



# Developing for Digital I



Student Guide





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## About the Course

<b>Description</b>	This course covers how to modify and customize the Commerce Cloud Digital reference application, SiteGenesis, using core Digital programming concepts, files, and scripting language.
<b>Audience</b>	Developers who have the following background and experience: <ul style="list-style-type: none"> <li>▪ Java or JavaScript programming (at least 2 years)</li> <li>▪ Working with XML files (data imports and exports)</li> <li>▪ Familiarity with jQuery library and JSON syntax</li> <li>▪ Use of Firebug or Web Developer toolkits</li> </ul>
<b>Duration</b>	4 days
<b>Prerequisites</b>	To successfully participate in this course, you must complete the following prior to attending class: <ul style="list-style-type: none"> <li>▪ GEN001: Digital Overview</li> <li>▪ DEV001: Digital Architecture Overview</li> </ul>
<b>System Requirements</b>	A laptop computer (with the appropriate administrative system rights) with the Eclipse IDE and UX studio installed. A high-speed Internet connection and reference code installed.

### Course Objectives

After completing this course, you will be able to:

- Create cartridges to add reusable functionality to a site.
- Use JavaScript controllers to add business logic to a site.
- Create reusable code using ISML templates.
- Use Commerce Cloud Digital Script in ISML templates and script files.
- Use content slots to improve the appearance and flexibility of a site.
- Use the Forms Framework to control the validation, rendering, and storing of consumer-entered values.

Note: The focus of the course is to use JavaScript controllers for new site development. If you need to use pipelines to maintain an existing site, notify your instructor—Appendix A. covers pipeline concepts.

## Module 1: Getting Started

### Learning Objectives

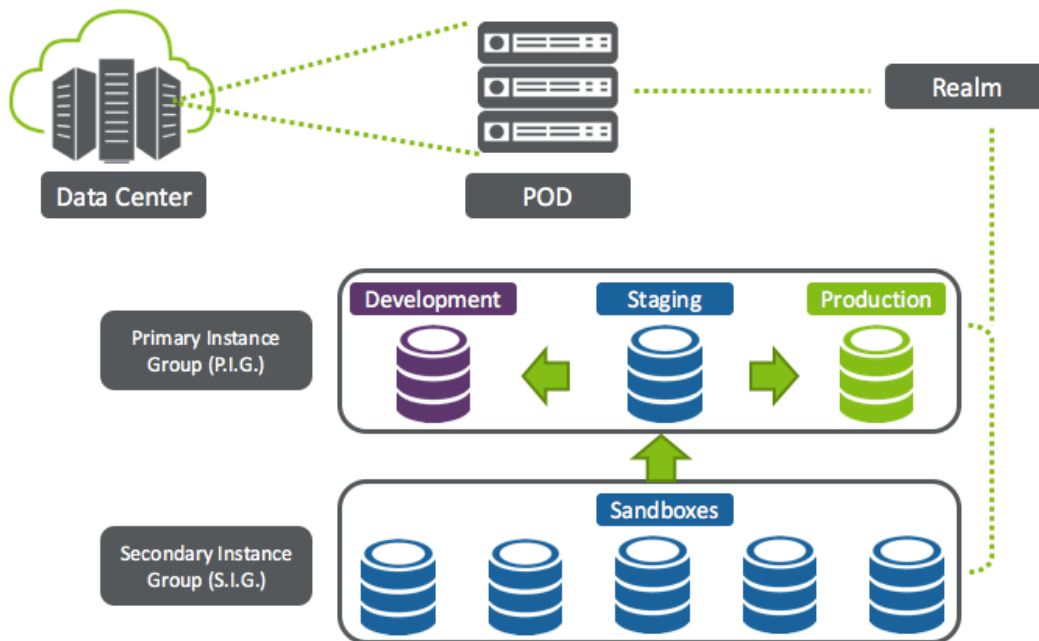
After completing this module, you will be able to:

- Create a new empty site.
- Import a copy of SiteGenesis into a site and configure its settings.



### Lesson 1.1: Platform Review

A realm contains segmentation for development, staging, and production for one or more storefronts.



Every Realm includes a Primary Instance Group (PIG) which includes three Commerce Cloud Digital instances:

- **Production** – this is the live instance used as the actual eCommerce storefront.
- **Staging** – use this instance for configuration, data enrichment, data import, and uploading of code to prepare it for testing in the Development instance. Through data replication you can move data from the staging instance to either the development or the production instance.
- **Development** – developers use this instance to test processes without impacting the production storefront (i.e. Product import feed)

Every Realm also includes a Secondary Instance Group (SIG) that has five sandboxes (but can accommodate more). Developers use sandboxes to develop and test code. They are not as powerful as PIG instances in terms of performance, memory, and storage. However, they have a smaller footprint.

## Platform Tools: Business Manager

Both merchants and developers use Business Manager to manage administrative tasks. Every Digital instance has a Business Manager portal. For example, a merchandiser would log into Business Manager in the Staging instance.



Merchandisers use Business Manager to manage...	Developers use Business Manager to manage...
<ul style="list-style-type: none"> <li>Products &amp; Catalogs</li> <li>Content</li> <li>Marketing campaigns</li> <li>Search settings</li> <li>Customers</li> <li>Site Analytics</li> <li>Site URLs</li> <li>Site Preferences</li> </ul>	<ul style="list-style-type: none"> <li>Code &amp; Data Replication</li> <li>Code Versioning</li> <li>Site Development</li> <li>Data Import/Export</li> <li>Global Preferences for all sites /organization</li> </ul>



### Exercise: Business Manager Organization

1. In Business Manager, click each of the Merchant menu items in SiteGenesis to determine the main tasks in Business Manager. These are located on the left side under **Site – SiteGenesis**.
2. Click the **Administration** menu items to determine the main tasks in Business Manager.

## Deploying a Storefront

When you first log into Business Manager for a given instance, by default no storefront has been deployed. You must either:

- Create a new empty site (which contains no data).
- Import an existing site, such as SiteGenesis.



### Exercise: Create an Empty Site

1. In Business Manager, select **Administration > Sites > Manage Sites**.
2. Click **New**.
3. Enter the site **ID**, "Training". The ID is required and should not include spaces.
4. Enter the **Name**, "Training". The Name is required and can be any text string.
5. Click the **Currency** drop-down and select the default currency. You can only have one default currency per site. This is a required field.
6. Click **Apply**.
7. Now, you can view or configure your new site.
  - a. To select the site, click the site name, **Training**, located on the site list.
  - b. Select **Site > Storefront**. A browser window opens, displaying the storefront URL.



### Lesson 1.2: SiteGenesis Overview

Commerce Cloud includes the SiteGenesis sample reference site, which you can use as the basis of your custom Commerce Cloud Digital sites. It is a full featured demonstration eCommerce site, which you can use to explore the Digital platform and its capabilities. SiteGenesis is a resource for both developers and merchants:

- For developers, it provides sample code—scripts, and ISML templates.
- For merchants, it provides sample configurations for catalogs, categories, products, and so on.

### Notes on Importing SiteGenesis

Import the current version of the SiteGenesis package (read-only) as a sample site into every Sandbox instance. **Caution: Never Import SiteGenesis into a Primary Instance Group (PIG) Instance.**

- It is recommended that you import SiteGenesis into an **empty** sandbox **before** importing your custom sites. This prevents you from overwriting existing attributes and data for the custom site.



After importing SiteGenesis, you can validate its behavior by comparing it to the site running on the demo instance.



### Exercise: Import SiteGenesis from a SiteGenesis Package

#### Import the latest version of SiteGenesis

1. Log into Business Manager.
2. Select **Administration > Site Development > Site Import & Export**.
3. Determine if you want to import the site from a local or a remote instance and select the corresponding radio button.

#### Import a site from a local copy

1. Select the **SiteGenesis Demo Site** (alternatively click **Browse** to retrieve another local file; then click **Upload**).
2. A confirmation message displays. Click **OK**.
3. You can view the status of the import in the **Status** section of the page.
4. When the import has completed, Business Manager lists the new site. You will also receive an email that the job has completed.

#### Import from a remote server

1. Enter all required data for accessing the remote server account, including the Hostname, Login, and Password. Click **Connect**.
2. You can view the importable files from the remote server. Select the radio button next to the name of the import file you want to use.
3. Click **Import**.
4. A confirmation message displays. Click **OK**.
5. You can view the status of the import in the **Status** section of the page.

When your import has completed, Business Manager lists the new site. You will also receive an email that the job is complete.



### Lesson 1.3: Site Configuration

After creating an empty site, disable site caching in your sandbox to see your code changes immediately in the site. This prevents the page cache from taking effect, so that pages reflect the most recent code changes. In production instances the cache is on by default.

You need to index the site to be able to search for products from the storefront.



### Exercise: Disable Caching for an Empty Site or Training Site

1. In Business Manager, select **Administration > Sites > Manage Sites**. Select your site name.
2. Select the **Cache** tab.
3. Set the **Time to Live** value to 0 and uncheck the **Enable Page Caching** setting.
4. Click **Apply**.
5. You should invalidate the cache at this stage. You can **Invalidate Page Cache** fully or partially.
6. Check the status of the Training site.



### Exercise: Re-Index Search for SiteGenesis

1. In Business Manager, select the site to index (**SiteGenesis**).
2. Select **Site > Search**.
3. Click **Search Indexes**.
4. Select the top checkbox **Index Type** to select all the indexes.
5. Click **Reindex**.
6. In **Site > SiteGenesis > Site Preferences > Storefront URLs** uncheck **Enable Storefront URLs**. This enables you to see the pipeline calls, rather than just the categories.

The indexes begin rebuilding. When complete, the status changes to *Online*.

### Using Catalogs to Share Data Between Sites

The SiteGenesis import contains both site-specific data and data shared among all sites in the organization. The SiteGenesis catalogs are available to the empty site you created earlier.

There are two types of catalogs: master catalogs define all shared products of an organization, while site catalogs specific category navigation and products for a site. Therefore, a site can have only one site catalog. However, a site can have one or more master catalogs.

Because multiple sites can share a master catalog, you can specify some attributes at the site level. For example, use the **OnlineFlag** attribute enables a product to be online in one site, but offline in another.



### Exercise: Share a Catalog between Sites and Set a Product Offline

1. In Business Manager, select **SiteGenesis > Products and Catalogs > Catalogs**.
2. Open Storefront Catalog – EN. Click **Edit**.

3. To share this catalog with the Training site:
  - a. Select the Site Assignments tab.
  - b. Check the Training site.
  - c. Click **Apply**.
4. Select **Training > Search > Search Indexes**.
5. Check the top index box to select all indexes.
6. Click **Reindex**. This ensures that indexing occurs automatically after any changes that require it.
7. Select **Training > Products and Catalogs > Products**. Find the P0048 product.
8. **Lock** the product for editing.
9. Locate the *Online/Offline* site attribute. Set the **Online** field to **No** for the Training site only.
10. Apply your changes and verify that the product is not available on the Training site. (Go to SiteGenesis and search for P0048).



## Knowledge Check

Question	True	False
A Realm is a Digital instance used only by developers.		
Merchants use Business Manager to manage products and catalogs.		
You can import SiteGenesis through site import at any time without risk.		
Catalogs are not shareable between sites within an organization.		
A site must have one and only one site catalog.		

Enter item number from Column B that matches the item in Column A

Column A		Column B	
	Sandbox instance	1.	Is a customer's live storefront
	Production instance	2.	Used for code testing

## Module 2: UX Studio

### Learning Objectives

After completing this module, you will be able to:

- Use UX Studio to create a new workspace.
- Set up a server connection.
- Navigate the user interface.

### Introduction

UX Studio is an Integrated Development Environment (IDE) used for programming for Commerce Cloud Digital. It is a plugin built on the Eclipse open-source development platform ([www.eclipse.org](http://www.eclipse.org)), which many developers use to build Java applications. It is not necessary to know Java to use UX Studio.



### Lesson 2.1: Creating a Workspace

A workspace is an Eclipse-specific local directory that contains Eclipse projects. Normally, Eclipse projects are connected to Java source directories (packages). UX Studio projects are different: they either define a connection to a Digital instance or they point to a Digital cartridge. They are never used to compile Java projects, since Java code is not used in Digital application programming.

Each workspace should have only one Digital server connection. For example, if you are working on numerous client projects, you should create a separate workspace for each client. Each client workspace then has only one specific server connection.



### Exercise: Install the UX Studio Plugin and Create a Workspace

Create a new workspace (when using UX Studio for the first time). Note: This assumes that you have installed the UX Studio plugin into Eclipse.

1. The first time you use the application, you will be prompted to create a new workspace name. You can use a workspace that references your client.
2. Eclipse displays a Welcome message in the main working area.
3. Select **Help > Install New Software**.
4. Click **Add**. The **Add Repository** dialog displays.
5. In the **Name** field, enter UX Studio.
6. In the **Location** field, enter one of the following URLs based on your version of Eclipse:
  - Juno - <http://updates.demandware.com/uxstudio/4.2>

- Kepler - <http://updates.demandware.com/uxstudio/4.3>
- Luna - <http://updates.demandware.com/uxstudio/4.4>
- Mars - <http://updates.demandware.com/uxstudio/4.5>
- Neon - <http://updates.demandware.com/uxstudio/4.6>

7. Provide a name for the URL.
8. Select **Salesforce Commerce Cloud** from the list. Click **Next**. At this point, Eclipse compares UX Studio's requirements with what is available to ensure compatibility. The **Install Details** dialog displays.
9. Click **Next**. The **Review Licenses** dialog displays.
10. Select the license agreement radio button. Click **Finish**. The **Installing Software** dialog displays, indicating the installation's progress.
11. In the **Security Warning** dialog, click **OK**.
12. Select **Yes** when prompted to restart Eclipse.

UX Studio is now installed. You can now use the **Digital Development** perspective in the upper right corner.

*If you already have a workspace and need to create a new one:*

1. From the main menu in UX Studio, select **File > Switch Workspace > Other**.
2. The **Workspace Launcher** dialog displays.
3. In the Workspace field, enter a new workspace name and location. Click **OK**.
4. UX Studio closes and reopens.



## Lesson 2.2: Creating a Server Connection

You must create a server connection in UX Studio to be able to upload your code to the Digital server instance. Note: It is a one-way push connection; you cannot pull code onto a local computer from the Digital server.



### Exercise: Create a New Server Connection

1. From UX Studio, select **File > New > Digital Server Connection**. The **New Digital Server Connection** dialog displays.
2. In the **Project name** and **Host name** fields, enter the host name provided by your instructor or client:
  - student##-training-na-dw.demandware.net (where # is unique for each student).

- partner##.cloud01.pod3.demandware.net (where partner## varies by partner company)
- 3. Enter your Business Manager password.
- 4. Click **Next**.
- 5. A security warning regarding an invalid certificate for your sandbox displays. Click **Yes** to continue.
- 6. In the Target version directory field, select **version1** as the target version for your uploaded files.
- 7. Click **Finish**.

Your project is now connected to your sandbox. You will use that connection to upload any cartridge projects to that sandbox.



### Exercise: Run the View Commerce Cloud Digital Help

To open the Digital API Javadoc:

1. From UX Studio, click **Help > Help Contents**.
2. Expand the **Digital API** link.
3. Select any of the available help items. Note: The first two items offer Javadoc-style help.



### Exercise: Import a Project into UX Studio

1. In UX Studio, select **File > Import**. An Import dialog displays.
2. Expand the **General** menu and select **Existing Projects into Workspace**.
3. Click **Next**.
4. In the **Select Root Directory** field, click **Browse**.
5. Find the folder on your hard drive where cartridges are stored. Your instructor will provide a zip file with all solution cartridges for you to install locally.
6. Click **OK**.
7. Any cartridges in the folder structure (including subfolders) will display in the **Projects** box. Click **Select All**.
8. Click **Finish**.
9. If you already have an active server connection in your workspace, the next dialog prompts you to link your imported projects with that server connection.

Note: If you want to upload the imported cartridges to the active server, click **Yes**. Otherwise the cartridges will reside in your workspace, but will *not* upload automatically when you make changes.

10. Click **OK** to upload the cartridges and finish the import process.

**Note:** You might receive a dialog that asks if you want to delete projects on the server not matching the ones in your workspace. If you are the only one working on that instance (e.g. it's your personal sandbox), you can make that decision. However, if you are working on a collaborative instance consult first with your colleagues.

**Note:** If you import cartridges before you have an active server connection or have failed to link a cartridge to the server, perform the following steps to ensure that cartridges upload correctly:

- Right-click the server connection and select **Properties**.
- In the **Properties** dialog, select **Project References**. Then select every cartridge that you want uploaded to the server connection. Click **OK**.



## Lesson 2.3: Commerce Cloud Digital Views

The UX Studio plugin provides access to specific Digital programming files. These files are sorted and given their own custom views in the application. The primary files include: cartridges, templates, and scripts. UX Studio contains tabs for each.

### Tips

- You can filter the results by typing in the first few letters of the file name you are searching for.
- To view the file path for a file, click the **Show/Hide Resource Part** icon.
- The **Navigation** tab enables you to view all files in your workspace in a tree view structure. It also facilitates common tasks, such as: copy/paste, file comparisons, etc.

### Searching for Text in Files

There are often numerous files used to display a single web page in a browser. You can use the UX Studio search tool to quickly find specific code within that set of files.



### Exercise: Search for Text in Files

1. In the main menu bar, select **Search > Search**. Select the **File Search** tab. The search window displays.
2. In the **Containing text** field, enter your text search criteria.
3. In the **File name patterns** field, enter any patterns to use as a filter.
4. Click **Search**. Your results display in the **Search** box.
5. Double-click a file to view it. The file will open in the workspace area with the search term highlighted.





## Knowledge Check

Question	Answer
<p>1. To upload your code to a Digital server</p> <ul style="list-style-type: none"> <li>A. Copy files to the root folder on the web server.</li> <li>B. Connect to a production server in a PIG.</li> <li>C. Create a server connection in Studio.</li> <li>D. Contact Digital support to open a server connection for you.</li> </ul>	
<p>2. To find text in any workspace file:</p> <ul style="list-style-type: none"> <li>A. Select <b>File &gt; Find Text</b>.</li> <li>B. Select <b>Search &gt; Search</b>.</li> <li>C. Select <b>Edit &gt; Find</b>.</li> <li>D. Use the Windows search option.</li> </ul>	

## Module 3: Cartridges

### Learning Objectives

After completing this module, you will be able to

- Describe what a cartridge is, its directory structure, and its path in Business Manager.
- Create an empty cartridge.
- Create a new storefront cartridge.

### Introduction

A cartridge is a directory structure that provides a flexible deployment mechanism for customized functionality. It can contain many different types of files including: static files (CSS, JavaScript, etc.), image files, etc. It also contains folders for Commerce Cloud Digital specific files, such as: scripts, templates, and form definitions.

A cartridge is fully contained in one directory. Every cartridge has specific sub-directories where certain file-types must be stored. For instance, you must store all Digital Script files in a **scripts** folder.

**Note:** UX Studio generates the required `storefront.properties` file when you create a new cartridge.



### Lesson 3.1: Cartridge Path

For a site to use a cartridge, you must add the cartridge to the cartridge path in Business Manager. Select **Sites > Manage Sites > Site Genesis – Settings**.

When a call is made to a file, the Digital server looks for the file starting with the first cartridge listed in the cartridge path. For example, if a call is made to the `productfound.isml` file and that file is located in two cartridges that are both in the cartridge path, the Digital server uses the first one it finds.



### Exercise: Add a Cartridge to a Cartridge Path

1. In Business Manager, select **Administration > Sites > Manage Sites**.
2. Select the site where you want to add the cartridge. In this case, select SiteGenesis.
3. Select the **Settings** tab.
4. Enter the name of the cartridge to add.

To add multiple cartridges, use a colon between cartridge names. In this case, delete the existing path completely and add the following path:

```
training:storefront_core:storefront_controllers
```

**Note:** All names are case-sensitive and must match your cartridge name if they exist in Eclipse. There should be no spaces between each item.

5. Click **Apply**.



## Lesson 3.2: Cartridge Types

Your business needs determine the type. However, every new site will have at least one cartridge.

Cartridge Type	Description
SiteGenesis Storefront Cartridge	A new storefront cartridge contains a copy of the default SiteGenesis cartridge available in the SiteGenesis Demo Site package. Most projects start with this SiteGenesis reference code.
Cartridge	<p>Use to build site-specific, re-usable functionality when there are multiple sites in a production instance.</p> <p>You may want to add a new cartridge when functionality is:</p> <ul style="list-style-type: none"> <li>▪ Generic: reusable code used in multiple sites.</li> <li>▪ An integration to an external system.</li> <li>▪ Specific to a localized site: CSS, images and resource files for a language-specific site.</li> </ul>
Business Manager Extension Cartridge	See your Commerce Cloud Digital documentation for more information.

### Best Practices

- Keep an original SiteGenesis cartridge in your project for comparison or refer to your demo instance.
- Use a storefront cartridge for common code that you intend to reuse in multiple sites: `<client>_core`
- Create cartridges for site-specific functionality that might overwrite the core: `app_<site>`
- Place any integration code in a `int_<site>` cartridge.



## Exercise: Working with Cartridges

### View the WebDAV Cartridge Directory in Business Manager

1. Log into the Business Manager instance where you want to view cartridge contents (i.e.: staging instance).
2. Select **Administration > Site Development**. Click **Development Setup**.
3. In the **WebDAV Access** section, click the Cartridges link.
4. The Authentication dialog displays. Enter your Business Manager username/password.
5. Click **OK**.
6. Click the link that corresponds to the code version that you want to view.
7. Click a version to see the uploaded cartridges.

### Create a New Version on the Server

1. In Business Manager, select **Administration > Site Development**. Click **Code Deployment**.
2. Click **Add** to create version2. Click **Apply**.
3. Click the new version. Notice that the Cartridges directory is empty.
4. In UX Studio on the connection project, select **Digital Server > Change Upload Staging Directory....** The Change Upload Staging Directory dialog displays.
5. Select version2 from the dropdown.
6. Click **OK**. Wait for the cartridges to upload.
7. In Business Manager, check the version2. Note the contents of the Cartridges directory.
8. In the **File Filter** field, enter a filename and click Find to see all versions of it.
9. Click **Activate** to make version2 active.

Now, any new cartridges are uploaded to version2, which is also the active version on the server.

### Create an Empty Cartridge

When you need to segregate code between sites, you can create a new empty cartridge. This enables you to add only the code you need for a site (or specific sites) in an organization.

1. In UX Studio, log into your workspace.
2. From the main menu, select **File > New > Cartridge**. The **New Cartridge** dialog displays.
3. Enter the cartridge properties exactly as listed:
  - Name: training
  - Location: C:\projects\DigitalServer\sources\cartridges

- Link to Digital Server: Checked
4. Click **Finish**.
  5. Review the **training** cartridge. Notice that the directory structure was created but there are no files.



### Lesson 3.3: Creating a SiteGenesis Storefront Cartridge

When you create a new storefront cartridge in UX Studio, a copy of the **SiteGenesis** cartridge downloads to your workspace and is renamed with the name you specify. The reference cartridge has all of the code needed for a SiteGenesis storefront to work in Commerce Cloud Digital. It contains:

- The business layer, all of the server-side components (such as Digital scripts).
- The simple presentation layer, including ISML templates, common CSS files, forms, and resource files.

The specific CSS and advanced UI elements required create the look and feel of the SiteGenesis storefront.

Changes made to the new storefront cartridge are uploaded to the Digital server. To view them immediately:

1. Set the cartridge to be uploaded to your workspace server.
2. Put the new cartridge in the cartridge path.
3. Disable site caching for the site.



