SL1 PowerFlow for Developers

Version 2.0.0

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Chapter 1

Introduction to SL1 PowerFlow Tools

Overview

This manual describes how you can use the tools included in SL1 PowerFlow and your own tools to create your own PowerFlow applications, steps, and configuration objects that you can use with PowerFlow.

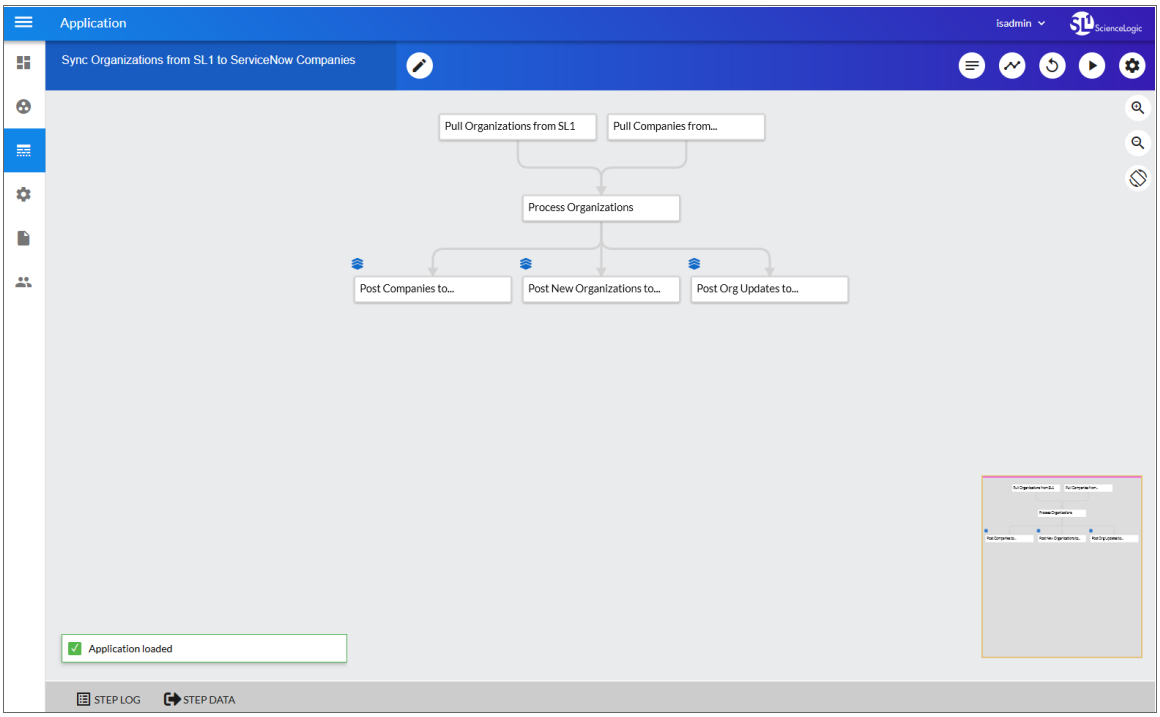
> **NOTE:** After the 2.1.0 release of the Integration Service platform, the *Integration Service* was rebranded as *SL1 PowerFlow*, which is available in SL1 Standard solutions. Also, the *Automation Builder* was rebranded as *SL1 PowerFlow builder*, which is available in SL1 Premium solutions.

This chapter covers the following topics:

What is SL1 PowerFlow?

SL1 PowerFlow enables intelligent, bi-directional communication between the ScienceLogic data platform and external data platforms to promote a unified management ecosystem. PowerFlow allows users to translate and share data between SL1 and other platforms without the need for programming knowledge. PowerFlow is designed to provide high availability and scalability.

The following image shows an example of a PowerFlow application and its steps in the PowerFlow user interface:



The key elements of the PowerFlow user interface include the following:

- ***Steps***. A step is a generic Python class that performs a single action. Steps can accept zero or many input parameters or data from previous steps, and steps can specify output to be used by other steps. The input parameters are configurable variables and values used during execution. Steps can be re-used in multiple PowerFlow applications. When these steps are combined in an application, they provide a workflow that satisfies a business requirement. All Python step code should be Python 3.7 or later. In the image above, the steps display as part of the flowchart in the main viewing pane as well as the **Steps Registry** pane.
- ***Applications***. An application is a JSON object that includes all the information required for executing an integration on the PowerFlow platform. An application combines a set of steps that execute a workflow. The input parameters for each step are also defined in the application and can be provided either directly in the step or in the parent application. In the image above, the group of connected steps in the large pane make up the "Sync Organizations from SL1 to ServiceNow Companies" application. You can access all applications on the **Applications** page ( ).

> **NOTE:** You can also build automations from the **Applications** page.

- ***Configuration Objects***. A configuration object is a stand-alone JSON file that contains a set of configuration variables used as input for an application. Configurations can include variables like hostname, user name, password, or other credential information. Configuration objects allow the same application to be deployed in multiple PowerFlow instances, with different configurations. Click the **[Configure]** button from an application in the PowerFlow user interface to access the configuration object for that application. You can access all configuration objects on the **Configurations** page ( ).
- ***Synchronization PowerPacks***. A Synchronization PowerPack (also called a SyncPack) contains all the code and logic needed to perform integrations on the PowerFlow platform. You can access the latest steps, applications, and configurations for PowerFlow or a third-party integration (such as ServiceNow, Cherwell, or Restorepoint) by downloading the most recent Synchronization PowerPack for that integration from ScienceLogic. You can access all Synchronization PowerPacks on the **SyncPacks** page ( ).

The topics in this section describe how to create a step that is compatible with the PowerFlow system. These topics also describe parameters, built-in parameters, and transferring data.

After you have created one or more steps, you can use them in one or more *applications*.

Tools Included with PowerFlow

PowerFlow includes the following tools for creating custom integrations:

- ***iscli***. PowerFlow includes a command line tool called ***iscli*** (PowerFlow Command Line Interface). When you install PowerFlow, ***iscli*** is automatically installed. The iscli allows you to upload PowerFlow applications, steps, and configuration objects. For more information on the iscli, see the section on *iscli*.
- ***IS API***. PowerFlow includes an API. When you install PowerFlow, the API is available. For more information on the API, see the section on *the API*.
- ***ipaascore.BaseStep class***. PowerFlow includes a Python class called ***ipaascore.BaseStep class***. This class includes multiple pre-defined functions that you can use when you are writing or editing a step. For more information, see the section on *ipaascore.BaseStep class*.
- ***Base Steps Synchronization PowerPack***. The *Base Steps* Synchronization PowerPack includes a number of basic steps that perform common API calls. For more information, see *Default Steps*.

Prerequisites for Creating PowerFlow Applications

To create your own PowerFlow application, you must:

- Deploy a PowerFlow system and ensure it is accessible. For details, see the ***SL1 PowerFlow Platform*** manual.
- Have SSH or console access to the PowerFlow system, so you can use the iscli (PowerFlow Command Line Interface). You will use the iscli to upload steps, applications, and configurations to PowerFlow.
- Be comfortable with Python.
- Install a local copy of a Python IDE to use for development.
- Install a local copy of an API tool, like cURL, Insomnia, or Postman.
- Install a local copy of a source-code editor like Notepad++, vi, or TextEdit.

Chapter 2

Creating a Step

Overview

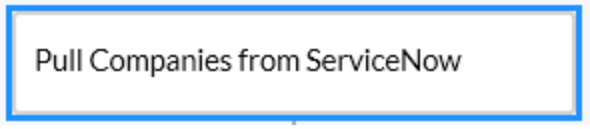
This chapter explains how to create your own custom step that you can then upload and run on an SL1 PowerFlow system.

> **NOTE:** All Python step code should be Python 3.7 or later.

This chapter covers the following topics:

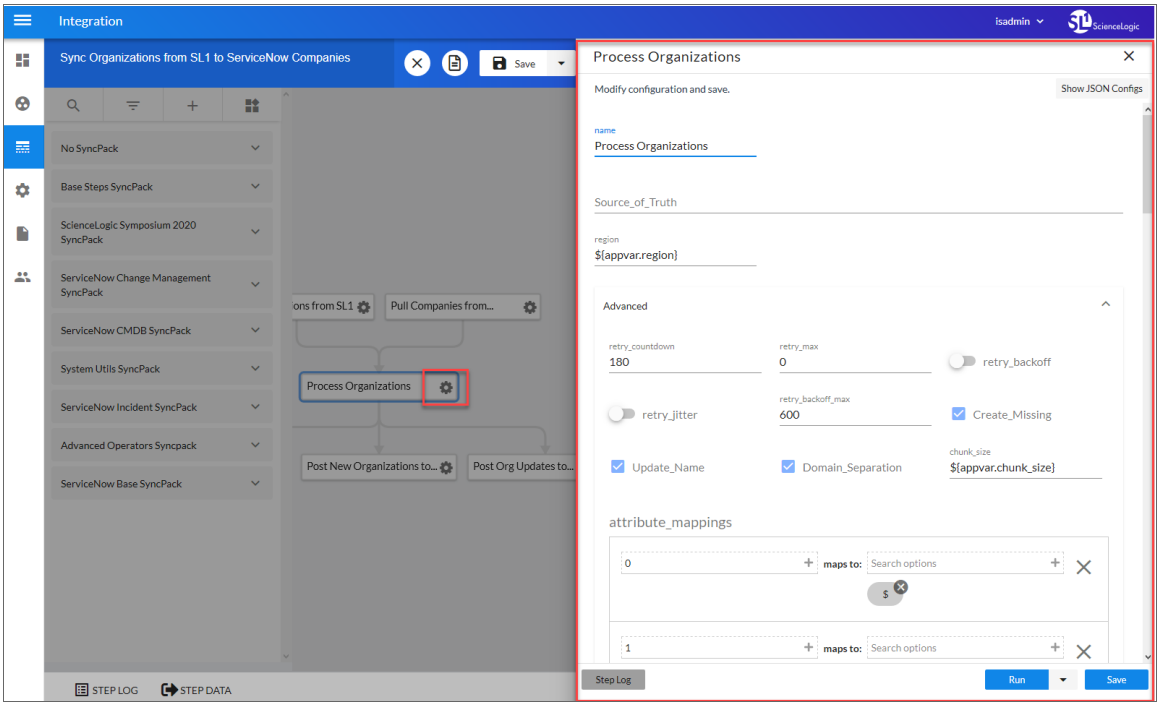
What is a Step?

In PowerFlow, a ***step*** is a generic Python class that performs a single action, such as caching device data:



Steps accept arguments called ***input parameters***. The parameters specify the values, variables, and configurations to use when executing the step. Parameters allow steps to accept arguments and allow steps to be re-used in multiple integrations. For example, you can use the same step to query both the local system and another remote system; only the arguments, such as hostname, username, and password change.

You can view and edit the parameters for a step by opening the PowerFlow application, clicking **[Open Editor]** ( ), and then clicking the gear icon ( ) on a step. The **Configuration** pane for that step appears:



A step can pass the data it generates during execution to a subsequent step. A step can use the data generated by another step. Also, you can add test data to the step and click the down arrow next to the **[Run]** button ( ) and select *Custom Run* to run test data for that step.

PowerFlow analyzes the required parameters for each step and alerts you if any required parameters are missing before PowerFlow runs the step.

Steps are grouped into the following types:

- ***Standard***. Standard steps do not require any previously collected data to perform. Standard steps are generally used to generate data to perform a transformation or a database insert. These steps can be run independently and concurrently.
- ***Aggregated***. Aggregated steps require data that was generated by a previously run step. Aggregated steps are not executed by PowerFlow until all data required for the aggregation is available. These steps can be run independently and concurrently.
- ***Trigger***. Trigger steps are used to trigger other PowerFlow applications. These steps can be configured to be blocking or not.

Default Steps

The *Base Steps* Synchronization PowerPack contains the "Template App" application. You can use the "Template App" application as a template for building new PowerFlow applications.

The *Base Steps* Synchronization PowerPack also includes the following steps, which you can use in new and existing applications:

- Cache Delete
- Cache Read
- Cache Save
- Direct Cache Read
- Jinja Template Data Render
- MS-SQL Describe
- MS-SQL Insert
- MS-SQL Select
- MySQL Describe
- MySQL Insert
- MySQL Select
- Query GraphQL
- Query REST
- Run a command through an SSH tunnel
- Trigger Application

TIP: To view the code for a step, select a Synchronization PowerPack from the **SyncPacks** page, click the **[Steps]** tab, and select the step you want to view.

Requirements

To create a custom step, you must perform the following tasks:

1. Download or copy the step template, called *stepTemplate*.
2. Set up the required classes and methods in the step.
3. Define logic for the step, including transferring data between steps.
4. Define parameters for the step.
5. Define logging for the step.
6. Define exceptions for the step.
7. Upload the step to PowerFlow.
8. Validate and test the step.

Creating a Step from the Step Template

The easiest way to create a new step is to use the step template that is included with PowerFlow. To copy this template to your desktop:

1. Using an API tool like Postman or cURL, use the API ***GET /steps/{step_name}***:

   ```
   GET URL_for_your_PowerFlow_system/api/v1/steps/stepTemplate
   ```

   where:

   - *URL_for_your_PowerFlow _system* is the IP address or URL for PowerFlow.

2. Select and copy all the text in the stepTemplate.
3. Open a source-code editor and paste the content of the stepTemplate in the source-code editor.
4. Save the new file as *newfilename*.py

   where:

   - *newfilename*.**py** is the new name of the step and includes the .py suffix. The file name must be unique within your PowerFlow system and cannot contains spaces. Note that the step name will also be the name of the Python class for the step.

Including the SubClass and Required Methods

To execute successfully on PowerFlow, your step must be a subclass of the ipaascore.BaseStep class and include the init method and the execute method.

