SNMP

Simple Network Management Protocol

17th May 2021

Network Monitoring Workshop (Online)

Dhammika Lalantha / LEARN

What is SNMP

- Wikipedia says “**is an Internet Standard protocol for collecting and organizing information about managed devices on IP networks and for modifying that information to change device behavio**r”.
- Used for monitoring and management of network devices(managed devices).
- Can query (Polling) devices and retrieve information
- Can receive notifications (Traps) from devices
- Can change device states/information
- Industry standard protocol
- Supported by almost every network device(vendor)
- Supported by many of available network monitoring and management tools/applications.

What is SNMP

- Application Layer Protocol
- Uses UDP and ports 161, 162
  - Agent receives Polling requests on port 161
  - Manager receives Traps and Informs on port 162
- History and versions
  - V1 (1988)
  - V2 (1996)
    - Currently used version v2c
  - V3 (1998)
    - With security (Authentication + Privacy)
- Widely used version is v2

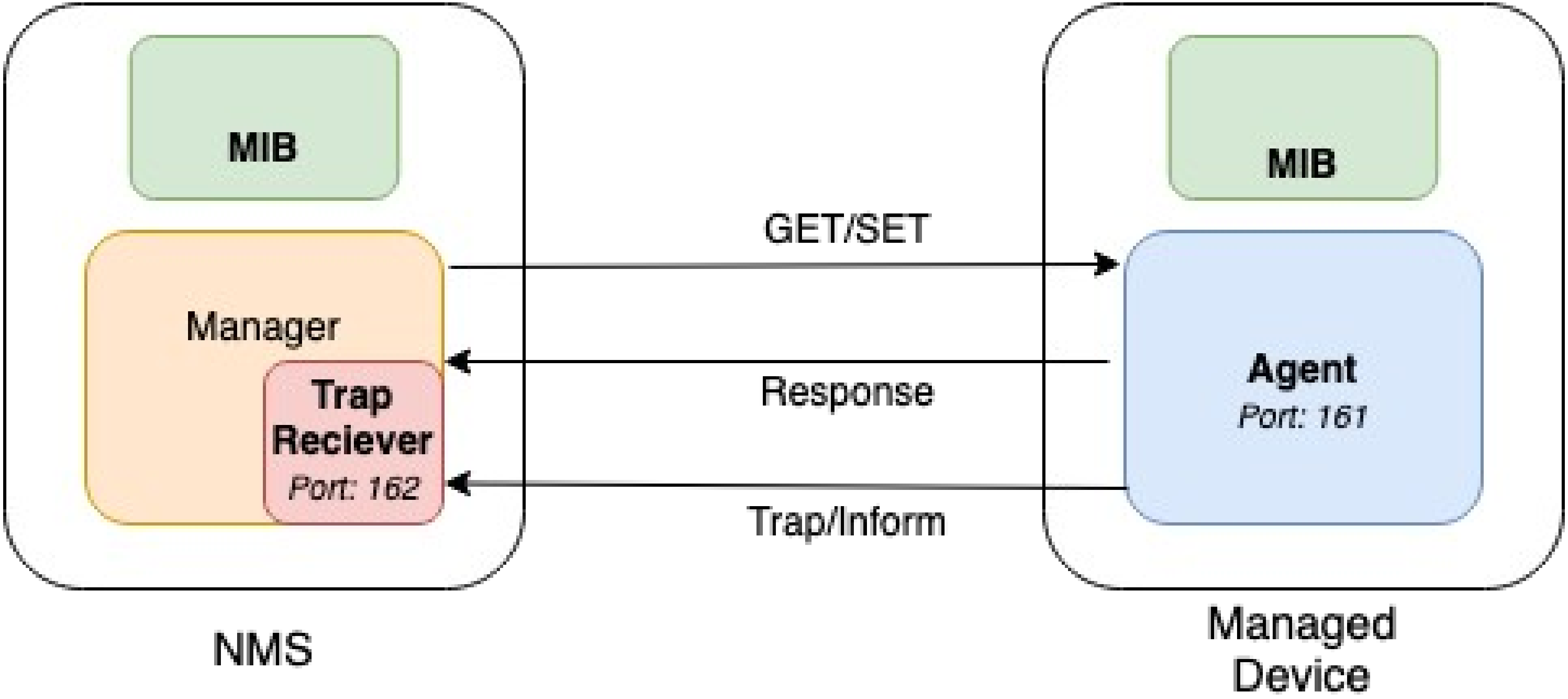
What it can do

- Monitor and manage network routers and switches
  - Device status
  - Interface bandwidth
  - CPU usage
  - Temperature
- Servers, PCs/Workstations
  - Disk utility
  - Installed applications/processes
  - CPU load average
- Network printer ink level and paper tray status
- UPS remaining backup power

