

Network Working Group
Request for Comments: 1360
Obsoletes: RFCs 1280, 1250,
1100, 1083, 1130, 1140, 1200
STD: 1

Internet Architecture Board
J. Postel, Editor
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IAB OFFICIAL PROTOCOL STANDARDS

Status of this Memo

This memo describes the state of standardization of protocols used in the Internet as determined by the Internet Architecture Board (IAB). Distribution of this memo is unlimited.

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Introduction

Discussion of the standardization process and the RFC document series is presented first, followed by an explanation of the terms. Sections 6.2 - 6.9 contain the lists of protocols in each stage of standardization. Finally come pointers to references and contacts for further information.

This memo is intended to be issued approximately quarterly; please be sure the copy you are reading is current. Current copies may be obtained from the Network Information Center or from the Internet Assigned Numbers Authority (see the contact information at the end of this memo). Do not use this edition after 15-Jan-93.

See Section 6.1 for a description of recent changes. In the official lists in sections 6.2 - 6.9, an asterisk (*) next to a protocol denotes that it is new to this document or has been moved from one protocol level to another, or differs from the previous edition of this document.

1. The Standardization Process

The Internet Architecture Board maintains this list of documents that define standards for the Internet protocol suite. See RFC-1358 for the charter of the IAB and RFC-1160 for an explanation of the role and organization of the IAB and its subsidiary groups, the Internet Engineering Task Force (IETF) and the Internet Research Task Force (IRTF). Each of these groups has a steering group called the IESG

and IRSG, respectively. The IAB provides these standards with the goal of co-ordinating the evolution of the Internet protocols; this co-ordination has become quite important as the Internet protocols are increasingly in general commercial use. The definitive description of the Internet standards process is found in RFC-1310.

The majority of Internet protocol development and standardization activity takes place in the working groups of the Internet Engineering Task Force.

Protocols which are to become standards in the Internet go through a series of states or maturity levels (proposed standard, draft standard, and standard) involving increasing amounts of scrutiny and testing. When a protocol completes this process it is assigned a STD number (see RFC-1311). At each step, the Internet Engineering Steering Group (IESG) of the IETF must make a recommendation for advancement of the protocol and the IAB must ratify it. If a recommendation is not ratified, the protocol is remanded to the IETF for further work.

To allow time for the Internet community to consider and react to standardization proposals, the IAB imposes a minimum delay of 6 months before a proposed standard can be advanced to a draft standard and 4 months before a draft standard can be promoted to standard.

It is general IAB practice that no proposed standard can be promoted to draft standard without at least two independent implementations (and the recommendation of the IESG). Promotion from draft standard to standard generally requires operational experience and demonstrated interoperability of two or more implementations (and the recommendation of the IESG).

In cases where there is uncertainty as to the proper decision concerning a protocol the IAB may convene a special review committee consisting of experts from the IETF, IRTF and the IAB with the purpose of recommending an explicit action to the IAB.

Advancement of a protocol to proposed standard is an important step since it marks a protocol as a candidate for eventual standardization (it puts the protocol "on the standards track"). Advancement to draft standard is a major step which warns the community that, unless major objections are raised or flaws are discovered, the protocol is likely to be advanced to standard in six months.

Some protocols have been superseded by better ones or are otherwise unused. Such protocols are still documented in this memorandum with the designation "historic".

Because the IAB believes it is useful to document the results of early protocol research and development work, some of the RFCs document protocols which are still in an experimental condition. The protocols are designated "experimental" in this memorandum. They appear in this report as a convenience to the community and not as evidence of their standardization.

Other protocols, such as those developed by other standards organizations, or by particular vendors, may be of interest or may be recommended for use in the Internet. The specifications of such protocols may be published as RFCs for the convenience of the Internet community. These protocols are labeled "informational" in this memorandum.

In addition to the working groups of the IETF, protocol development and experimentation may take place as a result of the work of the research groups of the Internet Research Task Force, or the work of other individuals interested in Internet protocol development. The IAB encourages the documentation of such experimental work in the RFC series, but none of this work is considered to be on the track for standardization until the IESG has made a recommendation to advance the protocol to the proposed standard state, and the IAB has approved this step.

A few protocols have achieved widespread implementation without the approval of the IESG and the IAB. For example, some vendor protocols have become very important to the Internet community even though they have not been recommended by the IESG or ratified by the IAB. However, the IAB strongly recommends that the IAB standards process be used in the evolution of the protocol suite to maximize interoperability (and to prevent incompatible protocol requirements from arising). The IAB reserves the use of the terms "standard", "draft standard", and "proposed standard" in any RFC or other publication of Internet protocols to only those protocols which the IAB has approved.

In addition to a state (like "Proposed Standard"), a protocol is also assigned a status, or requirement level, in this document. The possible requirement levels ("Required", "Recommended", "Elective", "Limited Use", and "Not Recommended") are defined in Section 4.2. When a protocol is on the standards track, that is in the proposed standard, draft standard, or standard state (see Section 5), the status shown in Section 6 is the current status. For a proposed or draft standard, however, the IAB will also endeavor to indicate the eventual status this protocol will have after adoption as a standard.

Few protocols are required to be implemented in all systems; this is because there is such a variety of possible systems, for example,

gateways, terminal servers, workstations, and multi-user hosts. The requirement level shown in this document is only a one word label, which may not be sufficient to characterize the implementation requirements for a protocol in all situations. For some protocols, this document contains an additional status paragraph (an applicability statement). In addition, more detailed status information is contained in separate requirements documents (see Section 3).

2. The Request for Comments Documents

The documents called Request for Comments (or RFCs) are the working notes of the "Network Working Group", that is the Internet research and development community. A document in this series may be on essentially any topic related to computer communication, and may be anything from a meeting report to the specification of a standard.

Notice:

All standards are published as RFCs, but not all RFCs specify standards.

Anyone can submit a document for publication as an RFC. Submissions must be made via electronic mail to the RFC Editor (see the contact information at the end of this memo, and see RFC 1111).

While RFCs are not refereed publications, they do receive technical review from the task forces, individual technical experts, or the RFC Editor, as appropriate.

The RFC series comprises a wide range of documents, ranging from informational documents of general interests to specifications of standard Internet protocols. In cases where submission is intended to document a proposed standard, draft standard, or standard protocol, the RFC Editor will publish the document only with the approval of both the IESG and the IAB. For documents describing experimental work, the RFC Editor will notify the IESG before publication, allowing for the possibility of review by the relevant IETF working group or IRTF research group and provide those comments to the author. See Section 5.1 for more detail.