Subclass

The stepTemplate.py file is already configured to include the new step as a subclass of the ipaascore.BaseSetp class. To update your step:

1. Use a source-code editor to open the re-named file for editing.
2. Notice that the file includes these lines of text:

```
from ipaascore.BaseStep import BaseStep
from ipaascommon import ipaas_exceptions
```

3. Do not remove or alter these lines of text.
4. Search for the following:

```
class stepTemplate(BaseStep):
```

5. Replace ***stepTemplate*** with the new name of the file (without the .py suffix).
6. Save and close the file.

Required Methods

To execute successfully on PowerFlow, your step must contain at least two methods:

- ***init method***. Allows you to define initialization options and parameters for the step.
- ***execute method***. The execute method includes the logic for the step and performs the action. After PowerFlow evaluates all parameters and initialization settings and aligns the step with a worker process, PowerFlow examines the execute method.

Without these methods, PowerFlow will consider your step to be "incomplete" and will not execute the step.

The stepTemplate.py file includes these two methods and the syntax of some of the sub-methods you can use within the main methods.

Defining the Logic for the Step

Each step requires the init method and the execute method. Within those methods, you can specify parameters and logic for the step. The following sections describe how to do this.

The init Method

From the init method, you can define the friendly name, the step description, and the step version:

```
self.friendly_name = "friendly name of the step. This name appears in the user
interface"
self.description = "Description of the step"
self.version = "version number"
```

In the QueryREST step, the friendly name, description, and version number are defined like this:

```
def __init__(self):
     self.friendly_name = "Query REST"
     self.description = "Step facilitates REST interactions and will return the
     returned data dictionary and specified headers as data to the next step"
     self.version = "1.0.0"
```

From the init method, you also define the parameters for the step. PowerFlow will examine the parameters and enforce the parameters when the step is run.

For example, if you specify a parameter as required, and the user does not specify the required parameter when calling the step, PowerFlow will display an error message and will not execute the step.

To define a parameter, use the self.*new_step_parameter* function.

```
self.new_step_parameter(name=parameter_name, description="description", sample_
value="sample value", default_value=None, required=False)
```

where:

- *name*. The name of the parameter. This value will be used to create a name:value tuple in the PowerFlow application file (in JSON).
- *description*. A description of the step parameter.
- *sample_value*. A sample value of the required data type or schema.
- *default_value*. If no value is specified for this parameter, use the default value. Can be any Python data structure. To prevent a default value, specify "None".
- *required*. Specifies whether this parameter is required by the step. The possible values are "True" or "False".

Here is an example from the QueryREST step (available on each PowerFlow system):

```
self.new_step_parameter(name=PREFIX_URL, description="used with relative_url to
create the full URL.", sample_value="http://10.2.11.253", default_value=None,
required=True)
```

The execute Method

From the execute method you can:

- Use Python logic and functions
- retrieve the value of a parameter with self.*get_parameter*
- retrieve the value of a variable with self.*get_app_variables* (variables are defined in the PowerFlow application)
- *Retrieve data from a previous step* in the application
- *Save data for use by the next step* in the application
- Define logging for the step
- Define exceptions for the step

For details on all the functions you can use in the execute method, see the chapter on the *ipaascore.BaseStep class*.

You can also define additional methods in the step. For examples of this, see the QueryREST step provided with PowerFlow.

For examples of the logic in a step, view one or more of the steps listed in *Default Steps*.

Transferring Data Between Steps

An essential part of integrations is passing data between tasks. PowerFlow includes native support for saving and transferring Python objects between steps. The *ipaascore.BaseStep class* includes multiple functions for transferring data between steps.

Saving Data for the Next Step

The *save_data_for_next_step* function saves an object or other type of data and make the data available to another step. The object to be saved and made available must be able to be serialized with pickle:

```
save_data_for_next_step(data_to_save)
```

where:

- *data_to_save* is a variable that contains the data.

NOTE: The *data_to_save* object must be of a data type that can be pickled by Python: None, True and False, integers, long integers, floating point numbers, complex numbers, normal strings, unicode strings, tuples, lists, set, and dictionaries.

The following is an example of the ***save_data_for_next_step*** function:

```
save_data = {'key': 'value'}
self.save_data_for_next_step(save_data)
```

The PowerFlow application must then specify that the data from the current step should be passed to one or more subsequent step, using the **output_to** parameter. For details, see the section about *using applications to transfer data between steps*.

Retrieving Data from a Previous Step

The *ipaascore.BaseStep class* includes multiple functions that retrieve data from a previous step:

- *get_data_from_step_by_name*
- *get_data_from_step_by_order*
- *join_previous_step_data*

> **NOTE**: To retrieve data from a previous step, that previous step must save the data with the ***save_data_for_next_step*** function, and the application must specify that the data from the previous step should be passed to the current step using the ***output_to*** parameter.

get_data_from_step_by_name

The ***get_data_from_step_by_name*** function retrieves data saved by a previous step.

> **NOTE**: Although the ***get_data_from_step_by_name*** function is simple to use, it does not allow you to write a generic, reusable step, because the step name will be hard-coded in the function. The functions ***join_previous_step_data*** or **get_data_from_step_by_order** allow you to create a more generic, reusable step.

```
get_data_from_step_by_name(step_name)
```

where:

- *step_name* is the name of a previous step in the PowerFlow application.

The following is an example of the ***get_data_from_step_by_name*** function:

```
em7_data = self.get_data_from_step_by_name('FetchDevicesFromEM7')
snow_data = self.get_data_from_step_by_name('FetchDevicesFromSnow')
```

get_data_from_step_by_order

The ***get_data_from_step_by_order*** function retrieves data from a step based on the position of the step in the application.

```
get_data_from_step_by_order(position)
```

where:

- *position* is the position of the step (the order that the step was run) in the application. Position starts at "0" (zero).

For example:

- Suppose your application has four steps: stepA, stepB, stepC, and stepD
- Suppose stepA was run first (position "0") and includes the parameter "output_to":["stepD"]
- Suppose stepB was run second (position "1") and includes the parameter "output_to":["stepD"]
- Suppose stepC was run third (position "2") and includes the parameter "output_to":["stepD"]

- Suppose stepD was run fourth
- If the current step is stepD, and stepD needs the data from stepC, you could use the following:

```
data_from_stepC = self.get_data_from_step_by_order(2)
```

join_previous_step_data

The *join_previous_step_data* function is the easiest and most generic way of retrieving data from one or more previous steps in the application.

If you are expecting similar data from multiple steps, or expecting data from only a single step, the ***join_previous_step_data*** function is the best choice.

The ***join_previous_step_data*** function gathers all data from all steps that included the **save_data_for_next_step** function and also include the ***output_to*** parameter in the application. By default, this function returns the joined set of all data that is passed to the current step. You can also specify a list of previous steps from which to join data.

The retrieved data must be of the same type. The data is then combined into a list in a dictionary.

If the data types are not the same, then the function will raise an exception.

```
join_previous_step_data([step_name])
```

where:

- *step_name* is an optional argument that specifies the steps. For example, if you wanted to join only the data from stepA and stepD, you could specify

```
self.join_previous_step_data(["stepA", "stepD"]),
```

The following is an example of the ***join_previous_step_data*** function in the QueryREST step (included in each PowerFlow system):

```
def query_with_url_generated_from_input(self):
"""
Iterates over data from previous steps and generates a relative url for each. Then
executes that command
:return:
"""
count = 0
input_data = self.join_previous_step_data()
payload = self.get_parameter(PAYLOAD)
if type(input_data) is list:
  for input_d in input_data:
    relative_url = self.get_parameter(RELATIVE_URL, input_d)
    self.process_REST_command(payload, relative_url)
    count += 1
  elif type(input_data) is dict:
    relative_url = self.get_parameter(RELATIVE_URL, input_data)
    self.process_REST_command(payload, relative_url)
    count += 1
else:
  raise NotImplementedError("Data type: {} is not currently supported for generating
  relative urls form data".format(type(input_data)))
```

Step Parameters

Steps accept arguments, called ***parameters***. These arguments specify the values, variables, and configurations to use when executing.

Base Parameters Available in All Steps

The PowerFlow BaseClass has a few base parameters that are automatically inherited by all steps and cannot be overwritten. You do not need to define these parameters before using them in steps:

- ***name***. The Application-unique name for this step. That parameter can be used by other steps to refer to a step.
- ***file***. The name of the file that will be executed by the step. For example, you could write step logic in a single file, but use that step logic with different applications and use different names for the step in each application.
- ***output_to***. A list indicating that the data retrieved from this step should be output to another step. Setting this parameter links the steps, and the subsequent step will be able to retrieve data from the current step. The format is:

```
"output_to":["stepA", "stepB"]
```

Defining a Parameter

From the init method, you define the parameters for the step. The PowerFlow system will examine the parameters and enforce the parameters when the step is run.

For example, if you specify a parameter as required, and the user does not specify the required parameter when calling the step, the PowerFlow system will display an error message and will not execute the step.

To define a parameter, use the ***new_step_parameter*** function.

```
new_step_parameter(name='', description='', sample_value='', default_value=None,
required=False)
```

where:

- *name*. The name of the parameter. This value will be used to create a name:value tuple in the application file (in JSON).
- *description*. A description of the step parameter.
- *sample_value*. A sample value of the required data type or schema.
- *default_value*. If no value is specified for this parameter, use the default value. Can be any combination of alphanumeric characters. To prevent a default value, specify "None".
- *required*. Specifies whether this parameter is required by the step. The possible values are "True" or "False".

Here is an example from the QueryREST step:

```
self.new_step_parameter(name=PREFIX_URL, description="used with relative_url to
create the full URL.", sample_value="http://10.2.11.253", default_value=None,
required=True)
```

Retrieving Parameter Values

To retrieve the latest value of a parameter, use the ***get_parameter*** function.

```
get_parameter(param_name, lookup_data=None)
```

where:

- *param_name* is the name of the parameter that you want to retrieve the value for.
- *lookup_data* is an optional dictionary that can provide a reference for additional variable substitutions.

For example, suppose we defined this parameter in the step named "GETgoogle.com":

```
self.new_step_parameter(name=prefix_url, description="used with relative_url to create
the full URL.", sample_value="http://10.2.11.253", default_value=None, required=True)
```

Suppose in the PowerFlow application that calls "GETgoogle.com", we specified:

```
"steps": [
  {
    "file": "QueryREST",
    "method": "GET",
    "name": "GETgoogle.com",
    "output_to": ["next_step"],
    "prefix_url": "http://google.com"
  }
],
```

Suppose we use the ***get_parameter*** function in the step "GETgoogle.com" to retrieve the value of the "prefix_url" parameter:

```
build_url_1 = self.get_parameter("prefix_url")
```

The value of ***build_url_1*** would be "http://google.com".

Variable Substitution in Parameters

The PowerFlow system allows users to define variables, so that parameters can be populated dynamically.

To include a variable in a parameter, use the following syntax:

```
${exampleVariable}
```

The PowerFlow system includes the following types of variables for use in parameters:

- ${*object_from_previous_step*}. The PowerFlow system will search the data from the previous steps for *object_from_previous_step*. If found, the PowerFlow system will substitute the value of the object for the variable
- ${**config**.*exampleVariable*}. Configuration variables are defined in a stand-alone file that lives on the PowerFlow system and can be accessed by all applications and their steps. Including the **config.** prefix with a variable tells the PowerFlow system to look in a configuration file to resolve the variable. If you want to re-use the same settings (like hostname and credentials) between applications, define configuration variables.
- ${**appvar**.*exampleVariable*}. Application variables are defined in the PowerFlow application. These variables can be accessed only by steps in the application. Including the **appvar.** prefix with a variable tells the PowerFlow system to look in the application to resolve the variable.
- ${**stepfunc**.*exampleFunctionargs*}. The variable value will be the output from the user-defined function, specified in *exampleFunction*, with the arguments specified in *args*. The *exampleFunction* must exist in the current step. Additional parameters can be specified as *args* with a space delimiter. You can also specify additional variable substitution values as the arguments. This allows you to dynamically set the value of a variable using a proprietary function, with dynamically generated arguments. For example:

  ```
  "param": "${step_func.add_numbers 1 2}"
  ```

  will call a function (defined in the current step) called "add_numbers" and pass it the arguments "1" and "2". The value of "param" will be "3".

For details on defining configuration variables and application variables, see *the chapter on defining an application*.

Retrieving Variable Values

You can use the *get_app_variable* function to retrieve the latest value of a variable.

```
get_app_variable (variable_name)
```

where:

- *variable_name* is the name of the application variable that you want to retrieve the value for.

For example, suppose we defined this application variable in the application:

```
"app_variables": [
  {
    "name": "sl1_hostname",
    "description": "The SL1 hostname to participate in the sync",
    "sample_value": "10.2.253.115",
    "default_value": null,
    "required": true,
    "value": 10.64.68.25
  },
]
```

Suppose this application calls the step "sync_SL1_data".

In the step "sync_SL1_data" , we could use the following function to resolve the value of "sl1hostname":

```
hostname = self.get_app_variable("sl1_hostname")
```

The value of ***hostname*** would be "10.64.68.25".

Defining Logging for the Step

The PowerFlow system includes a logger for steps. The BaseStep class initializes the logger, so it is ready for use by each step.

To define logging in a step, use the following syntax:

```
self.logger.logging_level ("log_message")
```

where:

- *logging_level* is one of the following Python logging levels:
    - critical
    - error
    - info
    - warning
- *log_message* is the message that will appear in the step log.

For example :

```
self.logger.info("informational message")
```

Raising Exceptions

The PowerFlow platform natively handles exceptions raised from custom steps. You can include a user-defined exception or any standard Python exception.

If an exception is raised at runtime, the step will immediately be marked as a failure and be discarded.

To view the exception and the complete stack trace, use the steps from the section on *Viewing Logs*.

Uploading Your Step

When you create a new step or edit an existing step, you must upload the step to the PowerFlow system.

There are two ways to upload a step to the PowerFlow system:

- At the command line with the iscli utility
- With the API

Uploading a Step with iscli

The PowerFlow system includes a command line tool called ***iscli***. When you install PowerFlow, ***iscli*** is automatically installed.

