



UNIVERSITAS
GADJAH MADA

May 17, 2024

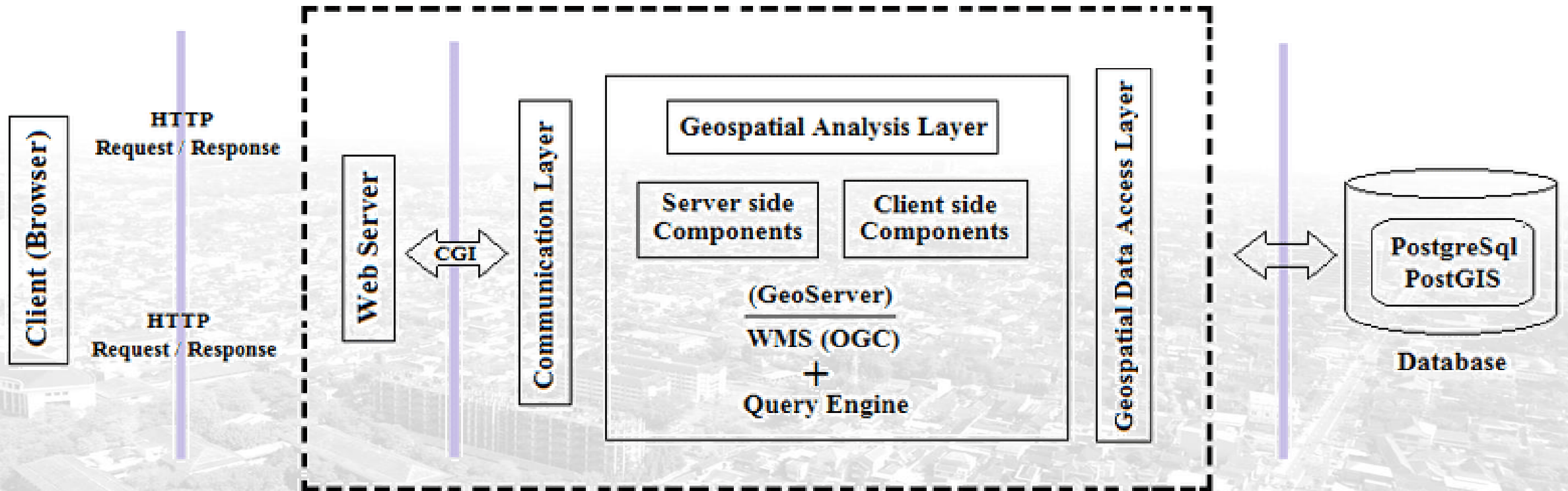
Enterprise FOSS-GIS

Arsitektur Aplikasi Enterprise FOSS-GIS

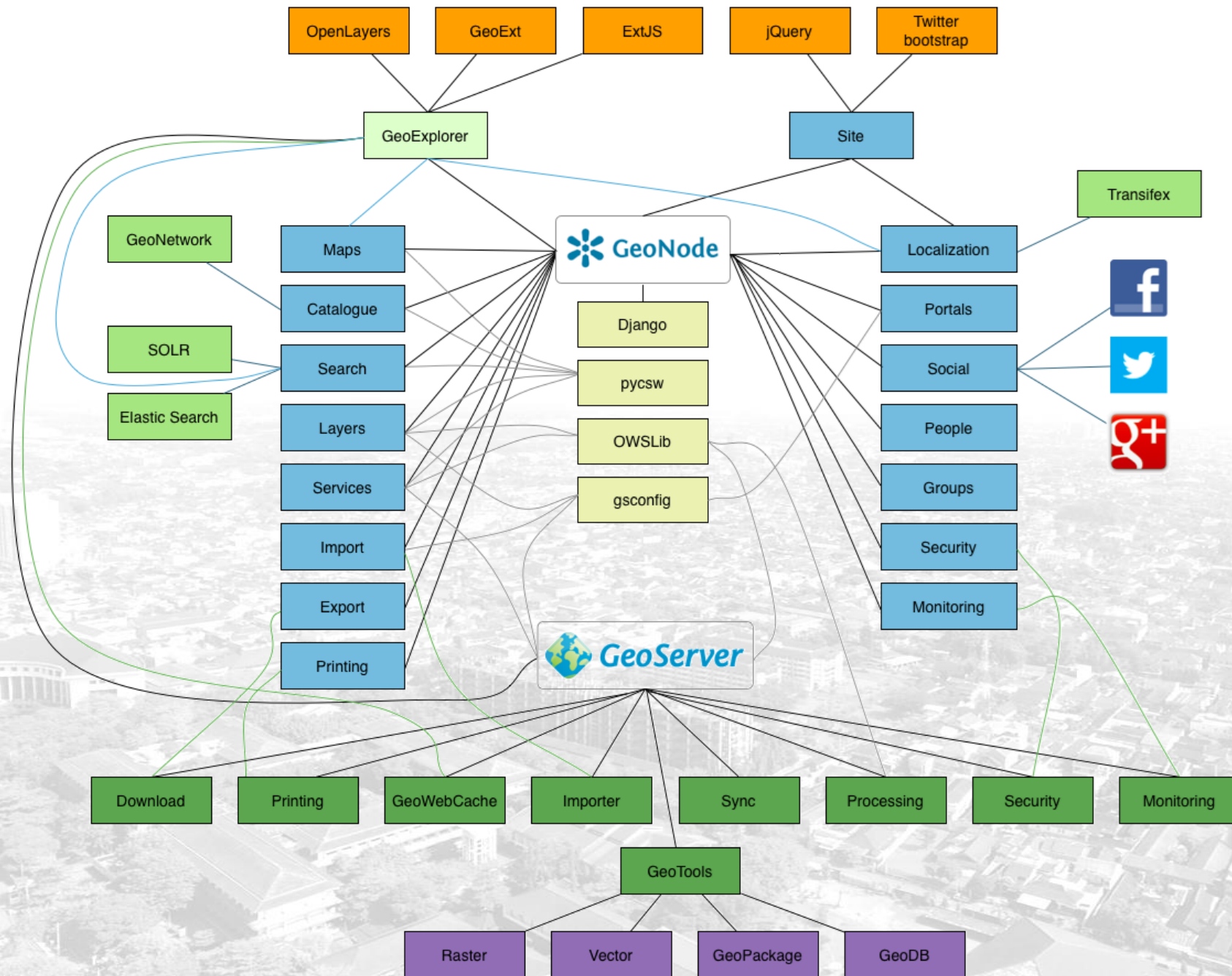
Dany Laksono

Departemen Teknik Geodesi UGM

Arsitektur Fullstack WebGIS



GeoNode Component Architecture

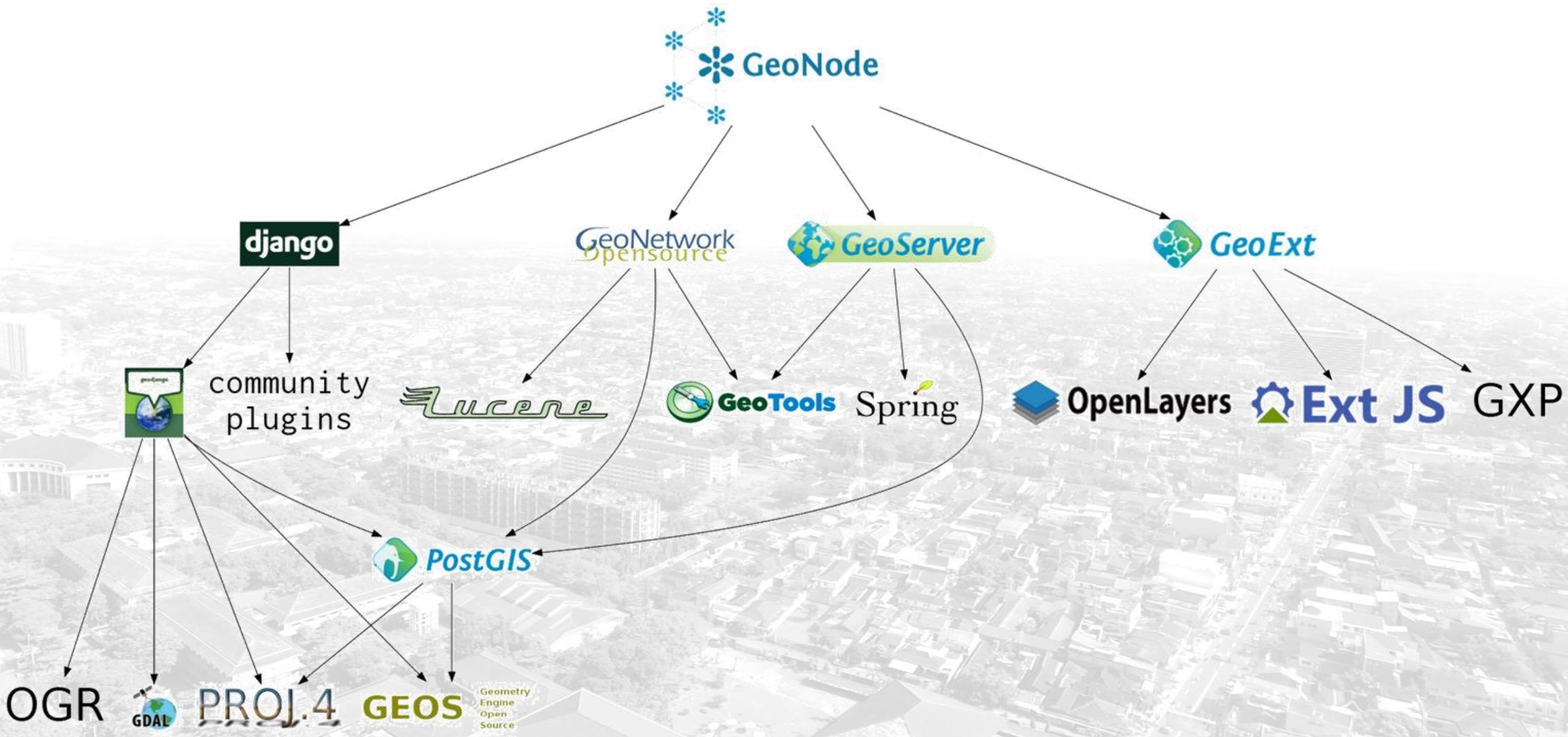


Arsitektur Geoportal: Geonode

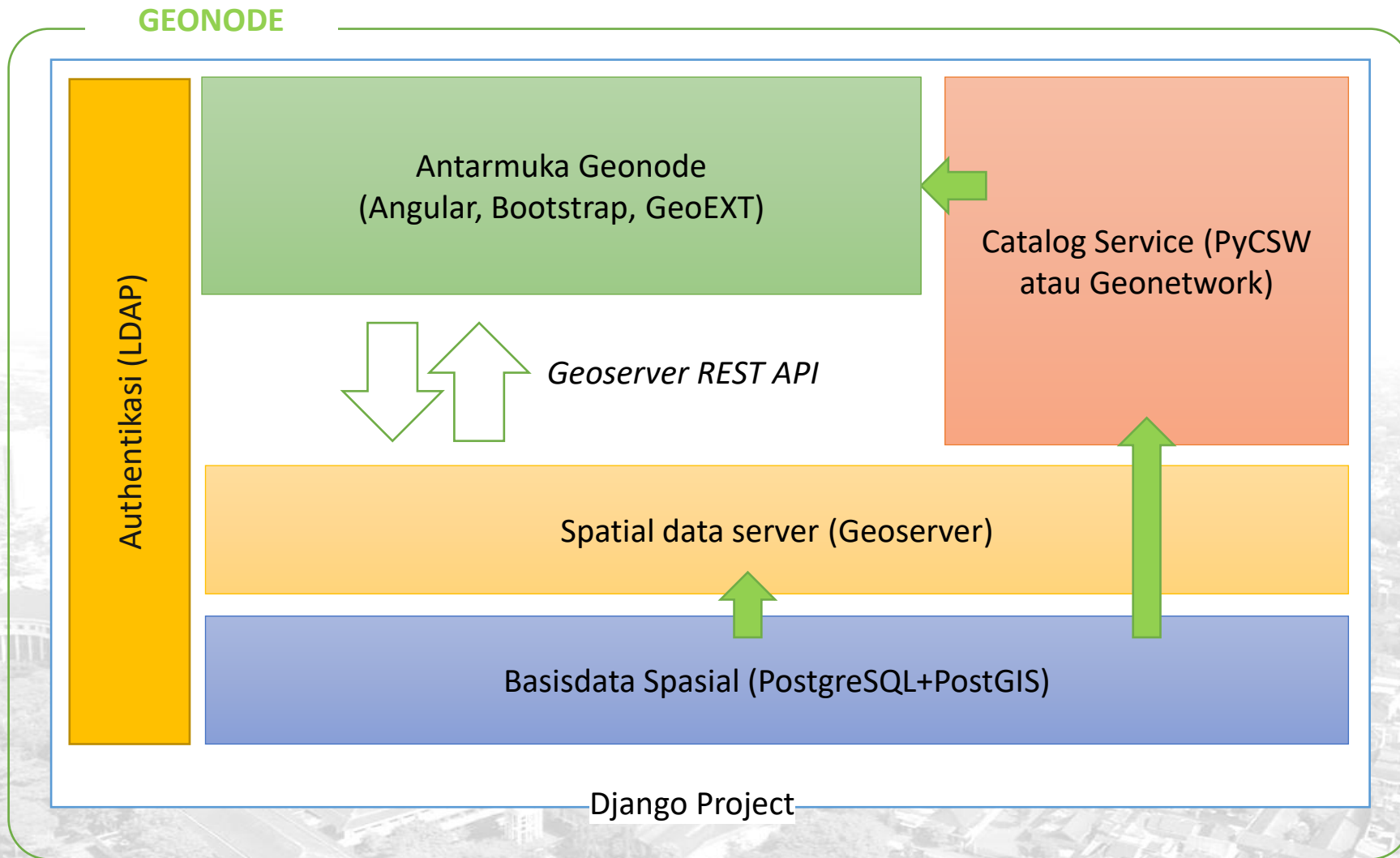
Sebuah Geoportal terdiri dari banyak komponen yang saling terkait

Masing-masing komponen mengatur proses bisnis yang berbeda (katalog, map viewer, basisdata spasial, map service, dst)

Arsitektur Geoportal: Geonode



Arsitektur Geoportal: Geonode



Geonode
menggabungkan
komponen-
komponen
manajemen portal
dan data spasial
dalam satu project
berbasis Django

Arsitektur Geoportal: Geonode

Komponen Geonode

- **UI Logic:** MVP/MVC based on Django WSGI, Apache
- **Metadata manager:** pycsw (default), Geonetwork
- **Spatial data server:** Geoserver (default), ArcGIS server
- **Spatial DBMS:** PostGIS/PostgreSQL (default), MySQL, Oracle Spatial, MS SQL, ArcSDE
- **Protocol:** OGC Standards (WMS, WFS/WFS-T, WCS, CSW, TMS, etc)

Add Layer(s) from a WM(T)S Server

Layers | Layer Order | Tilesets

wms from MetaSearch 2

Connect | New | Edit | Remove | Load | Save

ID	Name	Title	Abstract
0		GeoNode Local ...	This is a description of your Web Map Server.
1	_3404_100kw_ar...	Peta Geologi Ka...	Data ini berisikan informasi geologi di Kawasan Sleman Utara ya...
3	_3404_25kw_ar_l...	Peta Lereng Ka...	Data ini berisikan informasi kemiringan lereng Kawasan Sleman ...
5	_3404_25kw_ar_...	Peta Morfologi ...	Data ini berisikan informasi Morfologi Kawqasan Sleman Utara y...
7	_3404_50kb_ar_...	Daerah Irigasi K...	Data ini berisikan informasi sebaran Daerah Irigasi kewenangan P...
9	_3404_50kb_ar_j...	Peta Jumlah Ke...	Peta jumlah kepala keluarga Kabupaten Sleman diambil dari dat...
11	_3404_50kb_ar_j...	Peta Jumlah Pe...	Peta Jumlah Penduduk Kabupaten Sleman diambil dari data kep...
13	_3404_50kb_ar_...	Kawasan Rawan...	Data ini berisikan informasi Kawasan Rawan Gunung Api yang di...
