pycsw Documentation

Release 1.10.1

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CHAPTER 1

Introduction

pycsw is an OGC CSW server implementation written in Python.

CHAPTER 2

Features

- certified OGC Compliant and OGC Reference Implementation
- harvesting support for WMS, WFS, WCS, WPS, WAF, CSW, SOS
- implements INSPIRE Discovery Services 3.0
- implements ISO Metadata Application Profile 1.0.0
- implements FGDC CSDGM Application Profile for CSW 2.0
- implements the Search/Retrieval via URL (SRU) search protocol
- implements Full Text Search capabilities
- implements OGC OpenSearch Geo and Time Extensions
- implements Open Archives Initiative Protocol for Metadata Harvesting
- supports ISO, Dublin Core, DIF, FGDC and Atom metadata models
- CGI or WSGI deployment
- simple configuration
- transactional capabilities (CSW-T)
- flexible repository configuration
- GeoNode connectivity
- Open Data Catalog connectivity
- CKAN connectivity
- federated catalogue distributed searching
- realtime XML Schema validation
- extensible profile plugin architecture

2.1 Standards Support

Standard	Version(s)
OGC CSW	2.0.2
OGC Filter	1.1.0
OGC OWS Common	1.0.0
OGC GML	3.1.1
OGC SFSQL	1.2.1
Dublin Core	1.1
SOAP	1.2
ISO 19115	2003
ISO 19139	2007
ISO 19119	2005
NASA DIF	9.7
FGDC CSDGM	1998
SRU	1.1
OGC OpenSearch	1.0
OAI-PMH	2.0

2.2 Supported Operations

Request	Optionality	Supported	HTTP method binding(s)
GetCapabilities	mandatory	yes	GET (KVP) / POST (XML) / SOAP
DescribeRecord	mandatory	yes	GET (KVP) / POST (XML) / SOAP
GetRecords	mandatory	yes	GET (KVP) / POST (XML) / SOAP
GetRecordById	optional	yes	GET (KVP) / POST (XML) / SOAP
GetRepositoryItem	optional	yes	GET (KVP)
GetDomain	optional	yes	GET (KVP) / POST (XML) / SOAP
Harvest	optional	yes	GET (KVP) / POST (XML) / SOAP
Transaction	optional	yes	POST (XML) / SOAP

Note: Asynchronous processing supported for GetRecords and Harvest requests (via `csw:ResponseHandler`)

Note: Supported Harvest Resource Types are listed in *Transactions*

2.3 Supported Output Formats

- XML (default)
- JSON

2.4 Supported Output Schemas

- Dublin Core
- ISO 19139
- FGDC CSDGM

- NASA DIF
- Atom

2.5 Supported Sorting Functionality

- ogc:SortBy
- ascending or descending
- aspatial (queryable properties)
- spatial (geometric area)

2.6 Supported Filters

2.6.1 Full Text

- csw:AnyText

2.6.2 Geometry Operands

- gml:Point
- gml:LineString
- gml:Polygon
- gml:Envelope

Note: Coordinate transformations are supported

2.6.3 Spatial Operators

- BBOX
- Beyond
- Contains
- Crosses
- Disjoint
- DWithin
- Equals
- Intersects
- Overlaps
- Touches
- Within

2.6.4 Logical Operators

- Between
- EqualTo
- LessThanEqualTo
- GreaterThan
- Like
- LessThan
- GreaterThanEqualTo
- NotEqualTo
- NullCheck

2.6.5 Functions

- length
- lower
- ltrim
- rtrim
- trim
- upper

CHAPTER 3

Installation

3.1 System Requirements

pycsw is written in Python, and works with (tested) version 2.6 and 2.7

pycsw requires the following Python supporting libraries:

- lxml for XML support
- SQLAlchemy for database bindings
- pyproj for coordinate transformations
- Shapely for spatial query / geometry support
- OWSLib for CSW client and metadata parser

Note: You can install these dependencies via easy_install or pip

Note: For *GeoNode* or *Open Data Catalog* deployments, SQLAlchemy is not required

3.2 Installing from Source

Download the latest stable version or fetch from Git.

3.2.1 For Developers and the Truly Impatient

The 4 minute install:

```
$ virtualenv pycsw && cd pycsw && . bin/activate
$ git clone https://github.com/geopython/pycsw.git && cd pycsw
$ pip install -e . && pip install -r requirements-standalone.txt
$ cp default-sample.cfg default.cfg
$ vi default.cfg
# adjust paths in
# - server.home
# - repository.database
# set server.url to http://localhost:8000/
$ python csw.wsgi
$ curl http://localhost:8000/?service=CSW&version=2.0.2&request=GetCapabilities
```

3.2.2 The Quick and Dirty Way

```
$ git clone git://github.com/geopython/pycsw.git
```

Ensure that CGI is enabled for the install directory. For example, on Apache, if pycsw is installed in `/srv/www/htdocs/pycsw` (where the URL will be `http://host/pycsw/csw.py`), add the following to `httpd.conf`:

```
<Location /pycsw/>
 Options +FollowSymLinks +ExecCGI
 Allow from all
 AddHandler cgi-script .py
</Location>
```

Note: If pycsw is installed in `cgi-bin`, this should work as expected. In this case, the *tests* application must be moved to a different location to serve static HTML documents.

Make sure, you have all the dependencies from `requirements.txt` and `requirements-standalone.txt`

3.2.3 The Clean and Proper Way

```
$ git clone git://github.com/geopython/pycsw.git
$ python setup.py build
$ python setup.py install
```

At this point, pycsw is installed as a library and requires a CGI `csw.py` or WSGI `csw.wsgi` script to be served into your web server environment (see below for WSGI configuration/deployment).

3.3 Installing from the Python Package Index (PyPi)

```
# easy_install or pip will do the trick
$ easy_install pycsw
# or
$ pip install pycsw
```

3.4 Installing from OpenSUSE Build Service

In order to install the OBS package in openSUSE 12.3, one can run the following commands as user `root`:

```
# zypper -ar http://download.opensuse.org/repositories/Application:/Geo/openSUSE_12.3/ GEO
# zypper -ar http://download.opensuse.org/repositories/devel:/languages:/python/openSUSE_12.3/ pytho
# zypper refresh
# zypper install python-pycsw pycsw-cgi
```

For earlier openSUSE versions change `12.3` with `12.2`. For future openSUSE version use `Factory`.

