

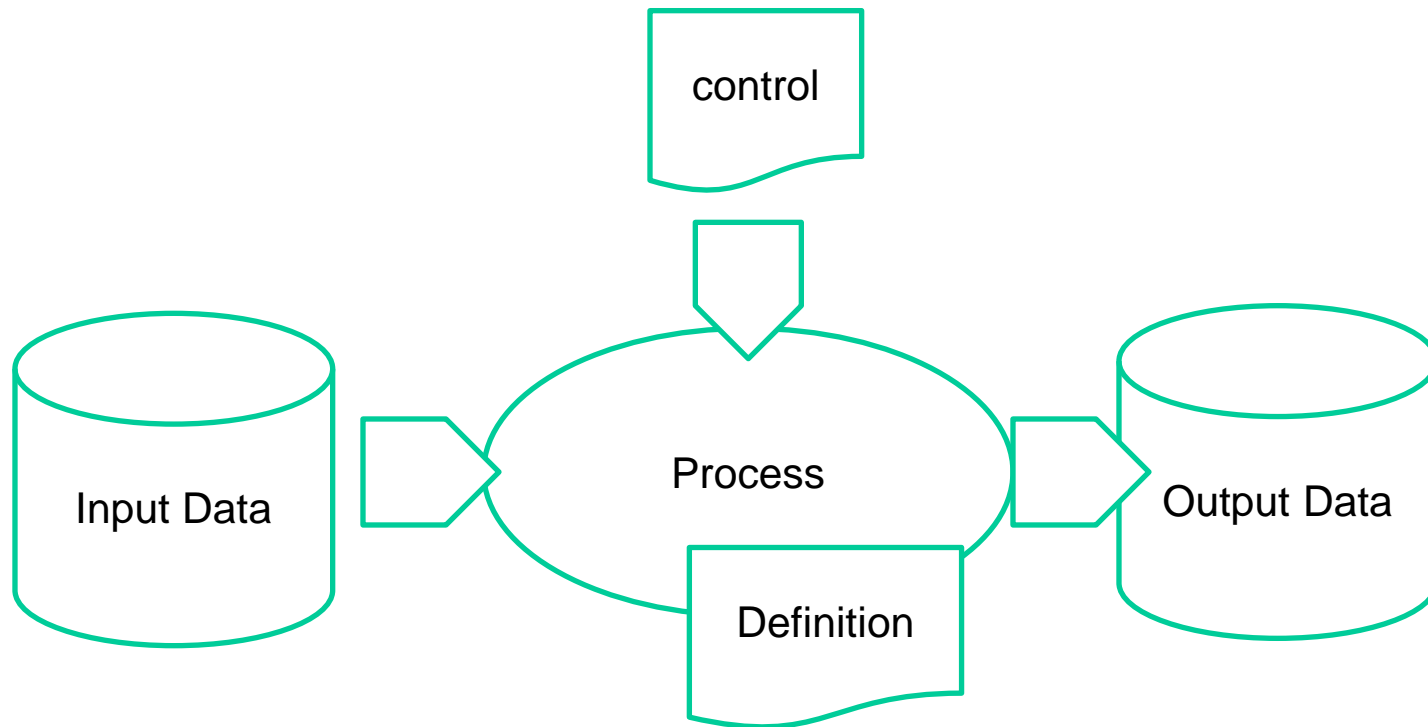
Web Processing Standards and Application Patterns

**4th Workshop on the use of GIS/OGC Standards in Meteorology
ECMWF, Reading, March 2013**

**Daniel Nüst
52°North GmbH**

PROCESSING

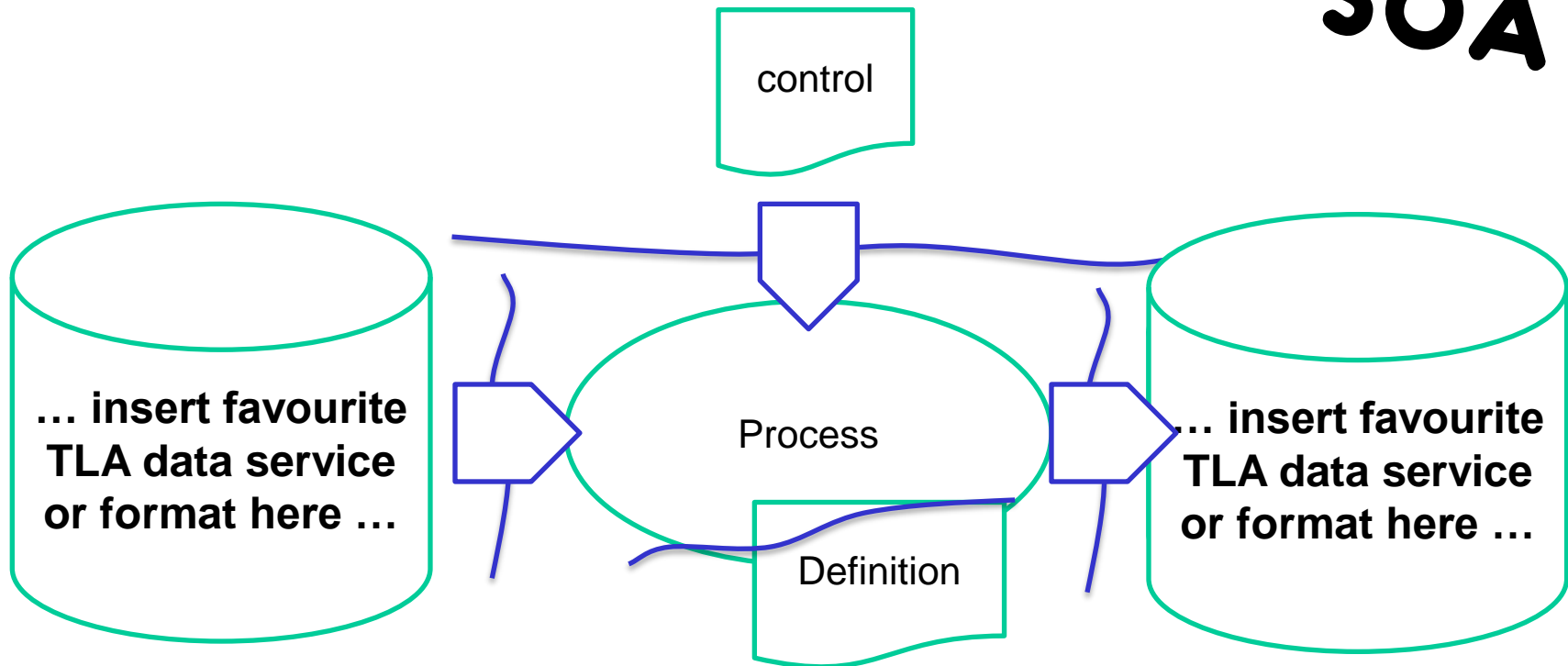
What is processing?



What is web-based Processing?

