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# Cisco ParStream

## Cisco ParStream DSA Link Guide

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# Table of Contents

<b>Cisco ParStream DSA Link Guide</b>	<b>i</b>
<b>Table of Contents</b>	<b>iii</b>
<b>1 Cisco ParStream DSA Link</b>	<b>1</b>
1.1 Introduction . . . . .	1
1.2 Installation . . . . .	1
1.2.1 Requirements . . . . .	1
1.2.2 Networking . . . . .	2
1.2.3 Filesystem . . . . .	2
1.2.4 Configuration . . . . .	3
1.3 Link Actions . . . . .	4
1.3.1 ParStream Import Actions . . . . .	5
1.3.2 Database Actions . . . . .	5
1.3.3 Cluster Actions . . . . .	7
1.3.4 Cluster Node Actions . . . . .	7
1.3.5 Table Actions . . . . .	8
1.3.6 Historian Actions . . . . .	9
1.3.7 Watch Group Actions . . . . .	10
1.3.8 Watch Path Metric Actions . . . . .	10
1.4 Incompatible Changes . . . . .	10
1.4.1 Version 6.0 . . . . .	10
1.5 Known Issues . . . . .	11



# 1 Cisco ParStream DSA Link

This document describes the usage of the Cisco ParStream DSA Link.

## 1.1 Introduction

Distributed Services Architecture (DSA) from DGLogik, is an open source IoT platform that facilitates device inter-communication, logic, and applications at every layer of the Internet of Things infrastructure. For an introduction and documentation about DSA see <http://iot-dsa.org/>.

The Cisco ParStream DSA Link is able to insert data into single tables and query the database using SQL statements. Additionally, the link provides a historian interface to import time stamped single value data into a Cisco ParStream database.

## 1.2 Installation

The Cisco ParStream DSA Link can be easily installed by the DGLux5 web application via action *Install Link from ZIP* found at node *sys/links*.

From the technical side, the ZIP file will be unpacked into a sub-folder of `dglux-server/dslinks/` and started with the node description `dslink.json` as initial configuration by the DSA broker. The Cisco ParStream DSA Link is a Java application and the DSA broker will run the script `bin/parstream-dsa-link`. If this link terminates unexpectedly, the DSA broker will restart the Cisco ParStream DSA Link automatically.

Optionally, you can start the Cisco ParStream DSA Link as a stand-alone Java application with the standard DSA Link options:

```
--name Name of this Cisco ParStream DSA Link instance
--broker URL of the DSA broker (i.e. http://127.0.0.1:8080/conn or https://127.0.0.1:8443/conn)
--nodes Name of the node configuration file (default: nodes.json)
--log Logging level (default: info)
--key Name of the node key file (default: .key)
--token Token used by the DSA broker
```

In this case, you have to restart the link manually if the Java application terminates unexpectedly. The script `bin/parstream-dsa-link` will respect the environment variable `JAVA_OPTS` for additional JVM runtime options.

### 1.2.1 Requirements

- Cisco ParStream 6.0.0 or newer
- Java SE 8

- DSA Broker accepting sdk-dslink-java v0.20.1 connections
- Supported Operating System for Cisco ParStream Java Streaming Import
- For Microsoft Windows: Microsoft Visual C++ Redistributable for Visual Studio 2017 (x64)

## 1.2.2 Networking

The Cisco ParStream DSA Link will connect to its DSA broker via tcp/http(s) communication. If the link was started from the DSA broker, the link will use a tcp connection to a local dynamic port of the DSA broker. If the link was started manually, the link has to use the public http or https DSA broker port.

The link will also connect to configured Cisco ParStream databases via JDBC and netcat ports.

### 1.2.2.1 Secure Database Connections

The Cisco ParStream database uses X.509 certificates for encrypting the connections to the JDBC and netcat ports. The signing certificate must be announced to the used OpenSSL and Java SSL Cisco ParStream DSA Link implementations. Deactivation of certificate verification is not possible for these two connection types.

To use self-signed certificates or custom CA certificates, the certificate can be installed in the Cisco ParStream DSA Link folder. The current implementation need the public certificate as PEM file `ssl/parstream.pem` and inside of a Java Keystore `ssl/parstream.jks`. Unfortunately the Java Keystore file is forced to be password protected even if it contains only public certificates. The start scripts define the password of the Java Keystore file.

