Configuration Examples for Displaying CPU Usage of the Device Using SNMP

Keywords: SNMP, NMS, agent, MIB, CPU usage

Abstract: Net-SNMP is a set of open source implementation tools of the SNMP protocol and can function as the NMS or the agent. This document introduces the how to display CPU usage of the agent (H3C device) through SNMP by using Net-SNMP as the NMS.

Acronyms:

Acronym	Full spelling
SNMP	Simple Network Management Protocol
NMS	Network Management System
MIB	Management Information Base

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Overview

The SNMP protocol defines the communication rules between network management stations (NMSs) and network agents (programs that reside in the managed devices). An NMS gets and reconfigures the value of one or more objects in the agent MIB (Management Information Base) by means of the Get and Set operations, thus realizing remote management and monitoring to agents. The CPU usage of the agent is an important variable monitored by the NMS.

CPU usage reflects the usage of the CPU resources of the device for a period of time. High CPU usage for a period of time indicates that the device is heavily loaded. In this case, you need to analyze the current status of the device and find out the causations to prevent and diagnose network problems.

There are various NMS products on the market, and Net-SNMP is widely used as an open source implementation. It provides a complete set of applications and realizes SNMPv1, SNMPv2c and SNMPv3 functions. This document describes how to obtain the CPU usage of the device by accessing the MIB objects with the Net-SNMP tools.

Introduction to Net-SNMP

This document describes the snmpset and snmpwalk functions of Net-SNMP.

- The snmpset function: Executes a Set operation to set the value of a specified MIB object of the agent. The command format is **snmpset [OPTIONS] AGENT OID TYPE VALUE [OID TYPE VALUE]**.
- The snmpwalk function: Executes a Walk operation to get values of multiple MIB objects of the agent. The command format is **snmpwalk [OPTIONS] AGENT [OID]**.

The following table describes the parameters in the above two commands:

Parameter	Description
snmpget	This keyword indicates to execute the Set operation.
snmpwalk	This keyword indicates to execute the Walk operation.
OPTIONS	Command line options (see Table 1 for commonly used options).
AGENT	IP address of the agent.
OID	OID of the MIB object in the agent. For the Get operation, this parameter must be the OID of a leaf node or a node entity; for the Walk operation, this parameter can be the OID of any type of objects.

Table 1 Commonly used options of Net-SNMP command line tool

Option	Description	Example
-h	Displays command line help information	-h
-v	Specifies the SNMP version, the value of	-v 1

Option	Description	Example
	which can be 1, 2c, or 3.	
-c	Sets the community name.	-c public
-a	Sets authentication protocol type, the value of which can be MD5 or SHA.	-a MD5
-A	Sets the authentication password.	-A 12345678
-e	Sets the security engine ID.	-e 800063A203000056000000
-u	Sets the username.	-u v3user
-x	Sets the privacy protocol type, and the value is DES.	-x DES
-X	Sets the privacy password.	-X 12345678
-m	Loads the MIB table, the value is the MIB file name. If the value is **ALL**, it indicates to load all files.	• -m ALL • -m d:/net-snmp/xxx.mib
-M	Specifies the directory of the MIB file.	-M d:/nets-snmp

Note

For detailed introduction of Net-SNMP tools used in this document, access the website http://www.net.snmp.org/.

Related MIB Nodes

This document helps you to display CPU usage by accessing the H3C private MIB. You can access MIB nodes with either their OIDs or their names. For the latter, you need to download file **hh3c-entity-ext.mib** or **h3c-entity-ext.mib** to the NMS, and then compile the file; otherwise, you can only access MIB nodes with their OIDs.

hh3c-entity-ext.mib is an H3C new-style MIB file, and **h3c-entity-ext.mib** is an H3C compatible-style MIB file. The MIB file used depends on the current MIB style of the device. You can view the MIB style of the device with the **display mib-snmp** command on the agent. The **Current MIB style** field is displayed as one of the following:

- new for H3C new-style. Node **hh3cEntityExtCpuUsage** in file **hh3c-entity-ext.mib** should be used. For description of this node, refer to Table 2.
- compatible for H3C compatible-style. Node **h3cEntityExtCpuUsage** in file **h3c-entity-ext.mib** should be used. For description of this node, refer to Table 3.

