

Chapter 5
SNMPv1:
Communication and Functional Models

Network Management

- Organization Model (ch. 4)
 - 2 tier
 - 3 tier
- Information Model (ch. 4)
 - SMI
 - MIB
- Communication Model (ch. 5)
- Functional Model (ch. 5)

SNMP Architecture

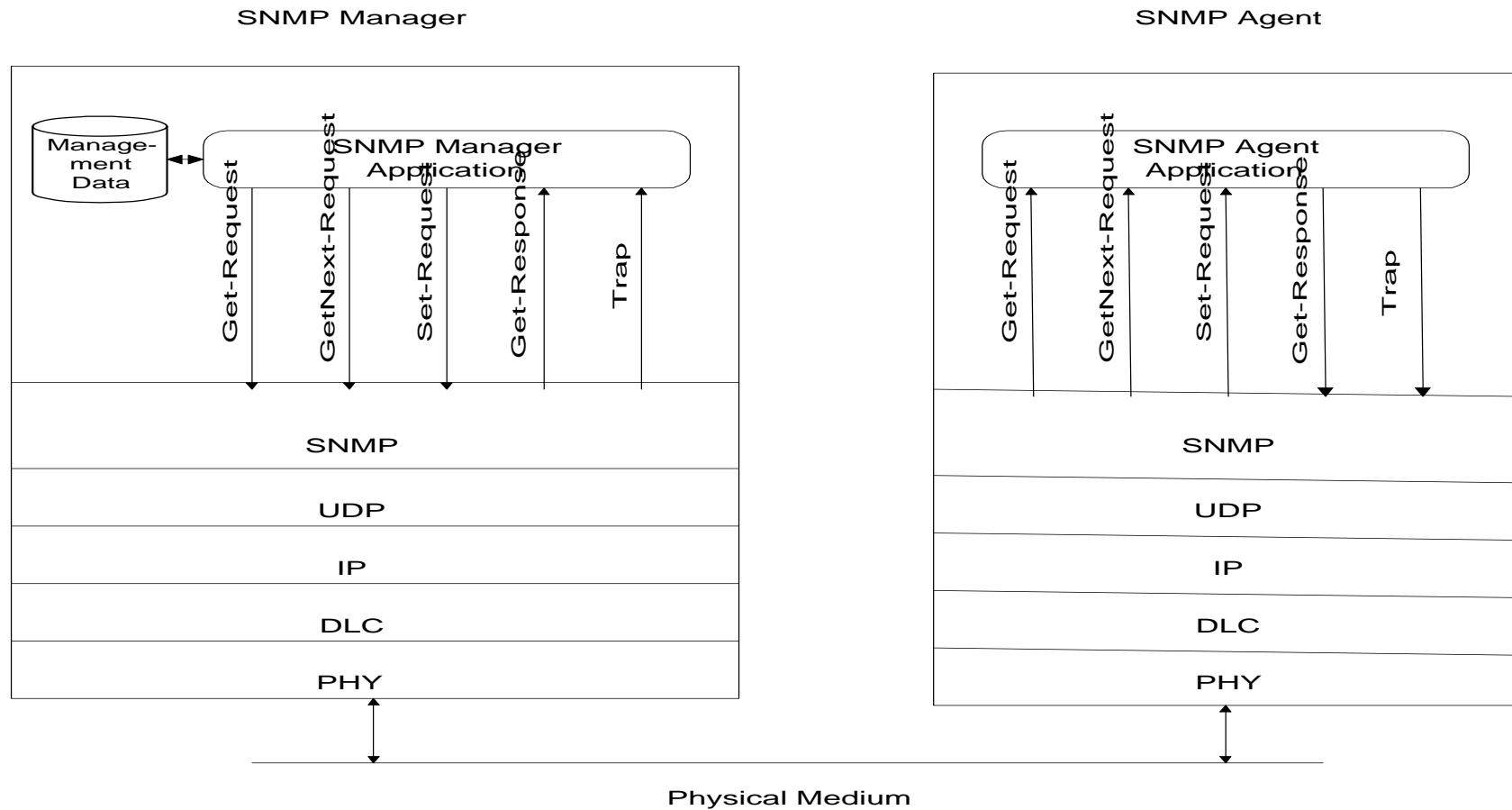


Figure 4.9 SNMP Network Management Architecture

SNMP Messages

- Get-Request
 - Get-Next-Request
 - Set-Request
 - Get-Response
 - Trap
 - Generic trap
 - Specific trap
 - Time stamp
-

Administrative Model

- Based on community profile and policy
 - SNMP Entities:
 - SNMP application entities
 - Reside in management stations and network elements
 - Manager and agent
 - SNMP protocol entities
 - Communication processes (PDU handlers)
 - Peer processes that support application entities
-

