CEOS CWIC Project

CWIC Client Partner Guide (OpenSearch)

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CEOS WGISS Integrated Catalog

CWIC Client Partner Guide (OpenSearch)

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1. Introduction

This document contains the comprehensive client partner's guide for OpenSearch, as adopted in the CEOS WGISS Integrated Catalog (CWIC) project. The document introduces the CWIC background, required skills to be a client, query interface, and an implementation outline. Several detailed use cases about how to retrieve the IDN (International Directory Network) dataset ID and how to interact with the CWIC server are also included in this document.

2. Scope

This client partner guide applies to the CEOS WGISS Integrated Catalog (CWIC) version 1.0. CWIC has three instances: operational (PROD), public testing (TEST) and development (DEV). This client partner guide is applicable to both CWIC PROD and CWIC TEST instances.

The target audience for this document is the community of software developers who are:

a) Implementers of IDN OpenSearch/CSW server

b) Implementers of CWIC OpenSearch server

c) Implementers of CWIC OpenSearch client

3. Document Name and Version Control

Every CWIC technical document may have multiple versions, in which modifications or updates have been made. If necessary, some documents will be approved to be publicly released. Every released document has a unique reference number, which follows the naming rule below:

CWIC-DOC-Last two digit of Year-Document Series No-Release No

For example: CWIC-DOC-12-001r1 means this is the first released document (i.e., r1), which is the first CWIC technical document (i.e., 001) in 2012 (i.e., 12).

4. References

The following documents provide more background and supportive information.

Document Reference & Version	Document Title / Description
CWIC-DOC-12-006r1	CWIC Client Partner Guide (CSW)

5. Before You Begin

This chapter introduces the background, concepts and architecture of CWIC, which presents an overview of the CWIC system. The related skills you will need as a client partner are also listed.

5.1. CWIC Background

For scientists who conduct multi-disciplinary research, there may be a need to search multiple catalogs in order to find the data they need. Such work can be very time-consuming and tedious, especially when different catalogs may use different metadata models and catalog interface protocols. It would be desirable, therefore, for those catalogs to be integrated into a catalog federation which will present a well-known and documented metadata model and interface protocol to users and hide the complexity and diversity of the affiliated catalogs behind the interface. With such a federation, users only need to work with the federated catalog through the public interface or API to find the data they need instead of working with various catalogs individually.

The Committee on Earth Observation Satellite (CEOS) addresses coordination of the satellite Earth Observation (EO) programs of the world's government agencies, along with agencies that receive and process data acquired remotely from space. The Working Group on Information Systems and Services (WGISS) is a subgroup of CEOS, which aims to promote collaboration in the development of systems and services that manage and supply EO data to users world-wide. To realize a federated catalogue for data discovery from multiple EO data centers, the CEOS WGISS Integrated Catalog (CWIC) system has been implemented. CWIC provides inventory search to WGISS agency catalog systems for EO data.

5.2. CWIC Concept and Design

CWIC uses a mediator-wrapper architecture that has been widely adopted to realize the integrated access to heterogeneous, autonomous data sources. As depicted in Fig. 1, the data source archives data and disseminates it through the Internet. The wrapper on top of the data source provides a universal query interface by encapsulating heterogeneous data models, query protocols, and access methods. The mediator interacts with the wrapper and provides the user with an integrated access through the global information schema.

Wrappers offer query interfaces hiding the underlying data model, access path, and interface technology of the partner catalog systems. Wrappers are accessed by a mediator, which offers users a front-end integrated access through its global schema. The user poses queries against the global schema of the mediator; the mediator then distributes the query to the individual systems using the appropriate wrappers. The wrappers transform the queries so

they are understandable and executable by the partner catalog systems they wrap, collect the results, transform them appropriately and return them to the mediator. Finally, the mediator integrates the results as a user response.

