

ECONOMIC COOPERATION ORGANIZATION (ECO) TRAINING COURSE



The National Cartographic Center of Iran with the support of ECO

Secretariat holds a training course on:

**The Current Technologies and Trends in Various
Levels of Spatial Data Infrastructure (SDI)**

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Web Processing Services and its Applications

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WPS Standard

- The WPS interface standard is one of the OGC standards that aims to facilitate the sharing of spatial processes over the Internet.
- This standard enables easy access and utilization of spatial processes over the web, creating connection between users and processes.
- WPS can perform a variety of simple and complex spatial analyses.
- The user can perform the process without special knowledge and using intuitive interfaces.



WPS Standard

- Access the input data required by the WPS from various resources such as Layer, URL, Text, and Subprocess via the Internet/Intranet or by accessing the server.
- Input data generated from an analysis can be used by OGC services. For example, a polygon retrieved from a WFS service can be used as input to an intersect operation.

a* - Geometry

First input geometry

REFERENCE ▾

Method GET ▾

Mime type application/json ▾

URL http://localhost:8080/geoserver/sf/ows?service=WFS&version=1.0.0&request=GetFeature&tyl

**Introduction of input data
through WFS service**

Applications of WPS



Spatial Data Infrastructure (SDI)







A decorative graphic on the left side of the slide. It features a dark blue vertical bar on the far left. A black arrow points to the right from the top of this bar. Several thin, light blue curved lines originate from the bottom left and sweep upwards and to the right across the slide.

WPS Operations

- The WPS interface specifies three operations that can be requested by the user and performed by the server, which are required to be performed by all servers.
- These operations are:
 - GetCapabilities
 - DescribeProcess
 - Execute

WPS Functions

- GetCapabilities: This operation allows the user to request and receive metadata documents or services.
- An example of a GetCapabilities request and response through the GET method:

*http://localhost:8080/geoserver/ows?
service=WPS&
version=1.0.0&
request=GetCapabilities*

```
<?xml:capabilities xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xml:lang="en" service="WPS" version="1.0.0"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:ServiceIdentification>
    <ows:Title/>
    <ows:Abstract/>
    <ows:ServiceType>WPS</ows:ServiceType>
    <ows:ServiceTypeVersion>1.0.0</ows:ServiceTypeVersion>
  </ows:ServiceIdentification>
  <ows:ServiceProvider>
    <ows:ProviderName>OSGeo</ows:ProviderName>
    <ows:ProviderSite xlink:href="https://www.osgeo.org/">
    <ows:ServiceContact/>
  </ows:ServiceProvider>
  <ows:OperationsMetadata>
    <ows:Operation name="GetCapabilities">
      <ows:DCP>
        <ows:HTTP>
          <ows:Get xlink:href="http://localhost:8080/geoserver/wps/">
          <ows:Post xlink:href="http://localhost:8080/geoserver/wps/">
          </ows:HTTP>
        </ows:DCP>
      </ows:Operation>
    <ows:Operation name="DescribeProcess">
      <ows:DCP>
        <ows:HTTP>
          <ows:Get xlink:href="http://localhost:8080/geoserver/wps/">
          <ows:Post xlink:href="http://localhost:8080/geoserver/wps/">
          </ows:HTTP>
        </ows:DCP>
      </ows:Operation>
    <ows:Operation name="Execute">
      <ows:DCP>
        <ows:HTTP>
          <ows:Get xlink:href="http://localhost:8080/geoserver/wps/">
          <ows:Post xlink:href="http://localhost:8080/geoserver/wps/">
          </ows:HTTP>
        </ows:DCP>
      </ows:Operation>
    </ows:OperationsMetadata>
</ows:Capabilities>
```

WPS Functions

- DescribeProcess: This operation enable users to provide detailed XML documents describing instance processes, including name, title, abstract, etc.
- An example of a DescribeProcess request and response via the GET method is:

http://localhost:8080/geoserver/ows?