SNMP Network Components

- An SNMP-managed network consists of three key components:
  - **Manager**
    - Run on Network management station (NMS)
    - Tools like SNMP tools, Cacti, Zabbix, MRGT
  - **Agent**
    - Software which runs on Managed Devices like Routers, Switches, Printers, UPS etc.
  - **MIBs** (Management Information Base)
    - Specification containing definitions of management information of a particular device
    - A formatted text file

How it works


MIB
MIB
GET/SET
Manager
Response
Agent
Port: 161
Trap
Reciever
Port: 162
Trap/Inform
NMS
Managed
Device

Basic operations (PDU types)

1) GetRequest (Manager → Agent)

    - Query for a value

2) GetNextRequest (Manager → Agent)

    - Get next value (from a list of values of table)

3) GetBulkRequest (Manager → Agent)

    - Multiple iterations of GetNextRequest

4) Response (Agent → Manager)

    - Response to GetRequest/GetNextRequest/GetBulkRequest/SetRequest

5) SetRequest (Manager → Agent)

    - Modify a value

6) Trap (Agent → Manager)

    - Notification from equipment like link down, temperature warning

7) InformRequest (Agent → Manager)

    - UDP, yet reliable

Management Information Base (MIB)

- A Specification that defines management information of managed devices.
- Is a Text file which defines information in a hierarchical (tree-structured) way using ASN.1 notation.
- Each Entry(Information) is called a variable or object.
- Each variable/object is identified by a unique identifier which is called Object Identifier (OID).
- OID is a series of numbers separated by periods/dots.
  - Ex: .1.3.6.1.2.1.1.5
- Read from left to right
- Has a corresponding textual representation
  - iso.org.dod.internet.mgmt.mib-2.system.sysName = .1.3.6.1.2.1.1.5
  - Last word of the OID is called (here *sysName*) the LabelName.

Management Information Base (MIB)

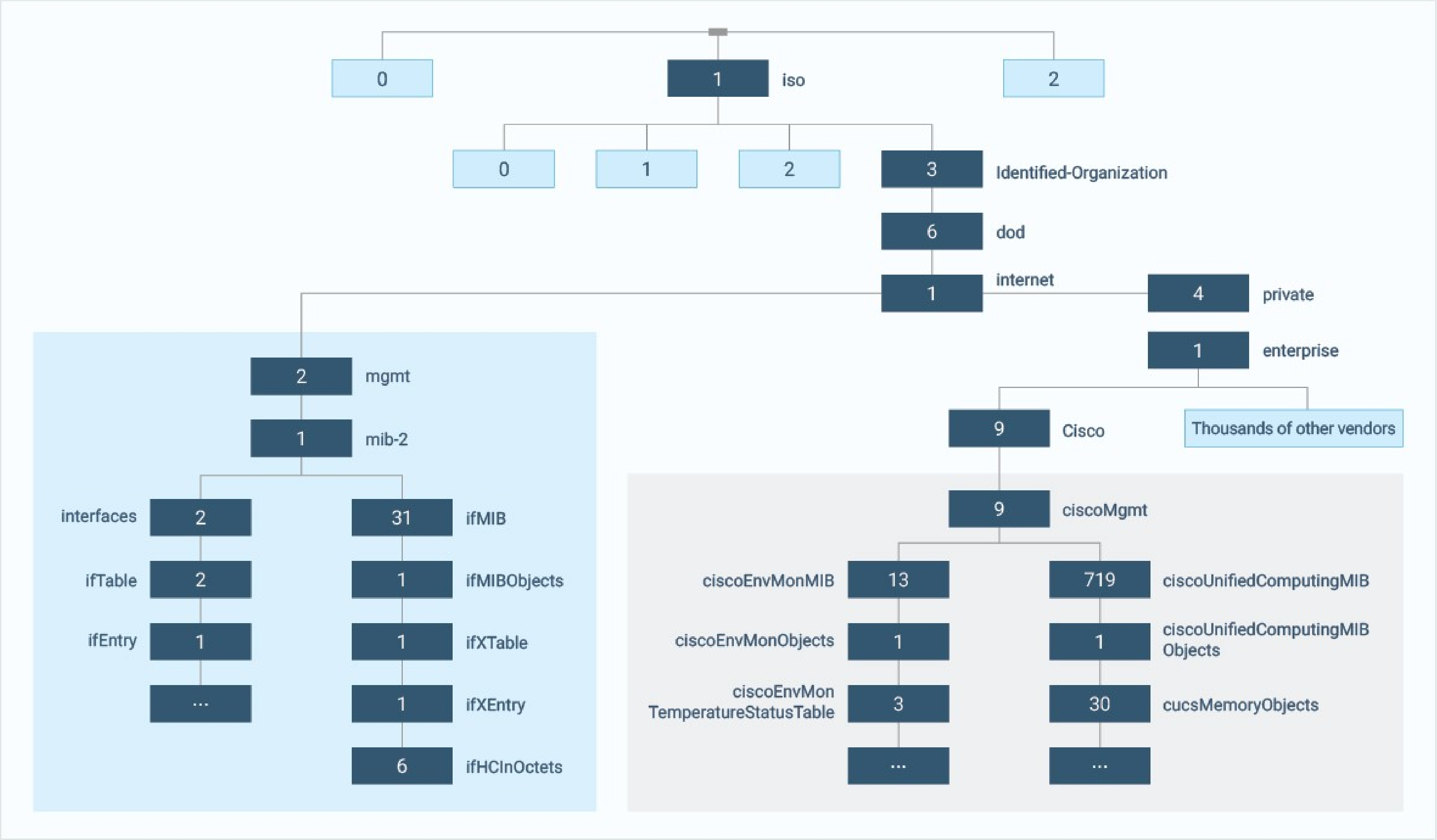
- MIB Object Types (Two Types)
  - Scalar objects
    - Has single instance

