

Network Management (SNMP)

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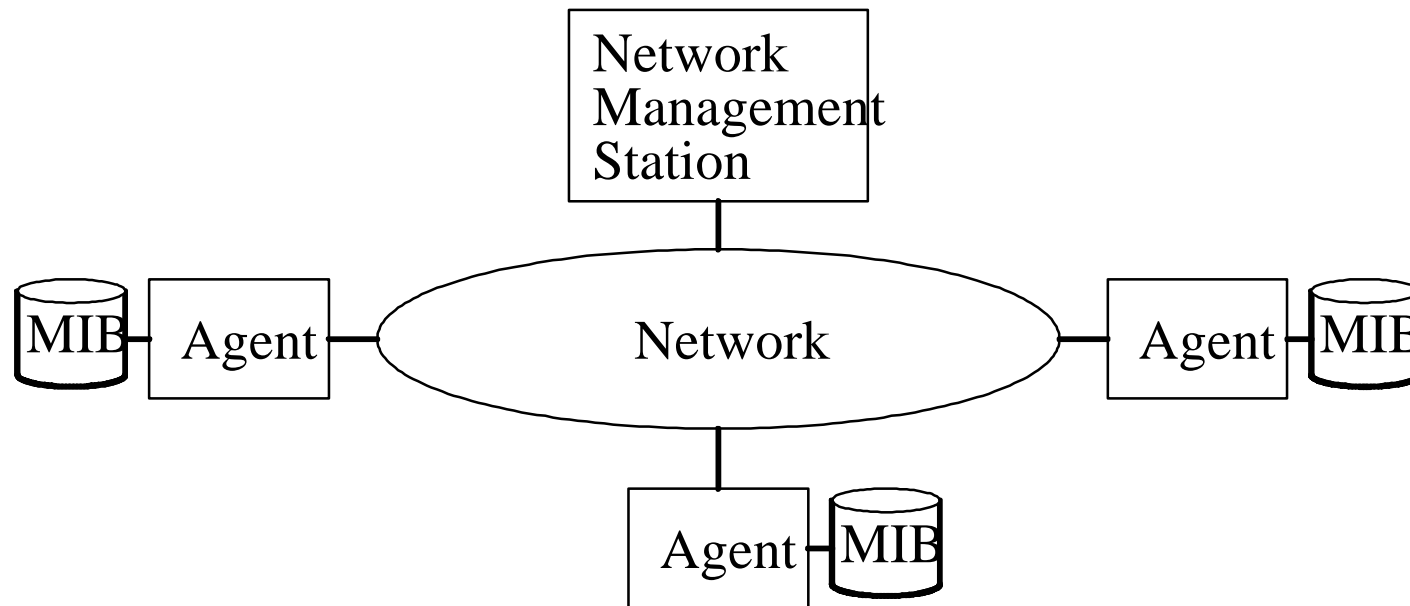
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- ❑ Network Management
- ❑ SNMP
- ❑ Management information base (MIB)
- ❑ ASN.1 Notation

Network Management

- ❑ Management = Initialization, Monitoring, Control
- ❑ Manager, Agents, and Management Information Base (MIB)



SNMP

- ❑ Based on Simple Gateway Management Protocol (SGMP)
- ❑ SNMP = Simply Not My Problem [Rose]
Simple Network Management Protocol
- ❑ Only Five commands

Command	Meaning
get-request	Fetch a value
get-next-request	Fetch the next value (in a tree)
get-response	Reply to a fetch operation
set-request	Store a value
trap	An event

