Analytics Templates Developer Guide

Salesforce, Summer '18

@salesforcedocs

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CONTENTS

INTRODUCING ANALYTICS TEMPLATES

A template is a prototype of an app that others can use to create apps.

Note: The word "app" is used so often in this context, that we want to distinguish its two meanings right away.

There is the app you start with, the one on which you want to base your template. To avoid confusion going forward, we will call this the *master app*, and we'll say that you *templatize* this master app by making a template out of it.

Then there are the apps that users will create based on your template. We'll call these the *downstream apps*.

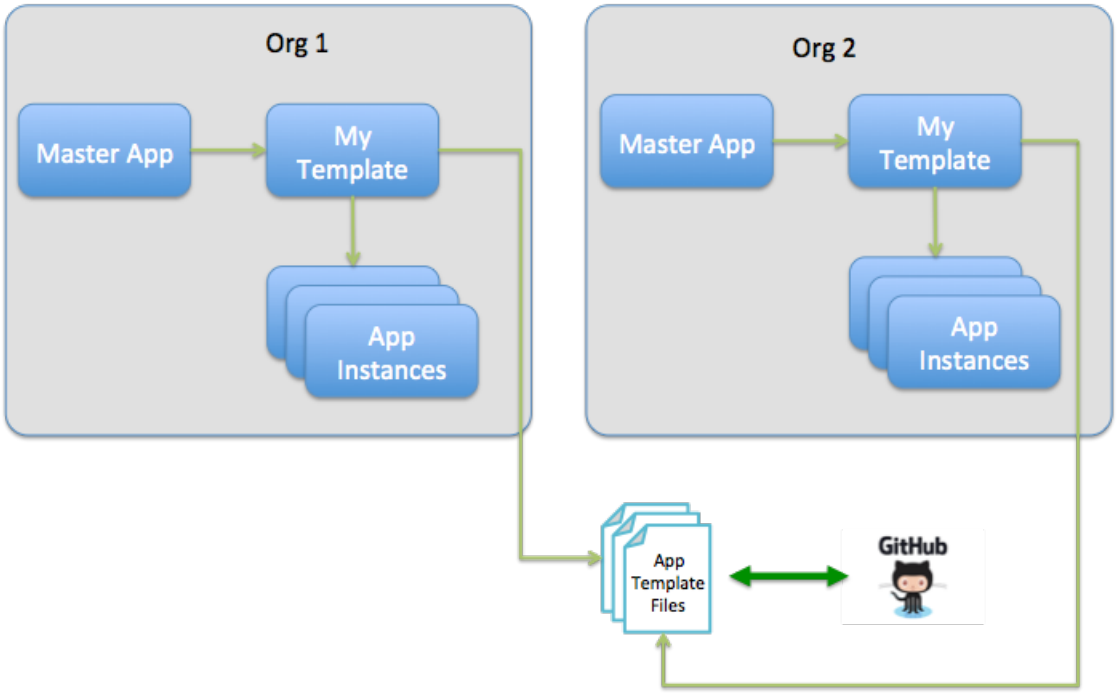
Template at a High Level

You design an app based on your ideas about the best way to visualize a specific type of content. Creating an app from scratch requires a fair amount of know-how: you have to load and transform the data, create lenses from the data, and design the dashboards. To spare other users that trouble, you can share the app you designed, and others can benefit from its datasets, lenses, and dashboards built with your existing Salesforce data.

However, if the app would be useful to others as long as they could point it at different data (their data instead of yours, typically) and make customizations, the solution is to templatize the app, and share the *template* with others. When you create a template, you determine the superset of information available in any resulting app, as well as its look and feel. The users of your template will build apps from it, and they will determine the apps' content and other specifics, depending on the flexibility you build into your template.

The app you templatize is the *master app*. The only difference between it and apps you create from the template is that only the master app can be used to update the template. There can be only one master app per template per org. The same template can, however,

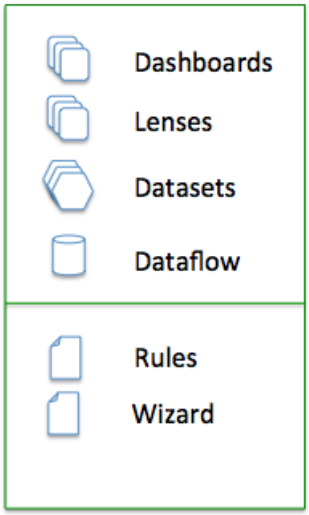
have another master app in a different org. This allows more than one developer to work on a template at the same time. The following figure depicts an example of this collaboration.



Template Dissected

At a more detailed level, two types of components make up a WaveTemplate object.

- **Analytics app UI assets:** These are all the assets that make up an Analytics app. They include dashboards, lenses, datasets, and, optionally, dataflows. Every template must have at least one dashboard, and at least one dataset (whether internal or external). Having a dataflow is optional, but common for anything but the simplest template.



Each of these assets has a corresponding JSON file. You manipulate these assets in the UI, and do not have to worry about their associated JSON files, except to know that they exist and are referenced in the `template-info.json` file (one of the Analytics Template assets).

- **Analytics Template assets:** These consist of four files that control the templatization of your master app. They include `template-info.json` file, which manages all elements of your template and the tokenized assets from the master app; `variables.json`, which contains all the variables used by the remaining JSON files; `ui.json`, which manages the configuration wizard that drives the users' app creation; any number of `rules.json` files; and a `folder.json` file, used to feature assets on dashboards.

Full Inventory of a WaveTemplate Object

You design an app based on your ideas about the best way to visualize a specific type of content. Creating an app from scratch requires a fair amount of know-how: you have to load and transform the data, create lenses from the data, and design the dashboards. To spare other users that trouble, you can share the app you designed, and others can benefit from its datasets, lenses, and dashboards built with your existing Salesforce data.

Full Inventory of a WaveTemplate Object

You design an app based on your ideas about the best way to visualize a specific type of content. Creating an app from scratch requires a fair amount of know-how: you have to load and transform the data, create lenses from the data, and design the dashboards. To spare other users that trouble, you can share the app you designed, and others can benefit from its datasets, lenses, and dashboards built with your existing Salesforce data.

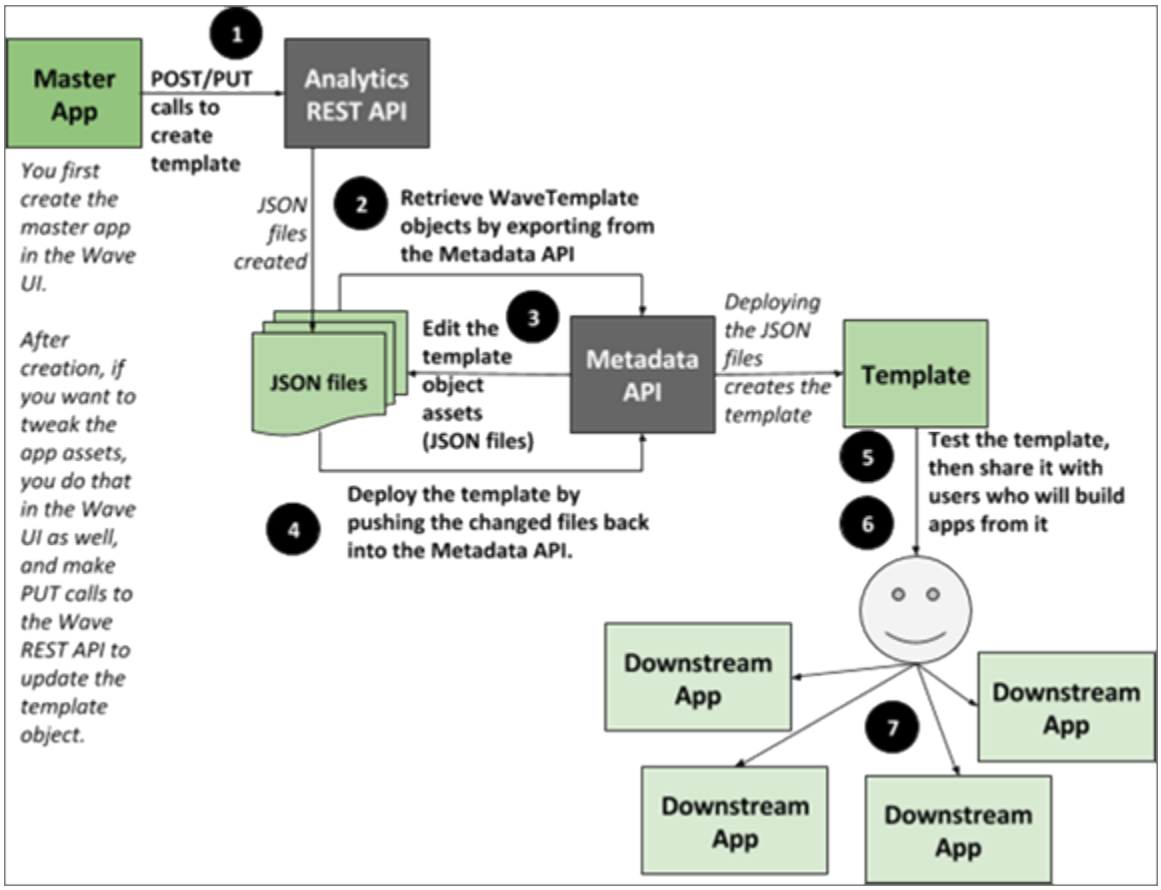
File	Required?	Description
`template-info.json`	Required	This file contains metadata information about the template, as well as lists of objects defining dashboards and lenses. It references every asset of the WaveTemplate object, including the remaining JSON files in this list.
`variables.json`	Optional	This file contains all the variables used in the template.
`ui.json`	Optional	This file defines the configuration wizard that will drive the users' app creation. Any questions the configuration wizard asks of the user are defined in this file. Questions can be displayed or hidden based on conditions that are defined in the variables.json file.
rules files (JSON)	Optional	A rules file defines the rules that enable you to alter any part of a dashboard or lens. There are typically multiple rules files. These can define rules from the master app to the template (app-to-template) and rules from the template to downstream apps (template-to-app). The order of these rules files is important. The last file can reference items inside the first, but the first file cannot reference the last.
`dashboard_name``.json`	Optional	There is one JSON file for each dashboard in the master app, with the same name as its corresponding dashboard.

File	Required?	Description
lens_name.json	Optional	There is one JSON file for each lens in the master app, with the same name as its corresponding lens.
dataset files • internal datasets – internal dataset files – user xmd.json • external datasets – *dataset*.csv – dataset_schema.json – user xmd.json	Optional	Every template requires at least one dataset. Dataset files can be internal or external, so we are calling each of them optional, but you must have one or the other. If you have internal datasets, and if those datasets have User XMD defined, it is all picked up by the template. External dataset files refer to CSV datasets such as dataset.csv, but also include dataset_schema.json, and extended metadata (user XMD) files, such as xmd.json. You must have one CSV file for every external dataset in the master app; without it, there will be no external files in the template. The dataset_schema.json and user xmd.json files are optional.
dataflow files	Optional	You will need dataflow files if you are using one or more internal datasets and need to extract and process them to make the data useful. Very simple apps can manage without a dataflow, but you'll find that most apps need one.
image files (JSON)	Optional	You will have image files if images have been used in any of the dashboards in the master app. There is one image file per image in the dashboards.
folder.json	Optional	This file contains information about the featuredAssetsfor the application. It enables you to set the order of assets in a dashboard instead of keeping them in alphabetical order.

Refer to the "Template Folder Structure" section for the directory structure of these files when you've exported them from the Metadata API.

The Process at a Glance

The template creation process follows seven major stages, which form the structure of this document.



Start with an app you want to templatize. This master app is your prototype.

1. **Create (or update) the WaveTemplate object:**
   - **Create the object for the first time:** Create the object by making an API POST call to the `/services/data/v39.0/wave/templates` endpoint of the Analytics REST API. A number of JSON files are created; these are instrumental to your template. But they are not editable until their content is retrieved from the database in the next step.
   - **Update an existing template object:** If you have updated the master app (by altering its assets in Analytics Builder) after this step, you must update the corresponding template object. Do this by making an API PUT call to the `/services/data/v39.0/wave/templates/<templateId or APIName>` endpoint of the Analytics REST API. The JSON files are updated, and the template version number is automatically incremented.
2. **Retrieve (export) the WaveTemplate object:** You will do this by exporting from the Metadata API; the object is retrieved as JSON files that you will edit.
3. **Edit the JSON files:** This is how you harness the power and flexibility of templates. Build the configuration wizard user interface, variables, conditions, and rules into your template by editing the JSON files. This step is where the power of the template feature is unleashed. You can make as few as zero edits, which will create a template that is identical to the master app (useful for testing that a template object was created correctly); or you can add countless user options to maximize flexibility.
4. **Deploy the WaveTemplate object:** Push the changed files back into the database with calls to the Metdata API to deploy the template. Remember to push your JSON file changes every time you edit them on your file system; otherwise, your next Metadata API export will overwrite all the work work you've done.

5. **Test the template:** Testers and other contributors to the template can now retrieve the object from the Metadata API (as described in Step 2), make their own edits (Step 3 on page 5), and re-deploy (Step 4 on page 5). It's an iterative cycle, and every time you make changes to the JSON files, deploy your template and build apps from it to test it.
6. Share it with users who will build apps from it.
7. Create new (downstream) apps from the template.

SEE ALSO:

Create an App

Template Dependencies

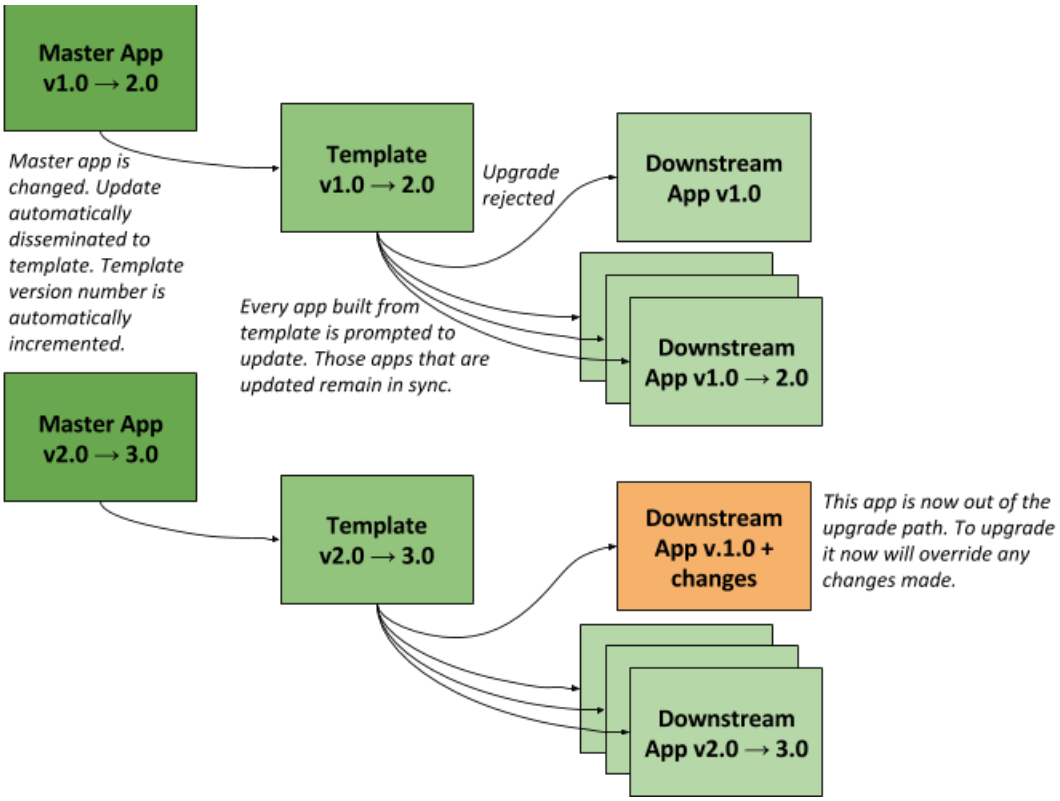
A template is dependent on its master app; if the master app is deleted, so is the `folderSource`, and any PUT calls to the Metadata API to update the template will fail. Likewise, the resulting apps built using the template depend on that template. The template cannot be deleted as long as downstream apps that were built from it still exist.

Customizing Downstream Apps Prohibits Upgrades

If the master app is altered in any way, making an API PUT call to the `/services/data/v39.0/wave/templates/<templateId or APIName>` endpoint propagates the changes to the template. The template is saved with a new version (for example, the version is incremented from 1.0 to 2.0). Users running apps based on that template are prompted to update their apps.

Avoid customizations of dashboards, lenses, and dataflows in downstream apps. Those customizations will be lost in app upgrades whenever the template is updated. Try to account for users' likely customizations by addressing them in the template wizard; this keeps the app flexible in the upgrade process.

Accepting the upgrade prompt keeps apps on the upgrade path from the master app to the template to the downstream app. Rejecting the prompt takes an app out of the upgrade path (refer to Figure 3). This non-upgraded app may continue to evolve as it is edited; however, the master app, along with the template, are likely to evolve at the same time. When users are again prompted to upgrade their downstream apps, the app that has strayed from the upgrade path will lose those independently-made edits if the user accepts the upgrade. To keep the edits made out of the upgrade path, the user must reject the upgrade and miss out on any improvements made to the master app and template.


Master App
v1.0 → 2.0
Master app is changed. Update automatically disseminated to template. Template version number is automatically incremented.
Template
v1.0 → 2.0
Upgrade rejected
Downstream App v1.0
Every app built from template is prompted to update. Those apps that are updated remain in sync.
Downstream App v1.0 → 2.0
Master App
v2.0 → 3.0
Template
v2.0 → 3.0
Downstream App v.1.0 + changes
This app is now out of the upgrade path. To upgrade it now will override any changes made.
Downstream App v2.0 → 3.0

QUICK START

Make sure you're all set with these five prerequisites before you go forth and create templates.

Prerequisites

Make sure you're all set with these five prerequisites before you go forth and create templates.

Permission set licenses

Most likely you already have an Analytics platform license for your org (either one InsightsStarter or one Analytics platform license will do the job). The license is required to create dashboards, lenses, and datasets.

- Assign the following permission set licenses:
  - Analytics Builder
- Assign the following permission sets:
  - Use Templated App
  - Manage Templated App
  - Manage Analytics

Org preferences

Set your Org Preferences to enable Analytics Templates. In the Admin Setup page, under **Settings**, select **Enable Analytics Templates**. You'll need this to create Analytics Template assets in the form of JSON files.

Developer Edition Org Namespace

Set up a namespace for your DE org to enable the use of Managed Packages. It is recommended that you do this before creating any Analytics assets.

Analytics REST API access

Refer to the documentation on Authentication to the Analytics REST API to access and use the API.

Metadata API access

Refer to the Metadata API Developer's Guide to access and use the Metadata API.

Master app and its ID

Typically, you build an app and it becomes a master app when you decide to templatize it. However, if you have a template but no master app in your org, you may find yourself making a master app from a template.

Create the app you plan to templatize:

1. Build an app with lenses, dashboards, datasets, and the default Salesforce dataflow.
2. Note the app ID in the URL; it becomes the `folderId` you will use as you work with the WaveTemplate object.

Create a master app from a template if you don't have a master app for your org:

1. Create an app from the template using the wizard.

   You can also create an app from the template by using a direct Analytics REST API call. Use this option if the wizard doesn't expose all the variables, and you need to answer them differently to create all the app's assets.

2. Turn this app into the master app by updating the template with a PUT call with the following syntax:

   ```
   PUT: /services/data/v39.0/wave/templates/0Nkxx00000002OPCAY
   ```

   Request Body:

   ```
   {"folderSource" : {"id" : "00lxx000000ftItAAI"}}
   ```

   This updates the template's `folderSourceId` to the master app's folder. This constitutes assigning the master app.

   Note: You can only have one master app per org, so you can only do this for one app.

STEP 1: CREATE (OR UPDATE) THE WAVETEMPLATE OBJECT

Your master app is complete and you are ready to templatize it. You will need its app ID, which you can find both in the URL for this app, and in the app's folder structure in the Analytics REST Explorer.

This step explains how to create the WaveTemplate object when you first templatize a master app. This step also explains how to update the WaveTemplate object if you have made changes to dashboards, lenses, datasets, or dataflows in the master app. The two actions are almost identical: you make a request with the same contents in the JSON body. The only difference is that creating the template object for the first time requires a POST request to the `/services/data/v39.0/wave/templates` endpoint, whereas updating the template object to reflect subsequent changes you've made to the master app requires a PUT request to the `/services/data/v39.0/wave/templates/<templateId or APIName>` endpoint.