### Exercise: Create a New Storefront Cartridge

1. In UX Studio, log into your workspace.
2. From the main menu, select **File > New > SiteGenesis Storefront Cartridge**. The **New Storefront Cartridge** dialog displays.
3. Complete the fields in the New Standard Storefront cartridge dialog.
  - Name: storefront
  - Location: C:\projects\DigitalServer\sources\cartridges
  - Attach to Commerce Cloud Digital Servers (studentxxx.training.dw.demandware.net): Checked
4. Click **Finish**.



## Knowledge Check

Question	True	False
A SiteGenesis Storefront cartridges are an empty cartridges with empty sub-folders.		
You should create a new cartridge when you need to build generic functionality that can be reused in many sites.		
You can view a list of all files in a cartridge located on a Digital server from Business Manager.		

## Module 4: JavaScript Controllers

### Learning Objectives

After completing this module, you will be able to:

- Describe JavaScript controller usage
- Create, execute and troubleshoot JavaScript controllers

### Lesson 4.1: Introduction to JavaScript Controllers

JavaScript controllers enable you to use a common open technology to build the business logic of the site. Note: Salesforce recommends that all new sites use JavaScript controllers rather than pipelines. However, if you need to maintain an existing site that use pipelines, see Appendix A.

#### Cartridge Folder Structure

```
<cartridge>
  +-- modules
  +-- package.json
  +-- cartridge
  +-- controllers
  +-- forms
  +-- pipelines
  +-- scripts
  +-- static
```

#### Controller Code Example

Here is a simple example of a JavaScript controller.

```
var guard = require('storefront_controllers/cartridge/scripts/guard');
var ISML = require('dw/template/ISML');

function start() {
    ISML.renderTemplate(
        'helloworld1.isml',
        {
            myParameteronISML: "Hello from Controllers"
        }
    );
};
exports.Start = guard.ensure(['get'], start);
```

The `require` keyword imports a class from the API package to be used in the code.

The guard exposes the function with a new name. In this case, the function `start` is exposed to the URL with the name `Start`. It can also enforce an http method (In this case, it is exposing the function with a `get` method).

The ISML object gives the control to ISML, which can display the results. You can use response object directly to display the results as shown below but it is not recommended.

```
response.setContentType('text/html');
response.getWriter().println('<h1>Hello World from Javascript controllers!</h1>');
```

Ideally the output should be rendered through ISML which is the view (Just like HTML or JSP). Also to pass the results to the ISML. Here is an example code to output the results to an isml named `demo.isml` and passing a string message to the parameter `myParameter` to the ISML.

```
ISML.renderTemplate(
    'demo.isml',
    {
        myParameter:"Message from Controllers"
    }
);
```

The parameter `myParameter` gets loaded on a hashmap named `pdict` and can be retrieved from the ISML (`demo.isml`) using the syntax shown below.

```
${pdict.myParameter}
```

More details about the `pdict` are coming later in this course.



### Exercise: Create a JHelloWorld JavaScript Controller

1. In Business Manager, select **Administration > Sites > Manage Sites > SiteGenesis > Settings**.
2. If it is not already there, add the `storefront_controllers` cartridge to the cartridge path. It should now be similar to:  
11. `training:storefront_controllers:storefront_core`
3. Upload your cartridge to the Sandbox:
4. Select Eclipse. Right-click and select **DigitalServer > Properties > Project References**. Check the `storefront_controllers` cartridge.
5. Create a new controller named `JHelloWorld.js` in the training cartridge (right-click controllers. Select **New** file). Note: This is the only cartridge that you will use in this course.
6. Copy and paste the following structure to create a start function. Use ISML and guard.



```
/**
 * A hello world controller. This file is in cartridge/controllers folder
 * @module controllers JHelloWorld
 */

var guard = require('storefront_controllers/cartridge/scripts/guard');
var ISML = require('dw/template/ISML');

function start() {

};
exports.Start = guard.ensure(['get'], start);
```

- Inside the function `start`, add the following code to render the control to ISML:

```
ISML.renderTemplate(
    'helloworld1.isml', {
        myParameteronISML:
            "Hello from Controllers"
    }
);
```

- In the `templates/default` folder, create an ISML file named `helloworld1.isml` with the following code in it. Note: `pdict` will be discussed later.

```
${pdict.myParameteronISML}
```

- Execute the controller.
- Navigate to the storefront.
- At the end of the URL add `/default/JHelloWorld-Start`
- Press <enter> to execute the controller.

### Pipeline Dictionary to Global Variables

`pdict` is a hashmap on which key, object pairs can be loaded. However, there are some built in `pdict` keys (variables) that provide access to the most commonly used objects, such as session and request.

JavaScript controllers can use alternatives to `pdict` keys. Here are some of them. The strikethroughs indicate implicit packages or classes in JavaScript controllers.

pdict keys	Alternatives
<code>CurrentSession</code>	<del><code>TopLevel.global.session</code></del>
<code>CurrentRequest</code>	<del><code>TopLevel.global.request</code></del>
<code>CurrentCustomer</code>	<del><code>TopLevel.global.customer</code></del>
<code>CurrentHttpRequestParameterMap</code>	<del><code>TopLevel.global.request.httpParameterMap</code></del>
<code>CurrentPageMetaData</code>	<del><code>TopLevel.global.request.pageMetaData</code></del>

CurrentForms	TopLevel.global.session.forms
--------------	-------------------------------

In other words, controllers have access to `request`, `response`, `session`, `customer` objects if you have used the `valid` import or `require` statements. They also have access to `CurrentHttpParameterMap` variable using `request.httpParameterMap` and `pageMetaData`.



### Exercise: Create a JavaScript Controller

The goal of this activity is to display query parameters using JavaScript controllers.

1. Create a controller named `JCall.js` in the controllers folder.
2. Use the quickcard (section “Import an Object”) to require `ISML` and `guard` in your controller.
3. Use the quickcard (section “Function declaration and exposure”) to declare the function and expose `start` function as `Start`
4. Inside the `start` function, paste the following template:

```
var myParam =
/* Use the quickcard section “Dealing with query parameters” get the
Parameter named param */

if (myParam.stringValue != null)
{
/* Use the quickcard section “Giving control to ISML” to give control
to call/jnotEmpty.isml
and loading myParam on a variable paramOnPdict
*/

}
else{
    ISML.renderTemplate(
        'call/jempty.isml',
        {
            paramOnPdict:'param not found'
        }
    );
};
```

5. Follow the instructions in the template comments to complete the code.
6. Create two templates `jnotEmpty.isml` and `jempty.isml` (under `templates/default/call` ) that display different messages.

The successful path should have an ISML code in `jnotEmpty.isml` as shown:

Got the parameter `${pdict.paramOnPdict.stringValue}`

The path which does not have parameter () should have ISML code in `jempty.isml` as shown:

Could not find the parameter!

7. Execute the code by Navigating to storefront and adding `/default/JCall?param=1234` to the URL at the end.
8. Execute the code without the query parameter.

### Import Packages

Use the `require` method to import Digital script packages, JavaScript, or Digital script modules. You can use it anywhere in your script so that you can only load the functionality as needed to improve performance.

For example: `require('dw/system/Transaction')`

Note: Earlier versions of SiteGenesis used `importPackage` to import Digital packages into scripts. `Require` is now the recommended approach as it has greater flexibility and improves performance. However, you may still see `importPackage` if you are maintaining a site from earlier version.

### Troubleshooting with the Request Log Tool

The Request Log tool enables you to troubleshoot error messages on your storefront. It displays the log for the last request and any request prior to that request during the current session. You can view both debug messages and error messages. The tool is part of the Storefront Toolkit, which is available in all instances (except Production).



#### Exercise: Run the Request Log

1. From Business Manager, click the storefront link to open your sandbox storefront.
2. Click the Storefront Toolkit drop-down located in the upper-left hand corner of the site.
3. Check the **Request Log**. The Request Log window displays.

Note: If a login screen displays instead of the request log, enter your Business Manager login credentials; close the window; and repeat steps 2-3.

### Lesson: Displaying a Product Using Script API



#### Exercise: Create a JavaScript Controller `JShowProduct`

1. Create a new JavaScript Controller called `JShowProduct.js`.

2. Copy and paste the following template to it.

```
'use strict';
/** @module controllers/JShowProduct */

var ISML = require('dw/template/ISML');
var guard = require('storefront_controllers/cartridge/scripts/guard');

function start() {

}

exports.Start = guard.ensure(['get'], start);
```

3. Use the `require` syntax to import `ProductMgr` class from `dw.catalog` package after the guard.

4. Inside the `start()` function, paste the following code to get the parameter `pid` from the URL.

```
var parameterId = request.httpParameterMap.<parameter name>.stringValue
```

5. Get the product from `ProductMgr` as shown.

```
var product = ProductMgr.getProduct(parameterId);
```

6. Copy and paste the following code to forward the control to ISML.

```
if (product===null) {
    ISML.renderTemplate(
        'productnotfound.isml',
        {
            message:'product with id '+parameterId+' not found'
        }
    );
}
else{
    ISML.renderTemplate(
        'productfound.isml',
        {
            myProduct:product
        }
    );
}
```

7. If not already created, create `templates/default/productnotfound.isml` with the following code in it.

```
${pdict.message}
```

8. If not already created, create `templates/default/productfound.isml` with the following code in it.

```
${pdict.myProduct.name} has been found
```

9. Run the JavaScript Controller (add `/default/JShowProduct?pid=P0048` at the end of storefront URL).



## Knowledge Check

Commerce Cloud JavaScript Controller Review Questions	True	False
If the execution of a controller is not providing accurate results, you should use the request log tool.		
You should preferably use <code>response.getWriter(..)</code> to print results on the browser		

## Module 5: ISML

### Learning Objectives

After completing this module, you will be able to:

- Use ISML tags in templates, including: `<isset>`, `<isinclude>`, `<isdecorate>`, and conditional tags.
- Use local and remote includes in ISML.

### Introduction

Internet Store Markup Language (ISML) templates are files with a `.ism1` extension. They define how data, tags, and page markup are transformed into HTML that is sent to the browser, using Cascading Style Sheets (CSS) for page layout and styling.

Commerce Cloud Digital uses templates to generate dynamic HTML-based web pages for responses sent back to the client. Templates are created using ISML tags and expressions.

When describing a Digital application using the Model-View-Controller (MVC) pattern, the Digital Script API represents the model, templates represent the view, and the JavaScript controllers are the controller.

### Create an ISML Template

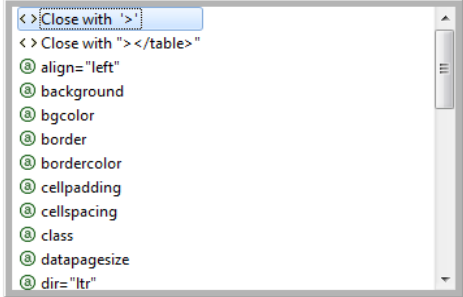
1. In UX Studio, select a cartridge in Navigator View. Select **File > New > ISML Template**. The **Create Template** dialog displays.
2. In the parent folder field, enter the name of the folder where you want to store your template. If the folder does not exist, it will be created.
3. In the Template name box, enter a name for your template. You do not need to enter the `.ism1` extension.
4. Click **Finish**.

Your new template opens in the ISML editor in UX Studio. This editor supports HTML and ISML system tag auto-completions as shown.

```

2
3<html>
4  <head>
5
6  </head>
7  <body>
8    <table>
9
10  </body>
11
12
13</html>

```




## Lesson 5.1: ISML Tags and Expressions

ISML tags are Commerce Cloud proprietary extensions to HTML that developers use inside ISML templates. ISML tags and expressions can only be written in in ISML templates. ISML tags are SGML-like extension tags that start with **is**, e.g. `<isprint>` and describe, together with regular HTML, how dynamic data will be embedded and formatted on the page.

Depending on their tasks, ISML tags can be divided into the following groups:

Group	Tags	Purpose
HTTP-related	<code>&lt;iscookie&gt;</code>	Sets cookies in the browser
	<code>&lt;iscontent&gt;</code>	Sets the MIME type
	<code>&lt;isredirect&gt;</code>	Redirects browsers to specific URLs
	<code>&lt;isstatus&gt;</code>	Define status codes
Flow Control	<code>&lt;isif&gt;</code>	Evaluates a condition
	<code>&lt;iselse&gt;</code> <code>&lt;iselseif&gt;</code>	Specifying alternative logic when an <code>&lt;isif&gt;</code> condition does not evaluate to true
	<code>&lt;isloop&gt;</code>	Creates a loop statement
	<code>&lt;isnext&gt;</code>	Jumps to the next iteration in a loop statement
	<code>&lt;isbreak&gt;</code>	Terminates loops
	<code>&lt;isset&gt;</code>	Creates a variable



Variable-related	<isremove>	Removes a variable
Include	<isinclude>	Includes the contents of one template on the current template
	<ismodule>	Declares a custom tag
	<iscomponent>	Includes the output of a controller or pipeline on the current page
Scripting	<isscript>	Allows Commerce Cloud Digital Script execution inside templates
Forms	<isselect>	Enhances the HTML <select> tag
Output	<isprint>	Formats and encodes strings for output
	<isslot>	Creates a content slot
Others	<iscache>	Caches a page
	<iscomment>	Adds comments
	<isdecorate>	Reuses a template for page layout
	<isreplace>	Replaces content inside a decorator template
Active Data	<isactivedatahead>	Allows collection of active data from pages with a <head> tag
	<isactivecontenthead>	Collects category context from a page for active data collection
	<isobject>	Collects specific object impressions/views dynamically

## ISML Expressions

ISML Expressions are based on the Digital Script language. Since Digital Script implements the ECMAScript standard, access to variables, methods, and objects is the same as using JavaScript.

ISML expressions are embedded inside `${...}` to enable the ISML processor to interpret the expression prior to executing an ISML tag or the rest of the page. ISML expressions provide access to data by using dot notation. This example accesses a property of the `Product` object in the pipeline dictionary:

```
${pdict.myProduct.UUID}
```

The difference between this ISML expression and one used inside a pipeline node property (i.e. decision node) is that in ISML you must specify the `${pdict.object.property}` if you want to access a value in the pipeline dictionary, whereas inside pipeline node properties the access to the `pdict` is implicit and the `${}` not used: i.e. `Product.UUID`.

ISML expressions can also access Digital Script classes and methods. Two packages are available implicitly in ISML, so classes do not need to be fully qualified:

- TopLevel package: `session.getCustomer()`
- `dw.web` package: `URLUtils.url()`, `URLUtils.webRoot()`

`TopLevel` package has a class named `global` which is implied so doesn't need to be in the prefix.

Other access to classes and methods must be fully qualified:

```
${dw.system.Site.getCurrent().getName() }
```

Examples of ISML expressions:

```
${TopLevel.global.session.getCustomer().getProfile().getLastName() }
```

Since `TopLevel` package and `global` class are implicit, the previous code is equivalent to the following code:

```
${session.getCustomer().getProfile().getLastName() }
```

You can replace the `get` method with properties. So the previous code example is equivalent the following code:

```
${session.customer.profile.lastName}
${pdict.CurrentSession.customer.profile.lastName}
${pdict.CurrentCustomer.profile.lastName}
${dw.system.Site.getCurrent().getName() }
${dw.system.Site.current.name}
```

ISML expressions allow complex arithmetical, boolean, and string operations:

```
${pdict.myProduct.getLongDescription() != null}
```

This course covers the most frequently used tags: `<isset>`, `<isinclude>`, `<isdecorate>`, `<isloop>` and the conditional tags `<isif>`, `<iselseif>`, and `<iselse>`

**Note:** Although there are some ISML tags that do not need a corresponding closing `</>` tag (i.e.: the `<isslot>` tag), it is best practice to always use a closing tag.

#### `<isredirect>` tag

This tag can redirect the control to another pipeline and redirect can be permanent or temporary.

```
<isredirect location="${URLUtils.https('Account-Show')}"
permanent="true"/>
<isredirect location="${URLUtils.url('LoginPanel')}">
<isredirect location="${URLUtils.url('LoginPanel-Start')}"
permanent="false">
```

#### `<iscomment>` tag

This tag is used to write comments in the ISML. For example.

```
<iscomment> ....This is a comment....</iscomment>
```

## <isprint> tag

This tag can print formatted output of a variable or an expression to the browser. In order to do so, it uses built in styles or formatters. You can see the documentation for formatters. Examples using isprint with styles:

```
<isprint value="{myMoney}" style="MONEY_LONG"/>
<isprint value="{myMoney}" style="MONEY_SHORT"/>
<isprint value="{myNumber}" style="DECIMAL"/>
<isprint value="{myNumber}" style="INTEGER"/>
<isprint value="{myDate}" style="DATE_LONG"/>
<isprint value="{myDate}" style="DATE_SHORT"/>
<isprint value="{myString}" encoding="off"/>
```

MONEY\_LONG prints money with currency symbol e.g. \$3,333.00

MONEY\_SHORT prints money without the symbol e.g. 3,333.00

DECIMAL prints the value with two decimal places e.g. 3,455.35

INTEGER rounds of and prints only the integer portion e.g. 3,455

DATE\_LONG prints date in the long format like Jul 24, 2016

DATE\_SHORT prints date in the long format like 07/24/2016

encoding="off" prints strings containing HTML, for example:

<h1> Welcome to Developing for Digital I Class</h1> prints as:

Welcome to Developing for Digital I Class



## Lesson 5.2: Creating and Accessing Variables

You can create and access your own custom variables in an ISML template by using the <isset> tag.

When using the <isset> tag, name and value are required attributes that must be assigned. The default scope is session, so you must be careful to qualify your variables accordingly if you do not want them.

Example:

```
<isset
name = "<name>"
value = "<expression>"
scope = "session"|"request"|"page"
>
```

Here are some examples of using isset tag and retrieving the variables back from the scope

session Scope

```
<isset name = "x" value = "12343" scope="session"/>
<isset name = "x" value = "12343" /> (session is implied here)
<isset name = "x" value = "${12343}" scope="session"/>
```

### Retrieving from session

```
${session.custom.x}
${pdict.CurrentSession.custom.x}
```

### request Scope

```
<isset name="x" value="${12343}" scope="request"/>
${request.custom.x}
${pdict.CurrentRequest.custom.x}
```

### pdict Scope

```
<isset name = "x" value = "${12343}" scope = "pdict"/>
```

### Retrieving from pdict

```
${pdict.x}
```

### Page Scope

```
<isset name = "x" value = "${12343}" scope = "page"/>
${page.custom.x} does not work
```

### Retrieving from page

```
${page.x} does not work
${x} works
```

## Value Attribute

The value attribute can be a hardcoded string or number, or an ISML expression accessing another variable or object.

Value Type	Example
String	value="hardcoded text"
Expression	value="\${pdict.myProduct.name}"

## Scope Attribute

A variable's scope attribute refers to its accessibility level, such as `session`, `request`, and `page`. It is important to understand the scopes of a variable and which objects can access that variable at each level. Listed are the scopes from widest to narrowest access.

Scope	Description
Global Preferences	Available to any site within an organization. Accessible via the <code>dw.system.OrganizationPreferences</code> class.

Site Preferences	Available to any controller or pipeline executing as part of a site. Accessible via the <code>dw.system.SitePreferences</code> class.
Session	Available through the whole customer session, even across multiple requests. Any variable added to the session scope becomes a custom attribute of the session object. Since it is not a standard attribute it must be accessed with the <code>session.custom</code> qualifier: <code>\${session.custom.myVar}</code>
pdict	A hashmap, the scope of which is the JavaScript controller itself. It can span across multiple requests if there is a form displayed and submitted as a part of the JavaScript controller.
Request	Available through a single browser request-response cycle; it does not persist in memory for a subsequent request. Typically, it has the same scope as the JavaScript controller execution. They are available via the <code>request</code> scope. Similar to session variables, you must prefix request variables with a qualifier <code>request.custom</code> when accessing them: <code>\${request.custom.myRequestVar}</code>
Page	Available only for a specific ISML page, and its locally included pages. Their scope is limited to the current template, and any locally included templates. They are accessed without a prefix: <code>\${pageVar}</code>
Slotcontent	Available only in the rendering template for a content slot.
<isloop> variable	Available only inside the loop.



### Exercise: Set and Retrieve Variables

1. Create a controller (using the quickcard as a guide) called `VarTest`. Note: You can use `JVarTest.js` from `jsolutions` cartridge.
2. Create a new ISML template called `vartest`.
3. In the template, create a new variable called `sessionVar` with hardcoded text as the value and print the value to the page:  

```
<isset name="sessionVar" value="{1}" scope = "session"/>
```
4. Display the contents of the `sessionVar` variable. Its value is:  

```
${session.custom.sessionVar}<br/>
```
5. Open a web browser and test the controller.
6. Add similar examples of request and page variables to the `vartest` template and display them.

7. Modify the examples using boolean and string values (i.e., `"${false}"` and `"Hello"`).
8. Test the JavaScript controller again to see the new variable values.
9. Increment the variables using the following syntax:  
`"${request.custom.requestVar + 1}"`



## Lesson 5.3: Reusing Code in Templates

Reusable code saves time in both code creation and update. It also reduces errors and helps to ensure a consistent look and feel.

You can use the following tags to reuse code in ISML templates:

Tag	Description
<code>&lt;isinclude&gt;</code>	<p>Embed an ISML template inside an invoking template. There are two types:</p> <p>12. Local Include – include the code of one ISML template inside of another while generating the page. All variables from the including template are available in the included template, including page variables. SiteGenesis uses local includes extensively.</p> <p>13. Remote Include – include the output of another controller or pipeline inside of an ISML template. This is used primarily for partial page caching. Note: Pipeline dictionary and page variables from invoking template are <b>not</b> available in the included template. The only variables available to a remotely included JavaScript controller are session variables.</p> <p><b>Note:</b> Includes from another server are not supported.</p>
<code>&lt;isdecorate&gt;</code>	Decorate the enclosed content with the contents of the specified (decorator) template. A decorator is an ISML template that has HTML, CSS, and the overall page design.
<code>&lt;ismodule&gt;</code>	Define your own ISML tags which can be used like any standard tags.
<code>&lt;iscomponent&gt;</code>	Invokes a remote include. You can pass as many attributes as you want without having to use the <code>URLUtils</code> methods.

### Local Include Syntax

```
<isinclude template="[directory/]templatename"/>
```

**Note:** You do not need to add the `.isml` extension when including a template.

### Example

#### Template 1:

```
<h1>My Template</h1> <br/>
<isinclude template="extras/calendar"/>
```

Template 2:

(calendar.isml)

```
<h1>Included template</h1>
```

When the browser renders the template, the user will see:

**My Template**

**Included template**

[Locally include one template into another](#)

1. Open any ISML template.
2. In the ISML code, determine where you want to embed the locally included template.
3. Add the `<isinclude>` tag to the template.
4. Save the template.
5. To test, use your template in a JavaScript controller.



### Exercise: Use Local Includes

1. Study the template to include:
2. Locate and study the `producttile.isml` template.
3. Notice that the first `<isset>` tag expects `pdict.product` in the pipeline dictionary.
4. Include `producttile.isml` in your current template:
5. Open the `JShowProduct` controller that you previously created.

Note that you will output `myProduct` object on `pdict`, however the `producttile` template expects `pdict.product`. These are not the same variables.

6. Open the `productfound.isml` template.
7. Create a pipeline dictionary variable that matches the variable and scope expected in the `producttile.isml` template:

```
<isset name="product" value="{pdict.myProduct}" scope="pdict"/>
```

8. Use a local include to display the product tile:

```
<isinclude template="product/producttile"/>
```

9. Test the JavaScript controller with an existing product:  
`JShowProduct-Start?pid=P0048`.

## Remote Includes

Using a remote include in a template will invoke another controller or pipeline which returns HTML at runtime. This example calls a pipeline without passing URL parameters:

### Syntax

```
<isinclude url="pipeline_url"/>
```

### Example

```
<isinclude url="${URLUtils.url('Product-IncludeLastVisited')}}" />
```

In this example, the `dw.web.URLUtils.url()` method builds a site-specific URL for the `Product-IncludeLastVisited` controller. This is a best practice since you should never hardcode a controller URL since it would contain a specific server in it. Use the `URLUtils` methods instead.

