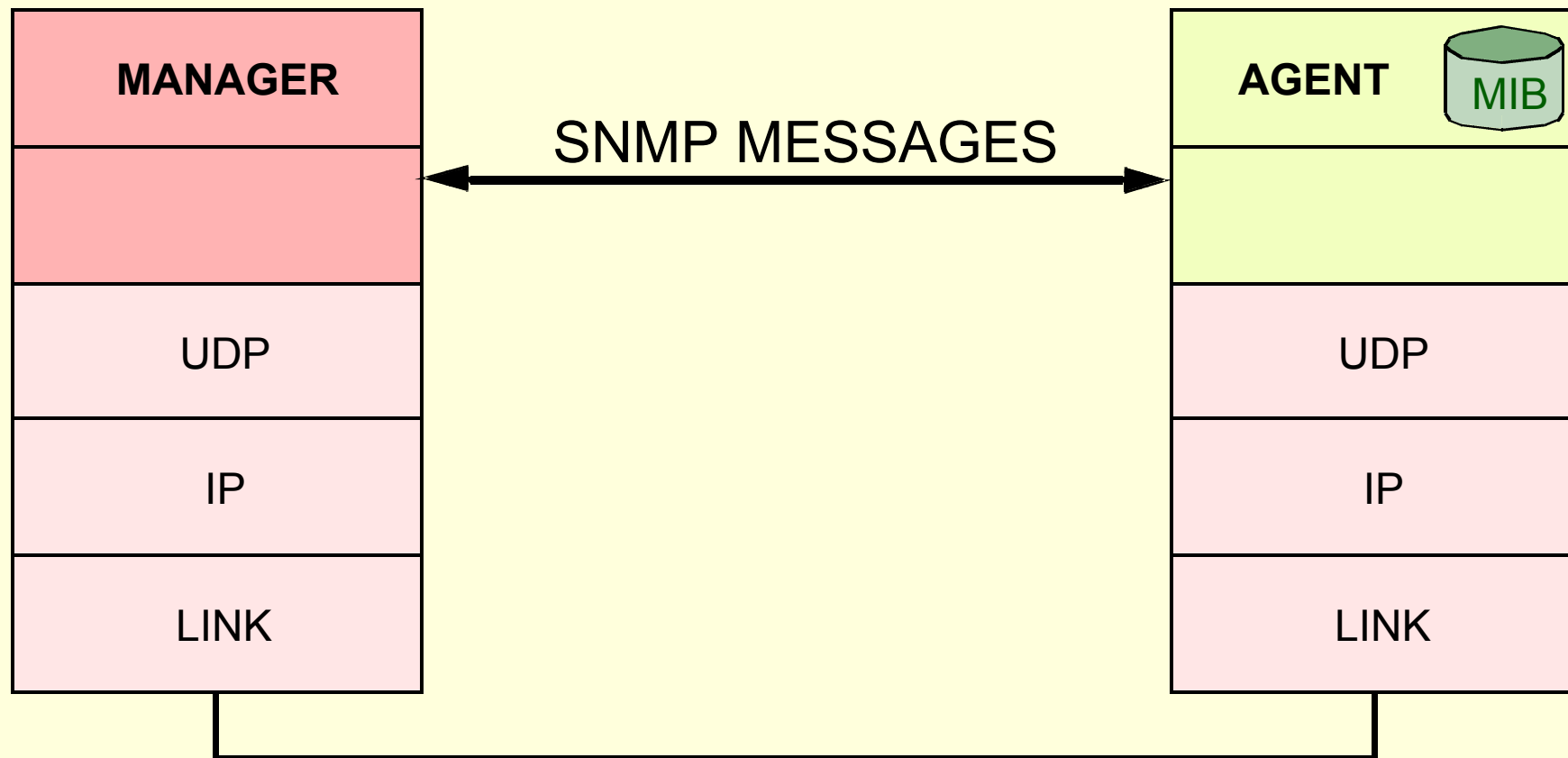


Moderní technologie Internetu

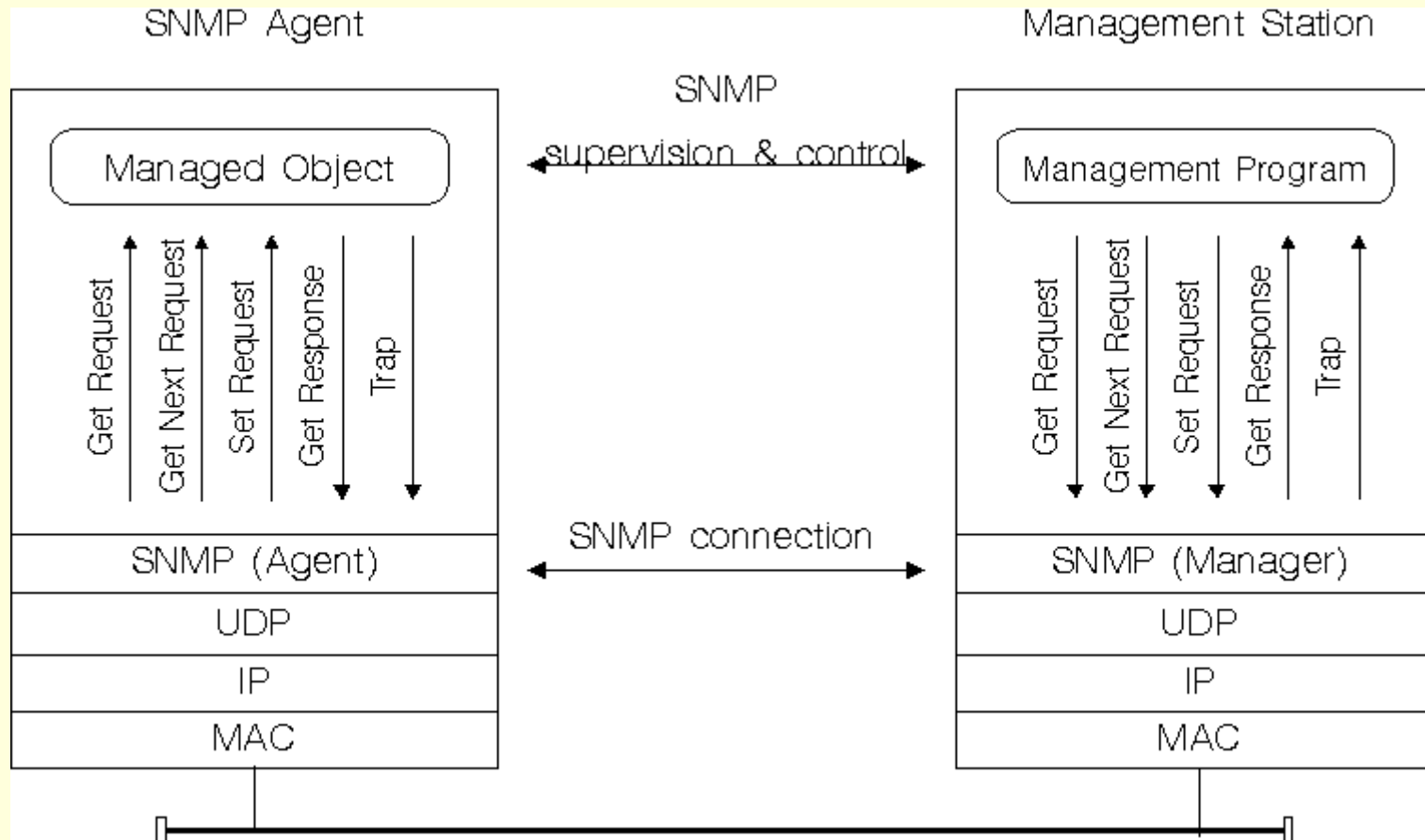
(2)

