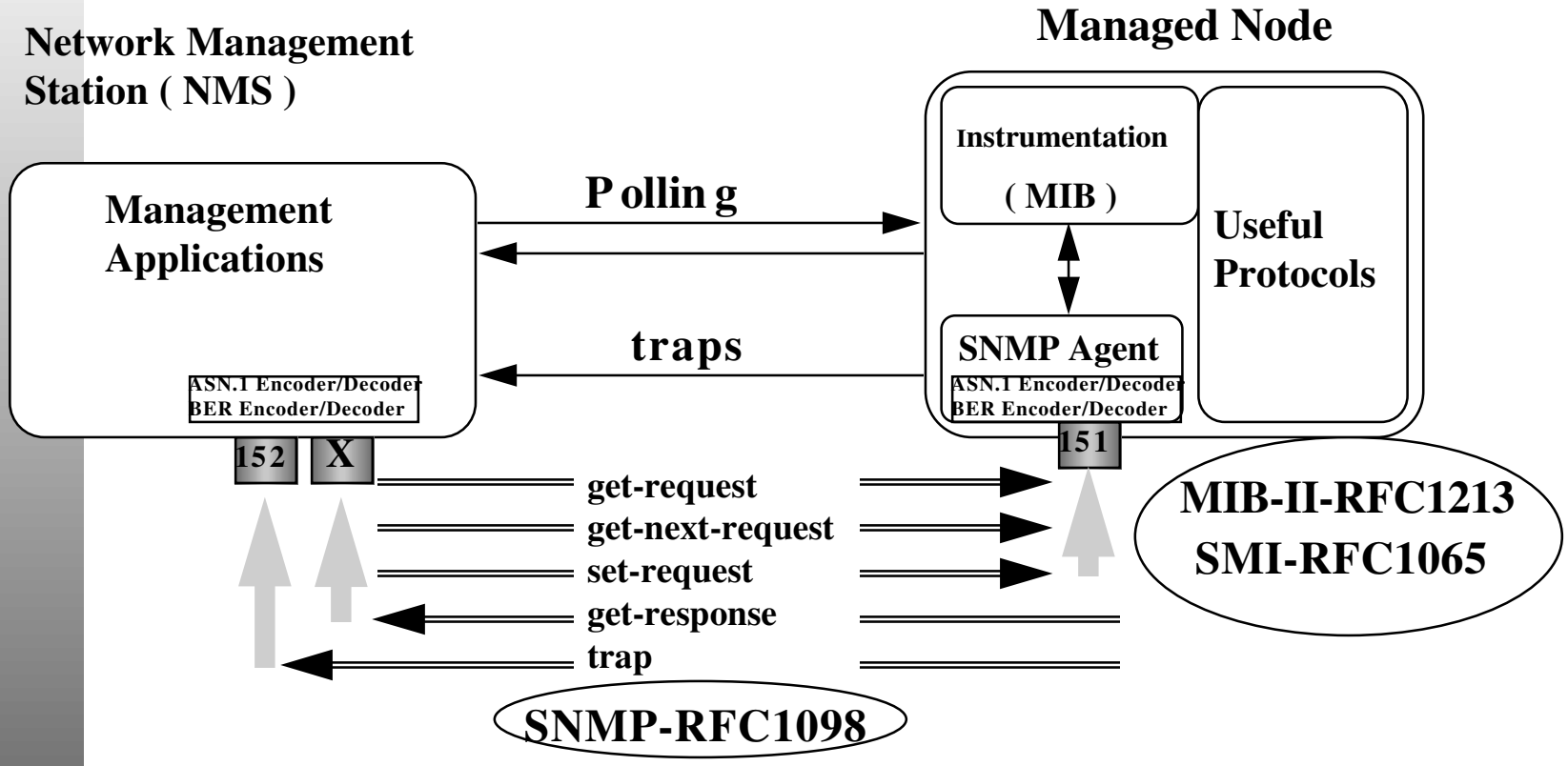
Issues in Applications Development with SNMP

Issues in SNMP Applications Development

- Review of Internet-Standard Network Management Framework
- SNMP Network Management Environment
- NMS Programming Environment
- Management Information Base
- OSI View of Network Management Areas
- Building SNMP Applications