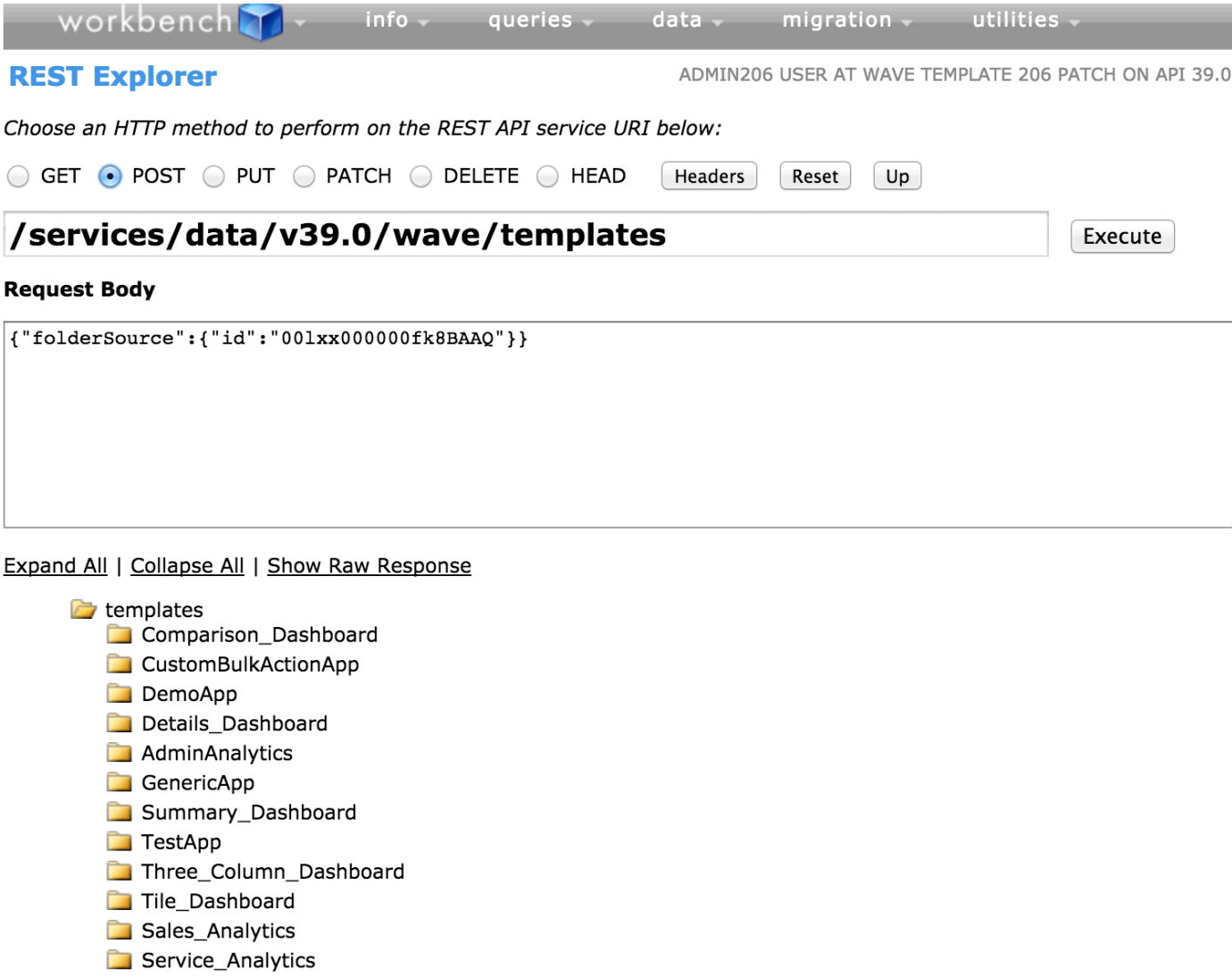
Access the Analytics REST API through your Developerforce Workbench REST Explorer. Use REST Explorer to build your POST, PUT, and (if necessary) DELETE requests:

1. Begin by going to https://workbench.developerforce.com/ and logging in to your org.
2. Select **Utilities** **Rest Explorer**.

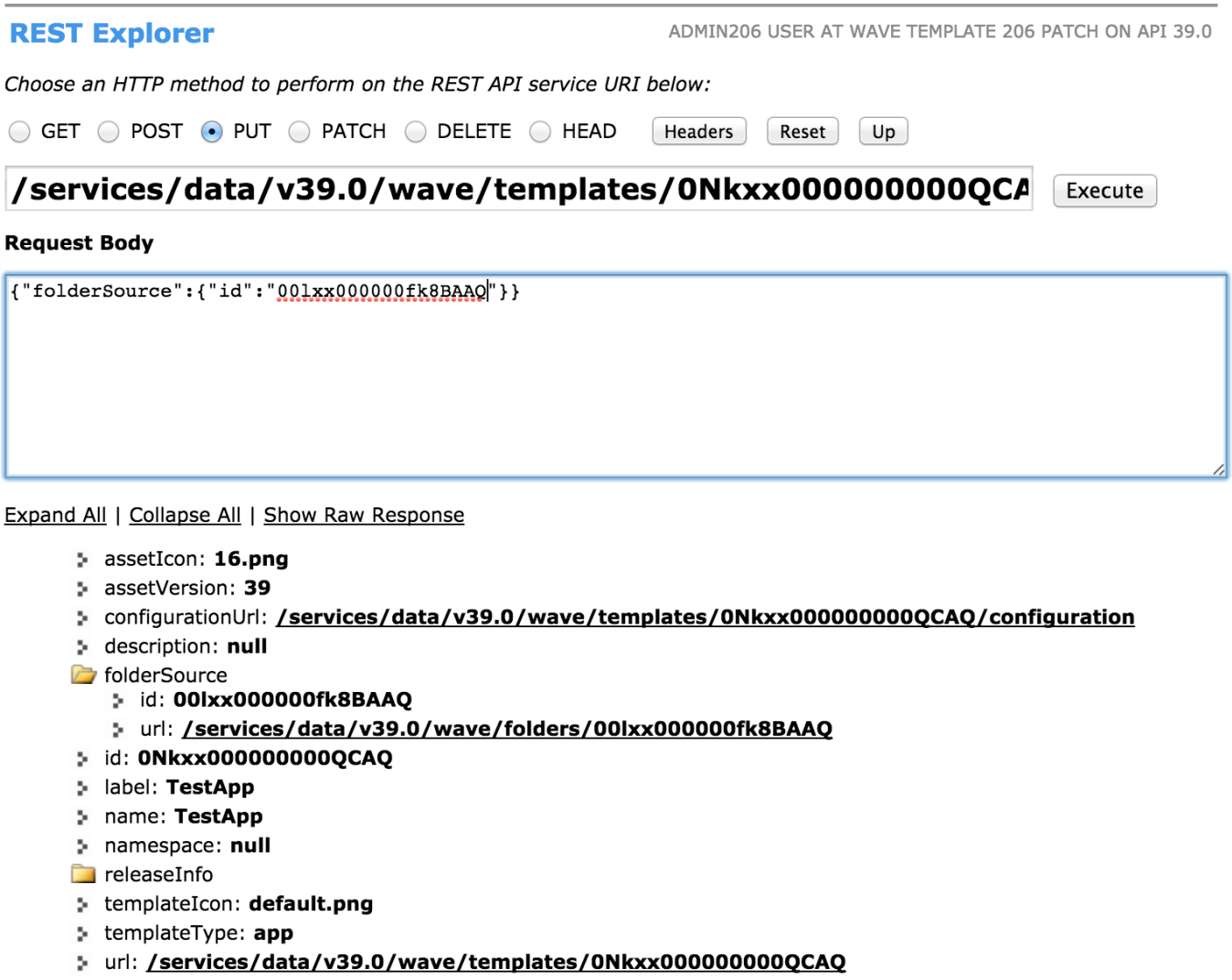
   A GET call to the `/services/data/v39.0/wave/templates` endpoint returns all the templates to which you have access.
3. Select **POST** (this method is called on the `/services/data/v39.0/wave/templates` collection URL).

   Use this method to create a brand new template object the first time you templatize a master app.

Step 1: Create (or update) the WaveTemplate Object



If you have *updated* the master app and are now updating the *already-created* template object, you must first click into the URL of your existing template, and then select the **PUT** method instead of POST.



4. Referring to the REST Explorer images in the previous step, enter the JSON Request Body, using the app ID from the app's URL as the `folderId`:

   ```
   {
     "folderSource" : { "id" : "<folderId>"}
   }
   ```

   The master app assets are contained in a folder. The `folderSource` attribute attaches a template to this folder.

   Add dataflow information from the next step to your request body before executing the request.

5. Add dataflow information to your request body if necessary (read on to determine when it's necessary).

   - **Syntax for adding the ID:** If you have built (or altered) a default dataflow, include its ID in the request by adding dataflow information as follows:

     ```
     "dataflow" : {"id" : "<dataflowId>"}
     ```

- **Finding out the ID:** You can find the dataflow ID either by using the REST Explorer in Workbench to make a GET call to the `/services/data/v39.0/wave/dataflows` endpoint (provided that your WaveDataflowAPI org permission is enabled), or by navigating to the Data Manager in your browser and using the Chrome Developer Tools to inspect some of the XHR Network payloads. To facilitate your search, note that dataflow IDs start with `'02K'`, while folder IDs start with `'00I'`.
- **You don't need to enter a dataflow ID if** the POST call can figure it out automatically, as in these cases:
  - Your master app is made up of assets that do not use a dataflow. In this case, the POST call to create the template will not generate a dataflow template file or dataflow reference in the `template-info.json` file.
  - The master app does contain a dataflow *that has been created for the application and has the same name as the app*. In this case, the POST call will automatically generate a dataflow template file from it and add a dataflow reference in the `template-info.json` file. In both of these instances, you don't need to enter a dataflow ID.
- **You do need to enter a dataflow ID if** the POST call can't figure it out automatically, as in these cases:
  - Your master app is made up of assets that do not use a dataflow, but you want to use one.
  - Your master app is made up of assets that use more than one dataflow. In this case, you must specify which one to use.
- **You need to do an extra cleanup step if** your master app is using the *default dataflow* to create datasets for the app, you must add it manually as shown. The POST call will then generate a dataflow template file from your default dataflow, *in addition to generating a unique dataflow for the master app* and adding a dataflow reference in the `template-info.json` file. You will need to clean up the duplicate dataflow information in the default dataflow after template creation. Do not use the unique dataflow for any master app updates; this way, it will be the template dataflow file that receives any updates from PUT calls, and the master app can be cleanly deleted if necessary.

6. Click **Execute**. If everything executes correctly, you receive no notifications. You should still perform the testing recommended in the next step.

   Note: If a master app is referencing datasets that are *not* contained in the master app, the template creation process will fail.

7. Test if your template creation was successful before proceeding to edit the template files by checking that it has yielded all the following results:
   - Executing creates a WaveTemplate object that contains all of the template information.
   - The server responds with template details and configuration URLs.
   - The response to the `GET wave/templates` call now includes your new template.
   - In Analytics Builder, selecting **Create -->App** now includes your new template in the list (provided that template permissions are enabled).
   - If you have updated assets in the master app and made this API call using the PUT method, your changes are reflected in the corresponding files in the WaveTemplate object. (To see the updated files, call Metadata API export on WaveTemplateBundle, as we describe in the next step, where you retrieve (export) the WaveTemplate object.

   Note: To execute POST, PUT, and DELETE calls using the Ant Migration Tool instead of Workbench, refer to the reference section "Examples of Using the Ant Migration Tool."

STEP 2: RETRIEVE (EXPORT) THE WAVETEMPLATE OBJECT

Analytics templates are no different than any other metadata (such as Visualforce pages and Apex classes). You can retrieve and deploy them using the Metadata API, and store the files in a configuration management system such as Git. The MDAPI export command extracts the WaveTemplate object from its org and packages it into a zip file (including the JSON files that define the template object), which you download and explore on your workstation using either the Lightning Platform Eclipse Plugin or the Ant Migration tool.

Note: Performing this step overwrites your template object folder contents. If you have edited JSON files (such as making changes to your `rules.json` files), make sure you have first pushed those changes back to the Metadata API by making an MDAPI deploy call as described in "Step 4: Deploy the WaveTemplate Object."

Using the Lightning Platform EclipsePlugin to Export

Follow these steps to set up the Eclipse project:

1. Install the Lightning Platform eclipse plugin and create a new project (refer to the Force.com IDE Developer Guide for instructions).
2. Update `package.xml` to include WaveTemplate by adding:

```
<types>
<members>*</members>
<name>WaveTemplateBundle</name>
</types>
```

3. Right-click on the project and select **Lightning Platform Refresh from Server**.
4. Create and install the package by following the instructions in our Packaging documentation. Specify **WaveTemplate** as the component type.

Using the Ant Migration to Export

Follow these steps to export the template using the Ant Migration Tool:

1. Refer to this guide's reference section, "Examples of Using the Ant Migration Tool." It provides you with two sample files for running an MDAPI export template call and deploy template call from ANT.

   Refer to the Ant Migration Tool Guide for additional information on using this tool.
2. Run `ant exportTemplate`, which retrieves the template artifacts via the Metadata API for editing.
3. Run `ant deployTemplate` to update the template on the server with any template edits.

4. To validate a successful export, first check that the unzipped file has all the components described in the "Template Folder Structure" section that follows, and that there are JSON files to represent each asset in the master app.

   Then create an app from the template by following the instructions in this guide's "Step 7: Create New (Downstream) Apps from the Template" to validate that all template dashboards, datasets, and dataflow are in place and working. To expedite this step, you can do this without editing the `ui.json` file that creates the wizard. Your test downstream app should then be identical to the master app.

Template Folder Structure

Decompressing the exported template file exposes the following folder structure:

-  *<TemplateName>*

  (top directory)

  -  `template-info.json`

    (do not change the name of this file; processing depends on it)

  -  `variables.json`
  -  `ui.json`
  -  `template-to-app-rules.json`

    (we recommend this naming convention to manage your rules files most easily)

  -  `app-to-template-rules.json`

    (we recommend this naming convention to manage your rules files most easily)

  -  `releaseNotes.html`
  -  `dashboards`

    (subdirectory containing one or more dashboard JSON files corresponding to each dashboard in the master app; this subdirectory does not exist if the master app has no dashboards)

  -  `lenses`

    (subdirectory containing one or more lens JSON files corresponding to each lens in the master app; this subdirectory does not exist if the master app has no lenses)

  -  `dataflows`

    (subdirectory containing one or more dataflow JSON files corresponding to each dataflow in the master app; this subdirectory does not exist if the master app has no dataflows)

- 
`external_files`

  (subdirectory containing one or more CSV dataset and related JSON files, such as schema and user XMD files, corresponding to each dataset in the master app; this subdirectory does not exist if the master app has no CSV datasets)

- 
`dataset_files`

  (subdirectory containing User XMD files for SFDC datasets; this subdirectory does not exist if there are no SFDC datasets with User XMD defined)

- 
`images`

  (subdirectory containing one or more image files; this subdirectory does not exist if the master app has no images)

- 
`folder.json`

STEP 3: EDIT THE JSON FILES

Your master app looks fantastic, with all the shiny widgets rendered beautifully in their dashboards. Now you want the same user experience in the configuration wizard that will dictate the creation of all downstream apps. The wizard is how you ask your future template user to decide which dimensions in a dataset to include and which to exclude, what name a new dashboard, or how to label a field in a chart. You control all this by editing the four types of JSON files discussed in this step (`template-info.json`, `ui.json`, `variables.json`, and any number of `rules.json`), which constitute the template assets. These JSON files open a world of flexibility and power in the template creation universe.

The files interact as follows:

- The `ui.json` file uses the variables in the `variables.json` file to dictate what goes on the each page of the wizard. The `ui.json` file can contain conditionals that dictate which questions or pages are displayed in the wizard.
- The `template-info.json` file identifies all the template components, including the references to the rules, variables, and UI files. The `template-info.json` file can contain conditionals that dictate whether assets should be generated in the downstream app.
- The `rules.json` files can use variables to set constants, and then use rules to set values that dictate how assets within the downstream app should be generated. The most common uses for rules include adding and removing dashboard widgets and dataflow actions.
- The `folder.json` file enables you to set a preferred order of the dashboards in the downstream app (as opposed to leaving them alphabetized).

And yet, editing these JSON files is really an optional step. A template is complete even without your touching any of these files; such a minimal template simply yields apps that mirror the master app without straying or flexibility. This is good to remember for testing your template when all you want is to make sure the creation worked.

The four template assets discussed here are not to be confused with the JSON files representing the *master app assets* (for example, `dashboard_name.json` and `lens_name.json`), which are also exported as part of the Metadata API retrieval. We recommend that you alter app assets and widgets in Analytics Builder (remembering, of course, to update the template object with a PUT call to the Analytics REST API), and leave their corresponding JSON files untouched.

Best Practices

Consider these recommendations as possible user experience guidelines:

Edit template-info.json

The `template-info.json` file is the main file that describes the template. It includes or references all the information required to create a downstream app.

Edit folder.json

The `folder.json` file describes the `featuredAssets` for the application.

Edit variables.json

The `variables.json` file describes all the variables used in the `template-info.json`, `ui.json`, and the different `rules.json` files. Variables enable the customization of apps; without them, everything is hard-coded. Variables allow the framework to replace tokenized data with customer-specific data.

Edit ui.json

The `ui.json` file defines your template's configuration wizard. Without a configuration wizard, the user creating a downstream ap is only asked to name the app, and an exact replica of the master app is created.

Edit rules.json

Customizing the installation of an Analytics application is crucial. Why? Because not all customers' orgs are the same, and a "one size fits all" application simply doesn't work.

Best Practices

Consider these recommendations as possible user experience guidelines:

- Try to strike a balance between too few questions and too many. Too few questions fail leave less flexibility for the user creating the app; too many can be daunting.
- Consider using an Apex callback class to create a Smart Wizard that can automatically detect certain information, thus sparing the user unnecessary questions. For example, a Smart Wizard can detect whether an org has a Product dimension, and that's one less question for the user to bother with. Call the Smart Wizard from the template-info.json file. It's a very powerful tool. Refer to the reference information about the Apex callback class at the end of this guide.

  You can call the Smart Wizard just as the template configuration wizard is loading, and use the Smart Wizard's results to either hide questions from the configuration wizard, display the detected information and disable the answer, or display the detected answers but enable the user to overwrite them.

  You can also call the Smart Wizard when the user clicks Create App after completing the template configuration wizard. This time, you can use the Smart Wizard to validate their answers, sparing them from encountering errors down the line. You can customize the Smart Wizard per page using VisualForce pages and a JavaScript library.
- Try to strike a balance between number of questions on each wizard page and number of pages in the wizard. Too many questions on each wizard page requires the user to scroll down, a practice best avoided; at the same time, a wizard with too many pages is cumbersome. We find that a page containing between five and eight questions is best.
- Group wizard questions by theme (for example, questions about quotas on one page; questions about products on another).
- Use templates without a configuration wizard for testing the creation of the template object.
- Organize like variables together (for instance, group variables about the Product dimension together).

Edit template-info.json

The `template-info.json` file is the main file that describes the template. It includes or references all the information required to create a downstream app.

In addition to the required content for a template to work, the `template-info.json` file can also contain conditionals. For example, the master app can have a dashboard with a superset of widgets in it, and you can include conditionals in the `template-info.json` file to remove specific widgets upon creation.

You can also call a Smart Wizard from this file (backing it up with an Apex callback class) to perform computations or detection on the user's data. You can call the Smart Wizard before the configuration wizard runs or after, when the app is being created. Refer to the "Best Practices" section for more about the Smart Wizard.

The `template-info.json` file has multiple parts:

- **Metadata information for the template:** name, developer name, description, template icon and asset icon

```
"name": "Wave-Analytics.edu Training Materials",
"developerName" : "wave_analytics_edu",
"description": "An example template to generate datasets, dashboards and lenses for the
 Analytics introduction course.",
"assetVersion": 39,
```

```
"templateType": "app",
"templateIcon": "default.png"
"assetIcon" : "17.png"
```

- `name` attribute defines the template ID; changing it creates a brand new template
- `templateIcon` is the icon that appears in the UI template wizard when selecting the template
- `assetIcon` is the icon displayed in the created app

- **Template version information:** The `templateVersion` is a string validated as "`#.#`". The `notesFile`, when present, must be an HTML file. If `releaseInfo` is present, an app created from the template can be reset or upgraded via the UI.

```
"releaseInfo":{
 "templateVersion": "1.0",
 "notesFile": "releaseNotes.html"
}
```

- **Reference to the variables file:** The file that contains all the variables used in the template is `variables.json`.

```
"variableDefinition":"variables.json",
```

- **Reference to the configuration wizard file:** The file that defines the wizard the user will fill out, answering questions to set variables, is `ui.json`.

```
"uiDefinition":"ui.json",
```

- **Reference to the rules file(s):** The file or files defining any rules to be applied to the template assets is `rules.json`.

```
"rules" : [ {
    "type" : "templateToApp",
    "file" : "template-to-app-rules.json"
  }, {
    "type" : "appToTemplate",
    "file" : "app-to-template-rules.json"
  } ],
```

  The `templateToApp` rules file defines rules that run when a downstream app is created or updated from a template; these are the rules you are most likely to edit.

  The `appToTemplate` rules file defines rules that run when a template is created or updated from a master app; these are the rules created by the framework code, you are not likely to edit them.

- **List of objects defining dashboards and lenses:** A dashboard or lens entry can contain a conditional statement to determine whether the asset is added at app creation time based on a given variable. This can be an empty list ("[]").

```
"dashboards": [
    {
"file": "dashboards/Elections_2012_Dashboard.json",
"name": "Elections Dashboard",
"condition" : "${Variables.StringValueInclude == 'Yes'}"
    }
],
"lenses":[
    {
"file": "lenses/Election_Breakdown_By_State.json",
"name": "Election Breakdown By State"
```

```
    }
],
```

- **Reference to external datasets:** List of files that define external datasets (CSVs) to create, can include XMD. Each dataset entry may contain an entry for a conditional statement, allowing for decisions to be made by variables on whether a dataset asset should be added at App creation time. This can be an empty list ("[]").

```
"externalFiles":[
   {
      "type" : "CSV",
      "name" : "State_Codes",
      "file" : "external_files/StateCode.csv",
      "schema" : "external_files/StateCode_schema.json"
   },
   {
      "type" : "CSV",
      "name" : "Election_2012",
      "file" : "external_files/Election_2012.csv",
      "schema" : "external_files/Election_2012_schema.json", (optional)
      "userXmd" : "external_files/Election_2012_XMD.json" (optional)
   }
],
```

- **References to datasets:** These are datasets created by the SFDC dataset builder.

```
"datasetFiles": [
 {
  "name": "Election_1980",
  "label": "Election 1980",
  "userXmd": "dataset_files/Election_1980_XMD.json
 },
{
  "name": "Election_2012",
  "label": "Election 2012"
 }
],
```

User XMD is NOT required. If it is present, there will be an XMD JSON file in the `dataset_files` directory; otherwise, no XMD JSON file will be present. If User XMD exists, it must be v2.0.

The dataflow file must contain a reference to the dataset (Extract and Register steps) in order for the dataset to be recreated in the creation process of any downstream app.

- **Reference to the dataflow file:** The file that contains the dataflow is `dataflow.json`. This can be an empty list ("[]").

```
"eltDataflows": [
   {
      "file": "dataflow/dataflow.json",
      "name": "Dataflow"
   }
]
```

- **Reference to the images:** These are the images associated with the app and used in dashboard files. Each image may contain an entry for a conditional statement, enabling decisions to be made by variables on whether an image should be added at app creation time.

```
"imageFiles" : [ {
"name" : "image1",
"condition" : "${Variables.ShowImage1}",
"file" : "images/image1.png"
},
{
"name" : "image2",
"file" : "images/image2.png"
}]
```

- **Reference to the folder file:** The file that contains the folder information for `featuredAssets` is `folder.json`.

```
"folderDefinition":"folder.json",
```

Edit folder.json

The `folder.json` file describes the `featuredAssets` for the application.

