



# VMware Smart Assurance K4M 1.0.0

## KPI Designer User Guide

### Abstract

This user guide describes use of the KPI Designer user interface in Smart Assurance. The KPI Designer is used to graphically define and visualize KPI definitions and the KPI streams that use them.

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# Chapter 1 Introduction

## About this document

This document is a user guide for the VMware K4M product's KPI Designer component.

Please refer to the following documents as well:

- Installation and operation details are available in the **VMware Smart Assurance UI documentation**. Though part of the VMware K4M product, the KPI Designer is installed as part of the VMware Smart Assurance UI.
- For details regarding the VMware K4M product please refer to the following documents:
  - **VMware Smart Assurance K4M 1.0.0 User Guide** – Contains several topics including:
    - Features
    - Concepts
    - Architecture
    - REST API.
  - **VMware Smart Assurance K4M 1.0.0 Installation and Administration Guide** – Includes:
    - Installation
    - Administration
    - Troubleshooting.

**NOTE:** This guide assumes the reader is familiar with the VMware K4M product's features, concepts and architecture.

## Overview

The KPI Designer is a Graphical User Interface (GUI) that helps users design KPI Definitions and KPI Streams. It provides users with a simple and clean interface that allows the creation and management of KPIs derived from business data.

The KPI Designer provides functions to create/read/update/delete (CRUD) KPI Definitions and KPI Streams. The following sections introduce the functionalities from the GUI perspective. For more information about KPI Definitions and KPI Streams, please refer to the **VMware Smart Assurance K4M 1.0.0 User Guide**.

## Preparing the Catalog before using KPI Designer

The first step in creating a KPI Definition is to select the input metrics to calculate the KPIs from. Based on the input source, the user could have hundreds of metrics to choose from. The KPI Designer's content assistant helps the user browse and search for metrics to be used in the KPI calculation. To enable this help, the KPI Designer must be pre-loaded with the set of available metrics i.e. a catalog of metrics. This is done through the /catalog endpoint of the K4M REST Service.

Details of the structure of a catalog and how to create it are described below.

### Catalog schema

The /catalog endpoint allows users to create a catalog, modeled as the "Catalog" resource which is in JSON format. Each Catalog contains metadata describing itself and one or more CatalogItems. Each CatalogItem represents a metric. The KPI Designer displays all the CatalogItems. The user can browse, search and select these CatalogItems during KPI configuration.

A Catalog has following fields:

- name: Name of the catalog
- displayName: The name of the catalog to be displayed. Can be same as the "name".
- type: Type of the catalog
  - metric:  
Specify this, if the catalog contains input metrics to be processed by the KPI Engine. The KPI Designer displays the CatalogItem(s) under the "Available Metrics" selection box and content assistant.
  - refdata:  
Specify this, if the catalog contains reference data. . The KPI Designer displays the CatalogItem(s) under the "Available Reference Data" selection box and content assistant.  
**NOTE:** Reference data capability is **not available** for this release. Use "metric" type only.
- values: Array of one or more CatalogItem objects. In each CatalogItem:
  - name: Name of the catalog item
  - displayName: The name of the catalog item to be displayed. Can be same as the "name" of the catalog item.
  - catalogName: Name of the catalog. Optional field.
  - description: Description of the catalog item

An example of a metric catalog with multiple catalog items(metrics) is shown below.

```
{
  "name": "vims-metrics-catalog",
  "type": "metric",
  "displayName": "vIMS metrics catalog",
  "values": [
    {
      "name": "SCSCFInitialRegistrationSuccesses",
      "displayName": "SCSCFInitialRegistrationSuccesses",
      "catalogName": "vims-metrics-catalog",
      "description": "number of initial registration successes"
    },
    {
      "name": "SCSCFInitialRegistrationAttempts",
      "displayName": "SCSCFInitialRegistrationAttempts",
      "catalogName": "vims-metrics-catalog",
      "description": "number of initial registration attempts"
    },
    {
      "name": "SCSCFInitialRegistrationFailures",
      "displayName": "SCSCFInitialRegistrationFailures",
      "catalogName": "vims-metrics-catalog",
      "description": "number of initial registration failures"
    },
    {
      "name": "SCSCFInitialRegistrationSuccessPercent",
      "displayName": "SCSCFInitialRegistrationSuccessPercent",
      "catalogName": "vims-metrics-catalog",
      "description": "initial registration success rate"
    },
    {
      "name": "SCSCFVideoSessionSetupTimeAverage",
```

```

    "displayName": "SCSCFVideoSessionSetupTimeAverage",
    "catalogName": "vims-metrics-catalog",
    "description": "average video session setup time"
  },
  {
    "name": "SCSCFAudioSessionSetupTimeAverage",
    "displayName": "SCSCFAudioSessionSetupTimeAverage",
    "catalogName": "vims-metrics-catalog",
    "description": "average audio session setup time"
  },
  {
    "name": "ICSCFSessionEstablishmentSuccesses",
    "displayName": "ICSCFSessionEstablishmentSuccesses",
    "catalogName": "vims-metrics-catalog",
    "description": "number of successful user terminating session attempts"
  },
  {
    "name": "ICSCFSessionEstablishmentFailures",
    "displayName": "ICSCFSessionEstablishmentFailures",
    "catalogName": "vims-metrics-catalog",
    "description": "number of failed user terminating session attempts"
  },
  {
    "name": "ICSCFSessionEstablishmentAttempts",
    "displayName": "ICSCFSessionEstablishmentAttempts",
    "catalogName": "vims-metrics-catalog",
    "description": "number of user terminating session attempts"
  },
  {
    "name": "ICSCFSessionEstablishmentSuccessPercent",
    "displayName": "ICSCFSessionEstablishmentSuccessPercent",
    "catalogName": "vims-metrics-catalog",

```



```

      "description": "user terminating session success rate"
    },
    {
      "name": "ICSCFSessionEstablishmentNetworkSuccesses",
      "displayName": "ICSCFSessionEstablishmentNetworkSuccesses",
      "catalogName": "vims-metrics-catalog",
      "description": "number of successful network terminating session
attempts"
    },
    {
      "name": "ICSCFSessionEstablishmentNetworkFailures",
      "displayName": "ICSCFSessionEstablishmentNetworkFailures",
      "catalogName": "vims-metrics-catalog",
      "description": "number of failed network terminating session attempts"
    },
    {
      "name": "ICSCFSessionEstablishmentNetworkAttempts",
      "displayName": "ICSCFSessionEstablishmentNetworkAttempts",
      "catalogName": "vims-metrics-catalog",
      "description": "number of network terminating session attempts"
    },
    {
      "name": "ICSCFSessionEstablishmentNetworkSuccessPercent",
      "displayName": "ICSCFSessionEstablishmentNetworkSuccessPercent",
      "catalogName": "vims-metrics-catalog",
      "description": "network terminating session success rate"
    }
  ]
}

```

## Catalog operations

The Catalog service is available in the K4M REST Service at the [http://k4m\\_host\\_ip:8083/v1/catalog](http://k4m_host_ip:8083/v1/catalog) endpoint.

