SNMP Diagnostics

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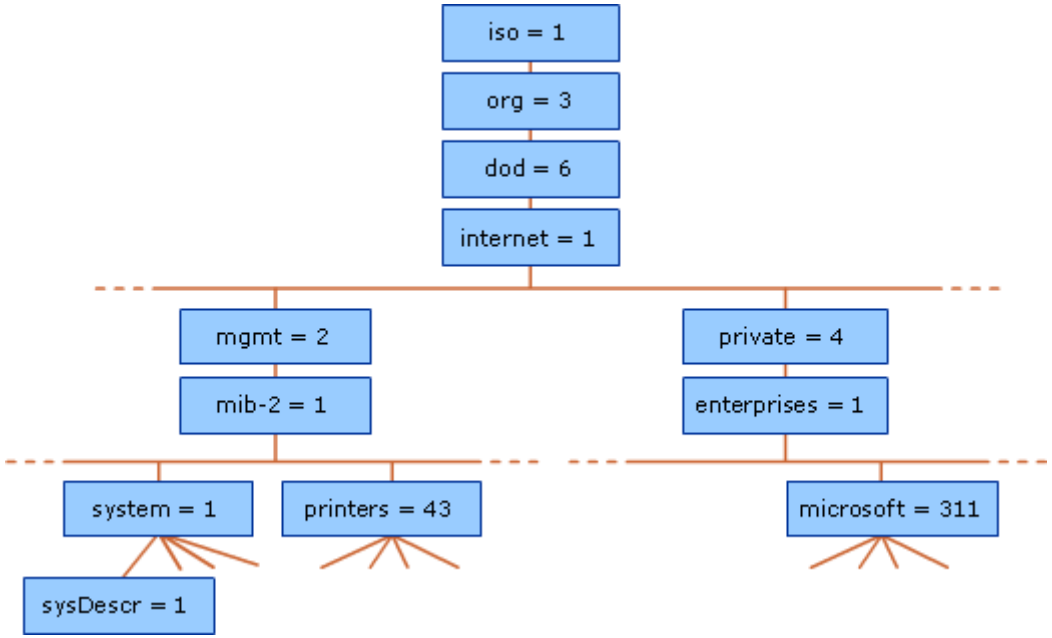
What is SNMP?

- SNMP is an abbreviation for Simple Network Management Protocol. It's a standard for gathering statistical data about network/host traffic and the behavior of network components. All standardization organization and main vendors support SNMP.
- Also SNMP is an application layer protocol within the OSI model (RFC-1157) and Internet protocol using UDP (port 161/162)

What is SNMP?

- Control point for SNMP is MIB - Management Information Base – database of network management information. Practically, it's the same as EPICS PV.
- MIB objects are organised in a tree structure that includes public (standard) and private branches.
- Standard, minimal MIBs have been defined (MIB I, MIB II), and vendors often have custom entries.
- See MIB-tree example in the next page:

MIB-tree:



- MIB example in symbolic and numeric view:

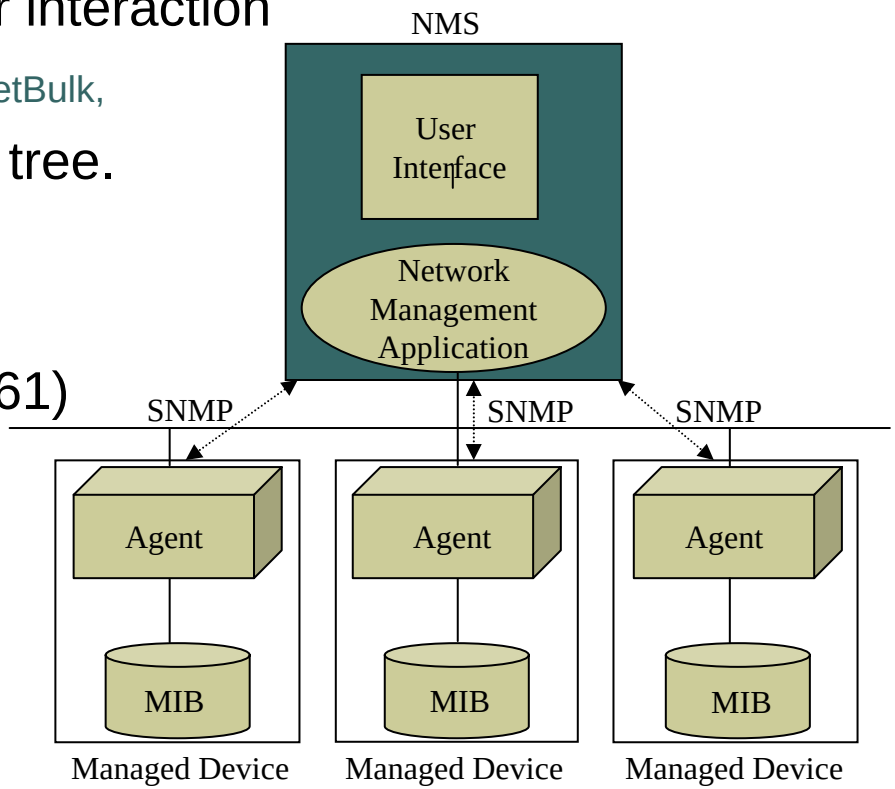
.iso.org.dod.internet.mgmt.mib-2.system.sysDescr =
.1.3.6.1.2.1.1.1

SNMP overview:

- SNMP is a simple client-server interaction with few operations - {Get, GetNext, GetBulk, Set, Trap, Inform} under MIB database tree.

Hardware agent is a server and NMS is a client.

- SNMPD is UDP-server (port 161)
- SNMP-trap has port 162



SNMP device support and soft IOC

- EPICS SNMP device support for soft-IOC has been developed at LANL by Richard Dabney
- We're using NET-SNMP tool-set and libraries from www.net-snmp.org-Open Source Product.
- We're using it in our Scientific Linux (RedHat-clone) as a softIoc:
  - Ssh kryklinuxm; cd $Base/softIoc; st.cmd:

SNMP device support and soft IOC

```
< envPaths
epicsEnvSet(ARCH,"linux-x86")
epicsEnvSet(IOC,"softIoc")
dbLoadDatabase("devSnmp.dbd")
softIoc_registerRecordDeviceDriver(pdbbase)
dbLoadRecords("network.db","HOST=kryklinuxm,MIB_P=IF,MIB=
ifInUcastPkts,ID=1")
iocInit()
############################################################
############
###  EPICS IOC CORE built on Apr  6 2005
###  EPICS R3.14.6 $R3-14-6$ $2004/05/28 19:27:47$
############################################################
############
Starting iocInit
epicsSnmpInit
#   ************ shell started Have a fun ******
iocInit: All initialization complete
```

Dev-snmp Dbd-file:

```
device(stringin,INST_IO,devSnmpSi,"Snmp")
device(ai,INST_IO,devSnmpAi,"Snmp")
device(longin,INST_IO,devSnmpLi,"Snmp")
device(waveform,INST_IO,devSnmpWf,"Snmp")
```