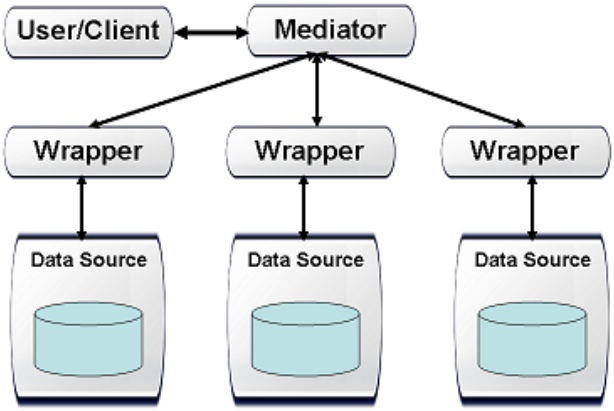

Fig. 1 The Mediator-Wrapper Architecture

Based on the mediator-wrapper architecture, current version of CWIC has been developed and operational with following data partner catalog systems: the Common Metadata Repository (CMR) of NASA, the National Centers for Environmental Information (NCEI) of NOAA, the Group for High Resolution Sea Surface Temperature (GHRSST) of NOAA, the USGS Landsat Surface Imaging (LSI) Explorer, the National Institute for Space Research (INPE) Catalog System of Brazil, the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the Canada Centre for Mapping and Earth Observation (CCMEO), the Meteorological and Oceanographic Satellite Data Archival Centre (MOSDAC) of the Indian Space Research Organisation (ISRO), and the National Remote Sensing Center (NRSC) of ISRO.

Different query interfaces were used to access the data partner catalog systems:

Data partner	OpenSearch	OGC CSW	Native query interface
NASA CMR	Yes	No	Yes
NOAA GHRSST	Yes	Yes	No
NOAA NCEI	Yes	Yes	No
USGS LSI	No	No	Yes
Brazil INPE	No	No	Yes
Canada CCMEO	Yes	Yes	No
ISRO MOSDAC	No	Yes	Yes
ISRO NRSC	Yes	No	Yes

Table 1 Query interfaces of CWIC

In order to implement a one-stop federated catalog system, wrappers have been developed to implement CWIC OpenSearch for individual member catalogs that do not currently offer that capability.

