pubsubplus-connector-database

User Guide

Solace Corporation

Version 2.0.1

solace.

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Preface

Solace Database Connector

Getting Started

Assuming you're using the default `application.yml` within this package, following one of the below quick start guides will result in a connector that will connect to the PubSub+ broker and SolaceDBConnector using default credentials, with 2 workflows enabled, workflow 0 and workflow 1. Where:

- Workflow 0 is consuming messages from the Solace PubSub+ queue, `Solace/Queue/0`, and publishing them to the SolaceDBConnector producer destination, `producer-destination`.
- Workflow 1 is consuming messages from the SolaceDBConnector consumer destination, `consumer-destination`, and publishing them to the Solace PubSub+ topic, `Solace/Topic/1`.

A workflow is the configuration of a flow of messages from a source to a target. The connector supports up to 20 concurrent workflows per instance.

The connector will not provision queues which do not exist.

Prerequisites

- Solace PubSub+ Event Broker
- SolaceDBConnector

Quick Start common steps

These are the steps that are required to run all quick-start examples:

1. Update the provided `samples/config/application.yml` with the values for your deployment.

Quick Start: Running the connector via command line

Run:

```
java -jar pubsubplus-connector-database-2.0.1.jar --spring.config.additional-location
=file:samples/config/
```

By default, this command detects any Spring Boot configuration files as per the Spring Boot's default locations.

For more information, see Configure Locations to Find Spring Property Files.

Quick Start: Running the connector via `start.sh` script

For convenience, you can start the connector through the shell script using the following command:

```
chmod 744 ./bin/start.sh
./bin/start.sh [-n NAME] [-l FOLDER] [-p PROFILE] [-c FOLDER] [-ch HOST] [-cp PORT] [
-j FILE] [-cm] [-cmh HOST] [-cmp PORT] [-mh HOST] [-mp PORT] [-o OPTIONS] [-b]
```

The script shows you all errors at the same time:

```
./bin/start.sh -l dummy_folder -c dummy_folder -j dummy_file.jar
```

The script shows you all errors at the same time:

```
pubsubplus-connector-database

Connector startup failed:

Following folder doesn't exists on your filesystem:     'dummy_folder'
Following folder doesn't exists on your filesystem:     'dummy_folder'
Following file doesn't exists on your filesystem:       'dummy_file.jar'
```

In situations where you don't provide a parameter, the script runs with the predefined values as follows:

Parameter	Default Value	Description
`-n, --name`	`application`	The name of the connector instance, that is configured in [spring.application.name]. This name impacts on grouping connectors only.
`-l, --libs`	`./libs`	The directory that contains the required and optional dependency JAR files, such as Micrometer metrics export dependencies (if configured). If this option is not specified, it will use the current `./libs/` directory.
`-p, --profile`	`empty, no profile is used`	The profile to be used with the connector's configuration. The configuration file named 'application-<profile>.yml' is used. If this option is not specified, no profile is used.

Parameter	Default Value	Description
`-c, --config`	`./ or current folder`	The path to the folder containing the configuration files to be applied when the connector starts up the chosen profile. If not specified, the current directory is used.
`-H, --host`	`127.0.0.1`	Specifies the host where the connector runs.
`-P, --port`	`8090`	Specifies the port where connector runs.
`-mp, --mgmt_port`	`9009`	Specifies the management port for back calls of current connector from PubSub+ Connector Manager. This parameter is ignored if the `-cm` parameter is not provided.
`-j, --jar`	`pubsubplus-connector-database-2.0.1.jar`	The path to the specified JAR file to start the connector. If the option is not specified, the default JAR file is used from the current directory.
`-cm, --manager`	`application`	Specifies PubSub+ Connector Manager to use the configuration storage and allows you to enable the cloud configuration for the connector. When this parameter is enabled, you can specify the `-mp` or `--mgmt_port`, `-H` or `--host`, and `-cmh` with the `-cmp` parameters, unless you want to use default values for those parameters. Be aware, this option disable listed parameters to be read from configuration file. In this case, the operator must explicitly specify the parameters for the script, otherwise defaultdefault values are used.
`-cmh, --cm_host`	`127.0.0.1`	Specifies the host where Connector Manager is running. This parameter is ignored if the `-cm` parameter is not provided.

Parameter	Default Value	Description
`-cmp, --cm_port`	`9500`	Specifies the port where Connector Manager is running. This parameter is ignored if `-cm` parameter is not provided.
`-o, --options`	`no default values`	Specifies the JVM options used on when the connector starts. For example, `-Xms64M -Xmx1G`.
`-tls`	`N/A`	Specifies to use HTTPS instead of HTTP. . When this parameter is used, the configuration file must contain an additional section with the preconfigured paths for the key store and trust store files.
`-s, --show`	`N/A`	Performs a dry run (does nothing). The output prints the start CLI command and its raw output and exits. This parameter is useful to check your parameters without running the connector.
`-b, --background`	`N/A`	Runs the connector in the background. No logs are shown and the connector continues running in detached mode.
`-h, --help`	`N/A`	Prints the help information and exits.

Script also provides that help information from command line using parameter `-h`.

More configuration example of starting Connector together with Connector Manager are provided by the Connector Manager samples.

Quick Start: Running the connector as a Container

The following steps show how to use the sample docker compose file that has been included in the package:

1. Change to the `docker` directory:

   ```
   cd samples/docker
   ```

   This directory contains both the `docker-compose.yml` file as well as an `.env` file that contains

environment secrets required for the container's health check.

2. Run the connector:

```
docker-compose up -d
```

This sample docker compose file will:

- Exposes the connector's `8090` web port to `8090` on the host.
- Connects a PubSub+ event broker and SolaceDBConnector exposed on the host using default ports.
- Mounts the `samples/config` directory.
- Mounts the previously defined `libs` directory.
- Creates a `healthcheck` user with read-only permissions.
  - The default username and password for this user can be found within the `.env` file.
  - This user overrides any users you have defined in your `application.yml`. See here for more information.
- Uses the connector's management health endpoint as the container's health check.

For more information about how to use and configure this container, see the connector's container documentation.

Enabling Workflows

The provided `application.yml` enables workflow 0 and 1. To enable additional workflows, define the following properties in the `application.yml`, where `<workflow-id>` is a value between `[0-19]`:

```
spring:
  cloud:
    stream:
      bindings: # Workflow bindings
        input-<workflow-id>:
          destination: <input-destination> # Queue name
          binder: (solace|solace-db) # Input system
        output-<workflow-id>:
          destination: <output-destination> # Topic name
          binder: (solace|solace-db) # Output system

solace:
  connector:
    workflows:
      <workflow-id>:
        enabled: true
```

The connector only supports workflows in the directions of:

- `solace` → `SolaceDBConnector`
- `SolaceDBConnector` → `solace`

For more information about Spring Cloud Stream and the Solace PubSub+ binder, see:

- Spring Cloud Stream Reference Guide
- Spring Cloud Stream Binder for Solace PubSub+

Configuring Connection Details

Solace PubSub+ Connection Details

The Spring Cloud Stream Binder for PubSub+ uses Spring Boot Auto-Configuration for the Solace Java API to configure its session.

In the `application.yml`, this typically is configured as follows:

```
solace:
  java:
    host: tcp://localhost:55555
    msg-vpn: default
    client-username: default
    client-password: default
```

For more information and options to configure the PubSub+ session, see Spring Boot Auto-Configuration for the Solace Java API.

Preventing Message Loss when Publishing to Topic-to-Queue Mappings

If the connector is publishing to a topic that is subscribed to by a queue, messages may be lost if they are rejected. For example, if queue ingress is shutdown.

To prevent message loss, configure `reject-msg-to-sender-on-discard` with the `including-when-shutdown` flag.

Connecting to Multiple Systems

To connect to multiple systems of a same type, use the multiple binder syntax.

For example:

```
spring:
  cloud:
    stream:
      binders:

        # 1st solace binder in this example
        solace1:
          type: solace
          environment:
            solace:
              java:
                host: tcp://localhost:55555

        # 2nd solace binder in this example
```

```
        solace2:
          type: solace
          environment:
            solace:
              java:
                host: tcp://other-host:55555

        # The only solace-db binder
        solace-db1:
          type: solace-db
          # Add `environment` property map here if you need to customize this binder.
          # But for this example, we'll assume that defaults are used.

        # Required for internal use
        undefined:
          type: undefined
      bindings:
        input-0:
          destination: <input-destination>
          binder: solace-db1
        output-0:
          destination: <output-destination>
          binder: solace1 # Reference 1st solace binder
        input-1:
          destination: <input-destination>
          binder: solace-db1
        output-1:
          destination: <output-destination>
          binder: solace2 # Reference 2nd solace binder
```

The configuration above defines two binders of type `solace` and one binder of type `solace-db`, which are then referenced within bindings.

Each binder above is configured independently under `spring.cloud.stream.binders.<binder-name>.environment`.

- When connecting to multiple systems, all binder configuration must be specified using the multiple binder syntax for all binders. For example, under the `spring.cloud.stream.binders.<binder-name>.environment`.
- Do not use single-binder configuration (for example, `solace.java.*` at the root of your `application.yml`) while using the multiple binder syntax.

User-configured Header Transforms

Deprecated

This feature is deprecated and will be removed in a future release. Use Message Transforms instead.

Generic Migration Rules:

1. Configuration Structure Changes:
   a. Replace `solace.connector.workflows.<n>.transform-headers` with `solace.connector.workflows.<n>.transform` and within it:
      i. Add `enabled: true` to enable transforms
      ii. Move `transform-headers.expressions` to the `transform.expressions` list property
2. Expression Syntax Changes:
   - Replace direct header references, `headers.<headerName>`, with `source['headers']['<headerName>']` for reading
   - Use `target['headers']['<headerName>'] = ⋯` for writing
   - Replace Java methods (`T(String)`, etc.) with built-in functions:
     - `T(String).join()` → `#joinString()`
     - `split()` → `#splitString()`
     - `toUpperCase()` → `#upperCaseString()`
     - `toLowerCase()` → `#lowerCaseString()`
     - etc

Example Migration:

Old Configuration:

```
solace:
  connector:
    workflows:
      0:
        transform-headers:
          expressions:
            route: "T(String).format('%s/%s', headers.region,
headers.status)"
            count: "headers.count.toString()"
```

New Configuration:

```
solace:
```

```
  connector:
    workflows:
      0:
        transform:
          enabled: true
          expressions:
            - transform: "target['headers']['route'] = #joinString('/',
source['headers']['region'], source['headers']['status'])"
            - transform: "target['headers']['count'] =
#convertNumberToString(source['headers']['count'])"
```

Generally, the consumed message's headers are propagated through the connector to the output message. If you want to transform the headers, then you can do so as follows:

```
# <workflow-id> : The workflow ID ([0-19])
# <header> : The key for the outbound header
# <expression> : A SpEL expression which has "headers" as parameters

solace.connector.workflows.<workflow-id>.transform-
headers.expressions.<header>=<expression>
```

Example 1: To create a new header, `new_header`, for workflow `0` that is derived from the headers `foo` & `bar`:

```
solace.connector.workflows.0.transform-headers.expressions.new_header
="T(String).format('%s/abc/%s', headers.foo, headers.bar)"
```

Example 2: To remove the header, `delete_me`, for workflow `0`, set the header transform expression to `null`:

```
solace.connector.workflows.0.transform-headers.expressions.delete_me="null"
```

For more information about Spring Expression Language (SpEL) expressions, see Spring Expression Language (SpEL).

