

# Treinamento no desenvolvimento de aplicações GIS

## Módulo 03: Servidor de mapas GeoServer





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# Ficha técnica

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# Agenda

- Visão geral sobre o GeoServer
  - Web Map Service (WMS)
  - Web Feature Service (WFS)
- Instalação e execução do GeoServer
- Interface de administração
- Publicando dados geoespaciais
  - Arquivos: Shapefile e GeoTIFF
  - Banco de dados: PostGIS
- Edição de estilos customizados

# O que é o GeoServer?

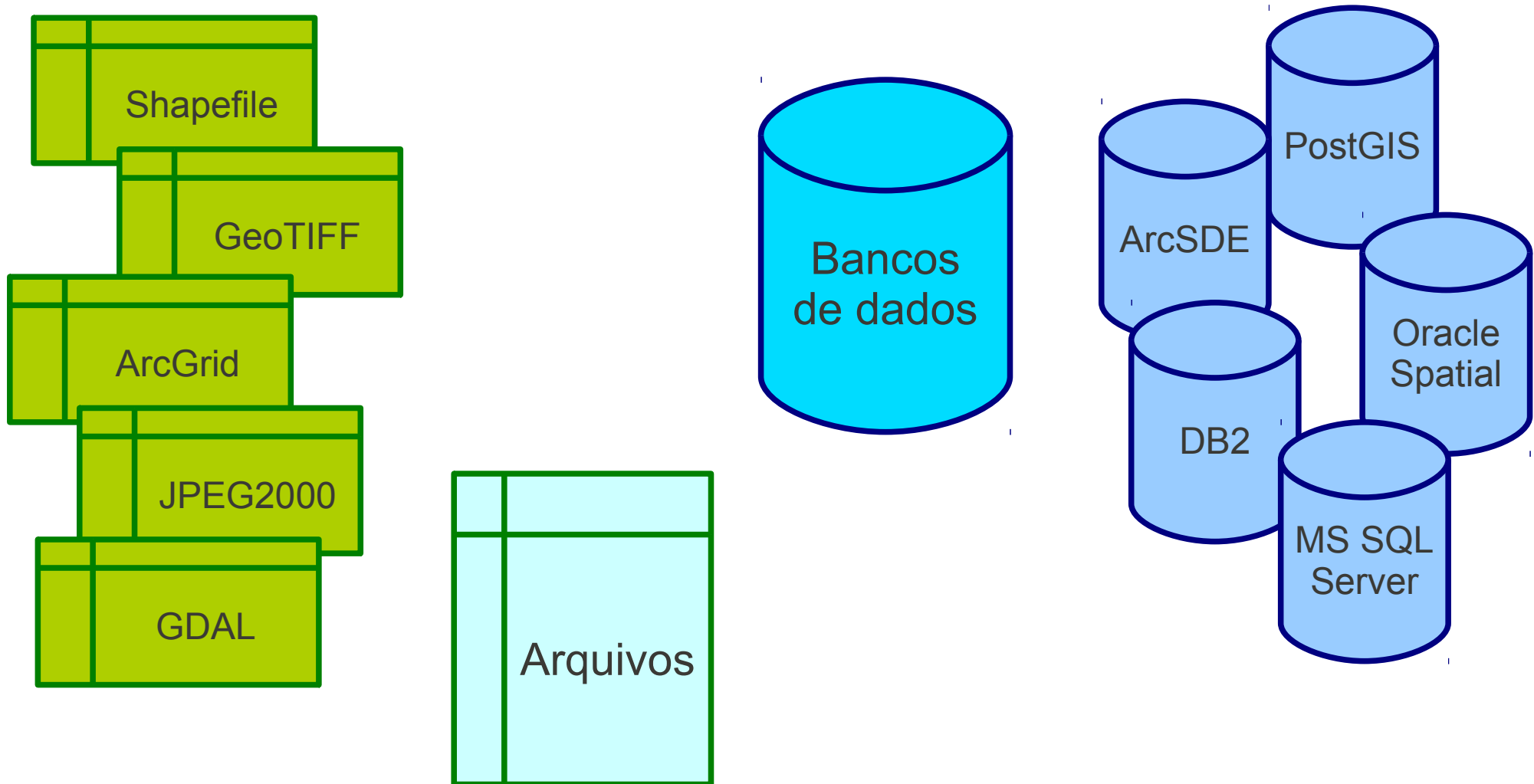
- Servidor Web de mapas (tal como MapServer, Mapnik e ArcGIS Server)
- Aplicação Java EE que permite a exibição e edição de dados geoespaciais
- De código aberto, escrito em Java
- Usa padrões abertos (visa interoperabilidade)



**GeoServer**



# Possíveis fontes de dados



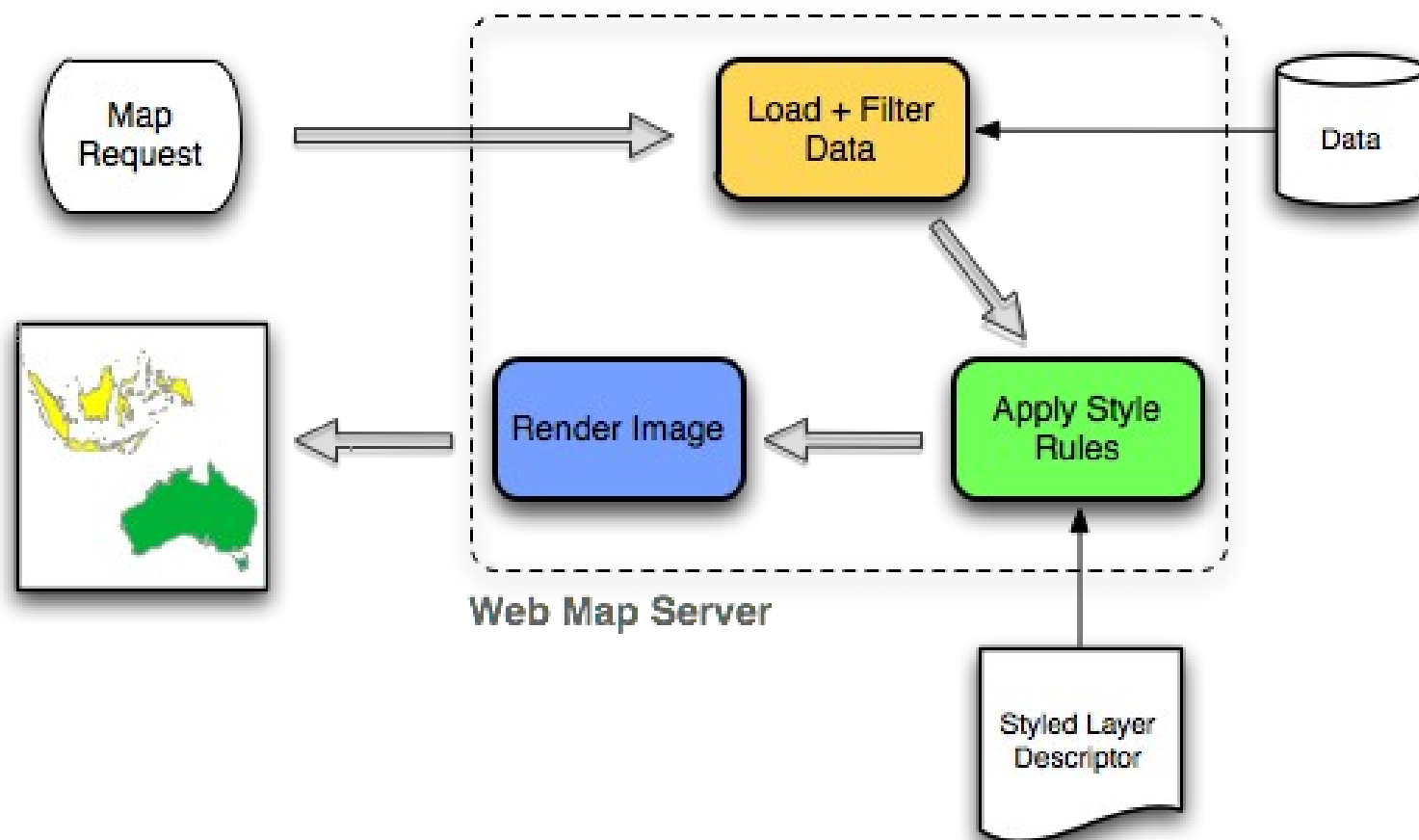
# Protocolos OGC no GeoServer

- GeoServer implementa protocolos padrões abertos da Web estabelecidos pelo **OGC**
- Geoserver é a **implementação de referência** dos padrões **WFS** e **WCS** e é altamente compatível com **WMS**
- GeoServer disponibiliza mapas e dados através destes protocolos