service=WPS&

version=1.0.0&

request=DescribeProcess&

identifier=JTS:buffer

```
*<wps:ProcessDescription xmlns:x="http://www.w3.org/2001/XMLSchema"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xml:lang="en" service="WPS" version="1.0.0" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ProcessDescription wps:processVersion="1.0.0" statusSupported="true" storeSupported="true">
    <ows:Identifier>JTS:buffer</ows:Identifier>
    <ows:Title>Buffer</ows:Title>
    <ows:Abstract>Returns a polygonal geometry representing the input geometry enlarged by a given distance
around its exterior.</ows:Abstract>
  </ProcessDescription>
  <wps:DataInputs>
    <wps:Input maxOccurs="1" minOccurs="1">
      <ows:Identifier>geom</ows:Identifier>
      <ows:Title>geom</ows:Title>
      <ows:Abstract>Input geometry</ows:Abstract>
      <wps:ComplexData>
        <wps:Default>
          <wps:Format>
            <wps:MimeType>text/xml; subtype=geom/3.1.1</wps:MimeType>
          </wps:Format>
          </wps:Default>
        </wps:ComplexData>
        <wps:Supported>
          <wps:Format>
            <wps:MimeType>text/xml; subtype=geom/3.1.1</wps:MimeType>
          </wps:Format>
          <wps:Format>
            <wps:MimeType>text/xml; subtype=geom/3.1.1</wps:MimeType>
          </wps:Format>
          <wps:Format>
            <wps:MimeType>application/vndt</wps:MimeType>
          </wps:Format>
          <wps:Format>
            <wps:MimeType>application/vndt</wps:MimeType>
          </wps:Format>
          <wps:Format>
            <wps:MimeType>application/geom-3.1.1</wps:MimeType>
          </wps:Format>
        </wps:Supported>
      </wps:ComplexData>
    </wps:Input>
  </wps:DataInputs>
</wps:ProcessDescription>
```

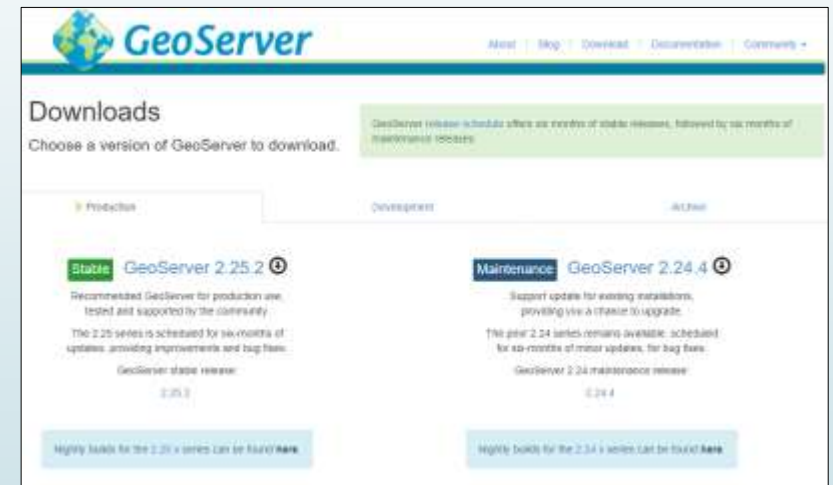
WPS Functions

- Execute: This operation allows the user to run a specified process using the values of the provided input parameters and return the generated outputs.
- The desired inputs and outputs for each request depend on the process being executed.

Analysis name	Function name	Description
Buffer	gs:BufferFeatureCollection	Creating a boundary around the features. Example: 500 meters around the Azadi square.

WPS Installation

- The WPS interface standard is not included with GeoServer by default, but it is available as an add-on and can be installed.
- To download and install the WPS module:
 - Select the Download link from the GeoServer website at "geoserver.org"
 - Select the option that corresponds to your GeoServer version.

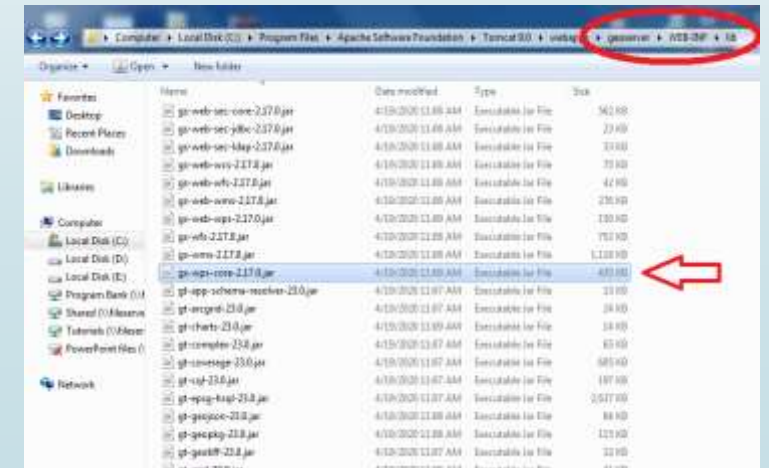


WPS Installation

- Select the WPS option from, the Services section.

