Web Processing Services in the context of the 52°North Geoprocessing community

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Agenda

- WPS Basics
- 52°North Implementation
- 52°North Geoprocessing Community Research
- Case Study

WPS 101 – What is WPS?

52°North WPS

- What is a WPS?

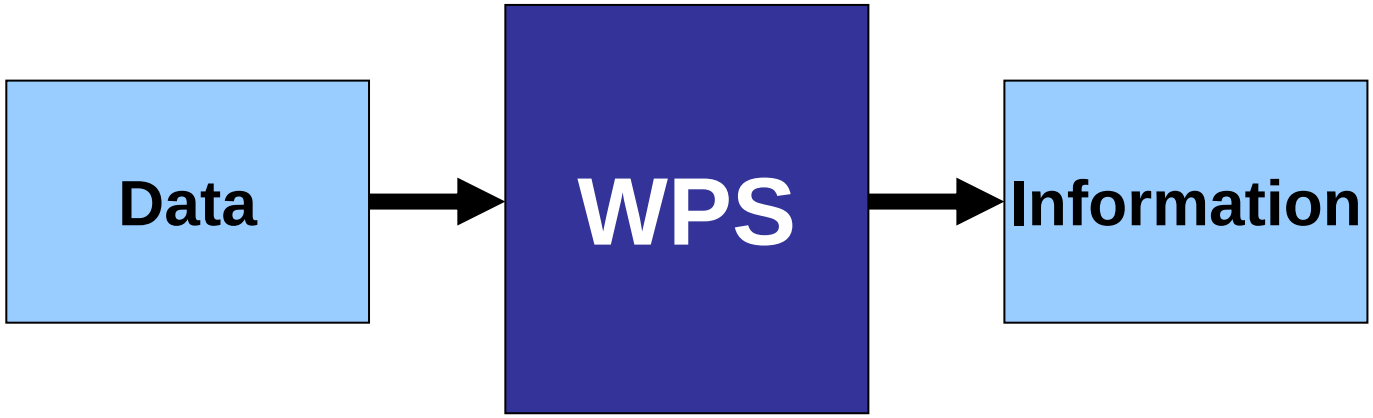
  →Geospatial data available (e.g. WFS, WCS)

  →Network capacity and computational power available

WPS

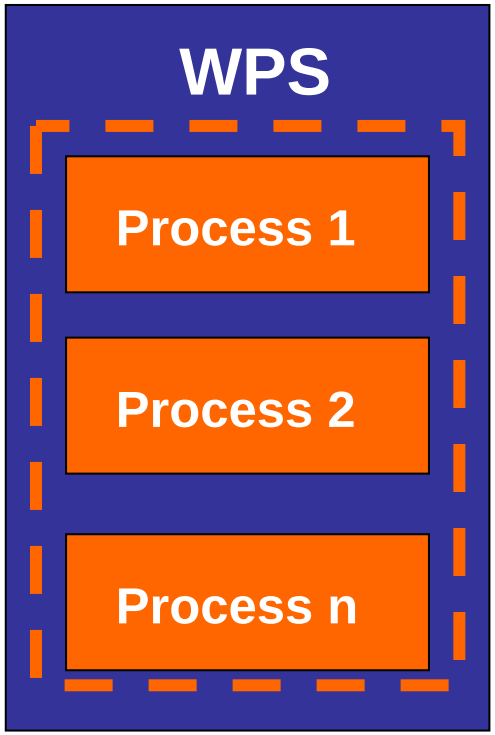
- What is a WPS?

