Distributed Data Framework Architecture

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Developers build or extend the functionality of the applications.

DDF includes several extension points where external developers can add functionality to support individual use cases.

DDF is written in Java and uses many open source libraries. DDF uses OSGi to provide modularity, lifecycle management, and dynamic services. OSGi services can be installed and uninstalled while DDF is running. DDF development typically means developing new OSGi bundles and deploying them to the running DDF. A complete description of OSGi is outside the scope of this documentation. For more information about OSGi, see the OSGi Alliance website.

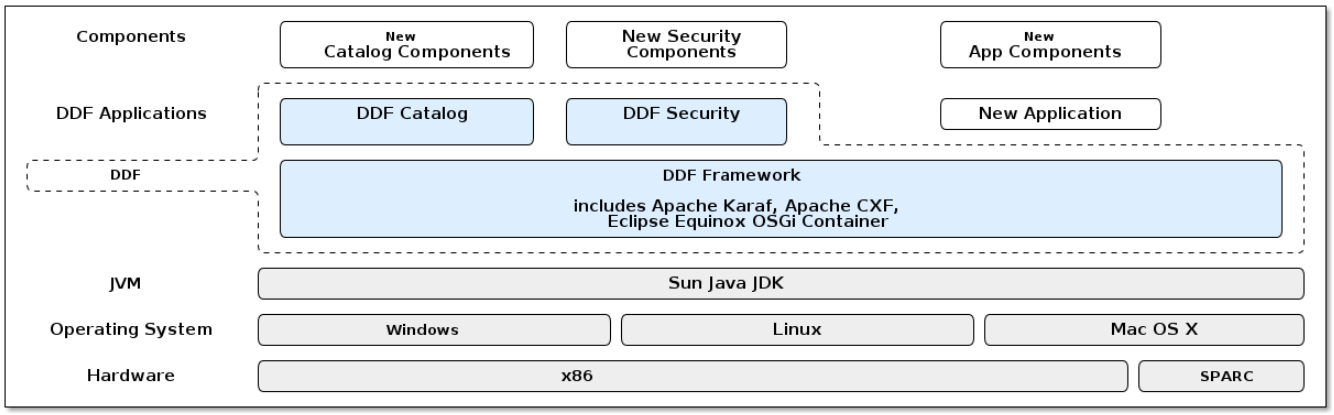


Figure 1. Architecture Diagram

IMPORTANT	If developing for a Highly Available Cluster of DDF, see High Availability Guidance.

1. Catalog Framework API

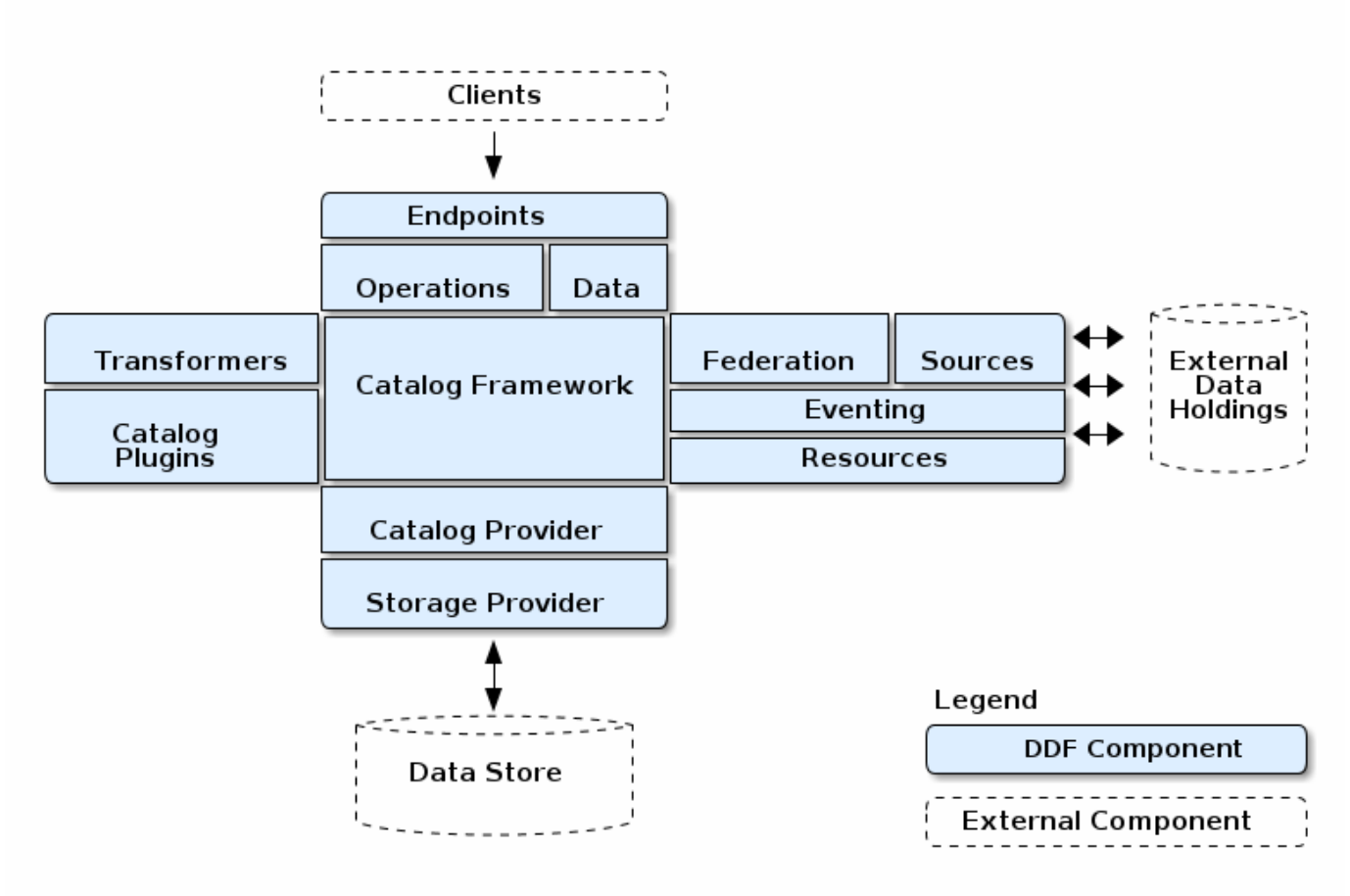


Figure 2. Catalog Architecture

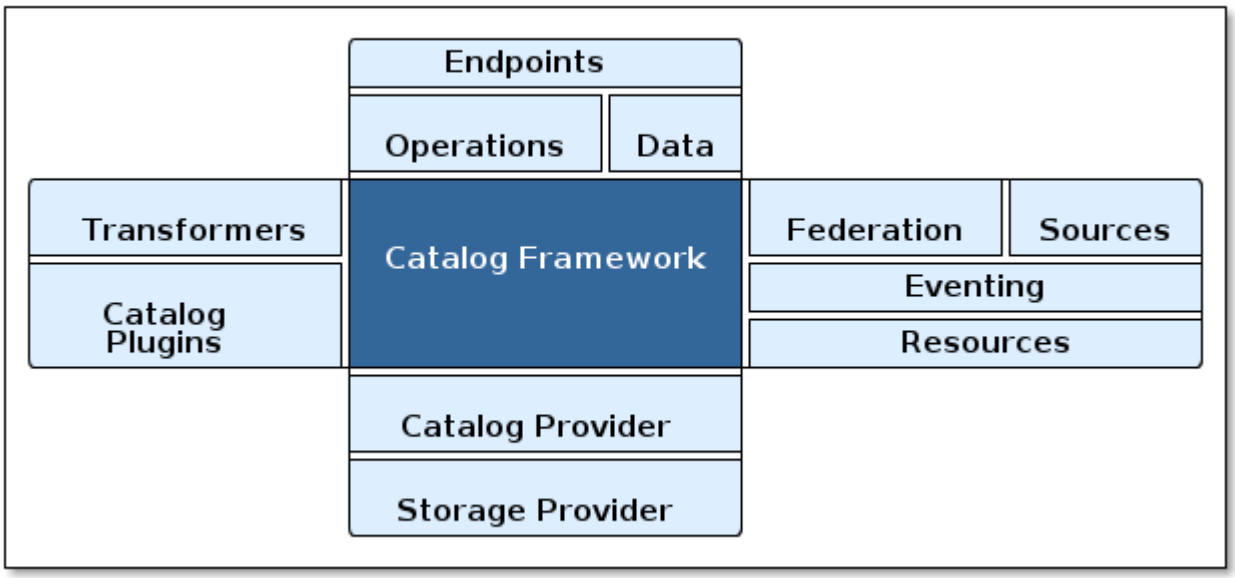


Figure 3. Catalog Framework Architecture

The `CatalogFramework` is the routing mechanism between catalog components that provides integration points for the Catalog Plugins. An endpoint invokes the active Catalog Framework, which calls any

configured Pre-query or Pre-ingest plug-ins. The selected federation strategy calls the active Catalog Provider and any connected or federated sources. Then, any Post-query or Post-ingest plug-ins are invoked. Finally, the appropriate response is returned to the calling endpoint.

The Catalog Framework wires all Catalog components together.

It is responsible for routing Catalog requests and responses to the appropriate target.

Endpoints send Catalog requests to the Catalog Framework. The Catalog Framework then invokes Catalog Plugins, Transformers, and Resource Components as needed before sending requests to the intended destination, such as one or more Sources.

The Catalog Framework decouples clients from service implementations and provides integration points for Catalog Plugins and convenience methods for Endpoint developers.

2. Catalog API Design

The Catalog is composed of several components and an API that connects them together. The Catalog API is central to DDF's architectural qualities of extensibility and flexibility. The Catalog API consists of Java interfaces that define Catalog functionality and specify interactions between components.

These interfaces provide the ability for components to interact without a dependency on a particular underlying implementation, thus allowing the possibility of alternate implementations that can maintain interoperability and share developed components. As such, new capabilities can be developed independently, in a modular fashion, using the Catalog API interfaces and reused by other DDF installations.

2.1. Ensuring Compatibility

The Catalog API evolves, but great care is taken to retain backwards compatibility with developed components. Compatibility is reflected in version numbers.

2.2. Catalog Framework Sequence Diagrams

Because the Catalog Framework plays a central role to Catalog functionality, it interacts with many different Catalog components. To illustrate these relationships, high-level sequence diagrams with notional class names are provided below. These examples are for illustrative purposes only and do not necessarily represent every step in each procedure.

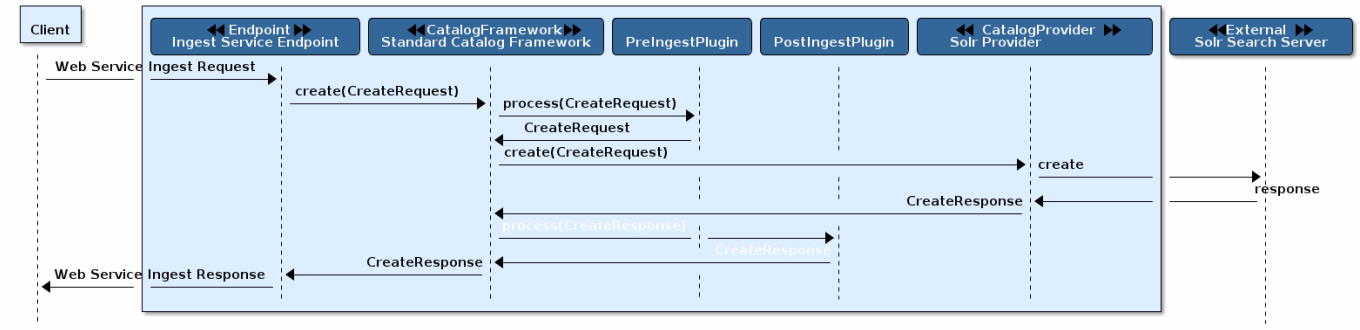


Figure 4. Ingest Request Data Flow

The Ingest Service Endpoint, the Catalog Framework, and the Catalog Provider are key components of the Reference Implementation. The Endpoint bundle implements a Web service that allows clients to create, update, and delete metacards. The Endpoint calls the `CatalogFramework` to execute the operations of its specification. The `CatalogFramework` routes the request through optional `PreIngest` and `PostIngest` Catalog Plugins, which may modify the ingest request/response before/after the Catalog Provider executes the ingest request and provides the response. Note that a `CatalogProvider` must be present for any ingest requests to be successfully processed, otherwise a fault is returned.

This process is similar for updating catalog entries, with update requests calling the `update(UpdateRequest)` methods on the Endpoint, `CatalogFramework`, and Catalog Provider. Similarly, for deletion of catalog entries, the delete requests call the `delete(DeleteRequest)` methods on the `Endpoint`, `CatalogFramework`, and `CatalogProvider`.

2.2.1. Error Handling

Any ingest attempts that fail inside the Catalog Framework (whether the failure comes from the Catalog Framework itself, pre-ingest plugin failures, or issues with the Catalog Provider) are logged to a separate log file for ease of error handling. The file is located at `<DDF_HOME>/data/log/ingest_error.log` and it logs the Metacards that fail, their ID and Title name, and the stack trace associated with their failure. By default, successful ingest attempts are not logged. However, that functionality can be achieved by setting the log level of the `ingestLogger` to DEBUG (note that enabling DEBUG can cause a non-trivial performance hit).

TIP

To turn off logging failed ingest attempts into a separate file, execute the following via the command line console

```
log:set
 ERROR ingestLogger
```

2.2.2. Query

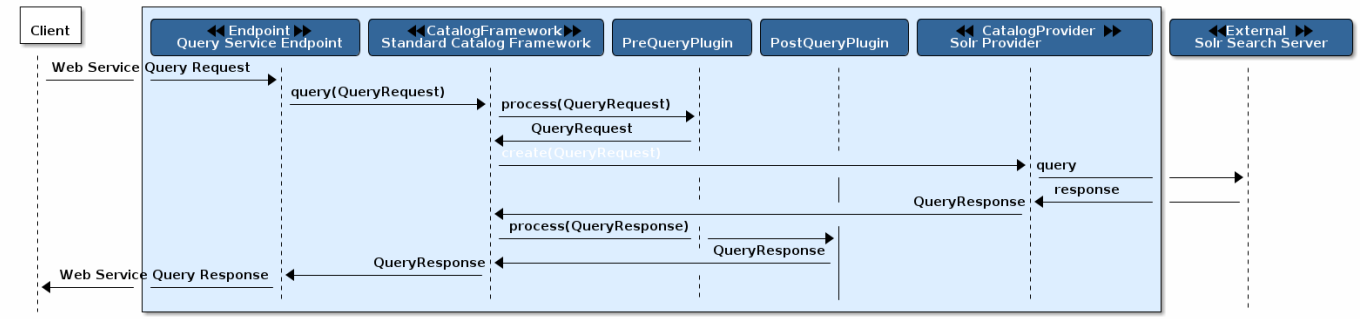


Figure 5. Query Request Data Flow

The Query Service Endpoint, the Catalog Framework, and the `CatalogProvider` are key components for processing a query request as well. The Endpoint bundle contains a Web service that exposes the interface to query for `Metacards`. The Endpoint calls the `CatalogFramework` to execute the operations of its specification. The `CatalogFramework` relies on the `CatalogProvider` to execute the actual query. Optional PreQuery and PostQuery Catalog Plugins may be invoked by the `CatalogFramework` to modify the query request/response prior to the Catalog Provider processing the query request and providing the query response. If a `CatalogProvider` is not configured, and no other remote Sources are configured, a fault is returned. It is possible to have only remote Sources configured and no local `CatalogProvider` configured and be able to execute queries to specific remote Sources by specifying the site names in the query request.

2.2.3. Product Caching

The Catalog Framework optionally provides caching of products, so future requests to retrieve the same product are serviced much quicker. If caching is enabled, each time a retrieve product request is received, the Catalog Framework looks in its cache (default location `<DDF_HOME>/data/product-cache`) to see if the product has been cached locally. If it has, the product is retrieved from the local site and returned to the client, providing a much quicker turnaround because remote product retrieval and network traffic was avoided. If the requested product is not in the cache, the product is retrieved from the Source (local or remote) and cached locally while returning the product to the client. The caching to a local file of the product and the streaming of the product to the client are done simultaneously so that the client does not have to wait for the caching to complete before receiving the product. If errors are detected during the caching, caching of the product is abandoned, and the product is returned to the client.

The Catalog Framework attempts to detect any network problems during the product retrieval, for example, long pauses where no bytes are read implying a network connection was dropped. (The amount of time defined as a "long pause" is configurable, with the default value being five seconds.) The Catalog Framework attempts to retrieve the product up to a configurable number of times (default = three), waiting for a configurable amount of time (default = 10 seconds) between each attempt, trying to successfully retrieve the product. If the Catalog Framework is unable to retrieve the product, an error message is returned to the client.

If the admin has enabled the **Always Cache When Canceled** option, caching of the product occurs

even if the client cancels the product retrieval so that future requests are serviced quickly. Otherwise, caching is canceled if the user cancels the product download.

2.2.4. Product Download Status

As part of the caching of products, the Catalog Framework also posts events to the OSGi notification framework. Information includes when the product download started, whether the download is retrying or failed (after the number of retrieval attempts configured for product caching has been exhausted), and when the download completes. These events are retrieved by the Search UI and presented to the user who initiated the download.

2.2.5. Catalog API

The Catalog API is an OSGi bundle (`catalog-core-api`) that contains the Java interfaces for the Catalog components and implementation classes for the Catalog Framework, Operations, and Data components.

2.2.5.1. Catalog API Search Interfaces

The Catalog API includes two different search interfaces.

Search UI Application Search Interface

The DDF Search UI application provides a graphic interface to return results and locate them on an interactive globe or map.

SSH Search Interface

Additionally, it is possible to use a client script to remotely access DDF via SSH and send console commands to search and ingest data.

2.2.5.2. Catalog Search Result Objects

Data is returned from searches as Catalog Search `Result` objects. This is a subtype of Catalog `Entry` that also contains additional data based on what type of sort policy was applied to the search. Because it is a subtype of Catalog `Entry`, a Catalog Search `Result` has all Catalog `Entry`'s fields such as metadata, effective time, and modified time. It also contains some of the following fields, depending on type of search, that are populated by DDF when the search occurs:

Distance

Populated when a point-radius spatial search occurs. Numerical value that indicates the result's distance from the center point of the search.

Units

Populated when a point-radius spatial search occurs. Indicates the units (kilometer, mile, etc.) for the distance field.

Relevance

Populated when a contextual search occurs. Numerical value that indicates how relevant the text in the result is to the text originally searched for.

2.2.5.3. Search Programmatic Flow

Searching the catalog involves three basic steps:

1. Define the search criteria (contextual, spatial, or temporal).
   a. Optionally define a sort policy and assign it to the criteria.
   b. For contextual search, optionally set the `fuzzy` flag to `true` or `false` (the default value for the `Metadata Catalog fuzzy` flag is `true`, while the `portal` default value is `false`).
   c. For contextual search, optionally set the `caseSensitive` flag to true (the default is that `caseSensitive` flag is NOT set and queries are not case sensitive). Doing so enables case sensitive matching on the search criteria. For example, if `caseSensitive` is set to true and the phrase is "Baghdad" then only metadata containing "Baghdad" with the same matching case is returned. Words such as "baghdad", "BAGHDAD", and "baghDad" are not returned because they do not match the exact case of the search term.
2. Issue a search.
3. Examine the results.

2.2.5.4. Sort Policies

Searches can also be sorted according to various built-in policies. A sort policy is applied to the search criteria after its creation but before the search is issued. The policy specifies to the DDF the order the Catalog search results should be in when they are returned to the requesting client. Only one sort policy may be defined per search.

There are three policies available.

Table 1. Sort Policies

Sort Policy	Sorts By	Default Order	Available for
Temporal	The catalog search result's effective time field	Newest to oldest	All Search Types
Distance	The catalog search result's distance field	Nearest to farthest	Point-Radius Spatial searches
Relevance	The catalog search result's relevance field	Most to least relevant	Contextual

If no sort policy is defined for a particular search, the temporal policy is automatically applied.

2.2.5.5. Product Retrieval

The DDF is used to catalog resources. A Resource is a URI-addressable entity that is represented by a Metacard. Resources may exist either locally or on a remote data store.

Examples of Resources

- NITF image
- MPEG video
- Live video stream
- Audio recording
- Document

Product Retrieval Services

- SOAP Web services
- DDF JSON
- DDF REST

The Query Service Endpoint, the Catalog Framework, and the `CatalogProvider` are key components for processing a retrieve resource request. The Endpoint bundle contains a Web service that exposes the interface to retrieve resources. The Endpoint calls the `CatalogFramework` to execute the operations of its specification. The `CatalogFramework` relies on the Sources to execute the actual resource retrieval. Optional `PreResource` and `PostResource` Catalog Plugins may be invoked by the `CatalogFramework` to modify the resource retrieval request/response prior to the Catalog Provider processing the request and providing the response. It is possible to retrieve resources from specific remote Sources by specifying the site names in the request.

Product Caching

Product Caching is enabled by default. Existing DDF clients are able to leverage product caching due to the product cache being implemented in the DDF.

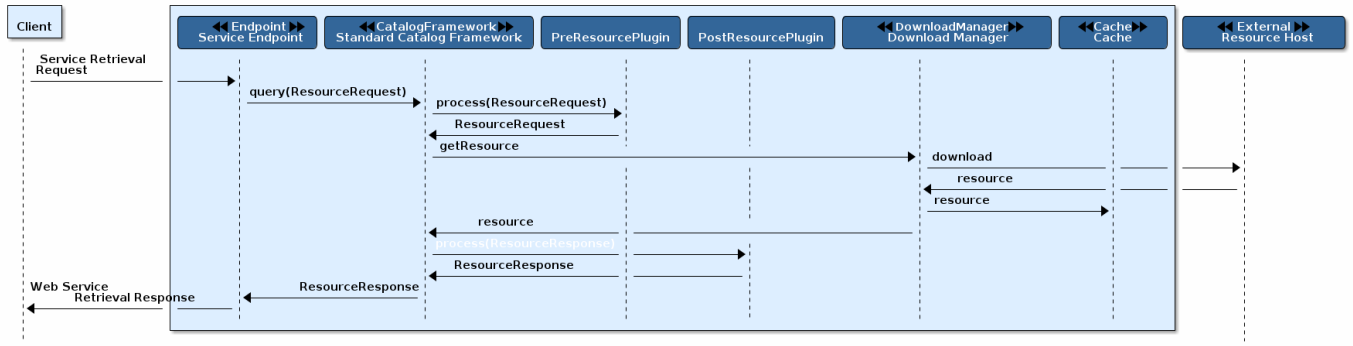


Figure 6. Product Retrieval Request

2.2.5.6. Notifications and Activities

DDF can send/receive notifications of "Activities" occurring in the system.

Currently, the notifications provide information about resource retrieval only.

Activity events include the status and progress of actions that are being performed by the user, such as searches and downloads.

2.3. Included Catalog Frameworks, Associated Components, and Configurations

These catalog frameworks are available in a standard DDF installation:

Standard Catalog Framework

Reference implementation of a Catalog Framework that implements all requirements of the Catalog API.

Catalog Framework Camel Component

Supports creating, updating, and deleting metacards using the Catalog Framework from a Camel route.

2.3.1. Standard Catalog Framework

The Standard Catalog Framework provides the reference implementation of a Catalog Framework that implements all requirements of the Catalog API. `CatalogFrameworkImpl` is the implementation of the DDF Standard Catalog Framework.

The Standard Catalog Framework is the core class of DDF. It provides the methods for create, update, delete, and resource retrieval (CRUD) operations on the `Sources`. By contrast, the Fanout Catalog Framework only allows for query and resource retrieval operations, no catalog modifications, and all queries are enterprise-wide.

Use this framework if:

- access to a catalog provider is required to create, update, and delete catalog entries.
- queries to specific sites are required.
- queries to only the local provider are required.

It is possible to have only remote Sources configured with no local `CatalogProvider` configured and be able to execute queries to specific remote sources by specifying the site names in the query request.

The Standard Catalog Framework also maintains a list of `ResourceReaders` for resource retrieval operations. A resource reader is matched to the scheme (the protocol, such as `file://`) in the URI of the resource specified in the request to be retrieved.

Site information about the catalog provider and/or any federated sources can be retrieved using the Standard Catalog Framework. Site information includes the source's name, version, availability, and the list of unique content types currently stored in the source (such as NITF). If no local catalog provider is configured, the site information returned includes site info for the catalog framework with no content types included.

2.3.1.1. Installing the Standard Catalog Framework

The Standard Catalog Framework is bundled as the `catalog-core-standardframework` feature and can be installed and uninstalled using the normal processes described in Configuration.

2.3.1.2. Configuring the Standard Catalog Framework

These are the configurable properties on the Standard Catalog Framework.

See Catalog Standard Framework configurations for all possible configurations.

Table 2. Standard Catalog Framework Exported Services

Registered Interface	Service Property	Value
`ddf.catalog.federation.FederationStrategy`	shortname	`sorted`
`org.osgi.service.event.EventHandler`	event.topics	`ddf/catalog/event/CREATED`, `ddf/catalog/event/UPDATED`, `ddf/catalog/event/DELETED`
`ddf.catalog.CatalogFramework`		
`ddf.catalog.event.EventProcessor`		
`ddf.catalog.plugin.PostIngestPlugin`		

Table 3. Standard Catalog Framwork Imported Services

Registered Interface	Availability	Multiple
`ddf.catalog.plugin.PostFederatedQueryPlugin`	optional	`true`
`ddf.catalog.plugin.PostIngestPlugin`	optional	`true`
`ddf.catalog.plugin.PostQueryPlugin`	optional	`true`
`ddf.catalog.plugin.PostResourcePlugin`	optional	`true`
`ddf.catalog.plugin.PreDeliveryPlugin`	optional	`true`
`ddf.catalog.plugin.PreFederatedQueryPlugin`	optional	`true`
`ddf.catalog.plugin.PreIngestPlugin`	optional	`true`
`ddf.catalog.plugin.PreQueryPlugin`	optional	`true`
`ddf.catalog.plugin.PreResourcePlugin`	optional	`true`
`ddf.catalog.plugin.PreSubscriptionPlugin`	optional	`true`

Registered Interface	Availability	Multiple
`ddf.catalog.plugin.PolicyPlugin`	optional	`true`
`ddf.catalog.plugin.AccessPlugin`	optional	`true`
`ddf.catalog.resource.ResourceReader`	optional	`true`
`ddf.catalog.source.CatalogProvider`	optional	`true`
`ddf.catalog.source.ConnectedSource`	optional	`true`
`ddf.catalog.source.FederatedSource`	optional	`true`
`ddf.cache.CacheManager`		`false`
`org.osgi.service.event.EventAdmin`		`false`

2.3.1.3. Known Issues with Standard Catalog Framework

None.

2.3.2. Catalog Framework Camel Component

The Catalog Framework Camel Component supports creating, updating, and deleting metacards using the Catalog Framework from a Camel route.

URI Format

```
catalog:framework
```

Table 4. Catalog Framework Producer Message Headers

Header	Description
operation	the operation to perform using the Catalog Framework (possible values are CREATE | UPDATE | DELETE)

2.3.2.1. Sending Messages to Catalog Framework Endpoint

Catalog Framework Producer

In Producer mode, the component provides the ability to supply different inputs and have the Catalog Framework perform different operations based upon the header values.

For the CREATE and UPDATE operation, the message body can contain a list of metacards or a single metacard object.

For the DELETE operation, the message body can contain a list of strings or a single string object. The string objects represent the IDs of metacards to be deleted. The exchange's "in" message is set with the affected metacards. In the case of a CREATE, it is updated with the created metacards. In the case of the UPDATE, it is updated with the updated metacards and with the DELETE it contains the deleted

metacards.

Table 5. Catalog Framework Camel Component Operations

Header	Message Body (Input)	Exchange Modification (Output)
operation = CREATE	List<Metacard> or Metacard	exchange.getIn().getBody() updated with List of Metacards created
operation = UPDATE	List<Metacard> or Metacard	exchange.getIn().getBody() updated with List of Metacards updated
operation = DELETE	List<String> or String (representing metacard IDs)	exchange.getIn().getBody() updated with List of Metacards deleted

NOTE If there is an exception thrown while the route is being executed, a `FrameworkProducerException` is thrown causing the route to fail with a CamelExecutionException.