To upload a step to the PowerFlow using iscli:

1. Either go to the console of the PowerFlow system or use SSH to access the server.
2. Log in as ***isadmin*** with the appropriate password.
3. Enter the following at the command line:

```
iscli -u -s -f path_and_name_of_step_file.py -H hostname_or_IP_address_of_
powerflow_system -P port_number_of_http_on_powerflow_system -u user_name -p
password
```

where:

- *name_of_step_file* is the full pathname for the step.
- *hostname_or_IP_address_of_powerflow_system* is the hostname or IP address of the PowerFlow system.
- *port_number_of_http_on_powerflow_system* is the port number to access the PowerFlow system. The default value is 443.
- *user_name* is the user name you use to log in to the PowerFlow system.
- *password* is password you use to log in to the PowerFlow system.

Uploading a Step with the API

The PowerFlow system includes an API. When you install the PowerFlow system, the API is available.

To upload a step with the API ***POST /steps***:

```
POST /steps
  {
    "name": "name_of_step",
    "data": "string"
  }
```

where:

- *data* is all the information included in the step.

Validating Your Step

After uploading a step, you can use the API ***POST /steps run*** to run the step individually without running an application. This allows you to validate that the step works as designed.

To run a step from the IS API:

```
POST /steps/run
  {
    "name": "name_of_step",
    all other data from the .json file for the step
  }
```

After the POST request is made, the PowerFlow system will dispatch the step to a remote worker process for execution. By default, the POST request will wait five seconds for the step to complete. To override the default wait period, you can specify wait time as a parameter in the POST request. For example, to specify that the wait time should be 10 seconds :

```
POST /steps/run?wait=10
  {
    "name": "example_step",
  }
```

If the step completes within the wait time, the PowerFlow system returns a 200 return code, logs, output, and the result of the step.

If the step does not complete within the wait time, the PowerFlow system returns a task ID. You can use this task ID to view the logs for the step.

The API returns one of the following codes:

- 200. Step executed and completed within the timeout period.
- 202. Step executed but did not complete with timeout period or user did not specify wait. Returned data includes task to query for the status of the step
- 400. Required parameter for the step is missing.
- 404. Step not found.
- 500. Internal error. Database connection might be lost.

Viewing Logs

After running a step, you can view the log information for a step. Log information for a step is saved for the duration of the ***result_expires*** setting in the PowerFlow system. The ***result_expires*** setting is defined in the file opt/iservices/scripts/docker-compose.yml. The default value for log expiration is 24 hours.

NOTE: To view the log information for a step before running an integration, you can use the API *POST /steps run* to run the step individually without running an application. You can then use the information in step 3-6 below to view step logs.

To view the log information for a step:

1. Run a PowerFlow application.
2. Using an API tool like Postman or cURL, use the API *GET /applications/{appName}/logs*:

   ```
   GET URL_for_your_PowerFlow_system/api/v1/applications/integration_application_name/logs
   ```

   where:

   - *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.

3. You should see something like this:


```
{
  "app_name": "example_integration",
  "app_vars": {},
"href": "/api/v1/tasks/isapp-af7d3824-c147-4d44-b72a-72d9eae2ce9f",
  "id": "isapp-af7d3824-c147-4d44-b72a-72d9eae2ce9f",
  "start_time": 1527429570,
  "state": "SUCCESS",
  "steps": [
    {
      "href": "/api/v1/tasks/2df5e7d5-c680-4d9d-860c-e1ceccd1b189",
      "id": "2df5e7d5-c680-4d9d-860c-e1ceccd1b189",
      "name": "First EM7 Query",
      "state": "SUCCESS",
      "traceback": null
    },
    {
      "href": "/api/v1/tasks/49e1212b-b512-4fa7-b099-ea6b27acf128",
      "id": "49e1212b-b512-4fa7-b099-ea6b27acf128",
      "name": "second EM7 Query",
      "state": "SUCCESS",
      "traceback": null
    }
  ],
  "triggered_by": [
    {
      "application_id": "isapp-af7d3824-c147-4d44-b72a-72d9eae2ce9f",
      "triggered_by": "USER"
    }
  ]
}
```


4. In the `"steps"` section, notice the lines that start with ***href*** and **id**. You can use these lines to view the logs for the application and the steps.

5. To use the **href** value to get details about a step, use an API tool like Postman or cURL and then use the API *GET /steps{step_name}*:

   ```
   GET URL_for_your_PowerFlow_system/href_value
   ```

   where:

   - *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.
   - *href_value* is the href value you can copy from the log file for the application. The href value is another version of the step name.

   > **NOTE:** To view logs for subsequent runs of the application, you can include the href specified in the ***last_run*** field.

6. To use the task **id** value to views details about a step, use an API tool like Postman or cURL and then use the API *GET /tasks/{task_ID}*:

   ```
   GET URL_for_your_PowerFlow _system/task_id
   ```

   where:

   - *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.
   - *task_id* is the ID value you can copy from the log file for the application. The task ID specifies the latest execution of the step.

> **NOTE:** After you find the href and task ID for a step, you can use those values to retrieve the most recent logs and status of the step.

Chapter 3

Creating an SL1 PowerFlow Application

Overview

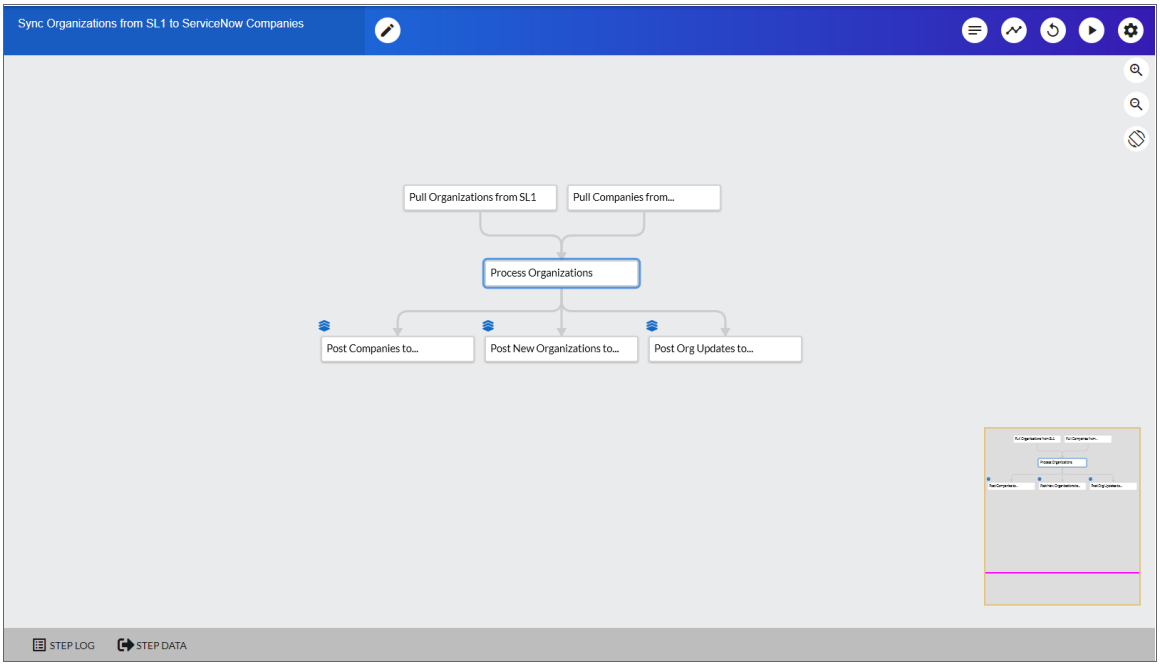
This chapter explains how to create your own application that can run on a PowerFlow system.

This chapter covers the following topics:

What is a PowerFlow Application?

In PowerFlow, an ***application*** is a JSON file that specifies which steps to execute and the order in which to execute those steps. An application also defines variables and provides arguments for each step.

The following is an example of a PowerFlow application:



PowerFlow application JSON objects are defined by configuration settings, steps that make up the application, and application-wide variables used as parameters for each step. The parameters of each step can be configured dynamically, and each step can be named uniquely while still sharing the same underlying class, allowing for maximum re-use of code.

Applications can be executed through the REST API and are processed as an asynchronous task in PowerFlow. During processing the user is provided a unique task ID for the application and each of its tasks. Using the task IDs, the user can poll for the status of the application and the status of each individual running step in the application.

Executing an application from the REST API allows the user to dynamically set one-time parameter values for the variables defined in the application.

The required parameters of applications are strictly enforced, and PowerFlow will refuse to execute the application if all required variables are not provided.

Default PowerFlow Application

The PowerFlow system includes a pre-defined application called ***integration_template***. This default application appears in the PowerFlow user interface as the ***Template App*** application.

To view this application:

1. Using an API tool like Postman or cURL, use the API *GET /applications/{application_name}*:

   ```
   GET URL_for_your_PowerFlow_system/api/v1/applications/integration_template
   ```

   where:

   - *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.

Requirements

To create a PowerFlow application, you must perform these tasks:

1. Download or copy the application template, called ***integration_template***.
2. Define the required fields for the application.
3. Create the list of steps and step parameters.
4. Define application variables.
5. Upload the application to PowerFlow.
6. Validate and test the application steps.

Creating an Application from the Application Template

The easiest way to create a new application is to use the application template that is included with the PowerFlow system. To copy this template to your desktop:

1. Using an API tool like Postman or cURL, use the API *GET /applications/{application_name }*:

   ```
   GET URL_for_your_PowerFlow_system/api/v1/applications/integration_template
   ```

   where:

   - *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.

2. Select and copy all the text in the application.
3. Open a source-code editor and paste the application in the source-code editor.
4. Save the new file as *newfilename*.json

   where:

   - *newfilename*.***json*** is the new name of the application includes the .json suffix. The file name must be unique within your PowerFlow system and cannot contain spaces.

Defining Required Fields for the Application

Each application should include the following key:value pairs

```
"author": "name of the author",
"configuration": "if this application uses configuration variables, specify the name
of the configuration",
"description": "description of the application",
"friendly_name": "name that appears in the user interface",
"name": "file name without the py suffix".
"version": "version number",
```

The integration_template includes these required fields. You can edit the value for each key. To do so:

1. Using an API tool like Postman or cURL, use the API ***GET /applications/{application_name}***:

   ```
   GET URL_for_your_PowerFlow_system/api/v1/applications/application_name
   ```

   where:

   - *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.
   - *application_name* is the application you want to edit.

2. Copy the contents of the application to a source-code editor.
3. Search for the section of the file that contains the text "description".
4. Supply new values for the following keys:

   - ***author***. User who created the application template.
   - ***configuration*** (if applicable). Configuration variables are defined in a stand-alone file (called a configuration object) that lives on the PowerFlow system and can be accessed by all PowerFlow applications and their steps. If your application or the steps in the application reference configuration variables, you must specify the name of the configuration object in this value. For more details on creating a configuration, see the section on ***Defining a Configuration Object***.
   - ***description***. This description will be displayed in the PowerFlow user interface when viewing the available applications.
   - ***friendly_name***. The name of the application as it will appear in the user interface.

- ***name***. Name of the file, without the .py suffix.
- ***Version***. Version number of the application.

5. Save your changes. Save the file to the same name (*application_name*.json.)
6. To upload the application to the PowerFlow system, see the section on *Uploading an Application*.

Creating the List of Steps and Step Parameters

In the PowerFlow application, you must specify the steps to execute and the order in which they should be executed.

If steps do not have dependencies, the PowerFlow system will execute steps in parallel. If steps have dependencies (meaning one of the steps requires data from another step), the PowerFlow system will execute the step that provides data and then execute the step that consumes that data.

To edit the steps section of the application:

1. Using an API tool like Postman or cURL, use the API *GET /applications/{application_name}*:

   ```
   GET URL_for_your_PowerFlow_system/api/v1/applications/application_name
   ```

   where:

   - *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.
   - *application_name* is the application you want to edit.

2. Copy the contents of the application to a source-code editor.
3. Search for the section of the file that contains the text "steps".
4. The section of the application that specifies steps should look like this:

   ```
   "steps":[
     {
       "name": "GETgoogle.com",
       "file": "QueryREST",
       "prefix_url": "http://google.com",
       "method": "GET",
       "output_to": ["next_step"]
     },
     {
       "name": "next_step",
       "file": "someOtherTask"
     }
   ]
   ```

5. Edit the "steps" section as needed and save your changes. Be sure to your file as a .JSON file with the same name as the application your downloaded.
6. To upload the application to the PowerFlow system, see the section on *Uploading an Application*.

Specifying Values for name and file

For each step, you must specify its name and the file it executes. These two keys can have the same value.

- ***name***. The name for the step. Other steps in the application can use this name to refer to the step. This value can include spaces. This name must be unique to the application.
- ***file***. The name of the file that will be executed by the step. You could write step logic in a single file but use that step logic with different applications and use different names for the step in each application.

Specifying the Parameters

When you add a step to an application, you must view the step and determine if it includes any required parameters.

To view details about a step (in our example, the step file is named QueryREST):

1. Using an API tool like Postman or cURL, use the API *GET /steps/{step_name}*:

   ```
   GET URL_for_your_PowerFlow_system/api/v1/steps/QueryREST
   ```

where:

- *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.

2. The step GETgoogle.com (and its parent file, QueryREST) includes the following parameters that are defined as "required":

   ```
   self.new_step_parameter(name=METHOD, sample_value="GET", description="HTTP method
   to perform", required=True)

   self.new_step_parameter(name=PREFIX_URL, description="used with relative_url to
   create the full URL.",sample_value="http://10.2.11.253", default_value=None,
   required=True)
   ```

3. Therefore, when the application includes the step GETgoogle.com, the application must supply values for the required parameters.

   ```
   "method": "GET",
   "prefix_url": "http://google.com",
   ```

Transferring Data Between Steps

An essential part of integrations is passing data between tasks. The PowerFlow system includes native support for saving and transferring Python objects between steps. Within a step, you can use one of the functions in the included in the ipaascore.BaseStep class.

