IBM RMF for z/OS Grafana Plugin User Guide

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1. IBM RMF for z/OS Grafana Plugin

1.1. Visualization of RMF Monitor III metrics in Grafana

Grafana is a platform for monitoring and visualizing data. It enables users to create, explore, and share dashboards that are interactive and customizable. The IBM® RMF for z/OS Grafana plugin provides effortless analysis and visualization of Resource Measurement Facility for z/OS (RMF for z/OS) Monitor III metrics and reports within the Grafana platform. Thereby, you can monitor and analyze the health and performance of applications.

The IBM RMF for z/OS Grafana plugin provides the following features:

- You can choose various visualization options, such as graphs, charts, panels, and reports, to help you understand your data's trends, patterns, and variances.
- You can create dynamic and engaging dashboards by piecing together various panels, each displaying a unique visualization.
- You have the freedom to customize each panel based on your requirements, including its appearance, size, and the data queries it displays.
- Grafana supports integration with numerous data sources, which helps you fetch data from various Distributed Data Servers (DDS) and display it in a unified dashboard.
- You can set up alerts based on specific conditions or thresholds in your RMF data. Grafana can trigger notifications via email or other communication channels when these conditions are met.
- You can define a dashboard variable to change the RMF data displayed in your dashboard simply by selecting a value from the drop-down list at the top.

1.2. Release notes

This article covers the new features, system requirements, and known issues of the IBM® RMF for z/OS Grafana plugin.

What's new

November 2025 v1.1.1

- The following plugin names have been changed to meet Grafana naming conventions:
  - *ibm-rmf* to *ibm-rmf-app*
  - *ibm-rmf-report* to *ibm-rmf-panel*
- The new plugin names must be added to the **allow_loading_unsigned_plugins** instead of the old ones. The new value is *ibm-rmf-app,ibm-rmf-datasource,ibm-rmf-panel*.

August 2025 v1.1.0

- Change in deployment method for sample dashboards.

  Sample dashboards are now deployed through the IBM RMF application instead of using the standard Grafana bundling process. Users can manage the deployment of sample dashboards directly on the app page.

- Sample dashboards are deployed into dedicated IBM RMF folders.

July 2025 v1.0.11

- Fixed issues that caused dashboards showing maximum 20 systems per sysplex.
- The following dashboards are updated:
  - Common Storage Activity (Timeline)
  - Common Storage Activity
  - General Activity (Timeline)
  - General Activity
  - Overall Image Activity (Timeline)
  - Overall Image Activity

> **Note:** You may need to re-import the dashboards to utilize the latest enhancements in the dashboards, depending on your installation method.

- Fixed internally found defects.

May 2025 v1.0.10

Fixed a Windows-specific regression that caused the plugin to serve data points with the incorrect TZ offset.

May 2025 v1.0.9

- IBM RMF for z/OS Grafana plugin has been enhanced to optimize the step size when querying and displaying time series data, based on the selected time range and panel size. This enhancement ensures that panels display the required number of data points.

- A bug has been fixed that was causing specific data points to be dropped from time series views, resulting in a flat line in the graphs.

- Fixed internally found defects.

April 2025 v1.0.8

- A new option, **Compression**, has been added to the data source creation process. This option enables the RMF data source to request HTTP compression from the Data Distributed Server (DDS) during data retrieval, which improves the efficiency of data transfer. See Creating RMF data sources (on page 13).

• Fixed certain scenarios of missing data within dashboards for time series visualizations.

• Fixed internally found defects.

November 2024 v1.0.7

Fixed internally found defects.

October 2024 v1.0.6

• The IBM RMF for z/OS Grafana plugin now allows customizing banner and caption fields in IBM RMF Report visualizations.

• After you modify any **IBM RMF** data source and save the changes, you no longer need to re-enter the password.

• Improved performance.

• Fixed internally found defects.

August 2024 v1.0.5

• When creating the datasource, you now have the option to specify the desired cache size in megabytes for the datasource.

• Fixed internally found defects.

• The topic of Creating RMF data sources has been updated per the new UI changes.

June 2024 v1.0.4

• The user interface for creating the datasource has been enhanced to improve the user experience.

• Fixed internally found defects.

• The following dashboards are updated:
  ◦ Common Storage Activity (Timeline)
  ◦ Common Storage Activity
  ◦ Coupling Facility Overview (Timeline)
  ◦ Coupling Facility Overview
  ◦ Execution Velocity (Timeline)
  ◦ Execution Velocity
  ◦ General Activity (Timeline)
  ◦ General Activity
  ◦ Overall Image Activity (Timeline)
  ◦ Overall Image Activity
  ◦ Performance Index (Timeline)
  ◦ Response Time (Timeline)
  ◦ Response Time
  ◦ XCF Activity (Timeline)
  ◦ XCF Activity

> 📝 **Note:** You must re-import the dashboards to utilize the latest enhancements in the dashboards.

- The documentation updates for v1.0.4 include the following changes:
  - The topic of Creating RMF data sources *(on page 13)* has been updated as per the new UI changes.
  - The Upgrading the RMF for z/OS plugin on Grafana *(on page 10)* topic is included to provide information about the upgrade process.

February 2024 v1.0.3

- Fixed specific issues related to the support of Grafana v10.x.x.
- Fixed empty settings issue for IBM RMF data source defined via `Home / Apps / IBM RMF` page.
- Fixed internally found defects.
- The documentation updates for v1.0.3 include the following changes:
  - The Grafana through IBM z/OS Management Facility *(on page 26)* topic explains more detailed setup instructions to access Grafana from the z/OSMF server.
  - The RMF for z/OS plugin installation *(on page 7)* section is updated to provide clear information and guidance on installing the RMF for z/OS plugin on different platforms based on specific requirements.
  - The troubleshooting *(on page 25)* topic is provided to help users analyze and resolve common issues that may occur while using the IBM RMF for z/OS Grafana plugin.

December 2023 v1.0.2

- Support spaces in Datasource name.
- Fixed internally found defects.

November 2023 v1.0.1

- Resolved security issues in dependencies.
- Fixed internally found defects.

November 2023 v1.0.0

The first release of the IBM RMF for z/OS Grafana plugin is in the following GitHub repository: https://github.com/IBM/RMF.

Requirements

You must have the following software to use the IBM RMF for z/OS Grafana plugin:

- Resource Measurement Facility for z/OS 3.1
- Distributed Data Server
- IBM RMF for z/OS Grafana plugin 1.0.x
- Grafana 10.0 or later

1.3. Installing the RMF for z/OS plugin on Grafana

You must install the IBM® RMF for z/OS Grafana plugin to analyze and visualize RMF Monitor III metrics and reports.

Before you begin
You must have completed the following tasks:

- Installed RMF for z/OS 3.1 DDS and the functionality level must be 3650 or higher.
- Installed Grafana 10.0 or later.

You must be familiar working with Grafana.