You can interact with the Catalog service using the Swagger interface available at, [http://k4m\\_host\\_ip:8083/v1/swagger-ui.html](http://k4m_host_ip:8083/v1/swagger-ui.html), also shown in the figure below.

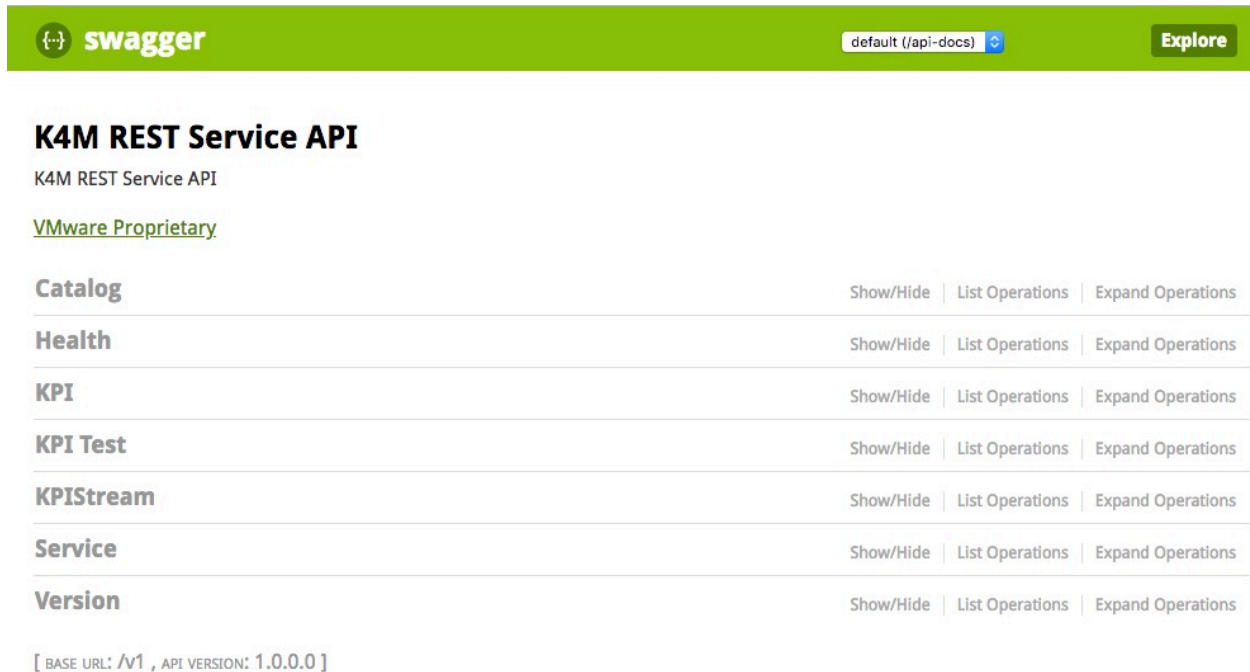


Figure 1 K4M REST Service endpoints

From the available resources click on the Catalog service to view all the operations as shown in the figure below.

<b>Catalog</b>		Show/Hide	List Operations	Expand Operations
GET	/catalog			Get all Catalogs
POST	/catalog			add a new Catalog
DELETE	/catalog/{catalogID}			Delete a Catalog
GET	/catalog/{catalogID}			Get CatalogItems with the given Catalog ID
POST	/catalog/{catalogID}			add a new CatalogItem in the Catalog with the given ID
PUT	/catalog/{catalogID}			Update an existing Catalog
DELETE	/catalog/{catalogID}/{catalogItemID}			Delete a CatalogItem
PUT	/catalog/{catalogID}/{catalogItemID}			Update an existing CatalogItem

Figure 2 Catalog REST endpoint

Operation	Description
GET /catalog	Retrieve all Catalog resources.
POST /catalog	Create a new Catalog.
DELETE /catalog/{catalogID}	Delete a Catalog with catalogID.
GET /catalog/{catalogID}	Retrieve all CatalogItems from a Catalog with catalogID.
POST /catalog/{catalogID}	Create a new CatalogItem in a Catalog with the catalogID.
PUT /catalog/{catalogID}	Update an existing Catalog with catalogID.
DELETE /catalog/{catalogID}/{catalogItemID}	Delete a CatalogItem from a Catalog with catalogID.
PUT /catalog/{catalogID}/{catalogItemID}	Update a CatalogItem in a Catalog with catalogID.

**NOTE:** Please refer to the Swagger UI for further details about the above operations. For general details about using the Swagger UI refer to Swagger documentation [1].

### Create Catalog

Click on the POST /catalog link to expand it and in the body of the request, paste the Catalog resource with all of its CatalogItems. Click the “Try it out” to submit the Catalog. Upon successful posting you should see the confirmation response.

One may also use utility such as CURL and run the above operations from the command line.

## Chapter 2 KPI Designer Usage

Open the VMware Smart Assurance UI in a browser. Refer to the **VMware Smart Assurance UI documentation** for the URL.

When the user clicks on the KPI Designer item at the left side navigation panel, the KPI Designer shows in the content area.

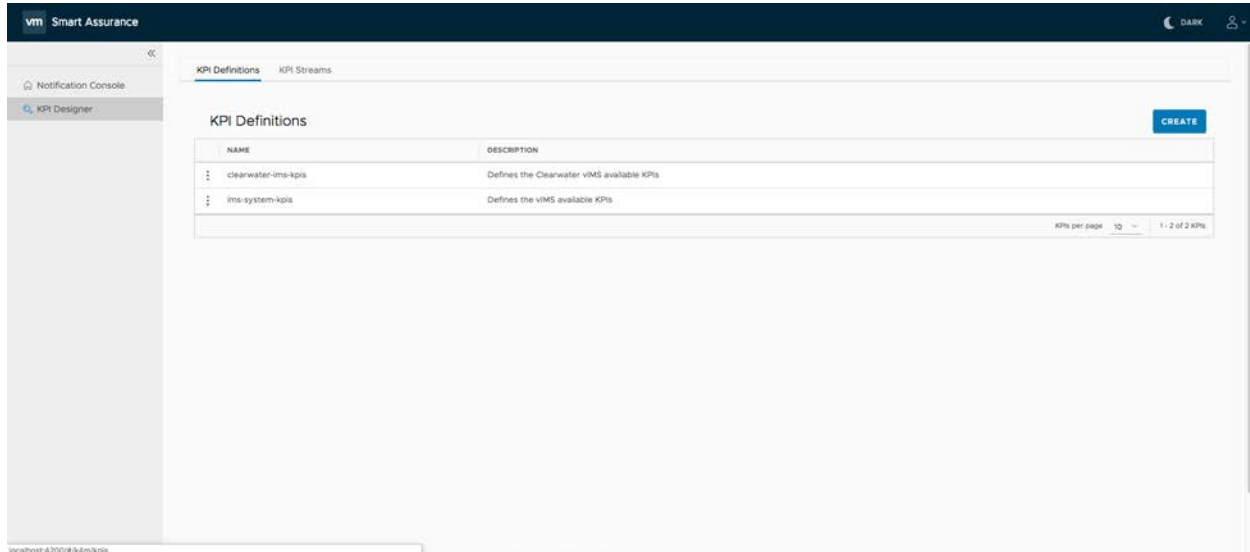


Figure 3 KPI Designer main page

The landing page of KPI Designer shows the list of KPI Definitions. As shown in the figure above, there are two menu items, “KPI Definitions” and “KPI Streams”, at the top of the page content section. The user can switch between the list of KPI Definitions and the list of KPI Streams by clicking the corresponding menu item.

