

NET311

Computer Network Management

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Chapter 6

SNMP Management: SNMPv2

Objectives

- Community-based security
- SNMPv2 enhancements
 - Additional messages
 - Formalization of SMI
- Get-bulk request and information-request
- SNMP MIB modifications
- Incompatibility with SNMPv1
- Proxy server
- Bilingual manager

Major Changes

- Bulk data transfer
 - Manager-to-manager message
 - Enhancements to SMI: SMIv2
 - Module definitions: MODULE-IDENTITY macro
 - Object definitions: OBJECT-TYPE macro
 - Trap definitions: NOTIFICATION-TYPE macro
 - Textual conventions
 - Conformance statements
 - Row creation and deletion in table
 - MIB enhancements
 - Transport mappings
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Notes

- Security features, originally to be in SNMPv2 moved to SNMPv3
- SNMPv2, like SNMPv1, is community-based administrative framework

SNMPv2 Internet Group

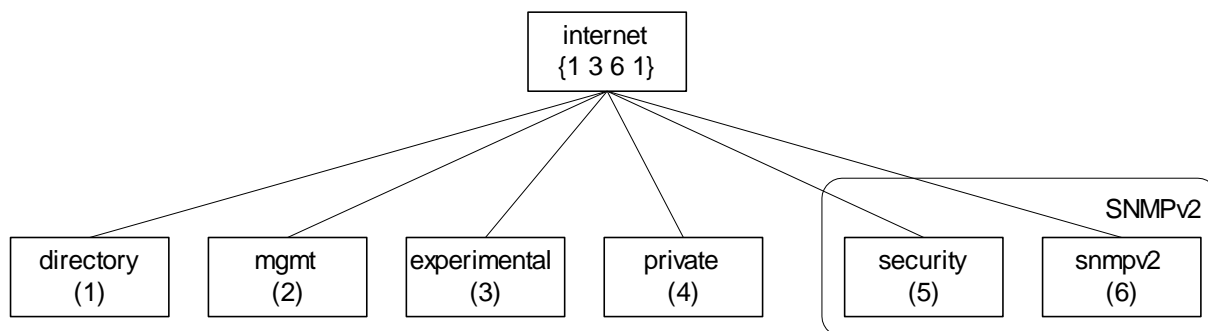


Figure 6.1 SNMPv2 Internet Group

Notes

- Objects added to System group
- Extensive modification of the SNMP group
- Additional SNMPv2 group added
- Security group is a placeholder

