

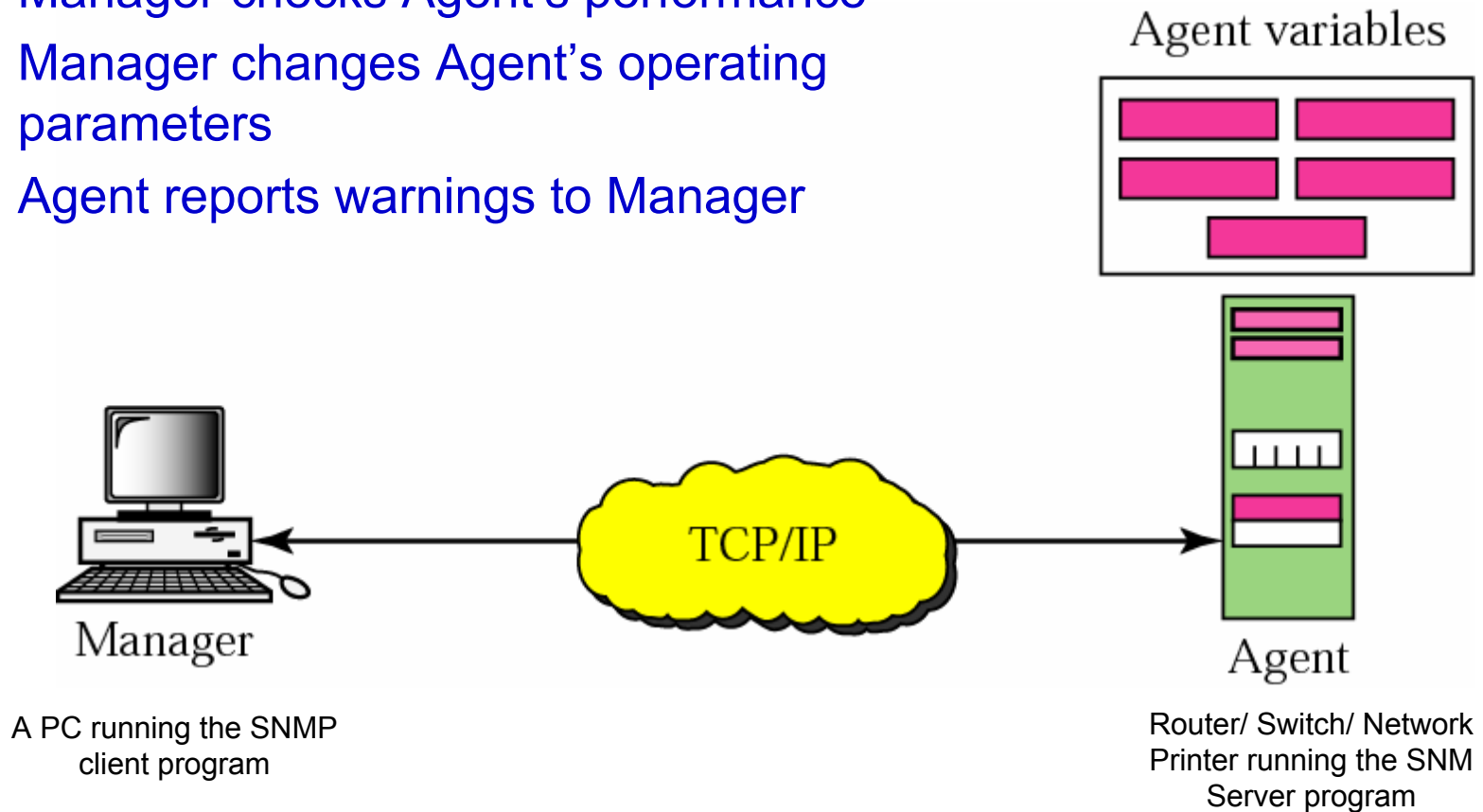
Simple Network Management Protocol (SNMP)

CONTENTS

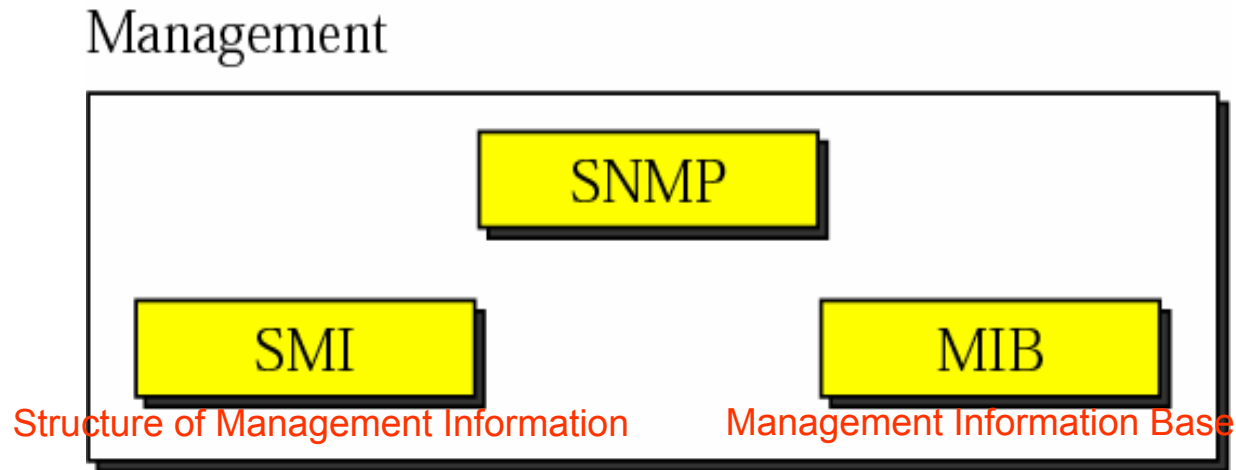
- **CONCEPT**
- **MANAGEMENT COMPONENTS**
- **SMI**
- **MIB**
- **SNMP**
- **MESSAGES**
- **UDP PORTS**
- **SECURITY**

23.1 Concept

- Manager checks Agent's performance
- Manager changes Agent's operating parameters
- Agent reports warnings to Manager