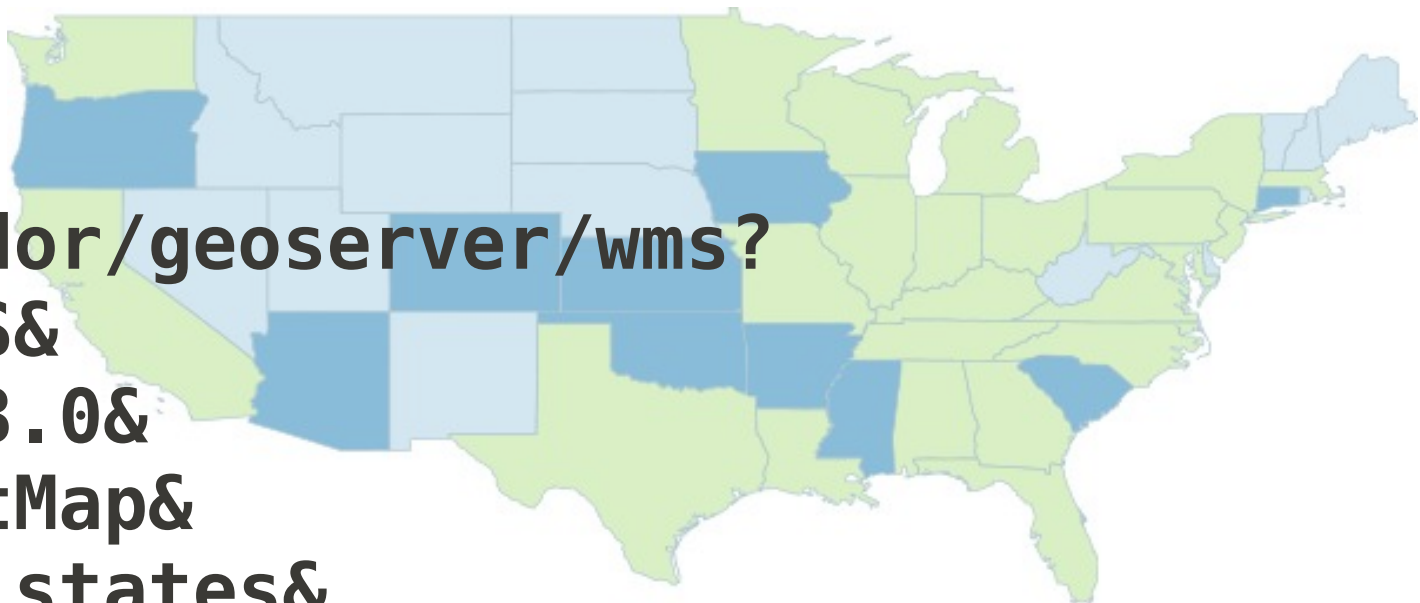
# Web Map Service (WMS)

- Requisição de ladrilhos de imagens (png, jpg, gif)





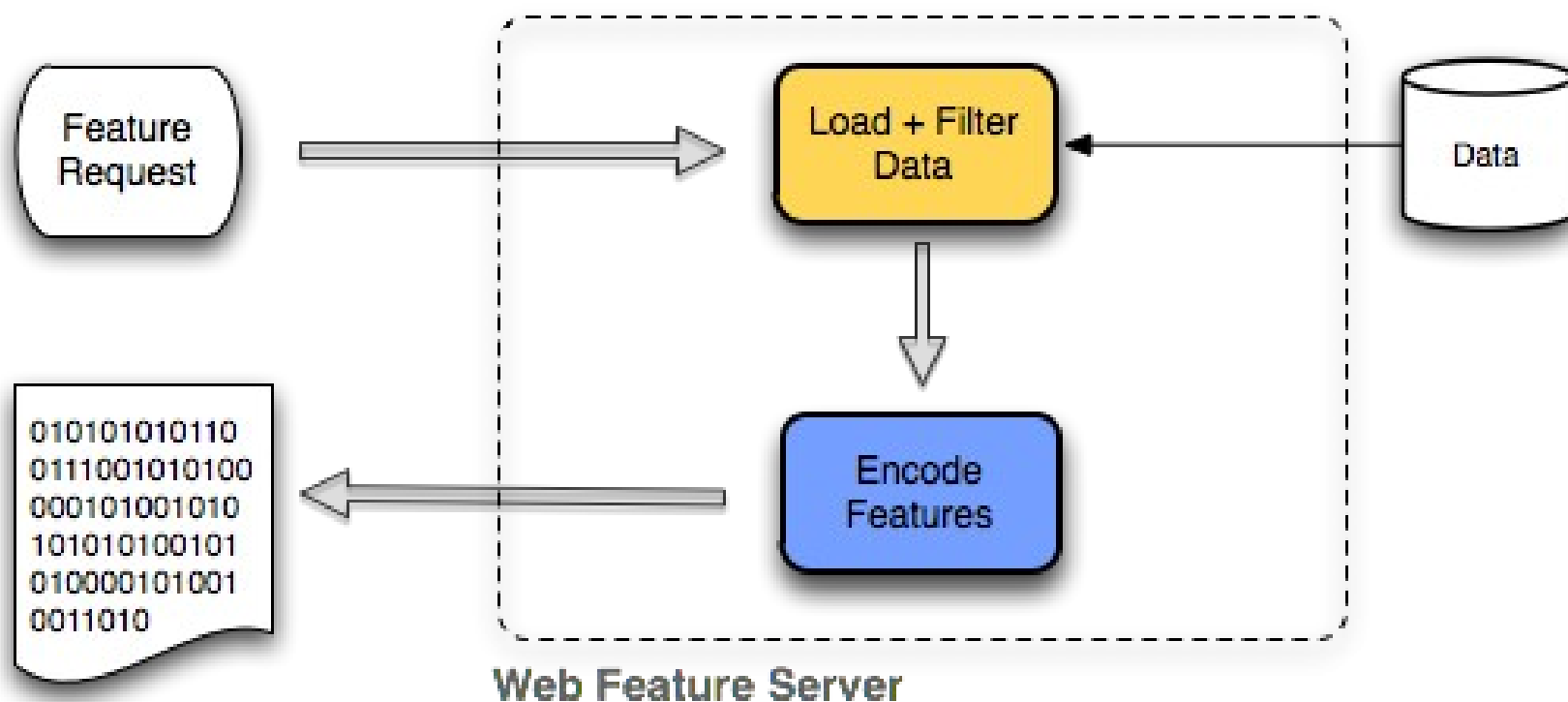
# Exemplo de requisição WMS



**`http://servidor/geoserver/wms?  
SERVICE=WMS&  
VERSION=1.3.0&  
REQUEST=GetMap&  
LAYERS=usa:states&  
SRS=EPSG:4326&  
BBOX=24.956,-124.731,49.372,-66.97&  
FORMAT=image/png&  
WIDTH=600&  
HEIGHT=255`**

# Web Feature Service (WFS)

- Requisição de dados geográficos de feições



# Exemplo de requisição WFS

```
- <wfs:FeatureCollection numberOfFeatures="1" timeStamp="2011-07-01T21:35:21.683Z" xsi:schemaLocation="http://usa.opengeo.org
http://suite.opengeo.org/geoserver/wfs?service=WFS&version=1.1.0&request=DescribeFeatureType&typeName=usa%3Astates
http://www.opengis.net/wfs http://suite.opengeo.org/geoserver/schemas/wfs/1.1.0/wfs.xsd">
- <gml:featureMembers>
- <usa:states gml:id="states.39">
- <usa:the_geom>
- <gml:MultiSurface srsDimension="2" srsName="urn:x-ogc:def:crs:EPSG:4326">
- <gml:surfaceMember>
- <gml:Polygon>
- <gml:exterior>
- <gml:LinearRing>
- <gml:posList>
```

**http://servidor/geoserver/wfs?**  
**SERVICE=wfs&**  
**VERSION=1.1.0&**  
**REQUEST=GetFeature&**  
**TYPENAME=usa:states&**  
**FEATUREID=states.39**

42.857365 -79.762466 42.419294 42.000000 42.000000 -79.444252 42.000000 -79.355118 42.574557 79.999999 79.999999 -79.142471  
42.699187 79.999999 -79.043991 42.792686 -78.859444 42.974174 40.000000 40.000005 -78.93679 43.022301 -78.883034  
42.06557 40.000001 -78.925835 43.090549 40.000000 40.000001 -79.061348 43.144684 40.000000 40.000001 -79.039558  
43.268161 79.999999 -79.062469 43.371937 -78.464905 43.365512 79.999999 -77.992271 43.335109 79.999999 986  
77.745277 43.240000 40.000000 40.000001 -77.575989 43.275650 40.000000 40.000001 -77.377602 43.278529 79.999999 999 -76.914841  
43.342667 40.000000 40.000006 -76.737152 43.323375 79.999999 999 -76.718796 43.414085 -76.619957 43.500652  
76.619957 43.500652 43.500652 76.619957 43.500652 43.500652 76.619957 43.500652 43.500652 76.619957 43.500652  
43.835063 79.999999 -76.240341 43.91243 -76.194069 43.932148 40.000000 40.000001 -76.129417 44.013172 -76.134872  
44.067469 79.999999 -76.200000 40.000001 -76.297226 44.098300 79.999999 999 -76.363213 44.390209  
-75.848351 44.517474 79.999999 -75.758972 44.810570 40.000000 40.000001 -75.329201 44.948578 -74.968819  
44.990000 79.999999 -74.990000 40.000001 -74.021935 45.0061 -73.345146 44.981933 79.999999 995 -73.351181  
44.022564 40.000000 40.000001 72.226929 44.047902 72.292700 44.010076 40.000000 40.000000 72.260476 44.700051 40.000000 40.000006