SNMP Community

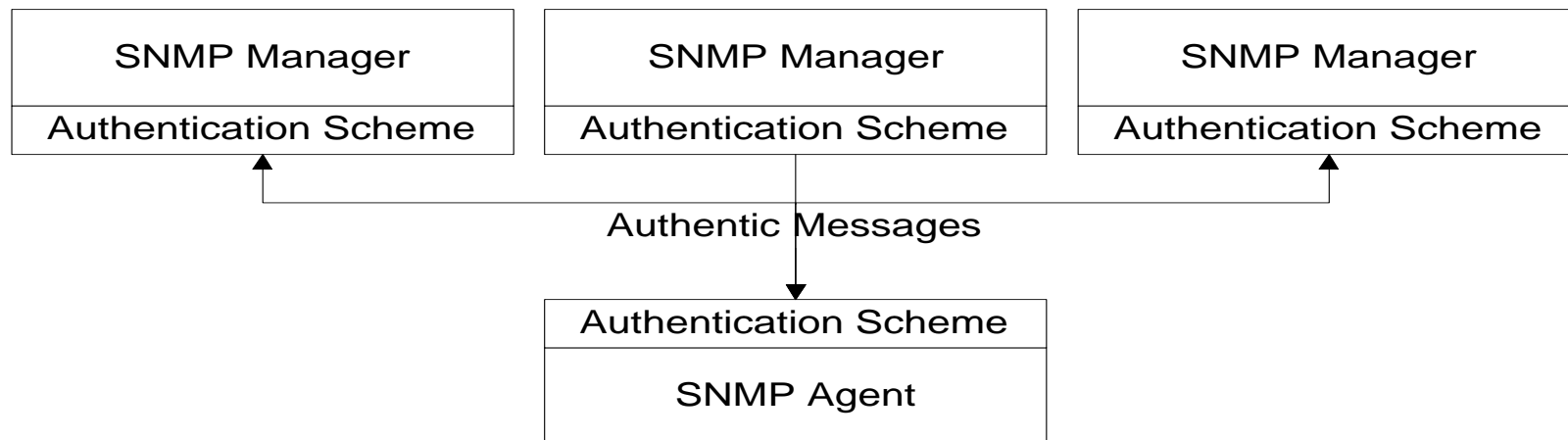


Figure 5.1 SNMP Community

Community Profile

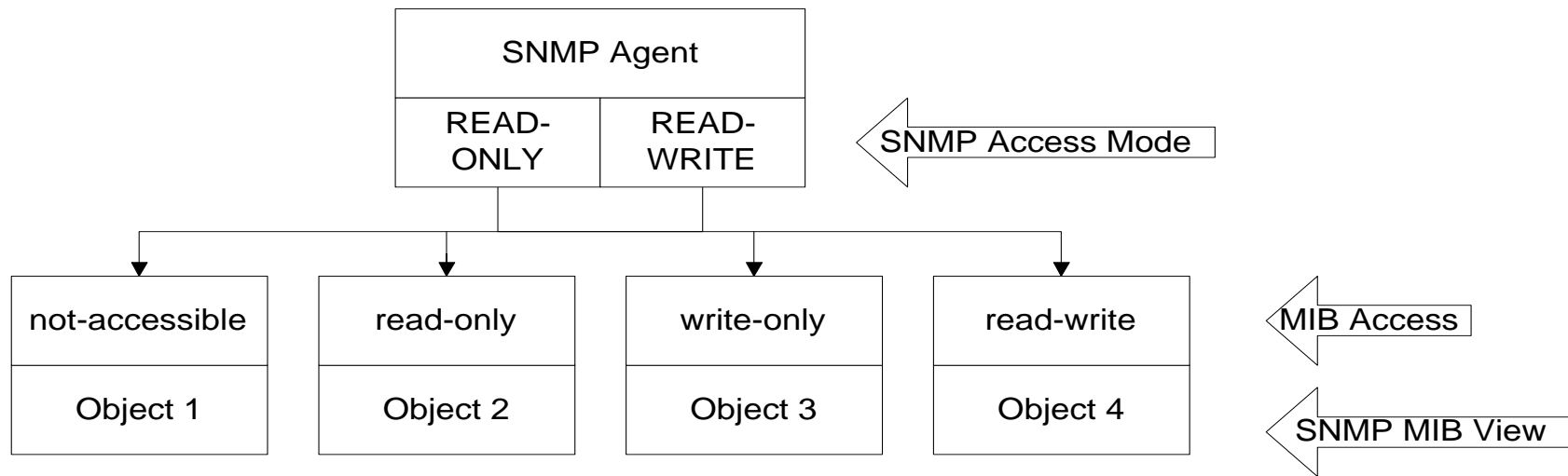
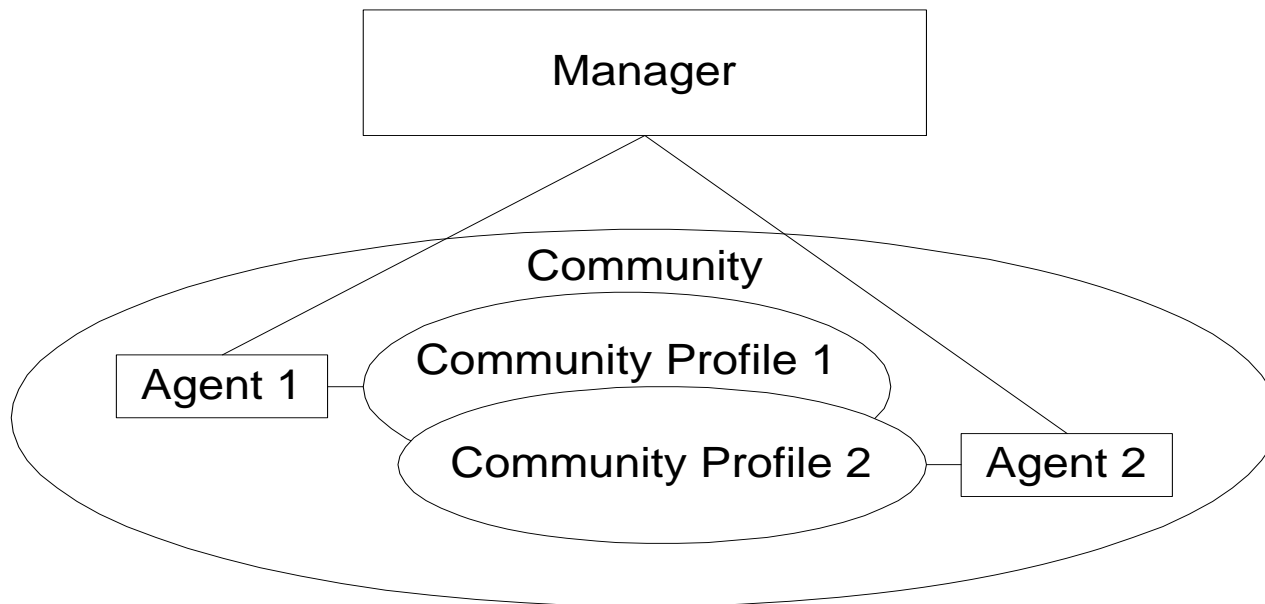


