RBMS Installation Guide

Version 20.11.1.2, 23 December 2020

Registered Address	Support	Sales
26, Kingston Terrace, Princeton, New Jersey 08540, United States		
		+91 80 4850 5445
http://www.rtbrick.com	support@rtbrick.com	sales@rtbrick.com

Table of Contents

1. RBMS Installation Guide

This document guides you through the installation and initial setup of RBMS.

1.1. Before you start

1.1.1. Prerequisites

RBMS is shipped in docker container images which are made aviable on docker.rtbrick.com. RBMS requires docker and docker-compose to be installed on your system. docker-compose simplifies the setup process by running all containers from a provided manifest file with a single command. Please follow the instructions in Get docker and Install docker-compose of the official docker documentation to install docker and docker-compose.

There is no advanced knowledge of docker needed to follow the installation instructions in the RBMS installation guide. All important commands to run the RBMS docker containers from the provided RBMS docker images are outlined in this installation guide.

> sudo priviliges are needed to install RBMS.

1.1.2. Preparing your user account to work with docker

Add your user to the docker group to not have to prepend all docker commands with sudo any longer.

Run the following command to add your user to the docker group.

```
~$ sudo usermod -aG docker $(whoami)
```

Exit the terminal and connect again to make the changes taking effect.

1.2. Overview

The installation process consists of the following phases:

1. RBMS setup
2. Grafana and Prometheus setup
3. Graylog setup

The RBMS setup addresses the installation of RBMS itself, including the RBMS database, applications and web user interface.

Prometheus, an open-source monitoring tool, samples metrics from the switches and stores them in a time series database. Grafana, an open-source visualization platform, provides means to visualize and inspect the metrics gathered by Prometheus. The Grafana and Prometheus setup installs both tools with pre-provisioned dashboards for a quick start.

Graylog is an open-source log management system. It stores data in an elasticsearch database and provides means to automate log processing. The switches send log messages to Graylog. RBMS queries elasticsearch to show the received log messages. The Graylog setup guides you through the steps to make Graylog ready for receiving log messages from RBFS.

1.3. Prepare Installation

Create the /opt/rbms folder and change to this directory.

```
~$ sudo mkdir -p /opt/rbms && cd "$_"
```

Extract the rbms.tar ball.

```
/opt/rbms$ sudo tar -xvf rbms.tar && rm rbms.tar
```

The following files and folders have been added to the /opt/rbms directory:

```
/opt/rbms$ tree -L 4 .
.
|-- docker-compose.yaml
|-- postgres
|   |-- data
|-- rbms.env
|-- telemetry
|   |-- docker-compose.yaml
|   |-- grafana.env
|   |-- grafana.ini
|   |-- prometheus
|   |   |-- etc
|   |       |-- bds.target.yml
|   |       |-- prometheus.yml
|   |-- provisioning
|       |-- dashboards
|       |   |-- basic
|       |   |-- default.yml
|       |   |-- fibd
|       |-- datasources
|           |-- default.
|-- templates
|-- wildfly
|   |-- logs
|-- ztp
    |-- configs

15 directories, 9 files
```

- The docker-compose.yaml file contains the instructions to run the RBMS docker containers.
- The postgres directory contains the data of the RBMS database.
- The rbms.env file contains the environment-specific settings. More details about the environment variables can be found in the next section.
- The telemetry directory contains the configuration for Prometheus and Grafana to gather and visualize metrics from switches. More details about configuring Prometheus and Grafana can be found later in this document.
- The templates folder contains templates for configuration generation.
- The wildfly directory contains the logs of the RBMS applications. Wildfly is an open-source application server hosting the RBMS application.
- The ztp directory contains the startup-configuraton for the switches in the network. More details about ZTP configuration can be found in post installation tasks section in this document.

1.4. RBMS Setup

The first step is to install the RBMS application, database and user interface. All services are started via docker-compose in a single command. However, before

running this command, the RBMS environment variables need to be set for *your* environment.