User-configured Payload Transforms

Deprecated

This feature is deprecated and will be removed in a future release. Use Message Transforms instead.

Message payloads going through a workflow can be transformed using a Spring Expression Language (SpEL) expression as follows:

```
# <workflow-id> : The workflow ID ([0-19])
# <expression> : A SpEL expression

solace.connector.workflows.<workflow-id>.transform-payloads.expressions[0].transform
=<expression>
```

A SpEL expression may reference:

- `payload`: To access the message payload.
- `headers.<header_name>`: To access a message header value.
- Registered functions.

While the syntax uses an array of expressions, only a single transform expression is supported in this release. Multiple transform expressions may be supported in the future.

Registered Functions

Registered functions are built-in and can be called directly from SpEL expressions. To call a registered function, use the `#` character followed by the function name. The following table describes the available registered functions:

Registered Function Signature	Description
`boolean isPayloadBytes(Object obj)`	Returns whether the object `obj` is an instance of `byte[]` or not. Sample usage of this function within a SpEL expression: `"#isPayloadBytes(payload) ? true : false"`

Example 1: To normalize `byte[]` and `String` payloads as upper-cased `String` payloads or leave payloads unchanged when of different types:

```
solace.connector.workflows.0.transform-payloads.expressions[0].transform
="#isPayloadBytes(payload) ? new String(payload).toUpperCase() : payload instanceof
```

```
T(String) ? payload.toUpperCase() : payload"
```

Example 2: To convert `String` payloads to `byte[]` payloads using a `charset` retrieved from a message header or leave payloads unchanged when of different types:

```
solace.connector.workflows.0.transform-payloads.expressions[0].transform="payload
instanceof T(String) ?
payload.getBytes(T(java.nio.charset.Charset).forName(headers.charset)) : payload"
```

For more information about Spring Expression Language (SpEL) expressions, see Spring Expression Language (SpEL).

Message Headers

Solace and solace-db headers can be created or manipulated using the User-configured Header Transforms feature described above.

Solace Headers

Solace headers exposed to the connector are documented in the Spring Cloud Stream Binder for Solace PubSub+ documentation.

Reserved Message Headers

The following are reserved header spaces:

- `solace_`
- `scst_`
- Any headers defined by the core Spring messaging framework. See Spring Integration: Message Headers for more info.

Any headers with these prefixes (that are not defined by the connector or any technology used by the connector) may not be backwards compatible in future releases of this connector.

Management and Monitoring Connector

Monitoring Connector's States

The connector provides an ability to monitor its internal states through exposed endpoints provided by Spring Boot Actuator.

An Actuator shares information through the endpoints reachable over HTTP/HTTPS. The endpoints that are available are configured in the connector configuration file.

What endpoints are available is configured in the connector configuration file:

```
management:
  simple:
    metrics:
      export:
        enabled: true
  endpoints:
    web:
      exposure:
        include:
"health,metrics,loggers,logfile,channels,env,workflows,leaderelection,bindings,info"
```

The above sample configuration enables metrics collection through the configuration parameter of `management.simple.metrics.export.enabled` set to `true` and then shares them through the HTTP/HTTPS endpoint together with other sections configured for the current connector.

Exposed HTTP/HTTPS Endpoints

The set of endpoints exposed through the HTTP/HTTPS endpoint.

- Exposed endpoints are available if you query the endpoints using the web interface (for example `https://localhost:8090/actuator/<some_endpoint>`) and also available in PubSub+ Connector Manager.
- The operator may choose to not expose all or some of these endpoints. If so, the Actuator endpoints that are not exposed are not visible if you query the endpoints (for example, `https://localhost:8090/actuator/<some_endpoint>`) nor in PubSub+ Connector Manager.

The simple metrics registry is only to be used for testing. It is not a production-ready means of collecting metrics. In production, use a dedicated monitoring system (for example, Datadog, Prometheus, etc.) to collect metrics.

The Actuator endpoint now contains information about Connector's internal states shared over the following HTTP/HTTPS endpoint:

```
GET: /actuator/
```

The following shows an example of the data shared with the configuration above:


```
{
  "_links": {
    "self": {
      "href": "/actuator",
      "templated": false
    },
    "workflows": {
      "href": "/actuator/workflows",
      "templated": false
    },
    "workflows-workflowId": {
      "href": "/actuator/workflows/{workflowId}",
      "templated": true
    },
    "leaderelection": {
      "href": "/actuator/leaderelection",
      "templated": false
    },
    "health-path": {
      "href": "/actuator/health/{*path}",
      "templated": true
    },
    "health": {
      "href": "/actuator/health",
      "templated": false
    },
    "metrics": {
      "href": "/actuator/metrics",
      "templated": false
    },
    "metrics-requiredMetricName": {
      "href": "/actuator/metrics/{requiredMetricName}",
      "templated": true
    }
  }
}
```

Health

The connector reports its health status using the Spring Boot Actuator health endpoint.

To configure the information returned by the `health` endpoint, configure the following properties:

- `management.endpoint.health.show-details`
- `management.endpoint.health.show-components`

For more information, about health endpoints, see Spring Boot documentation.

Health for the workflow, Solace binder, and solace-db binder components are exposed when `management.endpoint.health.show-components` is enabled. For example:

```
management:
  endpoint:
   health:
    show-components: always
    show-details: always
```

This configuration would always show the full details of the health check including the workflows and binders. The default value is `never`.

Workflow Health

A `workflows` health indicator is provided to show the health status for each of a connector's workflows. This health indicator has the following form:

```
{
  "status": "(UP|DOWN)",
  "components": {
    "<workflow-id>": {
      "status": "(UP|DOWN)",
      "details": {
        "error": "<error message>"
      }
    }
  }
}
```

Health Status	Description
`UP`	A status that indicates the workflow is functioning as expected.
`DOWN`	A status that indicates the workflow is unhealthy. Operator intervention may be required.

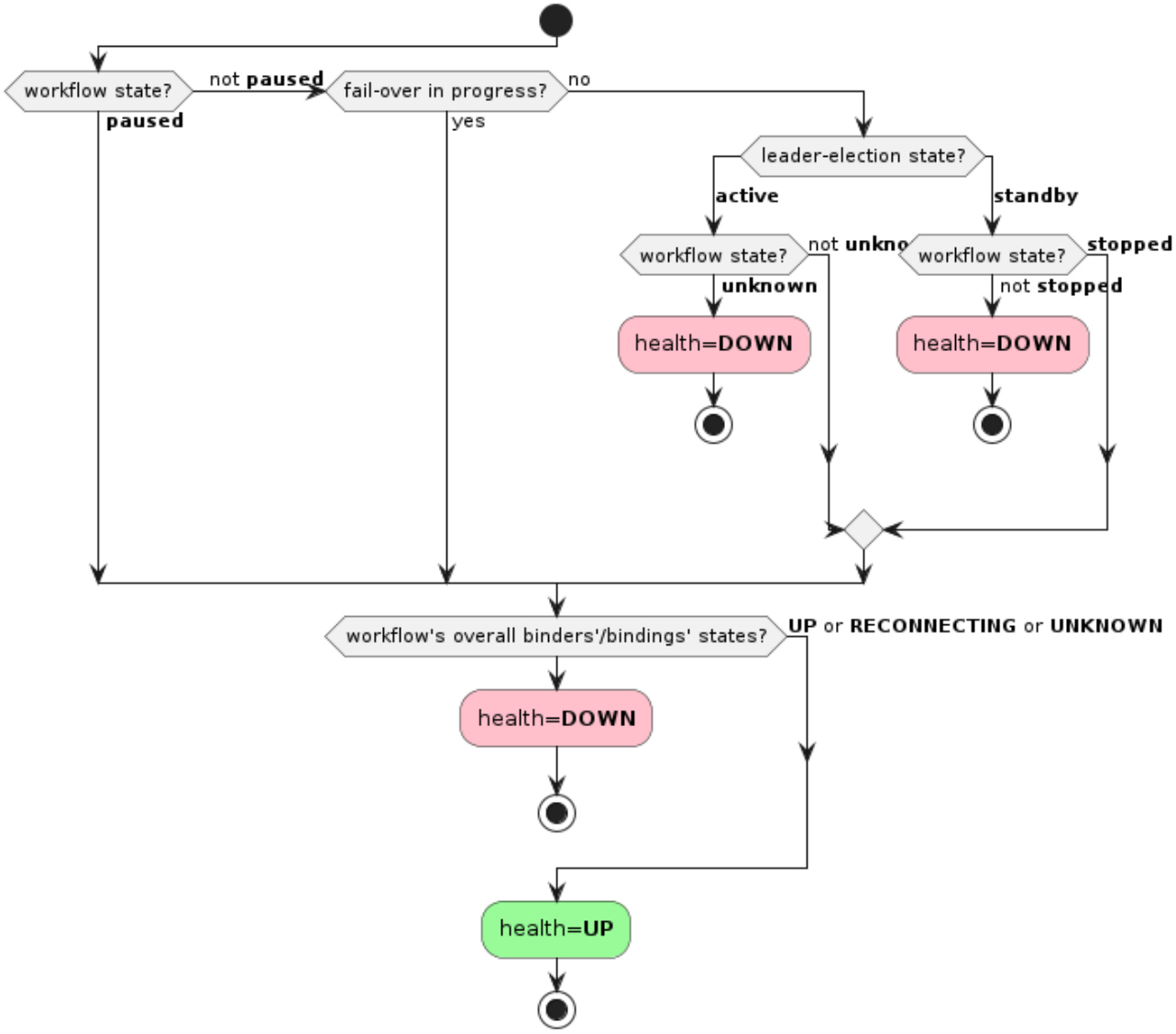


Figure 1. Workflow Health Resolution Diagram

This health indicator is enabled default. To disable it, set the property as follows:

```
management.health.workflows.enabled=false
```

Solace Binder Health

For details, see the Solace binder documentation.

Leader Election

The connector has three leader election modes for redundancy:

Leader Election Mode	Description
Standalone (Default)	A single instance of a connector without any leader election capabilities.
Active-Active	A participant in a cluster of connector instances where all instances are active.
Active-Standby	A participant in a cluster of connector instances where only one instance is active (i.e. the leader), and the others are standby.

Operators can configure the leader election mode by setting the following configuration:

```
solace.connector.management.leader-election.mode
=(standalone|active_active|active_standby)
```

Leader Election Modes: Standalone / Active-Active

When the connector starts, all enabled workflows start at the same time. The connector itself is considered as always active.

