Simple Network Management Protocol (SNMP) User Guide

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1. Overview

SNMP (Simple Network Management Protocol) provides a network monitoring mechanism that collects state information from various network devices and components. The protocol enables you to monitor the RBFS network and detect network faults on remote devices.

SNMP can monitor interfaces, CPU usage, temperature of the device, bandwidth usage, and so on. For example, if an interface goes down on one of the devices, SNMP can quickly alert the change.

1.1. Understanding RBFS SNMP Implementation

The RBFS SNMP implementation allows retrieving system state information using the Protocol Data Unit (PDU) from various network components. SNMP defines system objects in Management Information Bases (MIBs), where each object forms a Protocol Data Unit (PDU).

A device that is SNMP enabled is known as SNMP agent. SNMP agent collects information from various devices and components and stores the data within MIB. An SNMP agent includes several objects such as interfaces and routing tables which can be interacted with. Every object has a unique identifier which is known as OID (Object Identifier). OIDs provide a unique identity for managed objects in an MIB hierarchy.

RBFS implements the SNMP daemon (snmpd) that maps the operational state API to SNMP MIBs for retrieving system state data.

SNMP Operations

SNMP allows performing various operations that include GET for retrieving data, SET for modifying data, TRAP for notifying an event and so on. These operations provide management access to the MIB hierarchy.

1. **GET**: The SNMP GET operation retrieves data from the managed device's MIB.
2. **GETNEXT**: The GETNEXT operation retrieves data for the next object from the tree of objects on the device.
3. **SET**: The SNMP SET operation allows modifying data for a device.
4. **TRAP**: Event notification that is not requested.

RBFS does not currently support the SNMP SET and TRAP operations.

Supported SNMP MIBs

Management Information Base (MIB) is a collection of data that is organized hierarchically. You can define an MIB mapping for the supported MIBs. This MIB mapping provides a way to retrieve the required state information using the Operational State API or any other RBFS API or Prometheus.

Currently, RBFS supports two SNMP MIBs: the Interface MIB and the Host Resources MIBs.

Host resource MIB: Host resource MIB collects and provides information for host computer resources.

Interfaces MIB: Interfaces MIB retrieves information about the state of interfaces in devices.

1.2. Supported SNMP Versions

RBFS supports the SNMP version 2c and SNMP version 3. SNMP version 3 provides support for authentication and encryption and the data can be accessed after capture only by authorized users. You must choose either version 2c or version 3 before configuring other functionalities.

Information about SNMP v2c and v3

SNMP v2c allows access control through Communities, but the community information is not protected. Anyone with the community name can access all the information available for that community.

SNMP v3 provides a higher level of security using authentication and privacy protocols. RBFS supports the user-based security model defined in RFC 3414.

The user credentials verify the authenticity and integrity of the message by adding message authentication codes (MACs) to the SNMP packet. The privacy protocol allows for the encryption of the transmitted data.

2. Configuring SNMP

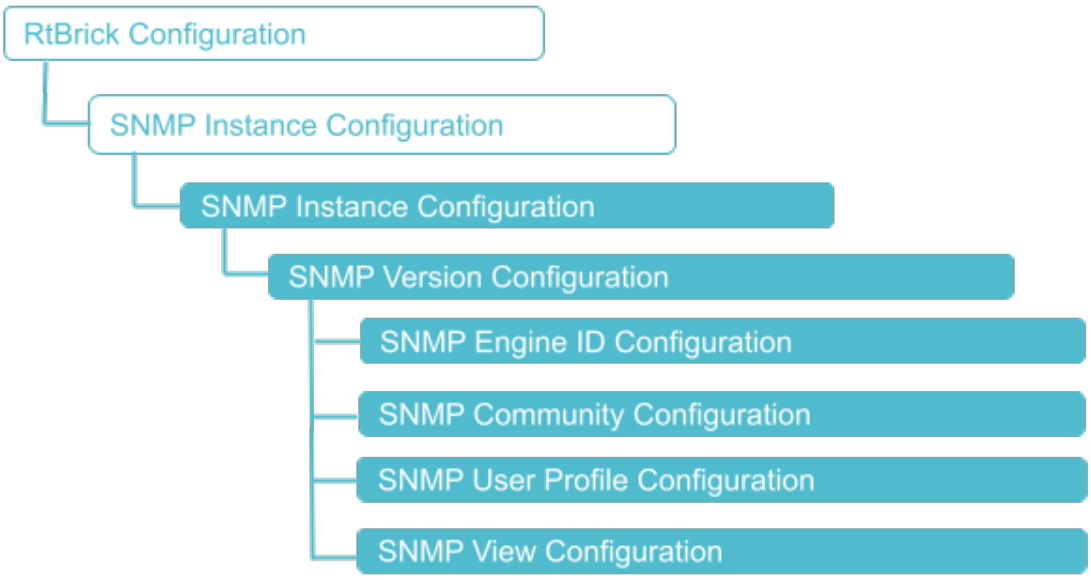
By default, SNMP is not enabled. To enable SNMP, you must complete the SNMP configurations.

