THE USE OF SNMP IN DATACOM ENVIRONMENTS

Aiko Pras

PRESENTATION AT INCAA DATACOM B.V.
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ADDRESS INFORMATION

Dr.Ir. A. Pras

Vakgroep
Tele-Informatica en
Open Systemen
(TIOS)

pras@cs.utwente.nl

http://www.cs.utwente.nl/~pras
http://wwwtios.cs.utwente.nl/
http://wwwsnmp.cs.utwente.nl/

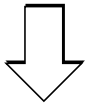
TIOS-INF
Universiteit Twente
Postbus 217
7500 AE Enschede

tel: 053-4893778

TELEMATICA EN DE UT

TELEMATICA RESEARCH CENTRUM
TRC

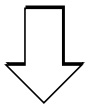
• Prof. dr. ir. C.A. VISSERS
vissers@trc.nl



• OVERHEID, BEDRIJFSLEVEN EN UT

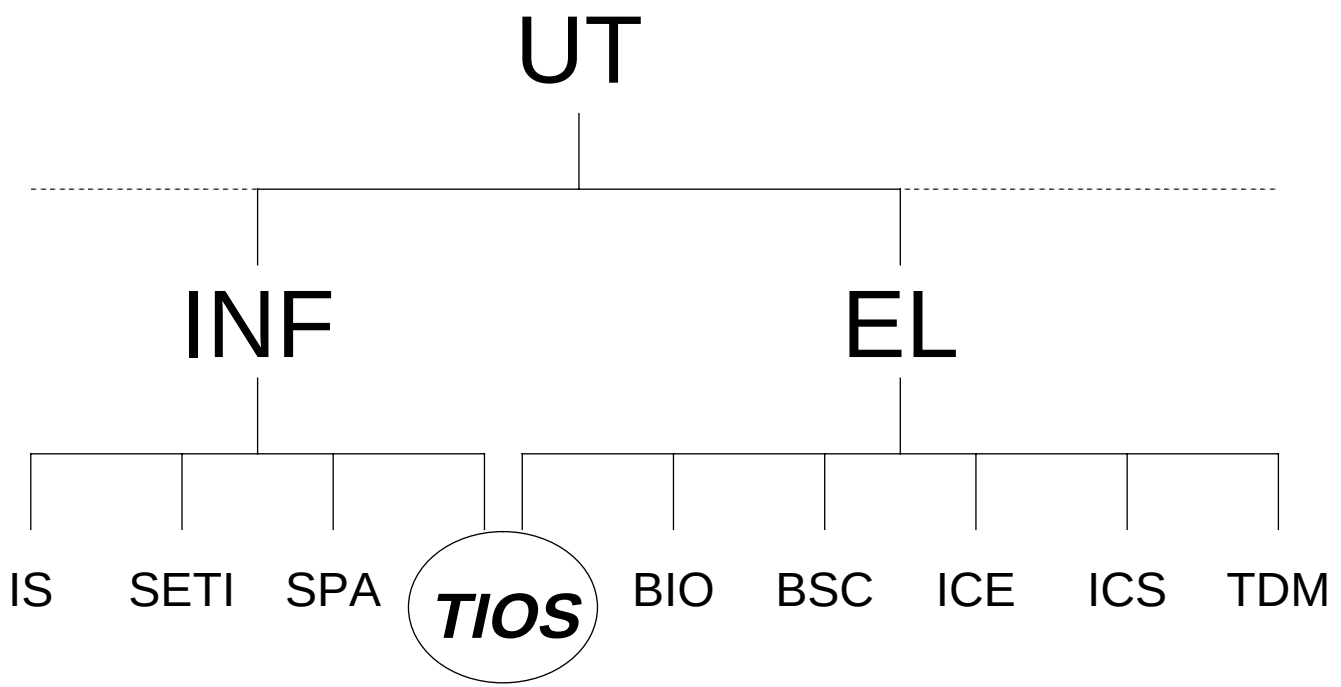
CENTRUM VOOR TELEMATICA
EN INFORMATIE TECHNOLOGIE
CTIT

• Prof. dr. ir. I.G.M.M. NIEMEGEERS
niemegee@ctit.utwente.nl
http://wwwtios.cs.utwente.nl/ctit

