ESA HMA-S Project
WP 6100 – WPS2.0 Specification

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Frascati – 24th January 2013
Agenda

• Introduction
  – Revise WPS Specification taking into account
  – Contribution Proposal to WPS2.0 SWG

• WPS 2.0 synchronous/asynchronous execution model
  – WPS 2.0 Core Specification
  – WPS 2.0 Transactional Extension

• WPS 2.0 Transactional Extension
  – Case study & Proposal
  – ESA DREAM Quality Assessment Case
  – WPS 2.0 Transactional Extension Summary

• Conclusion
Revise WPS Specification taking into account Contribution Proposal to WPS2.0 SWG

INTRODUCTION
Revise WPS Specification taking into account

- ESA project’s technical report “SSEGrid Processing On-Demand Extension (WPS-G)"
- ngEO needs in terms of process description and access to the processing outputs
- Relevant third party initiatives, about cloud computing standardisation, such as IEEE P2301.
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<th>OGC WPS Operation</th>
<th>Standard Component</th>
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Contribution Proposal to WPS2.0 SWG

- **WPS 2.0 Core Specification**
  Shaping/Editing
  - Execution Model Synchronous/Asynchronous
  - DescribeProcess and Execution operation update

- **WPS 2.0 Asynchronous Extension**
  Change Request and Extension Draft document submission
  - Abort
  - Pause
  - Resume
  - GetStatus

- **WPS 2.0 Transactional Extension**
  Discussion Paper and Extension Draft document submission
  - DeployProcess
  - UndeployProcess
Impact on
WPS 2.0 Core Specification
WPS 2.0 Transactional Extension

WPS 2.0 SYNCHRONOUS/ASYNCHRONOUS EXECUTION MODEL
Objective & Rational

- Objective
  - Efficient management of synchronous and asynchronous execution.
  - Foster WPS 2.0 adoption by easing implementation:
    - Limit effort to upgrade client/server from WPS 1.0 to WPS 2.0
    - Limit complexity/effort to support both WPS 1.0 and WPS 2.0
Objective & Rational

- **Objective**
  - Efficient management of synchronous and asynchronous execution.
  - Foster WPS 2.0 adoption by easing implementation:
    - Limit effort to upgrade client/server from WPS 1.0 to WPS 2.0
    - Limit complexity/effort to support both WPS 1.0 and WPS 2.0

- **Rational**
  - Keeps process detailed description at DescribeProcess level.
    Do not increase complexity and volume of GetCapabilities answer and ensure WPS1.0/WPS 2.0 compatibility.
  - Enable execution in different mode in one operation
    Execution mode based on a simple flag easy to set/unset from WUI – no conditional test
  - Asynchronous management in WPS Asynchronous Extension.
    Core provide simple synch/asynch execution support, Extension would provide fine grain and advanced control of asynchronous execution.
Proposal Summary

- **GetCapabilities - Core**
  unchanged

- **DescribeProcess - Core**
  Add description of supported execution model in `processBrief`
  Optional new argument – default: synchronous (~WPS1.0)

- **Execute - Core**
  Add optional `asynchMode` boolean in Execute request.
  Add `processInstanceIdentifier` URN in Execute response

- **Asynchronous Operations – WPS Asynchronous extension**
  - Abort, Pause, Resume, GetStatus operations
  - Use `processInstanceIdentifier` sent back by Execute operation
Server Capabilities and Process Description

- Keeps process detail description at DescribeProcess level
- Support requirements for synchronous only, asynchronous only or both execution models.
- Optional flag approach:
  - Easy generic WPS client supporting both 1.0 and 2.0 WPS server.
  - Existing WPS 1.0 clients interoperable with WPS 2.0 servers.
### Server Capabilities and Process Description

#### Name | Definition | Data Type and Value | Multiplicity and Use
--- | --- | --- | ---
executionModel | Indicates which execution model the process supports. | Enumerated type Values are: *synchOnly, *asynchOnly, *synchAndAsynch | One Optional
asynchSupports | List of supported process control operations for that specific process | Supports datastructure, table 5.1 | Zero or one Conditional (Mandatory when asynchronous execution model is
Execution