RBFS supports SNMP 2c and 3 versions. You must first configure the desired version before configuring other functionalities. RBFS does not support running both the SNMP 2c and 3 versions at the same time.

The RBFS CLI displays all options regardless of the selected version. Even though functionalities such as Community can be configured for both of the versions, it works only in SNMP 2c version. You can define 'user profiles' on SNMP v3 and 'Community' in version 2c. Similarly, Engine ID can be defined in SNMP version 3.

2.1. Configuration Hierarchy

The diagram illustrates the SNMP configuration hierarchy. All SNMP configurations are performed within an instance.



2.2. Configuration Syntax and Commands

The following sections describe the SNMP configuration syntax and commands.

2.2.1. SNMP Instance Configuration

At this instance configuration hierarchy, you configure SNMP protocol parameters which are generic to the SNMP instance.

Syntax

set instance <instance-name> **protocol snmp** <attribute> <value>

Attribute	Description
version	Specify the SNMP version. RBFS supports SNMP version 2c and version 3. You must first configure the desired version before configuring other functionalities.
engine-id	Specify the unique SNMP engine identifier. This is optional. If not specified, the system retrieves the default engine ID from the management port MAC address. Every SNMP v3 agent includes an engine ID that is a unique identifier for the agent. The engine ID is used to provide a higher level of security using authentication and encryption for SNMP v3 messages.

Example: SNMP Version and Engine Identifier Configuration

The following commands configure SNMP version 3 and engine ID: 268956.

```
set instance default protocol snmp version 3
set instance default protocol snmp engine-id 268956
```

The following example shows the SNMP version and engine ID configurations.

```
supervisor@rtbrick.net: cfg> show config instance default protocol snmp
{
  "rtbrick-config:snmp": {
    "version": "3",
    "engine-id": "268956"
  }
}
```

2.2.2. SNMP Community Configuration

An SNMP community can be defined only in the SNMP version 2c.

Syntax

set instance <instance-name> **protocol snmp community**

Attribute	Description
access-mode	Specify the access mode. Read, write and append are modes of access. 'ReadOnly' is the currently supported access mode.
view	Specify the list of view identifiers. View is optional. For information about Views, see section "2.2.3 SNMP View Configuration".

Example: SNMP v2c Community Configuration

The following commands configure a Community named 'public' with read-only access right to the 'interfaces' View.

```
set instance default protocol snmp version 2c
set instance default protocol snmp community public access-mode ReadOnly
set instance default protocol snmp community public view Interfaces
```

The following example shows SNMP v2c community configurations.

```
supervisor@rtbrick: cfg> show config instance default protocol snmp
{
  "rtbrick-config:snmp": {
    "version": "2c",
    "community": [
      {
        "name": "public"
        "access-mode": "ReadOnly"
      }
    ]
  }
}
```

2.2.3. SNMP View Configuration

An SNMP View is a subset of MIB objects. Views allow you to restrict access to certain items in the SNMP PDUs. You can restrict user and community access to certain attributes by defining views. A view restricts access to the PDUs included in the View. If the access is not restricted by views, the user or community is allowed to view all data available through SNMP.