Template developers can use it to specify the order of the dashboards in the application instead of accepting the default behavior of alphabetizing by dashboard label.

Example:

```
{
"featuredAssets": {
    "default": {
        "assets": [
            {"id": "${App.Dashboards['ZDashboard'].Id}"},
            {"id": "${App.Dashboards['BDashboard'].Id}"},
            {"id": "${App.Dashboards['ADashboard'].Id}"}
        ]
    }
}
}
```

The above example tells the application to display the "ZDashboard" first, as the most prominent dashboard, rather than the default of A, B, then Z. If a dashboard has a conditional attribute in `template-info.json` that resolves so that the dashboard is not added at app creation time, a rule must be added to the `template-to-app-rules.json` to remove the dashboard from the `folder.json` file. This rule will remove that dashboard entry from the `featuredAssets` list at runtime and prevent the app creation from failing with a "Dashboard not found" error. The rule looks like this:

```
{
        "name": "RemoveDashboardZFromFolderJson",
        "condition": "${!Variables.HasDashboardZ}",
        "appliesTo": [
            {
                "type": "folder",
                "name": "*"
```

```
            }
        ],
        "actions": [
            {
                "action": "delete",
                "description": "Remove conditional dashboard",
              "path": "$.featuredAssets.default.assets..[?(@.id=~ /^.DashboardZ.$/i)]"

            }
        ]
    }
```

Edit variables.json

The `variables.json` file describes all the variables used in the `template-info.json`, `ui.json`, and the different `rules.json` files. Variables enable the customization of apps; without them, everything is hard-coded. Variables allow the framework to replace tokenized data with customer-specific data.

The best practice for defining variables is to declare the SOAP data type within the `variableType` object. It is not required, but adds more validation when the default field is unavailable. Use the types described in this document for the `dataType`.

- Example string:

```
"stringExample":{
        "label":"What's the value of the string?",
        "description":"The String.",
        "defaultValue":null,
        "variableType": {
            "type":"StringType",
            "enums":["foo","bar","baz"]
        }
    }
```

- Example number:

```
"numberExampleByTens": {
        "label":"What's the maximum number to use for the offset?",
        "description":"",
        "defaultValue": 80,
        "required":true,
        "variableType": {
            "type":"NumberType",
            "min" : 0,
            "max" : 100,
            "enums":[10,20,30,40,50,60,70,80,90,100]
        }
    },
```

- Example boolean:

```
  "booleanExample" :{
        "label":"Please define the boolean parameter?",
        "description":"Some boolean value.",
```

```
        "defaultValue": false,
        "required" : true,
        "variableType":{
            "type":"BooleanType",
        }
    }
```

- Example array sobject-field:

```
"sobjectFieldArrayExample" : {
   "label":"Select the user name fields?",
   "description":"The user fields to use.",
   "defaultValue": [
       {"sobjectName":"User","fieldName":"FirstName"},
       {"sobjectName":"User","fieldName":"LastName"},
   ],
   "required" : true,
   "variableType":{
    "type":"array",
"itemsType" : {
           "type" : "SobjectFieldType"
       }
   }
}
```

- Then, if you want to use this variable, you need to call it as:

```
${Variables.sobjectFieldArrayExample[0].sobjectName}
${Variables.sobjectFieldArrayExample[0].fieldName}
${Variables.sobjectFieldArrayExample[0]}
```

Refer to the section on array functions in rules (for multi-select and looping) to learn how to use array functions in rules.json.

Config Syntax for variables.json

The config syntax for `variables.json` follows:

Values Hash for variables.json

The values hash for `variables.json` follows:

Variable Definition Structure for variables.json

The variable definition structure for `variables.json` follows:

Simple Variable Types for variables.json

We call the following variable types “simple” because they are standard, predefined datatypes.

Complex Variable Types for variables.json

Unlike the simple variable types, these complex types are specific to Salesforce (for example, `sobject`, `sobjectField`) and are used to query the org for access to Salesforce objects, which you can then pull out as different datatypes.

Array Variable Type for variables.json

An array type produces a multi-select in the wizard. With it, a user can make multiple choices out of a presented list, and you can define a minimum and maximum for how many items the user can choose.

Variable Value Reference Use Case and Syntax for variables.json

A template can contain questions to select one or more `sObjects` and one or more `sObjectFields`. There are individual questions for `sObjectFields`. On a page, the first question is to select an `sObject`, and when a user does so, the template UI must use the selected `sObject` to show `sObjectFields` for the subsequent questions/pickers.

Config Syntax for variables.json

The config syntax for `variables.json` follows:

Example:

```
{
       "variables":{

       "userObjectName":{

            "label":"What's the object name where User information is stored?",

            "description":"",

            "variableType":{"type": "SobjectType"},

            "defaultValue":{"sobjectName": "User"}
},


       "userObjectUsernameField":{

            "label":"What's the object name and field name where Username information
 is stored?",

            "description":"",

            "variableType":{"type": "SobjectFieldType"},

            "defaultValue":{
                         "sobjectName": "User",
                         "fieldName": "Username"
             }

        },


        "maxAllowedOffset": {

            "label":"What's the maximum number to use for the offset?",

            "description":"",

            "variableType": {"type": "NumberType","min": 100, "max": 2000},

            "defaultValue": 1500,

            "required":true
```

```
        },

        "userRoleFields" :{
            "label":"What are the User Role fields and their value type (dim or date)
to use?",
            "description":"",
            "variableType":{
                "type":"ArrayType",
                "items": {
                    "type":"StringType"
                }
            },
            "defaultValue":[
                {
                    "name": "Id",
                    "type": "dim"
                },
                {
                    "name": "Name",
                    "type": "dim"
                },
                {
                    "name": "ParentRoleId",
                    "type": "dim"
                },
                {
                    "name": "RollupDescription",
                    "type": "dim"
```

```
                },

                {

                    "name": "OpportunityAccessForAccountOwner",

                    "type": "dim"

                },

                {

                    "name": "CaseAccessForAccountOwner",

                    "type": "dim"

                }

            ]

        }

    }
}
```

Values Hash for variables.json

The values hash for `variables.json` follows:

Example:

```
{
    "values":{
        "userObjectName":{sobjectName:"User" },
        "userObjectUsernameField":{sobjectName:"User" , fieldName:"Username" },
        "maxAllowedOffset":1200,
        "userRoleFields":[
            {
                "name": "Id",
                "type": "dim"
            },
            {
                "name": "Name",
                "type": "dim"
            },
            {
                "name": "ParentRoleId",
                "type": "dim"
            },
            {
                "name": "RollupDescription",
                "type": "dim"
            },
```

```
            {
                "name": "OpportunityAccessForAccountOwner",
                "type": "dim"
            },
            {
                "name": "CaseAccessForAccountOwner",
                "type": "dim"
            },
            {
                "name": "ContactAccessForAccountOwner",
                "type": "dim"
            },
            {
                "name": "ForecastUserId",
                "type": "dim"
            },
            {
                "name": "MayForecastManagerShare",
                "type": "dim"
            },
            {
                "name": "LastModifiedDate",
                "type": "date"
            },
            {
                "name": "LastModifiedById",
                "type": "dim"
            },
            {
                "name": "SystemModstamp",
                "type": "date"
            },
            {
                "name": "DeveloperName",
                "type": "dim"
            },
            {
                "name": "PortalAccountId",
                "type": "dim"
            },
            {
                "name": "PortalType",
                "type": "dim"
            },
            {
                "name": "PortalAccountOwnerId",
                "type": "dim"
            }
        ]
    }
}
```

Variable Definition Structure for variables.json

The variable definition structure for `variables.json` follows:

Example:

```
"<Name of a variable>":{


            "label":"<Question to display>",
            "description":"<Text to help user to select/provide the right value>",


            "variableType":{"type": "SobjectType"},
            "defaultValue":{"sobjectName": "User"},


            "required":true|false, <Default is false>
           "excludes":[<list of comma-separated devNames or regex tokens, it can have
 both devNames and regex tokens  (to not show in a picker or not accept)> ],
            "excludeSelected":true|false <If there are two or more pickers with same
source and variable type and this field is true for both, they'll exclude (from the
list of options) the selected option in the other picker>
}
```

"excludes" attribute

Regex Token Definition: `"/<regex pattern>/flags"`

Flags are characters that Javascript RegEx global object takes, for example: g, i, m, u, etc. Refer to the RegEx Object API documentation for details.

Example excludes:

1. `["caseId", "/{{\s*[\w\.]+\s*}}/g", "caseName"]`
2. `"["Name", "/^(Billing).+/"]` --> To exclude "Name" field and all the fields that start with "Billing"
3. `["/^(?!Billing)^(?!Shipping).+/"]` --> To exclude all the fields except those that start with "Billing" or "Shipping"
4. `["/.+(_kav)$/"]` --> To exclude all the fields that end with "_kav"
5. `["/^(?:(?!_kav).)*$/"]` --> To exclude all the fields except those that end with "_kav"
6. `["/(?!^Case$|^Account$)(^.*$)/"]` --> To exclude all the objects except Case and Account

Note: The defaultValue CANNOT include a value that will be excluded here, or an error will be displayed to the user.

"excludeSelected" attribute

In the following example, once a user picks an option for Dim1, that option is not shown in Dim2's picker.

```
"SObjectField1": {
            "label": "Select a field from account",
            "description": "First account field.",
            "defaultValue": {

                "sobjectName": "Account",
                "fieldName": ""
            },
```

```
            "required": true,
            "excludeSelected": true,
            "variableType": {
                "type": "SobjectFieldType"
            }
        }
"SObjectField2": {
            "label": "Select another field from account",
            "description": "Second account field.",
            "defaultValue": {
                "sobjectName": "Account",
                "fieldName": ""
            },
            "required": true,
            "excludeSelected": true,
            "variableType": {
                "type": "SObjectFieldtype"
            }
        }
```

Simple Variable Types for variables.json

We call the following variable types "simple" because they are standard, predefined datatypes.

Type Name	Type Declaration
`BooleanType`	`"variableType":{"type": "BooleanType"}`
`StringType`	`"variableType":{"type": "StringType"}`
`NumberType`	`"variableType":{"type": "NumberType"}`
`NumberType` (Range)	`"variableType":{"type": "NumberType", "min":0, "max":100}`

Complex Variable Types for variables.json

Unlike the simple variable types, these complex types are specific to Salesforce (for example, `sobject`, `sobjectField`) and are used to query the org for access to Salesforce objects, which you can then pull out as different datatypes.

Type Name	Type Definition	Type Declaration	Example Value
`SobjectType`	`{ "type": "ObjectType", "properties": { "sobjectName":{"type": "StringType"} } }`	`"variableType": { "type": "SobjectType" }`	`{ "sobjectName": "Account" }`

Type Name	Type Definition	Type Declaration	Example Value
SobjectFieldType	{ "type": "ObjectType", "properties":{ "sobjectName":{"type":"StringType"}, "fieldName":{"type":"StringType"} } }	"variableType": { "type": "SobjectFieldType", "dataType":"xsd:double" } Refer here for more values for dataType.	{ "sobjectName": "Account", "fieldName": "CompanyName" }
DatasetType	{ "type": "ObjectType", "properties":{ "datasetId":{"type":"StringType"}, "datasetAlias":{"type":"StringType"} } }	"variableType": { "type": "DatasetType" }	{ "datasetId": "Dataset01", "datasetAlias": "Airlines Dataset" }
DatasetDimensionType	{ "type": "ObjectType", "properties":{ "datasetId":{"type":"StringType"}, "fieldName":{"type":"StringType"} } }	"variableType": { "type": "DatasetDimensionType" } { "datasetId": "DS0001", "fieldName": "Width"	{ "datasetId": "DS0001", "fieldName": "Width" }
DatasetMeasureType	{ "type": "ObjectType", "properties":{	"variableType": { "type": "DatasetMeasureType" }	{ "datasetId": "DS0001", "fieldName": "Count"

Type Name	Type Definition	Type Declaration	Example Value
	"datasetId":{"type":"StringType"}, "fieldName":{"type":"StringType"} } }		}

DatasetDateType	{
	"type":
	"ObjectType",
	"properties":{
	"datasetId":{"type":"StringType"},
	"dateAlias":{"type":"StringType"}
	}
	}
		"variableType": {
		"type":
		"DatasetDateType"
		}
			{
			"datasetId":
			"DS0001",
			"dateAlias":
			"Close_Date"
			}

Array Variable Type for variables.json

An array type produces a multi-select in the wizard. With it, a user can make multiple choices out of a presented list, and you can define a minimum and maximum for how many items the user can choose.

```
"variableType": {
  "type": "ArrayType",
  "itemsType": {
    "type": "NumberType"
  }
  "sizeLimit":{
   "min": minimum number of elements
   "max": maximum number of elements
   }
}
```

Example for `enum` ArrayType:

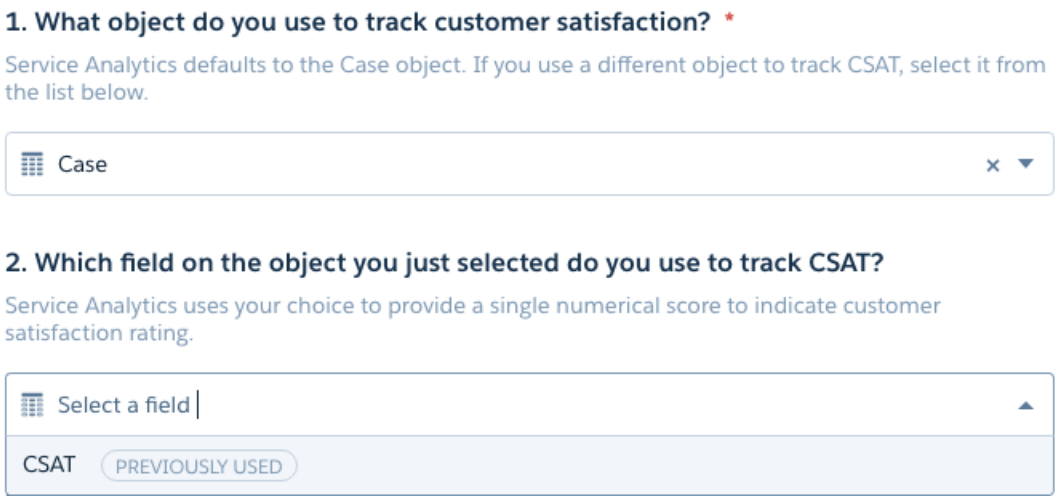
```
"required" : false,
   "variableType" :
    {
     "type":
          "ArrayType",
     "itemsType":
       {
         "type": "StringType",
         "enums" : [
                   "Leads",
```

```
                    "Campaigns",
                    "Campaign Members"
                     ]
          },
      "sizeLimit": {
        "max": 3
       }
      }
    },
```

Variable Value Reference Use Case and Syntax for variables.json

A template can contain questions to select one or more `sObjects` and one or more `sObjectFields`. There are individual questions for `sObjectFields`. On a page, the first question is to select an `sObject`, and when a user does so, the template UI must use the selected `sObject` to show `sObjectFields` for the subsequent questions/pickers.

For example, the `sObject` picker on top and `sObjectField` picker are connected, as shown in the image below.



Following is template JSON used to render the above UI. In the variables section, notice `CSATField` variable's type info: the `defaultValue` contains a reference to the variable's value `CSATObj` and the syntax is `{{Variables.CSATObj.sobjectName}}`. The intention here is to replace `{{Variables.CSATObj.sobjectName}}` with the value that user picked for the variable `CSATObj`.

```
{
  "ui": {
    "pages": [
      {
        "title": "Page1",
        "variables": [
          {
            "name": "CSATObj"
          },
          {
            "name": "CSATField"
          }
```

```
        ]
      }
    ]
  },
  "variables": {
    "CSATObj": {
     "description": "Service Analytics defaults to the Case object. If you use a different
 object to track CSAT, select it from the list below",
      "label": "1. What object do you use to track customer satisfaction?",
      "required": true,
      "variableType": {
        "type": "SObjectType"
      },
      "defaultValue": {
        "sobjectName": "Case"
      }
    },
    "CSATField": {
      "description": "Service Analytics uses your choice to provide a single numerical
score to indicate customer satisfaction rating.",
     "label": "2. Which field on the object you just selected do you use to track CSAT?",

      "defaultValue": {
        "datasetId": "{{Variables.CSATObj.sobjectName}}",
        "fieldName": ""
      },
      "required": true,
      "excludeSelected": true,
      "variableType": {
        "type": "SobjectFieldType",
        "datatype": "xsd:double"
      }
    }
  }
}
```

Variable Value Reference Syntax

```
"{{Variables.Dataset1.datasetId}}
{{Variables.<SObjectVariableName>.sobjectName}}"
```

Refer to the mustache.js documentation for more detail.

Edit ui.json

The `ui.json` file defines your template's configuration wizard. Without a configuration wizard, the user creating a downstream ap is only asked to name the app, and an exact replica of the master app is created.

The UI file describes the wizard page layout. It informs the display of the variables described in `variables.json` and looks like this:

```
{
    "ui" :{
```

```
        "pages": [
            {
                "title":"Customization Questions",

                "variables":[

                    {"name": "customizeUserObjectInfo"}
                ]
            }

            {

                "title":"User Object Information",
                // Only show this page if the user checked the "customizeUserObjectInfo"
checkbox.

                "condition":"{{Variables.customizeUserObjectInfo == 'Yes'}}",

                "variables":[

                    {"name": "userObjectUsernameField"},

                    {"name": "userObjectName"},
                    {"name": "pageConditionVariable"},

                    {"name": "showBoolean"}
                ],
                "helpUrl":"https://salesforce.com/wave/salesapp/page1/help.html"

            },

            {

                "title":"Job Information",

                "variables":[

                    {"name": "maxAllowedOffset"},
                    {"name": "booleanExample", "visibility": "{{Variables.showBoolean ?
'Visible' : 'Hidden'}}"},
                ],
     "helpUrl":"https://salesforce.com/wave/salesapp/page2/help.html"

            }
        ],
        "displayMessages": [
             {
                 "text":"When we're done creating the app, we'll send you an email.",
      "location": "AppLandingPage"
             }
         ]
    }
}
```

Page Condition Syntax for ui.json

You can make a page's appearance conditional on the value of a variable. For example, if the user answers "No" when asked if there is a Products dimension, you can use a conditional to ensure that no Products-related page displays in the wizard. Adding page conditions enables wizard page flow. If the condition is met, then the page with the condition will display; if the condition is not met, the page will not display. Use the following syntax to instruct which conditionals control the display of pages.

Variables Array in ui.json

Use a `variables` array to display a question to users conditionally. You can optionally display a question as disabled in the case where an answer has been found or computed using Apex Class. To accommodate variable condition and other fields, the `variables` array must be an array of objects instead of an array of variable names.

Creating Custom UI Wizard Pages Using VisualForce

You can use VisualForce and a JavaScript library to enhance the wizard display if you want to improve the user experience beyond the default interface.

Page Condition Syntax for ui.json

You can make a page's appearance conditional on the value of a variable. For example, if the user answers "No" when asked if there is a Products dimension, you can use a conditional to ensure that no Products-related page displays in the wizard. Adding page conditions enables wizard page flow. If the condition is met, then the page with the condition will display; if the condition is not met, the page will not display. Use the following syntax to instruct which conditionals control the display of pages.

Variable Type	Supported Operations	Example
`StringType`	`==, !=`	`{{Variables.x == 'Yes'}}`
`BooleanType`	`==, !=`	`{{Variables.x == true}}`
`NumberType`	`==, !=, <, <=, >, >=`	`{{Variables.x == 5}}`
`SobjectType`	`==, !=`	`{{Variables.x.sobjectName == 'x'}}`
`SobjectFieldType`	`==, !=`	`{{Variables.x.fieldName == 'x'}}`
`ArrayType --> StringType`	`contains`	`{{Variables.x contains 'x'`123}}`
`ArrayType --> NumberType`	`contains`	`{{Variables.x contains 5}}`

Variables Array in ui.json

Use a `variables` array to display a question to users conditionally. You can optionally display a question as disabled in the case where an answer has been found or computed using Apex Class. To accommodate variable condition and other fields, the `variables` array must be an array of objects instead of an array of variable names.

