What MIB Document Editors need to know

Bert Wijnen (bwijnen@lucent.com)

Dave Harrington
(dharrington@huawei.com)

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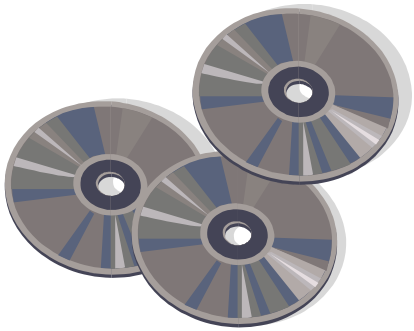
data transport (SNMP)

data content (MIB)



data structure (SMI)

MIB Documents

Agenda

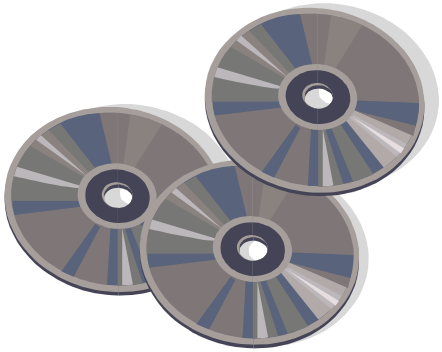
- **The IETF Management Framework**
- **The SNMP Protocol**
- **The Structure of Management Information**
- **The MIB and MIB Modules**
- **MIB Documents**
- **The MIB document checklist**
- **Tools for reviewing MIB documents**
- **MIB Doctors**

What MIB Document Editors Need to Know About the IETF Management Framework

data transport (SNMP)

data structure (SMI)

data content (MIB)

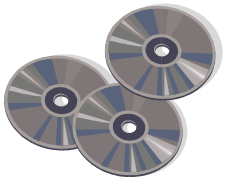


The IETF Management Framework

- **Three distinct parts**

  - **A protocol to carry the data**

  - **A language to describe the data types, data formats, and data sets**



A virtual database containing data sets of management information

- **The Current IETF-Standard framework**
  - **SNMPv3 + SMIv2 + The MIB**

The IETF Management Framework

- **The MIB is a portion of the OID registration tree shared by multiple organizations, such as ITU, IEEE, IANA, DoD, etc.**
- **IANA is the Internet Assigned Numbers Authority.**
- **IANA has allocated a subtree of the MIB for enterprise-specific assigned numbers for MIB objects and MIB-related definitions.**