Table 2 hh3cEntityExtCpuUsage object description

Object	hh3cEntityExtCpuUsage

OID	1.3.6.1.4.1.25506.2.6.1.1.1.1.6
Description	CPU entity usage during the last one minute
Type	Column object
Remarks	• This object contains many entities (leaf nodes), the object OID of which is 1.3.6.1.4.1.25506.2.6.1.1.1.1.6.n. The value of n (hereinafter referred to as entity number) varies with entities. • The number of a CPU entity is decided by objects entPhysicalDescr (with the OID of 1.3.6.1.2.1.47.1.1.1.1.2), entPhysicalClass (with the OID of 1.3.6.1.2.1.47.1.1.1.1.5), and entPhysicalName (with the OID of 1.3.6.1.2.1.47.1.1.1.1.7) in file **hh3c-entity-ext.mib**. • If the value of an entity is always 0, the entity is not a CPU entity.

Table 3 h3cEntityExtCpuUsage object description

Object	h3cEntityExtCpuUsage
OID	1.3.6.1.4.1.2011.10.2.6.1.1.1.1.6
Description	CPU entity usage during the last one minute
Type	Column object
Remarks	• This object contains many entities (leaf nodes), the object OID of which is 1.3.6.1.4.1.2011.10.2.6.1.1.1.1.6.n. The value of n (hereinafter referred to as entity number) varies with entities. • The number of a CPU entity is decided by objects entPhysicalDescr (with the OID of 1.3.6.1.2.1.47.1.1.1.1.2), entPhysicalClass (with the OID of 1.3.6.1.2.1.47.1.1.1.1.5), and entPhysicalName (with the OID of 1.3.6.1.2.1.47.1.1.1.1.7) in file **h3c-entity-ext.mib**. • If the value of an entity is always 0, the entity is not a CPU entity.

Configuration Example for Displaying CPU Usage of the Device Using SNMPv1 or SNMPv2c

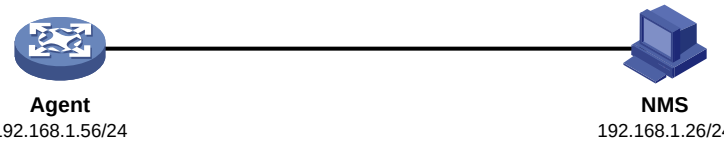
Note

Configurations for SNMPv1 are similar to those for SNMPv2c, and SNMPv1 is used in this example. For configurations for SNMPv2c, you can change the value of – v in the snmpget tool from 1 to 2c.

Network Requirements

- As shown in Figure 1, the NMS connects to the agent through an Ethernet.
- Net-SNMP runs on the NMS. It is required that on the NMS, the CPU usage of the agent during the last one minute can be displayed with the community name **public** using SNMPv1.

Figure 1 Network diagram for displaying CPU usage using SNMPv1



Configuration Considerations

- Configure interface parameters on the agent: configure the IP address of the interface and make sure that there is an available route between the agent and the NMS.
- Configure the SNMP basic information (including SNMP version and community name) on the agent, enabling the inter-access between the NMS and the agent.
- View the MIB style of the agent to determine the MIB objects to be used.
- Save files **snmpset.exe** and **snmpwalk.exe** in Net-SNMP to directory C:\usr\bin, and display the CPU usage of the agent during the last one minute through MIB objects.

Configuration Procedures

Configuration on the Agent

Configure the IP address of agent as 192.168.1.56/24 and make sure that there is an available route between the agent and the NMS.