Leader Election Mode: Active-Standby

If the connector is in active-standby mode, a PubSub+ management session and management queue must be configured as follows:

```
solace.connector.leader-election.mode=active_standby

# Management session
# Exact same interface as solace.java.*
solace.connector.management.session.host=<management-host>
solace.connector.management.session.msgVpn=<management-vpn>
solace.connector.management.session.client-username=<client-username>
solace.connector.management.session.client-password=<client-password>
solace.connector.management.session.<other-property-name>=<value>

# Management queue name accessible by the management session
# Must have exclusive access type
solace.connector.management.queue=<management-queue-name>
```

To determine if the connector is `active` or `standby`, it creates a flow to the management queue. If this flow is active, then the connector's state is `active` and will start its enabled workflows. Otherwise, if this flow is inactive, then the connector's state is `standby` and will stop its enabled workflows.

At a macro level for a cluster of connectors, failover only happens when there are infrastructure failures (for example, the JVM goes down or networking failures to the management queue).

If a workflow fails to start or stop during failover, it will retry up to some maximum defined by the configuration option, `solace.connector.management.leader-election.fail-over.max-attempts`.

During failover, the connector attempts to start or stop all enabled workflows. After an attempt has been made to start or stop each workflow, the connector transitions to the active/standby mode regardless of the status of the workflows.

Leader Election Management Endpoint

A custom `leaderelection` management endpoint was provided using Spring Actuator.

Operators can navigate to the connector's `leaderelection` management endpoint to view its leader election status.

Endpoint	Operation	Payloads
`/leaderelection`	Read (HTTP `GET`)	**Request:** None. **Response:** `{ "mode": { "type": "(standalone | active_active | active_standby)", ①  "state": "(active | standby)", ②  "source": { ③  "queue": "<management-queue-name>", "host": "<management-host>", "msgVpn": "<management-vpn>" } } }` ① Mandatory parameter in output ② Mandatory parameter in output ③ Optional section. Appears only when `type` is set to `active_standby`.

Workflow Management

Workflow Management Endpoint

A custom `workflows` management endpoint using Spring Actuator is provided to manage workflows.

To enable the `workflows` management endpoint:

```
management:
  endpoints:
    web:
      exposure:
        include: "workflows"
```

Once the `workflows` management endpoint is enabled, the following operations can be performed:

Endpoint	Operation	Payloads
`/workflows`	Read (HTTP `GET`)	**Request:** None. **Response:** Same payload as the `/workflows/{workflowId}` read operation, but as a list of all workflows.
`/workflows/{workflowId}`	Read (HTTP `GET`)	**Request:** None. **Response:** `{ "id": "<workflowId>", "enabled": (true|false), "state": "(running|stopped|paused|unknown)", "inputBindings": [ "<input-binding>" ], "outputBindings": [ "<output-binding>" ] }`
`/workflows/{workflowId}`	Write (HTTP `POST`)	**Request:** `{ "state": "STARTED|STOPPED|PAUSED|RESUMED" }` **Response:** None.

Only workflows with Solace PubSub+ consumers (where the `solace` binder is defined in the `input-#`) support pause/resume.

Some features require for the connector to manage workflow lifecycles. There's no guarantee that workflow states continue to persist when write operations are used to change the workflow states while such features are in use.

For example: When the connector is configured in the active-standby leader election mode, workflows will automatically transition from `running` to `stopped` when the connector fails over from `active` to `standby`. Vice-versa for a failover in the opposite direction.

Workflow States

A workflow's state is defined as the aggregate states of its bindings (see the `bindings` management endpoint) as follows:

Workflow State	Condition
`running`	All bindings have `state="running"`.
`stopped`	All bindings have `state="stopped"`.
`paused`	All consumer bindings and all pausable producer bindings have `state="paused"`.
`unknown`	None of the other states. Represents an inconsistent aggregate binding state.

When the producer or consumer binding is not implementing Spring's Lifecycle interface, Spring always reports the bindings as `state=N/A`. The `state=N/A` is ignored when deciding the overall state of the workflow. For example, if the consumer's binding is `state=running` and producer's binding `state=N/A` (or vise-versa), the workflow state would be `running`.

For more information about binding states, see Spring Cloud Stream: Binding visualization and control.

Metrics

This connector uses Spring Boot Metrics that leverages Micrometer to manage its metrics.

Connector Meters

In addition to the meters already provided by the Spring framework, this connector introduces the following custom meters:

Name	Type	Tags	Description	Notes

`solace.connector.process`	`Timer`	`type: channel`
		
		`name: <bindingName>`
		
		`result: (success|failure)`
		
		`exception: (none|exception simple class name)`
			The processing time.	This meter is a rename of `spring.integration.send` whose `name` tag matches a binding name.

`solace.connector.error.process`	`Timer`	`type: channel`
		
		`name: <bindingNames>`
		
		`result: (success|failure)`
		
		`exception: (none|exception simple class name)`
			The error processing time.	This meter is a rename of `spring.integration.send` whose `name` tag matches an input binding's error channel name (`<destination>.<group>.errors`).
				
				Meters might be merged under the same `name` tag (delimited by `|`) if multiple bindings have the same error channel name (for example, bindings can have a matching `destination`, `group`, or both). **NOTE: Setting a binding's `group` is not supported.**

`solace.connector.message.size.payload`	`DistributionSummary` Base Units: `bytes`	`name: <bindingName>`	The message payload size.	

Name	Type	Tags	Description	Notes
solace.connector.message.size.total	DistributionSummary Base Units: bytes	name: <bindingName>	The total message size.	
solace.connector.publish.ack	Counter Base Units: acknowledgments	name: <bindingName> result: (success|failure) exception: (none|exception simple class name)	The publish acknowledgment count.	
solace.connector.transform.expressions.count	Gauge Base Units: expressions	workflow.id: <workflowId>	Transformation expressions count	
solace.connector.transform.time	Timer	workflow.id: <workflowId> result: (success|failure)	Transformation execution time	This is the aggregate time for all expressions used to transform a single message.

The solace.connector.process meter with result=failure is not a reliable measure of tracking the number of failed messages. It only tells you how many times a step processed a message (or batch of messages), how long it took to process that message, and if that step completed successfully.

Instead, we recommend that you use a combination of solace.connector.error.process and solace.connector.publish.ack to track failed messages.

Add a Monitoring System

By default, this connector includes the following monitoring systems:

- Datadog
- Dynatrace
- Influx
- JMX
- OpenTelemetry (OTLP)

- StatsD

To add additional monitoring systems, add the system's `micrometer-registry-<system>` JAR file and its dependency JAR files to the connector's classpath. The included systems can then be individually enabled/disabled by setting `management.<system>.metrics.export.enabled=true` in the `application.yml`.

Security

Securing Endpoints

Exposed Management Web Endpoints

There are many endpoints that are automatically enabled for this connector. For a comprehensive list, see Management and Monitoring Connector.

The `health` endpoint only returns the root status by default (i.e. no health details).

To enable other management endpoints, see Spring Actuator Endpoints.

Authentication & Authorization

This release of the connector only supports basic HTTP authentication.

By default, no users are created unless the operator configures them in their configuration file. The configuration parameters responsible for security are as follows:

```
solace:
  connector:
    security:
      enabled: true
      users:
      - name: user1
        password: pass
      - name: admin1
        password: admin
        roles:
        - admin
```

In the above example, we have created two users:

- **user1**: Has access to perform GET (Read) requests.
- **admin1**: Has access to perform GET and POST (Read & Write) requests.

To fully disable security and permit anyone to access the connector's web endpoints, operators can configure the `solace.connector.security.enabled` parameter `false`.

While these properties could be defined in an `application.yml` file, we recommend that you use environment variables to set secret values.

The following example shows you how to define users using environment variables:

```
# Create user with no role (i.e. read-only)
SOLACE_CONNECTOR_SECURITY_USERS_0_NAME=user1
```

```
SOLACE_CONNECTOR_SECURITY_USERS_0_PASSWORD=pass

# Create user with admin role
SOLACE_CONNECTOR_SECURITY_USERS_1_NAME=admin1
SOLACE_CONNECTOR_SECURITY_USERS_1_PASSWORD=admin
SOLACE_CONNECTOR_SECURITY_USERS_1_ROLES_0=admin
```

In the above example, we have created two users:

- **user1**: Has access to perform GET (Read) requests.
- **admin1**: Has access to perform GET and POST (Read & Write) requests.

`solace.connector.security.users` is a list. When users are defined in multiple sources (different `application.yml` files, environment variables, and so on), overriding works by replacing the entire list. In other words, you must pick one place to define all your users, whether in a **single** application properties file or as environment variables.

For more information, see Spring Boot - Merging Complex Types.

TLS

TLS is disabled by default.

To configure TLS, see Spring Boot - Configure SSL and TLS Setup in Spring.

Consuming Object Messages

For the connector to process object messages, it needs access to the classes which define the object payloads.

Assuming that your payload classes are in their own project(s) and are packaged into their own jar(s), place these jar(s) and their dependencies (if any) onto the connector's classpath.

It is recommended that these jars only contain the relevant payload classes to prevent any oddities.

In the jar(s), your class files must be archived in the same directory/classpath as the application that publishes them.

e.g. If the source application is publishing a message with payload type, `MySerializablePayload`, defined under classpath `com.sample.payload`, then when packaging the payload jar for the connector, the `MySerializablePayload` class must still be accessible under the `com.sample.payload` classpath.

Typically, build tools such as Maven or Gradle will handle this when packaging jars.

Adding External Libraries

The connector jar uses the `loader.path` property as the recommended mechanism for adding external libraries to the connector's classpath.

See Spring Boot - PropertiesLauncher Features for more info.

To add libraries to the connector's container image, see the connector's container documentation.

Configuration

Providing Configuration

For information about about how the connector detects configuration properties, see Spring Boot: Externalized Configuration.

Converting Canonical Spring Property Names to Environment Variables

For information about converting the Spring property names to environment variables, see the Spring documentation.

Spring Profiles

If multiple configuration files exist within the same configuration directory for use in different environments (development, production, etc.), use Spring profiles.

Using Spring profiles allow you to define different application property files under the same directory using the filename format, `application-{profile}.yml`.

For example:

- `application.yml`: The properties in non-specific files that always apply. Its properties are overridden by the properties defined in profile-specific files.
- `application-dev.yml`: Defines properties specific to the development environment.
- `application-prod.yml`: Defines properties specific to the production environment.

Individual profiles can then be enabled by setting the `spring.profiles.active` property.

See Spring Boot: Profile-Specific Files for more information and an example.

Configure Locations to Find Spring Property Files

By default, the connector detects any Spring property files as described in the Spring Boot's default locations.

- If you want to add additional locations, add `--spring.config.additional-location=file:<custom-config-dir>` (This parameter is similar to the example command in Quick Start: Running the connector via command line).
- If you want to exclusively use the locations that you've defined and ignore Spring Boot's default locations, add `--spring.config.location=optional:classpath:/,optional:classpath:/config/,file:<custom-config-dir>`.