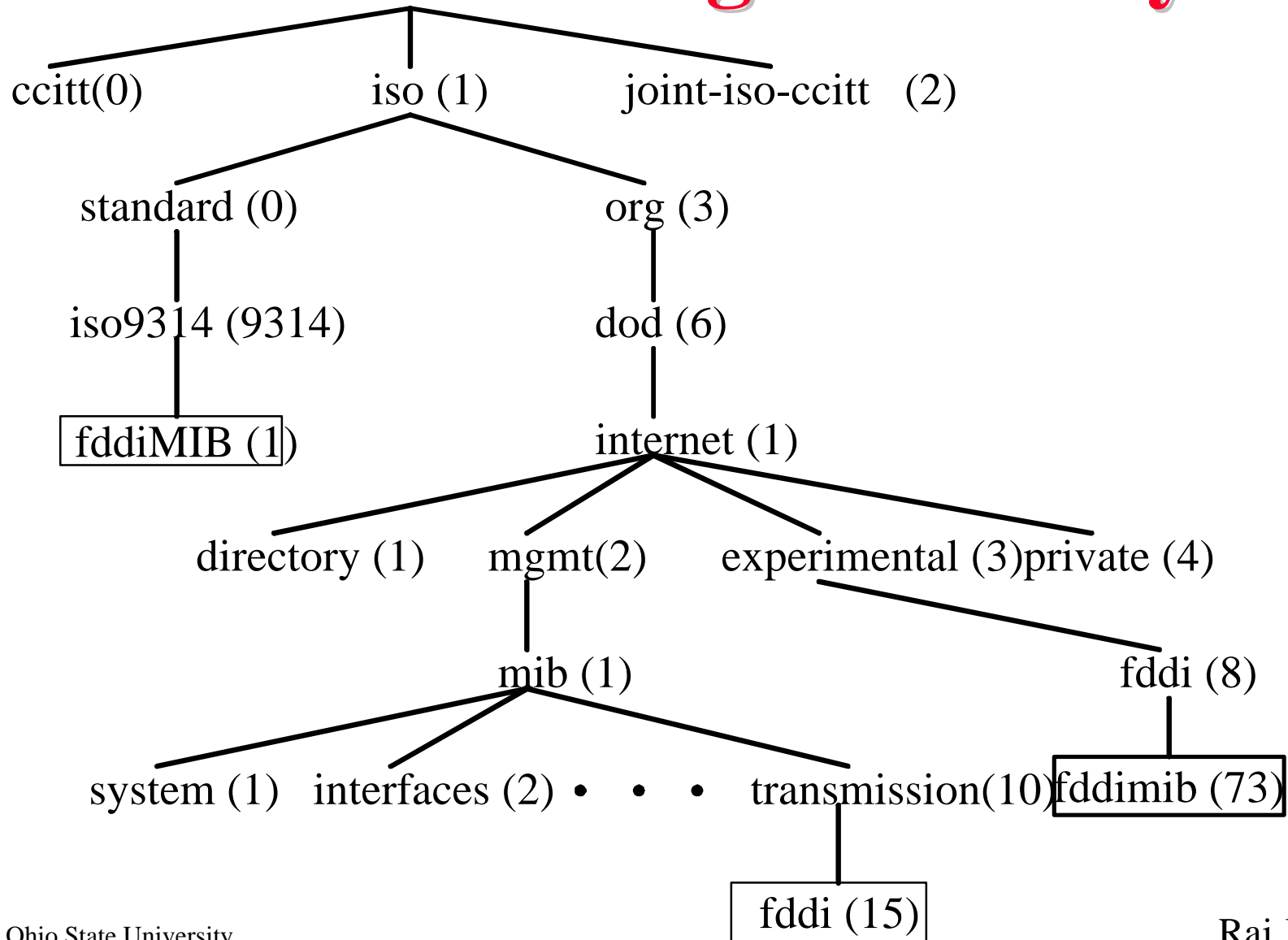
Management Information Base

- ❑ MIBs follow a fixed naming and structuring convention
 - ⇒ Structure of Management Information (SMI)
- ❑ All names are unique
- ❑ All nodes of the name tree are assigned numeric values by standards authorities
 - iso.org.dod.internet.mgmt.mib.ip.ipInReceives
 - 1.3.6.1.2.1.4.3
- ❑ Tables rows are referenced by appending the index

MIB (Cont)

- ❑ All names are specified using a subset of Abstract Syntax Notation (ASN.1)
- ❑ ASN.1 specifies notation (that humans can read) and encoding (representation and ranges)
- ❑ Only INTEGER, OCTET STRING, OBJECT IDENTIFIER, NULL types
- ❑ Only SEQUENCE, SEQUENCE OF, CHOICE constructors