# Outros protocolos: WCS e WPS

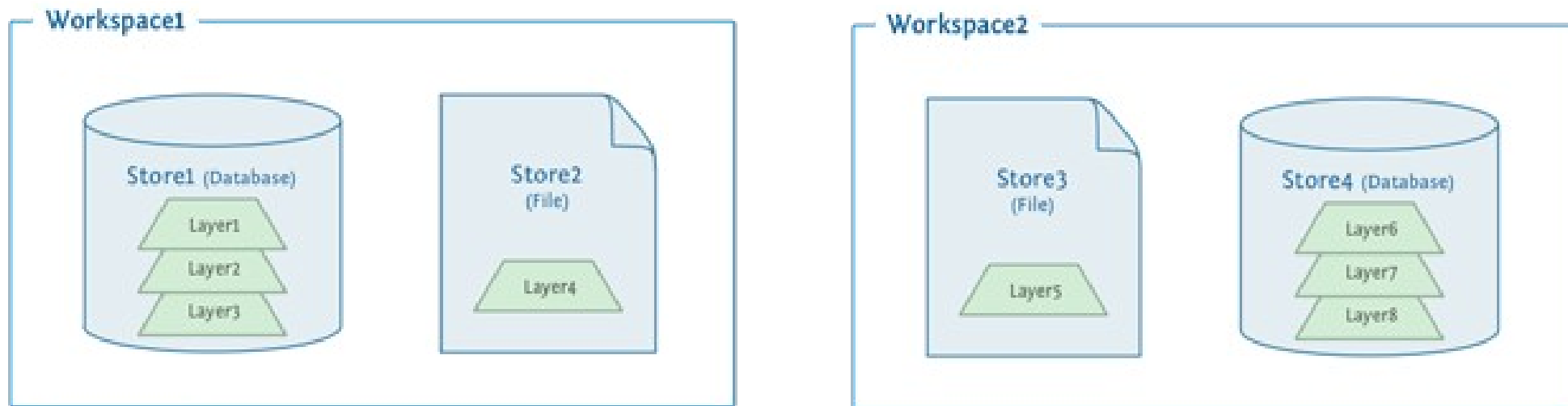
- **Web Coverage Service (WCS)**

- Permite acesso aos atributos dos dados matriciais (i.e., dados de cobertura)
- Análogo matricial do WFS (acesso aos dados rasterizados originais)

- **Web Processing Service (WPS)**

- Publicação de processos, algoritmos e cálculos geoespaciais
- Estende o servidor de mapas fornecendo análise geoespacial

# Objetos do GeoServer



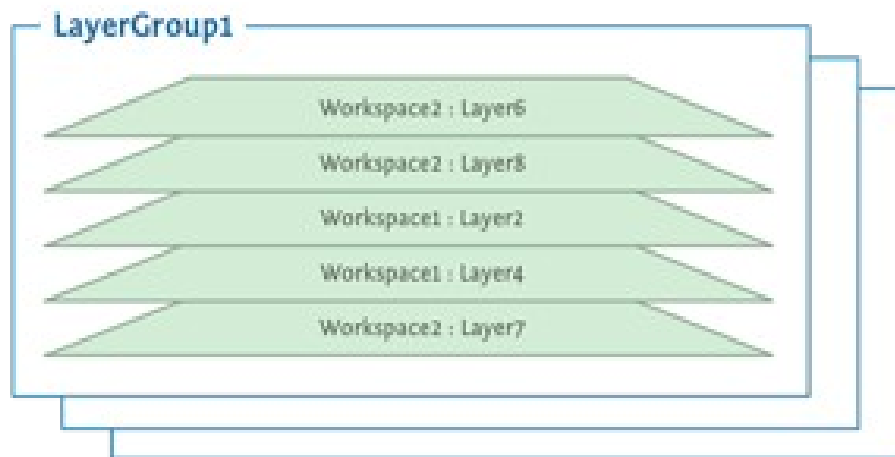
**workspace**

**store**

**layer**

**layer group**

**style**





# Instalando e executando o GeoServer

- Servidor Tomcat (Debian/Ubuntu)

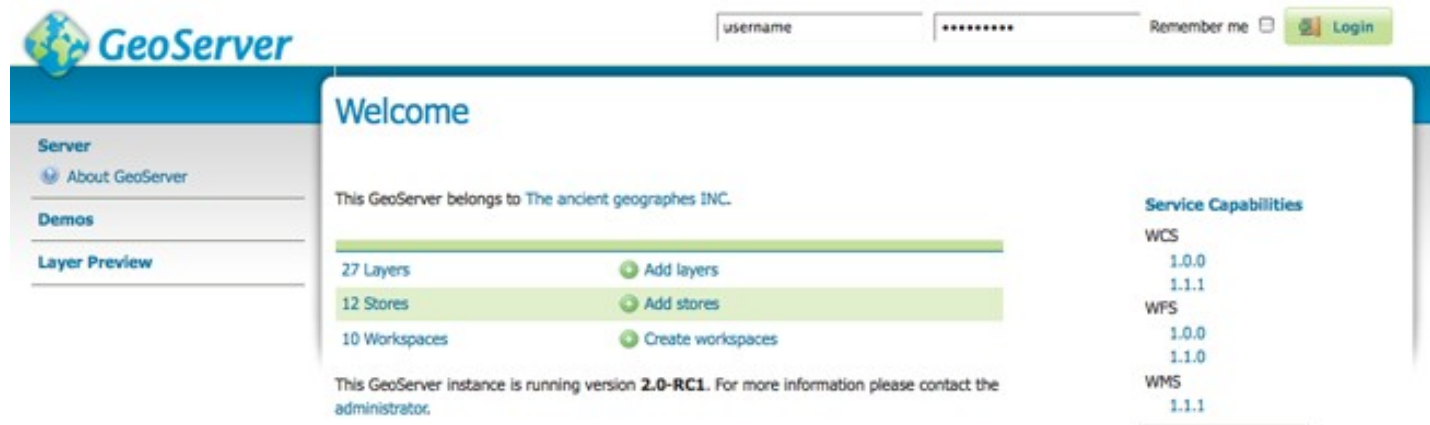
```
apt-get install tomcat6  
cp geoserver.war /var/lib/tomcat6/webapps
```

- Standalone Jetty

```
unzip geoserver-bin.zip  
chmod +x ./geoserver/bin/*.sh  
./geoserver/bin/startup.sh
```

# Interface de administração

- Web Administration Tool: aplicação usada para configurar o GeoServer
- Acesso via browser no endereço:  
<http://localhost:8080/geoserver/web>
- Usuário: **admin**, senha: **geoserver**



# Explorando o GeoServer

The screenshot displays the GeoServer web interface in a browser window. The address bar shows `localhost:8080/geoserver/web/`. The page is titled "GeoServer: Welcome" and indicates the user is logged in as "admin" with a "Logout" button.

**Navigation Menus:**

- About & Status:** Server Status, GeoServer Logs, Contact Information, About GeoServer.
- Data:** Layer Preview, Workspaces, Stores, Layers, Layer Groups, Styles.
- Services:** WCS, WFS, WMS, WPS.
- Settings:** Global.

**Welcome Message:**

Welcome

This GeoServer belongs to [SERPRO](#).

**Resource Summary:**

Resource	Count	Action
Layers	48	<a href="#">Add layers</a>
Stores	14	<a href="#">Add stores</a>
Workspaces	11	<a href="#">Create workspaces</a>

**Security Warnings:**

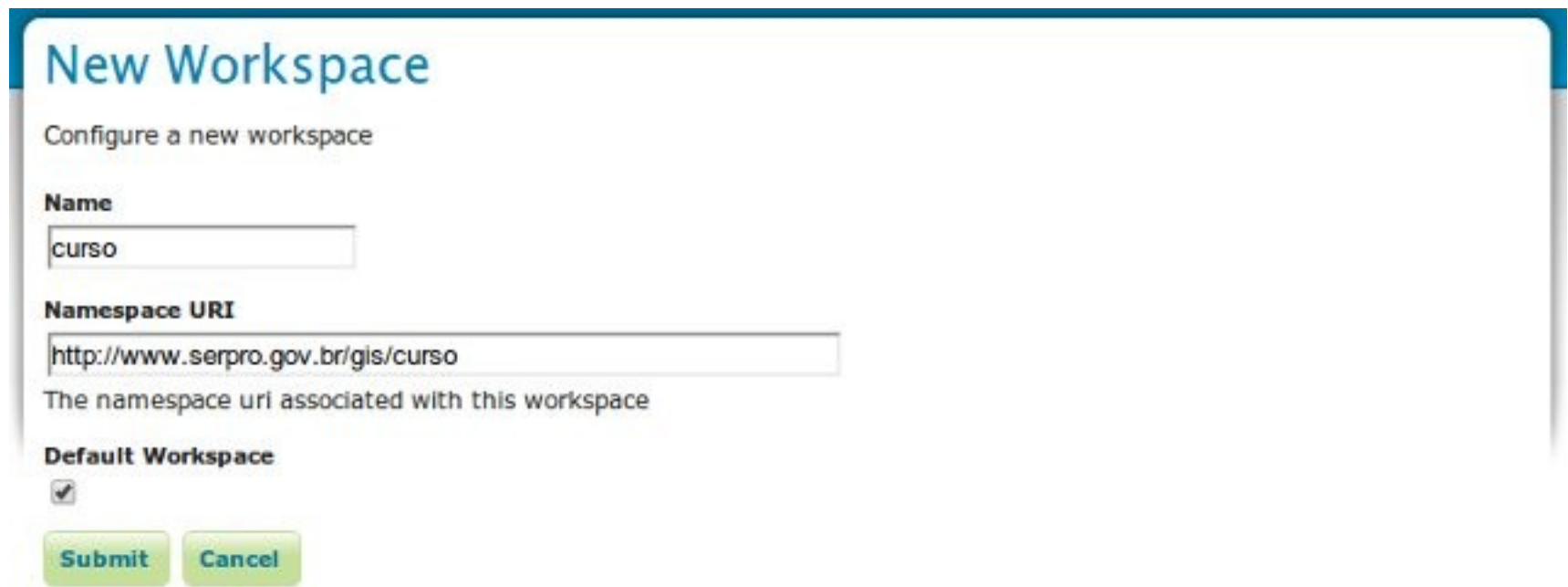
- Warning 1:** Please read the file `/var/lib/tomcat6/webapps/geoserver/data/security/masterpw.info` and remove it afterwards. This file is a **security risk**.
- Warning 2:** Please remove the file `/var/lib/tomcat6/webapps/geoserver/data/security/users.properties.old` because it contains user passwords in plain text. This file is a **security risk**.
- Warning 3:** The default user/group service should use digest password encoding.
- Warning 4:** The administrator password for this server has not been changed from the default. It is **highly** recommended that you change it now. [Change it](#)