- If Ethernet 1/1 is a Layer 3 interface, perform the following configuration:

```
<Sysname> system-view
[Sysname] interface ethernet 1/1
[Sysname-Ethernet1/1] ip address 192.168.1.56 24
[Sysname-Ethernet1/1] quit
```

- If Ethernet 1/1 is a Layer 2 interface, perform the following configuration:

```
<Sysname> system-view
[Sysname] vlan 2
[Sysname-vlan2] port Ethernet 1/1
[Sysname-vlan2] quit
[Sysname] interface vlan-interface 2
[Sysname-Vlan-interface2] ip address 192.168.1.56 24
[Sysname-Vlan-interface2] quit
```

Configure the SNMP version. To avoid the failure of establishing an SNMP connection between the agent and the NMS due to the problem of SNMP version, you are recommended to configure this keyword as **all**, which means SNMPv1, SNMPv2c and SNMPv3 are all supported.

```
[Sysname] snmp-agent sys-info version all
```

Configure **public** as the read-only community name.

```
[Sysname] snmp-agent community read public
```

View the MIB file style of the device to determine the MIB objects to be used.

```
[Sysname] display mib-style
 Current MIB style: new
```

```
Next reboot MIB style: new
```

The above information indicates that the MIB file style of the device is new; therefore, the **hh3cEntityExtCpuUsage** object is used and the OID is 1.3.6.1.4.1.25506.2.6.1.1.1.1.6. (If the current MIB style is displayed as compatible, you need to use 1.3.6.1.4.1.2011.10.2.6.1.1.1.1.6 to replace 1.3.6.1.4.1.25506.2.6.1.1.1.1.6 in the following configuration steps.)

Configuration on the NMS

1) Display numbers of CPU entities

Use objects entPhysicalDescr, entPhysicalClass, and entPhysicalName in file **hh3c-entity-ext.mib** to identify the CPU entity numbers. If these objects cannot identify the CPU entity numbers, or you want to display overall CPU usage on the device, you can Display overall CPU usage.

```
C:\usr\bin> snmpwalk -v 1 -c public 192.168.1.56 1.3.6.1.2.1.47.1.1.1.1.2
iso.3.6.1.2.1.47.1.1.1.1.2.1 = STRING: "H3C S7502E"
iso.3.6.1.2.1.47.1.1.1.1.2.2 = STRING: "Container for Board Modu
iso.3.6.1.2.1.47.1.1.1.1.2.3 = STRING: "Container for Board Modu
iso.3.6.1.2.1.47.1.1.1.1.2.4 = STRING: "Container for Board Modu
iso.3.6.1.2.1.47.1.1.1.1.2.5 = STRING: "Container for Board Modu
iso.3.6.1.2.1.47.1.1.1.1.2.16 = STRING: "Container for Power Mod
iso.3.6.1.2.1.47.1.1.1.1.2.17 = STRING: "Container for Power Mod
iso.3.6.1.2.1.47.1.1.1.1.2.18 = STRING: "Container for Fan Modul
iso.3.6.1.2.1.47.1.1.1.1.2.19 = STRING: "LSQ1MPUA0"
iso.3.6.1.2.1.47.1.1.1.1.2.20 = STRING: "LSQ1MPUA0"
iso.3.6.1.2.1.47.1.1.1.1.2.21 = ""
iso.3.6.1.2.1.47.1.1.1.1.2.33 = STRING: "PSU"
iso.3.6.1.2.1.47.1.1.1.1.2.35 = STRING: "FAN"
……
```