SNMPv2 NM Architecture

SNMP Manager

SNMP Manager

SNMP Agent

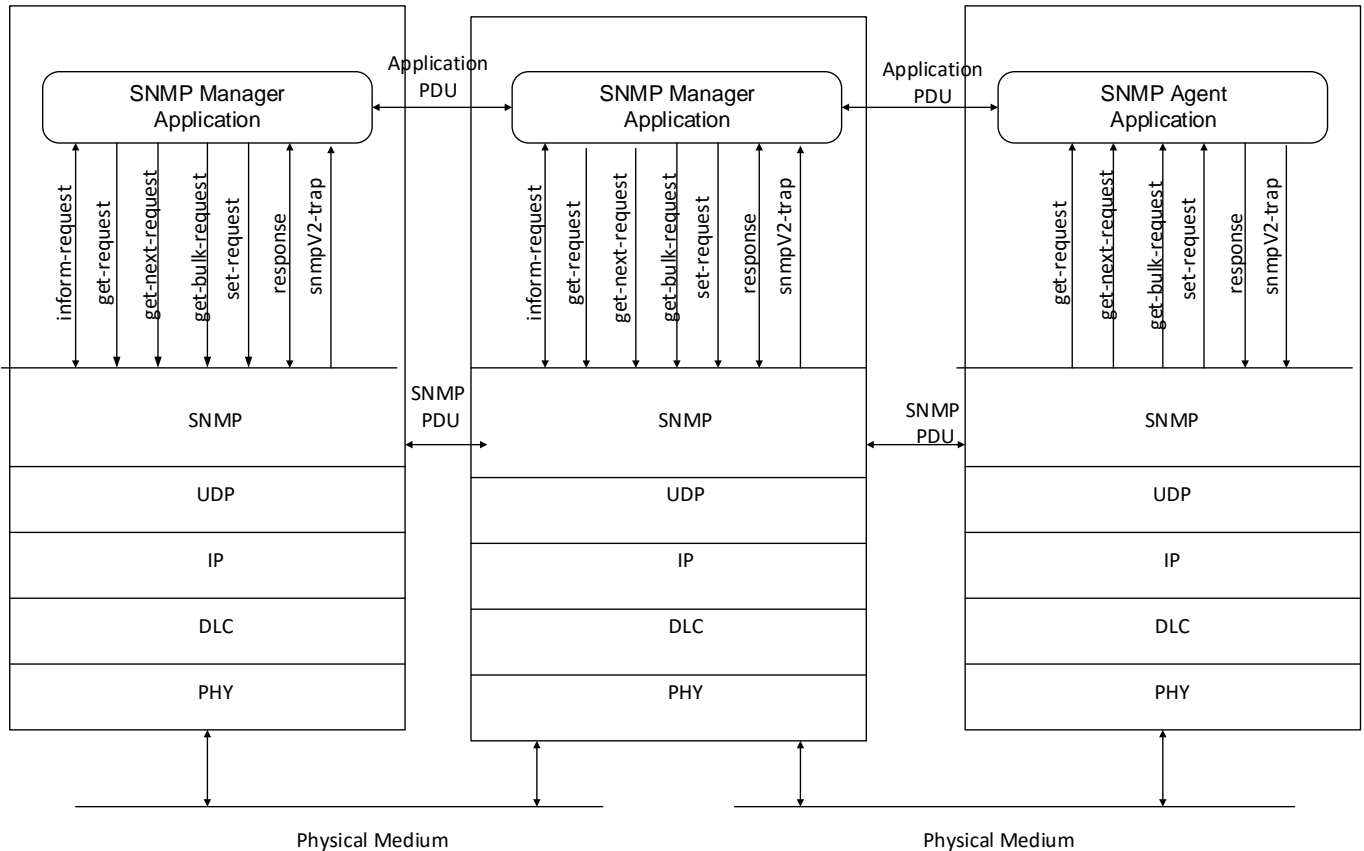


Figure 6.2 SNMPv2 Network Management Architecture

Notes

SNMPv2 New Messages

- inform-request
 - manager-to-manager message
- get-bulk-request
 - transfer of large data
- report
 - not used

Notes

SNMPv2 MIB

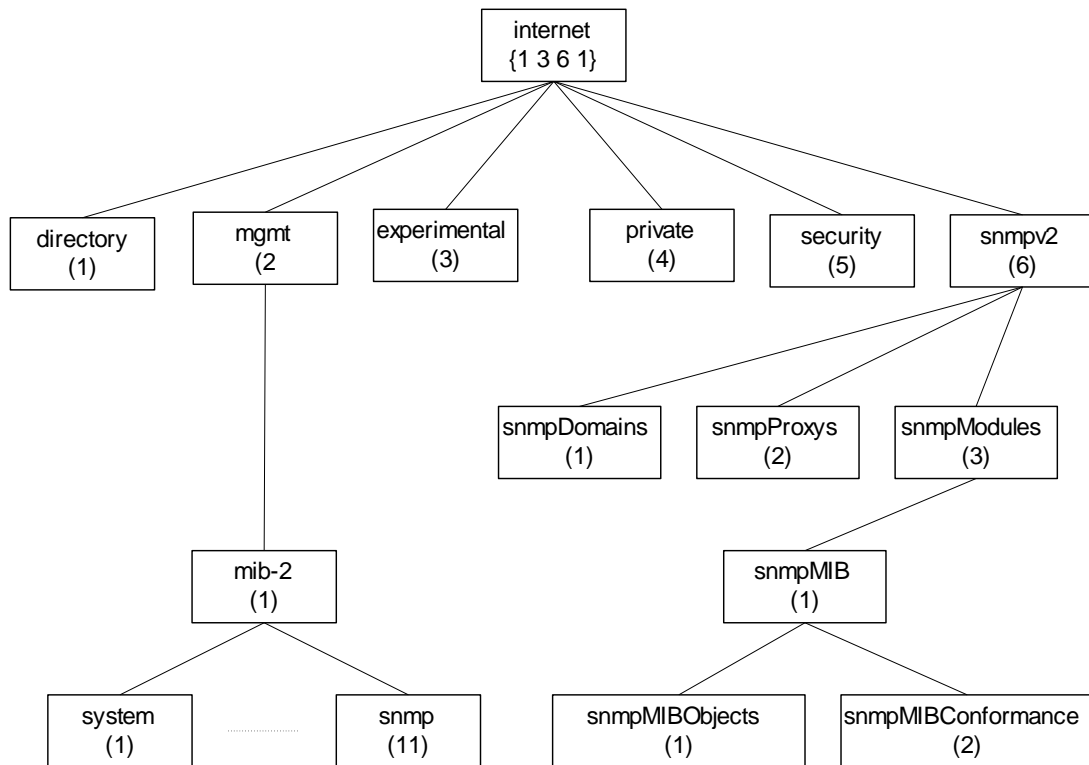


Figure 6.31 SNMPv2 Internet Group

Notes

- Security is a placeholder
- System group: A table sysORTable added that lists resources that the agent controls; NMS configures NE through the agents.
- Most of the objects in the SNMPv1 obsoleted
- Object Groups and Notification Groups defined for conformance specifications.