Here is an example of passing URL parameters:

```
<isinclude url="${URLUtils.https('Product-GetLowATSThreshold', 'productid', 'ETOTE', 'typeOfTV', 'Wide-screen')}}" />
```

The page generated by the invoked controller can be dynamic or it may come from cache.

You can also implement a remote include, via the `<iscomponent>` tag. It supports passing multiple attributes.

```
<iscomponent
  pipeline = <string> | <expression>
  [locale = <string> | <expression> ]
  [any number of additional arbitrarily named parameters]
/>
```

### Example

```
<iscomponent pipeline="Product-GetLowATSThreshold" productid="ETOTE"
  typeOfTV="Wide-screen"/>
```

## Using a Remote Include

1. Open an ISML template.
2. In the ISML code, determine where you want to embed the remotely included controller.
3. Add the `<isinclude>` tag to the template using the following as an example (param and value are optional):

```
<isinclude url="${URLUtils.url('Controller-Function', ['param', 'value', ...])}" />
```

4. Save the template.
5. Test your controller.





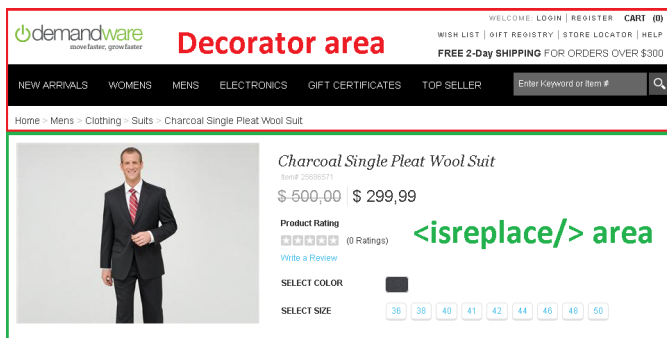
## Exercise: Use a Remote Include

1. Study the Digital Script API help for the `dw.web.URLUtils` class, `url()` method.
2. Locate and study the `Product-IncludeLastVisited` (look for `Product.js`) controller in the storefront cartridge.
3. Study the `lastvisited.isml` template, specifically:
  - The use of the `<isloop>` tag.
  - The use of the `pdict.LastVisitedProducts`.
4. Open the `JShowProduct` controller and the `productfound.isml` template.
5. Add a remote include at the bottom of the template to show the last visited products. Verify your syntax to ensure it is exactly as shown:
 

```
<isinclude url="{URLUtils.url('Product-IncludeLastVisited')}"/>
```
6. Test the controller with an existing product: `JShowProduct-Start?pid=P0048`.
7. On a different browser tab, visit at least three other products in the storefront.
8. Retest the controller: all the visited products should display.

## Using Decorator Templates

The decorator template uses `<isreplace/>` to identify where to include the decorated content. The following example shows a decorator and the area where the code is being replaced.



Typically, the decorator template only uses one tag, `<isreplace/>`. However, you can use multiple tags. If the decorator template uses multiple `<isreplace/>` tags, the content to be decorated will be included for each `<isreplace/>` tag.

A typical use case is to decorate the content body with a header and footer.

Example:

### Template using a decorator

```
<isdecorate template="decoratorFolder/pt_myDecorator">
...My content...to be decorated
</isdecorate>
```

Decorator Template (templates/default/decoratorFolder/pt\_myDecorator.isml)

```
<html>
  <head>...</head>
  <body>
    This contains Header/Banner/Menus etc.
    <isreplace/>
    This contains footer/Copyright notice etc.
  </body>
</html>
```

### Final generated page

```
<html>
  <head>...</head>
  <body>
    This contains Header/Banner/Menus etc.
    ...My content...to be decorated
    This contains footer/Copyright notice etc.
  </body>
</html>
```

### Using the <isdecorate> Tag

1. Open the ISML template that has the code you want to replace in a decorator. Add the <isdecorate> tag around the code to include in a decorator.  

```
<isdecorate template="[directory/]decoratorname">
  Your code goes here.
</isdecorate>
```
2. Save the template.
3. Open the decorator template. If you are using a SiteGenesis template, the decorator templates names start with pt\_.
4. Find the location in the code where you want to use the <isreplace/> tag. Add the tag to the template.
5. Test the page by calling the controller that uses the decorator template. For example, if the decorator template is used by the Account-Show controller, type in the URL that will execute the Account-Show controller.

/demandware.store/Sites-SiteGenesis-Site/default/Account-Show



## Exercise: Use a Decorator

1. In UX Studio, using the Search function, locate the `product/pt_productdetails` template. Notice the different areas of the page this decorator defines.
2. Locate the `<isreplace/>` tag.
3. Open the `ShowProduct` pipeline or `JshowProduct.js` that you created earlier.
4. In your `productfound.isml` template, remove any `html`, `body` and `head` tags as the decorator already contains these.
5. Add the `product/pt_productdetails` decorator so it wraps the existing content on the page:

```
<isdecorate template="product/pt_productdetails">
...existing content...
</isdecorate>
```

6. Test the controller with an existing product: `ShowProduct-Start?pid=P0048` (or `JShowProduct-Start?pid=P0048`)

## Creating Custom Tags with `<ismodule>`

There are three key ISML files required for creating and using a custom tag:

- The ISML file which sets the values of any attributes of the custom tag. This example is in `util/modules.isml`:

```
<ismodule template="components/breadcrumbs"
  name="breadcrumbs"
  attribute="bctext1"
  attribute="bcurl1"
  attribute="bctext2"
  attribute="bcurl2"
  attribute="bctext3"
  attribute="bcurl3"
/>
```

- The ISML file which specifies what happens when the attributes are passed. See the code snippet from inside `breadcrumbs.isml`:

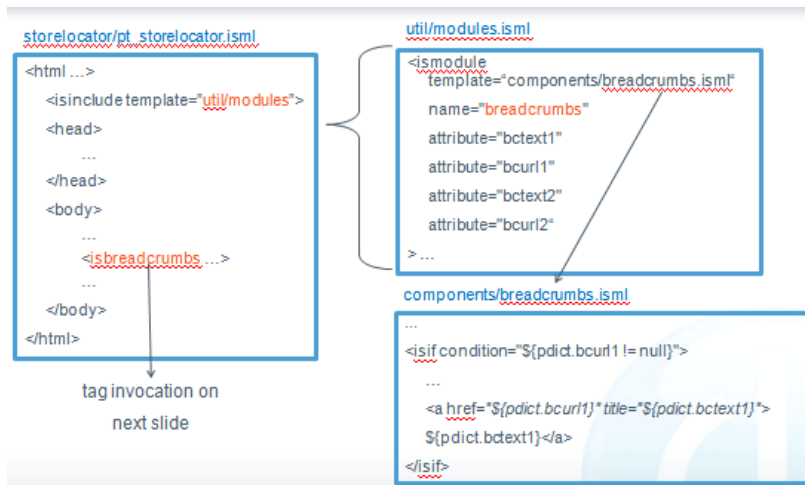
```
<isif condition="{pdict.bcurl1 != null}">
...
<a href="{pdict.bcurl1}" title="{pdict.bctext1}">
  {pdict.bctext1}</a>
</isif>
```

- Invoke the custom tag inside an ISML template:

```
<html ...>
```

```
<isinclude template="util/modules"/>
<head>
...
</head>
<body>
...
<isbreadcrumbs bctext1="..." bcurl1="..." />
</body>
</html>
```

Here is how it would be organized.



### Exercise: Use a Custom Tag

In this exercise, you will invoke a custom tag already created in SiteGenesis.

1. Open the `util/modules.isml` template.
2. Locate the `producttile` custom tag definition. Note the different inputs defined for the `producttile` custom tag.
3. Locate the template that implements this custom tag, and study it: `producttile.isml`.
4. Open the `productfound.isml` template that you were referring to from `JshowProduct` controller.
5. Remove the remote include.
6. Change the existing local include to include the template that contains all custom tag definitions:

```
<isinclude template="util/modules">
```
7. Invoke the `<isproducttile>` custom tag passing the product from the pipeline dictionary:

```
<isproducttile product="{dict.myProduct}"/>
```

8. Test the controller with an existing product: `JShowProduct-Start?pid= P0048`.
9. In the custom tag invocation, enable other attributes expected by the custom tag. Notice that a proper Digital script expression is required to specify true or false:

```
<isproducttile product="{dict.myProduct}" showswatches="{true}"
showpricing="{true}" />
```

10. Test the `JShowProduct` controller.



## Lesson 5.4: Conditional Statements and Loops

Most programming languages use the keywords *if*, *else if*, and *else* for conditional statements. Commerce Cloud Digital uses similar keywords, but adds *is* to the beginning of the syntax:

```
<isif condition="{ISML expression evaluated}">
  Do something here if true.
<elseif condition="{check another condition}">
  Do something if this one is true.
<elseif>
  If none of the above conditions are true, do this.
</isif>
```

### Using Conditional Statements

1. To use a conditional statement in an ISML template:
  - a. Determine the location on your ISML page where you want to write your conditional statement.
  - b. Open your conditional statement with the `<isif condition="">` tag.

Example:

```
<isif condition="{dict.myProduct.online}">
  Product is online
<elseif>
  Product is offline
</isif>
```

### Loops

With `<isloop>` you can loop through the elements of a specified collection or array. For example, you can list data such as: categories, products, shipping and payment methods. You can nest `<isloop>` statements.

You can use the following supporting tags with `<isloop>`:

- Use the `<isbreak>` tag within a loop to terminate a loop unconditionally. If used in a nested loop, it terminates only the inner loop.

- Use `<isnext>` to jump forward within a loop to the next list element of an iterator. This tag affects only the iterator of the inner loop. If an iterator has already reached its last element, or an iterator is empty when an `<isnext>` is processed, the loop is terminated instantly.

The full syntax for using the `<isloop>` tag is:

```
<isloop
  iterator|items = "<expression>"
  [ alias|var = "<var name>" ]
  [ status = "<var name>" ]
  [ begin = "<expression>" ]
  [ end = "<expression>" ]
  [ step = "<expression>" ]>
...do something in the loop using <var_name>...
</isloop>
```

The attributes have the following usage:

Attribute	Description
<code>items</code> ( <code>iterator</code> )	Expression returning an object to iterate over. Attributes <i>iterator</i> and <i>items</i> can be used interchangeably.
<code>var</code> ( <code>alias</code> )	Name of the variable referencing the object in the iterative collection referenced in the current iteration.
<code>Status</code>	Name of the variable name referencing loop status object. The loop status is used to query information such as the counter or whether it is the first item.
<code>Begin</code>	Expression specifying a begin index for the loop. If the begin is greater than 0, the <code>&lt;isloop&gt;</code> skips the first x items and starts looping at the begin index. If begin is smaller than 0, the <code>&lt;isloop&gt;</code> is skipped.
<code>End</code>	Expression specifying an end index (inclusive). If end is smaller than begin, the <code>&lt;isloop&gt;</code> is skipped.
<code>Step</code>	Expression specifying the step used to increase the index. If step is smaller than 1, 1 is used as the step value.

For the `status` variable, the following properties are accessible:

Attribute	Description
<code>Count</code>	The number of iterations, starting with 1.

<b>Index</b>	The current index into the set of items, while iterating.
<b>First</b>	True, if this is the first item while iterating (count == 1).
<b>Last</b>	True, if this is the last item while iterating.
<b>Odd</b>	True, if count is an odd value.
<b>Even</b>	True, if count is an even value.

For example, if the `<isloop>` tag declares a `status="loopstate"` variable, then it is possible to determine the first time the loop executes by using: `<isif condition="loopstate.first">`.

Another example of `<isloop>` tag is:

```
<isloop items="${order.object.shipments}" var="Shipment" status="loopState">

<isif condition="${loopState.count} >= (pdict.OrderPagingModel.pageSize + 1) ">
    <isbreak/>
</isif>
    <isif condition="${loopState.count==0}">
        <isnext/>
    </isif>
    ${loopState.count}
    ${loopState.index}
    ${loopState.first}
    ${loopState.last}
    ${loopState.even}
    ${loopState.odd}
</isloop>
```



### Exercise: Creating a JBasket JavaScript Controller and Using a Loop in ISML

1. Review the script API (The instructor will help you with this and visit the package `dw.order`).
2. In this package find the class named `BasketMgr` and property named `currentBasket`. Study what it does. You are going to use it in your code.
3. Create a JavaScript controller named `JBasket.js`
4. Copy and paste the following template and complete instructions described in the comment.

```
var ISML = /* get ISML object from dw.template package */
var guard = require('storefront_controllers/cartridge/scripts/guard');
var BasketMgr = /* get BasketMgr from dw.order package */
```

```
function start() {
    var basket=BasketMgr.currentBasket;

    /*use ISML to display basket on Basket. The rendered ISML should be
    showBasket.isml (Use the quickcard section "Giving control to ISML" for
    help*/
}
exports.Start = guard.ensure(['get'], start);
```

5. Create an ISML named `showBasket.isml` under `templates/default` folder.

6. Copy and paste the following code in the ISML to display the contents of the basket.

```
<br/>
<isloop
items="{pdict.Basket.allProductLineItems}" var="productLineItem">
  ${productLineItem.product.name}<br/>
</isloop>
```

7. Open a browser to your storefront. Add products to the cart first, including a product with an option (like a TV warranty).

8. Open another browser tab and invoke the `Basket-Start` controller.

9. Add a `status` attribute in the `<isloop>` tag so that you can see what the `count` and `index` parameters return.

10. Replace the `allProductLineItems` property of the basket with the method `getProductLineItems()`.

11. Execute the code (Navigate to storefront>add /default/JBasket-Start at the end of the URL)





## Knowledge Check

Question		Answer
1.	What ISML tag is used to create a variable?	
2.	What ISML tag is used to format output to a page?	
3.	What ISML tag is used to include a local template?	

## Module 6: Content Slots

### Learning Objectives

After completing this module, you will be able to:

- Create content slots for products and images.
- Use rendering templates with content slots.
- Configure content slots.

### Introduction

A content slot is an area on the page where a merchant defines content to display based on certain qualifiers or rules.

A content slot is used to show different types of content:

- One or many **products** selected by the merchant
- **Category attributes** (images or other visual)
- **Content assets** from the content library
- **Static HTML** and images from the static library

To view a content slot, use the **Storefront Toolkit > Content Information** tool. Hover the mouse pointer around the page to reveal where content slots exist and to access a link to the slot's configuration page in Business Manager.

There are several types of content slots:

- **Global slots** can appear on any page.
- **Category slots** appear on category-specific pages since they depend on the category ID.
- **Folder Slots** – appear in content library folders dependent on the folder ID.

There are many rules that drive the appearance of a slot: marketing campaigns, ranks, AB tests, customer groups, etc. Campaigns and A/B testing are out of the scope of this course.

### Content Slots vs. Content Assets

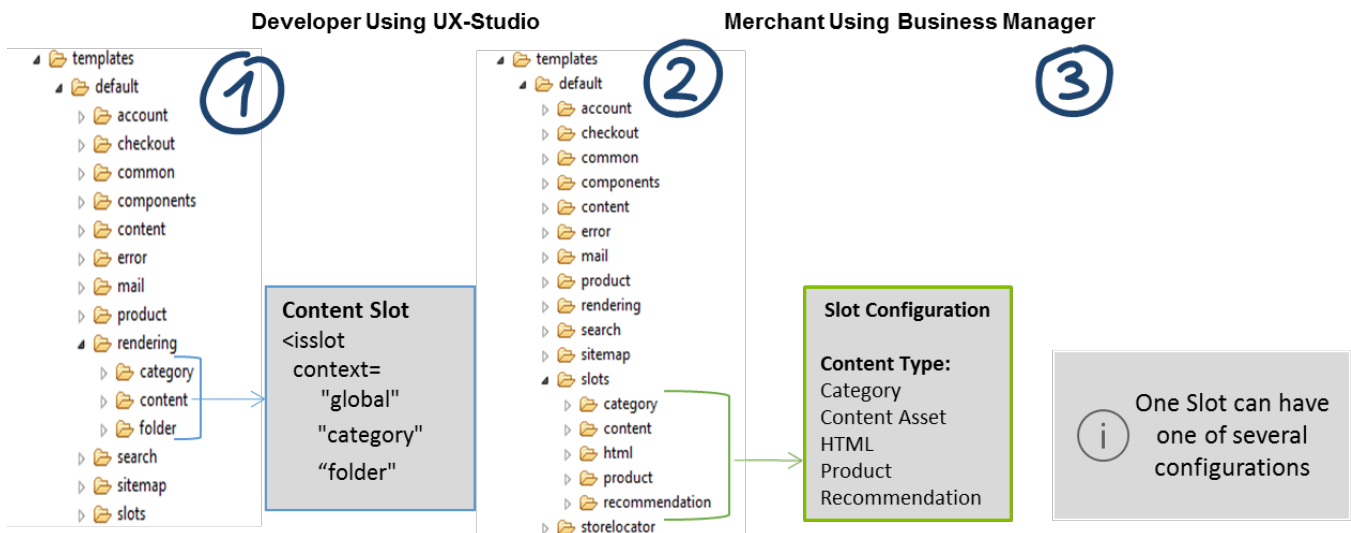
Slots are controlled by campaigns: start/end dates, customer groups, source codes, coupons and rank are qualifiers that affect the appearance of a slot. Content Assets are reusable elements that do not have qualifiers. Content slots and content assets are managed in different areas within Business Manager. Slots are a marketing tool, therefore configuration information for content slots reside in **Site > Online Marketing > Content Slots**; content assets are in the Content module.



### Lesson 6.1: Creating & Configuring Content Slots

Creating a content slot requires a collaborative effort:

- The developer inserts a `<isslot>` tag in a template in the location where the slot will appear.
- The developer creates a rendering template for the slot that defines how the slot data is to be presented.
- The merchant creates a configuration for the slot in Business Manager.



## Creating Content Slots - Developer Tasks

You create a content slot inside a template using the `<isslot>` tag. The tag must be located exactly where it should appear on the page. Here are some examples of tag usage:

Global slot example:

```
<isslot id="header_banner" description="..." context="global"/>
```

Category slot example:

```
<isslot id="category_top_featured" context="category" description="..."
context-object="{pdict.ProductSearchResult.category}"/>
```

Folder slot example:

```
<isslot id="fldr-landing-slotbanner" context="folder" description="Large
Folder Landing Banner"
context-object="{pdict.ContentSearchResult.folder}"/>
```

Whenever the template is saved, the new content slot automatically displays in the list of slots under **Site > Online Marketing > Content Slots** (this occurs because Commerce Cloud Digital scans any template for the use of the `<isslot>` tag).

## Creating the Slot Rendering Template

The slot displays the type of content out of four possible types. The developer creates a rendering template that takes into account the **type of content**, how many objects to display, plus any CSS styling required for the slot.

The `header_banner` slot uses the `htmlslotcontainer` template as the rendering template:

```
<iscache type="relative" hour="24"/>
<div class="htmlslotcontainer">
  <isif condition="{slotcontent != null}">
    <isloop items="{slotcontent.content}"
      var="markupText">

<isprint value="{markupText.markup}"
encoding="off"/>
</isloop>
  </isif>
</div>
```

### Using `slotcontent` and `<isprint>` in Rendering Templates

Every slot is rendered by a system pipeline inside the core cartridge: `_SYSTEM_Slot-Render`. You do not have access to this pipeline. It uses the slot configuration that the merchant creates and provides all the configuration information to the rendering template by means of the `TopLevel.global.slotcontent` constant. Only slot rendering templates get data via this constant.

The rendering template code checks that the `slotcontent` is not empty:

```
<isif condition="{slotcontent != null}">
Then it loops through the slotcontent.content (the content provided for
the slot):
<isloop items="{slotcontent.content}" var="markupText">
  <isprint value="{markupText.markup}" encoding="off"/>
</isloop>
```

Inside the loop the code uses the `<isprint>` tag:

```
<isprint value="{markupText.markup}" encoding="off"/>
```

**Note:** For more information on the `<isprint>` tag in detail, there is extensive documentation and usage examples for it in SiteGenesis.

Using the `encoding="off"` setting enables the HTML snippet to be generated without encoding, so that the browser renders it correctly.



### Exercise: Create a Slot

Create a banner slot containing an image on the `nohits.isml` template. This template displays when a search does not return any products.

1. Use the storefront search box and search for a product which does not exist.
2. Investigate which template is used to generate that page (which tool would you use to find that out?).

3. Copy the found template from the storefront cartridge to the exact same location into your cartridge.
4. Before the `no-hits-footer` div, add a global slot:

```
<isslot id="search-no-hits-banner"
description="recommendations banner for search no results page"
context="global" />
```
5. Study the `htmlslotcontainer.isml` rendering template that is used to render HTML-type slots.

### Creating Content Slot Configurations - Merchant Tasks

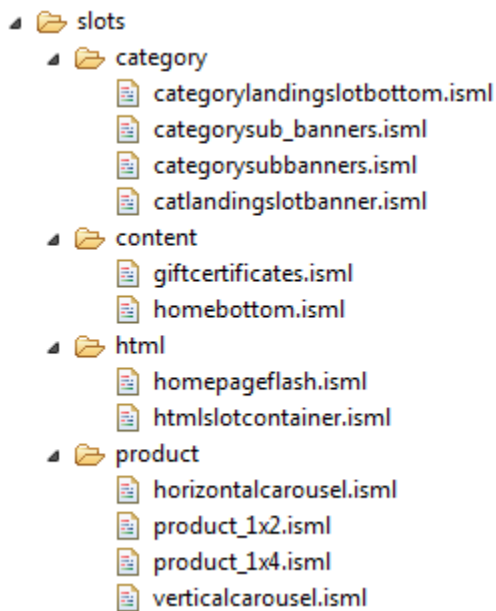
Merchants create content slot configurations by navigating to **Site > Online Marketing > Content Slots** and locating the specific slot that the developer created, e.g. `header-banner`. The merchant can select an existing configuration or click **New** to create a new one.

The merchant selects the type of content, for example, Product or HTML. Different fields display depending on the content type selected, for example:

- For a Product content slot, the **Product** field displays and the merchant enters the IDs of the products to be displayed. The merchant then selects one of the templates designed to display products from the **Template** drop-down menu.
- For an HTML content slot, an **HTML** text area displays and the merchant enters the HTML content. The merchant then selects one of the templates designed to display HTML from the **Template** drop-down menu.

The **Template** menu contains all possible rendering templates that are available in all cartridges in the cartridge path for this content type. The SiteGenesis storefront cartridge comes with default templates for every type of content. The templates are located in specially named folders that Business Manager discovers by default (for example, `slots/html` for the HTML type).

Here is the directory structure for the slot rendering templates in the SiteGenesis storefront cartridge:



The merchant can choose to reuse an existing rendering template or use a new one as instructed by the developer. This is why the collaboration between merchant and developer is important—without a rendering template, there is no way to visualize the slot.

The merchant also provides a schedule for the slot. This is either the default schedule or based on a marketing campaign.



## Lesson 6.2: Using Content Link Functions

Commerce Cloud Digital uses attributes of type HTML in many places: content assets, content slots with HTML-type content, product descriptions, etc. You can also add an attribute of type HTML to any system object where you may need to show HTML. These attributes are represented by the class `dw.content.MarkupText`.

**Note:** When using HTML in content assets or content slots, avoid hardcoding hyperlinks to pages or images in the storefront. They are instance-specific (e.g., Staging) and would have to be changed every time after a replication. Instead, Digital offers the following Content Link Functions for use in attributes of type HTML:

- `$staticlink$` - Creates a static link to an image.
- `$url()` - Creates an absolute URL that retains the protocol of the outer request.
- `$httpUrl()` - Creates an absolute URL, with the http protocol.
- `$httpsUrl()` - Creates an absolute URL, with the https protocol.
- `$include()` - Makes a remote include call (relevant for caching purposes).