For more information about configuring locations to find Spring property files, see Spring Boot documentation.

If you want configuration files for multiple, different connectors within the same `config` directory for use in different environments (such as development, production, etc.), we recommend that you use Spring Boot Profiles instead of child directories. For example:

- Set up your configuration like this:
  - `config/application-prod.yml`
  - `config/application-dev.yml`
- Do not do this:
  - `config/prod/application.yml`
  - `config/dev/application.yml`

Child directories are intended to be used for merging configuration from multiple sources of configuration properties. For more information and an example of when you might want to use multiple child directories to compose your application's configuration, see the Spring Boot documentation.

Obtaining Build Information

Build information, including version, build date, time and description is enabled by default via Spring Boot Actuator Info Endpoint. By default, every connector shares all information related to its build only.

Below is the structure of the output data:

```
{
  "build": {
    "version": "<connector version>",
    "artifact": "<connector artifact>",
    "name": "<connector name>",
    "time": "<connector build time>",
    "group": "<connector group>",
    "description": "<connector description>",
    "support": "<support information>"
  }
}
```

If you want to exclude build data from the output of the `info` endpoint, set `management.info.build.enabled` to `false`.

Alternatively, if you want to disable the info endpoint entirely, you can remove 'info' from the list of endpoints specified in `management.endpoints.web.exposure.include`.

Spring Configuration Options

This connector packages many libraries for you to customize functionality. Here are some

references to get started:

- Spring Cloud Stream
- Spring Cloud Stream Binder for Solace PubSub+
- Spring Logging
- Spring Actuator Endpoints
- Spring Metrics

Connector Configuration Options

The following table lists the configuration options. The following options in **Config Option** are prefixed with `solace.connector.`:

Config Option	Type	Default Value	Description
`management.leader-election.fail-over.max-attempts`	`int` **Constraint:** `> 0`	`3`	The maximum number of attempts to perform a fail-over.
`management.leader-election.fail-over.back-off-initial-interval`	`long` **Constraint:** `> 0`	`1000`	The initial interval (milliseconds) to back-off when retrying a fail-over.
`management.leader-election.fail-over.back-off-max-interval`	`long` **Constraint:** `> 0`	`10000`	The maximum interval (milliseconds) to back-off when retrying a fail-over.
`management.leader-election.fail-over.back-off-multiplier`	`double` **Constraint:** `>= 1.0`	`2.0`	The multiplier to apply to the back-off interval between each retry of a fail-over.
`management.leader-election.mode`	`enum` One of: • `standalone` • `active_active` • `active_standby`	`standalone`	The connector's leader election mode. **standalone:** A single instance of a connector without any leader election capabilities. **active_active:** A participant in a cluster of connector instances where all instances are active. **active_standby:** A participant in a cluster of connector instances where only one instance is active (i.e. the leader), and the others are standby.
`management.queue`	`string`	`null`	The management queue name.

Config Option	Type	Default Value	Description
`management.session.*`	See Spring Boot Auto-Configuration for the Solace Java API		Defines the management session. This has the same interface as that used by `solace.java.*`. See Spring Boot Auto-Configuration for the Solace Java API for more info.
`security.enabled`	`boolean`	`true`	If `true`, security is enabled. Otherwise, anyone has access to the connector's endpoints.
`security.users[<index>].name`	`string`	`null`	The name of the user.
`security.users[<index>].password`	`string`	`null`	The password for the user.
`security.users[<index>].roles`	`list<string>` Valid values: • `admin`	`empty list (i.e. read-only)`	The list of roles that the specified user has. It has read-only access if no roles are returned.

Workflow Configuration Options

These configuration options are defined under the following prefixes:

- `solace.connector.workflows.<workflow-id>.`: If the options support per-workflow configuration and the default prefixes.
- `solace.connector.default.workflow.`: If the options support default workflow configuration.

Config Option	Type	Default Value	Description
`enabled`	`boolean`	`false`	If `true`, the workflow is enabled.  Cannot be set at the default workflow level.
`transform.enabled`	`boolean`	`false`	If `true`, message transformation is enabled for the workflow. Disables the legacy `transform-headers.*` and `transform-payload.*` options. See Message Transforms for more info.

Config Option	Type	Default Value	Description
`transform.source-payload.content-type`	`string` One of: • `application/vnd.solace.micro-integration.unspecified` • `application/json`	`application/vnd.solace.micro-integration.unspecified`	The content type to interpret the source payload as. See Content Type Interpretation for more info.
`transform.target-payload.content-type`	`string` One of: • `application/vnd.solace.micro-integration.unspecified` • `application/json`	`application/vnd.solace.micro-integration.unspecified`	The content type to interpret and serialize the target payload as. See Content Type Interpretation for more info.
`transform.expressions[<index>].transform`	`string` A SpEL expression		A SpEL expression at some `<index>` in the ordered list of expressions to transform the message. See Message Transform for more info.
`transform-headers.expressions`	`Map<string, string>` **Key:** A header name. **Value:** A SpEL string that accepts `headers` as parameters.	`empty map`	⚠ Deprecated. Use Message Transforms (`transform.*`) instead. A mapping of header names to header value SpEL expressions. The SpEL context contains the `headers` parameter that can be used to read the input message's headers.
`acknowledgment.publish-async`	`boolean`	`false`	If `true`, publisher acknowledgment processing is done asynchronously. The workflow's consumer and producer bindings must support this mode, otherwise the publisher acknowledgments are processed synchronously regardless of this setting.

Config Option	Type	Default Value	Description
acknowledgment.back-pressure-threshold	int **Constraint:** >= 1	255	The maximum number of outstanding messages with unresolved acknowledgments. Message consumption is paused when the threshold is reached to allow for producer acknowledgments to catch up.
acknowledgment.publish-timeout	int **Constraint:** >= -1	600000	The maximum amount of time (in millisecond) to wait for asynchronous publisher acknowledgments before considering a message as failed. A value of -1 means to wait indefinitely for publisher acknowledgments.

include::../../../snippets/attributes/common.adoc

Database Source Configuration Options

application-operator.yml

These configuration options are all prefixed by solace-persistence.:

Config Option	Type	Valid Values	Default Value	Description
datasource	embedded config	see Spring Datasource Configuration		The spring datasource configuration to read data
jpa	embedded config	see Spring JPA Configuration		The spring jpa configuration
source.sendBatchSize	int	send in batch		currently only support sending one by one
source.sendPoolSize	int	max 255	100	the thread pool size used for sending messages
source.queryMax	int	query records a time	1000	query from table for the records number a time
source.maxDbRetry	int	int	3	retry times to db query on error occurred, in second
source.triggerInterval	long	long	1000	interval of each db query, in millisecond

Config Option	Type	Valid Values	Default Value	Description
source.enableRetry	string	true or false	true	if true, will retry to do db query
source.retryInterval	int	int	5	interval of sending to solace on error occurred, in second
source.maxSendRetry	int	int	3	retry times of sending to solace on error occurred, in second
source.enableBufferedJpaBatch	string	true or false	true	if true, connector will write back indicator values in batch mode
source.bufferWaitSeconds	int	int	5	max time to wait for the batch write, in second
source.enableDatabaseTimestamp	string	true or false	true	if true, will include the reading DB record time in the message header.
source.enableConnectorTimestamp	string	true or false	true	if true, will include the connector sending message time in the message header.
source.enableBenchmarkInfo	string	true or false	false	if true, print the performance statistics.
source.dbQueryMode	string	jpa or sql	jpa	the internal implementation of db query
source.strategy	string	readingIndicator , timestamp or sequential	readingIndicator	the strategy of handling db rows. readingIndicator stands for reading data by indicator values, timestamp stands for reading data by timestamp order and range ,sequential stands for reading data by specified order row;

application-db-processor.yml

These configuration options are all prefixed by solace-db.bindings.<binding-name>.consumer:

Config Option	Type	Valid Values	Default Value	Description
tableKey	string			key name for a source table
tableClass	string			entity class reference of source table
childTableKey	string			key name for a source child table
childTableClass	string			entity class reference of source child table
topic	string	topic name with multiple levels, using /		data topic name, send the event of record to this topic
lvqTopic	string	topic name with multiple levels, using /		lvq topic name, send checkpoint data to this topic
parentChildRelationKey	string			parent-child relations mapping as: <parent_table_column1>:<child_table_column1>,<parent_table_column2>:<child_table_column2>
dbParentCollection	string	map object		map object in the parent entity
parentChildMode	string	one2many or many2one	one2many	the parent-child table relationship mode
dbReadIndicatorColumn	string	source table indicator column		source table read indicator column
sql	string	a select sql		self defined sql to query source table, :<property-name> for variable
dbTrackingId	string	tracking id value		specify the tracking ID column property, disabled when value not presented

Config Option	Type	Valid Values	Default Value	Description
dbReadTime	string	connector will update this column when reading this record		specify the read time column property, update this column with the reading record time by connector. disabled when value not presented
dbReadIndicatorColumnUpdateValueInProgress	string	indicator column will change to this value		after records read by connector and in the process, only available on strategy readingIndicator
dbReadIndicatorColumnUpdateValueProcessed	string	indicator column will change to this value		after records read by connector, sent to solace as event and got the ack, only available on strategy readingIndicator
dbReadIndicatorColumnUpdateDefaultValue	string	default value		initial value and ready to read by connector, only available on strategy readingIndicator
dbReadIndicatorColumnUpdateFailedValue	string	set to a failed value		error or failed during processing, only available on strategy readingIndicator
dbReadRecordSequentialIndicator	string	table column property		table records reading sequencial column property
dbReadRecordSequentialOrder	string	asc or desc	asc	read table records
dbReadIndicatorBridgeFailedValue	boolean	true or false	false	if true, it will read the failed ones after starting the connector, if failed, it will ignore the failed one.
dbReadIndicatorBridgeInProgressValue	boolean	true or false	false	if true, it will read the in-progress ones after starting the connector, if failed, it will ignore the progress one.