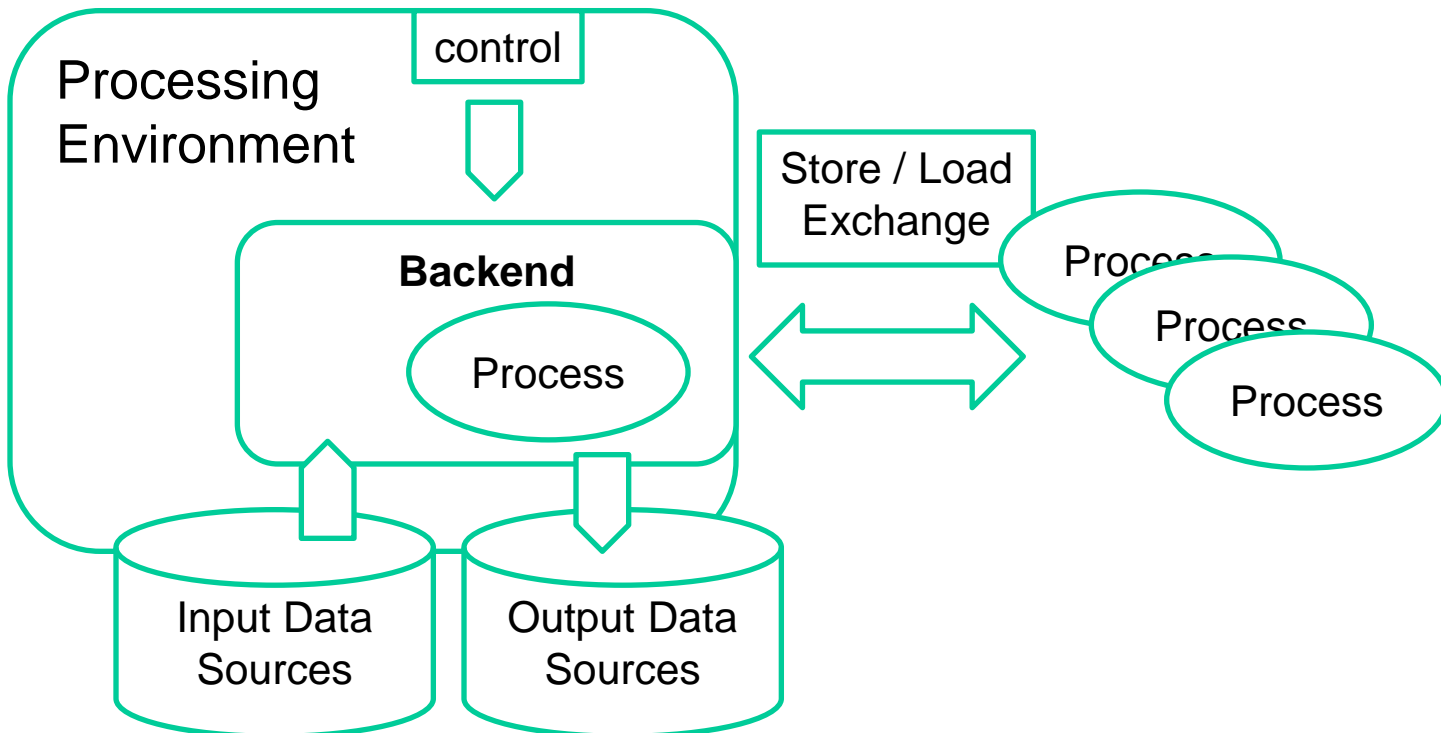
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SOA



What is web-based Processing?

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APPLICATION PATTERNS

Motivation

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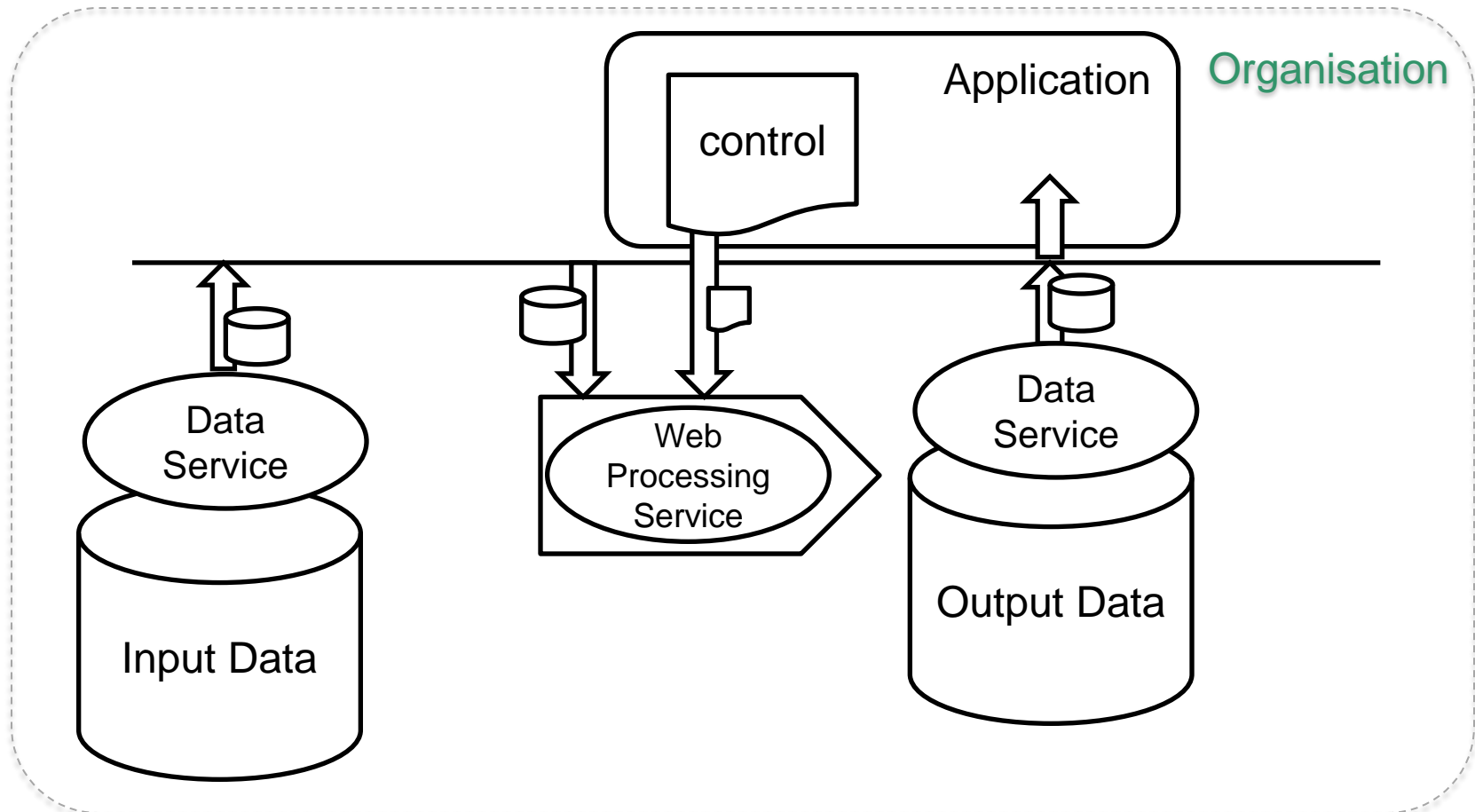
Sharing
Work