Once a document is assigned an RFC number and published, that RFC is never revised or re-issued with the same number. There is never a question of having the most recent version of a particular RFC. However, a protocol (such as File Transfer Protocol (FTP)) may be improved and re-documented many times in several different RFCs. It is important to verify that you have the most recent RFC on a particular protocol. This "IAB Official Protocol Standards" memo is

the reference for determining the correct RFC for the current specification of each protocol.

The RFCs are available from the Network Information Center at SRI International, and a number of other sites. For more information about obtaining RFCs, see Sections 7.4 and 7.5.

3. Other Reference Documents

There are three other reference documents of interest in checking the current status of protocol specifications and standardization. These are the Assigned Numbers, the Gateway Requirements, and the Host Requirements. Note that these documents are revised and updated at different times; in case of differences between these documents, the most recent must prevail.

Also, one should be aware of the MIL-STD publications on IP, TCP, Telnet, FTP, and SMTP. These are described in Section 3.4.

3.1. Assigned Numbers

This document lists the assigned values of the parameters used in the various protocols. For example, IP protocol codes, TCP port numbers, Telnet Option Codes, ARP hardware types, and Terminal Type names. Assigned Numbers was most recently issued as RFC-1340.

Another document, Internet Numbers, lists the assigned IP network numbers, and the autonomous system numbers. Internet Numbers was most recently issued as RFC-1166.

3.2. Gateway Requirements

This document reviews the specifications that apply to gateways and supplies guidance and clarification for any ambiguities. Gateway Requirements is RFC-1009. A working group of the IETF is actively preparing a revision.

3.3. Host Requirements

This pair of documents reviews and updates the specifications that apply to hosts, and it supplies guidance and clarification for any ambiguities. Host Requirements was issued as RFC-1122 and RFC-1123.

3.4. The MIL-STD Documents

The Internet community specifications for IP (RFC-791) and TCP (RFC-793) and the DoD MIL-STD specifications are intended to describe exactly the same protocols. Any difference in the protocols

specified by these sets of documents should be reported to DCA and to the IAB. The RFCs and the MIL-STDs for IP and TCP differ in style and level of detail. It is strongly advised that the two sets of documents be used together, along with RFC-1122 and RFC-1123.

The IAB and the DoD MIL-STD specifications for the FTP, SMTP, and Telnet protocols are essentially the same documents (RFCs 765, 821, 854). The MIL-STD versions have been edited slightly. Note that the current Internet specification for FTP is RFC-959 (as modified by RFC-1123).

Note that these MIL-STD are now somewhat out of date. The Gateway Requirements (RFC-1009) and Host Requirements (RFC-1122, RFC-1123) take precedence over both earlier RFCs and the MIL-STDs.

| | |
|--------------------------------------|--------------|
| Internet Protocol (IP) | MIL-STD-1777 |
| Transmission Control Protocol (TCP) | MIL-STD-1778 |
| File Transfer Protocol (FTP) | MIL-STD-1780 |
| Simple Mail Transfer Protocol (SMTP) | MIL-STD-1781 |
| Telnet Protocol and Options (TELNET) | MIL-STD-1782 |

These documents are available from the Naval Publications and Forms Center. Requests can be initiated by telephone, telegraph, or mail; however, it is preferred that private industry use form DD1425, if possible.

Naval Publications and Forms Center, Code 3015
5801 Tabor Ave
Philadelphia, PA 19120
Phone: 1-215-697-3321 (order tape)
1-215-697-4834 (conversation)

4. Explanation of Terms

There are two independent categorization of protocols. The first is the "maturity level" or STATE of standardization, one of "standard", "draft standard", "proposed standard", "experimental", "informational" or "historic". The second is the "requirement level" or STATUS of this protocol, one of "required", "recommended", "elective", "limited use", or "not recommended".

The status or requirement level is difficult to portray in a one word label. These status labels should be considered only as an indication, and a further description, or applicability statement, should be consulted.

When a protocol is advanced to proposed standard or draft standard, it is labeled with a current status and when possible, the IAB also

notes the status that the protocol is expected to have when it reaches the standard state.

At any given time a protocol occupies a cell of the following matrix. Protocols are likely to be in cells in about the following proportions (indicated by the relative number of Xs). A new protocol is most likely to start in the (proposed standard, elective) cell, or the (experimental, not recommended) cell.

| | | S T A T U S | | | | |
|---|-------|-------------|-----|-----|-----|-----|
| | | Req | Rec | Ele | Lim | Not |
| S | Std | X | XXX | XXX | | |
| | Draft | X | X | XXX | | |
| T | Prop | | X | XXX | | |
| | Info | | X | XXX | XX | X |
| E | Expr | | | X | XXX | XX |
| | Hist | | | | X | XXX |

What is a "system"?

Some protocols are particular to hosts and some to gateways; a few protocols are used in both. The definitions of the terms below will refer to a "system" which is either a host or a gateway (or both). It should be clear from the context of the particular protocol which types of systems are intended.

4.1. Definitions of Protocol State

Every protocol listed in this document is assigned to a "maturity level" or STATE of standardization: "standard", "draft standard", "proposed standard", "experimental", or "historic".

4.1.1. Standard Protocol

The IAB has established this as an official standard protocol for the Internet. These protocols are assigned STD numbers (see RFC-1311). These are separated into two groups: (1) IP protocol and above, protocols that apply to the whole Internet; and (2) network-specific protocols, generally specifications of how to do IP on particular types of networks.

4.1.2. Draft Standard Protocol

The IAB is actively considering this protocol as a possible Standard Protocol. Substantial and widespread testing and comment are desired. Comments and test results should be submitted to the IAB. There is a possibility that changes will be made in a Draft Standard Protocol before it becomes a Standard Protocol.

4.1.3. Proposed Standard Protocol

These are protocol proposals that may be considered by the IAB for standardization in the future. Implementation and testing by several groups is desirable. Revision of the protocol specification is likely.

4.1.4. Experimental Protocol

A system should not implement an experimental protocol unless it is participating in the experiment and has coordinated its use of the protocol with the developer of the protocol.

Typically, experimental protocols are those that are developed as part of an ongoing research project not related to an operational service offering. While they may be proposed as a service protocol at a later stage, and thus become proposed standard, draft standard, and then standard protocols, the designation of a protocol as experimental may sometimes be meant to suggest that the protocol, although perhaps mature, is not intended for operational use.

4.1.5. Informational Protocol

Protocols developed by other standard organizations, or vendors, or that are for other reasons outside the purview of the IAB, may be published as RFCs for the convenience of the Internet community as informational protocols. Such protocols may in some cases also be recommended for use in the Internet by the IAB.

4.1.6. Historic Protocol

These are protocols that are unlikely to ever become standards in the Internet either because they have been superseded by later developments or due to lack of interest.