15	_3404_50kb_ar_...	Peta Kepadatan...	Peta Kepadatan Penduduk Kabupaten Sleman diambil dari data ...
17	_3404_50kb_ar_...	Kepadatan Pen...	Data ini berisikan informasi kepadatan penduduk per Desa di Kab...
19	_3404_50kb_ar_...	Peta Penutup L...	Data berisikan informasi penutup lahan Kabupaten Sleman. Data...
21	_3404_50kb_ar_...	Tingkat Risiko P...	Data ini berisikan informasi tingkat risiko bencana gempa bumi...

Image Encoding

PNG PNG8 JPEG GIF TIFF SVG

Options (0 coordinate reference systems available)

Tile size:

Request step size:

Feature limit for GetFeatureInfo:

Use contextual WMS Legend

Layer name:

Select layer(s):

Harvesting
Geoportal

MetaSearch

Search | Services | Settings

Find

Keywords: From:

Xmax: Ymax:

Xmin: Ymin:

Results

Showing 1 - 10 of 586 result(s)

Type	Title
document	Peta Hasil Plotting POI Desa TirtomartaniKecamatan Kalasan 2019
document	Peta Epidemiologi Covid - 19 Kab. Sleman 2 Agustus 2020
document	Peta Hasil Plotting POI Desa Sidomoyo Kecamatan Godean 2019
dataset	Peta Toponim Kawasan Sleman Tengah
dataset	Jaringan Saluran Udara Tegangan Tinggi (SUTT) Kecamatan Gamping
dataset	Jaringan Telekomunikasi Sleman Timur
dataset	Peta Perairan (In) Kawasan Sleman Tengah
dataset	Lokasi Cagar Budaya Kabupaten Sleman
dataset	Jaringan Fiber Optic Kecamatan Gamping
dataset	Peta Jenis Tanah Kawasan Sleman Timur

External Map Viewer

The image shows a web-based map viewer interface. The main map area displays an aerial view of a residential or commercial area with various land use overlays in colors: orange for residential, green for parks or green spaces, blue for water, and grey for buildings. The interface includes a sidebar on the left with a search bar, an 'Add Data' button, and a 'DATA SETS' section. The 'DATA SETS' section shows a single data set named 'Bidang Tanah' with an opacity slider set to 100%. Below this is a 'Style' section with a legend for different land use types. The top right of the map has navigation and utility buttons like 'Story', 'Map', 'Share / Print', 'Help', and 'About'. The bottom of the map shows a scale bar and coordinates.