Sharing
Knowledge



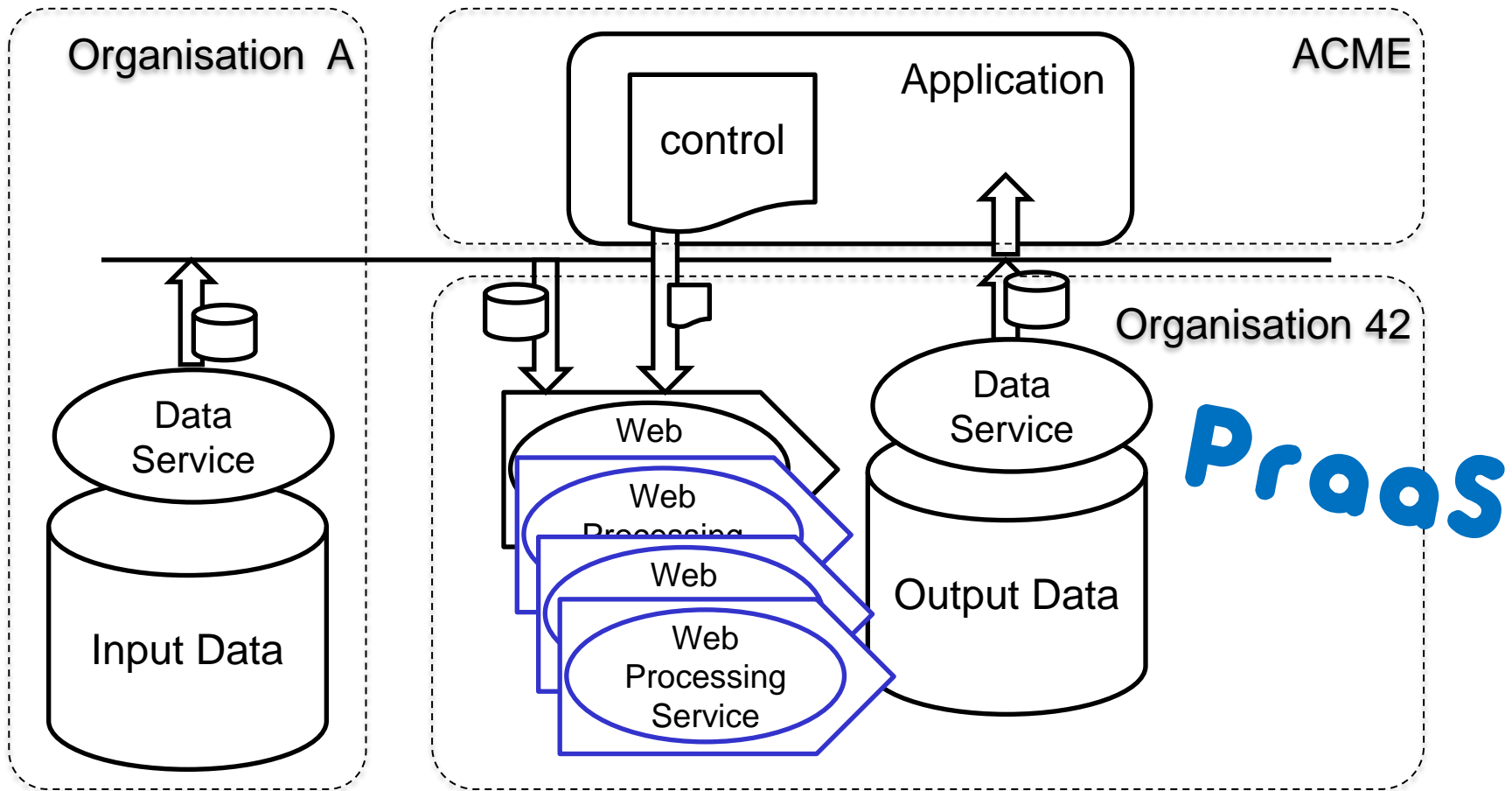
Web Processing

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Distribution and Collaboration

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Deployment Variants

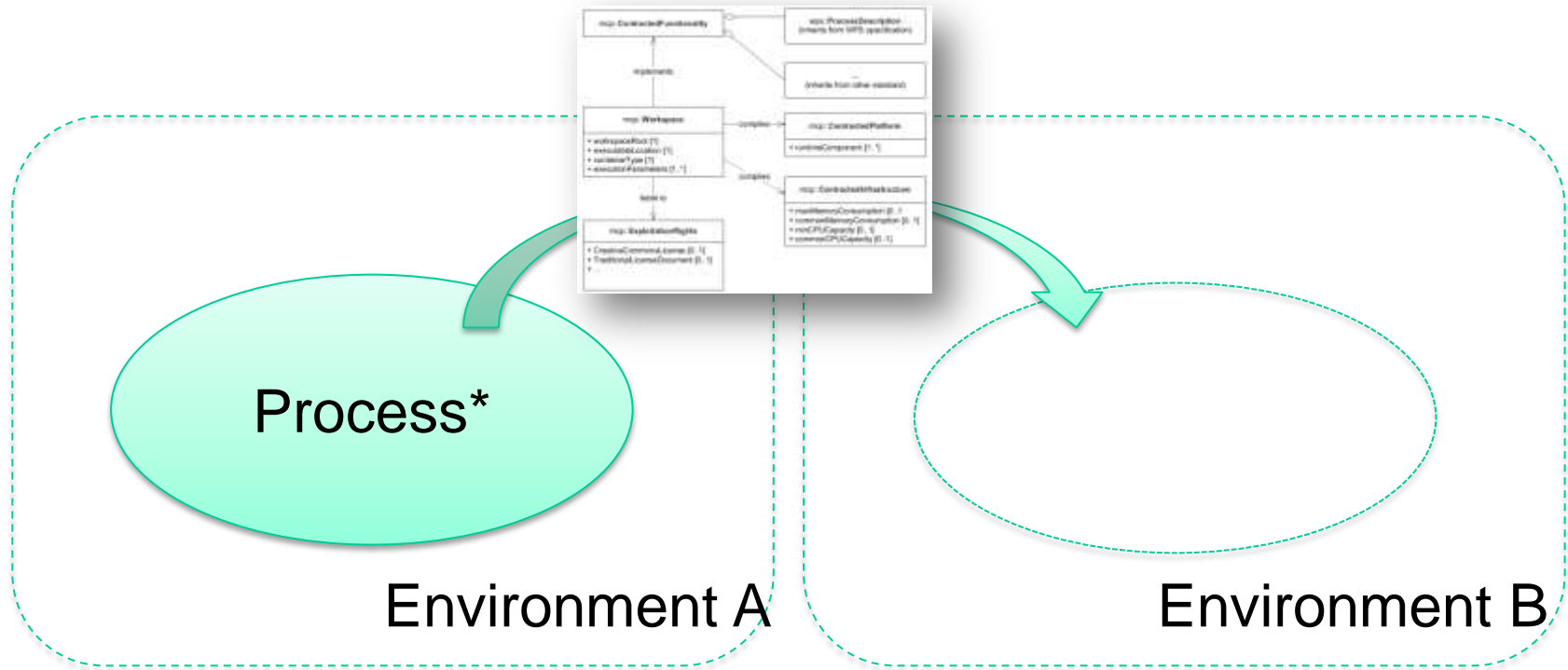
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Spatial Data	remote	B) Process external data sources in your local environment.	D) Process external data sources in an external environment
	local	A) Everything's local	C) Process your local data in an external environment
		local	remote

Processes

Moving Code

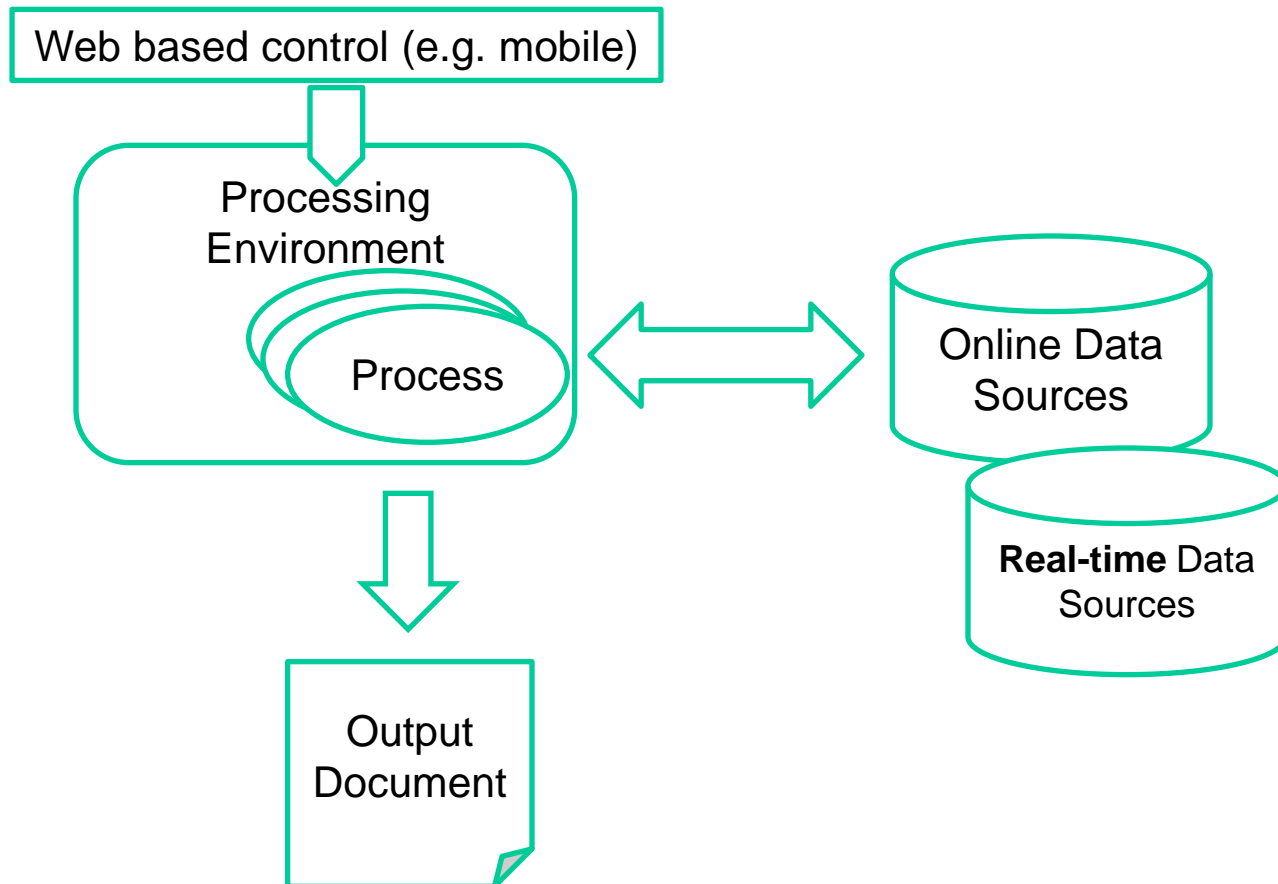
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(*) functional description, platform description, hardware description/infrastructure, exploitation rights/licenses/terms of use, ...