4.2. Definitions of Protocol Status

This document lists a "requirement level" or STATUS for each protocol. The status is one of "required", "recommended", "elective", "limited use", or "not recommended".

4.2.1. Required Protocol

A system must implement the required protocols.

4.2.2. Recommended Protocol

A system should implement the recommended protocols.

4.2.3. Elective Protocol

A system may or may not implement an elective protocol. The general notion is that if you are going to do something like this, you must do exactly this. There may be several elective protocols in a general area, for example, there are several electronic mail protocols, and several routing protocols.

4.2.4. Limited Use Protocol

These protocols are for use in limited circumstances. This may be because of their experimental state, specialized nature, limited functionality, or historic state.

4.2.5. Not Recommended Protocol

These protocols are not recommended for general use. This may be because of their limited functionality, specialized nature, or experimental or historic state.

5. The Standards Track

This section discusses in more detail the procedures used by the RFC Editor and the IAB in making decisions about the labeling and publishing of protocols as standards.

5.1. The RFC Processing Decision Table

Here is the current decision table for processing submissions by the RFC Editor. The processing depends on who submitted it, and the status they want it to have.

| ***** | | | | |
|------------------------------|-------------|----------------|----------------|----------------|
| S O U R C E | | | | |
| Desired Status | IAB | IESG | IRSG | Other |
| Standard or Draft Standard | Publish (1) | Vote (3) | Bogus (2) | Bogus (2) |
| Proposed Standard | Publish (1) | Vote (3) | Refer (4) | Refer (4) |
| Experimental Protocol | Publish (1) | Notify (5) | Notify (5) | Notify (5) |
| Information or Opinion Paper | Publish (1) | Discretion (6) | Discretion (6) | Discretion (6) |

(1) Publish.

(2) Bogus. Inform the source of the rules. RFCs specifying Standard, or Draft Standard must come from the IAB, only.

(3) Vote by the IAB. If approved then do Publish (1), else do Refer (4).

(4) Refer to an Area Director for review by a WG. Expect to see the document again only after approval by the IESG and the IAB.

(5) Notify both the IESG and IRSG. If no concerns are raised in two weeks then do Discretion (6), else RFC Editor to resolve the concerns or do Refer (4).

(6) RFC Editor's discretion. The RFC Editor decides if a review

is needed and if so by whom. RFC Editor decides to publish or not.

Of course, in all cases the RFC Editor can request or make minor changes for style, format, and presentation purposes.

The IESG has designated the IESG Secretary as its agent for forwarding documents with IESG approval and for registering concerns in response to notifications (5) to the RFC Editor. Documents from Area Directors or Working Group Chairs may be considered in the same way as documents from "other".

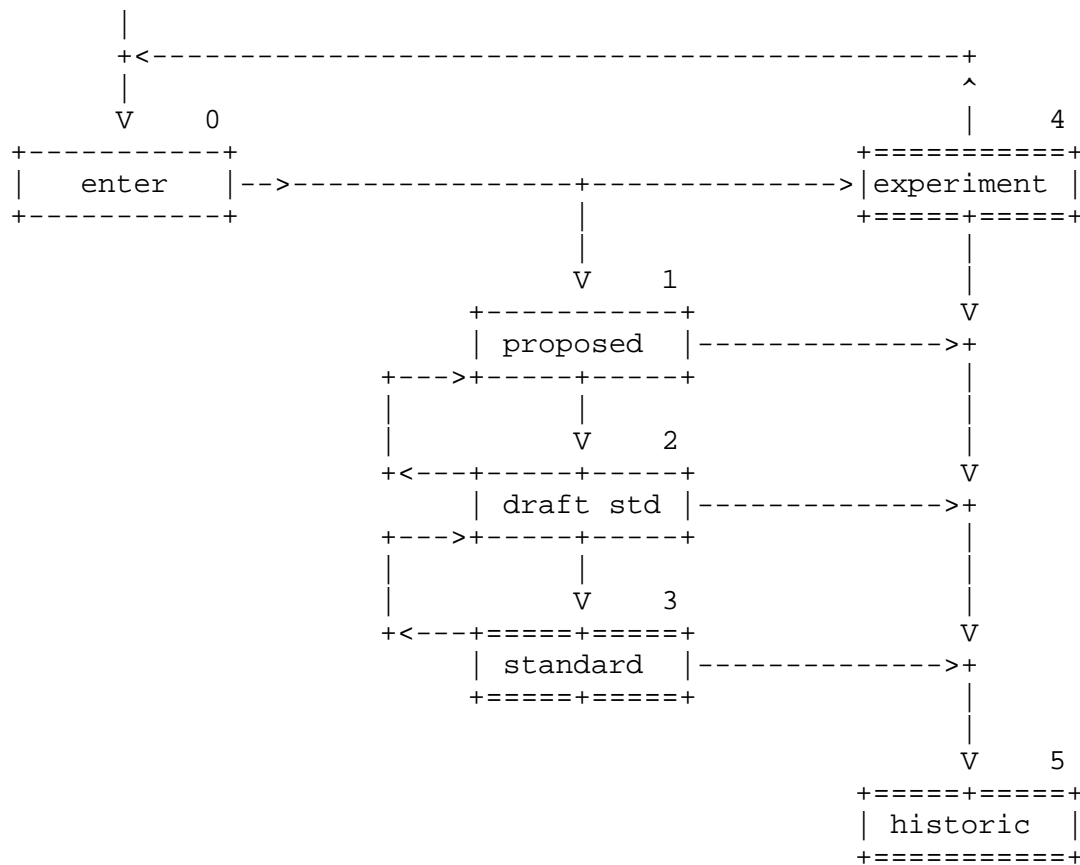
5.2. The Standards Track Diagram

There is a part of the STATUS and STATE categorization that is called the standards track. Actually, only the changes of state are significant to the progression along the standards track, though the status assignments may be changed as well.

The states illustrated by single line boxes are temporary states, those illustrated by double line boxes are long term states. A protocol will normally be expected to remain in a temporary state for several months (minimum six months for proposed standard, minimum four months for draft standard). A protocol may be in a long term state for many years.

A protocol may enter the standards track only on the recommendation of the IESG and by action of the IAB; and may move from one state to another along the track only on the recommendation of the IESG and by action of the IAB. That is, it takes both the IESG and the IAB to either start a protocol on the track or to move it along.

Generally, as the protocol enters the standards track a decision is made as to the eventual STATUS, requirement level or applicability (elective, recommended, or required) the protocol will have, although a somewhat less stringent current status may be assigned, and it then is placed in the the proposed standard STATE with that status. So the initial placement of a protocol is into state 1. At any time the STATUS decision may be revisited.



The transition from proposed standard (1) to draft standard (2) can only be by action of the IAB on the recommendation of the IESG and only after the protocol has been proposed standard (1) for at least six months.

