



SL1 PowerFlow Platform

Version 2.4.1

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Chapter

1

Introduction to SL1 PowerFlow and the PowerFlow Builder

Overview

SL1 PowerFlow provides a generic platform for integrations between SL1 and third-party applications, such as ServiceNow, Restorepoint, xMatters, Opsgenie, or Cherwell Service Management. The PowerFlow platform sits in the middle of SL1 and the third-party application and handles the flow of data.

From the PowerFlow user interface, you can use the PowerFlow builder to create complicated workflow automations with logical branching using drag-and-drop components.

NOTE: The PowerFlow builder is available only in SL1 Premium solutions. To upgrade, contact ScienceLogic Customer Support. For more information, see <https://sciencelogic.com/pricing>.

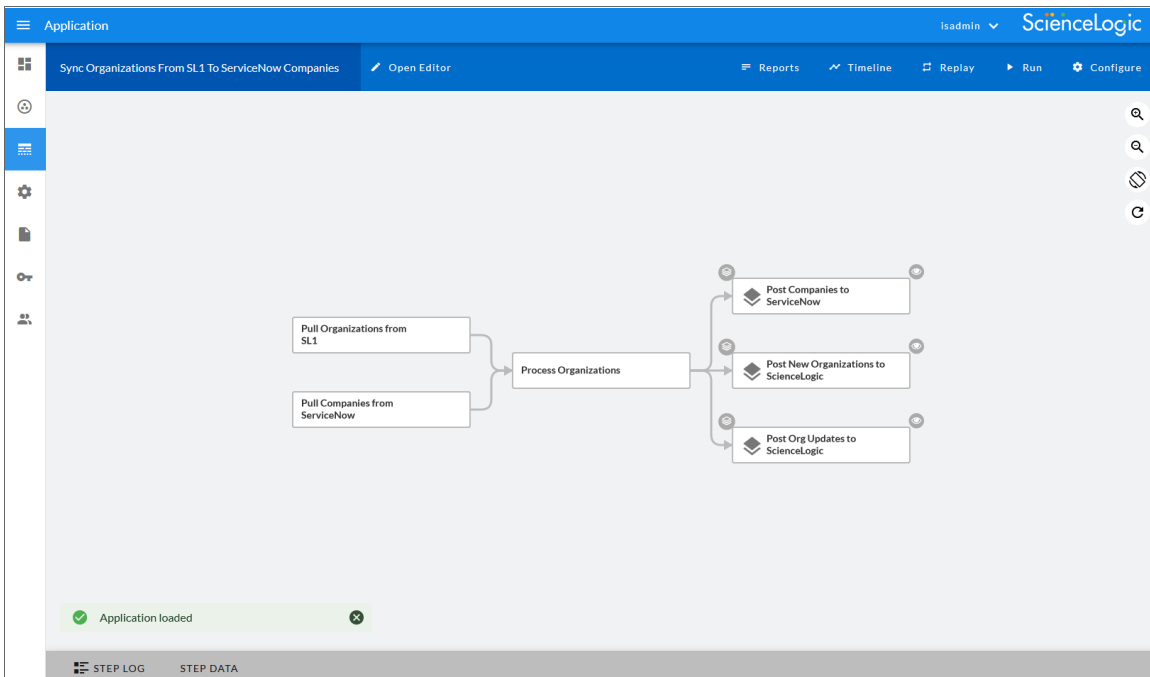
This chapter covers the following topics:

<i>What is SL1 PowerFlow?</i>	12
<i>What is a Step?</i>	13
<i>What is a PowerFlow Application?</i>	16
<i>What is a Configuration Object?</i>	17
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What is SL1 PowerFlow?

SL1 PowerFlow enables intelligent, bi-directional integration between SL1 and third-party applications to promote a unified management ecosystem. PowerFlow contains default workflows that let users translate and share data between SL1 and third-party applications, and it also allows the development of standardized, reusable snippets called "steps" that non-developers can use to create integration workflows without writing code. In addition, PowerFlow is designed to provide high availability and scalability.

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

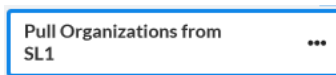


The key elements of the PowerFlow user interface include the following:

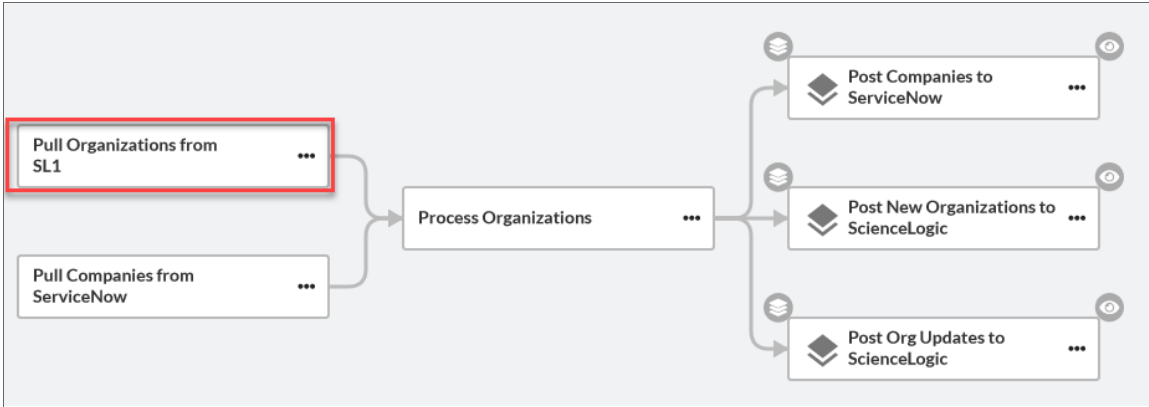
- **Synchronization PowerPacks.** A Synchronization PowerPack (also called a SyncPack) contains all the code and logic needed to perform integrations on the PowerFlow platform. You can access the latest steps, applications, and configurations for PowerFlow or a third-party integration (such as ServiceNow, Cherwell, or Restorepoint) by downloading the most recent Synchronization PowerPack for that integration. You can download Synchronization PowerPacks from the **PowerPacks** page at the ScienceLogic Support Site at <https://support.sciencelogic.com/s/>. You can access all Synchronization PowerPacks that have been uploaded to your PowerFlow system on the **SyncPacks** page (☺).
- **Applications.** A PowerFlow application or workflow is a JSON object that includes all of 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 (☰), and you can create new applications using the PowerFlow builder.
- **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. You can use existing steps to create your own workflows, and you can re-use steps in more than one workflow. 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. You can access all steps by using the PowerFlow builder on 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 (⚙️).

What is a Step?

In PowerFlow, a **step** is a generic Python class that performs a single action, such as gathering data about an organization:



You can use existing steps to create your own workflows, and you can re-use steps in more than one workflow. When these steps are combined as part of a PowerFlow application, they provide a workflow that satisfies a business requirement:



In the PowerFlow builder user interface, if you click the ellipsis icon (***) on a step in the PowerFlow builder, you can select *View step code* to view the code for that step:

```
Pull And Process SL1 Organizations [X]

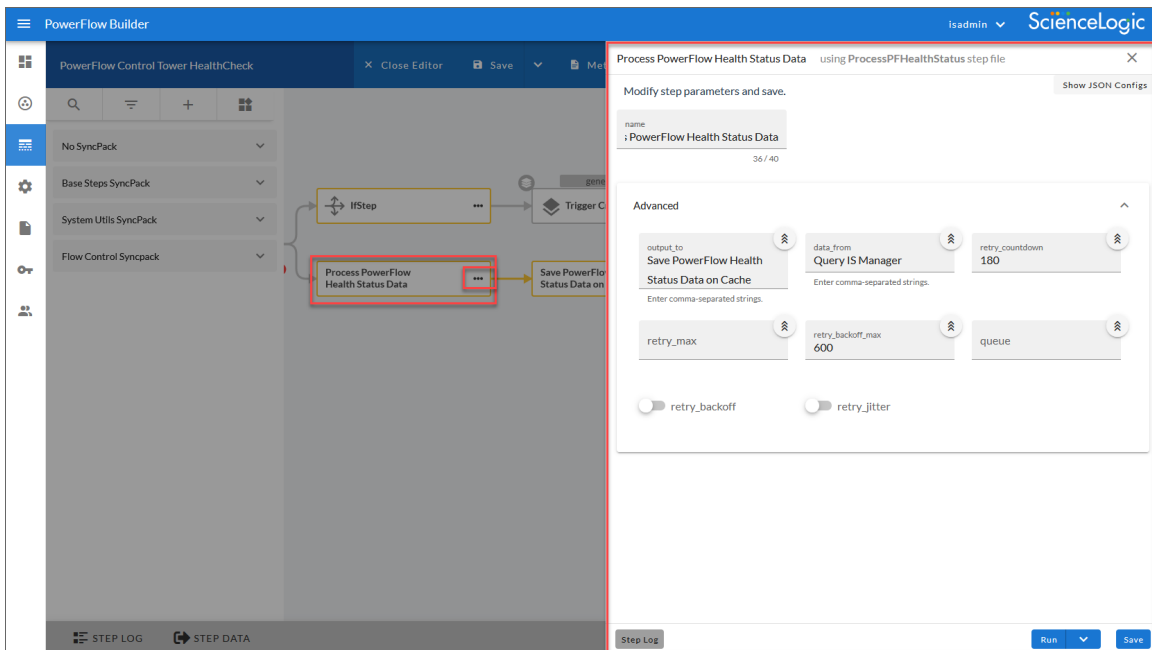
Step code
1 import pickle
2
3 from base_steps_syncpack.steps.QueryREST import OBJECT_KEY_VAL, QueryREST
4 from servicenow_base_syncpack.util.snow_parameters import region_param
5 from servicenow_cmdb_syncpack.util.org_utils import SL1Org
6
7
8 class PullAndProcessSL1Orgs(QueryREST):
9     def __init__(self):
10         super(PullAndProcessSL1Orgs, self).__init__()
11         self.friendly_name = "Pull and Process SL1 Organizations"
12         self.description = (
13             "Pulls Organizations from SL1 and converts them into SL1Org objects."
14         )
15         self.version = "1.0.0"
16
17         self.add_step_parameter_from_object(region_param)
18
19     def execute(self):
20         super(PullAndProcessSL1Orgs, self).execute()
21         region = self.get_parameter(region_param.name)
22         result = self.get_current_saved_data()
23         self.logger.flow(f"Pulled {len(result)} Organizations from SL1.")
24         self.logger.info(f"Pulled Orgs: {result}")
25         processed_orgs = dict()
26         for org in result:
27             sl1_org = SL1Org(org.pop(OBJECT_KEY_VAL), org, region)
28             processed_orgs[sl1_org.sl1_id] = sl1_org
29
30         self.save_data_for_next_step(pickle.dumps(processed_orgs))
31
```

expects type: python

You can configure how a step works by adjusting a set of 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 input parameters for a step:

1. Go to the **Applications** page of the PowerFlow user interface and click the name of a PowerFlow application.
2. Click the **[Open Editor]** button.
3. Click the ellipsis icon (***) on the step and select *Configure*. The **Configuration** pane for that step appears:



NOTE: The PowerFlow builder is available only in SL1 Premium solutions. To upgrade, contact ScienceLogic Customer Support. For more information, see <https://sciencelogic.com/pricing>.

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 run test data for that step by hovering over the **[Run]** button and selecting *Custom Run*.

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

Steps are grouped into the following types:

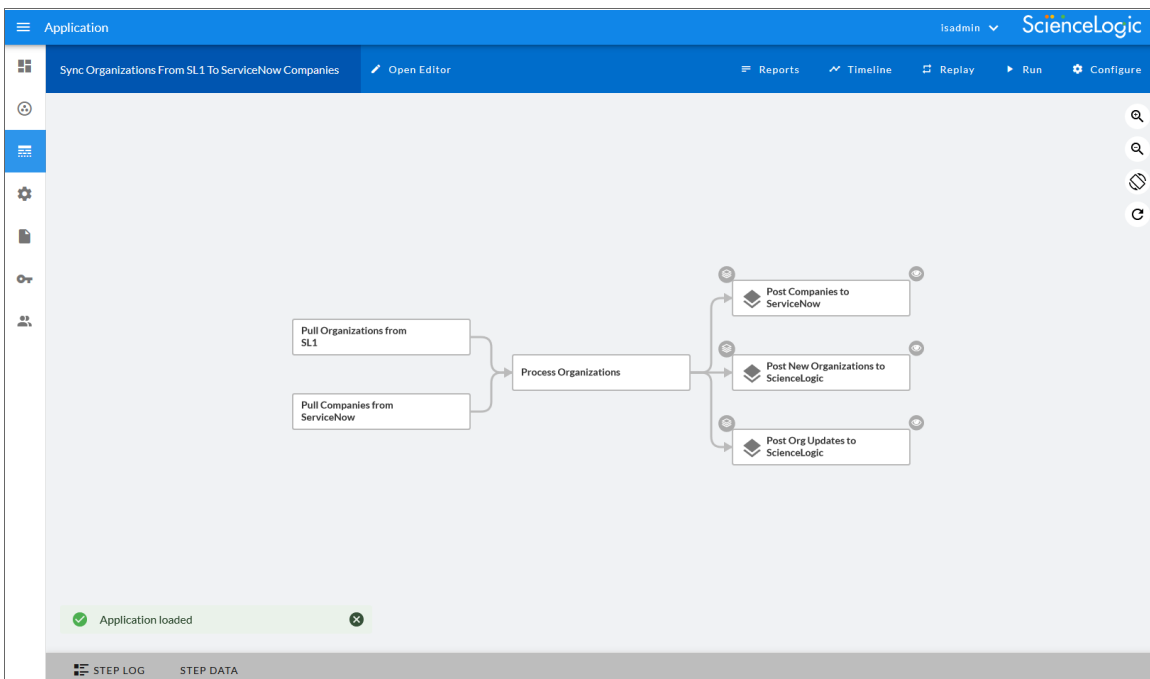
- **Standard**. Standard steps do not require any previously collected data to perform. Standard steps are generally used to generate data to perform a transformation or a database insert. These steps can be run independently and concurrently.
- **Aggregated**. Aggregated steps require data that was 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.

A variety of generic steps are available from ScienceLogic, and you can access a list of steps by sending a GET request using the [API /steps endpoint](#).

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 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.

For more information about PowerFlow applications, see [Managing PowerFlow Applications](#).

What is a Configuration Object?


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

Each global variable is defined as a JSON object in the configuration. Typically, the JSON code for a configuration object looks like the following:

```
{
  "encrypted": true,
  "name": "var_name",
  "value": "var_value"
}
```

Configuration objects can map variables from the SL1 platform to a third-party platform. For instance, SL1 has device classes and ServiceNow has CI classes; the configuration object maps these two sets of variables together.

Each global variable in the configuration has the option of being encrypted. The values of encrypted variables are encrypted within PowerFlow upon upload through the REST API.

You can access a list of all available configurations on the **Configurations** page () of the PowerFlow user interface. You can also create and edit configuration objects on this page.

Config Name	Ver	Author	Modified	Actions
223 and ven01056	1.0.0	fsun	Oct 03, 2021 17:41:11	Edit Download Delete
ID: 223_and_ven01056 Description: SL1 to ServiceNow Incident Automation Aligned Applications 1. Sync Devices from SL1 to ServiceNow 2. Cache ServiceNow CIs and SL1 Device Classes 3. demo app				
Backup Config			Oct 20, 2021 12:06:09	Edit Download Delete
IS - System Backup Configuration Example	1.0.1	ScienceLogic	Apr 27, 2022 10:12:13	Edit Download Delete
PF - System Diagnostic Configuration Example	2.0.0	ScienceLogic	Apr 27, 2022 10:12:13	Edit Download Delete
PF Check Connection Configuration Example	1.0.0	ScienceLogic	Apr 27, 2022 10:12:13	Edit Download Delete
PF Control Tower Configuration Example	1.0.1	ScienceLogic	Apr 27, 2022 10:12:13	Edit Download Delete
PF - RBA retry Configuration Example	1.0.0	ScienceLogic	Apr 27, 2022 10:12:13	Edit Download Delete
Power Tower HealthCheck Configuration Example	1.0.0	ScienceLogic	Sep 13, 2021 16:31:46	Edit Download Delete
Restorepoint Base Config	1.0.0	ScienceLogic	Mar 15, 2022 11:07:00	Edit Download Delete

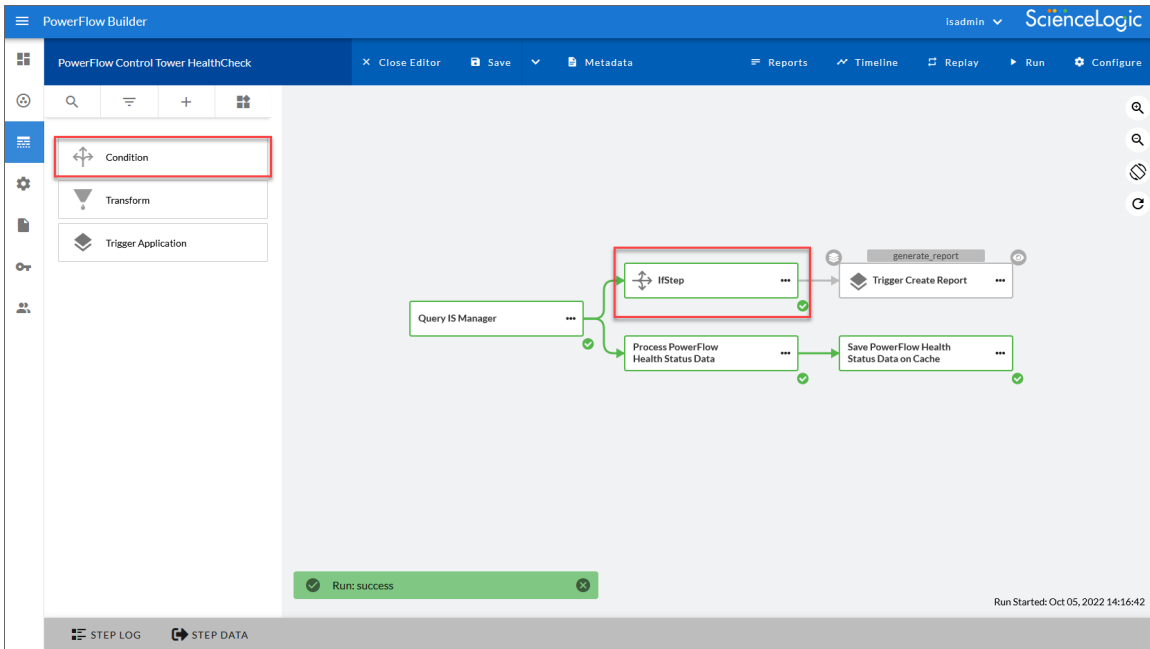
For more information about configuration objects, see [Managing Configuration Objects](#).

What is the SL1 PowerFlow Builder?

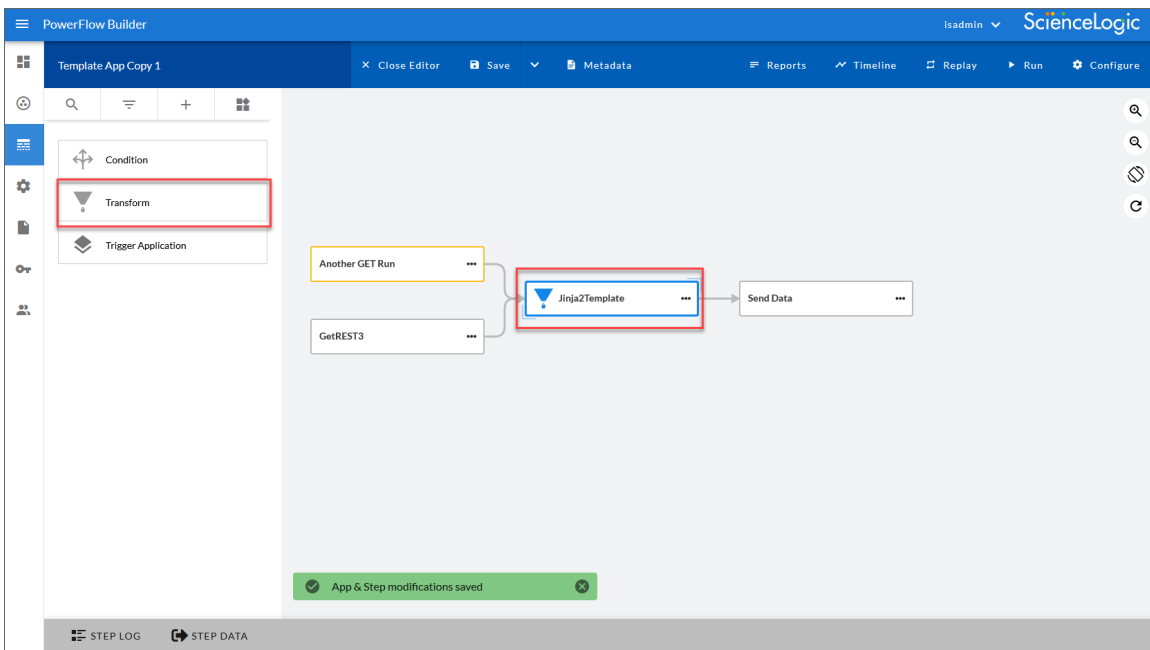
You can use the **SL1 PowerFlow builder** in the PowerFlow user interface to create complicated applications with logical branching and data transformation features using drag-and-drop components. You access the PowerFlow builder on the **Applications** page in the PowerFlow user interface.

NOTE: The PowerFlow builder is available only in SL1 Premium solutions. To upgrade, contact ScienceLogic Customer Support. For more information, see [ScienceLogic Pricing](#).

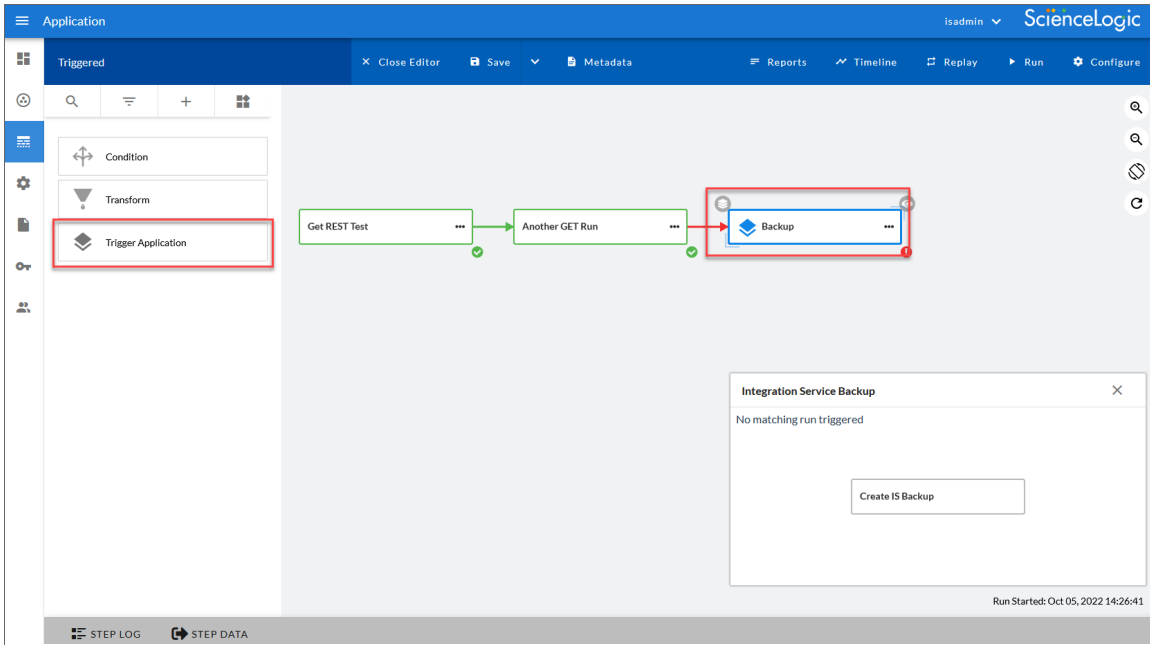
From the **Steps Registry** pane on an **Application** page, you can drag a **Condition** operator (⊕) onto an application workflow to create the option for branching flows, such as If-Else or If-Then-Else statements:



You can drag a **Transform** operator () from the **Steps Registry** pane onto an application workflow to pull data gathered by a previous step and modify or transform the data to fit into the next step:



You can also use the **Trigger Application** operator (👁) to launch one or more PowerFlow applications from within a new or existing PowerFlow application. This operator uses the same functionality as the "Trigger Application" step from the Base Steps Synchronization PowerPack:



TIP: Hovering over the eye icon (👁) generates a smaller window, also called a "picture-within-a-picture", that displays the step or steps for the triggered application.

For more information about the PowerFlow builder and PowerFlow applications, see [Managing PowerFlow Applications](#).

Elements of the PowerFlow User Interface

Starting with the 2.0.0 release of the PowerFlow platform, the PowerFlow user interface was updated to match the 8.12.0 and later release of the SL1 user interface, with the navigation tabs now located on the left-hand side of the window. The tabs provide access to the following pages: **PowerFlow Control Tower**, **SyncPacks**, **Applications**, **Configurations**, **Reports**, **API Keys**, and **Admin Panel**.

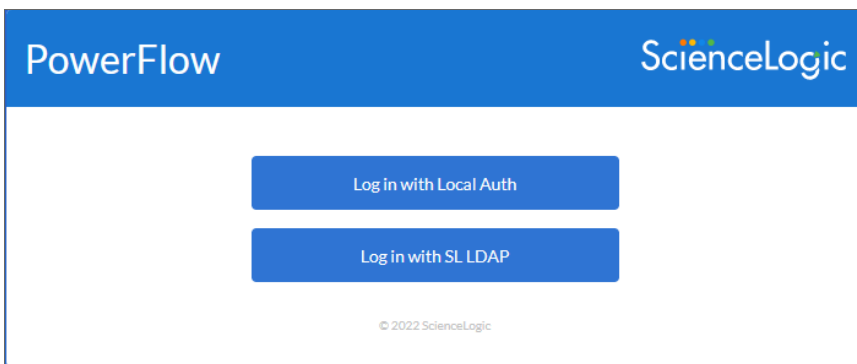
TIP: To view a pop-out list of menu options, click the menu icon (☰) at the top left of the window. Click the menu icon again to close the pop-out menu.

Logging In and Out of the PowerFlow User Interface

You can log in to PowerFlow using one of the following authorization types:

- **Local Authentication.** The same local Administrator user (*isadmin*) is supported by default. Local authentication only supports the *isadmin* administrator user.
- **Basic Authentication.** PowerFlow continues to support Basic Authentication as well. Because the PowerFlow PowerPacks, diagnostic scripts, and the *iscli* tool continue to use Basic Authentication, ScienceLogic does not recommend disabling Basic Authentication.
- **OAuth.** Lets PowerFlow administrators use their own authentication providers to enforce user authentication and lockout policies. Authentication using a third-party provider, such as LDAP or Active Directory, requires additional configuration. For optimal security, ScienceLogic recommends that you disable the local Administrator user (*isadmin*) and exclusively use your own authentication provider.
- **Common Access Card (CAC) Authentication.** Lets a PowerFlow user provide a CAC card through a browser to the PowerFlow root IP address. After identifying the CAC card, the ingress proxy verifies and authenticates the user. CAC authentication bypasses Dex authentication and does not use OIDC protocols. You can also use CAC authentication with LDAP, or CAC authentication with LDAP and SAN.

Depending on the authentication used by your PowerFlow system, the PowerFlow login page will display a single option for logging in, or more than one option:



For more information about configuring authorization for users, see [Managing Users in PowerFlow](#).

NOTE: After you log in to a PowerFlow system configured for Military Unique Deployment (MUD) and Department of Defense (DoDIN) a login banner containing information specific to DoDIN appears after you log in.

TIP: If you get a “SyncPacks service is not reachable” pop-up message in the user interface and the various pages are empty, log out of the PowerFlow user interface and log back in again. You can also click **[Refresh]** in your browser to automatically log out. This situation occurs only if the user interface is idle for a long period of time.


After you log in, a pair of pop-up notifications appear at the bottom of the PowerFlow user interface:


- The first notification at bottom left states the last time you logged into the PowerFlow system. This notification disappears after a short period of time.
- The second notification at bottom left states how much time is left in your PowerFlow license. The notification displays with a green background if your license is current, yellow if you have ten days or less in your license, and red if your license has expired. You need to click the Close icon (X) to close this notification.


Additional notifications will display in this same area at the bottom left of the window.


To log out of PowerFlow, click your user name in the navigation bar in the top right of any window and select *Log off*.


PowerFlow Pages


The **PowerFlow Control Tower** page () provides a graphical view of the various tasks, workers, and applications that are running on your PowerFlow system. This page was called the **Dashboard** page in previous versions of PowerFlow. For more information, see [Using the PowerFlow Control Tower Page](#).

The **SyncPacks** page () lets you import, install, and view Synchronization PowerPacks, which are also called "SyncPacks". For more information, see [Managing Synchronization PowerPacks](#).

The **Applications** page () provides a list of the applications available on your PowerFlow system. This page was called the **Integrations** page in previous versions of PowerFlow. From this page you can run and schedule applications. If you are a Premium solution user, you can use the PowerFlow builder to create applications that use logical branching and data transformation between steps. For more information, see [Managing PowerFlow Applications](#).

The **Configurations** page () lets you create or use a configuration object to define a set of variables that all steps and PowerFlow applications can use. For more information, see [Managing Configuration Objects](#).

The **Reports** page () contains a list of reports associated with PowerFlow applications that have the reporting feature enabled, such as the "Report: Identify Unmapped Device Classes" and the "System Diagnostics" application. For more information, see [Generating and Viewing Reports for PowerFlow Applications](#).

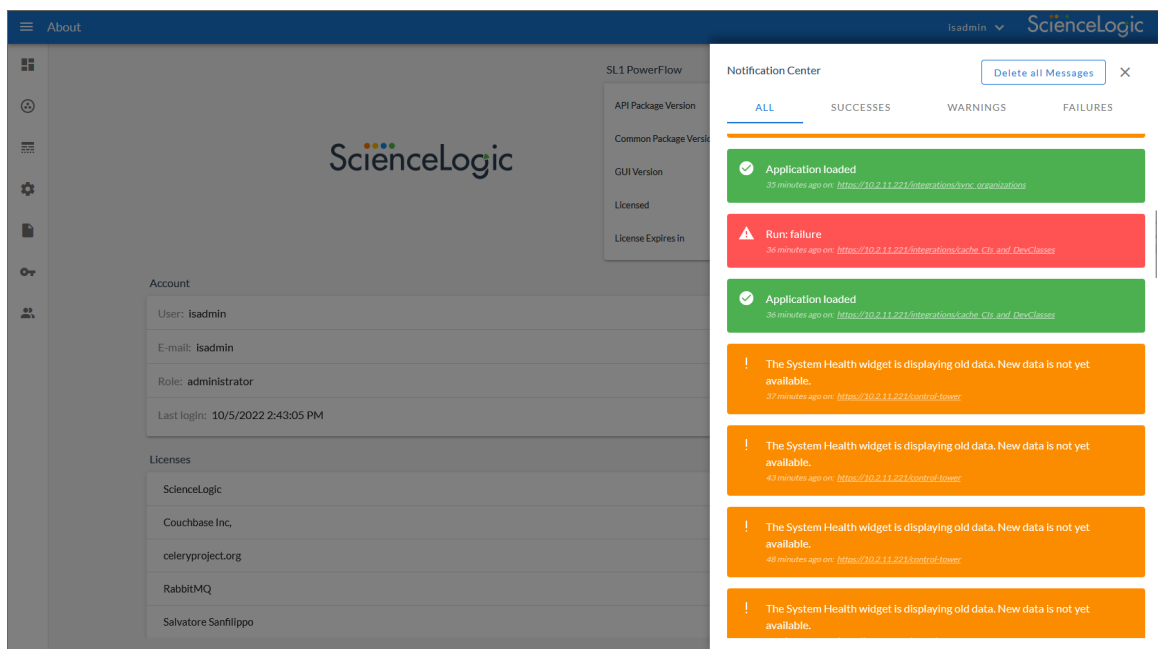
The **Admin Panel** page () contains a list of user groups, which lets you determine the roles and access for your users. You can also manage user sessions on this page. Only users with the *Administrator* role for this PowerFlow system can edit this page. For more information, see [Managing Users in PowerFlow](#).

TIP: While the **SyncPacks**, **Applications**, **Configurations**, **Reports**, **API Keys**, and **Admin Panel** pages are loading or running a procedure, you will see a dark blue, animated line running across the top of the page until the process completes. On the PowerFlow Control Tower page, the **System Health** widget displays an image that shows the progress of data loading in that widget.

Additional Navigation

The user name drop-down, which is found in the navigation bar in the top right of any window in the PowerFlow user interface, contains the following options:

- *About*. Displays package versions, user information for the current user, version information for PowerFlow, and licenses used by PowerFlow. This page also display whether the PowerFlow system is licensed, and when the license expires.
- *Help*. Displays the online product documentation for PowerFlow in a new browser window.
- *Notifications*. Opens the **Notification Center** pane, which contains a log of all previous pop-up notifications that appeared on the PowerFlow system about applications that were run successfully or with warnings or failures:



The different notifications are color-coded: green for success, yellow for warning, and red for failure. The number of notifications displays as a badge in the menu. For more information about a notification, click the link for the page where the notification appeared and review the **Step Log** and **Step Data** tabs for the application steps.

TIP: To clear the contents of the **Notification Center** pane, click the **[Delete all Messages]** button. Click the Close icon (X) to close the **Notification Center** pane.

- *Log off*. Logs you out of the PowerFlow user interface.

Using the API or Command Line Tool to Create PowerFlow Components

Instead of using the PowerFlow user interface, you can create steps, applications, and configurations in your own editor and then upload them using the API or the command line tool (iscli).

For more information, see the *SL1 PowerFlow for Developers* manual.

Installing and Configuring SL1 PowerFlow

Overview

This chapter describes how to install, upgrade, and configure PowerFlow, and also how to set up security for PowerFlow.

This chapter covers the following topics:

<i>PowerFlow Architecture</i>	26
<i>Reviewing Your Deployment Architecture</i>	29
<i>System Requirements</i>	30
<i>Additional Prerequisites for PowerFlow</i>	32
<i>Installing PowerFlow</i>	33
<i>Upgrading PowerFlow</i>	41
<i>Licensing PowerFlow</i>	53
<i>Configuring a Proxy Server</i>	56
<i>Changing the PowerFlow System Password</i>	58
<i>Configuring Security Settings</i>	59
<i>Configuring Additional Elements of PowerFlow</i>	61
<i>PowerFlow Management Endpoints</i>	62

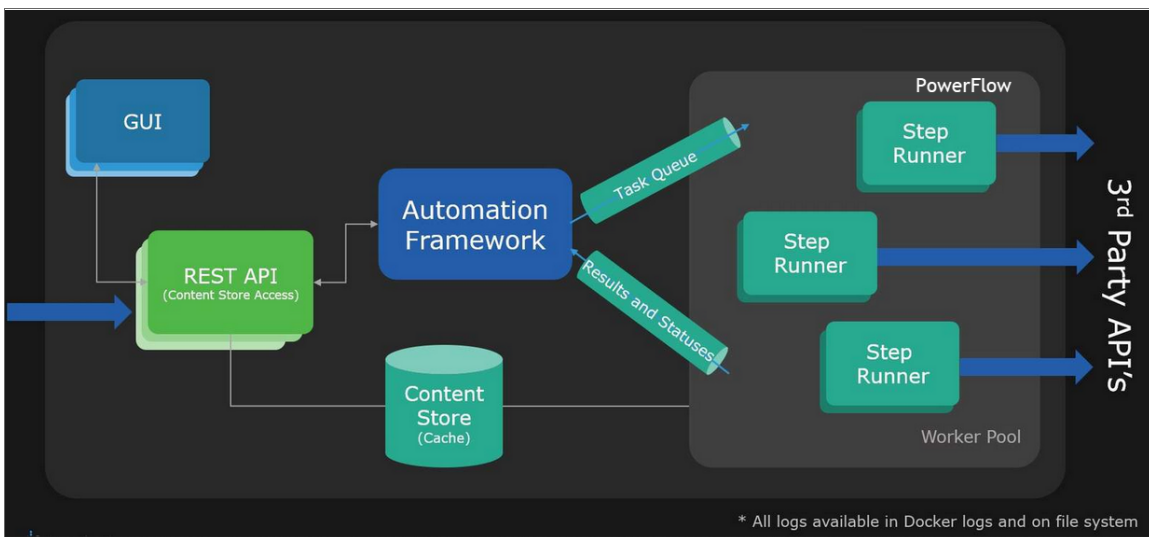
PowerFlow Architecture

This topic describes the different aspects of PowerFlow architecture.

PowerFlow Container Architecture

PowerFlow is a collection of purpose-built containers that are charged to pass information to and from SL1. Building PowerFlow architecture in containers allows you to add more processes to handle the workload as needed.

The following diagram describes the container architecture for PowerFlow:

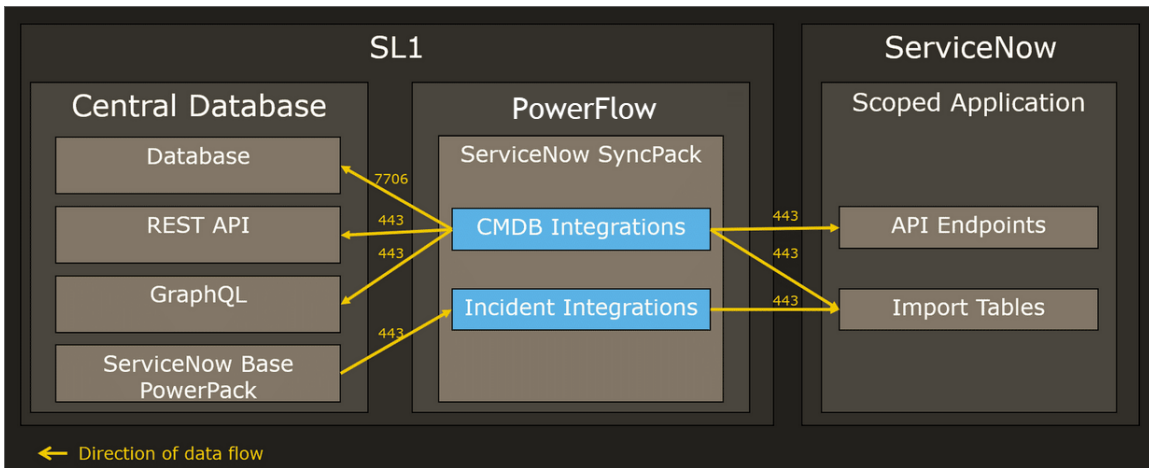


PowerFlow includes the following containers:

- **GUI**. The GUI container provides the user interface for PowerFlow.
- **REST API**. The REST API container provides access to the Content Store on the PowerFlow instance.
- **Content Store**. The Content Store container is basically a database service that contains all the reusable steps, applications, and containers in the PowerFlow instance.
- **Step Runners**. Step Runner containers execute steps independently of other Step Runners. All Step Runners belong to a Worker Pool and can run steps in order, based on the instructions in the applications. By default there are five Step Runners (worker nodes) include in the PowerFlow platform. PowerFlow users can scale up or scale down the number of worker nodes, based on the workload requirements.

Integration Workflow

The following high-level diagram for a ServiceNow Integration provides an example of how PowerFlow communicates with both the SL1 Central Database and the third-party (ServiceNow) APIs:



The workflow includes the following components and their communication methods:

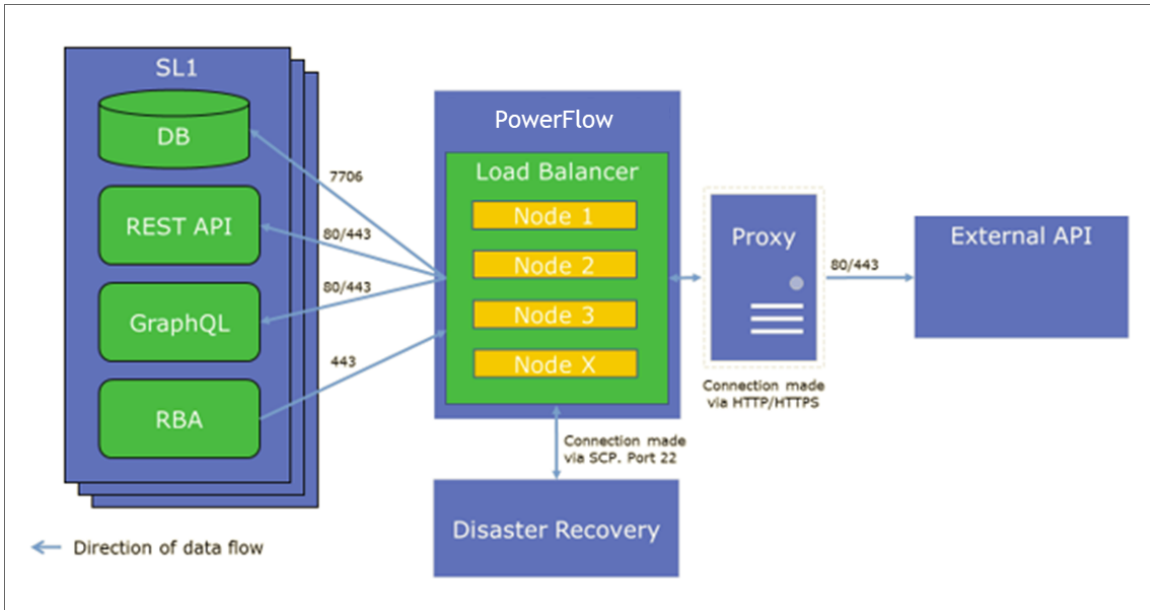
- **SL1 Central Database.** PowerFlow communicates with the SL1 database over port 7706.
- **SL1 REST API.** PowerFlow communicates with the SL1 REST API over port 443.
- **GraphQL.** PowerFlow communicates with GraphQL over port 443.
- **ServiceNow Base PowerPack.** In this example, the Run Book Automations from the ServiceNow Base PowerPack (and other SL1 PowerPacks) communicate with PowerFlow over port 443.
- **PowerFlow.** PowerFlow communicates with both the SL1 Central Database and an external endpoint.
- **ServiceNow API.** In this example, the ServiceNow applications in PowerFlow communicate with the ServiceNow API over port 443.

IMPORTANT: PowerFlow both pulls data from SL1 and has data pushed to it from SL1. PowerFlow both sends and retrieves information to and from ServiceNow, but PowerFlow is originating the requests.

High-Availability, Off-site Backup, and Proxy Architecture

You can deploy PowerFlow as a High Availability cluster, which requires at least *three* nodes to achieve automatic failover. While PowerFlow *can* be deployed as a single node, the single-node option does not provide redundancy through High Availability. PowerFlow also supports off-site backup and connection through a proxy server.

The following diagram describes these different configurations:



- **High Availability** for PowerFlow is a cluster of PowerFlow nodes with a Load Balancer managing the workload. In the above scenario, if one PowerFlow node fails, the workload will be redistributed to the remaining PowerFlow nodes. High Availability provides local redundancy. For more information, see [Appendix A: Configuring PowerFlow for High Availability](#).
- **Off-site Backup** can be configured by using PowerFlow to back up and recover data in the Couchbase database. The backup process creates a backup file and sends that file using Secure Copy Protocol (SCP) to a user-defined, off-site destination system. You can then use the backup file from the remote system and restore its content. For more information, see [Backing up Data](#).
- A **Proxy Server** is a dedicated computer or software system running as an intermediary. The proxy server in the above scenario handles the requests between PowerFlow and the third-party application. For more information, see [Configuring a Proxy Server](#).

In addition, you can deploy PowerFlow in a multi-tenant environment that supports multiple customers in a highly available fashion. After the initial High Availability (HA) core services are deployed, the multi-tenant environment differs in the deployment and placement of workers and use of custom queues. For more information, see [Appendix B: Configuring PowerFlow for Multi-tenant Environments](#).

NOTE: There is no support for active or passive Disaster Recovery. ScienceLogic recommends that your PowerFlow Disaster Recovery plans include regular backups and restoring from backup. For more information, see [Backing up Data](#).

Reviewing Your Deployment Architecture

Review the following aspects of your architecture before deploying PowerFlow:

- A. How many SL1 stacks will you use to integrate with the third-party platform (such as ServiceNow, Cherwell, or Restorepoint)?
- B. What is a good estimate of the number of devices across all of your SL1 stacks?
- C. How many data centers will you use?
- D. Specify the location of each data center.
- E. What is the latency between each data center? (Latency must be less than 80 ms.)
- F. How many SL1 stacks are in each data center?
- G. Are there any restrictions on data replication across regions?
- H. What is the location of the third-party platform (if applicable)?
- I. What is the VIP for Cluster Node Management?

Based on the above list, ScienceLogic recommends the following deployment paths:

- For question A, if you answered **three or fewer** SL1 stacks, consider a standard High-Availability deployment. For more information, see [Appendix A: Configuring PowerFlow for High Availability](#).
- For question A, if you answered **more than three** SL1 stacks to question A, consider configuring PowerFlow in a multi-tenant configuration. For more information, see [Appendix B: Configuring PowerFlow for Multi-tenant Environments](#).
- For question G, if you answered "Yes" to data replication restrictions, consider the following deployment options:
 - **Deploy separate PowerFlow clusters per region.** This deployment requires more management of PowerFlow clusters, but it ensures that the data is completely separated between regions. This deployment also ensures that if a single region goes down, you only lose operations for that region.
 - **Deploy a single PowerFlow cluster in the restrictive region.** This deployment is easier to manage, as you are only dealing with a single PowerFlow cluster. As an example, if Europe has a law that requires that data in Europe cannot be replicated to the United States, but that law does not prevent data from the United States from coming into Europe, you can deploy a single PowerFlow cluster in Europe to satisfy the law requirements.
- If you are deploying a multi-tenant configuration, check to see if your environment meets one the following:
 - **You have three or more data centers and the latency between each data center is less than 80 ms** (question E), consider deploying a multi-tenant PowerFlow where each node is in a separate data center to ensure data center resiliency. This deployment ensures that if a single data center goes down, PowerFlow will remain operational.

- **You have only two data centers and the latency between data centers is less than 80 ms,** consider deploying a multi-tenant PowerFlow where two nodes are in one data center and the other node is in the other data center. This deployment does not ensure data center resiliency, but it does provide standard High Availability if a single node goes down. If the data center with one node goes down, PowerFlow will remain operational. However, if the data center with two nodes goes down, PowerFlow will no longer remain operational.
- **You have only two data centers but the latency between data centers is more than 80 ms.** In this situation, you can still deploy a multi-tenant PowerFlow, but all nodes must be located in a single data center. This deployment still provides standard High Availability so that, if a single node goes down, the other two nodes ensure PowerFlow operations. If you require more resiliency than a single-node failure, you can deploy five nodes, which will ensure resiliency with two down nodes. However, if the data center goes down, PowerFlow will not be operational.
- **You only have one data center, you can still deploy a multi-tenant PowerFlow, but all nodes are located in a single data center.** This deployment still provides standard High Availability so that, if a single node goes down, the other two nodes ensure PowerFlow operations. If you require more resiliency than a single-node failure, you can deploy five nodes, which will ensure resiliency with two down nodes. However, if the data center goes down, PowerFlow will not be operational.

System Requirements

PowerFlow itself does not have specific minimum required versions for SL1 or AP2. However, certain Synchronization PowerPacks for PowerFlow have minimum version dependencies. Please see the documentation for those Synchronization PowerPacks for more information on those dependencies.

The following table lists the port access required by PowerFlow:

Source IP	PowerFlow Destination	PowerFlow Source Port	Destination Port	Requirement
PowerFlow	SL1 API	Any	TCP 443	SL1 API Access
SL1 Run Book Action	PowerFlow	Any	TCP 443	Send SL1 data to PowerFlow
Devpi	PowerFlow	Any	TCP 3141	Internal Python package repository for Synchronization PowerPacks; check for self-certification for PowerFlow
Dex Server	PowerFlow	Any	TCP 5556	Enable authentication for PowerFlow
PowerFlow	SL1 Database	Any	TCP 7706	SL1 Database Access
powerflowcontrol (pfctl, formerly called iservicecontrol) command-line utility	PowerFlow	Any	22 (on all host nodes)	Log in and perform admin tasks on nodes

Source IP	PowerFlow Destination	PowerFlow Source Port	Destination Port	Requirement
Encapsulated Security Protocol (ESP)	PowerFlow	IP Protocol 50	n/a	Security; ESP should be open and available between cluster nodes
Couchbase Dashboard	PowerFlow	8091	n/a	Couchbase Dashboard
RabbitMQ Dashboard	PowerFlow	15672	n/a	RabbitMQ Dashboard

ScienceLogic highly recommends that you disable all firewall session-limiting policies. Firewalls will drop HTTPS requests, which results in data loss.

CAUTION: PowerFlow clusters do not support vMotion or snapshots while the cluster is running. Performing a vMotion or snapshot on a running PowerFlow cluster will cause network interrupts between nodes, and will render clusters inoperable.

CAUTION: The site administrator is responsible for configuring the host, hardware, and virtualization configuration for the PowerFlow server or cluster. If you are running a cluster in a VMware environment, be sure to install open-vm-tools and disable vMotion.

IMPORTANT: You can configure one or more SL1 systems to use PowerFlow to sync with a *single* instance of a third-party application like ServiceNow or Cherwell. You cannot configure one SL1 system to use PowerFlow to sync with *multiple* instances of a third-party application like ServiceNow or Cherwell. The relationship between SL1 and the third-party application can be either one-to-one or many-to-one, but not one-to-many.

NOTE: The default internal network used by PowerFlow services is **172.21.0.1/16**. Please ensure that this range does not conflict with any other IP addresses on your network. If needed, you can change this subnet in the **docker-compose.yml** file.

TIP: For more information about system requirements for your PowerFlow environment, see the System Requirements page at the ScienceLogic Support site at <https://support.sciencelogic.com/s/system-requirements>.

Hardened Operating System

The operating system for PowerFlow is pre-hardened by default, with firewalls configured only for essential port access and all services and processes running inside Docker containers, communicating on a secure, encrypted overlay network between nodes. Please refer to the table, above, for more information on essential ports.

You can apply additional Linux hardening policies or package updates as long as Docker and its network communications are operational.

NOTE: The PowerFlow operating system is an Oracle Linux distribution, and all patches are provided within the standard Oracle Linux repositories. The patches are not provided by ScienceLogic.

Additional Prerequisites for PowerFlow

To work with PowerFlow, ScienceLogic recommends that you have knowledge of the following:

- Linux and vi (or another text editor).
- Python.
- Postman or another API tool for interacting with the PowerFlow API.
- Couchbase. For more information, see [Helpful Couchbase Commands](#).
- Docker. For more information, see [Helpful Docker Commands](#) and <https://docs.docker.com/engine/reference/commandline/cli/>.

NOTE: The most direct way of accessing the most recent containers of PowerFlow is by [downloading the latest RPM file](#) from the ScienceLogic Support Portal. As a separate option, you can also access the PowerFlow containers directly through Docker Hub. To access the containers through Docker Hub, you must have a Docker Hub ID and enable permissions to pull the containers from Docker Hub. To get permissions, contact your ScienceLogic Customer Success Manager.

Installing PowerFlow

You can install PowerFlow for the first time in the following ways:

- [Via ISO to a server on your network](#)
- [Via RPM to a cloud-based server](#)

If you are *upgrading* an existing version of the PowerFlow, see [Upgrading PowerFlow](#).

If you are installing PowerFlow in a clustered environment, see [Configuring the PowerFlow System for High Availability](#).

CAUTION: The site administrator is responsible for configuring the host, hardware, and virtualization configuration for the PowerFlow server or cluster. If you are running a cluster in a VMware environment, be sure to install open-vm-tools and disable vMotion.

Installing PowerFlow via ISO

Locating the ISO Image

To locate the PowerFlow ISO image:

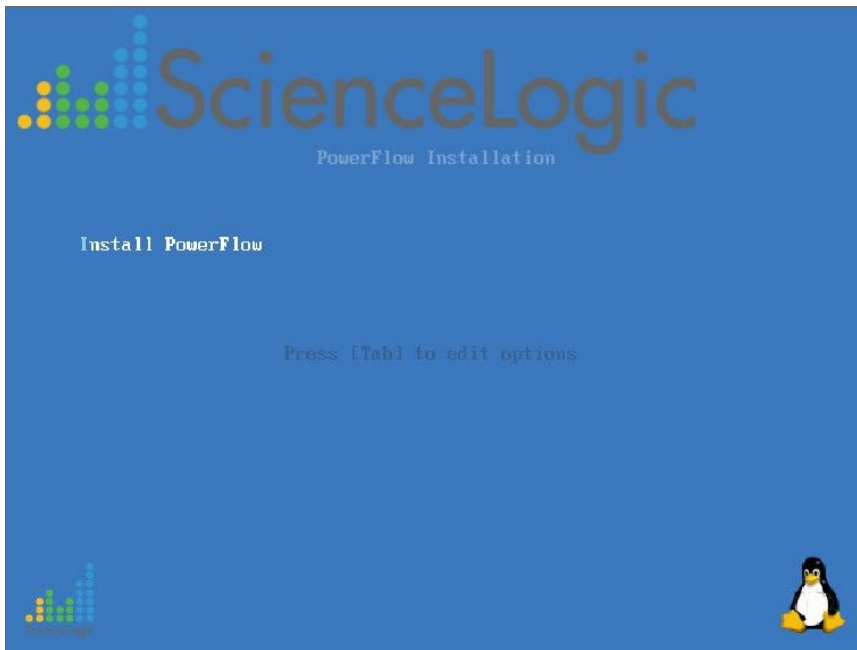
1. Go to the ScienceLogic Support site at <https://support.sciencelogic.com/s/>.
2. Click the **Product Downloads** tab and select *PowerFlow*. The **PowerFlow** page appears.
3. Click the link to the current release. The **Release Version** page appears.
4. In the **Release Files** section, click the ISO link for the PowerFlow image. A **Release File** page appears.
5. Click **[Download File]** at the bottom of the **Release File** page.

Installing from the ISO Image

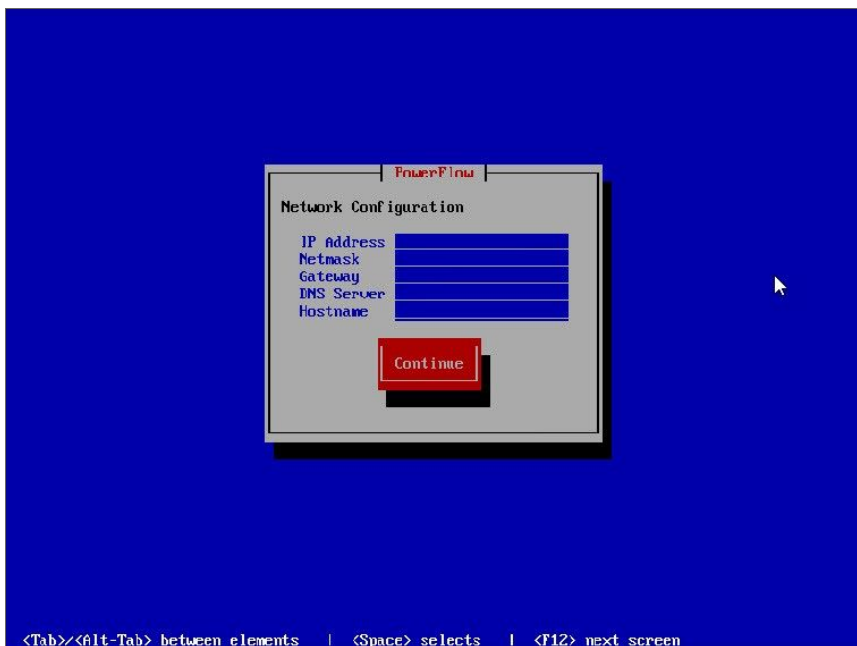
TIP: When installing PowerFlow from an ISO, you can now install open-vm-tools by selecting **Yes** to "Installing Into a VMware Environment" option during the installation wizard.

To install PowerFlow via ISO image:

1. Download the latest PowerFlow ISO file to your computer or a virtual machine center.
2. Using your hypervisor or bare-metal (single-tenant) server of choice, mount and boot from the PowerFlow ISO. The PowerFlow Installation window appears:



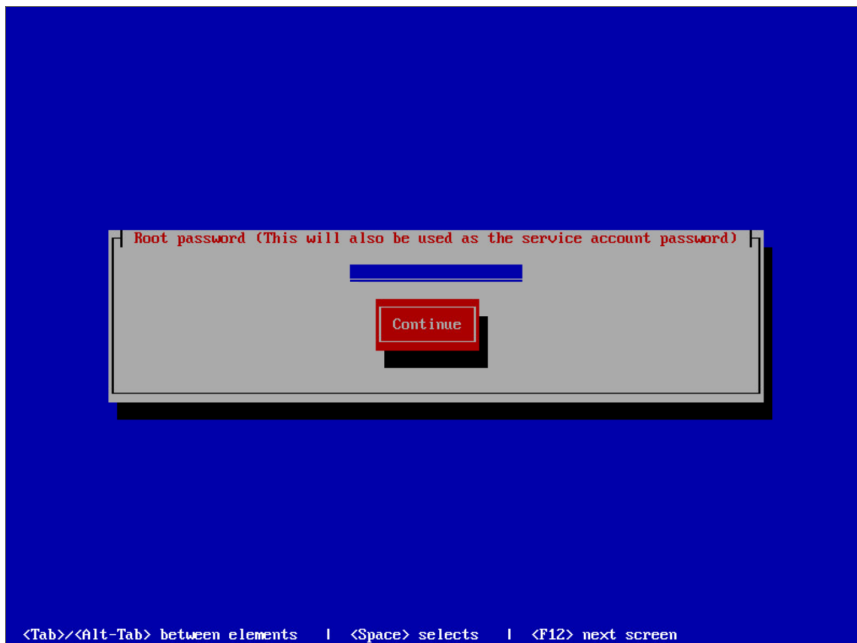
3. Select *Install PowerFlow*. After the installer loads, the **Network Configuration** window appears:



4. Complete the following fields:

- **IP Address.** Type the primary IP address of the PowerFlow server.
- **Netmask.** Type the netmask for the primary IP address of the PowerFlow server.
- **Gateway.** Type the IP address for the network gateway.
- **DNS Server.** Type the IP address for the primary nameserver.
- **Hostname.** Type the hostname for PowerFlow.

5. Press **[Continue]**. The **Root Password** window appears:



6. Type the password you want to set for the root user on the PowerFlow host (and the service account password) and press **[Enter]**. The password must be at least six characters and no more than 24 characters, and all special characters are supported.

NOTE: You use this password to log into the PowerFlow user interface, to SSH to the PowerFlow server, and to verify API requests and database actions. This password is set as both the "Linux host isadmin" user and in the `/etc/iservices/is_pass` file that is mounted into the PowerFlow stack as a "Docker secret". Because it is mounted as a secret, all necessary containers are aware of this password in a secure manner. For more information, see [Changing the PowerFlow Password](#).

7. Type the password for the root user again and press **[Enter]**. The PowerFlow installer runs, and the system reboots automatically. This process will take a few minutes.
8. After the installation scripts run and the system reboots, SSH into your system using PuTTY or a similar application. The default username for the system is `isadmin`.

- To start the Docker services, change directory to run the following commands:

```
cd /opt/iservices/scripts
./pull_start_iservices.sh
```

```
isadmin@dc2sisdcs01 ~1$ cd /opt/iservices/scripts
isadmin@dc2sisdcs01 scripts$ ls
compose_override.sh      is_gen_dex_auth_policy.pyc  ispasswd                      requirements.txt
docker-compose-override.yml  is_gen_dex_auth_policy.pyo  parse_task_times.py          swagger.yml
docker-compose.yml       is_gen_encryption_key.py    parse_task_times.pyc        system_updates
environment.sh           is_gen_encryption_key.pyc  parse_task_times.pyo        updatesets
is_gen_dex_auth_policy.py  is_gen_encryption_key.pyo  pull_start_iservices.sh
isadmin@dc2sisdcs01 scripts$ ./pull_start_iservices.sh
```

NOTE: This process will take a few minutes to complete.

- To validate that iservices is running, run the following command to view each service and the service versions for services throughout the whole stack:

```
docker service ls
```

- Navigate to the PowerFlow user interface using your browser. The address of the PowerFlow user interface is:

```
https://<IP address entered during installation>
```

- Log in with the default username of `isadmin` and the password you specified in step 6.
- After installation, you must license your PowerFlow system if you want to enable all of the features. For more information, see [Licensing PowerFlow](#).
- If you are setting up High Availability for the PowerFlow on a multiple-node cluster, see [Preparing the PowerFlow System for High Availability](#).

NOTE: The `HOST_ADDRESS` value in the `/etc/iservices/isconfig.yml` file should be the fully qualified domain name (FQDN) of either the host if there is no load balancer, or the FQDN of the load balancer if one exists. If you change the `HOST_ADDRESS` value, you will need to restart the PowerFlow stack.

Troubleshooting the ISO Installation

To verify that your stack is deployed, view your Couchbase logs by executing the following command:

```
docker service logs --follow iservices_couchbase
```

If no services are found to be running, run the following command to start them:

```
docker stack deploy -c docker-compose.yml iservices
```

To add or remove additional workers, run the following command:

```
docker service scale iservices_steprunner=10
```

Installing PowerFlow via RPM to a Cloud-based Environment

Considerations for the RPM Installation

- If you install the PowerFlow system on any operating system *other* than Oracle Linux 7, ScienceLogic will only support the running application and associated containers. ScienceLogic will not assist with issues related to host configuration for operating systems other than Oracle Linux 7.
- If you are deploying PowerFlow without a load balancer, you can only use the deployed IP address as the management user interface. If you use another node to log in to the PowerFlow system, you will get an internal server error. Also, if the deployed node is down, you must redeploy the system using the IP address for another active node to access the management user interface.
- The **HOST_ADDRESS** value in the `/etc/iservices/isconfig.yml` file should be the fully qualified domain name (FQDN) of either the host if there is no load balancer, or the FQDN of the load balancer if one exists. If you change the **HOST_ADDRESS** value, you will need to restart the PowerFlow stack.
- If you are installing the RPM in a cluster configuration, and you want to distribute traffic between the nodes, a load balancer is required.
- If you install the PowerFlow system in a cloud-based environment using a method other than an ISO install, you are responsible for setting up and configuring the requirements of the cloud-based environment.

Locating the RPM file

To locate the PowerFlow RPM file:

1. Go to the ScienceLogic Support site at <https://support.sciencelogic.com/s/>.
2. Click the **Product Downloads** tab and select *PowerFlow*. The **PowerFlow** page appears.
3. Click the link to the current release. The **Release Version** page appears.
4. In the **Release Files** section, click the RPM link for the PowerFlow image. A **Release File** page appears.
5. Click **[Download File]** at the bottom of the **Release File** page.

Installing from the RPM File

IMPORTANT: The following procedure describes how to install PowerFlow via RPM to Amazon Web Service (AWS) EC2. The **ec2-user** must belong to the **iservices** group.

You can also install PowerFlow on other cloud-based environments, such as Microsoft Azure. For other cloud-based deployments, the process is essentially the same as the following steps: PowerFlow provides the containers, and the cloud-based environment provides the operating system and server.

You can install PowerFlow on any Oracle Linux 7 or later operating system, even in the cloud, as long as you meet all of the operating system requirements. These requirements include CPU, memory, Docker and a **docker-compose** file installed, and open firewall settings. When these requirements are met, you can install the RPM and begin to deploy the stack as usual.

To install a single-node PowerFlow via RPM to a cloud-based environment (using AWS as an example):

1. In Amazon Web Service (AWS) EC2, click **[Launch instance]**. The **Choose an Amazon Machine Image (AMI)** page appears.

IMPORTANT: If you are installing PowerFlow to another cloud-based environment, such as Microsoft Azure, set up the operating system and server, and then go to step 7.

2. Deploy a new Oracle Linux 7.6 virtual machine by searching for **OL7.6-x86_64-HVM** in the **Search for an AMI** field.
3. Click the **results** link for Community AMIs.
4. Click **[Select]** for a virtual machine running Oracle Linux 7.6 or greater for installation. The following image shows an example of an **OL7.6-x86_64-HVM-*** AMI file:



5. From the **Choose an Instance Type** page, select at least a **t2.xlarge** AMI instance, depending on your configuration:
 - *Single-node deployments.* The minimum is **t2.xlarge** (four CPUs with 16 GB memory), and ScienceLogic recommends **t2.2xlarge** (8 CPUs with 32 GB memory).
 - *Cluster deployments.* Cluster deployments depend on the type of node you are deploying. Refer to the separate multi-tenant environment guide for more sizing information. ScienceLogic recommends that you allocate at least 50 GB or more for storage.
6. Go to the **Step 6: Configure Security Group** page and define the security group:
 - Only inbound port 443 needs to be exposed to any of the systems that you intend to integrate.
 - Port 8091 is exposed through *https*. ScienceLogic recommends that you make port 8091 available externally to help with troubleshooting:

Type ⓘ	Protocol ⓘ	Port Range ⓘ	Source ⓘ	Description ⓘ
Custom UDP Rule	UDP	8091	72.165.86.42/32	IS DB Admin Interf...
SSH	TCP	22	0.0.0.0/0	IS SSH access
Custom TCP Rule	TCP	8091	72.165.86.42/32	IS DB Admin interf...
HTTPS	TCP	443	0.0.0.0/0	IS HTTPS access

7. Upload the `sl1-powerflow-2.x.x-1.x86_64.rpm` file to the PowerFlow server using SFTP or SCP.
8. Enable the necessary repositories by running the following commands on the PowerFlow system:

```
sudo yum install yum-utils
sudo yum-config-manager --enable ol7_latest
sudo yum-config-manager --enable ol7_optional_latest
```

9. Run the following commands to update and install the host-level packages, and to upgrade to Python 3.6:

```
sudo yum remove python34-pip python34-setuptools python3
sudo yum --setopt=obsoletes=0 install python36-pip python36 python36-setuptools
python36-devel openssl-devel gcc make kernel
sudo yum update
sudo yum install python36-pip
```

10. Ensure that the latest required packages are installed by running the following commands on the server instance:

```
sudo yum install -y wget
sudo pip install --upgrade pip==20.2.4
sudo pip install docker-compose
wget https://download.docker.com/linux/centos/7/x86_64/stable/Packages/docker-
ce-19.03.5-3.el7.x86_64.rpm && sudo yum install docker-ce-19.03.5-3.el7.x86_
64.rpm
```

IMPORTANT: You might need to remove spaces from the code that you copy and paste from this manual. For example, in instances such as the `wget` command, above, line breaks were added to long lines of code to ensure proper pagination in the document.

NOTE: You will need to update both instances of the Docker version in this command if there is a more recent version of Docker CE on the Docker Download page:
https://download.docker.com/linux/centos/7/x86_64/stable/Packages/.

11. Create the Docker group:

```
sudo groupadd docker
```

12. Add your user to the Docker group:

```
sudo usermod -aG docker $USER
```

13. Log out and log back in to ensure that your group membership is re-evaluated.

14. Run the following commands for the configuration updates:

```
sudo setenforce 0
sudo vim /etc/sysconfig/selinux
SELINUX=permissive
sudo systemctl enable docker
sudo systemctl start docker
sudo yum install yum-utils
sudo yum-config-manager --enable ol7_addons ol7_optional_latest ol7_latest
sudo yum-config-manager --disable ol7_ociyum_config
wget http://dl.fedoraproject.org/pub/epel/epel-release-latest-7.noarch.rpm
sudo rpm -Uvh epel-release-latest-7*.rpm
sudo yum update
sudo pip install docker-compose
sudo yum install firewalld
systemctl enable firewalld
systemctl start firewalld
systemctl disable iptables
```

15. Run the following firewall commands as "sudo":

```
sudo firewall-cmd --add-port=2376/tcp --permanent
sudo firewall-cmd --add-port=2377/tcp --permanent
sudo firewall-cmd --add-port=7946/tcp --permanent
sudo firewall-cmd --add-port=7946/udp --permanent
sudo firewall-cmd --add-port=4789/udp --permanent
sudo firewall-cmd --add-protocol=esp --permanent
sudo firewall-cmd --reload
```

TIP: To view a list of all ports, run the following command: `firewall-cmd --list-all`

16. Copy the PowerFlow RPM to the instance of installation and install the RPM:

```
sudo yum install s11-powerflow
systemctl restart docker
```

17. Create a password for PowerFlow:

```
sudo printf <password> > /etc/iservices/is_pass
```

where <password> is a new, secure password.

18. Pull and start iservices to start PowerFlow:

```
/opt/iservices/scripts/pull_start_iservices.sh
```

IMPORTANT: For an AWS deployment, ScienceLogic recommends that you switch to an Amazon EC2 user as soon as possible instead of running all the commands on root.

NOTE: For a clustered PowerFlow environment, you must install the PowerFlow RPM on every server that you plan to cluster into PowerFlow. You can load the Docker images for the services onto each server locally by running `/opt/iservices/scripts/pull_start_iservices.sh`. Installing the RPM onto each server ensures that the PowerFlow containers and necessary data are available on all servers in the cluster.

After installation, you must license your PowerFlow system to enable all of the features. Licensing is required for production systems only, not for test systems. For more information, see [Licensing PowerFlow](#).

Troubleshooting a Cloud Deployment of PowerFlow

After completing the AWS setup instructions, if none of the services start and you see the following error during troubleshooting, you will need to restart Docker after installing the RPM installation.

```
sudo docker service ps iservices_couchbase --no-trunc
```

```
"error creating external connectivity network: Failed to Setup IP tables: Unable to enable SKIP DNAT rule: (iptables failed: iptables --wait -t nat -I DOCKER -i docker_gwbridge -j RETURN: iptables: No chain/target/match by that name.)"
```

Upgrading PowerFlow

ScienceLogic releases a major update to PowerFlow every six months. ScienceLogic also releases a monthly maintenance release (MMR) as needed to address major customer-facing bugs. If there are no major bugs to be addressed via MMR, the MMR will not be produced for the month. Security updates are included in an MMR only if an MMR is planned to be released.

IMPORTANT: You should always upgrade to the most recent release of PowerFlow.

Please note that you can use the latest RPM if you only need to upgrade the PowerFlow application.

If you need the most recent, stable version of the Oracle Linux 7 operating system (OS), you can upgrade by mounting the latest ISO to an existing PowerFlow system. If there are OS vulnerabilities discovered in PowerFlow, you will need to either patch the vulnerability yourself using `yum` or wait for the next PowerFlow ISO. For more information, see [Upgrading OS Packages \(for Offline Deployments Only\)](#).

NOTE: When a yum update is performed, there is no risk of PowerFlow operations being affected as long as Docker or networking services are not included in the updates.

Considerations for Upgrading PowerFlow

- If you made any modifications to the nginx configuration or to other service configuration files outside of the **docker-compose.yml** file, you will need to modify those custom configurations before upgrading, or contact ScienceLogic Support to prevent the loss of those modifications.
- If you are deploying PowerFlow without a load balancer, you can only use the deployed IP address as the management user interface. If you use another node to log in to the PowerFlow system, you will get an internal server error. Also, if the deployed node is down, you must redeploy the system using the IP address for another active node to access the management user interface.
- In PowerFlow 2.2.2 and older, the **gui** services could run on any node and provide traffic to the whole cluster. Starting with PowerFlow 2.3.0, Military Unique Deployment (MUD) system requirements required security updates. As a result, the **gui** services must run only on the nodes that are receiving the initial requests. The **gui** services have to be running on the nodes to which the load balance is routing, or the **host_address**.
- After upgrading to this version of PowerFlow, ensure that the PowerFlow platform is stable and that you do not wish to roll back to a previous version before you start installing or updating Synchronization PowerPacks. After you update the content on the PowerFlow platform, rolling back to a previous platform version requires restoring from a backup. You can roll back PowerFlow versions, but you should not roll back the database version.

