Czech technical university in Prague
Faculty of Civil engineering

Master thesis

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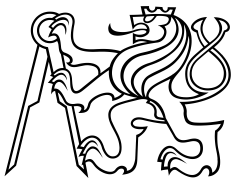

Master thesis

Process isolation in PyWPS framework

Izolace procesů ve frameworku PyWPS

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Abstract

Abstract

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Declaration of authorship

Prohlaseni

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Podekovani

Contents

Introduction

Mame hromadu dat, ktere je potreba zpracovat. Hodne to ulehci, kdyz to budem moct nejak standardizovat a pak pouzivat na cloudu.

https://pdfs.semanticscholar.org/bb17/7b12791d5ea58811955555be2d48226fd5ae.pdf

Uvod

Part I

Technological background

1 Web Processing Service

1.1 History

First mention of the Web Processing Service was in October 2004. Back then it was named Geoprocessing Service [1]. The specification was first implemented as a prototype in 2004 by Agriculture and Agri-Food Canada (AAFC). In its further development during a Geoprocessing Services Interoperability Experiment [2] the name was changed to "Web Processing Service" to avoid the acronym GPS, since this would have caused confusion with the conventional use of this acronym for Global Positioning System [4]. The first version of WPS was released in September 2005 [3]. The experiment demonstrated that various clients could easily access and bind to services which were set up according the WPS Implementation specification.

Currently two major versions of WPS Standard exist. The WPS version 1.0.0 is currently used mostly. If not explicitly said this thesis is dedicated to the version 1.0.0. The WPS version 2.0.0 was released in 2015 [5].

1.2 Web Processing Service

The OpenGIS® Web Processing Service (WPS) Interface Standard defines a standardized interface that facilitates the publishing of geospatil processes. Also provides rules how to standardize requests and responses for geospatial processing services.

Process means any operation on spatial data from simple ones as maps overlay or buffering to highly complex as complicated global models. Any kind of GIS funcionality can be offered to clients across network with correctly configured WPS.

Publishing means creating human-readable metadata that allow user to discover and use service as well as making available machine-readable binding information.

Data can be both vector or raster data and can be delivered across the network or be available at the server.

The interface does not specify any specific processes that can be implemented by a WPS nor any specific data inputs or outputs. instead it specifies a generic mechanisms to describe any geospatial process and data required and produced by

the process. The interface does not only provide mechanisms for calculation but also to identify required data, initiate the calculation and manage output data so clients can access it.

Web Processing Service as one of the OGC web services scpecifies three types of requests which can be requested by a client and performed by a WPS server. The implementation of these three requests is mandatory by by all servers:

- GetCapabilities
- DescribeProcess
- Execute

GetCapabilities - The request returns to client a Capabilities document that describes the abilities of the specific server implementation. It also returns the name and abstract of each of the processes that can be run on a WPS instance.

DescribeProcess - The request returns details about the processes offered by a WPS instance. Describes required inputs and produces outputs and their allowable formats.

Execute - The request allows a client to run a specified process with provided parameters and returns produced outputs.

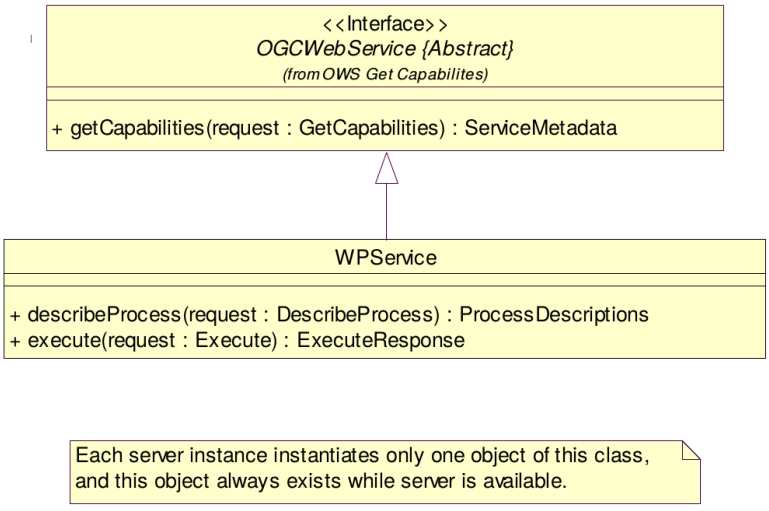

Figure 1: WPS interface UML description, source: [4]

These operations are very similar to other OGC Web Services such as WMS, WFS, and WCS. Common interface aspects are defined in the OpenGIS ® Web Services Common Implementation Specification [6]. As seen at class diagram at Fig. 1 the WPS interface class inherits the GetCapabilities operation from OGCWebService interface class. The operations Execute and DescribeProcess are specific for the WPS. The WPS operations are based on GET and POST requests.