- All execution models supported in one *execution* operation.
- *ProcessInstanceIdentifier* attribute clearly distinct from *ProcessIdentifier*.
- *statusLocation* attribute keeps its original function.
- Optional flag approach:
  - Easy to set/unset from WUI at client side as parameter of the same operation.
  - Easy generic WPS client supporting both 1.0 and 2.0 WPS server.
  - Existing WPS 1.0 clients interoperable with WPS 2.0 servers.
### Execution

- **WPS Client**
- **WPS Server**

**Execute**

Identifier, [asynchMode]

**ProcessInstanceIdentifier** = *Process Instance Identifier URN*

**statusLocation** = ExecuteResponse document URL

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<th>Multiplicity and Use</th>
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<tr>
<td>asynchMode</td>
<td>Request an execution in asynchronous mode. If the attribute is not specified or set to false, execution is in synchronous mode (default).</td>
<td>Boolean type</td>
<td>Zero or One (optional)</td>
</tr>
<tr>
<td>processInstanceIdentifier</td>
<td>Unique identifier assigned to a specific instance of a process executed.</td>
<td>URN type</td>
<td>Zero or One (Optional)</td>
</tr>
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</table>

```xml
<wps:ExecuteResponse [...] service="WPS" version="1.0.0" xml:lang="en-CA"
[...]
    <wps:Status
        processInstanceIdentifier="cb1557397169547d63c2d1388e8dd810"
        creationTime="2009-05-29T13:00:03.0Z"/>
    <wps:ProcessTerminated terminationTime="2009-05-29T14:00:03.0Z"/>
</wps:Status>
[...]
</wps:ExecuteResponse>
```
Asynchronous Management

- Example GET “Abort” Process request: http://foo.bar.1/wps?version=1.0.0&request=Abort&service=WPS&ProcessInstanceIdentifier=cb1557397169547d63c2d1388e8dd810
- Example POST “Abort” Process Request:
  
  `<wps:Abort xmlns:wps="http://www.opengis.net/wps/1.0.0" [...]>`
  
  `<wps:ProcessInstance>`
  
  `<ows:Identifier>cb1557397169547d63c2d1388e8dd810</ows:Identifier>`
  
  `</wps:ProcessInstance>`
  
  `</wps:Abort>`

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<tr>
<td>ProcessInstanceIdentifier</td>
<td>Unique identifier assigned to a specific instance of an asynchronous process by the server and included in the Execute response of the process as value of the “processInstanceIdentifier” attribute.</td>
<td>URN type</td>
<td>One (Mandatory)</td>
</tr>
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Case study & Proposal

ESAF DREAM Quality Assessment Case

WPS 2.0 Transactional Extension Summary

**WPS 2.0**

**TRANSACTIONAL EXTENSION**
Case study & Proposal

- Grid Processing On Demand
  1. ESA G-POD: ngEO Hosted Processing Facilities
  2. SSEGrid: Vegetation processing chains

- Cross Cloud Processing
  3. ESA DREAM: Ortho-image quality assessment & improvement.

- Discussion Paper on ESA DREAM Project – quality assessment as cross cloud computing solution to avoid huge data transfer.
Features: On-demand service to

- Assess the quality of an ortho-image, including Positional Accuracy
- Improve the position accuracy of an ortho-image

In the context of multi-mission supports: multiple sensors
Features: On-demand service to

- Assess the quality of an ortho-image, including Positional Accuracy
- Improve the position accuracy of an ortho-image

In the context of multi-mission supports: multiple sensors

Cross Cloud Computing Model:

- Move processing code instead of data
- Collaborative processing
- Chained WPS process.
The issue

On-line Photogrammetry Web Services
- Ortho-rectification
- Ortho-image quality assessment

Ref3D

ASV GEO Infrastructure
The issue

On-line Photogrammetry Web Services

- Ortho-rectification
- Ortho-image quality assessment

Ref3D

ASV GEO Infrastructure

Raw Acquisition
Ortho

ESA/EUSC Cloud
The issue

On-line Photogrammetry Web Services
• Ortho-rectification
• Ortho-image quality assessment

Processes are here

ESA/EUSC Cloud

Raw Acquisition
Ortho

On-line Photogrammetry Web Services
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Ref3D