## KPI Definitions page

Clicking the KPI Definition menu item opens the KPI Definitions page. Here the user can browse, edit, export, or delete the list of created KPI Definitions. The user can also create new KPI Definition.

In the KPI Definition list, at the beginning of each row, there is an action button (three vertical dots). By clicking the action button, the action menu shows. On the action menu, there are three action menu items, Edit, Delete, and Export, as shown below:

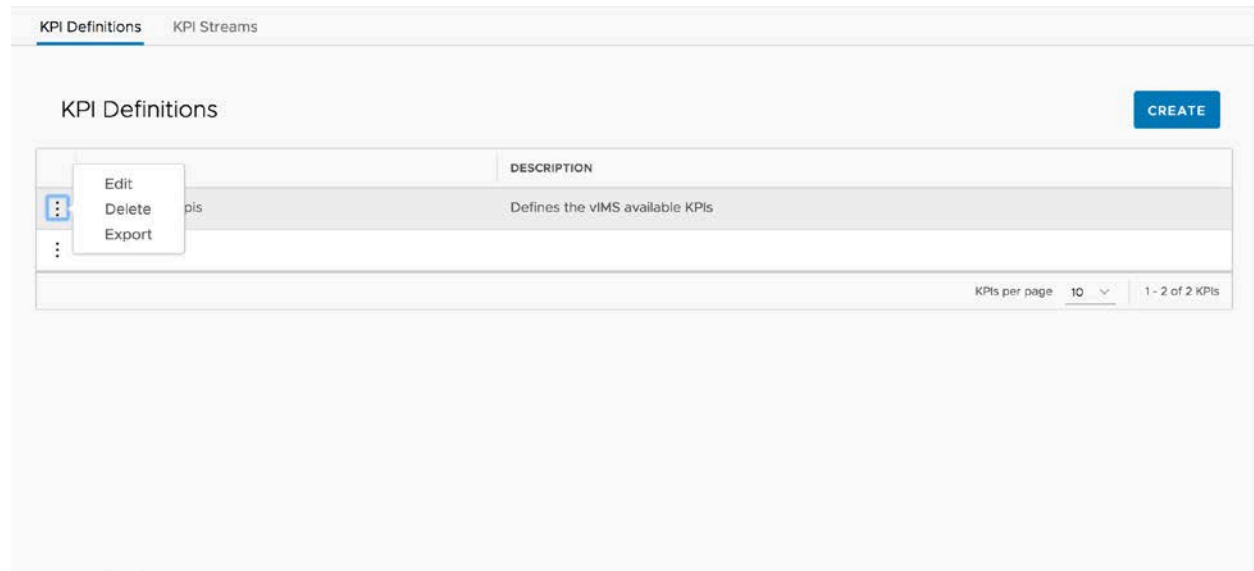


Figure 4 KPI Definition actions

By clicking on *Edit* menu, the page will navigate to the page to edit the selected KPI Definition.

By clicking on the *Delete* menu, the selected KPI Definition will be deleted.

By clicking on the *Export* menu, the JSON file of the selected KPI Definition will be exported and downloaded.

When the user clicks on the “CREATE” button. The page will navigate to KPI Definition page where a new KPI Definition is created.

## Create KPI Definition

A KPI Definition is a set of calculations and common settings that apply across all calculations.

Each calculation results in a single KPI.

KPI Definition page allows user to create or edit the KPI Definition. In Create mode, a blank KPI Definition page is shown. In Edit mode, the page is populated with the selected KPI definition.



The screenshot shows the 'KPI Definition' form in a 'Create' mode. At the top right, there are three buttons: 'CANCEL', 'CLONE', and 'SAVE'. The form fields are as follows:

- Name \***: A text input field.
- Description**: A large text area for entering a description.
- Window Configuration**: A section containing:
  - Type**: A dropdown menu with 'Tumbling' selected.
  - Time Policy**: A dropdown menu with 'Event Time' selected.
  - Length (seconds)**: A text input field with '60' entered.
- Group By**: A text input field with the placeholder text 'Type 1\* to prompt content assist'.
- Filters**: A text input field with the placeholder text 'Type 1\* to prompt content assist'.

Figure 5 Create KPI Definition

In KPI Definition page, user can enter the following information:

- **Name:** Name of the KPI Definition, mandatory field
- **Description:** Description of the KPI Definition
- **Window Configuration:**

KPIs are calculated over all the events(or metrics) that arrive within a certain time window. The window configuration, includes four sub-fields:

  - **Type:**
    - **Sliding:** This is an overlapping window of a certain length. When selected, a Period field is also displayed. The Period is the time after which the window slides.  
KPI is computed **once every time the window slides**, computation is using all the values within the window.
    - **Tumbling:** This is a disjoint window of certain length. When selected, this does not have a Period associated.  
KPI is compute **once every time the window tumbles** i.e. after the length of window.
  - **Time Policy:**
    - **Event Time:** Selecting this uses the event time which is the timestamp provided by the system generating this event(metric).



## Calculation

In the KPI Definition page, the user can configure one or more calculations in the Calculations section.

