

# OGC API - Processes - Part 1

## *Core*

# Open Geospatial Consortium

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## OGC API - Processes - Part 1: Core

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## i. Abstract

In many cases geospatial or location data, including data from sensors, must be processed before the information can be effectively used. The OGC Web Processing Service (WPS) Interface Standard provides a standard interface that simplifies the task of making simple or complex computational geospatial processing services accessible via web services. Such services include well-known processes found in GIS software as well as specialized processes for spatio-temporal modeling and simulation. While the OGC WPS standard was designed with spatial processing in mind, the standard could also be used to readily insert non-spatial processing tasks into a web services environment. The WPS standard provides a robust, interoperable, and versatile protocol for process execution on web services. WPS supports both immediate processing for computational tasks that take little time and asynchronous processing for more complex and time-consuming tasks. Moreover, the WPS standard defines a general process model that is designed to provide an interoperable description of processing functions. It is intended to support process cataloguing and discovery in a distributed environment.

The OGC API - Processes API builds on the WPS 2.0 standard and defines the processing standards to communicate over a RESTful protocol using JSON encodings. This API is a newer and more modern way of programming and interacting with resources over the web while allowing better integration into existing software packages.

The resources that are provided by a server implementing the OGC API - Processes are listed in [Table 1](#) below and include the capabilities document of the server, the list of processes available (Process list and Process description), jobs (running processes) and results of process executions.

*Table 1. Requirements class 'Core' - Overview of resources, applicable HTTP methods and links to the document sections*

Resource	Path	HTTP method	Parameter	Document reference
Landing page	/	GET	N/A	<a href="#">7.2 API landing page</a>
Conformance classes	/conformance	GET	N/A	<a href="#">7.4 Declaration of conformance classes</a>
Process list	/processes	GET	N/A	<a href="#">7.7 Retrieve a process list</a>
Process description	/processes/{processID}	GET	processID (in path)	<a href="#">7.8 Retrieve a process description</a>
Job status info	/processes/{processID}/jobs/{jobID}	GET	processID, jobID (in path)	<a href="#">7.10 Retrieve status information about a job</a>
Job results	/processes/{processID}/jobs/{jobID}/results	GET	processID, jobID (in path)	<a href="#">7.11 Retrieve job results</a>

Resource	Path	HTTP method	Parameter	Document reference
Job status info or results	<a href="#">/processes/{processID}/jobs</a>	POST	processID (in path), Execute request (contained in body)	<a href="#">7.9 Create a new job</a>

In general, the HTTP GET operation is used to provide access to the resources described above. However, in order to create a new job, the HTTP POST method is used to create a new job by sending an execute request to the server.

Additionally, a list of jobs for a specific process can be requested.

*Table 2. Requirements class 'Job list' - Overview of resources, applicable HTTP methods and links to the document sections*

Resource	Path	HTTP method	Parameter	Document reference
Job list	<a href="#">/processes/{processID}/jobs</a>	GET	processID (in path)	<a href="#">11 Requirements Class "Job list"</a>

As a further addition to the operations accessible through HTTP GET and POST methods, in order to cancel a job execution and/or remove traces of the job execution the DELETE method can be used.

*Table 3. Requirements class 'Dismiss' - Overview of resources, applicable HTTP methods and links to the document sections*

Resource	Path	HTTP method	Parameter	Document reference
Job status info	<a href="#">/processes/{processID}/jobs/{jobID}</a>	DELETE	processID, jobID (in path)	<a href="#">13 Requirements Class "Dismiss"</a>

## ii. Keywords

The following are keywords to be used by search engines and document catalogues.

ogcdoc, OGC document, OGC API, Geospatial API, processes, Web Processing Service, WPS, JSON, HTML, geoprocessing, API, OpenAPI, HTML

## iii. Preface

The Processing API is a continuation of WPS 2.0, a standard for web-based processing of geospatial data. The Processing API defines how the interfaces for WPS 2.0 operations should be constructed



and interpreted using a REST based protocol with JSON encoding. Within the current version of WPS 2.0, bindings are defined for HTTP/POST using XML encodings and HTTP/GET using KVP encodings. Also in the current WPS 2.0 standard, a core conceptual model is provided that may be used to specify a WPS in different architectures such as REST or SOAP. Therefore, the Processing API is a natural fit to what is already defined in the standard.

#### iv. Submitting organizations

The following organizations submitted this Document to the Open Geospatial Consortium (OGC):

- 52°North GmbH
- Hexagon
- CubeWerx Inc.
- Ecere Corporation
- Terradue Srl
- European Space Agency (ESA)
- Spacebel

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# Chapter 1. Scope

This OGC Standard specifies a Web API that enables the execution of computing processes and the retrieval of metadata describing their purpose and functionality. Typically, these processes combine raster, vector, coverage and/or point cloud data with well-defined algorithms to produce new raster, vector, coverage and/or point cloud information.

# Chapter 2. Conformance

This standard defines seven requirements / conformance classes.

The standardization targets of all conformance classes are "Web APIs."

The main requirements class is:

- [Core](#).

The *Core* specifies requirements that all Web APIs have to implement.

Two requirements classes depend on the *Core* and specify representations for the resources specified in the *Core*:

- [JSON](#), and
- [HTML](#).

The JSON encoding is mandatory.

The *Core* does not mandate any encoding or format for the formal definition of the API. One option is the OpenAPI 3.0 specification and a requirements class has been specified for OpenAPI 3.0, which depends on the *Core*:

- [OpenAPI Specification 3.0](#).

An implementation of the *Core* requirements class may also decide to use other API definition representations in addition or instead of an OpenAPI 3.0 definition. Examples for alternative API definitions: OpenAPI 2.0 (Swagger), future versions of the OpenAPI specification, an OWS Common 2.0 capabilities document or WSDL.

The *Core* is intended to be a minimal useful API for the execution of processes from the geospatial domain. It is designed to map the operations of a Web Processing Service 2.0.

The *Core* does not mandate the use of any specific process description to specify the interface of a process. Instead this standard defines and recommends the use of the following conformance class:

- [OGC Process Description](#)

which defines an information model, encoded in JSON, that may be used to specify the interface of a process.

Three additional conformance classes are specified that extend the basic functionality of an API:

- [Job list](#), and
- [Callback](#), and
- [Dismiss](#).

Additional capabilities such as support for transactions, extended job monitoring, etc., may be specified in future parts of the OGC API - Processes series or as vendor-specific extensions.

Conformance with this standard shall be checked using all the relevant tests specified in Annex A (normative) of this document. The framework, concepts, and methodology for testing, and the criteria to be achieved to claim conformance are specified in the OGC Compliance Testing Policies and Procedures and the OGC Compliance Testing web site.

*Table 4. Conformance class URIs*

<b>Conformance class</b>	<b>URI</b>
Core	<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/core">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/core</a>
OGC Process Description	<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/ogc-process-description">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/ogc-process-description</a>
JSON	<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/json">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/json</a>
HTML	<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/html">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/html</a>
OpenAPI Specification 3.0	<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/oas30">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/oas30</a>
Job list	<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/job-list">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/job-list</a>
Callback	<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/callback">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/callback</a>
Dismiss	<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/dismiss">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/dismiss</a>

# Chapter 3. References

The following normative documents contain provisions that, through reference in this text, constitute provisions of this document. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

OGC 14-065, OGC WPS 2.0 Interface Standard, version 2.0.2

OGC 06-121r9, OGC Web Service Common Specification, version 2.0

OGC 08-131r3 – The Specification Model – A Standard for Modular Specifications

IETF RFC 2616. Hypertext Transfer Protocol - HTTP/1.1. <http://tools.ietf.org/html/rfc2616>

IETF RFC 2617. HTTP Authentication: Basic and Digest Access Authentication. <https://tools.ietf.org/html/rfc2617>

IETF RFC 2246. Transport Layer Security. <http://tools.ietf.org/html/rfc2246>

IETF RFC 2818. HTTP Over TLS. <http://tools.ietf.org/html/rfc2818>

IETF RFC 3986: Uniform Resource Identifier (URI): Generic Syntax. <https://tools.ietf.org/html/rfc3986>

IETF RFC 4646: Tags for Identifying Languages. <https://tools.ietf.org/html/rfc4646>

IETF RFC 8288: Web Linking <https://tools.ietf.org/html/rfc8288>

# Chapter 4. Terms and Definitions

This document uses the terms defined in Sub-clause 5.3 of [OGC 06-121r9], which is based on the ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards. In particular, the word “shall” (not “must”) is the verb form used to indicate a requirement to be strictly followed to conform to this standard.

For the purposes of this document, the following additional terms and definitions apply.

## 4.1. Process

A process  $p$  is a function that for each input returns a corresponding output

$$p: X \rightarrow Y$$

where  $X$  denotes the domain of arguments  $x$  and  $Y$  denotes the co-domain of values  $y$ . Within this specification, process arguments are referred to as process inputs and result values are referred to as process outputs. Processes that have no process inputs represent value generators that deliver constant or random process outputs.

## 4.2. Job

The (processing) job is a server-side object created by a processing service for a particular process execution. A job may be latent in the case of synchronous execution or explicit in the case of asynchronous execution. Since the client has only oblique access to a processing job, a Job ID is used to monitor and control a job.

## 4.3. JSON

JavaScript Object Notation is a lightweight data-interchange format. JSON is easy for humans to read and write and it is easy for machines to parse and generate.

## 4.4. Process description

A process description is an information model that specifies the interface of a process. A process description is used for a machine-readable description of the process itself but also provides some basic information about the process inputs and outputs.

## 4.5. Process execution

The execution of a process is an action that calculates the outputs of a given process for a given set of data inputs.

## 4.6. Process input

Process inputs are the arguments of a process and refer to data provided to a process. Each process input is an identifiable item.

## 4.7. Process offering

A process offering is an identifiable process that may be executed on a particular service instance. A process offering contains a process description as well as service-specific information about the supported execution protocols (e.g. synchronous and asynchronous execution).

## 4.8. Process output

Process outputs are the results of a process and refer to data returned by a process. Each process output is an identifiable item.

## 4.9. Process profile

A process profile is a description of a process on an interface level. Process profiles may have different levels of abstraction and cover several aspects. On a generic level, a process profile may only refer to the provided functionality of a process, i.e. by giving a verbal or formal definition how the outputs are derived from the inputs. On a concrete level a process profile may completely define inputs and outputs including data type definitions and formats.

## 4.10. REST or RESTful

Representational state transfer. REST-compliant Web services allow requesting systems to access and manipulate textual representations of Web resources using a uniform and predefined set of stateless operations.

## 4.11. Service profiles for WPS

A service profile for WPS is a conformance class that defines the general capabilities of a WPS server, by (1) specifying the supported service operations, (2) the process model, (3) the supported process execution modes, (4) the supported operation binding(s).

## 4.12. WPS Server

A WPS Server is a web server that provides access to simple or complex computational processing services.

# Chapter 5. Conventions

This section provides details and examples for any conventions used in the document. Examples of conventions are symbols, abbreviations, use of XML schema, or special notes regarding how to read the document.

## 5.1. Identifiers

The normative provisions in this specification are denoted by the URI

<http://www.opengis.net/spec/ogcapi-processes-1/1.0>

All requirements, permission, recommendations and conformance tests that appear in this document are denoted by partial URIs which are relative to this base.

## 5.2. Link relations

To express relationships between resources, [RFC 8288 \(Web Linking\)](#) is used.

The following [registered link relation types](#) are used in this document.

- **alternate**: Refers to a substitute for the link's context.
- **license**: Refers to a license associated with the link's context.
- **service-desc**: Identifies service description for the context that is primarily intended for consumption by machines.
  - API definitions are considered service descriptions.
- **service-doc**: Identifies service documentation for the context that is primarily intended for human consumption.
- **self**: Conveys an identifier for the link's context.
- **status**: Identifies a resource that represents the context's status.
- **up**: Refers to a parent document in a hierarchy of documents.

In addition the following link relation types are used for which no applicable registered link relation type could be identified.

- **conformance**: Refers to a resource that identifies the specifications that the link's context conforms to.
- **exceptions**: The target URI points to exceptions of a failed process.
- **execute**: The target URI points to the execution endpoint of a process.
- **process-desc**: The target URI points to a specific process description.
- **processes**: The target URI points to the list of processes the API offers.
- **results**: The target URI points to the results of a process.