Example Route

This example demonstrates:

1. Reading in some sample data from the file system.
2. Using a Java bean to convert the data into a metacard.
3. Setting a header value on the Exchange.
4. Sending the Metacard to the Catalog Framework component for ingesting.

```
<route>
 <from uri="file:data/sampleData?noop=true/>
    <bean ref="sampleDataToMetacardConverter" method="covertToMetacard"/>\
   <setHeader name="operation">
  <constant>CREATE</constant>
 </setHeader>
    <to uri="catalog:framework"/>
</route>
```

3. Transformers

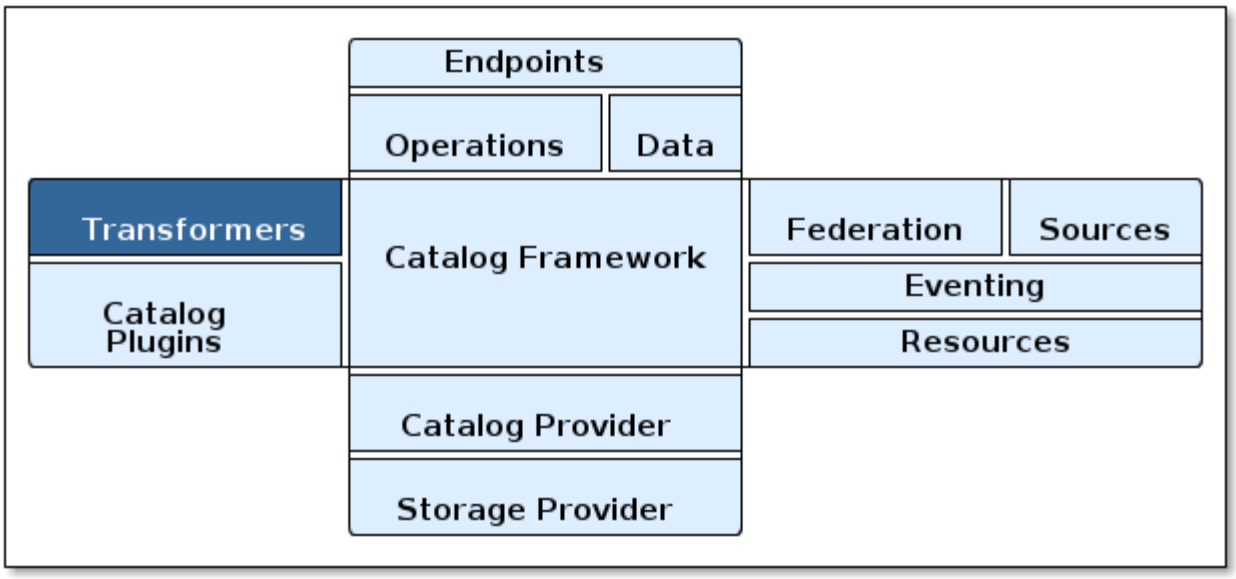


Figure 7. Transformers

Transformers transform data to and from various formats. Transformers are categorized by when they are invoked and used. The existing types are Input transformers, Metacard transformers, and Query Response transformers. Additionally, XSLT transformers are provided to aid in developing custom, lightweight Metacard and Query Response transformers.

Transformers are utility objects used to transform a set of standard DDF components into a desired format, such as into PDF, GeoJSON, XML, or any other format. For instance, a transformer can be used to convert a set of query results into an easy-to-read GeoJSON format (GeoJSON Transformer) or convert a set of results into a RSS feed that can be easily published to a URL for RSS feed subscription. Transformers can be registered in the OSGi Service Registry so that any other developer can access them based on their standard interface and self-assigned identifier, referred to as its "shortname." Transformers are often used by endpoints for data conversion in a system standard way. Multiple endpoints can use the same transformer, a different transformer, or their own published transformer.

WARNING	The current transformers only work for UTF-8 characters and do not support Non-Western Characters (for example, Hebrew). It is recommend not to use international character sets, as they may not be displayed properly.

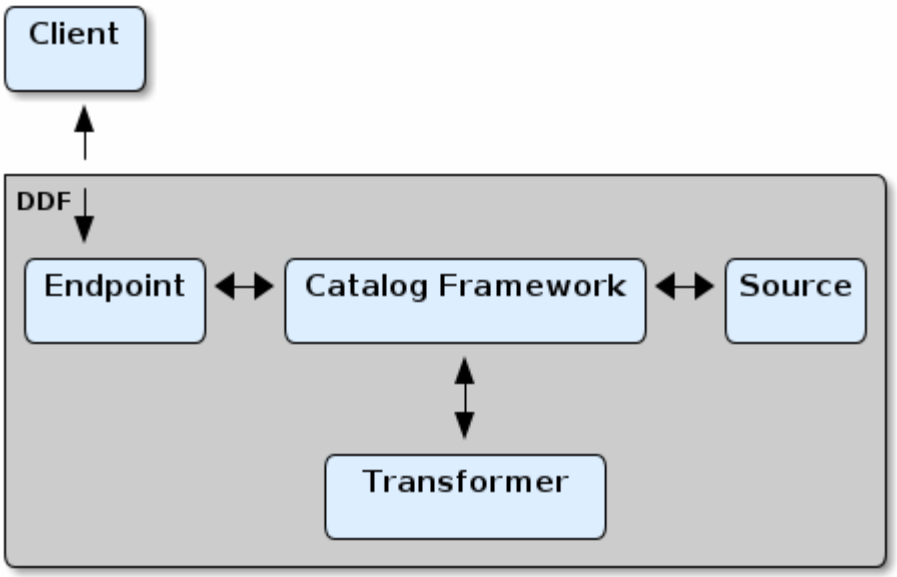


Figure 8. Communication Diagram

Transformers are used to alter the format of a resource or its metadata to or from the catalog's metacard format.

Types of Transformers

Input Transformers

Input Transformers create metacards from input. Once converted to a Metacard, the data can be used in a variety of ways, such as in an `UpdateRequest`, `CreateResponse`, or within Catalog Endpoints or Sources. For instance, an input transformer could be used to receive and translate XML into a Metacard so that it can be placed within a `CreateRequest` to be ingested within the Catalog. Input transformers should be registered within the Service Registry with the interface `ddf.catalog.transform.InputTransformer` to notify Catalog components of any new transformers.

Metacard Transformers

Metacard Transformers translate a metacard from catalog metadata to a specific data format.

Query Response Transformers

Query Response transformers convert query responses into other data formats.

3.1. Available Input Transformers

The following input transformers are available in a standard installation of DDF:

PPTX Input Transformer

Translates Microsoft PowerPoint (OOXML only) documents into Catalog Metacards.

XML Input Transformer

Translates an XML document into a Catalog Metacard.

Tika Input Transformer

Translates Microsoft Word, Microsoft Excel, Microsoft PowerPoint, OpenOffice Writer, and PDF documents into Catalog records.

PDF Input Transformer

Translates a PDF document into a Catalog Metacard.

GeoJSON Input Transformer

Translates GeoJSON into a Catalog metacard.

Video Input Transformer

Creates Catalog metacards from certain video file types.

3.2. Available Metacard Transformers

The following metacard transformers are available in a standard installation of DDF:

Thumbnail Metacard Transformer

Retrieves the thumbnail bytes of a Metacard by returning the `Metacard.THUMBNAIL` attribute value.

XML Metacard Transformer

Translates a metacard into an XML-formatted document.

KML Style Mapper

Maps a KML Style URL to a metacard based on that metacard's attributes.

Metadata Metacard Transformer

returns the `Metacard.METADATA` attribute when given a metacard.

GeoJSON Metacard Transformer

Translates a metacard into GeoJSON.

Resource Metacard Transformer

Retrieves the resource bytes of a metacard by returning the resource associated with the metacard.

KML Metacard Transformer

Translates a metacard into a KML-formatted document.

3.3. Available Query Response Transformers

The following query response transformers are available in a standard installation of DDF:

XML Query Response Transformer

Translates a query response into an XML-formatted document.

Atom Query Response Transformer

Transforms a query response into an Atom 1.0 feed.

CSW Query Response Transformer

Transforms a query response into a CSW-formatted document.

KML Query Response Transformer

Translates a query response into a KML-formatted document.

Query Response Transformer Consumer

Translates a query response into a Catalog Metacard.

GeoJSON Query Response Transformer

Translates a query response into a GeoJSON-formatted document.

3.4. Transformers Details

Availability and configuration details of available transformers.

3.4.1. XML Query Response Transformer

The XML Query Response Transformer is responsible for translating a query response into an XML-formatted document. The metacard element generated is an extension of `gml:AbstractFeatureCollectionType`, which makes the output of this transformer GML 3.1.1 compatible.

3.4.1.1. Installing the XML Query Response Transformer

This transformer is installed by default with a standard installation in the Catalog application. To uninstall, uninstall the `catalog-transformer-xml` feature.

3.4.1.2. Configuring the XML Query Response Transformer

To configure the XML Query Response Transformer:

1. Navigate to the **Admin Console**.
2. Select the **Catalog** application.
3. Select the **Configuration** tab.
4. Select the XML Query Response Transformer.

See XML Query Response Transformer configurations for all possible configurations.

3.4.1.3. Using the XML Query Response Transformer

Using the OpenSearch Endpoint, for example, query with the format option set to the XML shortname `xml`.

XML Query Response Transformer Query Example

```
http://{FQDN}:{PORT}/services/catalog/query?q=input?format=xml
```

XML Query Response Transformer Example Output

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ns3:metacards xmlns:ns1="http://www.opengis.net/gml" xmlns:ns2=
"http://www.w3.org/1999/xlink" xmlns:ns3="urn:catalog:metacard" xmlns:ns4=
"http://www.w3.org/2001/SMIL20/" xmlns:ns5="http://www.w3.org/2001/SMIL20/Language">
    <ns3:metacard ns1:id="000ba4dd7d974e258845a84966d766eb">
        <ns3:type>ddf.metacard</ns3:type>
        <ns3:source>southwestCatalog1</ns3:source>
        <ns3:dateTime name="created">
          <ns3:value>2013-04-10T15:30:05.702-07:00</ns3:value>
        </ns3:dateTime>
        <ns3:string name="title">
            <ns3:value>Input 1</ns3:value>
        </ns3:string>
    </ns3:metacard>
    <ns3:metacard ns1:id="00c0eb4ba9b74f8b988ef7060e18a6a7">
        <ns3:type>ddf.metacard</ns3:type>
        <ns3:source>southwestCatalog1</ns3:source>
        <ns3:dateTime name="created">
          <ns3:value>2013-04-10T15:30:05.702-07:00</ns3:value>
        </ns3:dateTime>
        <ns3:string name="title">
            <ns3:value>Input 2</ns3:value>
        </ns3:string>
    </ns3:metacard>
</ns3:metacards>
```

3.4.2. PPTX Input Transformer

The PPTX Input Transformer translates Microsoft PowerPoint (OOXML only) documents into Catalog Metacards, using Apache Tika for basic metadata and Apache POI for thumbnail creation. The PPTX Input Transformer ingests PPTX documents into the DDF Content Repository and the Metadata Catalog, and adds a thumbnail of the first page in the PPTX document.

The PPTX Input Transformer takes precedence over the Tika Input Transformer for PPTX documents.

Table 6. PPTX Input Transformer Usage

Schema	Mime-types
N/A	`application/vnd.openxmlformats-officedocument.presentationml.presentation`

3.4.2.1. Installing the PPTX Input Transformer

This transformer is installed by default with a standard installation in the Catalog application.

3.4.2.2. Configuring the PPTX Input Transformer

The PPTX Input Transformer has no configurable properties. '''

3.4.3. Atom Query Response Transformer

The Atom Query Response Transformer transforms a query response into an Atom 1.0 feed. The Atom transformer maps a `QueryResponse` object as described in the Query Result Mapping.

3.4.3.1. Installing the Atom Query Response Transformer

The Atom Query Response Transformer is installed by default with a standard installation.

3.4.3.2. Configuring the Atom Query Response Transformer

The Atom Query Response Transformer has no configurable properties.

3.4.3.3. Using the Atom Query Response Transformer

Use this transformer when Atom is the preferred medium of communicating information, such as for feed readers or federation. An integrator could use this with an endpoint to transform query responses into an Atom feed.

For example, clients can use the OpenSearch Endpoint. The client can query with the format option set to the shortname, `atom`.

Sample OpenSearch Query with Atom Specified as Return Format

```
http://{FQDN}:{PORT}/services/catalog/query?q=ddf?format=atom
```

Developers could use this transformer to programmatically transform `QueryResponse` objects on the fly.

Sample Atom Feed from `QueryResponse` object

```
 <feed xmlns="http://www.w3.org/2005/Atom" xmlns:os="http://a9.com/-
/spec/opensearch/1.1/">
    <title type="text">Query Response</title>
```

```
    <updated>2017-01-31T23:22:37.298Z</updated>
    <id>urn:uuid:a27352c9-f935-45f0-9b8c-5803095164bb</id>
    <link href="#" rel="self" />
    <author>
        <name>Organization Name</name>
    </author>
    <generator version="2.1.0.20130129-1341">ddf123</generator>
    <os:totalResults>1</os:totalResults>
    <os:itemsPerPage>10</os:itemsPerPage>
    <os:startIndex>1</os:startIndex>
    <entry xmlns:relevance="http://a9.com/-/opensearch/extensions/relevance/1.0/"
xmlns:fs="http://a9.com/-/opensearch/extensions/federation/1.0/"
        xmlns:georss="http://www.georss.org/georss">
        <fs:resultSource fs:sourceId="ddf123" />
        <relevance:score>0.19</relevance:score>
        <id>urn:catalog:id:ee7a161e01754b9db1872bfe39d1ea09</id>
        <title type="text">F-15 lands in Libya; Crew Picked Up</title>
        <updated>2013-01-31T23:22:31.648Z</updated>
        <published>2013-01-31T23:22:31.648Z</published>
        <link href=
"http://123.45.67.123:8181/services/catalog/ddf123/ee7a161e01754b9db1872bfe39d1ea09" rel
="alternate" title="View Complete Metacard" />
        <category term="Resource" />
        <georss:where xmlns:gml="http://www.opengis.net/gml">
            <gml:Point>
                <gml:pos>32.8751900768792 13.1874561309814</gml:pos>
            </gml:Point>
        </georss:where>
        <content type="application/xml">
            <ns3:metacard xmlns:ns3="urn:catalog:metacard" xmlns:ns2=
"http://www.w3.org/1999/xlink" xmlns:ns1="http://www.opengis.net/gml"
                xmlns:ns4="http://www.w3.org/2001/SMIL20/" xmlns:ns5=
"http://www.w3.org/2001/SMIL20/Language" ns1:id="4535c53fc8bc4404a1d32a5ce7a29585">
                <ns3:type>ddf.metacard</ns3:type>
                <ns3:source>ddf.distribution</ns3:source>
                <ns3:geometry name="location">
                    <ns3:value>
                        <ns1:Point>
                            <ns1:pos>32.8751900768792 13.1874561309814</ns1:pos>
                        </ns1:Point>
                    </ns3:value>
                </ns3:geometry>
                <ns3:dateTime name="created">
                    <ns3:value>2013-01-31T16:22:31.648-07:00</ns3:value>
                </ns3:dateTime>
                <ns3:dateTime name="modified">
                    <ns3:value>2013-01-31T16:22:31.648-07:00</ns3:value>
                </ns3:dateTime>
```

```
                <ns3:stringxml name="metadata">
                    <ns3:value>
                        <ns6:xml xmlns:ns6="urn:sample:namespace" xmlns=
"urn:sample:namespace">Example description.</ns6:xml>
                    </ns3:value>
                </ns3:stringxml>
                <ns3:string name="metadata-content-type-version">
                    <ns3:value>myVersion</ns3:value>
                </ns3:string>
                <ns3:string name="metadata-content-type">
                    <ns3:value>myType</ns3:value>
                </ns3:string>
                <ns3:string name="title">
                    <ns3:value>Example title</ns3:value>
                </ns3:string>
            </ns3:metacard>
        </content>
    </entry>
</feed>
```

Table 7. Atom Query Response Transformer Result Mapping

XPath to Atom XML	Value
`/feed/title`	"Query Response"
`/feed/updated`	ISO 8601 dateTime of when the feed was generated
`/feed/id`	Generated UUID URN
`/feed/author/name`	Platform Global Configuration organization
`/feed/generator`	Platform Global Configuration site name
`/feed/generator/@version`	Platform Global Configuration version
`/feed/os:totalResults`	SourceResponse Number of Hits
`/feed/os:itemsPerPage`	Request's Page Size
`/feed/os:startIndex`	Request's Start Index
`/feed/entry/fs:resultSource/@fs:sourceId`	Source Id from which the Result came. `Metacard.getSourceId()`
`/feed/entry/relevance:score`	Result's relevance score if applicable. `Result.getRelevanceScore()`
`/feed/entry/id`	`urn:catalog:id:<Metacard.ID>`
`/feed/entry/title`	`Metacard.TITLE`
`/feed/entry/updated`	ISO 8601 dateTime of `Metacard.MODIFIED`
`/feed/entry/published`	ISO 8601 dateTime of `Metacard.CREATED`

XPath to Atom XML	Value
`/feed/entry/link[@rel='related']`	URL to retrieve underlying resource (if applicable and link is available)
`/feed/entry/link[@rel='alternate']`	Link to alternate view of the Metacard (if a link is available)
`/feed/entry/category`	`Metacard.CONTENT_TYPE`
`/feed/entry//georss:where`	GeoRSS GML of every Metacard attribute with format `AttributeFormat.GEOMETRY`
`/feed/entry/content`	Metacard XML generated by `DDF.catalog.transform.MetacardTransformer` with `shortname=xml`. If no transformer found, `/feed/entry/content/@type` is text and `Metacard.ID` is displayed `<content type="text">4e1f38d1913b4e93ac622e6c1b258f89</content>`

3.4.4. XML Input Transformer

The XML Input Transformer is responsible for translating an XML document into a Catalog Metacard.

Table 8. XML Input Transformer Usage

Schema	Mime-types
urn:catalog:metacard	`text/xml`

3.4.4.1. Installing the XML Input Transformer

The XML Input Transformer is installed by default with a standard installation in the Catalog application.

3.4.4.2. Configuring the XML Input Transformer

The XML Input Transformer has no configurable properties.

3.4.5. CSW Query Response Transformer

The transforms a query response into a CSW-formatted document.

3.4.5.1. Installing the CSW Query Response Transformer

The CSW Query Response Transformer is installed by default with a standard installation in the Spatial application.

3.4.5.2. Configuring the CSW Query Response Transformer

The CSW Query Response Transformer has no configurable properties.

3.4.6. Tika Input Transformer

The Tika Input Transformer is the default input transformer responsible for translating Microsoft Word, Microsoft Excel, Microsoft PowerPoint, OpenOffice Writer, and PDF documents into Catalog records. This input transformer utilizes Apache Tika to provide basic support for these mime types. The metadata common to all these document types, such as creation date, author, last modified date, etc., is extracted and used to create the catalog record. The Tika Input Transformer's main purpose is to ingest these types of content into the Metadata Catalog.

The Tika input transformer is most basic input transformer and the last to be invoked. This allows any registered input transformers that are more specific to a document type to be invoked instead of this rudimentary input transformer.

Table 9. Tika Input Transformer Usage

Schema	Mime-types
N/A	This basic transformer can ingest many file types. See All Formats Supported.

3.4.6.1. Installing the Tika Input Transformer

This transformer is installed by default with a standard installation in the Catalog.

3.4.6.2. Configuring the Tika Input Transformer

The properties below describe how to configure the Tika input transformer.

See Tika Input Transformer configurations for all possible configurations.

3.4.7. Thumbnail Metacard Transformer

The Thumbnail Metacard Transformer retrieves the thumbnail bytes of a Metacard by returning the `Metacard.THUMBNAIL` attribute value.

3.4.7.1. Installing the Thumbnail Metacard Transformer

This transformer is installed by default with a standard installation in the Catalog application.

3.4.7.2. Configuring the Thumbnail Metacard Transformer

The Thumbnail Metacard Transformer has no configurable properties.

3.4.7.3. Using the Thumbnail Metacard Transformer

Endpoints or other components can retrieve an instance of the Thumbnail Metacard Transformer using its id `thumbnail`.

Sample Blueprint Reference Snippet

```
<reference id="metacardTransformer" interface="ddf.catalog.transform.MetacardTransformer"
filter="(id=thumbnail)"/>
```

The Thumbnail Metacard Transformer returns a `BinaryContent` object of the `Metacard.THUMBNAIL` bytes and a MIME Type of `image/jpeg`.

3.4.8. XML Metacard Transformer

The XML metacard transformer is responsible for translating a metacard into an XML-formatted document. The metacard element that is generated is an extension of `gml:AbstractFeatureType`, which makes the output of this transformer GML 3.1.1 compatible.

3.4.8.1. Installing the XML Metacard Transformer

This transformer comes installed by default with a standard installation in the Catalog application.

To install or uninstall manually, use the `catalog-transformer-xml` feature.

3.4.8.2. Configuring the XML Metacard Transformer

The XML Metacard Transformer has no configurable properties.

3.4.8.3. Using the XML Metacard Transformer

Using the REST Endpoint for example, request a metacard with the transform option set to the XML shortname.

XML Metacard Transformer URL

```
https://{FQDN}:{PORT}/services/catalog/ac0c6917d5ee45bfb3c2bf8cd2ebaa67?transform=xml
```

Table 10. Metacard to XML Mappings

Metacard Variables	XML Element
`id`	`metacard/@gml:id`
`metacardType`	`metacard/type`
`sourceId`	`metacard/source`

Metacard Variables	XML Element
all other attributes	metacard/<AttributeType>[name='<AttributeName>']/value For instance, the value for the metacard attribute named "title" would be found at metacard/string[@name='title']/value

XML Adapted Attributes (AttributeTypes)

- boolean
- base64Binary
- dateTime
- double
- float
- geometry
- int
- long
- object
- short
- string
- stringxml

3.4.9. KML Style Mapper

The KML Style Mapper provides the ability for the KMLTransformer to map a KML Style URL to a metacard based on that metacard's attributes. For example, if a user wanted all JPEGs to be blue, the KML Style Mapper provides the ability to do so. This would also allow an administrator to configure metacards from each source to be different colors.

The configured style URLs are expected to be HTTP URLs. For more information on style URL's, refer to the KML Reference.

The KML Style Mapper supports all basic and extended metacard attributes. When a style mapping is configured, the resulting transformed KML contain a <styleUrl> tag pointing to that style, rather than the default KML style supplied by the KMLTransformer.

3.4.9.1. Installing the KML Style Mapper

The KML Style Mapper is installed by default with a standard installation in the Spatial Application in the spatial-kml-transformer feature.

3.4.9.2. Configuring the KML Style Mapper

The properties below describe how to configure a style mapping. The configuration name is `Spatial KML Style Map Entry`.

See KML Style Mapper configurations for all possible configurations.

KML Style Mapper Example Values

```
<xmlns="http://www.opengis.net/kml/2.2"
  xmlns:ns4="urn:oasis:names:tc:ciq:xsdschema:xAL:2.0"
xmlns:ns3="http://www.w3.org/2005/Atom">
  <Placemark id="Placemark-0103c77e66d9428d8f48fab939da528e">
    <name>MultiPolygon</name>
    <description>&lt;!DOCTYPE html&gt;
&lt;html&gt;
  &lt;head&gt;
    &lt;meta content="text/html; charset=windows-1252" http-equiv="content-type"&gt;
    &lt;style media="screen" type="text/css"&gt;
      .label {
        font-weight: bold
      }
      .linkTable {
width: 100% }
      .thumbnailDiv {
        text-align: center
} img {
        max-width: 100px;
        max-height: 100px;
        border-style:none
      }
    &lt;/style&gt;
  &lt;/head&gt;
  &lt;body&gt;
        &lt;div class="thumbnailDiv"&gt;&lt;a
href="http://{FQDN}:{PORT}/services/catalog/sources/ddf.distribution/0103c77e66d9428d8f48
fab939da528e?transform=resource"&gt;&lt;img alt="Thumnail"
src=" CA=="&gt;&lt;/a&gt;&lt;/div&gt;
    &lt;table&gt;
      &lt;tr&gt;
        &lt;td class="label"&gt;Source:&lt;/td&gt;
        &lt;td&gt;ddf.distribution&lt;/td&gt;
      &lt;/tr&gt;
      &lt;tr&gt;
        &lt;td class="label"&gt;Created:&lt;/td&gt;
        &lt;td&gt;Wed Oct 30 09:46:29 MDT 2013&lt;/td&gt;
      &lt;/tr&gt;
      &lt;tr&gt;
```

```
        &lt;td class="label"&gt;Effective:&lt;/td&gt;
        &lt;td&gt;2014-01-07T14:58:16-0700&lt;/td&gt;
      &lt;/tr&gt;
    &lt;/table&gt;
    &lt;table class="linkTable"&gt;
      &lt;tr&gt;
        &lt;td&gt;&lt;a
href="http://{FQDN}:{PORT}/services/catalog/sources/ddf.distribution/0103c77e66d9428d8f48
fab939da528e?transform=html"&gt;View Details...&lt;/a&gt;&lt;/td&gt;
        &lt;td&gt;&lt;a
href="http://{FQDN}:{PORT}/services/catalog/sources/ddf.distribution/0103c77e66d9428d8f48
fab939da528e?transform=resource"&gt;Download...&lt;/a&gt;&lt;/td&gt;
      &lt;/tr&gt;
    &lt;/table&gt;
  &lt;/body&gt;
&lt;/html&gt;
</description>
    <TimeSpan>
      <begin>2014-01-07T21:58:16</begin>
    </TimeSpan>
 <styleUrl>http://example.com/kml/style#sampleStyle</styleUrl>
    <MultiGeometry>
      <Point>
        <coordinates>102.0,2.0</coordinates>
      </Point>
      <MultiGeometry>
        <Polygon>
          <outerBoundaryIs>
            <LinearRing>
              <coordinates>102.0,2.0 103.0,2.0 103.0,3.0 102.0,3.0
102.0,2.0</coordinates>
            </LinearRing>
          </outerBoundaryIs>
        </Polygon>
        <Polygon>
100.8,0.2
<outerBoundaryIs>
  <LinearRing>
    <coordinates>100.0,0.0 101.0,0.0 101.0,1.0 100.0,1.0 100.0,0.0 100.2,0.2
      100.8,0.8 100.2,0.8 100.2,0.2</coordinates>
  </LinearRing>
    </outerBoundaryIs>
  </Polygon>
</MultiGeometry>
</MultiGeometry>
</Placemark>
</kml>
```

3.4.10. Metadata Metacard Transformer

The Metadata Metacard Transformer returns the `Metacard.METADATA` attribute when given a metacard. The MIME Type returned is `text/xml`.

3.4.10.1. Installing the Metadata Metacard Transformer

The Metadata Metacard Transformer is installed by default in a standard installation with the Catalog application.

3.4.10.2. Configuring the Metadata Metacard Transformer

The Metadata Metacard Transformer has no configurable properties.

3.4.10.3. Using the Metadata Metacard Transformer

The Metadata Metacard Transformer can be used programmatically by requesting a metacard transformer with the id `metadata`. It can also be used within the REST Endpoint by providing the transform option as `metadata`.

Example REST GET method with the Metadata Metacard Transformer

```
http://{FQDN}:{PORT}/services/catalog/0123456789abcdef0123456789abcdef?transform=metadata
```

3.4.11. KML Query Response Transformer

The KML Query Response Transformer translates a query response into a KML-formatted document. The KML contains an HTML description for each metacard that displays in the pop-up bubble in Google Earth. The HTML contains links to the full metadata view as well as the resource.

3.4.11.1. Installing the KML Query Response Transformer

The `spatial-kml-transformer` feature is installed by default in the Spatial Application.

3.4.11.2. Configuring the KML Query Response Transformer

The KML Query Response Transformer has no configurable properties.

3.4.11.3. Using the KML Query Response Transformer

Using the OpenSearch Endpoint, for example, query with the format option set to the KML shortname: `kml`.

KML Query Response Transformer URL