An alternative method is to use the One-Click Installer.

3.5 Installing on Ubuntu/Xubuntu/Kubuntu

In order to install pycsw to an Ubuntu based distribution, one can run the following commands:

```
# sudo add-apt-repository ppa:pycsw/stable
# sudo apt-get update
# sudo apt-get install python-pycsw pycsw-cgi
```

An alternative method is to use the OSGeoLive installation script located in `pycsw/etc/dist/osgeolive`:

```
# cd pycsw/etc/dist
# sudo ./install_pycsw.sh
```

The script installs the dependencies (Apache, lxml, sqlalchemy, shapely, pyproj) and then pycsw to `/var/www`.

3.6 Running on Windows

For Windows installs, change the first line of `csw.py` to:

```
#!/Python27/python -u
```

Note: The use of `-u` is required to properly output gzip-compressed responses.

3.7 Security

By default, `default.cfg` is at the root of the pycsw install. If pycsw is setup outside an HTTP server's `cgi-bin` area, this file could be read. The following options protect the configuration:

- move `default.cfg` to a non HTTP accessible area, and modify `csw.py` to point to the updated location
- configure web server to deny access to the configuration. For example, in Apache, add the following to `httpd.conf`:

```
<Files ~ "\.(cfg)$">
 order allow,deny
 deny from all
</Files>
```

3.8 Running on WSGI

pycsw supports the Web Server Gateway Interface (WSGI). To run pycsw in WSGI mode, use `csw.wsgi` in your WSGI server environment. Below is an example of configuring with Apache:

```
WSGIDaemonProcess host1 home=/var/www/pycsw processes=2
WSGIProcessGroup host1
WSGIScriptAlias /pycsw-wsgi /var/www/pycsw/csw.wsgi
<Directory /var/www/pycsw>
  Order deny,allow
  Allow from all
</Directory>
```

or use the WSGI reference implementation:

```
$ python ./csw.wsgi
Serving on port 8000...
```

which will publish pycsw to `http://localhost:8000/`

CHAPTER 4

Configuration

pycsw's runtime configuration is defined by `default.cfg`. pycsw ships with a sample configuration (`default-sample.cfg`). Copy the file to `default.cfg` and edit the following:

[server]

- **home**: the full filesystem path to pycsw
- **url**: the URL of the resulting service
- **mimetype**: the MIME type when returning HTTP responses
- **language**: the ISO 639-1 language and ISO 3166-1 alpha2 country code of the service (e.g. `en-CA`, `fr-CA`, `en-US`)
- **encoding**: the content type encoding (e.g. `ISO-8859-1`, see https://docs.python.org/2/library/codecs.html#standard-encodings). Default value is 'UTF-8'
- **maxrecords**: the maximum number of records to return by default. This value is enforced if a CSW's client's `maxRecords` parameter is greater than `server.maxrecords` to limit capacity. See *MaxRecords Handling* for more information
- **loglevel**: the logging level (see http://docs.python.org/library/logging.html#logging-levels)
- **logfile**: the full file path to the logfile
- **ogc_schemas_base**: base URL of OGC XML schemas tree file structure (default is http://schemas.opengis.net)
- **federatedcatalogues**: comma delimited list of CSW endpoints to be used for distributed searching, if requested by the client (see *Distributed Searching*)
- **pretty_print**: whether to pretty print the output (`true` or `false`). Default is `false`
- **gzip_compresslevel**: gzip compression level, lowest is `1`, highest is `9`. Default is off
- **domainquerytype**: for GetDomain operations, how to output domain values. Accepted values are `list` and `range` (min/max). Default is `list`
- **domaincounts**: for GetDomain operations, whether to provide frequency counts for values. Accepted values are `true` and `False`. Default is `false`
- **profiles**: comma delimited list of profiles to load at runtime (default is none). See *Profile Plugins*
- **smtp_host**: SMTP host for processing `csw:ResponseHandler` parameter via outgoing email requests (default is `localhost`)
- **spatial_ranking**: parameter that enables (`true` or `false`) ranking of spatial query results as per K.J. Lanfear 2006 - A Spatial Overlay Ranking Method for a Geospatial Search of Text Objects.

[manager]

- **transactions**: whether to enable transactions (`true` or `false`). Default is `false` (see *Transactions*)
- **allowed_ips**: comma delimited list of IP addresses (e.g. 192.168.0.103), wildcards (e.g. 192.168.0.*) or CIDR notations (e.g. 192.168.100.0/24) allowed to perform transactions (see *Transactions*)
- **csw_harvest_pagesize**: when harvesting other CSW servers, the number of records per request to page by (default is 10)

[metadata:main]

- **identification_title**: the title of the service
- **identification_abstract**: some descriptive text about the service
- **identification_keywords**: comma delimited list of keywords about the service
- **identification_keywords_type**: keyword type as per the ISO 19115 MD_KeywordTypeCode codelist). Accepted values are `discipline`, `temporal`, `place`, `theme`, `stratum`
- **identification_fees**: fees associated with the service
- **identification_accessconstraints**: access constraints associated with the service
- **provider_name**: the name of the service provider
- **provider_url**: the URL of the service provider
- **contact_name**: the name of the provider contact
- **contact_position**: the position title of the provider contact
- **contact_address**: the address of the provider contact
- **contact_city**: the city of the provider contact
- **contact_stateorprovince**: the province or territory of the provider contact
- **contact_postalcode**: the postal code of the provider contact
- **contact_country**: the country of the provider contact
- **contact_phone**: the phone number of the provider contact
- **contact_fax**: the facsimile number of the provider contact
- **contact_email**: the email address of the provider contact
- **contact_url**: the URL to more information about the provider contact
- **contact_hours**: the hours of service to contact the provider
- **contact_instructions**: the how to contact the provider contact
- **contact_role**: the role of the provider contact as per the ISO 19115 CI_RoleCode codelist). Accepted values are `author`, `processor`, `publisher`, `custodian`, `pointOfContact`, `distributor`, `user`, `resourceProvider`, `originator`, `owner`, `principalInvestigator`

[repository]

- **database**: the full file path to the metadata database, in database URL format (see http://docs.sqlalchemy.org/en/latest/core/engines.html#database-urls)
- **table**: the table name for metadata records (default is `records`). If you are using PostgreSQL with a DB schema other than `public`, qualify the table like `myschema.table`
- **mappings**: custom repository mappings (see *Mapping to an Existing Repository*)
- **source**: the source of this repository only if not local (e.g. *GeoNode Configuration*, *Open Data Catalog Configuration*). Supported values are `geonode`, `odc`

- **filter**: server side database filter to apply as mask to all CSW requests (see *Repository Filters*)

Note: See *Administration* for connecting your metadata repository and supported information models.

