

Document Subdomain

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This module (`incode-module-document`) provides the ability to create and attach `Document` objects to arbitrary domain objects from `DocumentTemplates`.

`Documents` can be rendered using a number of technologies:

- `Apache Freemarker` (using the `Freemarker DocRendering library` module)
- `stringinterpolator` module to interpolate and download a URL (using the `StringInterpolator DocRendering` module).

This can be used to integrate with pre-existing reporting servers (for example Microsoft's `SQL Server Reporting Services`).

- `XDocReport` (using the `XDocReport DocRendering` module).

The rendering mechanism is pluggable; additional implementations can be plugged in as required.

Also, the rendering can be done either in the foreground or the background. A "backgroundCommands" mixin collection will show any such background commands scheduled for a `Document`.

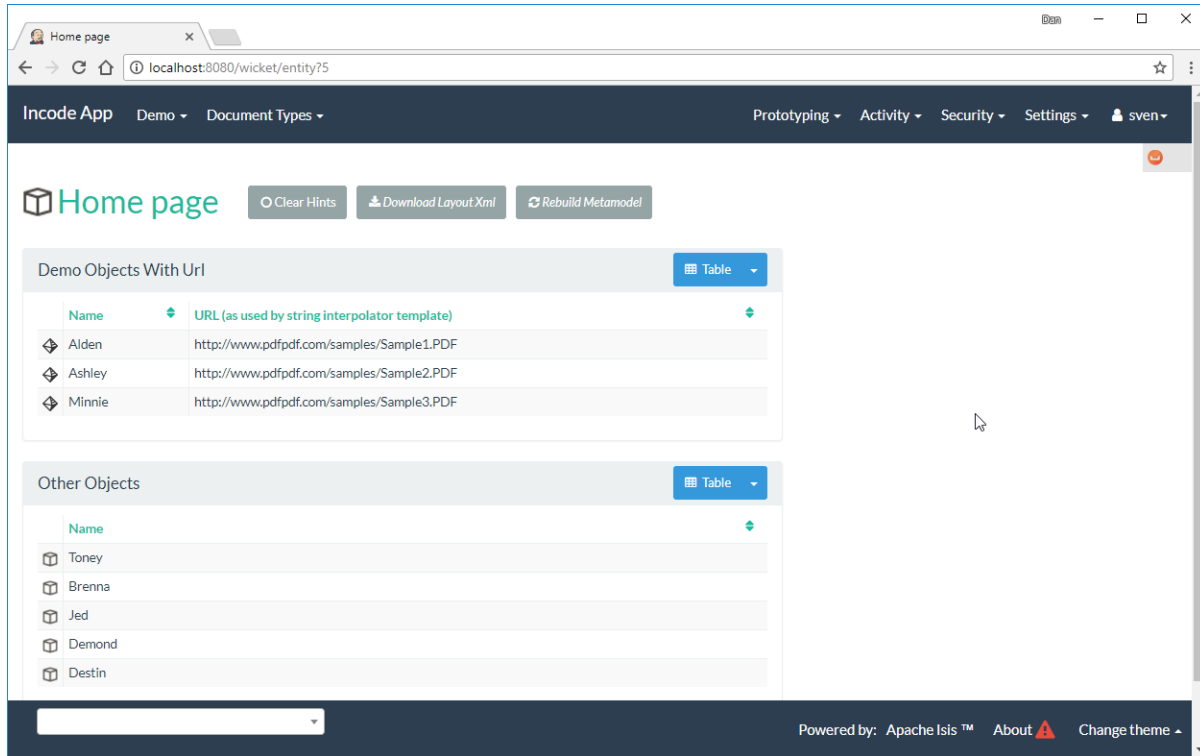
Once a `Document` has been created, other supporting PDFs (for example tax receipts for a generated invoice) can then be attached to it. A `Document` is created to wrap these PDFs. Like all `Documents`, a `DocumentType` is required which helps categorise the supporting document, but no corresponding `DocumentTemplate` is required because they are never rendered (they exist already). An SPI service (`DocumentAttachmentAdvisor`) is used to obtain the list of available `DocumentTypes` to use.

The module implements a rule that chains of `Documents` are not allowed: a `Document` either has supporting `Documents` attached to it, or it is a supporting `Document`. In the former case a "supportingDocuments" mix-in collection lists all the supporting `Documents` that have been attached. In the latter, a "supports" mixin property points back to the `Document` being supported.

Screenshots

The module's functionality can be explored by running the [quickstart with example usage](#) using the `org.incode.domainapp.example.app.modules.ExampleDomDomDocumentAppManifest`.

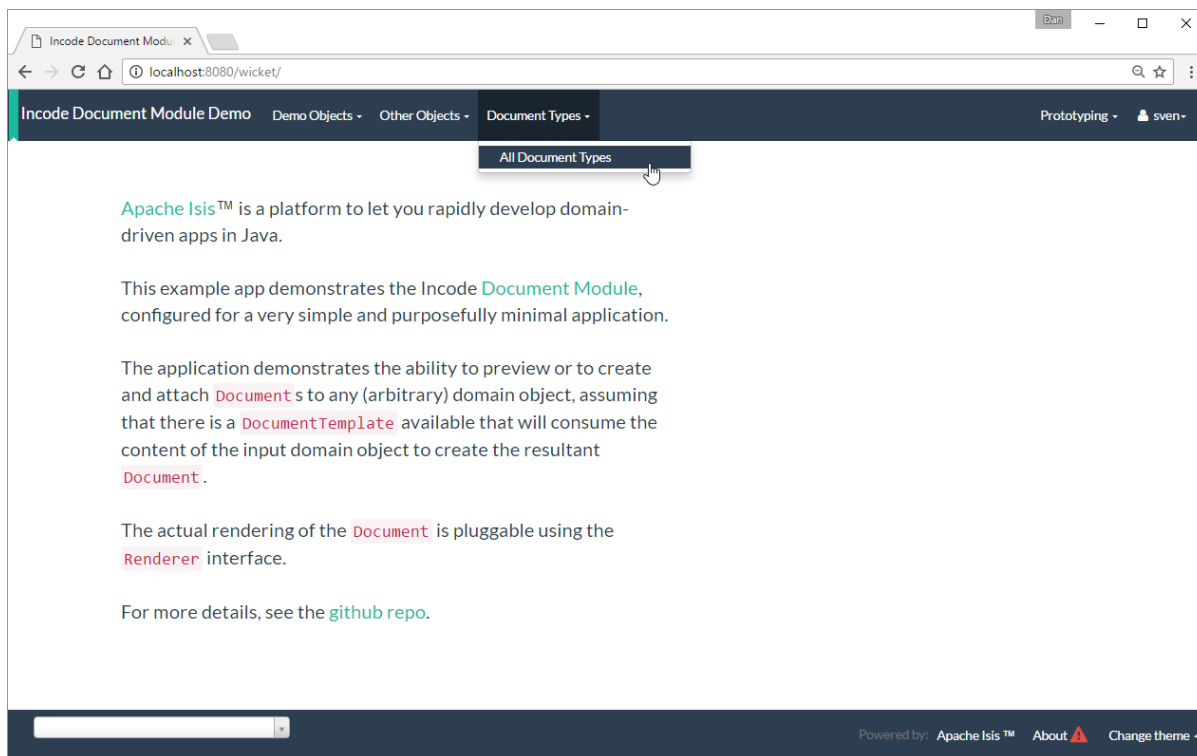
A home page is displayed when the app is run:



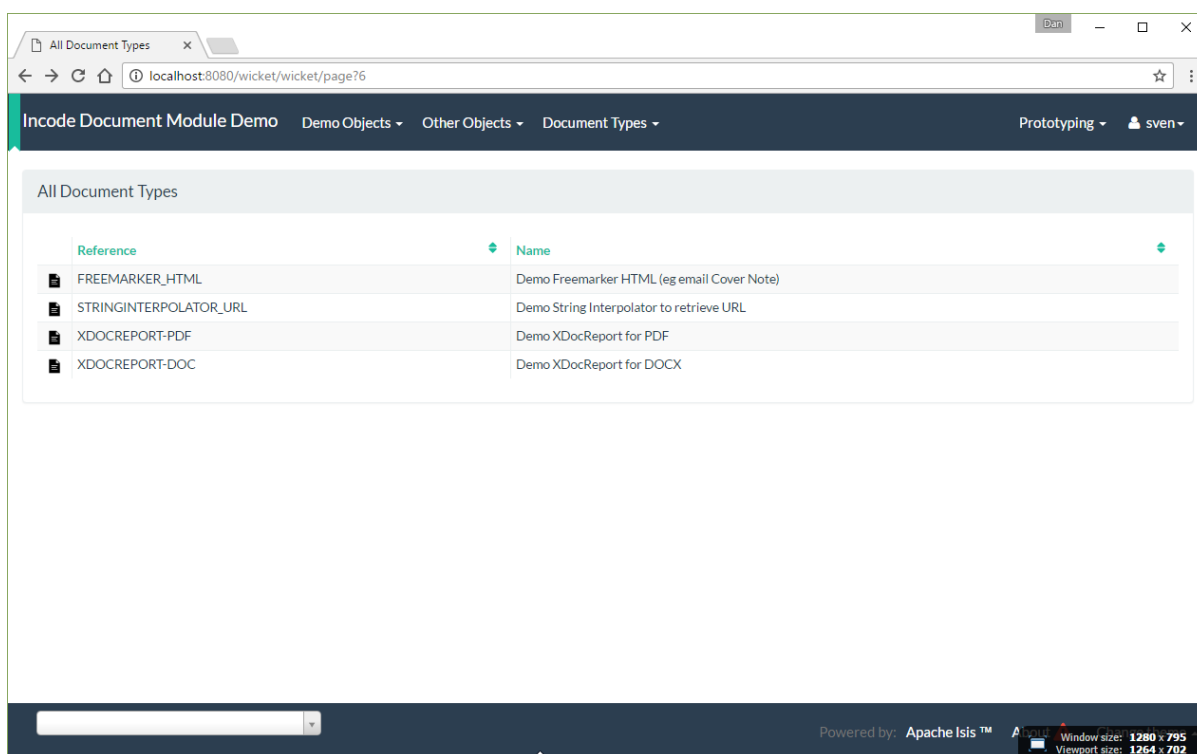
The remaining screenshots below **do** demonstrate the functionality of this module, but are out of date in that they are taken from the original `isisaddons/incodehq` module (prior to being amalgamated into the `incode-platform`).

Document Types

The app manifest's fixture script defines a set of `DocumentTypes`. These are reference data:



Four example `DocumentTypes` are set up, showcasing the four `RenderingStrategies` provided by the `Freemarker docrendering library`, `StringInterpolator docrendering library` and `XDocReport docrendering library` modules:



The two `DocumentTypes` for XDocreport are very similar; the difference is only that one results in a PDF, while the other results in a Word `.docx` document.

Freemarker Document Template

A `DocumentType` holds a collection of `DocumentTemplates`, by date. This allows new versions of

template to be altered/evolved over time.

The example `DocumentType` for Freemarker defines just a single `DocumentTemplate`:

The screenshot shows the 'Incode Document Module Demo' interface. The top navigation bar includes 'Demo Objects', 'Other Objects', and 'Document Types'. The main content area is titled '[FREEMARKER_HTML]' and has tabs for 'General' and 'Metadata'. Under the 'General' tab, there is an 'Identifier' section with fields for 'Reference*' (FREEMARKER_HTML) and 'Name*' (Demo Freemarker HTML (eg email Cover Note)). Below this is a 'Current Templates' table with columns: Name, Date, Type, Preview Only, Sort, Mime Type, and File Suffix. The table contains one entry: 'Demo Freemarker HTML (eg email Cover Note)' with Date '16-11-2016', Type '[FREEMARKER_HTML]', and File Suffix 'html'. The bottom of the interface shows 'Powered by: Apache Isis™' and links for 'About' and 'Change theme'.

The `DocumentTemplate` contains template text that can be either text, clob or a blob. In the case of the demo freemarker template it is a clob:

The screenshot shows the 'Incode Document Module Demo' interface for a specific document template. The top navigation bar is the same. The main content area is titled '[FREEMARKER_HTML] (2016-11-16)' and has tabs for 'Identifier', 'Metadata', 'Content', and 'Name'. The 'Identifier' tab is active, showing fields for 'Name*' (Demo Freemarker HTML (eg email Cover Note)), 'Date*' (16-11-2016), and a 'Change Date' button. Below this is a 'Details' section with fields for 'Type*' ([FREEMARKER_HTML]), 'Application tenancy*' (/), and a 'Preview Only' checkbox. To the right, the 'Content' tab is active, showing a 'Rendering' section with 'Content Rendering Strategy*' ([FMK] RendererForFreemarker Rendering Strategy) and a 'Change' button. Below this is a 'Template' section with 'Sort*' (Clob) and a 'Clob' field containing 'Demo Freemarker HTML (eg email Cover Note)', with 'Download' and 'Upload' buttons. The 'Mime type' section has 'Mime Type*' (text/html) and 'File Suffix*' (html). At the bottom, the 'Applies To' section shows a table with columns 'Domain Class Name' and 'Applies To', containing the entry 'org.incode.module.document.fixture.dom.demo.DemoObject'. The bottom of the interface shows 'Powered by: Apache Isis™' and links for 'About' and 'Change theme'.

The clob itself is an HTML email file. This can be downloaded from the template:

```

padding-right: 10px !important;
}
}
</style>
</head>
<body>
<table class="body">
<tr>
<td class="center" align="center" valign="top">
<table class="container">
<tr>
<td>
<table class="row">
<tr>
<td class="wrapper last">
<table class="twelve columns">
<tr>
<td>
<p>Dear Sirs</p>
<p>This is a cover note for demo object with name: ${demoObject.name}</p>
<p>Faithfully etc etc</p>
</td>
</tr>
</table>
</td>
</tr>
</table>
</td>
</tr>
</table>
</body>
</html>

```

The template text clob can be modified by uploading new versions. However, once Documents have been created from a DocumentTemplate, the template should be considered as immutable and not be updated; instead create a new version.