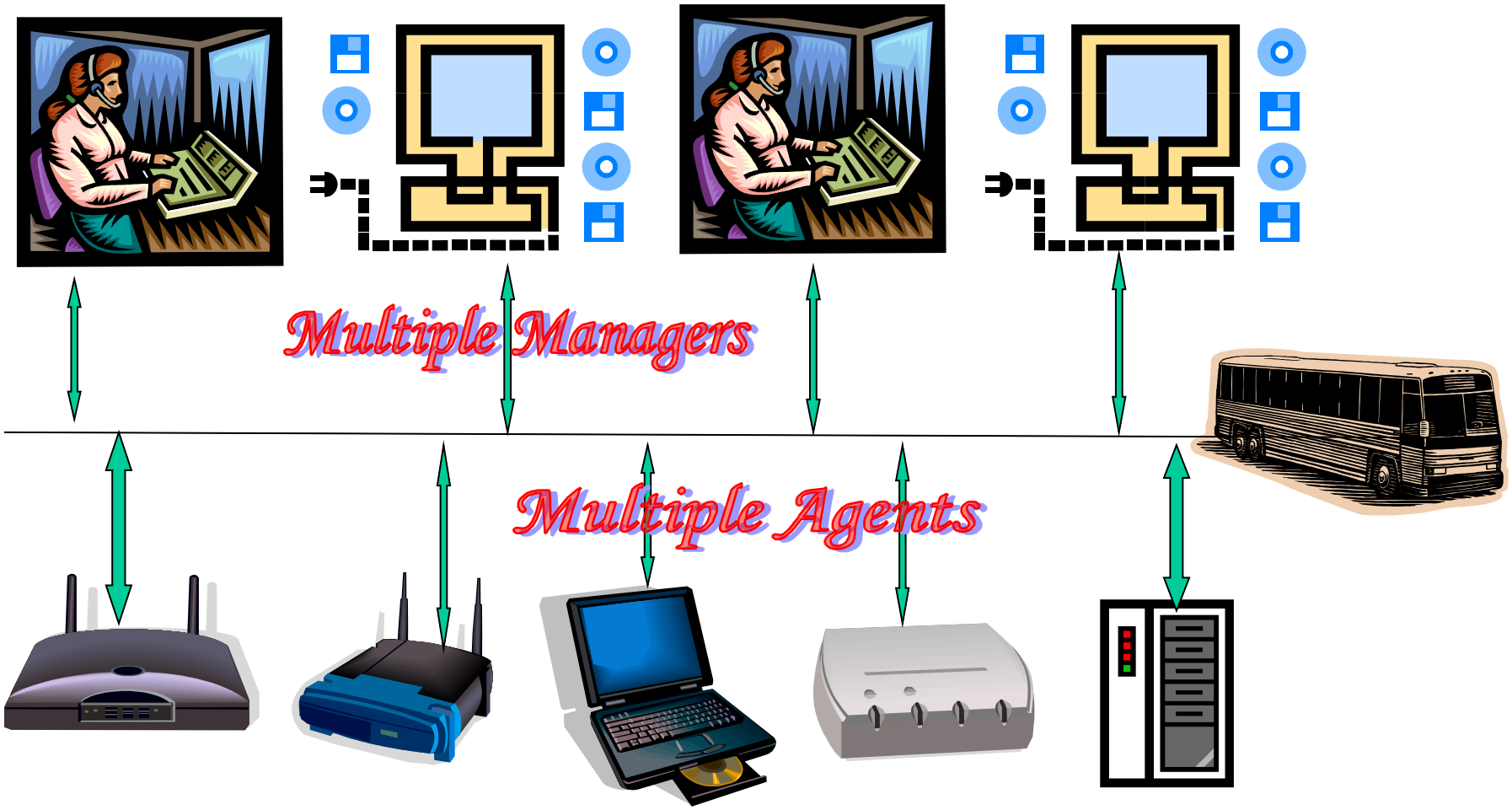
The IETF Management Framework

- **The SMI and the MIB are designed to work with multiple protocols, including SNMP and CMIP.**
- **Historically, SNMP is the only protocol typically used with IETF MIBs, and we have been sloppy about maintaining the separation.**
- **COPS-PR can carry MIB objects**
- **Netconf may carry MIB objects**

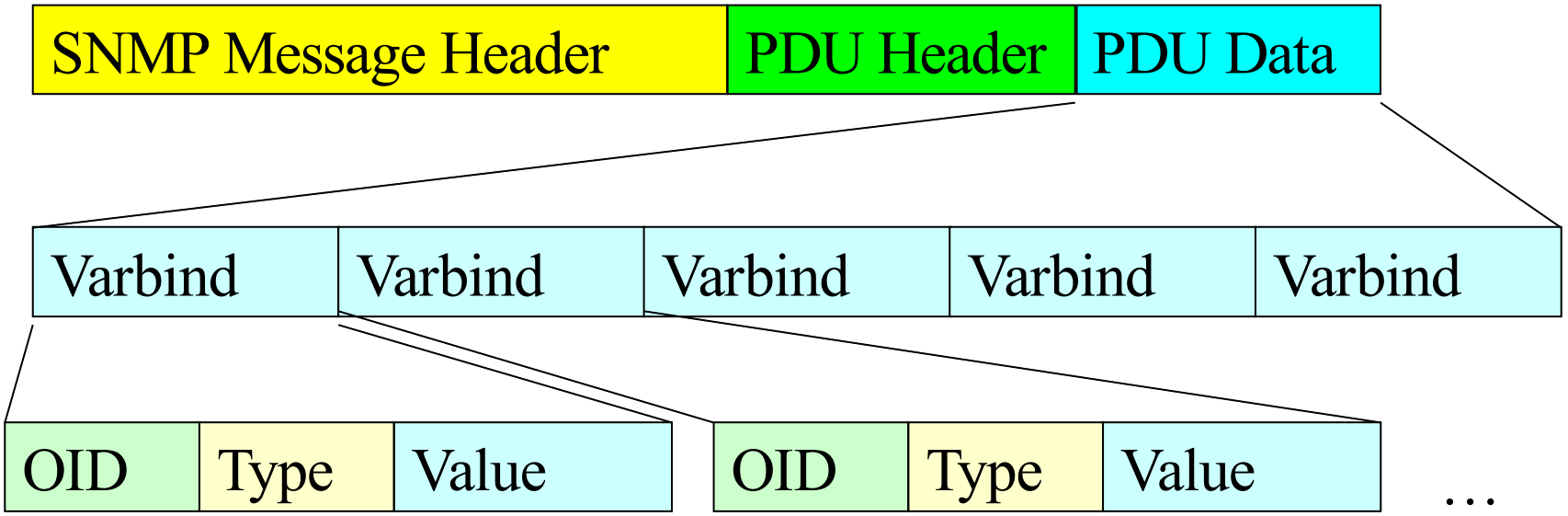
The IETF Management Framework

- **Do not create dependencies on SNMP in object descriptions.**
- **E.g., DESCRIPTIONS should include the nature of error conditions "inconsistent value", but use SNMP "inconsistentValue" error code only as an example.**

What MIB Document Editors Need to Know About SNMP



SNMP Messages



The varbinds are (your) MIB objects.