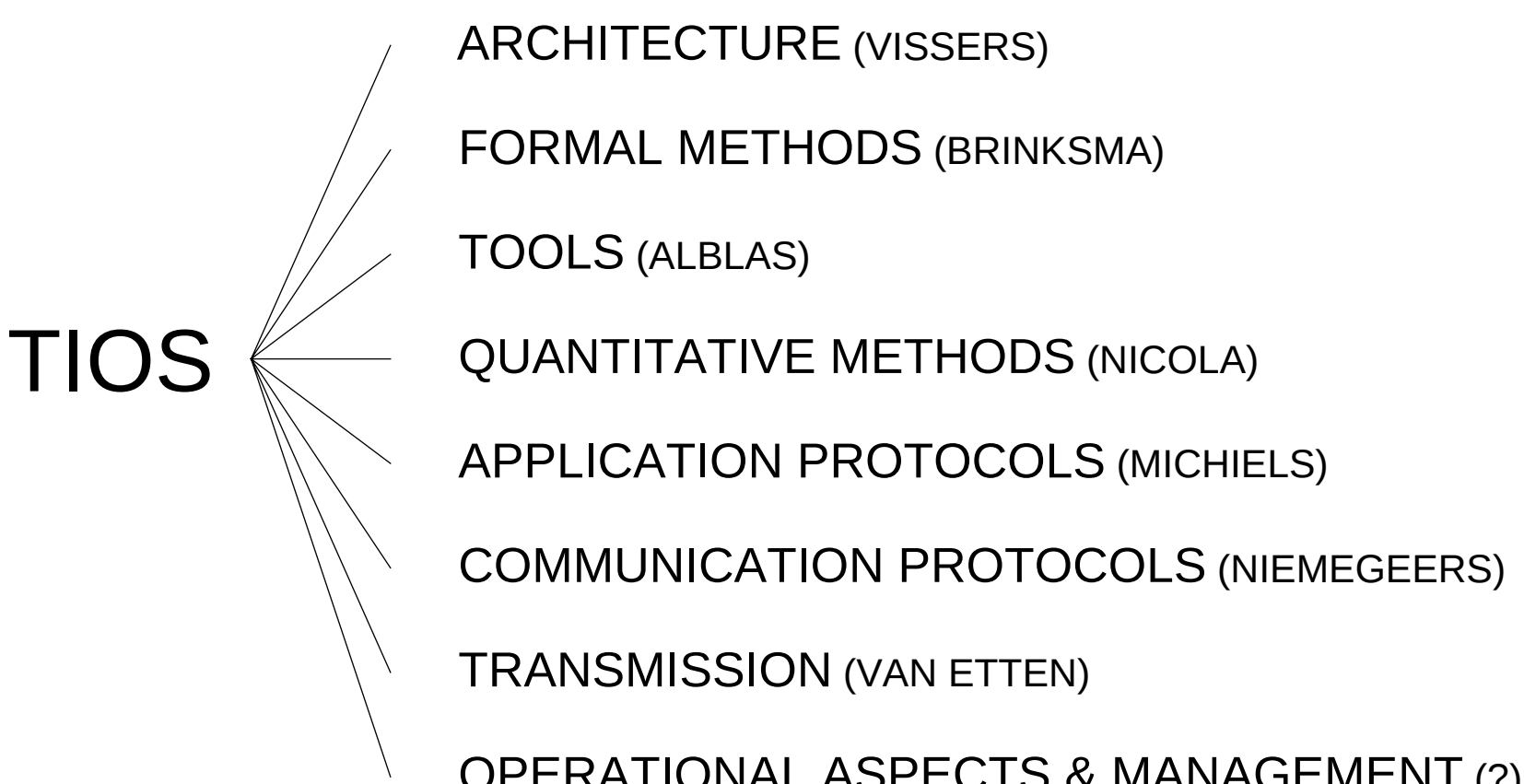


• ONDERZOEKSINSTITUUT VAN DE UT
• COORDINEERT TELEMATICA ONDERZOEK
VAN DE VERSCHILLENDE UT FACULTEITEN

TIOS and the UT



ORGANIZATION TIOS



OPERATIONAL ASPECTS & MANAGEMENT

MEMBERS:

- ? (PART-TIME PROFESSOR)
- AIKO PRAS (SENIOR RESEARCHER)
- JÜRGEN SCHÖNWÄLDER (POST-DOC)
- ERIC VAN HENGSTUM (SOFTWARE ENGINEER)
- HARRIE HAZEWINKEL (PROJECT RESEARCHER)
- MANY STUDENTS

PROJECTS:

- UT-SNMPv2 / DAMOCLES (INTERNAL)
- ATM MANAGEMENT (SURFNET-4)
- WWW MANAGEMENT (EC)
- MACONET (ACTS?)

MANAGEMENT STANDARDS

INTERNET

- INTERNET ENGINEERING TASK FORCE (IETF)
- NM-AREA
- SNMP

ISO

- ISO-IEC/JTC 1/WG 1
- OSI
- CMIP-CMIS

ITU-T

- THE FORMER CCITT
- SG IV
- TMN

OTHERS

- IEEE
- NM FORUM
- OSF/DME
- TINA-C
- RACE

MANAGEMENT STANDARDS

PARADIGMS

IETF

• MANAGEMENT SHOULD BE SIMPLE
• VARIABLE ORIENTED APPROACH
• MANAGEMENT INFORMATION EXCHANGES MAY BE UNRELIABLE

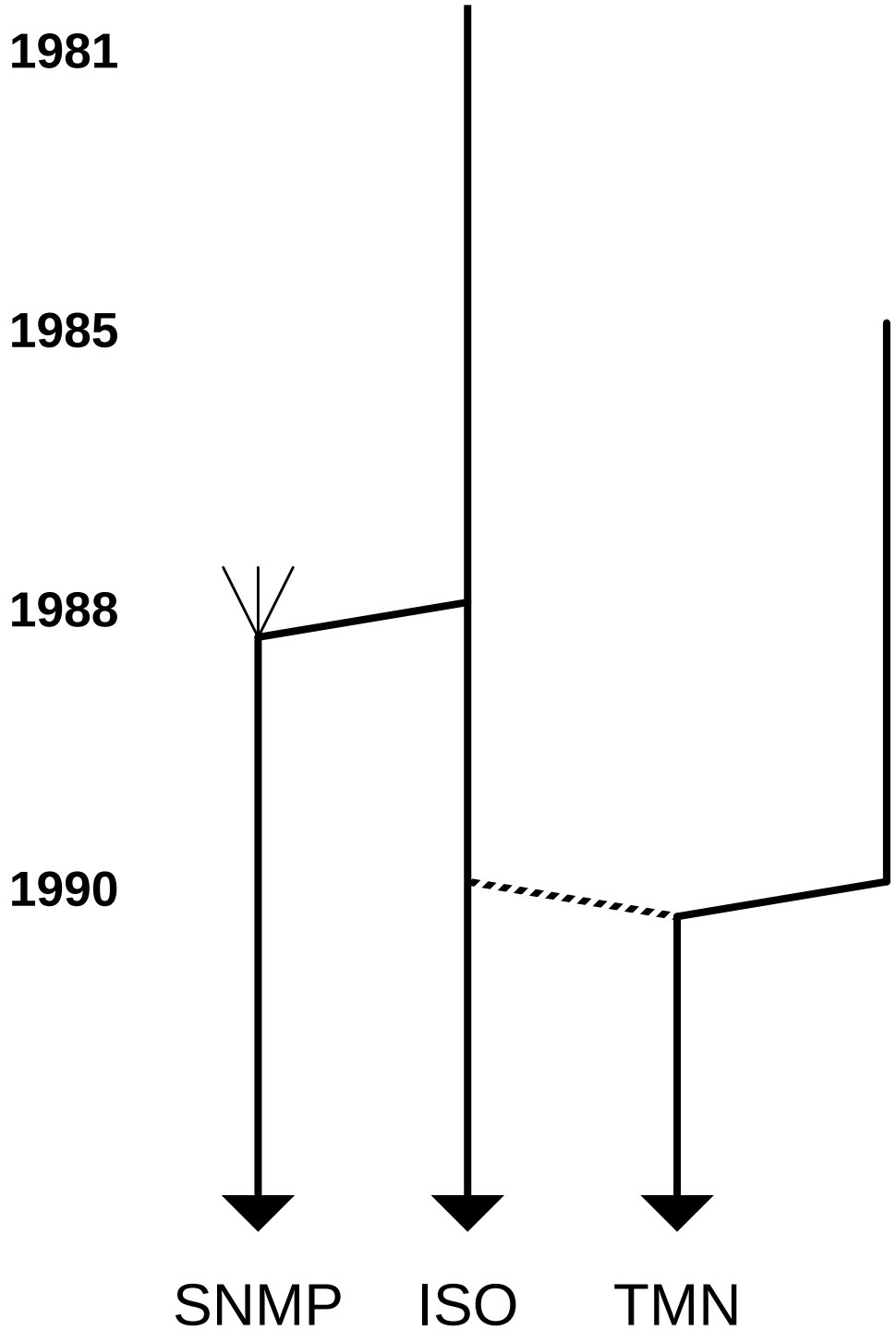
ISO

• MANAGEMENT SHOULD BE POWERFUL
• OBJECT ORIENTED APPROACH
• MANAGEMENT INFORMATION MUST BE EXCHANGED IN A RELIABLE FASHION

TMN

• DEFINES ONLY A MANAGEMENT *ARCHITECTURE*
• THE ACTUAL PROTOCOLS ARE THOSE OF OSI
• OUT-OF-BAND MANAGEMENT

MANAGEMENT STANDARDS



MARKET SHARE

NUMBER OF AGENTS?