4.1 MaxRecords Handling

The The following describes how `maxRecords` is handled by the configuration when handling `GetRecords` requests:

server.maxrecords	GetRecords.maxRecords	Result
none set	none passed	10 (CSW default)
20	14	20
20	none passed	20
none set	100	100
20	200	20

4.2 Alternate Configurations

By default, pycsw loads `default.cfg` at runtime. To load an alternate configuration, modify `csw.py` to point to the desired configuration. Alternatively, pycsw supports explicitly specifiying a configuration by appending `config=/path/to/default.cfg` to the base URL of the service (e.g. `http://localhost/pycsw/csw.py?config=tests/suites/default/default.cfg&service=CSW&version=2` When the `config` parameter is passed by a CSW client, pycsw will override the default configuration location and subsequent settings with those of the specified configuration.

This also provides the functionality to deploy numerous CSW servers with a single pycsw installation.

4.2.1 Hiding the Location

Some deployments with alternate configurations prefer not to advertise the base URL with the `config=` approach. In this case, there are many options to advertise the base URL.

Environment Variables

One option is using Apache's `Alias` and `SetEnvIf` directives. For example, given the base URL `http://localhost/pycsw/csw.py?config=foo.cfg`, set the following in Apache's `httpd.conf`:

```
Alias /pycsw/csw-foo.py /var/www/pycsw/csw.py
SetEnvIf Request_URI "/pycsw/csw-foo.py" PYCSW_CONFIG=/var/www/pycsw/csw-foo.cfg
```

Note: Apache must be restarted after changes to `httpd.conf`

pycsw will use the configuration as set in the `PYCSW_CONFIG` environment variable in the same manner as if it was specified in the base URL. Note that the configuration value `server.url` value must match the `Request_URI` value so as to advertise correctly in pycsw's Capabilities XML.

Wrapper Script

Another option is to write a simple wrapper (e.g. `csw-foo.sh`), which provides the same functionality and can be deployed without restarting Apache:

```
#!/bin/sh

export PYCSW_CONFIG=/var/www/pycsw/csw-foo.cfg

/var/www/pycsw/csw.py
```

CHAPTER 5

Administration

pycsw administration is handled by the `pycsw-admin.py` utility. `pycsw-admin.py` is installed as part of the pycsw install process and should be available in your PATH.

Note: Run `pycsw-admin.py -h` to see all administration operations and parameters

5.1 Metadata Repository Setup

pycsw supports the following databases:

- SQLite3
- PostgreSQL
- PostgreSQL with PostGIS enabled
- MySQL

Note: The easiest and fastest way to deploy pycsw is to use SQLite3 as the backend.

Note: PostgreSQL support includes support for PostGIS functions if enabled

Note: If PostGIS (1.x or 2.x) is activated before setting up the pycsw/PostgreSQL database, then native PostGIS geometries will be enabled.

To expose your geospatial metadata via pycsw, perform the following actions:

- setup the database
- import metadata
- publish the repository

5.2 Supported Information Models

By default, pycsw supports the `csw:Record` information model.

Note: See *Profile Plugins* for information on enabling profiles

5.3 Setting up the Database

```
$ pycsw-admin.py -c setup_db -f default.cfg
```

This will create the necessary tables and values for the repository.

The database created is an OGC SFSQL compliant database, and can be used with any implementing software. For example, to use with OGR:

```
$ ogrinfo /path/to/records.db
INFO: Open of 'records.db'
using driver 'SQLite' successful.
1: records (Polygon)
$ ogrinfo -al /path/to/records.db
# lots of output
```

Note: If PostGIS is detected, the pycsw-admin.py script does not create the SFSQL tables as they are already in the database.

5.4 Loading Records

```
$ pycsw-admin.py -c load_records -f default.cfg -p /path/to/records
```

This will import all `*.xml` records from `/path/to/records` into the database specified in `default.cfg` (`repository.database`). Passing `-r` to the script will process `/path/to/records` recursively.

Note: Records can also be imported using CSW-T (see *Transactions*).

5.5 Exporting the Repository

```
$ pycsw-admin.py -c export_records -f default.cfg -p /path/to/output_dir
```

This will write each record in the database specified in `default.cfg` (`repository.database`) to an XML document on disk, in directory `/path/to/output_dir`.

5.6 Optimizing the Database

```
$ pycsw-admin.py -c optimize_db -f default.cfg
```

Note: This feature is relevant only for PostgreSQL and MySQL

5.7 Deleting Records from the Repository

```
$ pycsw-admin.py -c delete_records -f default.cfg
```

This will empty the repository of all records.

5.8 Database Specific Notes

5.8.1 PostgreSQL

- if PostGIS is not enabled, pycsw makes uses of PL/Python functions. To enable PostgreSQL support, the database user must be able to create functions within the database. In case of recent PostgreSQL versions (9.x), the PL/Python extension must be enabled prior to pycsw setup
- PostgreSQL Full Text Search is supported for `csw:AnyText` based queries. pycsw creates a tsvector column based on the text from anytext column. Then pycsw creates a GIN index against the anytext_tsvector column. This is created automatically in `pycsw.admin.setup_db`. Any query against *csw:AnyText* or *apiso:AnyText* will process using PostgreSQL FTS handling

5.8.2 PostGIS

- pycsw makes use of PostGIS spatial functions and native geometry data type.
- It is advised to install the PostGIS extension before setting up the pycsw database
- If PostGIS is detected, the pycsw-admin.py script will create both a native geometry column and a WKT column, as well as a trigger to keep both synchronized.
- In case PostGIS gets disabled, pycsw will continue to work with the WKT column
- In case of migration from plain PostgreSQL database to PostGIS, the spatial functions of PostGIS will be used automatically
- When migrating from plain PostgreSQL database to PostGIS, in order to enable native geometry support, a "GEOMETRY" column named "wkb_geometry" needs to be created manually (along with the update trigger in `pycsw.admin.setup_db`). Also the native geometries must be filled manually from the WKT field. Next versions of pycsw will automate this process

5.9 Mapping to an Existing Repository

pycsw supports publishing metadata from an existing repository. To enable this functionality, the default database mappings must be modified to represent the existing database columns mapping to the abstract core model (the default mappings are in `pycsw/config.py:MD_CORE_MODEL`).

