### SNMP OID

This document is a reference material that systematically organizes OID (Object Identifier) information required when configuring SNMP GET collectors.

#### Understanding OID Structure

OID Tree Structure

SNMP OIDs have a **hierarchical tree structure** where each node inherits a unique number from its parent node. This is similar to a file system directory structure.

Hierarchical Structure from Root Node

1 - ISO (International Organization for Standardization)└── 1.3 - org (ISO identified organization) └── 1.3.6 - dod (US Department of Defense) └── 1.3.6.1 - internet (Internet) ├── 1.3.6.1.1 - directory (X.500 Directory) ├── 1.3.6.1.2 - mgmt (Management) │ └── 1.3.6.1.2.1 - mib-2 (MIB-II, standard management objects) ├── 1.3.6.1.3 - experimental (experimental objects) ├── 1.3.6.1.4 - private (private) │ └── 1.3.6.1.4.1 - enterprises (enterprise-specific private objects) ├── 1.3.6.1.5 - security (security) ├── 1.3.6.1.6 - snmpV2 (SNMPv2) ├── 1.3.6.1.7 - mail (mail) └── 1.3.6.1.8 - features (features)

Role and Management Authority of Each Branch

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| OID | Name | Role | Authority | Usage Example |
| 1.3.6.1.2.1 | mib-2 | Standard MIB objects | IANA/IETF | System info, interface statistics |
| 1.3.6.1.4.1 | enterprises | Vendor-specific objects | Companies | Cisco: 1.3.6.1.4.1.9 |
| 1.3.6.1.3 | experimental | Experimental objects | IANA | Pre-standardization testing |
| 1.3.6.1.6 | snmpV2 | SNMPv2-specific objects | IANA | SNMPv2 modules, domains |

Benefits of Hierarchical Structure

**Uniqueness Guarantee**: Each OID is a globally unique identifier

**Scalability**: New nodes can be added to existing structure

**Management Efficiency**: Clear separation of management authority per branch

**Standardization**: Systematic standard management through RFC documents

Real OID Example Interpretation

**Example**: 1.3.6.1.2.1.1.1.0 (system description)

1 - ISO root1.3 - ISO identified organization1.3.6 - US Department of Defense1.3.6.1 - Internet1.3.6.1.2 - Management objects1.3.6.1.2.1 - MIB-II standard1.3.6.1.2.1.1 - system group1.3.6.1.2.1.1.1 - sysDescr object1.3.6.1.2.1.1.1.0 - scalar instance (single value)

**Example**: 1.3.6.1.4.1.9.2.1.56.0 (Cisco CPU utilization)

1.3.6.1.4.1 - Enterprise private branch1.3.6.1.4.1.9 - Cisco Systems (enterprise number: 9)1.3.6.1.4.1.9.2.1.56.0 - avgBusy5 (5-minute average CPU utilization)

Notation Methods

**Numeric Notation** (used in Sonar collectors):

1.3.6.1.2.1.1.1.0

**Name Notation** (used in MIB files):

iso.org.dod.internet.mgmt.mib-2.system.sysDescr.0

#### Major Standard OIDs

System Group (1.3.6.1.2.1.1)

OIDs that provide basic system information.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| OID | Name | Description | Data Type | Example Value |
| 1.3.6.1.2.1.1.1.0 | sysDescr | System description | string | Cisco IOS Software |
| 1.3.6.1.2.1.1.2.0 | sysObjectID | System object ID | OID | 1.3.6.1.4.1.9.1.1 |
| 1.3.6.1.2.1.1.3.0 | sysUpTime | System uptime | 32-bit int | 12345678 (unit: centiseconds) |
| 1.3.6.1.2.1.1.4.0 | sysContact | Administrator contact | string | admin@company.com |
| 1.3.6.1.2.1.1.5.0 | sysName | System name | string | router01.company.com |
| 1.3.6.1.2.1.1.6.0 | sysLocation | System location | string | Seoul Data Center |

Interfaces Group (1.3.6.1.2.1.2)

OIDs that provide network interface information.