ASV GEO Infrastructure
The issue

On-line Photogrammetry Web Services
- Ortho-rectification
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ESA/EUSC Cloud

Reference Data are here

Processes are here

On-line Photogrammetry Web Services
- Ortho-rectification
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Ref3D

ASV GEO Infrastructure
The issue

Data to process are here

Reference Data are here

Processes are here

On-line Photogrammetry Web Services
- Ortho-rectification
- Ortho-image quality assessment

ESA/EUSC Cloud

ASV GEO Infrastructure
Typical Approach – WPS – WCS/WFS Chaining

On-line Photogrammetry Web Services
- Ortho-rectification
- Ortho-image quality assessment

Raw Acquisition → Ortho → WCS

ESA/EUSC Cloud

ASV GEO Infrastructure

Ref3D
Typical Approach – WPS – WCS/WFS Chaining

On-line Photogrammetry Web Services
- Ortho-rectification
- Ortho-image quality assessment

Execute request
ProcessId=MyProcess
Input=Data URL

ESA/EUSC Cloud

ASV GEO Infrastructure

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Typical Approach – WPS – WCS/WFS Chaining

On-line Photogrammetry Web Services
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ESA/EUSC Cloud

ASV GEO Infrastructure

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Typical Approach – WPS – WCS/WFS Chaining

- Ortho-rectification
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- On-line Photogrammetry Web Services
- Ortho-rectification
- Ortho-image quality assessment

ESA/EUSC Cloud
Gb
ASV GEO Infrastructure

Ref3D
Typical Approach – WPS – WCS/WFS Chaining

According EO dataset size
Download time is in hour
(Pleiade scene up to 33 Gb)

Raw Acquisition
Ortho
WCS
WCS GetCoverage

Execute request
ProcessId=MyProcess
Input=Data URL

On-line Photogrammetry Web Services
Ortho-rectification
Ortho-image quality assessment

ESA/EUSC Cloud
Gb
Too big and/or forbidden to transfer

ASV GEO Infrastructure
Ref3D
Tested solution in the prototype

On-line Photogrammetry Web Services
- Ortho-rectification
- Ortho-image quality assessment

ESA/EUSC Cloud

ASV GEO Infrastructure

Ref3D

Raw Acquisition
Ortho
Tested solution in the prototype

- Ortho-rectification
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On-line Photogrammetry Web Services
- Ortho-rectification
- Ortho-image quality assessment

ASV GEO Infrastructure

Raw Acquisition → Ortho → Cloud Processing Proxy

ESA/EUSC Cloud

Ref3D
Architecture – Web Services

On-line Photogrammetry Web Services
- Ortho-rectification
- Ortho-image quality assessment

Raw Acquisition → Ortho → Cloud Processing Proxy → ESA/EUSC Cloud

ASV GEO Infrastructure

Ref3D
On-line Photogrammetry Web Services

- Ortho-rectification
- Ortho-image quality assessment

Architecture – Web Services

OGC WMS
- Compute AOI WPS Processing
- Compute RPC WPS Processing
- Compute Quality WPS Processing

Ref3D
- Reference Orthoimages
- DEM

Reference

ASV GEO Infrastructure

ESA/EUSC Cloud

Cloud Processing Proxy

Raw Acquisition

Compute AOI

Compute RPC

Compute Quality
Architecture – Processing Proxy

On-line Photogrammetry Web Services
- Ortho-rectification
- Ortho-image quality assessment

ESA/EUSC Cloud
Architecture – Processing Proxy

On-line Photogrammetry Web Services
- Ortho-rectification
- Ortho-image quality assessment

Cloud Processing Proxy
- Raw Image Handler
- OrthoRectify WPS Process
- Ortho-Image Producer
- AssessQuality WPS Process
- OGC WPS Client

Raw Acquisition
Ortho
Cloud Processing Proxy

ESA/EUSC Cloud

ASV GEO Infrastructure
Ref3D
Collaborative Processing in motion

OGC WMS
- Raw Image Handler
- Ortho-Image Producer
- OrthoRectify WPS Process
- AssessQuality WPS Process