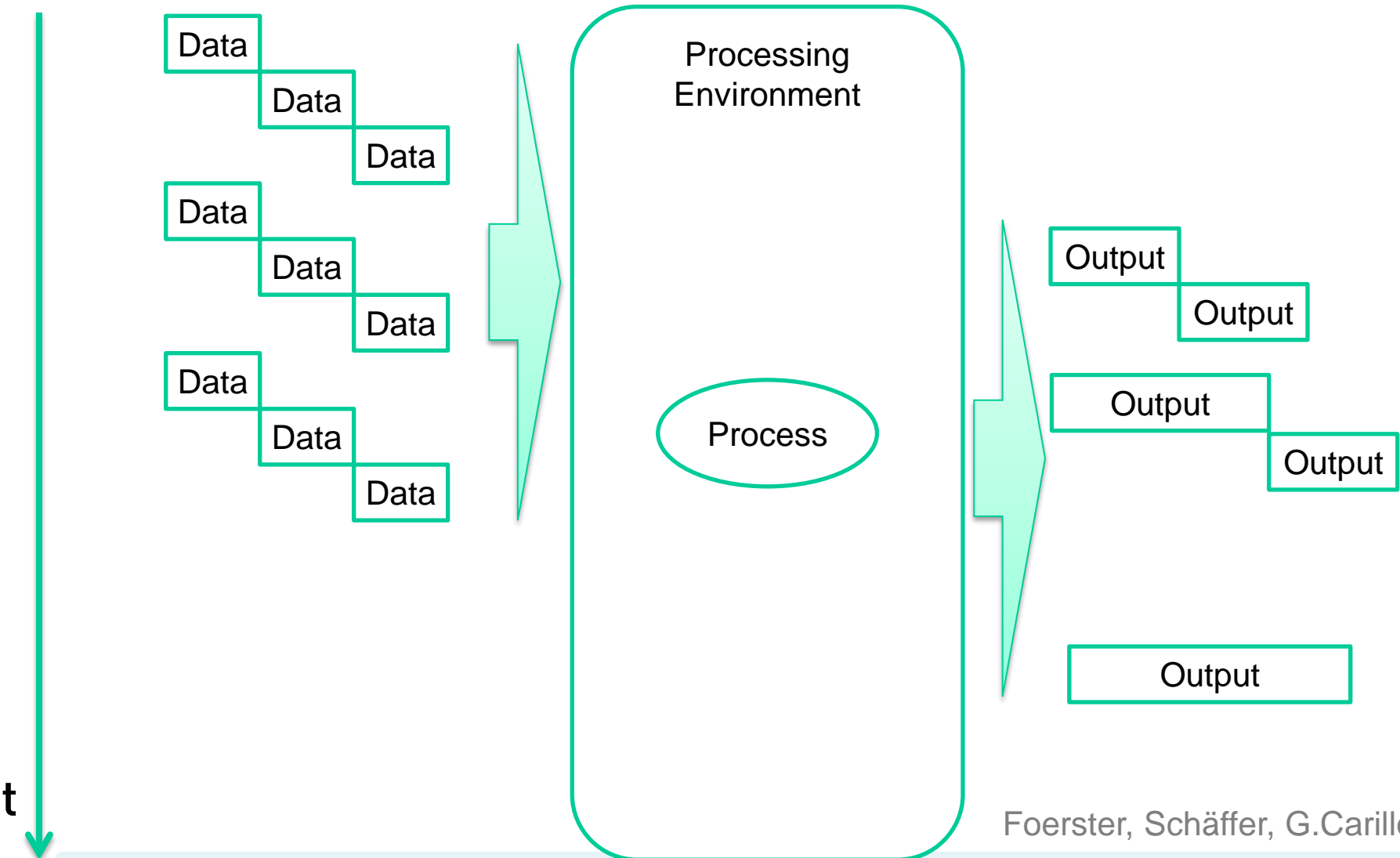
Enabling Generic Views

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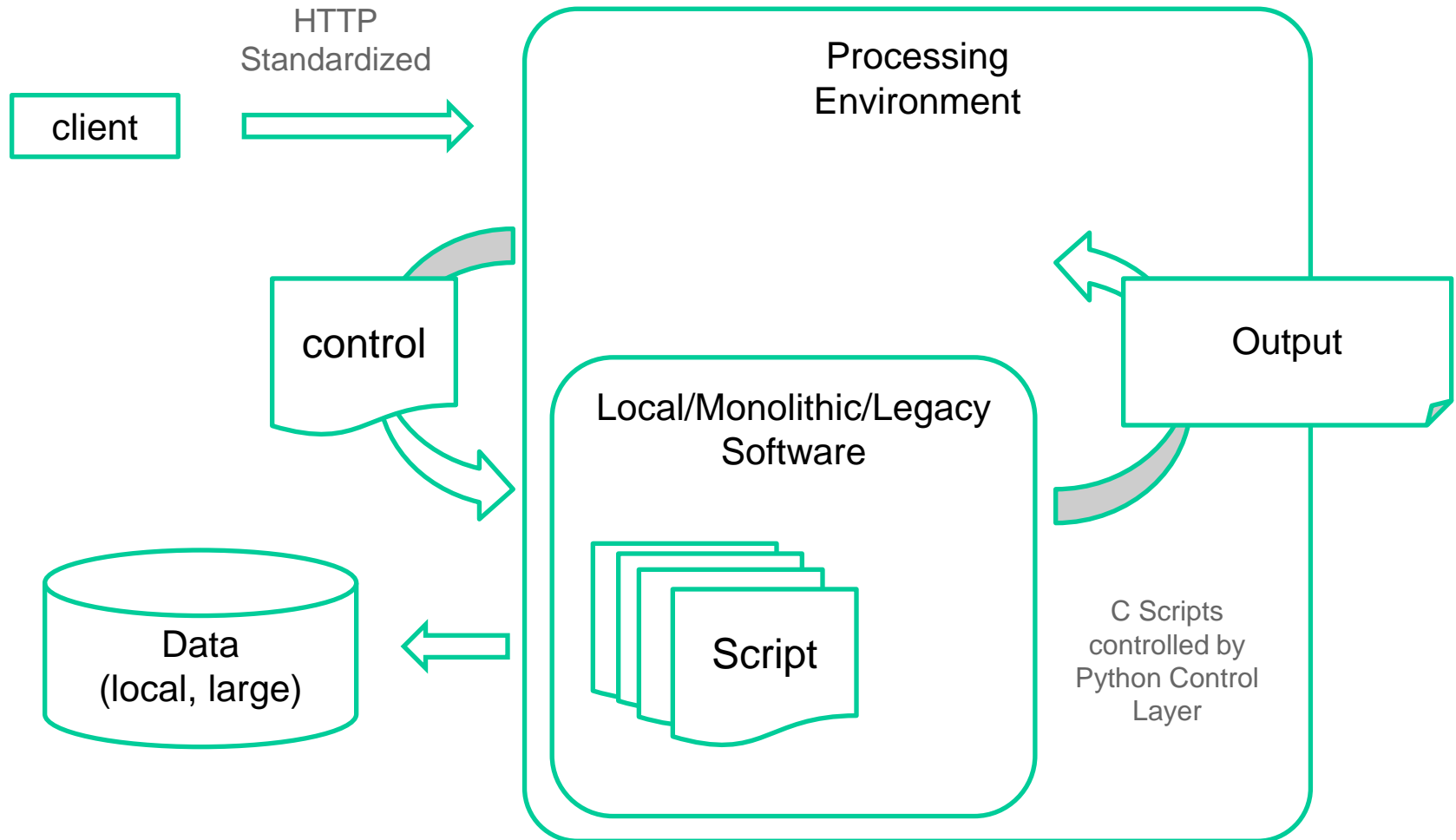
Streaming