Variable Object

A variable object can have following fields:

```
{
   "name": "userObjectUsernameField",

   "visibility": "{{Variables.orgHasUserObject == 'Yes'}}"
}
```

Key	Required	Value Description
`name`	Yes	Name of the variable.
`visibility`	No	• Display condition: – If the condition is evaluated to `'true'`, then this variable (question+input control) is displayed. – If evaluated to `'false'`, this variable won't be displayed. – If evaluated to `'disabled'`, this variable is grayed out. • This is evaluated on the client side. • Valid values `'Disabled' | 'Visible' | 'Hidden'` • Example Expressions: – `"{{Variables.booleanType ? 'Visible' : 'Hidden'}}"` – `"{{Variables.orgHasUserObject == 'Yes' ? 'Visible' : 'Hidden'}}"` – `"{{Variables.orgHasUserObject == 'Yes' ? 'Disabled' : 'Visible' }}"`

Example: Example of variable object:

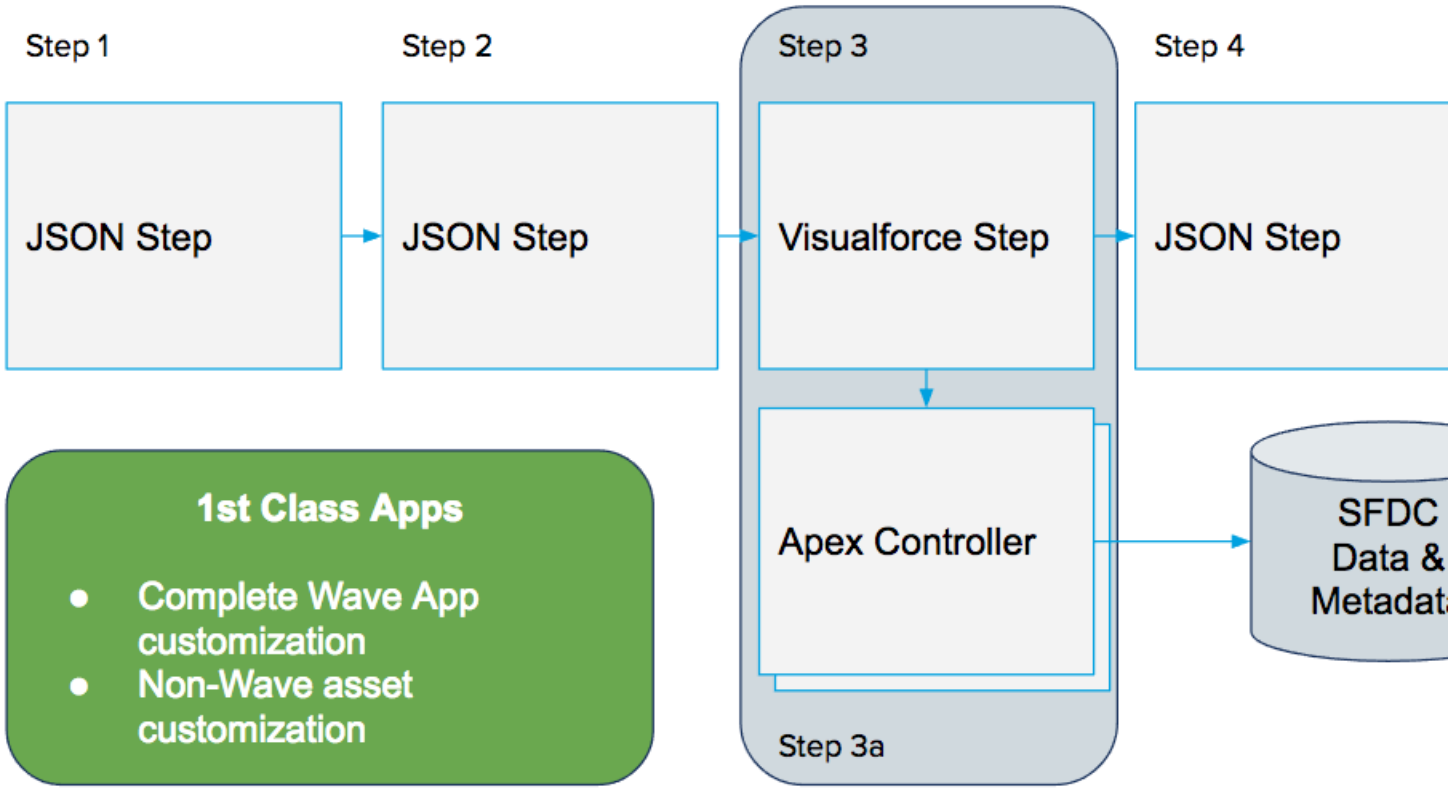
```
{

    "ui" :{

        "pages": [

            {

                "title":"User Object Information",
                // Only show this page if the user checked the "Customize" button.

                "condition":"{{Variables.customizeOpportunities == 'Yes'}}",

                "variables":[
                    {
                        "name": "userObjectUsernameField",

                      "visibility": "{{Variables.orgHasUserObject == 'Yes' ? 'Visible'
 : 'Hidden'}}"
                    },
                    {
                        "name": "userObjectName",

                      "visibility": "{{Variables.orgHasUserObject == 'Yes' ? 'Visible'
 : 'Hidden'}}"
                    }
                ],
                "helpUrl":"https://salesforce.com/wave/salesapp/page1/help.html"

            },

            {

                "title":"Job Information",

                "variables":[

                    "maxAllowedOffset"
                ],
                "helpUrl":"https://salesforce.com/wave/salesapp/page2/help.html"

            }
        ],
        "displayMessages": [
             {
               "text":"When we're done creating the app, we'll send you an email.
Before you access the dashboards, you need to wait for the dataflow for the app to
finish running. After that, refresh this page and start exploring.",
   "location": "AppLandingPage"
             }
         ]
    }
}
```

Creating Custom UI Wizard Pages Using VisualForce

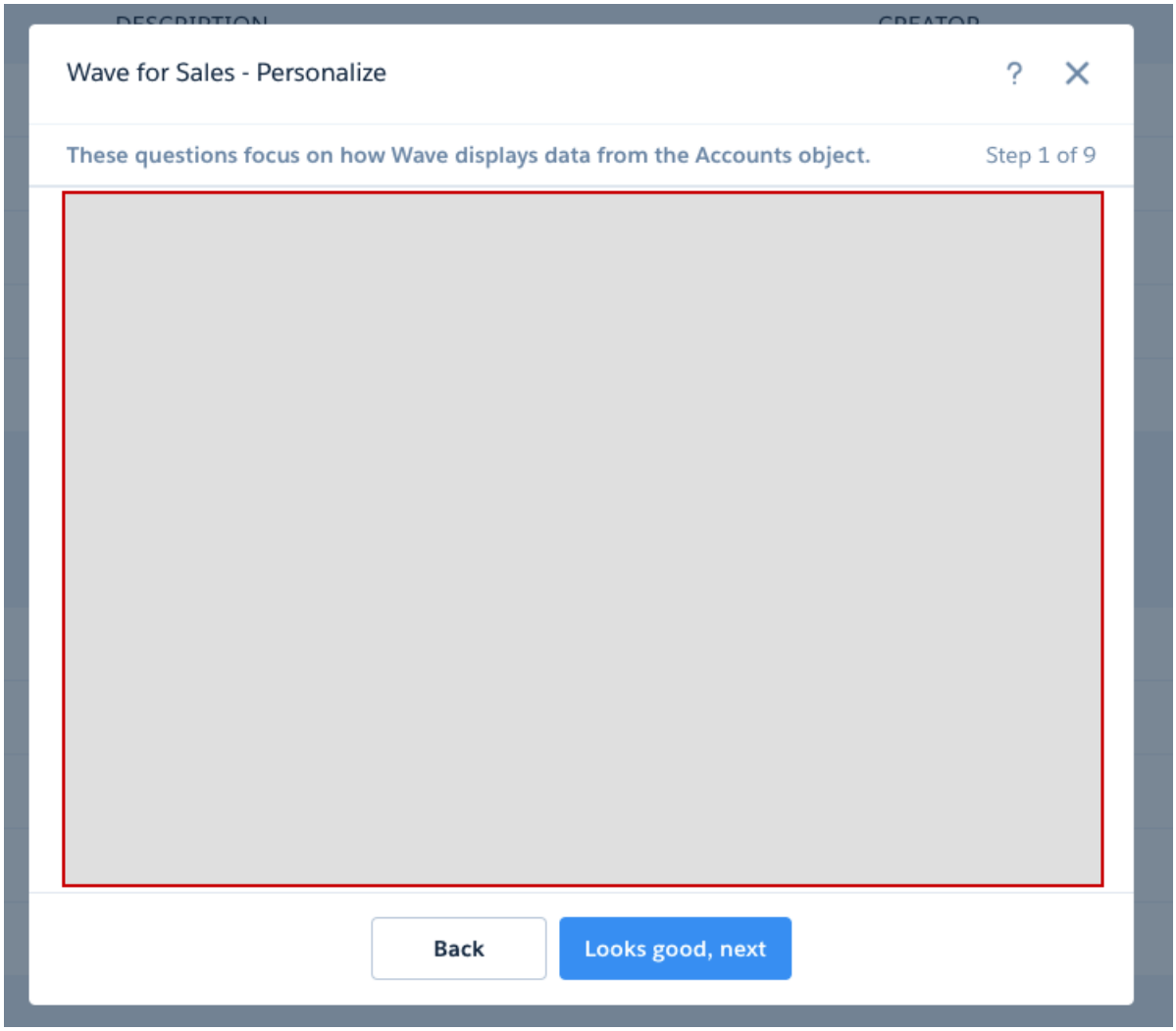
You can use VisualForce and a JavaScript library to enhance the wizard display if you want to improve the user experience beyond the default interface.

The wizard you create is run prior to application generation and consists of a set of pages, each of which contains a set of questions. All of this is declaratively configured in `ui.json`. The framework also enables you to run a custom APEX class before and after the wizard, allowing the application developer to answer questions automatically or validate the org to ensure it has the minimum set of requirements to install the application. You can accept the default format of the error messages generated by the validation process by ignoring the rest of this section. Or you can use VisualForce and a JavaScript library to enhance the display if you want to improve the user experience or include links for making configuration changes.

Using VisualForce, you can replace any or all of the autogenerated wizard pages with a custom VisualForce page, where you can display anything you want. Refer to the illustration below for an example of how you can integrate a custom VisualForce page into the wizard flow.



The VisualForce page is responsible for rendering everything inside the red lines in the figure below and interacts with the wizard through a JavaScript SDK.



The JavaScript SDK is essentially be a pub/sub eventing mechanism with a set of well defined events fired and consumed during a well defined lifecycle. The SDK is versioned and can be included in any VisualForce page as follows:

```
<script type="text/javascript"
src="/analytics/wave/sdk/js/40.0/wizard.js"></script>
```

Example code:

```
// Subscribe to event that gets fired when the page first loads
Wave.wizard.publish(
   {name : 'wizard.ready', "payload" : {}, callback : function (response) {
var payload = response.payload;
var metadata = {
   page : payload.page,
   variableDefinitions : payload.variableDefinitions,
   values : payload.initialValues
}
   }});

// Update and validate a single answer to a question
```

```
Wave.wizard.publish({
   name: "wizard.update",
   payload: {name: "Fiscal_Month", value: "01 - January"},
   function(response) {
       var errors = response.payload;
   }
});
```

Declaring the VisualForce Page in ui.json

In order to replace the default rendering of a wizard page the application developer will simply specify the visualforce name in `ui.json` page as follows:

```
   "pages" : [
   {
       "title": "These questions focus on how Analytics displays data for Accounts”,
"variables": [
           { "name": "Customer" },
           { "name": "Customer_L2" },
           { "name": "Source" },
           { "name": "Geo_Maps" },
           { "name": "Geography" },
           { "name": "Geography_L2" }
       ],
       "helpUrl":"https://help.salesforce.com/HTViewHelpDoc?id=bi_app_sales_wave.htm",
       "vfPage":{
           "namespace": "<visualforce_namespace>",
           "name": "<visualforce_page_name>"
       }

   }]
```

Refer to the "VisualForce Events for Customizing the Wizard UI" reference section at the end of this guide for details on the events to which you can subscribe or publish.

Edit rules.json

Customizing the installation of an Analytics application is crucial. Why? Because not all customers' orgs are the same, and a "one size fits all" application simply doesn't work.

Not all customers have enabled the same features. Not all customers store the data in the same place. Not all customers close on the same date. Not all customers have the same colors or logos. You get the idea.

There are a couple of different ways to customize the installation of an Analytics application from a template. One method is to use EL expressions in-lined in the JSON, but these are typically reserved for certain IDs and developer names. Another method is to use conditional expressions in the `template-info.json` to conditionally include or exclude certain assets. But by far the most powerful way to morph the JSON so that it is completely customized to the customer organization is through rules. Rules are a very powerful way to express changes to the template's JSON during app creation.

Rules can be complex, but are also optional, and with the help of macros and constants can be greatly simplified. Rules are used in combination with variables (answers from the wizard), and, when combined, can alter your template's JSON in any way you see fit.

There are two type of rules: app-to-template rules and template-to-app rules. They are syntactically identical; the only difference is when they get applied. App-to-template rules are less common, but can be used to convert your master app back to template form. Template-to-app rules are more common and are powered by the answers from the wizard.

Rules are made up of these parts:

- **Action:** The action designates what CRUD operation to perform.
- **Path:** A JSON path to where in the document to perform the action.
- **AppliesTo:** Consists of a name and type and denotes to which asset files to apply the rules.

Rules can also be broken out into multiple files for convenience. The order in which they are declared in `template-info.json` is the order in which they are executed.

Here is a simple sample rule for changing the title text on a dashboard:

```
{
    "name": "Update dashboard title",
    "appliesTo": [
        {
            "type": "dashboard",
            "name": "DashboardOne"
        }
    ],
    "actions": [
        {
            "action": "set",
            "description": "change the title text of the dashboard",
            "path": "$.state.widgets.title_text.parameters.text",
            "value": "${Variables.DashboardTitle}"
        }
    ]
}
```

Template-to-App Rules

Template-to-app rules dictate which parts of the app are generated, and which are excluded. They run when the wizard has been completed and the assets for the app are being built. For example, rules can say "If the user answered 'No' to the Product dimension (based on variables), delete Product pages from the wizard; in this case, rules are used to pull unwanted parts of dashboards and dataflows out when the app is being built (otherwise, dataflow builds will fail and dashboards will display blank portions if they don't fail). Rules can also say "Take the content of this text box and place it here."

App-to-Template Rules

You can also apply rules to the app-to-template process, which is the process of templatizing the master app. These rules run when the master app has been updated and you update the template object with a PUT call to the Analytics REST API. For example, you may choose to to tokenize all the asset files every time they are pulled out of the master app. Use an app-to-template rules file for this.

The need for app-to-template rules is far less common. Most of this discussion addresses template-to-app rules.

Actions and Constants in Rules

The component that defines rules is *actions*. To facilitate your use of this functionality, we have also provided *constants*, which are similar to variables, and completely optional.

Multiple Rules Files

The order of rules files is important. When we write rules into our system on deploy, they are processed in order. This means that `rules1.json` cannot have a constant based on a conditional in `rules5.json`.

Rules Syntax

The rules object may contain any number of rule objects. A rule object is made up of:

Actions Syntax for Rules

The actions syntax for rules is:

String Functions in Rules

You can manipulate string functions using rules. For instance, you can replace all occurrences of one string with another or convert strings from uppercase to lowercase. If a user enters a dashboard title in the wizard using all lowercase letters, for example, you can use functions to change that to sentence case when the asset is actually being generated in the downstream app. In conjunction with string functions, we also introduced a new built property,`"Rules.CurrentNode"`. This property contains the last results of the JSON `'path'` argument you supplied in the action of your rule.

Array Functions in Rules (for Multi-Select and Looping)

To create a multi-select widget in the Template Wizard, add a variable of `"ArrayType"`.

Macros in Rules

Template rules play an important role in the transformation of assets within a template. Rule definitions can grow at an unmanageable pace (depending on the complexity of the template), and the same type of rules are executed repetitively, but are executed on different JSON node paths. (After reading this section, refer to the macros portion of the reference section in this guide.)

Actions and Constants in Rules

The component that defines rules is *actions*. To facilitate your use of this functionality, we have also provided *constants*, which are similar to variables, and completely optional.

Actions

Actions are edits you want to perform on a set of JSON documents. The valid actions are `'delete'`, `'put'`, `'set'`, and `'add'`.

- `delete`: deletes a node in the document
- `put`: adds a node to an object
- `set`: sets the value of an existing node in the document
- `add`: adds an element to an array

Each action has a **path** attribute. This path is a JsonPath pointing to the node in the document. JsonPath is for JSON like XPath is for XML. You can practice it here.

Actions can be conditionally applied to a document. You can set the condition on a set of actions or on a collection of actions.

The rules file is referenced from the `template-info.json`.

Constants

Constants are like variables, but are not passed in or declared in the UI. The idea is to create shortcuts for longer expressions to reduce typing and cut and paste errors. Constants can be references in the document via the normal expression language `${Constants.<constantName>}`.

Multiple Rules Files

The order of rules files is important. When we write rules into our system on deploy, they are processed in order. This means that `rules1.json` cannot have a constant based on a conditional in `rules5.json`.

Rules can grow to be numerous and rules files hard to read. We recommend the following best practices for organizating your rules:

- Have one rules file for all your constants, and another for all your actions.

- When the actions grow to be more than 500 lines, consider breaking them up into; for example, a dashboard rules file and a a dataflow rules file.
- Because the rules file order is important, we recommend putting content that all the rules files are going to use in the first file.

Rules Syntax

The rules object may contain any number of rule objects. A rule object is made up of:

Attribute	Type	Example	Required	Notes
`name`	String	`"name": "ruleName"`	Yes	
`condition`	String	`"condition": "${Variables.foo == "Yes"}"`	No	Use freemarker conditions to apply the rule (same syntax as conditions used in `template-info.json`)
`appliesTo`	Array	`{ "type": "dashboard", "name": "dashboardOne" }`	Yes	Use `"type": "*"` to apply to all JSON assets. Other valid values are `"dashboard"` , `"lens"`, `"workflow"`, `"schema"`, and `"xmd"` The `"name"` string allows specific JSON assets to be referenced The `"name"` can take `"*"` as well, to apply to all of one asset type or a group of one asset type Note: NOTE: for workflow type, name has to be `"*"`
`actions`	Array	`{ "action": "set", "description" : "A desc", "path": "$.json.path", "value":`	Yes	4 actions types: `add`, `put`, `set`, and `delete` Can have as many actions as needed in array

Attribute	Type	Example	Required	Notes
		`"setValue"` `}`		

Actions Syntax for Rules

The actions syntax for rules is:

Action	Example	Notes

`add`	`{`
	`"action": "add",`
	`"description" : "Add desc",`
	`"path": "$.json.path.to.existing.json,array",`
	`"index": 0,`
	`"value": "value to add"`
	`}`
		Adds an entry to an existing array
		Needs `"index"` and `"value"`
		`"index"` should be 0 for first element in array, any number after that for middle of array
		If `"index"` is larger than array size, value will be added to end of array

`put`	`{`
	`"action": "put",`
	`"description" : "Put desc",`
	`"path": "$.json.path.to.existing.json",`
	`"key": "jsonAttributeName",`
	`"value": "new value"`
	`}`
		Add an attribute and value to an existing JSON value
		Needs `"key"` and `"value"`
		`"value"` can be a string or an array

`set`	`{`
	`"action": "set",`
	`"description" : "Set desc",`
	`"path": "$.json.path.to.attribute",`
	`"value": "setValue"`
	`}`
		Set a value on an existing JSON attribute
		Needs `"value"`

`delete`	`{`
	`"action": "delete",`
	`"description" : "Delete desc",`
	`"path":`
		Remove a node in the existing JSON tree

Action	Example	Notes
	`"$.json.path.to.delete"` `}`	

`eval`	`[`
	`{`
	`"action": "eval",`
	`"key": "helloResult",`
	`"value": "${myMacros:sayHello('Hello')}"`
	`},`
	`{`
	`"action": "set",`
	`"path": "$.path.json.node",`
	`"value": "${Rules.Eval.helloResult}"`
	`}`
	`]`
		Evaluate the expression specified in `'value'` and assign results to the context variable specified by `'key'` (if set). Context attribute can be referenced using the expression: `${Rules.Eval.<variable_name>}`.
		Scope of the eval variable is either:
		• The entire document if performed in a rule, or
		• The macro if performed within a macro

String Functions in Rules

You can manipulate string functions using rules. For instance, you can replace all occurrences of one string with another or convert strings from uppercase to lowercase. If a user enters a dashboard title in the wizard using all lowercase letters, for example, you can use functions to change that to sentence case when the asset is actually being generated in the downstream app. In conjunction with string functions, we also introduced a new built property,`"Rules.CurrentNode"`. This property contains the last results of the JSON `'path'` argument you supplied in the action of your rule.

The EL Expression Language allows for custom functions to be invoked in an expression. Functions can appear in the static text of an EL expression. For example:

```
"name" : "my name in lowercase is
    ${string:toLowerCase(Variables.myName)}",
```

Function Quick Reference

To use rules for manipulating string functions, use this list for a quick reference:

Function Quick Reference

To use rules for manipulating string functions, use this list for a quick reference:

Namespace	Name	Description
string	`toUpperCase`	Converts all of the characters in this Object to uppercase.
string	`toLowerCase`	Converts all of the characters in this Object to lowercase.
string	`replace`	Returns a new object resulting from replacing all occurrences of `oldStr` in this object with `newStr`.
string	`replaceAll`	Replaces each substring of this string that matches the given regular expression with the given replacement.
string	`replaceFirst`	Replaces the first substring of this string that matches the given regular expression with the given replacement.

string	`split`	Parses a string and slices it into an array defined by the specified delimiter.
		`${string:split(<string>, <delimiter>)}`
		For example:
		`${string:split('one:two:three', ':')}`
		Results in array of strings:
		`['one','two','three']`
		If more complex regular expression matching is required, see `string:match` below.

string	`match`	Performs more complex regular expression matching and returns an array of matching results. For example, to capture items surrounded by square single quote and square brackets:
		`${string:match('['foo']['bar']['baz']', '\\\\[\\'(.*?)\\'\\\\]')`
		Returns the following array, containing:
		`foo`

Namespace	Name	Description

		`bar`
		
		`baz`

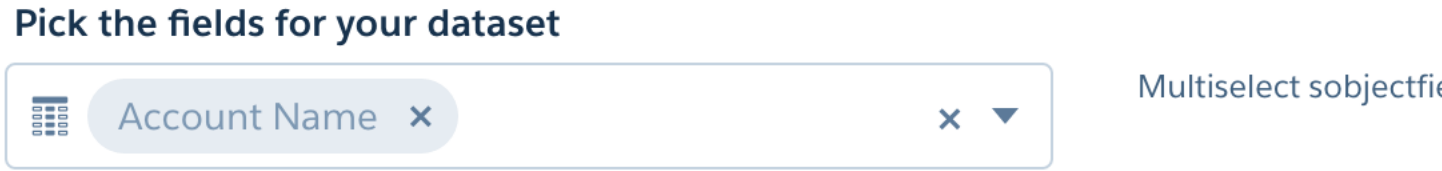
string	`join`	Creates a string from an array of strings and separates each item by the specified delimiter. `${string:split(<string>, <delimiter>)}`
array	`forEach`	Evaluate returnValue as an EL expression for each item in the given array and collects each eval result in an array and returns it.
array	`concat`	Returns an array after concatenating the given array1 and array2.
array	`unique`	Returns an array with unique items. Note: There are two versions of this function; for differences, refer to the reference section for function documentation.
array	`union`	Returns a combined array array of unique items which is an union of array1 and array2. Note: There are two versions of this function; for differences, refer to the reference section for function documentation.
array	`size`	Returns the number of items in the array. If the array is null or empty, 0 will be returned.
array	`last`	Returns the last item in an array. If the array is null or empty, null will be returned.
json	`searchPaths`	Searches the current JSON document and returns matching fully qualified JSON paths. If no results are found, an empty array will be returned. If more than one item is found, an array of JSON paths will be returned. For example: `${json:searchPaths('$.path.to.json.object')}` If this function is called outside of rules execution, an error will be thrown.