23.2 Components of network management on the Internet

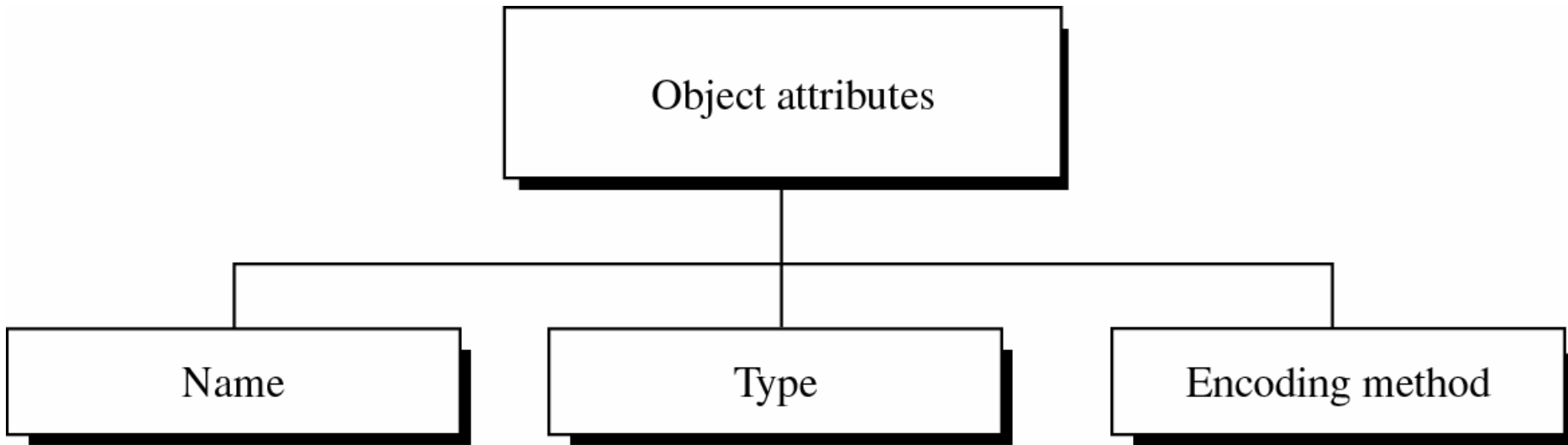


- **SNMP** defines the format of packets exchanged between a manager and an agent. It reads and changes the status (values) of objects (variables) in SNMP packets.
- **SMI** defines the general rules for naming objects, defining object types (including range and length), and showing how to encode objects and values.
 - SMI defines neither the number of objects an entity should manage, nor names the objects to be managed nor defines the association between the objects and their values.
- **MIB** creates a collection of named objects, their types, and their relationships to each other in an entity to be managed.

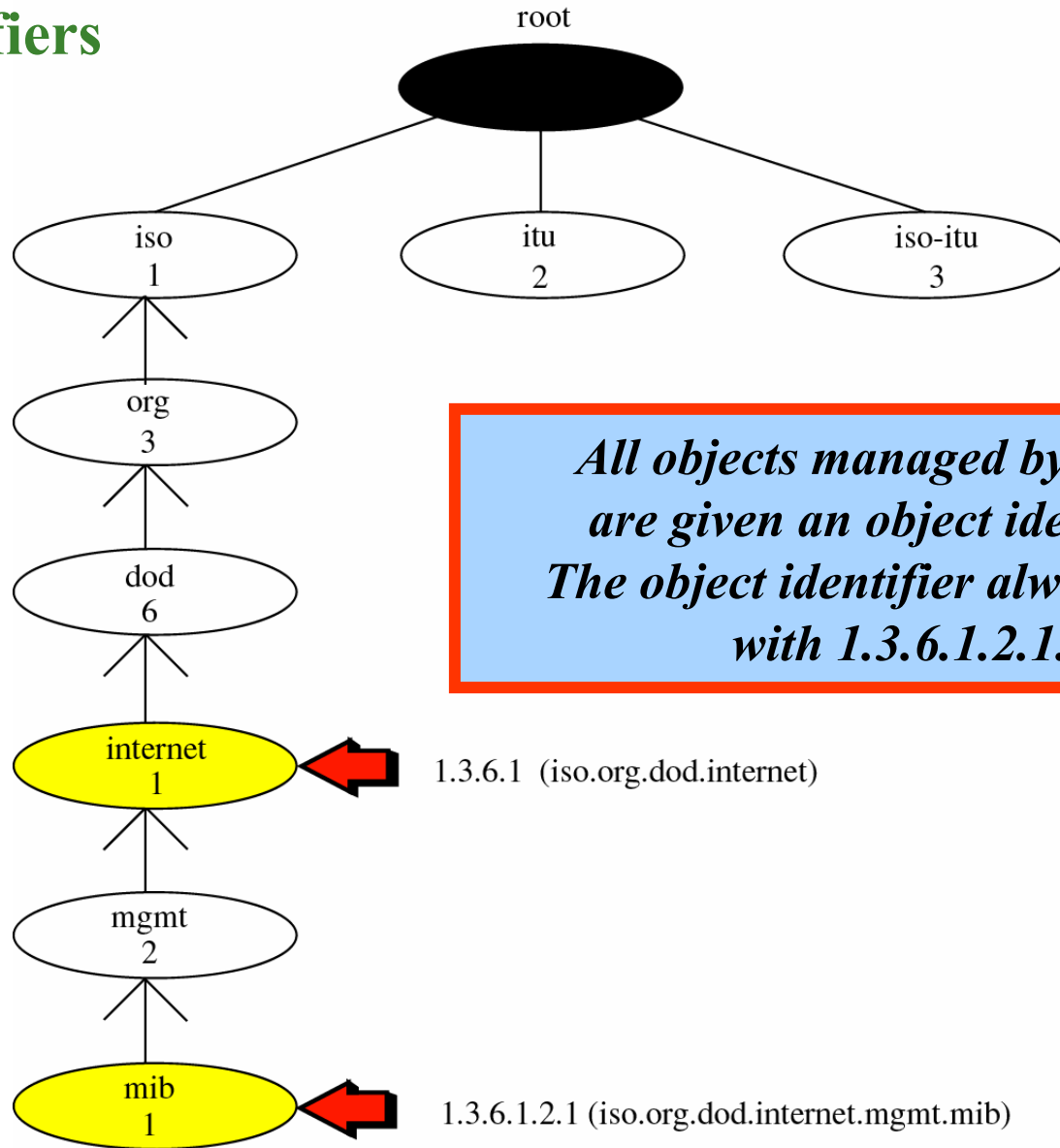
We can compare the task of network management to the task of writing a program.

- 1. Both tasks need rules. In network management this is handled by SMI.**
- 2. Both tasks need variable declarations. In network management this is handled by MIB.**
- 3. Both tasks have actions performed by statements. In network management this is handled by SNMP.**