Can be from multiple MIB Modules

SNMP Versions

Message Format	**v1**	**v2c**	**v3**
IETF Status	Full Standard, now Historic	Experimental, now Historic	Full Standard
Message Security	Plaintext password	Plaintext password	Authentication (MD5, SHA) Encryption (DES, AES) Integrity, Replay
Operations	RFC1157	RFC3416	RFC3416
MIB Format	SMIv1	SMIv2	SMIv2
Access Control	No	No	yes

SNMP Operations

Message Format	v1	v2c	v3
GET	yes	yes	yes
GET-NEXT	yes	yes	yes
GET-RESPONSE	yes	yes	yes
SET	yes	yes	yes
Trapv1	yes	no	no
GET-BULK	no	yes	yes
Trapv2	no	yes	yes
Inform	no	yes	yes

SNMP version 1 family

- SNMPv1 – (Full) Internet Standard
  - RFC1157 (STD15)
  - Now Historic due to inadequate security
- PDUs in SMIv1 format
  - SMIv1 - (Full) Internet Standard
  - RFC1155 and RFC1212 (STD16)
  - RFC1215 (informational)
- MIB II - (Full) Internet Standard
  - RFC 1213 (STD 17)
  - Various Other MIB Documents (Proposed and Draft Stds)

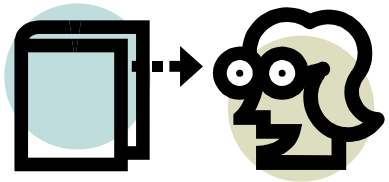
SNMP version 2c family

- SNMPv1 style message header
- SNMP Protocol Operations, version 2
  - Improved PDU error codes, exceptions
  - Get-Bulk for efficient table retrieval
  - Inform for acknowledged traps
- SMIv2 data types
  - Textual Conventions
  - Conformance
  - 64-bit Counters, BIT STRINGS
- IETF declared Historic
  - Inadequate security

SNMP version 3 family

- SNMPv3 – (full) Internet Standard (STD 62)
  - RFC3410 - Introduction (Informational)
  - RFC3411 - Architecture
  - RFC3412 - Message Processing
  - RFC3413 - Applications
  - RFC3414 - User Based Security Model
  - RFC3415 - View-Based Access Control Model
  - RFC3416 - Protocol Operations
  - RFC3417 - Transport Mappings
- SMIv2 - (Full) Internet Standard (STD 58)
  - RFC2578 - SMIv2
  - RFC2579 - Textual Conventions for SMIv2
  - RFC2580 - Conformance Statements for SMIv2

What Editors Need to Know About the Structure of Management Information



Information

+ MIB Structure =

MIB Module

IETF Data Modeling

- All new technologies from IETF should be manageable
- The Internet Standard for Management data modeling is SMIv2, used to write MIB modules
  - That means a MIB module is needed for devices, protocols and applications that we want to manage
- The Internet Standard NM Protocol is SNMP
  - Most IETF management will run over the SNMP protocol
- All new technologies from IETF should be manageable via MIB modules, typically using the SNMP protocol

SMIv1

- SMIv1 - (Full) Internet Standard
  - RFC1155, STD 15
- Used in SNMPv1 Messages
- Not Recommended
  - SMIv2 has important added features
- Not Historic - Yet
  - Existing standard MIB modules depend on SMIv1
  - Cannot declare Historic

SMIv2

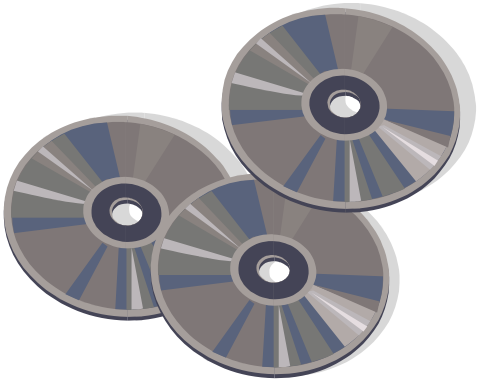
- SMIv2 - (Full) Internet Standard (STD 58)
  - RFC2578 - SMIv2
  - RFC2579 - Textual Conventions for SMIv2
  - RFC2580 - Conformance Statements for SMIv2
- Used in SNMPv2c and SNMPv3 messages
- Required for Standards Track MIB modules