  →Web Based Processing



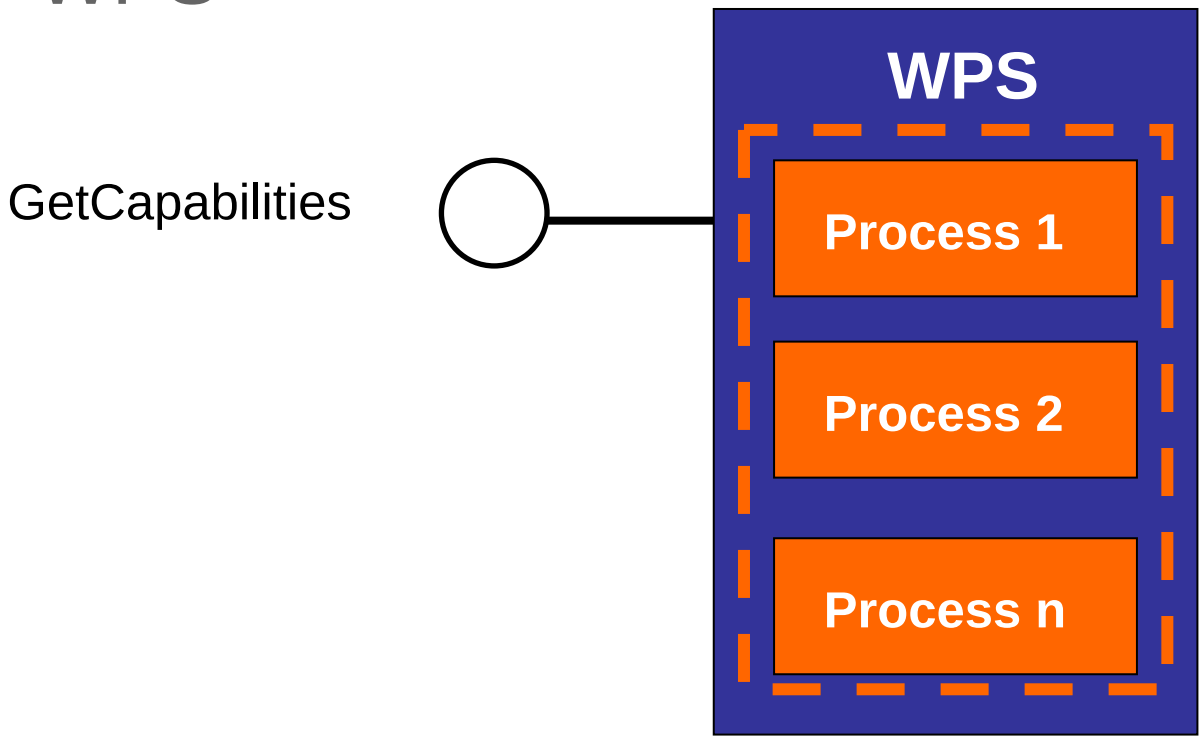
WPS

- WPS



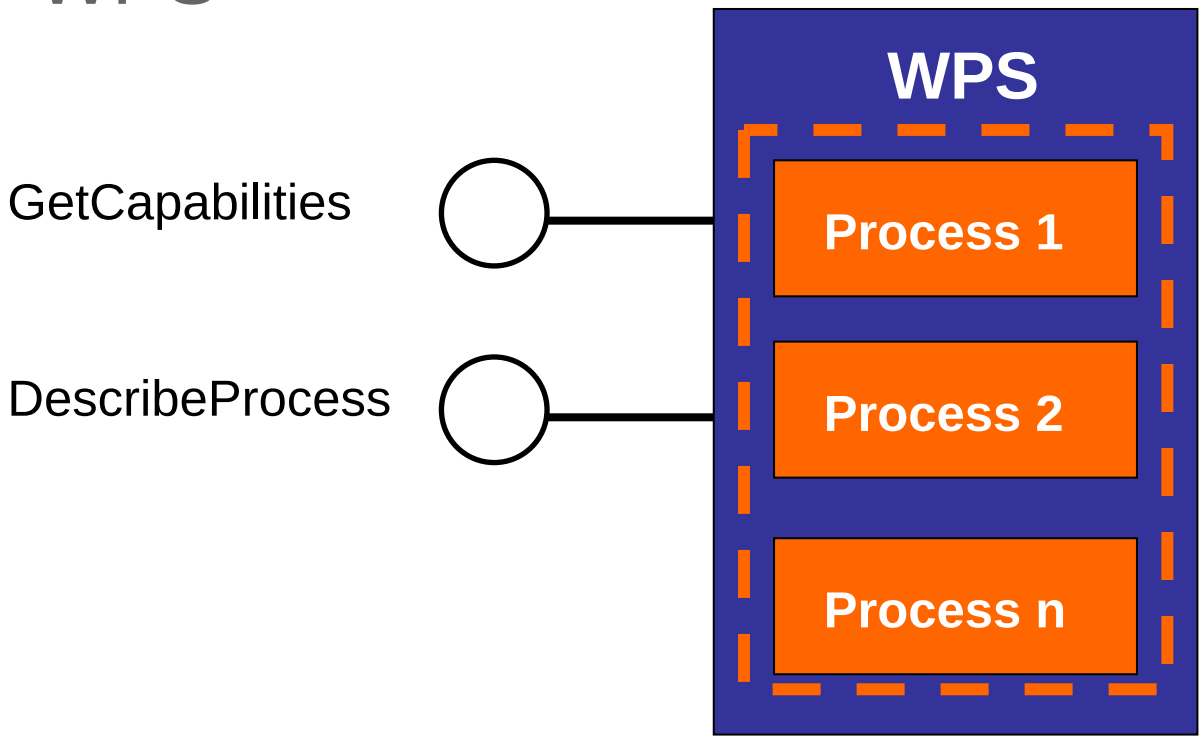
WPS

- WPS



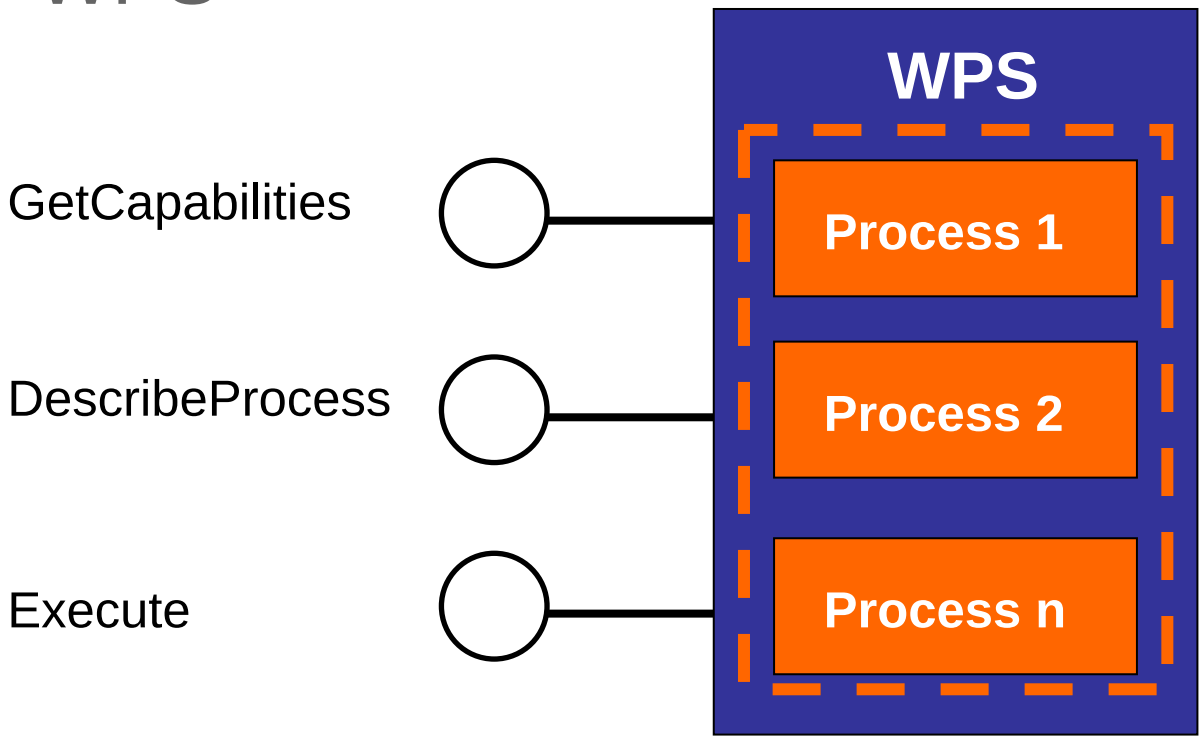
WPS

- WPS


WPS
GetCapabilities
DescribeProcess
Process 1
Process 2
Process n

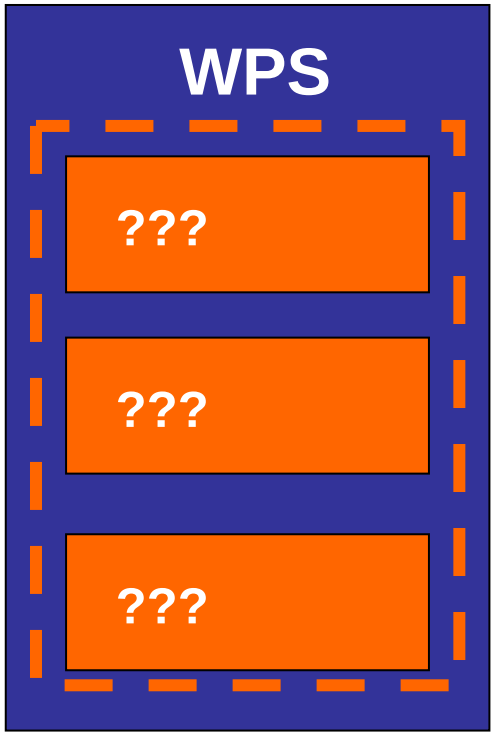
WPS

- WPS


WPS
GetCapabilities
DescribeProcess
Execute
Process 1
Process 2
Process n

WPS

- Example



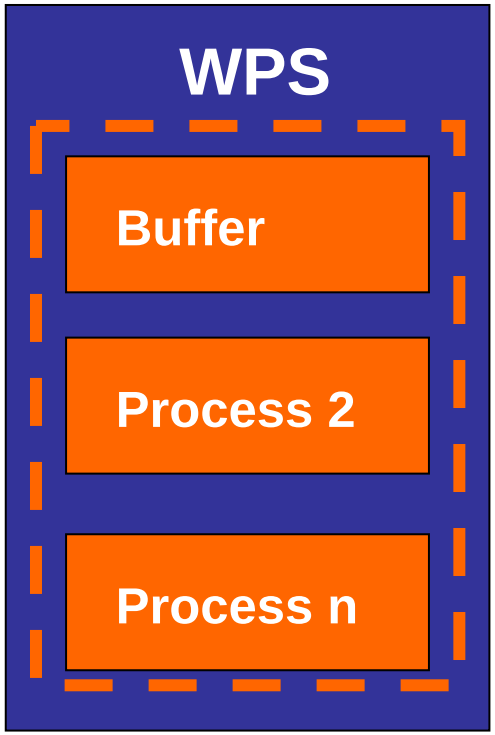
WPS

- Discovery
  → GetCapabilities

```
            </ows:HTTP>
          </ows:DCP>
        </ows:Operation>
        <ows:Operation name="DescribeProcess">
          <ows:DCP>
            <ows:HTTP>
              <ows:Get xlink:href="http://geoserver.itc.nl:8080/wps/WebProcessingService"/>
            </ows:HTTP>
          </ows:DCP>
        </ows:Operation>
        <ows:Operation name="Execute">
          <ows:DCP>
            <ows:HTTP>
              <ows:Post xlink:href="http://geoserver.itc.nl:8080/wps/WebProcessingService"/>
            </ows:HTTP>
          </ows:DCP>
        </ows:Operation>
      </ows:OperationsMetadata>
      <ProcessOfferings>
        <Process>
          <ows:Identifier>org.n52.wps.server.algorithm.SimpleBufferAlgorithm</ows:Identifier>
        </Process>
        <Process>
          <ows:Identifier>org.n52.wps.server.algorithm.simplify.DouglasPeuckerAlgorithm</ows:Identifier>
        </Process>
        <Process>
          <ows:Identifier>org.n52.wps.server.algorithm.simplify.TopologyPreservingSimplificationAlgorithm</ows:Identifier>
        </Process>
      </ProcessOfferings>
    </Capabilities>
```

WPS

- Example



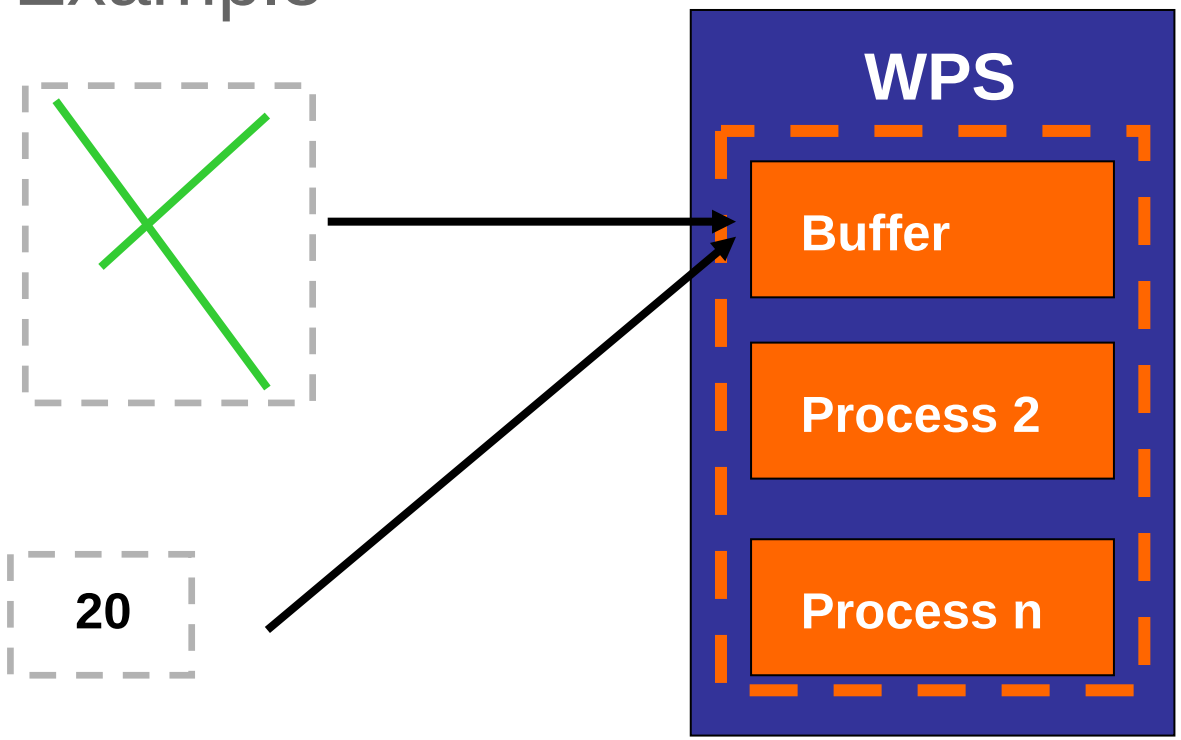
WPS

- Discovery
  - → DescribeProcess

```
<DataInputs>
  <Input minOccurs="1" maxOccurs="1">
    <ows:Identifier>data</ows:Identifier>
    <ows:Title>Polygon to be buffered</ows:Title>
    <ows:Abstract>The Geometries to buffer</ows:Abstract>
    <ComplexData>

    <Default>
      <Format>
        <MimeType>text/XML</MimeType>
        <Schema>http://geoserver.itc.nl:8080/wps/schemas/gml/2.1.2/gmlpacket.xsd</Schema>
      </Format>
    </Default>
    <Supported>
    <Format>

      <MimeType>text/XML</MimeType>
      <Schema>http://schemas.opengis.net/gml/2.1.2/feature.xsd</Schema>
    </Format>

    </Supported>
    </ComplexData>
  </Input>
  <Input minOccurs="1" maxOccurs="1">
    <ows:Identifier>width</ows:Identifier>

    <ows:Title>Buffer Distance</ows:Title>
    <ows:Abstract>URI to a GML resource file</ows:Abstract>
    <LiteralData>
    <ows:DataType ows:reference="xs:double"/>
      <ows:AllowedValues>
        <ows:Value/>
      </ows:AllowedValues>
    </LiteralData>
  </Input>
</DataInputs>
```

WPS

- Example

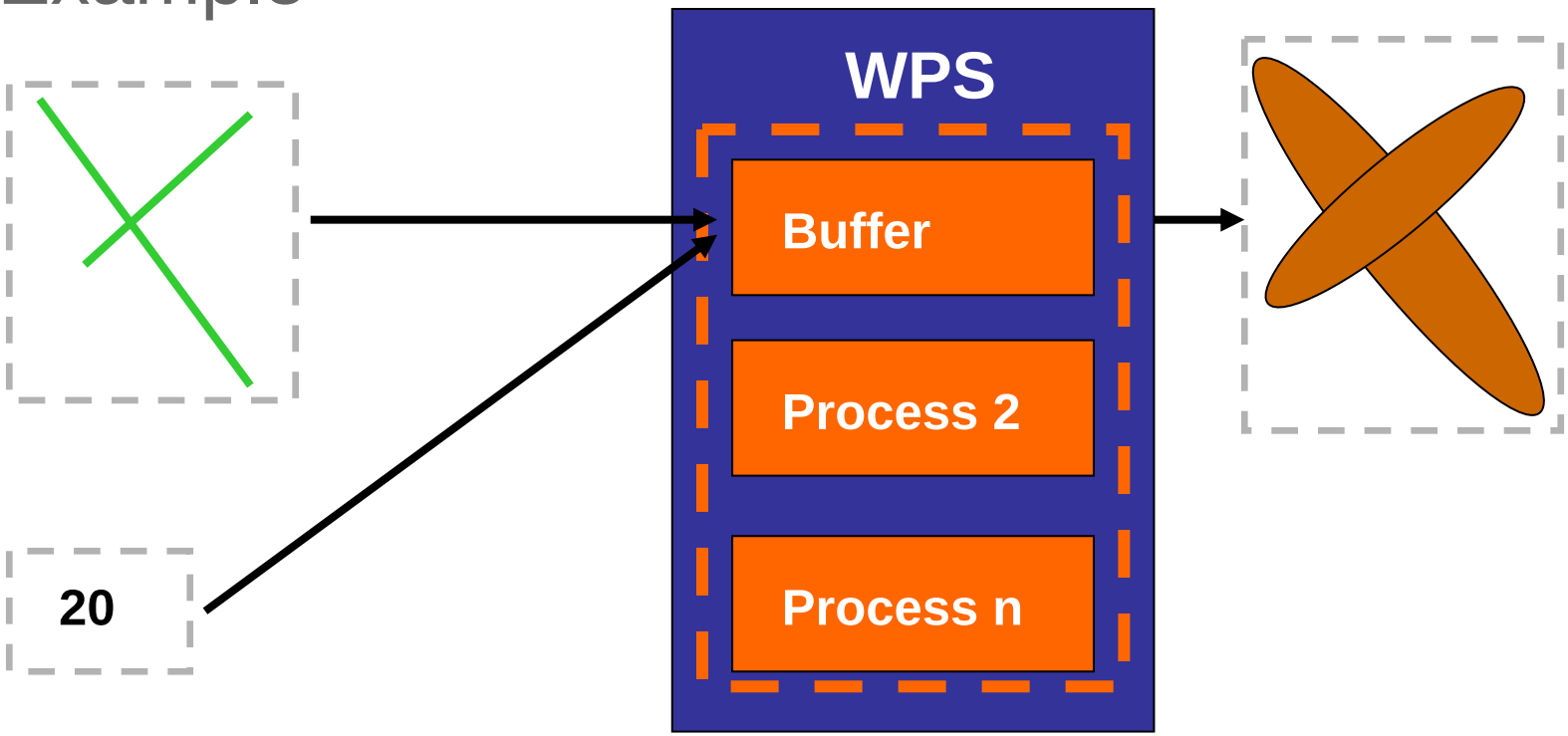


WPS

- Execution

WPS

- Example



WPS additional features

- Execution
  - →Synchronous
  - →Asynchronous

WPS additional features

- Execution
  - →Synchronous
  - →Asynchronous

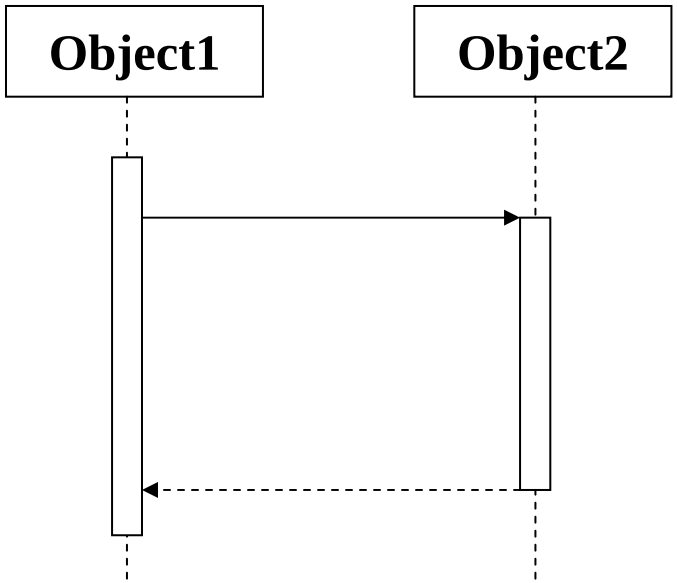
  - →Wrapped XML payload
  - →Raw data payload

  - →Referencing data (HTTP-GET & HTTP-POST

WPS additional features

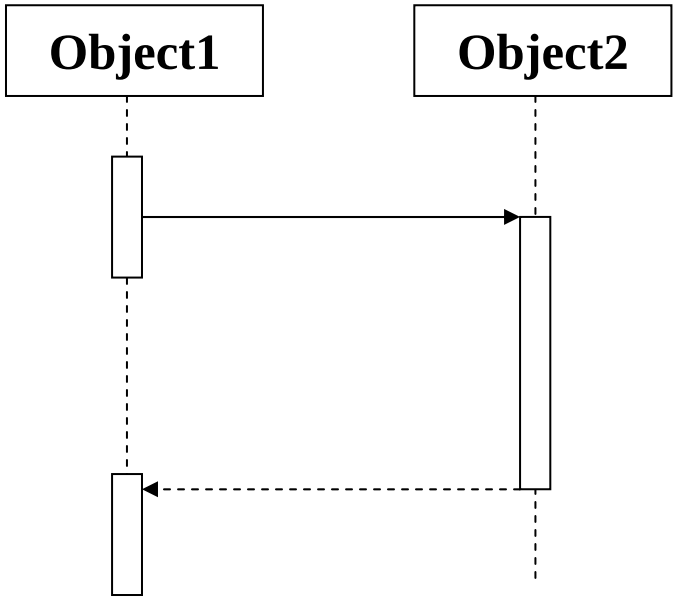
- Execution
  → Asynchronous

Execution synchronous



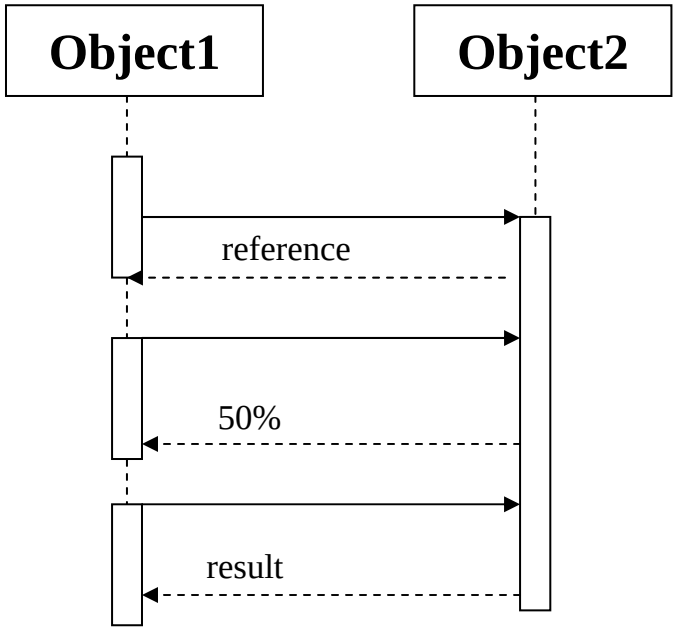
Execution asynchronous

- Push-model



Execution asynchronous

- Pull-model



Execution asynchronous

- Request

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<wps:Execute service="WPS" version="1.0.0" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:xsi="
http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
http://www.opengis.net/wps/1.0.0
   http://geoserver.itc.nl:8080/wps/schemas/wps/1.0.0/wpsExecute_request.xsd">
   <ows:Identifier>org.n52.wps.server.algorithm.SimpleBufferAlgorithm</ows:Identifier>
   <wps:DataInputs>
      <wps:Input>
```

