A Brief Introduction to Internet Network Management

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What are we talking about?

- Network Management Tasks
  - fault management
  - configuration management
  - performance management
  - security management
  - inventory management
  - accounting management
Fault Management

- detection
- exception alarm generation
- investigation and analysis
- statistics for steady state behaviour
  characterisation
Configuration Management

- installation of new hardware/software
- tracking changes in control configuration
  - who, what and why!
- revert/undo changes
- change management
- configuration audit
  - does it do what was intended?
IP Route Management

- routing integrity
- consistency with customer requirements
- consistency with external peers
- conformance with imposed policy constraints
Security Management

- exception alarm generation
- detection
- uniform access controls to resources
- backup
Performance Management

- Availability and Reliability metrics
- Quality metrics
- real-time measurement
- historical analysis
Accounting Management

- identifying consumers and suppliers
  - of network resources
- mapping network resources to customer identity
- charge back
  - volumetric data
  - time data
  - date time of day
Problem Tracking

- reporting procedures
- fault management
- escalation and referral
- historical data for component reliability analysis
Inventory Control

- **hardware**
  - components
  - identity
  - location

- **software**
  - version control
Knowledge Based Management

- "expert" systems
- Modelling
  - simulation
  - routing
  - configuration changes
No single system will solve all your problems or meet all your requirements.

Any Network Management package can only complement effective and efficient operational procedures.

Need to identify what is important to you and your organisation.
SNMP

- Simple Network Management Protocol
- Doesn't SNMP solve all these problems?
  – Don't be silly!
SNMP

- Where did it come from?
  - Internet Engineering Task Force
    » Network Management Area
  - SNMP V1
  - MIB definitions
  - SNMPV2*
What is it?

- more than just a protocol...
Structure of Management Information (SMI)

- identifies and defines structure of management information
  - RFC1155
- defines
  - commonly defined data item
  - syntax of the data type
  - semantics of the data object
Syntax

- uses ASN.1 (Abstract Syntax Notation)
  - binary encoding
    02 01 06 is a 1 byte integer, value 6

- Primitive Types
  INTEGER, OCTECT STRING, OBJECT IDENTIFIER, NULL

- Constructor Types
  SEQUENCE <primitive-type> ... ie. a record
  SEQUENCE OF <primitive-type> ... ie. an array
Syntax

- **Defined Data Types**
  - IpAddress: what you expect
  - Counter: non-negative integer that wraps
  - Gauge: non-negative integer that latches
  - TimeTicks: time in hundredths of seconds
SNMP NAMES

SNMP Name Structure

1 - iso
3 - org
6 - dod
1 - Internet

1 - directory
2 - mgmt
3 - expt
4 - private

1 - mib

1 - system
2 - interfaces

1 - sysDescr
2 - sysObjectID
1 - ifTable

1 - ifEntry

1 - ifIndex
2 - ifDescr
3 - ifType
.........
10 - ifInOctets
SNMP

- Management Information Base (MIB)
  - "database" of network objects
  - Groups:
    » System, Interfaces, Address Translation, IP, ICMP, TCP, UDP, EGP
  - "Access" and "Status" attributes
  - actual variables are "instances" of OIDs

1.3.6.1.2.1.1.1.0  sysDescr
1.3.6.1.2.1.2.1.1.10.3  ifInOctets for interface 3
1.3.6.1.2.1.4.21.1.7.130.56.0.0  ipRouteNextHop for network 130.56.0.0
SNMP

- The SNMP protocol itself
  - allows inspection and alteration of MIB variables
- UDP Based
  - not acknowledged transactions
- PUT, GET, GET-NEXT operators
SNMP

- SNMP Traps
  - unsolicited notification of events
  - can include variable list
  - ColdStart, WarmStart
  - LinkUp, LinkDown
  - Authentication Failure
  - EGPNeighbourLoss
  - Enterprise Specific
Network Management Software

- **SNMP Agents**
  - provided by all router vendors
  - many expanded (enterprise) MIBs
  - bridges, wiring concentrators, toasters
Network Management Software

- Public Domain
  - Application Programming Interfaces available from CMU and MIT
  - include variety of applications
Network Management Software

- Commercially
  - many offerings, UNIX and PC based
    » HP OpenView
    » SunNet Manager
    » ciscoworks
    » Cabletron Spectrum
    » *MANY* others
Choosing a Management Platform

- Does it:
  - a) Support your systems?
  - b) Run on your platforms?
  - c) Meet your requirements?
  - d) Match your resources?