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Foerster, Schäffer, G.Carillo

Control Layer



WPS

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GetCapabilities

DescribeProcess

Execute

More:

<http://www.ogcnetwork.net/wps>



<http://www.photo-dictionary.com/phrase/1389/swiss-knife.html>

<http://www.formengifts.com/victorinox-swiss-army-swiss-champ-multitool-knife/>

State of WPS 2.0

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Active SWG

https://portal.opengeospatial.org/?m=projects&a=view&project_id=315

Discussions on mailing list, Telcos

Roadmap: 2.0

- > existing CRs only, 3rd quarter 2013
- > discussion: “core”, Simple WPS

WCPS

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Coverage processing language

Interface to coverages (4d+)

Semantic interoperability (!= WPS)

More:

<http://www.ogcnetwork.net/wcps>

http://en.wikipedia.org/wiki/Web_Coverage_Processing_Service

EXAMPLE SCENARIOS

SSEGrid

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Satellite Data

SOA and Grid

WPS-G (extension, based on WPS-T)

(un)deployment of processes and data, process mgmt (monitor, control), download results



<http://blog.52north.org/2013/01/14/a-look-into-wps-branches-today-spacebel/>
<http://wiki.services.eoportal.org/tiki-index.php?page=SSEGrid>

Processes Tasks Auxiliary Data

Service Filter State Filter Process Filter Entries Limit

a6243130-59c3-44b5-9bee-c90db4cb261e	VGTMODISFaparGridChoiceChain	FPI (at SPB)	2012-03-06 15:05	2012-03-06 16:24	Succeeded
e6d80d7c-b0bb-4a95-bdea-f6f8751b506a	VGTMODISFaparGridChoiceChain	FPI (at SPB)	2012-03-06 15:04	2012-03-06 16:24	Succeeded
581fb335-a20e-4191-9d1c-002ab6f4d9b7	VGTMODISFaparChoiceChain	FPI (at SPB)	2012-03-06 11:04	2012-03-06 11:48	Succeeded
71464d6f-ac6e-4938-8854-75499e5d5845	VGTMODISFaparChoiceChain	FPI (at SPB)	2012-03-05 16:15	2012-03-05 16:37	Succeeded
0168d9d3-442f-4e37-82e5-432297b50ee7	VGTMODISFaparGridChoiceChain	FPI (at SPB)	2012-02-28 15:52	2012-02-28 17:45	Succeeded
1d889424-9852-4fe4-8a11-61e52f1631fe	VGTMODISFaparGridChoiceChain	FPI (at SPB)	2012-02-28 10:47	2012-02-28 13:03	Succeeded
5ac526b5-5e42-4b94-8ea0-340befc999f0	VGTMODISFaparGridChoiceChain	FPI (at SPB)	2012-02-27 17:13	2012-02-27 19:01	Failed

Actions for selected task:

Monitoring

- Task 581fb335-a20e-4191-9d1c-002ab6f4d9b7 - VGTMODISFaparChoiceChain - Started on 2012-03-06T09:04:46.826Z
 - Task d2804bf2-9d81-49b9-b4e6-67206ccf18c9 - VGTFaparChain - Started on 2012-03-06T10:05:03.395+01:00
 - Task 89257c34-6d2d-4c4c-8f1f-05d6f23f9950 - VITOCACollectData - Started on 2012-03-06T10:09:40.003+01:00
 - Task 5e7c3e7d-d7e5-4526-a43b-3754e9aeb0e4 - ImportVGT - Started on 2012-03-06T10:11:12.010+01:00
 - Task 06ddaba5-362e-4ae6-bb2-d8e282443c21 - FaparVGT - Started on 2012-03-06T10:25:19.811+01:00
 - Task f77f1856-86d7-44f3-97f1-7875bee4f01f - CompositeVGT - Started on 2012-03-06T10:40:09.676+01:00
 - Task f704a0da-abc6-4d0c-acae-436d15a65dfe - Publish - Started on 2012-03-06T10:50:31.427+01:00
 - Task e8dd78b3-4938-4369-a5b2-4d27ff6a5991 - Cleanup - Started on 2012-03-06T10:51:30.428+01:00

Audit Files

```
ftp://ssegrid.vgt.vito.be/gai/execute/VITOCACollectData/89257c34-6d2d-4c4c-8f1f-05d6f23f9950/d9379376-d942-40aa-aeb0-a218c819465d/audits/queryResults
ftp://ssegrid.vgt.vito.be/gai/execute/VITOCACollectData/89257c34-6d2d-4c4c-8f1f-05d6f23f9950/d9379376-d942-40aa-aeb0-a218c819465d/audits/Application.unpack.log
ftp://ssegrid.vgt.vito.be/gai/execute/VITOCACollectData/89257c34-6d2d-4c4c-8f1f-05d6f23f9950/d9379376-d942-40aa-aeb0-a218c819465d/audits/CollectData.stdout
ftp://ssegrid.vgt.vito.be/gai/execute/VITOCACollectData/89257c34-6d2d-4c4c-8f1f-05d6f23f9950/d9379376-d942-40aa-aeb0-a218c819465d/audits/CollectData.stderr
```

Wrapping Script Language

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The screenshot shows the 52north Web Admin Console interface. The main header displays the 52north logo and the text "Web Admin Console". Below the header, there are two tabs: "WPS Config Configuration" (selected) and "WPS Test Client". A row of buttons includes "Save and Activate Configuration", "Load Active Configuration", "Upload Configuration File", "Reset", "Upload Process", "Update Remote Repositories", and "Upload R Script".

The left sidebar contains a tree view with the following items:

- Server Settings
- Algorithm Repositories (expanded)
- Properties
- Parsers
- Generators
- Remote Repositories

The main content area shows the configuration for the "LocalAlgorithmRepository". The "Name" is "LocalAlgorithmRepository", the "Class" is "org.n52.wps.server.r.LocalAlgon...", and the "Active" checkbox is checked. A "Properties" section is visible with fields for "Name", "Algorithm", "Rserve_Host", and "Rserve_Port". An "Add Repository" button is located at the bottom left of the main content area.