1.4.1. Configuring RBMS Environment variables

The rbms.env file contains all RBMS environment variables.

> The <RBMS_IP_OR_HOST> placeholder needs to be replaced by the actual IP address or host name.

Detailed information about the existing environment variables can be taken from the tables below:

Environment Variable	Description
POSTGRES_DB	The name of the RBMS database (Default: leitstand)
POSTGRES_USER	The postgres user name (Default: leitstand)
POSTGRES_PASSWORD	The postgres user password. RBMS uses the provided credentials to connect to the database (Default: changeit)
LEITSTAND_DB_URL	The JDBC connections string to establish a database connection to the created database (Default: jdbc:postgresql://rbms-db:5432/leitstand)
LEITSTAND_DB_USER	The user name to authenticate Leitstand for establishing a database connection (Default: leitstand)
LEITSTAND_DB_PASSWORD	The password for the specified LEITSTAND_DB_USER (Default: changeit)
LEITSTAND_TERMINAL_EMULATOR_ENDPOINT	The external URL to access the RBMS terminal emulator (Default: http://<RBMS_IP_OR_HOST>/ssh/host, where <RBMS_IP_OR_HOST> needs to be replaced by the actual IP address or DNS name)
LEITSTAND_ACCESS_CONTROL_ALLOW_ORIGIN	Sets the origins from which RBMS UI is allowed to embedd content from (Default: *).
ELASTICSEARCH_ENDOINT	Sets the endpoint URL of the elasticsearch API

Environment Variable	Description
TEMPLATE_ENGINE_ENDPOINT	Sets the endpoint URL of the template engine rendering RBFS configurations (Default: http://rbms-fabric-template-engine)
ZTP_SERVICE_ENDPOINT	Sets the enpoint URL of the ZTP service to publish new device configurations.
GRAFANA_UI_ENDPOINT	The URL to access the Grafana user interface.

In addition, the following environment variable exist to connect RBMS with an OAuth2/OpenID Connect-compliant authorization service.

Environment Variable	Description
OIDC_CONFIGURATION_ENDPOINT	URL to auto-discover the authorization settings.
OIDC_CLIENT_ID	Client identifier to authenticate RBMS against the authorization service.
OIDC_CLIENT_SECRET	The shared secret to authenticate RBMS agains the authorization service.
OIDC_CONNECT_TIMEOUT	Connect timeout in milliseconds to establish a connection to the authorization service. Defaults to 10 seconds.
OIDC_READ_TIMEOUT	Read timeout in milliseconds to wait for response from the authorization service. Defaults to 10 seconds.

Add the following environment variables if your authorization service does not support automatic configuration discovery.

Environment variable	Description
OIDC_AUTHORIZATION_ENDPOINT	Authorization service URL to prompt an unauthenticated user for credentials.
OIDC_TOKEN_ENDPOINT	Token service endpoint URL to obtain an access token from.
OIDC_USERINFO_ENDPOINT	User info endpoint URL to query the user profile of the authenticated user.
OIDC_TOKEN_X5C	Base64 URL-encoded X509 certificate chain to verify JWS tokens signed with asymmetric keys.

Environment variable	Description
OIDC_TOKEN_SECRET	Token secret to verify JWS tokens signed with symmetric key.
OIDC_JWS_ALGORITHM	The token signature algorithm (e.g. HS256)

In case you prefer the RBMS built-in user repostory, you have to provide a secret to sign all issued access tokens.

Environment variable	Description
JWS_SECRET	The secret for signing the issued access tokens. RBMS uses HS256 to sign access tokens and the provided secret must have a minimum length of 256 bits.

1.4.2. Setting File System Permissions

root group requires write access to the postgres/data and wildfly/logs directories.