      EX: sysName (.1.3.6.1.2.1.1.5)
    - Always accessed with Index .0

      Ex: snmpget [options] <target-IP> sysName.0
    - snmpget [options] <target-IP> .1.3.6.1.2.1.1.5.0
  - Tabular objects
    - Has Multiple instances like table or list

      EX: ifOperStatus (.1.3.6.1.2.1.2.2.1.8)
    - snmpwalk [options] <target-IP> ifOperStatus
    - snmpwalk [options] <target-IP> .1.3.6.1.2.1.2.2.1.8

Management Information Base (MIB)



Querying information through SNMP

- SNMP Client (Manager) Tools has utilities
  - snmpget, snmpgetnext, snmpwalk, snmpbulkget, snmpbulkwalk, snmpstatus, snmpset etc.
- Syntax:
  - snmpxxx -v <1|2c|3> -c community target-host [OID]
- Examples
  - snmpget -v 1 -c NetCommunity 192.168.10.2 .1.3.6.1.2.1.2.2.1.8.1
  - snmpwalk -v 2c -c NetCommunity 192.168.10.2 ifOperStatus
  - snmpgetnext -v 3 -a SHA -A NetAdmin@1 192.168.10.2 IF-MIB::ifOperStatus
  - snmpstatus -v 2c -c NetCommunity 192.168.10.2

SNMP versions

- SNMP v1
  - Manager(or Request) authenticated through Community String
- SNMP v2c
  - SNMP v1 +
  - Inform request
  - New Data types
  - New retrieval methods (getbulk)
  - Improved error handling
  - Improved SET commands
  - Widely used

SNMP versions

- SNMP v3 security
    - Authentication
        - User based
        - Uses SHA, MD5 hash functions
    - Privacy
        - Encrypted messages using AES, DES
    - Message Integrity
        - Ensure the message has not been tampered while in transit

SNMP Views and Groups

- Views
  - Used for controlling access to MIBs
- Groups
  - combine users into groups of different authorization and access privileges.

SNMPv3 Security Levels

- NoAuthNoPriv – No authentication and No privacy
    - Similar to community string level security (Just like v1 v2c)
- AuthNoPriv – Authentication but no Privacy
    - Messages are not encrypted
- AuthPriv – Both authentication and privacy
    - Access authenticated while messages are encrypted
    - High resource consumption

SNMP Agent Configuration on a Network device (Generic)

- SNMPv1-v2c configuration
  - *snmp-server community <COMMUNITY-STRING> view <VIEW-NAME> <read-only|read-write> acl <ACL-NUMBER>*

- SNMPv3 configuration
  - *snmp-server group v3 <GROUP-NAME> <noAuthNoPriv|authNoPriv|authPrivacy> <read-view|write-view> <VIEW-NAME> acl <ACL-NUMBER>*
  - *snmp-server user v3 <USER-NAME> <GROUP-NAME> authentication-mode <md5|sha> <AUTHENTICATION-PASSPHRASE> privacy-mode <des|aes> <PRIVACY-PASSPHRASE>*

Thank You

Dhammika Lalantha/LEARN

Email: lalantha@learn.ac.lk