A modal dialog box is open in the center, containing the following text and form elements:

Please enter the process name:
(only if process name should be unlike filename)

Please enter the location of an annotated R. script

Random.R

*Process id will be org.n52.wps.server.r.[filename]. or
org.n52.wps.server.r.[process name]*

```

- <ns:ProcessDescriptions xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsDescribeProcess_response.xsd"
  version="1.0.0">
- <ProcessDescription statusSupported="true" storeSupported="true" ns:processVersion="1.0.0">
  <ns1:Identifier>org.n52.wps.server.r.SosPlot</ns1:Identifier>
  <ns1:Title>Plot SOS Time Series</ns1:Title>
- <ns1:Abstract>
  Accesses a SOS with sos4R and creates a plot with a fitted regression line
  </ns1:Abstract>
  <ns1:Metadata xlin:title="R Script" about="The R script which is used for this process" xlin:href="http://localhost:8080/wps/\R/scripts/SosPlot.R"/>
  <ns1:Metadata xlin:title="R Session Info" about="R Console output of sessionInfo() method in R, content is generated dynamically for the current state
  /sessioninfo.jsp"/>
- <DataInputs>
- <Input minOccurs="0" maxOccurs="1">
  <ns1:Identifier>sos_url</ns1:Identifier>
  <ns1:Title>null</ns1:Title>
  <ns1:Abstract>SOS URL endpoint</ns1:Abstract>
- <LiteralData>
  <ns1:DataType ns1:reference="xs:string"/>
  <ns1:AnyValue/>
  <DefaultValue>http://v-swe.uni-muenster.de:8080/WeatherSOS/sos</DefaultValue>
  </LiteralData>
  </Input>
- <Input minOccurs="1" maxOccurs="1">
  <ns1:Identifier>offering_id</ns1:Identifier>
  <ns1:Title>identifier for the used offering</ns1:Title>
  <ns1:Abstract>null</ns1:Abstract>
- <LiteralData>
  <ns1:DataType ns1:reference="xs:string"/>
  <ns1:AnyValue/>
  </LiteralData>
  </Input>
- <Input minOccurs="0" maxOccurs="1">
  <ns1:Identifier>offering_days</ns1:Identifier>
  <ns1:Title>temporal extent</ns1:Title>
  <ns1:Abstract>the number of days the plot spans to the past</ns1:Abstract>
- <LiteralData>
  <ns1:DataType ns1:reference="xs:integer"/>

```

```

- <ns:ProcessDescriptions xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsDescribeProcess_response.xsd"
  version="1.0.0">
- <ProcessDescription statusSupported="true" storeSupported="true" ns:processVersion="1.0.0">
  <ns:Identifier>org.n52.wps.server.r.SosPlot</ns:Identifier>
  <ns:Title>Plot SOS Time Series</ns:Title>
- <ns:Abstract>
  Accesses a SOS with sos4R and create
  </ns:Abstract>
  <ns:Metadata xlin:title="R Script" about="The R script which is used for this process" xlin:href="http://localhost:8080/wps/R/scripts/SosPlot.R"/>
  <ns:Metadata xlin:title="R Session Info" about="R Console output of sessionInfo() method in R, content is generated dynamically for the current state"
    /sessioninfo.jsp"/>
- <DataInputs>
  - <Input minOccurs="0" maxOccurs="1">
    <Input minOccurs="0" maxOccurs="1">
      <ns:Identifier>sos_url</ns:Identifier>
      <ns:Title>null</ns:Title>
      <ns:Abstract>SOS URL endpoint</ns:Abstract>
    - <LiteralData>
      <ns:DataType ns:reference="xs:string"/>
      <ns:AnyValue/>
      <DefaultValue>http://v-swe.uni-muenster.de:8080/WeatherSOS/sos</DefaultValue>
    </LiteralData>
  </Input>
  </LiteralData>
  </Input>
- <Input minOccurs="0" maxOccurs="1">
  <ns:Identifier>offering_days</ns:Identifier>
  <ns:Title>temporal extent</ns:Title>
  <ns:Abstract>the number of days the plot spans to the past</ns:Abstract>
- <LiteralData>
  <ns:DataType ns:reference="xs:integer"/>

```



```

<?xml version="1.0" encoding="UTF-8"?>
<ns: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://schemas.opengis.net/wps/1.0.0/wpsExecute_request.xsd">
  <ows:Identifier>org.n52.wps.server.r.SosPlot</ows:Identifier>
  <wps>DataInputs>
    <wps:Input>
      <ows:Identifier>offering_days</ows:Identifier>
      <ows:Title></ows:Title>
      <wps:Data>
        <wps:LiteralData>3</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <!-- <wps:Input -->
    <!-- <ows:Identifier>offering_id</ows:Identifier -->
    <!-- <ows:Title></ows:Title -->
    <!-- <wps:Data -->
    <!-- <wps:LiteralData>ATMOSPHERIC_TEMPERATURE</wps:LiteralData -->
    <!-- </wps:Data -->
    <!-- </wps:Input -->
    <wps:Input>
      <ows:Identifier>image_width</ows:Identifier>
      <ows:Title></ows:Title>
      <wps:Data>
        <wps:LiteralData>500</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>image_height</ows:Identifier>
      <ows:Title></ows:Title>
      <wps:Data>
        <wps:LiteralData>500</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps>DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="image/jpeg">
      <ows:Identifier>output_image</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
<!-- <wps:ResponseForm -->
</ns:Execute requestReference="xs:integer"/>

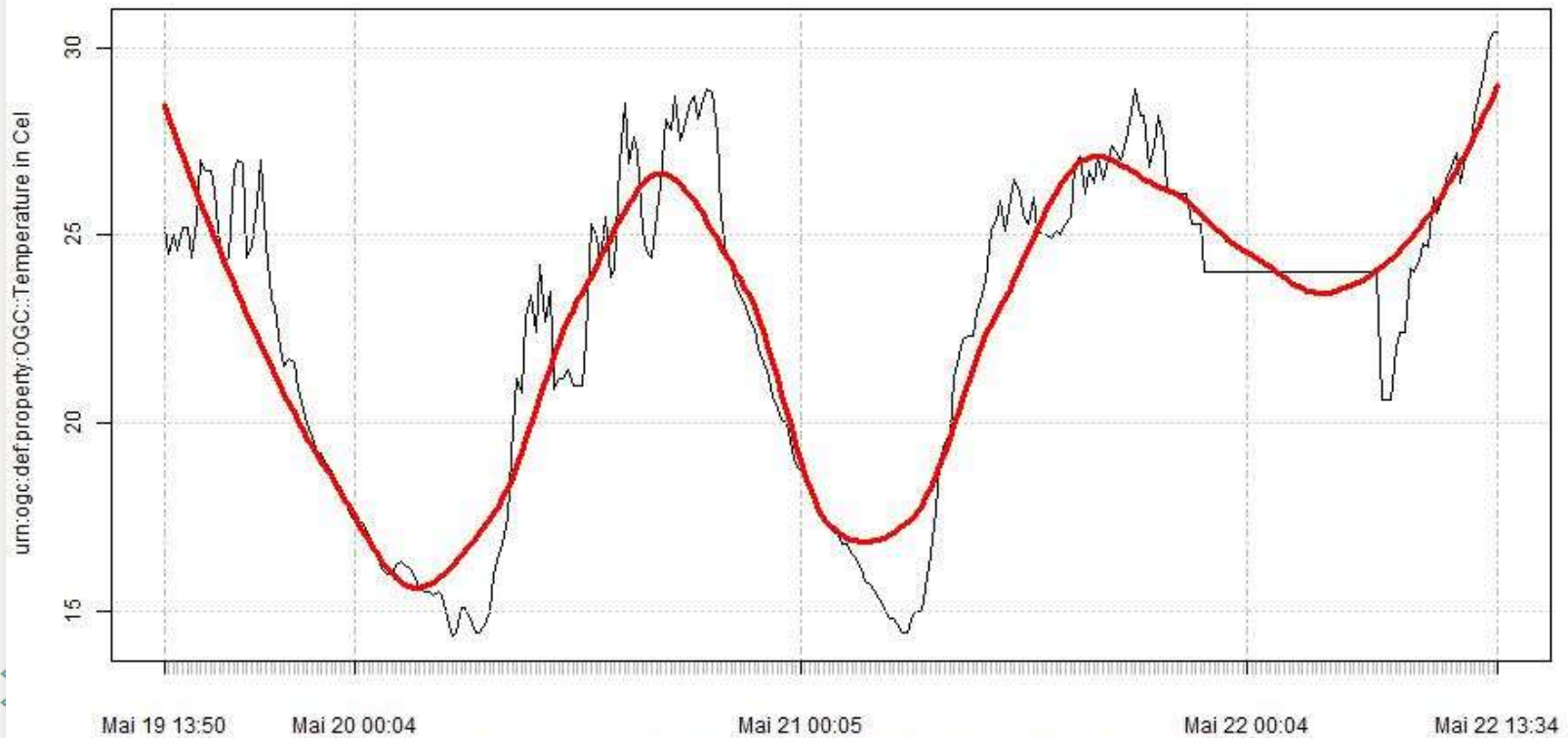
```

```

<?xml version="1.0" encoding="UTF-8"?>
<ns:
vers
- Δ
-
<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://schemas.opengis.net/wps/1.0.0/wpsExecute_request.xsd">
<ows:Identifier>org.n52.wps.server.r.SosPlot</ows:Identifier>
<wps>DataInputs>
  <wps:Input>
    <ows:Identifier>offering days</ows:Identifier>