The transition from draft standard (2) to standard (3) can only be by action of the IAB on the recommendation of the IESG and only after the protocol has been draft standard (2) for at least four months.

Occasionally, the decision may be that the protocol is not ready for standardization and will be assigned to the experimental state (4). This is off the standards track, and the protocol may be resubmitted to enter the standards track after further work. There are other paths into the experimental and historic states that do not involve IAB action.

Sometimes one protocol is replaced by another and thus becomes historic, or it may happen that a protocol on the standards track is in a sense overtaken by another protocol (or other events) and becomes historic (state 5).

6. The Protocols

Subsection 6.1 lists recent RFCs and other changes. Subsections 6.2 - 6.9 list the standards in groups by protocol state.

6.1. Recent Changes

6.1.1. New RFCs:

1361 - Simple Network Time Protocol (SNTP)

This is an information document and does not specify any level of standard.

1360 - This memo.

1359 - Connecting to the Internet What Connecting Institutions Should Anticipate

This is an information document and does not specify any level of standard.

1358 - Charter of the Internet Architecture Board (IAB)

This is an information document and does not specify any level of standard.

1357 - A Format for E-mailing Bibliographic Records

This is an information document and does not specify any level of standard.

1356 - Multiprotocol Interconnect on X.25 and ISDN in the Packet Mode

A Proposed Standard protocol.

1355 - Privacy and Accuracy Issues in Network Information Center Databases

This is an information document and does not specify any level of standard.

1354 - IP Forwarding Table MIB

A Proposed Standard protocol.

- 1353 - Definitions of Managed Objects for Administration of SNMP Parties
A Proposed Standard protocol.
- 1352 - SNMP Security Protocols
A Proposed Standard protocol.
- 1351 - SNMP Administrative Model
A Proposed Standard protocol.
- 1350 - The TFTP Protocol (Revision 2)
A Standard protocol.
- 1349 - Type of Service in the Internet Protocol Suite
A Proposed Standard protocol.
- 1348 - DNS NSAP RRs
An Experimental protocol.
- 1347 - TCP and UDP with Bigger Addresses (TUBA), A Simple Proposal for Internet Addressing and Routing
This is an information document and does not specify any level of standard.
- 1346 - Resource Allocation, Control, and Accounting for the Use of Network Resources
This is an information document and does not specify any level of standard.
- 1345 - Character Mnemonics & Character Sets
This is an information document and does not specify any level of standard.
- 1344 - Implications of MIME for Internet Mail Gateways
This is an information document and does not specify any level of standard.

- 1343 - A User Agent Configuration Mechanism For Multimedia Mail Format Information

This is an information document and does not specify any level of standard.

- 1342 - Representation of Non-ASCII Text in Internet Message Headers

A Proposed Standard protocol.

- 1341 - MIME (Multipurpose Internet Mail Extensions): Mechanisms for Specifying and Describing the Format of Internet Message Bodies

A Proposed Standard protocol.

- 1340 - Assigned Numbers

This is an information document and does not specify any level of standard.

- 1339 - Remote Mail Checking Protocol

An Experimental protocol.

- 1338 - Supernetting: an Address Assignment and Aggregation Strategy

This is an information document and does not specify any level of standard.

- 1337 - TIME-WAIT Assassination Hazards in TCP

This is an information document and does not specify any level of standard.

- 1336 - Who's Who in the Internet - Biographies of IAB, IESG and IRSG Members

This is an information document and does not specify any level of standard.

- 1335 - A Two-Tier Address Structure for the Internet: A Solution to the Problem of Address Space Exhaustion

This is an information document and does not specify any level of standard.

- 1334 - Not yet issued.
- 1333 - PPP Link Quality Monitoring
A Proposed Standard protocol.
- 1332 - The PPP Internet Protocol Control Protocol (IPCP)
A Proposed Standard protocol.
- 1331 - The Point-to-Point Protocol (PPP) for the Transmission of
Multi-protocol Datagrams over Point-to-Point Links
A Proposed Standard protocol.
- 1330 - Recommendations for the Phase I Deployment of OSI Directory
Services (X.500) and OSI Message Handling Services (X.400)

This is an information document and does not specify any
level of standard.
- 1329 - Thoughts on Address Resolution for Dual MAC FDDI Networks

This is an information document and does not specify any
level of standard.
- 1328 - X.400 1988 to 1984 downgrading
A Proposed Standard protocol.
- 1327 - Mapping between X.400(1988) / ISO 10021 and RFC 822
A Proposed Standard protocol.
- 1326 - Mutual Encapsulation Considered Dangerous

This is an information document and does not specify any
level of standard.
- 1325 - FYI on Questions and Answers - Answers to Commonly asked
"New Internet User" Questions

This is an information document and does not specify any
level of standard.

1324 - A Discussion on Computer Network Conferencing

This is an information document and does not specify any level of standard.

1323 - TCP Extensions for High Performance

A Proposed Standard protocol.

1322 - A Unified Approach to Inter-Domain Routing

This is an information document and does not specify any level of standard.

1321 - The MD5 Message-Digest Algorithm

This is an information document and does not specify any level of standard.

1320 - The MD4 Message-Digest Algorithm

This is an information document and does not specify any level of standard.

1319 - The MD2 Message-Digest Algorithm

This is an information document and does not specify any level of standard.

1318 - Definitions of Managed Objects for Parallel-printer-like Hardware Devices

A Proposed Standard protocol.

1317 - Definitions of Managed Objects RS-232-like Hardware Devices

A Proposed Standard protocol.

1316 - Definitions of Managed Objects for Character Stream Devices

A Proposed Standard protocol.

1315 - Management Information Base for Frame Relay DTEs

A Proposed Standard protocol.

1314 - A File Format for the Exchange of Images in the Internet
A Proposed Standard protocol.

1313 - Today's Programming for KRFC AM 1313 Internet Talk Radio
This is an information document and does not specify any
level of standard.

1312 - Message Send Protocol 2
An Experimental protocol.

6.1.2. Other Changes:

The following are changes to protocols listed in the previous
edition.

1172 - The Point-to-Point Protocol (PPP) Initial Configuration
Options

Moved to Historic (obsoleted by RFC-1331).

1113 - Privacy Enhancement for Internet Electronic Mail: Part I --
Message Encipherment and Authentication Procedures

Moved to Historic.

1114 - Privacy Enhancement for Internet Electronic Mail: Part II
-- Certificate-Based Key Management

Moved to Historic.

1115 - Privacy Enhancement for Internet Electronic Mail: Part III
-- Algorithms, Modes, and Identifiers

Moved to Historic.

1056 - PCMAIL: A Distributed Mail System for Personal Computers

Moved to Historic.