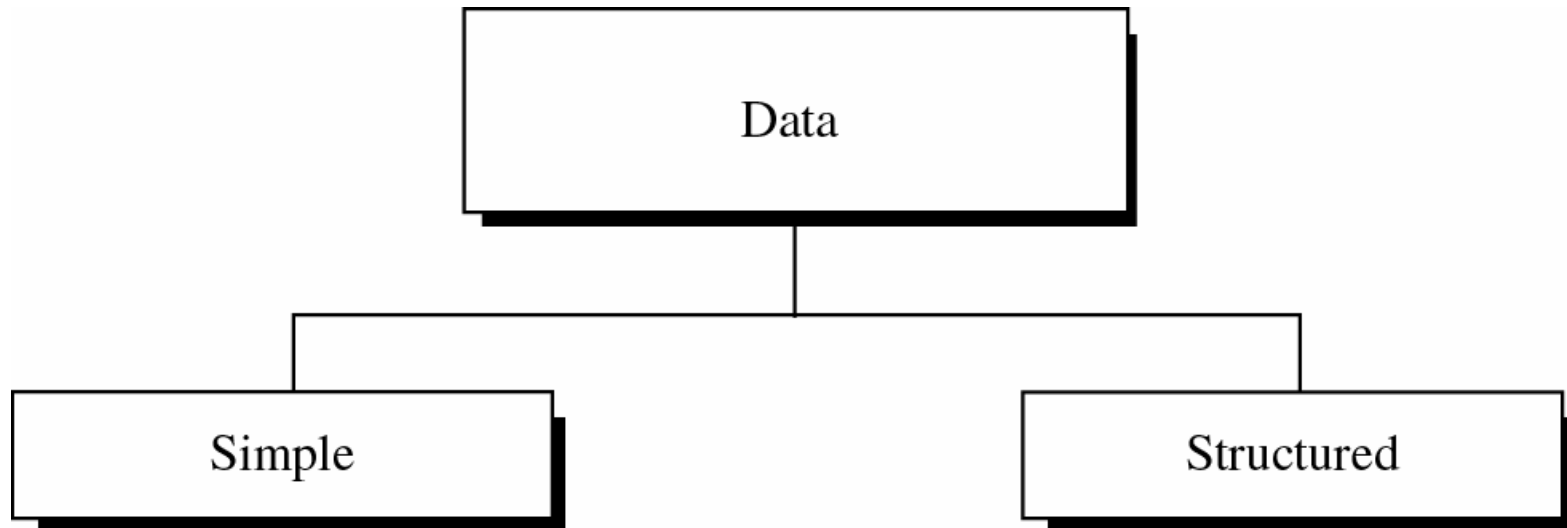
23.3 SMI



Object Identifiers



Data Types



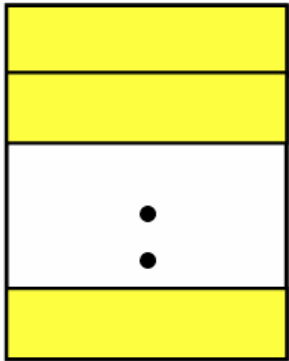
Simple Data Types

Type	Size (in bytes)	Description
INTEGER	4	An integer -2^{31} to $2^{31} - 1$
Integer32	4	Same as INTEGER
Unsigned32	4	0 to $2^{32} - 1$
OCTET STRING	Variable	Byte-string up to 64K Bytes long
OBJECT IDENTIFIER	Variable	An object identifier
IPAddress	4	An IP address
Counter32	4	An integer whose value can be incremented from 0 to $2^{32} - 1$ then wraps back to 0
Counter64	8	A 64-bit counter
Gauge32	4	Same as Counter32 but remains at its maximum value (without wrapping) until it is reset
TimeTicks	4	A counting value that records time in 1/100ths of a second
BITS		A string of bits
Opaque	Variable	Uninterpreted string

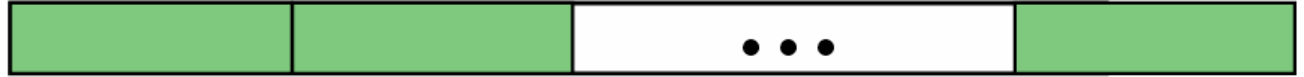
Structured Data Types



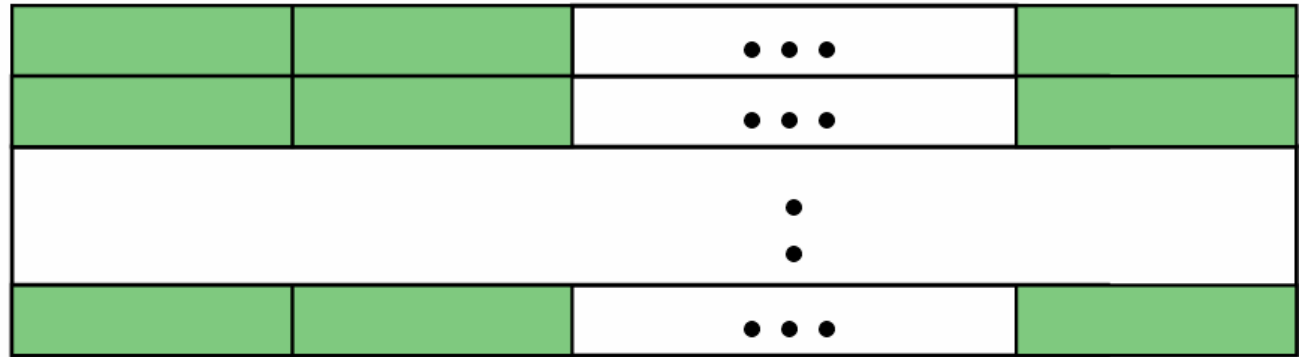
a. Simple variable



b. Sequence of
(simple variables)

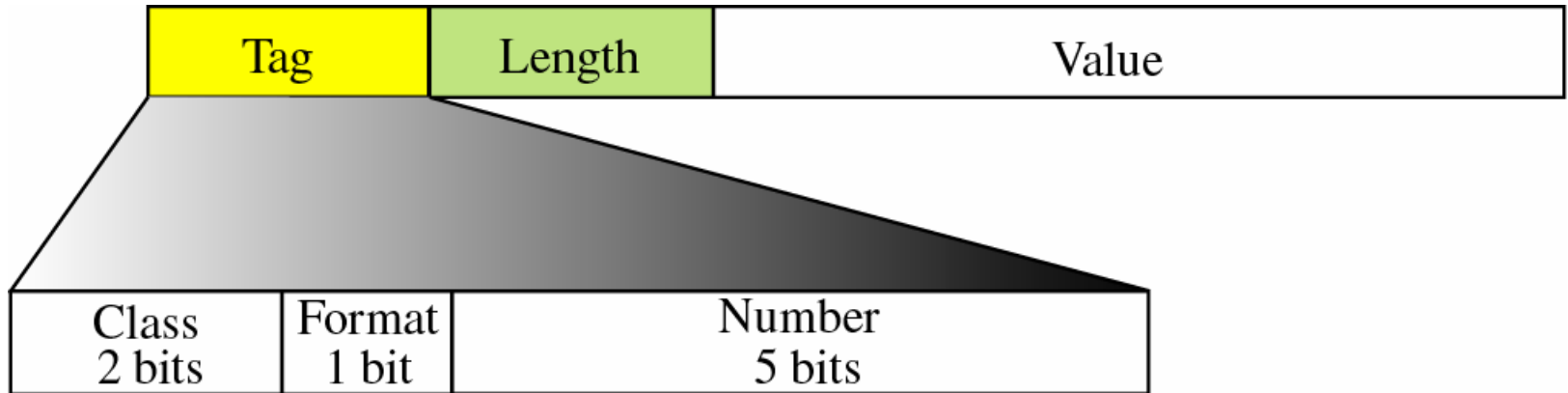


c. Sequence



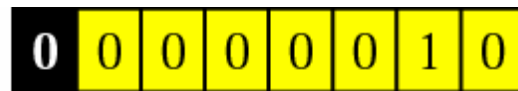
d. Sequence of
(sequences)

TLV Encoding Format

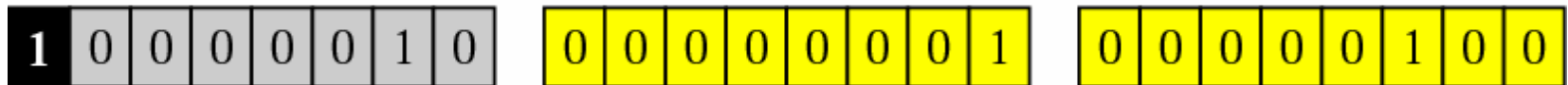


Type	Tag (Hex)	Type	Tag (Hex)
INTEGER	02	IPAddress	40
OCTET STRING	04	Counter	41
OBJECT IDENTIFIER	06	Gauge	42
NULL	05	TimeTicks	43
Sequence, sequence of	30	Opaque	44