Each resource representation includes an array of links. Implementations are free to add additional links for all resources provided by the API.

## 5.3. Abbreviated Terms

Abbreviated Term	Meaning
API	Application Programming Interface
CRS	Coordinate Reference System
GML	Geography Markup Language
HTTP	Hypertext Transfer Protocol
ISO	International Organization for Standardization
JSON	JavaScript Object Notation
KVP	Keyword Value Pair
MIME	Multipurpose Internet Mail Extensions
OGC	Open Geospatial Consortium
REST	Representational State Transfer
URI	Universal Resource Identifier
URL	Uniform Resource Locator
WPS	Web Processing Service
XML	Extensible Markup Language

## 5.4. Use of the Term "Process"

The term process is one of the most used terms both in the information and geosciences domain. If not stated otherwise, this specification uses the term process as an umbrella term for any algorithm, calculation or model that either generates new data or transforms some input data into output data as defined in section 4.1 of the WPS 2.0 standard.

## 5.5. Use of HTTPS

For simplicity, this document only refers to the HTTP protocol. This is not meant to exclude the use of HTTPS. It is simply a shorthand notation for "HTTP or HTTPS". In fact, most servers are expected to use [HTTPS](#), not [HTTP](#).

OGC Web API standards do not prohibit the use of any valid HTTP option. However, implementers should be aware that optional capabilities which are not in common use could be an impediment to interoperability.

## 5.6. HTTP URIs

This document does not restrict the lexical space of URIs used in the API beyond the requirements

of the [HTTP](#) and [URI Syntax](#) IETF RFCs. If URIs include reserved characters that are delimiters in the URI subcomponent, these have to be percent-encoded. See Clause 2 of [RFC 3986 \(URI Syntax\)](#) for details.

# Chapter 6. Overview

The OGC API - Processes builds on the WPS 2.0 standard and is modularized, meaning that there is a separation between

- Core requirements, that specify basic capabilities and can easily be mapped to existing OGC Web Processing Services;
- More advanced functionality, that was not specified in WPS 2.0.

## 6.1. Encodings

This standard uses JSON as the encoding for requests and responses. The inputs and outputs of a process can be any format. The formats of are defined at the time of job creation and are fixed for the specific job.

[Support for HTML is recommended](#) as HTML is the core language of the World Wide Web. A server that supports HTML will support browsing with a web browser and will enable search engines to crawl and index the processes.

# Chapter 7. Requirements Class "Core"

The following section describes the core requirements class.

## 7.1. Overview

Requirements Class	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/core">http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/core</a>	
Target type	Web API
Dependency	<a href="#">API - Common Core</a>
Dependency	<a href="#">RFC 2616 (HTTP/1.1)</a>
Dependency	<a href="#">RFC 2818 (HTTP over TLS)</a>
Dependency	<a href="#">RFC 8288 (Web Linking)</a>

A server that implements the OGC API - Processes provides access to processes.

Each OGC API - Processes has a single **LandingPage** (path `/`) that provides links to

- the **APIDefinition** (no fixed path),
- the **Conformance** statements (path `/conformance`),
- the **processes** metadata (path `/processes`).

The **APIDefinition** describes the capabilities of the server that can be used by clients to connect to the server or by development tools to support the implementation of servers and clients. Accessing the **APIDefinition** using HTTP GET returns a description of the API.

Accessing **Conformance** using HTTP GET returns a list of URIs of requirements classes implemented by the server.

The list of processes contains a summary of each process the OGC API - Processes offers, including the link to a more detailed description of the process.

The process description contains information about inputs and outputs and a link to the execution-endpoint for the process.

A HTTP POST request to the execution-endpoint creates a new job. The inputs and outputs need to be passed in a JSON `execute-request`.

The URL for accessing status information is delivered in the HTTP header **location**.

After a process is finished (status = success/failed), the results/exceptions can be retrieved.

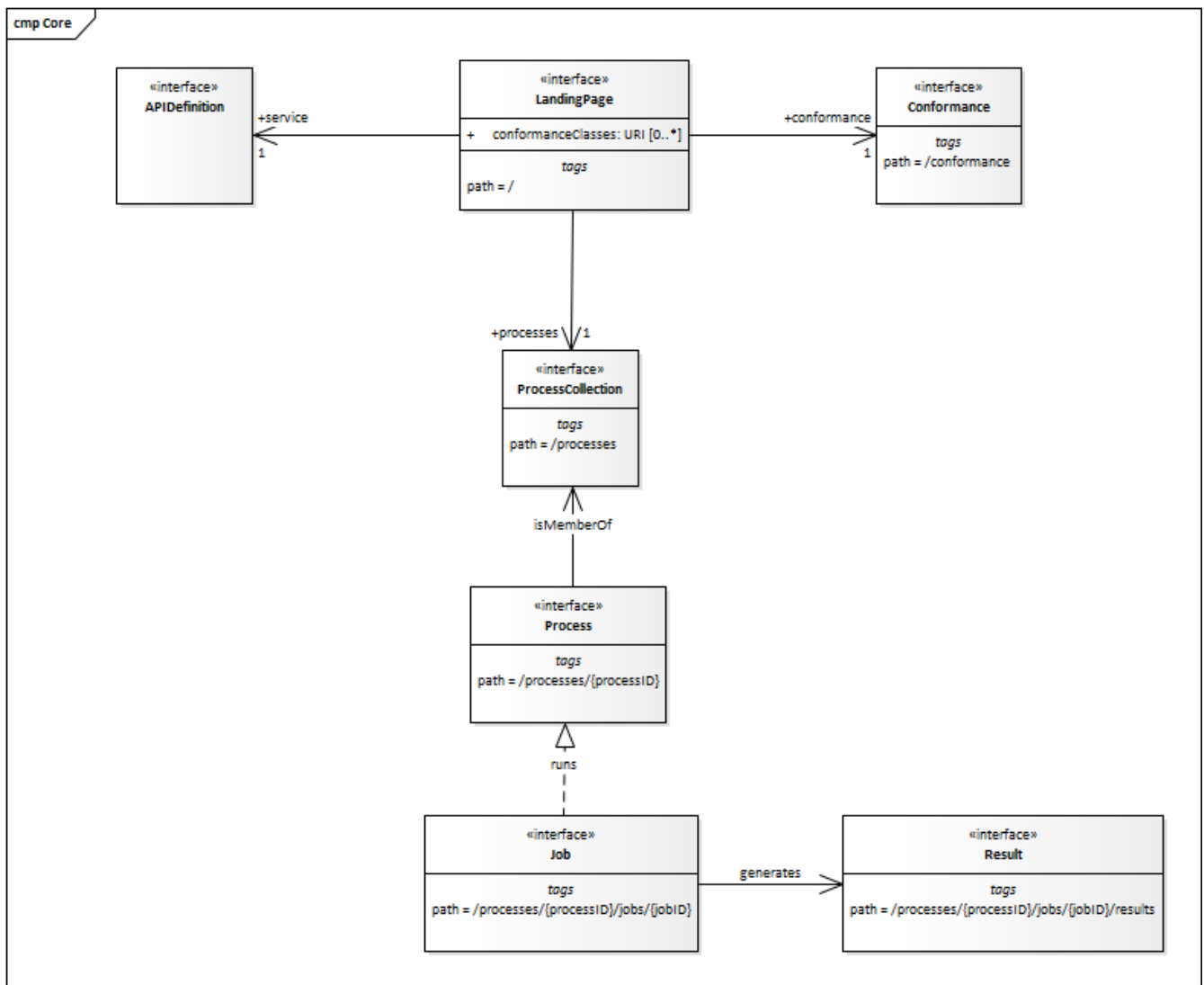


Figure 1. Resources in the Core requirements class

The OGC API - Processes standard is build upon the OGC API-Common standard. Table 5 Identifies the API-Common Requirements Classes which are applicable to each section of this standard.

Table 5. Mapping API - Processes Sections to API-Common Requirements Classes

API - Processes Section	API-Common Requirements Class
API Landing Page	<a href="http://www.opengis.net/spec/ogcapi_common-1/1.0/req/core">http://www.opengis.net/spec/ogcapi_common-1/1.0/req/core</a>
API Definition	<a href="http://www.opengis.net/spec/ogcapi_common-1/1.0/req/core">http://www.opengis.net/spec/ogcapi_common-1/1.0/req/core</a>
Declaration of Conformance Classes	<a href="http://www.opengis.net/spec/ogcapi_common-1/1.0/req/core">http://www.opengis.net/spec/ogcapi_common-1/1.0/req/core</a>
OpenAPI 3.0	<a href="http://www.opengis.net/spec/ogcapi_common-1/1.0/req/oas30">http://www.opengis.net/spec/ogcapi_common-1/1.0/req/oas30</a>
HTML	<a href="http://www.opengis.net/spec/ogcapi_common-1/1.0/req/html">http://www.opengis.net/spec/ogcapi_common-1/1.0/req/html</a>

## 7.2. Retrieve the API landing page

The following section describes a method to retrieve an API landing page.

### 7.2.1. Operation

Requirement 1	<b>/req/core/landingpage-op</b> The server SHALL support the HTTP GET operation at the path <b>/</b> .
---------------	---

### 7.2.2. Response

Requirement 2	<b>/req/core/landingpage-success</b> A successful execution of the operation SHALL be reported as a response with a HTTP status code <b>200</b> . The content of that response SHALL be based upon the OpenAPI 3.0 schema <b>landingPage.yaml</b> and include at least links to the following resources: * the API definition (relation type 'service-desc' or 'service-doc') * <b>/conformance</b> (relation type 'conformance') * <b>/processes</b> (relation type 'processes')
---------------	--

#### *Schema for the landing page*

```
type: object
required:
  - links
properties:
  title:
    type: string
    example: Example processing server
  description:
    type: string
    example: Example server implementing the OGC API - Processes 1.0
  links:
    type: array
    items:
      $ref: link.yaml
```

```
{
  "links": [{
    "href": "http://processing.example.org/oapi-p?f=application/json",
    "rel": "self",
    "type": "application/json",
    "title": "This document"
  }, {
    "href": "http://processing.example.org/oapi-p?f=text/html",
    "rel": "alternate",
    "type": "text/html",
    "title": "This document as HTML"
  },
  {
    "href": "http://processing.example.org/oapi-p/api?f=application/json",
    "rel": "service-desc",
    "type": "application/json",
    "title": "API definition for this endpoint as JSON"
  },
  {
    "href": "http://processing.example.org/oapi-p/api?f=text/html",
    "rel": "service-desc",
    "type": "text/html",
    "title": "API definition for this endpoint as HTML"
  },
  {
    "href": "http://processing.example.org/oapi-p/conformance",
    "rel": "conformance",
    "type": "application/json",
    "title": "OGC API - Processes conformance classes implemented by this
server"
  },
  {
    "href": "http://processing.example.org/oapi-p/processes",
    "rel": "processes",
    "type": "application/json",
    "title": "Metadata about the processes"
  }
}]
}
```

### 7.2.3. Error situations

See [HTTP status codes](#) for general guidance.

## 7.3. Retrieve an API definition

The following section describes a method to retrieve an API definition.

### 7.3.1. Operation

Every OGC API - Processes provides an API definition that describes the capabilities of the server and which can be used by developers to understand the API, by software clients to connect to the server, or by development tools to support the implementation of servers and clients.

<b>Requirement 3</b>	<b>/req/core/api-definition-op</b> <b>The server SHALL support the HTTP GET operation at the path /api.</b>
----------------------	--

### 7.3.2. Response

<b>Requirement 4</b>	<b>/req/core/api-definition-success</b> <b>A successful execution of the operation SHALL be reported as a response with a HTTP status code 200. The server SHALL return an API definition document.</b>
----------------------	--

<b>Recommendation 1</b>	<b>/rec/core/api-definition-oas</b> <b>If the API definition document uses the OpenAPI Specification 3.0, the document SHOULD conform to the <a href="#">OpenAPI Specification 3.0 requirements class</a>.</b>
-------------------------	---

If multiple API definition formats are supported by a server, use content negotiation to select the desired representation.

The API definition document describes the API. In other words, there is no need to include the `/api` operation in the API definition itself.