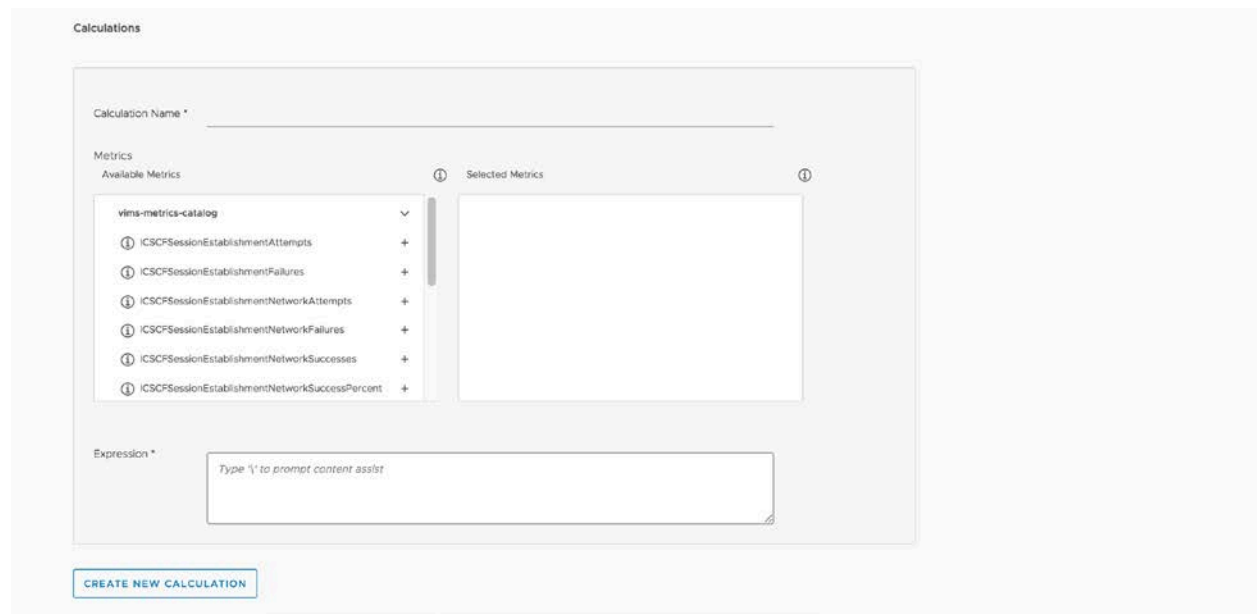


Figure 7 KPI Calculations

A KPI result is obtained from a Calculation which is a mathematical expression made up of metrics combined with arithmetic operators, and built-in functions. Function parameters can themselves be other expressions.

Each calculation section has the following fields:

- Calculation Name: Name of the calculation. This will be KPI name as well.
- Metrics: User can select the metrics from the Available Metrics box by clicking on the metric name, and de-select the metrics from the Selected Metrics box by clicking on the metric name. When the cursor hovers over the information icon, the description for the metrics (from the CatalogItem) displays as a tooltip.
- Expression: This is the Calculation expression. Pressing “\” displays the user-selected metrics and built-in functions.  
**NOTE:** Only those metrics that have been selected (appearing in the Selected Metrics box) also appear in the content assistant. So metrics must be selected first.  
Select the metrics, combine with arithmetic operators and built-in functions. Replace the parameters with metric(s) and other expressions as needed to complete the expression for your KPI.

For example, an expression may be:

```
percent((average(metricA) + average(metricB)), average(metricC))
```



The figure below shows the content assistant for Expression field, with the user-selected metrics and built-in functions listed.

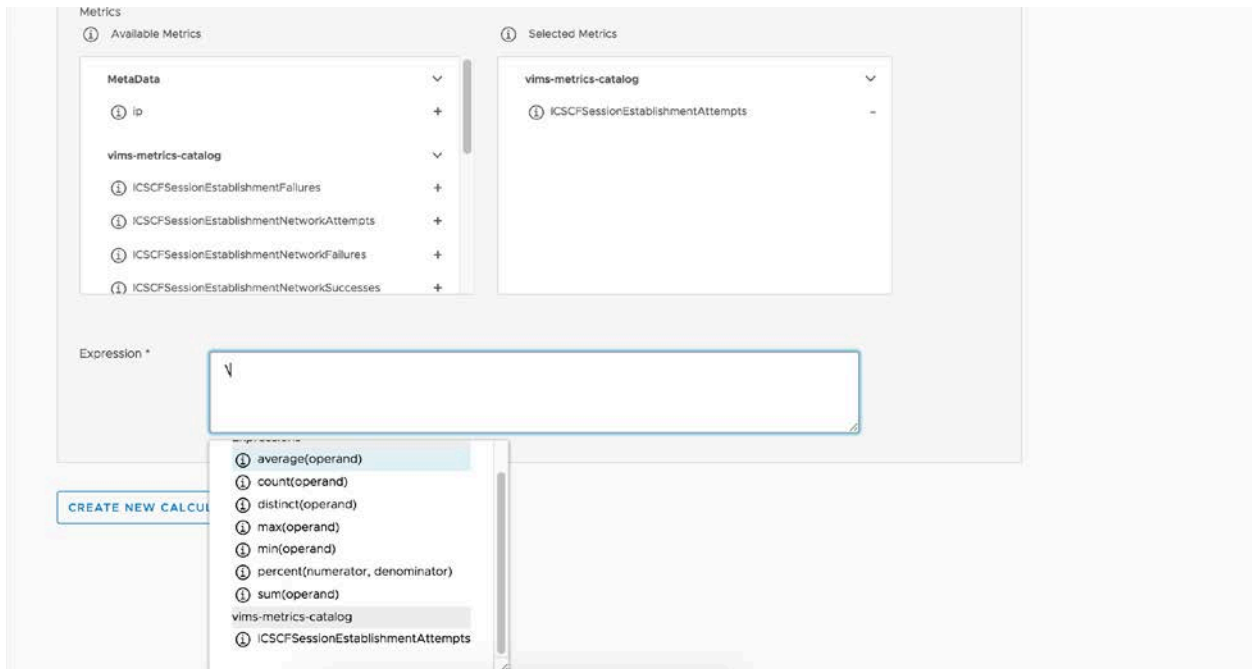


Figure 8 Calculation expression

**NOTE:** Functions should be used to aggregate the incoming metric values over the time window and then combined with other aggregated metrics and operators and functions. This ensures all the values in the window are considered in the computation.

The complete list of arithmetic operators and built-in functions is described in the next section.

The user can create more Calculations section by clicking the “CREATE NEW CALCULATION” button.

As shown in the following figure, when two or more Calculations are configured, the delete button (red X) is shown in the Calculation section to allow the user to delete any unwanted calculation.