```
http://{FQDN}:{PORT}/services/catalog/query?q=schematypesearch&format=kml
```

KML Query Response Transformer Example Output

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<kml xmlns:ns2="http://www.google.com/kml/ext/2.2" xmlns="http://www.opengis.net/kml/2.2"
xmlns:ns4="urn:oasis:names:tc:ciq:xsdschema:xAL:2.0" xmlns:ns3=
"http://www.w3.org/2005/Atom">
  <Document id="f0884d8c-cf9b-44a1-bb5a-d3c6fb9a96b6">
    <name>Results (1)</name>
    <open xsi:type="xs:boolean" xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:xsi=
"http://www.w3.org/2001/XMLSchema-instance">false</open>
    <Style id="bluenormal">
      <LabelStyle>
        <scale>0.0</scale>
      </LabelStyle>
      <LineStyle>
        <color>33ff0000</color>
        <width>3.0</width>
      </LineStyle>
      <PolyStyle>
        <color>33ff0000</color>
        <fill xsi:type="xs:boolean" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">true</fill>
      </PolyStyle>
      <BalloonStyle>
        <text>&lt;h3&gt;&lt;b&gt;$[name]&lt;/b&gt;&lt;/h3&gt;&lt;table&gt;&lt;tr&gt;
&lt;td width="400"&gt;$[description]&lt;/td&gt;&lt;/tr&gt;&lt;/table&gt;</text>
      </BalloonStyle>
    </Style>
    <Style id="bluehighlight">
      <LabelStyle>
        <scale>1.0</scale>
      </LabelStyle>
      <LineStyle>
        <color>99ff0000</color>
        <width>6.0</width>
      </LineStyle>
      <PolyStyle>
        <color>99ff0000</color>
        <fill xsi:type="xs:boolean" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">true</fill>
      </PolyStyle>
      <BalloonStyle>
        <text>&lt;h3&gt;&lt;b&gt;$[name]&lt;/b&gt;&lt;/h3&gt;&lt;table&gt;&lt;tr&gt;
```

```
&lt;td width="400"&gt;$[description]&lt;/td&gt;&lt;/tr&gt;&lt;/table&gt;</text>
      </BalloonStyle>
    </Style>
    <StyleMap id="default">
      <Pair>
        <key>normal</key>
        <styleUrl>#bluenormal</styleUrl>
      </Pair>
      <Pair>
        <key>highlight</key>
        <styleUrl>#bluehighlight</styleUrl>
      </Pair>
    </StyleMap>
    <Placemark id="Placemark-0103c77e66d9428d8f48fab939da528e">
      <name>MultiPolygon</name>
      <description>&lt;!DOCTYPE html&gt;
&lt;html&gt;
  &lt;head&gt;
    &lt;meta content="text/html; charset=windows-1252" http-equiv="content-type"&gt;
    &lt;style media="screen" type="text/css"&gt;
      .label {
        font-weight: bold
      }
      .linkTable {
width: 100% }
      .thumbnailDiv {
        text-align: center
} img {
        max-width: 100px;
        max-height: 100px;
        border-style:none
      }
    &lt;/style&gt;
  &lt;/head&gt;
  &lt;body&gt;
        &lt;div class="thumbnailDiv"&gt;&lt;a
href="http://{FQDN}:{PORT}/services/catalog/sources/ddf.distribution/0103c77e66d9428d8f
48fab939da528e?transform=resource"&gt;&lt;img alt="Thumnail"
src=" CA=="&gt;&lt;/a&gt;&lt;/div&gt;
    &lt;table&gt;
      &lt;tr&gt;
        &lt;td class="label"&gt;Source:&lt;/td&gt;
        &lt;td&gt;ddf.distribution&lt;/td&gt;
      &lt;/tr&gt;
      &lt;tr&gt;
        &lt;td class="label"&gt;Created:&lt;/td&gt;
        &lt;td&gt;Wed Oct 30 09:46:29 MDT 2013&lt;/td&gt;
      &lt;/tr&gt;
```

```
      &lt;tr&gt;
        &lt;td class="label"&gt;Effective:&lt;/td&gt;
        &lt;td&gt;2014-01-07T14:48:47-0700&lt;/td&gt;
      &lt;/tr&gt;
    &lt;/table&gt;
    &lt;table class="linkTable"&gt;
      &lt;tr&gt;
        &lt;td&gt;&lt;a
href="http://{FQDN}:{PORT}/services/catalog/sources/ddf.distribution/0103c77e66d9428d8f
48fab939da528e?transform=html"&gt;View Details...&lt;/a&gt;&lt;/td&gt;
        &lt;td&gt;&lt;a
href="http://{FQDN}:{PORT}/services/catalog/sources/ddf.distribution/0103c77e66d9428d8f
48fab939da528e?transform=resource"&gt;Download...&lt;/a&gt;&lt;/td&gt;
      &lt;/tr&gt;
    &lt;/table&gt;
  &lt;/body&gt;
&lt;/html&gt;
</description>
      <TimeSpan>
        <begin>2014-01-07T21:48:47</begin>
      </TimeSpan>
      <styleUrl>#default</styleUrl>
      <MultiGeometry>
        <Point>
          <coordinates>102.0,2.0</coordinates>
        </Point>
        <MultiGeometry>
          <Polygon>
            <outerBoundaryIs>
              <LinearRing>
                <coordinates>102.0,2.0 103.0,2.0 103.0,3.0 102.0,3.0
102.0,2.0</coordinates>
              </LinearRing>
100.8,0.2
  </outerBoundaryIs>
</Polygon>
<Polygon>
  <outerBoundaryIs>
    <LinearRing>
      <coordinates>100.0,0.0 101.0,0.0 101.0,1.0 100.0,1.0 100.0,0.0 100.2,0.2
        100.8,0.8 100.2,0.8 100.2,0.2</coordinates>
              </LinearRing>
            </outerBoundaryIs>
          </Polygon>
        </MultiGeometry>
      </MultiGeometry>
    </Placemark>
  </Document>
```

```
</kml>
```

3.4.12. Query Response Transformer Consumer

The Query Response Transformer Consumer is responsible for translating a query response into a Catalog Metacard.

3.4.12.1. Installing the Query Response Transformer Consumer

The Query Response Transformer Consumer is installed by default with a standard installation in the Catalog application.

3.4.12.2. Configuring the Query Response Transformer Consumer

The Query Response Transformer Consumer has no configurable properties.

3.4.13. GeoJSON Metacard Transformer

GeoJSON Metacard Transformer translates a metacard into GeoJSON.

3.4.13.1. Installing the GeoJSON Metacard Transformer

The GeoJSON Metacard Transformer is not installed by default with a standard installation.

To install:

1. Navigate to the **Admin Console**.
2. Select the **System** tab.
3. Select the **Features** tab.
4. Install the `catalog-transformer-json` feature.

3.4.13.2. Configuring the GeoJSON Metacard Transformer

The GeoJSON Metacard Transformer has no configurable properties.

3.4.13.3. Using the GeoJSON Metacard Transformer

The GeoJSON Metacard Transformer can be used programmatically by requesting a `MetacardTransformer` with the id `geojson`. It can also be used within the REST Endpoint by providing the transform option as `geojson`.

Example REST GET Method with the GeoJSON Metacard Transformer

```
https://{FQDN}:{PORT}/services/catalog/0123456789abcdef0123456789abcdef?transform=geojson
```

Example REST GET Output from the GeoJSON Metacard Transformer


```
{
    "properties":{
        "title":"myTitle",
        "thumbnail":"CA==",
        "resource-uri":"http:\/\/example.com",
        "created":"2012-08-31T23:55:19.518+0000",
        "metadata-content-type-version":"myVersion",
        "metadata-content-type":"myType",
        "metadata":"<xml>text<\/xml>",
        "modified":"2012-08-31T23:55:19.518+0000",
        "metacard-type": "ddf.metacard"
    },
    "type":"Feature",
    "geometry":{
        "type":"LineString",
        "coordinates":[
            [
                30.0,
                10.0
            ],
            [
                10.0,
                30.0
            ],
            [
                40.0,
                40.0
            ]
        ]
    }
}
```


3.4.14. PDF Input Transformer

The PDF Input Transformer is responsible for translating a PDF document into a Catalog Metacard.

Table 11. PDF Input Transformer Usage

Schema	Mime-types
N/A	`application/pdf`

3.4.14.1. Installing the PDF Input Transformer

The PDF Transformer is installed by default with a standard installation in the Catalog application.

3.4.14.2. Configuring the PDF Input Transformer

To configure the PDF Input Transformer:

1. Navigate to the **Catalog** application.
2. Select the **Configuration** tab.
3. Select the **PDF Input Transformer**.

These configurations are available for the PDF Input Transformer:

See PDF Input Transformer configurations for all possible configurations.

3.4.15. GeoJSON Input Transformer

The GeoJSON input transformer is responsible for translating GeoJSON into a Catalog metacard.

Table 12. GeoJSON Input Transformer Usage

Schema	Mime-types
N/A	`application/json`

3.4.15.1. Installing the GeoJSON Input Transformer

The GeoJSON Input Transformer is installed by default with a standard installation.

3.4.15.2. Configuring the GeoJSON Input Transformer

The GeoJSON Input Transformer has no configurable properties.

3.4.15.3. Using the GeoJSON Input Transformer

Using the REST Endpoint, for example, HTTP POST a GeoJSON metacard to the Catalog. Once the REST Endpoint receives the GeoJSON Metacard, it is converted to a Catalog metacard.

Example HTTP POST of a Local `metacard.json` *File Using the Curl Command*

```
curl -X POST -i -H "Content-Type: application/json" -d "@metacard.json"
https://{FQDN}:{PORT}/services/catalog
```

3.4.15.4. Conversion to a Metacard

A GeoJSON object consists of a single JSON object. This can be a geometry, a feature, or a `FeatureCollection`. The GeoJSON input transformer only converts "feature" objects into metacards because feature objects include geometry information and a list of properties. A geometry object alone does not contain enough information to create a metacard. Additionally, the input transformer currently does not handle `FeatureCollection`s.

IMPORTANT

Cannot create Metacard from this limited GeoJSON

```
{ "type": "LineString",
 "coordinates": [ [100.0, 0.0], [101.0, 1.0] ]
 }
```

The following sample *does* create a valid metacard:

Sample Parseable GeoJson (Point)

```
{
    "properties": {
        "title": "myTitle",
        "thumbnail": "CA==",
        "resource-uri": "http://example.com",
        "created": "2012-09-01T00:09:19.368+0000",
        "metadata-content-type-version": "myVersion",
        "metadata-content-type": "myType",
        "metadata": "<xml></xml>",
        "modified": "2012-09-01T00:09:19.368+0000"
    },
    "type": "Feature",
    "geometry": {
        "type": "Point",
        "coordinates": [
            30.0,
            10.0
        ]
    }
}
```

In the current implementation, `Metacard.LOCATION` is not taken from the properties list as WKT, but instead interpreted from the `geometry` JSON object. The geometry object is formatted according to the GeoJSON standard. Dates are in the ISO 8601 standard. White space is ignored, as in most cases with JSON. Binary data is accepted as Base64. XML must be properly escaped, such as what is proper for normal JSON.

Currently, only **Required Attributes** are recognized in the properties.

3.4.15.4.1. Metacard Extensibility

GeoJSON supports custom, extensible properties on the incoming GeoJSON using DDF's extensible metacard support. To have those customized attributes understood by the system, a corresponding `MetacardType` must be registered with the `MetacardTypeRegistry`. That `MetacardType` must be specified by name in the metacard-type property of the incoming GeoJSON. If a `MetacardType` is specified on the GeoJSON input, the customized properties can be processed, cataloged, and indexed.

Sample GeoJSON input

```
{
    "properties": {
        "title": "myTitle",
        "thumbnail": "CA==",
        "resource-uri": "http://example.com",
        "created": "2012-09-01T00:09:19.368+0000",
        "metadata-content-type-version": "myVersion",
        "metadata-content-type": "myType",
        "metadata": "<xml></xml>",
        "modified": "2012-09-01T00:09:19.368+0000",
        "min-frequency": "10000000",
        "max-frequency": "20000000",
        "metacard-type": "ddf.metacard.custom.type"
 },
    "type": "Feature",
    "geometry": {
        "type": "Point",
        "coordinates": [
            30.0,
            10.0
        ]
    }
}
```

When the GeoJSON Input Transformer gets GeoJSON with the `MetacardType` specified, it performs a lookup in the `MetacardTypeRegistry` to obtain the specified `MetacardType` in order to understand how to parse the GeoJSON. If no `MetacardType` is specified, the GeoJSON Input Transformer assumes the default `MetacardType`. If an unregistered `MetacardType` is specified, an exception is returned to the client indicating that the `MetacardType` was not found.

3.4.15.5. Usage Limitations of the GeoJSON Input Transformer

The GeoJSON Input Transformer does not handle multiple geometries.

3.4.16. GeoJSON Query Response Transformer

The GeoJSON Query Response Transformer translates a query response into a GeoJSON-formatted document.

3.4.16.1. Installing the GeoJSON Query Response Transformer

The GeoJSON Query Response Transformer is installed by default with a standard installation in the Catalog application.

3.4.16.2. Configuring the GeoJSON Query Response Transformer

The GeoJSON Query Response Transformer has no configurable properties.

3.4.17. Video Input Transformer

The Video Input transformer Creates Catalog metacards from certain video file types. Currently, it is handles MPEG-2 transport streams as well as MPEG-4, AVI, MOV, and WMV videos. This input transformer uses Apache Tika to extract basic metadata from the video files and applies more sophisticated methods to extract more meaningful metadata from these types of video.

Table 13. Video Input Transformer Usage

Schema	Mime-types
N/A	• video/avi • video/msvideo • video/vnd.avi • video/x-msvideo • video/mp4 • video/MP2T • video/mpeg • video/quicktime • video/wmv • video/x-ms-wmv

3.4.17.1. Installing the Video Input Transformer

This transformer is installed by default with a standard installation in the Catalog application.

3.4.17.2. Configuring the Video Input Transformer

The Video Input Transformer has no configurable properties.

3.4.18. Resource Metacard Transformer

The Resource Metacard Transformer retrieves a resource associated with a metacard.

3.4.18.1. Installing the Resource Metacard Transformer

The Resource Metacard Transformer is installed by default in a standard installation with the Catalog application as the feature `catalog-transformer-resource`.

3.4.18.2. Configuring the Resource Metacard Transformer

The Resource Metacard Transformer has no configurable properties.

3.4.18.3. Using the Resource Metacard Transformer

Endpoints or other components can retrieve an instance of the Resource Metacard Transformer using its `id` resource.

Sample Resource Metacard Transformer Blueprint Reference Snippet

```
<reference id="metacardTransformer" interface="ddf.catalog.transform.MetacardTransformer"
filter="(id=resource)"/>
```

3.4.19. KML Metacard Transformer

The KML Metacard Transformer is responsible for translating a metacard into a KML-formatted document. The KML contains an HTML description that displays in the pop-up bubble in Google Earth. The HTML contains links to the full metadata view as well as the resource.

3.4.19.1. Installing the KML Metacard Transformer

The KML Metacard Transformer is installed by default with a standard installation in the Spatial Application.

3.4.19.2. Configuring the KML Metacard Transformer

The KML Metacard Transformer has no configurable properties.

3.4.19.3. Using the KML Metacard Transformer

Using the REST Endpoint for example, request a metacard with the transform option set to the KML

shortname.

KML Metacard Transformer Example Output

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<kml xmlns:ns2="http://www.google.com/kml/ext/2.2" xmlns="http://www.opengis.net/kml/2.2"
xmlns:ns4="urn:oasis:names:tc:ciq:xsdschema:xAL:2.0" xmlns:ns3=
"http://www.w3.org/2005/Atom">
  <Placemark id="Placemark-0103c77e66d9428d8f48fab939da528e">
    <name>MultiPolygon</name>
    <description>&lt;!DOCTYPE html&gt;
    &lt;html&gt;
      &lt;head&gt;
        &lt;meta content="text/html; charset=windows-1252" http-equiv="content-type"&gt;
        &lt;style media="screen" type="text/css"&gt;
          .label {
            font-weight: bold
          }
          .linkTable {
width: 100% }
          .thumbnailDiv {
            text-align: center
          }
          img {
            max-width: 100px;
            max-height: 100px;
            border-style:none
          }
    &lt;/style&gt;
  &lt;/head&gt;
  &lt;body&gt;
        &lt;div class="thumbnailDiv"&gt;&lt;a
href="http://{FQDN}:{PORT}/services/catalog/sources/ddf.distribution/0103c77e66d9428d8f48
fab939da528e?transform=resource"&gt;&lt;img alt="Thumnail"
src=" CA=="&gt;&lt;/a&gt;&lt;/div&gt;
    &lt;table&gt;
      &lt;tr&gt;
        &lt;td class="label"&gt;Source:&lt;/td&gt;
        &lt;td&gt;ddf.distribution&lt;/td&gt;
      &lt;/tr&gt;
      &lt;tr&gt;
        &lt;td class="label"&gt;Created:&lt;/td&gt;
        &lt;td&gt;Wed Oct 30 09:46:29 MDT 2013&lt;/td&gt;
      &lt;/tr&gt;
      &lt;tr&gt;
      &lt;td class="label"&gt;Effective:&lt;/td&gt;
        &lt;td&gt;2014-01-07T14:58:16-0700&lt;/td&gt;
      &lt;/tr&gt;
```

```
    &lt;/table&gt;
    &lt;table class="linkTable"&gt;
      &lt;tr&gt;
        &lt;td&gt;&lt;a
href="http://{FQDN}:{PORT}/services/catalog/sources/ddf.distribution/0103c77e66d9428d8f48
fab939da528e?transform=html"&gt;View Details...&lt;/a&gt;&lt;/td&gt;
        &lt;td&gt;&lt;a
href="http://{FQDN}:{PORT}/services/catalog/sources/ddf.distribution/0103c77e66d9428d8f48
fab939da528e?transform=resource"&gt;Download...&lt;/a&gt;&lt;/td&gt;
      &lt;/tr&gt;
    &lt;/table&gt;
  &lt;/body&gt;
&lt;/html&gt;
</description>
    <TimeSpan>
      <begin>2014-01-07T21:58:16</begin>
    </TimeSpan>
    <Style id="bluenormal">
      <LabelStyle>
        <scale>0.0</scale>
      </LabelStyle>
      <LineStyle>
        <color>33ff0000</color>
        <width>3.0</width>
      </LineStyle>
      <PolyStyle>
        <color>33ff0000</color>
        <fill xsi:type="xs:boolean" xmlns:xs="http://www.w3.org/2001/XMLSchema"
          xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">true</fill>
      </PolyStyle>
      <BalloonStyle>
<text>&lt;h3&gt;&lt;b&gt;$[name]&lt;/b&gt;&lt;/h3&gt;&lt;table&gt;&lt;tr&gt;&lt;td
width="400"&gt;$[description]&lt;/td&gt;&lt;/tr&gt;&lt;/table&gt;</text>
      </BalloonStyle>
    </Style>
    <Style id="bluehighlight">
      <LabelStyle>
        <scale>1.0</scale>
      </LabelStyle>
      <LineStyle>
        <color>99ff0000</color>
        <width>6.0</width>
      </LineStyle>
      <PolyStyle>
        <color>99ff0000</color>
        <fill xsi:type="xs:boolean" xmlns:xs="http://www.w3.org/2001/XMLSchema"
          xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">true</fill>
      </PolyStyle>
```