Namespace	Name	Description
json	`searchValues`	Searches the current JSON document and returns values of the matching nodes. If no results are found, an empty array will be returned. If more than one item is found, an array of objects will be returned. For example: `${json:searchValues('$.path.to.json.object')}` If this function is called outside of rules execution, an error will be thrown.
json	`toJsonObject`	Converts a string in JSON form to a JSON object. `${json:toJsonObject(<stringified_object>)}`

Array Functions in Rules (for Multi-Select and Looping)

To create a multi-select widget in the Template Wizard, add a variable of `"ArrayType"`.

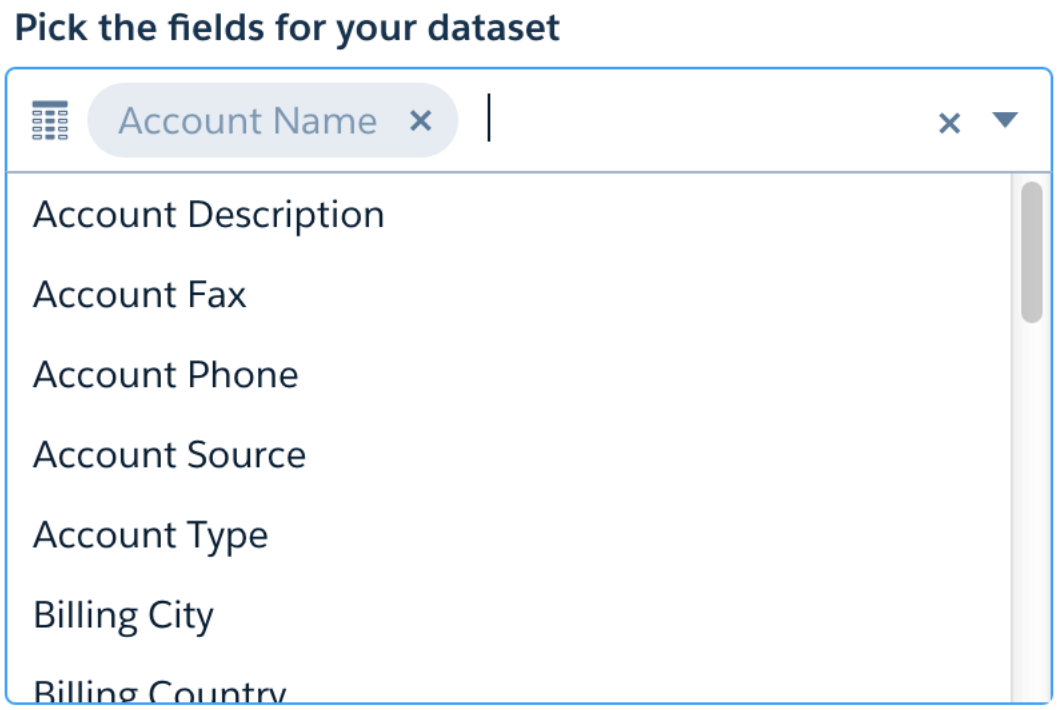
```
"Account_Fields": {
        "label": "Pick the fields for your dataset",
        "description": "Multiselect sobjectfield test",
        "defaultValue": [
          {
            "sobjectName": "Account",
            "fieldName": "Name"
          }
        ],
        "required": false,
        "variableType": {
            "type": "ArrayType",
            "itemsType": {
                "type": "SobjectFieldType"
            }
        },
        "excludeSelected": true
    }
```

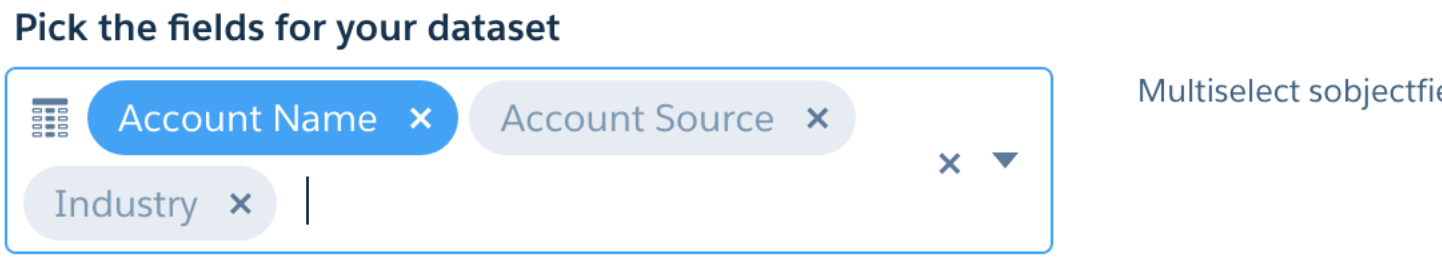


The `ArrayType` variable contains an `itemsType` attribute, which can be:

- `SObjectType`
- `SObjectFieldType`
- `DatasetType`
- `DatasetDateType`
- `DatasetDimensionType`
- `DatasetMeasureType`
- `StringType`, or
- `NumberType`

Selections in the widget are placed into an array as shown:





Items in the array can be referenced by index. Arrays of `StringType` and `NumberType` are easy to work with, but arrays of `SObjectType` and `SObjectFieldType` contain multiple attributes for each item in the array:

Array of `SobjectFieldType`:

- `${Variables.Account_Fields[0]}` returns (`sobjectName`=Account, `fieldName`=Name, `sobjectLabel`=Account, `fieldLabel`=Account Name)
- `${Variables.Account_Fields[0].fieldName}` returns Name
- `${Variables.Account_Fields[0].fieldLabel}` returns Account Name
- `fieldName` is required for dataflow

The selection values from the widget are stored in the variable and there are two ways to access them in the template files (rules, dashboards, workflow):

- Use array values from `SobjectFieldType` without looping, accessing by index

```
"fields":[
        {"name":"${Variables.Account_Fields[0].fieldName}"},
        {"name":"${Variables.Account_Fields[1].fieldName}"},
        {"name":"${Variables.Account_Fields[2].fieldName}"},
        {"name":"${Variables.Account_Fields[3].fieldName}"},
        {"name":"${Variables.Account_Fields[4].fieldName}"}
    ]
```

  This example, without looping, would be tricky to use, because there would always need to be at least five items in the array. Any fewer would fail, and anything over five would not be used.

- Use array values from `SobjectFieldType` with looping via the `array:forEach` function. In this example, a `"set"` action is going to loop through the `SObjectFieldTypes` in the array and add them to the `"fields"` attribute in the `Extract_Account` step of the workflow. Each entry in `"fields"` will need "name" and `"var.fieldName"`.
- – `rules.json`

```
"name": "AddAccountFilesToDataflow",
  "appliesTo": [
    {
      "type": "workflow",
      "name": "*"
    }
  ],
  "actions": [
    {
      "action": "set",
      "description": "use selected values for sfdcDigest in dataflow",
      "path": "$.workflowDefinition.Extract_Account.parameters.fields",
      "value": "${array:forEach(Variables.Account_Fields, '{\"name\":
\"${var.fieldName}\"}')}"
    }
  ]
```

- – `dataflow.json`

```
"Extract_Account":{
   "action":"sfdcDigest",
   "parameters":{
```

```
        "fields":[],
        "object":"Account"
    }
}
```

- Results after processing if Account Name, Account Source, and Industry are selected

```
"Extract_Account":{
    "action":"sfdcDigest",
    "parameters":{
        "fields":[
            {"name":"Name"},
            {"name":"AccountSource"},
            {"name":"Industry"}
        ]
    }
]
```

Here are more ways to work with arrays that extend the power of the `array:forEach` function:

- `array:union` (only uses unique values, so no duplicated values)

```
"value": "${array:union(array:forEach(Variables.Account_Fields,
 '{\"name\": \"${var.fieldName}\"}'),array:forEach(Variables.Account_Fields2,
 '{\"name\": \"${var.fieldName}\"}'))}"
```

- `array:concat` (2 new arrays)

```
"value": "${array:concat(array:forEach(Variables.Account_Fields,
'{\"name\": \"${var.fieldName}\"}'),array:forEach(Variables.Account_Fields2,
 '{\"name\": \"${var.fieldName}\"}'))}"
```

- `array:concat` (1 new array with existing array)

```
"value":"${array:concat(Rules.CurrentNode,
 array:forEach(Variables.Account_Fields,
 '{\"name\":\"${var.fieldName}\"}'))}"
```

- You can use array functions in the `"set"` and `"put"` actions, but not in the `"add"` or `"delete"`.
  - In `"add"`, the value is being added to an existing array, so the result is an array inside an array, which is not well-formed json. To add more array values to an existing array, use `"set"` with the `array:concat` function
  - For `"delete"`, value is not used
- Use array values from `StringType` (same for `NumberType`)
  - `variables.json`

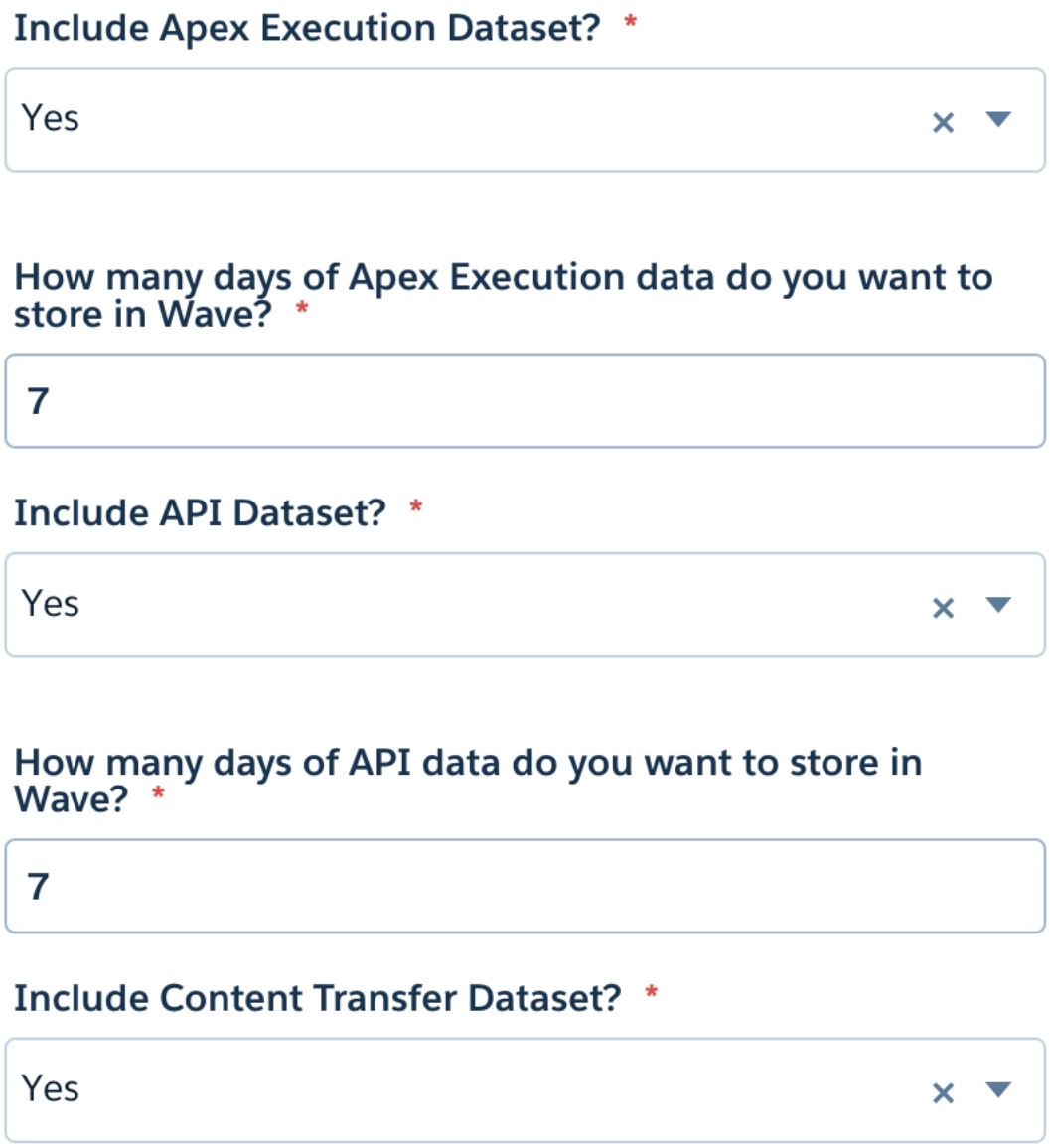
```
"Account_Fields_String": {
        "label": "Pick string fields for your dataset",
        "description": "Multiselect string test",
        "defaultValue": ["Name"],
        "required": true,
        "variableType": {
            "type": "ArrayType",
            "itemsType": {
```

```
                "type": "StringType",
                "enums": ["Name", "AccountSource", "Industry", "Type"]
            }
        }
    }
```

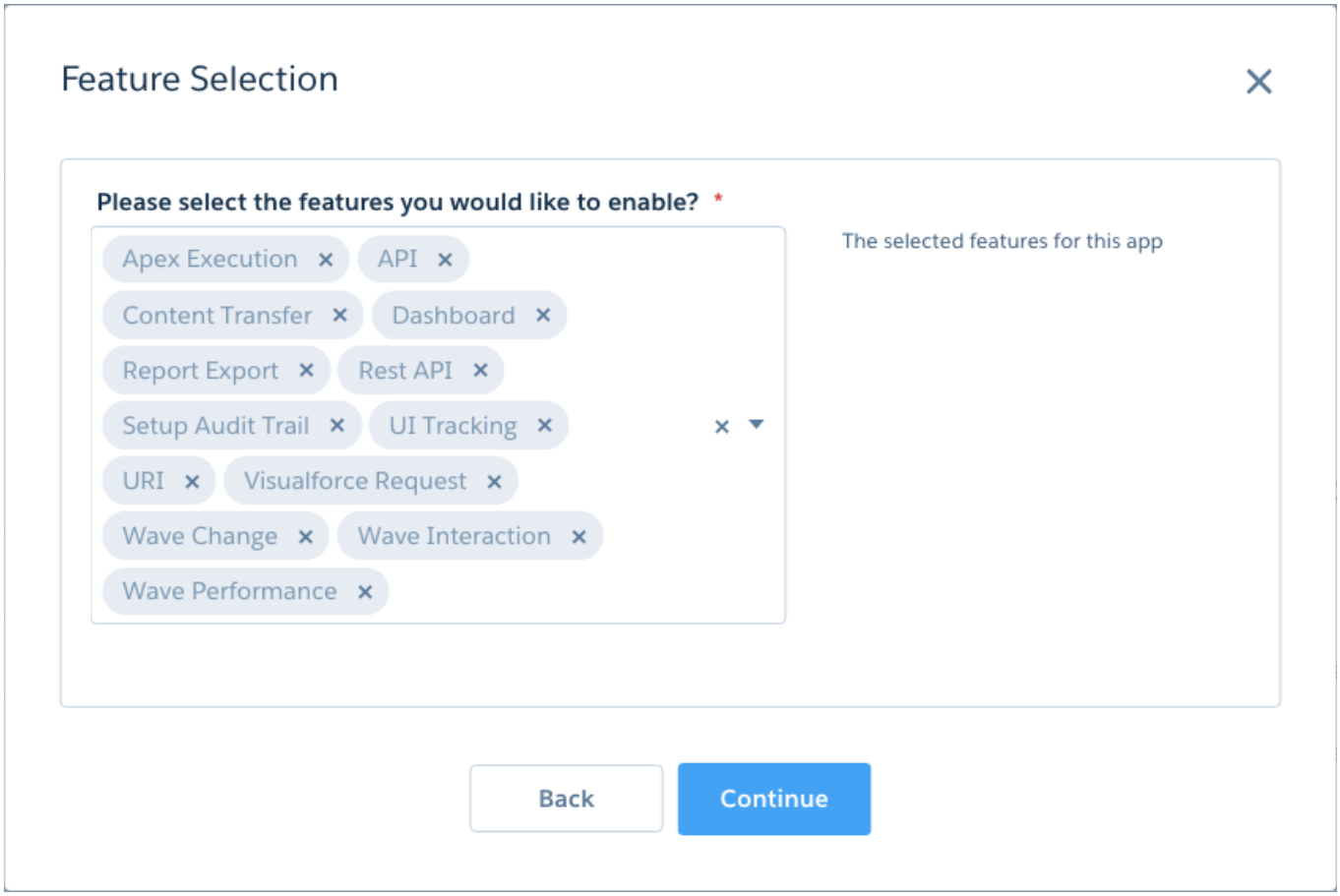
- rules.json

```
"value": "${array:forEach(Variables.Account_Fields_String,
 '{\"name\":
        \"${var}\"}')}"
```

- You can also use the multiselect widget to replace the current use of multiple `StringType` widgets with `"Yes"` and `"No"` selections. The following is an example using three `StringType` widgets on one wizard page:



You can replace this with a single `ArrayType` widget:



The JSON for this variable is:

```
"SelectedFeatures": {
    "label": "Please select the features you would like to enable?",
    "description": "The selected features for this app",
    "defaultValue": [
     "Apex Execution"
    ],
    "variableType": {
      "type": "ArrayType",
      "itemsType" : {
        "type" : "StringType",
        "enums" : [
         "Apex Execution",
         "API",
         "Content Transfer",
         "Dashboard",
         "Login",
         "Report Export",
         "Rest API",
```

```
          "Setup Audit Trail",
          "UI Tracking",
          "URI",
          "Visualforce Request",
          "Wave Change",
          "Wave Interaction",
          "Wave Performance"
        ]
      }
    },
    "required": true
  }
```

You can use the selected values to set constants in `rules.json`, which you can then reference in conditionals for actions or in `template-info.json`.

```
"constants" : [
 {"name":"hasApexExecution", "value": "${array:contains(Variables.SelectedFeatures,
'Apex Execution')}"},
 {"name":"hasAPI", "value": "${array:contains(Variables.SelectedFeatures, 'API')}"},
 {"name":"hasContentTransfer", "value": "${array:contains(Variables.SelectedFeatures,
'Content Transfer')}"},
 {"name":"hasDashboard", "value": "${array:contains(Variables.SelectedFeatures,
'Dashboard')}"},
 {"name":"hasLogin", "value": "${array:contains(Variables.SelectedFeatures, 'Login')}"},

 {"name":"hasReport", "value": "${array:contains(Variables.SelectedFeatures, 'Report
Export')}"},
 {"name":"hasRestApi", "value": "${array:contains(Variables.SelectedFeatures, 'Rest
API')}"}
]
```

Macros in Rules

Template rules play an important role in the transformation of assets within a template. Rule definitions can grow at an unmanageable pace (depending on the complexity of the template), and the same type of rules are executed repetitively, but are executed on different JSON node paths. (After reading this section, refer to the macros portion of the reference section in this guide.)

Rule macros enable template developers to define repeatable, well-tested rule code units that can be called within the context of any JSON transformation, simplifying and making the rule definition source easier to maintain. Two examples follow:

- The following example calls a macro with namespace `'myNS'` and macro name `'getSomething'` defined with no parameters. Results of the macro are stored in the template context, and can be referenced using this expression: `${Rules.Eval.macroResults}`.

```
{
  "action": "eval",
  "key": "macroResults",
  "value": "${myNS:getSomething()}"
}
```

- This example sets the JSON node at path $.path.to.json.node with the result of macro `myNS:getJsonValue` defined with no parameters. This action will only be called if the macro `myNS:shouldExecute` (defined with one parameter) returns true.

```
{
  "action": "set",
  "condition": "${myNS:shouldExecute(true)}",
  "path": "$.path.to.json.node",
  "value": "${myNS:getJsonValue()}"
}
```

Macro Syntax

Use the following example of macro syntax:

RuleMacro Attributes

A `RuleMacro` is an object that contains a collection of `MacroDefinition` objects. A `RuleMacro` is defined with the following attributes:

MacroDefinition Attributes

A `MacroDefinition` is an object that defines the actual logic of the macro and its return value.

Parameters

Macros can define a collection of parameters that are expected as part of the macro function call. The number of parameters passed in the function must match the number of parameters defined in the macro, and are passed in the order defined in the macro definition. You are allowed to specify up to 10 parameters per macro.

Macro Syntax

Use the following example of macro syntax:

```
"macros":
 [

        {

            "namespace": "myMacroNamespace",

           "definitions": [

                {

                    "name": "multiplyTwoNumbers",

                   "parameters": [

                        "firstNumber",

                       "secondNumber"

                    ],

                   "returns": "${p.firstNumber * p.secondNumber}"

                },
```

```
                {
                    "name": "deleteWidget",
                   "description": "Deletes a widget and any references to the widget.",
                   "parameters": [
                        "widgetName"
                    ],
                   "actions": [
                        {
                            "action": "eval",
                           "key": "results",
                        "path": "${json:searchPaths(\"$.state.widget['p.widgetName']\")}"

                       },
                        {
                            "condition": "${!empty results}",
                           "action": "delete",
                           "path": "$.state.widgets['${p.widgetName}']"
                        },
                        {
                            "condition": "${!empty results}",
                           "action": "delete",
                           "path":
"$.state.gridLayouts..pages..widgets[?(@.name=='${p.widgetName}')]"
                        }
                    ]
                }
            ]
        }
```

```
    ],

    "constants": [...],

    "rules": [...]
}
```

RuleMacro Attributes

A `RuleMacro` is an object that contains a collection of `MacroDefinition` objects. A `RuleMacro` is defined with the following attributes:

- **namespace:** Required. A unique string identifier (to the template) used to scope the collection of macro definitions.
- **definitions:** Array of `MacroDefinition` objects defined within the `RuleMacro`.

MacroDefinition Attributes

A `MacroDefinition` is an object that defines the actual logic of the macro and its return value.

A `MacroDefinition` is described using:

- **name:** Required. The name of the macro.
- **description:** A string that describes what the macro does..
- **parameters:** An array of zero or more parameter names that the macro expects. Maximum number of 10 parameters.
- **actions:** An array of zero or more rule actions to perform as part of the macro.
- **returns:** An expression or literal value to be returned from the macro.

