

Network Management

- . introduction
- . Internet SNMP: Simple Network Management Protocol
- . required reading: section 7.3 in text, KR Ch 8

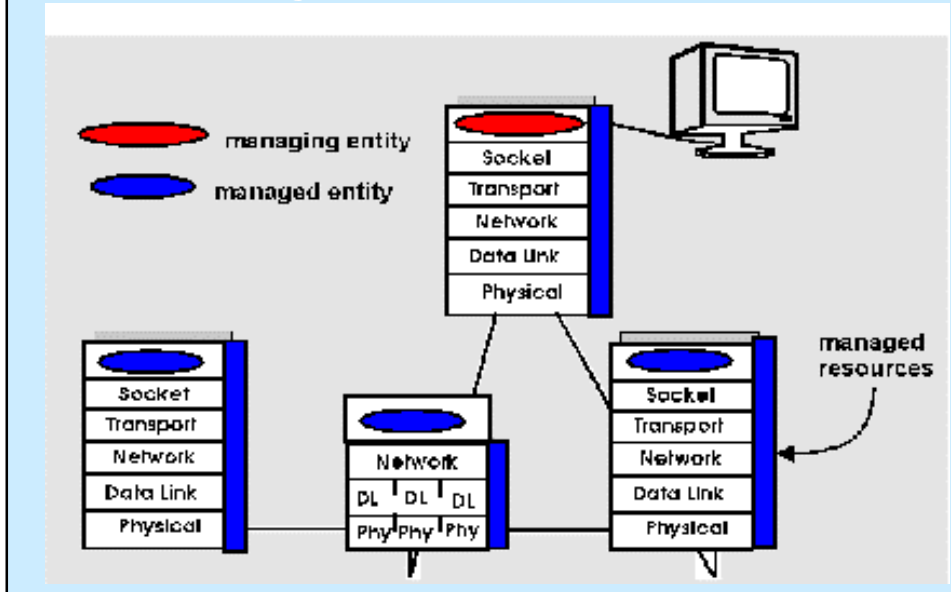
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Network Management: Introduction

- . network consists of many heterogeneous, multi-vendor resources: routers, bridges, hosts, terminal servers, modems, links, interfaces
- . goal of network management:
 - ◆ identification and correction of hardware/software failure or malfunction
 - ◆ performance monitoring and tuning

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network management view of the world:



Network Management issues

Approaches to network management must:

- . scale well: large number of entities to manage
- . not interfere with normal operating (low overhead)
- . operate under stress: most important when network under stress

Issues:

- . which resources will be managed
- . how to name/describe managed resources

standards:

- ◆ Internet: SNMP: Simple Network Management Protocol
- ◆ OSI CMIP: Common Management Information Protocol

Managing and Managed Entities

Managing entity:

- . has "big picture" view of network
- . set of application-level programs controlling/managing network
 - ◆ with human intervention
 - ◆ with rule-based AI (expert) system assistance
- . communicates with managed entities to:
 - ◆ query (poll) status (e.g., link states, routing tables, number of packets dropped)
 - ◆ have managed entities make changes: e.g., change turn a link off

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Managed Entity:

- . application-level process located at each resource site to communicate with network manager and do its bidding
 - ◆ responds to queries from manager
 - ◆ notify manager of significant events (e.g., link down)

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SNMP

- . managing entity resides in network management station (NMS)
- . managed entity called SNMP agent
- . MIB: Management Information Base
 - ◆ logical store of information for network management
 - ◆ locally maintained by SNMP agent
 - ◆ queried and modified by NMS
 - ◆ 175 "objects" organized into 10 groups: system, interfaces, address translation, IP, ICMP, TCP, UDP, EGP, transmission, SNMP

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UDP-related MIB variables

| name | description |
|-----------------|---|
| udpInDatagrams | # UDP dg's delivered to processes |
| udpNoPorts | # UDP dg's with no receiving applic. |
| udpInErrors | #other UDP errors (e.g., checksums) |
| udpOutDatagrams | # UDP dg's sent |
| udpTable | table of IP (interface) addresses and ports for which system will receive UDP dg's. e.g., port 520 for RIP routing msgs |
| ifIndex | index of interface |
| ifDescr | textual description of interface |
| ifType | interface type (e.g., 7 for IEEE 802.3) |

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MIB Variables (cont)

| name | description |
|---------------|---|
| ifMTU | maximum packet size |
| ifSpeed | speed in bits/sec |
| ifPhysAddress | physical address (e.g., 802.* address) |
| ifOperStatus | 1 if up, 2 if down, 3 if testing |
| ifInErrors | # incoming pkts discarded due to errors |
| ifInDiscards | #incoming pkts discarded due to buffer overflow |
| ifInUcastpkts | # incoming unicast pkts received |
| ifOutQLen | # pkts in outbound queue |

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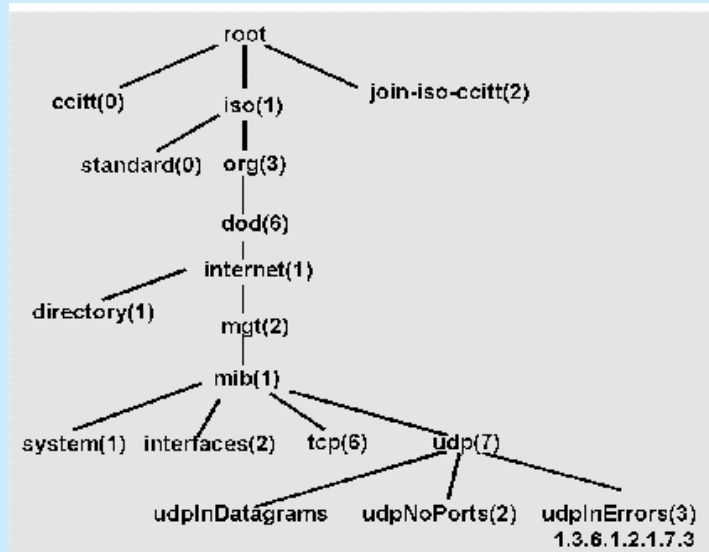
Referencing MIB variables

Recall (?) ASN.1 OBJECT IDENTIFIER type:

- . provides structured, ISO-standard method for naming objects
- . nameable objects include protocols and MIB variables

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- e.g., 1.3.6.1.2.1.7.1 specifies number of udp packets delivered to user processes:



SNMP Protocol

- communication between managing entity and managed entity via UDP ports 161, 162
 - ◆ aside: why not TCP!
- SNMP protocol has 5 message types:
 - ◆ **get-request:** fetch value of one or more MIB variables
 - ◆ **get-next-request:** for looping through variables and tables
 - ◆ **set-request:** tell agent to set value of MIB variable to specified value
 - ◆ **get-response:** used by agent to return value to manager
 - ◆ **trap:** used by agent to notify manager of "event"

Trap packets:

| trap name | description |
|------------------------|---|
| cold start | SNMP agent initializing self |
| warm start | SNMP agent reinitializing |
| link up | interface changed from down to up state |
| link down | interface changed from up to down state |
| authentication failure | SNMP pkt received from unknown manager |

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Network Management: Summary

- . emerging standard for naming, access, modification for network resources and data
- . network management tools: focus on display and management of large amounts of data
- . how to manage network
 - ◆ manage/avoid failures
 - ◆ manage performance

Still much more art than science!

- . wide open, important research field
- . FYI reading:
 - ◆ Nov. 1993 issue of IEEE Network magazine

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