The above information indicates that the CPU entity numbers are 19 and 20. If you want to identify the entity number of the active main board (AMB) and that of the standby main board (SMB), execute the following commands:

```
C:\usr\bin> snmpwalk -v 1 -c public 192.168.1.56 1.3.6.1.2.1.47.1.1.1.1.7
iso.3.6.1.2.1.47.1.1.1.1.7.1 = STRING: "H3C S7502E"
iso.3.6.1.2.1.47.1.1.1.1.7.2 = STRING: "Slot 0"
iso.3.6.1.2.1.47.1.1.1.1.7.3 = STRING: "Slot 1"
iso.3.6.1.2.1.47.1.1.1.1.7.4 = STRING: "Slot 2"
iso.3.6.1.2.1.47.1.1.1.1.7.5 = STRING: "Slot 3"
iso.3.6.1.2.1.47.1.1.1.1.7.16 = STRING: "Slot 14"
iso.3.6.1.2.1.47.1.1.1.1.7.17 = STRING: "Slot 15"
iso.3.6.1.2.1.47.1.1.1.1.7.18 = STRING: "Slot 16"
iso.3.6.1.2.1.47.1.1.1.1.7.19 = STRING: "Master Board 0"
iso.3.6.1.2.1.47.1.1.1.1.7.20 = STRING: "Slave Board 1"
iso.3.6.1.2.1.47.1.1.1.1.7.21 = STRING: "Board 2"
……
```

The above information indicates that the entity number of the AMB is 19, and that of the SMB is 20.

2) Display the CPU usage of the AMB

```
C:\usr\bin> snmpget -v 1 -c public 192.168.1.56 1.3.6.1.4.1.25506.2.6.1.1.1.1.6.19
```

The system returns the following information:

```
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.19 = INTEGER: 2
```

The above information indicates that the CPU usage of the AMB is 2%.

3) Display the CPU usage of the SMB

```
C:\usr\bin> snmpget -v 1 -c public 192.168.1.56 1.3.6.1.4.1.25506.2.6.1.1.1.1.6.20
```

The system returns the following information:

```
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.20 = INTEGER: 2
```

The above information indicates that the CPU usage of the SMB is 2%.

4) Display overall CPU usage

Execute the command of the snmpwalk tool, and values that are not 0 are the CPU usage.

```
C:\usr\bin> snmpwalk -v 1 -c public 192.168.1.56 1.3.6.1.4.1.25506.2.6.1.1.1.1.6
```

The system returns the following information:

```
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.1 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.2 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.3 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.4 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.5 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.16 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.17 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.18 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.19 = INTEGER: 2
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.20 = INTEGER: 2
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.21 = INTEGER: 3
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.33 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.35 = INTEGER: 0
……
```

The above information indicates that the CPU usage of the AMB (with the entity number of 19) is 2%, and that of the SMB (with the entity number of 20) is 2%, and that of the interface card (with the entity number of 21) is 3%.

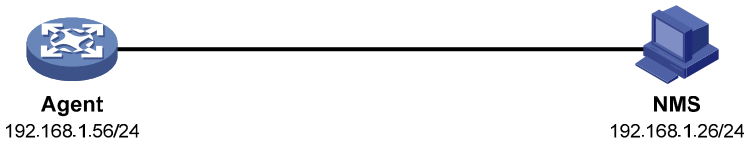
Configuration Example for Displaying CPU Usage of the Device Using SNMPv3

Network Requirements

- As shown in Figure 2, the NMS connects to the agent through an Ethernet.
- Net-SNMP runs on the NMS. The NMS uses SNMPv3 to display the CPU usage on the agent during the last one minute with the community name as **v3user**, authentication protocol as **MD5**,

authentication password as **aaaaaaaaaa**, privacy protocol as **DES56**, and privacy password as **bbbbbbbbbb**.

Figure 2 Network diagram for displaying CPU usage using SNMPv3



Configuration Considerations

- Configure interface parameters on the agent: configure the IP address of the interface and make sure that there is an available route between the agent and the NMS.
- Configure the SNMP basic information (including SNMP version, group, user and authentication and encryption parameters) on the agent, enabling the inter-access between the NMS and the agent.
- View the MIB style of the agent to determine the MIB objects to be used.
- Save files **snmpset.exe** and **snmpwalk.exe** in Net-SNMP to directory C:\usr\bin, and display the CPU usage of the agent during the last one minute through MIB objects.

Configuration Procedures

Configuration on the Agent

Configure the IP address of the agent as 192.168.1.56/24 and make sure that there is an available route between the agent and the NMS.