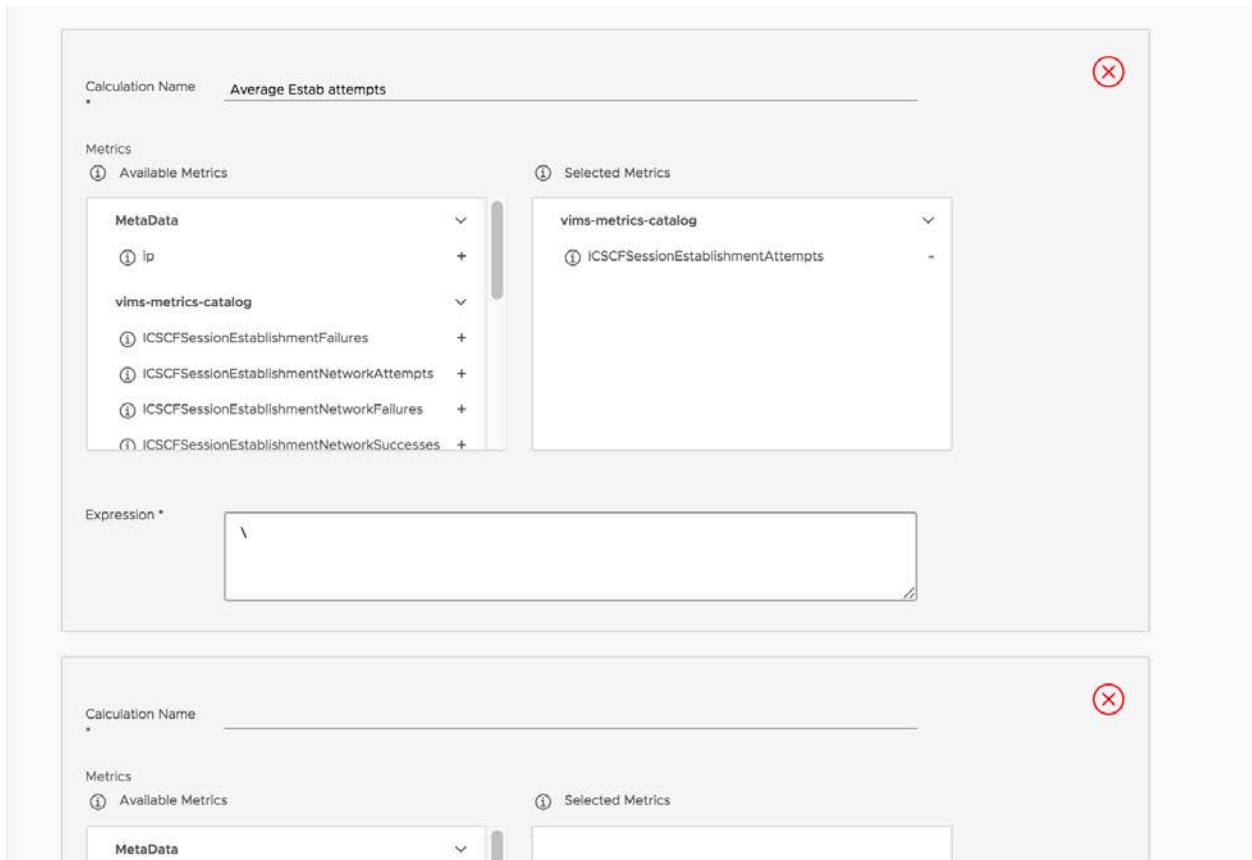


Figure 9 Deleting a Calculation

After all the fields are filled, the user can save the KPI Definition by clicking the “SAVE” button as shown below. After the KPI Definition is saved, the KPI Definitions page is displayed.

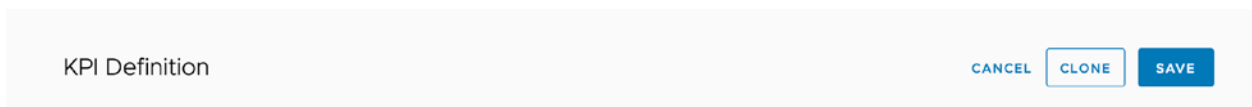


Figure 10 Save KPI Definition

The CANCEL button allows the user to cancel current edition, and navigate back to the KPI Definitions page.

### Cloning a KPI Definition

If the user wants to clone the current KPI Definition and makes minor changes on certain fields. The user can click on the “CLONE” button, the Name field of the KPI Definition will be changed to “Clone of

Previous-Name (change me please)". The user can make desired changes on the fields, rename the KPI Definition, and click the "SAVE" button to save the new KPI Definition.

## Operators and Built-in Functions

KPI Engine supports the following arithmetic operators:

- addition (+)
- subtraction (-)
- multiplication (\*)
- division (/)

Parenthesis ( ) can be used to specify precedence.

Built-in functions are described below:

Name	Definition	Description
Average	<code>average (operand)</code>	Average of the operand values arriving in the time window
Count	<code>count (operand)</code>	Number of operand values arriving in the time window
Distinct	<code>distinct (operand)</code>	Number of distinct operand values arriving in the time window
Maximum	<code>max (operand)</code>	Maximum of the operand values arriving in the time window
Minimum	<code>min (operand)</code>	Minimum of the operand values arriving in the time window
Percentage	<code>percent (numerator , denominator)</code>	Percentage of numerator to the denominator operands. Both numerator and denominator must be aggregated over operand values arriving in the time window
Sum	<code>sum (operand)</code>	Summation of the operand values arriving in the time window

## KPI Streams page

On the main page, click the KPI Streams link to open the KPI Streams page. Here, the user can browse, edit, export, or delete the list of created KPI Streams. The user can also create a new KPI Stream by clicking on the CREATE button.

In the KPI Stream list, at the beginning of each row, there is an action button similar to the KPI Definition list. By clicking the action button, the action menu shows. On the action menu, there are three action menu items, Edit, Delete, and Export, as shown below:

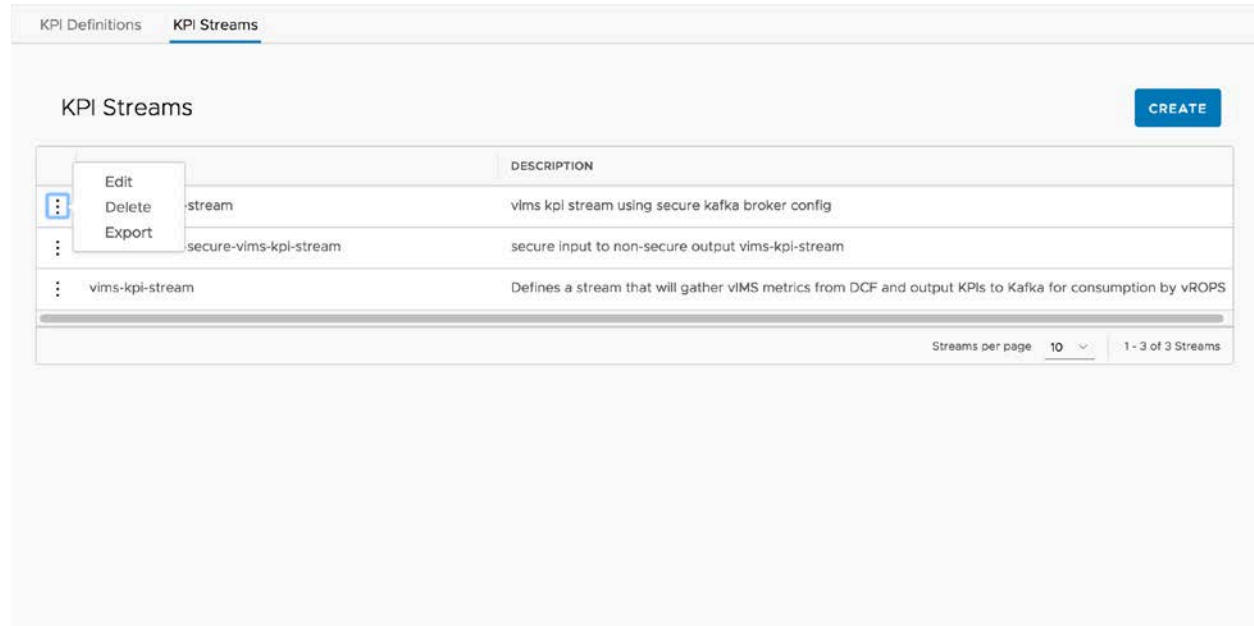


Figure 11 KPI Stream actions

By clicking on *Edit* menu, the page will navigate to the page to edit the selected KPI Stream.