Basic Interface Information

|  |  |  |  |
| --- | --- | --- | --- |
| OID | Name | Description | Data Type |
| 1.3.6.1.2.1.2.1.0 | ifNumber | Total number of interfaces | 32-bit int |
| 1.3.6.1.2.1.2.2.1.1.X | ifIndex | Interface index | 32-bit int |
| 1.3.6.1.2.1.2.2.1.2.X | ifDescr | Interface description | string |
| 1.3.6.1.2.1.2.2.1.3.X | ifType | Interface type | 32-bit int |
| 1.3.6.1.2.1.2.2.1.4.X | ifMtu | Maximum transmission unit | 32-bit int |
| 1.3.6.1.2.1.2.2.1.5.X | ifSpeed | Interface speed | 32-bit int |

Traffic Statistics (32-bit Counters)

|  |  |  |  |
| --- | --- | --- | --- |
| OID | Name | Description | Data Type |
| 1.3.6.1.2.1.2.2.1.10.X | ifInOctets | Received bytes | 32-bit int |
| 1.3.6.1.2.1.2.2.1.11.X | ifInUcastPkts | Received unicast packets | 32-bit int |
| 1.3.6.1.2.1.2.2.1.12.X | ifInNUcastPkts | Received non-unicast packets | 32-bit int |
| 1.3.6.1.2.1.2.2.1.13.X | ifInDiscards | Received dropped packets | 32-bit int |
| 1.3.6.1.2.1.2.2.1.14.X | ifInErrors | Received error packets | 32-bit int |
| 1.3.6.1.2.1.2.2.1.16.X | ifOutOctets | Transmitted bytes | 32-bit int |
| 1.3.6.1.2.1.2.2.1.17.X | ifOutUcastPkts | Transmitted unicast packets | 32-bit int |
| 1.3.6.1.2.1.2.2.1.18.X | ifOutNUcastPkts | Transmitted non-unicast packets | 32-bit int |
| 1.3.6.1.2.1.2.2.1.19.X | ifOutDiscards | Transmitted dropped packets | 32-bit int |
| 1.3.6.1.2.1.2.2.1.20.X | ifOutErrors | Transmitted error packets | 32-bit int |

**Note**: X is the interface index number. Example: 1.3.6.1.2.1.2.2.1.10.1 (received bytes of first interface)

High Capacity Counters (1.3.6.1.2.1.31)

64-bit counters for high-speed interfaces.

|  |  |  |  |
| --- | --- | --- | --- |
| OID | Name | Description | Data Type |
| 1.3.6.1.2.1.31.1.1.1.1.X | ifName | Interface name | string |
| 1.3.6.1.2.1.31.1.1.1.6.X | ifHCInOctets | Received bytes (64-bit) | 64-bit int |
| 1.3.6.1.2.1.31.1.1.1.7.X | ifHCInUcastPkts | Received unicast packets (64-bit) | 64-bit int |
| 1.3.6.1.2.1.31.1.1.1.8.X | ifHCInMulticastPkts | Received multicast packets (64-bit) | 64-bit int |
| 1.3.6.1.2.1.31.1.1.1.9.X | ifHCInBroadcastPkts | Received broadcast packets (64-bit) | 64-bit int |
| 1.3.6.1.2.1.31.1.1.1.10.X | ifHCOutOctets | Transmitted bytes (64-bit) | 64-bit int |
| 1.3.6.1.2.1.31.1.1.1.11.X | ifHCOutUcastPkts | Transmitted unicast packets (64-bit) | 64-bit int |
| 1.3.6.1.2.1.31.1.1.1.12.X | ifHCOutMulticastPkts | Transmitted multicast packets (64-bit) | 64-bit int |
| 1.3.6.1.2.1.31.1.1.1.13.X | ifHCOutBroadcastPkts | Transmitted broadcast packets (64-bit) | 64-bit int |

Host Resources MIB (1.3.6.1.2.1.25)

OIDs that provide system resource information.