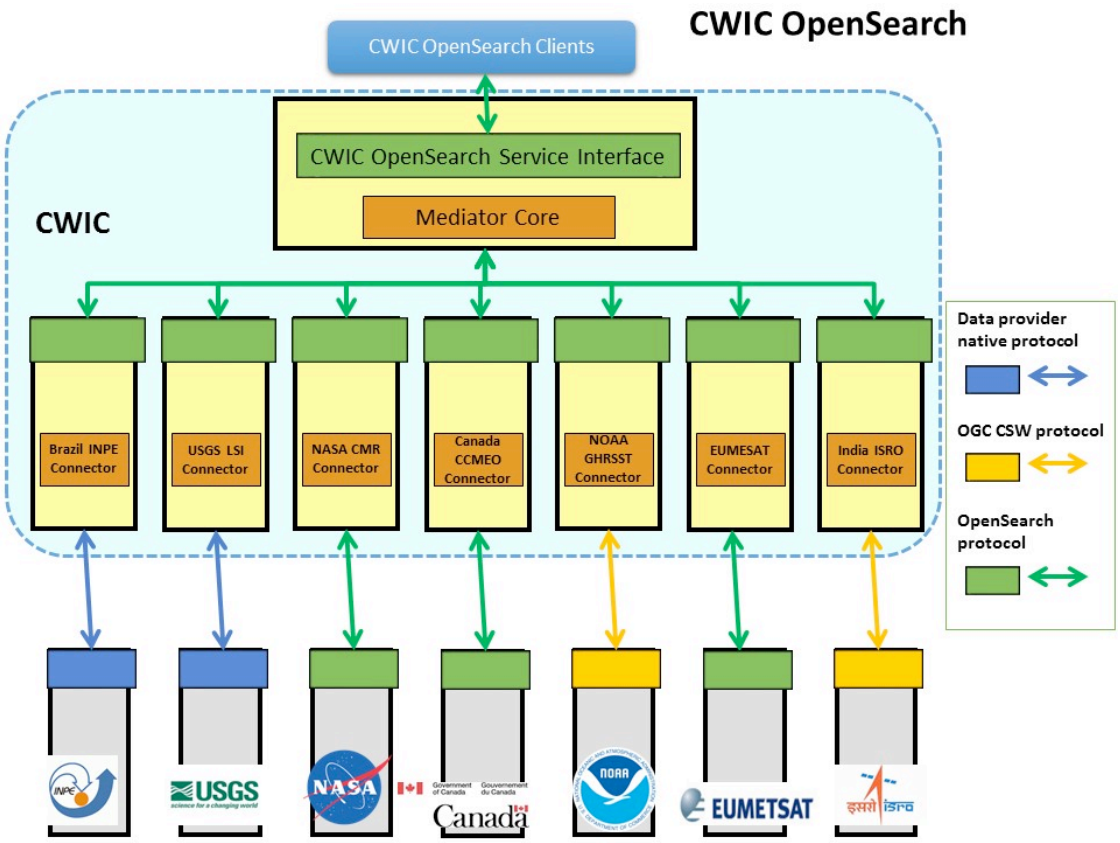

Fig. 2 The System Architecture of CWIC

Fig. 2 illustrates the system architecture of CWIC. Wrappers were implemented for different data partner catalog systems (i.e., NASA CMR, NOAA GHRSST, NOAA NCEI, USGS LSI, INPE, CCMEO, ISRO MOSDAC, and ISRO NRSC). The wrapper is responsible for translating and dispatching requests to different data inventories. The mediator is in charge of dispatching the query request to the wrapper for the data partner inventory system and returns the response to data user.

5.3. CWIC Architecture for OpenSearch

At its core, CWIC presents to End Users and Clients an OpenSearch server. To Data Partners, it appears to be a web-based client to their inventory system. It connects the two (End Users and Data Partners) through the Mediator on the front end serving as the OpenSearch server to end users and OpenSearch client to Connectors. The Connectors are custom-written proxies for the data granule inventory search systems at the individual Data Partners, accepting OpenSearch search requests from the Mediator, translating them into valid search requests for the target dataset, then parsing the results from the inventory search system and translating those into OpenSearch search responses which are passed back to the Mediator.

In this way, outside clients and, for the most part, the Mediator itself need to have no specific knowledge of the particular partner data systems and communicate only via OpenSearch.

Each Data Partner will generally be accessed by a dedicated Connector called by the Mediator. The Connector handles all of the details unique to individual data partner inventory system and all of the communications with the partner's inventory system is managed exclusively by the connector.

5.4. Skills You Will Need as a Client Partner

As a CWIC Client Data Partner, you need to be familiar with basic web application technology such as:

- XML and XML Schema (XSD[1])
- OpenSearch[2] related technologies
- RESTFul[3] related architecture and technologies
- Web development programming language

5.5. CWIC Terms and Definitions

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

(1) **client**

A software component that can invoke an operation from a server

(2) **data clearinghouse**

The collection of institutions providing digital data, which can be searched through a single interface using a common metadata standard

(3) **identifier**

A character string that may be composed of numbers and characters that is exchanged between the client and the server with respect to a specific identity of a resource

(4) IDN dataset ID

Unique dataset identifier in IDN, returned from the IDN in response to the OSDD request. This identifier is assigned by the IDN CMR database.

(5) native ID

Dataset identifier used by CWIC to retrieve granule metadata through data provider API. This identifier is assigned by the data provider.

(6) catalog ID

Identifiers of data provider serving granule metadata

[1] XML Schema: http://en.wikipedia.org/wiki/XML_Schema_%28W3C%29

[2] OpenSearch specification verison 1.1 draft 5 (http://www.opensearch.org/Specifications/OpenSearch/1.1)

[3] RESTFul: http://en.wikipedia.org/wiki/Representational_state_transfer

(7) **operation**

The specification of a transformation or query that an object may be called to execute

(8) **profile**

A set of one or more base standards and - where applicable - the identification of chosen clauses, classes, subsets, options and parameters of those base standards that are necessary for accomplishing a particular function

(9) **request**

The invocation of an operation by a client

(10) **response**

The result of an operation, returned from server to client

(11) **collection**

A grouping of granules that all come from the same source, such as a modeling group or institution. Collections have information that is common across all the granules they "own" and a template for describing additional attributes not already part of the metadata model.

(12) **dataset**

Has the same meaning as collection, see (8)

(13) **granule**

The smallest aggregation of data that can be independently managed (described, inventoried, and retrieved). Granules have their own metadata model and support values associated with the additional attributes defined by the owning collection.

(14) **IDN**

The CEOS International Directory Network (IDN) is a Gateway to the world of Earth Science data and services.

5.6. CWIC Systems

There are two operational CWIC systems to which end-users have access.

- CWIC PROD – this is CWIC production instance and is available to all users.

  Location: http://cwic.wgiss.ceos.org/

- CWIC TEST – this is CWIC testing instance used by data partners and CWIC clients to perform testing before changes are made to the CWIC production instance.