This can be acchieved by transferring ownership to root and modifying the file permissions accordingly:

```
/opt/rbms$ sudo chown root:root  postgres/data
/opt/rbms$ sudo cmod 775  postgres/data
/opt/rbms$ sudo chown root:root  wildfy/logs
/opt/rbms$ sudo cmod 775  wildfly/data
```

1.4.3. Starting RBMS Containers

Run docker-compose up -d to start RBMS.

This command pulls all docker images from *docker.rtbrick.com* and starts the following containers:

Container	Description
rbms-pxy	Nginx reverse proxy as ingress node for all incoming HTTP traffic
rbms-app	RBMS application and web user interface
rbms-db	Postgresql database to store the RBMS data

Container	Description
rbms-terminal	Terminal emulator to access a switch terminal from the browser
rbms-fabric-template-engine	Template engine to render switch configurations from templates.
rbms-fabric-ztp	ZTP service providing access to the startup configuration and installer images.

1.5. Grafana and Prometheus Setup

Change to the /opt/rbms/telemetry directory.

```
~$ cd /opt/rbms/telemetry/
```

This directory contains the following artefacts: - docker-compose.yaml file to create the Grafana and Prometheus docker containers. - grafana.env file to configure the Grafana environment. - prometheus/etc directory to configure Prometheus.

1.5.1. Configuring Prometheus

Change to the /opt/rbms/telemetry/prometheus/etc directory:

```
~$ cd /opt/rbms/telemetry/prometheus/etc
```

Edit the bds.target.yml file and add the CTRLD endpoint for all switches to the list of targets.

Say you run four switches in your fabric:

Switch	IP Address
l1.pod1	192.168.1.10
l2.pod1	192.168.1.11
s1.pod1	192.168.1.20
s1.pod1	192.168.1.21

then the following targets need to be added to the bds.target.yml file:

```
# l1.pod1
- targets: ['192.168.1.10:19091']
  labels:
    __metrics_path__:
"/api/v1/rbfs/elements/l1.pod1/services/prometheus/proxy/federate"
# l2.pod1
- targets: ['192.168.1.11:19091']
  labels:
    __metrics_path__:
"/api/v1/rbfs/elements/l2.pod1/services/prometheus/proxy/federate"
# s1.pod1
- targets: ['192.168.1.20:19091']
  labels:
    __metrics_path__:
"/api/v1/rbfs/elements/s1.pod1/services/prometheus/proxy/federate"
# s2.pod1
- targets: ['192.168.1.10:19091']
  labels:
    __metrics_path__:
"/api/v1/rbfs/elements/s2.pod1/services/prometheus/proxy/federate"
```

The targets attribute specifies the CTRLD endpoint. The *metrics_path* label sets the path to pull the metrics from the configured CTRLD endpoint. Prometheus reloads the file periodically. See the Prometheus configuration guide for more information about Prometheus configurations.

> Run docker restart rbms-prometheus to apply changes immediately.

1.5.2. Configuring Grafana environment

Change to the /opt/rbms/telemetry directory:

```
~$ cd /opt/rbms/telemetry
```

Edit the grafana.env file to configure Grafana and enable Single Sign-On (SSO) using OAuth2/OpenID Connect.

> Single Sign-On is key to embedd Grafana dasbhoard panels seamlessly in the RBMS UI.

The following environment variables exist:

Environment Variable	Description
GRAFANA_UI_ENDPOINT	The URL to access the Grafana user interface.

Environment Variable	Description
AUTH_SERVICE_ENDPOINT	The URL to prompt a user for credentials.
TOKEN_SERVICE_ENDPOINT	The URL to obtain the access token from.
USERINFO_ENDPOINT	The URL to obtain the user profile information of the authenticated user.
CLIENT_ID	The client identifier to authenticate Grafana against the authorization service.
CLIENT_SECRET	The client secret to authenticate Grafana against the authorization service.
ADMIN_USER_EMAIL	The email address of the Grafana admin account that is allowed to configure Grafana.

The ADMIN_USER_EMAIL environment is mandatory to create an administrator account that can then nominate additional administrators in Grafana.

