government matters

<https://www.whitehouse.gov/blog/2009/12/09/why-open-government-matters>

OGC Open Standards for Geospatial Information



“Open standards” means that the standards documents are:

- Freely and publicly available
- Non discriminatory
- Free of license fees
- Vendor neutral
- Data neutral
- Agreed to by a formal, member based consensus process

What are OGC standards?

- Technical documents that detail interfaces or encodings.
- Software developers use these documents to build open interfaces and encodings into their products and services.
- Ideally, when OGC standards are implemented in products or online services by two different software engineers working independently, the resulting components plug and play, that is, they work together without further debugging.



OGC Works Closely With Standards Organizations and Consortia in the Technology Community



– Primary Alliances for standards coordination

- Internet Engineering Task Force (IETF)
- OASIS
- International Organization for Standards (ISO)
- National Emergency Number Association (NENA)
- COMCARE
- Digital Geospatial Information Working Group (DGIWG)
- Open Mobile Alliance (OMA)
- National Institute of Building Sciences (NIBS)
- IEEE Technical Committee 9 (Sensor Web)



– Secondary alliances

- Global Spatial Data Infrastructure Association (GSDI)
- Web3D
- World Wide Web Consortium (W3C)
- Simulation Interoperability Standards Organization
- International Alliance for Interoperability (IAI)
- IEEE GRSS and ICEO
- Taxonomic Data Working Group (TDWG)



– Others

Why Geospatial Open Standards? Benefits of Interoperability

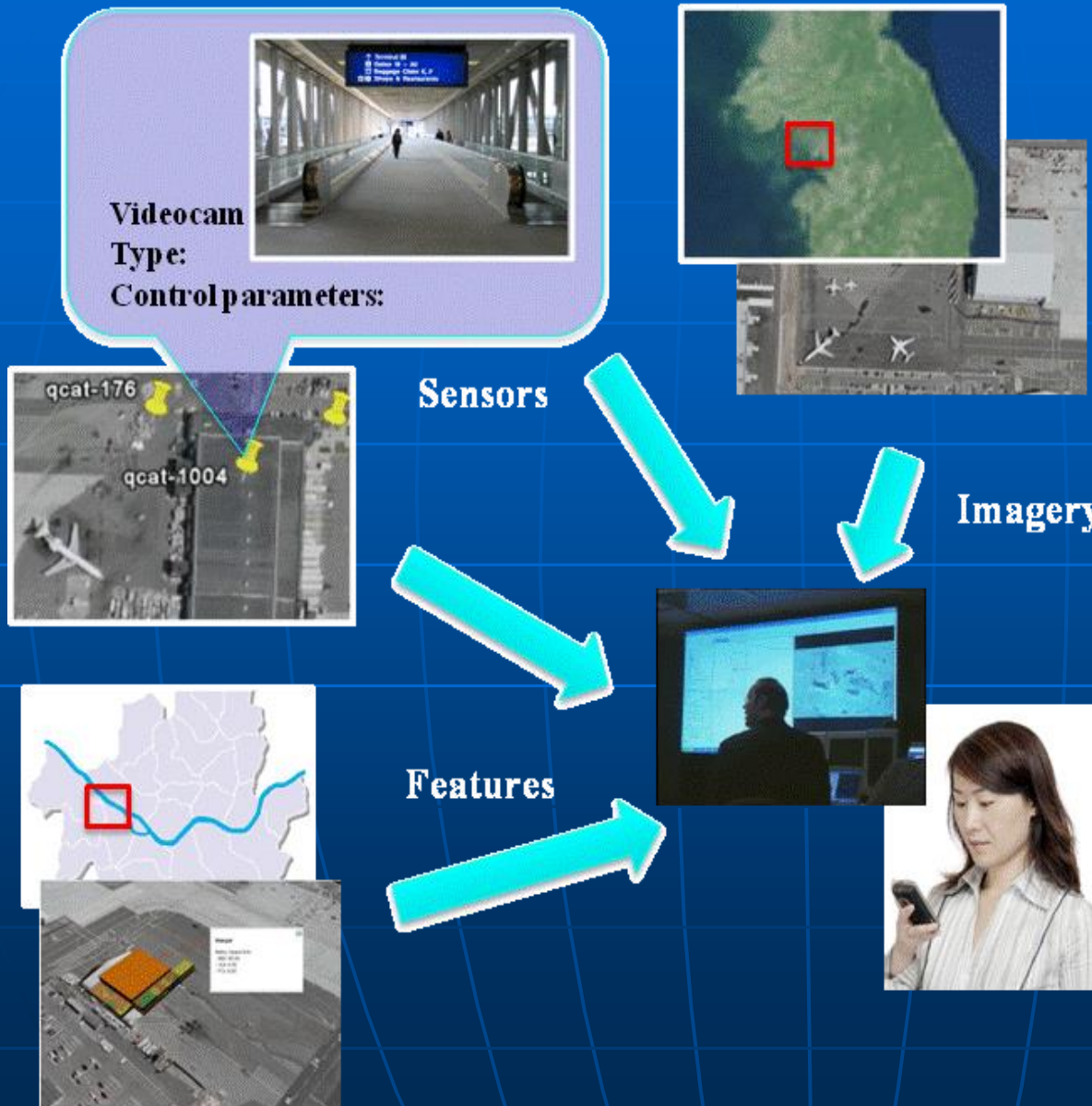
- Avoid over-dependence on a single vendor.
- Broadened product acquisition opportunities: Mix and match components.
- Minimize risks as technology change.
- Leverage legacy investments.
- Maximize access to outside information resources.
- Maximize outside access to your information resources.
- Ready access to data; data integration.
- Work more quickly and cheaply.
- Higher return on investment.

Why Geospatial Open Standards? Benefits of Interoperability

- Easier access to multiple online info and data sources and services.
- Use and reuse different vendor solutions.
- Reduce deployment costs by reusing information from other communities.
- Rapidly mobilize new capabilities (plug and play).
- Meet requirements for citizen access.
- Foundation for interoperable service networks.
- Standards reduce risk and costs.