Config Option	Type	Valid Values	Default Value	Description
propertiesEnabled.dbTrackingId	boolean	true or false	none	if false , dbTrackingId property must be configured as empty value; if true, dbTrackingId property must be configured and not empty
propertiesEnabled.dbReadTime	boolean	true or false	none	if false , dbReadTime property must be configured as empty value; if true, dbReadTime property must be configured and not empty
customMessageHeaders	map	header name		it will have custom_header in the message property, its value is from the record of the column property specified, prefixed by MESSAGE_HEADER_

Database Sink Configuration Options

application-operator.yml

These configuration options are all prefixed by solace-persistence.:

Config Option	Type	Valid Values	Default Value	Description
datasource	embedded config	see Spring Datasource Configuration		The spring datasource configuration to write data
jpa	embedded config	see Spring JPA Configuration		The spring jpa configuration
sink.db-crud-mode	string	jpa or sql(not fully supported)		db operations using jpa or sql
sink.jpaBatchMode	string	true or false	true	true to enable batch insert to the DB table

Config Option	Type	Valid Values	Default Value	Description
sink.jpaBatchSize	int	25,100…	25	Set the batch size to DB when jpaBatchMode is true
sink.jpaMaxRetry	int	2,3,4…	3	Retry times to insert to DB table times.
sink.jpaRetryWaitMilliseconds	int	3000	empty	Interval between retry, milliseconds
sink.redirectOnFailEnable	boolean	true or false	false	when true, if error occurred during consuming message payload , it will redirect this message to another new topic with a redirectPrefix prepend to the original topic name
sink.redirectOnUnknownTopic	boolean	true or false	false	when true, if the topic name in the queue is not mapped to any table, it will redirect this message to another new topic with a redirectPrefix prepend to the original topic name,available only when redirectOnFailEnable=true
sink.redirectTopicPattern	string		RD/${TOPIC}	pattern for redirected topic, ${TOPIC} stands for the original topic name
sink.payloadFormat	string	xml or json	xml	payload format sent to Solace queue

application-db-processor.yml

These configuration options are all prefixed by solace-db.bindings.<binding-name>.producer:

Config Option	Type	Valid Values	Default Value	Description
dbConnectorBlobEncoding	string	BASE64 or HEX	BASE64	Blob Encoding format in the message payload
dbConnectorTimestampFormat	string	timestamp format	yyyy/dd/MM.HH:mm:ss	Set the timestamp format pattern
dbMsgHeaderTimestampFormat	string	timestamp format	yyyy/dd/MM.HH:mm:ss	Set the message header timestamp format pattern

Config Option	Type	Valid Values	Default Value	Description
entities	map			map of embedding configurations of entity

ParentChildRelation configuration options are all prefixed by `solace-db.bindings.<binding-name>.producer.parentChildRelation`:

Config Option	Type	Valid Values	Default Value	Description
childNode:	string			the json node name relative to jsonNodePrefix conatins the child table data
childKey:	string			name of child entity if needed, childKey should be specified in entities
parentChildRelationKey:	string			parent-child relations mapping as: <parent_table_column1>:<child_table_column1>,<parent_table_column2>:<child_table_column2>

Entity configuration options are all prefixed by `solace-db.bindings.<binding-name>.producer.entities.<entity_name>`:

Config Option	Type	Valid Values	Default Value	Description
clazz:	string			entity class reference
jsonNodePrefix:	string			json node path of entity data
topicOperations:	map			map of embedding configurations of topic operation detail mappings
customMessageHeaders:	map	<header_property>:<entity property>		map of embedding configurations of custom message headers vs entity property mapping. ex : TRACK_ID: dbtrackid stands for : value of header MESSAGE_HEADER_TRACK_ID will be set to dbtrackid property

Topic operation configuration options are all prefixed by `solace-db.bindings.<binding-name>.producer.entities.<entity_name>.topicOperations`:

Config Option	Type	Valid Values	Default Value	Description
`save.topics`	`list`			list of topic names apply for `JPA save` operation, the event of contain this topic name will be saved to the table. wildcard `>`,`*` can be used for filter the topic.
`insert.topics`	`list`			list of topic names apply for `SQL insert` operation, the event of contain this topic name will be saved to the table. wildcard `>`,`*` can be used for filter the topic.
`insert.sql`	`string`			a prepared sql , ? for variable, ex: insert into passenger(passenger_id,name,address,nationality,contact_no) values(?,?,?,?,?)
`update.topics`	`list`			list of topic names apply for `SQL update` operation, the event of contain this topic name will be saved to the table. wildcard `>`,`*` can be used for filter the topic.
`update.sql`	`string`			a prepared sql , ? for variable, ex: update passenger set name=?,address=?,nationality=?,contact_no=? where passenger_id=?
`delete.topics`	`list`			list of topic names apply for `SQL delete` operation, the event of contain this topic name will be saved to the table. wildcard `>`,`*` can be used for filter the topic.
`delete.sql`	`string`			a prepared sql , ? for variable, ex: delete from passenger where passenger_id=?

More information

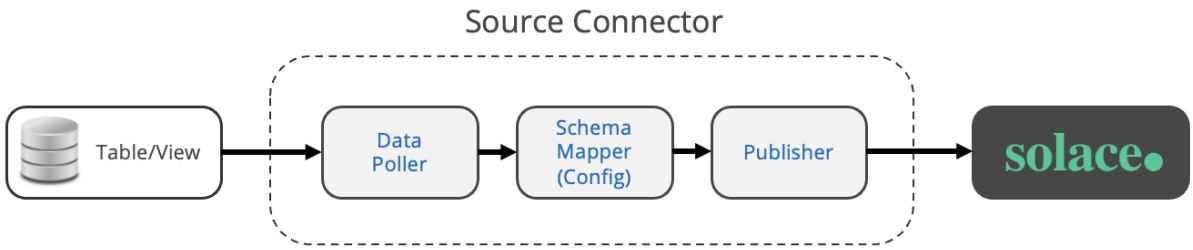
Solace Pubsub Connector For Database Source

1 Introduction

The **Solace Pubsub Connector For DB Source** has been built to make DB transactions participated in event mesh by using the Connector for DB Source

Solace Pubsub Connector For DB Source helps to read the database records and make it available as an event in the Solace Event Mesh for enterprise applications to consume.

Note: Pulls the records which are marked as unread.



1.1 Purpose

To guide the technical teams to setup the **Solace Pubsub Connector For DB Source**.

1.2. Scope

Covering the step-by-step guide to setup the **Solace Pubsub Connector For DB Source**.

1. Generate JPA Entities using the tool
2. Configure DB Souce Connector
    1. Connection Configuration (Database & Solace)
    2. Connector & Entity Configuration
    3. Schema Mapping (Table Structure to Solace Event Payload)

`Note: This document currently captures the deployment in Java environment.`

1.3 DB Connector Features

S.No	Feature
1	The source DB object from where Adapter polls remains as-is (as EMS). No change expected at application DB end (Includes Tables, Views & Child Table)
2	Adapter should pick records in sequence only (Based on Sequence Number and timestamp field)
3	The Adapter should be able to update each record with appropriate flag (in existing adb_l_delivery_status field) N - New : set by trigger P - Pending: under process (picked up by adapter, not yet published to messaging layer) C - Completed: Processing completed (published successfully to messaging layer) F - Failed: Fail to publish record
4	The adapter should have the capability to read in batch and update flag in batch to avoid chattiness and ensure better performance
5	Oracle DB should be supported (12g onwards (19C and ADG and RAC)
6	Design should be future proof for oracle version upgrades. Should support Thick and Thin DB driver
7	Should support ADG URL
8	Should have option to retry before marking record as 'F' The query to poll should be configurable.
9	Schema mapping feature should be Forward compatible.
10	Any new addition to DB schema should be ignored by Adapter unless Field name and mapping is provided.
11	Option to specify the data type of each field in the mapping.
12	Support for CLOB and BLOB
13	Date format to be as per the TIBCO specs - Should be configurable. default is yyyy-MM-dd’T’HH:mm:ss.SSS
14	Logging & Syslog

S.No	Feature
15	High Available & Fault Tolerance
16	Event Headers: In Solace Message Header, for each message published, add Tracking Id coming from source table Time at which picked from DB Time of publish to Solace

2 DB Connector Configuration

2.1. Pre-requisites

- JDK 17
- Maven 3.8+
- Solace
- Database for Oracle or MySQL

2.2. Install Solace Framework and Transform Engine

Go to the Framework jar and pom files folder and run below command to install into your local maven repo:

```
mvn install:install-file
-Dfile=solace-transformation-engine-1.0.10-SNAPSHOT.jar
-DgroupId=com.solace.connector.core
-DartifactId=solace-transformation-engine  -Dversion=1.0.10-SNAPSHOT
-DpomFile=solace-transformation-engine-1.0.10-SNAPSHOT.pom
```

2.3. Solace Pubsub Connector For DB Source

Download the Solace DB connector (spring-cloud-stream-binder-db and pubsubplus-connector-database) and unzip to the location/machine where the connector is getting installed

Go to spring-cloud-stream-binder-db folder and run:

```
mvn -DskipTests=true install
```

Go to pubsubplus-connector-database folder and run:

```
mvn -DskipTests=true clean package
```

2.4 DB Configuration

Cofiguration File: `projConfig/application.yml`

```
solace-persistence:
  datasource:
    driver-class-name: oracle.jdbc.OracleDriver
    url: jdbc:oracle:thin:@//192.168.3.178:1524/ORCLCDB
    username: c##test
    password: test
    hikari:
      initializationFailTimeout: -1
      connection-timeout: 5000
  jpa:
    hibernate:
      ddl-auto: none
      show-sql: false
    properties:
      hibernate:
        jdbc: batch_size: 100
        order_updates: true
        generate_statistics: false
      dialect: org.hibernate.dialect.Oracle10gDialect
      database: oracle
  source:
    dbQueryMode: jpa # jpa or sql(not fully supported)
    sendBatchSize: 1 #records per message
    sendPoolSize: 100 # send thread pool size, defalut 100 max 255
    queryMax: 2 #limited records per DB query
    maxDbRetry: 3
    triggerInterval: 2000
    retryInterval: 10 # seconds
    enableRetry: true #enable retry to send the message to Solace.
    retryCount: 3
    enableBufferedJpaBatch: true # only available when sendBatchSize = 1
    bufferWaitSeconds: 5
    enableTrackingId: true #update tracking Id to table
    enableDatabaseTimestamp: true
    enableConnectorTimestamp: true
    enableBenchmarkInfo: true
    skipMismatchError: false
    indicatorFlag: true
```

- Fill in all the required details of `solace-persistence.datasource` to establish a connection with Database.
- `solace-persistence.datasource` section, `batch_size`\: Given batch size will allow connector to update the status back to Database in a batch mode
- `solace-persistence.datasource.hikari` section, Hikari Settings: Will enable connector to perform retry/reconnect until it is timeout.
- `solace-persistence.source` section, Additional configurations to pull the data from Database.

2.5 Solace Configuration

Configuration File: `projConfig/application.yml`

```
spring:
  cloud:
    stream:
      bindings:
        input-0:
          destination: souceBinderLVQ #LVQ queue name
          binder: solace-db #Solacedatabase binder
          group: no
        output-0:
          destination: dxb/passenger #topic to send data
          binder: solace
          content-type: application/x-java-serialized-object
```

- `spring.cloud.stream.bindings.input-0` section, Fill in all the required details to establish a connection with Solace
- `spring.cloud.stream.bindings.output-0` section, Set contentType to application/x-java-serialized-object to send plain text message, the default is bytes.