Figure 5.2 SNMP Community Profile

Administration Model

- Administration model is SNMP access policy
 - SNMP community paired with SNMP community profile is SNMP access policy
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Access Policy



Generalized Administration Model

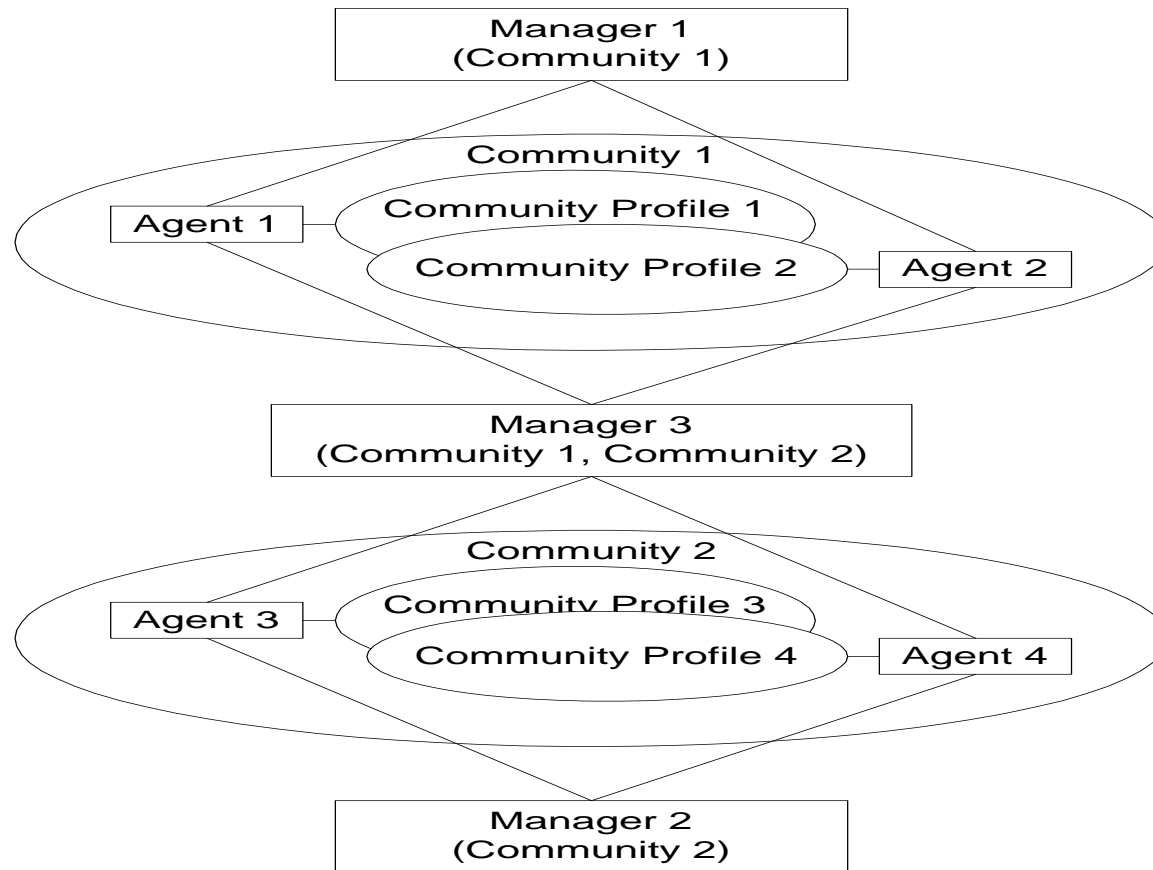


Figure 5.3 SNMP Access Policy

Proxy Access Policy

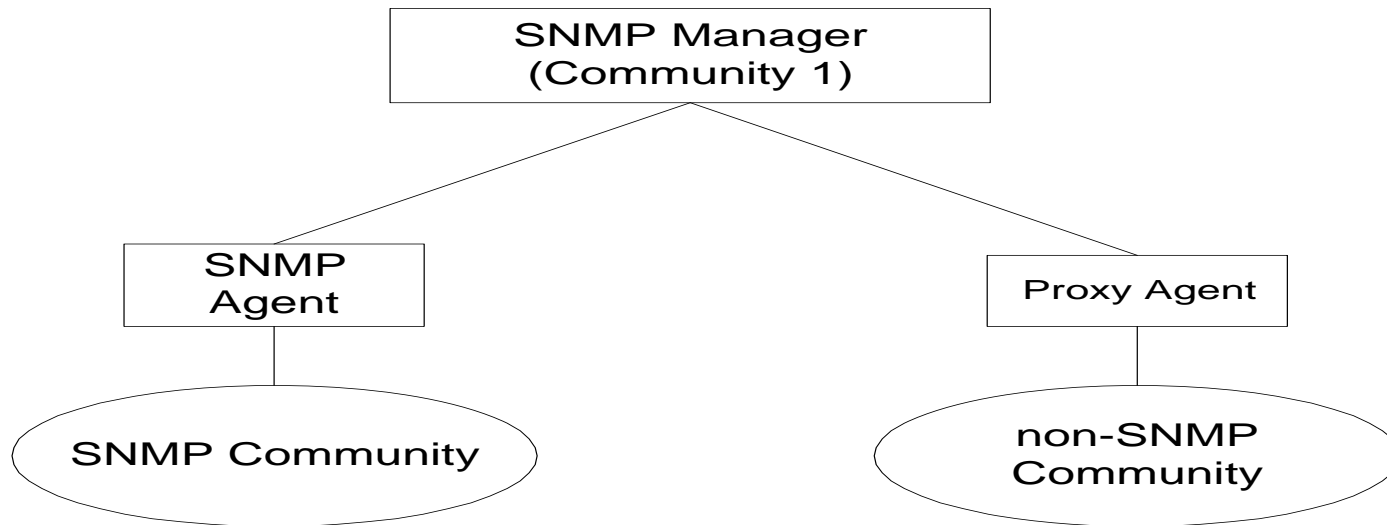


Figure 5.4 SNMP Proxy Access Policy

Protocol Entities

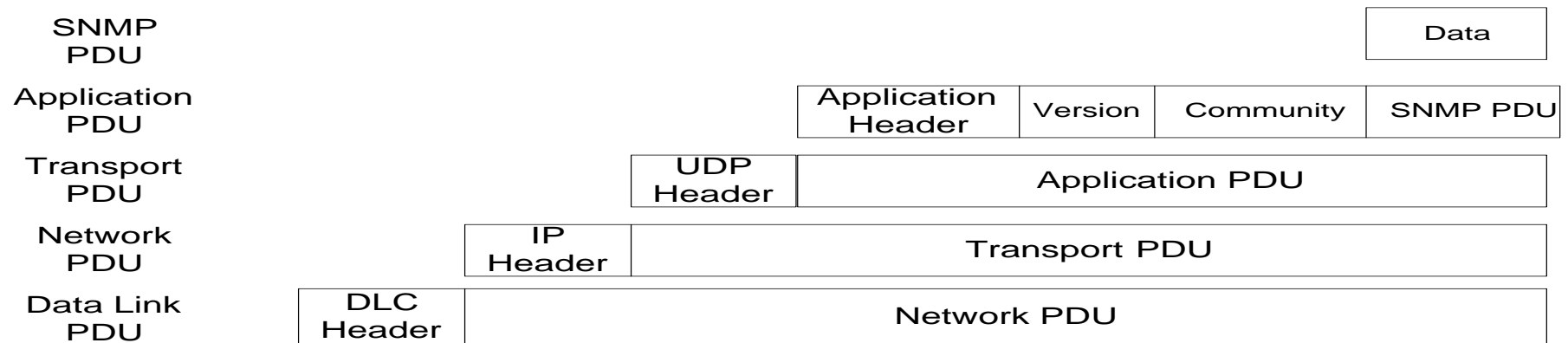


Figure 5.5 Encapsulated SNMP Message

Get and Set PDU

PDU Type	RequestID	Error Status	Error Index	VarBind 1 name	VarBind 1 value	...	VarBind n name	VarBind n value
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Figure 5.8 Get and Set Type PDUs

- VarBindList: multiple instances of VarBind pairs

```

P D U s ::=
    C H O I C E {
        get-request           G e t R e q u e s t - P D U ,
        get-next-request     G e t N e x t R e q u e s t - P D U ,
        get-response         G e t R e s p o n s e - P D U ,
        set-request          S e t R e q u e s t - P D U ,
        trap                 T r a p - P D U
    }

```

PDU Types: enumerated INTEGER

```

get-request           [0]
get-next-request     [1]
set-request          [2]
get-response         [3]
trap                 [4]

```

Error in Response

```
ErrorStatus ::=
  INTEGER {
    noError(0)
    tooBig(1)
    noSuchName(2)
    badValue(3)
    readOnly(4)
    genErr(5)
  }
```

Error Index: No. of VarBind that the first error occurred (1 if error occurred in first VarBind, ...)

VarBind - pairing of the variable and its value

Trap PDU

PDU Type	Enterprise	Agent Address	Generic Trap Type	Specific Trap Type	Timestamp	VarBind 1 name	VarBind 1 value	...	VarBind n name	VarBind n value
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Generic Trap Type	Description (brief)
coldStart(0)	Sending protocol entity is reinitializing itself; agent's configuration or protocol entity implementation may be altered
warmStart(1)	Sending protocol entity is reinitializing itself; agent configuration or protocol entity implementation not altered
linkDown(2)	Failure of one of the communication links
linkUp(3)	One of the links has come up
authenticationFailure(4)	Authentication failure
egpNeighborLoss(5)	Loss of EGP neighbor
enterpriseSpecific(6)	Enterprise-specific trap