  Location: http://cwictest.wgiss.ceos.org/

The production instance will provide access to only datasets which have been registered with the IDN. The testing instance may provide access to additional datasets (*e.g.*, new

datasets undergoing testing and not yet registered in the IDN), and capabilities which have not yet been tested sufficiently to move to the production system.

5.7. Contact Information

All the documents and information about CWIC are available at WGISS CWIC page at

http://wgiss.ceos.org/cwic

Any questions regarding to CWIC, please send the email to

cwic-help@wgiss.ceos.org

6. CWIC OpenSearch Query Interface

The Query Interface stipulates the protocol between client and catalog server.

6.1. Obtaining the OpenSearch Description Document (OSDD)

OpenSearch Description Documents (OSDDs) provide necessary information for clients to programmatically formulate valid search requests. Specifically, clients are expected to acquire both the cardinality and the domain of request parameters based on the query template in the OSDD. Dataset valids (*i.e.* spatial footprint and temporal extent) are also provided in the OSDD in both machine parseable and human readable formats. Dataset valids enable clients to formulate valid requests yielding more accurate results.

CWIC provides both generic and dataset specific OSDDs. Clients are able to fetch a generic OSDD through the CWIC OSDD endpoint. The OSDD request must also include a client identifier string, as recommended by the CWIC OpenSearch Best Practices. Clients are also able to retrieve a dataset-specific OSDD through the OSDD endpoint by sending both client ID and dataset identifier. In a dataset specific OSDD, the domain is provided for some parameters (*i.e.* timeStart and timeEnd) in addition to the request parameter syntax.

Generic OSDD request URL example:
http://cwic.wgiss.ceos.org/opensearch/datasets/osdd.xml?clientId=cwicClient

Dataset specific OSDD request URL example:
http://cwic.wgiss.ceos.org/opensearch/datasets/C1235542031-USGS_LTA/osdd.xml?clientId=cwicClient

Fig. 3 Examples of CWIC OSDD request

6.2. Search request

CWIC OpenSearch supports searching for granules in a specific dataset. It executes an inventory search and returns the matching granule results.

In order to initialize a valid request, clients are supposed to fill request parameters with proper values and set the dataset identifier. The template of the CWIC OpenSearch request is available under the <Url> element in OSDD. Both cardinality and domain of request parameters extracted from the CWIC OSDD are listed as follows:

Request Parameter [a]	Description [b]	Value & Cardinality (M) = mandatory (O) = optional	Type [c]
datasetId	Dataset identifier	(M) Allowed value is IDN dataset ID	cwic[d]:datasetId
geoBox	Returned granules will have a spatial extent overlapping this bounding box	(O) Supported formats are in W,S,E,N coordinate order: W: WestBoundingLongitude S: SouthBoundingLatitude E: EastBoundingLongitude N: NorthBoundingLatitude All coordinates are in EPSG:4326	geo[e]:box
timeStart	Returned granules will have a temporal extent containing this start time	(O) Supported formats are: 'yyyy-MM-dd', 'yyyy-MM-ddTHH:mm:ssZ' or 'yyyy-MM-dd HH:mm:ss'	time[f]:start
timeEnd	Returned granules will have a temporal extent containing this end time	(O) Supported formats are: 'yyyy-MM-dd', 'yyyy-MM-ddTHH:mm:ssZ' or 'yyyy-MM-dd HH:mm:ss'	time[f]:end
startPage	Start page number of the set of search results desired by the search client	(O) Allowed value is any integer equal and greater than '1'.	os[g]:startPage
count	Number of search results per page desired by the search client	(O) Allowed value is any integer within the interval of [1,200].	os[g]:count
clientId	The identifier of client	(O) Allowed value is any URL	esipdiscover[h]:clientId

		well-formed string representing client identifier.	
a: All request parameters are case sensitive b: “Definition” represents the semantic meaning of request parameter. c: “Type” represents request parameter type restricted by namespace. d: http://cwic.wgiss.ceos.org/opensearch/extensions/1.0/ e: http://a9.com/-/opensearch/extensions/geo/1.0/ f: http://a9.com/-/opensearch/extensions/time/1.0/ g: http://a9.com/-/spec/opensearch/1.1/ h: http://commons.esipfed.org/ns/discovery/1.2/			

Table 2 Table of CWIC OpenSearch request parameters

6.3. Search response

A CWIC OpenSearch response is an ATOM[4] feed with zero or more ATOM entries. Each entry represents metadata pertaining to single granule with submitted query.