Procedure

1. Set the value of **allow_loading_unsigned_plugins** to *ibm-rmf-app,ibm-rmf-datasource,ibm-rmf-panel* in the **[plugins]** section of your custom configuration file.
   The default configurations for a Grafana installation are in the `defaults.ini` file. You can copy the `default.ini` file and rename it to `custom.ini` for customizing your Grafana configuration.

   The default location of the configuration file is as follows:

Operating systems	Default path to the configuration file
Windows®	`WORKING_DIR/conf/defaults.ini`
Linux®	`/etc/grafana/grafana.ini`
macOS®	`/usr/local/etc/grafana/grafana.ini`

   > **Note:** You can use the **GF_PLUGINS_ALLOW_LOADING_UNSIGNED_PLUGINS** environment variable to override **allow_loading_unsigned_plugins**.

2. Choose any one of the methods described in the following table to install the RMF for z/OS plugin based on your requirements:

Methods	Step #
Installing the RMF for z/OS plugin in the Grafana stand-alone application.	Perform steps 3 *(on page 8)* and 4 *(on page 8)*.
Installing the RMF for z/OS plugin along with Grafana within the Docker environment.	Perform steps 5 *(on page 8)* and 6 *(on page 8)*.

3. Run the following command to install the plugin by using Grafana CLI:

```
grafana cli
  --pluginUrl https://github.com/IBM/RMF/releases/download/ibm-rmf-grafana/v<versi
on>/ibm-rmf-grafana-<version>.zip plugins install ibm-rmf
```

> 🔔 **Remember:** You must replace the value of *<version>* for the **pluginURL** option to version number of the plugin to be installed.

4. Restart the Grafana server, and then go to step 7 *(on page 8)*.
5. Run the following command to create a volume for storing the Grafana state:

```
docker volume create rmf-grafana-data
```

6. Run the following command to create and run a container:

```
docker run --name rmf-grafana --hostname rmf-grafana --detach --restart
 unless-stopped --volume rmf-grafana-data:/var/lib/grafana --publish 3000:3000
 --env
 "GF_INSTALL_PLUGINS=https://
github.com/IBM/RMF/releases/download/ibm-rmf-grafana/v<version>/ibm-rmf-grafana-<
version>.zip;ibm-rmf" --env
 "GF_PLUGINS_ALLOW_LOADING_UNSIGNED_PLUGINS=ibm-rmf-app,ibm-rmf-datasource,ibm-rm
f-panel" <image>
```

> 🔔 **Remember:** You must replace the values of the following options in the command:
> - *<version>* for the **env** option to the version number of the plugin to be installed.
> - *<image>* to the version of the Grafana image to be used.

> ✏️ **Note:** zCX/zLinux images are available at Container Images for IBM Z and LinuxONE. Similarly, images of other required platforms are available at Docker Hub.

7. To enable the RMF for z/OS plugin on the Grafana UI, you must perform the following sub-steps:

    a. Enter the URL of Grafana in your web browser.

    b. Enter the username and password of Grafana on the **sign-in** page.

    c. Go to **Administration > Plugins**.

> ✏️ **Note:** The navigation of the user interface can differ based on the Grafana version that is currently installed.

    d. Enter RMF in the **Search** bar on the **Plugins** page.

    e. Click **IBM RMF** in the search results.

f. Click **Enable**.

> 📝 **Note:** If the `Invalid plugin signature` warning is displayed, the warning does not have any impact on the users.

8. **Optional:** To install the sample dashboards, perform the following sub-steps:

a. Go to **IBM RMF App** by selecting the **Go to IBM RMF App** option on the plugin configuration or the **More Apps** option from the sidebar menu.

b. On the **IBM RMF App** page, follow the instructions provided to manage the sample dashboard deployment.

> 📝 **Note:** Clicking **Install** creates a folder with a reserved UID and the sample dashboards are added to the folder. Neither the folder nor dashboards are owned by the plugin and can be managed by users.
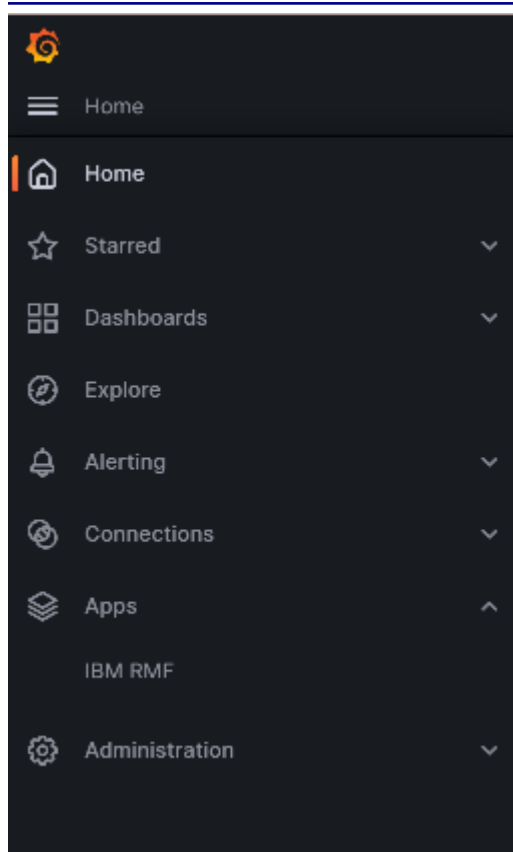
> ⚠️ **Important:** After the installation is complete, you may need to reload the page to see the folders under the Dashboards section.

Results

You have installed the IBM RMF for z/OS Grafana plugin. You can find the **IBM RMF** plugin listed under the **Apps** section.

What to do next

You can add an RMF data source to fetch data from Distributed Data Servers (DDS). See Creating RMF data sources *(on page 13)*.

Related information

Grafana CLI documentation
docker run command
docker volume create command

1.4. Upgrading the RMF for z/OS plugin on Grafana

You must ensure that the IBM RMF for z/OS Grafana plugin is up to date to leverage its enhanced functionalities. You can do so by either installing or upgrading to the latest version of the plugin.

About this task

The upgrade procedures differ based on the environment you used to install the Grafana server.

Methods	Step #
Upgrading the plugin in the Grafana stand-alone application.	Perform steps 1 *(on page 11)* to 3 *(on page 11)*.
Upgrading the plugin in the Grafana within the Docker environment.	Perform steps 4 *(on page 11)* to 7 *(on page 12)*.

Procedure

1. Stop the Grafana server.
2. Run the following command to upgrade the plugin by using Grafana CLI:

```
grafana cli
  --pluginUrl https://github.com/IBM/RMF/releases/download/ibm-rmf-grafana/v<versi
on>/ibm-rmf-grafana-<version>.zip plugins install ibm-rmf
```

> 📝 **Note:** You must replace the value of *<version>* for the **pluginURL** option with the plugin's version number to be upgraded.
>
> For example, if you want to install the *v1.0.3* version of the plugin, the value of **pluginURL** is https://github.com/IBM/RMF/releases/download/ibm-rmf-grafana/v1.0.3/ibm-rmf-grafana-1.0.3.zip.