```
      <BalloonStyle>
        <text>&lt;h3&gt;&lt;b&gt;$[name]&lt;/b&gt;&lt;/h3&gt;&lt;table&gt;&lt;tr&gt;
&lt;td width="400"&gt;$[description]&lt;/td&gt;&lt;/tr&gt;&lt;/table&gt;</text>
      </BalloonStyle>
    </Style>
    <StyleMap id="default">
      <Pair>
        <key>normal</key>
        <styleUrl>#bluenormal</styleUrl>
      </Pair>
      <Pair>
        <key>highlight</key>
        <styleUrl>#bluehighlight</styleUrl>
      </Pair>
    </StyleMap>
    <MultiGeometry>
      <Point>
        <coordinates>102.0,2.0</coordinates>
      </Point>
      <MultiGeometry>
        <Polygon>
          <outerBoundaryIs>
            <LinearRing>
              <coordinates>102.0,2.0 103.0,2.0 103.0,3.0 102.0,3.0 102.0,2.0</
coordinates>
            </LinearRing>
          </outerBoundaryIs>
        </Polygon>
        <Polygon>
100.8,0.2
    <outerBoundaryIs>
      <LinearRing>
        <coordinates>100.0,0.0 101.0,0.0 101.0,1.0 100.0,1.0 100.0,0.0 100.2,0.2 100.8
,0.8 100.2,0.8 100.2,0.2</coordinates>
      </LinearRing>
    </outerBoundaryIs>
  </Polygon>
</MultiGeometry>
</Placemark>
</kml>
```


3.5. Mime Type Mapper

The Mime Type Mapper is the entry point in DDF for resolving file extensions to mime types, and vice versa.

`MimeTypeMappers` are used by the `ResourceReader` to determine the file extension for a given mime type in aid of retrieving a resource. `MimeTypeMappers` are also used by the `FileSystemProvider` in the Catalog Framework to read a file from the content file repository.

The `MimeTypeMapper` maintains a list of all of the `MimeTypeResolvers` in DDF.

The `MimeTypeMapper` accesses each `MimeTypeResolver` according to its priority until the provided file extension is successfully mapped to its corresponding mime type. If no mapping is found for the file extension, `null` is returned for the mime type. Similarly, the `MimeTypeMapper` accesses each `MimeTypeResolver` according to its priority until the provided mime type is successfully mapped to its corresponding file extension. If no mapping is found for the mime type, `null` is returned for the file extension.

For files with no file extension, the MimeTypeMapper attempts to determine the mime type from the contents of the file. If it is unsuccessful, the file is ingested as a binary file.

DDF Mime Type Mapper

Core implementation of the DDF Mime API.

3.5.1. DDF Mime Type Mapper

The DDF Mime Type Mapper is the core implementation of the DDF Mime API. It provides access to all `MimeTypeResolvers` within DDF, which provide mapping of mime types to file extensions and file extensions to mime types.

3.5.1.1. Installing the DDF Mime Type Mapper

The DDF Mime Type Mapper is installed by default with a standard installation in the Platform application.

3.5.1.2. Configuring DDF Mime Type Mapper

The DDF Mime Type Mapper has no configurable properties.

3.6. Mime Type Resolver

A Mime Type Resolver is a DDF service that can map a file extension to its corresponding mime type and, conversely, can map a mime type to its file extension.

`MimeTypeResolvers` are assigned a priority (0-100, with the higher the number indicating the higher priority). This priority is used to sort all of the `MimeTypeResolvers` in the order they should be checked to map a file extension to a mime type (or vice versa). This priority also allows custom `MimeTypeResolvers` to be invoked before default `MimeTypeResolvers` by setting custom resolver's priority higher than the default.

`MimeTypeResolvers` are not typically invoked directly. Rather, the `MimeTypeMapper` maintains a list of `MimeTypeResolvers` (sorted by their priority) that it invokes to resolve a mime type to its file extension (or to resolve a file extension to its mime type).

Tika Mime Type Resolver

Provides support for resolving over 1300 mime types.

Custom Mime Type Resolver

The Custom Mime Type Resolver is a `MimeTypeResolver` that defines the custom mime types that DDF will support.

3.6.1. Tika Mime Type Resolver

The `TikaMimeTypeResolver` is a `MimeTypeResolver` that is implemented using the Apache Tika open source product.

Using the Apache Tika content analysis toolkit, the `TikaMimeTypeResolver` provides support for resolving over 1300 mime types, but not all mime types yield the same quality metadata.

The `TikaMimeTypeResolver` is assigned a default priority of `-1` to insure that it is always invoked last by the `MimeTypeMapper`. This insures that any custom `MimeTypeResolvers` that may be installed is invoked before the `TikaMimeTypeResolver`.

The `TikaMimeTypeResolver` provides the bulk of the default mime type support for DDF.

3.6.1.1. Installing the Tika Mime Type Resolver

The `TikaMimeTypeResolver` is bundled as the `mime-tika-resolver` feature in the `mime-tika-app` application.

This feature is installed by default.

3.6.1.2. Configuring the Tika Mime Type Resolver

The Tika Mime Type Resolver has no configurable properties.

3.6.2. Custom Mime Type Resolver

These are mime types not supported by the default `TikaMimeTypeResolver`.

Table 14. Custom Mime Type Resolver Default Supported Mime Types

File Extension	Mime Type
`nitf`	`image/nitf`
`ntf`	`image/nitf`
`json`	`json=application/json;id=geojson`

As a `MimeTypeResolver`, the Custom Mime Type Resolver provides methods to map the file extension to the corresponding mime type, and vice versa.

3.6.2.1. Installing the Custom Mime Type Resolver

One Custom Mime Type Resolver is configured and installed for the `image/nitf` mime type. This custom resolver is bundled in the `mime-core-app` application and is part of the `mime-core` feature.

Additional Custom Mime Type Resolvers can be added for other custom mime types.

3.6.2.2. Configuring the Custom Mime Type Resolver

The configurable properties for the Custom Mime Type Resolver are accessed from the **MIME Custom Types** configuration in the Admin Console.

- Navigate to the Admin Console.
- Select the **Platform** application.
- Select **Configuration**.
- Select **MIME Custom Types**.

Managed Service Factory PID

- `Ddf_Custom_Mime_Type_Resolver`

See Custom Mime Type Resolver configurations for all possible configurations.

---

4. Catalog Plugins

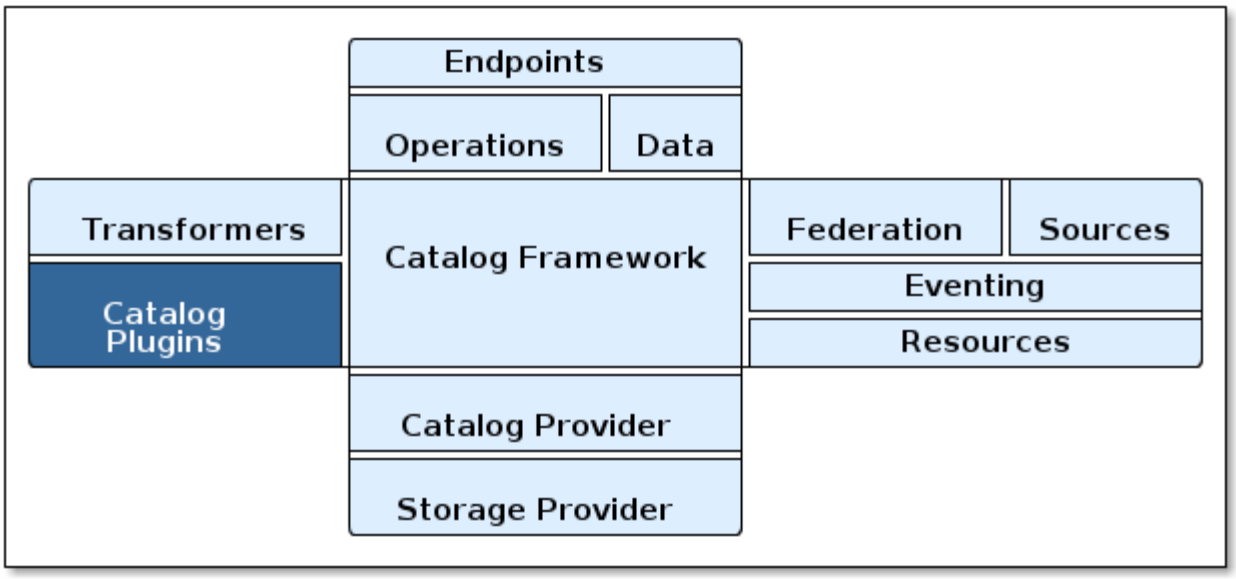


Figure 9. Catalog Architecture Catalog Plugins

Catalog Plugins are additional tools to use to add additional business logic at certain points, depending on the type of plugin.

The Catalog Framework calls Catalog Plugins to process requests and responses as they enter and leave the Framework.

4.1. Types of Plugins

Plugins can be designed to run before or after certain processes. They are often used for validation, optimization, or logging. Many plugins are designed to be called at more than one time. See Catalog Plugin Compatibility.

Pre-Authorization Plugins

Perform any changes needed before security rules are applied.

Policy Plugins

Allows or denies access to the Catalog operation or response.

Access Plugins

Used to build policy information for requests.

Pre-Ingest Plugins

Perform any changes to a metacard prior to ingest.

Post-Ingest Plugins

Perform actions after ingest is completed.

Post-Process Plugins

Performs additional processing after ingest.

Pre-Query Plugins

Perform any changes to a query before execution.

Pre-Federated-Query Plugins

Perform any changes to a federated query before execution.

Post-Query Plugins

Perform any changes to a response after query completes.

Post-Federated-Query Plugins

Perform any changes to a response after federated query completes.

Pre-Resource Plugins

Perform any changes to a request associated with a metacard prior to download.

Post-Resource Plugins

Perform any changes to a resource after download.

Pre-Create Storage Plugins

Perform any changes before creating a resource.

Post-Create Storage Plugins

Perform any changes after creating a resource.

Pre-Update Storage Plugins

Perform any changes before updating a resource.

Post-Update Storage Plugins

Perform any changes after updating a resource.

Pre-Subscription Plugins

Perform any changes before creating a subscription.

Pre-Delivery Plugins

Perform any changes before delivering a subscribed event.

Plugins are called in a specific order during different operations. Custom Plugins can be added to the chain for special use cases.

Figure 10. Query Request Plugin Call Order

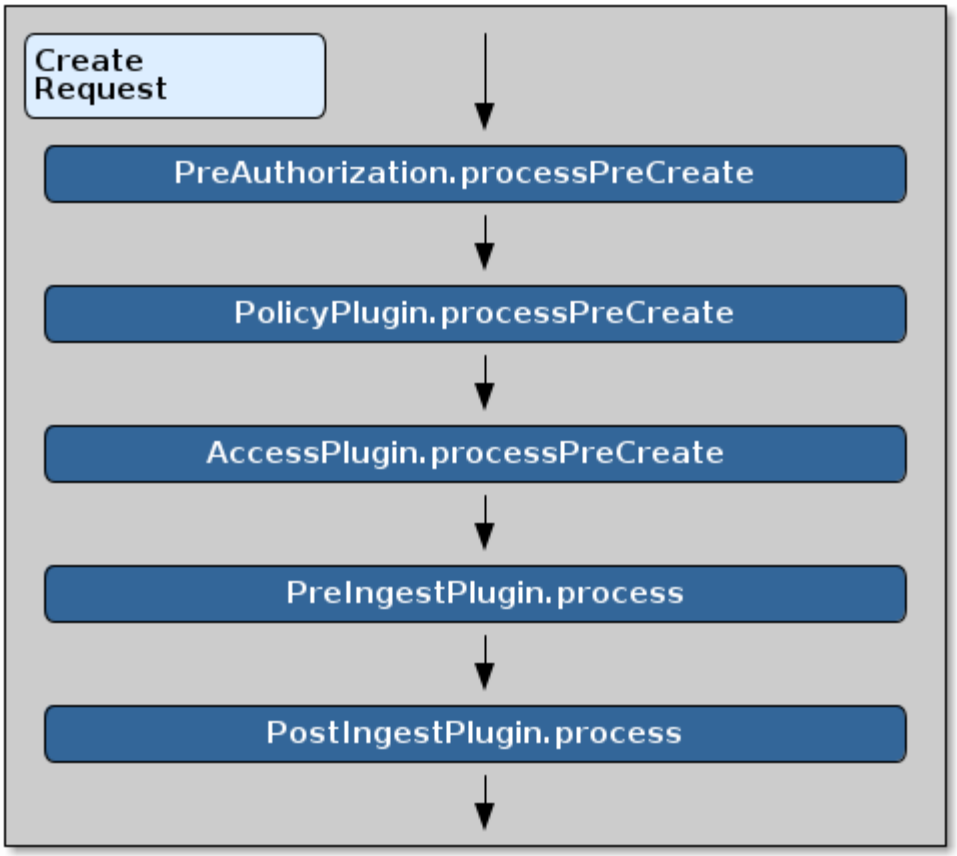


Figure 11. Create Request Plugin Call Order

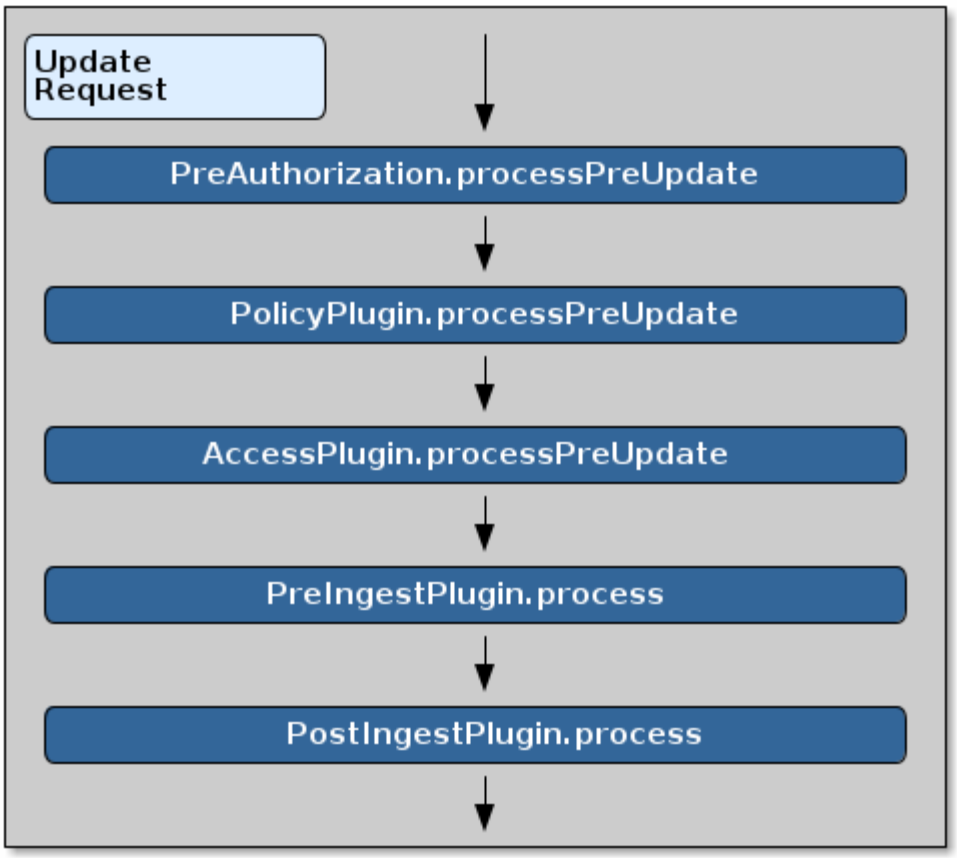


Figure 12. Update Request Plugin Call Order

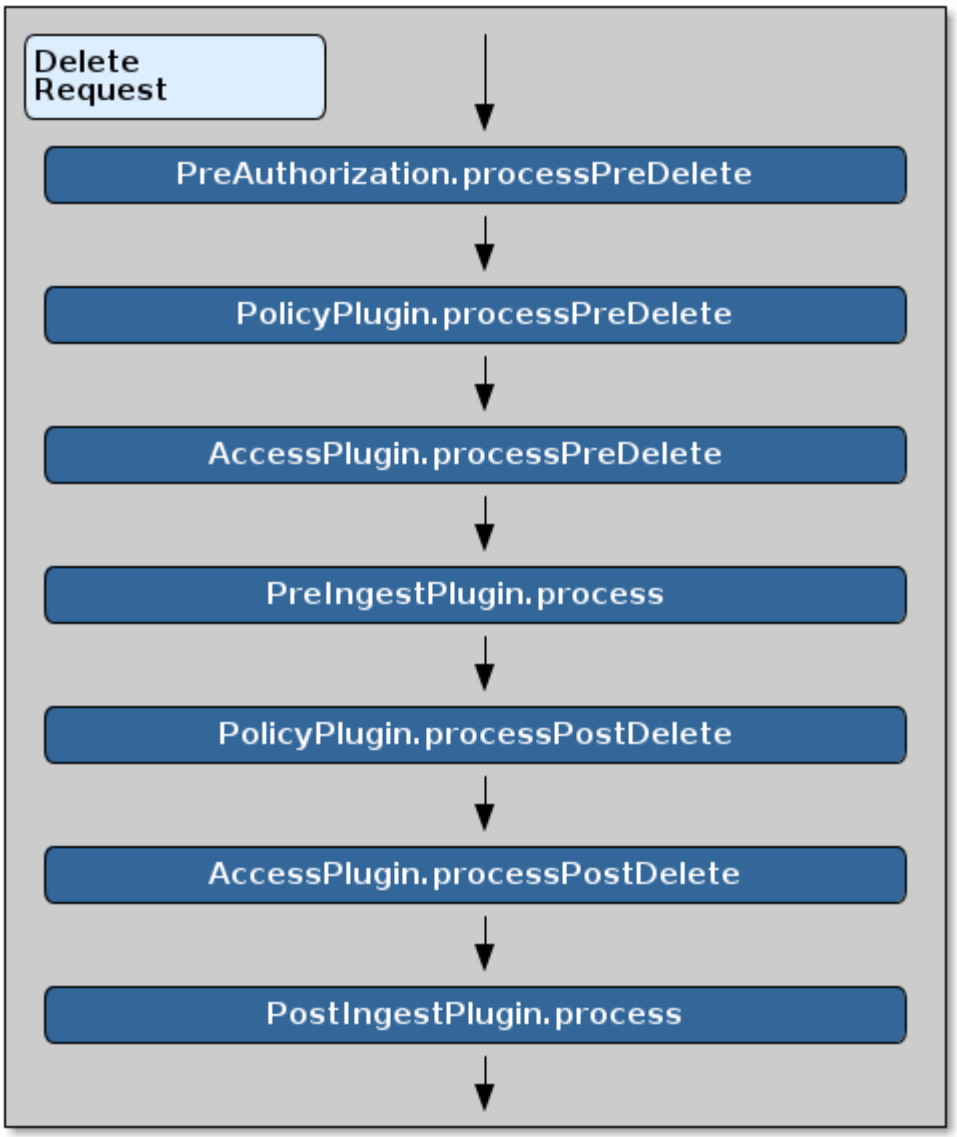


Figure 13. Delete Request Plugin Call Order

Figure 14. Resource Request Plugin Call Order

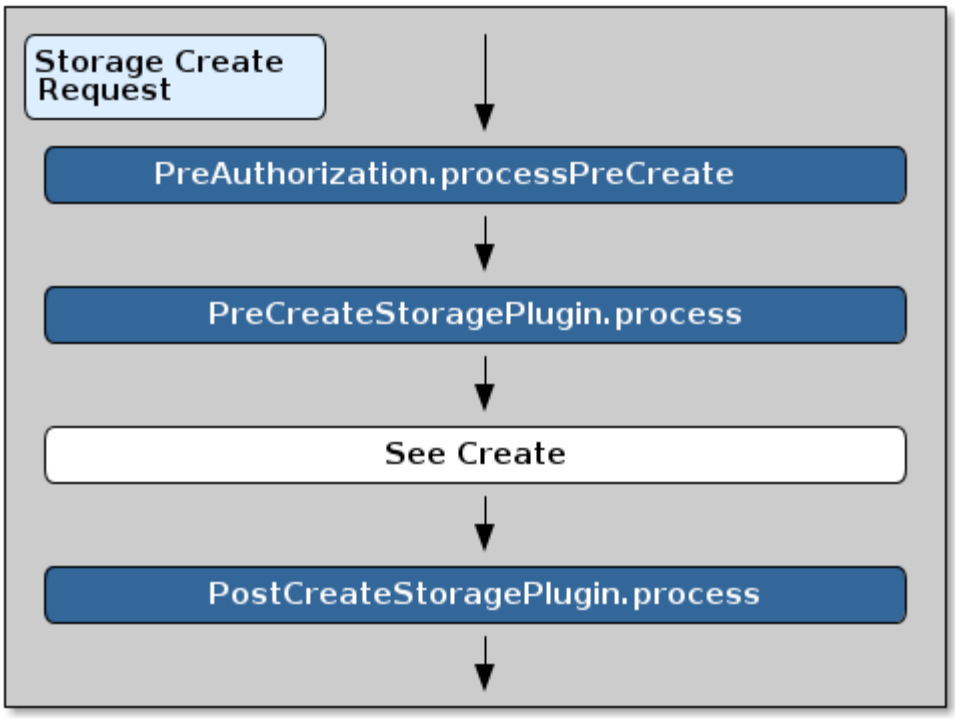


Figure 15. Storage Create Request Plugin Call Order

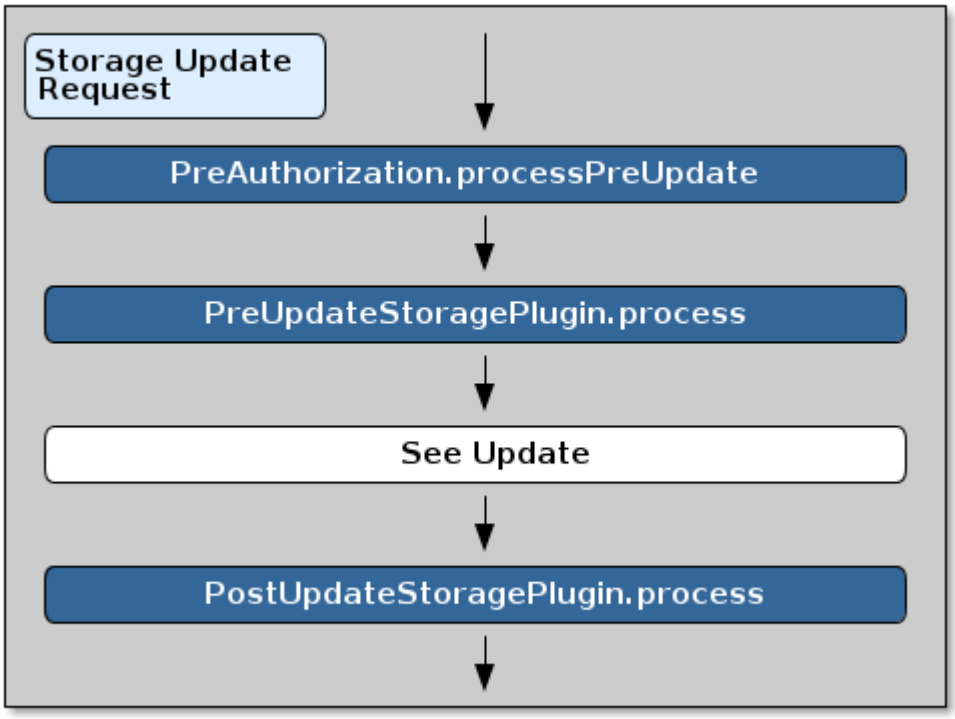


Figure 16. Storage Update Request Plugin Call Order

Table 15. Catalog Plugin Compatibility

Plugin	Pre-Authorization Plugins	Policy Plugins	Access Plugins	Pre-Ingest Plugins	Post-Ingest Plugins	Pre-Query Plugins	Post-Query Plugins	Post-Process Plugins
Metacard Ingest Network Plugin	x							
Operation Plugin			x					
Metacard Attribute Security Policy Plugin		x						
Client Info Plugin	x							
Expiration Date Pre-Ingest Plugin				x				
Catalog Policy Plugin		x						
Workspace Access Plugin			x					
GeoCoder Plugin				x				
Catalog Backup Plugin					x			
Metacard Groomer				x				
Historian Policy Plugin		x						

Plugin	Pre-Authorization Plugins	Policy Plugins	Access Plugins	Pre-Ingest Plugins	Post-Ingest Plugins	Pre-Query Plugins	Post-Query Plugins	Post-Process Plugins
Security Audit Plugin			x					
JPEG2000 Thumbnail Converter							x	
Security Logging Plugin				x	x	x	x	
Filter Plugin			x					
Metacard Backup S3 Storage Provider					x			
Point of Contact Policy Plugin		x						
Event Processor					x			
Metacard Validity Marker				x				
Metacard Resource Size Plugin							x	
Processing Post-Ingest Plugin					x			
Security Plugin			x					

Plugin	Pre-Authorization Plugins	Policy Plugins	Access Plugins	Pre-Ingest Plugins	Post-Ingest Plugins	Pre-Query Plugins	Post-Query Plugins	Post-Process Plugins
Metacard Validity Filter Plugin		x						
Workspace Pre-Ingest Plugin				x				
Content URI Access Plugin			x					
XML Attribute Security Policy Plugin		x						
Resource URI Policy Plugin		x						
Workspace Sharing Policy Plugin		x						
Metacard Backup File Storage Provider					x			

Table 16. Catalog Plugin Compatibility, Cont.

Plugin	Pre-Federated-Query Plugins	Post-Federated-Query Plugins	Pre-Resource Plugins	Post-Resource Plugins	Pre-Create Storage Plugins	Post-Create Storage Plugins	Pre-Update Storage Plugins	Post-Update Storage Plugins	Pre-Subscription Plugins	Pre-Delivery Plugins
Checksum Plugin					x		x			
Security Logging Plugin	x!	x	x	x	x	x	x	x		
Video Thumbnail Plugin						x		x		

4.1.1. Pre-Authorization Plugins

Pre-delivery plugins are invoked before any security rules are applied. This is an opportunity to take any action before authorization, including but not limited to:

- logging.
- adding network-specific information.
- adding user-identifying information.

4.1.1.1. Available Pre-Authorization Plugins

Client Info Plugin

Injects request-specific network information into a request.

Metacard Ingest Network Plugin

Adds attributes for network info from ingest request.

4.1.2. Policy Plugins

Policy plugins are invoked to set up the policy for a request/response. This provides an opportunity to attach custom requirements on operations or individual metacards. All the 'requirements' from each Policy plugin are combined into a single policy that is included in the request/response. Access plugins are used to act on this combined policy.

4.1.2.1. Available Policy Plugins

Catalog Policy Plugin

Configures user attributes required for catalog operations.

Historian Policy Plugin

Protects metacard history from being edited by users without the history role.

Metacard Attribute Security Policy Plugin

Collects attributes into a security field for the metacard.

Metacard Validity Filter Plugin

Determines whether to filter metacards with validation errors or warnings.

Point of Contact Policy Plugin

Adds a policy if Point of Contact is updated.

Resource URI Policy Plugin

Configures required user attributes for setting or altering a resource URI.

Workspace Sharing Policy Plugin

Collects attributes for a workspace to identify the appropriate policy to allow sharing.

XML Attribute Security Policy Plugin

Finds security attributes contained in a metacard's metadata.

4.1.3. Access Plugins

Access plugins are invoked directly after the Policy plugins have been successfully executed. This is an opportunity to either stop processing or modify the request/response based on policy information.

4.1.3.1. Available Access Plugins

Content URI Access Plugin

Prevents a Metacard's resource URI from being overridden by an incoming UpdateRequest.

Filter Plugin

Performs filtering on query responses as they pass through the framework.

Operation Plugin

Validates a user or subject's security attributes.

Security Audit Plugin

Audits specific metacard attributes.

Security Plugin

Identifies the subject for an operation.

Workspace Access Plugin

Prevents non-owner users from changing workspace permissions.

4.1.4. Pre-Ingest Plugins

Pre-ingest plugins are invoked before an ingest operation is sent to the catalog. They are not run on a query. This is an opportunity to take any action on the ingest request, including but not limited to:

- validation.
- logging.
- auditing.
- optimization.
- security filtering.

4.1.4.1. Available Pre-Ingest Plugins

Expiration Date Pre-Ingest Plugin

Adds or updates expiration dates for the resource.

GeoCoder Plugin

Populates the `Location.COUNTRY_CODE` attribute if the Metacard has an associated location.

Metacard Groomer

Modifies metacards when created or updated.

Metacard Validity Marker

Modifies metacards when created or ingested according to metacard validator services.

Security Logging Plugin

Logs operations to the security log.

Workspace Pre-Ingest Plugin

Verifies that a workspace has an associated email to enable sharing.

4.1.5. Post-Ingest Plugins

Post-ingest plugins are invoked after data has been created, updated, or deleted in a Catalog Provider.

4.1.5.1. Available Post-Ingest Plugins

Catalog Backup Plugin

Enables backup of the catalog and its metacards.

Event Processor

Creates, updates, and deletes subscriptions.

Metacard Backup File Storage Provider

Stores backed-up metacards.

Metacard Backup S3 Storage Provider

Stores backed-up metacards in a specified S3 bucket and key.

Processing Post-Ingest Plugin

Submits catalog Create, Update, or Delete requests to the Processing Framework.

Security Logging Plugin

Logs operations to the security log.

4.1.6. Post-Process Plugins

NOTE	This code is experimental. While this interface is functional and tested, it may change or be removed in a future version of the library.

Post-Process Plugins are invoked after a metacard has been created, updated, or deleted and committed to the Catalog. They are the last plugins to run and are triggered by a **Post-Ingest Plugin**. Post-Process plugins are well-suited for asynchronous tasks. See the Asynchronous Processing Framework for more information about how **Post-Process Plugins** are used.

4.1.6.1. Available Post-Process Plugins

None.

4.1.7. Pre-Query Plugins

Pre-query plugins are invoked before a query operation is sent to any of the Sources. This is an opportunity to take any action on the query, including but not limited to:

- validation.
- logging.
- auditing.
- optimization.
- security filtering.

4.1.7.1. Available Pre-Query Plugins

Security Logging Plugin

Logs operations to the security log.

4.1.8. Pre-Federated-Query Plugins

Pre-federated-query plugins are invoked before a federated query operation is sent to any of the Sources. This is an opportunity to take any action on the query, including but not limited to:

- validation.
- logging.
- auditing.
- optimization.
- security filtering.

4.1.8.1. Available Pre-Federated-Query Plugins

Security Logging Plugin

Logs operations to the security log.

Tags Filter Plugin

Updates queries without filters.

4.1.9. Post-Query Plugins

Post-query plugins are invoked after a query has been executed successfully, but before the response is returned to the endpoint. This is an opportunity to take any action on the query response, including but not limited to:

- logging.
- auditing.
- security filtering/redaction.
- deduplication.

4.1.9.1. Available Post-Query Plugins

JPEG2000 Thumbnail Converter

Creates thumbnails for jpeg2000 images.

Metacard Resource Size Plugin

Updates the resource size attribute of a metacard.

Security Logging Plugin

Logs operations to the security log.

4.1.10. Post-Federated-Query Plugins

Post-federated-query plugins are invoked after a federated query has been executed successfully, but before the response is returned to the endpoint. This is an opportunity to take any action on the query response, including but not limited to:

- logging.
- auditing.
- security filtering/redaction.
- deduplication.

4.1.10.1. Available Post-Federated-Query Plugins

Security Logging Plugin

Logs operations to the security log.

4.1.11. Pre-Resource Plugins

Pre-Resource plugins are invoked before a request to retrieve a resource is sent to a Source. This is an opportunity to take any action on the request, including but not limited to:

- validation.
- logging.
- auditing.
- optimization.
- security filtering.

4.1.11.1. Available Pre-Resource Plugins

Security Logging Plugin

Logs operations to the security log.

4.1.12. Post-Resource Plugins

Post-resource plugins are invoked after a resource has been retrieved, but before it is returned to the endpoint. This is an opportunity to take any action on the response, including but not limited to:

- logging.
- auditing.
- security filtering/redaction.

4.1.12.1. Available Post-Resource Plugins

Security Logging Plugin

Logs operations to the security log.

4.1.13. Pre-Create Storage Plugins

Pre-Create storage plugins are invoked immediately before an item is created in the content repository.

4.1.13.1. Available Pre-Create Storage Plugins

Checksum Plugin

Creates a unique checksum for ingested resources.

Security Logging Plugin

Logs operations to the security log.

4.1.14. Post-Create Storage Plugins

Post-Create storage plugins are invoked immediately after an item is created in the content repository.

4.1.14.1. Available Post-Create Storage Plugins

Security Logging Plugin

Logs operations to the security log.

Video Thumbnail Plugin

Generates thumbnails for video files.

4.1.15. Pre-Update Storage Plugins

Pre-Update storage plugins are invoked immediately before an item is updated in the content repository.

4.1.15.1. Available Pre-Update Storage Plugins

Checksum Plugin

Creates a unique checksum for ingested resources.

Security Logging Plugin

Logs operations to the security log.

4.1.16. Post-Update Storage Plugins

Post-Update storage plugins are invoked immediately after an item is updated in the content repository.

4.1.16.1. Available Post-Update Storage Plugins

Security Logging Plugin

Logs operations to the security log.

Video Thumbnail Plugin

Generates thumbnails for video files.

4.1.17. Pre-Subscription Plugins

Pre-subscription plugins are invoked before a Subscription is activated by an Event Processor. This is an opportunity to take any action on the Subscription, including but not limited to:

- validation.
- logging.
- auditing.
- optimization.
- security filtering.

4.1.17.1. Available Pre-Subscription Plugins

None.

4.1.18. Pre-Delivery Plugins

Pre-delivery plugins are invoked before a Delivery Method is invoked on a Subscription. This is an opportunity to take any action before event delivery, including but not limited to:

- logging.
- auditing.
- security filtering/redaction.

4.1.18.1. Available Pre-Delivery Plugins

None.

4.2. Catalog Plugin Details

Installation and configuration details listed by plugin name.

4.2.1. Catalog Backup Plugin

The Catalog Backup Plugin is used to enable data backup of the catalog and the metacards it contains.

WARNING	*Catalog Backup Plugin Considerations* Using this plugin may impact performance negatively.

4.2.1.1. Installing the Catalog Backup Plugin

The Catalog Backup Plugin is installed by default with a standard installation in the Catalog application.

4.2.1.2. Configuring the Catalog Backup Plugin

To configure the Catalog Backup Plugin:

1. Navigate to the **Admin Console**.
2. Select **Catalog** application.
3. Select **Configuration** tab.
4. Select **Backup Post-Ingest Plugin**.

See Catalog Backup Plugin configurations for all possible configurations.

4.2.1.3. Usage Limitations of the Catalog Backup Plugin

- May affect performance.
- Must be installed prior to ingesting any content.
- Once enabled, disabling *may* cause incomplete backups.

4.2.2. Catalog Policy Plugin

The Catalog Policy Plugin configures the attributes required for users to perform Create, Read, Update, and Delete operations on the catalog.

4.2.2.1. Installing the Catalog Policy Plugin

The Catalog Policy Plugin is installed by default with a standard installation in the Catalog application.

4.2.2.2. Configuring the Catalog Policy Plugin

To configure the Catalog Policy Plugin:

1. Navigate to the **Admin Console**.
2. Select Catalog application.
3. Select **Configuration** tab.
4. Select **Catalog Policy Plugin**.

See Catalog Policy Plugin configurations for all possible configurations.

4.2.3. Checksum Plugin

The Checksum plugin creates a unique checksum for resources input into the system to identify updated content.

4.2.3.1. Installing the Checksum Plugin

The Checksum is installed by default with a standard installation in the Catalog application.

4.2.3.2. Configuring the Checksum Plugin

The Checksum Plugin has no configurable properties.

4.2.4. Client Info Plugin

The Client Info plugin injects request-specific network information into request properties, such as Remote IP Address, Remote Host Name, Servlet Scheme, and Servlet Context.

4.2.4.1. Related Components to the Client Info Plugin

- Client info filter
- Metacard Ingest Network Plugin

4.2.4.2. Installing the Client Info Plugin

The Client Info Plugin is installed by default with a standard installation in the Catalog application.

4.2.4.3. Configuring the Client Info Plugin

The Client Info Plugin has no configurable properties.

4.2.5. Content URI Access Plugin

The prevents a Metacard’s resource URI from being overridden by an incoming UpdateRequest.

4.2.5.1. Installing the Content URI Access Plugin

The Content URI Access Plugin is installed by default with a standard installation in the Catalog application.

4.2.5.2. Configuring the Content URI Access Plugin

The Content URI Access Plugin has no configurable properties.

4.2.6. Event Processor

The Event Processor creates, updates, and deletes subscriptions for event notification. These subscriptions optionally specify a filter criteria so that only events of interest to the subscriber are posted for notification.

As metacards are created, updated, and deleted, the Catalog's Event Processor is invoked (as a post-ingest plugin) for each of these events. The Event Processor applies the filter criteria for each registered subscription to each of these ingest events to determine if they match the criteria.

For more information on creating subscriptions, see Creating a Subscription.

4.2.6.1. Installing the Event Processor

The Event Processor is installed by default with a standard installation in the Catalog application.

4.2.6.2. Configuring the Event Processor

The Event Processor has no configurable properties.

4.2.6.3. Usage Limitations of the Event Processor

The Standard Event processor currently broadcasts federated events and should not. It should only broadcast events that were generated locally, all other events should be dropped. See DDF-3151 for status.

4.2.7. Expiration Date Pre-Ingest Plugin

The Expiration Date plugin adds or updates expiration dates which can be used later for archiving old data.

4.2.7.1. Installing the Expiration Date Pre-Ingest Plugin

The Expiration Date Pre-Ingest Plugin is not installed by default with a standard installation. To install:

1. Navigate to the **Admin Console**.
2. Select the **Catalog** application.
3. Select the **Configuration** tab.
4. Select the **Expiration Data Pre-Ingest Plugin**.

4.2.7.2. Configuring the Expiration Date Pre-Ingest Plugin

To configure the Expiration Date Pre-Ingest Plugin:

1. Navigate to the **Admin Console**.
2. Select the **Catalog** application.
3. Select the **Configuration** tab.
4. Select the **Expiration Date Pre-Ingest Plugin**.

See Expiration Date Plugin configurations for all possible configurations.

4.2.8. Filter Plugin

The Filter Plugin performs filtering on query responses as they pass through the framework.

Each metacard result can contain security attributes that are pulled from the metadata record after being processed by a `PolicyPlugin` that populates this attribute. The security attribute is a Map containing a set of keys that map to lists of values. The metacard is then processed by a filter plugin that creates a `KeyValueCollectionPermission` from the metacard's security attribute. This permission is then checked against the user subject to determine if the subject has the correct claims to view that metacard. The decision to filter the metacard eventually relies on the installed Policy Decision Point (PDP). The PDP that is being used returns a decision, and the metacard is either filtered or allowed to pass through.

How a metacard gets filtered is left up to any number of FilterStrategy implementations that might be installed. Each `FilterStrategy` returns a result to the filter plugin that says whether or not it was able to process the metacard, along with the metacard or response itself. This allows a metacard or entire response to be partially filtered to allow some data to pass back to the requester. This could also include filtering any resources sent back to a requester.

The security attributes populated on the metacard are completely dependent on the type of the metacard. Each type of metacard must have its own `PolicyPlugin` that reads the metadata being returned and then returns the appropriate attributes.

Example (represented as simple XML for ease of understanding):

```
<metacard>
    <security>
        <map>
            <entry assertedAttribute1="A,B" />
            <entry assertedAttribute2="X,Y" />
            <entry assertedAttribute3="USA,GBR" />
            <entry assertedAttribute4="USA,AUS" />
        </map>
```