Operation	Request encoding	
	Mandatory	Optional
GetCapabilities	KVP	XML
DescribeProcess	KVP	XML
Execute	XML	KVP

Table 1: Operations request encoding

The GetCapabilities and DescribeProcess shall use HTTP GET with KVP encoding and Execute operation shall use HTTP POST with XML encoding. Summarized in Table 1.

1.2.1 GetCapabilities

The GetCapabilities operation is mandatory. The operation allows clients to retrieve capabilities document (metadata) from a server. The response XML document contains service metadata about server and all implemented processes description.

AcceptVersion vs version, AcceptFormats vs format

GetCapabilities request

Request parameters

- *service* - Mandatory parameter, WPS is only possible value.
- *request* - Mandatory parameter, GetCapabilities is only possible value.

Name	Optionality and use	Definition and format
service=WPS	Mandatory	Service type identifier text
request=GetCapabilities	Mandatory	Operation name text
AcceptVersion=1.0.0	Optional	Specification version
Sections=All	Optional	Comma-separated unordered list of sections
updateSequence=XXX	Optional	Service metadata document version
AcceptFormats=text/xml	Optional	Comma-separated prioritized sequence of response formats

Table 2: GetCapabilities operation request URL parameters, source: [6]

- *version* - Optional parameter, version number. Three non-negative integers separated by decimal point. Servers and their clients should support at least one defined version.
- *sections* - Optional parameter that contains a list of section names. Possible values are: *ServiceIdentification, ServiceProvider, OperationsMetadata, Contents, All.*
- *updateSequence* - Optional parameter for maintaining the consistency of a client cache of the contents of a service metadata document. The parameter value can be an integer, a timestamp, or any other number or string.
- *updateSequence* - Optional parameter for maintaining the consistency of a client cache of the contents of a service metadata document. The parameter value can be an integer, a timestamp, or any other number or string.
- *format* - Optional parameter that defines response format.

The GetCapabilities operation can be requested with parameters from table 2. A corresponding request URL looks like: `http://localhost:5000/wps?service=WPS&request=GetCapabilities&AcceptVersion=1.0.0&Section=ServiceIdentification,OperationsMetadata&updateSequence=XXX&AcceptFormats=text/xml`

GetCapabilities response

Normal response When GetCapabilities operation requested a client retrieve service metadata document that contains sections specified in *sections* parameter. If the parameter value is *All* or is not specified all sections retrieved.

- *ServiceIdentification* - Server metadata.
- *ServiceProvider* - Server operating organization metadata.
- *OperationsMetadata* - Metadata about operations implemented by the WPS server, including URLs to request them.
- *ProcessOfferings* - List of processes with name and brief description implemented by the WPS server.

In addition to sections each GetCapabilities response should contains:

- *version* - Specification version for GetCapabilities operation.
- *updateSequence* - Server metadata document version, value is increased whenever any change is made in complete service metadata document.

Exceptions In case that WPS server encounters an error a client retrieve an exception report message with one of there exception code:

- *MissingParameterValue* - GetCapabilities request does not contain a required parameter value.
- *InvalidParameterValue* - GetCapabilities request contains an invalid parameter value.
- *VersionNegotiation* - Any version from AcceptVersions parameter list does not match any version supported by the WPS server.
- *InvalidUpdateSequence* - Value of updateSequence parameter is greater than current value of service metadata updateSequence number.
- *NoApplicableCode* - Other exceptions.

1.2.2 DescribeProcess

The DescribeProcess operation is mandatory. The operation allows clients to retrieve a detailed description about one or more processes implemented by a WPS server. The detailed information describe both required inputs and produced outputs and allowed format.

DescribeProcess request

Name	Optionality	Definition and format
service=WPS	Mandatory	Service type identifier text
request=DescribeProcess	Mandatory	Operation name text
version=1.0.0	Mandatory	WPS specification version
Identifier=buffer	Optional	List of one or more process identifiers, separated by commas

Table 3: DescribeProcess operation request URL parameters, source: [6]

Request parameters The DescribeProcess operation can be requested with parameters from table 3. A corresponding request URL looks like: `http://localhost:5000/wps?request=DescribeProcess&service=WPS&identifier=all&version=1.0.0`

DescribeProcess response

1.2.3 Execute

1.3 PyWPS

2 Docker

Part II

Practical part

Seznam použitých zkratek

KVP	Key Value Pair
OGC	Open Geospatial Consortium
URL	Uniform Resource Locator
WPS	Web Processing Service
WMS	Web Map Service
WFS	Web Feature Service
WCS	Web Coverage Service
XML	eXtensible Markup Language

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