Here is an example of a function that creates a hyperlink to the `Page-Show` controller passing `cid=2-day-shipping-popup` in the query string:

```
href="$url('Page-Show', 'cid', '2-day-shipping-popup')$"
```



### Exercise: Create a Slot Configuration

Complete the configuration for the content slot created previously.

1. In Business Manager, select **Site > Online Marketing > Content Slots**.
2. Locate the new `search-no-hits-banner` slot in the global section. Create a new configuration for the slot.
3. Provide an ID: `banner-for-everyone`.
4. Enable it.
5. Make it the default.
6. Select HTML for the content type.
7. In the HTML editor:
  - a. Click the Insert/Edit Image icon.
  - b. Click **Browse Server**.
  - c. Locate the `/images/slot/` directory and select it.
  - d. On the Upload File section, find the `nohits.png` image in the `contentslot` cartridge, `static/default` folder, and upload it.
  - e. After uploading, select the image.
  - f. The generated HTML should look like this:
 

```
<p></p>
```
8. Select `slots/html/htmlslotcontainer.isml` as the rendering template for the slot.
9. Click **Add Schedule > Default Schedule** to ensure that the slot displays continuously.
10. Click **Apply** to save the configuration.
11. Test the slot by searching for some non-existent product: the `nohits` page should display with the new slot visible.



## Knowledge Check

Question	Answer
1. What contexts of content slots can you create?	
2. Can a slot be created in Business Manager?	
3. How does <code>&lt;isprint&gt;</code> preserve the markup of an HTML slot?	
4. Where can <code>&lt;isslot&gt;</code> be placed in templates?	

### Demo: Create a Slot with a Rendering Template for a Vertical Carousel of Products

Create a content slot in the `nohits.isml` that displays some products selected by a merchant. The components involved will be: a rendering template, a style sheet, an ISML that has the content slot and finally an ISML to link to the style sheet.

1. Open the `nohits.isml` template in your cartridge. This is the page which shows up when the product that the customer searches is not found.
2. Below the search-no-hits-banner slot, add another global slot: `<isslot id="merchant-products" description="content for search no results page" context="global"/>`
3. Create a directory structure so that you have slots/product folder as follows.

```
training/cartridge/templates/default/slots/product
```

4. Copy the `verticalcarousel.isml` from storefront to exactly the same location in the training cartridge. This is the rendering template that you are going to modify.
5. Rename this `verticalcarousel.isml` in the training cartridge to `verticalcarouselx4.isml`
6. Modify the carousel to match the following code:

```
<iscontent type="text/html" charset="UTF-8" compact="true"/>
<iscache type="relative" minute="30" varyby="price_promotion"/>
<isinclude template="util/modules"/>
<h2>${Resource.msg('global.carousel.featuredproducts','locale',null)}</h2>
<
<div id="vertical-carousel">
  <ul>
    <li>
      <div class="productcarousel">
        <isloop items="${slotcontent.content}" var="product" status="status" >
```



```

<div class="analytics capture-product-id"><isprint
value="${product.getID() }"/></div>
        <isproducttile product="${product}"
showpricing="${true}"/>
        <isif condition="${status.count%4==0 &&
!status.last}">
            </div>
            </li>
            <li>
                <div class="productcarousel">
                    </isif>
                </isloop>
            </div><!-- END: productcarousel -->
        </li>
    </ul>

    <a class="jcarousel-prev" href="${'#'}"></a>
    <a class="jcarousel-next" href="${'#'}"></a>

</div>

<!-- END: verticalcarousel -->

```

7. Create a template named `pt_productsearchresult_UI.isml` in the following location in the training cartridge: `training/cartridge/templates/default/search`

8. Add the following line to point to a new CSS file that redefines the vertical carousel styling.

```

<link href="${URLUtils.staticURL('/css/verticalcarouselx4.css')}" type="text/css"
rel="stylesheet"/>

```

9. Copy the provided `verticalcarouselx4.css` file to

`/static/default/css/verticalcarouselx4.css` in your cartridge (create the directory structure if it is not there).

10. Copy the `pt_productsearchresult_nohits.isml` from the storefront cartridge into your cartridge to the same location (create the folder structure if it is not present).

11. The event handler for our buttons is in the Namespace named `storefront`. So modify the script block to match the following:

```

<isscript>
    var pageContext = {
        title: 'Product Search Results No Hits',
        type: 'storefront',
        ns: 'storefront'
    };
</isscript>

```

12. In Business Manager, select **Site > SiteGenesis > Online Marketing > Content Slots**.

13. Search for the `merchant-products` slot. Create a new slot configuration for this slot so that it displays multiple products using the new `verticalcarouselx4.isml` rendering template. The

rendering template will have to be chosen from the training cartridge. Make sure that you add some products rather than the HTML (unlike you did in one of the previous exercise).

14. Go to the storefront from Business Manager in the browser. Search for some non-existent product like `MyBestPants`.
15. Verify that the `nohits.isml` shows both the previous banner and multiple products in a vertical carousel.

## Module 7: Commerce Cloud Digital Script

### Learning Objectives

After completing this module, you will be able to:

- Describe the Commerce Cloud Digital Script syntax.
- Describe the Digital Script API packages.
- Use Digital Script in ISML.
- Debug Digital Script in UX Studio.
- Use the Resource API and resource bundles.

### Introduction

Commerce Cloud Digital Script (Digital Script) is the server-side language used for coding in Commerce Cloud Digital.

- It is based on JavaScript, which is standardized as ECMAScript. It implements ECMA-262 and the ECMA-357 standard, also known as ECMA for XML or E4X.
- It supports all JavaScript language extensions by Mozilla known as JavaScript 1.7 as well as optional type specification (from JavaScript 2.0/ECMA 4th edition proposal and ActionScript).

Use Commerce Cloud Digital Script to access data about the system, such as: products, catalogs, prices, etc. You write Digital Script in controllers and in ISML templates for expressions or inside `<isscript>` tags.

### ISML

```
<isscript>
  var cat = pdict.ProductSearchResult.category;
  var path = new dw.util.ArrayList();
  while( cat != null && cat.parent != null )
  {
    if( !cat.online )
    {
      cat = cat.parent;
      continue;
    }
    path.addAt( 0, cat );
    cat = cat.parent;
  }
</isscript>
```



### Lesson 7.1: Commerce Cloud Digital Script API

Each new Digital update includes a well-documented API. The Script is available under the Studio Help menus. The ISML documentation is available in the Digital documentation.

Salesforce continually updates clients to the latest version. Deployments happen globally on Tuesday and Thursday between 2 and 7 am local POD time. The current version number displays at the bottom of the Business Manager screen and it corresponds to *Year.Deployment*, for example, version 17.4 represents the fourth deployment in 2017.

Salesforce provides access to Preview releases by updating sandboxes prior to updating the PIG instances. This gives your organization an opportunity to test any new API updates and other customizations on your site prior to using that update in production. For more information, refer to the Global Release Process FAQ <https://xchange.demandware.com/docs/DOC-1815>.

The Global Release Process ensures that all Salesforce clients stay on the same version of code and that updates containing defect corrections as well as new functionality can be applied uniformly with minimal down time.

## API Packages

The Digital Script API is organized in packages, just like Java. Unlike Java, inheritance is not possible from these classes or packages when you create a script. You can only use the properties and methods of these classes in your scripts.

In Commerce Cloud Digital Script, the `TopLevel` package is the default package. It is similar to `java.lang` in Java. It does not need to be imported in scripts. It provides standard ECMAScript classes and extensions, such as: `Error`, `Date`, `Function`, `String`, `Math`, `Number`, `XML`.

The `TopLevel.global` class contains many of the common constants, and properties used in scripts. Some properties are: `customer`, `request` and `session`.

**Note:** In the following packages there are many classes that end with `Mgr` (e.g., `dw.catalog.ProductMgr`). These classes **retrieve instances of business objects related to the package they belong to**. For example, use `ProductMgr.getProduct(String id)` to get a product using a unique identifier. The method returns a `Product` instance which you can use to find information about the product. This pattern is repeated for all Managers.

eCommerce API Packages	
<code>dw.campaign</code>	For campaign and promotions Classes: <code>PromotionMgr</code> , <code>Campaign</code> , <code>Promotion</code> , <code>SourceCodeGroup</code> , etc.
<code>dw.catalog</code>	For catalog, product, and price book Classes: <code>CatalogMgr</code> , <code>Category</code> , <code>Product</code> , <code>Recommendation</code> , <code>PriceBook</code> , etc.
<code>dw.content</code>	For non-product content management Classes: <code>ContentMgr</code> , <code>Content</code> , <code>Folder</code> , <code>Library</code> , etc.

dw.customer	<p>For customer profile and account</p> <p><b>Classes:</b> CustomerMgr, Customer, Profile, ProductList, OrderHistory, etc.</p>
dw.order	<p>For orders, including: basket, coupons, line items, payment, shipment</p> <p><b>Classes:</b> Basket, Order, ProductLineItem, ShippingMgr, TaxMgr, etc.</p>

Generic API Packages	
dw.crypto	Encryption services using JCA; DES, Triple-DES, AES, RSA, etc. Classes: Cipher, MessageDigest
dw.io	Input and output Classes: File, FileReader, CSVStreamReader, XMLStreamReader, etc.
dw.net	Networking Classes: FTPClient, HTTPClient
dw.object	System base classes and custom objects Classes: PersistentObject, ExtensibleObject, CustomObjectMgr, etc.
dw.rpc	Web services related APIs Classes: WebReference, Stub
dw.system	System functions Classes: Site, Request, Session, Logger
dw.util	Similar to the java.util API: collections, maps and calendar classes
dw.value	Immutable value objects Classes: Money, Quantity
dw.web	Web-processing Classes: URLUtils, Forms, Cookie, HttpParameterMap, etc.

## Using Commerce Cloud Digital Script in ISML

You can embed Commerce Cloud Digital Script into ISML by using the `<isscript>` tag. This example uses Digital Script to get the root category of a current site's navigation catalog and the category named 'sale'.

```
<iscomment>
    This template displays a 3-level category tree as top navigation.
    Only categories marked with showInMenu are shown.
</iscomment>

<isscript>
    // get root category of current site's navigation catalog
    var siteCatalog = dw.catalog.CatalogMgr.getSiteCatalog();
    var root = null;
    if(siteCatalog!=null) {root = siteCatalog.getRoot();}

    // get the "sale" category
    var saleCategory = dw.catalog.CatalogMgr.getCategory('sale');
</isscript>
<isif condition="{Root != null}">
<div class="categorymenu">
```

Inside of the `<isscript>` tag you can fully qualify every class you want to use or you can import any packages at the top of the script:

```
<isscript>
  var CatalogMgr=require('dw.catalog.CatalogMgr'); get smart quotes out.
  var siteCatalog = CatalogMgr.getSiteCatalog();
  ...
</isscript>
```



### Exercise: Use Commerce Cloud Digital Script in ISML

1. Create a new JavaScript controller called `JDScript`.
2. Create a new ISML template named `dscript.isml` and display it using the controller.
3. Using the `dw.customer.CustomerMgr` class, print the registered customer count.
4. Test your controller in the storefront.

### Calling a script with JavaScript Controller

A script can be invoked by using 'require' to get Script and then invoking method on it. For example the following piece of code can invoke the script method `doJobForMe (...)`

```
var myModel = require('~cartridge/scripts/MyModel');
var co=myModel.doJobForMe(takeThisObject);
```

`~` indicates the current cartridge from where the script is being invoked. If the script is invoked from some other cartridge then the cartridge still has to be in the cartridge path and it has to be mention in the `require` statement as well.



### Exercise: Calling a Script from the JShowProduct JavaScript Controller

1. You can keep a backup copy of the `JShowProduct` that you previously created.
2. Copy `jsolutions/cartridge/scripts/ProductFinder.js` to your training cartridge in the same location.
3. In the present controller, remove all the previous code and copy and paste the following template

```
'use strict';
/** @module controllers/JShowProductCallingScript */
```

```
var ISML = require('dw/template/ISML');
var guard = require('storefront_controllers/cartridge/scripts/guard');
/*
```

Use the quickcard section "Invoking a Script". Use that as a help to complete the following code to use the script named `ProductFinder` from the scripts folder.

```
var ProductFinder= ...require
```

```

*/
function start() {
  var parameterId = request.httpParameterMap.pid.stringValue;;
  //var product = ProductMgr.getProduct(parameterId);

  var product=/* Use the quickcard section “Invoking a Script” again to invoke the
method on ProductFinder */

  if (product==null) {
    ISML.renderTemplate(
      'productnotfound.isml',
      {
        Log:'product with id '+parameterId+' not found'
      }
    );
  }
  else{
    ISML.renderTemplate(
      'productfound.isml',
      {
        myProduct:product
      }
    );
  }
}
exports.Start = guard.ensure(['get'], start);

```

4. If not done already, modify your `productnotfound.isml` template so that it displays the contents of the `Log` as follows:

```

${pdict.Log}

```

5. Test your controller. Verify that the product name appears as before and check the error path as well.



### Lesson 7.3: Script and JavaScript Controller Debugging

UX Studio enables you to debug scripts and controllers. To use the script debugger you must first create a script debug configuration. The process for creating a script debug configuration is identical to the pipeline debug configuration setup. To use the debug configuration, you need to add breakpoints in your script files.

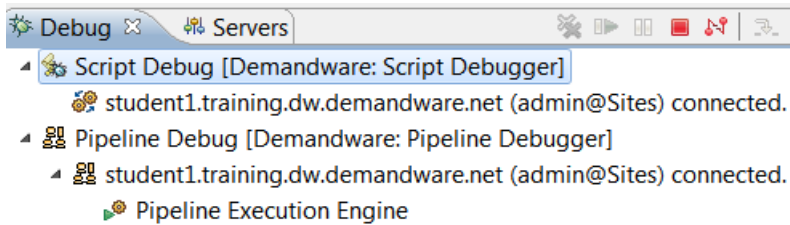


```

19 function handleForm() {
20     var TriggeredAction = request.trigg
21     response.getWriter().println('Hel
22     if ( (TriggeredAction != null) &&
23         //response.getWriter().println(
24         ISML.renderTemplate('newsle
25         CurrentForms    · sessi

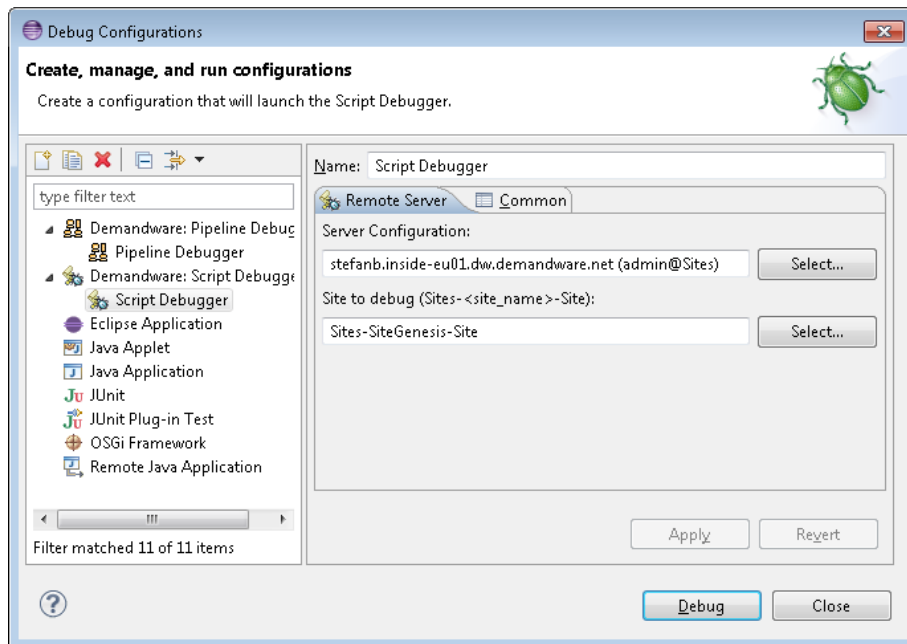
```

When debugging, it is possible to run the script debugger along with the pipeline debugger.



### Exercise: Create a Script/Controller Debug Configuration

1. In UX Studio, find the menu to create debug configurations.
2. Double-click **UX Studio: Script Debugger** to create a new configuration.
3. Complete the dialog as follows. Click **Select** to select your server and site.



4. Click **Debug** and change to the **Debug** Perspective.
5. Open the `JShowProduct` controller you previously created.
6. Put a breakpoint in the first executable line inside the controller's `start()` function: double-click the gray border to the left of the highlighted line. The breakpoint display has a blue dot.

```

9 function start() {
10     var parameterMap = request.httpParameterMap;
11     var parameterId = parameterMap.pid.stringValue
12     var product = ProductMgr.getProduct(parameterId);
13     if (product==null) {

```

7. Refresh the controller's invocation on the browser to hit the breakpoint (**F5**).
8. The debugger stops at the breakpoint.
9. Debug the script.
10. Check the **Variables** window to determine the `args` that are coming into the `execute()` function.
11. Use **F5** to execute the line.
12. Study the `output` variable which has the product: it should not be `null`.
13. Execute through the end of the controller (**F8**). The product name should display in the browser.
14. Fix any errors that you may have found, or just continue.
15. Debug the controller again, but this time use an invalid product ID in the URL.
16. Change the `product` URL parameter on the browser to a non-existing product.
17. After the breakpoint, verify the `output` variable holding the product: it should be `null` in this case.
18. Execute through the end of the controller.



## Lesson 7.4: Resource API and Resource Bundles

In storefront code, avoid hard-coding text strings that become visible to the user. Titles, labels, messages, button and field names should all be externalized by using resource bundles (a.k.a. properties files.). If you do not want to duplicate ISML templates in order to create locale-specific templates, you can use resource bundles to keep your template generic and reusable.

A resource bundle is a file with a `.properties` extension that contains the hardcoded strings to be used in ISML templates. In SiteGenesis bundles are loosely named by the functional area where the strings are used, but you can use any file name and organization you want.

**Note:** Property files can be suffixed by `Bundlename_<<locale_id>>.properties` where `<<locale_id>>` stands for a specific locale term **other than the default locale**. For example, “de” or “en” (or locale plus country like “de\_DE” or “en\_GB”).

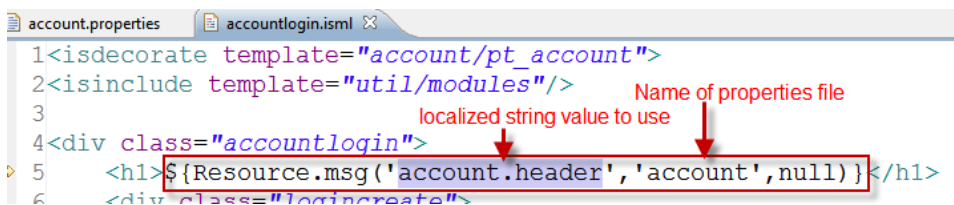
```

account.properties
1account.header=My Account
2account.sendfriend=Send to a Friend
3account.sendlisttofriend=Send my List to a Friend
4
5#####
6# ISML Directory: account/
7#####
8accountoverview.welcome=Hello
9accountoverview.welcome2=, Welcome Back
10accountoverview.not=Are you not
11
12accountredirect.title=Redirect
13accountredirect.permanent=This account has been
14accountredirect.accountlogin=login page.
15account.forbidden=This page has timed out. You
16
17#####
18# ISML Directory: account/addressbook/
19#####
20editaddress.editaddress=Edit Address
21editaddress.addaddress=Add Address
22editaddress.defaultaddress=Default Address

```

The resource bundles contain **key=value** pairs where the key might be compound (`key.subkey`) and the value is a hard-coded string that uses Java MessageFormat syntax to implement parameter replacement. Bundles are stored in each cartridge within the `/templates/resources` directory.

Strings from the bundles are accessible to all ISML templates via the `dw.web.Resource.msg(key : String , bundleName : String , defaultMessage : String )` method:



```

accountlogin.isml
1<isdecorate template="account/pt_account">
2<isinclude template="util/modules"/>
3
4<div class="accountlogin">
5  <h1>${Resource.msg('account.header', 'account', null)}</h1>
6  <div class="logincreate">

```

Notice that the second parameter points to the `account.properties` file, which may be overridden by another cartridge in the cartridge path. The **null** in the third parameter means that the key itself will be used whenever that key is not found in any resource bundle. Instead of the `null` you can also show a string to display on the storefront in case the key could not be found.

Another useful method is the `dw.web.Resource.msgf(key : String , bundleName : String , defaultMessage : String , args : Object ...)`. Using this method, you can specify a key with placeholders which can be dynamically replaced by the parameters specified in the `args` argument of the method. For example, this usage of the method:

```

${Resource.msgf('singleshopping.wishlist', 'checkout', null,
owners.get(addressKey).profile.firstName )}

```

will be paired with the following Java MessageFormat definition in the resource bundle to allow the first name of the wishlist's owner to show up as **Stefan's Wishlist**:

```

singleshopping.wishlist={0}\'\s Wishlist

```



## Knowledge Check

Commerce Cloud Digital Script Review Questions	True	False
You have to mention the cartridge name when requiring a script from another cartridge into a script file		
If cartridgeA invokes a script from cartridgeB, cartridgeB does not need to be in the cartridge path		



## Exercise: Use a Resource Bundle in the Commerce Cloud Digital Script in JavaScript Controller

**Goal:** Modify the `GetProduct` script and ISML to use an externalized string instead of a hardcoded string.

1. Open `controllers/JShowProduct.ds`. Inside this controller, after checking if the product is null, add the following line of code to pick up a string `productnotfoundMsg` from the resource bundle named `myBundle.properties`:

```
var errorMsg=dw.web.Resource.msgf('productnotfoundMsg', 'myBundle', null,
parameterId);
```

2. Using the quickcard as a guide (section “Giving control to ISML”), edit the next line to use the ISML to render the template `productnotfound.isml` and pass the JSON code `{message:errorMsg}`.
3. Create a file `/templates/resources/myBundle.properties` with the following content (create the folder structure if not already there).

```
productnotfoundMsg=The product with the id {0} is not found
```

4. Create a file `/templates/resources/myBundle_fr.properties`.
5. Change the encoding of this file to UTF8 to support French characters.  
Right-click `myBundle_fr.properties` and change the default encoding to UTF-8.
6. In `myBundle_fr.properties` enter:

```
productnotfoundMsg = Le produit avec l'\''ID {0} ne est pas trouvé
```

7. In Business Manager, select **Site-SiteGenesis > Site Preferences > Locales**. Check ‘fr’ and click **Apply**.
8. Run the `ShowProduct` pipeline or `JShowProduct` controller as you have been running before. Your URL will be similar to:

<https://studentXX.training-na02.dw.demandware.net/on/demandware.store/Sites-SiteGenesis-Site/default/JShowProduct-Start?pid=452345>

Note: Replace the xx with your student id.

You should see the message of the product not being found in English language

9. In the URL, replace 'default' with 'fr'.
10. You should see the results in French.
11. Internationalize the product name. In Business Manager, select **Products & Catalogs > Products**.
12. Search for the product with id 'P0048'.
13. Click the product link and lock it for editing.

