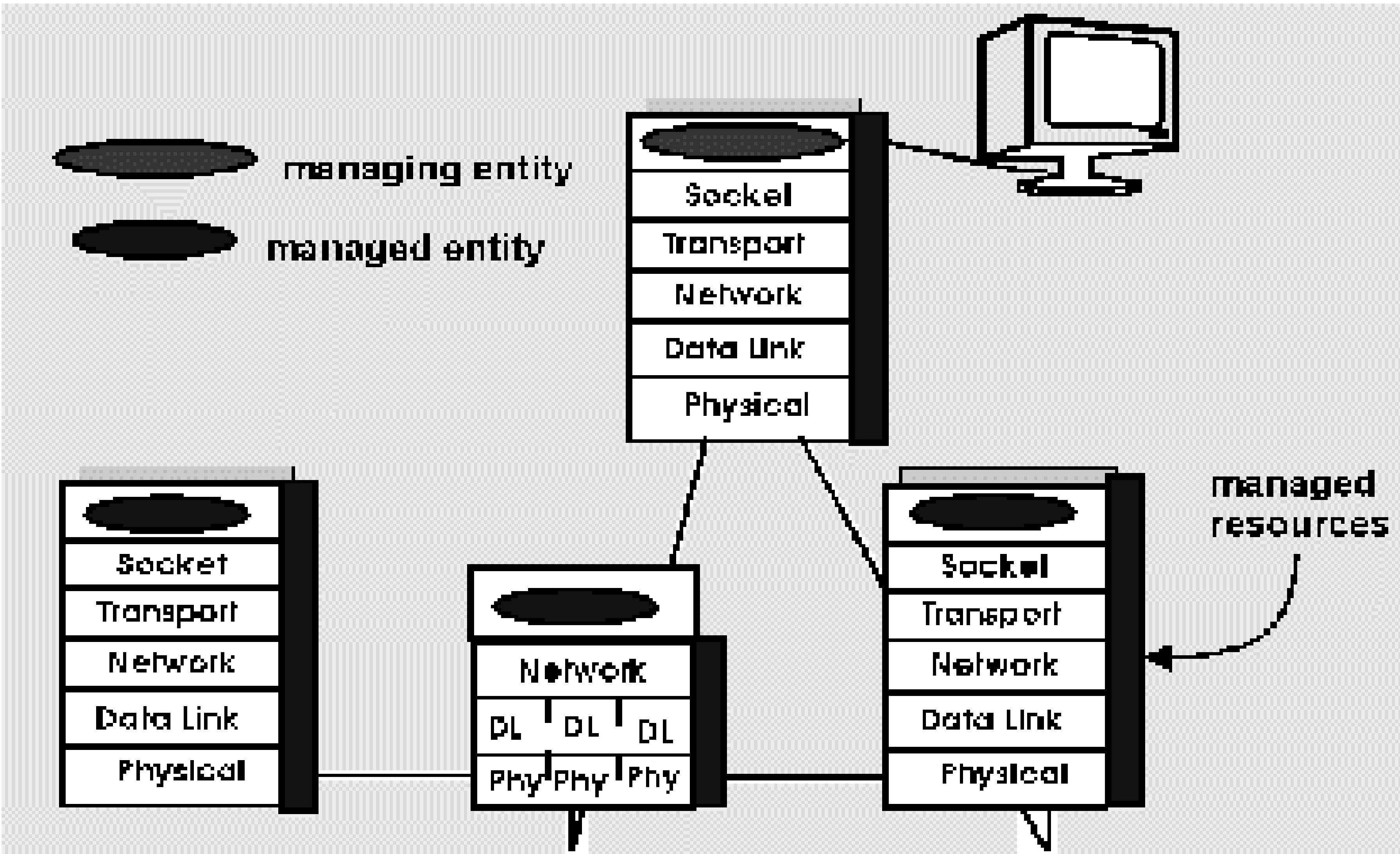
Network Management

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

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 of malfunction
  - performance monitoring and tuning

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

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)

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

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)

MIB Variables (cont)