The idea is that any OGC API - Processes can be used by developers that are familiar with the API definition language(s) supported by the server. For example, if an OpenAPI definition is used, it should be possible to create a working client using the OpenAPI definition. The developer may need to learn a little bit about geospatial data types, etc., but it should not be required to read this standard to access the processes and results via the API.

### 7.3.3. Error situations

See [HTTP status codes](#) for general guidance.

## 7.4. Declaration of conformance classes

### 7.4.1. Operation

To support "generic" clients for accessing Web Processing Services in general - and not "just" a specific API / server, the server has to declare the requirements classes it implements and conforms to.



<b>Requirement 5</b>	<b>/req/core/conformance-op</b> <b>The server SHALL support the HTTP GET operation at the path</b> <b>/conformance.</b>
----------------------	---

### 7.4.2. Response

<b>Requirement 6</b>	<b>/req/core/conformance-success</b> <b>A successful execution of the operation SHALL be reported as</b> <b>a response with a HTTP status code 200. The content of that</b> <b>response SHALL be based upon the OpenAPI 3.0 schema</b> <b>req-classes.yaml and list all OGC API - Processes requirements</b> <b>classes that the server conforms to.</b>
----------------------	---

#### *Schema for the list of requirements classes*

```

type: object
required:
  - conformsTo
properties:
  conformsTo:
    type: array
    items:
      type: string
      example: "http://www.opengis.net/spec/ogcapi_processes/1.0/req/core"

```

#### *Example 2. Requirements class response document*

This example response in JSON is for a server that supports OpenAPI 3.0 for the API definition and HTML and JSON as encodings.

```

{
  "conformsTo": [
    "http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/core",
    "http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/json",
    "http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/html",
    "http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/oas30"
  ]
}

```

### 7.4.3. Error situations

See [HTTP status codes](#) for general guidance.

## 7.5. Use of HTTP 1.1

<b>Requirement 7</b>	<b>/req/core/http</b> <b>The server SHALL conform to <a href="#">HTTP 1.1</a>. If the server supports HTTPS, the server SHALL also conform to <a href="#">HTTP over TLS</a>.</b>
----------------------	---

### 7.5.1. HTTP status codes

[Table 6](#) lists the main HTTP status codes that clients should be prepared to receive.

This includes, for example, support for specific security schemes or URI redirection.

In addition, other error situations may occur in the transport layer outside of the server.

*Table 6. Typical HTTP status codes*

Status code	Description
200	A successful request.
201	The request was successful and one or more new resources have being created.
400	The server cannot or will not process the request due to an apparent client error. For example, a query parameter had an incorrect value.
401	The request requires user authentication. The response includes a <b>WWW-Authenticate</b> header field containing a challenge applicable to the requested resource.
403	The server understood the request, but is refusing to fulfill it. While status code 401 indicates missing or bad authentication, status code 403 indicates that authentication is not the issue, but the client is not authorized to perform the requested operation on the resource.
404	The requested resource does not exist on the server. For example, a path parameter had an incorrect value.
405	The request method is not supported. For example, a POST request was submitted, but the resource only supports GET requests.
406	The <b>Accept</b> header submitted in the request did not support any of the media types supported by the server for the requested resource.
429	The user has sent too many requests in a given amount of time ("rate limiting").
500	An internal error occurred in the server.

More specific guidance is provided for each resource, where applicable.

<b>Permission 1</b>	<b>/per/core/additional-status-codes</b> <b>Servers MAY support other capabilities of the HTTP protocol and, therefore, MAY return other status codes than those listed in <a href="#">Table 6</a>, too.</b>
---------------------	---

## 7.6. Support for cross-origin requests

Access to content from a HTML page is by default prohibited for security reasons, if the content is

located on another host than the webpage ("same-origin policy"). A typical example is a web-application accessing processes and data from multiple servers.

<b>Recommendation 2</b>	<b>/rec/core/cross-origin</b> <b>If the server is intended to be accessed from the browser, cross-origin requests SHOULD be supported. Note that support can also be added in a proxy layer on top of the server.</b>
-------------------------	--

Two common mechanisms to support cross-origin requests are:

- [Cross-origin resource sharing \(CORS\)](#)
- [JSONP \(JSON with padding\)](#)

<b>Recommendation 3</b>	<b>/rec/core/html</b> <b>To support browsing a WPS with a web browser and to enable search engines to crawl and index a dataset, implementations SHOULD consider to support an HTML encoding.</b>
-------------------------	--

## 7.7. Retrieve a process list

The following section describes a method to retrieve the available processes offered by the server.

### 7.7.1. Operation

<b>Requirement 8</b>	<b>/req/core/process-list</b> <b>The server SHALL support the HTTP GET operation at the path <a href="#">/processes</a>.</b>
----------------------	---

### 7.7.2. Response

<b>Requirement 9</b>	<b>/req/core/process-list-success</b> <b>A successful execution of the operation SHALL be reported as a response with a HTTP status code 200. The content of that response SHALL be based upon the OpenAPI 3.0 schema <a href="#">processList.yaml</a>.</b>
----------------------	--

*Schema for the process list*

```
type: array
items:
  $ref: "processSummary.yaml"
```

**NOTE** | References to additional schemas can found in Annex TODO

Example of HTTP GET request for retrieving the list of offered processes encoded as JSON.

```
GET /processes HTTP/1.1
Host: processing.example.org
```

Example of Process list encoded as JSON.

```
[
  {
    "id": "EchoProcess",
    "title": "EchoProcess",
    "version": "1.0.0",
    "jobControlOptions": ["async-execute", "sync-execute"],
    "outputTransmission": ["value", "reference"],
    "links": [
      {
        "href": "https://processing.example.org/processes/EchoProcess",
        "type": "application/json",
        "rel": "process-desc",
        "title": "process description"
      }
    ]
  }
]
```

### 7.7.3. Error situations

See [HTTP status codes](#) for general guidance.

## 7.8. Retrieve a process description

The following section describes a method to retrieve metadata about a process.

### 7.8.1. Operation

<b>Requirement 10</b>	<b>/req/core/process</b> <b>The server SHALL support the HTTP GET operation at the path <code>/processes/{processID}</code>.</b>
-----------------------	---

### 7.8.2. Response

<b>Requirement 11</b>	<b>/req/core/process-success</b>
A	A successful execution of the operation SHALL be reported as a response with a HTTP status code 200.

B	The content of the response SHALL be a process description.
---	---

The [Core](#) does not mandate the use of a specific process description to specify the interface of a process. That said, the [Core](#) requirements class makes the following recommendation:

<b>Recommendation 4</b>	<b><a href="#">/rec/core/ogc-process-description</a></b> <b>Implementations SHOULD consider supporting the <a href="#">OGC process description</a>.</b>
-------------------------	--

### 7.8.3. Error situations

See [HTTP status codes](#) for general guidance.

<b>Requirement 12</b>	<b><a href="#">/req/core/process-exception/no-such-process</a></b> <b>If the operation is executed using an invalid process identifier, the response shall have HTTP status code 404. The content of that response SHALL be based upon the OpenAPI 3.0 schema <a href="#">exception.yaml</a>. The exception code of the exception shall be "NoSuchProcess".</b>
-----------------------	--

## 7.9. Create a new job

The following section describes a method to create a new job, i.e. execute a process.

### 7.9.1. Operation

<b>Requirement 13</b>	<b><a href="#">/req/core/job-creation-op</a></b> <b>The server SHALL support the HTTP POST operation at the path <a href="#">/processes/{processID}/jobs</a>.</b>
-----------------------	--

### 7.9.2. Request body

<b>Requirement 14</b>	<b><a href="#">/req/core/job-creation-request</a></b> <b>The content of a request to create a new job SHALL be based upon the OpenAPI 3.0 schema <a href="#">execute.yaml</a>.</b>
-----------------------	---

### Schema for execute

```
type: object
required:
  - outputs
  - mode
properties:
  inputs:
    type: array
    items:
      $ref: "input.yaml"
  outputs:
    type: array
    items:
      $ref: "output.yaml"
  mode:
    type: string
    enum:
      - sync
      - async
      - auto
  response:
    type: string
    enum:
      - raw
      - document
  subscriber:
    $ref: "subscriber.yaml"
```

The creation of a job can be done synchronously or asynchronously.

Requirement 15	/req/core/job-creation-mode
A	To create a job asynchronously, the "mode" attribute of the execute request body SHALL be set to "async".
B	To create a job synchronously, the "mode" attribute of the execute request body SHALL be set to "sync".
C	To let the server decide the execution mode, the "mode" attribute of the execute request body SHALL be set to "auto".

```
{
  "inputs": [{
    "id": "complexInput",
    "input": {
      "format": {
        "mimeType": "application/xml"
      },
      "value": {
        "inlineValue": "<test/>"
      }
    }
  },
  {
    "id": "literalInput",
    "input": {
      "dataType": {
        "name": "double"
      },
      "value": "0.05"
    }
  },
  {
    "id": "boundingboxInput",
    "input": {
      "bbox": [51.9, 7, 52, 7.1],
      "crs": "EPSG:4326"
    }
  }
  ],
  "outputs": [{
    "id": "literalOutput",
    "transmissionMode": "value"
  },
  {
    "id": "boundingboxOutput",
    "transmissionMode": "value"
  },
  {
    "id": "complexOutput",
    "format": {
      "mimeType": "application/xml"
    },
    "transmissionMode": "value"
  }
  ],
  "response": "document",
  "mode": "async"
}
```

### 7.9.3. Response

In case of asynchronous execution, the requirements below apply:

<b>Requirement 16</b>	<b>/req/core/job-creation-success-async</b> <b>A successful execution of the operation SHALL be reported as a response with a HTTP status code 201.</b>
<b>Requirement 17</b>	<b>/req/core/job-creation-success-header-async</b> <b>The 201 response of the operation SHALL return a HTTP header named 'Location' which contains a link to the newly created job.</b>

For synchronous execution, the following requirement applies:

<b>Requirement 18</b>	<b>/req/core/job-creation-success-sync</b>
A	A successful execution of the operation SHALL be reported as a response with a HTTP status code 200.
B	If the "response" attribute of the execute request was set to "document", the content of the response SHALL be based upon the OpenAPI 3.0 schema <a href="#">results.yaml</a>
C	If the "response" attribute of the execute request was set to "raw", the content of the response SHALL only include the one output selected by the execute request body.

### 7.9.4. Error situations

See [HTTP status codes](#) for general guidance.

If the process with the specified identifier doesn't exist on the server, the status code of the response will be **404** (see [\[req\\_core\\_no-such-process\]](#)).

## 7.10. Retrieve status information about a job

The following section describes a method to retrieve information about the status of a job.

### 7.10.1. Operation

<b>Requirement 19</b>	<b>/req/core/job</b> <b>The server SHALL support the HTTP GET operation at the path <a href="#">/processes/{processID}/jobs/{jobID}</a>.</b>
-----------------------	---



## 7.10.2. Response

<b>Requirement 20</b>	<b><code>/req/core/job-success</code></b> <b>A successful execution of the operation SHALL be reported as a response with a HTTP status code 200. The content of that response SHALL be based upon the OpenAPI 3.0 schema <a href="#">statusInfo.yaml</a>.</b>
-----------------------	---

### *Schema for status info*

```
type: object
required:
  - jobID
  - status
properties:
  jobID:
    type: string
  status:
    type: string
    enum:
      - accepted
      - running
      - successful
      - failed
      - dismissed
  message:
    type: string
  progress:
    type: integer
    minimum: 0
    maximum: 100
  links:
    type: array
    items:
      $ref: "link.yaml"
```

*Example of HTTP GET request for retrieving status information about a job encoded as JSON.*

```
GET /processes/EchoProcess/jobs/81574318-1eb1-4d7c-af61-4b3fbcf33c4f HTTP/1.1
Host: processing.example.org
```

Example of a job encoded as JSON.

```
{
  "jobID" : "81574318-1eb1-4d7c-af61-4b3fbcf33c4f",
  "status": "accepted",
  "message": "Process started",
  "progress": 0,
  "links": [
    {
      "href": "http://processing.example.org/processes/EchoProcess/jobs/81574318-1eb1-4d7c-af61-4b3fbcf33c4f",
      "rel": "self",
      "type": "application/json",
      "title": "this document"
    }
  ]
}
```

### 7.10.3. Error situations

See [HTTP status codes](#) for general guidance.

If the process with the specified identifier doesn't exist on the server, the status code of the response will be **404** (see [\[req\\_core\\_no-such-process\]](#)).