14. Notice that the name of the product in 'default' language is 'Laptop Briefcase with wheels (37L)'. Change Select Language dropdown to 'French'. The name entry will be now blank. Paste 'Laptop Briefcase avec des roues (37L)' without quotes in the name. Click Apply.
15. In your isml that displays your product (`productfound.isml`), enter the following to print the product name (remove the earlier text):

```
${Resource.msgf('productfoundMessage', 'myBundle', null, pdict.myProduct.name)}
```

16. In `templates/resources/myBundle_fr.properties` add the following:

```
productfoundMessage=Le nom du produit est {0}
```

17. In `templates/resources/myBundle.properties` add the following:

```
productfoundMessage=The product is found and the name is {0}
```

18. Run the `ShowProduct` pipeline or `JShowProduct` controller with the parameter `pid=P0048`. Your URL will be similar to:

<https://studentXX.training-na02.dw.demandware.net/on/demandware.store/Sites-SiteGenesis-Site/default/JShowProduct-Start?pid=P0048>

Note: Replace the XX with your student id.

You should see the product page with product name in English.

19. In the URL, replace 'default' with 'fr'.

You should see the results in French.

## Module 8: Forms Framework

### Learning Objectives

After completing this module, you will be able to:

- Describe the concepts and usage of the Commerce Cloud Digital Forms framework.
- Create a new form and implement it in a pipeline.

### Introduction

Commerce Cloud Digital provides tools to simplify form display and processing. Use the Digital Forms framework to control how consumer-entered values are validated by the application, rendered in a browser, and possibly stored on a server.

#### Template file

```
<isinputfield
formfield="{pdict.CurrentForms.preferences.interestApparel}"
type="checkbox">
<input type="submit" value="Submit"
name="{pdict.CurrentForms.preferences.subscribe.htmlname}">
```

#### Metadata file (preferences.xml)

```
<field formid="interestApparel"
label="forms.interestedinApparel" type="boolean"
binding="custom.intApparel"/>
<action formid="subscribe" valid-form="true"/>
```

Transition name (for Pipelines)  
Triggered Form Action (for JS Controllers)

#### Object

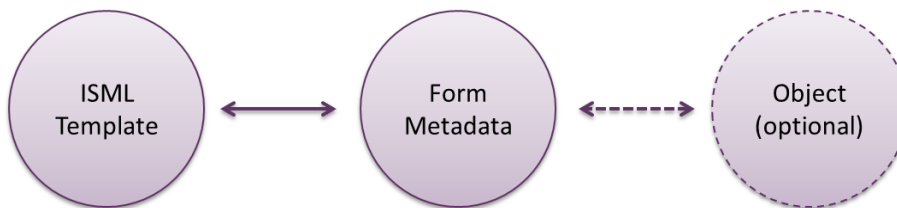


To use the DigitalForms framework, you need the following files:

- An xml form to define and store the metadata
- A pipeline or JS Controller that will validate and process the form
- A properties file that contains externalized form labels and possible error messages
- An ISML template that will display the form to the user

There are three objects that interact when working with Digital forms:

- XML metadata file: located in the `cartridge/forms/default` directory. It describes the fields, labels, validation rules and actions that apply when the field is used in an ISML template.
- ISML template: it uses the form metadata fields and actions to show an HTML form to the user.
- Object (optional): this object represents a single system or custom object in the `pdict`, and it can be used to pre-fill the metadata file as well as to store submitted form data to the database.



## Example

Given this form metadata XML file:

```

customeraddress.xml
<?xml version="1.0"?>
<form>
  <field formid="firstname" label="forms.custor
  <field formid="address1" label="forms.custome
  <field formid="city" label="forms.city.citie:
  <field formid="state" label="forms.state.stat
  <field formid="zip" label="forms.customeraddi
  <field formid="country" label="forms.country.
  <field formid="phone" label="forms.customerac
  <action formid="cancel" valid-form="false"/>
  <action formid="confirm" valid-form="true"/>
</form>
  
```

You can create this ISML template whose fields depend on the data from the form metadata.

First Name:	<input type="text" value="Patricia"/>	*
Address Line 1:	<input type="text" value="120 Presidential Way"/>	*
	<small>Street Address, P.O. Box</small>	
City:	<input type="text" value="Woburn"/>	*
State:	<input type="text" value="Massachusetts"/>	*
Country:	<input type="text" value="United States"/>	*
Phone:	<input type="text" value="781-756-3700"/>	
	<small>Format: XXX-XXX-XXXX</small>	

\* Indicates required field

[go back](#)

Optionally, a `pdict` object containing data from the database can be bound to the form metadata file, allowing it to be prefilled with data. This data would appear in the ISML template since it references the form fields.



### Manage Address "Work"

Fields with a red asterisk (\*) are mandatory.

#### Standard Address

Address ID:

Title:

Company:

Salutation:

First Name:

Second Name:

Last Name:

Suffix:

Address 1:



## Lesson 8.1: XML Metadata File

Identify the fields that a user will need to enter, and what actions can be taken when implementing a form. This information typically comes from a wireframe or a functional specification. Once the form fields are determined, create them in an xml form that will set the form field parameters and hold the data for the form.

The form metadata file uses the following xml elements:

Element	Description
form	Required: top level tag that contains all other elements inside <code>&lt;form&gt;...&lt;/form&gt;</code>
field	Required: Defines data field with many attributes (see table below)
options	Use as a child element inside a field to pre-fill multiple options like months, days, etc.
Option	Use as a child element inside an options element to specify a single option
action	Required: Defines a possible action the user might take on the form
Include	Allows inclusion of one form metadata definition into another
List	Allows inclusion of several items (i.e. collection of addresses) as a single field
Group	Allows grouping of elements to be invalidated together

The `field` element may use the following attributes:

Attributes	Description
<code>formid</code>	Required: unique ID to identify the field for ISML templates and controllers.
<code>Type</code>	Required: data type for field (see table below).
<code>label</code>	Usually a key to an externalized string in the <code>forms.properties</code> resource bundle.
<code>description</code>	Description for field, might be used in tooltips.
<code>min-length, max-length</code>	Restricts the field length for data entry.
<code>min, max</code>	Valid range for integer, number and dates.
<code>range-error</code>	Message shown if value provided does not fall within the specified range.
<code>regexp</code>	Regular expression for string fields: email, phone, zip code, etc.
<code>parse-error</code>	Message shown when the data entered does not match the regex. Usually a key to an externalized string.
<code>mandatory</code>	Field is required via server-side validation when true.
<code>missing-error</code>	Message shown if the primary key validation error is generated in a pipeline.
<code>value-error</code>	Shown if an element is invalidated in a pipeline.
<code>Binding</code>	Used to match <code>field</code> to a persistent object attribute.
<code>Masked</code>	Specify # of characters to mask.
<code>Format</code>	Format for display of dates, numbers, etc.
<code>whitespace</code>	Specify whitespace handling (none or remove).
<code>timezoned</code>	Optional flag for date objects (true or false).
<code>default-value</code>	Pre-defines a value for a field.
<code>checked-value</code>	Value when field is checked in a form.
<code>unchecked-value</code>	Value when field is unchecked in form.

Field types can be as follows:

Field type	Description
<code>string</code>	Use for text data.
<code>integer</code>	Use for numeric data like days, months.
<code>number</code>	Use for quantity fields.

boolean	Use with multiple-choice fields.
Date	Use this when timezoned or format are needed for dates.

Here is an example of a simple form metadata file:

```
<?xml version="1.0"?>
<form>
<field formid="fname" label="forms.contactus.firstname.label" type="string"
mandatory="true" binding="custom.firstName" max-length="50"/>

<field formid="lname" label="forms.contactus.lastname.label" type="string"
mandatory="true" binding="custom.lastName" max-length="50"/>

<field formid="email" label="forms.contactus.email.label" type="string"
mandatory="true" regexp="^[\\w-\\.]{1,}\\@([\\da-zA-Z-]{1,}\\.){1,}[\\da-zA-Z-]{2,6}$"
parse-error="forms.contactus.email.parse-error"
value-error="forms.contactus.email.value-error" binding="custom.email"
max-length="50"/>

<action formid="subscribe" valid-form="true"/>
</form>
```

In this example, the fields `fname`, `lname` and `email` store the information needed to send a newsletter to a non-registered user. The fields are:

- Mandatory
- Contain label keys that point to the `cartridge/templates/resources/forms.properties` file

The email field has an extra requirement. It uses a **regular expression (regexp)** to define what an acceptable email can be. Additionally, it specifies a `parse-error` key which matches an error message in the `forms.properties` file.

The action `subscribe` identifies the possible actions that a user may take on the form. The attribute `valid-form="true"` means that this form requires validation: 3 required fields plus a valid email format for the last one will be enforced on the server side.

**Note:** Although it is not a requirement, it is a best practice to use lower-case letters when naming your xml forms.



## Lesson 8.2: ISML Form Template

Define an ISML template with the same tags needed for a valid HTML form:

```
<form>...</form>
```

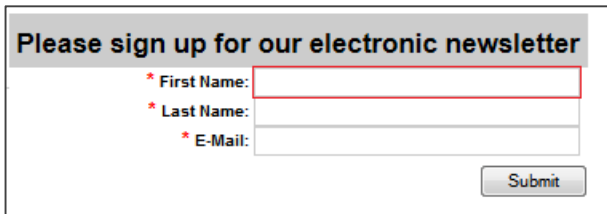
You can implement your own form action by specifying a controller URL, but that would circumvent the Forms framework.

`<form action="{URLUtils.continueURL()}" method="post">`The method `dw.web.URLUtils.continueURL()` ensures that the form gets submitted back to the controller that displayed the form template.

When creating input fields, use the object `pdict.CurrentForms.<form metadata file>.<formid>` to reference the specific `formid` in the form metadata. SiteGenesis has an `<isinputfield>` custom tag which facilitates the creation of form fields. For example, to show the `fname` field from the `newsletter.xml` file as a text field in an ISML template, use:

```
<isinputfield formfield="{pdict.CurrentForms.newsletter.fname}"
type="input">
```

The custom tag uses the `fname` `formid` from the metadata file and builds an HTML label using the `forms.properties` file to pull the text for the `forms.contactus.firstname.label` key. It also creates an HTML input field to the right of the label with the necessary client-side JavaScript to enforce required fields, as shown.



You can modify the behavior of the `<isinputfield>` tag since it is a custom tag implemented in the SiteGenesis cartridge.

The final requirement in the ISML template is to implement the button that matches the action in the form metadata. For this, create a standard HTML button with a `name` attribute that points to a specific action in the form metadata:

```
<input type="submit"
value="{Resource.msg('global.submit','locale',null)}"
name="{pdict.CurrentForms.newsletter.subscribe.htmlName}"/>
```

Here the `pdict.CurrentForms.newsletter.subscribe.htmlName` refers to the `htmlName` property of the action `subscribe` in the form metadata. In the debugger you can view the value of this property at runtime: `dwfrm_newsletter_subscribe`. This value identifies a specific action for a specific form, which is necessary when the controller determines which form action to process.



## Lesson 8.3: Pipeline Elements

A controller that uses the Digital Forms framework has a distinctive pattern that uses these elements:

- `ClearFormElement` function to clear an existing form object in the `pdict` using a specified form metadata file.
- `InvalidateFormElement` function invalidates the specified `FormElement`
- Use the ISML object to display ISML form, and to perform server-side validation.

To create a form using the form framework:

1. Create an xml metadata file that will hold your form data.
2. Create an ISML template that will display a form to a visitor.
3. Create a controller to display and process the form.



### Exercise: Use the Forms Framework

**Note:** Perform steps 1- 4, if you did not complete them from the previous exercise.

1. Define form metadata to store newsletter subscription data.
2. Study the fields and action in the `newsletter.xml` file from the `solutions` cartridge.
3. Save `newsletter.xml` into your cartridge at exactly **the same location** as in `solutions`.
4. Create `templates/resources/forms.properties` and externalize the keys in `newsletter.xml`. For example:  

```
forms.contactus.firstname.label=Enter your first name please.
```
5. Define a template to capture form data.
6. Study the use of the `<isinputfield>` custom tag in the `newslettersignup.isml` template in the `jsolutions` cartridge.
7. Study the use of the `URLUtils.httpsContinue()` method. What will this method accomplish in the context of the form action?
8. Save `newslettersignup.isml` from the `solutions` cartridge into your cartridge under similar directory structure (`templates/default/newsletter`).
9. Create a template to display the form values submitted.
10. Save `newslettersuccess.isml` from the `solutions` cartridge into your cartridge: this displays a “Thank you <fname> <lname> for signing up” under similar directory structure.

11. Create resource bundle `templates/resources/locale.properties` and externalize the keys used in `newslettersignup.isml` and `newslettersuccess.isml`.

For example:

```
global.newslettersignup=Please sign up for our newsletter
global.newsletterthanks=Thank you {0} {1} for signing up!
```

12. Create a JavaScript controller named `JNewsletter.js`. Copy code from `JNewsletter_exercise.js` into it. Follow the instructions in the comments to complete the code.
13. Adjust the links in `newslettersuccess.isml` to point to `JNewsletter` controller.
14. Execute the code.



### Knowledge Check

4.

Forms Framework Questions	True	False
The <code>&lt;isinputfield&gt;</code> is a custom tag used to populate form field attributes.		
<p>The following piece of code can display and submit a form</p> <pre>ISML.renderTemplate('registerForBenefits', {     displayForm : session.forms,     Subscription : co });</pre>		



## Exercise: Create Form Metadata on Your Own

To add rows, right-click in any cell and select **Insert Rows Above (or below)**.

In this exercise, you will capture customer interests related to categories and products on the site. You will just create the form interaction; Later, you will store this data in the profile system object.

1. Copy `cartridges/forms/default/newsletter.xml` from the training cartridge to `preferences.xml` in the same location. You will modify this form metadata file that captures marketing and personal information from a registered visitor. The modification must use the following:

Formid	Label	Data type	binding	Externalized Strings
interestApparel	forms.interestedinApparel	boolean	custom.interestApparel	Are you interested in Apparel ?
interestElectronics	forms.interestedinElectronics	boolean	custom.interestElectronics	Are you interested in Electronics ?
newsletter	forms.interestedinNewsletter	boolean	custom.newsletter	Are you interested in Newsletter ?

None of the choices are mandatory.

2. Add an `apply` action that does not require validation. You will not use this metadata until a later exercise.

## Module 9: Custom Objects

### Learning Objectives

After completing this module, you will be able to:

- Define custom objects and create instances programmatically.
- Use transactions to save the custom object in the database.
- Implement custom logging to allow debugging and error messages to be written to logs.

### Introduction

Previously, you created a simple form using an Interaction Continue Node. You validated the data being submitted, but did not store the data permanently. **Custom Objects (CO)** enable the data to be persistent.

Custom Objects extend the Commerce Cloud Digital data model. They are basically a new table in the database where you specify the primary key and storage attributes (columns) that suit your business needs.

**Note:** Always first consider if you can use a Digital System object (Product, Catalog, etc.) instead of creating a custom object. Although you can create custom objects, they are best used to store static data (like configuration parameters), not for uncontrolled amounts of data (like analytics). Custom objects searches can be slow if the data is large. You should consider data growth and cleanup in your Custom Objects. Commerce Cloud Digital Governance has quotas around custom object API usage and data size which will be enforced in the future.

### Custom Object Creation

You create custom objects at the organization level; therefore, they are available for use in all storefronts within the organization. You use two Business Manager modules to define and manage your custom objects:

- Custom Object Definitions: facilitates naming, primary key and column specification. It is located in **Administration > Site Development**.
- Custom Object Editor: facilitates instance creation and editing. It is located in **Site - <site> > Custom Objects > Custom Object Editor**.

When defining the Custom Object, specify the storage scope of the instances: site or organization.

- Organization Custom Objects can be used by any site.
- Site Custom Objects are created by one site and cannot be read by another.

The Custom Object type itself is always available to the entire organization. Also, you can specify if you want Custom Object instances to be replicable. This means you can copy them from Staging to Production during the replication process.



An example of Custom Object usage is a newsletter. Customers can sign up for it, but the platform does not have a system table to support. These subscriptions are intended for export since the platform should not be used for mass mailing campaigns. It is tempting to add the subscription data to the Profile system object, but this would imply that only registered users would be able to sign up. To enable anyone to get a newsletter, you need to define a Custom Object. This Custom Object should not be replicable, since subscriptions created in staging should not be copied to Production.

You also need to consider how to clean up Custom Objects once they have been exported or after a certain expiration period. This means the creation of a cleanup batch job that should run on a schedule.

Custom Objects can also store configuration parameters to integrate with external systems, avoiding the need to create multiple Site Preferences. These Custom Objects need to be replicable if the settings made in Staging are suitable for Production.

You can either create custom objects using Business Manager or programmatically. Before you can create a custom object instance you must first define the custom object data type in Business Manager.

### Creating a New Custom Object Type Using Business Manager

1. Log into Business Manager.
2. Select **Administration > Site Development > Custom Object Definitions**.
3. Click **New** to create a new Custom Object type.
4. Fill in the required fields for the Custom Object type:
  - ID:** the unique ID of the object type. It cannot contain spaces.
  - **Key Attribute:** This is the unique key for the custom object type.
  - **Data Replication:** Specify whether the custom object type data will be replicable to other instances.
  - **Storage Scope:** Specify whether the custom object type will be available for a site or for the entire organization.
5. Click **Apply**. The Attribute Definitions and Attribute Grouping tabs become available.
6. Click the Attribute Definitions tab. Notice the default values created with your Custom Object type. These values cannot be changed once they are created.
7. To create the attributes (values you wish to capture in the table), click **New**.
8. In the ID field, specify a unique name. In the Value Type drop-down, select the type of data being entered for the attribute.
9. Click **Apply**.
10. Click the **Back** button to add another attribute.

11. When you are finished adding attribute definitions, create an Attribute Group. Click the **Attribute Grouping** tab.
12. In the **ID** field, enter a name for your grouping. In the **Name** field, enter a name. Click **Add**.
13. Add field attributes to the group. Click the **Edit** link.
14. To the right of the ID field, click the ellipses to select field attributes.
15. Select the attributes you wish to add from the list by clicking in the checkbox next to each one. Click **Select**.

You can now view, add, and edit new instances of the custom object type you just created in the Custom Object Editor section.

### Creating a New Custom Object Instance Manually Using Business Manager

1. In Business Manager, select the site for which you want to manage custom objects.
2. Select **Custom Objects > Custom Object Editor**. The Manage Custom Objects page display.
3. From the drop-down list, select the custom object type that you wish to manage.
4. To create a new custom object, click **New**.
5. Enter data in each of the required fields. Click **Apply**.
6. You have now created a custom object. Click the **Back** button to exit the custom object editor.



### Exercise: Create a Custom Object Definition

Define a custom object to store the customer data gathered from your Newsletter form.

7. In Business Manager, select **Administration > Site Development > Custom Object Definitions**.
8. Create a new Custom Object type with the following attributes:
  - ID – NewsletterSubscription
  - Key Attribute – email, type String
  - Name of the Table - your choice
  - Data Replication – not replicable
  - Storage Scope – Site
9. Add the following attributes:
  - `firstName`, type String
  - `lastName`, type String
10. Create an attribute group for the `NewsletterSubscription` Custom Object:
  - Name: Presentation.

- Attributes: firstName, lastName and email

11. Select **Site - SiteGenesis > Custom Objects > Custom Object Editor**. Find the new `NewsletterSubscription` type and manually enter a new subscription.



## Lesson 9.1: Using Digital Script to Create Custom Object Instances

The Digital Script API provides the following classes in the **dw.object** package, among others:

- `CustomAttributes`: attributes defined by a user in Business Manager to extend a system object or Custom Object. Accessible via the syntax: `co_instance.custom.attribute`.
- `CustomObject`: represents an instance of a Custom Object.
- `CustomObjectMgr`: enables Custom Object instance creation.
- `PersistentObject`: enables persistent storage.
- `ExtensibleObject`: enables custom attributes to be added.

This is the inheritance tree for the `CustomObject` type:

```
Object > dw.object.PersistentObject > dw.object.ExtensibleObject >
dw.object.CustomObject (or dw.object.SystemObject)
```

Custom Objects persist in the database. An administrator or developer can add custom attributes added to them in Business Manager. Many commonly used classes such as `dw.catalog.Product`, `dw.system.SitePreferences` and many others share this inheritance tree. Objects of these class types are saved in the database and can be extended to store extra attributes.

The following use of the `CustomObjectMgr` class enables creation of an instance of a Custom Objects by providing the Custom Object type and the primary key:

```
CustomObjectMgr.createCustomObject("NewsletterSubscription", UUIDUtils.createUUID());
```

This creates an instance with a system-generated, unique PK. You could also use:

```
CustomObjectMgr.createCustomObject("NewsletterSubscription", args.email);
```

This assumes that the `args.email` value is a unique string every time a Custom Object is created. Otherwise, a duplicate PK error occurs.

### Database Transaction Handling

There are two approaches to database transaction handling in Commerce Cloud Digital:

- **Implicit** – The script automatically starts the transaction and then commits or rolls back if Commerce Cloud Digital determines it to be appropriate.
- **Explicit** – the transaction is controlled in the script. The developer explicitly indicates in the code when the transaction should begin, rollback, or commit.



## Exercise: Create a Custom Object Using a JavaScript Controller

Create a JavaScript controller named `JNewsletterV2.js`. Copy code from `JNewsletterV2_exercise.js` into it. Follow the instructions in the comments to complete the code.

1. Copy `MyModel.js` from the `JSolutions` cartridge to your training cartridge (in similar location) and study how it is creating the object.
2. Copy `newsletter/newslettererrorV2.isml` and `newslettererrorV2` from `JSolutions` cartridge into your cartridge in the similar location. Adjust the links in `newslettererrorV2.isml` to point to `JNewsletterV2.js` controller.
3. Execute the controller and see if objects are being created.



## Lesson 9.2: Custom Logging

Commerce Cloud Digital supports custom logging using log categories and severity levels as defined by the Apache log4j open source project.

Log4j supports multiple severities and categories of logging to enable the developer to capture debug messages at different levels of granularity. The severity levels are:

**Debug < Info < Warn < Error < Fatal**

If custom logging is enabled for a certain severity level, then it is enabled for higher severity levels as well (read from left to right). **Fatal and Error are always enabled and cannot be turned off.**

The developer can define as many levels of categories and subcategories as needed. Commerce Cloud Digital does not impose a certain categorization; the developer determines the organization. For example:

- `product`
- `product.import`
- `product.import.staging`

If logging is enabled for a category (such as `product`), all its subcategories are also enabled. For example, if Warn logging is enabled for `product`, then Warn, Error and Fatal errors are logged for `product` and all its sub-categories.

However, if Warn logging is enabled for `product` and Debug is enabled for `product.import`, then:

- Warn, Error and Fatal messages are logged for "product" and all its sub-categories.
- Debug and Info are logged for "product.import" and all its sub-categories.

To write to a custom log, you need to use the `dw.system.Logger.getLogger()` factory method. This method creates a `Logger` object for a specified category:

```
var logger = Logger.getLogger("logFilePrefix", "category" );
logger.debug("Input params received in pipelet
    firstName: {0}\n lastName: {1}\n email: {2}",
    args.firstName, args.lastName, args.email);

try
{
    ... do something...
}
catch (e)
{
    logger.warn("error description: {0}", e.causeMessage );
}
```

Use the `Logger` object to write a message for a specific severity level: `Logger.error(String msg)`.

The message uses the Java MessageFormat API, so you can specify placeholders. Typically, these messages are not localized since they are read internally by site administrators, but they can be.

### Enabling Custom Logging

In order to write to log files, you need to enable Custom Log Settings:

1. In Business Manager, select **Administration > Operations > Custom Log Settings**.
2. Create a log category. Enter it in the field under a given severity. Click **Add**.
3. Enable the checkbox next to the log category where you want to write. Click **Apply**.
4. Click Log Debug to File to enable debug messages to be written to a log up to 10 megabytes. Usually Debug and Info messages are written to memory only, and visible via the Request Log tool.
5. Run the pipeline you wish to debug.
6. In Business Manager, review the custom log file. Select **Administration > Site Development > Development Setup > Log Files**.
7. Open the log file that was just created. Search for the file by date. The custom log file name is similar to: `customdebug-177.aaq.demandware.net-appserverxxxxx.log`. However, if you gave a prefix while creating the log, the file name starts with `custom-<prefix name>`



### Exercise: Custom Logging in a JavaScript Controller

Modify the script from the Newsletter Subscription so that it writes debug messages to a log file, as well as error messages when a duplicate key is used.