The Internet-Standard Network Management Framework



Preferred Mapping: SNMP/UDP port 151/152

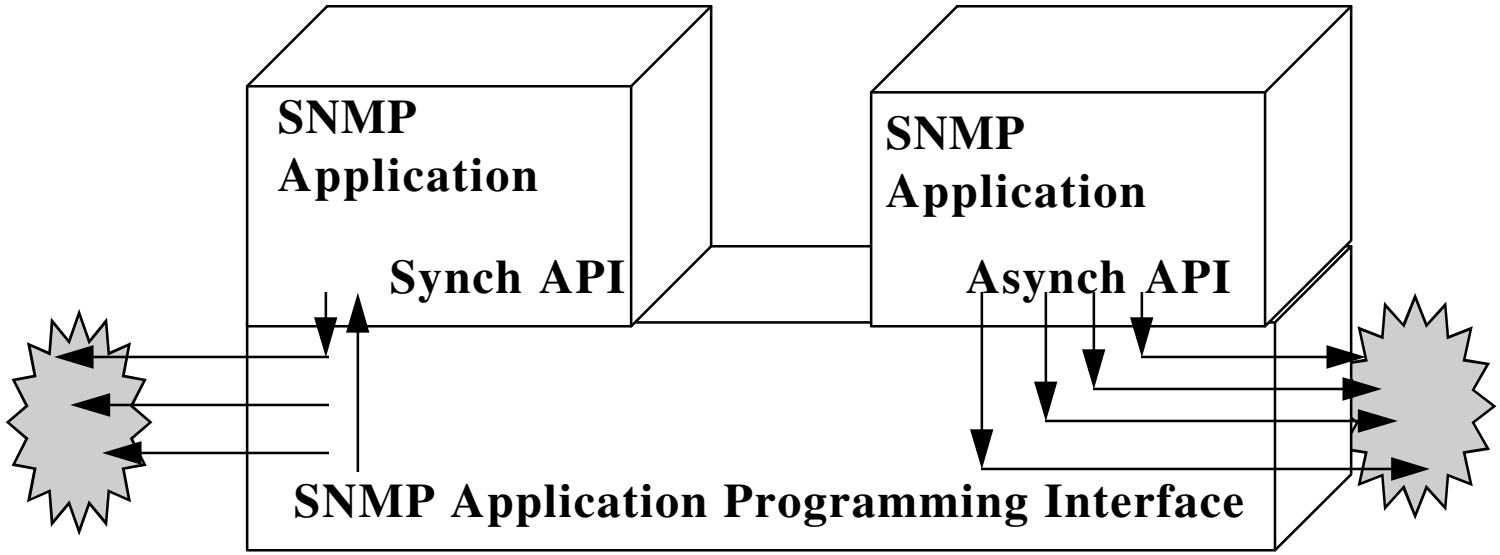
SNMP Network Management Environment

- SNMP
  - Message based
  - Simple: 5 messages, 7 traps, 5 error types
  - stateless protocol (What does this mean?)
  - very few supported data types defined in SMI
  - ASN.1 - architecture independent data transport
  - OID Tree for naming management information
- UDP transport mapping - Unreliable
- trap-directed polling
- UDP vs. TCP argument
- “When all else fails, network management must continue to function, if at all possible.”

NMS Programming Environment

- UDP:(Unreliable) User Data Protocol
- Buggy Agents: examples?
- Potentially MANY nodes to manage
- NMS part of network topology
- Synch/Asynch SNMP API

Dead Agents
Don't allow arbitrary OIDs in get-nexts
Don't handle end of table
Return data of wrong type
Don't handle ASN.1/BER encoding correctly



Managed Nodes Instrumentation: The MIB

- MIB II - 175 managed objects defined
- Groups of conformance
- OBJECT-TYPE Macro: NAME, SYNTAX,DESCRIPTION,ACCESS clauses
- Tree diagram much easier to peruse
- Q: What is the SYNTAX and ACCESS of ipRouteNextHop managed object in MIB II?
- Q: Draw a picture of the tcp Connection Table...What is the INDEX for this table?