> ⚠️ **Important:** When upgrading from v1.1.0 or older, the **allow_loading_unsigned_plugins** Grafana option must be updated with amended plugin names. Set the value to *ibm-rmf-app,ibm-rmf-datasource,ibm-rmf-panel*.

   The CLI tool downloads the mentioned version of the plugin and replaces the existing files.
3. Restart the Grafana server, and then go to step .
4. Run the following command to stop the docker container:

```
docker stop rmf-grafana
```

   Where *rmf-grafana* is the name of the container.

5. Run the following command to remove the docker container:

```
docker rm rmf-grafana
```

6. Run the following command to upgrade the plugin by creating and running a container:

```
docker run --name rmf-grafana --hostname rmf-grafana --detach --restart
 unless-stopped --volume rmf-grafana-data:/var/lib/grafana --publish 3000:3000
 --env
 "GF_INSTALL_PLUGINS=https://
github.com/IBM/RMF/releases/download/ibm-rmf-grafana/v<version>/ibm-rmf-grafana-<
version>.zip;ibm-rmf" --env
 "GF_PLUGINS_ALLOW_LOADING_UNSIGNED_PLUGINS=ibm-rmf,ibm-rmf-datasource,ibm-rmf-re
port" <image>
```

> 🔔 **Remember:** You must replace the values of the following options in the command:
> - *<version>* for the **env** option to the version number of the plugin to be upgraded.
> - *<image>* to the version of the Grafana image used.

7. **Optional:** To update the sample dashboards, perform the following sub-steps:

    a. Go to **IBM RMF App** by selecting the **Go to IBM RMF App** option on the plugin configuration or the **More Apps** option from the sidebar menu.

    b. On the **IBM RMF App** page, follow the instructions provided to manage the sample dashboard deployment.

> ✏️ **Note:** After clicking the **Update/ Reset** or **Delete** option, the destination folder with the reserved UID is deleted.

> ⚠️ **Important:** If you rename or move the reserved folder, it retains the same UID and will be reset.

Results

You have updated the IBM RMF for z/OS Grafana plugin.

1.5. Prometheus Sample Dashboards

The RMF Distributed Data Server exposes Monitor III data to third-party tools using the OpenMetrics exposition format.

> ✏️ **Note:** OA67701 has to be applied for the feature.

Some examples of the tools are:

- Prometheus
- VictoriaMetrics
- Telegraf

The Monitor III data is exposed through the `/metrics/m3` endpoint.

The endpoint accepts an optional **groups** parameter to request specific metric groups:

```
GET /metrics/m3?groups=<metric-groups>
```

where **<metric-groups>** is a comma-separated list of metric groups to be expose retrieved. For more information, see RMF Distributed Data Server documentation.

The Prometheus sample dashboards are included in the plugin. To be able to use them, follow the steps below:

1. Install and deploy the IBM RMF for z/OS Grafana plugin. For more information, see Installing the RMF for z/OS plugin on Grafana *(on page 7)*.

2. Configure Prometheus to scrape the metrics exposed by RMF Distributed Data Server. For more information, see the Prometheus documentation.

    Some of the scrape target definition examples for Prometheus are as follows:

    To scrape all the configured metrics as defined in DDS GPMOMC:

```
- job_name: "m3@plex00"
  scrape_interval: 100s # Should be equal to the Monitor III mintime
  scrape_timeout: 50s
  metrics_path: /metrics/m3
  static_configs:
  - targets: [ "ddshostname:8803" ]
```

To scrape all the CPC and LPAR related metrics as defined in DDS GPMOMC:

```
- job_name: "m3@plex00"
    scrape_interval: 100s  # Should be equal to the Monitor III mintime
    scrape_timeout: 50s
    metrics_path: /metrics/m3
    params:
        groups: cpcs,lpars
    static_configs:
      - targets: [ "ddshostname:8803" ]
```

3. Create a Prometheus data source in Grafana pointing to the Prometheus server. For more information, see the Grafana documentation.

1.6. Creating RMF data sources

To access RMF Monitor III metrics in Grafana, you need to connect to the Distributed Data Server (DDS) by adding an RMF data source.

Before you begin
- You must have installed the RMF for z/OS Grafana plugin. See Installing the RMF for z/OS plugin on Grafana *(on page 7)*.
- You must know the hostname and port number of DDS.

Procedure

1. Go to **Apps > IBM RMF > Add RMF Data Source**.
   Alternatively, you can click **Administration > Data sources > + Add new data source**, then search for the IBM RMF to choose a data source type.

   > **Note:** The navigation of the user interface can differ based on the Grafana version that is currently installed.

2. Enter a name for the data source in the **Name** field.
3. **Optional:** Set **Default** ⬤ to ON to make the added data source the default one.

   > **Note:** When you create new panels, the default data source is preselected.

4. Enter the details for the following fields in the **HTTP** section:

Fields	Action
DDS URL	Enter the URL of the DDS in this field.

Fields	Action
	The format of the URL is `http://hostname:port_num-ber[/path]` or `https://hostname:port_number[/path]`
	⚠️ **Important:** In the DDS URL, the `/path` is optional, and you must exclude it in the default network configuration. However, it might be required in more advanced setups, such as when DDS functions behind a reverse proxy.
Timeout	Specify the duration, in seconds in this field, for which Grafana is allowed to wait for a connection to the DDS before it closes the connection. The default value is `60`.
Compression	This option is enabled by default, which means that when RMF requests data from DDS, HTTP compression is utilized, provided that the DDS is operating on a maintenance level OA67541. The compression setting is ignored if DDS is not at this maintenance level. You can turn off HTTP compression by setting the **Compression** option to `OFF`, resulting in DDS data being always transferred in an uncompressed format.

5. **Optional:** Set the **Skip TLS Verify** option to `ON` if you are accepting any certificate presented by the DDS and any hostname listed in that certificate. However, this practice is not considered secure and is typically used in development or testing environments.

   📝 **Note:** By default, the **Skip TLS Verify** option is set to `OFF`.

6. Set the **Basic Auth** option to `ON` to create the data source with basic authentication.
7. Enter the credentials of the DDS in the **User** and **Password** fields.

   📝 **Note:** The **User** and **Password** fields are visible only when you enable the basic authentication.

8. Specify the size of the cache (in MB) for the data source in the **Size** field.

   🔔 **Remember:** The value must be greater than or equal to `128`. The default value is `1024`.

9. Click **Save & test**.
   The `Data source is working` message is displayed if the connection to DDS succeeds.

Results
You have added the RMF data source.

What to do next

You can refer to the RMF master dashboard *(on page   )* topic for information about RMF master dashboard and its features.

1.7. Applying visualization to RMF data

By adding panels to dashboards, you can effectively present your RMF data in a visual format. Each panel must require at least one query to display a significant visualization.