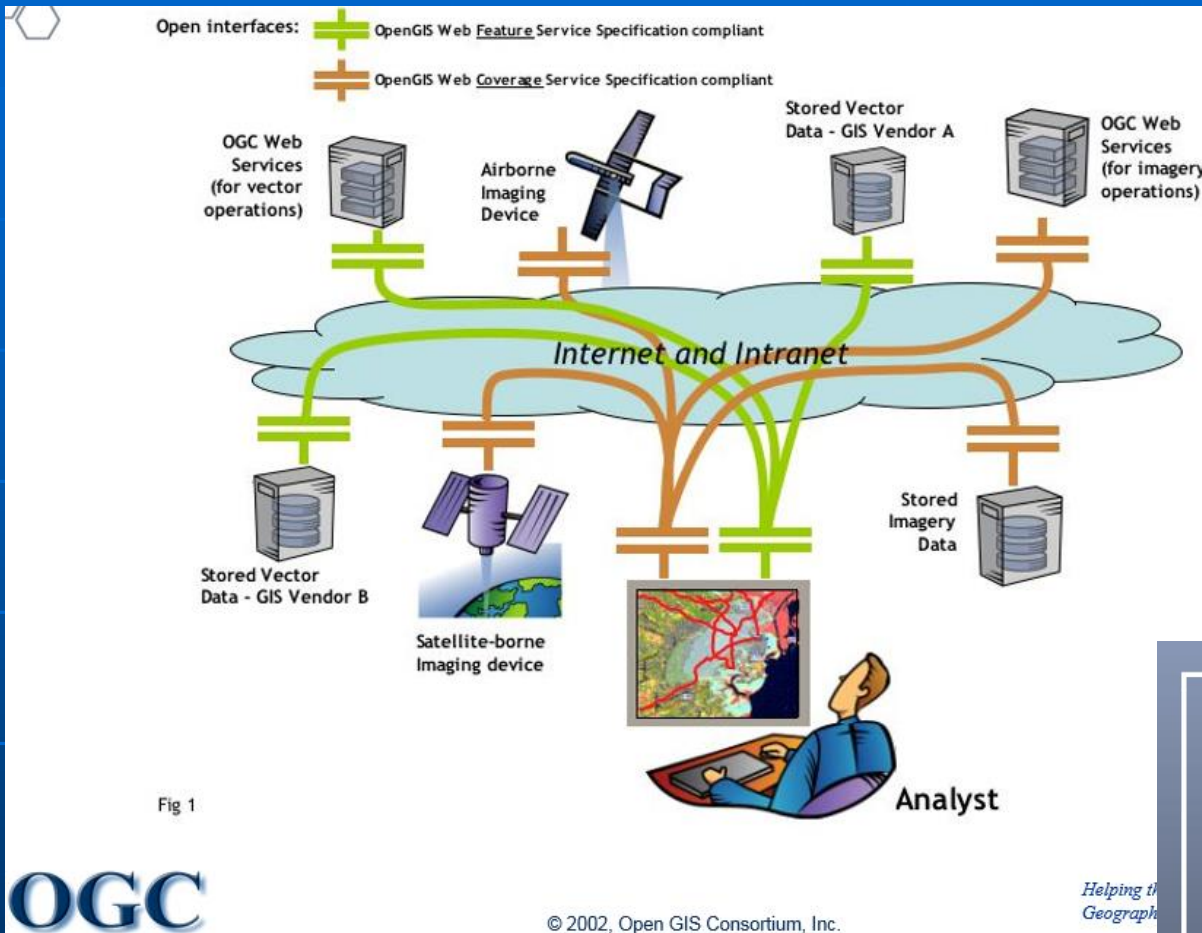
Create a common picture of reality

The need



- Integration
- Interoperability
- Collaboration
- Transparency
- A common picture

Fusion of Geospatial Information



Making data discoverable and accessible through one spatial framework

NGA's work with the National Network of Fusion Centers

Inter-Agency Geospatial Collaboration at Work



OGC Geospatial Fusion Pilot Project

<http://www.opengeospatial.org/projects/initiatives/gfspp>
<https://www.ise.gov/blog/ise-bloggers/inter-agency-geospatial-collaboration-work>