```
<wps:ResponseForm>
<wps:ResponseDocument storeExecuteResponse="true" status="true">
   <wps:Output asReference="true">
      <ows:Identifier>result</ows:Identifier>
   </wps:Output>
</wps:ResponseDocument>
</wps:ResponseForm>
```

Execution asynchronous

- Response

```
- <ns:ExecuteResponse xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://geoserver.itc.nl:8080/wps/schemas/wps/
  serviceInstance="http://geoserver.itc.nl:8080/wps100/WebProcessingService?SERVICE=GetCapabilities&SERVICE=WPS" x
  statusLocation="http://geoserver.itc.nl:8080/wps100/RetrieveResultServlet?id=1213091000334">
  - <ns:Process ns:processVersion="2">
      <ns1:Identifier>org.n52.wps.server.algorithm.SimpleBufferAlgorithm</ns1:Identifier>
      <ows:Title>Create a buffer around a polygon.</ows:Title>
    </ns:Process>
  - <ns:Status creationTime="2008-06-10T11:43:20.334+02:00">
      <ns:ProcessStarted percentCompleted="33"/>
    </ns:Status>
</ns:ExecuteResponse>
```

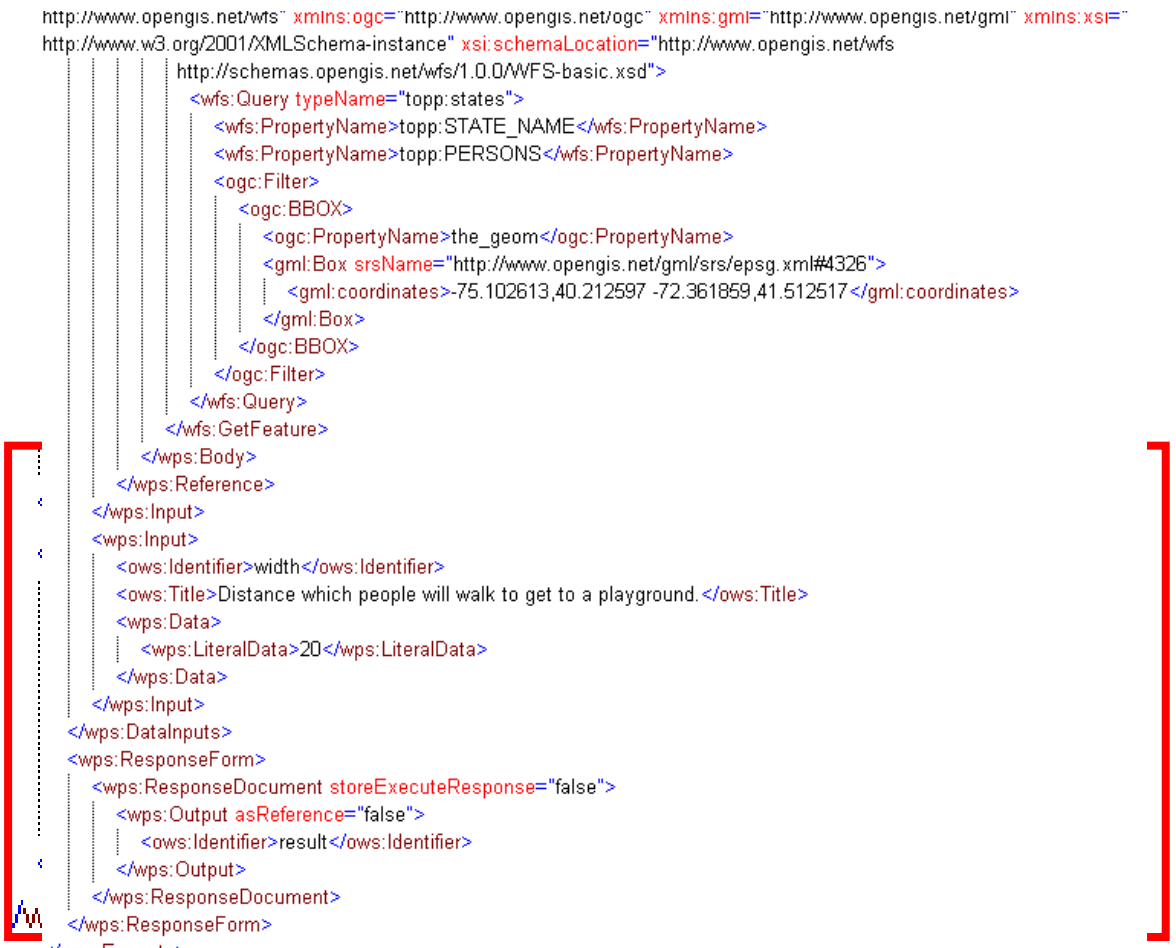
Execution asynchronous

- Response (process finished)

```
- <ns:ExecuteResponse xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://geoserver.itc.nl:8080/wps/schemas/wps/1.0.0/wpsExecute_response.xsd"
  serviceInstance="http://geoserver.itc.nl:8080/wps100/WebProcessingService?SERVICE=GetCapabilities&SERVICE=WPS" xml:lang="en-US" service="WPS" version="1.0.0"
  statusLocation="http://geoserver.itc.nl:8080/wps100/RetrieveResultServlet?id=1213091000334">
  - <ns:Process ns:processVersion="2">
      <ns1:Identifier>org.n52.wps.server.algorithm.SimpleBufferAlgorithm</ns1:Identifier>
      <ows:Title>Create a buffer around a polygon.</ows:Title>
    </ns:Process>
  - <ns:Status creationTime="2008-06-10T11:43:20.428+02:00">
      <ns:ProcessSucceeded>Process successful</ns:ProcessSucceeded>
    </ns:Status>
  - <ns:Output>
      <ns1:Identifier>result</ns1:Identifier>
      <ows:
      <ns:F xsd" href="http://geoserver.itc.nl:8080/wps100/RetrieveResultServlet?id=1213091000334@result"/> tServlet?id=12130910003
    </ns:Ou
```

Wrapped XML

- Request



```
http://www.opengis.net/wfs" xmlns:ogc="http://www.opengis.net/ogc" xmlns:gml="http://www.opengis.net/gml" xmlns:xsi="
http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.opengis.net/wfs
                http://schemas.opengis.net/wfs/1.0.0/WFS-basic.xsd">
                  <wfs:Query typeName="topp:states">
                    <wfs:PropertyName>topp:STATE_NAME</wfs:PropertyName>
                    <wfs:PropertyName>topp:PERSONS</wfs:PropertyName>
                    <ogc:Filter>
                      <ogc:BBOX>
                        <ogc:PropertyName>the_geom</ogc:PropertyName>
                        <gml:Box srsName="http://www.opengis.net/gml/srs/epsg.xml#4326">
                          <gml:coordinates>-75.102613,40.212597 -72.361859,41.512517</gml:coordinates>
                        </gml:Box>
                      </ogc:BBOX>
                    </ogc:Filter>
                  </wfs:Query>
                </wfs:GetFeature>
              </wps:Body>
            </wps:Reference>
          </wps:Input>
          <wps:Input>
            <ows:Identifier>width</ows:Identifier>
            <ows:Title>Distance which people will walk to get to a playground.</ows:Title>
            <wps:Data>
              <wps:LiteralData>20</wps:LiteralData>
            </wps:Data>
          </wps:Input>
        </wps:DataInputs>
        <wps:ResponseForm>
          <wps:ResponseDocument storeExecuteResponse="false">
            <wps:Output asReference="false">
              <ows:Identifier>result</ows:Identifier>
            </wps:Output>
          </wps:ResponseDocument>
        </wps:ResponseForm>
      </wps:Execute>
```

Wrapped XML

- Response


```
<ns:ExecuteResponse xmlns:ns="http://www.opengis.net/wps/1.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
http://www.opengis.net/wps/1.0.0 http://geoserver.itc.nl:8080/wps/schemas/wps/1.0.0/wpsExecute_response.xsd" serviceInstance="
http://geoserver.itc.nl:8080/wps100/WebProcessingService?SERVICE=GetCapabilities&amp;SERVICE=WPS" xml:lang="en-US" service="WPS" version
="1.0.0">
  <ns:Process ns:processVersion="2">
    <ns1:Identifier xmlns:ns1="http://www.opengis.net/ows/1.1">org.n52.wps.server.algorithm.SimpleBufferAlgorithm</ns1:Identifier>
    <ows:Title xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
>Create a buffer around a polygon.</ows:Title>
  </ns:Process>
  <ns:Status creationTime="2007-09-22T18:01:38.092+02:00">
    <ns:ProcessSucceeded>The service succesfully processed the request.</ns:ProcessSucceeded>
  </ns:Status>
  <ns:ProcessOutputs>
    <ns:Output>
      <ns1:Identifier xmlns:ns1="http://www.opengis.net/ows/1.1">result</ns1:Identifier>
      <ows:Title xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:xlink="
http://www.w3.org/1999/xlink">Buffered Polygon</ows:Title>
      <ns:Data>
        <ns:ComplexData>
          <pac:GMLPacket xmlns:pac="http://www.opengis.net/examples/packet">
            <pac:packetMember>
              <pac:StaticFeature>
                <gml:polygonProperty xmlns:gml="http://www.opengis.net/gml">
                  <gml:Polygon>
                    <gml:outerBoundaryIs>
                      <gml:LinearRing>
                        <gml:coord>
                          <gml:X>-99.7631088660699</gml:X>
                          <gml:Y>42.147748166422396</gml:Y>
                        </gml:coord>
                        <gml:coord>
                          <gml:X>-99.7631088660699</gml:X>
                          <gml:Y>42.1477481664224</gml:Y>
                        </gml:coord>
```

Wrapped XML

- Response


```
<ns:ExecuteResponse xmlns:ns="http://www.opengis.net/wps/1.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
http://www.opengis.net/wps/1.0.0 http://geoserver.itc.nl:8080/wps/schemas/wps/1.0.0/wpsExecute_response.xsd" serviceInstance="
http://geoserver.itc.nl:8080/wps100/WebProcessingService?SERVICE=GetCapabilities&amp;SERVICE=WPS" xml:lang="en-US" service="WPS" version
="1.0.0">
  <ns:Process ns:processVersion="2">
    <ns1:Identifier xmlns:ns1="http://www.opengis.net/ows/1.1">org.n52.wps.server.algorithm.SimpleBufferAlgorithm</ns1:Identifier>
    <ows:Title xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
>Create a buffer around a polygon.</ows:Title>
  </ns:Process>
  <ns:Status creationTime="2007-09-22T18:01:38.092+02:00">
    <ns:ProcessSucceeded>The service succesfully processed the request.</ns:ProcessSucceeded>
  </ns:Status>
  <ns:ProcessOutputs>
    <ns:Output>
      <ns1:Identifier xmlns:ns1="http://www.opengis.net/ows/1.1">result</ns1:Identifier>
      <ows:Title xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:xlink="
http://www.w3.org/1999/xlink">Buffered Polygon</ows:Title>
      <ns:Data>
        <ns:ComplexData>
          <pac:GMLPacket xmlns:pac="http://www.opengis.net/examples/packet">
            <pac:packetMember>
              <pac:StaticFeature>
                <gml:polygonProperty xmlns:gml="http://www.opengis.net/gml">
                  <gml:Polygon>
                    <gml:outerBoundaryIs>
                      <gml:LinearRing>
                        <gml:coord>
                          <gml:X>-99.7631088660699</gml:X>
                          <gml:Y>42.147748166422396</gml:Y>
                        </gml:coord>
                        <gml:coord>
                          <gml:X>-99.7631088660699</gml:X>
                          <gml:Y>42.1477481664224</gml:Y>
                        </gml:coord>
```

WPS additional features

- Execution
  - →Raw Data
- Advantages
  - →Less overhead
  - →Especially interesting for binary data

Raw Data

- Request