In a PowerFlow application, you can use the ***ouput_to*** key to specify that the results of a step should be piped to one or more specified steps. The output_to key uses the following syntax:

```
"output_to": ["step_name1", "step name2"]
```

To pass data from step to step, you must include the output_to key along with the parameters for a step.

To edit the step parameters in the application:

1. Using an API tool like Postman or cURL, use the API *GET /applications/{application_name}*:

   ```
   GET URL_for_your_PowerFlow_system/api/v1/applications/application_name
   ```

   where:

   - *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.
   - *application_name* is the application you want to edit.

2. Copy the contents of the application to a source-code editor.
3. If you wanted the step "GETgoogle.com" to pass its output to the step "next-step",the application would include the following :

```
"steps":[
  {
    "name": "GETgoogle.com",
    "file": "QueryREST",
    "prefix_url": "http://google.com",
    "method": "GET",
    "output_to": ["next_step"]
  },
  {
    "name": "next_step",
    "file": "someOtherTask"
  }
]
```

> **NOTE:** If steps have dependencies , the PowerFlow system will first analyze all steps in an application and ensure that data-gathering steps are performed before steps that require that data.

4. Edit the "steps" section as needed and save your changes. Be sure to your file as a .JSON file with the same name as the application your downloaded.
5. To upload the application to the PowerFlow system, see the section on *Uploading an Application*.

Defining Retry Options for a Step

The following parameters allows you to define multiple retry options for a step. You can specify that the PowerFlow system try to re-run a step if that step fails. Retries work following the rules of exponential backoff: the first retry will have a delay of 1 second, the second retry will have a delay of 2 seconds, the third retry will delay 4 seconds, the fourth retry will delay 8 seconds, and so on. You can edit the ***retry_max*** and ***retry_backoff_max*** values, below to further refine the retry settings.

You can include the following retry options in the PowerFlow application file, where you define parameters for each step:

- ***retry_max*** . The maximum number of times the PowerFlow system will retry to execute the step before it stops retrying and logs a step failure. For example, if ***retry_max*** is *3*, PowerFlow will retry after 1 second, then 2 seconds, then 4 seconds, and stop if the last retry fails. Possible values are:
    - Integer that specifies number of retries.
    - The default value is "0" (zero).
- ***retry_backoff***. Instead of using a defined interval between retries, the PowerFlow system will incrementally increase the interval between retries. Possible values are:
    - True
    - False
    - The default value is "False".
- ***retry_jitter***. Instead of using a defined interval between retries, the PowerFlow system will retry the step execution at random intervals. Possible values are:
    - True
    - False
    - The default value is "False".
- ***retry_backoff_max***. The maximum time interval for the ***retry_backoff*** option, in seconds. For example, This means, if you have *retry_max* set to 15, the delays will be 1, 2, 4, 8, 16, 32, 64, 120, 240, 480, 600, 600, 600, 600, and 600. Possible values are:
    - Integer that specifies number of seconds
    - The default value is "600"
- ***retry_countdown***. The interval between retries, in seconds. If you enabled ***retry_backup***, the PowerFlow system will incrementally increase this interval:
    - Integer that specifies number of seconds
    - The default value is "180"

To define the retry options for a step in the application file:

1. Using an API tool like Postman or cURL, use the API GET **/applications/{application_name}**:

    ```
    GET URL_for_your_PowerFlow_system/api/v1/applications/application_name
    ```

    where:

    - *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.
    - *application_name* is the application you want to edit.

2. Copy the contents of the application to a source-code editor.
3. If you wanted to add retry options to the step "GETgoogle.com", you could include the following:

```
"steps":[
  {
    "name": "GETgoogle.com",
    "file": "QueryREST",
    "prefix_url": "http://google.com",
    "method": "GET",
    "retry_max": 5
    "retry_backoff": True
    "retry_backoff_max": 600
    "retry_countdown": 120
    "output_to": ["next_step"]
  },
  {
    "name": "next_step",
    "file": "someOtherTask"
  }
]
```

4. Edit the "steps" section as needed and save your changes. Be sure to your file as a .JSON file with the same name as the application your downloaded.

Defining Variables for an Application

Application variables are defined in the PowerFlow application. These variables can be accessed only by steps in the application. In a step, including the **appvar.** prefix in a variable tells the PowerFlow system to look in the application to resolve the variable. In a step, application variables are used in step parameters.

To define an application variable:

1. Using an API tool like Postman or cURL, use the API *GET /applications/{application_name}*:

   ```
   GET URL_for_your_PowerFlow_system/api/v1/applications/application_name
   ```

   where:

   - *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.
   - *application_name* is the application you want to edit.

2. Copy the contents of the application to a source-code editor.
3. Search for the section of the file that contains the text "app_variables".
4. In the integration_template file, the section looks like this:

   ```
   "app_variables": [
     {
       "name": "exampleVariable", "value": "exampleValue","description": "Variables
       defined here will be available in all steps of an application","required":
       true,"sample_value": "SampleValue", "default_value": "DefaultValue"
     }
   ],
   ```

5. You can copy and paste the example section above for each application variable you want to define.
6. For each application variable, supply values for the following keys:

    - ***name***. This key requires a value. The name of the variable.
    - ***value***. This key requires a value. This is the value that the variable will resolve to at runtime.
    - ***description***. A description of this variable. This description appears in the user interface. The default value is null.
    - ***required***. Specifies whether the variable is required. Possible values are "True" or "False". The default value is "False". If the variable is required, but a value is not specified and a default value is not specified, the application will fail.
    - ***sample_value***. A sample value of the required data type or schema. The default value is null. For example, if the parameter is "port" and the expected value is an integer, a good ***sample_value*** would be "443".
    - ***default_value***. If no value is specified for this variable (in the ***value*** key), use the value of this key. The default value of this key is null.

7. Edit the "app_variables" section as needed and save your changes. Be sure to your file as a .JSON file with the same name as the application your downloaded.
8. To upload the application to PowerFlow system, see the section on *Uploading an Application*.

Uploading the Application to PowerFlow

When you create a new application or edit an existing application, you must upload the application to the PowerFlow system. There are two ways to upload an application to the PowerFlow system:

- at the command line with the iscli tool
- with the API

Uploading an Application with iscli

The PowerFlow system includes a command-line utility called ***iscli***. When you install PowerFlow system, ***iscli*** is automatically installed.

To upload an application to the PowerFlow system using iscli:

1. Either go to the console of the PowerFlow system or use SSH to access the server.
2. Log in as ***isadmin*** with the appropriate password.
3. Enter the following at the command line:

```
iscli -u -a -f path_and_name_of_application_file.py -H hostname_or_IP_address_of_
PowerFlow_system -P port_number_of_http_on_PowerFlow_system -U user_name -p
password
```

where:

- *name_of_application_file* is the full pathname for the application.
- *hostname_or_IP_address_of_PowerFlow_system* is the hostname or IP address of the PowerFlow system.
- *port_number_of_http_on_PowerFlow_system* is the port number to access the PowerFlow system. The default value is 443.
- *user_name* is the user name you use to log in to the PowerFlow system.
- *password* is password you use to log in to the PowerFlow system.

Uploading an Application with the API

The PowerFlow system includes an API. When you install the PowerFlow system, the API is available.

To upload an application with the IS API:

```
POST /applications
  {
    "name": "name_of_application",
    contents of the .json file for the application
  }
```

The API returns one of the following:

- 200. Application successfully updated or added.
- 400. Name or data parameter is missing.
- 500. Internal error. Database connection might be lost.

Running the Application

After uploading an application to PowerFlow, you can run it to ensure that it works as designed.

To run an application from the API:

1. Using an API tool like Postman or cURL, use the API *POST/applications/{application_name}/run*:

   ```
   POST https"//URL_for_your_PowerFlow_system/api/v1/applications/run
   ```

   where:

   - *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.
   - *application_name* is the application you want to edit.

2. The body of the post should contain:

   ```
   {
     "name": "name_of_application",
     "params": {}
   }
   ```

3. You can include the following parameters with the POST request:

    - parameters use the syntax:

      ```
      "parameter name":"parameter value"
      ```

    - ***wait***. Number of seconds to wait for application to complete.
    - ***configuration***. The configuration file to use with the application. For details, see the section on *configurations*.

4. The API returns one of the following:

    - 200. Application started successfully.
    - 400. Name or data parameter is missing.
    - 404. Application not found.
    - 500. Internal error. Database connection might be lost.

Running the Application with a Custom Queue

If your PowerFlow system runs multiple applications, you might want to ensure that one of those applications runs before other applications in the processing queues. To do this, you can align a queue with a worker process; the worker process will be dedicated to only that queue, will listen only to that queue, and process only jobs from that queue. You can then configure the high-priority application to use the queue that you aligned with its own worker process.

There are two steps to using a custom queue:

- Defining the queue and aligning it with a worker
- Configuring the application to use the custom queue

Defining a Custom Queue

To create a custom queue:

1. SSH to the PowerFlow system.
2. Use a text editor like vi to edit the file **/opt/iservices/scripts/docker-compose.yml**.
3. The docker-compose.yml file contains definitions for worker processes. For example, you might see something like this:

```
services:
  steprunner:
    image: sciencelogic/is-worker:latest
    environment:
    LOGLEVEL: 10
    celery_log_level: 10
    logdir: /var/log/iservices
    broker_url: 'pyamqp://guest@rabbit//'
    result_backend: 'redis://redis:6379/0'
    db_host: 'couchbase,localhost'
```

```
    secrets:
      - is_pass
      - encryption_key
    deploy:
    replicas: 2
    networks:
      - isnet
    depends_on:
      - redis
      - rabbitmq
      - couchbase
    volumes:
      - "/var/log/iservices:/var/log/iservices"
      - "statedb:/var/run/celery/states/"

  steprunner_1:
    image: sciencelogic/is-worker:latest
    environment:
    LOGLEVEL: 10
    celery_log_level: 10
    logdir: /var/log/iservices
    broker_url: 'pyamqp://guest@rabbit//'
    result_backend: 'redis://redis:6379/0'
    db_host: 'couchbase,localhost'
    user_queues: 'test_queue'
    secrets:
      - is_pass
      - encryption_key
    deploy:
    replicas: 2
    networks:
      - isnet
    depends_on:
      - redis
      - rabbitmq
      - couchbase
    volumes:
      - "/var/log/iservices:/var/log/iservices"
      - "statedb:/var/run/celery/states/"

  steprunner_2:
    image: sciencelogic/is-worker:latest
    environment:
    LOGLEVEL: 10
    celery_log_level: 10
    logdir: /var/log/iservices
    broker_url: 'pyamqp://guest@rabbit//'
    result_backend: 'redis://redis:6379/0'
    db_host: 'couchbase,localhost'
    user_queues: 'critical_queue'
    secrets:
      - is_pass
      - encryption_key
    deploy:
    replicas: 2
    networks:
      - isnet
    depends_on:
      - redis
      - rabbitmq
      - couchbase
```

```
volumes:
  - "/var/log/iservices:/var/log/iservices"
  - "statedb:/var/run/celery/states/"
```

4. The services with names that start with "steprunner" are the workers for the PowerFlow system.

   - Notice that the service named "steprunner" does not include any queues. This means that the worker "steprunner" listens to the default queues in the PowerFlow system.

     NOTE: ScienceLogic recommends that you allot at least one worker to handle the default queues.

   - To add additional services to your PowerFlow system. copy all the lines included in the service definition, paste it into the file, and rename the service.
   - For example, you could copy all the lines from "steprunner_2", paste the text in the "services" section, and rename the service "steprunner_3".

5. To create one or more queues and dedicate a worker to them, enter the following line in definition of the worker, under the ***environment*** section:

   ```
   user_queues: 'queue_name1, queue_name2'
   ```

   where:

   - *queue_name1, queue_name2*. The name of the new queues. The worker will monitor only these queues and execute tasks only from these queues.

6. After you have updated the docker-compose file, you can update and re-deploy the PowerFlow system to pick up the changes to the docker-compose.yml file. To do this, SSH to the PowerFlow system and execute the following command:

   ```
   docker stack deploy -c /opt/iservices/scripts/docker-compose.yml is4
   ```

Configuring an Application to Use a Custom Queue

There are two ways to specify that an application should use a custom queue:

- In the .JSON file for an application , you can specify that the application should always use a custom queue.
- At run time, you can specify that an application should use a custom queue only for that single execution of the application.

Configuring an Application to Always Use a Custom Queue

To specify that an application always uses a custom queue, edit the .JSONfile for the application. To do this:

1. Using an API tool like Postman or cURL, use the API *GET /applications/{application_name}*.

   ```
   GET URL_for_your_PowerFlow_system/api/v1/applications/application_name
   ```

where:

- *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.
- *application_name* is the application you want to edit.

2. Copy the contents of the application to a source-code editor.
3. Search for the section of the file that contains the lines "author", "configuration", "description", "friendly_name", and "name".
4. In that section of the file, added the bolded line:

```
"queue": "name_of_queue",
```

where:

- *name_of_queue* is one of the custom queues you defined in the docker-compose.yml file.

5. For example:

```
"author": "ScienceLogic, Inc.",
"configuration": "",
"description": "Read SL1 and ServiceNow devices and write them to a cache.",
"friendly_name": "Cache SL1 Devices using GraphQL",
"name": "cache_em7_device_data",
"generate_report": true,
"queue": "test_queue",
```

6. Save your changes. Save the file to the same name (*application_name*.json.)
7. The application will now always use the specified queue.
8. To upload your changes to the PowerFlow system, see the section on ***Uploading an application***.

Configuring an Application to Use a Custom Queue at Run Time

After uploading an application, you can run it and specify a queue. To run an application from the IS API:

1. Using an API tool like Postman or cURL, use the API *POST/applications/{application_name}/run*:

   ```
   POST https://URL_for_your_PowerFlow_system/api/v1/applications/run
   ```

   where:

   - *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.
   - *application_name* is the application you want to edit.