To override the default settings:

- define a custom database mapping based on `etc/mappings.py`
- in `default.cfg`, set `repository.mappings` to the location of the mappings.py file:

```
[repository]
...
mappings=path/to/mappings.py
```

See the *GeoNode Configuration* and *Open Data Catalog Configuration* for further examples.

5.9.1 Existing Repository Requirements

pycsw requires certain repository attributes and semantics to exist in any repository to operate as follows:

- `pycsw:Identifier`: unique identifier

- `pycsw:Typename`: typename for the metadata; typically the value of the root element tag (e.g. `csw:Record`, `gmd:MD_Metadata`)
- `pycsw:Schema`: schema for the metadata; typically the target namespace (e.g. `http://www.opengis.net/cat/csw/2.0.2`, `http://www.isotc211.org/2005/gmd`)
- `pycsw:InsertDate`: date of insertion
- `pycsw:XML`: full XML representation
- `pycsw:AnyText`: bag of XML element text values, used for full text search. Realized with the following design pattern:
  - capture all XML element and attribute values
  - store in repository
- `pycsw:BoundingBox`: string of WKT or EWKT geometry

The following repository semantics exist if the attributes are specified:

- `pycsw:Keywords`: comma delimited list of keywords
- `pycsw:Links`: structure of links in the format "name,description,protocol,url[^,,,[^,,,]]"

Values of mappings can be derived from the following mechanisms:

- text fields
- Python datetime.datetime or datetime.date objects
- Python functions

Further information is provided in `pycsw/config.py:MD_CORE_MODEL`.

CHAPTER 6

Distributed Searching

Note: Your server must be able to make outgoing HTTP requests for this functionality.

pycsw has the ability to perform distributed searching against other CSW servers. Distributed searching is disabled by default; to enable, `server.federatedcatalogues` must be set. A CSW client must issue a GetRecords request with `csw:DistributedSearch` specified, along with an optional `hopCount` attribute (see subclause 10.8.4.13 of the CSW specification). When enabled, pycsw will search all specified catalogues and return a unified set of search results to the client. Due to the distributed nature of this functionality, requests will take extra time to process compared to queries against the local repository.

6.1 Scenario: Federated Search

pycsw deployment with 3 configurations (CSW-1, CSW-2, CSW-3), subsequently providing three (3) endpoints. Each endpoint is based on an opaque metadata repository (based on theme/place/discipline, etc.). Goal is to perform a single search against all endpoints.

pycsw realizes this functionality by supporting *alternate configurations*, and exposes the additional CSW endpoint(s) with the following design pattern:

CSW-1: `http://localhost/pycsw/csw.py?config=CSW-1.cfg`

CSW-2: `http://localhost/pycsw/csw.py?config=CSW-2.cfg`

CSW-3: `http://localhost/pycsw/csw.py?config=CSW-3.cfg`

...where the `*.cfg` configuration files are configured for each respective metadata repository. The above CSW endpoints can be interacted with as usual.

To federate the discovery of the three (3) portals into a unified search, pycsw realizes this functionality by deploying an additional configuration which acts as the superset of CSW-1, CSW-2, CSW-3:

CSW-all: `http://localhost/pycsw/csw.py?config=CSW-all.cfg`

This allows the client to invoke one (1) CSW GetRecords request, in which the CSW endpoint spawns the same GetRecords request to 1..n distributed CSW endpoints. Distributed CSW endpoints are advertised in CSW Capabilities XML via `ows:Constraint`:

```
<ows:OperationsMetadata>
...
    <ows:Constraint name="FederatedCatalogues">
        <ows:Value>http://localhost/pycsw/csw.py?config=CSW-1.cfg</ows:Value>
        <ows:Value>http://localhost/pycsw/csw.py?config=CSW-2.cfg</ows:Value>
        <ows:Value>http://localhost/pycsw/csw.py?config=CSW-3.cfg</ows:Value>
```

```
    </ows:Constraint>
...
</ows:OperationsMetadata>
```

...which advertises which CSW endpoint(s) the CSW server will spawn if a distributed search is requested by the client.

in the CSW-all configuration:

```
[server]
...
federatedcatalogues=http://localhost/pycsw/csw.py?config=CSW-1.cfg,http://localhost/pycsw/csw.py?con
```

At which point a CSW client request to CSW-all with `distributedsearch=TRUE`, while specifying an optional `hopCount`. Query network topology:

```
     AnyClient
         ^
         |
         v
      CSW-all
         ^
         |
         v
  /-------------\
  ^      ^      ^
  |      |      |
  v      v      v
CSW-1  CSW-2  CSW-3
```

As a result, a pycsw deployment in this scenario may be approached on a per 'theme' basis, or at an aggregate level.

All interaction in this scenario is local to the pycsw installation, so network performance would not be problematic.

A very important facet of distributed search is as per Annex B of OGC:CSW 2.0.2. Given that all the CSW endpoints are managed locally, duplicates and infinite looping are not deemed to present an issue.

CHAPTER 7

Search/Retrieval via URL (SRU) Support

pycsw supports the Search/Retrieval via URL search protocol implementation as per subclause 8.4 of the OpenGIS Catalogue Service Implementation Specification.

SRU support is enabled by default. HTTP GET requests must be specified with `mode=sru` for SRU requests, e.g.:

```
http://localhost/pycsw/csw.py?mode=sru&operation=searchRetrieve&query=foo
```

See http://www.loc.gov/standards/sru/simple.html for example SRU requests.