Deploying PowerFlow as a MUD System (Optional)

Starting with PowerFlow version 2.3.0, you can deploy PowerFlow as a Military Unique Deployment (MUD) system. Please note the following criteria:

- You cannot convert a 2.3.0 or later non-MUD PowerFlow system to a MUD system.
- If you want to upgrade from an older (non-MUD) PowerFlow system to a MUD system, you will need to run a backup and restore to the new deployment.
- Upgrading from a 2.2.x system to a 2.3.0 or later non-MUD system is fully supported.

Steps for Upgrading PowerFlow

1. [Validate the cluster configuration](#)
2. [Locate the RPM or ISO file for upgrading](#)
3. [Upgrade OS packages \(for offline deployments only\)](#)
4. [Download updates to address common vulnerabilities and exposures \(CVEs\)](#)
5. [Install the audit package for audit logging](#)
6. [Upgrade from version 2.2.0 or later](#) (choose one of the following):
 - [Single-node upgrade](#)
 - [Cluster upgrade with short downtime](#)
 - [Rolling cluster upgrade with no downtime](#)

Validating the Cluster Configuration

Perform the following tasks to ensure the cluster configuration is valid for this version of PowerFlow:

1. Ensure that the GUI service is constrained to, and is running, the nodes that are expected to receive traffic.
2. After the system is running, run the **powerflowcontrol** (pfctl) **healthcheck** and **autoheal** actions to address any missed role-based access control (RBAC) or index updates included with this version.
3. If your system is using a Load Balancer, update the settings to forward traffic for Couchbase (:8091) and RabbitMQ (:15672). Review the example configuration generated by the following command:

```
pfctl --host <host_IP> user:pass cluster-action --action generate_haproxy_config
```

where *<host_IP>* is the IP address of the host.
4. If your system is using a Load Balancer, open up firewall ports to accept traffic via 8091 and 15672 on the Load Balancer.

Locating the RPM or ISO File for Upgrading

CAUTION: As a best practice, you should *always* upgrade to the most recent version of PowerFlow that is currently available at <https://support.sciencelogic.com/s/>. Versions of PowerFlow before version 2.2.0 are no longer supported by ScienceLogic.

To locate and download the PowerFlow RPM file:

1. Go to the ScienceLogic Support site at <https://support.sciencelogic.com/s/>.
2. Click the **Product Downloads** tab and select *PowerFlow*. The **PowerFlow** page appears.
3. Click the link to the current release. The **Release Version** page appears.

4. In the **Release Files** section, click the RPM or ISO link. A **Release File** page appears.
5. Click **[Download File]** at the bottom of the **Release File** page.

Upgrading OS Packages (for Offline Deployments Only)

Upgrading OS packages for an offline deployment require you to mount the ISO and update the packages that are shipped with the ISO.

TIP: Mounting the ISO and upgrading via the ISO in this way is the same process as running a `yum update` with an Internet connection.

1. Mount the PowerFlow ISO onto the system:

```
mount -o loop /dev/cdrom /mnt/tmpISMount
```

2. After you mount the ISO, add a new repository file to access the ISO as if it were a yum repository. Create a `/etc/yum.repos.d/localiso.repo` file with the following contents:

```
[localISISOMount]
name=Locally mounted IS ISO for packages
enabled=1
baseurl=file:///mnt/tmpISMount
gpgcheck=0
```

After you create and save this file, the Linux system can install packages from the PowerFlow ISO.

3. Optionally, you can import the latest GNU Privacy Guard (GPG) key to verify the packages by running the following commands:

```
rpm --import /mnt/repo_keys/RPM-GPG-KEY-Oracle
rpm --import /mnt/tmpISMount/repo_keys/RPM-GPG-KEY-Docker-ce
rpm --import /mnt/tmpISMount/repo_keys/RPM-GPG-KEY-EPEL-7
```

4. Run the following command to update and install the host-level packages:

```
yum update
```

Downloading Updates to Address Common Vulnerabilities and Exposures (CVEs)

This release includes updates that address the common vulnerabilities and exposures (CVEs) identified since the last release of PowerFlow. If you are using PowerFlow version 2.3.0 or older, you can run a `sudo yum update` to address these CVEs.

If you do not have Internet access to the Oracle Linux 7 repos used by the `yum update`, you can manually download the packages directly from the repository links below and copy them to your PowerFlow system:

- https://yum.oracle.com/repo/OracleLinux/OL7/latest/x86_64/getPackage/glibc-2.17-325.0.3.el7_9.x86_64.rpm
- https://yum.oracle.com/repo/OracleLinux/OL7/latest/x86_64/getPackage/glibc-common-2.17-325.0.3.el7_9.x86_64.rpm
- https://yum.oracle.com/repo/OracleLinux/OL7/latest/x86_64/getPackage/glibc-devel-2.17-325.0.3.el7_9.x86_64.rpm
- https://yum.oracle.com/repo/OracleLinux/OL7/latest/x86_64/getPackage/glibc-headers-2.17-325.0.3.el7_9.x86_64.rpm

Installing the Audit Package for Audit Logging

To upgrade to the latest version of PowerFlow from version 2.2.0 or later, you will need to install the audit package used for audit logging in the latest release.

1. If your PowerFlow system is connected to the Internet, run the following command to download and install the audit package:

```
sudo yum install pf-iso
```

2. If your PowerFlow system is *not* connected to the Internet, you can upgrade using the packages on the ISO file:

a. Mount the 2.x.x ISO file onto your PowerFlow system by running the relevant `mount` command for your system. For example:

```
mount -o loop /home/isadmin/2.x.x.iso /home/isadmin/2.x.xiso-iso-mount-point/
```

where `/home/isadmin/2.x.x.iso` is the path to your ISO file that you have uploaded, and `/home/isadmin/2.x.xiso-iso-mount-point/` is the directory created for the purposes of mounting the ISO locally.

b. Run the following commands:

```
sudo yum install 2.x.xiso-iso-mount-point/audit-2.8.5-4.el7.x86_64.rpm
```

```
sudo yum install 2.x.xiso-iso-mount-point/audit-libs-2.8.5-4.el7.x86_64.rpm
```

```
sudo yum install 2.x.xiso-iso-mount-point/audit-libs-python-2.8.5-4.el7.x86_64.rpm
```

c. Create the following file: **`/etc/yum.repos.d/local-yum-repo.repo`**.

d. Add the following lines to the new **`local-yum-repo.repo`** file:

```
[local-yum-repo]
name=yum repo from mounted ISO
baseurl=file:///mnt/tmp_install_mount/
enabled=1
gpgcheck=0
```

e. Run the following command:

```
sudo yum update --disablerepo=* --enablerepo=local-yum-repo
```

3. You can also manually download and install the audit package from the following links:

- https://yum.oracle.com/repo/OracleLinux/OL7/latest/x86_64/getPackage/audit-2.8.4-4.el7.x86_64.rpm
- https://yum.oracle.com/repo/OracleLinux/OL7/latest/x86_64/getPackage/audit-libs-2.8.4-4.el7.x86_64.rpm
- https://yum.oracle.com/repo/OracleLinux/OL7/latest/x86_64/getPackage/audit-libs-python-2.8.4-4.el7.x86_64.rpm

4. Continue to the following procedure, which is the standard upgrade process used in previous releases.

Upgrading from Version 2.2.0 or Later

Depending on your PowerFlow environment and your company's requirements, select one of the following upgrade options:

- [Single-node Upgrade](#)
- [Cluster Upgrade with Short Downtime](#)
- [Rolling Cluster Upgrade with No Downtime](#)

WARNING: When you are upgrading to version 2.3.0 or later, you must perform the steps in the following procedure, in order, to ensure a proper upgrade.

Single-node Upgrade

To upgrade a single-node PowerFlow system from version 2.2.0 or later:

1. Make a copy of the **docker-compose** file that you used to deploy PowerFlow (in case you need to roll back to the previous version).
2. Either go to the console of the PowerFlow system or use SSH to access the server.
3. Log in as **isadmin** with the appropriate (root) password. You must be root to upgrade using the RPM file.
4. Download the PowerFlow RPM and copy the RPM file to the PowerFlow system.
5. Type the following at the command line:

```
sudo rpm -Uvh <full_path_of_rpm>
```

where *full_path_of_rpm* is the name and path of the RPM file, such as **/home/isadmin/sl1-powerflow-2.x.x-1.x86_64**.

6. After the RPM is installed, run the following Docker command:

```
docker stack rm iservices
```

After you run this command, the stack is no longer running.

NOTE: If you want to upgrade your services in place, without bringing them down, you may skip this step. Please note that skipping this step might cause the services to take longer to update.

7. *If the upgrade process recommends restarting Docker*, run the following command:

```
systemctl restart docker
```

NOTE: If you restart Docker for this step, you should skip step 10, below.

8. Re-deploy the Docker stack to update the containers:

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

9. After you re-deploy the Docker stack, the services automatically update themselves. Wait a few minutes to ensure that all services are updated and running before using the system.

10. *If the upgrade process recommends restarting Docker*, run the following command:

```
systemctl restart docker
```

WARNING: If you restarted Docker after the RPM was installed and before the stack was redeployed with the new **docker-compose** file, you can run the following **powerflowcontrol** (pfctl) action to correct potential upgrade issues:

```
pfctl --host pf-node-ip '<username>:<password>' node-action --action modify_
iservices_volumes_owner
```

WARNING: After you run the above **pfctl** action, you will need to restart the **syncpacks_**
steprunner service.

11. To view updates to each service and the service versions for services throughout the whole stack, type the following at the command line:

```
docker service ls
```

Each service now uses the new version of PowerFlow.

Cluster Upgrade with Short Downtime

If you are running PowerFlow in a clustered environment, you should install the RPM on all nodes in the cluster for the upgrade. The order in which you install the RPM on the nodes does not matter. Installing the RPM on each node simply makes the latest PowerFlow container images and scripts available to the system.

Please note that installing the RPM on the nodes does not change the version of the currently running PowerFlow application stack. The new version of PowerFlow is only deployed when you run the `docker stack deploy` command on the new **docker-compose** file that is generated after you install the RPM.

The following upgrade procedure for a clustered PowerFlow environment results in only five to ten minutes of downtime.

For more information, including extensive examples, see [PowerFlow Multi-tenant Upgrade Process](#) in *Appendix B: Configuring the PowerFlow System for Multi-tenant Environments*.

To perform a cluster upgrade with short downtime:

1. Make a copy of the **docker-compose** file that you used to deploy PowerFlow (in case you need to roll back to the previous version).
2. Use SSH to access the node.
3. Log in as **isadmin** with the appropriate (root) password. You must be root to upgrade using the RPM file.
4. Copy the RPM file to each node.
5. Install the RPM on all nodes in the cluster by typing the following command at the command line for each node:

```
sudo rpm -Uvh <full_path_of_rpm>
```

where *full_path_of_rpm* is the name and path of the RPM file, such as **/home/isadmin/sl1-powerflow-2.x.x-1.x86_64**. For more information, see [Installing the PowerFlow RPM](#).

NOTE: Installing the RPM on all the nodes makes the containers available and updates the **docker-compose** file on each node, but the existing PowerFlow version will continue running.

6. After you have installed the RPM on all of the nodes, open the new **docker-compose.yml** file at **/opt/iservices/scripts/** and confirm that the versions of Couchbase, RabbitMQ, and any custom workers are using the latest, updated version numbers.
7. After the RPM is installed on the nodes, run the following Docker command:

```
docker stack rm iservices
```

After you run this command, the stack is no longer running.

NOTE: If you want to upgrade your services in place, without bringing them down, you may skip this step. Please note that skipping this step might cause the services to take longer to update.

8. **If the upgrade process recommends restarting Docker**, run the following command:

```
systemctl restart docker
```

NOTE: If you restart Docker for this step, you should skip step 11, below.

9. Re-deploy the Docker stack with the **docker-compose** file you reviewed in step 6:

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

The time between removing the old version of the stack and deploying the new version of the stack is the only period of down time.

10. After you re-deploy the Docker stack, the services automatically update themselves. Wait a few minutes to ensure that all services are updated and running before using the system.
11. **If the upgrade process recommends restarting Docker**, run the following command:

```
systemctl restart docker
```

WARNING: If you restarted Docker after the RPM was installed and before the stack was redeployed with the new **docker-compose** file, you can run the following **powerflowcontrol** (pfctl) action to correct potential upgrade issues. This node-action should be run over all of the cluster nodes, including the manager and worker nodes:

```
pfctl --host pf-node1-ip -host pf-node2-ip .. .. '<username>:<password>'  
node-action --action modify_iservices_volumes_owner
```

WARNING: After you run the above **pfctl** action, you will need to restart the **syncpacks_steprunner** service.

12. To view updates to each service and the service versions for services throughout the whole stack, type the following at the command line:

```
docker service ls
```

Each service now uses the new version of PowerFlow.

Rolling Cluster Upgrade with No Downtime

For a clustered PowerFlow environment, the following rolling cluster update results in no downtime, but the process requires intermediate compose updates.

For more information, including extensive examples, see [PowerFlow Multi-tenant Upgrade Process](#) in *Appendix B: Configuring the PowerFlow System for Multi-tenant Environments*.

To perform a rolling cluster upgrade with no downtime:

1. Make a copy of the **docker-compose** file that you used to deploy PowerFlow (in case you need to roll back to the previous version).
2. Use SSH to access the node.
3. Log in as **isadmin** with the appropriate (root) password. You must be root to upgrade using the RPM file.
4. Copy the RPM file to each node.

5. Install the RPM on all nodes in the cluster by typing the following command at the command line for each node:

```
sudo rpm -Uvh full_path_of_rpm
```

where *full_path_of_rpm* is the name and path of the RPM file, such as `/home/isadmin/sl1-powerflow-2.x.x-1.x86_64`. For more information, see [Installing the PowerFlow RPM](#).

NOTE: Installing the RPM on all the nodes makes the containers available and updates the **docker-compose** file on each node, but the existing PowerFlow version will continue running.

6. After the RPM is installed on the nodes, remove the "core nodes" one by one to cause a failover, and then re-add a new version of the same node without taking down the stack:
 - a. Access the Couchbase user interface at <https://<IP of PowerFlow>:8091>.
 - b. On the **[Servers]** tab, select a single database node and click **Failover**. Select **Graceful Failover**. Manually failing over before updating ensures that the system is still operational when the container comes down.
 - c. Modify the `/opt/iservices/scripts/docker-compose.yml` file at that you used to deploy PowerFlow, and change just one of the Couchbase services to use the new version (the same Couchbase server you previously failed over).
 - d. Deploy the **docker-compose** file with the new updated Couchbase server.
 - e. Wait for the new instance of Couchbase to join the existing cluster as the latest version. When it has joined, that core node is updated.
7. Continue failing over nodes and re-deploying them with the new PowerFlow version until all core nodes are updated.
8. After the core nodes are updated, you can proceed similarly with each individual worker nodes. You can update these nodes in groups if that is faster. You do not need to fail over the worker nodes; you can just change the services and images.
9. At the end of the node-by-node upgrade, your existing **docker-compose** should contain all of the new versions specified by the latest **docker-compose** file shipped with the RPM.

Troubleshooting the Upgrade from Version 2.2.0 or Later

After upgrading to version 2.4.0 or later, you might encounter an issue with a missing role-based access control (RBAC) permission that prevents the PowerFlow user interface from accessing Flower or RabbitMQ.

You can resolve this scenario by running one of the following steps:

- If you just upgraded to PowerFlow version 2.4.0, run this **powerflowcontrol** (pfctl) command:

```
pfctl --host <ip_address> <username>:<password> node-action --action upload_default_content
```

- For PowerFlow version 2.4.1 and later, run the pfctl **healthcheck** and **autoheal** actions.

For more information, see [Using the powerflowcontrol \(pfctl\) Command-line Utility](#).

Uploading Custom Dependencies to the PyPI Server with the iscli Tool

You can use the PowerFlow command-line tool (iscli) to upload custom dependencies to the PowerFlow local Python Package Index (PyPI) Server:

1. Copy the Python package to the pypiserver container.
2. Exec into the container and run the following commands:

```
devpi login isadmin
devpi use http://127.0.0.1:3141/isadmin/dependencies
devpi upload <location of your package dependencies>
```

Troubleshooting Upgrade Issues

The following topics describe issues that might occur after the upgrade to version 2.2.0 or later, and how to address those issues.

Cannot mount the virtual environment, or the virtual environment is not accessible

If the docker container does not properly mount the virtual environment, or the virtual environment is not accessible to the environment, you might need to remove and re-deploy the service to resolve the issue.

After upgrading, the syncpack_steprunner fails to run

This error flow tends to happen when the syncpack_steprunner is deployed, but the database is not yet updated with the indexes necessary for the Synchronization PowerPack processes to query the database. In most deployments, the index should be automatically created. If the index is not automatically created, which it might do in a clusterd configuration, you can resolve this issue by manually creating the indexes.

In this situation, if you check the logs, you will most likely see the following message:

```
couchbase.exceptions.HTTPError: <RC=0x3B[HTTP Operation failed. Inspect status code for details], HTTP Request failed. Examine 'objextra' for full result, Results=1, C Source=(src/http.c,144), OBJ=ViewResult<rc=0x3B[HTTP Operation failed. Inspect status code for details], value={'requestID': '57ad959d-bafb-46a1-9ede-f80f692b0dd7', 'errors': [{'code': 4000, 'msg': 'No index available on keyspace content that matches your query. Use CREATE INDEX or CREATE PRIMARY INDEX to create an index, or check that your expected index is online.'}], 'status': 'fatal', 'metrics': {'elapsedTime': '5.423085ms', 'executionTime': '5.344487ms', 'resultCount': 0, 'resultSize': 0, 'errorCount': 1}}, http_status=404, tracing_context=0, tracing_output=None>, Tracing Output={"nokey:0": null}>
```

To address this issue, wait a few minutes for the index to be populated. If you are still getting an error after the database has been running for a few minutes, you can manually update the indexes by running the following command:

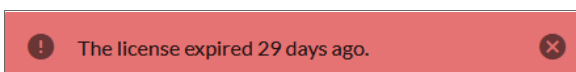
```
initialize_couchbase -s
```

NOTE: Creating a primary index is only for troubleshooting, and primary indexes should not be left on the system.

Licensing PowerFlow

Before users can access all of the features of PowerFlow, the *Administrator* user must license the PowerFlow instance through the ScienceLogic Support site. For more information about accessing PowerFlow files at the ScienceLogic Support site, see the following Knowledge Base article: [SL1 PowerFlow Download and Licensing](#).

When you log in to the PowerFlow system, a notification appears at the bottom right of the screen that states how much time is left in your PowerFlow license. The notification displays with a green background if your license is current, yellow if you have ten days or less in your license, and red if your license has expired. You need to click the Close icon (X) to close this notification.



You can also track your licensing information on the **About** page (username menu > About). You can still log into a system with an expired license, but you cannot create or schedule PowerFlow applications.

NOTE: The administrator and all users cannot access certain production-level capabilities until the administrator licenses the instance. For example, users cannot create schedules or upload PowerFlow applications and steps that are not part of a Synchronization PowerPack until PowerFlow has been licensed.

TIP: If you are not deploying PowerFlow on a production or pre-production environment, you can skip the licensing process.

NOTE: If you are licensing a PowerFlow High Availability cluster, you can run the following licensing process on any node in the cluster. The node does not have to be the leader, and the licensing process does not have to be run on all nodes in the Swarm.

Licensing a PowerFlow System

To license a PowerFlow system:

1. Run the following command on your PowerFlow system to generate the **.iskey** license file:

```
iscli --license --customer "<user_name>" --email <user_email>
```

where *<user_name>* is the first and last name of the user, and *<user_email>* is the user's email address. For example:

```
iscli --license --customer "John Doe" --email jdoe@sciencelogic.com
```

2. Run an `ls` command to locate the new license file: **customer_key.iskey**.
3. Using WinSCP or another utility, copy the **.iskey** license file to your local machine.
4. Go to the **PowerFlow License Request** page at the ScienceLogic Support site: <https://support.sciencelogic.com/s/integration-service-license-request>:

Step 1: Generate License File
Please generate an iskey license file on your integration service using the following iscli command:

```
iscli --license --customer "Tim May" --email tmay@sciencelogic.com
```

Once generated, please retrieve the iskey file from the current working directory and upload the file in Step 3.

Step 2: Select an Integration Service to License

IS License Testing Status: Available to License Version: 1.84 Contract Dates: 12/17/2019 to 12/17/2020	New IS4 For Licensing Status: Available to License Version: Unknown Contract Dates: 1/9/2020 to 1/16/2020
Test Already Licensed IS Status: Available to License Version: Unknown Contract Dates: 12/17/2019 to 12/17/2020	

Step 3: Upload License File
Please upload the key file generated by the above commands.

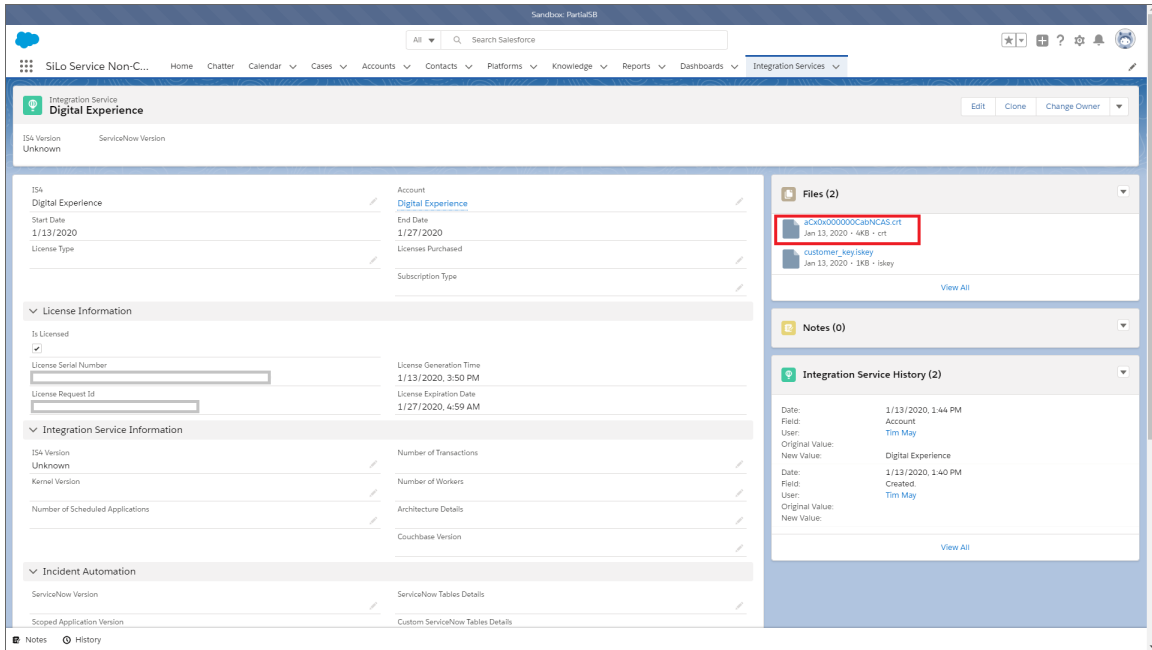
Or drop files

5. For Step 2 of the "Generate License File" process, select the PowerFlow record you want to license.

TIP: You already covered Step 1 of the "Generate License File" process in steps 1-3 of this procedure.

6. Scroll down to Step 3 of the "Generate License File" process and upload the **.iskey** license file you created in steps 1-3 of this procedure.
7. Click **[Upload Files]**.

- After uploading the license file, click **[Generate PowerFlow License]**. A new **Licensing** page appears:



- Click the **.crt** file in the **Files** pane to download the new **.crt** license file.
- Using WinSCP or another file-transfer utility, copy the **.crt** license file to your PowerFlow system.
- Upload the **.crt** license file to the PowerFlow server by running the following command on that server:

```
iscli -l -u -f ./<license_name>.crt -H <IP_address> -U <user_name> -p <user_password>
```

where *<license_name>* is the system-generated name for the **.crt** file, *<IP_address>* is the IP address of the PowerFlow system, *<user_name>* is the user name, and *<user_password>* is the user password. For example:

```
iscli -l -u -f ./aCx0x000000CabNCAS.crt -H 10.2.33.1 -U isadmin -p passw0rd
```

NOTE: ScienceLogic determines the duration of the license key, not the customer.

TIP: If you have any issues licensing your PowerFlow system, please contact your ScienceLogic Customer Success Manager (CSM) or open a new Service Request case under the "Integration Service" category.

Licensing Solution Types

The licensing for the PowerFlow platform was separated into three solution types:

- **Standard:** This solution lets you import and install Synchronization PowerPacks published by ScienceLogic and ScienceLogic Professional Services, and to run and schedule PowerFlow applications from those Synchronization PowerPacks. You cannot customize or create PowerFlow applications or steps with this solution type. Features that are not available display in gray text in the user interface.
- **Advanced:** This solution contains all of the Standard features, and you can also build your own Synchronization PowerPacks and upload custom applications and steps using the command-line interface. You can create PowerFlow applications using the PowerFlow command-line interface, but you cannot create and edit applications or steps using the PowerFlow builder in the user interface.
- **Premium:** This solution contains all of the Advanced features, and you can also use the PowerFlow builder, the low-code/no-code, drag-and-drop interface, to create and edit PowerFlow applications and steps.

A yellow text box appears in the PowerFlow user interface when the license is close to expiring, displaying how many days are left before the license expires. The license status and expiration date also displays on the **About** page in the PowerFlow user interface.

An unlicensed system will not be able to create PowerFlow applications, steps, or schedules. Unlicensed systems will only be able to run applications that are installed manually through Synchronization PowerPacks.

Features that are locked by licensing solution type are grayed out. If you click on a grayed-out feature, the user interface will display a notification prompting you to upgrade your license.

Configuring a Proxy Server

To configure PowerFlow to use a proxy server:

1. Either go to the console of the PowerFlow system or use SSH to access the PowerFlow server.
2. Log in as *isadmin* with the appropriate password.
3. Using a text editor like *vi*, edit the file `/opt/iservices/scripts/docker-compose-override.yml`.

NOTE: PowerFlow uses a `docker-compose-override.yml` file to persistently store user-specific configurations for containers, such as proxy settings, replica settings, additional node settings, and deploy constraints. The user-specific changes are kept in this file so that they can be re-applied when the `/opt/iservices/scripts/docker-compose.yml` file is completely replaced on an RPM upgrade, ensuring that no user-specific configurations are lost.

4. In the **environment** section of the **steprunner** service, add the following lines:

```
services:
  steprunner:
    environment:
      https_proxy: "<proxy_host>"
      http_proxy: "<proxy_host>"
      no_proxy: ".isnet"
```

WARNING: If your proxy appears to only use HTTP and not HTTPS, you will need to use `http` in both `https_proxy` environment variables.

TIP: If you do not want to use more than one proxy location, you can use the `no_proxy` setting to specify all of the locations, separated by commas and surrounded by quotation marks. For example: `no_proxy: ".isnet,10.1.1.100,10.1.1.101"`

NOTE: If you want to access external pypi packages while using a proxy, be sure to include `pypi.org` and `files.pythonhosted.org` to this section to ensure the proxy enables those locations.

5. In the **environment** section of the **syncpack_steprunner** service, add the following lines:

```
services:
  syncpack_steprunner:
    environment:
      https_proxy: "<proxy_host>"
      http_proxy: "<proxy_host>"
      no_proxy: ".isnet"
```

WARNING: If your proxy appears to only use HTTP and not HTTPS, you will need to use `http` in both `https_proxy` environment variables.

NOTE: If you want to access external pypi packages while using a proxy, be sure to include `pypi.org` and `files.pythonhosted.org` to this section to ensure the proxy enables those locations.

6. Save the settings in the file and then run the `/opt/iservices/scripts/compose_override.sh` script.

NOTE: The `compose_override.sh` script validates that the configured `docker-compose.yml` and `docker-compose-override.yml` files are syntactically correct. If the settings are correct, the script applies the settings to your existing `docker-compose.yml` file that is used to actually deploy.

7. Re-deploy the steprunners to use this change by typing the following commands:

```
docker service rm iservices_steprunner
docker stack deploy -c /opt/iservices/scripts/docker-compose.yml iservices
```

Changing the PowerFlow System Password

The PowerFlow system uses two primary passwords. For consistency, both passwords are the same after you install PowerFlow, but you can change them to separate passwords as needed.

PowerFlow uses the following passwords:

- **The PowerFlow Administrator (*isadmin*) user password.** This is the password that you set during the PowerFlow [ISO installation process](#), and it is only used by the default local Administrator user (*isadmin*). You use this password to log into the PowerFlow user interface and to verify API requests and database actions. This password is set as both the "Linux host *isadmin*" user and in the `/etc/iservices/is_pass` file that is mounted into the PowerFlow stack as a "Docker secret". Because it is mounted as a secret, all necessary containers are aware of this password in a secure manner. Alternatively, you can enable third-party authentication, such as LDAP or AD, and authenticate with credentials other than *isadmin*. However, you will need to set the user policies for those LDAP users first with the default *isadmin* user. For more information, see [Managing Users in PowerFlow](#).
- **The Linux Host OS SSH password.** This is the password you use to SSH and to log in to *isadmin*. You can change this password using the standard Linux `passwd` command or another credential management application to manage this user. You can also disable this Linux user and add your own user if you want. The PowerFlow containers and applications do not use or know this Linux login password, and this password does not need to be the same between nodes in a cluster. This is a standard Linux Host OS password.

To change the PowerFlow Administrator (*isadmin*) user password:

1. You can change the mounted *isadmin* password secret (which is used to authenticate via API by default) and the Couchbase credentials on the PowerFlow stack by running the `ispasswd` script on any node running PowerFlow in the stack:

```
/opt/iservices/scripts/ispasswd
```

2. Follow the prompts to reset the password. The password must be at least six characters and no more than 24 characters, and all special characters are supported.

NOTE: Running the `ispasswd` script automatically changes the password for all PowerFlow application actions that require credentials for the `isadmin` user.

3. If you have multiple nodes, copy `/etc/iservices/is_pass` file, which was just updated by the `ispasswd` script, to all other manager nodes in the cluster. You need to copy this password file across all nodes in case you deploy from a different node than the node where you changed the password. The need to manually copy the password to all nodes will be removed in a future release of PowerFlow.

NOTE: If a PowerFlow user makes multiple incorrect login attempts, PowerFlow locks out the user. To unlock the user, run the following command: `unlock_user -u <username>`

Configuring Security Settings

This topic explains how to change the HTTPS certificate used by PowerFlow, and it also describes password and encryption key security.

Changing the HTTPS Certificate

The PowerFlow user interface only accepts communications over HTTPS. By default, HTTPS is configured using an internal, self-signed certificate.

You can specify the HTTPS certificate to use in your environment by mounting the following two files in the user interface (`gui`) service:

- `/etc/iservices/is_key.pem`
- `/etc/iservices/is_cert.pem`

The SSL certificate for the PowerFlow system only requires the **HOST_ADDRESS** field to be defined in the certificate. That certificate and key must be identical across all nodes. If needed, you can also add non-HOST_ADDRESS IPs to the **Subject Alternative Name** field to prevent an insecure warning when visiting the non-HOST_ADDRESS IP.

NOTE: If you are using a load balancer, the certificates installed on the load balancer should use and provide the hostname for the load balancer, not the PowerFlow nodes. The SSL certificates should always match the IP or hostname that exists in the **HOST_ADDRESS** setting in `/etc/iservices/isconfig.yml`. If you are using a load balancer, the **HOST_ADDRESS** must also be the IP address for the load balancer.

NOTE: If you are using a clustered configuration for PowerFlow, you will need to copy the key and certificate to the same location on the node.

To specify the HTTPS certificate to use in your environment:

1. Copy the key and certificate to the PowerFlow host.
2. Modify the `/opt/iservices/scripts/docker-compose-override.yml` file and mount a volume to the gui service. The following code is an example of the volume specification:

```
volumes:  
  - "<path to IS key>:/etc/iservices/is_key.pem"  
  - "<path to IS certificate>:/etc/iservices/is_cert.pem"
```

3. Run the following script to validate and apply the change:

```
/opt/iservices/scripts/compose_override.sh
```

4. Re-deploy the gui service by running the following commands:

```
docker service rm iservices_gui  
  
/opt/iservices/scripts/pull_start_iservices.sh
```

Using Password and Encryption Key Security

When you install the PowerFlow platform, you specified the PowerFlow root password. This root password is also the default `isadmin` password:

- The root/admin password is saved in a root read-only file here: `/etc/iservices/is_pass`
- A backup password file is also saved in a root read-only file here: `/opt/iservices/backup/is_pass`

The user-created root password is also the default PowerFlow password for couchbase (:8091) and all API communications. The PowerFlow platform generates a unique encryption key for every platform installation:

- The encryption key exists in a root read-only file here: `/etc/iservices/encryption_key`
- A backup encryption key file is also saved in a root read-only file here:
`/opt/iservices/backup/encryption_key`

NOTE: This encryption key is different from the HTTPS certificate key discussed in the previous topic.

You can use the encryption key to encrypt all internal passwords and user-specified data. You can encrypt any value in a configuration by specifying `"encrypted": true`, when you POST that configuration setting to the API. There is also an option in the PowerFlow user interface to select `encrypted`. Encrypted values use the same randomly-generated encryption key.

User-created passwords and encryption keys are securely exposed in the Docker containers using Docker secrets at <https://docs.docker.com/engine/swarm/secrets/> to ensure secure handling of information between containers.

NOTE: The encryption key must be identical between two PowerFlow systems if you plan to migrate from one to another. The encryption key must be identical between High Availability or Disaster Recovery systems as well.

TIP: PowerFlow supports all special characters in passwords.

NOTE: For detailed security information about the configuration of Docker Enterprise, see the *SL 1 PowerFlow: System Security Plan for Docker Enterprise* document.

Configuring Additional Elements of PowerFlow

If you have multiple workers running on the same PowerFlow system, you might want to limit the amount of memory allocated for each worker. This helps prevent memory leaks, and also prevents one worker using too many resources and starving other workers. You can apply these limits in two ways:

- Set a hard memory limit in Docker (this is the default)
- Set a soft memory limit in the worker environment

Setting a Hard Memory Limit in Docker

Setting a memory limit for the worker containers in your `docker-compose.yml` file sets a hard limit. If you set a memory limit for the workers in the `docker-compose` file and a worker exceeds the limit, the container is terminated via SIGKILL.

If the currently running task caused memory usage to go above the limit, that task might not be completed, and the worker container is terminated in favor of a new worker. This setting helps to prevent a worker from endlessly running and consuming all memory on the PowerFlow system.

You can configure the hard memory limit in the steprunner service of the `docker-compose.yml` file:

```
deploy:
  resources:
    limits:
      memory: 2G
```

Setting a Soft Memory Limit in the Worker Environment

You can set the memory limit for a worker application, and not at the Docker level. Setting the memory limit at the application level differs from the hard memory limit in Docker in that if a worker exceeds the specified memory limit, that worker is not immediately terminated via SIGKILL.

Instead, if a worker exceeds the soft memory limit, the worker waits until the currently running task is completed to recycle itself and start a new process. As a result, tasks will complete if a worker crosses the memory limit, but if a task is running infinitely with a memory leak, that task might consume all memory on the host.

NOTE: The soft memory limit is less safe from memory leaks than the hard memory limit.

You can configure the soft memory limit with the worker environment variables. The value is in KiB (1024 bytes). Also, each worker instance contains three processes for running tasks. The memory limit applies to each individual instance, and not the container as a whole. For example, a 2 GB memory limit for the container would translate to 2 GB divided by three, or about 700 MB for each worker:

```
steprunner:
  image: repository.auto.sciencelogic.local:5000/is-worker:2.4.0
  environment:
    additional_worker_args: '--max-memory-per-child 700000'
```

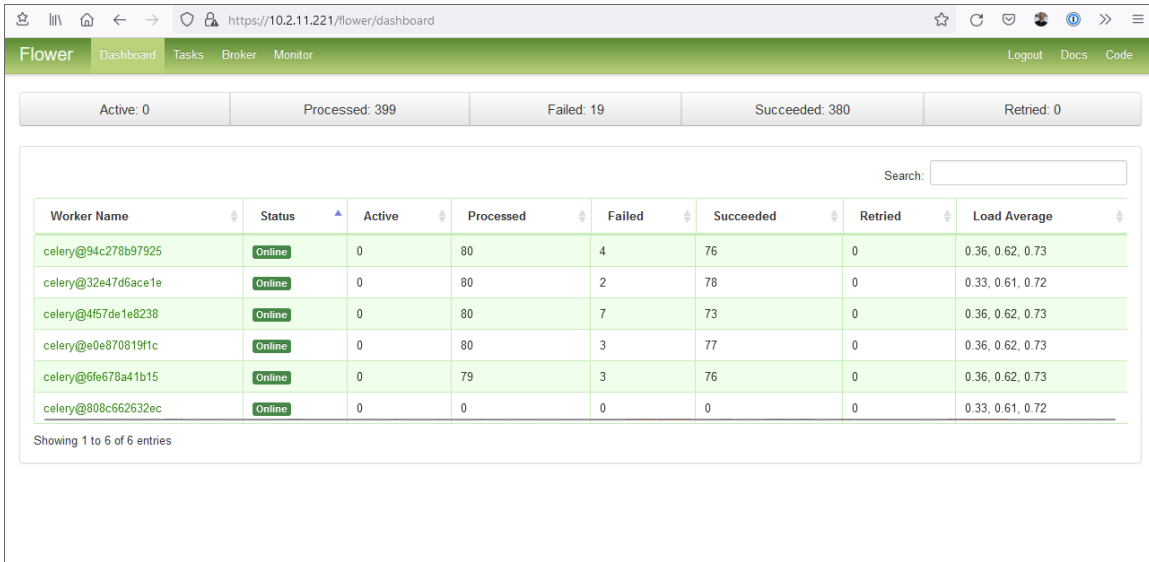
PowerFlow Management Endpoints

This section provides technical details about managing PowerFlow. The following information is also available in the PowerPacks in [Using SL1 to Monitor SL1 PowerFlow](#).

Flower API

Celery Flower is a web-based tool for monitoring PowerFlow tasks and workers. You can access Flower at <https://<IP of PowerFlow>/flower/dashboard>.

Flower lets you see task progress, details, and worker status:



The screenshot shows the Flower dashboard interface. At the top, there are navigation tabs for 'Flower', 'Dashboard', 'Tasks', 'Broker', and 'Monitor'. Below the tabs, there are summary statistics: Active: 0, Processed: 399, Failed: 19, Succeeded: 380, and Retried: 0. A search bar is located above a table of workers. The table has columns for Worker Name, Status, Active, Processed, Failed, Succeeded, Retried, and Load Average. There are 6 entries in the table, all with a status of 'Online'.

Worker Name	Status	Active	Processed	Failed	Succeeded	Retried	Load Average
celery@94c278b97925	Online	0	80	4	76	0	0.36, 0.62, 0.73
celery@32e47d6ace1e	Online	0	80	2	78	0	0.33, 0.61, 0.72
celery@4f57de1e8238	Online	0	80	7	73	0	0.36, 0.62, 0.73
celery@e0e870819f1c	Online	0	80	3	77	0	0.36, 0.62, 0.73
celery@6fe678a41b15	Online	0	79	3	76	0	0.36, 0.62, 0.73
celery@808c662632ec	Online	0	0	0	0	0	0.33, 0.61, 0.72

The following Flower API endpoints return data about the Flower tasks, queues, and workers. The **tasks** endpoint returns data about task status, runtime, exceptions, and application names. You can filter this endpoint to retrieve a subset of information, and you can combine filters to return a more specific data set.

/flower/api/tasks. Retrieve a list of all tasks.

/flower/api/tasks?app_id={app_id}. Retrieve a list of tasks filtered by app_id.

/flower/api/tasks?app_name={app_name}. Retrieve a list of tasks filtered by app_name.

/flower/api/tasks?started_start=1539808543&started_end=1539808544. Retrieve a list of all tasks received within a time range.

/flower/api/tasks?state=FAILURE|SUCCESS. Retrieve a list of tasks filtered by state.

/flower/api/workers. Retrieve a list of all queues and workers

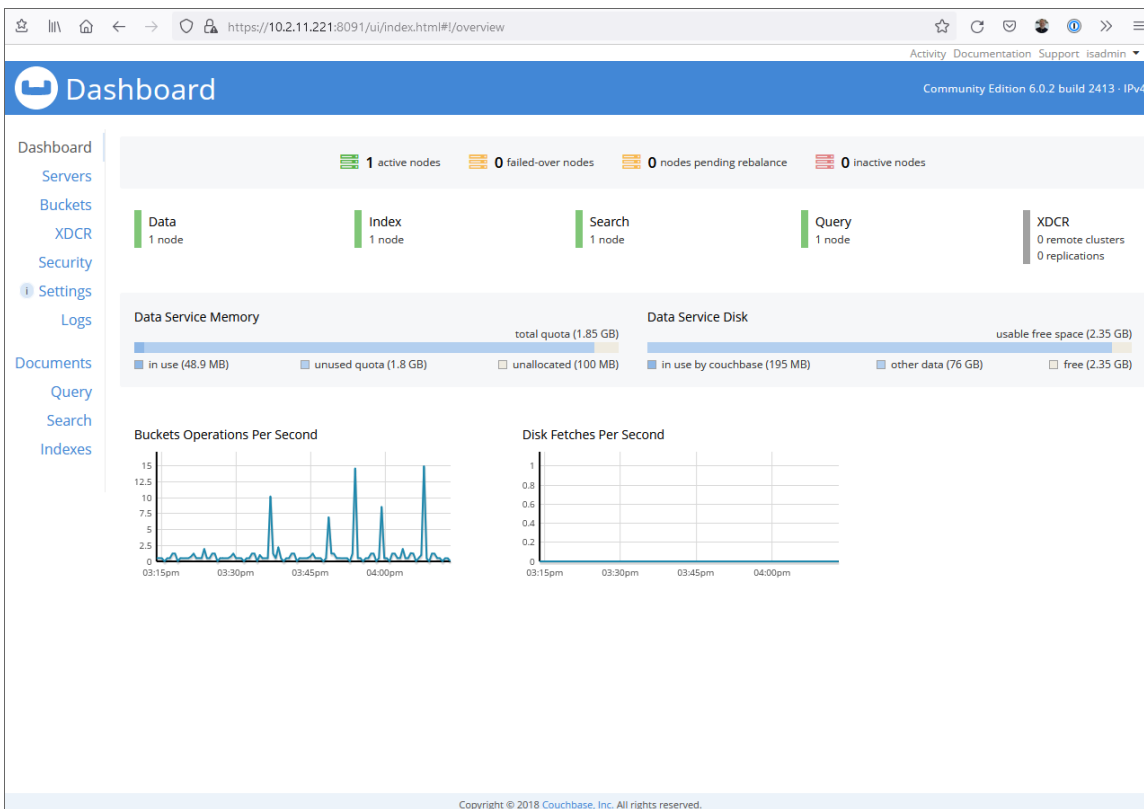
For more information, see the Flower API Reference at <https://flower.readthedocs.io/en/latest/api.html>.

NOTE: If you use the ScienceLogic: PowerFlow PowerPack to collect this task information, the PowerPack will create events in SL1 if a Flower task fails. For more information, see [Using SL1 to Monitor PowerFlow](#).

Couchbase API

The Couchbase Server is an open-source database software that can be used for building scalable, interactive, and high-performance applications. Built using NoSQL technology, Couchbase Server can be used in either a standalone or cluster configuration.

The following image shows the CouchBase user interface, which you can access at port 8091, such as <https://<IP of PowerFlow>:8091>:



The following Couchbase API endpoints return data about the Couchbase service. The **pools** endpoint represents the Couchbase cluster. In the case of PowerFlow, each **node** is a Docker service, and **buckets** represent the document-based data containers. These endpoints return configuration and statistical data about each of their corresponding Couchbase components.

`<hostname_of_PowerFlow_system>:8091/pools/default`. Retrieve a list of pools and nodes.

`<hostname_of_PowerFlow_system>:8091/pools/default/buckets`. Retrieve a list of buckets.

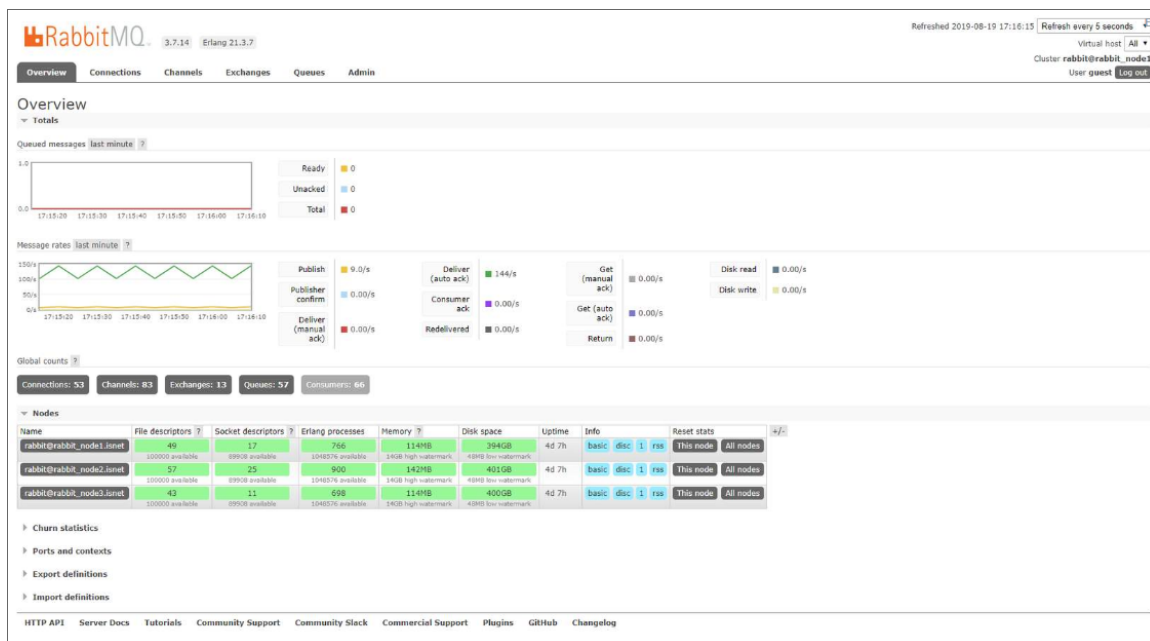
For more information, see the [Couchbase API Reference](#).

NOTE: You can also use the Couchbase PowerPack to collect this information. For more information, see [Using SL1 to Monitor PowerFlow](#).

RabbitMQ

RabbitMQ is an open-source message-broker software that originally implemented the Advanced Message Queuing Protocol and has since been extended with a plug-in architecture to support Streaming Text Oriented Messaging Protocol, Message Queuing Telemetry Transport, and other protocols.

The following image shows the RabbitMQ user interface, which you can access at port 15672, such as <https://<IP of PowerFlow: 15672>>:



Docker Statistics

You can collect Docker information by using SSH to connect to the Docker socket. You cannot currently retrieve Docker information by using the API.

To collect Docker statistics:

1. Use SSH to connect to the PowerFlow instance.
2. Run the following command:

```
curl --unix-socket /var/run/docker.sock http://docker<PATH>
```

where <PATH> is one of the following values:

- /info
- /containers/json
- /images/json
- /swarm
- /nodes
- /tasks
- /services

NOTE: You can also use the Docker PowerPack to collect this information. For more information, see [Using SL1 to Monitor PowerFlow](#).

Using the PowerFlow Control Tower Page

Overview


This chapter describes how to use the **PowerFlow Control Tower** page () in the PowerFlow user interface to monitor the health of your PowerFlow system and PowerFlow applications.

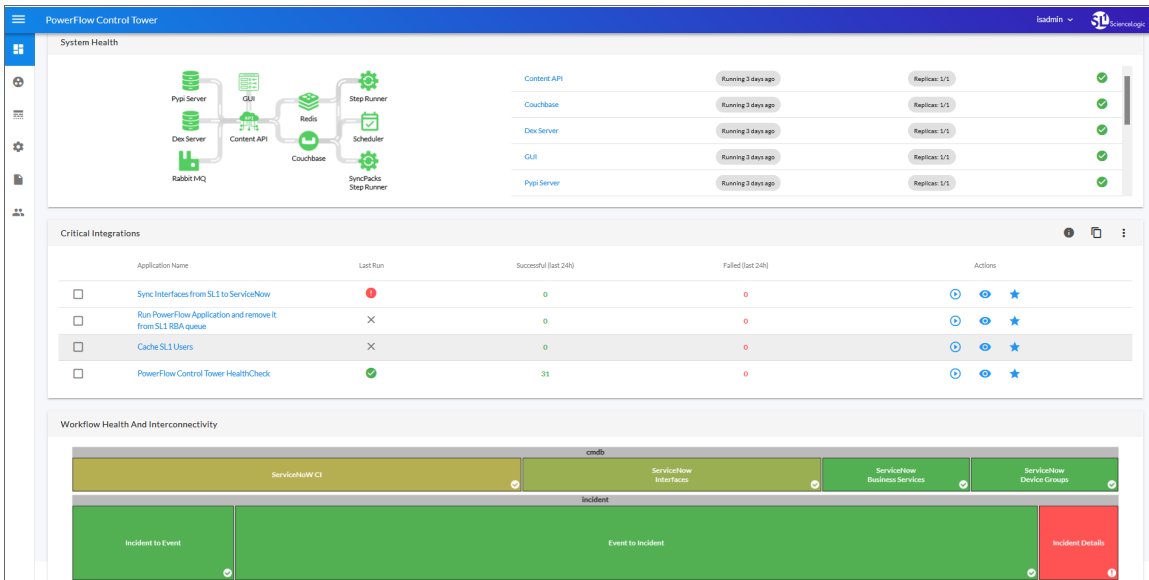
For an overview of the **PowerFlow Control Tower** page, watch the "Visualize Automation Workflows in Flight with SL1 PowerFlow Control Tower" at https://www.youtube.com/watch?v=Fc_TSKbq9fg.

This chapter covers the following topics:

<i>What is the PowerFlow Control Tower?</i>	68
<i>The System Health Widget</i>	68
<i>The Favorite Applications Widget</i>	71
<i>The Workflow Health and Interconnectivity Widget</i>	74
<i>The All Tasks, Workers, and Applications Widgets</i>	75

What is the PowerFlow Control Tower?

The **PowerFlow Control Tower** page () in the PowerFlow user interface provides visibility into system health and automation health. This page is made up of a group of widgets that provide key information about your PowerFlow system:



The **PowerFlow Control Tower** page contains the **System Health**, the **Favorite Applications**, and the **Workflow Health and Interconnectivity** widgets alongside high-level statistics about the health of the worker services that are being used by the PowerFlow instance.

You can use the widgets on this page to monitor the health of your PowerFlow system, the various workflows you use regularly, and track the PowerFlow applications that you use the most. You can use this information to quickly determine if your PowerFlow instance is performing as expected.

NOTE: The **Dashboard** page that was in the PowerFlow user interface before version 2.3.0 was replaced by the **PowerFlow Control Tower** page. The new page includes new widgets along with the widgets from the previous **Dashboard** page.

The System Health Widget

The **System Health** widget on the **PowerFlow Control Tower** page lets you see at a glance the health of the various elements of your PowerFlow system. Before you can view Health Status data on the dashboard, you need to configure PowerFlow.

Configuring the System Health Widget

To populate the system health widget, you need to install and activate the latest version of the *System Utils Synchronization PowerPack*, which includes the "PowerFlow Control Tower HealthCheck" application that gathers system health data and populates it in the cache.

The latest version of the *System Utils Synchronization PowerPack* requires the latest version of the *Base Steps* and *Flow Control Synchronization PowerPacks*. You can download these Synchronization PowerPacks from the PowerPacks of the ScienceLogic Support site at <https://support.sciencelogic.com/s/powerpacks>.

To set up PowerFlow Health Status data:

1. Ensure that your PowerFlow system has the following Synchronization PowerPacks activated and installed:
 - *Base Steps Synchronization PowerPack* version 1.5.0 or later
 - *System Utils Synchronization PowerPack* version 1.1.4 or later
 - *Flow Control Synchronization PowerPack* version 1.0.1 or later. This Synchronization PowerPack ships with the latest version of PowerFlow.
2. Create a configuration object for the "PowerFlow Control Tower HealthCheck" application. You can make a copy of the "PF Control Tower Configuration Example" to use as a template for this configuration object. For more information, see [Creating a Configuration Object](#).
3. Align the new configuration object with the "PowerFlow Control Tower HealthCheck" application by clicking the **[Configure]** button from the detail page for the application and selecting this configuration object from the **Configuration** drop-down.

NOTE: The "PowerFlow Control Tower Healthcheck" Application supports using SSH keys for collecting data from a PowerFlow node. You must select the **use_ssh_key** option on the **Configuration** pane for the HealthCheck application to use the **ssh_key** application variable that is defined in the aligned configuration object

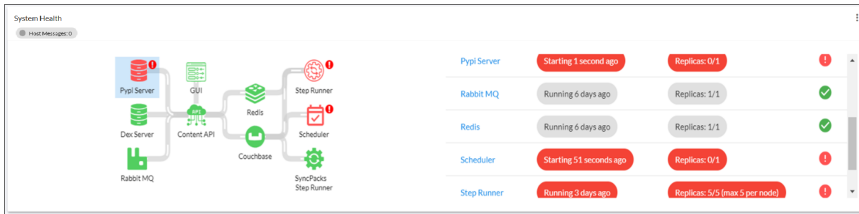
4. Run or schedule the "PowerFlow Control Tower HealthCheck" application to update the PowerFlow Health Status data.

NOTE: The **System Health** widget runs the "PowerFlow Control Tower HealthCheck" application automatically when you are on the **PowerFlow Control Tower** page, but only if the data saved on the most recent run of the application is older than five minutes. You can override this update by creating a schedule. For more information, see [Scheduling Applications](#).

Using the System Health Widget

The **System Health** widget monitors all of the components that make up your PowerFlow system. These components include the Pypi Server, the Dex Server, RabbitMQ, the GUI service, the Content API, Redis, Couchbase, Step Runner and SyncPacks Step Runner, and the Scheduler. If the newest data is unavailable, the **System Health** widget displays the last available data.

The following image shows an example of a **System Health** widget:



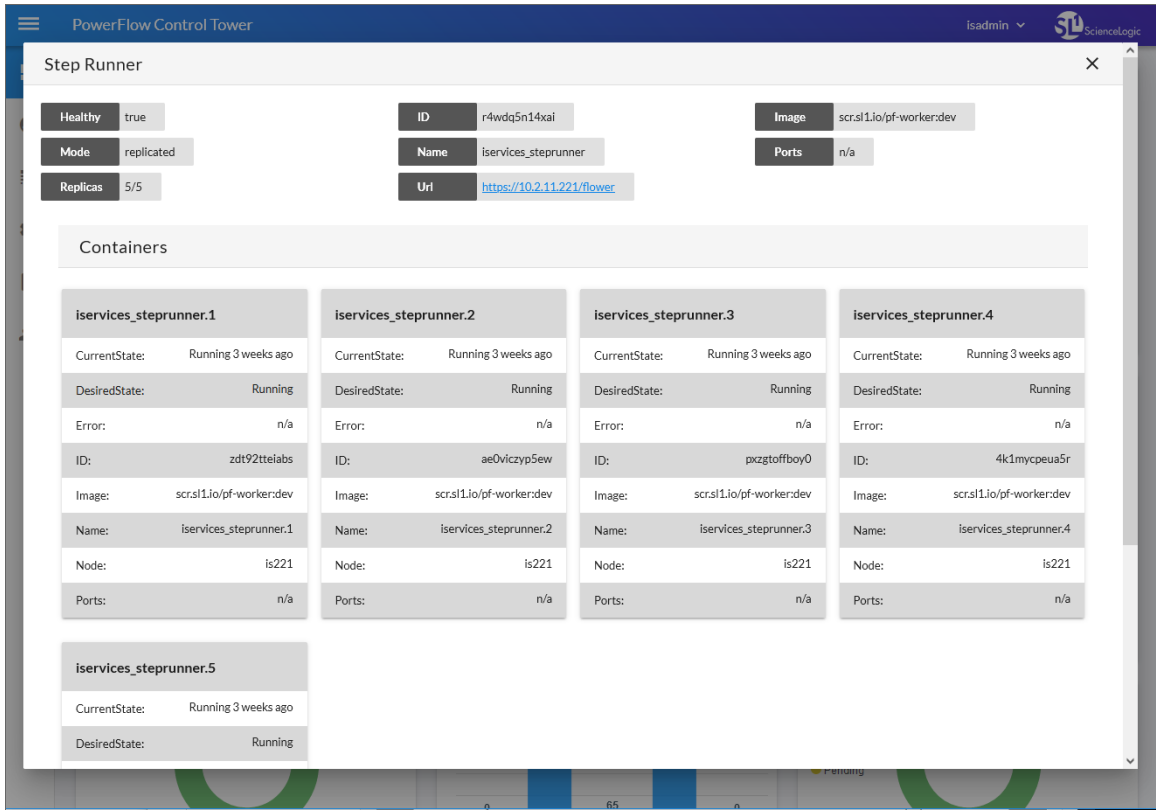
The left pane of the **System Health** widget contains the **Process Flow View** of the components of your PowerFlow system, and the right pane is the **Tabular View** of those components. The following are the possible health statuses for each component and how they are displayed:

- **Successful health:** The component is working as expected when the component's icon is green in the **Process Flow View** and a green check mark (✓) appears in the corresponding line of the **Tabular View**.
- **Failed health:** The component has errors that need attention (the service is down) when the component's icon is red in the **Process Flow View**, with a red exclamation point (❗) next to the component's icon. The red exclamation point (❗) also appears in the corresponding line of the **Tabular View**, along with red ovals for the second and third columns of the table.

The **Tabular View** has two behaviors:

- In the default display, the information in the **Process Flow View** on the left is duplicated in a tabular format in the **Tabular View** on the right.

- When you click a component's icon in the **Process Flow View** or a component's name in the **Tabular View**, the high-level information for a particular component appears in a pop-up window:



The pop-up displays the current status and related information for all containers in that component. The pop-up also includes a link to the internal user interface for that service within the cluster, such as a link to the Couchbase user interface for the Couchbase component, or the Flower user interface for a step runner.

The Favorite Applications Widget

The **Favorite Applications** widget on the **PowerFlow Control Tower** page lets you select the PowerFlow applications that are important to you and track their status:

Application Name	Last Run	Successful (last 24h)	Failed (last 24h)	Actions
<input type="checkbox"/> Sync Business Services from SL1 to ServiceNow	✓	139	0	🔄 👁️ ★
<input type="checkbox"/> Sync Devices from SL1 to ServiceNow	✓	12	0	🔄 👁️ ★
<input type="checkbox"/> Sync SL1 Event to ServiceNow Incident	❌	0	1	🔄 👁️ ★
<input type="checkbox"/> Sync Installed Software from SL1 to ServiceNow	✗	0	0	🔄 👁️ ★

By displaying the most frequently run applications, you can see how your PowerFlow system is automating your most common use cases.

NOTE: The number of favorite applications is limited to 16 applications per user.




Contents of the Favorite Applications Widget

The toolbar at the top right of the widget includes the following buttons:

- **[Info]** (i). Displays a pop-up message with data for the Time Stamp, Number of Runs to Display, and the Queue for the widget.
- **[Duplicate the Widget]** (📄). Creates a copy of the **Favorite Applications** widget. The copy is added below the original widget. Making a copy lets you display more than one set of favorite applications, and you can create multiple widgets to group applications that serve a specific purpose.
- **[Actions]** (⋮). Displays the following options:
 - *Configure*. Opens the **Configure Widget** pane, where you can update the Widget Title, Widget Size, Time Stamp for the application runs (24 hours or 48 hours), Total Number of Application Runs to Display, Queue information, and an editable list of Favorite Applications to display in the widget.
 - *Reorder Items*. Reorder the applications currently showing in the **Favorite Applications** widget. Use the up and down arrows to arrange the applications, and click **[Save]** when you are done.
 - *Delete*. Deletes that **Favorite Applications** widget.

The following details are included in this widget:

- **Application Name**. Names and links to favorite applications.
- **Last Run**. Status of the most recent run of a favorite applications; hover over the icon to see more information:

Icon	Status
	The application ran successfully.
	The application failed to run successfully.
	The application has not been run.

- **Successful**. Number of successful runs in the last 24 hours.
- **Failed**. Number of failed runs in the last 24 hours.
- **Actions**. Includes the following icons:
 - *Run* (🏃). Runs that PowerFlow application. If you hover over the button, you can select *Custom Run* to open the **Custom Run** window, where you can specify logging levels, the configuration object, and custom parameters for the run.

- **View** (👁). Opens the **Application** detail page, where you can see the steps that make up the application.
- **Unfavorite** (★). Removes the application from the list of favorites.

TIP: If you are using a small screen, or if the browser window where you are running PowerFlow is not maximized, the three Actions icons might not display. To access the icons, click the Actions button (⋮) and select an icon from the pop-up menu.

Using the Favorite Applications Widget

To add an application to the **Favorite Applications** widget:

1. Go to the **Applications** page and click the Favorite icon (★) for the application you want to add to the list. A **Favorite the App** window appears.
2. Select the group or groups of favorites that will include that application and click **[Save]**. The application is added to the list of favorite applications on the **Favorite Applications** widget.

NOTE: The data that displays in the widget can be adjusted by editing the **Configuration** pane, which you can access by clicking the **[Actions]** button (⋮) and selecting *Configure*.

3. To remove an application from the **Favorite Applications** widget, click the Unfavorite icon (★).

NOTE: If a favorite PowerFlow application is deleted, that application is removed from the **Favorite Applications** widget.

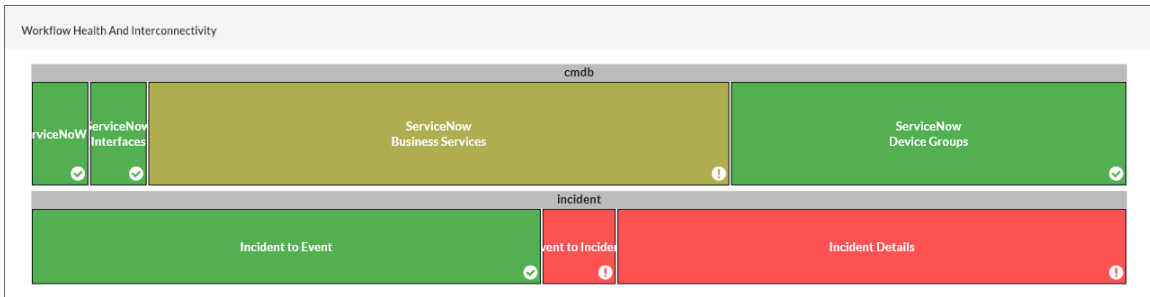
To run a favorite application in the **Favorite Applications** widget:

1. Click the **[Run]** button that corresponds to the application in the **Actions** column. If you hover over the button, you can select *Custom Run* to open the **Custom Run** window, where you can specify logging levels, the configuration object, and custom parameters for the run.
2. If the run succeeded, a green check mark will appear; if the run failed, a red exclamation point will appear.

TIP: You can select multiple applications to run them at the same time or remove them from your favorites.

The Workflow Health and Interconnectivity Widget

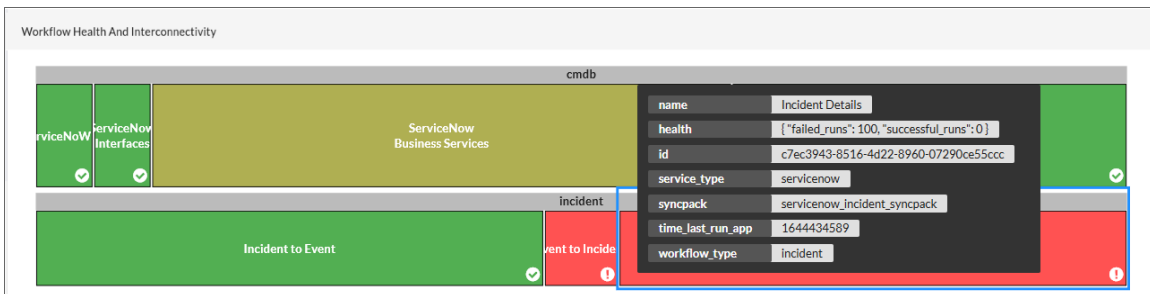
The **Workflow Health and Interconnectivity** widget on the **PowerFlow Control Tower** page lets you monitor the connectivity of the third-party applications that you are integrating with SL1. Each pane in the widget represents a workflow that you are monitoring with PowerFlow, such as ServiceNow Business Services or Incident Details.



The color of the panes in the widget change based on the number of failed runs compared to the number of successful runs. More failed runs cause a pane to turn red, while successful runs cause a pane to turn green. If there are a combination of failed and successful runs, the pane might be a lighter shade of green or red.

Using the Workflow Health and Interconnectivity Widget

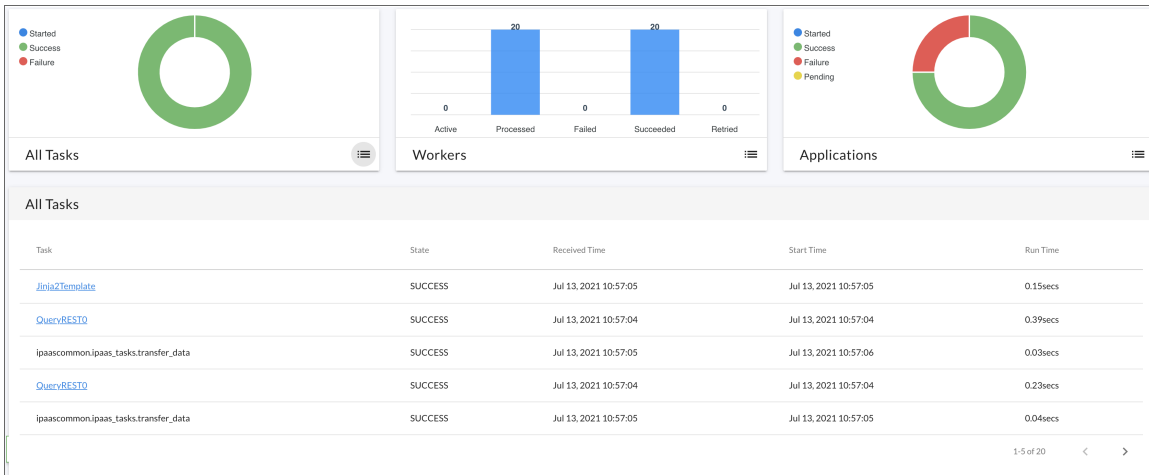
On the **Workflow Health and Interconnectivity** widget, you can hover over an endpoint on the widget to view a pop-up with additional information, including the health, last run and the Synchronization PowerPacks used by the endpoint.



NOTE: A message will display in the PowerFlow user interface if the **Workflow Health and Interconnectivity** widget or the **System Health** widget detect a missing or misconfigured Synchronization PowerPack.

The All Tasks, Workers, and Applications Widgets

The **All Tasks**, **Workers**, and **Applications** widgets on the **PowerFlow Control Tower** page let you monitor the status of the various tasks, workers, and applications that are running on your PowerFlow system. You can use this information to quickly determine if your PowerFlow instance is performing as expected:



To view more information about your system:

1. Hover over a circle graph or a bar chart item to view a pop-up field that contains the count for that item on the graph or chart, such as "Success: 48" for successful tasks on the **All Tasks** graph.
2. Click the List icon (☰) for the **All Tasks**, **Workers**, or **Applications** graphs to view a list of relevant tasks, workers, or applications. Use the left and right arrow icons to move through the list of items. Click on the slice of the pie or the bar in one of the graphs to see that specific sub-group.
3. To view additional details about a specific tasks, click the List icon (☰) for the **All Tasks** graph and then click the link for the task, where relevant. The application aligned with that task appears, and you can select a step and view the **Step Log** details for that step.

TIP: If a "Scheduled fetch failed" pop-up message appears on this page or any other page in the PowerFlow user interface, your user interface session might have expired. To address this issue, simply log out of the PowerFlow user interface and log back in again.

Managing Synchronization PowerPacks

Overview

This chapter describes how to use the **SyncPacks** page (☺) of the PowerFlow user interface to import, install, and view Synchronization PowerPacks, which are also called "SyncPacks".

WARNING: PowerFlow and Synchronization PowerPacks content not created by ScienceLogic is *not* supported by ScienceLogic. This includes custom steps, PowerFlow applications, and Synchronization PowerPacks.

This chapter covers the following topics:

<i>What is a Synchronization PowerPack?</i>	77
<i>Viewing the List of Synchronization PowerPacks</i>	78
<i>Importing and Installing a Synchronization PowerPack</i>	80
<i>Default Synchronization PowerPacks</i>	83

What is a Synchronization PowerPack?

A Synchronization PowerPack contains all of the code and logic needed to perform integrations on the PowerFlow platform. A Synchronization PowerPack is saved as a Python `.whl` file, and it typically includes Python steps that are listed in PowerFlow applications and shipped with one or configuration objects:

NAME	ACTIVATED	ACTIVATED VERSION	PUBLISHER	DESCRIPTION	MINIMUM IS VERSION
servicenow_cmdb_syncpack	✓	3.1.2	ScienceLogic, Inc.	SyncPack for Integrating SL1 to ServiceNow CMDB.	>=2.0.0

Package Contents

Applications: 31 Configurations: 0 Steps: 44

APPLICATIONS ↑	TYPE	CRITICAL
Create ServiceNow CI	apps	
Sync Devices from SL1 to ServiceNow	apps	
Sync Interfaces from SL1 to ServiceNow	apps	
Bulk Delete Devices	apps	
Cache ServiceNow CIs and SL1 Device Classes	apps	
Create Discovery Session in SL1	apps	
Create Virtual Device in SL1	apps	
Delete Devices from SL1	apps	
Generate Required CI Relations for ServiceNow	apps	
Sync Discovery Session Status from SL1 to ServiceNow	apps	

1-10 of 31 < >

You can access the latest steps, applications, and configurations for PowerFlow or a third-party integration, such as ServiceNow, by downloading the most recent Synchronization PowerPack for that integration. You can download Synchronization PowerPacks from the **PowerPacks** page at the ScienceLogic Support Site at <https://support.sciencelogic.com/s/>.

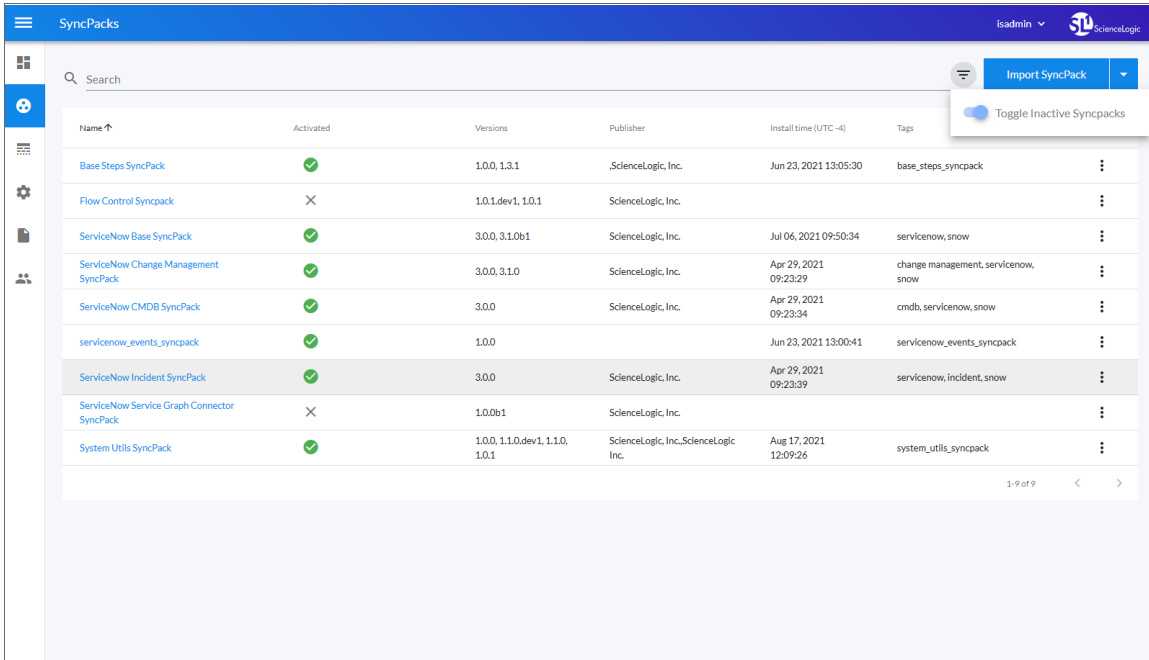
You can access all Synchronization PowerPacks that have been uploaded to your PowerFlow system on the **SyncPacks** page.