2. The body of the post should contain:

   ```
   {
     "name": "name_of_application",
     "params": {
     "queue": "custom_queue"
     }
   }
   ```

3. You can include the following parameter with the POST request:

   ```
   "queue": "name_of_queue"
   ```

   where:

   - *name_of_queue* is one of the custom queues you defined in the docker-compose.yml file.

4. The API returns one of the following:

   - 200. Application started successfully.
   - 400. Name or data parameter is missing.
   - 404. Application not found.
   - 500. Internal error. Database connection might be lost.

Defining a Configuration Object

Configuration variables are defined in a stand-alone JSON file called a configuration that lives on the PowerFlow system and can be accessed by all applications and their steps.

In a step, including the **config.** prefix with a variable tells the PowerFlow system to look in a configuration file to resolve the variable.

If you want to re-use the same settings (like hostname and credentials) between applications, define configuration variables.

To define a configuration file:

1. Use a source-code editor to open a new file.
2. Copy and paste the following example text into the new file:

```
{
  "author": "ScienceLogic, Inc.",
  "description": "Fsun's config for demo.",
  "name": "fsun-demo-settings",
  "friendly_name": "Demo Settings",
  "configuration_data": [
    {
      "encrypted": false,
      "name": "em7_host",
      "value": "10.2.11.42"
    },
    {
      "encrypted": false,
      "name": "em7_user",
      "value": "em7admin"
    },
    {
      "encrypted": true,
      "name": "em7_password",
      "value": "+dqGJe1NwTyvdaO2EizTWjJ2uj2C1wzBzgNqVhpdTHA="
    },
  ],
  }
```

3. To create your own configuration file, edit the following keys:
   - ***author***. Name of the author of the configuration file. This field is optional.
   - ***description***. Description of the configuration file. This field is optional.
   - ***name***. Name of the configuration file. The name cannot contain any spaces and should be unique in your PowerFlow system.
   - ***friendly_name***. User-friendly name for the configuration.
4. The section under "configuration_data" defines each configuration variable. You can use these variables as examples.
5. To create your own configuration variables, note the syntax:
   - The variable definition is surrounded by curly braces
   - Each key:value pair in the definition is separated with a comma.

6. To create your own configuration variable, define the following keys:

    - ***encrypted***. Specifies whether the value will appear in plain text or encrypted in this .json file. If set to "true", specifies that when the value is uploaded, the PowerFlow system will encrypt value of the variable. The plain text value will never again be retrievable by an end user. The encryption key is unique to each PowerFlow system.
    - ***name***. Name of the configuration file (without the .json suffix). This value appears in the user interface.
    - ***value***. The value to assign to the variable.
7. Repeat steps 5-6 for each configuration variable.
8. Save the new file as *config_file*.json

    where:

    - *config_file****.json*** is the name of the configuration file. This value must match the ***name*** key in the file. The file name must be unique within your PowerFlow system and cannot contains spaces.

Uploading the Configuration File to PowerFlow

When you create a new configuration file or edit an existing configuration object, you must upload the step to the PowerFlow system. There are two ways to upload a configuration object file to the PowerFlow system:

- at the command line with the iscli tool
- with the API

Uploading a Configuration with iscli

The PowerFlow system includes a command line tool called ***iscli***. When you install PowerFlow system, ***iscli*** is automatically installed.

To upload a configuration file to the PowerFlow system using iscli:

1. Either go to the console of the PowerFlow system or use SSH to access the server.
2. Log in as ***isadmin*** with the appropriate password.

3. Type the following at the command line:

```
iscli -u -c -f path_and_name_of_configuration__file.py -H hostname_or_IP_address_
of_PowerFlow_system -P port_number_of_http_on_PowerFlow_system -U user_name -p
password
```

where:

- *path_and_name_of_configuration__file* is the full pathname for the step.
- *hostname_or_IP_address_of_PowerFlow_system* is the hostname or IP address of the PowerFlow system.
- *port_number_of_http_on_PowerFlow_system* is the port number to access the PowerFlow system. The default value is 443.
- *user_name* is the user name you use to log in to the PowerFlow system.
- *password* is password you use to log in to the PowerFlow system.

Uploading a Configuration with the API

The PowerFlow system includes an ***API***. When you install the PowerFlow system, the API is available.

To upload a configuration with the API:

```
POST /configurations
  {
    contents of the .json file for the configuration
  }
```

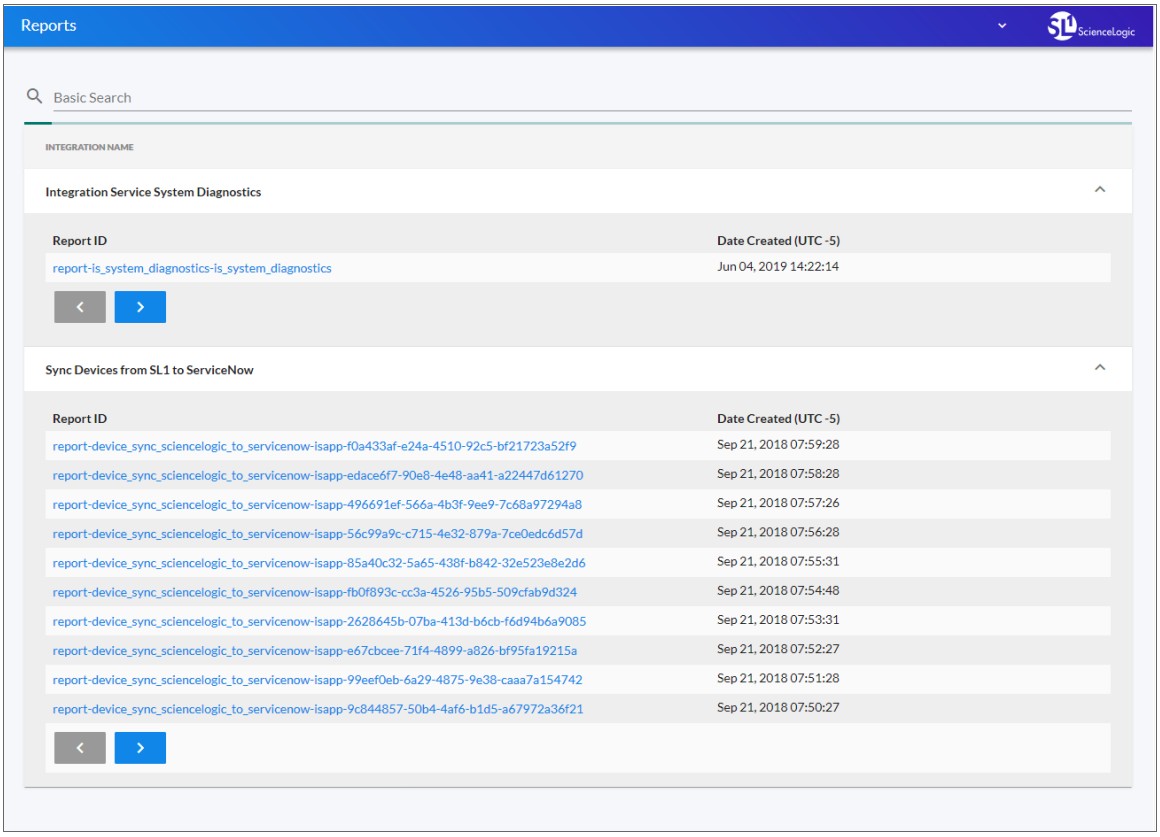
The API returns one of the following:

- 200. Configuration successfully updated or added.
- 400. Name or data parameter is missing.
- 500. Internal error. Database connection might be lost.

Viewing a Report for a PowerFlow Application

In the PowerFlow user interface, the **Reports** page ( ) contains a list of reports associated with applications. If an application has the reporting feature enabled and the application supports reports, then PowerFlow will generate a report each time you run the application.

An individual report displays data only from the most recent run of the application; a report is not an aggregation of all previous runs.



You can search for a specific report by typing the name of that report in the ***Search*** field at the top of the **Reports** page. The user interface filters the list as you type.

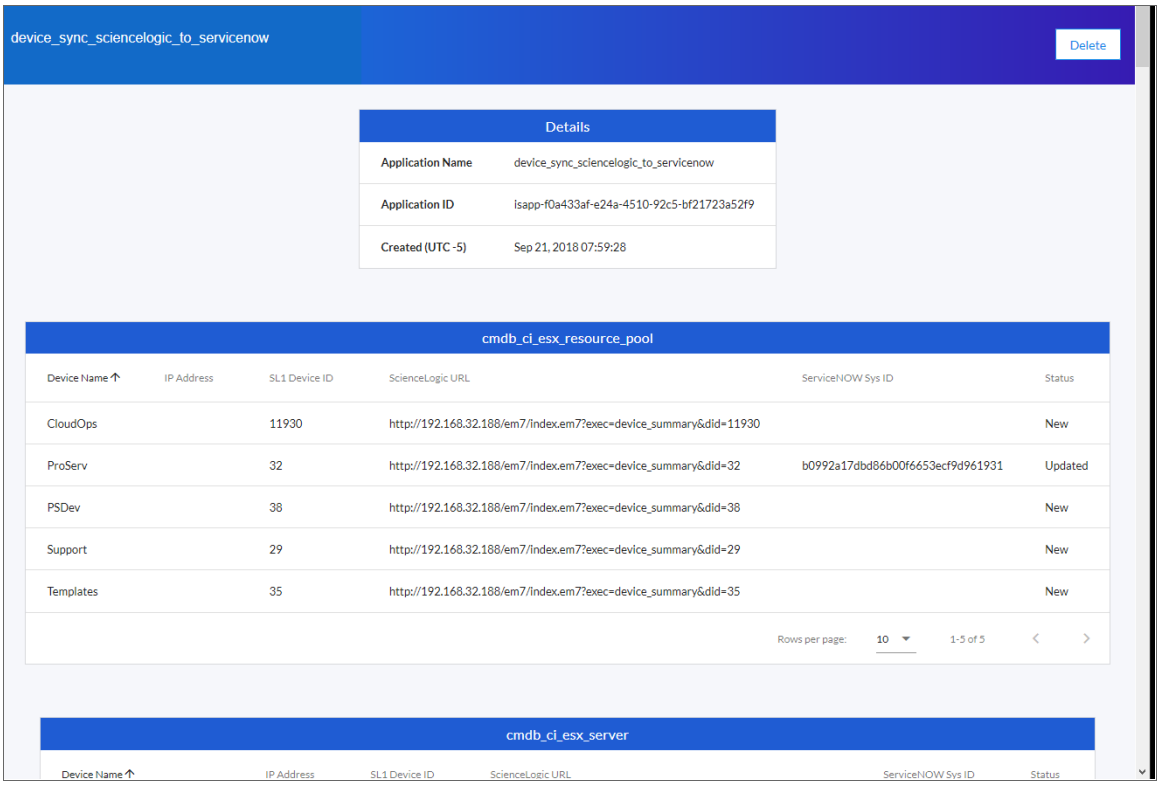
NOTE: Not all applications generate reports. Currently, only the "PowerFlow System Diagnostics" applications support the generation of reports.

To view details for an application report:

1. On the **Reports** page ( ), click the name of the application to expand the list of reports for that application.

> **TIP:** Click the arrow buttons to scroll forward and back through the list of reports.

2. Click a report name in the **Report ID** column. The **Report Details** page appears:



> **TIP:** The ***Status*** field in a report displays the current state of the synced item, which can include *New*, *Removed*, *Updated*, or *Unchanged*.

3. To view the detail page for the application on the **Applications** page, click the **Application Name** link.

> **TIP:** From the detail page for the application, click **[Reports]** ( ) to return to the **Reports** page.

4. To delete a report, open the report and click **[Delete]**. Click **[OK]** to delete the report.

Viewing Logs for an Application

After running an application, you can view its log information. To view the log information for an application:

1. In PowerFlow, run an application.
2. Using an API tool like Postman or cURL, use the API *GET /applications/{appName}/logs*:

   ```
   GET URL_for_your_PowerFlow_system/api/v1/applications/integration_application_
   name/logs
   ```

   where:

   - *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.

3. You should see something like this:


```
{
     "app_name": "example_integration",
     "app_vars": {},
     "href": "/api/v1/tasks/isapp-af7d3824-c147-4d44-b72a-72d9eae2ce9f",
     "id": "isapp-af7d3824-c147-4d44-b72a-72d9eae2ce9f",
     "start_time": 1527429570,
     "state": "SUCCESS",
     "steps": [
     {
       "href": "/api/v1/tasks/2df5e7d5-c680-4d9d-860c-e1ceccd1b189",
       "id": "2df5e7d5-c680-4d9d-860c-e1ceccd1b189",
       "name": "First EM7 Query",
       "state": "SUCCESS",
       "traceback": null
     },
     {
       "href": "/api/v1/tasks/49e1212b-b512-4fa7-b099-ea6b27acf128",
       "49e1212b-b512-4fa7-b099-ea6b27acf128",
       "name": "second EM7 Query",
       "state": "SUCCESS",
       "traceback": null
     }
   ],
   "triggered_by": [
     {
       "application_id": "isapp-af7d3824-c147-4d44-b72a-72d9eae2ce9f",
       "triggered_by": "USER"
     }
   ]
}
```


4. Notice the bolded lines that start with ***href*** and **id**. You can use these lines to view the logs for the application.
5. To use the **href** value to get details about an application, use an API tool like Postman or cURL and use the API *GET /applications/{appName}*:

   ```
   GET URL_for_your_PowerFlow_system/href_value
   ```

where:

- *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.
- *href_value* is the href value you can copy from the log file. The href value is another version of the application name.

> **NOTE:** To view logs for subsequent runs of the application, you can include the href specified in the ***last_run*** field.

6. To use the task **id** value to views details about an application, use an API tool like Postman or cURL and use the API ***GET /tasks/{task_ID}***:

```
GET URL_for_your_PowerFlow_system/task_id
```

where:

- *URL_for_your_PowerFlow_system* is the IP address or URL for the PowerFlow system.
- *task_id* is the id value you can copy from the log file for the application. The task ID specifies the latest execution of the application.