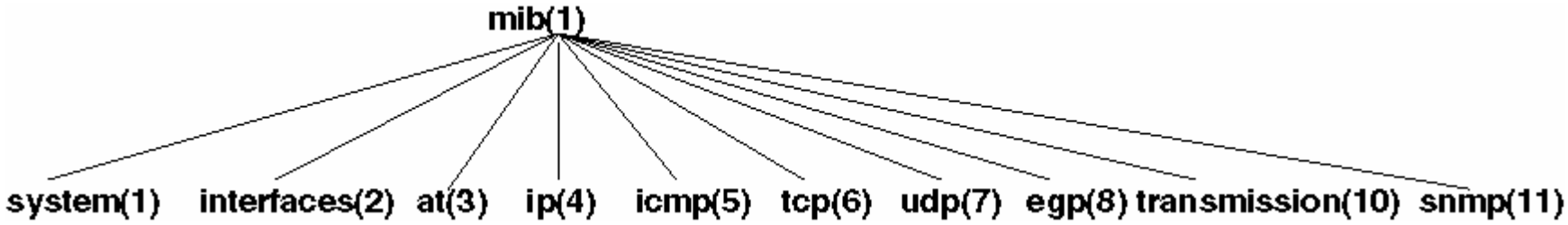
- DevSNMP supports ai, longin, stringin and waveform - it's enough to cover SNMP dataTypes: {Counter32,Signed_integer,IPAddress,Network Address,OID,String, Gauge, TimeTicks}

Db-file example:

```
record(longin, "NET:D_$(HOST_ID):$(MIB_$MIB_IDID)_li"){
   field(DTYP, "Snmp")
   field(INP,"@$(HOST) .iso.org.dod.internet.mgmt.mib-
   2.interfaces.ifTable.ifEntry.$(MIB) Counter32: 11")
   field(SCAN,“5 second")
   field(DESC,"$(MIB)")}
```

- Important field here is INP. It is “option-string” for standard snmpGet command. For example $HOST is IP of network device, next parameter is MIB. Here we have a lot of macros as $HOST, $MIB, $MIB_ID, etc, so it’s better to use ORACLE db-helper as EpicsOra for create real db-file.

MIB-II overview



system	*1.3.6.1.2.1.1*	Defines a list of objects of system operation: sys uptime, sys contact, and sys name
interfaces	*1.3.6.1.2.1.2*	It monitors interfaces are up/down and # octets sent/received, errors and discards…
at	*1.3.6.1.2.1.3*	The address translation
ip	*1.3.6.1.2.1.4*	Keeps track of many aspects of IP, including IP routing.
icmp	*1.3.6.1.2.1.5*	Tracks things such as ICMP errors, discards, etc.
tcp	*1.3.6.1.2.1.6*	Tracks, sockets, the state of the TCP connection (e.g., *closed*, *listen*, *synSent*, etc.).
udp	*1.3.6.1.2.1.7*	Tracks UDP statistics, datagrams in and out, etc.
egp	*1.3.6.1.2.1.8*	Tracks various statistics about EGP and keeps an EGP neighbor table.
host	*1.3.6.1.2.1.25*	Host: filesystems, media, memory, CPU, disks, Installed Software, all process etc.

Interface (1.3.6.1.2.1.2) MIBs:

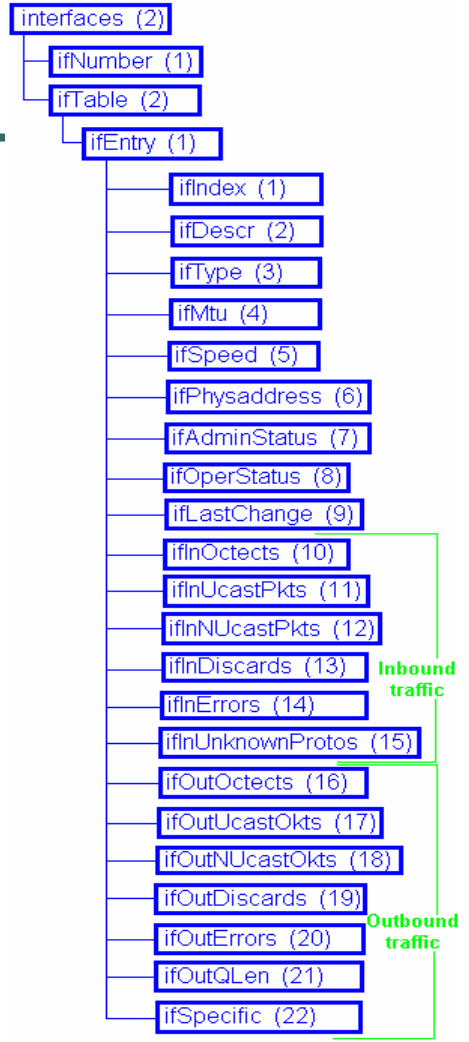
TCP/IP traffic we can find under ifMIB:

- **•ifInOctets -The number of octets received by the interface.**
- **•ifOutOctets - The number of octets sent by the interface.**
- **•ifInNUcastPkts -The number of non_unicast (i.e., subnetwork_ broadcast or subnetwork_multicast) packets delivered to a higher_layer protocol.**

For example:

$ snmpget kryklinuxm iso.org.dod.internet.mgmt.mib-2.interfaces.ifTable.ifEntry.ifInOctets

Counter32: 578697860



Interesting host (1.3.6.1.2.1.25) MIBs:

Interesting host resource we can find under hostResource MIB:

MIB-2.host.hrStorage.hrStorageTable:

• hrStorageUsed - The amount of the storage represented by this entry that is allocated (USED_SIZE)

• hrStorageSize - The size of the storage represented by this entry (SIZE)

• hrStorageDescr - A description of the type and instance of the storage described by this entry (LABEL)

For example:

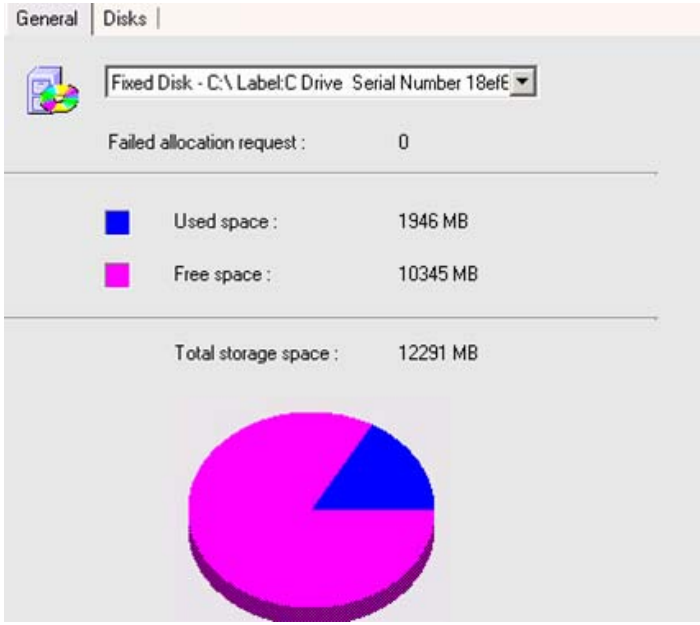
$snmpget .hrStorageTable.hrStorageEntry.hrStorageDescr.8

STRING: /usr

$ snmpget .hrStorageTable.hrStorageEntry.hrStorageUsed.8

INTEGER: 543814

diskUsage=(hrStorageUsed/ hrStorageSize)*100%



SNMP for host

- Disk Usage

mib2.host.hrStorage.hrStorageTable.hrStorageEntry.hrStorageSize.#

- Memory Usage

(# = 101 for memory, 102 for swap)

