

EMC® Documentum® D2

Version 4.7

Developers Guide

EMC Corporation
Corporate Headquarters:
Hopkinton, MA 01748-9103
1-508-435-1000
www.EMC.com

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Preface

EMC® Documentum® D2 consists of two components:

- D2 Configuration: It is a web-based application, hereafter known as D2 Config, for administrators to use to configure settings such as automated content-handling processes and background settings for D2 Client.
- D2 Client: It is a web-based application, hereafter known as D2 Client, for users to interact with content in one or more repositories.

When this guide refers to D2, it refers to the product as a whole and not the individual components.

Intended audience

The information in this guide is for developers who create and configure extensions for D2, using the D2 and D2 Foundation Services (D2FS) API.

Revision history

The following table lists changes in this guide.

Revision Date	Description
December 2016	Initial publication.

Extending D2

This chapter contains the following topics:

- [Introduction to Extending D2](#)

Introduction to Extending D2

Before customizing D2 by using extensions, you must carefully re-examine the functionalities available through D2 and its official plug-ins. In almost all cases, using existing capabilities to achieve your use cases provides a cheaper and more reliable solution.

D2 offers the following methods of extending D2 by using the D2 API:

- Building integrated solutions by using the D2FS services to interact with the D2 web application.
- Using Open Ajax Hub (OAH) and Javascript to create external web applications that can be manipulated as iframes (External Widgets) from within the D2 web application.
- Using D2 Java packages to create and configure D2 plug-ins that add custom actions or override existing D2 services.

You can use any Integrated Development Environment (IDE) such as Eclipse for building the code.

Migrating to Use the Content Checkin Service

This chapter contains the following topics:

- **Content Checkin Service**

Content Checkin Service

For D2 4.2 and later releases, the content checkin process uses `IDownloadService.getCheckinUrls()` service to perform the checkin operation as a single, atomic operation.

To use this checkin process for D2 4.1 release, cease the usage of the `checkin()` and `getUploadUrls()` services and use the `getCheckinUrls()` service. You can continue to use the `checkin()` service for content-less objects and the `getUploadUrls()` method for non-checkin operations.

EMC Documentum D2 D2FS API JavaDoc contains further information on `getCheckinUrls()` and its required attributes.

Understanding D2 Architecture

This chapter contains the following topics:

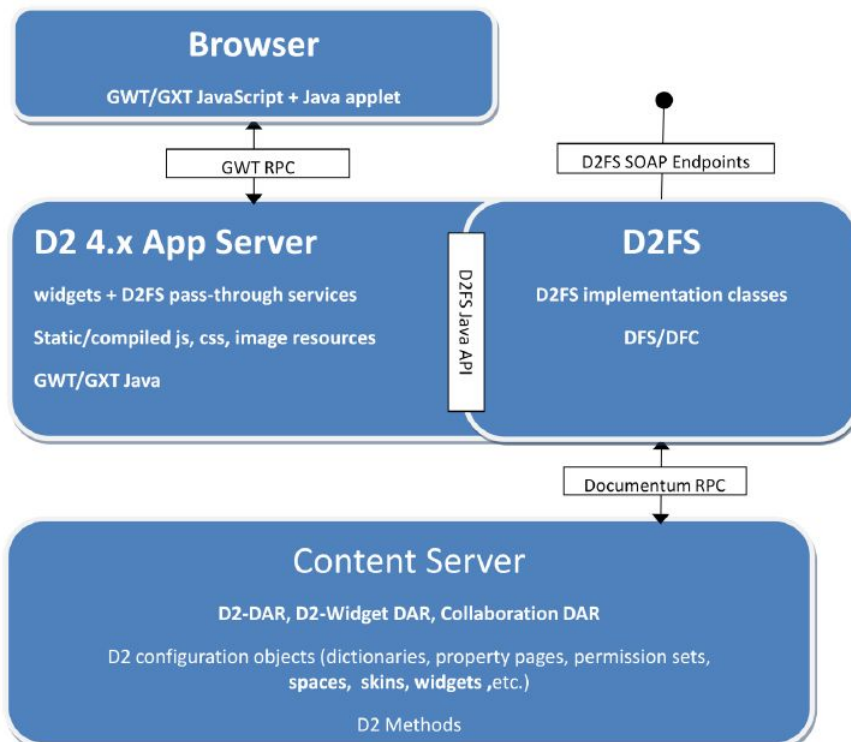
- [Understanding the D2 Client Architecture](#)
- [Understanding the D2 Config Architecture](#)
- [Understanding D2 File Transfer](#)

Understanding the D2 Client Architecture

D2 Client consists of three layers:

- The Browser layer denoting the web browsers that are used by end users to connect to D2.
- The web application server layer that corresponds to the installation and configuration of D2 .war.
- The Documentum Content Server layer that consists of the installed DAR files.

The following graphic illustrates the composition and relationship between the three layers:



Browser Layer

D2 Client is a web 2.0 browser-based application. End users can navigate to the D2 Client web application URL to log in to use D2. D2 Client is:

- GWT/GXT-based: D2 Client uses Sencha GXT and the Google Web Toolkit (GWT) to manage JavaScript. As a result, the D2 Client JavaScript code is delivered hidden and in a single large file. You cannot extend or debug D2 Client without the original source.

The Sencha website (<http://www.sencha.com/products/gxt>) contains further information on GXT.

- Loaded onto a single HTML page: D2 Client interprets and loads JavaScript into the browser memory at the start. As a result, D2 manipulates HTML DOM to remove and replace interface portions rather than switching the HTML pages upon user navigation.
- GWT RPC-based: D2 uses standard HTTP requests for all communication between the browser client and the D2 web application. For requests for static resources such as images, D2 uses GWT RPC calls backed by the D2FS services layer, to retrieve dynamic data.

The Google developer site (<https://developers.google.com/>) has more information on GWT RPC.

Application Server Layer (D2.war)

D2 Client is packaged as a .war file that can be deployed on most J2EE application servers. The web application server consists of:

- The D2 web application: Includes most of the presentation logic, including the GWT and GXT libraries, custom interface controls, static web resources, and pass-through services to allow web browsers to invoke the D2FS services. The layer does not link to the Documentum Foundation Classes (DFC) or Documentum Foundation Services (DFS) client libraries because all communication between the D2 web application and the Documentum repository passes through the D2FS interface.
- The D2FS library: Contains all D2 business logic, including the communication between the Documentum Content Server through DFC and DFS, the logic for interpreting and applying D2 configurations to service requests, and a set of SOAP services.

The application server layer uses the D2FS Java API while allowing external clients to use the SOAP interface because D2FS is merged with D2. Plug-ins to D2 exist in the D2FS layer and can intercept existing calls to the D2FS interface to change or enhance D2 behaviors.

Content Server Layer

The D2 installation includes three DAR files:

- D2-DAR.dar: Includes most of the Documentum types necessary for storing configuration objects in the repository. Configuration objects are subtypes of `d2_module_config` or `d2_moduledoc_config`, depending on whether the configuration is stored as object metadata or as XML content. D2 favors XML for representing forms, dialog boxes, mail templates, and other structured content, where a set of repeating attributes is insufficient for representing a configuration.