To create the Java Keystore from a single PEM file you can use:

```
keytool -import -keystore parstream.jks -storepass cisco123 -alias parstream
-file parstream.pem
```

## 1.2.3 Filesystem

The installed Cisco ParStream DSA Link consists of:

Artifact	Type	Brief Description
<code>bin</code>	folder	Contains the start scripts
<code>lib</code>	folder	Contains all depending libraries
<code>.key</code>	file	Contains the DSA broker token
<code>dslink-json</code>	file	Configuration for the initial link configuration and start
<code>nodes.json</code>	file	Configuration for the current link configuration and current metric information

**Table 1.1:** *Installation artifacts*

### 1.2.3.1 Upgrade Files

With a new version the installation zip file will contain a "libnew" folder, which will replace the "lib" folder while upgrading the link right before starting the link.

### 1.2.3.2 Logging Files

Normally the DSA broker will start the Cisco ParStream DSA Link, capture all output and log them to the file `./dglux-server/logs/<link instance name>`. If the link is started manually, the user has to take care to capture and log all output.

## 1.2.4 Configuration

The Cisco ParStream DSA Link node will be automatically configured with its first connection to its DSA broker. The node configuration is a list of connection configurations consisting of database table configuration and watch group configuration. The connection parameters are listed in Table 1.2.

The table configuration will be automatically configured while introspecting the database connection. The table configuration parameters listed in Table 1.3 are set initially to their default values. These parameters define the commit behavior for importing data into the Cisco ParStream database.

**Note:** Using the default configuration the Cisco ParStream DSA Link will commit every single row to the database. This will lead to performance problems, if the commit rate is too high. Therefore `$insertBufferSize` or `$insertBufferMaxDelayMs` or both should be set to a proper value in order to perform bulk inserts into the database.

Watch group configurations are defined by the historian API provided by the DSA Java SDK. For partitioning new historian table with the standard historian API the default configuration listed in Table 1.4 will be used.

**Warning:** The historian API provides an additional message buffer. By default this buffer is unbound and will be flushed every 5 seconds by writing each message one by one into the database. This contradicts the table based buffer configuration. Setting the "Buffer Flush Time" of the watch group to 0 will disable the historian API buffer. However the table based buffer configuration of the Cisco ParStream DSA Link will be respected while importing historian data.

Connection Parameter	Brief Description
<code>\$name</code>	Name of this connection
<code>\$host</code>	Hostname for this connection
<code>\$port</code>	Port for this connection
<code>\$user</code>	Login name for the generic database account
<code>\$pwd</code>	Passphrase for the generic database account
<code>\$importPriority</code>	Import priority (normally set to "MEDIUM")
<code>\$importTimeout</code>	Streaming Import Request Timeout (normally set to 0)
<code>\$connectTimeout</code>	Streaming Import Connect Timeout (normally set to 10)

**Table 1.2:** *Brief Description of the Connection Configuration*

Table Import Parameter	Default Value	Brief Description
\$name	N/A	Name of the table
\$insertBufferMaxSize	0	Number of rows to be collected before auto-committing (disable buffering by row count if value is 0 or negative; any 32bit signed integer value is accepted)
\$insertBufferMaxDelayMs	0	Milliseconds since last commit to wait before auto-committing pending rows (disable buffering by delay if value is 0 or negative; any 32bit signed integer value is accepted))
\$columnInfo	N/A	Description of the table columns (will be set while introspecting this table)
\$outputChannel	PARSTREAM	Type of output: PARSTREAM for streaming into a Cisco ParStream Server or CSVFILE for writing into a CSV File
\$outputCsvFolder	N/A	The output folder to write CSV files, if outputChannel is CSVFILE
\$outputCsvPrefix	table name	Prefix of the CSV file name

**Table 1.3:** *Brief Description of the Table Import Configuration*

Table Import Parameter	Default Value	Brief Description
\$defaultTimeSlicing	MONTH	Segmentation granularity for new historian tables by time. (valid values are HOUR, DAY, WEEK or MONTH)
\$defaultWatchPathModulo	11	If set, maximum number of partitions per time-slice, which are grouped by watched paths. (valid values are >0)

**Table 1.4:** *Brief Description of the Watch Groups Configuration*

## 1.3 Link Actions

The primary actions of this link are "inserting a single row" and "querying the database" using SQL. All available actions of the Cisco ParStream DSA Link are described in the following chapters.

Any data inserted into a table by using an action or a subscription can be buffered by setting the target table configurations. Errors can be raised while performing the actions or by committing the data into the database. To have a consistent way, we populate any errors into the metric fields *lastInsertStatus*, *errorReason* and *lastInsertAttempt* of the target table. These metric values can be subscribed to monitor any insertion failures.