SNMP Operations

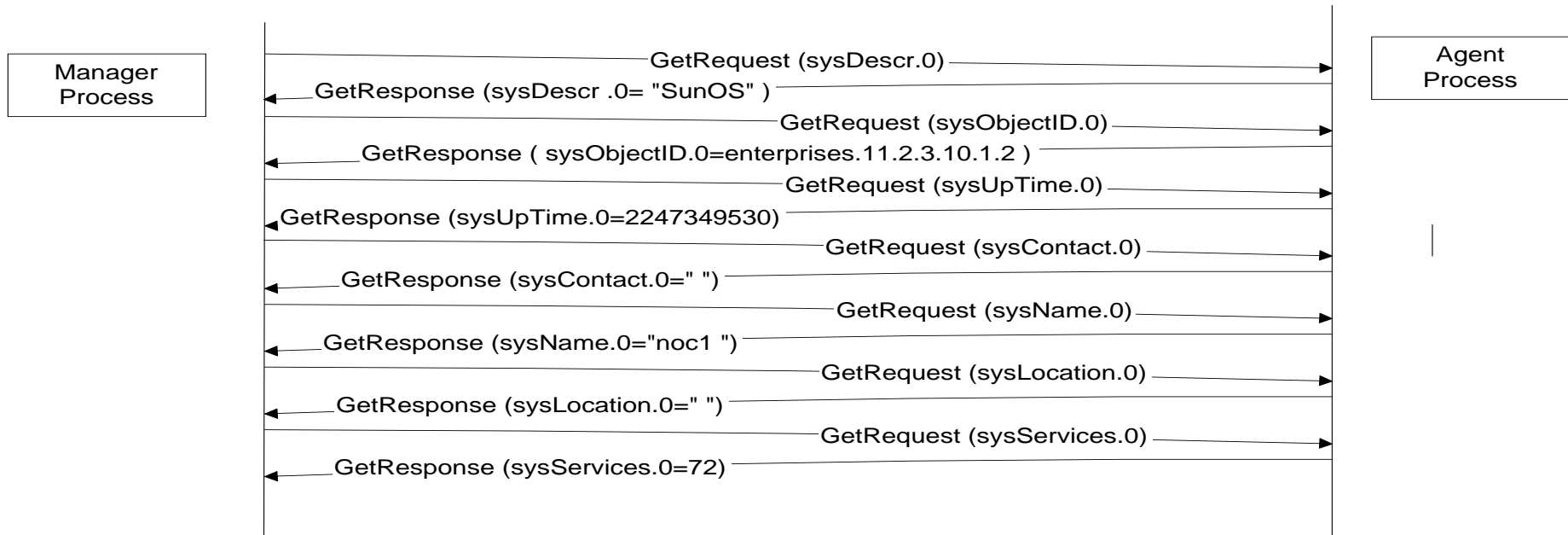


Figure 5.10 Get-Request Operation for System Group

MIB for Get-Next-Request

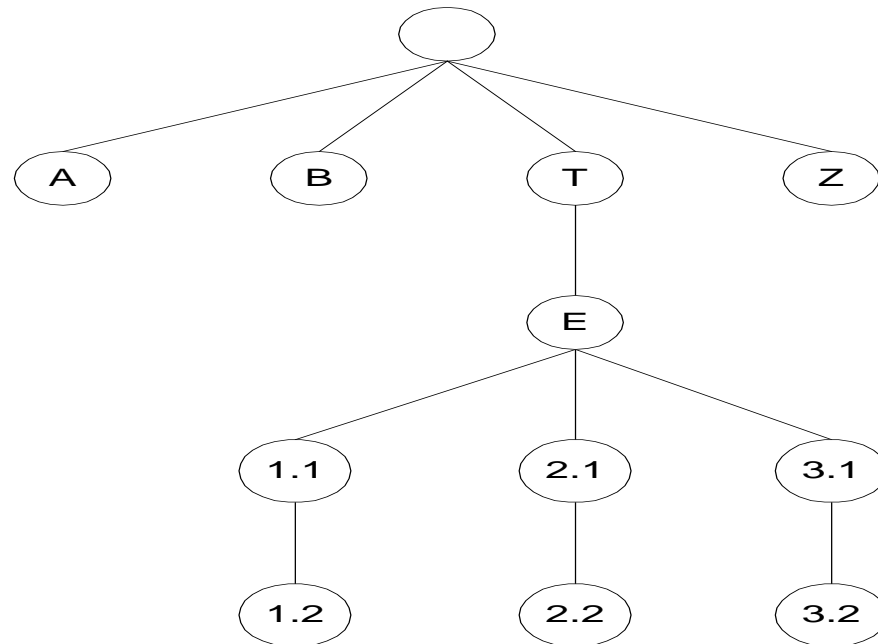


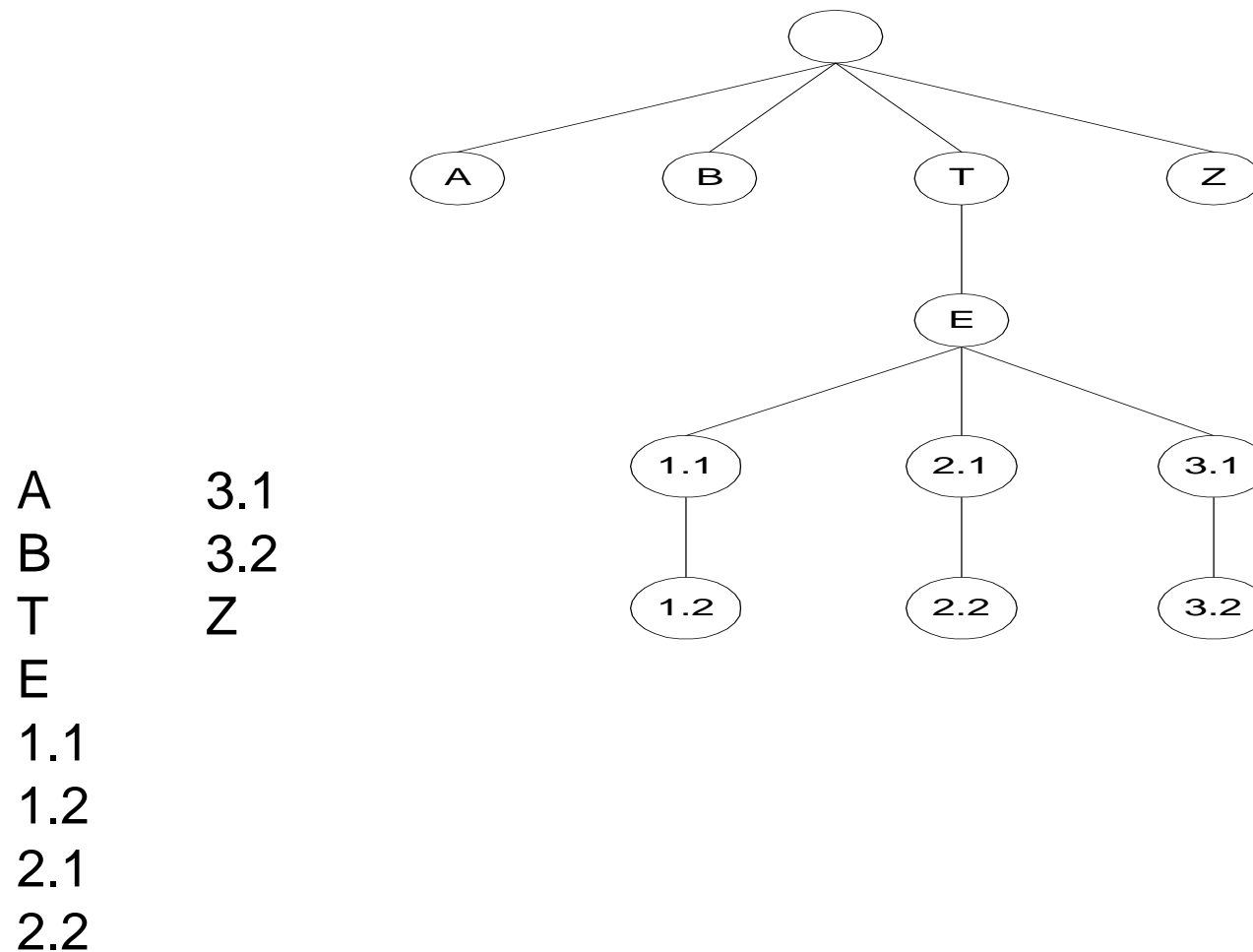
Figure 5.12 MIB for Operation Sequences in Figures 5.13 and 5.15

Lexicographic Order

Numerical Order	Lexicographic order
1	1
2	1118
3	115
9	126
15	15
22	2
34	22
115	250
126	2509
250	3
321	321
1118	34
2509	9

- Procedure for ordering:
 - Start with leftmost digit as first position
 - Before increasing the order in the first position, select the lowest digit in the second position
 - Continue the process till the lowest digit in the last position is captured
 - Increase the order in the last position until all the digits in the last position are captured
 - Move back to the last but one position and repeat the process
 - Continue advancing to the first position until all the numbers are ordered
- Tree structure for the above process