```
    </security>
</metacard>
```

```
<user>
    <claim name="subjectAttribute1">
        <value>A</value>
        <value>B</value>
    </claim>
    <claim name="subjectAttribute2">
        <value>X</value>
        <value>Y</value>
    </claim>
    <claim name="subjectAttribute3">
        <value>USA</value>
    </claim>
    <claim name="subjectAttribute4">
        <value>USA</value>
    </claim>
</user>
```

In the above example, the user's claims are represented very simply and are similar to how they would actually appear in a SAML 2 assertion. Each of these user (or subject) claims is converted to a `KeyValuePermission` object. These permission objects are implied against the permission object generated from the metacard record. In this particular case, the metacard might be allowed if the policy is configured appropriately because all of the permissions line up correctly.

4.2.8.1. Installing the Filter Plugin

The Filter Plugin is installed by default with a standard installation in the Catalog application.

4.2.8.2. Configuring the Filter Plugin

The Filter Plugin has no configurable properties.

4.2.9. GeoCoder Plugin

The GeoCoder plugin is a pre-ingest plugin that is responsible for populating the Metacard's `Location.COUNTRY_CODE` attribute if the Metacard has an associated location. If there is a valid country code for the Metacard, it is in ISO 3166-1 alpha-3 format. If the metacard's country code is already populated, the plugin does **not** override it. The GeoCoder relies on either the WebService or Offline Gazetteer to retrieve country code information.

WARNING	For a polygon or polygons, this plugin takes the center point of the bounding box

---

> to assign the country code.

4.2.9.1. Installing the GeoCoder Plugin

The GeoCoder Plugin is installed by default with the Spatial application, when the WebService or Offline Gazetteer is started.

4.2.9.2. Configuring the GeoCoder Plugin

To configure the GeoCoder Plugin:

1. Navigate to the **Admin Console**.
2. Select **Spatial** application.
3. Select **Configuration** tab.
4. Select **GeoCoder Plugin**.

These are the available configurations:

See GeoCoder Plugin configurations for all possible configurations.

4.2.10. Historian Policy Plugin

The Historian Policy Plugin protects metacard history from being edited or deleted by users without the history role (a `http://schemas.xmlsoap.org/ws/2005/05/identity/claims/role` of `system-history`).

4.2.10.1. Installing the Historian Policy Plugin

The Historian is installed by default with a standard installation in the Catalog application.

4.2.10.2. Configuring the Historian Policy Plugin

The Historian Policy Plugin has no configurable properties.

4.2.11. JPEG2000 Thumbnail Converter

The JPEG2000 Thumbnail converter creates thumbnails from images ingested in jpeg2000 format.

4.2.11.1. Installing the JPEG2000 Thumbnail Converter

The JPEG2000 Thumbnail Converter is installed by default with a standard installation in the Catalog application.

4.2.11.2. Configuring the JPEG2000 Thumbnail Converter

The JPEG2000 Thumbnail Converter has no configurable properties.

4.2.12. Metacard Attribute Security Policy Plugin

The Metacard Attribute Security Policy Plugin combines existing metacard attributes to make new attributes and adds them to the metacard. For example, if a metacard has two attributes, `sourceattribute1` and `sourceattribute2`, the values of the two attributes could be combined into a new attribute, `destinationattribute1`. The `sourceattribute1` and `sourceattribute2` are the *source attributes* and `destinationattribute1` is the *destination attribute*.

There are two way to combine the values of source attributes. The first, and most common, is to take all of the attribute values and put them together. This is called the union. For example, if the source attributes `sourceattribute1` and `sourceattribute2` had the values:

`sourceattribute1 = MASK, VESSEL`

`sourceattribute2 = WIRE, SACK, MASK`

...the **union** would result in the new attribute `destinationattribute1`:

`destinationattribute1 = MASK, VESSEL, WIRE, SACK`

The other way to combine attributes is use the values common to all of the attributes. This is called the intersection. Using the previous example, the **intersection** of `sourceattribute1` and `sourceattribute2` would create the new attribute `destinationattribute1`

`destinationattribute1 = MASK`

because only `MASK` is common to all of the source attributes.

The policy plugin could also be used to rename attributes. If there is only one source attribute, and the combination policy is union, then the attribute's values are effectively renamed to the destination attribute.

4.2.12.1. Installing the Metacard Attribute Security Policy Plugin

The Metacard Attribute Security Policy Plugin is installed by default with a standard installation in the Catalog application.

See Metacard Attribute Security Policy Plugin configurations for all possible configurations.

4.2.13. Metacard Backup File Storage Provider

The Metacard Backup File Storage Provider is a storage provider that stores backed-up metacards in a

specified file system location.

4.2.13.1. Installing the Metacard Backup File Storage Provider

To install the Metacard Backup File Storage Provider

1. Navigate to the **Admin Console**.
2. Select the **System** tab.
3. Select the **Features** tab.
4. Install the `catalog-metacard-backup-filestorage` feature.

4.2.13.2. Configuring the Metacard Backup File Storage Provider

To configure the Metacard Backup File Storage Provider

1. Navigate to the **Admin Console**.
2. Select Catalog application.
3. Select **Configuration** tab.
4. Select **Metacard Backup File Storage Provider**.

See Metacard Backup File Storage Provider configurations for all possible configurations.

4.2.14. Metacard Backup S3 Storage Provider

The Metacard Backup S3 Storage Provider is a storage provider that stores backed up metacards in the specified S3 bucket and key.

4.2.14.1. Installing the Metacard S3 File Storage Provider

To install the Metacard Backup File Storage Provider

1. Navigate to the **System** tab.
2. Select the **Features** tab.
3. Install the `catalog-metacard-backup-s3storage` feature.

4.2.14.2. Configuring the Metacard S3 File Storage Provider

To configure the Metacard Backup S3 Storage Provider:

1. Navigate to the **Admin Console**.
2. Select Catalog application.
3. Select **Configuration** tab.

4. Select **Metacard Backup S3 Storage Provider**.

See Metacard Backup S3 Storage Provider configurations for all possible configurations.

4.2.15. Metacard Groomer

The Metacard Groomer Pre-Ingest plugin makes modifications to `CreateRequest` and `UpdateRequest` metacards.

Use this pre-ingest plugin as a convenience to apply basic rules for your metacards.

This plugin makes the following modifications when metacards are in a `CreateRequest`:

- Overwrites the `Metacard.ID` field with a generated, unique, 32 character hexadecimal value if missing or if the resource URI is not a catalog resource URI.
- Sets `Metacard.CREATED` to the current time stamp if not already set.
- Sets `Metacard.MODIFIED` to the current time stamp if not already set.
- Sets `Core.METACARD_CREATED` to the current time stamp if not present.
- Sets `Core.METACARD_MODIFIED` to the current time stamp.

In an `UpdateRequest`, the same operations are performed as a `CreateRequest`, except:

- If no value is provided for `Metacard.ID` in the new metacard, it is set using the `UpdateRequest` ID if applicable.

4.2.15.1. Installing the Metacard Groomer

The Metacard Groomer is included in the `catalog-core-plugins` feature. It is not recommended to uninstall this feature.

4.2.15.2. Configuring the Metacard Groomer

The Metacard Groomer has no configurable properties.

4.2.16. Metacard Ingest Network Plugin

The Metacard Ingest Network Plugin allows the conditional insertion of new attributes on metacards during ingest based on network information from the ingest request; including IP address and hostname.

For the extent of this section, a 'rule' refers to a configured, single instance of this plugin.

4.2.16.1. Related Components to the Metacard Ingest Network Plugin

- Client Info Plugin

4.2.16.2. Installing the Metacard Ingest Network Plugin

The Metacard Ingest Network Plugin is installed by default during a standard installation in the Catalog application.

4.2.16.3. Configuring the Metacard Ingest Network Plugin

To configure the Metacard Ingest Network Plugin:

- Navigate to the **Admin Console**.
- Select the Catalog application.
- Select the **Configuration** tab.
- Select the label *Metacard Ingest Network Plugin* to setup a network rule.

See Metacard Ingest Network Plugin configurations for all possible configurations.

Multiple instances of the plugin can be configured by clicking on its configuration title within the configuration tab of the Catalog app. Each instance represents a conditional statement, or a 'rule', that gets evaluated for each ingest request. For any request that meets the configured criteria of a rule, that rule attempts to transform its list of key-value pairs to become new attributes on all metacards in that request.

The rule is divided into two fields: `"Criteria"` and `"Expected Value"`. The `"Criteria"` field features a drop-down list containing the four elements for which equality can be tested:

- IP Address of where the ingest request came from
- Host Name of where the ingest request came from
- Scheme that the ingest request arrived on, for example, *http* vs *https*
- Context Path that the ingest request arrived on, for example, */services/catalog*

In order for a rule to evaluate to true and the attributes be applied, the value in the "Expected Value" field must be an exact match to the actual value of the selected criteria. For example, if the selected criteria is `"IP Address"` with an expected value of `"192.168.0.1"`, the rule only evaluates to true for ingest requests coming from `"192.168.0.1"` and nowhere else.

IMPORTANT	*Check for IPv6* Verify your system's IP configuration. Rules using "IP Address" may need to be written in IPv6 format.

The key-value pairs within each rule should take the following form: "key = value" where the "key" is

the name of the attribute and the "value" is the value assigned to that attribute. Whitespace is ignored unless it is within the key or value. Multi-valued attributes can be expressed in comma-separated format if necessary.

Examples of Valid Attribute Assignments

```
contact.contributor-name = John Doe
contact.contributor-email = john.doe@example.net
language = English
language = English, French, German
security.access-groups = SJ202, SR 101, JS2201
```

4.2.16.3.1. Useful Attributes

The following table provides some useful attributes that may commonly be set by this plugin:

Table 17. Useful Attributes

Attribute Name	Expected Format	Multi-Valued
expiration	ISO DateTime	no
description	Any String	no
metacard.owner	Any String	no
language	Any String	yes
security.access-groups	Any String	yes
security.access-individuals	Any String	yes

4.2.16.4. Usage Limitations of the Metacard Ingest Network Plugin

- This plugin only works for ingest (create requests) performed over a network; data ingested via command line does not get processed by this plugin.
- Any attribute that is already set on the metacard is not overwritten by the plugin.
- The order of execution is not guaranteed. For any rule configuration where two or more rules add different values for the same attribute, it is undetermined which provides the final value for that attribute.

4.2.17. Metacard Resource Size Plugin

The Metacard Resource Size post-query plugin updates the resource size attribute of each metacard in the query results if there is a cached file for the resource and it has a size greater than zero; otherwise, the resource size is unmodified and the original result is returned.

Use this post-query plugin as a convenience to return query results with accurate resource sizes for

cached products.

4.2.17.1. Installing the Metacard Resource Size Plugin

The Metacard Resource Size Plugin is installed by default with a standard installation.

4.2.17.2. Configuring the Metacard Resource Size Plugin

The Metacard Resource Size Plugin has no configurable properties.

4.2.18. Metacard Validity Filter Plugin

The Metacard Validity Filter Plugin determines whether metacards with validation errors or warnings are filtered from query results.

4.2.18.1. Related Components to the Metacard Validity Filter Plugin

- Metacard Validity Marker.

4.2.18.2. Installing the Metacard Validity Filter Plugin

The Metacard Validity Filter Plugin is installed by default with a standard installation in the Catalog application.

4.2.19. Metacard Validity Marker

The Metacard Validity Marker Pre-Ingest plugin modifies the metacards contained in create and update requests.

The plugin runs each metacard in the `CreateRequest` and `UpdateRequest` against each registered `MetacardValidator` service.

NOTE	This plugin can make it seem like ingested resources are not successfully ingested if a user does not have permissions to access invalid metacards. If an ingest did not fail, there are no errors in the ingest log, but the expected results do not show up after a query, verify either that the ingested data is valid or that the Metacard Validity Filter Plugin is configured to show warnings and/or errors.

4.2.19.1. Related Components to the Metacard Validity Marker

- Metacard Validity Filter Plugin.

4.2.19.2. Installing Metacard Validity Marker

This plugin is installed by default with a standard installation in the Catalog application.

4.2.19.3. Configuring Metacard Validity Marker

See Metacard Validity Marker Plugin configurations for all possible configurations.

4.2.19.4. Using Metacard Validity Marker

Use this pre-ingest plugin to validate metacards against metacard validators, which can check schemas, schematron, or any other logic.

4.2.20. Operation Plugin

The Operation plugin validates the subject's security attributes to ensure they are adequate to perform the operation.

4.2.20.1. Installing the Operation Plugin

The Operation Plugin is installed by default with a standard installation in the Catalog application.

4.2.20.2. Configuring the Operation Plugin

The Operation Plugin has no configurable properties.

4.2.21. Point of Contact Policy Plugin

The Point of Contact Policy Plugin is a PreUpdate plugin that checks if the point-of-contact attribute has changed. If it does, then it adds a policy to that metacard's policy map that cannot be implied. This denies such an update request, which essentially makes the point-of-contact attribute read-only.

4.2.21.1. Related Components to Point of Contact Policy Plugin

Point of Contact Update Plugin

4.2.21.2. Installing the Point of Contact Policy Plugin

The Point of Contact Policy Plugin is installed by default with a standard installation in the Catalog application.

4.2.21.3. Configuring the Point of Contact Policy Plugin

The Point of Contact Policy Plugin has no configurable properties.

4.2.22. Processing Post-Ingest Plugin

The Processing Post Ingest Plugin is responsible for submitting catalog Create, Update, and Delete (CUD) requests to the Processing Framework.

4.2.22.1. Related Components to Processing Post-Ingest Plugin

None.

4.2.22.2. Installing the Processing Post-Ingest Plugin

The Processing Post-Ingest Plugin is not installed by default with a standard installation, but is installed by default when the in-memory Processing Framework is installed.

4.2.22.3. Configuring the Processing Post-Ingest Plugin

The Processing Post-Ingest Plugin has no configurable properties.

4.2.23. Resource URI Policy Plugin

The Resource URI Policy Plugin configures the attributes required for users to set the resource URI when creating a metacard or alter the resource URI when updating an existing metacard in the catalog.

4.2.23.1. Installing the Resource URI Policy Plugin

The Resource URI Policy Plugin is installed by default with a standard installation in the Catalog application.

4.2.23.2. Configuring the Resource URI Policy Plugin

To configure the Resource URI Policy Plugin:

1. Navigate to the **Admin Console**.
2. Select Catalog application.
3. Select **Configuration** tab.
4. Select **Resource URI Policy Plugin**.

See Resource URI Policy Plugin configurations for all possible configurations.

4.2.24. Security Audit Plugin

The Security Audit Plugin is used to allow the auditing of specific metacard attributes. Any time a

metacard attribute listed in the configuration is updated, a log entry is generated in the security log.

4.2.24.1. Installing the Security Audit Plugin

The Security Audit Plugin is installed by default with a standard installation in the Catalog application.

4.2.25. Security Logging Plugin

The Security Logging Plugin logs operations to the security log.

4.2.25.1. Installing Security Logging Plugin

The Security Logging Plugin is installed by default in a standard installation in the Security application.

4.2.25.2. Enhancing the Security Log

The security log contains attributes related to the subject acting on the system. To add additional attributes related to the subject to the logs, append the attribute's key to the comma separated values assigned to `security.logger.extra_attributes` in `/etc/custom.system.properties`.

4.2.26. Security Plugin

The Security Plugin identifies the subject for an operation.

4.2.26.1. Installing the Security Plugin

The Security Plugin is installed by default with a standard installation in the Catalog application.

4.2.26.2. Configuring the Security Plugin

The Security Plugin has no configurable properties.

4.2.27. Tags Filter Plugin

The Tags Filter Plugin updates queries without filters for tags, and adds a default tag of `resource`. For backwards compatibility, a filter is also added to include metacards without any tags attribute.

4.2.27.1. Related Components to Tags Filter Plugin

None.

4.2.27.2. Installing the Tags Filter Plugin

The Tags Filter Plugin is installed by default with a standard installation in the Catalog application.

4.2.27.3. Configuring the Tags Filter Plugin

The Tags Filter Plugin has no configurable properties.

4.2.28. Video Thumbnail Plugin

The Video Thumbnail Plugin provides the ability to generate thumbnails for video files stored in the Content Repository.

It is an implementation of both the `PostCreateStoragePlugin` and `PostUpdateStoragePlugin` interfaces. When installed, it is invoked by the Catalog Framework immediately after a content item has been created or updated by the Storage Provider.

This plugin uses a custom 32-bit LGPL build of FFmpeg (a video processing program) to generate thumbnails. When this plugin is installed, it places the FFmpeg executable appropriate for the current operating system in `<DDF_HOME>/bin_third_party/ffmpeg`. When invoked, this plugin runs the FFmpeg binary in a separate process to generate the thumbnail. The `<DDF_HOME>/bin_third_party/ffmpeg` directory is deleted when the plugin is uninstalled.

NOTE	Prebuilt FFmpeg binaries are provided for Linux, Mac, and Windows only.

4.2.28.1. Installing the Video Thumbnail Plugin

The Video Thumbnail Plugin is installed by default with a standard installation in the Catalog application.

4.2.28.2. Configuring the Video Thumbnail Plugin

To configure the Video Thumbnail Plugin:

1. Navigate to the **Admin Console**.
2. Select the **Catalog** application.
3. Select the **Configuration** tab.
4. Select the **Video Thumbnail Plugin**.

See Video Thumbnail Plugin configurations for all possible configurations.

4.2.29. Workspace Access Plugin

The Workspace Access Plugin prevents non-owner users from changing workspace permissions.

4.2.29.1. Related Components to The Workspace Access Plugin

- Workspace Sharing Policy Plugin.
- Workspace Pre-Ingest Plugin.
- Workspace Extension.

4.2.29.2. Installing the Workspace Access Plugin

The Workspace Access Plugin is installed by default with a standard installation in the Catalog application.

4.2.29.3. Configuring the Workspace Access Plugin

The Workspace Access Plugin has no configurable properties.

4.2.30. Workspace Pre-Ingest Plugin

The Workspace Pre-Ingest Plugin verifies that a workspace has an associated email to enable sharing and assigns that email as `"owner"`.

4.2.30.1. Related Components to The Workspace Pre-Ingest Plugin

- Workspace Sharing Policy Plugin.
- Workspace Access Plugin.
- Workspace Extension.

4.2.30.2. Installing the Workspace Pre-Ingest Plugin

The Workspace Pre-Ingest Plugin is installed by default with a standard installation in the Catalog application.

4.2.30.3. Configuring the Workspace Pre-Ingest Plugin

The Workspace Pre-Ingest Plugin has no configurable properties.

4.2.31. Workspace Sharing Policy Plugin

The Workspace Sharing Policy Plugin collects attributes for a workspace to identify the appropriate

policy to apply to allow sharing.

4.2.31.1. Related Components to The Workspace Sharing Policy Plugin

- Workspace Access Plugin.
- Workspace Pre-Ingest Plugin.
- Workspace Extension.

4.2.31.2. Installing the Workspace Sharing Policy Plugin

The Workspace Sharing Policy Plugin is installed by default with a standard installation in the Catalog application.

4.2.31.3. Configuring the Workspace Sharing Policy Plugin

The Workspace Sharing Policy Plugin has no configurable properties.

4.2.32. XML Attribute Security Policy Plugin

The XML Attribute Security Policy Plugin parses XML metadata contained within a metacard for security attributes on any number of XML elements in the metadata. The configuration for the plugin contains one field for setting the XML elements that are parsed for security attributes and the other two configurations contain the XML attributes that are pulled off of those elements. The **Security Attributes (union)** field computes the union of values for each attribute defined and the **Security Attributes (intersection)** field computes the intersection of values for each attribute defined.

4.2.32.1. Installing the XML Attribute Security Policy Plugin

The XML Attribute Security Policy Plugin is installed by default with a standard installation in the Security application.

---

5. Data

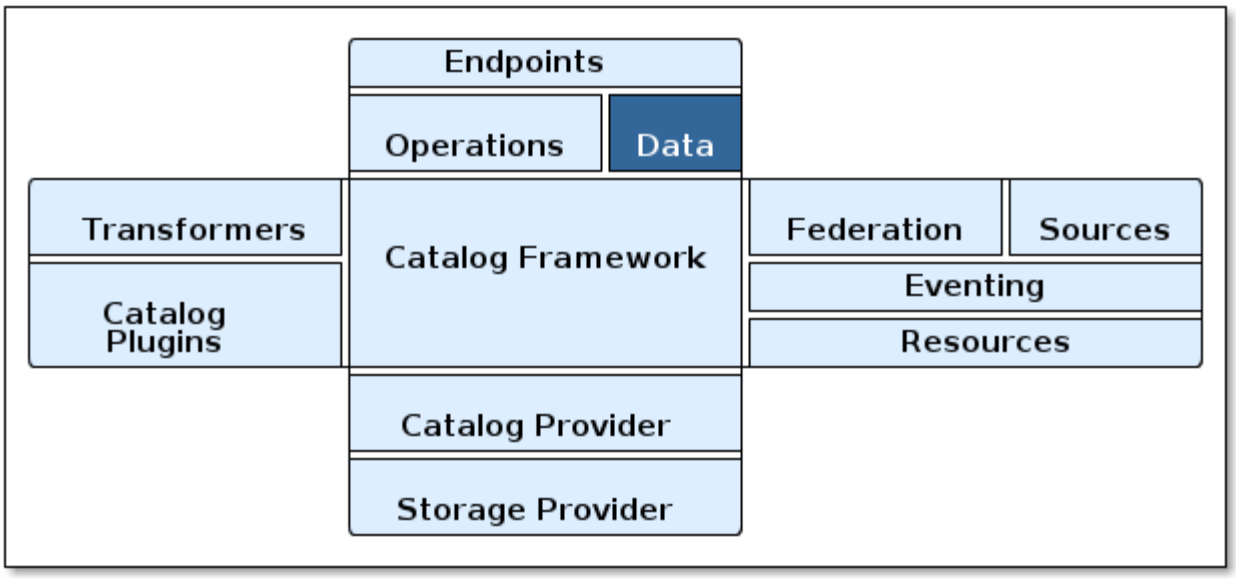


Figure 17. Catalog Architecture Diagram Data

The Catalog stores and translates Metadata, which can be transformed into many data formats, shared, and queried. The primary form of this metadata is the metacard. A `Metacard` is a container for metadata. `CatalogProviders` accept `Metacards` as input for ingest, and `Sources` search for metadata and return matching `Results` that include `Metacards`.

5.1. Metacards

A metacard is a single instance of metadata in the Catalog (an instance of a metacard type) which generally contains general information about the resource, such as the title of the resource, the resource's geo-location, the date the resource was created and/or modified, the owner or producer, and/or the security classification.

5.1.1. Metacard Type

A metacard type indicates the attributes available for a particular metacard. It is a model used to define the attributes of a metacard, much like a schema.

A metacard type indicates the attributes available for a particular type of data. For example, an image may have different attributes than a PDF document, so each could be defined to have their own metacard type.

5.1.1.1. Default Metacard Type and Attributes

Most metacards within the system are created using the default metacard type or a metacard type based on the default type. The default metacard type of the system can be programmatically retrieved by calling `ddf.catalog.data.impl.MetacardImpl.BASIC_METACARD`. The name of the default `MetacardType` can be retrieved from `ddf.catalog.data.MetacardType.DEFAULT_METACARD_TYPE_NAME`.

The default metacard type has the following required attributes. Though the following attributes are required on all metacard types, setting their values is optional except for ID.

Core Attributes

NOTE	It is highly recommended when referencing a default attribute name to use the `ddf.catalog.data.types.*` interface constants whenever possible. Mapping to a normalized taxonomy allows for higher quality transformations between different formats and for improved federation. This neutral profile facilitates improved search and discovery across disparate data types.

WARNING	Every Source should at the very least return an ID attribute according to Catalog API. Other fields may or may not be applicable, but a unique ID must be returned by a source.

5.1.1.2. Extensible Metacards

Metacard extensibility is achieved by creating a new `MetacardType` that supports attributes in addition to the required attributes listed above.

Required attributes must be the base of all extensible metacard types.

WARNING	Not all Catalog Providers support extensible metacards. Nevertheless, each Catalog Provider should at least have support for the default `MetacardType`. That is, it should be able to store and query on the attributes and attribute formats specified by the default metacard type. Catalog providers are neither expected nor required to store attributes that are not in a given metacard's type. Consult the documentation of the Catalog Provider in use for more information on its support of extensible metacards.

Often, the `BASIC_METACARD` `MetacardType` does not provide all the functionality or attributes necessary for a specific task. For performance or convenience purposes, it may be necessary to create custom attributes even if others are not aware of those attributes. One example could be if a user wanted to optimize a search for a date field that did not fit the definition of `CREATED`, `MODIFIED`, `EXPIRATION`, or `EFFECTIVE`. The user could create an additional `java.util.Date` attribute in order to query the attribute separately.

`Metacard` objects are extensible because they allow clients to store and retrieve standard and custom

key/value Attributes from the `Metacard`. All `Metacards` must return a `MetacardType` object that includes an `AttributeDescriptor` for each `Attribute`, indicating it's key and value type. `AttributeType` support is limited to those types defined by the Catalog.

New `MetacardType` implementations can be made by implementing the `MetacardType` interface.

5.1.2. Metacard Type Registry

WARNING	The `MetacardTypeRegistry` is experimental. While this component has been tested and is functional, it may change as more information is gathered about what is needed and as it is used in more scenarios.

The `MetacardTypeRegistry` allows DDF components, primarily catalog providers and sources, to make available the `MetacardTypes` that they support. It maintains a list of all supported `MetacardTypes` in the `CatalogFramework`, so that other components such as Endpoints, Plugins, and Transformers can make use of those `MetacardTypes`. The `MetacardType` is essential for a component in the `CatalogFramework` to understand how it should interpret a metacard by knowing what attributes are available in that metacard.

For example, an endpoint receiving incoming metadata can perform a lookup in the `MetacardTypeRegistry` to find a corresponding `MetacardType`. The discovered `MetacardType` is then used to help the endpoint populate a metacard based on the specified attributes in the `MetacardType`. By doing this, all the incoming metadata elements can then be available for processing, cataloging, and searching by the rest of the `CatalogFramework`.

`MetacardTypes` should be registered with the `MetacardTypeRegistry`. The `MetacardTypeRegistry` makes those `MetacardTypes` available to other DDF `CatalogFramework` components. Other components that need to know how to interpret metadata or metacards should look up the appropriate `MetacardType` from the registry. By having these `MetacardTypes` available to the `CatalogFramework`, these components can be aware of the custom attributes.

The `MetacardTypeRegistry` is accessible as an OSGi service. The following blueprint snippet shows how to inject that service into another component:

MetacardTypeRegistry Service Injection

```
<bean id="sampleComponent" class="ddf.catalog.SampleComponent">
    <argument ref="metacardTypeRegistry" />
</bean>