1. Modify `MyModel.js` to Write to Debug Log.
2. Open the `scripts/MyModel.js` script.
  - a. Use the `require` to get `Logger` from `dw.system` package.
  - b. Copy `MyModel_exercise.js` and overwrite it to `MyModel.js`. Complete the template by following the comments. If you're unsure on how to complete it, use `MyModelWithLogging.js` as a guideline.
3. Enable Logging for Debug Messages.
4. In Business Manager, select **Administration > Operations > Custom Log Settings**.
5. In the Log Category field, set `root` to `DEBUG` Level. This covers all categories.
6. Click **Add** to enable debugging for all debug messages.
7. Click Log Debug to File.
8. Click **Save**.
9. Test your pipeline with a duplicate email address and verify the **latest customwarn** log files.
10. Select **Administration > Site Development > Development Setup > Log Files**.
11. Verify the messages on the `customdebug` and `customerror` log files that appear with the most recent timestamp. The name of the file should start with `custom-NewsLogs`
12. Verify the debug messages also appear on the request log.



## Knowledge Check

Custom Object Questions	True	False
Custom objects are the only way to store custom data in Commerce Cloud Digital.		
The “custom” keyword is required to access custom attributes of an object.		
A custom object needs a primary key.		
Custom object instances can only be created in Business Manager.		

## Module 10: Data Binding and Explicit Transactions

### Learning Objectives

After completing this module, you will be able to:

- Use data binding to pre-fill forms and update persistent data from the form.
- Use an explicit transaction to commit changes to the database.



### Lesson 10.1: Data Binding with Forms and Objects

The Commerce Cloud Digital forms framework supports binding of persistent objects to form fields by automatically updating a persistent object with form data without having to issue an insert statement or calling a Digital API. The reverse mechanism is also supported: pre-populating a form object with data from a persistent object.





The object that is bound to the form must be a persistent object (system or custom), and must be available in the `pdict`. The form metadata must have field(s) with the `binding` attribute specified. The field `formid` attribute is not used to make the match; only the `binding` attribute identifies what fields match between the form and the object. The following form metadata uses

`custom.firstName`, `custom.lastName`, `custom.email` as the bindings

```
<?xml version="1.0"?>
<form xmlns="http://www.demandware.com/xml/form/2008-04-19">
  <field formid="fname" ... binding="custom.firstName" max-length="50"/>
  <field formid="lname" ... binding="custom.lastName" max-length="50"/>
  <field formid="email" ... binding="custom.email" max-length="50"/>

  <action formid="subscribe" valid-form="true"/>
</form>
```

Because `NewsletterSubscription` is a Custom Object, you want to bind this form to have `firstName`, `lastName` and `email` fields which are all custom attributes. Notice that the fields do not have a lock icon (you added them as custom attributes of the Custom Object):

	ID	Name
	<u>UUID</u>	UUID
	<u>creationDate</u>	Creation Date
	<u>email</u>	
	<u>firstName</u>	First Name
	<u>lastModified</u>	Last Modified
	<u>lastName</u>	Last Name



When the information is stored in a custom object in the code, you can manage that transaction explicitly in the code using `dw.system.Transaction`. The following methods can then handle the transaction.

```
Transaction.begin(..)
Transaction.commit(..)
Transaction.rollback(..)
```

Transactions can also be implicit. This means that the transactions will not have to be explicitly begun or committed. They will be handled by the Commerce Cloud Digital. The following is an example code for implicit transaction.

```
var txn = require('dw/system/Transaction');
txn.wrap(function() {
    // work with business objects here
});
```



### Exercise: Create a Custom Object Using a JavaScript Controller

1. Save the controller `JNewsletterV2.js` as `JNewsletterV3.js` in your training cartridge.
2. In `JNewsletterV3.js` replace all occurrences of `JNewsletterV2` as `JNewsletterV3` in the code.
3. Comment the following lines of code:

```
var myModel = require('~cartridge/scripts/MyModel');
var co=myModel.createMyObject(newsletterForm);
```

4. Just below these lines, use the `require` syntax to get `CustomerObjectMgr` from `dw.object` package.s
5. Add the next line as:

```
var co=CustomObjectMgr./*invoke a method to create object from
NewsletterSubscription custom object type with the
newsletterForm.email.value as the primary key. */
```

**Note:** Follow the instruction in the comment to make the line fully executable and working (use Script API as the guide if needed).

6. Use the `copyTo` method (use the quickcard section “Handling Forms”) to store `newsletterForm` to the object created above.
7. Adjust `newslettersuccessV2.isml` to point to the controller `JNewsletterV3.js`.
8. Execute the JavaScript controller.
9. In Business Manager, select **Merchant Tools > Custom Objects > Custom Object Editor**. Determine if the object was created.



## Knowledge Check

Forms Framework Questions	True	False
To implement Explicit Transactions you use the <code>beginTransaction()</code> method in the controller.		
You can rollback a transaction in the code using implicit transaction.		



## Exercise: Store and Retrieve the Preferences using the JavaScript Controller JEditPreferences.js

Create a new `JEditPreferences.js` controller to pre-fill the form with the logged-in customer preferences. Once the customer changes his/her preferences, save the data to the database.

**Note:** Perform Step 1-3 only if you have not so in the previous exercise.

1. Extend the `Profile` System Object.
1. In Business Manager, extend the `Profile` system object with the following custom attributes: (Administration > Site Development > System Object Definitions)
  2. `interestApparel` : Boolean
  3. `interestElectronics` : Boolean
  4. `newsletter` : Boolean
    - a. None of the attributes are mandatory.
    - b. Add them to an Attribute Group `Preferences` to view the settings later in the Customer area.
5. Modify the Content Asset that shows the Account Overview.
6. Login to your Storefront account (register as a new customer if you haven't already).
  - a. On the account overview page, use the **Storefront Toolkit > Content Information** to locate the `account-landing` content asset which is located in the middle of the page (or locate it Business Manager).
  - b. In the `account-landing` asset, add a new list item that calls the `JEditPreferences` pipeline. Use the `$httpsUrl(JEditPreferences-Start)$` content link function to invoke your pipeline (this syntax was covered in the Content Slot module):

```
<li>
  <a title="View and modify items on your list or invite friends"
  href="$httpsUrl(JEditPreferences-Start)$">
    <i class="fa fa-bookmark"></i>
    <h2>Preferences</h2>
    <p>View and modify your preferences</p>
  </a>
</li>
```

7. Edit the Form Metadata to add bindings and externalization of strings.
8. Open the `preferences.xml` form metadata file.
9. Externalize the keys in `preferences.xml` in `templates/resources/forms.properties` file for example:

```
forms.preferences.apparel=Are you interested in Apparel ?
```

Likewise externalize the other two keys.

10. For each custom attribute you defined in the `Profile` system object, make sure there is a corresponding form field with a binding that matches the spelling you used as the object attribute. For example:

```
<field formid="interestApparel"
  label="forms.preferences.apparel" type="boolean"
  binding="custom.interestApparel"/>
```

11. Copy the `editpreferences.isml` from the `customerpreferences` cartridge to your own cartridge under similar directory structure (`templates/default/account/user`). Make sure the formfields are matching the formids of the `preferences.xml` metadata file.
12. Create a JavaScript controller named `JEditPreferences.js`. Copy code from `JEditPreferences_exercise.js` into it. Follow the instructions in the comments to complete the code.
13. Execute the controller from the account page (You will have to modify the content asset to invoke `JEditPreferences` (not `EditPreferences`)).

## Module 11: Site Maintenance

### Learning Objectives

After completing this module, you will be able to:

- Learn about page caching
- Use the JavaScript Controller Profiler
- Replicate code and data in the Primary Instance Group (PIG).

Note: In the Business Manager, the JavaScript Controller Profiler is referred to as the Pipeline Profiler.

### Introduction

Commerce Cloud Digital provides tools that you can use to improve site performance as well as replicate code and data.

**Note:** The *Developing for Digital II* course provides additional information on this topic.



### Lesson 11.1 Site and Page Caching

Page download time is a critical factor in keeping visitors in your storefront. The longer it takes to download a page, the higher your risk of losing a sale. Therefore, it is best to cache your pages as much as possible to minimize page download times.

Furthermore, rendering pages containing many business objects or complex calculations such as category and search result pages or product detail pages can consume a lot of resources. Since this information generally does not change from one user to another, not caching these pages can excessively waste processing resources which slows down the entire site for all users (including job processing) and not just for the requested pages.

Commerce Cloud Digital controls caching on a per page basis, via the ISML template for the page. Set caching on a page using the `<iscache>` tag:

```
<iscache type="relative" hour="24">
```

Commerce Cloud Digital follows these rules when using the tag:

- If `<iscache>` tag occurs multiple times in a template or its locally included templates, the shortest duration is used.
- Caching from a local include affects the including template.
- If there is no `<iscache>` defined, the template is not cached.

Use the `<iscache>` to set the following parameters:

Parameter	Description
-----------	-------------

<code>type = "relative   daily"</code>	Relative enables you to specify a certain period of time, in minutes and hours, after which the page will be deleted from the cache. Daily enables you to specify an exact time when the page will be deleted from the cache.
<code>hour = integer</code>	Indicates either the caching duration or the time of day. If the <code>type</code> attribute is set to <code>daily</code> , the <code>hour</code> value must be an integer, ranging from 0 to 23. If <code>type</code> is set to <code>relative</code> , all integer values greater than 0 are valid (the default value is 0, meaning either the page is never cleared from the cache or only the <code>minute</code> attribute is relevant).
<code>minute = integer</code>	Indicates either the caching duration or the time of day. If the <code>type</code> attribute is set to <code>daily</code> , the <code>minute</code> value must be an integer ranging from 0 to 59. If <code>type</code> is set to <code>relative</code> , all integer values greater than 0 are valid (the default value is 0, meaning either the page is never cleared from the cache or only the <code>hour</code> attribute is relevant).
<code>varyby= "price_promotion"</code>	Enables you to mark a page as personalized: this does not mean that the page is unique for a person but rather that different versions of the same page showing different prices, promotions, sorting rules or AB test segments will be cached by Commerce Cloud Digital. For example, this parameter is necessary for product pages since a customer belonging to a customer group might get special promotions that other customer groups don't get. While the ISML template is the same, the generated pages vary, and therefore caching every version of the page benefits performance. For performance reasons, a page should only be <b>marked with the <code>varyby</code> property if the page is really personalized</b> ; otherwise, the performance can unnecessarily degrade.

Frequently changing pages benefit from a shorter caching period. Stored pages are only invalidated and a new one pulled from the application server if any of the following occur:

- The defined caching time is exceeded.
- A replication has been performed (with the exception of coupons and geolocation data).
- An explicit page cache invalidation is triggered by a merchant in Business Manager.

As a best practice, disable page caching on sandboxes, development and staging environments in order to see changes immediately. In Production caching is always on by default.

Portions of pages can be cached separately. You can assemble a page from snippets with different caching attributes using remote includes. Each part:

- Must be a result of a pipeline request to the application server.
- Is included using the `<isinclude url="">` or the `<iscomponent pipeline=...>` syntax.
- Can have different cache times or no caching at all.

In general, do not cache pages that show buyer or session information.

## Studying Page Analytics to Determine Caching Problems

To access Digital caching metrics, select **Site > Analytics > Technical Reports**. Shown is the **Pipeline Performance** report.

Main Request Pipelines													
Pipeline	Call Count	Includes	Total	%	Processing Time (ms)							Total Own	Avg Own
					Avg	< 500	< 1000	< 3000	< 5000	< 10000	> 10000		
Page-Show	9,819	0.0	216,886	58.29%	22	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	216,886	22
Default-Start	1,273	0.0	69,717	18.74%	55	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	69,717	55
Analytics-Tracking	4,274	0.0	48,538	13.04%	11	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	48,538	11
Search-ShowContent	220	1.0	25,705	6.91%	117	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	25,705	117
Page-Include	518	0.0	4,317	1.16%	8	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4,317	8
Search-Show	28	2.4	2,791	0.75%	100	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2,638	94
Home-Show	52	0.0	2,749	0.74%	53	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2,749	53
lightbox	32	0.0	685	0.18%	21	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	685	21
SiteMap-Google	14	0.0	546	0.15%	39	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	546	39
Link-Page	1	0.0	89	0.02%	89	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	89	89
Cart-MiniAddProduct	3	0.0	62	0.02%	21	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	62	21

These types of analytics are only collection on Production instances, not Sandboxes. In this example, it reveals that the `Home-Show` controller (which generates the homepage) is not cached: the Caching column shows red for all hits. If you see this trend in your analytic data, you may decide to alter the caching settings or the caching interval.

Across Digital customers, the two critical metrics to focus on from a performance perspective are the average response times of `Search-Show` and `Product-Show` controllers. These controllers are used across all customers and are the main components of most pages on Digital installations.

- For `Search-Show` the average response is 400ms. Customers should be  $\leq$  to this value to be in a good performance range.
- For `Product-Show` the average response is 320ms-400ms. Customers should be  $\leq$  to this value to be in a good performance range.

Salesforce strongly recommends that you check analytics reports each week and after you make code changes to track these metrics.

## Page Level Caching

Once the `<iscache>` tag is added to an ISML template, the entire ISML page will be cached for the time specified in the tag.

For example, the page shown will be cached for 1 hour and 30 minutes:



### Exercise: Page-Level Caching

- Create an ISML template named `cachedpage.isml` that has caching enabled for 30 minutes:

```
<iscache type="relative" minute="30" />
```

- Add a `Date` object to the page that prints the current time:

```
<isprint value="{new Date()}" style="DATE_TIME" />
```

3. Create a new pipeline named `Caching` or a JavaScript controller named `JCaching` to display the above template.
4. Test the template in your SiteGenesis storefront. Refresh your page. Does the time change on refresh?
5. Enable caching on your SiteGenesis site. Retest the template. You may need to wait a minute before you see the page has been cached.

### Partial Page Caching

Generally, a single page should not be cached completely. Some parts of the page should be cached, while other parts should not be cached. In this case you need to use remote includes for every part that has unique caching characteristics. Every remote include calls a different pipeline which generates an ISML template, each template having (possibly) different page caching.

The syntax for a remote includes uses the `URLUtils` class to call a remote pipeline with optional parameters appended:

```
<isinclude url="{URLUtils.url('Page-Include', 'cid',
    'COOKIE_TEST')}">
```

You can also use the newer `<iscomponent>` tag to implement a remote include.]



### Exercise: Partial Page Caching

1. In the template `cachedPage.isml`, add a remote include call to the `Product-IncludeLastVisited` (pipeline or controller)

```
<iscomponent pipeline="Product-IncludeLastVisited" />
```

2. Invalidate the cache in Business Manager.
3. Go to another tab and visit a few products (3 at most).
4. Refresh the `Caching-Start` pipeline or `JCaching-Start` controller
5. Visit more products on the other browser.

Result: the time remains unchanged while the last visited products change every time a new product is visited.

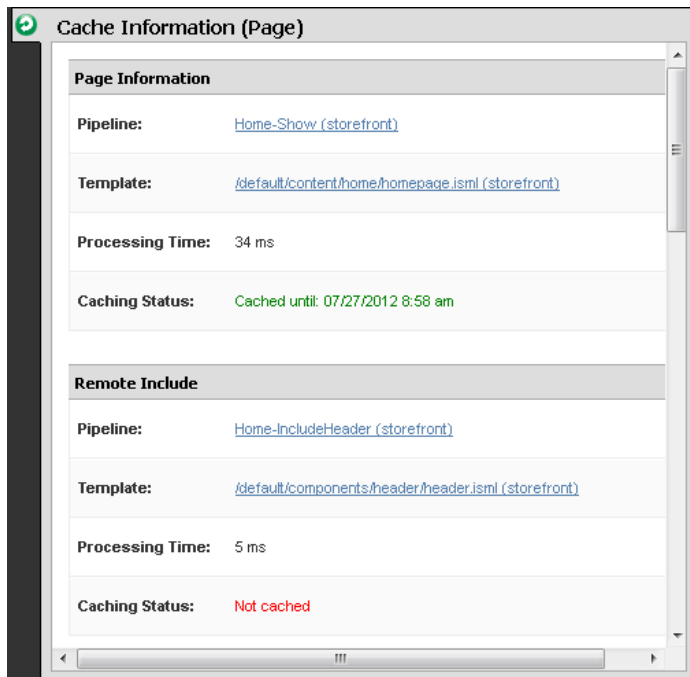
6. Once you have finished this exercise, do not forget to turn your caching off again in Business Manager ( Administration > Sites > Manage Sites > SiteGenesis > Cache )

### Using the Storefront Toolkit to Determine Cache Settings

You can enable the Cache Information tool in the Storefront Toolkit to see how partial page caching is implemented for a page:

The page now shows special icons that you can click to reveal how the whole page and its remote includes are cached:





### Exercise: Use the Cache Information Tool

1. Browse the SiteGenesis home page.
2. Turn on **Storefront Toolkit > Cache Information**.
3. Study the cache information for the whole page.
4. Study the cache information for a content slot and open the template to see the cache settings.
5. Study the cache information for the Cart remote include. Why is this page not cached?



### Lesson 11.2 Site Performance

The Pipeline Profiler is a Business Manager tool that provides insight into pipeline and script performance. It tracks pipeline execution metrics, which is a critical component of overall page and site load and performance. This enables you to proactively identify bottlenecks in performance while developing applications.

To track the performance of a pipeline using the Pipeline Profiler:

1. In Business Manager, select **Administration > Operations > Pipeline Profiler**.
2. Reset previously collected statistics and turn on the Pipeline Profiler.
3. Browse specific pipeline in storefront.
4. Return to profiler and analyze the collected data.

5. Click the link for that site where you want to capture data:

- a. The pipeline profiler displays a high-level view of response times per script or pipeline, such as hits, total time for a page to be generated, average time, etc.

#### Profiler - Pipeline Performance

The Pipeline Performance page displays the results of the performance profiling of pipelines. All values are displayed in milliseconds.

Pipeline Name	Pipeline Start Node	Hits	Total Time	Average Time	Minimum Time	Maximum Time
<a href="#">OnSession</a>	Do	2	29	14	11	18
<a href="#">OnRequest</a>	Do	2	0	0	0	0
<a href="#">Error</a>	Forbidden	1	20	20	20	20
<a href="#">Page</a>	Include	1	18	18	18	18
<a href="#">Home</a>	IncludeHeader	1	11	11	11	11
<a href="#">Home</a>	IncludeHeaderCustomerInfo	1	4	4	4	4
<a href="#">Home</a>	IncludeHeaderMenu	1	70	70	70	70
<a href="#">Cart</a>	MiniCart	1	12	12	12	12
<a href="#">_SYSTEM_Slot</a>	Render	6	97	16	2	80
<a href="#">_SYSTEM_Slot</a>	Request	6	14	2	2	3
<a href="#">Home</a>	SetLayout	1	6	6	6	6
<a href="#">Home</a>	Show	1	76	76	76	76

- b. Look for scripts with high average run times and high hits. These are the first areas to focus on performance improve.
- c. To view more detailed data for a specific script, click the script name.

6. Test the script or a different one again.

7. While the pipeline profiler runs you have access also to captured script data.

8. Turn off the profiler and analyze the results.

9. If you make modifications to the script, retest to verify if performance has improved.

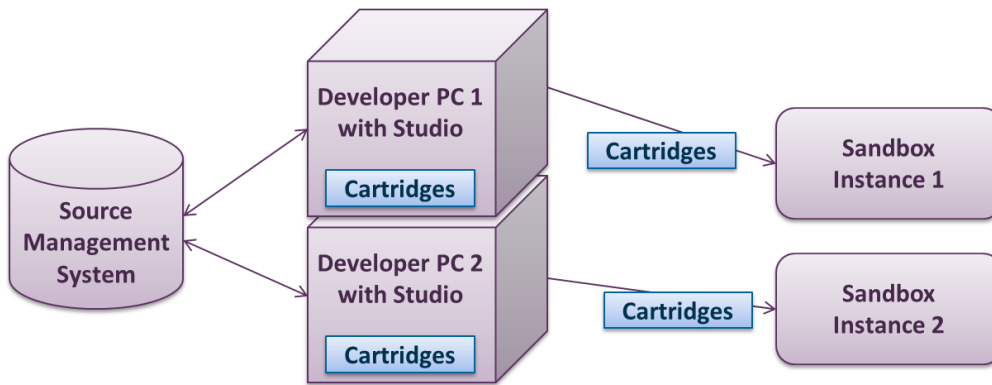


## Lesson 11.3 Code Replication

Code replication is set and managed in Business Manager. Once you have uploaded a new code version to the PIG staging instance, you can set code replication to occur between staging and development or staging and production.

### Code Replication Overview

In a typical development environment, a source management system is used for code version control. Each developer uses their own sandbox for development, while checking in their code to a source management system.

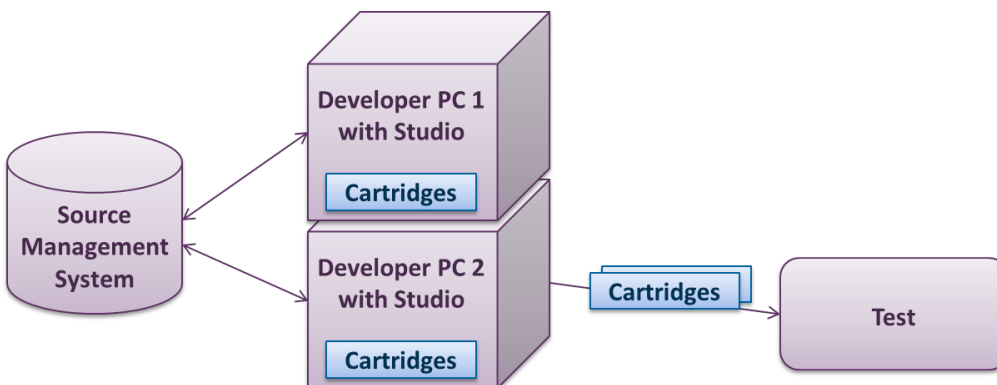


UX Studio integrates with SVN for source management. To learn more about using SVN in UX Studio, view our online webinar in XChange: <http://xchange.demandware.com/docs/DOC-2667>.

When a developer has tagged a new code version and is ready to upload the new code to staging, he/she creates a new code version on Staging in Business Manager from **Administration > Site Development > Code Deployment** page.

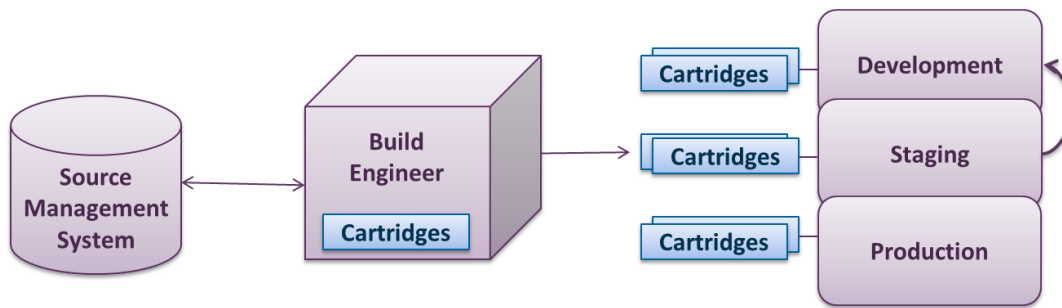
Next, the developer uploads custom cartridges with UX Studio or WebDAV client using 2-factor authentication and tests the storefront in Staging. A rollback to a previous version is available.