OGC WPS
- WPS Client
- Compute AOI WPS Processing
- Compute RPC WPS Processing
- Compute Quality WPS Processing

Ortho-images

Cloud Processing Proxy

On-line Photogrammetry Web Services

Reference Orthoimages DEM (Ref3D)
Collaborative Processing in motion

Cloud Processing Proxy

- OGC WMS
- Raw Image Handler
- Ortho-Image Producer
- Multiple Sensors
- Raw Acquisitions
- Ortho-images

- WPS
- OrthoRectify WPS Process
- AssessQuality WPS Process

- WPS Client

On-line Photogrammetry Web Services

- OGC WMS
- Compute AOI WPS Processing
- Compute RPC WPS Processing
- Compute Quality WPS Processing

- Reference Orthoimages
- DEM (Ref3D)

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Collaborative Processing in motion

On-line Photogrammetry

Web Services

OGC WPS

Compute AOI
WPS Processing

Compute RPC
WPS Processing

Compute Quality
WPS Processing

Reference Orthoimages
DEM (Ref3D)

OGC WMS

OrthoRectify
WPS Process

AssessQuality
WPS Process

WPS Client

Cloud Processing Proxy

Multiple Sensors
Raw Acquisitions
Ortho-images

Raw Image Handler
Ortho-Image Producer

OGC WMS

On-line Photogrammetry
Web Services

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Collaborative Processing in motion

On-line Photogrammetry

Web Services

Compute AOI
Compute RPC
Compute Quality

OGC WMS
OGC WPS

Ortho-Image Producer
AssessQuality WPS Process
Ortho-Rectify WPS Process
Raw Image Handler

Multiple Sensors
Raw Acquisitions
Ortho-images

Cloud Processing Proxy

Reference Orthoimages DEM (Ref3D)

On-line Photogrammetry Web Services

Session 4: State of the art technology and standards, 12/10/2012
Use Case for WPS-T

Data Cloud

WPS

Processing Cloud

WPS Server

Proxy

Process

Proxy

Process
Use Case for WPS-T

Execute request
ProcessId=MyProcess
Input=MyData URL

Data Cloud

WPS

Processing Cloud

WPS Server
Proxy
Process
Proxy
Process
Use Case for WPS-T

Execute request
ProcessId=MyProcess
Input=MyData URL

Add Process

WPS

Data Cloud

WPS Server

Proxy

Process

Proxy

Process

Processing Cloud
Use Case for WPS-T

Execute request
ProcessId=MyProcess
Input=MyData URL

Proxy
WPS

Data Cloud

Add Process

Processing Cloud

WPS Server
Proxy
Process
Proxy
Process

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Use Case for WPS-T

Execute request
ProcessId=MyProcess
Input=MyData URL

Add Process
Execute

Proxy
WPS

Data Cloud

WPS Server
Proxy
Process
Proxy
Process

Processing Cloud
Use Case for WPS-T

- **Proxy**: Requests the WPS service
- **WPS Server**: Processes the request
- **Data Cloud**: Stores the input data
- **Processing Cloud**: Stores the output

**Execute request**
- ProcessId=MyProcess
- Input=MyData URL

**ResponseDocument**
- Output = Result URL

**Add Process**
- Execute
Use Case for WPS-T

Data Cloud

Proxy

WPS

WPS Server

Proxy

Process

Proxy

Process

Processing Cloud

Execute request
ProcessId=MyProcess
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ResponseDocument
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Add Process
Execute
Del Process

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Use Case for WPS-T

Data Cloud

WPS

Result URL

Processing Cloud

WPS Server
Proxy
Process
Proxy
Process

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Summary of WPS-T

- WPS-T: deployment and undeployment operations
  Note: TransactionMonitor(action={add, update, del}, process)
- ESA GSTP DREAM – Quality Assessment Service WPS based with mobile code as a use case for WPS-T
Conclusion

- **WPS 2.0 SWG contribution:**
  - WPS 2.0 Core Specification
  - WPS 2.0 Asynchronous Extension
  - WPS 2.0 Transactional Extension

- **Based on cases study:**
  - ngEO project
  - ESA GSTP DREAM Project
  - SSEGrid project
Thank You

Q&A