Network Working Group
Request for Comments: 1540
Obsoletes: RFCs 1500, 1410, 1360,
1280, 1250, 1100, 1083, 1130, 1140, 1200
STD: 1
Category: Standards Track

Internet Architecture Board
J. Postel, Editor
October 1993

INTERNET 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.

Table of Contents

Introduction

A 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 are 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 (INTERNIC) or from the Internet Assigned Numbers Authority (IANA) (see the contact information at the end of this memo). Do not use this edition after 28-February-94.

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 IETF develops 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 IETF.

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.

To allow time for the Internet community to consider and react to standardization proposals, 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 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 a special review committee may be appointed consisting of experts from the IETF, IRTF and the IAB with the purpose of recommending an explicit action.

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 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 the documentation of such experimental work in the RFC series is encouraged, 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.

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

Few protocols are required to be implemented in all systems; this is because there is such a variety of possible systems, for example, gateways, routers, 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 may be 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 the IESG. 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 "Internet 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 INTERNIC, 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

The "Assigned Numbers" 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.

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 DISA and to the IESG. 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 Internet 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)

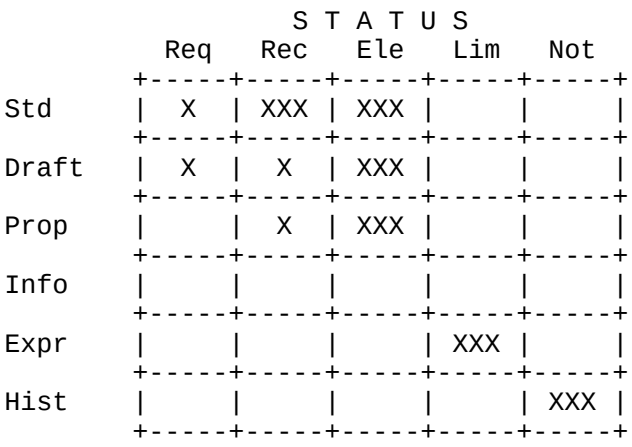
4. Explanation of Terms

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.

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.



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 IESG 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 IESG 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 IESG. 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 IESG 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 IESG, may be published as RFCs for the convenience of the Internet community as informational protocols.

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 IESG 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	Bogus (2)	Publish (1)	Bogus (2)	Bogus (2)
Proposed Standard	Refer (3)	Publish (1)	Refer (3)	Refer (3)
Experimental Protocol	Notify (4)	Publish (1)	Notify (4)	Notify (4)
Information or Opinion Paper	Publish (1)	Publish (1)	Discretion (5)	Discretion (5)

(1) Publish.

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

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

(4) Notify both the IESG and IRSG. If no concerns are raised in two weeks then do Discretion (5), else RFC Editor to resolve the concerns or do Refer (3).

(5) 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 (4) to the RFC Editor. Documents from Area Directors or Working Group Chairs may be considered in the same way as documents from "other".