For major code changes, it is recommended to use a sandbox for testing:



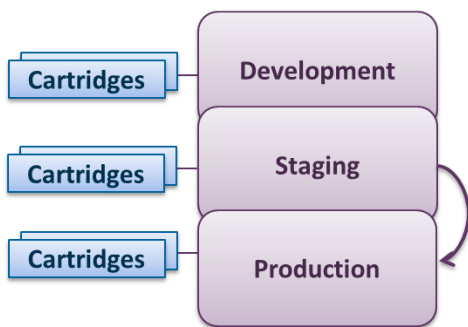
To test in a sandbox, export the site data to the global directory from staging and import it into your sandbox using the Site Import/Export module in Business Manager.

When you need to test code metadata (site preferences, new attributes, etc.), the build engineer replicates from Staging to Development:



This is also good practice for testing processes without impacting the production storefront (i.e. Product import feed).

The last step in code replication is moving code from Staging to Production using Business Manager.



To replicate code from Staging to Development or Staging to Production:

1. Log into the Staging Business Manager with an account that has code replication permissions.
1. Select **Administration > Replication > Code Replication**.
2. Click **New** to create a new replication process.
3. From the **Target** drop-down menu, specify whether the replication process is to Development or Production.
4. Select whether you want to process to run manually or automatically. Click **Next**.
5. Specify what type of replication you want:
  1. Code Transfer & Activation: immediately activates the new code version.
    - d. Code Transfer: Only transfers the code.
2. Click **Next**.
3. Click **Start** to start the replication process. Click Create to add the replication process to the list.
4. If you selected the process to run manually, click Start to start the job from the list.



## Lesson 11.4 Data Replication

Data replication promotes merchant edits, product, and system objects from Staging to Production (or Development). The best practice is to replicate to development first, verify that data and storefront work, and then replicate from staging to production.

Data can be replicated granularly:

- Organization objects

Global	
<input type="checkbox"/> Catalogs	Catalog content including categories, products, recommendations and static content of all catalogs.
<input type="checkbox"/> <b>apparel-catalog</b>	Catalog content including categories, products, recommendations and static content of catalog 'apparel-catalog'
<input type="checkbox"/> <b>electronics-catalog</b>	Catalog content including categories, products, recommendations and static content of catalog 'electronics-catalog'
<input type="checkbox"/> <b>storefront-catalog-en</b>	Catalog content including categories, products, recommendations and static content of catalog 'storefront-catalog-en'
<input type="checkbox"/> Customer Lists	All customer lists.
<input type="checkbox"/> Custom Objects	Organization specific custom objects.
<input type="checkbox"/> OAuth Providers	All OAuth Providers.
<input type="checkbox"/> Preferences	System and custom preferences of the organization including regional settings and locales.
<input type="checkbox"/> <b>System Preferences</b>	System preferences of the organization including regional settings and locales.
<input type="checkbox"/> <b>Custom Preferences</b>	Custom preferences of the organization.
<input type="checkbox"/> Price Books	All price books.
<input type="checkbox"/> Geolocations	Geolocation data.
<input type="checkbox"/> Sites	Site definition, content library and site preferences of all sites.
<input type="checkbox"/> <b>SiteGenesis</b>	Site definition, content library and site preferences of site 'SiteGenesis'
<input type="checkbox"/> Static content	Global static content (non-catalog and non-library static resources).
<input type="checkbox"/> Object Definitions	System object type extensions and custom object definitions.

- Per Site objects

SiteGenesis	
<input type="checkbox"/> AB Tests	All AB tests and contained test experiences.
<input type="checkbox"/> Active Data Feeds	All active data feed definitions.
<input type="checkbox"/> Content Library	All library content including content assets, folders and library static content.
<input type="checkbox"/> Coupons	Coupon configurations and single coupon codes.
<input type="checkbox"/> Customer Groups	Definition of customer groups.
<input type="checkbox"/> Custom Objects	Site specific custom objects.
<input type="checkbox"/> OCAPI Settings	The OCAPI settings for this site.
<input type="checkbox"/> Payment	Payment processors, payment methods, payment cards, payment-specific system preferences and all custom preferences (make sure to replicate changed preference definitions before this group).
<input type="checkbox"/> Preferences	Site specific system and custom preferences including assignments to catalogs, pricebooks, inventory and customer lists.
<input type="checkbox"/> <b>System Preferences</b>	Site specific system preferences including assignments to catalogs, pricebooks, inventory and customer lists.
<input type="checkbox"/> <b>Custom Preferences</b>	Site specific custom preferences.
<input type="checkbox"/> Campaigns	Campaigns and promotions.
<input type="checkbox"/> Search Indexes	Search indexes for products, spelling, content, synonym, redirect and suggest (availability and active data indexes are not replicated).
<input type="checkbox"/> Shipping Methods	All shipping methods.
<input type="checkbox"/> Content Slots	Slots and slot configurations.
<input type="checkbox"/> Sorting	All sorting rules and storefront sorting options.
<input type="checkbox"/> Source Codes	All source code groups and source codes.
<input type="checkbox"/> Stores	All defined stores including addresses and store hours.
<input type="checkbox"/> Taxation	Tax classes, tax jurisdictions, tax rates and tax-specific system preferences.
<input type="checkbox"/> Site URLs	Site URLs, mappings and redirect rules (site aliases are not replicated).
<input type="checkbox"/> <b>Catalog URLs</b>	Generated category URLs, catalog-specific URL rules and settings, locale and general settings
<input type="checkbox"/> <b>Content URLs</b>	Generated folder URLs, library-specific URL rules and settings, locale and general settings
<input type="checkbox"/> <b>Pipeline URLs</b>	Pipeline URLs, locale and general settings
<input type="checkbox"/> <b>Mapping and Redirect Rules</b>	Mapping rules, static mappings and redirect rules

Data Replication has two phases:

- Transfer – long running processes where data is copied from Staging into shadow tables and folders on Production. No changes are shown in storefront.

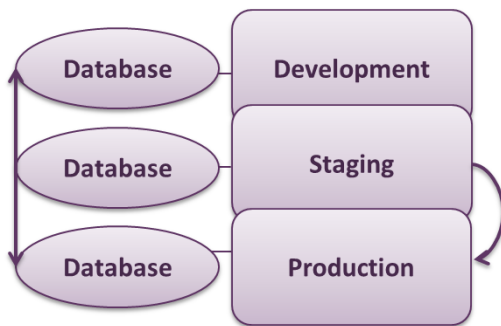
- **Publishing** – Very fast process. Changes in shadow tables and folders become active, the page cache is purged, and the new version is shown in storefront.

After data has been replicated, a one-time rollback (undo) is possible. This reverses the data to the state of the last successful replication.

To view the progress of a replication, monitor the staging logs on the staging and production instance.

Like code replication, you set up data replication in Business Manager. The process is similar, except you select the data that you want to replicate.

Just as code replication can only occur between Staging and Development or Staging and Production, data replication is a one-way process from Staging to the other primary instances.



To replicate data from Staging to Development or Staging to Production:

1. Log into the Staging Business Manager with an account that has code replication permissions.
2. Select **Administration > Replication > Data Replication**.
3. Click **New** to create a new data replication process.
4. Specify the target for the data replication process: Development or Production.
5. Select whether you want to process to run manually or automatically. If automatically, specify the date and time the process should run.
6. Specify when you want an email notification and who should receive it. Click **Next**.
7. At the next screen, specify what type of replication you want: Data Transfer & Publishing or Data Transfer.
8. Expand the sites to select the site data you wish to replicate. Click **Next**.
9. Click **Start** to create and trigger the process immediately. Click **Create** to add the replication process to the list. Click **Cancel** to go back to the list of replication processes without saving anything.
10. If you clicked **Create**, to start the process, click **Start** from the list of processes.



## Knowledge Check

Question		Answer
1.	What instance is used to replicate data in a PIG?	
2.	What two caching types can be used when using the <iscache> tag?	

## Appendix A: Pipelines

### Learning Objectives

After completing this module, you will be able to:

- Describe what a pipeline is, the pipeline dictionary, and the elements in a pipeline.
- Create a pipeline that includes: start, interaction, call, and jump.
- Use pipelets within pipelines.
- Execute and troubleshoot pipelines.

Note: In general, JavaScript controllers replace pipelines throughout Commerce Cloud Digital. If you are creating a new site, Salesforce strongly recommends the use of JavaScript controllers. However, if you are working with an existing site that has pipelines, it is important to understand how pipelines work so that you can maintain and extend them if needed.

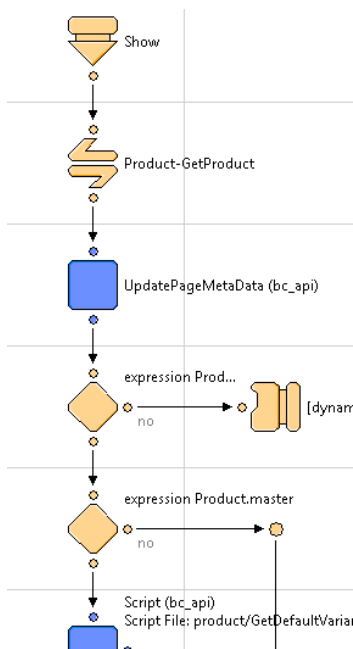
### Cartridge Folder Structure

Cartridges can contain either controllers and pipelines or controllers alone. If you have controllers and pipelines in the same cartridge, and they have the same name, the platform uses the controller and not the pipeline. Even if they are in different cartridges and have the same name, the platform uses the controller in the path and not the pipeline.

### Pipeline Overview

A pipeline is a logical model of a particular business process, similar to a flow chart. UX Studio provides a visual representation of the process within the Eclipse IDE. This example shows the Product-Show pipeline that renders the product detail page on the SiteGenesis site.




















Pipelines are stored in XML files in the file system, both locally and on the server. You define and store pipelines within the context of a cartridge.

When the storefront application references a pipeline in a cartridge, it searches for the pipeline in the cartridge path and uses the first one it finds. When a pipeline with the same name exists on two cartridges, the first one found in the path is used. Therefore, use unique pipeline names to ensure that the framework locates the correct pipeline.

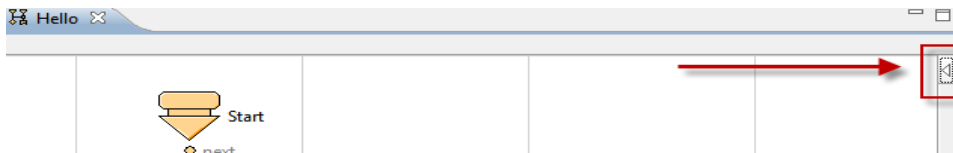
There are many pipeline elements available.

Element	Icon	Description
Start Node		Begins the logical branch of a pipeline.
Interaction Node		Use when a request requires a page as a response.
Transition Node		Define a path along a pipeline between pipeline nodes.
Call Node		Invoke a specified sub-pipeline. After the sub-pipeline execution, the workflow returns to the calling pipeline.
End Node		Terminate a sub-pipeline and return to the calling pipeline.
Jump Node		Use when the pipeline forwards the request to another pipeline.
Join Node		Provide a convergence point for multiple branches in workflow.

Interaction Continue Node		Process a template based on user action via a browser.
Script Node		Execute Digital scripts.
Eval Node		Evaluate an expression.
Assign Node		Assign values to new or existing Pipeline Dictionary entries, using up to 10 configured pairs of dictionary-input and dictionary-output values
Stop Node		Terminate a sub-pipeline and calling pipelines; stops execution immediately. Use in pipelines that execute a batch job.
Loop Node		Use to loop through an iterator.
Pipelet Placeholder		Placeholder for a script node.
Decision Node		Evaluate a condition and navigate to a different branch in the pipeline.

## Creating a Pipeline

A new pipeline needs at least one Start node and one Interaction Node. In UX Studio, when creating a new pipeline, access the pipeline palette from the Pipeline Editor. Note: If the palette is not visible, click the button on the upper-right corner of the editor.



### Start Nodes

A pipeline may have multiple Start nodes, but each node must have a unique name. Every Start node is the beginning of a specific logical branch within the pipeline. Configuration properties include:

- Name: Used in pipeline calls.
- Call mode: Specifies the accessibility of the pipeline from a browser.
  - Public: Can be called from the browser or from another pipeline.
  - Private: Can be called from another pipeline via Call or Jump Nodes.
- Secure Connection Required:
  - False: Pipeline can be invoked with HTTP and HTTPS protocols.

- True: Start node can only be accessed via secure (HTTPS) protocol.

### Interaction Node

This node specifies the template to display in the browser. If the Dynamic Template is:

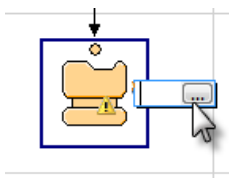
- true: Template Expression must be a variable containing a template name. The template to be called by an Interaction node is not always hard-coded in the node. Instead, the name can be determined dynamically during runtime from the Pipeline Dictionary.
- false: The template expression contains a path to the template under the `templates/default` folder.

### Transition Node

The transition node creates a transition between two nodes. To create a transition between two nodes click and drag your mouse between two nodes in a pipeline.

To create a simple pipeline using a Start node and an Interaction node:

1. From UX Studio, click **File > New > Pipeline**. The Create Pipeline dialog displays.
2. Provide a name that describes its business purpose.
3. Click **Finish**.
4. From the palette, click and drag a Start node to the work area.
5. Click and drag an Interaction Node to the work area.
6. Hold your mouse pointer down over the white dot at the bottom of the Start Node. Drag-and-drop your mouse pointer over to the white dot at the top of the Interaction Node. Release your mouse. A Transition Node connects the two elements.
7. Click the Interaction Node twice (**not double-click**). This displays an ellipsis button next to the node.



8. Click the ellipsis button to select the template you wish to display with the Interaction node.
9. Select the template. Click **OK**.
10. Save the pipeline: **CTRL+S**.



### Exercise: Create a Pipeline

1. In UX Studio, select **File > New > Pipeline** in the **training** cartridge.
2. Name the pipeline **Hello**. Do not specify a group. Keep **View** as the pipeline type.

3. Use the palette to drag a **start node** onto the pipeline editor. The name defaults to *Start*.
4. Drag an **Interaction Node** below the start node, and connect them with a **Transition**.
5. Create a template **hello.isml** that renders a simple HTML page with a “Hello World!” greeting:

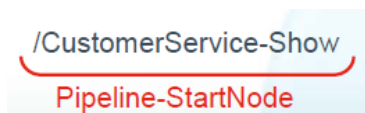
```
<html>
  <head>
    <title>Hello</title>
  </head>
  <body>
    Hello World!
  </body>
</html>
```

6. In the pipeline’s Interaction node, specify the template name **hello.isml** in its properties.
7. Double-click the Interaction node to verify that it opens the hello.isml template.
8. Save both the pipeline and the template.

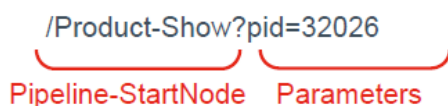
### Executing a Pipeline

Execute pipelines from the browser via an HTTP(S) request or via Call or Jump Nodes. **Note:** If the pipeline Start node is set as Private it can only be called via a Call or Jump node.

Calling a pipeline via a HTTP request requires the pipeline name and start node at the end of the storefront URL: `http://instance.realm.client.demandware.net/on/demandware.store/Sites-YourSite-Site/default`



You can also pass parameters via HTTP requests using this syntax:



To execute a public pipeline from the storefront:

1. Open your storefront in a browser window.
2. At the end of the URL add the `default/` directory, then enter your pipeline name and start node using the following syntax:  
`/Sites-SiteGenesis-Site/default/Hello-Start`
3. To pass parameters, add a query string after the pipeline invocation:  
`Sites-SiteGenesis-Site/Default/Product-Show?pid=ETOTE`



### Exercise: Execute a Pipeline

## 1. Test your pipeline in the storefront:

`http://student1.training.dw.demandware.net/on/demandware.store/Sites-SiteGenesis-Site/default`

2. Close the Storefront Toolkit on the upper-left corner of the page to view the output.
3. Bookmark this URL to use it for future pipelines invocations during this class.

## Pipeline Setting Troubleshooting

If your pipeline does not work, use this checklist to review your settings from the Navigator view.

- Right-click **DigitalServer**. A pop-up menu displays. Hover your mouse pointer over the **Digital Server** menu item. Ensure that **Active Server** and **Auto-Upload** are checked.
- Select **DigitalServer > Properties > Project References**. Ensure that your cartridges are checked for being uploaded to the server.
- Select **DigitalServer > Digital Server > Change Upload Staging Directory**. Ensure that the **Target** version directory and **Active** version directory match.
- Select **DigitalServer > Digital Server > Update Server Configuration**. Ensure that the configuration strings are correct.
- In Business Manager, select **Administration > Sites > Manage Sites > SiteGenesis**. Select the **Settings** tab. Check your cartridge path. It should have the exact name as the cartridges in Eclipse. Names are case sensitive and should have no spaces in the path. There should be no semicolons in place of colons.
- Select **Administration > Sites > Manage Sites > SiteGenesis**. Select the **Cache Tab**. Check if **Time to live (TTL)** is 0 and **Enable Page Caching** is disabled.
- If you have not done so, index your site. Select **Site > SiteGenesis > Search > Search Indexes**. Check all checkboxes and click **Reindex**.
- Save your project before executing the pipeline and type the URL correctly.

In Eclipse, in the **Project** menu ensure that your project is configured to **build automatically**.

## Invoke a Pipeline

1. Open your sandbox storefront.
2. Invoke a `Test-Start` pipeline (which has not been created).
3. Open the **Request Log** to view the error message.



## Call Nodes and End Nodes

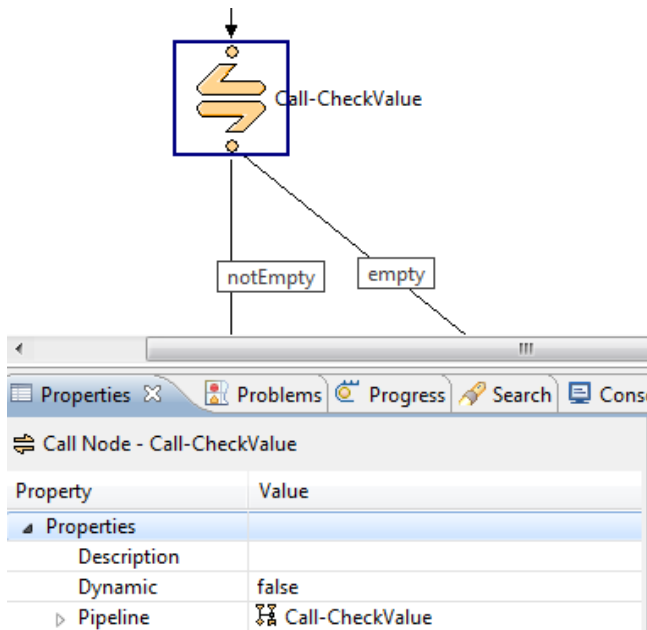
Call nodes and End nodes work together to process specific functionality in a pipeline.

## Call Nodes

A Call node invokes a specified sub-pipeline. A sub-pipeline is a pipeline that is designed for reusability and typically is defined as **private**, meaning that it cannot be invoked from a URL.

After the sub-pipeline executes, the workflow returns to the calling pipeline by means of an End node. It behaves like a function call where the function might return one or multiple values.

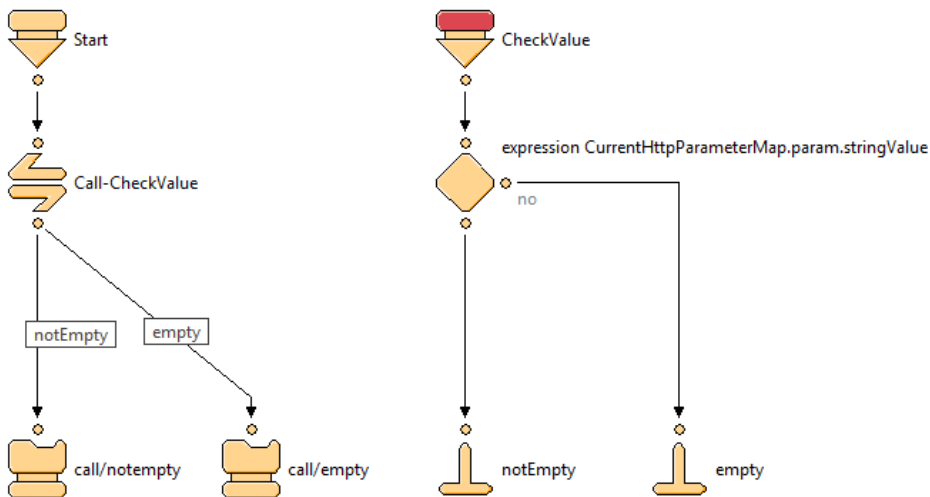
A Call node requires only a Pipeline-Start node to invoke. You can provide this information as a fixed configuration value or from a pipeline dictionary key.



## End Nodes

An End node finishes the execution of the called sub-pipeline and returns a value equal to the End node name. This name must be unique within the sub-pipeline and it may be used by the calling pipeline to control flow after the call.

After the call, a transition from the Call node with the same name as the returned value is followed. In the following example, if the CheckValue sub-pipeline returns a **notEmpty** value, then that transition is followed on the Start pipeline. Additionally, a Call node is used to invoke another pipeline. At the end of the execution of the called pipeline is a Decision node that checks whether a value called **param** has been passed in a URL string. The End nodes return control back to the Call node.



To use a Call node with a Transition node:

1. In UX Studio, open the pipeline where you want to add the Call node.
2. Select the Call node from the palette and drag it over the transition node where you want it. Note: Be sure the transition node turns red before you release the mouse.
3. Click the ellipsis next to the Call node.
4. Select the pipeline and start node you want to call using the Call node.
5. From the Called Pipeline dialog, select Show Pipelines from the drop-down. In the first field, enter the name of the pipeline that you want to find. The lower boxes will populate with available pipelines and Start nodes.
6. Click OK.
7. Add Interaction nodes that will display the proper `isml` template, depending on which value is returned by the called pipeline.
8. Name the Transition nodes from the Call node according to the values returned by the End nodes in the called pipeline.

## Jump Nodes

A Jump node invokes a specified sub-pipeline. After the sub-pipeline's execution, the workflow does not return to the calling pipeline. It is the responsibility of the sub-pipeline to complete the task.

A Jump node requires:

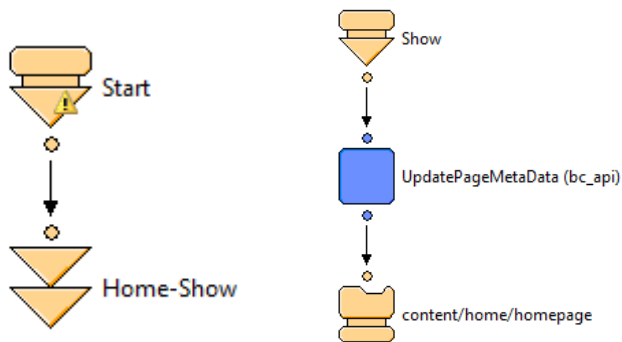
- The name of the pipeline to be jumped to
- The name of the pipeline start node to be used

This information can be provided either:

- As a fixed configuration value

- From a pipeline dictionary key (covered later)

An example of using Jump nodes is the `Default` pipeline. This is a special pipeline that the system calls if no pipeline name was provided in the URL. In SiteGenesis the `Default-Start` pipeline jumps to the `Home-Show` pipeline, which shows the homepage.



## The Pipeline Dictionary

The pipeline dictionary or `pdict` is the main data container for each pipeline execution. It is created and initialized when a pipeline is invoked and remains in memory as long as the pipeline executes.