D2 DAR includes jobs and methods that are used by D2 for implementing some D2 configurations. These methods are invoked by a scheduled job for completing the background tasks, or are invoked

by the D2 web application in response to events. *EMC Documentum D2 Administrator Guide* contains further information about D2 jobs and methods.

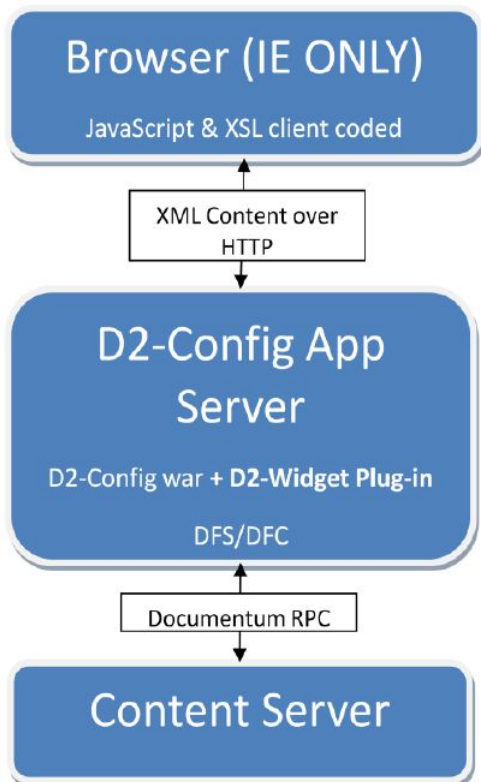
- `D2-Widget-DAR.dar`: Includes configuration types related to the D2 4.x interface, such as widgets, workspace layouts, and themes.
- `Collaboration_Services.dar`: Includes types and Documentum Business Object Framework modules for Documentum collaboration capabilities. D2 requires this DAR file to enable commenting within D2 Client.

Understanding the D2 Config Architecture

D2 Config is comprised of three layers:

- The Browser layer denoting the web browsers that are used by end users to connect to D2 Config.
- The web application server layer that corresponds to the installation and configuration of `D2-Config.war` and the D2-Widget plug-in.
- The Documentum Content Server layer.

The following graphic illustrates the composition and relationship between the three layers:



Browser Layer

D2 Config is a web 2.0 browser-based application. End users can navigate to the D2 Config web application URL to log in to use D2. D2 Config is:

- ActiveX control-based: D2 Config uses the ActiveX control such as the old D2 3.x architecture and is accessible only by using the Microsoft Internet Explorer browsers.
- XML-based: D2 Config uses the old D2 3.x architecture for D2 and delivers the interface to the web browser in XML representation.

Application Server Layer (D2-Config.war)

D2 Config is packaged as a .war file that can be deployed on most J2EE application servers. The web application server consists of the following:

- D2 Config web application: Includes most of the presentation logic, including the ActiveX controls. The layer includes the Documentum Foundation Classes (DFC) or the Documentum Foundation Services (DFS) client libraries because the layer controls communication between the D2 Config web application and the Documentum repository.
- D2-Widget plug-in: Adds the configuration components for D2 Client to D2 Config.

Content Server Layer

D2 installation includes three DAR files:

- `D2-DAR.dar`: Includes most of the Documentum types necessary for storing configuration objects in the repository. Configuration objects are subtypes of `d2_module_config` or `d2_moduledoc_config` depending on whether the configuration is stored as object metadata or as XML content. D2 uses XML for representing forms, dialog boxes, mail templates, and other structured content, where a set of repeating attributes is insufficient for representing a configuration. D2 DAR includes jobs and methods that are used by D2 for implementing some D2 configurations. These methods are invoked by a scheduled job for completing the background tasks, or are invoked by the D2 web application in response to events. *EMC Documentum D2 Administrator Guide* contains further information about D2 jobs and methods.
- `D2-Widget-DAR.dar`: Includes configuration types related to the D2 4.x interface, such as widgets, workspace layouts, and themes.
- `Collaboration_Services.dar`: Includes types and Documentum Business Object Framework modules for Documentum collaboration capabilities. D2 requires this DAR file to enable commenting within D2 Client.

Understanding D2 File Transfer

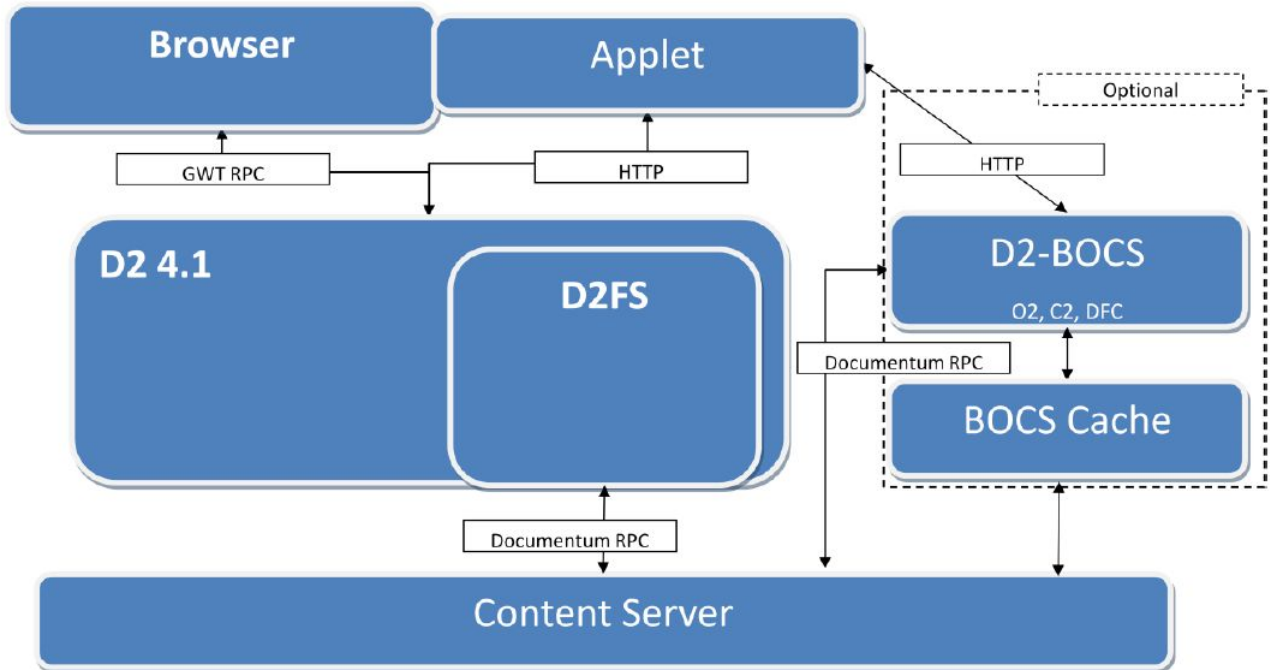
D2 uses either the D2 Java applet or HTML5 (thin client mode) to perform content transfer, giving it several advantages over the standard HTML4 <fileinput> form control:

- Multiple-file upload.
- Upload of entire folder structures.
- Drag-and-drop of files from the desktop for upload.
- Client-side compression of content before the upload.