Cyberinfrastructure for the Geosciences



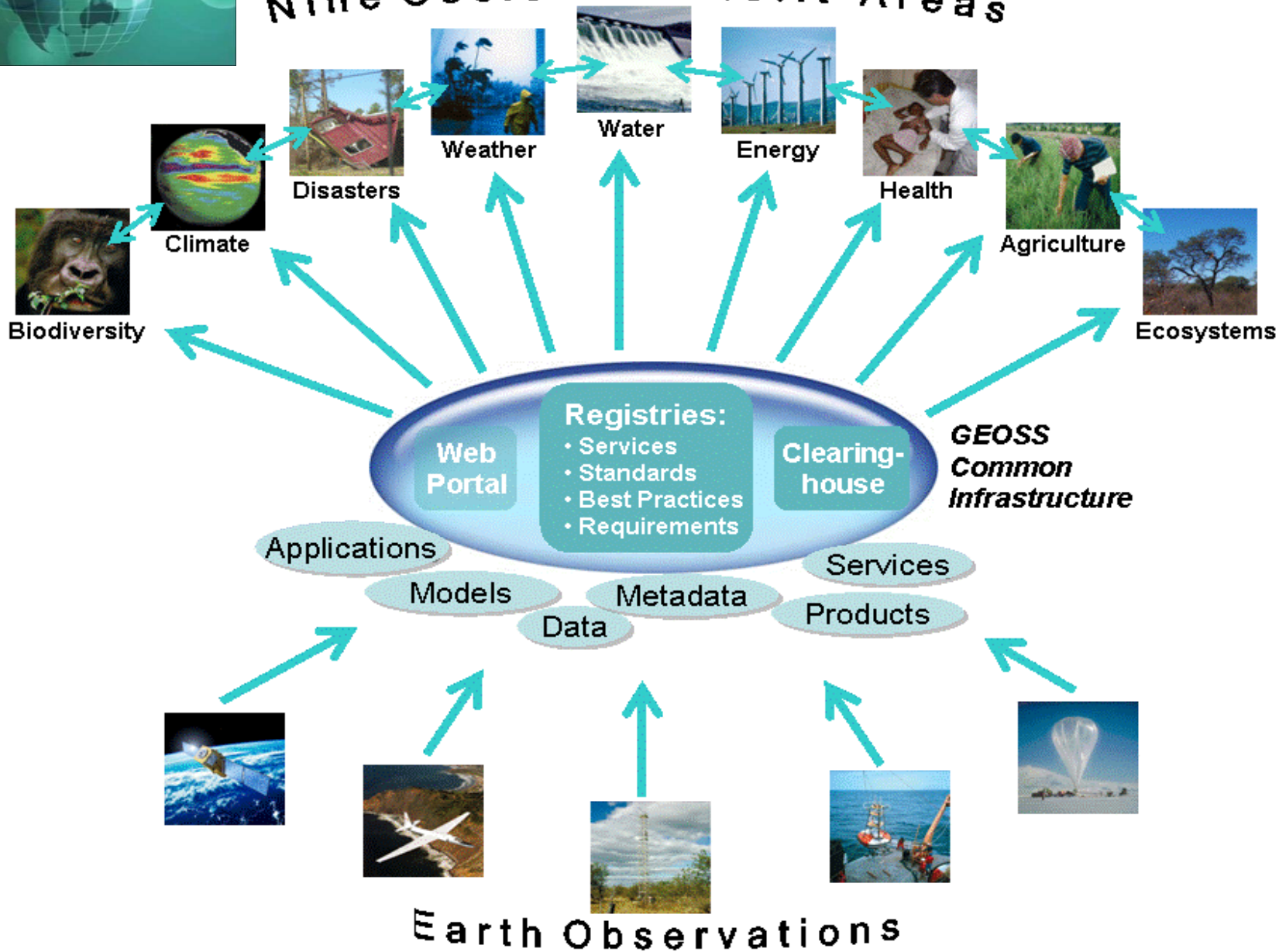
EARTHCUBE



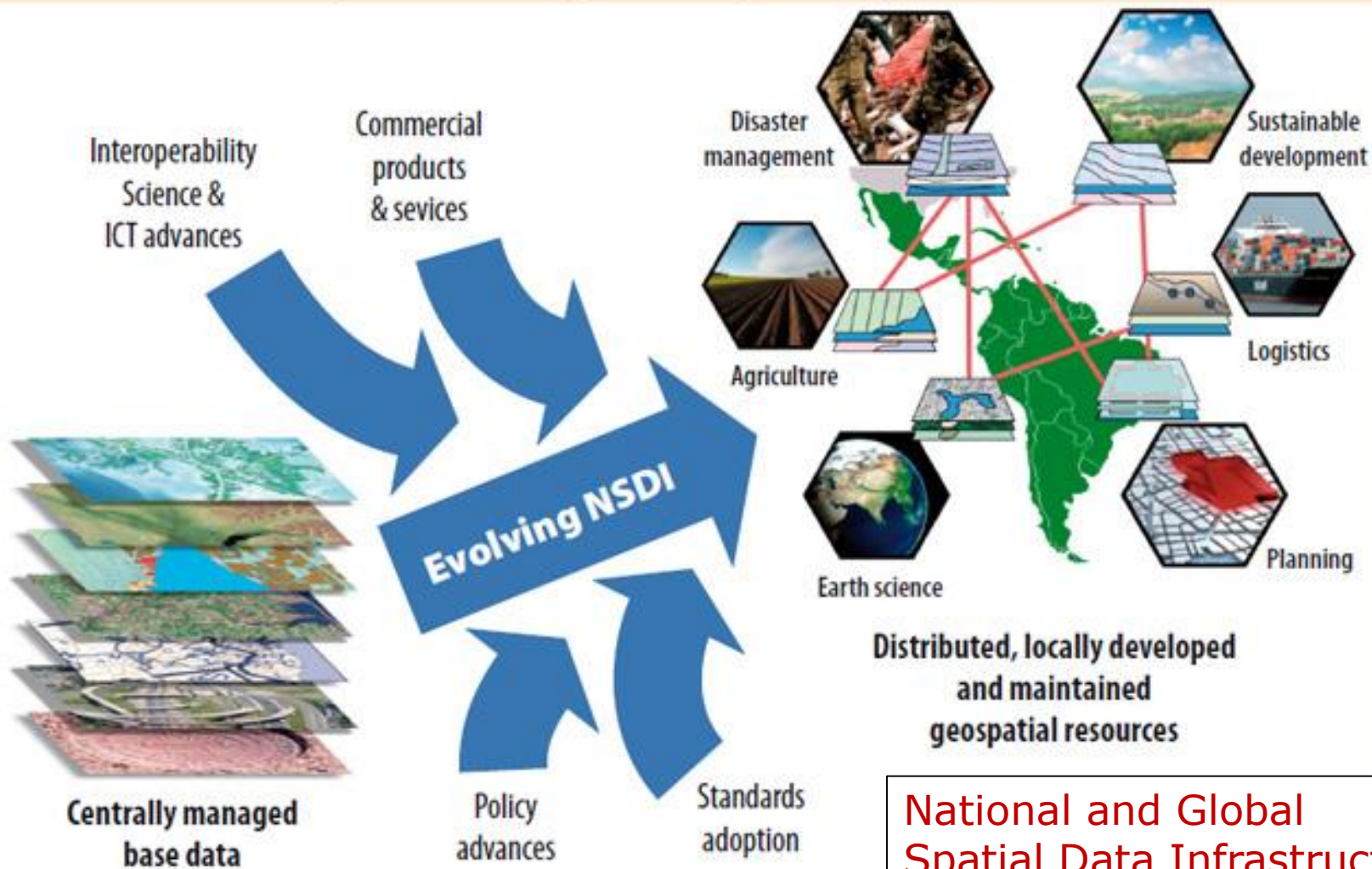
GEOSS

Earth Observation System of Systems

Nine Societal Benefit Areas



Standards contribute significantly to the evolution of National Spatial Data Infrastructures from centrally managed Geographic Information Systems to distributed networks of diverse geospatial resources, many of which are locally developed and maintained. Standards enable the diverse systems to exchange data and processing instructions



OGC Implementation Standards

They are written for a more technical audience and detail the interface structure between software components.

More than 30 baseline standards

<http://www.opengeospatial.org/docs/is>

https://en.wikipedia.org/wiki/Open_Geospatial_Consortium#Standards

GML 3.0 alone is 529 pages.



OGC Implementation Standards

Approximately 70
September 2015



<http://www.opengeospatial.org/docs/is>

<http://www.opengeospatial.org/standards/specifications/list>

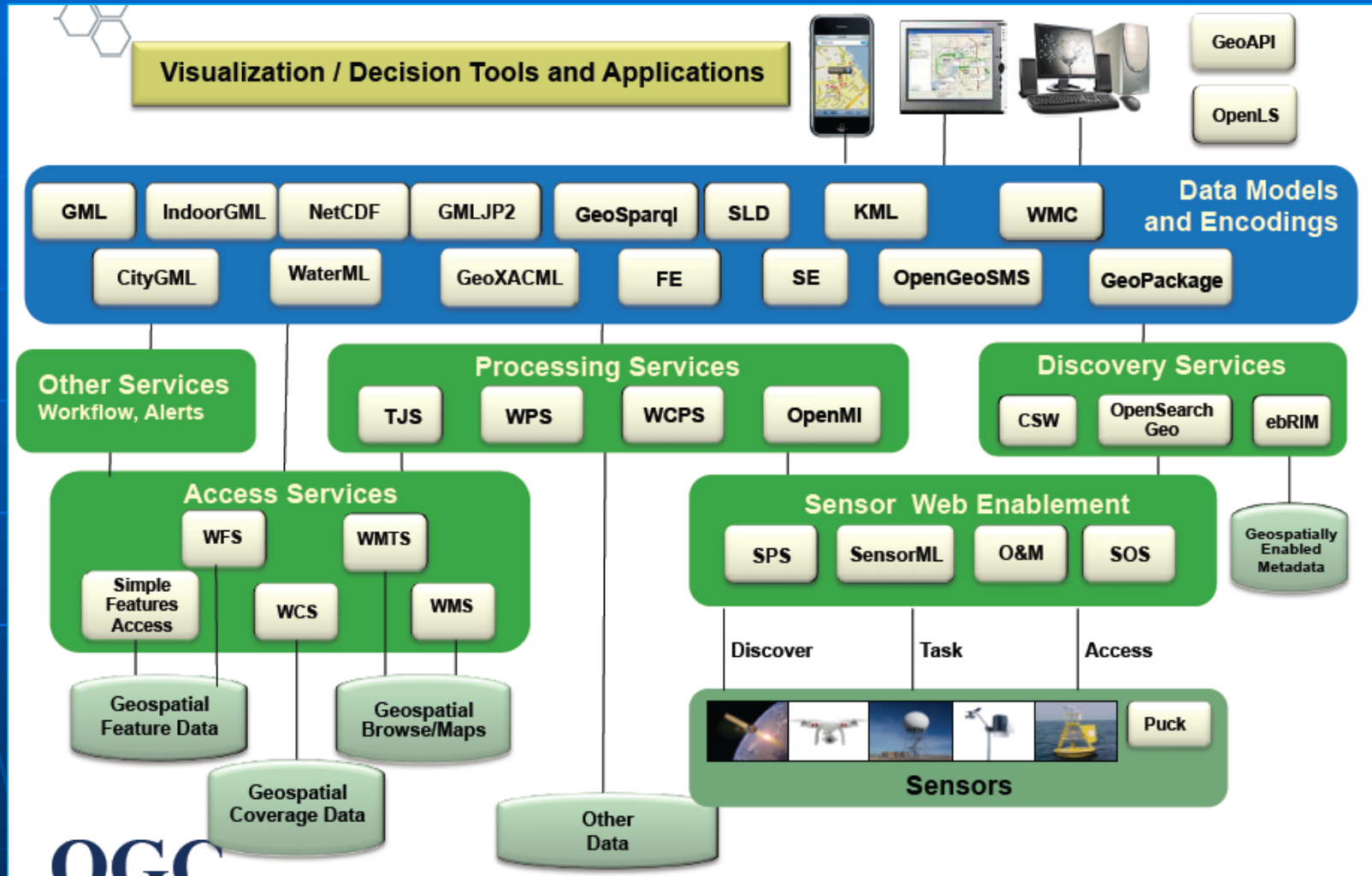
What is the difference between a specification and a standard?