Global Naming Hierarchy



Variable	Category	Meaning
sysUpTime	system	Time since last reboot
ifNumber	interfaces	# of Interfaces
ifMTU	interfaces	MTU
ipDefaultTTL	ip	Default TTL
ipInReceives	ip	# of datagrams received
ipForwDatagrams	ip	# of datagrams forwarded
icmpInEchos	icmp	# of Echo requests received
tcpRtoMin	tcp	Min retrans time
tcpMaxConn	tcp	Max connections allowed

MIB Definition: Example

```
ipAddrTable ::= SEQUENCE of ipAddrEntry
ipAddrEntry ::= SEQUENCE {
  ipAdEntAddr ipAddress,
  ipAdEntIfIndex INTEGER,
  ipAdEntNetMask ipAddress,
  ipAdEntBcastAddr ipAddress,
  ipAdEntReasmMaxSize INTEGER (0..65535)
}
ipAddrEntry { ipAddrTable 1 }
ipAdEntNetMask { ipAddrTable 3 }
```

SNMP Message Format

□ In ASN.1 Notation:

```
SNMP-Message ::= SEQUENCE {  
  version INTEGER {version-1 (0)},  
  community OCTET STRING,  
  data ANY  
}
```

SNMP Message Types

```
SNMP-PDUs ::= CHOICE{  
  get-request GetRequest-PDU,  
  get-next-request GetNextRequest-PDU,  
  get-response GetResponse-PDU,  
  set-request SetRequest-PDU,  
  trap Trap-PDU  
}
```

Message Types (Cont)

```
GetRequestPDU ::= [0]
IMPLICIT SEQUENCE{
request-id RequestID,
error-status ErrorStatus,
error-index ErrorIndex,
variable-bindings VarBindList
}
```

SNMPv2

- ❑ Improved security: authentication and integrity using Data Encryption Standard (DES)
- ❑ *inform request* ⇒ Multiple manager coordination
Locking mechanisms prevent multiple managers from writing at the same time
- ❑ *get bulk* ⇒ Better table handling
- ❑ Confirmation option for Traps
⇒ Agents can ensure that trap was received correctly.
- ❑ New Error codes: noSuchName, badValue, readOnly
- ❑ Reference: RFC 1441