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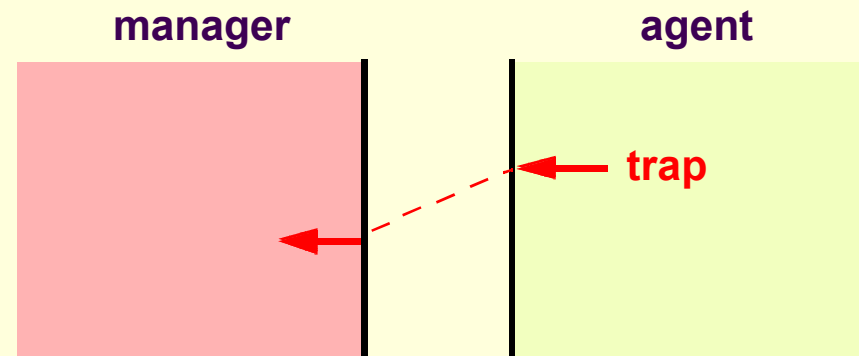
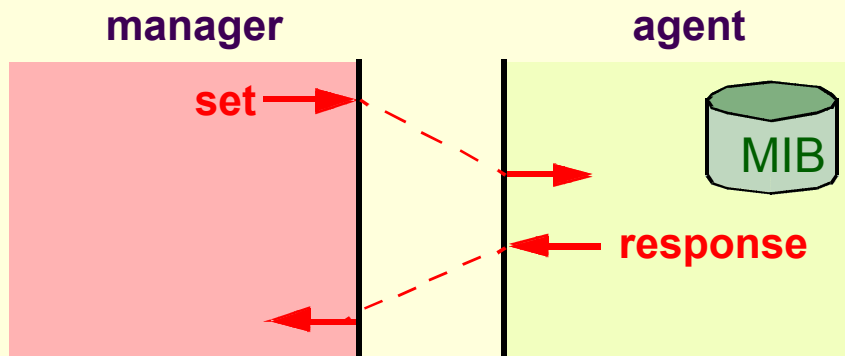
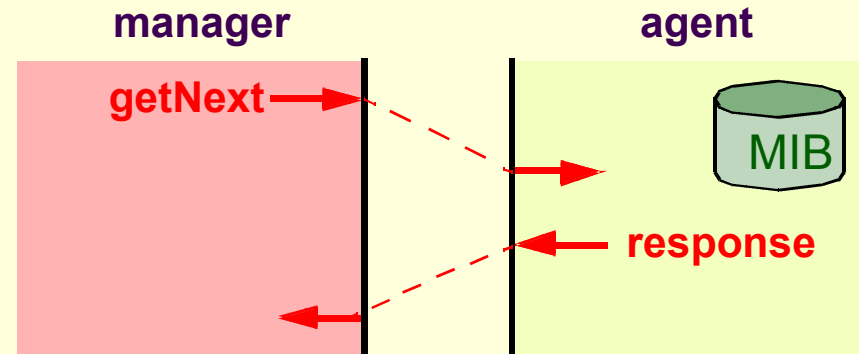
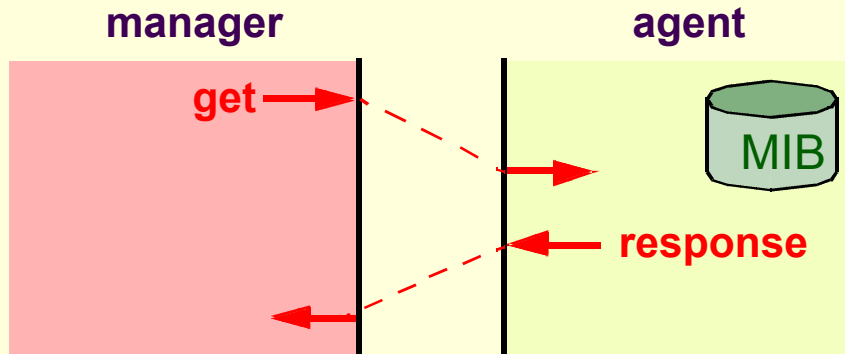
SNMP protokol



SNMP komunikace



SNMP operace



SNMP zprávy

variable bindings:

NAME 1	VALUE 1	NAME 2	VALUE 2	NAME n	VALUE n
--------	---------	--------	---------	-----	-----	----------	-----------

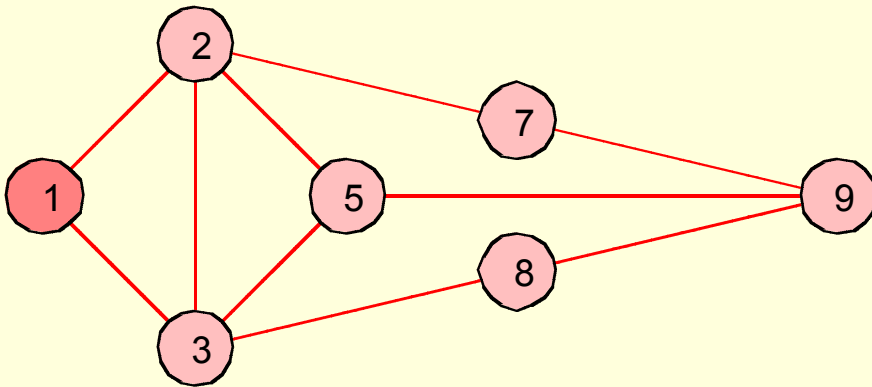
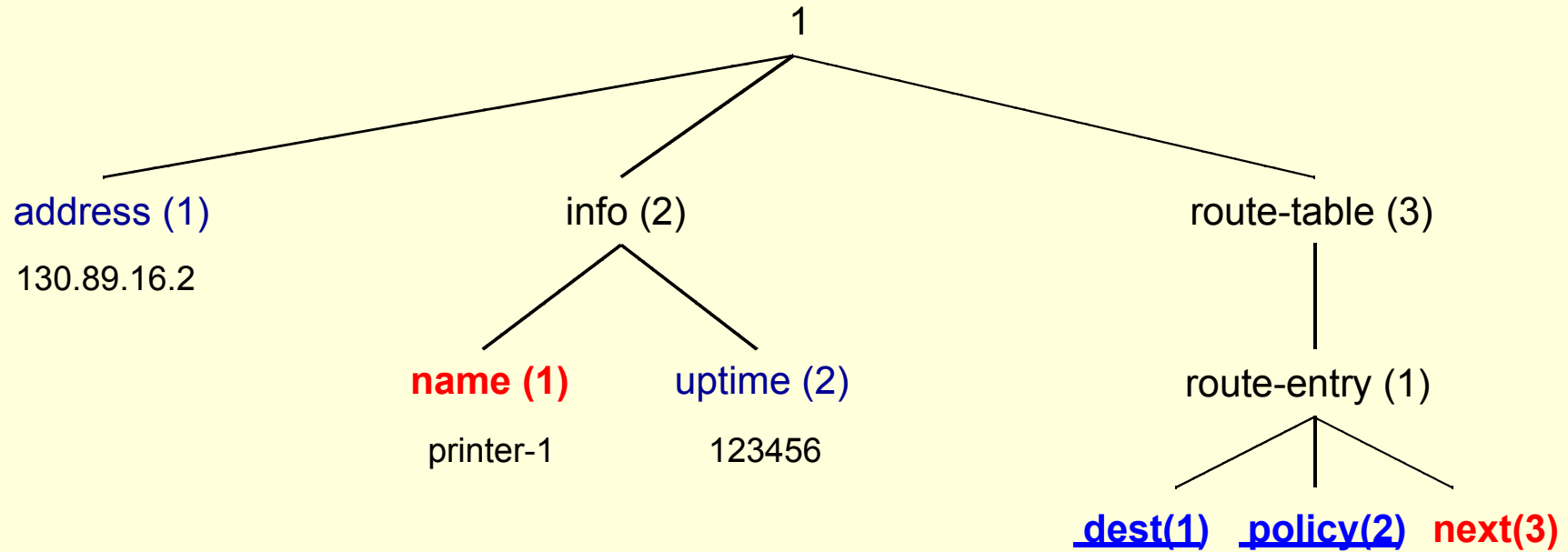
SNMP PDU:

PDU TYPE*	REQUEST ID	ERROR STATUS	ERROR INDEX	VARIABLE BINDINGS
-----------	------------	--------------	-------------	-------------------

SNMP message:

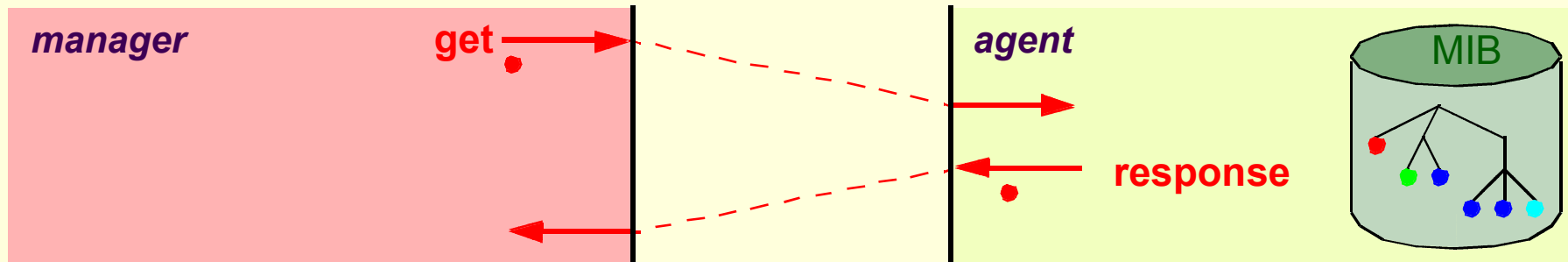
VERSION	COMMUNITY	SNMP PDU
---------	-----------	----------

Příklad



<u>dest(1)</u>	<u>policy(2)</u>	next(3)
2	1	2
3	1	3
5	1	2
5	2	3
7	1	2
8	1	3
9	1	2

Operace get



get(1.1.0)
response(1.1.0 => 130.89.16.2)

get(1.2.0)
response(error-status = noSuchName)