Agent Capabilities

- AGENT-CAPABILITIES macro
 - SUPPORTS modules and includes groups
 - VARIATION identifies additional features

Notes

```

routerIsi123 AGENT-CAPABILITIES
    PRODUCT-RELEASE    "InfoTech Router isiRouter123 release 1.0"
    STATUS              current
    DESCRIPTION         "InfoTech High Speed Router"
    SUPPORTS            snmpMIB
        INCLUDES        {systemGroup, snmpGroup, snmpSetGroup,
                        snmpBasicNotificationsGroup }
        VARIATION        coldStart
            DESCRIPTION  "A coldStart trap is generated on all
                        reboots."
    SUPPORTS            IF-MIB
        INCLUDES        {ifGeneralGroup, ifPacketGroup}
    SUPPORTS            IP MIB
        INCLUDES        {ipGroup, icmpGroup}
    SUPPORTS            TCP-MIB
        INCLUDES        {tcpGroup}
    SUPPORTS            UDP-MIB
        INCLUDES        {udpGroup}
    SUPPORTS            EGP-MIB
        INCLUDES        {egpGroup}
::= { isiRouter 1 }

```

Figure 6.30 Example of AGENT-CAPABILITIES Macro

SNMPv2 SNMP MIB

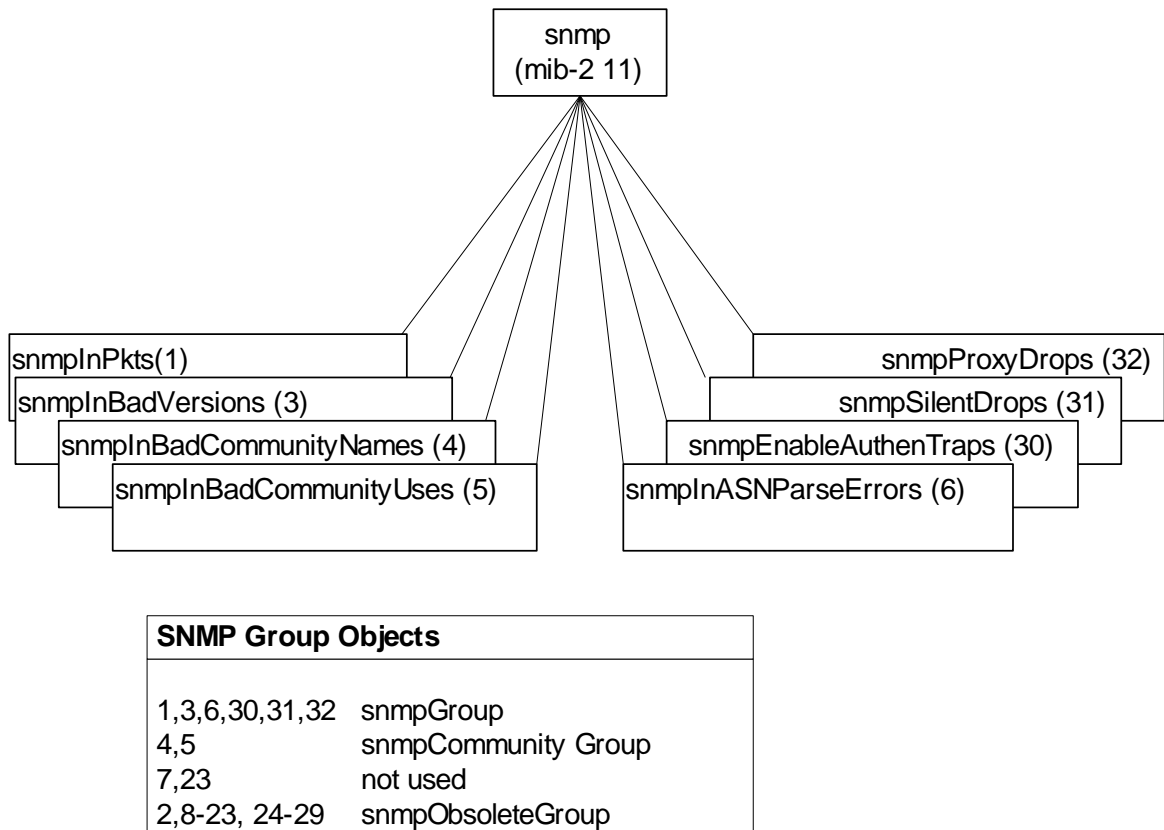


Figure 6.33 SNMPv2 SNMP Group

Notes

- Compare this to SNMPv1 MIB!