A Synchronization PowerPack is highly customizable, and you can modify the contents of a Synchronization PowerPack to meet your business needs, instead of changing your SL1 configuration. You can categorize and segment your business integration solutions using a Synchronization PowerPack.

Synchronization PowerPacks let you distribute content to simplify installations, upgrades, and maintenance of integration solutions. Just like PowerPacks, you can also share Synchronization PowerPacks. In addition, Synchronization PowerPacks protect a company's intellectual property using licensing and encryption technologies.

Viewing the List of Synchronization PowerPacks

The **SyncPacks** page provides a list of the Synchronization PowerPacks on your PowerFlow system. From this page you can search for and view Synchronization PowerPacks, and you can also install and uninstall Synchronization PowerPacks:



Name ↑	Activated	Versions	Publisher	Install time (UTC -4)	Tags
Base Steps SyncPack	✓	1.0.0, 1.3.1	,ScienceLogic, Inc.	Jun 23, 2021 13:05:30	base_steps_syncpack
Flow Control SyncPack	✗	1.0.1.dev1, 1.0.1	ScienceLogic, Inc.		
ServiceNow Base SyncPack	✓	3.0.0, 3.1.0b1	ScienceLogic, Inc.	Jul 06, 2021 09:50:34	servicenow, snow
ServiceNow Change Management SyncPack	✓	3.0.0, 3.1.0	ScienceLogic, Inc.	Apr 29, 2021 09:23:29	change management, servicenow, snow
ServiceNow CMDB SyncPack	✓	3.0.0	ScienceLogic, Inc.	Apr 29, 2021 09:23:34	cmdb, servicenow, snow
servicenow_events_syncpack	✓	1.0.0		Jun 23, 2021 13:00:41	servicenow_events_syncpack
ServiceNow Incident SyncPack	✓	3.0.0	ScienceLogic, Inc.	Apr 29, 2021 09:23:39	servicenow, incident, snow
ServiceNow Service Graph Connector SyncPack	✗	1.0.0b1	ScienceLogic, Inc.		
System Utils SyncPack	✓	1.0.0, 1.1.0.dev1, 1.1.0, 1.0.1	ScienceLogic, Inc., ScienceLogic Inc.	Aug 17, 2021 12:09:26	system_utils_syncpack

Searching for a Synchronization PowerPack

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

You can also sort the list of Synchronization PowerPacks by clicking the headers of the columns.

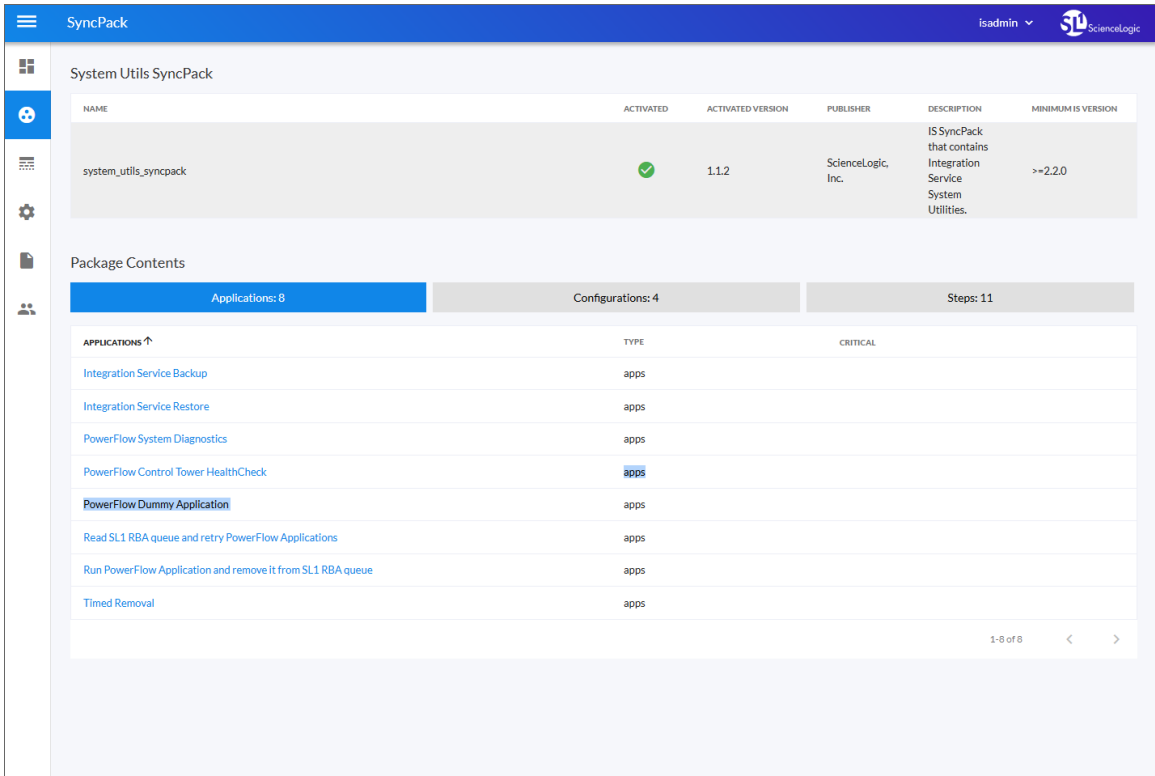
If you have more than one version of a Synchronization PowerPack the active version of the Synchronization PowerPack is highlighted in green in the **Versions** column.

TIP: Click the Filter icon (☰) at the top right of the **SyncPacks** page and select *Toggle Inactive SyncPacks* to show all Synchronization PowerPacks on the PowerFlow system.

Viewing a Detail Page for a Synchronization PowerPack


Click the name of a Synchronization PowerPack from the list to view the detail page for the Synchronization PowerPack.

From this page you can view the contents of the Synchronization PowerPack, including the applications, configuration objects, and steps included in the Synchronization PowerPack:



You can also view additional metadata, including the active version, the minimum PowerFlow platform version, and other details.

Using the Actions Button to Manage Synchronization PowerPacks

On the **SyncPacks** page of the PowerFlow user interface, you can access the following Synchronization PowerPack options by clicking the **[Actions]** button () next to a Synchronization PowerPack:

- **Activate & Install.** Before you can use a Synchronization PowerPack, you will need to activate and install it. An *activated* Synchronization PowerPack has been installed and is ready to be used. For more information, see [Activating and Installing a Synchronization PowerPack](#).

NOTE: If you try to activate and install a Synchronization PowerPack that is already activated and installed, you can choose to "force" installation across all the nodes in the PowerFlow system.


- **Change active version.** If you have more than one Synchronization PowerPack installed, select this option to specify a new active version (other than the version that is currently running).

- *Uninstall*. Select this option if you want to completely remove all versions of a Synchronization PowerPack, instead of deleting one or more versions using the *Delete* option, below.
- *Delete*. Remove one or more versions of a Synchronization PowerPack from PowerFlow. You cannot delete the active version of a Synchronization PowerPack (the version that is currently running).

TIP: Click the Filter icon () at the top right of the **SyncPacks** page and select *Toggle Inactive SyncPacks* to show all Synchronization PowerPacks on the PowerFlow system.

Importing and Installing a Synchronization PowerPack

The **SyncPacks** page in the PowerFlow user interface lets you import and install the latest version of a Synchronization PowerPack. After you install a Synchronization PowerPack, PowerFlow considers that Synchronization PowerPack to be **activated** and ready to be used.

By default, the **SyncPacks** page displays all activated and installed Synchronization PowerPacks. If you do not see the PowerPack that you want to install, click the Filter icon () on the **SyncPacks** page and select *Toggle Inactive SyncPacks* to see a list of the imported PowerPacks.

After you install a Synchronization PowerPack, that Synchronization PowerPack is available on the **SyncPacks** page of the PowerFlow user interface. The PowerFlow applications from that Synchronization PowerPack are added to the **Applications** page of the user interface. You can click the name of that Synchronization PowerPack to view the detail page for that Synchronization PowerPack.

If you want to upload and install multiple ServiceNow Synchronization PowerPacks at the same time, you should upload *all* of the Synchronization PowerPacks first, and then install them to address any dependencies between the Synchronization PowerPacks.

Also, you can click the dropdown arrow next to the **[Import SyncPack]** button to import or view dependencies for PowerFlow Synchronization PowerPacks. For more information, see [Locating and Importing Dependencies for a Synchronization PowerPack](#).

NOTE: If a Synchronization PowerPack has a dependency on another specific Synchronization PowerPack version, you will need to install that Synchronization PowerPack version on the PowerFlow system before you can install the Synchronization PowerPack with the dependency. For more information, see the **SL1 PowerFlow Dependency Matrix** page at https://docs.sciencelogic.com/latest/Content/Web_General_Information/Doc_Archive/powerflow_release_matrix.htm.

NOTE: You must have the *Develop* or *Administrator* role to install a Synchronization PowerPack. For more information, see [Managing Users in PowerFlow](#).

NOTE: If your PowerFlow system uses self-signed certificates, you will need to manually accept the certificate before you can upload Synchronization PowerPacks. Go to <https://<IP address of PowerFlow>:3141/isadmin>, accept the certificate, and then exit out of the tab. When you log into PowerFlow again, you will be able to upload Synchronization PowerPacks.

Locating and Downloading a Synchronization PowerPack

A Synchronization PowerPack file has the **.whl** file extension type. You can download the Synchronization PowerPack file from the ScienceLogic Support site.

WARNING: If you are *upgrading* to this version of the Synchronization PowerPack from a previous version, make a note of any settings you made on the **Configuration** pane of the various PowerFlow applications in this Synchronization PowerPack, as these settings are *not* retained when you upgrade.

To locate and download the Synchronization PowerPack:

1. Go to the ScienceLogic Support Site at <https://support.sciencelogic.com/s/>.
2. Click the **[Product Downloads]** tab and select *PowerPack*.
3. In the **Search PowerPacks** field, search for the Synchronization PowerPack and select it from the search results. The **Release Version** page appears.
4. On the **[PowerPack Versions]** tab, click the name of the Synchronization PowerPack version that you want to install. The **Release File Details** page appears.
5. Click the **[Download File]** button or click the name of the **.zip** file containing the **.whl** file for this Synchronization PowerPack to start downloading the file.

NOTE: After you download a Synchronization PowerPack, you can import it to your PowerFlow system using the PowerFlow user interface.

NOTE: If you are installing or upgrading to the latest version of this Synchronization PowerPack in an offline deployment, see "Installing or Upgrading in an Offline Environment" in the Synchronization PowerPack release notes to ensure you install any external dependencies.

Importing a Synchronization PowerPack

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 **Import SyncPack** page.

3. Click **[Import]**. 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.






Activating and Installing a Synchronization PowerPack

To activate and 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.

NOTE: If you try to activate and install a Synchronization PowerPack that is already activated and installed, you can choose to "force" installation across all the nodes in the PowerFlow system.

TIP: If you do not see the PowerPack that you want to install, click the Filter icon () on the **SyncPacks** page and select *Toggle Inactive SyncPacks* to see a list of the imported 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.
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.
4. If you have other versions of the same Synchronization PowerPack on your PowerFlow system, you can click the **[Actions]** button () for that Synchronization PowerPack and select *Change active version* to activate a different version other than the version that is currently running.

Locating and Importing Dependencies for a Synchronization PowerPack


The most common error that occurs when installing a Synchronization PowerPack is that the Synchronization PowerPack dependencies are not installed. If a Synchronization PowerPack has a dependency on another specific Synchronization PowerPack version, you will need to import and install that Synchronization PowerPack version on the PowerFlow system before you can install the Synchronization PowerPack with the dependency.

Review the "System Requirements" section of the release notes for that Synchronization PowerPack to ensure that you have installed all of the required applications for that Synchronization PowerPack.


To view a list of additional PowerFlow and SL1 products that are required by the various Synchronization PowerPacks, see the **SL1 PowerFlow Dependency Matrix** page at https://docs.sciencelogic.com/latest/Content/Web_General_Information/Doc_Archive/powerflow_release_matrix.htm.

In addition, you can click the dropdown arrow next to the **[Import SyncPack]** button to import or view dependencies for PowerFlowSynchronization PowerPacks.

To view a list of available dependency files:

1. Click the down arrow icon  next to the **[Import SyncPack]** button and select *View Dependencies*. A devpi dependencies page appears.
2. To view more information about a dependency, click the link in the **Info page** column.
3. To download a dependency file, click the link in the **Releases** column.

To import a dependency:

1. Click the down arrow icon  next to the **[Import SyncPack]** button and select *Import Dependency*.
2. Click **[Browse]** and select the relevant dependency file from the previous step.


TIP: You can also drag and drop a file onto the **Import SyncPacks** page.

3. Click **[Import]**. The dependency file is added to the PowerFlow system .

Default Synchronization PowerPacks

When you install PowerFlow, the following Synchronization PowerPacks are added to the **SyncPacks** page by default:

- [Base Steps](#)
- [Flow Control](#)
- [System Utils](#)

If you need to install these Synchronization PowerPacks, click the **[Actions]** button () and select *Activate & Install* for each Synchronization PowerPack.

Base Steps Synchronization PowerPack

The *Base Steps* Synchronization PowerPack contains a set of steps that are used in a variety of different Synchronization PowerPacks, including "Query REST", "Query GQL", and "MySQL Select" steps, which are used throughout PowerFlow for a variety of use cases.

NOTE: The *Base Steps* Synchronization PowerPack is included with the most recent release of the PowerFlow Platform. The *Base Steps* Synchronization PowerPack version 1.5.0 was shipped with PowerFlow Platform version 2.4.0. You can also download newer versions of this Synchronization PowerPack, if available, from the **PowerPacks** page of the ScienceLogic Support Site at <https://support.sciencelogic.com/s/>.

Version 1.5.0

Version 1.5.0 of the *Base Steps* Synchronization PowerPack includes support for sending multiple payloads using the new "PostREST" and "GetREST" steps. This release also includes a new "DeleteREST" step and a new "PutREST" step.

For more information, see the [Base Steps Synchronization PowerPack Release Notes, version 1.5.0](#).

Version 1.4.2

Version 1.4.2 of the *Base Steps* Synchronization PowerPack includes updates to the third-party packages used by PowerFlow.

For more information, see the [Base Steps Synchronization PowerPack Release Notes, version 1.4.2](#).

Version 1.4.1

Version 1.4.1 of the *Base Steps* Synchronization PowerPack includes the following features:

- Updated the "QueryREST" to return a response body when errors occur.
- The "SSHCommand" step can now use SSH keys.

For more information, see the [Base Steps Synchronization PowerPack Release Notes, version 1.4.1](#).

Contents of This Synchronization PowerPack

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

This Synchronization PowerPack includes the following steps, which you can use in new and existing applications:

- Cache Delete
- Cache Read
- Cache Save
- DeleteREST
- Direct Cache Read (deprecated)
- GetREST
- Jinja Template Data Render
- MS-SQL Describe
- MS-SQL Insert
- MS-SQL Select
- MySQL Delete
- MySQL Describe
- MySQL Insert
- MySQL Select
- PostREST
- PutREST
- Query GraphQL
- Query REST (deprecated)
- QueryRest: BearerAuth
- QueryRest: OAuth
- 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.

You can configure the existing "Query REST" step to use bearer authentication by adding the bearer token to the request headers in the **Configuration** pane for that step. The **headers** field should look like the following:

```
{
  "Authorization": "Bearer <token_id>",
  "accept": "application/json",
  "content-type": "application/json"
}
```

Flow Control Synchronization PowerPack

The *Flow Control* Synchronization PowerPack contains just one item: the "IfStep" step that enables the logical branching used by the PowerFlow builder. The most recent version of this Synchronization PowerPack is version 1.0.1, and it is included in the PowerFlow Platform release.

System Utils Synchronization PowerPack

The *System Utils* Synchronization PowerPack is a Standard Synchronization PowerPack that contains applications, a configuration object, and steps. Version 1.1.4 of this Synchronization PowerPack is included with PowerFlow version 2.5.0.

NOTE: You must install the *Base Steps* Synchronization PowerPack before you can install this Synchronization PowerPack. Version 1.1.1 of this Synchronization PowerPack requires version 1.3.2 or later of the *Base Steps* Synchronization PowerPack.

NOTE: You can download newer versions of this Synchronization PowerPack from the [PowerPacks](#) page of the ScienceLogic Support Site.

The *System Utils* Synchronization PowerPack version includes the following PowerFlow applications:

- **Integration Service Backup.** Creates a backup file of the Couchbase database used by PowerFlow and sends the file to a remote location. For more information, see [Backing up Data](#).
- **Integration Service Restore.** Restores a Couchbase backup file that was created up with the "Integration Service Backup" application. For more information, see [Restoring a Backup](#).
- **PowerFlow Check Connections.** Checks connections and saves that data to a cache. You can edit the number of days of data to query by editing the **Configuration** pane for this application.
- **PowerFlow Control Tower HealthCheck.** Queries PowerFlow, gathers health data about the system, and displays the data in the PowerFlow System Health widget on the **PowerFlow Control Tower** page. For more information, see [PowerFlow System Health](#).
- **PowerFlow PFCTL HealthCheck.** Uses the **powerflowcontrol** (pfctl) utility to gather HealthCheck data, and then the application saves that data into a health cache document.
- **PowerFlow System Diagnostics.** Displays a report of platform diagnostics for the services used by PowerFlow. For more information, see [Viewing PowerFlow System Diagnostics](#).
- **Read SL1 RBA Queue and Retry PowerFlow Applications.** Pulls and retries any failed Run Book Actions that failed because PowerFlow was not available. Requires Base Steps Synchronization PowerPack version 1.3.2 or later.
- **Run PowerFlow Application and Remove It from SL1 RBA Queue.** Runs the PowerFlow application and removes it from the Run Book Action queue. This application is triggered by the "Read SL1 RBA Queue and Retry PowerFlow Applications" and does not need to be configured.
- **Timed Removal.** Removes logs from Couchbase on a regular schedule. For more information, see [Removing Logs on a Regular Schedule](#).

This Synchronization PowerPack includes the following configuration objects:

- **IS - System Backup Configuration Example.** Contains the structure needed for the "Integration Service Backup" and "Integration Service Restore" PowerFlow applications.

- **PF - System Diagnostic Configuration Example.** Contains the structure needed for the "PowerFlow System Diagnostics" application.
- **PF Check Connection Configuration Example.** Contains the structure needed for the "PowerFlow Check Connection" application.
- **PF Control Tower Configuration Example.** Contains the structure needed for the "PowerFlow Control Tower HealthCheck" application.
- **PF PFCTL Healthcheck Configuration Example.** Contains the structure needed for the "PowerFlow PFCTL HealthCheck " application.
- **PF - RBA retry Configuration Example.** Contains the structure needed for Run Book Action retries. Includes variables for the SL1 system from which the data will be read, the number of rows to be read from the SL1 Run Book Action queue in every run, and the **generate_report** variable to create a report about triggered PowerFlow applications.


TIP: You should do a **Save As** with the example configuration objects, above, to make a new configuration object that you can customize for your specific PowerFlow system. You cannot use an example configuration object to run PowerFlow applications.

This Synchronization PowerPack also includes the following steps, which are used in the PowerFlow applications listed above:

- Collect IS diagnostics
- Create Integration Service Backup
- Diagnostic reporter
- Get Couchbase Metrics
- PowerFlow Check Connection
- PowerFlow Failover Actions Reporter
- PowerFlow PFCTL HealthCheck
- PowerFlow PFCTL Credentials to run PFCTL healthcheck app
- Process PowerFlow System Health Status Data
- Pull And Process Failover Actions from SL1
- Query an IS Node
- Query Application Logs and Remove
- Query IS Manager node
- Remove Dex Sessions and their tokens
- Restore Couchbase From Backup
- Set Template Data for the next step

Managing PowerFlow Applications

Overview

This chapter describes how to use the **Applications** page () of the PowerFlow user interface to view, run, and schedule PowerFlow applications. You can use the PowerFlow builder to create custom applications, and those applications can use "flow control" operators that enable logical branching and data transformation between steps.

WARNING: PowerFlow and Synchronization PowerPacks content not created by ScienceLogic is not supported by ScienceLogic. This includes custom steps, PowerFlow applications, and Synchronization PowerPacks.

For more information about building low-code integrations with PowerFlow Builder, watch the video at <https://sciencelogic.com/product/resources/building-no-codelow-code-integrations-with-powerflow-builder>.

This chapter covers the following topics:

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Viewing the List of PowerFlow Applications

The **Applications** page (📄) provides a list of available PowerFlow applications on your PowerFlow system. From this page you can schedule, edit, view, and create applications and steps:




APPLICATION NAME ↑	VERSION	SYNCPACK	EDITED	LAST RUN	ACTIONS
Cache ServiceNow CIs and SL1 Device Classes	3.0.0	ServiceNow CMDB SyncPack	Sep 27, 2021 12:23:14	↓ n/a	Schedule ⋮ ☆
Cache SL1 Device Classes	1.0.0	ServiceNow Service Graph Connector SyncPack	Sep 07, 2021 10:24:57	↓ n/a	Schedule ⋮ ☆
Cache SL1 Users	1.0.2	ServiceNow Base SyncPack	Sep 07, 2021 10:24:24	↓ n/a	Schedule ⋮ ☆
Create Event in ServiceNow from SL1 Event	1.0.0	servicenow_events_syncpack	Jun 23, 2021 13:00:41	↓ n/a	Schedule ⋮ ☆
Create or Update ServiceNow Incident from SL1 Event	2.0.3	ServiceNow Incident SyncPack	Feb 24, 2020 10:48:43	↓ n/a	Schedule ⋮ ☆
Delete Devices from SL1	1.0.0	ServiceNow CMDB SyncPack	Feb 24, 2020 11:18:31	↓ n/a	Schedule ⋮ ☆
demo app		n/a	Sep 13, 2021 16:28:26	👍 Oct 14, 2021 09:52:49	Schedule ⋮ ☆
Generate Required CI Relations for ServiceNow	3.0.0	ServiceNow CMDB SyncPack	Sep 27, 2021 12:23:15	↓ n/a	Schedule ⋮ ☆
Integration Service Backup	2.0.0	System Utilis SyncPack	Oct 20, 2021 13:45:51	↓ n/a	Schedule ⋮ ☆
Integration Service Restore	2.0.0	System Utilis SyncPack	Oct 20, 2021 14:15:26	↓ n/a	Schedule ⋮ ☆
PowerFlow Control Tower HealthCheck	1.0.0	System Utilis SyncPack	Oct 19, 2021 14:15:51	👍 Oct 20, 2021 15:52:41	Schedule ⋮ ☆
PowerFlow System Diagnostics	2.0.1	System Utilis SyncPack	Oct 06, 2021 13:34:59	🚫 Oct 19, 2021 14:15:56	Schedule ⋮ ☆
Report: Identify Unmapped Device Classes	1.0.0	ServiceNow CMDB SyncPack	Sep 27, 2021 12:23:15	↓ n/a	Schedule ⋮ ☆
Sync Advanced Topology from SL1 to ServiceNow	1.0.3	ServiceNow CMDB SyncPack	Feb 24, 2020 11:18:46	↓ n/a	Schedule ⋮ ☆
Sync Business Services from ServiceNow to SL1	1.0.0	ServiceNow CMDB SyncPack	Sep 27, 2021 12:23:19	↓ n/a	Schedule ⋮ ☆




You can search for a specific application by typing the name of that in the **Search** field at the top of the **Applications** page. The user interface filters the list as you type. You can also sort the list of applications by clicking the headers of the columns.


The **Applications** page displays the following information:


- **Application Name.** Lists the name of the application.
- **Version.** Lists the version of the application.
- **SyncPack.** Lists the name of the Synchronization PowerPack (or "SyncPack") to which a specific application belongs, where relevant. You can click the name of the Synchronization PowerPack to which an application belongs to go to the Synchronization PowerPack page for that pack.


- **Edited.** List the date and time for when the application was last edited by a user.
- **Last Run.** Shows the current status of all of the PowerFlow applications:

Icon	Status
	The application ran successfully.
	The application is currently running. An application can have one of the following statuses: <ul style="list-style-type: none"> • Started. The application is currently running. • Pending. The application has not run or will not run. If you stop the application, the next tasks will not run.
	The application failed to run successfully.
-	The application has not been run.

- **Actions.** Contains the following icons, or, if the browser window is not fully maximized, displays the **[Actions]** button () with the following options:
 - The **[Schedule]** button lets you use the Scheduler to define how often or at what time to run an application. A scheduled application displays a check mark in the **[Schedule]** button on this page. For more information, see [Scheduling a PowerFlow Application](#).
 - The **[Favorite]** button () lets you select the applications that you want to see in the **Favorite Applications** widget on the **PowerFlow Control Tower** page.
 - The **[Actions]** button () for an application gives you the option to run, view, or delete that application. You cannot run an application in Debug Mode or run an application with custom attributes from this menu. Click **View** to open the **Application** detail page if you want to use Debug Mode and custom attributes.

Some of the applications on the **Applications** page of the PowerFlow user interface are *internal* applications that you should not run directly. Instead, other "parent" applications run these internal applications. To view the internal applications, click the Filter icon () at the top right of the **Applications** page and select *Show Hidden Applications*. Internal applications are hidden by default.

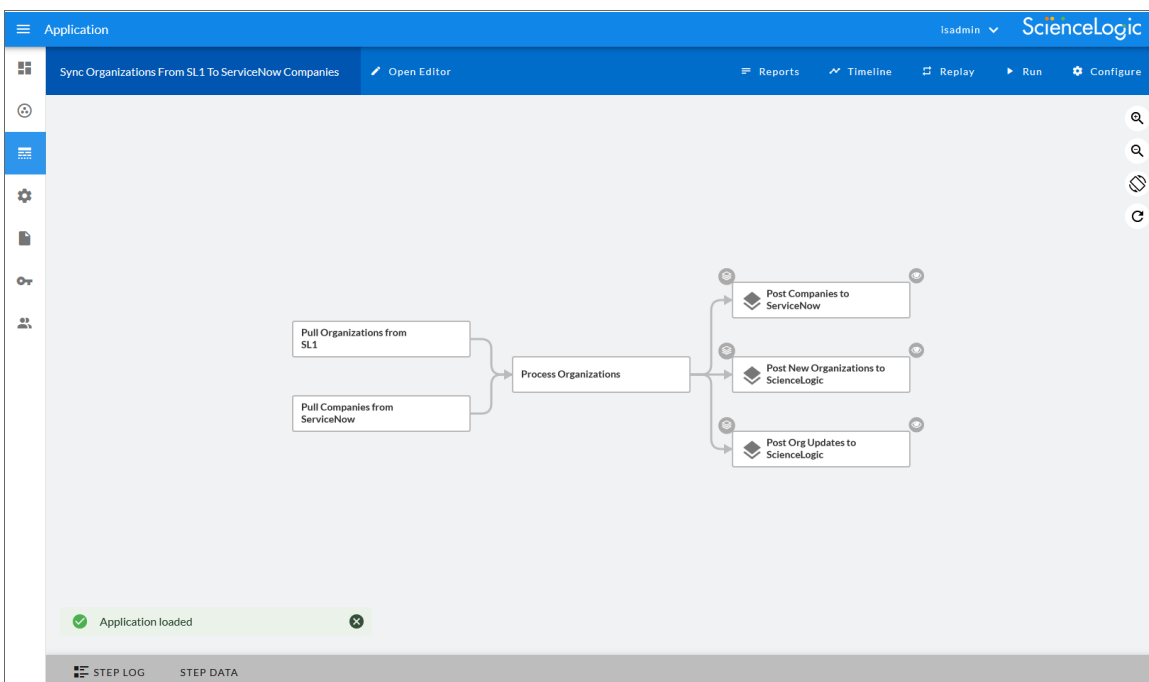
TIP: To view the applications that belong to only one Synchronization PowerPack or some of the Synchronization PowerPacks, click the Filter icon () and select the Synchronization PowerPacks that contain the applications you want to view from the **Filter by SyncPack** drop-down. To go back to seeing all applications on the **Applications** page, click **Clear selected items**.

To manually refresh the **Applications** page, click the refresh icon () next to the "countdown timer". Otherwise, PowerFlow automatically refreshes the page after 300 seconds (five minutes).

TIP: To open the **Notification Center** pane, which contains a list of all of the pop-up messages about PowerFlow applications that were run successfully or with warnings or failures, click your user name in the navigation bar in the top right and select *Notifications*. The different notifications are color-coded: green for success, yellow for warning, and red for failure. The number of notifications displays as a badge in the menu. For more information about a notification, click the link for the notification and review the **Step Log** and **Step Data** tabs for the application steps.

Elements of an Application Page

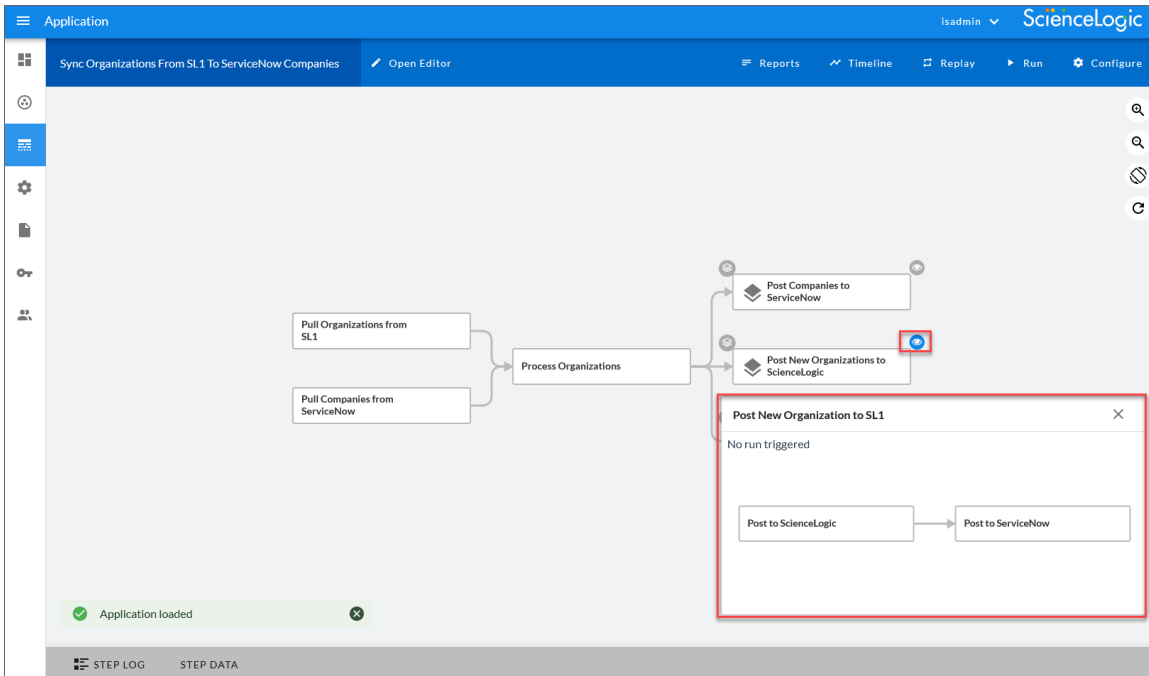
When you click the name of an application on the **Applications** page, an **Application** detail page appears:



The **Application** detail page contains the logic for the application. In the main viewing pane, the steps for the application are organized as a flowchart. Each rectangular block is a step, and the arrows indicate the order in which the steps will execute when you run the application. The color of each step changes to show the progress of the application run as it runs: green for success, red for failure, and blue for running.

If a step triggers a child application, a blue information icon (📘) appears in the upper left corner of the step. Click the icon to display the triggered application's run as a link in a pop-up window, which lists the run IDs by Success, Failure, or In Progress. You can click the link in the pop-up window to view the detail page for the triggered application. If no run ID is present, the pop-up window displays "No runs available".

Also, you can click the eye icon (👁️) next to a step to open a smaller window, also called a "picture-within-a-picture", that displays the step or steps for the triggered application:



Buttons

The buttons at the top of an **Application** page include the following:

- **[Open Editor]**. Opens the **Steps Registry** pane and launches the PowerFlow builder interface. The **Steps Registry** pane contains a list of all available steps in the PowerFlow builder.

After you click **[Open Editor]** button, the following buttons appear in the top navigation bar:

- **[Close Editor]**. Closes the **Steps Registry** pane.
- **[Save]**. Lets you save any changes to the steps and application. You can also save the edited application as a new application with new metadata using the Save as option.
- **[Metadata]**. Opens the **Integration Metadata** window for that application so you can update the description, version, or author of the application.

For more information, see [Editing an Application](#).

NOTE: The PowerFlow builder is available only in SL1 Premium solutions. To upgrade, contact ScienceLogic Customer Support. For more information, see [ScienceLogic Pricing](#).

- **[Reports]**. Displays a report of the results of this application, where applicable. For more information, see [Generating and Viewing Reports for PowerFlow Applications](#).



- **[Timeline]**. Opens the Timeline view at the top of the window where you can view past runs of this application, and whether the application failed or succeeded. For more information, see [Viewing Previous Runs of an Application](#).
- **[Replay]**. Replays the last run of this application. If you hover over this, you can choose from the following options:
 - *Info Replay*. Replay the last run the application in Debug Mode, which provides more log data in the Step Logs to help you with troubleshooting.
 - *Custom Replay*. Replay the last run of the application with custom parameters for testing or troubleshooting.
- **[Run]**. Runs the application if you click the button without hovering over it. If you hover over the **[Run]** button, you can choose from the following options:
 - *Info Run*. Run the application in Debug Mode, which provides more log data in the Step Logs to help you with troubleshooting.
 - *Custom Run*. Run the application with custom parameters for testing or troubleshooting.


TIP: You can click **[Run]** to run an application and then navigate to another page in the PowerFlow, and the application will complete on its own.


TIP: After you start a run, you can click **[Stop]** to stop that application and end all running tasks for that application. The **[Stop]** button only appears while an application is running.

For more information, see [Running a PowerFlow Application](#).

- **[Configure]**. Opens the **Configuration** pane for the application, where you can change the configuration object aligned with the application and edit other configuration variables as needed. For more information, see [Aligning a Configuration Object with an Application](#).

TIP: Click the **Zoom** icons ( , ) to change the size of the steps on the PowerFlow builder.

TIP: Click the **Rotate** icon () to turn the PowerFlow builder 90 degrees. Starting with PowerFlow Platform version 2.4.0, the flowcharts display horizontally by default instead of vertically.

TIP: Click the **Manual refresh** icon () to refresh the **Application** page.

Status Messages

In the bottom left-hand corner of the page, pop-up messages appear temporarily with the status of the application or an action. In the example above, the status is "Run: success". Click the close button on the message to close the message.

Step Pane

The **Step** pane at the bottom of an **Application** page displays two tabs:

- **[Step Log]**. Displays the time, the type of log, and the log messages from a step that you selected in the main pane. All times that are displayed in this pane are in seconds.
- **[Step Data]**. Displays the JSON data that was generated by the selected step.

Click the **Step** pane again to hide the pane.

TIP: For longer step log messages, click the down arrow icon (▼) in the **Message** column of the **[Step Log]** tab to open the message. To copy a message, triple-click the text of the message to highlight the entire text block, and then click the Copy Message icon (📄) next to that message. To copy the entire log, click the **[Copy Log]** button.

Creating a Basic PowerFlow Application

On the **Applications** page, you can create new applications using the PowerFlow builder interface.

TIP: To add a flow control operator to an application, such as a **Condition**, a **Transform**, or a **Trigger Application** operator, see [Working with Flow Control Operators](#).

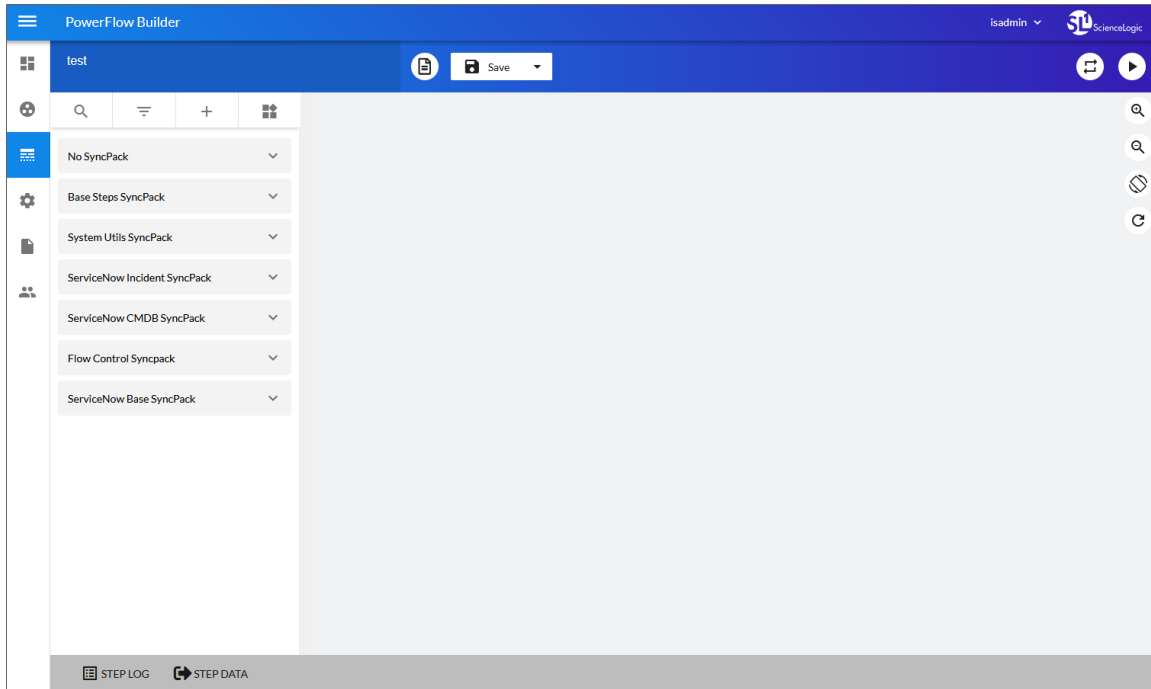
NOTE: The PowerFlow builder is available only in SL1 Premium solutions. To upgrade, contact ScienceLogic Customer Support. For more information, see [ScienceLogic Pricing](#).

To create a basic PowerFlow application:

1. From the **Applications** page (🏠), click **[Create Application]**. A **Create Application** window appears.
2. Complete the following fields:
 - **Friendly Name**. The name that you want users to see for this application. Required.
 - **Description**. A short description of what this application does.
 - **Author**. The name of the person or company that created this application. Use the same name for multiple applications. Required.
 - **Version**. The version for this application.

- **Configuration.** Select a configuration object to align with the new application, or select *Make New Configuration* to create a new configuration object.

3. Click **[Set Values]**. The PowerFlow builder interface appears:



4. On the **Steps Registry** pane, 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 view 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, and if the step does not belong to a published Synchronization PowerPack, you can also delete that step from the registry.

5. On the **Steps Registry** pane, select the step you want to add and drag it to the main viewing pane ("canvas"). The **Configuration** pane for that step appears.
6. On the **Configuration** pane, type a new name for the step and update the other fields on the pane as needed. If needed, click the down arrow on the **Advanced** section to update the advanced fields.

TIP: For example, if you are getting data from SL1, you would type the IP address for your SL1 system, along with the API endpoint in the **prefix_url** field, such as **10.10.10.1/api/device**.

7. To verify that the parameters you specified are correct and the step is configured correctly, click **[Run]** at the bottom of the pane to run the step.
8. On the **Configuration** pane, click **[Save]** to save the parameters for the new step. The **Application** detail page appears again.

NOTE: Clicking **[Save]** on the **Parameters** pane only saves the settings for this specific step; it does not save the new application.

9. Click **[Save]** in the top navigation bar to save the new application.
10. To test your application so far, click the **[Run]** button in the top navigation bar. Click the **[Step Log]** to view the results of the run on the **[Step Log]** and **[Step Data]** tab.
11. Repeat steps 4-10 to add more steps to the application.

TIP: To connect one step to another, click on the bottom of the first step and drag the mouse to the second step. An arrow appears between the two steps, which you can click and drag to reposition.

TIP: To adjust the position of any step on the main viewing pane, click the step you want to move and drag it to its new location. To *remove* a step from the main viewing pane, click the ellipsis icon (**⋮**) on the step and select *Delete*.




12. Click **[Save]** to save your work.

TIP: To add a flow control operator to an application, such as a **Condition**, a **Transform**, or a **Trigger Application** operator, see [Working with Flow Control Operators](#).

13. On the **Application** detail page, add any additional steps and operators to the new application, and then click **[Save]** and the **[Close Editor]** button. The application is added to the **Applications** page.

Working with Flow Control Operators

When you are creating or editing a application in the PowerFlow builder interface, you can use "flow control" operators, including the following operators that you can drag and drop onto the step workflow on the canvas:

- The **Condition** operator () lets you create for branching workflows, such as If-Else or If-Then-Else statements. The **Conditional Wizard** pane lets you modify the conditions that enable branching in the workflow. For more information, see [Creating an Application with a Condition Operator](#).
- The **Transform** operator () lets the application pull data gathered by a previous step and modify or transform that data to fit into the next step. The **Transform Wizard** pane lets you specify which data you want to use or transform from the previous steps. For more information, see [Creating an Application with a Transform Operator](#).
- The **Trigger Application** operator () lets you launch another PowerFlow application from within a new or existing PowerFlow application. The **Trigger App Wizard** pane lets you select the child application you want to launch from the current (parent) application and specify the data that you want to pull from the child application. For more information, see [Creating an Application with a Trigger Application Operator](#).

You can add more than one type of operator to the same PowerFlow application, and you can add more than one operator with the same type as well.


NOTE: The *Flow Control Synchronization* PowerPack contains the "IfStep" step that enables the logical branching used by the PowerFlow builder. This Synchronization PowerPack is included in PowerFlow.



For more information about how to use PowerFlow builder to create low-code automated workflows that use "flow control" operators, watch the video at <https://www.youtube.com/watch?v=isHImAGyQQc>

Creating an Application with a Condition Operator


You can drag a **Condition** operator () onto an application workflow to create the option for branching flows, such as If-Else or If-Then-Else statements.

To create an automation that contains a **Condition** operator:

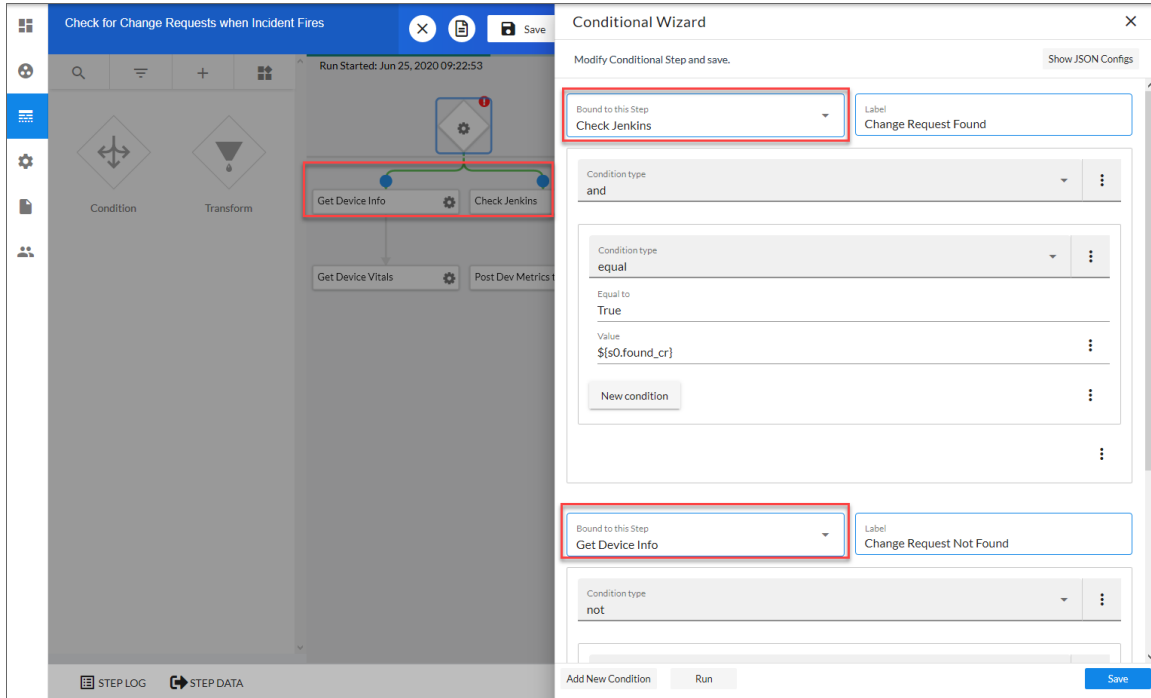
1. From the **Applications** page () , click **[Create Application]**. A **Create Application** window appears.
2. Complete the following fields:
 - **Friendly Name**. The name that you want users to see for this application. Required.
 - **Description**. A short description of what this application does.
 - **Author**. The name of the person or company that created this application. Use the same name for multiple applications. Required.
 - **Version**. The version for this application.
 - **Configuration**. Select a configuration object to align with the new application, or select *Make New Configuration* to create a new configuration object.

3. Click **[Set Values]**. The PowerFlow builder interface appears.
4. On the **Steps Registry** pane, search for a step or filter the list of steps to help you find the step you need.
5. On the **Steps Registry** pane, click the step you want to add and drag it to the main viewing pane ("canvas"). The **Configuration** pane for that step appears.
6. On the **Configuration** pane, type a new name for the step and update the other fields on the **Configuration** pane as needed. If needed, click the down arrow on the **Advanced** section to update the advanced fields.
7. To verify that the parameters you specified are correct and the step is configured correctly, click **[Run]** at the bottom of the pane to run the step.
8. On the **Configuration** pane, click **[Save]** to save the parameters for the new step. The **Application** detail page appears again.
9. Click **[Save]** in the top navigation bar to save the new application.
10. To test your application so far, click the **[Run]** button in the top navigation bar. Click the **[Step Log]** to view the results of the run on the **[Step Log]** and **[Step Data]** tab.
11. Repeat steps 4-10 to add more steps to the application.
12. Click **[Save]** to save your work.
13. Click the **[Run]** button to run the new application and gather data for the steps that will send data to the **Condition** operator.
14. On the **Steps Registry** pane, click the **[Advanced]** tab (). The flow control operators appear.
15. To add the option for branching flows, such as If-Else or If-Then-Else statements, drag the **Condition** operator () onto the canvas. The operator displays as a step with an "ifStep" label.
16. Connect the steps for the branching workflow to the **Condition** operator by clicking the outline of each step and dragging the arrow that appears to the **Condition** operator. Repeat this process for all of the steps that should be part of the branching workflow.

TIP: The arrows connecting the steps and the **Condition** operator display as green to show the flow of the data, based on the values in the application. In Edit mode, you can click the blue circle above a branched step to open the **Conditional Wizard** pane to see the conditions for that step.

17. Click the **[Save]** button and then click the **[Run]** button to gather data again for all of the steps that will send data to the **Transform** operator.
18. Click the ellipsis icon () on the **Condition** operator and select *Configure*. The **Conditional Wizard** pane for that operator appears.


19. Click **[Add New Condition]** to configure the conditions for the operator:




20. Complete the following fields on the **Conditional Wizard** pane for each step you want to include in the branching:

- **Bound to this Step.** Specify the step connected to the **Condition** operator.
- **Label.** Type a brief description of the branching condition, such as "Change Request Found". This text will display above the selected step when you are out of Edit mode.

- **Condition type.** Select the condition that this step needs to meet to allow branching. The condition type you select here determines what options display in the field or fields below this field. You can use variables from the previous step, which you can find on the **[Step Data]** tab of the **Step** pane for that step. Your options include:
 - *equal.* In the **Equal to** field, type *True* or *False*. In the **Value** field, specify the variable that should be true or false.
 - *numeric.* In the **Value** field, specify the variable that should fall within the range specified by the **Above** and **Below** fields .
 - *template.* In the **Value** field, type a condition that can include numeric or another kind or comparison. For example: `${step_name.stop_step} == true`
 - *and.* Joins two or more conditions with the AND logic operator, and these conditions can be simple or complex conditions. This is the default option.
 - *not.* Inverts the result of the simple condition type. This condition can contain only one condition inside of it.
 - *or.* Joins two or more conditions with the OR logic operator.

TIP: In a **Value** field under the **Condition type**, you can also click the **[Actions]** button () and click *Select property* to use data from one of the previous steps, if available.

21. You can add a sub-condition for the same step by clicking the **[Actions]** button () for the **Condition type** field and selecting *Add sub-condition*. You can also click the **[New condition]** button to add a sub-condition.
22. To add another set of conditions in addition to the first set of conditions, click the **[Add New Condition]** button and repeat steps 20-21 .
23. Edit the remaining conditions on the **Conditional Wizard** pane, and then click **[Save]**. The **Application** detail page appears.
24. Add additional steps and operators to the new application as needed, and then click the **[Save]** and the **[Close Editor]** buttons. The application is added to the **Applications** page.




Creating an Application with a Transform Operator

In the PowerFlow builder interface, you can drag a **Transform** operator () from the **Steps Registry** pane onto an application workflow.

The **Transform** operator can pull data gathered by a previous step, and then modify or transform the data to fit into the next step. The operator uses a Jinja2 template to merge the data from previous steps.

For example, you might want to use the **Transform** operator if a step in an application is pulling in a large amount of data, but you only want to focus on a specific sub-set of that data. The **Transform** operator lets you filter that data to show only the data you need, and you can use that data in the following steps of the application.

To create an application with a **Trigger Application** operator:

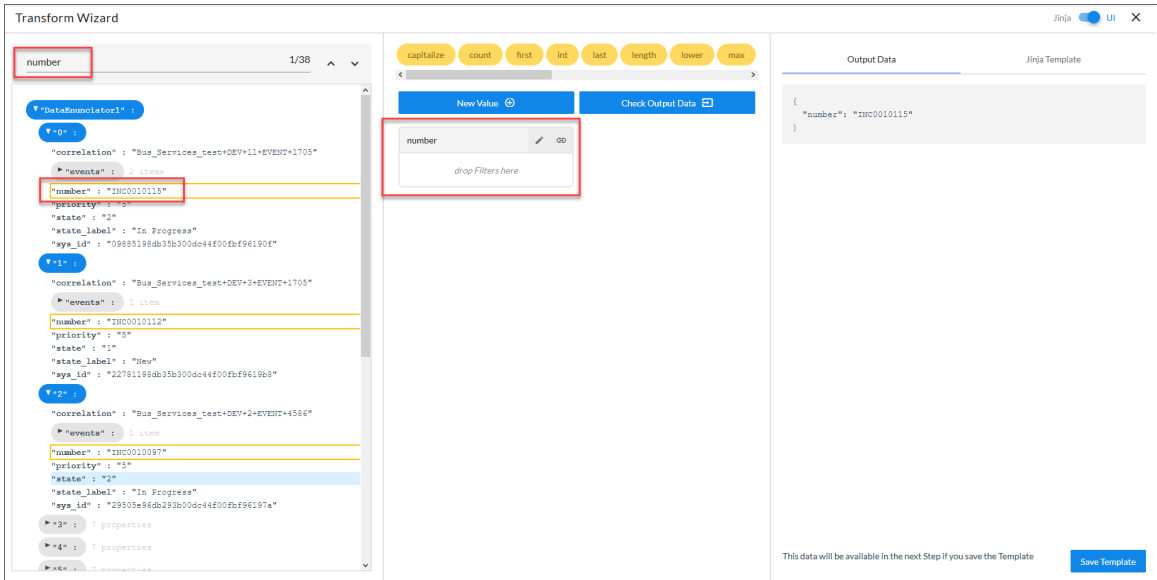
1. From the **Applications** page () , click **[Create Application]**. A **Create Application** window appears.
2. Complete the following fields:
 - **Friendly Name**. The name that you want users to see for this application. Required.
 - **Description**. A short description of what this application does.
 - **Author**. The name of the person or company that created this application. Use the same name for multiple applications. Required.
 - **Version**. The version for this application.
 - **Configuration**. Select a configuration object to align with the new application, or select *Make New Configuration* to create a new configuration object.
3. Click **[Set Values]**. The PowerFlow builder interface appears.
4. On the **Steps Registry** pane, search for a step or filter the list of steps to help you find the step you need.
5. On the **Steps Registry** pane, click the step you want to add and drag it to the main viewing pane ("canvas"). The **Configuration** pane for that step appears.
6. On the **Configuration** pane, type a new name for the step and update the other fields on the **Configuration** pane as needed. If needed, click the down arrow on the **Advanced** section to update the advanced fields.
7. To verify that the parameters you specified are correct and the step is configured correctly, click **[Run]** at the bottom of the pane to run the step.
8. On the **Configuration** pane, click **[Save]** to save the parameters for the new step. The **Application** detail page appears again.
9. Click **[Save]** in the top navigation bar to save the new application.
10. To test your application so far, click the **[Run]** button in the top navigation bar. Click the **[Step Log]** to view the results of the run on the **[Step Log]** and **[Step Data]** tab.
11. Repeat steps 4-10 to add more steps to the application.
12. Click **[Save]** to save your work.
13. Click **[Run]** to run the new application and gather data for the steps that will send data to the **Transform** operator.
14. On the **Steps Registry** pane, click the **[Advanced]** tab () . The flow control operators appear.
15. Drag the **Transform** operator () onto the canvas. The operator displays as a step with a "Jinja2Template" label.
16. Locate the step or steps that contain data you want to *send* to the following step or steps. Connect the step or steps to the **Transform** operator by clicking the outline of each step and dragging the arrow that appears to the **Transform** operator.
17. Connect the step or steps that will *receive* the transformed data by clicking the outline of the **Transform** operator and dragging the arrow that appears to those steps.

TIP: The arrows connecting the steps and the **Transform** operator display as green to show the flow of the data, based on the values in the application.




18. Click the **[Save]** button and then click the **[Run]** button to gather data from the step or steps that will send data to the **Transform** operator.
19. Click the ellipsis icon (**⋮**) on the **Transform** operator. The **Transform Wizard** page appears.
20. As needed, click the **Jinja/UI** toggle at the top right of the page to switch between the **Jinja** code-only view or the **UI** drag-and-drop view. The default view is **UI**.
 - If you are using the **UI** drag-and-drop view, see steps 21 to 26.
 - If you are using the **Jinja** code-only view, see steps 27 to 28.

TIP: Use the **Search** field at the top of the left-hand pane to search for the data you want to transform. Use the up and down arrows to move through the search results.

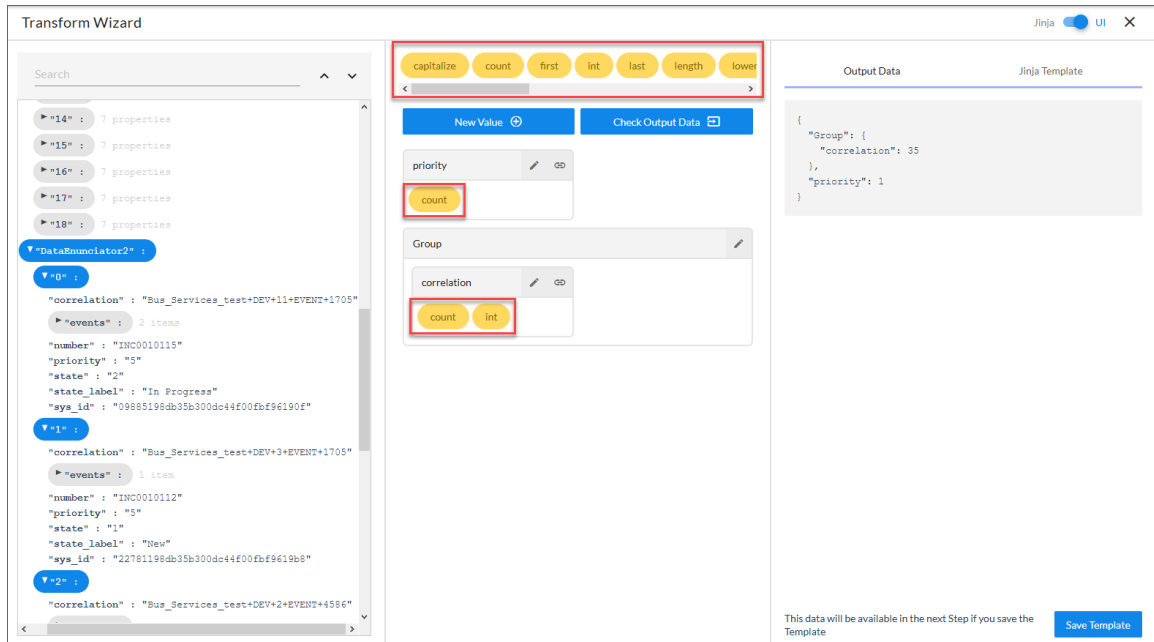
21. In the **UI** drag-and-drop view, search for the value that you want to transform in the first pane and drag and drop that value onto the middle pane. A new value box appears in the middle pane:



You can drag and drop add multiple values from the first pane onto the middle pane. PowerFlow uses these values to create the Jinja template for this **Transform** step. You can also drag and drop a group of values onto the middle pane by clicking the blue oval at the top of the list of values.

TIP: To edit the name of a value box in the middle pane , click the pencil icon () and type a new name. To see the link between a value from the first pane and the value in the middle pane, click the link icon (). To view the list of values from that value box that will be added to the Jinja2 template, click the Preview icon () .

22. To delete a value box from the middle pane, drag the box toward the bottom of the middle pane. A "drop here to delete" rectangle appears, and when you drag the box into that rectangle, it turns red. Drop the value box into the red rectangle to delete the box.
23. To create a new value box, click the **[New Value]** button and type a name for it in the middle pane. Then you can drag and drop data from the first pane into that value box.
24. To use a Jinja filter on a value in the middle pane, drag one or more of the yellow filter ovals into the relevant value box in the middle pane. The user interface will show a "Not supported" message for any filters that are not compatible with certain value types, such as a "capitalize" filter with a number value. For more information about Jinja filters, see the [List of Built-in Filters in the Jinja documentation](#).



TIP: If you add a "select" or a "reject" filter to a value box, additional fields will appear at the bottom of the middle pane when you add one of those filters. Depending on the filter you chose, type the value you want to include or reject in the **Name** field that appears, and select *String* or *Number* as needed. Click **[Save]** to finish configuring the filter.

25. When you are done adding values from the first pane and adding filters from the middle pane to the various value boxes, click **[Check Output Data]**. The data for the Jinja2 template you just created appears in the **[Output Data]** tab, while the actual code for the template appears in the **[Jinja Template]** tab.
26. If you are satisfied with the results of the Jinja2 template the **[Jinja Template]** tab and the data on the **[Output Data]** tab, go to step 29.

27. In the **Jinja** code-only view, on the first pane of the **Transform Wizard** page, you can view all of the data gathered from the steps that you selected to send to the **Transform** operator in step 13. You will use this data to create a Jinja2 template on the **[Jinja Template]** tab.

TIP: The data on the first pane matches the data you would see if you selected each step connected to the **Transform** operator and clicked the **[Step Data]** tab.

28. On the **[Jinja Template]** tab, you can use data from the first pane to create a Jinja2 template to manipulate and change that data to use in the next step of the application. A **Jinja2 template** lets you create complex, concatenated (linked) fields. For more information about Jinja2 Templates, see the [Template Designer Documentation](#).

Example 1

For a simple example for a step that gathers specific data about a device, you could create the following Jinja2 template on the **[Jinja Template]** tab:

```
{% set output =
{"sys_name": input["name"],
"sys_ip": input["ip"]} %}{{output|tojson}}
```

TIP: Click **[Check the Output Data]** on the **[Jinja Template]** tab to run the Jinja2 template you created on the **[Jinja Template]** tab. The results of this process appear on the **[Output Data]** tab.

After running the above Jinja2 template, you would see the following data on the **[Output Data]** tab:

```
{
"sys_ip": "10.2.11.154",
"sys_name": "pm-aio-11-154"
}
```

Example 2

For a more complicated example, you could create the following Jinja2 template to gather and merge data from the "GetIncidents" and the "GetCompletedCRs" steps:

```
{% set d=dict() %} {% set crupdate =
d.update(
'changeRequests': GetCompletedCRs,
'correlation': GetIncidents.0.correlation,
'device_id': GetIncidents.0.events.0.device.id,
'event_id': GetIncidents.0.events.0.event_id,
'device_name': GetIncidents.0.events.0.device.name,
'device_sysid': GetIncidents.0.events.0.device.sys_id,
'found_cr': GetIncidents.0.sys_id in GetCompletedCRs,
'incident_number': GetIncidents.0.number,
'incident_sys_id': GetIncidents.0.sys_id }) %} {{ d|tojson }} ]
```

After running the above Jinja2 template, you would see the following data on the **[Output Data]** tab:

```

{
  "changeRequests": [],
  "correlation": "Bus_Services_test+DEV+15+EVENT+3636",
  "device_id": "15",
  "device_name": "enagley-cmdr-34-242",
  "device_sysid": "7b01681edb1df300dc44f00fbf9619e7",
  "event_id": "12503",
  "found_cr": false,
  "incident_number": "INC0010104",
  "incident_sys_id": "06685154db35b300dc44f00fbf961933"
}


```

29. As needed, edit any other data on the **Transform Wizard** page, and then click the **[Save Template]** button.
30. Close the **Transform Wizard** page. The **Application** detail page appears again.
31. Click the **[Save]** button to save your work.


TIP: Click the **[Run]** button to test the new application. When the run completes, select the **Transform** operator and click the **[Step Data]** tab to view the filtered set of data.



32. Add any additional steps and operators to the new application, and then click the **[Save]** button and then the **[Close Editor]** button. The application is added to the **Applications** page.

Creating an Application that Uses a Trigger Application Operator

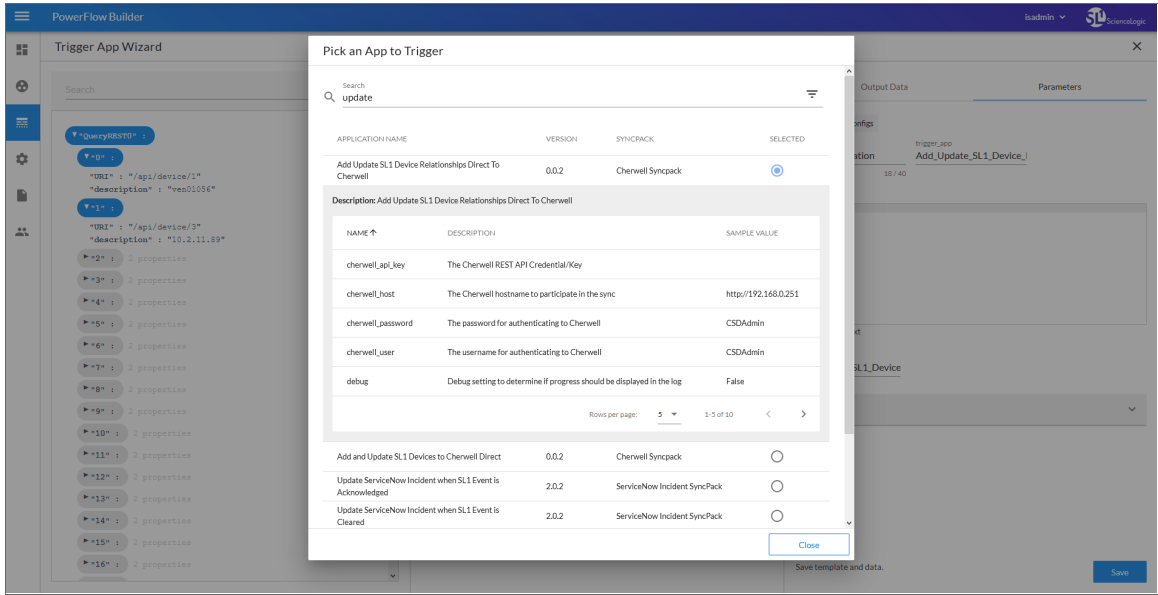
In the PowerFlow builder interface, you can use the **Trigger Application** operator () to launch one or more PowerFlow applications from within a new or existing PowerFlow application. This operator uses the same functionality as the "Trigger Application" step from the Base Steps Synchronization PowerPack.

The **Trigger Application** operator gathers data from a previous step in the application workflow, in the same way as the **Transform** operator. You can use the **Trigger Application** operator to organize specific data that will be used in the triggered application or applications.

1. From the **Applications** page () , click **[Create Application]**. A **Create Application** window appears.
2. Complete the following fields:
 - **Friendly Name**. The name that you want users to see for this application. Required.
 - **Description**. A short description of what this application does.
 - **Author**. The name of the person or company that created this application. Use the same name for multiple applications. Required.
 - **Version**. The version for this application.
 - **Configuration**. Select a configuration object to align with the new application, or select *Make New Configuration* to create a new configuration object.

3. Click **[Set Values]**. The PowerFlow builder interface appears.
4. On the **Steps Registry** pane, search for a step or filter the list of steps to help you find the step you need.
5. On the **Steps Registry** pane, click the step you want to add and drag it to the main viewing pane ("canvas"). The **Configuration** pane for that step appears.
6. On the **Configuration** pane, type a new name for the step and update the other fields on the **Configuration** pane as needed. If needed, click the down arrow on the **Advanced** section to update the advanced fields.
7. To verify that the parameters you specified are correct and the step is configured correctly, click **[Run]** at the bottom of the pane to run the step.
8. On the **Configuration** pane, click **[Save]** to save the parameters for the new step. The **Application** detail page appears again.
9. Click **[Save]** in the top navigation bar to save the new application.
10. To test your application so far, click the **[Run]** button in the top navigation bar. Click the **[Step Log]** to view the results of the run on the **[Step Log]** and **[Step Data]** tab.
11. Repeat steps 4-10 to add more steps to the application.
12. Click **[Save]** to save your work.
13. Click the **[Run]** button to run the new application and gather data for the steps that will send data to the **Trigger Application** operator.
14. On the **Steps Registry** pane, click the **[Advanced]** tab (). The flow control operators appear.
15. Drag the **Trigger Application** operator () onto the canvas. The operator displays as a step with a "TriggerApplication" label.
16. Connect an existing step to the **Trigger Application** operator by clicking the outline of the step and dragging the arrow that appears to the operator.
17. Add additional steps as needed and click the **[Save]** button.
18. Click the **[Run]** button to run the new application and gather data for the **Trigger Application** operator.

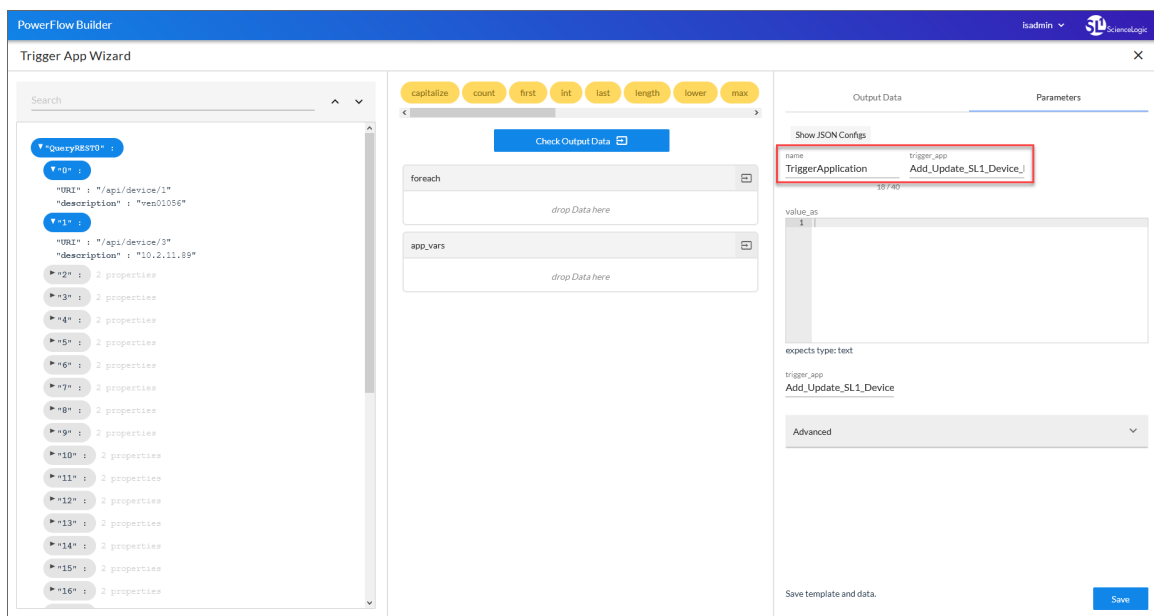
19. Click the ellipsis icon (**⋮**) on the **Trigger Application** operator. The **Pick an App to Trigger** window for the **Trigger App Wizard** page appears:



20. Select the PowerFlow application that you want to trigger with this step.

NOTE: When you select the application, a table appears below the application name. This table contains a description of the application you want to trigger, along with the required application variables from the **Configuration** pane for that application.

- Click **[Close]**. The main **Trigger App Wizard** page appears, with the name of the application you selected added to the **name** (friendly name) and **trigger_app** (system name) fields of the **[Parameters]** tab on the far right of the window:



TIP: To change the application that you want to trigger, click the application name in the **trigger_app** field, and the **Pick an App to Trigger** window appears again.

- In the first pane, search for the values that you want to use in the triggered application and drag and drop those values onto a value box in the middle pane:
 - foreach:** Triggers one or more instances of the application you specified in step 16 for each value in the list or dictionary. To enable this feature, you will need to specify the **input_iterator**, **key_as**, and **value_as** parameters on the **Advanced** section of the **[Parameters]** tab. For more information, see the [Parameters table](#).
 - app_vars:** Values added to this box are used as application variables for the triggered application.

NOTE: The middle pane works as a "transform wizard" that adds data to the **[Output Data]** and **[Parameters]** tabs of the third pane.

TIP: To edit the name of a value box in the middle pane, click the pencil icon (✎) and type a new name. To see the link between a value from the first pane and the value in the middle pane, click the link icon (🔗). To view the list of values from that value box that will be included in the output data, click the Preview icon (🔍).

23. To delete a value box from the middle pane, drag the box toward the bottom of the middle pane. A "drop here to delete" rectangle appears, and when you drag the box into that rectangle, it turns red. Drop the value box into the red rectangle to delete the box.
24. To use a Jinja filter on a value in the middle pane, drag one or more of the yellow filter ovals into the relevant value box in the middle pane. The user interface will show a "Not supported" message for any filters that are not compatible with certain value types, such as a "capitalize" filter with a number value. For more information about Jinja filters, see the [List of Built-in Filters in the Jinja documentation](#).

TIP: If you add a "select" or a "reject" filter to a value box, additional fields will appear at the bottom of the middle pane when you add one of those filters. Depending on the filter you chose, type the value you want to include or reject in the **Name** field that appears, and select *String* or *Number* as needed. Click **[Save]** to finish configuring the filter.

25. When you are done adding values from the first pane and adding filters from the middle pane to the various value boxes, click **[Check Output Data]**. The data you added in the middle pane is formatted and added to the **[Output Data]** tab.
26. As needed, update the values on the **[Parameters]** tab for the triggered application. For more information, see the [Parameters table](#).

NOTE: If you have a configuration object aligned with this application, that configuration object will also be used by the triggered applications. However, the values from the configuration object will be overwritten by any of the parameters you set in the **Trigger App Wizard** page.

27. Edit any other data on the **Trigger App Wizard** page, and then click **[Save]**. the **Application** detail page appears.
28. Click the **[Save]** button to save your work.

TIP: Click the **[Run]** button to test the new application. When the run completes, select the **Trigger Application** operator and click the **[Step Data]** to view the filtered set of data that will be sent to the triggered application.

29. Add additional steps and operators to the new application as needed, and then click the **[Save]** and the **[Close Editor]** buttons. The application is added to the **Applications** page.