- CPU

ucdavis.laTable.laEntry.laLoadInt.1

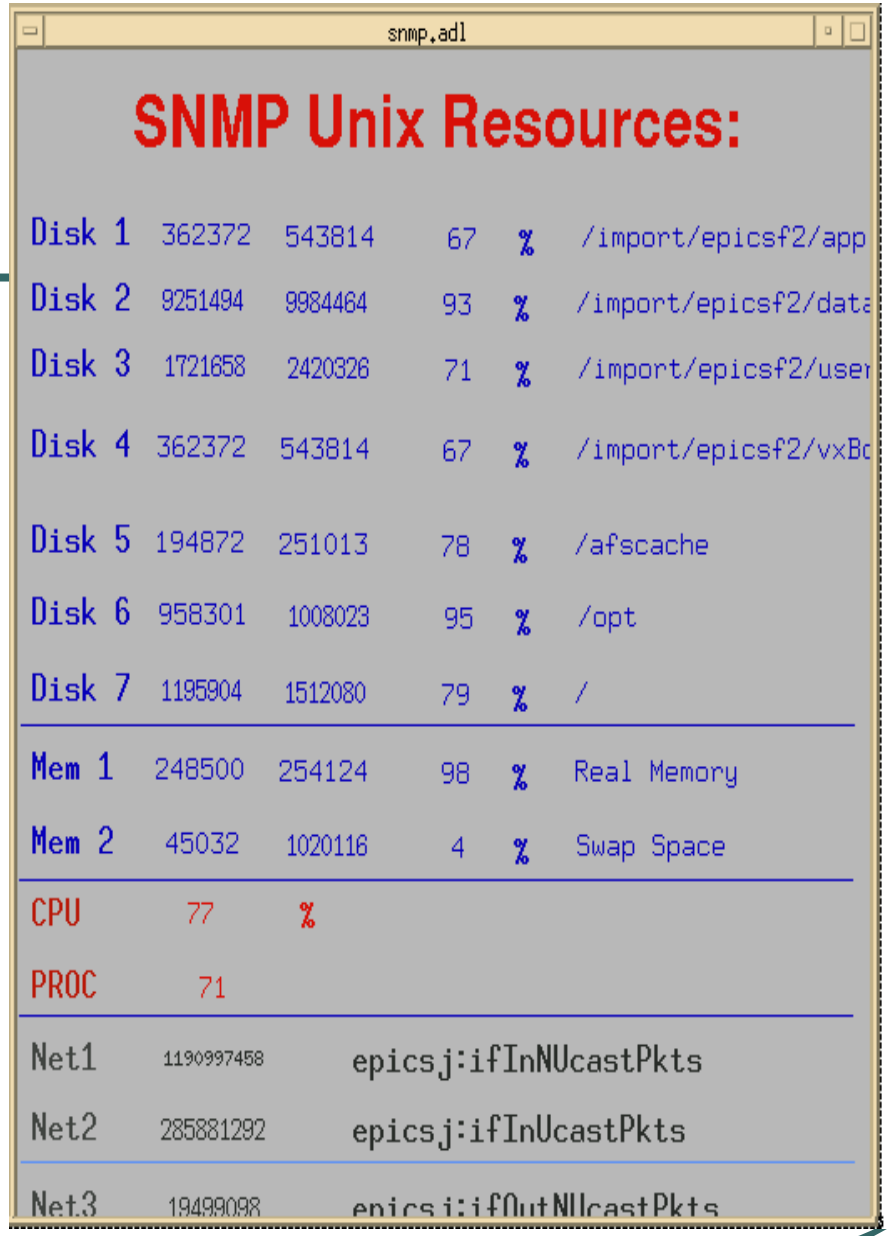
- PROC

mib2.host.hrSystem.hrSystemProcesses

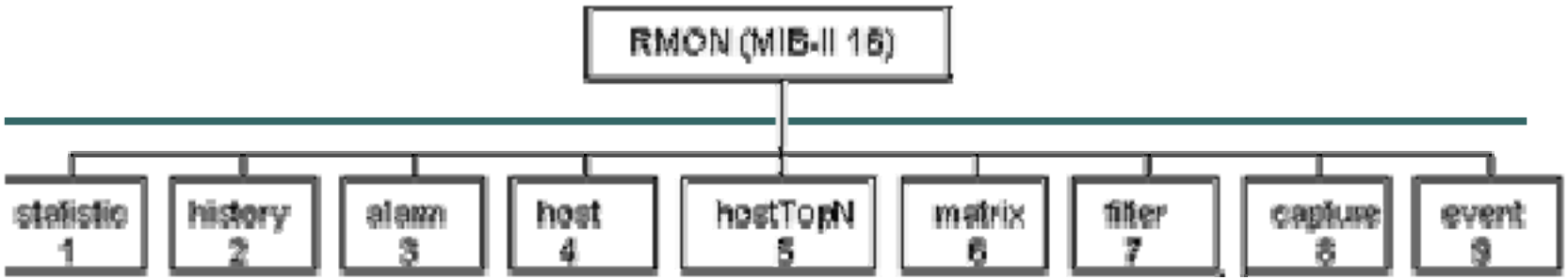
- Network traffic

mib2.interfaces.ifTable.ifEntry.ifInOctets

- See MEDM output:



RMON MIB overview



Statistics(1)	Total LAN statistics
History(2)	Time-based statistics for trend analysis
Alarm(3)	Notices that are triggered when statistics reach predefined thresholds
Hosts(4)	Statistics stored for each station's MAC address
HostTopN(5)	Stations ranked by traffic or errors
Matrix(6)	Map of traffic communication among devices (that is, who is talking to whom)
Filter(7)	Packet selection mechanism
Capture(8)	Traces of packets according to predefined filters
Event(9)	Reporting mechanisms for alarms
Token Ring(10)	Statistics associated with each token ring station

$snmpget kryknet02 .iso.org.dod.internet.mgmt.mib-2.rmon.statistics.etherStatsTable.etherStatsEntry.etherStatsBroadcastPkts