Namespaces referred in the CWIC OpenSearch response are listed as follows:

Namespace	URL
xmlns:atom	http://www.w3.org/2005/Atom
xmlns:opensearch	http://a9.com/-/spec/opensearch/1.1/
xmlns:dc	http://purl.org/dc/elements/1.1/
xmlns:georss	http://www.georss.org/georss/10
xmlns:geo	http://a9.com/-/opensearch/extensions/geo/1.0/
xmlns:time	http://a9.com/-/opensearch/extensions/time/1.0/
xmlns:cwic	http://cwic.wgiss.ceos.org/opensearch/extensions/1.0/
esipdiscover	http://commons.esipfed.org/ns/discovery/1.2/

Table 3 Table of CWIC OpenSearch namespaces

ATOM <feed> element

Element	Value
atom: title	Fixed value, which is ‘CWIC OpenSearch Response’
atom: updated	Date tag indicating when granule metadata is returned from data provider
atom: author	Fixed value, which is the contact information of CWIC team, *e.g.* <author> <name>CEOS WGISS Integrated Catalog (CWIC) - CWIC Contact - Email: cwic-help@wgiss.ceos.org - Web: http://wgiss.ceos.org/cwic</name> <email>cwic-help@wgiss.ceos.org</email> </author>

[4] Atom syndication format (http://tools.ietf.org/search/rfc4287)

atom: id	Fixed value. *e.g.* http://cwic.wgiss.ceos.org/opensearch/granules.atom
opensearch: totalResults	Number of records matched
opensearch: startPage	Number of start page desired by client
opensearch: itemsPerPage	Actual number of returned items per page
opensearch: Query	Query element recording actual request parameter values from client
atom: link	Traversal link. Supported 'rel' attribute values include: first: link to the first granule last: link to the last granule previous: link to previous granule, where applicable next: link to next granule, where applicable search: link to CWIC OSDD endpoint self: link of submitted CWIC OpenSearch request

Table 4 Table of Atom <feed> element

ATOM <entry> element

Element	Value
atom: title	Descriptive title for the granule
atom: id	Unique identifier of the granule within the CWIC system
atom: updated	Date tag indicating when granule metadata is last updated by data provider
atom: author	Fixed value, which is the contact information of data provider
spatial extent elements	For each granule, at least one <georss:box> will be provided to represent the minimum bounding rectangle of spatial extents of granule. <georss:box> is formatted with coordinate order of WestBoundingLongitude, SouthBoundingLatitude, EastBoundingLongitude, NorthBoundingLatitude. All coordinates are in EPSG:4326 If <georss:polygon> will also be provided if it is available in data provider's metadata.
temporal element	For each granule, a single <dc:date> element will be provided to represent the temporal extent of granule. *e.g.* 1989-10-19T00:00:00.000Z/1989-10-21T23:59:59.000Z
atom: link	Supported values under 'rel' attribute: via/enclosure/alternate/icon Detailed information refers to Table 6
atom: summary	Summary descriptive text for the granule

Table 5 Table of Atom <entry> element

'rel' attributes under ATOM <link> element

'rel' attribute	Artifact
via	Metadata
icon	Browse
alternate	Documentation
enclosure	Product

Table 6 Table of 'rel' attributes

7. CWIC Client Partner Implementation Outline

All CWIC clients are, at their core, just conventional OpenSearch clients with a few extensions and conventions to make the CWIC OpenSearch protocol useful in the CWIC environment. The IDN identifier of the dataset of interest is a mandatory element in CWIC OpenSearch request. Clients could retrieve the dataset ID from the IDN OpenSearch Description Document (OSDD).

This chapter will give brief steps about how to retrieve an IDN dataset ID and how to interact with CWIC server for inventory search. The corresponding details are elaborated in the chapter of Use Case.

Data providers in CWIC have registered the metadata of their archived datasets into the IDN. The client can query the IDN to retrieve the IDN dataset ID for a desired dataset of interest and, based on that dataset ID and other spatial-temporal query conditions, build a valid CWIC OpenSearch query. The following steps describe the client search scenario starting with IDN OpenSearch. Please notice that clients could alternatively execute collection-level query against the IDN CSW search based on both web portal and CSW interface.