A standard is a specification, but a specification is not necessarily a standard.

- Specifications are documents that describe protocols, data encodings, software interfaces and other aspects of information and process sharing.
- A standard is a specification that developers in numerous companies can use to ensure that their products "work together." the authority of a standard derives from the breadth of its acceptance in the marketplace and the authority of the standard setting organization sponsoring it.
- Every software company develops specifications to guide development of their proprietary technologies.
- OpenGIS® Specifications, on the other hand, are "consensus standards" similar to HTML, XML, TCP/IP and the other standards that define the Internet and the Web.

<http://www.opengeospatial.org/ogc/faq/abstractspec#2>

Jungle of Acronyms?



OGC

OGC Standards (30+)



- Encodings

- GML
- SLD
- SensorML
- CityGML
- WMC
- O&M
- Filter Encoding
- KML
- Symbology Encoding
- GML in JPEG 2000
-

- Data Services

- Sensor Observation Service
- Coverage Service
- Web Feature Service
- Web Map Service ..

- Catalogue Services

- Catalogue Service

- Processing Services

- Coordinate Transformation Service
- Web Processing Service

- Portrayal Services ...

Resources to Explore and Learn about OGC Open Standards

OpenGeospatial e-Learning

(<https://github.com/opengeospatial/e-learning/wiki>)

“The Goal of the OGC E-Learning program is to coordinate and provide educational materials that can support adoption of OGC standards and professional (skills) assessment”.

OGC White Papers

<http://www.opengeospatial.org/pressroom/papers>

Getting started with OGC standards for geospatial sharing

http://www.eclipse.org/community/eclipse_newsletter/2014/march/article1.php; <http://live.osgeo.org/en/standards/standards.html>

Communities of interest driving interoperability

(<https://www.fgdc.gov/ngac/meetings/april-2012/open-geospatial-consortium-activities-reichardt.pdf>)

Open Web Mapping course online

<https://www.e-education.psu.edu/geog585/>

Resources to Explore and Learn about OGC Open Standards

OGC Reference Model

<http://www.opengeospatial.org/standards/orm>

- Interested in an overview of **the consortium**? – See Section 1.
- Interested in the geospatial **information standards**? – See Section 2.
- Interested in geospatial **service standards**? – See Section 3.
- Interested in OGC-based **development patterns**? – See Section 4.
- Interested in **implementations** of OGC-based systems? – See Section 5.

OGC Reference Architecture Profile (RAP) Advisor

Recommendations for system development.

<http://rap.opengeospatial.org/>

OGC Best Practices documents

<http://www.opengeospatial.org/docs/bp>

Types of OGC Standards

Encodings and services can be categorized as follows based on the purpose.

Purpose	Encoding Standards	Interface Standards
find and location of data	metadata	catalog services
visualization	image	map services
data access	data models and encoding	data services

<https://github.com/opegeospatial/e-learning/wiki>

Encoding standards:

Rules that determine how to organize information, typically sent by a service provider or produced by an application.

GeoPackage GML 3.2 SensorML waterML CityGML IndoorGML

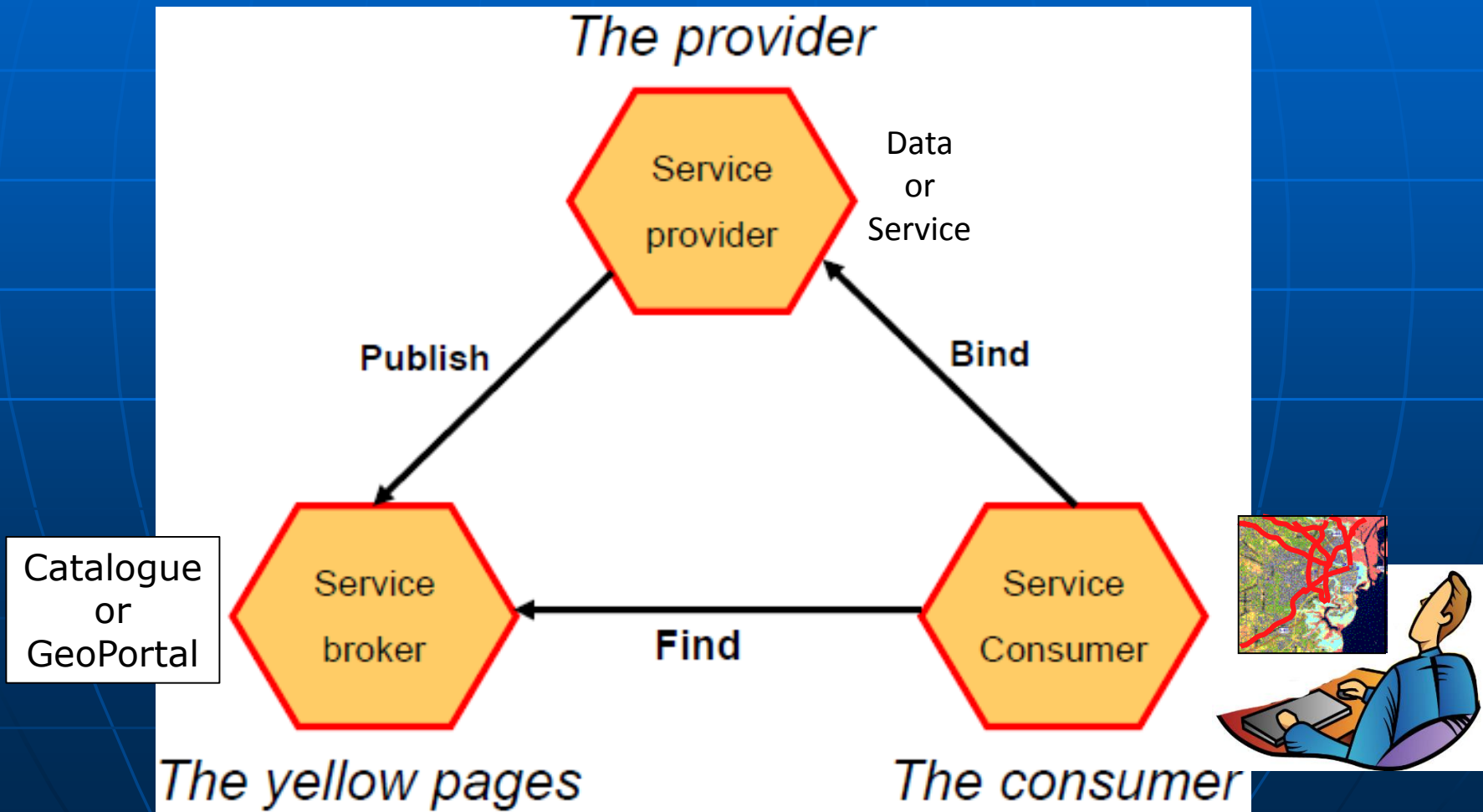
Interface standards:

Rules that determine the operations between service providers and service requesters. For example, an interface to request maps to a map service provider.

WMS, WFS, WCS

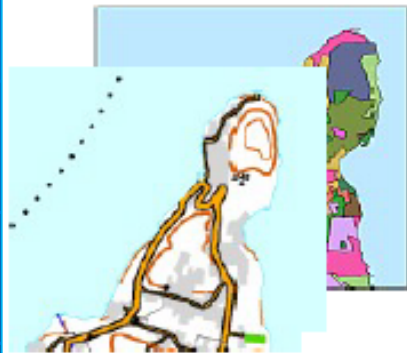
Geospatial Web services using OGC standards

It helps to think of **publish**, **find** and **bind** as the key functions for applications in a Web services environment (SOA Services Oriented Architecture).