Configure connection to Solace:

```
  java:
    host: tcp://192.144.217.87:55555
    msgVpn: default
    clientUsername: admin
    clientPassword: admin
    connectRetries: -1
    reconnectRetries: -1
    apiProperties:
      pub_ack_window_size: 50
      pub_ack_time: 200
```

Configure the management part for the HA:

```
solace:
  connector:
    workflows: # Workflow configuration
      0:
        enabled: true  # If true, the workflow is enabled.
        acknowledgment:
          publish-async: true
        transformation:
          mappingFile: ""
          mode: customentitytoxml
    #      1:
```

```
    #        enabled: false  # If true, the workflow is enabled.
    #        acknowledgment:
    #          publish-async: true
    management:
      leader-election:
        mode: active_standby  # The connector's leader election mode. (values:
standalone, active_active, active_standby)
        fail-over:
          max-attempts: 3  # The maximum number of attempts to perform a fail-over.
          back-off-initial-interval: 1000  # The initial interval (milliseconds) to
back-off when retrying a fail-over.
          back-off-max-interval: 10000  # The maximum interval (milliseconds) to back-
off when retrying a fail-over.
          back-off-multiplier: 2.0  # The multiplier to apply to the back-off interval
between each retry of a fail-over.
      queue: management-queue-push  # The management queue name.
      session: # The management session. This has the same interface as that used by
`solace.java.*`. For more info: https://github.com/SolaceProducts/solace-spring-
boot/tree/master/solace-spring-boot-starters/solace-java-spring-boot-starter#updating-
your-application-properties
        host: tcp://192.144.217.87:55555
        msgVpn: default
        client-username: admin
        client-password: admin
```

2.6. Config file and mapper file

Configuration File: `connector_config.properties\`:

```
#table entity mapping
source_passenger=entity.source.database.com.solacecoe.connectors.SourcePassenger
passAddress=entity.source.database.com.solacecoe.connectors.PassAddress

DB_TABLE=source_passenger
#--------------------source_passenger-------------
#<DB_TABLE>.ENABLE_<property>=true or false, if false , target property must be
configured as empty value; if true, target property must be configured and not empty
source_passenger.ENABLE_DB_READ_TIME=true
source_passenger.ENABLE_ DB_TRACKING_ID=false
#use default output-0
source_passenger.BINDING=output-0
#data topic name, send the event of record to this topic
source_passenger.TOPIC=dxb/source_passenger
#lvq topic name, send checkpoint data to this topic
source_passenger.LVQ_TOPIC=lvq/source_passenger
#parent table name
source_passenger.DB_TABLE=source_passenger
#DB_PARENT_CHILD_MODE: many2one or one2many, default is one2many
source_passenger.DB_PARENT_CHILD_MODE=many2one
#key column property in the parent table, have relationship with child table key.
```

```
source_passenger.PARENT_CHILD_RELATION_KEY=passengerId:passId,
nationality:zip,<parentKey>:<childKey>
#map in the main entity.
source_passenger.DB_PARENT_COLLECTION=addresses
#child table name
source_passenger.DB_CHILD_TABLE=passAddress
#source table read indicator column
source_passenger.DB_READ_INDICATOR_COLUMN=flag
#specify the tracking ID column property
source_passenger.DB_TRACKING_ID=dbtrackid
#specify the read time column property, update this column with the reading record
time by connector
source_passenger.DB_READ_TIME=readtime
# status of the indicator column value.
source_passenger.DB_READ_INDICATOR_COLUMN_UPDATE_VALUE_INPROGRESS=p
source_passenger.DB_READ_INDICATOR_COLUMN_UPDATE_VALUE_PROCESSED=c
source_passenger.DB_READ_INDICATOR_COLUMN_DEFAULT_VALUE=n
source_passenger.DB_READ_INDICATOR_COLUMN_FAILED_VALUE=f
# sequeial column property
source_passenger.DB_READ_RECORD_SEQUENTIAL_INDICATOR=id.passengerId
# order by, asc or desc
source_passenger.DB_READ_RECORD_SEQUENTIAL_ORDER=asc
#if true, it will read the failed ones after starting the connector, if failed, it
will ignore the failed one.
source_passenger.DB_READ_INDICATOR_BRIDGE_FAILED_VALUE=true
##message heasers
source_passenger.ENABLE_MESSAGE_HEADER_TRACK_ID=true
source_passenger.MESSAGE_HEADER_TRACK_ID=dbtrackid
#MESSAGE_HEADER_CREATE_TIME=createTime
```

Create mapper files for source_<table_name>_trgt_schema_mapper.yml for each table, ex source_passenger_trgt_schema_mapper.yml</table_name>

```
solace-connector-mapper:
  mapper-metadata:
    escape-special-characters: true
    schema-type:
    encrypted:
  payload-mapper:
    mapper-name0:
      source-xpath: source_passenger/passengerId
      source-datatype:
      target-xpath: passenger/id
      target-datatype:
    mapper-name1:
      source-xpath: source_passenger/name
      source-datatype:
      target-xpath: passenger/pname
      target-datatype:
    mapper-name2:
```

```
      source-xpath: source_passenger/birthday
      source-datatype:
      target-xpath: passenger/birthday
      target-datatype:
    mapper-name3:
      source-xpath: source_passenger/passAddress/city
      source-datatype:
      target-xpath: passenger/addresses/passAddress/city
      target-datatype:
```

2.7 Connector Logging

Logback has been used to enable the logging mechanism.

Configuration File: `resourceslogback.xml`

You can change your log default folder in logback.xml:

```
<property name="LOG_HOME" value="log/pull-connector/" />
```

You can change your log level as showed below:

```
<!--DEBUG,INFO,WARN,ERROR,FATAL-->

<root level="INFO">
  <appender-ref ref="STDOUT" />
  <appender-ref ref="FILE" />
  <appender-ref ref="RSYSLOG" />
</root>
```

2.8 Admin client configuration

Please configure the admin sever as follows in application.yml

```
spring:
  boot:
    admin:
      client:
        enabled: true
        url: http://localhost:8082       #configure your admin server url
        auto-registration: true
  application:
    name: Instance006                    #configure your application name
```

3 Generate Entity tool.

Hibernate API's has been used to generate the JPA entities and load into the connector code. This will reduce the manual efforts to write the entity file for all the tables.

Note: We are also finding a way to automate the entire entity generation process to reduce the manual interventions.

Download the generateEntity project and edit the below show file to generate the entities on the connected schema.

`pom.xml` configuration

```
<configuration>
    <!--
<templatePath>${project.basedir}/src/main/resources/jpagen/tempalate/</templatePath>--
>
    <!-- Defaults: -->
    <outputDirectory>${project.basedir}/src/main/java/</outputDirectory>
    <!--hibernate configuration file-->
    <propertyFile>src/main/resources/hibernate.properties</propertyFile>
    <!--DB and Entity data type mapping configuration file-->
    <revengFile>src/main/resources/reveng.xml</revengFile>
    <!--entity operation info -->
    <revengStrategy></revengStrategy>
    <packageName>com.solace.connector.db.pull.entity</packageName>
    <detectManyToMany>true</detectManyToMany>
    <detectOneToOne>true</detectOneToOne>
    <detectOptimisticLock>true</detectOptimisticLock>
    <createCollectionForForeignKey>true</createCollectionForForeignKey>
    <createManyToOneForForeignKey>true</createManyToOneForForeignKey>
    <!-- true JPA anotation -->
    <ejb3>true</ejb3>
    <jdk5>true</jdk5>
</configuration>
```

DB configuration The file `hibernate.properties` location is configured in pom.xml file:

```
default\_schema=TEST
hibernate.connection.driver\_class=oracle.jdbc.driver.OracleDriver
hibernate.connection.username=system
hibernate.connection.password=oracle
hibernate.connection.url=jdbc:oracle:thin:@localhost:47161/xe
hibernate.dialect=org.hibernate.dialect.Oracle10gDialect
```

Data type mapping configuration The file `reveng.xml` location is configured in pom.xml file:

```
<sql-type jdbc-type="DATE" hibernate-type="java.util.Date"/>
    <sql-type jdbc-type="TIMESTAMP" hibernate-type="java.util.Date"/>
```

```
    <!--<sql-type jdbc-type="NUMERIC" hibernate-type="java.lang.Double"/>-->
    <sql-type jdbc-type="DECIMAL" hibernate-type="java.lang.Double" />
    <sql-type jdbc-type="CHAR" hibernate-type="java.lang.String" />
    <sql-type jdbc-type="NUMERIC" length="10" precision="3"  hibernate-
type="java.math.BigDecimal" />
    <sql-type jdbc-type="NUMERIC" length="20" precision="5"  hibernate-
type="java.math.BigDecimal" />
    <sql-type jdbc-type="NUMERIC" length="37" precision="4"  hibernate-
type="java.math.BigDecimal" />
    <sql-type jdbc-type="FLOAT"   hibernate-type="java.math.BigDecimal" />
    <sql-type jdbc-type="NUMERIC" length="38" precision="0"  hibernate-
type="java.math.BigDecimal" />
    <sql-type jdbc-type="NUMERIC"  hibernate-type="java.math.BigDecimal" />
    <sql-type jdbc-type="BLOB"   hibernate-type="java.lang.Byte[]" />
    <sql-type jdbc-type="CLOB"   hibernate-type="java.lang.String" />
```

Note:

- match-name could be a single table name, or it can be a wildcard string (.*) to generate the entity.
- Some of the minute modifications needed to fit to DB Connector entity requirements
- Also, no modification to single table entity, this is only for parent/child table.
- Add tablename to generate a single table

```
<table-filter match-schema=".*" match-name="tablename" />
```

Parent table ex:

```
// Below are generated by tool, should be removed:
@OneToMany(fetch=FetchType.LAZY, mappedBy="sourcePassenger")
private Set<PassAddress> passAddresses = new HashSet<PassAddress>(0);
Set<PassAddress> passAddresses
Set<PassAddress> getPassAddresses()
Set<PassAddress> passAddresses

Replace all the Set<> to be List<Map> in the entity:
private List<Map> addresses;
@JsonIgnore
@Transient
public List<Map> getAddresses() {
    return addresses;}
public void setAddresses(List<Map> addresses) {
    this.addresses = addresses;}
```

The `addresses` is the `DB_PARENT_COLLECTION` `of` `connector_config.properties` .

If there is no PK for parent table. 2 entities are generated for parent table, `entity` and `entityId`.

Move all the properties/methods from entityId to entity.

In the entity, remove `@AttributeOverrides({})`.

For example: Parent table entity: `SourcePassenger` Parent table entityId: `SourcePassengerId`

Move all the property in SourcePassengerId to SourcePassenger, and remove `@AttributeOverrides({})` in SourcePassenger and add below:

Add `@Id` on the unique column of `SourcePassenger`\:

```
@Id
@Column(name="PASSENGER_ID", nullable=false, precision=10, scale=0)
```

Child table ex:

If there is no PK for child table. 2 entities are generated for child table, `entity` and `entityId`. Move all the properties/methods from entityId to entity .

In the entity, remove `@AttributeOverrides({})`.

For example: Child table entity: `PassAddress` Child table entityId: `PassAddressId` Move all the properties in PassAddressId to PassAddress. Add @Id on the unique column of PassAddressId:

```
@Id
@Column(name="ID", nullable=false, precision=10, scale=0)
```

Create VIEW entity:

When it is a VIEW object in DB, please treat it as a single table, just point your table name to your view name.