**Service Capabilities:**

Service	Version
WCS	1.0.0
	1.1.1
WFS	1.0.0
	1.1.0
	2.0.0
WMS	1.1.1
	1.3.0
WPS	1.0.0
TMS	1.0.0
WMS-C	1.1.1
WMTS	1.0.0

# Criando um workspace

- Nome: curso
- URI: `http://www.serpro.gov.br/gis/curso`
- Padrão



The screenshot shows a 'New Workspace' dialog box with the following fields and options:

- Name:** A text input field containing the value 'curso'.
- Namespace URI:** A text input field containing the value 'http://www.serpro.gov.br/gis/curso'. Below this field is the text 'The namespace uri associated with this workspace'.
- Default Workspace:** A checkbox that is checked.
- Buttons:** 'Submit' and 'Cancel' buttons at the bottom.

# Extrair shapes do Brasil

- Extrair conteúdo do arquivo **shapes-brasil.zip** para o diretório **/data/data/** do GeoServer

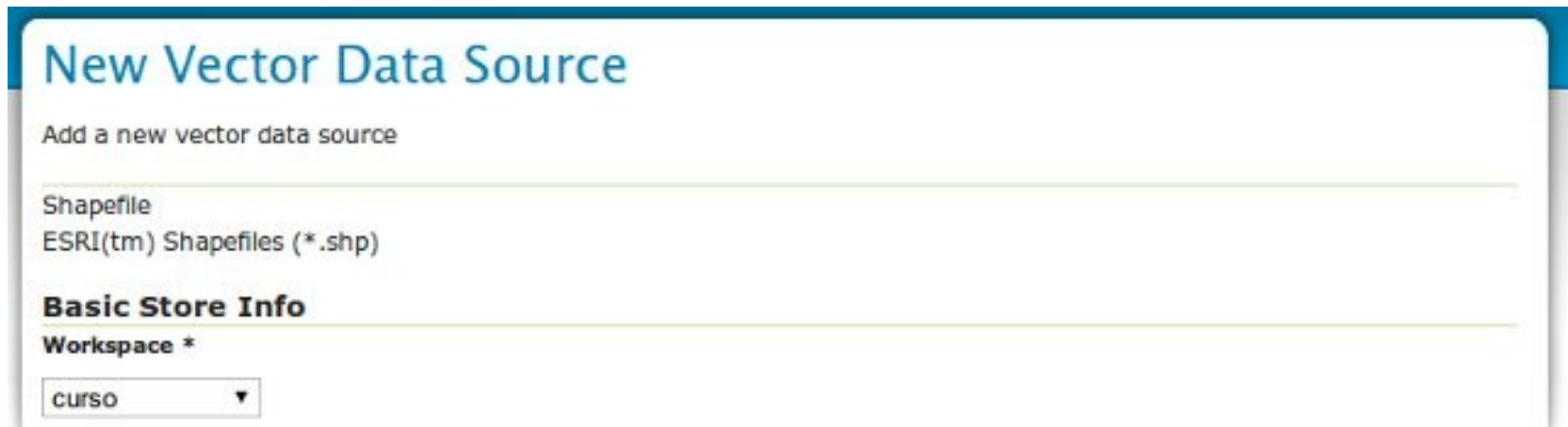
```
GEOSERVER=/var/lib/tomcat6/webapps/geoserver  
cd $GEOSERVER/data/data/
```

```
unzip shapes-brasil.zip  
chown tomcat6. shapes-brasil -R
```



# Criando um store de Shapefile

- **Vector Data Sources > Shapefile**
- Workspace: curso
- Nome: brasil-shp
- Descrição: Divisões do Brasil (Shapefile)
- Localização: file:data/shapes-brasil/BRASIL.shp



**New Vector Data Source**

Add a new vector data source

Shapefile  
ESRI(tm) Shapefiles (\*.shp)

**Basic Store Info**

Workspace \*

curso ▼

# Publicando uma camada Shapefile

Sistema de referências

Retângulo dos limites

Propriedades das feições

## Coordinate Reference Systems

### Native SRS

### Declared SRS

[EPSG:WGS 84...](#)

### SRS handling

## Bounding Boxes

### Native Bounding Box

Min X	Min Y	Max X	Max Y
-73,839434	-33,770856	-34,858104	5,38289

[Compute from data](#)

### Lat/Lon Bounding Box

Min X	Min Y	Max X	Max Y
-73,839434	-33,770856	-34,858104	5,38289

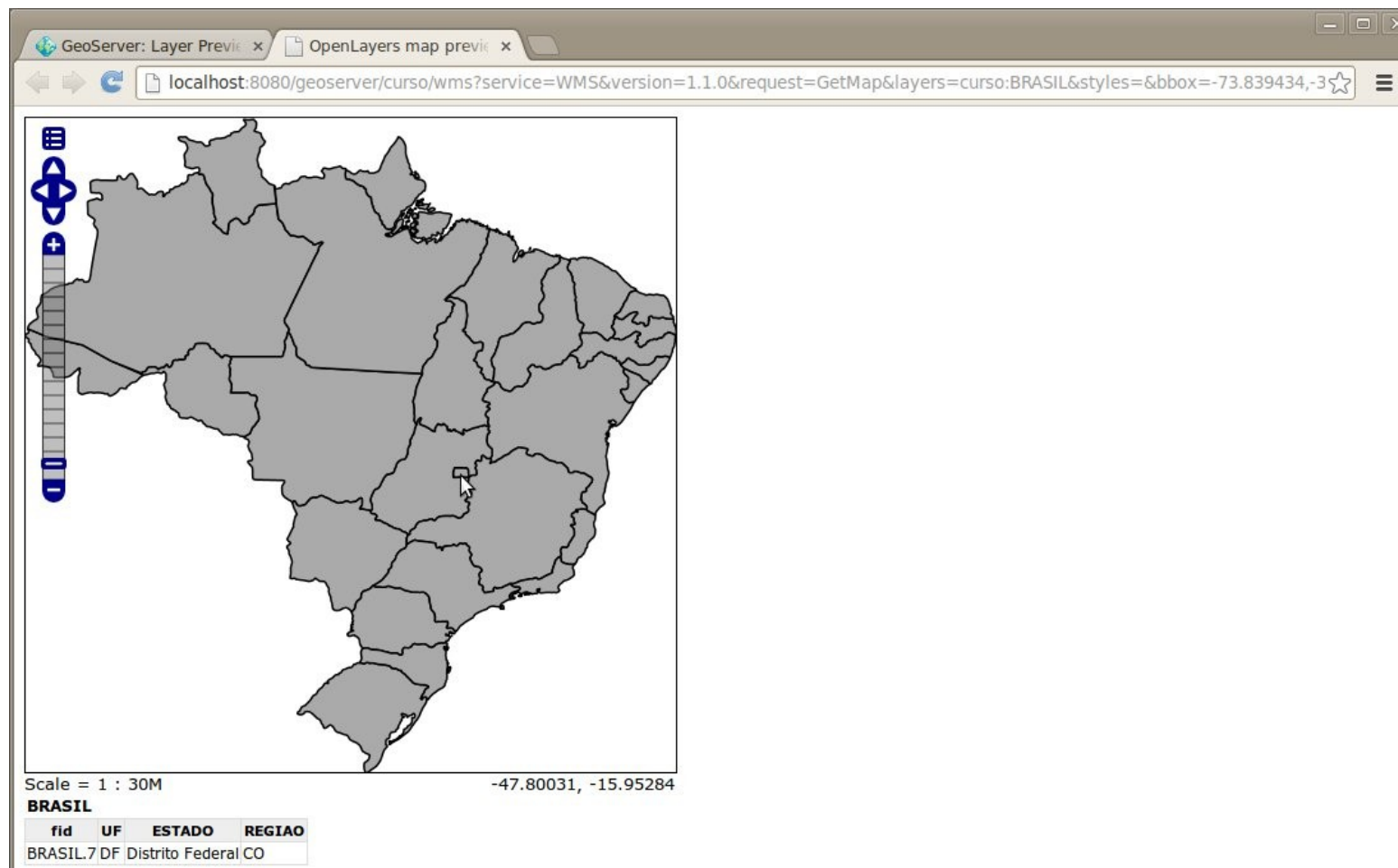
[Compute from native bounds](#)

## Feature Type Details

Property	Type	Nullable	Min/Max Occurrences
the_geom	MultiPolygon	true	0/1
UF	String	true	0/1
ESTADO	String	true	0/1
REGIAO	String	true	0/1