MIB DEFINITIONS using ASN.1 Language

- Data Definitions
- RFC1213-MIB DEFINITIONS ::= BEGIN
- IMPORTS
  - mgmt, NetworkAddress, IpAddress, Counter, Gauge, TimeTicks FROM RFC1155-SMI
  - OBJECT TYPE FROM RFC-1212;
- mib-2 OBJECT IDENTIFIER ::= {mgmt 1 }
- DisplayString ::= OCTET STRING
- PhysAddress ::= OCTET STRING
- system ::= OBJECT IDENTIFIER ::= { mib-2 1 }
- :

OBJECT-TYPE Macro

- Example Managed Object: ifOperStatus
- ifOperStatus OBJECT-TYPE
  - SYNTAX INTEGER {
    - up(1)
    - down(2)
    - testing(3)
    - }
  - ACCESS read-only
  - STATUS mandatory
  - DESCRIPTION
    - “The current operational state of the interface.
    - The testing(3) state indicates that no operational packets can be passed.”
  - ::= { ifEntry 8 }

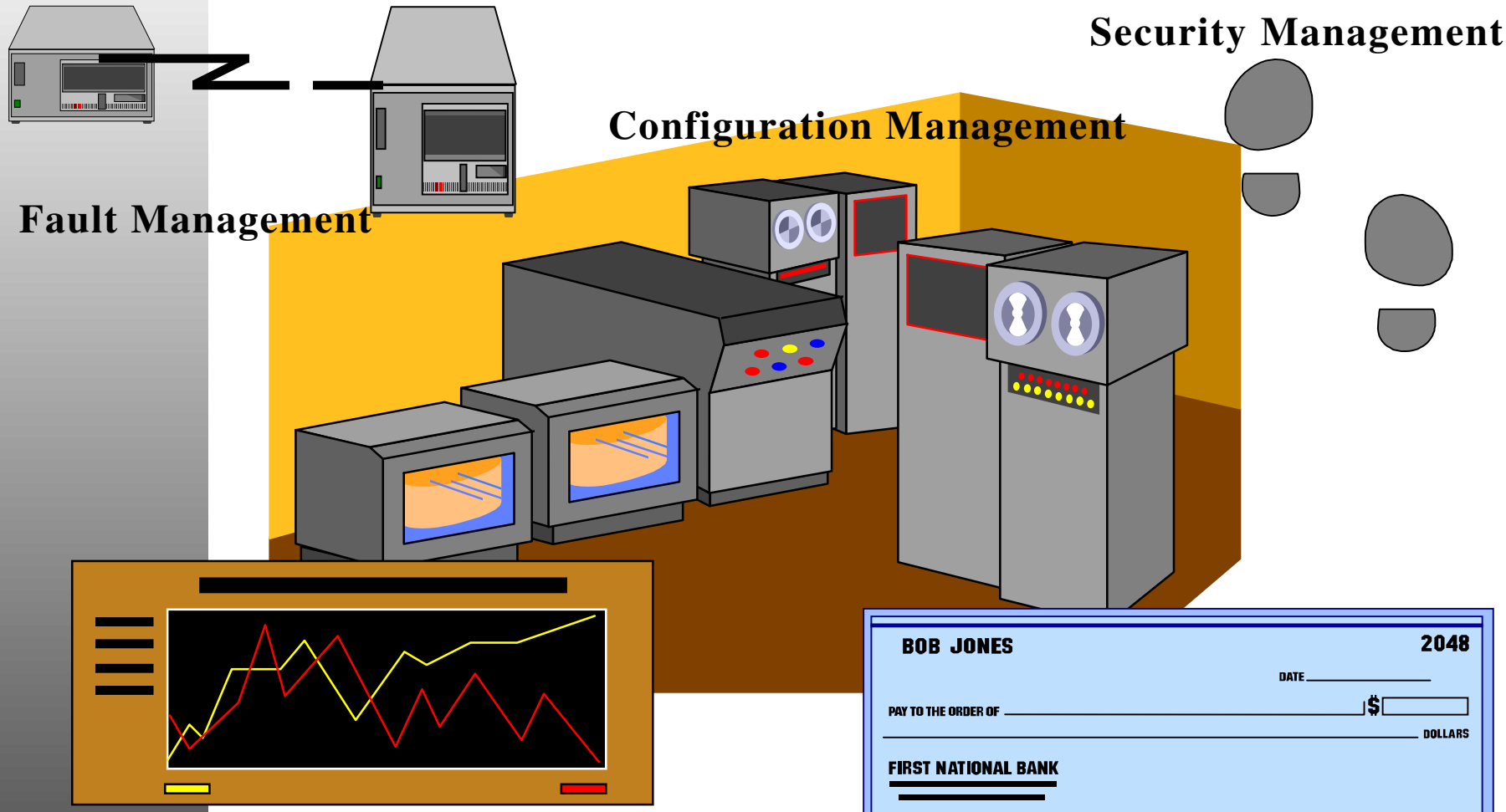
Tieing the pieces together: Algorithms+Data=Programs

- External Environment: Internet-Standard Network Management Framework
- Internal Environment: NMS Programming Environment
- Data: Management Information Base(s)
- Remaining Questions
  - Who do we want to query?
  - What do we want to ask for?
  - What to do with it once we get it?
- Simple Application: The MIB Browser

Agent Address:	**homefries.merit.edu**
Community String:	**public**
Management Object:	**sysDescr.0**

retries,dlayb4retry,multiple hosts, multiple objects, presentation,...