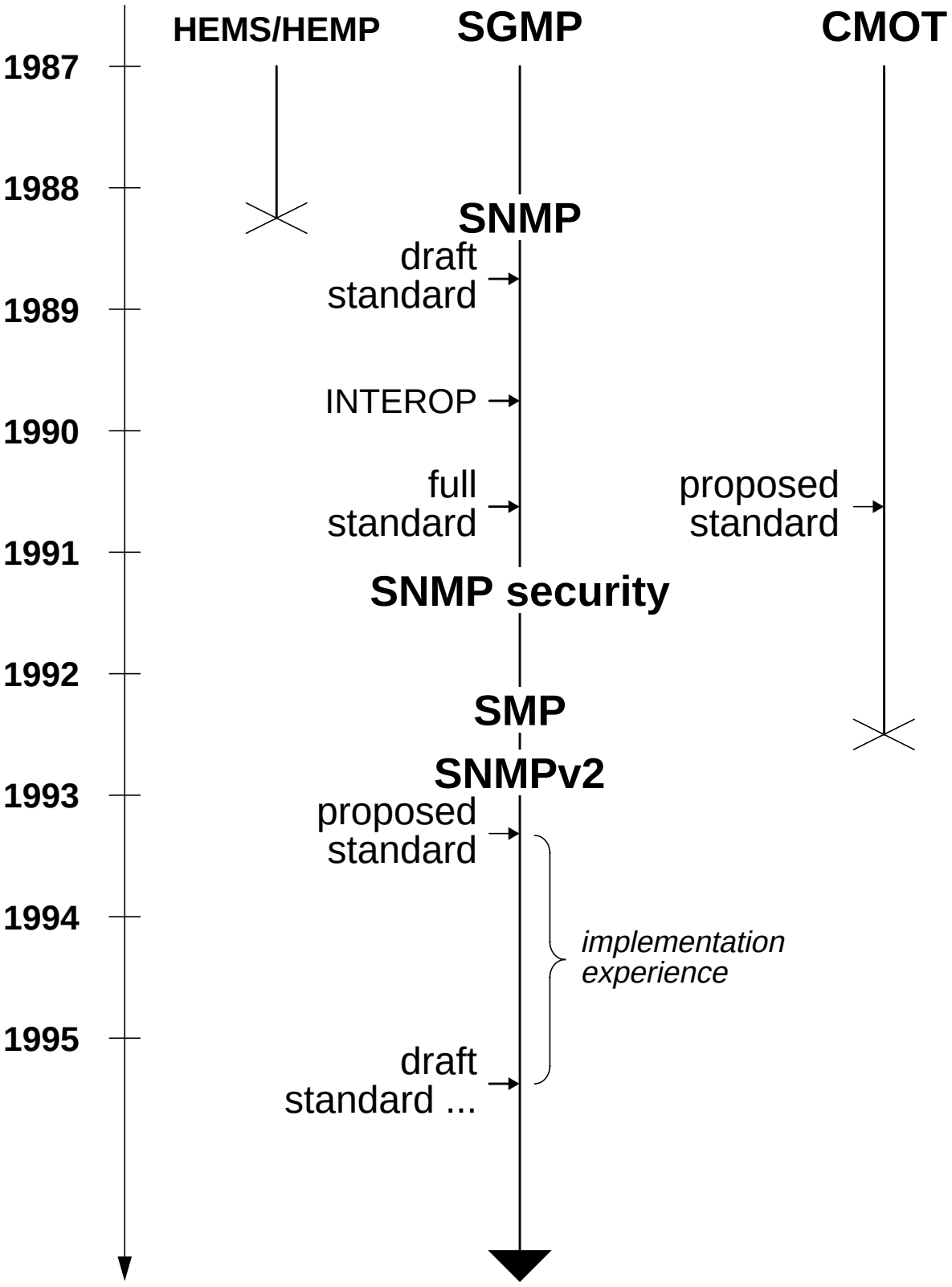
NUMBER OF MANAGERS?

MONEY?