MIB Lexicographic Order



A More Complex MIB Example

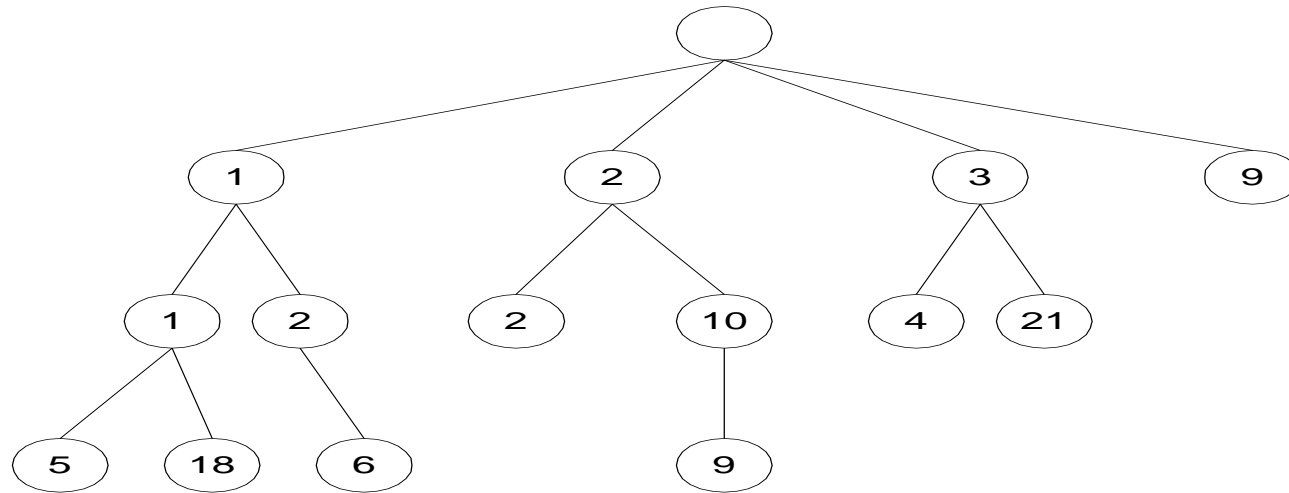


Figure 5.14 MIB Example for Lexicographic Ordering

1
1.1
1.1.5
1.1.18
1.2
1.2.6
2
2.2
2.10
2.10.9
3
3.4
3.21
9

Get-Next-Request Operation

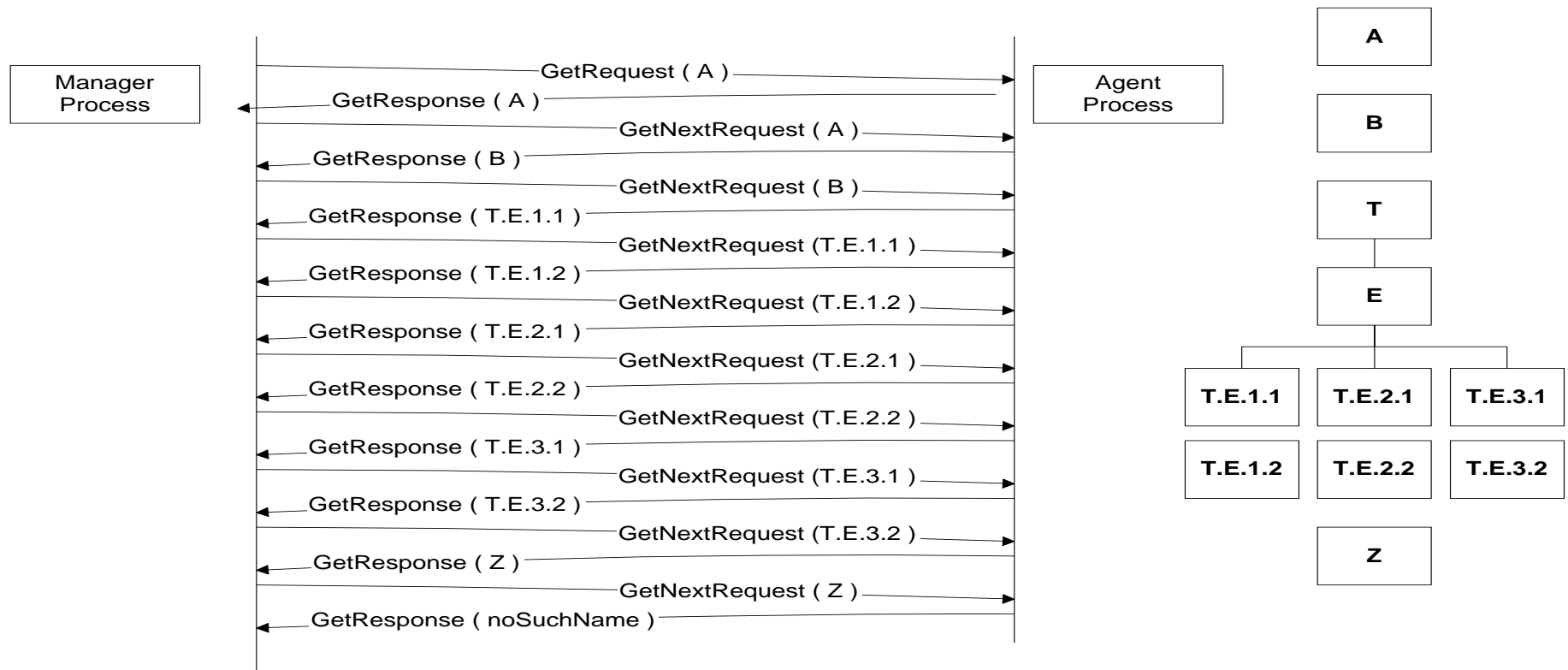


Figure 5.15 Get-Next-Request Operation for MIB in Figure 5.12

Get-Next-Request Operation

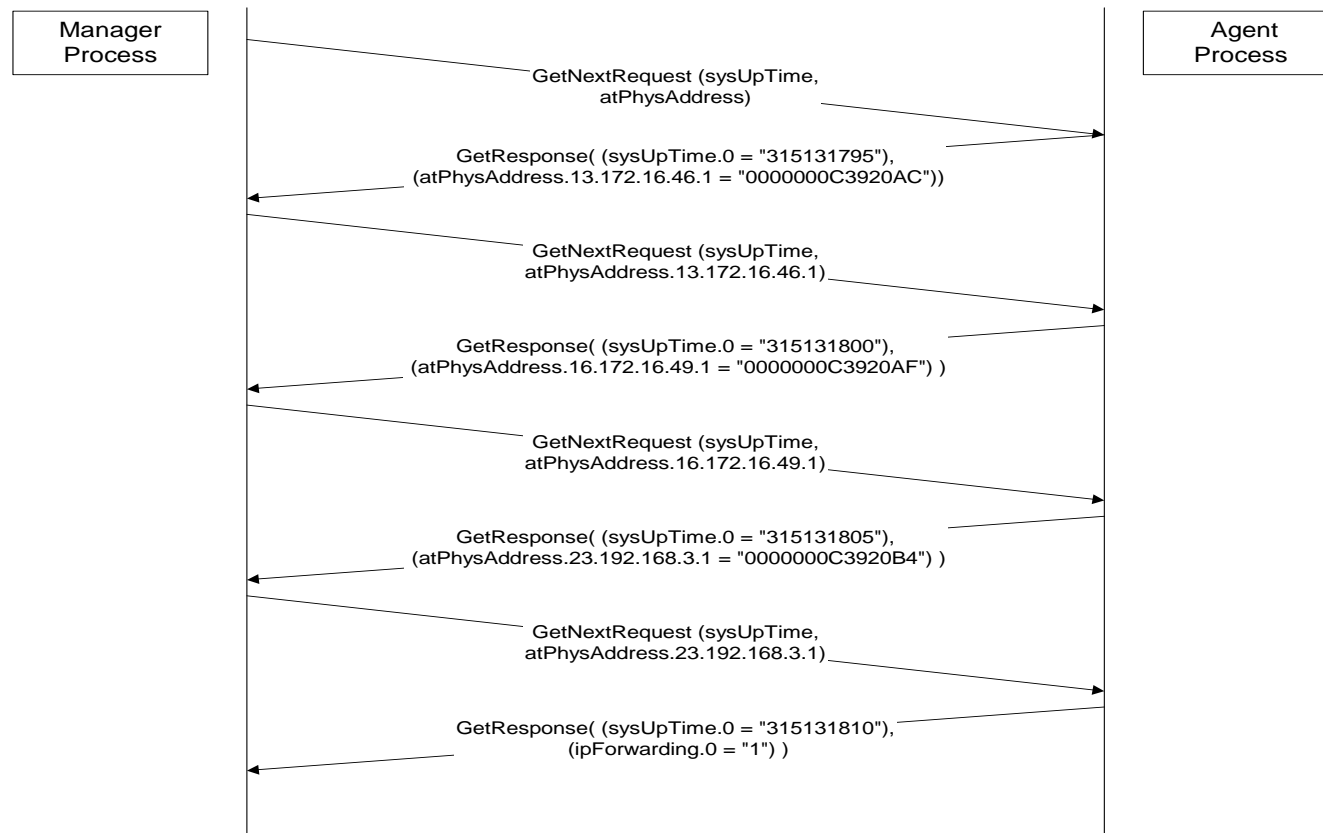


Figure 5.16 GetNextRequest Example with Indices

atIfIndex	atPhysAddress	atNetAddress
23	0000000C3920B4	192.168.3.1
13	0000000C3920AC	172.16.46.1
16	0000000C3920AF	172.16.49.1

Sniffer Data

```
14:03:36.788270 noc3.btc.gatech.edu.164 >
noc1.btc.gatech.edu.snmp:
Community = public
GetRequest(111)
RequestID = 4
system.sysDescr.0
system.sysObjectID.0
system.sysUpTime.0
system.sysContact.0
system.sysName.0
system.sysLocation.0