OGC Web Services OWS

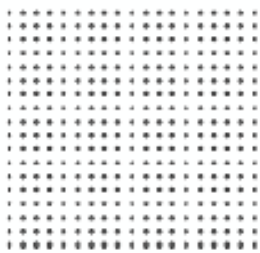
DATA DELIVERY



RASTER
DATA



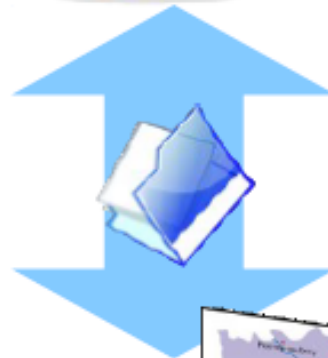
VECTOR
DATA



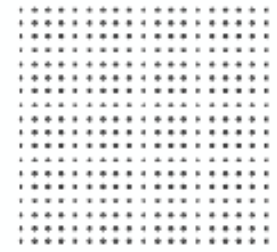
GRID
DATA

OTHER
GEOSPATIAL
DATA...
(e.g. XML Sensors Data)

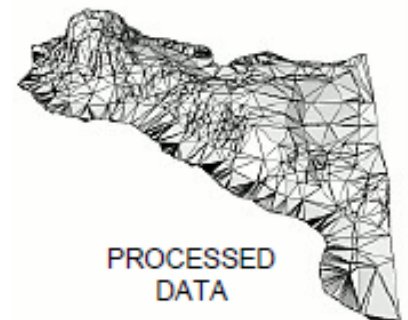
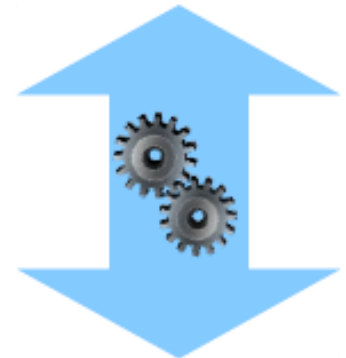
CATALOGUE