Length Format

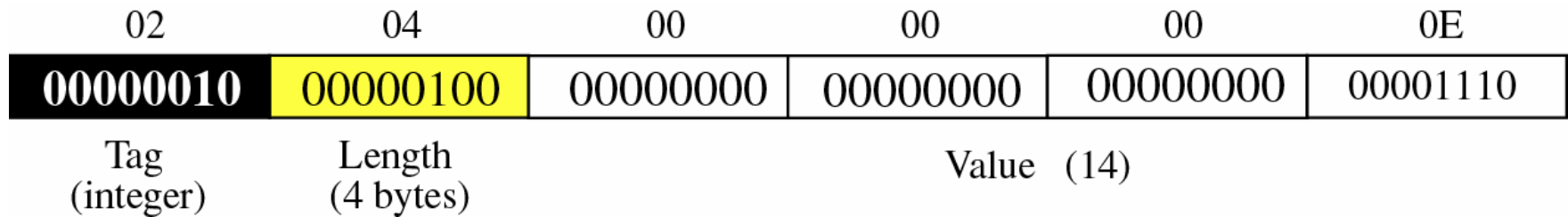


a. The colored part defines the length (2)

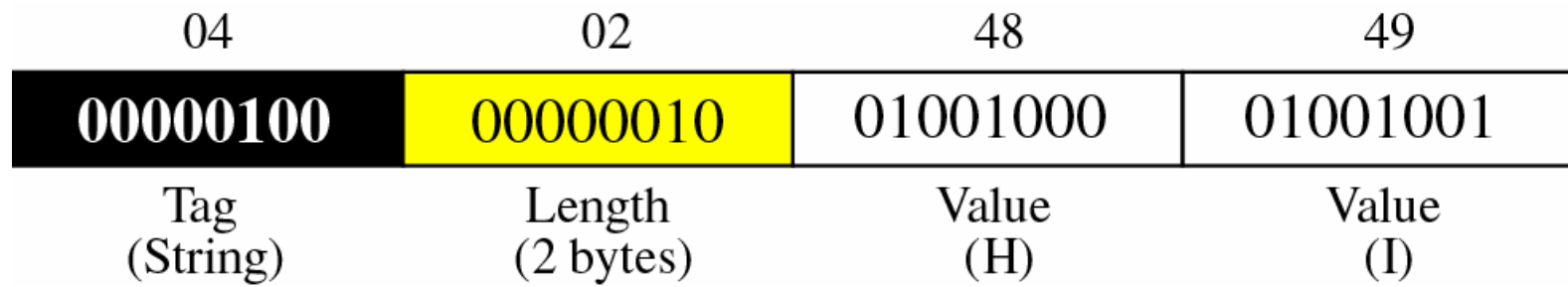


b. The shaded part defines the length of the length (2 bytes);
the colored bytes define the length (260 bytes)

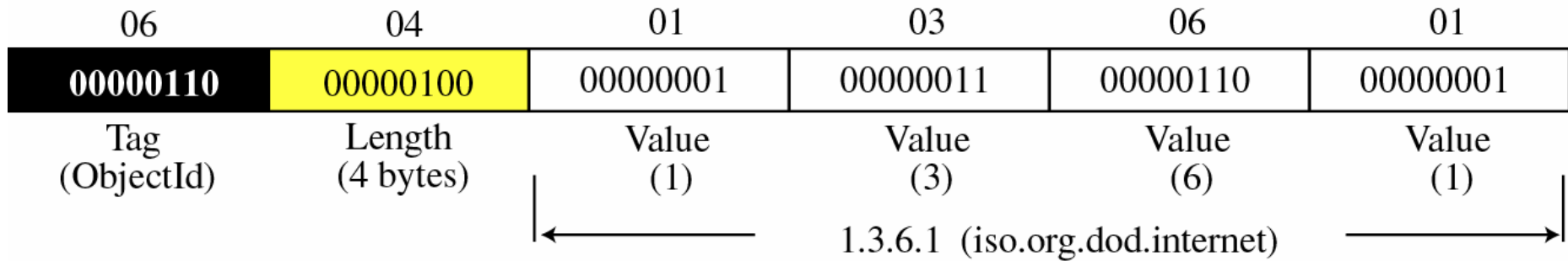
Example 1: The 32-bit INTEGER 14



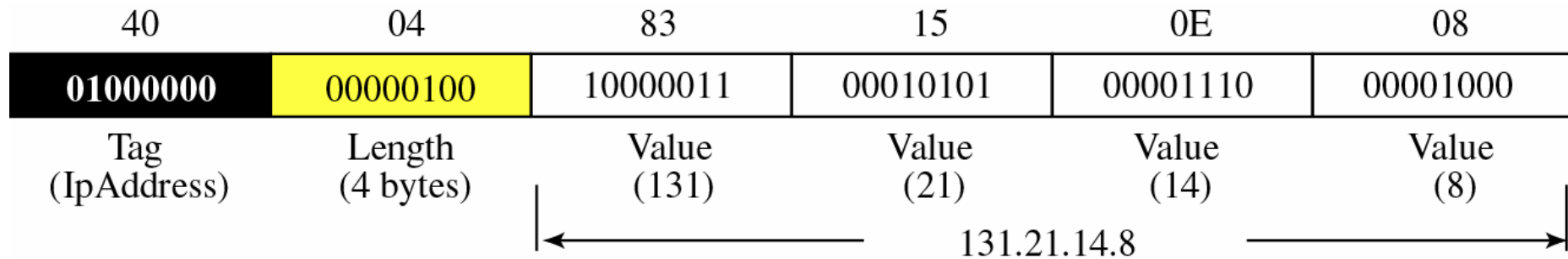
Example 2: OCTET STRING “HI”