Each DocumentTemplate also defines placeholder text for the name of the resultant Document:

The screenshot displays the Incode Document Module Demo web application. The main header shows the application name and navigation links. The main content area is titled "[FREEMARKER_HTML] (2016-11-16)" and includes a "Delete" button. The interface is divided into several sections: "Identifier" with fields for "Name" and "Date"; "Details" with fields for "Type", "Application tenancy", and "Preview Only"; "Applies To" with a "Domain Class Name" field; "Rendering" with a "Name Rendering Strategy" field; and "Template" with a "Name Text" field. The "Applies To" section has buttons for "Applicable", "Not Applicable", and "Table". The "Rendering" section has a "Change" button. The "Template" section has an "Update" button. The footer shows the application is powered by Apache Isis and includes links for "About" and "Change theme".

Along with the "content" and "name" text/clob/blob, the template also specifies the RenderingStrategy for each; these are used to interpolate the content/name.

Applicability

The `renderer(s)` associated with each `DocumentTemplate` require data (a "renderer model") to interpolate the placeholders in the content/name text; this renderer model ultimately is obtained from a domain object. Obviously not every domain object can be used with every `DocumentTemplate`; the `Applicability` entity catalogues which domain object types can be used as the input to the `renderer(s)` of its associated `DocumentTemplate`:

The screenshot shows a web application interface for configuring applicability. The title is "DemoObject applies to [FREEMARKER_HTML]". Below the title, there are two tabs: "Name" and "Metadata". The "Name" tab is active, showing a form with the following fields:

- Name:** A text input field.
- Document Template*:** A dropdown menu showing "[FREEMARKER_HTML] (2016-11-16)".
- Domain Class Name*:** A text input field containing "org.incode.module.document.fixture.dom.demo.DemoObject".

Below the form, there is a "Details" section with two fields:

- Renderer Model Factory Class Name*:** A text input field containing "org.incode.module.document.fixture.app.applicability.rmf.FreemarkerModelOfDemoObject". Below this field is a button labeled "Change Renderer Model Factory".
- Attachment Advisor Class Name*:** A text input field containing "org.incode.module.document.fixture.app.applicability.aa.ForDemoObjectAttachToSame". Below this field is a button labeled "Change Attachment Advisor".

The footer of the application shows "Powered by: Apache Isis™ About Change theme".

The `RendererModelFactory` of the `Applicability` is used to create the "renderer model" from the input domain object, while the `AttachmentAdvisor` is used to indicate which domain object(s) the resultant `Document` should be attached (often just the input domain object, but potentially to other domain objects also).

String Interpolator Template

The example String Interpolator `DocumentTemplate` obtains its content by interpolating (using the `stringinterpolator` module) the content placeholder text; the resultant string is parsed as a URL and the contents of that URL downloaded:

The name of **Documents** generated from this template also uses the [stringinterpolator](#) module:



The "renderer model" created (by an **DocumentTemplate's Applicability** for some domain object type) must be compatible with the **RenderingStrategy** for both content and name. This is true for all **DocumentTemplates**.

XDocReport Templates

There are two example `DocumentTemplate`s that use XDocReport for rendering. The content in both cases is a Word `.docx` file. The difference between them is simply that one renders this `.docx` and outputs a PDF, while the other produces an outputs another `.docx` file.

The example `DocumentTemplate` for the XDocReportPdf has the following content:

The screenshot shows a web application interface for configuring a `DocumentTemplate`. The browser address bar shows `localhost:8080/wicket/entity/incodeDocuments.DocumentTemplate:2`. The application has a dark blue header with navigation links: `Incode Document Module Demo`, `Demo Objects`, `Other Objects`, and `Document Types`. The main content area is titled `[XDOCREPORT-PDF] (2016-11-16)` with a `Delete` button. The interface is divided into two main sections: `Identifier` and `Content`.

Identifier Section:

- Identifier:** Includes fields for `Name*` (set to "Demo XDocReport for PDF.docx") and `Date*` (set to "16-11-2016"), with a `Change Date` button.
- Details:** Includes fields for `Type*` (set to "[XDOCREPORT-PDF]"), `Application tenancy*` (set to "/"), and a `Preview Only` checkbox (unchecked) with a `Toggle` button.

Content Section:

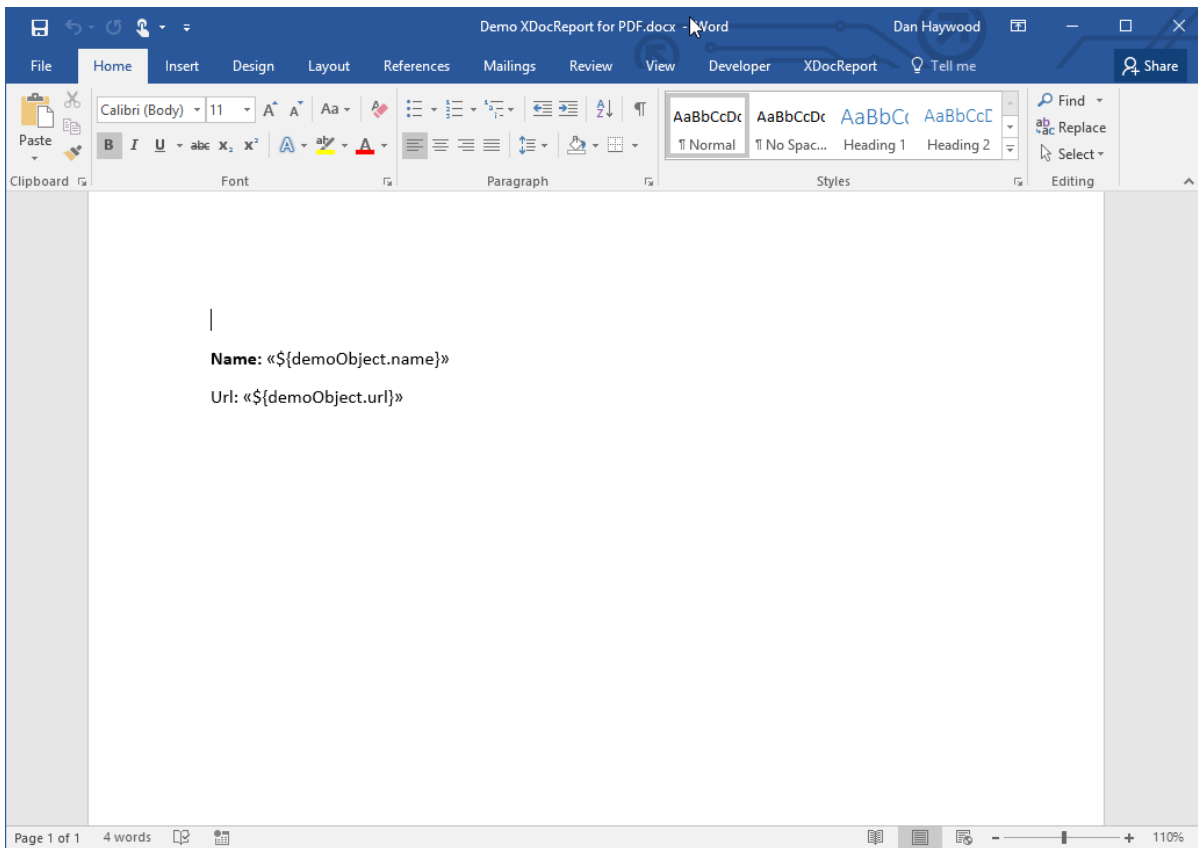
- Rendering:** Includes a `Content Rendering Strategy*` dropdown (set to "[XDP] XDocReport to .pdf") with a `Change` button.
- Template:** Includes a `Sort*` dropdown (set to "Blob") and a `Blob` field (set to "Demo XDocReport for PDF.docx") with `Download` and `Upload` buttons.
- Mime type:** Includes a `Mime Type*` field (set to "application/vnd.openxmlformats-officedocument.wordprocessingml.document") and a `File Suffix*` field (set to "pdf").

Applies To Section:

- Includes a `Domain Class Name` field (set to "org.incode.module.document.fixture.dom.demo.DemoObject") and buttons for `+ Applicable`, `- Not Applicable`, and `Table`.

The footer of the application shows "Powered by: Apache Isis™" and links for "About" and "Change theme".

Where the BLOB is a Word document:



This Word file uses Freemarker placeholders.



While XDocReport itself as a technology supports both Freemarker and Velocity, the integration here (in [XDocReport docrendering library](#) module) allows only Freemarker to be used.

The name text (used to create the name of the resultant **Document**) is also interpolated using Freemarker:

Incude Document Module Demo Demo Objects Other Objects Document Types Prototyping sven

[XDOCREPORT-PDF] (2016-11-16) Delete

Identifier Metadata

Identifier

Name* Demo XDocReport for PDF.docx

Date* 16-11-2016

Change Date

Details

Type* [XDOCREPORT-PDF]

Application tenancy* /

Preview Only

Toggle

Applies To

+ Applicable - Not Applicable Table

Domain Class Name

org.incode.module.document.fixture.dom.demo.DemoObject

Rendering

Name Rendering Strategy* [FMK] RendererForFreemarker Rendering Strategy

Change

Template

Name Text* \${demoObject.name}

Update

Powered by: Apache Isis About Change theme

The content of example `DocumentTemplate` for `XDocReportDocx` is almost identical:

Incude Document Module Demo Demo Objects Other Objects Document Types Prototyping sven

[XDOCREPORT-DOC] (2016-11-16) Delete

Identifier Metadata

Identifier

Name* Demo XDocReport for DOCX.docx

Date* 16-11-2016

Change Date

Details

Type* [XDOCREPORT-DOC]

Application tenancy* /

Preview Only

Toggle

Applies To

+ Applicable - Not Applicable Table

Domain Class Name

org.incode.module.document.fixture.dom.demo.DemoObject

Rendering

Content Rendering Strategy* [XDD] XDocReport to .docx

Change

Template

Sort* Blob

Blob

Download Demo XDocReport for DOCX.docx

Upload

Mime type

Mime Type* application/vnd.openxmlformats-officedocument.wordprocessingml.document

File Suffix* docx

Powered by: Apache Isis About Change theme

The only difference is that a different `RenderingStrategy` is used.

Previewing Documents

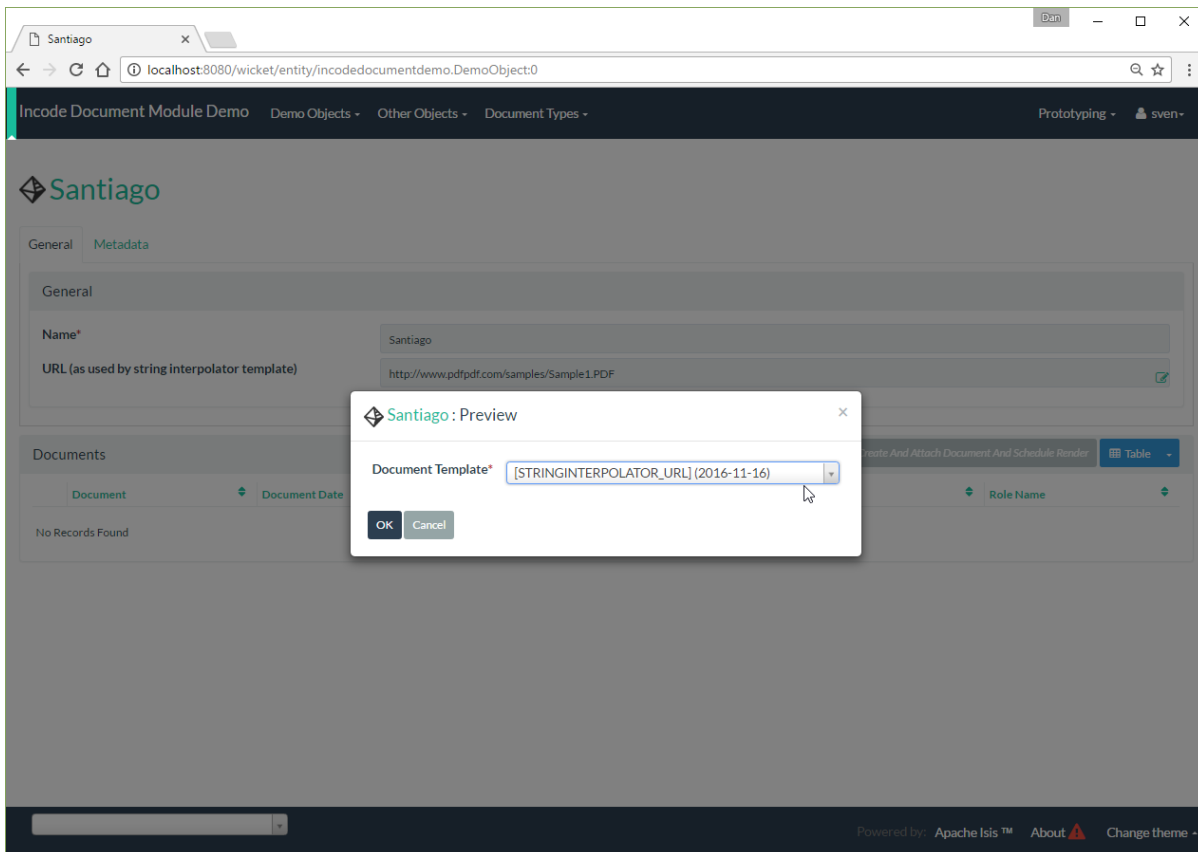
The fixture script also defines a number of demo domain objects, set up to allow **Documents** to be generated from them (for all the **DocumentTemplates** described above) and for those resultant **Documents** to be attached to them:

The screenshot shows a web browser window with the URL `localhost:8080/wicket/entity/incodedocumentdemo.DemoObject:0`. The application is titled "Santiago" and has a navigation bar with "Demo Objects", "Other Objects", and "Document Types". The main content area has a "General" tab selected, showing a form with the following fields:

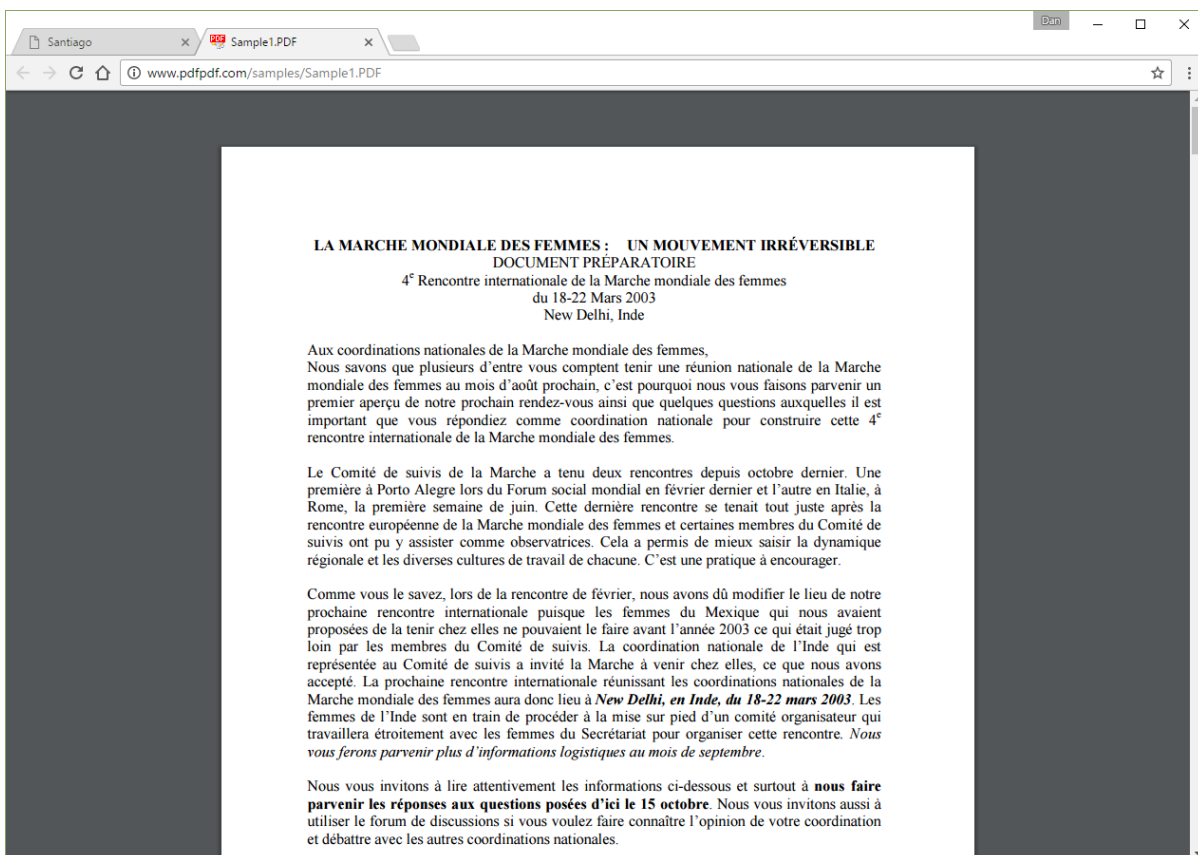
- Name***: Santiago
- URL (as used by string interpolator template)**: `http://www.pdfpdf.com/samples/Sample1.PDF`

Below the form is a "Documents" section with a table. The table has columns: Document, Document Date, Document State, Attached To, and Role Name. The table is empty, showing "No Records Found".

In the case of the String Interpolator **DocumentTemplate**, this also supports previewing:

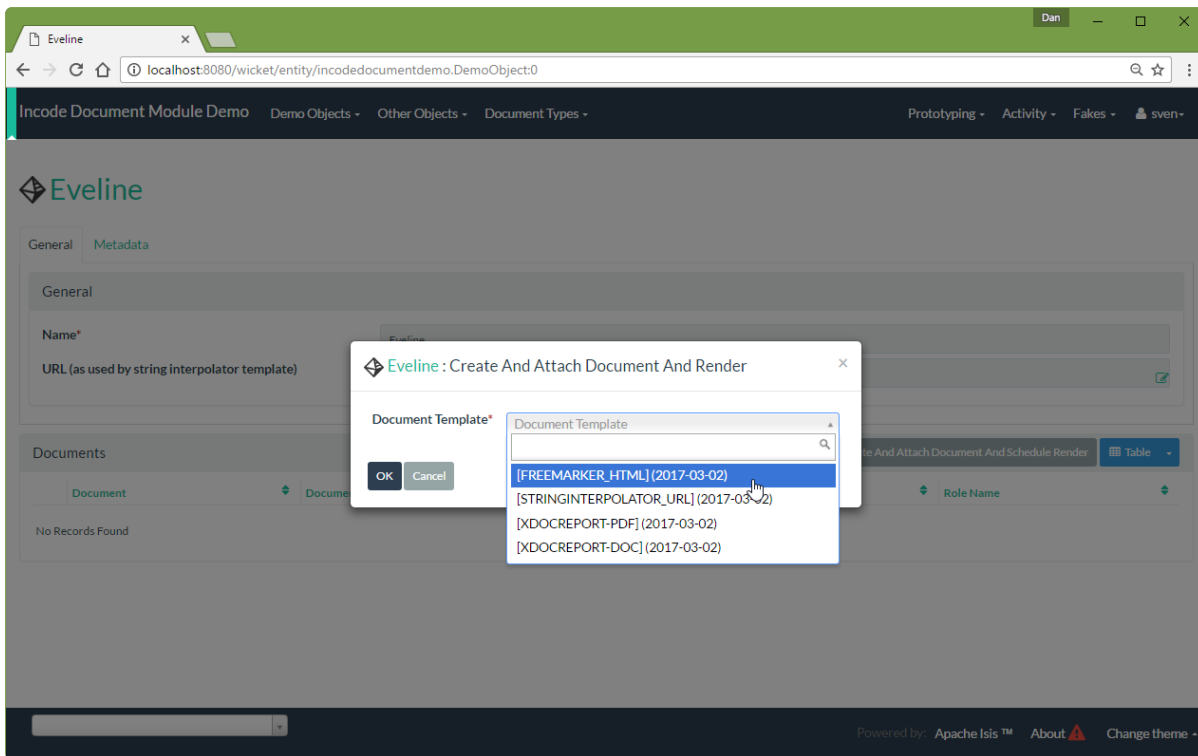


The resultant URL is opened up as a new tab; no new **Document** is created:

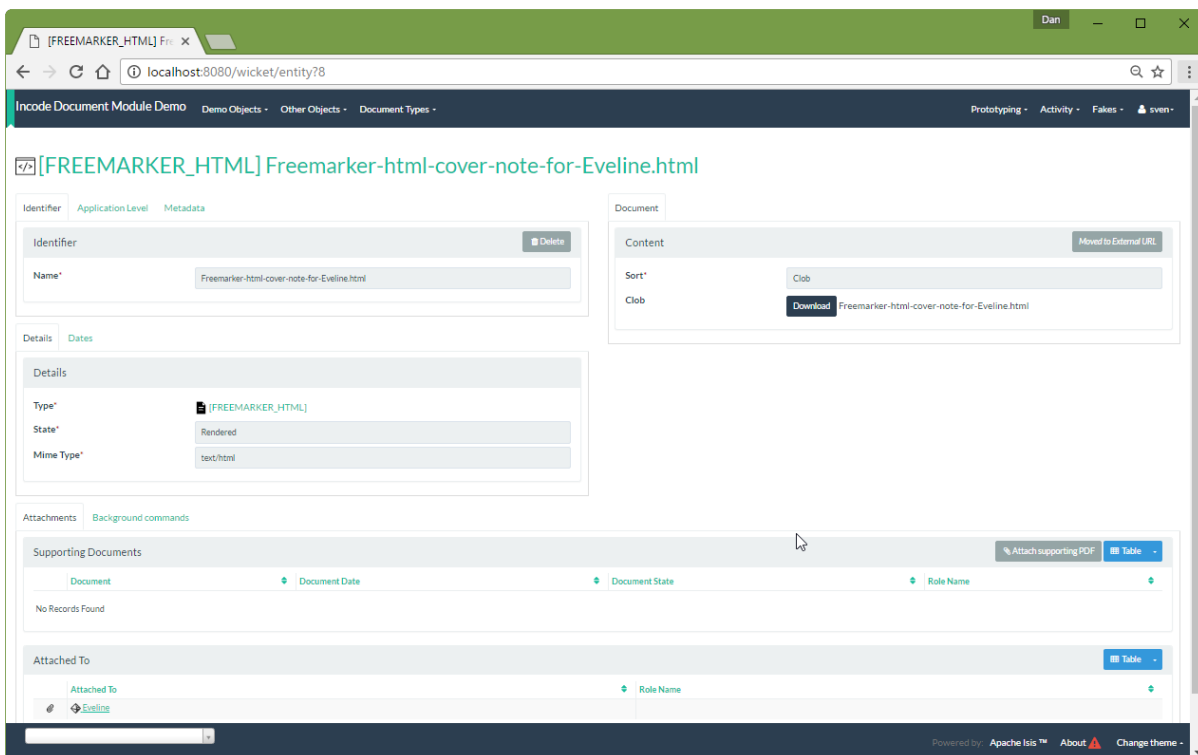


Generating Documents

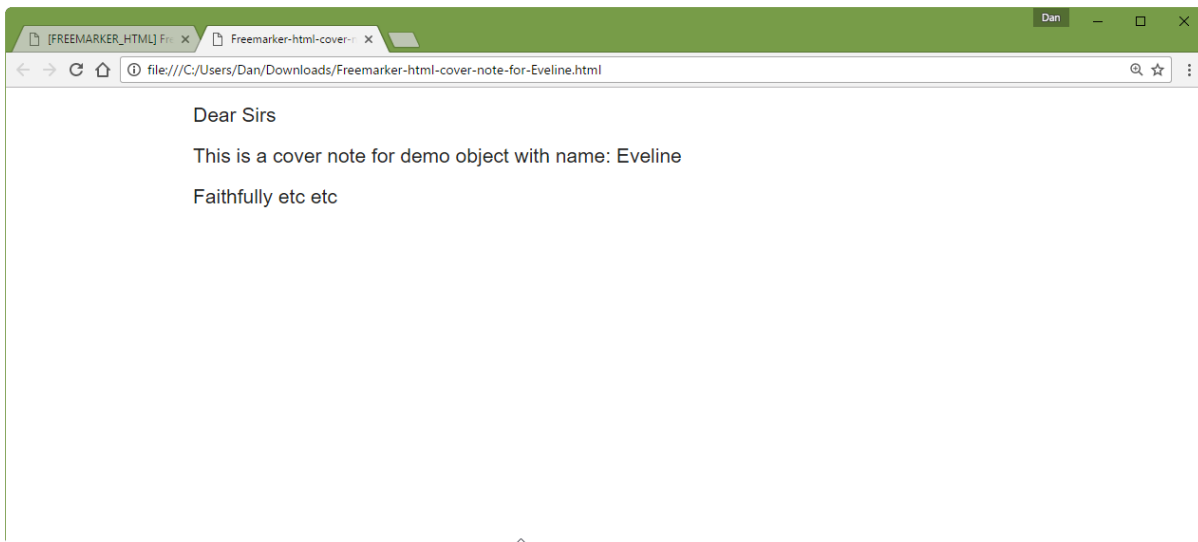
Generating a **Document** for the Freemarker **DocumentTemplate**:



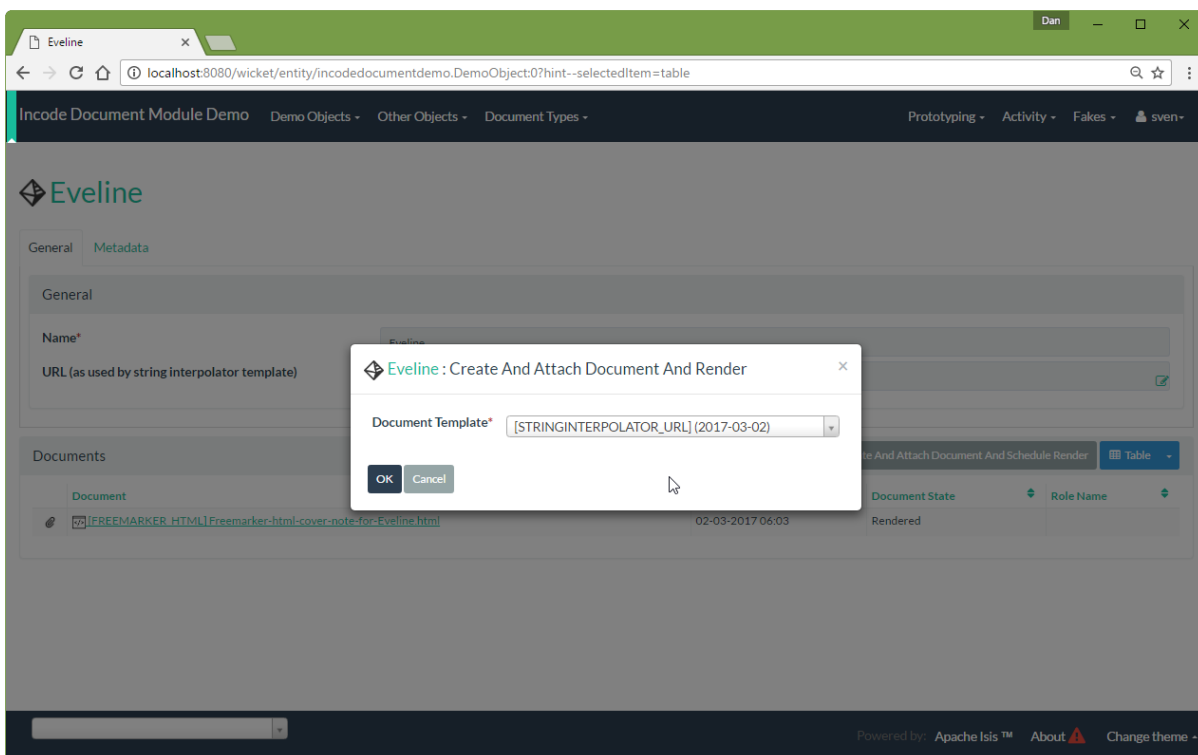
Results in a new **Document** attached to the demo object:



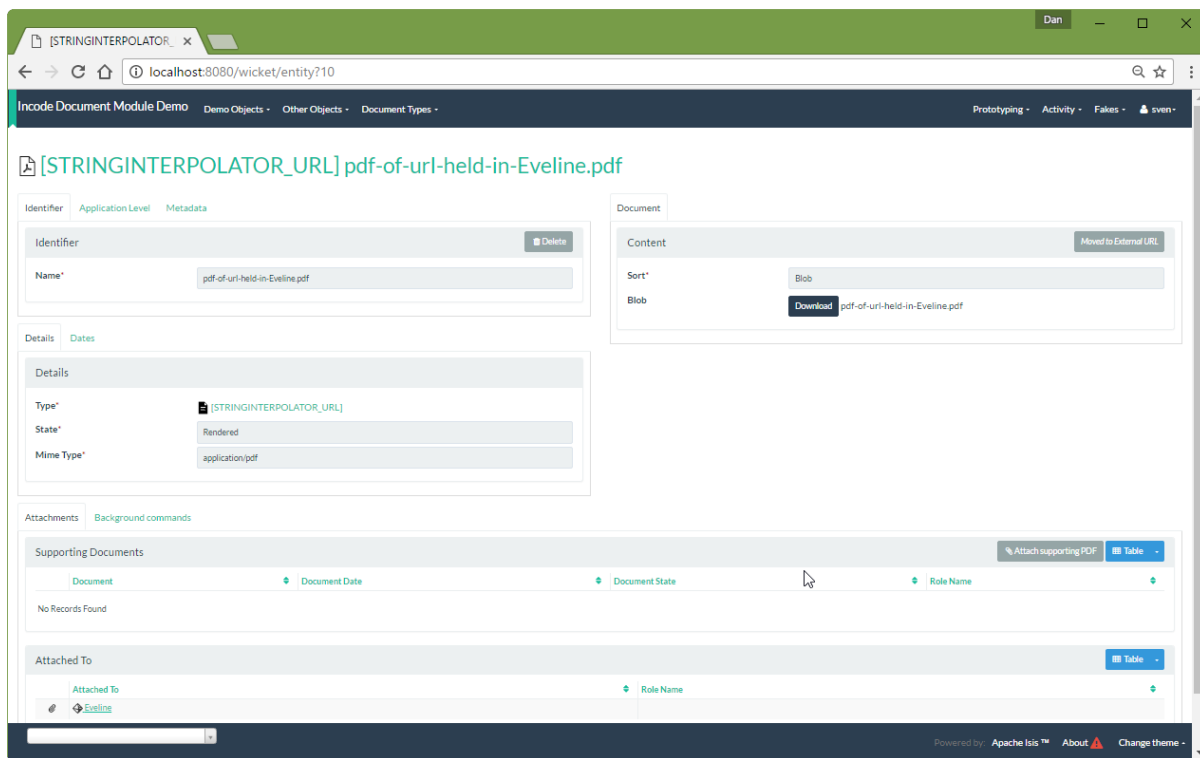
The content of this **Document** (HTML text) has correctly interpolated the details from the input demo object:



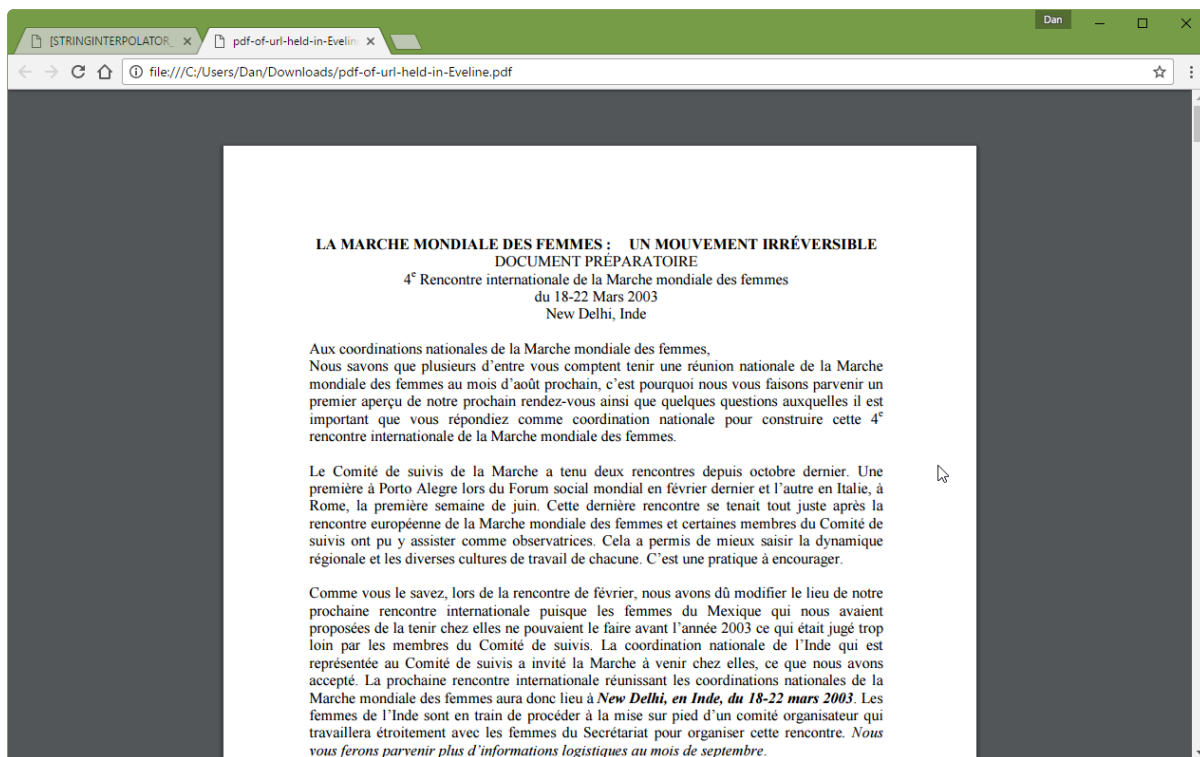
The StringInterpolator **DocumentTemplate** can similarly be used:



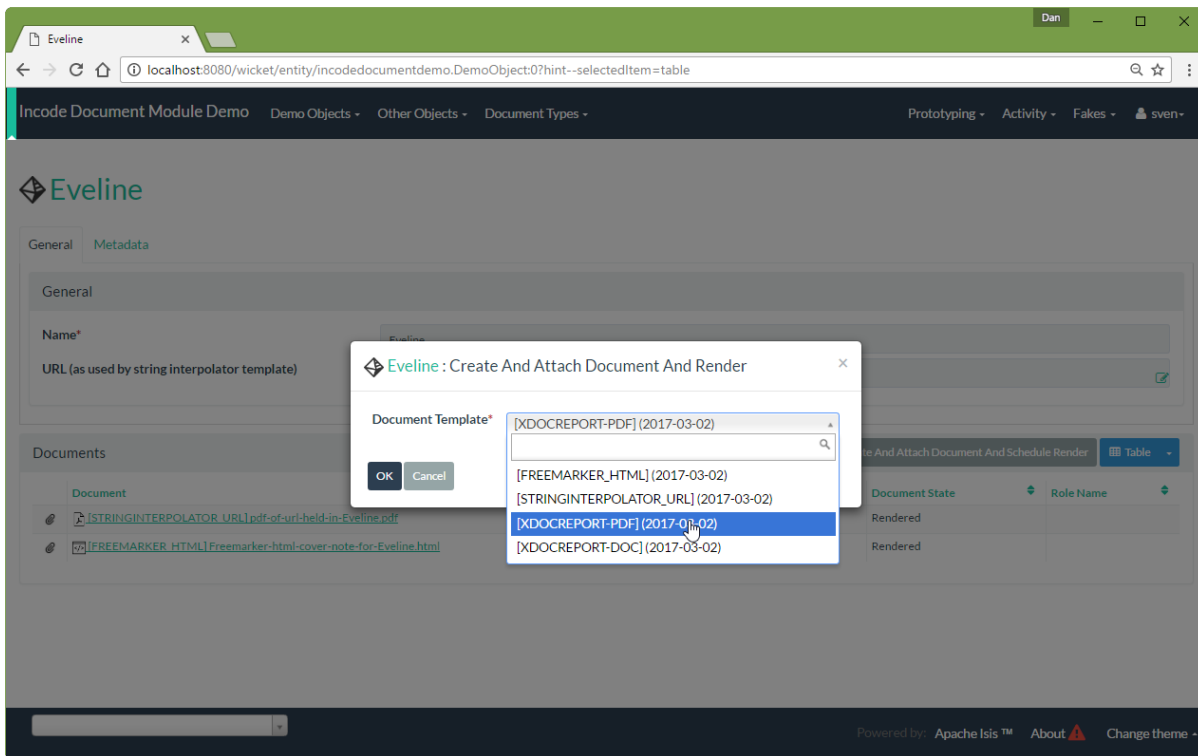
To create a new **Document** attached to the demo object:



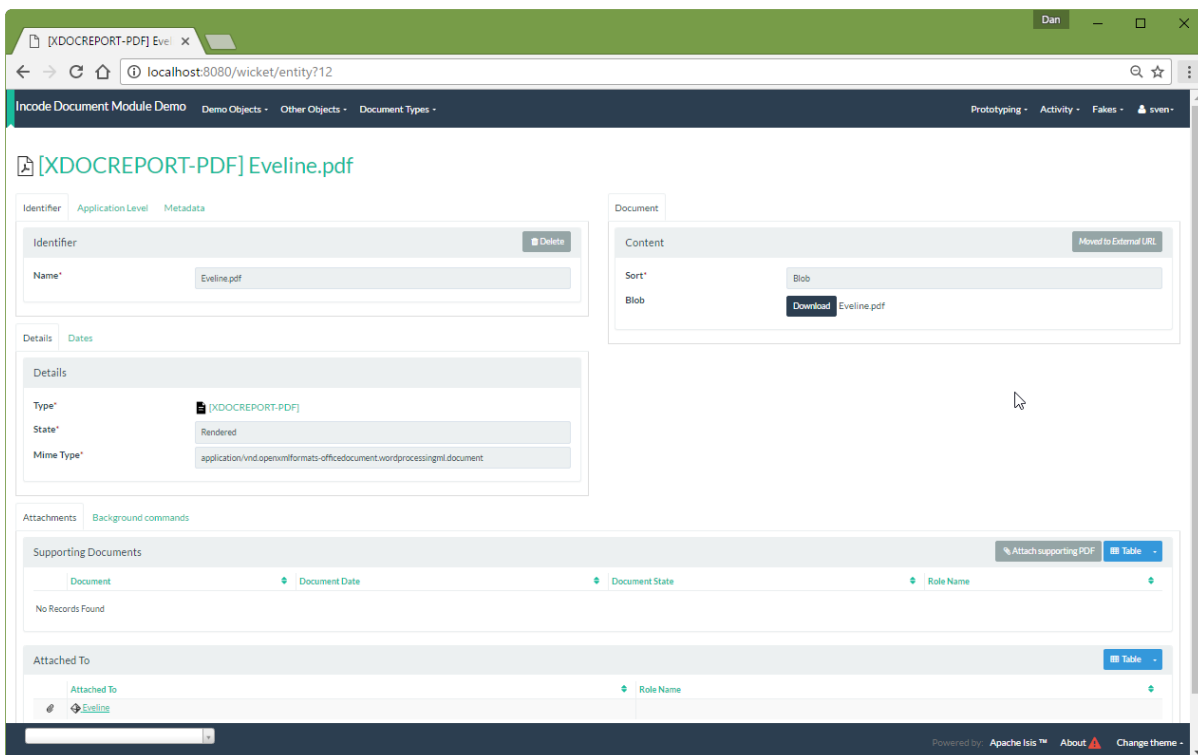
Its content is the contents of the interpolated URL:



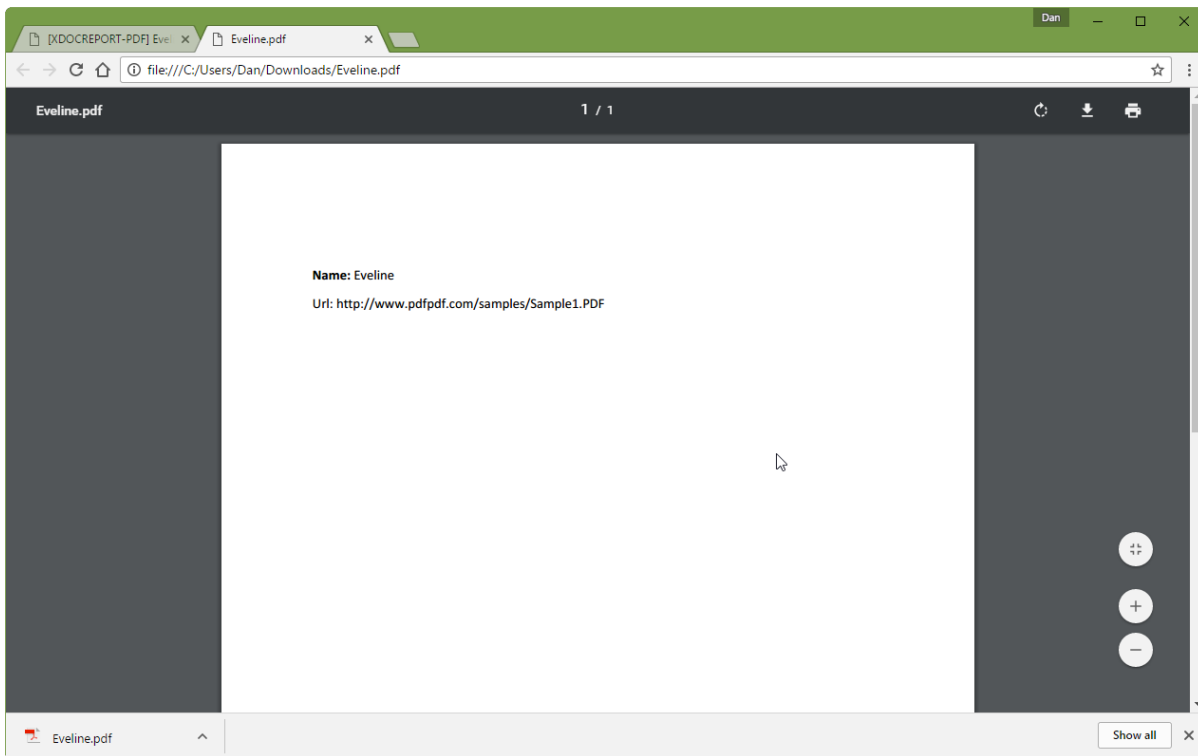
And again, the XDocReportPdf `DocumentTemplate` can be used:



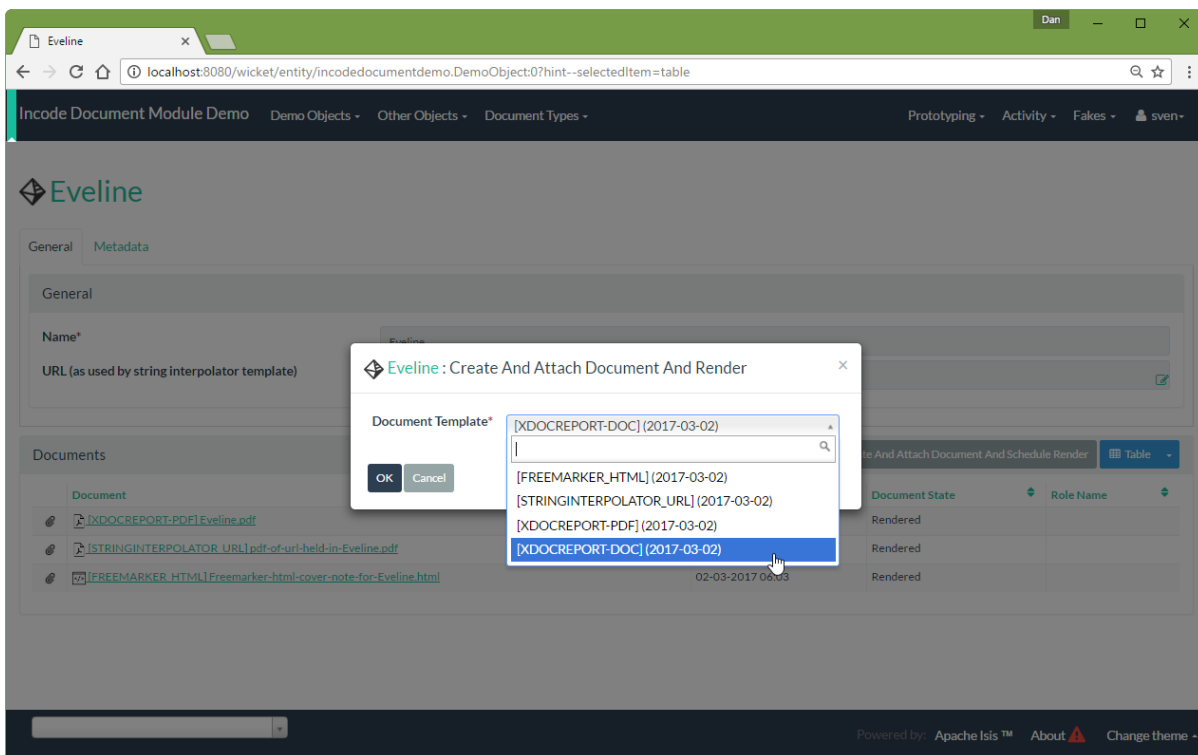
To create a new **Document** attached to the demo object:



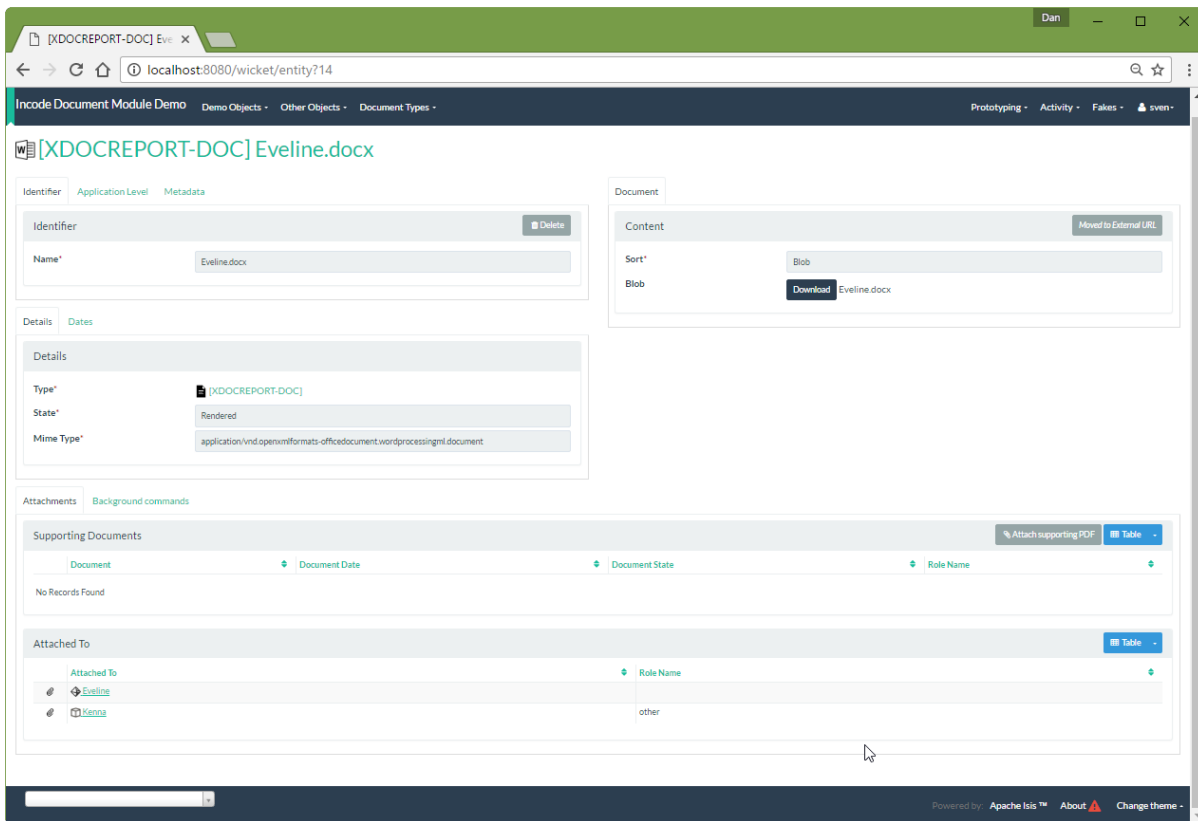
Its content is a PDF generated from the Word **.docx** of the template:



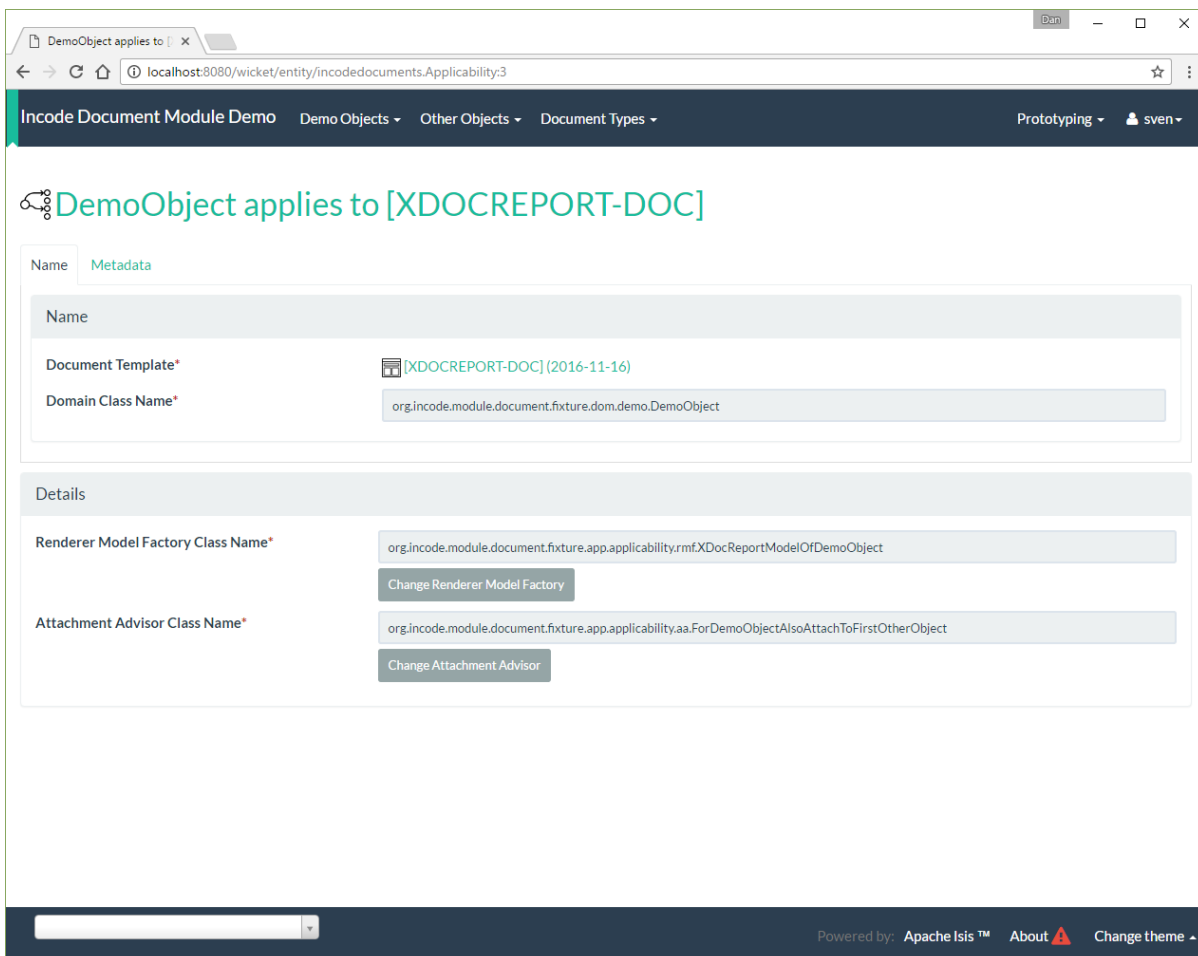
Finally, the XDocReportDoc **DocumentTemplate** can be used:



To create a new **Document** attached to the demo object, where the content is in this case a Word document. To demonstrate that **Documents** can be attached to arbitrary objects, this final template is set up so that the generated **Document** is attached both to the input demo object and also to one other object:

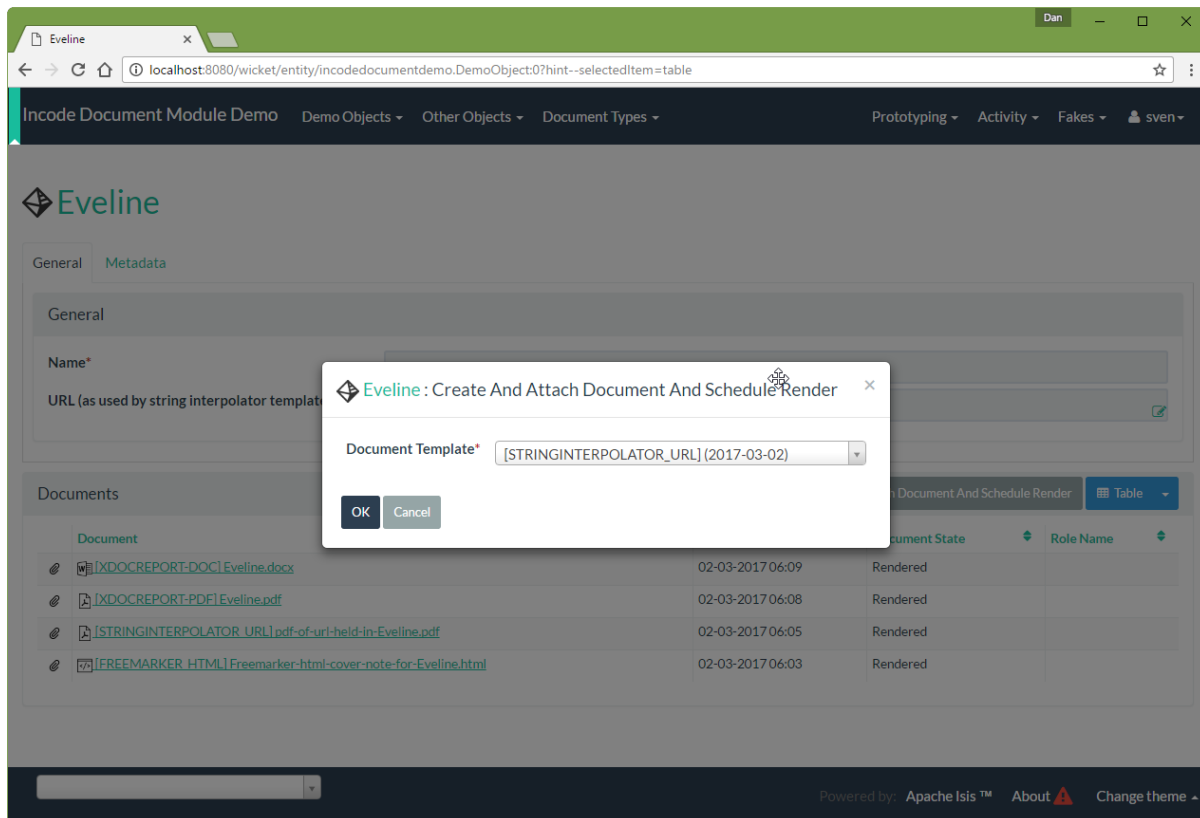


This is configured through the **AttachmentAdvisor** of the relevant **Applicability** of the **DocumentTemplate** for this input demo object's type:

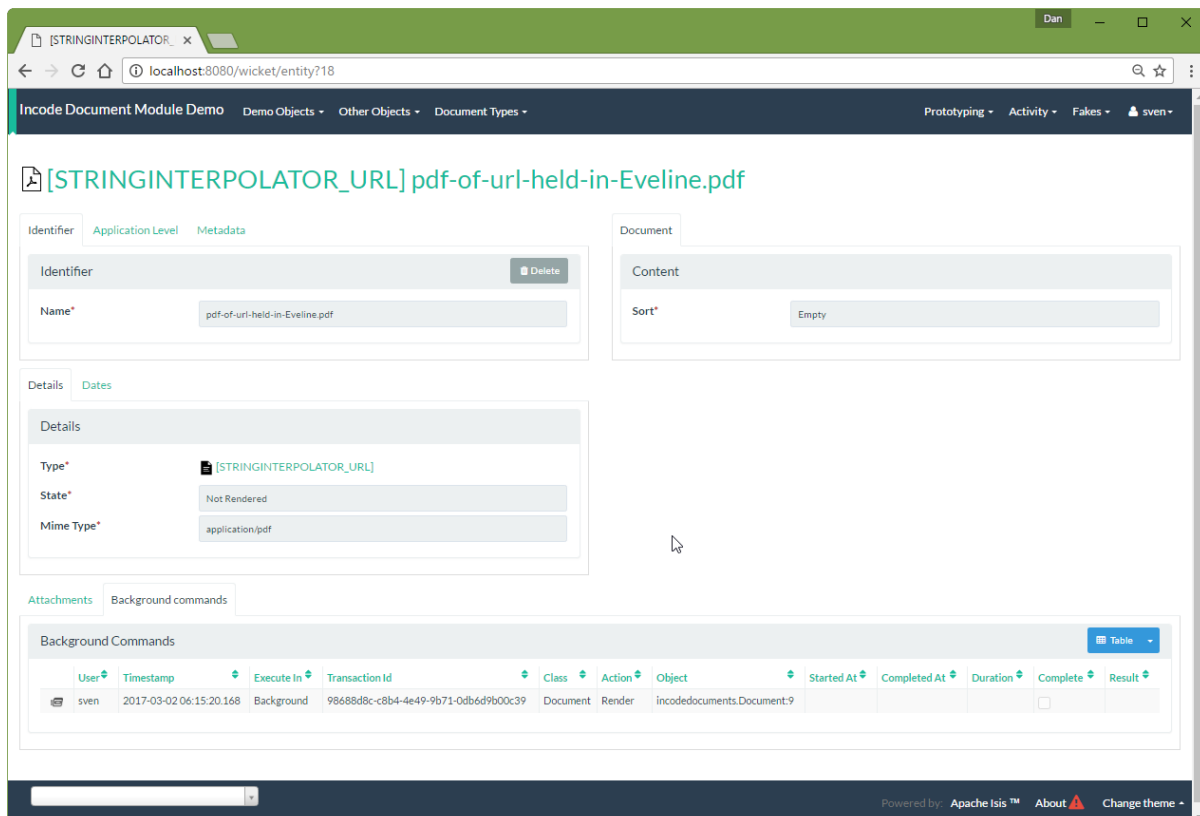


Generating Documents in Background

Documents can also be rendered in the background:



This results in a **Document** with an associated background command. Note that the document, at this stage, has a state of "Not rendered" and it has no content:



The demo app has not been configured with a background scheduler, but does provide a "fake" scheduler which can be used to run such commands:

The screenshot shows the Incode Document Module Demo application. The document is titled "[STRINGINTERPOLATOR_URL] pdf-of-url-held-in-Eveline.pdf". The "Details" tab is active, showing the document's state as "Not Rendered" and its MIME type as "application/pdf". A "Run Background Commands" button is located in the top right corner of the application interface.

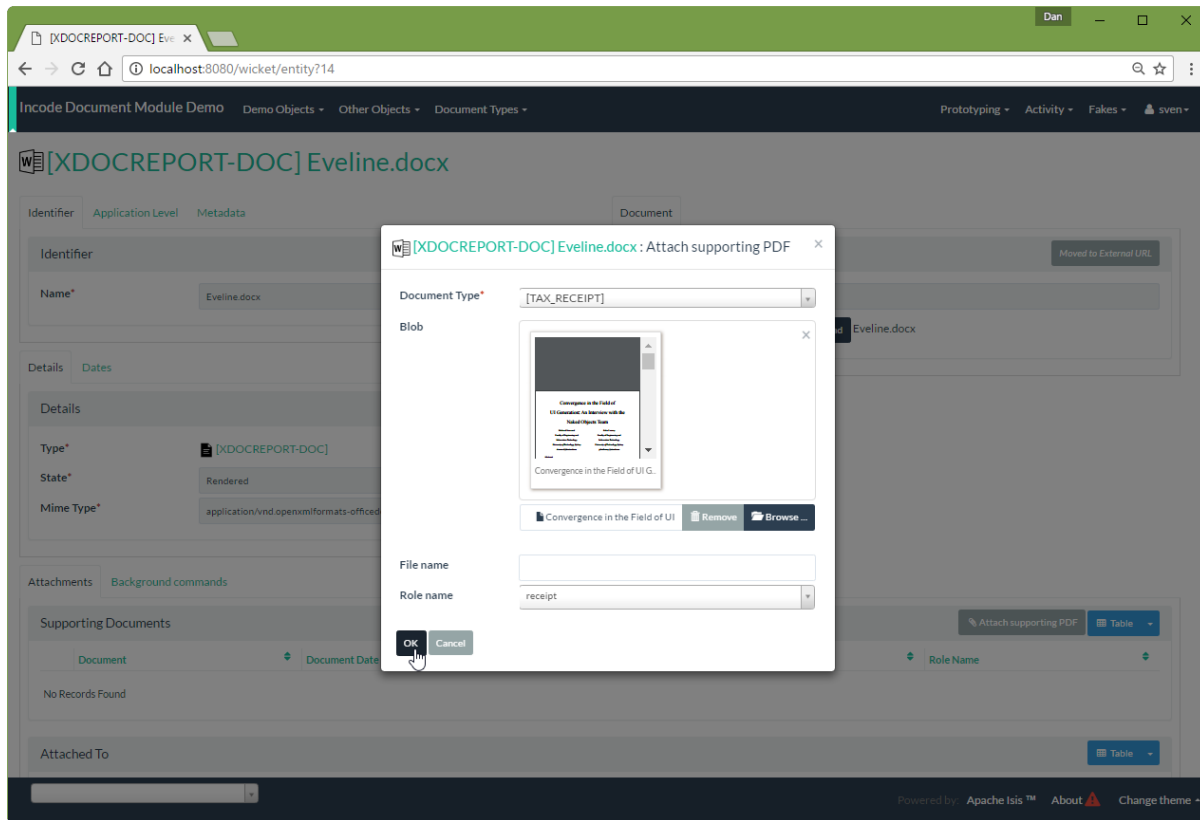
After the background commands have run, the document now has content and its state changes to "Rendered":

The screenshot shows the same Incode Document Module Demo application, but the document is now in a "Rendered" state. The "Content" tab is active, showing the document's content as "Moved to External URL" and a "Download" button. The "Details" tab shows the state as "Rendered". The "Background Commands" table at the bottom shows the command that was executed.

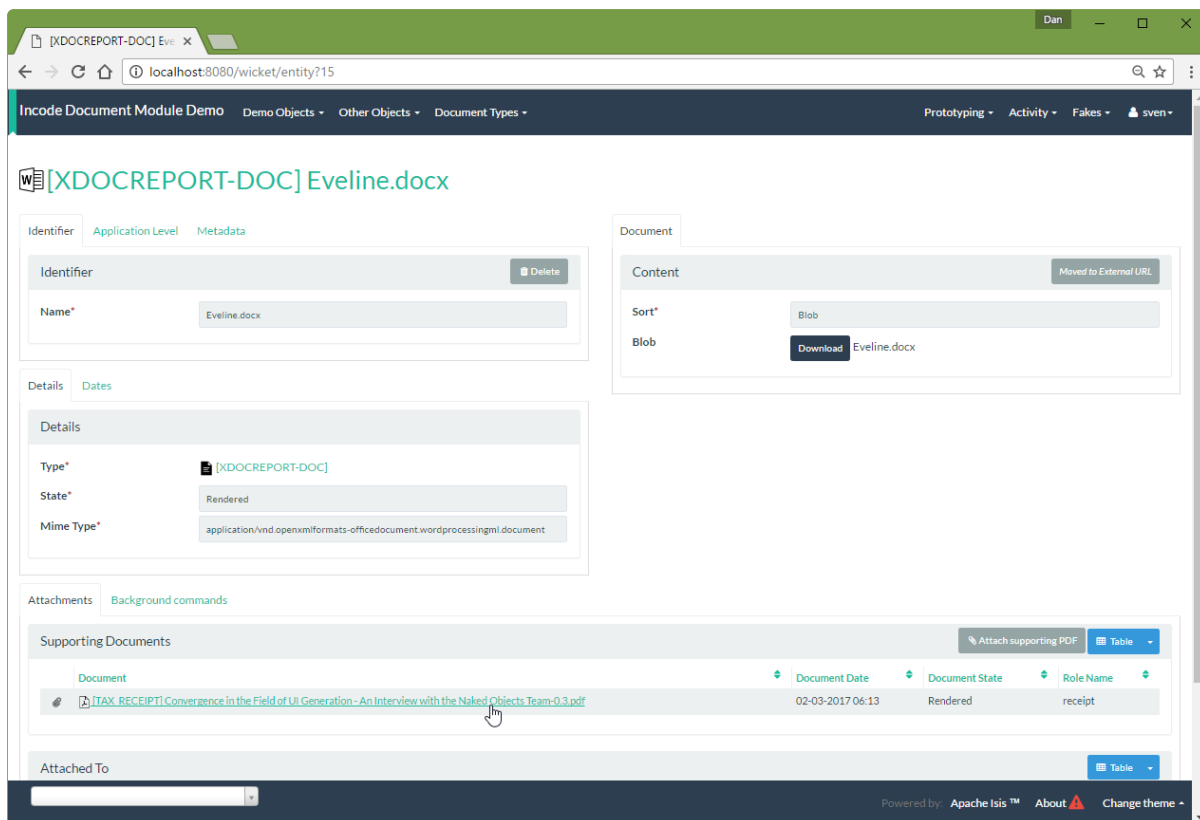
User	Timestamp	Execute In	Transaction Id	Class	Action	Object	Started At	Completed At	Duration	Complete	Result
sven	2017-03-02 06:15:20.168	Background	98688d8c-c8b4-4e49-9b71-0db6d9b00c39	Document	Render	Incodedocuments.Document:9	2017-03-02 06:17:29.470	2017-03-02 06:17:30.706	1.236	<input checked="" type="checkbox"/>	OK (VOID)