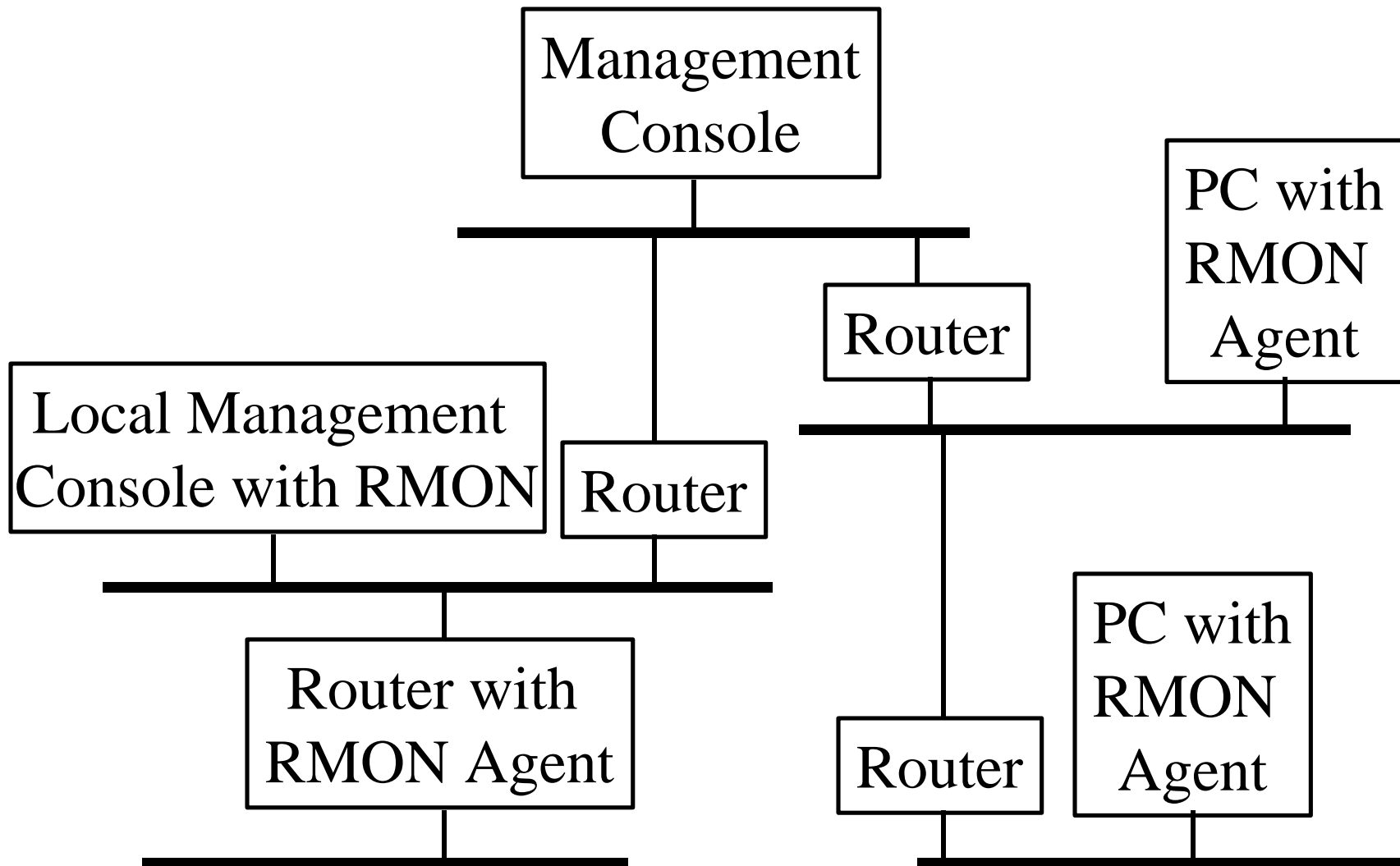
OSI Net Management Standards

- ❑ Common Management Information Protocol (CMIP)
- ❑ Common Management Information Service (CMIS)
- ❑ CMIP is the management (application layer) protocol
- ❑ CMIS is the service interface to CMIP
- ❑ M-GET (read attribute), M-SET (write attribute), M-EVENT-REPORT (report an event), M-ACTION (perform an action), M-CREATE (create an instance), M-DELETE (delete an instance)

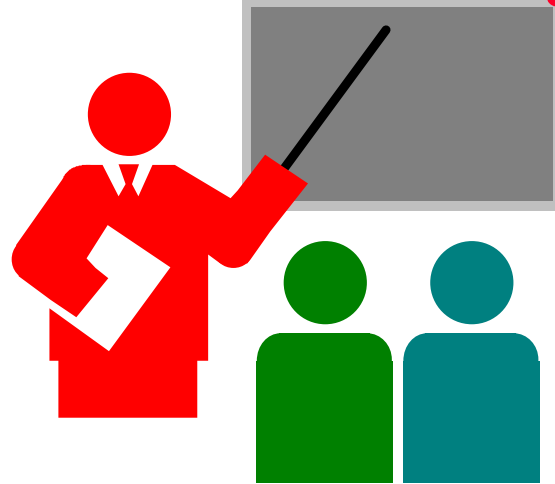
Remote Network Monitoring

- ❑ RMON Allows network managers to monitor the traffic on the network
- ❑ Network monitors/analyzers promiscuously monitor the LAN traffic
- ❑ RMON allows a central network management station to communicate with monitors throughout the network.
- ❑ RMON = Monitor MIB
- ❑ Allows remote control of monitors
- ❑ Allows multiple managers

A Sample RMON Configuration



Summary



- ❑ Management = Initialization, Monitoring, and Control
- ❑ SNMP = Only 5 commands
- ❑ Standard MIBs defined for each object
- ❑ Uses ASN.1 encoding