Parameters Table

The following table describes the different parameters you can set on the **[Parameters]** tab of the **Trigger App Wizard** page:

Parameter Name	Default Value	Description
name	TriggerApplication	Unique name of this step. Edit this field as needed.
trigger_app	N/A	The name of the PowerFlow application you want to run or "trigger" from the current application. This value is automatically set to the system name for the application you selected from the Pick an App to Trigger window.
value_as	N/A	<ul style="list-style-type: none"> If the input in the foreach value box in the middle pane of the wizard page is a dictionary, specify the name of the application variable for those values. If the input in the foreach value box is a list, the application variable will be set with the elements of the list.
Advanced parameters		
retry_countdown	180	The interval between retries, in seconds.
retry_max	0	The maximum number of times the PowerFlow system will retry to execute the step before it stops retrying and logs a step failure.
retry_backoff	unselected	Instead of using a defined interval between retries, the PowerFlow system will incrementally increase the interval between retries.
retry_jitter	unselected	Instead of using a defined interval between retries, the PowerFlow system will retry the step execution at random intervals.
retry_backoff_max	600	The maximum time interval for the retry_backoff option, in seconds.
template	N/A	Displays the Jinja2 template that is used for rendering the desired data.
foreach	N/A	The contents of the foreach value box in the middle pane of the Trigger App Wizard page triggers multiple applications for each value in that list or dictionary. Any values you specify in this text box will get overwritten if values are added to the foreach value box in the middle pane of the wizard.

Parameter Name	Default Value	Description
input_iterator	false	<ul style="list-style-type: none"> Set to "true" if you want to execute an instance of the triggered application for each item in the set of input data from the previous step. The data is added as an application variable to the triggered application, and that variable is defined by the value_as parameter . This option is not compatible with the foreach parameter. Set to "false" if you only want to trigger one instance of the triggered application.
key_as	N/A	If the input in the foreach value box is a dictionary, specify the name of application variable for the key.
app_vars	N/A	Specify any application variables you want to add to the triggered applications. Any values you specify in this text box will get overwritten if values are added to the app_vars value box in the middle pane of the wizard page.
exit_on_child_failure	Selected	If you select this option, if any triggered application fails, the step will be marked as a Failure. If you do not select this option, the step will not fail if a triggered application fails, but the step still wait until all triggered apps are completed. The wait_for_child_completion option, below, must be selected for this option to be enabled.
wait_for_child_completion	Selected	Select this option if you want PowerFlow to wait for the triggered applications to complete. If this parameter is not selected, the application ends as soon as the applications are triggered. In either case, if an error occurred with triggering an application, the state of the step is Failed.

TIP: If you receive an error running the step, select the step and click the *Step Log* tab. The error log should list which of the above parameters might be causing the error.

Editing a PowerFlow Application

In the PowerFlow builder 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 **Application** detail page appears.
2. Click the **[Open Editor]** button. The PowerFlow builder interface appears, including the **Steps Registry** pane, which contains a list of all of the available steps.
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, and if the step does not belong to a published Synchronization PowerPack, you can also delete that step from the registry.

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. For more information, see [Creating a Step](#).
5. To use existing steps, click the step or steps you want to add from the **Steps Registry** pane and drag them to the main viewing pane ("canvas") 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 ellipsis icon (⋮) on the step and update the fields as needed on the **Configuration** pane. You can also click the ellipsis icon (⋮) on a step to view the step code for the step or to delete the step.
9. While editing a step, click **[Show JSON Configs]** to view the JSON configuration data for the step. Click **[Hide JSON Editor]** to view the fields instead.
10. To remove a step, click the step to select it and press the **[Delete]** key on your keyboard.

11. To edit the metadata for an application, click the **[Metadata]** button and update the fields in the pop-up as needed.
12. 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.
13. To stop editing and close the **Search Steps Registry** pane, click the **[Close Editor]** button.

Enabling Run Book Automation Queue Retries

If you are using PowerFlow to sync incidents from a third-party application like ServiceNow or Cherwell, you can enable Run Book Action (RBA) queue retries to keep from losing any incidents if PowerFlow is unavailable. Those pending PowerFlow applications are added to an RBA queue that you can access to retry the applications that failed.

Requirements

The RBA queue retries feature has the following requirements:

- PowerFlow version 2.3.0 (Beta 3, CA1, or later)
- SL1 version 11.1.0 (Beta 3, CA1, or later)
- *ServiceNow Base Pack* PowerPack version 106 or later
- *Base Steps Synchronization* PowerPack version 1.3.2 or later
- *System Utils Synchronization* PowerPack version 1.1.2 or later (this Synchronization PowerPack is added to the **SyncPacks** page when you install PowerFlow Platform version 2.3.0 or later)

PowerFlow Applications

The *System Utils Synchronization* PowerPack version 1.1.2 or later includes two new PowerFlow applications to handle Run Book Action retries:

- **Read SL1 RBA Queue and Retry PowerFlow Applications.** Pulls and retries any PowerFlow applications that were not able to be executed by Run Book Actions because PowerFlow was not available.
- **Run PowerFlow Application and Remove It from SL1 RBA Queue.** Runs any pending PowerFlow applications from the RBA queue, and then removes those applications from the RBA queue. This application gets triggered by the "Read SL1 RBA Queue..." application, so no configuration is needed for this application.

Configuration Object

The *System Utils Synchronization* PowerPack also includes "PF RBA retry Configuration Example." You can make a copy of this example configuration object to use with the two applications listed above.

SL1 Action Type

The *ServiceNow Base Pack PowerPack* version 106 or later includes a new Run Book Action Type, "ServiceNow: Send to PowerFlow". You can add the following snippet code from that Action Type into the snippet code for the Run Book Action policy you want to use (if the Run Book Action policy does not already contain that code):

```
payload = {"name": "application_name",  
          "params": {"configuration": "config_name", "app_var1": "app_var1"}}
```

For example:

```
payload = { "name": "pf_controltower_healthcheck",  
           "params": {  
             "pf_host": "https://10.2.11.234",  
             "cmdb_integration": "cmdb_integration"  
           },  
           }
```

You should also add the following snippet code to the Run Book Action policy if the code is not already present:

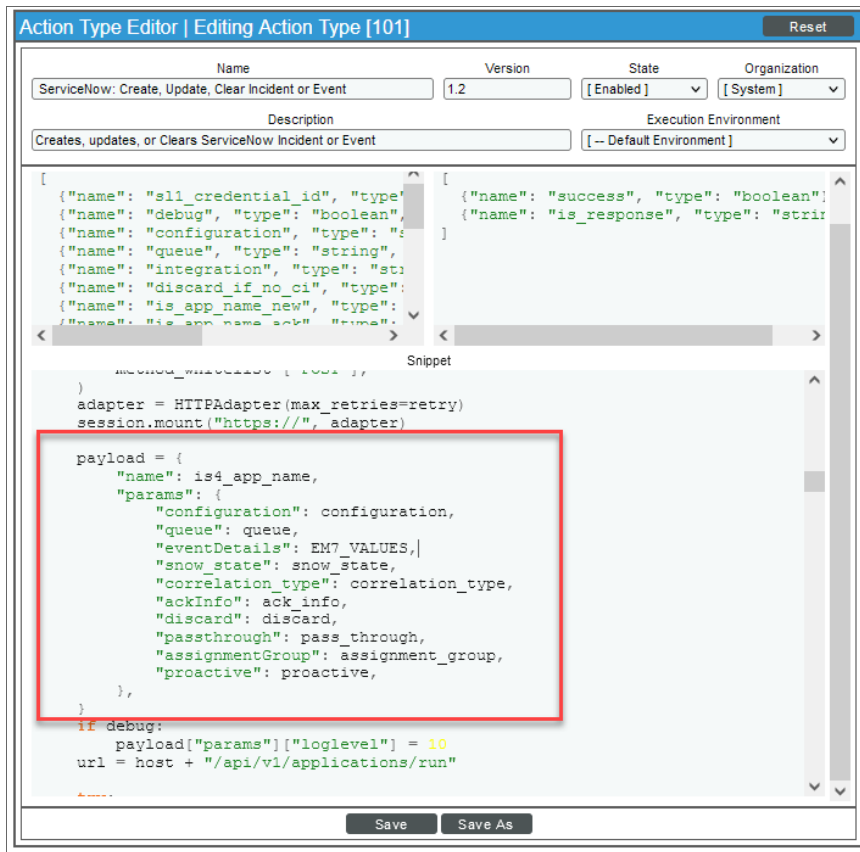
```
EM7_RESULT = {'EM7_RETRY': True, 'EM7_EXTRA_PARAMS': payload}
```

NOTE: The Run Book Action policies in *ServiceNow Base Pack PowerPack* version 106 or later contain this snippet code by default.

Enabling RBA Queue Retries

To enable RBA queue retries:

1. If you need to copy the snippet code, open SL1, navigate to the **Action Types** page (Registry > Run Book > Action Types), and click the edit icon (🔧) for the "ServiceNow: Create, Update, Clear Incident or Event" Action Type or the "ServiceNow: Send to PowerFlow" Action Type. The **Action Type Editor** modal appears:




2. Copy the payload section and close the Action Type Editor modal without saving it.
3. Go to the **Actions** page (Registry > Run Book > Action Types) and click the edit icon (🔧) for the Run Book Action policy you want to use. The **Action Editor** modal appears.
4. In the **Input Parameters** pane, paste the payload section from step 2, along with the following required code:
5. In the **Input Parameters** pane, update the parameters in the payload section as needed. The following parameters are examples:
 - **name**. Specifies the system name of the PowerFlow application you want to use for retries. The system name displays at the end of the URL, after **/integrations/**.
 - **configuration**. Specifies the system name of the configuration object aligned with the PowerFlow application. The system name displays in the **Configuration** field on the **Configuration** pane of any application aligned with that configuration object.
 - **queue**. Specifies the worker queue on which the application runs.

6. Make sure that the following snippet code is present in the **Input Parameters** pane; copy and paste it into the pane if it is not present:

```
EM7_RESULT = {'EM7_RETRY': True, 'EM7_EXTRA_PARAMS': payload}
```

NOTE: You can also add the snippet code from steps 2 and 3 to the **Input Parameters** pane of a Run Book Action policy.

7. Go to the **Actions** page (Registry > Run Book > Actions) and click the edit button () for the Run Book Action for which you want to enable retries.
8. Make sure that the "ServiceNow: Create, Update, Clear Incident or Event" Action Type is selected as the **Action Type** for that Run Book Action policy.
9. In PowerFlow, go to the **Applications** page and select the "Read SL1 RBA Queue and Retry PowerFlow Applications" application.
10. Click the **Configuration** tab and align the corresponding configuration object in the **Configuration** field.
11. Update the following fields as needed:
 - **limit_failover_actions**. Specifies the number of rows that will be read from the RBA queue. The default is 1000.
 - **generate_report**. Select this option to generate a report of all of the triggered PowerFlow applications read from the RBA queue.
12. Click **[Save]**.
13. Click the **[Run]** button. The application pulls and retries any PowerFlow applications that were not able to be executed by Run Book Actions because PowerFlow was not available.

NOTE: This application triggers the "Run PowerFlow Application and Remove It from SL1 RBA Queue" application, so you do not need to configure the "Run PowerFlow..." application.

14. If you selected the **generate_report** option, you can view the report for "Read SL1 RBA Queue and Retry PowerFlow Applications" and select an application in the report to see if any child applications failed to get triggered.



Creating a Step

On the **Applications** page, you can create new steps using Python that you can add to new or existing PowerFlow applications.

You cannot edit a step in a published Synchronization PowerPack. If you want to customize a step in a published Synchronization PowerPack, you need to create a new step using the code from the existing step.

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

To create a step:

1. From the **Applications** page () , click the down arrow () next to the **[Create Application]** button and select *Create Step*. A **Create Step** window appears.

TIP: You can also create a step in an existing application by navigating to the **Application** detail page for that application. Click the **[Open Editor]** button and Clicking the Create Step icon (+) on the **Steps Registry** pane.

2. In the **File Name** field, type a name for the step. The name *cannot* include spaces, and PascalCase, such as "CacheRead", is recommended. Also, the file name must match the *class* name in the Python code.
3. In the **Edit Step Code** text box, add or update the Python code for the step as needed, including the metadata information for the new step in the `def __init__(self) :` section. For more information, see the "Creating a Step" chapter in the *PowerFlow for Developers Manual*.
4. To test the new step and view its output, click the **[Run Step]** button. The **[Available Parameters]** and **[Output Data]** will update with data, including error messages, where relevant.
5. When you are done editing the step, click the **[Save]** button. The step is added to the **Steps Registry** pane.

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.

WARNING: As a best practice, you should only edit the **retry_max** parameter and avoid editing any of the other retry parameters. Only advanced users who understand how the retries work and their side effects when they are not set correctly should change the other retry parameters.

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. The default value is 3.
- **retry_backoff**. Instead of using a defined interval between retries, the PowerFlow system will incrementally increase the interval between retries. Possible values are True or 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 or 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. The default value is 600 seconds.
- **retry_countdown**. The interval between retries, in seconds. If you enabled **retry_backup**, the PowerFlow system will incrementally increase this interval. The default value is 180.


WARNING: Use caution when editing the **retry_countdown** option. If you set it to a value smaller than the default of 180 seconds, PowerFlow might experience collisions between task executions, and PowerFlow might stop unexpectedly. If you set this option to a value larger than the default, you might have to wait longer for a task to execute.

Aligning a Configuration Object with an Application

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 the **[Configure]** button. The **Configuration** pane opens on the right side of the **Application** page. For example:

PowerFlow System Diagnostics

Modify application configuration and save. Show JSON Configs

Configuration
health_check_config Edit Configuration

pf_manager_nodes 10.2.11.220
\$(config.pf_manager_nodes)

pf_username isadmin
\$(config.pf_username)

pf_password roorZ8A+h3WnsM+T

device_sync_app device_sync_sciencelogic_

incident_create_app incident_sync_update_cre:

collect_docker_info collect_snow_info

Configuration_data Linked to config: \$(config.all_config_data)

1	\$(config.all_config_data)
---	----------------------------

expects: json

Save

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 object 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. If you have a configuration object already selected, you can edit it by clicking the **[Edit Configuration]** button. The **Configuration** pane for that object displays to the left of the application **Configuration** pane. Add or edit the values on that pane and click the **[Save]** button.
5. Click **[Show JSON Configs]** to view the JSON configuration data for the configuration object. Click **[Hide JSON Editor]** again to view the fields instead.
6. As needed, edit the other application variables on the **Configuration** pane.
7. Click **[Save]**. The **Configuration** pane automatically closes.

Running a PowerFlow Application

You can run an application directly from the **Applications** page (the list view) or from an **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 the **[Run]** button 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
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 left-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".

Viewing Previous Runs of an Application with the Timeline

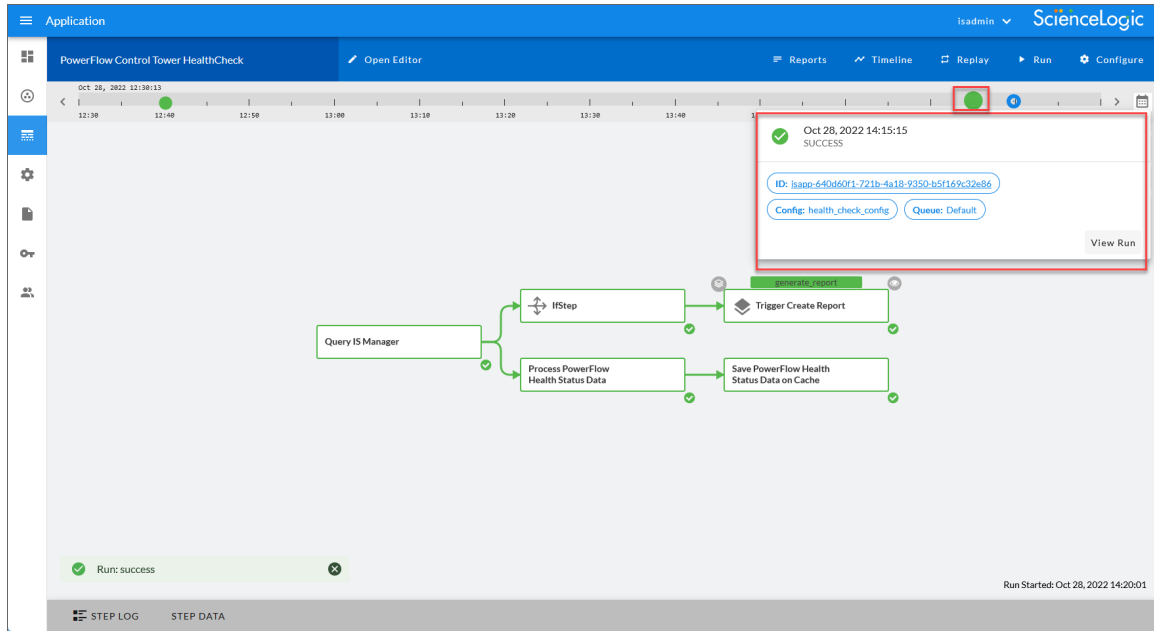
The **Application** detail page for a selected application contains a **[Timeline]** button that displays a history of previous runs of that application.



Also, you can click the **[Replay]** button to replay the last run of an application, such as when an application failed. You can also choose from the following options

- *Info Replay*. Replay the last run the application in Info Mode, which provides more log data in the Step Logs to help you with troubleshooting.
- *Custom Replay*. Replay the last run of the application with custom parameters for testing or troubleshooting.

To view and filter the Timeline:

1. From an **Application** detail page, click the **[Timeline]** button. The Timeline displays above the steps for that application:

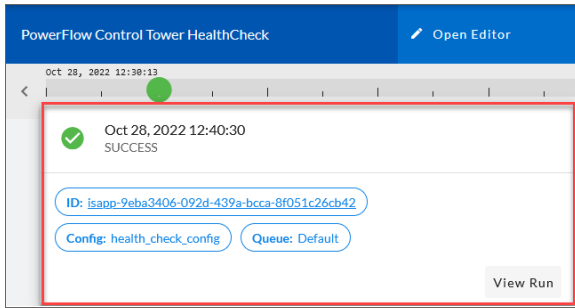


2. The default view for the Timeline shows the last two hours of runs for that application. The image above shows the last two hours of runs. Use the left arrow icon () and the right arrow icon () to move through the Timeline in 15-minute increments:



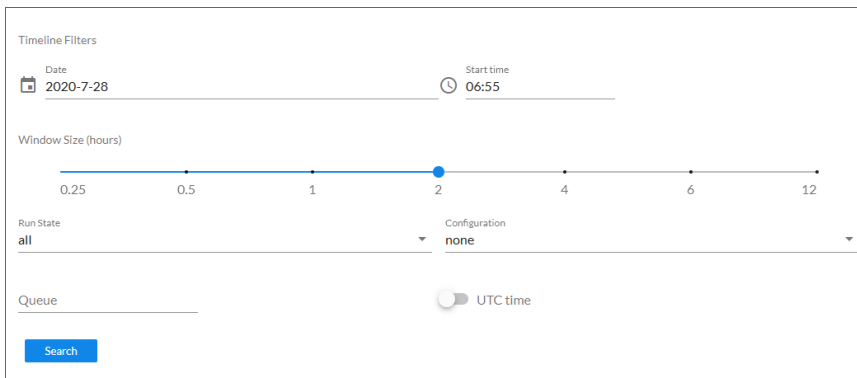
NOTE: The Timeline displays colored dots at a specific time that represent the last time this application was run. A green icon means a run was successful, a blue icon means a run is in progress, and a red icon means a run failed.

- You can hover over or click an icon for a run on the Timeline to view a pop-up window that displays the run ID, the configuration object and the queue used for that run:



TIP: Click the link for the run ID or click **View Run** to open the **Application** page for that specific run of the application. The run ID also displays in the **Step Log** pane for the "triggering" step for that application, and it also appears at the end of the URL for that application. On that page, you can select a step and open the **Step Log** to view any issues.

- Click the Filter icon (📅) to filter or search the list of previous runs for this application. A **Filter** window appears:



- Edit the following fields on the **Filter** window as needed:

- Date.** The date for the history of previous runs you want to view. Click the field to open a pop-up calendar.
- Start Time.** The starting time for the history, using local time instead of UTC time. Click the field to open a pop-up time selector.
- Window Size.** The length of the history, in hours. The default history view for the Timeline is two hours.
- Run State.** Select the type of previous runs you want to view. Your options include *all*, *success*, *failure*, and *pending*. The default is *all*.
- Configuration.** Select a configuration file to filter for application runs using that configuration only.

- **Queue.** Type a queue name to filter for application runs that use that queue.
- **UTC Time.** Select UTC if you do not want to use local time. The Schedule feature uses UTC time.

6. Click **[Search]** to run the filter or search.

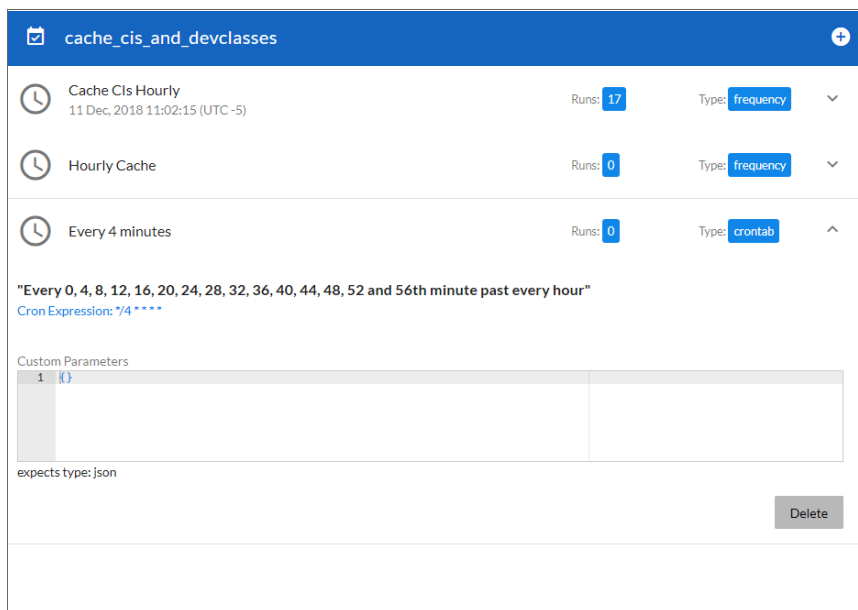
TIP: If the Timeline is open and you want to close it, click the **[Timeline]** button.

Scheduling a PowerFlow Application

You can create one or more schedules for a single application in the PowerFlow user interface. When creating each schedule, you can specify the queue and the configuration file for that application.

To schedule an application:

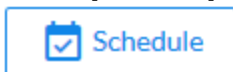
1. On the **Applications** page (🏠), click the **[Schedule]** button for the application you want to schedule. The **Schedule** window appears, displaying any existing schedules for that application:



NOTE: If you set up a schedule using a cron expression, the details of that schedule display in a more readable format in this list. For example, if you set up a cron expression of `*/4 * * * *`, the schedule on this window includes the cron expression along with an explanation of that expression: "Every 0, 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, and 56th minute past every hour".

2. Select a schedule from the list to view the details for that schedule.
3. Click the + icon to create a schedule. A blank **Schedule** window appears:

4. In the **Schedule** window, complete the following fields:
 - **Schedule Name**. Type a name for the schedule.
 - **Switch to**. Use this toggle to switch between a cron expression and setting the frequency in seconds.
 - **Cron expression**. Select this option to schedule the application using a cron expression. If you select this option, you can create complicated schedules based on minutes, hours, the day of the month, the month, and the day of the week. As you update the cron expression, the **Schedule** window displays the results of the expression in more readable language, such as *Expression: "Every 0 and 30th minute past every hour on the 1 and 31st of every month", based on */30 * */30 * **.
 - **Frequency in seconds**. Type the number of seconds per interval that you want to run the application.
 - **Custom Parameters**. Type any JSON parameters you want to use for this schedule, such as information about a configuration file or mappings.
5. Click [**Save Schedule**]. The schedule is added to the list of schedules on the initial **Schedule** window. Also, on the **Applications** page, the word "Scheduled" appears in the **Scheduled** column for this application, and the [**Schedule**] button contains a check mark:



NOTE: After you create a schedule, it continues to run until you delete it. Also, you cannot edit an existing schedule, but you can delete it and create a similar schedule if needed.

To view or delete an existing schedule:

1. On the **Applications** page, click the **[Schedule]** button for the application that contains a schedule you want to delete. The **Scheduler** window appears.
2. Click the down arrow icon (▼) to view the details of an existing schedule.
3. To delete the selected schedule, click **[Delete]**.

Backing up and Restoring PowerFlow Data

You can use PowerFlow to back up and recover data in the Couchbase database.

This option uses the "Backup" application in the PowerFlow user interface to create a backup file and send that file using secure copy protocol (SCP) to a destination system. You can then use the "Restore" application to get a backup file from the remote system and restore its content.

NOTE: The backup and restore applications are application-level backup and restore tools. For full-system backups, you will need to do a filesystem-level backup to ensure that you get the encryption key that was used to encrypt configuration objects as well as other files used to describe the environment, including the `/etc/ismervices` directory, the `docker-compose.yml` file and the `docker-compose-override.yml` file.

Creating a Backup

To create a backup:

1. To add the relevant configuration information, go to the **Configurations** page (⚙️) and click the **[Edit]** button for the "IS - System Backup Configuration Example" configuration object. The **Configuration** pane appears:

IS - System Backup Configuration Example

Description Toggle JSON Editor
Example Configuration for running Integration Service System Backup integration.

Version
1.0.0

Configuration Data Values

Name	Value	Encrypted	
backup_destination	/backup	<input type="checkbox"/>	×
remote_host	192.168.1.7	<input type="checkbox"/>	×
remote_user	backup_user	<input type="checkbox"/>	×
remote_password	i2A/dvqoUxKPN7eDjdfiFgY2H+v	<input checked="" type="checkbox"/>	×
remote_destination	/is_backup	<input type="checkbox"/>	×

Add Value

Copy as Save

2. Click the **[Copy as]** button and provide values for the following fields in the updated **Configuration** pane:
 - **Friendly Name**. Name of the configuration object that will display in the user interface.
 - **Description**. A brief description of the configuration object.
 - **Author**. User or organization that created the configuration object.
 - **Version**. Version of the configuration object.
 - **backup_destination**. The location where the backup file is created.
 - **remote_host**. The hostname for the remote location where you want to send the backup file via SCP from the *backup_destination* location.
 - **remote_user**. The user login for the remote location.
 - **remote_ssh_key**. The remote SSH key you want to use in place of a password for the remote location.
 - **remote_password**. The user password for the remote location. Encrypt this value.
 - **remote_destination**. The remote location where the application will send the backup file.
3. Click the **[Save]** button.
4. Go to the **Applications** page and select the "Integration Service Backup" application.

5. Click the **[Configure]** button. The **Configuration** pane appears:

Integration Service Backup

Modify configuration and save. [Show JSON Configs](#)

Configuration
backup

backup_destination /usr/tmp/backup/

remote_host 10.2.11.2

remote_user isadmin

remote_ssh_key SSHKey

remote_password

remote_destination /tmp/isadmin/is_backup

cluster_node couchbase-worker.isnet,couchbase-workerfake.isnet,couchbase.isnet

Enter comma-separated strings.

data_only compress include_syncpacks

installed_only

bucket all

document_key all

Save

6. On the **Configuration** pane, provide values for the following fields:

- **Configuration**. Select the configuration object you created in steps 1-3.
- **bucket**. Select which bucket in Couchbase you want to back up. Your options include all buckets, content-only buckets, or logs. The default is *all*.
- **document_key**: Select whether you want to back up all record or CI and device cache records.

NOTE: The options you select affect the name of the backup file that this application generates. For example, **is_couchbase_backup-data_only-2019-04-01T185527Z.tar** is a uncompressed data only backup, while **is_couchbase_backup-data_only-cache-logs-couchbase.isnet-2019-04-01T185937Z.tar.gz** is a compressed data-only backup of the CI and device cache from the *couchbase.isnet* node in a cluster.

- **cluster_node**. Specify the node from which you want to make the backup (for a single-node backup only). You can specify the order of the nodes that you are backing up by listing each node in order of preference, separated by commas. If one of the nodes fails or is unavailable, the backup application continues down the list of nodes in the order you specified in this field. For example: *couchbase-worker.isnet,couchbase-worker.isnet2,couchbase.isnet*. To use the ordered backup option, you must also check the **single_node** field.
- **use_ssh_key**. Select this option if you want to run the backup application using an SSH key for authentication instead of using a password. You will need to provide a **remote_ssh_key** value in the configuration object you aligned with this application, such as `config.remote_ssh_key`. Use the newline character `\n/` as a separator. If the SSH key needs a paraphrase to be decrypted, set the paraphrase by creating a `remote_password` variable in the configuration object aligned with the applications.

NOTE: You will need to edit the SSH Key values in the JSON Editor for this release to ensure the key is properly set. This is a known issue that will be addressed in a future release.

NOTE: To get a one-line string of the SSH key, run the following command: `sed -E ' :a;N;${!ba;s/\r{0,1}\n/\n/g}' ~/.ssh/id_rsa`

- **single_node**. Select this option if you want to back up from a single node in the cluster. Specify the node in the **cluster_node** field. You should also select this option if you want to specify the order of the nodes that you are backing up, and list each node in order of preference in the **cluster_node** field
 - **data_only**. Select this option if you only want to restore bucket data.
 - **compress**. Select this option to compress backups using Gzip.
 - **include_syncpacks**. Select this option if you want to back up the Synchronization PowerPacks on the PowerFlow system.
 - **installed_only**. Select this option if you want to back up only Synchronization PowerPacks that have been installed. If you do not select this option, the application will also back up Synchronization PowerPacks that have been uploaded to the PowerFlow system.
7. Click the **[Save]** button. The **Configuration** pane automatically closes.
 8. On the **Application** detail page, click the **[Run Now]** button. When the application completes, a file named "is_couchbase_backup-*<date>*.tar" is added to the remote server in the specified remote backup destination.
 9. To ensure that the backup was created, select the "Create IS Backup" step and open the **Step Log** section.

10. Look for entries related to backup and make a note of the of the backup file name, which you will need when you run the "Integration Service Restore" application:

Step Log			
		069	707759 707759 863227.0 ##### 103.0% (68/estimated 66 msgs)[A bucket: logs, msgs transferred... : total last per sec byte : 807807 807807 327325.5 done (w/2018-11-15T181652Z)]
3	ipaas_logger	15 Nov, 2018 12:16:56, 075	FLOW
4	ipaas_logger	15 Nov, 2018 12:16:56, 101	FLOW
5	ipaas_logger	15 Nov, 2018 12:16:56, 103	FLOW
6	ipaas_logger	15 Nov, 2018 12:16:56, 107	FLOW
7	ipaas_logger	15 Nov, 2018 12:16:56,	FLOW

TIP: You can schedule the "Integration Service Backup" application to run on a regular basis, or you can run the application as needed. To schedule the application, click the **[Schedule]** button for the "Integration Service Backup" application on the **Applications** page. For more information, see [Scheduling a PowerFlow Application](#).

Restoring a Backup

After you have created a backup using the "Integration Service Backup" application in the PowerFlow user interface, you can use the "Integration Service Restore" application to restore that file.

NOTE: Do not restore the PowerFlow backup to a system that uses a different encryption key.

To restore a backup:

1. In the PowerFlow user interface, go to the **Applications** page and select the "Integration Service Restore" application. The **Application** page appears.

2. Click **[Configure]** (⚙️). The **Configuration** pane appears:

Integration Service Restore

Modify configuration and save. Show JSON Configs

Configuration

remote_host
\${config.remote_host} 🔒

remote_user
\${config.remote_user} 🔒

remote_password
\${config.remote_password} 🔒

remote_destination
/backup.tar

data_only

include_syncpacks

force_syncpack_upload

Save

3. In the **Configuration** pane, provide values for the following fields:
 - **Configuration**. Select the same configuration object you aligned with the "PowerFlow Backup" application. Required.
 - **remote_ssh_key**. Specify the same remote SSH key you used when you created the backup (if you ran the backup application using an SSH key for authentication instead of using a password).
 - **remote_destination**. Type the name of the backup file created by the "PowerFlow Backup" application.
 - **use_ssh_key**. Select this option if you ran the backup application using an SSH key for authentication instead of using a password.
 - **data_only**. Select this option if you only want to restore bucket data.
 - **include_syncpacks**. Select this option if you want to restore the Synchronization PowerPacks you backed up with the "PowerFlow Backup" application.
 - **force_syncpack_upload**. Select this option if you want to force upload Synchronization PowerPacks if the files already exist in the PowerFlow system.


4. Click **[Save]**. The **Configuration** pane automatically closes.
5. On the **Application** detail page, click **[Run]**.
6. To ensure that the backup was restored, click to open the **Step Log** section and look for entries related to restoring the backup:

Step Log				
6	ipaas_logger	29 Nov, 2018 12:10:41, 681	FLOW	content bucket restored
7	ipaas_logger	29 Nov, 2018 12:10:41, 693	FLOW	[#####] 100.0% (99/estimated 99 msgs)[A bucket: content, msgs transferred... : total last per sec byte : 722761 722761 1226032.5 done
8	ipaas_logger	29 Nov, 2018 12:10:42, 765	FLOW	logs bucket restored
9	ipaas_logger	29 Nov, 2018 12:10:42, 766	FLOW	[#####] 100.0% (2/estimated 2 msgs)[A bucket: logs, msgs transferred... : total last per sec byte : 1921 6703.0 done
10	ipaas_logger	29 Nov, 2018 12:10:42, 770	FLOW	['is_couchbase_backup-2018-11-29T155710Z.tar', 'extract']
11	ipaas_logger	29 Nov, 2018 12:10:42, ---	FLOW	Removing folder: /tmp/restore

NOTE: After running the "Integration Service Restore" application, the "Integration Service Backup" application might display as "Run status pending". This issue occurs because at the time of the last backup from Couchbase, the logs for the "Integration Service Backup" application showed a pending state. This message is addressed during the next run, and it does not cause any issues with the backup or restore processes.

Managing Configuration Objects

Overview

This chapter describes how to use the **Configurations** page () of the PowerFlow user interface to create or use a **configuration object** that contains a set of variables that all steps and applications can use.

This chapter covers the following topics:

<i>What is a Configuration Object?</i>	136
<i>Creating a Configuration Object</i>	138
<i>Editing a Configuration Object</i>	140
<i>Downloading and Importing a Configuration Object</i>	140

What is a Configuration Object?

A **configuration object** is a stand-alone JSON file that lives on the PowerFlow system. A configuration object supplies the login credentials and other global variables that can be used by all steps and applications in PowerFlow. Configuration objects allow the same application to be deployed in multiple PowerFlow instances, with different configurations.

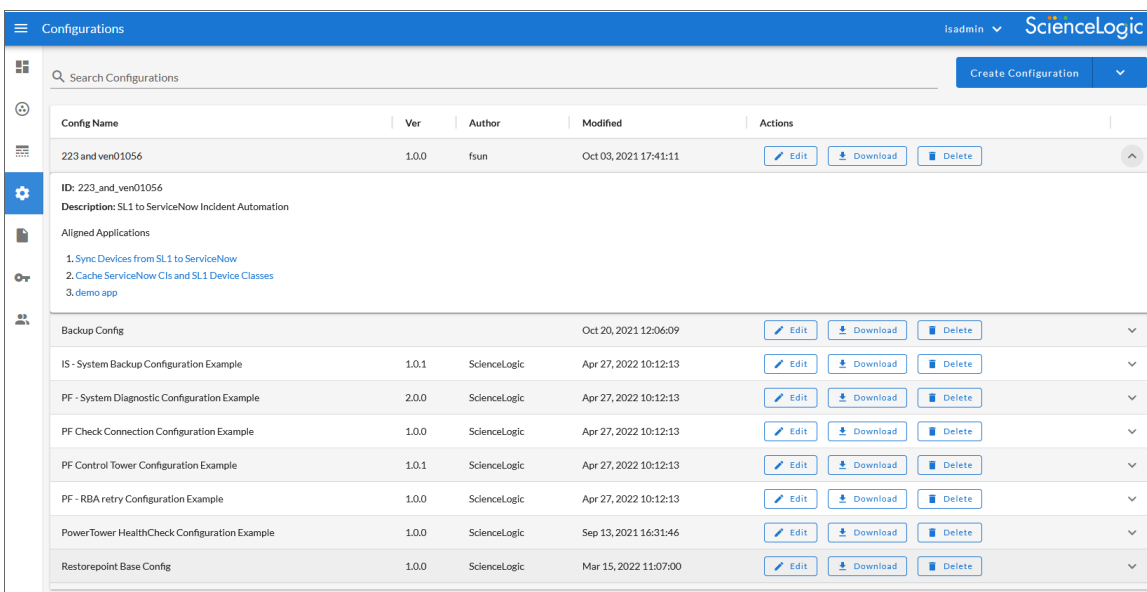
Configuration objects can map variables from SL1 to a third-party platform. For instance, SL1 has device classes and various third-party platforms like ServiceNow have CI classes; the configuration object would map these two variables.

You can create and edit configuration objects on the **Configurations** page of the PowerFlow user interface. After you create the configuration object, it appears in the **Configuration** drop-down on the **Configuration** pane of an **Application** detail page. Before you can run an application, you must select a configuration object and "align" that configuration object with the application.

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).

You can include the **config.** prefix with a variable to tell PowerFlow to use a configuration file to resolve the variable. If you want to re-use the same settings between applications, such as hostname and credentials, define configuration variables.

The **Configurations** page (⚙️) displays a list of available configurations. From this page you can create and edit configuration objects:



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

The **Configurations** page displays the following information about each configuration object:

- **Config Name.** The name of the configuration object.
- **Ver.** The version number of the configuration object.
- **Author.** The user or organization that created the configuration object.
- **Modified.** The date and time that the configuration object was last edited.
- **Actions.** Contains the following buttons:
 - **[Edit].** Opens a pane where you can edit the contents of the configuration object.
 - **[Download].** Lets you download the JSON file for the configuration object. If you have multiple PowerFlow systems, you can download a configuration object from one system and then use the *Import Configuration* option (under the **[Create Configuration]** button) to upload that object to the second PowerFlow system.
 - **[Delete].** Removed the configuration object from the PowerFlow system. Any PowerFlow applications that were aligned with that configuration object are no longer aligned with that object.

TIP: Click the down arrow icon (▼) for a configuration object to option a section that displays which applications are currently aligned with that configuration object. Click the up arrow icon (^) to close that section.

Creating a Configuration Object

When creating or editing a configuration object on the **Configurations** page, the name-value pairs in the **Configuration Data** section display in fields by default instead of a block of JSON code.

For more complex configuration objects, you can click **[Toggle JSON Editor]** to switch between text fields and JSON code for the configuration data. In the **Configuration Data** section, you can press **[Ctrl+F]** to search for code. Also, a red warning icon (⊗) appears in the first column of the **Configuration Data** section for a row where the JSON is not valid.

If you set 'null' as a value for a JSON parameter in a configuration object, the value reverts to its default value, if a default value exists. You can clear JSON parameters by specifying an empty dictionary {} as the value. Also, upgrading or downgrading a Synchronization PowerPack will not overwrite a user configuration.

TIP: Many Synchronization PowerPacks for PowerFlow contain an "example" configuration object that you can use as a template. You should do a **Save As** with the example configuration objects so you can make a copy of the example configuration that you can customize for your specific PowerFlow system. Do *not* use the example configuration objects to run PowerFlow applications.

To create a new configuration object:

1. From the **Configurations** page (⚙️), click **[Create Configuration]**. The **Create Configuration** pane appears.

TIP: Instead of creating a completely new configuration object, you can also edit an existing configuration object that has some of the configuration data that you want to use and click **[Copy as]** from the **Configuration** pane to create a copy of that configuration object.

2. Complete the following fields:
 - **Friendly Name.** Name of the configuration object that will display in the user interface.
 - **Description.** A brief description of the configuration object.
 - **Author.** User or organization that created the configuration object.
 - **Version.** Version of the configuration object.
 - **Configuration Data Values.** To add configuration values in the form of name-value pairs, click **[Add Value]**. Complete the **Name** and **Value** fields, and select **Encrypted** if needed.

TIP: Click **[Toggle JSON Editor]** to view the JSON configuration data for the configuration object at the bottom of the pane. Click **[Toggle JSON Editor]** again to return to the original view.

3. In the **Configuration Data** section, include the required block of code to ensure that the applications aligned to this configuration object do not fail:

```
{
  "encrypted": false,
  "name": "sll_db_host",
  "value": "${config.sll_host}"
}
```

For example:

```
{
  "encrypted": false,
  "name": "sll_db_host",
  "value": "10.2.11.42"
}
```

TIP: If you are using IPv6 for IP addresses, wrap the IP string in brackets, such as **https://[2001:db8:3333:4444:5555:6666:7777:8888]**

TIP: Click **[Toggle JSON Editor]** to show the JSON code. Click the button again to see the fields. You can also click **[Add Value]** and add a new name-value pair in the **Configuration Data Values** section.

NOTE: If you are using SL1 with an External Database (SL1 Extended architecture or a cloud-based architecture), update the "value" of that block of code to be the host of your database. This field accepts IP addresses. For example: "value": "db.sciencelogic.com". If you are *not* using the SL1 Extended architecture or a cloud-based architecture, you do not need to make any changes to the block of code other than pasting the code into the configuration object.

6. To create a configuration variable, define the following keys:
 - **encrypted**. Specifies whether the value will appear in plain text or encrypted in this JSON file. If you set this to "true", when the value is uploaded, PowerFlow encrypts the value of the variable. The plain text value cannot be retrieved again by an end user. The encryption key is unique to each PowerFlow system. The value is followed by a comma.
 - **name**. Specifies the name of the configuration file, without the JSON suffix. This value appears in the user interface. The value is surrounded by double-quotes and followed by a comma.
 - **value**. Specifies the value to assign to the variable. The value is surrounded by double-quotes and followed by a comma.
7. Click **[Save]** to save the new configuration object, or click **[Copy as]** to save the configuration object as a new configuration object with a different name.

- Align this configuration object with the PowerFlow applications that you want to run by clicking the **Configure** button from the detail page for each application and selecting this configuration object from the **Configuration** drop-down.

Editing a Configuration Object

To edit an existing configuration object:

- In the PowerFlow user interface, go to the **Configurations** page and click the **[Edit]** button for the configuration object you want to edit. The **Configuration** pane appears for that object.
- Edit the values in the following fields as needed:
 - Description.** A brief description of the configuration object.
 - Version.** Version of the configuration object.
 - Configuration Data Values.** To add configuration values in the form of name-value pairs, click **[Add Value]**. Complete the **Name** and **Value** fields, and select **Encrypted** if needed.

TIP: Click **[Toggle JSON Editor]** to view the JSON configuration data for the configuration object at the bottom of the pane. Click **[Toggle JSON Editor]** again to view the **Configuration Data Values** section with the **[Add Value]** button instead.

- If you want to make a copy of this configuration object, click **[Copy As]** and update the relevant fields in the **Create Configuration** pane.
- Click **[Save]** to save your changes.

Downloading and Importing a Configuration Object

If you have multiple PowerFlow systems that use similar environments, you can download the JSON file for a configuration object from one PowerFlow system and then upload that object to the second PowerFlow system.

To download and import a configuration object:

- In the PowerFlow user interface, go to the **Configurations** page and click the **[Download]** button for the configuration object you want to download.
- Save the file to a local computer.
- Log in to the second PowerFlow system and go to the **Configurations** page.
- Click the down arrow icon next to the **[Create Configuration]** button and select *Import Configuration*. The **Import Configuration** page appears.
- Click the **[Browse]** button and locate the file you saved in step 2, or drag the file onto the **Import Configuration** page.
- Click the **[Import]** button. The configuration object is added to the **Configurations** page.

Chapter

7

Generating and Viewing Reports for PowerFlow Applications

Overview


This chapter describes how to generate reports for PowerFlow applications, which you can view on the **Reports** page () of the PowerFlow user interface.

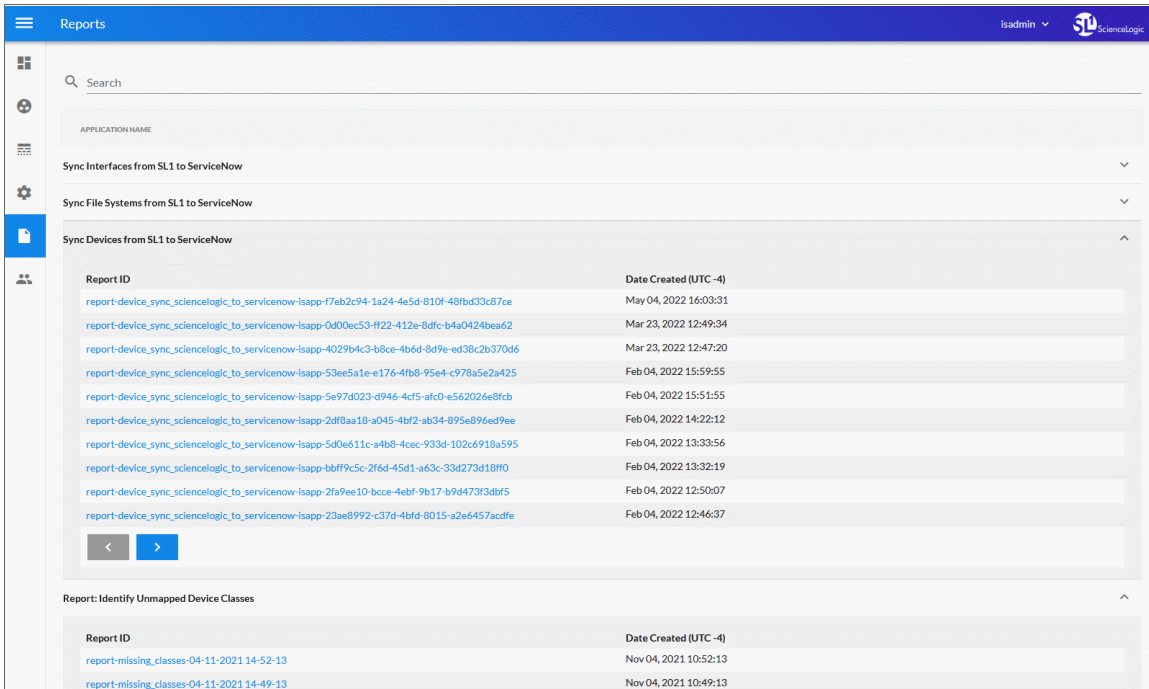
This chapter also lists the reports available in the various Synchronization PowerPacks that can be used in the PowerFlow user interface.

This chapter covers the following topics:

<i>Viewing the List of Reports in PowerFlow</i>	142
<i>PowerFlow Platform Reports</i>	143
<i>Synchronization PowerPack Reports</i>	146

Viewing the List of Reports in PowerFlow



In the PowerFlow user interface, the **Reports** page () contains a list of reports associated with PowerFlow applications. 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.



If a PowerFlow application supports reports and the reporting feature is enabled, PowerFlow will generate a report each time you run the application. Each report displays data only from the most recent run of the application; a report is not an aggregation of all previous runs.

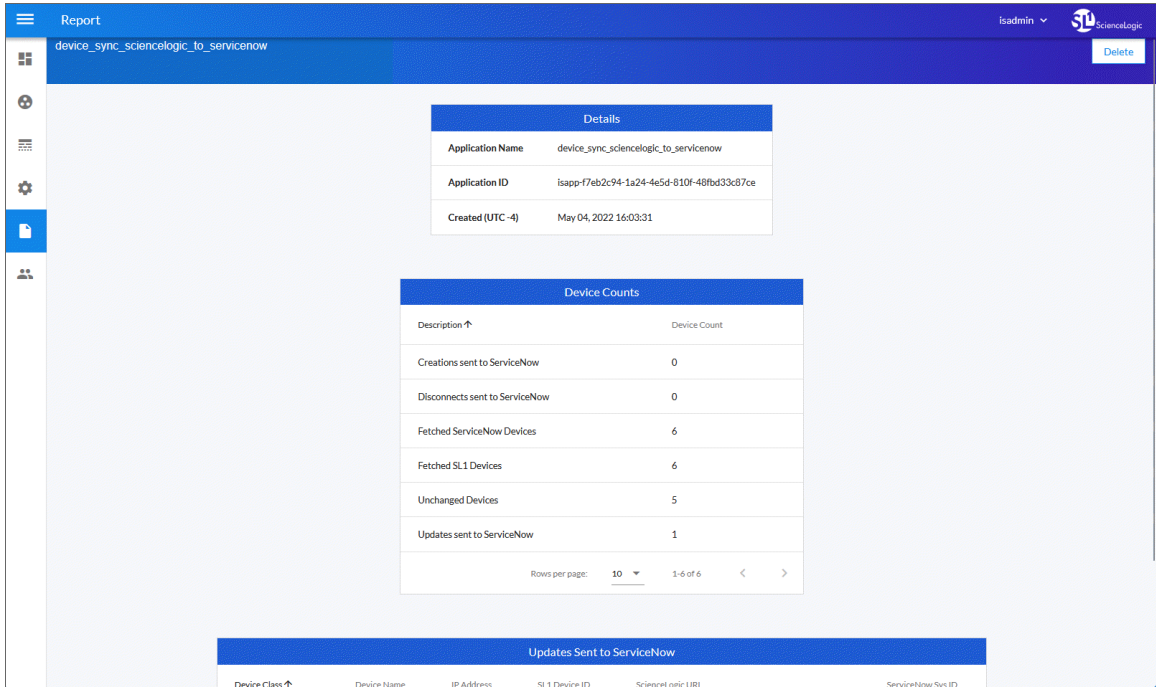
TIP: From the detail page for a PowerFlow application, click the **[Reports]** button to go to the **Reports** page.

To view a report:

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

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

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



- Click the down arrow icon (▼) to open a new section where you can view more information about an item in a report, and click the up arrow icon (^) to close that section.
- To delete the report, click **[Delete]**.

PowerFlow Platform Reports

The PowerFlow Platform includes the following reports by default:

- [PowerFlow System Diagnostics Report](#)
- [Read SL1 RBA Queue and Retry PowerFlow Applications Report](#)

The PowerFlow System Diagnostics Report

The "PowerFlow System Diagnostics" application lets you view platform diagnostics for the PowerFlow system. You can use the information displayed in these diagnostics to help you troubleshoot issues with the different tools used by PowerFlow.

NOTE: Older versions of this application were named "Integration Service System Diagnostics".

To view the diagnostics report:

1. From the **Applications** page, select the "PowerFlow System Diagnostics" application. The **Application** page appears.
2. Click **[Configure]** (⚙️). The **Configuration** pane appears:

PowerFlow System Diagnostics

Modify configuration and save. Show JSON Configs

Configuration
control_t

pf_manager_nodes
10.2.11.247

pf_username
isadmin

pf_password
.....

ssh_key
SSHKey

device_sync_app
device_sync_sciencelogic_to_ser

incident_create_app
incident_sync_update_create

collect_docker_info collect_snow_info use_ssh_key



configuration_data

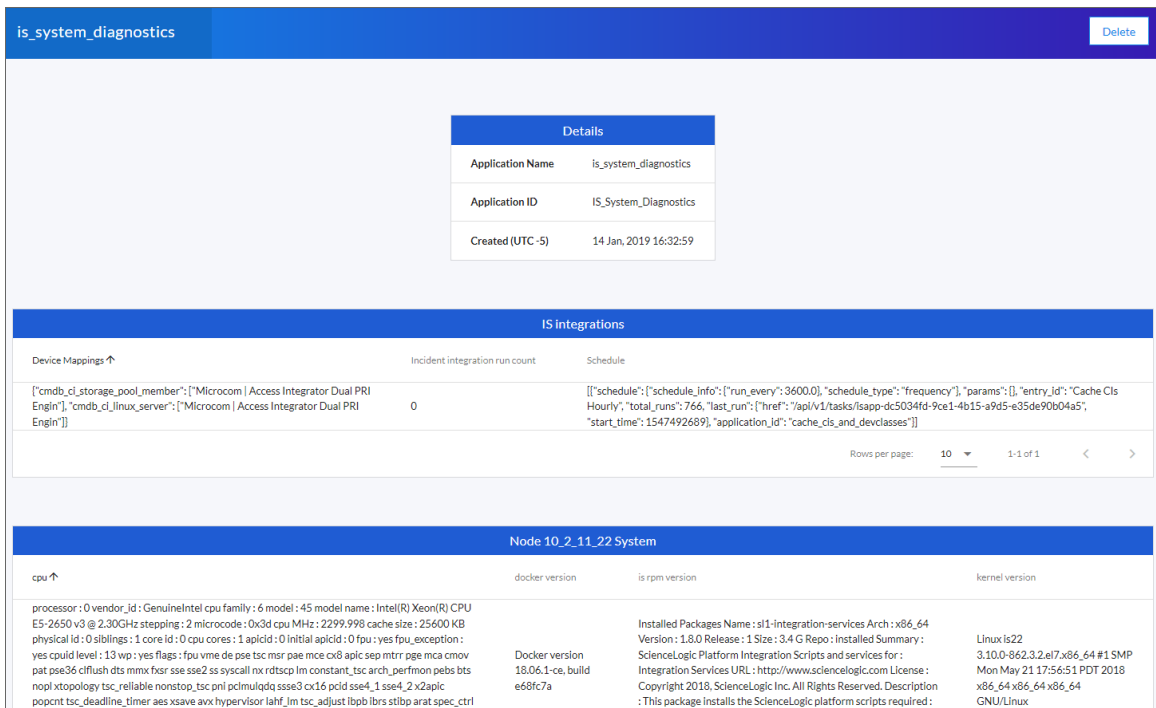
1	<code>`\${config.all_config_data}`</code>
---	-------------------------------------------

expects type: json

Save

3. Complete the following fields:
 - **Configuration**. Select a configuration to align with this application. The "IS - System Diagnostic Configuration Example" configuration object contains the structure needed for this application, and you can use that configuration object as a template. Be sure to update the configuration object with values for **is_swarm_manager**, **is_username**, and **is_password**.
 - **ssh_key**. The remote SSH key you want to use in place of a password for the remote location. You will need to edit the SSH Key values in the JSON Editor for this release to ensure the key is properly set. This is a known issue that will be addressed in a future release.
 - **device_sync_app**. Specify the name of the Incident Creation application that contains the relevant device mappings.
 - **incident_create_app**. Specify the name of the Device Sync application that contains information about the incidents that have been created.

- **api_alias**. Specify the alias to reference the API internally to make calls.
 - **collect_docker_info**. Select this option to collect Docker information.
 - **collect_snow_info**. Select this option to collect ServiceNow information.
 - **use_ssh_key**. Select this option if you want to use the value in the **ssh_key** field to authenticate to the remote system.
4. Click **[Save]** and wait for the "App & Config modifications saved" pop-up message to appear. The **Configuration** pane automatically closes after this message appears.
 5. On the **Application** page, click **[Run]** . The application generates a report that you can access on the **Reports** page ():



The screenshot displays the 'is_system_diagnostics' report page. It features a 'Details' table, an 'IS Integrations' section with a table of device mappings, and a 'Node 10_2_11_22 System' section with a table of system metrics.

Details	
Application Name	is_system_diagnostics
Application ID	IS_System_Diagnostics
Created (UTC-5)	14 Jan, 2019 16:32:59

IS Integrations		
Device Mappings ↑	Incident integration run count	Schedule
[{"cmdb_ci_storage_pool_member":{"Microcom Access Integrator Dual PRI Engin"}, {"cmdb_ci_linux_server":{"Microcom Access Integrator Dual PRI Engin"}]	0	[{"schedule":{"schedule_info":{"run_every":3600.0,"schedule_type":"frequency"},"params":{},"entry_id":"Cache Cts Hourly"},"total_runs":766,"last_run":{"href":"api/v1/tasks/isapp-dc5034fd-9ce1-4b15-a9d5-e83de90b04a5"},"start_time":1547492689},"application_id":"cache_cis_and_devclasses"}]

Node 10_2_11_22 System			
cpu ↑	docker version	is rpm version	kernel version
processor : 0 vendor_id : GenuineIntel cpu family : 6 model : 45 model name : Intel(R) Xeon(R) CPU E5-2650 v3 @ 2.30GHz stepping : 2 microcode : 0x3d cpu MHz : 2299.998 cache size : 25600 KB physical id : 0 siblings : 1 core id : 0 cpu cores : 1 apicid : 0 initial apicid : 0 fpu : yes fpu_exception : yes cpuid level : 13 wp : yes flags : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush dts mmx fxsr sse sse2 ss syscall nx rdtscp lm constant_tsc arch_perfmon pebs bts nopl xtopology tsc_reliable nonstop_tsc pni pclmulqdq sse3 cx16 pcid sse4_1 sse4_2 x2apic popcnt tsc_deadline_timer aes xsave avx hypervisorlahf_lm tsc_adjust ibpb lbrs stibp arat spec_ctrl	Docker version 18.06.1-ce, build e68fc7a	Installed Packages Name : sl1-integration-services Arch : x86_64 Version : 1.8.0 Release : 1 Size : 3.4 G Repo : Installed Summary : ScienceLogic Platform Integration Scripts and services for : Integration Services URL : http://www.sciencelogic.com License : Copyright 2018, ScienceLogic Inc. All Rights Reserved. Description : This package installs the ScienceLogic platform scripts required :	Linux ls22 3.10.0-862.3.2.el7.x86_64 #1 SMP Mon May 21 17:56:51 PDT 2018 x86_64 x86_64 x86_64 GNU/Linux

This diagnostic report displays overall PowerFlow settings, such as the PowerFlow version, Docker version, kernel version, hostname, cluster settings, scheduled applications, CPU and memory statistics, installation date, and cache information.

The Read SL1 RBA Queue and Retry PowerFlow Applications Report

If you are using PowerFlow to sync incidents from a third-party application like ServiceNow or Cherwell, you can enable Run Book Action (RBA) queue retries to keep from losing any incidents if PowerFlow is unavailable. Those pending PowerFlow applications are added to an RBA queue that you can access to retry the applications that failed. For more information, see [Enabling Run Book Automation Queue Retries](#).

When you configure the "Read SL1 RBA Queue and Retry PowerFlow Applications" application, you can enable the **generate_report** option from the **Configuration** pane to generate a report of all of the triggered PowerFlow applications that were read from the RBA queue.

After PowerFlow runs the application and generates the report, you can select the applications in the report to see if any child applications failed to get triggered.

NOTE: The "Read SL1 RBA Queue and Retry PowerFlow Applications" application is available in the *System UtilsSynchronization* PowerPack version 1.1.2 or later

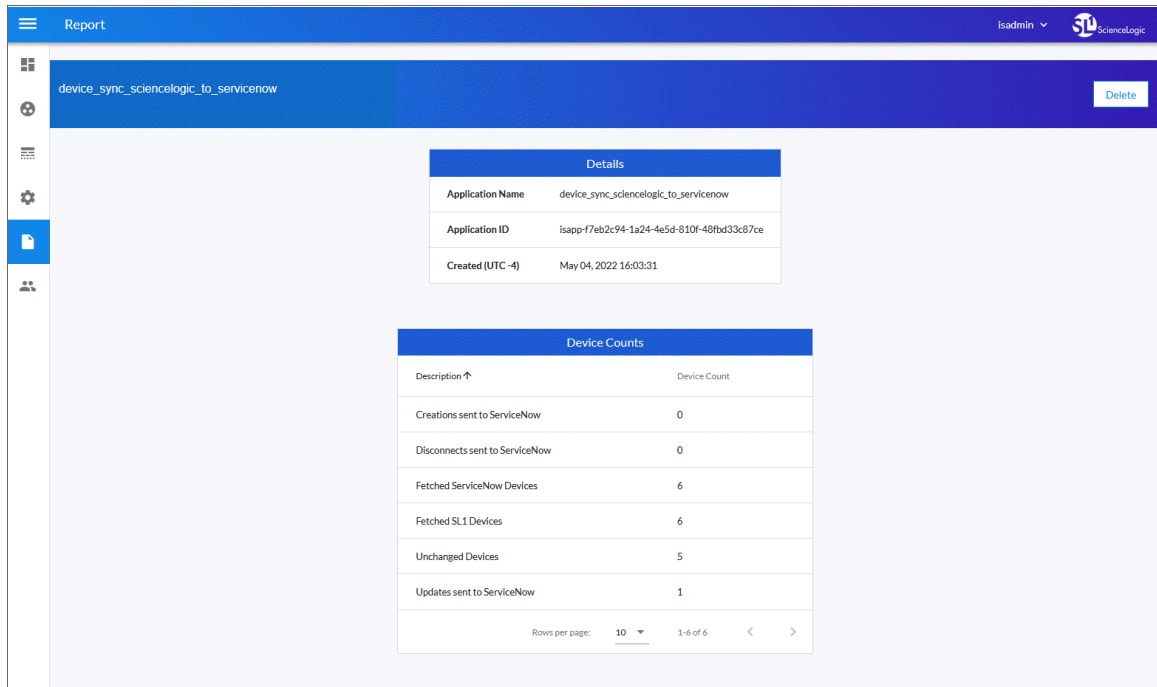
Synchronization PowerPack Reports

Some reports are included with a specific Synchronization PowerPack. You can download the most recent version of a Synchronization PowerPack from the **PowerPacks** page at the ScienceLogic Support Site at <https://support.sciencelogic.com/s/>.

ServiceNow CMDB Synchronization PowerPack Reports

The ServiceNow CMDB Synchronization PowerPack includes the following reports:

- Report: Identify Unmapped Device Classes
- Sync File Systems from SL1 to ServiceNow
- Sync Interfaces from SL1 to ServiceNow
- Sync Devices from SL1 to ServiceNow




For more information about each report, see the *ServiceNow CMDB Synchronization PowerPack* manual.

Managing Users in SL1 PowerFlow

Overview

This chapter describes how to configure authentication for PowerFlow to allow access to multiple users with a variety of roles and permissions.

This chapter also describes how to use the **Admin Panel** page () of the PowerFlow user interface to manage user group access to the PowerFlow user interface. Only users with the *Administrator* role for the PowerFlow system can edit this page.

This chapter covers the following topics:

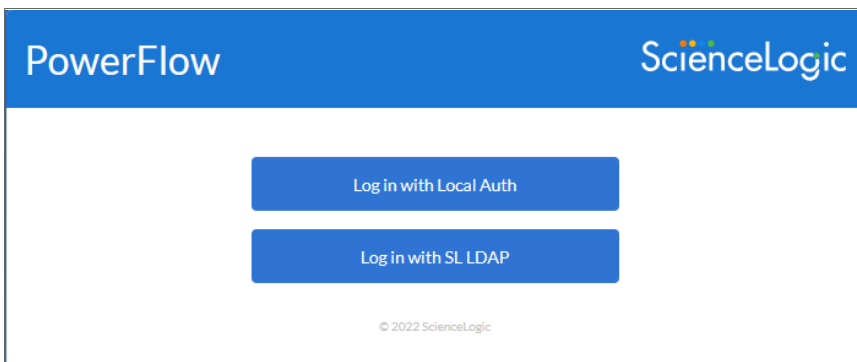
<i>Configuring Authentication with PowerFlow</i>	148
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Configuring Authentication with PowerFlow

SL1 PowerFlow supports the following authentication methods:

- **Local Authentication.** The same local Administrator user (*isadmin*) is supported by default. Local authentication only supports the *isadmin* administrator user.
- **Basic Authentication.** PowerFlow continues to support Basic Authentication as well. Because the PowerFlow PowerPacks, diagnostic scripts, and the *iscli* tool continue to use Basic Authentication, ScienceLogic does not recommend disabling Basic Authentication.
- **OAuth.** Lets PowerFlow administrators use their own authentication providers to enforce user authentication and lockout policies. Authentication using a third-party provider, such as LDAP or Active Directory, requires additional configuration. For optimal security, ScienceLogic recommends that you disable the local Administrator user (*isadmin*) and exclusively use your own authentication provider.
- **Common Access Card (CAC) Authentication.** Lets a PowerFlow user provide a CAC card through a browser to the PowerFlow root IP address. After identifying the CAC card, the ingress proxy verifies and authenticates the user. CAC authentication bypasses Dex authentication and does not use OIDC protocols. You can also use CAC authentication with LDAP, or CAC authentication with LDAP and SAN.

Depending on the authentication used by your PowerFlow system, the PowerFlow login page will display a single option for logging in, or more than one option:



Regardless of authentication strategy, authorization and role access is configured separately, based on user or user group. For more information, see [Creating a User Group in PowerFlow](#).

The following topics describe how to configure each authentication strategy for PowerFlow:

- [User Interface Login Administrator User \(default\)](#)
- [Basic Authentication Using a REST Administrator User \(default\)](#)
- [User Interface Login Using a Third-party Authentication Provider](#)
- [OAuth Client Authentication Using a Third-party Provider](#)
- [Common Access Card \(CAC\) Authentication](#)

- [CAC Authentication with LDAP](#)
- [CAC Authentication with LDAP and SAN](#)

User Interface Login Administrator User (Default)

The local Administrator user is the default login user for PowerFlow. The username is "isadmin" by default, and the password gets set during the ISO installation process. The PowerFlow administrator can change the default password or the Administrator user.

This authentication strategy allows authentication of the local Administrator user through the PowerFlow user interface. The "isadmin" user is the local Administrator by default, but you can change the username of the local Administrator to something other than "isadmin" if needed.

WARNING: If you disable this authentication strategy, you must first configure an alternative provider to appropriately authenticate to the PowerFlow system and also configure a user or user group policy that has the *Administrator* role. If you disable this user without a second authentication provider configured, PowerFlow will not be able to authenticate any users.

To disable this user, set the following environment variable in the `/etc/iservices/isconfig.yml` file:

```
BASIC_AUTH: False
```

To change the local Administrator username, set the following environment variable in the `/etc/iservices/isconfig.yml` file:

```
BASIC_AUTH_USER: "username"
```

NOTE: Before changing the local Administrator username, make sure that the user has *Administrator* permissions in the PowerFlow system. For more information, see [User Groups, Roles, and Permissions](#).

ScienceLogic recommends that you use the same system-wide password for the local Administrator user, which is located in `/etc/iservices/is_pass`. To change this password, run the `/opt/iservices/scripts/ispasswd` script.

Alternatively, you can set a different password for the local Administrator user by setting the following environment variable in `/etc/iservices/isconfig.yml`:

```
BASIC_AUTH_PASSWORD: "BASIC_AUTH_PASSWORD"
```

Basic Authentication Using a REST Administrator User (Default)

Basic Authentication through a REST administrator user enables the local Administrator user to access the PowerFlow API through REST using Basic Authentication. This authentication strategy enables users to make queries through the API using `<isadmin:password> basic authentication`.

This Basic Authentication is enabled by default in PowerFlow 2.0.0 or later. The REST administrator uses the same environment variables and configuration as the [user interface login Administrator user](#).

Basic Authentication is limited to only the local Administrator user. If your PowerFlow system is configured to use a different authentication provider, you must authenticate using OAuth 2.0 and a bearer token. For more information, see [OAuth Client Authentication Using an Internal Provider](#).

WARNING: This Basic Authentication user is enabled by default to support backward compatibility with any scripts or queries running against the versions of PowerFlow before 2.0.0. If you disable this authentication strategy, PowerPacks and end-user scripts will not be able to query or access the API unless they are updated to use OAuth 2.0 with bearer a token.

User Interface Login Using a Third-party Authentication Provider

This authentication strategy lets you set up user authentication through a third-party authentication provider, such as LDAP or Active Directory (AD). You configure additional providers and their connectors in the `/etc/iservices/isconfig.yml` file, following the Dex connector configuration described below. This authentication strategy is automatically disabled when no connectors are present in the configuration.

After you configure the providers, users can select one of the defined providers or the local Administrator authentication, and authenticate using that provider.

When using this authentication strategy, the PowerFlow system automatically retrieves the LDAP or AD groups to which the user belongs. You can use these groups can be used to apply specific role permissions. For more information, see [Role-based Access Control \(RBAC\) Configuration](#).

NOTE: By default, no third-party authentication providers are configured in PowerFlow.

Credentials for user authentication exist only with the third-party authentication provider, and the credentials are not imported into PowerFlow. The only information that PowerFlow retains for these users are the roles and permissions attached to the user names.

To configure a third-party authentication provider:

1. Go to <https://github.com/dexidp/dex#connectors> and locate the connector type, such as LDAP or SAML 2.0, that you would like to use for authentication.
2. Click the link for the connector type to view example configuration options for the connector.
3. Update the `/etc/iservices/isconfig.yml` file and add a **DEX_CONNECTORS** section with the configuration for the connector you want to use. The **DEX_CONNECTORS** section in the `isconfig.yml` file is identical to the **CONNECTORS** section described in the Dex documentation.
4. Re-deploy the PowerFlow stack and check for errors in docker service logs `iservices_dexserver`. If the dexserver starts successfully and PowerFlow is running, then PowerFlow has accepted the configuration.
5. Next, log in to the PowerFlow system with a user provided by the newly configured authentication.
6. Look for errors with searching users or user groups in the user interface or the Docker service logs.

For reference, the following is an example `/etc/iservices/isconfig.yml` file with an Active Directory authentication provider configured to look up users and their groups:

```
HOST_ADDRESS: 10.1.1.111
CLIENT_ID: isproxy
CLIENT_SECRET: knivq7uDpVORdrSlWJ0I4YiiwuQgGdsf9rMWquoInYs
SESSION_SECRET: BDLO2xPrBs_s-YkqY-j4lN6VPeBzYrVsYt_P10oWbn0
DB_HOST: couchbase.isnet,localhost
BIND_DN: auser # this can be encrypted for security
BIND_PW: password # this can be encrypted for security

DEX_CONNECTORS:
- type: ldap
  # Required field for connector id.
  name: ldap
  id: ldap
  # Required field for connector name.
  config:
    host: rstcsdc01.sciencelogic.local:636
      # Host and optional port of the LDAP server in the form "host:port".
      # If the port is not supplied, it will be guessed based on "insecureNoSSL",
      # and "startTLS" flags. 389 for insecure or StartTLS connections, 636
      # otherwise.

    insecureNoSSL: false
      # The insecureNoSSL field is required if the LDAP host is not using TLS (port 389).

    insecureSkipVerify: true
      # If a custom certificate isn't provide, this option can be used to turn on
      # TLS certificate checks. As noted, it is insecure and shouldn't be used outside
      # of explorative phases.

    bindDN: '{{BIND_DN}}'
    bindPW: '{{BIND_PW}}'
      # The DN and password for an application service account. The connector uses
      # these credentials to search for users and groups. Not required if the LDAP
      # server provides access for anonymous auth.
      # Please note that if the bind password contains a ``, it has to be saved in an
      # environment variable which should be given as the value to the bindPW field.

    usernamePrompt: silo credentials
      # The attribute to display in the provided password prompt. If unset, will
      # display "Username"

    userSearch:
      # User search maps a username and password entered by a user to a LDAP entry.
      baseDN: OU=Domain User Accounts,DC=ScienceLogic,DC=local
        # BaseDN to start the search from.
      filter: "(objectClass=user)"
        # Optional filter to apply when searching the directory.
      username: userPrincipalName
        # username attribute used for comparing user entries.
        # The following three fields are direct mappings of attributes on the user entry.
      idAttr: DN
        # String representation of the user.
      emailAttr: userPrincipalName
```

```

    # Required. Attribute to map to email.
nameAttr: cn
    # The nameAttr field maps to the display name of users. No default value.
groupSearch:
    # Group search queries for groups given a user entry. Group searches must match a
user
    # attribute to a group attribute.
baseDN: OU=Domain Groups,DC=ScienceLogic,DC=local
    # BaseDN to start the search from.
filter: "(objectClass=group)"
    # Optional filter to apply when searching the directory.
    # The following list contains field pairs that are used to match a user to a group.
    # It adds an additional requirement to the filter that an attribute in the group
    # must match the user's attribute value.
userAttr: DN
    # The userAttr field is the attribute used from the user search query.
    # to match to an element of the group search.
groupAttr: member
    # The groupAttr field is the attribute of the group results that should match the
userAttr value.
nameAttr: cn
    # This value must exactly match the group defined in the IS Group configuration.

```

OAuth Client Authentication Using a Third-party Provider

OAuth Client Authentication provides user authentication with a configured third-party provider, such as LDAP or AD. This allows users to use clients authenticating with OAuth 2.0 bearer tokens to authenticate against their configured provider.