Working with Applications in the PowerFlow User Interface

You can log into the PowerFlow user interface to edit, configure, and run an application.

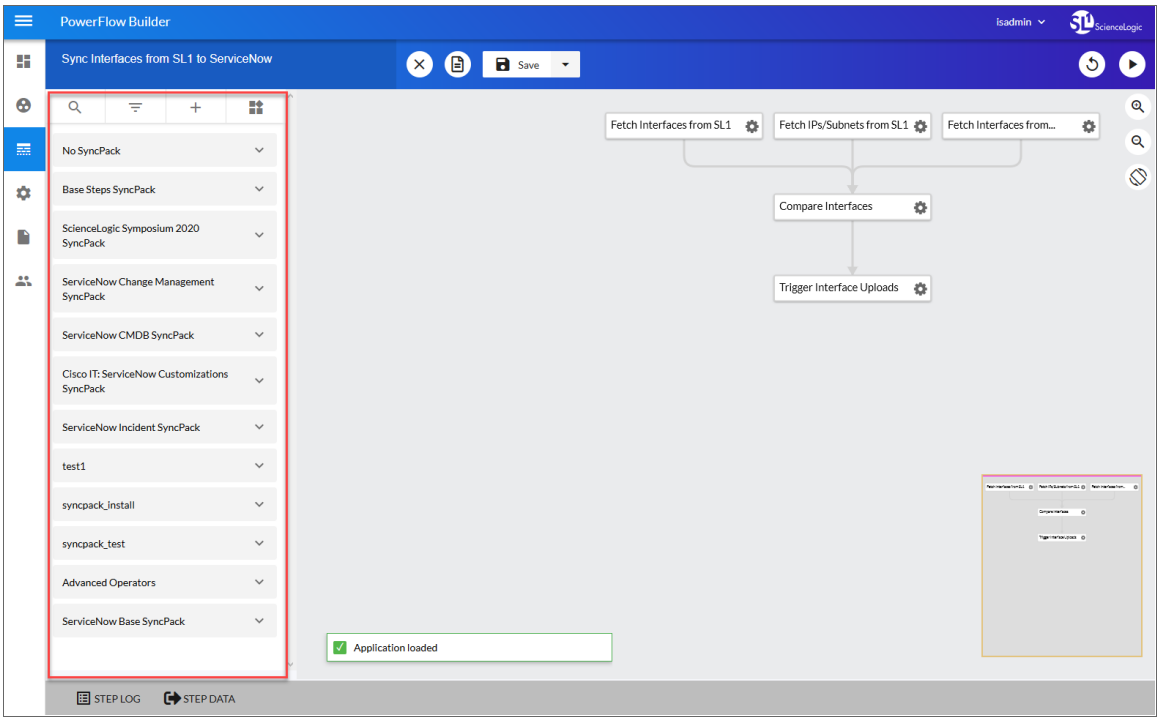
Editing an Application in the User Interface

On the **Applications** page in the PowerFlow user interface, you can edit an existing application and its steps. You can also add and remove steps from that application.

NOTE: You cannot overwrite applications where *ScienceLogic, Inc.* is listed as the Author, but you can edit a ScienceLogic application and save it with a different name.

To edit an application:

1. From the **Applications** page, select the application that you want to edit. The **PowerFlow Builder** page for that application appears.
2. Click the **[Open Editor]** button ( ). The **Steps Registry** pane appears with a list of all of the steps that are available for that application:



3. On the **Steps Registry** pane, you can search for a step or filter the list of steps to help you find the step you need:
   - Click the **[Search Steps]** tab ( ) to search the entire list of steps from the *Search Steps Registry* field.
   - Click the **[Group Steps]** tab ( ) to group the steps by Synchronization PowerPack, by a tag, or to show all of the steps in one list.

> **TIP:** Click the **[Actions]** button (•••) on a step in the **Steps Registry** pane to view more information about that step, including the step ID, the Synchronization PowerPack for that step, the version, and creator of the step. You can also click **[Edit Step Code]** to edit the code for that step.

4. To create a step, click **[Create a Step]** (+) on the **Steps Registry** pane, type a file name, and edit the step code for the new step.
5. Click the step or steps you want to add from the **Steps Registry** pane and drag them to the main viewing pane of the **PowerFlow Builder** page to add them to the application. Add any relevant information to the **Configuration** pane for that step, and click **[Save]** to close the **Configuration** pane.
6. To adjust the position of any step in the application, click the step you want to move and drag it to its new location.
7. To redirect the arrow between steps, click the arrow and drag it to reposition it.
8. To edit the configuration for a step, click the gear icon (⚙) on the step and update the fields as needed on the **Configuration** pane.

> **TIP:** You can also right-click the gear icon (⚙) on a step to edit the step (on the **Configuration** pane or to delete the step.

9. To remove a step, click the step to select it and press the **[Delete]** key on your keyboard.
10. To save the changes you made to the application, click **[Save]**. You can also click the *Save as* option to save the application with a new name.
11. To stop editing and close the **Search Steps Registry** panel, click the **[Close Editor]** button (⊗).

Configuring an Application in the PowerFlow User Interface

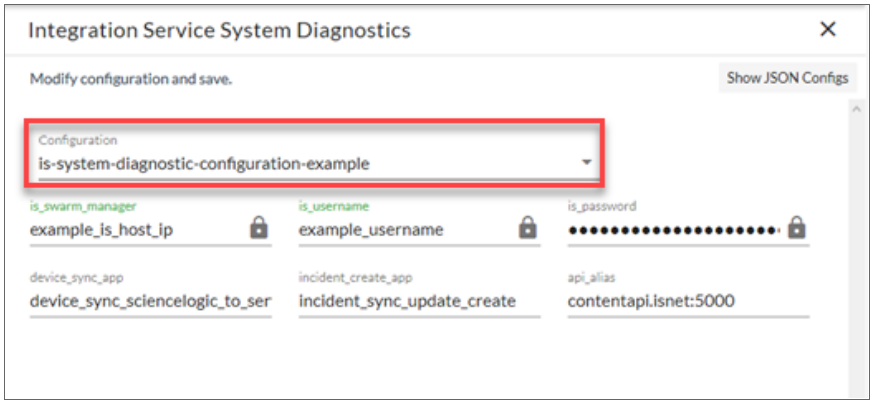
Before you can run a PowerFlow application, you must align the application with a configuration object from the **Configurations** page. A ***configuration object*** defines global variables, such as endpoints and credentials, that can be used by multiple steps and applications. Each variable in a configuration object is set up as a name and value pair. You can also encrypt a variable to protect sensitive data like a password.

You can "align" the configuration object you want to use with an application from the **Configuration** pane for that application.

To align a configuration object with an application:

1. From the **Applications** page (▦), select the application that you want to align with a configuration object. The **Application** page for that application appears.

2. Click **[Configure]** ( ). The **Configuration** pane opens on the right side of the **Application** page:



> **TIP:** To view a pop-up description of a field on the **Configuration** pane for an application, hover over the label name for that field.

3. Select a configuration from the ***Configuration*** drop-down to "align" to this application. This step is required for all applications.

> **TIP:** You can select *none* from the ***Configuration*** drop-down to clear or "un-align" the selected configuration object from an application. Also, if you did not select a configuration object when editing fields on the **Configuration** pane, the previously set configuration object will remain aligned (if there was a previously set configuration object).

4. Click **[Show JSON Configs]** to view the JSON configuration data for the configuration object. Click **[Hide JSON Editor]** again to view the fields instead.
5. As needed, edit the other configuration values for the application. Press **[Enter]** after editing an item to make sure your changes are saved.

> **NOTE:** To prevent potential issues with security and configuration, any fields that are encrypted and any configuration-specific fields containing a padlock icon ( ) on the **Configuration** pane cannot be edited.

6. Click **[Save]** and wait for the "App & Config modifications saved" pop-up message to appear. The **Configuration** pane automatically closes after this message appears.

Running or Stopping an Application in the PowerFlow User Interface

You can run an application directly from the **Applications** page (the list view) or from the **Application** page (the detail view). If you run the application from the **Application** page, you have the following additional options:

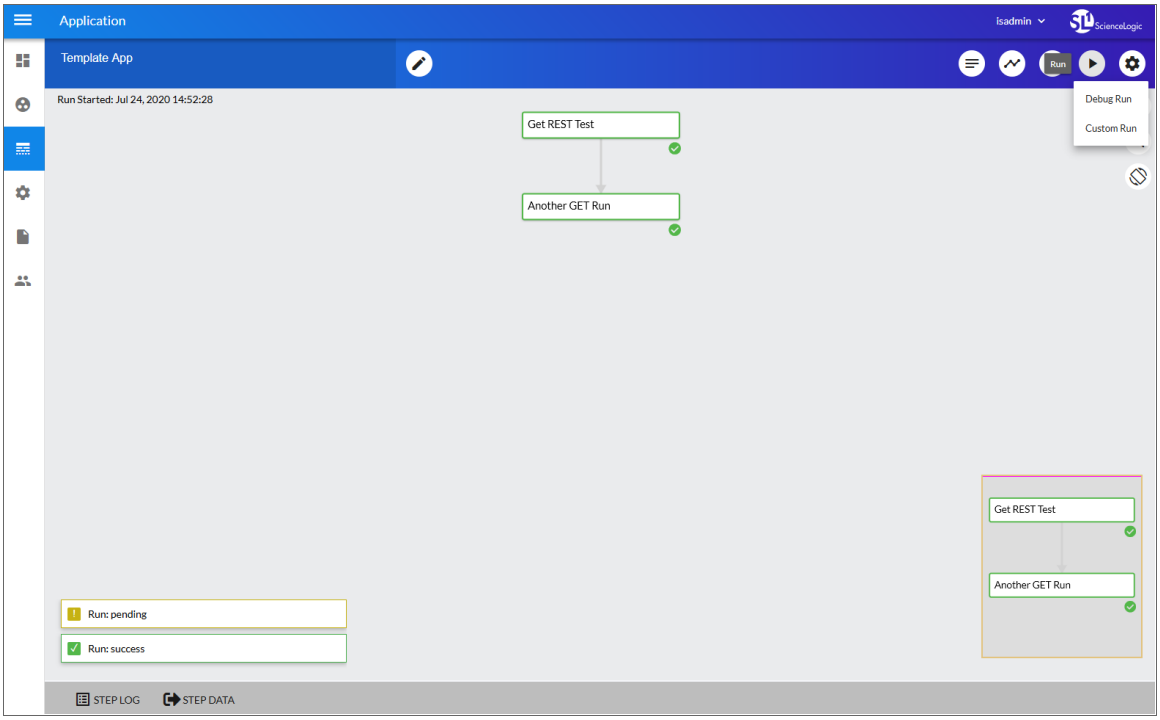
- ***Run***. Executes the application normally, with a log level of 1. This is the default, and it is the same as the *Run Now* option from the **Applications** page.
- ***Debug Run***. Executes the application in Debug Mode with a log level of 10.
- ***Custom Run***. Executes the application using a logging level that you specify (Error, Warning, Info, or Debug). You can also add any customer parameters that you might want to use to test specific features in the application.

To run an application:

1. From the **Applications** page (), click the **[Actions]** button ( ) for the application you want to run and select *Run Now*.

> **TIP:** You can also select an application from the **Applications** page and click **[Run]** () from the **Application** page. If you hover over the **[Run]** button, you can select *Debug Run* or *Custom Run*.

2. As the application runs, the color of the border around each step represents whether it is running, is successful, or has failed:



Step Color	Icon	State
Blue		Running

Step Color	Icon	State
Green		Successful
Red		Failed
Yellow		Warning

NOTE: Pop-up status messages also appear in the bottom left-hand corner of the **Application** page to update you on the progress of the application run.

3. If a step triggers a child application, a branch icon () appears in the upper right-hand corner of the step. Double-click the branch icon to open the child application. Click the branch icon once to display the triggered application's run ID as a link in a pop-up window. If no run ID is present, the branch icon displays "NONE".

Chapter 4

Creating a Synchronization PowerPack

Overview

This chapter describes how to package your PowerFlow applications, steps, configuration objects, and utilities into a Synchronization PowerPack.

> **NOTE:** The label "SyncPack" is used in place of "Synchronization PowerPack" in the PowerFlow user interface.

This chapter covers the following topics:

What is a Synchronization PowerPack?

A ***Synchronization PowerPack*** is a Python **.whl** file that contains PowerFlow applications, steps, configuration objects, and utilities that can be used in PowerFlow. Synchronization PowerPacks are versioned and can define dependencies on other Synchronization PowerPacks or on external Python packages.

When applications from a Synchronization PowerPack are executed, they run within a Python Virtual Environment that contains the Synchronization PowerPack itself and its dependencies.

Generating the Synchronization PowerPack Structure

ScienceLogic uses a ***Cookiecutter*** repository for generating the standard Synchronization PowerPack structure. This structure includes all necessary files and the default directory structure that is generated based on your response to the prompts.

For more information about Cookiecutter, see https://cookiecutter.readthedocs.io/en/latest/.

To use Cookiecutter to generate the Synchronization PowerPack structure:

1. On a system with Python 3.6 or later installed, run the following command:

```
pip install cookiecutter
cookiecutter https://github.com/ScienceLogic/is_syncpack_cookiecutter.git
```

2. Complete the following fields:

   - ***author***. Name of the person or organization that created this Synchronization PowerPack.
   - ***url_project***. URL of the repository where this Synchronization PowerPack is hosted.
   - ***syncpack_name***. Developer name of the Synchronization PowerPack, without spaces. For example: *test_syncpack*.
   - ***syncpack_friendly_name***. Friendly name of the Synchronization PowerPack, which will display in the PowerFlow user interface. For example: *Test Synchronization PowerPack*.
   - ***syncpack_description***. Short description of the Synchronization PowerPack, which will display in the PowerFlow user interface and in the **readme** file.
   - ***version***. Number of the Synchronization PowerPack version.
   - ***requires_minimum_is_version***. The minimum version of the PowerFlow platform required for this Synchronization PowerPack.