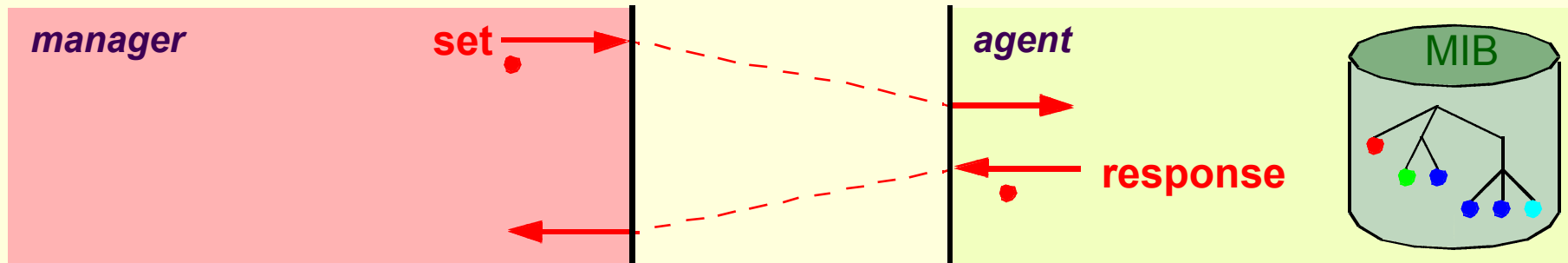
get(1.1.0; 1.2.2.0)
response(1.1.0 => 130.89.16.2; 1.2.2.0 => 123456)

get(1.3.1.3.5.1)
response(1.3.1.3.5.1 => 2)

get(1.3.1.1.5.1)
response(1.3.1.1.5.1 => 5)

get(1.3.1.1.5.1, 1.3.1.2.5.1, 1.3.1.3.5.1)
response(1.3.1.1.5.1 => 5, 1.3.1.2.5.1 => 1, 1.3.1.3.5.1 => 2)

Operace set



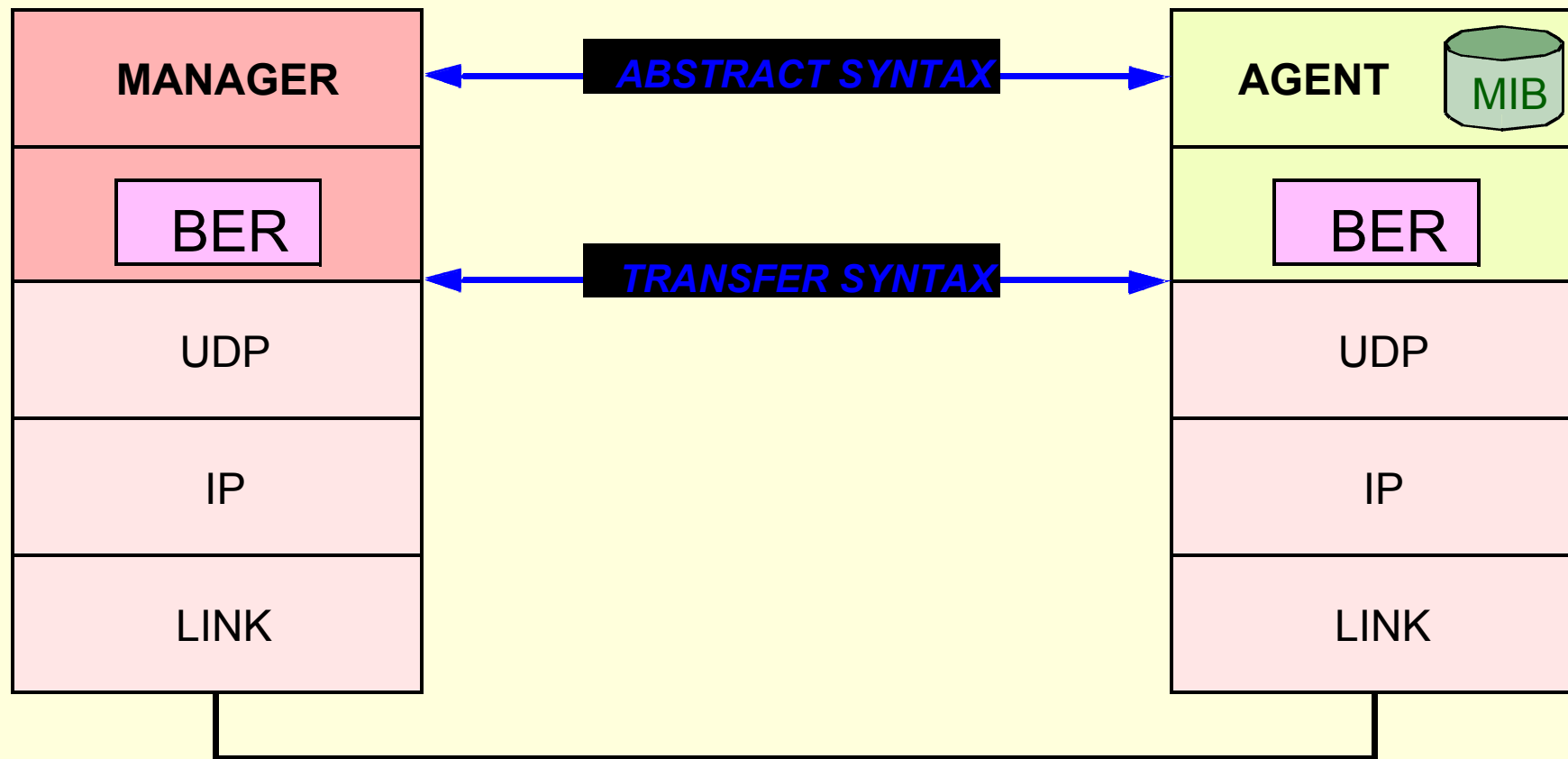
```
set(1.2.1.0 => my-printer)  
response(noError; 1.2.1.0 => my-printer)
```

```
set(1.2.1.0 => my-printer, 1.2.2.0 => 0)  
response(error-status = noSuchName; error-index = 2)
```


Lexikografické uspořádání

INSTANCE ID	INSTANCE VALUE
1.1.0	130.89.16.2
1.2.1.0	printer-1
1.2.2.0	123456
1.3.1.1.2.1	2
1.3.1.1.3.1	3
1.3.1.1.5.1	5
...	...
1.3.1.1.9.1	9
1.3.1.2.2.1	1
1.3.1.2.3.1	1
...	...
1.3.1.2.9.1	1
1.3.1.3.2.1	2
...	...

Kódování SNMP

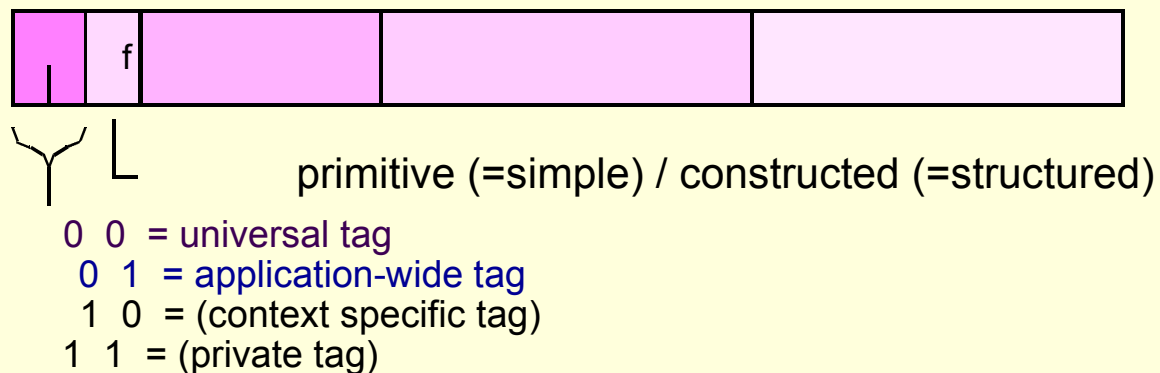


BER - Basic Encoding Rules

kódování ASN.1



ASN.1 - definice typu



Universal tags

BIT PATTERN	ASN.1 TYPE
00 0 0 0010	INTEGER
00 0 0 0100	OCTET STRING
00 0 0 0110	OBJECT IDENTIFIER

Application-wide tags

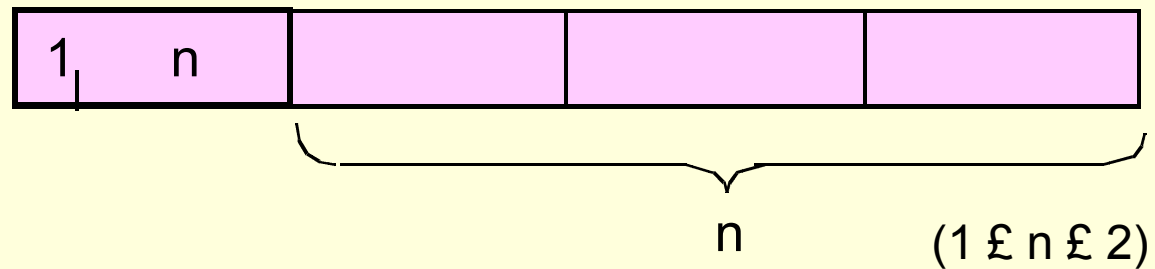
BIT PATTERN	APPLICATION TYPE
01 0 0 0000	IpAddress
01 0 0 0001	Counter32
01 0 0 0010	Gauge32
01 0 0 0010	Unsigned32
01 0 0 0011	TimeTicks
01 0 0 0100	Opaque
01 0 0 0110	Counter64