Syntax

set instance <instance-name> **protocol snmp** <attribute> <value>

Attribute	Description
include <include>	List of OID patterns that are included in the view.

Attribute	Description
instance	List of instances. It restricts the view to the specified instances. If no instance is defined, the view can access to all instances.

Example: SNMP View Configuration

The following commands configure SNMP View. In this example configuration, SNMP version has been specified as 2c and 'View' name is specified as interfaces. The 'interfaces' view includes the OID 1.3.6.1.2.1.2.* in the view list. In addition, the configuration shows a user 'community' named public has been configured and the community has read-only access to the View.

```
set instance default protocol snmp version 2c
set instance default protocol snmp view interfaces include 1.3.6.1.2.1.2.*
set instance default protocol snmp community public access-mode ReadOnly
```

The following example shows the SNMP View configuration.

```
supervisor@rtbrick: cfg> show config instance default protocol snmp
{
  "rtbrick-config:snmp": {
    "version": "2c",
    "view": [
      {
        "name": "interfaces",
        "include": [
          "1.3.6.1.2.1.2.*"
          ]
      }
    ],
    "community": [
      {
        "name": "public",
        "access-mode": "ReadOnly",
        "view": [
          "interfaces"
          ]
      }
    ]
  }
}
```

2.2.4. SNMP User Profile Configuration

You can create user profiles for SNMP version 3. It allows you to define login credentials, authentication methods, and privacy control.

Syntax

set instance <instance-name> **protocol snmp user-profile**

Attribute	Description
authentication-protocol	Specify SNMP authentication protocol. MD5, NoAuth, SHA, SHA224, SHA256, SHA384, and SHA512 are the supported authentication protocol.
password-encrypted-text	Specify SNMP user password in encrypted text.
password-plain-text	Specify SNMP user password in plain text.
privacy-password-encrypted-text	Specify SNMP privacy password in encrypted text.
privacy-password-plain-text	Specify SNMP privacy password in plain text.
privacy-protocol	Specify SNMP privacy protocol. Supported privacy protocols include AES192, AES192C, AES256, AES256C, DES, and NoPriv.
security-level	Specify SNMP v3 security level. Security levels exist only in SNMP v3. The following security levels are supported: • noAuthNoPriv: no authentication, no privacy • authNoPriv: authentication, no privacy • authPriv: authentication, privacy
view	Specify SNMP view list.

Example: SNMP User Profile Configuration

The following commands configure SNMP user profile. At first, SNMP Version 3 is configured with the user profile name as operator. Password type has been selected as password encrypted text. In this configuration, the security level is configured as AuthNoPriv and MD5 as type of the authentication protocol.

```
set instance default protocol snmp version 3
set instance default protocol snmp user-profile operator
set instance default protocol snmp user-profile operator password-encrypted-text
$2a6fd7db50a18a9f1f16b5c5b4214fab0
set instance default protocol snmp user-profile operator security-level AuthNoPriv
set instance default protocol snmp user-profile operator authentication-protocol
MD5
```

The following example shows the SNMP User Profile Configuration

```
supervisor@rtbrick: cfg> show config instance default protocol snmp
{
  "rtbrick-config:snmp": {
    "version": "3",
    "user-profile": [
      {
        "name": "operator",
        "password-encrypted-text": "$2a6fd7db50a18a9f1f16b5c5b4214fab0",
        "security-level": "AuthNoPriv",
        "authentication-protocol": "MD5"
      }
    ]
  }
}
```