Before you begin

You must have completed the following tasks:

- Installed the IBM RMF for z/OS Grafana plugin. See Installing the RMF for z/OS plugin on Grafana *(on page 7)*.
- Added a RMF data source in Grafana. See Creating RMF data sources *(on page 13)*.
- Understood query languages of the RMF. See IBM RMF query languages *(on page 17)*.

Procedure

1. Identify the dashboard for which you want to add visualization.
2. Perform one of the steps described in the following table:

Step description	Step #
If there are no panels added to the dashboard	Perform step 3 *(on page 15)*.
If at least one panel is added to the dashboard	Perform step 5 *(on page 15)*.

3. Click **+ Add visualization** to add visualization to your data.

> ✎ **Note:** The navigation of the user interface can differ based on the Grafana version that is currently installed.

   The **Edit panel** is displayed.
4. Go to step 6 *(on page 15)*.
5. Click **Add > Visualization** from the dashboard header.
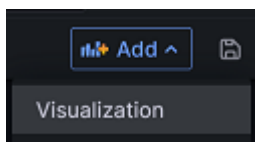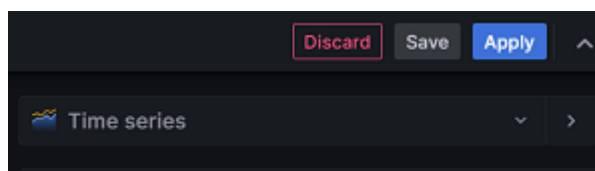

   The **Edit panel** is displayed.
6. Enter a name for the panel in the **Title** field.
   Optionally you can also provide a description for the panel that you are creating.

   When you add the description for the panel, a notification icon ⓘ is displayed after the **Panel** title, as shown in the following image:
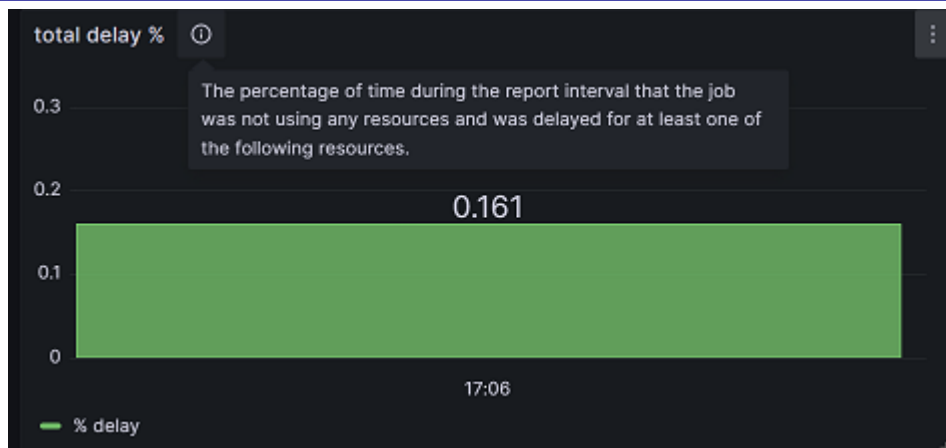
7. Select one of the visualization types from the drop-down menu:

You can choose **Report for IBM RMF for z/OS** or built-in **Bar chart** Grafana visualization types from the drop-down list.

8. Click the **Query** tab, and then enter a query in the query language of the RMF data source.

> ✏️ **Note:** You can click **+ Query** to add multiple queries.

9. Click the **Transformation** tab, and then select a transformation from the list.
   Upon accessing the transformation options, a dedicated row is presented for configuration.

> ✏️ **Note:** You can click **+ Add Transformation** to add multiple transformations to data.

10. Select the existing data sources from the **Data source** drop-down list.
11. Click the **Time Picker** drop-down list to select relative time range options and set custom absolute time ranges.

12. Click the **Refresh dashboard** 🔄 icon to query the RMF data source.
    Grafana provides you with a preview of your query results along with the corresponding visualization.
13. **Optional:** Click **Apply** to view your changes applied to the dashboard.
14. Click **Save**, and then enter a note describing the changes you have made.
15. Click **Save** to store the changes made to the dashboard.

Results
You have applied visualization to the RMF data.

What to do next
Grafana provides a range of visualizations that cater to different use cases. For more information about the built-in panels, options, and typical usage, refer to the Grafana documentation.

You can also configure the panel options based on your requirements. For more information refer to the Grafana documentation.

You can add multiple transformation to your data. When there are multiple transformations, Grafana applies them sequentially. Each transformation produces a result set that is passed on to the next transformation in the pipeline. Grafana provides several ways that you can transform data. For entire list of transformations, refer to the Grafana documentation.

1.8. IBM RMF query languages

In Grafana, queries are essential for fetching and transforming data from RMF data sources.

Executing a query is a process that involves defining the data source, specifying the desired data to retrieve, and applying relevant filters or transformations. IBM RMF for z/OS Grafana plugin provides a user-friendly RMF query editor that maximizes its unique capabilities. Grafana panels retrieve data for visualization from RMF data sources via queries.

You can use the following types of queries to retrieve data from the specified RMF data source:

- Metric query – Use this query to retrieve RMF Monitor III metrics.
- Report query – Use this query to retrieve RMF Monitor III reports.

Metric query syntax

The syntax of the Metric query is as follows:

`resource_type.metric_description {qualifications}`

Where:

- `resource_type` is the type of resource for which information is requested. You must enter the appropriate value in the `resource_type` field.

  The available resource types are documented in the z/OS RMF Monitor III resource model topic in the *z/OS Resource Measurement Facility Programmer's Guide*.

- `metric_description` is the name of the metric for the selected resource type.

  After entering the resource type, you can choose the metric description from the drop-down list.

- `qualifications` is an optional parameter and can contain any or all the following attributes separated by a comma:
  - `ulq`: The name of the resource type at the upper level.
  - `name`: The name of the resource.
  - `filter`: The filter helps to focus on the data of your interest when requesting a list of values.
    You can use one of the following values for the `filter` attribute:

    PAT=< pattern>

    Specifies one or more patterns that must match the name part of a list element.

    LB=<number>

    Specifies a lower bound value. Only list elements with values higher than the given lower bound are returned.

    UB=<number>

    Specifies an upper bound value. Only list elements with values lower than the established upper bound are returned.

    HI=<integer>

    Only the highest <integer> list elements are returned (mutually exclusive with LO).

    LO=<integer>

    Only the lowest <integer> list elements are returned (mutually exclusive with HI).

    ORD=< NA | ND | VA | VD | NN>

    - NA - Sort the list of names by their names in ascending order.
    - ND – Sort the list of names by their names in descending order.

- VA – Sort the list of values by their values in ascending order.
- VD – Sort the list of values by their values in descending order.
- NN - If you do not want to have any order, you can specify ORD=NN.