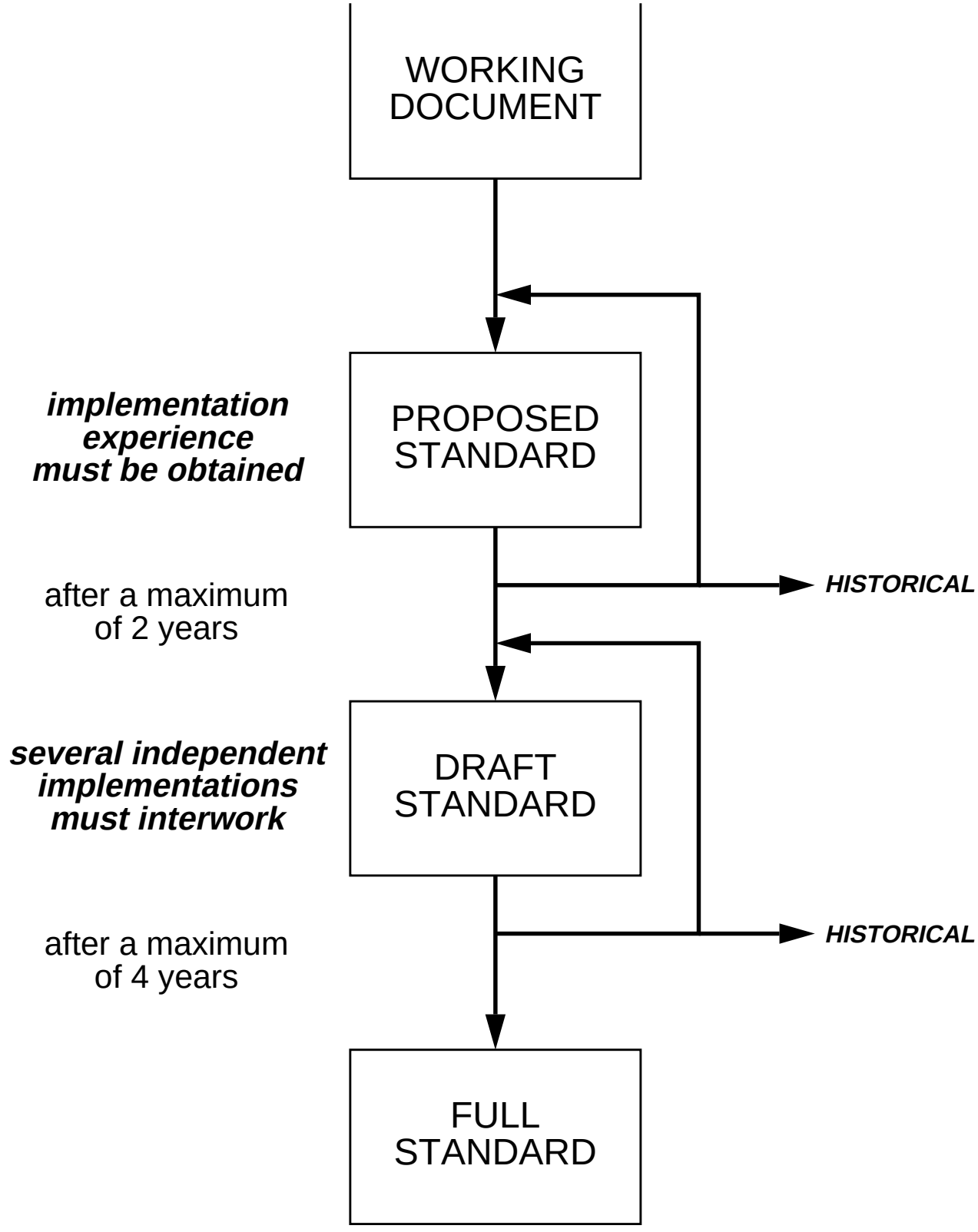
FOR SPECIFIC ENVIRONMENTS?