system.sysServices.0
```

Figure 5.17(a) Get-Request Message from Manager-to-Agent

```
14:03:36.798269 noc1.btc.gatech.edu.snmp >
noc3.btc.gatech.edu.164:
Community = public
GetResponse(196)
RequestID = 4
system.sysDescr.0 = "SunOS noc1 5.5.1 Generic_103640-08
sun4u"
system.sysObjectID.0 = E:hp.2.3.10.1.2
system.sysUpTime.0 = 247396453
system.sysContact.0 = "Brandon Rhodes"
system.sysName.0 = "noc1"
system.sysLocation.0 = "BTC NM Lab"
system.sysServices.0 = 72
```

Figure 5.17(b) Get-Response Message from Agent-to-Manager (After)

SNMP MIB

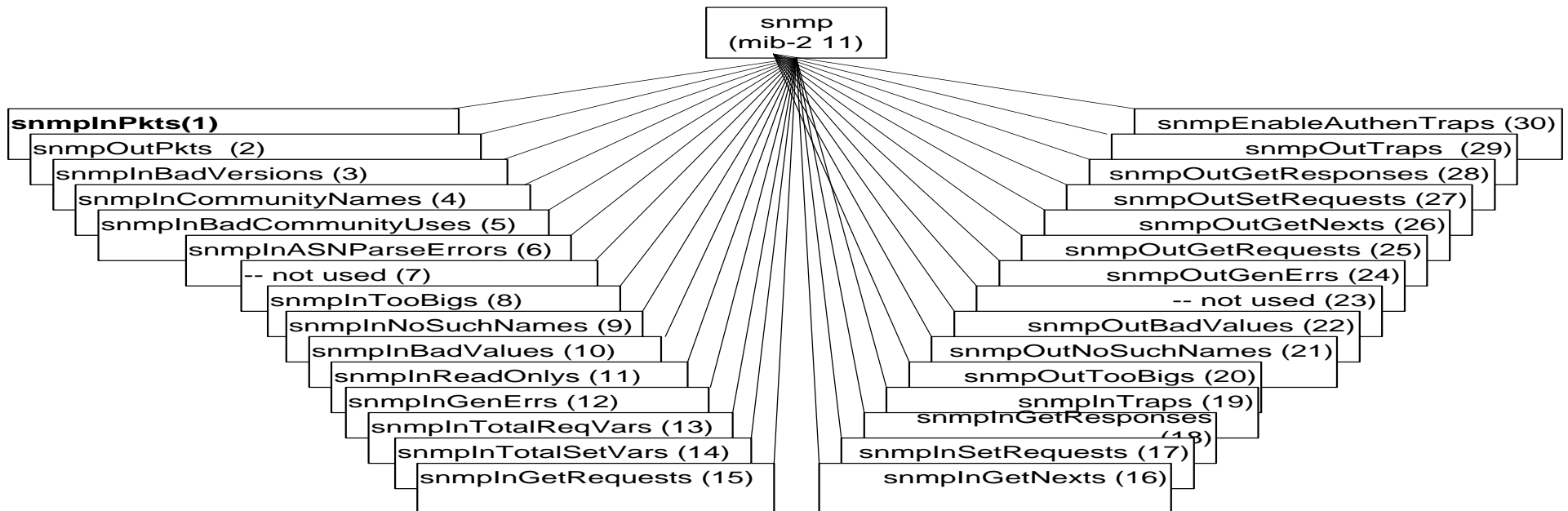


Figure 5.21 SNMP Group

Note: Most of the MIB objects were not used and hence deprecated in SNMPv2

5.2 Functional Model

- No formal specs of functions in SNMPv1
- OSI mode addresses
 - configuration
 - fault
 - performance
 - security
 - accounting