Example 3: The ObjectIdentifier 1.3.6.1

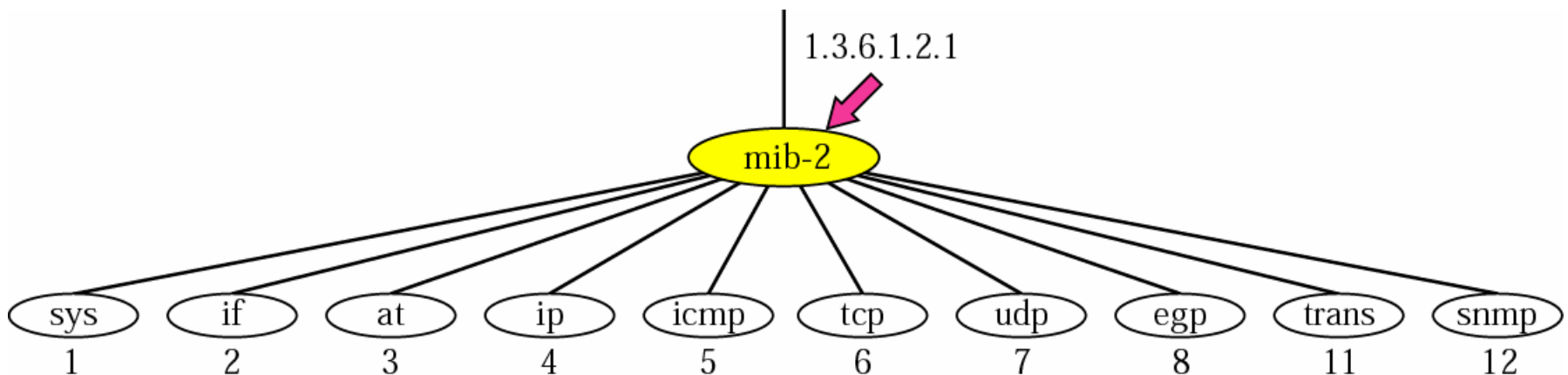


Example 4: The IP Address 131.21.14.8



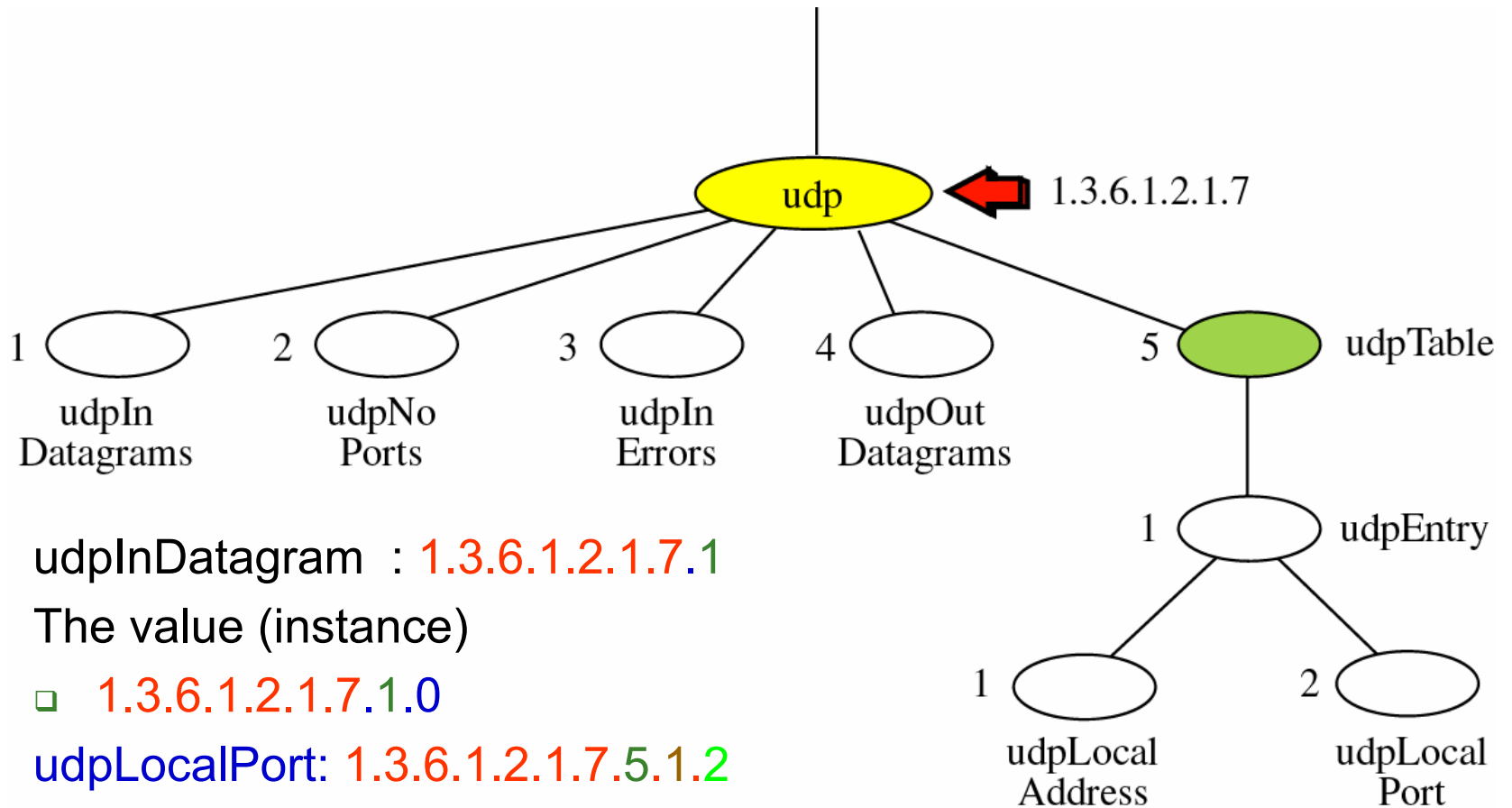
23.4 Management Information Base (MIB ver. 2)

- Each agent (i.e. managed network device) has its own MIB2, a collection of all manageable objects inside the agent.
- MIB2 classifies the objects into 10 groups




Accessing MIB Variable.


Example: UDP MIB2





- udpInDatagram : 1.3.6.1.2.1.7.1
- The value (instance)
 - 1.3.6.1.2.1.7.1.0
- udpLocalPort: 1.3.6.1.2.1.7.5.1.2