Parameters

Macros can define a collection of parameters that are expected as part of the macro function call. The number of parameters passed in the function must match the number of parameters defined in the macro, and are passed in the order defined in the macro definition. You are allowed to specify up to 10 parameters per macro.

Parameters can be referenced in the body of the macro using standard expression syntax: `${p.<parameter_name>}`. Parameters can be referenced in any action that accepts expressions. Special support has been added (in macros only) for action `"path"` statements so that expressions can be used for more dynamic JSON path handling (see example above).

Parameters are scoped to the execution of the macro call and any references to `${p.<parameter_name>)` will fail outside the scope of the macro.

STEP 4: DEPLOY THE WAVETEMPLATE OBJECT

The MDAPI deploy command updates all your template assets in the database. Without it, any edits you've made exist only in your file system. Deploying updates the template object and enables your collaborators to test the template and work off your changes.

If you're thinking of retrieving (MDAPI export) the latest template object from the Metadata API, know that performing this step overwrites your template object folder contents. So deploying to it first is a must if you've made any edits to the assets on your workstation.

Using the Eclipse Lightning Platform Plugin to Deploy

After you have finished editing the files, one of the two ways you can deploy the WaveTemplate object is by using the Eclipse Lightning Platform plugin.

Refer to the Force.com IDE Developer Guide for additional information on the plugin.

1. Once you are done editing the files, right-click on the project and select **Lightning Platform Refresh from Server**.
2. Create and install the package by following the instructions in our Packaging documentation. Specify **WaveTemplate** as the component type.

Using the Ant Migration Tool to Deploy

To export the template using the Ant Migration Tool, refer to the reference section "Examples of Using the Ant Migration Tool." It provides you with two sample files for running an MDAPI export template call and deploy template call from ANT.

STEP 5: TEST THE TEMPLATE

The template dev process is iterative. The typical cycle has testing opportunities in several steps.

1. Create the master app.
2. Create the template object by POSTing to the Analytics REST API.

   Test 1: Create an app from the unmodified template simply to make sure everything works.

3. Retrieve the template object using the MDAPI export call.
4. Edit the JSON files to update the template assets.
5. Deploy the updates to the Metadata API.

   Test 2: Create an app from the updated template to evaluate the wizard and the app assets it creates.

6. Most likely you will make many changes, mostly to the template assets, but sometimes also to the master app itself.
   a. Make changes in the master app to the dashboards, lenses, or dataset.Update the template object by making a PUT call to the Analytics REST API.This probably requires changes to the wizard or other template assets, so export from the Metadata API again and make edits to the JSON files. Update the template object by deploying to the Metadata API again.

      Test 2 again.

      OR

   b. Make changes in the template to the wizard, rules, or variables.Update the template object by deploying to the Metadata API again.

      Test 2 again.

7. If you are using Smart Wizard functionality, then test the Apex class once you have a fully functional template wizard. Test it to make sure the Apex class is working as expected; that is, giving variables programmatically assigned values, hiding/changing visibility of variables and/or UI pages, giving feedback to the user, and so forth.

   Save your template in the source control system of your choice, such as GitHub.

STEP 6: SHARE THE TEMPLATE

Deploying to the Metadata API is how you distribute the template to others in your org, or other orgs. With the correct permission sets (refer to the "Prerequisites" section earlier in this document), collaborators can retrieve the template object from the Metadata API and make their own contributions.

STEP 7: CREATE NEW (DOWNSTREAM) APPS FROM THE TEMPLATE

Users can now create apps using your template as follows:

1. In Analytics Builder, select **Create-->App**.
2. Select the template you have shared in the drop-down menu of templates.
3. Follow the configuration wizard!

   Anytime the user opens their downstream app, there will be a prompt to upgrade it if there have been changes to the template since the app's last use. It's important to accept this prompt in order to keep their downstream apps on the upgrade path and in sync with the master app and the template.

FEATURES NOT SUPPORTED IN THIS RELEASE

The following features are not available in this release of Analytics Templates:

- Custom Maps and Charts
- Data Recipes
- Remote Connected Datasets (only with replication)

APPENDIX

The reference section of this document contains detailed examples, attribute lists and descriptions, and other in-depth reference materials that build on the concepts we have discussed up to this point.

template-info.json Example

Refer to this example of the `template-info.json` file.

Example:

```
{
 "name": "my_unique_template_developer_name",
 "label" : "My Template Label",
 "description": "A short description about this template.",
 "assetIcon": "10.png",
 "templateIcon": "default.png",
 "assetVersion": 39,
 "releaseInfo" : {
   "templateVersion": "1.12", // Has to be a String in #.# format, with a limit of 20
 chars
   "notesFile" : "releaseNotes.html" // HTML support with server-side cleaning for
security
 }

"rules" : [
    { "type" : "appToTemplate", "file" : "appToTemplateRules.json"},
    { "type" : "templateToApp", "file" : "templateToAppRules.json"}
],
 "templateType": "app",
 "uiDefinition": "ui.json",
 "variableDefinition": "variables.json",
 "apexCallback": {
   "namespace": "my_ns",
   "name": "MyWaveTemplateCallback"
 },
 "dashboards": [
   {
     "condition": "${Variables.Has_Product == 'No'}",
     "file": "dashboard/Sales_Wave_-_Customer_Analysis.json",
     "label": "Sales Wave - Customer Analysis"
   },
   {
     "condition": "${Variables.Has_Product == 'Yes'}",
     "file": "dashboard/Sales_Wave_-_Customer_Analysis_w_Product.json",
     "label": "Sales Wave - Customer Analysis w/ Product"
   }
 ],
 "lenses": [
   {
     "file": "lenses/lensOne.json",
     "label": "lensOne"
   }
 ],
 "eltDataflows": [
   {
     "condition": "${Variables.Use_Eltflow1 == 'Yes'}",
     "file": "elt-flow1.json"
   },
   {
     "condition": "${Variables.Use_Eltflow1 == 'No'}",
     "file": "elt-flow2.json"
   },
 ],
```

```
"externalFiles": [
  {
    "condition": "${Variables.Has_Tasks == 'Yes'}",
    "file": "external_files/task.csv",
    "name": "task",
    "overwriteOnUpgrade": "${Variables.forceUpgrade ? 'Always' : 'IfDifferent'}",
    "schema": "external_files/task.json",
    "type": "CSV",
    "userXmd": "external_files/task_XMD_template.json"
  }
],
"datasetFiles": [
  {
    "name": "DatasetFile1",
    "label": "DatasetFile1",
    "userXmd": "dataset_files/DatasetFile1.json"  (optional)
  },
  {
    "name": "DatasetFile2",
    "label": "DatasetFile2",
    "imageFiles" : [ {
        "name" : "image1",
        "file" : "images/image1.png"
        }
    ],
"folderDefinition" : "folder.json"
  }
]
```

template-info.json Attributes

The `template-info.json` file is the main file that describes the template. It includes or references all the information required to create a downstream app.

Attribute	Required	Description
`"name"`	Yes	The unique developer name of the template. If this is changed, it creates a new template; if it is changed to an existing template `devName`, it overwrites the existing template.
`"label"`	Yes	The template name that is visible to users.
`"description"`	No	The template description - appears in the "Create App" template list to tell users about the app they will be creating using the template.
`"assetIcon"`	No	Sets the app icon at creation. There are 20 app icons stored as .png files in Analytics, which are numbered 1-20. If not specified, system will use default icon 1.png, for the app.

Attribute	Required	Description
`"templateIcon"`	No	Sets the template icon to display in the "Create-->App" template list. If not specified, system will use default icon for the template (default.png). Currently, `default.png` is the only icon ISVs can use.
`assetVersion`	Yes	This refers to the API version to use in processing Analytics assets (dashboards, datasets, XMDs, dataflows). 39 is the version for 206 (Spring '17). Older versions (36, 37, 38) can be used, but will not make use of the most current features. With every SFDC release, this assetVersion needs to be updated if newer features need to be used.
`releaseInfo`	Yes	Container attribute only.
`releaseInfo templateVersion`	Yes	The version of the template, tracked for the upgrade process. Calling wave/templates PUT will automatically increment this number, but it can be changed manually as well. The format is `##.##`, although it is a string.
`releaseInfo notesFile`	No	A template dev defined HTML file to describe new release details. Basic HTML formatting is supported, but not links or javascript. Defaults to using the template description as release notes if file is not specified.
`rules`	No	Container attribute only - can contain 1 or more rule file definitions (loaded 1st to last and order matters for dependencies).
`rules type`	Yes	appToTemplate - rules to apply when updating the template from the master app (Rest API PUT call). templateToApp - rules to apply when creating a new app from a template.
`rules file`	Yes	Path to the rules file.
`templateType`	Yes	Always "app".
`uiDefinition`	No	Path the `ui.json` file.
`variableDefinition`	No	Path to the `variables.json` file.
`folderDefinition`	No	Path to the `folder.json` file.
`apexCallback`	No	Container attribute only - this is for registering an APEX class that can run 1) on wizard load 2) on app create 3) on app upgrade. The Apex class is created by the template dev to examine the org programmatically and set variable values as needed. (For example, the Sales Analytics app has an Apex class that checks whether the org has Products set up, and if it doesn't, sets the "Has_Product" variable to "No").
`apexCallback namespace`	Yes	The SFDC namespace for the org.
`apexCallback name`	Yes	The name of the Apex class to be used.
`dashboards`	Yes	Container attribute only - array of dashboard json files to be used, can be empty if there are no dashboard files.

Attribute	Required	Description
`dashboards file`	Yes	Path to dashboard file.
`dashboards label`	Yes	The dashboard label which MUST match the "label" attribute in the dashboard file
`dashboards name`	No	The dashboard name which MUST match the "name" attribute in the dashboard file.
`dashboards conditional`	No	If condition is met, then the dashboard will be created in the app; if the condition is not met, the dashboard will not be created..
`lenses`	Yes	Container attribute only - array of dashboard JSON files to be used, can be empty if there are no dashboard files.
`lenses file`	Yes	Path to lens file.
`lenses label`	Yes	The lens label which MUST match the "label" attribute in the lens file.
`lenses name`	No	The lens name which MUST match the "name" attribute in the lens file.
`lenses conditional`	No	If the condition is met, then the lens will be created in the app; if the condition is not met, the dashboard will not be created.
`eltDataflows`	Yes	Container attribute only - array of dataflow JSON files to be used, can be empty if there are no dataflow files. Typically, there is only 1 dataflow file unless conditionals are used.
`eltDataflows file`	Yes	Path to dataflow file.
`eltDataflows label`	Yes	The dataflow label, which MUST match the "MasterLabel" attribute in the dataflow file.
`eltDataflows name`	Yes	The dataflow name, which MUST match the "name" attribute in the dataflow file.
`eltDataflows conditional`	No	If condition is met, then the dataflow will be created in the app; if the condition is not met, the dataflow will not be created.
`externalFiles`	Yes	Container attribute only - array of external files, CSV and descriptive files, to be used, can be empty if there are no external files.
`externalFiles file`	No	Path to the CSV file.
`externalFiles name`	Yes	The externalFile name, which MUST match the "name" attribute in the schema file.
`externalFiles schema`	No	Path to the schema file (describes the format of the data)
`externalFiles userXmd`	No	Path to the user XMD file (describes the display format of the data).

Attribute	Required	Description
`externalFiles type`	Yes	Needs to be “CSV”.
`externalFiles conditional`	No	If condition is met, then the external file will be created in the app; if the condition is not met, the external file will not be created.
`datasetFiles`	No	Container attribute only - array of SFDC dataset to be used, can be empty if there are no SFDC dataset.
`datasetFiles userXmd`	No	Path to user XMD file, if it exists.
`datasetFiles label`	Yes	The dataset label.
`datasetFiles name`	Yes	The dataset name.
`datasetFiles conditional`	No	If condition is met, then the dataset will be created in the app; if the condition is not met, the dataset will not be created.
`imageFiles`	No	Container attribute only: array of app images to be used, this can be empty if there are no app images.
`imageFiles name`	Yes	The image name.
`imageFiles conditional`	No	If the condition is met, then the image will be uploaded into the app; if the condition is not met, the image will not be uploaded.

ui.json Attributes

The `ui.json` file attributes are:

Attribute	Required	Description
`pages`	No	Container attribute only - array of UI pages to be displayed, 1 page is necessary if `“pages”` is used.
`pages title`	Yes	String title to be displayed at the top of the page.
`pages variables`	Yes	Array of variables to display on a page, 1 variable is necessary.
`pages variables name`	Yes	Variable name, must match name of variable defined in variables.json.
`pages variables visibility`	No	Variable visibility (visible, disabled, hidden) defined by conditional.

Attribute	Required	Description
`pages condition`	No	If condition is met, then the page will display; if the condition is not met, the page will not display.
`pages helpUrl`	No	URL provided by template dev to additional content to help user with creating app.
`pages vfPage`	No	Container attribute only: defines the VisualForce Page to customize this page.
`pages vfPage name`	Yes	The name of VisualForce class to use.
`pages vfPage name namespace`	Yes	The namespace for the VisualForce class.
`displayMessages`	No	Container attribute only - array of custom display message, currently only 1 `displayMessage` is supported.
`displayMessages text`	Yes	Text to display on the app creation landing page (coffee-cup page).
`displayMessages location`	Yes	`"AppLandingPage"` is only supported location.

variables.json Attributes

Named nodes, each representing a single variable. Each node contains the following attributes:

Attribute	Required	Description
`label`	Yes	Visible label for the variable in the UI wizard (typically a question like "Do you use product?")
`description`	No	Additional text that appears under the label for more information.
`defaultValue`	No	The default value for the variable, if the user does not change the value in the wizard. Can be the most likely value a user would use.
`required`	No	Makes the variable value required in the UI. The default if not includes is "false".
`variableType`	Yes	The type of the variable (`StringType`, `BooleanType`, `NumberType`, `SObjectType`, `SObjectFieldType`, `ArrayType`).

Attribute	Required	Description
`excludeSelected`	No	For a picker like `SObjectType` or `SObjectFieldType`, this will remove already selected values from appearing in the picker. Default is "false".
`excludes`	No	Allows specific values to be excluded from the picker selections (lots of doc on this in Template Config Syntax)

folder.json Attributes

The `folder.json` file attributes are:

Attribute	Required	Description
`featuredAssets`	Yes	Container for assets; this can be empty if no `featuredAssets` are present.
`featuredAssets default`	No	Container for assets.
`featuredAssets default assets`	No	Container for array of assets.
`featuredAssets default assets id` element	No	Tokenized ID of dashboard asset.

rules.json Example

Refer to this example of the `rules.json` file.

Example:

```
{ "constants": [
    {
"name": "ChartType",
 "value": "pie"
    }
  ],
  "rules": [
    {
"name": "rule1",
"appliesTo": [
"type": "dashboard",
"name": "dashboardOne",
],
"actions": [
{
"action": "put",
```

```
"description": "Put a section back in, but with different attributes",
"path": "$.state.widgets.chart_1",
"key": "pos",
"value": {
 "w": "501",
 "y": "41",
"h": "121",
"x": "51"
}
},
{
"action": "delete",
"description": "Delete a section",
"path": "$.state.widgets.chart_2"
}
]
    }
  ]
}
```

The corresponding `dashboardOne.json` file that uses the above rules files looks like:

```
{
    "_type": "dashboardTemplate",
    "name": "Dashboard From Template With Rules",
    "edgemarts": {
        "${Variables.Dataset1.datasetAlias}": {
            "_type": "edgemart",
            "_uid": "${Variables.Dataset1.datasetId}"
        },
        "${Variables.Dataset2.datasetAlias}": {
            "_type": "edgemart",
            "_uid": "${Variables.Dataset2.datasetId}"
        }
    },
    "folder": {
        "_type": "folder",
        "_uid": "${App.Folder.Id}"
    },
    "tags": [

    ],
    "state": {
        "widgets": {
            "chart_1": {
                "params": {
                    "chartType": "${Constants.ChartType}",
                    "minColumnWidth": 30,
                    "maxColumnWidth": 200,
                    "legend": false,
                    "selectMode": "single",
                    "sqrt": false,
                    "legendHideHeader": false,
                    "legendWidth": 145,
                    "step": "step_1"
```

```
            },
            "type": "ChartWidget",
            "pos": {
                "w": "500",
                "y": 60,
                "h": "120",
                "x": 40
            }
        },
        "chart_2": {
            "params": {
                "chartType": "${Constants.ChartType}",
                "minColumnWidth": 30,
                "maxColumnWidth": 200,
                "legend": false,
                "selectMode": "single",
                "sqrt": false,
                "legendHideHeader": false,
                "legendWidth": 145,
                "step": "step_2"
            },
            "type": "ChartWidget",data
            "pos": {
                "w": "500",
                "y": 190,
                "h": "120",
                "x": 40
            }
        }
    },
    "steps": {
        "step_1": {
            "isFacet": true,
            "start": null,
            "query": {
                "measures": [
                    [
                        "count",
                        "*"
                    ]
                ]
            },
            "selectMode": "single",
            "useGlobal": true,
            "em": "${Variables.Dataset1.datasetId}",
            "type": "aggregate",
            "isGlobal": false
        },
        "step_2": {
            "isFacet": true,
            "start": null,
            "query": {
                "measures": [
                    [
```

```
                            "count",
                            "*"
                        ]
                    ]
                },
                "selectMode": "single",
                "useGlobal": true,
                "em": "${Variables.Dataset2.datasetId}",
                "type": "aggregate",
                "isGlobal": false
            }
        },
        "type": "hbar"
    }
}
```

When the rules are applied to the dashboard, the `chart_1` widget will have a chartType of "pie" and the "pos" will be updated to w=501, y=41, h=121, and x=51. The `chart_2` widget will be removed.

rules.json Attributes

The `rules.json` file attributes are:

Attribute	Required	Description
`constants`	Yes	Container attribute only - array of constants to be defined, can be empty if no constants are needed
`constants --> name`	Yes	Unique name for a constant, used to reference the constant in other places
`constants --> value`	Yes	Value of the constant
`rules`	Yes	Container attribute only - array of rules to be defined, can be empty if no rules are needed
`rules --> name`	Yes	Unique name for a rule
`rules --> condition`	No	If condition is met, then the rule will run, if the condition is not met, the rule will not run.
`rules --> appliesTo`	Yes	Container attribute only - array of assets the rule should be be applied to (dashboards, dataflow, schemas, XMDs)
`rules --> appliesTo --> name`	Yes	Name of asset (can be * in case of dashboards for all dashboards); must match the "name" defined in the template-info for the asset

Attribute	Required	Description
`rules --> appliesTo --> type`	Yes	Type of asset (dashboard, dataflow, lens, schema, xmd)
`rules --> actions`	Yes	Container attribute only - array of actions the rule should invoke (one or more action is necessary)
`rules --> actions --> action`	Yes	Type of action - set, add, delete, put
`rules --> actions --> description`	No	Description of the rule action - for maintainability
`rules --> actions --> path`	Yes	JSONPath to take the action on
`rules --> actions --> value`	No	Value needed for set/add/put, defines the value to put in the JSONPath
`rules --> actions --> index`	No	Index needed for add action only
`rules --> actions --> key`	No	Key needed for put action only

Rules Function Documentation

This section expands on the functions portion of the `rules.json` file.

Function Name: toUpperCase

Namespace: string

Parameters: Object

Return: Object

Recursive: supported

Description: Converts all of the characters in this Object to uppercase. The object can be a single string or a JSON object that contains multiple strings

Example: Given the JSON:

```
    "objecttest" : {
        "obj" : {
            "greeting1" : "hello world",
            "greeting2" : "salut world",
            "greeting3" : "hallo world"
        },
        "list" : ["hello world", "salut world", "hallo world"]
    },
```

and the rule:

```
{
    "action": "set",
    "description": "Convert all strings to upper case",
```

```
    "path": "$.objecttest",
    "value" : "${string:toUpperCase(Rules.CurrentNode)}"
}
```

would produce:

```
"objecttest" : {
        "obj" : {
            "greeting1" : "HELLO WORLD",
            "greeting2" : "SALUT WORLD",
            "greeting3" : "HALLO WORLD"
        },
        "list" : ["HELLO WORLD", "SALUT WORLD", "HALLO WORLD"]
    },
```

Function Name: toLowerCase

Namespace: string

Parameters: object

Return: Object

Recursive: supported

Description: Converts all of the characters in this String to lowercase.

Function Name: replace

Namespace: string

Parameters: Object `obj`, String `oldStr`, String `newStr`

Return: Object

Recursive: supported

Description: Returns a new object resulting from replacing all occurrences of `oldStr` in this object with `newStr`

Function Name: replaceAll

Namespace: string

Parameters: Object `obj`, String `regex`, String `newStr`

Return: Object

Recursive: supported

Description: Replaces each substring of this Object that matches the given regular expression with the given replacement

Function Name: forEach

Namespace: array

Parameters: `Collection<Object>` array, String `returnValue`

Return: `Collection<Object>`

Recursive: not supported

Description: Evaluates returnValue as an EL expression for each item in the given array and collects each eval result in an array and returns it.

Example: Given JSON template:

```
{
    "fields": "${array:forEach(Variables.myArray, '{\"name\": \"${var}\"}')}"
}
```

Would produce:

```
{
    "fields": [{"name": "ProductName"},
               {"name": "Amount"},
               {"name": "CompanyName"},
               {"name": "Revenue"}]
};
```

Function Name: concat

Namespace: array

Parameters: `Collection<Object>` array1, `Collection<Object>` array2

Return: `Collection<Object>`

Recursive: not supported

Description: Returns an array after concatenating the given array1 and array2.

Function Name: unique

Namespace: array

Parameters: `Collection<String>` array

Return: `Collection<String>`

Recursive: not supported

Description: Returns an array with unique items, it expects items to be of type String

Function Name: unique

Namespace: array

Parameters: String `byFieldName`, `Collection<Object>` array

Return: `Collection<Object>`

Recursive: not supported

Description: Returns an array with unique items, it expects items to be of type Object and uniqueness is determined by comparing the value of a field identified by the given `byFieldName`.

Function Name: union

Namespace: array

Parameters: `Collection<String>` array1, `Collection<String>` array2

Return: `Collection<String>`

Recursive: not supported

Description: Returns a combined array array of unique items which is an union of array1 and array2. It expects the arrays to be of type String.