System Information

|  |  |  |  |
| --- | --- | --- | --- |
| OID | Name | Description | Data Type |
| 1.3.6.1.2.1.25.1.1.0 | hrSystemUptime | System uptime | 32-bit int |
| 1.3.6.1.2.1.25.1.2.0 | hrSystemDate | System date/time | string |
| 1.3.6.1.2.1.25.1.3.0 | hrSystemInitialLoadDevice | Boot device | 32-bit int |
| 1.3.6.1.2.1.25.1.4.0 | hrSystemInitialLoadParameters | Boot parameters | string |

Memory Information

|  |  |  |  |
| --- | --- | --- | --- |
| OID | Name | Description | Data Type |
| 1.3.6.1.2.1.25.2.2.0 | hrMemorySize | Total memory size (KB) | 32-bit int |
| 1.3.6.1.2.1.25.2.3.1.3.X | hrStorageSize | Storage size | 32-bit int |
| 1.3.6.1.2.1.25.2.3.1.6.X | hrStorageUsed | Used storage | 32-bit int |

CPU Information

|  |  |  |  |
| --- | --- | --- | --- |
| OID | Name | Description | Data Type |
| 1.3.6.1.2.1.25.3.3.1.2.X | hrProcessorLoad | CPU utilization (%) | 32-bit int |

#### Vendor-Specific Private Enterprise OIDs

Cisco Systems (1.3.6.1.4.1.9)

**Major Cisco OIDs**:

1.3.6.1.4.1.9.2.1.56.0 - avgBusy5 (5-minute average CPU utilization)1.3.6.1.4.1.9.2.1.57.0 - avgBusy1 (1-minute average CPU utilization)1.3.6.1.4.1.9.9.48.1.1.1.5.X - cpmCPUTotal5min (CPU 5-minute average)

HP Enterprise (1.3.6.1.4.1.11)

**Major HP OIDs**:

1.3.6.1.4.1.11.2.14.11.5.1.9.6.1.0 - hpSwitchCpuStat (CPU statistics)

Net-SNMP (1.3.6.1.4.1.8072)

**Major Net-SNMP OIDs**:

1.3.6.1.4.1.8072.1.3.2.3.1.2.X - ssSwapIn (swap usage)1.3.6.1.4.1.8072.1.3.2.4.1.2.X - ssCpuUser (user CPU)

#### Practical Usage Guide

1. OID Discovery Methods

Linux/macOS

**Installing Net-SNMP Tools**:

Ubuntu/Debian systems:

sudo apt-get install snmp snmp-mibs-downloader

CentOS/RHEL systems:

sudo yum install net-snmp-utils

macOS (Homebrew):

brew install net-snmp

**Basic discovery commands**:

Query all system information:

snmpwalk -v2c -c public 192.168.1.1 1.3.6.1.2.1.1

Query interface information:

snmpwalk -v2c -c public 192.168.1.1 1.3.6.1.2.1.2.2.1.2

Query specific OID value:

snmpget -v2c -c public 192.168.1.1 1.3.6.1.2.1.1.1.0

Display in table format:

snmptable -v2c -c public 192.168.1.1 1.3.6.1.2.1.2.2

Windows

**Method 1: Net-SNMP for Windows**

**Download and Installation**:

* Download from [Net-SNMP Windows Binaries](http://www.net-snmp.org/download.html)
* Use in Command Prompt (CMD) or PowerShell after installation

**Command Usage** (same as Linux):

Query all system information:

snmpwalk -v2c -c public 192.168.1.1 1.3.6.1.2.1.1

Query interface information:

snmpwalk -v2c -c public 192.168.1.1 1.3.6.1.2.1.2.2.1.2

Query specific OID value:

snmpget -v2c -c public 192.168.1.1 1.3.6.1.2.1.1.1.0

**Method 2: PowerShell SNMP Module**

**Install SNMP Module**:

Install SNMP module from PowerShell Gallery:

Install-Module -Name SNMP -Force

**PowerShell Commands**:

Query specific OID value:

Get-SnmpData -IP "192.168.1.1" -Community "public" -OID "1.3.6.1.2.1.1.1.0"