By clicking on the *Delete* menu, the selected KPI Stream will be deleted.

By clicking on the *Export* menu, the JSON file of the selected KPI Stream will be exported and downloaded.

When the user clicks on the “CREATE” button. The page will navigate to KPI Stream page where a new KPI Stream is created.

## Create KPI Stream

KPI Stream page allows the user to create or edit a KPI Stream. In Create mode, a blank KPI Stream page is shown. In Edit mode, the page is populated with the selected KPI Stream.

There are three sections as shown in the figure below. The stream form on the top of the page, the component palette at the left hand side panel, and the workspace in the content area.

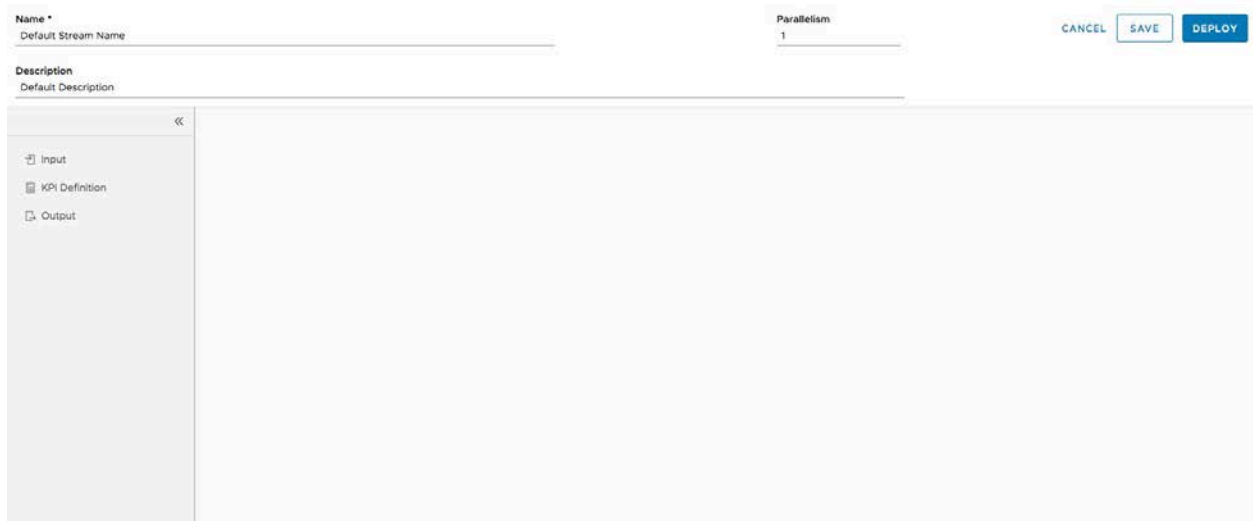


Figure 12 KPI Stream editor

The user can use the stream form on the top of the page to configure the stream with the following fields:

- Name: Name of the stream. Required field.
- Description: Description of the stream
- Parallelism: Parallelism of the steam. Numeric.  
**NOTE:** Default is 1. This value should not be changed unless the necessary changes have been made in the KPI Engine (Flink) to accommodate for the extra resources needed when parallelism is greater than 1.

The left side component palette contains the stream components (blocks). There are three component categories supported for this release. When the user clicks on the name of the component category, the component detail panel is displayed. The categories are:

- Input: Contains Input components (blocks), that represent the source of the streaming metrics. The Input block should be configured with the details of the metric source so the KPI Engine can connect to that source and process the metrics.  
**NOTE:** The current release supports Kafka input only

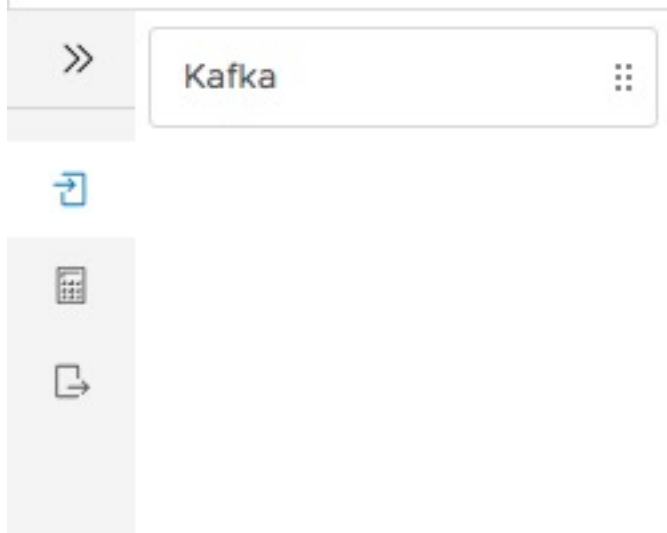


Figure 13 Kafka Input block

- **KPI Definition:** Contains the pre-configured KPI Definitions i.e. the definitions already created. When there are multiple KPI Definitions, the user can use the search box on the top to find the required KPI Definition.

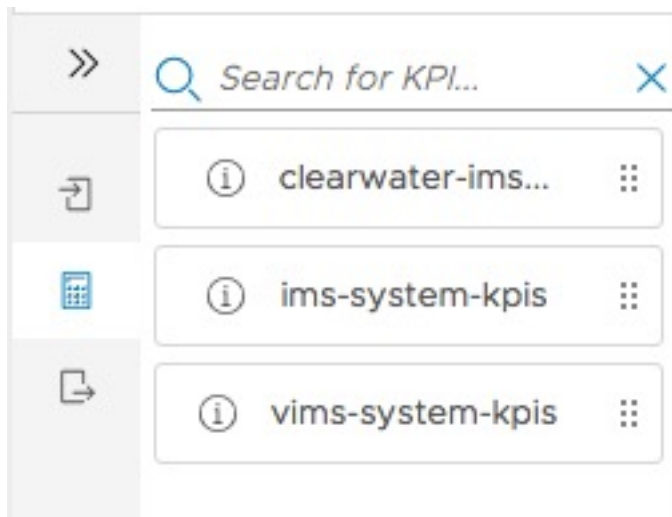


Figure 14 KPI Definition block

- **Output:** Contains output components (blocks), which represent the destination for the KPIs. The Output block should be configured with the details of the destination so the KPI Engine can connect to it and send KPIs.