1058 - Routing Information Protocol

Advanced to Standard protocol.

1037 - NFILE - A File Access Protocol

Moved to Historic.

1026 - Addendum to RFC 987 (Mapping between X.400 and RFC-822)

Moved to Historic (obsoleted by RFC-1327).

987 - Mapping between X.400 and RFC-822

Moved to Historic (obsoleted by RFC-1327).

953 - Hostname Server

Moved to Historic.

913 - Simple File Transfer Protocol

Moved to Historic.

734 - SUPDUP

Moved to Historic.

6.2. Standard Protocols

| Protocol | Name | Status | RFC | STD | * |
|----------|-------------------------------------|--------|-----------|-------|-------|
| ===== | ===== | ===== | ===== | ===== | ===== |
| ----- | IAB Official Protocol Standards | Req | 1360 | 1 | * |
| ----- | Assigned Numbers | Req | 1340 | 2 | * |
| ----- | Host Requirements - Communications | Req | 1122 | 3 | |
| ----- | Host Requirements - Applications | Req | 1123 | 3 | |
| ----- | Gateway Requirements | Req | 1009 | 4 | |
| IP | Internet Protocol | Req | 791 | 5 | |
| | as amended by:----- | | | | |
| ----- | IP Subnet Extension | Req | 950 | 5 | |
| ----- | IP Broadcast Datagrams | Req | 919 | 5 | |
| ----- | IP Broadcast Datagrams with Subnets | Req | 922 | 5 | |
| ICMP | Internet Control Message Protocol | Req | 792 | 5 | |
| IGMP | Internet Group Multicast Protocol | Rec | 1112 | 5 | |
| UDP | User Datagram Protocol | Rec | 768 | 6 | |
| TCP | Transmission Control Protocol | Rec | 793 | 7 | |
| TELNET | Telnet Protocol | Rec | 854,855 | 8 | |
| FTP | File Transfer Protocol | Rec | 959 | 9 | |
| SMTP | Simple Mail Transfer Protocol | Rec | 821 | 10 | |
| MAIL | Format of Electronic Mail Messages | Rec | 822 | 11 | |
| CONTENT | Content Type Header Field | Rec | 1049 | 11 | |
| NTP | Network Time Protocol | Rec | 1119 | 12 | |
| DOMAIN | Domain Name System | Rec | 1034,1035 | 13 | |
| DNS-MX | Mail Routing and the Domain System | Rec | 974 | 14 | |
| SNMP | Simple Network Management Protocol | Rec | 1157 | 15 | |
| SMI | Structure of Management Information | Rec | 1155 | 16 | |
| MIB-II | Management Information Base-II | Rec | 1213 | 17 | |
| EGP | Exterior Gateway Protocol | Rec | 904 | 18 | |
| NETBIOS | NetBIOS Service Protocols | Ele | 1001,1002 | 19 | |
| ECHO | Echo Protocol | Rec | 862 | 20 | |
| DISCARD | Discard Protocol | Ele | 863 | 21 | |
| CHARGEN | Character Generator Protocol | Ele | 864 | 22 | |
| QUOTE | Quote of the Day Protocol | Ele | 865 | 23 | |
| USERS | Active Users Protocol | Ele | 866 | 24 | |
| DAYTIME | Daytime Protocol | Ele | 867 | 25 | |
| TIME | Time Server Protocol | Ele | 868 | 26 | |
| TFTP | Trivial File Transfer Protocol | Ele | 1350 | 33* | |
| RIP | Routing Information Protocol | Ele | 1058 | 34* | |

[Note: an asterisk at the end of a line indicates a change from the previous edition of this document.]

Applicability Statements:

IGMP -- The Internet Architecture Board intends to move towards general adoption of IP multicasting, as a more efficient solution

than broadcasting for many applications. The host interface has been standardized in RFC-1112; however, multicast-routing gateways are in the experimental stage and are not widely available. An Internet host should support all of RFC-1112, except for the IGMP protocol itself which is optional; see RFC-1122 for more details. Even without IGMP, implementation of RFC-1112 will provide an important advance: IP-layer access to local network multicast addressing. It is expected that IGMP will become recommended for all hosts and gateways at some future date.

SMI, MIB-II SNMP -- The Internet Architecture Board recommends that all IP and TCP implementations be network manageable. At the current time, this implies implementation of the Internet MIB-II (RFC-1213), and at least the recommended management protocol SNMP (RFC-1157).

6.3. Network-Specific Standard Protocols

| Protocol | Name | State | Status | RFC |
|------------|---|-------|--------|---------|
| ===== | ===== | ===== | ===== | ===== |
| IP-FR | Multiprotocol over Frame Relay | Prop | Ele | 1294 |
| IP-SMDS | Transmission of IP Datagrams over SMDS | Prop | Ele | 1209 |
| ARP | Address Resolution Protocol | Std | Ele | 826 |
| RARP | A Reverse Address Resolution Protocol | Std | Ele | 903 |
| IP-ARPA | Internet Protocol on ARPANET | Std | Ele | BBN1822 |
| IP-WB | Internet Protocol on Wideband Network | Std | Ele | 907 |
| IP-X25 | Internet Protocol on X.25 Networks | Std | Ele | 877 |
| IP-E | Internet Protocol on Ethernet Networks | Std | Ele | 894 |
| IP-EE | Internet Protocol on Exp. Ethernet Nets | Std | Ele | 895 |
| IP-IEEE | Internet Protocol on IEEE 802 | Std | Ele | 1042 |
| IP-DC | Internet Protocol on DC Networks | Std | Ele | 891 |
| IP-HC | Internet Protocol on Hyperchannel | Std | Ele | 1044 |
| IP-ARC | Internet Protocol on ARCNET | Std | Ele | 1051 |
| IP-SLIP | Transmission of IP over Serial Lines | Std | Ele | 1055 |
| IP-NETBIOS | Transmission of IP over NETBIOS | Std | Ele | 1088 |
| IP-IPX | Transmission of 802.2 over IPX Networks | Std | Ele | 1132 |
| IP-FDDI | Transmission of IP over FDDI | Draft | Ele | 1188 |

[Note: an asterisk at the end of a line indicates a change from the previous edition of this document.]

Applicability Statements:

It is expected that a system will support one or more physical networks and for each physical network supported the appropriate protocols from the above list must be supported. That is, it is elective to support any particular type of physical network, and for the physical networks actually supported it is required that they be supported exactly according to the protocols in the above list. See

also the Host and Gateway Requirements RFCs for more specific information on network-specific ("link layer") protocols.