- If Ethernet 1/1 is a Layer 3 interface, perform the following configuration:

```
<Sysname> system-view
[Sysname] interface ethernet 1/1
[Sysname-Ethernet1/1] ip address 192.168.1.56 24
[Sysname-Ethernet1/1] quit
```

- If Ethernet 1/1 is a Layer 2 interface, perform the following configuration:

```
<Sysname> system-view
[Sysname] vlan 2
[Sysname-vlan2] port Ethernet 1/1
[Sysname-vlan2] quit
[Sysname] interface vlan-interface 2
[Sysname-Vlan-interface2] ip address 192.168.1.56 24
[Sysname-Vlan-interface2] quit
```

Configure the SNMP version. To avoid the failure of establishing an SNMP connection between the agent and the NMS due to the problem of SNMP version, you are recommended to configure this keyword as **all**, which means SNMPv1, SNMPv2c and SNMPv3 are all supported.

```
<Sysname> system-view
[Sysname] snmp-agent sys-info version all
```

Set SNMP parameters: set the user name to **v3user**, authentication protocol to **MD5**, authentication password to **aaaaaaaaaa**, privacy protocol to **DES56**, and privacy password to **bbbbbbbbbb**.

- You can select whether to authenticate and encrypt the SNMP packets as needed. In this example, authentication with privacy is used.
- To make the configured authentication and privacy passwords valid after the system startup, you need to encrypt the plain text password, and then when you create the user, use the encrypted password in your configuration.

```
[Sysname] snmp-agent calculate-password aaaaaaaaaa mode md5 local-engineid
 The secret key is: 17CED5A1298DF35A643D81EC14E0E816
[Sysname] snmp-agent calculate-password bbbbbbbbbb mode md5 local-engineid
 The secret key is: 5D32509925039901 47EEB03B04CF2190
[Sysname] snmp-agent group v3 test
[Sysname] snmp-agent usm-user v3 v3user test cipher authentication-mode md5
17CED5A1298DF35A643D81EC14E0E816 privacy-mode des56 5D32509925039901 47EEB03B04CF2190
```

View the MIB file style of the device to determine the MIB objects to be used.

```
[Sysname] display mib-style
 Current MIB style: new
 Next reboot MIB style: new
```

The above information indicates that the MIB file style of the device is new; therefore, the **hh3cEntityExtCpuUsage** object is used and the OID is 1.3.6.1.4.1.25506.2.6.1.1.1.1.6. (If the current MIB style is displayed as compatible, you need to use 1.3.6.1.4.1.2011.10.2.6.1.1.1.1.6 to replace 1.3.6.1.4.1.25506.2.6.1.1.1.1.6 in the following configuration steps.)

Configuration on the NMS

1) Display numbers of CPU entities

Use objects entPhysicalDescr, entPhysicalClass, and entPhysicalName in file **hh3c-entity-ext.mib** to identify the CPU entity number. If these objects cannot identify the CPU entity numbers, or you want to display overall CPU usage on the device, you can go to Display overall CPU usage directly.

```
C:\usr\bin> snmpwalk -v 3 -a MD5 -A aaaaaaaaaa -u v3user -x DES -X bbbbbbbbbb
192.168.1.56 1.3.6.1.2.1.47.1.1.1.1.2
iso.3.6.1.2.1.47.1.1.1.1.2.1 = STRING: "H3C S7502E"
iso.3.6.1.2.1.47.1.1.1.1.2.2 = STRING: "Container for Board Modu
iso.3.6.1.2.1.47.1.1.1.1.2.3 = STRING: "Container for Board Modu
iso.3.6.1.2.1.47.1.1.1.1.2.4 = STRING: "Container for Board Modu
iso.3.6.1.2.1.47.1.1.1.1.2.5 = STRING: "Container for Board Modu
iso.3.6.1.2.1.47.1.1.1.1.2.16 = STRING: "Container for Power Mod
iso.3.6.1.2.1.47.1.1.1.1.2.17 = STRING: "Container for Power Mod
iso.3.6.1.2.1.47.1.1.1.1.2.18 = STRING: "Container for Fan Modul
iso.3.6.1.2.1.47.1.1.1.1.2.19 = STRING: "LSQ1MPUA0"
iso.3.6.1.2.1.47.1.1.1.1.2.20 = STRING: "LSQ1MPUA0"
iso.3.6.1.2.1.47.1.1.1.1.2.21 = ""
iso.3.6.1.2.1.47.1.1.1.1.2.33 = STRING: "PSU"
iso.3.6.1.2.1.47.1.1.1.1.2.35 = STRING: "FAN"
……
```