```
<wps:Execute service="WPS" version="1.0.0" xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:xlink="
http://www.w3.org/1999/xlink" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
    http://geoserver.itc.nl:8080/wps/schemas/wps/1.0.0/wpsExecute_request.xsd">
    <ows:Identifier>org.n52.wps.server.algorithm.SimpleBufferAlgorithm</ows:Identifier>
    <wps:DataInputs>
        <wps:Input>
            <ows:Identifier>data</ows:Identifier>
            <wps:Reference schema="http://schemas.opengis.net/gml/2.1.2/feature.xsd" xlink:href="
http://geoserver.itc.nl:8080/geoserver/wfs?Request=GetFeature&amp;TypeName=topp:tasmania_roads"/>
        </wps:Input>
        <wps:Input>
            <ows:Identifier>width</ows:Identifier>
            <ows:Title>Distance which people will walk to get to a playground.</ows:Title>
            <wps:Data>
                <wps:LiteralData>20</wps:LiteralData>
            </wps:Data>
        </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
        <wps:RawDataOutput>
            <ows:Identifier>result</ows:Identifier>
        </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

Raw Data

- Response

```
<pac:GMLPacket xmlns:pac="http://www.opengis.net/examples/packet">
  <pac:packetMember>
    <pac:StaticFeature>
      <gml:polygonProperty xmlns:gml="http://www.opengis.net/gml">
        <gml:Polygon>
          <gml:outerBoundaryIs>
            <gml:LinearRing>
              <gml:coord>
                <gml:X>135.6352068605522</gml:X>
                <gml:Y>-57.93913839049884</gml:Y>
              </gml:coord>
              <gml:coord>
                <gml:X>133.8893059134356</gml:X>
                <gml:Y>-56.79016968573322</gml:Y>
              </gml:coord>
```

52°North WPS

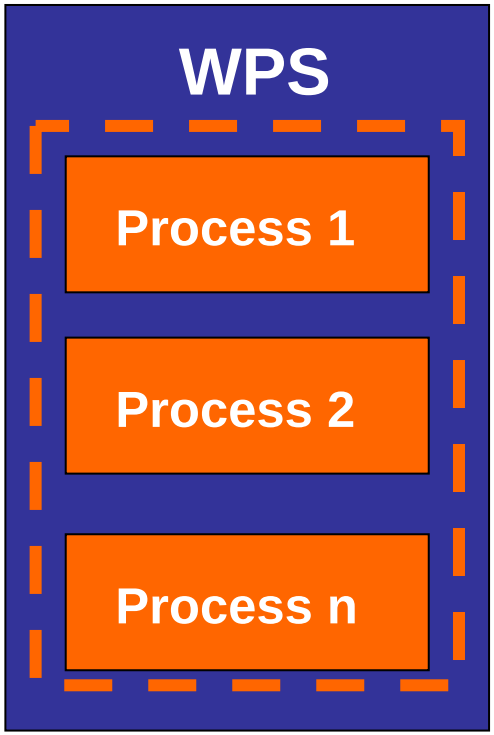
52°North WPS Features

- Overview
  - →Features
    - →Full java-based Open Source implementation
    - →Pluggable framework for algorithms and XML data handling
    - →Build up on robust OS libraries (JTS, geotools, xmlBeans, servlet API, derby)
    - →Supports full logging of service activity
    - →Supports exception handling according to the spec
    - →Storing of execution results
    - →Full GML2 support for ComplexValues (i.e. FeatureCollections)
    - →Support of raster processing (beta)

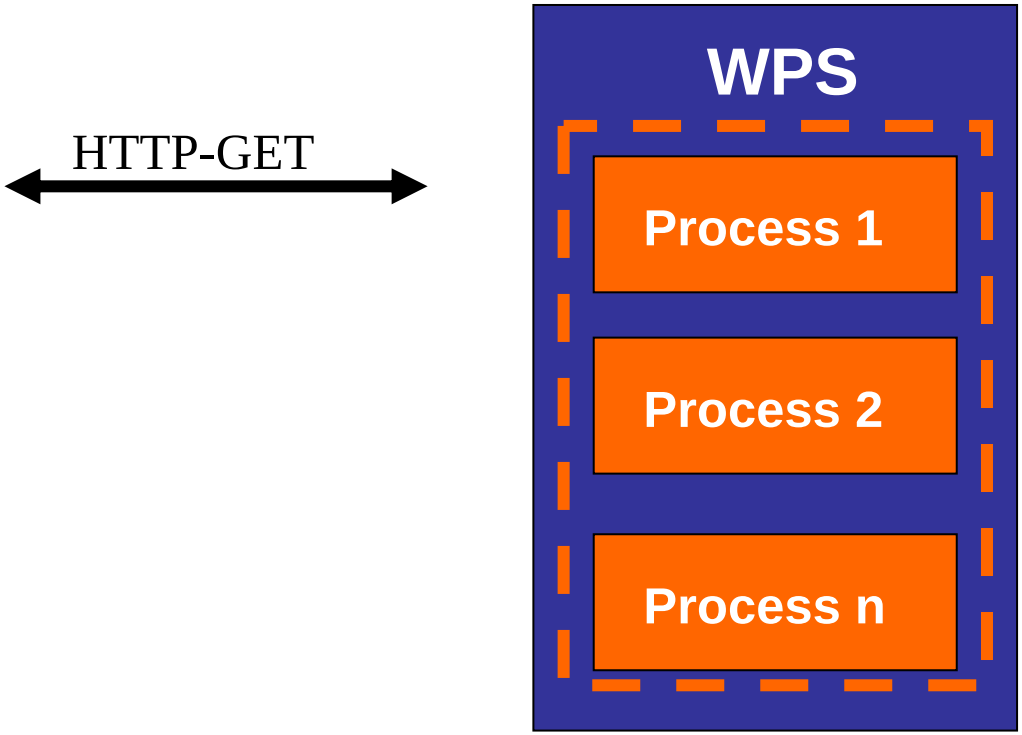
52°North WPS Features

- Overview
  - →New features
    - → SOAP/WSDL support
    - → Repository Concept
    - → Plug&Play parsers
    - → Synchronous processing
    - → Asynchronus processing
    - → Easy Maven deployment