# Visualizando a camada Shapefile

- Layer Preview > curso:BRASIL > OpenLayers



# Extraindo TIFFs de São Paulo

- Extrair conteúdo do arquivo **tiffs-sampa.zip** para o diretório **/data/data/** do GeoServer

```
GEOSERVER=/var/lib/tomcat6/webapps/geoserver  
cd $GEOSERVER/data/data/
```

```
unzip tiffs-sampa.zip  
chown tomcat6. tiffs-sampa -R
```

# Criando um store de GeoTIFF

- **Raster Data Sources > GeoTIFF**
- Workspace: curso
- Nome: TM\_5
- Localização: `file:data/tiffs-sampa/TM_5.tif`



**Add Raster Data Source**

Description

GeoTIFF  
Tagged Image File Format with Geographic information

**Basic Store Info**

Workspace \*

curso ▼



# Publicando uma camada GeoTIFF

## Sistema de referências

### Coordinate Reference Systems

#### Native SRS

UNKNOWN

[unnamed...](#)

#### Declared SRS

EPSG:5530

[Find...](#)

[EPSG:SAD69\(96\) / Brazil Polyconic...](#)

#### SRS handling

Force declared ▼

## Retângulo dos limites

### Bounding Boxes

#### Native Bounding Box

Min X	Min Y	Max X	Max Y
309.587,563	7.340.309,707	364.337,563	7.419.509,707

[Compute from data](#)

#### Lat/Lon Bounding Box

Min X	Min Y	Max X	Max Y
-98,93598506600	-18,78496268389	-98,26092838299	-18,14495447474

[Compute from native bounds](#)

## Parâmetros

### Coverage Parameters

#### InputTransparentColor

#### SUGGESTED\_TILE\_SIZE

512,512

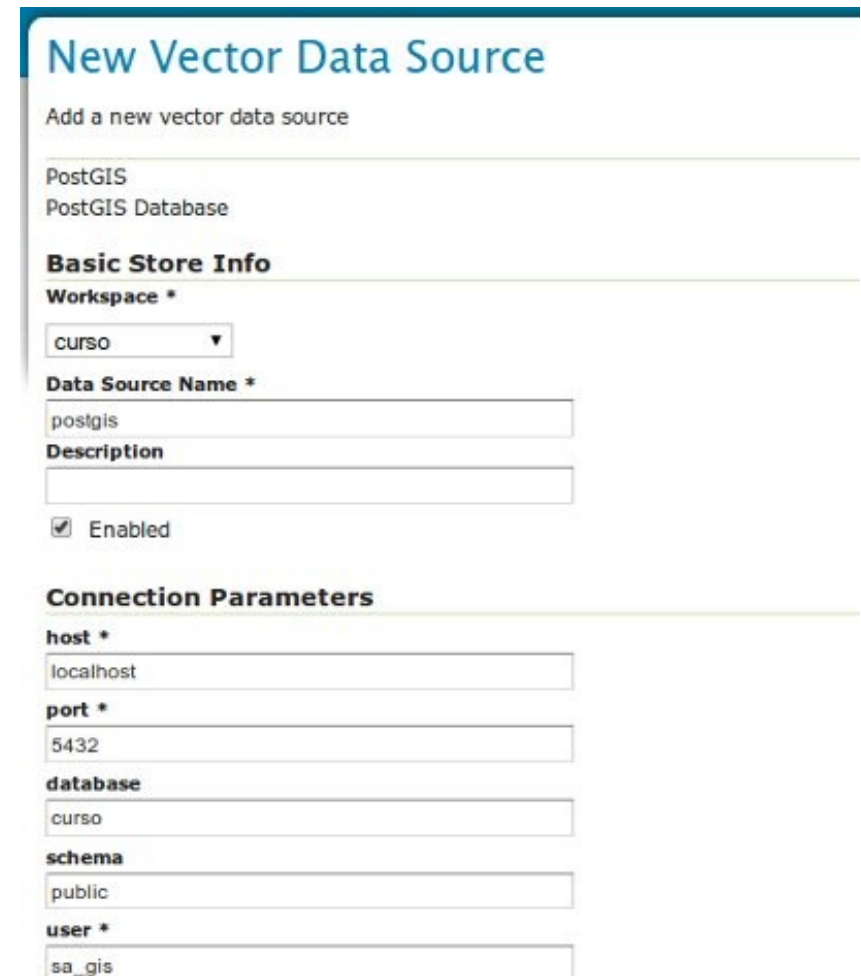
# Visualizando a camada GeoTIFF

- Layer Preview > curso:TM\_5 > OpenLayers



# Criando um store de banco PostGIS

- **Vector Data Sources > PostGIS**
- Workspace: curso
- Nome: postgis
- Host: localhost
- Banco: curso
- Usuário: sa\_gis
- Expor chaves primárias



**New Vector Data Source**  
Add a new vector data source

PostGIS  
PostGIS Database

**Basic Store Info**

**Workspace \***  
curso

**Data Source Name \***  
postgis

**Description**

☒ Enabled

**Connection Parameters**

**host \***  
localhost

**port \***  
5432

**database**  
curso

**schema**  
public

**user \***  
sa\_gis



# Publicando camadas do PostGIS

- Layers > New Layer > curso:postgis

## New Layer

Add a new layer

Add layer from

You can create a new feature type by manually configuring the attribute names and types. [Create new feature type...](#)  
On databases you can also create a new feature type by configuring a native SQL statement. [Configure new SQL view...](#)  
Here is a list of resources contained in the store 'postgis'. Click on the layer you wish to configure

<< < 1 > >>

Results 0 to 0 (out of 0 items)

Published	Layer name	action
	aeroportos	<a href="#">Publish</a> ←
	brasil	<a href="#">Publish</a> ←
	edificios	<a href="#">Publish</a>
	geometrias	<a href="#">Publish</a>
	rodovias	<a href="#">Publish</a> ←

<< < 1 > >>

Results 0 to 0 (out of 0 items)






# Visualizando camadas do PostGIS

- Layer Preview > “curso” > Search > OpenLayers

## Layer Preview

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

<< < 1 > >> Results 1 to 5 (out of 5 matches from 62 items)

Type	Name	Title	Common Formats	All Formats
	curso:BRASIL	BRASIL	<a href="#">OpenLayers</a> <a href="#">KML</a> <a href="#">GML</a>	<input type="text" value="Select one"/>
	curso:TM_5	TM_5	<a href="#">OpenLayers</a> <a href="#">KML</a>	<input type="text" value="Select one"/>
	curso:brasil	brasil	<a href="#">OpenLayers</a> <a href="#">KML</a> <a href="#">GML</a>	<input type="text" value="Select one"/>
	curso:rodovias	rodovias	<a href="#">OpenLayers</a> <a href="#">KML</a> <a href="#">GML</a>	<input type="text" value="Select one"/>
	curso:aeroportos	aeroportos	<a href="#">OpenLayers</a> <a href="#">KML</a> <a href="#">GML</a>	<input type="text" value="Select one"/>

<< < 1 > >> Results 1 to 5 (out of 5 matches from 62 items)



# Criando um grupo de camadas

- Layer Groups > Add new > Nome: grupo-brasil

## Workspace

curso ▼

## Bounds

Min X	Min Y	Max X	Max Y
-73,839434	-33,770856	-34,858104	5,38289

## Coordinate Reference System

EPSG:4326

Find...

EPSG:WGS 84...

Generate Bounds

+ Add Layer...