CHAPTER 8

OpenSearch Support

pycsw supports the OGC OpenSearch Geo and Time Extensions 1.0 standard via the following conformance classes:

- Core (GeoSpatial Service) `{searchTerms}`, `{geo:box}`
- Temporal Search core `{time:start}`, `{time:end}`

OpenSearch support is enabled by default. HTTP requests must be specified with `mode=opensearch` in the base URL for OpenSearch requests, e.g.:

```
http://localhost/pycsw/csw.py?mode=opensearch&service=CSW&version=2.0.2&request=GetCapabilities
```

This will return the Description document which can then be autodiscovered.

CHAPTER 9

OAI-PMH Support

pycsw supports the The Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) standard.

OAI-PMH OpenSearch support is enabled by default. HTTP requests must be specified with `mode=oaipmh` in the base URL for OAI-PMH requests, e.g.:

```
http://localhost/pycsw/csw.py?mode=oaipmh&verb=Identify
```

See http://www.openarchives.org/OAI/openarchivesprotocol.html for more information on OAI-PMH as well as request / reponse examples.

CHAPTER 10

SOAP

pycsw supports handling of SOAP encoded requests and responses as per subclause 10.3.2 of OGC:CSW 2.0.2. SOAP request examples can be found in `tests/index.html`.

CHAPTER 11

XML Sitemaps

XML Sitemaps can be generated by running:

```
$ pycsw-admin.py -c gen_sitemap -f default.cfg -o sitemap.xml
```

The `sitemap.xml` file should be saved to an an area on your web server (parallel to or above your pycsw install location) to enable web crawlers to index your repository.

CHAPTER 12

Transactions

pycsw has the ability to process CSW Harvest and Transaction requests (CSW-T). Transactions are disabled by default; to enable, `manager.transactions` must be set to `true`. Access to transactional functionality is limited to IP addresses which must be set in `manager.allowed_ips`.

12.1 Supported Resource Types

For transactions and harvesting, pycsw supports the following metadata resource types by default:

Resource Type	Namespace	Transaction	Harvest
Dublin Core	`http://www.opengis.net/cat/csw/2.0.2`	yes	yes
FGDC	`http://www.opengis.net/cat/csw/csdgm`	yes	yes
ISO 19139	`http://www.isotc211.org/2005/gmd`	yes	yes
ISO GMI	`http://www.isotc211.org/2005/gmi`	yes	yes
OGC:CSW 2.0.2	`http://www.opengis.net/cat/csw/2.0.2`		yes
OGC:WMS 1.1.1	`http://www.opengis.net/wms`		yes
OGC:WFS 1.1.0	`http://www.opengis.net/wfs`		yes
OGC:WCS 1.0.0	`http://www.opengis.net/wcs`		yes
OGC:WPS 1.0.0	`http://www.opengis.net/wps/1.0.0`		yes
OGC:SOS 1.0.0	`http://www.opengis.net/sos/1.0`		yes
OGC:SOS 2.0.0	`http://www.opengis.net/sos/2.0`		yes
WAF	`urn:geoss:urn`		yes

Additional metadata models are supported by enabling the appropriate *Profile Plugins*.

Note: For transactions to be functional when using SQLite3, the SQLite3 database file (**and its parent directory**) must be fully writable. For example:

```
$ mkdir /path/data
$ chmod 777 /path/data
$ chmod 666 test.db
$ mv test.db /path/data
```

For CSW-T deployments, it is strongly advised that this directory reside in an area that is not accessible by HTTP.

12.2 Harvesting

Note: Your server must be able to make outgoing HTTP requests for this functionality.

pycsw supports the CSW-T `Harvest` operation. Records which are harvested require to setup a cronjob to periodically refresh records in the local repository. A sample cronjob is available in `etc/harvest-all.cron` which points to `pycsw-admin.py` (you must specify the correct path to your configuration). Harvest operation results can be sent by email (via `mailto:`) or ftp (via `ftp://`) if the Harvest request specifies `csw:ResponseHandler`.

Note: For `csw:ResponseHandler` values using the `mailto:` protocol, you must have `server.smtp_host` set in your *configuration*.

12.2.1 OGC Web Services

When harvesting OGC web services, requests can provide the base URL of the service as part of the Harvest request. pycsw will construct a `GetCapabilities` request dynamically.

When harvesting other CSW servers, pycsw pages through the entire CSW in default increments of 10. This value can be modified via the `manager.csw_harvest_pagesize` *configuration* option. It is strongly advised to use the `csw:ResponseHandler` parameter for harvesting large CSW catalogues to prevent HTTP timeouts.

12.3 Transactions

pycsw supports 3 modes of the `Transaction` operation (`Insert`, `Update`, `Delete`):

- **Insert**: full XML documents can be inserted as per CSW-T
- **Update**: updates can be made as full record updates or record properties against a `csw:Constraint`
- **Delete**: deletes can be made against a `csw:Constraint`

Transaction operation results can be sent by email (via `mailto:`) or ftp (via `ftp://`) if the Transaction request specifies `csw:ResponseHandler`.

The *Tester* contain CSW-T request examples.

CHAPTER 13

Repository Filters

pycsw has the ability to perform server side repository / database filters as a means to mask all CSW requests to query against a specific subset of the metadata repository, thus providing the ability to deploy multiple pycsw instances pointing to the same database in different ways via the `repository.filter` configuration option.

Repository filters are a convenient way to subset your repository at the server level without the hassle of creating proper database views. For large repositories, it may be better to subset at the database level for performance.