**NOTE:** The current release supports Kafka output only.

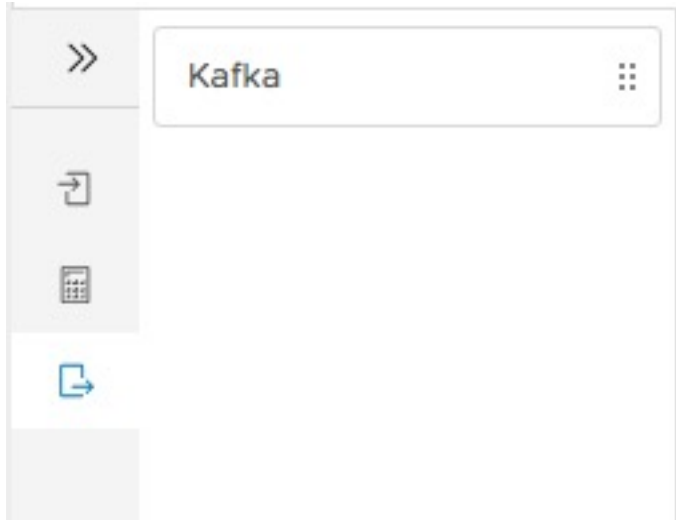


Figure 15 Output block

A KPI Stream begins with the Input, connects to the KPI Definitions for calculation over the streaming metrics, and publishes the calculation result to the Output. The blocks are arranged in the following sequence:

Input → KPI Definitions → Output

A KPI Stream can have multiple Input/KPI Definition/Output blocks. For example, multiple Input blocks can be connected to one or more KPI Definition blocks to process streams from different sources. Similarly, the KPI Definition blocks could be connected to multiple Output blocks to distribute the KPIs to different destinations.

To build a stream, the user drags-and-drops the block from the component panel to the workspace as shown in the following figure. After the KPI Definition or Output components are added, the connection lines are added automatically to indicate the flow of the data.

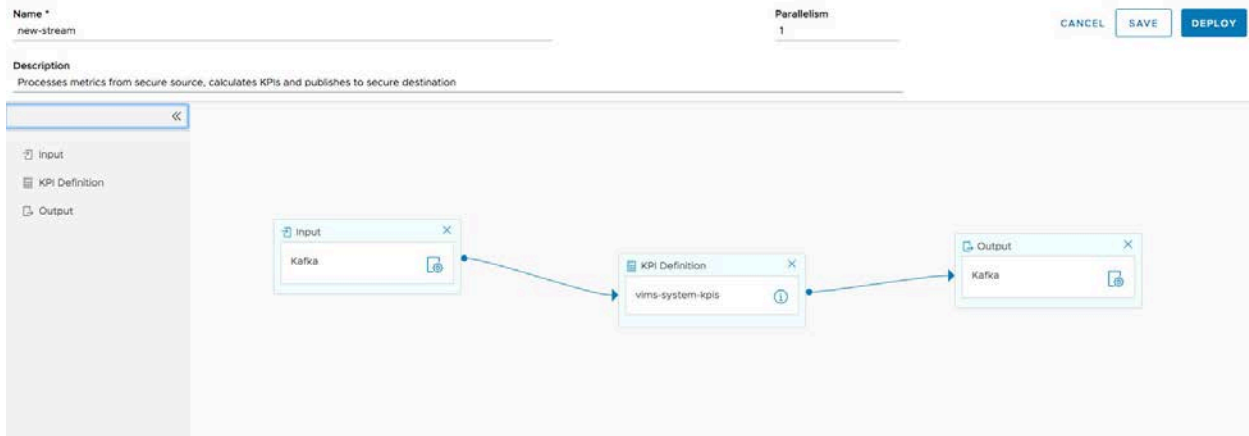


Figure 16 KPI Stream design



The user can configure the Input and Output blocks by clicking the edit (gear) icon on the block. The component edit panel is displayed in the right hand side of the workspace.

The figure below displays the Input block edit panel. Configure the following properties:

- **Group ID:** consumer group id
- **Bootstrap Servers:** kafka\_broker\_ip:kafka\_broker\_port  
For Kafka cluster enter list as:  
kafka\_broker\_ip1:kafka\_broker\_port1,kafka\_broker\_ip2:kafka\_broker\_port2,...
- **Topic:** Topic name to subscribe for metrics.
- **Username & Password :** User name and password if Kafka broker is configured for secure password authentication.
- **Formatter:** Select input metric format.

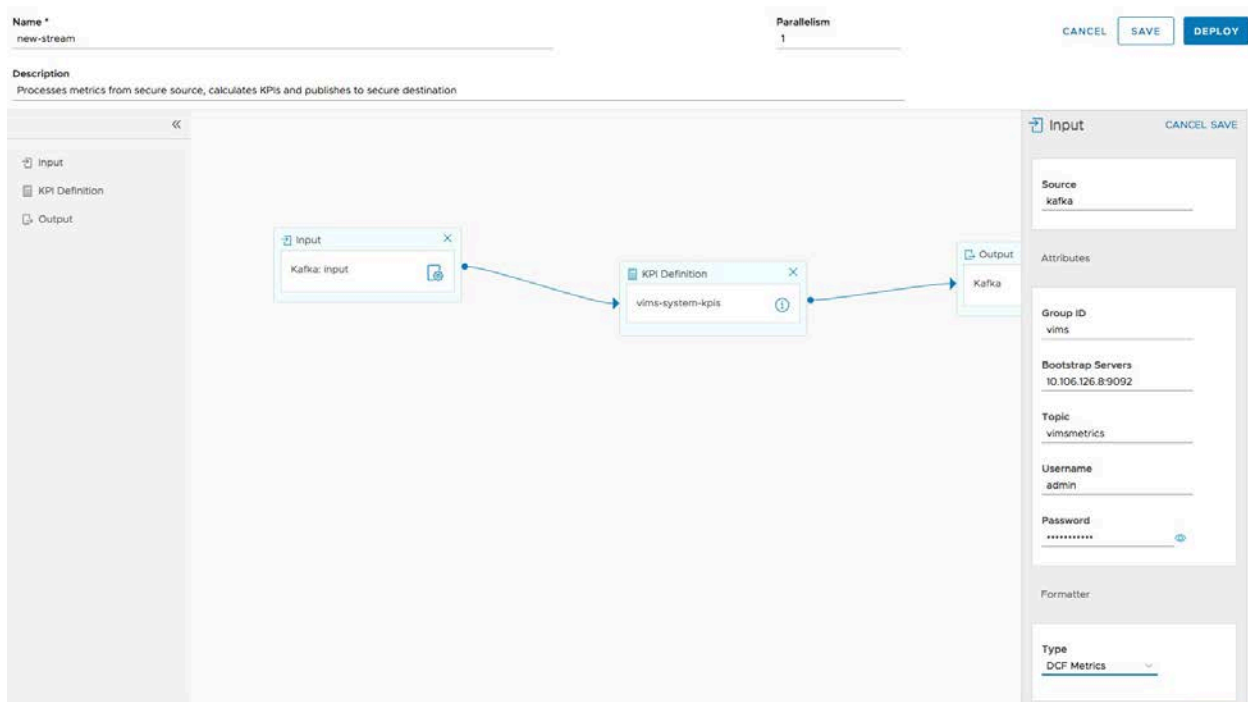


Figure 17 Input block configuration

After configuring all the fields click the SAVE button.

Similarly, the Output block should also be configured as shown below.