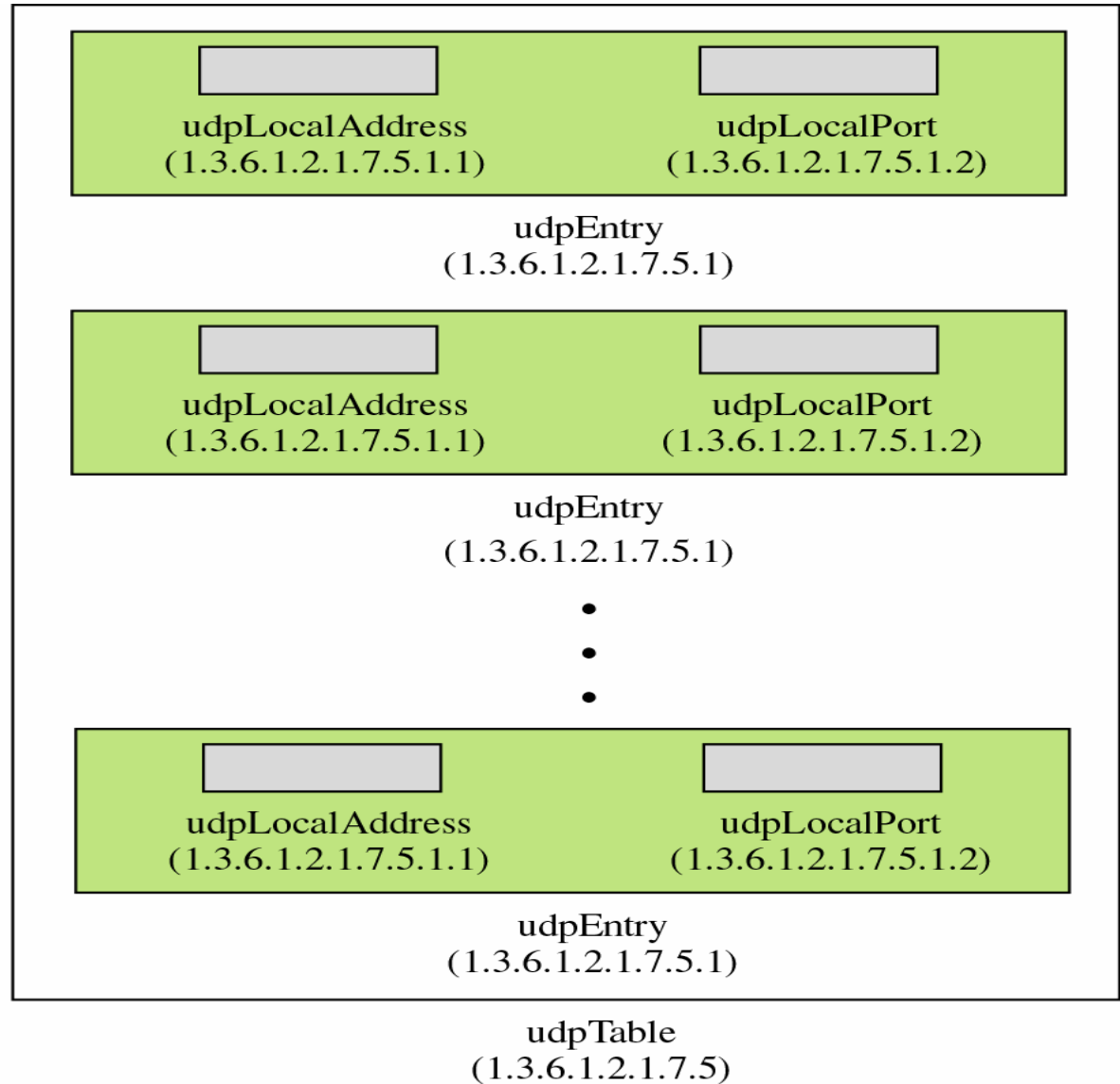
udp variables and tables


udpInDatagrams
(1.3.6.1.2.1.7.1)


udpNoPorts
(1.3.6.1.2.1.7.2)


udpInErrors
(1.3.6.1.2.1.7.3)


udpOutDatagrams
(1.3.6.1.2.1.7.4)