ASN.1 - definice délky

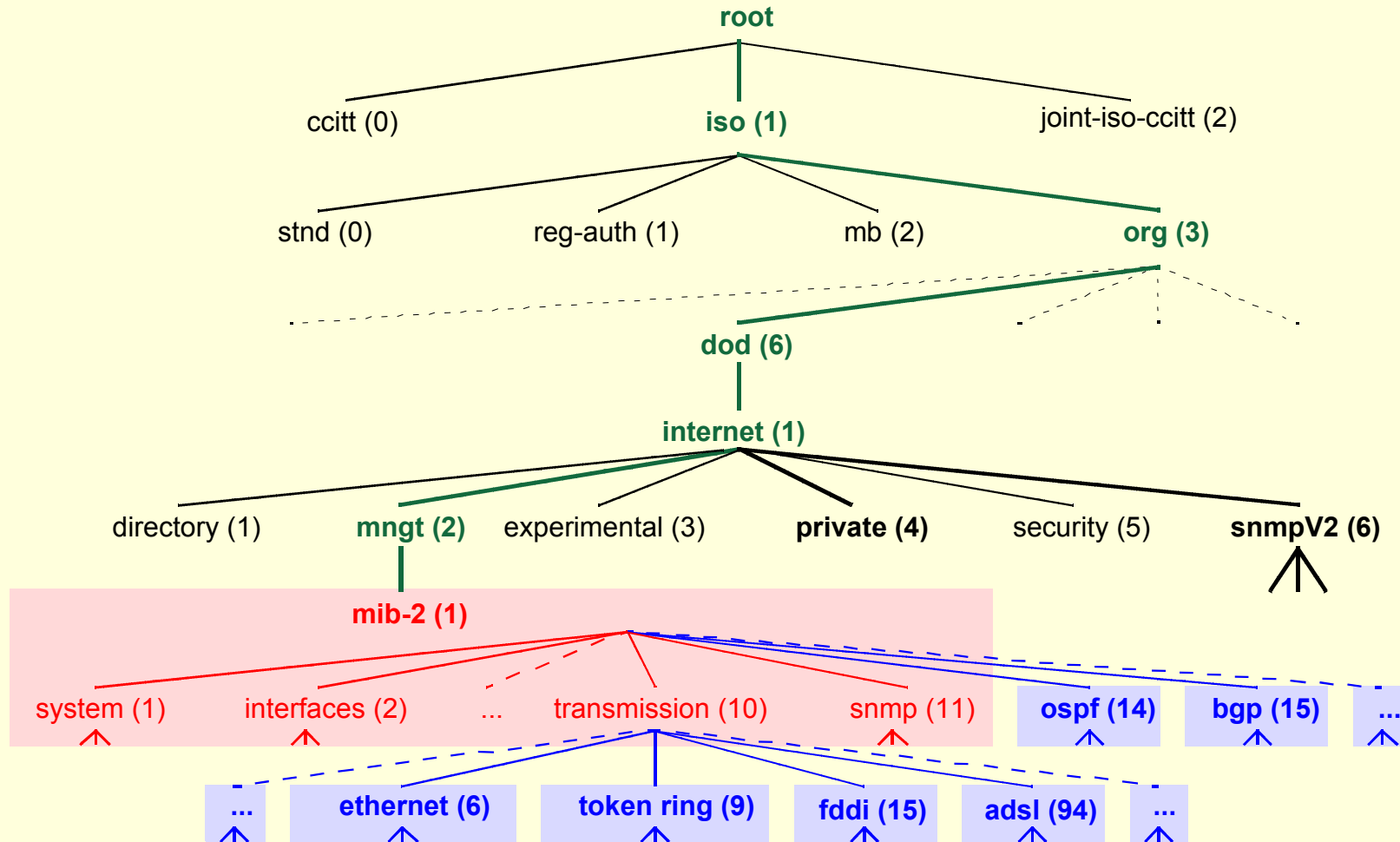
SHORT FORM:



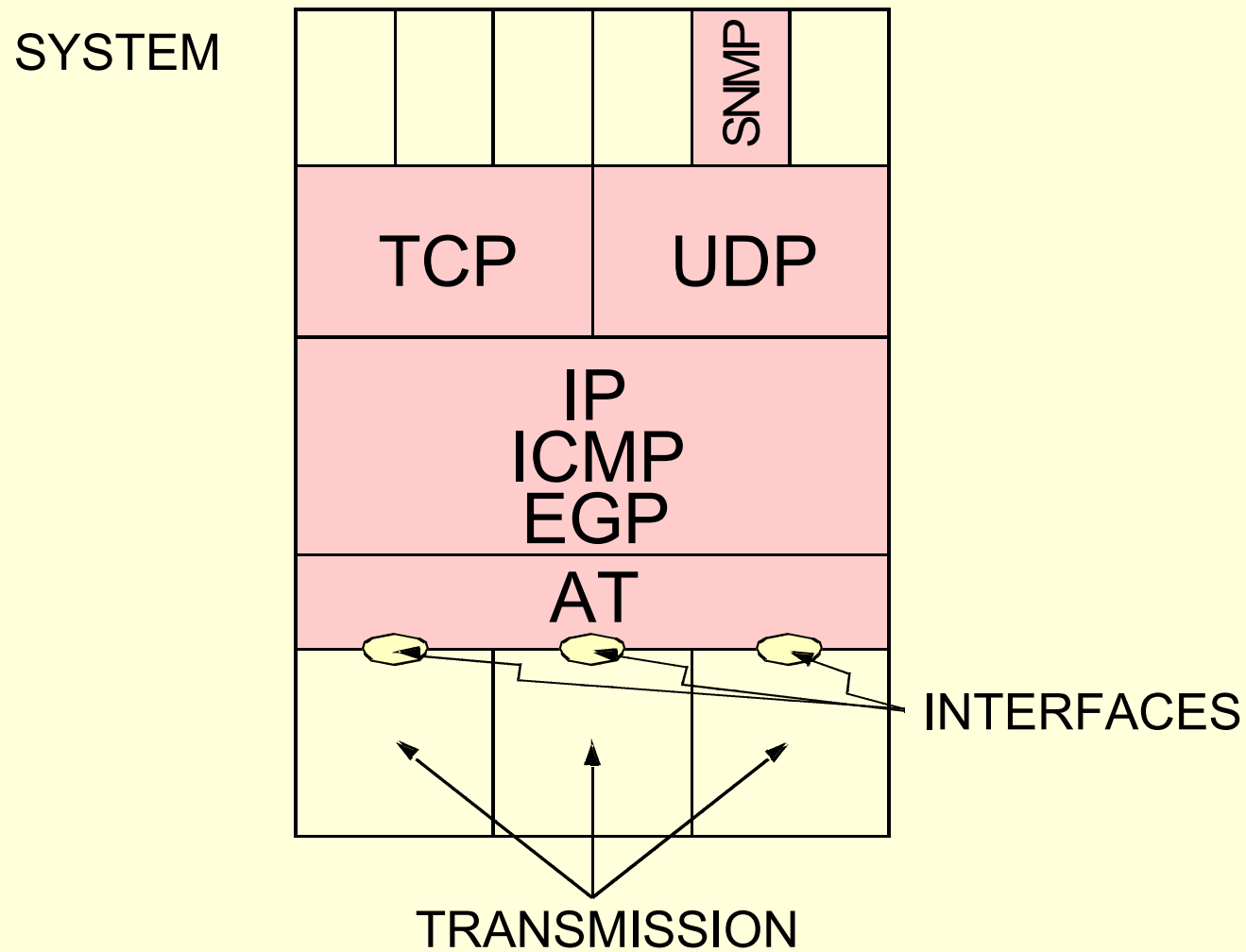
LONG FORM:



Hierarchie MIB



MIB-II - Protokoly



MIB-II - Protokoly

SYSTEM GROUP SNMPv2 MIB (RFC 1907)

INTERFACES (IF) GROUP IF-MIB (RFC 2863)

ADDR. TRANSLATION GROUP deprecated

IP & ICMP GROUPS IP-MIB (RFC 2011)

TCP GROUP TCP-MIB (RFC 2012)

UDP GROUP UDP-MIB (RFC 2013)

EGP GROUP outdated (BGP)