6.4. Draft Standard Protocols

| Protocol | Name | Status | RFC |
|-------------|---|-------------|-----------|
| ===== | ===== | ===== | ===== |
| FINGER | Finger Protocol | Elective | 1288 |
| BGP3 | Border Gateway Protocol 3 (BGP-3) | Elective | 1267,1268 |
| OSPF2 | Open Shortest Path First Routing V2 | Elective | 1247 |
| POP3 | Post Office Protocol, Version 3 | Elective | 1225 |
| Concise-MIB | Concise MIB Definitions | Elective | 1212 |
| IP-FDDI | Internet Protocol on FDDI Networks | Elective | 1188 |
| TOPT-LINE | Telnet Linemode Option | Elective | 1184 |
| PPP | Point to Point Protocol | Elective | 1171 |
| BOOTP | Bootstrap Protocol | Recommended | 951,1084 |
| TP-TCP | ISO Transport Service on top of the TCP | Elective | 1006 |
| NICNAME | WhoIs Protocol | Elective | 954 |

[Note: an asterisk at the end of a line indicates a change from the previous edition of this document.]

Applicability Statements:

RIP -- The Routing Information Protocol (RIP) is widely implemented and used in the Internet. However, both implementors and users should be aware that RIP has some serious technical limitations as a routing protocol. The IETF is currently developing several candidates for a new standard "open" routing protocol with better properties than RIP. The IAB urges the Internet community to track these developments, and to implement the new protocol when it is standardized; improved Internet service will result for many users.

TP-TCP -- As OSI protocols become more widely implemented and used, there will be an increasing need to support interoperation with the TCP/IP protocols. The Internet Engineering Task Force is formulating strategies for interoperation. RFC-1006 provides one interoperation mode, in which TCP/IP is used to emulate TP0 in order to support OSI applications. Hosts that wish to run OSI connection-oriented applications in this mode should use the procedure described in RFC-1006. In the future, the IAB expects that a major portion of the Internet will support both TCP/IP and OSI (inter-)network protocols in parallel, and it will then be possible to run OSI applications across the Internet using full OSI protocol "stacks".

PPP -- Point to Point Protocol is a method of sending IP over serial lines, which are a type of physical network. It is anticipated that PPP will be advanced to the network-specifics standard protocol state

in the future.

6.5. Proposed Standard Protocols

| Protocol | Name | Status | RFC |
|------------|--|----------|-------|
| ===== | ===== | ===== | ===== |
| | X.25 and ISDN in the Packet Mode | Elective | 1356* |
| TABLE-MIB | IP Forwarding Table MIB | Elective | 1354* |
| ----- | Administration of SNMP | Elective | 1353* |
| SNMP-SEC | SNMP Security Protocols | Elective | 1352* |
| SNMP-ADMIN | SNMP Administrative Model | Elective | 1351* |
| TOS | Type of Service in the Internet... | Elective | 1349* |
| ----- | Representation of Non-ASCII Text... | Elective | 1342* |
| MIME | Multipurpose Internet Mail Extensions | Elective | 1341* |
| PPP-LINK | PPP Link Quality Monitoring | Elective | 1333* |
| PPP | Point-to-Point Protocol (PPP) | Elective | 1331* |
| ----- | X.400 1988 to 1984 downgrading | Elective | 1328* |
| ----- | Mapping between X.400(1988)... | Elective | 1327* |
| TCP-EXT | TCP Extensions for High Performance | Elective | 1323* |
| ----- | Def. Man. Objs Parallel-printer-like... | Elective | 1318* |
| ----- | Def. Man Objs RS-232-like... | Elective | 1317* |
| ----- | Def. Man. Objs. Character Stream... | Elective | 1316* |
| FRAME-MIB | Management Information Base for Frame.. | Elective | 1315* |
| NETFAX | File Format for the Exchange of Images.. | Elective | 1314* |
| SIP-MIB | SIP Interface Type MIB | Elective | 1304 |
| IARP | Inverse Address Resolution Protocol | Elective | 1293 |
| DECNET-MIB | DECNET MIB | Elective | 1289 |
| BRIDGE-MIB | BRIDGE-MIB | Elective | 1286 |
| FDDI-MIB | FDDI-MIB | Elective | 1285 |
| ETHER-MIB | Ethernet MIB | Elective | 1284 |
| ----- | Encoding Network Addresses... | Elective | 1277 |
| ----- | Replication and Distributed Operations.. | Elective | 1276 |
| ----- | COSINE and Internet X.500 Schema... | Elective | 1274 |
| RMON-MIB | Remote Network Monitoring MIB | Elective | 1271 |
| BGP-MIB | Border Gateway Protocol MIB (Version 3) | Elective | 1269 |
| ICMP-ROUT | ICMP Router Discovery Messages | Elective | 1256 |
| OSPF-MIB | OSPF Version 2 MIB | Elective | 1253 |
| IPSO | DoD Security Options for IP | Elective | 1108 |
| AT-MIB | Appletalk MIB | Elective | 1243 |
| OSI-UDP | OSI TS on UDP | Elective | 1240 |
| STD-MIBs | Reassignment of Exp MIBs to Std MIBs | Elective | 1239 |
| OSI-NSAP | Guidelines for OSI NSAP Allocation | Elective | 1237 |
| IPX-IP | Tunneling IPX Traffic through IP Nets | Elective | 1234 |
| DS3-MIB | DS3 Interface Objects | Elective | 1233 |
| DS1-MIB | DS1 Interface Objects | Elective | 1232 |
| 802.5-MIB | IEEE 802.5 Token Ring MIB | Elective | 1231 |
| 802.4-MIB | IEEE 802.4 Token Bus MIB | Elective | 1230 |
| GINT-MIB | Extensions to the Generic-Interface MIB | Elective | 1229 |

| | | | |
|-------------|--|----------|------|
| PPP-EXT | PPP Extensions for Bridging | Elective | 1220 |
| OIM-MIB-II | OSI Internet Management: MIB-II | Elective | 1214 |
| IP-SMDS | IP Datagrams over the SMDS Service | Elective | 1209 |
| IP-ARCNET | Transmitting IP Traffic over ARCNET Nets | Elective | 1201 |
| IS-IS | OSI IS-IS for TCP/IP Dual Environments | Elective | 1195 |
| IP-MTU | Path MTU Discovery | Elective | 1191 |
| CMOT | Common Management Information Services.. | Elective | 1189 |
| IP-CMPRS | Compressing TCP/IP Headers | Elective | 1144 |
| ISO-TS-ECHO | Echo for ISO-8473 | Elective | 1139 |
| SUN-NFS | Network File System Protocol | Elective | 1094 |
| SUN-RPC | Remote Procedure Call Protocol | Elective | 1057 |
| NNTP | Network News Transfer Protocol | Elective | 977 |
| RLP | Resource Location Protocol | Elective | 887 |

[Note: an asterisk at the end of a line indicates a change from the previous edition of this document.]