PROCESSING



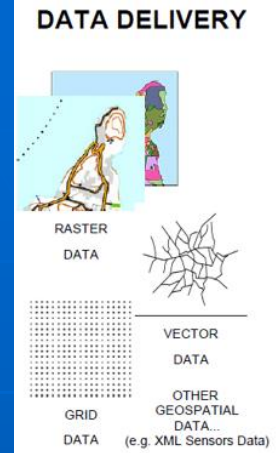
INPUT DATA



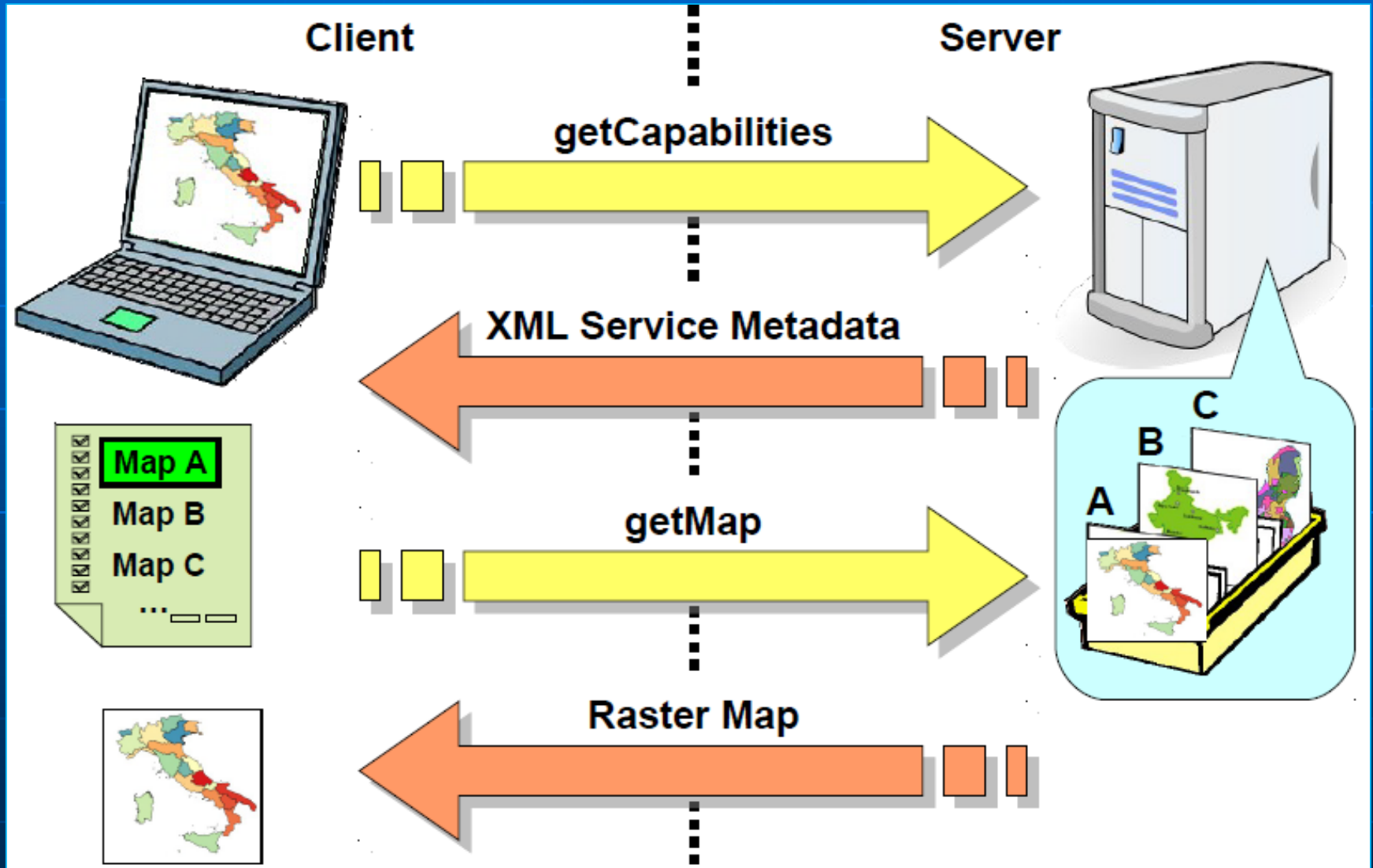
PROCESSED
DATA

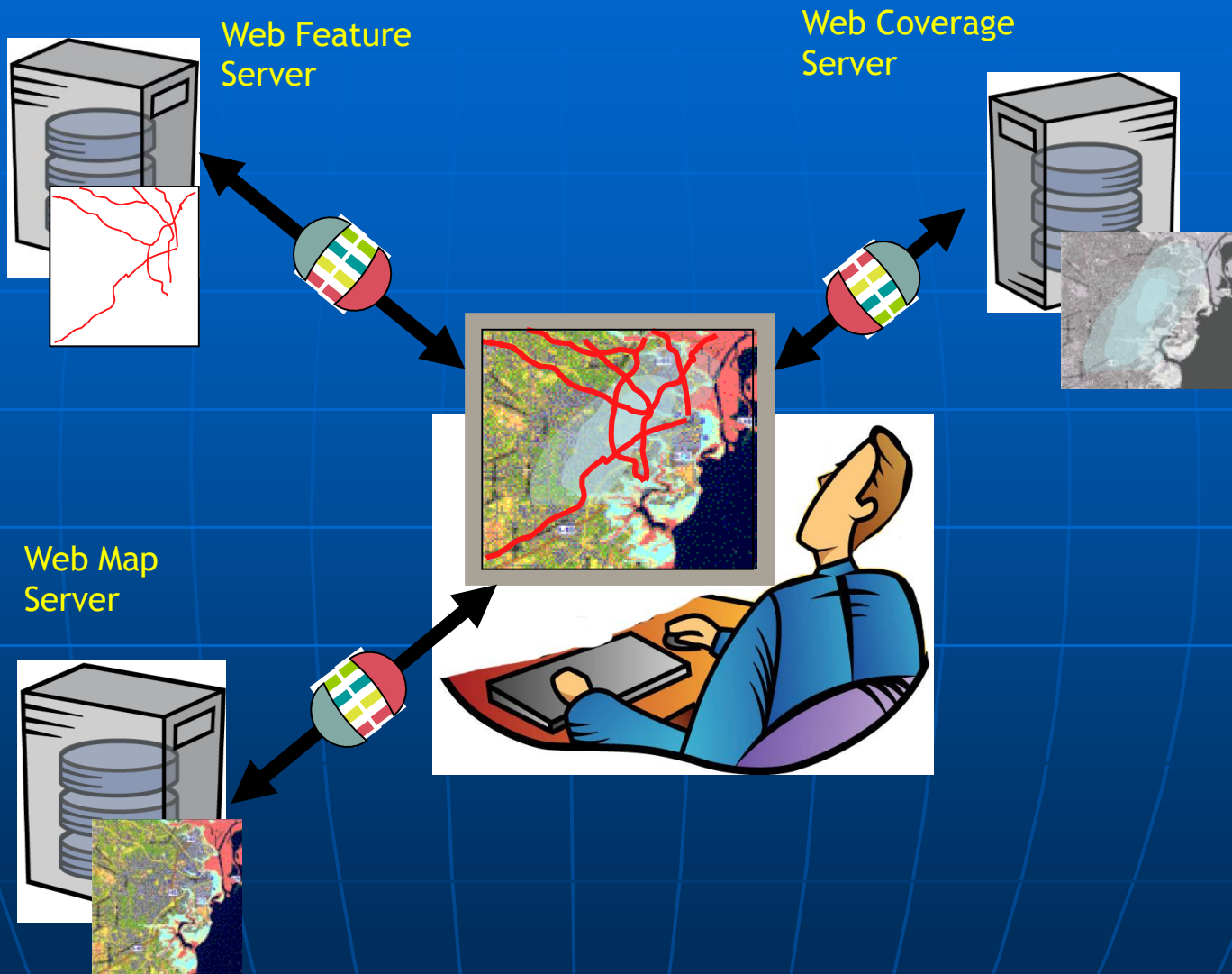
Data Delivery Services

- **WMS** (Web Map Service): Generates maps as images. Response: Geo-registered JPG, PNG, etc.. → Raster
- **WFS** (Web Feature Service): Generates geographic entities or features. → Vector
- Response: Features usually in GML format.
- **WFS-T** (WFS-Transactions): Allows creation, deletion and updating of features. → Vector
- **WCS** (Web Coverage Service): Generates geospatial coverages representing space-varying phenomena → Grid
- **SOS** (Sensor Observation Service): API for managing measured data as well as metadata from heterogenous sensors → Data XML



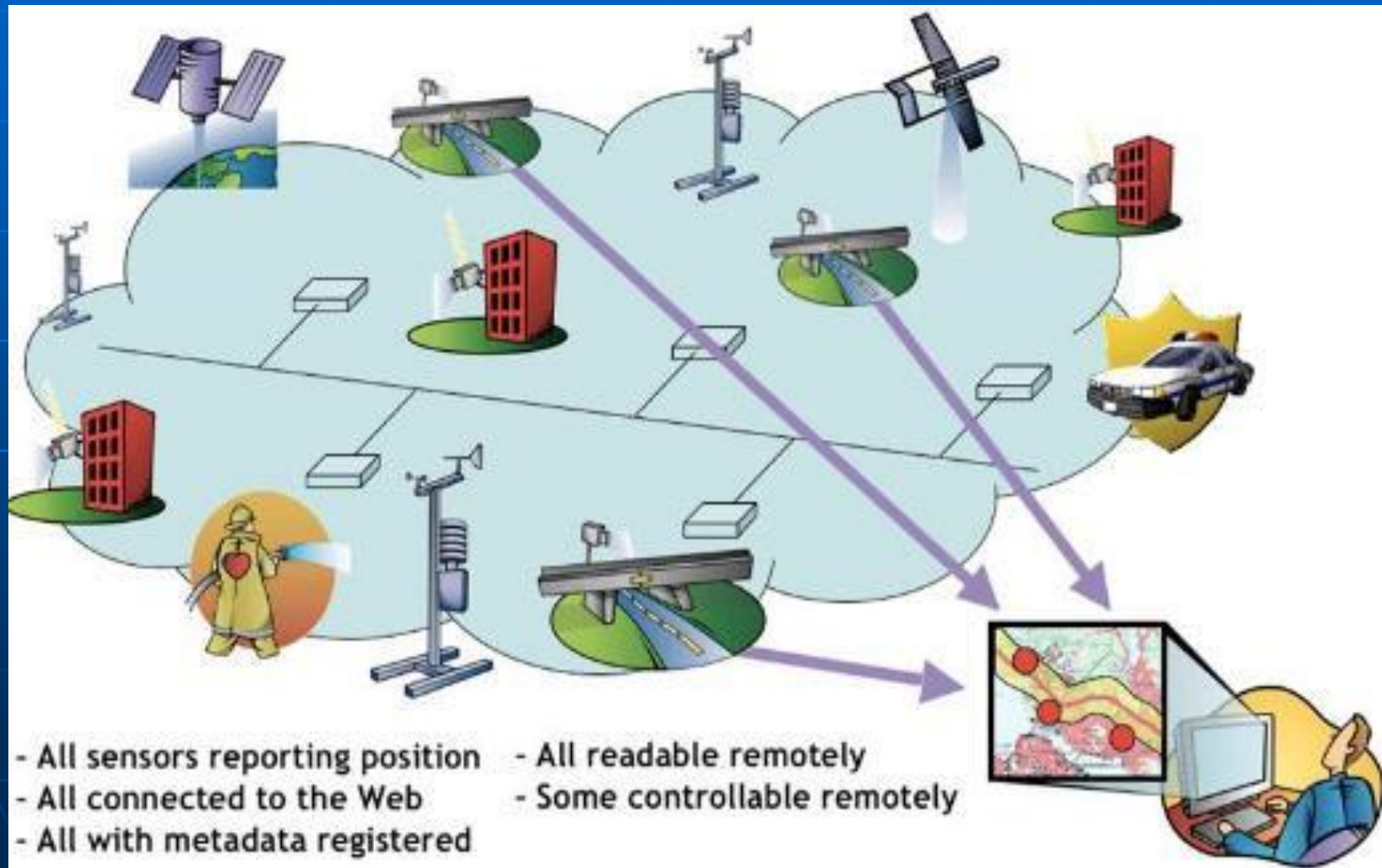
WMS





Sensor Web Enablement (SWE) Standards

- sensorML
- Sensor Observation Service (SOS)
- Sensor Planning Service (SPS)
- Sensor Alert Service (SAS)
- Catalogue Service/Sensors

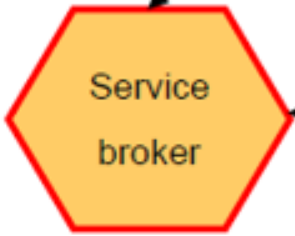


CSW Catalogue Service for the Web

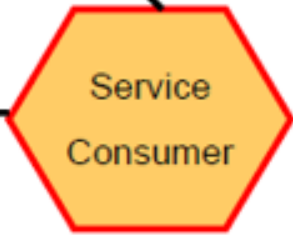
Tool that supports the ability to publish and search collections of descriptive information (metadata) for data, services, and related information objects.