OID Walk (PowerShell script example) - Query system information:

$target = "192.168.1.1" $community = "public" $baseOid = "1.3.6.1.2.1.1" 1..6 | ForEach-Object { $oid = "$baseOid.$\_.0" try { $result = Get-SnmpData -IP $target -Community $community -OID $oid -UDPport 161 Write-Host "$oid : $($result.Data)" } catch { Write-Host "$oid : Error - $($\_.Exception.Message)" } }

**Method 3: GUI Tools**

* **[ManageEngine MibBrowser](https://www.manageengine.com/products/mibbrowser-free-tool/)**: Free MIB browser
* **[iReasoning MIB Browser](https://ireasoning.com/)**: Commercial MIB browser

**Recommended Installation Path**:

**Developers/IT Administrators**: Net-SNMP for Windows (prefer command-line tools)

**PowerShell Users**: PowerShell SNMP module

**General Users**: GUI tools (MIB Browser, etc.)

2. SNMP GET Collector Configuration Examples

**System monitoring**:

1.3.6.1.2.1.1.1.0=system\_description,1.3.6.1.2.1.1.3.0=uptime,1.3.6.1.2.1.25.1.1.0=hr\_uptime

**Interface traffic monitoring**:

1.3.6.1.2.1.2.2.1.10.1=if1\_in\_octets,1.3.6.1.2.1.2.2.1.16.1=if1\_out\_octets,1.3.6.1.2.1.31.1.1.1.6.1=if1\_hc\_in\_octets

**CPU and memory monitoring**:

1.3.6.1.2.1.25.3.3.1.2.1=cpu\_load,1.3.6.1.2.1.25.2.2.0=memory\_size,1.3.6.1.2.1.25.2.3.1.6.1=memory\_used

3. 32-bit vs 64-bit Counter Selection

|  |  |  |
| --- | --- | --- |
| Interface Speed | Recommended Counter | Reason |
| ≤ 20 Mbps | 32-bit | Sufficient wrap around time |
| 20 Mbps ~ 650 Mbps | 64-bit (Octets), 32-bit (Packets) | Bytes increase rapidly |
| ≥ 650 Mbps | 64-bit | All counters increase rapidly |

4. Counter Wrap Around Time Calculation

**32-bit counter maximum value**: 4,294,967,295

**Wrap Around time examples**:

* **10 Mbps**: approximately 57 minutes
* **100 Mbps**: approximately 5.7 minutes
* **1 Gbps**: approximately 34 seconds

For high-speed networks, always use 64-bit counters (ifHCInOctets, ifHCOutOctets).

#### Online Reference Materials

Official Standard Documents

* **[RFC 1155](https://tools.ietf.org/html/rfc1155)**: Structure and Identification of Management Information
* **[RFC 1213](https://tools.ietf.org/html/rfc1213)**: Management Information Base for Network Management (MIB-II)
* **[RFC 2578](https://tools.ietf.org/html/rfc2578)**: Structure of Management Information Version 2 (SMIv2)
* **[RFC 2233](https://tools.ietf.org/html/rfc2233)**: The Interfaces Group MIB using SMIv2

OID Databases

* **[Object Identifier Repository](https://oid-base.com/)**: Comprehensive OID database and search
* **[IANA Structure of Management Information](https://www.iana.org/assignments/smi-numbers/)**: Official SMI numbers and MIB-II registry
* **[IANA Private Enterprise Numbers](https://www.iana.org/assignments/enterprise-numbers/)**: Official enterprise number registry
* **[MonitorTools MIB Collection](https://www.monitortools.com/tech/snmp/mib/)**: Vendor-specific MIB file collection

Vendor-Specific MIB Information

* **[Cisco SNMP Object Navigator](https://snmp.cloudapps.cisco.com/Support/SNMP/do/BrowseMIB.do)**: Cisco MIB object search
* **[Juniper MIB Explorer](https://apps.juniper.net/mib-explorer/)**: Juniper device MIB information

This reference material enables effective SNMP GET collector configuration and collection of various information from network devices.