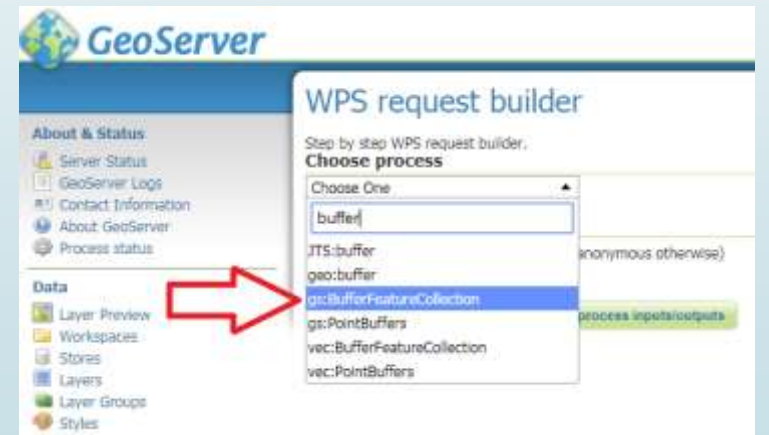
Note. The plugin version must match the GeoServer software version.

- Unzip the file, copy it to WEB-INF > lib in the GeoServer installation path, and restart the software



WPS Example

- To perform Buffer Analysis as a basic spatial analysis using WPS standards:
 - Navigate to the Demos section and select the WPS Request Builder option.
 - Enter Buffer in the Choose process section
 - Select gs:BufferFeatureCollection



WPS Example

- Select one of the vector layers that are available in GeoServer from the Input feature collection section
- Enter the desired distance value based on the the coordinate reference system of the layer.

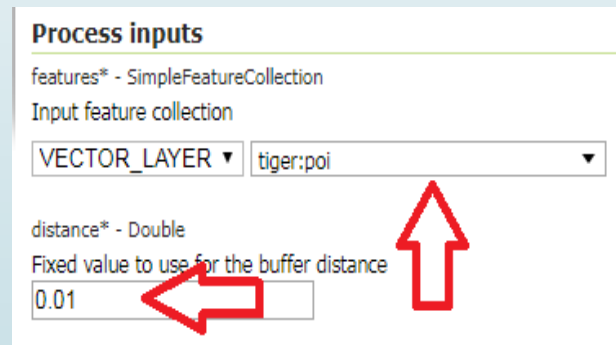
Process inputs

features* - SimpleFeatureCollection
Input feature collection

VECTOR_LAYER ▾ tiger:poi ▾

distance* - Double
Fixed value to use for the buffer distance

0.01

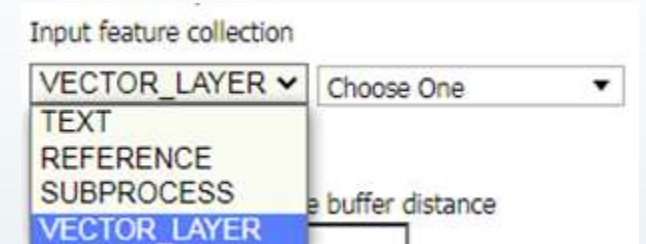


Input feature collection

VECTOR_LAYER ▾ Choose One ▾

TEXT
REFERENCE
SUBPROCESS
VECTOR_LAYER

buffer distance



Input feature collection

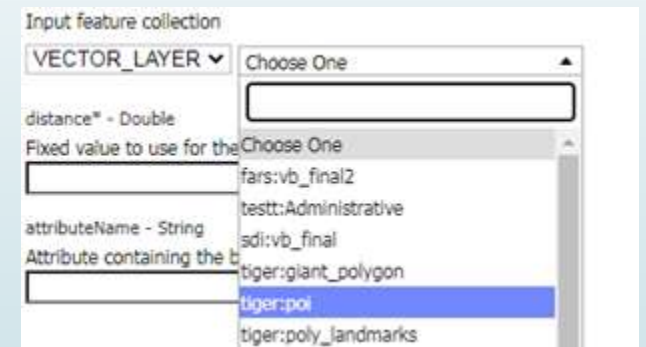
VECTOR_LAYER ▾ Choose One ▾

distance* - Double

Fixed value to use for the buffer distance

Choose One

fars:vb_final2
testt:Administrative
sdi:vb_final
tiger:giant_polygon
tiger:poi
tiger:poly_landmarks



WPS Example

- The "Generate" option of the Process outputs section allows you to select output file format like GML, GeoJSON, Shapefile etc.
- Selecting 'Execute Process' allows users to visually access Buffer Analysis results and the output file for improved review.