<!-- Access MetacardTypeRegistry -->
<reference id="metacardTypeRegistry" interface="ddf.catalog.data.MetacardTypeRegistry"/>
```

The reference to this service can then be used to register new `MetacardTypes` or to lookup existing ones.

New `MetacardTypes` are typically registered by `CatalogProviders` or sources indicating they know how to

persist, index, and query attributes from that type. Endpoints or `InputTransformers` typically use the lookup functionality to access a `MetacardType` based on a parameter in the incoming metadata. Once the appropriate `MetacardType` is discovered and obtained from the registry, the component knows how to translate incoming raw metadata into a DDF Metacard.

5.1.3. Attributes

An attribute is a single field of a metacard, an instance of an attribute type. Attributes are typically indexed for searching by a source or catalog provider.

5.1.3.1. Attribute Types

An attribute type indicates the attribute format of the value stored as an attribute. It is a model for an attribute.

5.1.3.1.1. Attribute Format

An enumeration of attribute formats are available in the catalog. Only these attribute formats may be used.

Table 18. Attribute Formats

AttributeFormat	Description
`BINARY`	Attributes of this attribute format must have a value that is a Java `byte[]` and `AttributeType.getBinding()` should return `Class<Array>of` byte.
`BOOLEAN`	Attributes of this attribute format must have a value that is a Java boolean.
`DATE`	Attributes of this attribute format must have a value that is a Java date.
`DOUBLE`	Attributes of this attribute format must have a value that is a Java double.
`FLOAT`	Attributes of this attribute format must have a value that is a Java float.
`GEOMETRY`	Attributes of this attribute format must have a value that is a WKT-formatted Java string.
`INTEGER`	Attributes of this attribute format must have a value that is a Java integer.
`LONG`	Attributes of this attribute format must have a value that is a Java long.
`OBJECT`	Attributes of this attribute format must have a value that implements the serializable interface.

AttributeFormat	Description
`SHORT`	Attributes of this attribute format must have a value that is a Java short.
`STRING`	Attributes of this attribute format must have a value that is a Java string and treated as plain text.
`XML`	Attributes of this attribute format must have a value that is a XML-formatted Java string.

5.1.3.1.2. Attribute Naming Conventions

Catalog taxonomy elements follow the naming convention of `group-or-namespace.specific-term`, except for extension fields outside of the core taxonomy. These follow the naming convention of `ext.group-or-namespace.specific-term` and must be namespaced. Nesting is not permitted.

5.1.3.2. Result

A single "hit" included in a query response.

A result object consists of the following:

- a metacard.
- a relevance score if included.
- distance in meters if included.

5.1.4. Creating Metacards

The quickest way to create a `Metacard` is to extend or construct the `MetacardImpl` object. `MetacardImpl` is the most commonly used and extended `Metacard` implementation in the system because it provides a convenient way for developers to retrieve and set `Attributes` without having to create a new `MetacardType` (see below). `MetacardImpl` uses `BASIC_METACARD` as its `MetacardType`.

5.1.4.1. Limitations

A given developer does not have all the information necessary to programmatically interact with any arbitrary source. Developers hoping to query custom fields from extensible `Metacards` of other sources cannot easily accomplish that task with the current API. A developer cannot question a source for all its *queryable* fields. A developer only knows about the `MetacardTypes` which that individual developer has used or created previously.

The only exception to this limitation is the `Metacard.ID` field, which is required in every `Metacard` that is stored in a source. A developer can always request `Metacards` from a source for which that developer has the `Metacard.ID` value. The developer could also perform a wildcard search on the `Metacard.ID` field if the source allows.

5.1.4.2. Processing Metacards

As `Metacard` objects are created, updated, and read throughout the Catalog, care should be taken by all catalog components to interrogate the `MetacardType` to ensure that additional `Attributes` are processed accordingly.

5.1.4.3. Basic Types

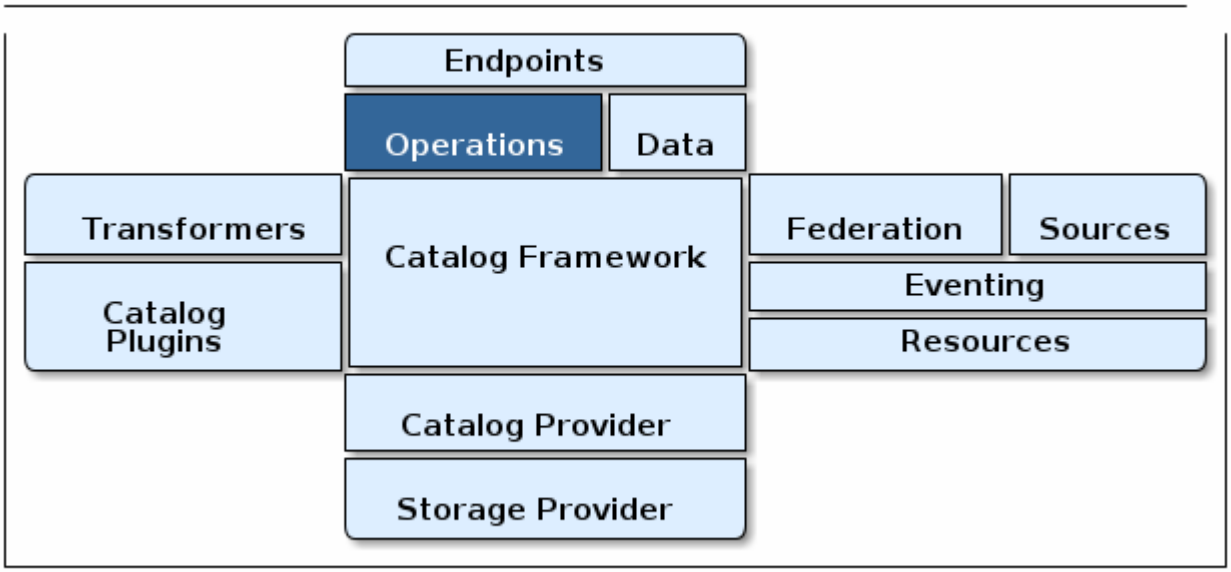
The Catalog includes definitions of several basic types all found in the `ddf.catalog.data.BasicTypes` class.

Table 19. Basic Types

Name	Type	Description
`BASIC_METACARD`	MetacardType	Represents all required Metacard Attributes.
`BINARY_TYPE`	AttributeType	A Constant for an `AttributeType` with `AttributeType.AttributeFormat.BINARY`.
`BOOLEAN_TYPE`	AttributeType	A Constant for an `AttributeType` with `AttributeType.AttributeFormat.BOOLEAN`.
`DATE_TYPE`	AttributeType	A Constant for an `AttributeType` with `AttributeType.AttributeFormat.DATE`.
`DOUBLE_TYPE`	AttributeType	A Constant for an `AttributeType` with `AttributeType.AttributeFormat.DOUBLE`.
`FLOAT_TYPE`	AttributeType	A Constant for an `AttributeType` with `AttributeType.AttributeFormat.FLOAT`.
`GEO_TYPE`	AttributeType	A Constant for an `AttributeType` with `AttributeType.AttributeFormat.GEOMETRY`.
`INTEGER_TYPE`	AttributeType	A Constant for an `AttributeType` with `AttributeType.AttributeFormat.INTEGER`.

Name	Type	Description
`LONG_TYPE`	AttributeType	A Constant for an `AttributeType` with `AttributeType.AttributeFormat.LONG`.
`OBJECT_TYPE`	AttributeType	A Constant for an `AttributeType` with `AttributeType.AttributeFormat.OBJECT`.
`SHORT_TYPE`	AttributeType	A Constant for an `AttributeType` with `AttributeType.AttributeFormat.SHORT`.
`STRING_TYPE`	AttributeType	A Constant for an `AttributeType` with `AttributeType.AttributeFormat.STRING`.
`XML_TYPE`	AttributeType	A Constant for an `AttributeType` with `AttributeType.AttributeFormat.XML`.

6. Operations



The Catalog provides the capability to query, create, update, and delete metacards; retrieve resources; and retrieve information about the sources in the enterprise.

Each of these operations follow a request/response paradigm. The request is the input to the operation and contains all of the input parameters needed by the Catalog Framework's operation to communicate with the Sources. The response is the output from the execution of the operation that is returned to the client, which contains all of the data returned by the sources. For each operation there is an associated request/response pair. For example, the `QueryRequest` and `QueryResponse` pair for the Catalog Framework's query operation.

All of the request and response objects are extensible in that they can contain additional key/value properties on each request/response. This allows additional capability to be added without changing the Catalog API, helping to maintain backwards compatibility.

7. Resources

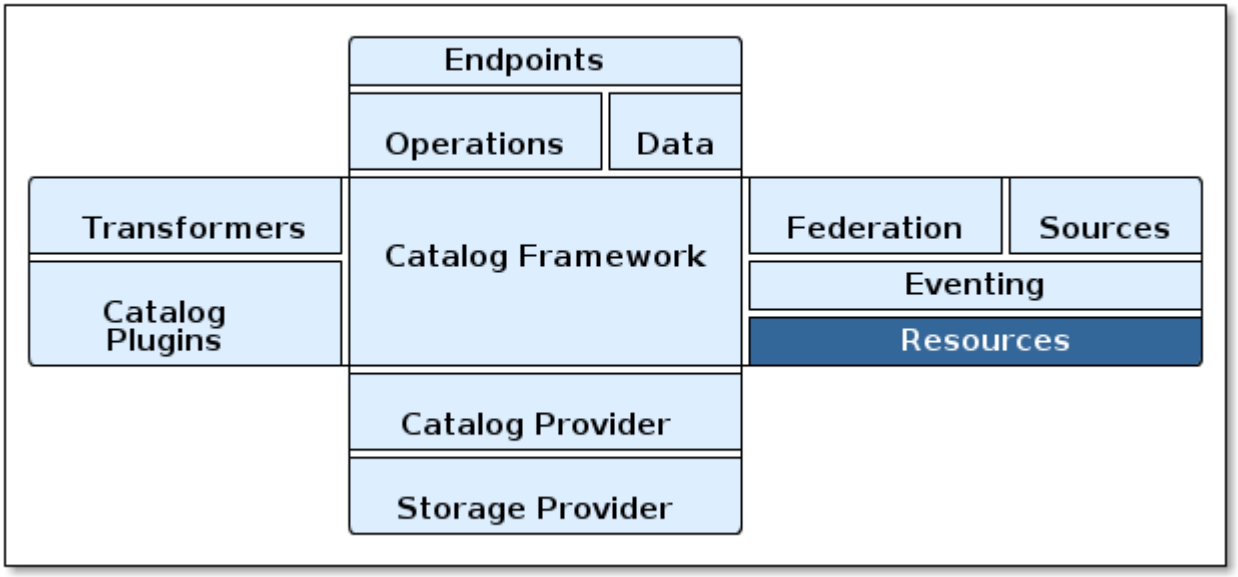


Figure 18. Resources Architecture

Resources are the data that is represented by the cataloged metadata in DDF.

Metacards are used to describe those resources through metadata. This metadata includes the time the resource was created, the location where the resource was created, etc. A DDF `Metacard` contains the `getResourceUri` method, which is used to locate and retrieve its corresponding resource.

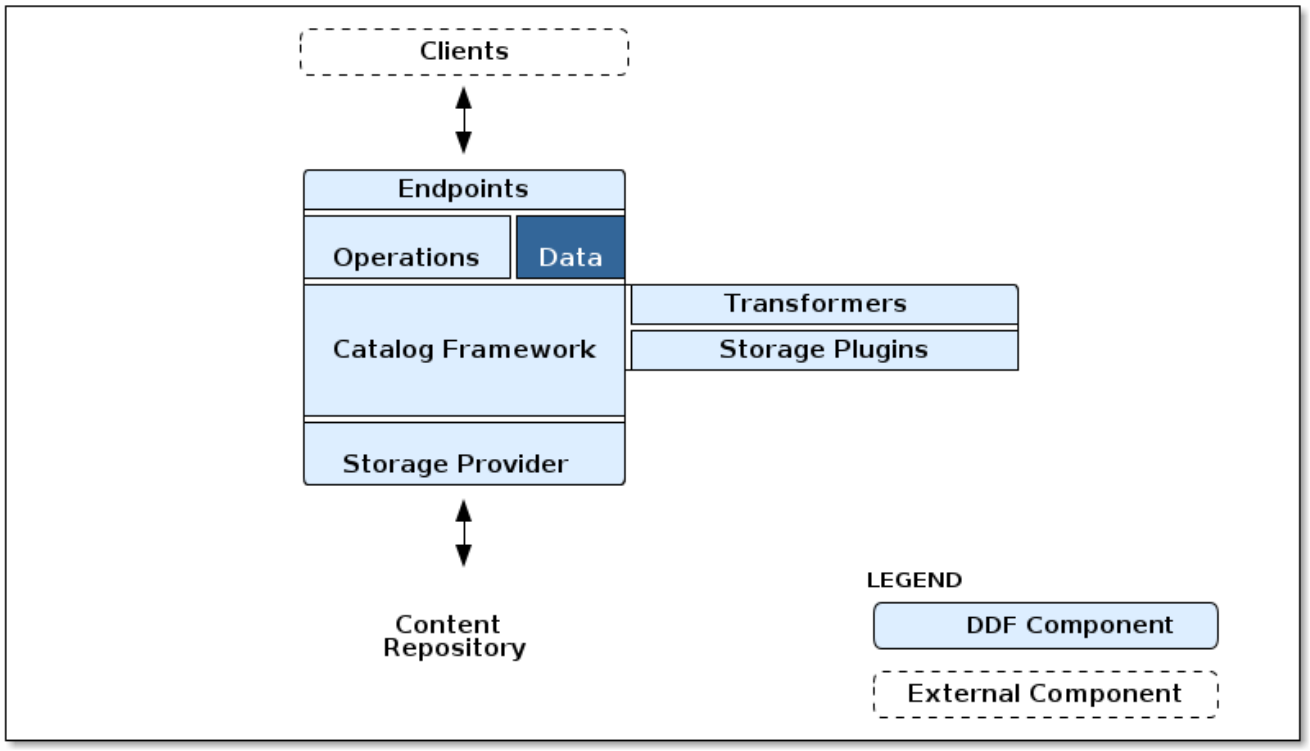


Figure 19. Content Data Component Architecture

7.1. Content Item

Content Item is the domain object populated by the Storage Provider that represents the information about the content to be stored or content that has been stored in the Storage Provider. A `ContentItem` encapsulates the content's globally unique ID, mime type, and input stream (that is, the actual content). The unique ID of a `ContentItem` always corresponds to a Metacard ID.

7.1.1. Retrieving Resources

When a client attempts to retrieve a resource, it must provide a metacard ID or URI corresponding to a unique resource. As mentioned above, the resource URI is obtained from a `Metacard`'s `getResourceUri` method. The `CatalogFramework` has three methods that can be used by clients to obtain a resource: `getEnterpriseResource`, `getResource`, and `getLocalResource`. The `getEnterpriseResource` method invokes the `retrieveResource` method on a local `ResourceReader` as well as all the `Federated` and `Connected` Sources inthe DDF enterprise. The second method, `getResource`, takes in a source ID as a parameter and only invokes `retrieveResource` on the specified `Source`. The third method invokes `retrieveResource` on a local `ResourceReader`.

The parameter for each of these methods in the `CatalogFramework` is a `ResourceRequest`. DDF includes two implementations of `ResourceRequest`: `ResourceRequestById` and `ResourceRequestByProductUri`. Since these implementations extend `OperationImpl`, they can pass a `Map` of generic properties through

the `CatalogFramework` to customize how the resource request is carried out. One example of this is explained in the Retrieving Resource Options section below. The following is a basic example of how to create a `ResourceRequest` and invoke the `CatalogFramework` resource retrieval methods to process the request.

Retrieve Resource Example

```
Map<String, Serializable> properties = new HashMap<String, Serializable>();
properties.put("PropertyKey1", "propertyA"); //properties to customize Resource retrieval
ResourceRequestById resourceRequest = new ResourceRequestById(
"0123456789abcdef0123456789abcdef", properties); //object containing ID of Resource to be
retrieved
String sourceName = "LOCAL_SOURCE"; //the Source ID or name of the local Catalog or a
Federated Source
ResourceResponse resourceResponse; //object containing the retrieved Resource and the
request that was made to get it.
resourceResponse = catalogFramework.getResource(resourceRequest, sourceName); //Source-
based retrieve Resource request
Resource resource = resourceResponse.getResource(); //actual Resource object containing
InputStream, mime type, and Resource name
```

`DDF.catalog.resource.ResourceReader` instances can be discovered via the OSGi Service Registry. The system can contain multiple `ResourceReaders`. The `CatalogFramework` determines which one to call based on the scheme of the resource's URI and what schemes the `ResourceReader` supports. The supported schemes are obtained by a `ResourceReader`'s `getSupportedSchemes` method. As an example, one `ResourceReader` may know how to handle file-based URIs with the scheme `file`, whereas another `ResourceReader` may support HTTP-based URIs with the scheme `http`.

The `ResourceReader` or `Source` is responsible for locating the resource, reading its bytes, adding the binary data to a `Resource` implementation, then returning that `Resource` in a `ResourceResponse`. The `ResourceReader` or `Source` is also responsible for determining the `Resource`'s name and mime type, which it sends back in the `Resource` implementation.

7.1.1.1. BinaryContent

`BinaryContent` is an object used as a container to store translated or transformed DDF components. `Resource` extends `BinaryContent` and includes a `getName` method. `BinaryContent` has methods to get the `InputStream`, `byte` array, MIME type, and size of the represented binary data. An implementation of `BinaryContent` (`BinaryContentImpl`) can be found in the Catalog API in the `DDF.catalog.data` package.

7.1.2. Retrieving Resource Options

Options can be specified on a retrieve resource request made through any of the supporting endpoint. To specify an option for a retrieve resource request, the endpoint needs to first instantiate a `ResourceRequestByProductUri` or a `ResourceRequestById`. Both of these `ResourceRequest` implementations allow a `Map` of properties to be specified. Put the specified option into the `Map` under the key

`RESOURCE_OPTION`.

Retrieve Resource with Options

```
Map<String, Serializable> properties = new HashMap<String, Serializable>();
properties.put("RESOURCE_OPTION", "OptionA");
ResourceRequestById resourceRequest = new ResourceRequestById(
"0123456789abcdef0123456789abcdef", properties);
```

Depending on the support that the `ResourceReader` or `Source` provides for options, the `properties` `Map` is checked for the `RESOURCE_OPTION` entry. If that entry is found, the option is handled. If the `ResourceReader` or `Source` does not support options, that entry is ignored.

A new `ResourceReader` or `Source` implementation can be created to support options in a way that is most appropriate. Since the option is passed through the catalog framework as a property, the `ResourceReader` or `Source` has access to that option as long as the endpoint supports options.

7.1.3. Storing Resources

Resources are saved using a `ResourceWriter`. `DDF.catalog.resource.ResourceWriter` instances can be discovered via the OSGi Service Registry. Once retrieved, the `ResourceWriter` instance provides clients with a way to store resources and get a corresponding URI that can be used to subsequently retrieve the resource via a `ResourceReader`. Simply invoke either of the `storeResource` methods with a resource and any potential arguments. The `ResourceWriter` implementation is responsible for determining where the resource is saved and how it is saved. This allows flexibility for a resource to be saved in any one of a variety of data stores or file systems. The following is an example of how to use a generic implementation of `ResourceWriter`.

Using a ResourceWriter

```
InputStream inputStream = <Video_Input_Stream>; //InputStream of raw Resource data
MimeType mimeType = new MimeType("video/mpeg"); //Mime Type or content type of Resource
String name = "Facility_Video";  //Descriptive Resource name
Resource resource = new ResourceImpl(inputStream, mimeType, name);
Map<String, Object> optionalArguments = new HashMap<String, Object>();
ResourceWriter writer = new ResourceWriterImpl();
URI resourceUri; //URI that can be used to retrieve Resource
resourceUri = writer.storeResource(resource, optionalArguments); //Null can be passed in
here
```

7.2. Resource Components

Resource components are used when working with resources

A resource is a URI-addressable entity that is represented by a metacard.

Resources may exist either locally or on a remote data store.

Examples of resources include:

- NITF image
- MPEG video
- Live video stream
- Audio recording
- Document

A resource object in DDF contains an `InputStream` with the binary data of the resource. It describes that resource with a name, which could be a file name, URI, or another identifier. It also contains a mime type or content type that a client can use to interpret the binary data.

7.3. Resource Readers

A Resource Reader retrieves resources associated with metacards via URIs. Each resource reader must know how to interpret the resource's URI and how to interact with the data store to retrieve the resource.

There can be multiple resource readers in a Catalog instance. The `Catalog Framework` selects the appropriate resource reader based on the scheme of the resource's URI.

In order to make a resource reader available to the Catalog Framework, it must be exported to the OSGi Service Registry as a `DDF.catalog.resource.ResourceReader`.

7.3.1. URL Resource Reader

The `URLResourceReader` is an implementation of `ResourceReader` which is included in the DDF Catalog. It obtains a resource given an http, https, or file-based URL. The `URLResourceReader` connects to the provided Resource URL and reads the resource's bytes into an `InputStream`.

WARNING	When a resource linked using a file-based URL is in the product cache, the `URLResourceReader`'s `rootResourceDirectories` is not checked when downloading. It is downloaded from the product cache which bypasses the `URLResourceReader`. For example, if path `/my/valid/path` is configured in the `URLResourceReader`'s `rootResourceDirectories` and one downloads the product with resource-uri `file:///my/valid/path/product.txt` and then one removes `/my/valid/path` from the `URLResourceReader`'s `rootResourceDirectories` configuration, the product is still accessible via the product cache.

7.3.1.1. Installing the URL Resource Reader

The `URLResourceReader` is installed by default with a standard installation in the Catalog application.

7.3.1.2. Configuring Permissions for the URL Resource Reader

Configuring the URL Resource Reader to retrieve files requires adding Security Manager read permission entries for the directory containing the resources. To add the correct permission entries, edit the file <DDF_HOME>/security/configurations.policy. In the URL Resource Reader section of the file, add two new permission for each top-level directory that the Resource Reader needs to access. The Resource Reader needs one permission to read the directory and another to read its contents.

WARNING	*Adding New Permissions* After adding permission entries, a system restart is required for them to take effect.

```
grant codeBase "file:/org.apache.tika.core/catalog-core-urlresourcereader" {
//# Add permissions here
permission java.io.FilePermission "<DIRECTORY_PATH>", "read";
permission java.io.FilePermission "<OTHER_DIRECTORY_PATH>", "read";
}
```

Trailing slashes after `<DIRECTORY_PATH>` have no effect on the permissions granted. For example, adding a permission for `"${/}test${/}path"` and `"${/}test${/}path${/}"` are equivalent. The recursive forms `"${/}test${/}path${/}-"`, and `"${/}test${/}path${/}${/}-"` are also equivalent.

7.3.1.3. Configuring the URL Resource Reader

Configure the URL Resource Reader from the Admin Console.

1. Navigate to the **Admin Console**.
2. Select the **Catalog** application.
3. Select the **Configuration** tab.
4. Select the **URL Resource Reader**.

See URL Resource Reader configurations for all possible configurations.

7.3.1.4. Using the URL Resource Reader

`URLResourceReader` is used by the Catalog Framework to obtain a resource whose metacard is cataloged in the local data store. This particular `ResourceReader` is chosen by the `CatalogFramework` if the requested resource's URL has a protocol of `http`, `https`, or `file`.

For example, requesting a resource with the following URL makes the Catalog Framework invoke the `URLResourceReader` for retrieval.

Example

```
file:///home/users/DDF_user/data/example.txt
```

If a resource was requested with the URL `udp://123.45.67.89:80/SampleResourceStream`, the `URLResourceReader` would *not* be invoked.

Supported Schemes:

- http
- https
- file

NOTE	If a file-based URL is passed to the `URLResourceReader`, that file path needs to be accessible by the DDF instance.

7.4. Resource Writers

A Resource Writer stores a resource and produces a URI that can be used for retrieval. The resource URI uniquely locates and identifies the resource. Resource writers can interact with an underlying data store and store the resource in the proper place. Each implementation can do this differently, providing flexibility in the data stores used to persist the resources.

Resource Writers should be used within the Content Framework if and when implementing a custom Storage Provider to store data. The default Storage Provider that comes with the DDF writes the resources to the file system.

8. Queries

Clients use `ddf.catalog.operation.Query` objects to describe which metacards are needed from Sources.

Query objects have two major components:

- Filters
- Query Options

A Source uses the Filter criteria constraints to find the requested set of metacards within its domain of metacards. The Query Options are used to further restrict the Filter's set of requested metacards.

8.1. Filters

An OGC Filter is a Open Geospatial Consortium (OGC) standard that describes a query expression in

terms of Extensible Markup Language (XML) and key-value pairs (KVP). The OGC Filter is used to represent a query to be sent to sources and the Catalog Provider, as well as to represent a Subscription. The OGC Filter provides support for expression processing, such as adding or dividing expressions in a query, but that is not the intended use for DDF.

The Catalog Framework does not use the XML representation of the OGC Filter standard. DDF instead uses the Java implementation provided by GeoTools. GeoTools provides Java equivalent classes for OGC Filter XML elements. GeoTools originally provided the standard Java classes for the OGC Filter Encoding 1.0 under the package name `org.opengis.filter`. That package name was changed to `org.geotools.api.filter` in version 30.0 and is currently used by DDF. Java developers do not parse or view the XML representation of a Filter in DDF. Instead, developers use only the Java objects to complete query tasks.

Note that the `ddf.catalog.operation.Query` interface extends the `org.geotools.api.filter.Filter` interface, which means that a Query object is an OGC Java Filter with Query Options.

A Query is an OGC Filter