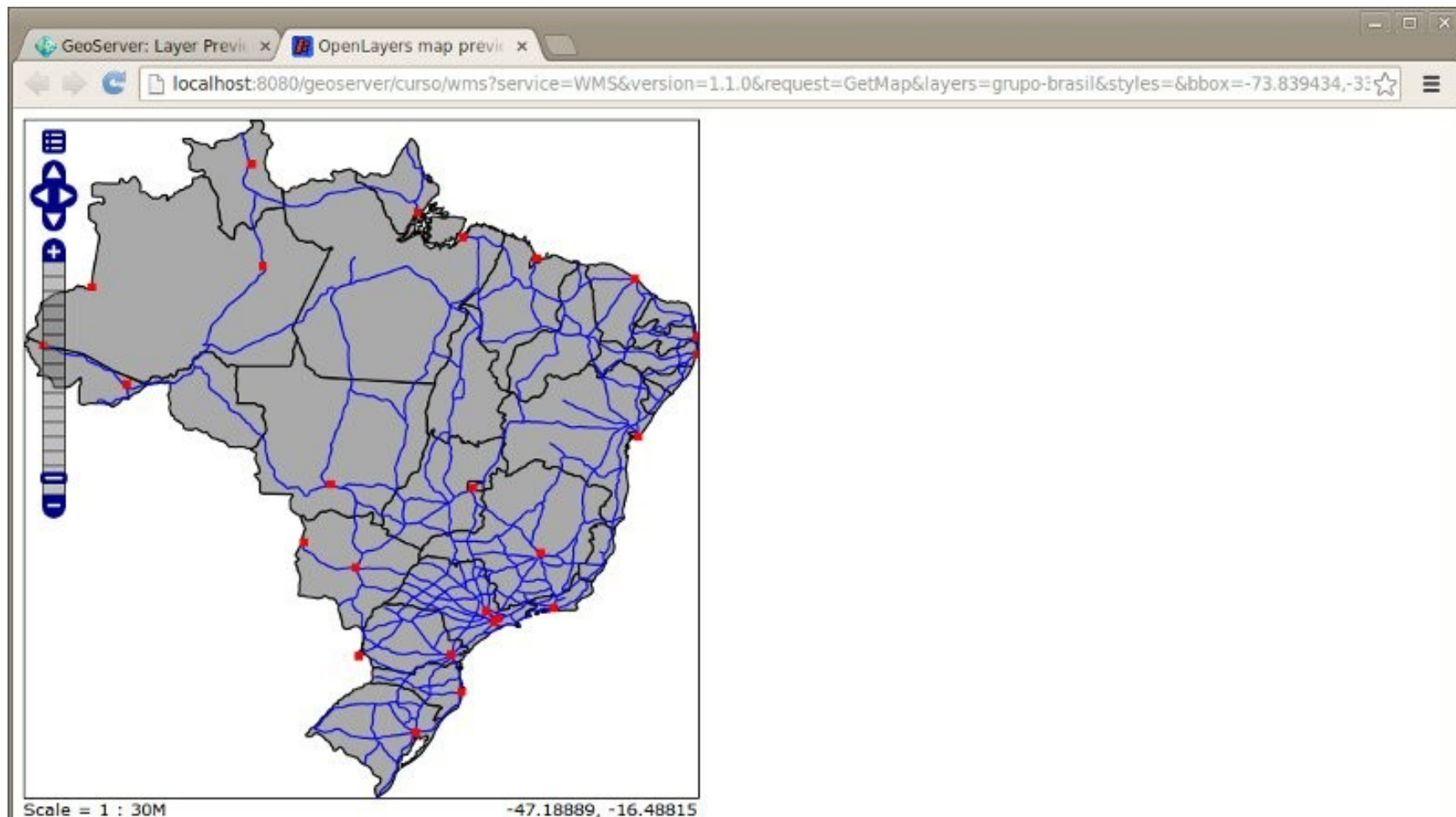
## Layers

Position	Layer	Default Style	Style	Remove
↓	curso:brasil	<input type="checkbox"/>	polygon	⊖
↑ ↓	curso:rodovias	<input type="checkbox"/>	line	⊖
↑	curso:aeroportos	<input type="checkbox"/>	point	⊖

<< < 1 > >> Results 1 to 3 (out of 3 items)

# Visualizando o grupo de camadas

- Layer Preview > curso:grupo-brasil > OpenLayers



# Criar tabela de apoio: IDH Brasil

- Indicador de desenvolvimento para cada UF

```
SELECT uf, random() AS idh  
INTO idh_uf  
FROM brasil;
```

```
GRANT ALL ON idh_uf TO public;
```

```
SELECT * FROM idh_uf;
```

# Criando uma visão SQL

- Layers > New Layer > curso:postgis > SQL view
- Nome: brasil-idh
- Instrução SQL:

```
SELECT b.gid, b.uf, b.regiao,  
       i.idh AS valor, b.geom  
FROM brasil b  
       JOIN idh_uf i ON (i.uf = b.uf)
```

# Publicando uma visão SQL

Sistema de referências

Retângulo dos limites

Propriedades das feições

## Coordinate Reference Systems

### Native SRS

[EPSG:WGS 84...](#)

### Declared SRS

[EPSG:WGS 84...](#)

### SRS handling

## Bounding Boxes

### Native Bounding Box

Min X	Min Y	Max X	Max Y
-73,839434	-33,770856	-34,858104	5,38289

[Compute from data](#)

### Lat/Lon Bounding Box

Min X	Min Y	Max X	Max Y
-73,839434	-33,770856	-34,858104	5,38289

[Compute from native bounds](#)

## Feature Type Details

Property	Type	Nullable	Min/Max Occurrences
gid	Integer	false	1/1
uf	String	true	0/1
regiao	String	true	0/1
valor	Double	true	0/1
geom	MultiPolygon	true	0/1

[Edit sql view](#)



# Criando parâmetros na visão SQL

- Layers > curso:brasil-idh > Edit sql view
- Instrução SQL:

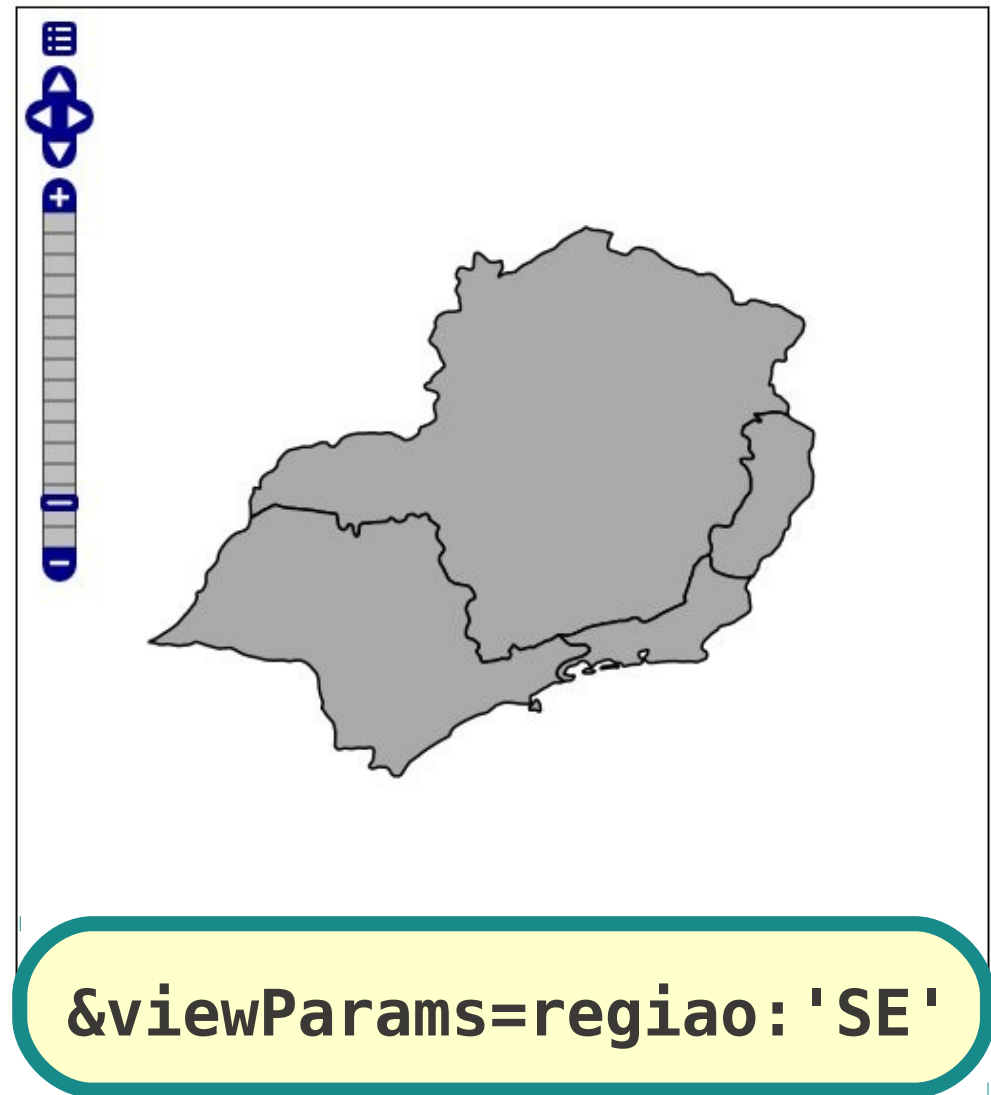
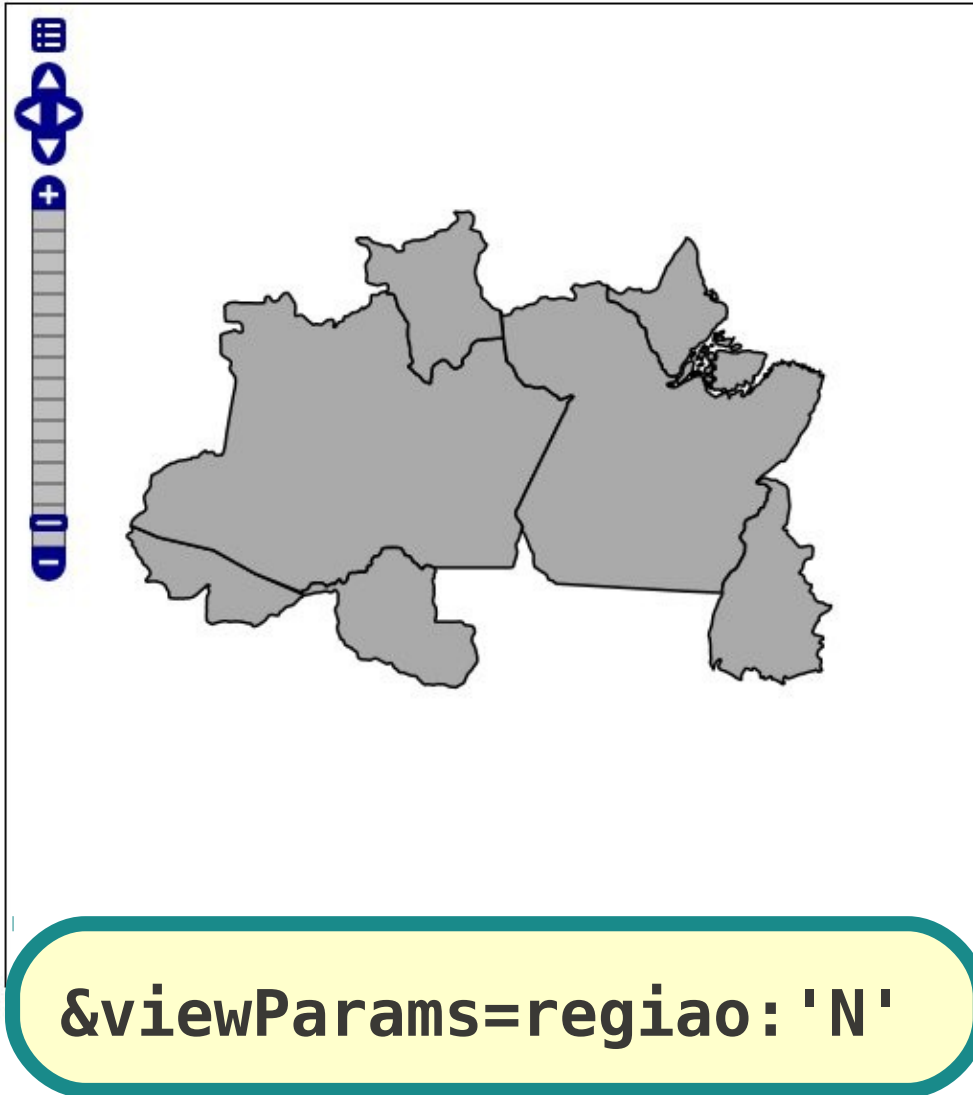
```
SELECT b.gid, b.uf, b.regiao,  
       i.idh AS valor, b.geom  
FROM brasil b  
      JOIN idh_uf i ON (i.uf = b.uf)  
WHERE b.regiao = %regiao%
```