OSI View of Network Management



Performance Management

Accounting Management

Fault Management Applications

- Q: What MIB objects can be used for Fault Management?
- Q: NMS issues:
  - How do you know which boxes to query?
  - What if the primary query interface is down?
  - How many retries?
  - How much time between retries?
  - What if the node doesn't answer your query?
  - Alerts, automated diagnostics procedure?
  - May be side effect ...how would you tell?
- Clever Fault Mgmt
  - Derived Nominal response time
  - Derived State information
  - Expert system dependence recognition

Configuration Management Applications

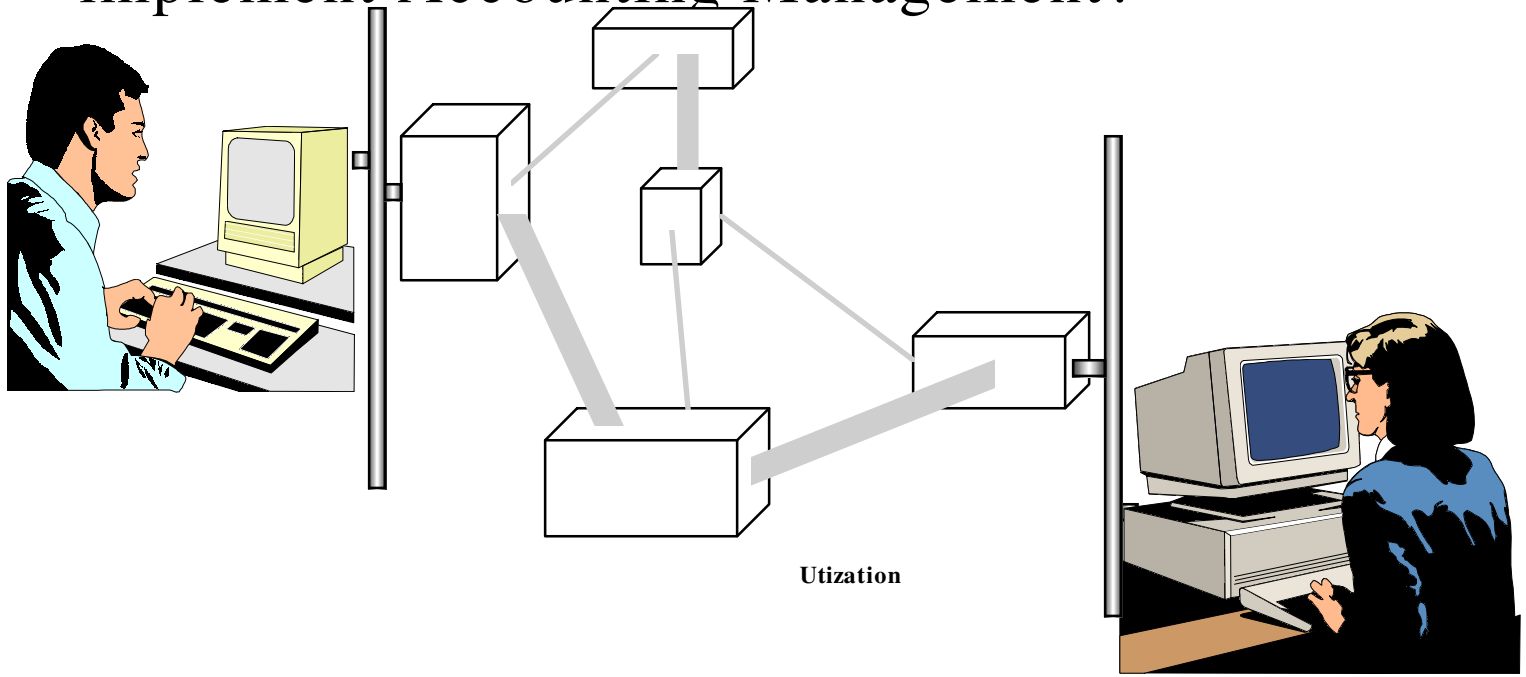
- Q: What MIB objects can be used to perform Configuration Management?
- Q: NMS Issues:
  - What information do your other applications need?
  - How frequently will you verify your configuration data?
  - What reports would you like to have regarding the components of your network?
- Maintaining bootp files, node/link DB for NMS subsystems, inventory lists(serial #s), vendor negotiating point
- Benefits engineers by rapidly providing vital configuration data. Compare what is with what should be. Systematically reconfigure boxes.