```
public interface Query extends Filter
```

8.1.1. FilterBuilder API

To avoid the complexities of working with the Filter interface directly and implementing the DDF Profile of the Filter specification, the Catalog includes an API, primarily in `DDF.filter`, to build Filters using a fluent API.

To use the `FilterBuilder` API, an instance of `DDF.filter.FilterBuilder` should be used via the OSGi registry. Typically, this is injected via a dependency injection framework. Once an instance of `FilterBuilder` is available, methods can be called to create and combine Filters.

TIP	The fluent API is best accessed using an IDE that supports code-completion. For additional details, refer to the [Catalog API Javadoc].

8.1.1.1. Boolean Operators

Filters use a number of boolean operators.

`FilterBuilder.allOf(Filter …)`

creates a new Filter that requires all provided Filters are satisfied (Boolean AND), either from a List or Array of Filter instances.

`FilterBuilder.anyOf(Filter …)`

creates a new Filter that requires at least one of the provided Filters are satisfied (Boolean OR), either from a List or Array of Filter instances.

`FilterBuilder.not(Filter filter)`

creates a new Filter that requires the provided Filter must not match (Boolean NOT).

8.1.1.2. Attribute

Filters can be based on specific attributes.

`FilterBuilder.attribute(String attributeName)`

begins a fluent API for creating an Attribute-based Filter, which is a Filter that matches on Metacards with Attributes of a particular value.

9. Action Framework

The Action Framework was designed as a way to limit dependencies between applications (apps) in a system. For instance, a feature in an app, such as an Atom feed generator, might want to include an external link as part of its feed's entries. That feature does not have to be coupled to a REST endpoint to work, nor does it have to depend on a specific implementation to get a link. In reality, the feature does not identify how the link is generated, but it does identify whether the link works or does not work when retrieving the intended entry's metadata. Instead of creating its own mechanism or adding an unrelated feature, it could use the Action Framework to query the OSGi container for any service that can provide a link. This does two things: it allows the feature to be independent of implementations, and it encourages reuse of common services.

The Action Framework consists of two major Java interfaces in its API:

1. `ddf.action.Action`
2. `ddf.action.ActionProvider`

Actions

Specific tasks that can be performed as services.

Action Providers

Lists of related actions that a service is capable of performing.

9.1. Action Providers

Included Action Providers

Download Resource ActionProvider

Downloads a resource to the local product cache.

IdP Logout Action Provider

Identity Provider Logout.

Karaf Logout Action

Local Logout.

LDAP Logout Action

Ldap Logout.

Overlay ActionProvider

Provides a metacard URL that transforms the metacard into a geographically aligned image (suitable for overlaying on a map).

View Metacard ActionProvider

Provides a URL to a metacard.

Metacard Transformer ActionProvider

Provides a URL to a metacard that has been transformed into a specified format.

10. Asynchronous Processing Framework

NOTE	This code is experimental. While this interface is functional and tested, it may change or be removed in a future version of the library.

The Asynchronous Processing Framework is a way to run plugins asynchronously. Generally, plugins that take a significant amount of processing time and whose results are not immediately required are good candidates for being asynchronously processed. A **Processing Framework** can either be run on the local or remote system. Once the **Processing Framework** finishes processing incoming requests, it may submit `(Create|Update|Delete)Request`s to the Catalog. The type of plugins that a **Processing Framework** runs are the **Post-Process Plugins**. The **Post-Process Plugins** are triggered by the **Processing Post Ingest Plugin**, which is a **Post-Ingest Plugin**. **Post-Ingest Plugins** are run after the metacard has been ingested into the Catalog. This feature is uninstalled by default.

WARNING	The **Processing Framework** does not support partial updates to the Catalog. This means that if any changes are made to a metacard in the Catalog between the time asynchronous processing starts and ends, those changes are overwritten by the **ProcessingFramework** updates sent back to the Catalog. This feature should be used with caution.

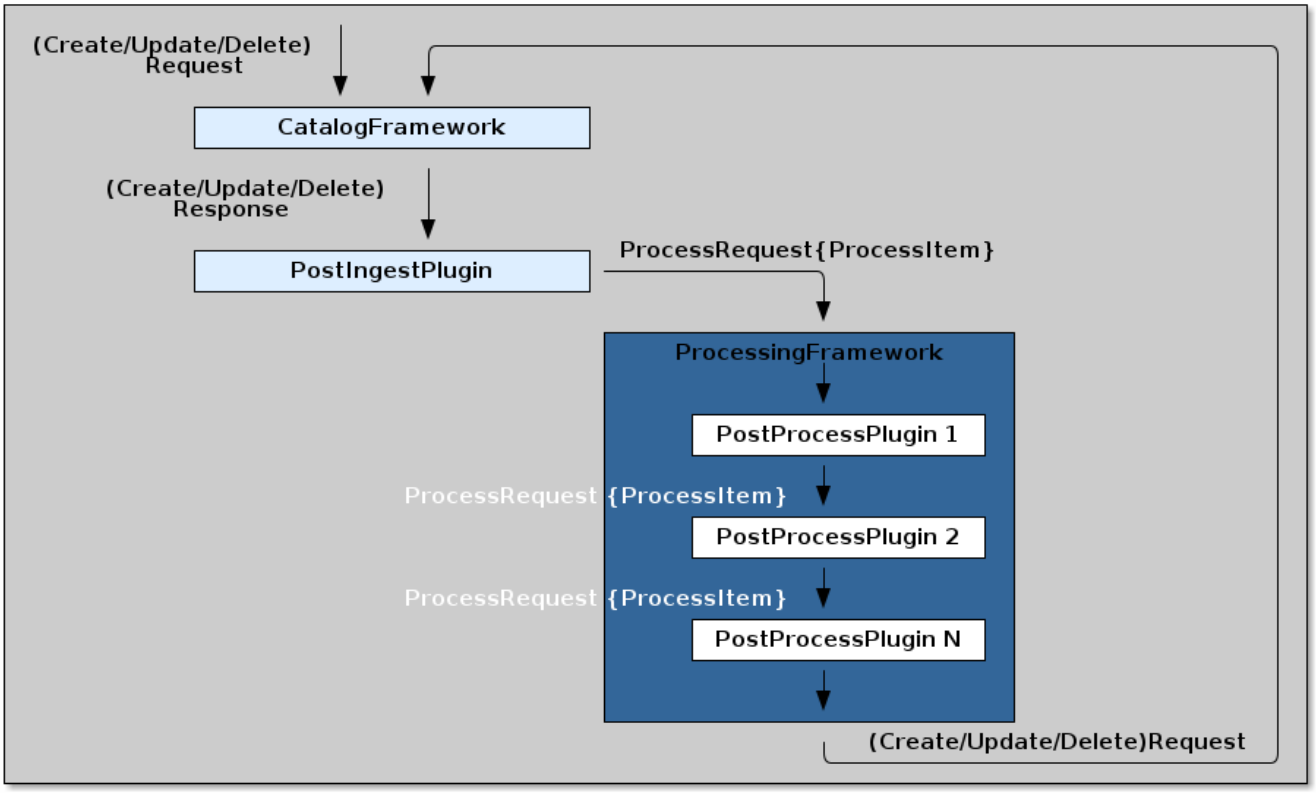


Figure 20. Processing Framework Architecture

The Asynchronous Processing Framework API Interfaces

1. `org.codice.ddf.catalog.async.processingframework.api.internal.ProcessingFramework`
2. `org.codice.ddf.catalog.async.plugin.api.internal.PostProcessPlugin`
3. `org.codice.ddf.catalog.async.data.api.internal.ProcessItem`
4. `org.codice.ddf.catalog.async.data.api.internal.ProcessCreateItem`
5. `org.codice.ddf.catalog.async.data.api.internal.ProcessUpdateItem`
6. `org.codice.ddf.catalog.async.data.api.internal.ProcessDeleteItem`
7. `org.codice.ddf.catalog.async.data.api.internal.ProcessRequest`
8. `org.codice.ddf.catalog.async.data.api.internal.ProcessResoure`
9. `org.codice.ddf.catalog.async.data.api.internal.ProcessResourceItem`

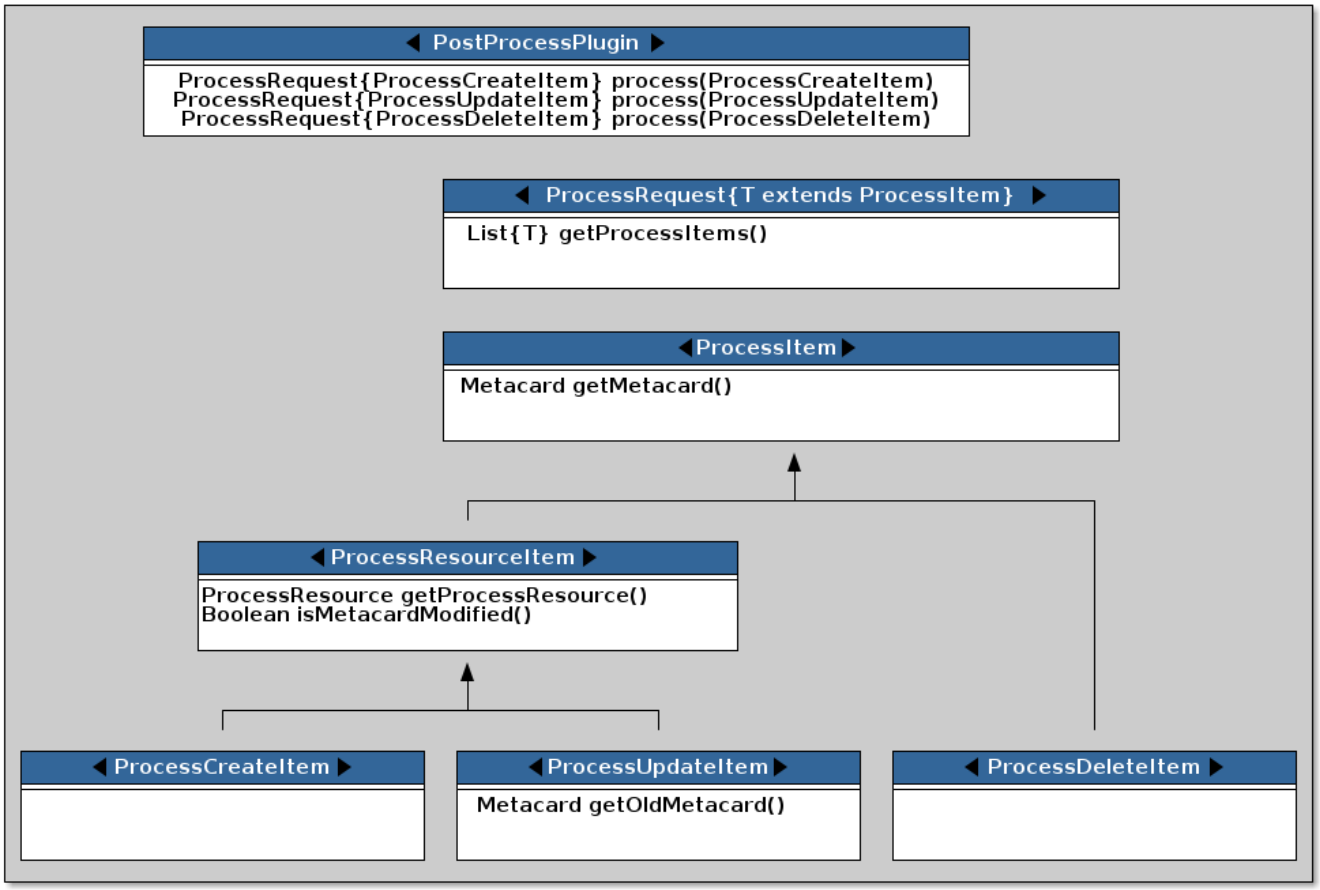


Figure 21. Processing Framework Interface Diagram

ProcessingFramework

The `ProcessingFramework` is responsible for processing incoming `ProcessRequest`s that contain a `ProcessItem`. A `ProcessingFramework` should never block. It receives its `ProcessRequest`s from a `PostIngestPlugin` on all CUD operations to the Catalog. In order to determine whether or not asynchronous processing is required by the `ProcessingFramework`, the `ProcessingFramework` should mark any request it has submitted back the Catalog, otherwise a processing loop may occur. For example, the default **In-Memory Processing Framework** adds a `POST_PROCESS_COMPLETE` flag to the Catalog CUD request after processing. This flag is checked by the `ProcessingPostIngestPlugin` before a `ProcessRequest` is sent to the `ProcessingFramework`. For an example of a `ProcessingFramework`, please refer to the `org.codice.ddf.catalog.async.processingframework.impl.InMemoryProcessingFramework`.

ProcessRequest

A `ProcessRequest` contains a list of `ProcessItem`s for the `ProcessingFramework` to process. Once a `ProcessRequest` has been processed by a `ProcessingFramework`, the `ProcessingFramework` should mark the `ProcessRequest` as already been processed, so that it does not process it again.

PostProcessPlugin

The `PostProcessPlugin` is a plugin that is run by the `ProcessingFramework`. It is capable of processing `ProcessCreateItem`s, `ProcessUpdateItem`s, and `ProcessDeleteItem`s.

WARNING	*ProcessItem* Do not implement `ProcessItem` directly; it is intended for use only as a common base interface for `ProcessResourceItem` and `ProcessDeleteItem`.

The `ProcessItem` is contained by a `ProcessRequest`. It can be either a `ProcessCreateItem`, `ProcessUpdateItem`, or `ProcessDeleteItem`.

ProcessResource

The `ProcessResource` is a piece of content that is attached to a metacard. The piece of content can be either local or remote.

ProcessResourceItem

The `ProcessResourceItem` indicates that the item being processed may have a `ProcessResource` associated with it.

WARNING	*ProcessResourceItem Warning* Do not implement `ProcessResourceItem` directly; it is intended for use only as a common base interface for `ProcessCreateItem` and `ProcessUpdateItem`.

ProcessCreateItem

The `ProcessCreateItem` is an item for a metacard that has been created in the Catalog. It contains the created metacard and, optionally, a `ProcessResource`.

ProcessUpdateItem

The `ProcessUpdateItem` is an item for a metacard that has been updated in the Catalog. It contains the original metacard, the updated metacard and, optionally, a `ProcessResource`.

ProcessDeleteItem

The `ProcessDeleteItem` is an item for a metacard that has been deleted in the Catalog. It contains the deleted metacard.

11. Eventing

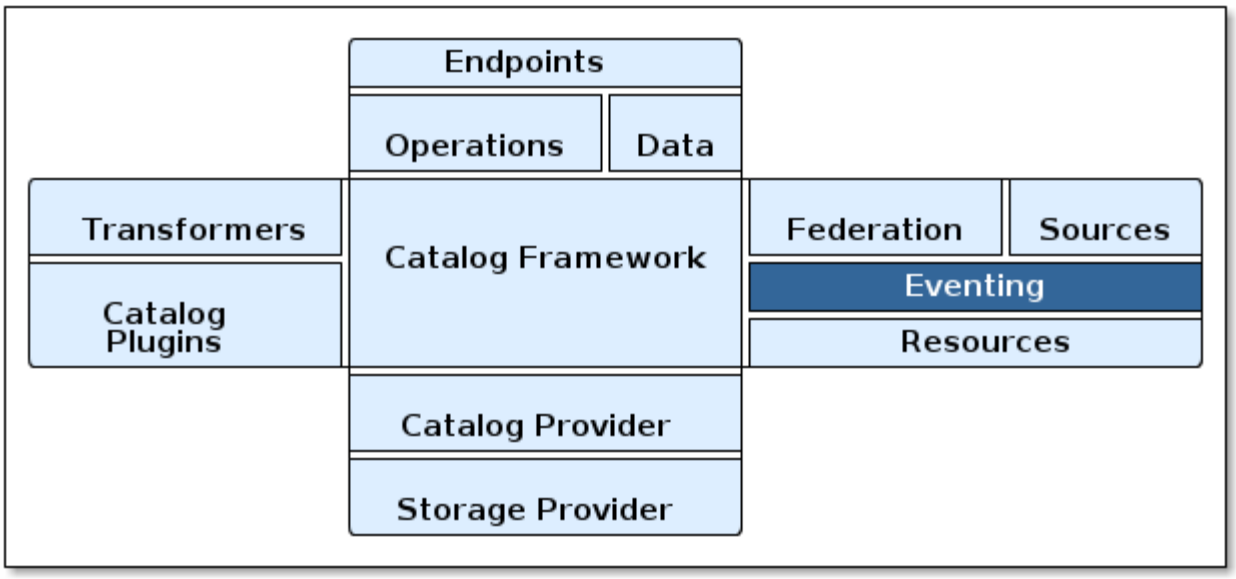


Figure 22. Eventing Architecture

The Eventing capability of the Catalog allows endpoints (and thus external users) to create a "standing query" and be notified when a matching metacard is created, updated, or deleted.

Notably, the Catalog allows event evaluation on both the previous value (if available) and new value of a Metacard when an update occurs.

Eventing allows DDFs to receive events on operations (such as create, update, delete) based on particular queries or actions. Once subscribed, users receive notifications of events such as update or create on any source.

11.1. Eventing Components

The key components of DDF Eventing include:

- Subscription
- Delivery Method
- Event Processor

12. Security Framework

The DDF Security Framework utilizes Apache Shiro as the underlying security framework. The classes mentioned in this section have their full package name listed, to make it easy to tell which classes come

with the core Shiro framework and which are added by DDF.

12.1. Subject

`ddf.security.Subject <extends> org.apache.shiro.subject.Subject`

The Subject is the key object in the security framework. Most of the workflow and implementations revolve around creating and using a Subject. The Subject object in DDF is a class that encapsulates all information about the user performing the current operation. The Subject can also be used to perform permission checks to see if the calling user has acceptable permission to perform a certain action (for example, calling a service or returning a metacard). This class was made DDF-specific because the Shiro interface cannot be added to the Query Request property map.

Table 20. Implementations of Subject:

Classname	Description
`ddf.security.impl.SubjectImpl`	Extends `org.apache.shiro.subject.support.DelegatingSubject`

12.1.1. Security Manager

`ddf.security.service.SecurityManager`

The Security Manager is a service that handles the creation of Subject objects. A proxy to this service should be obtained by an endpoint to create a Subject and add it to the outgoing `QueryRequest`. The Shiro framework relies on creating the subject by obtaining it from the current thread. Due to the multi-threaded and stateless nature of the DDF framework, utilizing the Security Manager interface makes retrieving Subjects easier and safer.

Table 21. Implementations of Security Managers:

Classname	Description
`ddf.security.service.SecurityManagerImpl`	This implementation of the Security Manager handles taking in both `org.apache.shiro.authc`. AuthenticationToken and `org.apache.cxf.ws.security.tokenstore.SecurityToken` objects.

12.1.2. Realms

DDF uses Apache Shiro for the concept of Realms for Authentication and Authorization. Realms are components that access security data such as such as users or permissions.

12.1.2.1. Authenticating Realms

`org.apache.shiro.realm.AuthenticatingRealm`

Authenticating Realms are used to authenticate an incoming Authentication Token and return Authentication Info on successful authentication. This Authentication Info is used by the Shiro framework to put together a resulting Subject. A Subject represents the application user and contains all available security-relevant information about that user.

Table 22. Implementations of Authenticating Realms in DDF:

Classname	Description
`org.codice.ddf.security.guest.realm.GuestRealm`	This realm checks if Guest access is allowed on the incoming Authentication Token, and if so the Guest realm returns the Guest Authentication Info.
`org.codice.ddf.security.oidc.realm.OidcRealm`	This realm takes in any OIDC/OAuth credentials found on the incoming Authentication Token, and if so resolves the ID_Token using those credentials. The ID_Token is then used to put together the resulting Authentication Info.
`ddf.security.realm.sts.StsRealm`	This realm delegates authentication to the Secure Token Service (STS). It creates a `RequestSecurityToken` message from the incoming Authentication Token and converts a successful STS response into Authentication Info.

12.1.2.2. Authorizing Realms

`org.apache.shiro.realm.AuthorizingRealm`

Authorizing Realms are used to perform authorization on the current Subject. These are used when performing both service authorization and filtering. They are passed in the `AuthorizationInfo` of the Subject along with the permissions of the object wanting to be accessed. The response from these realms is a true (if the Subject has permission to access) or false (if the Subject does not).

Table 23. Other implementations of the Security API within DDF

Classname	Description
`org.codice.ddf.platform.filter.delegate.DelegateServletFilter`	The `DelegatingHttpFilterHandler` detects any servlet filters that have been exposed as OSGi services implementing `org.codice.ddf.platform.filter.SecurityFilter` and places them in-order in front of any servlet or web application running on the container.

Classname	Description
`org.codice.ddf.security.filter.websso.WebSSOFilter`	This filter is the main security filter that works with a number of handlers to protect a variety of web contexts, each using different authentication schemes and policies. It attaches an Authentication Token to the request by either checking the session or calling the configured Security Handlers.
`org.codice.ddf.security.handler.basic.BasicAuthenticationHandler`	Checks for basic authentication credentials in the http request header. If no credentials are found, it supports the acquisition of basic credentials on user-agent requests.
`org.codice.ddf.security.handler.pki.PKIHandler`	Handler for PKI based authentication. X509 chain is extracted from the HTTP request.
`org.codice.security.idp.client.IdpHandler`	Handler for IdP/SAML based authentication. If no credentials are found, it supports the acquisition of credentials through the configured SAML IdP.
`org.codice.ddf.security.handler.oidc.OidcHandler`	Handler for OIDC based authentication. If no credentials are found, and is a user-agent request, this handler supports the acquisition of credentials through the configured OIDC IdP.
`org.codice.ddf.security.handler.oauth.OAuthHandler`	Handler for OAuth based authentication. Does not support the acquisition of credentials.
`org.codice.ddf.security.filter.login.LoginFilter`	This filter runs immediately after the WebSSOFilter and exchanges an Authentication Token found in the request with a Subject via Shiro.
`org.codice.ddf.security.filter.authorization.AuthorizationFilter`	This filter runs immediately after the `LoginFilter` and checks any permissions assigned to the web context against the attributes of the Subject via Shiro.
`org.apache.shiro.realm.AuthenticatingRealm`	This is an abstract authenticating realm that exchanges an `org.apache.shiro.authc.AuthenticationToken` for a `org.apache.shiro.authc.AuthenticationInfo`, which is used by the Shiro framework to put together a `ddf.security.Subject`.
`ddf.security.service.AbstractAuthorizingRealm`	This is an abstract authorizing realm that takes care of caching and parsing the Subject's `AuthorizingInfo` and should be extended to allow the implementing realm to focus on making the decision.

Classname	Description
`ddf.security.pdp.realm.AuthZRealm`	This realm performs the authorization decision and may or may not delegate out to the external XACML processing engine. It uses the incoming permissions to create a decision. However, it is possible to extend this realm using the `ddf.security.policy.extension.PolicyExtension interface`. This interface allows an integrator to add additional policy information to the PDP that can't be covered via its generic matching policies. This approach is often easier to configure for those that are not familiar with XACML.
`org.codice.ddf.security.validator.*`	A number of validators are provided for X.509 and Username tokens.

WARNING	An update was made to the IdpHandler to pass SAML assertions through the Authorization HTTP header. Cookies *are* still accepted and processed to maintain legacy federation compatibility, but assertions are sent in the header on outbound requests. While a machine's identity still federates between versions, a user's identity is ONLY federated when a DDF version 2.7.x server communicates with a DDF version 2.8.x+ server, or between two servers whose versions are 2.8.x or higher.

12.2. Security Core

The contains all of the necessary components that are used to perform security operations (authentication, authorization, and auditing) required in the framework.

12.2.1. Security Core API

The Security Core API contains all of the DDF APIs that are used to perform security operations within DDF.

12.2.1.1. Installing the Security Core API

The Security Services App installs the Security Core API by default. Do not uninstall the Security Core API as it is integral to system function and all of the other security services depend upon it.

12.2.1.2. Configuring the Security Core API

The Security Core API has no configurable properties.

12.2.2. Security Core Implementation

The Security Core Implementation contains the reference implementations for the Security Core API interfaces that come with the DDF distribution.

12.2.2.1. Installing the Security Core Implementation

The Security Core app installs this bundle by default. It is **recommended** to use this bundle as it contains the reference implementations for many classes used within the Security Framework.

12.2.2.2. Configuring the Security Core Implementation

The Security Core Implementation has no configurable properties.

12.2.3. Security Core Commons

The Security Core Services bundle contains services that are used within DDF to help with performing common security operations. Most notably, this bundle contains the `ddf.security.audit.SecurityLogger` class that performs the security audit logging within DDF.

12.2.3.1. Configuring the Security Core Commons

The Security Core Commons bundle has no configurable properties.

12.3. Security Encryption

The Security Encryption application offers an encryption framework and service implementation for other applications to use. This service is commonly used to encrypt and decrypt default passwords that are located within the metatype and Admin Console.

The encryption service and encryption command, which are based on tink, provide an easy way for developers to add encryption capabilities to DDF.

12.3.1. Security Encryption API

The Security Encryption API bundle provides the framework for the encryption service. Applications that use the encryption service should use the interfaces defined within it instead of calling an implementation directly.

12.3.1.1. Installing Security Encryption API

This bundle is installed by default as part of the `security-encryption` feature. Many applications that come with DDF depend on this bundle and it should not be uninstalled.

12.3.1.2. Configuring the Security Encryption API

The Security Encryption API has no configurable properties.

12.3.2. Security Encryption Implementation

The Security Encryption Implementation bundle contains all of the service implementations for the Encryption Framework and exports those implementations as services to the OSGi service registry.

12.3.2.1. Installing Security Encryption Implementation

This bundle is installed by default as part of the `security-encryption` feature. Other projects are dependent on the services this bundle exports and it should not be uninstalled unless another security service implementation is being added.

12.3.2.2. Configuring Security Encryption Implementation

The Security Encryption Implementation has no configurable properties.

12.3.3. Security Encryption Commands

The Security Encryption Commands bundle enhances the DDF system console by allowing administrators and integrators to encrypt and decrypt values directly from the console.

The `security:encrypt` command allows plain text to be encrypted using AES for encryption. It uses randomly generated keys and associated data that are created when the system is installed, and can be found in the `<DDF_HOME>/etc/keysets` directory. This is useful when displaying password fields in a GUI.

Below is an example of the `security:encrypt` command used to encrypt the plain text `"myPasswordToEncrypt"`. The output, `bR9mJpDVo8bTRwqGwIFxHJ5yFJzatKwjXjIo/8USWm8=`, is the encrypted value.

```
ddf@local>security:encrypt myPasswordToEncrypt

bR9mJpDVo8bTRwqGwIFxHJ5yFJzatKwjXjIo/8USWm8=
```

12.3.3.1. Installing the Security Encryption Commands

This bundle is installed by default with the `security-encryption` feature. This bundle is tied specifically to the DDF console and can be uninstalled if not needed. When uninstalled, however, administrators are not able to encrypt and decrypt data from the console.

12.3.3.2. Configuring the Security Encryption Commands

The Security Encryption Commands have no configurable properties.

12.4. Security LDAP

The Security LDAP application allows the user to configure either an embedded or a standalone LDAP server. The provided features contain a default set of schemas and users loaded to help facilitate authentication and authorization testing.

12.4.1. Embedded LDAP Server

DDF includes an embedded LDAP server (OpenDJ) for testing and demonstration purposes.

WARNING	The embedded LDAP server is intended for testing purposes only and is not recommended for production use.

12.4.1.1. Installing the Embedded LDAP Server

The embedded LDAP server is not installed by default with a standard installation.

1. Navigate to the **Admin Console**.
2. Select the **System** tab.
3. Select the **Features** tab.
4. Install the `opendj-embedded` feature.

12.4.1.2. Configuring the Embedded LDAP

Configure the Embedded LDAP from the Admin Console:

1. Navigate to the **Admin Console**.
2. Select the **OpenDj Embedded** application.
3. Select the **Configuration** tab.

Table 24. OpenDJ Embedded Configurable Properties

Configuration Name	Description
LDAP Port	Sets the port for LDAP (plaintext and startTLS). 0 disables the port.
LDAPS Port	Sets the port for LDAPS. 0 disables the port.

Configuration Name	Description
Base LDIF File	Location on the server for a LDIF file. This file is loaded into the LDAP and overwrites any existing entries. This option should be used when updating the default groups/users with a new LDIF file for testing. The LDIF file being loaded may contain any LDAP entries (schemas, users, groups, etc.). If the location is left blank, the default base LDIF file included with DDF is used.

12.4.1.3. Connecting to Standalone LDAP Servers

DDF instances can connect to external LDAP servers by installing and configuring the `security-jaas-ldap` and `security-claims-ldap` features detailed here.

In order to connect to more than one LDAP server, configure these features for each LDAP server.

12.4.1.4. Embedded LDAP Configuration

The Embedded LDAP application contains an LDAP server (OpenDJ version 2.6.2) that has a default set of schemas and users loaded to help facilitate authentication and authorization testing.

Table 25. Embedded LDAP Default Ports Settings

Protocol	Default Port
`LDAP`	1389
`LDAPS`	1636
`StartTLS`	1389

Table 26. Embedded LDAP Default Users

Username	Password	Groups	Description
`testuser1`	`password1`		General test user for authentication
`testuser2`	`password2`		General test user for authentication
`nromanova`	`password1`	`avengers`	General test user for authentication
`lcage`	`password1`	`admin`, `avengers`	General test user for authentication, Admin user for karaf
`jhowlett`	`password1`	`admin`, `avengers`	General test user for authentication, Admin user for karaf
`pparker`	`password1`	`admin`, `avengers`	General test user for authentication, Admin user for karaf
`jdrew`	`password1`	`admin`, `avengers`	General test user for authentication, Admin user for karaf

Username	Password	Groups	Description
tstark	password1	admin, avengers	General test user for authentication, Admin user for karaf
bbanner	password1	admin, avengers	General test user for authentication, Admin user for karaf
srogers	password1	admin, avengers	General test user for authentication, Admin user for karaf
admin	admin	admin	Admin user for karaf

Table 27. Embedded LDAP Default Admin User Settings

Username	Password	Groups	Attributes	Description
admin	secret			Administrative User for LDAP

12.4.1.5. Schemas

The default schemas loaded into the LDAP instance are the same defaults that come with OpenDJ.

Table 28. Embedded LDAP Default Schemas

Schema File Name	Schema Description
00-core.ldif	This file contains a core set of attribute type and objectclass definitions from several standard LDAP documents, including draft-ietf-boreham-numsubordinates, draft-findlay-ldap-groupofentries, draft-furuseth-ldap-untypedobject, draft-good-ldap-changelog, draft-ietf-ldup-subentry, draft-wahl-ldap-adminaddr, RFC 1274, RFC 2079, RFC 2256, RFC 2798, RFC 3045, RFC 3296, RFC 3671, RFC 3672, RFC 4512, RFC 4519, RFC 4523, RFC 4524, RFC 4530, RFC 5020, and X.501.
01-pwpolicy.ldif	This file contains schema definitions from draft-behera-ldap-password-policy, which defines a mechanism for storing password policy information in an LDAP directory server.
02-config.ldif	This file contains the attribute type and objectclass definitions for use with the directory server configuration.
03-changelog.ldif	This file contains schema definitions from draft-good-ldap-changelog, which defines a mechanism for storing information about changes to directory server data.
03-rfc2713.ldif	This file contains schema definitions from RFC 2713, which defines a mechanism for storing serialized Java objects in the directory server.
03-rfc2714.ldif	This file contains schema definitions from RFC 2714, which defines a mechanism for storing CORBA objects in the directory server.

Schema File Name	Schema Description
`03-rfc2739.ldif`	This file contains schema definitions from RFC 2739, which defines a mechanism for storing calendar and vCard objects in the directory server. Note that the definition in RFC 2739 contains a number of errors, and this schema file has been altered from the standard definition in order to fix a number of those problems.
`03-rfc2926.ldif`	This file contains schema definitions from RFC 2926, which defines a mechanism for mapping between Service Location Protocol (SLP) advertisements and LDAP.
`03-rfc3112.ldif`	This file contains schema definitions from RFC 3112, which defines the authentication password schema.
`03-rfc3712.ldif`	This file contains schema definitions from RFC 3712, which defines a mechanism for storing printer information in the directory server.
`03-uddiv3.ldif`	This file contains schema definitions from RFC 4403, which defines a mechanism for storing UDDIv3 information in the directory server.
`04-rfc2307bis.ldif`	This file contains schema definitions from the `draft-howard-rfc2307bis` specification, used to store naming service information in the directory server.
`05-rfc4876.ldif`	This file contains schema definitions from RFC 4876, which defines a schema for storing Directory User Agent (DUA) profiles and preferences in the directory server.
`05-samba.ldif`	This file contains schema definitions required when storing Samba user accounts in the directory server.
`05-solaris.ldif`	This file contains schema definitions required for Solaris and OpenSolaris LDAP naming services.
`06-compat.ldif`	This file contains the attribute type and `objectclass` definitions for use with the directory server configuration.

12.4.1.6. Starting and Stopping the Embedded LDAP

The embedded LDAP application installs a feature with the name `ldap-embedded`. Installing and uninstalling this feature starts and stops the embedded LDAP server. This also installs a fresh instance of the server each time. If changes need to persist, stop then start the `embedded-ldap-opendj` bundle (rather than installing/uninstalling the feature).

All settings, configurations, and changes made to the embedded LDAP instances are persisted across DDF restarts. If DDF is stopped while the LDAP feature is installed and started, it automatically restarts with the saved settings on the next DDF start.

12.4.1.7. Limitations of the Embedded LDAP

Current limitations for the embedded LDAP instances include:

- Inability to store the LDAP files/storage outside of the DDF installation directory. This results in any LDAP data (that is, LDAP user information) being lost when the `ldap-embedded` feature is uninstalled.
- Cannot be run standalone from DDF. In order to run `embedded-ldap`, the DDF must be started.

12.4.1.8. External Links for the Embedded LDAP

Location to the default base LDIF file in the DDF source code.

OpenDJ documentation

12.4.1.9. LDAP Administration

OpenDJ provides a number of tools for LDAP administration. Refer to the OpenDJ Admin Guide.

12.4.1.10. Downloading the Admin Tools

Download OpenDJ (Version 2.6.4) and the included tool suite.

12.4.1.11. Using the Admin Tools

The admin tools are located in `<opendj-installation>/bat` for Windows and `<opendj-installation>/bin` for `nix. These tools can be used to administer both local and remote LDAP servers by setting the *host` and **port** parameters appropriately.

In this example, the user **Bruce Banner (uid=bbanner)** is disabled using the **manage-account** command on Windows. Run **manage-account --help** for usage instructions.

Example Commands for Disabling/Enabling a User's Account