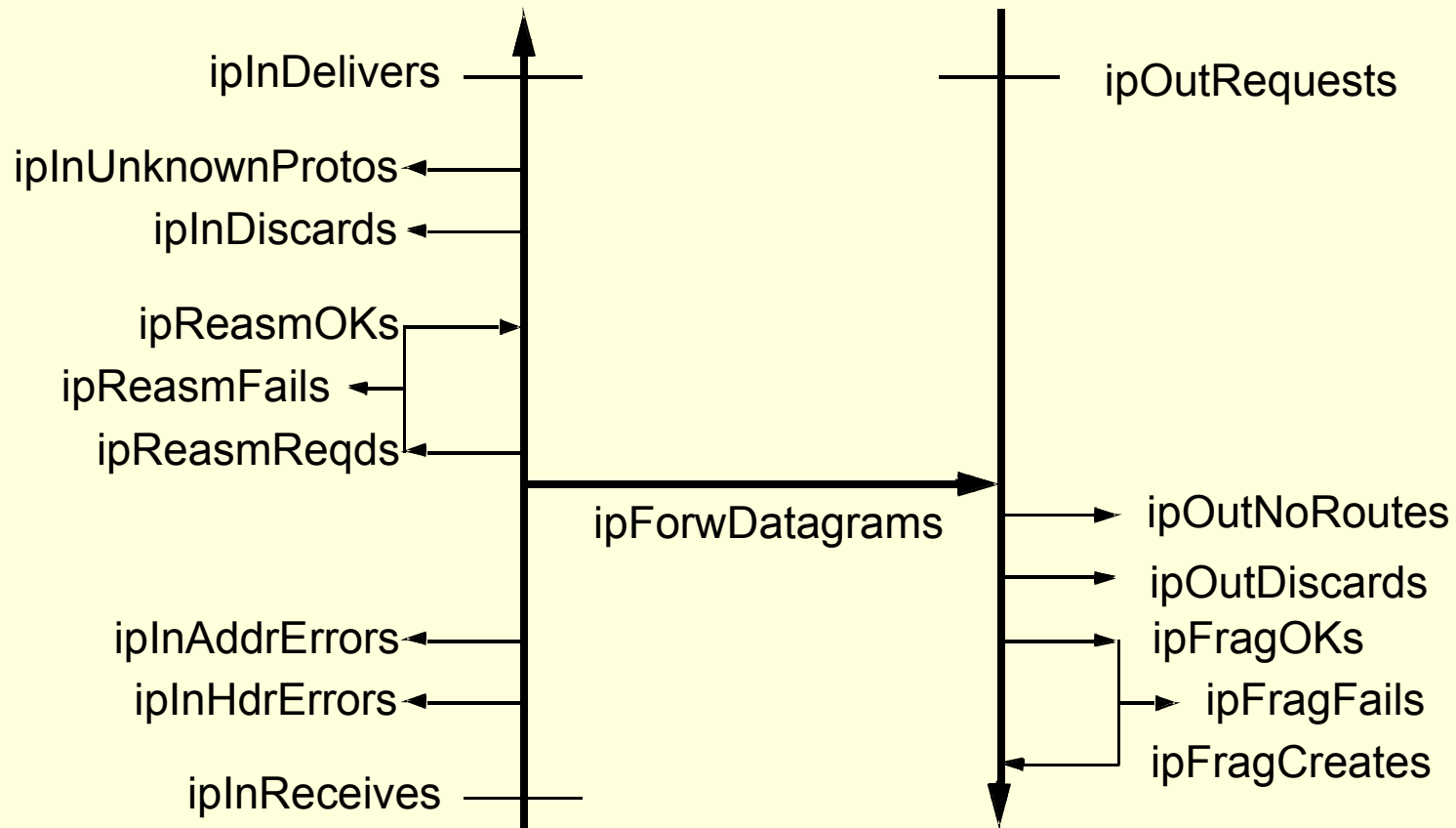
TRANSMISSION GROUP IS PLACEHOLDER

SNMP GROUP SNMPv2 MIB (RFC 1907)

IP MIB - Tabulka adres

ipAdEntAddr	ipAdEntIfIndex	ipAdEntNetMask	ipAdEntBcastAddr	ipAdEntReasmMaxSize
192.89.16.4	1	255.255.255.0	1	65535
192.89.16.8				

IP MIB - Čítače paketů



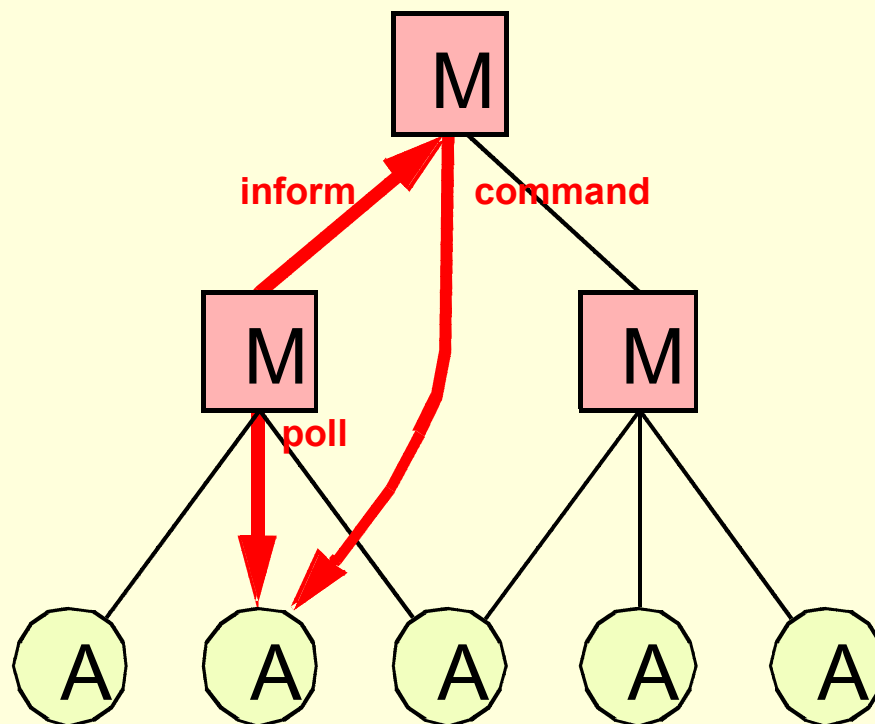
IP MIB - ARP tabulka

ipNetToMedia IfIndex	ipNetToMedia PhysAddress	ipNetToMedia NetAddress	ipNetToMedia Type
1	08:00:20:00:25:66	129.14.16.4	3 (dynamic)
2			

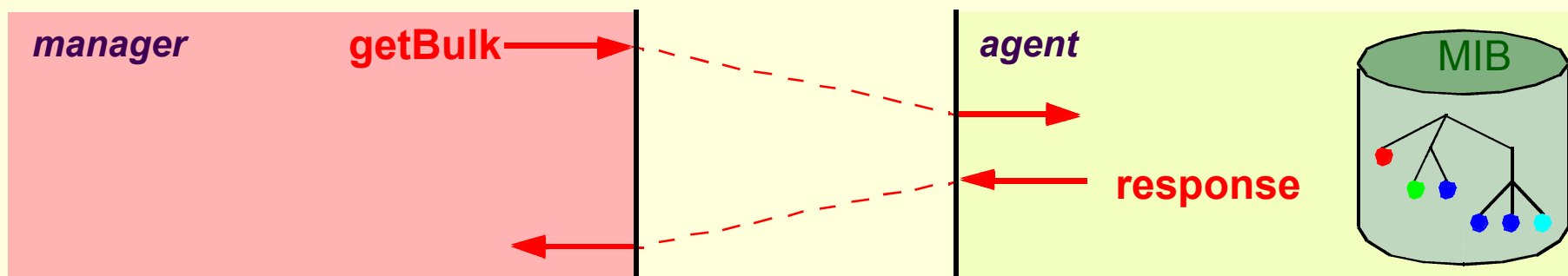
IP MIB - Směrovací tabulka

ipRouteDest	ipRouteNextHop	ipRouteIfIndex	ipRouteMask	ipRouteType	ipRouteMetric1	ipRouteMetric2	ipRouteMetric3	ipRouteMetric4	ipRouteMetric5	ipRouteAge	ipRouteProto	ipRouteInfo
129.14.16.4	129.16.1.7	1	255.255.0.0	3							ospf	● →
												● →
192.89.16.8												● →

SNMPv2 - Basic idea



SNMPv2 - getBulk



SBNMPv2 - getBulk

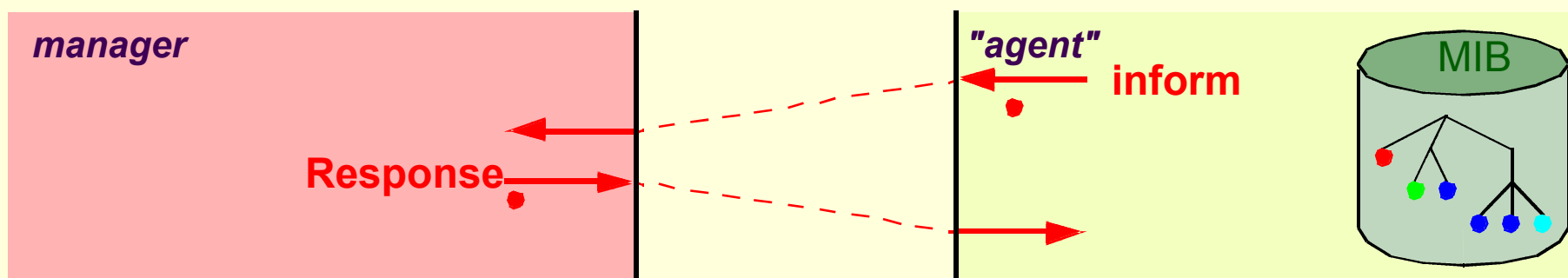
getBulk(max-repetitions = 4; 1.1)