- IBM MAIN-FRAMES
- PRIVATE DATA LANs
- PRIVATE DATA WANs
- PABX
- PUBLIC VOICE NETWORKS
- PUBLIC DATA NETWORKS

INTERNET MANAGEMENT



INTERNET STANDARDIZATION



INTERNET STANDARDIZATION

• STANDARDS CAN BE OBTAINED FOR FREE

• STANDARDS ARE AVAILABLE
ON FTP-SERVERS
IN AN ELECTRONIC FORM

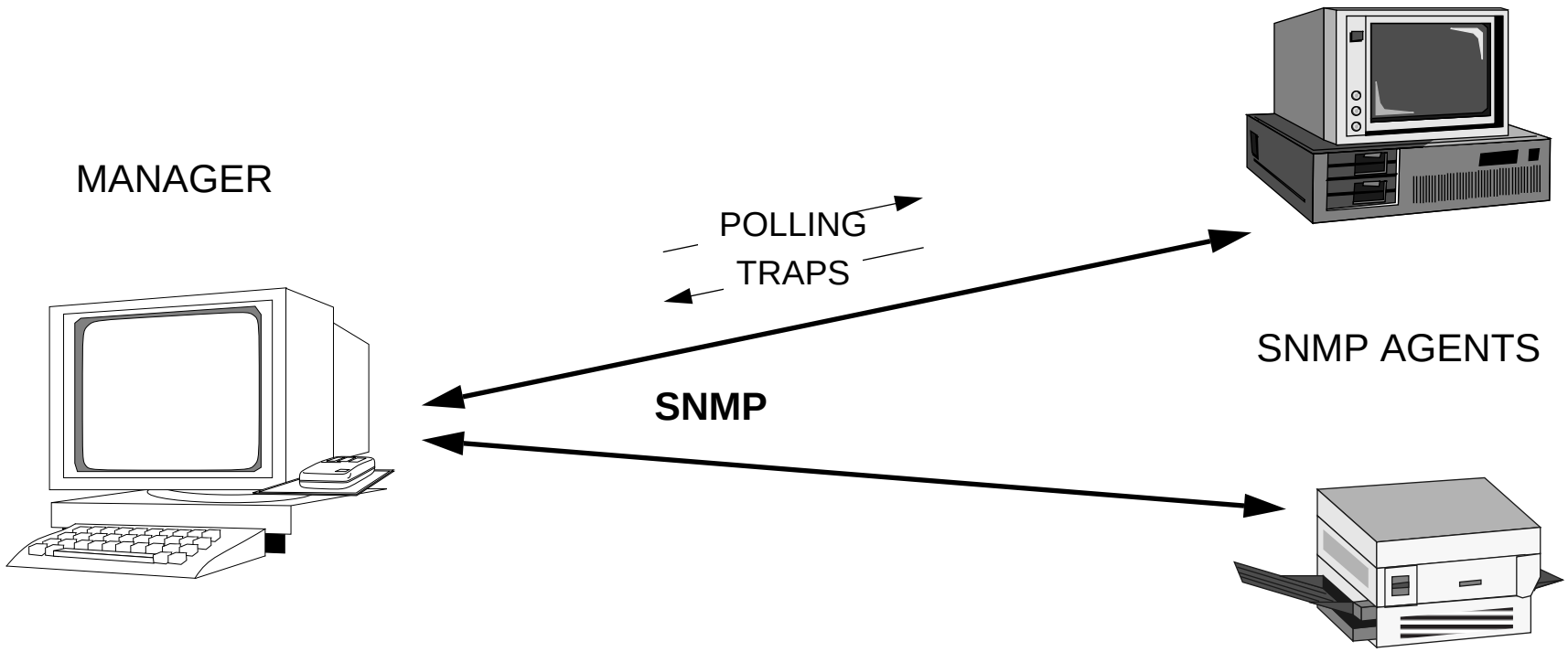
• RAPID DEVELOPMENT OF STANDARDS

• PROTOTYPES MUST DEMONSTRATE
THE NEED FOR, AND
THE FEASIBILITY OF STANDARDS

INTERNET MANAGEMENT

- SNMP
- MIBS
- SNMPv2
- PROXIES
- EXTENSIBLE AGENTS

SNMP STRUCTURE



SNMP STANDARDS

SMI

• STRUCTURE OF MANAGEMENT INFORMATION
• RFC 1155

MIB-II

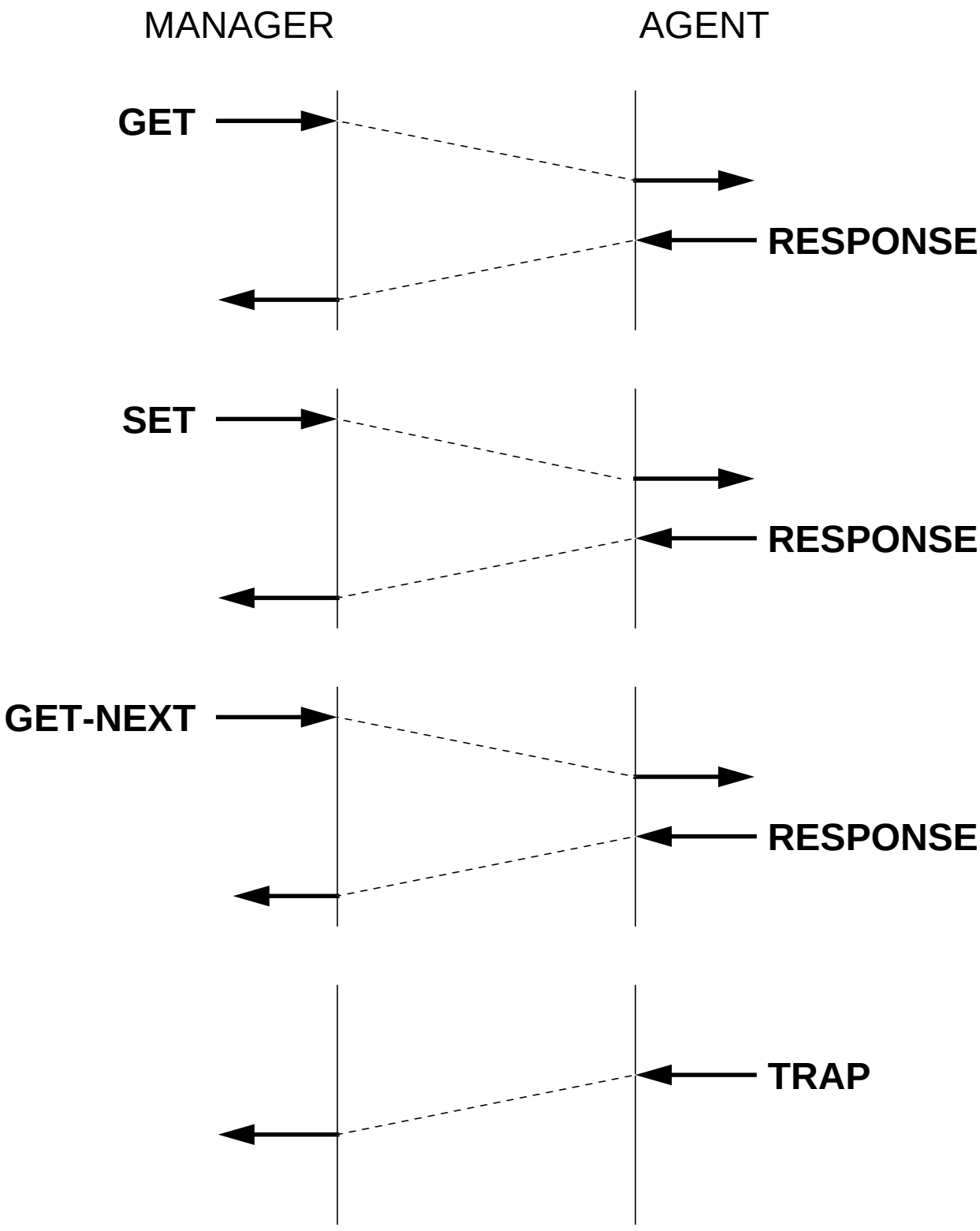
• MANAGEMENT INFORMATION BASE
• RFC 1212
• A LARGE NUMBER OF ADDITIONAL MIBs EXIST

SNMP

• SIMPLE NETWORK MANAGEMENT PROTOCOL
• RFC 1157
• NAME IS USED IN A MORE GENERAL SENSE

NEW VERSION: SNMPv2

OVERVIEW OF SNMP PDUs



SNMP MESSAGE & PDU STRUCTURE

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

SNMP SMI

MANAGEMENT INFORMATION
WITHIN MANAGED SYSTEMS
MUST BE REPRESENTED AS:

- SCALARS
- TABLES

(= TWO DIMENSIONAL ARRAYS OF SCALARS)