SMIv2

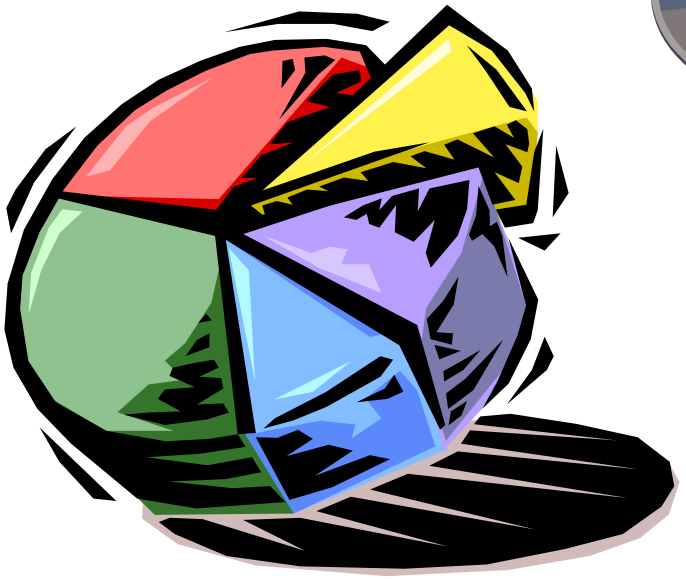
- High capacity counters
- Textual Conventions
  - Can define reusable complex syntax
  - similar to #defines in C
  - Re-use objects and Textual Conventions when possible. See:
    - `http://www.ops.ietf.org/mib-common-tcs.html`
- Conformance Statements
  - permits multiple levels of compliance
- Increased support for automated parsing

What MIB Document Editors Need to Know About MIBs

THE MIB



MIB Modules



MIB Documents

MIB Modules and MIB documents

- **There is one MIB, composed of many MIB Modules**
- **A MIB document defines one (or more) MIB modules.**
- **Structure of Management Information (SMI) is used to define MIB modules**

When to define a MIB module for a protocol?

- In principle we (IETF) want all new technologies from IETF to be (SNMP) manageable
- At a Minimum the IESG wants monitoring and notification of faults in functionality.
- Control (write access) is often handy but not mandatory
- Configuration (write and create access) is not mandatory, but fine if you want it.
- MIB work is done in the technology specific WG, by the experts in the managed technology.
  - MIB Advisors are available

Information Modeling

- Recommend doing an Information Model before writing a data model (MIB module)
  - See RFC3444: On the Difference between Information Models and Data Models
- The IETF has no consensus on a formal language to do information modeling
- Can be done using plain English

Information Modeling

- Think about what needs to be managed
- Think about how data can help deployment and operations.
- Start with a small set of data and add data only as needed.
  - should be essential for fault, performance, control or configuration.
  - Consider evidence of current use and/or utility.
  - Compact data sets are more likely to be implemented
- Exclude data that is derivable from other data
  - Keep the agent simple; move complexity to the manager
- Avoid causing critical sections to be heavily instrumented.
  - The guideline is one counter per critical section per layer.
- Should not specify data for debugging protocol implementation.

Information Modeling

- Specify the data that operators need/want for:
  - Monitoring
  - Control
  - Configuration
- Examples
  - RFC3290 An Informal Management Model for Diffserv Routers
  - RFC4377 OAM Requirements for MPLS Networks
  - RFC4687 Operations and Management (OAM) Requirements for Point-to-Multipoint MPLS Networks
  - draft-farrel-pce-manageability-requirements

MIB Module scope/content

- Be clear in DESCRIPTION clauses so a (new) reader/implementer can properly implement
- Be clear in DESCRIPTION clauses so all behavior is deterministic (for example persistence of writable objects)
- Add proper/good REFERENCE clauses
- Think about MODULE-COMPLIANCE statements.
  - Allow for read-only (monitoring) compliance
  - Allow for full (monitoring/control/configuration) compliance
  - Allow for subset compliance if that makes sense.
    - Allow for different MIB module versions (RFC1493 vs RFC4188)
    - BUT, separate MIB modules are easier for NMS applications

Checklist items for MIB documents

- MIB Review Guidelines:
  - RFC4181
- Seems a big document (40 pages), but it has a two page step by step list of checkpoints (Appendix A)
- Rest of doc is details and clarifications
  - Good to read through before writing MIB doc
  - Then use Appendix A for checking and rest as reference and explanatory text.
- MIB document template - http://www.ietf.org/internet-drafts/draft-harrington-text-mib-doc-template-00.txt