In PowerFlow 2.0.0 or later, the OAuth Client Authentication strategy is automatically enabled when a authentication provider is configured. You can configure this strategy using the same parameters as the [User Interface Login Using a Third-party Authentication Provider](#).

The PowerFlow system provides discovery endpoints for all OAuth 2.0 required endpoints. The discovery address is: **<https://IS-IP:5556/dex/.well-known/openid-configuration>**.

Using these discovery endpoints, you can use an OAuth 2.0 client to generate a secure token using a third-party authentication provider. You can use the generated secure token as a bearer authentication token (specified in request headers) to authenticate and make requests.

The **client_secret** and **session_secret** are unique, randomly generated strings generated for each IS deployment. To obtain an OAuth 2.0 token, you will need these values, which you can find in the **`/etc/iservices/isconfig.yml`** file.

Basic Authentication Lockout Removal

PowerFlow 2.0.0 or later supports OAuth 2.0 with OpenID Connect, which lets PowerFlow administrators use third-party authentication providers, such as LDAP or Active Directory, to enforce user authentication and lockout policies.

PowerFlow continues to support Basic Authentication as well, but PowerFlow no longer enforces automatically locking out the *isadmin* user if that user has too many failed login attempts.

If you are concerned about removing the lockout functionality for the *isadmin* user, you can perform one of the following actions:

1. Change the default username from *isadmin* to a different name to prevent brute force type attacks on the *isadmin* user.
2. Disable Basic Authentication and use third-party authentication providers, such as your company's LDAP server, to enforce user authentication and lockout policies.

NOTE: Before disabling Basic Authentication, make sure that all scripts or tools that query the PowerFlow API have been updated to use OAuth 2.0.

Common Access Card (CAC) Authentication

Enabling Common Access Card (CAC) authentication lets a PowerFlow user provide a CAC card through a browser to the PowerFlow root IP address. After identifying the CAC card, the ingress proxy verifies and authenticates the user. CAC authentication bypasses Dex authentication and does not use OIDC protocols.

Applying CAC Authorization

To enable Common Access Card (CAC) authorization on the PowerFlow system:

1. Link to a valid server CA certificate:
 - ScienceLogic Certificate: <http://ca.pivkey.com/server-ca.crt>
 - DODIN Certificate for sample CAC cards: http://repository.auto.sciencelogic.local/artifactory/misc-artifacts/DoD_CAs.crt
2. Set up Public-Key Cryptography Standards (PKCS) #11 in Firefox for your CAC card according to the following instructions: <https://developer.mozilla.org/en-US/docs/Mozilla/Add-ons/WebExtensions/API/pkcs11>.

NOTE: Use the certificates in step 1 for loading authorities.

3. Add the corresponding `server-ca` secret into the **gui** container in the **docker-compose** file:

```
gui:
  secrets
  - source: server-ca.crt
secrets:
  server-ca.crt:
    file: /etc/iservices/server-ca.crt
```

4. Add the following line to `/etc/iservices/isconfig.yml`:

```
CAC_AUTH: 'true'
```

Adding CRL to CAC Authentication

To add a certificate revocation list (CRL) to CAC authentication:

1. Download an example CRL from this site: <http://ca.pivkey.com/server-ca.crt>.
2. Install the following Synchronization PowerPack that contains a PowerFlow application that you can run to continually update CRL: http://repository.auto.sciencelogic.local/artifactory/pypi-local/is_syncpack_mud/1.0.0/is_syncpack_mud-1.0.0-py3-none-any.whl.

3. Add the corresponding volume information to `gui` and `syncpack_steprunner` in the **docker-compose** file:

```
syncpack_steprunner:
volumes:
...
- source: ca_crl
  target: /var/crl
  type: volume
gui:
...
volumes:
  - read_only: true
    source: ca_crl
    target: /var/crl
    type: volume
volumes:
...
  ca_crl: {}
```

4. Restart the PowerFlow services.
5. Install the MUD Synchronization PowerPack from step 2 and run the PowerFlow application to Fetch CRL.

NOTE: Alternatively, you can manually mount a PEM-formatted CRL file to `/var/server-ca.crl`.

6. After the CRL is applied to the volume, update the configuration of `/etc/iservices/isconfig.yml` with the following line and then re-deploy:

```
CAC_CRL: 'true'
```

CAC Authentication with LDAP

CAC authentication with LDAP uses the standard CAC authentication process, and it additionally searches the LDAP server for relevant groups of the user, which can be used for role-based access control (RBAC) checking later.

This authentication process uses the same `DEX_CONNECTORS` configuration settings for the configured LDAP/AD server and associated certificates to perform a search of the users' LDAP server. Using the search strings configured for Dex, if the CAC logic identifies group membership, the user session will be updated with their groups.

Environment Expectations

CAC authentication with LDAP requires the following:

- The user must provide an Admin Bind DN and password to provide a search of the LDAP system.
- The user from CAC will not attempt to be bound and authenticated to LDAP.
- The end user has necessary certificates to form a trusted **ldaps//** connection. SSL certificate verification can be disabled, but is not recommended.
- The administrator is aware of the LDAP environment, search attributes, and object classes necessary to link either a CAC user's SAN or CN to their group membership
- Only SAN or CN is supported for group membership search.

Add LDAP to CAC Query

CAC authentication with LDAP requires **ldapCA.pem**, which is a file with the internal LDAP server CA chain. This will get concatenated to **tls-ca-bundle.pem**, the ca-trust bundle of the **is_gui** container.

To copy an LDAP CA certificate for verification:

1. Create **tls-ca-bundle.pem** by running the following command:

```
docker cp 0b26b93af179:/etc/pki/ca-trust/extracted/pem/tls-ca-bundle.pem ~/ cat
ldapCA.pem >> tls-ca-bundle.pem
```

2. Use an SCP tool to move **tls-ca-bundle.pem** to **/etc/iservices/**.

Docker configuration:

```
configs:
  tlsbundle:
    file: /etc/iservices/tls-ca-bundle.pem
...

gui:
  read_only: true
  configs:
  - source: tlsbundle
    target: /etc/pki/ca-trust/extracted/pem/tls-ca-bundle.pem
...
```

CAC Authentication with LDAP and SAN

CAC authentication with LDAP and SAN allows the user to use their Subject Alternative Name (SAN) value when performing group lookup.

To implement CAC authentication with LDAP and SAN , use the configuration variable called **CAC_LDAP_SEARCH_BY**. This environment variable specifies whether to use Subject Alternative Name (SAN) or Common Name (CN) for LDAP group membership searches when LDAP is enabled and when CAC_LDAP_VERIFY is enabled. The default value of this environment variable is *san*; use *cn* for Common Name in the environment variable section.

Role-based Access Control (RBAC) Configuration

Regardless of the authentication method you have chosen to use, the role-based permissions assigned to users is applied in the same way. PowerFlow uses the existing users and user groups that you have already set up in your authentication system.

Assigning a Role to a Specific User

By applying a role permission to a single username on the **Admin Panel** page, or through the API, permissions will be granted to any user who logs in through a provider matching that username.

Assigning Roles to a Specific User Group

By applying a role permission to a group name on the **Admin Panel** page, or through the API, permissions will be granted to any user who logs in and is a member of the specified group.

For authentication to work properly, **group_search** must be configured in the authentication provider's connector information. When requesting authentication tokens, be sure to also request the **groups** claim.


NOTE: If a user belongs to multiple groups, with varying permissions defined to each group, the user will be permitted to do all actions provided by the group that provides the most roles.

Viewing User and Group Information

After configuring your third-party authentication connector in Dex, you can run the following command to view the search strategy and group results for any user that attempts to authenticate by looking at the Dexserver logs:

```
docker service logs -f iservices_dex
```

Changing Roles and Permissions

To change roles and permissions through the PowerFlow user interface, go to the **Admin Panel** page () to create and edit the roles and permissions of the users or user groups. For more information, see [Creating a User Group in PowerFlow](#).


To change roles and permissions through the API, refer to the **swagger.yml** file for API required parameters and endpoints to update roles and permissions.

Configuring Authentication Settings in PowerFlow

The following configuration settings can be configured and used with the PowerFlow authentication and authorization strategies:

- **DEX_CONNECTORS**. This environment variable specifies which authentication providers Dex will use. For more information, see [User Interface Login Using a Third-party Authentication Provider](#).
- **BASIC_AUTH_USER**. This environment variable specifies the basic_auth and admin login username. For more information, see [User Interface Login Administrator User](#).
- **BASIC_AUTH_PASSWORD**. This environment variable specifies the basic_auth and admin login password. For more information, see [User Interface Login Administrator User](#).
- **BASIC_AUTH**. This environment variable specifies whether the local Administrator user will be enabled. For more information, see [User Interface Login Administrator User](#).
- **CLIENT_ID**. The IS client_id in use by default is *isproxy*, and you should not change this value.
- **CLIENT_SECRET**. The client_secret is a randomly generated string unique to each PowerFlow deployment. In most configurations, you do not need to change this secret.
- **CAC_AUTH**. This environment variable specifies whether to enable CAC certificate checking. If this is used, there should be a public CA certificate added as a **server-ca.crt** secret to the **gui** container. For more information, see [CAC Authentication](#).
- **CAC_CRL**. This environment variable specifies whether certificate revocation list (CRL) checking is enabled for the CAC client certificate. If this is true and updated, the user should must add a **ca_crl:/var/ca_crl** volume to both the **gui** and **syncpacks_steprunner** services.
- **CAC_LDAP_VERIFY**. This environment variable specifies whether to enable lookup of group permissions based on the user Subject Alternative Name (SAN) or Common Name (CN) to the configured LDAP server. If this is configured, the user must configure an LDAP or AD server under the **DEX_CONNECTORS** environment variable.
- **CAC_LDAP_SEARCH_BY**. This environment variable specifies whether to use Subject Alternative Name (SAN) or Common Name (CN) for LDAP group membership searches when LDAP is enabled and when **CAC_LDAP_VERIFY** is enabled. The default value of this environment variable is *san*; use *cn* for Common Name in the environment variable section.
- **BIND_DN**. Use this encrypted value in the **dex_connectors** section when using LDAP as a connector.
- **BIND_PW**. Use this encrypted value in the **dex_connectors** section when using LDAP as a connector.

User Groups, Roles, and Permissions

On the **Admin Panel** page () , you can edit and create **user groups** that define the different roles and permissions for your users. Depending on their assigned permissions, users have access to certain features, or they are blocked from certain features.

On this page, you can allocate permissions to users and user groups that exist in your authentication system. The **User Group** field in the PowerFlow user interface can specify either an individual user or a group that already exists in your authentication system.

The available roles and permissions for PowerFlow include the following:

- **View**. The user can view and get via the API the list of applications, the list of installed Synchronization PowerPacks, the dashboards, the reports, the configuration objects, and the results of application runs.
- **Execute**. The user has all of the privileges of the **View** permission, but the user can also trigger application runs through the user interface or the API.
- **Configuration**. The user has all of the privileges of the **Execute** permission, but the user can also add and edit configuration objects and modify the application variables.
- **Developer**. The user has all of the privileges of the **Configure** permission, but the user can also add, copy, and edit step definitions; add, copy, and edit application variables; and create Synchronization PowerPacks.
- **Administrator**. The user has all of the privileges of the **Develop** permission, but the user can also add, install, activate, and delete Synchronization PowerPacks; delete applications, steps, and configuration objects; and access to (but not authorization to) the user interfaces for Couchbase, Flower, and RabbitMQ.

Additional information about roles and permissions in PowerFlow:

- Roles in PowerFlow are automatically assigned to a user based on the user's group with the external provider (such as LDAP or AD) .
- If a PowerFlow system does not have an external provider configured, such as LDAP or Active Directory, that PowerFlow system can only support a single *isadmin* Administrator user.
- The *only* password saved in the PowerFlow system is the password for the *isadmin* Administrator user. All other user passwords are saved in the third-party authentication provider configured for PowerFlow.
- The authentication configuration used by PowerFlow is also supported in SL1 .
- API queries made by users will also be checked for proper authorization.
- The PowerFlow administrator can configure which users are in which roles.
- The PowerFlow administrator can test and configure the LDAP and Active Directory settings to ensure that the settings work before proceeding.
- The PowerFlow administrator can always log in with the *isadmin* Administrator user, even if the underlying LDAP provider is inaccessible.

Creating a User Group in PowerFlow

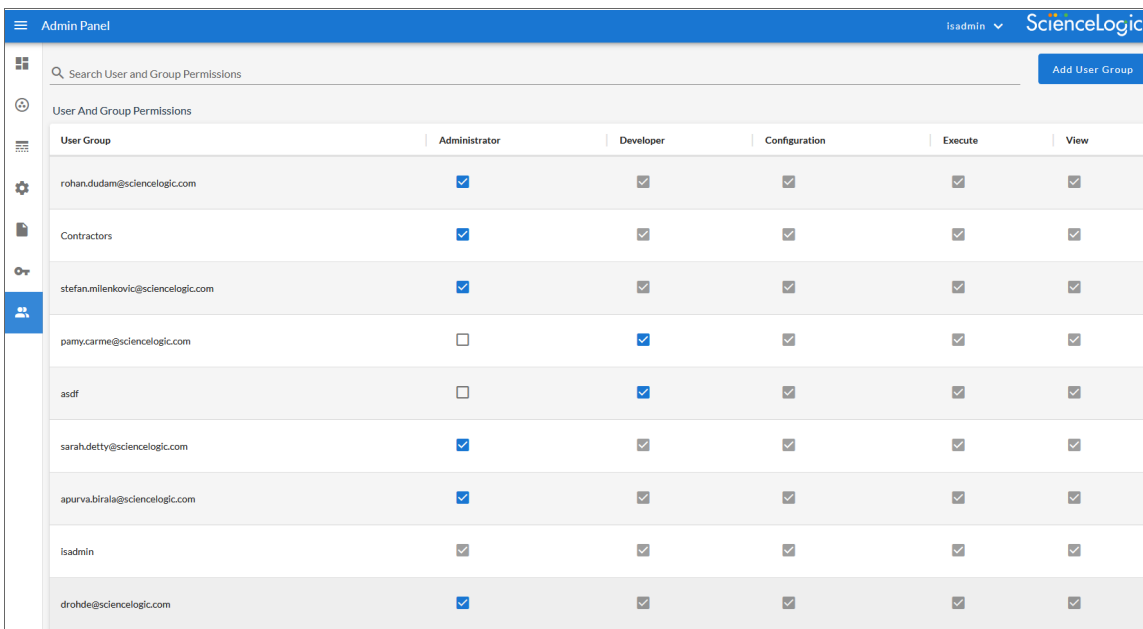
On the **Admin Panel** page, you can allocate permissions to users and user groups that exist in your authentication system.

If you have the *Administrator* role, you can modify the permissions for each user group on the page. You cannot change the permissions for the user group to which you currently belong. A user with the *Administrator* role can also create a user group and assign permissions to that group.

NOTE: The *only* password saved in the PowerFlow system is the password for the *isadmin* Administrator user. All other user passwords are saved in the third-party authentication provider configured for PowerFlow.

To create a user group:

1. In the PowerFlow user interface, go to the **Admin Panel** page (👤):




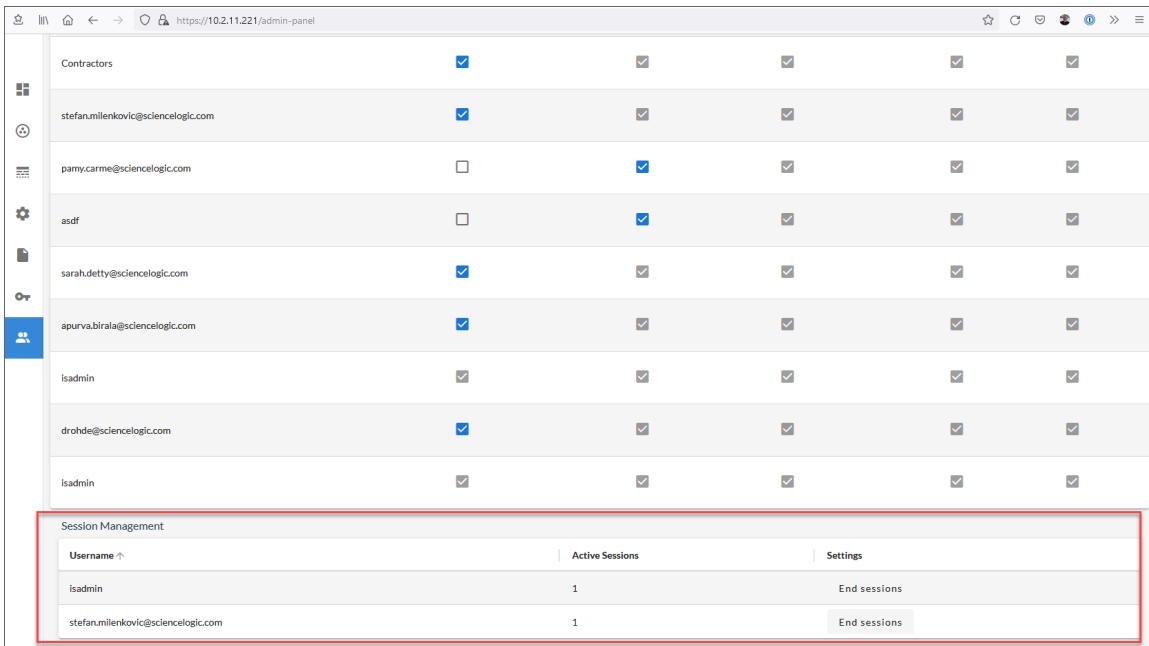
User Group	Administrator	Developer	Configuration	Execute	View
rohan.dudam@sciencelogic.com	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Contractors	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
stefan.milenkovic@sciencelogic.com	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
pamy.carme@sciencelogic.com	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
asdf	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
sarah.detty@sciencelogic.com	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
apurva.birala@sciencelogic.com	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
isadmin	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
drohde@sciencelogic.com	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

2. Click **[Add User Group]**. The **Create User Group** window appears.
3. Complete the following fields:
 - **User Group Name.** Type a name for this user group, *without* spaces. This is the name that the user or the users in the user group will use when logging in to PowerFlow. You can specify either an individual user or a user group that already exists in your authentication system.
 - **Choose Permissions Group.** Click **Add Permission** to select the permission to assign to this new user group. Your choices include *Developer*, *Configuration*, *View*, *Execute*, and *Administrator*, and these choices are defined in [User Groups, Roles, and Permissions](#).

4. Click **[Create User Group]**. The group is added to the **Admin Panel** page.
5. If you want to give a user group *more* permissions, select the empty checkbox () for that role from the **Admin Panel** page. You must have the *Administrator* role to change these settings.
6. If you want to *remove* permissions from a user group, select the highest level role, which has a blue check mark (). The role to the right (with fewer permissions) becomes the new role for that user group.

Managing User Sessions

A user with the *Administrator* role can use the **Session Management** pane of the **Admin Panel** page () to monitor which users have been logged into the PowerFlow system. The admin user can end active sessions as needed. Non-admin users can view user sessions, but they cannot end those sessions.



The screenshot shows the Admin Panel interface. The top part is a table of user groups with various permissions indicated by checkboxes. Below this is the Session Management pane, which is highlighted with a red border. It contains a table with the following data:

Username ↑	Active Sessions	Settings
isadmin	1	End sessions
stefan.milenkovic@sciencelogic.com	1	End sessions

When an administrator ends a session for a user by clicking the **[End sessions]** button, that user is redirected to the PowerFlow login page.

Enabling Session Management

Session management is disabled by default. You can use the following set of configuration variables to enable and configure session management. You can set these variables in the PowerFlow configuration file **/etc/iservices/isconfig.yml** or on the services environment variables:

- **ENABLE_SESSION_STORAGE**. Set to true to enable session management with default values. This variable is set to false by default.

- **SESSION_IDLE_TIME**: Specify the idle time in seconds. The default is 900 seconds. This value and the following values should be declared as a string.
- **SESSION_RENEW_EVERY**: Specify the automatic session regeneration time in seconds. The default is 600 seconds.
- **SESSION_ABSOLUTE_TIME**: Specify the longest time allowed for a session, in hours, such as *25h*. You can also use minutes, such as *60m*. This variable uses Dex notation. The default is 25 hours.
- **CONCURRENT_SESSIONS_BY_USER**. Specify the number of sessions that can be running at the same time, by number of users. The default is 30 users.

NOTE: When the number of user sessions is exceeded, the user trying to log in is redirected to a "Session limit has been reached" page, and then the user is returned to the login page.

Authentication and Authorization for Services Used by PowerFlow

The PowerFlow administrator can control the level of access to the specific PowerFlow services, including Couchbase and RabbitMQ. Authentication for these services is provided by Dex authentication, which is already used for role-based access control (RBAC) in PowerFlow.

NOTE: This feature requires LDAP/AD authentication for the PowerFlow system. For more information, see [OAuth Client Authentication Using a Third-party Provider](#).

Couchbase

- Couchbase authentication. To access the Couchbase user interface, a user must log in to PowerFlow first, using his or her PowerFlow credentials. If the user is authorized to access the Couchbase user interface, the user can add port "8091" to the PowerFlow URL, and the user will be automatically redirected to the Couchbase user interface.
- Couchbase authorization. The roles and user groups defined in PowerFlow are applied to the Couchbase user interface based on the default user group policies. The PowerFlow administrator can update these user policies to specify which groups can access Couchbase. Couchbase authorization uses the following default permissions:
 - *Administrator*. The user has access to all resources at all levels.
 - *Developer*. The user can add and edit buckets and documents, but the user cannot delete anything.
 - *Configuration*. The user can add and delete indexes and add nodes to Couchbase.
 - *Execute*. The user has read-only access.
 - *View*. The user cannot login to the Couchbase user interface. This was explicitly set that way as Couchbase is the main database for PowerFlow.

RabbitMQ

- RabbitMQ authentication. RabbitMQ authentication works the same as PowerFlow authentication and Couchbase authentication.
- RabbitMQ authorization. RabbitMQ authorization uses the following default permissions:
 - *Administrator*: The user has access to all resources, at all levels, and the user can create internal users and policies. These policies do not impact PowerFlow users.
 - *Developer*: The user can create resources and read all resources on all vhosts.
 - *Configuration*: The user can create queues and exchanges only in the default vhost, but the user can read queues and exchanges on all vhosts.
 - *Execute*: The user can read queues and exchanges on all vhosts, but the user cannot create or configure any resources.
 - *View*: The user can only view queues and exchanges on the default vhost.

NOTE: If you want to disable the auto-login feature for RabbitMQ and Couchbase, you can set the **force_auth_validation** environment variable to "true" under the GUI container configurations in the **docker-compose** file. Setting this variable to "true" allows you to access the Couchbase or RabbitMQ user interface to address issues without needed to authorize. If the flag is missing or set to "false", the auto-login feature continues to work.

Viewing Logs in SL1 PowerFlow

Overview

This chapter describes the different types of logging available in PowerFlow.

This chapter covers the following topics:

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<i>Logging Configuration</i>	165
<i>PowerFlow Log Files</i>	165
<i>Working with Log Files</i>	166
<i>Viewing the Step Logs and Step Data for a PowerFlow Application</i>	168
<i>Removing Logs on a Regular Schedule</i>	169

Logging Data in PowerFlow

PowerFlow allows you to view log data locally, remotely, or through Docker.

Local Logging

PowerFlow writes logs to files on a host system directory. Each of the main components, such as the process manager or Celery workers, and each application that is run on the platform, generates a log file. The application log files use the application name for easy consumption and location.

In a clustered environment, the logs must be written to the same volume or disk being used for persistent storage. This ensures that all logs are gathered from all hosts in the cluster onto a single disk, and that each application log can contain information from separately located, disparate workers.

You can also implement log features such as rolling, standard out, level, and location setting, and you can configure these features with their corresponding environment variable or setting in a configuration file.

NOTE: Although it is possible to write logs to file on the host for persistent debug logging, as a best practice, ScienceLogic recommends that you utilize a logging driver and write out the container logs somewhere else.

TIP: You can use the "Timed Removal" application in the PowerFlow user interface to remove logs from Couchbase on a regular schedule. On the **Configuration** pane for that application, specify the number of days before the next log removal. For more information, see [Removing Logs on a Regular Schedule](#).

Remote Logging

If you use your own existing logging server, such as Syslog, Splunk, or Logstash, PowerFlow can route its logs to a customer-specified location. To do so, attach your service, such as logspout, to the microservice stack and configure your service to route all logs to the server of your choice.

CAUTION: Although PowerFlow supports logging to these remote systems, ScienceLogic does not officially own or support the configuration of the remote logging locations. Use the logging to a remote system feature at your own discretion.

Viewing Logs in Docker

You can use the Docker command line to view the logs of any current running service in the PowerFlow cluster. To view the logs of any service, run the following command:

```
docker service logs -f iservices_<service_name>
```

Some common examples include the following:

```
docker service logs -f iservices_couchbase
docker service logs -f iservices_steprunner
docker service logs -f iservices_contentapi
```

NOTE: *Application* logs are stored on the central database as well as on all of the Docker hosts in a clustered environment. These logs are stored at **/var/log/iservices** for both single-node or clustered environments. However, the logs on each Docker host only relate to the services running on that host. For this reason, using the Docker service logs is the best way to get logs from all hosts at once.

Logging Configuration

The following table describes the variables and configuration settings related to logging in PowerFlow:

Environment Variable/Config Setting	Description	Default Setting
logdir	The directory to which logs will be written.	/var/log/iservices
stdoutlog	Whether logs should be written to standard output (stdout).	True
loglevel	Log level setting for PowerFlow application modules.	debug/info (varies between development and product environments)
celery_log_level	The log level for Celery-related components and modules.	debug/info (varies between development and product environments)

PowerFlow Log Files

In PowerFlow version 2.1.0 and later, additional logging options were added for **gui**, **api**, and **rabbitmq** services. The logs from a service are available in the **/var/log/iservices** directory on which that particular service is running.

To aggregate logs for the entire cluster, ScienceLogic recommends that you use a tool like Docker Syslog: <https://docs.docker.com/config/containers/logging/syslog/>.

Logs for the gui Service

By default all nginx logs are written to stdout. Although not enabled by default, you can also choose to write access and error logs to file in addition to stdout.

To log to a persistent file, simply mount a file to **/host/directory:/var/log/nginx**, which will by default log both access and error logs.

For pypiserver logs, the logs are not persisted to disk by default. You can choose to persist pypiserver logs by setting the **log_to_file** environment variable to true.

If you choose to persist logs, you should mount a host volume to **/var/log/devpi** to access logs from a hos. For example: **/var/log/iservices/devpi:/var/log/devpi**.

Logs for the api Service

By default all log messages related to PowerFlow are written out to **/var/log/iservices/contentapi**.

PowerFlow-specific logging is controlled by existing settings listed in [Logging Configuration](#). Although not enabled by default, you can also choose to write nginx access and error logs to file in addition to stdout.

To log to a persistent file, simply mount a file to **/file/location/host:/var/log/nginx/nginx_error.log** or **/host/directory:/var/log/nginx** depending if you want access or error logs.

Logs for the rabbitmq Service

Logs for the rabbitmq service were not previously persisted, but with PowerFlow 2.1.0, all rabbitmq service logs are written to stdout by default. You can choose write to a logfile (stdout or logfile, not both).

To write to the logfile:

1. Add the following environment variable for the rabbitmq service:

```
RABBITMQ_LOGS: "/var/log/rabbitmq/rabbit.log"
```

2. Mount a volume: **/var/log/iservices/rabbit:/var/log/rabbitmq**

The retention policy of these logs is 10 MB, for a total of five maximum logs written to file.

Working with Log Files

Use the following procedures to help you locate and understand the contents of the various log files related to PowerFlow.

Accessing Docker Log Files

The Docker log files contain information logged by all containers participating in PowerFlow. The information below is also available in the PowerPacks listed above.

To access Docker log files:

1. Use SSH to connect to the PowerFlow instance.
2. Run the following Docker command:

```
docker service ls
```

3. Note the Docker service name, which you will use for the `<service_name>` value in the next step.
4. Run the following Docker command:

```
docker service logs -f <service_name>
```

Accessing Local File System Logs

The local file system logs display the same information as the Docker log files. These log files include debug information for all of the PowerFlow applications and all of the Celery worker nodes.

To access local file system logs:

1. Use SSH to connect to the PowerFlow instance.
2. Navigate to the `/var/log/iservices` directory to view the log files.

Understanding the Contents of Log Files

The pattern of deciphering log messages applies to both Docker logs and local log files, as these logs display the same information.

The following is an example of a message in a Docker log or a local file system log:

```
"2018-11-05 19:02:28,312","FLOW","12","device_sync_sciencelogic_to_servicenow","ipaas_logger","142","stop Query and Cache ServiceNow CIs|41.4114570618"
```

You can parse this data in the following manner:

```
'YYYY-MM-DD' 'HH-MM-SS,ss' 'log-level' 'process_id' 'is_app_name' 'file'  
'lineOfCode' 'message'
```

To extract the runtime for each individual task, use regex to match on a log line. For instance, in the above example, there is the following sub-string:

```
"stop Query and Cache ServiceNow CIs|41.4114570618"
```

Use regex to parse the string above:

```
"stop ..... | ..."
```

where:

- Everything after the | is the time taken for execution.
- The string between "stop" and | represents the step that was executed.

In the example message, the "Query and Cache ServiceNow Cls" step took around 41 seconds to run.

Viewing the Step Logs and Step Data for a PowerFlow Application

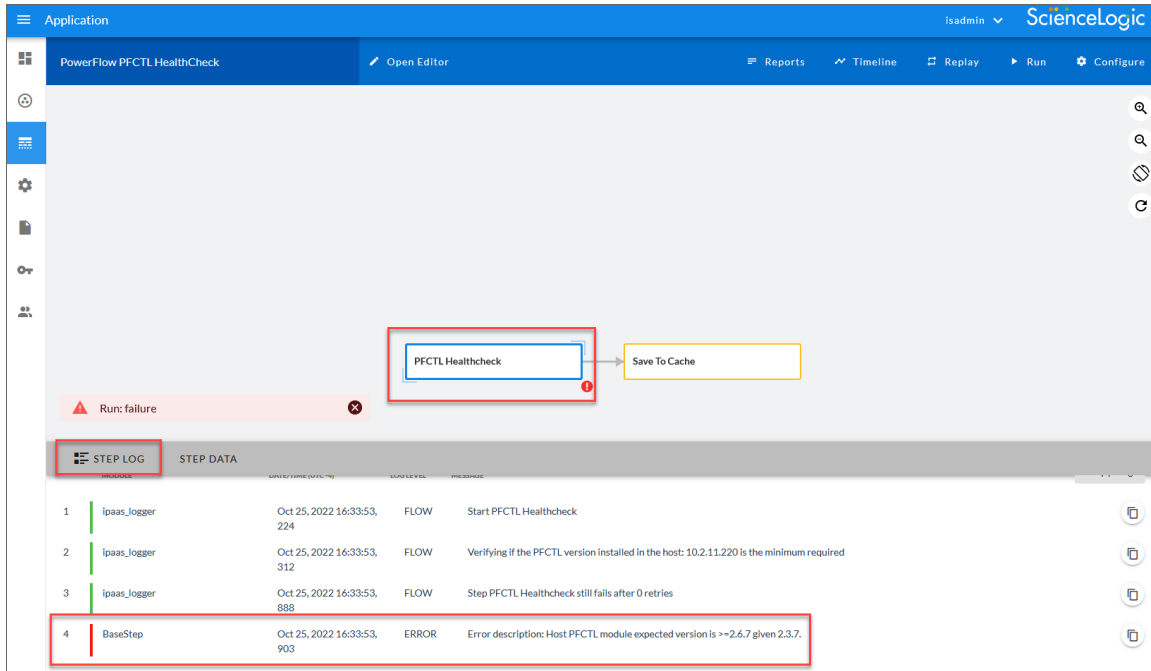
The **[Step Log]** tab on an **Application** page displays the time, the type of log, and the log messages from a step that you selected in the main pane. All times that are displayed in the **Message** column of this pane are in seconds, such as "stop Query and Cache ServiceNow Cl List|**5.644190788269043**".

TIP: You can view log data for a step on the **[Step Log]** tab while the **Configuration** pane for that step is open.

To view logs for the steps of an application:

1. From the **[Applications]** tab, select an application. The **Application** page appears.
2. Select a step in the application.

- Click the **[Step Log]** tab in the bottom left-hand corner of the screen. The **[Step Log]** tab appears at the bottom of the page, and it displays log messages for the selected step:



TIP: For longer log messages, click the down arrow icon (▼) in the **Message** column of the **[Step Log]** tab to open the message.

- To copy a message, triple-click the text of the message to highlight the entire text block, and then click the Copy Message icon (📄) next to that message.
- To copy the entire log, click the **[Copy Log]** button.
- Click the **[Step Data]** tab to display the JSON data that was generated by the selected step.
- Click the **[Step Log]** tab to close the tab.
- To generate more detailed logs when you run this application, hover over the **[Run]** button and select *Debug Run*.

TIP: 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 **opt/iservices/scripts/docker-compose.yml** file. The default value for log expiration is 7 days. This environment variable is set in seconds.

Removing Logs on a Regular Schedule

The "Timed Removal" application in the PowerFlow user interface lets you remove logs from Couchbase on a regular schedule.

To schedule the removal of logs:

1. In the PowerFlow user interface, go to the **[Applications]** tab and select the "Timed Removal" application.
2. Click the **[Configure]** button. The **Configuration** pane appears.
3. Complete the following fields:
 - **Configuration**. Select the relevant configuration object to align with this application. Required.
 - **time_in_days**. Specify how often you want to remove the logs from Couchbase. The default is 7 days. Required.
 - **remove_dex_sessions**. Select this option if you want to remove Dex Server sessions from the logs.
4. Click the **[Save]** button and close the **Configuration** pane.
5. Click the **[Run]** button to run the "Timed Removal" application.

Using the **powerflowcontrol (pfctl)** Command-line Utility

Overview

This chapter describes how to use the **powerflowcontrol** (pfctl) command-line utility to run automatic cluster **healthcheck** and **autoheal** actions that will verify the configuration of your PowerFlow cluster or a single PowerFlow node. The **powerflowcontrol** utility also includes an **autocluster** action that performs multiple administrator-level actions on either the node or the cluster. You can use this action to automate the configuration of a three-node cluster.

NOTE: The **powerflowcontrol** command-line utility was called **iservicecontrol** in previous release of SL1 PowerFlow. You can use either "iservicecontrol" or "pfctl" in commands, but "iservicecontrol" will eventually be deprecated in favor of "pfctl".

For more information about using the **powerflowcontrol** (pfctl) command-line utility, watch the video at <https://www.youtube.com/watch?v=IWTACuLhepA>.

This chapter covers the following topics:

<i>What is the powerflowcontrol (pfctl) Utility?</i>	172
<i>healthcheck and autoheal</i>	173
<i>autocluster</i>	176
<i>open_firewall_ports</i>	177
<i>password</i>	177

What is the powerflowcontrol (pfctl) Utility?

The **powerflowcontrol** (pfctl) command-line utility included in PowerFlow contains automatic cluster **healthcheck** and **autoheal** actions that will verify the configuration of your cluster or single node. The utility also includes an **autocluster** action that performs multiple administrator-level actions on either the node or the cluster.

The **powerflowcontrol** utility is included in the latest release of PowerFlow. If you need a newer version, you can download the latest version from the ScienceLogic Support site at <https://support.sciencelogic.com/s/>.

To install the **powerflowcontrol** utility:

1. Go to the ScienceLogic Support site at <https://support.sciencelogic.com/s/>.
2. Click the **[Product Downloads]** tab and select *PowerFlow*. The **PowerFlow** page appears.
3. Click the link for the current release. The **Release Version** page appears.
4. In the **Release Files** section, click the link for the version of PowerFlow Control you want to download. The **Release File Details** page appears.
5. Click the **[Download File]** button to download the **.whl** file for the **powerflowcontrol** utility.
6. Using WinSCP or another file-transfer utility, copy the **.whl** file to a directory on the PowerFlow system.
7. Go to the console of the PowerFlow system or use SSH to access the PowerFlow system.
8. To install the utility, run the following command:

```
sudo pip3 install iservicecontrol-x.x.x-py3-none-any.whl
```

where *x.x.x* is the pfctl version number.

9. To check the version number of the utility, run the following command:

```
pip3 show iservicecontrol
```

NOTE: The **powerflowcontrol** command-line utility requires port 22 on all host nodes.

NOTE: You can use key-based authentication instead of username and password authentication for the **powerflowcontrol** command-line utility.

The **powerflowcontrol** command-line utility was updated to let any user run the **powerflowcontrol** utility. The default **isadmin** user already meets these requirements, and this update is relevant only if your PowerFlow environment uses custom users or processes.

The user requirements for working with **powerflowcontrol** include the following:

- The user must belong to the **iservices** group
- The user must belong to the **docker** group

- The user must belong to the **systemd-journal** group, or have permission to view **journalctl** logs (to check for errors in Docker services)
- The user must have sudo permission (to set PowerFlow configuration file group ownership)

WARNING: If the isadmin (host) password contains a special character, such as an "@" or "#" symbol, the password must be escaped in the **iservicecontrol** commands by adding single quotes, such as 'user:password'. For example: `pfctl --host 10.10.10.100 'isadmin:testing@is' --host 10.10.10.102 'isadmin:testing@is' --host 10.10.10.105 'isadmin:testing@is' autocluster`

For a detailed list of all of the actions you can run on a single node, SSH to the PowerFlow server and run the following command:

```
pfctl node-action --help
```

For a detailed list of all of the actions you can run on a clustered system, run the following command:

```
pfctl cluster-action --help
```

Starting with version 2.7.2 of the pfctl utility, you can run the following command to view updated and expanded help text:

```
pfctl --help
```

healthcheck and autoheal

The **powerflowcontrol** (pfctl) command-line utility performs multiple administrator-level actions in a clustered PowerFlow environment. The **powerflowcontrol** utility contains automatic cluster **healthcheck** and **autoheal** capabilities that you can use to prevent issues with your PowerFlow environment:

- The **healthcheck** action executes various commands to verify configurations, proxies, internal connectivity, queue cluster, database cluster, indexes, NTP settings, Docker versions on all clusters, and more. Any previously reported troubleshooting issues are addressed with the healthcheck action.
- The **autoheal** action automatically takes corrective action on your cluster.

After deploying any clusters in a PowerFlow system, or if you are troubleshooting an existing cluster, you should first run the **healthcheck** action to generate immediate diagnostics of the entire cluster and all services and containers associated with the cluster. If the **healthcheck** action finds any issues, you can run the **autoheal** action to attempt to address those issues.

healthcheck

The following commands show the formatting for a **healthcheck** action for a *single node*, followed by an example:

```
pfctl --host <pf_host_ip_address> <username>:<password> node-action --action healthcheck
```

```
pfctl --host 10.2.11.222 isadmin:isadmin222 node-action --action healthcheck
```

The following commands show the formatting for a **healthcheck** action for a *clustered environment*, followed by an example:

```
pfctl --host <pf_host_ip_address> <username>:<password> --host  
<host> <username>:<password> --host <pf_host_ip_address> <username>:<password> cluster-  
action --action healthcheck
```

```
pfctl --host 10.2.11.222 isadmin:isadmin222 --host 10.2.11.232 isadmin:isadmin232 --  
host 10.2.11.244 isadmin:isadminpass cluster-action --action healthcheck
```

TIP: As a best practice, run the **healthcheck** action once a day on your PowerFlow to identify and address any potential issues with the system before those issues impact operations.

autoheal

The following commands show the formatting for an **autoheal** action for a *single node*, followed by an example:

```
pfctl --host <host> <username>:<password> node-action --action autoheal
```

```
pfctl --host 10.2.11.222 isadmin:isadmin222 node-action --action autoheal
```

The following commands show the formatting for an **autoheal** action for a *clustered environment*, followed by an example:

```
pfctl --host <host> <username>:<password> --host <host> <username>:<password> --host  
<host> <username>:<password> cluster-action --action autoheal
```

```
pfctl --host 10.2.11.222 isadmin:isadmin222 --host 10.2.11.232 isadmin:isadmin232 --  
host 10.2.11.244 isadmin:isadminpass cluster-action --action autoheal
```

Example Output

The following section lists example healthcheck output:

```
verify db host for cluster 10.2.11.222.....[OK]  
check dex connectivity 10.2.11.222.....[OK]  
check rabbit cluster count 10.2.11.222.....[OK]  
check rabbit cluster alarms 10.2.11.222.....[OK]  
verify cmd in container 10.2.11.222.....[OK]  
verify cmd in container 10.2.11.222.....[OK]  
verify cmd in container 10.2.11.222.....[OK]  
verify cmd in container 10.2.11.222.....[OK]  
verify cmd in container 10.2.11.222.....[OK]
```

```

verify cmd in container 10.2.11.222.....[OK]
verify cmd in container 10.2.11.232.....[Skipped - iservices_steprunner not
found on 10.2.11.232]
verify cmd in container 10.2.11.232.....[OK]
verify cmd in container 10.2.11.232.....[OK]
verify cmd in container 10.2.11.232.....[Skipped - iservices_contentapi not
found on 10.2.11.232]
verify cmd in container 10.2.11.232.....[OK]
verify cmd in container 10.2.11.232.....[Skipped - iservices_steprunner not
found on 10.2.11.232]
verify cmd in container 10.2.11.232.....[OK]
verify cmd in container 10.2.11.232.....[OK]
verify cmd in container 10.2.11.232.....[Skipped - iservices_contentapi not
found on 10.2.11.232]
verify cmd in container 10.2.11.232.....[OK]
verify cmd in container 10.2.11.244.....[OK]
verify cmd in container 10.2.11.244.....[OK]
verify cmd in container 10.2.11.244.....[OK]
verify cmd in container 10.2.11.244.....[OK]
verify cmd in container 10.2.11.244.....[OK]
verify cmd in container 10.2.11.244.....[OK]
verify cmd in container 10.2.11.244.....[OK]
get file hash 10.2.11.222.....[OK]
get file hash 10.2.11.232.....[OK]
/etc/iservices/isconfig.yml does not match between 10.2.11.222 and 10.2.11.232
get file hash 10.2.11.222.....[OK]
get file hash 10.2.11.232.....[OK]
get file hash 10.2.11.244.....[OK]
/opt/iservices/scripts/docker-compose.yml does not match between 10.2.11.222 and
10.2.11.244
get file hash 10.2.11.222.....[OK]
get file hash 10.2.11.232.....[OK]
get file hash 10.2.11.244.....[OK]
get file hash 10.2.11.222.....[OK]
get file hash 10.2.11.232.....[OK]
get file hash 10.2.11.244.....[OK]
get file hash 10.2.11.222.....[OK]
get file hash 10.2.11.232.....[OK]
get file hash 10.2.11.244.....[OK]
get file hash 10.2.11.222.....[OK]
get file hash 10.2.11.232.....[OK]
get file hash 10.2.11.244.....[OK]
check cpu 10.2.11.222.....[OK]
check disk 10.2.11.222.....[OK]
check memory 10.2.11.222.....[Failed]
check cpu 10.2.11.232.....[OK]
check disk 10.2.11.232.....[OK]
check memory 10.2.11.232.....[OK]
check cpu 10.2.11.244.....[OK]
check disk 10.2.11.244.....[OK]
check memory 10.2.11.244.....[OK]
Utilization warnings in the cluster:
{'10.2.11.222': ['There is less than 2000mb memory available']}
verify ntp sync 10.2.11.222.....[OK]
verify ntp sync 10.2.11.232.....[OK]
verify ntp sync 10.2.11.244.....[OK]
check replica count logs 10.2.11.222.....[OK]
check replica count content 10.2.11.222.....[Failed]
Identified missing replicas on some buckets: ['Replica count for bucket: content is
not the expected 2']

```

```
verify pingable addr 10.2.11.222.....[OK]
verify pingable addr 10.2.11.232.....[OK]
verify pingable addr 10.2.11.244.....[OK]
get exited container count 10.2.11.222.....[OK]
get exited container count 10.2.11.232.....[OK]
get exited container count 10.2.11.244.....[OK]
6 exited (stale) containers found cluster-wide
verify node indexes 10.2.11.222.....[Failed]
Some nodes are missing required indexes. Here are the nodes with the missing indexes:
Missing the following indexes: {'couchbase.isnet': ['idx_casbin'], 'couchbase-worker2.isnet':
['idx_content_configuration']}
```

Using powerflowcontrol healthcheck on the docker-compose file

You can also validate the **docker-compose** file with the **powerflowcontrol healthcheck** action. The action will show a message if pypiserver or dexserver services are not configured properly in the docker-compose file. You can fix these settings manually or with the **powerflowcontrol autoheal** action, which corrects the **docker-compose** file and copies it to all the nodes in the clustered environment.

When using version 1.3.0 or later of the **powerflowcontrol** (pfctl) command-line utility, the **autocluster** action validates and fixes the pypiserver and dexserver services definitions in the **docker-compose** file.

NOTE: The **healthcheck** action in the **powerflowcontrol** command-line utility for PowerFlow clusters will check the Docker version for each cluster to ensure that the Docker version is the same in all the hosts.

autocluster

You can use the **powerflowcontrol** (pfctl) command-line utility to perform multiple administrator-level actions on your PowerFlow cluster. You can use the **autocluster** action with the **powerflowcontrol** command to automate the configuration of a three-node cluster.

NOTE: If you are using another cluster configuration, the deployment process should be manual, because the **powerflowcontrol** utility *only* supports the automated configuration of a three-node cluster.

WARNING: The **autocluster** action will completely reset and remove all data from the system. When you run this action, you will get a prompt verifying that you want run the action and delete all data.

To automate the configuration of a three-node cluster, run the following command:

```
pfctl --host <pf_host1> <username>:<password> --host <pf_host2> <username>:<password>
--host <pf_host3> <username>:<password> autocluster
```

For example:


```
pfctl --host 192.11.1.1 isadmin:passw0rd --host 192.11.1.2 isadmin:passw0rd --host 192.11.1.3 isadmin:passw0rd autocluster
```

Running this command will configure your PowerFlow three-node cluster without any additional manual steps required.

NOTE: You can use the **generate_haproxy_config** cluster-action in the **powerflowcontrol** (pfctl) utility to create an HAProxy configuration template that lets you easily set an HAProxy load balancer for a three-node cluster. For example: `pfctl cluster-action --action generate_haproxy_config`

open_firewall_ports

To open firewall ports for a single node, SSH to the PowerFlow server and run the following command:

```
pfctl --host <pf_host_IP_address> isadmin:<password> node-action --action open_firewall_ports
```

password

To encrypt a password using the **powerflowcontrol** (pfctl) command-line utility, SSH to the PowerFlow server and run the following command:

```
pfctl password encrypt
```

To view the current node password unencrypted, run the following command:

```
pfctl password decrypt
```

This command displays the decrypted password on standard output. It does not alter the contents of **/etc/iservices/is_pass** in place, but just decrypts to **stdout**.



This command is used locally when the decrypted password is needed for certain tasks that are, in turn, remotely started. On certain systems where the password is encrypted, this involves decrypting the password using the **encryption_key** file contents. For remote nodes, the nodes must also support the same version or later of the **powerflowcontrol** (pfctl) command-line utility, as that command is executed locally.

Using SL1 to Monitor SL1 PowerFlow

Overview

This chapter describes the various ScienceLogic PowerPacks that you can use to monitor the components of the PowerFlow system. This chapter also describes the suggested settings, metrics, and situations for healthy SL1 and PowerFlow systems.

Use the following menu options to navigate the SL1 user interface:

- To view a pop-out list of menu options, click the menu icon (.
- To view a page containing all of the menu options, click the Advanced menu icon ().

This chapter covers the following topics:

<i>Monitoring PowerFlow</i>	179
<i>Configuring the Docker PowerPack</i>	180
<i>Configuring the SL1 PowerFlow PowerPack</i>	183
<i>Configuring the Couchbase PowerPack</i>	185
<i>Configuring the RabbitMQ PowerPack</i>	187
<i>Stability of the PowerFlow Platform</i>	190

Monitoring PowerFlow

You can use a number of ScienceLogic PowerPacks to help you monitor the health of your PowerFlow system. This section describes those PowerPacks and additional resources and procedures you can use to monitor the components of PowerFlow.

TIP: You can also use the **PowerFlow Control Tower** page in the PowerFlow user interface to monitor the status of the various tasks, workers, and applications that are running on your PowerFlow system. You can use this information to quickly determine if your PowerFlow instance is performing as expected.

You can download the following PowerPacks from the **PowerPacks** page of the ScienceLogic Support Site at <https://support.sciencelogic.com/s/> to help you monitor your PowerFlow system:

- **Linux Base Pack PowerPack:** This PowerPack monitors your Linux-based PowerFlow server with SSH (the PowerFlow ISO is built on top of an Oracle Linux Operating System). This PowerPack provides key performance indicators about how your PowerFlow server is performing. The only configuration you need to do with this PowerPack is to install the latest version of it.
- **Docker PowerPack:** This PowerPack monitors the various Docker containers, services, and Swarm that manage the PowerFlow containers. This PowerPack also monitors PowerFlow when it is configured for High Availability. Use version 103 or later of the Docker PowerPack to monitor PowerFlow services in SL1. For more information, see [Configuring the Docker PowerPack](#).
- **SL1 PowerFlow PowerPack** . This PowerPack monitors the status of the applications in your PowerFlow system. Based on the events generated by this PowerPack, you can diagnose why applications failed on PowerFlow. For more information, see [Configuring the SL1 PowerFlow PowerPack](#).

NOTE: Versions 105 and earlier of this PowerPack were named the *ScienceLogic: Integration Service PowerPack*.

- **Couchbase PowerPack:** This PowerPack monitors the Couchbase database that PowerFlow uses for storing the cache and various configuration and application data. This data provides insight into the health of the databases and the Couchbase servers. For more information, see [Configuring the Couchbase PowerPack](#).
- **AMQP: RabbitMQ PowerPack.** This PowerPack monitors RabbitMQ configuration data and performance metrics using Dynamic Applications. You can use this PowerPack to monitor the RabbitMQ service used by PowerFlow. For more information, see [Configuring the RabbitMQ PowerPack](#).

You can use each of the PowerPacks listed above to monitor different aspects of PowerFlow. Be sure to download and install the latest version of each PowerPack.

The following sub-topics describe the configuration steps you need to take for each PowerPack. For best results, complete these configuration steps in the given order to set up monitoring of PowerFlow within SL1.

Configuring the Docker PowerPack

The Docker PowerPack monitors the various Docker containers, services, and Swarm that manage the PowerFlow containers. This PowerPack also monitors PowerFlow when it is configured for High Availability. Use version 103 or later of the Docker PowerPack to monitor PowerFlow services in SL1.

To configure the Docker PowerPack to monitor PowerFlow:

1. Make sure that you have already installed the Linux Base Pack PowerPack and the Docker PowerPack.
2. In SL1, go to the **Credential Management** page (Manage > Credentials or System > Manage > Credentials in the classic user interface) and click to edit the **Docker Basic - Dev ssh** credential. The **Edit Credential** page appears.
3. Complete the following fields, and keep the other fields at their default settings:
 - **Name.** Type a new name for the credential.
 - **Hostname/IP.** Type the hostname or IP address for the PowerFlow instance, or type "%D".
 - **Username.** Type the username for the PowerFlow instance.
 - **Password.** Type the password for the PowerFlow instance.
4. Click **[Save & Close]**.
5. On the **Devices** page, click **[Add Devices]** to discover your PowerFlow server using the new Docker SSH new credential.

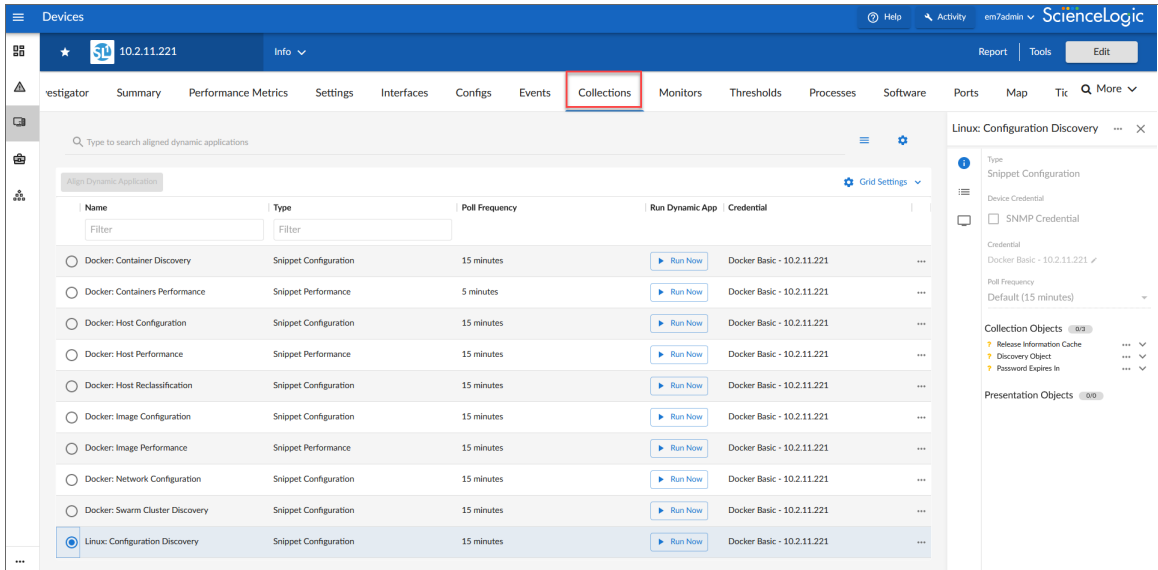
TIP: Use the **Unguided Network Discovery** option and search for the new Docker credential on the **Choose credentials** page of the Discovery wizard. For more information, see the **Discovery and Credentials** manual.

NOTE: Select **Discover Non-SNMP** and **Model Devices** in the **Advanced options** section.

After the discovery is complete, SL1 creates a new Device record for the PowerFlow server and new Device Component records for Docker containers.

6. Go to the **Devices** page and select the new device representing your PowerFlow server.

7. Go to the **[Collections]** tab of the **Device Investigator** page for the new device and make sure that all of the Docker and Linux Dynamic Applications have automatically aligned. This process usually takes a few minutes. A group of Docker and Linux Dynamic Applications should now appear on the **[Collections]** tab:



- To view your newly discovered device components, navigate to the **Device Components** page (Devices > Device Components). If you do not see your newly discovered Docker Host, wait for the dynamic applications on the Docker host to finish modeling out its component devices. A Docker Swarm virtual root device will also be discovered. After discovery finishes, you should see the following devices representing your PowerFlow system on the **Device Components** page:

Device Name	IP Address	Device Category	Device Class Sub-class	DD	Organization	Current State	Collection Group	Collection State
1. Docker Swarm 533q9lyk5nfn2na6z6w...	--	EM7	ScienceLogic Integration Service	70	System	Healthy	CUG	Active
1. Iservices	--	Service	Stack Docker Stack	71	System	Healthy	CUG	Active
1. + default	--	Pool	Couchbase Pool	83	System	Healthy	CUG	Active
2. Iservices_contentapi	--	Service	Service Docker Service	73	System	Healthy	CUG	Active
3. Iservices_couchbase	--	Service	Service Docker Service	77	System	Healthy	CUG	Active
4. Iservices_flower	--	Service	Service Docker Service	78	System	Healthy	CUG	Active
5. Iservices_gui	--	Service	Service Docker Service	76	System	Healthy	CUG	Active
6. Iservices_pypiserver	--	Service	Service Docker Service	74	System	Healthy	CUG	Active
7. Iservices_rabbitmq	--	Service	Service Docker Service	82	System	Healthy	CUG	Active
8. Iservices_redis	--	Service	Service Docker Service	79	System	Healthy	CUG	Active
9. Iservices_scheduler	--	Service	Service Docker Service	81	System	Healthy	CUG	Active
10. Iservices_steprunner	--	Service	Service Docker Service	75	System	Healthy	CUG	Active
11. Iservices_syncpacks_steprunner	--	Service	Service Docker Service	80	System	Healthy	CUG	Active
12. Iservices_visual	--	Service	Service Docker Service	72	System	Healthy	CUG	Active
2. Isdocs01	10.128.68.31	Servers	Linux Oracle Linux Server 7	103	System	Healthy	CUG	Active
1. Iservices_contentapi_1jczrc4r5u5w...	--	Service	Container Docker Container	111	System	Healthy	CUG	Active
2. Iservices_couchbase_1or9ekz534g9e...	--	Service	Container Docker Container	108	System	Healthy	CUG	Active
3. Iservices_flower_1pi6wfw3mcsbd3ut...	--	Service	Container Docker Container	106	System	Healthy	CUG	Active
4. Iservices_gui_1wysoxzfhgupt3ln9xtz...	--	Service	Container Docker Container	107	System	Healthy	CUG	Active
5. Iservices_pypiserver_1k7ndh4l9dk4f...	--	Service	Container Docker Container	114	System	Healthy	CUG	Active
6. Iservices_rabbitmq_1mzbzmo2kgs9c...	--	Service	Container Docker Container	116	System	Healthy	CUG	Active
7. Iservices_redis_16v8k4mcsbzv9l3...	--	Service	Container Docker Container	112	System	Healthy	CUG	Active

NOTE: If the Docker Swarm root device is modeled with a different device class, go to the Devices page and select the Docker Swarm root device. Click the **[Edit]** button on the **Device Investigator** page, click the **Info** drop-down, and edit the *Device Class* field. From the **Select a Device Class** window, select *ScienceLogic | Integration Service* as the Device Class and click **[Set Class]**. Click **[Save]** on the **Device Investigator** page to save your changes.

NOTE: At times, the advertised host IP for a Docker node might display as "0.0.0.0" instead of the actual external address. This is a known issue in Docker. To work around this issue, remove and rejoin the nodes of the swarm one by one, and use the following argument to add them: `--advertise-addr <ip-to-show>`. For example, `docker swarm join --advertise-addr ...` Do not remove a leader node unless there are at least two active leaders available to take its place.

Configuring the SL1 PowerFlow PowerPack

NOTE: Versions 105 and earlier of this PowerPack were named the *ScienceLogic: Integration Service PowerPack*.

The *SL1 PowerFlow* PowerPack monitors the status of the applications in your PowerFlow system. Based on the events generated by this PowerPack, you can diagnose why applications failed in PowerFlow.

To configure SL1 to monitor PowerFlow, you must first create a SOAP/XML credential. This credential allows the Dynamic Applications in the *PowerFlow* PowerPack to communicate with PowerFlow.

In addition, before you can run the Dynamic Applications in the *PowerFlow* PowerPack, you must manually align the Dynamic Applications from this PowerPack to your PowerFlow device in SL1. These steps are covered in detail below.

Configuring the PowerPack

To configure the PowerFlow PowerPack:

1. In SL1, make sure that you have already installed the Linux Base PowerPack, the Docker PowerPack, and the SL1 PowerFlow PowerPack on your SL1 system.
2. In SL1, navigate to the **Credentials** page (Manage > Credentials or System > Manage > Credentials in the classic user interface) and select the **ScienceLogic: PowerFlow Example** credential. The **Edit Credential** modal appears.
3. Complete the following fields, and keep the other fields at their default settings:
 - **Profile Name.** Type a new name for the credential.
 - **URL.** Type the URL for your PowerFlow system.
 - **HTTP Auth User.** Type the PowerFlow administrator username.
 - **HTTP Auth Password.** Type the PowerFlow administrator password
 - **Embed Value [%1].** Type "False".
4. Click the **[Save & Close]** button. You will use this new credential to manually align the following Dynamic Applications:
 - REST: Performance Metrics Monitor
 - ScienceLogic: PowerFlow Queue Configuration
 - ScienceLogic: PowerFlow Workers Configuration

5. Go to the **Devices** page, select the device representing your PowerFlow server, and click the **[Collections]** tab.
6. Click **[Edit]**, click **[Align Dynamic App]**, and select *Choose Dynamic Application*. The **Choose Dynamic Application** window appears.
7. In the **Search** field, type the name of the first of the PowerFlow Dynamic Applications. Select the Dynamic Application and click **[Select]**.
8. Select *Choose Dynamic Application*. The **Choose Credential** window appears.
9. In the **Search** field, type the name of the credential you created in steps 2-4, select the new credential, and click **[Select]**. The **Align Dynamic Application** window appears.
10. Click **[Align Dynamic App]**. The Dynamic Application is added to the **[Collections]** tab.
11. Repeat steps 6-10 for each remaining Dynamic Application for this PowerPack, and click **[Save]** when you are done aligning Dynamic Applications.

Events Generated by the PowerPack

The "ScienceLogic: Integration Service Queue Configuration" Dynamic Application generates a Major event in SL1 if an application fails in PowerFlow:

Event Information [111244] Actions Acknowledge Clear

For Event [111244]

Event Message SL1 PowerFlow Application "app_created_to_trigger" has failed. Task ID: "isapp-8931cc08-5d24-4eaf-962a-f9c6fee47b19". Exception: CouchbaseNetworkError(rc: 44, message: There was a problem while tr...

Severity Major

For Device 10.2.11.220

First Occurrence 11 minutes 15 seconds @ 2022-01-20 11:29:32

Last Occurrence 11 minutes 15 seconds @ 2022-01-20 11:29:32

Occurrence Count 1

Acknowledged On --

Acknowledged By --

Policy Name / ID ScienceLogic: PowerFlow Application has failed [1645]

Policy Type Dynamic Event

Ticket Description --

Probable Cause & Resolution

Description:
A step or application running on the PowerFlow has failed.

Probable Cause:
Reference the config data collected by the ScienceLogic: PowerFlow Queue Configuration Dynamic Application for information about which application id's failed and with what exception.

Resolution:
Task failures can be due to incorrect configurations, faulty step code, connectivity issues, etc. Please see the exception message for the relevant task ID for more information on how to resolve the task failure.

To view more information about the execution of an application in PowerFlow, navigate to the

Correlation Reason Save Correlation Reason

Note Save Note

The related Event Policy includes the name of the application, the Task ID, and the traceback of the failure. You can use the application name to identify the application that failed in PowerFlow. You can use the Task ID to determine the exact execution of the application that failed, which you can then use for debugging purposes.

To view more information about the execution of an application in PowerFlow, navigate to the relevant page in PowerFlow by formatting the URL in the following manner:

```
https://<PowerFlow_hostname>/integrations/<application_name>?runid=<task_id>
```

For example:

```
https://192.0.2.0/integrations/sync_credentials?runid=c7e157ae-5644-4161-a241-59516feeadeec
```

Configuring the Couchbase PowerPack


Couchbase stores all cache and configuration data on PowerFlow. Monitoring the performance of your PowerFlow is critical in ensuring the health of your PowerFlow instance.

After you install the Couchbase PowerPack in SL1, create a new Couchbase SOAP/XML credential. Using that credential, you need to manually align the "Couchbase Component Count" and "Couchbase Pool Discovery" Dynamic Applications with the Docker Swarm root device. These steps are covered in detail below.

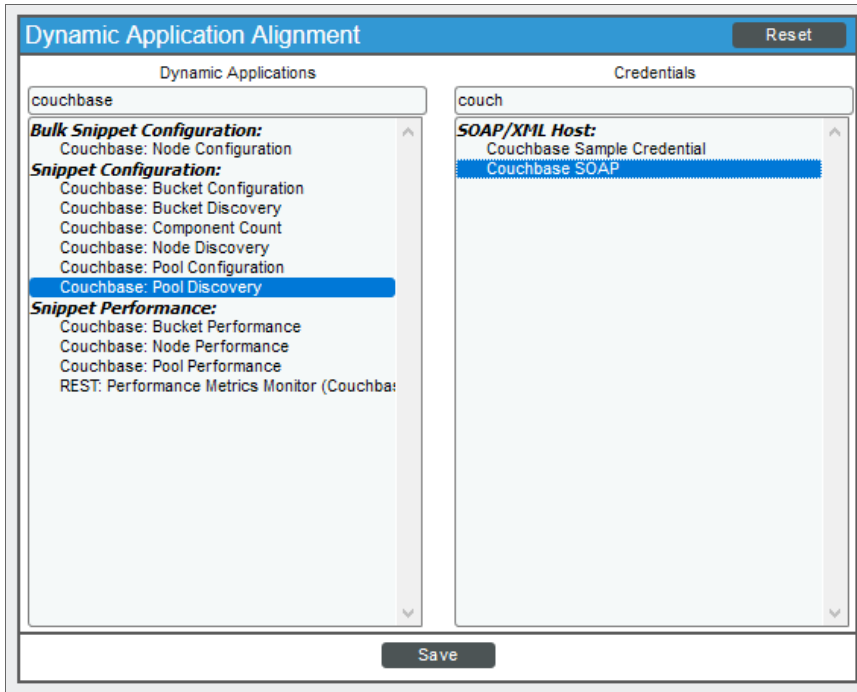
To configure the Couchbase PowerPack:

1. In SL1, navigate to the **Credentials** page (Manage > Credentials or System > Manage > Credentials in the classic user interface) and select the **Couchbase Sample** credential. The **Edit Credential** modal appears.
2. Complete the following fields, and keep the other fields at their default settings:
 - **Name**. Type a new name for the credential.
 - **URL**. Type the full URL for PowerFlow. Ensure that the port 8091 is appended to the hostname, and use *https* for this URL.
 - **HTTP Auth User**. Type the username for your PowerFlow instance.
 - **HTTP Auth Password**. Type the password for your PowerFlow instance.

NOTE: For a clustered PowerFlow environment, point the Couchbase credentials at the load balancer for PowerFlow. The example above is for a single node deployment.

3. Click **[Save & Close]**.
4. Go to the **Device Components** page (Devices > Device Components) and expand the Docker Swarm root device by clicking the + icon.
5. Click the wrench icon () for the "Stack | Docker Stack" component device (iservices) and click the **[Collections]** tab.

- Align the "Couchbase: Pool Discovery" Dynamic Application by clicking the **[Actions]** button and selecting *Add Dynamic Application*. The **Dynamic Application Alignment** modal appears:



- Select the "Couchbase: Pool Discovery" Dynamic Application and select the Couchbase credential that you created in steps 1-3. Click **[Save]**.
- Click the **[Actions]** button, select *Add Dynamic Application* and align the "Couchbase: Component Count" Dynamic Application and the Couchbase credential. Click **[Save]**.
- Select the "Couchbase: Component Count" Dynamic Application and select the IS credential that you created in steps 2-3. Click **[Save]**. SL1 models out your Couchbase components and provides you with additional information about the usage of the Couchbase service.

10. Navigate to the **Device Components** page (Devices > Device Components) to see the Couchbase components:

Device Name	IP Address	Device Category	Device Class / Sub-class	DD	Organization	Current State	Collection Group	Collection State
1. Docker Swarm 533q9lyk5nsh2nax6zw8	--	EM7	ScienceLogic Integration Service	70	System	Healthy	CUG	Active
1. iservices	--	Service	Stack Docker Stack	71	System	Healthy	CUG	Active
1. default	--	Pool	Couchbase Pool	83	System	Healthy	CUG	Active
1. content	--	Volume	Couchbase Bucket	86	System	Healthy	CUG	Active
2. couchbase isnet8091	--	Node	Couchbase Node	84	System	Healthy	CUG	Active
3. logs	--	Volume	Couchbase Bucket	85	System	Healthy	CUG	Active
2. iservices_contentapi	--	Service	Service Docker Service	73	System	Healthy	CUG	Active
3. iservices_couchbase	--	Service	Service Docker Service	77	System	Healthy	CUG	Active
4. iservices_flowr	--	Service	Service Docker Service	78	System	Healthy	CUG	Active
5. iservices_gui	--	Service	Service Docker Service	76	System	Healthy	CUG	Active
6. iservices_pypiserver	--	Service	Service Docker Service	74	System	Healthy	CUG	Active
7. iservices_rabbitmq	--	Service	Service Docker Service	82	System	Healthy	CUG	Active
8. iservices_redis	--	Service	Service Docker Service	79	System	Healthy	CUG	Active
9. iservices_scheduler	--	Service	Service Docker Service	81	System	Healthy	CUG	Active
10. iservices_steprunner	--	Service	Service Docker Service	75	System	Healthy	CUG	Active
11. iservices_syncpacks_steprunner	--	Service	Service Docker Service	80	System	Healthy	CUG	Active
12. iservices_visual	--	Service	Service Docker Service	72	System	Healthy	CUG	Active
2. isdoccd1	--	EM7	ScienceLogic Integration Service	54	System	Healthy	CUG	Active
1. iservices_contentapi.1@ccrq4r5ubtwc	--	Service	Container Docker Container	82	System	Healthy	CUG	Active

Configuring the RabbitMQ PowerPack

You can monitor the RabbitMQ service with the AMQP: RabbitMQ PowerPack. This PowerPack monitors RabbitMQ configuration data and performance metrics using Dynamic Applications, and the PowerPack creates a major event in SL1 for any applications in PowerFlow that are in a *Failed* state.

After you install the RabbitMQ PowerPack in SL1, create a new SOAP/XML credential. Using that credential, you need to manually align the following Dynamic Applications:


- ScienceLogic: PowerFlow Queue Configuration
- AMQP: RabbitMQ Configuration
- AMQP: RabbitMQ Performance

To configure the RabbitMQ PowerPack:

1. In SL1, navigate to the **Credentials** page (Manage > Credentials or System > Manage > Credentials in the classic user interface) and duplicate the **ScienceLogic: PowerFlow Example** credential. You can also create a new SOAP/XML credential. The **Edit Credential** modal appears.

2. Complete the following fields, and keep the other fields at their default settings:
 - **Name**. Type a new descriptive name for the credential.
 - **URL**. Type the full URL for your PowerFlow and use *https* for this URL.
 - **HTTP Auth User**. Type the username for your PowerFlow instance.
 - **HTTP Auth Password**. Type the password for your PowerFlow instance.

NOTE: For a clustered PowerFlow environment, point the credentials at the load balancer for the PowerFlow system. The example above is for a single node deployment.

3. Click **[Save & Close]**.
4. Go to the **Device Components** page (Devices > Device Components) and click the wrench icon () for the Docker Swarm root device.
5. Click the **[Collections]** tab on the **Device Properties** window.
6. Align the "ScienceLogic: Integration Service Queue Configuration" Dynamic Application by clicking the **[Actions]** and selecting *Add Dynamic Application*. The **Dynamic Application Alignment** modal appears.

7. Select the "ScienceLogic: Integration Service Queue Configuration" Dynamic Application and select the credential that you created in step 2. Click **[Save]**. This Dynamic Application queries PowerFlow every 15 minutes by default to retrieve information about any failed integrations, which generates a Major event in SL1 (the events auto-expire after 90 minutes):

The screenshot displays the ScienceLogic interface for a device configuration. The top navigation bar includes tabs for Close, Summary, Performance, Topology, Configs, Journals, Interfaces, Logs, Events, Tickets, Software, Processes, Services, TCP/UDP Ports, and Organization. The main content area is divided into two sections: a configuration summary and a table of active events.

Configuration Summary:

- Device Name: Docker Swarm | qc80yfu3fp8afs0cnbcgmpng
- ID: 44
- Class: ScienceLogic
- Organization: System
- Device Hostname: [Empty]
- Managed Type: Virtual Device
- Category: System EM7
- Sub-Class: Integration Service
- Uptime: 0 days, 00:00:00
- Group / Collector: CUG | fsunem7aio42

Viewing Active Events Table:

Event Message Severity	Acknowledged	Age / Elapse	Ticket	External Ticket	Last Detected	EID	Source	Count	Del
The sync_credentials integration on Integration Service has failed	<input checked="" type="checkbox"/>	22 mins 24 secs	--	--	2019-02-15 01:00:14	1290	3rd Party	8	[Icons]
The sync_collectors integration on Integration Service has failed	<input checked="" type="checkbox"/>	22 mins 24 secs	--	--	2019-02-15 01:00:14	1291	3rd Party	8	[Icons]
The cache_Cls_and_DevClasses integration on Integration Service has failed	<input checked="" type="checkbox"/>	22 mins 24 secs	--	--	2019-02-15 01:00:13	1292	3rd Party	2	[Icons]
The incident_sync_update_create integration on Integration Service has failed	<input checked="" type="checkbox"/>	15 mins 3 secs	--	--	2019-02-15 01:00:13	1293	3rd Party	4	[Icons]

At the bottom of the interface, a status bar indicates "4 Major" events.