BHUMI.atrbpn

Search for locations

Add Data

DATA SETS [1] Remove All

Bidang Tanah

Zoom To Extent About This Data Split Remove

Opacity: 100 %

Style

simbologi untuk persil berdasarkan jenis hak

- Hak Milik
- Hak Guna Usaha
- Hak Guna Bangunan
- Hak Pakai
- Hak Pengelolaan
- Tanah Wakaf
- Tanah Adat

Story Map Share / Print Help About


Give Feedback

Disclaimer: Peta ini tidak dianjurkan untuk keperluan navigasi dan analisis spasial presisi. | Bing maps, CESIUM ion, © 2020 Microsoft Corporation, © 2020 Maxar, ©CNES (2020) Distribution Airbus DS

Lat 6.23066°S Lon 106.79440°E Elev 200 m

Spatial Data Server










← → ↻ ⓘ Not secure | gis.jogjaprov.go.id:8080/geoserver/web/wicket/bookmarkable/org.geoserver.web.demo.MapPreviewPage?1 ☆

 Remember me

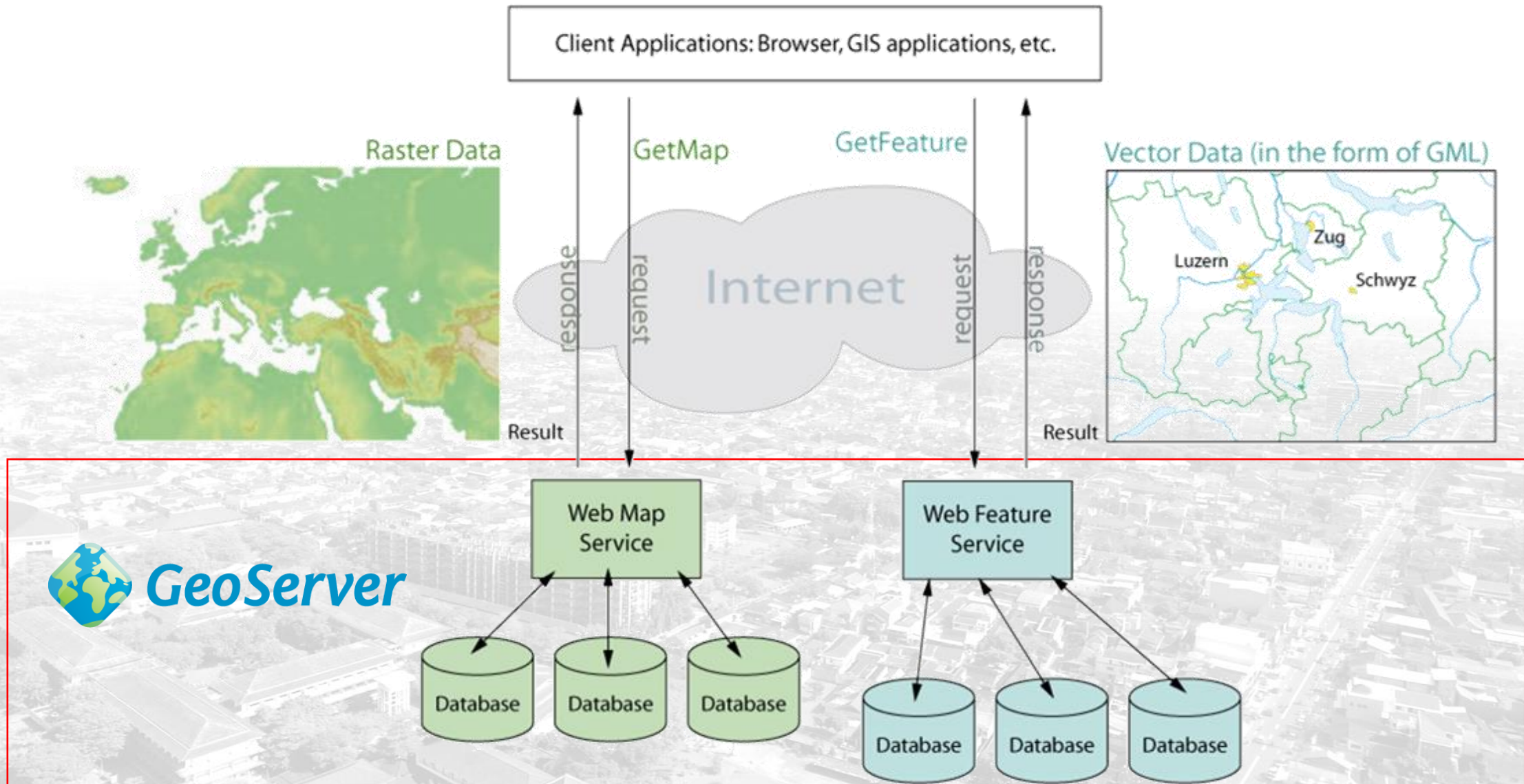
Layer Preview

List of all layers configured in GeoServer and provides previews in various formats for each.

<< < 1 2 3 4 > >> Results 1 to 25 (out of 89 items)

Type	Title	Name	Common Formats	All Formats
	Landsat DIY 2017	geonode:l8_diy_17	OpenLayers KML	Select one ▼
	Aset di Madugondo	geonode:aset_madugondo	OpenLayers KML GML	Select one ▼
	ibukota_kabupaten	geonode:ibukota_kabupaten	OpenLayers KML GML	Select one ▼
	ibukota_provinsi	geonode:ibukota_provinsi	OpenLayers KML GML	Select one ▼
	penutupan_lahan	geonode:penutupan_lahan	OpenLayers KML GML	Select one ▼
	tanah	geonode:tanah	OpenLayers KML GML	Select one ▼
	aksesibilitas	geonode:aksesibilitas	OpenLayers KML GML	Select one ▼
	sungai	geonode:sungai	OpenLayers KML GML	Select one ▼
	Tata Guna Lahan DIY 2016	geonode:penggunaan_lahan_2016	OpenLayers KML GML	Select one ▼

Interoperabilitas Data Spasial



Protokol Layanan Data Spasial

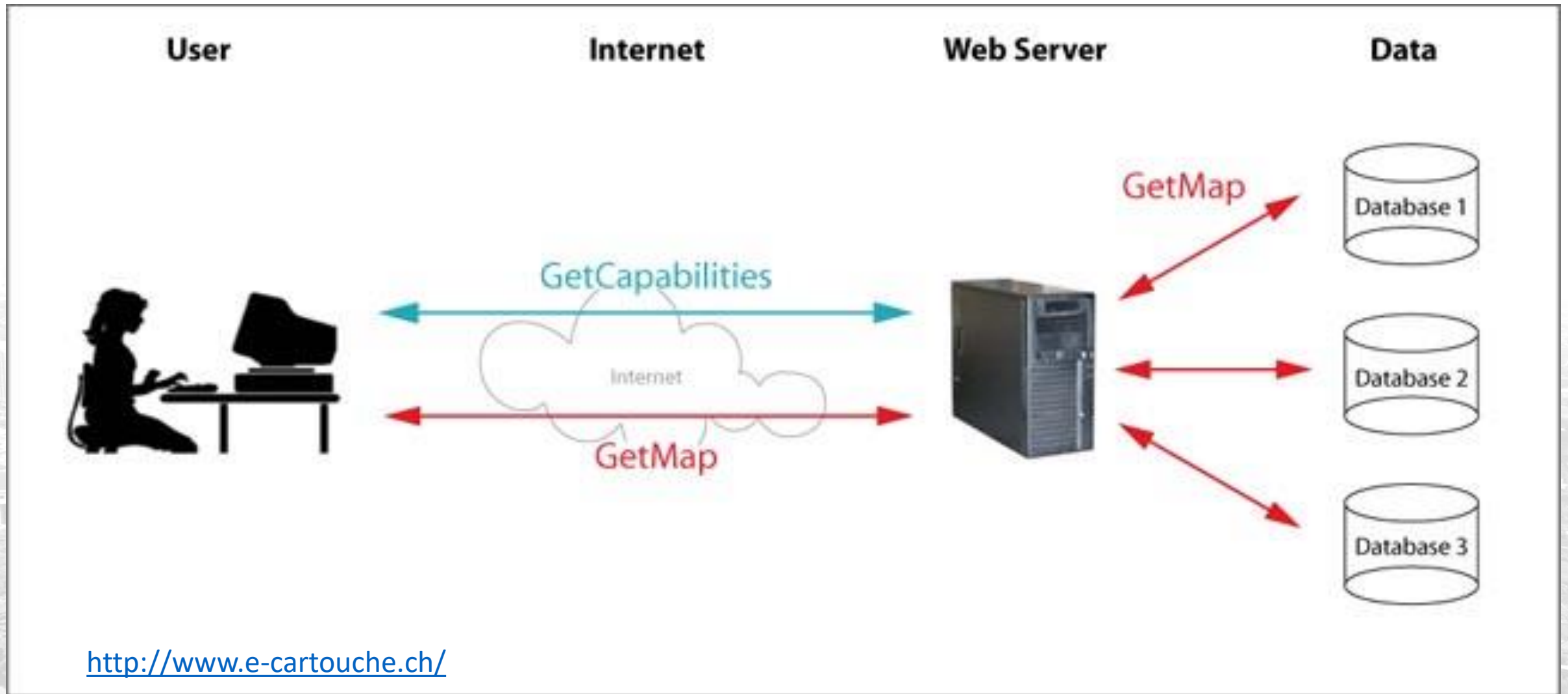
Standar Layanan Data Spasial untuk Interoperabilitas