1) Obtain the IDN OpenSearch OSDD to formulate a valid IDN OpenSearch request.

```
https://cmr.earthdata.nasa.gov/opensearch/collections/descriptor_document.xml?clientId=cswOpenSearchDoc
```

Fig. 4 Example of IDN OpenSearch OSDD request

2) Search datasets of interest through IDN OpenSearch with proper request parameters (*e.g.* spatial footprint, temporal extent and keyword).

```
https://cmr.earthdata.nasa.gov/opensearch/collections.atom?keyword=Landsat*&isCwic=true&numberOfResults=10&clientId=cswOpenSearchDoc
```

Fig. 5 Example of IDN OpenSearch request

3) With the IDN OpenSearch response, select the dataset ID for dataset of interest by parsing <dc:identifier> element URI. Obtain the CWIC OSDD endpoint for the dataset by parsing the href attribute in <link rel="search">.

```
<feed xmlns="http://www.w3.org/2005/Atom" xmlns:dc="http://purl.org/dc/terms/">
    <entry>
        …
            <dc:identifier>
              http://cwic.wgiss.ceos.org/opensearch/granules.atom/?datasetId=C1235542031-USGS_LTA
            </dc:identifier>
        …
```

```
                <link
href="http://cwic.wgiss.ceos.org/opensearch/datasets/C1235542031-USGS_LTA/osdd.xml?clientId=csw
OpenSearchDoc"
    hreflang="en-US"
    type="application/opensearchdescription+xml"
    rel="search"
    title="CWIC Granule Open Search Descriptor Document"/>
        …
    </entry>
</feed>
```

Fig.6 Example of IDN OpenSearch response

4) Based on the CWIC OSDD, formulate a CWIC OpenSearch request for granules belonging to that dataset.

```
http://cwic.wgiss.ceos.org/opensearch/granules.atom?datasetId=C1235542031-USGS_LTA&startPage=
1&count=10&timeStart=2000-02-24T00:00:00Z&timeEnd=2014-02-19T00:00:00Z&geoBox=-180,-90,
180,90&clientId=cwicClient
```

Fig. 7 Example of CWIC OpenSearch request

8. Use Case

This chapter provides a comprehensive and detailed process about how to implement a CWIC OpenSearch client, which includes how to retrieve the IDN dataset ID for the dataset of interest, and how to build an OpenSearch request.

Technically, CWIC clients could acquire the IDN dataset ID from the IDN OpenSearch or the IDN CSW search (*i.e.* web portal and CSW interface). This chapter will only describe how to retrieve IDN dataset ID from the IDN OpenSearch in details. Acquiring IDN dataset ID from the IDN CSW search is covered in CWIC Client Partner Guide (CSW)[5].

8.1. Retrieve IDN Dataset ID from IDN OpenSearch

Use Case Overview	
Title	CWIC Clients start from the IDN OpenSearch
Description	This use case describes steps for retrieving a dataset ID from the IDN OpenSearch.
Actors	CWIC client
Initial Status and Preconditions	CWIC clients have the IDN OpenSearch access URL.

Table 7 Use Case: Retrieve Dataset ID from IDN OpenSearch

The following steps describe this use case.

Step 1: Obtain IDN OpenSearch OSDD to formulate a valid IDN OpenSearch request.

```
https://cmr.earthdata.nasa.gov/opensearch/collections/descriptor_document.xml?clientId=cswOpenSearchDoc
```

Fig. 8 Example of IDN OpenSearch OSDD request

Step 2: Search datasets of interest through IDN OpenSearch with proper request parameters (e.g. spatial footprint, temporal extent and keyword). A complete list of supported request parameters, extracted from the IDN OpenSearch OSDD, is listed as follow:

```
<os:OpenSearchDescription xmlns:os="http://a9.com/-/spec/opensearch/1.1/"
      xmlns:echo="http://www.echo.nasa.gov/esip"
      xmlns:geo="http://a9.com/-/opensearch/extensions/geo/1.0/"
      xmlns:time="http://a9.com/-/opensearch/extensions/time/1.0/"
      xmlns:esipdiscovery="http://commons.esipfed.org/ns/discovery/1.2/" esipdiscovery:version="1.2"
      xmlns:params="http://a9.com/-/spec/opensearch/extensions/parameters/1.0/"
      xmlns:referrer="http://www.opensearch.org/Specifications/OpenSearch/Extensions/Referrer/1.0"
      xmlns:eo="http://a9.com/-/opensearch/extensions/eo/1.0/"
      xmlns:atom="http://www.w3.org/2005/Atom" >
```