**response(1.1.0 => 130.89.16.2
1.2.1.0 => printer-1
1.2.2.0 => 123456
1.3.1.1.2.1 => 2)**

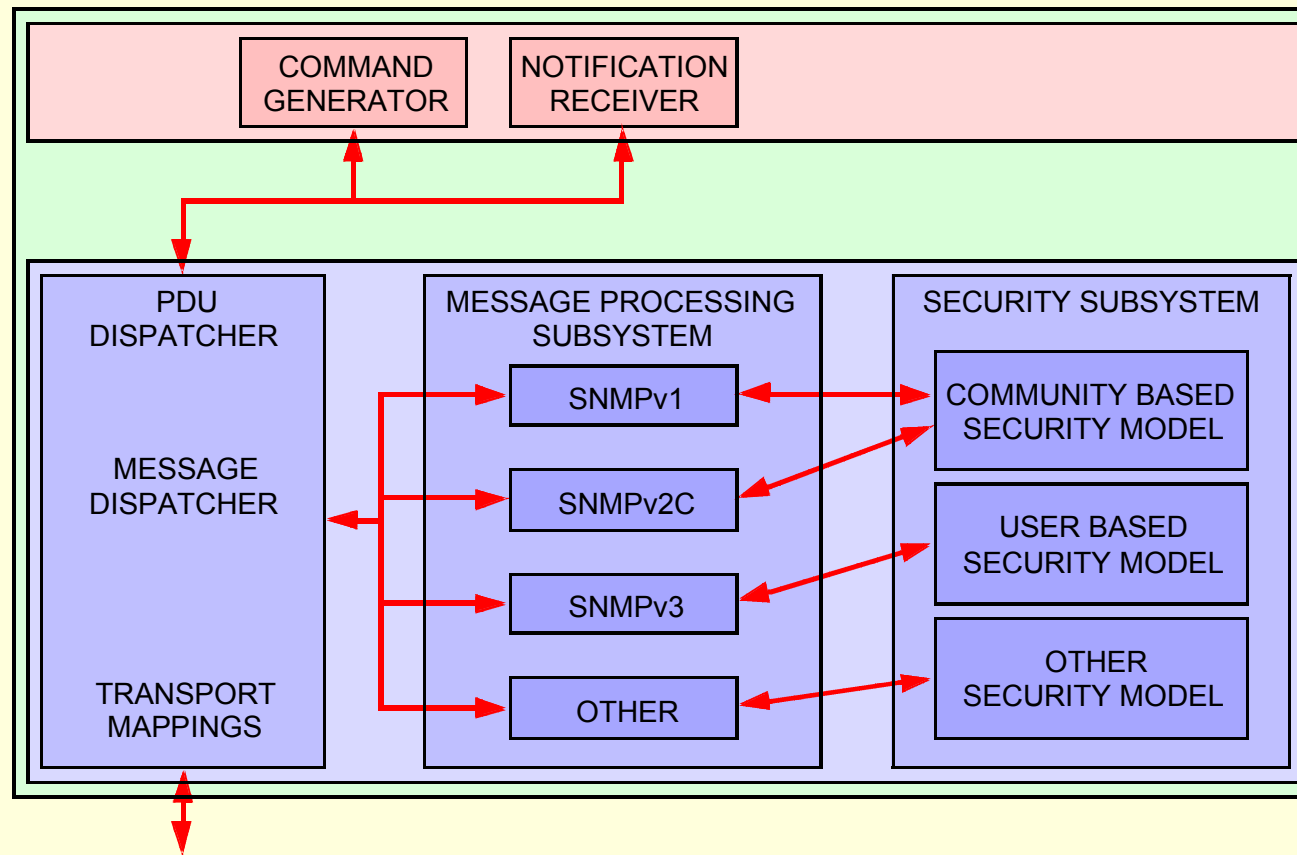
getBulk(max-repetitions = 3; 1.3.1.1; 1.3.1.2; 1.3.1.3)

**response(1.3.1.1.2.1 => 2; 1.3.1.2.2.1 => 1; 1.3.1.3.2.1 => 2
1.3.1.1.3.1 => 3; 1.3.1.2.3.1 => 1; 1.3.1.3.3.1 => 3
1.3.1.1.5.1 => 5; 1.3.1.2.5.1 => 1; 1.3.1.3.5.1 => 2)**