2.3. Examples for SNMP Walk Operation

2.3.1. SNMP v2c SNMP Walk Output

The following is a sample output for the SNMP Walk for SNMP version 2c. SNMP version 2c has been configured with Community name as 'public' and, host IP address as 10.200.134.25.

```
snmpwalk -v 2c -c public 10.200.134.25
iso.3.6.1.2.1.2.2.1.1.1 = INTEGER: 1
iso.3.6.1.2.1.2.2.1.1.2 = INTEGER: 2
iso.3.6.1.2.1.2.2.1.1.3 = INTEGER: 3
iso.3.6.1.2.1.2.2.1.1.4 = INTEGER: 4
iso.3.6.1.2.1.2.2.1.1.5 = INTEGER: 5
iso.3.6.1.2.1.2.2.1.1.6 = INTEGER: 6
iso.3.6.1.2.1.2.2.1.1.7 = INTEGER: 7
iso.3.6.1.2.1.2.2.1.1.8 = INTEGER: 8
iso.3.6.1.2.1.2.2.1.1.9 = INTEGER: 9
iso.3.6.1.2.1.2.2.1.1.10 = INTEGER: 10
iso.3.6.1.2.1.2.2.1.1.11 = INTEGER: 11
iso.3.6.1.2.1.2.2.1.1.12 = INTEGER: 12
iso.3.6.1.2.1.2.2.1.1.13 = INTEGER: 13
iso.3.6.1.2.1.2.2.1.1.14 = INTEGER: 14
iso.3.6.1.2.1.2.2.1.1.15 = INTEGER: 15
iso.3.6.1.2.1.2.2.1.1.16 = INTEGER: 16
iso.3.6.1.2.1.2.2.1.1.17 = INTEGER: 17
iso.3.6.1.2.1.2.2.1.1.18 = INTEGER: 18
iso.3.6.1.2.1.2.2.1.1.19 = INTEGER: 19
iso.3.6.1.2.1.2.2.1.1.20 = INTEGER: 20
iso.3.6.1.2.1.2.2.1.1.21 = INTEGER: 21
iso.3.6.1.2.1.2.2.1.1.22 = INTEGER: 22
iso.3.6.1.2.1.2.2.1.1.23 = INTEGER: 23
<...>
```

2.3.2. SNMP v3 SNMP Walk Output

The following is a sample output for the SNMP Walk for SNMP version 3. SNMP version 3 has been configured with user as 'operator', MD5 as the authentication

protocol, authNoPriv as the security level, and 10.200.134.25 as the host IP address.

```
snmpwalk -v 3 -u operator -A operator -a MD5 -l authNoPriv 10.200.134.25
iso.3.6.1.2.1.2.2.1.1.1 = INTEGER: 1
iso.3.6.1.2.1.2.2.1.1.2 = INTEGER: 2
iso.3.6.1.2.1.2.2.1.1.3 = INTEGER: 3
iso.3.6.1.2.1.2.2.1.1.4 = INTEGER: 4
iso.3.6.1.2.1.2.2.1.1.5 = INTEGER: 5
iso.3.6.1.2.1.2.2.1.1.6 = INTEGER: 6
iso.3.6.1.2.1.2.2.1.1.7 = INTEGER: 7
iso.3.6.1.2.1.2.2.1.1.8 = INTEGER: 8
iso.3.6.1.2.1.2.2.1.1.9 = INTEGER: 9
iso.3.6.1.2.1.2.2.1.1.10 = INTEGER: 10
iso.3.6.1.2.1.2.2.1.1.11 = INTEGER: 11
iso.3.6.1.2.1.2.2.1.1.12 = INTEGER: 12
iso.3.6.1.2.1.2.2.1.1.13 = INTEGER: 13
iso.3.6.1.2.1.2.2.1.1.14 = INTEGER: 14
iso.3.6.1.2.1.2.2.1.1.15 = INTEGER: 15
iso.3.6.1.2.1.2.2.1.1.16 = INTEGER: 16
iso.3.6.1.2.1.2.2.1.1.17 = INTEGER: 17
iso.3.6.1.2.1.2.2.1.1.18 = INTEGER: 18
iso.3.6.1.2.1.2.2.1.1.19 = INTEGER: 19
iso.3.6.1.2.1.2.2.1.1.20 = INTEGER: 20
iso.3.6.1.2.1.2.2.1.1.21 = INTEGER: 21
iso.3.6.1.2.1.2.2.1.1.22 = INTEGER: 22
iso.3.6.1.2.1.2.2.1.1.23 = INTEGER: 23
<...>
```