<b>Requirement 21</b>	<b>/req/core/job-exception-no-such-job</b> If the operation is executed using an invalid job identifier, the response shall have HTTP status code 404. The content of that response SHALL be based upon the OpenAPI 3.0 schema <a href="#">exception.yaml</a> . The exception code of the exception shall be "NoSuchJob".
-----------------------	--

## 7.11. Retrieve job results

The following section describes a method to retrieve the results of a job. In case the job execution failed, an exception is returned.

### 7.11.1. Operation

<b>Requirement 22</b>	<b>/req/core/job-result</b> The server SHALL support the HTTP GET operation at the path <a href="#">/processes/{processID}/jobs/{jobID}/results</a> .
-----------------------	--

### 7.11.2. Response

<b>Requirement 23</b>	<b>/req/core/job-result-success</b> <b>A successful execution of the operation SHALL be reported as a response with a HTTP status code 200. The content of that response SHALL be based upon the OpenAPI 3.0 schema <a href="#">result.yaml</a>.</b>
-----------------------	---

#### *Schema for the result of a job*

```

type: array
items:
  $ref: "outputInfo.yaml"

```

#### *Schema for output info*

```

type: object
required:
  - id
  - value
properties:
  id:
    type: string
  value:
    $ref: "valueType.yaml"

```

*Example of HTTP GET request for retrieving the result a job encoded as JSON.*

```

GET /processes/EchoProcess/jobs/81574318-1eb1-4d7c-af61-4b3fbcf33c4f/result HTTP/1.1
Host: processing.example.org

```

Example of a result encoded as JSON.

```
[
  {
    "id": "literalOutput",
    "value": {
      "inlineValue": 0.05
    }
  },
  {
    "id": "boundingboxOutput",
    "value": {
      "inlineValue": {
        "bbox": [51.9, 7, 52, 7.1],
        "crs": "EPSG:4326"
      }
    }
  },
  {
    "id": "complexOutput",
    "value": {
      "inlineValue": "<test/>"
    }
  }
]
```

### 7.11.3. Error situations

See [HTTP status codes](#) for general guidance.

If the process with the specified id doesn't exist on the server, the status code of the response will be **404** (see [\[req\\_core\\_no-such-process\]](#)).

Requirement 24	<b>/req/core/job-result-exception/no-such-job</b> If the operation is executed using an invalid job identifier, the response shall have HTTP status code 404. The content of that response SHALL be based upon the OpenAPI 3.0 schema <a href="#">exception.yaml</a> . The exception code of the exception shall be "NoSuchJob".
Requirement 25	<b>/req/core/job-result-exception/result-not-ready</b> If the operation is executed on a running job with a valid job identifier, the response shall have HTTP status code 404. The content of that response SHALL be based upon the OpenAPI 3.0 schema <a href="#">exception.yaml</a> . The exception code of the exception shall be "ResultNotReady".

Requirement 26	<p><b>/req/core/job-result-failed</b></p> <p>If the operation is executed on a failed job using a valid job identifier, the response shall have a HTTP error code that corresponds to the reason of the failure. The content of that response SHALL be based upon the OpenAPI 3.0 schema <a href="#">exception.yaml</a>. The exception code shall correspond to the reason of the failure, e.g. InvalidParameterValue for invalid input data.</p>
----------------	---

# Chapter 8. Requirements Class "OGC Process Description"

The following section describes the **OGC Process Description** requirements class.

## 8.1. Overview

Requirements Class	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/ogc-process-description">http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/ogc-process-description</a>	
Target type	Web API
Dependency	<a href="#">OGC API - Processes Core</a>
Dependency	<a href="#">JSON</a>

The OGC process description is an information model that may be used to specify the interface of a process. This model is an evolution of the process description model originally defined in the [OGC WPS 2.0.2 Interface Standard](#) and as such provides a bridge from legacy implementations into the OGC API Framework.

The process description allows the following information to be specified:

- An identifier for the process
- Descriptive metadata about the process;
  - a title
  - a narrative description of the process
  - keywords that can be associated with the process
  - references to additional metadata
- A description of each process input
- A description of each process output
- A job control specification that indicates whether the process can be invoked synchronously, asynchronously, or either.
- An output transmission specification that indicates how the results of a process are retrieved; either by value or by reference
- A section for additional parameters that are intended for communities of use to extend the process description as required

This clause defines a JSON-encoding of the OGC process description.

## 8.2. OGC process description

<b>Requirement 27</b>	<b>/req/ogc-process-description/json-encoding</b> A JSON-encoded OGC process description shall validate against the OpenAPI 3.0 schema: <a href="#">process.yaml</a> .
-----------------------	---

#### *Schema for a process (process.yaml)*

```

allof:
  - $ref: "processSummary.yaml"
  - type: object
    properties:
      inputs:
        type: array
        items:
          $ref: "inputDescription.yaml"
      outputs:
        type: array
        items:
          $ref: "outputDescription.yaml"
      links:
        type: array
        items:
          $ref: "link.yaml"

```

*Example of HTTP GET request for retrieving the list of offered processes encoded as JSON.*

```
https://processing.example.org/processes/EchoProcess
```

*Example of a process encoded as JSON.*

```

{
  "id": "EchoProcess",
  "title": "EchoProcess",
  "version": "1.0.0",
  "jobControlOptions": ["async-execute", "sync-execute"],
  "outputTransmission": ["value", "reference"],
  "inputs": [{
    "id": "boundingboxInput",
    "title": "boundingboxInput",
    "input": {
      "supportedCRS": [{
        "default": true,
        "crs": "EPSG:4326"
      }]
    },
    "minOccurs": 1,
    "maxOccurs": 1
  },
  {
    "id": "literalInput",

```

```

    "title": "literalInput",
    "input": {
      "literalDataDomain": {
        "dataType": {
          "name": "double"
        },
        "valueDefinition": {
          "anyValue": true
        }
      }
    },
    "minOccurs": 1,
    "maxOccurs": 1
  },
  {
    "id": "complexInput",
    "title": "complexInput",
    "input": {
      "formats": [{
        "default": true,
        "mimeType": "application/xml"
      },
      {
        "mimeType": "application/xml"
      },
      {
        "mimeType": "text/xml"
      }
    ],
    "minOccurs": 1,
    "maxOccurs": 1
  }
],
"outputs": [{
  "id": "boundingboxOutput",
  "title": "boundingboxOutput",
  "output": {
    "supportedCRS": [{
      "default": true,
      "crs": "EPSG:4326"
    }
  ]
}
],
{
  "id": "literalOutput",
  "title": "literalOutput",
  "output": {
    "literalDataDomain": {
      "dataType": {
        "name": "double"
      },
      "valueDefinition": {

```



```

        "anyValue": true
    }
}
},
{
    "id": "complexOutput",
    "title": "complexOutput",
    "output": {
        "formats": [{
            "default": true,
            "mimeType": "application/xml"
        },
        {
            "mimeType": "application/xml"
        },
        {
            "mimeType": "text/xml"
        }
    ]
}],
"links": [
    {
        "href": "https://processing.example.org/processes/EchoProcess/jobs",
        "rel": "execute",
        "title": "Execute endpoint"
    }
]
}

```

# Chapter 9. Security Considerations

The OGC API - Processes specifies a Web API that enables the execution of computing processes, the retrieval of metadata describing their purpose and functionality and the retrieval of the results of the process execution. The API makes use of different HTTP methods, namely GET, POST and DELETE. (Note that future extensions could introduce additional HTTP methods.)

HTTP methods can be classified as

- Safe, meaning that they do not alter the state of (a resource on) the server, and
- Idempotent, meaning that can be executed an indefinite number of times and deliver the same result.

[Table 7](#) gives an overview of the classification of HTTP the methods used in this standard:

*Table 7. Classification of HTTP methods*

HTTP Method	Idempotent	Safe
GET	yes	yes
POST	no	no
DELETE	yes	no

Note that there is discussion whether the DELETE method is idempotent. This is discussed in section [Dismiss](#).

The following resources can be retrieved using the safe HTTP GET method and can contain sensible information:

Requirements class "Core":

- Process list
- Process description
- Job status info
- Job result

Requirements class "Job list"

- Job list

The following API operations use unsafe HTTP methods, modify resources and therefore require special attention:

Requirements class "Core":

- Execute, HTTP POST

Requirements class "Dismiss"

- Dismiss, HTTP DELETE

## 9.1. Information returned by operations using safe HTTP methods

Most of the operations defined in this standard are use the safe HTTP GET method. However, the resources that are returned by these operations contain information that could be used to exploit the API. [Table 8](#) gives an overview of the resources specified in this standard and what kind of information they contain.

*Table 8. Requirements class 'Core' - Overview of core operations and returned sensitive information*

Resource	Path	HTTP method	Information delivered
Landing page	/	GET	General information about the service, links to API endpoints
Conformance classes	/conformance	GET	List of conformance classes
Process list	/processes	GET	Process identifiers, links to process descriptions
Process description	/processes/{processID}	GET	Information about a process, e.g. inputs/outputs
Job status info	/processes/{processID}/jobs/{jobID}	GET	Status info, links to results or exceptions
Job results	/processes/{processID}/jobs/{jobID}/results	GET	Job results

The resources and contained information in more detail:

- The landing page contains links to the API endpoints and so leads to all other resources the API offers.
- The list of conformance classes could contain information about extensions like "dismiss" that pose additional security issues.
- The process list contains process identifiers and links to the respective process descriptions.
- The process description contains all necessary information needed to execute a process. This information can be used to send an JSON execute request to the API that will pass initial sanity checks, for example checks for the correct input/output identifiers. If this barrier is taken by an attacker, issues as discussed in section [Execute](#) can occur.
- The job status info contains not only status information, but for finished processes also links to results / exceptions. The results of a process execution are a valuable resource as well as the exceptions that could contain hints about why the execution has failed.

*Table 9. Requirements class 'Job List' - Overview of operations and returned sensitive information*

Resource	Path	HTTP method	Information delivered
Job list	<code>/processes/{processID}/jobs</code>	GET	List of job ids and status info, links to results or exceptions

The retrieval of the job list of a process returns the job ids and links to the respective job status.

## 9.2. Operations using unsafe HTTP methods

### 9.2.1. Execute

The execute operation uses HTTP POST to create new processing jobs (process executions). As discussed above, the HTTP POST method is not safe and it poses the following threats if misused:

- The processing can use up considerable server resources, for example computing time, network traffic (when accessing referenced inputs) or storage space for inputs and outputs.
- Malicious inputs can be provided. Either inline in the execute request JSON or referenced.

*Table 10. Requirements class 'Core' - Overview of the execute operation and returned sensitive information*

Resource	Path	HTTP method	Information delivered
Job status info	<code>/processes/{processID}/jobs</code>	POST	Job id, status info, (links to) results or exceptions

The ids that are used for new jobs and that are returned in the status info document should be created in a non-guessable way, for example using UUIDs. This will prevent random attempts to get job status information, results / exceptions or even cancel jobs / delete job artifacts.

### 9.2.2. Dismiss

The optional dismiss extension uses the HTTP DELETE method and can be used to

- cancel a running job, and
- remove artifacts of a finished job.

Both usages pose security related issues. The cancellation of a running job (if not done on purpose) is wasting the resources that the job has used until it was canceled. The same goes for the unwanted removal of artifacts of a finished job. If the dismiss extension is implemented, access control for the operation should be considered. The dismiss operation is idempotent, as it is specified by this standard to be called using a specific job identifier. The first dismiss request to that identifier will result in a HTTP 200 status code. Continued dismiss requests using the same identifier result in a HTTP 404 error code, but nothing else is changed on the server. A successful dismiss request returns a status info document containing the job identifier and the status "dismissed". This status info document has no further security implications.

# Chapter 10. Requirements classes for encodings

## 10.1. Overview

This clause specifies two pre-defined requirements classes for encodings to be used with the OGC API Processes.

- [JSON](#)
- [HTML](#)

The JSON encoding is mandatory.

The [Core](#) requirements class includes recommendations to support [HTML](#) and [JSON](#) as encodings, where practical.

## 10.2. Requirement Class "JSON"

This section defines the requirements class JSON.