- *workscope*: To qualify a request for performance data in more detail about address spaces and WLM entities. You can use one of the following values for the workscope attribute:
  - G - Global (no workscope required)
  - W - WLM workload
  - S - WLM service class
  - P - WLM service class period
  - R - WLM report class
  - J - Job

Examples:

```
SYSPLEX.% total physical utilization (AAP) by partition
```

```
COUPLING_FACILITY.% processor utilization
```

```
CPC.% total physical utilization (shared IIP)
```

```
MVS_IMAGE.% delay by WLM report class period {name=RS21}
```

```
MVS_IMAGE.% workflow by WLM report class period
  {ulq=RS21,name=RS2*,filter=ORD=NA,workscope=,,G}
```

Report query syntax

The syntax of the Report query is as follows:

```
resource_type.REPORT.report_name
```

Where:

- *resource_type* is the type of resource for which information is requested. You must enter the appropriate value in the *resource_type* field.
- *report_name* is the name of the report.

  You can find the report names in the Interactive performance analysis with Monitor III, which is documented in the *z/OS Resource Measurement Facility Report Analysis*.

  Note: You can view reports on the Grafana dashboard only for the resource types SYSPLEX and MVS_IMAGE.

Examples:

```
SYSPLEX.REPORT.CACHSUM
```

```
SYSPLEX.REPORT.CPC
```

1.9. RMF Variable Query syntax

Variables are a powerful tool to create more interactive and dynamic dashboards. They offer a way to replace hard-coded values in metric queries and panel titles with placeholders for values.

Variables make it easy to change the data displayed in your dashboard simply by selecting a value from the drop-down list at the top. Using variables in your dashboard simplifies maintenance, particularly if you have multiple identical data sources. Instead of creating separate dashboards for each data source, you can create one dashboard and use variables to change what you are viewing.

> ⚠️ **Important:** It's important to note that variables don't have a default value. Each variable drop-down list in Dashboard settings displays the variable list in the order it appears.

You can define a dashboard variable in **Dashboard Settings > Variables** using Grafana's RMF Variable Query syntax with and without a filter.

Syntax of the query without a filter

The general syntax of the query without a filter is as follows:

```
SELECT <COLUMN_NAME> FROM RESOURCE WHERE condition1 or condition2 or condition3
```

> 📝 **Note:** The `<COLUMN_NAME>` is limited to *"label"* and `RESOURCE` is limited to *"resource"* only and cannot be used for other purposes.

Where:

- `condition1`: **ULQ**=*Value* and **TYPE**=*Value*
- `condition2`: **Name**=*Value* and **TYPE**=*Value*
- `condition3`: **Name**=*Value* and **ULQ**=*Value* and **TYPE**=*Value*

Examples for *condition1***:**

- `select label from resource where` **ulq**=*"hostname of the DDS"* `and` **type**=*"CHANNEL_PATH"*
- `select label from resource where` **ulq**=*"hostname of the DDS"* `and` **type**=*"ALL_CHANNELS"*

Examples for *condition2***:**

```
select label from resource where name="resource_name" and type="SYSPLEX"
```
Examples for *condition3***:**

- `select label from resource where` **ulq**=*"hostname of the DDS"* `and` **name**=*"*"* `and` **type**=*"CHANNEL_PATH"*
- `select label from resource where` **ulq**=*"hostname of the DDS"* `and` **name**=*"*"* `and` **type**=*"ALL_CHANNELS"*

Syntax of the query with a filter

The general syntax of the RMF query with a filter is as follows:

```
SELECT <COLUMN_NAME> FROM RESOURCE WHERE condition
```

Where *condition* is **Name**=*Value* and **ULQ**=*Value* and **TYPE**=*Value* and **Filter**= *Value*

Examples for *condition***:**

```
select label from resource where name="resource_name" and type="SYSPLEX" and
filter="MVS_IMAGE"
```

To learn how to effectively add and manage variables of your choice in Grafana, you can refer to the Grafana documentation.

1.10. Integrating DDS Dashboards with IBM Z OMEGAMON Dashboards

To enhance visibility and provide deeper insights, the DDS dashboards can be integrated with IBM Z OMEGAMON Web UI dashboards.

About this task
IBM Z OMEGAMON provides its own Grafana plugin with detailed dashboards. This integration seamlessly allows users to navigate from DDS dashboards to OMEGAMON dashboards, preserving context such as object names.

Follow the steps below to enable and configure the integration between DDS and OMEGAMON dashboards:

Procedure
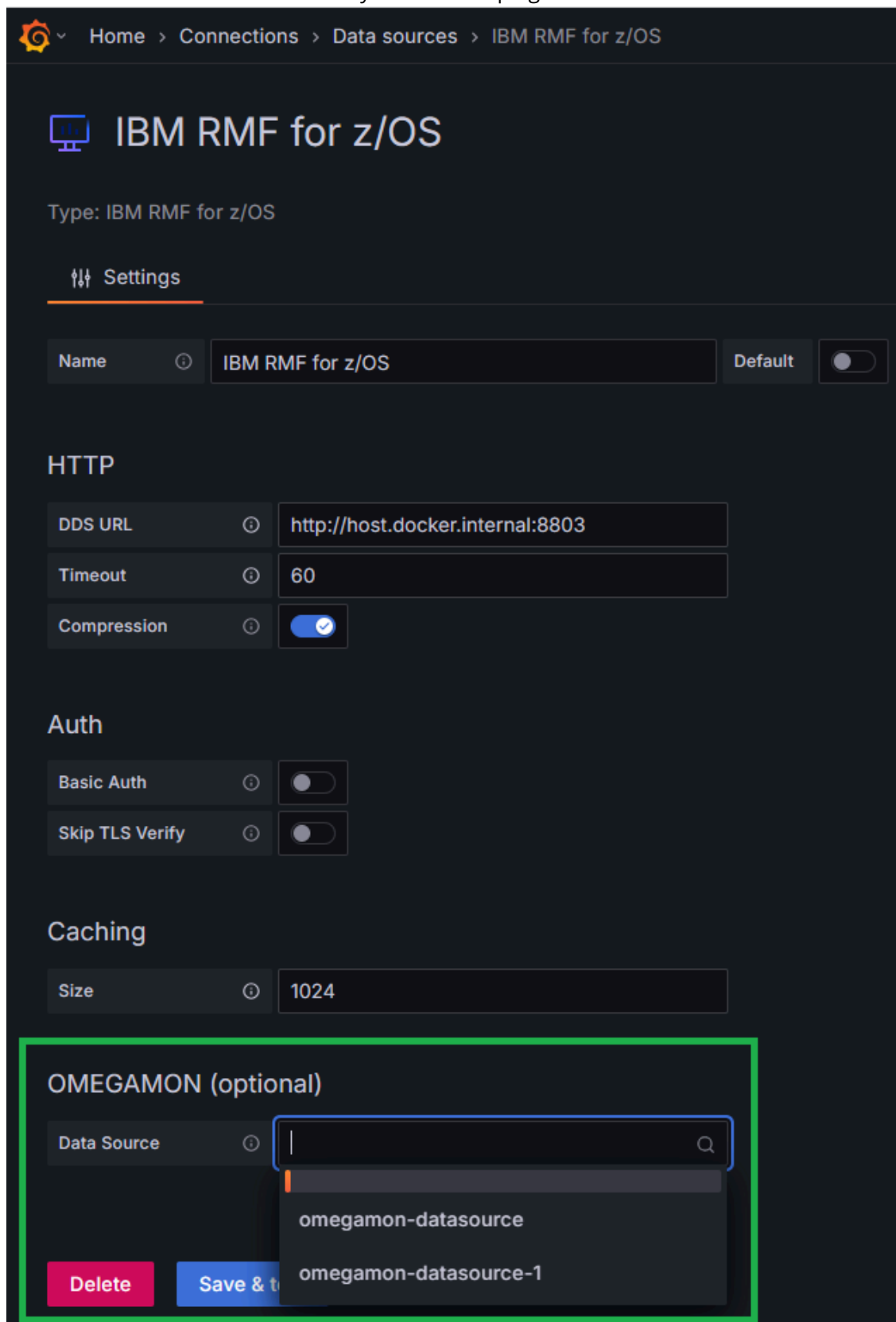
1. While installing the DDS Sample Dashboards, on the IBM RMF page, go to **DDS Sample Dashboards** section and select the **Link with IBM Z OMEGAMON Web UI dashboards** button to create links to the OMEGAMON dashboards.
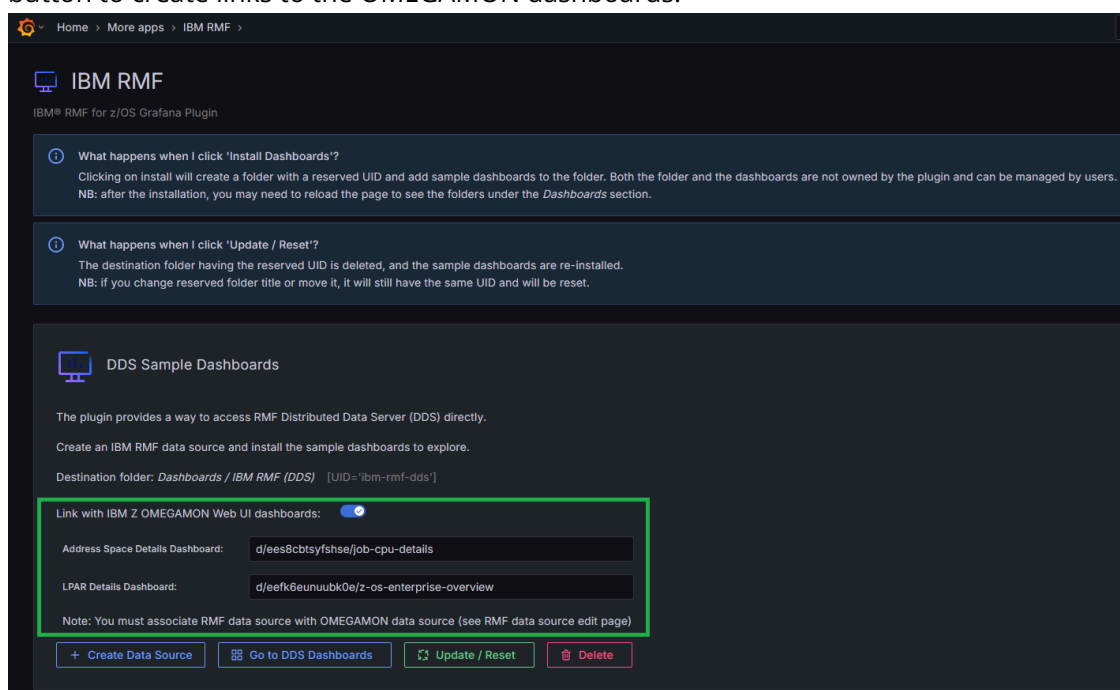
2. Go to **Home > Connections > Data sources > IBM RMF for z/OS**.
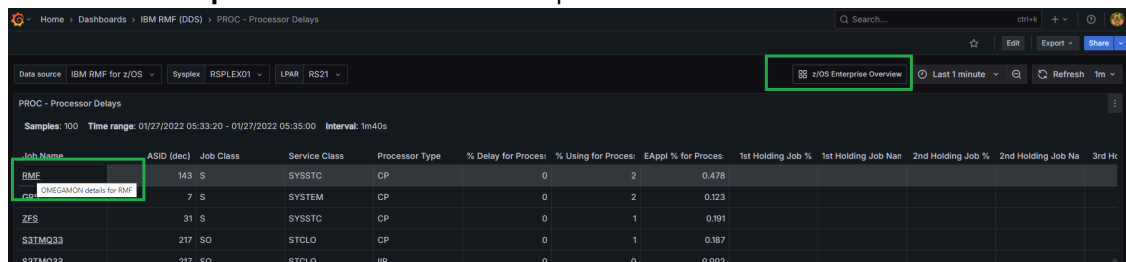
3. On the IBM RMF for z/OS page, go to **OMEGAMON (optional)** section. Enter the OMEGAMON data source name in the **Data Source** field that reads from the same sysplex as the RMF data source.
This ensures consistent data visibility across both plugins.

4. Once the integration is configured, the DDS dashboards will display interactive links. In **Address space-related** tables, click **Address space name** to open a new browser tab showing detailed metrics in the OMEGAMON dashboard.
5. Click **z/OS Enterprise Overview** button to open a new tab with all current LPAR details.

Results

The integration between DDS Dashboards and IBM Z OMEGAMON Web UI dashboards is successfully configured.

1.11. Introduction to Alerts

Grafana Alerting feature provides a reliable solution to detect and respond to system issues in real time.

Through Grafana monitoring capabilities, you can keep track of incoming metrics data and configure the alerting system to detect specific events or circumstances. When the system identifies any issues, it automatically sends notifications to ensure that you are up to date. With Grafana Alerting, you can eliminate the need for manual monitoring and control system outages that could lead to significant incidents.

For more information about configuration of alerts and contact points, refer to the Grafana documentation.

1.12. Historical data collection

In Grafana, you can view historical data using absolute and relative time ranges.

Viewing historical data is a common practice across organizations for various purposes. The importance and use of historical data are significant in decision-making, research, analysis, and planning. Analyzing historical data provides valuable insights into the status, usage, performance, and health of various resources.

You can also access cached metric data for queries, data sources, and timestamp combinations that have already viewed by other user on Grafana. This means that if any user requests metrics data for the same query, datasource, and timestamp, the cached data can be displayed faster than a service call from DDS. If data for a particular timestamp is not found in the cache, it will be fetched by a service call from DDS. This feature can save you time and provide a faster experience accessing metric data.