A **Web Map Service (WMS)** is a standard **protocol** for serving georeferenced map images over the Internet that are generated by a map server using data from a GIS database

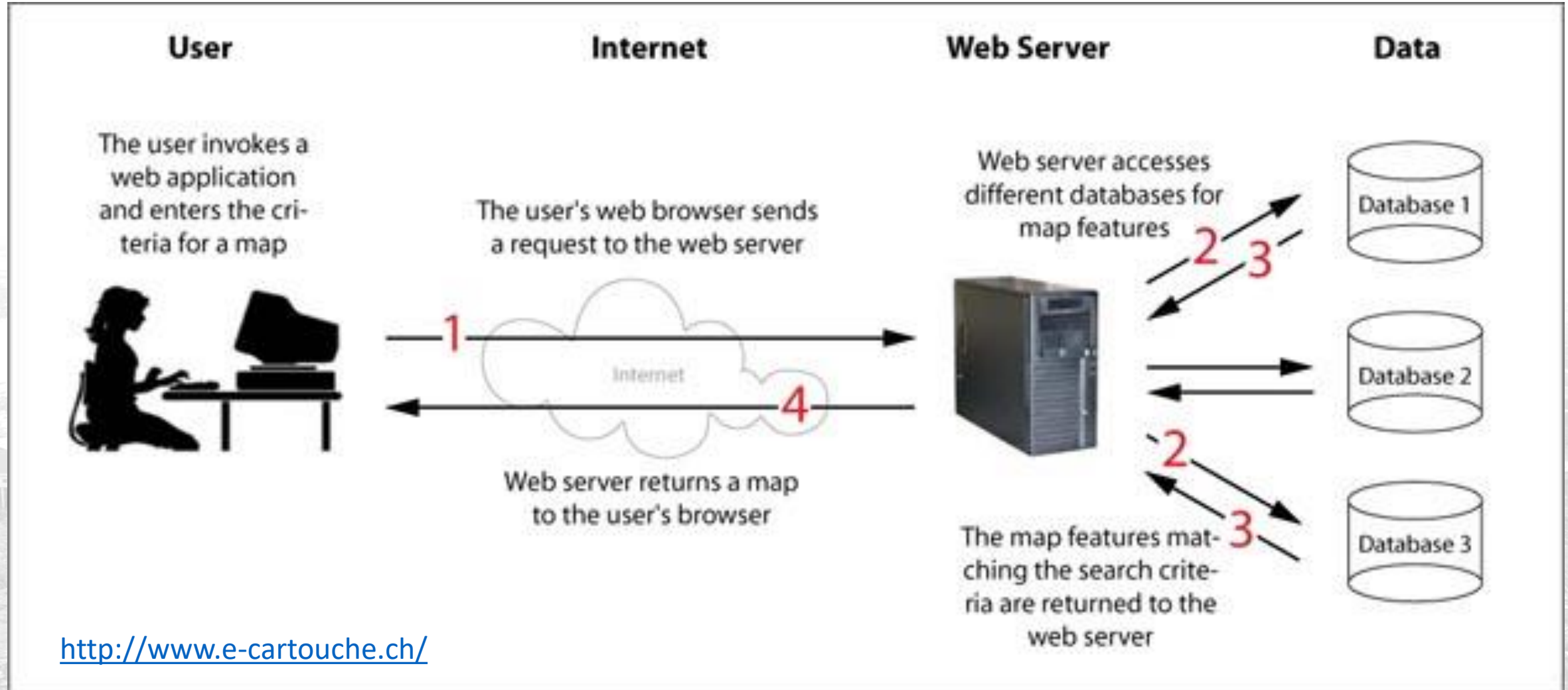
Web Feature Service Interface Standard (**WFS**) provides an interface allowing requests for geographical features across the web using platform-independent calls

Web Coverage Service Interface Standard (**WCS**) defines Web-based retrieval of coverages – that is, digital geospatial information representing space/time-varying phenomena

How WMS Works



How WMS Works



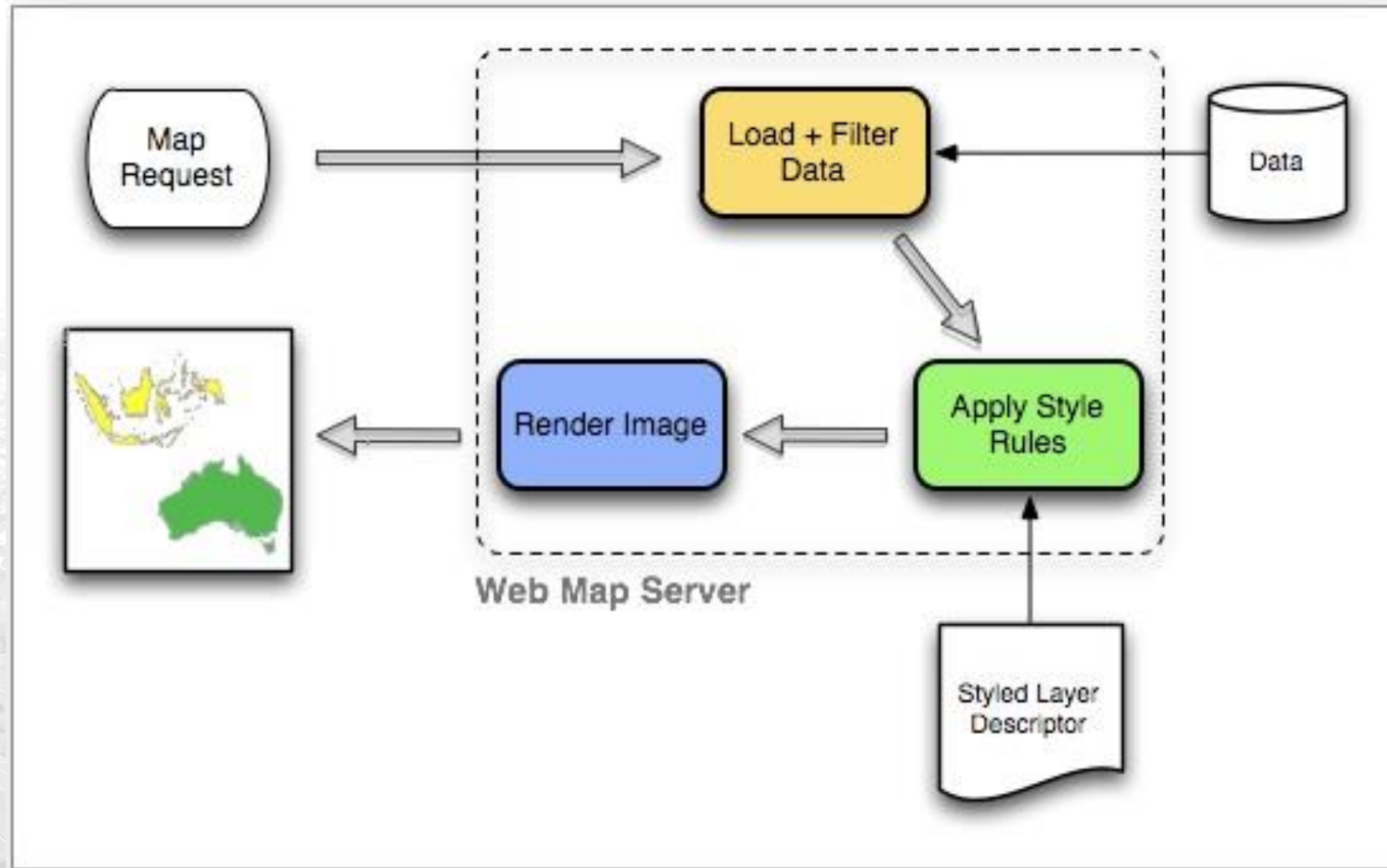
How WMS Works

In particular WMS defines the following *operations*:

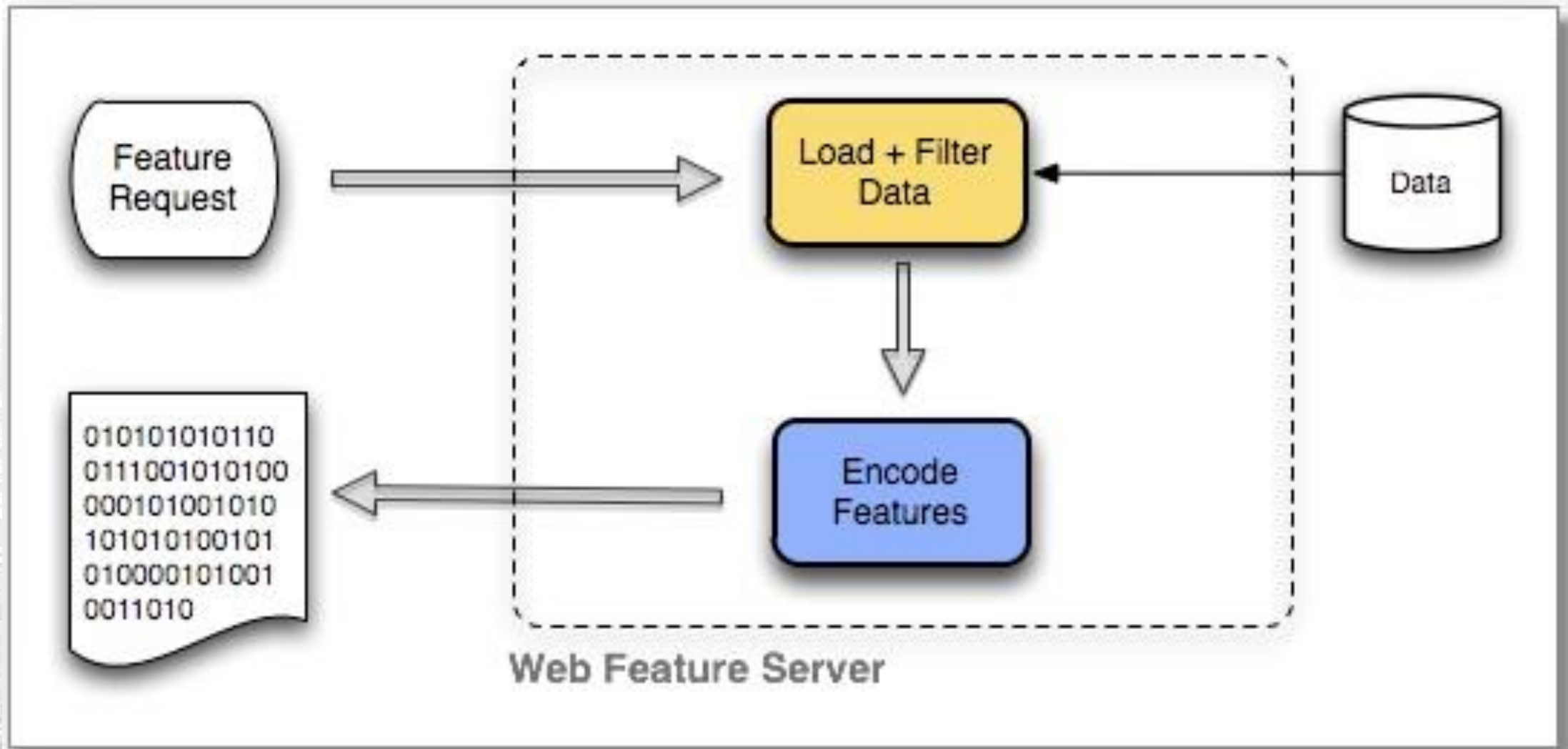
- 1) How to get and provide information about what types of maps a server can deliver (**GetCapabilities**)
- 2) How to request and provide a map as a picture or set of features (**GetMap**)
- 3) How to get and provide information about the content of a map such as the value of a feature at a location (**GetFeatureInfo**)