Performance Management Applications

- Utilization management
- Measure response time, rejection rate, availability
- Q: What MIB objects can be used to perfoam Performance Management?
- utilization=(8 * max(delta(ifInOctets,t1,ifInOctets,t0),delta(ifOutOctets, t1,ifOutOctets,t0)) / (t1-t0))/ifSpeed
- input_error_rate=delta(ifInErrors,t1,ifInErrors,t0)/(t1-t0)
- output_error_rate=delta(ifInErrors,t1,ifInErrors,t0) /(t1-t0)
- etc. See Simple Times Volume 1 Number 5
- What to do with the reports? McDonald's Report...

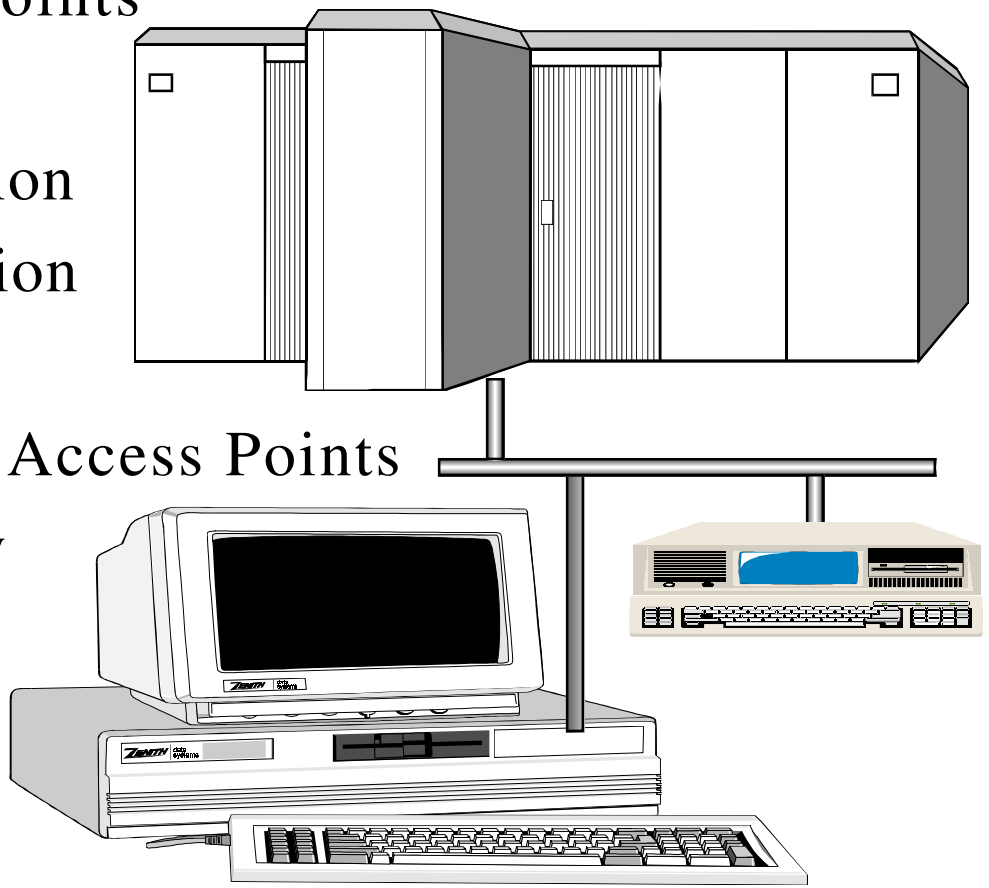
Accounting Management

- Cost recovery, monitor usage
- Identify users/groups, chargeback and growth pattern
- Which management objects might be used to implement Accounting Management?



Security Management

- Identify access points to sensitive information
- Secure Access Points
- Packet filtering
- Host Authentication
- User Authentication
- Privacy
- Maintain Secure Access Points
- Physical Security



Summary

- Framework is sufficient for most mgmt applications
- Many management objects defined
- NMS environment
- Many options for performing network management
- OSI 5 areas of network management
- Tieing the pieces together remains to be done

Thank you for coming