The image shows a screenshot of the QGIS Web Processing Service (WPS) interface. On the left, the 'Process outputs' section is visible, showing the result type as 'SimpleFeatureCollection' and the output format as 'application/json'. A red arrow points to the 'Generate' dropdown menu. Below this, the 'Authentication' section is shown with the 'Authenticate' checkbox unchecked. At the bottom, the 'Execute process' button is circled in red. On the right, the 'Process inputs' section is visible, showing a list of input layers and a preview of the output GeoJSON data.

Process outputs

result* - SimpleFeatureCollection
Buffered feature collection

Generate application/json

Authentication

Authenticate (will run the request as anonymous otherwise)

Execute process Generate XML from process inputs/outputs

Process inputs

```
{
  "type": "FeatureCollection",
  "features": [
    {
      "type": "Feature",
      "geometry": {
        "type": "MultiPolygon",
        "coordinates": [
          [
            [
              [-74.0005, 40.7076],
              [-74.0007, 40.7056],
              [-74.0012, 40.7038],
              [-74.0021, 40.702],
              [-74.0034, 40.7005],
              [-74.0049, 40.6993],
              [-74.0066, 40.6983],
              [-74.0085, 40.6978],
              [-74.0105, 40.6976],
              [-74.0124, 40.6978],
              [-74.0143, 40.6983],
              [-74.016, 40.6993],
              [-74.0175, 40.7005],
              [-74.0188, 40.702],
              [-74.0197, 40.7038],
              [-74.0203, 40.7056],
              [-74.0205, 40.7076],
              [-74.0203, 40.7095],
              [-74.0197, 40.7114],
              [-74.0188, 40.7131],
              [-74.0175, 40.7147],
              [-74.016, 40.7159],
              [-74.0143, 40.7168],
              [-74.0124, 40.7174],
              [-74.0105, 40.7176],
              [-74.0085, 40.7174],
              [-74.0066, 40.7168],
              [-74.0049, 40.7159],
              [-74.0034, 40.7147],
              [-74.0021, 40.7131],
              [-74.0012, 40.7114],
              [-74.0007, 40.7095],
              [-74.0005, 40.7076]
            ]
          ]
        ],
        "properties": {
          "NAME": "museum",
          "THUMBMAIL": "pics/22037827-Ti.jpg",
          "HAINPAGE": "pics/22037827-L.jpg",
          "id": "0"
        }
      }
    }
  ]
}
```


WPS Example

- Use the "Generate XML from Process Inputs/Outputs" option to generate a request based on an XML file.

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://  
<ows:Identifier>vec:BufferFeatureCollection</ows:Identifier>  
<wps:DataInputs>  
  <wps:Input>  
    <ows:Identifier>features</ows:Identifier>  
    <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">  
      <wps:Body>  
        <wfs:GetFeature service="WFS" version="1.0.0" outputFormat="GML2" xmlns:tiger="http://www  
          <wfs:Query typeName="tiger:poi"/>  
        </wfs:GetFeature>  
      </wps:Body>  
    </wps:Reference>  
  </wps:Input>  
  <wps:Input>  
    <ows:Identifier>distance</ows:Identifier>  
    <wps>Data>  
      <wps:LiteralData>0.01</wps:LiteralData>  
    </wps>Data>  
  </wps:Input>  
</wps:DataInputs>  
<wps:ResponseForm>  
  <wps:RawDataOutput mimeType="application/json">  
    <ows:Identifier>result</ows:Identifier>  
  </wps:RawDataOutput>  
</wps:ResponseForm>  
</wps:Execute>
```

Other WPS Analysis

- Some common spatial analysis available in the WPS request builder in GeoServer are:

- Clip
- Nearest
- Contain
- Contour
- Query