<http://www.e-cartouche.ch/>

How WMS Works



How WFS Works



Pengaturan Geoserver: Cek Capabilities

localhost:8080/geoserver/ows?service=WCS&version=2.0.1&request=GetCapabilities

This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
<wcs:Capabilities xmlns:wcs="http://www.opengis.net/wcs/2.0" xmlns:ows="http://www.opengis.net/ows/2.0" xmlns:gml="http://www.opengis.net/gml/3.2"
xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0" xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:wscrs="http://www.opengis.net/wcs/service-extension/crs/1.0" xmlns:int="http://www.opengis.net/WCS_service-extension_interpolation/1.0" version="2.0.1" up
xsi:schemaLocation=" http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCapabilities.xsd">
  <ows:ServiceIdentification>
    <ows:Title>Web Coverage Service</ows:Title>
    <ows:Abstract>
      This server implements the WCS specification 1.0 and 1.1.1, it's reference implementation of WCS 1.1.1. All layers published by this service are available o
    </ows:Abstract>
    <ows:Keywords>
      <ows:Keyword>WCS</ows:Keyword>
      <ows:Keyword>WMS</ows:Keyword>
      <ows:Keyword>GEOSERVER</ows:Keyword>
    </ows:Keywords>
    <ows:ServiceType>urn:ogc:service:wcs</ows:ServiceType>
    <ows:ServiceTypeVersion>2.0.1</ows:ServiceTypeVersion>
    <ows:ServiceTypeVersion>1.1.1</ows:ServiceTypeVersion>
    <ows:ServiceTypeVersion>1.1.0</ows:ServiceTypeVersion>
    <ows:Profile>http://www.opengis.net/spec/WCS/2.0/conf/core</ows:Profile>
  </ows:ServiceIdentification>
  <ows:Profile>
    http://www.opengis.net/spec/WCS_protocol-binding_get-kvp/1.0.1
  </ows:Profile>
  <ows:Profile>
    http://www.opengis.net/spec/WCS_protocol-binding_post-xml/1.0
  </ows:Profile>
  <ows:Profile>
    http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs-gridded-coverage
  </ows:Profile>
  <ows:Profile>
    http://www.opengis.net/spec/WCS_geotiff-coverages/1.0/conf/geotiff-coverage
  </ows:Profile>
  <ows:Profile>
    http://www.opengis.net/spec/GMLCOV/1.0/conf/gml-coverage
  </ows:Profile>
  <ows:Profile>
    http://www.opengis.net/spec/GMLCOV/1.0/conf/special-format
  </ows:Profile>
  <ows:Profile>
    http://www.opengis.net/spec/GMLCOV/1.0/conf/multipart
  </ows:Profile>
  <ows:Profile>
```

Service Capabilities

WCS

1.0.0
1.1.0
1.1.1
1.1
2.0.1

WFS

1.0.0
1.1.0
2.0.0

WMS

1.1.1
1.3.0

TMS

1.0.0

WMS-C

1.1.1

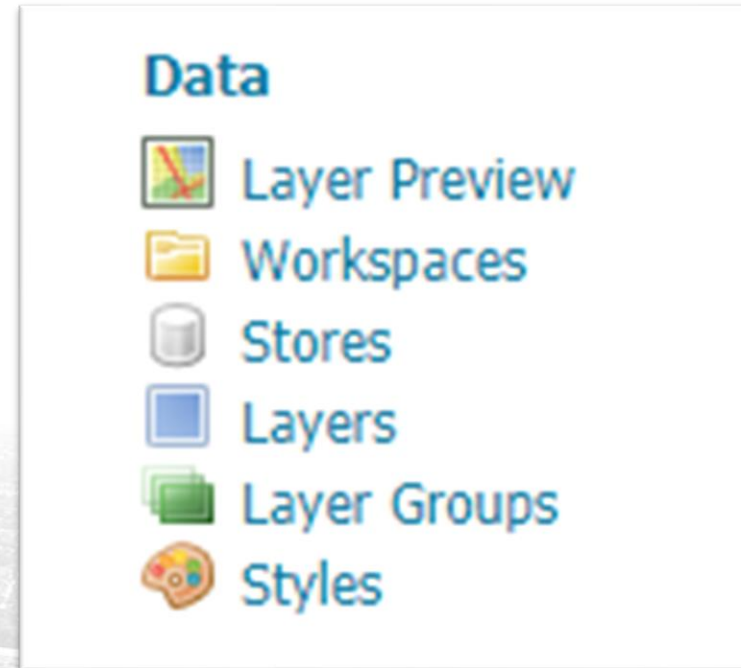
WMTS

1.0.0

Pengaturan Geoserver: Menambahkan Layer

Menambahkan data pada Geoserver

1. Buat **Workspace** baru (workspace \approx nama project)
2. Buat **Store** baru sesuai jenis data (vector/raster/cascading). Pilih workspace yang telah dibuat
3. **Publish layer** dengan mengatur extent, proyeksi dan styling
4. **Atur Style** apabila diperlukan
5. Uji Layanan Layer dengan menggunakan **Layer Preview**



Pengaturan Geoserver: Publish Layer

Coordinate Reference Systems

Native SRS

WGS_1984_UTM_Zone_49S...

Declared SRS

EPSG:WGS 84 / UTM zone 49S...

SRS handling

Bounding Boxes

Native Bounding Box

Min X

Min Y

Max X

Max Y

[Compute from data](#)

[Compute from SRS bounds](#)

Lat/Lon Bounding Box

Min X

Min Y

Max X

Max Y

[Compute from native bounds](#)

SRS handling

Native bounding box

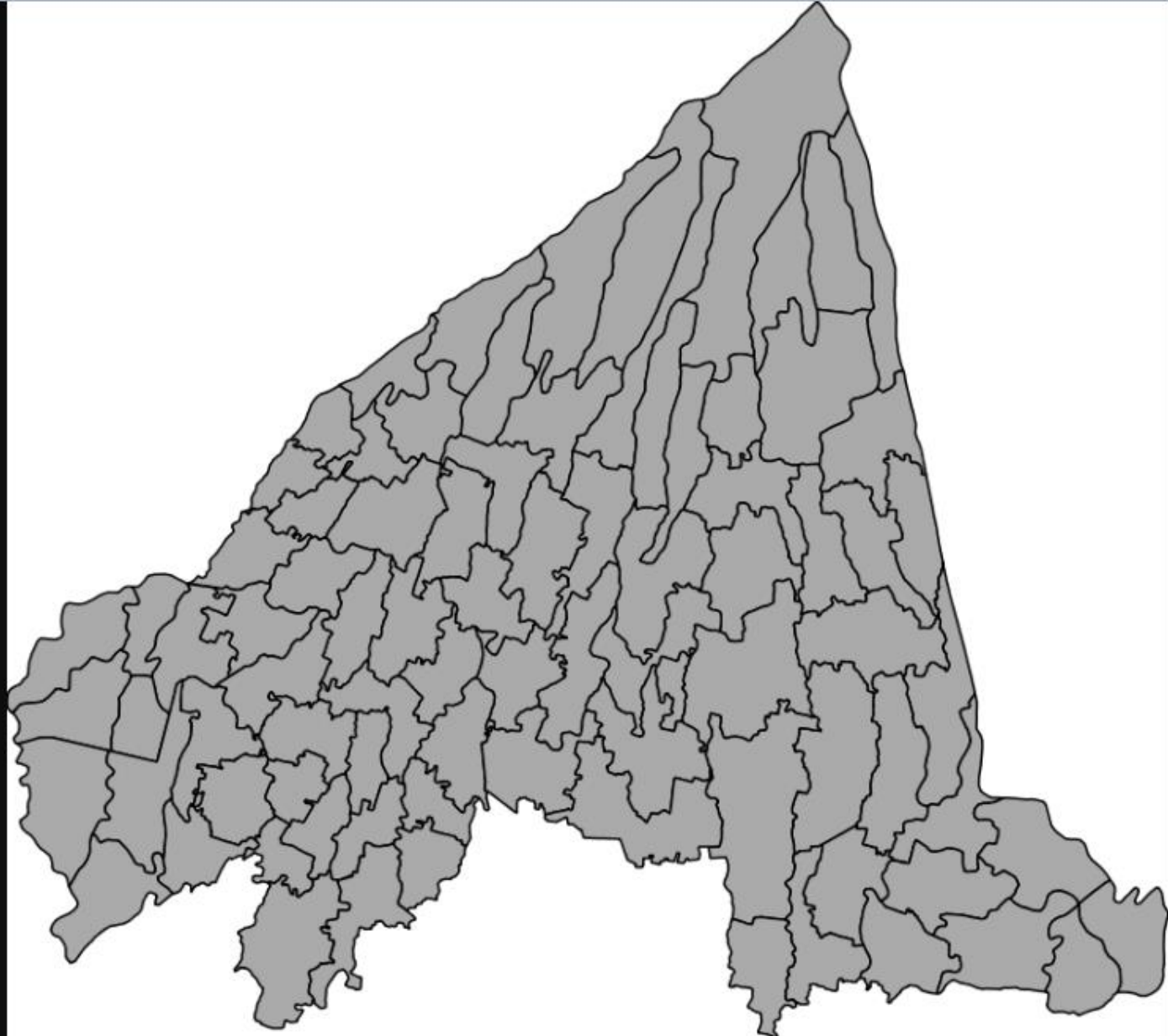
Memanggil Layer Geoserver pada QGIS