Function Name: union

Namespace: array

Parameters: String `byFieldName`, `Collection<Object>` array1, `Collection<Object>` array2

Return: `Collection<Object>`

Recursive: not supported

Description: Returns an array which is an union of array1 and array2 items. it expects items to be of type Object and uniqueness is determined by comparing the value of a field identified by the given `byFieldName`.

Rules Macros in Depth

Macros are specifically designed to run during asset transformation; that is to say, when rules are invoked. Any other references or calls to macros (such as references in constants, or expressions within `template-info.json`) will result in an invalid function error.

Macros are invoked using standard function syntax and can be referenced anywhere a traditional expression is resolved within a rule action. For example, given the following rule macro and definitions:

```
{
            "namespace": "testMacroNamespace",
            "definitions": [
                {
                    "name": "multiplyTwoNumbers",
                    "parameters": [
                        "firstNumber",
                        "secondNumber"
                    ],
                    "returns": "${p.firstNumber * p.secondNumber}"
                },
                {
                    "name": "shouldExecuteAction",
                    "returns": true
                }
            ]
}
```

Macros can be invoked like the actions in this set of rules:

```
{
    "rules": [
        {
```

```
            "name": "Testing of example macro",
            "actions": [
                {
                    "action": "set",
                    "key": "macroResult",
                    "path": "$.path.to.a.number",
                    "value": "${testMacroNamespace:multiplyTwoNumbers(3,3)}"
                },
                {
                    "action": "put",
                    "condition": "${testMacroNamespace:shouldExecuteAction()}",
                    "path": "$.my.json.path",
                    "value": {
                        "foo": "bar",
                        "anotherNumber": "${testMacroNamespace:multiplyTwoNumbers(5,5)}"
                    }
                }
            ]
        }
    ]
}
```

Nested Macro Calls and Recursion

Macros can call other macros (nested macros) and macro recursion is supported. If the macro stack depth gets too deep (depth of 10 for the initial release), an overflow error will occur and app creation will fail.

Sample Use Case: Recursive Operations

As a template developer, I want to delete an `sfdcDigest` node and I should be able to write/perform a recursive macro to cascade delete the digest node and all other nodes that depend on that node.

To perform this use case, we need to delete the specified node and be able to dynamically query the json document and delete each dependency of those nodes.

Consider the simplified JSON below. If we wanted to delete 'node3' and its dependencies, the result should delete: node3, node4, node5 (depends on node4), node6 (depends on node5), node7, node8, node9.

Example: Example JSON

```
{
    "node1": { },
    "node2": {
```

```
        "dependsOn": "node1"
    },
    "node3": {
        "dependsOn": "node2"
    },
    "node4": {
        "dependsOn": "node3"
    },
    "node5": {
        "dependsOn": "node4"
    },
    "node6": {
        "dependsOn": "node5"
    },
    "node7": {
        "dependsOn": "node3"
    },
    "node8": {
        "dependsOn": "node3"
    },
    "node9": {
        "dependsOn": "node3"
    }
}
```

Example: Without Macros

Prior to macros (and associated enhancements), these nodes would have to be deleted individually.

```
{
    "actions": [
        {
            "action": "delete",
            "path": "$.node3"
        },
        {
            "action": "delete",
            "path": "$.node4"
        },
       {
            "action": "delete",
            "path": "$.node5"
        },
       {
            "action": "delete",
            "path": "$.node6"
        },
        {
            "action": "delete",
            "path": "$.node7"
        },
        {
            "action": "delete",
            "path": "$.node8"
```

```
        },
        {
            "action": "delete",
            "path": "$.node9"
        }
    ]
}
```

This code is very rigid and difficult to maintain because rules would need to be modified as node dependencies are added and removed from the JSON payload.

Example: Macro Source

```
{

    "namespace": "macroRecursion",

   "definitions": [

        {

            "name": "deleteNodeAndDependencies",

           "description": "Delete a node and its dependencies.  Returns an array of
json paths of all the nodes that were deleted.",

           "parameters": [

                "nodeName"

            ],

           "actions": [

                {"action": "eval", "key": "fullNodePath",  "value": "$.${p.nodeName}"
 },

               {"action": "eval", "key": "dependencies",  "value":
"${macroRecursion:getDependents(p.nodeName)}"},

               {

                  "action": "eval",

                  "value": "${array:forEach(Rules.Eval.dependencies,
'${macroRecursion:deleteNodeAndDependencies(macroRecursion:deleteSingleNodeByFullJsonPath(var))}')}"


                },

                {

                    "action": "eval",
```

```
                    "value":
"${macroRecursion:deleteSingleNodeByFullJsonPath(Rules.Eval.fullNodePath)}"

                }

            ]

        },

        {

            "name": "deleteSingleNodeByFullJsonPath",

           "description": "Deletes a node by full json path.",

           "parameters": [

                "fullJsonPath"

            ],

           "actions": [

               {"action": "eval", "key": "pathSegments",
  "value": "${string:match(p.fullJsonPath,'\\\\[\\'(.*?)\\'\\\\]')}"},

              { "action": "delete",  "path": "${p.fullJsonPath}"}

            ],

           "returns": "${array:last(Rules.Eval.pathSegments)}"

        },

        {

            "name": "getDependents",

           "description": "Returns the full json path to search results",

           "parameters": [

                "nodeName"

            ],

           "actions": [

               { "action": "eval", "key": "searchString", "value":
"$.*[?(@.dependsOn=='${p.nodeName}')]"},

              { "action": "eval", "key": "paths", "value":
"${json:searchPaths(Rules.Eval.searchString)}"}
```

```
            ],

           "returns": "${Rules.Eval.paths}"

        }

    ]
}
```

Example: Rule Calling the Macro

```
{
    "rules": [
        {
            "name": "Recursively delete node3 and dependencies",
            "actions": [
                {"action": "eval", "value":
"${macroRecursion:deleteNodeAndDependencies('node3')}" }
            ]
        }
    ]
}
```

Sample Use Case: Delete Workflow Nodes

As a developer, I'd like to delete multiple nodes from the workflow, and not have to write the same code over and over.

Example: Macro

```
        {
            "name": "deleteWorkflowNode",
            "description": "Deletes a workflow node.",
            "parameters": [
                "nodeName"
            ],
            "actions": [
                { "action": "delete",  "path": "$.workflowDefinition.${p.nodeName}"}
            ]
        },
        {
            "name": "deleteArrayOfWorkflowNodes",
            "description": "Deletes a set of workflow nodes.",
            "parameters": [
                "nodeNameArray"
            ],
            "actions": [
                { "action": "eval",
                "value": "${array:forEach(p.nodeNameArray,
'${macros:deleteWorkflowNode(var)}')}"}
            ]
        }
```

Example: Rule Calling the Macro

```
{"action":"eval","key" :
"myArray","value":["Extract_Queue","Add_Fields_To_Queue","Append_Queue_User"]},
     {
          "action": "eval",
          "description": "remove multiple nodes in dataflow",
          "value": "${macros:deleteArrayOfWorkflowNodes(Rules.Eval.myArray)}"
        }
```

Sample Use Case: Add an Array of SObject Names to Extract Workflow

As a user, I'd like to take an array of `sObjects` and add their field names to the extract workflow.

Example: Macro

```
{
       "name" : "concatArrayFieldName",
       "description" : "Concatenates field names from an sobject array node",
       "parameters" :
       [
        "variable"
       ],
       "returns": "${array:concat(Rules.CurrentNode,
array:forEach(p.variable,'{\"name\":\"${var.fieldName}\"}'))}"

     },
     {
      "name" : "addToExtractCaseWorkflow",
      "description" : "Adds array fields to Extract Case node",
      "parameters" :
      [
       "variable"
      ],
      "actions": [
       {
        "action": "set",
            "description": "put selected values for sfdcDigest in dataflow",
            "path": "$.workflowDefinition.Extract_Case.parameters.fields",
            "value" : "${macros:concatArrayFieldName(p.variable)}"
           }
           ]
     }
```

Example: Rule Calling the Macro

```
{
          "action": "eval",
          "description": "put selected values for sfdcDigest in dataflow",
          "value": "${macros:addToExtractCaseWorkflow(Variables.CaseMoreDims)}"
        }
```

Rules Testing with jsonxform/transformation endpoint

Test results of a rule before deployment by calling the `jsonxform/transformation` endpoint.

Process for Using `jsonxform/transformation`

1. Login to Workbench.
2. Make sure you're using version 43 or higher.
3. Run a `Post` call. See examples for starting points.
4. If Rule works, returns results.
5. If Rule does not work, returns errors with guidance to fix Rule.

The following examples show how you can take advantage of built-in tokens we provide.

Example: Post Transform

A "put" rule that adds a name/value pair to the JSON.

```
{
 "document": {
  "user": {
   "firstName": "${User.FirstName}",
   "lastName": "${User.LastName}",
   "userName": "${User.UserName}",
   "id": "${User.Id}",
   "hello": "${Variables.hello}"
  },
  "company": {
   "id": "${Org.Id}",
   "name": "${Org.Name}",
   "namespace": "${Org.Namespace}"
  }

 },
 "values": {

  "Variables": {
   "hello": "world"
  }
 },
 "definition": {
  "rules": [{
   "name": "Example",
   "actions": [{
    "action": "put",
    "description": "add hobby to user",
    "key": "hobby",
    "path": "$.user",
    "value": "mountain biking"
   }]
  }]
```

```
 }
}
```

Example: Constant Array

Tests an array function (`contains`) to determine the right value to add to the final JSON.

```
{
 "document": {
  "user": {
   "firstName": "${User.FirstName}",
   "lastName": "${User.LastName}",
   "userName": "${User.UserName}",
   "id": "${User.Id}",
   "hello": "${Variables.hello}"
  },
  "company": {
   "id": "${Org.Id}",
   "name": "${Org.Name}",
   "namespace": "${Org.Namespace}"
  }

 },
 "values": {
  "Variables": {
   "hello": "world",
   "choices": ["Products", "Cases"]
  }
 },
 "definition": {
  "constants": [{
   "name": "ConstantTest",
   "value": "${array:contains(Variables.choices, 'Products') ? 'Products' : 'No Products'}"

  }],
  "rules": [{
   "name": "Example",
   "actions": [{
    "action": "put",
    "description": "add hobby to user with constant",
    "key": "hobby",
    "path": "$.user",
    "value": "${Constants.ConstantTest}"
   }]
  }]
 }
}
```

Example: Macro Transform

Tests a macro with a rule.

```
{
 "document": {
  "user": {
   "firstName": "${User.FirstName}",
   "lastName": "${User.LastName}",
   "userName": "${User.UserName}",
   "id": "${User.Id}",
   "favorite": null
  }
 },
 "values": {},
 "definition": {
  "macros": [{
   "namespace": "jsonTest",
   "definitions": [{
    "name": "setNodeByPath",
    "parameters": [
     "jsonPath",
     "value"
    ],
    "actions": [{
     "action": "set",
     "path": "${p.jsonPath}",
     "value": "${p.value}"
    }]
   }]
  }],
  "rules": [{
   "name": "Example",
   "actions": [{
     "action": "put",
     "description": "add hobby to user",
     "key": "hobby",
     "path": "$.user",
     "value": "mountain biking"
    },
    {
     "action": "eval",
     "description": "Set the value of 'favorite' with the value from 'hobby'",
     "path": "$.user.hobby",
     "value": "${jsonTest:setNodeByPath('$.user.favorite', Rules.CurrentNode)}"
    }

   ]
  }]
 }
}
```

Ant Migration Tool Usage Examples

The `sample-build.xml` file uses `ant-util.xml`. These files also contain examples of using ANT tasks to make REST POST/PUT/DELETE calls instead of using Workbench.

Sample ant-util.xml

Refer to this example of the `ant-util.xml` file.

Example:

```
<project name="ant-util">

 <taskdef resource="com/salesforce/antlib.xml" uri="antlib:com.salesforce">
  <classpath>
   <pathelement location="./lib/ant-salesforce.jar" />
  </classpath>
 </taskdef>

 <taskdef name="http" classname="org.missinglink.ant.task.http.HttpClientTask">
  <classpath>
   <pathelement location="./lib/ml-ant-http-1.1.3.jar" />
  </classpath>
 </taskdef>

 <taskdef name="xmltask" classname="com.oopsconsultancy.xmltask.ant.XmlTask">
  <classpath>
   <pathelement location="./lib/xmltask.jar"/>
  </classpath>
 </taskdef>

 <taskdef resource="net/sf/antcontrib/antlib.xml">
  <classpath>
   <pathelement location="./lib/ant-contrib.jar" />
  </classpath>
 </taskdef>

 <!--
  Turns down logging around the specified body.
  -->
 <macrodef name="quiet">
  <element name="body" implicit="yes"/>
  <sequential>
   <script language="javascript">
    project.getBuildListeners().firstElement().setMessageOutputLevel(0);
   </script>
```

```
   <body/>
   <script language="javascript">
    project.getBuildListeners().firstElement().setMessageOutputLevel(2);
   </script>
  </sequential>
 </macrodef>

 <!--
  Creates a template based on the specified folder source
  -->
 <macrodef  name="createTemplate">
  <attribute name="serverUrl"/>
  <attribute name="sessionId"/>
  <attribute name="folderSourceId"/>
  <sequential>
   <fail message="No server URL specified. s">
    <condition>
     <equals arg1="@{serverUrl}" arg2=""/>
    </condition>
   </fail>
   <fail message="No session ID provided. You must login and provide a valid session
ID.">
    <condition>
     <equals arg1="@{sessionId}" arg2=""/>
    </condition>
   </fail>
   <fail message="No folderSource ID provided. ">
    <condition>
     <equals arg1="@{folderSourceId}" arg2=""/>
    </condition>
   </fail>
   <local name="createTemplateBody"/>
   <property name="createTemplateBody">
    {
    "folderSource": {"id": "@{folderSourceId}"}
    }
   </property>
   <length string="${createTemplateBody}" property="body.length" />
   <http url="@{serverUrl}/services/data/v${apiVersion}/wave/templates" method="POST"
 printrequest="false" printrequestheaders="false" printresponse="false"
printresponseheaders="false" failonunexpected="false" expected="201"
entityProperty="postResponse" statusProperty="postResponseStatus">
    <headers>
     <header name="Authorization" value="OAuth ${sessionId}"/>
     <header name="Content-Type" value="application/json"/>
     <header name="Content-Length" value="${body.length}"/>
    </headers>
    <entity binary="false" value="${createTemplateBody}">\n</entity>
   </http>
   <if>
    <not><equals arg1="${postResponseStatus}" arg2="201"/></not>
    <then>
     <fail>
      Received unexpected response from server: ${postResponseStatus}
```

```
      ${postResponse}
     </fail>
    </then>
   </if>
  </sequential>
 </macrodef>

 <!--
  Updates a template based on the specified template id and folder source
  -->
 <macrodef  name="updateTemplate">
  <attribute name="serverUrl"/>
  <attribute name="sessionId"/>
  <attribute name="templateId"/>
  <attribute name="folderSourceId"/>
  <sequential>
   <fail message="No server URL specified. s">
    <condition>
     <equals arg1="@{serverUrl}" arg2=""/>
    </condition>
   </fail>
   <fail message="No session ID provided. You must login and provide a valid session
ID.">
    <condition>
     <equals arg1="@{sessionId}" arg2=""/>
    </condition>
   </fail>
   <fail message="No template id specified.">
    <condition>
     <equals arg1="@{templateId}" arg2=""/>
    </condition>
   </fail>
   <fail message="No folderSource id specified.">
    <condition>
     <equals arg1="@{folderSourceId}" arg2=""/>
    </condition>
   </fail>
   <local name="updateTemplateBody"/>
   <property name="updateTemplateBody">
    {
    "folderSource": {"id": "@{folderSourceId}"}
    }
   </property>
   <length string="${updateTemplateBody}" property="body.length" />

   <http url="@{serverUrl}/services/data/v${apiVersion}/wave/templates/${templateId}"
 method="PUT" printrequest="false" printrequestheaders="false" printresponse="false"
printresponseheaders="false" failonunexpected="false" expected="201"
entityProperty="putResponse" statusProperty="putResponseStatus">
    <headers>
     <header name="Authorization" value="OAuth ${sessionId}"/>
     <header name="Content-Type" value="application/json"/>
     <header name="Content-Length" value="${body.length}"/>
    </headers>
```

```
    <entity binary="false" value="${updateTemplateBody}">\n</entity>
   </http>
   <if>
    <not><equals arg1="${putResponseStatus}" arg2="200"/></not>
    <then>
     <fail>
      Received unexpected response from server: ${putResponseStatus}
      ${putResponse}
     </fail>
    </then>
   </if>
  </sequential>
 </macrodef>

 <!--
  deletes a template based on the specified template id
  -->
 <macrodef  name="deleteTemplate">
  <attribute name="serverUrl"/>
  <attribute name="sessionId"/>
  <attribute name="templateId"/>
  <sequential>
   <fail message="No server URL specified. s">
    <condition>
     <equals arg1="@{serverUrl}" arg2=""/>
    </condition>
   </fail>
   <fail message="No session ID provided. You must login and provide a valid session
ID.">
    <condition>
     <equals arg1="@{sessionId}" arg2=""/>
    </condition>
   </fail>
   <fail message="No template id specified.">
    <condition>
     <equals arg1="@{templateId}" arg2=""/>
    </condition>
   </fail>

   <http url="@{serverUrl}/services/data/v${apiVersion}/wave/templates/${templateId}"
 method="DELETE" printrequest="false" printrequestheaders="false" printresponse="false"
 printresponseheaders="false" failonunexpected="false" expected="201"
entityProperty="deleteResponse" statusProperty="deleteResponseStatus">
    <headers>
     <header name="Authorization" value="OAuth ${sessionId}"/>
    </headers>
   </http>
   <if>
    <not><equals arg1="${deleteResponseStatus}" arg2="204"/></not>
    <then>
     <fail>
      Received unexpected response from server: ${deleteResponseStatus}
      ${deleteResponse}
     </fail>
```

```
    </then>
   </if>
  </sequential>
 </macrodef>

 <!--
  Login to the specified server url and retrieve a valid session ID.
  -->
 <macrodef name="login">
  <attribute name="username" description="Salesforce user name."/>
  <attribute name="password" description="Salesforce password."/>
  <attribute name="serverurl" description="Server Url property."/>
  <sequential>
   <!-- Obtain Session Id via Login SOAP service -->
   <echo>Retrieving session from server ${sf.serverurl}</echo>
   <quiet>
    <http url="@{serverurl}/services/Soap/c/${apiVersion}" method="POST"
failonunexpected="false" entityProperty="loginResponse"
statusProperty="loginResponseStatus">
     <headers>
      <header name="Content-Type" value="text/xml"/>
      <header name="SOAPAction" value="login"/>
     </headers>
     <entity>
      <![CDATA[
       <env:Envelope xmlns:xsd='http://www.w3.org/2001/XMLSchema'
xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'
xmlns:env='http://schemas.xmlsoap.org/soap/envelope/'>
       <env:Body>
       <sf:login xmlns:sf='urn:enterprise.soap.sforce.com'>
       <sf:username>@{username}</sf:username>
       <sf:password>@{password}</sf:password>
       </sf:login>
       </env:Body>
       </env:Envelope>
      ]]>
     </entity>
    </http>
    <!-- Parse response -->
    <xmltask destbuffer="loginResponseBuffer">
     <insert path="/">${loginResponse}</insert>
    </xmltask>
    <if>
     <!-- Success? -->
     <equals arg1="${loginResponseStatus}" arg2="200"/>
     <then>
      <!-- Parse sessionId and serverUrl -->
      <xmltask sourcebuffer="loginResponseBuffer" failWithoutMatch="true">
       <copy
path="/*[local-name()='Envelope']/*[local-name()='Body']/:loginResponse/:result/:sessionId/text()"
 property="sessionId"/>
       <copy
path="/*[local-name()='Envelope']/*[local-name()='Body']/:loginResponse/:result/:serverUrl/text()"
 property="serverNode"/>
```

```
      </xmltask>
     </then>
     <else>
      <!-- Parse login error message and fail build -->
      <xmltask sourcebuffer="loginResponseBuffer" failWithoutMatch="true">
       <copy
path="/*[local-name()='Envelope']/*[local-name()='Body']/*[local-name()='Fault']/*[local-name()='faultstring']/text()"
 property="faultString"/>
      </xmltask>
      <fail message="${faultString}"/>
     </else>
    </if>
   </quiet>
   <echo>SessionId: ${sessionId}</echo>
  </sequential>
 </macrodef>

</project>
```

Sample build.xml

Refer to this example of the `build.xml` file.