THE SNMP PROTOCOL
CAN ONLY EXCHANGE
(A LIST OF) SCALARS

DEFINED IN TERMS OF
ASN.1

CONSTRUCTS

SMI: DATA TYPES FOR SCALARS

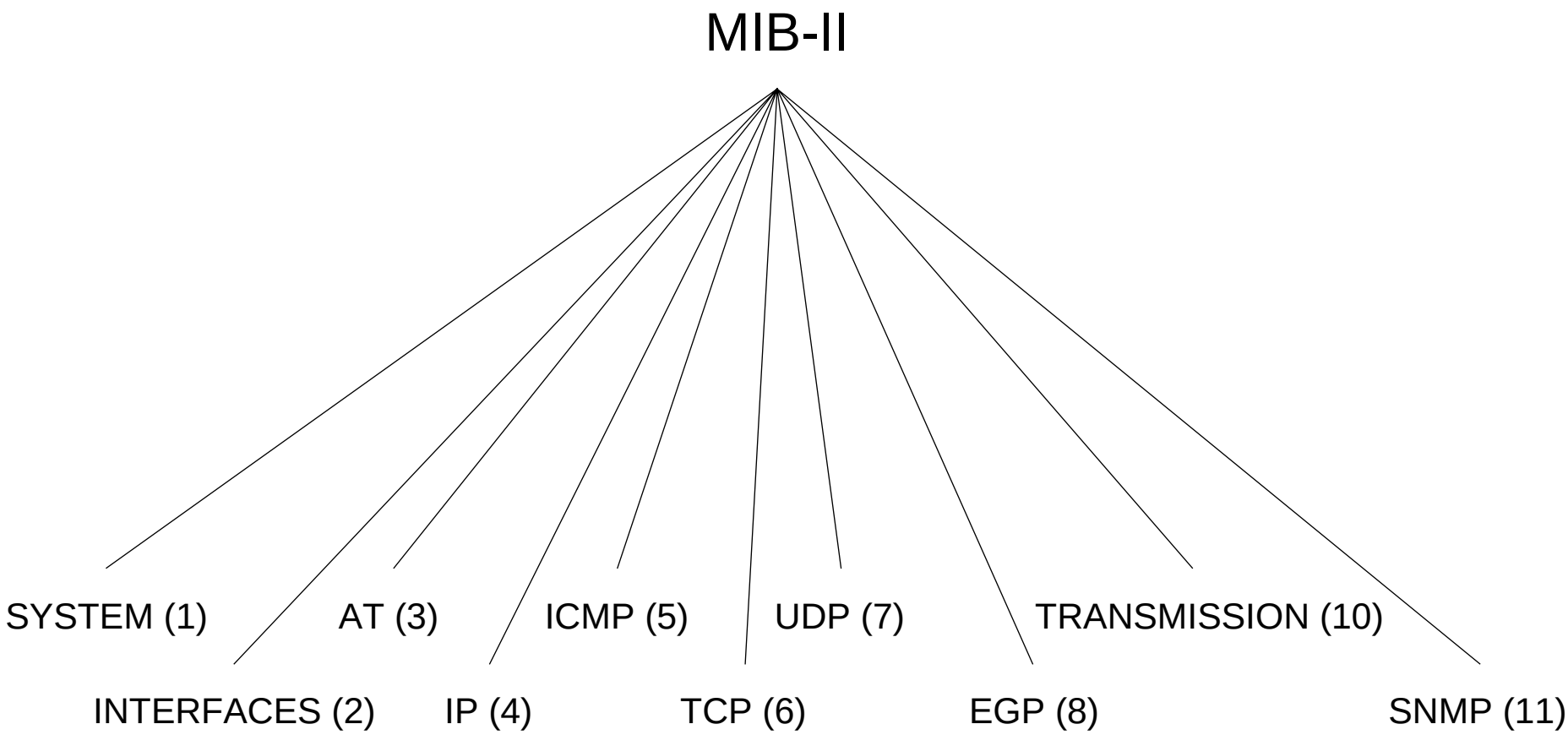
SIMPLE TYPES

- INTEGER
- OCTET STRING
- OBJECT IDENTIFIER
- NULL

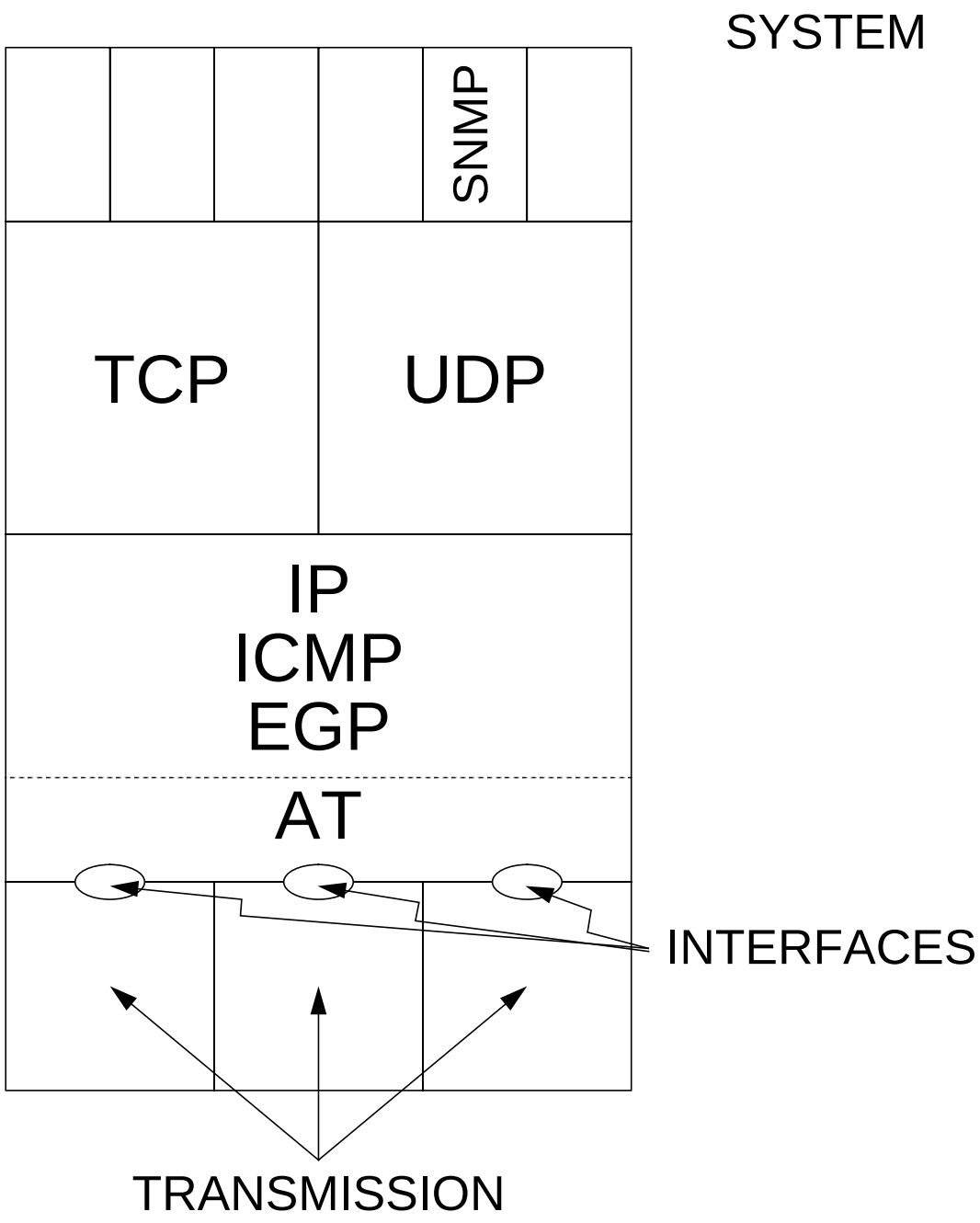
APPLICATION-WIDE TYPES

- IpAddress
- NetworkAddress
- Counter
- Gauge
- TimeTicks
- Opaque

MIB-II


MIB-II
SYSTEM (1)
INTERFACES (2)
AT (3)
IP (4)
ICMP (5)
TCP (6)
UDP (7)
EGP (8)
TRANSMISSION (10)
SNMP (11)

MIB-II GROUPS



MIB-II

• ESSENTIAL FOR
FAULT OR CONFIGURATION MANAGEMENT

• ONLY WEAK CONTROL OBJECTS

• SMALL NUMBER OF OBJECTS

• AVOID REDUNDANCY

• EVIDENCE OF UTILITY

• DO NOT DISTURB NORMAL OPERATION

• NO IMPLEMENTATION SPECIFIC ISSUES

OVERVIEW MIBs

Title	RFC
MIB-II	1213
IEEE 802.5 Token Ring	1231
Appletalk	1243
OSPF version 2	1253
Remote Network Monitoring	1271
IP Forwarding Table MIB	1354
RIP Version 2	1389
DS1 and E1 Interface Types	1406
DS3 and E3 Interface Types	1407
X.25	1461
Point-to-Point Protocol	1471-1474
Bridges	1493
FDDI	1512
Remote Network Monitoring - Token Ring	1513
Host Resources	1514
IEEE 802.3 Medium Attachment Units	1515
IEEE 802.3 Repeater Devices	1516
Source Routing Bridges	1525

OVERVIEW MIBs (cont.)