The image shows the QGIS Data Source Manager interface with the 'WMS/WMTS' section selected. A dialog box titled 'Create a New WMS/WMTS Connection' is open, displaying the following fields and options:

- Connection Details:** Name (text input), URL (text input).
- Authentication:** Configurations (Basic), Choose or create an authentication configuration (No authentication dropdown), and a note: 'Configurations store encrypted credentials in the QGIS authentication database.'
- WMS/WMTS Options:** Referer (text input), DPI_Mode (all dropdown), and several checkboxes: Ignore GetMap/GetTile URI reported in capabilities, Ignore GetFeatureInfo URI reported in capabilities, Ignore axis orientation (WMS 1.3/WMTS), Ignore reported layer extents, Invert axis orientation, and Smooth pixmap transform.

On the right side, a list of available geoserver protocols is shown:

- WMS/WMTS
- WCS
- WFS
- ArcGIS Map Server
- ArcGIS Feature Server
- GeoNode



Menggunakan Layanan OGC: WMS

WMS Parameter (Key Value Pair)

[http://localhost:8080/geoserver/Sleman/wms?](http://localhost:8080/geoserver/Sleman/wms?service=WMS&version=1.1.0&request=GetMap&layers=Sleman%3ABatas_Desa&bbox=413535.5625%2C9133697.0%2C450074.4375%2C9166253.0&width=768&height=684&srs=EPSG%3A32749&format=image%2Fpng)

service=WMS

&version=1.1.0

&request=GetMap

&layers=Sleman%3ABatas_Desa

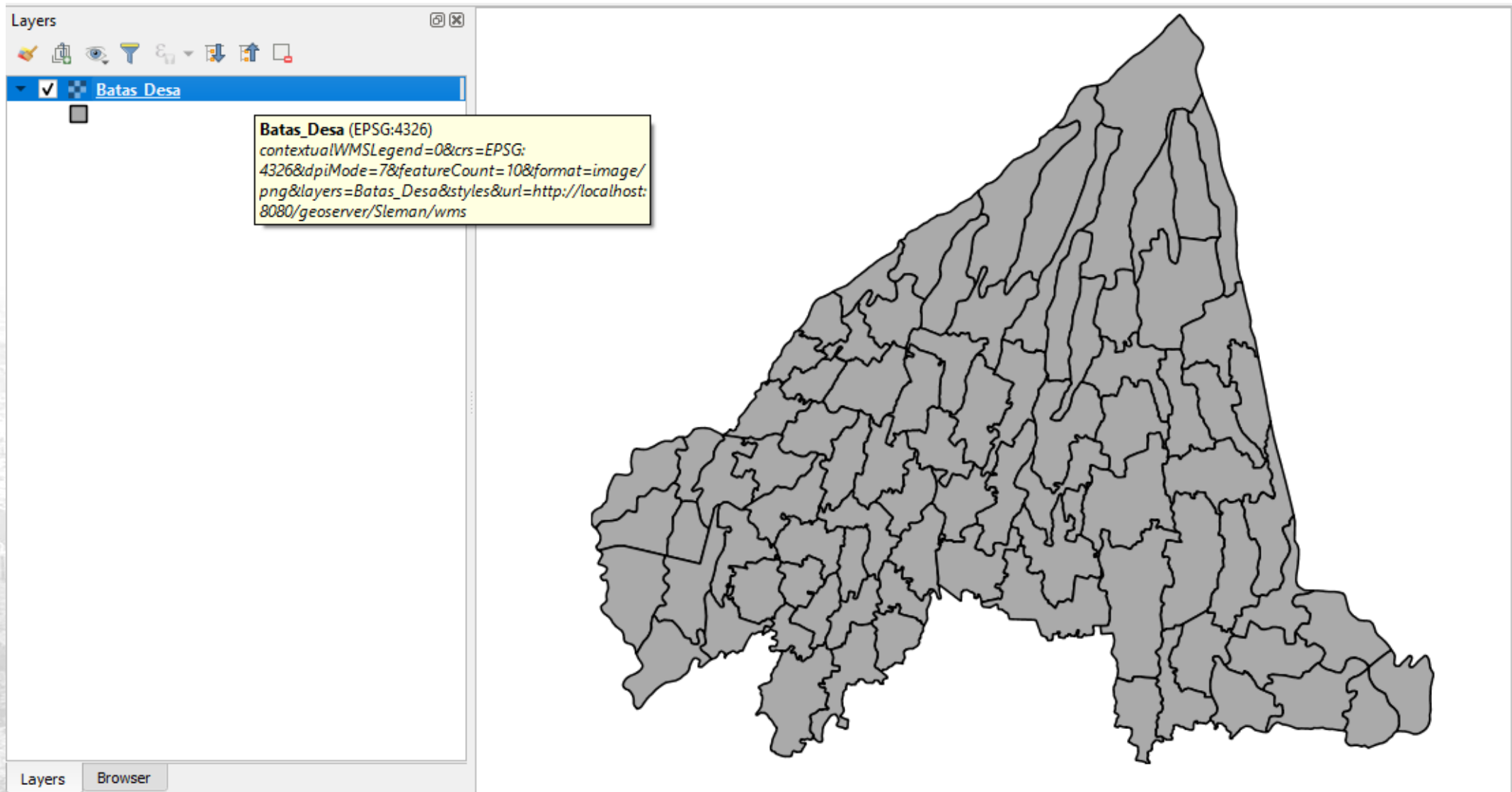
&bbox=413535.5625%2C9133697.0%2C450074.4375%2C9166253.0

&width=768&height=684

&srs=EPSG%3A32749

&format=image%2Fpng

Menggunakan Layanan OGC: WMS



Menggunakan Layanan OGC: WFS

WFS Parameter (Key Value Pair)

[http://localhost:8080/geoserver/Sleman/ows?](http://localhost:8080/geoserver/Sleman/ows?service=WFS&version=1.0.0&request=GetFeature&typeName=Sleman%3ABatas_Desa&maxFeatures=50&outputFormat=application%2Ffgml%2Bxml%3B%20version%3D3.2)

service=WFS

&version=1.0.0

&request=GetFeature

&typeName=Sleman%3ABatas_Desa

&maxFeatures=50

&outputFormat=application%2Ffgml%2Bxml%3B%20version%3D3.2

Menggunakan Layanan OGC: WFS

The screenshot displays a GIS interface with a map of village boundaries (Batas Desa) in Sleman, Indonesia. The map is color-coded by village. A layer list on the left shows two layers named 'Batas Desa'. A tooltip for the selected layer provides the following details:

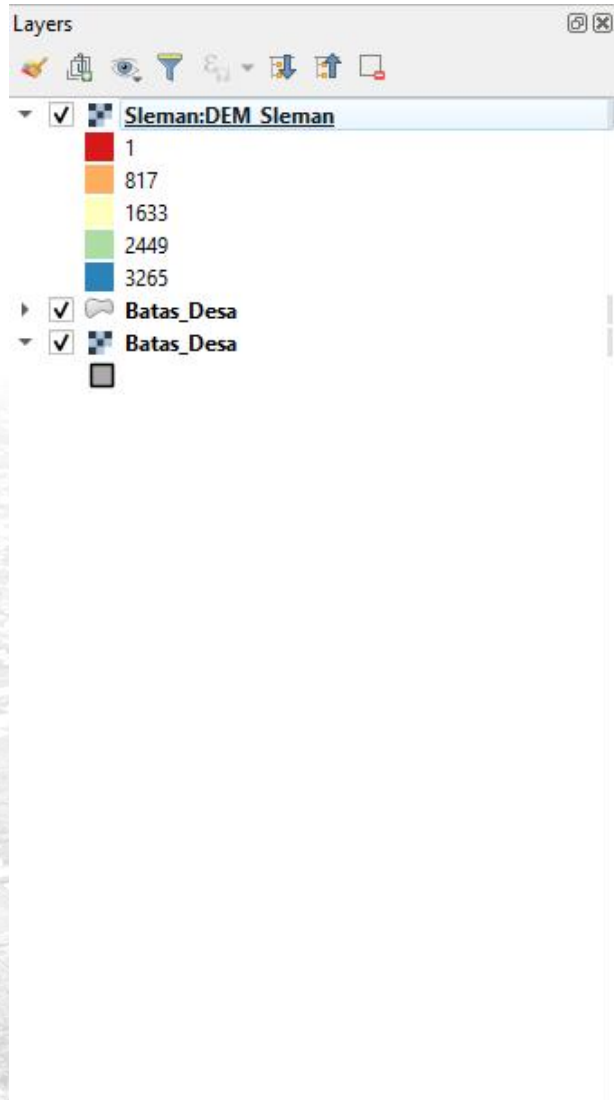
```
Batas_Desa (MultiPolygon - EPSG:32749)  
user='admin' pagingEnabled='true'  
srsname='EPSG:32749'  
typename='Sleman:Batas_Desa'  
url='http://localhost:8080/geoserver/  
Sleman/ows' version='auto' table='' sql=
```










Below the map, a data table window titled 'Batas_Desa :: Features Total: 86, Filtered: 86, Selected: 0' is open, showing a list of village features with their attributes:

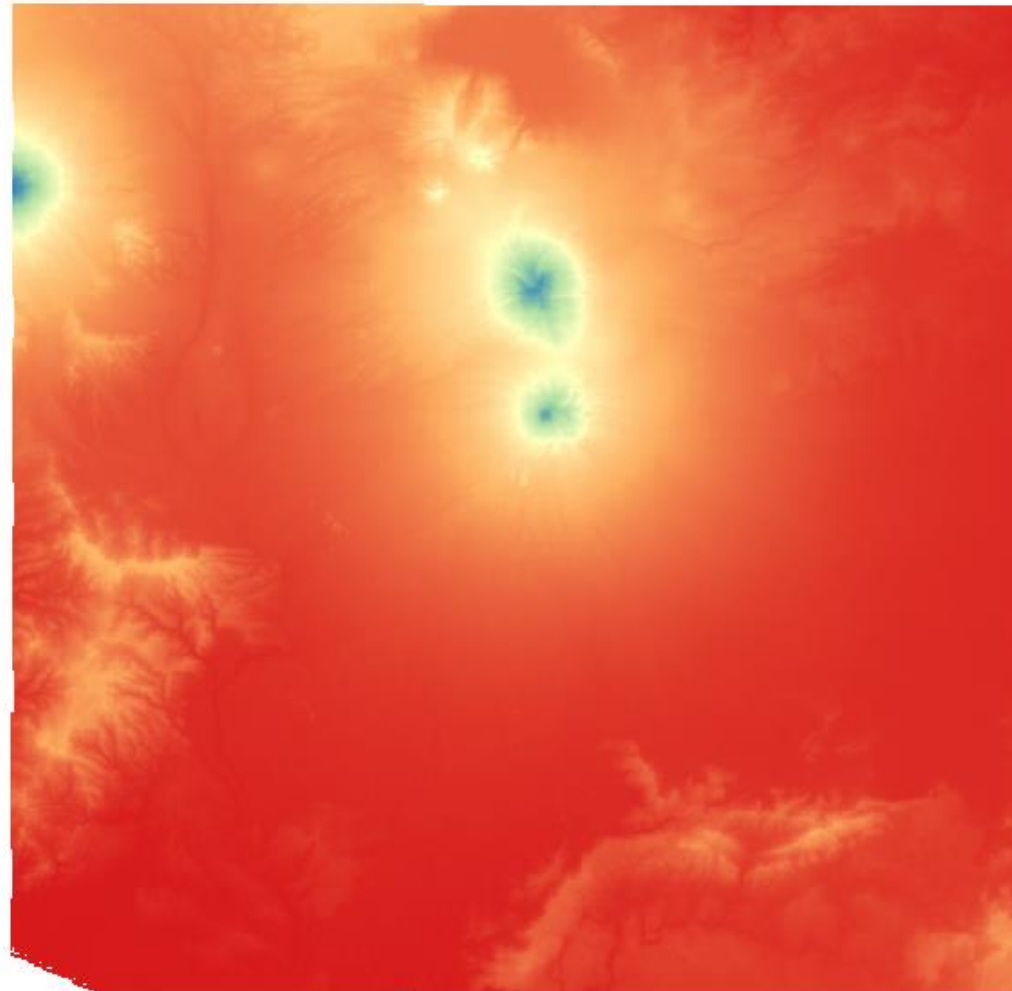
	STATUS_KOT	KODE_2008	DESA_2008	KEC_2008	KAB_2008	PROP_2008
1	DESA	-2147483648	CANDI BINANG...	PAKEM	SLEMAN	DIY
2	DESA	-2147483648	WUKIR SARI	CANGKRINGAN	SLEMAN	DIY
3	DESA	-2147483648	HARGO BINAN...	PAKEM	SLEMAN	DIY
4	DESA	-2147483648	MARGO REJO	TEMPEL	SLEMAN	DIY
5	DESA	-2147483648	PAKEM BINAN...	PAKEM	SLEMAN	DIY
6	KOTA	-2147483648	DONOKERTO	TURI	SLEMAN	DIY
7	KOTA	-2147483648	LUMBUNG REJO	TEMPEL	SLEMAN	DIY
8	DESA	-2147483648	MORO REJO	TEMPEL	SLEMAN	DIY

Menggunakan Layanan OGC: WCS

Layers



-  Sleman:DEM Sleman
 -  1
 -  817
 -  1633
 -  2449
 -  3265
-  Batas_Desa