Requirements Class	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/json">http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/json</a>	
Target type	Web API
Dependency	<a href="#">OGC API - Processes Core</a>
Dependency	<a href="#">JSON</a>

Requirement 28	<b><a href="#">/req/json/definition</a></b> <b><del>200</del>-responses of the server SHALL support the following media type: * <del>application</del>/json</b>
----------------	--

## 10.3. Requirement Class "HTML"

This section defines the requirements class HTML.

Requirements Class	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/html">http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/html</a>	
Target type	Web API
Dependency	<a href="#">OGC API - Processes Core</a>
Dependency	<a href="#">API - Common HTML</a>
Dependency	<a href="#">HTML5</a>

Requirement 29	<p><b>/req/html/definition</b></p> <p>Every 200-response of an operation of the server SHALL support the media type <code>text/html</code>.</p>
Requirement 30	<p><b>/req/html/content</b></p> <p>Every 200-response of the server with the media type "text/html" SHALL be a <b>HTML 5 document</b> that includes the following information in the HTML body: * all information identified in the schemas of the <b>Response Object</b> in the HTML <code>&lt;body/&gt;</code>, and * all links in HTML <code>&lt;a/&gt;</code> elements in the HTML <code>&lt;body/&gt;</code>.</p>

# Chapter 11. Requirements Class "OpenAPI 3.0"

## 11.1. Basic requirements

APIs conforming to this requirements class are documented as an [OpenAPI Document](#).

Requirements Class	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/oas30">http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/oas30</a>	
Target type	Web service
Dependency	<a href="#">OGC API - Processes 1.0 Core</a>
Dependency	<a href="#">API - Common OpenAPI 3.0</a>
Dependency	<a href="#">OpenAPI Specification 3.0.1</a>

Requirement 31	/req/oas30/oas-definition-1
A	An OpenAPI definition in JSON using the media type <code>application/vnd.oai.openapi+json;version=3.0</code> and a HTML version of the API definition using the media type <code>text/html</code> SHALL be available.

Requirement 32	/req/oas30/oas-definition-2
	The JSON representation SHALL conform to the <a href="#">OpenAPI Specification, version 3.0</a> .

TODO check if additional text is needed, e.g. for the additional process descriptions

Requirement 33	/req/oas30/oas-impl
	The server SHALL implement all capabilities specified in the OpenAPI definition.

## 11.2. Complete definition

Requirement 34	/req/oas30/completeness
	The OpenAPI definition SHALL specify for each operation all <a href="#">HTTP Status Codes</a> and <a href="#">Response Objects</a> that the server uses in responses. This includes the successful execution of an operation as well as all error situations that originate from the server.

Note that APIs that, for example, are access-controlled (see [Security](#)), support web cache validation, CORS or that use HTTP redirection will make use of additional HTTP status codes beyond regular

codes such as **200** for successful GET requests and **400**, **404** or **500** for error situations. See [HTTP status codes](#).

Clients have to be prepared to receive responses not documented in the OpenAPI definition. For example, additional errors may occur in the transport layer outside of the server.

## 11.3. Exceptions

<b>Requirement 35</b>	<b>/req/oas30/exceptions-codes</b> <b>For error situations that originate from the server, the API definition SHALL cover all applicable HTTP Status Codes.</b>
-----------------------	--

*Example 3. An exception response object definition*

```
description: An error occurred.
content:
  application/json:
    schema:
      $ref:
        https://raw.githubusercontent.com/opengeospatial/OAPI/openapi/schemas/exception.yaml
  text/html:
    schema:
      type: string
```

## 11.4. Security

<b>Requirement 36</b>	<b>/req/oas30/security</b> <b>For cases, where the operations of the server are access-controlled, the security scheme(s) SHALL be documented in the OpenAPI definition.</b>
-----------------------	---

The OpenAPI specification currently supports the following [security schemes](#):

- HTTP authentication,
- an API key (either as a header or as a query parameter),
- OAuth2's common flows (implicit, password, application and access code) as defined in RFC6749, and
- OpenID Connect Discovery.



# Chapter 12. Requirements Class "Job list"

This requirement class specifies how to retrieve a job list from the API.

Requirements Class	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/job-list">http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/job-list</a>	
Target type	Web API
Dependency	<a href="#">OGC API - Processes Core</a>

## 12.1. Operation

Requirement 37	<b>/req/job-list/job-list-op</b> <b>The server SHALL support the HTTP GET operation at the path</b> <b><a href="#">/processes/{processID}/jobs</a>.</b>
----------------	---

## 12.2. Response

Requirement 38	<b>/req/job-list/job-list-success</b> <b>A successful execution of the operation SHALL be reported as a response with a HTTP status code 200. The content of that response SHALL be based upon the OpenAPI 3.0 schema</b> <b><a href="#">jobList.yaml</a>.</b>
----------------	--

*Schema for the job list*

```
type: array
items:
  $ref: "jobInfo.yaml"
```

*Example of HTTP GET request for retrieving the list of jobs of a process encoded as JSON.*

```
http://processing.example.org/processes/EchoProcess/jobs
```

*Example of a job list encoded as JSON.*

```
[
  {
    "jobID": "8ca109b4-3b86-4a9c-a284-a6d50f91019e",
    "status": "running",
    "message": "Perform step 1/2",
    "progress": 50,
    "links": [
      {
        "href":
http://processing.example.org/processes/EchoProcess/jobs/8ca109b4-3b86-4a9c-a284-a6d50f91019e

```

```

a6d50f91019e",
    "rel": "status",
    "type": "application/json",
    "hreflang": "en",
    "title": "Job status"
  }
]
},
{
  "id": "0cf773a5-282a-4e23-96cc-f5dab18123e5",
  "infos": {
    "jobID": "0cf773a5-282a-4e23-96cc-f5dab18123e5",
    "status": "successful",
    "message": "EchoProcess job finished successful",
    "progress": 100,
    "links": [
      {
        "href":
"http://processing.example.org/processes/EchoProcess/jobs/0cf773a5-282a-4e23-96cc-f5dab18123e5",
        "rel": "status",
        "type": "application/json",
        "hreflang": "en",
        "title": "Job status"
      },
      {
        "href":
"http://processing.example.org/processes/EchoProcess/jobs/0cf773a5-282a-4e23-96cc-f5dab18123e5/results",
        "rel": "results",
        "type": "application/json",
        "hreflang": "en",
        "title": "Job result"
      }
    ]
  }
},
{
  "id": "63aadd9c-c0e5-4a7f-80f0-228dbb158f09",
  "infos": {
    "jobID": "63aadd9c-c0e5-4a7f-80f0-228dbb158f09",
    "status": "failed",
    "message": "EchoProcess job failed",
    "progress": 100,
    "links": [
      {
        "href":
"http://processing.example.org/processes/EchoProcess/jobs/63aadd9c-c0e5-4a7f-80f0-228dbb158f09",
        "rel": "status",
        "type": "application/json",

```

```

        "hreflang": "en",
        "title": "Job status"
      },
      {
        "href":
"http://processing.example.org/processes/EchoProcess/jobs/63aadd9c-c0e5-4a7f-80f0-
228dbb158f09/results",
        "rel": "exceptions",
        "type": "application/json",
        "hreflang": "en",
        "title": "Job exception"
      }
    ]
  }
}
]

```

## 12.3. Error situations

See [HTTP status codes](#) for general guidance.

If the process with the specified identifier doesn't exist on the server, the status code of the response will be **404** (see [\[req\\_core\\_no-such-process\]](#)).

# Chapter 13. Requirements Class "Callback"

This conformance class specifies a callback mechanism for completed jobs. In contrast to the pull-based mechanism specified in [Create a new job](#) and [Retrieve status information about a job](#), this conformance class specifies a push-based mechanism, where a subscriber-URL is passed to the API in the execute request. After the job is completed, the result response is sent to the specified URL.

Requirements Class	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/callback">http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/callback</a>	
Target type	Web API
Dependency	<a href="#">OGC API - Processes Core</a>

<b>Requirement 39</b>	<b><a href="#">/req/callback/job-callback</a></b> <b>The server SHALL support callback functions for jobs.</b>
-----------------------	---

*Example for a callback in the execute operation*

```
callbacks:
  jobCompleted:
    '{$request.body#/subscriber/successUri}':
      post:
        requestBody:
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/result'
        responses:
          '202':
            description: Results received successfully
```

If the server implements this conformance class, the optional subscriber element of the execute request JSON must be used.

It is possible to add multiple callbacks for getting progress updates and notifications of a successful job completion or of a failure.

Further guidance about how to use callbacks can be found in the [OpenAPI documentation](#).

# Chapter 14. Requirements Class "Dismiss"

This requirement class specifies how to dismiss a job. Dismiss can be seen as canceling a running job or removing artifacts of a finished job.

Requirements Class	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/dismiss">http://www.opengis.net/spec/ogcapi-processes-1/1.0/req/dismiss</a>	
Target type	Web API
Dependency	<a href="#">OGC API - Processes Core</a>

## 14.1. Operation

Requirement 40	<b><code>/req/dismiss/job-dismiss-op</code></b> <b>The server SHALL support the HTTP DELETE operation at the path <code>/processes/{processID}/jobs/{jobID}</code>.</b>
----------------	--

## 14.2. Response

Requirement 41	<b><code>/req/dismiss/job-dismiss-success</code></b> <b>A successful execution of the operation SHALL be reported as a response with a HTTP status code 200. The content of that response SHALL be based upon the OpenAPI 3.0 schema <a href="#">statusInfo.yaml</a>. The status SHALL be set to "dismissed".</b>
----------------	--

*Example of a dismissed job encoded as JSON.*

```
{
  "jobID" : "81574318-1eb1-4d7c-af61-4b3fbcf33c4f",
  "status": "dismissed",
  "message": "Job dismissed",
  "progress": 56,
  "links": [
    {
      "href": "http://processing.example.org/processes/EchoProcess/jobs",
      "rel": "up",
      "type": "application/json",
      "title": "The job list for the current process"
    }
  ]
}
```

## 14.3. Error situations

See [HTTP status codes](#) for general guidance.

If the process with the specified identifier doesn't exist on the server, the status code of the response will be 404 (see [\[req\\_core\\_no-such-process\]](#)).

If the job with the specified identifier doesn't exist, the status code of the response will be 404 (see [\[req\\_core\\_job-exception-no-such-job\]](#)).

# Chapter 15. Media Types

JSON media types that would typically be used in a server that supports JSON are:

- `application/json` for all resources.

The typical HTML media type for all "web pages" in a server would be:

- `text/html`.

The media type for an OpenAPI 3.0 definition is `application/vnd.oai.openapi+json;version=3.0` (JSON) or `application/vnd.oai.openapi;version=3.0` (YAML).

## NOTE

The OpenAPI media types have not been registered yet with IANA and can change in the future.

# Chapter 16. Additional API Building Blocks

The core requirements classes of this standard are designed for the following workflow:

1. Access the list of available processes
2. Access the description of a specific process
3. Create an execute JSON request (based on the description) and send it to the server via POST
4. Process the status info and/or results

This workflow is useful for generic client that are implemented against the JSON schemas and paths specified in this standard. Generic clients can communicate with any server implementing the OGC API - Processes. However, here may be limitations regarding the handling of input and output formats.

The approach describe above requires implementers of clients to have knowledge about the standard.

An alternative that could make it easier for implementers that are not familiar with OGC (API) standards is permitting deviations from strictly following the schemas and paths specified in this standard.

<b>Permission 2</b>	<b>/per/core/alternative-process-description</b> <b>Servers MAY support alternative means of describing the inputs and outputs of a process.</b>
---------------------	---

This permission allows server implementations to describe a process, such as by defining the request and response body of a POST request to a process endpoint.

<b>Permission 3</b>	<b>/per/core/alternative-process-paths</b> <b>Servers MAY support alternative API paths.</b>
---------------------	---

This permission allows server implementations to specify alternative paths to processes and jobs.