- **Bootstrap Servers:** kafka\_broker\_ip:kafka\_broker\_port  
For Kafka cluster enter list as:  
kafka\_broker\_ip1:kafka\_broker\_port1,kafka\_broker\_ip2:kafka\_broker\_port2,...
- **Topic:** Topic name to publish KPIs.
- **Username & Password:** User name and password if Kafka broker is configured for secure password authentication.
- **Formatter:** Select KPI output format.

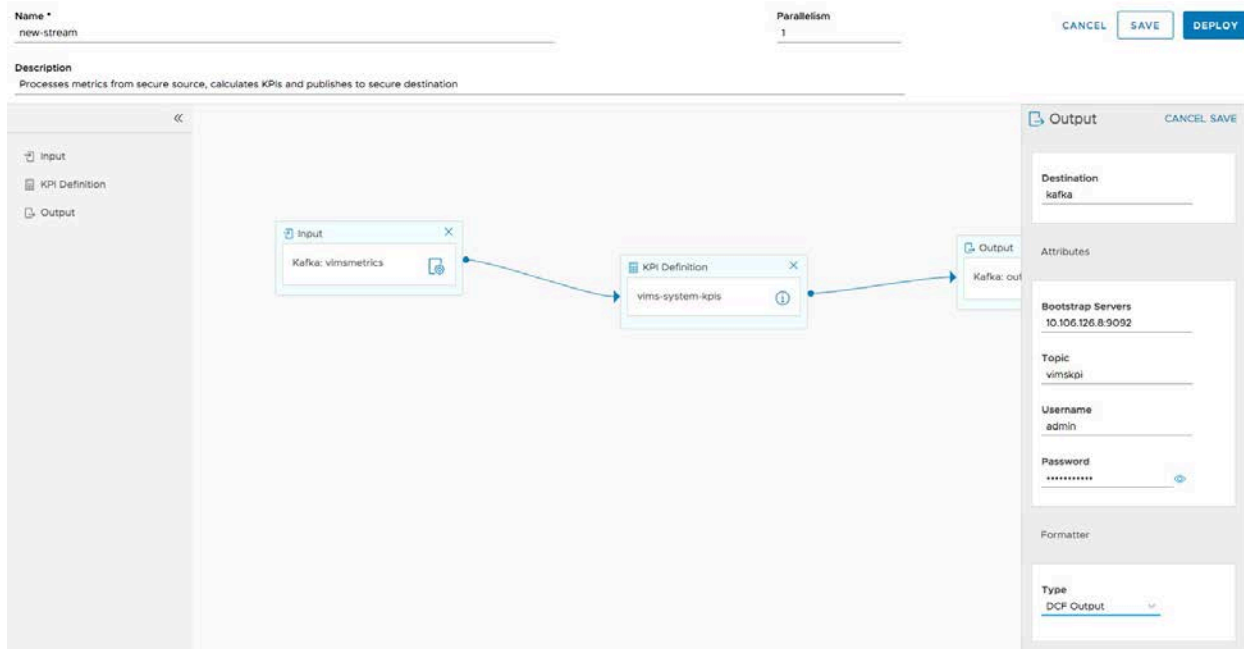


Figure 18 Output block configuration

**NOTE:** Clicking SAVE in the edit panel saves the block configuration in the client only. To save the configuration to the KPI Configuration Store, click the SAVE button in the workspace form (top right corner). This is also described below. The CANCEL button allows the user to dismiss the edit panel without saving any changes.

Clicking on the “info” icon on the KPI Definition block allows user to view the summary of the KPI Definition. The summary is shown in a popup window as the figure below. The OK button allows the user to dismiss the popup window.

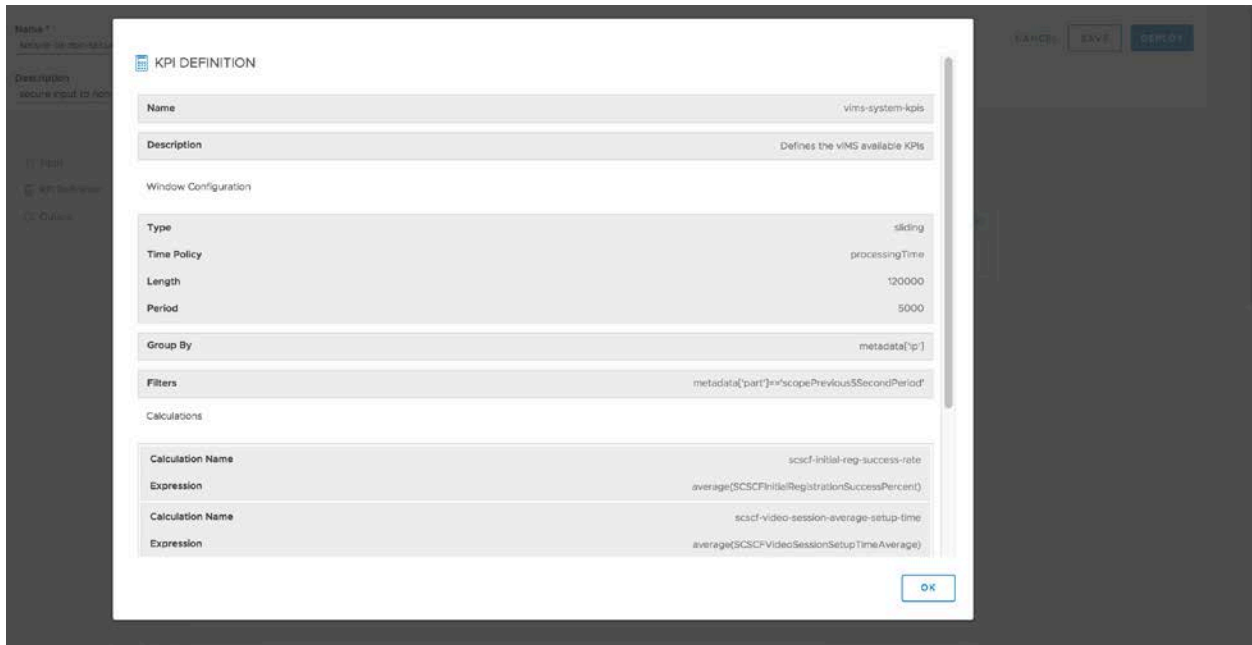


Figure 19 KPI Definition block

After configuring all the blocks in the workspace, click the SAVE button at the top right corner.

This will save the stream to the KPI Configuration Store **without** deploying the stream to the KPI Engine. Clicking the DEPLOY button will both save the stream to the KPI Configuration Store **and** deploy the stream to the KPI Engine.

After the stream is successfully saved or deployed, the KPI Streams page is displayed.

The CANCEL button allows the user to cancel the stream editing and return to the KPI Streams page.

## Chapter 3 References

1. Swagger - <https://swagger.io/docs/>
2. SpEL – Spring Expression Language <https://docs.spring.io/spring/docs/4.3.23.RELEASE/spring-framework-reference/htmlsingle/#expressions>