snmpMIBObjects MIB

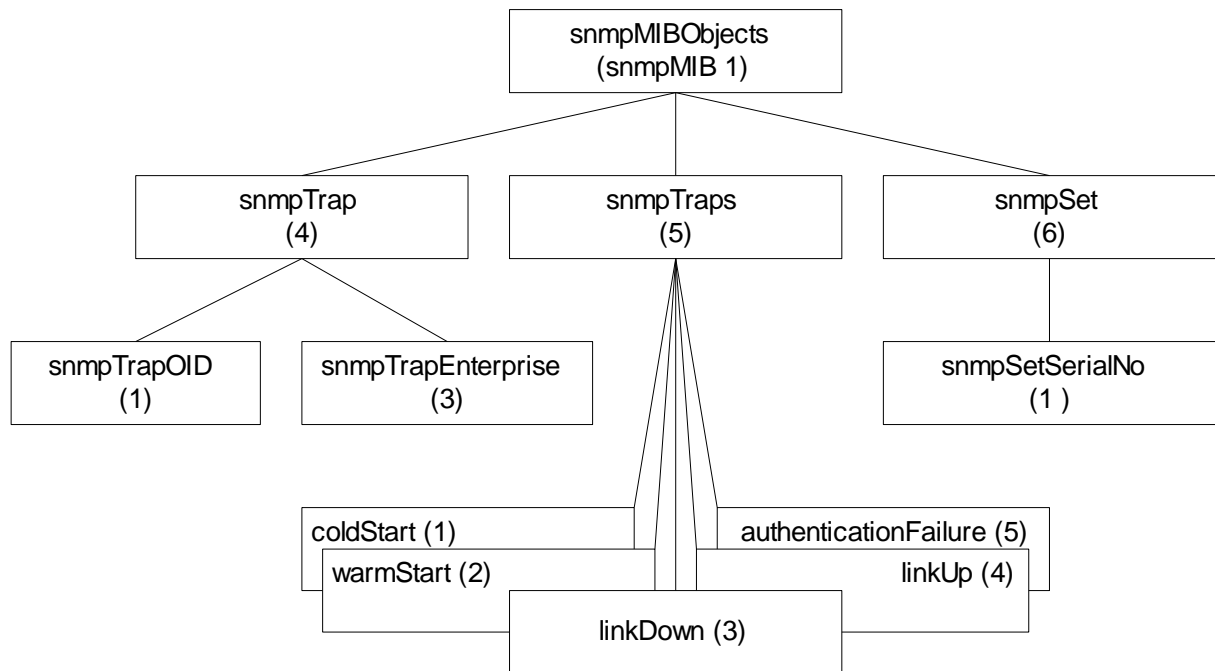


Figure 6.34 MIB Modules under snmpMIBObjects

Notes

SNMPv2 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 6.37 SNMPv2 PDU (all but Bulk)

Notes

- Standardized format for all messages
- Interpretation of error status and error index fields; In v1, if error occurs status and index field filled, but varBindList blank

Interpretation in v2	Status	Index
varBindList ignored	x	
varBind of index field ignored	x	x

SNMPv2 PDU and Error Status

Table 6.11 Values for Types of PDU and Error-status Fields in SNMPv2 PDU

Field	Type	Value
PDU	0	Get-Request-PDU
	1	GetNextRequest-PDU
	2	Response-PDU
	3	Set-Request- PDU
	4	obsolete
	5	GetBulkRequest-- PDU
	6	InformRequest- PDU
	7	SNMPv2 - Trap- PDU
Error Status	0	noError
	1	tooBig
	2	noSuchName
	3	badValue
	4	readOnly
	5	genErr
	6	noAccess
	7	wrongType
	8	wrongLength
	9	wrongEncoding
	10	wrongValue
	11	noCreation
	12	inconsistentValue
	13	resourceUnavailable
	14	commitFailed
	15	undoFailed
	16	authorizationError
	17	notWritable
	18	inconsistentName

SNMPv2 GetBulkRequest PDU

PDU Type	RequestID	Non-Repeaters	Max Repetitions	VarBind 1 name	VarBind 1 value	...	VarBind n name	VarBind n value
----------	-----------	---------------	-----------------	----------------	-----------------	-----	----------------	-----------------

Figure 6.38 SNMPv2 GetBulkRequest PDU

Notes

- *Error status* field replaced by *Non-repeaters*
- *Error index* field replaced by *Max repetitions*
- No one-to-one relationship between request and response