[5] CWIC Client Partner Guide (CSW): CWIC-DOC-12-006r1

…
<os:Url type="application/atom+xml" rel="collection" params:method="GET" template="https://cmr.earthdata.nasa.gov/opensearch/collections.atom?keyword={os:searchTerms?}&instrument={echo:instrument?}&satellite={eo:platform?}&boundingBox={geo:box?}&geometry={geo:geometry?}&placeName={geo:name?}&startTime={time:start?}&endTime={time:end?}&cursor={os:startPage?}&numberOfResults={os:count?}&offset={os:startIndex?}&uid={geo:uid?}&hasGranules={echo:hasGranules?}&isCwic={echo:isCwic?}&isGeoss={echo:isGeoss?}&isEosdis={echo:isEosdis?}&clientId=cswOpenSearchDoc">
<params:Parameter name="keyword" uiDisplay="Search terms" value="{os:searchTerms}" title="Inventory with terms expressed by these search terms" minimum="0">
<atom:link rel="profile" href="http://www.elasticsearch.org/guide/en/elasticsearch/reference/current/query-dsl-query-string-query.html" title="This parameter follows the elastic search free text search implementations"/>
</params:Parameter>
<params:Parameter name="instrument" uiDisplay="Instrument" value="{echo:instrument}" title="Inventory associated with a satellite instrument expressed by this short name" minimum="0"/>
<params:Parameter name="satellite" uiDisplay="Satellite" value="{eo:platform}" title="Inventory associated with a Satellite/platform expressed by this short name" minimum="0"/>
<params:Parameter name="boundingBox" uiDisplay="Bounding box" value="{geo:box}" title="Inventory with a spatial extent overlapping this bounding box" minimum="0"/>
<params:Parameter name="geometry" uiDisplay="Geometry" value="{geo:geometry}" title="Inventory with a spatial extent overlapping this geometry" minimum="0">
<atom:link rel="profile" href="http://www.opengis.net/wkt/LINESTRING" title="This service accepts WKT LineStrings"/>
<atom:link rel="profile" href="http://www.opengis.net/wkt/POINT" title="This service accepts WKT Points"/>
<atom:link rel="profile" href="http://www.opengis.net/wkt/POLYGON" title="This service accepts WKT Polygons"/>
</params:Parameter>
<params:Parameter name="placeName" uiDisplay="Place name" value="{geo:name}" title="Inventory with a spatial location described by this name" minimum="0"/>
<params:Parameter name="startTime" uiDisplay="Start time" value="{time:start}" title="Inventory with a temporal extent containing this start time" minimum="0"/>
<params:Parameter name="endTime" uiDisplay="End time" value="{time:end}" title="Inventory with a temporal extent containing this end time" minimum="0"/>
<params:Parameter name="cursor" uiDisplay="Start page" value="{os:startPage}" title="Start page for the search result" minimum="0"/>
<params:Parameter name="numberOfResults" uiDisplay="Number of results" value="{os:count}" title="Maximum number of records in the search result" minimum="0" maxInclusive="2000"/>
<params:Parameter name="offset" uiDisplay="Start index" value="{os:startIndex}" title="0-based offset used to skip the specified number of results in the search result set" minimum="0"/>
<params:Parameter name="uid" uiDisplay="Unique identifier" value="{geo:uid}" title="Inventory associated with this unique ID" minimum="0"/>

```
    <params:Parameter name="hasGranules" uiDisplay="Has granules" value="{echo:hasGranules}"
title="Inventory with granules">
        <params:Option value="true" label="Yes"/>
        <params:Option value="false" label="No"/>
    </params:Parameter>
    <params:Parameter name="isCwic" uiDisplay="CWIC collection" value="{echo:isCwic}"
title="Inventory related to CWIC">
        <params:Option value="true" label="Yes"/>
    </params:Parameter>
    <params:Parameter name="isGeoss" uiDisplay="GEOSS collection" value="{echo:isGeoss}"
title="Inventory related to GEOSS">
        <params:Option value="true" label="Yes"/>
    </params:Parameter>
    <params:Parameter name="isEosdis" uiDisplay="EOSDIS collection" value="{echo:isEosdis}"
title="Inventory related to EOSDIS">
        <params:Option value="true" label="Yes"/>
    </params:Parameter>
    <params:Parameter name="clientId" uiDisplay="Client identifier" value="{referrer:source}"
title="Client identifier to be used for metrics" minimum="0"/>
</os:Url>
    …
</os:OpenSearchDescription>
```