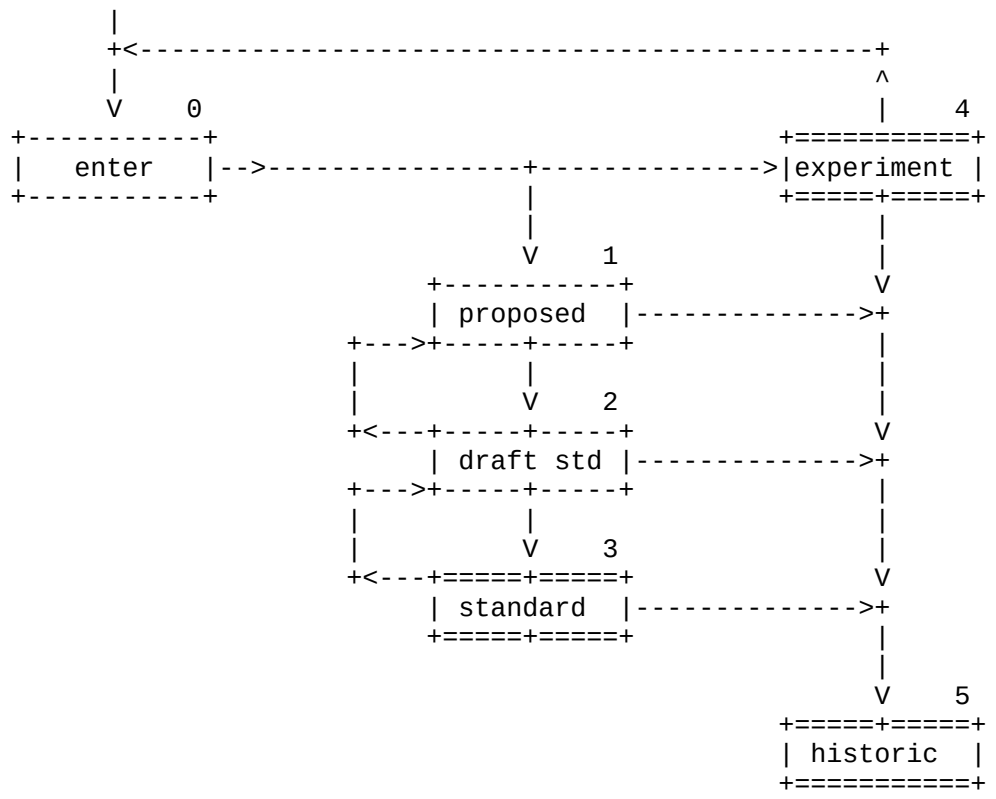
5.2. The Standards Track Diagram

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 change 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 may move from one state to another along the track only on the recommendation of the IESG. That is, it takes action by the IESG 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 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 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 IESG 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:

1540 - This memo.

1539 - The Tao of IETF - A Guide for New Attendees of the Internet Engineering Task Force

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

1538 - Advanced SNA/IP : A Simple SNA Transport Protocol

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

1537 - Common DNS Data File Configuration Error

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

1536 - Common DNS Implementation Errors and Suggested Fixes

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

1535 - A Security Problem and Proposed Correction With Widely Deployed
DNS Software

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

1534 - Interoperation Between DHCP and BOOTP

A Proposed Standard protocol.

1533 - DHCP Options and BOOTP Vendor Extensions

A Proposed Standard protocol.

1532 - Clarifications and Extensions for the Bootstrap Protocol

A Proposed Standard protocol.

1531 - Dynamic Host Configuration Protocol

A Proposed Standard protocol.

1530 - Principles of Operation for the TPC.INT Subdomain: General Principles and Policy

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

1529 - Principles of Operation for the TPC.INT Subdomain: Remote Printing -- Administrative Policies

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

1528 - Principles of Operation for the TPC.INT Subdomain Remote Printing -- Technical Procedures

An Experimental protocol.

1527 - What Should We Plan Given the Dilemma of the Network?

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

1526 - Assignment of System Identifiers for TUBA/CLNP Hosts

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

1525 - Definitions of Managed Objects for Source Routing Bridges

A Proposed Standard protocol.

1524 - A User Agent Configuration Mechanism For Multimedia Mail Format Information

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

1523 - The text/enriched MIME Content-type

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

1522 - MIME (Multipurpose Internet Mail Extensions) Part Two: Message Header Extensions for Non-ASCII Text

A Draft Standard protocol.

1521 - MIME (Multipurpose Internet Mail Extensions) Part One: Mechanisms for Specifying and Describing the Format of Internet Message Bodies

A Draft Standard protocol.

1520 - Exchanging Routing Information Across Provider Boundaries in the CIDR Environment

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

1519 - Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy

A Proposed Standard protocol.

1518 - An Architecture for IP Address Allocation with CIDR

A Proposed Standard protocol.

1517 - Applicability Statement for the Implementation of Classless Inter-Domain Routing (CIDR)

A Proposed Standard protocol.

1516 - 802.3 Repeater MIB

A Draft Standard protocol.

1515 - Definitions of Managed Objects for IEEE 802.3 Medium Attachment Units (MAUs)

A Proposed Standard protocol.

1514 - Host Resources MIB

A Proposed Standard protocol.

1513 - Token Ring Extensions to the Remote Network Monitoring MIB

A Proposed Standard protocol.

1512 - FDDI Management Information Base

A Proposed Standard protocol.

1511 - Common Authentication Technology Overview

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

1510 - The Kerberos Network Authentication Service (V5)

A Proposed Standard protocol.

1509 - Generic Security Service API : C-bindings

A Proposed Standard protocol.

1508 - Generic Security Service Application Program Interface

A Proposed Standard protocol.