> ⚠️ **CAUTION:** When you view data over extended time ranges, the system may require considerable CPU resources on the host.

1.13. Error reporting in the plugin

Whenever you encounter issues while using the IBM RMF for z/OS Grafana plugin, you can view detailed error messages that contain sufficient information to help you identify and troubleshoot the problem.

By viewing these error messages, you can quickly and efficiently troubleshoot any issues you may encounter while using the IBM RMF for z/OS Grafana plugin.

The errors that can occur vary in severity and are classified into different types as described in the following table:

| Type	Error Code	Description
Severe	S	A critical error has arisen that will cause the task you are currently performing to terminate immediately. It is essential to take necessary measures to prevent such errors to ensure the smooth functioning of the IBM RMF for z/OS Grafana plugin.
Eventual Action	E	An error of a transient nature has arisen but can be resolved with an action by the user.
Warning	W	Receiving a warning message from the IBM RMF for z/OS Grafana plugin is not indicative of an error within the application.
Information	I	An information message informs the users about changes or updates in the IBM RMF for z/OS Grafana plugin. You need not take any action in response, but it's essential to stay up-to-date and be aware of these updates.

When an error occurs, it is assigned a unique Error ID that can help quickly identify the root cause of the issue by referring to the log file. The Error ID is a combination of 10 characters comprising lower and upper case alphabets.

In case of any problems with the Distributed Data Server (DDS), you can identify the issues by looking into DDS-specific errors, which will be displayed without any modifications. The messages issued by the Distributed Data Server are documented in the Distributed Data Server messages - GPM topic in the *z/OS Resource Measurement Facility Messages and Codes*.

The following are the examples of error messages that you may encounter while using the IBM RMF for z/OS Grafana plugin:
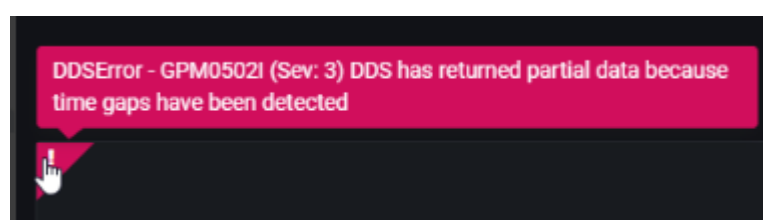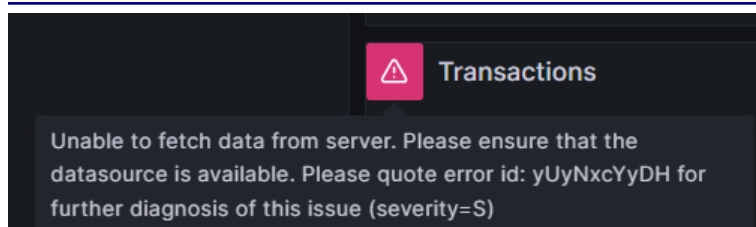
> **Tip:** To diagnose the issue from the docker logs of the IBM RMF for z/OS Grafana plugin, you can run the following command:
>
> ```
> docker logs <container_name> 2>&1 | grep "<unique error code shown in the error
> message>"
> ```

1.14. Troubleshooting issues

This section guides how to analyze and address typical issues that may arise when using the IBM® RMF for z/OS Grafana plugin.

This article is regularly updated with the latest information on discovering and solving issues that may arise. You can search through the article to find the precise information you need.

You can open a case by navigating to IBM support if you cannot find any solutions for the issue you encountered. Before opening a case, gather all the required information and provide the details to IBM support for further investigation.

The following table describes the details of issues and the resolutions you can apply to fix the problems:

Issues	Cause	Resolutions
RMF Time Series dashboards do not plot the Monitor 3 metrics data, whereas RMF Reports and RMF Charts dashboards plot correctly.	The proxy settings configured by your network administrator block web socket connections from the Grafana server. The IBM RMF for z/OS Grafana plugin streams time series data to the clients through web socket connections.	Unblocking web sockets and configuring the appropriate proxy settings is necessary to ensure that web sockets with the name "ws" in the URI work correctly with the IBM RMF for z/OS Grafana plugin. You can contact your network administrator to modify the proxy configuration settings.

1.15. Grafana through IBM z/OS Management Facility

When you use IBM® z/OS Management Facility to monitor the performance of the z/OS sysplexes in your environment, you can also access Grafana dashboards from z/OSMF.

You must complete certain tasks to access Grafana through z/OSMF. The following table lists the task flows to access Grafana from z/OSMF:

Tasks	More information
Complete the tasks provided in the Prerequisites topic.	Prerequisites for accessing Grafana dashboards on z/OSMF *(on page 26)*
Install the RMF for z/OS plugin on Grafana.	Installing the RMF for z/OS plugin on Grafana *(on page 7)*
Define Grafana servers as target systems.	Defining the Grafana server *(on page 31)*
Access Grafana dashboards	Accessing the Grafana dashboard *(on page 32)*

1.15.1. Prerequisites for accessing Grafana dashboards on z/OSMF

Before you can start working with Grafana dashboards through z/OSMF, there are some prerequisites that you need to complete.

The following sections describe each prerequisite in detail:

Configure z/OSMF

When installing z/OS, z/OSMF is automatically installed as a fundamental component of the operating system. However, to use its features, you must configure the z/OSMF nucleus on your system and add core and optional services. This enables you to take advantage of the many benefits that z/OSMF offers. For more information, refer to the *z/OS Management Facility Configuration Guide*.

Install Grafana

You must install Grafana v10.0 or later.

For more information, refer to the Grafana documentation for detailed instructions on installing Grafana and its dependencies and starting the Grafana server on your system.

User administration

You must review the default user management settings provided by the Grafana server to determine if you need any additional permissions to be added for the users.

For more information, refer to the User Management section of the Grafana documentation.

Configure JSON Web Token (JWT) support on z/OSMF

You must configure the z/OSMF server to build and use JSON Web Token (JWT) tokens. Because, by default, the JWT function is turned off on the z/OSMF server. You can turn on the JWT authentication by modifying the server's configuration files directly. Once enabled, the JWT function allows you to use JWT tokens to authenticate and authorize user access to the Grafana through the z/OSMF server.

When configuring z/OSMF JWK files, it is essential to use the **jwksUri** parameter. This parameter specifies a URL for the JSON Web Key service, which is necessary for building the JWK files.

The format of the **jwksUri** parameter is as follows:

```
https://${hostname}:${port}/jwt/ibm/api/zOSMFBuilder/jwk
```

For example, if your z/OSMF server is running on https://abc.com:12345, then the value of **jwksUri** is:

```
https://abc.com:12345/jwt/ibm/api/zOSMFBuilder/jwk
```

Where,

- `abc` is the hostname where the z/OSMF server runs.
- `12345` is the port number.