An example of an OpenAPI document making use of the building blocks is shown in the following:

```
openapi: 3.0.2
info:
  title: Alternative OGC API - Processes
  description: This is an alternative OGC API - Processes
  contact:
    email: you@your-company.com
  license:
    name: Apache 2.0
    url: http://www.apache.org/licenses/LICENSE-2.0.html
  version: 1.0.0
paths:
  /buffer:
    post:
```



```

summary: execute buffer process
operationId: executeBuffer
requestBody:
  description: buffer inputs
  content:
    application/json:
      schema:
        $ref: '#/components/schemas/bufferExecute'
responses:
  "200":
    description: buffer created
    content:
      application/json:
        schema:
          $ref: '#/components/schemas/bufferResult'
  "400":
    description: invalid input
components:
  schemas:
    bufferExecute:
      required:
        - data
        - width
      type: object
      properties:
        data:
          maxItems: 10
          minItems: 1
          type: array
          description: this is possible to provide the abstract in here
          items:
            oneOf:
              - type: string
                format: application/geo+json
              - type: string
                format: application/gml+xml
        width:
          maximum: 100
          minimum: 1
          type: integer
          default: 20
    bufferResult:
      type: object
      properties:
        outputs:
          type: array
          items:
            oneOf:
              - type: string
                format: application/geo+json
              - type: string

```

```
format: application/gml+xml
```

The goals of these additional API building blocks are:

- enabling an more seamless integration of this API with other OGC API standards and
- enabling the use of tools to auto-generate clients from the API description.

# Annex A: Abstract Test Suite (Normative)

## A.1. Introduction

OGC Web APIs are not a Web Services in the traditional sense. Rather, they define the behavior and content of a set of Resources exposed through a Web Application Programming Interface (Web API). Therefore, an API may expose resources in addition to those defined by the standard. A test engine must be able to traverse the API, identify and validate test points, and ignore resource paths which are not to be tested.

## A.2. Conformance Class Core

Conformance Class	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/core">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/core</a>	
Target type	Web API
Requirements class	<a href="#">Requirements Class "Core"</a>

### A.2.1. Landing Page /

<b>Abstract Test 1</b>	<b><a href="#">/conf/core/landingpage-op</a></b>
Test Purpose	Validate that a landing page can be retrieved from the expected location.
Requirement	<a href="#">/req/core/landingpage-op</a>
Test Method	<ol style="list-style-type: none"><li>1. Issue an HTTP GET request to the root URL <a href="#">/</a></li><li>2. Validate the contents of the returned document using test <a href="#">/conf/core/landingpage-success</a>.</li></ol>

<b>Abstract Test 2</b>	<b><a href="#">/conf/core/landingpage-success</a></b>
Test Purpose	Validate that the landing page complies with the require structure and contents.
Requirement	<a href="#">/req/core/landingpage-success</a>

Test Method	<ol style="list-style-type: none"> <li>1. Validate that a document was returned with an HTTP status code or 200.</li> <li>2. Validate the landing page for all supported media types using the resources and tests identified in <a href="#">Schema and Tests for Landing Pages</a></li> <li>3. For formats that require manual inspection, perform the following: <ol style="list-style-type: none"> <li>a. Validate that the landing page includes a "service-desc" and/or "service-doc" link to an API Definition.</li> <li>b. Validate that the landing page includes a "conformance" link to the conformance class declaration.</li> <li>c. Validate that the landing page includes a "data" link to the Feature contents.</li> </ol> </li> </ol>
-------------	--

The landing page may be retrieved in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validate the landing page against that schema. All supported formats should be exercised.

Table 11. Schema and Tests for Landing Pages

Format	Schema Document	Test ID
HTML	<a href="#">landingPage.yaml</a>	<a href="#">/conf/html/content</a>
JSON	<a href="#">landingPage.yaml</a>	<a href="#">/conf/geojson/content</a>

## A.2.2. API Definition /api

Abstract Test 3	<a href="#">/conf/core/api-definition-op</a>
Test Purpose	Validate that the API Definition document can be retrieved from the expected location.
Requirement	<a href="#">/req/core/api-definition-op</a>
Test Method	<ol style="list-style-type: none"> <li>1. Construct a path for the API Definition document that ends with <a href="#">/api</a>.</li> <li>2. Issue a HTTP GET request on that path</li> <li>3. Validate the contents of the returned document using test <a href="#">/conf/core/api-definition-success</a>.</li> </ol>
Abstract Test 4	<a href="#">/conf/core/api-definition-success</a>

Test Purpose	Validate that the API Definition complies with the required structure and contents.
Requirement	<a href="#">/req/core/api-definition-success</a>
Test Method	<ol style="list-style-type: none"> <li>1. Validate that a document was returned with a status code 200</li> <li>2. Validate the API Definition document against an appropriate schema document.</li> </ol>

### A.2.3. Conformance Path [/conformance](#)

<b>Abstract Test 5</b>	<b><a href="#">/conf/core/conformance-op</a></b>
Test Purpose	Validate that a Conformance Declaration can be retrieved from the expected location.
Requirement	<a href="#">/req/core/conformance-op</a>
Test Method	<ol style="list-style-type: none"> <li>1. Construct a path for each "conformance" link on the landing page as well as for the {root}/conformance path.</li> <li>2. Issue an HTTP GET request on each path</li> <li>3. Validate the contents of the returned document using test <a href="#">/conf/core/conformance-success</a>.</li> </ol>

<b>Abstract Test 6</b>	<b><a href="#">/conf/core/conformance-success</a></b>
Test Purpose	Validate that the Conformance Declaration response complies with the required structure and contents.
Requirement	<a href="#">/req/core/conformance-success</a>
Test Method	<ol style="list-style-type: none"> <li>1. Validate that a document was returned with an HTTP status code of 200.</li> <li>2. Validate the response document against OpenAPI 3.0 schema link: <a href="#">confClasses.yaml</a></li> <li>3. Validate that the document includes the conformance class "http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/core"</li> <li>4. Validate that the document list all OGC API conformance classes that the API implements.</li> </ol>

## A.2.4. HTTP 1.1

<b>Abstract Test 7</b>	<b>/conf/core/http</b>
Test Purpose	Validate that the resource paths advertised through the API conform with HTTP 1.1 and, where appropriate, TLS.
Requirement	<a href="#">/req/core/http</a>
Test Method	<ol style="list-style-type: none"><li>1. All compliance tests shall be configured to use the HTTP 1.1 protocol exclusively.</li><li>2. For APIs which support HTTPS, all compliance tests shall be configured to use <a href="#">HTTP over TLS</a> (RFC 2818) with their HTTP 1.1 protocol.</li></ol>

## A.2.5. Processes /processes

### A.2.5.1. Process collection

<b>Abstract Test 8</b>	<b>/conf/core/process-collection</b>
Test Purpose	Validate that information about the processes can be retrieved from the expected location.
Requirement	<a href="#">/req/core/process-collection</a>
Test Method	<ol style="list-style-type: none"><li>1. Issue an HTTP GET request to the URL {root}/processes</li><li>2. Validate the contents of the returned document using test <a href="#">/req/core/process-collection-success</a>.</li></ol>

<b>Abstract Test 9</b>	<b>/conf/core/process-collection-success</b>
Test Purpose	Validate that the process collection content complies with the required structure and contents.
Requirement	<a href="#">/req/core/process-collection-success</a>
Test Method	<ol style="list-style-type: none"><li>1. Validate that a document was returned with an HTTP status code of 200.</li><li>2. Validate the process collection content for all supported media types using the resources and tests identified in <a href="#">Schema and Tests for Collections content</a></li></ol>

The process collection may be retrieved in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validate the against that schema. All supported formats should be exercised.

*Table 12. Schema and Tests for Collections content*

Format	Schema Document	Test ID
HTML	<a href="#">processCollection.yaml</a>	<a href="#">/conf/html/content</a>
JSON	<a href="#">processCollection.yaml</a>	<a href="#">/conf/json/content</a>

#### A.2.5.2. Process description `/processes/{processID}`

<b>Abstract Test 10</b>	<b><code>/conf/core/process</code></b>
Test Purpose	Validate that a process description can be retrieved from the expected location.
Requirement	<a href="#">/req/core/process</a>
Test Method	For every Process described in the process collection content, issue an HTTP GET request to the URL <code>/processes/{processID}</code> where <code>{processID}</code> is the <code>id</code> property for the process. . Validate the response using the test <a href="#">/req/core/process-success</a> .

<b>Abstract Test 11</b>	<b><code>/conf/core/process-success</code></b>
Test Purpose	Validate that the content complies with the required structure and contents.
Requirement	<a href="#">/req/core/process-success</a>
Test Method	<ol style="list-style-type: none"> <li>1. Validate that a document was returned with an HTTP status code of 200.</li> <li>2. Verify that the content of the response is valid description of the interface of the process for all supported process description models.</li> </ol>

The interface of a process may be describing using a number of different models or process description languages. The following table identifies the applicable schema document for each process description model described in this standard.

*Table 13. Schema and Tests for Process Description Models*

Model	Schema Document	Test ID
OGC Process Description JSON	<a href="#">process.yaml</a>	<a href="#">/req/ogc-process-description/json-encoding</a>

### A.2.5.3. Process exception

<b>Abstract Test 12</b>	<b>/conf/core/process-exception-no-such-process</b>
Test Purpose	Validate that an invalid process identifier is handled correctly.
Requirement	<a href="#">/req/core/process-exception-no-such-process</a>
Test Method	<ol style="list-style-type: none"> <li>1. Issue an HTTP GET request to a URL that includes the <code>{processID}</code> as a path element using a non-existent process identifier.</li> <li>2. Validate that the document was returned with a 404.</li> <li>3. Validate that the document contains the exception code "NoSuchProcess".</li> <li>4. Validate the document for all supported media types using the resources and tests identified in <a href="#">Schema and Tests for Non-existent Process</a></li> </ol>

An exception response caused by the use of an invalid process identifier may be retrieved in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validate the response. All supported formats should be exercised.

Table 14. Schema and Tests for Non-existent Process

Format	Schema Document	Test ID
HTML	<a href="#">exception.yaml</a>	<a href="#">/conf/html/content</a>
JSON	<a href="#">exception.yaml</a>	<a href="#">/conf/json/content</a>

## A.2.6. Jobs

### A.2.6.1. Job creation /processes/{processID}/jobs

<b>Abstract Test 13</b>	<b>/conf/core/job-creation-op</b>
Test Purpose	Validate the creation of a new job.
Requirement	<a href="#">/req/core/job-creation-op</a>



Test Method	<ol style="list-style-type: none"> <li>1. Issue an HTTP POST request to the URL '/processes/{processID}/jobs' for each execution mode according to the test <a href="#">[ats_core_job-creation-mode]</a>.</li> <li>2. Validate the contents of the POST request using the test <a href="#">/req/core/job-creation-request</a>.</li> <li>3. Validate the creation of the job according to the execution mode using test <a href="#">/req/core/job-creation-mode</a>.</li> </ol>
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<b>Abstract Test 14</b>	<b>/conf/core/job-creation-request</b>
Test Purpose	Validate that the body of a job creation operation complies with the required structure and contents.
Requirement	<a href="#">/req/core/job-creation-request</a>
Test Method	Verify the contents of the request body against the OpenAPI 3.0 schema <a href="#">execute.yaml</a> .

<b>Abstract Test 15</b>	<b>/conf/core/job-creation-mode</b>
Test Purpose	Validate the creation of a new job according to its execution mode.
Requirement	<a href="#">/req/core/job-creation-mode</a>
Test Method	<ol style="list-style-type: none"> <li>1. Create a job for each execution mode according to the test <a href="#">/req/core/job-creation-op</a>.</li> <li>2. Validate the creation of the job according to the execution mode using the resource and tests identified in <a href="#">Schema and Tests for Job Creation</a>.</li> </ol>

A job may be executed in one of the three modes; **sync**, **async** or **auto**. The following tables identified the applicable test to check based on the execution mode.