The RBMS built-in user repository also includes a minimal authorization flow implementation to enable Single Sign-On for Grafana if no authorization service is available.

Use the following settings to connect Grafana to the built-in authorization flow shipped with RBMS:

```
AUTH_SERVICE_ENDPOINT=http://<RBMS_IP_OR_HOST>/api/v1/oauth2/authorize
TOKEN_SERVICE_ENDPOINT=http://<RBMS_IP_OR_HOST>/api/v1/oauth2/token
USER_INFO_ENDPOINT=http://<RBMS_IP_OR_HOST>/api/v1/oidc/userinfo
```

Replace <RBMS_IP_OR_HOST> with the IP address or DNS name of your RBMS installation.

1.5.3. Starting Grafana and Prometheus

Run docker-compose up -d to run Grafana and Prometheus

This command pulls the Grafana and Prometheus images runs the following containers from them:

Container	Description
rbms-grafana	Grafana to visualize RBFS time series data
rbms-prometheus	Prometheus to scrape metrics from the switches

1.6. Graylog Setup

Graylog is an open-source enterprise log management system. It stores data in an elasticsearch database and provides means to query and process log files.

The RBMS distribution includes a dockerized Graylog allowing you to setup Graylog quickly for a first try.

> RBMS can be connected to other log management systems by providing a connector that translates the RBMS log queries to queries of the underlying log managment system.

```
Change to the `log` directory.
```

```
~$ cd /opt/rbms/log/
```

Edit graylog.env and provide the IP address or hostname of your graylog server.

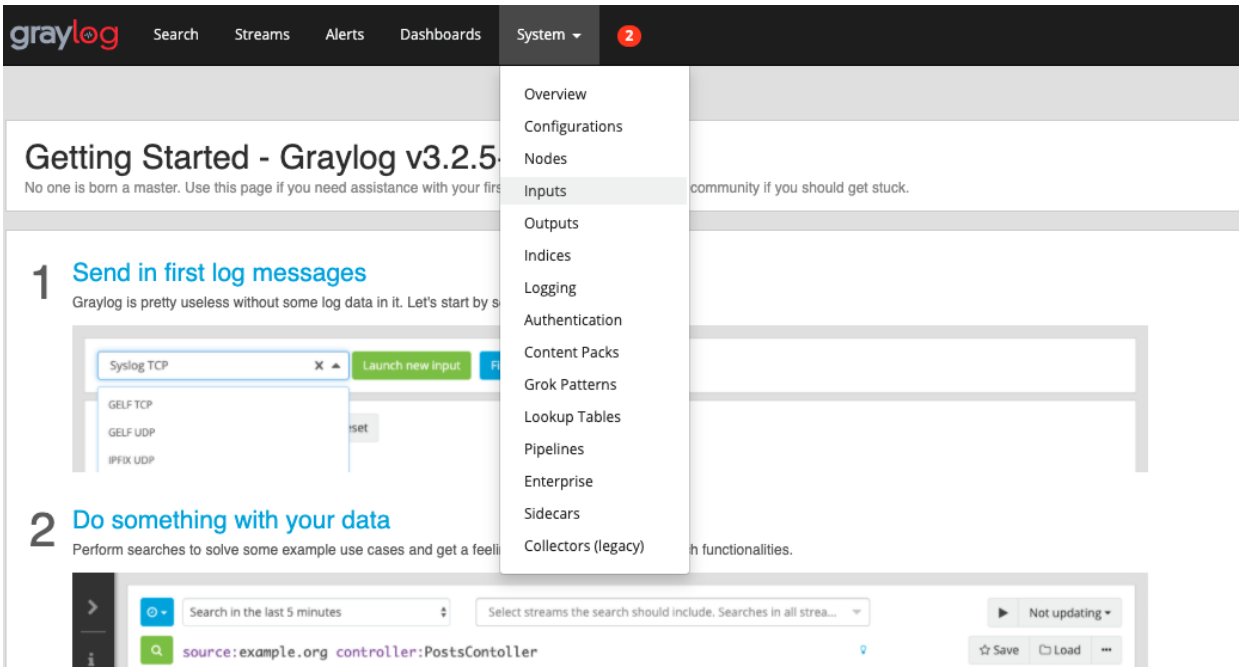
Run sudo sysctl -w vm.max_map_count=262144 to grant sufficient virtual memory for elasticsearch.