Example:

```
<project name="Sample usage of Salesforce Ant tasks" default="usage" basedir="."
xmlns:sf="antlib:com.salesforce">
 <property file="build.properties"/>
 <property environment="env"/>

 <import file="./ant-util.xml"/>

 <!-- Setting default value for username, password and session id properties to empty
 string
  so unset values are treated as empty. Without this, ant expressions such as
${sf.username}
  will be treated literally.
  -->
 <condition property="sf.username" value=""> <not> <isset property="sf.username"/>
</not> </condition>
 <condition property="sf.password" value=""> <not> <isset property="sf.password"/>
</not> </condition>
 <condition property="sf.sessionId" value=""> <not> <isset property="sf.sessionId"/>
</not> </condition>
 <condition property="wave.sfdcVersion" value="206"> <not> <isset
property="wave.sfdcVersion"/> </not> </condition>
 <condition property="apiVersion" value="39.0"> <not> <isset property="apiVersion"/>
</not> </condition>
 <!-- MDAPI targets -->
 <target name="deployTemplate" description="Deploy version ${wave.sfdcVersion} to
${sf.serverurl}">
  <condition property="noDeployRoot"><not><isset
property="wave.deployRoot"/></not></condition>
```

```
  <fail message="No deployRoot specified in request (wave.deployRoot)."
if="noDeployRoot"/>
  <sf:deploy username="${sf.username}" password="${sf.password}"
sessionId="${sf.sessionId}" serverurl="${sf.serverurl}" maxPoll="${sf.maxPoll}"
deployRoot="${wave.deployRoot}" rollbackOnError="true"/>
 </target>

 <target name="exportTemplate" description="Export version ${wave.sfdcVersion} to
${sf.serverurl}">
  <condition property="noDeployRoot"><not><isset
property="wave.deployRoot"/></not></condition>
  <fail message="No deployRoot specified in request (wave.deployRoot)."
if="noDeployRoot"/>
  <sf:bulkRetrieve username="${sf.username}" password="${sf.password}"
sessionId="${sf.sessionId}" serverurl="${sf.serverurl}" metadataType="WaveTemplateBundle"
 apiVersion="${apiVersion}"  retrieveTarget="${wave.deployRoot}"/>
 </target>

 <target name="exportSingleTemplate" description="Export version ${wave.sfdcVersion}
to ${sf.serverurl}">
  <condition property="noDeployRoot"><not><isset
property="wave.deployRoot"/></not></condition>
  <fail message="No deployRoot specified in request (wave.deployRoot)."
if="noDeployRoot"/>
  <sf:retrieve username="${sf.username}" password="${sf.password}"
sessionId="${sf.sessionId}" serverurl="${sf.serverurl}"
unpackaged="${wave.deployRoot}/package.xml" apiVersion="${apiVersion}"
 retrieveTarget="${wave.deployRoot}"/>
 </target>

 <!-- REST API Targets -->

 <!-- Requires the 18 digit SFDC folder id as folderSourceId -->
 <target name="createTemplate" description="Create an Analytics template from an
existing app.  After creation, call exportTemplate or exportSingleTemplate to download
 and edit template files">
  <login username="${sf.username}" password="${sf.password}"
serverurl="${sf.serverurl}"/>
  <condition property="folderSourceId" value=""><not><isset
property="folderSourceId"/></not></condition>
  <createTemplate serverurl="${sf.serverurl}" sessionid="${sessionId}"
folderSourceId="${folderSourceId}"/>
 </target>

 <!-- Requires the 18 digit SFDC template id as templateId and the 18 digit SFDC folder
 id as folderSourceId -->
 <target name="updateTemplate" description="Update an Analytics template from an
existing app.  After updating, call exportTemplate or exportSingleTemplate to get
updated template files">
  <login username="${sf.username}" password="${sf.password}"
serverurl="${sf.serverurl}"/>
  <condition property="folderSourceId" value=""><not><isset
property="folderSourceId"/></not></condition>
  <condition property="templateId" value=""><not><isset
```

```
property="templateId"/></not></condition>
  <updateTemplate serverurl="${sf.serverurl}" sessionid="${sessionId}"
templateId="${templateId}" folderSourceId="${folderSourceId}"/>
 </target>

 <!-- Requires the 18 digit SFDC template id as templateId -->
 <target name="deleteTemplate" description="Delete an Analytics template">
  <login username="${sf.username}" password="${sf.password}"
serverurl="${sf.serverurl}"/>
  <condition property="templateId" value=""><not><isset
property="templateId"/></not></condition>
  <deleteTemplate serverurl="${sf.serverurl}" sessionid="${sessionId}"
templateId="${templateId}"/>
 </target>
</project>
```

Analytics Template Apex Callback Class

This appendix describes all the classes and interfaces in the Analytics Template Apex callback class.

The main class is `WaveTemplateConfigurationModifier`, with the following supporting classes:

- `WaveTemplate`
- `Page`
- `UI`
- `Answers`
- `Variable`
- `VariableDefinition`
- `VariableType`
- `VariableTypeEnum`
- `VisibilityTypeEnum`

The idea is to replicate the JSON files as much as possible, because the same author will be working with both.

```
/**
* Template authors extend this class, override the methods and register their class in
* the template-info.json file.
*/
global abstract class WaveTemplateConfigurationModifier {

   /**
    * This callback method gets called before Analytics template configuration data is
retrieved from
    * the UI. It allows for overrides on certain configuration values. Specifically one
can set
    * computedValue, visibility, enums, ...
    */
   void onConfigurationRetrieval(WaveTemplateInfo waveTemplate) {
   }

   /**
```

```
    * This callback method gets called after the completion of each page. It allows for
    * overrides on certain configuration values.
    */
   // @Future - additional work needed in ui, and new Connect API endpoint
   //WaveTemplate onPageComplete(WaveTemplateInfo waveTemplate, Answer answers, Integer
page) {
   //    return waveTemplate;
   //}


   /**
    * This callback method is called right before app creation. It allows for Answer
overrides
    * on the final answers supplied by the user.
    */
   void beforeAppCreate(WaveTemplateInfo waveTemplate, Answers answers) {
   }

    /**
     * This callback method is called right before app is upgraded or reset. It allows for
 Answer
     * overrides on the final answers supplied by the user.
     */
   void beforeAppUpdate(WaveTemplateInfo waveTemplate, String previousAppVersion, Answers
 answers) {
   }
}

global interface WaveTemplateInfo {

   // private constructor

   /**
    *  Gets release information about the Analytics template
    */
   ReleaseInfo getReleaseInfo();

   /**
    * Get the UI information about the template.
    */
   UI getUI();

   /**
    * Get all the variable definitions.
    */
   Map<String, VariableDefinition> getVariables();
}

global interface ReleaseInfo {

   /**
    * Get all the variable definitions.
    */
   String getTemplateVersion();
```

```
}

global interface UIPage {


   /**
    * Retrieve the title of this page
    */
   String getTitle();

   /**
    * Get the condition expression for this page
    */
   String getCondition();

   /**
    * Get all the variables (Questions) associated with this page
    */
   Map<String, Variable> getVariables();

   /**
    * Set the title for this page
    */
   void setTitle(String title);

   /**
    * set the variables for this page
    */
   // @future can't add questions to a page yet
   //void setVariables(Set<Variable> variables);
}

global interface UI {

   /**
    * Get a list of all the pages for the wizard.
    */
   List<UIPage> getPages();

   /**
    * Set the pages to be contained within the wizard
    */
   // @Future can't add pages to the wizard yet
   //void setPages(Set<Pages> pages);
}

/**
* This class contains a collection of all the answers to the variables.
*/
global interface Answers {


   /**
    * Get the value (answer) of a particular variable (question).
```

```
     */
    Object get(String name);

    /**
     * Override a value (answer) to a particular variable (question).
     */
    void put(String name, Object obj);
}

global interface Variable {

    /**
     * Get the name of the variable definition referenced here.
     */
    String getName();

    /**
     * Get the visibility of this question. Note: returns a string because it can contain
a ternary operator
     */
    String getVisibility();

    /**
     * Set the visibility for this variable (question).
     */
    void setVisibility(VisibilityEnum visibility);
}

global interface VariableDefinition {

    /**
     * Get the unique name for this variable
     */
    String getName();

    /**
     * Return the label for this variable
     */
    String getLabel();

    /**
     * Return the description for this variable
     */
    String getDescription();

    /**
     * Return the default value for this variable
     */
    Object getDefaultValue();

    /**
     * Get the variable type information about this variable definition.
     */
    VariableType getVariableType();
```

```
    /**
     * Is this variable required
     */
    Boolean isRequired();

    /**
     * Is this variable exclude select
     */
    Boolean isExcludeSelected();

    /**
     * Return a list of variable values to be excluded from the pick list. This can be a
single regex.
     */
    Set<String> getExcludes();

    /**
     * Override the label for this variable
     */
    void setLabel(String label);

    /**
     * Override the description for this variable
     */
    void setDescription(String description);

    /**
     * Set the 'Computed' values for this Answer, This will be displayed instead of
defaultValue.
     */
    void setComputedValue(String Object);

    /**
     *  Override isRequired
     */
    void setRequired(Boolean required);

    /**
     * Override the list of excludes.
     */
    void setExcludes(Set<String> excludes);

}

global interface VariableType {

    /**
     * Get the VariableTypeEnum of this variable
     */
    VariableTypeEnum getType();

    /**
     * Get the soap datatype of the SObjectFieldType
```

```
     * valid values: xsd:int, xsd:string, xsd:datetime, xsd:boolean, xsd:any
     */
    String getDataType();

    /**
     * Get an set of valid valued for this variable definition
     */
    Set<Object> getEnums();

    /**
     * Override the set of valid values for this variable definition.
     */
    void setEnums(Set<Object> enums);
}

global enum VariableTypeEnum {
    BooleanType,
    StringType,
    NumberType,
    ArrayType,
    DateTimeType,
    ObjectType,
    SobjectType,
    SobjectFieldType,
    DatasetType,
    DatasetDimensionType,
    DatasetMeaseType,
    DatasetDateTpe
}

global enum VisibilityEnum {
    Visible,
    Disabled,
    Hidden
}
```

Apex Examples

Examples include setting computed values for questions, hiding a question, managing enum values, working with array type variables, and more.

Checking the Analytics Integration User Access

Dataflows fail if they reference an sobject field that is hidden to the Integration User.

Apex Examples

Examples include setting computed values for questions, hiding a question, managing enum values, working with array type variables, and more.

Example: Set the computed value for one of the questions:

```
WaveTemplate onConfigurationRetrieval(WaveTemplate waveTemplate) {

    Map<String, VariableDefinition> variables = waveTemplate.getVariables();
```

```
   VariableDefinition hasProduct = variables.get("Has_Product");
   hasProduct.setComputedValue("No");
   return waveTemplate;
}
```

Example: Hide one of the questions:

```
WaveTemplate onConfigurationRetrieval(WaveTemplate waveTemplate) {

   Set<Page> pages = waveTemplate.getUI().getPages();
   Page firstPage = Pages.get(0);
   Map<String Variable> variables = firstPage.getVariables();
   Variable variable = variables.get("Has_Product");
   variable.setVisibility(VisibilityEnum.Hidden);
}
```

Example: Reduce the number of enum values in the drop-down list box:

```
WaveTemplate onConfigurationRetrieval(WaveTemplate waveTemplate) {

   Map<String, VariableDefinition> variables = waveTemplate.getVariables();
   VariableDefinition hasProduct = variables.get("Has_Product");
   VariableType variableType = hasProduct.getVariableType();
   Set<Object> enums = variableType.getEnums();
   enums.remove('Yes');
}
```

Example: Populate the enum values in the drop-down list box (StringType variable):

```
global override void onConfigurationRetrieval(WaveTemplateInfo template){
Map<String, VariableDefinition> variables = template.getVariables();
VariableDefinition caseRecordTypes = variables.get('IncludeCaseRecordTypes');
VariableType variableType = caseRecordTypes.getVariableType();
Set<Object> enums = variableType.getEnums();
RecordType [] results = [SELECT Name FROM RecordType where sobjectType = 'Case'];
for (RecordType record : results){
 //adds the record type names to the drop down list
 enums.add((String)record.get('Name'));
}
variableType.setEnums(enums);
}
```

Example: Given the following ArrayType variable, you can set its enums as well:

```
  "OpptyRecordType": {
    "label": "Select OpptyRecordTypes that you want to bring in to Salesforce",
    "description": "Choose OpptyRecordTypes that you want to bring in to Salesforce.",

    "required": false,
    "variableType": {
      "type": "ArrayType",
      "itemsType":
       {
       "type": "StringType",
```

```
        "enums": ["Test", "Test2"]
       }
     }
   }
```

Using:

```
Map<String, wavetemplate.VariableDefinition> variables = template.getVariables();
wavetemplate.VariableDefinition enumsTest = variables.get('OpptyRecordType');
List<Object> enums = enumsTest.getVariableType().getItemsType().getEnums(); //create
an empty list if you want to overwrite the original enums.

RecordType [] results = [SELECT Name FROM RecordType where sobjectType = 'Opportunity'
 AND IsActive = true];
for ( RecordType record : results ) {
 enums.add((string)record.get('Name'));
}
enumsTest.getVariableType().getItemsType().setEnums(enums);
```

Reduce the possible answers via the excludes:

```
WaveTemplate onConfigurationRetrieval(WaveTemplate waveTemplate) {

   Map<String, VariableDefinition> variables = waveTemplate.getVariables();
   VariableDefinition hasProduct = variables.get("Has_Product");
   Set<String> excludes = new Set<String>();
   excludes.add("Foo");
   excludes.add("Bar");
   hasProduct.setExcludes(excludes);

   return waveTemplate;

}
```

Checking the Analytics Integration User Access

Dataflows fail if they reference an sobject field that is hidden to the Integration User.

To determine if that user has access to a specific field, use the `wavetemplate.Access` Apex class and call the `integUserHasAccessToSObjectField` or `checkIntegUserAccessToArrayOfSObjectFields` method. Call these methods either before the wizard is displayed or before app creation/upgrade.

In the `onConfigurationRetrieval` method, use `integUserHasAccessToSObjectField(String` *`sObjectName`*`, String` *`fieldName`*`)`, which returns a boolean:

```
public override void onConfigurationRetrieval(wavetemplate.WaveTemplateInfo template) {
    if (!wavetemplate.Access.integUserHasAccessToSObjectField('Account', 'Industry')) {
 //do something….
 template.getVariables().get('stringExample').setComputedValue('NoAccess');
    }
}
```

In the `beforeAppCreate` method, use either:

- `integUserHasAccessToSObjectField (String variableName, WaveTemplateInfo template, Answers answers)`, which returns a boolean, to check access to an SObject or SObject Field variable type, or
- `checkIntegUserAccessToArrayOfSObjectFields (String variableName, WaveTemplateInfo template, Answers answers)`, which returns an array of `fieldName` strings to which the user does not have access, to check access to an Array variable type that contains SObjects or SObject fields.

```
public override void beforeAppCreate(wavetemplate.WaveTemplateInfo template,
wavetemplate.Answers answers) {
    //Check access to a single sobjectFieldType answer:
    Boolean access  =
      wavetemplate.Access.integUserHasAccessToSObjectField('sobjectFieldExample',template,

          answers);
    //Do something based on the result...
    answers.put('booleanExample', !access);

    //Check access to all the answers in an sobjectField Array Type answer:
    List<String> badItems =

     wavetemplate.Access.checkIntegUserAccessToArrayOfSObjectFields('sobjectFieldArrayExample',

          template, answers);
    //Do something based on the result...
    if(!badItems.isEmpty()){
       answers.put('stringExample', badItems.get(0));
    }
}
```

VisualForce Events for Customizing the Wizard UI

This reference section explains the details of using VisualForce for customizing the Wizard user interface.

Table 1: List of Events to Which You Can Subscribe or Publish

Event Name	Subscribe/Publish	Description	Response
`ready`	publish	Fired from client indicating they are ready to receive events.	Response contains all the metadata: page, variableDefinitions, initialValues needed to render the questions and possible answers for the page.
`update`	publish	Fired from client when ready to update one or more variables.	Variables with errors messages.
`visibility`	publish	Fired from client to check 'visibility' of one or more questions.	Variables and their visibility enum.
`values`	publish	Fired from client to request the most up-to-date values of each question.	The values of all variables in the entire wizard.

Event Name	Subscribe/Publish	Description	Response
`next`	subscribe	Fired from parent when use clicks "continue" button. May or may not advance the page. If there are errors in the variable values, the page will not advance.	A list of variables that are required with no values.
`resize`	publish	Fired from client to change the size of the VisualForce page.	None.
`options`	publish	Fired from client to get a list of 'options' for filling in drop-down list boxes.	List will be filtered for "queryable," "excludes," "exclude selected." "Tags" will be applied to indicate which option values are "default," "recommended," or "previous" values. You can use this for sObjects, sObjectFields, string enums, and number enums.
`computed`	publish	Fired from client to set the computed (suggested) values for a variable.	Variables with success or error messages.
`close`	publish	Fired from client to close the wizard. No actions are taken as part of the close.	None.
`buttons`	publish	Change the text of the Back and Next button. Can also enable or disable the Back or Next button.	
`create`	publish	Fired from the client to create an app before the final screen. Calls `POST /wave/folder` and returns results.	The status of the POST call. Success if app creation is kicked off successfully (not final app status), otherwise Fail.
`dataset`	COMING SOON	Dataset	*Coming soon; not currently supported in this release. We intend to implement this as an 'options' event.*
`dataset fields`	COMING SOON	Dimensions, Measures tied to parent datasets	*Coming soon; not currently supported in this release. We intend to implement this as an 'options' event.*

Event: wizard.ready

- **Subscribe/Publish:** publish
- **Input/Multiple:** optional
  - **Size:** small, medium, large
  - **Banner:** visible, title, progress

    Note: for VisualForce pages, the banner is hidden by default.

- **Response:** Yes
- **Normalized Input:** N/A
- **Input Examples:**
  - `{}`
  - `{size : “large” }`
  - `{banner : visible : true, title : “My Custom title”, progress : “Almost done”}}`
  - `{size : “small”, banner : {visible : false}}`
- **Output Example:**

```
{
  "page": {
    "condition": null,
    "helpUrl": null,
    "title": "Page 1",
    "variables": [
      {
        "name": "stringExample",
        "visibility": "Visible"
      },
      {
        "name": "visibilityControl"
        "visibility": "Visible"
      },
      {
        "name": "visibilityTest",
        "visibility": "Hidden"
      }
    ]
  },
  "variableDefinitions": {
    "stringExample": {
      "label": "What is the value of the string?",
      "description": "The String.",
      "defaultValue": null,
      "variableType": {
        "type": "StringType",
        "enums": [
          "foo",
          "bar",
          "baz",
          "testStr"
        ]
```

```
    }
  },
  "stringExample2": {
    "label": "What is the value of this string?",
    "description": "The String2.",
    "defaultValue": null,
    "variableType": {
      "type": "StringType"
    }
  },
  "visibilityControl": {
    "label": "Do you want to answer more questions?",
    "description": "Check to test visibility",
    "variableType": {
      "type": "BooleanType"
    },
    "defaultValue": false,
    "required": true
  },
  "visibilityTest": {
    "label": "I should only be visible when visibilityControl is checked",
    "variableType": {
      "type": "StringType",
      "enums": [
        "aaa",
        "bbb",
        "ccc"
      ]
    }
  },
  "visibilityTest2": {
    "label": "I should only be enabled when visibilityControl is checked",
    "variableType": {
      "type": "StringType"
    }
  },
  "datasetExample": {
    "label": "Pick a dataset",
    "description": "Interesting dataset",
    "variableType": {
      "type": "DatasetType"
    }
  },
  "dimensionExample": {
    "label": "Pick a dimension",
    "description": "Dim testing",
    "defaultValue": {
      "datasetId": "{{Variables.datasetExample.datasetId}}",
      "fieldName": "test"
    },
    "variableType": {
      "type": "DatasetDimensionType"
    },
    "required": false
```

```
    }
  },
  "initialValues": {
    "stringExample": null,
    "stringExample2": null,
    "visibilityControl": false,
    "dimensionExample": {
      "datasetId": "{{Variables.datasetExample.datasetId}}",
      "fieldName": "test"
    }
  }
}
```

Event: wizard.update

- **Subscribe/Publish:** publish
- **Input/Multiple:** yes
- **Response:** yes
- **Normalized Input:** yes
- **Input Examples:**
  - `{name : “myVariable”, value : “some value” }`
  - `[{name : “myVariable”, value : “some value” }]`
  - `[{name : “myVariable”, value : “some value” }, {name : “myNumber”, value : 123}]`
  - `{myVariable : “some value”, myNumber: 123, myBoolean : true}`
  - `{name : “mySObject”, value : {sobjectName : “Account”}}`
- **Output Example:** always an array

```
[
    {name : “myVariable”: value : “some value”, valid : true },
   {name : “myNumber”: value : null, valid : false, errorMessage : “Not a valid value”}

    {name : “mySObject”: value : {sobjectName : “Account”}, valid : true}
]
```

Event: wizard.visibility

- **Subscribe/Publish:** publish
- **Input/Multiple:** yes
- **Response:** yes
- **Normalized Input:** yes
- **Input Examples:**
  - `[“myVariable”, “myNumber”]`
  - `[{name : “myVariable”}]`
  - `{name : “myVariable”}`

  - `"myVariable"`
- **Output Example:** always an array

```
[

  {name : "myVariable": visibility : "Hidden"},

  {name : "myNumber": visibility : "Visible"},

  {name : "myOtherVariable": visibility : "Disabled"}

]
```

Event: wizard.values

- **Subscribe/Publish:** publish
- **Input/Multiple:** n/a
- **Response:** yes
- **Normalized Input:** n/a
- **Input Examples:**
  - `{}`
- **Output Example:**

```
{
    values : {
        myVariable: "foo",
        myNumber: 123,
        myBoolean: true,
        myDimension: {fieldName : "days"}
   }
}
```

Event: wizard.next

- **Subscribe/Publish:** subscribe
- **Input/Multiple:** n/a
- **Response:** yes
- **Normalized Input:** n/a
- **Output Example:** Page will not advance if required fields are not met.

```
{
        "myVariable": {
              errorMessage: "Not a valid value",
              isRequired : true,
              variableName : "myVariable"
        }
}
```

```
{}
```

Event: wizard.resize

- **Subscribe/Publish:** publish
- **Input/Multiple:** n/a
- **Response:** no
- **Normalized Input:** n/a
- **Input Examples:**
  - `{size : "small"}`
  - `{size : "medium"}`
  - `{size : "large"}`

Event: wizard.options

- **Subscribe/Publish:** publish
- **Input/Multiple:** no
- **Response:** yes
- **Normalized Input:** n/a
- **Input Examples:**
  - `{name : "mySObjectVariableName"}`
  - `{name : "mySObjectFieldVariableName"}`
  - `{name : "myStringVariableName"}`
  - `{name : "myNumbertVariableName"}`
- **Output Example:**

```
{
 "options": [
   {
     "label": "Account",
     "value": "Account",
     "tags": [
       {
         "tag": "Default",
         "toolTip": "Default answer"
       }
     ]
```

```
    },
    {
      "label": "Oppty",
      "value": "Opportunities"
    }
  ]
}
```

Event: wizard.buttons

- **Subscribe/Publish:** publish
- **Input/Multiple:** n/a
- **Response:** no
- **Normalized Input:** n/a
- **Input Examples:**
  - ```
    {buttons : {
        next : {disabled : true, text : "Fix error before continue"},
        back : {disabled : false, text : "Go Back"}
      }
    }
    ```
  - ```
    {  buttons : {
        back : {disabled : true}
      }
    }
    ```
  - ```
    {  buttons : {
        next: {"text" : "Proceed at Own Risk"}
      }
    }
    ```
- **Output Example:**

  None. Buttons should update accordingly.

Event: wizard.create

- **Subscribe/Publish:** publish
- **Input/Multiple:** no
- **Response:** yes
- **Normalized Input:** yes
- **Input Examples:**
  - ```
    {folder : {label : "vfTest", description : "my desc"}}
    ```