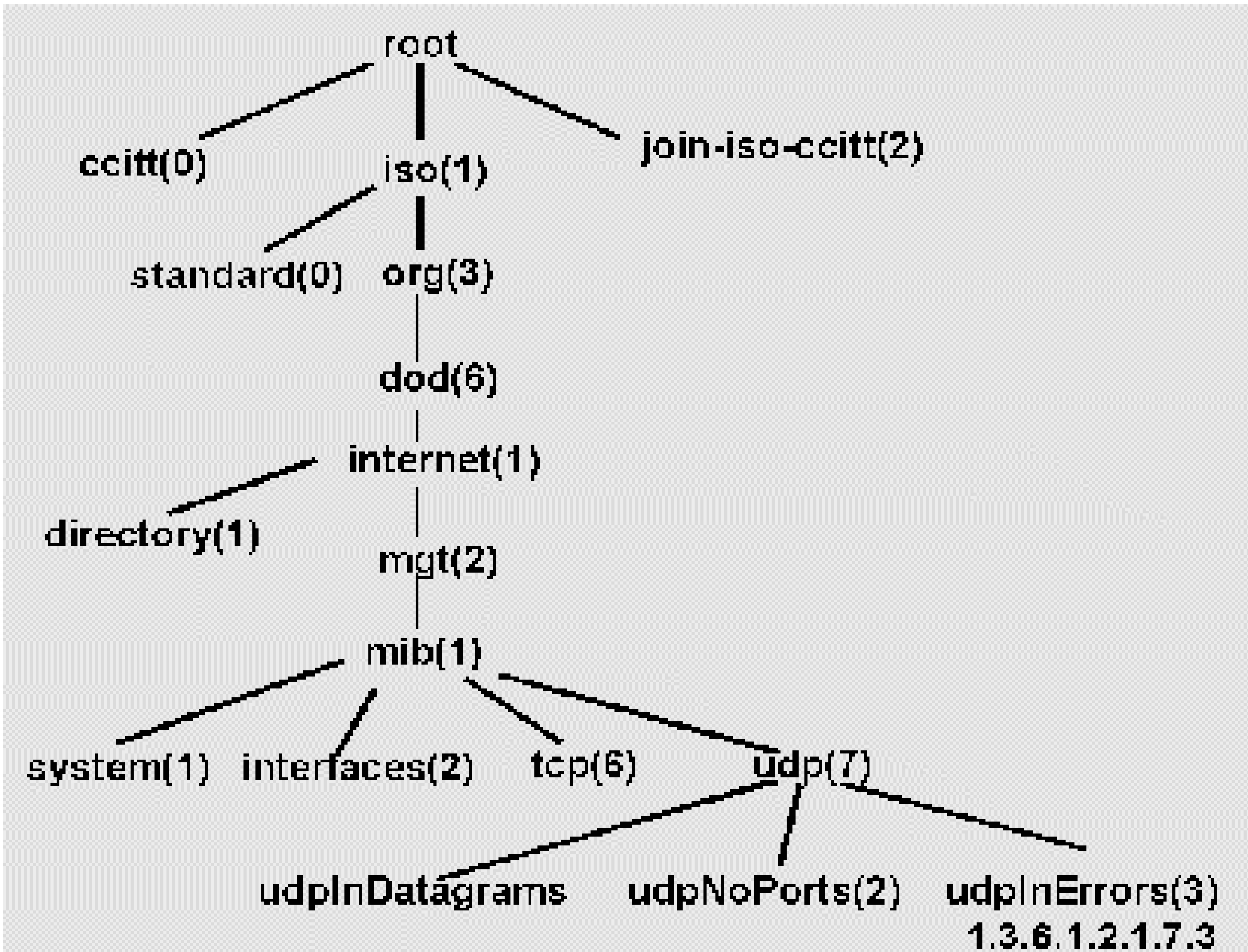
name	description
ifMTU	maximum packet size
ifSpeed	speed in bits/sec
ifPhysAddress	physcial address (e.g., 802.* address)
ifOperStatus	1 if up, 2 if down, 3 if testing
ifInErrors	# incoming pkts discarded due to errors
ifInDiscards	#incoming pkts discarded due to buffer overflow
ifInUcastpkts	# incoming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

Referencing MIB variables

Recall (?) ASN.1 OBJECT IDENTIFIER type:

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

- 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

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