Attaching Supporting Documents

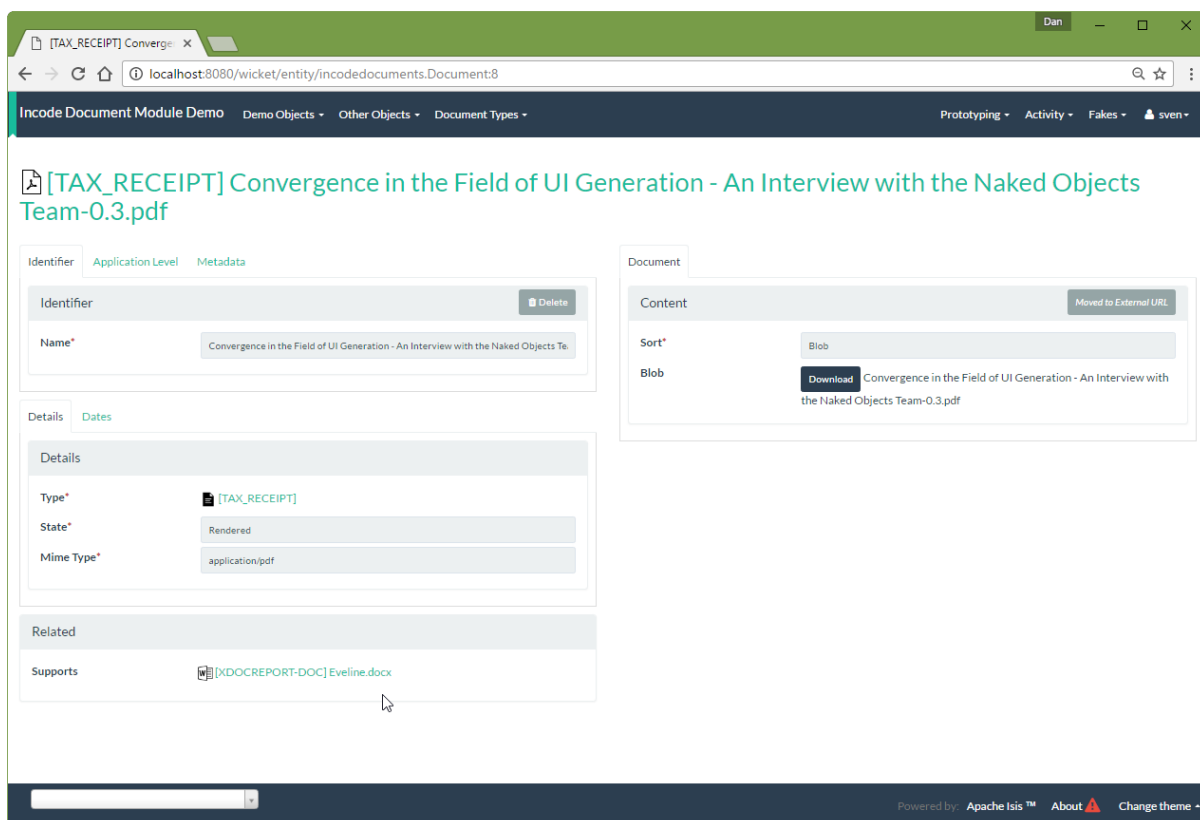
On any (generated) **Document**, it is also possible to attach supporting PDF documents. For example, this could be a tax or supplier receipt. The "attachSupportingPdf" action uses the **DocumentAttachmentAdvisor** SPI service to obtain a list of appropriate **DocumentTypes** to display:



The uploaded PDFs are wrapped in a **Document** of their own, and listed in the "supporting documents" collection:



The supporting **Document** itself can also be viewed. The "supports" property refers back to the **Document** that it supports:



Domain Model

Document, DocumentTemplate and Paperclip

The following class diagram highlights the main concepts:

(The colours used in the diagram are - approximately - from [Object Modeling in Color](#)).

The central concept is, of course, **Document**. **Documents** have content that is either a Blob, Clob or is text, these attributes being defined in the **DocumentAbstract** supertype (more on this shortly). Alternatively, the **Document**'s content can be stored externally, eg in a CMS or cloud storage service, in which case the **Document**'s own **externalUrl** attribute is used. The **DocumentSort** determines how the content of the **Document** is physically stored (along with the supporting **DocumentNature** and **DocumentStorage** enums). Conceptually **Documents** are immutable (though if their content is moved to an external URL, the original entity would be update in that case).

Each **Document** also has a corresponding **DocumentType**, eg "Invoice" or perhaps a form id, eg "ABC123".

The **DocumentTemplate** is also a document (ie subclass of **DocumentAbstract**), however its content will have placeholders. These placeholders are populated with respect to some sort of domain object acting as an input (like a "mail merge"), to generate a resultant **Document**. The **DocumentTemplate** also has a **DocumentType**, and so it is the **DocumentType** that acts as the link between the **DocumentTemplate** with the **Documents** created from those templates. It is possible for there to be multiple **DocumentTemplates** over time for a particular **DocumentType** (distinguished by date), to allow for minor changes to a template over time. The domain model deliberately does **not** keep track of which particular **DocumentTemplate** was used to create a **Document**, just the type is used.

Each **DocumentTemplate** has a **RenderingStrategy**, this being a mechanism to actually produce its content by interpolating the template text with placeholders.



Actually, each **DocumentTemplate** has two sets of placeholders and also corresponding **RenderingStrategies**. The "content" template text is used to generate the actual content of the resultant **Document**'s content; this could be characters (eg a HTML email) or bytes (eg a PDF). The "name" template text, while the other is used to interpolate the name of the resultant **Document**; this will always result in a simple character string.

Each **DocumentTemplate** also has an associated set of **Applicabilitys**. Each of these identifies a domain class that can be used as an input the rendering of the **DocumentTemplate**, with a corresponding implementation of the **RendererModelFactory** interface being responsible for actually creating an input "renderer model" used to feed into the template's **RenderingStrategy**. The **Applicability** also defines the implementation of **AttachmentAdvisor** interface; this is used to attach the resultant **Document** to arbitrary domain objects (usually the input domain object, and perhaps others also).

Every **Document** is created from a **DocumentTemplate**, but rather than hold a reference to this original template, instead **Document** and **DocumentTemplate** are unified through the **DocumentType** entity. The **DocumentType** can be considered as a set of versioned **DocumentTemplates** (identified by date), along with all the **Documents** that were created from (any of) those **DocumentTemplates**.

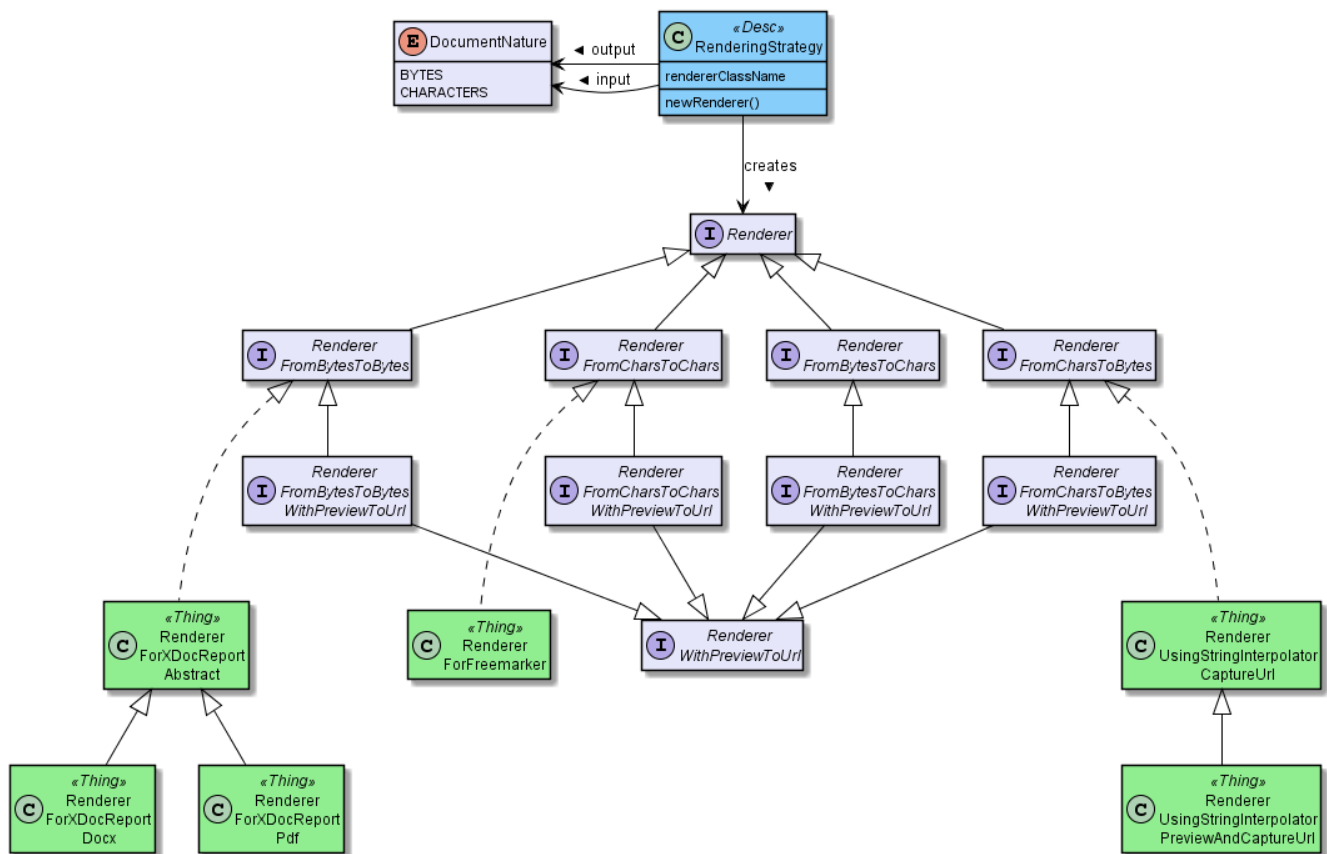
Once a **Document** has been created it is attached to one or more target domain object using **Paperclip**. This requires a custom subclass for the domain object in question; the polymorphic pattern ("table of two halves") is used for this linkage. The module uses this capability itself for **PaperclipForDocument**, which is used to attach supporting (PDF) **Documents** to generated **Documents**.

Based upon the implementation of `RenderingStrategy` and `Renderer`, each `DocumentTemplate` can support either previewing and/or rendering. Previewing means to return a representation as a URL; the end-user can then navigate to this URL without any change in state to the application. Rendering on the other hand means the creation and persisting of a `Document` from the `DocumentTemplate`.

The `createAndAttachDocumentAndRender()` mixin is contributed to all domain objects where there is a `DocumentTemplate` available for the domain object's application tenancy path (`atPath`) that supports either previewing and/or rendering. The similar `createAndAttachDocumentAndScheduleRender()` mixin is also available, allowing the rendering to be performed as a background task using `command spi` module. This can be scheduled using, for example, the `quartz extension` module.

RenderingStrategy & Renderer

The `Renderer` interface has the following subtypes and (example) implementations:



The owning `RenderingStrategy` for each `Renderer` identifies the nature of the inputs and outputs (bytes or characters) of each `RenderingStrategy`; the associated `Renderer` implementation must meet those constraints. Note that a `Renderer` may produce nature of the inputs vs outputs may vary: a character template might result in byte array output.

External blob/clob storage

When a `Document` is initially generated, it will contain content as either a text string, a clob or as a blob; its `#getSort()` accessor - returning the `DocumentSort` enum - specifies which.

Storing blobs or clobs within a single database table can become unwieldy - backing up the database and performing other DB maintenance activities can start taking significant resources/time. At the same time, the `Document` entity itself is immutable; the blobs/clobs stored within never change once created.

Therefore the `Document` allows for the blob/clob to be moved into an offsite storage, and then to hold the URL to access that blob/clob. Typically this would be performed by some background process that would:

- query for all newly created `Documents` that contain a blob or clob
- copy the blob/clob to some external storage, for example an external document management system running on-premise, or perhaps an off-site Cloud storage. A URL would represent a key to retrieve this blob/clob whenever required
- update the `Document`, updating its `externalUrl` property, and setting its blob/clob to null. It would also update the `Document` so that `#getSort()` accessor indicates that the storage is stored externally.

The `Document_movedToExternalUrl` mixin action captures these tasks.

The above algorithm is idempotent and so resilient to potential failure.

Once a `Document`'s content has been moved to be stored externally, it can subsequently be retrieved dynamically as required using the `UrlDownloadService` SPI service.

How to configure/use

Classpath

Update your classpath by adding this dependency in your dom project's `pom.xml`:

```
<dependency>
  <groupId>org.incode.module.document</groupId>
  <artifactId>incode-module-document-dom</artifactId>
  <version>1.15.0</version>
</dependency>
```

Check for later releases by searching [Maven Central Repo](#).

For instructions on how to use the latest `-SNAPSHOT`, see the [contributors guide](#).

Bootstrapping

In the `AppManifest`, update its `getModules()` method:

```
@Override
public List<Class<?>> getModules() {
    return Arrays.asList(
        ...
        org.incode.module.document.dom.DocumentModule.class,
    );
}
```

Input

For each domain object class that you want to use as the input data to a `DocumentTemplate`, you need to:

- implement `ApplicationTenancyService`

To return the application tenancy path of the domain object in order that available `DocumentTemplates` can be located:

```
public interface ApplicationTenancyService {
    String atPathFor(final Object domainObject);
}
```

- implement a `RendererModelFactory`

This constructs the "renderer model" from the input domain object, which is then fed into the

RenderingStrategy of the DocumentTemplate:

```
public interface RendererModelFactory {
    @Programmatic
    Object newRendererModel(
        DocumentTemplate documentTemplate, ①
        Object domainObject);              ②
}
```

① the template to which this implementation applies, as per `DocumentTemplate#getAppliesTo()` and `Applicability#getRendererModelFactoryClassName()`

② provides the input for the renderer model



The `RendererModelFactoryAbstract<T>` can be used to implement the `RendererModelFactory` interface, adding the capability of verifying the input document is of the correct type.

- implement a `AttachmentAdvisor`

This returns a data structure (`List<PaperclipSpec>`) which describes to which object(s) the resultant `Document` should be attached:

```
public interface AttachmentAdvisor {
    @lombok.Data ①
    public static class PaperclipSpec {
        private final String roleName;
        private final Object attachTo;
        private final Object createdDocument;
    }
    List<PaperclipSpec> advise(
        DocumentTemplate documentTemplate, ②
        Object domainObject,              ③
        Document createdDocument);        ④
}
```

① immutable value type, defined using `@Data` annotation from Project Lombok

② to which this implementation applies, as per `DocumentTemplate#getAppliesTo()` and `Applicability#getAttachmentAdvisorClassName()`

③ acting as the context for document created, from which derive the objects to attach the newly created `Document`

④ the document that has been created. Note that this may be `null` when the advisor is being asked if it *could* be used to attach for the domain object.

The `PaperclipSpec` describes how create instances of `Paperclip` from attach the resultant `Document` to other domain objects.



The `AttachmentAdvisorAbstract<T>` can be used to implement the `AttachmentAdvisor` interface, adding the capability of verifying the input document is of the correct type.