The structure of the pipeline dictionary is a hashtable with key/value pairs.

The default keys in the `pdict` include:

- `CurrentDomain`
- `CurrentOrganization`
- `CurrentPageMetadata`
- `CurrentSession`
- `CurrentRequest`
- `CurrentUser`
- `CurrentHttpParameterMap`
- `CurrentForms`
- `CurrentCustomer`
- `CurrentVersion`

The pipeline dictionary is passed across sub-pipeline calls. Whenever a call or jump to another pipeline is executed, the same `pdict` is passed to the invoked sub-pipeline.

To view the values stored in the pipeline dictionary at run-time, run a pipeline from the storefront while in a debug session.



## Passing Parameters

You can pass parameters to the pipeline dictionary using a URL query string:

</default/Call-Start?param=1234>

The parameters will be added to the `CurrentHttpParameterMap` object inside the `pdict`. You can see the values stored in the pipeline dictionary when you run the pipeline debugger.

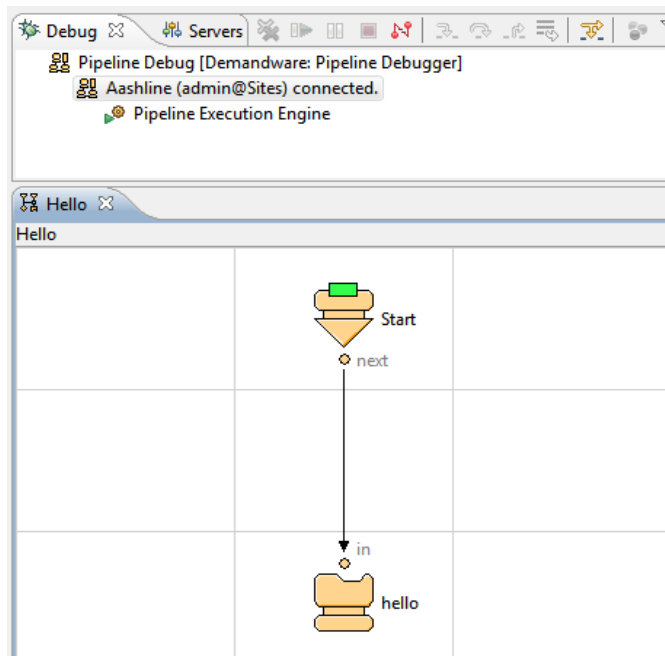
In this example, the `CurrentHttpParameterMap` is an object of type `HttpParameterMap`. It contains (on this invocation) a single key called `param`, which in turn contains multiple values. One of them is the `stringValue`, which contains the string '1234'. You could also use the `intValue` if you wanted to use the integer value 1234 on a calculation.

**Note:** For more information on the different classes mentioned here, consult the Digital Script and Pipeline APIs in the Help menu.



## Troubleshooting with the Pipeline Debugger

When testing your pipelines in the storefront, if you receive an error on execution, you can use the Request Log tool as well as the Studio Pipeline Debugger to troubleshoot your pipeline.

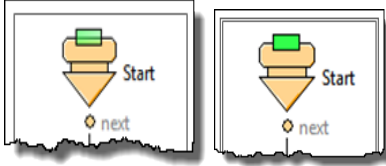


## Pipeline Debugger

The Pipeline Debugger operates at the pipeline level, not at source code level. It provides step-by-step tracking for pipeline execution and for examining the pipeline dictionary at runtime.

The Debugger requires a running Commerce Cloud Digital system and a properly configured Remote Server connection. You also need to create a debug configuration before running the Debugger.

To execute the pipeline debugger properly, you need a pipeline with breakpoints set on at least one node. When you launch a pipeline debugger, the breakpoint color changes from a semi-transparent green to solid green:





## Exercise: Create a Debug Configuration for a Pipeline

To create a debug configuration:

1. In UX Studio, go to the main menu and select **Run> Debug Configurations** or select **Debug Configurations** from the drop-down menu under the green bug icon:
2. Double-click the **UX Studio: Pipeline Debugger** to create a new configuration.
3. Enter a configuration name: **Pipeline Debug**.
4. In the **Server Configuration** section, click **Select**. Select the server connection you wish to debug then click **OK**.
5. In the **Site to Debug** section, click **Select**. Select the site to debug. Click **OK**.
6. Click **Apply** to save the configuration.
7. Click **Debug** to start the debugger.

### Set Breakpoints Where the Debugger Will Pause

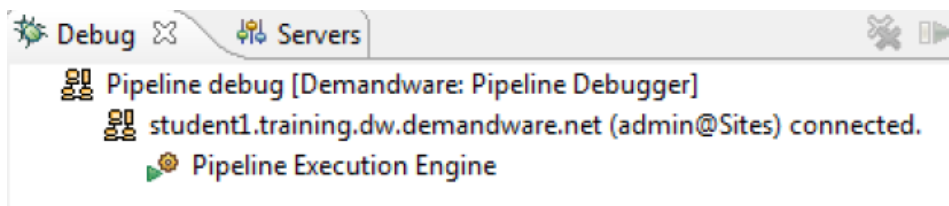
1. In UX Studio, open the pipeline to debug.
2. Click the pipeline node where you want the Debugger to pause during execution.
3. Right-click and select **Add/Remove Pipeline Node Breakpoint** from the pop-up menu.

To debug a pipeline using a debug configuration:

1. In UX Studio, open the Debug perspective so that you can view a debugging session. Use one of the following methods:
  - Window > Open Perspective > Other > Debug
  - Click the Open Perspective icon on the upper-right corner and select Other > Debug.

Start a debugging session:

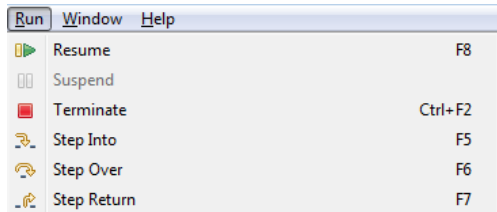
1. From the Debug icon, select **Debug Configurations**. Double-click the **Pipeline Debug** configuration.
2. Verify that the Pipeline Execution Engine is running.



3. In a browser, launch the pipeline to debug.
4. Click the UX Studio icon on the taskbar, it should blink since the breakpoint was triggered. Sometimes the OS will switch the context to UX Studio automatically, but this is rare.

5. In UX Studio, the execution stops at the breakpoint, as indicated by the vertical bars:

The **Debug Perspective** toolbar enables you to step through the pipeline. Or use the corresponding keyboard shortcuts:



### Exercise: Use the Debugger for a Pipeline

1. Create a pipeline debug configuration called **Pipeline Debug**.
2. Add a breakpoint on the `Call-Start` pipeline.
3. From the storefront, invoke the pipeline.
4. View the variables window when the debugger stops at the breakpoint.
5. Using the F5 key, step through the debugger. What are the values stored in the `pdict`? Rerun the **Call-Start** pipeline but this time add a parameter at the end of the string:  
`/Call-Start?param=1234`
6. Check the values of the `CurrentHttpParameterMap` after the Start Node.
7. Continue stepping thru the pipeline and observe changes in the `pdict`.



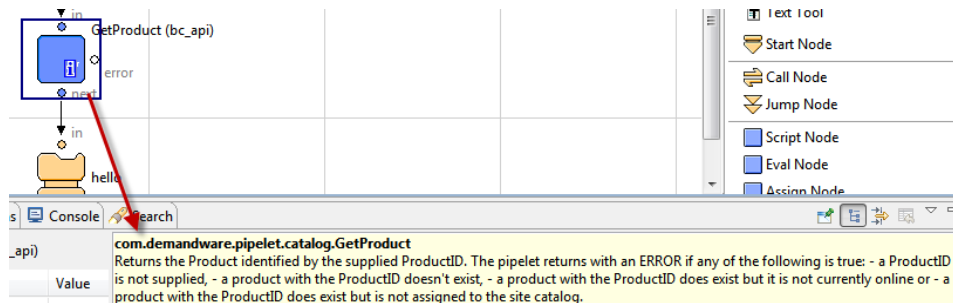
### Pipelets

In this section, you will use the pipeline dictionary to print information to a page using Pipelets. A pipelet executes an individual business function within a Digital pipeline. Pipelets are pre-coded pieces of functionality provided by Salesforce, but you can also use other types of pipelets from the palette such as:

- Script: invoke a custom Digital script file
- Eval: evaluate data in the Pipeline Dictionary
- Assign: assign values to specific keys in the `pdict`

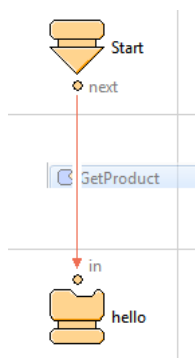
Commerce Cloud Digital Pipelets are available in UX Studio via the Pipelets view. They belong to the `bc_api` cartridge, which downloads as part of the Digital API the first time you connect to a server. There is a published API available under UX Studio Help menus or in the Commerce Cloud Digital documentation.

Each Digital pipelet has documentation on its functionality, input and output parameters. You can see this information in the Properties view when the pipelet is selected on the pipeline.



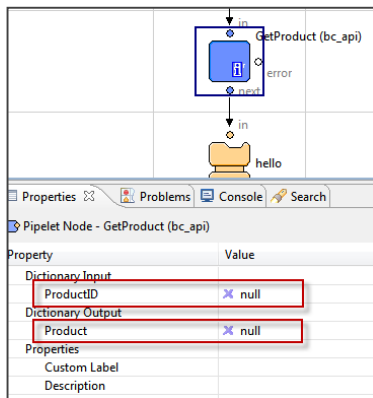
To access and use a Digital API pipelet:

1. In UX Studio, open or create the pipeline where you wish to add a pipelet.
2. Open the Pipelet view tab.
3. Drag and drop the pipelet onto the Transition node between the two nodes where you want the pipelet to execute. Be sure the Transition node turns red when you hover your mouse pointer over it. Otherwise, the pipelet will not be connected to the node.

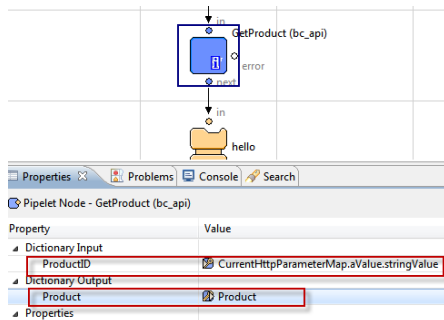


4. Depending on the pipelet you are using, you will need to configure the pipelet for execution in the Properties tab of the pipelet. In the example shown, a GetProduct pipelet creates a product object by using a ProductID value. The value for the input comes from a stored variable in the pipeline dictionary. The product object output will need a name value.

Undeclared Values



## Declared Values



## 5. Save your pipeline.

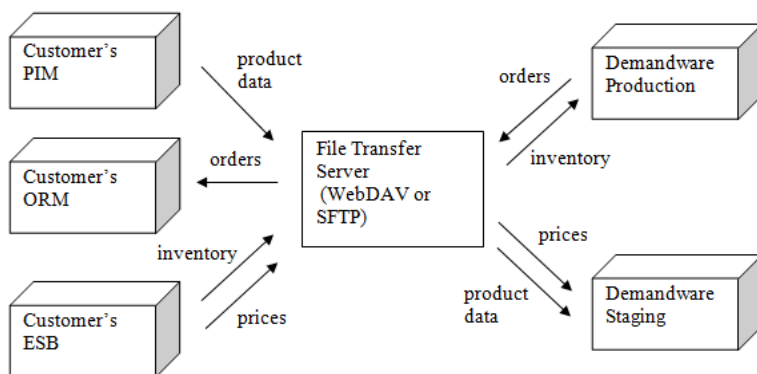
## Appendix B: Data Integration: Simple Feeds

### Introduction

Simple Feed Integration loosely couples Commerce Cloud Digital and external systems by exchanging files on a File Transfer Server. Simple Feed Integration supports the protocols WebDAV (HTTP and HTTPS) and SFTP for the transfer with the File Transfer Server. WebDAV HTTP (no network layer encryption) is meant for development/testing purposes only. When considering WebDAV HTTPS, note that an SSL-certificate from a Digital accepted Certificate Authority (CA) needs to be installed at the File Transfer Server. The list of accepted CAs is available at Commerce Cloud Digital's Customer Central.

The File Transfer Server needs to be hosted by the customer or another 3rd party. Commerce Cloud Digital does not offer hosting File Transfer Servers. The WebDAV access to certain folders on a Digital instance cannot be used for that purpose.

The simple feed cartridges support the following integration flow:



### File Format

The file format for the incoming and outgoing feeds is the standard Commerce Cloud Digital import/export format. For XML files the schema definitions (XSD files) can be downloaded from Customer Central. A good approach to create a sample file to set up the data as desired in Business Manager, run an export from the Business Manager user interface, and use the exported file as a template.

All import files can alternatively be provided in gzip format (not to be confused with zip). In that case provide the file with extensions `.xml.gz` or `.csv.gz` at the File Transfer Server and adjust the file matching rule. The validation and import processes automatically unzip the files during processing.

### Simple Feed Cartridges

The two cartridges included in the Simple Feed integration are:

- `int_simplefeeds`: Implementation of generic logic. Needs to be assigned to the storefront site and the Business Manager site. Modification of the `Custom_FeedJobs` pipeline is necessary to use the feed configuration custom object. Do not modify other code.

- `test_simplefeeds`: Cartridge to help troubleshooting WebDAV or SFTP connection issues and trigger a Simple Feed Integration job from the storefront during development. This cartridge must not be assigned to a site on Production systems. It may be assigned to the storefront site on sandbox instances if the storefront is password protected.

WebDAV is the only protocol that CCDDW supports where CCDDW can access files external to Commerce Cloud Digital and where external systems can push files to CCDDW. It is the only protocol that works on both directions.

You cannot use SFTP to access files in CCDDW: there is no SFTP server in CCDDW instances. However, CCDDW can access an external SFTP server.

### Importing Objects Using Simple Feed via the `int_simplefeed` cartridge

1. Download and import the `int_simplefeeds` cartridge into UX Studio.
2. Import Custom Cartridges to your Project Code Base.
  1. Add `int_simplefeeds` to your code repository (e.g. SVN).
    - e. Import into Studio for uploading to the server.
  2. Assign Cartridge to Sites
    1. The feeds are processed by Digital jobs that are executed in the context of a site. Pipelines for jobs are looked up in the cartridges at the Business Manager site, i.e. Sites-Site; templates (they are used for emails) are looked up in the cartridges for the respective storefront site.
      - f. In Business Manager, select **Administration > Sites > Manage Sites** and then to **Sites-Site**, and to each storefront site. Under Cartridges add `int_simplefeeds`.
2. Import Custom Object Type Definitions
  1. The generic implementation uses a custom object, `FeedJobConfiguration`, to store configuration data. The custom object exists in the context of a site.
    - g. The custom object definition is located in `metadata/ FeedJobConfigurationCO.xml`. You must load it on all instances that use the feed integration cartridge. You can store, share, and distribute the definition using **Site Import / Export**. To load it:
      - In Business Manager, select **Administration > Site Development > Import & Export**. Upload the file and then import it.

**Note:** Business Manager users that have the right to modify custom objects, can view and modify Simple Feed Integration configuration data, including connection endpoints, login/password, and public key for encryption of credit card data in order to export feeds. Make sure access privileges in Business Manager are set so that only authorized users can access respective modules.
2. Create Job Schedules



1. Technically an arbitrary number of schedules and feed configurations can be set up on a Commerce Cloud Digital instance. Currently, however, it is not possible to tell the schedule what configuration to use. Therefore, the only way to tie a schedule to a configuration is to use a unique pipeline start node. The cartridge `int_simplefeeds` comes with a pipeline `Custom_FeedJobs`. There is a start node `StartDefault` that reads the feed configuration with the ID `Default`. In this course, we only cover start node and feed configuration. To set up additional configurations, add additional parameters and reference those when setting up the schedules.
  - h. In most cases, the feed jobs are triggered by a pre-defined schedule (e.g. hourly, daily). It is also possible to keep the schedule disabled and trigger it manually in Business Manager, or to provide code that triggers the job with the `RunJobNow` pipelet.
  - i. To set up a new job schedule, in Business Manager select **Administration > Operations > Job Schedules**. Create a new job, name it (e.g. `CatalogUpdate`), make sure the execution scope is `Sites`, Pipeline is `Custom_FeedJobs`, **Start** node `StartDefault`.
  - j. On the **Sites** tab, select all storefront sites for which you want to execute the job. Note: You can provide site specific feed job configurations.
  - k. On the **Resources** tab, specify all object types that your feed job will modify. The job framework tries to acquire locks for these resources before the job starts, effectively avoiding parallel execution with other import processes or data replication.
  - l. On the **Notification** tab, configure email addresses to receive job execution status emails. Additionally, you can send more granular success and error emails by feed tasks. Configure them with the task. Feed tasks can report temporary errors such as communication errors with external systems as job failures to the job framework (on-temporary-error: FAIL). Here you can define how to handle them: Continue as Scheduled, Retry, or Stop on Error.
  - m. In the **Parameters** tab, you can define a parameter for any resource you want to import into a site.
  - n. Create Feed Job Configuration
    - o. A feed job configuration is stored in a site specific custom object and may contain multiple tasks (e.g. `DownloadAndImportCatalog` and `DownloadAndImportPriceBooks`).
    - p. To create a feed job configuration, in Business Manager select **Custom Objects > Custom Object Editor**. Create a new instance of Feed Job Configuration.
    - q. As ID provide the ID you previously used when creating a new instance of the `FeedJobConfiguration` custom object (the identifier used in pipeline `Custom_FeedJobs-StartDefault` > check the properties of the **Script** Node),
    - r. The file `documentation/TasksXMLCatalogOnly.xml` provides an example for TasksXML. It lists all supported tasks and contains inline documentation. Derive project specific configurations from that file by removing unneeded tasks and updating the information. It may be sensible to have the same task (e.g. `DownloadAndImportCatalog`) multiple times in a feed configuration if feeds from different sources or with different content are processed.

## 2. Testing

1. The structure of the XML for the custom object `FeedJobConfiguration` can be found in the sample file `TasksXML.xml` in the `documentation` folder.
  - s. There are sample import files in the `sampladata` folder.
  - t. In most cases, the feed jobs are triggered by a pre-defined schedule (e.g. hourly, daily). It is also possible to keep the schedule disabled and trigger it manually in Business Manager, or to provide code that triggers the job with the `RunJobNow` pipelet.

**Note:** It is not advisable to expose the `RunJobNow` pipelet in a public pipeline as this could be exploited to flood your job queue. If you must use this pipelet in the storefront, implement a custom security mechanism so that only authorized requests can execute the pipelet.



### Exercise: Simple Feed Integration

1. Import two Simple Feed cartridges, to help in import data from the WebDAV file server.
1. In UX Studio, import the two cartridges that appear in the `C:\projects\simplefeeds\cartridges` directory.
  - u. Add the following cartridges to the Project References on your sandbox connection project so they get uploaded to your sandbox.
    1. `int_simplefeeds`
    2. `test_simplefeeds`
  - v. Add the `int_simplefeeds` cartridge to the SiteGenesis site (for downloading the files).
  - w. Add the `int_simplefeeds` cartridge to the Business Manager site (for debugging and email notifications) cartridge path.
2. Import the `FeedJobConfiguration` Custom Object Definition from `FeedJobConfigurationCO.xml`. The `CustomFeedJobs` pipeline uses this type of object. It is in the `int_simplefeeds` cartridge.
1. Select Administration > Site Development > Import & Export.
  - x. Click Upload.
  - y. Click Browse and locate `C:\projects\training\cartridges\simplefeeds\metadata\`.
  - z. Upload the `FeedJobConfigurationCO.xml` file.
  - aa. Click the Back button to go to the previous screen.
  - bb. Click Import (the metadata import on top, not the one in the Geolocations section). This creates a `FeedJobConfiguration` custom object type for the instance.

- cc. Check it. Select Administration > Site Development > Custom Object Definitions. Do you see a Custom Object Type `FeedJobConfiguration`?
- dd. Edit `TasksXMLCatalogOnly.xml`. The contents of this file becomes an attribute value of our custom object, which the pipeline uses to determine the logic for importing our data.
- ee. Open

`C:\projects\training\cartridges\simplefeeds\documentation\TasksXMLCatalogOnly.xml` using your favorite editor.

- 2. Refer to your specific student## instance.

```
<remote-folder-url>
  https://mydisk.se/training/studentXX/
</remote-folder-url>
```

Instead of `studentXX`, use the number given by the instructor.

- 3. Use your email address for job notifications

```
<success-email>noreply@demandware.com</success-email>
<error-email>noreply@demandware.com</error-email>
```

Note: This file is a simplified version of the `TasksXML.xml` file. It points to a specific, non-DigitalWebDAV server, and performs only a catalog download and import.

- 4. Select **SiteGenesis > Custom Object > Custom Object Editor**. Create a new `FeedJobConfiguration` object (not definition) with the following values for its attributes:
  - 1. ID – `catalogTest`
  - 2. From Email – **your email**
  - 3. Tasks XML – copy the contents of `C:\projects\training\cartridges\simplefeeds\documentation\TasksXMLCatalogOnly.xml` to this field.
- 5. Create a job to test the catalog import.
  - 1. In Business Manager, select Administration > Operations > Job Schedules.
    - 1. Create a new schedule and name it `CatalogUpdate`.
    - 2. Check **Enabled**.
    - 3. Change the **Execution Scope** to Sites.
    - 4. Set the pipeline to `Custom_FeedJobs`.
    - 5. Start node to `StartDefault`.
    - 6. Click **Apply**.
  - 2. On the **Sites** tab, select the **SiteGenesis** site. Click **Apply**.

3. On the **Resources** tab, specify the **catalog** and **product** object types that your feed job will modify.
4. On the **Notification** tab:
  1. Configure your email address to receive job execution status emails.
  2. Check **Enabled**.
  3. Click **Apply**.
4. On the **Parameters** tab, use the same **ID** as the parameter in the **Script** Node of the `Custom_FeedJobs-StartDefault` pipeline (Check it, it is Jobid?). For **Value**, use the ID of the instance of your `FeedJobConfiguration` (`catalogTest`) custom object.
5. Run the job:
  1. Go to <https://mydisk.se/training/student##/> to see the contents of the WebDAV server.
  2. Verify that the remote WebDAV server directory referenced in the `TasksXML` is already populated with test files from the `C:\projects\simplefeeds\sampledata` directory.
  3. Test the job by running the feed job from Business Manager.
  4. Verify if the job worked (your catalog imported).
    1. Select Site > SiteGenesis > Products and Catalogs > Catalogs > Catalog > Cat1.
    2. Check if Prod1 is assigned to it. Do you know where it came from?

From the WebDAV server ... from `Catalog_2008-03-11_20-49-12.xml` perhaps.

## Congratulations

This concludes Developing for Digital I. At this point, you should apply what you have learned to the Digital platform in preparation for DEV101: Developing in Commerce Cloud Digital exam. Additionally, you should further your knowledge and skills by taking the DEV201: *Developing for Digital II* course and its associated certification.

### Cartridges when Controllers are Used in Conjunction with Pipelines

Cartridges can contain either controllers and pipelines or controllers alone. Controllers must be located in a controllers folder in the cartridge, at the same level as the Pipelines folder. If you have controllers and pipelines in the same cartridge, and they have the same name, the platform uses the controller and not the pipeline. Even if they are in different cartridges and have the same name, the platform uses the controller in the path and not the pipeline.

Note: If your sub-pipeline is not named using JavaScript method naming conventions, you must rename it to selectively override it. For example, if your subpipeline start node is named 1start, you must rename it before overriding it with a controller method, because the controller method cannot have the same name and be a valid JavaScript method.