Catalogue
or
GeoPortal



Find



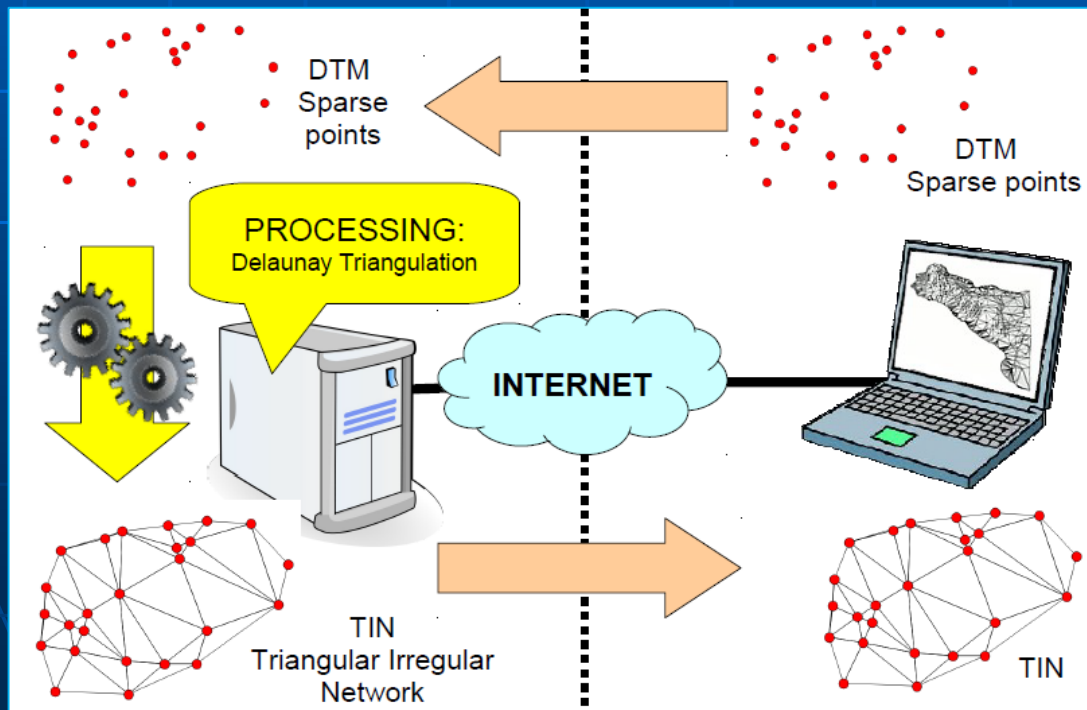
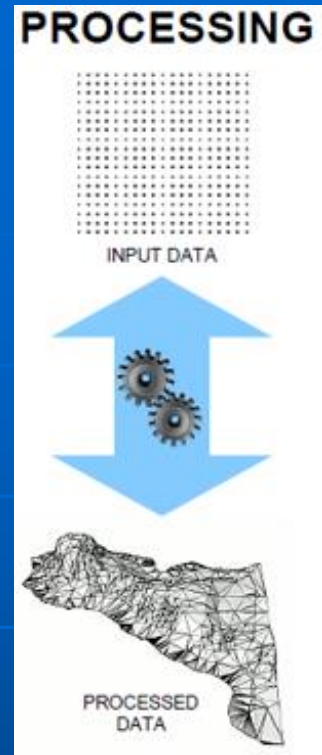
The yellow pages

The consumer

WPS Web Processing Service

A WPS can be configured to offer GIS functionality to clients across a network access to pre-programmed calculations and/or computation models that operate on spatially referenced data.

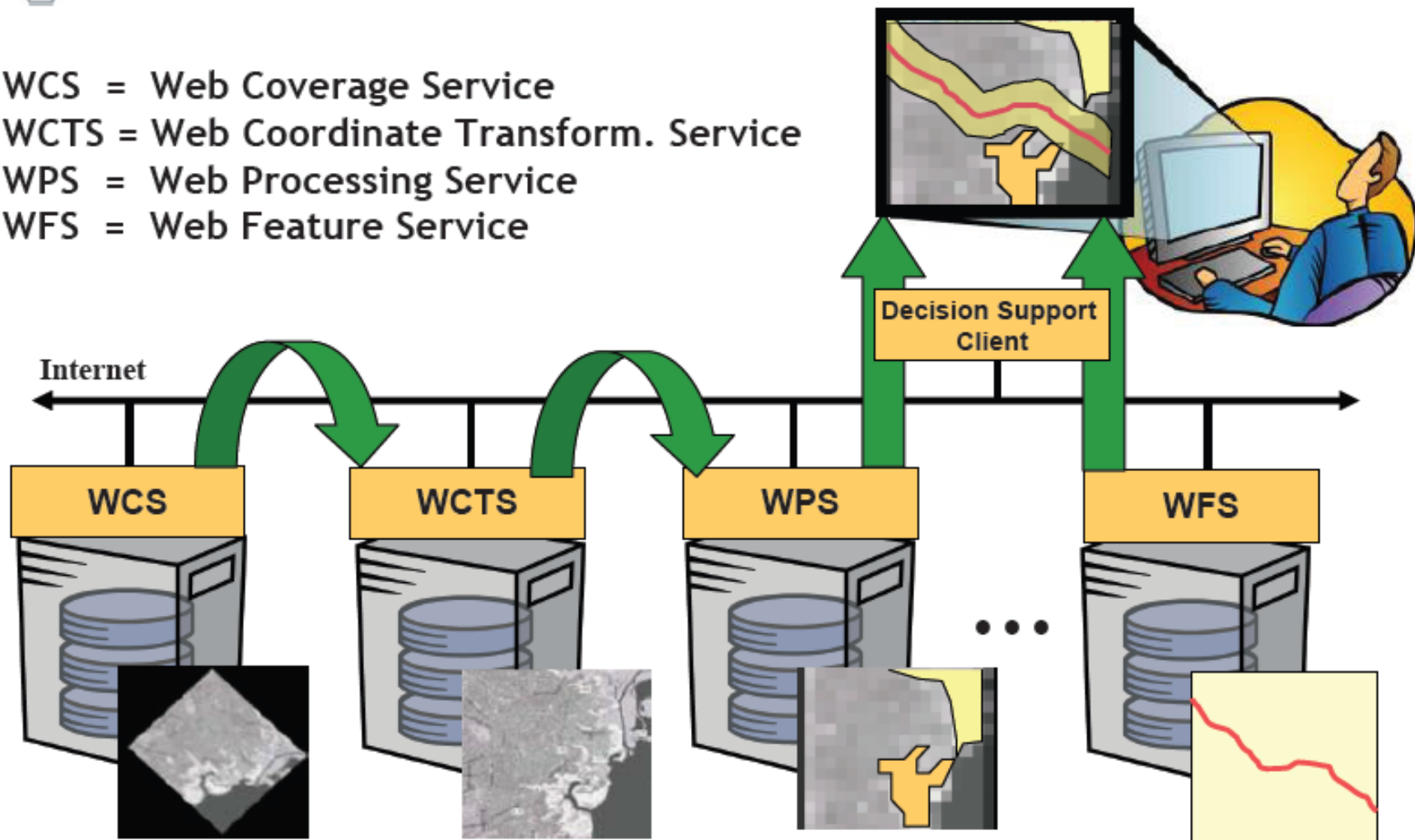
It provides rules for standardizing how inputs and outputs (requests and responses) for invoking geospatial processing services, such as polygon overlay, as a Web service.