Run docker-compose up -d to start Graylog. This commands pulls the Graylog, MongoDB and elasticsearch images and runs the following three containers:

Container	Description
graylog3	The graylog log management application.
graylog3-mongo	The mongo database to store the graylog configuration and metadata
graylog3-elastic	The elastcisearch database to store the log data.

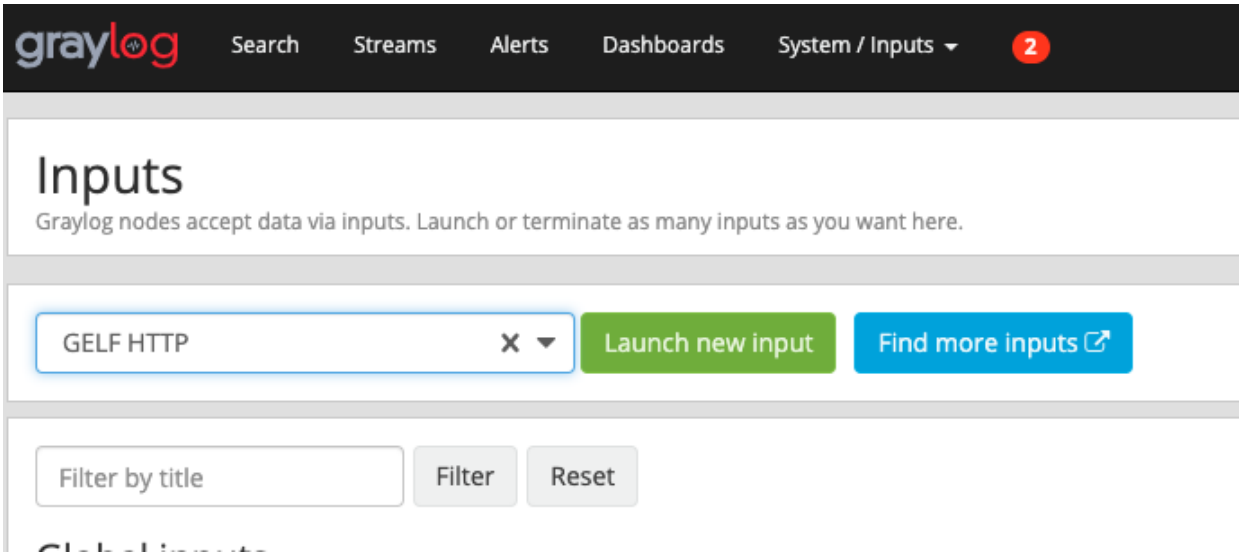
Log in to Graylog UI using default credentials (*admin/admin*).

Click **System** and select **Inputs**.



Select **GELF HTTP** from the drop down list.