Get-Bulk-Request: Generic MIB

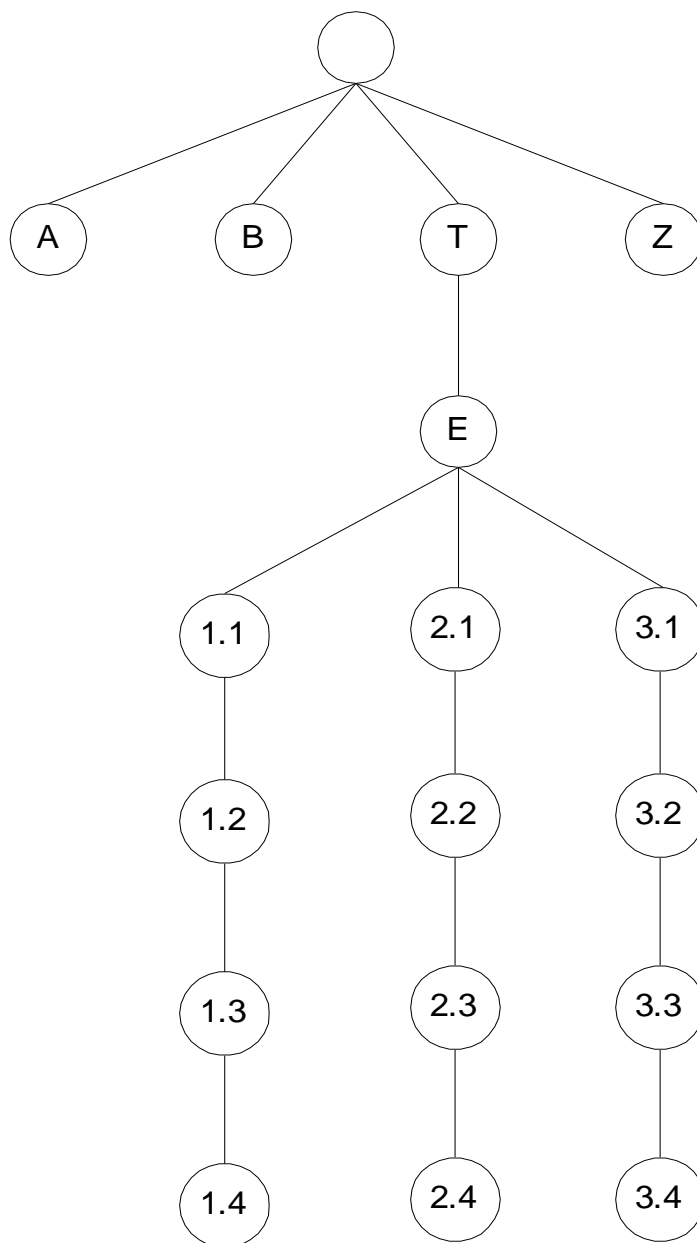


Figure 6.39 MIB for Operation Sequences in Figures 6.40 and 6.41

Get-Next-Request Operation

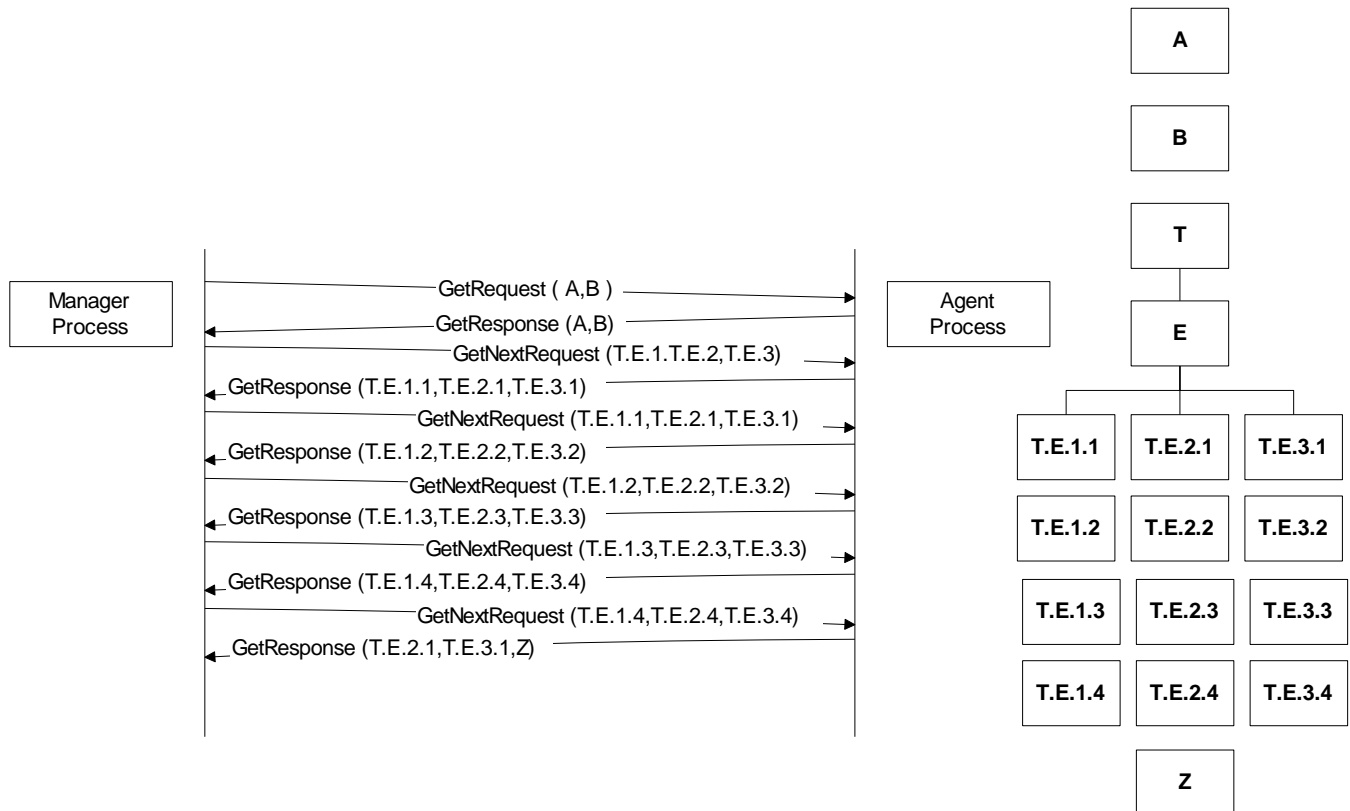


Figure 6.40 Get-Next-Request Operation for MIB in Figure 6.39

Notes

Get-Bulk-Request Operation

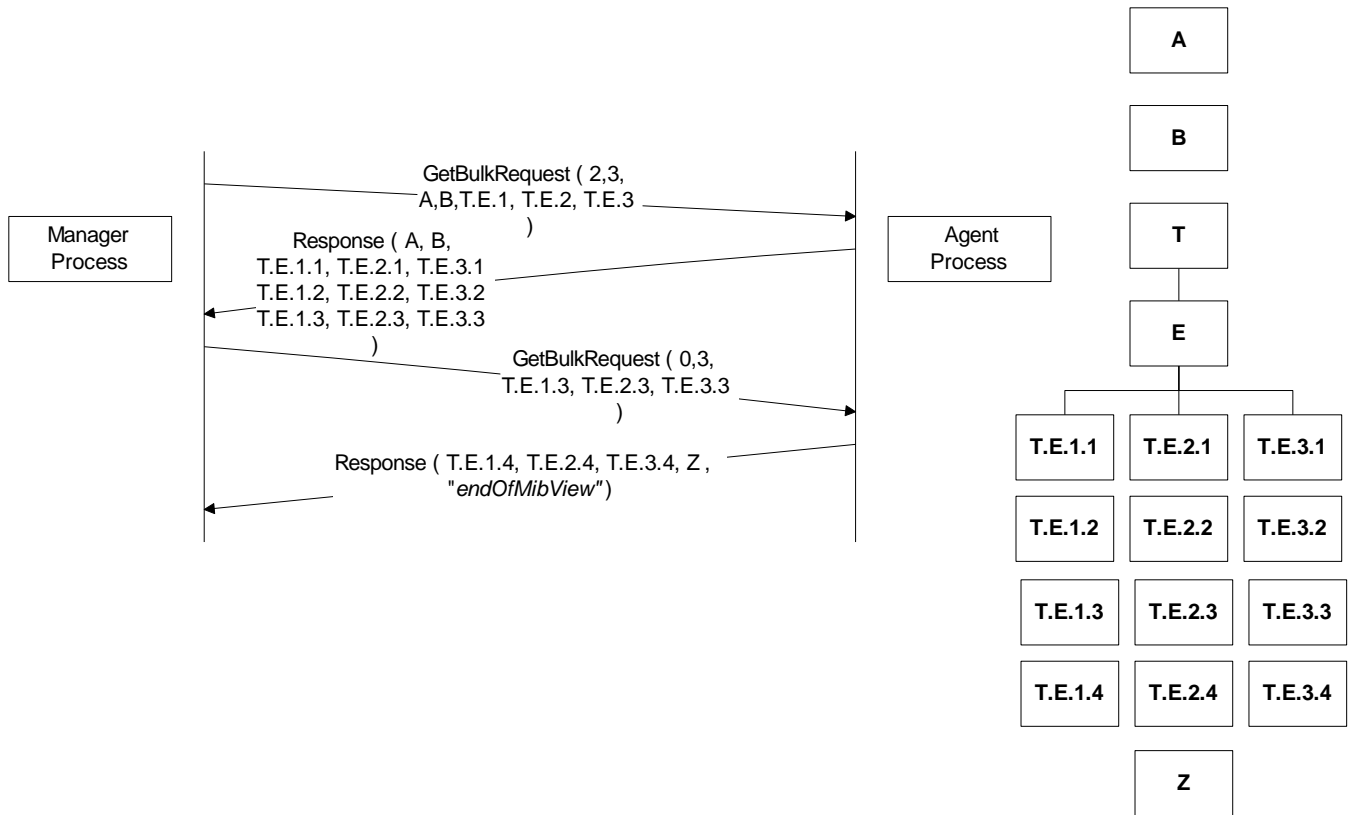


Figure 6.41 Get-Bulk-Request Operation for MIB in Figure 6.39

Notes

- `GetBulkRequest(2, 3, ..)`
 - 2: two non-repetitive objects (A and B)
 - 3: three **repetitive** instances of columnar objects (TE.1, TE.2 and TE.3)
- `GetBulkRequest(0, 3, ..)`
 - 3: three more rows of the table
- `Response`
 - only one row left
 - sends next lexicographic entry Z, error: `endOfMibView`