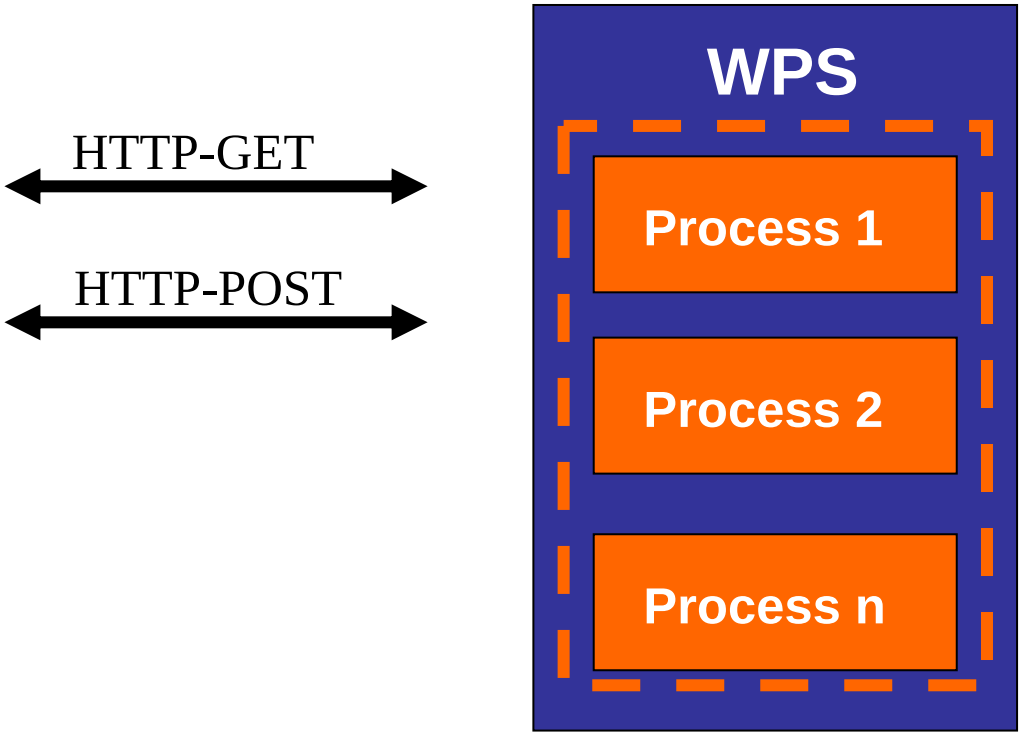
Binding



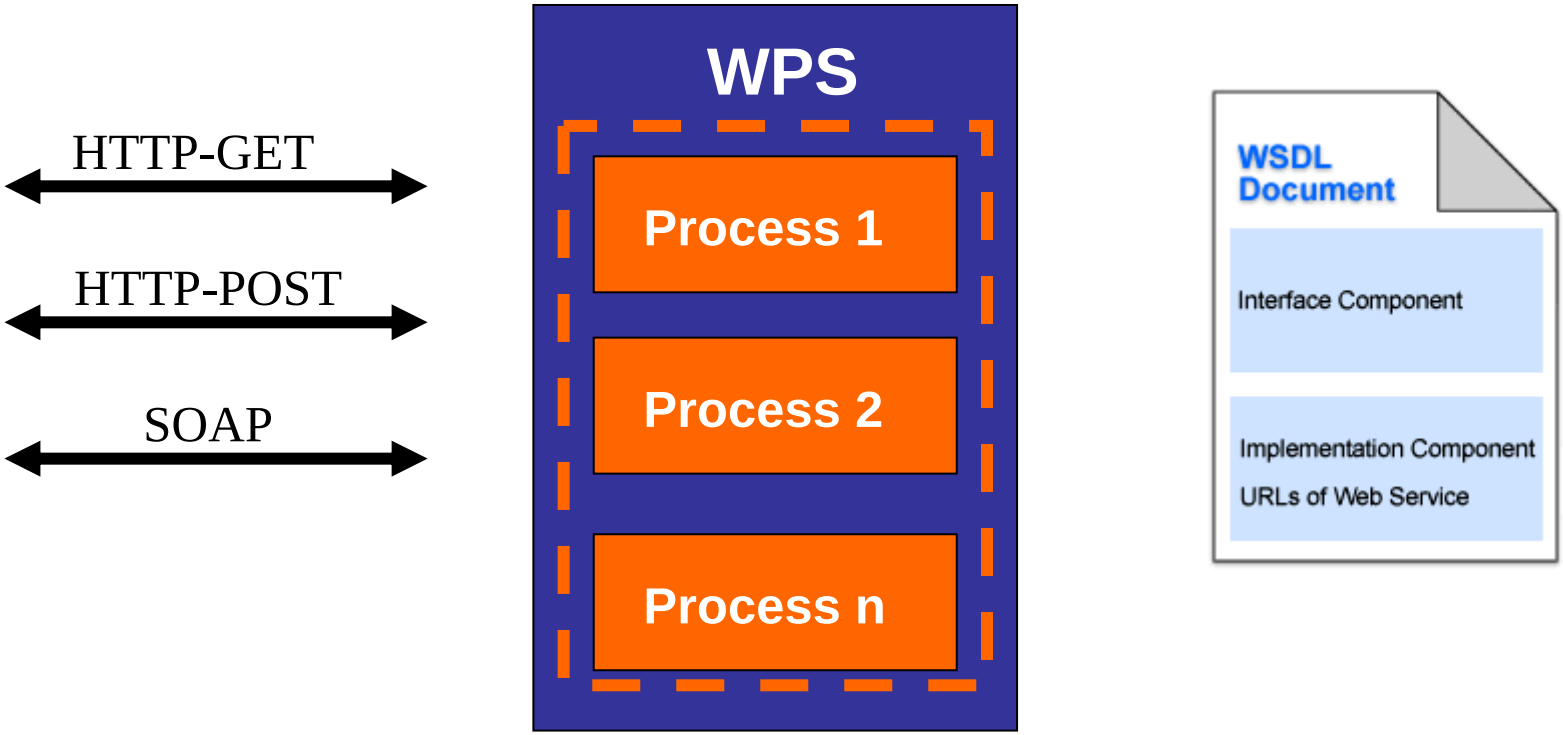
Binding



Binding



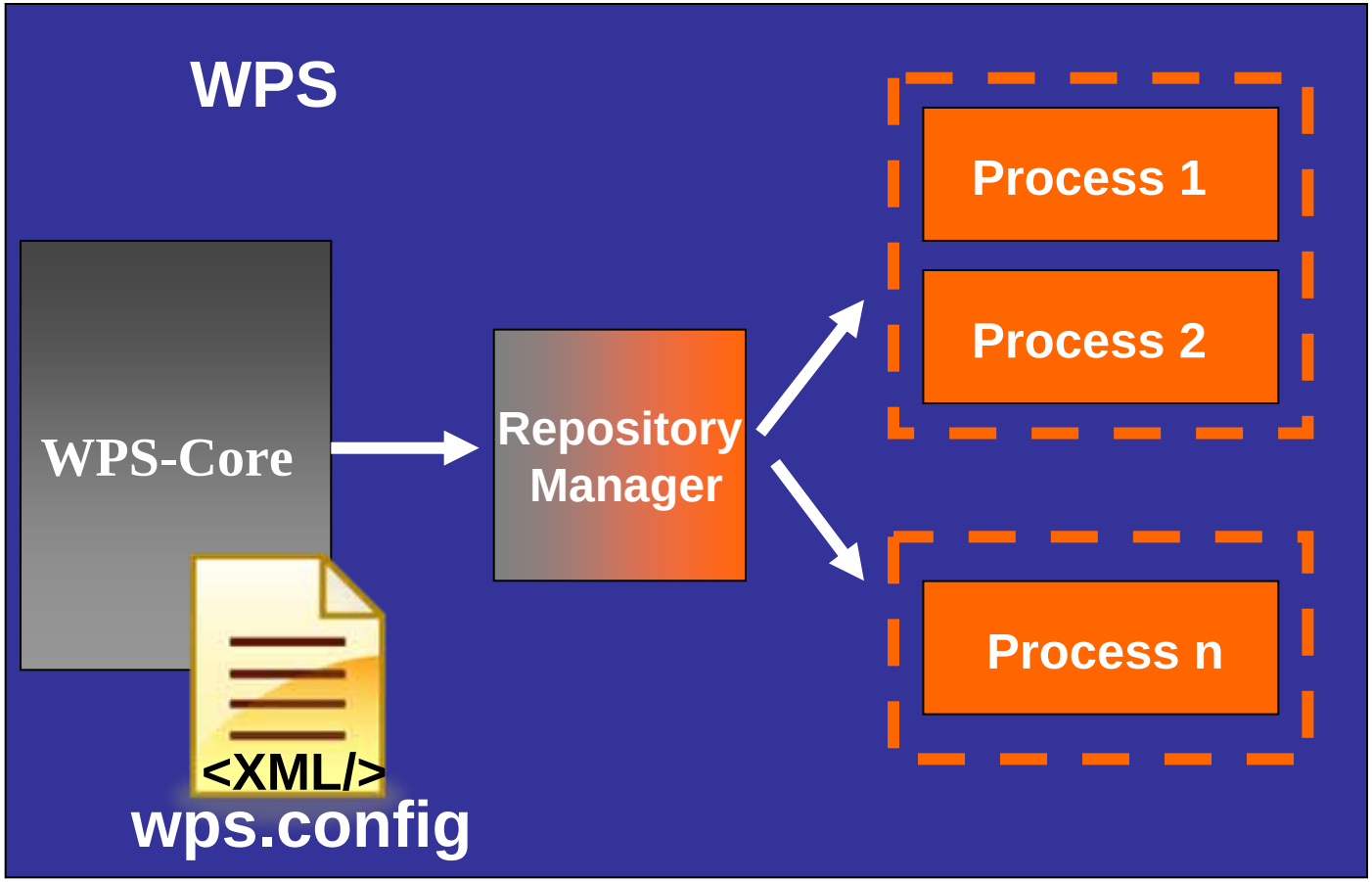
Binding


HTTP-GET
HTTP-POST
SOAP
WPS
Process 1
Process 2
Process n
WSDL Document
Interface Component
Implementation Component
URLs of Web Service