Fig. 9 Example of supported IDN OpenSearch request parameters

An example request can be formed as follows.

```
https://cmr.earthdata.nasa.gov/opensearch/collections.atom?keyword=Landsat_8&isCwic=tru
e&numberOfResults=10&clientId=cswOpenSearchDoc
```

Step 3: From the IDN OpenSearch response, select the dataset ID for dataset of interest by parsing <dc:identifier> element. Obtain CWIC OSDD endpoint for the dataset by parsing the href attribute under <link rel="search"> element.

```
<feed xmlns="http://www.w3.org/2005/Atom" xmlns:dc="http://purl.org/dc/terms/" >
    <entry>
        …
            <dc:identifier>
          http://cwic.wgiss.ceos.org/opensearch/granules.atom/?datasetId=C1235542031-USGS_LTA
            </dc:identifier>
        …
            <link
    href="http://cwic.wgiss.ceos.org/opensearch/datasets/C1235542031-USGS_LTA/osdd.xml?clientId
=cswOpenSearchDoc"
    hreflang="en-US"
```

```
        type="application/opensearchdescription+xml"
        rel="search"
        title="CWIC Granule Open Search Descriptor Document"/>
            …
        </entry>
</feed>
```

Fig. 10 Example of IDN OpenSearch Response

8.2. Interact with CWIC Server

After retrieving the dataset ID by querying through the IDN OpenSearch, CWIC OpenSearch clients will sequentially interact with CWIC server for inventory search. The following table shows the basic information about the use case of interacting with CWIC OpenSearch.

Use Case Overview	
Title	Interact with CWIC server for inventory search
Description	This use case describes steps for executing inventory search based on the IDN dataset ID of interest.
Actors	CWIC client
Initial Status and Preconditions	CWC clients have acquired IDN dataset ID. CWIC clients have the dataset specific OSDD.

Table 8 Use Case: Interact with CWIC Server

Step 1: Obtain the dataset specific OSDD by dataset ID

```
http://cwic.wgiss.ceos.org/opensearch/datasets/C1235542031-USGS_LTA/osdd.xml?clientId=cwicClient
```

Fig. 11 Example of CWIC dataset specific OSDD request

Step 2: Based on the OSDD, formulate an OpenSearch request for granules belonging to that dataset.

```
http://cwic.wgiss.ceos.org/opensearch/granules.atom?datasetId=C1235542031-USGS_LTA&startPage=1&count=10&timeStart=2000-02-24T00:00:00Z&timeEnd=2014-02-19T00:00:00Z&geoBox=-180,-90,180,90&clientId=cwicClient
```

Fig. 12 Example of OpenSearch request

Step 3: Parse the OpenSearch response and extract the identifier for the granule of interest from <id> element.

```
<feed xmlns="http://www.w3.org/2005/Atom">
    <entry>
        …
    <id>http://cwic.wgiss.ceos.org/opensearch/granules.atom?uid=C1235542031-USGS_LTA:Landsat_8:LC81300472013101LGN01</id>
    </entry>
```

```
</feed>
```

Fig. 13 Example of CWIC OpenSearch response

9. Abbreviations and Glossary

Term	Meaning
AOE	Academy of Optic-Electronic (AOE) of Chinese Academy of Science
CCRS	Canada Centre for Remote Sensing (now CCMEO)
CEOS	Committee on Earth Observation Satellites
CLASS	Comprehensive Large Array-data Stewardship System
CSW	OpenGIS Catalog Service for Web
CCMEO	Canada Center for Mapping and Earth Observation
CWIC	CEOS WGISS Integrated Catalog
CMR	NASA Common Metadata Repository
CWIC DEV	CWIC development instance
CWIC PROD	CWIC operational instance
CWIC TEST	CWIC public testing instance
GHRSST	Group for High Resolution Sea Surface Temperature
IDN	International Directory Network
INPE	Instituto Nacional de Pesquisas Espaciais (National Institute For Space Research, Brazil)
ISRO	Indian Space Research Organisation
JAXA	Japan Aerospace Exploration Agency
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanographic Data Center
OGC	Open Geospatial Consortium
USGS	U.S. Geological Survey
WGISS	Working Group on Information Systems and Services