The above information indicates that the CPU entity numbers are 19 and 20. If you want to identify the entity number of the AMB and that of the SMB, execute the following commands:

```
C:\usr\bin> snmpwalk -v 3 -a MD5 -A aaaaaaaaaa -u v3user -x DES -X bbbbbbbbbb
192.168.1.56 1.3.6.1.2.1.47.1.1.1.1.7
iso.3.6.1.2.1.47.1.1.1.1.7.1 = STRING: "H3C S7502E"
iso.3.6.1.2.1.47.1.1.1.1.7.2 = STRING: "Slot 0"
iso.3.6.1.2.1.47.1.1.1.1.7.3 = STRING: "Slot 1"
iso.3.6.1.2.1.47.1.1.1.1.7.4 = STRING: "Slot 2"
iso.3.6.1.2.1.47.1.1.1.1.7.5 = STRING: "Slot 3"
iso.3.6.1.2.1.47.1.1.1.1.7.16 = STRING: "Slot 14"
iso.3.6.1.2.1.47.1.1.1.1.7.17 = STRING: "Slot 15"
iso.3.6.1.2.1.47.1.1.1.1.7.18 = STRING: "Slot 16"
iso.3.6.1.2.1.47.1.1.1.1.7.19 = STRING: "Master Board 0"
iso.3.6.1.2.1.47.1.1.1.1.7.20 = STRING: "Slave Board 1"
iso.3.6.1.2.1.47.1.1.1.1.7.21 = STRING: "Board 2"
……
```

The above information indicates that the entity number of the AMB is 19, and that of the SMB is 20.

2) Display the CPU usage of the AMB

```
C:\usr\bin> snmpget -v 3 -a MD5 -A aaaaaaaaaa -u v3user -x DES -X bbbbbbbbbb
192.168.1.56 1.3.6.1.4.1.25506.2.6.1.1.1.1.6.19
```

The system returns the following information:

```
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.19 = INTEGER: 1
```

The above information indicates that the CPU usage of the AMB is 1%.

3) Display the CPU usage of the SMB

```
C:\usr\bin> snmpget -v 3 -a MD5 -A aaaaaaaaaa -u v3user -x DES -X bbbbbbbbbb
192.168.1.56 1.3.6.1.4.1.25506.2.6.1.1.1.1.6.20
```

The system returns the following information:

```
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.20 = INTEGER: 2
```

The above information indicates that the CPU usage of the SMB is 2%.

4) Display overall CPU usage

Execute the command of the snmpwalk tool, and values that are not 0 are the CPU usage.

```
C:\usr\bin> snmpwalk -v 3 -a MD5 -A aaaaaaaaaa -u v3user -x DES -X bbbbbbbbbb
192.168.1.56 1.3.6.1.4.1.25506.2.6.1.1.1.1.6
```

The system returns the following information:

```
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.1 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.2 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.3 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.4 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.5 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.16 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.17 = INTEGER: 0
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.18 = INTEGER: 0
```

```
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.19 = INTEGER: 1
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.20 = INTEGER: 2
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.21 = INTEGER: 3
iso.3.6.1.4.1.25506.2.6.1.1.1.1.6.33 = INTEGER: 0
……
```

The above information indicates that the CPU usage of the AMB (with the entity number of 19) is 1%, and that of the SMB (with the entity number of 20) is 2%, and that of the interface card (with the entity number of 21) is 3%.