Counter32: 294198478 Packets

We are using RMON MIB for CISCO Catalyst 2950 .CISCO supports SNMP for all models. By default SNMP is disable for network devices, but in www.cisco.com you can find very detailed instruction for SNMP-enable procedure for any CISCO-hardware.

EPICS Switches/routers info:

- Broadcastings MIB:
  rmon.statistics.etherStatsTable.etherStatsEntry.etherStatsBroadcastPkts

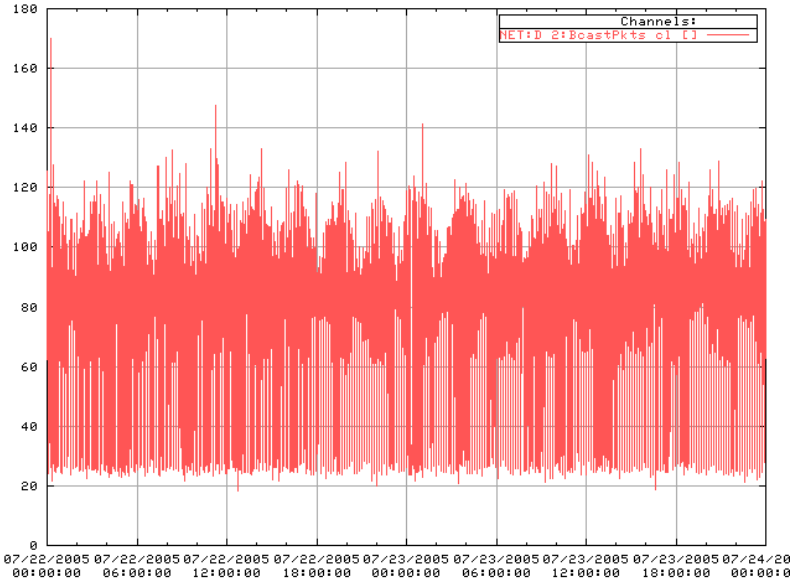
- Correspondent PV is

NET:kryknet2:Bcast_li (bcast #)➔

- Calc PV:

NET:kryknet2:Bcast_calc (bcast/sec)

- This picture is ChannelArchiver web-interface for bcast/sec:



Conclusion:

- SNMP dev. support allows us to access management data from any network device in the same manner as we are used to for our EPICS PVs. (MEDM, ChannelArchiver, ALH)
- Useful for co-relate Control System aberrations and errors with network traffic and hosts problems.