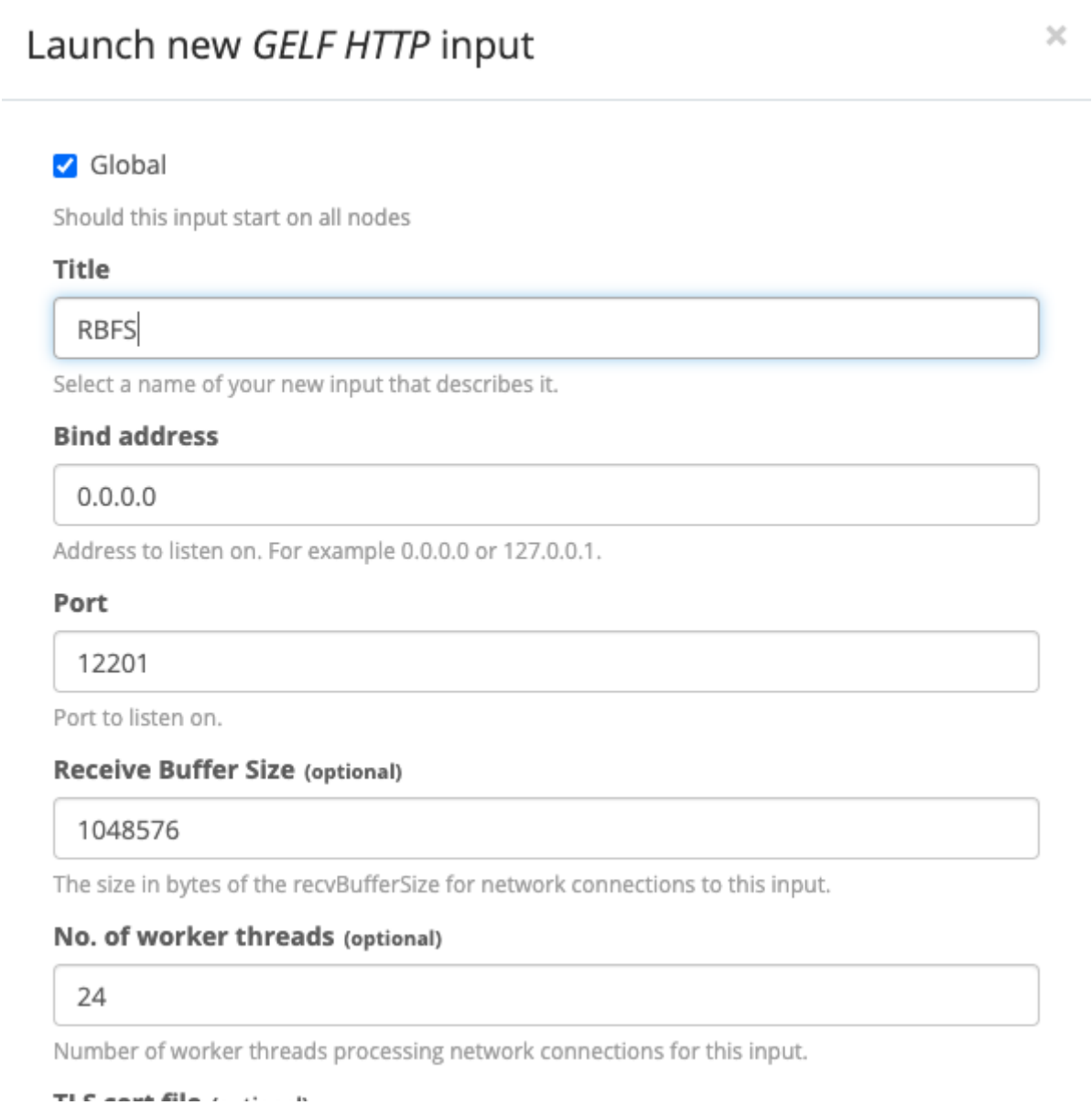
Click **Launch new input**



Check the **Global** option.

In **Title** add a descriptive name (e.g. RBFS)

Click **Save**. A new GELF input is displayed.



1.7. Post Installation Tasks

1.7.1. User and Group Management

Create the users and groups with RBMS access previliges.

1.7.2. Network Inventory Management

Start population the inventory with information about your network, including network facilities, pods and elements.

Use rtb-image to register software images in RBMS.

Create configuration templates to generate switch configurations.

Issue an accesskey for CTRLD to grant RBMS access for CTRLD. This is required to

allow CTRLD to maintain switch information in the RBMS inventory. The accesskey should include the ivt.element and job.task scopes.

1.7.3. Zero-Touch Provisioning (ZTP)

Configure the DHCP server to convey the DHCP options required by ONIE to discover the ONL installer image.