## SQL view parameters

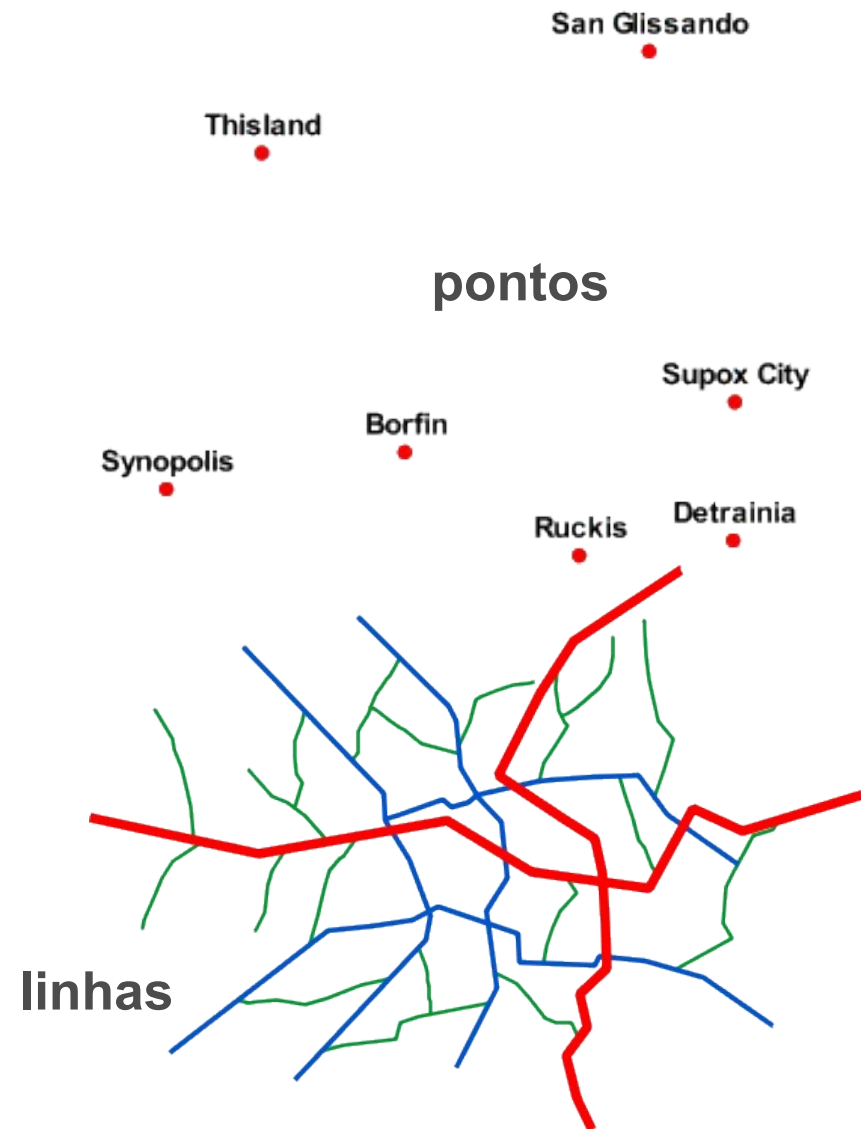
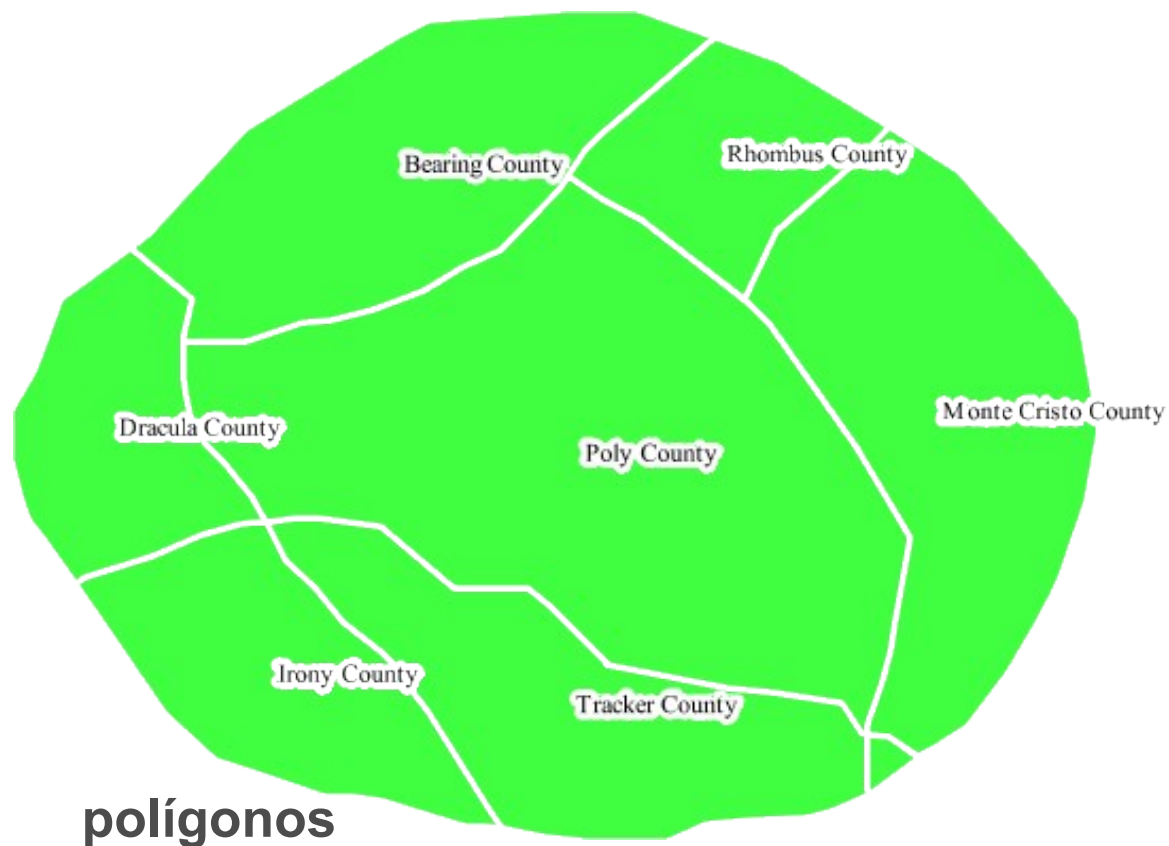
[Guess parameters from SQL](#) [Add new parameter](#) [Remove selected](#)

<input type="checkbox"/>	Name	Default value	Validation regular expression
<input type="checkbox"/>	regiao	'NO'	^[w]+\$

# Visualizando camada com parâmetros



# Edição de estilos customizados



<http://docs.geoserver.org/stable/en/user/styling/sld-cookbook/>

# O que é SLD?

- **Styled Layer Descriptor** é um padrão OGC
- Define uma linguagem para expressar estilos sobre dados espaciais (i.e., cartografia)
- Linguagem de estilo primária no GeoServer
- Especificações OGC:
  - Styled Layer Descriptor (SLD)
    - Symbology Encoding
    - Styled Layer Descriptor profile of the Web Map Service

# Criando estilo para polígonos

- Styles > New style
- Nome: poligono-brasil, Workspace: curso
- Copiar estilo de: polygon

```
<PolygonSymbolizer>
  <Fill>
    <CssParameter name="fill">#f2f2f2</CssParameter>
  </Fill>
  <Stroke>
    <CssParameter name="stroke">#7d7d7d</CssParameter>
    <CssParameter name="stroke-width">0.5</CssParameter>
  </Stroke>
</PolygonSymbolizer>
```