OWS Geo-Processing Workflow

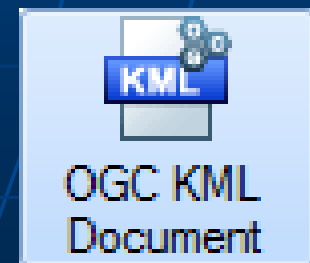
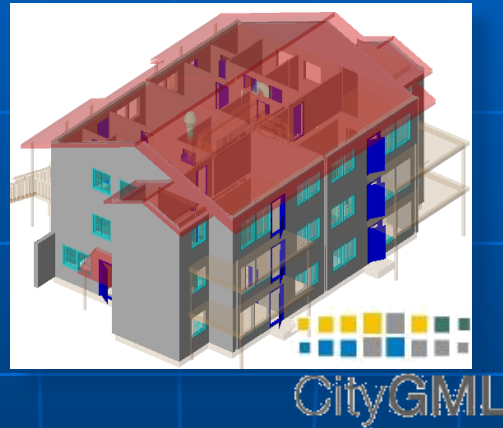


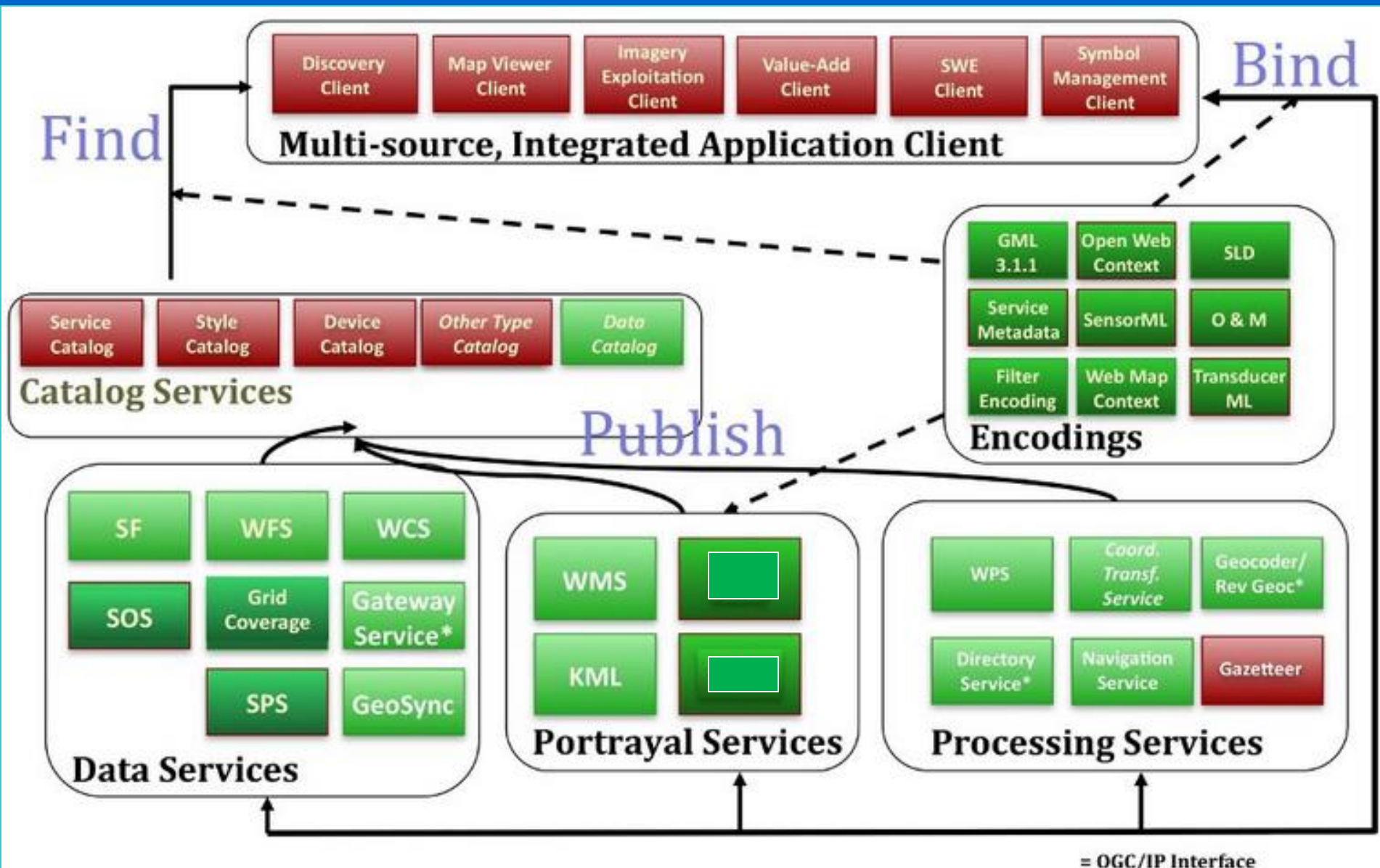
WCS = Web Coverage Service
WCTS = Web Coordinate Transform. Service
WPS = Web Processing Service
WFS = Web Feature Service



Encoding Standards storing and transferring data

- GeoPackage
- GML 3.2 CityGML IndoorGML
- sensorML
- waterML
- KML
- Open GeoSMS
- GeoSPARQL
- Moving Features
- Symbology encoding







Visualization / Decision Tools and Applications



GeoAPI

OpenLS

Data Models and Encodings

- GML, IndoorGML, NetCDF, GMLJP2, GeoSparql, SLD, KML, WMC
- CityGML, WaterML, GeoXACML, FE, SE, OpenGeoSMS, GeoPackage

Other Services
Workflow, Alerts

Processing Services

- TJS, WPS, WCPS, OpenMI

Discovery Services

- CSW, OpenSearch Geo, ebRIM

Access Services

- WFS, WMTS, WCS, WMS
- Simple Features Access

Sensor Web Enablement

- SPS, SensorML, O&M, SOS

Geospatially Enabled Metadata

Geospatial Feature Data

Geospatial Browse/Maps

Geospatial Coverage Data

Other Data

Discover Task Access

Sensors

- Images of satellite, drone, weather station, antenna, buoy
- Puck

FOSS4G to Implement an OGC Web Services Architecture

SERVER SIDE

- Geoserver (WMS, WFS, WFS-T, WCS)
- MapServer (WMS, WFS, WCS)
- Deegree (WMS, WFS, WFS-T, WCS, CSW, WPS)
- WorldWind (WMS, WFS*)
- GeoNetwork (CSW)
- Zoo (WPS)
- istSOS (SOS)
- ...

CLIENT SIDE

DESKTOP-CLIENT

- Quantum QIS
- GvSIG
- UDIG
- OpenJump
- World Wind
- ...

WEB-CLIENT

- OpenLayers
- Mapbender
- geomajas
- p.mapper
- World Wind (Applet/JWS)
- ...