### 1.3.1 ParStream Import Actions

Action Name	API Name	Brief Description
Add Database	addDb	Create new database connection

#### 1.3.1.1 Add Database

Create a new database connection to a Cisco ParStream database.

Several alternative connections can be configured for fail-safe operation. This action includes the parameters for the first connection. The alternative connection parameters can be added with the Cluster Action `Add Cluster Node`.

Parameter	Type	Default	Description
name	String		Name of the database
host	String		IP address or host name of the Cisco ParStream database connection
port	String		Port or service name of the Cisco ParStream database connection
user	String	null	Database account name for queries and imports
password	String	null	Database account password
autoIntrospect	Boolean		Introspect tables after connecting this database
importPriority	Enum		Import query priority (LOW, MEDIUM, HIGH)
initialFailoverDelay	Number		Seconds to wait before switching to an alternative connection
useTLS	Boolean	false	Use TLS for connection encryption
connectTimeout	Number		Timeout for establishing a new connection; 0 deactivates the timeout

### 1.3.2 Database Actions

Action Name	API Name	Brief Description
Connect	connect	Connect to database
Delete	delete	Delete this database
Disconnect	disconnect	Close database connection
Edit	editDb	Edit this database
Introspect	introspect	Update table list
Query	query	Query database
Set Import Timeout	setImportTimeout	Set streaming import request timeout
Set Connect Timeout	setConnectTimeout	Set streaming import connect timeout

#### 1.3.2.1 Connect

Connect to this database.

### 1.3.2.2 Delete

Delete this database.

### 1.3.2.3 Disconnect

Disconnect will close all TCP/IP connections to the database. This includes netcat and JDBC connections.

### 1.3.2.4 Edit

Edit this database.

Only the filled in fields are changed. The not filled in fields are defaulted with the current values. The change results in a re-connect, so that it becomes effective immediately.

Parameter	Type	Default	Description
user	String		Database account name for queries and imports
password	String		Database account password
importPriority	Enum		Import query priority (LOW, MEDIUM, HIGH)
initialFailoverDelay	Number		Seconds to wait before switching to an alternative connection
useTLS	Boolean		Use TLS for connection encryption

### 1.3.2.5 Introspect

Introspect will override all table column information and might change the `insertRow` action parameters. In addition, all non existing tables are removed from the table list.

### 1.3.2.6 Query

Query the database by a single SQL statement.

Parameter	Type	Default	Description
sqlQuery	String		Single SQL query statement

This action will fail to process statements which do not return a proper result set, like DDL statements. However these SQL statements will be processed on the database.

### 1.3.2.7 Set Import Timeout

Set the streaming import request timeout. Normally the timeout is deactivated by setting its value to 0.

Parameter	Type	Default	Description
Import Timeout	Number		Streaming import request timeout in seconds; 0 deactivates the timeout.

### 1.3.2.8 Set Connect Timeout

Set the streaming import connect timeout.

Parameter	Type	Default	Description
Connect Timeout	Number		Streaming import connect timeout in seconds; 0 deactivates the timeout.

### 1.3.3 Cluster Actions

Action Name	API Name	Brief Description
Add Cluster Node	add	Add alternative connection parameters

#### 1.3.3.1 Add Cluster Node

Add alternative connection parameters for connecting to a Cisco ParStream database for failover. The prioritization of the cluster nodes for failover is defined by the `rank` parameter in ascending order. Note: The rank does not have to be unique.

Parameter	Type	Default	Description
name	String		Name of the connection
host	String		IP address or host name of the Cisco ParStream database
port	String		Port or service name of the Cisco ParStream database
rank	Number		The rank is a natural number ( $\geq 1$ )

### 1.3.4 Cluster Node Actions

Action Name	API Name	Brief Description
Delete	delete	Delete this cluster node
Edit	edit	Edit this cluster node

#### 1.3.4.1 Delete

Delete this cluster node.

The change may results in a disconnect and connect to an alternative cluster node if it is currently in use.

#### 1.3.4.2 Edit

Edit this cluster node.

The fields are preset with the current value. The change may results in a re-connect if it is currently in use.

Parameter	Type	Default	Description
host	String		IP address or host name of the Cisco ParStream database
port	String		Port or service name of the Cisco ParStream database
rank	Number		The rank is a natural number ( $\geq 1$ )

### 1.3.5 Table Actions

Action Name	API Name	Brief Description
Insert Row	insertRow	Insert a single row
Insert CSV	insertCSV	Insert CSV content into this table
Set insert buffer max size	setMaxBufferSize	Set row count for auto-commit
Set insert buffer max delay	setMaxBufferDelay	Set duration to wait for auto-commit

#### 1.3.5.1 Insert Row

Insert values as a single row into this table.