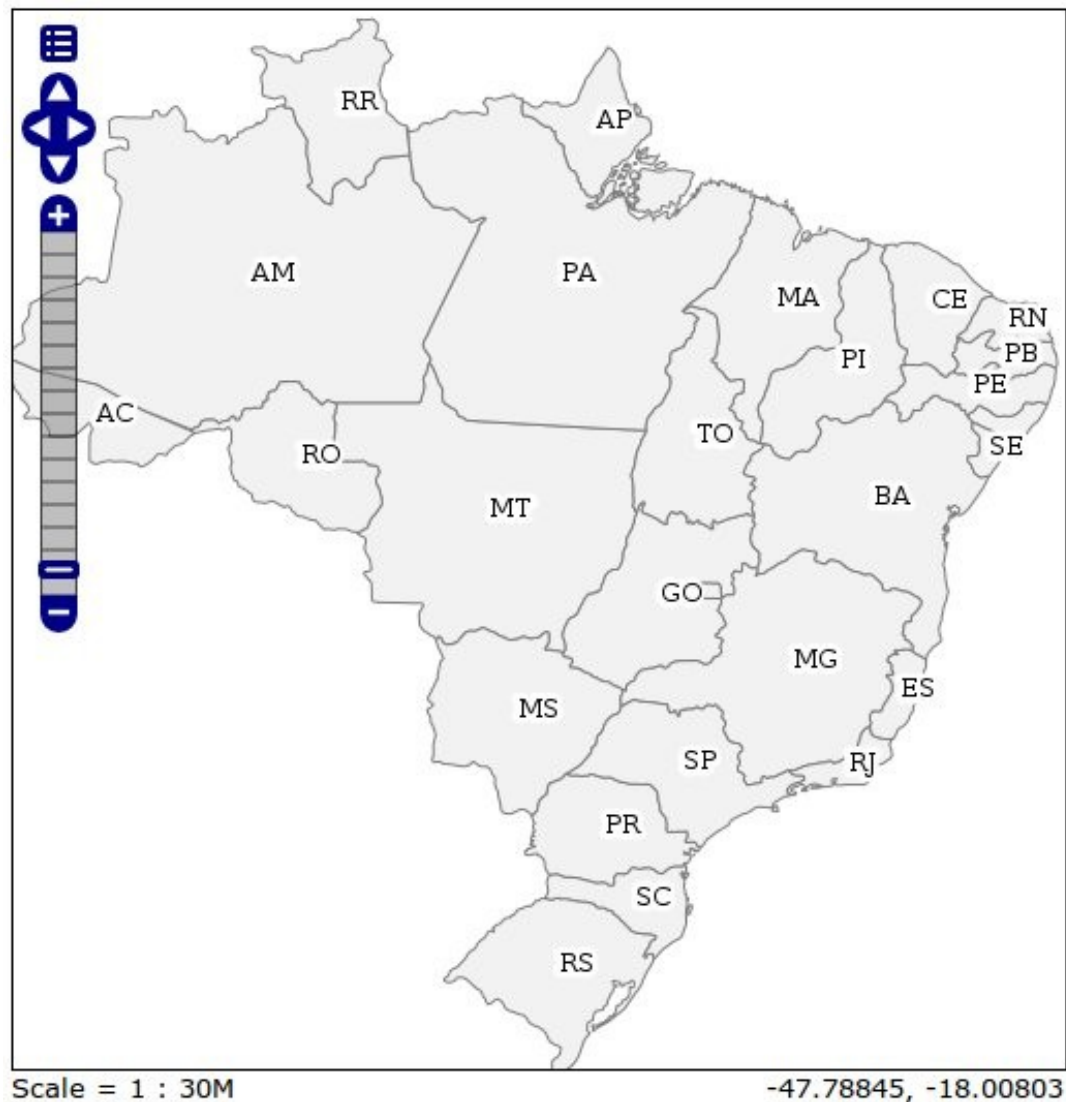
# Exibindo rótulos nos polígonos

- Styles > poligono-brasil

```
<TextSymbolizer>
  <Label>
    <ogc:PropertyName>uf</ogc:PropertyName>
  </Label>
  <Halo>
    <Radius>3</Radius>
    <Fill>
      <CssParameter name="fill">#FFFFFF</CssParameter>
    </Fill>
  </Halo>
</TextSymbolizer>
```

# Visualizando mapa com novo estilo

curso:brasil



# Estilo baseado em atributos

- Styles > New style
- Nome: poligono-brasil-idh, Workspace: curso
- Copiar estilo de: poligono-brasil

```
<PolygonSymbolizer>
  <Fill>
    <CssParameter name="fill">#f2f2f2</CssParameter>
  </Fill>
  <Stroke>
    <CssParameter name="stroke">#7d7d7d</CssParameter>
    <CssParameter name="stroke-width">0.5</CssParameter>
  </Stroke>
</PolygonSymbolizer>
```

# Criar regras para o estilo

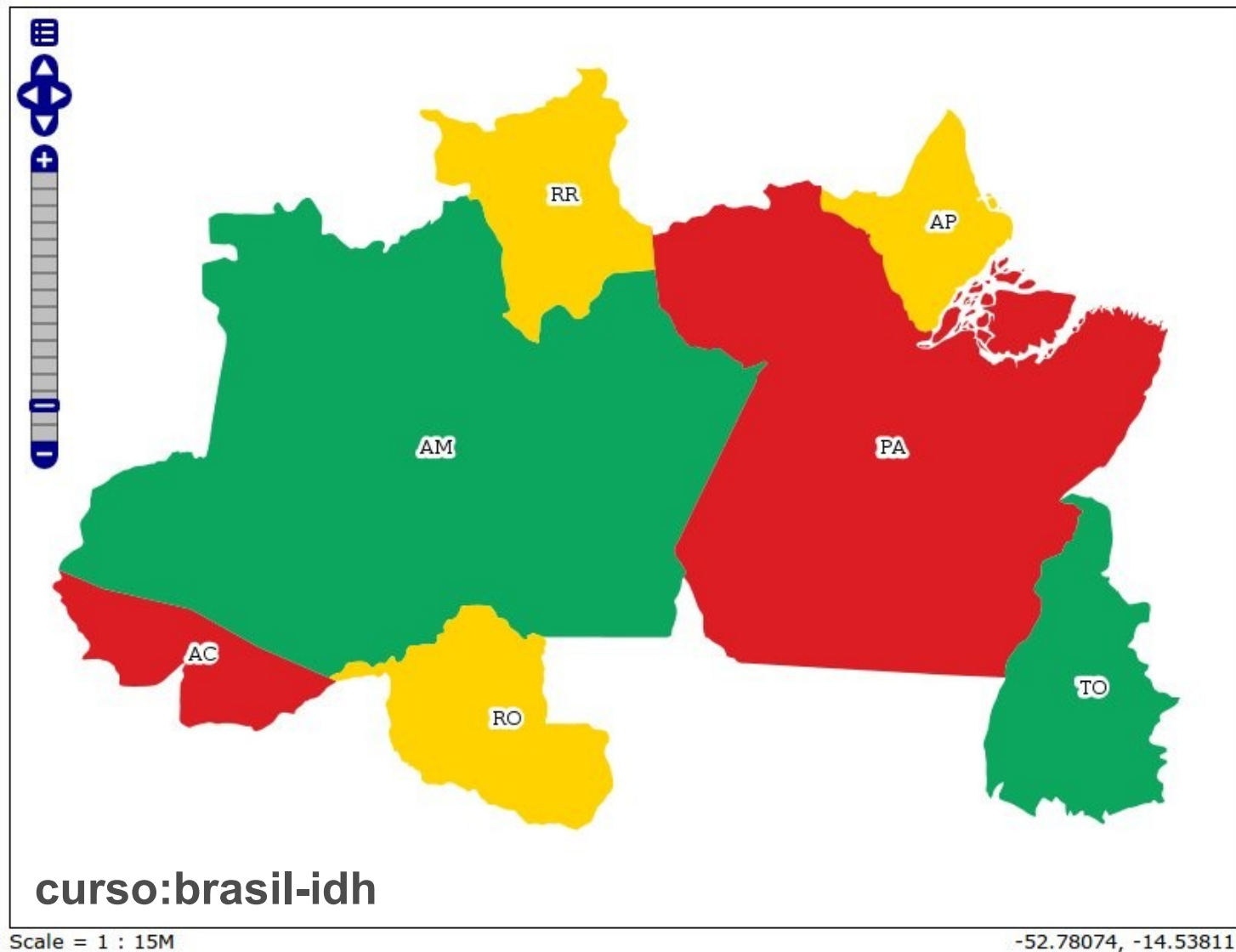
```
<Rule>
<Name>rotulo</Name>
<TextSymbolizer>
<Label>
<ogc:PropertyName>uf</ogc:PropertyName>
</Label>
<Halo>
<Radius>3</Radius>
<Fill>
<CssParameter name="fill">#FFFFFF</CssParameter>
</Fill>
</Halo>
</TextSymbolizer>
</Rule>

<Rule>
<Name>idh-baixo</Name>
<Title>menos de 0,3</Title>
<ogc:Filter>
<ogc:PropertyIsLessThan>
<ogc:PropertyName>valor</ogc:PropertyName>
<ogc:Literal>0.3</ogc:Literal>
</ogc:PropertyIsLessThan>
</ogc:Filter>
<PolygonSymbolizer>
<Fill>
<CssParameter name="fill">#dd1d24</CssParameter>
</Fill>
</PolygonSymbolizer>
</Rule>
```

```
<Rule>
<Name>idh-medio</Name>
<Title>entre 0,3 e 0,6</Title>
<ogc:Filter>
<ogc:And>
<ogc:PropertyIsGreaterThanOrEqualTo>
<ogc:PropertyName>valor</ogc:PropertyName>
<ogc:Literal>0.3</ogc:Literal>
</ogc:PropertyIsGreaterThanOrEqualTo>
<ogc:PropertyIsLessThan>
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```

# Visualizando o mapa temático de IDH







# Bibliografia

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