1507 - DASS - Distributed Authentication Security Service

An Experimental protocol.

1506 - A Tutorial on Gatewaying between X.400 and Internet Mail

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

1505 - Encoding Header Field for Internet Messages

An Experimental protocol.

1504 - Appletalk Update-Based Routing Protocol: Enhanced Appletalk Routing

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

1503 - Algorithms for Automating Administration in SNMPv2 Managers

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

1502 - X.400 Use of Extended Character Sets

A Proposed Standard protocol.

6.1.2. Other Changes:

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

No changes to report.

6.2. Standard Protocols

Protocol	Name	Status	RFC	STD	*
--------	Internet Official Protocol Standards	Req	1540	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	
NTPV2	Network Time Protocol (Version 2)	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	
Concise-MIB	Concise MIB Definitions	Rec	1212	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	
TP-TCP	ISO Transport Service on top of the TCP	Ele	1006	35	

[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).

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".

6.3. Network-Specific Standard Protocols

All Network-Specific Standards have Elective status.

Protocol	Name	State	RFC	STD	*
IP-FR	Multiprotocol over Frame Relay	Draft	1490		
ATM-ENCAP	Multiprotocol Encapsulation over ATM	Prop	1483		
IP-TR-MC	IP Multicast over Token-Ring LANs	Prop	1469		
IP-FDDI	Transmission of IP and ARP over FDDI Net	Std	1390	36	
IP-HIPPI	IP and ARP on HIPPI	Prop	1374		
IP-X.25	X.25 and ISDN in the Packet Mode	Prop	1356		
IP-SMDS	IP Datagrams over the SMDS Service	Prop	1209		
IP-FDDI	Internet Protocol on FDDI Networks	Draft	1188		
ARP	Address Resolution Protocol	Std	826	37	
RARP	A Reverse Address Resolution Protocol	Std	903	38	
IP-ARPA	Internet Protocol on ARPANET	Std	BBN1822	39	
IP-WB	Internet Protocol on Wideband Network	Std	907	40	
IP-E	Internet Protocol on Ethernet Networks	Std	894	41	
IP-EE	Internet Protocol on Exp. Ethernet Nets	Std	895	42	
IP-IEEE	Internet Protocol on IEEE 802	Std	1042	43	
IP-DC	Internet Protocol on DC Networks	Std	891	44	
IP-HC	Internet Protocol on Hyperchannel	Std	1044	45	
IP-ARC	Transmitting IP Traffic over ARCNET Nets	Std	1201	46	
IP-SLIP	Transmission of IP over Serial Lines	Std	1055	47	
IP-NETBIOS	Transmission of IP over NETBIOS	Std	1088	48	
IP-IPX	Transmission of 802.2 over IPX Networks	Std	1132	49	

[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
-------	Message Header Ext. of Non-ASCII Text	Elective	1522*
MIME	Multipurpose Internet Mail Extensions	Elective	1521*
802.3-MIB	IEEE 802.3 Repeater MIB	Elective	1516*
BRIDGE-MIB	BRIDGE-MIB	Elective	1493
ETHER-MIB	Ethernet MIB	Elective	1398
NTPV3	Network Time Protocol (Version 3)	Elective	1305
IP-MTU	Path MTU Discovery	Elective	1191
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	1460
PPP	Point to Point Protocol	Elective	1171
BOOTP	Bootstrap Protocol	Recommended	951,1497
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:

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
DHCP-BOOTP	Interoperation Between DHCP and BOOTP	Elective	1534*
DHCP-BOOTP	DHCP Options and BOOTP Vendor Extensions	Elective	1533*
BOOTP	Clarifications and Extensions BOOTP	Elective	1532*
DHCP	Dynamic Host Configuration Protocol	Elective	1531*
SRB-MIB	Source Routing Bridge MIB	Elective	1525*
CIDR-STRA	CIDR Address Assignment...	Elective	1519*
CIDR-ARCH	CIDR Architecture...	Elective	1518*
CIDR-APP	CIDR Applicability Statement	Elective	1517*
--------	802.3 MAU MIB	Elective	1515*
HOST-MIB	Host Resources MIB	Elective	1514*
--------	Token Ring Extensions to RMON MIB	Elective	1513*
FDDI-MIB	FDDI Management Information Base	Elective	1512*
KERBEROS	Kerberos Network Authentication Ser (V5)	Elective	1510*
GSSAPI	Generic Security Service API: C-bindings	Elective	1509*
GSSAPI	Generic Security Service Application...	Elective	1508*
DASS	Distributed Authentication Security...	Elective	1507*
--------	X.400 Use of Extended Character Sets	Elective	1502*
HARPOON	Rules for Downgrading Messages...	Elective	1496
Mapping	MHS/RFC-822 Message Body Mapping	Elective	1495
Equiv	X.400/MIME Body Equivalences	Elective	1494
X.500syn	X.500 String Representation ...	Elective	1488
X.500lite	X.500 Lightweight ...	Elective	1487
STR-REP	String Representation ...	Elective	1485
OSI-Dir	OSI User Friendly Naming ...	Elective	1484
IDPR	Inter-Domain Policy Routing Protocol	Elective	1479
IDPR-ARCH	Architecture for IDPR	Elective	1478
PPP/Bridge	MIB Bridge PPP MIB	Elective	1474
PPP/IP MIB	IP Network Control Protocol of PPP MIB	Elective	1473
PPP/SEC MIB	Security Protocols of PPP MIB	Elective	1472
PPP/LCP MIB	Link Control Protocol of PPP MIB	Elective	1471
X25-MIB	Multiprotocol Interconnect on X.25 MIB	Elective	1461
SNMPv2	Coexistence between SNMPv1 and SNMPv2	Elective	1452
SNMPv2	Manager-to-Manager MIB	Elective	1451
SNMPv2	Management Information Base for SNMPv2	Elective	1450
SNMPv2	Transport Mappings for SNMPv2	Elective	1449
SNMPv2	Protocol Operations for SNMPv2	Elective	1448
SNMPv2	Party MIB for SNMPv2	Elective	1447
SNMPv2	Security Protocols for SNMPv2	Elective	1446
SNMPv2	Administrative Model for SNMPv2	Elective	1445
SNMPv2	Conformance Statements for SNMPv2	Elective	1444
SNMPv2	Textual Conventions for SNMPv2	Elective	1443
SNMPv2	SMI for SNMPv2	Elective	1442
SNMPv2	Introduction to SNMPv2	Elective	1441
SMTP-SIZE	SMTP Service Ext for Message Size	Elective	1427

SMTP-8BIT	SMTP Service Ext or 8bit-MIMEtransport	Elective	1426
SMTP-EXT	SMTP Service Extensions	Elective	1425
PEM-KEY	PEM - Key Certification	Elective	1424
PEM-ALG	PEM - Algorithms, Modes, and Identifiers	Elective	1423
PEM-CKM	PEM - Certificate-Based Key Management	Elective	1422
PEM-ENC	PEM - Message Encryption and Auth	Elective	1421
SNMP-IPX	SNMP over IPX	Elective	1420
SNMP-AT	SNMP over AppleTalk	Elective	1419
SNMP-OSI	SNMP over OSI	Elective	1418
FTP-FTAM	FTP-FTAM Gateway Specification	Elective	1415
IDENT-MIB	Identification MIB	Elective	1414
IDENT	Identification Protocol	Elective	1413
DS3/E3-MIB	DS3/E3 Interface Type	Elective	1407
DS1/E1-MIB	DS1/E1 Interface Type	Elective	1406
BGP-OSPF	BGP OSPF Interaction	Elective	1403
--------	Route Advertisement In BGP2 And BGP3	Elective	1397
RIP2-MIB	RIP Version 2 MIB Extension	Elective	1389
RIP2	RIP Version 2-Carrying Additional Info.	Elective	1388
SNMP-X.25	SNMP MIB Extension for X.25 Packet Layer	Elective	1382
SNMP-LAPB	SNMP MIB Extension for X.25 LAPB	Elective	1381
PPP-ATCP	PPP AppleTalk Control Protocol	Elective	1378
PPP-OSINLCP	PPP OSI Network Layer Control Protocol	Elective	1377
PPP-DNCP	PPP DECnet Phase IV Control Protocol	Elective	1376
TABLE-MIB	IP Forwarding Table MIB	Elective	1354
SNMP-PARTY-MIB	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
PPP-AUTH	PPP Authentication	Elective	1334
PPP-LINK	PPP Link Quality Monitoring	Elective	1333
PPP-IPCP	PPP Control Protocol	Elective	1332
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
FDDI-MIB	FDDI-MIB	Elective	1285
-------	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
802.5-MIB	IEEE 802.5 Token Ring MIB	Elective	1231
GINT-MIB	Extensions to the Generic-Interface MIB	Elective	1229
PPP-EXT	PPP Extensions for Bridging	Elective	1220
IS-IS	OSI IS-IS for TCP/IP Dual Environments	Elective	1195
IP-CMPRS	Compressing TCP/IP Headers	Elective	1144
ISO-TS-ECHO	Echo for ISO-8473	Elective	1139
NNTP	Network News Transfer Protocol	Elective	977