Get-Bulk-Request Example

Manager Process	atIfIndex	atPhysAddress	atNetAddress	Agent Process
	13	0000000C3920AC	172.46.46.1	
	16	0000000C3920AF	172.46.49.1	
	23	0000000C3920B4	192.168.3.1	

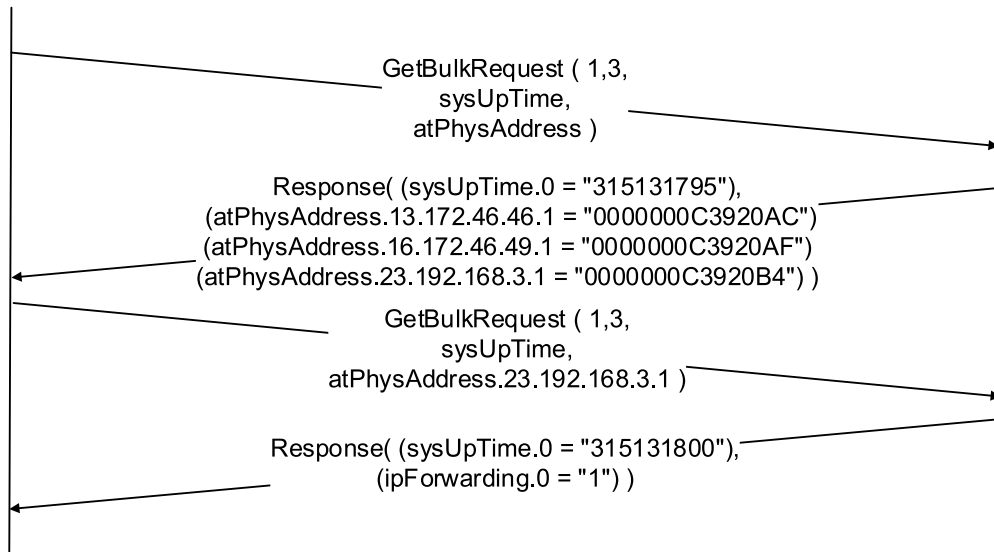


Figure 6.42 Get-Bulk-Request Example

Notes

SNMPv2 Trap

PDU Type	RequestID	Error Status	Error Index	VarBind 1 sysUpTime	VarBind 1 value	VarBind 2 snmpTrapOID	VarBind 2 value	...
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Figure 6.43 SNMPv2 Trap PDU

Notes

- Addition of NOTIFICATION-TYPE macro
- OBJECTS clause, if present, defines order of variable bindings
- Positions 1 and 2 in VarBindList are sysUpTime and snmpTrapOID

linkUp NOTIFICATION-TYPE

OBJECTS { ifIndex }

STATUS current

DESCRIPTION "A linkUp trap signifies that the SNSMPv2 entity, acting in an agent role, recognizes that one of the communication links represented in its configuration has come up."

Figure 6.44 Example of OBJECTS Clause in NOTIFICATION-TYPE

Inform-Request

PDU Type	RequestID	Error Status	Error Index	VarBind 1 sysUpTime	VarBind 1 value	VarBind 2 snmpTrapOID	VarBind 2 value	..
----------	-----------	--------------	-------------	---------------------	-----------------	-----------------------	-----------------	----

Figure 6.43 SNMPv2 Trap PDU

Notes

- Inform-Request behaves as trap in that the message goes from one manager to another unsolicited
- The receiving manager sends response to the sending manager