   After you complete this process, Cookiecutter creates a new directory in your current working directory named with the ***syncpack_name*** you specified.

Synchronization PowerPack Structure

After you use Cookiecutter to generate the Synchronization PowerPack structure, you can access the following files and folders in the folder created by the previous process.

- ***MANIFEST.in***. Allows the Python **.whl** file to contain non-Python files.
- ***README.md***. The **readme** file for this Synchronization PowerPack, which is pre-populated with basic information.
- ***docker***. This directory contains the following Docker information:
    - ***Dockerfile***. Sample Dockerfile that can be used for building and testing the Synchronization PowerPack in a CI/CD environment.
    - ***docker-compose.yml***. Docker Compose file that uses above container.
- ***setup.py***. Python setup file for building the Synchronization PowerPack. You should not need to modify this file.
- ***test_syncpack***. This directory contains all Synchronization PowerPack content, including the following:
- ***__init__.py***. Python init file.
- ***apps***. This directory contains Synchronization PowerPack application .JSON files.
- ***configs***. This directory contains Synchronization PowerPack configuration object .JSON files.
- **[meta.json]**. This file defines the *Synchronization PowerPack properties*.
- ***steps***. This directory contains Synchronization PowerPack Step Python files.
- ***util***. This directory contains Python classes or modules that can be used by multiple steps in the Synchronization PowerPack.
- ***tox.ini***. Basic tox configuration for running unit tests.

Synchronization PowerPack Properties

The **meta.json** file contains all configurable properties for a Synchronization PowerPack. This file is where you define the name, friendly name, version, description, default schedules, tags, and supported PowerFlow version of the Synchronization PowerPack.

`requires_dist` is where you define the Python packages on which this Synchronization PowerPack depends. For example, if you would like to use a step from the *Base Steps* Synchronization PowerPack and also use Amazon's boto library, you would use the following:

```
"requires_dist": ["boto", "base_steps_syncpack"],
```

The following code block contains an example of the **meta.json** file:

```
{
  "name": "test_syncpack",
  "version": "0.0.1",
  "summary":"Testing Syncpack",
  "description":"IS Syncpack for testing",
```

```
  "author":"John Smith",
  "home_page":"https://example.com/test_syncpack",
  "requires_dist":[],
  "schedules": [
    {
      "application_id": "dummy_app",
      "entry_id": "dummy app",
        "params": {},
        "schedule": {
          "schedule_info": {
            "run_every": 3600
          },
          "schedule_type": "frequency"
        }
    }
  ],
  "tags":["test_syncpack"],
  "critical": [],
  "requires_is_version": ">=2.0.0"
}
```

Building a Synchronization PowerPack

After you complete your Synchronization PowerPack structure and place your applications, steps, and configuration objects in the right directories, you can build the Synchronization PowerPack **.whl** file (wheel).

You can build a Synchronization PowerPack with Python3 or with the iscli utility that comes with PowerFlow.

NOTE: Not included is how to build a Synchronization PowerPack automatically with CI/CD platforms.

Building a Synchronization PowerPack with Python3

To build the Synchronization PowerPack wheel with Python3, run the following command from the top-level Synchronization PowerPack directory:

```
python3 setup.py sdist bdist_wheel
```

This command creates **build** and **dist** folders within your SyncPack directory. In the **dist** folder, you will now have a Python wheel that you can upload to PowerFlow.

Building a Synchronization PowerPack with the iscli Utility

If you build your Synchronization PowerPack with the iscli utility, the utility builds and uploads the Synchronization PowerPack to PowerFlow in one step.

To build and upload your Synchronization PowerPack with the iscli utility, run the following command:

```
iscli -H <IS-IP-host> -U <IS User> -p <IS Password> -ukf </path/to/SyncPack/Directory>
```

where `</path/to/SyncPack/Directory>` is the Synchronization PowerPack root that contains the **setup.py** file.

Uploading a Synchronization PowerPack to PowerFlow

After you create your Synchronization PowerPack wheel, you can upload it to PowerFlow. You can upload this Synchronization PowerPack to PowerFlow using the PowerFlow user interface or with the iscli utility.

Uploading a Synchronization PowerPack with the User Interface

To import a Synchronization PowerPack in the PowerFlow user interface:

1. On the **SyncPacks** page of the PowerFlow user interface, click **[Import SyncPack]**. The **Import SyncPack** page appears.
2. Click **[Browse]** and select the **.whl** file for the Synchronization PowerPack you want to install.

TIP: You can also drag and drop a **.whl** file to the **SyncPacks** page.

3. Click **[Import]**. The PowerFlow registers and uploads the Synchronization PowerPack. The Synchronization PowerPack is added to the **SyncPacks** page.

NOTE: You cannot edit the content package in a Synchronization PowerPack published by ScienceLogic. You must make a copy of a ScienceLogic Synchronization PowerPack and save your changes to the new Synchronization PowerPack to prevent overwriting any information in the original Synchronization PowerPack when upgrading.

Uploading a Synchronization PowerPack with the iscli Utility

To upload a Synchronization PowerPack with the iscli utility:

1. Using a tool like secure copy (SCP), copy the Synchronization PowerPack from your local computer to your PowerFlow host.
2. Start an SSH session with your PowerFlow host.
3. Run the following command:

```
iscli -ukf /path/to/test_syncpack-0.0.1-py2.py3-none-any.whl
```

NOTE: If you have already uploaded this Synchronization PowerPack to your PowerFlow system and you want to re-upload with the same version, add the `-F` flag to the above command.

4. You can now activate the Synchronization PowerPack in PowerFlow. See the following topic for more information.

Activating and Installing a Synchronization PowerPack

After you upload a Synchronization PowerPack to PowerFlow, you need to activate and install the Synchronization PowerPack to access its applications, steps, and configuration objects.

Activating and Installing with the User Interface

To install a Synchronization PowerPack in the PowerFlow user interface:

1. On the **SyncPacks** page of the PowerFlow user interface, click the **[Actions]** button (⋮) for the Synchronization PowerPack you want to install and select *Activate & Install*. The **Activate & Install SyncPack** modal appears.

   > **TIP:** By default, the **SyncPacks** page displays only activated and installed PowerPacks. If you do not see the PowerPack that you want to install, click the Filter icon (⚌) on the **SyncPacks** page and select *Show All SyncPacks* to see a list of the uninstalled PowerPacks.

2. Click **[Yes]** to confirm the activation and installation. When the Synchronization PowerPack is activated, the **SyncPacks** page displays a green check mark icon (✔) for that Synchronization PowerPack. If the activation or installation failed, then a red exclamation mark icon (❗) appears.

   > **TIP:** While the Synchronization PowerPack is installing, you cannot click any of the options that appear when you click the **[Actions]** button (⋮).

3. For more information about the activation and installation process, click the check mark icon (✔) or the exclamation mark icon (❗) in the **Activated** column for that Synchronization PowerPack. For a successful installation, the "Activate & Install SyncPack" application appears, and you can view the Step Log for the steps. For a failed installation, the **Error Logs** window appears.

Activating and Installing with the iscli Utility

To activate and install an uploaded Synchronization PowerPack using the iscli utility, run the following command:

```
iscli -AIkn <syncpack_name> -V <syncpack version>
```

where <*syncpack_name*> is the name from the meta.json file, and <*syncpack_version*> is the version number of the Synchronization PowerPack.

For example:

```
iscli -AIkn test_syncpack -V 0.0.1
```

NOTE: To force a re-activation of the Synchronization PowerPack, add `-F` to the above command.

Extending an Existing Synchronization PowerPack

Because the content that is included in a Synchronization PowerPack cannot be overwritten inside PowerFlow, you will need to extend existing Synchronization PowerPacks with your own Synchronization PowerPack to add customizations.

Restrictions

- The names for applications, steps, and configuration objects must be unique within the entire PowerFlow platform. For example, you cannot have a step named "QueryREST", because that step is already included in the *Base Steps*Synchronization PowerPack. You will need to change the name of your customized step.
- Your new Synchronization PowerPack must include the Synchronization PowerPack you are extending in the **requires_dist** list in your **meta.json**. This ensures that your Synchronization PowerPack will have access to the applications and steps of the parent Synchronization PowerPack in its execution environment.
- After you install the Synchronization PowerPack, its environment will never be modified, even if the parent Synchronization PowerPacks are updated. If you wish to include changes from the parent Synchronization PowerPack, you will need to re-install your customized Synchronization PowerPack.

Modifying Application Definitions

To change the API endpoint or query used in an existing application:

1. Copy the entire JSON file for the application from the original Synchronization PowerPack into the apps directory of your new Synchronization PowerPack.
2. Rename the file so it will not conflict with the existing application.
3. In the JSON code, change the `friendly_name`, `author`, `description`, and `version` as required.
4. Make any other changes to the application as desired.

Modifying a Step

You have two methods for modifying a step. The first method is to change the code in a step itself, and the second is to extend the step class and execute your own code before or after the existing step.

To change the logic performed within a step:

1. Copy the entire step Python file from the original Synchronization PowerPack into the steps directory of your new Synchronization PowerPack.
2. Rename the file so it will not conflict with the existing step.
3. In the step file, change the class name to match the name of the step file.

4. In the `__init__()` section of the code, change the `friendly_name`, `description` , and `version` as required.
5. Make any other changes to the step as desired.

To "extend" the behavior of an existing step by performing work before or after the existing logic:

1. Create a new step and give it a unique name.
2. Instead of importing and extending BaseStep import and extend the step class you would like to modify. For example:

```
from base_steps_syncpack.steps.QueryGQL import QueryGQL

class OptionalQueryGQL(QueryGQL):
```

3. Complete the `__init__()` as normal, but make sure to call init of the super class to include all of its parameters. For example:

```
super(OptionalQueryGQL, self).__init__()
```

4. Create your additional logic in the `execute()` function. This logic can be performed either before or after you call the execute of the parent step. For example:

```
super(OptionalQueryGQL, self).execute()
```

NOTE: If you would like to perform additional logic after the execute of the parent step runs, you can access the data from that step via `self.get_current_saved_data()`.

Full Extended Step Example

```
from base_steps_syncpack.steps.QueryGQL import QueryGQL
from ipaascore import parameter_types
from ipaascommon.ipaas_utils import str_to_bool

class OptionalQueryGQL(QueryGQL):

  def __init__(self):
    super(OptionalQueryGQL, self).__init__()
    self.friendly_name = "Optional QueryGQL Call"
    self.description = "Optionally Runs GQL call."
    self.version = "1.0.0"

    self.new_step_parameter(
      name="enable",
      description="Should this step run.",
      default_value=True,
      required=False,
      param_type=parameter_types.BoolParameterToggle()
    )

  def execute(self):
    enabled = str_to_bool(self.get_parameter("enable", None))
    if enabled:
      super(OptionalQueryGQL, self).execute()
```

```
else:
  self.logger.flow(
    "Step is Disabled. Returning empty dict."
  )
  self.save_data_for_next_step(dict())
```

Chapter 5

ipaascore.BaseStep class

Overview

This chapter describes functions included in the ipaascore.BaseStep class. You can use these functions to define the logic in a step.

This chapter covers the following topics:

get_app_variable

Description

Retrieve the value of an application variable.

Syntax

get_app_variable*(name)*

Parameters

variable_name. The name of the application variable that you want to retrieve the value for.

Return

The value of the application variable.

Example

Suppose we defined this application variable in the application:

```
 "app_variables": [
    {
      "name": "sl1_hostname",
      "description": "The SL1 hostname to participate in the sync",
      "sample_value": "10.2.253.115",
      "default_value": null,
      "required": true,
      "value": 10.64.68.25
    },
]
```

Suppose this application calls the step "sync_SL1_data".

In the step "sync_SL1_data", we could use the following function to resolve the value of "sl1hostname":

```
hostname = self.get_app_variable("sl1_hostname")
```

The value of ***hostname*** would be "10.64.68.25".

get_available_previous_step_input_positions

Description

Retrieves the list of steps in the application along with the position of the step (the order that the step was run in the application. Position "0" (zero) is reserved for the current step's arguments.

Syntax

get_available_previous_step_input_positions()

Return

Returns a list of tuples. Each tuple includes a step name and the step's position.

get_data_from_step_by_name

Description

Retrieves data saved from a previous step.

NOTE: To retrieve data from a previous step, that previous step must save the data use the ***save_data_for_next_step*** function and the application must specify that the data from the previous step should be passed to the current step using the ***output_to*** parameter.

NOTE: Although the ***get_data_from_step_by_name*** function is simple to use, it does not allow you to write a generic, reusable step, because the step name will be hardcoded in the function. The functions ***join_previous_step_data*** or **get_data_from_step_by_order** allow you to create a more generic, reusable step.

Syntax

get_data_from_step_by_name*(step_name)*

Parameters

step_name. The name of a previous step in the application.

Return

The data that was saved by the previous step.

Example

The following is an example of the ***get_data_from_step_by_name*** function:

```
em7_data = self.get_data_from_step_by_name('FetchDevicesFromEM7')
snow_data = self.get_data_from_step_by_name('FetchDevicesFromSnow')
```

get_data_from_step_by_order

Description

This function retrieves data from a step based on the position of the step in the application.

> **NOTE**: To retrieve data from a previous step, that previous step must save the data use the ***save_data_for_next_step*** function and the application must specify that the data from the previous step should be passed to the current step using the ***output_to*** parameter.

Syntax

get_data_from_step_by_order*(pos)*

Parameters

position. The position of the step (order that the step was run) in the application. Position values start at "0" (zero) .

Return

The data that was saved by the previous step.

Exception

DataNotAvailableException

Example

- Suppose your application has four steps: stepA, stepB, stepC, and stepD
- Suppose stepA was run first (position "0") and includes the parameter "output_to":["stepD"]
- Suppose stepB was run second (position "1") and includes the parameter "output_to":["stepD"]
- Suppose stepC was run third (position "2") and includes the parameter "output_to":["stepD"]
- Suppose stepD was run fourth
- If the current step is stepD, and stepD needs the data from stepC, you could use the following:

```
data_from_stepC = self.get_data_from_step_by_order(2)
```

get_name

Description

Returns the name of the current step.