13.1 Scenario: One Database, Many Views

Imagine a sample database table of records (subset below for brevity):

identifier	parentidentifier	title	abstract
1	33	foo1	bar1
2	33	foo2	bar2
3	55	foo3	bar3
4	55	foo1	bar1
5	21	foo5	bar5
5	21	foo6	bar6

A default pycsw instance (with no `repository.filters` option) will always process CSW requests against the entire table. So a CSW *GetRecords* filter like:

```
<ogc:Filter>
    <ogc:PropertyIsEqualTo>
        <ogc:PropertyName>apiso:Title</ogc:PropertyName>
        <ogc:Literal>foo1</ogc:Literal>
    </ogc:PropertyIsEqualTo>
</ogc:Filter>
```

...will return:

identifier	parentidentifier	title	abstract
1	33	foo1	bar1
4	55	foo1	bar1

Suppose you wanted to deploy another pycsw instance which serves metadata from the same database, but only from a specific subset. Here we set the `repository.filter` option:

```
[repository]
database=sqlite:///records.db
filter=pycsw:ParentIdentifier = '33'
```

The same CSW *GetRecords* filter as per above then yields the following results:

identifier	parentidentifier	title	abstract
1	33	foo1	bar1

Another example:

```
[repository]
database=sqlite:///records.db
filter=pycsw:ParentIdentifier != '33'
```

The same CSW *GetRecords* filter as per above then yields the following results:

identifier	parentidentifier	title	abstract
4	55	foo1	bar1

The `repository.filter` option accepts all core queryables set in the pycsw core model (see `pycsw.config.StaticContext.md_core_model` for the complete list).

CHAPTER 14

Profile Plugins

14.1 Overview

pycsw allows for the implementation of profiles to the core standard. Profiles allow specification of additional metadata format types (i.e. ISO 19139:2007, NASA DIF, INSPIRE, etc.) to the repository, which can be queried and presented to the client. pycsw supports a plugin architecture which allows for runtime loading of Python code.

All profiles must be placed in the `pycsw/plugins/profiles` directory.

14.2 Requirements

```
pycsw/
  plugins/
  __init__.py # empty
  profiles/ # directory to store profiles
    __init__.py # empty
    profile.py # defines abstract profile object (properties and methods) and functions to load plugi
    apiso/ # profile directory
      __init__.py # empty
      apiso.py # profile code
      ... # supporting files, etc.
```

14.3 Abstract Base Class Definition

All profile code must be instantiated as a subclass of `profile.Profile`. Below is an example to add a `Foo` profile:

```
from pycsw.plugins.profiles import profile

class FooProfile(profile.Profile):
    profile.Profile.__init__(self,
        name='foo',
        version='1.0.3',
        title='My Foo Profile',
        url='http://example.org/fooprofile/docs',
        namespace='http://example.org/foons',
        typename='foo:RootElement',
        outputschema=http://example.org/foons',
        prefixes=['foo'],
```

```
        model=model,
        core_namespaces=namespaces,
        added_namespaces={'foo': 'http://example.org/foons'}
        repository=REPOSITORY['foo:RootElement'])
```

Your profile plugin class (`FooProfile`) must implement all methods as per `profile.Profile`. Profile methods must always return `lxml.etree.Element` types, or `None`.

14.4 Enabling Profiles

All profiles are disabled by default. To specify profiles at runtime, set the `server.profiles` value in the *Configuration* to the name of the package (in the `pycsw/plugins/profiles` directory). To enable multiple profiles, specify as a comma separated value (see *Configuration*).

14.5 Testing

Profiles must add examples to the *Tester* interface, which must provide example requests specific to the profile.

CHAPTER 15

Supported Profiles

15.1 ISO Metadata Application Profile (1.0.0)

15.1.1 Overview

The ISO Metadata Application Profile (APISO) is a profile of CSW 2.0.2 which enables discovery of geospatial metadata following ISO 19139:2007 and ISO 19119:2005/PDAM 1.

15.1.2 Configuration

No extra configuration is required.

15.1.3 Querying

- **typename**: `gmd:MD_Metadata`
- **outputschema**: `http://www.isotc211.org/2005/gmd`

15.1.4 Enabling APISO Support

To enable APISO support, add `apiso` to `server.profiles` as specified in *Configuration*.

15.1.5 Testing

A testing interface is available in `tests/index.html` which contains tests specific to APISO to demonstrate functionality. See *Tester* for more information.

15.2 INSPIRE Extension

15.2.1 Overview

APISO includes an extension for enabling INSPIRE Discovery Services 3.0 support. To enable the INSPIRE extension to APISO, create a `[metadata:inspire]` section in the main configuration with `enabled` set to `true`.

15.2.2 Configuration

[metadata:inspire]

- **enabled**: whether to enable the INSPIRE extension (`true` or `false`)
- **languages_supported**: supported languages (see http://inspire.ec.europa.eu/schemas/common/1.0/enums/enum_eng.xsd, simpleType `euLanguageISO6392B`)
- **default_language**: the default language (see http://inspire.ec.europa.eu/schemas/common/1.0/enums/enum_eng.xsd, simpleType `euLanguageISO6392B`)
- **date**: date of INSPIRE metadata offering (in ISO 8601 format)
- **gemet_keywords**: a comma-seperated keyword list of GEMET INSPIRE theme keywords about the service (see http://inspire.ec.europa.eu/schemas/common/1.0/enums/enum_eng.xsd, complexType `inspireTheme_eng`)
- **conformity_service**: the level of INSPIRE conformance for spatial data sets and services (`conformant`, `notConformant`, `notEvaluated`)
- **contact_organization**: the organization name responsible for the INSPIRE metadata
- **contact_email**: the email address of entity responsible for the INSPIRE metadata
- **temp_extent**: temporal extent of the service (in ISO 8601 format). Either a single date (i.e. `yyyy-mm-dd`), or an extent (i.e. `yyyy-mm-dd/yyyy-mm-dd`)

15.3 CSW-ebRIM Registry Service - Part 1: ebRIM profile of CSW

15.3.1 Overview

The CSW-ebRIM Registry Service is a profile of CSW 2.0.2 which enables discovery of geospatial metadata following the ebXML information model.

15.3.2 Configuration

No extra configuration is required.

15.3.3 Querying

- **typename**: `rim:RegistryObject`
- **outputschema**: `urn:oasis:names:tc:ebxml-regrep:xsd:rim:3.0`

15.3.4 Enabling ebRIM Support

To enable ebRIM support, add `ebrim` to `server.profiles` as specified in *Configuration*.

15.3.5 Testing

A testing interface is available in `tests/index.html` which contains tests specific to ebRIM to demonstrate functionality. See *Tester* for more information.

CHAPTER 16

Output Schema Plugins

16.1 Overview

pycsw allows for extending the implementation of output schemas to the core standard. outputschemas allow for a client to request metadata in a specific format (ISO, Dublin Core, FGDC, NASA DIF and Atom are default).