```

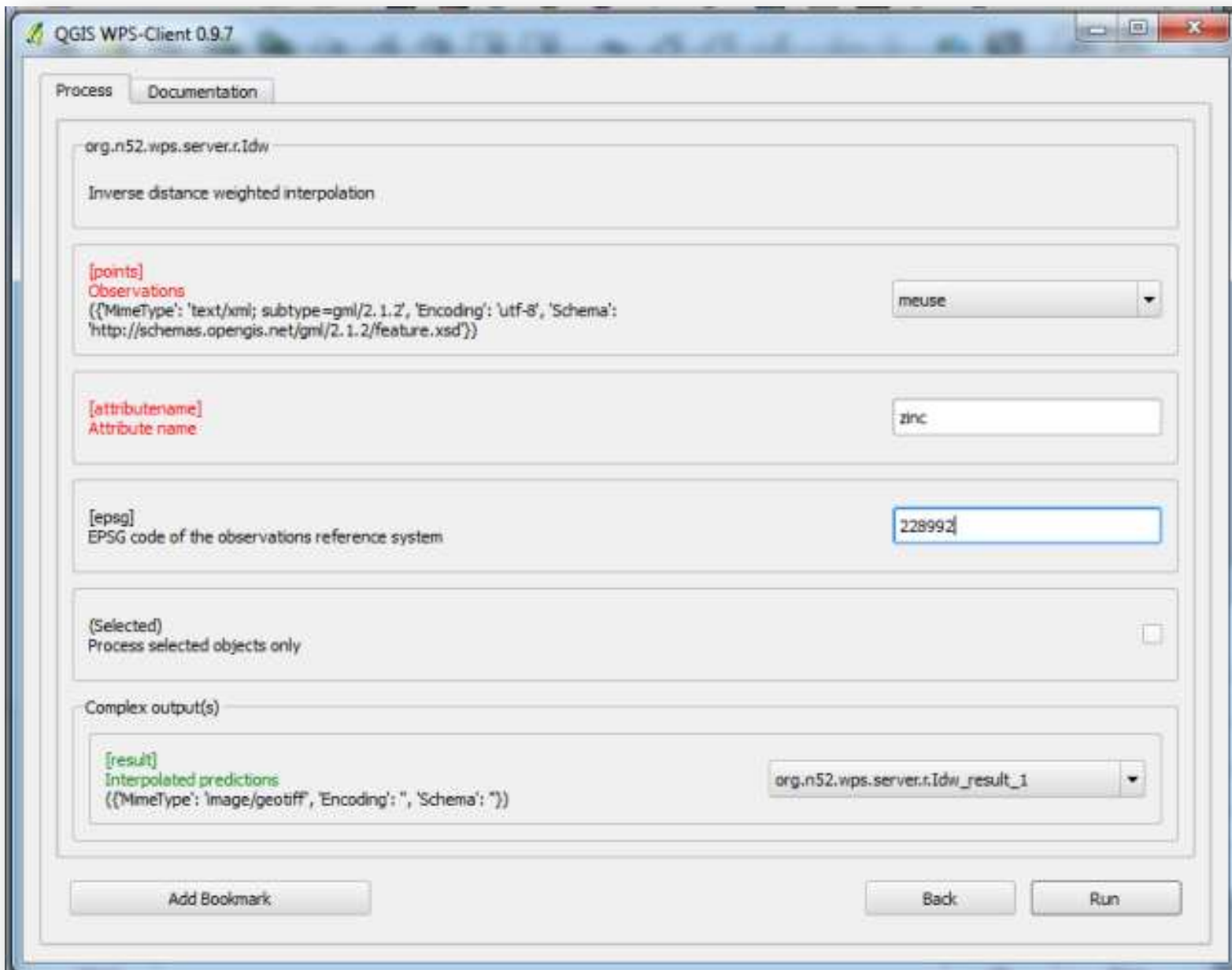
Dynamic Time Series Plot

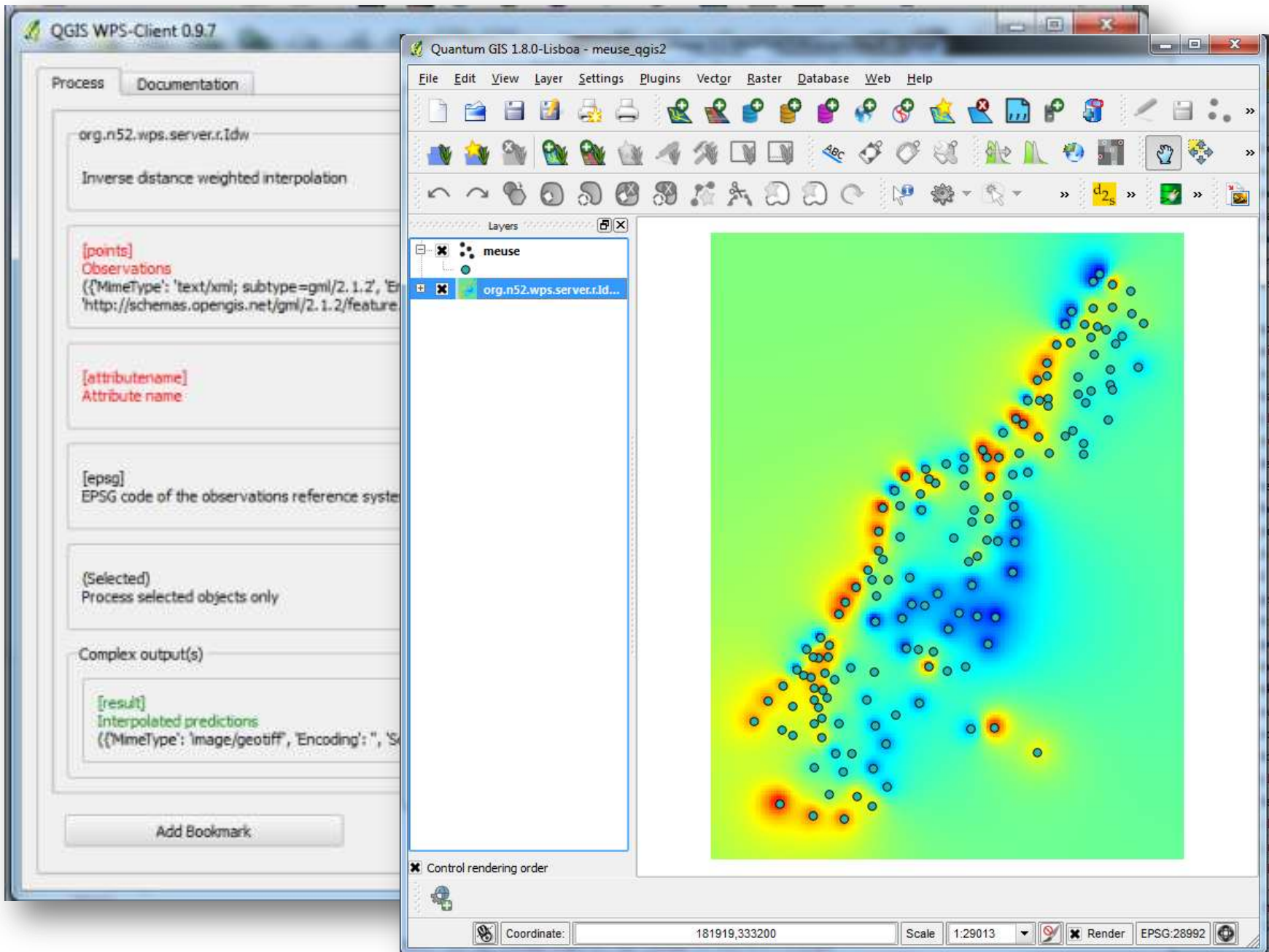


```

</wps:ResponseForm>
</wps:Execute>

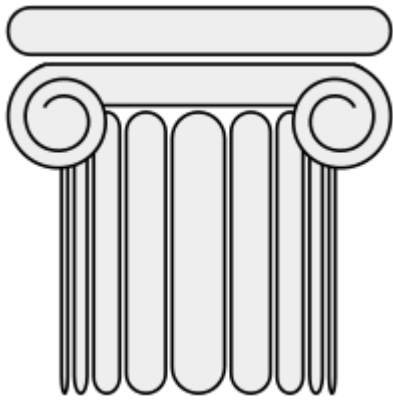
```