Browsers that support HTML5 can run D2 without the Java applet in thin client mode but do so with limited functionality. *EMC Documentum D2 Installation Guide* contains information about

the functionalities that are restricted by the thin client mode and the instructions for setting the file transfer mode.

The following graphic illustrates the data flow of content transfer between Documentum Content Server and the D2 web applications:



In basic installations, with most users in close geographic proximity, the D2 applet uses a standard HTTP connection to connect directly to the D2 web application.

Use the Documentum Branch Office Caching Services (BOCS) cache to speed up the transfer of large files to users in remote locations. You must install the D2-BOCS plug-in on the same server as the BOCS cache to:

- Facilitate communication between the D2 applet and the BOCS cache.
- Allow D2 to manipulate content in and out of the repository. For example, the C2 plug-in can be used to insert configuration-based watermarks.

D2-BOCS must apply configuration rules to complete the C2 and the O2 content operations. As a result, D2-BOCS opens a DFC session with the repository, which makes Documentum RPC calls to the repository to retrieve configuration objects and content metadata. Due to the relatively high latency of the connection between the BOCS cache and Content Server, administrators and end users must limit the number of applicable O2 and C2 configurations. Configure D2 so that only large files are transferred using the BOCS cache to reduce load on the connection and to connect directly to the D2 application for the transfer of smaller files.

Building Integrations Using D2FS

This chapter contains the following topics:

- [Using SOAP to Allow External Applications to Affect D2 Processes and Data](#)
- [Generating Java Stub Libraries to Call D2FS Using SOAP](#)
- [D2FS Examples](#)
- [Setting Up the D2FS Examples](#)

Using SOAP to Allow External Applications to Affect D2 Processes and Data

The D2FS API is exposed from the D2 web application as a set of SOAP services. [Generating Java Stub Libraries to Call D2FS Via SOAP, page 17](#) contains instructions for generating the Java stub libraries that are required to invoke D2FS by using SOAP services.

The D2 SDK package contains the sample Java classes that use the Java stub libraries to invoke and modify the D2 processes and data.

EMC Documentum D2 D2FS API JavaDoc contains further information on the available D2FS services.

Generating Java Stub Libraries to Call D2FS Using SOAP

1. Deploy D2 to a local application server.
2. Use the following command to generate the Java source files for the stub libraries that are needed to connect to D2:

```
wsimport -keep http://localhost:8080/D2/ws/d2fs.wsdl
```

The `-keep` parameter saves the files so that you can copy them to your project.

3. If you have generated stubs by using a different D2 server than the one you have used to call D2FS, modify the URL. To do this, open `ModelPortService.java` and edit the following line:

```
static { url = new URL("http://<D2 server address and  
port>/D2/ws/d2fs.wsdl"); }
```

D2FS Examples

Navigate to the `D2FS/Java/D2FSExamples/src/com/emc/d2/d2fs/examples` folder in the D2 SDK package for the following examples of Java classes:

Class	Description
<code>ContextAndLoginExample.java</code>	Demonstrates how to establish a D2FS login context with the D2 server.
<code>ImportAndUploadDocumentExample.java</code>	Demonstrates how to use <code>createproperties()</code> to import and upload content.
<code>DestroyExample.java</code>	Demonstrates how to destroy content.
<code>SavePropertiesExample.java</code>	Demonstrates how to set content attributes.
<code>SearchQuickExample.java</code>	Demonstrates how to run a quick search.
<code>SearchAdvancedExample.java</code>	Demonstrates how to: <ul style="list-style-type: none"> • Use <code>SearchService</code> and <code>ContentService</code> to search the repository. • Save or run an advanced search. • List saved searches. • Run a saved search.
<code>CheckinContentExample.java</code>	Demonstrates how to use <code>getCheckinUrls()</code> to: <ul style="list-style-type: none"> • Check out content. • Request a checkin URL. • Post new content with checkin parameters.
<code>TaxonomyEnumAndExportUrlExample.java</code>	Demonstrates how to use <code>ContentService</code> to: <ul style="list-style-type: none"> • Enumerate taxonomy objects. • Download and save the exported taxonomy.

[Setting Up the D2FS Examples, page 18](#) contains instructions for setting up the D2FS examples after you generate the Java stub libraries.

Setting Up the D2FS Examples

1. Use Eclipse to create a new workspace, and then import the existing projects into the workspace from the `D2FS/Java/D2FSExamples` folder.
2. Delete the `com.emc.d2fs.*` and `org.w3.*` packages if they are available in the project.
3. Copy the generated `com` and `org` folders to your project.

You can paste the folders directly from the local file directory to the `src/` folder of your IDE.

4. Update `LoginInfo.java` to specify the repository name, login id, password, and URL of the web application.
5. Check the setup comments available above the example, to confirm the required inputs.

Using OAH to Create and Configure a Sample External Widget

This chapter contains the following topics:

- [Understanding Open Ajax Hub \(OAH\) and External Widgets](#)
- [Setting Up the Sample External Widget](#)
- [Walking Through the Sample External Widget](#)

Understanding Open Ajax Hub (OAH) and External Widgets

Open Ajax Hub (OAH) is a standard JavaScript library for publishing and subscribing to web applications and is defined by OpenAjax Alliance to address interoperability and security issues that arise when multiple Ajax libraries and components are used in the same web page. You can use OAH to:

- Publish to a channel to send a message.
- Subscribe to a channel to listen for a message.

A D2 external widget is a web application URL that is hosted in an iframe within the D2 Client application. D2 uses OAH to communicate between widgets and to broadcast events and actions such as content selection, object location, and content view.

- Events notify listeners about the D2 application and widget-specific attributes.
- Actions cause D2 or widgets to perform a specified operation.

The D2 implementation of OAH, called D2-OAH.js, provides the binding between a web page and the surrounding D2 application. D2 Config refers to these web pages as external widgets, which are hosted in an iframe within the D2 Client web application.

The `X3PubSubEvents` section of *EMC Documentum D2 Open Ajax Hub (OAH) Event and Actions JavaDoc* contains a complete reference of the OAH message objects, the D2-OAH API, and the list of available actions and events. **Note:** The D2 actions and events not covered by the SDK are not available.

Setting Up the Sample External Widget

1. Extract `UpdateDocList` folder from D2 `<version> SDK.zip` to a temporary location.
2. Stop the web application server.
3. Copy the `X3-Ext-UpdateDoclist` folder to the `<web application server>/webapps/` folder.

4. Start the web application server.
5. Log in to D2 Config:
 - a. Navigate to **File > Import configuration** from the menu bar.
 - b. Import `X3-Ext-UpdateDoclist - Config.zip`
EMC Documentum D2 Administration Guide contains further instructions on importing configurations.
 - c. Navigate to **Widget view > Widget** from the menu bar.
 - d. Select the `WG_EXT_UpdateDoclist` widget.
 - e. Modify the **Widget url** field to match the location of the web application server that you have deployed. For example:
`http://myserver:8080/X3-Ext-UpdateDoclist`
The sample external widget also contains a second URL that displays an Open Ajax Hub publish and subscribe application:
`http://myserver:8080/X3-Ext-UpdateDoclist/devindex.html`
6. Log in to D2 Client and add the new widget to your workspace.