*Table 15. Schema and Tests for Job Creation*

Mode	Test ID
sync	<a href="#">/req/core/job-creation-success-sync</a>
async	<a href="#">/req/core/job-creation-success-async</a>
auto	<a href="#">/req/core/job-creation-success-auto</a>

<b>Abstract Test 16</b>	<b>/conf/core/job-creation-success-async</b>
Test Purpose	Validate the result of a job that has been created using the <b>async</b> execution mode.
Requirement	<a href="#">/req/core/job-creation-success-async</a>
Test Method	<ol style="list-style-type: none"> <li>1. Validate that result of the job was returned with an HTTP status code 201.</li> <li>2. Validate the HTTP headers of the result using the test <a href="#">/req/core/job-creation-success-header-async</a>.</li> </ol>

<b>Abstract Test 17</b>	<b>/conf/core/job-creation-success-header-async</b>
Test Purpose	Validate the HTTP header for an asynchronously executed job.
Requirement	<a href="#">/req/core/job-creation-success-header-async</a>
Test Method	<ol style="list-style-type: none"> <li>1. Validate that the response contains the 'Location' header.</li> <li>2. Issue an HTTP GET request to the URL that is the value of the 'Location' header.</li> <li>3. Validate the result of resolving the 'Location' header URL using the test <a href="#">/req/core/job-result-op</a>.</li> </ol>

<b>Abstract Test 18</b>	<b>/conf/core/job-creation-success-sync</b>
Test Purpose	Validate the result of a job that has been created using the <b>sync</b> execution mode.
Requirement	<a href="#">/req/core/job-creation-success-sync</a>
Test Method	<ol style="list-style-type: none"> <li>1. Validate that result of the job was returned with a status code 200.</li> <li>2. Validate the content of the result using the resource and tests identified in <a href="#">Schema and Tests for the Response of a Synchronously Executed Job</a>.</li> </ol>

The type of response a job generates is determined by the value of the **response** attribute. The value of the **response** attribute may be **document** or **raw**. The following table identified the applicable test to check based on the value of the **response** attribute.

*Table 16. Schema and Tests for the Response of a Synchronously Executed Job*

Response Type	Schema	Test ID
document	<a href="#">results.yaml</a>	<a href="#">/req/core/job-result-success</a>
raw	N/A	<a href="#">[ats_job-creation-success-sync-raw]</a>

<b>Abstract Test 19</b>	<b><a href="#">/conf/core/job-result-failed</a></b>
Test Purpose	Validate the job result when the <b>response</b> attribute is set to <b>raw</b> .
Requirement	<a href="#">/req/core/job-creation-success-sync</a>
Test Method	<ol style="list-style-type: none"> <li>1. Validate that the result of the job was returned with an HTTP status code 200.</li> <li>2. Get a description of the executed process using test <a href="#">/conf/core/process</a>.</li> <li>3. From the process description, note the expected media type(s) for the output that was specified in the execute request body.</li> <li>4. Verify that the response is of the expected media type.</li> <li>5. If the response has an associated schema, validate the response against that schema.</li> </ol>

#### A.2.6.2. Job status [/processes/{processID}/jobs/{jobID}](#)

<b>Abstract Test 20</b>	<b><a href="#">/conf/core/fc-op</a></b>
Test Purpose	Validate that the status info of a job can be retrieved.
Requirement	<a href="#">/req/core/fc-op</a>
Test Method	<ol style="list-style-type: none"> <li>1. Create a job as per <a href="#">/req/core/job-creation-op</a> and note the {jobID} assigned to the job.</li> <li>2. Issue an HTTP GET request to the URL '<a href="#">/processes/{processID}/jobs/{jobID}</a>'.</li> <li>3. Validate the contents of the returned document using the test <a href="#">/req/core/job-success</a>.</li> </ol>

<b>Abstract Test 21</b>	<b><a href="#">/conf/core/job-success</a></b>
Test Purpose	Validate that the job status info complies with the require structure and contents.

Requirement	<a href="/req/core/job-success">/req/core/job-success</a>
Test Method	<ol style="list-style-type: none"> <li>1. Validate that the document was returned with an HTTP status code of 200.</li> <li>2. Validate the job status info for all supported media types using the resources and tests identified in <a href="#">Schema and Tests for the Job Status Info</a></li> </ol>

The status info page for a job may be retrieved in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validate the status info against that schema. All supported formats should be exercised.

*Table 17. Schema and Tests for the Job Status Info*

Format	Schema Document	Test ID
HTML	<a href="#">statusInfo.yaml</a>	<a href="/conf/html/content">/conf/html/content</a>
JSON	<a href="#">statusInfo.yaml</a>	<a href="/conf/json/content">/conf/json/content</a>

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<b>Abstract Test 22</b>	<b><a href="/conf/core/job-exception-no-such-job">/conf/core/job-exception-no-such-job</a></b>
Test Purpose	Validate that an invalid job identifier is handled correctly.
Requirement	<a href="/req/core/job-exception-no-such-job">/req/core/job-exception-no-such-job</a>
Test Method	<ol style="list-style-type: none"> <li>1. Issue an HTTP GET request to the URL that includes the <b>{jobID}</b> as a path element using a non-existent job identifier.</li> <li>2. Validate that the document was returned with a 404.</li> <li>3. Validate that the document contains the exception code "NoSuchJob".</li> <li>4. Validate the document for all supported media types using the resources and tests identified in <a href="#">Schema and Tests for the Job Result for Non-existent Job</a></li> </ol>

An exception response caused by the use of an invalid job identifier may be retrieved in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validate the response. All supported formats should be exercised.

*Table 18. Schema and Tests for the Job Result for Non-existent Job*

Format	Schema Document	Test ID
HTML	<a href="#">exception.yaml</a>	<a href="/conf/html/content">/conf/html/content</a>
JSON	<a href="#">exception.yaml</a>	<a href="/conf/json/content">/conf/json/content</a>

#### A.2.6.3. Job results /processes/{processID}/jobs/{jobID}/results

<b>Abstract Test 23</b>	<b>/conf/core/job-result</b>
Test Purpose	Validate that the results of a job can be retrieved.
Requirement	<a href="#">/req/core/job-result</a>
Test Method	<ol style="list-style-type: none"><li>1. Create a job as per <a href="#">/req/core/job-creation-op</a> and note the {jobID} assigned to the job.</li><li>2. Issue an HTTP GET request to the URL '/processes/{processID}/jobs/{jobID}/results'.</li><li>3. Validate that the document was returned with a status code 200.</li><li>4. Validate the contents of the returned document using the test <a href="#">/req/core/job-result-success</a>.</li></ol>

<b>Abstract Test 24</b>	<b>/conf/core/job-result-success</b>
Test Purpose	Validate that the job result complies with the require structure and contents.
Requirement	<a href="#">/req/core/job-result-success</a>
Test Method	Validate the job result for all supported media types using the resources and tests identified in <a href="#">Schema and Tests for the Job Result</a>

The job result page for a job may be retrieved in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validate the status info against that schema. All supported formats should be exercised.

Table 19. Schema and Tests for the Job Result

Format	Schema Document	Test ID
HTML	<a href="#">result.yaml</a>	<a href="#">/conf/html/content</a>
JSON	<a href="#">result.yaml</a>	<a href="#">/conf/json/content</a>

<b>Abstract Test 25</b>	<b>/conf/core/job-result-failed</b>
Test Purpose	Validate that the job result retrieved using an invalid job identifier complies with the require structure and contents.

Requirement	<a href="#">/req/core/job-result-exception-no-such-job</a>
Test Method	<ol style="list-style-type: none"> <li>1. Issue an HTTP GET request to the URL '/processes/{processID}/jobs/{jobID}/results' using an invalid {jobID}.</li> <li>2. Validate that the document was returned with a 404.</li> <li>3. Validate that the document contains the exception code "NoSuchJob".</li> <li>4. Validate the document for all supported media types using the resources and tests identified in <a href="#">Schema and Tests for the Job Result for Non-existent Job</a></li> </ol>

The job result page for a job may be retrieved in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validate the job result for a non-existent job against that schema. All supported formats should be exercised.

*Table 20. Schema and Tests for the Job Result for Non-existent Job*

Format	Schema Document	Test ID s/exception.yaml[exception.yaml]
<a href="#">/conf/html/content</a>	JSON	link:http://schemas.opengis.net/ogcapi/processes/part1/1.0/openapi/schemas/exception.yaml[exception.yaml]

<b>Abstract Test 26</b>	<b><a href="#">/conf/core/job-result-exception-result-not-ready</a></b>
Test Purpose	Validate that the job result retrieved for an incomplete job complies with the require structure and contents.
Requirement	<a href="#">/req/core/job-result-exception-result-not-ready</a>

Test Method	<ol style="list-style-type: none"> <li>1. Create a job as per <a href="#">/req/core/job-creation-op</a> and note the {jobID} assigned to the job; ensure that the job is long-running.</li> <li>2. Issue an HTTP GET request to the URL '/processes/{processID}/jobs/{jobID}/results' before the job completes execution.</li> <li>3. Validate that the document was returned with a 404.</li> <li>4. Validate that the document contains the exception code "ResultNotReady".</li> <li>5. Validate the document for all supported media types using the resources and tests identified in <a href="#">Schema and Tests for the Job Result for an Incomplete Job</a></li> </ol>
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The job result page for a job may be retrieved in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validate the job results for an incomplete job against that schema. All supported formats should be exercised.

*Table 21. Schema and Tests for the Job Result for an Incomplete Job*

Format	Schema Document	Test ID s/exception.yaml[exception.yaml]
<a href="#">/conf/html/content</a>	JSON	link: <a href="http://schemas.opengis.net/ogcapi/processes/part1/1.0/openapi/schemas/exception.yaml">http://schemas.opengis.net/ogcapi/processes/part1/1.0/openapi/schemas/exception.yaml</a> [exception.yaml]

<b>Abstract Test 27</b>	<b>/conf/core/job-result-failed</b>
Test Purpose	Validate that the job result for a failed job complies with the require structure and contents.
Requirement	<a href="#">/req/core/job-result-failed</a>

Test Method	<ol style="list-style-type: none"> <li>1. Create a job as per <a href="#">/req/core/job-creation-op</a> but arrange a priori that the job will fail; note the {jobID} assigned to the job.</li> <li>2. Ensure that the failed job will not result in an HTTP error code of 404.</li> <li>3. Issue an HTTP GET request to the URL '/processes/{processID}/jobs/{jobID}/results'.</li> <li>4. Validate that the document was returned with a HTTP error code (4XX or 5XX).</li> <li>5. Validate that the document contains an exception code that corresponds to the reason the job failed (e.g. InvalidParameterValue for invalid input data).</li> <li>6. Validate the document for all supported media types using the resources and tests identified in <a href="#">Schema and Tests for the Job Result for a Failed Job</a></li> </ol>
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The job result page for a job may be retrieved in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validate the job result for a failed job against that schema. All supported formats should be exercised.

Table 22. Schema and Tests for the Job Result for a Failed Job

Format	Schema Document	Test ID
HTML	<a href="#">exception.yaml</a>	<a href="#">/conf/html/content</a>
JSON	<a href="#">exception.yaml</a>	<a href="#">/conf/json/content</a>

## A.3. Conformance Class OGC Process Description

Conformance Class	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/ogc-process-description">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/ogc-process-description</a>	
Target type	Web API
Requirements class	<a href="#">Requirements Class "OGC Process Description"</a>

<b>Abstract Test 28</b>	<b><a href="#">/conf/core/job-creation-request</a></b>
Test Purpose	Validate a JSON-encoded OGC process description complies with the required structure and contents.
Requirement	<a href="#">/req/ogc-process-description/json-encoding</a>



Test Method	Verify the contents of the request body against the OpenAPI 3.0 schema <a href="#">process.yaml</a> .
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## A.4. Conformance Class JSON

<b>Conformance Class</b>	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/json">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/json</a>	
Target type	Web API
Requirements class	<a href="#">Requirements Class "Core"</a>

<b>Abstract Test 29</b>	<b>/conf/json/definition</b>
Test Purpose	Verify support for JSON.
Requirement	<a href="#">/req/json/definition</a>
Test Method	<ol style="list-style-type: none"> <li>1. A resource is requested with response media type of <b>application/json</b>.</li> <li>2. All <b>200</b> responses SHALL support the following media types: <b>application/json</b> for all resources.</li> </ol>

## A.5. Conformance Class HTML

<b>Conformance Class</b>	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/html">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/html</a>	
Target type	Web API
Requirements class	<a href="#">Requirements Class "HTML"</a>
Dependency	<a href="#">Conformance Class 'Core'</a>

<b>Abstract Test 30</b>	<b>/conf/html/content</b>
Test Purpose	Verify the content of an HTML document given an input document and schema.
Requirement	<a href="#">/req/html/content</a>

Test Method	<ol style="list-style-type: none"> <li>1. Validate that the document is an <a href="#">HTML 5 document</a></li> <li>2. Manually inspect the document and verify that the HTML body contains: <ul style="list-style-type: none"> <li>◦ all information in the schemas of the <a href="#">Response Object</a> in the HTML <code>&lt;body/&gt;</code></li> <li>◦ all links in HTML <code>&lt;a/&gt;</code> elements in the HTML <code>&lt;body/&gt;</code>.</li> </ul> </li> </ol>
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<b>Abstract Test 31</b>	<b>/conf/html/definition</b>
Test Purpose	Verify support for HTML
Requirement	<a href="#">/req/html/definition</a>
Test Method	Verify that every <b>200</b> response of every operation of the API where HTML was requested is of media type <b>text/html</b> .