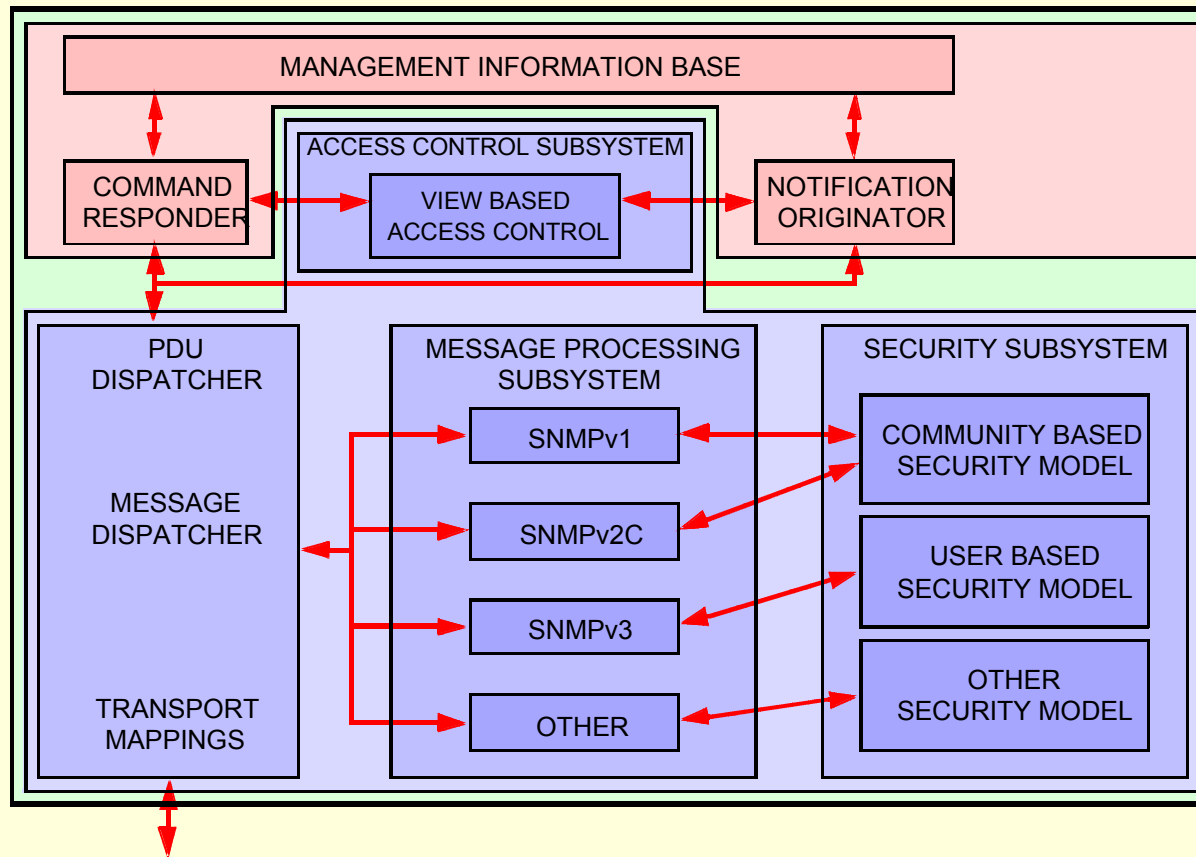
SNMPv2 - Inform



SNMPv3 - Manager



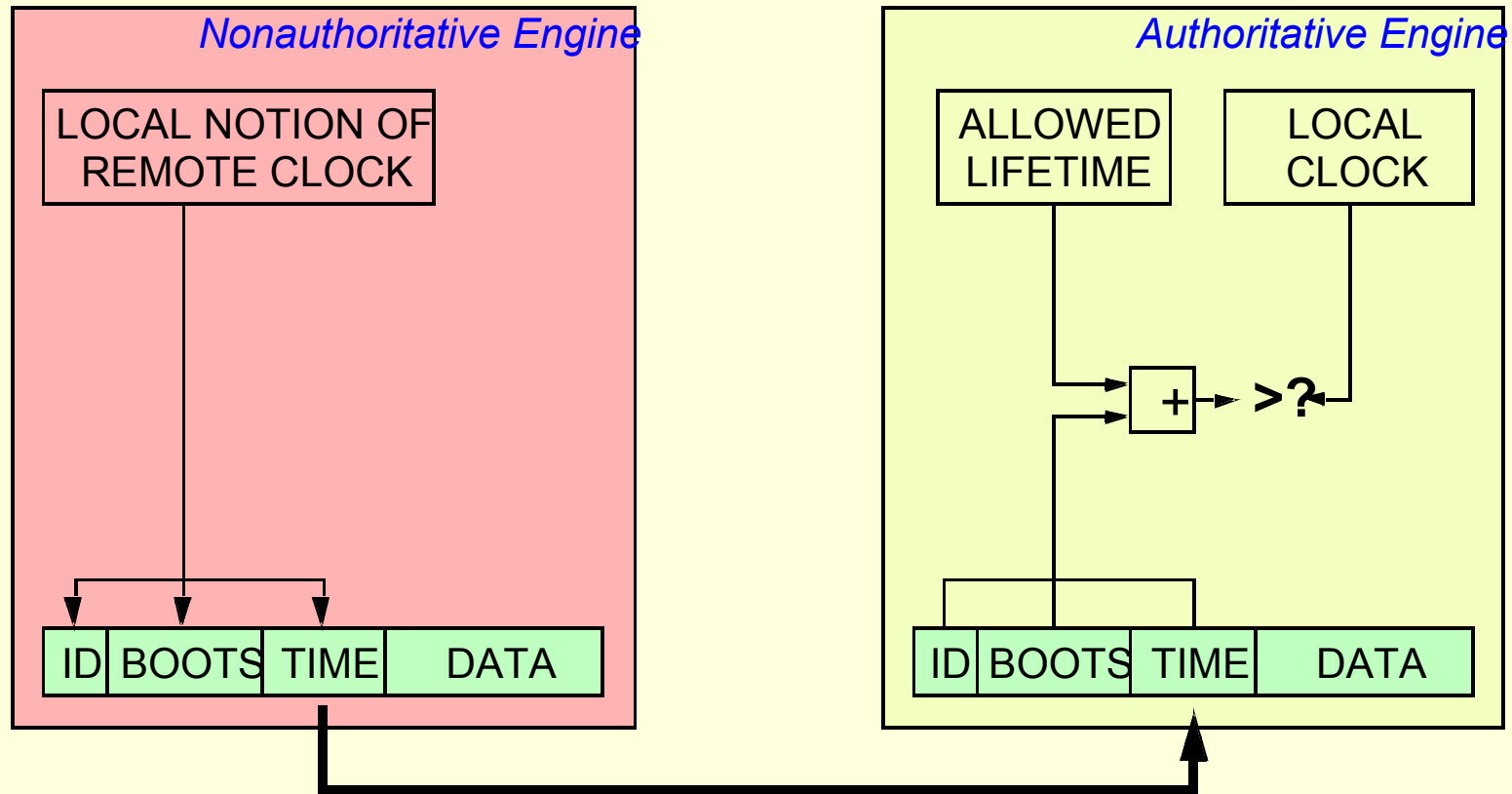
SNMPv3 - Agent



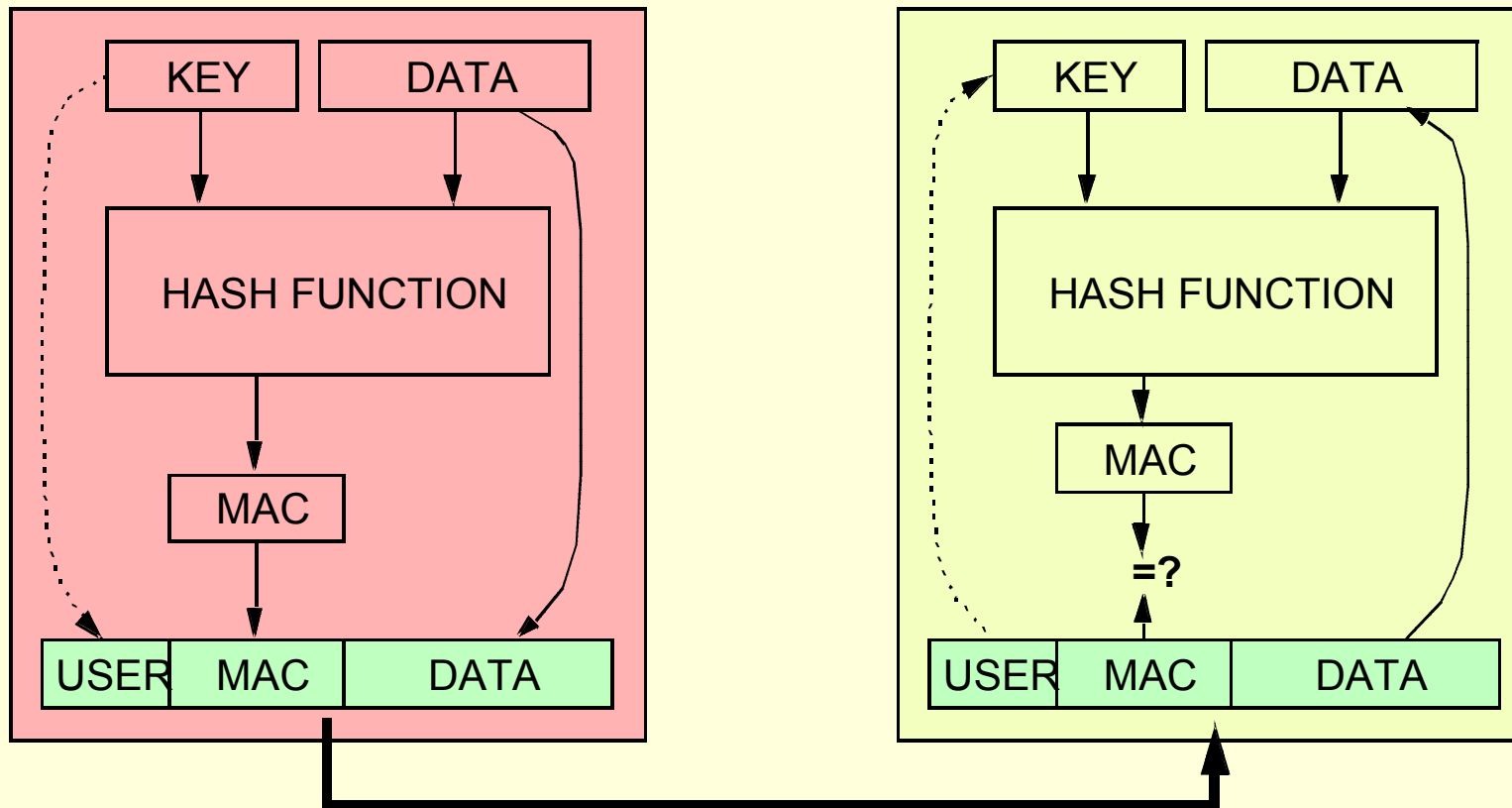
SNMPv3 - Bezpečnost

THREAT	ADDRESSED?	MECHANISM
REPLAY	YES	TIME STAMP
MASQUERADE	YES	MD5 / SHA-1
INTEGRITY	YES	(MD5 / SHA-1)
DISCLOSURE	YES	DES
DENIAL OF SERVICE	YES	
TRAFFIC ANALYSIS	YES	