All outputschemas must be placed in the `pycsw/plugins/outputschemas` directory.

16.2 Requirements

```
pycsw/
  plugins/
  __init__.py # empty
  outputschemas/
    __init__.py # __all__ is a list of all provided outputschemas
    atom.py # default
    dif.py # default
    fgdc.py # default
```

16.3 Implementing a new outputschema

Create a file in `pycsw/plugins/outputschemas`, which defines the following:

- `NAMESPACE`: the default namespace of the outputschema which will be advertised
- `NAMESPACE`: dict of all applicable namespaces to outputschema
- `XPATH_MAPPINGS`: dict of pycsw core queryables mapped to the equivalent XPath of the outputschema
- `write_record`: function which returns a record as an `lxml.etree.Element` object

Add the name of the file to `__init__.py:__all__`. The new outputschema is now supported in pycsw.

16.4 Testing

New outputschemas must add examples to the *Tester* interface, which must provide example requests specific to the profile.

CHAPTER 17

GeoNode Configuration

GeoNode (http://geonode.org/) is a platform for the management and publication of geospatial data. It brings together mature and stable open-source software projects under a consistent and easy-to-use interface allowing users, with little training, to quickly and easily share data and create interactive maps. GeoNode provides a cost-effective and scalable tool for developing information management systems. GeoNode uses CSW as a cataloguing mechanism to query and present geospatial metadata.

pycsw supports binding to an existing GeoNode repository for metadata query. The binding is read-only (transactions are not in scope, as GeoNode manages repository metadata changes in the application proper).

17.1 GeoNode Setup

pycsw is enabled and configured by default in GeoNode, so there are no additional steps required once GeoNode is setup. See the `CATALOGUE` and `PYCSW` settings.py entries at http://docs.geonode.org/en/latest/developers/reference/django-apps.html#id1 for customizing pycsw within GeoNode.

CHAPTER 18

Open Data Catalog Configuration

Open Data Catalog (https://github.com/azavea/Open-Data-Catalog/) is an open data catalog based on Django, Python and PostgreSQL. It was originally developed for OpenDataPhilly.org, a portal that provides access to open data sets, applications, and APIs related to the Philadelphia region. The Open Data Catalog is a generalized version of the original source code with a simple skin. It is intended to display information and links to publicly available data in an easily searchable format. The code also includes options for data owners to submit data for consideration and for registered public users to nominate a type of data they would like to see openly available to the public.

pycsw supports binding to an existing Open Data Catalog repository for metadata query. The binding is read-only (transactions are not in scope, as Open Data Catalog manages repository metadata changes in the application proper).

18.1 Open Data Catalog Setup

Open Data Catalog provides CSW functionality using pycsw out of the box (installing ODC will also install pycsw). Settings are defined in https://github.com/azavea/Open-Data-Catalog/blob/master/OpenDataCatalog/settings.py#L165.

At this point, pycsw is able to read from the Open Data Catalog repository using the Django ORM.

CHAPTER 19

CKAN Configuration

CKAN (http://ckan.org) is a powerful data management system that makes data accessible – by providing tools to streamline publishing, sharing, finding and using data. CKAN is aimed at data publishers (national and regional governments, companies and organizations) wanting to make their data open and available.

ckanext-spatial is CKAN's geospatial extension. The extension adds a spatial field to the default CKAN dataset schema, using PostGIS as the backend. This allows to perform spatial queries and display the dataset extent on the frontend. It also provides harvesters to import geospatial metadata into CKAN from other sources, as well as commands to support the CSW standard. Finally, it also includes plugins to preview spatial formats such as GeoJSON.

19.1 CKAN Setup

Installation and configuration Instructions are provided as part of the ckanext-spatial documentation.

CHAPTER 20

Testing

20.1 OGC CITE

Compliance benchmarking is done via the OGC Compliance & Interoperability Testing & Evaluation Initiative. The pycsw wiki documents testing procedures and status.

20.2 Tester

The pycsw tests framework (in `tests`) is a collection of testsuites to perform automated regession testing of the codebase. Test are run against all pushes to the GitHub repository via Travis CI.

20.2.1 Running Locally

The tests framework can be run from `tests` using Paver (see `pavement.py`) tasks for convenience:

```
$ cd /path/to/pycsw
# run all tests (starts up http://localhost:8000)
$ paver test
# run tests only against specific testsuites
$ paver test -s apiso,fgdc
# run all tests, including harvesting (this is turned off by default given the volatility of remote s
$ paver test -r
```

The tests perform HTTP GET and POST requests against `http://localhost:8000`. The expected output for each test can be found in `expected`. Results are categorized as `passed`, `failed`, or `initialized`. A summary of results is output at the end of the run.

20.2.2 Failed Tests

If a given test has failed, the output is saved in `results`. The resulting failure can be analyzed by running `diff tests/expected/name_of_test.xml tests/results/name_of_test.xml` to find variances. The Paver task returns a status code which indicates the number of tests which have failed (i.e. `echo $?`).

20.2.3 Test Suites

The tests framework is run against a series of 'suites' (in `tests/suites`), each of which specifies a given configuration to test various functionality of the codebase. Each suite is structured as follows:

- `tests/suites/suite/default.cfg`: the configuration for the suite
- `tests/suites/suite/post`: directory of XML documents for HTTP POST requests
- `tests/suites/suite/get/requests.txt`: directory and text file of KVP for HTTP GET requests
- `tests/suites/suite/data`: directory of sample XML data required for the test suite. Database and test data are setup/loaded automatically as part of testing

When the tests are invoked, the following operations are run:

- pycsw configuration is set to `tests/suites/suite/default.cfg`
- HTTP POST requests are run against `tests/suites/suite/post/*.xml`
- HTTP GET requests are run against each request in `tests/suites/suite/get/requests.txt`

The CSV format of `tests/suites/suite/get/requests.txt` is `testname,request`, with one line for each test. The `testname` value is a unique test name (this value sets the name of the output file in the test results). The `request` value is the HTTP GET request. The `PYCSW_SERVER` token is replaced at runtime with the URL to the pycsw install.