-  Batas_Desa
- 



Menggunakan Layanan OGC: Tiling Service


Terdapat tiga macam Tiling Service (Slippy Maps) yang didukung oleh OGC/Geoserver:

1. TMS (Tile Map Service)
2. WMS-C (WMS-Cached)
3. WMTS (Web Map Tile Service)

Selain itu, WMS juga mendukung operasi untuk tiling ('on-the-fly' tiling) dengan WMS-T

Menggunakan Layanan OGC: Tiling Service

localhost:8080/geoserver/gwc/rest/seed/Sleman:Guna_Lahan

 GeoWebCache

List (there are no tasks for other Layers)

Kill Tasks for Layer 'Sleman:Guna_Lahan'.

List of currently executing tasks:

- none

[Refresh list](#)

Please note:

- This minimalistic interface does not check for correctness.
- Seeding past zoomlevel 20 is usually not recommended.
- Truncating KML will also truncate all KMZ archives.
- Please check the logs of the container to look for error messages and

Here are the max bounds, if you do not specify bounds these will be used.

- EPSG:4326: 110.21571350111506,-7.836982600789105,110.54744
- EPSG:900913: 12269157.104361456,-875142.0341967946,1230608

Create a new task:

Number of tasks to use:
































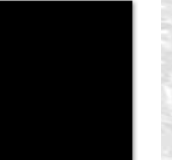
Type of operation:

Grid Set:

Format:

Zoom start:

Windows (C:) > gwc_cache > Sleman_Batas_Desa > EPSG_4326_13 > 103_029

 013208_003739.png	 013208_003740.png	 013208_003741.png	 013208_003742.png	 013208_003743.png	 013208_003752.png	 013209_003739.png	 013209_003740.png
 013209_003743.png	 013209_003752.png	 013210_003739.png	 013210_003740.png	 013210_003741.png	 013210_003742.png	 013210_003743.png	 013210_003752.png
 013211_003741.png	 013211_003742.png	 013211_003743.png	 013211_003752.png	 013212_003739.png	 013212_003740.png	 013212_003741.png	 013212_003742.png
 013212_003745.png	 013212_003746.png	 013212_003747.png	 013212_003748.png	 013212_003749.png	 013212_003750.png	 013212_003751.png	 013212_003752.png

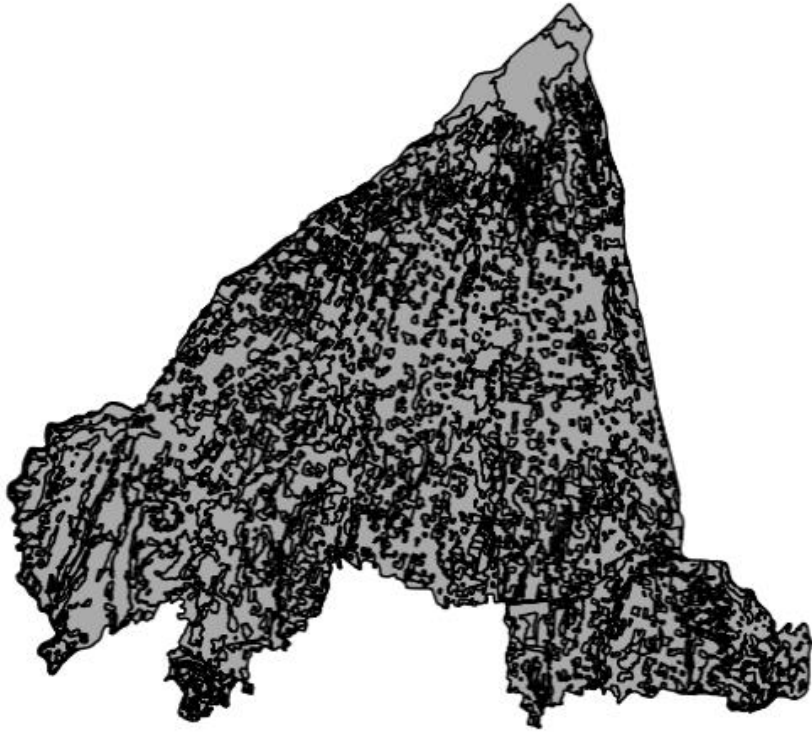
Menggunakan Layanan OGC: Tiling Service (WMTS)

localhost:8080/geoserver/gwc/demo/Sleman:Guna_Lahan?gridSet=EPSG:4326&format=image/png

Modifiable Parameters:
STYLES: polygon ▾

+
-

110.43010711669922,-7.570953369140625
Scale = 1 : 273K



Guna_Lahan

fid	FID_per_ka	KAB_2008	PROV	FID_pt_340	PL_T2	LUAS_m	LUAS_ha
Guna_Lahan.108	3	SLEMAN	DIY	14445	HUTAN	9328658.04	932.87

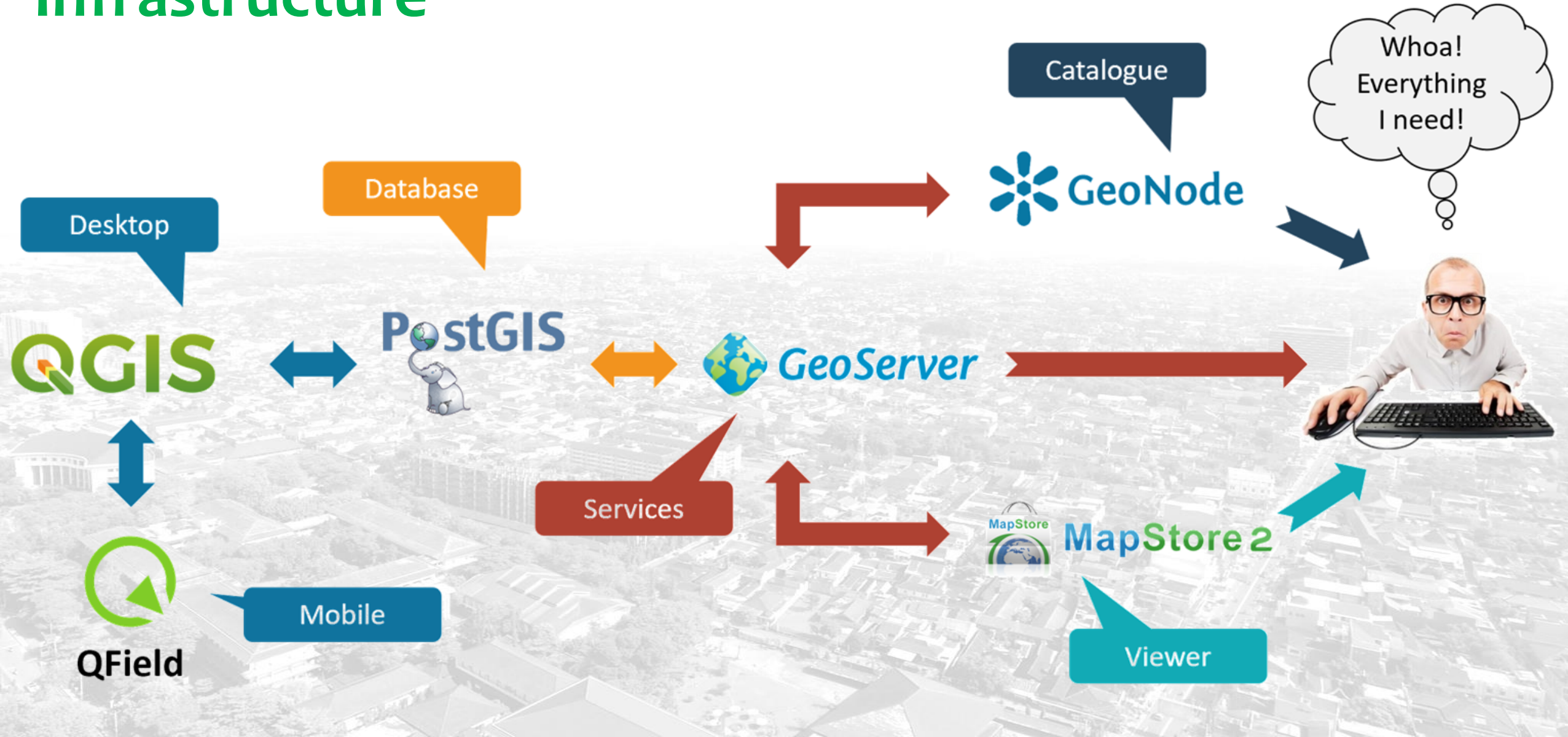
Penggunaan Layanan OGC

Contoh pemanfaatan layanan OGC untuk interoperabilitas:

WebGIS desa yang memanfaatkan data:

1. WMS Citra SPOT 6 desa dari Badan Informasi Geospasial sebagai latar belakang
2. WMS Batas Desa dari BPS sebagai latar belakang
3. WFS Jaringan Jalan dari PU untuk analisis buffer
4. WFS bangunan desa dari server local untuk simbologi atribut
5. WCS Cuaca terkini dari BMKG

Enterprise Geospatial Information Infrastructure



Tugas Akhir Mata Kuliah IIG

Buat skenario dan rancangan sistem yang mendemonstrasikan Infrastruktur Informasi Geospasial dalam bentuk:

- Satu buah geoportal nasional
- Minimal satu geoportal node (boleh digunakan geoportal yang sudah ada)
- Masing-masing satu Map Viewer dan Satu Server Data Spasial
- Detil dan panduan teknis tugas menyusul



Arsitektur Infrastruktur Informasi Geospasial

Spatial Data Server
Only



Full-Fledge Geoportal



Map Viewer Only

MapStore 2





UNIVERSITAS
GADJAH MADA

TERIMA KASIH

LOCALLY ROOTED, GLOBALLY RESPECTED

UGM.AC.ID