Renderers

For each rendering technology, an implementation of `Renderer` is required. A number of such `Renderers` have been developed, using Freemarker, XDocReport or just capturing the content of arbitrary URLs (eg as exposed by an external reporting server such as SQL Server Reporting Services).

Paperclips (attach output)

For each domain object that you want to attach `Documents` (that is, add `Paperclips` to), you need to

- implement a subclass of `Paperclip` for the domain object's type.

This link acts as a type-safe tuple linking the domain object to the `Document`.

- implement the `PaperclipRepository.SubtypeProvider` SPI interface:

```
public interface SubtypeProvider {  
    Class<? extends Paperclip> subtypeFor(Class<?> domainObject);  
}
```

This tells the module which subclass of `Paperclip` to use to attach to the domain object to attach to. The `SubtypeProviderAbstract` adapter can be used to remove some boilerplate.

For example:


```

@javax.jdo.annotations.PersistenceCapable(identityType=IdentityType.DATASTORE)
@javax.jdo.annotations.Inheritance(strategy = InheritanceStrategy.NEW_TABLE)
@DomainObject(objectType = "estatioAssets.PaperclipForInvoice")
@DomainObjectLayout( bookmarking = BookmarkPolicy.AS_ROOT)
public class PaperclipForInvoice extends Paperclip {                                ①

    @Column( allowsNull = "false", name = "invoiceId" )
    @Getter @Setter
    private Invoice invoice;

    @NotPersistent
    @Override
    public Object getAttachedTo() {                                                ②
        return getInvoice();
    }
    @Override
    protected void setAttachedTo(final Object object) {
        setInvoice((Invoice) object);
    }

    @DomainService(nature = NatureOfService.DOMAIN)
    public static class SubtypeProvider                                           ③
        extends PaperclipRepository.SubtypeProviderAbstract {
        public SubtypeProvider() {
            super(Invoice.class, PaperclipForInvoice.class);
        }
    }
}

```

- ① inherit from **Paperclip**
- ② implement hook methods
- ③ SubtypeProvider SPI implementation



To view the **Paperclips** once created there is also a **T_paperclips** mixin collection, discussed below.

Mixins

The document module is fully data-driven, in that the ability to be able to preview and create a document for any given domain entity is defined by the data held in `DocumentTemplate` (its `atPath`) and `Applicability` (the `domainClassName` and corresponding `RendererModelFactory` and `AttachmentAdvisor` implementations).

This is generally done using mixins (though `Documents` can also be created programmatically, see [below](#)).

T_preview

The `T_preview` mixin action provides the ability to preview a document without creating it.

To support this the `DocumentTemplate` selected must have a content `RenderingStrategy` that supports previewing to URL.

To use, the mixin simply need to be subclassed. For example:

```
@Mixin
public class Invoice_preview extends T_preview<Invoice> {
    public Invoice_preview(Invoice invoice) { super(invoice); }
}
```

Add similar mixins for all classes where there exists a `DocumentTemplate` and `Applicability` capable of consuming the object as an input to the template, and where (as noted just above) the `DocumentTemplate` has a content `RenderingStrategy` that supports previewing to a URL.

T_createDocumentAndRender, T_createDocumentAndScheduleRender

The `T_createDocumentAndRender` and `T_createDocumentAndScheduleRender` mixin actions provide the ability to create and render a document, either in the foreground or as a background command (so that the rendering can be performed asynchronously).

To use, the mixin simply need to be subclassed. For example:

```
@Mixin
public class Invoice_createDocument extends T_createDocumentAndRender<Invoice> {
    public Invoice_createDocument(Invoice invoice) { super(invoice); }
}
```

Add similar mixins for all classes where there exists a `DocumentTemplate` and `Applicability` capable of consuming the object as an input to the template.

Note that this *doesn't* necessarily require that there is an implementation of `Paperclip` for the target

object: where the generated `Document` is attached depends upon the definition of the `DocumentTemplate`.



If you want make this action available for all domain objects, simply use:

```
@Mixin
public class Object_createDocument extends T_createDocumentAndRender
<Object> {
    public Object_createDocument(Object object) { super(object); }
}
```

If there is no `DocumentTemplate/Applicability`, then the action will be hidden in the UI. The reason that the module doesn't just provide this mixin out-of-the-box is (a) for consistency with other modules and (b) for understandability/traceability ("not **too** much magic").

T_documents

The `T_documents` mixin collection returns the list of `Paperclips` that each attach a `Document` to the specified domain object.

Since `Paperclips` can only be created for domain objects where a subclass of `Paperclip` has been defined (see above), it's typical for this mixin to be defined as a nested static class of that `Paperclip` subclass. For example:

```
...
public class PaperclipForInvoice extends Paperclip {
    ...
    @Mixin
    public static class _documents extends T_documents<Invoice> {
        public _documents(Invoice invoice) {
            super(invoice);
        }
    }
}
```

Document_supportingDocuments, Document_attachSupportingPdf & Document_supports

These three mixins work together.

For generated `Documents`, the `Document_attachSupportingPdf` mixin allows PDFs to be associated (eg a supplier receipt), and a corresponding `Document` is created to hold that PDF. These are then displayed in the `Document_supportingDocuments` mixin collection.

For the supporting `Documents` themselves, the `Document_supports` collection mixin points back to the

associated **Document**. (Sometimes a supporting **Document** might be attached to multiple **Documents** - eg a piece of general correspondence - which is why this is a collection rather than a single property).

The **_supportingDocuments** collection mixin is hidden for "secondary" supporting documents themselves, conversely the **_supports** property is hidden for the "primary" supported documents. In other words these form a parent/child relationship.

Services (API)

DocumentService

The `DocumentService` service allows documents to be created and attached (using `Paperclips`) programmatically to other domain objects. It also allows existing blobs (PDFs) to be created and optionally attached.

The API is:

```
public class DocumentService {  
    public boolean canCreateDocumentAndAttachPaperclips(  
        Object domainObject,  
        DocumentTemplate template);  
    public Document createDocumentAndAttachPaperclips(  
        Object domainObject,  
        DocumentTemplate template);  
  
    public Document createForBlob(  
        DocumentType documentType,  
        String documentAtPath,  
        String documentName,  
        Blob blob);  
    public Document createAndAttachDocumentForBlob(  
        DocumentType documentType,  
        String documentAtPath,  
        String documentName,  
        Blob blob,  
        String paperclipRoleName,  
        Object paperclipAttachTo);  
}
```

- ① allows a programmatic check as to whether the provided `DocumentTemplate` is applicable to the domain object.
- ② go ahead and actually create the new `Document`, attaching it as specified by the `AttachmentAdvisor` associated with the `DocumentTemplate` ('s `Applicability` for this domain object).
- ③ `documentName` - override the name of the blob (if null, then uses the blob's name)

SPI Services

UrlDownloadService

The `UrlDownloadService` is used to download any `Documents` whose content is stored as an external URL, eg in an on-site CMS or on a cloud storage service.

A default implementation of this service is provided that simply uses Java's `URLConnection` to download the URL; in particular the URL must be accessible and require no user credentials/passwords.

The service can be optionally overridden if credentials are required.

The service is defined as:

```
public interface UrlDownloadService {
    public Blob downloadAsBlob(Document document) { ... }
    public Clob downloadAsClob(Document document) { ... }
}
```

RendererModelFactoryClassNameService

The `RendererModelFactoryClassNameService`, if implemented, provides UI to allow the renderer model factory class name to be changed on an `Applicability`:

```
public interface RendererModelFactoryClassNameService {
    List<ClassNameViewModel> rendererModelFactoryClassNames();
}
```

This can most conveniently be implemented using the `ClassNameServiceAbstract` convenience class, eg:

```
@DomainService(nature = NatureOfService.DOMAIN)
public class RendererModelFactoryClassNameServiceForDemo
    extends ClassNameServiceAbstract<RendererModelFactory>
    implements RendererModelFactoryClassNameService {
    public RendererModelFactoryClassNameServiceForDemo() {
        super(RendererModelFactory.class, "org.incode.module.document.fixture");
    }
    public List<ClassNameViewModel> rendererModelFactoryClassNames() {
        return this.classNames();
    }
}
```

AttachmentAdvisorClassNameService

The `AttachmentAdvisorClassNameService`, if implemented, provides UI to allow the renderer model factory class name to be changed on an `Applicability`:

```
public interface AttachmentAdvisorClassNameService {
    List<ClassNameViewModel> attachmentAdvisorClassNames();
}
```

Like `RendererModelFactoryClassNameService` (above), this can most conveniently be implemented using the `ClassNameServiceAbstract` convenience class.

RendererClassNameService

The `RendererClassNameService`, if implemented, provides UI to allow the renderer class name to be changed on an `Applicability`:

```
public interface RendererClassNameService {
    public List<ClassNameViewModel> renderClassNamesFor(
        DocumentNature inputNature,
        DocumentNature outputNature);
    <C extends Renderer> Class<C> asClass(String className);
}
```

This can most conveniently be implemented using the `ClassNameServiceAbstract` convenience class, eg:

```
@DomainService(nature = NatureOfService.DOMAIN)
public class RendererClassNameServiceForDemo
    extends ClassNameServiceAbstract<Renderer>
    implements RendererClassNameService {
    public RendererClassNameServiceForDemo() {
        super(Renderer.class, "org.incode.module.document.fixture");
    }
    public List<ClassNameViewModel> renderClassNamesFor(
        final DocumentNature inputNature, final DocumentNature outputNature) {
        if(inputNature == null || outputNature == null){
            return Lists.newArrayList();
        }
        return classNames(x -> inputNature.canActAsInputTo(x) && outputNature
            .canActAsOutputTo(x));
    }
    public Class<Renderer> asClass(final String className) {
        return super.asClass(className);
    }
}
```

DocumentAttachmentAdvisor

The `DocumentAttachmentAdvisor` service, if implemented, is used by the "attachSupportingPdf" action. It allows (existing) PDFs (eg supplier receipts) to be attached to generated `Documents`.

```
public interface DocumentAttachmentAdvisor {  
    public List<DocumentType> documentTypeChoicesFor(Document document);  
    public DocumentType documentTypeDefaultFor(Document document);  
    public List<String> roleNameChoicesFor(Document document);  
    public String roleNameDefaultFor(Document document);  
}
```

SupportingDocumentsEvaluator

Some applications may have the concept of a "supporting document", whereby one document is attached to another document and supports it in some way. For example, an application could generate a document for an invoice, and this invoice might have receipts attached to it.

To continue this example, such receipts most likely exist already, for example as PDFs. In such a case the application would directly create the supporting document representing that PDF `Blob` programmatically:

```
final Document receiptDoc = documentRepository.create(  
    documentType, atPath, name, blob.getMimeType().getBaseType());  
receiptDoc.setRenderedAt(clockService.nowAsDateTime());  
receiptDoc.setState(DocumentState.RENDERED);  
receiptDoc.setSort(DocumentSort.BLOB);  
receiptDoc.setBlobBytes(blob.getBytes());
```

For such supporting documents much of the state normally associated with a `Document` should be suppressed:

- a supporting document are probably not generated, so the "backgroundCommands" is not required.
- the "attachedTo" collection does not make sense either, to avoid chains of `Documents` (one attached to another, attached to another).

On the other hand we might want to explicitly identify that one document supports another, and so the "supportedBy" and "supports" collections help reinforce the semantics of the relationship.

The `SupportingDocumentsEvaluator` is a SPI to tell the document module that such-and-such a `Document` is a supporting document:


```
public interface SupportingDocumentsEvaluator {  
    enum Evaluation {  
        SUPPORTING,  
        NOT_SUPPORTING,  
        UNKNOWN  
    }  
    Evaluation evaluate(Document candidateSupportingDocument);  
    List<Document> supportedBy(Document candidateSupportingDocument);  
}
```

The module provides a default implementation that will indicate a **Document** is supporting if it can find any other **Document** that attaches to the candidate document. This implementation can be suppressed if necessary in the usual fashion of a higher priority implementation returning a definitive **Evaluation** one way or the other for the document in question.

Internal Services

These are services that are not part of the formal API/SPI, but nevertheless allow the behaviour of the module to be overridden/fine-tuned.

DocumentTemplateForAtPathService

The `DocumentTemplateForAtPathService` service is used to return the choices for `DocumentTemplates` for the "preview" and "createAndAttach" mixins.

```
@DomainService(nature = NatureOfService.DOMAIN)
public class DocumentTemplateForAtPathService {
    public List<DocumentTemplate> documentTemplatesForPreview(
        Object domainObject) { ... }
    public List<DocumentTemplate> documentTemplatesForCreateAndAttach(
        Object domainObject) { ... }
}
```

The default implementation of this service uses the `ApplicationTenancyService` to determine the application tenancy of the supplied domain object, and from that looks up the appropriate (possibly localized) template to use.

However, the "ForAtPath" bit of the name of this service is a mistake, because the service could in fact use any any attributes of the provided domain object to determine the list of `DocumentTemplates` to make available.

Known issues

When using with PostgreSQL or MsSQL server you are likely to run into data-type issues with the mapping of jdbc-type **BLOB** and/or **CLOB**. By using **.orm**-files we can override the mapping. To activate use setting `isis.persistor.datanucleus.impl.datanucleus.Mapping=xxx` in `persistor_datanucleus.properties`. Thus, setting to `postgres` will activate `DocumentAbstract-postgres.orm` and to `sqlserver` `DocumentAbstract-sqlserver.orm` by naming convention.

Dependencies

Maven can report modules dependencies using:

```
mvn dependency:list -o -pl modules/dom/document/impl -D excludeTransitive=true
```

which, excluding the Incode Platform and Apache Isis modules, returns no direct compile/runtime dependencies.

From the Incode Platform it uses:

- [base library](#) module
- [command spi](#) module

The module also uses icons from [icons8](#).