Title	RFC
DECnet Phase IV Extensions	1559
Network Services Monitoring	1565
Mail Monitoring	1566
X.500 Directory Monitoring	1567
SNA APPN Node	1593
SONET/SDH Interface	1595
Frame Relay Service	1604
Domain Name System	1611-1612
Uninterrupted Power Supply	1628
Ethernet-like Interface Types	1643
Border Gateway Protocol	1657
Character Stream Devices	1658
RS-232-like Hardware Devices	1659
Parallel-printer-like Hardware Devices	1660
SNA NAU	1666
SMDS - SIP Interface Type	1694
ATM	1695
Modem	1696
Relational Database Management System	1697

RELATION BETWEEN MIBs - 1

	MIB-II	HOST	REPEATER	BRIDGE	RMON
INTERFACE STATISTICS	x				
IP, TCP & UDP STATISTICS	x				
SNMP STATISTICS	x				
HOST JOB COUNTS		x			
HOST FILE SYSTEM INFORMATION		x			
LINK TESTING			x	x	
NETWORK TRAFFIC STATISTICS			x	x	x
TABLE WITH ALL ADDRESSES			x		x
HOST STATISTICS			x		x

RELATION BETWEEN MIBs - 2

	MIB-II	HOST	REPEATER	BRIDGE	RMON
HISTORICAL STATISTICS					x
SPANNING TREE PERFORMANCE				x	
WIDE AREA LINK PERFORMANCE				x	
TRESHOLDS FOR ANY VARIABLE					x
CONFIGURABLE STATISTICS					x
TRAFFIC MATRIX WITH ALL NODES					x
‘HOST TOP N’ INFORMATION					x
PACKET / PROTOCOL ANALYSIS					x
DISTRIBUTED LOGGING					x

SNMPv2 versus SNMPv1

IMPROVED PERFORMANCE

• GET-BULK PDU

SECURITY

• AUTHENTICATION
• ENCRYPTION
• ACCESS CONTROL

MANAGEMENT HIERARCHY

• MANAGER TO MANAGER COMMUNICATION

OTHER IMPROVEMENTS

OTHER IMPROVEMENTS

• DEFINITION OF ADDITIONAL DATA TYPES
AND FORMALISMS
BASED ON IMPLEMENTATION EXPERIENCE

• TRANSPORT SERVICE INDEPENDENCE:
MAPPINGS FOR SNMPV2
OVER SEVERAL TRANSPORTS ARE DEFINED

• RECORDING THE UNWRITTEN RULES OF SNMP
- ROW STATUS PLUS OTHER TEXTUAL CONVENTIONS

• REDEFINED TRAP PDU
- HAS SAME PDU FORMAT AS OTHER PDUs
- MAY BE SEND TO ZERO, ONE OR MORE MANAGERS

WHAT HAPPENED TO SNMPv2?

APRIL 1993:
PROPOSED STANDARD

UNTIL NOVEMBER 1994:
IMPLEMENTATION EXPERIENCE

SPRING 1995:
SPECIAL WORKING GROUP FORMED
ON MANAGEMENT HIERARCHIES
(DISMAN)

JUNE 1995:
130 MODIFICATIONS WERE MADE, BUT
PROPOSED STANDARD REJECTED
BY TWO OF THE ORIGINAL EDITORS!

PARTY BASED MODEL WAS
CONSIDERED TO BE TOO COMPLEX!

WHAT HAPPENED TO SNMPv2?