Parameter	Type	Default	Description
<dynamic>	<dynamic>		Value of named column

The parameter names are the column names of the target table. The type of the field is deviated from the column type.

This action is asynchronous, therefore it will not return any result. The result of the deferred database insertion can be retrieved from the metric fields *lastInsertStatus*, *errorReason* and *lastInsertAttempt* of the target table.

#### 1.3.5.2 Insert CSV

Insert multiple rows from a CSV content into this table.

Parameter	Type	Default	Description
Csv	String		Standard comma separated format, as for RFC4180 but allowing empty lines.
CSV Null	String	Null	explicit null literal for column values

The CSV columns must match the exact order defined by the table create statement. An optional CSV header containing the column names will be ignored. The type of the field is deviated from the column type.

Result Name	Type	Description
Status	String	Result of insert invocation (FAILED, FAILED_FATAL, BUFFERED, INSERTED)

#### 1.3.5.3 Set insert buffer max size

Set row count for auto-commit.

Parameter	Type	Default	Description
Size	Number	null	Maximum number of rows to wait before committing to database. Null or 0 will disable row buffering by row count.

See configuration `$insertBufferMaxSize` in Table 1.3 for parameter details.

#### 1.3.5.4 Set insert buffer max delay

Set duration in milliseconds to wait before auto-committing pending rows.

Parameter	Type	Default	Description
Delay (ms)	Number	null	Maximum number of milliseconds to wait before committing to database. Null or 0 will disable row buffering by delay time.

See configuration `$insertBufferMaxDelayMs` in Table 1.3 for parameter details.

### 1.3.6 Historian Actions

Action Name	API Name	Brief Description
Create Watch Group	createWatchGroup	Create a new watch group
Set Default Partitioning	setPartitioningDefaults	Set default partitioning configuration

#### 1.3.6.1 Create Watch Group

Create a new watch group with additional table partitioning configuration and optional deletion job creation.

Parameter	Type	Default	Description
Name	String		Name of the new watch group
Buffer max Delay	Number	0	Maximum number of milliseconds to wait before committing to database. Null or 0 will disable row buffering by delay time.
Buffer max Size	Number	0	Maximum number of rows to wait before committing to database. Null or 0 will disable row buffering by row count.
Max Time Slices	Number	0	Maximum number of time-slices to retain in the database. Older time-slices will be purged periodically. If the number is zero no time-slices will be purged.
Time Slicing	Enum	<configuration>	Segmentation granularity for historian table by time (HOUR, DAY, WEEK, MONTH)
Buckets per Time Slice	Number	<configuration>	Maximum number of partitions grouped by watched paths. Null will disable partitioning by watched paths.

Each watch group will create a generic table as historian storage. The name of the watch group will be used as table name prefixed with "WG\_". The name must meet the requirements as a Cisco ParStream table name. A space is converted into an underscore character. If the parameter "max time slices" is a positive number, a deletion job will be created for this historian table.

### 1.3.6.2 Set Default Partitioning

Set default partitioning configuration for new historian tables.

Parameter	Type	Default	Description
Buckets per Time Slice	Number		Maximum number of partitions grouped by watched paths. Null will disable partitioning by watched paths.
Time Slicing	Number		Segmentation granularity for historian table by time (HOUR, DAY, WEEK, MONTH)

See Table 1.4 for parameter details.

### 1.3.7 Watch Group Actions

Action Name	API Name	Brief Description
Edit	edit	Edit watch group
Add Watch Path	addWatchPath	Add a new path to be monitored in this group
Delete	delete	Delete this watch group

Any of these action are predefined by the IOT-DSA Java Historian SDK.

### 1.3.8 Watch Path Metric Actions

Action Name	API Name	Brief Description
Get History	getHistory	Read historian data from the database
Unsubscribe	unsubscribe	Remove this path to be monitored in this group

Any of these action are predefined by the IOT-DSA Java Historian SDK.

#### 1.3.8.1 Unsubscribe

Unsubscribe will not delete any data from this watch path in the historian table.

## 1.4 Incompatible Changes

### 1.4.1 Version 6.0

- action insertRow will not return field *Status* any more; see 1.3.5.1 for details

## 1.5 Known Issues

- (PSDSLINK-138) updates of metric information will alter the link configuration



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