For example, if you have a view `Customer`. 2 entities will be generated, `Customer` and `CustomerId`, please move all properties from CustomerId to Customer. In the entity, remove `@AttributeOverrides({})`. Add `@Id` on the unique column of `Customer`\:

```
@Id
@Column(name="CUSTOMER_ID", nullable=false, precision=10, scale=0)
```

Command to run:

```
mvn hibernate-tools:hbm2java
```

Generate the entity jar:

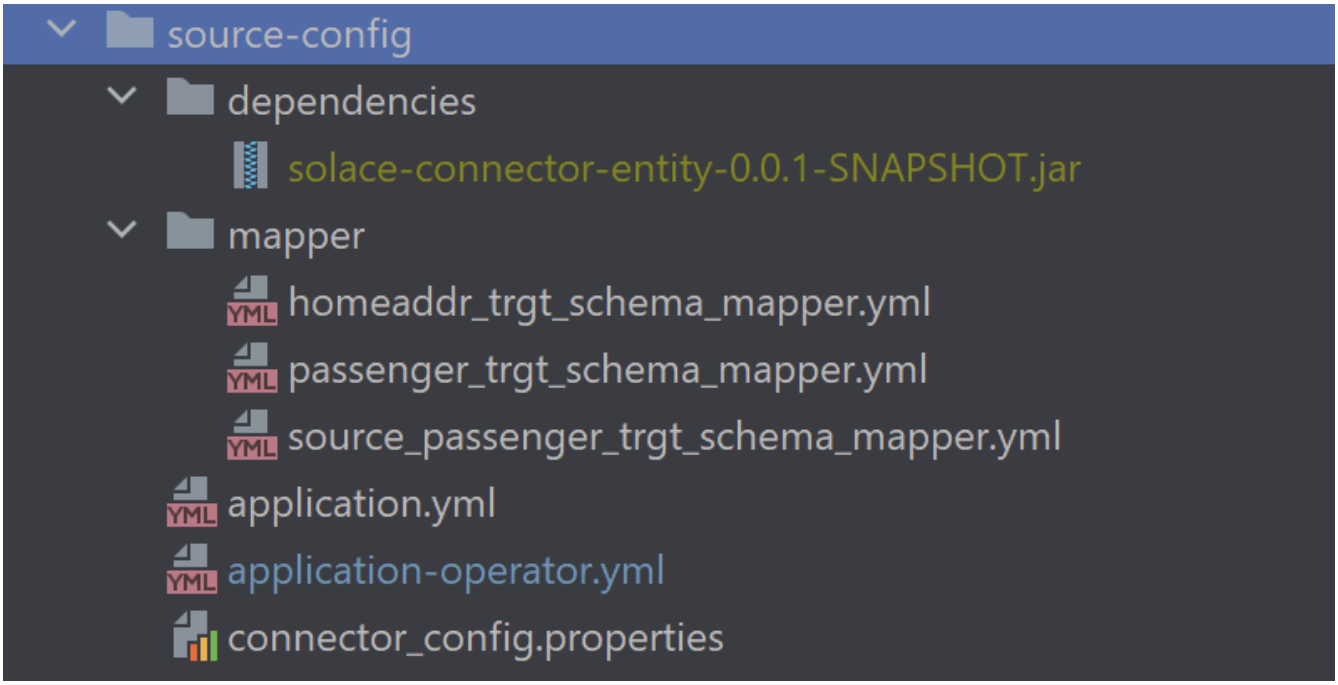
Put the entities to your entity project, manually add entity repo and generate the entity jar, put the entity jar to \\config\\dependencies folder.

4 Run Connector

4.1 Command line to run the Solace Pubsub Connector For DB source

Go the project

```
mvn clean package
```



Go to project folder and run as standalone mode:

```
java -cp ./target/pubsubplus-connector-database-1.2.0-SNAPSHOT.jar
-D"loader.path=./source-config/dependencies,./source-config"
org.springframework.boot.loader.PropertiesLauncher
--spring.config.additional-location="./source-config/application-operator.yml"
-server.port=8081
```

4.2 Command line to run the Solace Pubsub Connectors as HA

Please specify server.port to another value that is not used.

```
java -cp ./target/pubsubplus-connector-database-1.2.0-SNAPSHOT.jar
-D"loader.path=./source-config/dependencies,./source-config"
org.springframework.boot.loader.PropertiesLauncher
--spring.config.additional-location="./source-config/application-operator.yml"
-server.port=8082
```

Please refer to 1.4.2 Solace Configuration> Configure the management part for the HA.

4.3 Deploy as docker container and run

```
docker run --name pubsubplus-connector-database -v
D:\\GitHub\\docker\_config:/config pubsubplus-connector-database:v1
docker\_config refers to source-config and sink-config
```

5 Connector Monitoring

Connector monitoring is a Spring Boot Admin server which helps to visualize the connectors deployed in the organization

5.1 Prerequisites

- Maven 3
- JDK 17

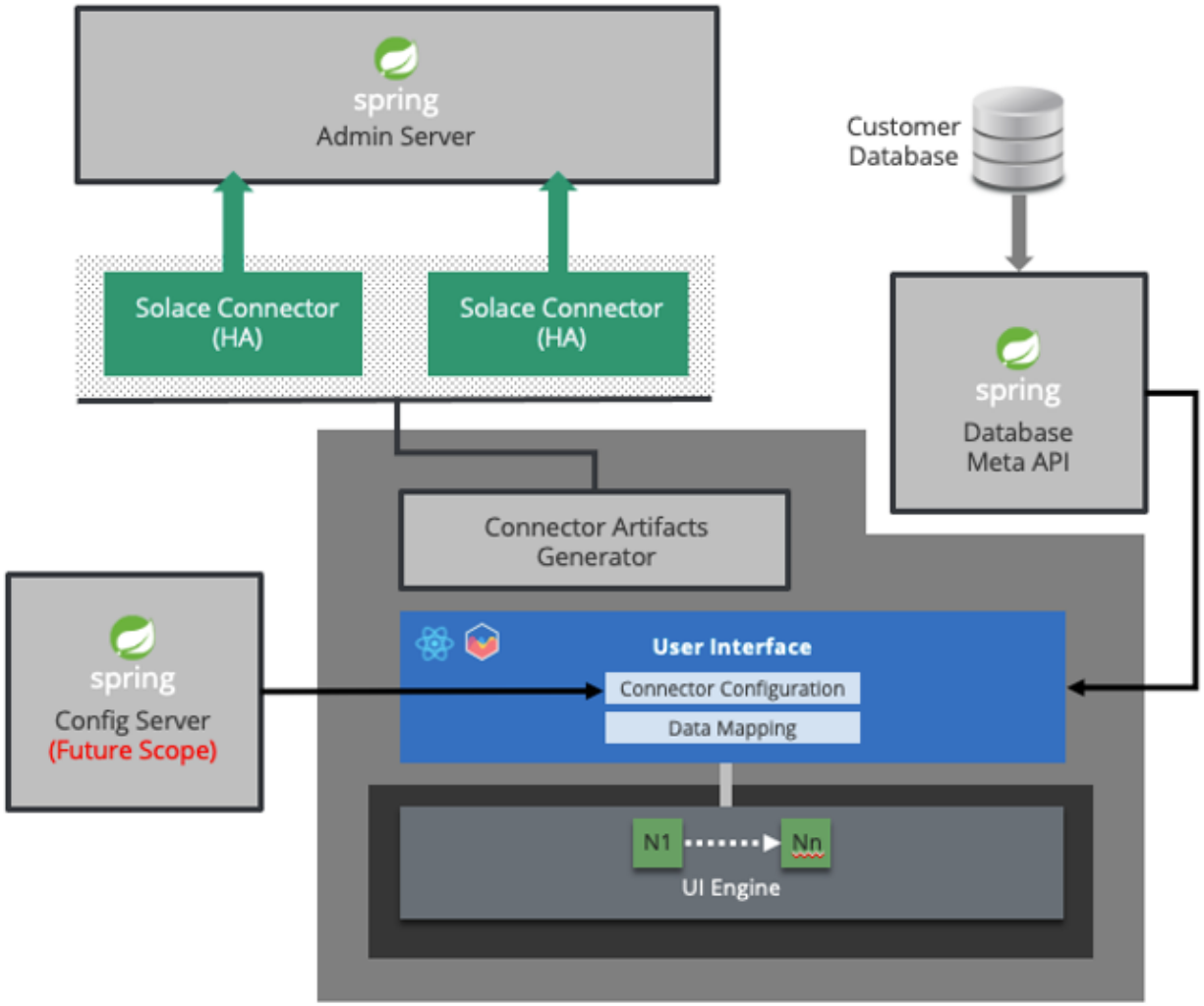
5.2 Infrastructure Requirement

Component Name	Cores	RAM (GB)	Runtime
Spring Boot Admin	2	4	Java

6 Connector Management

- Connector management is a UI based tool to generate the code binary based on the configuration provided in the tool.
- All the connector configurations will be stored in the database attached to the CM
- Will allow to edit the configuration for the available connectors in the CM database.

6.1 Architecture



6.2 Pre-Requisites

S.No	Runtime	Version	Description
1	NodeJS	V12	Used for CM runtime
2	NPM	V6	Used to manage node packages required by CM
3	PM2	5.2	Used to manage NodeJS process for scalabilty
4	Java	17	Used for Database Meta API runtime
5	Oracle Instant Client	21	Required for NodeJS library to initiate connection with Oracle
6	Maven	3	Used to Manage dependencies required by Meta API

6.3 Infrastructure Requirement

Solace Connector Management will be deployed in a single VM

Component Name	Cores	RAM (GB)	Runtime
Connector Management (UI+Services)	4	6	NodeJS
DB Meta API (Per Schema)	1	2	Java

6.4 Connector Management Installation Guide

CM Deployment kit contains:

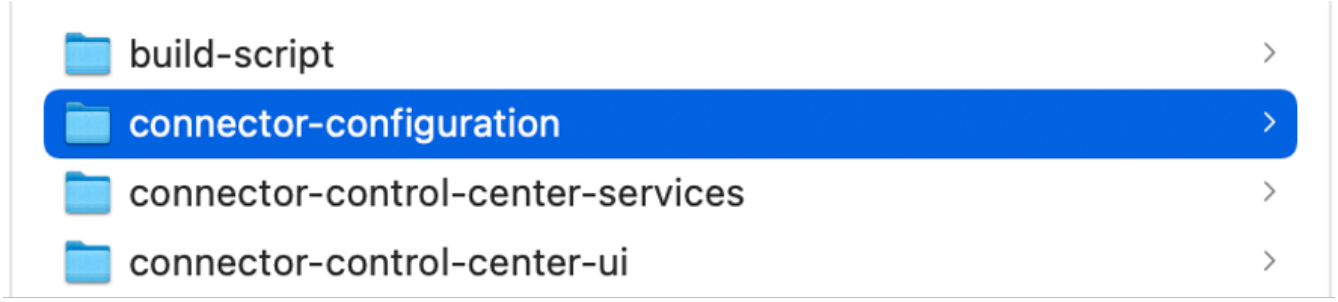
- Schema script (Oracle)
- This script includes all the required database commands to create tables required for Connector Management
- Spring Admin Server Binary
- This binary spins ups the Spring Admin server after providing required configurations
- CM NodeJS Binary
- User interface component which can be used to configure/manage connectors.

