

# **Network Management Principles**

# Network Management Principles

- Manager
- Agent
- Management Protocol
- Management Information Base

- It controls the operation of the network devices
  - Printer
  - Router
  - Server
  - Base stations
  - PCs etc

## ■ Managed devices called agents

- Denotes a piece of software implemented within the devices that provides the management information.
- In real network a single manager can be responsible for 1000 of agents.

# Management Protocols

- The manager can communicate with agents using well defined protocols such as,
  - Ping
  - Traceroute
  - Telnet/SSH
  - CLI etc
    - ▲ These are the generic protocols
  - In addition to that some dedicated management protocols.
    - ▲ SNMP (Simple Network Management Protocol)
    - ▲ NetCONF (Network Configuration Protocol)
    - ▲ CMIP (Common Mgt. information Protocol)
    - ▲ WBEM (Web Based Enterprise Management)
    - ▲ SysLog (System Log)

## ■ SNMP

- It's the best known example, its standardized by IETF in early 90s.
- Since SNMP is not easy to configure devices in the network.

## ■ NetCONF

- In around 2003, IETF decided to develop NetCONF, at the same time the SNMP was being developed.

## ■ CMIP

- Used for mobile telecommunication network

## ■ WBEM

- Developed by DMTF (Distributed Management Task Force)
  - ▲ Supported by various operating systems.

## ■ SysLog

- It allows the agents to signals the manager.
- Implemented in UNIX systems
- Implemented in 80's and standardized it now by IETF.

- On of the task that managers performs is to monitor the specific management data such as,
  - No. of packets stopped on a specific interface of an agent or a router.
  - To retrieve such mgt. data for the managed devices, the manager uses a GET Request PDU.
  - After successfully getting the GET PDU by agent, it retrieved the requested information and send it to Managers using RESPONSE PDU.



# Device configuration

- The manager is responsible for device configuration by setting certain management variables such as,
  - An entry in the forwarding table (Set PDU by the manager to the agent → Set Write)
  - Finally agents may be able to autonomously signal/notify certain events to the managers.
    - ▲ E.g. an interface when down or a device is been reset.

- In the first version of SNMP, only the limited no. of events are notified by Agents to Managers.
  - This is done through special message called TRAP PDU.
  - In the later versions of SNMP, the capability of agents was extended to notify all kinds of events.
    - ▲ For that purpose a new PDU was defined called INFORM PDU, which is ACK by the Manager, so the agent know that manager is aware of the event.

## ■ SNMP

- Most important management protocol for the internet.
- In the early development of the SNMP, the major goal was to make the Agent Module as simple as possible.
- Agent has minor capabilities to notify device events or problems to manager.
- As a consequence, the manager had to continuously polls the Agents to learn the statistics using GET PDU.
  - ▲ CMIP's Agent is more powerful for sending its problems to Managers timely.

- In case the polling performs sequentially, the manager polls each device one after another.
  - The requested information is retrieved by agents in ms and send this information back to manager using RESPONSE PDU.
    - ▲ Some agents however has poor configuration, which get results even in seconds before being able to send the response.
    - ▲ Since polling make take quite some time for retrieving and sending the desired information to the managers.
      - ✧ It not works properly in case of scalability, i.e. to get the response from 1000 of devices.

# Distributed Management

- To overcome this single manager polling issue, the researcher developed an alternate way called distributed management.
  - The task of the manager is distributed among several low level managers.
    - ▲ To distribute the management functionality, the hierarchy of the managers are created.
    - ▲ Top level managers interacts with intermediate level or mid level managers.
      - ✦ Intermediate level managers may be tailored to the specific level of agents of polling, such as all routers or generic for all kind of agents.
      - ✦ Within the IETF, the protocol and information for such management Hierarchy has been defined by Distributed Management (DisMAN) working group.

- **Managers can poll all agents in Parallel.**
  - Care should be taken, to not to generate too much management traffic at the same time.
  - After five minutes of interval, managers polls all the agents.
    - ▲ Polling goes on 24 hours on a day and will therefore be responsible to the major share for all management traffic.

# Management Information Base (MIB)

- Its included in every Agent.
  - Its organized into so called MIB Module.
  - Every agent has this module.
    - ▲ E.g. the IP address of the device at the time the agents up.
    - ▲ Other modules are implemented in certain kind of devices, since the whole info is specific for a particular device such as forwarding table in router or Turn on level of Printers.
  - The manager usually knows the structure of the MIB of various agents.
    - ▲ In SNMP, the MIB information is kept in a Scalar, such as 64 bit counter or textual strings.
    - ▲ In addition to that MIB information is also structured in two dimensional table.

- If the agent has several interfaces.
  - For each interface we need to count the no. of in and out packets or in and outgoing Octets.



End