20.2.4 Adding New Tests

To add tests to an existing suite:

- for HTTP POST tests, add XML documents to `tests/suites/suite/post`
- for HTTP GET tests, add tests (one per line) to `tests/suites/suite/get/requests.txt`
- run `paver test`

To add a new test suite:

- create a new directory under `tests/suites` (e.g. `foo`)
- create a new configuration in `tests/suites/foo/default.cfg`
  - Ensure that all file paths are relative to `path/to/pycsw`
  - Ensure that `repository.database` points to an SQLite3 database called `tests/suites/foo/data/records.db`. The database *must* be called `records.db` and the directory `tests/suites/foo/data` *must* exist
- populate HTTP POST requests in `tests/suites/foo/post`
- populate HTTP GET requests in `tests/suites/foo/get/requests.txt`
- if the testsuite requires test data, create `tests/suites/foo/data` are store XML file there
- run `paver test` (or `paver test -s foo` to test only the new test suite)

The new test suite database will be created automatically and used as part of tests.

20.2.5 Web Testing

You can also use the pycsw tests via your web browser to perform sample requests against your pycsw install. The tests are is located in `tests/`. To generate the HTML page:

```
$ paver gen_tests_html
```

Then navigate to `http://host/path/to/pycsw/tests/index.html`.

CHAPTER 21

Cataloguing and Metadata Tools

21.1 CSW Clients

- Geoportal CSW Clients
- OWSLib
- MetaSearch (QGIS plugin)

21.2 CSW Servers

- deegree
- eXcat
- GeoNetwork opensource

21.3 Metadata Editing Tools

- CatMDEdit
- EUOSME
- GIMED
- Metatools (QGIS plugin)

CHAPTER 22

Support

22.1 Community

Please see the Community page for information on the pycsw community, getting support, and how to get involved.

CHAPTER 23

Contributing to pycsw

The pycsw project openly welcomes contributions (bug reports, bug fixes, code enhancements/features, etc.). This document will outline some guidelines on contributing to pycsw. As well, pycsw community is a great place to get an idea of how to connect and participate in pycsw community and development.

23.1 GitHub

Code, tests, documentation, wiki and issue tracking are all managed on GitHub. Make sure you have a GitHub account.

23.2 Code Overview

- the pycsw wiki documents an overview of the codebase

23.3 Documentation

- documentation is managed in `docs/`, in reStructuredText format
- Sphinx is used to generate the documentation
- See the reStructuredText Primer on rST markup and syntax.

23.4 Bugs

pycsw's issue tracker is the place to report bugs or request enhancements. To submit a bug be sure to specify the pycsw version you are using, the appropriate component, a description of how to reproduce the bug, as well as what version of Python and platform. For convenience, you can run `pycsw-admin.py -c get_sysprof` and copy/paste the output into your issue.

23.5 Forking pycsw

Contributions are most easily managed via GitHub pull requests. Fork pycsw into your own GitHub repository to be able to commit your work and submit pull requests.

23.6 Development

23.6.1 GitHub Commit Guidelines

- enhancements and bug fixes should be identified with a GitHub issue
- commits should be granular enough for other developers to understand the nature / implications of the change(s)
- for trivial commits that do not need Travis CI to run, include `[ci skip]` as part of the commit message
- non-trivial Git commits shall be associated with a GitHub issue. As documentation can always be improved, tickets need not be opened for improving the docs
- Git commits shall include a description of changes
- Git commits shall include the GitHub issue number (i.e. `#1234`) in the Git commit log message
- all enhancements or bug fixes must successfully pass all *OGC CITE* tests before they are committed
- all enhancements or bug fixes must successfully pass all *Tester* tests before they are committed
- enhancements which can be demonstrated from the pycsw *Tester* should be accompanied by example CSW request XML

23.6.2 Coding Guidelines

- pycsw instead of PyCSW, pyCSW, Pycsw
- always code with PEP 8 conventions
- always run source code through `pep8` and pylint, using all pylint defaults except for `C0111`. `sbin/pycsw-pylint.sh` is included for convenience
- for exceptions which make their way to OGC `ExceptionReport` XML, always specify the appropriate `locator` and `code` parameters
- the pycsw wiki documents developer tasks for things like releasing documentation, testing, etc.

23.6.3 Submitting a Pull Request

This section will guide you through steps of working on pycsw. This section assumes you have forked pycsw into your own GitHub repository.

```
# setup a virtualenv
$ virtualenv mypycsw && cd mypycsw
$ . ./bin/activate
# clone the repository locally
$ git clone git@github.com:USERNAME/pycsw.git
$ cd pycsw
$ pip install -e . && pip install -r requirements-standalone.txt
# add the main pycsw master branch to keep up to date with upstream changes
$ git remote add upstream https://github.com/geopython/pycsw.git
$ git pull upstream master
# create a local branch off master
# The name of the branch should include the issue number if it exists
$ git branch 72-foo
$ git checkout 72-foo
#
# make code/doc changes
```

```
#
$ git commit -am 'fix xyz (#72-foo)'
$ git push origin 72-foo
```

Your changes are now visible on your pycsw repository on GitHub. You are now ready to create a pull request. A member of the pycsw team will review the pull request and provide feedback / suggestions if required. If changes are required, make them against the same branch and push as per above (all changes to the branch in the pull request apply).

The pull request will then be merged by the pycsw team. You can then delete your local branch (on GitHub), and then update your own repository to ensure your pycsw repository is up to date with pycsw master:

```
$ git checkout master
$ git pull upstream master
```

23.7 GitHub Commit Access

- proposals to provide developers with GitHub commit access shall be emailed to the pycsw-devel mailing list. Proposals shall be approved by the pycsw development team. Committers shall be added by the project admin
- removal of commit access shall be handled in the same manner
- each committer shall be listed in https://github.com/geopython/pycsw/blob/master/COMMITTERS.txt

CHAPTER 24

License

The MIT License (MIT)

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CHAPTER 25

Committers

Login(s)	Name	Email / Contact	Area(s)
tomkralidis	Tom Kralidis	tomkralidis at gmail.com	Overall
kalxas	Angelos Tzotsos	tzotsos at gmail.com	INSPIRE, APISO profiles, Packaging
adamhinz	Adam Hinz	hinz dot adam at gmail.com	WSGI/Server Deployment