Bilingual Manager

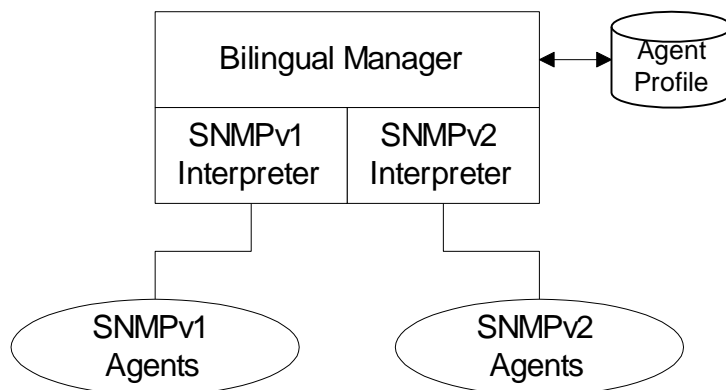


Figure 6.45 SNMP Bilingual Manager

Notes

- Compatibility with SNMPv1
 - Bilingual Manager
 - Proxy Server
- Bilingual Manager expensive in resource and operation

SNMP Proxy Server

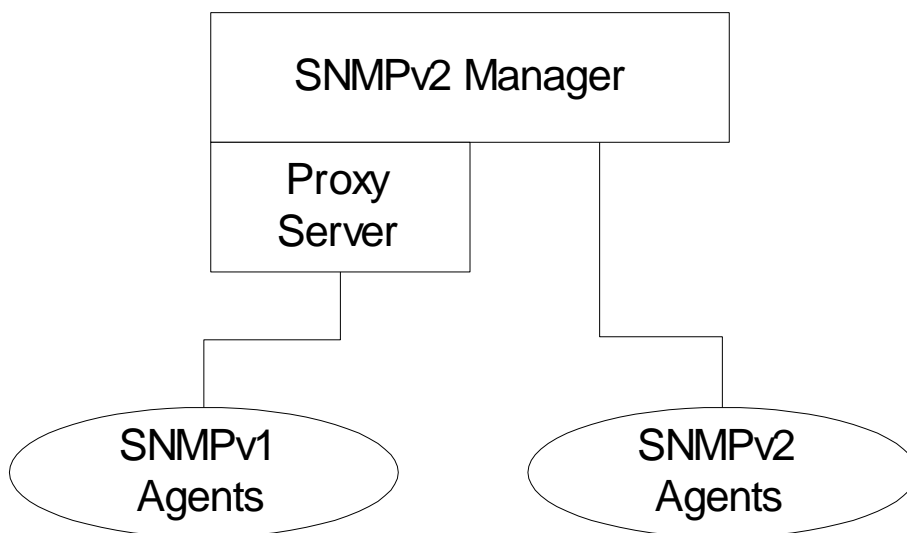


Figure 6.46 SNMPv2 Proxy Server Configuration

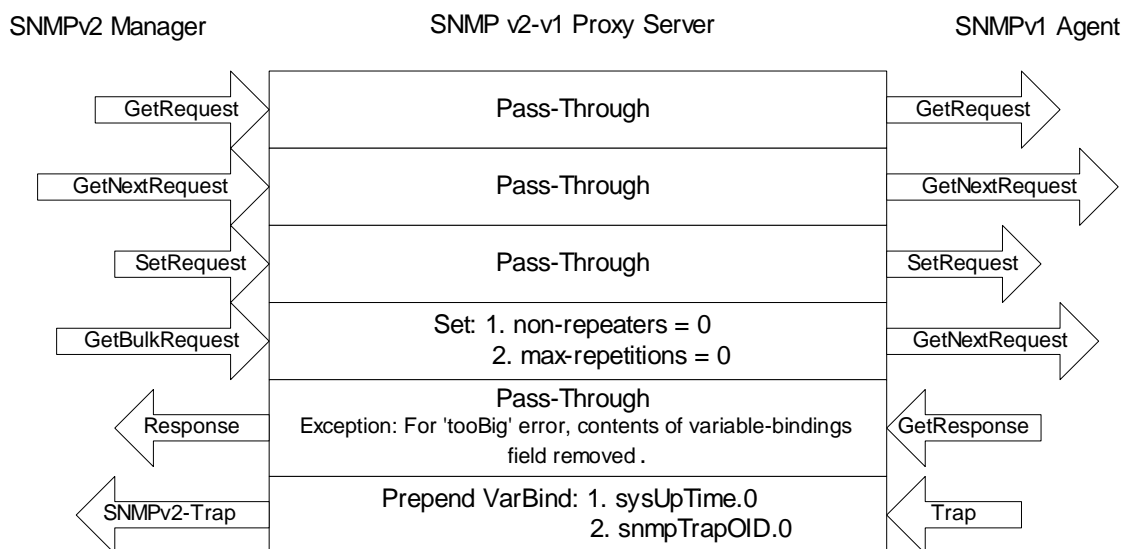


Figure 6.47 SNMP v2-v1 Proxy Server