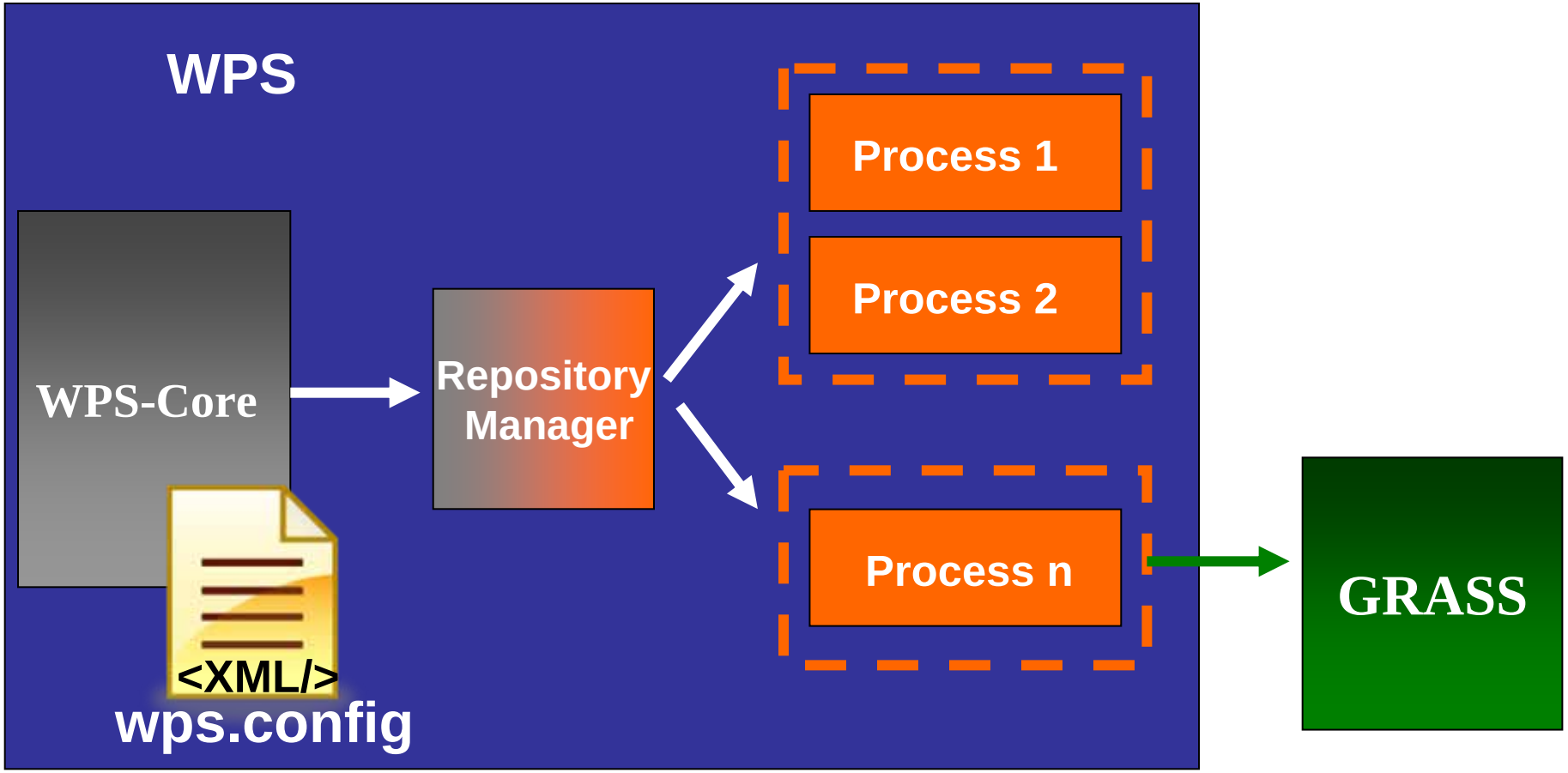
Repository Concept

- Discovery
- Execution

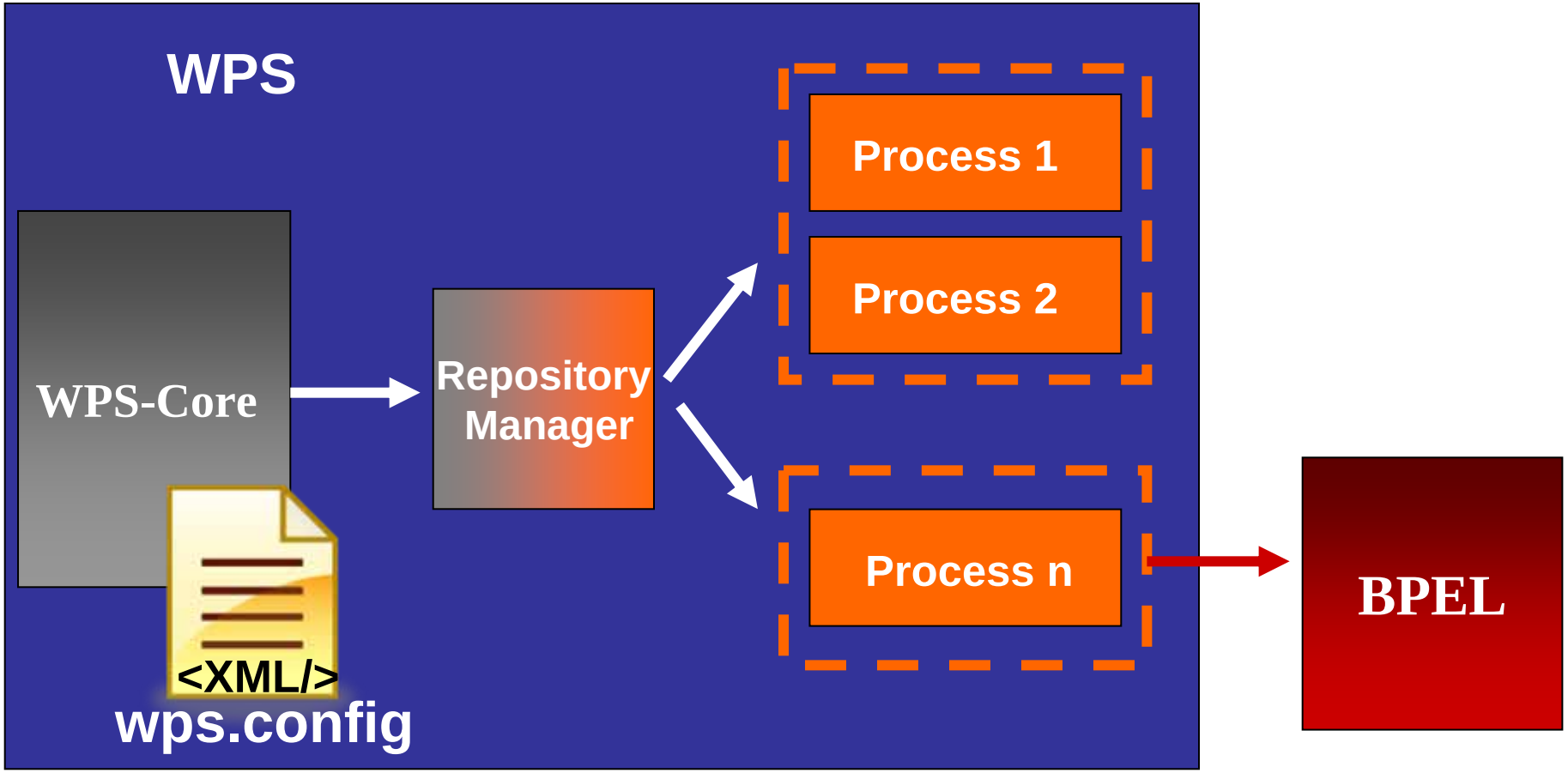
Repository Concept



Repository Concept



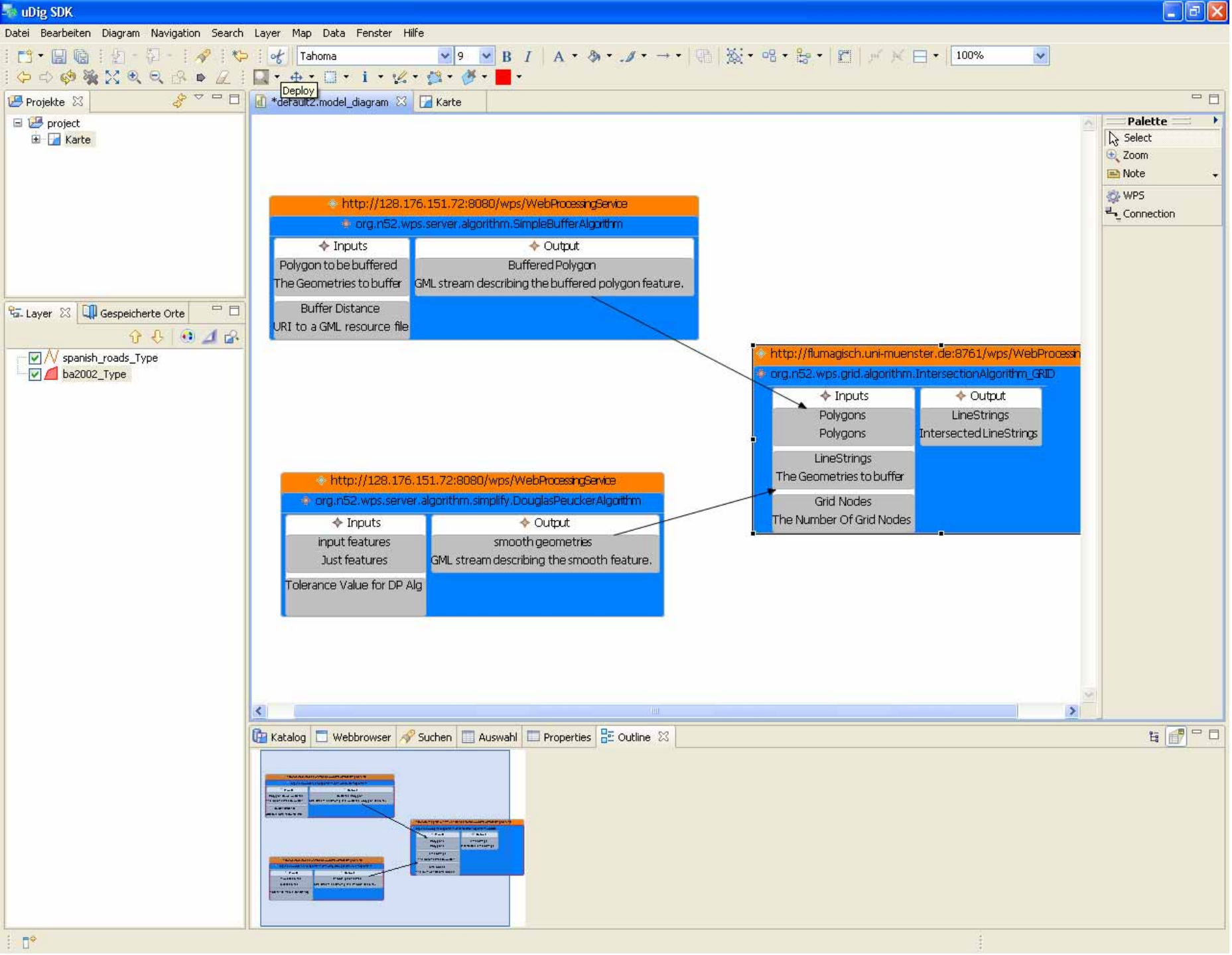
Repository Concept



52°North Geoprocessing Community Research

Udig workflow modelling plugin

- Current 52°North Geoprocessing Research
  - Udig workflow modelling plugin


uDig SDK
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project
Karte
Layer
Gespeicherte Orte
spanish_roads_Type
ba2002_Type
*default2.model_diagram
Karte
http://128.176.151.72:8080/wps/WebProcessingService
org.n52.wps.server.algorithm.SimpleBufferAlgorithm
Inputs
Polygon to be buffered
The Geometries to buffer
Buffer Distance
URI to a GML resource file
Output
Buffered Polygon
GML stream describing the buffered polygon feature.
http://flumagisch.uni-muenster.de:8761/wps/WebProcessin
org.n52.wps.grid.algorithm.IntersectionAlgorithm_GRID
Inputs
Polygons
Polygons
LineStrings
The Geometries to buffer
Grid Nodes
The Number Of Grid Nodes
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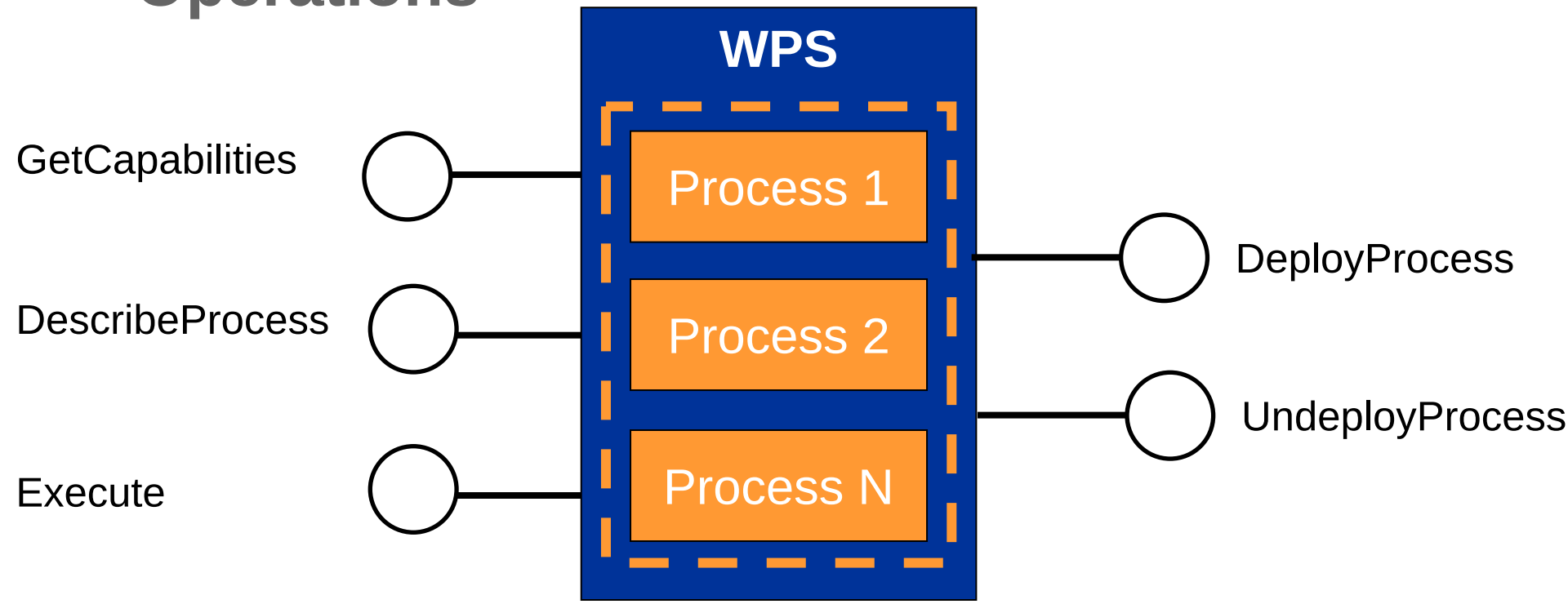
smooth geometries
GML stream describing the smooth feature.
Palette
Select
Zoom
Note
WPS
Connection
Katalog
Webbrowser
Suchen
Auswahl
Properties
Outline

WPS-T

- Current 52°North Geoprocessing Research
  - Udig workflow modelling plugin
  - WPS-T

WPS-T

Operations

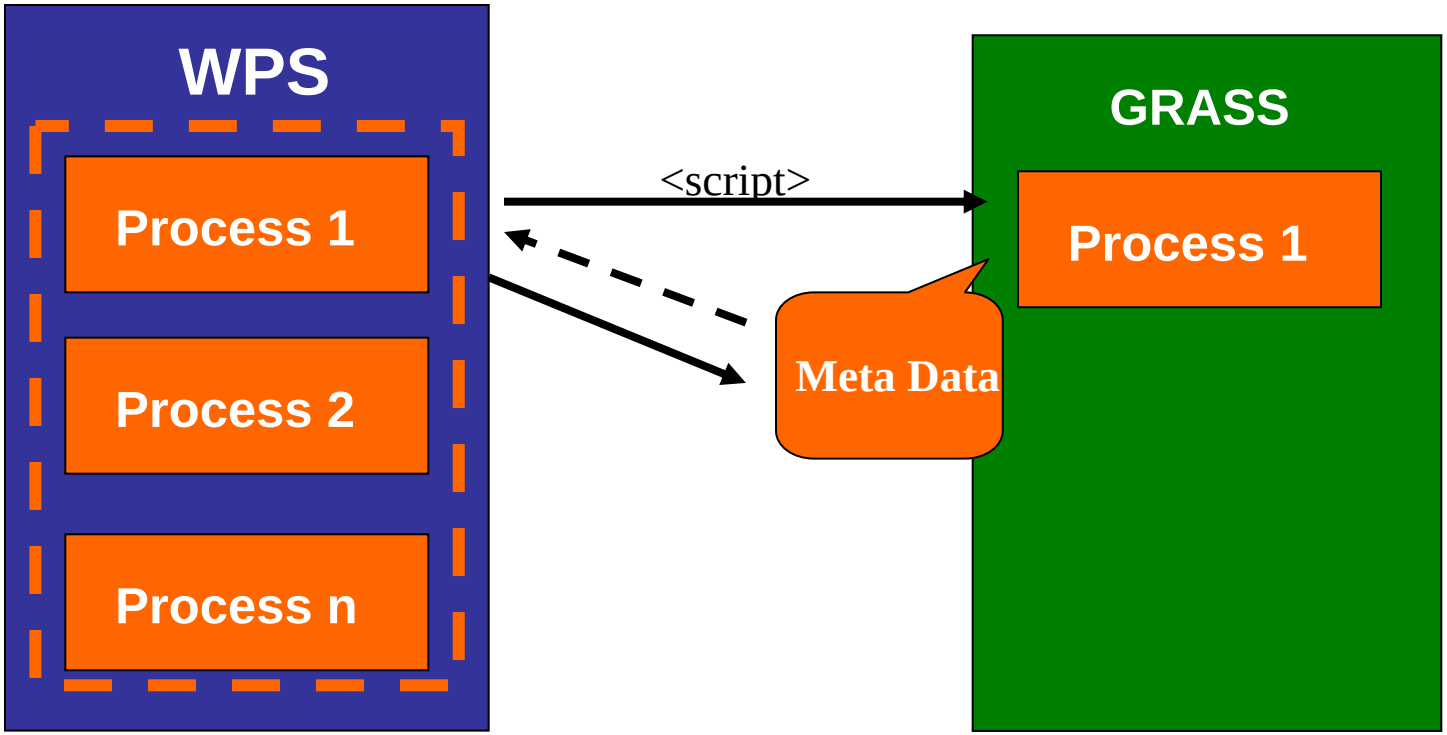


WPS GRASS support

- Current 52°North Geoprocessing Research
  - Udig workflow modelling plugin
  - WPS-T
  - WPS GRASS support

WPS GRASS support

- WPS & GRASS

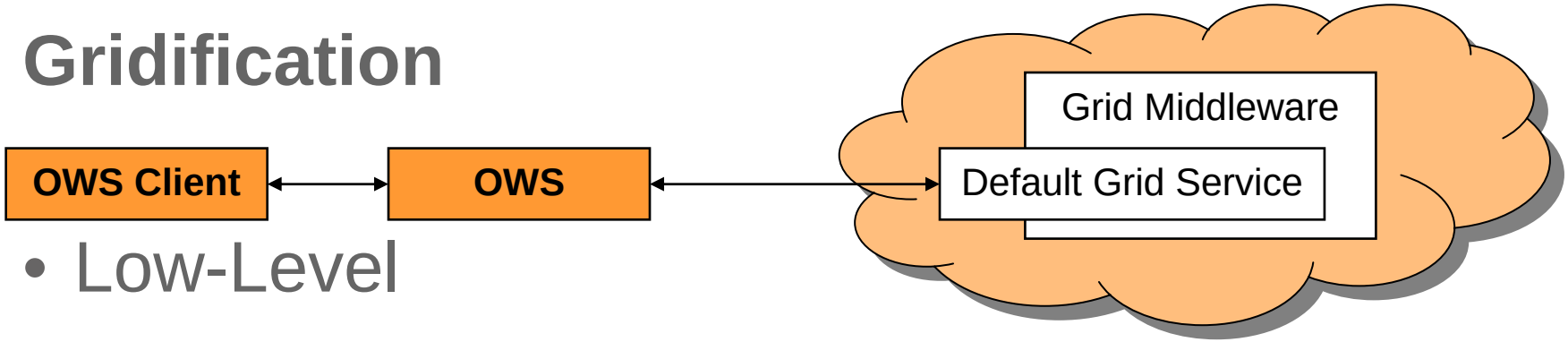


WPS and GRID technologies

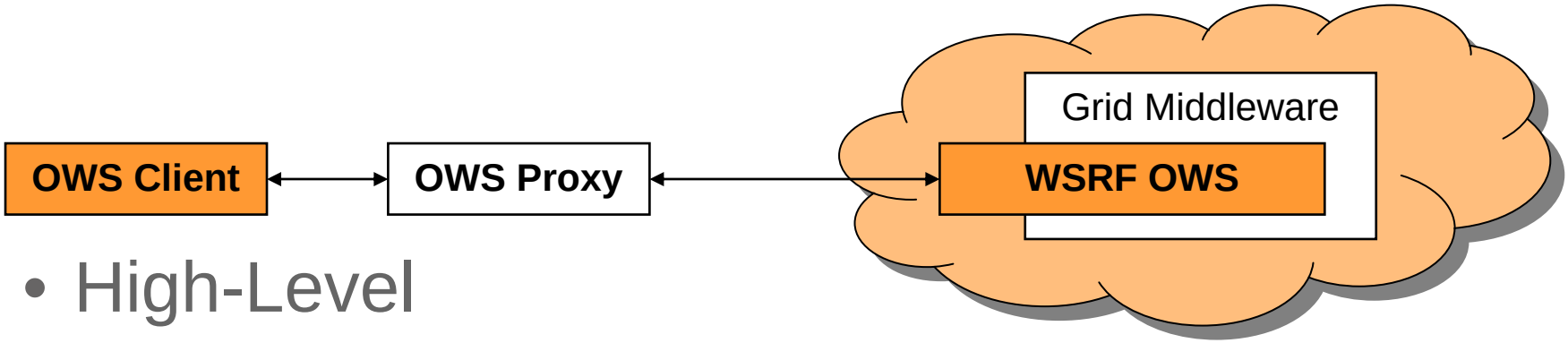
- Current 52°North Geoprocessing Research
  - Udig WPS 1.0.0-Client
  - Udig workflow modelling plugin
  - WPS-T
  - WPS GRASS support
  - WPS and GRID technologies