Applicability Statements:

IP-SMDS and IP-ARCNET -- These define methods of sending IP over particular network types. It is anticipated that these will be advanced to the network specific standard protocol state in the future.

6.6. Telnet Options

For convenience, all the Telnet Options are collected here with both their state and status.

| Protocol | Name | Number | State | Status | RFC | STD |
|-----------|------------------------------------|--------|-------|--------|-------|-------|
| ===== | ===== | ===== | ===== | ===== | ===== | ===== |
| TOPT-BIN | Binary Transmission | 0 | Std | Rec | 856 | 27 |
| TOPT-ECHO | Echo | 1 | Std | Rec | 857 | 28 |
| TOPT-RECN | Reconnection | 2 | Prop | Ele | ... | |
| TOPT-SUPP | Suppress Go Ahead | 3 | Std | Rec | 858 | 29 |
| TOPT-APRX | Approx Message Size Negotiation | 4 | Prop | Ele | ... | |
| TOPT-STAT | Status | 5 | Std | Rec | 859 | 30 |
| TOPT-TIM | Timing Mark | 6 | Std | Rec | 860 | 31 |
| TOPT-REM | Remote Controlled Trans and Echo | 7 | Prop | Ele | 726 | |
| TOPT-OLW | Output Line Width | 8 | Prop | Ele | ... | |
| TOPT-OPS | Output Page Size | 9 | Prop | Ele | ... | |
| TOPT-OCRD | Output Carriage-Return Disposition | 10 | Prop | Ele | 652 | |
| TOPT-OHT | Output Horizontal Tabstops | 11 | Prop | Ele | 653 | |
| TOPT-OHTD | Output Horizontal Tab Disposition | 12 | Prop | Ele | 654 | |
| TOPT-OFD | Output Formfeed Disposition | 13 | Prop | Ele | 655 | |
| TOPT-OVT | Output Vertical Tabstops | 14 | Prop | Ele | 656 | |
| TOPT-OVTD | Output Vertical Tab Disposition | 15 | Prop | Ele | 657 | |
| TOPT-OLD | Output Linefeed Disposition | 16 | Prop | Ele | 658 | |

| | | | | | |
|-------------|-----------------------------|-----|-------|-----|--------|
| TOPT-EXT | Extended ASCII | 17 | Prop | Ele | 698 |
| TOPT-LOGO | Logout | 18 | Prop | Ele | 727 |
| TOPT-BYTE | Byte Macro | 19 | Prop | Ele | 735 |
| TOPT-DATA | Data Entry Terminal | 20 | Prop | Ele | 1043 |
| TOPT-SUP | SUPDUP | 21 | Prop | Ele | 734 |
| TOPT-SUPO | SUPDUP Output | 22 | Prop | Ele | 749 |
| TOPT-SNDL | Send Location | 23 | Prop | Ele | 779 |
| TOPT-TERM | Terminal Type | 24 | Prop | Ele | 1091 |
| TOPT-EOR | End of Record | 25 | Prop | Ele | 885 |
| TOPT-TACACS | TACACS User Identification | 26 | Prop | Ele | 927 |
| TOPT-OM | Output Marking | 27 | Prop | Ele | 933 |
| TOPT-TLN | Terminal Location Number | 28 | Prop | Ele | 946 |
| TOPT-3270 | Telnet 3270 Regime | 29 | Prop | Ele | 1041 |
| TOPT-X.3 | X.3 PAD | 30 | Prop | Ele | 1053 |
| TOPT-NAWS | Negotiate About Window Size | 31 | Prop | Ele | 1073 |
| TOPT-TS | Terminal Speed | 32 | Prop | Ele | 1079 |
| TOPT-RFC | Remote Flow Control | 33 | Prop | Ele | 1080 |
| TOPT-LINE | Linemode | 34 | Draft | Ele | 1184 |
| TOPT-XDL | X Display Location | 35 | Prop | Ele | 1096 |
| TOPT-EXTOP | Extended-Options-List | 255 | Std | Rec | 861 32 |

[Note: an asterisk at the end of a line indicates a change from the previous edition of this document.]

6.7. Experimental Protocols

| Protocol | Name | Status | RFC |
|-----------|--|-------------|-------|
| ===== | ===== | ===== | ===== |
| DNS NSAP | DNS NSAP RRs | Elective | 1348* |
| RMCP | Remote Mail Checking Protocol | Elective | 1339* |
| MSP2 | Message Send Protocol 2 | Elective | 1312* |
| DSLCP | Dynamically Switched Link Control | Elective | 1307 |
| ----- | X.500 and Domains | Elective | 1279 |
| SNMP-OSI | SNMP over OSI | Elective | 1283 |
| IN-ENCAP | Internet Encapsulation Protocol | Limited Use | 1241 |
| CLNS-MIB | CLNS-MIB | Limited Use | 1238 |
| CFDP | Coherent File Distribution Protocol | Limited Use | 1235 |
| SNMP-DPI | SNMP Distributed Program Interface | Limited Use | 1228 |
| SNMP-MUX | SNMP MUX Protocol and MIB | Limited Use | 1227 |
| IP-AX25 | IP Encapsulation of AX.25 Frames | Limited Use | 1226 |
| ALERTS | Managing Asynchronously Generated Alerts | Limited Use | 1224 |
| MPP | Message Posting Protocol | Limited Use | 1204 |
| ST-II | Stream Protocol | Limited Use | 1190 |
| SNMP-BULK | Bulk Table Retrieval with the SNMP | Limited Use | 1187 |
| DNS-RR | New DNS RR Definitions | Limited Use | 1183 |
| NTP-OSI | NTP over OSI Remote Operations | Limited Use | 1165 |
| EHF-MAIL | Encoding Header Field for Mail | Elective | 1154 |
| DMF-MAIL | Digest Message Format for Mail | Elective | 1153 |

| | | | |
|------------|--|-----------------|-----------|
| RDP | Reliable Data Protocol | Limited Use | 908,1151 |
| ----- | Mapping between X.400(88) and RFC-822 | Elective | 1148 |
| TCP-ACO | TCP Alternate Checksum Option | Not Recommended | 1146 |
| ----- | Mapping full 822 to Restricted 822 | Elective | 1137 |
| IP-DVMRP | IP Distance Vector Multicast Routing | Not Recommended | 1075 |
| TCP-LDP | TCP Extensions for Long Delay Paths | Limited Use | 1072 |
| IMAP2 | Interactive Mail Access Protocol | Limited Use | 1176,1064 |
| IMAP3 | Interactive Mail Access Protocol | Limited Use | 1203 |
| VMTP | Versatile Message Transaction Protocol | Elective | 1045 |
| COOKIE-JAR | Authentication Scheme | Not Recommended | 1004 |
| NETBLT | Bulk Data Transfer Protocol | Not Recommended | 998 |
| IRTP | Internet Reliable Transaction Protocol | Not Recommended | 938 |
| AUTH | Authentication Service | Not Recommended | 931 |
| LDP | Loader Debugger Protocol | Not Recommended | 909 |
| NVP-II | Network Voice Protocol | Limited Use | ISI-memo |
| PVP | Packet Video Protocol | Limited Use | ISI-memo |

[Note: an asterisk at the end of a line indicates a change from the previous edition of this document.]