Walking Through the Sample External Widget

The `X3-Ext-UpdateDoclist` external widget shows how to:

- Create a `D2OpenAjaxHub` object to connect the external widget to D2.
- Use the Open Ajax Message Hub to execute a query form and to update the doclist widget.
- Use the Open Ajax Hub to subscribe to the D2 events and to receive messages.

Open `X3-Ext-UpdateDoclist/index.html` in a text editor to view the sample code.

The `X3PubSubEvents` section of *EMC Documentum D2 Open Ajax Hub (OAH) Event and Actions JavaDoc* contains a complete reference to the Open Ajax Hub (OAH) classes and methods as well as a complete list of D2 events, actions, and their corresponding attributes.

Importing OAH Scripts

You must import the following two Javascript scripts:

- Use one of the following:
 - `http://YourServer:8080/D2/container/OpenAjaxManagedHub-all-obf.js`
 - `http://YourServer:8080/D2/container/external-api/OpenAjaxManagedHub-all.js`

`OpenAjaxManagedHub-all-obf.js` is the smaller version that is used by D2 for production purposes and `OpenAjaxManagedHub-all.js` is the full version that is used for development purposes.
- `http://YourServer:8080/D2/container/external-api/D2-OAH.js`

Creating and Connecting an Open Ajax Hub

Create and connect a `D2OpenAjaxHub()` object. The sample code uses the following code:

```
var d2OpenAjaxHub = new D2OpenAjaxHub();
// connect hub providing callback functions.
d2OpenAjaxHub.connectHub(connectCompleted, onInitWidget, onActiveWidget,
onDisplayWidget);
```

You can then set a callback for a successful connection to the hub to perform initialization tasks. For example, the sample waits for the hub client to connect, and then initiates the subscription to events.

```
function connectCompleted(hubClient, success, error) {
  if (success) {

    logit("Hub client connected");

    // subscribe to events
    subscribeEvents();

  } else
    logit("Hub client NOT connected - please check console");
}
```

The sample widget always subscribes to events even if you do not request that the widget track and display objects of the selected type.

```
// onInitWidget is called to allow widget initialization (can subscribe or
// initialize as needed)
// message contains an OpenAjaxMessage() object
function onInitWidget(message) {
  logit("onInitWidget()");
}

// onActiveWidget is called when the external widget is activated or
//deactivated.
function onActiveWidget(bActiveFlag) {
  logit("onActiveWidget(): bActiveFlag=" + bActiveFlag);
}

// onDisplayWidget is called with the external widget is displayed or
//hidden.
function onDisplayWidget(bDisplay) {
  logit("onDisplayWidget(): bDisplay="+ bDisplay);
}
```

Subscribing to Events

You can interact with the external widget to set or change subscriptions to D2 events. You can then use the subscription to listen to messages and to extract information. Select **Track selected type** to track the content that is selected by users in D2 Client, receive notifications, and view the document type in the external widget form.

Call the `subscribeToChannel()` method to use this feature of Open Ajax Hub as shown in the sample code:

```
function subscribeEvents() {
```

```
logit("subscribe to events...");
d2OpenAjaxHub.subscribeToChannel ("D2_EVENT_SELECT_OBJECT",
    selectObjectCallback, true);
}
```

The `selectObjectCallback` method is an example method in the sample that dictates how the widget uses the message received through this event.

Sending Messages

You can interact with the external widget both as a widget in a D2 Client workspace or by accessing the URL directly through a web browser. The sample web application contains an HTML form that contains the same fields as the QF HR a_status query form which is imported when the external widget is installed. Type a document type, select a document status, and click the **Update Doclist** button. The external widget sends an Open Ajax Message to D2 to execute the QF HR a_status query form search. The query form then functions as a Doclist widget filter because it updates the Doclist widget with the search results.

Call the `sendMessage()` method to use this feature of Open Ajax Hub as shown in the sample code:

```
function updateDoclist() {

    //Query form configuration name is defined below
    var queryFormConfigName = "QF HR a_status";

    //To update the doclist a new OpenAjax message will be build to be posted
    //in the Hub using the D2-OAH API
    var messageToSend = new OpenAjaxMessage();

    // Specify a non-null ID (to pass request validation)
    messageToSend.put("oam_id", "");

    //In the message, we need to define what properties will be sent.
    //Here a_status and r_object_type
    messageToSend.put("list", "a_status-r_object_type");

    //We set the a_status value
    messageToSend.put("a_status", a_status.value);
    //We set the r_object_type value
    messageToSend.put("r_object_type", r_object_type.value);

    //set the query form config name which will be used to update the doclist
    messageToSend.put("config", queryFormConfigName);

    //Then we define what service and what method in the service will be called.
    //We call the Search service and the runQueryFormSearch method.
    //Calling this service will update the user's last search object
    messageToSend.put("eService", "Search");
    messageToSend.put("eMethod", "runQueryFormSearch");

    // When the service call completes, we can define an action to be executed.
    //Here, an event will be posted.
    messageToSend.put("rType", "EVENT");
}
```

```
// As the last search has been updated by the web service call, we will post
// the D2_ACTION_SEARCH_DOCUMENT event to display the search results
messageToSend.put("rAction", "D2_ACTION_SEARCH_DOCUMENT::oam_id==node_last_search");

//The message is now ready, it can be posted in the Hub
d2OpenAjaxHub.sendMessage("D2_ACTION_EXECUTE", messageToSend);

}
```


Understanding Audit Events

This chapter contains the following topics:

- **Understanding Documentum D2 Auditable Events**
- **Adding a New Audit Event**
- **Adding a Human Readable Label to the Audit Event**
- **Adding an Extended Label to the Audit Event**
- **Creating an Audit Event at Code Level**

Understanding Documentum D2 Auditable Events

Documentum D2 provides a configuration module to set up the audits that will be available to the end user in the application.

This configuration is used by the Audit widget to present audit information to the end user, as set up by the Administrator and in accordance with the matrix configuration.

The configuration module allows two different audit displays: normal and extended.

The configuration module might be configured to list D2 events only, or might be configured to include out of the box Documentum DFC audit events, as per the D2 Audit module configuration.

The Documentum Audit table (refer to the *Documentum Core Object Guide* for full documentation on the `dm_audittrail` object definition) allows five strings of data to be saved along with the event name and user name responsible for triggering the audit event. There are also three attributes sometimes used on the `audittrail` object, such as `workflow_id`, `event_source` and `version_label`, which are used for D2 workflow overview and management (workflow, delegation and task send mail features). The most important element is the Documentum Persistent Object, which the audit event is all about.

The next section explains how to add new, correctly labelled events to D2 using the plugin system and the D2 internal API. Currently, there is no other way to add new events. The information and example(s) presented are in use by all D2 plugins such as C2 or O2.

You will not need the full plugin project stack to add those resources to D2. Creating a JAR with two resources will create the event definition and make it available to the D2 product. The JAR library must be placed in the library folder of the D2-Config web application, which should be enough to allow the Administrator to view and set up the new events.