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

Applicability Statements:

OSPF - RFC 1370 is an applicability statement for OSPF.

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	736	
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	1372	
TOPT-LINE	Linemode	34	Draft	Ele	1184	
TOPT-XDL	X Display Location	35	Prop	Ele	1096	
TOPT-ENVIR	Telnet Environment Option	36	Prop	Ele	1408	
TOPT-AUTH	Telnet Authentication Option	37	Exp	Ele	1416	
TOPT-EXTOP	Extended-Options-List	255	Std	Rec	861	32

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previous edition of this document.]

6.7. Experimental Protocols

All Experimental protocols have the Limited Use status.

Protocol	Name	RFC
REM-PRINT	TPC.INT Subdomain Remote Printing - Technical	1528*
EHF-MAIL	Encoding Header Field for Internet Messages	1505*
REM-PRT	An Experiment in Remote Printing	1486
RAP	Internet Route Access Protocol	1476
TP/IX	TP/IX: The Next Internet	1475
X400	Routing Coordination for X.400 Services	1465
DNS	Storing Arbitrary Attributes in DNS	1464
IRCP	Internet Relay Chat Protocol	1459
TOS-LS	Link Security TOS	1455
SIFT/UFT	Sender-Initiated/Unsolicited File Transfer	1440
DIR-ARP	Directed ARP	1433
TEL-SPX	Telnet Authentication: SPX	1412
TEL-KER	Telnet Authentication: Kerberos V4	1411
MAP-MAIL	X.400 Mapping and Mail-11	1405
TRACE-IP	Traceroute Using an IP Option	1393
DNS-IP	Experiment in DNS Based IP Routing	1383
DNS NSAP	DNS NSAP RRs	1348
RMCP	Remote Mail Checking Protocol	1339
TCP-HIPER	TCP Extensions for High Performance	1323
MSP2	Message Send Protocol 2	1312
DSLCP	Dynamically Switched Link Control	1307
--------	X.500 and Domains	1279
IN-ENCAP	Internet Encapsulation Protocol	1241
CLNS-MIB	CLNS-MIB	1238
CFDP	Coherent File Distribution Protocol	1235
SNMP-DPI	SNMP Distributed Program Interface	1228
IP-AX.25	IP Encapsulation of AX.25 Frames	1226
ALERTS	Managing Asynchronously Generated Alerts	1224
MPP	Message Posting Protocol	1204
ST-II	Stream Protocol	1190
SNMP-BULK	Bulk Table Retrieval with the SNMP	1187
DNS-RR	New DNS RR Definitions	1183
IMAP2	Interactive Mail Access Protocol	1176
NTP-OSI	NTP over OSI Remote Operations	1165
DMF-MAIL	Digest Message Format for Mail	1153
RDP	Reliable Data Protocol	908,1151
TCP-ACO	TCP Alternate Checksum Option	1146
--------	Mapping full 822 to Restricted 822	1137
IP-DVMRP	IP Distance Vector Multicast Routing	1075
VMTP	Versatile Message Transaction Protocol	1045

COOKIE-JAR	Authentication Scheme	1004
NETBLT	Bulk Data Transfer Protocol	998
IRTP	Internet Reliable Transaction Protocol	938
LDP	Loader Debugger Protocol	909
RLP	Resource Location Protocol	887
NVP-II	Network Voice Protocol	ISI-memo
PVP	Packet Video Protocol	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

Information protocols have no status.