WPS and GRID technologies

Gridification

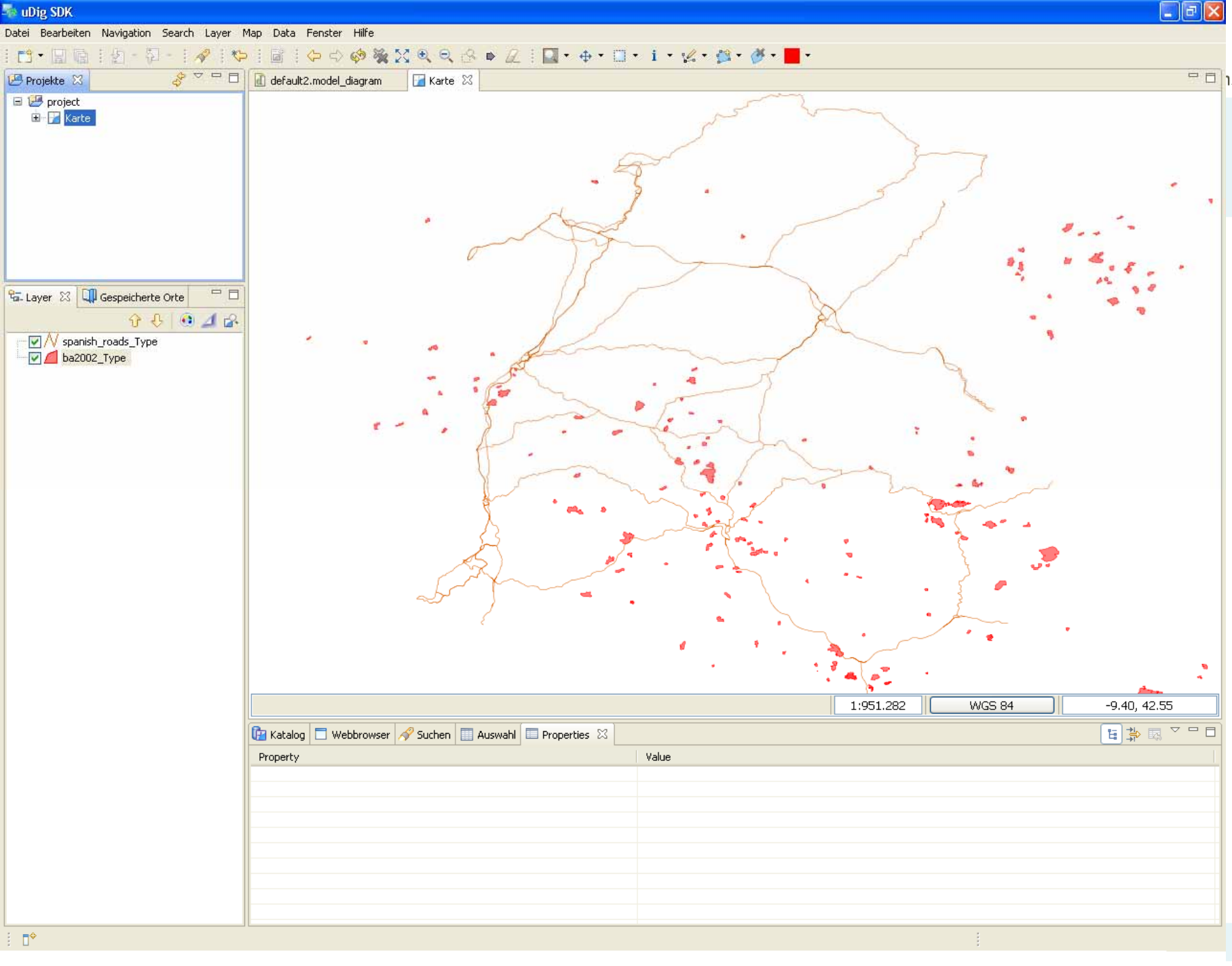


- Low-Level



- High-Level

Case Study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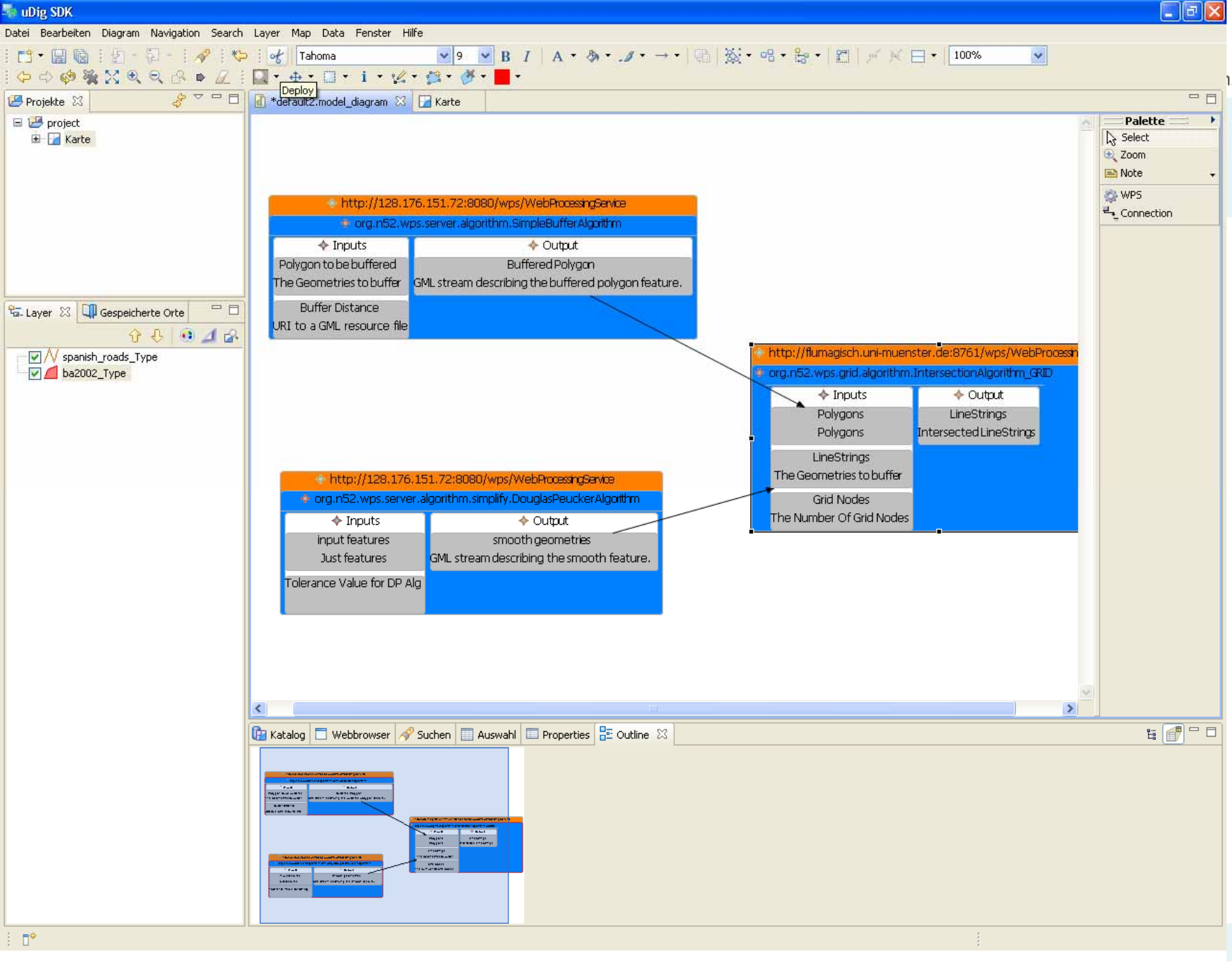
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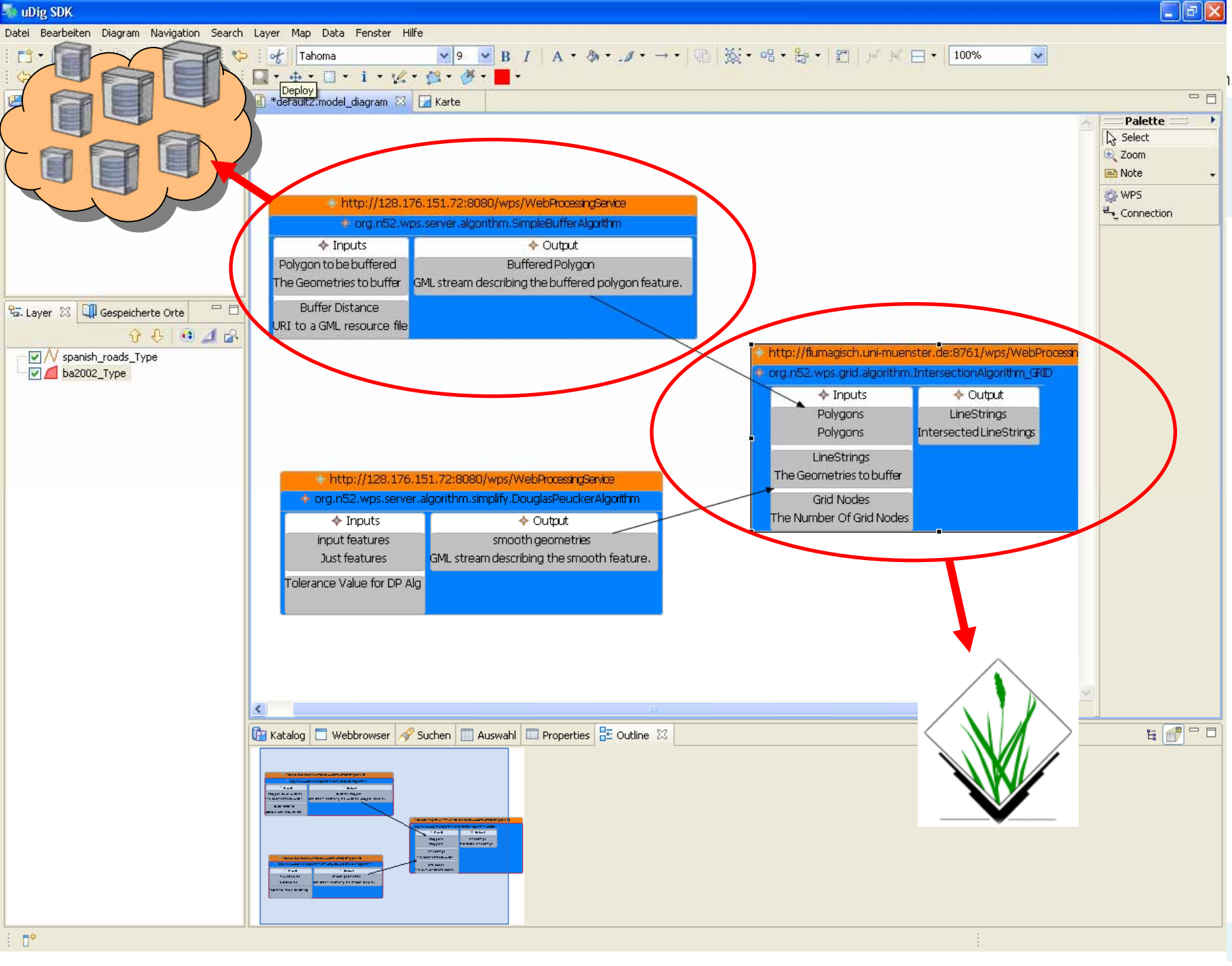
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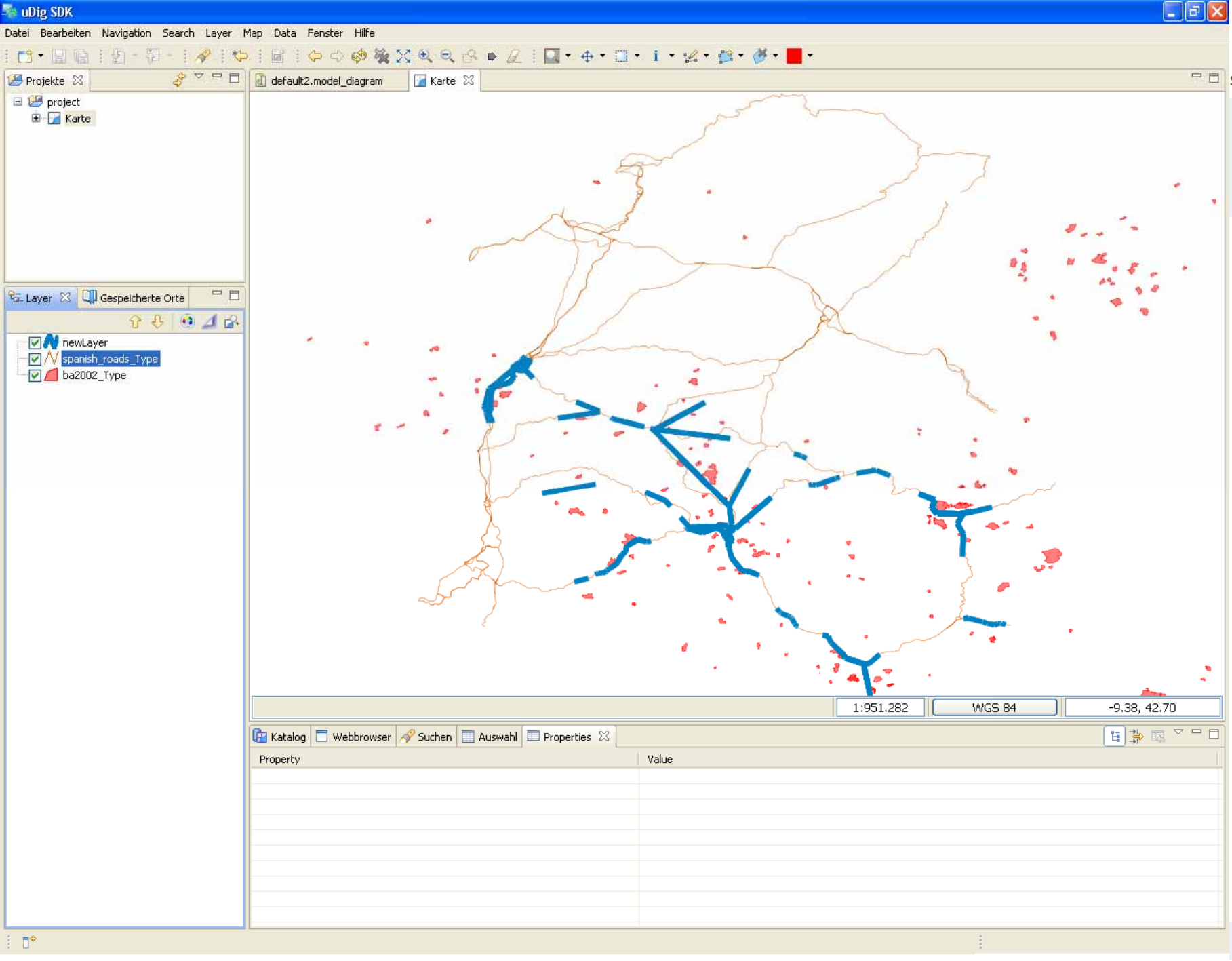
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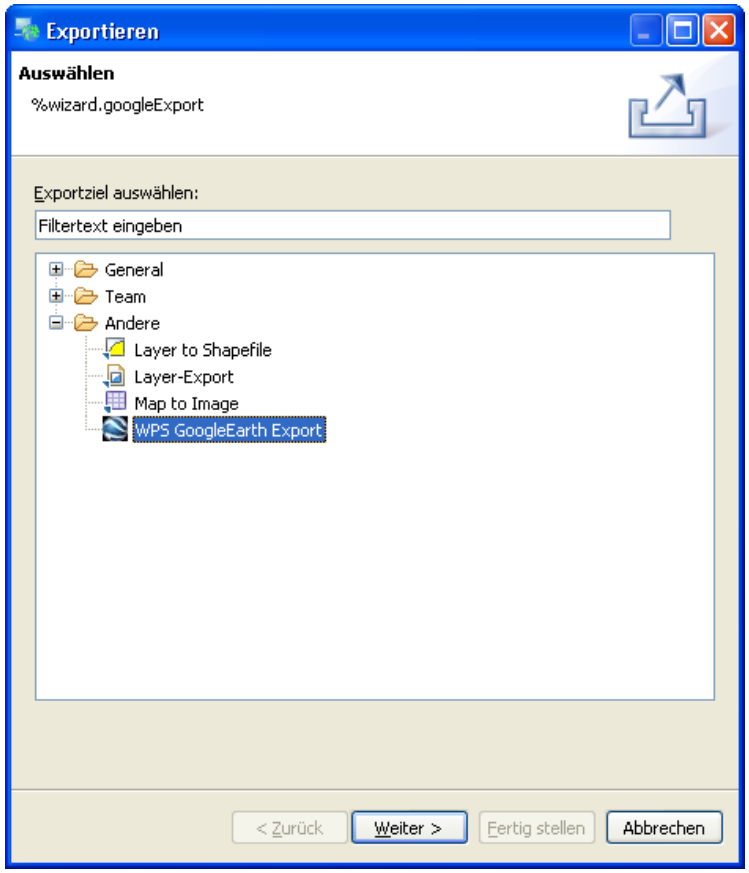
Exportieren
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Exportziel auswählen:
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Andere
Layer to Shapefile
Layer-Export
Map to Image
WPS GoogleEarth Export
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Fertig stellen
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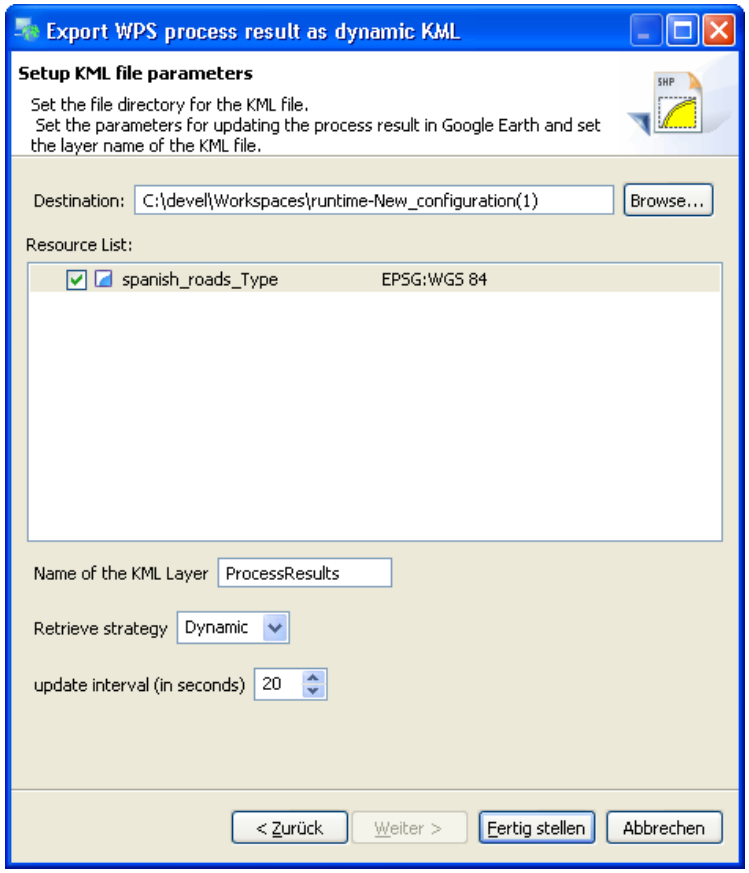
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Set the file directory for the KML file.
Set the parameters for updating the process result in Google Earth and set the layer name of the KML file.
Destination:
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Browse...
Resource List:
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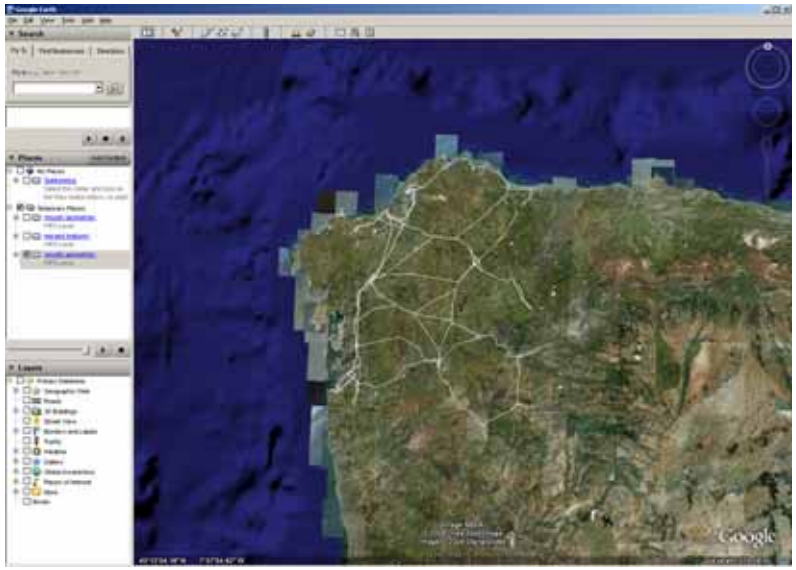
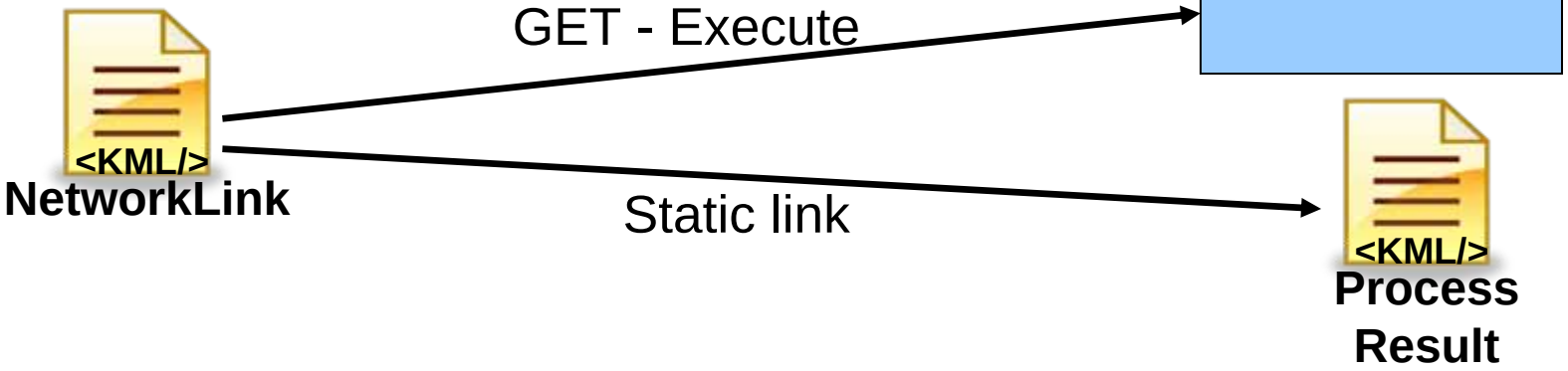
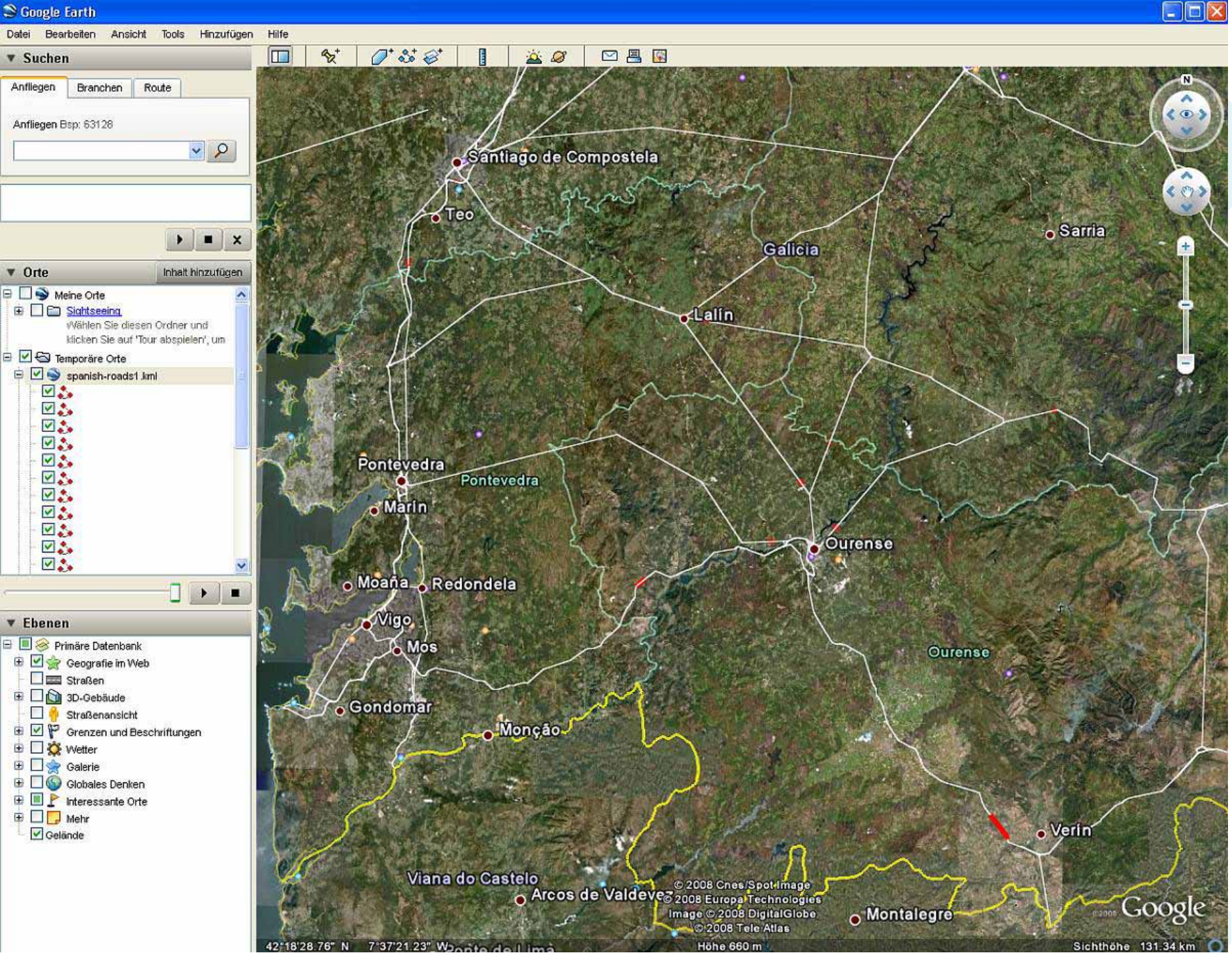
EPSG:WGS 84
Name of the KML Layer
ProcessResults
Retrieve strategy
Dynamic
update interval (in seconds)
20
< Zurück
Weiter >
Fertig stellen
Abbrechen

Google Earth process integration






Google Earth
Datei Bearbeiten Ansicht Tools Hinzufügen Hilfe
Suchen
Anfliegen Branchen Route
Anfliegen Bsp: 63128
Orte
Inhalt hinzufügen
Meine Orte
Sightseeing
Wählen Sie diesen Ordner und klicken Sie auf 'Tour abspielen', um
Temporäre Orte
spanish-roads1.kml
Ebenen
Primäre Datenbank
Geografie im Web
Straßen
3D-Gebäude
Straßenansicht
Grenzen und Beschriftungen
Wetter
Galerie
Globales Denken
Interessante Orte
Mehr
Gelände
Santiago de Compostela
Teo
Galicia
Sarria
Lalín
Pontevedra
Pontevedra
Marín
Ourense
Moaña
Redondela
Vigo
Mos
Ourense
Gondomar
Monção
Verín
Viana do Castelo
Arcos de Valdevez
Montalegre
© 2008 Cnes/Spot Image
© 2008 Europa Technologies
Image © 2008 DigitalGlobe
© 2008 Tele Atlas
Google
42°18'28.76" N 7°37'21.23" W
Höhe 660 m
Sichthöhe 131.34 km

52°North WPS

Thank You

Questions?

schaeffer@uni-muenster.de
foerster@itc.nl

http://www.52north.org/wps