Syntax

get_name()

Return

The name of the current step.

get_parameter

Description

Retrieves a parameter value.

Syntax

get_parameter*(param_name, lookup_data=None)*

Parameters

param_name. The name of the parameter that you want to retrieve the value for.

lookup_data. An optional dictionary that can provide a reference for additional variable substitutions.

Return

Value of the requested parameter.

Example

For example, suppose we defined this parameter in the step named "GETgoogle.com":

```
self.new_step_parameter(name=prefix_url, description="used with relative_url to create
the full URL.",sample_value="http://10.2.11.253", default_value=None, required=True)
```

Suppose in the application that calls "GETgoogle.com", we specified:

```
"steps": [
   {
     "file": "QueryREST",
     "method": "GET",
     "name": "GETgoogle.com",
     "output_to": ["next_step"],
     "prefix_url": "http://google.com"
   }
],
```

Suppose we use the ***get_parameter*** function in the step "GETgoogle.com" to retrieve the value of the "prefix_url" parameter:

```
build_url_1 = self.get_parameter("prefix_url")
```

The value of ***build_url_1*** would be "http://google.com".

get_parameter_from_previous_step

Description

Retrieves a parameter value from a previous step.

Syntax

get_parameter_from_previous_step*(parameter_name, step_name)*

Parameters

param_name. The name of the parameter that you want to retrieve the value for.

step_name. the step from which you want to retrieve a parameter value.

Return

The value of the parameter.

join_previous_step_data

Description

This function retrieves data from one or more previous steps in the application.

> **NOTE**: To retrieve data from a previous step, that previous step must save the data use the ***save_data_for_next_step*** function and the application must specify that the data from the previous step should be passed to the current step using the ***output_to*** parameter.

If you are expecting similar data from multiple steps, or expecting data from only a single step, the ***join_previous_step_data*** function is the best choice.

The ***join_previous_step_data*** function gathers all data from all steps that included the **save_data_for_next_step** function and also include the ***output_to*** parameter in the application. By default, this function returns the joined set of all data that is passed to the current step. You can also specify a list of previous steps from which to join data.

The retrieved data must be of the same type. The data is then combined into a list or a dictionary. If the data types are not the same, then the function will raise an exception

Syntax

join_previous_step_data*(data_from)*

Parameters

data_from. An optional argument that specifies the steps. For example, if you wanted to join only the data from stepA and stepD, you could specify

```
self.join_previous_step_data(["stepA", "stepD"]),
```

Return

Combined data structure, either a list or a dictionary, of all the retrieved step data.

Example

The following is an example of the ***join_previous_step_data*** function in the QueryREST step:

```
def query_with_url_generated_from_input(self):
"""
Iterates over data from previous steps and generates a relative url for each. Then
executes that command
:return:
"""
count = 0
input_data = self.join_previous_step_data()
payload = self.get_parameter(PAYLOAD)
if type(input_data) is list:
  for input_d in input_data:
    relative_url = self.get_parameter(RELATIVE_URL, input_d)
    self.process_REST_command(payload, relative_url)
    count += 1
elif type(input_data) is dict:
  relative_url = self.get_parameter(RELATIVE_URL, input_data)
  self.process_REST_command(payload, relative_url)
  count += 1
else:
  raise NotImplementedError("Data type: {} is not currently supported for generating
  relative urls form data".format(type(input_data)))
```

new_step_parameter

Description

Define a parameter for the step. The application will provide the parameter values during runtime. If a parameter is defined as required, the step will fail with an exception if the parameter is not provided.

Syntax

new_step_parameter*(name=", description=", sample_value=", default_value=None, required=False)*

Parameters

name. The name of the parameter. This value will be used to create a name:value tuple in the application file (in JSON).

description. A description of the step parameter.

sample_value. A sample value of the required data type or schema.

default_value. If no value is specified for this parameter, use the default value. Can be any combination of alphanumeric characters. To prevent a default value, specify "None".

required. Specifies whether this parameter is required by the step. The possible values are "True" or "False".

Example

Here is an example from the QueryREST step:

```
self.new_step_parameter(name=PREFIX_URL, description="used with relative_url to create
the full URL.", sample_value="http://10.2.11.253", default_value=None, required=True)
```

save_data_for_next_step

Description

This function saves an object (usually a variable) and makes the data available to another step. The object must be of a data type that can be pickled by Python.

Syntax

save_data_for_next_step*(data_to_save)*

Parameters

data_to_save. A variable that contains the data.

> **NOTE**: The *data_to_save* object must be of a data type that can be pickled by Python: None, True and False, integers, long integers, floating point numbers, complex numbers, normal strings, unicode strings, tuples, lists, set, and dictionaries.

Example

The following is an example of the ***save_data_for_next_step*** function:

```
save_data = {'key': 'value'}
self.save_data_for_next_step(save_data)
```

The application must then specify that the data from the current step should be passed to one or more subsequent step, using the **output_to** parameter. For details, see the section about *using applications to transfer data between steps*.

validate_parameter_values

Description

Validates the parameter values provided for an application. For example, the validate_parameter_value function will raise an error if the user failed to provide a required parameter.

Syntax

validate_parameter_values()

Chapter 6

Tools for SL1 PowerFlow

Overview

PowerFlow includes the following developer tools to help you manage content:

- ***iscli***. PowerFlow includes a command line tool called ***iscli***. When you install PowerFlow, ***iscli*** is automatically installed. The iscli tool allows you to upload PowerFlow applications, steps, and configurations.
- ***PowerFlow API***. PowerFlow includes an API. When you install PowerFlow, the API is available.

This chapter covers the following topics:

iscli

PowerFlow includes a command line tool called ***iscli***. When you install PowerFlow, ***iscli*** is automatically installed. The iscli tool allows you to upload PowerFlow applications, steps, and configurations.

To access the iscli tool:

1. Either go to the console of the PowerFlow system or use SSH to access the server.
2. Log in as ***isadmin*** with the appropriate password.
3. Type the following at the command line:

```
iscli -h
```

Syntax

- To upload a step:

```
iscli -u -s -f path_and_name_of_step_file.py -H hostname_or_IP_address_of_
powerflow_system -P port_number_of_http_on_powerflow_system -U user_name -p
password
```

- To upload an application:

```
iscli -u -a -f path_and_name_of_application_file.json -H hostname_or_IP_address_
of_powerflow_system -P port_number_of_http_on_powerflow_system -U user_name -p
password
```

- To upload a configuration:

```
iscli -u -c -f path_and_name_of_configuration_file.json -H hostname_or_IP_
address_of_powerflow_system -P port_number_of_http_on_powerflow_system -U user_
name -p password
```

List of Arguments

The following is a list of arguments you can use in the iscli tool:

- **-h or --help.** Help message.
- **-H or --host.** Hostname of content store. If left blank, default from config is used.
- **-P or --port.** Port of content store. If left blank, default from config is used.
- **-U or --username.** Username used to access content store. If left blank, default is used.
- **-p or --password.** Password used to access content store. If left blank, default is used.
- **-u or --upload.** Upload data to content store. Requires **-f** tag and a version to be used.

- **-f or --fileLocation.** File path of Synchronization PowerPacks, PowerFlow applications, steps, and configuration objects to upload. Note that while you can bulk upload applications, steps, and configuration objects, you cannot bulk upload Synchronization PowerPacks.
- **-c or --configuration.**
- **-a or --application.** Use the iscli tool to interact with an application.
- **-s or --step.** Use the iscli tool to interact with a step.
- **-i or --insecure**. Upload with an insecure (http) connection.
- **-k or --syncpack**. Use the iscli tool to interact with a Synchronization PowerPack.
- **-A or --activate**. Activate a Synchronization PowerPack. Requires **-n, -v** tag. **-F** is optional to force the activation and the tag -I to install the Synchronization PowerPack.
- **-I or --install**. Install a Synchronization PowerPack. Requires **-n, -v** tag. **-F** is optional to force the installation.
- **-n or --name**. Name of the Synchronization PowerPack that will be activated.
- **-V or --version**. Version of the Synchronization PowerPack that will be activated.
- **-F or --force**. Force a Synchronization PowerPack activation or installation.
- **-O or --overwrite**. Specify if non-Synchronization PowerPack content will be overwritten.
- **-l or --license**. Use the CLI to license your IS system.
- **-e or --email**. Licensing: Customer Email.
- **-C or --customer**. Licensing: Customer Name.
- **-o or --output**. Licensing: Path to output license file.

You will use the following commands most often:

- ***Upload an application file***. `iscli –uaf <app-file>`
- ***Upload a configuration file***. `iscli –ucf <config-fil>`
- ***Upload a step file***. `iscli –usf <step-file>`

Example

```
iscli -u -s -f path_and_name_of_step_file.py -H hostname_or_IP_address_of_powerflow_
system -P port_number_of_http_on_powerflow_system -U user_name -p password
```

where:

- *name_of_step_file* is the full pathname for the step.
- *hostname_or_IP_address_of_powerflow_system* is the hostname or IP address of the PowerFlow system.
- *port_number_of_http_on_powerflow_system* is the port number to access the PowerFlow system.
- *user_name* is the user name you use to log in to the PowerFlow system.
- *password* is password you use to log in to the PowerFlow system.

API

PowerFlow includes an API. When you install PowerFlow, the API is available.

Viewing API Documentation

To view the full documentation for the IS API:

1. From the PowerFlow system, copy the **/opt/iservices/scripts/swagger.yml** file to your local computer.
2. Open a browser session and go to editor.swagger.io.
3. In the Swagger Editor, open the **File** menu, select **Import File**, and import the file **swagger.yml**. The right pane in the Swagger Editor displays the API documentation.

Available Endpoints

POST

/applications. Add a new application or overwrite an existing application.

/applications/{appName}/run. Run a single application by name with saved or provided configurations.

/applications/run. Run a single application by name. For more information, see *Querying for the State of a PowerFlow Application*.

/configurations. Add a new configuration or overwrite an existing configuration.

/license. Add license data for this PowerFlow system.

/roles/owner. Add a new owner assigned a specific role.

/steps. Add a new step or overwrite an existing step.

/steps/run. Run a single step by name.

/schedule. Add a new scheduled PowerFlow application.

/syncpacks/{syncpackName}/install. Install a specific Synchronization PowerPack version by name.

/tasks/{taskId}/replay. Replay a specific PowerFlow application. Replayed applications run with the same application variables, configuration, and queue as the originally executed application.

/tasks/{taskId}/revoke. Revoke or terminate a specific task or application. By default, this command will not terminate the current running task. If an application ID is provided, all tasks associated with that application are revoked.

Querying for the State of a PowerFlow Application

When triggering PowerFlow application from the **applications/run** endpoint, you can query for the state of that application in two ways:

1. **Asynchronously**. When you POST a run of a PowerFlow application to **/applications/run**, the response is an integration status with a Task ID, such as: *isap-23233-df2f24-etc*. At any time, you can query for the current state of that task from the endpoint **/api/v1/tasks/isap-23233-df2f24-etc**. The response includes all of the steps run by the application, along with the status of the steps, and URL links to additional info, such as logs for each step.
2. **Synchronously**. When you POST a run of an application, you can tell PowerFlow to wait responding until the application is complete by adding the **wait** argument. For example, **/api/v1/applications/run?wait=20** will wait for 20 seconds before responding. The maximum wait time is 30 seconds. When the application completes, or 30 seconds has passed, the API returns the current status of the integration run. This process works the same as if you had manually queried **/api/v1/tasks/isapp-w2ef2f2f**. Please note that while the API is waiting for your application to complete, you are holding on to a thread. If you have multiple applications that run for a long period of time, do not use a synchronous query unless you have no other option. ScienceLogic recommends using an *asynchronous* query whenever possible.

GET

/about. Retrieve version information about the packages used by this PowerFlow system.

/applications. Retrieve a list of all available applications on this PowerFlow system.

/applications/{appName}. Retrieve a specific application.

/applications/{appName}/logs. Retrieve the logs for the specified application.

/cache/{cache_id}. Retrieve a specific cache to gather information about the user interface and the PowerFlow applications.

/configurations. Retrieve a list of all configurations on this PowerFlow system.

/configurations/{configName}. Retrieve a specific configuration.

/license. Retrieve license data for this PowerFlow system.

/reports. Retrieve a list of paginated reports.

/reports/{reportId}. Retrieve a specific report by ID.

/roles. Retrieve a list of available roles on this PowerFlow system.

/roles/owner. Retrieve a list of roles assigned to owners on this PowerFlow system.

/roles/owner/{owner}. Retrieve the role assigned to a specific owner.

/schedule. Retrieve a list of all scheduled applications on this PowerFlow system.

/steps. Retrieve a list of all steps on this PowerFlow system.

/steps/{stepName}. Retrieve a specific step.

/syncpacks. Retrieve a list of all Synchronization PowerPacks on this PowerFlow system.

/syncpacks/{synpackName}. Retrieve the full details about a specific Synchronization PowerPack.

/api/v1/syncpacks?only_installed=true. Retrieve a list of only the installed Synchronization PowerPacks on this system.

/api/v1/syncpacks?only_activated=true. Retrieve a list of only the activated Synchronization PowerPacks on this system.

/tasks/{taskId}. Retrieve a specific task.

REST

/tasks. Terminate all running tasks.

/tasks/{taskId}. Terminate a specific running task.

DELETE

/applications/{appName}. Delete a PowerFlow application by name.

/cache/{cache_id}. Delete a cache entry by name.

/configurations/{configName}. Delete a configuration by name.

/license. Delete license data for this PowerFlow system.

/roles/owner. Delete a specific owner role.

/schedule. Delete a scheduled PowerFlow application by ID.

/reports/{appName}. Delete a specific report by name.

/reports/{reportId}. Delete a specific report by report ID.

/steps/{stepName}. Delete a specific step by name.

/syncpacks/{spName}. Delete a specific Synchronization PowerPack by name.

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