The last part of the documentation presents some required D2 API calls that facilitate audit creation. Some make use of the D2 configuration engine logic, removing the decision to create the audit or not

(the decision will be based on the D2 audit configuration that applies). It is not mandatory to use the D2 API as it might not always be available for external development; regardless, it allows for creating a `dm_audittrail` object using the underlying DFC API. Please refer to the *Documentum Foundation Guide* for help with this approach.

Adding a New Audit Event

1. Add a `D2AuditConfig.properties` file to the root of the JAR.
2. Add one entry per line to the properties file, using only alphanumeric lowercase (a-z, 0-9) and no special characters except underscore. For example,

```
proj_event_custom
```

or in this example, C2 has two entries:

```
c2_controlled_print  
c2_controlled_print_recall
```

3. Make the JAR available inside the D2-Config web application. Your events appear in the D2 audit list.

Adding a Human Readable Label to the Audit Event

1. Add a `DfAuditBundle_xx.properties` file to the `strings/bundles` path in the JAR. Replace `xx` with the two-letter language code for locale (for example, `DfAuditBundle_en.properties` contains labelling for English). There should be as many property files as locales supported by your application/repository.
2. Add, at a minimum, a list of keys=values where the keys should be the event names and the values the corresponding label. For example,

```
proj_event_custom = My Proj Custom event
```

or in this example, C2 has two event entries:

```
c2_controlled_print = Controlled print  
c2_controlled_print_recall = Controlled print recall
```

This is all the labelling that is required for a “normal” display. If you don’t intend to use “extended” display, you can skip the next section. **Note:** If you use the extended feature but do not define the extended label, D2 will fall back to the normal label. You will also miss the display of the strings data holder in this mode.

Adding an Extended Label to the Audit Event

Extended display is a feature that provides more meaningful human readable information, as opposed to simple labels. For example, you could provide the end-user with a complete phrase describing the event logged using the additional information that may be provided with the event (there are five string data holders where you can store information along with your audit).

1. Create additional keys in `DfAuditBundle_xx.properties` where the root key will be your event name and the second node must be “extended”. Here are some common use cases with examples:

- If you want one simple label with the only `string_1` information:

```
proj_event_custom.extended = In Proj Custom, "$value(string_1)" was applied
```

`string_1` to `string_5` is available. Again, depending of the audit creator, some may be empty. The bundle definition logic is tightly linked with audit usage.

- If you want to display all the string data in a raw way:

```
proj_event_custom.extended = My Proj Custom is using this information:
"$value(strings) "
```

In most audit use cases, the available string `#s` (`string_1` through `string_5`) are filled in ascending order (1-5). You wouldn’t usually fill in information in `string_5` if `string_4` were vacant. As a best practice, use `string_#` in order.

- If you generally use all five strings, but occasionally one of the string `#s` is not present or is empty, you can avoid an odd-looking message by using an empty placeholder:

```
proj_event_custom.extended = Link to "$value(string_1)/$value(string_2)
/$value(string_3)/$value(string_4)/$value(string_5) "
```

If `string_5` is not provided, you can add a third property node saying “nostring5”. When the D2 audit bundle logic sees the audit to display and that you have provided the following bundle key, it will use the following message instead of the generic message above:

```
proj_event_custom.extended.nostring5 = Link to "$value(string_1)
/$value(string_2)/$value(string_3)/$value(string_4) "
```

If no `string_4`:

```
proj_event_custom.extended.nostring4 = Link to "$value(string_1)
/$value(string_2)/$value(string_3) "
```

You can see that the `nostring4` is not using `string_5` either. That is because the normal case is that you don’t fill `string_5` if `string_4` is missing. There is no conditioning logic that detects `string_5` but no `string_4`. We detect the key definition that looks the best suitable to the audit case we have; it may not match all your different use cases.

- If you want to make the message more reusable for other labels, you can use five different combinations of bundle keys.; In each of them, define what represents the “string_#” data as it will provide more meaning to the end-user and represents only one bundle key to change:

```
proj_event_custom.extended.string_3Label = reason
```

The key can then be used inside other label:

```
proj_event_custom.extended.nostring4 = Link to "$value(string_1)
/$value(string_2) " where $value(string_3Label) is "$value(string_3) "
```

The bundle definition will look like this (avoid making any cyclic use of key):

```
proj_event_custom.extended.nostring4 = Link to "$value(string_1)
/$value(string_2)" where $value(string_3Label) is "$value(string_3)"
proj_event_custom.extended.string_3Label = reason
```

- If only one string is present among the others:

```
proj_event_custom.extended.onlystring4 = My event is using "$value(string_4)"
```

For example, in the C2 plugin, we have the following partial event bundle definition, where the goal was to define the controlled printing feature.:

```
c2_controlled_print=Controlled print
c2_controlled_print.extended.juststring4=Controlled print with : $value(string_4Label)
equals "$value(string_4)"
c2_controlled_print.extended.nostring5=Controlled print with : $value(string_3Label)
equals "$value(string_3)" and $value(string_4Label) equals "$value(string_4)"
c2_controlled_print.extended.nostring4=Controlled print with : $value(string_3Label)
equals "$value(string_3)"
c2_controlled_print.extended=Controlled print with : $value(string_3Label)
equals "$value(string_3)", $value(string_4Label) equals "$value(string_4)"
" and $value(string_5Label) equals "$value(string_5)"

c2_controlled_print.extended.string_3Label=recipient
c2_controlled_print.extended.string_4Label=reason
c2_controlled_print.extended.string_5Label=field n°3
```

For example in D2, we have this simple declaration where all strings are being used. The unlink event has its strings filled with each folder level; sometimes five levels deep, sometimes two levels deep:

```
dm_unlink.extended=Unlink from "$value(string_1)/$value(string_2)/$value(string_3)
/$value(string_4)/$value(string_5)"
dm_unlink.extended.nostring5=Unlink from "$value(string_1)/$value(string_2)
/$value(string_3)/$value(string_4)"
dm_unlink.extended.nostring4=Unlink from "$value(string_1)/$value(string_2)
/$value(string_3)"
dm_unlink.extended.nostring3=Unlink from "$value(string_1)/$value(string_2)"
dm_unlink.extended.nostring2=Unlink from "$value(string_1)"
```

Another example in D2 where signoff is not always configured with user intention. When intention is available, we display it, when not, we do not:

```
d2_import_signoff=Signoff for import
d2_import_signoff.extended.nostring1=Signoff for import
d2_import_signoff.extended=Signoff for import with this intention : $value(string_1)
```

Creating an Audit Event at Code Level

The pre-requisite for code level event creation is to have C6-Common and D2-API libraries in your project classpath.

An audit event is linked to an existing DFC object, and requires an event name and a username (user responsible for triggering the audit). You can also store five additional strings (placeholders), which correspond to the five table cells in the Audit Widget display.