Indexes for udpTable

181.23.45.14

1.3.6.1.2.1.7.5.1.1.181.23.45.14.23

23

1.3.6.1.2.1.7.5.1.2.181.23.45.14.23

192.13.5.10

1.3.6.1.2.1.7.5.1.1.192.13.5.10.161

161

1.3.6.1.2.1.7.5.1.2.192.13.5.10.161

227.2.45.18

1.3.6.1.2.1.7.5.1.1.227.2.45.18.180

180

1.3.6.1.2.1.7.5.1.2.227.2.45.18.180

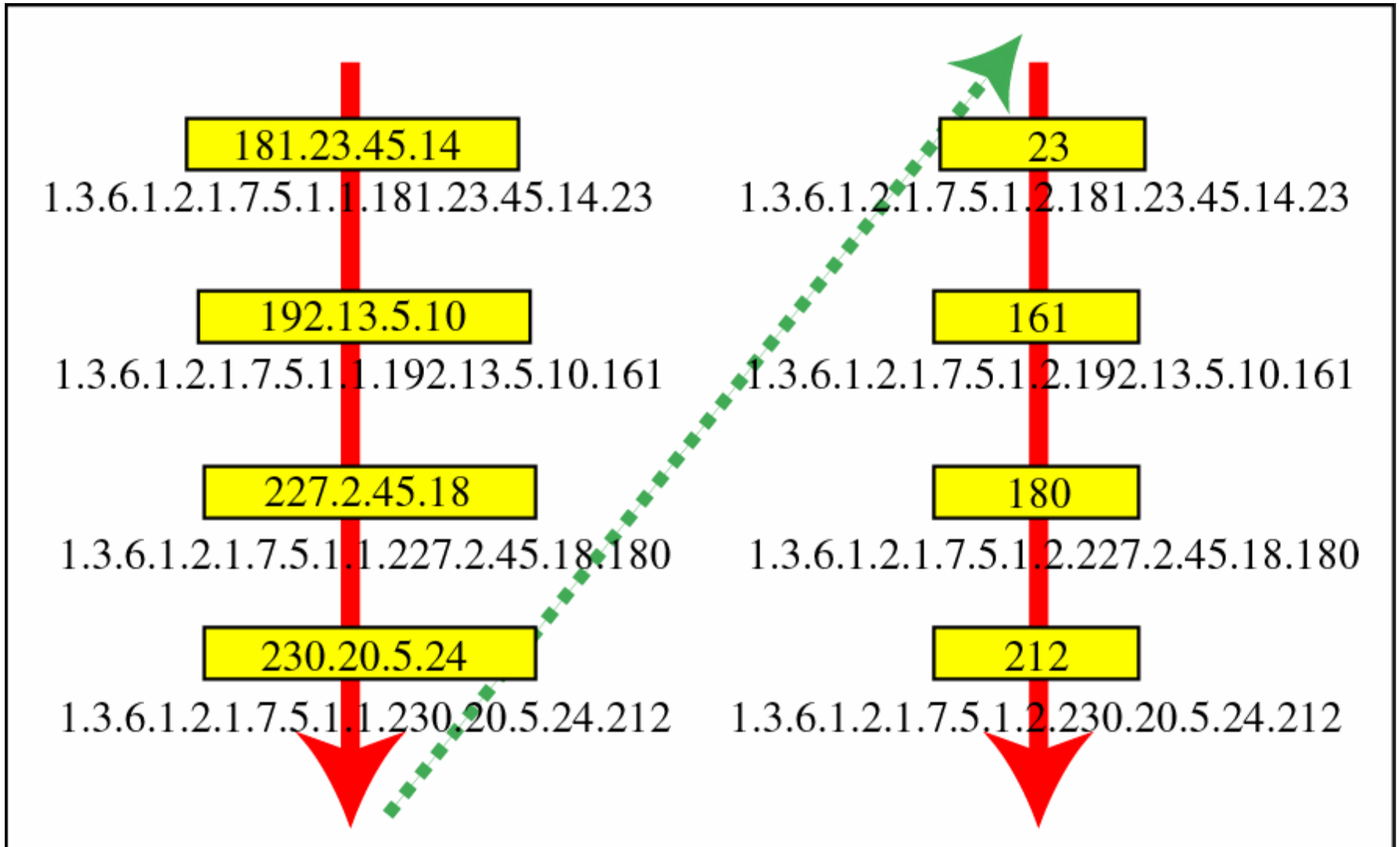
230.20.5.24

1.3.6.1.2.1.7.5.1.1.230.20.5.24.212

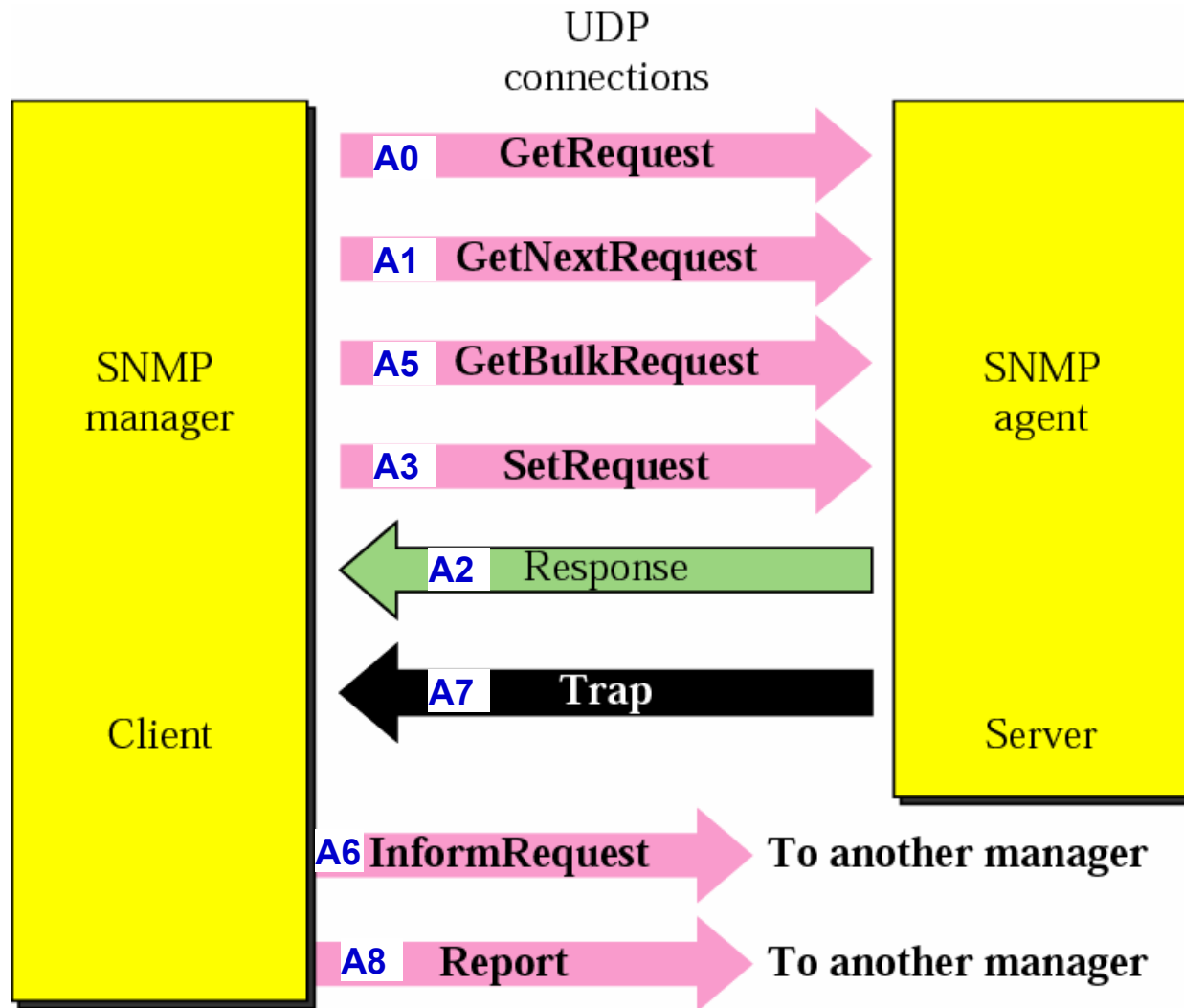
212

1.3.6.1.2.1.7.5.1.2.230.20.5.24.212

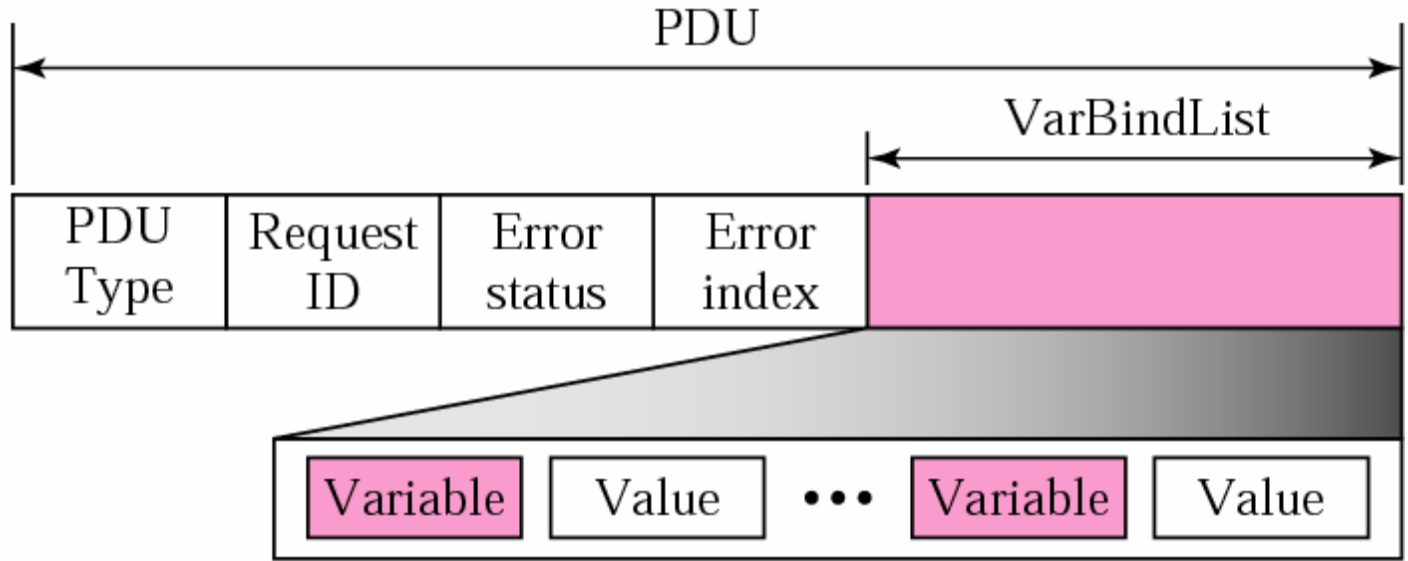
Lexicographic ordering



23.5 SNMP PDUs (8 PDUs)



SNMP PDU format

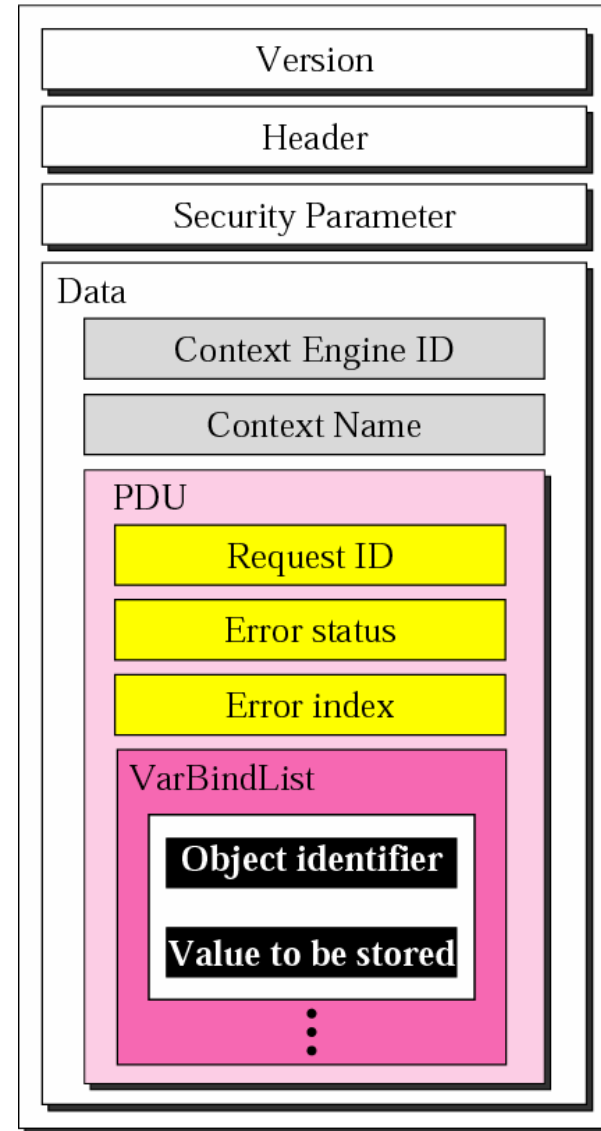


Differences:

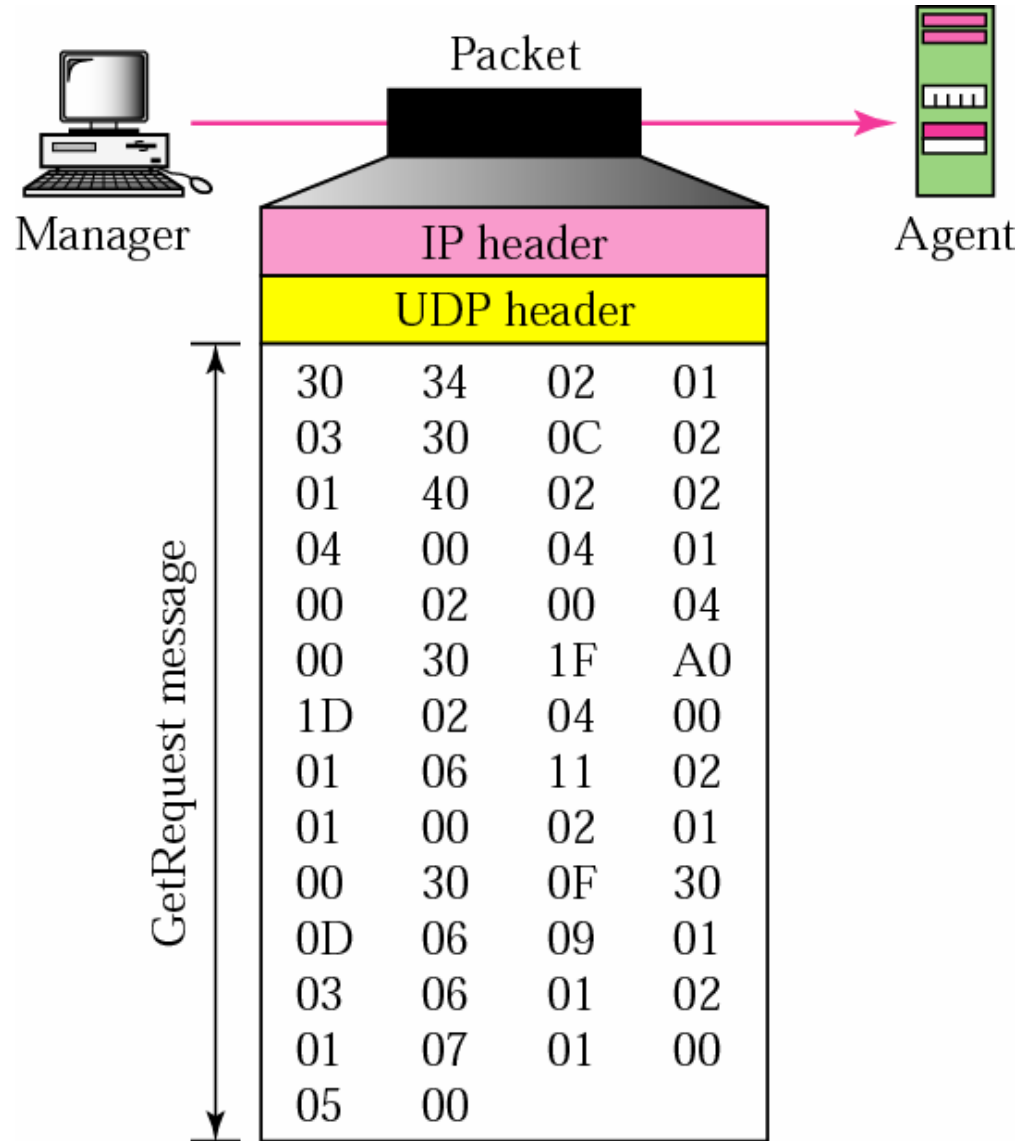
1. Error status and error index values are zeros for all request messages except GetBulkRequest.
2. Error status field is replaced by non-repeater field and error index field is replaced by max-repetitions field in GetBulkRequest.

23.6 SNMP message

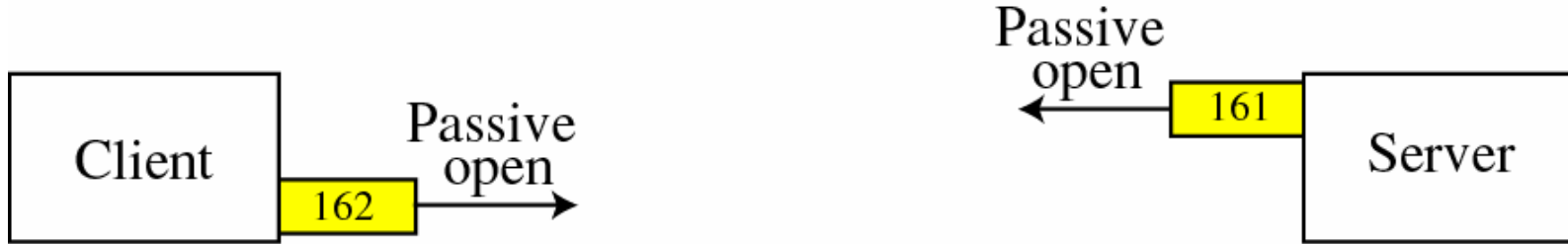
Message



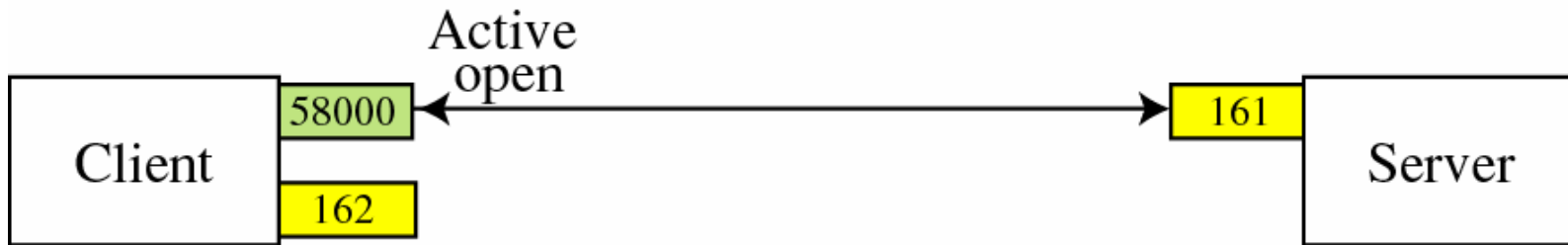
GetRequest message



23.7 Port numbers for SNMP



a. Passive open by both client and server



b. Exchange of request and response messages



c. Sending trap messages by the server