## A.6. Conformance Class OpenAPI 3.0

<b>Conformance Class</b>	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/oas30">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/oas30</a>	
Target type	Web API
Requirements class	<a href="#">Requirements Class "OpenAPI Specification 3.0"</a>
Dependency	<a href="#">Conformance Class 'Core'</a>

<b>Abstract Test 32</b>	<b>/conf/oas30/completeness</b>
Test Purpose	Verify the completeness of an OpenAPI document.
Requirement	<a href="#">/req/oas30/completeness</a>
Test Method	Verify that for each operation, the OpenAPI document describes all <a href="#">HTTP Status Codes</a> and <a href="#">Response Objects</a> that the API uses in responses.

<b>Abstract Test 33</b>	<b>/conf/oas30/exceptions-codes</b>
Test Purpose	Verify that the OpenAPI document fully describes potential exception codes.

Requirement	<a href="#">/req/oas30/exceptions-codes</a>
Test Method	Verify that for each operation, the OpenAPI document describes all <a href="#">HTTP Status Codes</a> that may be generated.

<b>Abstract Test 34</b>	<b><a href="#">/conf/oas30/oas-definition-1</a></b>
Test Purpose	Verify that JSON and HTML versions of the OpenAPI document are available.
Requirement	<a href="#">/req/oas30/oas-definition-1</a>
Test Method	<ol style="list-style-type: none"> <li>1. Verify that an OpenAPI definition in JSON is available using the media type <code>application/vnd.oai.openapi+json;version=3.0</code> and link relation <code>service-desc</code></li> <li>2. Verify that an HTML version of the API definition is available using the media type <code>text/html</code> and link relation <code>service-doc</code>.</li> </ol>

<b>Abstract Test 35</b>	<b><a href="#">/conf/oas30/oas-definition-2</a></b>
Test Purpose	Verify that the OpenAPI document is valid JSON.
Requirement	<a href="#">/req/oas30/oas-definition-2</a>
Test Method	Verify that the JSON representation conforms to the <a href="#">OpenAPI Specification, version 3.0</a> .

<b>Abstract Test 36</b>	<b><a href="#">/conf/oas30/oas-impl</a></b>
Test Purpose	Verify that all capabilities specified in the OpenAPI definition are implemented by the API.
Requirement	<a href="#">/req/oas30/oas-impl</a>
Test Method	<ol style="list-style-type: none"> <li>1. Construct a path from each URL template including all server URL options and all enumerated path parameters.</li> <li>2. For each path defined in the OpenAPI document, validate that the path performs in accordance with the API definition and the API-Features standard.</li> </ol>

<b>Abstract Test 37</b>	<b><a href="#">/conf/oas30/security</a></b>
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Test Purpose	Verify that any authentication protocols implemented by the API are documented in the OpenAPI document.
Requirement	<a href="#">/req/oas30/security</a>
Test Method	<ol style="list-style-type: none"> <li>1. Identify all authentication protocols supported by the API.</li> <li>2. Validate that each authentication protocol is described in the OpenAPI document by a Security Schema Object and its use is specified by a Security Requirement Object.</li> </ol>

## A.7. Conformance Class Job collection

<b>Conformance Class</b>	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/job-list">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/job-list</a>	
Target type	Web API
Requirements class	<a href="#">Requirements Class "Core"</a>

<b>Abstract Test 38</b>	<b><a href="#">/conf/job-collection/job-collection-op</a></b>
Test Purpose	Validate that information about jobs can be retrieved from the expected location.
Requirement	<a href="#">/req/job-collection/job-collection-op</a>
Test Method	<ol style="list-style-type: none"> <li>1. Issue an HTTP GET request to the URL <code>/processes/{processID}/jobs</code>.</li> <li>2. Validate the contents of the returned document using test <a href="#">/req/job-collection/job-collection-success</a>.</li> </ol>

<b>Abstract Test 39</b>	<b><a href="#">/conf/job-collection/job-collection-success</a></b>
Test Purpose	Validate that the job collection content complies with the required structure and contents.
Requirement	<a href="#">/req/job-collection/job-collection-success</a>

Test Method	<ol style="list-style-type: none"> <li>1. Validate that a document was returned with an HTTP status code of 200.</li> <li>2. Validate the job collection content for all supported media types using the resources and tests identified in <a href="#">Schema and Tests for Job Collection Content</a></li> </ol>
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A job collection may be retrieved in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validate the against that schema. All supported formats should be exercised.

Table 23. Schema and Tests for Job Collection Content

Format	Schema Document	Test ID
HTML	<a href="#">jobCollection.yaml</a>	<a href="#">/conf/html/content</a>
JSON	<a href="#">jobCollection.yaml</a>	<a href="#">/conf/json/content</a>

## A.8. Conformance Class Callback

<b>Conformance Class</b>	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/callback">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/callback</a>	
Target type	Web API
Requirements class	<a href="#">Requirements Class "Core"</a>

<b>Abstract Test 40</b>	<b><a href="#">/conf/callback/job-callback</a></b>
Test Purpose	Validate the passing of a subscriber-URL in an execute request.
Requirement	<a href="#">/req/callback/job-callback</a>
Test Method	<ol style="list-style-type: none"> <li>1. Configure a URL endpoint to accept message body from the server.</li> <li>2. Create an asynchronous execute request that includes the optional <b>subscriber</b> key (see <a href="#">execute.yaml</a>).</li> <li>3. Execute the asynchronous job using test <a href="#">[ats_core_job-creation-op]</a>.</li> <li>4. Validate the job result is received by the specified callback URL.</li> </ol>

## A.9. Conformance Class Dismiss

Conformance Class	
<a href="http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/dismiss">http://www.opengis.net/spec/ogcapi-processes-1/1.0/conf/dismiss</a>	
Target type	Web API
Requirements class	<a href="#">Requirements Class "Core"</a>

<b>Abstract Test 41</b>	<b>/conf/dismiss/job-dismiss-op</b>
Test Purpose	Validate that a running job can be dismissed.
Requirement	<a href="#">/req/dismiss/job-dismiss-op</a>
Test Method	<ol style="list-style-type: none"><li>1. Create an asynchronous job as per test <a href="#">[ats_core_job-creation-op]</a>; not the job identifier, {jobID}, assigned to the job.</li><li>2. Issue an HTTP DELETE operation to the URL '/processes/{processID}/jobs/{jobID}'.</li><li>3. Validate the contents of the returned document using test <a href="#">/req/dismiss/job-dismiss-success</a>.</li></ol>

<b>Abstract Test 42</b>	<b>/conf/dismiss/job-dismiss-success</b>
Test Purpose	Validate that the content returned when dismissing a job complies with the required structure and contents.
Requirement	<a href="#">/req/dismiss/job-dismiss-success</a>
Test Method	<ol style="list-style-type: none"><li>1. Validate that a document was returned with an HTTP status code of 200.</li><li>2. Validate that the status is the response is set to "dismissed".</li><li>3. Validate the process collection content for all supported media types using the resources and tests identified in <a href="#">Schema and Tests for Dismissing a Job</a></li></ol>

The response to dismissing a job can be presented in a number of different formats. The following table identifies the applicable schema document for each format and the test to be used to validate the against that schema. All supported formats should be exercised.

*Table 24. Schema and Tests for Dismissing a Job*

Format	Schema Document	Test ID
HTML	<a href="#">statusInfo.yaml</a>	<a href="#">/conf/html/content</a>
JSON	<a href="#">statusInfo.yaml</a>	<a href="#">/conf/json/content</a>

# Annex B: Revision History

Date	Release	Editor	Primary clauses modified	Description
2017-03-07	0.1	Benjamin Pross	all	initial version
2018-05-16	0.1	Stan Tillman	1-5	Update section 1-5
2018-07-25	1.0-draft	Benjamin Pross	all	1.0-draft
2018-08-15	1.0-draft	Benjamin Pross	all	Restructuring, added requirements classes
2018-11-29	1.0-draft	Benjamin Pross	7	Update schemas and examples
2019-02-20	1.0-draft	Benjamin Pross	7	Fix for #3
2019-03-21	1.0-draft	Benjamin Pross	6,7,8,9,10	Alignment with OAPI Common, adjust schemas
2019-03-27	1.0-draft	Tom Kralidis, Benjamin Pross	6,7,8,9,10	Fix for #7, align bbox schema to WFS
2019-03-28	1.0-draft	Benjamin Pross	7	Formatting
2019-03-29	1.0-draft	Benjamin Pross	7	Adjust schemas and examples
2019-04-16	1.0-draft	Benjamin Pross	7	Adjust schemas, fix validation errors, add more data types
2019-06-05	1.0-draft	Gérald Fenoy	7	Allow unbounded for maxOccurs, Fix issue with ValueDefinition references
2019-06-12	1.0-draft	Benjamin Pross	7	Possible solution for #26



<b>Date</b>	<b>Release</b>	<b>Editor</b>	<b>Primary clauses modified</b>	<b>Description</b>
2019-06-19	1.0-draft	Gérald Fenoy	7	Add additionalParameter.yaml, update metadata.yaml and, descriptionType.yaml, fix intendation
2019-06-20	1.0-draft	Brad Hards	6,7	Fix typo noted during OGC API presentation, fix for #34
2019-08-09	1.0-draft.2	Benjamin Pross	7	1.0-draft.2, use plural for results path, remove wrapper
2019-08-21	1.0-draft.2	Benjamin Pross	7	adjust schemas, examples and figures, remove section about web caching
2019-10-01	1.0-draft.3	Benjamin Pross	7	1.0-draft.3, minor edits
2019-10-10	1.0-draft.3	Gérald Fenoy, Tom Kralidis	7	Add implementations, Use status in place of infos in jobInfo definition
2019-10-22	1.0-draft.3	Benjamin Pross	7	Remove mandatory path /api, fix for #50
2020-01-06	1.0-draft.3	Francis Charette	7	Add implementation
2020-01-28	1.0-draft.3	Gérald Fenoy	7	Adjust schemas and examples
2020-02-03	1.0-draft.3	Benjamin Pross	7	Fix for #63
2020-02-18	1.0-draft.3	Chris Durbin	7	Fix for #61

Date	Release	Editor	Primary clauses modified	Description
2020-04-01	1.0-draft.3	Benjamin Pross	7	Add optional subscriber property to execute request, avoid duplication, create own type for entities with properties name and reference
2020-04-06	1.0-draft.3	Benjamin Pross	5,7	Abbreviate process-description link relation to process-desc, update example, alphabetical ordering of link relations
2020-04-09	1.0-draft.3	Benjamin Pross	7	Rename root.yaml to landingPage.yaml, add title and description to root.yaml
2020-04-28	1.0-draft.3	Benjamin Pross	7	Move examples, responses and parameters from core asciidoc to external files
2020-04-29	1.0-draft.3	Benjamin Pross	11	Add Requirements Class 'Callback'
2020-04-30	1.0-draft.3	Benjamin Pross	6,11	Move overview table to abstract, allow multiple URIs for callbacks

<b>Date</b>	<b>Release</b>	<b>Editor</b>	<b>Primary clauses modified</b>	<b>Description</b>
2020-05-05	1.0-draft.3	Gérald Fenoy	12	Add Requirements Class 'Dismiss', fix includes and section headers
2020-05-8	1.0-draft.3	Benjamin Pross	14	Add section with info about additional/alternative building blocks
2020-05-11	1.0-draft.3	Benjamin Pross	12	Move 'Job List' from core to separate Requirements Class
2020-05-12	1.0-draft.3	Panagiotis (Peter) A. Vretanos	N/A	Create a home for extensions to the core, initial check in of draft transactions extension, add placeholders for the quotation and billing APIs
2020-05-12	1.0-draft.3	Stan Tillman	6,7,8,9,10	Review
2020-05-20	1.0-draft.3	Panagiotis (Peter) A. Vretanos	2,7	Separate the OGC process description into its own conformance class.