Database preparation

- Create Schema: `connector_control_schema`
- Create the tables: Execute the Schema Script provided in the kit to create the required tables.

Deploy CM:

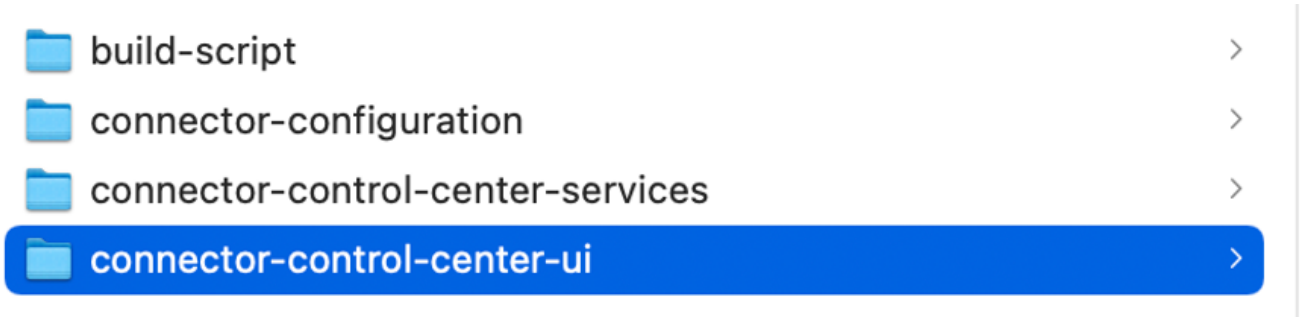
- Unzip the file <file-name> to the desired location</file-name>
- Edit the ecosystem.config.js file located in `connector_configuration` folder. This configuration is used by PM2



```
env_dev: {
  "NODE_ENV": "dev",
  "DATABASE_HOST": "",
  "DATABASE_PORT": 5432,
  "DATABASE_USER": "",
  "DATABASE_PASSWORD": "",
  "DATABASE_NAME": "",
  "CONTROL_CENTER_UI_DOMAIN": "",
  "CONTROL_CENTER_BACKEND_DOMAIN": "",
  "SECRET_KEY": "",
  "REFRESH_TOKEN_KEY": "",
  "API_PORT": 3001,
  "SOLACE_VPN_NAME": '',
  "SOLACE_HOST": '',
  "SOLACE_AUTH_TOPIC": "",
  "SOLACE_ACC_DATA_PROTOCOL": "",
  "SOLACE_ACC_REST_PORT": 9443,
  "SOLACE_CLIENT_USER": "",
  "SOLACE_CLIENT_PWD": "",
  "CCC_GENERATE_ENTITY_TEMPLATE_PATH": 'generateEntity.zip',
  "CCC_SOLACE_DB_PULL_CONNECTOR_TEMPLATE_PATH": 'solace-db-pull-connector.zip',
  "CCC_DOWNLOAD_GENERATE_ENTITY_PATH" : "deploy-connectors"
},
```

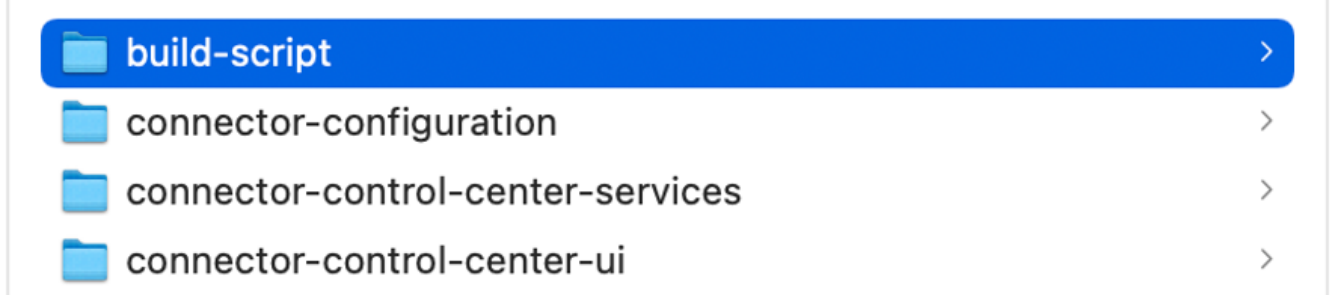
The same configuration can be repeated for different environments like dev, qa, prod.

Edit the `.env` file in the UI folder `connector-control-center-ui`




```
REACT_APP_API_SERVICES_URL = 'http://<host-name>:3001'
REACT_APP_DOMAIN = 'http://<host-name>:3000'
#### CCC META API
REACT_APP_CCC_META_API_URL = 'http://<host-name>:8082'
```

Run the script located in `build-script` folder in the kit to create the build.



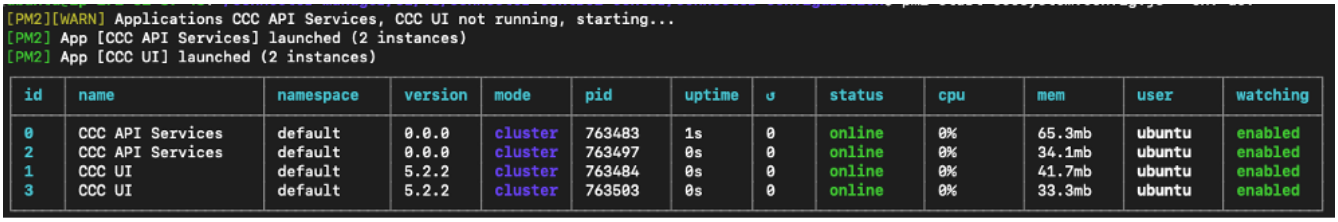
Command to execute the script

```
cc_deploy.sh
```

Once successfully executed the script navigate to connector-configuration folder and execute the below command

```
pm2 start ecosystem.config.js env <dev,qa,prod>
```

To validate, run `pm2 ls` and you should see the following services up and running.



6.5. Connector Generation Guide

Generating the connector binary is a three-step process

1. Add schema to CM
2. Generate entity (JPA Notation) for the schema
3. Generate connector configurations as per the selected schema tables to bridge the data to Solace as events

6.6. Add Schema

6.7. Generate Entity

6.8. Generate Connector Configurations

7 Connector Config Parameters

7.1. Connector parameters

Config Type	Config Location	Parameter (Hierarchy)	Description
Generic-DB	application.yml	solace-persistence:datasource:driver-class-name	DB Connection Details
solace-persistence:datasource:url			
solace-persistence:datasource:username			
solace-persistence:datasource:password			
solace-persistence:datasource:hikari:minimum-idle	Config the connection pool for DB		
solace-persistence:datasource:hikari:idle-timeout			
solace-persistence:datasource:hikari:maximum-pool-size			
solace-persistence:datasource:hikari:max-lifetime			
solace-persistence:datasource:hikari:connection-timeout			
solace-persistence:jpa:hibernate:ddl-auto	hibernate property, recommended to use none in production		
solace-persistence:jpa:show-sql	True, will print the queries in the logs		
solace-persistence:jpa:database	Type of the target database ex: mysql,oracle		

Config Type	Config Location	Parameter (Hierarchy)	Description
solace-persistence:jpa:properties:jdbc:batch_size	The size of jpa batch opration		
spring:cloud:function:stream:poller:fixed-delay	Defines the interval frequency of the data polling from Database		
spring:cloud:function:stream:bindings:dataCollectting-out-0:destination	Allowed to configure both static and dynamic topics Some of the parameterized notations will add data to topic during the runtime. {COL:column name}: adds the value for defined column name into the to the topic {DB_TABLE}: adds a table name to the topics based on connector_config.properties file Ex: DXB/{COL:passengerId}/{COL:name}/SGP/{DB_Table}		
logging	logback.xml	<root level="INFO"> <appender-ref ref="STDOUT" /> <appender-ref ref="FILE" /> <appender-ref ref="RSYSLOG" /> </root>	used logback to config logging, it has different levels: DEBUG,INFO,WARN,ERROR,FATAL
Source property	application.yml	solace-persistence:source:jpaBatchMode	Allow to merge multiple records into a single event
solace-persistence:source:queryMax	Set the max records for each query read from database		
solace-persistence:source:maxDbRetry	it will do retry to connect the db		

Config Type	Config Location	Parameter (Hierarchy)	Description
solace-persistence:source:enableRetry	If true, it will retry query to db		
solace-persistence:source:retryInterval	Messages resent to Solace in the defined interval		
solace-persistence:source:retryCount	Max retry count and mark the record as a failure attempt		
solace-persistence:source:enableBufferedJpaBatch	if true, connector will write back indicator values in batch mode		
solace-persistence:source:bufferWaitSeconds	timeout for getting ack from Solace		
solace-persistence:source:enableRetry	True, to enable resend the message to Solace		
solace-persistence:source:retryCount	When enableRetry is true, retry numbers to the Solace.		
solace-persistence:source:enableBufferedJpaBatch	True to enable batch update to the DB		
solace-persistence:source:bufferWaitSeconds	Interval between batch update to the DB		
solace-persistence:source:enableTrackingId solace-persistence:source:enableDatabaseTimestamp solace-persistence:source:enableConnectorTimestamp	True, to enable message header contain those info.		
solace-persistence:source:enableBenchmarkInfo	True, to print performance detail log		
Admin Client	application.yml	sping.boot.admin.client.enable:true	True to enable.

Config Type	Config Location	Parameter (Hierarchy)	Description
sping.boot.admin.client.enable:url	Set the admin server url		
sping.boot.application.name	Name of the application		
Solace	application.yml	sping.cloud.stream.binding.input-0.destination	LVQ queue name
sping.cloud.stream.binding.output-0.destination	LVQ topic name		
sping.cloud.stream.binding.output-0.content-type	Message content typ: plain text is application/x-java-serialized-object		

7.2 File Naming Convention

File Type	Naming Convention	Description	Note
Spring Application	application.yml	A standard spring boot configuration	Follow the sring standard yaml notations
Connector for DB source(Config)	connnector_config.properties	Solace DB Connector Configuration file	Generated
Connector For DB souce(Mapper File)	<DB_TABLE>_trgt_schema_mapper.properties </DB_TABLE>	A mapper file which will have the mapping definition between the parent table Schema to the target event payload schema	DB_TABLE value can be identified from connector_config.properties file. All the field mappings should follow the xpath format
Connector for DB source(Mapper File)	<child table="">_trgt_schema_mapper.properties</child>	A mapper file which will have the mapping definition between the parent table Schema to the target event payload schema	Generated

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Support

Support is offered best effort via our Solace Developer Community.

Premium support options are available, please Contact Solace.