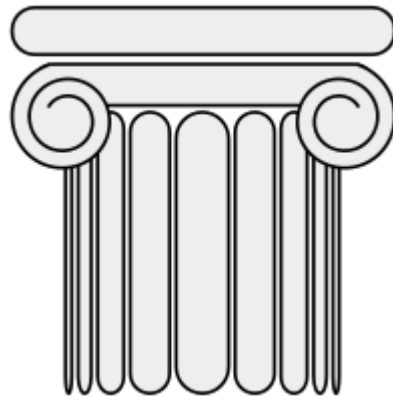


BIG PICTURE

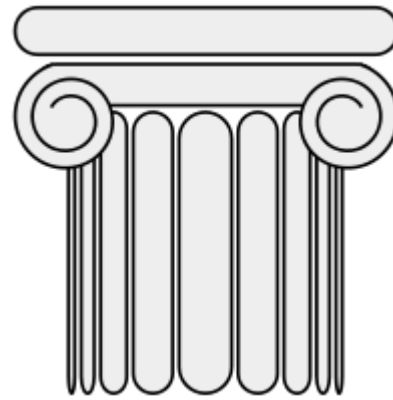
S C I E N C E



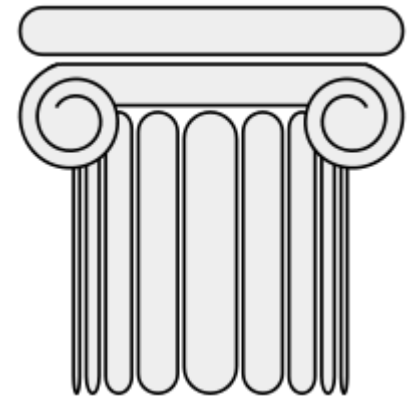
theoretical
investigation



laboratory
experiment



simulation/
computation



NEW!
data
analysis

HOW STANDARDS PROLIFERATE:
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC)



<http://xkcd.com/927/>

Challenges

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Exchangeability and **Interoperability** of Processes versus
(Identifier Problem)

Lingua Franca for Processes ~~across Domains?~~

Security

Reusability | Scalability | Performance

Documentation and **Discovery**

Granularity

Collaboration

Co-ordination

Concentration

Recommendations for Met

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- a) Collect collaboration points.
(common “pains” vs. huge problems, don’t limit yourself to data)
- b) Discuss where “sharing” is useful, and possible.
- c) Do a **vertical** crosscut... learn.
- d) Define profiles and best practices.
> Identify requirements now, be ready to build upon WPS 2.0
- e) Use open approaches (e.g. open source software) and share!

More information:

<http://52north.org/processing>

d.nuest@52north.org



@FiveTwoN



FURTHER RESOURCES

Computers & Geosciences Special Issue

Towards a Geoprocessing Web

<http://www.sciencedirect.com/science/journal/00983004/47/supp/C>

The OGC web coverage processing service (WCPS) standard.

<http://www.informatik.uni-trier.de/~ley/db/journals/geoinformatica/geoinformatica14.html>

WPS Implementations

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Server

http://en.wikipedia.org/wiki/Web_Processing_Service

Open Source: 52°North, Geoserver, pyWPS, degree, ZOO project

Clients

ArcGIS, uDig, Jump, OpenLayers >

<http://52north.org/wps/>

Please let me know if you are aware of other implementations!

Report Generation - Example

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The screenshot displays a web interface for 'On-demand Report Generation'. It features a sidebar with buttons for 'Open PDF', 'Download Link', 'Pegel Report', and 'Sweave For'. The main area contains a text input field for the source file, a 'Sweave For' button, and a preview window. The preview window shows a rendered PDF of a document titled 'An Sweave Demo' by Charles J. Geyer, dated October 9, 2012. The document content includes a preface about the Sweave command in R, followed by a code block showing the LaTeX source code and the resulting PDF output. A success message at the bottom states 'The service successfully processed your report'.

```
§ SOURCE: http://users.stat.umn.edu/~geyer/Sweave/#exam
\documentclass{article}

\usepackage{amsmath}
\usepackage{amscd}
\usepackage[tableposition=top]{caption}
\usepackage{ifthen}
\usepackage[utf8]{inputenc}

\begin{document}

\title{An Sweave Demo}
\author{Charles J. Geyer}
\maketitle

This is a demo for using the \verb@
get started make a regular \LaTeX
give it the suffix \verb@.Rnw@
turn it into a \LaTeX\ file (\verb@
\begin{verbatim}
R CMD Sweave foo.Rnw
\end{verbatim}
So you can do
\begin{verbatim}
latex foo
xdvi foo
\end{verbatim}
and so forth.

So now we have a more complicated
\begin{CD}
\texttt{foo.Rnw} @>Sweave>> \texttt{foo.tex} @>latex>> \texttt{foo.dvi} @>xdvi>> view of document
\end{CD}
and what have we accomplished other than making it twice as annoying to the
WYSIWYG crowd (having to run both Sweave and latex to get anything that
looks like the document)?

Well, we can now include R in our document. Here's a simple example:

>> 2 + 2
[1] 4

What I actually typed in foo.Rnw was:

<<pre>>
2 + 2
@

This is not LATEX. It is a "code chunk" to be processed by Sweave. When
Sweave hits such a thing, it processes it, runs R to get the results, and stuffs
```

ArcGIS Client

The image displays the ArcGIS Client interface with several overlapping windows. The primary window is the 'Model' dialog, which is currently in a 'Run' state. The dialog shows the following information:

- Executing org.n52.wps.server.algorithm.SimpleBufferAlg
- Start Time: Fri Sep 09 11:07:03 2011
- wpsURL: http://localhost:8080/wps/WebProcessingService

Below the dialog, a workflow diagram is shown. It consists of the following elements:

- A red rounded rectangle representing the 'org.n52.wps.server.algorithm.SimpleBufferAlgorithm' tool.
- A yellow rounded rectangle representing the 'v.hull' tool.
- A green oval representing the 'buffer.shp' output.
- A green oval representing the 'bufferhull.shp' output.

Arrows indicate the flow of data: from the red tool to the 'buffer.shp' oval, from the 'buffer.shp' oval to the yellow 'v.hull' tool, and from the yellow tool to the 'bufferhull.shp' oval.



INTeroperability and Automated MAPping

“backend” R package

- <http://www.intamap.org/intamap-package.php>

WPS Server

O&M Input

Clients

- JAVA API
- Stand-alone: <http://www.intamap.org/tryGenericClient.php>

52°North does applied research and ...

52n

is a collaboration network

Communities

Company

is a service center

Code Repositories

is a dissemination platform



Long Term License Management

GENESIS
OSIRIS
UncertWeb
INTAMAP
DETECT
GeoViQua
SME
OWS



con terra



esri

Hochschule Bochum
Bochum University
of Applied Sciences **BO**



Collaboration **Communities**

**Ilwis
Geoprocessing
Earth
Observation**

**Security
Semantics
Sensor
Web**

**Geostatistics
3D
Metadata
Management**



con terra



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Hochschule Bochum
Bochum University
of Applied Sciences **BO**