You must save the content of **jwksUri** as the `jwks.json` file and place it in the following directory:

```
/PATH/TO/jwks.json
```

For information about enabling the JWT function, refer to the *z/OS Management Facility Configuration Guide*.

Configure JWT authentication on Grafana

You must configure Grafana to accept a JWT token in the HTTP header. You can also verify the token's validity using a JSON Web Key Set (JWKS) stored in a local file.

As a system administrator, when you install Grafana, you can pass values for some of the individual parameters in the `.ini` configuration file to configure JWT authentication on Grafana. See Grafana configuration parameters *(on page 28)*.

The default location of the configuration file is as follows:

Operating systems	Default path to the configuration file
Windows®	`WORKING_DIR/conf/defaults.ini`
Linux®	`/etc/grafana/grafana.ini`
macOS®	`/usr/local/etc/grafana/grafana.ini`

1.15.1.1. Grafana configuration parameters

You can find the information about parameters you can use during the configuration of JWT authentication on Grafana.

The following table lists the minimum parameters that you must configure to enable JWT authentication on Grafana:

Section	Parameters	Description	Values to be configured for z/OSMF
`[auth.jwt]`	**enabled**	Use this parameter to allow JWT to authenticate on the Grafana server. The default value is set to `true`.	`true`
	enable_login_token	Upon successful authentication proxy header validation, this parameter provides the user with a login token. The default value is set to `false`.	`true`
	header_name	Use this parameter to specify the header's name that holds a token. The default value is set to `X-JWT-Assertion`.	`X-Forwarded-Access-Token`
	username_claim	Use this parameter to identify the user. The `sub` claim is mandatory and needs to be present in a JWT, and it should mention the subject of the JWT. The default value is also set to `sub`.	`sub`
	jwk_set_file	Use this parameter to verify the token with a JSON Web Key Set loaded from a JSON file.	`/PATH/TO/jwks.json`
	cache_ttl	Use this parameter to establish the duration for	`60m`

Section	Parameters	Description	Values to be configured for z/OSMF
		caching data retrieved from the HTTP endpoint. This parameter enables the user to store the data for a specified period, allowing for faster access and retrieval of information. The default value is set to `60m` (minutes).	
	expect_claims	Use this parameter to verify the validity of other claims that contain JSON-encoded information. When it comes to validation, only the `exp`, `nbf`, and `iat` claims are automatically checked by default. You must validate if you are using other claims such as `iss`, `sub`, `aud`, and `jti`.	`{"iss": "zOSMF"}`
	auto_sign_up	Use this parameter to automatically create user profiles in Grafana using the `TSO ID` of z/OSMF for users who do not have user profiles in the Grafana server. The default value is set to `false`.	`true`
	url_login	Use this parameter to enable JWT authentication in the URL. The default value is set to `false`.	`true`
`[server]`	**protocol**	Use this parameter to configure z/OSMF to work over HTTPS.	`https`

Section	Parameters	Description	Values to be configured for z/OSMF
		When you configure z/OSMF to work over HTTPS, it is recommended to configure Grafana to also work over HTTPS. This ensures the secure data transfer between the user's web browser and the Grafana server. The default value is set to `http`.	
	cert_file	Use this parameter to specify the path to the certificate file when the protocol parameter is set to `https` or `h2`.	`/PATH/TO/certificate.crt`
	cert_key	Use this parameter to specify the path to the certificate key file when the protocol parameter is set to `https` or `h2`.	`/PATH/TO/privateKey.key`
`[Security]`	**cookie_secure**	Use this parameter if you hosted the Grafana instance over HTTPS. The default value is set to `false`.	`true`
	cookie_samesite	Use this parameter to prevent the browser from sharing cookies with other websites. The default value is set to `lax`.	`disabled`
	allow_embedding	Use this parameter to enable web browsers to display Grafana within z/OSMF HTML <frame>, <iframe>, <embed>, or <object> element. The default value is set to `false`.	`true`

For more information about customizing the Grafana instance by modifying the parameters in the configuration file, refer to the following sections in the Grafana documentation.

- Configure JWT authentication
- Configure Grafana

1.15.2. Defining the Grafana server

You must define the Grafana server as a target system in z/OSMF to access Grafana from the **Resource Monitoring** page of z/OSMF.

Before you begin
You must have completed the following tasks:

- Completed the tasks provided in the Prerequisites section. See Prerequisites for accessing Grafana dashboards on z/OSMF *(on page 26)*.
- Installed the IBM RMF for z/OS Grafana plugin. See Installing the RMF for z/OS plugin on Grafana *(on page 7)*.

Procedure

1. Enter the URL of z/OSMF in a web browser.
2. Log in to z/OSMF if you are not already logged in.
3. Double-click **System Status**.
4. Click **Add Entry** from the **Actions** drop-down list.
5. Perform the following steps to add details about the Grafana server:

   a. Enter a name for the Grafana server in the **Resource name** field.
      The **Resource name** is the required field, and you must provide a unique name.
      The **Resource name** can contain up to 24 characters including alphanumeric characters (A-Z, a-z, and 0-9) and special characters (@ # $).

      > 📝 **Note:** You must note that the **Resource name** is not case sensitive. Therefore, the entries with similar names but different capitalization, such as SYS1 and Sys1 are considered as identical by the system.

   b. Enter the host name or IP address of the Grafana server that you want to access in the **Host name or IP address** field.
      The host name or IP address can contain up to 4000 characters.

   c. Select **Grafana** from the **Target system type** drop-down list.

   d. Select the **Use HTTPS** checkbox to enable secure communication.

   e. Enter the port number where the Grafana server is hosted in the **Port** field.

The **Port** is the required field, and the default port number is set to `3000`.

> ⓘ **Tip:** Alternatively, you can use **up-down** controls to specify the port number.

6. Click **OK**.

Results
You have defined the Grafana server as the target system.

What to do next
You can perform the following tasks:

- Modify or Remove the Grafana server by clicking the **Action** drop-down menu from the **System Status** page.
- Access Grafana dashboards. See Accessing the Grafana dashboard *(on page 32)*.

1.15.3. Accessing the Grafana dashboard

You can access the Grafana dashboard from the **Resource Monitoring** page of z/OSMF to investigate the RMF Monitor III metrics and reports.

Before you begin
You must have defined the Grafana server in z/OSMF. See Defining the Grafana server *(on page 31)*.

Procedure

1. Enter the URL of z/OSMF in a web browser.
2. Log in to z/OSMF if you are not already logged in.
3. Double-click **Resource Monitoring**.
4. Select the Grafana server that you want to access from the drop-down list.
5. Click **OK**.

Results
You have accessed Grafana from z/OSMF.

What to do next
You can perform the following tasks:

- View the dashboards by navigating to **Apps > IBM RMF > Dashboards**.
- Add a RMF data source to fetch data from Distributed Data Servers (DDS). See Creating RMF data sources *(on page 13)*.