1. Create your code level event according to the use cases described here, which employ two different APIs (the first one conditioning the use of the second one):

- If you want to create an audit only if the configuration engine has the event name set up to be displayed:

```
com.emc.d2.api.config.modules.audit.D2AuditConfig
```

Two static methods are provided:

```
IDfPersistentObject apply(IDfPersistentObject persistentObject,
    String eventName, String string1,
    String string2, String string3, String string4, String string5)
    throws DfException;
```

```
IDfPersistentObject apply(IDfPersistentObject persistentObject,
    String eventName, String userName,
    String string1, String string2, String string3, String string4,
    String string5) throws DfException;
```

The only difference between the two declarations is the passing of the user name. In the first API call, the username (event creator) is not passed (it is null). This will cause the “loginUserName” to be retrieved from the current DFC Session object currently being used by the persistentObject. In the second API call, the username (event creator) is passed. Your event will not be created if the D2-Config context engine and audit configuration module indicates it is not audited (checking D2-Config context engine either based on type and/or group).

- If you want to create an audit and have it display only if the configuration engine has the event name set up.

```
com.emc.common.dctm.objects.DfAuditTrailEx
```

There are multiple method signatures available, mainly relying on this first one, simplifying the different parts that are not meant to be used.

```
IDfPersistentObject create(IDfPersistentObject persistentObject,
    IDfSession privateSession, String eventName,
    String userName, String string1, String string2, String string3,
    String string4, String string5, List<String>
    attributes, String eventSource, IDfId workflowId, String version)
    throws DfException;
```

The other commonly used methods are:

```
IDfPersistentObject create(IDfPersistentObject persistentObject,
    String eventName, String userName, String
    string1, String string2, String string3, String string4, String string5,
    List<String> attributes) throws DfException;
```

In the method shown above, the session is retrieved from the persistent object directly.

```
IDfPersistentObject create(IDfPersistentObject persistentObject,
    IDfSession privateSession,
    String eventName, String userName, String string1, String string2,
    String string3, String
    string4, String string5, List<String> attributes) throws DfException;
```

In the method shown above, the session object can be defined, and will be used to extract the username and create the audit object.

Note: You can see a list of string attributes. These are used, for example, to audit properties. Each of the strings are the attribute/property name of the “persistentObject”. The previous values from

the persistent object are extracted and both the old and new list are part of the audit trail. They will be used by our audit engine to present them as old value and new value or added/removed value.

Here is a longer example, with the context of use:

D2 create user is auditing using D2AuditConfig statics since audit is needed only if configured.

C2 recall printing system will use “DfAuditTrailEx” statics, since the plugin is basing its control logic for printing on audit trail existence.

The decision point between those two APIs, is dependent on whether or not you have a plugin logic base on audit event existence.

You have to take into consideration the cost of creating an in terms of resources (DB, JVM) but also in terms of space (DB). For example, it is preferable to create an audit for a batch of work, rather than an audit per task in a batch.

When possible, it is recommended to use the D2 API, as it has been optimized for session management when a lot of events are to be created. Although it is not always possible to use the API for external development, you can still rely upon the DFC API for the same functionality (please refer to the corresponding DFC documentation).

Creating and Configuring a Custom Plug-in

This chapter contains the following topics:

- [Understanding Custom Plug-ins](#)
- [Overview of the Template Plug-in Examples](#)
- [Downloading and Setting Up the Template Plug-in](#)
- [Building, Installing, and Verifying the Template Plug-in](#)
- [Configuring a Menu Item for the Template Plug-in](#)
- [Creating a New Plug-in Using the Template](#)
- [Configuring a Custom Action](#)
- [Understanding Service Interface Overrides](#)
- [Setting Up D2 Service Overrides](#)
- [Deploying D2 Plug-ins](#)
- [Extending C2 PDF functionality](#)

Understanding Custom Plug-ins

You can create and configure custom plug-ins using the Java classes and the resources that are packaged with the D2 API framework to:

- Add features as custom actions.

[Configuring a Custom Action](#), page 36 contains instructions for creating and configuring a custom action.

- Modify existing features by changing the pre-processing, post-processing, and the overriding D2 services.

[Setting Up D2 Service Overrides](#), page 39 contains instructions for modifying the D2 services and [Understanding Service Overrides](#), page 36 contains information about the various overrides you can use.

EMC Documentum D2 D2FS API JavaDoc contains more information on the available services and actions.

The *Read Me — Getting Started with D2 Plugin.txt* file contains more information on creating and configuring a custom plug-in. This file is available in the SDK package.

Overview of the Template Plug-in Examples

The template plug-in located in the `Plugins` folder of the `D2 4.5 SDK.zip` archive contains the following three examples:

Customizing Content Export

This example for customizing content export explains the procedure to use the condition service override, add a custom service (`IPluginAction`), and configure error reporting. The resulting plug-in allows end users to use a menu item in D2 Client to download dynamically-generated custom content using the D2 web service. To do this, the plug-in uses D2 OpenAjaxHub to post an event named `D2_ACTION_EXPORT_FROM_URL` to trigger content download from the URL contained in a parameter.

The plug-in consists of the following classes:

- `D2CustomService` implements the `IPluginAction` interface to allow being called as a standard D2 web service. The class contains the `getCustomDownloadURL` method that returns a URL with dynamic IDs to the `ExportContent` servlet.
- `D2ExportServicePlugin` intercepts the standard `D2ExportService` web service that is called by the `ExportContent` servlet. The class overrides the `exportTo` method to send custom content to D2.
- D2 uses `D2PluginTemplateVersion` and `D2PluginVersion` for plug-in detection.

After configuring a menu item using D2 Config, an end user can click the menu item in D2 Client to trigger the following chain of events:

1. The plug-in calls the `getCustomDownloadURL` method in the `D2CustomService` service.
2. The method returns a URL to the `ExportContent` servlet in an `oam_value` attribute.
3. The servlet posts the URL as a parameter of the `D2_ACTION_EXPORT_FROM_URL` event.
4. The D2 applet detects the event and triggers a download using the `ExportContent` servlet.
5. The `ExportContent` servlet retrieves content from the `D2ExportService` service.
6. The `D2ExportServicePlugin` intercepts the call and sends the custom content.

Overriding a Service with Post-Processing

This example performs a D2 Service but adds post-processing to make `object_name` values appear in upper case.

The plug-in consists of the `D2ContentServicePlugin` class.

Overriding a Service with Pre-Processing

This example performs a D2 Service but adds pre-processing to add a timestamp suffix to the `title` attribute.

The plug-in consists of the `D2CreationServicePlugin` class.