Checklist items for MIB documents

- 1.) I-D Boilerplate
- 2.) Abstract
- 3.) MIB Boilerplate
  - www.ops.ietf.org/mib-boilerplate.html
- 4.) IPR notice
- 5.) References
- 6.) Security Considerations Section
  - www.ops.ietf.org/mib-security.html

Checklist items for MIB documents

- 7.) IANA Considerations Section
- 8.) Copyrights
- 9.) Other issues
  - http://www.ietf.org/ID-Checklist.html
- 10.) Technical content
  - Including MIB SYNTAX check (compile)
  - http://www.ops.ietf.org/mib-review-tools.html

Tools to check/review MIB modules

- Mstrip – to extract MIB
- SMICng – to compile/syntax check
  - Commercial product
- SMIlint – to compile/syntax check etc
  - Free, plus mail service
- There are others
- Idnits script: http://tools.ietf.org/tools/idnits/
- http://www.ops.ietf.org/mib-review-tools.html

What is a MIB doctor?

- SNMP/MIB expert selected by AD for directorate
- MIB Doctor expert review arranged by AD or proto-shepherd/chairs after WG Last Call, and before IETF Last Call
- Acts as Mentor
  - Reviews MIB documents upon AD request
  - May choose to review MIB documents unofficially
  - May do early review and help/guide MIB design
  - May function as official SNMP/MIB Advisor to a WG

What is a MIB doctor?

- In role as SNMP/MIB Advisor to WG:
  - Is not supposed to be writing the MIB document(s)
  - Is often not very familiar with the technology
  - Can help find other MIB modules/objects for re-use
  - Can help to construct proper MIB tables
- But the WG and MIB document Editor MUST:
  - do the work
  - Must be willing to translate the technology into a Data Model that can be represented in a MIB module.
  - Often modeling uncovers problems/issues with the protocol and/or technology specification.

MIB expertise – how to find it

- send a request to OPS AD Dan Romascanu if you need an SNMP/MIB Advisor (copy your own AD)
- Send a request to OPS AD Dan Romascanu if you have a MIB doc ready for MIB Doctor review.
  - Make sure to first check against MIB review guidelines
  - Copy your own AD
- Ask for help on ietf-mib@ops.ietf.org where you may find people with SNMP/MIB skills and interest in your protocol/technology.

How can I motivate my WG comrades to care about MIB documents?

- Once you know how to do a MIB it is FUN
- It helps to better understand your own protocol or technology
- Users (Operators) of your protocol will be happy to hear it is manageable from the start as opposed to management being an afterthought

Thank You

- Questions?

SNMPv3 Features

- Modular, Extensible, Coexistence Architecture
  - Transports
    - Can support UDP, TCP, SSH, TLS, etc.
  - Message Versions
    - Can support SNMPv1, SNMPv2c, SNMPv3, future versions
  - Message Security
    - Can support multiple authentication methods - MD5, SHA-1, etc.
    - Can support multiple encryption methods - DES, AES, etc.
  - Data Access Control
    - Can support multiple access control methods – views, domains, etc.
  - Operations/Applications
    - Supports SNMPv1 and SNMPv2 operations
      - GetBulk, Inform, better error codes, exception codes
    - Can support new operations (proxy, etc.)

SNMPv3 Message Security Features

- SNMPv3 message wrapper
  - Real Message Security
  - User Based Security Model
    - Authentication (SHA-1 and MD5)
    - Privacy (CBC-DES encryption)
  - Allows 3 security Levels
    - not Authenticated, no Privacy (same as SNMPv1/v2c)
    - authenticated but no Privacy
    - authenticated with Privacy
  - Replay protection (limited)
  - Message level error reporting (Reports)
  - Scoped PDU allows for Multiple Contexts

MIB Modules to Manage SNMP

- Remote Configuration of SNMP Engine
  - RFC3411 - SNMP-FRAMEWORK-MIB
  - RFC3412 - SNMP-MPD-MIB
  - RFC3413 - 3 MIB modules
    - SNMP-TARGET-MIB
    - SNMP-NOTIFICATION-MIB
    - SNMP-PROXY-MIB
  - RFC3414 - SNMP-USER-BASED-SM-MIB
  - RFC3415 - SNMP-VIEW-BASED-ACM-MIB
  - RFC3418 - SNMPv2 MIB
- SNMP Co-existence – (BCP)
  - RFC3584 - SNMP-COMMUNITY-MIB