SECOND HALF OF 1995:
NEW PROPOSALS APPEARED

SNMPv2:
- THE ORIGINAL PROPOSAL

USER BASED SECURITY:
- NO HIERARCHIES
- SECURITY STILL INCLUDED
- PARTY MODEL REMOVED
- NO REMOTE CONFIGURATION

COMMUNITY-BASED SNMP
- NO SECURITY

AND MANY OTHERS

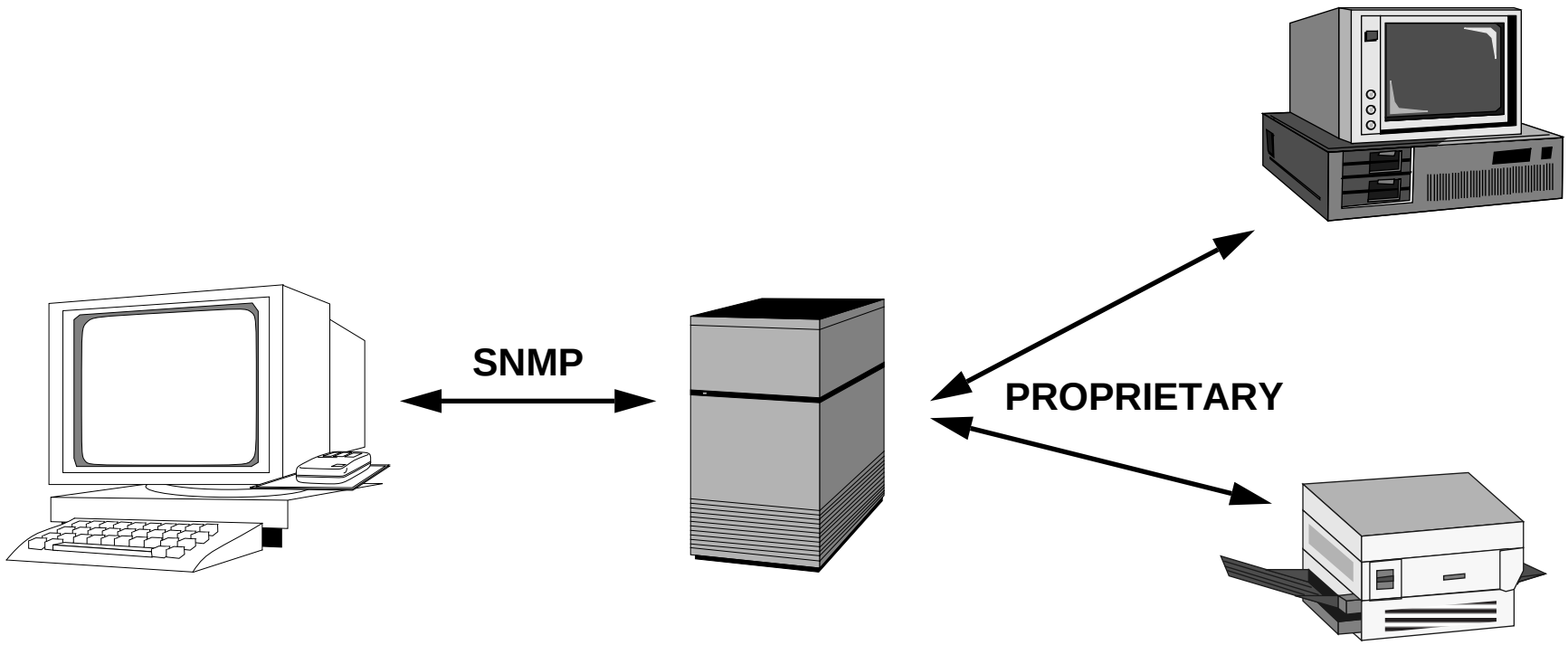
STATUS

THE IESG HAS DECIDED TO MOVE
COMMUNITY BASED SNMP
TO DRAFT STANDARD

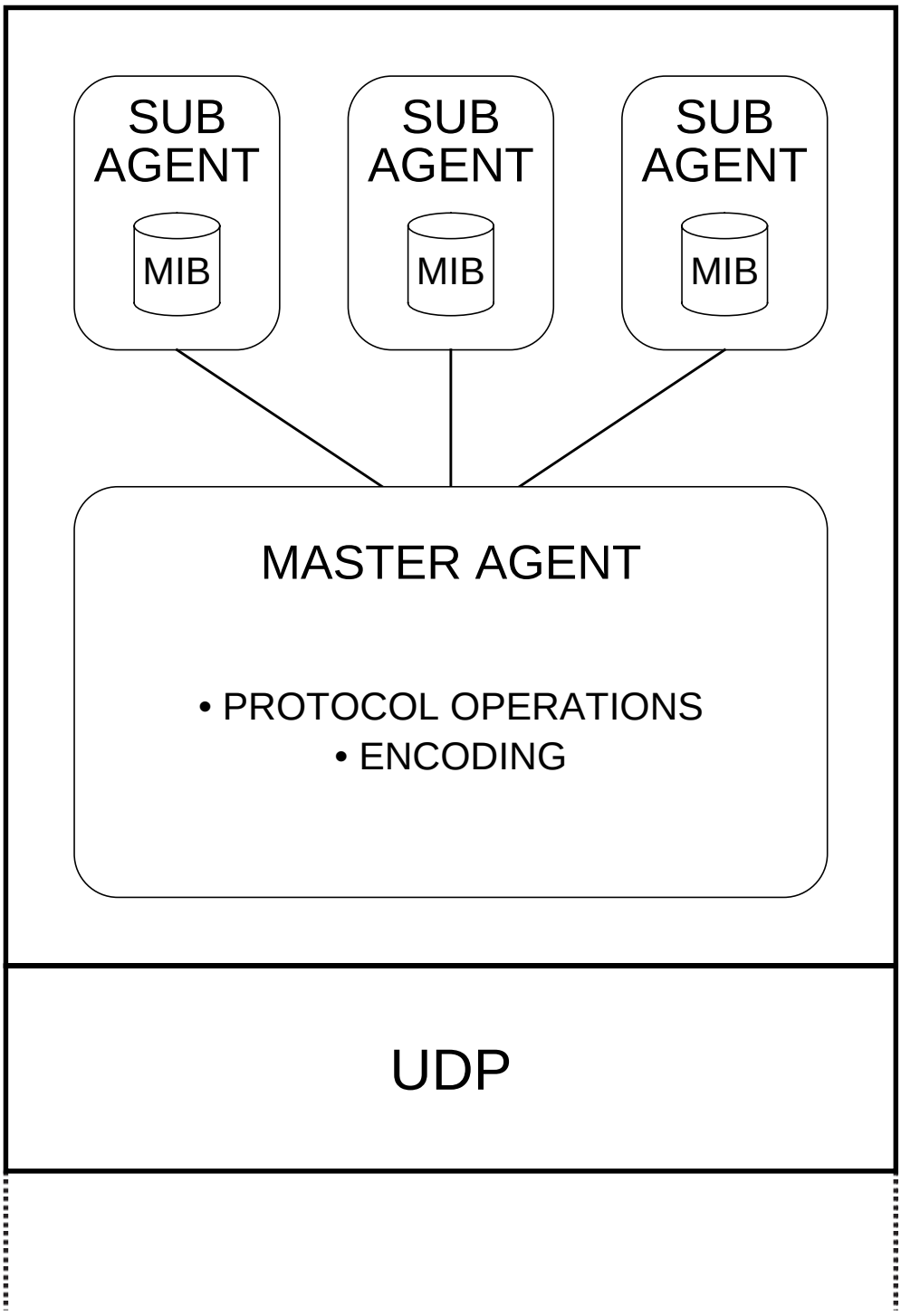
Title	RFC
Introduction to community-based SNMP*	1901
SMI for SNMPv2	1902
Textual conventions for SNMPv2	1903
Conformance statements for SNMPv2	1904
Protocol operations for SNMPv2	1905
Transport mappings for SNMPv2	1906
MIB for SNMPv2	1907
Coexistance between SNMPv1 and SNMPv2	1908

* RFC 1901 is experimental

PROXY MANAGEMENT



EXTENSIBLE AGENTS



EXTENSIBLE AGENTS

PROPOSALS

SMUX
SNMP MULTIPLEXING PROTOCOL
RFC 1227

DPI
DISTRIBUTED PROTOCOL INTERFACE
RFC 1228 & RFC 1592

OAA
OPEN AGENT ARCHITECTURE

EMANATE
ENHANCED MANAGEMENT AGENT THROUGH EXTENSIONS

MCSA
MULTIPLE COMPONENT SNMP AGENT

UNIVERSITY OF TWENTE
UT-SNMPv2

COMMERIAL PRODUCTS

MANAGER PLATFORMS

- HP OpenView
- SUNNet Manager
- IBM: SystemView
- Cabletron: Spectrum
- BULL: ISM

AGENT PLATFORMS

- EMANATE

PUBLIC DOMAIN

- CMU
- UT-SNMPv2
- SCOTTY
- TRICKLET
- MIT
- MIB COMPILERS
- ETC, ETC, ETC