Downloading and Setting Up the Template Plug-in

1. Download D2_4.5_SDK.zip to a temporary location.
2. Extract the Plugins folder from D2_4.5_SDK.zip
3. Open your IDE and select the extracted Plugins folder as a workspace.
If you select the YourCo-PluginName folder, the IDE might not recognize the project.
4. Import the project to the workspace. In Eclipse:
 - a. Navigate to **File > Import**.
 - b. Select **General > Existing Projects into Workspace** and click **Next**.
 - c. In **Select root directory**, click **Browse** and select the YourCo-PluginName folder.
 - d. Click **Finish**.
5. Configure the Java Build Paths for D2. In Eclipse:
 - a. Right-click YourCo-PluginName in the Package Explorer and click **Properties**.
 - b. Click **Java Build Path** in the **Properties for YourCo-PluginName** dialog box.
 - c. Click the **Libraries** tab.
 - d. Click **Add Variable**, then click **Configure Variables**.
 - e. Click **New** and fill out the form as described in the following table:

Field	Description
Name	Type D2_4x_LIB
Path	Type the path to the WEB-INF/lib folder in the D2 web application. For example: C:/Program Files/Apache Software Foundation/Tomcat 6.0/webapps/D2/WEB-INF/lib

- f. Click **New** and fill out the form as described in the following table:

Field	Description
Name	Type D2_4x_CLASSES
Path	Type the path to the WEB-INF/classes folder in the D2 web application. For example: C:/Program Files/Apache Software Foundation/Tomcat 6.0/webapps/D2/WEB-INF/classes

- g. Click **New** and fill out the form as described in the following table:

Field	Description
Name	Type D2_DFC_JAR
Path	Type the path to the folder containing DFC.jar file. For example: C:/emc-dfs-sdk-6.7.2/lib/java/dfc/dfc.jar

Eclipse will not show any errors now.

- h. Click **OK** until you are back at the Package Explorer window.
6. Edit build\build.properties to set D2_4x_LIB, D2_4x_CLASSES, and D2_DFC_JAR variables for use by Ant build (using the same paths from the above step). For example:

```
D2_4x_LIB = C:/Program Files/Apache Software Foundation/Tomcat
6.0/webapps/D2/WEB-INF/lib
```

```
D2_4x_CLASSES = C:/Program Files/Apache Software Foundation/Tomcat
6.0/webapps/D2/WEB-INF/classes
```

```
D2_DFC_JAR = C:/emc-dfs-sdk-6.7.2/lib/java/dfc/dfc.jar
```

Building, Installing, and Verifying the Template Plug-in

1. Build the plug-in:
 - a. In Eclipse, expand the `build` folder in Package Explorer.
 - b. Right-click `build.xml` and navigate to **Run As > Ant build**
When your IDE finishes building the `.jar` file, the `dist` folder contains `YourCo-PluginName.jar`.
2. Stop the web application server.
3. Copy `YourCo-PluginName.jar` to the `WEB-INF/lib` folder of the D2 web application. For example,

```
C:/Program Files/Apache Software Foundation/Tomcat
6.0/webapps/D2/WEB-INF/lib
```
4. Start the web application server.
5. Verify the plug-in installation:
 - a. Log in to D2 Client.
 - b. Navigate to **Help > About D2** from the menu bar.
 - c. Look for `YourCo-PluginName v1.0.0 (0001)` in the list of **Plugins**.

Configuring a Menu Item for the Template Plug-in

Configure a menu item using D2 Config to allow end users to call the custom download action.

1. Log in to D2 Config and navigate to **Go to > Menu D2** to open the D2 Client menu configuration page.
2. Add a new menu item to the menu in which you want the button to appear. *EMC Documentum D2 Administration Guide* contains further instructions for configuring a D2 Client menu.
3. Fill out the form for the new menu item as described in the following table.

Field	Description
Label en	Export Custom Content
Shortcut	Ctrl+D
Action	Calling service's method
Service	D2CustomService

Field	Description
Method	getCustomDownloadURL
Selection	Select MULTI to allow end users to select multiple content for the download action.
Type	Select EVENT to post an event if the web service call is successful.
Action	D2_ACTION_EXPORT_FROM_URL

- Click **Save**.

Creating a New Plug-in Using the Template

You must declare and insert the necessary resources using the following folder tree for D2 to recognize the custom plug-in:

```
<company name>-<plug-in name>
|--src
|   |--com
|       |--<your namespace>
|           |--<plug-in name>
|               |--> D2PluginVersion.java
|               |--> <plug-in name>Version.java
|               |--> <plug-in name>Version.properties
```

- Rename the `YourCo-PluginName` project.
For example: `DaveCo-CoolPlugin`
- Rename `com.yourdomainhere.yourplugin` in Eclipse to your domain namespace and package name for each package in the plug-in template.
For example: `com.daveco.coolplugin`
- Optionally, rename `PluginNameVersion.java` and `PluginNameVersion.properties`
For example: `CoolPluginVersion.java` and `CoolPluginVersion.properties`
If you rename the files, you must edit `build.properties` to reflect the name change.
- Edit `build.properties` and change `project.version.file` to reflect your package structure and the plug-in properties file name.
For example: `/src/com/daveco/coolplugin/CoolPluginVersion.properties`
- Edit `PluginNameVersion.properties` or `CoolPluginVersion.properties` (if you have renamed it) to set the company, project, and so on.
- Remove the example plug-in classes and replace them with your plug-in implementation.
For example: `*.webfs.services.content` and `*.webfs.services.create`
- Re-run `.\build\build.xml` to rebuild your plug-in.

Configuring a Custom Action

1. Create a Java class in the `<project folder>/src/com/<your namespace>/<plug-in name>/webfs/services/custom/` folder.
2. Import the following resources:

```
import java.util.List;
import com.emc.d2fs.dctm.plugin.IPluginAction;
import com.emc.d2fs.dctm.web.services.D2fsContext;
import com.emc.d2fs.models.attribute.Attribute;
```

The *EMC Documentum D2 D2FS API JavaDoc* contains more information about the packages that you can use to configure a custom action.

3. Implement `IPluginAction`:

```
public class <name of the class> implements IPluginAction
```

4. The class must contain a method that has at minimum the following format:

```
public List<attribute> <methodName>(D2fsContext context);
```

For example, the `YourCo-PluginName` plug-in sample contains the following method declaration for `D2CustomService.java`:

```
public List<Attribute> getCustomDownloadURL(D2fsContext context)
throws UnsupportedOperationException, DfException, D2fsException
```

5. After building and installing the plug-in, create a menu button in D2 Config to allow end users to perform the custom action. The *EMC Documentum D2 Administration Guide* contains further instructions for configuring a D2 Client menu.

For example, [Configuring a Menu Item for the Sample Plug-in, page 34](#) contains the instructions for creating a menu button for the `YourCo-PluginName` plug-in sample.

Understanding Service Interface Overrides

You can override all D2 services interfaces using the `@Override` annotation.