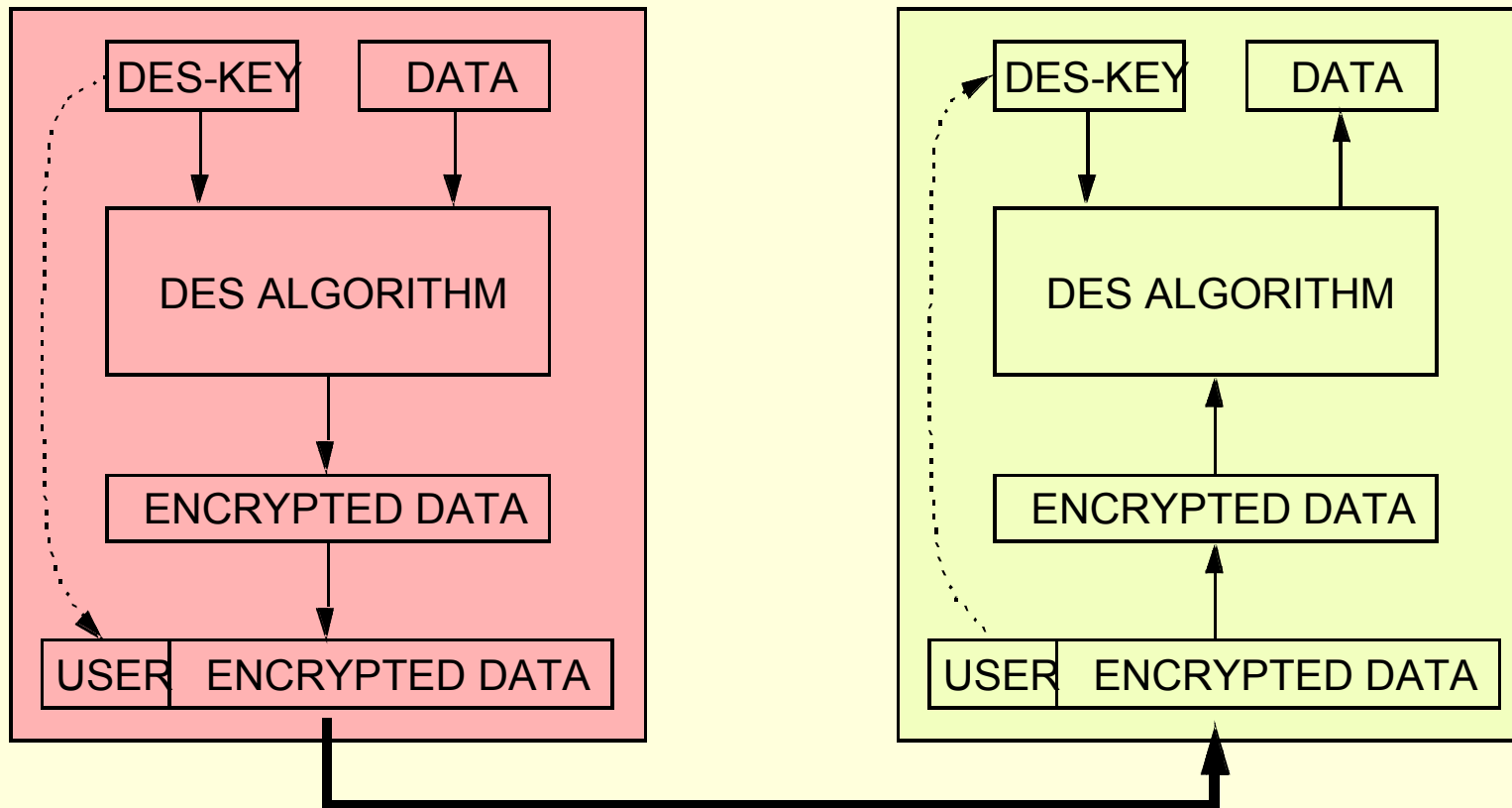
SNMPv3 - Reply protection



SNMPv3 - Authentication



SNMPv3 - Encryption

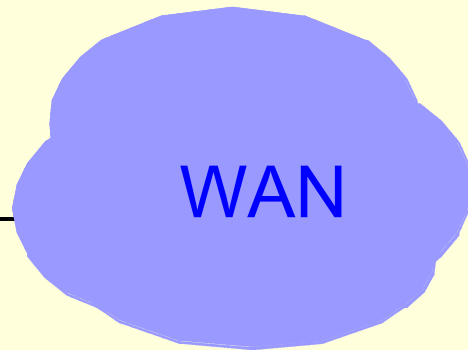
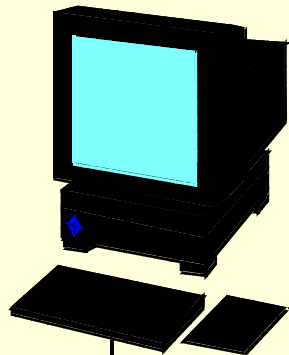


SNMPv3 - Access Control

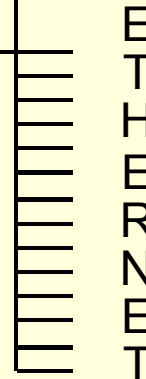
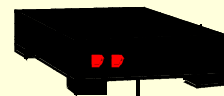
MIB VIEW	ALLOWED OPERATIONS	ALLOWED MANAGERS	REQUIRED LEVEL OF SECURITY
Interface Table	SET	John	Authentication Encryption
Interface Table	GET / GETNEXT	John, Paul	Authentication
Systems Group	GET / GETNEXT	George	None
...
...
...
...

RMON - Groups

MANAGER



RMON



- statistics
- history
- host
- host top N
- traffic matrix
- alarms
- filters
- packet capture
- events

RMON - Statistics

Counts

Packets

Oktets

Broadcasts

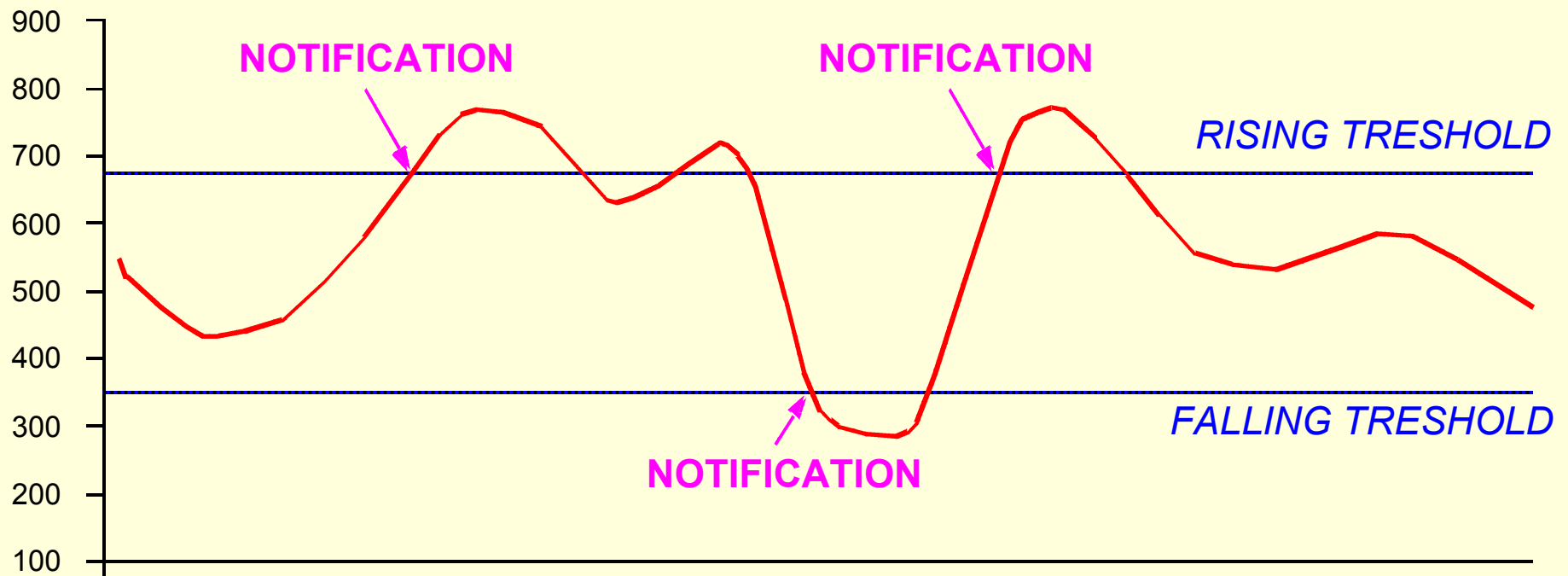
Multicasts

Collisions

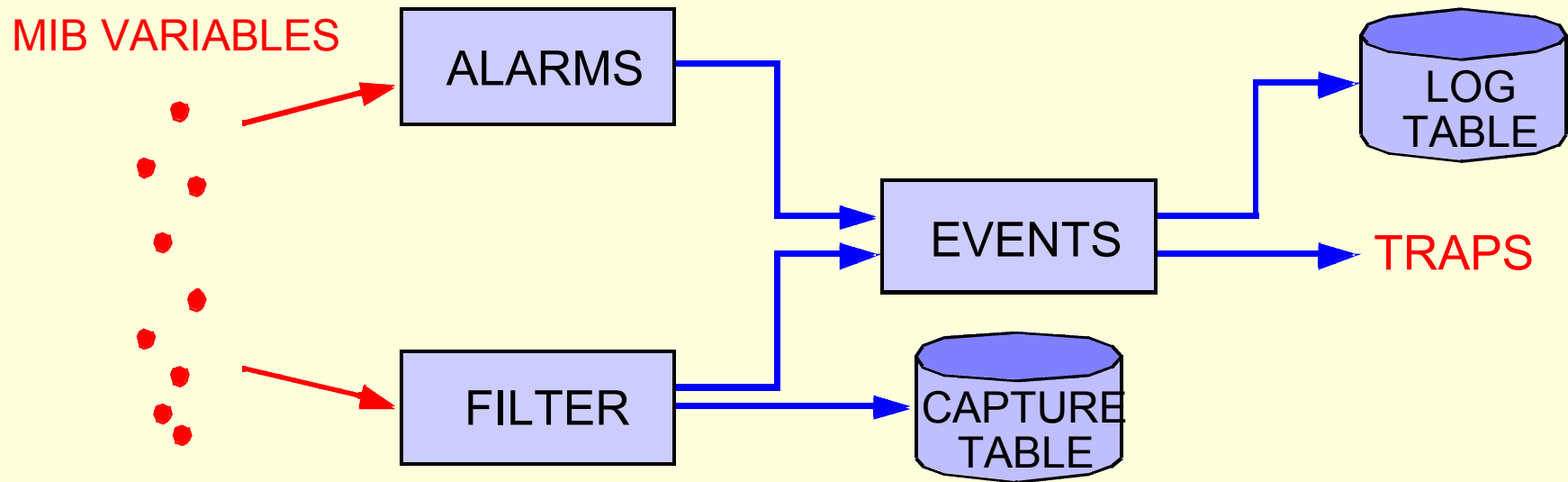
Errors

Size distribution

RMON - Alarms



RMON - Filters



Konec