```
D:\OpenDJ-2.4.6\bat>manage-account set-account-is-disabled -h localhost -p 4444 -O true
-D "cn=admin" -w secret -b "uid=bbanner,ou=users,dc=example,dc=com"
The server is using the following certificate:
    Subject DN:  CN=Win7-1, O=Administration Connector Self-Signed Certificate
    Issuer DN:  CN=Win7-1, O=Administration Connector Self-Signed Certificate
    Validity:  Wed Sep 04 15:36:46 MST 2013 through Fri Sep 04 15:36:46 MST 2015
Do you wish to trust this certificate and continue connecting to the server?
Please enter "yes" or "no":yes
Account Is Disabled:  true
```

Notice `Account Is Disabled: true` in the listing:

Verifying an Account is Disabled

```
D:\OpenDJ-2.4.6\bat>manage-account get-all -h localhost -p 4444  -D "cn=admin" -w secret
-b "uid=bbanner,ou=users,dc=example,dc=com"
The server is using the following certificate:
    Subject DN:  CN=Win7-1, O=Administration Connector Self-Signed Certificate
    Issuer DN:  CN=Win7-1, O=Administration Connector Self-Signed Certificate
    Validity:  Wed Sep 04 15:36:46 MST 2013 through Fri Sep 04 15:36:46 MST 2015
Do you wish to trust this certificate and continue connecting to the server?
Please enter "yes" or "no":yes
Password Policy DN:  cn=Default Password Policy,cn=Password Policies,cn=config
Account Is Disabled:  true
Account Expiration Time:
Seconds Until Account Expiration:
Password Changed Time:  19700101000000.000Z
Password Expiration Warned Time:
Seconds Until Password Expiration:
Seconds Until Password Expiration Warning:
Authentication Failure Times:
Seconds Until Authentication Failure Unlock:
Remaining Authentication Failure Count:
Last Login Time:
Seconds Until Idle Account Lockout:
Password Is Reset:  false
Seconds Until Password Reset Lockout:
Grace Login Use Times:
Remaining Grace Login Count:  0
Password Changed by Required Time:
Seconds Until Required Change Time:
Password History:
```

Enabling an Account

```
D:\OpenDJ-2.4.6\bat>manage-account clear-account-is-disabled  -h localhost -p 4444  -D
"cn=admin" -w secret -b "uid=bbanner,ou=users,dc=example,dc=com"
The server is using the following certificate:
    Subject DN:  CN=Win7-1, O=Administration Connector Self-Signed Certificate
    Issuer DN:  CN=Win7-1, O=Administration Connector Self-Signed Certificate
    Validity:  Wed Sep 04 15:36:46 MST 2013 through Fri Sep 04 15:36:46 MST 2015
Do you wish to trust this certificate and continue connecting to the server?
Please enter "yes" or "no":yes
Account Is Disabled:  false
```

Notice `Account Is Disabled: false` in the listing.

Verifying an Account is Enabled

```
D:\OpenDJ-2.4.6\bat>manage-account get-all -h localhost -p 4444  -D "cn=admin" -w secret
-b "uid=bbanner,ou=users,dc=example,dc=com"
The server is using the following certificate:
    Subject DN:  CN=Win7-1, O=Administration Connector Self-Signed Certificate
    Issuer DN:  CN=Win7-1, O=Administration Connector Self-Signed Certificate
    Validity:  Wed Sep 04 15:36:46 MST 2013 through Fri Sep 04 15:36:46 MST 2015
Do you wish to trust this certificate and continue connecting to the server?
Please enter "yes" or "no":yes
Password Policy DN:  cn=Default Password Policy,cn=Password Policies,cn=config
Account Is Disabled:  false
Account Expiration Time:
Seconds Until Account Expiration:
Password Changed Time:  19700101000000.000Z
Password Expiration Warned Time:
Seconds Until Password Expiration:
Seconds Until Password Expiration Warning:
Authentication Failure Times:
Seconds Until Authentication Failure Unlock:
Remaining Authentication Failure Count:
Last Login Time:
Seconds Until Idle Account Lockout:
Password Is Reset:  false
Seconds Until Password Reset Lockout:
Grace Login Use Times:
Remaining Grace Login Count:  0
Password Changed by Required Time:
Seconds Until Required Change Time:
Password History:
```

12.5. Security PDP

The Security Policy Decision Point (PDP) module contains services that are able to perform authorization decisions based on configurations and policies. In the Security Framework, these components are called realms, and they implement the `org.apache.shiro.realm.Realm` and `org.apache.shiro.authz.Authorizer` interfaces. Although these components perform decisions on access control, enforcement of this decision is performed by components within the notional PEP application.

12.5.1. Security PDP AuthZ Realm

The Security PDP AuthZ Realm exposes a realm service that makes decisions on authorization requests

using the attributes stored within the metacard to determine if access should be granted. This realm can use XACML and delegates decisions to an external processing engine if internal processing fails. Decisions are first made based on the "match-all" and "match-one" logic. Any attributes listed in the "match-all" or "match-one" sections are not passed to the XACML processing engine and they are matched internally. It is recommended to list as many attributes as possible in these sections to avoid going out to the XACML processing engine for performance reasons. If it is desired that all decisions be passed to the XACML processing engine, remove all of the "match-all" and "match-one" configurations. The configuration below provides the mapping between user attributes and the attributes being asserted - one map exists for each type of mapping (each map may contain multiple values).

Match-All Mapping

This mapping is used to guarantee that all values present in the specified metacard attribute exist in the corresponding user attribute.

Match-One Mapping

This mapping is used to guarantee that at least one of the values present in the specified metacard attribute exists in the corresponding user attribute.

12.5.1.1. Configuring the Security PDP AuthZ Realm

1. Navigate to the **Admin Console**.
2. Select **Security** Application.
3. Select **Configuration** tab.
4. Select **Security AuthZ Realm**.

See Security AuthZ Realm for all possible configurations.

12.5.2. Guest Interceptor

The goal of the `GuestInterceptor` is to allow non-secure clients (such as SOAP requests without security headers) to access secure service endpoints.

All requests to secure endpoints must satisfy the WS-SecurityPolicy that is included in the WSDL.

Rather than reject requests without user credentials, the guest interceptor detects the missing credentials and inserts an assertion that represents the "guest" user. The attributes included in this guest user assertion are configured by the administrator to represent any unknown user on the current network.

12.5.2.1. Installing Guest Interceptor

The `GuestInterceptor` is installed by default with Security Application.

12.5.2.2. Configuring Guest Interceptor

Configure the Guest Interceptor from the Admin Console:

1. Navigate to the **Admin Console** at https://{FQDN}:{PORT}/admin
2. Select the **Security** application.
3. Select the **Configuration** tab.
4. Select the **Guest Claims Configuration** configuration.
5. Select the + next to Attributes to add a new attribute.
6. Add any additional attributes that apply to every user.
7. Select **Save changes**.

Once these configurations have been added, the GuestInterceptor is ready for use. Both secure and non-secure requests are accepted by all secure DDF service endpoints.

12.6. Web Service Security Architecture

The Web Service Security (WSS) functionality that comes with DDF is integrated throughout the system. This is a central resource describing how all of the pieces work together and where they are located within the system.

DDF comes with a **Security Framework** and **Security Services**. The Security Framework is the set of APIs that define the integration with the DDF framework and the Security Services are the reference implementations of those APIs built for a realistic end-to-end use case.

12.6.1. Securing REST

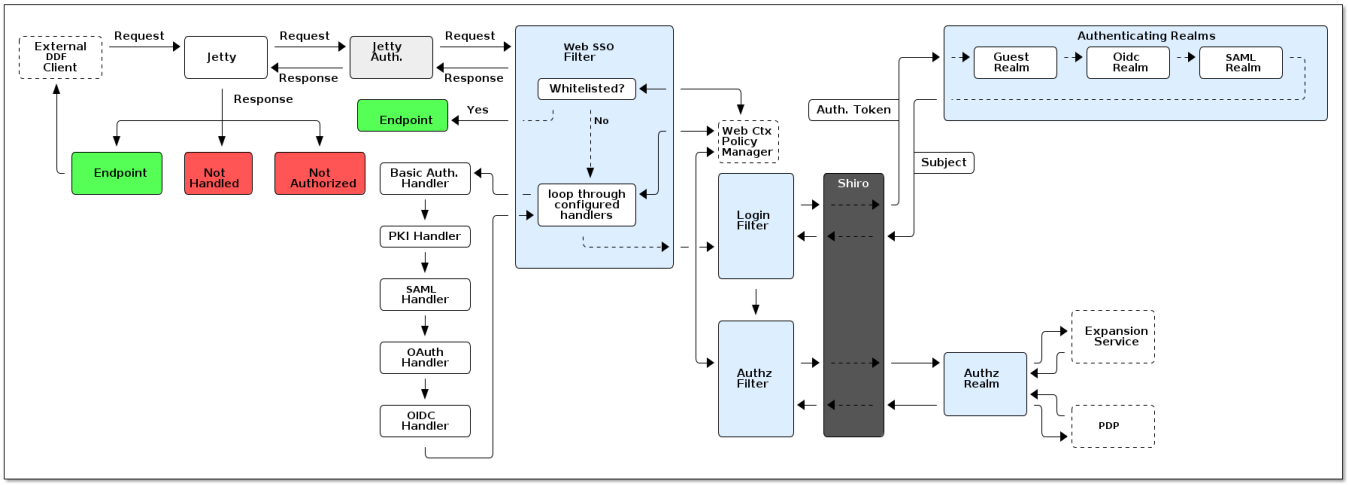


Figure 23. Security Architecture

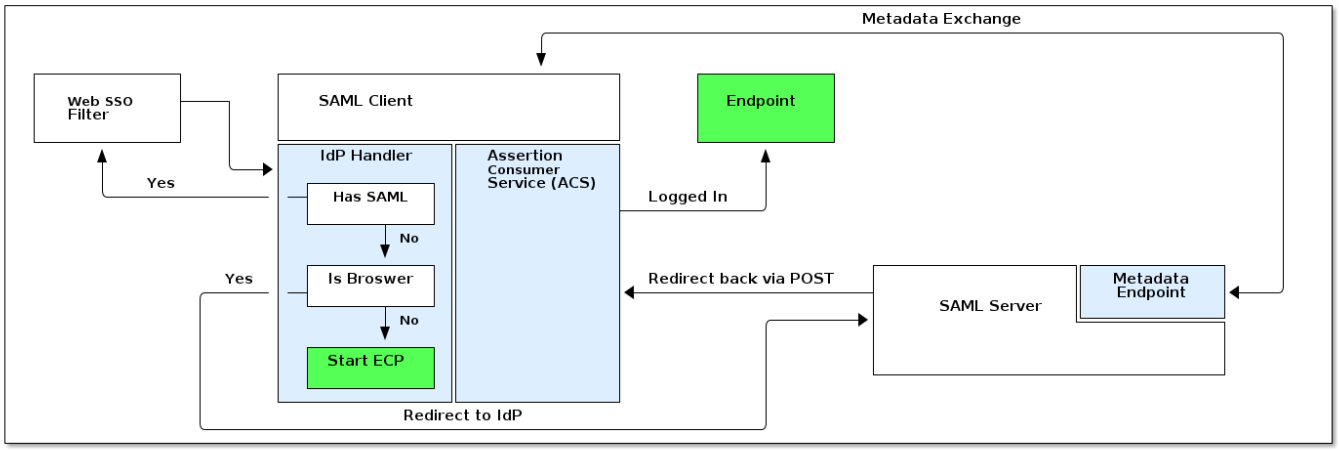
The Jetty Authenticator is the topmost handler of all requests. It initializes all Security Filters and runs them in order according to service ranking:

1. The **Web SSO Filter** reads from the web context policy manager and functions as the first decision point. If the request is from a whitelisted context, no further authentication is needed and the request skips through the rest of the security filters to the desired endpoint.

If the context is not on the whitelist, the filter first attempts to pull authentication information off of the session. If authentication information cannot be found on the session, the filter then attempts to get an authentication handler for the context. The filter loops through all configured context handlers until one signals that it has found authentication information that it can use to build a token. This configuration can be changed by modifying the web context policy manager configuration. If unable to resolve the context, the filter returns an authentication error and the process stops. If a handler is successfully found, an auth token is assigned and the request continues to the login filter.

1. The **Login Filter** receives an authentication token and returns a subject. To retrieve the subject, the authentication token is sent through Shiro to the configured authenticating realms. The realms takes the authentication token and attempts to return authentication info to the Shiro framework in order to put together a subject.
2. If the Subject is returned, the request moves to the **AuthZ Filter** to check permissions on the user. If the user has the correct permissions to access that web context, the request can hit the endpoint.

SAML IdP Architecture



The SAML Handler is a configured handler on the Web SSO Filter just like the other handlers in the previous diagram. The SAML Handler and the Assertion Consumer Service are both part of the IdP client that can be used to interface with any compliant SAML 2.0 Web SSO Identity Provider.

The Metadata Exchange happens asynchronously from any login event. The exchange can happen via HTTP or File, or the metadata XML itself can be pasted into the configuration for the SAML client. The metadata contains information about what bindings are accepted by the client or server and whether or not either expects messages to be signed, etc. The redirect from the Assertion Consumer Service to the Endpoint causes the client to pass back through the entire filter chain, which gets caught at the `Has Session` point of the `WebSsoFilter`. The request proceeds through the rest of the filters as any other connection would in the previous diagram.

Unauthenticated non-browser clients that pass the HTTP headers signaling that they understand SAML ECP can authenticate via that mechanism as explained below.

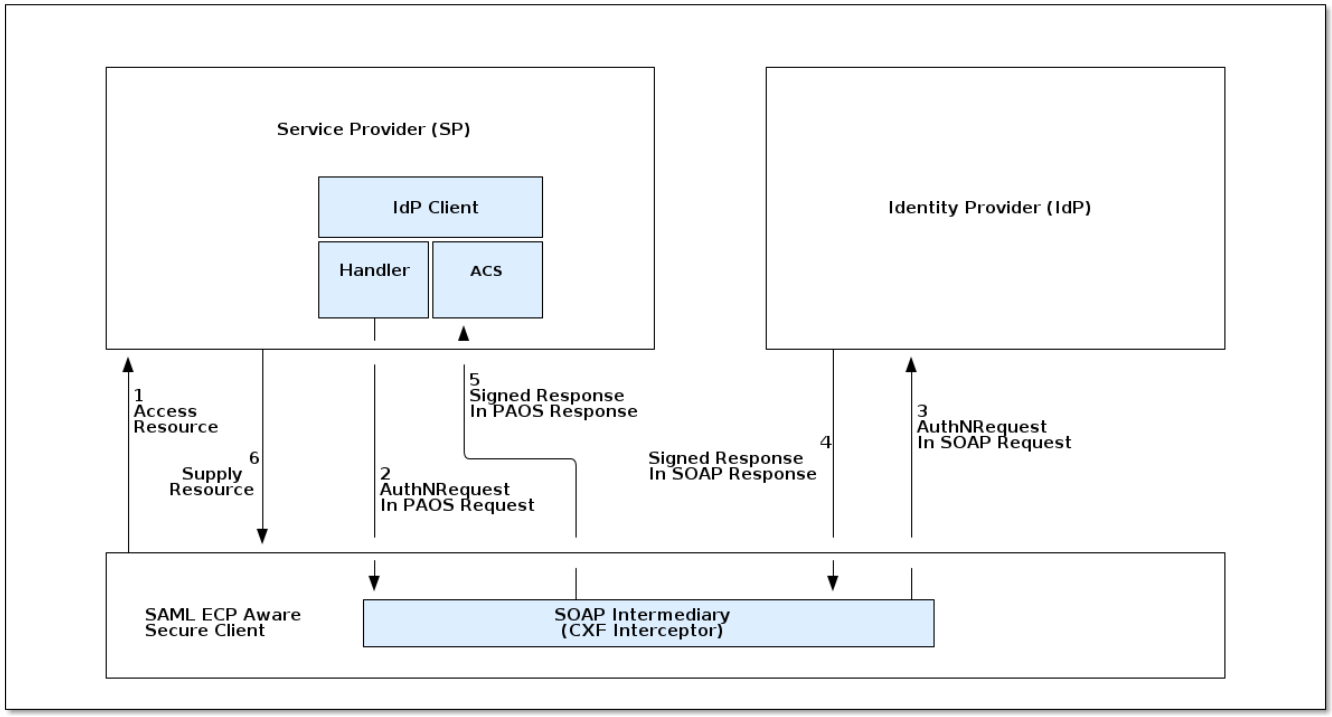


Figure 24. SAML ECP Architecture

SAML ECP can be used to authenticate a non-browser client or non-person entity (NPE). This method of authentication is useful when there is no human in the loop, but authentication with an IdP is still desired. The SAML Handler sends a PAOS (Reverse SOAP) request as an initial response back to the Secure Client, assuming the client has sent the necessary HTTP headers to declare that it supports this function. That response does not complete the request/response loop, but is instead caught by a SOAP intermediary, which is implemented through a CXF interceptor. The PAOS response contains an `<AuthNRequest>` request message, which is intended to be rerouted to a SAML IdP via SOAP. The SOAP intermediary then contacts an IdP (selection of the IdP is not covered by the spec). The IdP either rejects the login attempt, or issues a Signed `<Response>` that is to be delivered to the Assertion Consumer Service by the intermediary. The method of logging into the IdP is not covered by the spec and is up to the implementation. The SP is then signaled to supply the originally requested resource, assuming the signed Response message is valid and the user has permission to view the resource.

The ambiguity in parts of the spec with regard to selecting an IdP to use and logging into that IdP can lead to integration issues between different systems. However, this method of authentication is not necessarily expected to work by default with anything other than other instances of DDF. It does, however, provide a starting point that downstream projects can leverage in order to provide ECP based authentication for their particular scenario or to connect to other systems that utilize SAML ECP.

12.7. Security PEP

The Security Policy Enforcement Point (PEP) application contains bundles that allow for policies to be enforced at various parts of the system, for example: to reach contexts, view metacards, access catalog operations, and others.

12.7.1. Security PEP Interceptor

The Security PEP Interceptor bundle contains the `ddf.security.pep.interceptor.PEPAuthorizingInterceptor` class. This class uses CXF to intercept incoming SOAP messages and enforces service authorization policies by sending the service request to the security framework.

12.7.1.1. Installing the Security PEP Interceptor

This bundle is not installed by default but can be added by installing the `security-pep-serviceauthz` feature.

WARNING	To perform service authorization within a default install of DDF, this bundle MUST be installed.

12.7.1.2. Configuring the Security PEP Interceptor

The Security PEP Interceptor has no configurable properties.

12.8. Filtering

Metacard filtering is performed by the Filter Plugin after a query has been performed, but before the results are returned to the requestor.

Each metacard result contains security attributes that are populated by the CatalogFramework based on the PolicyPlugins that populates this attribute. (These plugins are NOT provided by default. You must create your own plugin for your specific metadata) The security attribute is a HashMap containing a set of keys that map to lists of values. The metacard is then processed by a filter plugin that creates a `KeyValueCollectionPermission` from the metacard's security attribute. This permission is then checked against the user subject to determine if the subject has the correct claims to view that metacard. The decision to filter the metacard eventually relies on the PDP (`feature:install security-pdp-authz`). The PDP returns a decision, and the metacard is either filtered or allowed to pass through.

The security attributes populated on the metacard are completely dependent on the type of the metacard. Each type of metacard must have its own PolicyPlugin that reads the metadata being returned and returns the metacard's security attribute. If the subject permissions are missing during filtering, all resources are filtered.

Example (represented as simple XML for ease of understanding):

```
<metacard>
    <security>
        <map>
            <entry key="entry1" value="A,B" />
            <entry key="entry2" value="X,Y" />
            <entry key="entry3" value="USA,GBR" />
            <entry key="entry4" value="USA,AUS" />
        </map>
    </security>
</metacard>
```

```
<user>
    <claim name="claim1">
        <value>A</value>
        <value>B</value>
    </claim>
    <claim name="claim2">
        <value>X</value>
        <value>Y</value>
    </claim>
    <claim name="claim3">
        <value>USA</value>
    </claim>
    <claim name="claim4">
        <value>USA</value>
    </claim>
</user>
```

In the above example, the user's claims are represented very simply and are similar to how they would actually appear in a SAML 2 assertion. Each of these user (or subject) claims are converted to a `KeyValuePermission` object. These permission objects are implied against the permission object generated from the metacard record. In this particular case, the metacard might be allowed if the policy is configured appropriately because all of the permissions line up correctly.

To enable filtering on a new type of record, implement a PolicyPlugin that is able to read the string metadata contained within the metacard record. Note that, in DDF, there is no default plugin that parses a metacard. A plugin must be created to create a policy for the metacard.

12.9. Expansion Service

The Expansion Service and its corresponding expansion-related commands provide an easy way for developers to add expansion capabilities to DDF during user attribute and metadata card processing. In addition to these two defined uses of the expansion service, developers are free to utilize the service

in their own implementations.

Expansion Service Rulesets

Each instance of the expansion service consists of a collection of rulesets. Each ruleset consists of a key value and its associated set of rules. Callers of the expansion service provide a key and a value to be expanded. The expansion service then looks up the set of rules for the specified key. The expansion service cumulatively applies each of the rules in the set, starting with the original value. The result is returned to the caller.

Table 29. Expansion Service Ruleset Format

Key (Attribute)	Rules (original → new)	
key1	`value1`	`replacement1`
	value2	`replacement2`
	value3	`replacement3`
key2	`value1`	`replacement1`
	value2	`replacement2`

Included Expansions

Note that the rules listed for each key are processed in order, so they may build upon each other. That is, a new value from the new replacement string may be expanded by a subsequent rule. In the example `Location:Goodyear` would expand to `Goodyear AZ USA` and `Title:VP-Sales` would expand to `VP-Sales VP Sales`.

To use the expansion service, modify the following two files within the `<DDF_HOME>/etc/pdp` directory:

- `<DDF_HOME>/etc/pdp/ddf-metacard-attribute-ruleset.cfg`
- `<DDF_HOME>/etc/pdp/ddf-user-attribute-ruleset.cfg`

The examples below use the following collection of rulesets:

Table 30. Expansion Service Example Ruleset

Key (Attribute)	Rules (original → new)	
Location	`Goodyear`	`Goodyear AZ`
	AZ	`AZ USA`
	CA	`CA USA`
Title	`VP-Sales`	`VP-Sales VP Sales`
	VP-Engineering	`VP-Engineering VP Engineering`

It is expected that multiple instances of the expansion service are running at the same time. Each instance of the service defines a unique property that is useful for retrieving specific instances of the expansion service. There are two pre-defined instances used by DDF: one for expanding user attributes

and one for metacard attributes.

Property Name	Value	Description
mapping	security.user.attribute.mapping	This instance is configured with rules that expand the user's attribute values for security checking.
mapping	security.metacard.attribute.mapping	This instance is configured with rules that expand the metacard's security attributes before comparing with the user's attributes.

Expansion Service Configuration Files

Additional instance of the expansion service can be configured using a configuration file. The configuration file can have three different types of lines:

comments

any line prefixed with the # character is ignored as a comment (for readability, blank lines are also ignored)

attribute separator

a line starting with separator= defines the attribute separator string.

rule

all other lines are assumed to be rules defined in a string format <key>:<original value>:<new value>

The following configuration file defines the rules shown above in the example table (using the space as a separator):

Sample Expansion Configuration File

```
# This defines the separator that will be used when the expansion string contains
multiple
# values - each will be separated by this string. The expanded string will be split at
the
# separator string and each resulting attribute added to the attribute set (duplicates
are
# suppressed). No value indicates the default value of ' ' (space).
separator=

# The following rules define the attribute expansion to be performed. The rules are of
the
# form:
#       <attribute name>:<original value>:<expanded value>
# The rules are ordered, so replacements from the first rules may be found in the
original
```

```
# values of subsequent rules.
Location:Goodyear:Goodyear AZ
Location:AZ:AZ USA
Location:CA:CA USA
Title:VP-Sales:VP-Sales VP Sales
Title:VP-Engineering:VP-Engineering VP Engineering
```

Expansion Commands

DDF includes commands to work with the Expansion service.

Table 31. Included Expansion Commands

Title	Namespace	Description
DDF::Security::Expansion::Commands	security	The expansion commands provide detailed information about the expansion rules in place and the ability to see the results of expanding specific values against the active ruleset.

Command	Description	Sample Input	Results
security:expand	Runs the expansion service on the provided data returning the expanded value. It takes an attribute and an original value, expands the original value using the current expansion service and ruleset and dumps the results.	ddf@local>security:expand Location Goodyear	[Goodyear, USA, AZ]
		ddf@local>security:expand Title VP-Engineering	[VP-Engineering, Engineering, VP]
		ddf@local>expand Title "VP-Engineering Manager"	[VP-Engineering, Engineering, VP, Manager]
security:expansions	Displays the ruleset for each active expansion service.	Expansion service configured: ddf@local>security:expansions	[Location : Goodyear : Goodyear AZ Location : AZ : AZ USA Location : CA : CA USA Title : VP-Sales : VP-Sales VP Sales Title : VP-Engineering : VP-Engineering VP Engineering]
		No active expansion service: ddf@local>security:expansions	No expansion services currently available.

12.10. Federated Identity

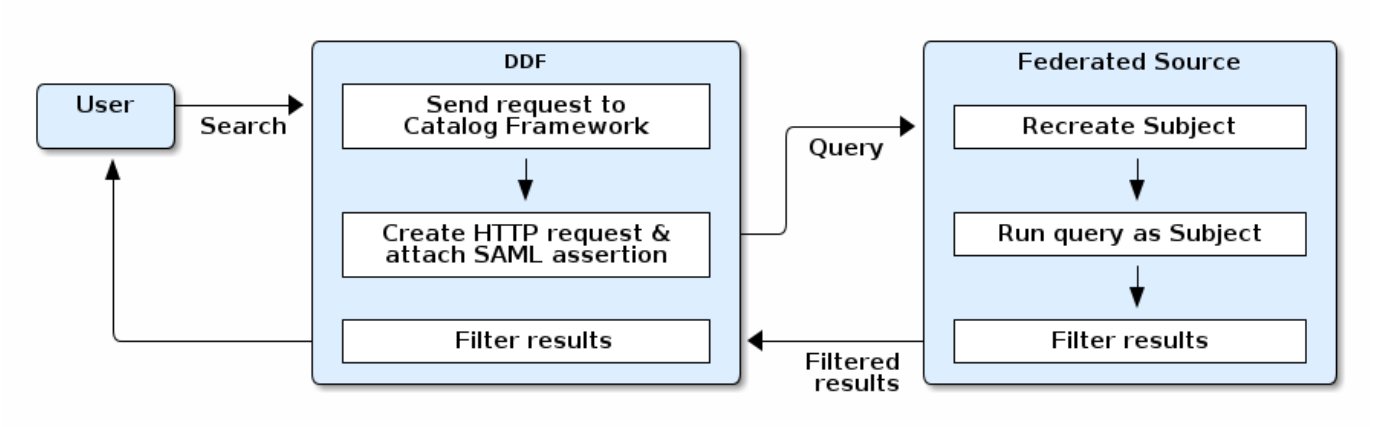
Each instance of DDF may be configured with its own security policy that determines the resources a user may access and the actions they may perform. To decide whether a given request is permitted, DDF references any attributes stored internally in the requestor's Subject. Based on these attributes and the configured policy, DDF makes an authorization decision. See Security PDP for more information.

This authorization process works when the requestor authenticates directly with DDF as they are guaranteed to have a Subject. However, when federating, DDF proxies requests to federated Sources and this poses a problem. The requestor doesn't authenticate with federated Sources, but Sources still need to make authorization decisions.

To solve this problem, DDF uses federated identity. When performing any federated request (query, resource retrival, etc), DDF attaches the requestor's SAML assertion to the outgoing request. The federated Source extracts the assertion and validates its signature to make sure it was generated by a trusted entity. If so, the federated Source constructs a Subject for the requestor and perform the request using that Subject. The Source can then make authorization decisions using the process already described.

How DDF attaches SAML assertions to federated requests depends on the endpoint used to connect to a federated Source. When using a REST endpoint such as CSW, DDF places the assertion in the HTTP Authorization header. When using a SOAP endpoint, it places the assertion in the SOAP security header.

The figure below shows a federated query between two instances of DDF that support federated identity.



1. A user submits a search to DDF.
2. DDF generates a catalog request, attaches the user's Subject, and sends the request to the Catalog Framework.

3. The Catalog Framework extracts the SAML assertion from the Subject and sends an HTTP request to each federated Source with the assertion attached.
4. A federated Source receives this request and extracts the SAML assertion. The federated Source then validates the authenticity of the SAML Assertion. If the assertion is valid, the federated Source generates a Subject from the assertion to represent the user who initiated the request.
5. The federated Source filters all results that the user is not authorized to view and returns the rest to DDF.
6. DDF takes the results from all Sources, filters those that the user is not authorized to view and returns the remaining results to the user.

NOTE	With federated identity, results are filtered both by the federated Source and client DDF. This is important as each may have different authorization policies.

WARNING	Support for federated identity was added in DDF 2.8.x. Federated Sources older than this do not perform any filtering. Instead, they return all available results and leave filtering up to the client.

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