Pre-Processing

You can add data processing before a service by adding code before the super call. The following example code adds a custom timestamp to the end of a content title before the service creates content properties. The pre-processing ensures that content created using the plug-in have a timestamp at the end of the title:

```
/** Override createProperties to add custom pre-processing.
 *
 */
@Override
public String createProperties(Context context,
    java.util.List<Attribute> parameters) throws Exception {
    // pre-processing -- look for 'title' attribute and add a custom
    //timestamp at the end.
```

```

for(Attribute attr : parameters){
    if (attr.getName().equals("title")){
        String timeStamp = new SimpleDateFormat("yyyyMMdd_HH:mm:ss").
            format(Calendar.getInstance().getTime());
        attr.setValue(attr.getValue() + " : " + timeStamp);
        break;
    }
}
return super.createProperties(context, parameters);
};

```

Post-Processing

You can add data processing after a service by adding code after the super call. The following example code runs the result of the service through a capitalization process. The post-processing ensures that the plug-in returns the name of the `object_name` attribute in upper-case letters.

```

/** Override getContent() to demonstrate post processing
 *      (make object_name attributes upper case).
 *
 * NOTE: If overriding getContent() you may want to similarly override
 *      getFilteredContent().
 *
 */
@Override
public DocItems getContent(Context context, String contentId,
    String contentTypeName, String viewMode, String checkChildren)
    throws Exception {

    LOGGER.debug("D2ContentServicePlugin calling super.getContent()...");

    // Call base class implementation to get the default results.
    DocItems result = super.getContent(context, contentId, contentTypeName,
        viewMode, checkChildren);

    LOGGER.debug("D2ContentServicePlugin post processing items...");

    // Return post processed results
    return postProcessItems(result);
}

```

Overriding the Process

You can perform a replacement override by forcing the service to return a different value than the original super method. The following example overrides the original `exportTo` class and returns `dh = new DataHandler(new FileDataSource(new File(myFile)))`.

```

@InjectSession
public FileContent exportTo(Context context, String parentId, String typeName,
    String colType, String exportType, String fileName) throws Exception
{
    FileContent result = null;

```

```
D2fsContext d2fsContext = (D2fsContext) context;
ParameterParser parameterParser = d2fsContext.getParameterParser();

LOGGER.info ("D2ExportServicePlugin Before exportTo");

// If the parameter custom_call is sent and is true,
//     the customization will be used.
if (parameterParser.getBooleanParameter("custom_call"))
{
    // overridden
    LOGGER.info ("custom_call, overridden...");

    List<String> ids = StringUtil.split(parameterParser.
        getStringParameter("id"), "-");
    LOGGER.info ("SELECTED IDs = " + ids);

    //Retrieve user session
    IDfSession session = d2fsContext.getSession();

    //Prepare file content for result
    result = new FileContent();
    result.setName("MyFile.pdf");
    result.setMime(IDfFormatEx.PDF);
    result.setFormat(IDfFormatEx.PDF);

    //SETUP Here!!!: This file must exist on your server
    //(with sufficient permissions).
    String myFile = "c:\\temp\\MyFile.pdf";
    DataHandler dh = new DataHandler(new FileDataSource(new File(myFile)));
    result.setFileContent(dh);
}
else {
    //not overridden; proceed with default behavior.

    LOGGER.info ("(not overridden) calling super.exportTo()...");

    result = super.exportTo (context, parentId, typeName,
        colType, exportType, fileName);
}

return result;
}
```

Throwing Exceptions

You can use `Exception()` and `D2fsException()` to report exceptions or errors encountered in your Service extension or Custom Action code back to D2 and the end user. The following example shows how to use `D2fsException()`:

```
public List<Attribute> getCustomDownloadURL(D2fsContext context) throws
    UnsupportedEncodingException, DfException, D2fsException
{
    LOGGER.debug("getCustomDownloadUrl()...");
```

```

/**
 * Error reporting -- Note that when you need to report an error to D2
 * and the user, you can simply throw an Exception() or D2fsException(),
 * whichever is compatible with the api your are overriding
 * For example, this custom action throws D2fsException()
 */
Boolean bNeedToReportAnError = false;
//
if (bNeedToReportAnError) {
    // Error detected; Build your localized message and throw the
    //Exception() to notify user.
    throw new D2fsException("A problem was encountered with your
        custom export...");
}

// Code omitted for example clarity

return result;
}

```

Setting Up D2 Service Overrides

Use the following folder structure when you want to create a class to override D2 services:

```

<company name>-<plug-in name>
|--src
    |--com
        |--<your namespace>
            |--<plug-in name>
                |--webfs
                    |--services
                        |--<name of the service package>
                            |--> <name of the service>Plugin.java

```

1. Determine the *<name of the service>*.

The *com.emc.d2fs.interfaces* section of *EMC Documentum D2 D2FS API JavaDoc* contains a list of D2FS interfaces prefixed by the letter I. For example, the sample *D2ExportServicePlugin* class is based on the *IExportService* interface.

To determine the *<name of the service>*, replace the prefix I with D2. For example, in the sample the interface *IExportService* uses the D2 service *D2ExportService*.

2. Create a .java file named *<name of the service>Plugin.java* for the services class to configure the process in the *<company name>-<plug-in name>/src/com/<your namespace>/<plug-in name>/webfs/services/<name of the service package>/* folder.
3. Create and name the class *<name of the service>Plugin*.

For example, the sample uses the service *D2ExportService* to name its class *D2ExportServicePlugin*.

4. Extend the service class with the *<name of the service>* and implement the `ID2fsPlugin` interface.

For example, the sample declares the class:

```
public class D2ExportServicePlugin extends D2ExportService
implements ID2fsPlugin
```

The `ID2fsPlugin` interface forces the implementation of two methods:

- `getFullName`: Returns the full plug-in name with its version number. The method is called by the **About** dialog box in D2.
- `getProductName`: Returns the plug-in name to determine whether the plug-in should be executed based on the D2 configuration matrix.

Deploying D2 Plug-ins

1. Create the plug-in .jar file.
2. Copy the plug-in .jar file to the *<install path of D2>/WEB-INF/lib/* folder. For example:

```
C:\apache-tomcat-<version>\webapps\D2\WEB-INF\lib
```

3. Restart the web application server.
4. Verify the plug-in installation by logging in to D2 Client and navigating to **Help > About**.

Extending C2 PDF functionality

The `PdfConverterListener.java` sample code shows how to convert or process any PDF output generated by C2 into a linearized PDF. The `PdfConverterListener.java` sample is based on the Big Faceless (BFO) Java PDF library that supports post processing capabilities such as linearization for faster display of PDF documents downloaded from the web. The `PdfConverterListener.java` sample implements the `IPdfProcessorListener` API and can be packaged as a JAR and installed where the `PDF-API.jar` files are located along with third party library dependencies. The `PDF-API.jar` is located under `/WEB-INF/lib` in D2-Config and D2-BOCS. It can also be found on JMS, BOCS, and Content server installations.

Out-of-the box, the sample code can be run by providing the input path of a valid PDF file and an output path for the linearized PDF file.

1. Import the following resources

```
import java.io.File;
import java.io.OutputStream;
import com.emc.pdf.api.IPdfProcessorListener
```
2. Implement `IPdfProcessorListener`

```
public class implements IPdfProcessorListener
```
3. Provide the name of the class. The sample uses `public class PdfConverterListener`

An example of the sample code is as follows:

```
package your.package.name;

import java.io.File;
```



```
import java.io.OutputStream;
import com.emc.pdf.api.IPdfProcessorListener;

public class PdfConverterListener implements IPdfProcessorListener {
    @Override
    public void onAfter(Object abstractData, File file,
        OutputStream outputData, String userPassword, String ownerPassword)
```

In this sample:

- <file> is the input source
- <OutputStream> generates the output after the change is made by the library, code, or logic.
- <File> is the resulting PDF encrypted using userPassword or ownerPassword.
- <abstractData> is converted to a java.util.Map and contains all available data used during processing.