TIP: The events generated by this Dynamic Application include the **Integration ID**, which you can use to find the relevant application on your PowerFlow instance. Copy the name in the event message and navigate to https://<PowerFlow>/integrations/<integration_ID>.

8. To view more information about your failed applications, navigate to the **[Configurations]** tab for the device and click the report for the "ScienceLogic: Integration Service Queue Configuration" Dynamic Application. This configuration report shows you more information about the failed integrations on your Integration Service instance. For example, you can use the **Last Run ID** field to find the exact logs for a specific execution of the application. To do this, copy the *Integration ID* and the *Last Run ID* and navigate to https://<PowerFlow>/integrations/<integration_ID>?runid=<last_run_id>
9. Align the "AMQP: RabbitMQ Configuration" and "AMQP: RabbitMQ Performance" Dynamic Applications using the same process as steps 6-7.

Stability of the PowerFlow Platform

This topic defines what a healthy SL1 system and a healthy PowerFlow system look like, based on the following settings, metrics, and situations.

What makes up a healthy SL1 system?

To ensure the stability of your SL1 system, review the following settings in your SL1 environment:

- The SL1 system has been patched to a version that has been released by ScienceLogic within the last 12 months. ScienceLogic issues a software update at least quarterly. It is important for the security and stability of the system that customers regularly consume these software updates.
- The user interface and API response times for standard requests are within five seconds:
 - Response time for a specific user interface request.
 - Response time for a specific API request.
- At least 20% of local storage is free and available for new data. **Free space** is a combination of unused available space within InnoDB datafiles and filesystem area into which those files can grow
- The central system is keeping up with all collection processing:
 - Performance data stored and available centrally within three minutes of collection
 - Event data stored and available centrally within 30 seconds of collection
 - Run book automations are completing normally
- Collection is completing normally. Collection tasks are completing without early termination (sigterm).
- All periodic maintenance tasks are completing successfully:
 - Successfully completing daily maintenance (pruning) on schedule
 - Successfully completing backup on schedule
- High Availability and Disaster Recovery are synchronized (where used):
 - Replication synchronized (except when halted / recovering from DR backup).
 - Configuration matches between nodes.

What makes up a healthy PowerFlow system?

To ensure the stability of the PowerFlow system, review the following settings in your environment:

- The settings from the previous list are being met in your SL1 system.
- You are running a supported version of PowerFlow.
- The memory and CPU percentage of the host remains less than 80% on core nodes.
- Task workloads can be accepted by the API and placed onto the queues for execution.

- The PowerFlow API is responding to POST calls to run applications within the default timeout of 30 seconds. For standard applications triggers, this is usually sub-second.
- The PowerFlow Scheduler is configured correctly. For example, there are no tasks accidentally set to run every minute or every second.
- Task workloads are actively being pulled from queues for execution by workers. Workers are actively processing tasks, and not just leaving items in queue.
- Worker nodes are all up and available to process tasks.
- Couchbase does not frequently read documents from disk. You can check this value with the "Disk Fetches per second" metric in the Couchbase user interface.
- The Couchbase Memory Data service memory usage is not using all allocated memory, forcing data writes to disk. You can check this value with the "Data service memory allocation" metric in the main Couchbase dashboard.
- Container services are not restarting.
- The RabbitMQ memory usage is not more than 2-3 GB per 10.000 messages in queues. The memory usage might be a little larger if you are running considerably larger tasks.
- RabbitMQ mirrors are synchronized.
- RabbitMQ is only mirroring the dedicated queues, not temporary or TTL queues.
- All Couchbase indexes are populated on all Couchbase nodes.
- The Couchbase nodes are fully rebalanced and distributed.
- The Docker Swarm cluster has at least three active managers in a High Availability cluster.
- For any Swarm node that is also a swarm manager, and that node is running PowerFlow services :
 - At least one CPU with 4 GB of memory is available on the host to actively manage the swarm cluster.
 - Any PowerFlow services running on this host are not able to consume all of the available resources, causing cluster operations to fail.

Some of the following PowerFlow settings might vary, based on your configuration:

- The number of applications sitting in queue is manageable. A large number of applications sitting in queue could indicate either a large spike in workload, or no workers are processing.
- The number of failed tasks is manageable. A large number of failed tasks could be caused by ServiceNow timeouts, expected failure conditions, and other situations.
- ServiceNow is not overloaded with custom table transformations that cause long delays when PowerFlow is communicating with ServiceNow.

Chapter

12

Troubleshooting SL1 PowerFlow

Overview

This chapter includes troubleshooting resources, procedures, and frequently asked questions related to working with SL1 PowerFlow.

WARNING: PowerFlow and Synchronization PowerPacks content not created by ScienceLogic is *not* supported by ScienceLogic. This includes custom steps, PowerFlow applications, and Synchronization PowerPacks.

This chapter covers the following topics:

<i>Initial Troubleshooting Steps</i>	193
<i>Resources for Troubleshooting</i>	193
<i>Identifying Why a Service or Container Failed</i>	199
<i>Identifying Why a PowerFlow Application Failed</i>	201
<i>Troubleshooting Clustering and Node Failover</i>	203
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Initial Troubleshooting Steps

PowerFlow acts as a middle server between data platforms. For this reason, the first steps should always be to ensure that there are no issues with the data platforms with which PowerFlow is talking. There might be additional configurations or actions enabled on ServiceNow or SL1 that result in unexpected behavior. For detailed information about how to perform the steps below, see [Resources for Troubleshooting](#).

SL1 PowerFlow

1. Run `docker service ls` on the PowerFlow server.
2. Note the Docker container version, and verify that the Docker services are running.
3. If a certain service is failing, make a note the service name and version.
4. If a certain service is failing, run `docker service ps <service_name>` to see the historical state of the service and make a note of this information. For example: `docker service ps iservices_contentapi`.
5. Make a note of any logs impacting the service by running `docker service logs <service_name>`. For example: `docker service logs iservices_couchbase`.

ServiceNow

1. Make a note of the ServiceNow version and Synchronization PowerPack version, if applicable.
2. Make a note of the Synchronization PowerPack application that is failing on PowerFlow.
3. Make a note of what step is failing in the application, try running the application in debug mode, and capture any traceback or error messages that occur in the step log.

Resources for Troubleshooting

This section contains port information for PowerFlow and troubleshooting commands for Docker, Couchbase, and the PowerFlow API.

Useful PowerFlow Ports

- <https://<IP of PowerFlow>:8091>. Provides access to Couchbase, a NoSQL database for storage and data retrieval.
- <https://<IP of PowerFlow>:15672>. Provides access to the RabbitMQ Dashboard, which you can use to monitor the service that distributes tasks to be executed by PowerFlow workers.
- <https://<IP of PowerFlow>/flower/dashboard>. Provides access to Flower, a tool for monitoring and administrating Celery clusters.

NOTE: Port 5556 must be open for both PowerFlow and the client.

powerflowcontrol healthcheck and autoheal actions

SL1 PowerFlow includes a command-line utility called **powerflowcontrol** (`pfctl`) that performs multiple administrator-level actions in a clustered PowerFlow environment. The **powerflowcontrol** utility contains automatic cluster **healthcheck** and **autoheal** actions that you can use to prevent issues with your PowerFlow environment.

For more information, see [Using the powerflowcontrol \(pfctl\) Command-line Utility](#).

Helpful Docker Commands

PowerFlow is a set of services that are containerized using Docker. For more information about Docker, see the [Docker tutorial](#).

Use the following Docker commands for troubleshooting and diagnosing issues with PowerFlow:

Viewing Container Versions and Status

To view the PowerFlow version, SSH to your PowerFlow instance and run the following command:

```
docker service ls
```

In the results, you can see the container ID, name, mode, status (see the *replicas* column), and version (see the *image* column) for all the services that make up PowerFlow:

```
[root@sunislab ~]# docker service ls
ID                NAME                MODE                REPLICAS                IMAGE                PORTS
omaihuj5v301     iservices_gui        replicated          1/1                     repository.auto.sciencelogic.local:5000/is-gui:1.7.0      *:80->80/tcp, *:443->443/tcp
40v99it1vnh3     iservices_redis      replicated          1/1                     redis:4.0.2
j1m6h1jvumif     iservices_flowerv    replicated          1/1                     repository.auto.sciencelogic.local:5000/is-worker:1.7.0   *:5555->5555/tcp
hh9p2l1zsf       iservices_scheduler replicated          1/1                     repository.auto.sciencelogic.local:5000/is-worker:1.7.0
htim1v96kxh      iservices_contentapi replicated          1/1                     repository.auto.sciencelogic.local:5000/is-api:1.7.0      *:5000->5000/tcp
eyin9qgsudmi     iservices_rabbitmq   replicated          1/1                     rabbitmq:3
klui9h8jfs6      iservices_visual      replicated          2/1                     dockersamples/visualizer:latest                          *:8081->8080/tcp
vcy38w8buauw     iservices_couchbase  replicated          1/1                     repository.auto.sciencelogic.local:5000/is-couchbase:1.7.0 *:8091->8091/tcp, *:8092->8092/tcp
p->8093/tcp, *:8094->8094/tcp, *:11210->11210/tcp
libxaxo7uf       iservices_steprunner replicated          5/5                     repository.auto.sciencelogic.local:5000/is-worker:1.7.0
```

Restarting a Service

Run the following command to restart a single service:

```
docker service update --force <service_name>
```

Stopping all PowerFlow Services

Run the following command to stop all PowerFlow services:

```
docker stack rm iservices
```

Restarting Docker

Run the following command to restart Docker:

```
systemctl restart docker
```

NOTE: Restarting Docker does not clear the queue.

Viewing Logs for a Specific Service

You can use the Docker command line to view the logs of any current running service in the PowerFlow cluster. To view the logs of any service, run the following command:

```
docker service logs -f iservices_<service_name>
```

Some common examples include the following:

```
docker service logs -f iservices_couchbase
docker service logs -f iservices_steprunner
docker service logs -f iservices_contentapi
```

NOTE: *Application* logs are stored on the central database as well as on all of the Docker hosts in a clustered environment. These logs are stored at **/var/log/iservices** for both single-node or clustered environments. However, the logs on each Docker host only relate to the services running on that host. For this reason, using the Docker service logs is the best way to get logs from all hosts at once.

Clearing RabbitMQ Volume

RabbitMQ is a service that distributes tasks to be executed by PowerFlow workers. This section covers how to handle potential issues with RabbitMQ.

The following error message might appear if you try to run a PowerFlow application via the API:

```
Internal error occurred: Traceback (most recent call last):\n File \"./content_
api.py\", line 199,
in kickoff_application\n task_status = ... line 623, in _on_close\n (class_id,
method_id),
ConnectionError)\nInternalError: Connection.open: (541) INTERNAL_ERROR - access to
vhost '/'
refused for user 'guest': vhost '/' is down
```

First, verify that your services are up. If there is an issue with your RabbitMQ volume, you can clear the volume with the following commands:

```
docker service rm iservices_rabbitmq
docker volume rm iservices_rabbitdb
```

If you get a message stating that the volume is in use, run the following command:

```
docker rm <id of container using volume>
```

Re-deploy PowerFlow by running the following command:

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

NOTE: Restarting Docker does not clear the queue, because the queue is persistent. However, clearing the queue with the commands above might result in data loss due to the tasks being removed from the queue.

Viewing the Process Status of All Services

Run the following command:

```
docker ps
```

Deploying Services from a Defined Docker Compose File

Run the following command:

```
docker stack deploy -c <compose-file> iservices
```

Dynamically Scaling for More Workers

Run the following command:

```
docker service scale iservices_steprunner=10
```

Completely Removing Services from Running

Run the following command:

```
docker stack rm iservices
```

Helpful Couchbase Commands

Checking the Couchbase Cache to Ensure an SL1 Device ID is Linked to a ServiceNow Sys ID

You can determine how an SL1 device links to a ServiceNow CI record by using the respective device and sys IDs. You can retrieve these IDs from the PowerFlow Couchbase service.

First, locate the correlation ID with the following Couchbase query:

```
select meta().id from logs where meta().id like "lookup%"
```

This query returns results similar to the following:

```
[
  {
    "id": "lookup-ScienceLogicRegion+DEV+16"
  },
  {
    "id": "lookup-ScienceLogicRegion+DEV+17"
  }
]
```

After you locate the correlation ID, run the following query:

```
select cache_data from logs where meta().id = "lookup-ScienceLogicRegion+DEV+16"
```

This query returns the following results:

```
[
  {
    "cache_data": {
      "company": "d6406d3bdbbc72300c40bdec0cf9619c2",
      "domain": null,
      "snow_ci": "u_cmdb_ci_aws_service",
      "sys_id": "0c018f14dbd36300f3ac70adbf9619f7"
    }
  }
]
```

Accessing Couchbase with the Command-line Interface

If you don't have access to port 8091 on your PowerFlow instance, you can connect to the Couchbase container by using the command-line interface (CLI).

To access Couchbase by using the CLI, run the following commands:

```
docker exec -it <container_id> /bin/bash
cbq -u <username> -p <password> -e "https://<localhost>:8091"
```

Useful API Commands

Getting PowerFlow Applications from the PowerFlow API

You can use the API or cURL to retrieve the application code, which is useful when you are troubleshooting potential code-related issues. You cannot access these API endpoints with a browser, but you can request these API endpoints by using an application such as Postman:

```
https://<PowerFlow>/api/v1/applications/<application_name>
```

If you do not have access to Postman, you can use cURL to get the same information.

```
curl -iku <username>:<password> -H "Accept: application/json" -H "Content-Type: application/json" -X GET https://<PowerFlow>/api/v1/applications/<application_name>
```

Creating and Retrieving Schedules with the PowerFlow API

You can define and retrieve schedules using the PowerFlow API. You can define all of these schedules in the PowerFlow user interface as well.

To create a schedule via the API, POST the following payload to the API endpoint:

```
https://<PowerFlow>/api/v1/schedule
```

```

{
  "application_id": "APP_ID",
  "entry_id": "SCHEDULE_NAME",
  "params": {"a": "B"},
  "schedule": {
    "schedule_info": {
      "day_of_month": "*",
      "day_of_week": "*",
      "hour": "*",
      "minute": "*",
      "month_of_year": "*"
    },
    "schedule_type": "crontab"
  },
  "total_runs": 0
}

```

You can also specify the schedule to run on a frequency in seconds by replacing the schedule portion with the following:

```

"schedule": {
  "schedule_info": {
    "run_every": FREQUENCY_IN_SECONDS
  },
  "schedule_type": "frequency"
}

```

Diagnosis Tools

Multiple diagnosis tools exist to assist in troubleshooting issues with the PowerFlow platform:

- **Docker PowerPack.** This PowerPack monitors your Linux-based PowerFlow server with SSH (the PowerFlow ISO is built on top of an Oracle Linux Operating System). This PowerPack provides key performance indicators about how your PowerFlow server is performing. For more information on the Docker PowerPack and other PowerPacks that you can use to monitor PowerFlow, see the "Using SL1 to Monitor SL1 PowerFlow" chapter in the *SL1 PowerFlow Platform* manual.
- **Flower.** This web interface tool can be found at the /flower endpoint. It provides a dashboard displaying the number of tasks in various states as well as an overview of the state of each worker. This tool shows the current number of active, processed, failed, succeeded, and retried tasks on the PowerFlow platform. This tool also shows detailed information about each of the tasks that have been executed on the platform. This data includes the UUID, the state, the arguments that were passed to it, as well as the worker and the time of execution. Flower also provides a performance chart that shows the number of tasks running on each individual worker.
- **Debug Mode.** All applications can be run in "debug" mode via the PowerFlow API. Running applications in debug mode may slow down the platform, but they will result in much more detailed logging information that is helpful for troubleshooting issues. For more information on running applications in Debug Mode, see [Retrieving Additional Debug Information](#).

- **Application Logs.** All applications generate a log file specific to that application. These log files can be found at `/var/log/iseservices` and each log file will match the ID of the application. These log files combine all the log messages of all previous runs of an application up to a certain point. These log files roll over and will get auto-cleared after a certain point.
- **Step Logs.** Step logs display the log output for a specific step in the application. These step logs can be accessed via the PowerFlow user interface by clicking on a step in an application and bringing up the **Step Log** tab. These step logs display just the log output for the latest run of that step.
- **Service Logs.** Each Docker service has its own log. These can be accessed via SSH by running the following command:

```
docker service logs -f <service_name>
```

Identifying Why a Service or Container Failed

This section outlines the troubleshooting steps necessary to determine the underlying root cause of why a service or container was restarted. For this section, we use the `iseservices_redis` service as an example.

Step 1: Obtain the ID of the failed container for the service

Run the following command for the service that failed previously:

```
docker service ps --no-trunc <servicename>
```

For example:

```
docker service ps --no-trunc iservices_redis
```

```
root@is-scale-03 ~]# docker service ps iservices_redis
ID                NAME                IMAGE                NODE                DESIRED STATE        CURRENT STATE        ERROR
PORTS
1s1u2qwabte      iservices_redis.1   redis:4.0.2         is-scale-04        Running              Running 2 hours ago
3s7s86n45skf     _iseservices_redis.1 redis:4.0.2         is-scale-03        Shutdown            Failed 2 hours ago   "task: non-zero exit (137)"
```

From the command result above, we see that one container with the id `3s7s86n45skf` had failed previously while running on node `is-scale-03`, with the error "non-zero exit", and another container was restarted in its place.

At this point, we can ask the following questions:

- When you run `docker service ps --no-trunc`, is the error something obvious? Does the error say that it cannot mount a volume, or that the image is not found? If so, that's most likely the root cause of the issue and what needs to be addressed
- Did the node on which that container was running go down? Or is that node still up?
- Are the other services running on that node running fine? Was only this single service affected?
- If other services are running fine on that same node, it is probably a problem with the service itself. If all services on that node are not functional, it could mean a node failure.

At this point, we should be confident that the cause of the issue is not a deploy configuration issue, it is not an entire node failure, and the problem exists within the service itself. Continue to Step 2 if this is the case.

Step 2: Check for any error messages or logs indicating an error

Using the id obtained from step 1 we can collect the logs from the failed container with the following commands:

```
docker service logs <failed-id>
```

For example:

```
docker service logs 3s7s86n45skf
```

Search the service logs for any explicit errors or warning messages that might indicate why the failure occurred.

Usually, you can find the error message in those logs, but if the container ran out of memory, it may not be seen here. Continue to Step 3 if the logs provide nothing fruitful.

Step 3: Check for out of memory events

If there were no errors in the logs, or anywhere else that can be seen, a possible cause for a container restart could be that the system ran out of memory.

Perform the following steps to identify if this is the case:

1. Log in to the node where the container failed in our example. As seen in step 1, the container failed on *is-scale-03*.
2. From the node where the container failed, run the following command:

```
journalctl -k | grep -i -e memory -e oom
```

3. Check the result for any out of memory events that caused the container to stop. Such an event typically looks like the following:

```
is-scale-03 kernel: Out of memory: Kill process 5946 (redis-server) score 575  
or sacrifice child
```

Troubleshooting a Cloud Deployment of PowerFlow

After completing the AWS setup instructions, if none of the services start and you see the following error during troubleshooting, you will need to restart Docker after installing the RPM installation.

```
sudo docker service ps iservices_couchbase --no-trunc
```

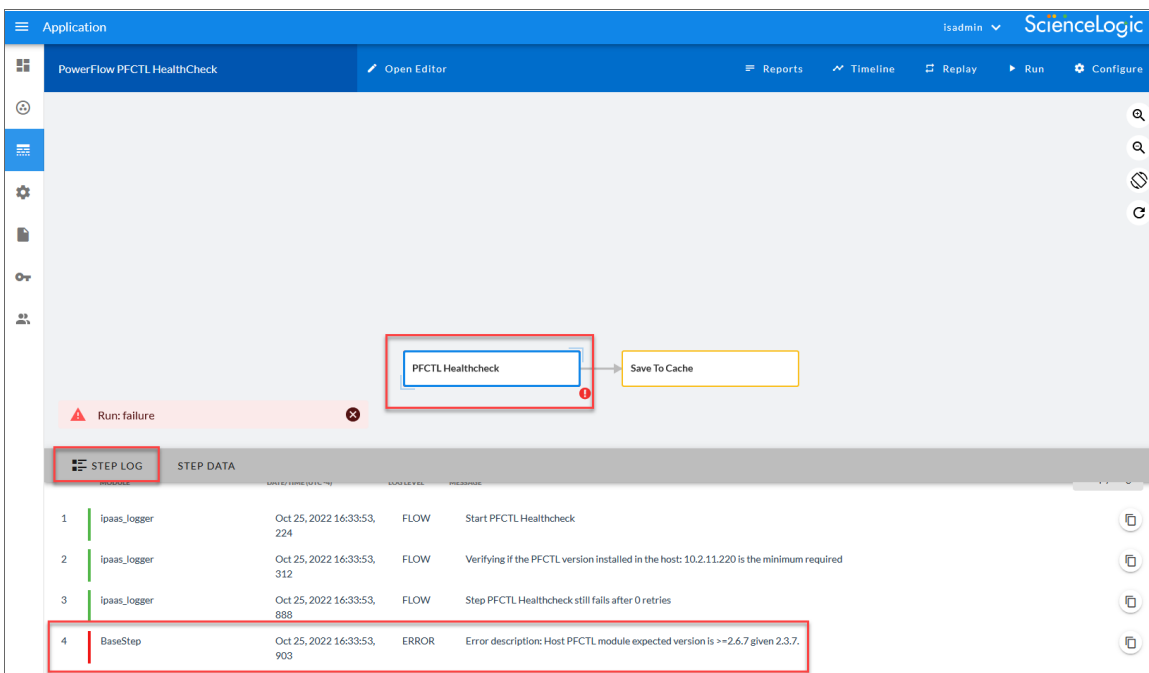
```
"error creating external connectivity network: Failed to Setup IP tables: Unable to  
enable SKIP DNAT rule: (iptables failed: iptables --wait -t nat -I DOCKER -i docker_  
gwbridge -j RETURN: iptables: No chain/target/match by that name."
```


Identifying Why a PowerFlow Application Failed

The following topics describe how to determine where a PowerFlow application failed, and how to retrieve more log information related to that failure from the logs.

Determining Where an Application Failed

If a PowerFlow application fails, a red failure icon appears under that application on the **Application** detail page.



To determine where the application is failing:

1. Open the application and locate which step is failing. A failed step is highlighted in red in the image above.
2. Select the step and click the **Step Log** tab to view the logs for that step.
3. Review the error message to determine the next steps.

Retrieving Additional Debug Information (Debug Mode)

The logs in PowerFlow use the following **loglevel** settings, from most verbose to least verbose:

- **10**. Debug Mode.
- **20**. Informational.
- **30**. Warning. This is the default settings if you do not specify a loglevel.
- **40**. Error.

WARNING: If you run applications with "loglevel": 10, those applications will take longer to run because of increased I/O requirements. Enabling debug logging using the following process is the only recommended method. ScienceLogic does not recommend setting "loglevel": 10 for the whole stack with the docker-compose file.

To run an application in Debug Mode using the PowerFlow user interface:

1. Select the PowerFlow application from the **Applications** page.
2. Hover over the **[Run]** button and select *Debug Run* from the pop-up menu. PowerFlow executes the application in Debug Mode with a log level of 10.

To run an application in Debug Mode using the API:

1. POST the following to the API endpoint:

```
https://<PowerFlow_IP>/api/v1/applications/run
```

2. Include the following in the request body:

```
{  
  "name": "<application_name>",  
  "params": {  
    "loglevel": 10  
  }  
}
```

After running the application in Debug Mode, review the step logs in the PowerFlow user interface to see detailed debug output for each step in the application. This information is especially helpful when trying to understand why an application or step failed:

The screenshot displays the PowerFlow user interface for an application named "Delete Devices from SL1". The workflow diagram shows a sequence of steps: "Pull Disabled Devices from...", "Pull Affected Device Info...", "Verify Device Delete...", and a decision diamond. A red box highlights the "Pull Disabled Devices from..." step. Below the workflow, a "Run: failure" notification is visible. The "STEP LOG" section shows a detailed error message for step 3, "BaseStep", which occurred on August 11, 2021, at 13:14:31. The error is a "Traceback (most recent call last):" with the following details:

```
Traceback (most recent call last):  
File "/usr/local/lib/python3.7/site-packages/paascore/BaseStep.py", line 578, in execute_step max_retries=retry_max  
File "/usr/local/lib/python3.7/site-packages/paascore/BaseStep.py", line 929, in retry_step max_retries=max_retries  
File "/usr/local/lib/python3.7/site-packages/celery/app/task.py", line 706, in retry_raise_with_context(exc)  
File "/usr/local/lib/python3.7/site-packages/paascore/BaseStep.py", line 554, in execute_step self.execute()  
File "/var/syncpacks/virtualenvs/service_now_cmdb_syncpack/lib/python3.7/site-packages/service_now_cmdb_syncpack/steps/  
/PullAndProcessDisabledDevices.py", line 70, in execute delete_device_vcug_param.name, self.application_name  
ipaascommon.exceptions.MissingRequiredStepParameter: target_vcug is required but is not populated in either delete_devices or in Sync  
ServiceRequests.
```

You can also run an application in debug using curl via SSH:

1. SSH to the PowerFlow instance.
2. Run the following command:

```
curl -v -k -u isadmin:em7admin -X POST "https://<your_
hostname>/api/v1/applications/run"
-H 'Content-Type: application/json' -H 'cache-control: no-cache' -d '{"name":
"interface_sync_sciencelogic_to_servicenow","params": {"loglevel": 10}}'
```

Troubleshooting Clustering and Node Failover

This section covers how to troubleshoot a clustered environment and what to expect with a node failover in a PowerFlow system.

After a failover, Couchbase or the PowerFlow user interface are not available

In this situation, a failover occurred in a three-node cluster. Docker was stopped on the Swarm Leader, and another node in the cluster took the Swarm Leader role. After that, you could not access the PowerFlow user interface, and Couchbase was not running.

The reason that the master of Couchbase on that node was not running was that the node was down. The other two Couchbase systems in the cluster were still running, and you should have been able to access the system through the PowerFlow user interface.

If you could not access the PowerFlow user interface, check to make sure you have a load balancer in front of the cluster. Each instance of Couchbase is "pinned" to a specific node so that it can persist data to that local node. The locally persisted data is then replicated between all three Couchbase nodes.

I get a 502 error when I try to log in using the load balancer IP address

Make sure that the **HOST_ADDRESS** in the `/etc/iservices/isconfig.yml` file is pointing to that load balancer. If needed, update that value and re-deploy the PowerFlow system.

NOTE: You should only use the load balancer IP when you want to log into or otherwise access the system.

Also, you should make sure that your contentapi service is properly configured in the `docker-compose.yml` file. If this service only specifies one of the Couchbase nodes, such as `db_host: couchbase.isnet,localhost`, you will not get API responses when that Couchbase node is down.

To properly configure the contentapi service in the `docker-compose.yml` file, use the following example as a template:

```
db_host:couchbase.isnet,couchbase-worker.isnet,couchbase-worker2.isnet
```

TIP: The **healthcheck** and **autoheal** actions in the **powerflowcontrol**(pfctl) command-line utility will report problems like this to you, and it will also creates relevant templates. The **healthcheck** and **autoheal** ations are supported in PowerFlow 2.0.0 and later. For more information, see [Using the powerflowcontrol \(pfctl\) Command-line Utility](#).

After a node goes down, the SyncPacks page does not display the expected content

In this situation, the node that went down was the node that was hosting the PyPi server, which is not an operationally critical service. The PyPi server is only used to install new Synchronization PowerPacks onto the system.

After a node goes down, I cannot access the db port for that instance of Couchbase :8091 directly

You will not be able to access the db port for that instance of couchbase :8091 directly. Because that node is down, the Couchbase server is not available to provide the Administrator IP. By default, only the user interface for that node is exposed, but you can expose the admin user interfaces on the other systems as well, and those admin user interfaces will be available even when the primary node goes down.

If you fail over one of the other nodes instead of that master, you will see that the Couchbase user interface stays up, because the node hosting that Couchbase instance is still up).

Couchbase fails to properly initialize or keeps trying to initialize

Couchbase might fail to properly initialize or keep trying to initialize if the Couchbase database is in a highly virtualized environment, where the CPUs are over-provisioned, and high CPU ready wait and costop times are occurring. In this situation, you will not be able to access the Couchbase user interface at **https://<IP of PowerFlow>:8091**.

To address this issue, make sure that the VMware environment is optimized and ready waits are minimized. For more information about CPU over-allocation in VMware, see [Maximizing VMware Performance and CPU Utilization](#).

The system will not be as optimal as possible due to high ready wait times at the vCPU level. As a result, you will need to retry to initialize Couchbase on the first startup. Also, rebalances might need to be done multiple times to eventually succeed in over-provisioned environments.

Frequently Asked Questions

This section contains a set of frequently asked questions (FAQs) and the answers to address those situations:

- [What is the first thing I should do when I have an issue with PowerFlow?](#)206
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- [What is the difference between the steprunner_syncpacks and the steprunner services?](#)206

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TIP: For additional troubleshooting information specific to multi-tenant environments, see [Common Problems, Symptoms, and Solutions](#) in the *PowerFlow for Multi-tenant Environments* appendix.

What is the first thing I should do when I have an issue with PowerFlow?

Ensure that all the services are up and running by running the following command:

```
docker service ls
```

If any service is not running, such as display a 0/1, run the following commands:

```
docker service ps <service not running>
docker service logs <service not running>
```

Can the `steprunner_syncpacks` service can be limited to just workers?

The `syncpack_steprunners` are responsible for keeping all Synchronization PowerPack virtual environments in sync on all nodes. As you install or upgrade Synchronization PowerPacks, these steprunners consistently maintain the virtual environment changes throughout the cluster without network storage. Disabling these steprunners will not affect the system operationally unless you need to update, modify, or install new Synchronization PowerPacks onto the nodes of a system.

What is the difference between the `steprunner_syncpacks` and the `steprunner` services?

The `syncpack_steprunners` accept no other tasks, beside create and update tasks for the virtual environment.

What is the minimal image required for workers?

At a minimum, worker nodes that will only be used to process tasks will need just the worker image.

If the GUI server is constrained to use only the manager nodes, do the worker nodes need to have their `isconfig.yml` file updated with the correct `HOST` value?

The `isconfig.yml` file is applied to all nodes in the cluster when the stack is deployed. The config used is created from the config on the system where you actually run Docker stack deploy and applied to all other nodes. In other words, only the managers from which you are deploying the stack need to have the `isconfig.yml` value correct.

Can I unload unwanted images from a worker node?

Removing unwanted images is part of typical Docker operations, and it uses the following command: `docker image rm <image name>`

For more information, see https://docs.docker.com/engine/reference/commandline/image_rm/.

If I dedicated workers to one SL1 stack, how are jobs configured to run only on those workers?

You create a worker service with the `user_queues` variable set, with a list of queues that you want that worker to process only. The queues are auto-created. That worker service can also be pinned to run on specific nodes. You can tell an integration to run on a specific queue at runtime, on a schedule, or in the application configuration. The queue will be processed by the workers that you previously defined. If no workers are listening to the queue, the task will not process.

Approximately how much data is sent between distributed PowerFlow nodes?

The amount of data sent between distributed PowerFlow nodes largely depends on the applications that are currently running, the size of the syncs for those applications, and how much of the cache those syncs use. In general, only configuration files, cache, and some logs are stored or replicated between database nodes, while the queue service mirrors messages between its nodes as well. As a result, not a lot of information is being replicating at any given time, as only necessary cluster and vital data are replicated.

Why can't I find a Synchronization PowerPack on the SyncPacks page?

If you have uploaded a Synchronization PowerPack, but you cannot see it on the SyncPack page, make sure that the SyncPack filter is showing all SyncPacks. By default, the **SyncPacks** page will only show SyncPacks that are activated. An *activated* Synchronization PowerPack has been installed and is ready to be used.

Click the Filter icon (☰) at the top right of the **SyncPacks** page and enable the *Toggle Inactive SyncPack* toggle to show all of the Synchronization PowerPacks.

Why can't I see or upload a Synchronization PowerPack?

If your PowerFlow system uses self-signed certificates, you will need to manually accept the certificate before you can upload Synchronization PowerPacks.

Go to `https://<IP address of PowerFlow>:3141/isadmin`, accept the certificate, and then exit out of the tab. When you log into PowerFlow again, you will be able to upload Synchronization PowerPacks.

Also, if a Synchronization PowerPack failed to load or activate, a red exclamation mark icon (❗) appears next to that Synchronization PowerPack on the **SyncPacks** page. Click the red icon (❗) to view errors logs related to the loading or activation process.

TIP: The most common error that occurs when installing a Synchronization PowerPack is that the Synchronization PowerPack dependencies are not installed. Review the "System Requirements" section of the release notes for that Synchronization PowerPack to ensure that you have installed all of the required applications for that Synchronization PowerPack.

Why do I get a "Connection error" message when I try to install the System Utils Synchronization PowerPack?

In this situation, you get the following error message:

```
Connection error, please verify that the steprunners can request data from
pypiserver and that the syncpack system_utils_syncpack==1.0.1 uploaded to the local
pypiserver is a valid syncpack.
```

To address this issue, review the following checklist

- Review the logs for the "Activate & Install SyncPacks" PowerFlow application for relevant error details.
- Make sure that the cluster nodes are not offline.
- If the error is related to the "Activate & Install SyncPacks" application, make sure that the Synchronization PowerPack that you uploaded to pypi does not have extra characters at the end, such as a "(1)" or anything else that does not follow the correct name syntax.
- If the failure is related to the "Activate & Install SyncPacks" application, then the environment might be preventing the connection, such as the `no_proxy` setting in the **docker-compose.yml** file.
- Make sure that the pypiserver has a `pypiserver.isnet` alias in the **docker-compose.yml** file.
- Validate all of the required settings in the **docker-compose.yml** file, including `no_proxy` and Couchbase database settings.

The following is an example of a portion of a **docker-compose.yml** file for this issue:

```
syncpacks_steprunner:
  ....
  environment:
    ...
    db_host: couchbase.isnet,couchbase-worker.isnet,couchbase-worker2.isnet
    http_proxy: http://is.cms.com:8080/
    https_proxy: https://is.cms.com:8080/
    no_proxy: .isnet, 172.1.1.1/16
```

How can I optimize workers, queues, and tasks?

The PowerFlow system uses Celery to spawn and manage worker processes and queues. You can define environment variables to optimize these worker processes.

You can use the following environment variables to optimize worker processes:

- **task_soft_time_limit**. Enforces global timeout for all tasks in the PowerFlow system. If a task exceeds the specified timeout limit, the PowerFlow system terminates the task so that the next task in the queue can be processed. Possible values are:
 - Integer that specifies the time in seconds.
 - Default value is "3600" (1 hour).

- **optimization**. Determines how tasks are distributed to worker processes. Possible values are:
 - *-Ofair*. Celery distributes a task only to the worker process that is available for work.
 - "" (double-quotation mark, space, double-quotation mark). Distributes and queues all tasks to all available workers. Although this increases performance, tasks in queues might be delayed waiting for long-running tasks to complete.
 - Default value is *-Ofair*.
- **task_acks_late**. Specifies that if a worker process crashes while executing a task, Celery will redistribute the task to another worker process. Possible values are:
 - *True*. Enables the environment variable.
 - *False*. disabled the environment variable.
 - Default value is "False"

NOTE: Because many applications run at regular intervals or are scheduled, the PowerFlow system re-executes tasks even if the **task_acks_late** environment variable is disabled. in the event of a worker crash, if you want to ensure that tasks are completed, you can enable the **task_acks_late** variable. However, be aware that if tasks are not idempotent, the **task_acks_late** variable can cause unpredictable results.

To define these environment variables:

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. Use a text editor like vi to edit the file **/opt/iservices/scripts/docker-compose.yml**.
4. You can define the environment variables for one or more worker processes. 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
    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
    task_soft_time_limit: 30
    optimization: ""
    task_acks_late: 'False'
    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
  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
    task_soft_time_limit: 30
    optimization: '-Ofair'
    task_acks_late: 'False'
    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
  volumes:
    - "/var/log/iservices:/var/log/iservices"
    - "statedb:/var/run/celery/states/"

```

5. The services with names that start with "steprunner" are the workers for the PowerFlow system. To define the optimization variables, enter the variables and values in the definition of the worker, under the **environment** section. See the example in step #3 to see the syntax for environment variables.
6. After you have updated the docker-compose file, you can update and re-deploy the PowerFlow system to pick up your changes to the file. To do this, execute the following command:

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

Why do I get a "Connection refused" error when trying to communicate with Couchbase?

If you get a "Connection refused to Couchbase:8091" error when you are trying to communicate with Couchbase, check the firewalld service by running the following command:

```
systemctl status firewalld
```

Firewalld is responsible for all of the internal communications between the various Docker services on the Docker Swarm. If firewalld is not active, there will be no communications between the services, and you might see an error like "Connection refused to Couchbase:8091".

To start the firewalld service, run the following command:

```
systemctl start firewalld
```

Why do I have client-side timeouts when communicating with Couchbase?

If you are running an intensive application, or if you are running in Debug Mode, you might see the following stack trace error:

```
(generated, catch TimeoutError): <RC=0x17[Client-Side timeout exceeded for operation. Inspect network conditions or increase the timeout], HTTP Request failed. Examine 'objextra' for full result, Results=1, C Source=(src/http.c,144), OBJ=ViewResult<rc=0x17[Client-Side timeout exceeded for operation. Inspect network conditions or increase the timeout], value=None, http_status=0, tracing_context=0, tracing_output=None>, Tracing Output={"nokey:0": null}>
```

This error occurs when there is too much load going into the Couchbase database. If you're running with Debug Mode, that mode creates a large number of extra log messages in the database, which can contribute to this error.

To work around this issue, increase the timeout being used by setting the `db_host` environment variable in the steprunner service:

```
db_host: 'couchbase.isnet,localhost?n1ql_timeout=100000000.00'
```

If you increase the timeout, the timeout errors should go away.

NOTE: Increasing the timeout might not always be the correct action. If you are using an especially large system, you might want to allocate additional resources to the Couchbase services, including more memory for indexing and search. If you are encountering timeouts in a non-temporary fashion, such as only running Debug Mode for an application to determine what went wrong, you might want to add more resources instead of increasing the timeout.

What should I do if the Couchbase disk is full, the indexer is failing, and the database is unusable?

If the Couchbase database stops unexpectedly and the disk is full:

1. Check the size of the `/var/data/couchbase/lib/couchbase/data/@2i` directory.
2. If the contents of this directory are causing the disk to fill up, stop the couchbase service and remove the `@2i` directory.
3. Restart Couchbase to return the PowerFlow system to normal operations.

Use the following optimizations to ensure that the indexer directory `@2i` does not overuse disk space:

- When running PowerFlow in production, do not run applications in Debug Mode by default.
- Remove any **#primary** index that exists in content or logs. Primary indexes are useful for troubleshooting, but they should not be used in production. In prior versions of PowerFlow, the primary index was automatically created, which caused no problems with typical workloads. However, with large workloads, the primary index adds unnecessary overhead that might impact the system. ScienceLogic recommends removing primary indexes that exist on systems in production.
- Qualys scans running against a whole cluster at once have been known to affect the performance of the database, and these scans have caused crashes resulting in index corruption in the past. If you plan on running Qualys scans on the PowerFlow system, run them at an off-peak time, and only on one node of the cluster.
- Under heavy workloads, the default auto-compaction settings might occur too frequently, causing issues due to heavy operations and compaction activities running at the same time. To reduce this possibility, select a specific day and time of the week for the database compaction to occur. Ideally compaction is configured to occur during a time of lower workloads, and not at peak. You can configure these settings in the Couchbase user interface (Settings > Auto-Compaction), or through the API: [Configure Auto-Compaction with the CLI](#).

NOTE: Needing to change auto-compaction defaults might be an early indication that the PowerFlow system needs additional resources with more load. For more information, see the following list of workload considerations.

Sizing the Couchbase database for workload considerations:

- **indexer memory.** Under heavy workloads, the indexer might be constrained and causing a bottleneck in the system due to its default 500 MB memory allocation. In real-time you can monitor the index memory percentage used through the Couchbase Administrator user interface (<https://<IP of PowerFlow>:8091>). If memory is constantly at 90% or greater, the system might benefit from an increase in memory allocation to the indexer service (Settings > Service Memory Quotas).
- Make sure that VMotion is disabled in VMware, and make sure that PowerFlow nodes will not be VMotioned while running.

- **db disk size:** Depending on the workload being performed and how much data is being saved into the system via logs, you might need to increase the database disk space. In general, you can expect the database to use at most twice the size of a bucket fully compacted. For more information, see [Indexes size and compaction](#). The disk size available to the Couchbase system should be sufficient for whatever size workloads are expected.

What causes a Task Soft Timeout?

The following error might occur when you see a long-running task fail:

```
raise SoftTimeLimitExceeded() SoftTimeLimitExceeded: SoftTimeLimitExceeded()
```

This error message means that the default timeout for a task on your PowerFlow system is too low. By default the task timeout, which is set by the environment variable `task_soft_time_limit`, is set to 3600 seconds (1 hour).

If you intend to have tasks executing for longer than an hour at a time, you can increase this setting by changing the `task_soft_time_limit` environment variable in your steprunners. Note that the value is set in seconds.

How do I address an "Error when connecting to DB Host" message when access is denied to user "root"?

In this situation, you get an error similar to the following:

```
Error when connecting to DB Host... (1045, "Access denied for user 'root'@'10.86.21.224' (using password: NO) ")
```

This issue occurs when the **encryption_key** file from one PowerFlow system does not match the **encryption_key** file on another system, such as when you take data from a production PowerFlow system to a test PowerFlow system.

The encryption key must be identical between two PowerFlow systems if you plan to migrate from one to another. The encryption key must be identical between High Availability or Disaster Recovery systems as well.

To address this issue:

1. Copy the **encryption_key** file from the `/etc/iservices/` folder on the production system to the `/etc/iservices/` folder on the test system.
2. Re-upload all applications and configurations from the production system to the test system.
3. Remove and redeploy the stack on the test PowerFlow after copying the key by running the following command on the test system:

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

How do I identify and fix a deadlocked state?

If PowerFlow appears to be running, but it is not processing any new applications or tasks, then PowerFlow could be in a **deadlocked** state.

A deadlocked state occurs when one or more applications include steps that are either ordered improperly or that contain syntax errors. In this situation, tasks are waiting on subsequent tasks to finish executing, but the worker pool is exhausted. As a result, PowerFlow is not able to execute those subsequent tasks.

To identify a deadlocked state with a PowerFlow system:

1. Navigate to the Celery Flower interface for PowerFlow by typing the URL or IP address for your PowerFlow and adding `/flower/dashboard` at the end of the URL, such as <https://192.0.2.0/flower/dashboard>.
2. Click the **[Dashboard]** tab for Flower. A list of workers appears:

The screenshot shows the Celery Flower dashboard with a green header. Below the header, there are summary statistics: Active: 0, Processed: 128, Failed: 62, Succeeded: 66, and Retired: 0. A search bar is present above a table of workers. The table has columns for Worker Name, Status, Active, Processed, Failed, Succeeded, Retried, and Load Average. The workers listed are:

Worker Name	Status	Active	Processed	Failed	Succeeded	Retried	Load Average
celery@da1d794b63c	Offline	0	0	0	0	0	0.61, 0.46, 0.34
celery@66543106dbaa	Offline	0	0	0	0	0	0.7, 0.47, 0.34
celery@a8573255ba5e	Offline	0	0	0	0	0	0.62, 0.48, 0.34
celery@95d40c6577bd	Offline	0	0	0	0	0	0.54, 0.46, 0.34
celery@7c8795e293d4	Online	0	25	12	13	0	0.21, 0.17, 0.22
celery@6ed702260335	Online	0	25	13	12	0	0.21, 0.17, 0.22
celery@efbd942d3ef	Online	0	25	12	13	0	0.21, 0.17, 0.22
celery@abc7af99ab76	Online	0	27	12	15	0	0.21, 0.17, 0.22
celery@046a2af830a2	Online	0	26	13	13	0	0.21, 0.17, 0.22

At the bottom of the table, it says "Showing 1 to 9 of 9 entries".

3. Review the number of active or running tasks for all workers. If all workers have the maximum number of tasks, and no new tasks are being consumed, then you might have a deadlock state.

To fix a deadlocked state in a PowerFlow system, perform one of the following steps:

1. 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. Increase the number of workers by either:

A. Running the following command at the shell prompt:

```
docker service scale iservices_steprunner=x
```

where x is the number of workers.

B. Using a text editor like vi to edit the file **/opt/iservices/scripts/docker-compose.yml**. In the **environment:** section at the top of the file, add the following:

```
worker_threads: number_greater_than_3
```

where *number_greater_than_3* is an integer greater than 3.

4. After you have updated the docker-compose file, you can update and re-deploy the PowerFlow system to pick up the changes in the docker-compose.yml file To do this, execute the following at the shell prompt:

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

The PowerFlow system should now include additional workers.

5. Navigate to the Celery Flower interface for PowerFlow by typing the URL or IP address for PowerFlow and adding **/flower/dashboard** at the end of the URL, such as **https://192.0.2.0/flower/dashboard**.
6. Click the **[Dashboard]** tab for Flower. A list of workers appears:

Worker Name	Status	Active	Processed	Failed	Succeeded	Retried	Load Average
celery@d41d794b63c	Offline	0	0	0	0	0	0.61, 0.46, 0.34
celery@66543106bbaa	Offline	0	0	0	0	0	0.7, 0.47, 0.34
celery@e8573255ba5e	Offline	0	0	0	0	0	0.62, 0.48, 0.34
celery@9540c55f7bd	Offline	0	0	0	0	0	0.54, 0.46, 0.34
celery@71c8795e2936d	Online	0	25	12	13	0	0.21, 0.17, 0.22
celery@6ed702260335	Online	0	25	13	12	0	0.21, 0.17, 0.22
celery@efbd94243ef	Online	0	25	12	13	0	0.21, 0.17, 0.22
celery@abc7af95ab76	Online	0	27	12	15	0	0.21, 0.17, 0.22
celery@946a2afbc30a2	Online	0	26	13	13	0	0.21, 0.17, 0.22

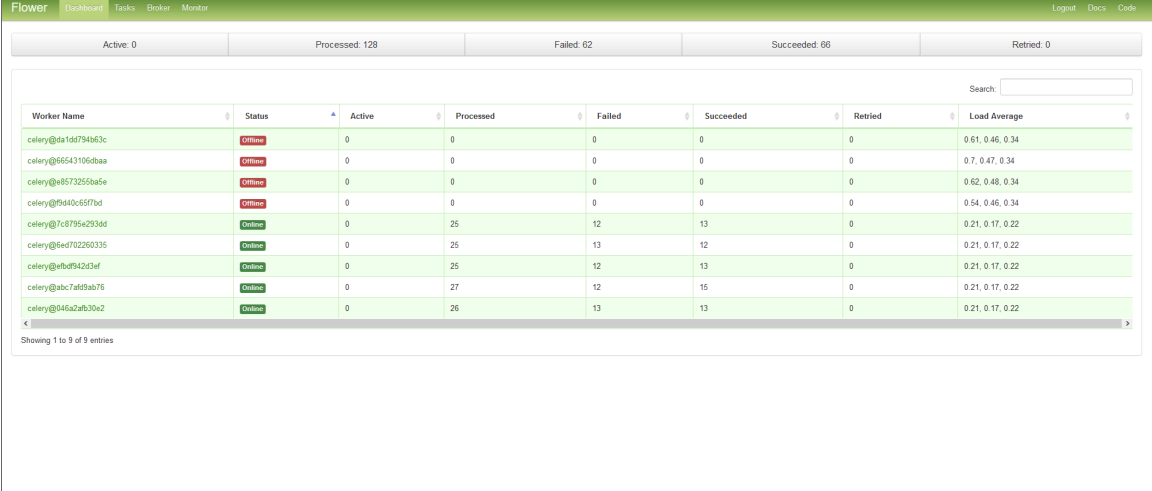
7. Review the number of active or running tasks for all workers.

If PowerFlow appears to be running, but it is not processing any new applications or tasks, then PowerFlow could be in a **deadlocked** state.

A deadlocked state occurs when one or more applications include steps that are either ordered improperly or that contain syntax errors. In this situation, tasks are waiting on subsequent tasks to finish executing, but the worker pool is exhausted. As a result, PowerFlow is not able to execute those subsequent tasks.

To identify a deadlocked state with a PowerFlow system:

1. Navigate to the Celery Flower interface for PowerFlow by typing the URL or IP address for your PowerFlow and adding **/flower/dashboard** at the end of the URL, such as **https://192.0.2.0/flower/dashboard**.
2. Click the **[Dashboard]** tab for Flower. A list of workers appears:



The screenshot shows the Celery Flower dashboard with the following data:

Worker Name	Status	Active	Processed	Failed	Succeeded	Retried	Load Average
celery@da1d7341b63c	Offline	0	0	0	0	0	0.61, 0.46, 0.34
celery@66543106dbaa	Offline	0	0	0	0	0	0.7, 0.47, 0.34
celery@v8573255ba5e	Offline	0	0	0	0	0	0.62, 0.48, 0.34
celery@99440c65f7bd	Offline	0	0	0	0	0	0.54, 0.46, 0.34
celery@7c8795e2934d	Online	0	25	12	13	0	0.21, 0.17, 0.22
celery@6eed702260335	Online	0	25	13	12	0	0.21, 0.17, 0.22
celery@efbc94243ef	Online	0	25	12	13	0	0.21, 0.17, 0.22
celery@abc7af99ab76	Online	0	27	12	15	0	0.21, 0.17, 0.22
celery@046a2ab30e2	Online	0	26	13	13	0	0.21, 0.17, 0.22

Summary statistics at the top of the dashboard: Active: 0, Processed: 128, Failed: 62, Succeeded: 66, Retried: 0.

3. Review the number of active or running tasks for all workers. If all workers have the maximum number of tasks, and no new tasks are being consumed, then you might have a deadlock state.

To fix a deadlocked state in a PowerFlow system, perform one of the following steps:

1. 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. Increase the number of workers by either:

A. Running the following command at the shell prompt:

```
docker service scale iservices_steprunner=x
```

where x is the number of workers.

B. Using a text editor like vi to edit the file **/opt/iservices/scripts/docker-compose.yml**. In the **environment:** section at the top of the file, add the following:

```
worker_threads: number_greater_than_3
```

where *number_greater_than_3* is an integer greater than 3.

4. After you have updated the docker-compose file, you can update and re-deploy the PowerFlow system to pick up the changes in the docker-compose.yml file To do this, execute the following at the shell prompt:

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

The PowerFlow system should now include additional workers.

5. Navigate to the Celery Flower interface for PowerFlow by typing the URL or IP address for PowerFlow and adding **/flower/dashboard** at the end of the URL, such as **https://192.0.2.0/flower/dashboard**.
6. Click the **[Dashboard]** tab for Flower. A list of workers appears:

The screenshot shows the Celery Flower dashboard with the following data:

Worker Name	Status	Active	Processed	Failed	Succeeded	Retried	Load Average
celery@d41d794b63c	Offline	0	0	0	0	0	0.61, 0.46, 0.34
celery@66543106bbaa	Offline	0	0	0	0	0	0.7, 0.47, 0.34
celery@e8573255ba5e	Offline	0	0	0	0	0	0.62, 0.48, 0.34
celery@f9440c55f7bd	Offline	0	0	0	0	0	0.54, 0.46, 0.34
celery@71c8795e2936d	Online	0	25	12	13	0	0.21, 0.17, 0.22
celery@6ed702260335	Online	0	25	13	12	0	0.21, 0.17, 0.22
celery@efbd94243ef	Online	0	25	12	13	0	0.21, 0.17, 0.22
celery@abc7af95ab76	Online	0	27	12	15	0	0.21, 0.17, 0.22
celery@946a2afbc30a2	Online	0	26	13	13	0	0.21, 0.17, 0.22

Summary: Active: 0, Processed: 128, Failed: 62, Succeeded: 66, Retried: 0

7. Review the number of active or running tasks for all workers.

How can I point the "latest" container to my latest available images for PowerFlow?

If you force-upgraded an RPM on top of an existing PowerFlow RPM of the same version, and you have custom worker types pointing to specific images, the *latest* tag gets created incorrectly.

To address this issue:

1. Modify the **docker-compose.yml** file and update all SL1 images to point to the correct version that you expect to be latest.
2. Change any custom worker or custom services using SL1 containers to point to: *latest*.
3. Re-install the RPM of the same version via force.

Why does the "latest" tag not exist after the initial ISO installation?

This situation only affects users with custom services that point to the latest tag. To work around this issue, run the tag latest script manually after running the `./pull_start_iservices.sh` command:

```
python /opt/iservices/scripts/system_updates/tag_latest.py
/opt/iservices/scripts/docker-compose.yml
```

How do I address permissions errors with Synchronization PowerPack virtual environments?

This situation is relevant only for upgrades to PowerFlow version 2.3.0. Permission errors might occur if you restarted Docker before the stack was redeployed, using the old stack services definition. In this situation:

- The permission that was properly set during the RPM installation for PowerFlow version 2.3.0 was reset to root. This change was not expected for PowerFlow version 2.3.0, because containers were rootless starting with version 2.3.0 for more security.
- The PowerFlow version 2.3.0 Docker containers (rootless users) cannot recreate the syncpacks virtual environments, because containers in versions of PowerFlow before 2.3.0 used root as user.

To address this issue, you need to force the steprunners to recreate the syncpacks virtual environments:

1. Run the following commands:

```
pfctl --host pf-node-ip '<username>:<password>' node-action --action modify_
iservices_volumes_owner
```

```
docker service update --force iservices_syncpacks_steprunner
```

2. Verify that the syncpacks virtual environments owner is not root and that the environments were recently recreated:

```
sudo ls -la /var/lib/docker/volumes/iservices_syncpacks_virtualenvs/_data/sudo
ls -la /var/lib/docker/volumes/iservices_syncpacks_virtualenvs/_data/
```

3. If the syncpacks virtual environments were not recreated, perform steps 4-5.

WARNING: Use caution while performing these next two steps.

4. Remove the syncpacks virtualenvironments volume on every node:

```
sudo rm -r /var/lib/docker/volumes/iservices_syncpacks_virtualenvs/_data/*
```

5. Restart the **syncpacks_steprunners** service using either of the following actions:

```
docker service update --force iservices_syncpacks_steprunner  
or
```

```
docker service rm iservices_syncpacks_steprunner
```

```
docker stack deploy -c /opt/iservices/scripts/docker-compose.yml --resolve-  
image never iservices
```

How do I restore an offline backup of my PowerFlow system?

To completely restore a PowerFlow system from an existing backup using a fresh PowerFlow installation, copy the following files and make sure that they match what existed on the previous PowerFlow system:

- **/etc/iservices/encryption_key**. This file ensures that the restored data can be decrypted as it was on the previous system.
- **/etc/iservices/is_pass**. Use this file if you wish to re-use the same password from the old system.
- **/etc/iservices/isconfig.yml**. This file contains authentication related settings, if used, and it sets the hostname to the load balancer, if it's a clustered environment.
- **/opt/iservices/scripts/docker-compose-override.yml**. This file contains your PowerFlow container versions and environment settings.
- **/opt/iservices/scripts/docker-compose.yml**. This file contains your PowerFlow container versions and environment settings.

The swarm cluster should have the same amount of nodes and node labels applied as in the previous system to ensure identically matching Docker environments. All nodes in the cluster must have the PowerFlow images in your **docker-compose.yml** file loaded and available (use **[docker image ls]**).

After the PowerFlow system is started, you can run the "PowerFlow Restore" application to restore all previously used applications, cache, and config data. For more information, see [Backing up Data](#).

NOTE: If the workers/api are now running on completely new nodes after the restore, you will have to re-install the Synchronization PowerPacks from the PowerFlow user interface to install the environments on the new nodes. Applications from those Synchronization PowerPacks will already be configured with the restored settings.

NOTE: This process is not considered a "Passive Disaster Recovery failover scenario. Active/Passive relationships between PowerFlow clusters is not supported.

What do I do if I get a Code 500 Error when I try to access the PowerFlow user interface?

To address this issue:

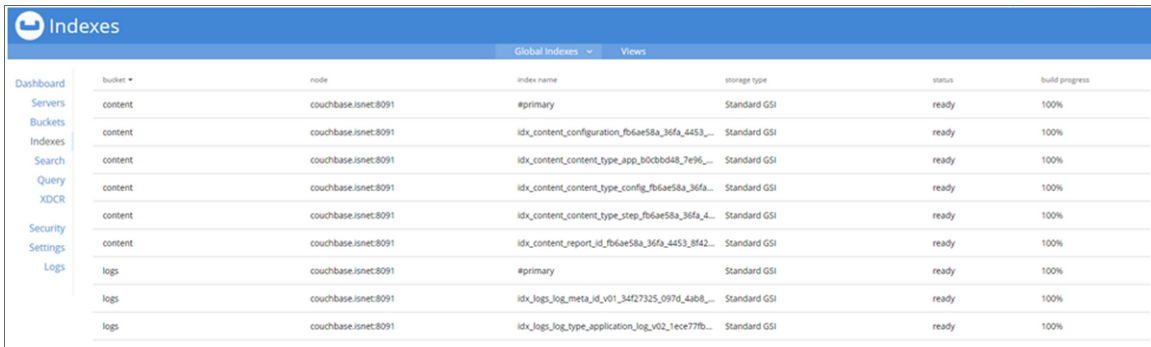
1. SSH to your PowerFlow instance.
2. Check your Docker services with the following command:

```
docker service ls
```

3. Ensure that all of your services are up and running:

```
root@fsumis1lab ~# docker service ls
ID                IMAGE                MODE                REPLICAS                IMAGE                PORTS
163947d0c96a     services_contentapi replicated           1/1                    repository.auto.sciencelogic.local:8000/ls-api:1.0.2
8672121q7ef     services_couchbase   replicated           1/1                    repository.auto.sciencelogic.local:8000/ls-couchbase:1.0.2
97107048cc       services_flower       replicated           1/1                    repository.auto.sciencelogic.local:8000/ls-worker:1.0.2
880c93f2c9a3     services_gsi          replicated           1/1                    repository.auto.sciencelogic.local:8000/ls-gsi:1.0.2
8e2b2jlag4wo     services_rabbitmq     replicated           1/1                    repository.auto.sciencelogic.local:8000/ls-rabbit:3.7.7-2
82e8e5a9e6d     services_redis        replicated           1/1                    repository.auto.sciencelogic.local:8000/ls-redis:4.0.11-2
97107048cc       services_scheduler    replicated           1/1                    repository.auto.sciencelogic.local:8000/ls-worker:1.0.2
7ac3b84y9e9h     services_steprunner   replicated           5/5                    repository.auto.sciencelogic.local:8000/ls-worker:1.0.2
8ml1w9ed5ip     services_visual       replicated           1/1                    dockersamples/visualizer:latest
root@fsumis1lab ~#
```

4. If all of your services are up and running, but you are still getting Code 500 Errors, navigate to the Couchbase management portal of your PowerFlow server at port 8091 over HTTPS.
5. In the Couchbase portal, navigate to the **[Indexes]** tab and verify that all of your indexes are in a ready state:



bucket	node	index name	storage type	status	build progress
content	couchbase.isnet:8091	#primary	Standard GSI	ready	100%
content	couchbase.isnet:8091	idx_content_configuration_fb6ae58a_36fa_4453_...	Standard GSI	ready	100%
content	couchbase.isnet:8091	idx_content_content_type_app_b0cbbd48_7e96_...	Standard GSI	ready	100%
content	couchbase.isnet:8091	idx_content_content_type_config_fb6ae58a_36fa_...	Standard GSI	ready	100%
content	couchbase.isnet:8091	idx_content_content_type_step_fb6ae58a_36fa_4_...	Standard GSI	ready	100%
content	couchbase.isnet:8091	idx_content_report_id_fb6ae58a_36fa_4453_8f42_...	Standard GSI	ready	100%
logs	couchbase.isnet:8091	#primary	Standard GSI	ready	100%
logs	couchbase.isnet:8091	idx_logs_log_meta_id_v01_34f27325_097d_44b8_...	Standard GSI	ready	100%
logs	couchbase.isnet:8091	idx_logs_log_type_application_log_v02_1ece77fb_...	Standard GSI	ready	100%

6. Wait until all **status** entries are *ready* and all **build progress** entries are *100%*, and then navigate back to your PowerFlow user interface.
7. Verify that the Code 500 Error no longer exists.
8. If an index is stuck in a non-ready state, find the index name, copy that value and execute the following command in the Couchbase Query Editor:

```
BUILD INDEX ON content (INDEX_NAME_HERE)
```

What should I do if I get a 500 Error?

A 500 Internal Server Error will always have some kind of stack trace in the contentapi logs. Run the following command to find the cause of the 500 Error:

```
docker service logs -t iservices_contentapi
```

A 502 or 504 Error might mean that the user interface cannot reach an API container on a node, or the API container cannot reach a database node in the cluster. To address this issue:

- For a cluster, make sure the cluster is healthy, and all database nodes are balanced.
- For a cluster, make sure that the firewall ports are open on all nodes.
- Run the following commands to check the logs for 502 or 504 Errors:

```
docker service logs -t iservices_gui
docker service logs -t iservices_contentapi
```

The logs will specify which container caused a timeout when trying to reach that container.

What are some common examples of using the iscli tool?

The PowerFlow system includes a command line utility called the iscli tool. You can use the iscli tool to upload components such as steps, configurations, and applications from the local file system onto PowerFlow.

For more information on how to use this tool, SSH to your PowerFlow instance and type the following command:

```
iscli --help
```

You can use the iscli tool to add drop files or additional content onto the PowerFlow. You can also use the utility to upload content to a remote host. Examples of common syntax include the following:

```
iscli -usf <STEP_FILE.PY> -U isadmin -p em7admin
iscli -uaf <APPLICATION_FILE.JSON> -U isadmin -p em7admin
iscli -ucf <CONFIG_FILE.JSON> -U isadmin -p em7admin
iscli -usf <STEP_FILE.PY> -U isadmin -p em7admin -H <PF_HOST>
```

NOTE: The password for the iscli tool should be the same password as the PowerFlow Administrator (*isadmin*) user password. For more information, see [Changing the PowerFlow Password](#).

How do I view a specific run of an application in PowerFlow?

To view the log results of a previous execution or run of an application in the PowerFlow:

1. Use Postman or another API tool to locate the applID and the name of the application.
2. In the PowerFlow, update the PowerFlow URL with the applID, in the following format:

```
https://<PowerFlow>/integrations/<application_name>?runid=<App_ID>
```

For example:

```
https://<PowerFlow>/integrations/CreateServiceNowCI?runid=isapp-d8d1afad-74f8-42d4-
b3ed-4a2ebcaef751
```

Why am I getting an "ordinal not in range" step error?

If you get an "ordinal not in range" error, check your CI Class Mappings to make sure the mappings do not contain international or "special" characters.

For example:

```
AWS | Availability Zone - São Paulo
```

If you find a class mapping with a special character like the above example, remove the class mapping, or rename the device class in SL1 to not include the special characters. Then you can sync the CI classes again.

How do I clear a backlog of Celery tasks in Flower?

To clear a backlog of Celery tasks:

1. docker exec into a bash shell in a worker process. For example:

```
docker exec -it e448db31aaec /bin/bash
```

where *e448db31aaec* is the container ID of the is-worker process on your system

2. Run the Python interpreter.
3. Run the following commands:

```
from ipaascommon.celeryapp import app
app.control.purge()
```

Why does traffic from specific subnets not get a response from PowerFlow?

In this situation, you can see traffic going into the host and into the Docker network, the traffic is not being routed back out. Responses were lost in the Docker ingress network, and the client timed out.

To address this issue:

1. Remove the Docker service by running the following command:

```
docker stack rm iservices
```

2. Remove the default ingress network:

```
docker network rm ingress
```

3. Add a newly addressed ingress network:

```
docker network create --driver overlay --ingress --subnet=172.16.0.0/16 --
gateway=172.16.0.1 ingress
```

4. Redeploy PowerFlow:

```
docker stack deploy -c docker-compose.yml iservices
```

If the containers have an exposed port and you find the following error in the logs, you might need to remove **/var/lib/docker/network/files/local-kv.db**:

```
error="failed to detect service binding for container iservices_gui..."
```

To address this issue:

1. Remove the Docker service:

```
docker stack rm iservices
```

2. Remove the .db file:

```
rm /var/lib/docker/network/files/local-kv.db
```

3. Restart the docker daemon:

```
systemctl restart docker
```

4. Redeploy PowerFlow:

```
docker stack deploy -c docker-compose.yml iservices
```

What should I do if the number of tasks listed in the dashboards is not accurate?

To address an issue where the number of tasks listed in the PowerFlow and Flower dashboards do not match the Task List, you can set the `FLOWER_MAX_TASKS` environment variable in the PowerFlow **docker-compose** file to 20,000 tasks or higher. (Case: 00194044. JIRA ID: EM-45576)

For example:

```
flower:  
environment:  
... ..  
worker_type: flower  
FLOWER_MAX_TASKS: 20000
```

Chapter

13

API Endpoints in SL1 PowerFlow

Overview

SL1 PowerFlow includes an API that is available after you install the PowerFlow system.

This chapter covers the following topics:

<i>Interacting with the API</i>	225
<i>Available Endpoints</i>	225

Interacting with the API

To view the full documentation for the PowerFlow 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

`/api/v1/applications`. Add a new application or overwrite an existing application.

`/api/v1/applications/{appName}/run`. Run a single application by name with saved or provided configurations.

`/api/v1/applications/run`. Run a single application by name. For more information, see [Querying for the State of a PowerFlow Application](#).

`/api/v1/configurations`. Add a new configuration or overwrite an existing configuration.

`/api/v1/roles/owner`. Add a new owner assigned a specific role.

`/api/v1/schedule`. Add a new scheduled PowerFlow application.

`/api/v1/steps`. Add a new step or overwrite an existing step.

`/api/v1/steps/run`. Run a single step by name.

`/api/v1/syncpacks/{syncpackName}/install`. Install a specific Synchronization PowerPack version by name.

`/api/v1/tasks/{taskId}/replay`. Replay a specific PowerFlow application. Replayed applications run with the same application variables, configuration, and queue as the originally executed application.

`/api/v1/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.

`/api/v1/me/widgets/{widget_id}`. Creates a new widget or updates an existing widget used on the **PowerFlow Control Tower** page.

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

/api/v1/about. Retrieve version information about the packages used by this PowerFlow system, including the version of PowerFlow.

/api/v1/applications. Retrieve a list of all available applications on this PowerFlow system.

/api/v1/applications/{appName}. Retrieve a specific application.

/api/v1/applications/{appName}/logs. Retrieve the logs for the specified application.

/api/v1/cache/{cache_id}. Retrieve a specific cache to gather information about the user interface and the PowerFlow applications.

/api/v1/cache/{cache_key}. Retrieve cache documents, but only if this cache document was explicitly saved to be exposed to the API. You will need to save the cache document using the latest version of the "SaveToCache" step in the *Base Steps Synchronization PowerPack*. This step has a step parameter called "read_from_api" that lets you decide whether the cache document can be requested from the API.

/api/v1/configurations. Retrieve a list of all configurations on this PowerFlow system.

/api/v1/configurations/{configName}. Retrieve a specific configuration.

/api/v1/license?type=platform. Retrieve license data for this PowerFlow system.

/api/v1/reports. Retrieve a list of paginated reports.

/api/v1/reports/{reportId}. Retrieve a specific report by ID.

/api/v1/roles. Retrieve a list of available roles on this PowerFlow system.

`/api/v1/roles/owner`. Retrieve a list of roles assigned to owners on this PowerFlow system.

`/api/v1/roles/owner/{owner}`. Retrieve the role assigned to a specific owner.

`/api/v1/sessions`. Retrieve a list of sessions for this PowerFlow system.

`/api/v1/sessions/status`. Retrieve the Session Management status for this PowerFlow system.

`/api/v1/sessions/username/{username}`. Retrieve the session IDs for a specific user.

`/api/v1/sessions/{session_id}`. Retrieve a specific session from Session Management for this PowerFlow system.

`/api/v1/schedule`. Retrieve a list of all scheduled applications on this PowerFlow system.

`/api/v1/steps`. Retrieve a list of all steps on this PowerFlow system.

`/api/v1/steps/{stepName}`. Retrieve a specific step.

`/api/v1/syncpacks`. Retrieve a list of all Synchronization PowerPacks on this PowerFlow system.

`/api/v1/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.

`/api/v1/tasks/{taskId}`. Retrieve a specific task.

`/api/v1/webhooks`. Retrieve all available webhooks saved in the PowerFlow system.

`/api/v1/me/widgets`. Returns a list of all installed widgets used on the **PowerFlow Control Tower** page.

`/api/v1/me/widgets/{widget_id}`. Returns a specific widget using the specified widget ID.

REST

`/api/v1/tasks`. Terminate all running tasks.

`/api/v1/tasks/{taskId}`. Terminate a specific running task.

DELETE

`/api/v1/apikeys/{api_key}`. Delete an API key.

`/api/v1/applications/{appName}`. Delete a PowerFlow application by name.

`/api/v1/cache/{cache_id}`. Delete a cache entry by name.

`/api/v1/configurations/{configName}`. Delete a configuration by name.

`/api/v1/license?type=platform`. Delete license data for this PowerFlow system.

`/api/v1/roles/owner`. Delete a specific owner role.

`/api/v1/schedule`. Delete a scheduled PowerFlow application by ID.

`/api/v1/sessions`. Delete a list of sessions for this PowerFlow system.

`/api/v1/sessions?all=true`. Delete all sessions for this PowerFlow system.

`/api/v1/sessions/status`. Delete the Session Management status for this PowerFlow system.

`/api/v1/sessions/username/{username}`. Delete the session IDs for a specific user.

`/api/v1/sessions/{session_id}`. Delete a specific session from Session Management for this PowerFlow system.

`/api/v1/reports/{appName}`. Delete a specific report by name.

`/api/v1/reports/{reportId}`. Delete a specific report by report ID.

`/api/v1/steps/{stepName}`. Delete a specific step by name.

`/api/v1/syncpacks/{spName}`. Delete a specific Synchronization PowerPack by name.

`/api/v1/me/widgets/{widget_id}`. Delete the specified widget used on the **PowerFlow Control Tower** page.

Appendix

A

Configuring the PowerFlow System for High Availability

Overview

This appendix describes how to create High Availability deployments to protect the data in PowerFlow.

This chapter covers the following topics:

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Types of High Availability Deployments for PowerFlow

The following table contains a set of ratings that depict the level of resiliency enabled by various PowerFlow deployment types. The higher the rating, the more resilient the PowerFlow system, not just from a node failure perspective, but also from a throughput and load-balancing regard.

Deployment Type	Resiliency Rating	Typical Audience
Single-node deployment	F	Users who want PowerFlow running, but do not care about failover.
Three-node cluster	B+	Users who want PowerFlow running, and also want support for automatic failover for one-node failure.
3+ node cluster with separate workers (at least 4 nodes)	A-	Users who want automatic failover for one-node failure, and intend to have very CPU- or memory-intensive tasks executing on the workers constantly.
3+ node cluster with separate workers, and drained manager nodes (at least 6 nodes)	A	Users who want automatic failover for one-node failure, intend to have very CPU- or memory-intensive tasks executing on the workers, and want to completely mitigate risks of resource contention between services.

You can start with any deployment type, and at a later time scale up to any other deployment type as needed. For example, you can start with a single-node deployment, then at a later date add three more nodes to enable a 3+ node cluster with separate workers.

The deployments listed in the table are just the standards for deployment. For very high-scale customers, a more advanced deployment might be necessary. For deployment requirements like this, please contact ScienceLogic Support.

WARNING: If you are deploying PowerFlow without a load balancer, you can only use the deployed IP address as the management user interface. If you use another node to log in to the PowerFlow system, you will get an internal server error. Also, if the deployed node is down, you must redeploy the system using the IP address for another active node to access the management user interface.

NOTE: There is no support for active or passive Disaster Recovery. ScienceLogic recommends that your PowerFlow Disaster Recovery plans include regular backups and restoring from backup. For more information, see [Backing up Data](#).

The standard deployments are listed below in the following topics:

- [Standard Single-node Deployment \(1 Node\)](#)
- [Standard Three-node Cluster \(3 Nodes\)](#)

- [3+ Node Cluster with Separate Workers \(4 or More Nodes\)](#)
- [3+ Node Cluster with Separate Workers and Drained Manager Nodes \(6 or More Nodes\)](#)

NOTE: You can use a command-line utility called **powerflowcontrol** (pfctl) that performs multiple administrator-level actions on either the node or the cluster. You can use this script to automate the configuration of a three-node cluster. For more information, see [Automating the Configuration of a Three-Node Cluster](#).

Standard Single-node Deployment (1 Node)

Single-node deployment is the standard deployment that comes along with the ISO and RPM installation. This is the default deployment if you install the ISO and run the **pull_start_iservices.sh** script.

This deployment provides a single node running the PowerFlow system. If this node fails, the system will not be operational.

Requirements

One node, 8 CPU, 24 GB memory minimum, preferably 34 GB to 56 GB memory, depending on workload sizes. For more information, see [System Requirements](#).

Risks

A single node supports no data replication, no queue mirroring, and no failover capabilities.

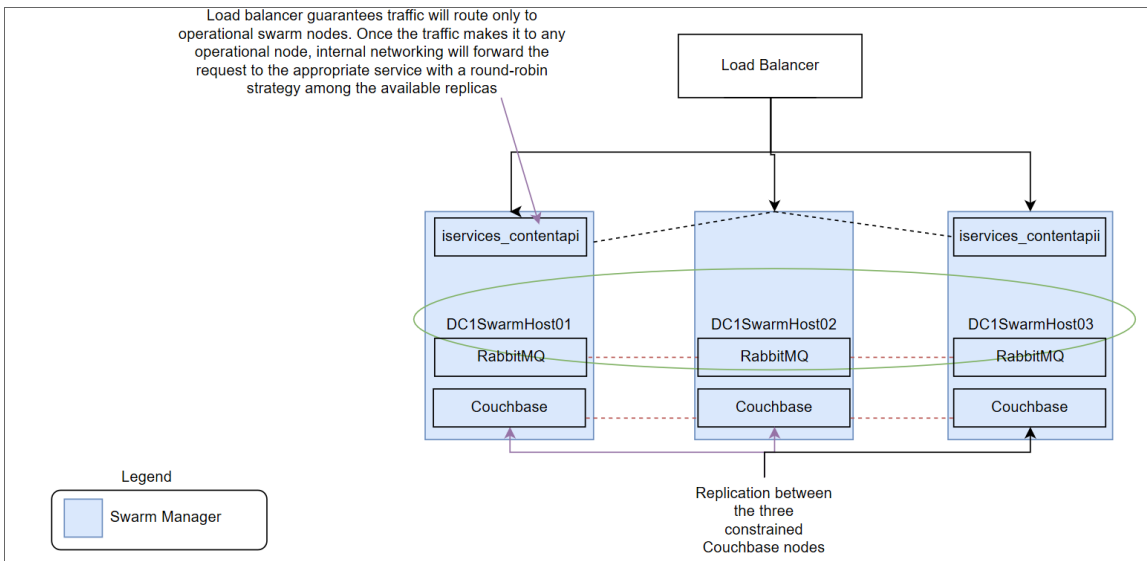
Configuration

This configuration is available as a default deployment with the docker-compose included in the PowerFlow 2.0.0 or later ISO or RPM.

Standard Three-node Cluster (3 Nodes)

The following High Availability deployment is an example of a three-node cluster:

- Each node in the Swarm is a Swarm Manager.
- All Swarm nodes are located within the same data center.



The three-node cluster is the most basic option providing full High Availability and data replication support among three nodes. In this deployment, each of the three nodes are running the same services in a clustered environment, which provides failover and data loss prevention capabilities. This deployment option will satisfy most High Availability needs, but it does not mitigate risks with the potential for worker operations to affect and degrade the database and queue services, because all services are running on the same nodes.

This deployment provides:

- **Automatic failover for one out of three node failure:** If one node in the cluster fails, automatic failover occurs, and the PowerFlow system will continue to be operational running on two out of three of the nodes.
- **Full data replication between all three nodes.** All nodes have a copy of the same data replicated across all three nodes. If one or two nodes fail, you will not experience data loss in the database or in the queues.
- **Full queue mirroring between all three nodes.** All nodes have a mirror of the queues defined in the PowerFlow environment. If one or two nodes fail, the system still retains messages in queues using the autoheal policy by default. For more information about autoheal behavior in RabbitMQ, see [The RabbitMQ Split-brain Handling Strategy](#).

Requirements

Three nodes, 8 CPU, 24 GB memory minimum, preferably 34 GB to 56 GB memory, depending on workload sizes. For more information, see [System Requirements](#).

Risks

When only three nodes are allocated used for High Availability, the following risks are present:

- **Over-utilization of nodes causing clustering issues.** In a three node cluster, worker containers, and Docker Swarm Managers are running on the same node as the database and queue services. As a result, if the node is not provisioned correctly, there could be some resource contention. If a node reaches 100% CPU, Docker Swarm cluster operations might fail, causing a node to completely restart, and causing a failover or other unexpected behavior.
- **Over-utilization of workers nodes causing database or queue issues.** Since all services are sharing the same nodes in this configuration, if worker operations become extremely CPU- or memory-intensive, the system might try to use resources needed from the database or queue. If this happens, you might encounter failures when querying the database or using the queues.

Mitigating Risks

The above risks can be mitigated by ensuring that the node is deployed with adequate CPU and memory for the workloads that you plan to run on the node. Memory limits are placed on containers by default. If needed, you could also add CPU limits to worker containers to further prevent resource contention.

Configuration

PowerFlow uses a **docker-compose-override.yml** file to persistently store user-specific configurations for containers, such as proxy settings, replica settings, additional node settings, and deploy constraints. The user-specific changes are kept in this file so that they can be re-applied when the **/opt/iservices/scripts/docker-compose.yml** file is completely replaced on an RPM upgrade, ensuring that no user-specific configurations are lost.

Below is an example **docker-compose-override.yml** file for PowerFlow:

```
services:
  contentapi:
    environment:
      db_host: "couchbase.isnet,couchbase-worker.isnet,couchbase-worker2.isnet"
  couchbase:
    deploy:
      placement:
        constraints:
          - "node.hostname == <Swarm node hostname1>"
    environment:
      db_host: couchbase.isnet
      hostname: couchbase.isnet
    networks:
      isnet:
        aliases:
          - couchbase
          - couchbase.isnet
  couchbase-worker:
    container_name: couchbase-worker
    deploy:
      placement:
        constraints:
```

```

        - "node.hostname == <Swarm node hostname2>"
    replicas: 0
environment:
    AUTO_REBALANCE: "true"
    TYPE: WORKER
    db_host: couchbase
hostname: couchbase-worker.isnet
image: "sciencelogic/pf-couchbase:1.7.0"
networks:
    isnet:
        aliases:
            - couchbase-worker
            - couchbase-worker.isnet
ports:
    - "8100:8091"
secrets:
    - is_pass
    - encryption_key
volumes:
    - "/var/data/couchbase:/opt/couchbase/var"
couchbase-worker2:
    container_name: couchbase-worker2
    deploy:
        placement:
            constraints:
                - "node.hostname == <Swarm node hostname3>"
        replicas: 0
environment:
    AUTO_REBALANCE: "true"
    TYPE: WORKER
    db_host: couchbase
hostname: couchbase-worker2.isnet
image: "sciencelogic/pf-couchbase:1.7.0"
networks:
    isnet:
        aliases:
            - couchbase-worker2
            - couchbase-worker2.isnet
ports:
    - "8101:8091"
secrets:
    - is_pass
    - encryption_key
volumes:
    - "/var/data/couchbase:/opt/couchbase/var"
dexserver:
    deploy:
        replicas: 2
environment:
    db_host: "couchbase.isnet,couchbase-worker.isnet,couchbase-worker2.isnet"
pypiserver:
    deploy:
        placement:
            constraints:
                - "node.hostname == <Swarm node hostname1>"
rabbitmq:

```

```

deploy:
  placement:
    constraints:
      - "node.hostname == <Swarm node hostname1>"
hostname: rabbit_node1.isnet
image: "sciencelogic/pf-rabbit:3.7.14-3"
networks:
  isnet:
    aliases:
      - rabbit
      - rabbit_node1.isnet
volumes:
  - "rabbitdb:/var/lib/rabbitmq"
rabbitmq2:
  deploy:
    placement:
      constraints:
        - "node.hostname == <Swarm node hostname2>"
hostname: rabbit_node2.isnet
image: "sciencelogic/pf-rabbit:3.7.14-3"
networks:
  isnet:
    aliases:
      - rabbit
      - rabbit_node2.isnet
volumes:
  - "rabbitdb2:/var/lib/rabbitmq"
rabbitmq3:
  deploy:
    placement:
      constraints:
        - "node.hostname == <Swarm node hostname3>"
hostname: rabbit_node3.isnet
image: "sciencelogic/pf-rabbit:3.7.14-3"
networks:
  isnet:
    aliases:
      - rabbit
      - rabbit_node3.isnet
volumes:
  - "rabbitdb3:/var/lib/rabbitmq"
scheduler:
  environment:
    db_host: "couchbase.isnet,couchbase-worker2.isnet,couchbase-worker.isnet"
steprunner:
  environment:
    db_host: "couchbase.isnet,couchbase-worker2.isnet,couchbase-worker.isnet"
version: "3.4"
volumes:
  rabbitdb2:
  rabbitdb3:

```

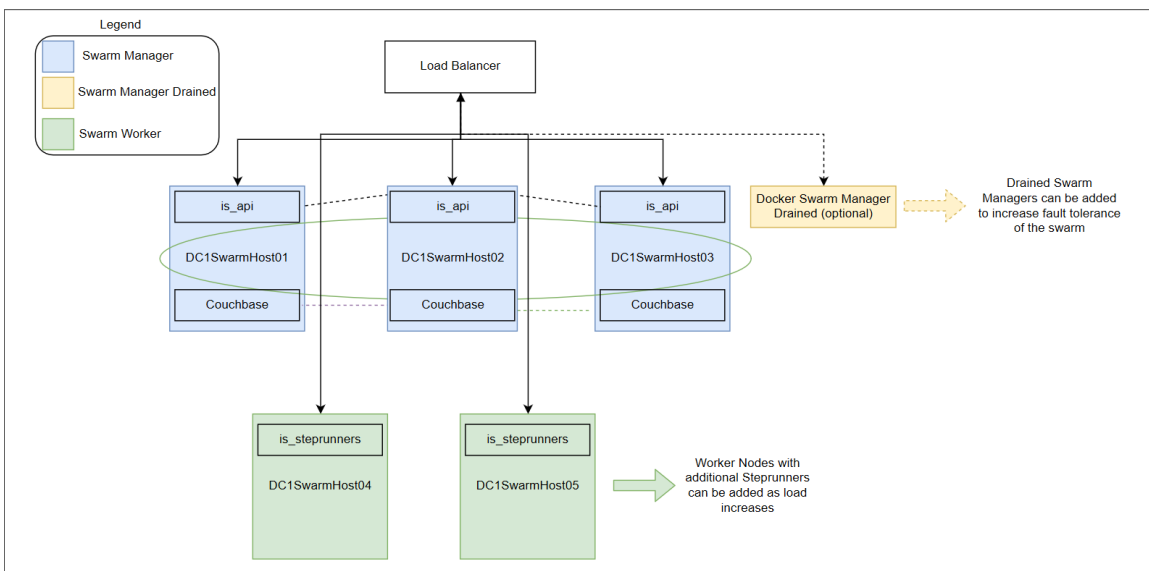
3+ Node Cluster with Separate Workers (4 or More Nodes)

The three-node cluster with separate workers is a slight variation of the standard three-node cluster. With this deployment strategy, all worker operation load is run by a separate independent node. This is preferable over the standard three-node deployment, because it completely prevents worker operations from stealing resources from the databases or queues.

Since steprunner workload is entirely on dedicated servers, you have greater ability to scale up to more workers, or even add additional nodes of workers to the system, without affecting critical database or queue operations.

This deployment provides a complete separation of worker processing from the database and queue processing, which is very helpful for users which have very CPU-intensive tasks that execute frequently.

The following High Availability deployment adds Docker Swarm worker nodes where steprunners can be constrained. This lets you continue to scale out new worker nodes as the load increases. This also lets you distribute steprunners based on workloads. Core services include ContentAPI, RabbitMQ, and Couchbase.



You can add drained Docker Swarm Manager nodes to increase fault tolerance of the Swarm, and to ensure that the orchestration of the Swarm is not impeded by large workloads on the core nodes.

The maximum Couchbase cluster with fully replicated nodes is four. Anything greater than four will not have a full replica set and will auto-shard data across additional nodes. There is no way as of this version of Couchbase to set the placement of the replicas. Redis replication and clustering is not currently supported in this version of PowerFlow.

Requirements

Three nodes, 8 CPU, 24 GB memory minimum, preferably 34 GB to 56 GB memory, depending on workload sizes. For more information, see [System Requirements](#).

One or more worker node with your choice of sizing.

Worker Node Sizing

Worker nodes can be sized to any CPU or memory constraints, though the greater the memory and CPU, more workers the node can run. The minimum size of a worker node is 2 CPU, 4 GB memory.

Risks

Core Node over-utilization could cause Swarm clustering problems. Because the Swarms are the same nodes as the core managers, there is a possibility for heavily loaded databases and queues to contend with the Swarm hosts for resources. In this case the Swarm may restart itself and the services running on that node. This is not as likely to occur with workers running on their own dedicated nodes.

Mitigating Risks

The above risks can easily be mitigated by ensuring the node is deployed with adequate CPU and memory for the workloads it is expected to run. Additionally, you can apply CPU and memory limits to the database or queue containers so that there will always be enough resources allocated to the host to prevent this scenario. For more information, see [Configuring Additional Elements of PowerFlow](#).

Configuration

Using this configuration consists of:

- Joining the standard three-node Swarm cluster with one or more nodes as a Swarm worker.
- Labeling each additional "worker" node with a Swarm label "worker". For more information, see [Creating a Node Label](#). You can also use the worker node role to restrict the steprunners to run only in the Swarm worker nodes using `node.role==worker` in the `constraints` section in the **docker-compose** file.
- In addition to the standard three-node deployment, you should update the steprunners to run on a dedicated node in the **docker-compose** file:

```
steprunner3:
  deploy:
    placement:
      constraints:
        - node.labels.types == worker
```

- You can edit the value of `--max-replica-per-node` in the **docker-compose-override** file to restrict the number of replicas that will run in each Swarm node. The default value is 5:

```

steprunner:
  deploy:
    replicas: 15
    ...
  placement:
    max_replicas_per_node: 5
environment:
  ...

```

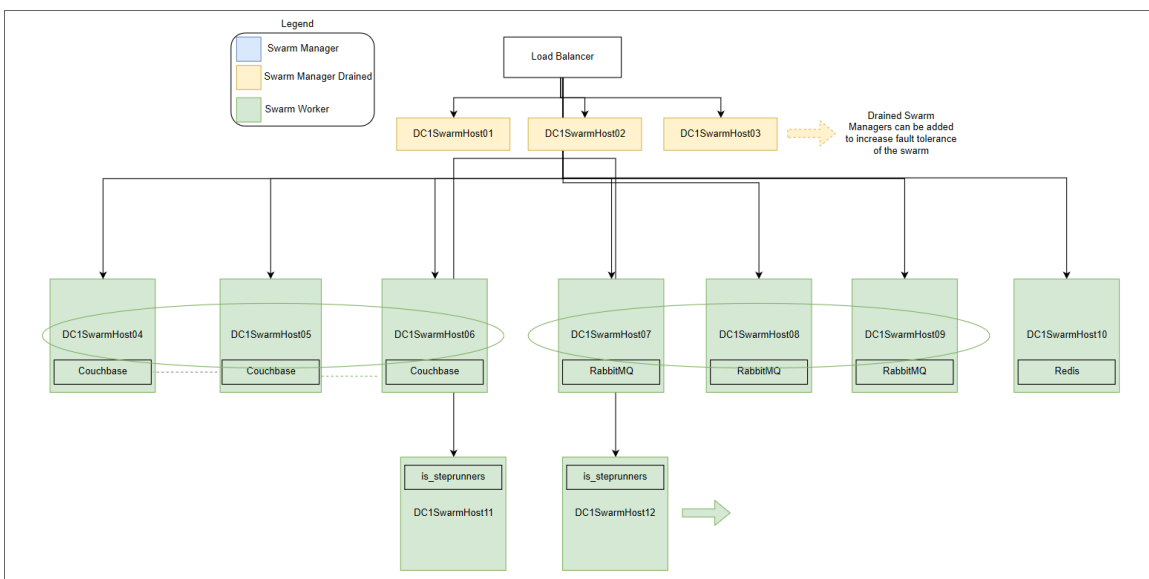
NOTE: The `--max-replica-per-node` option is available with docker-compose 3.8 or later. Add `version: '3.8'` at the start of the **docker-compose** file to ensure compatibility.

3+ Node Cluster with Separate Workers and Drained Manager Nodes (6 or More Nodes)

This deployment option is the most robust of the one-node auto-failover deployments, and completely mitigates known risks for resource contention in clusters.

This configuration provides everything that the 3+ node cluster with dedicated workers provides, with the addition of drained Swarm Managers. The drained Swarm Managers mitigate the risk of database or queue processing causing contention of resources for the Swarm clustering operations at the host level.

This deployment should only be used for large deployments of PowerFlow. This deployment separates out all the core services onto their own dedicated worker node and lets you distribute steprunners based on workloads:



You can add drained Docker Swarm Manager nodes to increase fault tolerance of the Swarm, and to ensure that the orchestration of the Swarm is not impeded by large workloads on the core nodes.

The maximum Couchbase cluster with fully replicated nodes is four. Anything greater than four will not have a full replica set and will auto-shard data across additional nodes. There is no way as of this version of Couchbase to set the placement of the replicas. Redis replication and clustering is not currently supported in this version of PowerFlow.

Requirements

Three nodes, 8 CPU, 24 GB memory minimum, preferably 34 GB to 56 GB memory, depending on workload sizes. For more information, see [System Requirements](#).

Also, three nodes, 2 CPU, 4 GB memory for the Swarm Manager.

Risks

None.

Configuration

Use the same `docker-compose-override.yml` file found in [Standard Three-node Cluster \(3 Nodes\)](#).

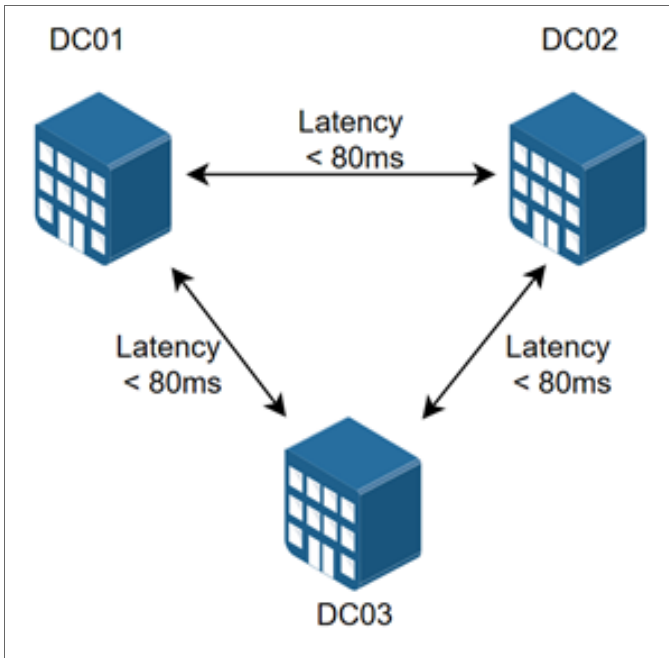
Next, add the additional three nodes to the cluster as managers, and drain them of all services (see [Using Drained Managers to Maintain Swarm Health](#)). Promote the drained nodes to Swarm Managers, and make all other nodes workers.

Additional Deployment Options

The following diagrams show additional High Availability deployment architectures that are supported for PowerFlow.

Cross-Data Center Swarm Configuration

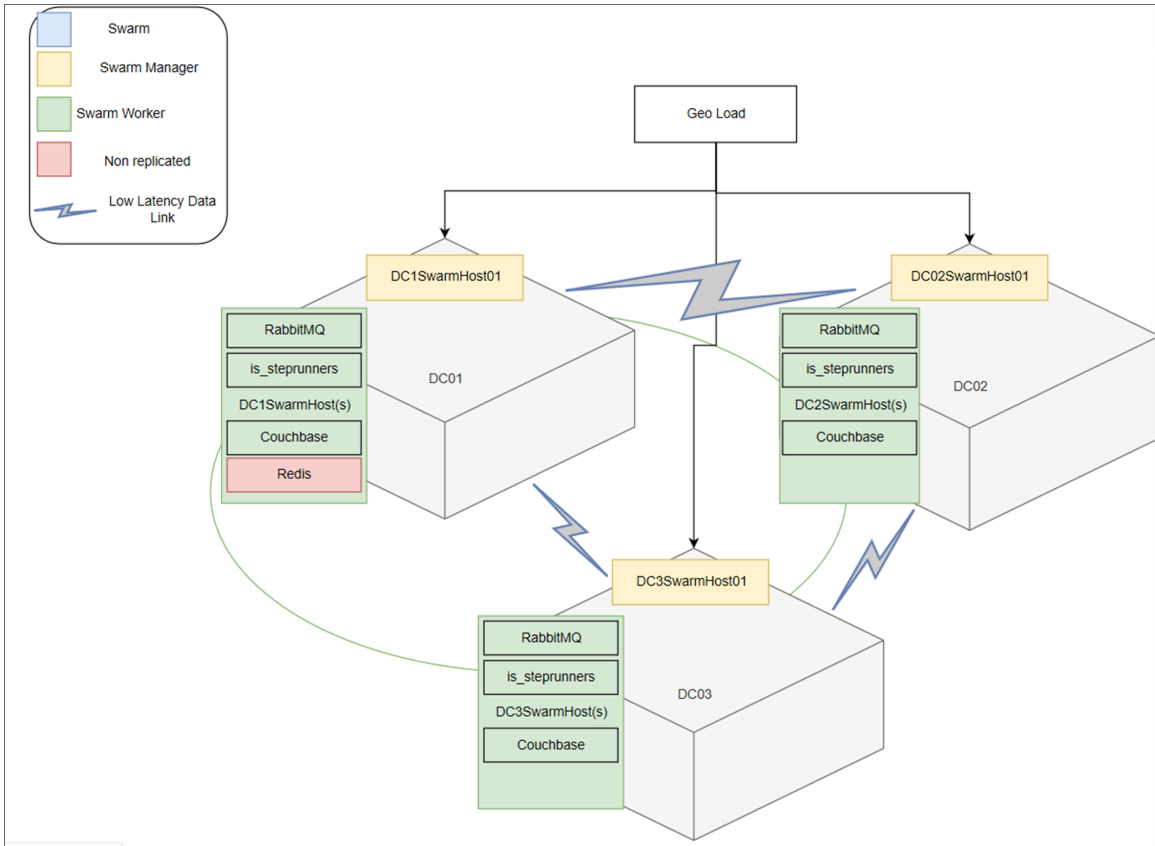
Docker Swarm requires three data centers to maintain quorum of the swarm in the event of a full data center outage. Each data center must have a low-latency connection between the data centers.



NOTE: Implementing clustering across links with a latency that is greater than 80 ms is not supported, and may cause one or more of the following situations: nodes dropping out of the cluster, or automatically failover, failed data replication, and potential cluster communication issues resulting in timeouts and significantly increased overhead.

The cross-data center configuration has the following limitation: the Redis service cannot be deployed in High Availability. As a result, all task results saved by any steprunner will have to be saved within that data center. Upon a failure of that data center, a new Redis service will be created, but an application in the middle of its run would have to retry.

The following High Availability deployment shows a cross-data center swarm configuration:



Additional Notes

Tagging and constraints in the Docker compose file should be used to ensure proper placement. Example compose files are not available at this time.

Configuration management solutions such as Ansible should be used to update and manage large swarm environments.

For an easy upgrade of PowerFlow, use Docker Hub to pull the latest images or use an internal Docker registry.

Requirements Overview

Because PowerFlow uses the Docker Swarm tool to maintain its cluster and automatically re-balance services across nodes, ScienceLogic strongly recommends that you implement the following best practices from Docker, Couchbase, and RabbitMQ. The topics in this section describe those best practices, along with requirements and frequently asked questions.

IMPORTANT: To support automatic failover of the Couchbase database without manual intervention, you must set up at least **three nodes** for automatic failover of a single node, **five nodes** for automatic failover of two nodes, and so on.

NOTE: For a clustered PowerFlow environment, you must install the PowerFlow RPM on every server that you plan to cluster the PowerFlow. You can load the Docker images for the services onto each server locally by running `/opt/iservices/scripts/pull_start_iservices.sh`. Installing the RPM onto each server ensures that the PowerFlow containers and necessary data are available on all servers in the cluster. For more information, see [Installing PowerFlow via RPM](#).

NOTE: You can use a command-line utility called `powerflowcontrol` (pfctl) that performs multiple administrator-level actions on either the node or the cluster. You can use this script to automate the configuration of a three-node cluster. For more information, see [Automating the Configuration of a Three-Node Cluster](#).

Docker Swarm Requirements for High Availability

After implementing Docker Swarm High Availability, if a node goes down, all the services on that failed node can be dynamically re-provisioned and orchestrated among the other nodes in the cluster. High Availability for Swarm also facilitates network connections with the various other High Availability components.

Docker Swarm requires the following:

- The cluster contains at least **three nodes** running as managers. With three nodes, there can be a quorum vote between managers when a node is failed over.
- A load balancer with a virtual IP running in front of all nodes in the cluster. The load balancer allows user interface requests to be distributed among each of the hosts in the case one of the hosts fails for ports 443:HTTPS, 3141:Devpi and 5556:Dex.

An example of why a load balancer is needed in front of the virtual IP is the ServiceNow ticketing workflow. If you're only directing the request to a single node and that node goes down, your ticketing will stop even if the other PowerFlow nodes are still up and functional. The load balancer will account for the downed node and automatically route to the other nodes in the cluster.

For more information, see the [Docker High Availability Documentation](#).

What happens if I use three nodes and two of the nodes fail?

Docker fault tolerance is limited to one failure in a three-node cluster. If more than one node goes down in a three-node cluster, automatic High Availability and failover cannot be guaranteed, and manual intervention may be required. Adding more nodes is the only way to increase the fault tolerance.

In the event of a two out of three failure, after you perform manual failover actions, the PowerFlow system will be back up and running.

For more information about the manual failover steps, see the [Failover](#) section.

Couchbase Database Requirements for High Availability

Couchbase High Availability ensures that no application, configuration, or step data from the PowerFlow system will be lost in the event of a node failure.

To support automatic failover, Couchbase requires at least **three nodes** in the high availability cluster.

Each node will have an independent and persistent storage volume that is replicated throughout the cluster. Alternatively, shared storage can be used instead of independent persistent volumes. This replication ensures that data is replicated in all places, and if a single node goes down, no data will be lost.

For more information, see the [Couchbase documentation](#).

What if I have three nodes and two of them fail?

In the event of a failure of two out of three nodes, no data will be lost, because the data is being replicated.

If multiple Couchbase data nodes go down at the same time, automatic failover might not occur (not even nodes for quorum to failover). You will then need to perform manual failover steps. After you perform these manual actions, the PowerFlow system will be operational again. For more information about the manual failover steps, see the [Failover](#) section.

RabbitMQ Clustering and Persistence for High Availability

Implementing RabbitMQ High Availability ensures that if any integrations or tasks are waiting in the Rabbit queue, those tasks will not be lost if a node containing the Rabbit queue fails.

NOTE: You can switch between both single-node and cluster options at any time during deployment.

RabbitMQ clustering requires a Docker Swarm configuration with multiple nodes. For more information, see [Configuring Docker Swarm](#).

As a best practice for security, enable the user interface only temporarily during cluster configuration.

RabbitMQ Option 1: Persisting Queue to Disk on a Single Node (Default Configuration)

With this configuration, the PowerFlow queue runs on a single node, and the queue is persisted on disk. As a result, if the PowerFlow stack is removed and re-deployed, no messages are lost during the downtime. Any messages that exist in the queue before the stack is stopped continue to exist after the stack is re-deployed.

Potential Risks and Mitigations

Because the queue runs on a single node, if that node fails, then the queue and its related data might be lost.

You can mitigate data loss by persisting the queues on your choice of network shared storage, so that if the queue fails on one node, the queue and its messages can be brought back up on another node.

Requirements/Setup (Enabled by Default)

- You must define a static hostname for the RabbitMQ host in the docker-compose file. The default is *rabbit_node1.isnet*.
- You must mount a volume to */var/lib/rabbitmq* in the docker-compose file.

Example docker-compose Definition

```
rabbitmq:
  image: sciencelogic/is-rabbit:3.7.7-1
  hostname: rabbit_node1.isnet
  volumes:
    - "rabbitdb:/var/lib/rabbitmq"
  networks:
    isnet:
      aliases:
        - rabbit
        - rabbit_node1.isnet
```

RabbitMQ Option 2: Clustering Nodes with Persistent Queues on Each Node

This configuration lets multiple nodes join a RabbitMQ cluster. When you include multiple nodes in the RabbitMQ cluster, all queue data, messages, and other necessary information is automatically replicated and persisted on all nodes in the cluster. If any node fails, then the remaining nodes in the cluster continue maintaining and processing the queue.

Because the RabbitMQ cluster includes disk-persisted queues, if all nodes in the Rabbit cluster fail, or if the service is removed entirely, then no data loss should occur. Upon restart, the nodes will resume with the same cluster configuration and with the previously saved data.

If you include multiple nodes in a RabbitMQ cluster, PowerFlow automatically applies an HA policy of all-node replication, with retroactive queue synchronization disabled. For more information, refer to the [RabbitMQ documentation](#).

Potential Risks and Mitigations

If you create a Docker Swarm cluster with only two nodes, the cluster might stop functioning if a single node fails. To prevent this situation, include at least **three nodes** in each cluster.

Requirements/Setup

For a Docker Swarm configuration with multiple independent nodes:

- Both RabbitMQ services must be "pinned" to each of the two nodes. See the **Example Compose Definition** below.
- You must add a new RabbitMQ service to the docker-compose.yml file. This new service should have a hostname and alias following the designated pattern. The designated pattern is: *rabbit_nodex.isnet*, where *x* is the node number. This configuration supports up to 20 clustered nodes by default.
- After you update the docker-compose.yml file, the nodes will auto-cluster when you perform a deployment.

Example docker-compose Definition of Two Clustered Rabbit Services

```
rabbitmq:
  image: sciencelogic/is-rabbit:3.7.7-1
  hostname: rabbit_node1.isnet
  volumes:
    - "rabbitdb:/var/lib/rabbitmq"
  networks:
    isnet:
      aliases:
        - rabbit
        - rabbit_node1.isnet
  deploy:
    placement:
      constraints:
        - node.hostname == node-number-1.domain
rabbitmq2:
  image: sciencelogic/is-rabbit:3.7.7-1
  hostname: rabbit_node2.isnet
  volumes:
    - "rabbitdb:/var/lib/rabbitmq"

  networks:
    isnet:
      aliases:
        - rabbit
        - rabbit_node2.isnet
  deploy:
    placement:
      constraints:
        - node.hostname == node-number-2.domain
```

Checking the Status of a RabbitMQ Cluster

This section contains commands and additional resources for administering your clusters.

To check the status of your clustered RabbitMQ environment:

1. Run `docker ps` and locate the `iservices_rabbit` container.
2. Run the following command on the RabbitMQ container:

```
docker exec -it [container_id] /bin/bash
```

You can run the following commands for more information:

- `rabbitmqctl cluster_status`. Returns information about the current cluster status, including nodes in the cluster, and failed nodes.
- `rabbitmqctl list_policies`. Returns information about current policies. Ensure that the `ha-all` policy is automatically set for your cluster.

For additional cluster-related administrative commands, see the [RabbitMQ Cluster Management documentation page](#).

Preparing the PowerFlow System for High Availability

You need to prepare your PowerFlow system in the following ways before configuring the High Availability solution:

1. Make sure that your PowerFlow system has been updated with `yum upgrade`.
2. Run the following commands to open up the proper firewall ports for Docker Swarm on each swarm node:

```
firewall-cmd --add-port=2376/tcp --permanent
firewall-cmd --add-port=2377/tcp --permanent
firewall-cmd --add-port=7946/tcp --permanent
firewall-cmd --add-port=7946/udp --permanent
firewall-cmd --add-port=4789/udp --permanent
firewall-cmd --add-protocol=esp --permanent
```

NOTE: If your system is fully yum-updated, you only need to run the following commands:

```
firewall-cmd --add-service docker-swarm --permanent
firewall-cmd --reload
```

TIP: To view a list of all ports, run the following command: `firewall-cmd --list-all`

3. Make sure that the `/etc/iservices/is_pass` and `/etc/iservices/encryption_key` are identical on all clustered nodes.
4. Make sure that NTP is properly configured on all nodes:
 - Edit the `/etc/chrony.conf` file to add NTP servers. If you want to use the pool.ntp.org NTP servers, remove the `.ol.` from the domain names.
 - Enable chronyd by running the following commands:

```
systemctl start chronyd
systemctl enable chronyd
timedatectl #ensure ntp is enabled is yes and ntp sync is yes
```

Troubleshooting Ports and Protocols

If you have trouble with cluster configuration, make sure that all of the following ports and protocols are enabled between each of the nodes in the PowerFlow cluster within your network:

- 2376/tcp
- 2377/tcp

- 7946/tcp
- 7946/udp
- 4789/udp
- protocol=esp (IP Protocol 50)

Firewall rules are automatically configured within the PowerFlow operating system. Failing to allow required ports between nodes block PowerFlow clustering and networking.

Additionally, when using a load balancer, ensure that each of the PowerFlow cluster nodes are able to communicate to the load balancer listening ports (443, 5556, 3141).

Configuring Clustering and High Availability

This section describes how to configure clustering and High Availability with Docker Swarm and the Couchbase database, using three or more nodes.

NOTE: This topic assumes you are using PowerFlow ISOs for each node, which includes an initial Docker Swarm node configuration. The use of the PowerFlow ISO is not required, however. You could instead deploy another node (without using the PowerFlow ISO) and configure a Linux operating system based on Red Hat. You could then add that system to the swarm.

TIP: When configuring a three-node clustered environment, you can set the **OPEN_SECONDARY_CB_PORTS** configuration variable to "true" to expose Couchbase secondary ports through the main node IP or host name. You can set this configuration variable as a GUI environment variable in the **docker-compose.yml** file, or you can set it in the **isconfig.yml** file in the host. If **OPEN_SECONDARY_CB_PORTS** is set to "true", the GUI service exposes the Couchbase secondary ports in the compose file. The **autocluster** cluster-action in the **powerflowcontrol** (pfctl) utility was updated to automatically expose Couchbase secondary ports when creating a three-node clustered environment.

For more information about troubleshooting issues with clustering, see [Troubleshooting Clustering and Node Failover](#).

Automating the Configuration of a Three-Node Cluster

You can use the **powerflowcontrol** (pfctl) command-line utility to perform multiple administrator-level actions on your PowerFlow cluster. You can use the **autocluster** action with the **powerflowcontrol** command to automate the configuration of a three-node cluster.

NOTE: If you are using another cluster configuration, the deployment process should be manual, because the **powerflowcontrol** utility *only* supports the automated configuration of a three-node cluster.

WARNING: The **autocluster** action will completely reset and remove all data from the system. When you run this action, you will get a prompt verifying that you want run the action and delete all data.

To automate the configuration of a three-node cluster, run the following command:

```
pfctl --host <pf_host1> <username>:<password> --host <pf_host2> <username>:<password>
--host <pf_host3> <username>:<password> autocluster
```

For example:

```
pfctl --host 192.11.1.1 isadmin:passw0rd --host 192.11.1.2 isadmin:passw0rd --host
192.11.1.3 isadmin:passw0rd autocluster
```

Running this command will configure your PowerFlow three-node cluster without any additional manual steps required.

NOTE: You can use the **generate_haproxy_config** cluster-action in the **powerflowcontrol** (pfctl) utility to create an HAProxy configuration template that lets you easily set an HAProxy load balancer for a three-node cluster. For example: `pfctl cluster-action --action generate_haproxy_config`

TIP: For more information about other actions you can perform with the **powerflowcontrol** utility, see [Using the powerflowcontrol \(pfctl\) Command-line Utility](#).

Configuring Docker Swarm

To configure Docker Swarm for clustering (three or more nodes) and High Availability:

NOTE: Two-Node High Availability is not possible because Docker Swarm requires an odd number of nodes (3+) for quorum and consensus.

1. If you do not already have PowerFlow running in your environment, install PowerFlow on a single node. Doing this creates a single-node Docker Swarm manager.
2. Ensure that NTP is configured on all swarm nodes. For more information, see [Preparing PowerFlow System for High Availability](#).
3. SSH to the Docker Swarm manager (leader) and run the following command to retrieve the join token. Make note of the token, because you will need it to join a node to the swarm in step 4, below:

```
docker swarm join-token manager
```


4. Run the following commands on each Docker Swarm node that you want to join to the cluster:

```
docker swarm init
docker swarm join --token <join token> <swarm manager ip>:<port>
```

where <join token> is the value from step 3. For example:

```
docker swarm join --token SWMTKN-1-
5e8skxby61cthkfkv6gzhhil89v0og2m7lx014tvvv42n7m0rz-an0fdam5zj0v7d471co57d09h
10.7.3.21:2377
```

5. Run the following command to verify that the nodes have been added:

```
docker node ls
```

6. If you are using local images and not connecting to Docker Hub, load docker images on the other swarm nodes:

```
for i in $(ls -l /opt/iservices/images/); do docker load -i
/opt/iservices/images/$i; done
```

Configuring the Couchbase Database

To add a Couchbase worker node:

1. In the **docker-compose-override.yml** file, add the following line to constrain the Couchbase container to a single Docker Swarm node at the bottom of the **couchbase** section:

```
deploy:
...
hostname: couchbase.isnet
deploy:
  placement:
    constraints:
      - node.hostname == <name of Docker Swarm node>

networks:
  isnet:
    aliases:
      - couchbase
      - couchbase.isnet

environment:
  db_host: couchbase.isnet
```

2. Add the couchbase-worker and couchbase-worker2 section. `deploy > replicas` on the workers should be set to 0:

```
couchbase-worker:
  image: repository.auto.sciencelogic.local:5000/is-couchbase:feature-INT-1208-HA-
  IS-Services
  container_name: couchbase-worker.isnet
  volumes:
    - "/var/data/couchbase:/opt/couchbase/var"
  deploy:
    placement:
      constraints:
        - node.hostname == <name of Docker Swarm node>
  networks:
    isnet:
      aliases:
        - couchbase-worker
        - couchbase-worker.isnet
  hostname: couchbase-worker.isnet

  ports:
    - "8095:8091"
  secrets:
    - is_pass
    - encryption_key
  ulimits:
    nofile: 80000
    core: 100000000
    memlock: 100000000
  environment:
    TYPE: 'WORKER'
    AUTO_REBALANCE: 'true'
    db_host: 'couchbase'
```

NOTE: This deployment makes the Couchbase worker user interface available on port 8095 of the Docker Swarm stack. If the master node goes down, or if the primary Couchbase user interface is not available on port 8091, you can still access the secondary Couchbase user interface through port 8095.

3. Add couchbase-worker to the `db_host` setting for contentapi:

```
contentapi:
  ...
  environment:
    ...
    db_host: 'couchbase,couchbase-worker,couchbase-worker2'
```

4. All `db_host` variables in docker-compose should be in the following format:

```
db_host: 'couchbase,couchbase-worker,couchbase-worker2'
```

5. If you are using the override file, run the `/opt/iservices/compose_override.sh` script to validate and update the `docker-compose.yml` file with your changes.

6. Deploy the stack with only the Couchbase node by editing the replicas on couchbase-worker to 1 and running the following command:

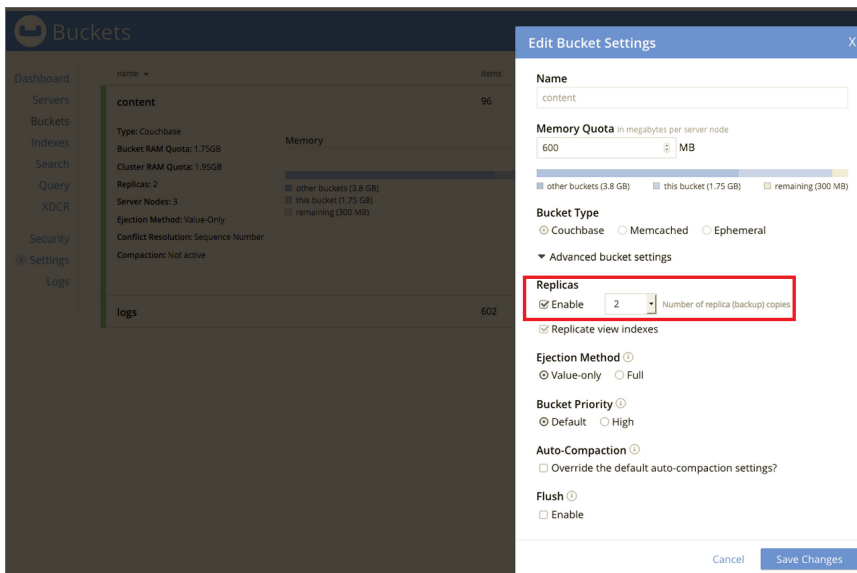
```
docker stack deploy -c <location of compose file> iservices
```

7. After the two-node Couchbase cluster has been successfully deployed and the secondary indexes are successfully added, edit the replicas on couchbase-worker2 to 1 and run the following command:

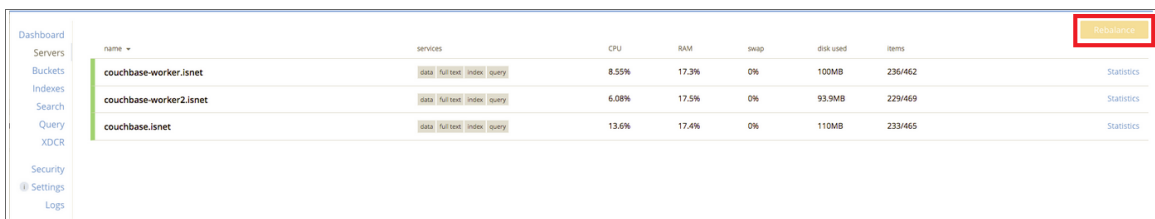
```
docker stack deploy -c <location of compose file> iservices
```

8. Set the replicas in the `docker-compose-override.yml` file as well.

9. After the second worker is added, set the number of replicas to "2" on each bucket (content and logs) in the Couchbase Administrator user interface and click **[Save Changes]**:



10. Rebalance the cluster by navigating to the **Servers** section of the Couchbase Administrator user interface and clicking the **Rebalance** button:



Code Example: docker-compose-override.yml

PowerFlow uses a **docker-compose-override.yml** file to persistently store user-specific configurations for containers, such as proxy settings, replica settings, additional node settings, and deploy constraints. The user-specific changes are kept in this file so that they can be re-applied when the **/opt/iservices/scripts/docker-compose.yml** file is completely replaced on an RPM upgrade, ensuring that no user-specific configurations are lost.

If you are running PowerFlow in a cluster, these files should always be the same between all manager nodes. With this in place, if any manager node dies, you can re-deploy with the same settings from any other manager node.

The following section includes a complete example of the **/opt/iservices/scripts/docker-compose-override.yml** file for a three-node Couchbase and RabbitMQ clustered deployment:

NOTE: If shared volumes are available in the cluster, the deploy placement can be omitted and removed.

```
version: '3.2'
services:
  steprunner:
    environment:
      db_host: couchbase.isnet,couchbase-worker2.isnet,couchbase-worker.isnet

  scheduler:
    environment:
      db_host: couchbase.isnet,couchbase-worker2.isnet,couchbase-worker.isnet

  couchbase:
    environment:
      db_host: 'couchbase.isnet'
    deploy:
      placement:
        constraints:
          - node.hostname == <swarm node hostname>
    networks:
      isnet:
        aliases:
          - couchbase
          - couchbase.isnet
    hostname: couchbase.isnet

  couchbase-worker:
    image: sciencelogic/pf-couchbase:1.7.0
    container_name: couchbase-worker
    volumes:
      - "/var/data/couchbase:/opt/couchbase/var"
    ports:
      - "8100:8091"
    deploy:
      replicas: 0
      placement:
        constraints:
          - node.hostname == <swarm node hostname>
```

```

networks:
  isnet:
    aliases:
      - couchbase-worker
      - couchbase-worker.isnet
hostname: couchbase-worker.isnet
secrets:
  - is_pass
  - encryption_key
environment:
  TYPE: 'WORKER'
  AUTO_REBALANCE: 'true'
  db_host: 'couchbase'

couchbase-worker2:
  image: sciencelogic/pf-couchbase:1.7.0
  container_name: couchbase-worker2
  ports:
    - "8101:8091"
  volumes:
    - "/var/data/couchbase:/opt/couchbase/var"
  deploy:
    replicas: 0
    placement:
      constraints:
        - node.hostname == <swarm node hostname>
networks:
  isnet:
    aliases:
      - couchbase-worker2
      - couchbase-worker2.isnet
hostname: couchbase-worker2.isnet
secrets:
  - is_pass
  - encryption_key
environment:
  TYPE: 'WORKER'
  AUTO_REBALANCE: 'true'
  db_host: 'couchbase'

rabbitmq:
  image: sciencelogic/pf-rabbit:3.7.7-1
  hostname: rabbit_node1.isnet
  volumes:
    - "rabbitdb:/var/lib/rabbitmq"
  networks:
    isnet:
      aliases:
        - rabbit
        - rabbit_node1.isnet
  deploy:
    placement:
      constraints:
        - node.hostname == <swarm node hostname>

rabbitmq2:
  image: sciencelogic/pf-rabbit:3.7.7-1
  hostname: rabbit_node2.isnet

```

```

volumes:
  - "rabbitdb2:/var/lib/rabbitmq"

networks:
  isnet:
    aliases:
      - rabbit
      - rabbit_node2.isnet
  deploy:
    placement:
      constraints:
        - node.hostname == <swarm node hostname>
rabbitmq3:
  image: sciencelogic/pf-rabbit:3.7.7-1
  hostname: rabbit_node3.isnet
  volumes:
    - "rabbitdb3:/var/lib/rabbitmq"

networks:
  isnet:
    aliases:
      - rabbit
      - rabbit_node3.isnet
  deploy:
    placement:
      constraints:
        - node.hostname == <swarm node hostname>
contentapi:
  environment:
    db_host: 'couchbase.isnet,couchbase-worker.isnet,couchbase-worker2.isnet'

pypiserver:
  image: sciencelogic/pf-pypi:4.8.0-1
  hostname: devpi
  container_name: devpi
  volumes:
    - "devpi:/data"
  networks:
    isnet:
      aliases:
        - pypiserver
  secrets:
    - is_pass
dexserver:
  image: scr.sll.io/is-dex:2.18.0-1
  ports:
    - "5556:5556"
    - "5558:5558"
  command: ["serve", "/dexConfiguration.yaml"]
  networks:
    isnet:
      aliases:
        - dexserver
  configs:
    - source: dex_config
      target: /dexConfiguration.yaml

```

```
volumes:
  rabbitdb2:
  rabbitdb3:
  devpi:
configs:
  dex_config:
    file: /etc/iservices/dexConfiguration.yaml
```

Scaling iservices-contentapi

To scale out the iservices-contentapi to distribute the service across the three nodes, run the following command:

```
docker service scale iservices-contentapi=3
```

Manual Failover

If you have a cluster with three or more nodes that is not configured with automatic failover, you must perform the following manual failover steps.

NOTE: If you can access the Couchbase Administrator user interface (<https://<IP of PowerFlow>:8091>) on the node that is still running, you can simply click the **[Failover]** button in the Couchbase Administrator user interface instead of manually running the couchbase-cli commands below.

NOTE: In a three-node cluster, a single failed node will be automatically removed, you will still need to perform a re-balance.

Initiating Manual Failover

To initiate a manual failover:

1. Log in to the Docker Swarm node where the node that is running resides.
2. Run the following command on that node to see which node IDs exist:

```
docker node ls
```

3. Remove any failed manager nodes from the cluster by running the following Docker commands:

```
docker swarm init --force-new-cluster
```

```
docker node rm <failed node id>
```

4. Run the following command to identify the Container ID of the running Couchbase container:

```
docker ps
```

5. Connect to the Docker container:

```
docker exec -i -t <container id> /bin/bash
```

6. Use the instance of Couchbase that is up by running the following commands:

```
couchbase-cli server-list -c <operating-couchbase-node> -u isadmin -p <password>
```

where *<operating-couchbase-node>* could be one of the following:

- couchbase.isnet
- couchbase-worker.isnet
- couchbase-worker2.isnet

7. One of the previous commands will show a failed node. Copy the IP address and port number of the failed node for step 7.
8. Use the currently running cluster and the failed node's IP address and port to run the following command to failover:

```
couchbase-cli failover -c <operating-couchbase-worker> -u isadmin -p <password> --server-failover <isnet name:8091> --force
```

For example, if the operating node is *couchbase-worker*, and the isnet name:port of the failed service is *couchbase.isnet:8091*, then the command would be:

```
couchbase-cli failover -c couchbase-worker -u isadmin -p <password> --server-failover couchbase.isnet:8091 --force
```

NOTE: If the surviving node is couchbase-worker2 and the contentapi is in a waiting state, restart couchbase-worker2 to reset the connection and resolve the API waiting. Run the following command: `docker service update --force iservices_couchbase-worker2`

9. Rebalance the cluster using the functioning container name:

```
couchbase-cli rebalance -c <operating-couchbase-worker> -u isadmin -p <password>
```

10. In the unlikely event that a failover occurs and no queries can be performed, validate that the indexes exist, and if not, rebuild them. To rebuild the primary indexes, run the following commands:

```
cbq -u isadmin  
CREATE PRIMARY INDEX ON content;  
CREATE PRIMARY INDEX ON logs;
```

NOTE: Creating a primary index is only for troubleshooting, and primary indexes should not be left on the system.

Recovering a Docker Swarm Node

To recover a Docker Swarm node:

1. Restart the node.
2. If manual failover actions were taken while this node was offline, be sure to force the node to leave the swarm now that the node is back online by running the following command:

```
docker swarm leave --force
```
3. Follow the steps in [Configuring Docker Swarm](#) to add the node back to the existing swarm by obtaining the join-token from the manager.

Restoring a Couchbase Node

CAUTION: You should take the restoration actions in this topic *only* after a manual or automatic failover has been performed and the node has been completely removed from the cluster (the node should not be visible in the user interface or server-list).

If the surviving node is a worker node, you will need to update **docker-compose.yml** to restore the node. The following updates to **docker-compose.yml** ensure that the **couchbase** service is told to join the node that is currently up and running:

```
couchbase:
  ...
  environment:
    JOIN_ON: "couchbase-worker2"
```

NOTE: This process defaults to couchbase-worker. As a result, this update is only needed when the only surviving node is couchbase-worker2, couchbase-worker3, couchbase-worker4, and so on. Also, this process only relates to re-clustering nodes that have been removed.

To restore the failed Couchbase node:

1. Log in to the node where the failed Couchbase cluster node was pinned.
2. Run one of the following commands, depending on the Couchbase node being recovered:
 - `docker service scale iservices_couchbase=0`
 - `docker service scale iservices_couchbase-worker=0`

3. If the Docker Swarm node was restored and not rebuilt, remove files from the old container:

```
rm -rf /var/data/couchbase/*
docker service scale iservices_couchbase=1
```

A new node is added to Couchbase that will automatically re-balance the cluster after it is added.

NOTE: If the server is not completely removed from the cluster and is just waiting to be added back, you may do so using the Couchbase user interface, or by running **healthcheck** and **autoheal** actions with the **powerflowcontrol** (pfctl) command-line utility.

4. After all nodes in a cluster are running, be sure to perform **healthcheck** and **autoheal** actions with the **powerflowcontrol** (pfctl) command-line utility to re-validate the cluster and re-set configurations such as replication and index counts. For more information, see [healthcheck and autoheal](#).

NOTE: If the master node goes down, the Synchronization PowerPacks for the PowerFlow system might not display. This is because the pypiserver is constrained by default to one master node, so it does not start on workers if that master node goes down. To address this issue after completing the failover steps, above, you can re-import the Synchronization PowerPacks.

Additional Configuration Information

Optimization Settings to Improve Performance of Large-Scale Clusters

In large-scale clusters, one of the root causes of abnormal memory and CPU usage is from inter-worker communication overhead, or overly "chatty" workers, and their event queues. You can completely disable inter-worker eventing to significantly reduce overhead on the queuing system and prevent the symptoms associated with abnormal memory usage.

Also, to improve the performance of large-scale clusters by default, the following optimization settings were added to the **docker-compose.yml** file for all workers in version 2.0.1 of the PowerFlow platform:

```
steprunner-<worker-x>:
  environment:
    additional_worker_args: "--max-tasks-per-child 1 --without-gossip --without-mingle"
```

In addition to the default optimization settings above, you can further reduce system overhead by setting the `--without-heartbeat` environment variable in `additional_worker_args`. Please note that this setting will reduce the memory and CPU utilization of the system, but it will come at the cost of preventing the Flower service from getting an accurate depiction of current worker states.

If you want to disable these new configuration settings, set the environment variable `"disable_default_optimizations"` to `"True"` for all workers.

NOTE: Workers will continue to generate events for consumption from monitoring tools like Flower even with the new default configuration settings. In some extremely large clusters, you might want to completely disable eventing of workers completely, especially if Flower is not in use. To completely disable worker eventing, set the environment variable "disable_events" to "True".

For more information, see

<https://docs.celeryproject.org/en/latest/reference/celery.bin.worker.html#cmdoption-celery-worker-without-gossip>

Additional suggestions for improving performance in large-scale clusters:

- Assess the impact of using Flower before keeping it enabled for a long period of time. Running Flower can cause increased overhead on the RabbitMQ nodes, but the overhead is not significant initially. However, the overhead generated by Flower will continue to increase as more workers are added to the stack, and those workers send events to Flower.
- ScienceLogic recommends that you monitor memory and queue utilization before and after running Flower with your current environment size to determine whether the extra overhead provided is worth the task information it provides.
- If a system event causes workers to restart, it is possible that all workers constantly restarting at the same time, every 0 seconds will generate increased load on the system, making it difficult for other services to start up. To prevent this, it is recommended to add a **restart_delay** to workers to prevent a "rush" of hundreds of workers trying to re-connect over the network all at once. For example:

```
steprunner-<worker-x>:  
  deploy  
  restart_policy:  
    delay: 30s
```

Exposing Additional Couchbase Cluster Node Management Interfaces over TLS

The **is_gui** container acts as a reverse proxy to the internal services and their individual management interfaces. This container configured in **/etc/nginx/conf.d/default.conf**.

To expose the management interfaces of additional Couchbase nodes within a cluster:

1. Copy the configuration from the gui container:

```
docker cp <container id>:/etc/nginx/conf.d/default.conf ./
```

2. Edit the configuration to include the desired services:

```
server {
    listen      8092 ssl;
    server_name couchbase-worker;

    location = / {
        return 301 https://$host:8092/ui/index.html;
    }

    location / {
        resolver 127.0.0.11 valid=5s;
        set $upstream couchbase-worker.isnet;
        proxy_pass http://$upstream:8092$request_uri;
        proxy_pass_header Server;
        proxy_pass_header Cache-Control;
        proxy_pass_header Content-Length;
        proxy_pass_header Connection;
        proxy_pass_header Pragma;
        proxy_pass_header ns-server-ui;
        proxy_pass_header invalid-auth-response;
    }

    ssl_certificate      /etc/iservices/is_cert.pem;
    ssl_certificate_key  /etc/iservices/is_key.pem;
    ssl_protocols        TLSv1.2;
    ssl_ciphers           'ECDHE-ECDSA-AES256-GCM-SHA384:ECDHE-RSA-AES256-GCM-SHA384:ECDHE-ECDSA-CHACHA20-POLY1305:ECDHE-RSA-CHACHA20-POLY1305:ECDHE-ECDSA-AES128-GCM-SHA256:ECDHE-RSA-AES128-GCM-SHA256:ECDHE-ECDSA-AES256-SHA384:ECDHE-RSA-AES256-SHA384:ECDHE-ECDSA-AES128-SHA256:ECDHE-RSA-AES128-SHA256';
    ssl_prefer_server_ciphers on;
    ssl_session_cache shared:SSL:20m;
    ssl_session_timeout 180m;
    add_header Strict-Transport-Security "max-age=31536000" always;
}
```

3. Create the following Dockerfile:

```
FROM sciencelogic/is_gui
COPY ./default.conf /etc/nginx/conf.d/default.conf
```

4. Build the container with the new configurations:

```
docker build -t <customer>/is_gui:<PowerFlow version>-1 -f Dockerfile
```

5. Add the image name to the **is_gui** section in the **docker-compose-override.yml** file, and do a Docker stack deploy to enable the new **is_gui** container.

Restricting the Number of Replicas

If you use the `max-replica-per-node` option in the **docker-compose-override** file to restrict the number of replicas that will run in each Swarm node, you should also specify more than one replica for the `replicas` option.

ScienceLogic recommends using three replicas for the **gui** service: one running on each of the core nodes. The default `max-replica-per-node` value is 1 for the **gui** service.

For the **gui** service, the `max_replicas_per_node` option is set, but the **gui** service is not pinned to the core nodes using labels. If there are more than three nodes (core and worker nodes) the **gui** service replicas will run in any node, so you will need to add a restriction to the **docker-compose-override** file, such as the following:

```
placement:
  constraints:
    - node.labels.types == master
```

If you update the **docker-compose-override** file, you will need to redeploy the corresponding service. In the example below, you will need to redeploy the **gui** service after you update the override file:

```
gui:
  deploy:
    replicas: 3
    ...
  placement:
    max_replicas_per_node: 1
  environment:
    ...
```

TIP: You can also configure the `max_replicas_per_node` option for the **contentapi**, **dexserver** and **steprunners** services, and any other PowerFlow services that have more than one replica.

NOTE: The `max-replica-per-node` option is available with docker-compose 3.8 or later. Add `version: '3.8'` at the start of the **docker-compose** file to ensure compatibility.

HAProxy Configuration (Optional)

CAUTION: As a convenience, ScienceLogic provides an example configuration for the HAProxy load balancer below. Please note that it is your responsibility to configure the load balancer. ScienceLogic cannot be held responsible for any deployments that deviate from the example HAProxy load balancer configuration.

The following example configuration describes using HAProxy as a load balancer:

```
defaults
  mode                http
  log                 global
  option              httplog
  option              dontlognull
  option http-server-close
  option              redispatch
  retries             3
  timeout http-request 1m
  timeout queue       1m
```

```

        timeout connect          1m
        timeout client           1m
        timeout server           1m
        timeout http-keep-alive 10s
        timeout check            10s
        maxconn                  6000

frontend http_front
    bind *:80
    bind *:443
    option tcplog
    mode tcp
    tcp-request inspect-delay 5s
    default_backend http_back

frontend dex_front
    bind *:5556
    option tcplog
    mode tcp
    tcp-request inspect-delay 5s
    default_backend dex_back
frontend devpi_front
    bind *:3141
    option tcplog
    mode tcp
    tcp-request inspect-delay 5s
    default_backend devpi_back

backend http_back
    mode tcp
    balance roundrobin
    server master1 <docker swarm node 1 ip>:443 check
    server master2 <docker swarm node 2 ip>:443 check
    server master3 <docker swarm node 3 ip>:443 check

backend dex_back
    mode tcp
    balance roundrobin
    server master1 <docker swarm node 1 ip>:5556 check
    server master2 <docker swarm node 2 ip>:5556 check
    server master3 <docker swarm node 3 ip>:5556 check

backend devpi_back
    mode tcp
    balance roundrobin
    server master1 <docker swarm node 1 ip>:3141 check
    server master2 <docker swarm node 2 ip>:3141 check
    server master3 <docker swarm node 3 ip>:3141 check

```

Known Issues

The following section describes the known issues you might encounter with the High Availability solution and how to address those issues.

Docker container on last swarm node cannot communicate with other swarm nodes

This is an issue with the Encapsulating Security Payload (ESP) protocol not being enabled in firewalld. You can enable the ESP protocol with the firewalld docker-swarm script.

To address this issue, add the following firewall rule to each node:

```
firewall-cmd --add-protocol=esp --permanent
firewall-cmd --reload
```

Couchbase service does not start, remains at nc -z localhost

To address this issue, stop the container where this is happening and remove its persistent volume:

```
rm -rf /var/data/couchbase
```

Couchbase-worker fails to connect to master

A connection failure might happen a few times when a stack is freshly deployed. You can ignore these messages, and the worker should eventually connect to the master.

Couchbase database stops unexpectedly and the disk is full

If you are running large or customized workloads, you might encounter a situation where Couchbase stops unexpectedly because the disk is full. To prevent this situation, review the considerations in [What should I do if the Couchbase disk is full, indexer is crashing, and the database is unusable?](#)

Couchbase rebalance fails with "Rebalance exited" error

In this situation, you received the following error:

```
Rebalance exited with reason {service_rebalance_failed,index,
{linked_process_died,<12807.821.0>,
{no_connection,"index-service_api"}
}}
```

If the Couchbase rebalance fails on the initial rejoin of a failed node into a cluster, you should check the index states and wait until the indexes are no longer in a warmup state. After the indexes are created on that node, the rebalance should succeed.

When setting up a three-node High Availability Couchbase cluster, the second node does not appear

In this situation, if you have cloned any of the nodes, the nodes might think that there is a split-brain condition.

To address this issue, delete the Couchbase data on the newly added nodes by running the following command on each node:

```
rm -rf /var/data/couchbase/*
```

The PowerFlow user interface fails to start after a manual failover of the swarm node

To address this issue, run the following commands on the relevant node:

```
docker stack rm iservices
systemctl restart docker
docker stack deploy -c docker-compose.yml iservices
```

The PowerFlow user interface returns 504 errors

Ensure that your PowerFlow systems have been updated with `yum upgrade`.

NTP should be used, and all node times should be in sync

If all nodes time are not in sync, you might experience issues with the `iservices_steprunners`.

The following is an example of a Docker Swarm error caused by the time not being in sync:

```
Error response from daemon: certificate (1 - 2v4umws4pxag6kbxae1wfl3vf) not valid
before Fri, 30 Nov 2018 13:47:00 UTC, and it is currently Fri, 30 Nov 2018 06:41:24
UTC: x509: certificate has expired or is not yet valid
For more information, see Preparing the PowerFlow System for High Availability.
```

Example Logs from Flower

```
iservices_flower.1.jg6glaf298d2@is-scale-05 | [W 181023 20:17:40 state:113]
Substantial drift from celery@1ee384863e37 may mean clocks are out of sync. Current
drift is iservices_flower.1.jg6glaf298d2@is-scale-05 | 18 seconds. [orig: 2018-10-23
20:17:40.090473 recv: 2018-10-23 20:17:58.486666]
```

Appendix

B

Configuring the PowerFlow System for Multi-tenant Environments

Overview

This appendix describes the best practices and troubleshooting solutions for deploying PowerFlow in a multi-tenant environment that supports multiple customers in a highly available fashion. This section also covers how to perform an upgrade of PowerFlow with minimal downtime.

This chapter covers the following topics:

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Quick Start Checklist for Deployment

1. Deploy and cluster the initial High Availability stack. Label these nodes as "core".
2. Create the PowerFlow configuration object for the new PowerFlow systems. The configuration object includes the SL1 IP address, the ServiceNow user and domain, and other related information.
3. Deploy and cluster the worker node or nodes for the customer.
4. Label the worker node or nodes specifically for the customer.
5. Update the **docker-compose.yml** file on a core node:
 - Add two steprunner services for each customer, one for real-time eventing, and one for backlogged events, labeled based on the organization name: *acme* and *acme-catchups*.
 - Update the new steprunner hostnames to indicate who the steprunner works for.
 - Update the new steprunner deploy constraints to deploy only to the designated labels.
 - Update the new steprunner *user_queues* environment variable to only listen on the desired queues.
6. Schedule the required PowerFlow integrations:
 - Run Device Sync daily, if desired
 - Correlation queue manager running on the catchup queue
7. Modify the Run Book Automations in SL1 to trigger the integration to run on the queue for this customer:
 - Modify the IS_PASSTHROUGH dictionary with "queue" setting.
 - Specify the configuration object to use in PowerFlow for this SL1 instance.

Deployment

The following sections describe how to deploy PowerFlow in a multi-tenant environment. After the initial High Availability (HA) core services are deployed, the multi-tenant environment differs in the deployment and placement of workers and use of custom queues.

Core Service Nodes

For a multi-tenant deployment, ScienceLogic recommends that you dedicate at least three nodes to the **core** PowerFlow services. These core PowerFlow services are shared by all workers and customers. As a result, it is essential that these services are clustered to handle failovers.

Because these core services are critical, ScienceLogic recommends that you initially allocate a fairly large amount of resources to these services. Allocating more resources than necessary to these nodes allows you to further scale workers in the future. If these nodes become overly taxed, you can add another node dedicated to the core services in the cluster.

These core services nodes are dedicated to the following services:

- API
- UI
- RabbitMQ
- Couchbase
- Redis

It is critical to monitor these core service nodes, and to always make sure these nodes have enough resources for new customers and workers as they are on-boarded.

To ensure proper failover and persistence of volumes and cluster information, the core services must be pinned to each of the nodes. For more information, see *Configuring Core Service Nodes*, below.

Requirements

Three nodes (or more for additional failover support) with six CPUs and 56 GB memory each.

Configuring Core Service Nodes

- Install the PowerFlow RPM on your core three nodes.
- See the [High Availability section](#) for information about how to join the cluster as a manager, and copy **the** `/etc/iservices/encryption_key` and `/etc/iservices/is_pass` file from a core service node to the new worker node (same location and permissions).
- [Create a label on the node](#) and label these nodes as "core node".
- See the [Configuring Clustering and High Availability](#) section for details on clustering Couchbase and RabbitMQ, and an example compose file of this setup.
- [Update the contentapi, UI, and redis services](#) so that those services are only ever deployed onto the core nodes.

Critical Elements to Monitor on Core Nodes

- Memory utilization: Warnings at 80%
- CPU utilization: Warnings at 80%
- RabbitMQ queue sizes (can also be monitored from the Flower API, or the PowerFlow user interface)

Worker Service Nodes

Separate from the core services are the **worker services**. These worker services are intended to be deployed on nodes separate from the core services, and other workers, and these worker services aim to provide processing only for specified dedicated queues. Separating the VMs or modes where worker services are deployed will ensure that one customer's workload, no matter how heavy it gets, will not negatively affect the other core services, or other customer workloads.

Requirements

The resources allocated to the worker nodes depends on the worker sizing chosen, the more resources provided to a worker, the faster their throughput. Below is a brief guideline for sizing. Please note that even if you exceed the number of event syncs per minute, events will be queued up, so the sizing does not have to be exact. The below sizing just provides a suggested guideline.

Event Sync Throughput Node Sizing

CPU	Memory	Worker count	Time to sync a queue full of 10,000 events	Events Synced per second
2	16 GB	6	90 minutes	1.3
4	32 GB	12	46 minutes	3.6
8	54 GB	25	16.5 minutes	10.1

Test Environment and Scenario

- Each Event Sync consists of PowerFlow workers reading from the pre-populated queue of 10000 events. The sync interprets, transforms, and then POSTS the new event as a correlated ServiceNow incident into ServiceNow. This process goes on to then query ServiceNow for the new sysID generated for the incident, transforms it, and then POSTs it back to SL1 as an external ticket to complete the process.
- Tests were performed on a node of workers only.
- Tests were performed with a 2.6 GHz virtualized CPU in a vCenter VM. Both SL1 and ServiceNow were responding quickly when doing so.
- Tests were performed with a pre-populated queue of 10000 events.
- Tests were performed with the current deployed version of Cisco custom integration. Data will again be gathered for the next version when it is completed by Pro Services.
- Each event on the queue consisted of a single correlated event.

Configuring the Worker Node

- Install the PowerFlow RPM on the new node.
- See the [High Availability section](#) for information about how to join the cluster as a manager or worker, and copy the `/etc/iservices/encryption_key` and `/etc/iservices/is_pass` file from a core service node to the new worker node (same location and permissions).
- By default, the worker will listen on and accept work from the default queue, which is used primarily by the user interface, and any integration run without a custom queue.
- To configure this worker to run customer-specific workloads with custom queues, see [Onboarding a Customer](#).
- Modify the `docker-compose.yml` on a core service node accordingly.
- If you just want the node to accept default work, the only change necessary is to increase worker count using the table provided in the requirements section

- If you want the node to be customer specific, be sure to add the proper labels and setup custom queues for the worker in the docker-compose when deploying. This information is contained in the Onboarding a customer section.

Initial Worker Node Deployment Settings

It is required that there is always at least one worker instance listening on the default queue for proper functionality. The default worker can run in any node.

Worker Failover Considerations and Additional Sizing

When deploying a new worker, especially if it is going to be a custom queue dedicated worker, it is wise to consider deploying an extra worker listening on the same queues. If you have on a single worker node listening to a dedicated customer queue, there is potential for that queue processing to stop completely if that single node worker fails.

For this reason, ScienceLogic recommends that for each customer dedicated worker you deploy, you deploy a second one as well. This way there are two nodes listening to the customer dedicated queue, and if one node fails, the other node will continue processing from the queue with no interruptions.

When deciding on worker sizing, it's important to take this into consideration. For example, if you have a customer that requires a four-CPU node for optimal throughput, an option would be to deploy two nodes with two CPUs, so that there is failover if one node fails.

- How to know when more resources are necessary
- Extra worker nodes ready for additional load or failover

Knowing When More Resources are Necessary for a Worker

Monitoring the memory, CPU and pending integrations in queue can give you an indication of whether more resources are needed for the worker. Generally, when queue times start to build up, and tickets are not synced over in an acceptable time frame, more workers for task processing are required.

Although more workers will process more tasks, they will be unable to do so if the memory or CPU required by the additional workers is not present. When adding additional workers, it is important to watch the memory or CPU utilization, so long as the utilization is under 75%, it should be okay to add another worker. If utilization is consistently over 80%, then you should add more resources to the system before adding additional workers.

Keeping a Worker Node on Standby for Excess Load Distribution

Even if you have multiple workers dedicated to a single customer, there are still scenarios in which a particular customer queue spikes in load, and you'd like an immediate increase in throughput to handle this load. In this scenario you don't have the time to deploy a new PowerFlow node and configure it to distribute the load for greater throughput, as you need increased load immediately.

This can be handled by having a node on standby. This node has the same PowerFlow RPM version installed, and sits idle in the stack (or is turned off completely). When a spike happens, and you need more resources to distribute the load, you can then apply the label to the corresponding to the customer who's queues spiked. After setting the label on the standby node, you can scale up the worker count for that particular customer. Now, with the stand-alone node labeled for work for that customer, additional worker instances will be distributed to and started on the standby node.

When the spike has completed, you can return the node to standby by reversing the above process. Decrease the worker count to what it was earlier, and then remove the customer specific label from the node.

Critical Elements to Monitor in a Steprunner

- Memory utilization: Warnings at 80%
- CPU utilization: Warnings at 80%
- Successful, failed, active tasks executed by steprunner (retrievable from Flower API or PowerPack)
- Pending tasks in queue for the worker (retrievable by Flower API or PowerPack)
- Integrations in queue (similar information here as in pending tasks in queue, but this is retrievable from the PowerFlow API).

Advanced RabbitMQ Administration and Maintenance

This section describes how multi-tenant deployments can use separate virtual hosts and users for each tenant.

Using an External RabbitMQ Instance

In certain scenarios, you might not want to use the default RabbitMQ queue that is prepackaged with PowerFlow. For example, you might already have a RabbitMQ production cluster available that you just want to connect with PowerFlow. You can do this by defining a new virtual host in RabbitMQ, and then you configure the PowerFlow broker URL for contentapi, steprunner, scheduler services so that they point to the new virtual host.

Any use of an external RabbitMQ server will not be officially supported by ScienceLogic if there are issues in the external RabbitMQ instance.

Setting a User other than Guest for Queue Connections

When communicating with RabbitMQ in the swarm cluster, all communication is encrypted and secured within the overlay Docker network.

To add another user, or to change the user that PowerFlow uses when communicating with the queues:

1. Create a new user in RabbitMQ that has full permissions to a virtual host. For more information, see the [RabbitMQ documentation](#).
2. Update the **broker_url** environment variable with the new credentials in the **docker-compose** file and then re-deploy.

Configuring the Broker (Queue) URL

When using an external RabbitMQ system, you need to update the `broker_url` environment variable in the `contentapi`, `steprunner`, and `scheduler` services. You can do this by modifying the environment section of the services in `docker-compose` and changing `broker_url`. The following line is an example:

```
broker_url: 'pyamqp://username:password@rabbitmq-hostname/v-host'
```

Creating a Custom Configuration Object

When a new SL1 system is to be onboarded into PowerFlow, by default their integrations are executed on the default queue. In large multi-tenant environments, ScienceLogic recommends separate queues for each customer. If desired, each customer can also have specific queues.

Create the Configuration Object

The first step to setting up a new PowerFlow system is to create a configuration object with variables that will satisfy all PowerFlow applications. The values of these should be specific to the new system (such as SL1 IP address, username, password).

See the [example configuration](#) for a template you can fill out for new system.

Because integrations might update their variable names from EM7 to SL1 in the future, ScienceLogic recommends to cover variables for both `em7_` and `sl1_`. The [example configuration](#) contains this information.

Label the Worker Node Specific to the Customer

For an example label, if you want a worker node to be dedicated to a customer called "acme", you could create a node label called "customer" and make the value of the label "acme". Setting this label now makes it easier to cluster in additional workers and distribute load dynamically in the future.

Creating a Node Label

This topic outlines creating a label for a node. Labels provide the ability to deploy a service to specific nodes (determined by labels) and to categorize the nodes for the work they will be performing. Take the following actions to set a node label:

```
# get the list of nodes available in this cluster (must run from a manager node)
docker node ls

# example of adding a label to a docker swarm node
docker node update --label-add customer=acme <node id>
```

Placing a Service on a Labeled Node

After you create a node label, refer to the example below for updating your `docker-compose-override.yml` file and ensuring the desired services deploy to the matching labeled nodes:

```
# example of placing workers on a specific labeled node
```

```

steprunner-acme:
  ...
  deploy:
    placement:
      constraints:
        - node.labels.customer == acme
    resources:
      limits:
        memory: 1.5G
      replicas: 15
  ...

```

Dedicating Queues Per Integration or Customer

Dedicating a separate queue for each customer is beneficial in that work and events created from one system will not affect or slow down work created from another system, provided the multi-tenant system has enough resources allocated. In the example below, we created two new queues in addition to the default queue, and allocated workers to it. Both of these worker services use separate queues as described below, but run on the same labeled worker node.

Example Queues to Deploy:

- **acmequeue**. The queue we use to sync events specific from a customer called "acme". Only events syncs and other integrations for "acme" will run on this queue.
- **acmequeue-catchup**. The queue where any old events that should have synced over already (but failed due to PowerFlow not being available or other reason) will run. Running these catchup integrations on a separate queue ensures that real-time event syncing isn't delayed in favor of an older event catching up.

Add Workers for the New Queues

First, define additional workers in our stack that are responsible for handling the new queues. All modifications are made in **docker-compose-override.yml**:

1. Copy an existing steprunner service definition.
2. Change the steprunner service name to something unique for the stack:
 - steprunner-acmequeue
 - steprunner-acmequeue-catchup
3. Modify the "replicas" value to specify how many workers should be listening to this queue:
 - steprunner-acmequeue will get 15 workers as it's expecting a very heavy load
 - steprunner-acmequeue-catchup will get 3 workers as it's not often that this will run
4. Add a new environment variable labeled "user_queues". This environment variable tells the worker what queues to listen to:
 - steprunner-acmequeue will set user_queues= "acmequeue"
 - steprunner-acmequeue-catchup will set user_queues="acmequeue-catchup"
5. To ensure that these workers can be easily identified for the queue to which they are assigned, modify the hostname setting :

- Hostname: "acmequeue-{{.Task.ID}}"
- Hostname "acmequeue-catchup-{{.Task.ID}}"

6. After the changes have been made, run `/opt/iservices/script/compose-override.sh` to validate that the syntax is correct.

7. When you are ready to deploy, re-run the docker stack deploy with the new compose file.

After these changes have been made, your docker-compose entries for the new steprunners should look similar to the following:

```
steprunner-acme-catchup:
  image: sciencelogic/is-worker:latest
  hostname: "acme-catchup-{{.Task.ID}}"
  deploy:
    placement:
      constraints:
        - node.labels.customer == acme
  resources:
    limits:
      memory: 2G
  replicas: 3
  environment:
    user_queues: 'acmequeue-catchup'
  ..
  ..
  ..
```

```
steprunner-acme:
  image: sciencelogic/is-worker:latest
  hostname: "acmequeue-{{.Task.ID}}"
  deploy:
    placement:
      constraints:
        - node.labels.customer == acme
  resources:
    limits:
      memory: 2G
  replicas: 15
  environment:
    user_queues: 'acmequeue'
  ..
  ..
  ..
```

Once deployed via docker stack deploy, you should see the new workers in Flower, as in the following image:

Worker Name
celery@acme-queue-ikb81pi54ver91sxoysltcgbi
celery@acme-queue-9bkuebtrnfi349krlw8jc0tn6
celery@acme-queue-koo0bg18bpsw4uvc2iz2l0vf9
celery@acme-queue-gilscrrfx1giosh14pye73ui8
celery@acme-queue-u5kbd5m977wjfcbfohl230x3

You can verify the queues being listened to by looking at the "broker" section of Flower, or by clicking into a worker and clicking the **[Queues]** tab:

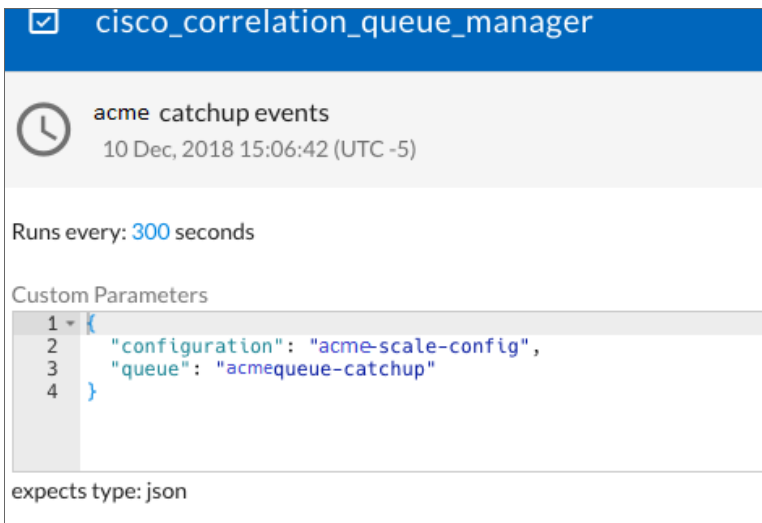
Name	Queues				Idle since
	Messages	Unacked	Ready	Consumers	
celery	0	0	0	5	2018-12-10 20:08:45
acmequeue	886	420	466	15	N/A
acmequeue-catchup	0	0	0	2	2018-12-10 20:09:02
priority:high	0	0	0	5	2018-12-10 20:06:41

Create Application Schedules and Automation Settings to Utilize Separate Queues

After the workers have been configured with specific queue assignments, schedule your PowerFlow applications to run on those queues, and configure Run Book Automations (RBAs) to place the applications on those queues.

Scheduling an Application with a Specific Queue and Configuration

To run an application on a specific queue using a configuration for a particular system, you can use the **Custom Parameters** override available in the scheduler. Below is an example of the scheduled application that utilizes the **acmequeue-catchup** queue:



```
1 {
2   "configuration": "acme-scale-config",
3   "queue": "acmequeue-catchup"
4 }
```

expects type: json

In the example above, the **cisco_correlation_queue_manager** is scheduled to run every 300 seconds, using the acme configuration, and will run on the **acmequeue**. You can have any number of scheduled runs per application. If we were to add additional customers, we would add a new schedule entry with differing configurations, and queues for each.

Configuring Automations to Utilize a Specific Queue and Configuration

The last step to ensuring integrations for your newly onboarded SL1 system is to update the Run Book Automations in SL1 to provide the configuration and queue to use when the Run Book Automation triggers an event.

Modify the Event-correlation policy with the following changes:

1. IS4_PASSTHROUGH= {"queue":"acmequeue"}
2. CONFIG_OVERRIDE= 'acme-scale-config'

Failure Scenarios

This topic cover how PowerFlow handles situations where certain services fail.

Worker Containers

In case of failure, when can the worker containers be expected to restart?

- The worker containers have a strict memory limit of 2 GB. These containers may be restarted if the service requests more memory than the 2 GB limit.
- The restart is done by a SIGKILL of the OOM_Killer on the Linux system.

What happens when a worker container fails?

- Worker containers are ephemeral, and simply execute the tasks allotted to them. There is no impact to a worker instance restarting.

What processing is affected when service is down?

- The `task_reject_on_worker_lost` environment variable dictates whether the task being executed at the time the worker was restarted will be re-queued for execution by another worker. (default false)
- For more information about Celery, the task-processing framework used by PowerFlow):
<http://docs.celeryproject.org/en/latest/userguide/configuration.html#task-reject-on-worker-lost>

What data can be lost?

- Workers contain no persistent data, so there is no data to lose, other than the data from the current task that is being executed on that worker when its shut down (if there is one)
- Any PowerFlow application that fails can be replayed (and re-executed by the workers) on demand with the `/api/v1/tasks/<task-id>/replay` endpoint.

API

When can the API be expected to restart?

- The API also has a default memory limit. As with the steprunners (worker containers), if the memory limit is reached, the API is restarted by a SIGKILL of the OOM_Killer on the Linux system to prevent a memory leak.

What happens when it fails?

- On the clustered system, there are always three contentapi services, so if one of the API containers fails, API requests will still be routed to the functioning containers through the internal load balancer.

What processing is affected when service is down?

- If none of the API services are up and running, any Run Book Automation calls to sync an incident through PowerFlow results in an error. The next time that scheduled integration runs, the integration recognizes the events that failed to send to PowerFlow, and the integration will process them so that the events sync.
- Even if the API is down, the events that were generated while it was down will be synced by the scheduled application. PowerFlow will reach out to SL1 for those items that SL1 failed to post to the PowerFlow.

What data can be lost?

- The API contains no persistent data, so there is no risk of data loss.

Couchbase

If a core service node running Couchbase fails, the database should continue to work normally and continue processing events, as long as a suitable number of clustered nodes are still up and running. Three core service nodes provides automatic failover handling of one node, five core service nodes provides automatic failover handling of two nodes, and so on. See the [High Availability section](#) for more information.

If there are enough clustered core nodes still running, the failover will occur with no interruptions, and the failing node can be added back at any time with no interruptions.

NOTE: For optimal performance and data distribution after rejoining a cluster, you can click the **[Re-balance]** button from the Couchbase user interface, if needed.

If there are not enough clustered core nodes still running, then you will manually have to fail over the Couchbase Server. In this scenario, since automatic failover could not be performed (due to too few nodes available), there will be disruption in event processing. For more information, see the [Manual Failover section](#).

In case of failure, when can Couchbase be expected to restart?

- In ideal conditions, the Couchbase database should not restart, although Couchbase might be restarted when the node it is running on is over-provisioned. For more information, see the [known issue](#).

What happens when it fails?

- Each Couchbase node in the cluster contains a fully replicated set of data. If any single node fails, automatic failover will occur after the designated time (120 seconds by default). Automatic failover, processing, and queries to the database will continue without issue.
- If the database simply is restarted and not down for a long period of time (120 seconds), then the system will not automatically fail over, and the cluster will still be maintained.
- If two out of three of the database nodes fail for a period of time, processing may be paused until a user takes manual failover action. These manual actions are documented in the [Manual Failover section](#).

What processing is affected when service is down?

- In the event of an automatic failover (1/3 node failure), no processing will be affected and queries to the database will still be functional.
- In the event of a large failure (2/3 node failure) automatic failover will not happen, and manual intervention may be needed to so you can query the database again.

What data can be lost?

- Every Couchbase node has full data replication between each of the three nodes. In the event of a failure of any of the nodes, no data is lost, as a replicated copy exists across the cluster.

RabbitMQ

RabbitMQ clustered among all core service nodes provides full mirroring to each node. So long as there is at least one node available running RabbitMQ, the queues should exist and be reachable. This means that a multiple node failure will have no effect on the RabbitMQ services, and it should continue to operate normally.

In case of failure, when can RabbitMQ be expected to restart?

- Similar to the Couchbase database, in a smooth-running system, RabbitMQ should never really restart.
- As with other containers, RabbitMQ might be restarted when the node it is running on is over-provisioned. For more information, see the [known issue](#).

What happens when RabbitMQ fails?

- All RabbitMQ nodes in the cluster mirror the other queues and completely replicate the data between them. The data is also persisted.
- In the event of any RabbitMQ node failure, the other nodes in the cluster will take over responsibility for processing its queues.
- If all RabbitMQ nodes are restarted, their messages are persisted to disk, so any tasks or messages sitting in queue at the time of the failure are not lost, and are reloaded once the system comes back up.
- In the event of a network partition ("[split-brain](#)" state) RabbitMQ will follow the configured partition handling strategy (default autoheal).
- For more information, see <https://www.rabbitmq.com/partitions.html#automatic-handling>.

What processing is affected when service is down?

- When this service is down completely (no nodes running), the API may fail to place event sync tasks onto the queue. As such, any Run Book Automation calls to sync an incident through PowerFlow will result in an error.
- These failed event syncs are then placed in a database table in SL1 which PowerFlow queries on a schedule every few minutes. The next time that scheduled integration runs, the integration recognizes the events that failed to send to PowerFlow, and the integration will process them so that the events sync.

What data can be lost?

- All data is replicated between nodes, so there is little risk of data loss.
- The only time there may be loss of tasks in queues is if there is a network partition, also called a "[split-brain](#)" state.

PowerFlow User Interface

In case of failure, when can the user interface be expected to restart?

- The PowerFlow user interface (GUI) should never be seen as restarted unless a user forcefully restarted the interface.

- The PowerFlow user interface might be restarted when the node it is running on is over-provisioned. For more information, see the [known issue](#).

What happens when it fails?

- The GUI service provides the proxy routing throughout the stack, so if the GUI service is not available, Run Book Automation POSTS to PowerFlow will fail. However, as with an API failure, if the Run Book Actions can not POST to PowerFlow, those events will be placed in a database table in SL1 that PowerFlow queries on a schedule every few minutes. The next time that scheduled integration runs, the integration recognizes the events that failed to send to PowerFlow, and the integration will process them so that the events sync.
- When the GUI service is down and SL1 cannot POST to it, the syncing of the events might be slightly delayed, as the events will be pulled in and created with the next run of the scheduled integration.

What data can be lost?

- The PowerFlow user interface persists no data, so there is no risk of any data loss.

Redis

If the Redis service fails, it will automatically be restarted, and will be available again in a few minutes. The impact of this happening, is that task processing in PowerFlow is delayed slightly, as the worker services pause themselves and wait for the Redis service to become available again.

Consistent Redis failures

Consistent failures and restarts in Redis typically indicate your system has too little memory, or the Redis service memory limit is set too low, or not low at all. PowerFlow ships with a default memory limit of 8 GB to ensure that the Redis service only ever uses 8 GB of memory, and it ejects entries if it is going to go over that limit. This limit is typically sufficient, though if you have enough workers running large enough integrations to overfill the memory, you may need to increase the limit.

Before increasing Redis memory limit, be sure that there is suitable memory available to the system.

Known Issue for Groups of Containers

If you see multiple containers restarting at the same time on the same node, it indicates an over-provisioning of resources on that node. This only occurs on Swarm manager nodes, as the nodes are not only responsible for the services they are running, but also for maintaining the Swarm cluster and communicating with other manager nodes.

If resources become over-provisioned on one of those manager nodes (as they were with the core nodes when we saw the failure), the Swarm manager will not be able to perform its duties and may cause a docker restart on that particular node. This failure is indicated by “context deadline exceeded”, and “heartbeat failures” in the `journalctl -no-page |grep docker |grep err` logs.

This is one of the reasons why docker recommends running “manager-only” nodes, in which the manager nodes are only responsible for maintaining the Swarm, and not responsible for running other services. If any nodes that are running PowerFlow services are also a Swarm manager, make sure that the nodes are not over-provisioned, otherwise the containers on that node may restart. For this reason, ScienceLogic recommends monitoring and placing thresholds at 80% utilization.

To combat the risk of over-provisioning affecting the docker Swarm manager, apply resource constraints on the services for the nodes that are also Swarm managers, so that docker operations always have some extra memory or CPU on the host to do what they need to do. Alternatively, you can only use drained nodes, which are not running any services, as Swarm managers, and not apply any extra constraints.

For more information about Swarm management, see https://docs.docker.com/engine/Swarm/admin_guide/.

Examples and Reference

Example of a PowerFlow Configuration Object

```
[
  {
    "encrypted": false,
    "name": "em7_host",
    "value": "<ip_address>"
  },
  {
    "encrypted": false,
    "name": "s11_host",
    "value": "${config.em7_host}"
  },
  {
    "encrypted": false,
    "name": "s11_id",
    "value": "${config.em7_id}"
  },
  {
    "encrypted": false,
    "name": "s11_db_port",
    "value": 7706
  },
  {
    "encrypted": false,
    "name": "snow_host",
    "value": "<instance>.service-now.com"
  },
  {
    "encrypted": true,
    "name": "em7_password",
    "value": "<password>"
  },
  {
    "encrypted": false,
    "name": "s11_user",
    "value": "${config.em7_user}"
  },
  {
    "encrypted": false,
    "name": "s11_password",
```



```

    "value": "${config.em7_password}"
  },
  {
    "encrypted": false,
    "name": "s11_db_user",
    "value": "${config.em7_db_user}"
  },
  {
    "encrypted": false,
    "name": "s11_db_password",
    "value": "${config.em7_db_password}"
  },
  {
    "encrypted": false,
    "name": "em7_user",
    "value": "<username>"
  },
  {
    "encrypted": false,
    "name": "em7_db_user",
    "value": "root"
  },
  {
    "encrypted": false,
    "name": "em7_db_password",
    "value": "<password>"
  },
  {
    "encrypted": false,
    "name": "snow_user",
    "value": "<username>"
  },
  {
    "encrypted": true,
    "name": "snow_password",
    "value": "<password>"
  },
  {
    "encrypted": false,
    "name": "Domain_Credentials",
    "value": {
      "c9818d2c4a36231201624433851894bb": {
        "password": "3m7Admin!",
        "user": "is4DomainUser2"
      }
    }
  },
  {
    "name": "region",
    "value": "ACMEScaleStack"
  },
  {
    "encrypted": false,
    "name": "em7_id",
    "value": "${config.region}"
  },
  {
    "encrypted": false,
    "name": "generate_report",
    "value": "true"
  }
}

```

```
]
```

Example of a Schedule Configuration

```
[
{
  "application_id": "device_sync_sciencelogic_to_servicenow",
  "entry_id": "dsync every 13 hrs acme",
  "last_run": null,
  "params": {
    "configuration": "acme-scale-config",
    "mappings": {
      "cmbd_ci_ip_router": [
        "Cisco Systems | 12410 GSR",
        "Cisco Systems | AIR-AP1141N",
        "Cisco Systems | AP 1200-IOS",
        "Cisco Systems | Catalyst 5505"
      ],
      "cmbd_ci_esx_resource_pool": [
        "VMware | Resource Pool"
      ],
      "cmbd_ci_esx_server": [
        "VMware | ESXi 5.1 w/HR",
        "VMware | Host Server",
        "VMware | ESX(i) 4.0",
        "VMware | ESX(i) w/HR",
        "VMware | ESX(i) 4.0 w/HR",
        "VMware | ESX(i)",
        "VMware | ESX(i) 4.1 w/HR",
        "VMware | ESXi 5.1 w/HR",
        "VMware | ESXi 5.0 w/HR",
        "VMware | ESX(i) 4.1",
        "VMware | ESXi 5.1",
        "VMware | ESXi 5.0"
      ],
      "cmbd_ci_linux_server": [
        "ScienceLogic, Inc. | EM7 Message Collector",
        "ScienceLogic, Inc. | EM7 Customer Portal",
        "ScienceLogic, Inc. | EM7 All-In-One",
        "ScienceLogic, Inc. | EM7 Integration Server",
        "ScienceLogic, Inc. | EM7 Admin Portal",
        "ScienceLogic, Inc. | EM7 Database",
        "ScienceLogic, Inc. | OEM",
        "ScienceLogic, Inc. | EM7 Data Collector",
        "NET-SNMP | Linux",
        "RHEL | Redhat 5.5",
        "Virtual Device | Content Verification"
      ],
      "cmbd_ci_vcenter": [
        "VMware | vCenter",
        "Virtual Device | Windows Services"
      ],
      "cmbd_ci_vcenter_cluster": [
        "VMware | Cluster"
      ],
      "cmbd_ci_vcenter_datacenter": [
        "VMware | Datacenter"
      ],
      "cmbd_ci_vcenter_datastore": [
        "VMware | Datastore",

```

```

    "VMware | Datastore Cluser"
  ],
  "cmdb_ci_vcenter_dv_port_group": [
    "VMware | Distributed Virtual Portgroup"
  ],
  "cmdb_ci_vcenter_dvs": [
    "VMware | Distributed Virtual Switch"
  ],
  "cmdb_ci_vcenter_folder": [
    "VMware | Folder"
  ],
  "cmdb_ci_vcenter_network": [
    "VMware | Network"
  ],
  "cmdb_ci_vmware_instance": [
    "VMware | Virtual Machine"
  ]
  ],
  "queue": "acmequeue",
  "region": "ACMEScaleStack"
},
"schedule": {
  "schedule_info": {
    "run_every": 47200
  },
  "schedule_type": "frequency"
},
"total_runs": 0
},
{
  "application_id": "device_sync_sciencelogic_to_servicenow",
  "entry_id": "dsync every 12 hrs on .223",
  "last_run": null,
  "params": {
    "configuration": "em7-host-223",
    "mappings": {
      "cmdb_ci_esx_resource_pool": [
        "VMware | Resource Pool"
      ],
      "cmdb_ci_esx_server": [
        "VMware | ESXi 5.1 w/HR",
        "VMware | Host Server",
        "VMware | ESX(i) 4.0",
        "VMware | ESX(i) w/HR",
        "VMware | ESX(i) 4.0 w/HR",
        "VMware | ESX(i)",
        "VMware | ESX(i) 4.1 w/HR",
        "VMware | ESXi 5.1 w/HR",
        "VMware | ESXi 5.0 w/HR",
        "VMware | ESX(i) 4.1",
        "VMware | ESXi 5.1",
        "VMware | ESXi 5.0"
      ],
      "cmdb_ci_linux_server": [
        "ScienceLogic, Inc. | EM7 Message Collector",
        "ScienceLogic, Inc. | EM7 Customer Portal",
        "ScienceLogic, Inc. | EM7 All-In-One",
        "ScienceLogic, Inc. | EM7 Integration Server",
        "ScienceLogic, Inc. | EM7 Admin Portal",
        "ScienceLogic, Inc. | EM7 Database",
        "ScienceLogic, Inc. | OEM",
      ]
    }
  }
}

```

```

        "ScienceLogic, Inc. | EM7 Data Collector",
        "NET-SNMP | Linux",
        "RHEL | Redhat 5.5",
        "Virtual Device | Content Verification"
    ],
    "cmdb_ci_vcenter": [
        "VMware | vCenter",
        "Virtual Device | Windows Services"
    ],
    "cmdb_ci_vcenter_cluster": [
        "VMware | Cluster"
    ],
    "cmdb_ci_vcenter_datacenter": [
        "VMware | Datacenter"
    ],
    "cmdb_ci_vcenter_datastore": [
        "VMware | Datastore",
        "VMware | Datastore Cluser"
    ],
    "cmdb_ci_vcenter_dv_port_group": [
        "VMware | Distributed Virtual Portgroup"
    ],
    "cmdb_ci_vcenter_dvs": [
        "VMware | Distributed Virtual Switch"
    ],
    "cmdb_ci_vcenter_folder": [
        "VMware | Folder"
    ],
    "cmdb_ci_vcenter_network": [
        "VMware | Network"
    ],
    "cmdb_ci_vmware_instance": [
        "VMware | Virtual Machine"
    ]
    ]
},
"schedule": {
    "schedule_info": {
        "run_every": 43200
    },
    "schedule_type": "frequency"
},
"total_runs": 0
},
{
    "application_id": "cisco_correlation_queue_manager",
    "entry_id": "acme catchup events",
    "last_run": {
        "href": "/api/v1/tasks/isapp-a20d5e08-a802-4437-92ef-32d643c6b777",
        "start_time": 1544474203
    },
    "params": {
        "configuration": "acme-scale-config",
        "queue": "acmequeue-catchup"
    },
    "schedule": {
        "schedule_info": {
            "run_every": 300
        },
        "schedule_type": "frequency"
    },
},

```

```

    "total_runs": 33
  },
  {
    "application_id": "cisco_incident_state_sync",
    "entry_id": "incident sync every 5 mins on .223",
    "last_run": {
      "href": "/api/v1/tasks/isapp-52b19097-e0bf-450b-948c-487aff33fc3b",
      "start_time": 1544474203
    },
    "params": {
      "configuration": "em7-host-223"
    },
    "schedule": {
      "schedule_info": {
        "run_every": 300
      },
      "schedule_type": "frequency"
    },
    "total_runs": 2815
  },
  {
    "application_id": "cisco_incident_state_sync",
    "entry_id": "incident sync every 5 mins acme",
    "last_run": {
      "href": "/api/v1/tasks/isapp-dde1dba5-2343-4026-8801-35a02e4e57a1",
      "start_time": 1544474202
    },
    "params": {
      "configuration": "acme-scale-config",
      "queue": "acmequeue"
    },
    "schedule": {
      "schedule_info": {
        "run_every": 300
      },
      "schedule_type": "frequency"
    },
    "total_runs": 1587
  },
  {
    "application_id": "cisco_correlation_queue_manager",
    "entry_id": "qmanager .223",
    "last_run": {
      "href": "/api/v1/tasks/isapp-cb7cc2e5-eab1-474a-907a-055f26dbc36d",
      "start_time": 1544474203
    },
    "params": {
      "configuration": "em7-host-223"
    },
    "schedule": {
      "schedule_info": {
        "run_every": 300
      },
      "schedule_type": "frequency"
    },
    "total_runs": 1589
  }
]

```

Test Cases

Load Throughput Test Cases

Event throughput testing with PowerFlow only:

The following test cases can be attempted with any number of dedicated customer queues. The expectation is that each customer queue will be filled with 10,000 events, and then you can time how long it takes to process through all 10,000 events in each queue.

1. Disable any steprunners.
2. Trigger 10,000 events through SL1, and let them build up in the PowerFlow queue.
3. After all 10,000 events are waiting in queue, enable the steprunners to begin processing.
4. Time the throughput of all event processing to get an estimate of how many events per second and per minute that PowerFlow will handle.
5. The results from the ScienceLogic test system are listed in the [sizing section of worker nodes](#).

Event throughput testing with SL1 triggering PowerFlow:

This test is executed in the same manner as the event throughput test described above, but in this scenario you never disable the steprunners, and you let the events process through PowerFlow as they are alerted to by SL1.

1. Steprunners are running.
2. Trigger 10,000 events through SL1, and let the steprunners handle the events as they come in.
3. Time the throughput of all event processing to get an estimate of how many events per second and per minute that PowerFlow will handle.

The difference between the timing of this test and the previous test can show how much of a delay the SL1 is taking to alert PowerFlow about an event, and subsequently sync it.

Failure Test Cases

1. Validate that bringing one of the core nodes down does not impact the overall functionality of the PowerFlow system. Also, validate that bringing the core node back up rejoins the cluster and the system continues to be operational.
2. Validate that bringing down a dedicated worker node only affects that specific workers processing. Also validate that adding a new "standby" node is able to pick up the worker where the previous failed worker left off.
3. Validate that when the Redis service fails on any node, it is redistributed and is functional on another node.
4. Validate that when a PowerFlow application fails, you can view the failure in the PowerFlow Timeline.
5. Validate that you can query for and filter only for failing tasks for a specific customer.

Separated queue test scenarios

1. Validate that scheduling two runs of the same application with differing configurations and queues works as expected:
 - Each scheduled run should be placed on the designated queue and configuration for that schedule.
 - The runs, their queues, and configurations should be viewable from the PowerFlow Timeline, or can be queried from the log's endpoint.
2. Validate that each SL1 triggering event is correctly sending the appropriate queue and configuration that the event sync should be run on:
 - This data should be viewable from the PowerFlow Timeline.
 - The queue and configuration should be correctly recognized by PowerFlow and executed by the corresponding worker.
3. Validate the behavior of a node left "on standby" waiting for a label to start picking up work. As soon as a label is assigned and workers are scaled, that node should begin processing the designated work.

Backup Considerations

This section covers the items you should back up in your PowerFlow system, and how to restore backups. For more information, see [Backing up Data](#).

What to Back Up

When taking backups of the PowerFlow environment, collect the following information from the host level of your primary manager node (this is the node from which you control the stack):

Files in `/opt/iservices/scripts`:

- `/opt/iservices/scripts/docker-compose.yml`
- `/opt/iservices/scripts/docker-compose-override.yml`

All files in `/etc/iservices/`:

- `/etc/iservices/is_pass`
- `/etc/iservices/encryption_key`

In addition to the above files, make sure you are storing Couchbase dumps somewhere by using the `cbbackup` command, or the "PowerFlow Backup" application.

Fall Back and Restore to a Disaster Recovery (Passive) System

You should do a data-only restore if:

- The system you are restoring to is a different configuration or cluster setup than the system where you made the backup.

- The backup system has all the indexes added and already up to date.

You should do a *full* restore if:

- The deployment where the backup was made is identical to the deployment where it is being restored (same amount of nodes).
- There are no indexes defined on the system you're backing up.

Once failed over, be sure to disable the "PowerFlow Backup" application from being scheduled.

Resiliency Considerations

The RabbitMQ Split-brain Handling Strategy (SL1 Default Set to Autoheal)

If multiple RabbitMQ cluster nodes are lost at once, the cluster might enter a "Network Partition" or "Split-brain" state. In this state, the queues will become paused if there is no auto-handling policy applied. The cluster will remain paused until a user takes manual action. To ensure that the cluster knows how to handle this scenario as the user would want, and not pause waiting for manual intervention, it is essential to set a partition handling policy.

For more information on RabbitMQ Network partition (split-brain) state, how it can occur, and what happens, see: <http://www.rabbitmq.com/partitions.html>.

By default, ScienceLogic sets the partition policy to *autoheal* in favor of continued service if any nodes go down. However, depending on the environment, you might wish to change this setting.

For more information about the automatic split-brain handling strategies that RabbitMQ provides, see: <http://www.rabbitmq.com/partitions.html#automatic-handling>.

autoheal is the default setting set by SL1, and as such, queues should always be available, though if multiple nodes fail, some messages may be lost.

NOTE: If you are using `pause_minority` mode and a "split-brain" scenario occurs for RabbitMQ in a single cluster, when the split-brain situation is resolved, new messages that are queued will be mirrored (replicated between all nodes once again).

ScienceLogic Policy Recommendation

ScienceLogic's recommendations for applying changes to the default policy include the following:

- If you care more about **continuity of service** in a data center outage, with queues always available, even if the system doesn't retain some messages from a failed data center, use *autoheal*. This is the SL1 default setting.
- If you care more about **retaining message data** in a data center outage, with queues that might not be available until the nodes are back, but will recover themselves once nodes are back online to ensure that no messages are lost, use *pause_minority*.
- If you prefer **not to have RabbitMQ handle this scenario automatically**, and you want to manually recover your queues and data, where queues will be paused and unusable until manual intervention is made to determine where to fallback, use *ignore*.

Changing the RabbitMQ Default Split-brain Handling Policy

The best way to change the SL1 default split-brain strategy is to make a copy of the RabbitMQ config file from a running rabbit system, add your change, and then mount that config back into the appropriate place to apply your overrides.

1. Copy the config file from a currently running container:

```
docker cp <container-id>:/etc/rabbitmq/rabbitmq.conf /destination/on/host
```

2. Modify the config file:

```
change cluster_partition_handling value
```

3. Update your **docker-compose.yml** file to mount that file over the config for all rabbitmq nodes:

```
mount "<path/to/config>/rabbitmq.conf:/etc/rabbitmq/rabbitmq.conf"
```

Using Drained Managers to Maintain Swarm Health

To maintain Swarm health, ScienceLogic recommends that you deploy some swarm managers that do not take any of the workload of the application. The only purpose for these managers is to maintain the health of the swarm. Separating these workloads ensures that a spike in application activity will not affect the swarm clustering management services.

ScienceLogic recommends that these systems have 2 CPU and 4 GB of memory.

To deploy a drained manager node:

1. Add your new manager node into the swarm.
2. Drain it with the following command:

```
docker node update --availability drain <node>
```

Draining the node ensures that no containers will be deployed to it. For more information, see https://docs.docker.com/engine/swarm/admin_guide/.

Updating the PowerFlow Cluster with Little to No Downtime

There are two potential update workflows for updating the PowerFlow cluster. The first workflow involves using a Docker registry that is connectable to swarm nodes on the network. The second workflow requires manually copying the PowerFlow RPM or containers to each individual node.

Updating Offline (No Connection to a Docker Registry)

1. Copy the PowerFlow RPM over to all swarm nodes.
2. Only install the RPM on all nodes. Do not stack deploy. This RPM installation automatically extracts the latest PowerFlow containers, making them available to each node in the cluster.
3. From the primary manager node, make sure your **docker-compose** file has been updated, and is now using the appropriate version tag: either *latest* for the latest version on the system, or *2.x.x*.
4. If all swarm nodes have the RPM installed, the container images should be runnable and the stack should update itself. If the RPM was missed installing on any of the nodes, it may not have the required images, and as a result, services might not deploy to that node.

Updating Online (All Nodes Have a Connection to a Docker Registry)

1. Install the PowerFlow RPM only onto the master node.
2. Make sure the RPM doesn't contain any host-level changes, such as Docker daemon configuration updates. If there are host level updates, you might want to make that update on other nodes in the cluster.
3. Populate your Docker registry with the latest PowerFlow images.
4. From the primary manager node, make sure your **docker-compose** file has been updated, and is now using the appropriate version tag: either *latest* for the latest version on the system, or *2.x.x*.
5. Docker stack deploy the services. Because all nodes have access to the same Docker registry, which has the designated images, all nodes will download the images automatically and update with the latest versions as defined by the **docker-compose** file.

Additional Sizing Considerations

This section covers the sizing considerations for the Couchbase, RabbitMQ, Redis, contentapi, and GUI services.

Sizing for Couchbase Services

The initial sizing provided for Couchbase nodes in the multi-tenant cluster for 6 CPUs and 56 GB memory should be more than enough to handle multiple customer event syncing workloads.

ScienceLogic recommends monitoring the CPU percentage and Memory Utilization percentage of the Couchbase nodes to understand when a good time to increase resources is, such as when Memory and CPU are consistently above 80%.

Sizing for RabbitMQ Services

The only special considerations for RabbitMQ sizing is how many events you will plan for in the queue at once.

Every 10,000 events populated in the PowerFlow queue will consume approximately 1.5 GB of memory.

NOTE: This memory usage is drained as soon as the events leave the queue.

Sizing for Redis Services

The initial sizing deployment for redis should be sufficient for multiple customer event syncing.

The only time memory might need to be increased to Redis is if you are attempting to view logs from a previous run, and the logs are not available. A lack of run logs from a recently run integration indicates that the Redis cache does not have enough room to store all the step and log data from recently executed runs.

Sizing for contentapi Services

The contentapi services sizing should remain limited at 2 GB memory, as is set by default.

If you notice timeouts, or 500s when there is a large load going through the PowerFlow system, you may want to increase the number of contentapi replicas.

For more information, see [placement considerations](#), and ensure the API replicas are deployed in the same location as the redis instance.

Sizing for the GUI Service

The GUI service should not need to be scaled up at all, as it merely acts as an ingress proxy to the rest of the PowerFlow services.

Sizing for Workers: Scheduler, Steprunner, Flower

Refer to the worker sizing charts provided by ScienceLogic for the recommended steprunner sizes.

Flower and Scheduler do not need to be scaled up at all.

Scaling the PowerFlow Devpi Server

For large environments, you can replicate the PowerFlow Devpi Server, which is the internal Python package repository. Creating Devpi Server replicas prevents multiple syncpacks_steprunners from attempting to access a single Devpi Server at the same time, which might cause failures when creating or recreating Synchronization PowerPack virtual environments.

NOTE: The Devpi Server is deployed as the **pypiserver** service on a PowerFlow stack.

When to Add a New Devpi Server Replica to the PowerFlow Stack

ScienceLogic recommends that you add replicas if you have more than 75 syncpack_steprunners, or add retries to the Synchronization PowerPack installation process.

Number of syncpack_steprunners	Devpi Server Replicas
75 or more	0
100 or more	1
150 or more	2

Adding a New Devpi Server Replica to the Stack

If you want to add a Devpi Server replica to the PowerFlow stack, you will need to add a new service to the **docker-compose-override** file, using the same configuration as the code block, below.

NOTE: You can add any number of replicas to the stack, but each replica must have its own unique alias and volume, as the Devpi Servermaster volume cannot be used by a replica.

```
pypiserver_replica:
  container_name: devpi_replica
  deploy:
    replicas: 1
    placement:
      constraints:
        - node.hostname == pf-node2 # name of the node where this replica is running
  environment:
    devpi_role: 'replica'
    devpi_threads: 200
  hostname: devpi_replica
  image: scr.sll.io/pf-pypi:6.3.1-7
  networks:
    isnet:
      aliases:
        - pypiserver_replica
        - pypiserver_replica.isnet
  secrets:
    - source: encryption_key
    - source: is_pass
  volumes:
    - devpi_replica:/data:rw
  .. . . .
volumes:
  devpi_replica: {}
  ... . . .
```

Considerations

- To initialize Devpi Server replicas, the master Devpi Server service should be running and healthy. Replicas have the same information as the master, because the replicas are constantly syncing with their master.
- To allow the Devpi Server and its replicas to receive more than 200 concurrent requests, you can increase the number of threads by setting the **devpi_threads** environment variable in the Devpi Server and its replicas.
- When a Devpi Server replica is running, the replica makes a request to the Devpi Server service every 30 seconds to sync Synchronization PowerPacks and their dependencies, which means that the Devpi Server can be busier than its replicas receiving requests from the steprunners.

Configuring Steprunners to Consume Data from Devpi Server Replicas

To allow **steprunner** and **syncpack_steprunner** services to use Devpi Server replicas:

1. Set the **devpi_trusted_host** environment variable for **syncpacks_steprunner** and **steprunner** services with a string that contains the aliases of the Devpi Server and its replicas separated by a comma.

Other custom configurations related to the **devpi_trusted_host** include the following:

- **devpi_trusted_host**. The default value is **pypiserver.isnet**.
- **devpi_random_order**. The default value is **false**. This configuration let you mix the order of the **devpi_trusted_host** list.
- **devpi_random_host_number**. The default value is the **devpi_trusted_host** length. This configuration defines how many hosts will be chosen randomly from the **devpi_trusted_host** list.

The following example uses two Devpi Server replicas:

```
syncpacks_steprunner:  
  environment:  
    devpi_trusted_host: pypiserver.isnet,pypiserver_replica.isnet,pypiserver_  
replica2.isnet  
    devpi_random_order: true  
    devpi_random_host_number: 2
```

2. For setting a Devpi Server replica as a main resource for a **syncpack_steprunner**, define the following environment variable:

```
syncpacks_steprunner:  
  environment:  
    devpi_host: pypiserver_replica.isnet
```

NOTE: You only need to do this step if you want to completely restrict a steprunner from calling the master Devpi Server service.

- To assign custom Devpi Server replicas to steprunners in different nodes, you can use a **pip.conf** file. The following example shows how to mount the custom **pip.conf** file as a volume.

```
syncpacks_steprunner:
  environment:
    PIP_CONFIG_FILE: /usr/tmp/pip.conf
  .. ....
volumes:
  - /tmp/pip.conf:/usr/tmp/pip.conf
```

Because volumes are owned by every node, this file can contain a different configuration based on the node where the syncpack_steprunners are running. This is not recommended, as managing different versions of **pip.conf** in different nodes can be difficult.

Additional Considerations

In environments where more than 75 **syncpack_steprunners** are running, ScienceLogic recommend the following configurations:

- The number of Devpi Server threads **devpi_threads** should be increased from the default value of 200. Start with 500 and increase it to 1000 if needed:

```
pypiserver_replica:
  container_name: devpi_replica
  deploy:
    replicas: 1
    placement:
      constraints:
        - node.hostname == pf-node2 # name of the node where this replica is
running
  environment:
    devpi_role: 'replica'
    devpi_threads: 1000
```

NOTE: When the number of Devpi Server threads is increased, that service's memory consumption is also slightly increased.

- When PowerFlow is running offline, more calls can occur to Devpi Server and its replicas, so take that situation into account that when setting replicas and its threads.
- Retries for pip should be set by setting by the environment variable **PIP_RETRIES** to 3. This configuration should be set on the **syncpack_steprunners**.
- Retries for the Synchronization PowerPack installation application is configured as an environment variable for the **using sp_installation_retries**, which has default value of 3.

```
syncpacks_steprunner:
  environment:
    devpi_trusted_host: pypiserver.isnet,pypiserver_replica.isnet,pypiserver_
replica2.isnet
    PIP_RETRIES: 3 # default value is 0
    sp_installation_retries: 5
    PIP_TIMEOUT: 10 # default value is 5
```

Node Placement Considerations

Preventing a Known Issue: Place contentapi and Redis services in the Same Physical Location

An issue exists where if there latency exists between the contentapi and redis, the Applications page may not load. This issue is caused by the API making too many calls before returning. The added latency for each individual call can cause the overall endpoint to take longer to load than the designated timeout window of thirty seconds.

The only impact of this issue is the Applications page won't load. There is no operational impact on the integrations as a whole, even if workers are in separate geos than redis.

There is also no risk to High Availability (HA) by placing the API andRedis services on the same geo. If for whatever reason that geo drops out, the containers will be restarted automatically in the other location.

Common Problems, Symptoms, and Solutions

Tool	Issue	Symptoms	Cause	Solution
Docker Visualizer	Docker Visualizer shows some services as "undefined".	When viewing the Docker Visualizer user interface, some services are displayed as "undefined", and states aren't accurate. Impact: Cannot use Visualizer to get the current state of the stack.	Failing docker stack deployment: https://github.com/dockersamples/docker-swarm-visualizer/issues/110	Ensure your stack is healthy, and services are deployed correctly. If no services are failing and things are still showing as undefined, elect a new swarm leader . To prevent: Ensure your configuration is valid before deploying.
RabbitMQ	RabbitMQ queues encountered a node failure and are in a "Network partition state" (split-brain scenario).	The workers are able to connect to the queue, and there are messages on the queue, but the messages are not being distributed to the workers. Log in to the RabbitMQ admin user interface, which displays a message similar to "RabbitMQ experienced a network partition and the cluster is paused". Impact: The RabbitMQ cluster is paused and	Multi-node failure occurred, and rabbit wasn't able to determine who the new master should be. This also will only occur if there is NO partition handling policy in place (see the resiliency section for more information) Note: ScienceLogic sets	Handle the split-brain partition state and resynchronize your RabbitMQ queues . Note: This is enabled by default. To prevent: Set a partition

Tool	Issue	Symptoms	Cause	Solution
		waiting for user intervention to clean the split-brain state.	the <i>autoheal</i> policy by default	handling policy. See the Resiliency section for more information.
RabbitMQ, <i>continued</i>		<p>Execing into the RabbitMQ container and running rabbitmqcli cluster-status shows nodes in a partition state like the following:</p> <pre>{nodes, [{disc, ['rabbit@rabbit_ node1.isnet', 'rabbit@rabbit_ node2.isnet', 'rabbit@rabbit_ node3.isnet', 'rabbit@rabbit_ node4.isnet', 'rabbit@rabbit_ node5.isnet', 'rabbit@rabbit_ node6.isnet']}]}, {running_nodes, ['rabbit@rabbit_ node4.isnet']}, {cluster_ name, <<"rabbit@rabbit_ node1">>}, {partitions, [{'rabbit@rabbit_ node4.isnet', ['rabbit@rabbit_ node1.isnet', 'rabbit@rabbit_ node2.isnet', 'rabbit@rabbit_ node3.isnet', 'rabbit@rabbit_ node5.isnet', 'rabbit@rabbit_ node6.isnet']}]}, {alarms, [{'rabbit@rabbit_ node4.isnet', []}]}</pre>		
PowerFlow steprunners and RabbitMQ	Workers constantly restarting, no real error message.	<p>Workers of a particular queue are not stable and constantly restart. Impact: One queue's workers will not be processing.</p>	<p>Multi-node failure in RabbitMQ, when it loses majority and can not failover. Queues go out of sync because of broken swarm.</p>	<p>Recreate queues for the particular worker. Resynchronize queues. To prevent: Deploy enough nodes to ensure</p>

Tool	Issue	Symptoms	Cause	Solution
				quorum for failover.
Couchbase	Couchbase node is unable to restart due to indexer error.	<p>This issue can be monitored in the Couchbase logs:</p> <pre>Service 'indexer' exited with status 134. Restarting. Messages: sync.runtime_Semacquire (0xc4236dd33c)</pre> <p>Impact: One couchbase node becomes corrupt.</p>	Memory is removed from the database while it is in operation (memory must be dedicated to the VM running Couchbase). The Couchbase node encounters a failure, which causes the corruption.	<p>Ensure that the memory allocated to your database nodes is dedicated and not shared among other VMs.</p> <p>To prevent: Ensure that the memory allocated to your database nodes is dedicated and not shared among other VMs.</p>
Couchbase	Couchbase is unable to rebalance.	<p>Couchbase nodes will not rebalance, usually with an error saying "exited by janitor".</p> <p>Impact: Couchbase nodes cannot rebalance and provide even replication.</p>	Network issues: missing firewall rules or blocked ports. The Docker swarm network is stale because of a stack failure.	<p>Validate that all firewall rules are in place, and that no external firewalls are blocking ports. Reset the Docker swarm network status by electing a new swarm leader.</p> <p>To prevent: Validate the firewall rules before deployment. Use drained managers to maintain swarm</p>
PowerFlow steprunners to Couchbase	Steprunners unable to communicate to Couchbase	<p>Steprunners unable to communicate to Couchbase database, with errors like "client side timeout", or "connection reset by peer".</p> <p>Impact:</p>	Missing Environment variables in compose: Check the db_host setting for the steprunner and make	Validate the deployment configuration and network settings of your

Tool	Issue	Symptoms	Cause	Solution
		Steprunners cannot access the database.	<p>sure they specify all Couchbase hosts available .</p> <p>Validate couchbase settings, ensure that the proper aliases, hostname, and environment variables are set.</p> <p>Stale docker network.</p>	<p>docker-compose.</p> <p>Redeploy with valid settings.</p> <p>In the event of a swarm failure, or stale swarm network, reset the Docker swarm network status by electing a new swarm leader.</p> <p>To prevent:</p> <p>Validate hostnames, aliases, and environment settings before deployment.</p> <p>Use drained managers to maintain swarm</p>
Flower	Worker display in flower is not organized and hard to read, and it shows many old workers in an offline state.	<p>Flower shows all containers that previously existed, even if they failed, cluttering the dashboard.</p> <p>Impact:</p> <p>Flower dashboard is not organized and hard to read.</p>	<p>Flower running for a long time while workers are restarted or coming up/coming down, maintaining the history of all the old workers.</p> <p>Another possibility is a known issue in task processing due to the <code>--max-tasks-per-child</code> setting. At high CPU workloads, the <code>max-tasks-per-child</code> setting causes workers to exit prematurely.</p>	<p>Restart the flower service by running the following command:</p> <pre>docker service update --force iservices_flower</pre> <p>You can also remove the <code>--max-tasks-per-child</code> setting in the steprunners.</p>
All containers on a particular node	All containers on a particular node do not deploy.	<p>Services are not deploying to a particular node, but instead they are getting moved to other nodes.</p> <p>Impact:</p> <p>The node is not running anything.</p>	<p>One of the following situations could cause this issue:</p> <p>Invalid label deployment configuration.</p> <p>The node does not have</p>	<p>Make sure the node that you are deploying to is labeled correctly, and that the services you expect to be</p>

Tool	Issue	Symptoms	Cause	Solution
			the containers you are telling it to deploy. The node is missing a required directory to mount into the container.	<p>deployed there are properly constrained to that system. Go through the troubleshooting steps of "When a docker service doesn't deploy" to check that the service is not missing a requirement on the host. Check the node status for errors:</p> <pre>docker node ls</pre> <p>To prevent: Validate your configuration before deploying.</p>
All containers on a particular node	All containers on a particular node periodically restart at the same time.	<p>All containers on a particular node restart at the same time. The system logs indicate an error like: <code>"error="rpc error: code = DeadlineExceeded desc = context deadline exceeded"</code></p> <p>Impact: All containers restart on a node.</p>	This issue only occurs in single-node deployments when the only manager allocates too many resources to its containers, and the containers all restart since the swarm drops. The manager node gets overloaded by container workloads and is not able to handle swarm management, and the swarm loses quorum.	<p>Use some drained manager nodes for swarm management to separate the workloads.</p> <p>To prevent: Use drained managers to maintain swarm.</p>
General Docker service	Docker service does not deploy. Replicas remain at 0/3.	Docker service does not deploy.	There are a variety of reasons for this issue, and you can reveal most causes by checking the service logs to address the issue.	Identify the cause of the service not deploying.
PowerFlow user interface	The Timeline or the Applications	The Timeline is not showing accurate information, or the Applications page is not rendering.	One of the following situations could cause these issues:	Solutions: Verify that indexes exist.

Tool	Issue	Symptoms	Cause	Solution
	page do not appear in the user interface.		<p>Indexes do not exist on a particular Couchbase node.</p> <p>Latency between the API and the redis service is too great for the API to collect all the data it needs before the 30-second timeout is reached.</p> <p>The indexer can't keep up to a large number of requests, and Couchbase requires additional resources to service the requests.</p>	<p>Place the API and redis containers in the same geography so there is little latency. This issue will be fixed in a future IS release</p> <p>Increase the amount of memory allocated to the Couchbase indexer service.</p>

Common Resolution Explanations

This section contains a set of solutions and explanations for a variety of issues.

Elect a New Swarm Leader

Sometimes when managers lose connection to each other, either through latency or a workload spike, there are instances when the swarm needs to be reset or refreshed. By electing a new leader, you can effectively force the swarm to redo service discovery and refresh the metadata for the swarm. This procedure is highly preferred over removing and re-deploying the whole stack.

To elect a new swarm leader:

1. Make sure there at least three swarm managers in your stack.
2. To identify which node is the current leader, run the following command:

```
docker node ls
```

3. Demote the current leader with the following command:

```
docker node demote <node>
```

4. Wait until a new node is elected leader:

```
docker node ls
```

5. After a new node is elected leader, promote the old node back to swarm leader:

```
docker node promote <node>
```

Recreate RabbitMQ Queues and Exchanges

NOTE: If you do not want to retain any messages in the queue, the following procedure is the best method for recreating the queues. If you do have data that you want to retain, you can [resynchronize RabbitMQ queues](#).

To recreate RabbitMQ queues:

1. Identify the queue or queues you need to delete:
 - If default workers are restarting, you need to delete queues `celery` and `priority.high`.
 - If a custom worker cannot connect to the queue, simply delete that worker's queue.
2. Delete the queue and exchange through the RabbitMQ admin console:
 - Log in to the RabbitMQ admin console and go to the **[Queues]** tab.
 - Find the queue you want to delete and click it for more details.
 - Scroll down and click the **[Delete Queue]** button.
 - Go to the **[Exchanges]** tab and delete the exchange with the same name as the queue you just deleted.
3. Delete the queue and exchange through the command line interface:
 - `exec` into a `rabbitmq` container
 - Delete the queue needed:

```
rabbitmqadmin delete queue name=name_of_queue
```
 - Delete the exchange needed:

```
rabbitmqadmin delete exchange name=name_of_queue
```

After you delete the queues, the queues will be recreated the next time a worker connects.

Resynchronize RabbitMQ Queues

If your RabbitMQ cluster ends up in a "split-brain" or partitioned state, you might need to manually decide which node should become the master. For more information, see <http://www.rabbitmq.com/partitions.html#recovering>.

To resynchronize RabbitMQ queues:

1. Identify which node you want to be the master. In most cases, the master is the node with the most messages in its queue.

2. After you have identified which node should be master, scale down all other RabbitMQ services:

```
docker service scale iservices_rabbitmq=x0
```

3. After all other RabbitMQ services except the master have been scaled down, wait a few seconds, and then scale the other RabbitMQ services back to 1. Bringing all nodes but your new master down and back up again forces all nodes to sync to the state of the master that you chose.

Identify the Cause of a Service not Deploying

Step 1: Obtain the ID of the failed container for the service

Run the following command for the service that failed previously:

```
docker service ps --no-trunc <servicename>
```

For example:

```
docker service ps --no-trunc iservices_redis
```

```
root@is-scale-03 ~]# docker service ps iservices_redis
D
ORTS
1slu2qwbte    iservices_redis.1    redis:4.0.2    is-scale-04    Running    Running 2 hours ago
s7s86n45skf    \ iservices_redis.1    redis:4.0.2    is-scale-03    Shutdown   Failed 2 hours ago    "task: non-zero exit (137)"
```

From the command result above, we see that one container with the ID **3s7s86n45skf** failed previously running on node **is-scale-03** (non-zero exit) and another container was restarted in its place.

At this point, you can ask the following questions:

- Is the error when using `docker service ps --no-trunc` something obvious? Does the error say that it cannot mount a volume, or that the image was not found? If so, that is most likely the root cause of the issue and needs to be addressed.
- Did the node on which that container was running go down? Or is that node still up?
- Are the other services running on that node running fine, and was only this service affected? If other services are running fine on that same node, it is probably a problem with the service itself. If all services on that node are not functional, it could mean a node failure.

At this point, the cause of the issue is not a deploy configuration issue, and it is not an entire node failure. The problem exists within the service itself. Continue to Step 2 if this is the case.

Step 2: Check for any interesting error messages or logs indicating an error

Using the ID obtained in Step 1, collect the logs from the failed container with the following command:

```
docker service logs <failed-id>
```

For example:

```
docker service logs 3s7s86n45skf
```

Review the service logs for any explicit errors or warning messages that might indicate why the failure occurred.

Repair Couchbase Indexes

Index stuck in “created” (not ready) state

This situation usually occurs when a node starts creating an index, but another index creation was performed at the same time by another node. After the index is created, you can run a simple query to build the index which will change it from created to “ready”:

```
BUILD index on 'content'('idx_content_content_type_config_a3f867db_7430_4c4b_b1b6_138f06109edb') using GSI
```

Deleting an index

If you encounter duplicate indexes, such as a situation where indexes were manually created more than once, you can delete an index:

```
DROP index content.idx_content_content_type_config_d8a45ead_4bbb_4952_b0b0_2fe227702260
```

Recreating all indexes on a particular node

To recreate all indexes on a particular Couchbase node, exec into the couchbase container and run the following command:

```
Initialize_couchbase -s
```

NOTE: Running this command recreates all indexes, even if the indexes already exist.

Add a Broken Couchbase Node Back into the Cluster

To remove a Couchbase node and re-add it to the cluster:

1. Stop the node in Docker.
2. In the Couchbase user interface, you should see the node go down, failover manually, or wait the appropriate time until it automatically fails over.
3. Clean the Couchbase data directory on the necessary host by running the following command:

```
rm -rf /var/data/couchbase/*
```

4. Restart the Couchbase node and watch it get added back into the cluster.
5. Click the **Rebalance** button to replicate data evenly across nodes.

Restore Couchbase Manually

Backup

1. Run the following command on each manager node:

```
docker ps
```

2. Find the container with the Couchbase name and make a note of that container's ID.
3. Run the following command on that manager node, inserting the container ID for that node:

```
docker exec -it <container_id> /bin/bash
```

4. Execute into the Couchbase container by running the following command:

```
cbbackup http://couchbase.isnet:8091 /opt/couchbase/var/backup -u <user> -p  
<password> -x data_only=1
```

5. Exit the Couchbase shell and then copy the backup file in **/var/data/couchbase/backup** to a safe location, such as **/home/isadmin**.
6. Repeat these steps on each PowerFlow node.

Delete Couchbase

```
rm -f /var/data/couchbase/*
```

Restore

1. Copy the backup file into **/var/data/couchbase/backup**.

2. Execute into the Couchbase container.

3. Run the following command to restore the content:

```
cbrestore /opt/couchbase/var/backup http://couchbase.isnet:8091 -b content -u  
<user> -p <password>
```

4. Run the following command to restore the logs:

```
cbrestore /opt/couchbase/var/backup http://couchbase.isnet:8091 -b logs -u  
<user> -p <password>
```

PowerFlow Multi-tenant Upgrade Process

This section describes how to upgrade PowerFlow in a multi-tenant environment with as little downtime as possible.

Performing Environment Checks Before Upgrading

Validate Cluster states

- Validate that all Couchbase nodes in the cluster are replicated and fully balanced.
- Validate that the RabbitMQ nodes are all clustered and queues have *ha-v1-all* policy applied.
- Validate that the RabbitMQ nodes do not have a large number of messages backed up in queue.

Validate Backups exist

- Ensure that you have a backup of the database before upgrading.
- Ensure that you have a copy of your most recently deployed docker-compose file. If all user-specific changes are only populated in docker-compose-override, this is not necessary, but you might want a backup copy.
- Make sure that each node in Couchbase is fully replicated, and no re-balancing is necessary.

Clean out old container images if desired

Before upgrading to the latest version of PowerFlow, check the local file system and see if there are any older versions taking up space that you might want to remove. These containers exist both locally on the file system and the internal Docker registry. To view any old container versions, check the **/opt/iservices/images** directory. ScienceLogic recommends that you keep at a minimum the last version of containers, so you can downgrade if necessary.

Cleaning out images is not mandatory, but it is just a means of clearing out additional space on the system if necessary.

To remove old images:

1. Delete any unwanted versions in **/opt/iservices/images**.
2. Identify any unwanted images known to Docker with `docker images`.
3. Remove the images with the ID `docker rmi <id>`.

Installing the PowerFlow RPM

The first step of upgrading is to install the new RPM on all nodes in the cluster. Doing so will ensure that the new containers are populated onto the system (if using that particular RPM), and any other host settings are changed. RPM installation does not pause any services or affect the Docker system in any way, other than using some resources.

PowerFlow has two RPMs, one with containers and one without. If you have populated an internal Docker registry with Docker containers, you can install the RPM without containers built in. If no internal Docker repository is present, you must install the RPM which has the containers built in it. Other than the containers, there is no difference between the RPMs.

For advanced users, installing the RPM can be skipped. However this means that the user is completely responsible for maintaining the docker-compose and host level configurations.

To install the RPM:

1. SSH into each node.
2. If you are installing the RPM that contains the container images built in, you may want to upgrade each core node one by one, so that the load of extracting the images doesn't affect all core nodes at once

3. Run the following command:

```
sudo rpm -Uvh <full_path_of_rpm>
```

where *full_path_of_rpm* is the name and path of the RPM file, such as **/home/isadmin/sl1-powerflow-2.x.x-1.x86_64**.

Compare docker-compose file changes and resolve differences

After the RPM is installed, you will notice a new **docker-compose.yml** file is placed in **/opt/iservices/scripts/**. As long as your environment-specific changes exist solely in the **compose-override** file, all user changes and new version updates will be resolved into that new docker-compose.yml file.

ScienceLogic recommends that you check the differences between the two docker-compose files. You should validate that:

1. All environment-specific and custom user settings that existed in the old docker-compose also exist in the new docker-compose file.
2. The image tags reference the correct version in the new docker-compose. If you are using an internal Docker registry, be sure these image tags represent the images from your internal registry.
3. Make sure that any new environment variables added to services are applied to replicated services. To ensure these updates persist through the next upgrade, also make the changes in **docker-compose-override.yml**. In other words, if you added a new environment variable for Couchbase, make sure to apply that variable to **couchbase-worker1** and **couchbase-worker2** as well. If you added a new environment variable for the default steprunner, make sure to set the same environment variable on each custom worker as well.
4. If you are using the *latest* tag for images, and you are using a remote repository for downloading, be sure that the *latest* tag refers to the images in your repository.
5. The old docker-compose is completely unchanged, and it matches the current deployed environment. This enables PowerFlow to update services independently without restarting other services.
6. After you resolve any differences between the compose files has been resolved, proceed with the upgrade using the old **docker-compose.yml** (the one that matches the currently deployed environment).

Make containers available to systems

After you apply the host-level updates, you should make sure that the containers are available to the system.

If you upgraded using the RPM with container images included, the containers should already be on all of the nodes, you can run Docker images to validate the new containers are present. If this is the case you may skip to the next section.

If the upgrade was performed using the RPM which did *not* contain the container images, ScienceLogic recommends that you run the following command to make sure all nodes have the latest images:

```
docker-compose -f <new_Docker_compose_file> pull
```

This command validates that the containers specified by your compose file can be pulled and reached from the nodes. While not required, you might want to make sure that the images can be pulled before starting the upgrade. If the images are not pulled manually, they will automatically be pulled by Docker when the new image is called for by the stack.

Perform the Upgrade

To perform the upgrade on a clustered system with little downtime, PowerFlow re-deploys services to the stack in groups. To do this, PowerFlow gradually makes the updates to groups of services and re-runs *docker stack deploy* for each change. To ensure that no unintended services are updated, start off using the same docker-compose file that was previously used to deploy. Reusing the same docker-compose file and updating only sections at a time ensures that only the intended services to be updated are affected at any given time.

Avoid putting all the changes in a single docker-compose file, and do a new *docker stack deploy* with all changes at once. If downtime is not a concern, you can update all services, but updating services gradually allows you to have little or no downtime.

WARNING: Before upgrading any group of services, be sure that the **docker-compose** file you are deploying from is *exactly* identical to the currently deployed stack (the previous version). Start with the same **docker-compose** file and update it for each group of services as needed,

Upgrade Redis, Scheduler, and Flower

The first group to update includes Redis, Scheduler and Flower. If desired, this group can be upgraded along with any other group.

To update:

1. Copy the service entries for Redis, Scheduler and Flower from the new compose file into the old **docker-compose** file (the file that matches the currently deployed environment). Copying these entries makes it so that the only changes in the docker-compose file (compared to the deployed stack) are changes for Redis, Scheduler and Flower.
2. Run the following command:

```
docker stack deploy -c /opt/iservices/scripts/docker-compose.yml iservices
```
3. Monitor the update, and wait until all services are up and running before proceeding.

Example image definition of this upgrade group

```
services:
  contentapi:
    image: repository.auto.sciencelogic.local:5000/is-api:2.4.0
  couchbase:
    image: repository.auto.sciencelogic.local:5000/is-couchbase:2.4.0
  couchbase-worker:
    image: repository.auto.sciencelogic.local:5000/is-couchbase:2.4.0
  flower:
    image: repository.auto.sciencelogic.local:5000/is-worker:hotfix-2.4.0
  gui:
    image: repository.auto.sciencelogic.local:5000/is-gui:2.4.0
```

```

rabbitmq:
  image: repository.auto.sciencelogic.local:5000/is-rabbit:3.7.7-2
rabbitmq2:
  image: repository.auto.sciencelogic.local:5000/is-rabbit:3.7.7-2
rabbitmq3:
  image: repository.auto.sciencelogic.local:5000/is-rabbit:3.7.7-2
redis:
  image: repository.auto.sciencelogic.local:5000/is-redis:4.0.11-2
scheduler:
  image: repository.auto.sciencelogic.local:5000/is-worker:hotfix-2.4.1
steprunner:
  image: repository.auto.sciencelogic.local:5000/is-worker:2.4.0
couchbase-worker2:
  image: repository.auto.sciencelogic.local:5000/is-couchbase:2.4.0
steprunner2:
  image: repository.auto.sciencelogic.local:5000/is-worker:2.4.0

```

Redis Version

As the Redis version might not change with every release of PowerFlow, there might not be any changes needed in the upgrade for Redis. This can be expected and is not an issue.

You can configure Redis to let the **contentapi** container iterate through multiple potential Redis result stores to find the correct result id for a task. To enable this option in the **docker-compose.yml** file, set the **result_backend** environment variable of the **contentapi** container to a comma-delimited list of URLs for Redis instances, such as **redis://redis:6378/0,redis:///redis2:6380/0**. To deploy multiple Redis instances, make sure that the stack deploys the instances with different aliases, ports, and hostnames. Also, multiple backends are only supported on **contentapi**, not the **steprunners**. Steprunners can only write to a single backend.

Upgrade Core Services (RabbitMQ and Couchbase)

The next group of services to update together are the RabbitMQ/Couchbase database services, as well as the GUI. Because the core services are individually defined and "pinned" to specific nodes, upgrade these two services at the same time, on a node-by-node basis. In between each node upgrade, wait and validate that the node rejoins the Couchbase and Rabbit clusters and re-balances appropriately.

Because there will always be two out of three nodes running these core services, this group should not cause any downtime for the system.

Rabbit/Couchbase Versions

The Couchbase and RabbitMQ versions used might not change with every release of PowerFlow. If there is no update or change to be made to the services, you can ignore this section for RabbitMQ or Couchbase upgrades, or both. Assess the differences between the old and new docker-compose files to check if there is an image or environment change necessary for the new version. If not, you can move on to the next section.

Update Actions (assuming three core nodes)

To update first node services:

1. Update just core `node01` by copying service entries for `couchbase`, `rabbitmq1` from the new compose file (compared and resolved as part of above prepare steps) into the old docker-compose file. At this point, the compose file you use to deploy should also contain the updates for the previous groups
2. Before deploying, access the Couchbase user interface, select the first server node, and click "failover". Select "graceful failover". Manually failing over before updating ensures that the system is still operational when the container comes down.
3. For the failover command that can be run through the command-line interface if the user interface is not available, see the [Manual Failover section](#).
4. Run the following command:


```
docker stack deploy -c <compose_file>
```
5. Monitor the process to make sure the service updates and restarts with the new version. To make sure that as little time as possible is used when updating the database, the database containers should already be available on the core nodes.
6. After the node is back up, go back to the Couchbase UI and add the node back, and rebalance the cluster to make it whole again.
7. For more information on how to re-add the node and rebalance the cluster if the user interface is not available, see the [Manual Failover section](#).

First node Couchbase update considerations

- When updating the first couchbase node, be sure to set the environment variable `JOIN_ON`: "**couchbase-worker2**", so that the couchbase master knows to rejoin the workers after restarting.
- Keep in mind by default, only the primary Couchbase node user interface is exposed. Because of this, when the first Couchbase node is restarted, the Couchbase admin user interface will be inaccessible. If you would like to have the Couchbase user interface available during the upgrade of this node, ensure that at least one other Couchbase-worker services port is exposed.

Example docker-compose with images and JOIN_ON for updating the first node:

```
services:
  contentapi:
    image: repository.auto.sciencelogic.local:5000/is-api:2.4.0
  couchbase:
    image: repository.auto.sciencelogic.local:5000/is-couchbase:hotfix-2.4.1
    environment:
      JOIN_ON: "couchbase-worker2"
  couchbase-worker:
    image: repository.auto.sciencelogic.local:5000/is-couchbase:2.4.0
  flower:
    image: repository.auto.sciencelogic.local:5000/is-worker:hotfix-2.4.1
  gui:
    image: repository.auto.sciencelogic.local:5000/is-gui:hotfix-2.4.1
  rabbitmq:
    image: repository.auto.sciencelogic.local:5000/is-rabbit:3.7.7-2
  rabbitmq2:
    image: repository.auto.sciencelogic.local:5000/is-rabbit:3.7.7-2
  rabbitmq3:
    image: repository.auto.sciencelogic.local:5000/is-rabbit:3.7.7-2
  redis:
```

```
  image: repository.auto.sciencelogic.local:5000/is-redis:4.0.11-2
scheduler:
  image: repository.auto.sciencelogic.local:5000/is-worker:hotfix-2.4.1
steprunner:
  image: repository.auto.sciencelogic.local:5000/is-worker:2.4.0
couchbase-worker2:
  image: repository.auto.sciencelogic.local:5000/is-couchbase:2.4.0
steprunner2:
  image: repository.auto.sciencelogic.local:5000/is-worker:2.4.0
```

Update second and third node services

To update the second and third node services, repeat the steps from the first node on each node until all nodes are re-clustered and available. Be sure to check the service port mappings to ensure that there are no conflicts (as described above), and remove any HTTP ports if you choose.

Update the GUI

Because the GUI service provides all ingress proxy routing to the services, there might be a very small window where PowerFlow might not receive API requests as the GUI (proxy) is not running. This downtime is limited to the time it takes for the GUI container to restart.

To update the user interface:

1. Make sure that any conflicting port mappings are handled and addressed.
2. Replace the docker-compose GUI service definition with the new one.
3. Re-deploy the docker-compose file, and validate that the new GUI container is up and running.
4. Make sure that the HTTPS ports are accessible for Couchbase/RabbitMG.

Update Workers and contentapi

You should update the workers and contentapi last. Because these services use multiple replicas (multiple steprunner or containerapi containers running per service), you can rely on Docker to incrementally update each replica of the service individually. By default, when a service is updated, it will update one container of the service at a time, and only after the previous container is up and stable will the next container be deployed.

You can utilize additional Docker options in docker-compose to set the behavior of how many containers to update at once, when to bring down the old container, and what happens if a container upgrade fails. See the *update_config* and *rollback_config* options available in Docker documentation: <https://docs.docker.com/compose/compose-file/>.

Upgrade testing was performed by ScienceLogic using default options. An example where these settings are helpful is to change the parallelism of *update_config* so that all worker containers of a service update at the same time.

The update scenario described below takes extra precautions and only updates one node of workers per customer at a time. If you decide, you can also safely update all workers at once.

To update the workers and contentapi:

1. Modify the docker-compose file, the contentapi, and "worker_node1" services of all customers to use the new service definition.
2. Run a `docker stack deploy` of the new compose file. Monitor the update, which should update the API container one instance at a time, always leaving a container available to service requests. The process updates the workers of node1 one container instance at a time by default.
3. After workers are back up and the API is fully updated, modify the docker-compose file and update the second node's worker's service definitions.
4. Monitor the upgrade, and validate as needed.

Example docker-compose definition with one of two worker nodes and contentapi updated:

```
services:
  contentapi:
    image: repository.auto.sciencelogic.local:5000/is-api:hotfix-2.4.1
    deploy:
      replicas: 3
  couchbase:
    image: repository.auto.sciencelogic.local:5000/is-couchbase:hotfix-2.4.1
    environment:
      JOIN_ON: "couchbase-worker2"
  couchbase-worker:
    image: repository.auto.sciencelogic.local:5000/is-couchbase:hotfix-2.4.1
  flower:
    image: repository.auto.sciencelogic.local:5000/is-worker:hotfix-2.4.1
  gui:
    image: repository.auto.sciencelogic.local:5000/is-gui:hotfix-2.4.1
  rabbitmq:
    image: repository.auto.sciencelogic.local:5000/is-rabbit:3.7.7-2
  rabbitmq2:
    image: repository.auto.sciencelogic.local:5000/is-rabbit:3.7.7-2
  rabbitmq3:
    image: repository.auto.sciencelogic.local:5000/is-rabbit:3.7.7-2
  redis:
    image: repository.auto.sciencelogic.local:5000/is-redis:4.0.11-2
  scheduler:
    image: repository.auto.sciencelogic.local:5000/is-worker:hotfix-2.4.1
  steprunner:
    image: repository.auto.sciencelogic.local:5000/is-worker:hotfix-2.4.1
  couchbase-worker2:
    image: repository.auto.sciencelogic.local:5000/is-couchbase:hotfix-2.4.1
  steprunner2:
    image: repository.auto.sciencelogic.local:5000/is-worker:2.4.0
```

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ScienceLogic

800-SCI-LOGIC (1-800-724-5644)

International: +1-703-354-1010