6.8. Informational Protocols

| Protocol | Name | Status | RFC |
|------------|-------------------------------------|-------------|-------|
| ===== | ===== | ===== | ===== |
| ----- | Replication Requirements... | Elective | 1275* |
| PCMAIL | Pcmail Transport Protocol | Elective | 1056* |
| MTP | Multicast Transport Protocol | Elective | 1301 |
| SNMP-IPX | SNMP over IPX | Elective | 1298 |
| BSD Login | BSD Login | Elective | 1282 |
| DIXIE | DIXIE Protocol Specification | Limited Use | 1249 |
| IP-X.121 | IP to X.121 Address Mapping for DDN | Limited Use | 1236 |
| OSI-HYPER | OSI and LLC1 on HYPERchannel | Limited Use | 1223 |
| HAP2 | Host Access Protocol | Limited Use | 1221 |
| SUBNETASGN | On the Assignment of Subnet Numbers | Limited Use | 1219 |
| SNMP-TRAPS | Defining Traps for use with SNMP | Limited Use | 1215 |
| DAS | Directory Assistance Service | Limited Use | 1202 |
| MD4 | MD4 Message Digest Algorithm | Limited Use | 1186 |
| LPDP | Line Printer Daemon Protocol | Limited Use | 1179 |

[Note: an asterisk at the end of a line indicates a change from the previous edition of this document.]

6.9. Historic Protocols

| Protocol | Name | Status | RFC |
|------------|---|-----------------|-----------|
| ===== | ===== | ===== | ===== |
| PPP-INIT | PPP Initial Configuration Options | Not Recommended | 1172* |
| MSP | Message Send Protocol | Not Recommended | 1159* |
| ----- | Mail Privacy: Procedures | Not Recommended | 1113* |
| ----- | Mail Privacy: Key Management | Not Recommended | 1114* |
| ----- | Mail Privacy: Algorithms | Not Recommended | 1115* |
| ----- | Mapping X.400(84) and RFC-822 | Not Recommended | 987,1026* |
| NFILE | A File Access Protocol | Elective | 1037* |
| HOSTNAME | HOSTNAME Protocol | Elective | 953* |
| SFTP | Simple File Transfer Protocol | Elective | 913* |
| SUPDUP | SUPDUP Protocol | Elective | 734* |
| BGP | Border Gateway Protocol | Not Recommended | 1163,1164 |
| MIB-I | MIB-I | Not Recommended | 1156 |
| SGMP | Simple Gateway Monitoring Protocol | Not Recommended | 1028 |
| HEMS | High Level Entity Management Protocol | Not Recommended | 1021 |
| STATSRV | Statistics Server | Not Recommended | 996 |
| POP2 | Post Office Protocol, Version 2 | Not Recommended | 937 |
| RATP | Reliable Asynchronous Transfer Protocol | Not Recommended | 916 |
| HFEP | Host - Front End Protocol | Not Recommended | 929 |
| THINWIRE | Thinwire Protocol | Not Recommended | 914 |
| HMP | Host Monitoring Protocol | Not Recommended | 869 |
| GGP | Gateway Gateway Protocol | Not Recommended | 823 |
| RTELNET | Remote Telnet Service | Not Recommended | 818 |
| CLOCK | DCNET Time Server Protocol | Not Recommended | 778 |
| MPM | Internet Message Protocol | Not Recommended | 759 |
| NETRJS | Remote Job Service | Not Recommended | 740 |
| NETED | Network Standard Text Editor | Not Recommended | 569 |
| RJE | Remote Job Entry | Not Recommended | 407 |
| XNET | Cross Net Debugger | Not Recommended | IEN-158 |
| NAMESERVER | Host Name Server Protocol | Not Recommended | IEN-116 |
| MUX | Multiplexing Protocol | Not Recommended | IEN-90 |
| GRAPHICS | Graphics Protocol | Not Recommended | NIC-24308 |

[Note: an asterisk at the end of a line indicates a change from the previous edition of this document.]

7. Contacts

7.1. IAB, IETF, and IRTF Contacts

7.1.1. Internet Architecture Board (IAB) Contact

Please send your comments about this list of protocols and especially about the Draft Standard Protocols to the Internet Architecture Board care of Bob Braden, IAB Executive Director.

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The protocol standards are managed for the IAB by the Internet Assigned Numbers Authority.

Please refer to the document "Assigned Numbers" (RFC-1340) for further information about the status of protocol documents. There are two documents that summarize the requirements for host and gateways in the Internet, "Host Requirements" (RFC-1122 and RFC-1123) and "Gateway Requirements" (RFC-1009).

How to obtain the most recent edition of this "IAB Official Protocol Standards" memo:

The file "in-notes/iab-standards.txt" may be copied via FTP from the VENERA.ISI.EDU computer using the FTP username "anonymous" and FTP password "guest".

7.3. Request for Comments Editor Contact

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RFC-Editor@ISI.EDU

Documents may be submitted via electronic mail to the RFC Editor for consideration for publication as RFC. If you are not familiar with the format or style requirements please request the "Instructions for RFC Authors". In general, the style of any recent RFC may be used as a guide.

7.4. The Network Information Center and Requests for Comments Distribution Contact

Contact:

Network Solutions
Attn: Network Information Center
14200 Park Meadow Drive
Suite 200
Chantilly, VA 22021

Help Desk Hours of Operation: 7:00 am to 7:00 pm Eastern Time

1-800-365-3642 (1-800-365-DNIC)
1-703-802-4535
Fax Number: 1-703-802-8376

NIC@NIC.DDN.MIL

The Network Information Center (NIC) provides many information services for the Internet community. Among them is maintaining the Requests for Comments (RFC) library.

7.5. Sources for Requests for Comments

Details on obtaining RFCs via FTP or EMAIL may be obtained by sending an EMAIL message to "rfc-info@ISI.EDU" with the message body "help: ways_to_get_rfcs". For example:

```
To: rfc-info@ISI.EDU
Subject: getting rfcs
```

```
help: ways_to_get_rfcs
```

8. Security Considerations

Security issues are not addressed in this memo.

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