Protocol	Name	RFC
ADSNA-IP	Advanced SNA/IP: A Simple SNA Transport Protocol	1538*
AUBR	Appletalk Update-Based Routing Protocol...	1504*
TACACS	Terminal Access Control Protocol	1492
SUN-NFS	Network File System Protocol	1094
SUN-RPC	Remote Procedure Call Protocol Version 2	1057
GOPHER	The Internet Gopher Protocol	1436
-------	Data Link Switching: Switch-to-Switch Protocol	1434
LISTSERV	Listserv Distribute Protocol	1429
-------	Replication Requirements	1275
PCMAIL	Pcmail Transport Protocol	1056
MTP	Multicast Transport Protocol	1301
BSD Login	BSD Login	1282
DIXIE	DIXIE Protocol Specification	1249
IP-X.121	IP to X.121 Address Mapping for DDN	1236
OSI-HYPER	OSI and LLC1 on HYPERchannel	1223
HAP2	Host Access Protocol	1221
SUBNETASGN	On the Assignment of Subnet Numbers	1219
SNMP-TRAPS	Defining Traps for use with SNMP	1215
DAS	Directory Assistance Service	1202
MD4	MD4 Message Digest Algorithm	1186
LPDP	Line Printer Daemon Protocol	1179

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

6.9. Historic Protocols

All Historic protocols have Not Recommended status.

Protocol	Name	RFC
SNMP-MUX	SNMP MUX Protocol and MIB	1227*
OIM-MIB-II	OSI Internet Management: MIB-II	1214
IMAP3	Interactive Mail Access Protocol Version 3	1203
SUN-RPC	Remote Procedure Call Protocol Version 1	1050
802.4-MIP	IEEE 802.4 Token Bus MIB	1230
CMOT	Common Management Information Services	1189
MSP	Message Send Protocol	1159
--------	Mail Privacy: Procedures	1113
--------	Mail Privacy: Key Management	1114
--------	Mail Privacy: Algorithms	1115
NFILE	A File Access Protocol	1037
HOSTNAME	HOSTNAME Protocol	953
SFTP	Simple File Transfer Protocol	913
SUPDUP	SUPDUP Protocol	734
BGP	Border Gateway Protocol	1163,1164
MIB-I	MIB-I	1156
SGMP	Simple Gateway Monitoring Protocol	1028
HEMS	High Level Entity Management Protocol	1021
STATSRV	Statistics Server	996
POP2	Post Office Protocol, Version 2	937
RATP	Reliable Asynchronous Transfer Protocol	916
HFEP	Host - Front End Protocol	929
THINWIRE	Thinwire Protocol	914
HMP	Host Monitoring Protocol	869
GGP	Gateway Gateway Protocol	823
RTELNET	Remote Telnet Service	818
CLOCK	DCNET Time Server Protocol	778
MPM	Internet Message Protocol	759
NETRJS	Remote Job Service	740
NETED	Network Standard Text Editor	569
RJE	Remote Job Entry	407
XNET	Cross Net Debugger	IEN-158
NAMESERVER	Host Name Server Protocol	IEN-116
MUX	Multiplexing Protocol	IEN-90
GRAPHICS	Graphics Protocol	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.

Contacts:

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The protocol standards are managed 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 "Internet Official Protocol Standards" memo:

The file "in-notes/std/std1.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

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

RFC's may be obtained from DS.INTERNIC.NET via FTP, WAIS, and electronic mail. Through FTP, RFC's are stored as rfc/rfcnnnn.txt or rfc/rfcnnnn.ps where 'nnnn' is the RFC number. Login as "anonymous" and provide your e-mail address as the password. Through WAIS, you may use either your local WAIS client or telnet to DS.INTERNIC.NET and login as "wais" (no password required) to access a WAIS client. Help information and a tutorial for using WAIS are available online. The WAIS database to search is "rfcs".

Directory and Database Services also provides a mail server interface. Send a mail message to mailserv@ds.internic.net and include any of the following commands in the message body:

document-by-name rfcnnnn	where 'nnnn' is the RFC number The text version is sent.
file /ftp/rfc/rfcnnnn.yyy	where 'nnnn' is the RFC number. and 'yyy' is 'txt' or 'ps'.
help	to get information on how to use the mailserver.

The InterNIC directory and database services collection of resource listings, internet documents such as RFCs, FYIs, STDs, and Internet Drafts, and publicly accessible databases are also

now available via Gopher. All our collections are WAIS indexed and can be searched from the Gopher menu.

To access the InterNIC Gopher Servers, please connect to "internic.net" port 70.

Contact: admin@ds.internic.net

7.5. Sources for Requests for Comments

Details on many sources of 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.

9. Author's Address

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